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PALMS OF BRITISH INDIA AND CEYLON



Young Avenue of Cabbage Palms in the Botanic Garden of Peradeniya (*Oreodoxa oleracea* Mart.).

THE PALMS OF BRITISH INDIA AND CEYLON

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PREFACE

It is my duty to thank the Bombay Natural History Society for allowing me the full use of the papers and illustrations which appeared in their Journal under the title: "The Palms of British India and Ceylon". The publication of my papers covered a period of almost eight years (1910-1918). What I present to the public in this volume are not mere reprints. Several things have been corrected, new information has been added, and the general arrangement has been changed in various places.

It was a favourite idea of the late Dr. Scheffer, formerly Director of the Botanic Gardens of Buitenzorg, to illustrate by means of photography the palms of the Malay Archipelago and many others from various parts of the world which grow so luxuriously in the famous Gardens of Java. His premature death (1880), however, prevented him from giving life to his idea and from finishing the promising series of illustrations which he had started in the "Annales du Jardin Botanique de Buitenzorg." Professor Beccari was kind enough to undertake the publication of some of Dr. Scheffer's notes and plates, enriched by his own valuable observations. It is to be regretted that, after the appearance of the "Reliquiæ Schefferianæ," nobody felt inclined to continue the work, as there is scarcely a better way of conveying correct notions regarding the habit of palms than by means of photographic illustrations. Even the most elaborate description and detailed analysis will never, in that respect, come up to a tolerably good photograph. It is for this reason that I publish this book on Indian palms, indigenous as well as introduced, and illustrate them by as many photographs as I am able to procure. I am sorry not to be in a position to give much fresh information with regard to the morphological characters of most palms, as the leisure required for such observations was not at my disposal. I have, however, tried to make the descriptions as complete as possible by carefully comparing and, where practicable, verifying the descriptions and illustrations as given by various authors. In many cases, where I found a good description of a species I have not hesitated to adopt it almost word for word, supposing that

everybody will understand that in a condensed, technical description of a plant not much originality can be expected, especially if a uniform plan has once been adopted. In this I am only following in the footsteps of systematic botanists.

With regard to the classification of the palms I shall follow the arrangement laid down by Professor Drude in the "Natürliche Pflanzenfamilien"; in minor points only I found it convenient to introduce a few changes. I have chosen Professor Drude's system of classification in preference to the one adopted in Sir J. D. Hooker's "Flora of British India" for entirely practical reasons. As I include in this volume a great number of exotic species, the plan given by Professor Drude seemed to simplify matters considerably. In order to give the series not only scientific interest, but also practical value, I shall add to the description of the species an account of their economic uses and, besides, a few notes on their cultivation. I cannot lay claim to the practical experience of a gardener and have, therefore, to rely in this matter on the remarks scattered in various books on gardening. As many of the palms described below have been introduced into European Conservatories, we hope that some hints on palm-growing in Europe will be welcome.

In order to avoid, on the one hand, too frequent references to authorities in the text, and on the other to indicate the books where those desirous of further information may easily find it, I have given a list of the literature on palms at the end of the volume. In the interest of those who are not familiar with the ways of botanists, I have also added a list of the authors with the abbreviations commonly used in botanical works.

I am fully aware of many imperfections regarding the treatment of my subject. Those who have ever made, or tried to make, a special study of palms will realise the many difficulties that lie in the way of such an undertaking. I shall always be very thankful for any suggestions or corrections.

My sincere thanks are due to Lt.-Col. Gage, the late Director of the Botanical Survey of India, and Mr. H. F. MacMillan, the Curator of the Royal Botanic Gardens at Peradeniya, who have supplied me with a considerable number of photographs which otherwise I should not have been able to secure. To Mr. MacMillan I am, moreover, indebted for his valuable suggestions. I owe another set of photographs to the kindness of Mr.

Phipson, the former Honorary Secretary of the Bombay Natural History Society, to the Rev. Max Maier, S. J., to Mr. and Mrs. I. H. Burkill, and to Mr. Roscoe Allen. Mr. Lock, the former Assistant Director of the Royal Botanic Gardens at Peradeniya, obliged me by putting the library and herbarium of the Gardens at my disposal. Lastly, I would express my thanks to Mr. W. S. Millard, once Honorary Secretary of the Bombay Natural History Society. Without his practical and untiring interest in the subject I should never have started this work.

INTRODUCTION

A short History of the Exploration of the Indian Palm-Flora

Alexander von Humboldt[1] wrote in the year 1849: "It is remarkable that of this majestic form of plants (palms) up to the time of the death of Linnæus only 15 species were described. The Peruvian travellers Ruiz and Pavon[2] added to these 8 more species. Bonpland[3] and I, in passing over a more extensive range of country from 12° S. Lat. to 21° N. Lat. described 20 new species of palms, and distinguished as many more, but without being able to obtain complete specimens of their flowers. At the present time, 44 years after my return from Mexico, there are from the Old and New World, including the East Indian species brought by Griffith, above 440 regularly described species. The "Enumeratio Plantarum" of my friend Kunth, published in 1841, had already 356 species." It is evident from this account, that the progress made in the exploration of the palm-flora in general was a very slow one, and it cannot be expected that the knowledge of the Indian palms was much advanced at that time. In Rheede's "Hortus Malabaricus," which was finished in 1703, only those palms are described which have been cultivated in India from time immemorial (Areca catechu, Phœnix sylvestris, Borassus flabellifer, Cocos nucifera, etc.). Roxburgh's "Plants of the Coast of Coromandel" (1795-1816) contains only a few species, whilst his "Flora Indica", which appeared 17 years after his death (in 1832) brings the number of palms up to 41. At about the same time Wallich's "Plantæ Asiaticæ Rariores" (between 1830 and 1832) was published by the East India Company. Though valuable

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[1] A. v. Humboldt, Aspects of Nature in Different Lands and Different Climates, Vol. II. 126. London, 1850. (Translated from the German.)

[2] Hipolito Ruiz Lopez, born in 1754, was in charge of the Botanic Garden of Madrid, and died in Madrid in 1815. He and Joseph Pavon undertook (1779-1788) a scientific tour through Peru, Chili, and the neighbouring Spanish Provinces. In a shipwreck they lost the greatest part of their botanical collections. The results of their travels were published in the "Flora Peruviana et Chilensis," Madrid, 1798-1802, and the "Systema vegetabilium floræ Peruvianæ et Chilensis." Madrid, 1798.

[3] Humboldt, in company with Bonpland, travelled in Spanish America between 1799 and 1804.

in other respects, the work did not add much to our knowledge of Indian palms.

It was not until Griffith with his untiring energy and enormous knowledge began his botanical investigations, that the palms of India became better known. As Assistant Surgeon he accompanied Wallich to Assam; he explored the tracks near the Mishmi Mountains between Sudiya and Ava; made a journey from Assam to Ava, and down the Irrawadi to Rangoon; traversed 400 miles of the Bhutan country; joined the Army of the Indus in a scientific capacity; went from Kabul to Khurasan and succumbed finally to the fatigue and sicknesses due to exposure during his long and restless journeys (1845). The various papers, including many on palms which he communicated to the "Calcutta Journal of Natural History" and to the Linnean Society of London, and his other publications, are models of scientific research. His drawings, microscopic analyses and descriptions of plants are evidence of astonishing industry and profound knowledge. For the fruits of these labours we are indebted to J. McClelland, who published in Calcutta, between 1847 and 1854, five volumes with a quarto volume of illustrations: 'Posthumous papers bequeathed to the H. E. I. C., and printed by order of the Government of Bengal; being journals of travels by the late William Griffith, Esq., arranged by John McClelland, M.D." The most important amongst these is the volume entitled: "Palms of British East India" (1850). The author's preface furnishes some information regarding the scope and origin of the book. "The present attempt," says Griffith, "will be found to include all the Palms of British East India that I have met with myself, or of which I have been able to procure such knowledge, as I considered sufficient for their determination. I wish it merely to be viewed as a slight sketch to be filled up hereafter. This subject, so far as regards systematic botany, is one of considerable interest, and in order to meet the convenience of the Indian public, I have written the descriptions in English, in preference to the common language of Botanists. This seemed to me the more proper, because English is the language through which scientific knowledge is communicated in this country, more especially in the Medical and other Colleges, from which all that is to be expected in the dissemination of this science among the natives of India must

at present be derived . . . The determination of the species having been difficult, indeed nearly insuperably so to me, in reference to the means possessed in India, the numerous names new to science proposed in this work must be taken with some qualification. I shall never regret to see any of these names cancelled in favour of others justly prior, that is to say, prior by definition, and by publication. However imperfect the definition may be, and it must be confessed, that most of those of palms are necessarily imperfect, still it bears evidence of a wish on the part of an author to do his duty by the science, for which, moreover, he thus endeavours to show a proper respect. But I would not be disposed to waive my right, in favour of mere MSS. names originating in indolence, and too often fostered by a courtesy of a very mischievous nature, inasmuch as the practice is directly opposed to proper observation and due discrimination. Such names are, in fact, only weak and temporary usurpations of authority."

The materials from which the work has been prepared were an extensive collection of palms made by Griffith himself and his friends in various parts of India, more especially at Malacca, and in Assam, and of a few found in the Botanic Gardens of Calcutta. To these we must add the species figured in Roxburgh's national collection of drawings and most of those described in his "Flora Indica." The species of Buchanan Hamilton, amounting to nine in number, Griffith has not been able to determine, in default either of manuscripts, specimens, or drawings. For the rest, Griffith has been much assisted, as he says himself, by Martius' great work on palms, so far as regards the sections, and from Mohl's contribution to it he derived most of what relates to structure. It was Griffith, on the other hand, that enabled Martius to describe in his 3rd volume a considerable number of Indian species, as only a few months before his death he had sent his whole collection of palms to Martius, who at that time was engaged in finishing his monumental "Historia Naturalis Palmarum."

During the lifetime of Griffith and especially in the second half of the 19th century, valuable work has been done in the exploration of the palm-flora by many botanists in various parts of India. We mention only Anderson, Thwaites, Scheffer, Kurz, Brandis, Trimen, and especially Beccari and J. D. Hooker,

who in the VIth Volume of the "Flora of British India" (1894) give a concise account of all the palms which had previously been found in India and to which they were able to add some new species. Lately, Prof. Beccari has enriched the literature on palms by his magnificent monograph on the tribe Lepidocaryinæ.

In spite of all the labour spent by many scientific men in the study of Indian palms, there still remains much to be done. A great number of species are only partially known; the knowledge of others is extremely scanty, and there are, besides, a few, of which we know only the name, the original not having been discovered as yet.

The Palms in General.

The Stem. The adult palm has generally a tall, woody stem, bearing a crown of leaves; a considerable number, however, remain shrubby and some even have the appearance, but nothing save the appearance of perennial herbs. The stems in some species hardly appear above ground, in others they rise to the height of 500 feet (*Calamus*). It is doubtful whether there exist entirely stemless palms. Not seldom we find in descriptions palms mentioned as stemless, but on closer examination we usually find that the stem is very short and covered all over with the bases of the stalks of fallen leaves and the dense crown of new leaves. In diameter the stems vary from the reed-like *Chamædorea* and slender Rattan to the more usual sturdy, pillar-like structure as seen in the Date-palm, Palmyra-palm, the *Oreodoxa,* the Talipot and many others. While in some the stem is hardly as thick as a goose-quill, it measures in others from three to five feet in diameter (*Borassus flabellifer, Corypha*). The long, slender stems of the Rattans or cane-palms are not self-supporting, but scramble over the surrounding vegetation; but in most palms the stem exists quite independent of all other plants.

The trunks of some are almost perfectly smooth, others rough with concentric rings, the scars of the fallen leaves. Many are clothed with a woven or hairy fibrous covering, which binds together the sheathing bases of the fallen leaves; others are densely beset with cylindrical or flat spines, often eight or

ten inches long and as sharp as a needle. As in these cases also the leaf-sheaths are covered with spines, such palms offer a serious obstacle to the traveller who attempts to penetrate the tropical forest.

Branching is a rare occurrence in the tall aërial stem. It is the rule only in a few species of the genus *Hyphæne (thebaica, coriacea,* and *indica).* In these palms the stem forks, often several times in succession, and there is no doubt that here we have cases of true dichotomy, similar to the mode of branching observed in *Pandanus furcatus* (Screw-pine). In ten other genera (out of a total of 131) exceptional cases of branching are recorded. These are often due to an injury to the terminal bud, as in the Wild Date, where the apex is continually tapped for toddy. In other cases branching takes place in consequence of the replacement of flowering buds by leaf-buds, which develop into shoots. Mr. F. Field gives a photograph of a Wild Date Palm with 14 branches (Journal, Bombay Natural History Society, Vol. XVIII, p. 699) that was growing at a village named Amas in the Gaya District, and he mentions that at one time the tree had been struck by lightning and split, and that from the base of the split those branches started.

The formation of horizontal suckers at the base of the stem is more frequent. When they grow erect, they afford a characteristic bushy habit, as in the case of *Rhapis flabelliformis,* a species often cultivated in gardens.

The Leaf.—The foliage generally forms a magnificent crown at the end of the trunk. It is this crown that renders the palms objects of such beauty and elegance. The leaves are large and often gigantic, surpassing those of any other class of plants. In some species they are 50 feet long and 8 wide. We can easily distinguish two main types of leaves, the palmate and pinnate, which give rise to the popular terms Fan-palm and Feather-palm respectively. In the Fan-palms the blade is entire while enclosed in the bud, but folded up. When the leaf expands the folds become torn to a greater or less distance from the margin inwards. The depth of division varies much in different genera and species. In the pinnæ (leaflets, segments) of the Feather-palms we can observe similar characteristic foldings and tearings. The presence or absence of a terminal leaflet and the shape of the pinnæ in such a leaf afford

useful distinctive characters. Occasionally, in the genus *Caryota*, these segments are again divided (bipinnatisect), their ultimate divisions resembling in shape the fin or tail of a fish.

The petiole (leaf-stalk) is usually large and stout and has a strong, broad, sheathing base. The leaf-fall is, as generally in Monocotyledons, not a predetermined process, as observed in dicotyledonous trees. After some time, when the leaf has reached the end of its life-period, it gradually falls over, as the weight of the large blade is too great for the dying petiole. The blade remains attached until the stalk becomes so decayed that the leaf falls by its own weight or gets broken off by wind or rain-storm. The sheath is often seen to persist for some time, its tough fibres forming a dense matting round the bases of the younger leaves. In some genera (*Calamus, Desmoncus*) the stem is surrounded above the petiole by a sheath-like stipule, called ochrea. In a few species the ochrea forms a hollow smooth-walled chamber, in which ants make a home *(Korthalsia echinometra, scaphigera, scortechinii, wallichiæfolia).*

Within the leaf-sheath we often find stem-thorns, which are at first flattened upwards against the stem and spread only after leaf-fall. The stems and leaves of the Rattans often bear numerous recurved spines which aid them in scrambling over trees and bushes. Also the leaf-rhachis (midrib) may be produced into a naked, barbed, whip-like flagellum.

The leaves are generally green on both sides, but occasionally of a silvery white on the underside *(Copernicia cerifera)*, in rare cases blue. The middle of some leaves shows concentric bands of yellow and in the manner of a peacock's tail, as in the prickly *Mauritia.*

Another important character is the direction of the leaves. The segments may be arranged in a comb-like manner close to one another, with a stiff parenchyma, allowing the rays of the sun to play over their surface, and causing them to shine with a brilliant verdure in the Coco-nut Palm, and with a fainter ashy-coloured hue in the Date-tree, or they have a more flexible, grass-like texture, and are curled near the extremity. The more acute the angle formed by the leaves with the upper part of the stem, *i. e.*, the nearer the leaves approach the perpendicular, the bolder and nobler is the aspect of the species to which they

belong. A comparison between the Real Date Palm and the Wild Date Palm will show this sufficiently.

In Feather-Palms the petioles either burst from the dry, rough, woody portion of the stem *(Cocos nucifera, Phœnix dactylifera)*, or there rises in the rough part of the stem a grass-green, smooth, and thinner shaft, like one column above another from which the petioles spring *(Oreodoxa regia)*. A special character of melancholic solemnity and grandeur is added to the tree, when in Fan-Palms the living foliage rests on a circle of dead leaves.

There are various ways in which the leaf-blade protects itself against the influence of too intensive sun-light and the violent force of the rain. Fan-leaves as well as feathery leaves very often assume an inclined or even vertical position. This is effected either by the torsion of the petiole or by the leaf-stalk trying to get into a more upright position. It is not uncommon that the two rows of pinnæ are turned upwards till they form a small angle with each other *(Chrysalidocarpus lutescens)*, and even the two halves of a fan-leaf are sometimes seen to close upon each other – just like a half-open book.

The Root.—After germination the primary root soon perishes and is replaced by adventitious roots springing from the base of the stem. In the South American genus *Iriartea*, development takes place above ground, the short stem being supported by prop-like adventitious roots, which increase in size with the increase in circumference of the shoot. The Sabal-Palm, Wax-Palm, and others, differ in that they form on the surface a short, horizontal rhizome, which becomes gradually thicker until the normal sized leaf-rosette is produced, when it begins to grow erect and forms the cylindrical stem. At the base the stem is often conically thickened. This gives the necessary mechanical rigidity, in consequence of which the stem does not curve in a gale but bends from the base, from a position like | to one like /. The mechanical physiology of stem and root is on the whole very little known. Why, for example, the stems of *Cocos* and other palms are curved—and not straight, we are not yet able to explain.

The Flower.—The flowers of a palm are never solitary; they always form a usually very large and much-branched inflorescence. This is either a simple or compound spike, or a

richly-branched panicle. The branching is racemose and the flowers are often embedded in the fleshy surface of the branches; for this reason it is customary to call the inflorescence a spadix. In the Talipot and *Metroxylon* it is terminal; after many years growth and the production of a stout woody trunk, the growing point ceases to produce leaves and develops a gigantic inflorescence. This so exhausts the plant that, after fruiting, it dies. In most cases, however, the spadix is axillary and withers away after fruiting. It is formed in the sheathed axil of a leaf, but often does not develop until after the subtending leaf has fallen, when the spadix is, therefore, below the leaf-crown. In other cases, again, as in the *Sabal mauritiæforme* the large flower-shoots appear among the green leaves. These relations are constant for every species, sometimes even for a whole genus.

Before the flowers open a sugary sap in considerable quantities flows to the large spadix. The inhabitants of the tropics learned in early times how to obtain that sap, which by fermentation changes into a favourite intoxicating drink, toddy. Each spadix is enclosed in an often enormous spathe, or each branch is separately sheathed by smaller spathes. After some time the spathe becomes torn along definite lines by the rapidly growing flower-shoot and either separates completely at the base or remains to sheathe the stalk and lower branches.

The flowers are small and inconspicuous, generally of a white, pale-yellow, or green colour, but, as if to make up for this defect, they are mostly produced in such masses as to present an eminently striking and imposing appearance. A single spathe of the Date-Palm contains about 12,000 male flowers, and *Metroxylon rumphii* has been computed to have no less than 208,000 flowers in one spathe, or about 624,000 upon a single tree.

The flowers are sessile or sometimes embedded in the surface of a fleshy spadix, as in the male inflorescence of the Brab Tree (*Borassus*). They are arranged in a close or loose spiral, or more rarely are distichous. As a rule the flowers are unisexual, the male and female often occupying different parts of the same inflorescence, *e. g.*, a few females occur at the base of the branches whilst the upper part is thickly crowded with males, or the branches of the spike bear female flowers in the lower and male in the upper half. In other species, the two sexes may be

mixed, usually one female between two males. In this case the two male flowers appear in succession and then the female, so that the spike is for the time being unisexual. The male and female flowers may vastly differ in size, as in the Brab Tree where the enormous female flowers contrast strongly with the minute male.

The flowers are regular and follow the very general formula of monocotyledonous plants. We have therefore usually 3 sepals, 3 petals, 6 stamens or a multiple of it, and 3 carpels for the exceptional hermaphrodite flower, while the stamens are rudimentary (staminodes) in the female and the carpels in the male (pistillode). The sepals and petals are tough and persistent, leathery or fleshy in their structure. The sepals are generally smaller than the otherwise similar petals, and only in rare cases is the corolla entirely covered by the calyx. Sometimes a whorl of stamens is wanting, or there is an indefinite number. The powdery pollen is produced in great quantities, escaping in clouds from the large male spikes. The pollination-methods of the palms want investigation. Wind-pollination is probably most general, as *e.g.*, in the Coco-nut Palm, though some palms, *e.g.*, *Sabal* and *Chamædorea*, are said to be entomophilous. The sweet smell of the inflorescence and the great mass of flowers which form a conspicuous object, seem to be in favour of insect-pollination. Where the male and female flowers are close together on the same spike, self-pollination is excluded by the well-marked protandry which we have already mentioned.

The ovary consists almost throughout of 3 carpels which are either quite free or completely united. In the latter case the ovary is generally trilocular. The style is short and the ovules, one for each carpel, are either anatrapous, hemitropous, or rarely orthotropous.

Fruit and Seed.—When the fruit ripens, two of the carpels with their ovules may become abortive, as *e.g.*, in the Coco-nut, where we find only one seed, though the three carpels are distinctly indicated by three longitudinal sutures and by the constant presence of three round scars (germ-pores) on the hard endocarp. The fruit is either a berry or a drupe; in the latter case the endocarp is usually united to the seed. If the carpels are free, a syncarp of one-seeded fruits results; if they are

united, we shall have a single fruit with one, two or three seeds according to the number of ovules that develop. The fruit in *Lepidocaryinæ* (including the Rattans, the Sago-palm, and others) is covered with hard, closely fitting, generally smooth, imbricating scales.

Compared with the size of the plants, the fruits are generally small; some are in this respect like peas, as in the *Euterpe* of tropical America. The common Coco-nut is one of the largest; and the Double Coco-nut *(Lodoicea sechellarum),* measuring about four feet in circumference, is probably surpassed by no other fruit hitherto discovered.

In the seeds we observe a similar variety in size and shape. In fruits which contain only one seed it is generally more or less rounded, as in the Coco-nut; in the Date it is long and narrow. In fruits with three seeds, it often becomes flattened on two sides and rounded on the outer in consequence of mutual compression.

The point on the testa from which well-marked vascular bundles radiate, shows the position of the raphe or chalaza. The inner integument of the ovule is in some genera much thickened along the course of these bundles and becoming greatly increased during ripening, grows into the endosperm and produces the characteristic appearance in section known as ruminate. This can be seen in the Betel-nut. Within the thin, brittle seed-coat there is a copious endosperm which holds embedded in some part of its circumference the minute cylindrical or conical embryo. The endosperm may be comparatively soft, the cells containing a considerable amount of oil and proteid (Coco-nut), or it may be hard (Date), or occasionally mucilaginous.

Geographical Distribution.—There are about 1,100 known species of palms which are distributed among 131 genera. They form a monocotyledonous order, essentially characteristic of the tropical region *(cf. Map A.). Chamærops humilis* is the only native of Europe; it is a Mediterranean species which occurs in Southern Spain, Italy, and Greece. The monotypic genus *Nannorhops* which is indigenous on the Himalayas extends through Afghanistan and Baluchistan to south-east Persia. Of the Chinese-Japanese region, only the east-coast, as far as Korea and the south of Japan, shows some representatives of this

order. A few small genera are peculiar to the Southern United States and California. The Chilian genus *Jubæa* extends to the 37th parallel, while in the eastern hemisphere the southern limit is 44° S. Lat. in New Zealand. The great centres are tropical Asia. The order is represented in Central America by 7 genera, in the West Indies by 5, and extends southwards as far as Chili. In tropical Asia it covers the Indo-Malayan region, Borneo, New Guinea and Australia, always within the northern and southern limits indicated above. In tropical Africa only 14 species are known to occur. Several genera have been found in the Pacific Islands.

Drude has shown that, with the exception of three genera, all the rest are restricted either to the Old or to the New World. Of those three the Coco-nut has a wide distribution on the coasts of tropical America, in India and the South Seas, but all its allies are American. The Oil-palm (*Elæis guinensis*) is indigenous in western tropical Africa, whilst another species of the same genus is a native of equatorial Africa. One species of *Raphia* belongs to America, whilst several others have their original home in tropical Africa and Madagascar.

The following table gives all the genera of palms with the approximate number of species and their distribution. An asterisk indicates that the genus is represented by indigenous species in India and Ceylon, two asterisks, that representatives of the respective genus are cultivated in Indian gardens.

Tribe I. — Coryphinæ.

1. Phœniceæ.

1. * Phœnix, L. Sp. about 12, Sub-tropical Africa; Tropical Asia.

2. Sabaleæ.

2. * * Chamærops, L. Sp. 2. Mediterranean region.
3. * Trachycarpus, Wendl. Sp. 3, Northern India, Burma; Northern China; Japan.
4. Rhapidophyllum, Wendl. & Dr. Sp. 1, Florida, South Carolina.
5. * * Rhapis, L. Sp. 3, Eastern Asia, from China to the Sunda Islands.
6. Acanthorhiza, Wendl. & Dr. Sp. 4, Tropical America.
7. Colpothrinax, Griseb. & Wendl. Sp. 1, Cuba.
8. Coccothrinax Sarg. Sp. about 15, Tropics of the New World.
9. * * Thrinax, L. Sp. 9, Antilles; Florida.
10. * Corypha, L. Sp. 6, Tropical Asia, Malay-Archipelago.

11. * Nannorhops, Wendl. & Hook. Sp. 1, India; Afghanistan; S. Persia.
12. * Licuala, Wurmb. Sp. about 45, Indo-Malayan region; New Guinea; North Australia.
13. * Livistona, R. Br. Sp. about 13, Indo-Malayan region; New Guinea; East Australia.
14. Erythea, Wats. Sp. 2, South California and Guadalupe Island.
15. * * Pritchardia, Seem. & Wendl. Sp. 5, Sandwich Islands.
16. * * Washingtonia, Wendl. Sp. 2, South California and Arizona.
17. Brahea, Mart. Sp. 2. Mexico; South Texas.
18. Crysophila, Bl. Sp. 1, Mexico.
19. * * Sabal, Adans. Sp. 7, from Venezuela to the Antilles and the South-Eastern States of North-America.
20. Serenæa, Hook. f. Sp. 1, Florida.
21. * * Copernicia, Mart. Sp. 9, America.
22. Teysmannia, Zoll. Sp. 1, Sumatra.

Tribe II. — Borassinæ.

3. *Borasseæ.*

23. Pholidocarpus, Bl. Sp. 5, Amboina; Timor, Borneo.
24. Medemia, P. Guil. de Wuertt. & Braun. Sp. about 4, East Africa
25. * Hyphæne, Gaertn. Sp. at least 40, Africa, India.
26. * * Latania, Comm. Sp. 3, Mascarene Islands and neighbouring coast of Africa.
27. * Borassus, L. Sp. 1, Tropical Africa; India, from Ceylon to the Sunda Islands.
28. * * Lodoicea, Labill. Sp. 1, Seychelles Islands.

Tribe III. — Lepidocaryinæ.

4. *Mauritieæ.*

29. Mauritia, L. f. Sp. 11, Northern Brazil; Guiana; West Indies.
30. Lepidocaryum, Mart. Sp. 7, Northern Brazil; Guiana.

5. *Metroxyleæ.*

31. * * Raphia, P. de B. Sp. 20, Tropical Africa; Madagascar; Tropical America.
32. Oncocalamus, Wendl. & Mann. Sp. 1, West Africa.
33. Ancistrophyllum, Hook. Sp. 4, West Africa.
34. Eremospatha, Wendl. & Mann. Sp. 8, West Africa.
35. Eugeissona, Griff. Sp. 6, Malay-Archipelago.
36. * * Metroxylon, Rottb. Sp. 9, Malay-Archipelago; New Guinea.
37. Pigafetta, Becc. Sp. 1. Malay-Archipelago; New Guinea.
38. * Zalacca, Reinw. Sp. 13, Assam; Malay-Archipelago.
39. * Korthalsia, Bl. Sp. 26, Malay-Archipelago; New Guinea.
40. Ceratolobus, Bl. Sp. 6 Sumatra; Java.
41. * Plectocomia, Mart. Sp. 12, Khasya Hills; Himalaya; Assam; Malay-Archipelago.

42. * Plectocomiopsis, Becc. Sp. 5, Malayan.
43. * Calamus, L. Sp. 256, Tropical and Sub-tropical Asia; Tropical West-Africa; Australia.
44. * Dæmonorhops, Bl. Sp. 91, tropical and Sub-tropical Asia.

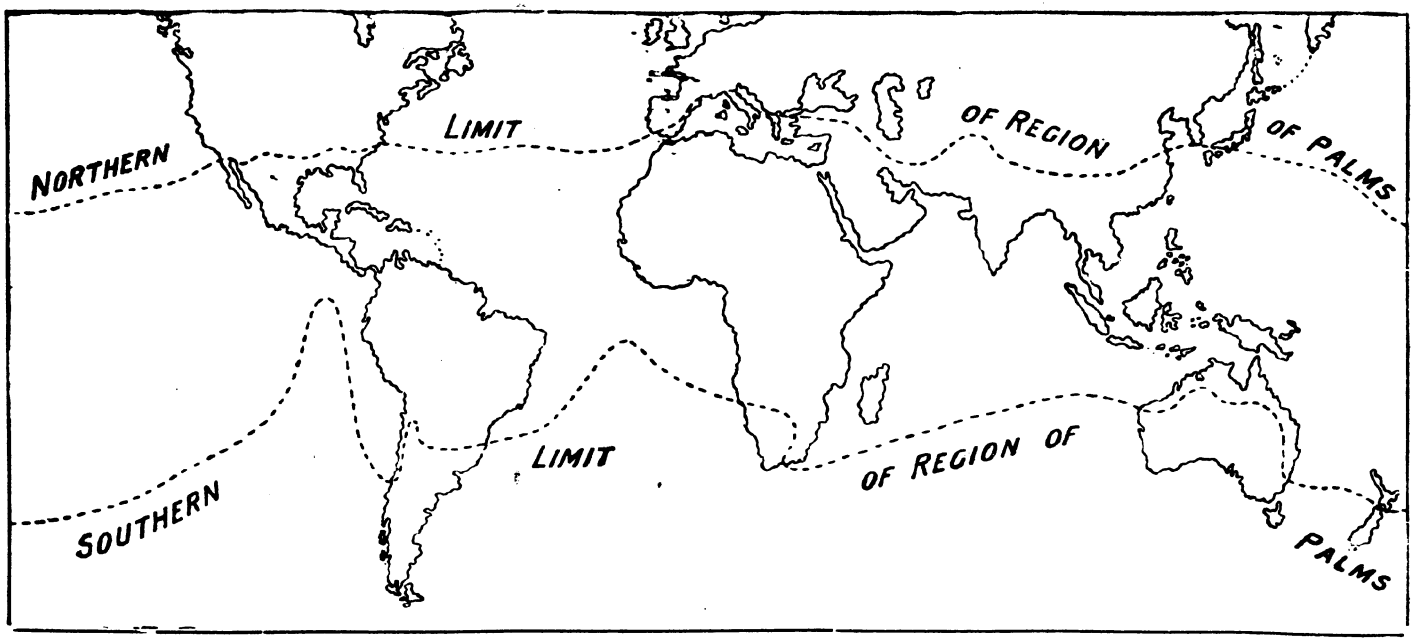
Tribe IV. — Ceroxylinæ.

6. Arecineæ.

45. * Caryota, L. Sp. about 10, Tropical Asia, Malay-Archipelago; Australia.
46. * Arenga, Labill. Sp. about 10, Tropical Asia; Malay-Archipelago; New Guinea; Australia.
47. * Didymosperma, W. & Dr. Sp. 8, East India; Malay-Archipelago.
48. * Wallichia, Roxb. Sp. 3, East India.
49. Orania, Sp. 5, Malay-Archipelago; Papua.
50. Podococcus, Wendl. & Mann. Sp. 1, West-Africa.
51. Sclerosperma, Wendl. & Mann. Sp. 1, West-Africa.
52. * Bentinckia, Berr. Sp. 2, Travancore; Nicobar Islands.
53. Manicaria, Gaertn. Sp. 1, Tropical America.
54. Leopoldinia, Mart. Sp. 4, Brazil.
55. Calyptronoma, Griseb. Sp. 4, Tropical America.
56. Geonoma, Willd. Sp. about 80, Tropical America.
57. Asterogyne, Wendl. Sp. about 2, Central America.
58. Calyptrogyne, Wendl. Sp. 3, Central America.
59. Welfia, Wendl. & Hook. Sp. 2, Central America.
60. Iriartea, R. & Pav. Sp. about 10, Tropical America.
61. Catoblastus, Wendl. Sp. 3, Columbia; West Brazil; Peru.
62. Wettinia, Pœpp. & Endl. Sp. 3, Andes.
63. Ceroxylon, H. B. Kth. Sp. 5, Andes.
64. Juania, Dr. Sp. 1, Juan Fernandez.
65. * * Chamædorea, Willd. Sp. about 60, Tropical America.
66. Morenia, R. & P. Sp. 5, Andes.
67. Kunthia, Humb. & Bonpl. Sp. 1, North-West Brazil; Columbia.
68. * * Hyophorbe, Gaertn. Sp. 3, Mascarene Islands.
69. Gaussia, Wendl. Sp. 1, Cuba.
70. Pseudophœnix, Wendl. & Dr. Sp. 1, South Florida.
71. Synechanthus, Wendl. Sp. 3, Central America; Columbia.
72. Reinhardtia, Liebm. Sp. 8, Central America; Mexico.
73. * * Dypsis, Noronh. Sp. 6, Madagascar.
74. Phloga, Hook. Sp. 1, Madagascar.
75. Hyospathe, Mart. Sp. 3, Tropical America.
76. Prestœa, Hook. Sp. 1, Trinidad.
77. * * Oreodoxa, Willd. Sp. 6, Tropical America.
78. Gigliolia, Becc. Sp. 2, Borneo.
79. * * Howea, Becc. Sp. about 3, Lord Howe's Island.
80. Linospadix, Wendl. & Dr. Sp. 6, New Guinea; east coast of Australia.
81. Iguanura, Bl. Sp. 10, from Malacca to Borneo.



Group of Palms in Peradeniya Gardens, Ceylon



MAP SHOWING THE LIMITS OF THE REGION OF PALMS.

82. Calyptrocalyx, Bl. Sp. 2, Moluccas; Australia.
83. Sommieria, Becc. Sp. 2, Papua-Archipelago.
84. Clinostigma, Wendl. Sp. 3, Samoa; Lord Howe's Island.
85. * * Heterospathe, Scheffer Sp. 1, Amboina.
86. Jessenia Karst. Sp. 3, South America.
87. Roscheria, Wendl. Sp. 1, Seychelles.
88. * * Nephrosperma, Balf. Sp. 1, Seychelles.
89. * * Verschaffeltia, Wendl. Sp. 1, Seychelles.
90. * * Phœnicophorium, Wendl. Sp. 1, Seychelles.
91. * * Deckenia, Wendl. Sp. 1, Seychelles.
92. * * Acanthophœnix, Wendl. Sp. about 3, Mascarene Islands.
93. * Oncosperma, Bl. Sp. 4, Tropical Asia.
94. Euterpe, Mart. Sp. about 10, Tropical America; West Indies.
95. Œnocarpus, Mart. Sp. 8, Tropical America.
96. Ptychandra, Scheff. Sp. 2, Moluccas.
97. Cyphokentia, Brongn. Sp. 10, New Caledonia. [Australia.
98. * * Hydriastele, Wendl. and Dr. Sp. 1, Tropical north-coast of
99. * * Kentia, Bel. Sp. 10, Moluccas; New Guinea; Lord Howe's Island; Norfolk Island; New Zealand; Chatham Islands.
100. Kentiopsis, Brongn. Sp. 2, New-Caledonia.
101. Veitchia, Wendl. Sp, 4, New Hebrides; Fiji Islands.
102. Drymophlœus, Zipp. Sp. 12, Malay-Archipelago; New Guinea; New-Caledonia? Australia?
103. * * Cyrtostachys, Bl. Sp. 2, Malay-Archipelago.
104. Ptychococcus, Becc. Sp. 3, New Guinea; Moluccas.
105. * * Ptychosperma, Labill. Sp. 13, Sunda Islands; Papua-Archipelago; Fiji Islands; North Australia.
106. * Loxococcus, Wendl. & Dr., Sp. 1, Ceylon.
107. * * Actinorhytis, Wendl. & Dr., Sp. 1, Malay-Archipelago.
108. Rhopaloblaste, Scheff. Sp. 2, Moluccas; New Guinea.
109. * Ptychoraphis, Becc. Sp. 3, Malayan.
110. * * Dictyosperma, Wendl. & Dr., Sp. 3, Mascarene Islands.
111. * * Archontophœnix, Wendl. & Dr., Sp. 3, Tropical and Subtropical East-Australia.
112. Nenga, Wendl. & Dr., Sp. about 11, from Malacca and the Sunda Islands to New Guinea.
113. Cyphophœnix, Wendl. & Hook., Sp. 2, New Caledonia.
114. Mischophlœus Scheff., Sp. 1, Ternate.
115. * Pinanga, Bl. Sp. about 40, India; Malay-Archipelago.
116. * Areca, L. Sp. 14, Tropical Asia; Malay-Archipelago; New-Guinea; Australia.

7. *Cocoineæ.*

117. Barcella, Trl. Sp. 1, Brazil.
118. * * Elæis, Jacq. Sp. 2, Tropical Africa and America.
119. Orbignya, Mart. Sp. 6, South America.
120. * * Attalea, H. B. Kth., Sp. 23, Tropical America.

121. * * Maximiliana, Karst. Sp. 3, Tropical Brazil; Guyana; Trinidad.
122. * Cocos, L. Sp. about 30, Tropical and Sub-tropical America.
123. Diplothemium, Mart. Sp. 5, Brazil.
124. * * Jubæa, Gay, Sp. 1, Chile, 31-35° S. Lat.
125. * * Martinezia, Kth. Sp. 7, Tropical America.
126. * * Acrocomia, Mart. Sp. 7, Tropical America; Brazil.
127. * * Astrocaryum, Mey., Sp. 29, Tropical America
128. * * Bactris, Jacq. Sp. 90, Tropical America.
129. Desmoncus, Mart., Sp. about 25, Tropical America.

Tribe V. Phytelephantinæ.

130. * * Phytelephas, R. & P. Sp. 3, Tropical America, between 9° N. Lat. and 8° S. Lat.
131. * Nipa, Thunb. Sp. 1, Tropical Asia; New Guinea; Australia.

Distribution of Palms in British India.

Roughly speaking about a hundred species have been described as being indigenous to British India and Ceylon; certainly a small number if compared with many regions in tropical America. Nearly all of them are comparatively unobtrusive, and if a traveller in India meets palms forming a conspicuous feature in the landscape of the plains, he may be sure that the trees are either Wild Date-Palms *(Phœnix sylvestris)* or Palmyra-Palms *(Borassus flabellifer)*, or, near the sea, Coco-nut Palms *(Cocos nucifera)*. The most majestic palm of India and easily distinguished by its stature, foliage and inflorescence, is the Talipot (*Corypha*), but it is exceedingly rare and confined to certain localities.

A short survey of the botanical regions of India, as laid down by Sir Joseph Hooker, will reveal some interesting facts regarding the distribution of Palms.

We begin with the Burmese region, which is richest in species, not only regarding its whole vegetation, but also as to its palm flora. According to Sir J. Hooker, the region is bounded on the north and north-east by the flanking mountains to the south of the Assam valley and China, on the east by China and Siam, on the west by Bengal and the Indian Ocean, and on the south by the State of Khedah in the Malay Peninsula. We include here also the Andaman and Nicobar Islands. Up to 70 species have been recorded from this region, of which,

according to our present knowledge of the neighbouring countries 28 are endemic.

We may divide this botanical region into four sub-regions. Northern, Western, Eastern, and Central, to which we shall add in the meantime, the two separate sub-regions of the Andaman and Nicobar Islands. Northern Burma extends for 500 miles in a north-eastern direction from the great bend of the Brahmaputra in Bengal to the Chinese Province of Yunnan. The range of mountains flanking the Assam valley on the south forms its northern boundary. It belongs politically to Assam and comprises the districts known as the Garo, Khasya, Jaintia, Nowgong, Naga, Patkai, and Manipur Hills. They rise, on the average, to 4,000 to 5,000 feet, a few peaks even above 10,000. Blanford's description of the climate of Shillong gives on the whole a fair idea of the meteorological condition of this sub-region. "This station is situated on a gently undulating table-land, 4,800 feet above the sea-level, immediately north of the culminating ridge of the Khasi hills, and about midway between the valley of Assam and the plains of Sylhet. . . On the average of the 4 years, 1869-1872 the mean temperature of Shillong was 62°, which is about the same as that of Constantinople, Barcelona, and Oran; in fact, of an average Mediterranean climate. In the warmest months, June to August, it is below 70°, and in April and May intermediate between the two, since in the Khasi Hills rain is so frequent in the spring months that the temperature does not rise to a maximum in May, and suffers no abatement when the monsoon rains set in in June. The lowest reading recorded was just above the freezing point; the average minimum of the 4 years 34°, and the mean temperature of December and January 51°. In December and January, the most serene months of the year, the mean difference of the early morning and afternoon temperatures is 19° or 20°. While in respect of temperature, the climate of Shillong much resembles that of places in the south of Europe, in the dampness of its atmosphere and its rainfall it is eminently tropical. In the driest month, March, the humidity is indeed only 59 per cent of saturation, but from July to October inclusive it ranges between 86 and 89, and from June to September, on an average eight-tenths or more of the sky is clouded. In April it rains on one day in three, in May on two days out of three, and in

the four succeeding months even more frequently. On the average of 18 years there have been 150 rainy days in the year. The average rainfall of the year hardly exceeds 85 inches."[1].

To this sub-region are exclusively confined the following species: *Areca nagensis, Pinanga griffithii, P. hookeriana, Didymosperma nana, D. gracilis* and *Plectocomia khasyana.* Of other species we find *Pinanga gracilis, Wallichia densiflora, Didymosperma nana, Caryota urens, Caryota obtusa, Phœnix rupicola, P. acaulis, P. humilis, Licuala peltata, Livistona jenkinsia, Trachycarpus martiana, Calamus erectus, C. flagellum, C. leptospadix, C. floribundus, C. acanthospathus, C. gracilis, Dœmonorops jenkinsianus, Zalacca secunda.*

Western Burma includes the humid strip of land between the sea and the crests of the Chittagong and Arakan Hills, and separated by the deltas of the Irrawaddy, Sittang, and other rivers, the coast of Tenasserim down to Mergui. The mean temperature of Chittagong is 77°. April and May are about equally hot, *viz.,* 81° and 82° and it remains nearly uniform from April to the end of September, the night temperature rising in the same measure as the day temperature falls, until the daily range is reduced by one-half, more or less. The highest temperature of the year occurs in April, or, more frequently in May, and varies between 91° and 99°. In the cool season the lowest temperature occurs as a rule in January, sometimes in February, and varies between 45° and 52°. The diurnal range of temperature in the drier seasons of the year does not exceed 23°. The humidity of the air averages 80, and in the driest month, either February or March, is as high as 70. At the height of the rains the humidity averages 87 per cent and upwards. The rainfall amounts on an average to 106 inches and the number of rainy days to 122. "The position and configuration of Arakan and Tenasserim on the west coast of the peninsula, with hill-ranges running parallel with the coast, expose them to the influence of the south-west monsoon of the Bay of Bengal, in the same manner and as fully as are the Konkan and Malabar to that of the Arabian Sea, and with a similar result, *viz.,* an excessive rainfall from June to September. In Arakan, however, this rainfall is more prolonged

[1] Blanford, Climates and Weather of India, p. 112.

than on the west coast of the Konkan in the same latitudes" (Blanford). Dense, evergreen forests cover this tract of country, Dipterocarps, Oaks, Bamboos, Orchids, Palms, and Ferns forming a conspicuous feature. In Chittagong occur *Wallichia densiflora, W. caryotoides, Calamus erectus, C. viminalis, C. tenuis, C. guruba, C. gracilis,* and *Dæmonorops jenkinsiannus,* in Tenasserim *Licuala longipes, L. speciosa, Calamus concinnus, C. feanus, C. nitidus, C. platyspathus, C. myrianthus, C. melanacanthus, C. palustris,* and *Plectocomia macrostachya.* Spread all over the sub-region, from Chittagong to Tenasserim, we find *Areca triandra, Pinanga gracilis, Caryota urens, Nipa fruticans* and *Calamus latifolia.* In Pegu the following species have been found:—*Pinanga herasticha* (endemic in Pegu), *P. hymenospatha* (endemic), *Wallichia disticha, Arenga saccharifera, Livistona speciosa, Calamus arborescens* (endemic), *C. longisetus, Zalacca beccarii, Plectocomiopsis paradoxus,* and others.

The sub-regions Eastern and Central Burma are little known, and no materials are at our disposal.

Of the Andaman Islands, only a few points have been explored by botanists, of which the chief is Port Blair. Barren Island, Narcondam and the Coco have been visited by Major Prain. The climate of these islands is almost equatorial in its uniformity, and in many respects similar to that of Tenasserim. They are hilly, the hills being for the most part only a few hundred feet in height, and covered with forests, which are typically Burmese. The vegetation of the interior hills, which reach 2,400 feet in height, is not known at all. The mean temperature of Port Blair is 80°. There is but little variation during the year; March and April are the warmest months, with a mean temperature of 82°, and a mean daily maximum of 92°. The average extreme range of temperature in the course of the year is only 26°. The diurnal range of temperature is as much as 14° or 15° in the driest months, February, March, and April. The mean humidity is 83 per cent of saturation. The monsoon sets in in May and the rainfall of that month is little less than that of June. The number of rainy days amounts to nearly half the days in the year, and during the summer monsoon there are only 5 or 7 rainless days in the month. A comparatively considerable number of palms have been recorded from the Andaman Islands: *Areca triandra, Pinanga nanii,*

Pinanga kuhlii, Caryota mitis, Phœnix paludosa, Corypha umbraculifera, Licuala peltata, L. spinosa, Calamus longisetus, C. viminalis, C. andamanicus, C. palustris, Dæmonorops manii (endemic), *D. kurzianus* (endemic), *Korthalsia laciniosa.*

The flora of the Nicobar Islands is even less known than that of the Andaman Islands. Climatically there is not a great difference between the two groups of Islands, and as to the vegetation of the Nicobars, we cannot decide at present whether it belongs to the Burmese or to the Malay Peninsular flora. Four species of palms are endemic in these Islands, *viz., Ptychoraphis augusta, Bentinckia nicobarica, Calamus nicobaricus* and *C. unifarius;* two species are endemic in the Nicobar and Andaman Islands: *Pinanga manii* and *Calamus andamanicus.*

Of the Eastern Himalayan region, only Sikkim is botanically well known. Its proximity to the Bay of Bengal and the direct exposure to the effects of the south-west monsoon make the district the most humid part of the whole range of the Himalayas. The total number of species of flowering plants is estimated to be about 4,000, of which only 20 are palms. Of these, only 2 inhabit the temperate zone (from 6,500-11,500 feet): a scandent Rattan (*Plectocomia himalaica*) and a Fan-Palm (*Trachycarpus martiana*). The rest belong to the tropical zone (1,000-6,500 feet). At the lowest elevations we find *Phœnix rupicola; Pinanga gracilis* and *Wallichia densiflora* reach as high as 3,000 feet, *Calamus erectus, C. flagellum* up to 4,000, *Caryota urens* up to 5,000, *Calamus acanthospadix* up to 6,000. Other palms belonging to the same zone are *Wallichia disticha, Licuala peltata, Calamus leptospadix* and *Dæmonorops jenkinsianus.*

The Western Himalayan region, which extends from Kumaon to Chitral has a much cooler and drier climate than the Eastern Himalaya. In consequence of it we find that 12 of the eastern species of palms have entirely disappeared in the western region. In the températe zone there occurs only one species (a *Trachycarpus*) which is confined to and local to Kumaon and Garhwal. Five others belong to the tropical zone of Kumaon, *viz., Phœnix sylvestris, P. acaulis, P. humilis, Wallichia densiflora* and *Calamus tenuis,* all of which have a very wide distribution.

In the Indus Plain region, including the Punjab, Sind, and Rajputana, west of the Aravalli range and Jumna river, Cutch, and Northern Gujarat, the only indigenous palms are *Phœnix*

sylvestris and *Nannorhops richieana*. The latter finds its north-eastern limit in the Salt range, and the south-western limit in Sind and Baluchistan.

The Gangetic Plain region stretches from the Aravalli hills and Jumna river to Bengal, including the Sundarbans, the plains of Assam and Sylhet, and the low country of Orissa north of the Mahanadi river. Hooker has divided this region into three sub-regions: an upper dry, a lower humid, and the Sundarbans. In the upper Gangetic plain, extending from Eastern Rajputana to a little above the bend of the Ganges at Rajmahal, we have a vegetation characteristic of a dry country. The trees are, for the most part, leafless during the hot season, and the herbaceous flora is burnt up. Two palms are cultivated in many parts (*Phœnix* and *Borassus*), and in thickets we find two species of Rattan (*Calamus*). The lower Gangetic plain or Bengal proper of the old maps is distinguished from the upper valley by its humidity and luxuriant evergreen vegetation. The Betel-nut palm, Phœnix, Palmyra, and Coconut are generally cultivated. Of indigenous palms the following are found, *Corypha elata*, *C. taliera*, *Calamus viminalis*, *C. tenuis*, *C. guruba*, *Dæmonorops jenkinsianus*. The Sundarbans consist of a great number of islets which, in great part, are covered with a dense evergreen forest of trees and shrubs with a rich undergrowth of climbers and herbaceous plants. *Nipa fruticans* is gregarious in the swamps and on river banks, whilst *Phœnix paludosa* is found in drier localities. There occur also two Rattans, a *Calamus* and a *Dæmonorops*, both common to Bengal.

The Malabar region (including Southern Guzarat, the southern half of Kathiawar, the Konkan, Kanara, Malabar Proper, Cochin, Travancore, and the Laccadive Islands) is for the greatest part a hilly or mountainous country and "is (except in the north) of excessive humidity, the mountains often rising abruptly from the flat coast of the Arabian Sea. Its abrupt western face is clothed with a luxuriant forest vegetation of Malayan type, except towards the north where, with the drier climate, the elements of the Deccan and Indus Plain Floras compete with that of Malabar. The eastern face slopes gradually into the elevated plateau of the Deccan, but it is varied by many spurs being thrown off which extend far to the eastward, often enclosing valleys with a Malabar Flora. One great break occurs

in the chain in lat. 11°N., where a transverse valley separates Travancore from the mountains north of it, and carries species characteristic of the Malabar Flora almost across the Peninsula" (Hooker).

To this region, including the Nilgiri Hills, belong over 20 species of palms. *Pinanga dicksonii, Bentinckia coddapanna, Calamus rheedii, C. huegelianus, C. brandisii, C. gamblei* are endemic. Of other palms we mention: *Phœnix sylvestris, P. robusta, P. acaulis, P. humilis, Caryota urens, Calamus pseudotenuis, P. thwaitesii, Corypha umbraculifera. Areca catechu, Borassus flabellifer* and *Cocos nucifera* are widely cultivated.

The Deccan region comprises the whole comparatively dry elevated tableland of the peninsula east of Malabar and south of the Gangetic and Indus plains. The Coromandel coast extending from Orissa to Tinnevelly may be considered as a sub-region. Deciduous forests form the most conspicuous feature of the Deccan plateau. Comparatively evergreen ones are found on the coasts and slopes with an eastern aspect. Of palms, there occur *Phœnix sylvestris, P. robusta, P. acaulis, P. humilis, Calamus viminalis, C. pseudotenuis, C. rotang, Borassus flabellifer. Phœnix pusilla* forms impenetrable thickets in sandy soils near the sea.

The Ceylon region presents, on the one hand, a close affinity to the vegetation of Malabar and the Deccan, on the other it differs from the Malabar flora in having many more Malayan types. Of endemic species 780 have been reported, and of these eleven are palms: *Areca concinna, Loxococcus rupicola, Oncosperma fasciculata, Phœnix zeylanica, Calamus rivalis, C. pachystemonus, C. digitatus, C. radiatus, C. zeylanicus, C. ovoideus.* The most conspicuous palm in Ceylon is *Corypha umbraculifera; Nipa fruticans* is rare. Other indigenous palms are *Phœnix pusilla, C. thwaitesii, C. pseudotenuis, C. delicatulus, C. rotang.*

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Blanco, 1780-1845.
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Mann, 1868.
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Pancher (Panch.).
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Persoon (Pers.), 1770-1836.
Plumier (Plum.), 1646-1706.
Poiret (Poir.), 1755-1834.

Reichenbach fil. (Rchbch. f.).
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Royle, 1799-1855.
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Smith (Sm.), 1785-1816.
Solander (Soland.), 1136-1782.
Sprengel (Spreng. or Sprgl.), 1766-1833.
Spruce.
Steudel (Steud.), 1784-1856.
Swartz (Sw.), 1760-1818.

Tejsman (Tejsm.).
Thunberg (Thbg. or Thunb.), 1743-1822.
Thwaites (Thwait.), 1882.
Tournefort (Tourn.), 1656-1708.
Trimen.

Vahl, 1749-1804.
Van Houtte, 1810-1876.
Veitch (J. Veitch), 1869.
Verschaffelt, (Versch.), 1825-1886.

Wallace.
Wallich (Wall.), 1787-1854.
Walpers (Walp.), 1816-1853.
Walter (Walt.), 1740-1821.
Wendland (Wendl.).
Wight, 1796-1872.
Wildenow (W.), 1765-1812.
Wurmb.
Wuerttemberg (Prinz. G. v. Wuertt.).

Zippelius (Zipp.), 1796-1828.
Zollinger (Zoll.), 1818-1859.

I. CORYPHINÆ

Spadix loosely branched, often a prolix panicle. Flowers diclinous, polygamous or hermaphrodite, single or in long rows flowering from above; carpels 3 (*Thrinax 1*), free or loosely united, always separating after fertilisation and developing into 1-3 smooth berries. Fan or feather leaves; leaflets induplicate.

1. PHŒNICEÆ.

Spadix surrounded by a large complete spathe, remaining closed up to the time of pollination. Flowers diœcious, dimorphic. Ovary of 3 free carpels, one only ripening. Seed ventrally grooved; embryo usually dorsal. Leaves imparipinnate; leaflets with induplicate sides.

DISTRIBUTION.—The whole of Africa (except the palmless regions), the South-African floral region and the East-African islands); Arabia; Western Asia in the region of the Euphrates and Tigris, through India to the Sunda Islands and Cochin-China.

The only genus is:

1. *PHŒNIX*, L. GEN. NAT. 1224.

(From the Greek "Phœnix," which was originally the name for "purple colour;" later on the name was given to the Date Palm on account of the colour of the dates, which is somewhat between yellow and purple red.)

Mart. Hist. Nat. Palm. III. 257, 320, t. 120, 124, 136, 164.—Gærtn. Fruct. I. t. 9.—Lam. III. t. 893.—Roxb. Corom. Pl. I. t. 74; III. t. 273.—Griff. Palms Brit. Ind. 136, t. 128 A, 129 A, B.—Jacq. Fragm. t. 24.—Kunth Enum. Pl. III., 254.—Miq. Fl. Ind. Bat. III., 62.—T. Anders. Journ. Lin. Soc. XI, 13.—Drude Bot. Zeitg. 1877, 638, t. VI, fig. 27-33.—Benth. & Hook. Gen. Pl. III, II., 921, 80.—Trim. Journ. of Bot. 1885, XXIII, No. 273, p. 266.

Tall trees or low shrubs, the entire stem of the upper portion only closely covered by the more or less rhomboid bases of the petioles; stems occasionally branched. The first leaf of the seedling, and sometimes the first leaf of root-suckers is lanceolate, entire. Leaves pinnate; leaflets entire, linear, folded longitudinally and attached obliquely with their folded

base to the common woody petiole, the lowest pinnæ usually transformed into spines; no midrib, but a slender nerve on either side of the fold; nerves longitudinal, parallel, stout and slender, the slender nerves often obscure; transverse veinlets present, but usually only visible under the microscope in thin sections, cut parallel with the surface of the leaf. In the majority of species the leaflets in the lower portion of the petiole stand in fascicles of 4 or 6, 2 or 3 on each side of the petiole, while the upper leaflets are usually alternate or opposite; common petiole semiterete or flat, often widening at the base into a sheath, which frequently expands into a mass of tough, reticulate fibres. Flowers diœcious, small, yellowish, coriaceous, sessile on the bends of long, glabrous, undulating spikelets, usually supported by 1 or 2 minute, subulate, or triangular bracts, the female flowers often approximate in pairs. The spikelets are inserted in horizontal or oblique lines on both sides of a flat, woody peduncle. Male flowers: Sepals 3, connate in a cupular 3-toothed calyx. Petals 3, obliquely ovate, valvate. Stamens 6; filaments short, subulate; anthers erect, dorsifixed; pistillode minute or absent. Female flowers: Sepals 3, connate in a globose, accrescent calyx. Petals 3, rounded, imbricate; staminodes 6, free or connate in a 6-toothed cup. Carpels 3, free; ovules erect; stigmas sessile, hooked. Peduncle often lengthening after flowering. Fruit a single, oblong, 1-seeded berry, with a terminal stigma, a fleshy pericarp, and a membranous endocarp; seed oblong, ventrally grooved; albumen uniform or subruminate; embryo small.

Species about 12.—Africa, Asia.

Sir Joseph Hooker calls his attempt at diagnosing the Indian species of *Phœnix* tentative and says that it awaits much further knowledge of the living plants before it can be accepted as trustworthy. The same applies to the African species whose classification and distribution is still subject to discussion in spite of the investigations of Schweinfurth, Beccari, Engler, and Drude.[1]

[1] Those who wish to get an insight into the difficulties of the Phœnix-question are referred to the following authors:—

Martius, Historia Naturalis Palmarum, vol. III.

Jacquin, Fragmenta botanica 1809, p. 27.

CULTIVATION IN EUROPE.—All the species are stove or greenhouse palms; they are readily raised from imported seeds, sown in sandy soil, in a mild hotbed. When the seedlings have reached a sufficient size, they are potted off singly into small pots with the same kind of soil in which the seeds were sown. Later on, good turfy loam will be better. In the South of France, many of the species are largely grown in the open air, to supply the demand for well grown specimens for the decoration of apartments in Paris and other places. The method adopted is this: "The plants are taken up, the soil shaken from the roots, the palms packed in bundles, and forwarded to Paris, where each one is firmly placed in as small a pot as possible; they are then plunged in a mild hotbed in a warm house which is kept shaded and syringed until new roots have formed, when shading is gradually removed, and the plants hardened off. By these means, much better specimens are more rapidly and cheaply obtained than would be possible under a system of pot-culture from the seedling stage onwards." (Nich. Dict. of Gard.)

* INDIGENOUS SPECIES.

1. **Phœnix sylvestris**, Roxb. Hort. Beng. 73; Fl. Ind. III. 787; Mart. Hist. Nat. Palm. III. 276 (excl. syn. Linn. et Kæmpf.) 326, t. 136. Kunth Enum. III. 255; Wall. Cat. 8602; Griff. in Calc. Journ. Nat. Hist. V. 350; Palms Brit. Ind. 141, t. 228, A; Brandis For. Fl. 554; Ind. Trees 645. Kurz For. Fl. II. 535; Becc. Males. III. 347, 364, t. 43, f. 3; Hook. Fl. Brit. Ind. VI. 425; Cooke, Fl. Bomb. Pres. II. 801.—*Elate sylvestris*, L. Spec. Pl. 1189 (partim).—*Katu Pindel*, Ham. in Trans. Linn. Soc. XV; 86.—Rheede Hort. Mal. III. t. 22, 25.

NAMES.—Wild Date Palm, Date-sugar Palm; Sendhi, Kejur, Khajur, Khaji, Salma, Thalma, Thakil, *(Hind.)*; Kajar, Kejur, *(Beng.)*;

Kirk, On the Palms of Eastern Tropical Africa, in the Journal of the Linn. Soc., London IX (1865).

Schweinfurth, Im Herzen von Africa.

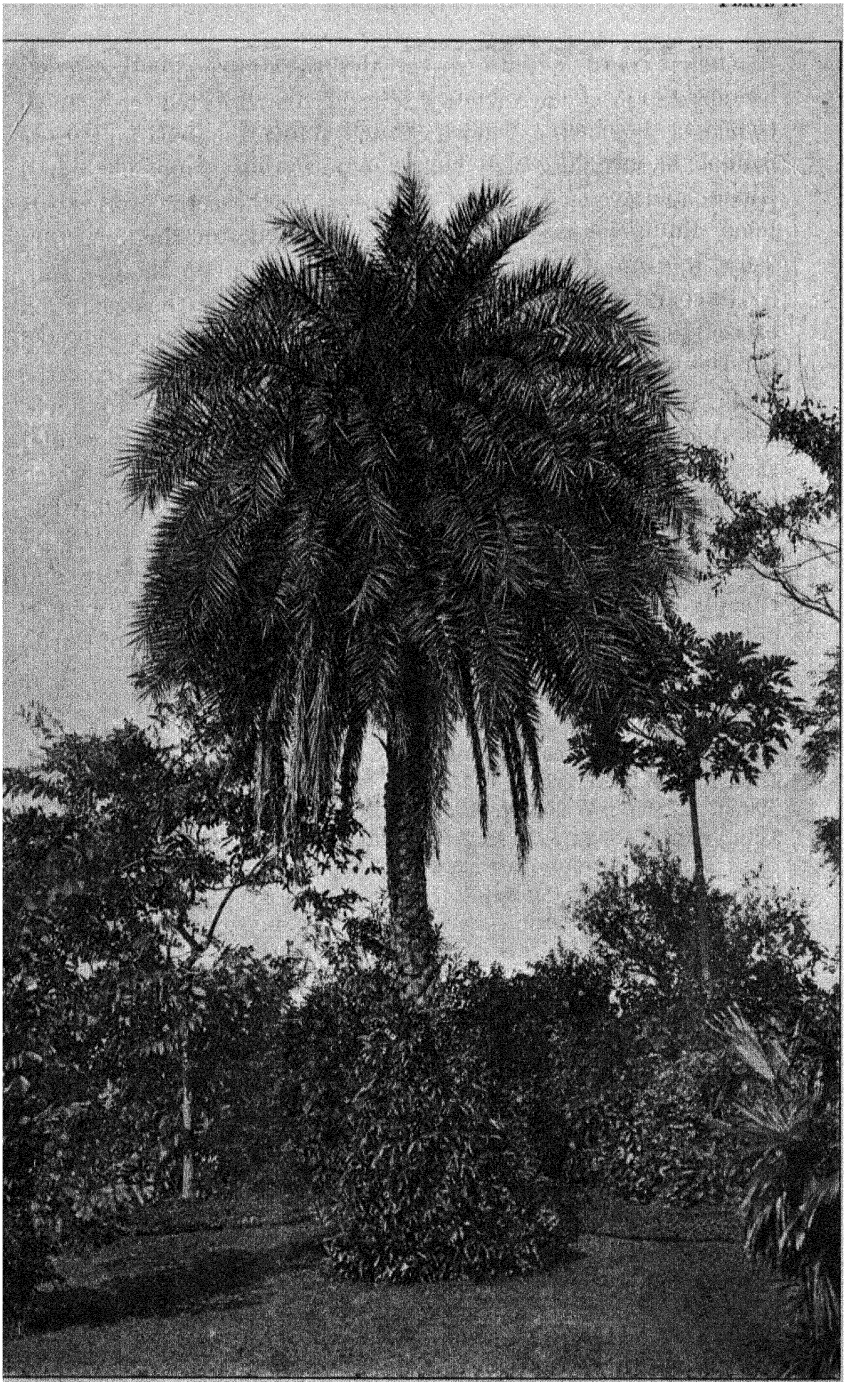
Beccari, Mitteilungen über die Colonia Eritrea, in "Verhandl. Ges. für Erdkunde" (1892), p. 347.

Engler, Hochgebirgsflora des tropischen Africa in Berliner Akad., Physik. Abt. II. 153.

Beccarri, Malesia, vol. III. 345 ff.

Drude, Die Palmenflora des tropischen Africa in Engler's Bot. Jahrb. vol. XXI (1895).

Drude, Palmæ (echte Palmen) in Nat. Pflanzenf. II. 3.



Phœnix sylvestris, Roxb.

Khejuri, (*Uriya*); Khajur, (*Kol.*); Khijur, (*Santal*); Sindi, (*Gond*); Khajur, Khaji, (*Panj.*); Seindi, (*Berar*); Sendi, Khajura, Khajuri, (*Bomb.*); Boichand, Sendri, Shindi (*Mar.*); Kharak, (*Guz.*); Sandole-ka-nar, (*Dec.*); Itchumpannay, Periaitcham, Itcham-nar, Itham pannay, (*Tam.*); Ita, Pedda-ita, Itanara, Ishan-chedi, (*Tel.*); Ichal, Kullu, Ichalu mara, (*Kan.*); Khurjjuri, Kharjura, Madhukshir, (*Sans.*).

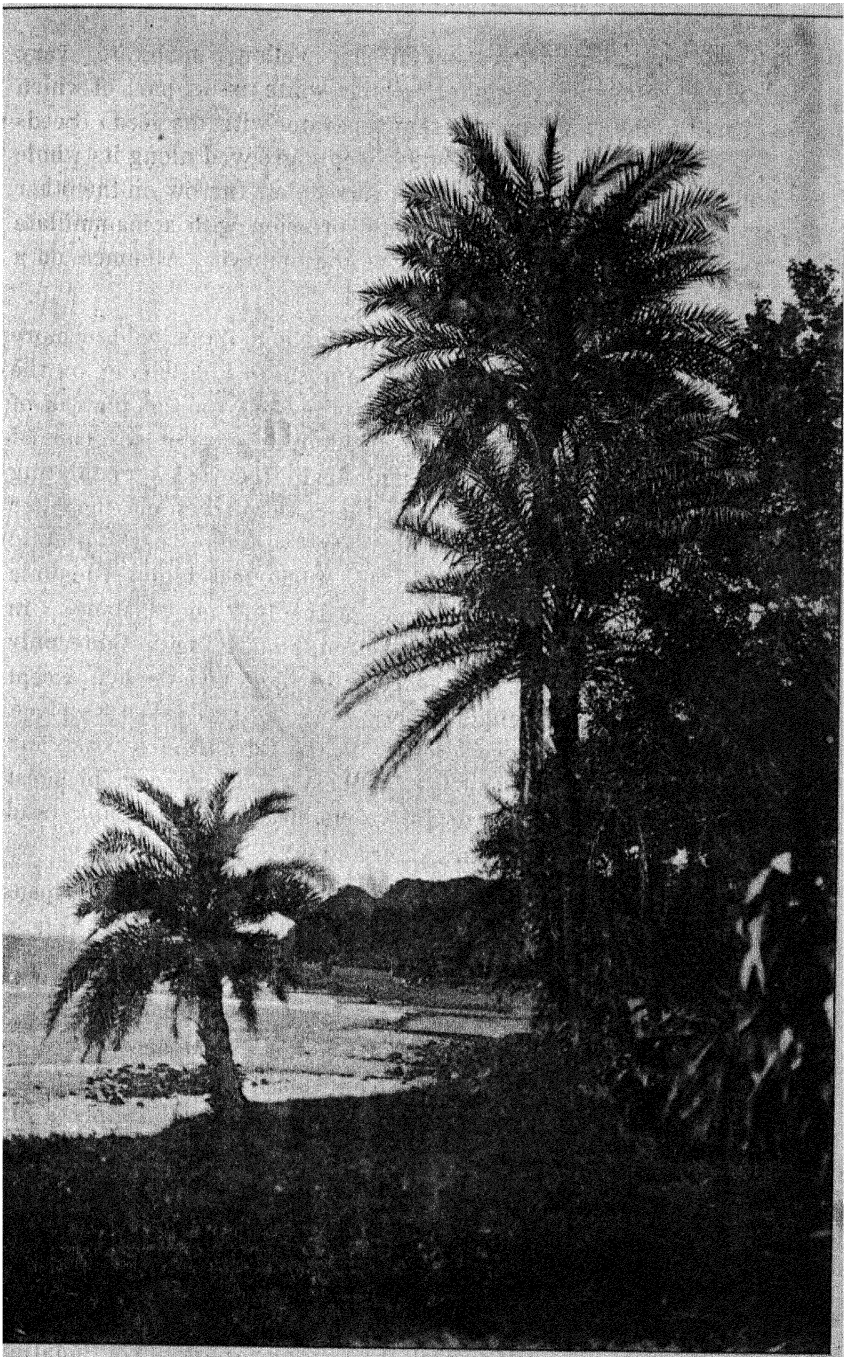
DESCRIPTION.—A very graceful palm, when not injured by extracting toddy, 30-50 feet high. Trunk rough from the persistent bases of the leaf-stalks. Crown hemispherical, very large and thick, leaves 10-15 feet long, greyish-green, quite glabrous, pinnate; petioles compressed only towards the apex, at the base bearing a few channelled triangular short spines reaching 4 inches. Pinnules very numerous, densely fascicled, 6-18 by ¾-1 inch long, glaucous, rigid, ensiform, conduplicate at the base, then canaliculate, subulately acuminated, almost spinous pointed, 2-4—farious, some intermediately spreading, others crossing these above and below in an ascending direction. Male flowers white, scented; spadix 2-3 feet long, erect; peduncle highly compressed. Spathes of about the same length, very coriaceous, almost woody, scurfy, separating into two boat-shaped valves. Spikes very numerous towards the apex of the peduncle, especially on its anterior face, generally in fascicles and simple, 4-6 inches long, slender, flexuose. Flowers ¼-⅓ inch long, very numerous, angular, oblique. Calyx cup-shaped, with 3 short rounded teeth. Petals three or four times longer than the sepals, concave, warty on the outside, on the inside deeply ridged and furrowed. Filaments scarcely any, or very short, free. Anthers linear, adnate, shorter than the petals. Female flowers: Spadix and spathe much the same as in the male. Spikes arranged in distinct groups, 1-1½ foot long, the lower 4-6 inches not bearing any flowers, flexuose. Flowers distant, roundish. Calyx cup-shaped, obsoletely 3-toothed. Petals 3, very broad, convolutely imbricate, having a small opening at the apex. Staminodes 3-4. Carpels 3, free, erect; ovules solitary; style recurved, inwardly papillose. Fruiting spadix 3 feet long, nodding at the apex from the weight of the fruit, much compressed, of a golden orange colour. Fruit scattered on long pendulous similarly coloured spikes, 1-1¼ inch long, oblong-ellipsoid, orange-yellow, with a terminal stigma, surrounded at the base

by the perianth. Pericarp fleshy, yellow, moderate, very astringent, lined by irregular cellular white tissue, part of which adheres to the thin envelope that separates with the seed. Seeds ⅔ inch long, rounded at the ends, deeply grooved along its whole length on one side, with a slight incomplete furrow on the other side, in the centre of which is a depression with a mammillate fundus, indicating the position of the embryo. Albumen on a transverse section horse-shoe-shaped.

HABITAT.—Tolerably common throughout India, wild or more often cultivated. Forms extensive forests in Rohilkhand, on the low ground along the Ramganga river, and on the plateau of Mysore, between Shimoga and Tumkur, in moister stretches of low ground which intersect and drain the rocky undulating granite hills. Not uncommon in the Siwalik tract and the outer Himalaya, often associated with *Pinus longifolia,* reaching up to 5,000 feet in Kumaon, with stems 40-50 feet high. Ghiaunla in Gharwal at 3,500 feet. Banks of the Bias above Mandi. In the Jamu hills at 2,000 feet elevation. Salt range. Commonly planted and self-sown in most parts of India and Ceylon, except in Sind and South Punjab, where *P. dactylifera* takes its place. Most abundant in Bengal, Behar, on the Coromandel Coast, and in Guzerat. In the Bombay Presidency it is common in moist ground throughout the dry districts, usually along banks and in the beds of streams and watercourses.

FLOWERS at the beginning of the hot season.—Fruit ripens in September and October.

USES.—In many localities, especially in Jessore and other districts of Bengal, this species is of considerable importance, owing to the extensive use of its sap in making sugar. According to Sir George Watt, there were in 1889, 168,262 acres of this palm under cultivation connected with the sugar supply. Sir James Westland has given a full account of the process of tapping the trees and of the manufacture of sugar from the crude sap in his "Report on the District of Jessore, 1774." When the tree is ripe the process of tapping begins, and it is continued each year thereafter. There are in the Date-palm two series or stories as it were, of leaves; the crown leaves, which rise straight out from the top of the trunk, being, so to speak, a continuation of it; and the lateral leaves, which spring out of the side of the



Group of Wild Date Palms *(Phœnix sylvestris).*

top part of the trunk. When the rainy season has completely passed, and there is no more fear of rain, the cultivator cuts off the lateral leaves for one-half of the circumference, and thus leaves bare a surface measuring about 10 or 12 inches each way. This surface is at first a brilliant white, but becomes by exposure quite brown, and puts on the appearance of coarse matting. The surface thus laid bare is not the woody fibre of the tree, but is a bark formed of many thin layers, and it is these layers which thus change their colour and texture.

"After the tree has remained for a few days thus exposed, the tapping is performed by making a cut into this exposed surface, in the shape of a very broad V, about three inches across and a quarter or half inch deep. Then the surface inside the angle of the V is cut down, so that a triangular surface is cut into the tree. From this surface exudation of the sap takes place, and caught by the sides of the V, it runs down to the angle where a bamboo of the size of a lead pencil is inserted in the tree to catch the dropping sap and carry it out as by a spout.

"The tapping is arranged, throughout the season, by periods of six days each. On the first evening a cut is made as just described, and the juice is allowed to run during the night. The juice so flowing is the strongest and best, and is called jiran juice. In the morning the juice collected in a pot hanging beneath the bamboo spout is removed, and the heat of the sun causes the exuding juice to ferment over and shut up the pores in the tree. So in the evening the new cut is made, not nearly so deep as the last, but rather a mere paring, and for the second night the juice is allowed to run. This juice is termed do-kat and is not quite so abundant or so good as the jiran. The third night no new cutting is made, but the exuding surface is merely made quite clean, and the juice which then runs is called jarra. It is still less abundant and less rich than the do-kat, and towards the end of the season, when it is getting hot, it is unfit even for sugar manufacture, the gur (molasses) made from it being sold simply as "droppings." These three nights are the periods of activity in the tree, and after these three it is allowed to remain for three nights at rest, when the same process again begins. Of course, every tree in the same grove does not run in the same cycle, some are at their first,

some at their second night, and so on; and thus the owner is always busy.

"Since every sixth day a new cut is made over the previous one it follows that the tree gets more and more hewed into as the season progresses, and towards the end of the season the exuding surface may be, and often is, as much as four inches below the surface above and below. The cuts are during the whole of one season made about the same place, but in alternate seasons alternate sides of the tree are used for the tapping; and as each season's cutting is thus above the previous season's and on the opposite side, the stem of the tree has a curious zigzag appearance. The age of a tree can of course be at once counted up by enumerating the notches and adding six or seven, the number of years passed before the first year's notch. I have counted more than forty notches on a tree, but one rarely sees them so old as that and when they are forty-six years old they are worth little as produce-bearing trees. It is somewhat remarkable that the notches are almost always on the east and west sides of the tree and very rarely on the north and south sides; also, the first notch appears to be made in by far the majority of instances on the east side.

"As to the produce of one tree, one may expect from a good tree a regular average of five seers per night (excluding the quiescent nights). The colder and clearer the weather, the more copious and rich the produce. In the beginning of November tapping has begun. In December and January the juice flows best, beginning sometimes as early as 3 p. m., and dwindles away as the warm days of March come. If the cultivator begins too early, or carries on too late, he will lose in quality and quantity as much as he will gain by extending the tapping season.

"The next process is the boiling, and this every rayat does for himself, and usually within the limits of the grove. Without boiling, the juice speedily ferments and becomes useless: but once boiled down into gur, it may be kept for very long periods. The juice, which was at first brilliant and limpid, becomes now a dark brown, half-viscid, half-solid mass, and when it is still warm, it is easily poured from the boiling pan into the earthenware pots in which it is ordinarily kept. As it takes from seven to ten seers of juice to produce one seer of gur or molasses we can calculate the amount of gur which one ordinarily good

tree can produce in a season. We may count four and a half months for the tapping season, or about sixty-seven tapping nights. These, at five seers each, produce 335 seers of juice, which will give about forty seers, or one maund of gur, the value of which, at present rates, is from Rs. 2 to Rs. 2-4-0."

After the juice is boiled down into gur it is then sold to the sugar-refiners and by them is manufactured in various ways into different grades of sugar. The best known is called dhulva, a soft, moist, powdery sugar, used largely in the manufacture of native sweetmeats. Another kind, termed pucka, is a purer, granular, and more expensive sugar. The waste molasses, collected during the preparation of sugar, is called chitiya gur; when boiled for a longer time, it becomes a black, sticky treacle, which is largely utilised for mixing with the tobacco for the native hookah, and also for making cheap sweets. A small proportion of the juice is consumed as a drink either fermented or unfermented, under the name of tari, or is converted into vinegar.

Sir George Watt mentions that in recent years an endeavour has been made to promote the manufacture of sugar in the Central Provinces; a company has already been formed under the name of the "Khandwa Sugar Manufacturing Company."

From the leaves bags, basket-work, brooms, fans, etc., are made. The footstalks, after being beaten, are converted into ropes for drawing water from wells. The fibres are plentiful, soft, bleach well, and are very well adapted for the use of paper-makers.

From the tree a gum is obtained, of which very little is known. The fruit is of an inferior kind and only eaten by the poorer classes, or used as medicine. Pounded and mixed with almonds, quince seeds, pistachio nuts, spices, and sugar it forms a restorative. A paste formed of the kernels and the root of *Achyranthes aspera,* is eaten with betel leaves as a remedy for ague.

Cultivation in India.—"The soil required for this palm is rich alluvial or black with moving water at about 10 feet from the surface or with irrigation and thorough underground drainage from a bed of gravel not less than 6 feet below the surface. The seeds should be sown when quite fresh, without removing the pulp, on a bed of rich loam dressed heavily with leaf-mould.

When 6 inches high the little plants should be put out 18 inches apart in carefully prepared nursery beds, and grown carefully till 4 feet high, then transplanted to their permanent quarters, which may be in lines 30 feet apart, with 20 feet between each tree in the line. The ground should then be kept under irrigated crops for two years to get the young trees established." (Woodrow).

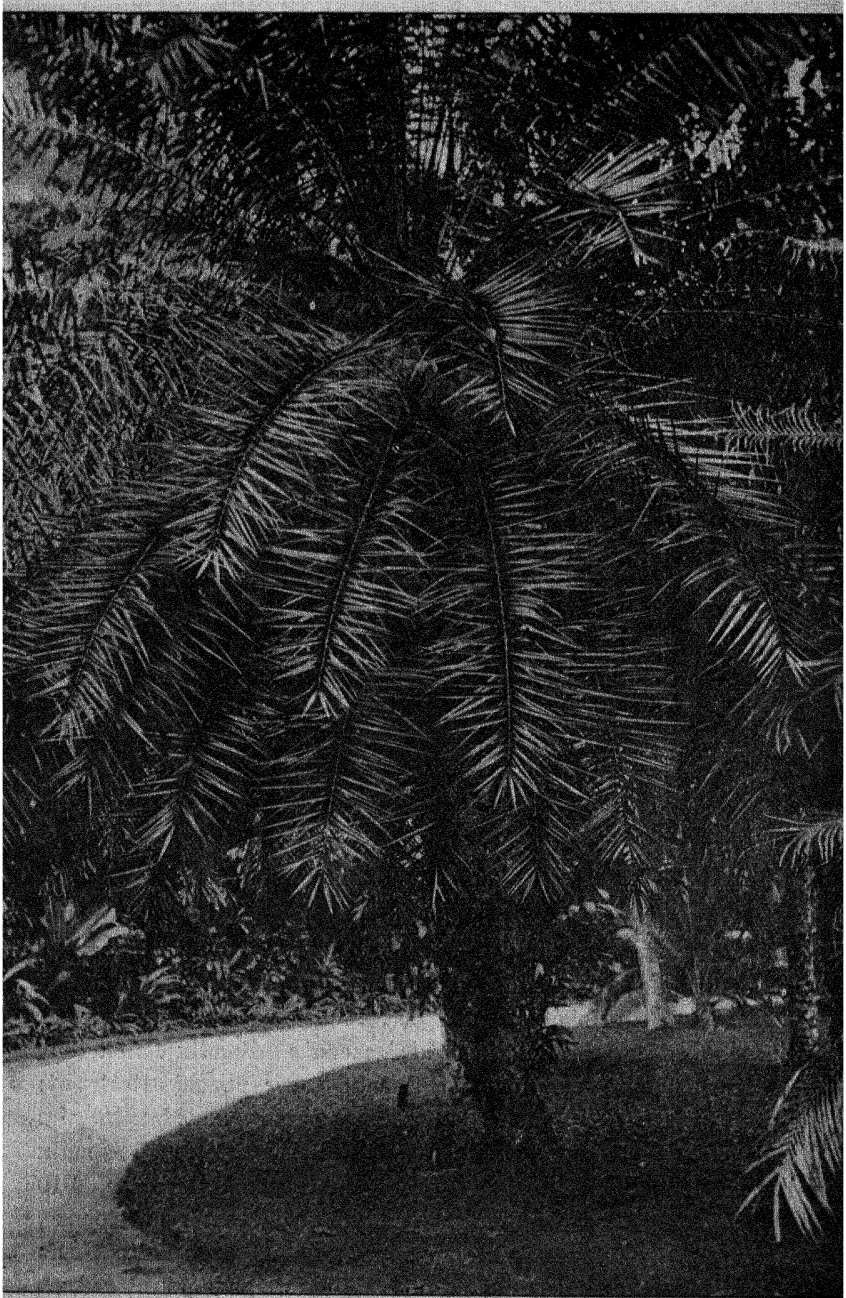
ILLUSTRATION.—Plate II. The photograph, supplied by Mr. Phipson, shows a fine specimen of *Phœnix sylvestris* growing on the Hanging Gardens, Malabar Hill, Bombay. The dense, almost spherical crown, with the gracefully bending leaves, at once distinguishes this species from the real Date Palm (*P. dactylifera*). The lower part of the stem is covered with ferns and other vegetation. As the stem, however, is the same throughout, *i. e.* covered by the persistent bases of the leaf-stalks, the imagination can easily supply the hidden part of the trunk.

Plate III. The photograph shows a small group of Wild Date Palms with their natural surroundings. It is a scene on the seashore on the East side of Malabar Hill, Bombay, characteristic of many parts of India.

2. **Phœnix zeylanica,** Trimen in Journ. Bot. XXIII. (1885) 267; Hook. Fl. Brit. Ind. VI. 425; Trimen Fl. Ceylon IV. 326. — *Phœnix zeylanica,* Hort,; Hook. f. in Kew Report, 1882, 63. — *Phœnix sylvestris,* Thw. Enum. 329 (*non*-Roxb.). — *Elate sylvestris,* L. Sp. Pl. 1189 (for the most part). — *Phœnix pusilla,* Becc. Malesia, III. 408 (*non*-Gærtn.).

NAME:—Ceylon Date Palm; Indi (in Ceylon).

DESCRIPTION:—Stem 8-20 feet high, rarely much shorter. Leaves rather short; leaflets very many, quadrifariously inserted, subequidistant, 7-10 inches long, linear-lanceolate, pungent, coriaceous, concave, spreading at right angles, bright green. Spathe 8-14 inches long, keel furfuraceous. Spadix 1 foot long or more, young scopiform; peduncle stout; rhachis flattened; branches of male 4-6 inches long, of female longer. Male flowers $\frac{1}{6}$ inch long; stamens 6; anthers subsessile, linear; female spadix long peduncled; peduncle 1 inch broad, flattened, branches 6-10 inches long, divergent in fruit. Female flowers scattered, globose, $\frac{1}{8}$ inch in diameter, calyx cup-shaped; petals orbicular. Fruit $\frac{1}{2}$ inch by $\frac{1}{4}$ inch in diameter, obovoid-oblong, apiculate, red, at length violet-blue; seed nearly as long, with the groove dilating into a canal of various forms.



Phœnix zeylanica, Trimen.



Phœnix rupicola, T. Anders.

HABITAT.—Ceylon, moist low country, especially on the Southern Coast, very common.

FLOWERS in February.

USES:—Mats and boxes are made of the leaves. The sweet pulp of the fruit is eaten.

ILLUSTRATION.—Plate IV. The photograph, supplied by Mr. Macmillan, shows a specimen of *Phœnix zeylanica*. The leaves are comparatively short and do not exhibit the graceful curves of the Wild Date Palm. The stem is very rough, being covered throughout with the bases of the fallen leaves.

3. **Phœnix rupicola**, T. Anders, in Journ. Linn. Soc. XI. 13, 1869. Beec. Males. III. 348, 395.—*P. Andersoni*, Cat. Hort. Calc. n. 119. (1886—7.); Gard. Chron. 1877, II. 45, fig. 4; Hook f. Flora Brit. Ind. VI. 425.—*Phœnicoidea*, Griff. Journals, 46.

DESCRIPTION.—Trunk solitary, slender, naked, 15-20 feet high, 8 inches in diameter. Leaves 10 feet long; leaflets 1½ foot long, bifarious, not fascicled, flaccid, bright green; petiole compressed. Spadices elongated, much compressed; female spadix 3-4 feet long, peduncled, with a few fascicled spikes on the acute margins near the apex; spathe 1 foot long. Fruit oblong, ¾ inch long, shining, yellow. Seed ½-¾ inch long. This species can easily be distinguished by the numerous bright green decurved leaflets being all in one plane. This is the handsomest species in the genus.

HABITAT.—Sikkim Himalaya, from 400-1,400 feet; Assam; Mishmi Hills. Generally growing on rocks.

USES.—The interior of the stem is, according to Gamble, often eaten by the Lepchas.

ILLUSTRATION.—Plate V. The Photograph, supplied by Mr. Macmillan, shows a young specimen of *Phœnix rupicola*. The very short stem appears to be bulb-like on account of the rather long remains of the petioles covering up the real stem. The wide spreading, arching leaves with the narrow leaflets situated in one plane distinguish this species at once. Some beautiful examples of this Palm may be seen growing in the open in the Sibpur Botanic Gardens, Calcutta, and also at Gwalior, C. I., Agra and many other places in India, where they bear seed freely.

4. **Phœnix acaulis**, Buch. ex Roxb. Fl. Ind. III. 783; Hort. Beng. 73; Ham. in Trans. Linn. Soc. XV. 87; Kunth Enum. III. 257; Griff. in Calc. Journ. Nat. Hist. V. 345; Palms Brit. Ind. 137, var. *melanacarpa* Il. cc. 346, 138, t. 228; Mart. Hist. Nat. Palm. III. 274, 321; Dalz. and Gibs. Bomb. Fl. 278; Brandis For. Fl. 555; Ind. Trees 645; Beec. Males. III. 348, 397, t. 44, IV. f. 51-57; Wall. Cat. 8602 C.; Cooke Fl. Bomb. Pres. II. 802.

NAMES.—Dwarf Date Palm; Khajuri, Pind Khajur, Jangly Khajur (*Hind.*); Schap (*Lepcha*); Chindi, Hindi, Jhari, Sindi (*Gond.*); Juno (*Kurku*); Pinn Khajur (*Panj.*); Boichind (*Mar.*); Yita (*Tel.*); Thin-boung (*Burm.*).

DESCRIPTION.—An almost stemless palm; stem bulbiferous, 6-10 inches in diameter; densely clothed with the sheaths and bases of the petioles, the ends of which are often bristly with the protruding hard fibro-vascular bundles. Leaves 2-6 feet long; leaflets nearly opposite, fasciculate, 10-20 by $\frac{1}{3}$-$\frac{3}{4}$ inch, stiff, the base thickened and decurrent; marginal nerve very strong; petioles one foot or more long, with spines 2-6 inches long. Spathes axillary, solitary, one-valved, about 6 inches long, with their bases rather below the surface of the ground, generally splitting into two portions down the middle on each side. Spadix 6-10 inches long, compressed, rather longer than the spathe, composed of many simple short erect flexuose branches; these are smooth and of a pale yellow. Male flowers $\frac{1}{4}$-$\frac{1}{3}$ inch long, alternate, solitary, sessile, pale yellow. Calyx cupular, 3-toothed; petals 3, obliquely lanceolate, acute, slightly united at the base; stamens 6, filaments very short, inserted into the base of the corolla; anthers linear, nearly as long as the petals; pistillode 0. Female flowers alternate, solitary, sessile, in bractiform notches on the sides of the branches of the spadix; calyx cup-shaped, truncate, with 3 obscure teeth on the margin; petals 3, sub-rotund, thick, fleshy, concave, smooth. Carpels 3, each 1-celled and 1-ovuled, ovule attached to the middle of the cell on the inside. Styles 3, small, short, recurved; stigma small. Fruiting peduncle short, usually concealed among the leaves; fruit $\frac{1}{2}$-$\frac{3}{4}$ inch long, oblong-ellipsoid, fleshy, smooth, mucronate, bright red to blue black; seed $\frac{1}{4}$-$\frac{1}{3}$ inch long, oblong, with a longitudinal groove on one side; embryo in the middle of the back or convex side of the seed.

HABITAT.—Northern India: from Kumaon eastwards to the Khasia Hills, elevated plains on the north side of the Ganges on

a clayey soil; Burma: in plains between the valley of Hookhoong and Mogam; Chota Nagpur; Ghats of the Sirsi taluka in Northern Kanara.

FLOWERS.—In the cold season; fruit ripens in April and May.

USES.—According to Stewart, rope is made in certain localities from the beaten leaves. In the Central Provinces the leaves are used to thatch houses.

The fruit is eatable. In Chota Nagpur, a sort of sago is prepared from the pith; the stem is apparently not tapped for its juice.

CULTIVATION.—A very ornamental palm, valuable for decorative purposes.

5. **Phœnix pusilla**, Gærtn. Fruct. I. 24 (1788); Trim. in Journ. Linn. Soc. XXIII, 173; Fl. Ceylon IV, 327—*P. farinifera*, Roxb. Cor. Pl. I. 55., t. 74; Hort. Beng. 73; Fl. Ind. III, 785; Mart. Hist. Palm. III, 274; Griff. in Calc. Journ. Nat. Hist. V, 348; Palms Brit. Ind. 140 (excl. syn.); Brandis For. Fl. 556.

I have followed Trimen in considering this palm to be identical with *Phœnix farinifera*, Roxb. He says in Vol. IV, 327 of his Flora of Ceylon: "Beccari will not allow that Gærtner's *P. pusilla* could have been this plant (*P. farinifera*), as he thinks it does not grow in the parts of Ceylon in possession of the Dutch in Hermann's time; indeed, when I first recorded the plant, I had seen it only from Anuradhapura, and therefore Beccari has supposed it to be very rare in Ceylon; but now I find it to be universal in the sandy forests of the north, all the coast-towns of which were held by the Dutch at the end of the seventeenth century. As for the character, Beccari finds in Gærtner's figure of having deeper and larger arms to the bifid excavation in the endosperm, which thus more resembles *P. zeylanica;* this is too variable (as seen in Beccari's own figures) to be of much value. This never forms any stem whatever, and Gærtners' specific name is thus very characteristic."

NAMES.—Inchu (*Ceylon*); Eethie (*Tam.*); Chiruta-itu (*Tel.*); Eentha (*Mal.*)

DESCRIPTION.—Shrubby; stem very short, stoloniferous, entirely enveloped in the sheaths of the leaves so that it is never seen; the whole appears like a large round bush. Leaves pinnate; petiole with one or more pairs of spines; leaflets subopposite, 4-farious, sword-shaped, much pointed, rigid, smooth, of a pale green. Spathes axillary, one-valved, concave on the inside, this concavity being bordered by two sharp edges, convex on the outside, there splitting longitudinally, leathery, smooth, withering. Spadix 8-12 inches long, erect, much branched; branches simple, spreading in all directions. Male flowers: calyx small, slightly 3-toothed; petals 3, oblong, rigid, white. Filaments six, very

short, inserted into a fleshy globular receptacle. Anthers oblong erect. Female flowers not on the same plant; calyx like the calyx of the male flower. Petals 3, orbicular, concave, equal, rigid, lasting. Ovaries 3, only one increasing in size, ovate, each having a short recurved style. Stigma simple. Ripe berry ½ inch long, of a dull purple black, of the size of a large French bean; pulp sweet and mealy. Seed cartilaginous, of the shape of the berry, grooved longitudinally, as in the Date, pretty smooth brown outside, light greyish-white within, with a small elevation on the middle of the back, under which is an oblong pit containing the embryo.

HABITAT.—Coromandel Coast, not far from the sea; in the northern part of Ceylon in dry forests.

FLOWERS from January to April; fruit ripens in May.

USES.—The fruit contains a sweet pulp which is eaten by the natives. "The leaflets are wrought into mats for sleeping upon, etc. The common petioles are split into three or four and used to make common baskets of various kinds, but they are not so good for this purpose as the Bamboo, which is very elastic, much more durable, and splits easily. The small trunk when divested of its leaves and the strong brown fibrous web that surrounds it at their insertions, is generally about 15 or 18 inches long, and 6 in diameter at the thickest part; the exterior or woody part consists of white fibres matted together; these envelope a large quantity of farinaceous substance, which the natives use for food in times of scarcity. To procure this meal, the small trunk is split into 6 or 8 pieces, dried, and beaten in wooden mortars till the farinaceous part is detached from the fibres; it is then sifted to separate them, after which the meal is fit for use. The only further preparation it undergoes is the boiling it into a thick gruel, or as it is called in India, *Kanji;* it seems to possess less nourishment than the common sago, and is less palatable, being considerably bitter when boiled." (Roxb.) Whenever rice is too dear or not to be had, many of the poor are forced to have recourse to this sort of food.

6. **Phœnix humilis**, Royle, Ill. 394, 397, 399; Becc. Males. III, 347, 373; Hooker, Fl. Brit. Ind., VI. 426; Brandis Ind. Trees 645.



A.—*Phœnix humilis*, Royle: *var. typica*, Becc.



B.—*Phœnix humilis*, Royle: *var. pedunculata*, Becc.

HABITAT.—Outer Himalaya, 1-5,000 feet. From Kumaon eastwards; Assam; Khasia Hills; Central India; Chota Nagpur.

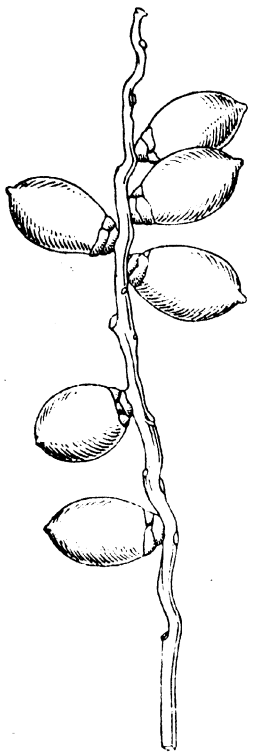


FIG. 2.
Branch with ripe fruits of *Phœnix humilis* (nat. size). (After Beccari.)

VAR. β. *LOUREIRII*. Becc. Males. III. 348, 379, t. 44, II. f. 16, 17; Hook. Fl. Brit. Ind. VI. 427.—*P. loureirii*, Kunth Enum. III. 257—*P. pusilla*, Lour. Fl. Cochinch. 614 (*non* Gærtn.)—*P. roebelinii*, O'Brien, in Gard. Chron. II. (1889) 475, 758, fig. 68.

DESCRIPTION.—Stem short, or very short. Leaflets subglaucous, often approximate, mostly falciform. Fruiting peduncle elongate. Fruit ovoid.

HABITAT.—Assam; Khasia Hills; Burma; Munipore; Cochin China.

VAR. δ. *PEDUNCULATA*, Becc. Males. III. 379, 387, t. 44, II. 13-15, 18-21, 25-27; Hook. Fl. Brit. Ind. VI. 427; Woodr. in Journ. Bomb. Nat. Hist. Soc. XII, 526; Talb. Trees Bomb. ed. 2, p. 342; Cooke, Fl. Bomb. Pres. II. 802.—*P. pedunculata*, Griff. Palms Brit. Ind. 139.—*P. acaulis*, Miq. Pl. Hohen. Nilg. n. 1243.

DESCRIPTION.—Soboliferous; stem ½-10 feet high, 9 inches in diameter, densely covered with the bases of the fallen petioles, more or less spirally arranged root suckers developing when the primary stem has been burnt or injured. Leaves 4-8 feet long; leaflets pliable, 10-20 inches long, ⅓-½ inch broad, fasciculate, more or less quadrifarious, the uppermost sometimes confluent, base not thickened and not decurrent into the common petiole; petioles 1 inch broad at the base, with spines reaching 3 inches long. Spathe about 8 inches long, with fringed margin. Spadix scarcely exceeding the spathe. Fruiting spadix 3-4 feet long, the compressed peduncle much elongate. Fruit ½ inch long, at first orange, then black.

HABITAT.—Western Ghats, from the Konkan southwards, ascending to about 6,000 feet on the Nilghiris; common on the Ghats of N. Kanara.

FLOWERS from December to February.

USES.—The fruit is edible. The leaflets are made into mats commonly used for covering bales of red pepper in the Dharwar district.

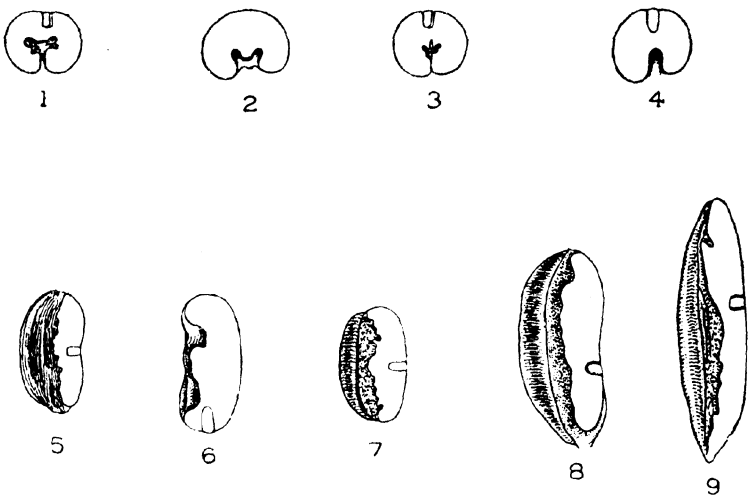


FIG. 3.

Transverse section of seed of—
1. *Phœnix sylvestris* (Nat. size)
2. *Phœnix paludosa* (×2)
3. *Phœnix canariensis* (Nat. size)
4. *Phœnix reclinata* (×2)

Longitudinal section of seed of—
5. *Phœnix sylvestris* (Nat. size)
6. *Phœnix paludosa* (×2)
7. *Phœnix canariensis* Nat. size)
8. *Phœnix humilis* (×2)
9. *Phœnix dactylifera* (Nat. size)
(After Beccari).

ILLUSTRATIONS. Plate VI. A. The photograph, supplied by Col. Gage, shows five old specimens of *Phœnix humilis, var. typica.* The short stems are conspicuously covered with the spirally arranged bases of the petioles.

Plate VI. B. The photograph, supplied by Mr. Roscoe Allen, shows *Phœnix humilis, var. pedunculata.* We selected this photograph (in preference to others, which showed the leaves much better) on account of the long fruiting spadices, which come out distinctly in our picture.

7. **Phœnix paludosa,** Roxb. Hort. Beng. 75; Fl. Ind. III. 789; Mart. Hist. Nat. Palm. III. 272, 320, t. 136; Kunth Enum. III. 256; Wall. Cat. 8603; Griff. in Calc. Journ. Nat. Hist. V. 353; Palms Brit. Ind. 144, t. 229 A. B.; Kurz in Journ. As. Soc. Beng. XLIII. II. 202; For. Fl. II. 536; Brandis, For. Fl. 556; Ind. Trees 646; Gamble Man. Ind. Timb. 419; Hook. Fl. Brit. Ind. VI. 427.—*P. siamensis* Miq. Palm. Archip. Ind. 14.

NAMES.—Hintal, Golpatta (Beng.); Thinboung (Burm.); Giruka tati (Tel.); Hintala (Sanscr.); Dangsa (in Penang).

DESCRIPTION.—Subarboreous, gregarious, forming elegant impenetrable tufts. Trunk 8-25 feet high, 3½ inches in diameter, often inclined, soboliferous, annulate at the base, higher up covered with the brown petioles. Leaves 8-10 feet, gracefully spreading. Petiole covered with scurf, brownish-glaucescent, armed in the lower three feet with irregularly spreading, hard, brown, triangular, channelled, long spines; sheath fibrous. Leaflets 1-2 feet long, opposite and alternate, bifarious, spreading, then curved downwards, not rigid, 8 lines broad, very acuminate, conduplicate at the base, otherwise flat, whitish or farinose underneath, the lowest being both the longest and the narrowest. Male spadix with peduncle about 1½ foot long, compressed; spathe as long, coriaceous, 2-keeled, orange-brownish; keels with irregular edges; flowers ¼ inch long, yellow; calyx cup-shaped, not as regularly 3-toothed as in *P. sylvestris;* petals 3; filaments 6, short. Female spadix about 1½ foot long; flowers subglobose, greenish; calyx as in the male; petals roundish, concave; staminodes 6. Carpels 3, free; styles recurved. Fruiting spadix 3-4 feet long, erect, yellowish orange, with branches at the apex; spikes of the same colour, with thickened bases, about a foot long, nodding, sometimes branched. Fruit sessile on thickened knobs, first yellowish, then red, and finally black purple, ½ inch long, 3-4 lines wide, mucronate, with the more or less split perianth at the base. Seed ovoid, compressed, rather deeply furrowed on one side up to the middle, and indistinctly so on the opposite side. Embryo basilar.

HABITAT.—Æstuarial shores from Bengal to Burma and the Andaman Islands; forms a considerable portion of the impenetrable woods which cover the Sunderbuns; along the Salwin, between Amherst and Moulmein; Penang; Siam; Cochin China.

FLOWERS.—In March and April; fruit ripens from June to December.

USES.—The leaves are used in the Sunderbuns to make ropes for tying boats and logs, and also for thatching.

The stems of the smaller trees are used as walking sticks; the longer ones serve for rafters.

The natives believe that snakes get out of the way of any person having such a stick.



Phœnix paludosa. Roxb.

CULTIVATION.—This palm is worth cultivation on account of its elegance, and well adapted for bank scenery.

ILLUSTRATION.—Plate VII. The photograph, supplied by Col. Gage, shows a dense tuft of *Phœnix paludosa*. This species is not likely to be confounded with any other. Its habit is less genuine than in the others. In the big leaf in the foreground of the picture the bifarious arrangement of the solitary and downwards curved leaflets can be distinctly seen.

8. **Phœnix robusta**, Hook. f. Fl. Brit. Ind., VI, 427; Woodrow in Journ. Bomb. Nat. Hist. Soc. XII, 526; Rec. Bot. Surv. Ind., I, part 6,94; Brandis Ind. Trees, 645; Cooke Fl. Pres. Bomb., II, 801.—*Phœnix humilis*, Royle, *var. robusta*, Becc. Males. III, 379.

Name: Shelu (Mar.).

DESCRIPTION.—Trunk 15-20 feet high, about 15 inches in diameter, closely clothed and appearing tessellated from the spirally arranged sheaths of fallen leaves. Leaves 3-5 feet long, glabrous, shining, shorter, broader, thinner, and smoother than those of *Phœnix sylvestris*; leaflets in fascicles, quadrifarious, strongly conduplicate. Spathe fringed with brown wool on the keel. Fruiting peduncle 2 feet long. Ripe fruit brown.—Materials are wanting for a complete diagnosis.

HABITAT.—On Parasnath in Behar; Deccan; gregarious on the top of trap hills near Bhorkas; Western Ghats: Nandgaon.

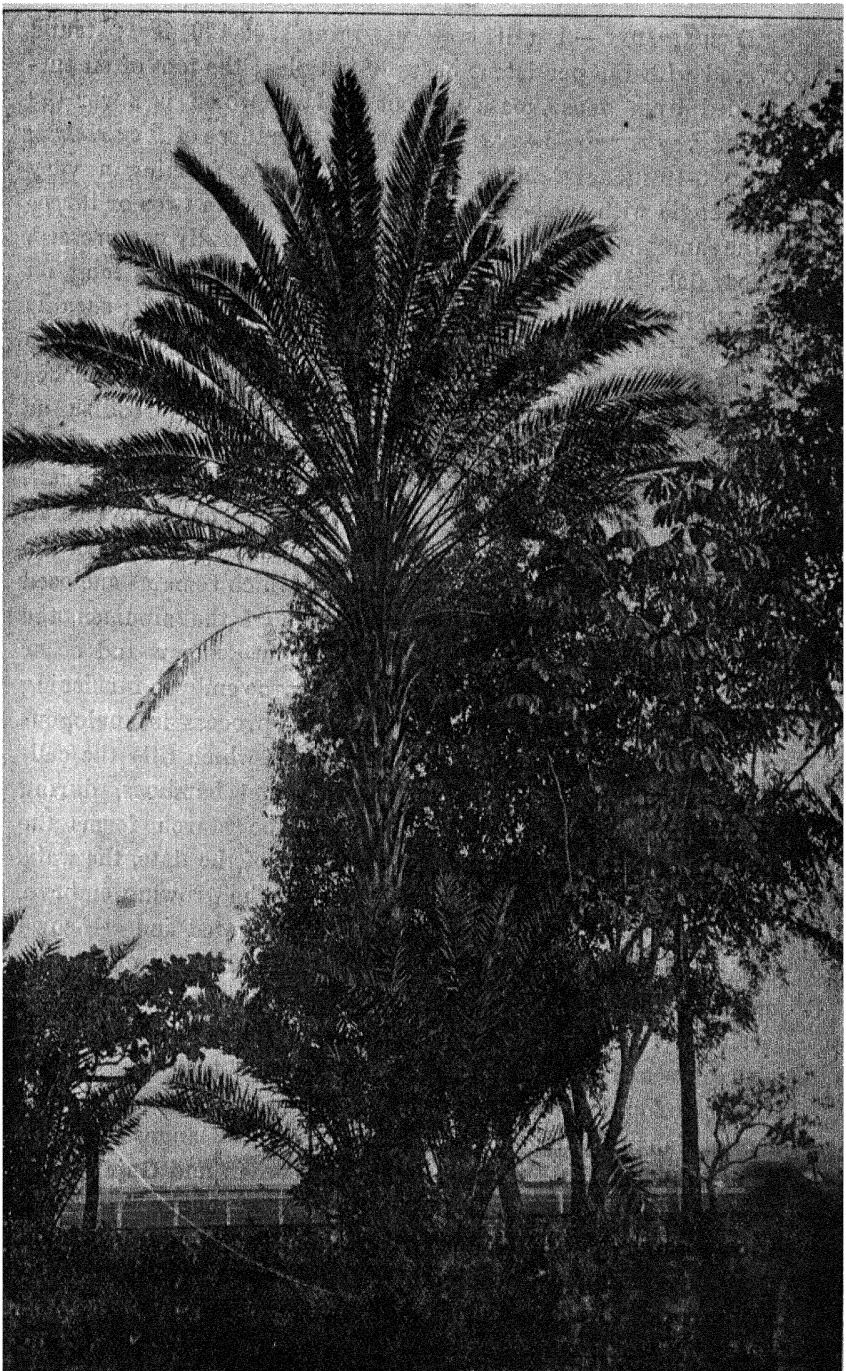
FLOWERS in February.

USES.—Woodrow says that in the country near Bhorkas, where it is locally abundant, it is used largely for the manufacture of date-matting.

* * Introduced Species.

9. **Phœnix dactylifera**, L. Hort. Cliff., 482; Spec. Pl. ed. Wild IV, 730.—*P. excelsior*, Cavan. Icon. et. Descr. Pl. II. 13.

NAMES.—The Edible Date; Khajur, Khaji (Hind.); Khajur (Beng.); Kasser (Bhot.); Khajur, Khaji (Panj.); Mach (N. Baluch); Kajura (Pushtu); Karmah (Turki.); Pind Chirdi, Kurma, Tar, Khaji (Sind); Khajur (Bomb.); Kharjur (Mar.); Khajur, Karek (Guz.); Perich-chankay (Tam.); Kharjurapu, Perita, Mudda Kharjurapu (Tel.); Kharjura (Kan.); Swonpalwon (Burm.); Indi (Sing.); Pindakharjura (Sans.).



Phœnix dactylifera, L.

DESCRIPTION.—A tall tree, attaining 100-120 feet; trunk covered with the persistent bases of petioles; the foot often surrounded by a dense mass of root suckers which is never the case in *P. sylvestris*. Leaves grey, longer than those of *P. sylvestris;* pinnæ 8-16 inches long, regularly distichous, forming a very acute angle with the petiole, often approximate in twos or threes on the same side of the petiole; petiole grey, laterally compressed, almost flat. Male panicles white, compact, 6-9 inches long, on a short peduncle, flowers $\frac{1}{4}$-$\frac{1}{3}$ inch long, sweet-scented; sheaths outside with rusty down. Peduncles of female inflorescence $\frac{1}{3}$-$\frac{1}{2}$ inch broad, sometimes broader below, spikes 12-24 inches long. Fruit oblong, 1-3 inches long, generally reddish or yellowish-brown when ripe, pulp fleshy, sweet; numerous varieties are cultivated, differing in colour, shape, and taste of the fruit. Seed cylindric, with a longitudinal furrow in front, and a small cylindric embryo in the middle of the rounded back. When the seed germinates, that end of the embryo which remains enclosed in the albumen enlarges at the expense of the albumen, the horny substance of which is converted into sugar and other soluble substances, which are absorbed by the embryo furnishing the substance for its early growth. The process is analogous to the conversion into sugar of the starch which fills the cells of the albumen of wheat, maize, rice and bamboos, during germination, with this difference, that the starch forms the contents of the cells, whereas, in the stone of the date, the walls of the cells themselves furnish the food of the growing embryo.

HABITAT.—In India the date palm is cultivated and self-sown in Sind and in the Southern Panjab, particularly near Multan and Muzaffargarah, also in the Sind Sagar Doab and trans-Indus territory. Near Dhera Ghazi Khan, date palms are very numerous on a strip 10-12 miles long from north to south. A few trees are found planted at many places in the Eastern Panjab, also at Saharanpur, and here and there in the Ganges Doab and Bandelkhand. It is also grown in the Deccan and Gujarat, but does not thrive in Bengal. The tree was probably introduced into India at the time of the first Mahomedan conquest of Sind, at the beginning of the eighth century. It thrives luxuriantly in the arid rainless regions of North Africa and West Asia, where it is exposed to extreme heat in the day-time, and not uncommonly to frost at night, but it requires a certain amount

of moisture in the soil. In Europe it is cultivated in Spain, where it was introduced by the Arabs, and where it produces eatable fruit; also on the Hyères islands, the Riviera near Nice, San Remo, and Genoa, where it attains its northernmost point at 44° 30′ N. L. There is a wood of Date Palms at Bordighera near San Remo, said to contain over 4,000 stems cultivated mainly to yield palms for Palm Sunday at Rome. In South Italy, Sicily, and Greece, the tree is not uncommon, but the fruit is small and poor.

FLOWERS in March and April; fruit ripens in August, September, and October.

HISTORY.—We do not feel competent to write a better account of the history of the Date Palm than DeCandolle in his "Origin of Cultivated Plants." His arguments are the following:—

"The Date Palm has existed from prehistoric times in the warm dry zone, which extends from Senegal to the basin of the Indus, principally between parallels 15 and 30. It is seen here and there further to the north, by reason of exceptional circumstances and of the aim which is proposed in its cultivation. Far beyond the limit within which the fruit ripens every year, there is a zone in which they ripen ill or seldom, and a further region within which the tree can live, but without fruiting or even flowering. These limits have been traced by de Martius, Carl Ritter and myself.

"As regards the Date Palm we can hardly rely on the more or less proved existence of really wild indigenous individuals. Dates are easily transported; the stones germinate when sown in damp soil near the source of a river, and even in the fissures of rocks. The inhabitants of oases have planted or sown Date Palms in favourable localities where the species perhaps existed before man, and when the traveller comes across isolated trees at a distance from dwellings, he cannot know that they did not spring from stones thrown away by caravans. Historical and philological data are of more value here, though doubtless from the antiquity of cultivation they can only establish probabilities.

"From Egyptian and Assyrian remains, as well as from tradition and the most ancient writings, we find that the Date Palm grew in abundance in the region lying between the

Euphrates and the Nile. Egyptian monuments contain fruits and drawings of the tree. Herodotus in a more recent age (fifth century before Christ), mentions the wood of the Date Palms of Babylonia, and still later Strabo used similar expressions about those of Arabia, whence it seems that the species was commoner than it is now, and more in the condition of a natural forest tree. On the other hand, Carl Ritter makes the ingenious observation that the earliest Hebrew books do not speak of the Date Palm as producing a fruit valued as a food for man. David, about one thousand years before Christ, and about seven centuries after Moses, does not mention the Date Palm in his list of trees to be planted in his gardens. It is true that except at Jericho dates seldom ripen in Palestine. Later, Herodotus says of the Babylonian Date Palms that only the greater part produced good fruit which was used for food. This seems to indicate the beginning of a cultivation perfected by the selection of varieties and of the transport of male flowers into the middle of the branches of female trees, but it perhaps signifies also that Herodotus was ignorant of the existence of the male plant.

"To the west of Egypt the Date Palm had probably existed for centuries or for thousands of years when Herodotus mentioned them. He speaks of Libya. There is no historical record with respect to the oases in the Sahara, but Pliny mentions the Date Palm in the Canaries.

"The names of the species bear witness to its great antiquity both in Asia and in Africa, seeing they are numerous and very different. The Hebrews called the Date Palm tamar, and the ancient Egyptians beg. The complete difference between these words, both very ancient, shows that these peoples found the species indigenous and perhaps already named in Western Asia and in Egypt. The number of Persian, Arabic, and Berber names is incredible. Some are derived from the Hebrew word, others from unknown sources. They often apply to different states of the fruit, or to different cultivated varieties, which again shows ancient cultivation in different countries. Webb and Berthelot have not discovered a name for the Date Palm in the language of the Guanchos, and this is much to be regretted. The Greek name *phœnix* refers simply to Phœnicia, and the Phœnicians, possessors of the Date Palm. The names *dactylus* and date are derivations of dachel in a Hebrew dialect. No

Sanskrit name is known, whence it may be inferred that the plantations of the Date Palm in Western India are not very ancient. The Indian climate does not suit the species. The Hindustani name kharma is borrowed from the Persian.

"Further to the East the Date Palm remained long unknown. The Chinese received it from Persia, in the third century of our era, and its cultivation was resumed at different times, but they have now abandoned it. As a rule, beyond the arid region which lies between the Euphrates and the south of the Atlas and the Canaries, the Date Palm has not succeeded in similar latitudes, or at least it has not become an important culture. It might be grown with success in Australia and at the Cape, but the Europeans who have colonised these regions are not satisfied, like the Arabs, with figs and dates for their staple food. I think in fine, that in times anterior to the earliest Egyptian dynasties the Date Palm already existed, wild or sown here and there by wandering tribes in a narrow zone extending from the Euphrates to the Canaries, and that its cultivation began later as far as the north-west of India on the one hand and the Cape de Verde Islands on the other, so that the natural area has remained very nearly the same for about five thousand years. What it was previously, palæontological discoveries may one day reveal."

USES.—The importance of the Date Palm is very extensive. A considerable part of the inhabitants of Egypt, Arabia and Persia subsist almost entirely on its fruit. They make a conserve of it with sugar, and even grind the hard stones in their hand-mills for their camels. "All Fezzan and half of Tripolitania satisfy most of their wants with the products of it. The huts of the poorer classes are entirely made of its leaves, and the more substantial habitations of the rich chiefly consist of the same material; every door, every post is made of its wood, and the ceilings of the rooms are formed by its trunks. The footstalks furnish the most common fuel, and they are often brought on men's backs from a distance of six to eight miles. The fruit is the common food of both man and beast: camels, horses, dogs, all eat dates. Even the stones are soaked in water, and when they have thus become soft are given to the cattle. The number of the Date Palms cultivated is enormous. When Abdel-Gelil besieged Suckna, in 1824, he cut down no fewer than 43,000 trees, to compel the town to surrender; nevertheless there are

still at least 70,000 left. Their produce is comparatively small, a hundred full-grown trees yielding about forty cwts. of dates. These, after having been gathered, are dried in the sun, and quite hard buried in the sand. They may thus be preserved about two years, but generally after eighteen months they are attacked by worms, and in the beginning of the third year nothing remains of them, save the stones. As an everyday food, dates are considered very heating, in consequence of which they are not much used on journeys, as causing great thirst. The most relishing and wholesome way to eat them is, when made into a paste, mixed with barley. When the heart of the leaves has been cut out a sweet thickish fluid collects at that cavity, called lagbi, which is very refreshing and slightly purgative. A few hours afterwards the fluid begins to ferment, becomes acid and very intoxicating. From the ripe fruit a kind of treacle is prepared, used especially for coating leather bags or pipes to render them tight."—(Vogel). In the Punjab dates form an important article of food in certain districts, and they are sold in the bazaar under different names, according to quality and the mode of preparation. Thus, according to Coldstream, the most esteemed kind is called Chirni in the Muzaffargarh district; this is the date of the best palms, split up in the middle and dried in the sun. The second best is called Pind; it is eaten as it comes from the tree, without further preparation. The least esteemed kind is Bugri, taken from inferior trees and boiled in oil and water. The Punjab dates are smaller than those of Arabia and Egypt, but they are very good, and particularly so when there has been little or no late rain. When beginning to get ripe, a piece of matting is often put over the cluster of dates to prevent birds eating them. The kernels are deemed medicinal. The large succulent head, cut from among the mass of leaves, is eaten (Gaddah, Gari, Galli). The tree yields a gum, called Hukm Chil. Attempts have been made, but without much success, to tap the Date Palms of Multan for their sugary sap.

The wood of the Date Palm is lighter than that of Cocos or Borassus. The cellular tissue is soft; the vascular bundles generally show, on a horizontal section, an oval shape with two distinct large pores at one end, the hard woody portion gray; on a vertical section they appear as shining narrow lines. The

wood of male trees and of trees past bearing is used for building, water-channels, bridges, and various other purposes.

Of the leaves, mats and the bag-like baskets universally used in the whole Mediterranean region, and in other countries, are made. In the Punjab mats and fans are made of the leaves; they are called Butra or Pattra in Muzaffargarh, and Khushab in Shahpur. The leaf stalks make excellent light walking-sticks, split up they furnish material for crates and baskets; the fibrous network, which forms the sheathing base of the petiole, is called Kabal or Khajurkabokla in Muzaffargarh, pack-saddles for oxen are made of it, and the fibre separated is made into ropes.

The sap is obtained by cutting off the head of the palm and scooping out a hollow in the top of the stem, where, in ascending, it lodges itself. Three or four quarts of sap may be obtained daily from a single palm, for ten days or a fortnight, after which the quantity lessens, until, at the end of six weeks or two months, the stem is exhausted, becomes dry, and is used for firewood. This liquor is sweetish when first collected and may be drunk as a mild beverage, but fermentation soon takes place, and a spirit is produced, which is distilled, and forms one of the kinds of Arrack, or spirit of eastern countries. Such being the importance and multiplied uses of the Date Palm, it is not surprising that in an arid and barren country it should form so prominent a subject of allusion and description in the works of Arab authors, and that it should be said to have 300 names in their language. Many of these are however applied to different parts of the plant, as well as to these at different ages. The Mahomedans are very proud of the Date Palm, and say that it refuses to grow well in any country which is not consecrated to Islam. There are many varieties, all exactly alike in appearance, but differing in the fruit. In Baghdad alone there are 40 or 50 well-known kinds of dates, some of them bearing romantic names, such as "lady's fingers," and "pretty maiden's eyes." In the Basra district there are even more varieties, as well as a vastly greater number of trees. The palms between Fao at the mouth of the river and Gurna and at the junction of the Tigris and Euphrates are numbered in millions, and each brings in an average income of Rs. 3 or 4 a year.

"The exports of Indian dates are not as yet important; they have averaged about 130 cwt., valued at Rs. 1,215, during the

four years ending 1904-5, but in 1905-6 were only 34 cwt., valued at Rs. 364, and in 1906-7, 14 cwt., valued at Rs. 254. The re-exports, during the same period, were as follows:—1900-1, 34,444 cwt., valued at Rs. 1,69,263; 1901-2, 27,632 cwt., valued at Rs. 1,41,939; 1902-3, 47,041 cwt., valued at Rs. 2,18,455; 1903-4, 25,330 cwt., valued at Rs. 1,27,277; 1904-5, 22,260 cwt., valued at Rs. 1,24,684; 1905-6, 23,542 cwt., valued at Rs. 1,31,373; and in 1906-7, 27,945 cwt., valued at Rs. 1,69,639.

"The foreign supplies, on the other hand, are large and important; in 1900-1 they came to 871,272 cwt., valued at Rs. 41,94,972; 1901-2, 901,006 cwt., valued at Rs. 42,11,091; 1902-3, 633,390 cwt., valued at Rs. 31,43,967; 1903-4, 725,003 cwt., valued at Rs. 36,27,590; 1904-5, 812,284 cwt., valued at Rs. 40,96,034; 1905-6, 867,229 cwt., valued at Rs. 44,87,709; and in 1906-7, 814,781 cwt., valued at Rs. 48,37,461. The largest quantities come usually from Turkey in Asia, *viz.*, 479,200 cwt., in 1906-7; Arabia, 238,101 cwt.; and Persia, 73,863 cwt., and are received chiefly by Bombay and Sind, which took as their shares 562,335 cwt. and 205,571 cwt. respectively."—(Watt).

I think it is not out of place to say a few words about the so-called "date-marks" or "Baghdad boils," as some wanted to find a connection between these boils and the eating of dates. The boils make their appearance in July or August as a small pimple, which grows very slowly for several months, and then becomes tender and swollen, continues as an open sore for some months more and slowly dries up. Considering the virulence of the sore, it is remarkably little painful, unless it happens to come on a joint or a part much exposed to knocks. Children are the greatest sufferers, and are always attacked on the face. Scarcely any resident of Baghdad, either European or Native, escapes from these boils, which in severe cases may cause the loss of the sight of an eye or carry off a bit of the nose or lip. Why the name "date-marks" should be given to these boils is not easy to understand; many explanations are offered, but none seem satisfactory. Some say that they come from eating dates, but this is certainly untrue. Others maintain that they are so called because they afflict people in date-bearing countries; but this explanation does not hold good either, for Basra is far more the region of Date Palms than Baghdad, and yet is free from the plague of boils. Another theory is that they are called

date-marks, because they almost always begin during the season of the ripening of the dates, and yet another that the name comes from the shape of the scar left, which is generally a long oval, not unlike the shape of the fruit. Some people boldly, casting aside any connection between the boils and dates, lay the blame on the unprotesting mosquito (*cf.* Journal, B. N. H. S., XVIII, 700). And they are right in doing so. Dr. Wright discovered in 1903 a small protozoon, called Leishmania tropica Wrightii, which is transferred to man by mosquito bites. This parasite causes first an inflammation, then a swelling and, finally, a boil.

CULTIVATION.—In the "Agricultural Ledger" (1906, No. 1), Mr. Fletcher gives a full account of the conditions under which successful cultivation of this valuable tree is carried out in countries other than India. He ascribes the uniform failure of the many attempts that have been made in this country to improve and extend the very limited cultivation of the Date Palm, to a lack of appreciation of those conditions. We give in the following some extracts from Mr. Fletcher's article:

"The low relative humidity and rainfall in all typical date-growing regions is very marked, and the lower these factors are the better is the quality of the dates grown. Excessive humidity probably acts indirectly by tempering the heat of the sun, while rain at the time of flowering spoils the pollen and during the ripening season causes fermentation in the fruit. The general time of flowering in almost all regions of the date belt is March to May and that of ripening August to November."

On an average, rainfall during the flowering and fruiting period should not much exceed 5 inches. In addition to this, irrigation is an essential accompaniment to the cultivation of the Date Palm. When the trees are in a dormant condition they can stand a temperature as low as 20° F., but for the formation of flowers and fruits a mean temperature of more than 64° F. is required; early varieties of dates will ripen fruit, if the mean temperature for the fruiting season (May to October) is above 70° F. and for one month at least above 80°. For the moderately late varieties these temperatures must be above 75° and 85° respectively, and for the best and latest varieties 84° and 94°. The tree must, moreover, be exposed to the direct rays of the sun; it will not grow under shade even when young.

The physical character of the soil, whether sand, loam or heavy clay, seems to have little influence on the growth and productiveness of the tree, except, perhaps, that on light soils flowers and fruits develop earlier than on heavy ones. On the whole sandy loams appear to be best suited for the cultivation of dates.

The Date Palm is equally indifferent to the quantity of alkali in the soil. The United States Department of Agriculture investigating the soils of the Algerian palm-bearing tracts came to the conclusion that this plant, although it can grow in soils containing 3 to 4 per cent. of their weight of alkali, does "not produce fruit, unless its roots reach a stratum of soil where the alkali content is below 1 per cent. and does not yield regular and abundant crops unless there are layers in the soil with less than 0·6 per cent. of alkali."

Propagation may take place in two ways by seeds and offshoots. Mr. Fletcher describes the method of rearing seedlings as follows:—"The seeds should be sown in a seed-bed that has been specially prepared on sweet soil by ploughing in a mixture of ordinary farmyard manure and on oil-cake at the rate of about 10 tons of the former and 400 lbs. of the latter per acre. Suitable oil-cakes for India are those obtained from the castor-oil plant (*Ricinus communis*), *Eruca sativa* or any of the mustard family; these cakes have the property of more or less preventing the attacks of white ants. Emphasis is laid on the fact that the soil of the seed-bed should be sweet and not impregnated with alkali soils (reh or usar lands), since, though offshoots and adult plants will tolerate large amounts of such salts, a very small percentage of these in the soil will suffice to kill the seedlings soon after germination, if not actually to prevent germination.

"After this preparation, the seed-beds should be irrigated in March or April and two or three days later the seeds sown in it at a depth of 1 or 2 inches in rows, 3 feet apart with intervals of 3 feet between seeds in the rows. The bed should then be watered every second day or so for the first three or four months and after that every week for a second period of similar duration; thenceforward the palms should be irrigated every month in the hot weather and every two months in the cold weather.

"The seedlings may be transplanted from April to September after reaching the age of three years. Preferably they should be left in the seed-bed until they flower. This in good soil may occur six to ten years after sowing—the shorter period being sufficient in a locality where the average temperature is high. When the flowers appear and then only the sex can be determined with certainty; the superfluous males may, therefore, now be weeded out and abandoned. During the process of transplantation the largest leaves of the seedlings should be cut off at a distance of about 2 feet from their bases. Special attention is called to the fact that though the adult palm requires water of irrigation only at long intervals or not at all if the subsoil is kept constantly moist by natural sub-irrigation, the seed will not germinate or the seedling survive unless water is present in abundance."

As one male tree will, under cultivation, suffice for the fertilization of about 100 females, it is evident that propagation by seeds is not to be recommended. The only rational method is by means of offshoots.

These are suckers arising from the base of the stem when the tree is between about 6 and 16 years old. Offshoots borne on male trees will give rise to male trees, and on female trees, females. The fruit will be of the same quality as that of the parent palm.

When the offshoots are from 3 to 6 years old they are separated from their parent with an ordinary hatchet by means of a cut parallel to the stem. The large leaves are removed and only the bud and young leaves are left on the rootless stump. April to September is probably the best time for the removal of the suckers in India. "The offshoots should be planted in rows 25 feet apart with similar intervals between plants in the row. For this purpose holes 3 feet deep and the same distance in diameter are made in the soil; half of the excavated earth is mixed with its own volume of farmyard manure with 4 or 5 lbs. of oil-cake and filled in, the offshoot being set in the centre of this hole. In doing this it is most important that the bud in the centre of the leafstalks and young leaves should not be choked by being covered with soil. For this reason the offshoot should be planted with the bud two or three inches above the general level of the ground and a circular trench a foot in

width be dug round it for the purpose of irrigation. The offshoots should be watered every day for the first month, twice, a week for the second month, and thenceforward every month for at least a year." No general rule can be given with regard to the amount of water required. This depends on local conditions; further, the palm needs more water during certain seasons of the year than others. Generally, at the time of flowering (February to March) little or no water should be given; from May till the fruit ripens water should be given liberally.

The time of flowering is determined by climate and soil, and the amount of water applied to the trees. Generally speaking, eight years in the case of propagation by seed, and four or five years after being detached from the parent stem in the case of propagation by offshoots, may be considered to be the age at which appreciable quantities of fruit are produced. The male inflorescence with its enclosing spathe is cut from the tree usually immediately before, but sometimes immediately after the splitting of the spathe. One inflorescence consists of over 100 slender branches, of which one or two bear sufficient pollen to fertilize a whole female inflorescence. When the female inflorescence becomes visible between the separating parts of its spathe, one or two branches of the male inflorescence are inserted among its branches. The enclosing branches of the female inflorescence are then loosely bound together with a thin strip of a palm leaf or string. This is regularly done in Arabia, but not in Sind.

About the beginning of June it is advisable to remove some clusters of fruit from the tree in order to increase the supply of good material to the remainder. One inflorescence will develop from 10 to 40 lbs. of ripe dates; a whole tree yields from 50 to 500 lbs., on the average 120 lbs.

The dates of one bunch do not ripen at the same time. In spite of this the bunch is usually cut off bodily when about half of the dates are ripe and is hung in a dry shady place until the rest ripen; but if the variety is a valuable one, the dates are picked singly as they ripen.

The varieties of dates number some thousands in all. According to Mr. Fletcher they may be classed as belonging to three types:—

Class I.—"Soft Dates."—These are the kind sold in the European and American markets. The percentage of sugar they contain, is so high (60 per cent.) as to preserve or candy them naturally. In some cases it is necessary to allow some of the syrup to drain off before packing.

Class II.—"Medium Dates."—These, too, are soft, but do not contain enough sugar to preserve them naturally. They do not dry readily and are, therefore, generally eaten fresh from the tree.

Class III.—"Dry Dates."—These are hard and not sticky even when ripe and may be allowed to dry on the tree. They can be stored without special preparation. They are esteemed in date-growing tracts for local consumption though not so sweet as the preceding classes.

Mr. Fletcher gives an instructive table of some well-known varieties of dates, which might be of interest to many who have no access to the publications of the Agricultural Department:—

SOME WELL-KNOWN VARIETIES OF DATES

Type	Country	Centre	Name of Variety	Date of ripening	Soil required	Market	Remarks on character of fruit
Class I.	Morocco	Tafilet Oases	Tafilet	October	Sandy	England	Darker than the Deglet Noor.
	Algeria	Tougourt	Deglet Noor	,,	,,	America and England	Medium size and dark brown.
		M'zab	Teddala	September	,,	Local	Long and yellow.
		Biskra	Ghars	,,	Clay	,,	,, ,,
	Tunis	.....	Monakhir	October (end)	Sandy	,,	Said to be superior even to Deglet Noor.
	Egypt	Seewah Oases	Wahi or Sewi	August	,,	Fayum (Egypt)	Plump and yellow.
		Lower... Sharkiah	Amri	September	Clay	Europe	Large and black.
		Lower... Gizeh	Ambat	,,	Sandy	Local	,, ,, ,,
	Arabia	El. Hassa	Khalasi	August	,,	,,	Medium size and golden brown.
		Muscat (Semail Valley)	Fard	,,	,,	America	,, ,, ,, dark brown.
			Berhi	September	Heavy clay	Local	,, ,, ,, golden brown
			Hevesi	,,	,,	,,	,, ,, ,, ,, ,,
			Helwi	,,	,,	America and Europe	,, ,, ,, dark brown. Superior quality.
		Bussorah	Khdravi	,,	,,	,, ,, ,,	Like Helvi, but darker and not so good.
	Mesopotamia		Sayer	,,	Sandy	America	Medium size, dark brown, not very good.
		Bagdad	Maktum	August	Heavy clay	Local	Medium size and golden brown.
			Kustawi	,,	,,	,,	Like Maktum, but not so good.
			Taberzal	Sept. (end)	,,	,,	Small, dark brown, very good.
	Persia	Minab	Murdasing	.....	.....	.....	.....
	Baluchistan	Pangh Gurh	Mozati	.....	Sandy	Local	Medium size, dark brown, excellent.
Class II.	Egypt	Upper Bedrashen	Ambat	August	,,	,,	Medium size, yellowish brown.
		Lower... Rosettu	Rachidi, Samani	September	,,	South Europe	Large and yellow.
		Lower... Marg	Hayani	July	Clay	Local	Red and coarse.
		Lower... Alexandria	Ramli	September	Sandy	,,	Long and black.
	Arabia	Muscat	Nagal	June	,,	,,	Small and light coloured.
			Mubsali	August	,,	India	Large ,, ,, ,,
			Khassab	,,	,,	Local	Medium size and red.
	Mesopotamia	Bagdad	Burni	,,	Heavy clay	India and Local	Small and light coloured.
Class III.	Egypt	Upper... Oases	Sultani	September	Sandy	Egypt	Short and brown.
		Upper... Berber	Ibrimi	,,	,,	,,	Long ,, ,,
			Gondaila	,,	,,	,,	Large and yellowish brown.
			Bedraihe	,,	Heavy clay	Local	Small and yellowish.
	Mesopotamia	Bagdad	Zehedi	Sept. (end)	,,	.....	,, ,, ,,

ILLUSTRATION.—Plate VIII. The photograph, supplied by Mr. Phipson, shows a well developed specimen of *Phœnix dactylifera,* and at the foot of the stem two young specimens which took their origin from the present plant. The habit of the whole tree differs considerably from that of the Wild Date Palm; the crown is less dense, the leaves are spreading and form an acute angle with the stem. The lower part of the stem is not covered with the bases of the petioles.

10. **Phœnix reclinata,** Jacq. Fragm. Bot. (1809) 27, t. 24; Willd. Sp. Pl. IV. 731; Spreng. Syst. Veg. II. 138; Klotzsch in Kunth, Enum. Pl. III. 256. Mart. Hist. Nat. Palm. III. 272, 321, t. 164, 124, f. 1; Becc. Males. III. 349.—*P. spinosa,* Thonning in Videnskabernes Selskabs Afhandl. IV. (1829) p. 211; Hornemann, De ind. plant. Guineens. 11; Klotzsch in Kunth Enum. Pl. III. 257; Mart. in Gel. Anzeig. der Bayr. Akad. der Wiss. 1839, VIII. 892, IX. 988; Hist. Nat. Palm. III. 275, 320; Kirk in Journ. Linn. Soc. IX. 234; Tchihatchef in Griseb.: La Végét. du Globe II. 193; Drude in Engl. und Pr.: Die Nat. Pflanz. I. 29, fig. 23; F. v. Mueller, Select Extra-trop. Pl. 263.—*P. leonensis,* Loddiges in Cat. Horti.—*P. farinifera* (non Roxb.) Zolling Pl. Jav. exsicc. No. 3098; Cat. Pl. quæ in hort. Bot. Bogor. col. (1866) p. 72.—*Fulchironia senegalensis,* Lesch. in Desf. Cat. Hort. Paris., ed. III. p. 29.

DESCRIPTION.—Stem soboliferous, 25 feet high, sometimes even 30-40 feet. Leaves long, armed with solitary or paired spines on the sides and lower surface. Segments narrow ensiform, very numerous, in fascicles of two or three. In young leaves the segments are covered with a white tomentum on the under surface of the midrib. A similar tomentum covers the whole central bud. Spathes of spadices fusiform, furfuraceous or glabrous, compressed, thinly coriaceous, with two sharp keels. Male spadix ovate in outline, consisting of a great number of thin, flexible branches. Male flowers trigonous, lanceolate, distinctly acuminate, about 4 lines long; calyx 3-dentate; petals lanceolate, acuminate or acute and often ciliate at the apex, but never cucullate. Stamens ⅓ shorter than the corolla. Female spadix composed of 25-35 rigid branches; fruiting branches patent or horizontal, or also reflexed. Fruit small, ovate-elliptic, mucronate. Perianth (in fruit) cupular, a little more than 2 lines long and 4 lines broad; calyx 3-dentate, a little less than half the length of the corolla. Petals not striate externally. Staminodes 6, dentiform, narrow, not united at the base. Seed oblong or subterete-cylindric, equally rounded at the two



Phœnix reclinata, Jacq.

extremities; in a median transverse section the process of the raphe is not seen, or is scarcely dilate, obtuse or superficially lobulate; longitudinal groove of seed pretty long.

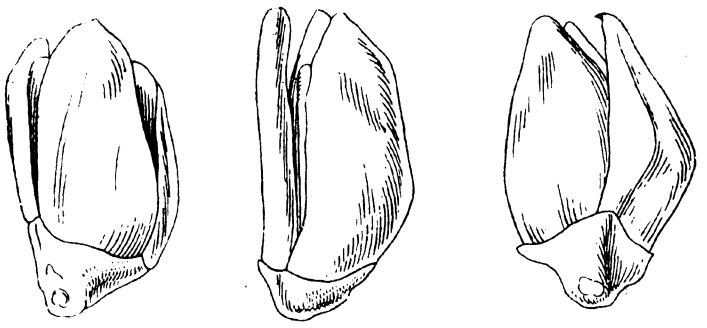


FIG. 4.

Male flowers of *Phœnix reclinata* (5×). (After Beccari.)

HABITAT.—Throughout Tropical Africa from Senegal to Kaffirland: Sansibar (rare), Pemba, Usambara (on the coast), Uganda.

USES.—The split leaf is made into fine mats and caps which take colour easily, and are worked of many patterns. The green bunches of fruit, if immersed for 12 hours in water, suddenly assume a rich scarlet hue, and the astringent pulp becomes sweet. Wine is also obtained from this palm.

ILLUSTRATION.—Plate IX. The photograph, supplied by Col. Gage, shows a characteristic tuft of specimens of *Phœnix reclinata*. The leaves which touch the ground belong to younger plants that have been produced by the parent stems.

11. **Phœnix canariensis,** Hort. Chabaud, La Provence agricole, No. 19 (Oct. 1882) p. 293, fig. 66-68. Naudin in Revue Horticole 1885, p. 541, et 1888, p. 180; Illustr. Hort. XXXIII, 8; Becc. Males. III. 371.—*P. dactylifera* β. *jubæ,* Webb. et Berth. Hist. Nat. des Canaries, III. 289; Christ in Engler's Bot. Jahrb. VI. 469.—*P. jubæ,* Christ in Engl. Bot. Jahrb. IX. 170.—*P. tenuis,* Hort.—*P. vigieri,* Hort. Revue Hort. 1888, p. 180.

DESCRIPTION.—Stem solitary, when young covered with the petioles of fallen leaves and then very often forming a bulbiform mass, in old plants cylindric, columnar and stout, reaching a height of 40-50 feet. The crown exceedingly large, hemispheric, dense, consisting of about 200 leaves. Leaves 17-20 feet long,

the base of the stalk thick and turgid, more so than in *Phœnix dactylifera;* the stalk is very short, armed with strong, long spines. On each side of the rhachis there are 150-200 segments, of the same green colour on the upper and lower surface, straight but not rigid, those lowest and next to the spines in fascicles of 2 or 3, above these they are less fascicled, but turned in various directions, those of the upper half of the leaf equidistant, not aggregate and almost opposite to each other. Male panicle on the whole ovate, with strongly angular branches; the longer branches 1 foot long. Male flowers alternate, often in pairs, ovate-asymmetrical, angular by mutual pressure, 6 lines long; calyx cup-shaped-obconic, trigonous, sharply 3-dentate; petals densely striate, thinly coriaceous, obtuse or slightly acute. Stamens slightly shorter than the petals; pistillode very small, papilliform, acute. Female flowers

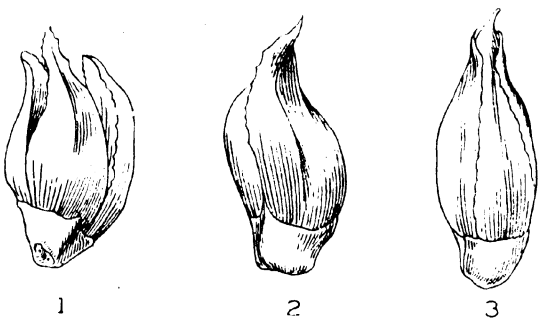


FIG. 5.

Male flowers of *Phœnix canariensis* (1×). (After Beccari.)

globose-depressed, 2-3 lines in diameter; calyx cupular, 3-ribbed, very acutely 3-dentate. Corolla by $\frac{1}{4}$ longer than the calyx; staminodes tooth-shaped, very small, perfectly free; petals twice as broad as long, subreniform, obtusely apiculate in the centre, sometimes the petals are shorter than the sepals. Branches of fruiting spadix 1-2 feet long, semiverticillate or spreading, erect patent, stout and rigid. Fruit ovate-elliptic or subglobose-ovate equally rounded at both extremities, slightly apiculate at the apex, yellow when ripe, smooth, $\frac{3}{4}$ inch long, 9 lines broad, pericarp thin, crustaceous, fragile. Seed ovate-elliptic or ovate-oblong, rounded at the two extremities, terete, or in a transverse section perfectly round, convex on the ventral side. Dorsal

groove quite straight and deep; process of the raphe, as seen in a median transverse section, very narrow in the beginning, getting broader and deeply lobed at the base; albumen horny, fragile, very hard; embryo almost in the middle of the ventral side.

HABITAT.—Canary Islands.- Grown in Indian gardens.

2. SABALEÆ.

Polygamous. Several or numerous half-complete spathes or such as cover only the peduncle of the spadix, often also on the branches of the panicle. Leaves fan-shaped, induplicate.

DISTRIBUTION.—The *Sabaleæ* have, after the *Arecineæ*, the greatest geographical distribution:

On the eastern hemisphere: *Chamærops* L., *Trachycarpus* Wendl., *Rhapis*, L., *Corypha*, L., *Nannorhops* Wendl., *Licuala* Thunb., *Livistona*, R. Br., *Pritchardia*, Wendl. & Seem, *Theysmania*, R. f. Zoll.

Southern Europe, Northern Africa, Asia, south of the northern limit of the region of palms including all the islands from Ceylon to the Sandwich Islands, north and east coast of Australia to the south coast (37½° S. Lat.).

On the western hemisphere: *Sabal*, Adans., *Rhapidophyllum*, Wendl., *Acanthorrhiza*, Wendl., *Trithrinax*, Mart., *Brahea*, Mart., *Serenoa*, Hook, f., *Colpothrinax*, Wendl. & Griseb., *Erythea*, S. Wats., *Copernicia*, Mart., *Thrinax* L., *Crysophila*, Bl.

America, from the northern limit of the palms to almost the southern limit (36° N. Lat.—32° S. Lat.), but are not found in the tropical region of the Amazonas.

Key to the genera described below:—

A.—Fruit with a smooth pericarp. *Gynœcium* of 3 free carpels; each carpel with its own style or stigma.

a. Perianth of 3 sepals and 3 petals alternating with the sepals.

1 Seed erect elliptic; albumen ruminate ... *Chamærops.*

2 Seed curved-reniform; albumen with a single excavation near the raphe... ... *Trachycarpus.*

3 Seed flat-globular; albumen with a deep excavation filled with a corky substance, otherwise uniform ... ... *Rhapis.*

b. Perianth of 6 bristles, or of 6 leaves grown together

1 Stamens 9—12 ... ... *Coccothrinax.*

2 „ 6... ... ... *Thrinax.*

B.—Fruit with a smooth pericarp. *Gynœcium* of 3 appressed carpels, or carpels united where they meet; stigma one.

a. Spadix terminal; remains of stigma at the base of the fruit.

1 Embryo apical, spiral ... ... *Corypha.*

2 Embryo dorsal or subbasilar ... ... *Nannorhops.*

b. Spadix axillary, lateral; remains of the stigma apical (except in *Sabal*).

γ. Berry drupaceous; endocarp hard, brittle.

1 Filaments on a fleshy urceolus which is united with the corolla ... ... *Licuala.*

2 Filaments free, slightly coherent at the base ... ... *Livistona.*

β. Berry drupaceous on a cylindrical stalk

1 Fruit perfectly round (in the species described) ... ... *Pritchardia.*

2 Fruit ellipsoidal ... ... *Washingtona.*

γ. Berry with a soft membranous endocarp.

1 Albumen uniform, except for an excavation near the umbilicus or raphe *Sabal.*

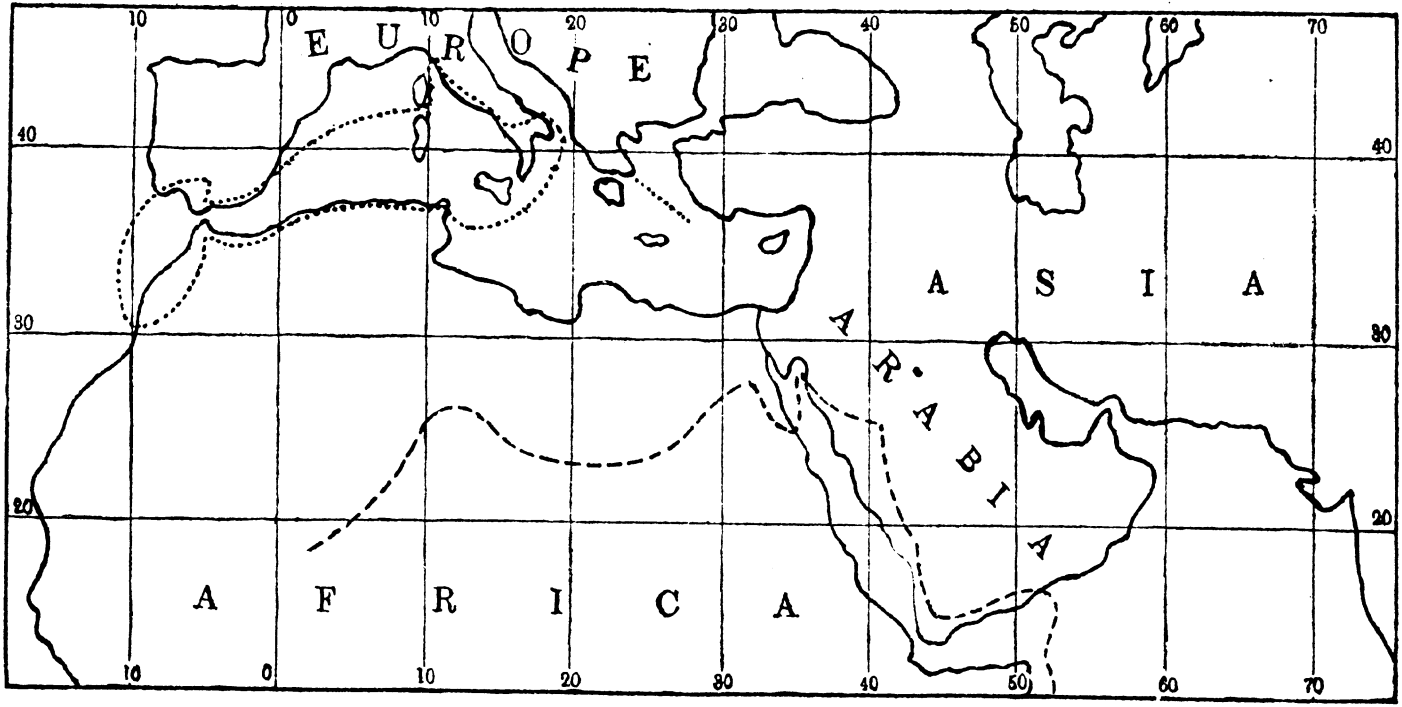
2 Albumen deeply ruminate ... ... *Copernicia.*

1. *CHAMÆROPS* L. GEN. NAT. 1219.

(From the Greek "Chamærops": "chamai"=on the ground, and "rops"=bush. Plinius called it Chamærepes, which means "creeping on the ground.")

Mart. Hist. Nat. Palm. III. 248, t. 120, 124 (sp. 1).—Kunth Enum. Pl. III. 248.—Drude Bot. Zeitg. 1877, 638.—Benth. and Hook. Gen. Pl. 924, 86.

Stem mostly low, bushy-cæspitose, covered with the remains of the petioles; leaves terminal, stiff, fan-shaped, regularly



[AFTER FISCHER]

Distribution of *Chamærops humilis* shown thus.....
Northern limit of *Hyphæne thebaica* shown thus - - - - - -



Dwarf Fan Palm (*Chamærops humilis* L.).

divided; petioles slender, spinous. Spadix short, erect, with mostly 2 leathery spathes, flowers diœcious or polygamous on the short branches of the simply-branched spadix, small, yellow. Petals broadly ovate-acute. Stamens 6 (—9); filaments short, situated on a fleshy cup. Carpels thick-fleshy with sessile stigmas, each flower developing 3 berries, rarely more, sometimes less. Berry elongate erect, with the remains of the stigma slightly lateral, reddish-brown or yellowish. Seed elliptic or ovate. Albumen ruminate.

Species 2.—In the western part of the Mediterranean region.

1. **Chamærops humilis** L. Hort. Cliff. 482; Willd. Spec. Pl. IV. 1154, n. 1; Houttuyn Pflanzensyst. I. 55; Giseke Prael. Ord. nat. 27; Savigny in Lam. Encycl. IV, 714, et Illustr. gen. t. 900; Spreng. Syst. Veg. II. 137, n. 1; Roem. & Schult. Syst. Veg. VII. 2. 1488, n. 1; Mill. Diction. I. 669; Brotero Fl. Lusit. I. 605; Cambess. Plant. Balear. in Mèm. du Mus: XIV. 321; Herrera Agricultura General (1818) II. 389; Allion. Fl. Pedemont. II. 363, n. 866; P. De Cand. Fl. Franc, III. 723; Moris Elench. Stirp. Sard. I. 47; Sebast. et Mauri Prodr. Fl. Roman. 135; Tenore Sylloge Fl. Neapol. 535; Philippi in Linnæa VII. 759, 760; Poiret Voy. en Barbar. II. 273; Desfont. Fl. Atlant. II. 436; Viviani Fl. Lib. specim. 62; Fraas Synops. plant. flor. class. 278.

NAMES.—Dwarf Fan Palm, European Palm; Palmeira, Palma das Vassouras (*Portug.*); Palmito, Margallonera (*Span.*); Palma (*Andal.*); Palmiste (*French*); Palmito (*Ital.*); Palmetta, Piumara, Giummara, Curina (*Sicily*).

DESCRIPTION.—Grows in hot-houses to the height of 15 feet and more; but in Spain and Barbary it is not more than 4 or 5 feet high, and in Italy it is much dwarfer, stem 5-6 inches in diameter, closely covered with triangular hard scales, the bases of the old leaves. The new leaves grow in a tuft at the top of the stem, and have smooth flat stalks, with rigid spines proceeding from the edge; blade deeply palmate, with from 12-15 narrow sword-shaped divisions, which are slightly glaucous and downy. Spadix short, compressed; spathes 6-8 inches long, compressed, downy at the edge.

This palm is too well-known as to need a detailed description.

C. humilis is a very variable palm. We mention only the following varieties: *C. humilis var. arborescens*, Mart. (= *C. arborescens* Pers., *C. elata* and *tomentosa*, Hort.) of N. Africa; var. *bilaminata*, Wendl.,—*conduplicata*, Kickx.; *glaucescens*, Rgl.;

gracilis, Lodd.; *inermis*, Rgl.; *melanacantha*, Rollis.; *robusta*, Van Houtte, etc.

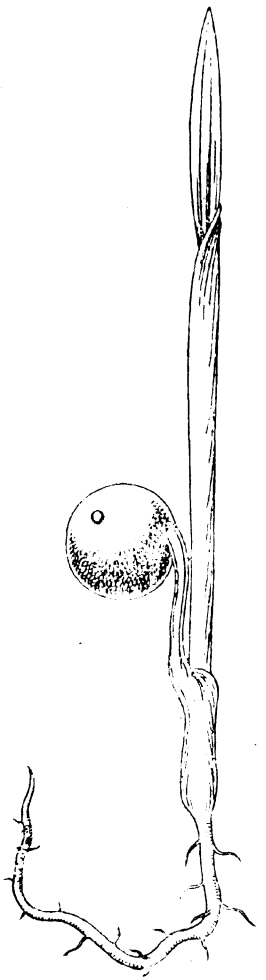


FIG. 6.
Germination of seed of *Chamærops humilis*.
(After Martins).

HABITAT.—This is the only palm indigenous to Europe. It is found as far up as Nice in Italy, but thence southward it has a great range, being met with in all the countries bordering the Mediterranean Sea.

USES.—The fibres furnished by the stem mixed with camel's hair are used for making tent covers. Of the leaves they make baskets, and cordage from all parts of the plant. The palm also affords materials for paper-manufacture. The tree furnishes a fibre resembling horse-hair, which is firm and elastic, and is used in great quantities in the manufacture of carpets, under the name of vegetable or African hair. The sails made from it are better than those prepared from the Spanish broom (*Genista scoparia*, Lam.). The fibres, divested of the glutinous matter which binds them together, are extremely divisible, as fine as flax, and can be used, in spite of their inferior length (10-16 inches), in the preparation of flax cotton.

CULTIVATION IN EUROPE.—The Dwarf Fan Palm is a greenhouse tree of very easy culture in a compost of rich strong loam, to which is added a small portion of vegetable mould and sand. Perfect drainage and copious supplies of water throughout the summer are most essential to success. Propagation may be effected by suckers or by seeds.

If the palm is employed in sub-tropical gardening, it should have a situation sheltered from strong winds.

ILLUSTRATION.—Plate X shows a clump of Dwarf Fan Palms which are growing in the Government Horticultural Gardens

of Lucknow. The leaves of two specimens have been badly attacked by insects.—We have to thank Mr. H. J. Davies who kindly supplied us with the photograph.

2. *TRACHYCARPUS* H. WENDL. BULL. SOC. BOT. FRANC. VIII. 429.

From the Greek "Trachys"=hard, rough, and "carpos" fruit, probably in allusion to the rough, hairy fruit.

Mart. Hist. Nat. Palm. III. 251 (spec. 3, 4, 7), t. 125.—Wall. Pl. Asiat. Rar. III. t. 211.—Bot. Mag. t. 5221 (excl. fig. 6, 7.)—Griff. Palms Brit. Ind. 133, t. 227 A. B.—Kurz For. Fl. II. 526.—Benth. & Hook. Gen. Pl. III., II. 928, 98.

Tall, unarmed palms. Leaves suborbicular or reniform, plicately multifid; segments narrow, rhachis 0. Spadices many, interfoliar, stout, branched; spathes many, sheathing, embracing the peduncle and branches of the spadix, coriaceous, compressed, tomentose; bracts and bracteoles minute. Flowers small, polygamo-monœcious. Sepals 3, ovate; petals 3, broadly ovate, valvate. Stamens 6, filaments free; anthers short, dorsifixed. Carpels 3; stigmas 3, recurved; ovules basilar. Drupes 1-3, globose or oblong; style subterminal. Seed erect, ventrally grooved; hilum basilar; albumen equable; embryo dorsal.

Species 3.—Himalaya, China, Japan.

CULTIVATION IN EUROPE.—All the species of this genus are easily cultivated; they are greenhouse or half-hardy palms. They grow well in a compost of rich, strong loam with a small portion of vegetable mould and sand. Perfect drainage, and copious supplies of water throughout the summer are essential. They may be propagated by suckers or by seeds.

Trachycarpus martiana H. Wendl. in Bull. Soc. Bot. Fr. VIII. (1861) 429; Hook. Fl. Brit. Ind., VI. 436.—*T. khasiana* H. Wendl. l. c; Hook. f. Bot. Mag. t. 7128.—*Chamærops martiana* Wall. Cat. n. 8621; Mart. in Wall. Pl. Asiat. Rar. III. 5, t. 211; Hist. Nat. Palm. III. 251, 320; Royle Ill. 394, (-73-9); Griff. in Calc. Journ. Nat. Hist. V. 339; Palms Brit. Ind. 133.—*Chamærops Griffithii* Lodd. Cat. Palm. 1841; Hort. Par. ex Rev. Hortic. 1879, 212, f. 43, ed. 1881, 143.—*Ch. khasyana* Griff. in Calc. Journ. Nat. Hist. V. 341; Palms Brit. Ind., 134; t. 227 A, B, C; Brand. For. Fl. 546; Kurz in Journ. Asiat. Soc. Beng. XLIII. 204; For. Fl. II. 526; Gamble Man. Ind. Timb. 418; Houllet in Rev. Hortic. 1879, 272.

NAMES.—Martius' Chusan Palm; Jhangra, Jhaggar, Tal, Takil (Kumaon); Pakha (Ass.); Taggu (Newar name in Nepal).





A.—Martius' Chusan Palm (*Trachycarpus martiana* H. Wendl.). *B.*—Fortune's Chusan Palm (*Trachycarpus excelsa* H. W

DESCRIPTION. A tall, slender tree, 20-50 feet high, often stunted on dry ground or in otherwise unfavourable localities, with a globose crown of dark shining leaves, clothed beneath the crown with persistent leaf-sheaths; young parts furfuraceously hairy. Petioles 3 feet long, the sheathing base consisting of two layers, the inner layer, which separates from the outer, being composed of a network of brown tough fibres, crossing each other at oblique angles, forming a close network of rhomboid meshes; upper part of petiole half-round, woolly, edges slightly denticulate. Blade orbicular, consisting of 30-40 linear segments, 15-20 inches long, connate to one-third or one-half their length, emarginate or shortly bifid at the top, rigidly coriaceous. Spadix a drooping compound panicle, 1-1½ foot long, covered with dark rust-coloured down, with several stout main branches, each in the axil of a large coriaceous sheathing bract; basal spathes 1 foot long. Petals ovate, concave, whitish; stamens 6; filaments subulate, nearly free, longer than the anthers. Ovary and the rudiments of ovary in male flowers hairy. Drupe 1, oblong, at first yellow, dark glossy blue when ripe.

HABITAT.—Central Himalaya, Nepal, 5-8,000 feet; Khasia Hills, 4-5000 feet; Manipur 6,000 feet; Upper Burma, Kachin Hills, 4-6,500 feet. (Grows in great numbers, forming clumps and rows, on the Thakil Mountain in Eastern Kumaon, in the Fork between the Sarju and Kali rivers, between 6,500 and 7,800 feet, where snow generally covers the ground from November till March above the zone of *Pinus longifolia* in the region of *Quercus, Rhododendron, Andromeda,* and *Taxus,* in damp shady glens on the north and south-east, but chiefly on the north-west side. Also on Dhuj Mountain, north-east of the Thakil, on the Kalimoandi range between the Ramgunga and Gori rivers, and in the Sarju valley near Bagesar. Dwarf specimens were found at the base of the Satbunga Mountain, south-east of the Gagar Pass, in very dense forest at 6,500 feet elevation, and on the Berchula, a spur of the Bhatkot Mountain, considerably farther in the interior and at about 8,000 feet elevation, which probably is its western limit.)

ILLUSTRATION.—Martius' Chusan Palm which is figured on Plate XI A, is kept in a hothouse of the Kew Gardens, whilst Fortune's Chusan Palm (Plate XI B) is growing in the same

garden in the open. I owe the two photographs to the kindness of Mr. A. W. Hill, the Director of the Royal Botanic Gardens in Kew.

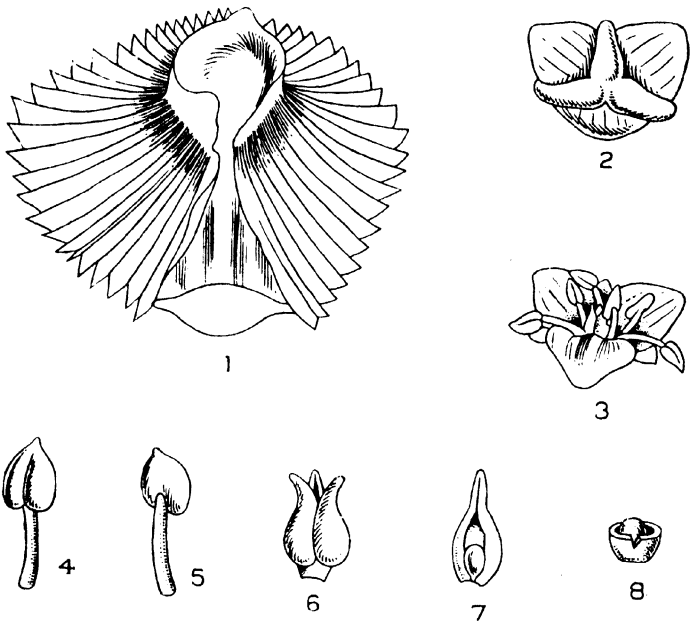


FIG. 7.
Trachycarpus martiana.

1. Base of lamina of leaf and ligule.
2. Back view of flower.
3. Flower.
4 and 5. Stamens.
6. Carpels.
7. The same dehiscing when still young.
8. Transverse Section of the same showing the ovule. (2—8 magnified) (After Hooker).

2. **Trachycarpus excelsa** H. Wendl. in Bull. Soc. Fr. VIII, 429; Hook. f. Fl. Brit. Ind. VI, 436.—*Trachycarpus fortunei* Wendl. l.c.—*Chamærops excelsa* Thunb. Fl. Jap. 130 (not var. ♂); Mart. Hist. Nat. Palm. III. 251; Miquel Fl. Jap. 329; J. Gay in Bull. Soc. Bot. Fr. VIII. 410; Franch. et Sav. Enum. Pl. Jap. II., 1; Carrière in Rev. Hortic. 1877, 223.—*C. fortunei* Hook. Bot. Mag., t. 5221.

NAME.—Fortune's Chusan Palm.

DESCRIPTION.—Stem of considerable height, clothed throughout with old leaf sheaths and a good deal of coarse transverse fibre, which also abounds among the perfect foliage. Leaves forming a handsome, more or less spreading crown. Petioles 1½ foot or more long, convex below, nearly plain above, the

margin quite unarmed or very obscurely toothed. Lamina semiorbicular, flabellate, 1½ foot long and broad, deeply plaited, cut for about a half or more of the way down into numerous linear segments, which are ¾-1 inch broad, pendulous towards their apices. Spadix small in proportion to the plant, and consequently not very conspicuous, emerging from several imbricating leafy bracts, and constituting a dense thyrsoid panicle, more than a span long and clothed with yellow flowers. Flowers clustered, 2-4 on a tubercle, sessile. Calyx small, of 3 sepals. Corolla of 3 orbicular petals. Stamens inserted on the base of the petals. Ovaries 3, ovate, hairy, tapering upwards into a thick subulate style. Drupe reniform, deeply hollowed on one side; embryo opposite the umbilicus.

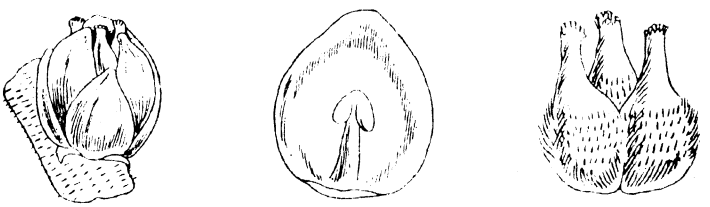


FIG. 8.

1. Female flower of *Trachycarpus excelsa*.
2. Petal and stamen of the same.
3. Ovaries of the same.

All magnified.
(After Hooker.)

HABITAT. - Upper Burma, Yunan; China, Japan.

USES.—The brown fibre surrounding the trunk is very strong; the Chinese employ it for many domestic purposes. It is made into ropes and cables for the junks and wrought into bed bottoms, used by all classes of the population. Labourers and coolies in Northern China make hats from the leaves. Also their "so-e," or garment of leaves, which they wear in wet weather, is manufactured from the leaves of this palm.

CULTIVATION IN INDIA: It needs protection from strong sunshine when grown in the plains.

3. **Trachycarpus takil** Becc. Webbia I, 52.—*Chamærops martiana* (non-Wallich) Duthie in Gard. Chronicle 1886, 10th April, p. 457.—Royle Illustr. of the Bot. of Himal. Mount., pp. 394, 397, 399 *(ex parte?)*—Hook. f. Himal. Journ. II, 280 *(quod ad plant. ex Himal. occid. pertinet)*.

NAMES. - Takil, Jhangra, Jhaggar, Tal (in Kumaon).

Stem of young plants growing oblique, then ascending, erect, straight and stout, distinctly conical when young (in a young specimen, 12½ feet high, the stem measured 3½ feet in circumference at the base and only 1 foot at the top); when fully developed 30-40 feet high, produces flowers when about 3½ feet high, always covered with the permanent leaves and the chestnut-brown fibrous network; the ligular appendages of the sheath erect, similar to those of *T. excelsa,* but much shorter, broad, triangular, remaining erect in the terminal bud. Leaves all permanent, similar to those of *T. excelsa,* but those of the previous year just below the last flowering spadices reflexed, but permanent. Petiole about as long as the limb, slender, subtrigonous, the lower angle rounded; margins very acute, armed with minute irregular subspinescent teeth or crenulations; ligule at the top of the petiole semilunar, irregular, crenate in the upper part. Blade ¾ orbicular, 3½-4 feet in diameter, with 45-50 divisions measuring 2½-2⅔ feet from the top of the petiole to the apex of the median segments. Segments very irregularly divided more or less down to the middle, green, rather shining on the upper surface, glaucescent pruinose on the lower; central segments about 1½ inch broad from the base to almost the top, where they are shortly bifid or bidentate with the teeth obtuse and divaricate; lateral segments gradually becoming narrower and shorter.

Male spadices very similar to those of *T. excelsa,* as regards size, ramification and shape of the spathes, but the branchlets are less densely covered with flowers. Flowers glomerulate, 2-4 together with minute yellow fleshy bracts at the base, in the well developed bud obscurely trigonous-globose, ⅛ inch long; calyx very small, sepals suborbicular, very obtuse and rounded at the apex; petals broadly ovate, concave, obtuse, twice as long as the calyx; stamens 6, equal, uniseriate; filaments cylindrical-resiniform, at least ¼ longer than the petals; anthers ovate-oblong, versatile; carpels 3, narrowly conical, slightly incurved and divergent, glabrous, half as long as the petals, with an ovule apparently well developed. Female spadix and flowers not yet described. Fruit similar to that of *T. excelsa,* but more distinctly reniform and somewhat broader. (After Beccari.)

HABITAT.—Up to now this palm has been found in the Western Himalaya only. It grows on Mount Takil in Kumaon at a

height of 6,600—8,000 feet, where it is annually covered with snow. According to Gamble it prefers the cool narrow valleys to the north-west. Duthie found hundreds of them at a height of 8,000 feet in the moist forests of *Quercus dilatata*.

CULTIVATION IN EUROPE.—Beccari was probably the first to introduce this palm in Europe. He obtained some plants from seeds in the year 1887. All the young plants showed a marked tendency towards unilateral development, as if they wanted to creep on the ground. In the course of time the stem grew upwards and became quite straight, but the lower part always remained much thicker than the upper portion. After the appearance of the stem this palm seems to grow quicker than *T. excelsa*. The trees were kept in the open in the vicinity of Florence and they did not suffer even during the severest of winters. Only once in an exceptionally cold winter the ice spoilt a few leaves. The heat seems to be more harmful to them than the cold. In 1904 some leaves were so to say burnt by the July sun and, perhaps, also in consequence of the exceedingly dry air.

In April 1902 one of the palms produced 3 male spadices. The same tree measured in November 1904 almost 13 feet, taken from the ground to the top of the central leaves.

3. *RHAPIS* L. f. IN AIT. HORT. KEW. III, 473.

(From the Greek "Rhapis": a rod.)

Jacq. Hort. Schœnbr. t. 316.—Mart. Hist. Nat. Palm. III, 253, t. 144.—Kunth Enum. Pl. III, 251.—Walp. Ann. III, 471.—Bot. Mag. t. 1371.—Miq. Fl. Ind. Bot. III, 61.—Benth. and Hook. Gen. Pl. III, II. 930, 99.

Stem low, cane-like, cæspitose, covered with the remains of the petioles. Leaves alternate, terminal, small, with the segments divided almost to the base; margins of segments denticulate. Spadix long-peduncled; peduncle with 2-3 short, tubular spathes. Flowers dicœcious or polygamous on the slender branches of the paniculately branched spadix, yellowish. Calyx cupular, 3-dentate. Corolla in male flowers club-shaped, in female flowers shorter, obovate. Stamens 6, rudimentary in the female flowers. Carpels 3, fleshy, ending in short styles. Berry small, 1-seeded; pericarp fleshy; endocarp soft; seed compressed-globose; embryo ventral.

Species at least 9[1].—Eastern Asia, from China to the Sunda Islands.

CULTIVATION IN EUROPE.—Densely tufted greenhouse palms. The species are of a very easy culture. They thrive in a compost of rich, strong loam to which is added a small portion of vegetable mould and sand; they require perfect drainage and plenty of water throughout the summer. Propagation may be effected by suckers.

1. **Rhapis flabelliformis** Ait. Hort. Kew. ed. I., III, 473.—Mart. Hist. Nat. Palm. III, 253, t. 144.—Kunth, En. Pl. III, 251.—Jacq. Hort. Schœnbr. t. 316.—Bot. Mag. t. 1371.—Franch. et Savat. En. Pl. Jap. II, 2.—Benth. Fl. Hongk. 340.—Bretschn. Hist. Europ. Bot. Disc. 126.—*R. kwanwortsik* H. Wendl. Ind. Palm. 34.—Seem. Bot. Voy. Herald, 416.

NAME.—Dwarf Ground-Rattan.

DESCRIPTION.—Stem about 5-6 feet high, of the thickness of the thumb, sheathed by the reticulate persistent bases of the leaves. Leaves about 8, petioled, palmate, 5-7-parted; segments subplicate, ciliate-spinulous along the edges and keel of the plaits, indented-erose at the end; petiole round-ancipital, naked, very, obscurely denticulate. Spadix sparse, paniculately branched, 4-5 inches long; spikelets thick-set with sessile yellowish flowers.

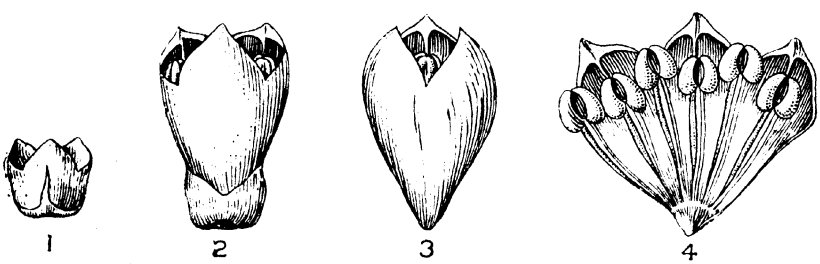


FIG. 9.

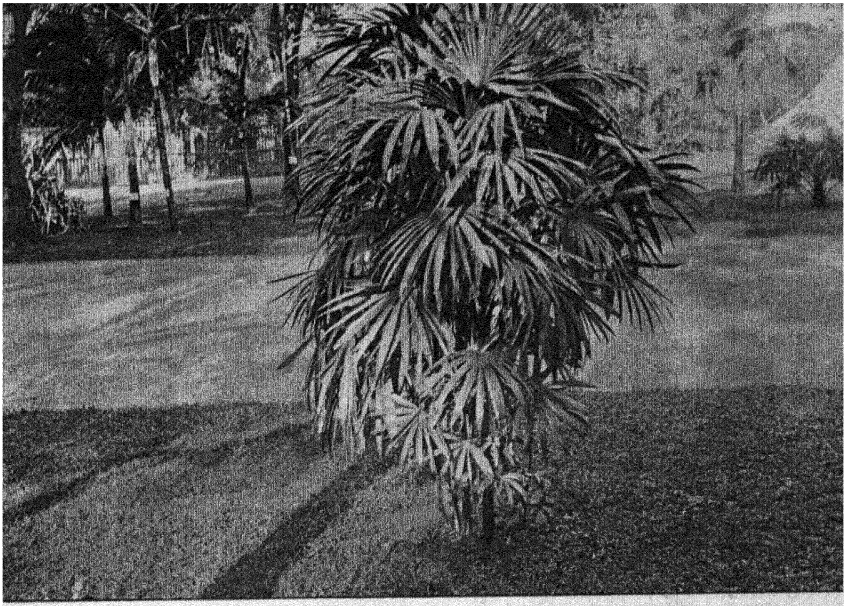
Rhapis flabelliformis.

1. Calyx of male flower with bract.
2. Male flower.
3. Corolla of male flower.
4. Open Corolla of male flower with stamens.

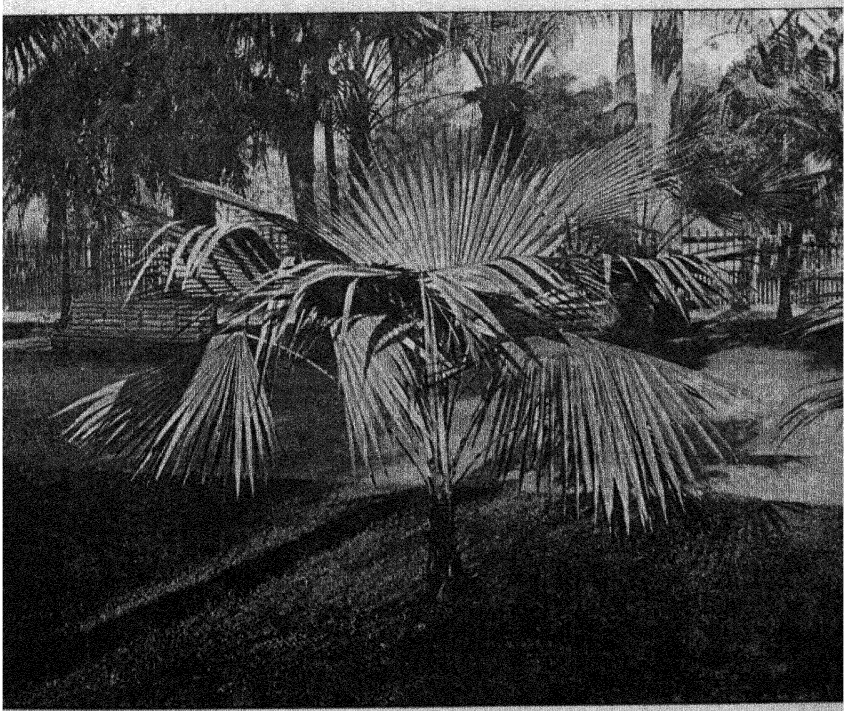
All magnified. (After Martius.)

Male flowers: calyx of one piece, urceolate, fleshy, green, smooth, scarcely 1 line in length, trifid, segments roundish-pointed, upright, with a membraneous border; corolla yellow, coriaceous-

[1] O. Beccari has described some new species of *Rhapis*. Cf. Webbia, vol. 3, Firenze, 1910.



A.—Low Ground-Rattan (*Rhapis humilis* Bl.).



B.—*Thrinax radiata* Lodd.

fleshy, obovate-oblong, tube clavate, triquetral, twice the length of the calyx, limb trifid, three times shorter than the tube,

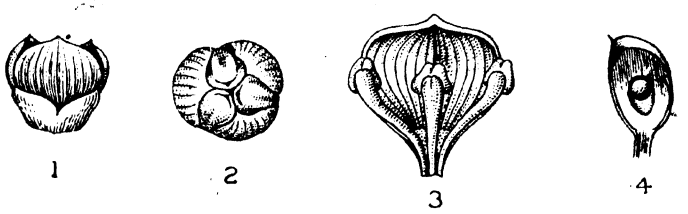


FIG. 10.

Rhapis flabelliformis.

1. Side view of female flower.
2. Female flower seen from above.
3. Part of Corolla of female flower with 3 staminodes.
4. Longitudinal section through ovary.

All magnified. (After Martius.)

segments ovate, acute, subconnivent; filaments 6, filiform-triquetral, shorter than the corolla, adnate to the tube, alternately somewhat thicker and more detached. Fig. 9 and 10.

HABITAT.—S. China and Loochoo, in the Happy Valley Woods.

USES.—This palm yields excellent walking-sticks, called "ground-rattans."

CULTIVATION IN EUROPE.—The Dwarf Ground-Rattan is adapted to room-cultivation and may be kept at a great distance from the window. Of this species there exist varieties with white and golden-yellow leaves.

ILLUSTRATION.—Plate XIII *A* shows a characteristic group of Dwarf Ground-Rattans as grown in the Royal Botanic Gardens of Peradeniya in Ceylon. Mr. H. F. Macmillan has been kind enough to take the photograph himself.

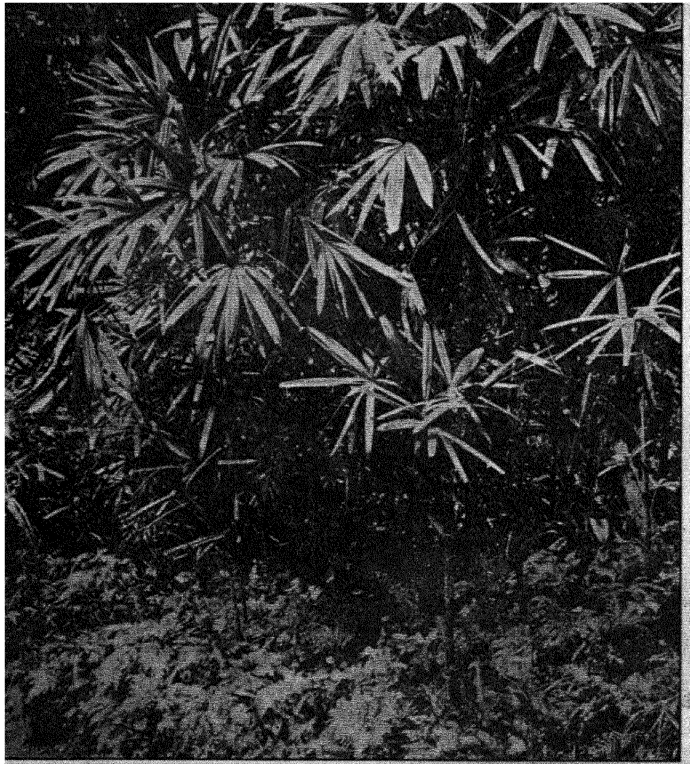
2. **Rhapis humilis** Bl. Rumphia, II, 54.—Mart. Hist. Nat. Palm. III, 254.—Walp. Ann. V. 818.—Wright J. Linn. Soc. vol. 36, p. 169.—*R. sierotsik.* Sieb.—*Chamærops excelsa* var. *humilior* Thbg. Fl. Jap. 130.

NAME.—Low Ground-Rattan.

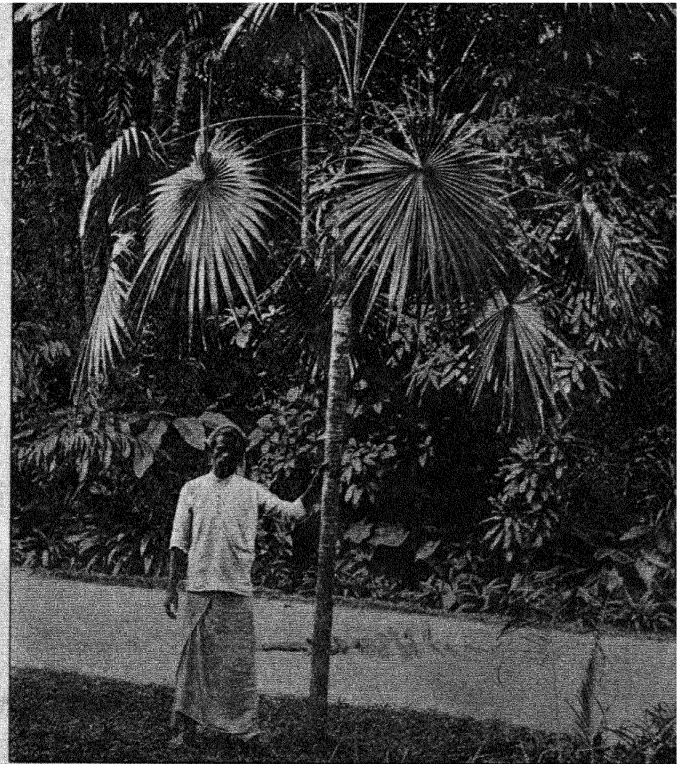
DESCRIPTION.—Leaves cut into from 7-10 spreading segments; petioles unarmed. Similar in general aspect to *R. flabelliformis.*

HABITAT.—China (cultivated in Japan).

CULTIVATION IN EUROPE.—The Low Ground Rattan is well adapted to room-cultivation. There exist beautiful garden-varieties with white and golden yellow leaves.



A.—Dwarf Ground-Rattan *(Rhapis flabelliformis* L. f.*)*.



B.—Silver Thatch Palm *(Coccothrinax argentea* Sarg.*)*

ILLUSTRATION.—The photograph on Plate XII *A*, taken by the Rev. M. Maier, S. J., shows several specimens of the Low Ground-Rattan growing in the Victoria Gardens of Bombay. The position of the leaves and the greater number of leaf-segments at once distinguish this species from the Dwarf Ground-Rattan on Plate XIII *A*. The plants are about 5 feet high.

4. *COCCOTHRINAX* SARGENT, BOT. GAZETTE, XXVII, 87 (1899).

(The name was given in allusion to the berry-like fruit.)

Thrinax Endlicher Gen. Pl. 253 (in part) 1836. Meissner Gen. 357 (in part).—Benth. and Hook. Gen. III, 930. Drude Engl. and Prantl. Pflanzenf. II, pt. III, 34 (sect. *Euthrinax*).—Baillon Hist. Pl. XIII, 317 (excl. sect. *Hemithrinax*). Sargent Silva N. Am. X. 49. (sect. *Euthrinax*).

Small unarmed trees, with simple or clustered stems or rarely stemless. Leaves orbicular, or truncate at the base, pale or silvery white on the lower surface, divided into narrow obliquely-folded segments, acuminate and divided at the apex; rhachises narrow; ligules thin, free, erect, concave, pointed at the apex; petioles compressed, slightly rounded and ridged above and below, thin and smooth on the margins, gradually enlarged below into elongated sheaths of coarse fibres forming an open network covered while young by thick hoary tomentum. Spadix interfoliar, paniculate, shorter than the leaf-stalks, its primary branches furnished with numerous short slender pendulous flower-bearing secondary branches; spathes numerous, papery, cleft at the apex. Flowers solitary, perfect, jointed on elongated slender pedicels; perianth cup-shaped, obscurely lobed; stamens 9-12, inserted on the base of the perianth, with subulate filaments enlarged and barely united at the base, and oblong anthers; ovary 1-celled, narrowed into a slender style, crowned by a funnel-formed oblique stigma; ovule basilar, erect. Fruit a subglobose berry raised on the thickened torus of the flower, with thick juicy black flesh. Seed free, erect, depressed-globose, with a thick hard vertically-grooved shell deeply infolded in the bony albumen; hilum basilar, minute: raphe hidden in the folds of the seed-coat; embryo lateral or apical.

Species about 15.

DISTRIBUTION.—*Coccothrinax* is confined to the tropics of the New World. Two species, of which one is stemless, inhabit southern Florida, and at least eleven other species are scattered over several of the West Indian Islands.

CULTIVATION IN EUROPE.—All the species of this and the next genus are stove-palms. When young they should be kept in a compost of loam, peat and sand; as they get older, turfy loam and sand is preferable. Propagation is effected by seeds. These should be obtained when freshly imported, sown in well-drained pots or pans of sandy loam, and plunged in bottom heat.

1. **Coccothrinax argentea** Sargent in Bot. Gaz. XXVII (1899), 89.—Beccari, Webbia, II (1907), 317.—*Thrinax argentea* Lodd. in Desf. Cat. ed. 3, 31; Rœm. et Schult. Syst. Veg. VII, 1300.—Mart. Hist. Nat. Palm. III, 256, t. 103, III.—*Th. multiflora* Mart. Hist. Nat. Palm. III, 255, t. 103, I. a.—*Th. excelsa* Hart. Bot. Mag. t. 7088?

NAMES.—Silver Thatch Palm, Silver-leaved Palmetto, Guano.

DESCRIPTION.—Stem reaching up to 40 feet high. Leaves peltate, radiate, suborbicular, green above, whitish or almost silvery below, in adult plants divided into about 60 segments down to a little below the middle, in young plants much deeper. Petiole very long and slender, depressed-biconvex with very acute margins; ligule glabrous, subligneous, broadly subcordate, prolonged in the centre into a triangular acuminate point; larger segments of adult plant up to $3\frac{1}{3}$ feet long and $1\frac{1}{5}$—$1\frac{2}{5}$ inch broad at the point where the segments divide, then narrowing into a very acuminate point which is shortly split at the apex; lateral segments gradually becoming narrower, longer acuminate and more deeply divided. Spadix shorter than the leaf, with a few partial inflorescences; primary spathes papery, reddish brown or cinnamon-coloured, delicately striate, more or less acuminate at the apex, on the ventral side of the upper part open, with the margins entire or slightly filamentous-fibrous; partial inflorescences forming panicles which are broadly ovate, 6-8 inches long with many flowering branchlets inserted irregularly on the principal axis; flowering branchlets filiform, about $\frac{1}{24}$ inch thick, the lowest ones $3\frac{1}{3}$—4 inches long, the upper ones a little shorter, with numerous flowers spirally arranged and borne on pedicels $\frac{1}{24}$—$\frac{1}{6}$ inch long. Perianth low-cupular, divided almost to the base into 6 narrow subulate teeth; stamens usually 9, anthers linear, $\frac{1}{12}$ inch long, spirally contorted, obtuse



High Thatch Palm (*Thrinax excelsa* Lodd. & Griseb.)

at the apex; ovary ovate-globose, very abruptly constricted into a short neck which widens into a large infundibuliform stigma.

Fruiting perianth disc-shaped, depressed. Ripe fruit $\frac{3}{8}$—$1\frac{5}{2}$ inch in diameter, spherical, black-violascent; pericarp fleshy. Seed $\frac{1}{4}$—$\frac{7}{24}$ and even $\frac{1}{3}$ inch in diameter, cerebriform. Embryo exactly apical.

HABITAT.—San Domingo.

NOTE.—It is good to remember that the specific name *"argentea"* has been applied, not only in gardens and hothouses, but also by many authors, to all the species of *Thrinax* and *Coccothrinax* which show a silvery white on the underside of their leaves.

ILLUSTRATION.—Plate XIII *B* shows a well grown specimen of the Silver Thatch Palm in the Royal Botanic Gardens of Peradeniya in Ceylon. The stem is about 12 feet high. I owe the photograph to the kindness of Mr. H. F. Macmillan.

5. *THRINAX* SW. PRODR. 57 (1788).

(From the Greek 'Thrinax,' a fan, alluding to the form of the leaves.)

Schreber Gen. 772.—Mart. Hist. Nat. Palm. III, 254, 320, t. 103, 163.—Endlicher Gen. 253. Meisner Gen. 357.—Drude Engl. und Prantl. Pflanzenf. II. pt. III, 34. (sect. *Porothrinax*).—Sargent Silva N. Am. X. 49. (sect. *Porothrinax*); Bot. Gaz. XXVII, 83; Becc. Webbia, II, 247.

Small unarmed trees, with stems covered with pale-grey rind. Leaves orbicular or truncate at the base, thick and firm, usually silvery white on the lower surface, divided to below the middle into narrow acuminate parted segments with thickened margins and midribs; rhachises with narrow borders, with thin usually undulating margins; ligules thick, concave, pointed, lined while young with hoary tomentum; petioles compressed, rounded above and below, thin and smooth on the margins, with large clasping bright mahogany-red sheaths of slender matted fibres covered with thick hoary tomentum. Spadix interfoliar, stalked, its primary branches short, alternate, flattened, incurved, with numerous slender rounded flower-bearing branchlets; spathes numerous, tubular, coriaceous, cleft and more or less tomentose at the apex. Flowers solitary, perfect; perianth 6-lobed; stamens six inserted on the base of the perianth, with subulate filaments

thickened and only slightly united at the base or nearly triangular and united into a cup adnate to the perianth, and oblong anthers; ovary 1-celled, gradually narrowed into a stout columnar style crowned by a large funnel-formed flat or oblique stigma; ovule basilar, erect. Fruit a globose drupe with juicy bitter flesh easily separable from the thin-shelled tawny brown nut. Seed free, erect, slightly flattened at the ends, with an oblong pale conspicuous subbasilar hilum, a short-branched raphe, a thin coat, and uniform albumen more or less deeply penetrated by a broad basal cavity; embryo lateral.

SPECIES.—At least ten are now generally recognized.

DISTRIBUTION. *Thrinax* is confined to the tropics of the New World and is distributed from Southern Florida through the West Indies to the shores of Central America.

NOTE.—Several beautiful and ornamental species of this genus are cultivated in European hothouses and Indian gardens; but with regard to their names mentioned in books, herbaria and tickets of living specimens it is difficult to imagine a greater confusion. Though the number of species is not great, Beccari does not hesitate to say that "a critical revision of the literature on *Thrinax* would be a bold, if not an impossible undertaking." "There are, besides," he continues, "numerous horticultural species which are only known by name or which have been described from the leaves of young specimens and which cannot be recognized any more."

If an authority like Beccari speaks in these terms, nobody will expect us to identify all the different species which, at present, are growing in Indian gardens, sometimes without name, sometimes with names not to be found in any book, and very often with wrong names.

The only way of clearing up the many doubts and uncertainties and to arrive at a correct nomenclature will be to describe accurately and with every possible detail the morphological structure of flowering and fruiting specimens, to preserve leaves, flowers and fruits, and wherever practicable, to take good photographs of young and adult plants.

We reproduce the photographs of two evidently different species, without adding the description, because we have not seen the flowers of those plants.

Plate XII-*B* shows a palm which is known in Indian gardens under the name of *Thrinax radiata*, Lodd. The photograph was taken by Rev. M. Maier in the Victoria Gardens of Bombay.

Very incomplete descriptions of *Thrinax radiata* are to be found in the following books: Rœm. et Schult. Syst. Veg. VII, 2, 1301; Desf. Cat. h. Paris. ed. 3, 31; Mart. Hist. Nat. Palm. III, 257; but they will not help much towards establishing the identity of our specimen.

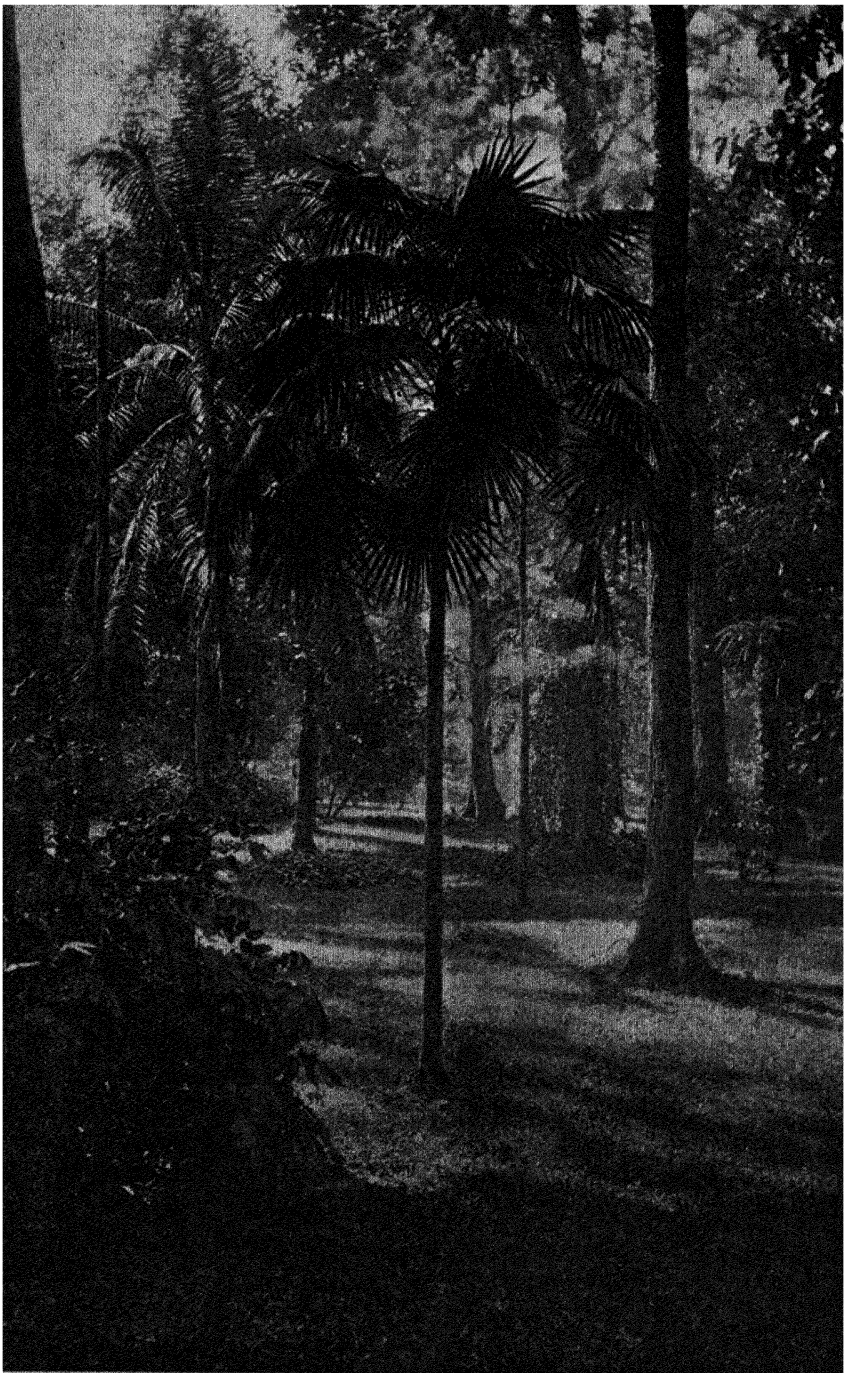
Plate XIV represents a beautiful specimen of the High Thatch Palm, which is called in Indian gardens *Thrinax excelsa*, Griseb. (or Lodd. et Griseb.). Mr. Phipson has taken the photograph in a Bombay garden. This palm is a favourite with amateurs on account of its ornamental character.

There are many palms which received the name of *Thrinax excelsa* in course of time. One of them is described and figured in Hooker's Botanical Magazine (t. 7088); but even so Beccari was not able to establish its exact identity.

1. **Thrinax parviflora** Sw. Prodr. 57 (1788); Fl. Ind. Occid. I, 614, t. 13.—Ait. Hort. Kew. III, 473.—Willd. Spec. Pl. II, pt. I, 202.—Pers. Syn. I, 383.—Lunan, Hort. Jam. II, 28.—Poiret, Lam. Dict. VII, 635.—Titford Hort. Bot. Am. 112.—Spreng. Syst. Veg. II, 50.—Rœm. & Sch. Syst. Veg. VII, pt. II, 1300.—Mart. Hist. Nat. Palm. III, 255, t. 103.—Kth. Enum. Pl. III, 253.—Dietrich Syn. II, 1091.—Walp. Ann. V, 818.—Grisebach Fl. Brit. W. Ind. 515.—*T. pumilo* Lodd. ex. Rœm. et Sch. Syst. Veg. VII, 2, 1301.—*T. excelsa* (Lodd.?) Griseb. Fl. Brit. W. Ind. 515.

NAMES.—Silk-Top Palmetto; Thatch Palm; Palmetto Royal; Palmetto Thatch.

DESCRIPTION. A tree from 10-20 feet in height, with a slender stem 4 or 5 inches in diameter, covered with thin smooth blue-grey rind. The leaves are orbicular, from 3-4 feet in diameter, thin, bright green on the upper surface, paler and coated while young on the lower surface with pale caducous tomentum, and, except at the base, where they are split nearly to the ligula, divided for about two-thirds of their diameter into laciniate lobes with stout yellow midribs prominent on the upper side, and with much thickened reflexed margins; the lobes near the middle of the leaf are 1-1¼ inch broad diminishing in width towards the base of the leaf, where they are not more than ¼ inch wide. Rhachis of leaf reduced to a thin truncate undulate border, and the ligula crescent-shaped, about ⅛ inch



Thatch Palm (*Thrinax parviflora* Sw.).

long, ¼ inch thick, and 1 inch wide, and furnished near the middle with a flat nearly triangular point ½ inch long, petiole thin and flexible, ¾ inch wide at the base of the blade, rounded and ridged on the upper and lower sides, about as long as the blade of the leaf, and enlarged below into the elongated sheath which is coated while young with a thick felt-like hoary tomentum. Three or four panicles of flowers, from 2-5 feet in length, usually appear each year; secondary branches much flattened, recurved, and 4-6 inches in length, the slender flower-bearing branchlets being from 1½-8 inches long, and in the axils of ovate acute scarious brownish bracts about ¼ inch long and ⅛ inch wide; spathes coriaceous, pubescent above the middle, and often ciliate on the margins at the apex. Flowers raised on rigid spreading pedicels ⅛ inch in length; perianth cup-like, 6-lobed; stamens usually 6, with slender exserted filaments slightly united below and large oblong light yellow anthers; ovary subglobose, dark orange-coloured, surmounted by an elongated style dilated into a broad oblique stigma (Fig. 11). Fruit dark chestnut-brown or nearly black, rather less than ½ inch in diameter, with a thin somewhat fleshy outer coat closely investing the rather thicker crustaceous light brown inner coat, and a deeply furrowed depressed globose tawny brown seed ¼ inch in diameter, with ruminate albumen. (Fig. 12.)

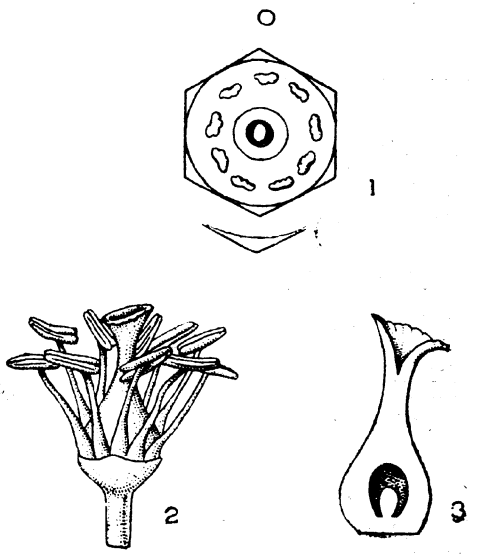


FIG. 11.
Thrinax parviflora.
1. Diagram of flower. 2. A flower (enlarged).
3. Longitudinal section of pistil (enlarged).
(After Sargent.)

HABITAT.—Up to now the Thatch Palm has been found in Jamaica only. A *Thrinax* from Florida, which was formerly included in this species, is now known under the name *Thrinax floridana*, Sargent.

USES.—The wood of the Silk-Top Palmetto is light, soft, and pale brown, with a hard outer rind about ⅛ inch in thickness, and contains numerous hard inconspicuous fibro-vascular bundles. The specific gravity of the absolutely dry wood is 0·5991, a cubic foot weighing 37·34 pounds.

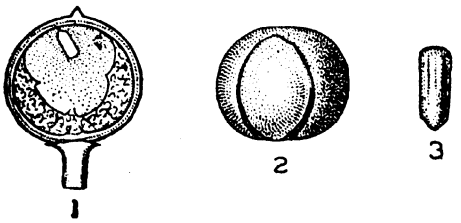


FIG. 12.
Thrinax parviflora.
1. Vertical section of fruit.
2. A seed (enlarged).
3. An embryo (much magnified).
(After Sargent.)

ILLUSTRATION.—Lt.-Col. A. T. Gage has kindly supplied me with a photograph of *Thrinax parviflora* as shown on Plate XV. The specimen is growing in the Calcutta Botanic Gardens.

2. **Thrinax barbadensis** Lodd. in Mart. Hist. Nat. Palm. III, 257.—Griseb. Fl. West. Ind. Isl. 515.—Duss Guadel. et Martinique, in Ann. Instit. Col. de Marseille, vol. III, 1896.—*T. parviflora* Maycock Fl. Barbad. 146.—*Copernicia barbadensis* Hort.

NAMES.—Thrinax de la Barbade, Latanier, Palmier à balai.

DESCRIPTION.—A very ornamental tree; stem up to 50 feet high and more, cylindric, 5-7 inches in diameter. Leaves large, flabelliform, palmatifid, glabrous; segments numerous, lanceolate, acuminate; ligule obsolete, truncate; petiole not armed, compressed-convex on both sides, about as long as the leaf-blade, covered at the base with a fibrous network. Spadix large, 10-20 inches long, consisting of about 4-10 partial panicles on a common axis, glabrous; each partial panicle enclosed in a membranous sheath which is closed up to the middle, upper part acuminate, concave. Flowers hermaphrodite, whitish with a strong disagreeable odour which attracts a great number of bees; pedicel short, a little longer than the stamens; stamens 8-12, hypogynous; filaments subulate, thickened, compressed and united at the base, slightly shorter than the ovary; anthers erect, bilocular, basifixed, bifid at both ends; style slightly shorter than the ovary, stout, funnel-shaped at the top; ovary 1-celled, 1-ovuled. Fruit globose, of the size of a pea or small cherry, pulpy, flesh black, containing a reddish-black juice.

HABITAT.—Barbadoes; Guadeloupe, on limestone hills.

FLOWERS.—Twice a year and often five times in two years (Duss).

USES.—When young the palm is well adapted for room-decoration.*

6. *CORYPHA* L. GEN. NAT. 1221.

(From the Greek "Corypha," crown of the head, vertex. The palm is called so on account of its beautiful crown of leaves.)

Gærtn. Fruct. I. t. 7.—Lam. Illustr. t. 899.—Bl. Rumph. II. 57, t. 97, 98, 105.—Roxb. Corom. Pl. t. 255, 256.—Kunth Enum. Pl. III, 235.—Mart. Hist. Nat. Palm. III, 231, 318, t. 108, 127.—Griff. Palms Brit. Ind. t. 220 D, E, F, append. 23.—Miq. Fl. Ind. Bat. III, 49.—Kurz For. Fl. II, 524.—Benth. et Hook. Gen. Pl. III, II, 922, 84.

Tall, stout, unarmed palms, dying after once flowering and ripening their seed at the age of between 20 and 80 years. Leaves very large, orbicular or lunate, flabellately multifid; segments induplicate in vernation; petioles stout, concave, spinous at the edges. Spadix a very large, terminal, erect, decompound panicle. Spathes many, tubular. Flowers small, hermaphrodite; calyx cupular, 3-fid; petals 3, connate below in a stipes, ovate, acute, imbricate or subvalvate; stamens 6; filaments subulate; anthers dorsifixed. Ovary 3-lobed, 3-celled; style short, subulate; stigma minute. Fruit of 1-3 fleshy, globose drupes; styles basilar; seeds erect, globose or oblong; albumen uniform; embryo spiral.

Species about 6; Tropical Asia.

CULTIVATION IN EUROPE.—The species of this genus are stove-plants. They are of somewhat slow growth and thrive best in a compost of two parts of loam, one of peat, and one of sand. Perfect drainage and much water are essential to success.

1. **Corypha elata** Roxb. Fl. Ind. II. 176; Mart. Hist. Nat. Palm. 233; Kunth Enum. III, 236; Griff. in Calc. Journ. Nat. Hist. V, 314; Palms Brit. Ind. 112, t. 220, D.—Hooker Fl. Brit. Ind. VI, 428; Brandis Ind. Trees, 658.

NAME.—Bajur (Beng.).

DESCRIPTION.—Trunk straight, often varying in thickness, 60-70 feet high by about 2 feet in diameter, strongly marked

* Note: Beccari has changed the old name of this species into *Coccothrinax barbadensis*. Cf. Webbia, II, 328.

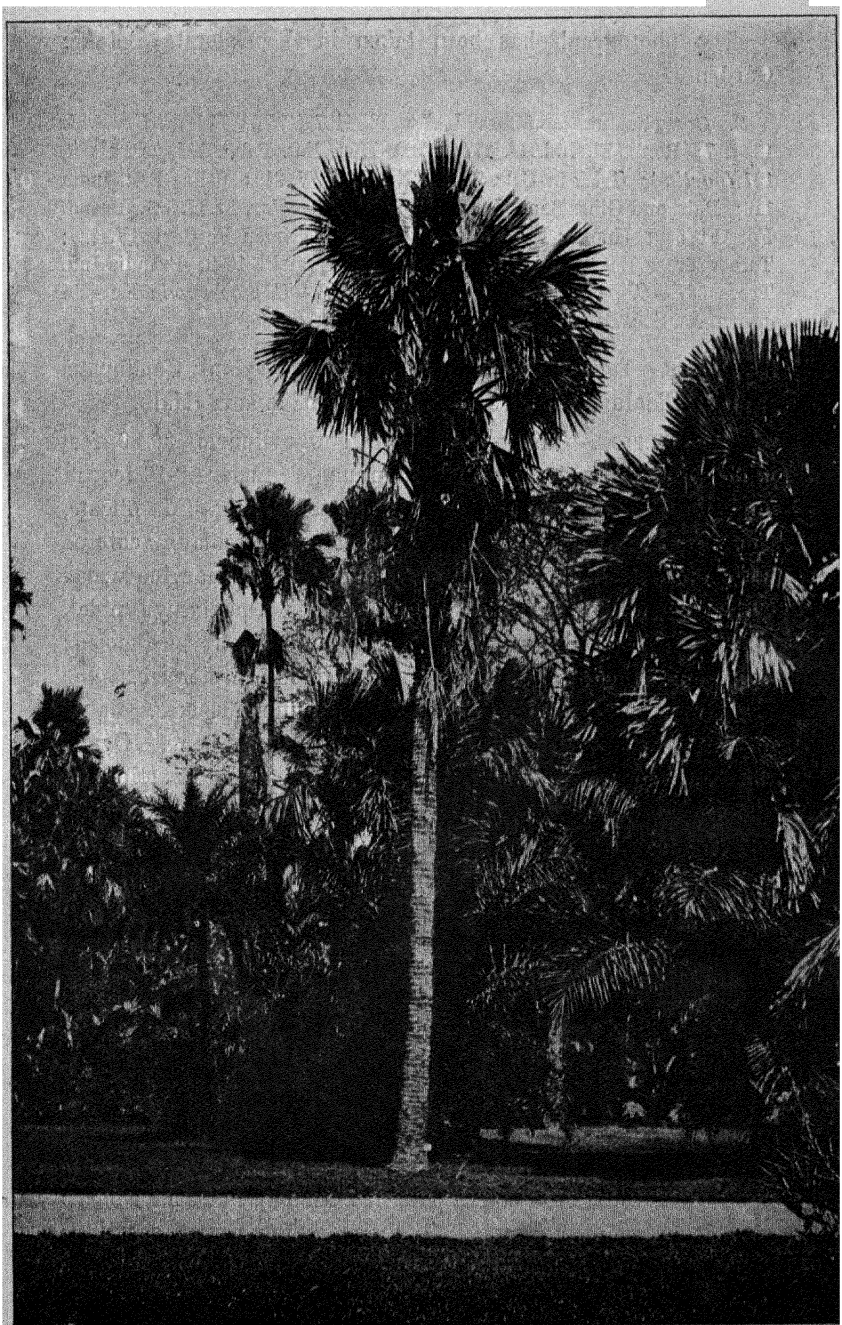
with rough, dark-coloured, spiral ridges and furrows. Leaves round the top of the tree, immediately under the base of the inflorescence, numerous, lunate, palmate-pinnatifid, plaited, 8-10 feet in diameter; segments generally from 40-50 pairs, united about half their length, ensiform, apices rather obtuse and bifid, texture hard, smooth on both sides. When the tree begins to flower, the leaves wither and fall off, leaving the fructiferous part naked; petioles 6-12 feet long, spirally arranged, auricled, concave above, with the thin, hard, black margins thereof cut into numerous, very short curved spines, spadix about ⅓ to ¼ the height of the trunk, much narrower in span than the foliage, supra-decompound; the various and innumerable ramifications are always alternate, smooth, and of a pale yellow colour. Spathes numerous, one at each joint of the various ramifications of the spadix, smooth and when young of a pale yellowish-green. Flowers small, sessile, collected in little fascicles over the ultimate divisions of the panicle, pale yellow, rather offensive. Calyx small, 3-toothed; petals 3, oblong, reflexed, shorter than the stamens; filaments 6, broad at the base, and there united, towards the apex slender and incurved; anthers ovate, dorsifixed. Ovary superior, round-ovate, suddenly contracted into the short style, 3-lobed, 3-celled, with 1 ovule in each cell, attached to the bottom of the cell; style short, 3-grooved; stigma 3-lobed. Drupe about 1 inch in diameter, stipitate, olive-coloured, smooth when fresh, but soon becoming dry and wrinkled, 1-celled; the two abortive lobes of the ovary are always to be found at the base; pericarp friable; endocarp adnate to the testa; seed solitary, subglobular, perisperm equable, hard, horny, pale grey; embryo simple, short, apical.

HABITAT.—Bengal and Burma.

FLOWERS.—In March and April; fruit ripens after about 12 months.

ILLUSTRATIONS.—The photograph reproduced on Plate XVI was kindly supplied by Lt.-Col. Gage and represents a fully developed specimen of *Corypha elata*. The spiral furrows on the stem at once distinguish this species from *Corypha umbraculifera* and *Corypha talliera*.

To the left of the Bajur is a young specimen of *Phœnix sylvestris* and to the right the huge crown of a young *Corypha umbraculifera*.



Bajur (*Corypha elata* Roxb.).

The photograph has been taken in the Calcutta Botanic Gardens.

2. **Corypha umbraculifera** L. Sp. Pl. 1187 (1753); Gærtn. Fruct. I. 18, t. 7; Roxb. Fl. Ind. II. 177; Mart. Hist. Nat. Palm. III, 232, t. 108, 127 *(partim);* Griff. in Calc. Journ. Nat. Hist. V. 319; Palms Brit. India 116; Dalz. and Gibs. Bombay Fl. Suppl. 94; Kurz For. Fl. II, 525, Brand. For. Fl. 549; Hooker Fl. Brit. Ind. VI, 428; Trimen Fl. Ceyl. IV, 328; Talbot Trees Bomb. ed. 2, p. 343; Prain Bengal Pl. 1090; Brandis Ind. Trees 657.—*C. gebanga* Kurz For. Fl. II, 525.—*C. macropoda* Kurz in Journ. As. Soc. Beng. XLIII, II. 197; For. Fl. II, 525.[1]

NAMES.—Talipot Palm; Fan-Palm; Tala (Ceylon); Condapana (Tam.); Sidalum (Tel.); Talee (Beng.); Coddapana (Mal.).

DESCRIPTION.—Trunk erect, straight, cylindric, 30-80 feet high, with a diameter of 2-3 feet, annulate. Leaves 8-16 feet in diameter, sublunate or circular, palmately pinnatifid, plicate, cleft to about the middle into 80-100 linear-lanceolate, acute or 2-fid lobes; petiole 5-10 feet long, very stout, the margins armed with short, compressed, dark-coloured spines. Spadix pyramidal, 10-20 feet long, decompound, shortly and stoutly peduncled; peduncle clothed with tubular spathes which are pierced by the primary branches, branchlets forming pendulous spikes. Calyx broadly 3-lobed: petals oblong, about $\frac{1}{12}$ inch long. Ovary suddenly contracted into the style. Drupe shortly stipitate, globose, 1½ inch in diameter, with 2 abortive carpels at its base, greyish olive-coloured roughish; seeds globose, very hard, smooth and polished. (Fig. 13.)

HABITAT.—Ceylon: in the moist low region below 2,000 feet, rather common; Malabar Coast; Kanara: moist forests of the Kumpta and Honavar talukas of Northern Kanara, covering extensive areas near the Gairsoppa and Yena rivers, also on the Yellapur Ghats; sometimes planted in gardens near the coast; South Andaman Islands; Little Coco; Great Coco; cultivated in tropical India and Burma.

Hooker makes the following remark in Trim. Fl. Ceyl. IV. 328: "This must be a native palm [of Ceylon], but I have never seen it in original jungle. Of the vast number of seedlings which come up near the parent tree, very few arrive at maturity,

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[1] *Corypha gebanga* Kurz and *C. macropoda*, Kurz have been referred to *C. umbraculifera* by Prain.

the young leaves being continually cut. Beddome remarks that he has never seen it wild in S. India."

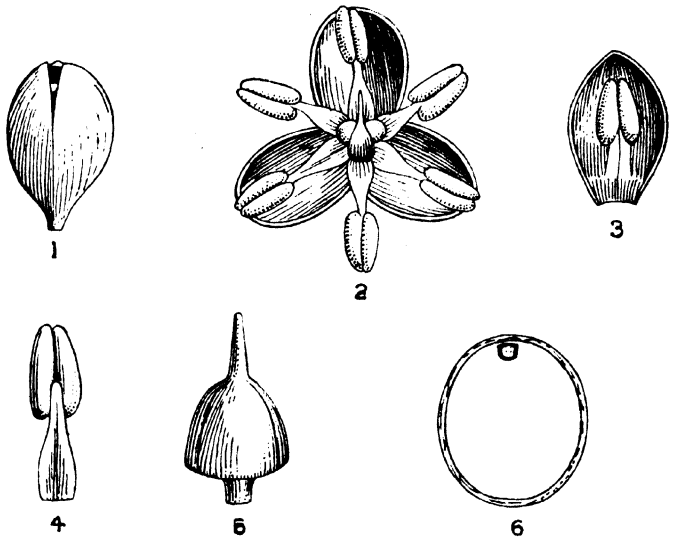


FIG. 13.—*Corypha umbraculifera.*

1. Corolla just before opening.
2. Open corolla seen from above.
3. Petal with stamen.
4. Dorsal view of stamen.
5. Longitudinal section through pistil.
6. Vertical section of seed.

1—5 enlarged. (After Martius.)

FLOWERS.—November to January.

GERMINATION.—The development of the young palm has been observed by Gatin.[1] The seed is globose with uniform albumen The embryo has the shape of a short cylinder with an elongated cone on top of it. It is covered all over, except in the central portion of the end of the radicle, with a continuous epidermis the cells of which are slightly elongated in the direction of the radius. The plumule is straight and its axis coincides with that of the embryo. In the peripheric portion of the cotyledon there are three or four hypo-epidermic layers consisting of smaller and more granular elements than the rest. Vascular bundles of elongated and narrow cells run through the cotyledon.

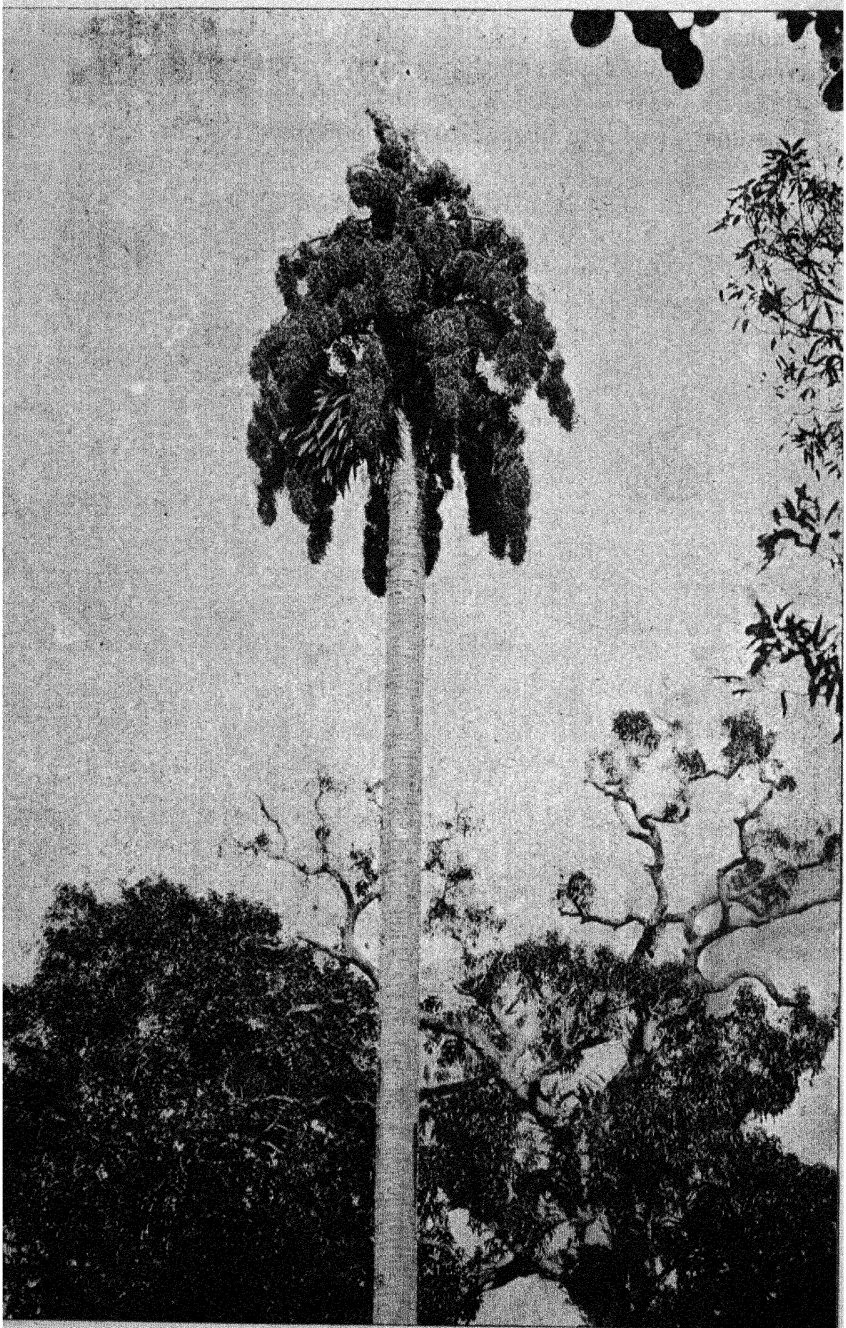
At the moment of germination the cotyledonal petiole becomes longer and forms, close to the seed, a swelling. At the base of the primary root thin lateral rootlets are formed, but

[1] Gatin, C. L., "Recherches Anatomiques et Chimiques sur la Germination des Palmiers" Paris, 1906, p. 248.



An avenue of Talipot Palms in Ceylon (*Corypha umbraculifera* L.).





Talipot Palm bearing Seed.

none of these bear root-hairs. At a later state numerous lateral roots are developed which are smaller than the primary root. The first leaf is reduced to a sheath. Finally the cotyledonal petiole and sheath begin to wither and decay. (Fig. 14.)

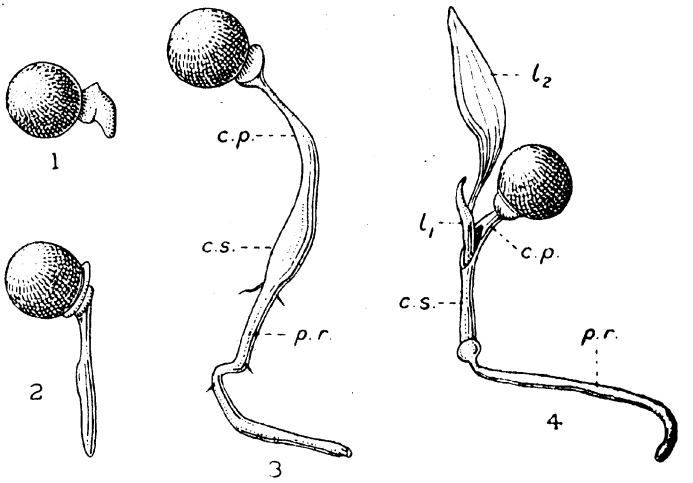


FIG. 14.—Successive stages in the germination of *Corypha umbraculifera*.
c. p.=cotyledonal petiole. *p. r.*=primary root.
c. s.=cotyledonal sheath. *l* 1. and *l* 2. =first and second leaf.

USES.—The leaves are extensively used by the lower classes of Singalese as umbrellas. They are extremely well adapted for that purpose, one outspread leaf affording sufficient shelter for seven or eight persons. Umbrellas made of the leaves are largely exported from Kanara. Some of the sacred records of the Singalese are written on pieces of the blade of these leaves with either a brass or iron style. It has been asserted by various authors that such records have resisted for ages the ravages of time, by others it has been denied. Under the native government of Ceylon each person was allowed, according to the social station he occupied, to have a certain number of the gigantic leaves of the Talipot, folded up in the form of fans, borne before him.

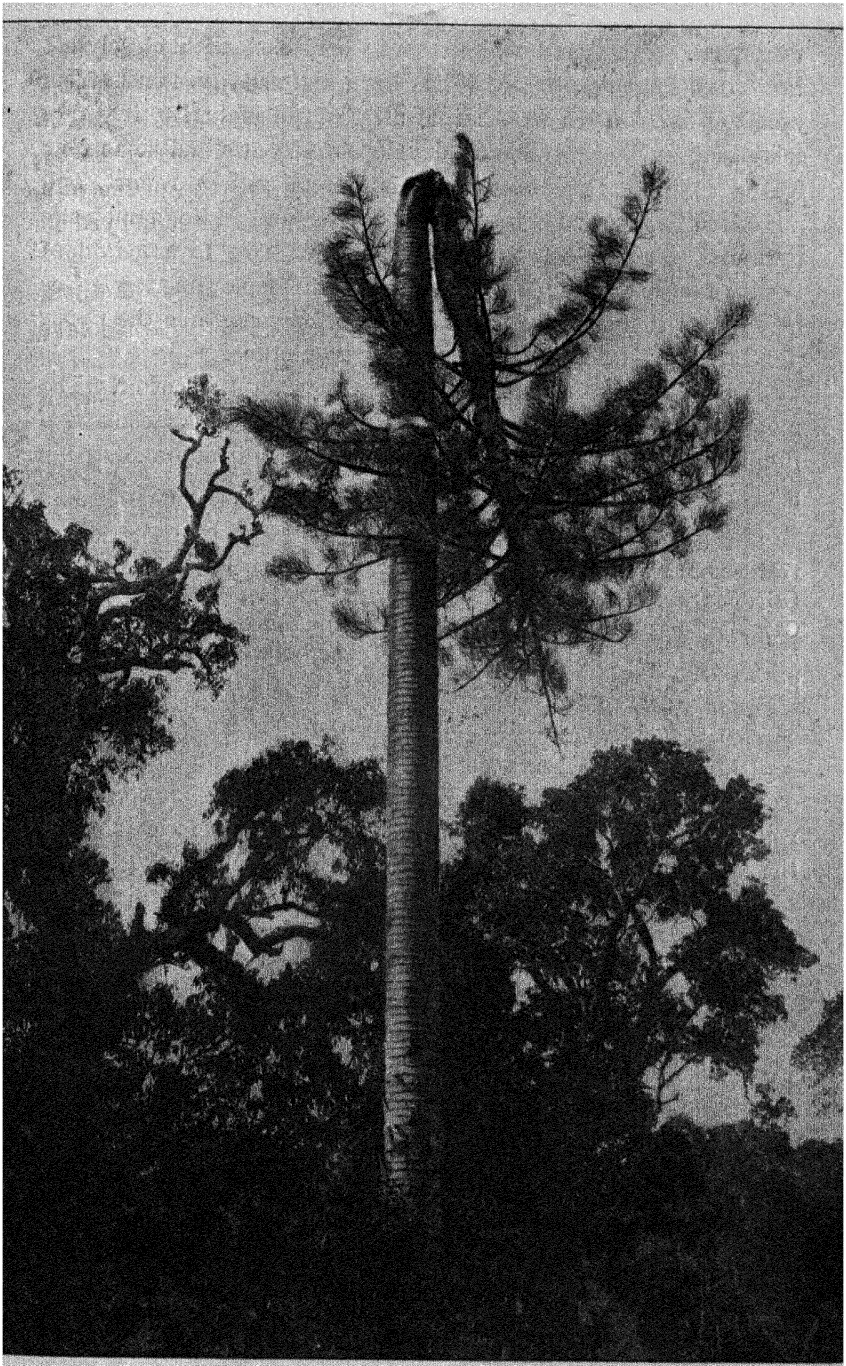
In Ceylon they beat the pith of the stem in mortars to flour, and bake cakes of it which taste much like white bread; it serves them instead of corn before their harvest is ripe. The seeds are nearly as hard as ivory and are extensively employed in the manufacture of beads, or are coloured and sold as coral, or even

made into small bowls. In Europe they are used in the manufacture of buttons. They are known in the trade as bazarbatu, bajurbet or bayurbatum nuts, and a fairly considerable export in these goes from Bombay. The trade is chiefly carried on by Arabs. It is not improbable that after the removal of the pith the long fibro-vascular cords of the stem might be employed in the same way as the fibre of *Caryota urens*.

Robert Knox's quaint description[1] of the Talipot is worth quoting, though it may contain some repetitions of what we have said above: "It is as big and tall as a ship's mast, and very straight, bearing only leaves which are of great use and benefit to this people, one single leaf being so broad and large that it will cover some fifteen or twenty men, and keep them dry when it rains. The leaf being dried is very strong and limber, and most wonderfully made for men's convenience to carry along with them, for though this leaf be thus broad when it is open, yet it will fold close like a lady's fan, and then it is no bigger than a man's arm. It is wonderfully light; they cut them into pieces and carry them in their hands. The whole leaf-spread is round almost like a circle, but being cut in pieces for use are near like unto a triangle; they lay them upon their heads as they travel, with the peaked end foremost, which is convenient to make their way through the boughs and thickets. When the sun is vehement hot they use them to shade themselves from the heat; soldiers all carry them, for besides the benefit of keeping them dry in case it rain upon the march these leaves make their tents to lie under in the night. A marvellous mercy, which Almighty God hath bestowed upon this poor and naked people in this rainy country."

ILLUSTRATIONS.—We reproduce on Plate XVII a photograph of the Talipot avenue in the Royal Botanic Gardens of Peradeniya. It is one of the most striking features of the garden, its shades of colour in green and gold affording delight to the artistic eye. The photograph has been taken by Messrs. Pláté & Co. Plate XVIII shows a gigantic specimen of the Talipot Palm in flower. In its youth it devotes itself to producing only huge fan-shaped leaves; later on a trunk begins to form which grows straight

[1] In "An Historical Relation of the Island of Ceylon, by Robert Knox, a captive there near twenty years." London, 1681.



The last stage of the Talipot Palm.

as a mast. The grand white stem is encircled with closely-set ring-marks, showing where it has born and shed its leaves from year to year. When the Talipot attains full maturity, it grows somewhat smaller leaves, and develops a gigantic bud some four feet in height. In due course this bursts with a report, and unfolds a lovely white blossom which expands into a majestic pyramid of cream-coloured flowers, which rise to a height of twenty feet above the leafy crown. At the same time the leaves begin to wither and cover in this state for some time the upper part of the stem, as may be seen in our picture.

Plate XIX shows the same palm a short time after. The magnificent bloom is succeeded by the fruit which consist of innumerable nuts or seeds. It now begins to droop and within a year it falls dead. (Plate XX.)

3. **Corypha talliera** Roxb. Cor. Pl. III, 125, t. 255, 256; Fl. Ind. III, 174; Kunth Enum. III, 236; Mart. Hist Nat Palm. III, 231; Griff. in Calc. Journ. Nat. Hist. V, 317; Palms Brit. Ind. 114, t. 220, E. F.; Wall. Cat 8616; Hook. Fl. Brit. Ind. VI, 428; Brandis Ind. Trees, 658.—*Talliera bengalensis* Spreng. Syst. Veg. II, 18.—*T. taleti* Mart. in Rœm. & Schult. Syst. VII, 1306.

NAMES.—Tara, Tallier, Tareet (Beng.).

DESCRIPTION.—Trunk perfectly straight, about 30 feet high, equally thick throughout, obsoletely annulate, dark-brown, rather rough. Leaves palmate-pinnatifid, subrotund, complicate above the middle, sub-glaucous, 6 feet long, 15 feet broad, 90-100-fid, lobes deeper and broader than in *umbraculifera*, the central 3-3½ feet, basal ones overlapping; petiole 5-10 feet long, not spirally arranged, bi-auricled, remarkably strong, upper side deeply channelled, the sharp margins armed with numerous, short, strong dark-coloured, polished, compressed spines. Spathes as many as there are primary and secondary ramifications in the spadix, all smooth and obtuse. Spadix 20 feet or more high, supradecompound; primary branches alternate, round, spreading nearly horizontally with their apices ascending; secondary ramifications alternate, bifarious, compressed, drooping, recurved, soon dividing into numerous, variously curved, smaller, sub-cylindric branchlets covered with innumerable, small, white, odorous, subsessile flowers. Calyx minute, obscurely 3-lobed; petals 3, oblong, concave, fleshy, smooth; stamens 6, nearly of the length of the petals, at the base broad, and somewhat united;

anthers ovate, dorsifixed. Ovary, 3-lobed, 3-celled, suddenly contracted into the style; style shorter than the stamens: stigma simple. Drupes 1-3, 1½ inch in diameter, wrinkled, dark olive or greenish-yellow, pulp in small proportion and yellow when the fruit is ripe. Seed solitary, round, attached to the base of the drupe, white, horny, with a small cavity in the centre; embryo apical. (Fig. 15.)

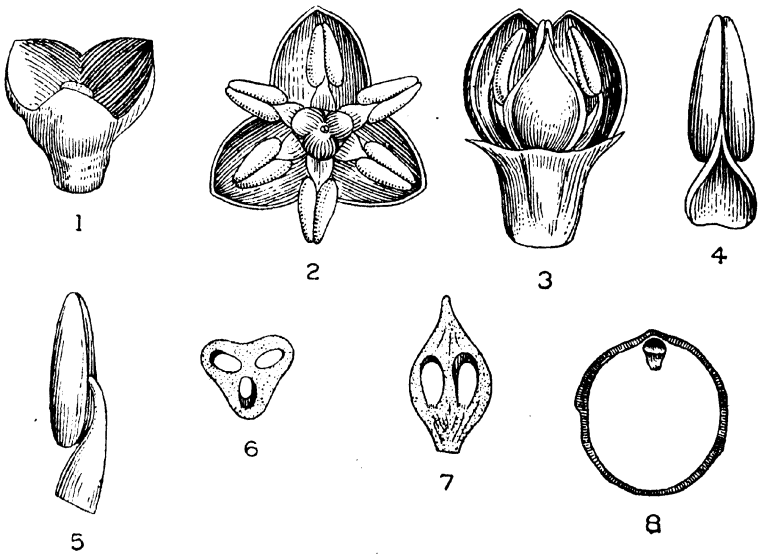


FIG. 15.—*Corypha taliera.*

1. Calyx.
2. Open flower seen from above.
3. Longitudinal section of flower showing 2 stamens and pistil.
4. Ventral view of stamen.
5. Side view of stamen.
6. Transverse section of ovary.
7. Longitudinal section of ovary.
8. Longitudinal section of seed.

1—7 magnified (After Martius).

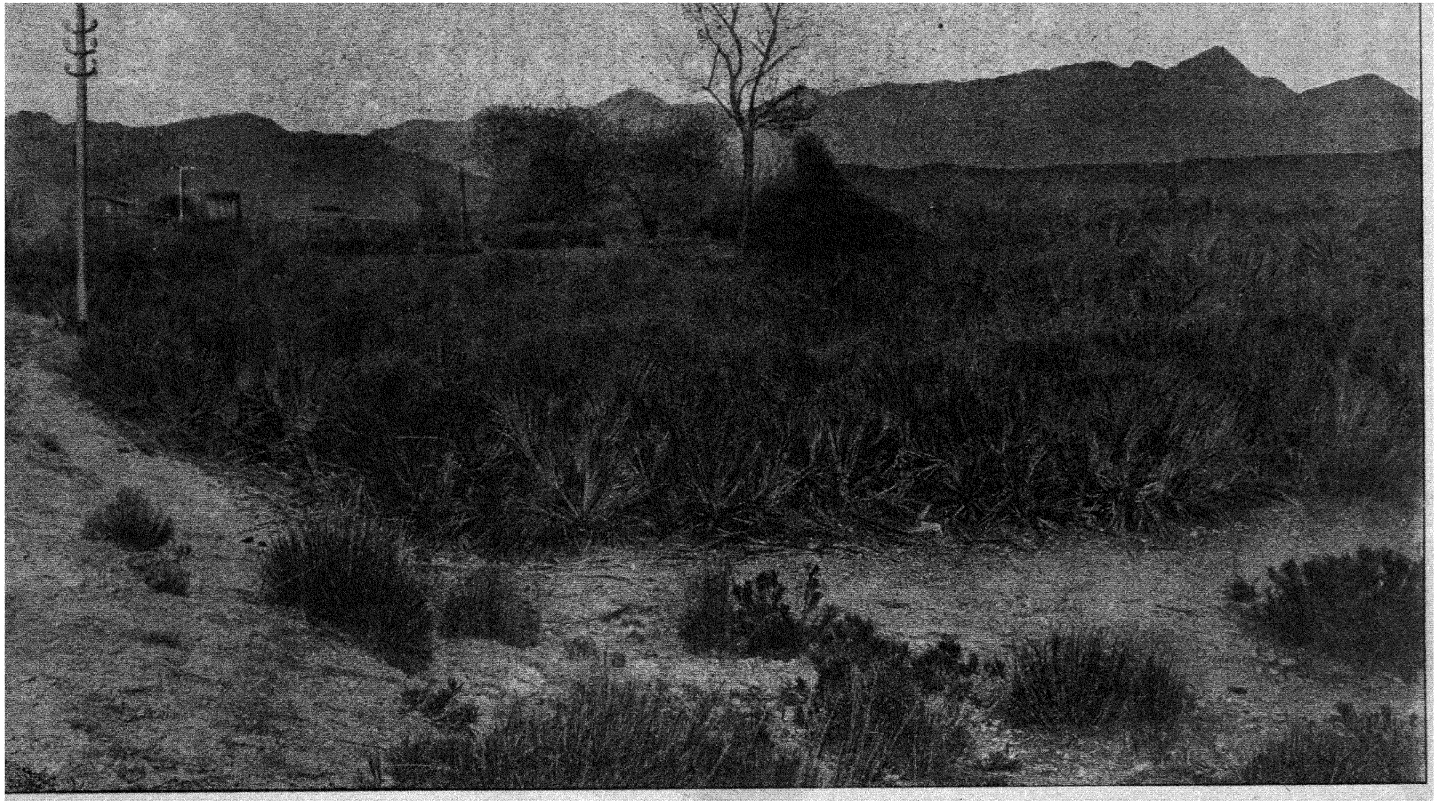
HABITAT.—Bengal.

FLOWERS.—At the beginning of the hot season; fruit ripens 9 or 10 months afterwards.

USES.—The leaves are used for writing upon with pointed steel bodkins; also for tying the rafters of the native houses, as they are strong and durable. The wood is not applied to any useful purpose.

7. *NANNORHOPS* H. WENDL. BOT. ZEITG. 1879, 147. (From the Greek "Nannos", a dwarf and "rhops", a low shrub.)

Griff. Palms Brit. Ind. 135.; Aitch. Journ. Lin. Soc. 19, 140, t. 26.—Benth. and Hook. Gen. Pl. III. II, 923, 84; Boiss. Fl. Or. V. 47, app. 754.



Landscape in Baluchistan, between Sibi and Quetta, showing a dense Growth of Mazari Palms (*Nannorhops ritchieana*, H. Wendl.).

A gregarious, tufted, low-growing, glabrous palm; stems or rhizomes robust, prostrate, branching. Leaves cuneately flabellate, rigid, plicate, split into curved 2-fid segments; petiole short. Spadix axillary (intrafoliar), much-branched; spathes tubular, sheathing, spathels ochreate. Flowers polygamous. Calyx tubular, membranous, unequally 3-lobed. Corolla 3-partite, valvate. Stamens in hermaphrodite flowers 6, in male flowers about 9. Ovary 3-gonous; ovules basilar; style short; stigma 3-toothed. Drupe small, globose or oblong, 1-seeded; style basilar. Seed free, erect, ventrally hollowed, hilum small; albumen uniform; embryo dorsal or subbasilar.

Species 1: India, Afghanistan.

1. **Nannorhops ritchieana** H. Wendl. in Bot. Zeit. 1879, 148; Aitchis. in Journ. Linn. Soc. XIX, 140, 141, 187, t. 26. *Chamærops ritchieana* Griff. in Calc. Journ. Nat. Hist. V. 342; Palms Brit. India 135; Brandis For. Fl. 547; Gard. Chron. 1886, 652, fig. 128, 129; Mart. Hist. Nat. Palm. III. 252.

NAMES.—Mazari (Vern.); Mzarai (trans-Indus); Maizûrrye (Pushtu); Kilu, Kaliun (Salt Range); the fibre is called patha in the Punjab; Pfis, Pesh, Pease, Fease, Pfarra, Dhora (Sind, Baluchistan).

DESCRIPTION.—A low gregarious shrub, the leaves usually tufted from an underground, much-branched rhizome 8-10 feet long, as thick as a man's arm, sometimes from an erect branching stem, reaching 20 feet high. Leaves 2-4 feet long and broad cuneately flabellate, rigid, plicate, greyish-green, consisting of 8-15 linear rigid segments 12-15 inches long, with often interposed fibres, folded, 2-partite; petioles unarmed, 6-12 inches long; base of petiole without any reticulate inner layer, but with a mass of rust-coloured wool. Flowers polygamous, male and hermaphrodite. Spadix pyramidal: branches ascending and recurved; branchlets slender; branches and branchlets arising from the axils of tubular, membranous, sheathing bracts with prominent, reticulate, longitudinal nerves; branchlets bifarious, with numerous flowers in the axils of turbinate, membranous, sheathing bracts, with a thin membranous edge. All the bracts are closed sheaths, with a short, subulate or triangular apex; they are spirally arranged, though apparently distichous on the principal axis and the main branches. Flowers in pairs in the axils of hyaline bracts, distinct or connate, and bicuspidate.

Calyx thinly membranous, flat, 3-toothed. Petals connate at the base. Stamens 6, sometimes 9 in the male flowers, in the male flowers inserted in the corolla-tube, in hermaphrodite flowers in its throat; anthers sagittate, attached at the back above the base to the subulate filaments. Ovary 3-celled, narrowed into the short style. Fruit an ovoid or subglobose 1-seeded drupe, with the rudiments of 2 abortive carpels, supported by the marcescent calyx, petals, and the remains of the filaments, $\frac{1}{2}$-$\frac{3}{4}$ inch in diameter, surface minutely wrinkled; albumen horny, with a central cavity.

Beccari is of opinion that there exist several forms of *Nannorhops ritchieana* on account of its wide distribution in the arid region of Western India, Baluchistan and Afghanistan. He says that the seeds show marked differences, some being spherical, others oval, some measuring $\frac{1}{2}$ inch in diameter, others $\frac{2}{3}$ inch. The seeds are said to be very hard and the albumen homogeneous.[1]

GERMINATION.—The successive stages in the development of this palm, as observed by Holm,[2] are given in figure 16.

HABITAT.—Sind, Baluchistan, Punjab, Afghanistan: Abundant in the Peshawar Valley, in Kohat, and in the trans-Indus territory along the eastern skirts of the Suliman range, ascending up to 3,000 feet; on the hills which form the western boundary of Sind; common locally on a limited area in the central Salt range, between 2,500 and 5,000 feet, and on Mount Sakesar; in one place in the Siwalik tract east of the Jhelam, near Sumani above Bhimbur; common in the Khaiber Pass, and generally in the low arid mountains of eastern Afghanistan; everywhere up to 5,000 feet in Baluchistan and Mekran, except near the coast.

FLOWERS.—From August to November; fruit ripens in summer.

USES.—It is a very useful plant in the arid regions where it is common. The stems, leaves, and petioles serve as fuel; the delicate young leaves are eaten as a vegetable; the reddish-brown, moss-like wool of the petioles is impregnated with saltpeter and used as tinder for matchlocks; the matting made of the leaves

[1] Beccari, O. Notizie sul '*Nannorhops Ritchieana*' H. Wendl. Webbia, vol. 1 (1905), p. 73.

[2] Holm in "Memoirs Torrey Bot. Club," Vol. II.

is considered to be superior to that made of *Phœnix*; of the leaves and petioles rope is made; the leaves are also made into

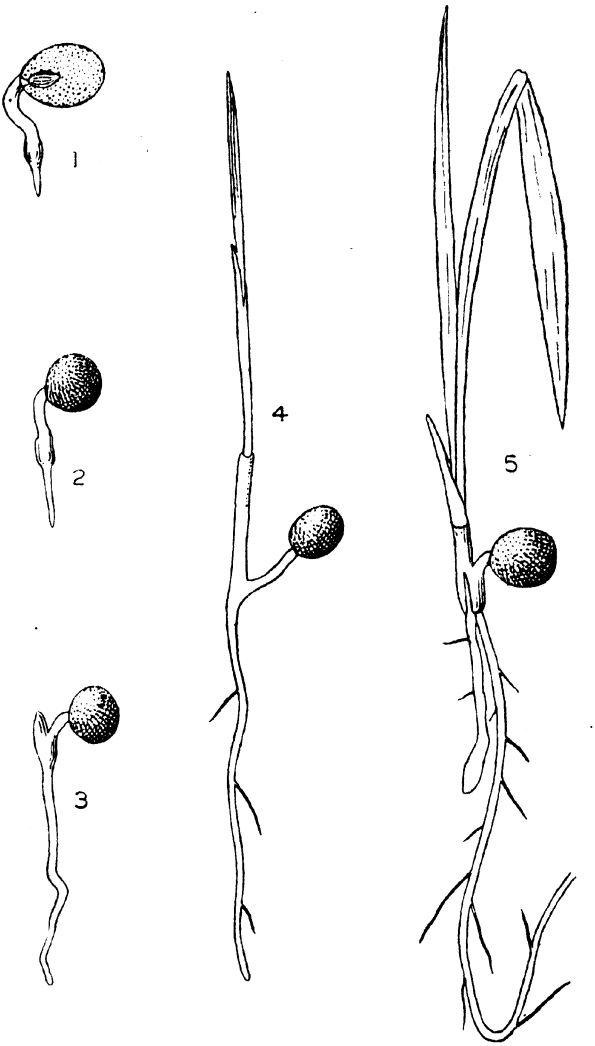


FIG. 16.—Successive stages in the germination of *Nannorhops ritchieana*, Natural size (After Holm).

1. A longitudinal section through a germinating plantlet in the first stage.

2. The same a little older.

3. An older germinating plantlet, where the plumule has commenced to break through.

4. A young plant with two leaves developed and with the fruit still attached.

5. The same, but older, where the primary root has ceased to grow, and the first secondary root has come out.

fans, sandals, baskets, pouches, and brushes; in the trans-Indus country a rude kind of drinking-cup is made of the entire blade by tying together the tops of the segments; the seeds are pierced, made into rosaries, and exported for that purpose to Mekka *via* Muskat, from Gwadur on the Baluchistan Coast, west of the Indus (Brandis). The leaf-bud or "cabbage," and the young inflorescence, as well as the flesh of the fruit, are commonly eaten.

CULTIVATION IN EUROPE.—This stove-plant grows best in a compost of sandy loam, to which some leaf soil and a little charcoal may be added with advantage. Good drainage is necessary. The palm is propagated by seeds and offsets, if the latter can be procured and detached without injury to the parent plant.

Opinions as to the treatment of this palm seem to be divided. A London Gardener writes that *Nannorhops* is probably one of the hardiest of Fan Palms and that it does not like artificial heat, preferring the temperature of an unheated greenhouse.

I have no practical experience of the cultivation of this palm, but considering the geographical distribution of the species, I should rather say, that it would prefer an unheated greenhouse to the moist temperature of a hothouse.

Beccari mentions two specimens which he is cultivating in the open in the vicinity of Florence, and he says that the plants are doing very well in the northern Mediterranean region.

ILLUSTRATIONS. I am indebted to Mr. H. V. Kemball, Mr. R. T. Harrison, and Mr. Advani for the following two photographs:

Plate XXI shows a characteristic landscape in Baluchistan with a dense growth of *Nannorhops*. The palms grow in thick small clusters and are about 6 feet high as a rule. The Railway station which is seen in the photograph is the Nakas Railway station, about 5 hours journey from Sibi towards Quetta.

Plate XXII. A cluster of *Nannorhops* from the same place.

8. *LICUALA* THUNB. ACTA HOLM. 1782, 84.

Gærtn. Fruct. II, t. 139.—Mart. Hist. Nat. Palm. III, 234, t. 134, 135, 162.—Kunth Enum. Pl. III, 238.—Bl. Rumph. II, 37, t. 82, 88-93, II, 47, t. 94.—Griff. Palms Brit. Ind. 117, t. 221 A.



A Cluster of Mazari Palms (*Nannorhops ritchieana* H. Wendl.).

B, C, 223-224 A, B.—Miq. Fl. Ind. Bat. III, 51, suppl. 254, 591.—Kurz For. Fl. II, 527.—Walp. Ann. III, 469, V, 815.—Becc. Males. I, 80.—Wendl. & Drude Linn. 39, 191, t. 3, fig. 2.—Benth. Fl. Austr. VII, 144.—Drude Bot. Zeitg. 1877, 638, t. 6, fig. 36-38.—Benth. & Hook. Gen. Pl. III, II, 928, 96.—Hook. Fl. Brit. Ind. VI, 430.

Low, rarely tall palms; stems annulate. Leaves more or less orbicular, or flabellate, plicate, deeply partite; petiole usually spinous. Spadices interfoliar, sheathed by tubular, coriaceous, persistent spathes, simple or branched, glabrous, tomentose or scurfy; flowers usually small, scattered, hermaphrodite; bracts and bracteoles obscure or absent. Calyx cupular or tubular, mouth 3-fid. Corolla-lobes coriaceous, valvate. Stamens 6; filaments subulate; anthers cordate. Ovary of 3 free or nearly free truncate 1-ovuled carpels; styles filiform; ovules erect. Drupes small; style terminal. Seed erect, globose, free, ventral face often hollowed, albumen equable; embryo dorsal.

Species about 50. Asia, Australia, Pacific Islands.

With regard to this genus J. D. Hooker has the following note:—"There are several unnamed Burmese and Malayan-Peninsular species in the Kew Herbarium, which I fail to identify with any of the Indian ones enumerated by Beccari. I refrain from describing them, as they are solitary specimens, and may be the same as known Malayan Island species, of which I have seen no specimens."

CULTIVATION IN EUROPE.—The species of this genus are dwarf stove palms. They grow in a compost of two parts peat and one of sandy loam. They require a strong moist heat. Propagation is effected by seeds sown in a sandy soil, and placed in a strong, moist bottom heat.

*INDIGENOUS SPECIES.

1. **Licuala peltata** Roxb. Fl. Ind. II, 179; Ham. in Mem. Wern. Soc. V, 313; Griff. in Calc. Journ. Nat. Hist. V, 325; Palms Brit. Ind. 120, t. 222; Mart. Hist. Nat. Palm. III, 234, t. 162; Kunth Enum. III, 238; Wall. Cat. 8617; Kurz in Journ. As. Soc. Beng. XLIII, II, 204; For. Fl. II, 527; T. Anders. in Journ. L. Soc. XI, 13; Gard. Chron. 1872, 1657, fig. 350; Fl. Brit. Ind. VI, 430; Grah. Cat. p. 225; Prain Beng. Pl. 1091; Brandis Ind. Trees 656.

NAMES.—Kurud, Kurkuti (Beng.); Patti, Chattah-pat (Ass.); Salu (Burm.).

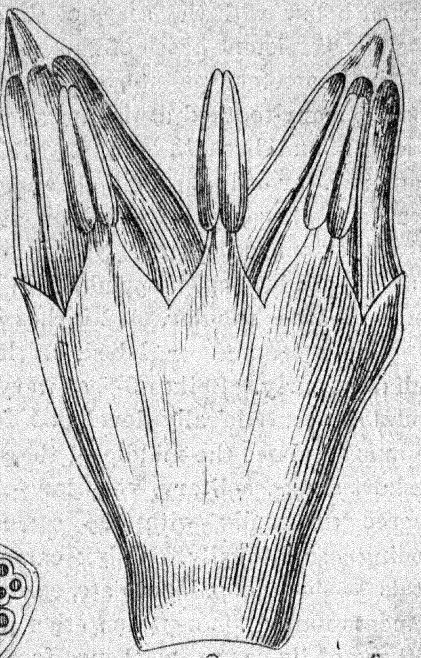
DESCRIPTION.—Stems 8-15 feet high, usually gregarious, marked below with the scars of the fallen leaves, above rough from the persistent bases of the petioles. Leaves orbicular, 3-5 feet in diameter, peltate, 12-30-partite, segments variously connate, many-toothed at the apex, teeth ½-2 inches, very variable in length and breadth, obtusely 2-fid. Petiole 6-7 feet long, triangular, armed throughout along the margins, especially towards the base, with stout, horny, black, very sharp, conical, and rather curved spines. Spadix erect, longer than the leaves, stout, simply branched, sprinkled in the upper parts with brown scurf. Spathes tubular, 6-12 inches long, ½-¾ inch broad, mouth irregularly toothed or lobed, at length variously split, and similarly scurfy. Spikes 3-5, solitary, 6-12 inches long, nodding-pendulous, centrifugally developed, fulvous-tomentose, adnate to the axis to about the middle of the spathe. Flowers numerous, on short stalks, solitary, very large, of a greenish-white colour, covered externally with the same pubescence as the spike, opening centrifugally. Calyx campanulate, shortly 3-toothed. Petals ⅛-½ inch long, lanceolate, coriaceous, reflexed. Stamens 6; filaments united among each other, and to the corolla as far as the base of its segments, thence free, long, stout, plano-subulate, keeled along the back; anthers linear, cordate, exserted, attached near the middle; otherwise the cells are nearly distinct. Ovary turbinate, short, with a depressed apex; carpels cohering by their apices. Ovules solitary, erect, anatropous. Style filiform, slender, 3 times longer than the ovary. Stigma obsoletely 3-toothed, on a level with the anthers. Fruit ½ inch long, ellipsoid, narrowed equally at both ends, orange coloured, one-seeded, apiculate by the persistent base of the style, and crowned with the 2 abortive carpels, surrounded at the base by the perianth, the tube of the calyx resembling a short pedicel. Seed oblong, with the intruded hilar process dilated within. Albumen horny. Embryo dorsal, situated below the middle. (Fig. 17.)

HABITAT.—Sikkim, deep hot valleys near the Teesta river; Assam; Khasia hills; Cachar, woody mountainous country to the east of and near Chitagong. Burma, Upper and Lower, in damp ravines of the Pegu Yoma; Andaman Islands.—Introduced into gardens.

FLOWERS.—In the cold season; fruiting in the hot season.



1



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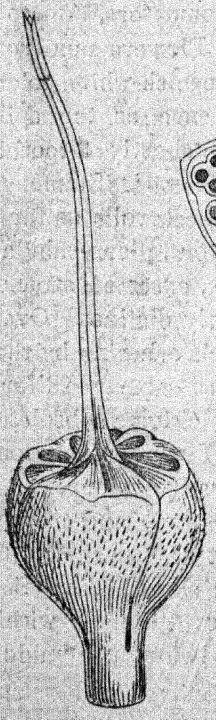

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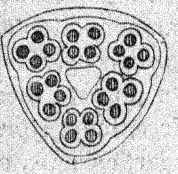

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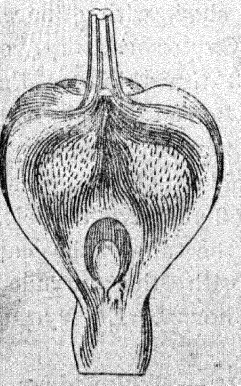

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FIG. 17.—*Licuala peltata*.

1. Calyx.
2. Part of corolla spread open with 3 stamens.
3. Pistil.
4. Pistil opened, an ovule is visible.
5. A floral diagram after a section through the upper part of the flower.

All much enlarged. (After Martius.)



Kurud (Beng.), Patti (Ass.) or Salu (Burm.) (*Licuala peltata* Roxb.).

USES.—The leaves, according to Jenkins, are used for the same purposes as those of the Toko-pat, but are much coarser, and only made use of by the lower orders. The demand for them is very great, scarcely a ploughman, cow-keeper or cooly, but has his hat made of chattah-pat.

ILLUSTRATION.—Plate XXIII shows a fine specimen of *Licuala peltata*. From between the round peltate leaves rise 6 simply branched spadices. The branches resemble large catkins on the photograph. We have to thank Mr. H. F. Macmillan who took the photograph in the Royal Botanic Gardens of Peradeniya.

2. **Licuala longipes** Griff. in Calc. Journ. Nat. Hist. V. 330; Palms Brit. Ind. 125, t. 224, A and B; Kurz in Journ. As. Soc. Beng. xliii. 204; For. Fl. II. 528; Brandis Indian Trees 656.

NAME.—Plass Bhatto (Malay).

DESCRIPTION.—Stem very short. Leaves peltate, orbicular, 3-4 feet in diameter, dark green. Segments about 20, the lateral ones being the narrowest, obliquely cut off, unequally 3-4 lobed, lobes irregularly denticulate, the terminal one cuneate, 5 inches broad, truncate, 11-keeled above, with as many short, truncate, broad, bifid, denticulate lobes as there are keels; intermediate ones narrower, generally 3-keeled, otherwise similar; the upper margins of all blackish brown. Petioles stout, 4-5 feet long, trigonous, deeply channelled above, armed (except the upper third) along the two inner angles with stout, horny, conical, tooth-shaped prickles. The rete consists of stout leathery fibres. Spadix stout, much branched, much shorter than the petioles, 1½-3 feet long, erect, undulate, flexuose. Flowers numerous, sessile, green, sparsely and sometimes densely pubescent. Calyx subcylindrical, 3-toothed, teeth bifid. Corolla almost twice as long as the calyx, divided to a little below the middle into 3 broad, cordate, lanceolate segments. Filaments short, setiform. Anthers cordato-ovate, slightly inflexed. Ovary turbinate, towards the base smooth and 3-partite, above entire and villous. Ovule solitary, erect, anatropous. Style cylindric, rather shorter than the ovary, hollow at the apex. Stigmas 3, minute. Fruit seated on the stout pedicel-like tube of the calyx, surrounded at the base by the perianth and annulus of the stamens, apiculate by the style, 1-seeded. Endocarp thin, sub-osseous.

HABITAT.—Tenasserim coast in forests near Lainear to the south of Mergui; Malacca, solitary in dense forests, Ayer Punnus

Goonoong Miring, and Mount Ophir, but not above an elevation of a thousand feet.

FLOWERS.—Nearly all the year.

3. **Licuala spinosa** Wurmb. in Verh. Bat. Genootsch. II. 469; Roxb. Fl. Ind. II, 181? (excl. syn. Rumph.); Griff. in Calc. Journ. Nat. Hist. V, 321; Palms Brit. Ind. 119; Blume Rumph. II, 39, t. 82, 88; Mart. Hist. Nat. Palm. III, 235, 318, t. 135, 1, 2; Miq. Fl. Ind. Bat. III. 53; Suppl. 254; Becc. Males. III, 74.—*L. paludosa* Kurz in Journ. As. Soc. Beng. xliii, 528; For. Fl. II, 528.—*L. ramosa* Bl. in Schult. Syst. VII, 1303; Rumphia II, 39.—*L. horrida* Blume Rumph. II. 41, t. 89, f. 1; Mart. l. c. 237, 318.—*Corypha pilearia* Lour. Fl Cochinch. I. 265

Beccari has lately reduced to this species his former varieties: *Licuala spinosa* var. *cochinchinensis* and var. *brevidens* Becc. Malesia III. There would be no end of varieties, he says, if all the different forms of a species so widely distributed were to be described. (Webbia, vol. 3 (1910) p. 240).

NAME.—Plass (Malay).

DESCRIPTION.—Stems stout, 8-10 feet high, 2-4 inches in diameter, densely tufted, rough with the scars of fallen leaves. Leaves orbicular-reniform, about 4 feet across the broad diameter; pinnules about 18 in number, narrow-cuneate; the central ones about 2 feet long; the terminal one is 10- or 11-plicate, truncate, with as many lobes as there are plaits, the lateral ones are the deepest, all are obtusely bifid, the intermediate ones are more or less truncate, 3-5-lobed, lobes larger and deeper, but otherwise similar to those of the terminal one, the lateral ones with oblique 3-lobed ends. Petiole about 4-4½ feet long, obtusely trigonous, margins armed throughout with stout, conical, somewhat curved spines. Ligule very narrow, 1-1½ inch long, scarious. Spathes green, sprinkled with brownish scurf, ⅔ inch in diameter, with scarious, lacerated ends, occasionally obliquely lacerated. Spadix a little longer than the leaves; branches 7-10, adnate to the rhachis as high as the mouths of the spathes; lower branches several, compound, stout, subulate, downy, spreading, generally secund. Flowers sessile, placed in twos or threes, small, nearly ovate. Calyx sub-ovate, divided to the middle into 3 rounded teeth. Corolla a little longer than the calyx, divided below the middle into 3 broad, lanceolate, acuminate segments. Annulus of stamens rather high, nearly entire. Filaments short, setaceous. Anthers oblong-ovate. Ovary depressed, turbinate, sculptured at the apex. Style filiform, rather longer than the ovary. Fruit obovoid, ¼ inch long, pedicelled by the calyx-tube, red, 1-seeded,

surrounded at the base by the perianth. Seed ovate; albumen horny, on a transverse section horse-shoe-shaped. (Fig. 18.)

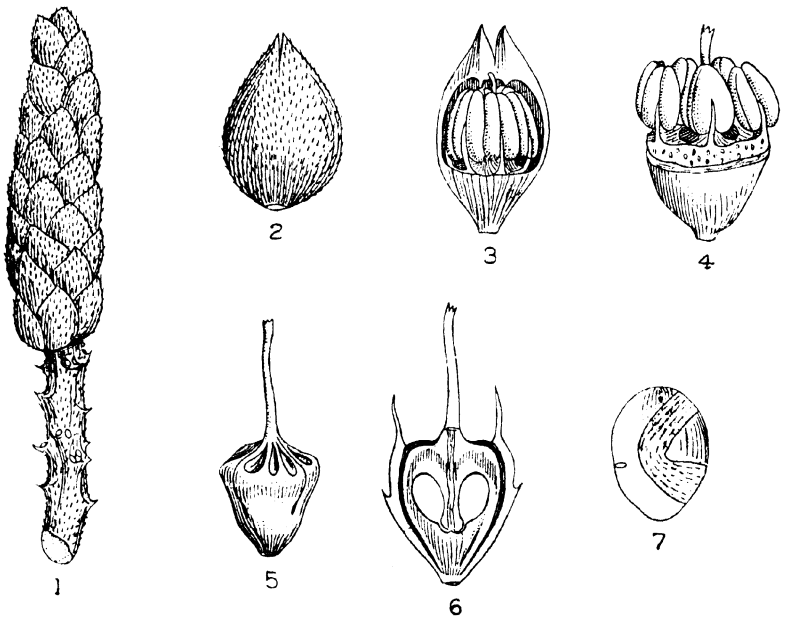


FIG. 18.—*Licuala spinosa*.

1. Top of a flowering branchlet before the flowers open.
2. Young flower.
3. Corolla, one petal removed to show æstivation of stamens.
4. Stamens surrounding the pistil.
5. Pistil.
6. Longitudinal section through pistil to show the ovules.
7. Longitudinal section of seed.

All enlarged. (After Martius.)

HABITAT.—Malacca, common in wet places, particularly in hedges; Andaman Islands, tidal forests; Nicobars; Malay Islands.

FLOWERS (in the Bot. Gard. Calcutta) in the cold season; fruit ripens in the hot season.

CULTIVATION IN EUROPE.—This palm must be kept in the hot-house, and it is well to remember that in its original home this species grows with preference in calcareous soil.

ILLUSTRATION.—*Licuala spinosa* will be figured later on together with *Sabal mauritiæformis*.

* * INTRODUCED SPECIES.

3. **Licuala paludosa** Griff. in Calc. Journ. Nat. Hist. V, 323; Palms Brit. Ind. 118, t. 221, A, B, C; Hook. Fl. Brit. Ind. VI, 430; Becc. Malesia III, 71.

DESCRIPTION.—Stem 4-10 feet high, 3-9 inches in diameter, unarmed, almost without marks of rings, except towards the apex where they are incomplete; crown of moderate size. Rete rather stout, of rich brown colour. Leaves flabelliform or orbicular, 3 feet in diameter, 6-9 partite; lateral segments oblique at the apex, deeply and acutely 3-4 lobed, lobes bilobed (except the side ones), the others are more or less truncate, with 4-8 broad, short, bifid lobes; petiole 1-2 feet long, subtrigonal, armed along the margins, except towards the apex, with small, black, horny, conical, curved spines; sheaths very fibrous. Spathes $\frac{3}{4}$ inch broad, tubular, green, with membranous or scarious, lacerated mouths. Spadix very stout, rather curved; branches of the spadix bearing 5 or 7 spikes, which are 4 or 6 inches long, curved, secund, generally nodding, slightly puberulous, often appearing as if they arose separately from within the mouth of the spathe. Flowers solitary, sessile, of a turbinate form; calyx cup-shaped, $\frac{1}{10}$ inch broad, nearly entire, irregularly split at the expansion of the flower; corolla (in bud) urceolate, about $\frac{1}{3}$ longer than the calyx, divided to the middle into 3 cordate-ovate segments. Ring of the stamens white, nearly entire, projecting considerably above the throat of the corolla; filaments short, setiform; anthers versatile, oblong, pale-brown. Ovary depressed, turbinate with a horny sculptured apex; carpels adhering by the style; ovules solitary, erect, anatropous; style subulate, rather shorter than the ovary; stigma simple. Fruit spherical, $\frac{1}{4}$ inch in diameter.

HABITAT.—Malacca, low sandy wet places along the sea-coast, about Tanjong Cling, Rundur, and Pulo Bissar, associated with *Pandanus, Eugenia, Diospyros, Helospora,* etc.; Perak; Siam.

Introduced in gardens.

FLOWERS.—From April to May.

4. **Licuala elegans** Bl. Rumphia II, 42, tab. 90 A, B.—Becc. Malesia III, 71.

DESCRIPTION.—Caudex of the thickness of a man's arm, 4 feet long, erect, with transverse scars. Petioles 3-4½ feet long, the margins with recurved spines, uppermost part of petiole unarmed. Lamina suborbicular, palmatisect, segments about 20, divided almost to the base, the inner ones 16 inches long, linear-cuneiform, with the apex straight-truncate, outer ones shorter, linear-lanceolate, with the apex obliquely truncate, all glabrous. Spadix



Licuala elegans Bl.

elongate, 7 feet long, rigid; spathes incomplete, vaginate, striate, pale green. Calyx in smaller unripe fruits cupuliform, in ripe ones more cylindrical, at the base depressed-truncate, on a very short, tuberculiform pedicel, teeth broadly-ovate, subacute, striate, persistent. Corolla deeply tripartite, longer than the calyx, with a staminiferous ring. Immature fruit turbinate-globose, yellowish-green, apex discoid-dilate. Berries ellipsoid, surrounded at the base by the persistent perianth, with the apex rounded, glabrous, fleshy, 1-seeded. Putamen ellipsoid-globose, obsoletely mucronate at the base, thin, fragile, whitish, outer side fibrous-striate, inner side smooth. Seed spheric-ellipsoidal. Albumen with a large irregular cavity, solid, cartilaginous, white. Embryo dorsal, transverse.

HABITAT.—Sumatra.

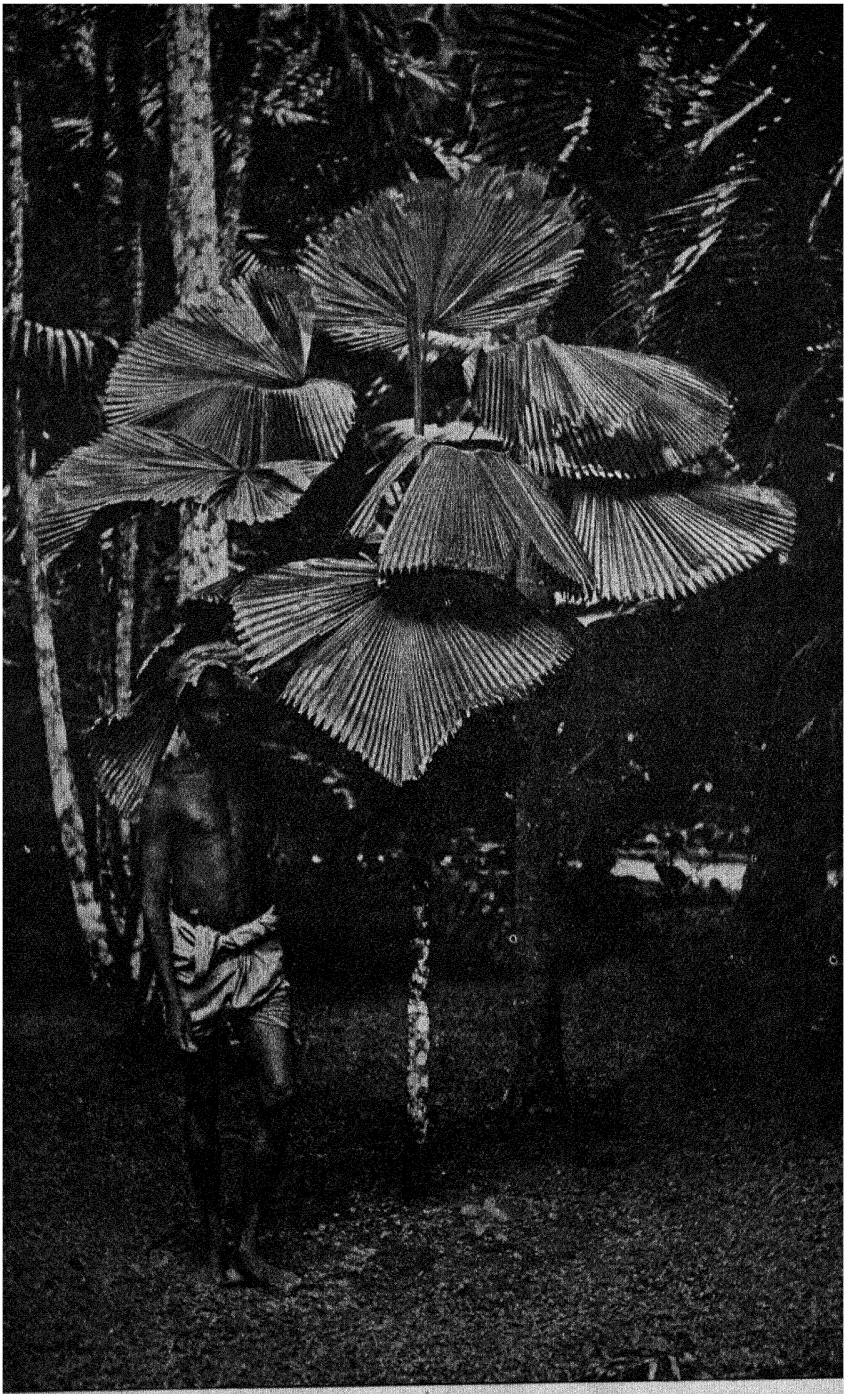
ILLUSTRATION.—Plate XXIV shows a well-developed specimen of *Licuala elegans*. At first sight this species might easily be mistaken for *Licuala peltata* (Plate XXIII). The straight-truncate segments, however, distinguish *L. elegans* from *L. peltata*, which even on our picture shows distinctly the many-toothed top of the segments. For other well-marked characters we refer to the description of the two plants.

On the left side of the picture a spadix is visible with the flowering spikes spreading in all directions.

The specimen, taken by Mr. H. F. Macmillan, is growing in the Botanic Gardens of Peradeniya.

5. Licuala grandis H. Wendl. MSS.; André Illustr. Horticol. t. 412; Hook. Bot. Mag. t. 6704 and in Report Kew 1882 (1884) p. 65; Gard: Chron. 1886, 139; Becc. Males. III, 73.—*Pritchardia grandis* Hort.

DESCRIPTION.—Whole plant about 6 feet high to the base of the topmost petiole; stem leaf-bearing for nearly half of its length, clothed shortly below the leaves with the sheaths of the old leaves, which are semi-amplexicaul and about 3 inches long. Leaves erect and slightly spreading, deep bright green; petiole $2\frac{1}{2}$-3 feet long, slender, concave-convex, armed with short, stiff, nearly straight or curved, sometimes irregularly forked spines along the margins from the base to the middle, ending in a short, ovate, acute, concave, thickly coriaceous ligule; blade sub-erect, 3 feet in diameter, and about two long, orbicular or semi-orbicular, concave from the incurving of the sides and more or



Licuala grandis H. Wendl.

less of the whole blade, closely plaited and a little wavy, base cuneate or truncate, margins cleft into bifid lobes about 1 inch long, lobules of the lobes very obtuse. Spadices several, rising from amongst the leaves and nearly as long as they are, sub-erect; rhachis as thick as the little finger, cylindric, terete, quite smooth, giving off at intervals of a foot or less flowering panicles 5-6 inches long. Spathes at the bases of the panicles, two or more, 2-3 inches long, lanceolate, acute, concave, brown, striate. Flowers $\frac{1}{3}$ inch long, jointed on to very short pedicels or sessile on the branches of the panicle. Calyx tubular-campanulate, terete; mouth truncate, slightly lobed. Petals as long as the calyx, ovate, acute, concave, very thick, with broad margins and an inflexed tip. Stamens very small, inserted between the triangular teeth of a 6-lobed coriaceous cup; filaments subulate, as long

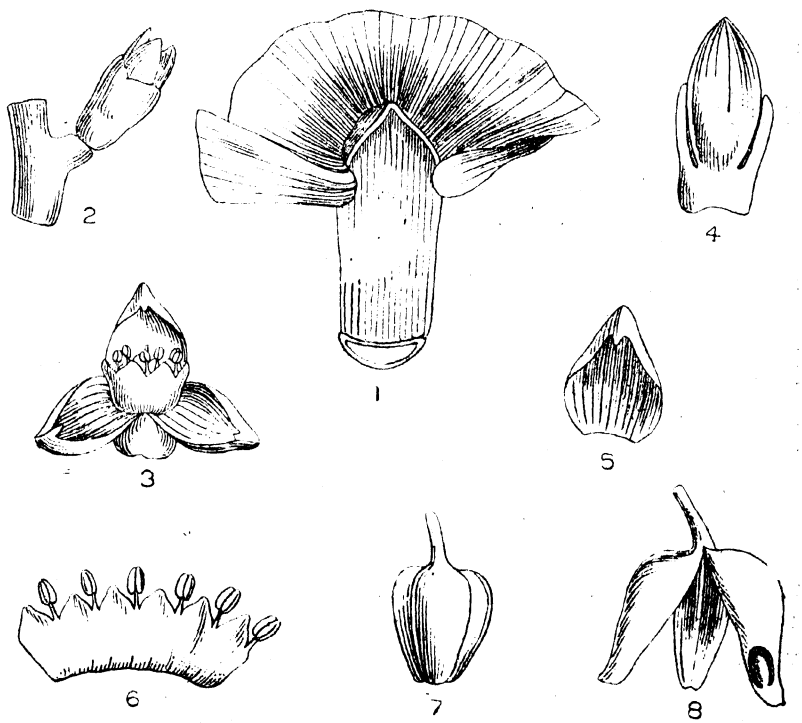


FIG. 19.—*Licuala grandis* H. Wendl.

1. Top of petiole and base of leaf blade. (nat. size).
2. Branch of panicle and flower.
3. Flower spread open.
4. Calyx cut open and petals in bud.
5. Petal.
6. Staminal cup and stamens.
7. Ovary.
8. Ovary with the carpels disunited.

All, except 1, enlarged. (After J. D. Hooker.)

as the teeth of the cup; anthers oblong. Ovary of 3 slightly cohering wedge-shaped carpels, united by a very short entire style; stigma simple. (Fig. 19.)

Easily distinguished from other species by the spathes not being tubular.

HABITAT.—New Britain.

ILLUSTRATION.—The palm figured on Plate XXV is an old specimen growing in the Botanic Gardens of Peradeniya.

The photograph was taken by Mr. H. F. Macmillan.

9. *LIVISTONA* R. BR. PRODR. III. 123.

(When Richard Brown discovered this genus of majestic and graceful palms, he dedicated it to one of the great promoters of English horticulture, *viz.*, Patrick Murray, Baron of Livistone, the founder of the Botanic Garden of Edinburgh.)

Bl. Rumph. II, 48, t. 95, 96 *(Saribus).*—Jacq. Fragm. t. 11, fig. 1. *(Latania).*—Kunth Enum. Pl. III, 241. Mart. Hist. Nat. Palm. III, 239, 319.—Griff. Palms Brit. Ind. 127, t. 226 A, B, C, D, append. 23.—Miq. Fl. Ind. Bat. III, 57, Suppl. 591—Becc. Males. I, 84.—Kurz. For. Fl. II, 524.—Benth. Fl. Austr. VII, 145.—F. Muell. Fragm. Austral. VIII, 221.—Wendl. and Drude Linn. 39. 192, 226.—Benth. and Hook. Gen. Pl. III, II. 929, 97.

Tall Palms; trunk annulate, leaves orbicular, flabellately plicate, split to about the middle into bifid narrow lobes; petiole long with spinous margins. Spathes many, tubular, sheathing. Spadices interfoliar, long-peduncled, erect, fruiting pendulous, loosely panicled. Flowers minute, hermaphrodite. Sepals 3, rounded, imbricate. Corolla 3-lobed, coriaceous, lobes valvate. Stamens 6; filaments subulate, united in a ring; anthers cordate. Ovary of 3 nearly free carpels; styles short, free or coherent; stigmas minute; ovules basilar, erect. Drupes 1-3, globose oblong or ellipsoid; style subterminal. Seed erect, ventral face hollowed; albumen equable; embryo dorsal.

Species about 17; Tropical Asia and Australia.

CULTIVATION IN EUROPE.—The species of *Livistona* are mostly stove palms. They grow best in a compost of two parts loam and one of peat, to which a little sand may be added. Much water is required throughout the summer. The seeds should be sown in sandy soil, and placed in a gentle bottom heat. Several

species are admirably adapted for various decorative purposes, and especially for subtropical gardening.

*INDIGENOUS SPECIES.

1. **Livistona jenkinsiana** Griff. in Calc. Journ. Nat. Hist. V, 334; Palms Brit. Ind. 128, t. 226 A & B; Hook. Fl. Brit. Ind. VI, 435; Brandis Ind. Trees 656.

NAME.—Toko Pat (Ass.).

DESCRIPTION.—Trunk 20-30 feet high, 6-7 inches in diameter, rough towards the apex from the adhering bases of the petioles, with a thick, round crown. Leaves 6-7 feet long, reniform flabelliform, greatest breadth 5-6 feet, length from the apex of the petiole 2-3½ feet, divided into about 70-80, obtuse, bilobed segments, of which the extreme lateral ones are the deepest, being 18 inches long, while the central ones are scarcely half that length, undersurface glaucous cæsious. Petiole channelled above, armed almost to the summit; ligule cordate. Spadices 2-3 feet long, axillary; branches a span or a foot long, dichotomous, opposite the ends of the spathes; lowermost branchlets 2-3 times divided, the other simple. Spathes chestnut-red, sometimes split, concealing the greater part of the peduncle, scurfy outside, the one next the first branch 1-1½ foot long, 3- or 5-keeled, with a large, oblong, deeply bilobed, split limb. Flowers small, several together, sessile or raised on small tubercles, greenish, ebracteate. Calyx short with a broad base, cup-shaped, with 3 short rounded teeth with membranous margins. Corolla about twice as long as the calyx, divided to a short distance from the middle into 3 triangular segments. Stamens 6, united in a ring. Filament short, setaceous from a very dilated base. Anthers oblong, versatile. Pollen lanceolar with one fold. Ovary obconical, yellow, with a depressed, red-spotted apex; carpels cohering by means of a short, trisulcate, filiform style. Stigma simple. Ovule solitary, erect, anatropous. Drupe ¾-1 inch in diameter, reniform-globose, slightly attenuate at the base, of a leaden blue colour, marked on one side with a depressed whitish line. Seed erect, presenting on the side corresponding with the above line on the fruit, a broad raphe-like line. Albumen horny, opposite the centre of the above line deeply excavated; cavity filled with a spongy substance. Embryo opposite the excavation or situated in the centre of the dorsal face.

HABITAT.—Upper Assam: Gubrow Purbut; common throughout Assam, but most plentiful in the Nowgong district; Naga Hills. Sikkim, lower hills and outer valleys.

USES.—"This palm is an indispensable accompaniment of every native gentleman's house, but in some parts it is rare, and the trees are then of great value. The leaves are in universal use throughout Assam for covering the tops of doolees (palanqueens), and the roofs of boats, also for making the peculiar hats, or rather umbrella-hats (jhapees) of the Assamese. For all these purposes the leaves are admirably adapted from their lightness, toughness, and durability." (Jenkins.)

CULTIVATION IN EUROPE.—This palm is a beautiful greenhouse plant.

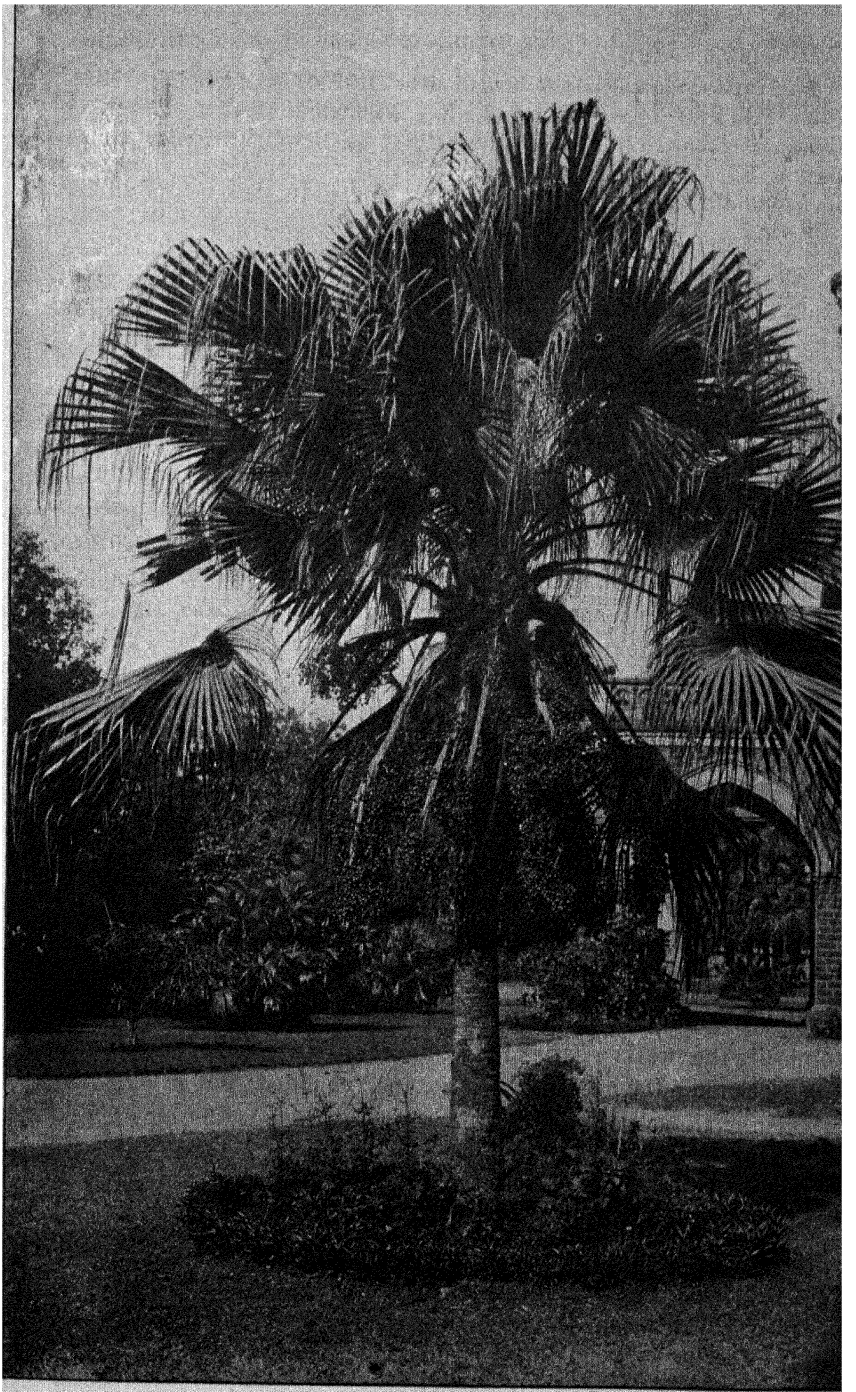
2. **Livistona speciosa** Kurz in Journ. As. Soc. Beng. xliii. II. (1874), 196, 204, t. 13, 14; For. Fl. II, 526; Hook. Fl. Brit. Ind. VI, 435; Brandis Ind. Trees 656.

NAMES.—Taung tan, Taw tan (Burm.).

DESCRIPTION.—Trunk 50-70 feet; all parts glabrous; leaves palmately flabellate, about 6-7 feet across each way, plaited; the petiole at the base up to an inch broad, armed with strong, sharp, falcately curved, flattish, blackish spines, the lower spines up to ½ inch long and longer by 3-4 lines broad at the base; sheaths dividing into netted fibres; leaflets all (the lateral ones up to half of their length, the central ones higher up) connate in a blade, linear, sharply 2-cleft at the apex, the ribs compressed, prominent, the veins rather visible and transverse. Flowers small, solitary, or by 2 on a nipple-like, very short and thick pedicel, racemose-spicate, forming a much-branched, smooth, panicle-shaped, 2-4 feet long spadix, furnished at the base and along the primary axis with large, fuscous, quite smooth spathes. Sepals and petals hardly 1 line long. Drupes elliptically obovoid, ⅔ to nearly 1 inch long, dark blue, smooth, 1-seeded, seated on the short, thick, indurated perianth, jointed with the nipple or disk-shaped very short peduncle.

HABITAT.—Frequent in the evergreen tropical forests of the eastern and southern slopes of the Pegu Yoma; Chittagong; Upper Tenasserim.

FLOWERS.—In March and April.



Chinese Livistona (*Livistona chinensis* R. Br.).

**INTRODUCED SPECIES

3. **Livistona chinensis** R. Br. Fl. Nov. Holl. 268; Mart. Hist. Nat. Palm. III, 240; Drude Palmæ in Nat. Fflanzenf. II, 3.35.—*Latania Chinensis* Jacq. Frag Bot. 16, t. ii, fig. 1.—*Latania borbonica* Lam. Encycl. III, 411; Willd. Spec. Pl. IV, 878; Spreng. Syst. Veg. II, 623.—*Livistona Mauritiana* Wall. in litt. 1831.—*Saribus* Bl. Rumphia II, 49.

NAMES.—Chinese Livistona.

DESCRIPTION.—Stem 20-30 feet high, stout, obscurely annulate. Crown round, leaves reniformly flabellate, 4-6 feet in diameter, much plicated and also conduplicate along the centre; segments 50-60, and more, linear-lanceolate, acuminate; the lateral ones much the narrowest, 2 feet, or 2 feet 2 inches long, their divisions about 1 foot long. Petiole 6 feet long, 6 inches broad, triangular, plane above or slightly concave towards the margins, armed from the base to about the middle with compressed-subulate, horny, brown spines; at the base a network of brown fibres. Ligule ovate-trigonous, concave, acute, green. Spadix paniculate-ramose, spreading, surrounded at the base and the primary branches by spathes, glabrous or slightly villous. Peduncle less than 1 inch thick; the upper part irregularly divided; the last branches 3-5 inches long. Basilar spathes compressed, tubular, with the apex bifid; segments triangular, woody-coriaceous, longitudinally grooved. Secondary spathes lanceolate, convex on the ventral side, apex bifid and obliquely open, membranous-coriaceous, villous. Flowers small, white, of an unpleasant smell, usually 4 together. Calyx subcampanulate, with 3 rounded teeth having membranous margins. Corolla campanulate, larger than the calyx, divided below the middle into 3 cordate, erect segments. Stamens 6, included; filaments compressed, united at the base, free in the upper part, those opposite the petals a little larger; anthers small, ovate, dorsifixed below the middle, bifid at the base, apex rounded; pollen elliptic. Ovary small, scarcely half as long as the corolla, 3-carpellary, carpels more or less united; ovules erect, elliptic, one or two usually smaller than the third. Style trigonous. Fruit-bearing spadix nodding, with sub-secund branches. Berry usually one, rarely 2 or 3, olive-shaped, oblong, dull-blue, 7 lines long and 4½ wide. Seed oblong, greyish, on a longitudinal section reniform, intrant process sub-central; embryo opposite to this a little below the centre of the dorsal face, looking downwards.

GERMINATION.—According to Gatin the cotyledonal petiole forms quite in the beginning a swelling just outside the seed. The radicle remains for a long time the principal root, but later on lateral roots are developed which, as to their size, equal or surpass the principal one. The first vegetative leaf is reduced to a sheath.

HABITAT.—China and Japan.—Cultivated in gardens.

FLOWERS in January and February.

CULTIVATION IN INDIA.—"This is perhaps the commonest and finest fan palm in Indian gardens. Its grand fan-shaped leaves gracefully disposed on long petioles, armed with short recurved spines, and rising from a network of brown fibre, render it very attractive. The length of the petiole varies with the position of the plant, being longer in slight shade than in the open. The palm does well with ordinary border treatment throughout India if watered freely during dry weather." (Woodrow.)

CULTIVATION IN EUROPE.—This palm is quite hardy in Cornwall and nearly so in many less southern districts. In winter the tree is satisfied with a mean temperature of 46½° F.

Gœbel's analysis of the ash of the leaves gives an idea of the food required by the palm:

	Young specimen.	*Adult specimen.*
Silica	35,804	36,437
Phosphoric Acid	4,823	5,408
Aluminium and Ferric Oxide	6,666	6,605
Lime	6,259	20,931
Magnesia	1,060	5,482
Soda	1,679	traces
Potash	18,434	18,387

De Kerchove got excellent results by adding to the soil 7 parts of assimilable nitrogen, 30 parts of bone phosphate and 50 parts of torrefied animal substances.

Many amateur gardeners in Central and Northern Europe have been sadly disappointed when buying this palm. There are professional gardeners who keep this palm in the hothouse during summer and the plant, though naturally adapted to the temperate house, grows rapidly and acquires great beauty. If, after that, the palm is transferred to the dry drawing room where, besides, the heat of the soil is wanting, the tips of the leaves begin to wither and the stalks of the forming leaves become shorter and shorter, and after a short time no trace of the

former beauty is left. If the Chinese Latania is expected to do well in the drawing-room, early and careful adaptation to its future conditions is required.

USES.—Fans are made of the leaves, and rope of the fibrous sheaths of the leaf stalks.

ILLUSTRATION.—The photograph reproduced on Plate XXVI was taken by Mr. Phipson in the garden of the Cama Hospital, Bombay. The overhanging tips of the segments of the leaves give the palm a very graceful appearance. Numerous bunches of fruits, which by their weight bend down the stalks of the spadices, are hiding the upper portion of the straight cylindrical stem.

4. **Livistona altissima** Zoll. in Tijdschr. Nederl. Ind. Vol. 14 (1857) 150.—*Saribus* n. sp.? Zoll. Verz. p. 78.

DESCRIPTION.—Stem 80 and more feet high, slender, about $\frac{2}{3}$ foot in diameter, obsoletely annulate, cinerascent. Habit and conglomeration of leaves similar to that of *L. rotundifolia* Mart. Leaves palmatifid; lamina cordate-orbicular, a little longer than broad, undivided at the base, plicate; segments about 80, outer ones shorter and narrower, $1\frac{1}{2}$ feet long and $\frac{7}{24}$ inch broad, divided for about $\frac{3}{4}$ of their length, bifid; laciniæ acute with acute sinuses, intra-radial nerves acutely carinate and thickened near the sinus; petiole subrecurved, unarmed, usually about 5 feet long, $\frac{3}{4}$ inch broad at the base. Spadix recurved, sub-nutant, unarmed, decompound, up to 6 feet long, glabrous, fuscescent. Spathe scarcely 1 foot long. Fruit globular, about the size of a small cherry.

HABITAT.—Sunda Islands.

USES.—The wood is hard like iron; it is used for rafters.

CULTIVATION IN EUROPE.—*L. altissima* is a very beautiful palm. Its original home being in the Sunda Islands, it is natural that the palm does not grow in Europe except in the hothouse. The stem remains covered for a long time with the bases of the leafstalks.

5. **Livistona subglobosa** Mart. Hist. Nat. Palm. III, 319.—Miq. Anal. Ind. II, 7; Flor. Nederl. Ind. III, 59.—*Saribus subglobosus* Hassk. Tijdschr. Nat. Gesch. IX, 176, 172; Cat. Bogor. 65.—*Saribus rotundifolius* Bl. Rumphia II, 49, tab. 96 (*quoad folium tantum*).

DESCRIPTION.—Petioles elongate, densely armed with spines, especially in young specimens, leaves suborbiculate, flabelliform-

palmatifid; segments usually united beyond the middle, bifid; laciniæ linear, elongate, pendulous. Spadix compound, paniculate, stout. Drupes subglobose, black-violaceous.

HABITAT.—Java.—Grown in Indian Gardens.

6 **Livistona rotundifolia** Mart. Hist. Nat. Palm. III, 241.—*Corypha rotundifolia* Lam. Encycl. II, 131; Willd. Spec. pl. II, 201; Spreng. Syst. Veg. II, 138. No. 2; Rœm. Schult. Syst. Veg. VII, 2., p. 1309, No. 2; Hayne Term. Bot. t. 11, f. 1; Houtt. I, t 2, f. 2.—*Licuala rotundifolia* Blume in litt. et in Rœm. Schult. Syst Veg. VII 2, p. 1305, No. 5—*Saribus rotundifolius* Blume Rumphia II, 49, t. 95, 96 (*excl. folio* tab. 96).

NAMES.—Wocka (in Ternate and Celebes); Saligi, Pohon Sadang (Java); Saribu (Macassar Strait).

DESCRIPTION.—Stem 40-50 feet high, 1-1½ foot and more in diameter, erect or slightly bent, obscurely annulate. Leaves 3-5 feet in diameter, suborbicular; segments between 60 and 90, united in the lower third; each segment bifid to the middle; petiole 6 feet long, lower part armed with strong compressed spines; spines with a conical base, almost ½ inch long. Spadix 3-5 feet long, hanging from between the leaves, porphyry-red. Spathes compressed-cylindric, obliquely truncate. Branches of the spadix decompound, the last branchlets spreading, 3-8 inches long. Flowers 3-4 aggregate, small, globose, yellow. Calyx tripartite, segments broadly ovate, obtuse, concave, keeled on the back. Corolla tripartite, segments triangular, a little larger than the calyx. Filaments broadened at the base; anthers subrotund. Ovary turbinate, trisulcate, 2 carpels abortive; styles connate; stigma simple. Berry depressed-globose. Endocarp thin, brown. Seed globose, ferruginous.

HABITAT.—Malay Archipelago.

USES.—The cellular tissue of the central part of the stem furnishes sago (In the Malayan language 'sago' means bread or flour).

CULTIVATION IN EUROPE.—This palm is pretty for stove decoration, when young.

7. **Livistona australis** Mart. Hist. Nat. Palm. III, 241; Wendl. and Drude in Linnæa XXXIX. 232; Bot. Magaz. t. 6274.—*L. inermis* Wendl. and Drude, l. c. 229.—*Corypha australis* R. Br. Fl Nov. Holl. 26 f. Spreng. Syst. Veg. II, 138, No. 2; Rœm. Schult. Syst. Veg. VII, 2, p. 1313, No. 11.

NAMES.—Australian Cabbage Palm. 'Kondo' of the aboriginals in Australia.

DESCRIPTION.—Stem 40-80 feet high, cylindrical, slender, red-brown, annulate. Leaves in a dense oblong crown; petiole spreading and decurved, spinous on the margins; blade 3-4 feet in diameter, orbicular, cut to about the middle into 30-50 radiating slender bifid lobes, the acuminate points of which do not droop. Spathes 6-10 inches long, lanceolate, compressed, acuminate, rigidly leathery, tomentose. Spadix 3-4 feet long, decurved, much paniculately branched, the branches and branchlets curved and slender, quite glabrous, rhachis compressed. Flowers minute, $\frac{1}{8}$ inch in diameter, spiked upon the very slender terminal branchlets, green. Calyx of 3 short very broad, obtuse segments. Corolla of 3 triangular-ovate, fleshy, coriaceous, valvate, subacute petals. Stamens 6; filaments very broad and short; anthers subglobose. Pistillode 3-cleft. Fruit globose, $\frac{3}{4}$ inch in diameter; pericarp thick, crustaceous, granular outside with a smooth buff, obscurely veined inner surface; remains of stigma evanescent. Seed globose, testa pale brown, smooth; chalaza a brown, subterminal, large polished areole; albumen very hard, white, not ruminate, with a broad, sack-like canal passing from the chalaza to the centre, and full of corky brown tissue; embryo dorsal above the base.

GERMINATION.—In the beginning the embryo becomes longer and grows thicker at the base in consequence of the plumule developing in the interior of the cotyledonal sheath. The axis of the plumule does not coincide with that of the embryo, as it passes laterally through the cotyledonal slit. The embryo has the shape of a cupule.

The first leaf is reduced to a sheath, the second shows the limb spread out.

At the base of the first root some lateral roots are developed which are thin and caducous. Gatin observed in a fourteen months old plant the formation of a new lateral root, which was stronger than the first and destined, in the course of time, to exercise the function of the principal root.

HABITAT.—The most southern palm of the Australian continent, reaching the snowy range in lat. 37° 30′ S. where its stem attains 80 feet in height, and extending thence along the west coast to the Illawara River, in lat. 34° 45′ S.

ECONOMIC USES.—The aboriginals of Australia are very fond of the growing centre or heart of this tree, which they eat in a

raw or cooked state. But Mueller says that the value of this esculent was not known to them in their uncivilized state.

Leichhardt mentions in his 'Overland Expedition to Port Essington' that the tops of the palm eat well, either baked in hot ashes or raw. Though very indigestible they do not prove injurious to health when eaten in small quantities, but 'several of my companions,' continues the same author, 'suffered by eating too much of the Cabbage-palm.'

The wood, or outer part of the stem is moderately hard and of a light colour. It is occasionally used for walking sticks, slabs for buildings, or the trunks are hollowed out for pig troughs. The central portion of the stem, when young and fresh, is said to be eaten by pigs.

The leaves are used for baskets. The unexpanded fronds, prepared by being immersed in boiling water, are dried, and the fibre thus obtained is much valued for the manufacture of hats which much resemble the celebrated Panama hats.[1]

CULTIVATION IN EUROPE.—On the islands of Hyères in the Mediterranean Sea (not far from Toulon) this palm may be seen growing in the open, but suffers a good deal from the strong wind.

It is one of the best known palms for room cultivation and for the temperate house. It does not suffer from the dry air of the room and is very little subject to the change of temperature. In summer it may be kept in the open. In the hothouse it attains a considerable size within short time.

The large rounded leaves are of a beautiful dark green with a metallic lustre. The leaf stalks, when getting old, assume a magnificent brownish red colour. The strong lateral spines of the petiole are almost black and as hard as iron.

Up to 1845 the only way of introducing palms from tropical countries into the hothouses of Europe was by means of young plants. This was not only troublesome and expensive, but very often unsuccessful. A lucky chance lead to the discovery that the seeds of palms retain their power of germination for a long time.

Allan Cunningham, the famous botanical explorer, wanted to send some cases of plants from Port Jackson to Kew. When

packing the specimens he told the servants to be careful as to the drainage of the lower part of the cases. The men, not having at hand for this purpose either potsherds or pebbles, made use of the round hard fruits of *Livistona australis*, covering with them the floor of the cases. In due time the cases were delivered at Kew, and Mr. Smith, the Curator of the Gardens, was so anxious to see the specimens sent by Cunningham that he personally supervised the unpacking of the cases. He saw the black seeds and noticed at the same time that the white delicate tip of the embryo had already broken through the hard shell. The seeds were at once confided to suitable ground and all the young palms developed rapidly.

From that time Mr. Smith instructed all the collectors in his employment to follow the simpler and safer way of enriching the palmhouses at Kew, *viz.*, by collecting and sending the seeds of the palms instead of young specimens.

How to send seeds to Europe.—The method first adopted by Smith and imitated very soon by all the travellers has long since become the general practice amongst gardeners and botanists.

In order to secure good results, it is first of all necessary to dry the seeds well. They are then put into a case filled with bran, soil, and sawdust in order to prevent them from becoming dried up, because dryness is as harmful to them as moisture. If packed in this way, they germinate on the way and usually arrive in good condition. If they do not germinate, they begin to rot as is mostly the case with seeds that contain oil. The latter begins to become rancid and the seed loses its power of germination.

8. **Livistona humilis** R. Br. Fl. Nov. Holl. 268, No. 2; Spreng. Syst. Veg. II, 137; Rœm. Schult. Syst. Veg. VII, 2, p. 1306, No. 2; Poir. Encycl. Suppl. III, 482, No. 2; Mart. Hist. Nat. Palm. III, 239, t. 109, 110, 111; Wendl. & Drude in Linnæa XXXIX, 231. Benth. Fl. Austr. VII, 146.—*L. leichhardtii* F. Muell. Fragm. VIII, 221.

Description.—Stems 4-15 feet high. Leaves orbicular-cordate in circumference when fully out, with a radius of about 1½ foot, deeply divided into narrow plicate segments tapering to a fine point, the thread-like bristles between the lobes varying from nearly 1 inch to very minute, or altogether wanting; petiole much flattened, the acute edges more or less bordered

by small prickles, said to be often intermixed with larger ones even as much as ½ inch long. General panicle very large and loose, the partial ones between the sheathing bracts pyramidal and 8 inches to 1 foot long, twice or three times branched, the ultimate branches or slender spikes ½-1 inch long in flower, often twice that in fruit. Flowers numerous, in little sessile clusters along the spikes. Inner perianth-segments scarcely 1 line long, the outer perianth about ½ as long with short, broad, rather obtuse lobes. Berry ovoid-oblong, obtuse, 7-8 lines long, more or less contracted at the base. Seed oblong, somewhat flattened.

HABITAT.—Australia: Arnhem's Land, Albert River, M'Adam Range, Port Darwin, Port Essington, Liverpool River, Wood Island.

USES.—The wood, or the outer portion of the stem, is hard, and of a light colour. The inner portion is soft and useless.

CULTIVATION IN EUROPE.—This palm is a handsome species for decorative purposes, when young.

9. Livistona inermis R. Br. Prodr. 268.—Mart. Hist. Nat. Palm. III, 329, t. 145, 146.—Benth. Flora Austral. vol. VII, 146.

NAMES.—Cabbage Palm; 'Partridge-wood.'

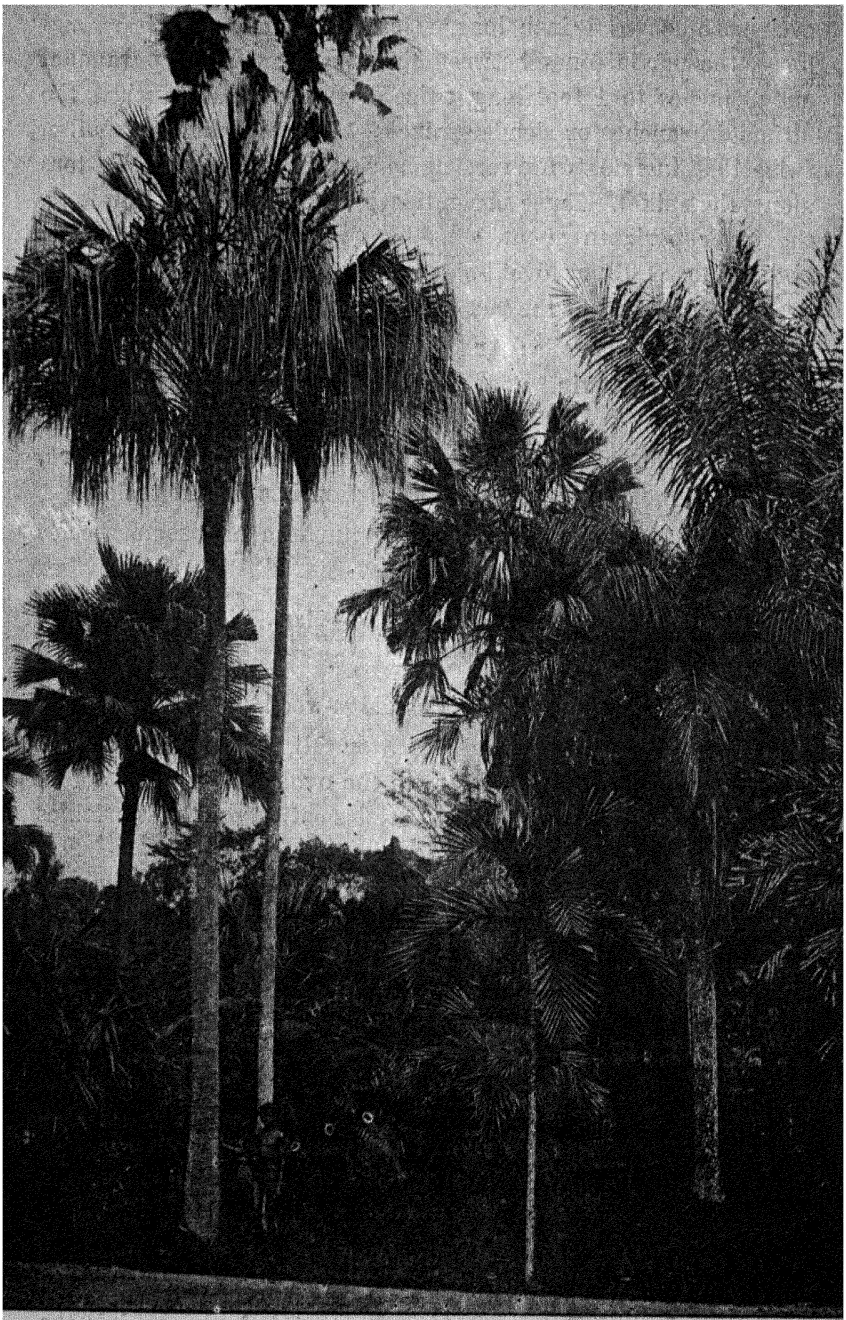
DESCRIPTION.—A moderate-sized or tall palm, 14-40 feet high and 12-15 inches in diameter, with the ovoid-oblong fruits of *L. humilis,* but said to differ in the petioles entirely without prickles and the lobes of the outer perianth more acute.

Bentham has the following note on this species: "I have seen no specimen of this palm and Martius appears only to have known it from Bauer's drawings which he copied, the general habit being also represented in Flinder's Voyage in the view of Sir E. Bellew's Island, Vol. II, p. 172. It may prove to be a variety only of *L. humilis.*"

HABITAT.—Northern Australia.

USES.—The outer portion of the trunk of this tree is very hard, beautifully marked and takes a good polish. In colour, it is light-grey, streaked with a darker colour.

ILLUSTRATION.—Mr. Macmillan's photograph reproduced on Plate XXVII shows a group of palms growing in the Royal Botanic Gardens of Peradeniya. Beginning from the left the picture contains the following trees:



From left: *Livistona chinensis* R. Br.; *Livistona inermis* R. Br.; *Livistona sp.*; *Howea forsteriana* Becc. (in front); *Livistona olivæformis* Mart. (at back); *Oreodoxa regia* Mart. (in front); *Arenga wightii* Griff. (at back).

1. *Livistona chinensis* R. Br., of which only the crown and the upper part of the stem are visible.
2. *Livistona inermis* R. Br., at the foot of which is standing a Singhalese coolie.
3. *Livistona sp.*, the highest palm with torn leaves.
4. *Howea forsteriana* Becc., the slender but low palm quite in front with elegant pinnate leaves.
5. *Livistona olivæformis* Mart., just behind *Howea;* the crown alone is visible.
6. *Oreodoxa regia* Mart., to the right of *Howea;* the lichen-covered stem and the crown are visible.
7. *Arenga wightii* Griff., quite to the right; only the upper large leaves can be seen, which rise above *Oreodoxa.*

10. **Livistona olivæformis** Mart. Hist. Nat. Palm. III, 319.—Miq. Anal. Ind. II, 5; Flora Nederl. Ind. III, 59.—*Saribus olivæformis* Hassk. Tijdschr. Nat. Gesch. IX, 176.

NAME.—Sadang Palm.

DESCRIPTION.—A tree, 15-20 feet high. Leaves palmate-flabelliform; petiole 5-6 feet long, semiterete, glabrous, with recurved spines at the base, for the rest unarmed, with a whitish tomentum on the underside when young; lamina usually 4½-5 feet long, consisting of about 90 segments; segments deeply bifid; laciniæ linear, long-acuminate, pendulous, glabrous on both sides. Spadix 1-3 feet long, paniculate; primary branches alternate, 5-6, 1½ feet long; branches and branchlets terete, glabrous. Flowers fasciculate, ternate or quaternate. Calyx trifid, corolla tripartite, both persistent. Drupe sessile, oblong-ellipsoidal (olive-shaped), slightly constricted at the base, scar of style sub-depressed, 6-7½ lines long, 3½ lines broad, violaceous-green; putamen thin, fragile; albumen white.

HABITAT.—Java.

11. **Livistona hoogendorpii** Teijsm. ex Teijsm. & Binn. Cat. Hort. Bog. 71.—André Illustr. Hortic. vol. 21 (1874) p. 108, 121, t. 174.—*Saribus Hoogendorpii* Zoll.

NAME.—Hoogendorp's Livistona.

DESCRIPTION.—Stem high, erect, shewing triangular scars after the fall of the petioles. Leaves rich dark green, fan-shaped, suborbicular, 5-6⅔ feet in diameter, divided into 10-12 lobes of which each has 5-7 subdivisions, plicate at the base, linear



Hoogendorp's Livistona (*Livistona hoogendorpii* Tijsm.).

acute at the apex, slightly furfuraceous like the uppermost part of the petiolé. Petioles stout, triangular at the base, enclosed in a network of reddish brown fibres, and trigonous, rounded on the dorsal side, furrowed on the sides, 3½-5½ feet long, reddîsh brown at the base, passing into olive green; lateral spines in two rows, very stout, reflexed, 1½-2½ inches distant from each other, towards the upper part of the petiole smaller and closer together, tubercled at the base, sharp pointed, ½-1½ inch long.

HABITAT.—Indian Archipelago.

CULTIVATION IN EUROPE.—Hoogendorp's Livistona was introduced in Europe in 1846. It is a very ornamental plant for the hothouse.

ILLUSTRATION.—Plate XXVIII, reproduced after a photograph of Mr. Macmillan, shows a young specimen of *Livistona hoogendorpii* growing in the Royal Botanic Gardens of Peradeniya.

The stem proper is not visible, being covered by the stout bases of the leaf-stalks. The latter are distinctly armed with strong, slightly reflexed spines.

10. *PRITCHARDIA* SEEM. et H. WENDL. IN BONPLAND, IX, 260, X, 197, 310, t. 15.

(After George Pritchard who explored the islands of the Pacific Ocean.)

Benth. et Hook. f. Gen. Pl. III, 928.—Becc. Malesia III, 286; Webbia II (1907) 200—Calpothrinax, Griseb. et Wendl. in Bot. Zeitg., 1879, 147.—Benth. et Hook. f. Gen. Pl. III, 927.—Drude in Engl. & Pr. Pflanzenf. II, 3 (1889), 33.

Stem erect, columnar, solitary, unarmed, with annular scars. Leaves terminal, large, flabellate, orbicular or more or less cuneate at the base, undivided in the central part, more or less deeply multifid on the periphery; the segments more or less deeply bifid, with or without filaments between the divisions; ligule short; rhachis more or less elongate. Spadix a doubly branched panicle; spathes two or more, complete, imbricate, very large, coriaceous, tubular in the lower part, open on one side of the upper part. Flowers hermaphrodite, scattered or spirally arranged on the branchlets, solitary, sessile on a bracteate pulvinus; bracteoles 0. Calyx tubular-campanulate.

3-denticulate. Corolla very much longer than the calyx with a short permanent tube and 3 valvate divisions. Stamens 6; filaments subulate, united at the base, dilatate and forming an erect corona; anthers linear, oblong, versatile. Ovary obovate or turbinate; carpels 3, half-free, united into an elongate style with common punctiform stigma, with one basilar erect ovule. Fruit globular or ovoid, with the remnants of the styles and sterile carpels more or less apical; pericarp thin, grumous or fibrous; endocarp more or less woody, often easily separating from the pericarp. Seed globular, free and erect in the endocarp; hilum small, basilar; raphe lightly impressed, occupying a whole side of the seed; albumen uniform, solid; embryo opposite to the raphe above the base or towards the middle.

Species about 10.—Fiji and Sandwich Islands.—The species described below has been introduced in Indian Gardens.

CULTIVATION IN EUROPE.—Very ornamental stove palms. They grow best in a compost of two parts of peat and one of loam and sand. A liberal supply of water is essential. Propagation is effected by seeds only.

1. **Pritchardia pacifica** Seem. and H. Wendl. in Bonpl. IX (1861) 260; X, 153, 310, t. 15.—Seem. Flora Vitiensis, 274, t 79; in 'Correspond. relat. the Fiji Isl., p. 70.—*Corypha umbraculifera* Forst. Pl. Escul. 49 et Prodr. p 88 (*ex parte*) (*non* Linn.).

NAMES.—Viu, Sakiki, Niu Masei (in Viti); Biu (by the Tonguese).

DESCRIPTION.—The palm seldom obtains more than 30 feet in height. Stem smooth, straight and unarmed, at the base from 10-12 inches in diameter. The crown has a globular shape, and is composed of about 20 leaves. Petioles unarmed, 3 feet and more long and densely covered at the base with a mass of brown fibres. Blade of the leaf rounded at the base, fan-shaped, very large, and when young, as is the petiole, densely covered with whitish-brown down, which, however, as the leaf advances in age, gradually disappears. From the axils of the leaves arise flowers, enveloped in several very fibrous flaccid spathes, which rapidly decay and have quite a ragged appearance even before the flowers open. Spadix 3 feet long, stiff and very straight, flowers numerous, minute, hermaphrodite, of a brownish-yellow colour. Fruit perfectly round, about ½ inch in diameter; when



Pritchardia pacifica Seem. et H. Wendl.

quite matured, it has exactly the colour of a black-heart cherry; the mesocarp has a slight astringent taste.

HABITAT.—Islands of the Pacific: Vanua Levu, Viti Levu, Tongan and Samoan Islands.

USES.—The leaves are made into fans, 'Iri masei' or 'Ai Viu,' which (in Seemann's time) were only allowed to be used by the chiefs, as those of the Talipot formerly were in Ceylon. The common people had to content themselves with fans made of *Pandanus caricosus*. "Hence, though there is not a village of importance without the Sakiki, or, as it is termed in the Samosomo dialect, which suppresses the letter k, Saii, there are never more than one or two solitary specimens to be met with in any place, the demand for the leaves being so limited, that they prove sufficient for the supply. The fans are from two to three feet across and have a border made of a flexible wood. They serve as a protection both from the sun and rain; during a shower of rain the fan is laid almost horizontally on the head, the water being allowed to run down behind the back of the bearer. The leaves are never employed as thatch, though their texture would seem to recommend them for that purpose: the trunk, however, is occasionally used for ridge-beams." (Seemann.)

CULTIVATION IN EUROPE.—Of all the palms introduced in Europe there is none that could rival as regards ornamental effect this magnificent palm. It was discovered by Seemann on the Fiji Islands and some other isles of the Pacific Ocean.

The regular globular silhouette of the crown of leaves borne on a straight erect stem gives the tree a very fine appearance. In the European hothouses the large leaves with long unarmed stalks are at once distinguished amongst the leaves of other palms. The gigantic fans are sometimes 5 feet broad and 4 feet long. Whilst young the leaves are covered with a tawny down which disappears very soon. The imported seeds germinate rapidly.

ILLUSTRATION.—We reproduce on Plate XXIX the photograph of *Pritchardia pacifica* kindly supplied by Col. Gage. The specimen represented is growing in the Royal Botanic Gardens of Sibpur, Calcutta.

11. *WASHINGTONIA* H. WENDL. BOT. ZEIT. XXXVII, (1879) 68.

The genus is dedicated to George Washington.

Benth. & Hook. Gen. Pl. III, 923; *Pritchardia* subg. *Washingtonia* Drude, Engl. und Prantl Pflanzenf. II, pt. III, 35 (in part) (1889); Baillon, Hist. Pl. XIII, 319 (in part).

Trees, with stout columnar endogenous trunks covered below with thick pale rind and above with the persistent sheaths of many dead leaves, long tough roots and a broad terminal crown of erect, then spreading, and ultimately pendulous leaves. Leaves induplicate in vernation, alternate, flabellate, orbicular, divided nearly to the middle into many narrow deeply two-cleft recurved segments, separating on the margins into numerous slender pale fibres, long-petiolate; those of the first year linear-lanceolate; rhachises short, slightly rounded on the back, gradually contracted from a broad base, their margins concave, and furnished below with narrow erect wings, slender and acute above. Ligules oblong, elongated, thin, broad and conspicuously laciniate at the apex. Petioles broad and thin, plano-convex or slightly concave on the upper side, rounded on the lower, armed irregularly with broad thin large and small, straight and hooked spines confluent into a thin bright orange-coloured cartilaginous margin, gradually enlarged at the base into the thick elongated broad concave light bright chestnut-brown vaginas composed of a network of thin strong fibres. Spadix interfoliar, paniculate, elongated, pedunculate, glabrous, its numerous branches flexuose and pendulous; spathes numerous, narrow, elongated, glabrous. Flowers minute, white, articulate on thickened disk-like pedicels in the axils of ovate acute scarious bracts, slender and acuminate before anthesis. Calyx tubular, indurate at the base, gradually enlarged and slightly 3-lobed at the apex, scarious, persistent under the fruit, the lobes retuse, scarious, erose, imbricated in æstivation. Corolla funnel-shaped, the fleshy tube included in the calyx, half as long as the lanceolate acute striate lobes, thickened and glandular on the inner surface at the base, reflexed, imbricated in æstivation, deciduous. Stamens 6, inserted on the throat of the corolla; filaments of the stamens opposite the lobes of the petals consolidated with them for nearly ½ their length and much thicker than the free filaments opposite the sinuses; anthers linear-oblong, attached on the back, versatile, pale yellow, 2-celled, the cells spreading below, opening longitudinally. Ovary superior sessile on a thick disc, depressed-obovoid,

3-lobed, 3-celled, crowned by an elongated flexuose exserted white horny style stigmatic at the apex; ovule solitary in each cell, lateral, erect, anatropous. Fruit baccate, small, ellipsoidal, 1-celled, 1-seeded, short-stalked, crowned with the remnants of the abortive carpels and of the style; pericarp of 2 coats, the outer thin, dry, black, and fleshy, the inner membranaceous, dark orange-coloured, lustrous on the inner surface. Seed free, erect, oblong-ovate, convex above the base, flat, depressed in the centre, marked by the minute sublateral hilum and the broad conspicuous raphe; micropyle lateral, minute; testa thin, light chestnut-brown, closely investing the uniform horny albumen; embryo minute lateral, the radicle turned towards the base of the fruit.

SPECIES.—3 or 4.

DISTRIBUTION.—California; ? Arizona.

Botanists have been at variance for a long time as to the number of species belonging to this genus. Some admitted 3, others 2 and many considered it necessary to reduce all of them to one species. Beccari is of opinion that two species, well characterized, but both very variable, can be distinguished. In order to facilitate the correct identification of the specimens grown in Indian gardens we shall give a complete description of the species and varieties as published by Beccari (in Vol. II of the 'Webbia,' p. 187-200), adding *W. gracilis* Parish, as a distinct species.

CULTIVATION IN EUROPE.—The species of Washingtonia are ornamental greenhouse plants. They are easily cultivated in a compost of rich strong loam to which is added a small portion of vegetable mould and sand. Good drainage and ample supply of water throughout the summer are necessary.

1. **Washingtonia filifera** H. Wendl. in Bot. Zeitg. vol 37 (1879) 68 [1].—Sargent Forest Trees N. Am. 10th Census U. S. IX, 217 (*pro parte ?*)—

[1] It might not be out of place to consider the question why we adopt the specific name "filifera" of H. Wendl. instead of "filamentosa" of O. Kuntze. "Wendland's original species was published as *W. filifera*; but in his Revisio, Kuntze (1891) proposed to change it to *W. filamentosa* on the ground of priority, citing in support *Brahea filamentosa* Wendl. in Cat. Haage and Schmidt (1875), *Pritchardia filamentosa* Wendl. ex Fenzi in Bull. Soc. Tosc. (April 1876). To seek in a tradesmen's catalogue for a pretext for displacing an established name, requires a lust for change almost amounting to a mania. But if an appeal to trade-lists is to be made, priority is against the change, for

Sprenger in Bull. Tosc. Ort. XIV, 319, f. 37.—Beccari in Webbia II, 187.—*W. filamentosa* Ω. Kuntze Rev. Gen. Pl. II, 737 (1891).—Sargent Silva N. Am. X 47, t. DIX *(pro parte?)*—*Brahea dulcis* Cooper, Smithon. Rep. 1860, 342 (not Martius).—*Pritchardia filamentosa* H. Wendl. in Bot. Zeitg. vol. 34, 807 (1876); Fenzi in Bull. Soc Tosc. Ort. I, (1876) 116, *cum icone xyl.*—*Pritchardia filifera* Linden Ill. Hort. vol. 24, 105 (1877) *cum ic. xyl.*—*Brahea filamentosa* Hort. ex S. Wats. in Proc. Am. Acad. XI (1876) 147.—*Brahea filifera* Hort. ex. W. Wats. in Kew Bull. (1889) 295.—*Brahea robusta* Hort. ex Salomon, Palmen (1887) 151.—*Corypha filifera* Hort. ex Salomon, l. c. 151.—*Livistona filifera* Makay and *Livistona ternatensis* Hort. ex Salomon l. c. 174.

DESCRIPTION.—Stem rising to a height of 60-70 feet, slightly thickened near the base, where it measures $2\frac{1}{2}$-$3\frac{1}{2}$ feet in diameter, then columnar and getting slightly thinner towards the apex, covered with the dead pendent leaves. Leaves large, measuring $3\frac{2}{3}$ feet from the apex of the petiole to the end of the central segments. Petiole about as long as the limb, dilated at the base into a coriaceous sheath which (in the centre of the crown) measures about 3 feet from its point of attachment to the point where the spines begin, more or less $1\frac{3}{5}$ inches broad at the apex and often $\frac{1}{2}$ inch only, much broader towards the base, plain above, convex below, in the leaves of old plants armed on the margins of the lower half with small spines which are deltoid, slightly or not at all uncinate, $\frac{1}{5}$-$\frac{5}{16}$ inch long; for the rest the petiole is free of spines or shows a very small one here and there; ligule triangular, in shape and length like the rhachis, with membraneous dry margins; rhachis triangular-elongate, twice or twice and a half times as long as broad, not counting the apical prolongation which projects into the limb. Limb divided to about the middle into about 80 segments, with long pale filaments between the segments and on the margins, equally green and glabrous on both surfaces; each segment deeply two-cleft and the two divisions arising thereof very acuminate and lacerate-filamentose at the extreme end; the central segments at the height of the deepest divisions are $1\frac{3}{5}$-$1\frac{4}{5}$ inches broad, the outer segments become gradually narrower and shorter and

Haage and Schmidt offered *Brahea filamentosa* in their autumn catalogue of 1875, but in the spring of the same year, Linden in his list had put the same plant on the market as *Pritchardia filifera* (Fenzi 1876). *Pritchardia filamentosa* of Fenzi's paper is a *nomen nudum*, being without a word of scientific description or any reference to a published species. As the proper specific name, *filamentosa* has absolutely no standing." Parish.

more deeply divided, the outermost segments are only $\frac{2}{3}$-$\frac{3}{5}$ inch broad and much shorter than the others. Spadices very large, arcuate-nutant, longer than the leaves, with several large partial inflorescences rising from within the tubular primary spathes; these secondary inflorescences consist of several superposed branches, each of which forms a cupressiform partial panicle, $1\frac{1}{3}$-$1\frac{2}{3}$ feet long, very dense, rising from the axil of a spathe; this spathe is tubular at first, but later on split lengthwise, laminar, longer than the respective panicle, $\frac{2}{5}$-1 inch or more broad, truncate, shortly bidentate and ciliate-barbate at the apex. The partial panicles are doubly branched and divided into numerous filiform straw-coloured flowering branchlets which are $2\frac{1}{2}$-$3\frac{1}{2}$ inches long. Flowers in bud lanceolate-acuminate, $\frac{1}{3}$ inch long and $\frac{1}{12}$ inch broad, obscurely angular; calyx tubular-campanulate, truncate at the base, lobes 3, divided to about the middle, broadly ovate, denticulate-crenulate, apex slightly furfuraceous-rubiginose; corolla twice as long as the calyx, tubular in the lower fifth, segments lanceolate-acuminate, subaristate, callous-papillose at the point of insertion of the respective stamen, spreading during anthesis in that part which is not surrounded by the calyx. The stamens opposite to the segments thickly fusiform, attached to the corolla with their lower third; the stamens alternating with the segments are terete, subulate, much thinner than the others, free almost to the base of the corolla; anthers lanceolate-sagittate, acute, shortly bifid at the apex. (Fig. 20.)

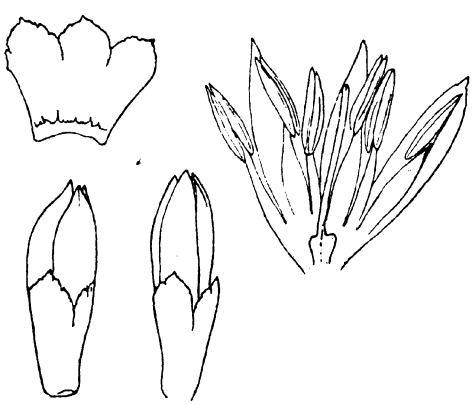


FIG. 20.—Flowers of *Washingtonia filifera* Wendl. × 3·5. (After Parish.)

Ovary small turbinate, 3-lobed, abruptly contracted into a filiform style. . Stigma punctiform, non-lobate. Fruit ovoid, black, shining, with fleshy mesocarp, usually $\frac{3}{8}$ inch long and $\frac{2}{8}$ inch broad, surmounted by the permanent, setiform, $\frac{1}{5}$-$\frac{1}{4}$ inch long style. Seed ovate-ellipsoid, equally rounded at the two extremities, no incavation on the side of the raphe.

Sometimes two carpels are developed and in this case the fruits are a little asymmetrical.

HABITAT.—The exact locality of the original home of this species is still doubtful.

Parish, who made a special study of the history of this species, tries to give an answer to the question: "What precisely was the palm variously known to gardeners and seed-dealers as *Brahea filifera* or *Pritchardia filamentosa,* and to which Wendland gave the name *Washingtonia filifera,* and whence came it?"

"Wendland had before him a few young trees which had been grown in the palm-houses of Linden in Ghent. It seems certain that the seeds were brought to Europe by Rœzl. They purported to have been collected in Arizona, near the Colorado River, and Fenzi (1876) even gives latitude and longitude, which would locate the parent trees in the neighbourhood of Prescott, Arizona, a region rather of pines than of palms.

"It appears . . . that the only opportunity which Rœzl had of procuring seeds of *Washingtonia* was during his visit to San Diego, in December 1869. The notes, however, contain no reference to this palm. But a visit to any of its desert habitats would certainly have been an experience far too notable to have failed of record. Nor is it probable that his visit to San Diego, so short and so diligently occupied in collecting, could have afforded time for the difficult journey to the desert. The vague and confused habitat assigned to the palm is itself a sufficient evidence that the collector, from whom the information must have come, could never have visited a native grove. It is safe to conclude that the seeds he sent to Europe came from some of the older cultivated trees at San Diego, and that his pardonable ignorance of local geography prevented him from correctly understanding what was told him of the location of the indigenous groves."[1]

[1] For further information cf. Parish S. B., Rœzl and the type of *Washingtonia*, in Bot. Gaz. vol. 48 (1909) 462.

Specimens cultivated in Italy flowered towards the middle of August and fruited in November.

2. **Washingtonia filifera var. microsperma** Becc. Webbia vol. II (1907) 191; Parish in Bot. Gaz. vol. 44 (1907) 420.

DESCRIPTION.—Stem as in the typical form. Leaves of adult specimens measuring 5 feet from the apex of the petiole to the extremity of the central segments. Petiole about as long as the limb, armed near the base with small dentiform, deltoid, horizontal spines, for the rest unarmed, $1\frac{3}{5}$-2 inches broad at the apex; rhachis much more prolonged into the limb than in the typical form, being about 3-4 times longer than broad. Spadix $11\frac{1}{2}$ feet long with partial inflorescences, each about $6\frac{3}{4}$ feet long; the partial inflorescences composed of 6-7 cupressiform panicles, the lowest being the largest, measuring $1\frac{1}{3}$-$1\frac{1}{2}$ foot in length and not differing in any way from those of the typical form; each panicle similarly provided with its spathe, which is broadly linear, $1\frac{3}{5}$-2 inches broad and slightly longer than the respective panicle. Flowers white, with a strong disagreeable odour, in the bud oblanceolate acuminate, very little shorter than in the typical form, slightly attenuate at the base, at the broadest point (towards the upper third) $\frac{1}{12}$-$\frac{1}{8}$ inch broad, not seldom slightly asymmetrical and sometimes more or less obtusely trigonous, calyx tubular-campanulate, truncate at the base, divided down to the middle or beyond the upper third into 3 lobes; lobes broadly ovate or suborbicular, with the margins slightly imbricate. Corolla undivided and tubular in the lower fourth; petals lanceolate, acuminate-aristate, slightly concave or almost plain with the margins superposed or imbricate when in bud, delicately striate on the outer side, during anthesis horizontal, very strongly callous-glandular at the base behind the respective stamen. Stamens biseriate, but all of equal length, those opposite to the petals united with those in the lower third, stout, fusiform, subulate at the apex, those alternating with the petals free as far as the corolla is divided, thinner, terete, subulate and not inflexed at the apex, for the rest like the others, anthers about $\frac{1}{8}$ inch long, narrowly lanceolate, acuminate at the apex but often very shortly bifid, and this occurs oftener in the stamens which are opposite to the petals. Carpels 3, very small, free at the base, forming a body slightly longer than $\frac{1}{24}$ inch; ovary turbinate, obtusely trigonous, trilobed and strongly gibbous

above; the 3 carpels very abruptly contracted into one filiform trisulcate style with one punctiform undivided and not thickened stigma.

As to the 'undivided style' Beccari does not wish to assert more than what he saw when examining several flowers, and he does not exclude the possibility of the stigma opening into 3 lobes at a certain moment of the development of the flower.

Fruits ovoid, similar in every point to those of the typical form, but long and short diameter by $\frac{1}{4}$ inch smaller; seeds accordingly reduced.

HABITAT.—The original home of this variety is as little known as that of the type.

CULTIVATION IN EUROPE.—In 1874 Linden brought very young specimens to Florence. Since then they have been growing in different gardens in the vicinity of Florence and Viareggio and have produced flowers and fruits.

There is no doubt that the same variety is cultivated in many other establishments in Europe and probably also in India, but they have never been distinguished as such. It is quite possible that a closer examination of all the specimens now known under the specific name of *W. filifera* will disclose many other varieties, and if the number of varieties is increasing, botanists will probably find it convenient one day to reduce all of them to the old well-established *W. filifera* H. Wendl.

3. **Washingtonia robusta** H. Wendl. in Berl. Garten Zeit. II (1883) 198.—Rev. Hort. 1883, 206 et 1885, 401, f. 73.—Bull. Soc. Tosc. Ort. 1883, 117 et 1886, 301.—Orcutt in Bot. Gazette IX (1885) 262.—Becc. Webbia II (1907) 194.—*W. filifera* (*non* Wendl.) S. Watson in Bot. Cal. II, 211, 485.—*Washingtonia filifera* Wendl. var. *robusta* Parish in Bot. Gaz., vol. 44 (1907) 420.

NAMES.—Desert Palm; Fan Palm; Palm Cañon.

The name 'Desert Palm' had been given to the tree actually growing in the Colorado Desert of California, whilst the name of *Washingtonia filifera* was given to specimens growing in European gardens, which were supposed to have been imported from the same locality in California. Though, therefore, the scientific name of the Colorado plant has been changed, the popular name must, nevertheless, be retained.

DESCRIPTION.—Trunk stout, enlarged at the base, 60-90 feet high. Petioles stout and until old erect, $3\frac{1}{3}$-5 feet long, 4-5 inches

broad at the dark-brown base, and half as wide at the blade; the upper surface concave, its thin, light-brown margins corneous and armed for their entire length with stout hooked spines, acuminately prolonged into the blade; ligule papyraceous, acuminate, lacerate, $\frac{1}{3}$-2 inches long; blades $3\frac{1}{3}$-5 feet in diameter, the 60-70 folds deciduously tomentulose on the lower edges, cleft two-thirds to the base, the margin of the divisions abundantly filiferous.

Spadices very large, longer than the leaves, nutant with 5-6 large pendent partial inflorescences, each bearing 2-5 separate thyrses, which are exceeded by their ligulate, chartaceous, spathoid bracts; flowering branchlets usually $3\frac{2}{3}$-4 inches long, $\frac{1}{24}$ inch in diameter, sinuose, glabrous, angular with the solitary flowers not very regularly inserted. Flowers, when in bud, $\frac{1}{12}$ inch long, $\frac{1}{10}$ inch broad. Calyx campanulate, truncate at the base, divided halfway down into 3 lobes, lobes more or less ovate, very irregularly ciliate-laciniate on the margin. Corolla much longer than the calyx, divided down to the lower fourth into 3 segments; petals lanceolate, acuminate-subulate, rather strongly calloso-glandular at the base. Stamens biseriate, but of equal length, as long as the petals, the three opposite the petals with the filaments very stout and subulate at the apex, tuberculately enlarged at the coherent base and abruptly subulate above; the other three stamens terete; anthers large, $\frac{1}{3}$ inch long, narrowly linear-sagittate, apparently acute or apiculate but in reality bifid at the apex for almost $\frac{1}{3}$ of their total length. Ovary turbinate at summit, truncato-rotundate, but neither excavated nor gibbous; stigma bilabiately 3-parted into 3 short lobes. (Fig. 21.)

The fruit ovoid, black, shining, with little fleshy mesocarp, about $\frac{2}{3}$ inch long, and $\frac{1}{3}$ inch broad, terminated by the permanent setiform style. Seed ovate, by $\frac{6}{12}$-$\frac{7}{12}$ inch long and about $\frac{1}{3}$ inch broad, very slightly incavate-umbilicate on the side of the raphe.

The flowers are copiously nectariferous, and exhale a heavy odour, disagreeable when near by, but when diffused somewhat suggestive of the perfume of orange blossoms.

Beccari sustains the specific rank of this palm on the following three characters:—

(a) The lobal filaments of the stamens tuberculately enlarged at the coherent base and abruptly subulate above.

(b) The stigma bilabiately 3-parted into 3 short lobes.

(c) The ovary turbinate at the summit, but not excavated and not gibbous.

"The first two characters," says Parish, "hold in the flowers of Californian trees which have been referred here, so far as concerns the few specimens I have examined. The ovarian character is less satisfactory."



FIG. 21—Flowers of *Washingtonia robusta* Wendl. ×3·5. (After Parish.)

HABITAT.—Borders of the Colorado desert of Southern California, at low altitudes, seldom exceeding 1,100 feet.

"The distribution of the Desert Palm appears to have been determined by the boundaries of the great lake which, in the not very distant part, occupied the central depression of the Colorado Desert. We may reasonably suppose the shores of this ancient lake to have been enlivened, here and there, with groves of stately palms. A few venerable trees still linger near the upper shore line of this vanished sea, gaunt and ready to perish, and without offspring to succeed them; but the most have retired to the cañons of the surrounding mountains. Here they find congenial homes along the few and feeble streams, by some scanty spring, or narrow oasis moistened by alkaline percolations. The necessity of soil moisture is the governing factor in their distribution.

"The most extensive groves occupy a tract of strongly alkaline soil along the foothills some ten miles north of Indio,

and extending to some of the neighbouring washes. This belt may be considered the centre of distribution. The finest grove occupies, for a mile or more the narrow Palm Cañon, on the opposite side of the desert at the base of San Jacinto Mountain. Here hundreds of fine trees fill the sandy bed of the stream or cling to the rocky bases of its steep sides. The older trees are still vigorous, and there are abundant younger ones of all sizes.

"Most of the cañons at the desert bases of San Jacinto contain palms. A few grow in the cañon of the Whitewater, which is the western limit of the species. Its southern outpost is probably at Carizo Creek; a few trees at Corn Springs mark its northern limit, and none are known east of Frink's Station."[1]

Duration of Leaves.—The functional life of a leaf is about one year. How long the dead leaves would remain attached to the trunk if undisturbed cannot be stated. Parish mentions a row of trees in San Bernardino over 30 feet high from which the leaves have never been removed, and the lowest are over 25 years old and still firmly attached to the trunk.

The thatch of dead leaves makes an admirable protection to the trunk from the scorching heat and drying winds of the desert. Unfortunately most trees have been deprived of this mantle. Its inflammable material is easily kindled by an accidental fire, and is an almost irresistible temptation to the passing vandal; but the greatest destruction is attributed to the desert Indians, who are said to burn the dry leaves that they may more easily gather the fruit. To burn them thus was the immemorial custom of the desert Indians and it has been erroneously alleged that in this they were influenced by a superstitious motive, *viz.*, the making of an offering by fire to the spirits of the dead. That any plants survive this ordeal of flames is strong evidence of the vitality of the species.

Uses.—The wood of the Desert Palm is light and soft, and contains numerous conspicuous dark orange-coloured fibro-vascular bundles. The specific gravity of the absolutely dry wood is 0·5173, a cubic foot weighing 32·24 pounds. Trimble[2], while examining this Palm for tannin, was impressed by the

[1] Parish, S. B., A contribution toward a knowledge of the Genus Washingtonia in Bot. Gaz. Vol. 44 (1907) 426.

[2] Garden and Forest, Vol. IX, 133.

sweet and salt taste of the fresh tissue. Less than one per cent. of tannin was found, but, as the specimen contained 68·97 per cent. of moisture, this raised the amount of tannin to 2·73 per cent. when calculated for absolutely dry substance. The quantity is too small, however, to give the tree any value on account of its astringency. Attention was then directed to the sugar content of the specimen with better results, for the amount found, when calculated for dry substance, was 15·50 per cent. Since this amount was not materially increased by first treating the infusion with acid, it was probably a glucose sugar. The ash in the absolutely dry specimen was found to be 11·86 per cent., over ¼ of which was sodium chloride, the actual amount of salt being 3·09 per cent. of the dry substance of the palm. The specimen analyzed was a cross-section of the trunk at the base of the leaves.

The habitations of the desert Indians were mere shelters, but naturally palm leaves, when easily procured, were utilized in their primitive construction. Strands split from the leaves were convenient for tying, and it is said were sometimes used for the spiral coil with which they built up their baskets. They were also used in building the characteristic granaries used by these Indians for storing the various seeds used by them for food.

Of these food supplies the fruit of the palm was an important part. It was eaten fresh, and also dried for preservation. A favourite method of preparing the dried fruit was by triturating it with water in a stone mortar until a pulpy mass, rich in saccharine properties, was produced. The seeds were then separated and the pulp was thickened with meal made from pounded 'chia' (*Salvia*), or grass seed, or pine nuts. The bony seed itself was pounded into meal which Edward Palmer (1878), who seems to have tried it, pronounces "not inferior to cocoanut," a statement which may be accepted with some reservation. The terminal bud also was baked and eaten. Each grove was the property of a particular clan, to whom alone belonged the right to gather the fruit (Parish).

CULTIVATION.—The Desert Palm was first cultivated by the Jesuits in their mission gardens of southern California long before this region became a part of the United States. It has now become one of the commonest trees in the gardens and

streets of the south-western part of California, growing rapidly and vigorously there, as it does in southern Europe, where, in a comparatively short time, it has attained a large size and produced flowers and fruits. Two specimens in San Pedro Street in Los Angeles, believed to have been planted by the Jesuit missionaries, with stems nearly 9 feet through at the ground, are estimated to be 100 feet high.[1]

Wendland founded this species (1883) on young plants grown by Van Houtte at Ghent, and its ascribed indigenous source is evidently wrong, since it was asserted to be "the borders of the Sacramento River". Van Houtte received the seeds under the name of the species already known, and under that name their product was at first sold, until Wendland recognized them as distinct, and published the name *W. robusta.*

About this time collectors began to secure palm seed at Palm Springs, in the Colorado desert. Parish is convinced that this place was the true source of Wendland's second type, and he considers it as certain that most of the trees growing there are identical with those now recognized in Europe as representing that species.

GERMINATION.—At the time of germination the cotyledonal petiole becomes slightly longer and then plumule and radicle develop at the same time. At the base of the primary root there arise some thin lateral roots and after some time it is covered with rootlets. The radicle remains for a long time the principal root, but after the development of several leaves, there arises a new lateral root which is much thicker than the primary root and destined to take its place in the course of time.

The first vegetative leaf is a mere sheath surrounded by the ligule of the cotyledonal sheath.

INSECT ENEMY.—According to Parish the Desert Palm is not known to be infested by any parasitic fungus, or to be subject to any bacterial infection. "Its sole enemy", he says, "is the larva of a Bostrychide beetle, *Dinapate Wrightii* Horn, the only species of the genus. The female oviposits at the base of the living leaves, whence the larva bores downward through the trunk, its continually enlarging galleries becoming at length 18 mm. in diameter. These are tightly packed, for the most

[1] Kinney in Scientific American, Vol. 60. p. 263.

part, with rejected gnawings. The larval life of the insect is three or four years, perhaps even longer. The mature beetle has a length of fully 5 cm. and is the heaviest North American coleopter.

"The number of contemporaneous larvæ that might inhabit a single trunk has been estimated as high as 200 or 300; but Mr. W. G. Wright, who discovered the beetle, and who has assiduously investigated its habits, is of opinion that it would probably not exceed 50. But even such a horde of huge and voraceous grubs, in their comparatively long life, might riddle a whole trunk with their galleries. They seem not to work any great destruction to the groves, however; in fact, the only evidences of their presence to the ordinary observer are the exit holes in dead trunks."

4. **Washingtonia gracilis** Parish in Bot. Gaz. vol. 44 (1907) 420. *Washingtonia robusta* Hort. (in California, not of Wendland). *Washingtonia robusta var. gracilis* Parish ex Webbia II, 197.

DESCRIPTION.—Trunk slender, at least 65 feet high. Petioles rather convex on the upper surface, $2\frac{1}{3}$-$3\frac{1}{3}$ feet long, about 4 inches wide at the brown base and $\frac{1}{2}$ as wide at the blade, the corneous margins armed with short hooked yellow spines for the entire length, accuminately prolonged in the blade; ligule papyraceous, narrow, the margin entire; blade $2\frac{2}{3}$-$3\frac{1}{3}$ feet in diameter, the folds 75-80, deciduously tomentose toward the base beneath, cleft little more than $\frac{1}{3}$ toward the base, not filiferous

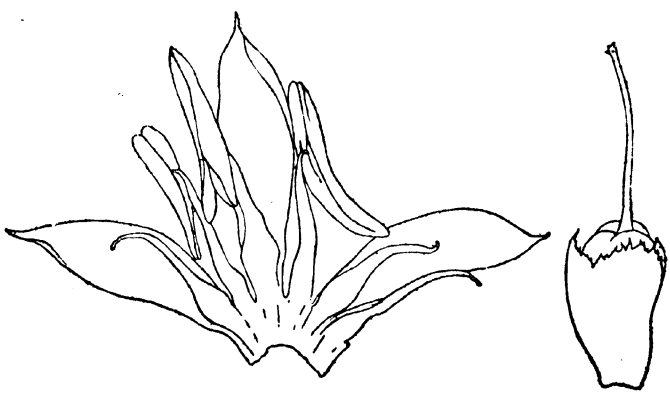


FIG. 22.—Flower of *Washingtonia gracilis* Parish. × 5 (After Parish.)

except for an occasional single filament in the sinuses of some of the folds.

Peduncles declined, exceeding the leaves; primary divisions 6-8, each bearing 5-10 separated thyrses, which are mostly exceeded by their narrow, deciduous, chartaceous bracts. Flowers nearly sessile. Calyx tubular-campanulate, $\frac{1}{8}$ inch long, the short rounded lobes lacerate. Corolla tube $\frac{1}{8}$ inch long, its lobes erect, narrowly lanceolate, $\frac{6}{16}$-$\frac{7}{16}$ inch long. Filaments subulate, $\frac{1}{8}$ inch long; anthers versatile, $\frac{1}{16}$ inch long. (Fig. 22.)

Seeds broadly ovate, $\frac{6}{16}$-$\frac{7}{16}$ inch long and $\frac{1}{5}$ inch broad, rugose on the side of the raphe.

This palm is readily distinguished from *W. filifera* and its varieties by its slender trunk and smaller and less deeply divided leaves, which are without filaments and on shorter petioles.

Beccari (l. c.) regards this palm as a variety of *W. robusta*. It seems to me, however, that Parish is right when he says: "It would be possible, although in my opinion undesirable to regard all the Washingtonias as varieties of a single polymorphous species, but the one now under consideration (*viz., W. gracilis*) would of all be the least capable of such comprehension. Without question floral characters are of greater diagnostic value than those drawn from foliage or habit; but when the latter are of marked distinction, and apparently constant, they cannot be refused great weight."[1]

HABITAT.—Probably indigenous in northern Lower California (Parish).

(Parish's description is taken from cultivated trees growing in San Bernardino and Riverside California.)

5. **Washingtonia sonoræ** Watson Proc. Am. Acad. XXIV (1889) 79; XXV (1890) 136; Parish in Bot. Gaz. vol. 44 (1907) 422.

Washingtonia sonora Hort. in Webbia II (1907) 198.

NAMES.—Palma Blanca, Palma Colorada, Palma Nigra (in the Cape region of California).

DESCRIPTION.—Stem about 25 feet high, 1 foot in diameter. Leaves glaucous, filiferous, 3-4 feet in diameter, borne on comparatively slender petioles beset on the margins with variously curved spines, connected by a web of floccose hairs. The spadix is shorter, more slender, and more sparingly branched, and the perianth is thinner and more scarious than those of *W. filifera*.

[1] Parish, S. B., The Flowers of Washingtonia, in Bot. Gaz., vol. 46 (1908) 145.

This species is still very imperfectly known. Parish says that it is easily separable from the others by the obtuse juncture of the petiole with the blade. The leaves of the young plants he was able to examine were very abundantly filiferous.

Beccari had not had an opportunity of examining flowers of *W. sonoræ*, and he regards it as a doubtful species, which may be a variety of *W. robusta,* suspecting that the obtusely triangular insertion of the petiole in the leaf blade may not prove a constant character.

Parish, in the meantime, had an opportunity of examining a few flowers taken from the type specimen of this species, collected by E. Palmer at Guyamas, Mexico. The flower has the characters assigned to *W. filifera* so far as the filaments are concerned, the character of *W. robusta* as to the divided tip of the stigma, and the markedly lobate ovary of *W. gracilis.* (Fig. 23.)

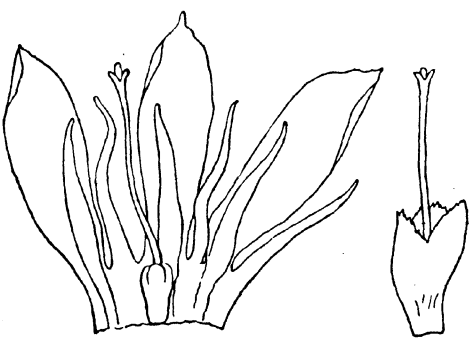


FIG. 23.—Flower of *Washingtonia sonoræ* S. Watson. ×5 (After Parish.)

It must not be forgotten, however, that these characters are drawn from a study of a few individuals only.

HABITAT.—First collected by Dr. Edward Palmer in 1887 "in secluded cañons in the mountains about Guyamas" (Watson); "in great quantities, and of great size, in the deep cañons running into the Gulf of California, far away from Guyamas" (E. Palmer); La Paz, in Lower California, and on the opposite side of the gulf (collected in these localities by E. Palmer and identified as *W. sonoræ* by Watson).

"The natives of the Cape region," says Parish, "recognize three distinct forms of *W. sonoræ.* Two of these—"Palma Blanca" and "Palma Colorada"—are distinguished by the white or red colour of the woody fibre of their trunks. The third—"Palma

Nigra"—is said to be the smaller tree, growing at higher altitudes, where winter snows are not infrequent."[1]

12. *SABAL* ADANS. FAM. NAT. II, 495.

("Sabal" is said to be a native name in South America; but Adanson, who originated the genus, gives no explanation.)

Mart. Hist. Nat. Palm. III, 245 et 319 (excl. *S. serulata*), t. 103, 130.—Benth. et Hook. Gen. Pl. III, 922.—Drude in Engl. u. Prantl Pflanzenf. I, 37,—Baill. Hist. des Pl. XIII, 313.—Sargent Silva N. Am. X, 37.—Beccari, Webbia II (1907) 10.—*Sabal* et *Inodes,* O. F. Cook in Bull. Torrey Bot. Club, 1901, 529.

Unarmed trees or shrubs, with columnar, and often stout or short annulated endogenous stems, ascending while young from a subterranean thickened descending clavate caudex, clothed above for many years with the remnants of the sheathing bases of the petioles of the fallen leaves, and below with light red-brown rind, and long stout tough roots, which ultimately often form a great densely matted ball at the base of a short underground stem. Leaves terminal, induplicate in vernation, alternate, flabellate, orbicular, or cuneate at the base, tough and coriaceous, divided from the apex deeply or slightly into many narrow two-parted long-pointed segments plicately folded at the base, inserted obliquely on the sides of the rhachis, often filamentose on the thickened margins, with narrow midribs prominent below, and numerous slender straight veins; rhachises on the lower surface rounded and broadly winged towards the base, nearly flat and wingless towards the apex, and gradually narrowed to above the middle of the blade of the leaf, thin and acute on the upper surface; ligules adnate to the rhachises, short or elongated, acute, concave, with thin incurved entire margins; petioles rounded on the back, biconcave with a central ridge on the upper side towards the apex, their margins acute, unarmed, concave and enlarged at the base into elongated chestnut-brown lustrous vaginas of stout tough fibres, young leaves lanceolate to oblong-lanceolate, gradually narrowed into slender petioles, entire. Spadix axillary, pedunculate, elongated, decompound, at first erect, its rhachis compressed and flattened

[1] For more detailed information on the genus and species of Washingtonia we refer to the extensive 'bibliography' on this subject by S. B. Parish in Bot. Gaz. vol. 44, 1907, p. 431-434.

horizontally; primary branches short and pendulous or decurved, angled or compressed, bearing numerous slender densely flowered secondary branches in the axils of ovate apiculate scarious persistent bracts; spathes numerous, the outer acuminate, enclosing the spadix in the bud, persistent on its peduncle, becoming hard and woody at maturity; the second tubular, conspicuously veined, thick and firm in texture, and scarious, oblique at the apex, prolonged on the lower side into a long narrow point, infolding the base of the rhachis, each branch with its short thin spathe and the node of the rhachis below it enclosed in a smaller although otherwise similar spathe. Flowers perfect, minute, glabrous, white or greenish white, solitary on the ultimate branches of the spadix, bibracteolate, in the axils of minute ovate acute persistent bracts. Calyx tubular, truncate at the base, unequally three-lobed, the lobes slightly imbricated in æstivation, acute. Corolla deeply 3-lobed, narrowed at the base into a short tube, the lobes ovate-oblong, concave, acute, in the bud slightly imbricated below, valvate at the apex. Stamens 6, those opposite the petals rather longer than the others; filaments white, subulate, dilated at the base, united into a shallow cup adnate to the tube of the corolla; anthers ovate, acute, bright yellow, dorsifixed, introrse, 2-celled, the cells free and spreading at the base, opening longitudinally. Ovary superior, sessile, composed of 3 carpels, 3-celled, gradually narrowed into an elongated 3-lobed columnar style, truncate and stigmatic at the apex, becoming sub-basilar on the fruit; ovule solitary in each cell, basilar, erect, semianatropous; micropyle superior, extrorse. Fruit small, baccate, or obovate and gradually narrowed below, black and rather lustrous, 1- or rarely 2-3-lobed, raised on a short stout stem adjacent to the remnants of the style; pericarp separable into 3 coats, the outer thin, sweet and fleshy, mesocarp dry and spongy, closely investing the membranaceous inner coat, lustrous on the inner surface. Seed depressed-globose, free, erect, marked on the side by the prominent micropyle, depressed near the minute basal light-coloured hilum by a shallow pit rugose on the margins; testa thin, light or dark chestnut-brown, and lustrous; raphe basilar, its branches obsolete; albumen uniform, horny, penetrated by a broad shallow basal cavity filled by the thickening of the testa. Embryo minute, lateral or subdorsal.

SPECIES.—About 20.

DISTRIBUTION.—Sabal is confined to the New World, where it is distributed from the Bermuda Islands and the south Atlantic and Gulf coasts of North America through the West Indies to Venezuela. The type has survived from the period when palm-trees abounded in North America and Europe, and traces of its ancestors have been found in the lower eocene of Western Europe and in the lignitic formations of Colorado. During the lower miocene period a large Sabal-like tree inhabited Europe as far north as 55 degrees, and existed in Italy until the later miocene.[1]

USES.—The large succulent leaf-buds of the arborescent species are cooked and eaten as a vegetable, although their removal kills the trees.

Coarse hats, mats, and baskets are manufactured from the leaves, which also afford durable thatch for the roofs of buildings.

Pieces of the spongy part of the stem are used as a substitute for scrubbing-brushes, and in the Southern United States brushes are made from the stout strong fibres of the sheaths of the leaf-stalks.

CULTIVATION IN EUROPE.—The species of Sabal are stove and greenhouse plants, or half-hardy. Most of them are highly ornamental and thrive well in a light loamy soil. Propagation is effected by means of seeds, and sometimes by suckers. These should be removed from the parent plant when about 1 foot long and, if they have no roots, must in the beginning be carefully nursed.

1. **Sabal adansoni** Guersent in Bull. Soc. philomat. III (1803) 206, t. 25.—Bot. Mag. t. 1434.—Mart. Hist. Nat. Palm. III, 246, 319, t. 103, f. 2 et tab. morph. S., f. 1, t. Y, f. 4, t. Z II, f. 2, 3, 4.—Pursh Fl. Amer. Sept. I, 239.—Shecut Fl. Carolinæens. I, 383, No. 1.—Rœm. et Schult. Syst. Veg. VII, 2, 1485.—H. B. Croom in Silliman Amer. Journ. XXVI (1834) 313.—Chapman Flora of the South. Unit. Stat., 2nd ed., 438.—O. F. Cook in Bull. Torrey Bot. Club, 1902, 530.—Hasskarl in Retzia I, 5.—Becc. Webbia II (1907) 20.—*Sabal minor* Pers. Enchir. I, 399.—Spreng. Syst. Veg. II, 137.—*Sabal pumila* Ell. Sketch I, 430 (ex Ind. Kew.)—*Sabal minima* Nott. in Ann. Journ. Sc. Ser. 1, V (1022) 293, (ex Ind. Kew.).—*Sabal*

[1] Lesquereux, Rep. U. S. Geol. Surv. VII., 112. t. 11, f. 3, 3a, t. 12, f 12.
Saporta, Origine Paléontologique des Arbres 118.
Zittel. Handb. Palæontol. II, 372.

caroliniana Hort. Paris. fide Schult fil. ex Kunth En. III, 246—*(?) Sabal taurina* Lodd. Cat. 1849 ex Mart. Hist. Nat. Palm. III, 320.—Griseb. Fl Brit. West Ind. 514.—O. F. Cook in Bull. Torrey Bot Club, 1901, 530,—*Sabal glabra* Sargent, Silva North Am. X, 38 in nota.—*Rhapis acaulis* Willd. Spec. Pl. IV, 1093, No. 2.—Smith in Rees Cyclop. No. 2.—Ait. Hort. Kew. ed. 2, V, 474.—*Corypha minor* Jacq. Hort. Vindob III, 8, t. 8.—Murr. Syst. Veg. ed. 14, 984.—Lamark Encycl II, 131.—*Corypha pumila* Walt. Flor. Carol. 119.—*Chamærops glabra* Mill. Gard. Dict. ed. 8. No. 2 (ex Ind. Kew.)—*Chamærops acaulis* Mich. Flor. Amer. II, 207 (ex Ind. Kew.).

NAMES.—Dwarf Sabal; Swamp Palmetto; Adanson's Sabal.

DESCRIPTION.—A stemless palm with a subterranean rhizome, producing a crown of few leaves. Petioles about as long as the limb and sometimes shorter, convex on the underside, broadly channelled above near the base, slightly or not at all concave towards the apex; ligule subtriangular, often inequilateral, obtuse or slightly acute; rhachis short, narrowly winged on the margins near the base, straight; limb $\frac{3}{4}$ orbicular or a little more than half-orbicular, divided into 20-30 and sometimes 35 segments; segments acuminate, rigid, entire or very shortly bifid, separated from each other in the central part of the limb for half their length or $\frac{2}{3}$ of the upper part, with a slender and fugaceous filament at the end of the primary sinus; central segments usually $1\frac{1}{2}$-$2\frac{1}{6}$ feet long, sometimes even 3 feet, $\frac{4}{5}$-$1\frac{2}{5}$ inches broad at the height of the sinuses and in well developed leaves even 2 inches. Spadix glabrous, erect, narrow, rigid, 2-5 feet long with 5-6, or also 10-12 branches, each one arising from within a spathe; axis of spadix $\frac{1}{5}$-$\frac{3}{5}$ inch in diameter, subterete in the upper part and more or less compressed in the lower, surrounded by several long tubular spathes without branches; upper spathes tubular in the lower part, acute or acuminate in the upper; branches born on a peduncular part which is surrounded by its respective spathe; the largest partial inflorescences (branches) near the base usually 4-6 inches long and divided into 8-15 simple branchlets; branchlets more or less angular, filiform $\frac{1}{16}$-$\frac{1}{16}$ inch in diameter and usually 2-$3\frac{1}{5}$ inches long; sometimes the partial inflorescences are 10 inches long bearing 25 and more branchlets of 4 inches in length and subdivided into shorter branchlets; the branchlets of the fruiting spadix are slightly stouter. Flowers inserted spirally and without great regularity on the branchlets, provided with a bract and a

bracteole, both exceedingly small and apiculate, in a well developed bud measuring $\frac{1}{8}$ inch, oblong, more or less obtusely apiculate at the apex, when quite open $\frac{7}{48}$-$\frac{1}{6}$ inch long; calyx cyathiform-campanulate, divided down to the middle into 3 broadly triangular or deltoid and slightly acute lobes; petals $1\frac{1}{2}$ times or twice as long as the calyx; petals united at the base into a short tube, ovate-ellipsoid, concave-cymbiform, slightly acute, not denticulate on the margins; stamens all equal, subulate; anthers small, very broadly cordate-sagittate, almost as broad as long. Ovary narrowly trigonous-pyramidal, $\frac{1}{10}$-$\frac{1}{9}$ inch long, 3-sulcate; stigma papillose, truncate-capitellate. Fruit supported by the perianth, perfectly spherical. showing the permanent style, when fully ripe $\frac{1}{3}$-$\frac{3}{8}$ inch in diameter, black, shining; pericarp thin, pellicular; mesocarp very slightly fleshy, brown-violescent, slightly bitter. Seed globular, a little depressed, with shining surface, about $\frac{1}{4}$ inch in diameter; hilum eccentric; embryo situated towards the middle of one side or a little below it, penetrating horizontally into the albumen for about $\frac{1}{3}$ of the seed. Sometimes 2 seeds are developed and then the fruit is didymous; sometimes again one ovule is perfect and the other incompletely developed; in this case the fruit is more or less distinctly gibbous at the base.

HABITAT.—In the south-eastern part of the United States: from North Carolina southwards to Florida and westwards to Arkansas, Louisiana and Texas.

Grows in low and humid forests and inundated places, prefers sandy soil; occurs also on the seashore.

NOTE.—*Sabal adansoni* is a very variable plant showing great adaptability to the various conditions of climate and soil. In this respect it resembles the Indian *Phœnix humilis*.

The polymorphism of the Swamp Palmetto can be observed especially in the vegetative parts and in the greater or smaller number of subdivisions of the partial inflorescences (branches). Beccari distinguishes 6 different forms; but it must be remembered that it is impossible to define them exactly, as all those forms are united by a great number of transition forms. It is, however, quite probable that a comprehensive study of this palm in its various localities will reveal the existence of well-defined sub-species in equally well-defined areas.



Dwarf Sabal (*Sabal adansoni*, Guers.).

These are the forms mentioned by Beccari[1]:—

(*a*) Leaves large, erect; petioles as long as or longer than the limb. Spadices 3-plicate-ramose; last branchlets very short.

(*b*) Leaves small or of middle size, patent; petioles much shorter than the limb. Spadices duplicate or sub-3-plicate-ramose; last branchlets very short.

(*c*) Leaves large, erect; petioles long; spadices duplicate-ramose or simply branched.

(*d*) Leaves small; spadices simply branched; branchlets rather short and rigid.

(*e*) Leaves small; spadices simply branched; branchlets slender, filiform, elongate, usually not numerous.

(*f*) Spadices simply branched; branchlets with smaller and more numerous flowers than usual.

CULTIVATION IN EUROPE.—The Dwarf Sabal is a greenhouse plant or even half-hardy. In the Mediterranean region it is very often cultivated in the open. Owing to its extraordinary power of adaptation the plant grows equally well in the climate of Calcutta, Peradeniya and Buitenzorg as in that of Florence and Collioure (43° 32′ N. L.).

It is usually not held in very great esteem, because it grows slowly and produces few leaves. In open places which are exposed to strong wind the leaves become torn after a short time. It is, however, not without ornamental effect when grown together with underwood.

ILLUSTRATION.—Plate XXX was reproduced from an excellent photograph taken by Mr. Macmillan.

It represents a characteristic specimen of *Sabal adansoni*, Guers.

The petioles, channelled towards the base, are about as long as the leaf-blade. The almost triangular ligule is distinctly visible on one of the left-hand leaves. Some of the segments are entire, but most of them are very shortly bifid. From between the leaves there rises a long spadix with about a dozen branches. In the upper part the flowers have just opened. The specimen is growing in the Royal Botanic Gardens of Peradeniya.

[1] Beccari, O. Le Palme americane della Tribù delle Coryphcæ, in Webbia, vol. II, (1907) 27.

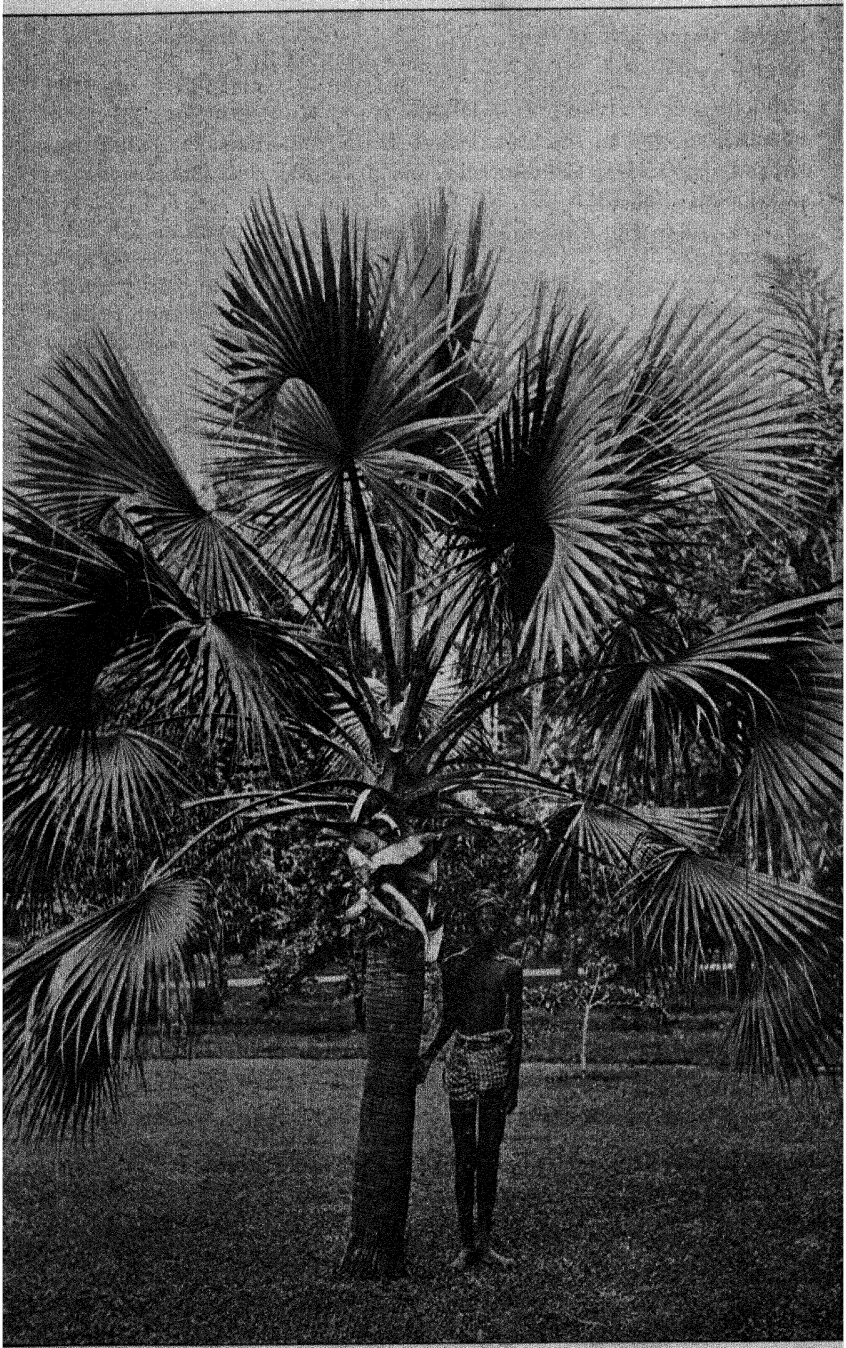
2. **Sabal palmetto** Lodd. ex Rœm. et. Schult. Syst. Veg. VII, pt. 2, 1487, No. 5.—Mart. Hist. Nat. III, 247.—Dietrich Syn. II, 1201.—Kunth, Enum. III, 247.—Spach. Hist. Veg. XII, 107.—Chapman Fl. South Unit. St. ed. 2a, 438.—Curtis Rep. Geolog. Surv. N. Car. (1860), III, 64.—Sargent For. Tr. N. Am. 19th Cens. U. S. IX, 217.—Nash in Bull. Torrey Bot. Club, XXIII, 99.—Beccari Webbia II, 32.—*Sabal umbraculifera* Mart. Hist. Nat. Palm. III, 245, t. 130, et tab. morph. T, f. 5; t. Y, f. 5, 6, 7; t. Z, I (excl. syn. Glaseb. et local[1]).—Griseb. Fl. West. Ind. Isl. 514.—*Inodes palmetto* O. F. Cook in Bull. Torrey Bot. Club, 1901, 532.—*Corypha umbraculifera* Jacq. Fragm. Bot. (1809) 7, No. 47.—*Corypha palmetto* Walter Fl. Carol. 119 (1788).—*Corypha glabra* Mill. ex Salomon Palmen, 150.—*Chamærops palmetto* Mich. Fl. Bor. Am. I, 206 (1803).—Willd. Spec. Pl. IV. Pt. II, 1158.—Mchx. f. Hist. Arb. Am. II, 186, t. 10.—Pursh Fl. Am. Sept. I, 240.—Nattal Gen. I, 231.—Elliot, Sk. I, 431.—Spreng. Syst. II, 137.—Croom Am. Journ. Sc. XXVI, 315.—London, Arb. Brit. IV, 2532.

NAMES.—Cabbage Palmetto, Cabbage Tree, Pond Thatch, Pond Top, Palmetto Royal.

DESCRIPTION.—A tree, with a trunk often 30-60 feet in height and 2 feet in diameter, broken by shallow irregular interrupted fissures into broad ridges, with a short pointed knob-like caudex surrounded by a dense mass of contorted roots, often 4 or 5 feet in diameter, and 5 or 6 feet deep, from which tough light orange-coloured roots, often nearly ½ inch in diameter, covered with thick loose rind easily broken into narrow fibres, and furnished with short slender brittle rootlets, penetrate the soil for a distance of 15 or 20 feet; and crowned with a broad head of

[1] Beccari gives the following reasons for his identifying *Sabal umbraculifera* Mart. with *Sabal Palmetto* Lodd.:—

"I have referred to *S. Palmetto* the species of Martius *S. umbraculifera*, which this author founded on *Corypha umbraculifera*, Jacq. (non Linn.). Martius writes with reference to this palm that it was brought by Jacquin from his journey in America and that it flowered in the Garden of Schœnbrunn. Jacquin, however, affirms that his *C. umbraculifera* came from Holland. Apart from this contradiction it is pretty sure that the description as well as the drawings of *S. umbraculifera* published by Martius were taken from the specimen which flowered at Schœnbrunn. Of this specimen I have seen a part of the spadix in the herbarium of Berlin, corresponding in everything and in the minutest details of the flower with wild specimens of *S. Palmetto*. Though Martius wrote that his *S. umbraculifera* grows in Cuba and Haiti, this statement must be considered as erroneous, because it was probably founded on the supposition that the palm described was brought from those regions by Jacquin. The specific name of *Palmetto*, Lodd. as recognised in Rœm. et Schult. is certainly older than that of *umbraculifera*. Though we are not sure as to the exact date of the publication of that part of Martius' work in which that name occurs for the first time, Martius himself mentions on p. 247 *S. Palmetto* as one of those species of which he is not able to say exactly in which point they differ from his *S. umbraculifera*."



Cabbage Palmetto or Palmetto Royal (*Sabal palmetto* Lodd.).

leaves which are at first upright, then spread nearly at right angles with the stem, and are finally pendulous. Leaves suborbicular with numerous segments (as many as 80 in cultivated specimens) measuring 4⅓-4⅔ feet from the apex of the petiole to the end of the central segment; petiole apparently a little longer than the limb, robust, at the apex 1-1⅔ inches broad and plain or slightly concave above and convex below; ligule lanceolate or lanceolate-acuminate; rhachis stout, winged at the base on both sides, curved and prolonged almost to the apex of the leaf. The central apical segments are much smaller than those in the middle of the sides. All the segments, including the outermost ones, are deeply bipartite, finely striated with numerous distinct secondary and tertiary nerves, of the same colour on both sides; primary and secondary sinuses provided with a distinct filament. Spadices forming large compound panicles as long as, or longer than, the leaves, nutant whilst in flower and curved-reflexed when in fruit; partial inflorescences forming secondary panicles of 1-1½ feet in length, the upper ones even shorter, each one divided into 6-10 alternately distichous branches; spathes of the partial inflorescences narrowly sheathing, tubular-infundibuliform, brown and dry in the terminal part, very finely striate, entire and obliquely truncate when they open, prolonged on one side into an acuminate point; branches of the partial inflorescences (inflorescences of the 3rd order) patent and arcuate in the lower part, 5-6 inches long, inserted within the respective spathe and each one having its own small tubular spathe, which is dry, bicarinate on the axillary side, shortly bidentate or bicornute at the apex; branches angular and giving off 10-20 flower-bearing branchlets in a spiral arrangement; branchlets patent and slightly arcuate, simple, filiform, more or less angular, thin, $\frac{1}{24}$-$\frac{1}{16}$ inch in diameter at the base, subulate, 2⅔-4 inches long, arising from the axil of a small broad scarious acute bract. Flowers arranged spirally and not very regularly, about 30-40 on each branchlet; at the base of each flower a large scarious acute and apiculate bract and a similar but smaller bracteole. Flowers in well developed bud about ⅙ inch long and about $\frac{1}{12}$ inch broad, oblong, obtuse, when open ⅕ inch long or slightly longer; calyx shortly campanulate, divided almost to the middle into 3 large deltoid narrowly scarious and non-ciliate lobes;

corolla more than twice as long as the calyx, tubular, in the lower $\frac{2}{5}$ concave-navicular; stamens as long as the petals; filaments subulate, anthers versatile, ovate-sagittate. Ovary including the style measuring about $\frac{1}{8}$ inch in length; style elongate, columnar, subtrigonous, slightly thicker at the base than in the upper part; stigma capitellate. Fruit perfectly spherical, $\frac{10}{24}$-$\frac{11}{24}$ inch in diameter, black and lustrous, with the remains of the style distinctly visible at the base; epicarp thin, fragile, easily separable from the mesocarp which is slightly fleshy; fruiting perianth shortly pedicelliform. Seed globose-depressed, regularly hemispherical in the upper part, $\frac{7}{24}$ inch broad, light chestnut coloured, flattened at the base and corrugate round the hilum, which is not very eccentric; micropyle very small; embryo situated about the middle of one side, deeply and obliquely penetrating into the albumen with the point directed downwards.

GERMINATION.—This process begins with the growth of the cotyledonal petiole, the radicular end of the embryo breaking through the seed-coat. The radicle continues growing for some time, but the rate of growth becomes slower at the moment when there appears a lateral emergence which increases rapidly in bulk, and from which, after some time, the plumule emerges. The primary root, producing a few rootlets, remains the only one for a long time. After this the cotyledonal ligule begins to swell and becomes longer towards the base. From this newly formed body (called stolon by Karsten) there arise adventitious roots which are below the primary root.

FLOWERS.—In June (in North America); fruit ripens late in the autumn.

HABITAT.—This palm inhabits sandy soil in the immediate neighbourhood of the coast, and is distributed from Smith's Island at the mouth of the Cape Fear River, North Carolina, to Key Largo, Florida (26° N. L.) and along the Gulf coast of the mouth of the Appalachicola River. Often forming groves of considerable extent on the Atlantic coast, it is most abundant and grows to its largest size on the west coast of the Florida Peninsula south of Cedar Keys.

"The survival of Sabal palmetto, with its tall columnar trunk and broad crown of foliage, the most boreal of existing palm trees in a region where the flora is northern in its predominating

types, gives special interest to the coast of the south-eastern United States, where it is the most conspicuous feature of the vegetation." (Sargent.)

USES.—The wood of the Cabbage Palmetto is light, soft, and pale brown in colour, and contains numerous hard fibro-vascular bundles which make it difficult to work, the outer rim of the stem, about 2 inches in thickness, being much lighter and softer. The specific gravity of the absolutely dry wood is 0·4404, a cubic foot weighing 27·45 pounds. In the Southern States the trunks are used for wharf-piles; polished cross-sections of the stem sometimes serve for the tops of small tables, and the wood is largely manufactured into cases. From the sheaths of young leaves the bristles of scrubbing-brushes, now often used in the United States, are made in Florida in considerable quantities. To obtain the fibre used in the manufacture, 3-4 feet of the top of the tree, 'the bud,' as it is technically called, consisting of the closely imbricating young leaf-stalks, is cut off and trimmed down to a diameter of about 8 inches. In this form the bud is received at the factory, where the soft edible core, consisting of the youngest leaves, is removed, leaving a cylinder with walls about 3 inches in thickness. This is boiled and shredded by machinery specially devised for the purpose, and when the fibre is dried, it is ready for the brush-maker. One factory in Jacksonville, Florida, used (1896) weekly 7,500 buds obtained chiefly from the west coast of the peninsula. As only young and healthy trees are used, and as the removal of the bud kills the tree, the industry is a wasteful and expensive one, destined to exterminate the Palmetto. Its existence is also threatened by the use for culinary purposes of the cabbage, or terminal bud, which is considered a great delicacy by the negroes of the Southern States of N. America.

Sleeping mats are made from the young leaves, and hats from the inner portion of the young leaves. They are said to be very cheap and durable. From the same material fancy baskets are made, also rope of the young leaves split and twisted.

HISTORICAL NOTE.—The Cabbage Palmetto has played an important part in the history of South Carolina. On June 28, 1776, a force of less than one hundred Carolinians, under the command of Moultrie, protected by the rude fortification on Sullivan's Island in Charleston Harbour, made of the trunks of

the Palmetto, repulsed the attack of a British fleet under the command of Sir Peter Parker, and when the State of South Carolina was organized, the State seal, which was first used in May 1777, was made to commemorate this victory. A palm-tree growing erect on the seashore represents the strength of the fort, while at its base an oak-tree torn from the ground and deprived of its branches recalls the British fleet built of oak timber overcome by the Palmetto.[1]

CULTIVATION.—It is remarkable that *Sabal palmetto,* which might be expected to be the hardiest of all arborescent palms, has remained comparatively rare in gardens. A plant has long been cultivated in the Palm House of the Royal Gardens at Kew and the species is said to be established in Ceylon. In California, where nearly all the palms of temperate regions grow vigorously, it has not proved a success. It is cultivated in the gardens of Southern France and the Riviera, where the tree is known under the names of *Sabal umbraculifera* and *Sabal Giesbreghtii.*

Beccari recommends the introduction and acclimatization of this palm in the vast barren marshes of southern Italy and Sicily, not only because the Cabbage Palmetto is propagated very easily, but also on account of its economic uses.

ILLUSTRATION.—The Cabbage Palmetto of Plate XXXI is growing at Peradeniya. I have to thank Mr. Macmillan for taking the photograph.

3. **Sabal mauritiæformis** Gr. and Wendl. in Griseb. Fl. Brit. West. Ind. 514; Drude in Engl. und Prantl Pflanzenf. I, 36, f. 27; Becc. in Webbia II (1907) 61. *Trithrinax mauritiæformis* Karsten in Flora vol. 28 (1856) 244 and in Fl. Columb. Sp. select II, 137, t. CLXXII. *Sabal glaucescens* Lodd. ex Mart. Hist. Nat. Palm. III, 247? *fide* Griseb.

NAME.—Savannah Palm.

DESCRIPTION.—Trunk cylindric, columnar, distinctly annular-cicatricose (the rings 6 inches distant), 60-80 feet high, 12 inches in diameter. Leaves very large. Petiole long and comparatively slender, fugaceously furfuraceo-cinerescent on the lower side, about 1½ inches broad, much depressed, flat above in the upper part, slightly convex on the underside with the margins very acute. Ligule well developed, 2 inches long; rhachis considerably elongate and arcuate. Limb quite glabrous, measuring about

[1] John Drayton, Memoirs of the American Revolution, II, 372.

6⅔ feet from the apex of the petiole to the end of the median segments, rigid-pâpyraceous, but thin, green above, distinctly paler and almost glaucescent below, divided into many broad laciniæ down to almost the lower fifth; laciniæ 2⅖-2½ inches broad, with their sides parallel or slightly divergent up to about 1⅓ feet from the apex; here they are once more divided into two laciniæ, which in their turn about 8 inches higher up are divided into 2 very acuminate flaccid points; the limb, therefore, is three times divided and there are 3 sinuses; sometimes 2 primary segments are united with each other up to the second sinus; at the lowest sinus there ends a secondary upper rib, at the second sinus the primary upper ribs and at the third sinus the primary lower ribs; the primary segments are consequently 3-costate. Spadices large, longer than the leaves, with various partial inflorescences 1⅙-1⅓ feet long and forming lax panicles. Secondary spathes tubular, striato-nervate, prolonged at the apex into a triangular acuminate point, entire at the mouth or scarcely split on the ventral side even when the fruits are ripe; each partial inflorescence consisting of 7-8 primary branches of which the lower are divided into 6-7 branchlets and the upper ones into 3-4; peduncular part of each branch provided with a special spathe exserted from the larger spathe and deeply divided into 2 points or subulate horns; branchlets very angular, filiform, $\frac{1}{12}$-$\frac{1}{16}$ inch thick, 2⅖-2½ inches long, with numerous flowers, each arising from the axil of a very small, triangular, acuminate bract.

Flowers in bud ⅛ inch long, $\frac{1}{18}$ inch broad, oblong, slightly restricted towards the apex. Calyx cupular-cyathiform, divided beyond the middle into 3 triangular acuminate lobes; corolla thrice as long as the calyx, shortly tubular below. Ovary conico-pyramidal, elongate, marked with the irregular impressions of the stamens; stigma capitellate. Fruiting perianth with the calyx perfectly truncate at the base, petals deflexed; of the stamens the subulate filaments alone remain, of which those opposite the petals are deflexed and the others erect.

Fruit globose-obpyriform, subresupinate, ½ inch long, perfectly spherical at the apex where it measures $\frac{9}{21}$-$\frac{10}{21}$ inch, attenuate into a somewhat asymmetrical base or incurved; style persistent, about $\frac{1}{12}$ inch long, curved below. Surface of fruit black,

shining, indistinctly and minutely granular under the magnifying glass; pericarp finely crustaceous, fragile, dry; mesocarp almost reduced to nothing. Seed hemispherical, or with the upper part rotundate and the lower flattened-undulate; hilum very eccentric, almost lateral. Surface of seed blackish brown, minutely and not very distinctly granular under the magnifying glass. Embryo situated about the middle on the hilar side, obliquely and rather deeply descending.

HABITAT.—In the moist warm forests of the old Republic Columbia (Karsten); Trinidad (Grisebach); Venezuela (Bot. Gard. of Buitenzorg).

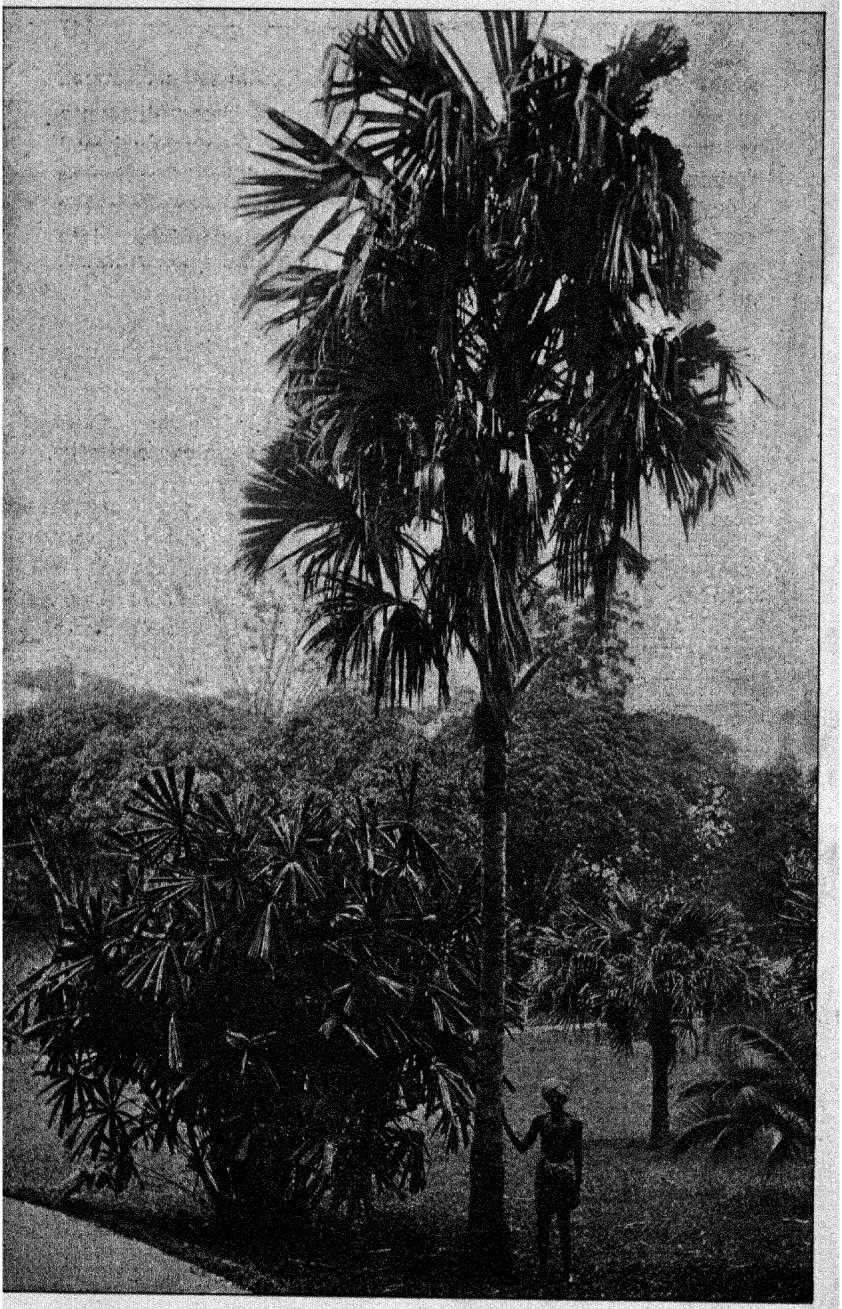
CULTIVATION IN EUROPE.—The Savannah Palm must be treated as a stove plant.

ILLUSTRATION.—Plate XXXII represents a group of palms from the Royal Botanic Gardens, Peradeniya. The photograph is by Mr. Macmillan.

To the left of the picture there is a dense tuft of the Spiny Licuala *(Licuala spinosa* Wurmb.). The palm in the centre is the Savannah Palm *(Sabal mauritiæformis* Gr. et. Wendl.), while on the right there is a small specimen of *Livistona chinensis* R. Br.

This palm may easily be distinguished by the following characters: The chief divisions of the leaves have got 3 ribs; the colour of the under surface of the leaves is glaucescent; the fruits are very much narrowed at the base; the seed is provided with a central-rotundate tubercle and the hilum is considerably eccentric; three stamens of the fruiting perianth are erect and three reflexed; the corolla-lobes are acuminate and not nervose-costulate.

4. **Sabal blackburniana** Glazebrook in London's Gardener's Mag. V (1829) 54, cum ic. xylogr.; Rœm. and Schult. Syst. Veg. VII, 1488; Hemsley in Voy. Challenger, Botany I, 70, t. VI—IX (excl. syn. aliquibus); Becc. in Webbia II (1907) 54.—*Sabal palmetto* (non Rœm. & Schult.) Rein. in Bericht Senckenb. Naturforsch. Gesellsch. Frankfurt a. M. (1873) 150; J. Morris in Bull. Torrey Bot. Club (1885) 72.—*Sabal Adansoni* (non Guers.) A. H. Moore List of Pl. collect. in Bermuda 1906, *et exsiccata* no. 3142 (ex Becc. l. c.).—*Sabal Mocini* Hort. Riccobono in Boll. Soc. Ort Palermo (1904) 32.—*Chamærops excelsa* and *Chamærops palmetto* Lefroy's List Bermuda Pl. (ex Hemsl. l. c.)—*Chamærops glabra* Jones



To the left: Spiny Licuala (*Licuala spinosa* Wurmb.).
In the centre: Savannah Palm (*Sabal mauritiæformis* Gr. et Wendl.).
To the right: Chinese Livistona (*Livistona chinensis* R. Br.).

Naturalist in Bermuda, 136 (ex Hemsl. l. c.)—*Inodes Blackburniana* O. F. Cook in Bull. Torrey Bot. Club (1901) 531.

NAME.—Bermuda Palm.

DESCRIPTION.—Trunk stout, straight, columnar, cylindric, growing more than 40 feet high, $1\frac{1}{3}$ feet in diameter, annulate-cicatricose. Leaves of adult plant very large, suborbicular, with numerous segments; petiole 8 feet long and up to $2\frac{2}{5}$ inches broad in the upper part, convex below, slightly concave above. Ligule up to 6 inches long, lanceolate, acuminate, with the margins involute. Rhachis prolonged to close the apex of the limb and strongly arcuate, with acute sides and winged in the lower part. Limb about as long as the petiole from the ligule to the apex of the central segments. The apical central segments much shorter and narrower than the outermost ones; all are long-ensiform and deeply bipartite; segments of the intermediate part of the sides 4 feet long and $1\frac{3}{5}$ inches broad at the height of the sinuses; the primary sinuses are at about the lower third and the secondary ones towards the middle, with a rather strong filament in each of them.

Spadices shorter than the petioles of the leaves, thrice branched, with rather dense partial inflorescences; secondary spathes tubular, narrowly infundibuliform, papyraceous-membranous, dry, comparatively short, $2\frac{1}{5}$-$3\frac{1}{5}$ inches long, obliquely truncate at the mouth, where they are prolonged into a short, broad, triangular, acute or acuminate point, finely striate. Branches divided into various simple, flower-bearing branchlets; peduncular part short, much longer than the respective spathe, provided with its own tubular acutely bicarinate spathellule; branchlets arising from the axil of a short, broadly triangular, acute bract, flexuose, 4-6 inches long, angular, $\frac{1}{12}$-$\frac{1}{8}$ inch thick at the base, gradually alternate-subulate towards the apex, not thickened when fruiting, but with the pulvinuli bearing the fruits slightly tuberculiform. Flowers relatively large, $\frac{1}{5}$ inch long when in bud, oblong, rotundate above. Calyx cupular or shortly tubular, slightly contracted at the throat, with a broad and fleshy base, divided in the upper third into 3 broadly triangular lobes. Corolla a little more than thrice as long as the calyx. Stamens inserted a little below the middle of the corolla, relatively stout, subulate, very acute, acutely carinate along the median line towards the apex; anthers sagittate, ovate, acute.

Ovary $\frac{1}{6}$ inch long, slightly attenuate-conical towards the apex; stigma capitellate.

Fruits (comprising the perianth) $\frac{4}{5}$-$1\frac{1}{2}$ inch long and $\frac{2}{3}$-$\frac{4}{5}$ inch broad, obpyriform, with the apex regularly rotundate, attenuate to a rather acute and symmetrical base; fruiting perianth small, reduced to the hardened calyx, which is not accrescent; remains of style slender and straight; surface black; mesocarp fleshy, brown-violaceous, $\frac{1}{8}$-$\frac{1}{6}$ inch thick; endocarp reduced to a very thin pellicle. Seed of the colour of roasted coffee, globose-depressed, $\frac{1}{2}\frac{1}{4}$-$\frac{1}{2}$ inch long and $\frac{1}{3}$ inch broad, with the base flattened and slightly concave; hilum almost central; embryo subdorsal, descending and penetrating beyond the middle of the albumen. Often 2 ovules are developed, and in this case the fruit is perfectly didymous.

HABITAT.—Bermuda Islands.

USES.—Of the leaves of the Bermuda Palm hats, baskets, fans, etc., are made.

CULTIVATION IN EUROPE.—*Sabal blackburniana* is one of the finest species of the genus and is very ornamental in open places where the tree is allowed to develop freely.

This species is easily distinguished by its large dimensions, by the spadix, which is shorter than the petioles of the leaves, and by the large obpyriform fruits.

13. *COPERNICIA* MART. HIST. NAT. PALM. III, 242, t. 49, 50 (excl. t. 50, A I—IV).

(After Nicolaus Copernicus, the famous astronomer, 1473-1543.)

Kunth Enum. Pl. III, 343.—Griseb. Fl. Brit. W. Ind. 544.—Benth. et Hook. f. Gen. Pl. III, 927 (excl. *Crysophila*).—Becc. in Webbia II (1907) 140.

Stem erect, mostly of considerable height, rarely low, annulate in the lower part, covered higher up with the bases of the persistent petioles. Leaves terminal, flabelliform. Petioles with strong spines and a ligule. Segments induplicate, often with fibres between the segments.

Spadices elongate-paniculate, much-branched, with several tubular spathes and superposed partial inflorescences, which are divided into several flower-bearing branchlets; each branchlet

provided with a more or less tubular spathe or with a simple bract at the point of its origin. Flowers hermaphrodite, single or in clusters, sessile, bracteate or bracteolate. Calyx tubular, more or less deeply 3-dentate. Corolla more or less distinctly tubular below, divided into 3-valvate, narrow segments, which are strongly sculptured-alveolate on the inner side. Stamens 6; filaments united at the base with the corolla-tube and forming in the throat a 6-lobed or 6-dentate corona, suddenly restricted and subulate in the upper part; anthers ovate or oblong, dorsifixed. Ovary consisting of 3 carpels which are free below and united above into one common style; stigma tridenticulate.

Fruit globose or ovoid, formed by one carpel, with the rest of the abortive carpels at the apex; endocarp crustaceous-woody, thin. Seed free in the endocarp; hilum basilar; albumen deeply ruminate; embryo basilar near the hilum.

Species about 9.

DISTRIBUTION.—Brazil, Venezuela, Argentine, S. Domingo, Cuba, New Granada.

1. **Copernicia cerifera** Mart. Hist. Nat. Palm. III, 56, t. 49 et 50 (excl. fig. 10) et 242 (partim).—Becc. in Webbia II (1907) 145—*Corypha cerifera* Man. Arruda da Camara in Koster Travels in Brazil (1816), App. (ex Mart. l. c. 56).

NAMES.—Brazilian Wax Palm; Carnauba (in Brazil).

DESCRIPTION.—Stem 30-40 feet high, cylindric, erect, at the base usually slightly thickened, 6-8 inches in diameter, covered with the bases of fallen leaves, either in the upper part only or throughout. Leaves 4-6$\frac{2}{3}$ feet long, forming a large spherical crown. Petiole 2-3 feet long with the base dilated, depressed, a little concave above and convex below, armed on the margins with stout, compressed spines; ligule glabrous, semirotundate-oblong, finely coriaceous; rhachis 0; limb suborbicular in outline, flabelliform-multifid, undivided in the central part for about 1-1$\frac{1}{3}$ feet from the apex of the petiole and on the sides only for about $\frac{1}{5}$-1$\frac{1}{5}$ inches, thinly coriaceous, cereo-pulverulent or whitish on both surfaces, divided into about 60 segments; central segments 2$\frac{2}{3}$ feet long from the apex of the petiole and about 1$\frac{2}{5}$ inches wide where broadest.

Spadices much elongate, erect-patent, 5-6 feet long, thrice divided, composed of several partial inflorescences which are

alternately superposed. Primary spathes elongate, tubular, cylindric (at least above where they measure about ½ inch in diameter), finely striate lengthwise, glabrous, obliquely truncate at the mouth where the margin is entire or scarcely reticulate-fibrous, prolonged on one side into a triangular, acute, dorsally carinate point; partial inflorescences laxly paniculate-elongate; panicles divided into 6-7 branches, each arising from within a tubular spathe which resembles the primary spathes except for being smaller and more attenuate in the lower part; branches densely pilose-velutinous in every part, with the peduncular part included in the respective spathe; flower-bearing branchlets alternate-distichous. Lower branches much larger than the upper ones, sometimes twice branched, bearing 10-12 and more flower-bearing branchlets. Flowering branchlets filiform, each arising from the axil of a thin, membranous, narrowly lanceolate-acuminate bract. Flowers in small glomerules, usually 2-4 together, alternate-spirally arranged, each with a minute bracteole. Calyx shortly tubular, $\frac{1}{12}$ inch in diameter, slightly longer than broad, obsoletely trigonous; segments acute. Corolla tubular for more than the lower half, divided into 3 broad deltoid teeth, 4-sulcate on the inner side. Stamens with their filaments united with the corolla-tube and forming a fleshy ring (at the mouth of the tube) which is provided with 6 small linear teeth; anthers dorsifixed, erect, small, shortly ovate, rotundate at both extremities; pollen exceedingly small, globose. Carpels forming a turbinate body, fleshy below, cartilaginous in the upper part, suddenly contracted into the style; stigma small, very shortly 3-lobed.

Fruit ovoid, sometimes globose-ovoid; mesocarp very small, with a few anastomosing-reticulate fibres; endocarp thinly parchment-like woody, fragile. Seed free in the endocarp, $\frac{2}{3}$-$\frac{4}{5}$ inches long, $\frac{13}{24}$-$\frac{17}{24}$ inch broad, rotundate at both extremities; hilum at the base of one side; raphe occupying one side of the seed with 7-8 ramifications; albumen distinctly ruminate; embryo conical, basilar, slightly eccentrical.

HABITAT.—Brazil (Bahia, Pernambuco, Piauhy). Sometimes grown in Indian Gardens.

USES.—The berries, though bitter, are, either raw or boiled, eaten by the Indians of S. America; the spadix also is edible.

The leaves serve for a variety of purposes, such as thatch, pack-saddles, hats, etc., and in time of scarcity the young leaves are chopped up and given as fodder to horses and cattle.

The well-known vegetable wax is produced by the leaves of this palm. The young leaves, after they have been detached from the tree, are shaken, when each leaf yields about 50 grains of a whitish scaly powder, which is melted in pots over a fire; the wax then collects at the surface of the water. The Brazilians use the wax occasionally to adulterate beeswax; it is, however, mostly imported into Europe for manufacturing candles and for various other purposes.[1]

From the juice of the palm arrack and syrup are prepared. The roots are used medicinally as a substitute for sarsaparilla.

From the inner part of the trunk the natives prepare a kind of farina for home consumption.

The wood, especially of the lower part of the adult tree, is very durable and lasts for many years, even when exposed to the weather; for this reason the trunk is used for almost every purpose, especially for the framework of houses and enclosures for cattle. The wood is not less useful in the manufacture of musical instruments.

CULTIVATION IN EUROPE.—This species is a stove palm. It is best cultivated in a compost of two parts of loam, one of peat, and one of sand. Perfect drainage and a liberal supply of water are required.

[1] Gissern, P. Die Amerikanische Carnaubapalme und die Gewinnung des Carnaubawachses. Seifens Ztg. Augsburg, 28 (1901) 581, 597-598.

Zimmermann, A. Die Wachspalme (*Copernicia cerifera*). Pflanzer, Tanga, 3 (1907) 191-195.

II. BORASSINÆ

Spadix simple or little branched with thick cylindrical twigs; flowers markedly diclinous, dimorphic, invested with bracts, the male in 1-8 cincinni in grooves of the twigs; carpels 3, fully united, producing a 1-seeded drupe; leaves fan-shaped, induplicate. The only tribe is:

3. BORASSEÆ.

DISTRIBUTION.—Tropical Africa from Guinea to Egypt and Natal, Mascarene Islands, Seychelles Islands, Coast of Arabia, East Indies, Philippines, New Guinea, Borneo, Sumatra.

The tribe comprises the following genera: *Medemia, Bismarkia, Hyphæne, Latania, Borassodendron, Borassus, Lodoicea.*

KEY TO THE GENERA DESCRIBED BELOW

Stamens 6.—Fruit by the abortion of 2 carpels unilocular with one central, woody, ovate stone	*Hyphæne*
Stamens 8.—Fruit with 3 bony stones, or rarely by abortion with 1 or 2	*Latania*
Stamens 6.—Fruit mostly with 3 stones; seed sinuate	*Borassus*
Stamens 8.—Fruit generally with one bilobed, kidney-shaped stone; seed bilobed	*Lodoicea*

1. *HYPHÆNE* GÆRTN. FRUCT. I (1788) 28, t. 10, f. II (1791) 13, t. 82.

(From the Greek 'Hyphaino,' I weave, alluding to the fibres of the fruit.)

Benth. & Hook. Gen. Pl. III, 940.—Dalla Torre et Harms Gen. Siph. p. 38.—*Douma* (Poir.) in Nouv. Duhamel ed. 2, IV (1801-9).—*Cucifera* Del. Fl. d'Egypte (1813) 145.—*Doma* Lam. Illustr. t. 900.—*Camæriphes* Dill. Cat. pl. Schawii No. 143 (1838).—O. Kuntze Rev. Gen. II (1891) 728 (non *Pontedera*). Baillon Hist. des Pl. XIII, 224.

Unarmed except for the spines on the petioles. Stem cylindrical or ventricose, simple or dichotomously branched.



Male Indian Doum Palm (*Hyphæne indica* Becc.) in the Bassein Fort.

Leaves in a terminal crown, orbicular or flabellate; segments ensiform, petiole concavo-convex, plano-convex or more rarely bi-convex; sheath short, open; ligule oblique or equilateral. Spathes cylindrical, incomplete; spadices diœcious, male and female similar; spadix-branches alternate; flower-bearing branches subfastigiate; bracts semicircular, very densely imbricate; bracteoles membranous, bearded. Male flowers: Sepals linear-oblong, imbricate, connate at the base. Petals broadly ovate, obtuse, concave, imbricate, connate at the base into a short stalk. Stamens 6; filaments short, subulate; anthers linear, inserted at the bifid base. Rudiment of ovary O. Female flowers larger than the male, very shortly pedicellate. Sepals 3, ovate-orbicular, obtuse, imbricate. Petals a little smaller than the sepals, broadly ovate, obtuse, imbricate. Staminodes 3, connate into a membranous ring. Ovary subglobose, obscurely 3-lobed, 3-celled; stigmas 3, minute, sessile, terminal, at length eccentric; ovule attached by a broad base to the side of the cell.

Fruit sessile or stalked, terete or obscurely lobed, often flat or intruded at the base and apex, 1-celled; stigma basal; pericarp fibrous, with a shining epidermis; endocarp woody, fleshy inside. Seed adnate to the endocarp, erect, ovoid or obovoid, intruded at the base; testa very hard, fuscous; raphe reticulately branched; albumen homogeneous, hollow; embryo apical.

Species at least 27.[1]

DISTRIBUTION.—All over tropical and subtropical Africa, Arabia, Western India.

INDIGENOUS SPECIES

1. **Hyphæne indica** Becc. in Agricoltura Coloniale, II (1908) fasc. III. *Borassus dichotoma* White in Graham Cat. of Plants of Bomb. (1839) 226.—Mart. Hist. Nat. Palm. III, 318, n. 179.

NAMES.—Indian Doum Palm; Oka mundel (in Gujarat).

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[1] On Hyphæne see:—

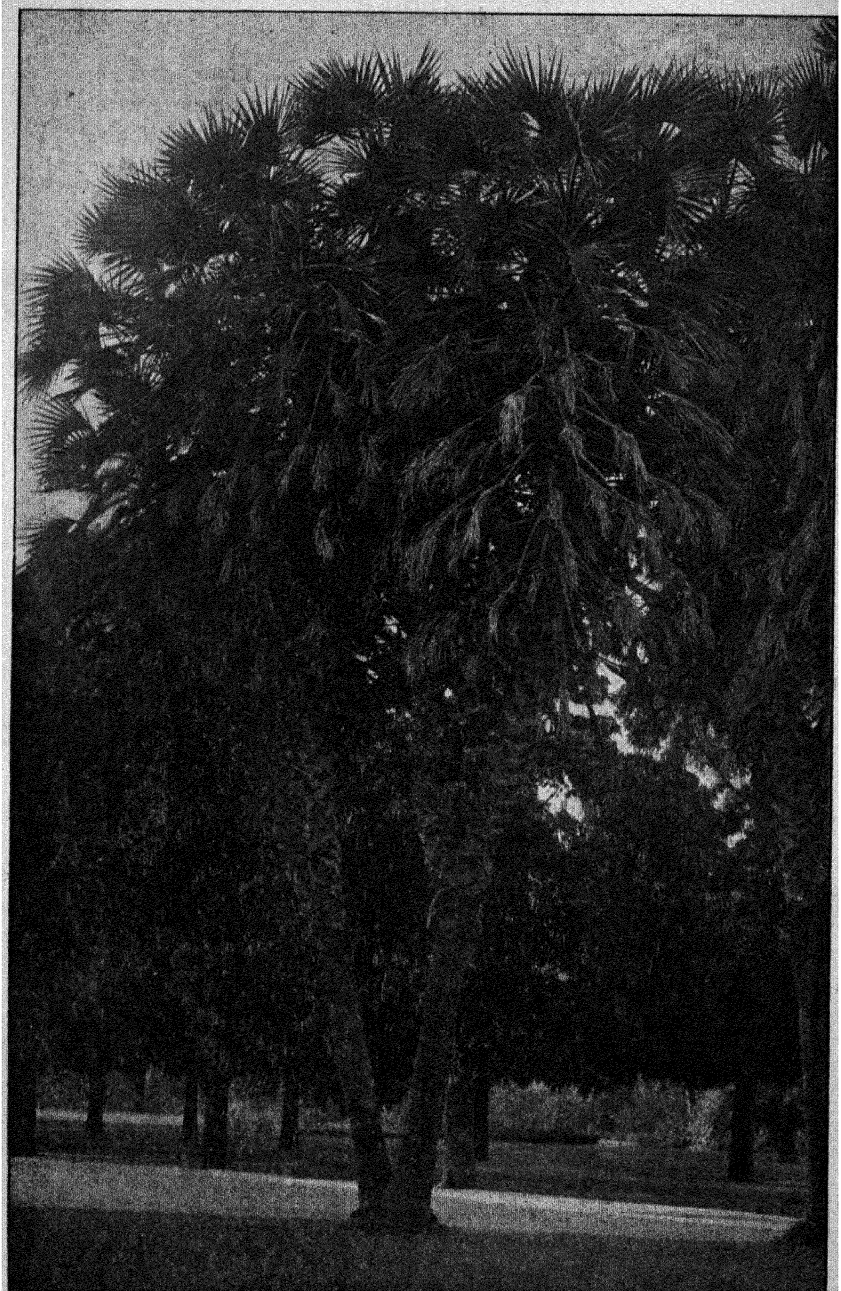
Beccari, O. Palmarum Madagascariensium Synopsis. Engl. Bot. Jahrb. Vol. 38 (1906), Beibl. No. 87, p. 1-41.

Beccari, O. Le Palme 'Dum' od Hyphæne e più specialmente quelle dell' Africa Italiana. In 'Agricoltura Coloniale,' Anno II, fasc. III. Firenze 1908 p. 137-183.

Carstensen, G. Doum Palms in India, Journ. Bombay Nat. Hist. Soc. VI, 271

Dammer, U. Ueber Hyphæne. Engl. Bot. Jahrb., 30 (1901) 267.

Thiselton-Dyer. Flora of Tropical Africa, Vol. VIII.



Female Indian Doum Palm (*Hyphæne indica* Becc.) growing at Baroda.

DESCRIPTION.—Stem dichotomously branched, similar in general aspect to that of *H. thebaica*. Leaves flabellate-multifid, suborbicular, measuring $3\frac{2}{3}$ feet from the apex of the petiole to the end of the central segments. Central segments much smaller and shorter than the intermediate ones, not inserted at the apex of the petiole, but at various heights on the stout rhachis which reaches almost half-way up the limb. Petiole about $3\frac{1}{3}$ feet long and about $\frac{1}{5}$ inch broad at the apex, regularly rounded on the under side, channelled on the upper side of the lower part and almost flattened near the apex, where it is plano-convex in a transverse section, armed with stout, uncinate, black spines with broad base. Ligule very irregular and asymmetrical, being much more developed on one side of the limb than on the other, margin subligneous, irregular and spinulose. Segments about 40; those of the middle portion of the sides are the largest and separate from each other about $\frac{2}{3}$-1 foot from the ligule; segments gradually narrowing into a very acuminate point which is divided for the distance of $3\frac{1}{3}$-4 inches into 2 secondary, rigid, very acuminate points; primary ribs of under surface rather stout and marked with small impressions; ribs of upper surface slightly weaker and finely punctulate-impressed under the magnifying glass.

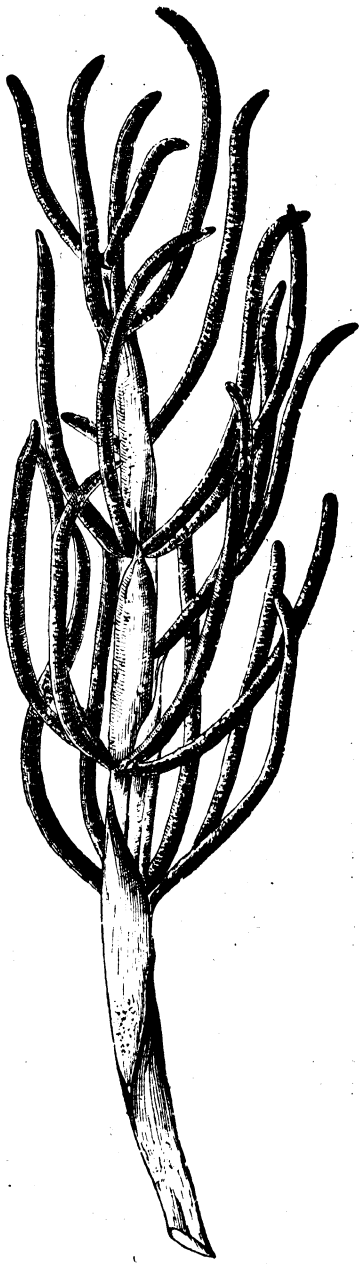


FIG. 24.—Male Spadix of *Hyphæne indica*.

Male spadix (Fig. 24) rather stout, about 3½ feet long (in Beccari's specimen) and about 1⅜ inches in diameter at the peduncular part. Spathes tubular, ending at the apex on one side in a triangular, acuminate limb, covered all over with a dense woolly tomentum which is difficult to remove; branches of spadix about 6, the lowest 1 inch in diameter, bearing about 6 flowering branchlets digitately arranged, the next bearing 5, and the apical branch, which is biconvex and only ⅓ inch in diameter, bearing only 2; the branches arise from their respective spathes. Branchlets ⅔-⅚ feet long, ⅜-⅔ inch in diameter, the axillary part tough and subligneous, no flowers at the base for the distance of about ⅔ inch. Flowers 3 for each scale and rising from it successively, having the appearance of small straw-coloured globules. Segments of corolla rigid and parchment-like, rotundate, and very strongly striate-nervose; at the apex the flowering branchlets are suddenly narrowed into a small obtuse tail about ⅓ inch long and devoid of flowers.

Female spadix not known.

Fruits pretty regularly obovate-pyriform, markedly and gradually attenuate towards the base, sub-hemispheric or almost regularly rotundate in the upper third, laterally slightly compressed, devoid of a distinct keel, with numerous and small inequalities on the surface; base somewhat irregular with small gibbosities and only 1-1⅓ inch broad, whilst in the upper third the antero-posterior diameter of the entire fruit is 2⅔-2⅔ inches and the transverse diameter 2 inches; total length of fruit 3⅔ inches; pericarp very large in comparison with the seed; sarcocarp well developed, ⅔ inch thick on the sides and ½⅛-½ inch at the base and apex; endocarp ⅛-2/11 inch thick on the ventral side, thinner on the other side and slightly thicker below and above, regularly incurved at the apex above the seed, leaving a broad opening in its tissue for the plumule to pass through at the time of germination. Seed slightly above the centre of the fruit, obovate, 1⅔ inches long and 1 inch broad towards the upper third, whence it gets very little narrower towards the flattened base; the upper part is broadly conical and the apex very obtuse; albumen 2/11-⅓ inch thick, the cavity being conform to the shape of the seed. Embryo perfectly apical.

Pedicel ½ inch long, comparatively slender, 2/11 inch broad at

the base and then restricted to a kind of neck; perianth-lobes opaque, puberulous, non-striate.

HABITAT.—Gujarat: Diu (Burkill), "passim in Guzerat," frequens in insula Diu (Vaupel), Ahmedabad, lat. bor. 23° (Bar. de Hügel), probably all along the Western Coast of India down to Goa (Gammie).

NOTE.—There are specimens of a species of *Hyphæne* growing at Jaffna in Ceylon; but whether they are identical with the Indian Doum Palm or not, has not been decided as yet.

ILLUSTRATIONS.—Plate XXXIII shows a male tree of *Hyphæne indica* growing in Bassein Fort on the island of Salsette. Mr. G. A. Gammie, to whose kindness we owe the photographs reproduced on this and the next plate, informs us that there is only one specimen of the Indian Doum Palm growing at Bassein and that this tree supplied part of the material on which Dr. Beccari founded his *Hyphæne indica*.

Plate XXXIV shows a female tree growing at Baroda.

** INTRODUCED SPECIES.

2. Hyphæne thebaica Mart. Hist. Nat. Palm. III, 226 (ed. 1), 225 (ed. 2) excl. syn. nonnullis, tab. 131, 132, 133 (excl. ic. spadicis masculæ in tab. 132); Becc. in Agricolt. Colon. (1908) II, fasc. III.—*Corypha thebaica* Linn. Sp. Pl. ed. 2, (1763) 1657.—*Cucifera thebaica* Delile Descr. de l'Egypte II, 57, t. 1, 2; Dict. d' Hist. Nat. XIII (1819) 472.—*Douma thebaica* Poir. Encycl. Suppl. II, 519.—*Hyphæne cucifera* Pers. Ench. II, 2245.—*Chamæriphes thebaica* O. Kuntze Rev. Gen. Pl. II (1891) 728.

NAMES.—Egyptian Doum Palm, Gingerbread Tree; Mama (in Egypt).

DESCRIPTION.—Stem terete, 10-30 feet high, about 1 foot in diameter, simple or more frequently dichotomously branched. Leaves 20-30 in a terminal crown on each branch; petiole sheathing at the base, triangular below, plano-convex upwards, spiny on the margins, with rusty tomentum; lamina suborbicular; lobes 20 or more, linear-lanceolate, acuminate, 1½ feet long, 1 inch wide; primary nerves thick, concave above, secondary numerous.

Male spadix about 4 feet long, 1-2 inches thick at the base, at first erect, afterwards patent; spathes nearly cylindrical; flower-bearing branches 6-7 inches long, 3-2 at the end of branches 3-4 inches long; bracteoles ½ line long. Flowers in pairs,

shortly pedicellate. Calyx divided down to the base into 3 narrow, acute, yellow sepals, contracted below. Corolla stipitate with the segments imbricate, rotundate and cucullate at the apex, thin and not strongly striate-nervose. Stamens 6, rarely 7; filaments subulate from a thickened base; anthers linear, slightly sagittate, nearly basifixed. Rudiment of ovary consisting of 1-3 small and short unequal points.

Female spadix like the male; bracteoles densely imbricate, with a transverse line of tomentum half-way up the back. Flowers very shortly pedicellate, calyx-lobes orbicular-ovate, light green. Petals smaller than the sepals, orbicular-ovate, concave. Staminodes 6. Ovary globose or 3-lobed; stigmas sessile or nearly so.

Fruit more or less obliquely ovoid or oblong, irregular, usually a little more constricted in the upper part than in the middle and lower part, always much longer than broad, $2\frac{1}{5}$-$3\frac{1}{5}$ inches long and $1\frac{1}{5}$-$2\frac{1}{5}$ inches broad, more or less obtusely triangular in transverse section, with the abortive carpels often much developed; surface rather irregular and usually very distinctly punctate-impressed. Sarcocarp rather strongly impregnated with sugar; wall of endocarp $\frac{1}{12}$-$\frac{1}{8}$ inch thick on one side, on the other (which corresponds to an obtuse longitudinal keel) $\frac{1}{6}$-$\frac{1}{5}$ inch, not thicker below than on the sides and not incurved at the apex of the seed; fulcrum of seed much depressed and little developed. Seed more or less ovate-conical and flattened at the base, always much attenuate above and, therefore, more or less pyriform, almost circular in transverse section, $1\frac{2}{5}$-$1\frac{3}{5}$ inch long, $1\frac{1}{12}$-$1\frac{1}{8}$ inch broad.

The fruit varies a good deal by being more or less attenuate above. A longitudinal section of the fruit of *H. thebaica* and *H. indica* is given on page 930 of Vol. XVIII of the Journ. of the Bomb. Nat. Hist. Soc. illustrating a short note on 'The Indian Doum' by I. H. Burkill.

HABITAT.—Along the valley of the Nile in Middle and Upper Egypt; Shaikh Othman near Aden.

HISTORY OF THE DOUM PALM.—Eighteen centuries already before Christ we find the Doum Palm in the middle course of the Nile. Anna, an officer of Thutmes I, (18th dynasty), superintendent of the granaries of Amon and director of the royal works, enumerates with great complacency on the inscription



Egyptian Doum Palm (*Hyphæne thebaica* Mart.).

of his tomb[1] the trees which he had planted in his garden. Amongst them there were not less than 120 Doum Palms. If the fruits discovered by Flinders Petrie at Kahun were not introduced from Æthiopia, we must even admit that the tree was planted in Egypt 800 years before that period.[2]

The palm received its native name 'Mama'[3] (which means "divided in two") from the fact that the stem of the tree is usually bifurcate. Theophrast, too, (371-286 B.C.) who calls the palm cucifera (cuciophorus) makes this the distinctive character of the tree:

"The tree," he says,[4] "which is called cucifera, shows with regard to its trunk and leaves a great resemblance to the Date Palm, but it is distinguished by the fact that, whilst the stem of the Date Palm is simple and entire, its trunk is divided into two branches, each of which in its turn is split up into two secondary branches, which bear short and few branches."

The Doum Palm is usually shown with the bifurcate stem on the pictures of the Egyptian tombs. There is one of them which represents the general arrangement as well as all the details of the park of an officer of Amenhotpu II, the seventh king of the 18th dynasty. Sycamores, Date-Trees and Doum Palms play an important part in the artistically laid out garden. On a picture from one of the tombs of Tell-el-Amarna,[6] on the contrary, the artist represented the Doum Palm with a simple stem, but with the characteristic fan-shaped leaves.

The fruits of the Doum Palm which have been found in im-

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[1] Brugsch, H. Recueil de Monuments Égyptiens. Leipzig, 1862; part I, p. 48, pl. XXXVI.

Moldenke, C. E. Ueber die in altägyptischen Texten erwähnten Bäume und deren Verwerthung. Leipzig, 1886, p. 18.

Boussac, H. Le tombeau d'Amna (Mém. de la mission archéol. au Caire, 1896, t. xviii. fasc. 1, pl. s. n.).

[2] Joret, C. Les Plantes dans l'Antiquité et au Moyen Age. Paris, 1897, I, 108.

[3] Moldenke, C. E. l. c. p. 66.

[4] Theophrastus. Historia plantarum, lib. iv. cap. II.

[5] Wilkinson, G. The Manners and Customs of the ancient Egyptians. London 1878, vol. I, p. 377, pl. 150.

Wœnig, F. Die Pflanzen im alten Egypten. Leipzig, 1886, p. 232.

Moldenke, C. l. c. p. 41.

Maspero, G. Histoire ancienne des peuples de l'Orient. Paris, ed. 4, 1886, vol. I, p. 291.

[6] Lepsius. Denkmäler. vol. III, pl. 95.

mense quantities in the pharaonic tombs and specimens of which may be seen in every Egyptian museum of Europe, are remarkable for their shape and size.

"They differ from the dates," says Theophrast[1], "by their dimension, their shape and their taste; large enough to fill one's hand, they are round and not oblong; being of yellow colour they contain a sweet and agreeable juice. They are not arranged in bunches like the dates, but grow isolated. The kernel is large and very hard."

The fruits were called 'quqn' in ancient[2] Egypt and it is not difficult to recognise in this word the root of Theophrast's cuci of the word cuciophorus.

USES.—The leaves of younger plants are eaten by camels. The old leaves are put to many minor uses.

The trunk is used for making water conduits, "and it is possible," says Burkill, "that it might contain a little sago in just the same measure as the common Indian fan palm, enough to make it a famine food."

The thick fleshy-fibrous part of the fruit resembles gingerbread both in colour and taste, hence the palm is often known as the Gingerbread Tree.

The chief use of the palm is for the manufacture of buttons from the hard inner fruit-wall. It is also made into beads for rosaries.

CULTIVATION IN EUROPE.—The Doum Palm is difficult to cultivate. It grows best in rich sandy loam. Fresh seeds vegetate readily, but the young plants are of slow and precarious growth.

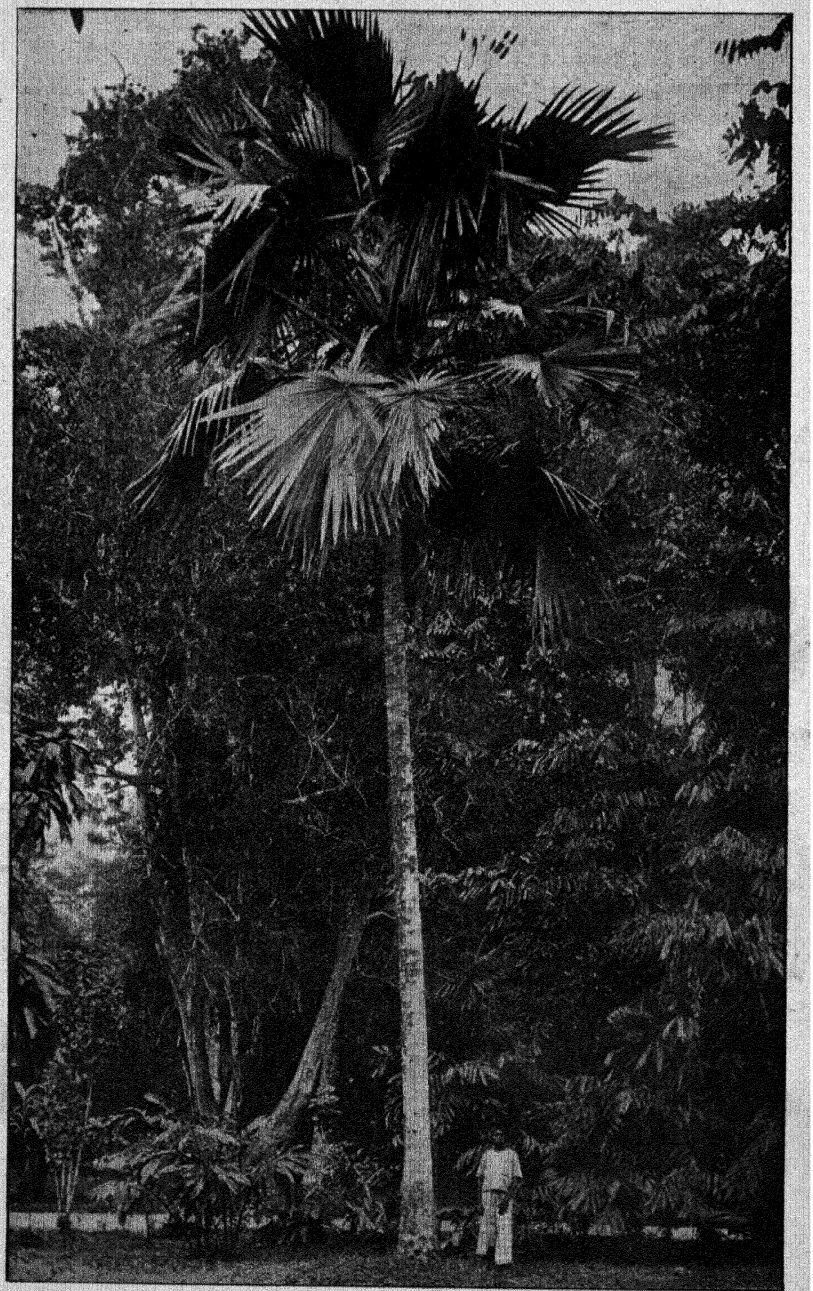
CULTIVATION IN INDIA.—Old specimens of the Egyptian Doum Palms may be seen in many a garden of India and Ceylon, and, as a rule, they are much better developed than the tree growing in Egypt. The climate seems, indeed, to exercise a great influence upon the development of this palm. When Hæckel saw the Doum Palm in Ceylon he was surprised to find it there under an aspect so altered that he could scarcely recognize it.

"Adaptation," he says, "to perfectly different conditions of existence have made the Doum Palm of Egypt quite another

[1] Theophrastus l. c. lib. IV, cap. 2, 7.

[2] Loret, V. Recherches sur quelques plantes. I. Les Palmiers d'Egypte. (Recueil de travaux relatifs à la Philologie et à l'Archéologie égyptiennes et assyriennes, t. II, p. 24.

Joret, C. Les Noms de Palmier. (Revue des études grecques. Paris 1892, p. 417.)



Commerson's Latania (*Latania commersonii* Gmel.).

tree in Ceylon. The trunk is developed to at least double the thickness, much larger than in its native land; the forked branches are more numerous but shorter and more closely grown; the enormous fan-leaves are much larger, more abundant and more solid; and even the flowers and fruit, so far as my memory served me, seemed to be finer and more abundant. At any rate, the whole habit of the tree had so greatly changed in the hothouse climate of Ceylon that the inherited physiognomy of the tree had lost many of its most characteristic features. And all this was the result of a change of external conditions and consequent adaptation, more particularly of the greater supply of moisture which had been brought to bear, from its earliest youth, on a plant accustomed to the dry desert climate of North Africa. These splendid trees had been raised from Egyptian seed, and in twenty years had grown to a height of thirty feet." (A Visit to Ceylon, p. 180.)

ILLUSTRATION.—Not having at our disposal a good photograph of an Egyptian Doum Palm growing in India, we reproduce on Plate XXXV a photograph of some characteristic specimens which grow at Shaikh Hammed, near the ruins of Athribis and Dairel-Abiadh in Egypt.

2. *LATANIA* COMM., JUSS. GEN. 39.

(After the vernacular name "Latanier" of *Latania burbonica* Lam., now *Livistona chinensis* R. Br.).

Jacq. Frag. tab. 8.—Mart. Hist. Nat. Palm. III, 223, tab. 154 et 161, fig. II.—Lemaire Ill. Hort. tab. 229.—Baker Fl. Maurit. 380.—Benth. & Hook. Gen. Pl. III, II, 940, 118.—Blatter Palms Brit. Ind. in Journ. B. N. H. S. XXI, 924, tab. XXXVI-XXXVII, fig. 25-26.—Becc. (cur. Martelli) Palme della Tribù Borasseæ (1924) 14.—*Cleophora* Gærtn. Fruct. et Sem. II, 185, tab. 120.

Of moderate height; leaves long-petioled, palmate-flabelliform; blade deeply laciniated.

DIŒCIOUS. Flowers in distichously-branched axillary spadices, each branch sheathed by an obliquely truncate spathe. Male: Spikes cylindrical, with pits formed by the union of imbricating bracts, each pit containing a single flower; perianth-lobes imbricate; stamens 15-30, exserted; filaments connate at the base; pistillode a triquetrous column or of 3 or more subulate processes. Female: Bracts toothed on their outer

edge, combined in pairs to form a cup for each flower; flowers fewer than in the male spikes; staminodes forming a toothed cup; ovary 3-celled; stigmas 3, distinct.

Fruit a drupe, containing 3 or, by abortion, 1-2 pyrenes; mesocarp succulent; pyrenes convex and sculptured externally; seed with a testa which adheres completely to the endocarp; albumen homogeneous; embryo apical.

Species 3.

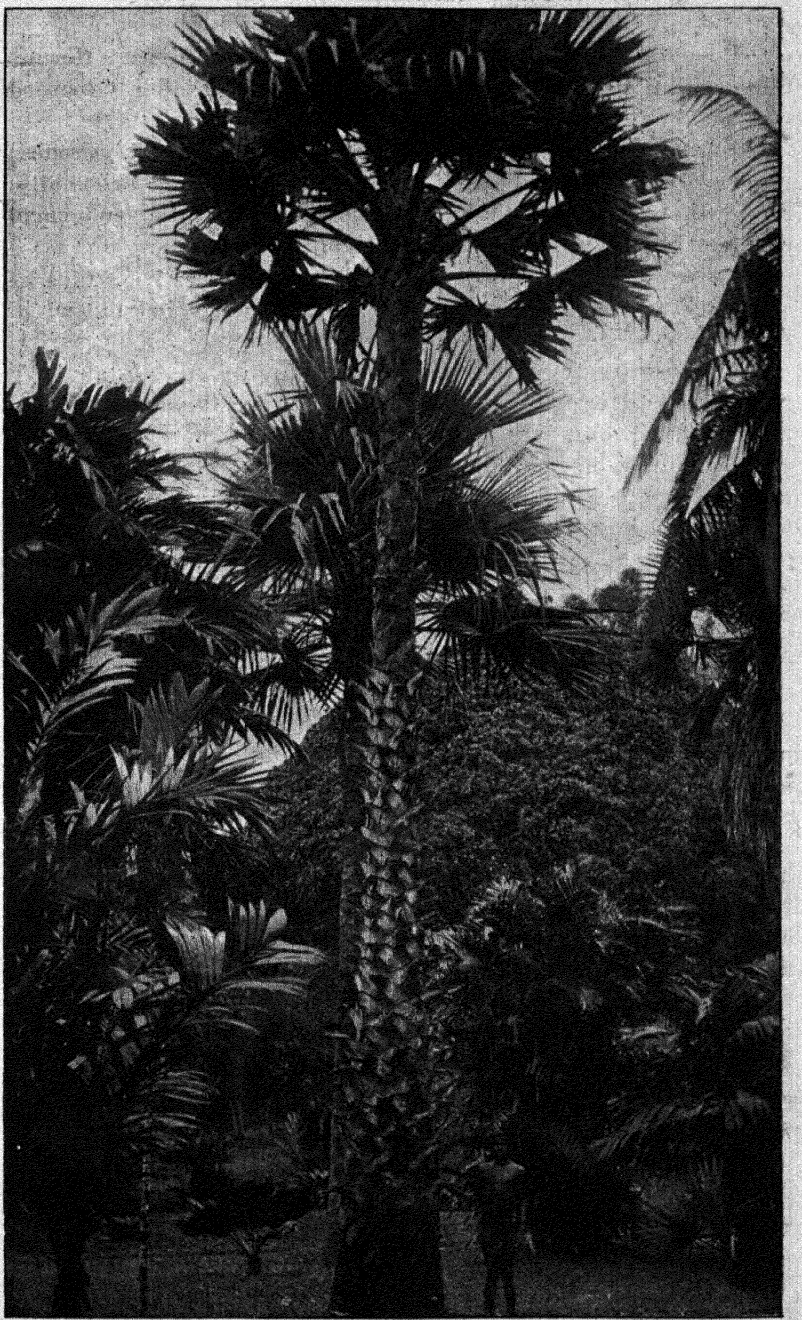
DISTRIBUTION.—Mascarene Islands; generally introduced in Indian gardens.

CULTIVATION IN EUROPE.—The species of Latania are very handsome stove plants. They grow well in a compost of two parts of rich loam and one of peat, to which may be added a small quantity of sand. Perfect drainage is required. Propagation is effected by seeds. These are sown in a compost similar to that just mentioned, and placed in a moist, gentle heat.

1. **Latania commersonii** Linn. Syst. Nat. ed. 13; Gmel. Syst. II, 1035; Mart. Hist. Nat. Palm. III, 223, t. 148, fig. 4, t. 154, 161, fig. 2, t. W.; Baker Fl. Maurit. and Seych. 381.—*L. plagœcoma* Comm. Mss. et Palmarium Vol. I. 26, 27, 28; Aub. Pet. Thouars Mélanges de Bot., Observat. sur les Plant. des îsles d'Afr. 51.—*L. rubra* Jacq. Frag. Bot. 13, n. 49, t 8; Willd. Spec. Plant. iv, 2. p. 878, n. 1; Spreng. Syst. Veg. ii, 623, n. 1.—*Cleophora lontaroides* Gærtn. Fruct. II, 185, t. 120, fig. 1.

NAMES.—Commerson's Latania; Latanier; Latanier rouge; Latanier de l'îsle de Bourbon.

DESCRIPTION.—Palm 40 feet high. Petiole 4-6 feet long, slightly tomentose, the margins smooth, spiny in young plants; blades 5-5½ feet long, dark green above, paler beneath; segments lanceolate, acuminate, 2 feet long, 3½-3½ inches broad, their margins entire, spiny in young plants; veins and margins tinged with red. Male spadix 3-6 feet long, with 9-16 branches; spikes 7-10 inches long, ½-⅓ inch broad, arising in clusters of 4-20 from the end of the branch within the mouth of the spathe. Perianth ⅙ inch long; margin of segments fringed; stamens 28-32; pistillode pyramidal-trigonous. Female spadix 3-6 feet long, with 8 or more branches, each bearing 3 spikes; free portion of bracts deltoid. Fruit a drupe, globose, 1½-1¾ inch in diameter; pyrenes obovoid, 1⅙-1½ inch long, marked with numerous ridges which pass from the base to the apex and then curve down again, a central ridge always most prominent; seed with a light brown testa.



Loddiges' Latania (*Latania loddigesii* Mart.).



FIG. 25.—A young specimen of *Latania commersonii* Linn.

HABITAT.—Mauritius, in various parts of the island, but not abundant; Seychelles (not indigenous); Bourbon.

Cultivated in most European conservatories and in many Indian gardens.

USES.—The fruit is eaten by the Negroes, but it has a rather disagreeable flavour. The leaves are used as thatch.

ILLUSTRATION.—Plate XXXVI shows a well developed specimen of this species growing in the Royal Bot. Gardens of Peradeniya. The photograph was taken by Mr. Macmillan.

2. **Latania loddigesii** Mart. Hist. Nat. Palm. III, 224, t. 161, fig. II, 10-14; Baker Fl. Maurit. and Seych. 381; Becc. (cur. Martelli) Palme della Tribù Borasseæ (1924) 16.—*L. glaucophylla* Hort. Flor. Maurit.—*Cleophora dendriformis* Loddiges in Cat. plant. hort. proprii in Hackney prope Lond.

NAME.—Loddiges' Latania.

DESCRIPTION.—Trunk 50 feet high. Petiole 3-4½ feet long, tomentose, the margins entire in the mature, spiny in the young plant; blade 3-5 feet long, very glaucous; the primary veins beneath slightly tomentose, and tinged with red, especially in young plants; segments 2 feet long, not quite 3 inches broad, unequally acuminate, the edges spiny in young plants.

Male spadix 5½ feet long, with 8-12 branches; spikes arising in clusters of 3-9 from the end of the branches on a level with the mouth of the spathe. Perianth ⅜ inch long; segments not fringed; stamens 16-20, or more; pistillode of 3-5 grooved filaments nearly as long as the stamens. Female spadix 3½-4 feet long, with 5-6 branches, each bearing 1 or 2 spikes.

Fruit a drupe, obovoid or pyriform, trigonous, 2½ inches long, 1¾ inch broad; pyrenes elongate-obovoid, faintly mucronate at the apex, 1¾-2¼ inches long, ¾-⅞ inch broad, with a central ridge along the convex face with tree-like branching in the upper third, the inner surface furnished with a central crest, usually for only a part of its length. Seed with a dark brown testa.

HABITAT.—Mauritius, on Round Island, Flat Island, and Coin de Mire; introduced on the main land.

ILLUSTRATION.—We reproduce on plate XXXVII a photograph of *Latania loddigesii,* taken by Mr. Macmillan in the Roy. Bot. Gardens of Peradeniya. The stem is covered, almost from the base, with the bases of fallen leaves.

3. **Latania verschaffeltii** Lemaire Ill. Hort. VI, tab. 229, fig. med. et fig. B, 1-3; Balfour in Bak. Fl. Maurit. 381; Blatter Palms Brit. Ind. in Journ. B. N. H. S. XXI (1912) 927; U. Dammer in Gard. Chron. (1902) 139; Becc. (cur. Martelli) Palme della Tribù Borasseæ (1924) 16.—*Latania aurea* Duncan Cat. Hort. Maurit. 52 *(nomen).—Areca Verschaffeltii* Hort. Balf. l. c.

DESCRIPTION.—Trunk 40 feet high; petiole 5-8 feet long, densely tomentose, with entire, orange margins, spiny in young plants; blade pale green, 4½-5 feet long; segments 2½ feet long, above 2 inches broad, acuminate, the entire margins and veins beneath slightly tomentose.

Male spadix 4-8 feet long, with 5-10 branches exceeding the spathes in length; spikes 1¼-2 feet long, ⅜ inch broad, arising singly or in clusters of 2-3 on each branch; perianth ½-¼ inch

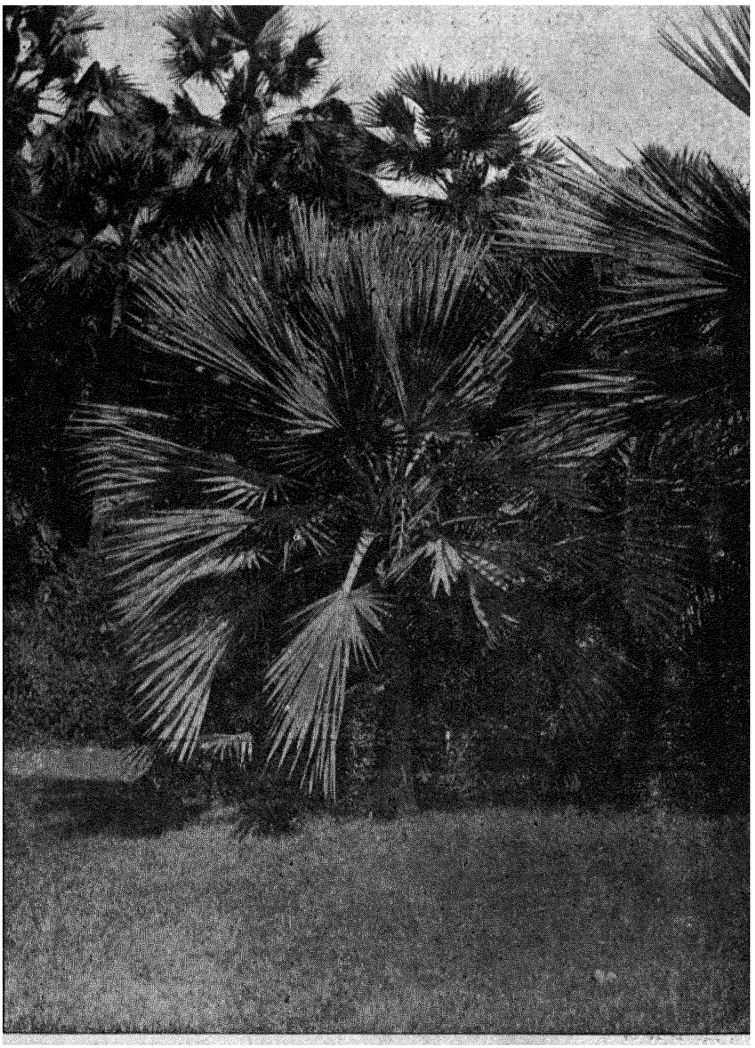


FIG. 26.—Young male specimen of *Latania loddigesii* Mart.
From between the leaves rises the male spadix.

long; stamens 20-30; pistillode a triquetrous column, shorter than the stamens. Female spadix 3-5 feet long, with 1-4 branches bearing usually solitary spikes; staminodes forming a minute cup with 6-8 teeth.

Fruit a drupe, obovoid, slightly trigonous, 2 inches long, $1\frac{1}{2}$ inch broad; pyrenes oblong, $1\frac{1}{3}$-$1\frac{3}{4}$ inch long, $\frac{1}{3}$ inch broad,

the convex surface marked by many hard prominences and a median ridge continued from the base to form a prominent apical crest, and thence passing a short way down the inner face and ending abruptly; on each side, also, a deep groove separates the apical crest from a sharp process, whence one or more ridges run downwards. Seed with a light brown testa.

HABITAT.—Rodriguez, abundant over the island.

CULTIVATION IN INDIA.—This palm is of slow growth in the Indian climate, but bears full exposure well.

USES.—Of the beautifully marked wood walking sticks are made.

3. *BORASSUS* LINN. GEN. NAT. 1220.

(From the Greek 'Borassus,' the cover surrounding the palm-fruit; 'Bora,' food for animals; according to Brande 'Borassus' means the skin of the date, whilst Hamilton states that it means the spathe common to most palms.)

Mart. Hist. Nat. Palm. III, 219, 318, tab. 108, 121, 162; Gærtn. Fruct. I, 21, t. 8; Kunth Enum. Pl. 221; Lam. Ill. t. 898; Brandis For. Fl. 544; Roxb. Cor. Pl. I, t. 71, 72; Griff. Notul. III, 167; Kurz For. Fl. II, 531; Drude Bot. Zeitg. (1887) 635, t. 5, f. 6-9; Benth. & Hook. Gen. Pl. III, 939; Engler & Prantl Nat. Pflanzenf. I, 39-40 cum ic. xyl.; Baill. Hist. Pl. XIII, 255, f. 202-204, 322; Luers. Bot. II, 338; Hook. f. Fl. Brit. Ind. VI, 481; Blatter Palms Brit. Ind. in Journ. B. N. H. S. (1912) 929, t. XXXVIII, XXXIX; Becc. in Martelli Webbia IV (1913) 294, fig. 32-42; Palme del Madag. 55, t. 50; Becc. (cur. Martelli) Palme della Tribù Borasseæ (1924) 2.

Very tall dicœcious palms; trunk stout, unarmed. Leaves terminal, fan-shaped, plicately multifid, sides of lobes induplicate in vernation; petiole spinous; ligule short. Spadix very large, interfoliar, simply branched; peduncle sheathed with open spathes, male with stout cylindric branches that are densely clothed with closely imbricating bracts, enclosing spikelets of flowers, which hence as if sunk in cavities of the branch; female spadix sparingly hed, bearing a few scattered solitary flowers. Male flowers te in small scorpioid spikelets enclosed in the bracts, erianth glumaceous; sepals and petals 3 each, imbricate s 6, pistillode of 3 bristles.

Female flowers larger, globose; perianth fleshy, greatly accrescent in fruit; sepals imbricate; petals convolute; staminodes 6-9; ovary globose, entire or 3-4-cleft, 3-4-celled; stigmas 3; ovules basilar, erect. Fruit a large subglobose drupe with 1-3 obcordate compressed pyrenes; pericarp thinly fleshy; stigmas terminal. Seeds compressed, quadrate, top 3-lobed; testa adherent to the pyrene; albumen equable, hollow; embryo apical.

Species 7.

DISTRIBUTION.—Up to a few years ago the genus *Borassus* was considered to be monotypical. In 1913 Martelli published his 'Studio sui Borassus' (see Webbia IV, 1293) in which he has proved conclusively that there are at least 7 species belonging to that genus: *B. flabellifer* (India), *B. sundaica* (Malay Archipelago), *B. æthiopum, B. deleb* (Africa), *B. sambiranensis, B. madagascariensis* (Madagascar), and *B. heineana* (N. Australia).

Considering the geographical distribution of the Borasseæ, Martelli arrives at the conclusion that Africa, India, the Malay Archipelago, New Guinea and Australia must have formed one vast continent in Tertiary times.

1. **Borassus flabellifer** Linn. Sp. Pl. (1753) 1187, (ed. 2) II, 1657; Hook. f. Fl. Brit. Ind. VI, 482 *(excl. B. æthiopum)*; Gamble Man. Ind. Timb. (edit. 2), 737; Brandis Indian Trees 657; Trimen Fl. Ceyl. IV, 336; Becc. in Martelli Webbia III (1910) 241 et IV (1913) 304, fig. 32 (1-8), 33 A, 34, 39, 42; Blatter Palms Brit. Ind. in Journ. Bomb. Nat. Hist. Soc. (1912) 930, fig. 27 et t. XXXVIII, XXXIX; Bailey in Queensl. Agr. Journ. I (1897) 1, et Queensl. Fl. 1686.—*B. flabelliformis* Linn. Mus. Cliff. (1736) 13 (ex Mart.) et Sp. Pl. (edit. Wild.) IV, 2, 800; Roxb. Fl. Corom. Pl. 1, 50, tab. 71 et Fl. Ind. III, 790; Mart. Hist. Nat. Palm. III, 219 (edit. 2 a), tab. 108, 121 (ex parte?), 162; Miq. Fl Ind. Bat. III, 45; Kurz For. Fl. Brit. Burma 529; Thw. Ceylon Pl. 329 et exsicc. No. 3743.—*B. tunicata* Lour. Fl. Coch. (edit. Wild.) 760; Kunth Enum. Pl III, 224.—*B. Carimpana* Reed. H. Malab. I, tab. 9 *(arbor fœmina)* et *Ampara* tab. 10 *(arbor mascula)*.

NAMES.—Palmyra Palm, Brab Tree[1] (English); Tala, Tal, Trinaraja (Sansk.); Tal, Tar, Tarka jhar (Hnd.); Tad, Tamar (Mar.); Tal, Talgachh (Beng.); Tan (Burm.); Taark Dizaar (Deccan); Tala-wruxium (Tanjore); Tal gaha (Singh.); Panay, Panaymaram [the tree], Arn / [the male tree], Purn- Panay [the female tree], Vadaly [t ng tree], Oly [the leaf],

[1] The name 'Brab,' commonly used i as derived from the Portuguese 'brava,' 'wild palm.'



A Grove of Palmyra Palms (*Borassus flabellifer* Linn.) in Northern Ceylon.

Panang-kai [the fruit], Nonku [the kernel] (Tamil); Pootpady, Poottaly, Ponthy, Talam (Poetical Tamil); Tatechutta [the tree], Potutadu [the male tree], Pentetadu [the female tree], Bonda [the young tree], Tatikaya [the fruit], Tataku [the leaf], Nungu [the edible part of the fruit] (Tel.); Panuguera, Palmeira macha brava (Portug.); Jager-Boom, Weingeevende Palm-Boom (Dutch); Palmyra Palme (German); Rondier (French).

DESCRIPTION.—Trunk attains 100 feet in height and 2-3 feet in diameter, black, swollen above the middle and again contracted upwards, while young covered with dry leaves or the bases of petioles, old stems marked with the black narrow scars of the petioles, near the ground with a dense mass of long rootlets. Leaves 3-5 feet in diameter, palmately fan-shaped, rigidly coriaceous, many-cleft into lanceolate or linear 2-fid lobes: segments 60-80, shining, folded along the midrib, with spinulose margins; petiole 2-4 feet long, stout, semiterete, edges with hard horny spinescent serratures; ligule short.

Male spadix simply branched, sheathed with many imbricated spathes, each vaginated at the base, but soon splitting into a long, concave, pointed, boat-like sheath, in substance very strong and fibrous; when young they are covered with a soft, downy, rust-coloured substance; (sometimes in the lower axil of the sheaths there is a bundle of smaller sheaths, forming a spathe like that now described, but without spadix). The superior 4 or 7 sheaths embrace each ramification of the spadix, each ramification ending in 1-3 cylindric spikes, beautifully imbricated with innumerable bracts. The lower and shorter ramifications of the spadix universally composed of 3 spikes spreading from each other in the same plane and distant from each other at the points about 3-5 inches, the middle one extending from 2-3 inches beyond the other two. One or two of the higher ramifications sometimes divided into only 2 spikes and occasionally consisting of one only. These spikes are 12-15 inches long, while the lower ones measure only 9-12 inches. The bracts of the spikes are broad, wedge-shaped, retuse, adhering by their lateral margins to the keel or back of the next above, forming a cavity for a second spikelet of about 10-12 small, sessile flowers; seldom more than one expanded at a time, beginning with the uppermost, so that there is a long succession of them. Flowers of [illegible] palm. [illegible] arranged in 2 vertical opposite rows,

beautifully serrated into each other, each spikelet forming an arch with its convex side undermost, the common receptacle of the little florets forming the other. Flowers appearing in parallel nearly straight rows, running from bottom to top, or in parallel oblique rows running from right to left, or from left to right round the spike, according to the position from which they are viewed. Sepals narrowly cuneate, tip truncate, inflexed. Petals shorter, obovate spatulate. Stamens 6; filaments connate with the corolla into a stalk; anthers large, subsessile, oblong.

Female spadix simple; spikes terminating the branches of the spadix; the lower end of the spadix is a smooth stem, sheathed with several spathes; spikes enveloped in bracts which cover all parts of it and rise over the flowers to the number of 8-12; a barren bract encircles the spadix, just below where the flowers commence to rise from it, and the upper end of the spadix, extending to a length of 2 or 3 inches beyond the flowers, is also enveloped by these bracts. Flowers larger than the male flowers, 1 inch in diameter, globose. Sepals fleshy, reniform, imbricate; petals smaller, convolute; staminodes 6-9. Ovary subtrigonous, 3-4-celled; stigmas sessile, recurved.

Fruit a drupe, when young pretty distinctly trigonous, but when old, the pulp round the pyrenes so swells as to give the fruit the appearance of an almost perfect globe, 6-8 inches in diameter, seated on the greatly enlarged perianth. Pyrenes 3-1, obcordate, fibrous outside; endosperm horny, hollow; mesocarp fleshy and fibrous.

GERMINATION.—When the nuts begin to germinate, the space within the kernel fills up with a cream-coloured substance of the consistency of cheese.[1] From this the root of the germ or young plant protrudes, through that end of the nut which was attached to the spadix, the body or actual stem of the plant following, until the two first leaflets are thrown up with the

[1] For the chemical aspect of the process of germination, see: Gatin, C. L. Contribution à l'étude chimique de la germination du Borassus flabelliformis L. in Bull. Soc. Bot. de France (1905), 4th series, vol. v., pp. 558-561.

By the same author: Nouvelle contribution à l'étude chimique de la germination du Borassus flabelliformis, L. in Rev. Gén. Bot. Paris, 18 (1906), 481-483.

Also: Recherches anatomiques et chimiques sur la germination des palmiers. Paris, 1906, pp. 307-308.

Transformation diastasique du mannose en glucose au cours de la germination du Borassus flabelliformis, L. in Bull. Soc. Bot. de France, vol. 55 (1908), pp. 383-386.



Palmyra Palm (*Borassus flabellifer* Linn.) in fruit.

shell of the nut attached. All these parts are, when very young, beautifully encased in an entire leathery substance like the sheaths of the spadix. These seedlings are called 'dantalas' or kelingoos.'

Each of these little trees has 1-4 rootlets attached to it. The lower part of the stem, where those roots are attached, resembles much that end of a carrot, parsnip or radish to which the crop is attached; and indeed the plant altogether looks very like an inverted long parsnip.

These dantalas, which are found beneath the surface, are about 1 inch thick at the lower part and taper off to a mere point, being 12-15 inches long. A slit or groove runs from near the bottom to the top. This groove is nothing but the folding inwards of the first leaf, which composes nearly the entire thickness of the stem. If it be cut across, it will be found to enclose the inner leaves in a small oval pipe about ⅛ inch in thickness.

When these dantalas are about 9-12 months old, they have usually two leaves just issuing from the surface. These are from 1-1½ inch in breadth, and from 2½-3 feet in length, having only four or five folds in each leaf. When the leaves issue from the ground, no part of the stem is seen, but a succession of leaves goes on, increasing in breadth and thickness, for 6 to 7 years. The stem close to the ground is then perhaps as stout as ever it will be; indeed in many cases stouter, as these trees harden and compress with age. (Ferguson.)

GROWTH OF PALMYRAS.—On this subject we refer to

Jackson, A. B.—The rate of growth of Palmyras, "Indian Forester", Vol. 35, p. 394.

Lushington, A. W.—The growth of Palmyras. Ibid., Vol. 35, p. 573, Vol. 36, p. 362.

Hole, R. S.—The growth of Palmyras, Ibid., Vol. 35, p. 632.

HABITAT.—A native of India. In North-West India as far north as Aligarh and Shahjehanpur. Isolated trees in gardens in Rohilkhand and the Upper Ganges, Doab, as far as Saharanpur. Also on both sides of the Persian Gulf, attaining there about the same latitude as in North-West India, *i.e.* 30° N. Lat. Immense groves of it are found on the Malabar coast, extending from Cape Comorin through Travancore, Calicut, Goa, and the Bombay Presidency, on through Gujarat and, some distance up. on the

banks of the Indus. But what are emphatically called the Palmyra regions may be included in a line extending along the Coromandel coast from Cape Comorin to Madras, including the northern portion of Ceylon, and from Madras all along, taking in a considerable belt of the coast between that and Point Palmyras, and then passing up to Gya on the 85th degree of E. Long. and nearly 25° of N. Lat. After that the line should be carried on about due east until it reaches Ava, below which, on the banks of the Irrawaddy, there are immense groves of this palm.

The Palmyra Palm is found in various parts of the mountain district of Ceylon, including the vicinity of Kandy and of Badulla at elevations of 1,680 and 2,450 feet, respectively, having a mean annual temperature of about 74° at the former and 71½° at the latter.

Although immense groves are found on the banks of the Irrawaddy, from the sea coast up to nearly as far as Ava or Amarapura in Burma, and as far inland as Gya in Bengal, and in isolated patches all round and through Ceylon, still the most congenial places for their favourable development will be found in low sandy plains scarcely elevated above the level of the sea, and where they are exposed to the burning sun, and the force of at least one of the monsoons. Such are Jaffna, with the surrounding islands, and other portions of the Northern Province of Ceylon, the District of Tinnevelly, with portions of the Madura Collectorate, and portions of the Madras and Bombay Presidencies.[1]

FLOWERS.—In March and April; fruit ripens in April and May and is matured in July and August.

THE PALMYRA PALM AND ITS GUESTS.—The tree is well adapted for sheltering animals and hence it is resorted to by birds at night, and by rats, squirrels, mungooses, monkeys, etc., during the daytime. When the leaves of a tree are undisturbed, the number of bats occupying it is sometimes incredibly great.

A great number of epiphytical plants find support and nourishment in the axils of the leaves. A very interesting union is that formed by the Palmyra and several species of Ficus. The birds which feed upon the fruit of Fig trees "drop the seeds in the alæ (axils) of the leaves, where they grow and extend

[1] Ferguson, W., Description of the Palmyra Palm of Ceylon. Colombo 1888, p. 11.

their roots, etc., so as in time to embrace the parent Palmyra, except its upper parts. In very old ones the top thereof is just seen issuing from the trunk of the Banyan, as if it grew from thence, whereas it runs down through its centre, and has its roots in the ground, the palm being the older. For such the Hindus entertain a religious veneration saying it is a holy marriage instituted by Providence." (Roxburgh.)

USES.—Every part of the Palmyra Palm is turned to account in some way or other.[1] By far the most important aspect of this tree is as a source of food.

1. The juice or toddy.—This is almost as famous for its use as notorious for its abuse. The juice can be obtained only after the young flowering branches have made their first appearance. The trees do not generally bear until 12 to 15 years after they have been planted, and only then can the male trees be distinguished from the female. Ferguson, who examined trees of both sexes most minutely before the spadices were to be seen, could detect no peculiarity in shape, size or colour by which to distinguish them. Were it possible to do so, it would be of the utmost importance to extensive cultivators of this useful palm. When the trees have arrived at the age mentioned, the spathes begin, in the months of November and December, to protrude from amongst the leaves near the top of the trees, which have then attained heights varying from 8-25 feet. The next natural course would be the bursting of these spathes, and the production of fruits, but in many cases the laws of nature are herein completely thwarted, for the toddy drawers now step forward and attack the trees of both sexes, but oftener the males, for the extraction of toddy—the life juice of the inflorescence. In the various written descriptions of the ways in which this is done, the information is often contradictory and unsatisfactory. Some writers, and recent ones too, state that the fruits of the trees are pierced for the purpose. Others say that a hole is bored in the body of the tree in which a plug is inserted, to be removed when toddy is wanted. In this conflict of opinions we consider it much safer to follow an experienced guide. Ferguson gives an excellent description of the whole process from personal observations made in Ceylon.

[1] Grisard, J., Produits et utilisation du Rondier, in Rev. Cult. Colon. Paris, 9 (1901) 110-114.

When the proper season arrives, which is in November and December, the too frequently degraded and drunken toddy drawers are seen and heard busy at work in the Palmyra groves throughout the Peninsula of Jaffna. Their practised eyes soon fix on those trees that are fit for the 'scalping knife', and if they have not dropped the footstalks of the leaves, the first operation, if the trees are valuable, is to wrench these off. This done, the toddy drawer, armed with his leathern protector for his breast, his raceme-batten of wood, his small thongs, straight and crooked knives, with the 'side leather pouch' to contain them, procures a piece of tough jungle vine, or a strip of the footstalk of a fresh leaf of a young Palmyra or Coconut tree, which he thoroughly twists, and then converts into a sort of loop of such dimensions as to admit of his feet getting through to a span large enough to allow them to clasp the tree. This done, he puts his feet in this thong, stands close to the tree, stretches himself at full length, clasps it with his hands, and pulls his feet up as close to his arms as possible; again he slides up his hands, and the same process is repeated, until, by a species of screw process, he ascends to the summit of the tree. When the trees are high, some use hoops of the same material, large enough to encircle both the tree and the toddy drawer, who slides it up the tree, so that it is always a support to the body while the climber is in the act of taking a fresh grasp.

Arrived at the summit, amongst the leaves, the climbing apparatus is laid across a leafstalk, and the pruning and phlebotomy commence. One or two of the lower leaves are left as a support to the toddy drawer until the operation is completed. He then draws his crooked knife, which, on a small scale, a good deal resembles a reaping-hook, and rids the tree of all the accumulated dirt, such as old leaves, the network which supports them, and, if an old tree that bore fruit before, the stumps of the fruitstalks. Then all the leaves are cut off, excepting 3 or 4, and the young top bud of the tree. Besides the removal of all these, the crooked knife is now used in shearing off the outer covering of that part of the tree from which spring the leaves and the racemes. These latter are supported during this operation by being tied up by several thongs to the footstalks of the uncut leaves. The pruning aving been completed, all or most of the spathes are effectually

encompassed from end to end by thongs, to prevent the membrane which covers the inflorescence from bursting. The racemes thus tied are then beaten and crushed between the wooden battens, to wound them, and to hurry on the flow of toddy. This done and the spathes being secured to stalks of the remaining leaves, the toddy drawer descends. The operation of beating and crushing takes place for 3 successive mornings, and on each of the 4 following a thin slice is cut from the points of the racemes, to encourage the flow of sap and keep them from bursting. On the eighth morning a clear sweet liquor begins to flow from the wounded spadix, which is indicated by the 'Toddy Birds' and crows fighting and chattering amongst the trees. The toddy drawer then ascends with a chatty or toddy-receiver stuck to his belt behind. He places the ends of the spadix in these, and when secured leaves them till evening, when they are found to contain quantities of this liquor. The operation of extracting the juice is repeated every morning and evening, or in the mornings only, until the whole of the spadix is sliced away.

The trees are drained in this way for several months of the year, but if the operation is repeated on the same trees for 3 successive years, without allowing any of the buds to burst naturally, the trees are said to die. A spadix continues to give toddy for about 5 months, at the rate of 3 or 4 quarts a day, and while there are seldom three spadices yielding toddy on the Coconut tree, seven or eight will yield juice at once on the Palmyra Palm. An expert climber can draw the toddy from about 40 trees in a few hours.

In Jaffna a distinction is made between 'toddy' and 'sweet toddy.' The former, called by the Tamils 'Culloo', is the juice when it is allowed to ferment, which it does in a few hours after sunrise. Sweet toddy, called 'Carupaner', is obtained by sprinkling the inside of the toddy-receiver with lime or chunam, which keeps it from fermenting.

The toddy procured from the male Palmyra tree is said to be sweeter than that from the female. The latter, besides, yields only about half as much sap as the male.

Many trees are encircled near the ground with a strip of tar, etc., to prevent ants and other vermin getting up and making a decoction of the toddy in the chatties.

It is not a little amusing to notice the various comparisons to which this juice has given rise. Sir W. Jones compares it, fresh from the tree, to Poubon water fresh from the fountain, or to the best mild champagne; Malcolm, the American, naturally enough associates its taste with that of his native cider; while Johnson, a traveller in Abyssinia, ranks it no higher than ginger beer. It is possible that it bears a resemblance to all these, and indeed a good deal of the Ceylon ginger beer is made from toddy. The result of partaking of toddy in the early morning is generally a listless, drowsy sensation.

2. *Sugar or Jaggery.*[1]—It appears, says Ferguson, that in the time of Menu, upwards of 4,000 years ago, the Hindus knew how to make sugar from the flowers of the Madhuca tree *(Bassia latifolia);* and this being the case, there is great reason to suppose that sugar was made from some of the palm-trees at a much earlier period. Sugar-candy is alluded to by Megasthenes under the name of 'Indian stone', and to this day the crystals formed either from jaggery or the juice of the cane are called 'Catcandu', or stone sugar. The common Indian name for the finer sorts of sugar, 'Cheenee', has been supposed to point to the Chinese origin of the production.

The usual process of making jaggery, as pursued at Jaffna, is exceedingly simple. The sweet toddy is boiled until it becomes a thick syrup; a small quantity of scraped Coconut-kernel is thrown in that it may be ascertained by the feel if the syrup has reached the proper consistency, and then it is poured into small baskets of Palmyra leaf, where it cools and hardens into jaggery. In these small plaited Palmyra baskets it is kept for home consumption, sent coastwise, chiefly to Colombo, or exported beyond seas to be refined. About 3 quarts of toddy suffice for boiling into 1 lb. of jaggery. The juice of the Palmyra is richer in saccharine matter than that of most other palms, in consequence, perhaps, of the tree more generally growing in dry sandy soil and in a dry climate.

To make 'Vellum' or crystallized jaggery, which is extensively used as a medicine, the process is nearly the same as for the common substance; only the syrup is not boiled for so long a

[1] These terms are variously derived from the Sanskrit 'Sakar', Arabic 'Shakar', whence the Latin 'Saccharum', and the English 'Sugar.'

period. The pot which contains it is covered and put aside for some months, at the end of which period the crystals are found in abundance.

Jaggery, besides being exported in large quantities, forms a considerable portion of the food of the poorer classes in India and Ceylon. The sweetness of Burmese bread seems to depend on the use of toddy-juice to raise it.

Amongst a variety of purposes to which it is put is that of being mixed, together with whites of eggs, with lime from burnt coral or shells. The result is a tenacious mortar, capable of receiving so beautiful a polish that it can with difficulty be distinguished from the finest white marble.

It is stated that palm sugar, which is chiefly the produce of the Palmyra tree, is more granulated and higher priced than that obtained from the cane. Small round cakes of jaggery were used formerly, and to some extent still pass, as currency in the Tinnevelly District.

3. Vinegar.—Large quantities of vinegar are made in Ceylon from toddy. It is prepared in the following way: a glazed earthen jar is buried three-fourths its depth in the earth, in a spot exposed to the full influence of the sun. A quantity of Palmyra or Coconut tree toddy is daily thrown into the jar, until it is nearly full, when the mouth of it is carefully clayed up. The fermenting process immediately commences and continues for some months. At a certain stage of the process, which is ascertained by removing the cover and testing the quality of the vinegar, a quantity of burnt paddy is thrown in, which in the course of a few days changes the watery colour of the fluid to that of pale brandy. The vinegar is then fit to be bottled. It is used extensively for pickling gherkins, limes, the cabbage from the heart of the Coconut and Palmyra trees, and several other substances.[1]

The following particulars regarding the preparation of vinegar apply to the Madras Presidency[2]: the producers are the toddy-shopkeepers, and they convert their unspent toddy into vinegar in either of the following ways. The toddy is placed in a clothed earthen pot and kept there till fermentation is complete and the liquid has become sour. The pot is either

[1] Ferguson, W. *l. c.* p. 29.

[2] Watt, G. The Commercial Products of India. London, 1908, p. 1111.

kept above ground for a month or two, or is buried underground for 3 or 4 months or more, and then taken out. The longer the pot is kept closed and underground, the better the quality of the vinegar. In either case pure vinegar is obtained when the pot is opened and the sediment has been removed. Vinegar is also made by heating fermented toddy either by fire or by exposure to the sun. It is procured in a shorter time by this method, but the quantity is less than by the slow or natural fermentation. The vinegar thus obtained is, however, used both for medicinal purposes and in cooking. There is no shop or bazaar in Madras where country-made vinegar is specially sold, and the trade is not so extensive as that in either English or German vinegar.

4. *Palm Wine or Arak.*—If the toddy be distilled the result is palm wine (arak). "The extent to which the spirituous liquor is employed", says Watt, "may be judged from the fact that at one time the Bombay Government became so alarmed at the excessive consumption of arak in Surat that they ordered large numbers of this useful palm to be destroyed. In this connection it is interesting to observe that Fryer, who visited Surat in 1673, mentions that on drawing near the roadstead they saw groves of Brab-trees, from which the Parsis made a 'wine akin to toddy.' This wine the sailors drank, and the result was perpetual disturbances of the peace. The plentifulness of the toddy resulted in the district being overrun by 'soldiers and seamen of the Moors.'"

5. *The Fruit.*—Within the shell of the young fruit there is a jelly-like fluid which is eventually transformed and deposited as a hard albumen. When the fruit is half-ripe (April-May), while the shell is yet soft, they are often torn off or cut from the tree, and stripped of the outer bark. The shell of it is then perforated with the finger, and then the soft kernel can be sucked up. It is pleasant to the taste and exceedingly refreshing; but too large a quantity of it ought not to be taken, for according to Rumphius, it debilitates the stomach. The jelly and soft albuminous layers are sometimes cut into pieces and flavoured with sugar and rosewater.

The fruit, when ripe, vary in colour from a light gold at the end which is attached to the spadix, to brown and nearly

black at the other. Some trees have all their fruit of a beautiful gold and others of a very dark colour, and these differences in their colour and other properties have induced the natives to give them various names. The fruit, when they fall ripe from the tree, are sometimes eaten raw, but are more generally roasted, and the scene exhibited at a roasting feast of Palmyra fruit is, in Ferguson's estimation, one of the most purely Oriental that can be witnessed. "When at hand, the shade of an Illipe (*Bassia longifolia*), of a Margosa (*Melia Azadirachta*) or Tamarind (*Tamarindus indica*) is chosen; a fire is lighted on the ground, composed of Palmyra leaves, etc., and the party, men, women, boys and girls, squat around, sucking the pulp out of the fibres of each fruit as it is roasted, tearing them asunder with nails and teeth in the most approved and natural style, all appearing wrapped in the highest possible state of alimentive enjoyment."

The mesocarp of the ripe fruit is a soft, mellow, luscious, semi-saccharine and farinaceous matter, known as Palmyra-pulp. The period during which the fruits are obtained being short and a greater number ripening than the inhabitants can consume, preserved pulp (called 'Punatoo' in Ceylon) is made in the following manner: "Pandals (stages) are constructed within 4 or 5 feet of the ground, and on these Palmyra-leaf mats are spread; the ripe fruits are then taken, torn up, put into ola-baskets containing fresh water, and are there squeezed by the hands till the pulp with the water forms a jelly. Layers of this jelly are spread on the mats to dry; this process is repeated for 15 to 18 days, one layer being deposited above the other until they amount to about 15 or attain to about half an inch in thickness. The mats are exposed in the sun to dry, being covered at night and protected from the rains and dews." The tough, leathery kind of preserved pulp made from the remaining fruit gathered at the end of the season is much inferior to the other, and is called 'Tot Punatoo.' The pulp is preserved in ola-baskets or bags by being hung up in the smoke. It is generally eaten plain or mixed with gruel made from the pounded farina of the young Palmyra seedlings and with Coconut-kernel.

Rumphius'[1] graphic account of the way in which Punatoo is

[1] Rumphius, G. E. Herbarium amboinense. Amstelod. 1741-1755, Vol. I, Cap. IX.

prepared, is well worth being quoted in this place: "In making 'Punata' more labour is required, for after the ripe fruits, which fall from the tree from July to September, have been collected, the stalks and the cups are twisted off with the hands; the outer rind is stripped off, and the peeled fruit are washed in water, and cleansed from the adhering fibres and earth; they are then pressed out, and rubbed for a long time with other limpid water, until all the yellow juice has been drawn out; this is sometimes repeated twice or thrice, lest the juice should be lost; and it assumes a thick consistency; and with a hooked stick they cleanse it from all the fibres of the shell; and then they prepare a machine made of sticks, which is here called Parra Parra, by the Malays Lante Lante, and in Malabar Pandel. On this machine they spread large palm mats from 14 to 16 cubits long, on which they then pour out the liquor so thick, that scarcely a leaf of the mat can be seen; they then leave it to dry for one day and on the next day they pour fresh juice, which is again left to dry, after repeating the same labour until this cake has acquired the thickness of three fingers; which labour is generally continued for 15 or 16 days; but these mats are folded up during the night, and are covered with leaves to preserve them from cats and dogs, who are exceedingly fond of this cake. When this becomes as hard as cheese, it is cut into square pieces or cakes, and they raise them gently from the mats with a knife and place them in layers in baskets, and sprinkle the layers with water in which salt has been dissolved.

"And these baskets or sacks are placed on a three-legged stool, which they fasten by a rope to a beam, that for some days they may be impregnated with smoke; but this should not be done too much, lest the Punata should become bitter; they also place the ropes in such a manner, that mice cannot enter; and then this work is finished, and the Punata or Pœnata so often mentioned is prepared—and this they reserve for use during winter.

"The people of Macassar prepare the fruit in a much more convenient manner, nor do they spend so much labour. They merely press out the juice, and then pour it into large pans and mix it with the farina of rice, and thence prepare many kinds of food."

The seed within the albumen is also eaten, being sold in Bengal under the name 'Talsans.'

6. Young seedlings (dantalas, kelingoos) as vegetable.—After the Punatoo, described above, is taken from the ripe fruit, the nuts are kept for future use. At a convenient season they are sown in 6 to 8 layers under loose, sandy soil, thrown up in parts of the gardens or fields close to the dwellings of the natives. Planted in beds in this manner there is, no doubt, a greater heat created in consequence of the fibre surrounding the nuts, etc., which induces them to grow more rapidly than otherwise and better for purposes of food. According to the 'Agricultural Ledger' about 50 fruit are planted to the square yard, and these may produce 100 and more dantalas.

These are taken up when they are two or three months old, the nuts cut from the points of the leaves, and then the seedlings are exported or eaten in various ways. "To keep these kelingoos for future use, they are deprived of the beautiful parchment-like sheath in which they are completely enveloped, and then dried in the sun. Those dried in this manner, before they are boiled, are emphatically called 'Odials', and those boiled after, are called 'Poolooc Odials.' It is the Odials that are reduced to flour or meal of which the favourite 'Cool' (of the Singhalese), or gruel is made. The kelingoos roasted, boiled, or cut into slips and fried like slices of Bread Fruit, are eaten by the natives and will be found in the bazaars of Colombo and elsewhere all the year round. In their dried state they seem to be chiefly farina with a few fibres running through them, and their taste is very astringent. It is of the Odials that the flour once so prized by the Dutch, according to Bennet, is made; though in these days [1850] we never hear of this substance being sent to the Cape of Good Hope or Holland. A substance called 'Putoo' is made of the kelingoo flour. To the meal is added a little water, into this are put prawns or small fish, scrapings of Coconut-kernel, unripe Jack fruit, etc. This mixture is put into an ola-basket which is placed on the top of a pot of boiling water, covered over with a chatty, and cooked by the steam This is reckoned a great delicacy."

In India the vegetable [illegible] lis and low-class people.

In a cheap year the gross value of a crop per acre at ordinary market rates would be about Rs. 1,800, rising in a dearer season to Rs. 3,000.

7. *Medicine.* The juice of this plant is used as a stimulant and anti-phlegmatic. "Europeans, especially delicate females, in India, who are apt to suffer much from constipation, find a cupful of this toddy, drunk every morning at five o'clock, one of the simplest and best remedies they can employ. The Vytians prescribe it in consumptive cases." (Ainslie, Materia Medica.)

The root is considered cooling and restorative, as also the gelatinous contents of the unripe seeds. The ash of the spathe is given for enlarged spleen.

A useful stimulant application, called toddy-poultice, is prepared by adding fresh drawn toddy to rice-flour till it has the consistence of a soft poultice; and this being subjected to a gentle fire, fermentation takes place. This, spread on a cloth and applied to the parts affected, acts as a valuable application to gangrenous ulcerations, carbuncles, and indolent ulcers. The light-brown cotton-like substance from the outside of the base of the leaves is employed as a styptic for arresting hæmorrhage from superficial wounds. (Pharmacop. of India.)

8. *Wood.*—The trees have to arrive at a considerable age before they are of use for timber; when a hundred years old, they are excellent. The heart of the tree is soft, but the outer wood is hard, heavy, and durable, consisting of numerous thick black vascular bundles. The weight of the solid foot is 65 lbs., the value of P. 944. Pillars and posts for verandahs of houses, well-sweeps, etc., are made of this timber. Trunks split into halves, with the heart scooped out, are used as spouts for various purposes, but more especially for carrying away the water from the eaves of houses. The thicker parts of the trunks are generally taken for rafters, the thinner or tops for laths. The trunks of young trees or the tops of old ones are often cut into pieces and placed where game is plentiful, as in the Patchelepalla District of Jaffna. Wild hogs and hares are very fond of th[illegible]hite, spongy hearts of the logs, and in resorting to th[illegible]uently shot by the natives. The dark outside [illegible] is used to some extent in Europe for [illegible]anes, paper rulers,

fancy boxes, wafer-stamps, and other articles. It is well known in India that the female tree produces the best and hardest timber, and that that of the male is considered so inferior that, unless the trees are very old, it is never used. The juice is used in the preparation of cements.

9. Leaves and Fibres.—When the leaves are intended for thatching houses, and for making fences for gardens and fields, they are laid flat on the ground in layers one over another and often with weights upon them to assist in flattening them. The thatch formed of these does not last so long nor is it so handsome as that made from the plaited Coconut leaves. Palmyra thatch, when laid on well, lasts for two years, but being so plentiful and cheap, the leaves are generally renewed yearly.

In India as well as in Ceylon the leaves are extensively used for manuring the rice fields. The fan parts are put into the ground till they rot off; they are found to be an excellent manure, giving a quantity of silicious and other matter to the soil.

Mats of various sizes, used instead of carpets on floors, for ceilings and for many other purposes, are made of the Palmyra leaves. Ola-bags are also formed and are useful for purposes where strength of texture is not an object. Even water baskets for raising water are made of the leaves. They are circular at the top but taper down in a triangular form to the bottom, which is a point. They are occasionally woven into hats and caps. At Diamond Harbour, near Calcutta, hats have for many years been made of this material and sold to the European sailors who visit Calcutta.

Umbrellas made of these leaves, though doubtless very good for protection from sun and rain, are rather inconvenient, as they are made in such a way that they cannot be folded. They have a handle and are about the size of an ordinary umbrella when expanded. Single leaves are occasionally used as a protection from the sun when the weather is very hot.

A great variety of fans are made from the leaves; some are nicely painted and covered with pieces of transparent and colourless talc, others are made to fold into a small compass, and again to expand, when wanted, into an almost perfect circle.

Several kinds of fibre may be obtained from the Palmyra Palm: a loose fibre which surrounds the base of the leaf-stalk;

a fibre which may be separated from the leaf-stalks; a fibre called 'tar', which may be prepared from the interior of the stem; a fibre or coir derived from the pericarp, and the fibrous material of the leaves.

The leaf-fibre is utilized in the manufacture of the basket-ware of Madras, produced at Pulikat in Chingleput, Kimedi in Ganjam and Bezwada in Godavari, etc. Fine strips of the leaves specially prepared and dyed are plaited into braids and worked up into fancy boxes, cigar-cases and the like.

Some years back investigations were instituted in India with a view to determining the extent to which the cord-like fibres might be employed in brush-making, as substitutes for the American piassaba fibre (*Attalea funifera*) and the Ceylon kittul (*Caryota urens*). So far indications have not been obtained of a very great demand for these special Indian fibres.

The stem or tar fibre is prepared in some special way by fishermen so that it becomes pliable and can be plaited into fish-traps. It is neither spun nor twisted, a single thread or fibro-vascular bundle being used. The method of preparation adopted by the fishermen has not as yet been made public. The export trade in tal coir, or 'palm-fibre' as it is often called, centres largely in Tuticorin.

One of the most singular purposes for which the Palmyra-leaf is employed in Ceylon is that of being used as a plug to keep open and enlarge the holes bored in the lobes of men's ears and in which are ultimately inserted those huge golden rings and masses of jewellery which the wealthy among the Tamils are so fond of displaying. For this purpose a thin leaflet is neatly cut into a narrow strip and closely rolled up. In this state its tendency to expand assists materially in keeping the hole open.[1]

The following passage, taken from Rumphius, who wrote in 1741, is more of historical interest: "By the inhabitants of Macassar," he says, "these leaves are so much esteemed that none of the common people dare carry an umbrella or large broad-brimmed hat made of them, except the three highest noblemen in that country, namely, the Princes of Tello, of Goa, and of Sadrabona. They accordingly make umbrellas from the leaf of the Talla (Palmyra), all the radii of which are inter-

[1] Cf. Ferguson, W. *l. c.* p. 23-25. Watt, G. *l. c.* p. 170.

woven with tinsel, and surrounded with a border of ebony, or even covered with Rottanga and silk, so that this broad-brimmed hat or umbrella is always open. If they wish to carry it, they place it on a stick, the handle of which is covered with gold; it is not proper for undistinguished persons to allow their servants to carry it behind them; this is permitted only to the nobles." ("Herbarium Amboinense".)

10. Leaves as writing material.—The most singular purposes to which they are devoted is that of being written upon. A well-informed Tamil Native furnished Ferguson with the following information: "The oldest Hindoo author who mentions writing on Olas (Palmyra leaves) is Panniny-rishee who lived about the year 790 of the Caliyugam; that is 4,161 years[1] ago, according to Hindoo reckoning. He resided near the source of the River Ganges at a place called Arrittuwarum. He was the inventor of the Sanscrit Alphabet, although verses in Sanscrit were in existence before his time, committed to memory and thus transmitted." We are not able to say what degree of evidence may be attributed to these statements. It is probable that Hœrnle's "Epigraphical Note on Palmleaf, Paper and Birchbark"[2] contains some more critical information on the subject, but, unfortunately, this publication is not at our disposal.

Pliny[3] says expressly that the most ancient way of writing as upon the leaf of the Palm tree, an assertion with all the eight of evidence in its favour.

The following quotations give some interesting details:—

Marshall, in his account of the Coconut tree, writes: "The ıaflets are sometimes used to write upon, and the instrument ɜmployed to make the impression is an iron stylus, the pen ɔf the scriptures. The stylus was used by the Romans to write ɔn waxen tablets, leather, etc. The leaves of the Palmyra *Borassus flabelliformis*), or Talipot (*Corypha umbraculifera*), ıre, however, much more frequently employed for this ɔurpose. Contracts and other legal instruments are often ɜngraven upon tablets of copper, similar in shape to a slip of ;he talipot leaf, which have occasionally a border of silver or gold. . . . . Palm leaves, when they are prepared to receive

[1] Ferguson wrote this in 1850.

[2] In Journ. As. Soc. Beng., Vol. 69, pt. I, No. 2.

[3] Lib. XIII, Cap. 4.

the impression of the stylus, are called ollahs. The natives write letters to one another upon ollahs, which are neatly rolled up, and sometimes sealed with a little gum-lac; in this manner they pass through the post-office. During the operation of writing, the leaf is supported by the left hand, and the letters scratched upon the surface with the stylus. Instead of moving the hand with which they write towards the right, they move the leaf in a contrary direction, by means of the thumb of the left hand. To render the characters more legible, the engraved lines are frequently filled by besmearing the leaf with fresh cow-dung, which is tinged black, by rubbing the lines over with coconut oil, or a mixture of oil and charcoal-powder. The natives can write standing, as well as walking, and they rarely use tables.

"Palm leaves, and perhaps the leaves of trees that do not belong to this natural class, were much used by the ancients as writing materials, hence the word leaf (of a book) is synonymous with that of a tree."

The statements, respecting the age of Palmyra manuscript books and the number of years they are likely to last, are somewhat conflicting. Ferguson does not doubt that Palmyra-leaf manuscripts 400 or 500 years old exist in Ceylon. He says that they are certainly of a more durable quality than paper, and resemble parchment in their texture, when well prepared.

We read in an article written by Brande[1] in 1849 on "Th Language and Literature of the Island of Bali": "The time at which the manuscript was composed, which I made use of, is the year of Saka 1724 (corresponding to the year of Christ 1802). To judge from the outward appearance I should have taken it to be much older; in 46 years the lontar leaves (Palmyra) have already become much injured and it seems to prove what is said also of Indian manuscripts, that they cannot survive 100 years This probably is also one of the causes that in Java in so short a time almost the whole of the ancient literature was lost, and that when the desire for the old literature was revived, hardly any of the old manuscripts could be discovered. In Bali also we must not look for old manuscripts; however, those which are guarded and transcribed in the families of the priests may

[1] Journal of the Indian Archipelago and Eastern Asia, Vol. III, No. 4, April 1849.

almost be considered as original, since in these families the knowledge of language and religion is preserved with the minutest care." [1]

The Palmyra books are never much beyond two feet in length and two inches in breadth, as the size of the webs between the little ribs will not admit of their increase in size. [2]

CULTIVATION IN INDIA.—"This grand palm is not much used in gardens, and perhaps rightly so. It takes up much space, and generally looks unhappy compared with the same species on hill-sides near Bombay, where its tall cylindrical stem crowned with immense fan-shaped leaves is a grand feature in the landscape. But in the Botanical Gardens at Calcutta a special use has been found for which it is well adapted. On the outskirts of the garden a gently winding path, about 12 feet in width, has this palm planted near the sides about 10 feet apart; the effect of the thick stems ornamented by the persistent leaf-stalks is strangely happy. To grow this palm quickly a moist climate is necessary, and the seed should be sown where it is required to grow, because it first sends a shoot downwards to a depth of 3-4 feet, and then from the bottom of this shoot the bud, which forms the stem, is developed" (Woodrow). Some few trees that from unknown causes do not flower in spring, put on their flowers in the cold season, and give a scanty supply of toddy, but in spring many are rendered artificially barren by breaking off the flowering bud as it begins to form. These also flower in the winter season, and are called Basanti. They do not give above 2½ maunds of juice, but this is of as much ue as the 6 maunds which a tree gives in spring. Either male or female will answer for the spring or winter crop, the female alone will yield juice in the rainy season. When is wanted, the fruit is allowed to form, and afterwards the t of the spadix or stem which supports the clusters is cut allowed to bleed. This does not prevent a great many fruit ach cluster from coming to maturity. Palms managed thus alled Ghour. The fruit ripens in August, but many of the continue to bleed until October.

ULTIVATION IN EUROPE.—This species is a stove plant. It

[1] f. also some notes of Lombok in the Journal of the Indian Archipelago, etc., No. 3., p. 161.

[2] guson, l. c. p. 26.

grows well in good fibrous loam, leaf mould, and sand, mainly in the former. It is propagated by seeds only, which must be sown in strong bottom heat.

FUNGAL DISEASE OF THE PALMYRA PALM.—In 1906 the Imperial Mycologist, E. J. Butler, described a severe epidemic of disease in Palmyra and other palms in the Godavari District of the East Coast of India.[1] As a result of field and microscopic examination, the cause of the disease was stated to be a fungus belonging to the genus *Pythium*. Butler gave a description of it, under the name of *Pythium palmivorum*, in the "Memoirs of the Department of Agriculture in India" in February 1907.[2] A fuller account of the disease was published by the same author in September 1910, under the title, "The Bud-Rot of Palms in India."[3] It is from this paper that we borrow the following notes:—

The disease was practically confined to a comparatively limited area in the delta of the Godavari River. A few cases of the same disease were observed at Changarachery (Travancore) in 1907, where the fungus was found producing its characteristic spores in young leaf blades of Coconut trees in the unexpanded stage of the bud.[4]

The bud-rot is said to have first appeared in Addenkivarilanka, an island in the Gautami Godavari belonging to the Ramachendrapur Taluk, about 1890. From this it spread to both banks of the river and extended along the banks as well as inland. Judging from the extension that has occurred in the area as a whole, the rate of spread is estimated at a little over a mile a year It has, however, been ascertained that in certain places an extension of between 2 and 3 miles occurred. It must not supposed that the disease is uniformly distributed within area. Great difference may be observed in the severity of attack from village to village and even from field to field. seems that the nature of the soil exercises a direct influence

[1] E. J. Butler. Some Diseases of Palms. Agricultural Journal of India, V p. 299, Oct. 1906.

[2] E. J. Butler. An account of the Genus Pythium and some Chytridiaceæ. M of the Dep. Agricult. in India, Vol. I, No. 5 (1907) p. 82.

[3] E. J. Butler. The Bud-Rot of Palms in India. Mem. of the Dep. Agri India, Vol. III, No. 5 (1910) p. 221-280, 5 pl. and 1 map.

[4] E. J. Butler. Report on Cocoanut Palm Disease in Travancore. Bull. Ag Inst. Pusa, No. 9, March 1908.

the susceptibility of the palm to attack. Thus, whilst trees along water courses and in periodically flooded localities die more quickly and in larger proportion, little disease has been found in the light sandy soils of the sea-coast villages. The black soils appear to favour the disease most.

The way in which infection is spread from tree to tree is not yet fully understood. Butler has shown that direct application of the parasitic fungus to the crown of a healthy tree leads to infection of the latter. If this be the case, it is not difficult to account for the spread of the disease by considering the chief possible methods of propagation in similar cases, namely, through the air in certain favourable circumstances, by human agency, especially in cases where the diseased parts of the plant are habitually handled by persons who afterwards come into contact with susceptible portions of healthy trees, e. g., by those who cut the leaves or draw toddy, and finally by birds and insects conveying infectious matter on their bodies.

Of the four species of palm common in the Godavari Delta only three were attacked, the Palmyra (*Borassus flabellifer*), the Coconut (*Cocos nucifera*), and the Betelnut (*Areca catechu*), whilst the wild Date Palm (*Phœnix sylvestris*), so far as has been observed, remained immune. By far the greatest mortality was noticed amongst Palmyras; Coconuts have suffered much less, and Arecanuts are even less liable to attack than Coconuts. That the Coconuts suffer much less seems to depend in large measure on a natural resistance presented by this species to the parasite. No experiments have been carried out to investigate the susceptibility of the Areca to attack.

Though palms of all ages are liable to the disease, the majority of cases are mature trees. The intensity of the disease varies enormously in different places.

From experiments conducted by Butler we are allowed to conclude that the fungus is capable of killing moderately-sized palms in from 5-10 months from the date of the first attack. aking of death in this connection, we are to understand that od when the central shoot, formed of the innermost partly ıded leaves, withers and dies. The time which elapses ..een the death of the central shoot and the loss of all the es of the crown is much longer. It appears that three years ›re may pass before all the leaves have fallen.

With regard to the seasonal prevalence of the disease there are villages in the area mentioned which do not show any marked period of maximum intensity, whilst the deaths are more numerous in the villages of Amalapur Taluk in the period from August to February, than from March to July. "This is in close relation", says Butler, "with the relative humidity of the two periods, and applies equally well to the other affected taluks. There is a less close relation with the rainfall. In the monsoon, especially in its second half, the mortality appears to reach its maximum, but it is high also in the cold weather months of heavy dew and ground fogs, when there is usually little rain. A distinct diminution in the mortality is observable in a good many instances after the cessation of the monsoon, followed by the cold weather recrudescence. This is not general, since a few cases can be quoted where no diminution after the rains occurred."

In its earlier stages the disease is usually confined to the large fleshy leaf-sheaths which encircle the apex of the palm. As the outermost of these are exposed to light and air and are, consequently, brown and dry, and moreover partially hidden by the cut bases of older leaves, it is not possible to detect the spots on the outer sheaths in standing trees. In such cases the first indication visible is the withering of the central shoot or of one of the expanded leaves. In certain cases the parasite also occurs on the leaf-blades and even on the petioles, and sometimes the top of the stem is also affected. 'The spots on the leaf-sheaths vary much in size, from only just visible to six inches or more across. In the inner sheaths they are white at first, becoming brown or reddish later on. On the outer sheaths they may eventually be black. A very early result of the attack is the collapse of affected cells, which leads to the spots being sunk below the level of the surface of the rest of the sheath. The margin of the depression is usually bounded by a raised rim. The early spots are dry and hard and may either be quite free from any external parasitic growth covered with a white mycelial web. Later on, particularly the soft heart of the bud, the diseased areas are invade numbers of saprophytic organisms, bacteria, moulds and i.. larvæ, and the whole is converted into a foul-smelling, rc mass. On the leaf-blades the spots are usually smaller th·

the sheaths, not often exceeding an inch in diameter on individual segments. They are straw-coloured in the centre and bounded by a broad dark-brown margin."

The body of the fungus consists of hyphæ forming a mycelium, which may be entirely buried in the palm tissue or may be partly superficial, where it frequently develops a thick white felt over the disease-spots. The hyphæ measure on an average 5-8 μ. They are unseptate except in rare cases, especially near where the organs of reproduction are formed. Within the tissues they occur in the intercellular spaces or between adjacent cells and derive their food from the living cells by means of haustoria. The parasite is found in all parts of the leaf, excepting the bundles and bands of sclerenchyma. The reproductive organs arise from the superficial hyphæ. They are of two types, sporangia and resting conidia.

The sporangia are formed terminally on the main branches of the mycelium or on short or long stalks borne laterally on these. They vary much in size and shape. On an average they measure 50 by 35 μ, extremes 38-70 by 33-42. Poor cultures show even smaller ones. The shape is typically pyriform. The narrow end of the ripe sporangium is papillate. There are four types of germination, which must be considered as modifications of the one process: (1) The apex of the papilla swells up into a very thin gelatinous vesicle. The protoplasm of the sporangium passes into the vesicle in a uniform granular mass, and forms a number of zoospores by segmentation. The wall of the vesicle ruptures and the ciliated spores escape. (2) Segmentation into zoospores occurs within the sporangium. No vesicle is formed, but the papilla dissolves, or if a vesicle is formed, it ruptures almost immediately. When an opening is formed, the protoplasm escapes and breaks up at once into free zoospores. Intermediate types between this and the foregoing are met with. (3) The zoospores ripen within the sporangium but, on the opening of the papilla, are not able, from one cause or another, to escape. They come to rest after a variable period of movement, round off, become clothed with a wall, begin to germinate and pierce the wall of the sporangium. (4) No zoospores are formed. The sporangium germinates by putting out one or several germ-tubes.

The zoospores measure from 8-10 μ after they come to rest

and assume a spherical shape. They germinate rapidly by one or sometimes two germ-tubes.

The second mode of reproduction is by resting conidia. These are spherical, thick-walled, and often yellowish when old. They are formed singly at the ends of usually large hyphæ. Intercalary ones are rare. They measure 25-40 μ. in diameter, the wall being up to 4 μ. thick. The stalk-hypha shows great variety as regards size, shape, and septation. Germination takes place by a germ-tube which, after a short growth, bears terminal sporangia.

Whilst sporangia are usually found on the attached plants only during the periods of considerable rainfall or heavy dews, the resting conidia are less common in the rainy season, but very common in the hot dry months. No trace of true zoospores has been discovered.

Butler is inclined to believe that the parasite can pass into a dormant condition actually within the bud of the palm and can recommence activity at a later date, progressing until the growing point falls a prey to the attack and death follows.

There are two ways of fighting the disease. The formation of spores may be checked by cutting off the bud from the stem as soon as the first leaf turns white. Infection of healthy trees can be guarded against by brushing or spraying the outside of the bud below the expanded leaves with a fungicide.

The following suggestions were made for an organized campaign against the disease by Butler in 1906:—

"A special staff is required, for it is certain that, at first at least, the villagers will be slow to take measures for their own protection. If, however, the results bear out the value of the work, real co-operation may be expected before long. A number of expert palm climbers (such as toddy drawers) should be selected, under the charge of an agricultural inspector or some similar official, and provided with small axes or saws. They should be instructed to climb all diseased trees, both those in the early stages and those already dead, and to cut off the green tops below the swelling of the leaf sheaths. It is particularly essential that all trees in the early stages should be dealt with, and these can be recognized, where the villagers themselves are unable to do so, by the whitening of one of the leaves towards the centre of the head. After cutting off the

heads, the whole of the tops should be collected into a heap in each village and burned. In this way every dead or attacked palm in a selected area would have its power of spreading infection destroyed by burning the diseased parts, and this measure alone, if steadily pursued, is certain to give good results. The infectious matter is confined to the head of the palm and, as the tree is doomed once the disease appears and will yield no further profit, its removal costs little but the actual expense of labour in cutting it down and burning it. To save healthy trees within the affected districts, in places where they are surrounded by large numbers of dead or dying trees, is difficult unless the above measures are very thoroughly carried out. But the chances of their infection may be very largely diminished if they are brushed with Bordeaux mixture on the leaf sheaths when the removal of diseased trees commences. Bordeaux mixture is a substance which adheres strongly to the surfaces of plants and, being poisonous to fungus spores, it prevents their germination or kills the young germ filaments as soon as they appear. A second gang of toddy drawers should be employed for this work and provided with small vessels containing the mixture and mops of rags for brushing it on to the sheaths. The expanded leaves need not be brushed, but only the leaf sheaths below these. The men employed for removing diseased trees should not be allowed to climb healthy ones, as there is some danger of their conveying the infection on their persons or axes. To prepare 50 gallons of the mixture, weigh out 6 lb. copper sulphate, break to powder and dissolve in 25 gallons of cold water by suspending in a piece of gunny sacking in the water. The latter must not be contained in a metal vessel but in a barrel or big earthenware pot. In another vessel weigh out 4 lb. of fresh quicklime. Slake this gradually till it falls to powder and then add water up to 25 gallons. Allow it to cool. When cool, add to the copper sulphate solution through a sieve so as to retain any lumps. A thick bluish liquid results, which on standing throws down a bluish precipitate, leaving the other part of the liquid clear. To test if fit for use, add a few drops of Ferrocyanide of Potassium to a small quantity of the clear liquid in a dish. If a brownish precipitate appears, more lime must be added till no precipitate is given on testing. Or a clean steel knife may be dipped in

it, and if more lime is necessary, a deposit of copper will form on the knife. If none is found, it is ready for use. Stir well before using."

Since the time these suggestions were made, a large campaign against the disease has been in continuous operation in the Godavari Delta and since January 1910 it is believed that, in spite of many and great difficulties, every part of the infected area is being systematically dealt with. There is no doubt that there has been no slight diminution in the disease within the area of the operations.

THE PALMYRA PALM IN THE TAMIL LANGUAGE.—Ferguson has collected a number of proverbial sayings and illustrations from a volume of Tamil proverbs, published by P. Percival. Many of them are so characteristic of Native life in India and interesting in themselves that we consider it worth while to reproduce the whole.

Fibre used as toothpick (a hit at a spendthrift): "He whose father possesses a thousand Palmyra trees has not a fibre to pick his teeth."

Sharpness of the petiole: "What he saw was a snake, but what bit him was the stalk of a Palmyra leaf."

Leaves young and old illustrative of heirship and succession: "It is said that the young leaves of the Palmyra tree laughed because the dry leaves fell off."

Tenacity with which fruit clings to the tree: "Will the Palmyra fruit fall because a crow alights on the tree?"

Size and weight of the fruit: "Can Palmyra fruit be suspended from the neck of a little bird?"

Tenderness of the germ (taking unnecessary trouble): "Why use a mallet and wedge for splitting the newly germinated root of the Palmyra, that may be split by the hand?"

Height of absurdity: "As the scorpion stung the Coconut tree, the Palmyra swelled in consequence."

Felled timber, removal of obstacles: "As an ass perambulated the place where Palmyra-timber has been felled."

Falling from a Palmyra tree, injuring a fallen man: "A snake bit him who had fallen from a Palmyra tree."

'Yorkshire, though in London': "The fox of the Palmyra tree is said to have deceived the fox of the city."

Avoid even the appearance of evil, toddy-drinking discredit-

able: "If you drink under a Palmyra tree, it will be regarded as toddy."

Palmyra tree insufficient for shade: "Is the shadow of the Palmyra tree a shade, or is the friendship of the malignant friendship?"

Rustling of leaves, effects of long experience: "Will the fox of the Palmyra grove be frightened by the rustling of leaves?"

'Tell that to the marines': "As one ascended a Palmyra-tree, and descended without touching the blossom."

The habit of drinking toddy cannot be concealed: "He who drinks milk will belch milk and he who drinks toddy will belch toddy."

Eating a Palmyra-tree, effects of perseverance: "By eating slowly, even a Palmyra-tree may be eaten."

How the fruit falls: "The fruit of the tree will fall at its foot."

Young trees (to save your property you must take care of it): "Preserve young Palmyras by cutting, and buffaloes by tying."

Turning the tree to a bad use: "Is it to drink toddy you have reared the Palmyra-tree?"

Witchcraft and basket-making easy arts: "Witchcraft is the easiest of all arts, and the common ola basket is the easiest of all plaits."

THE "TALA VILASAM"

There are many descriptions of the Palmyra Palm and its uses written in the various European languages, and nearly all of them mention a Tamil poem, entitled "Tala Vilasam," which is said to enumerate no fewer than 801 different purposes to which the Palmyra may be applied; and, if the writer is possessed of a good imagination, he invariably adds that the poem in question by no means exhausts the catalogue.

I searched a long time for that poem, of which nothing but the title seemed to be known, and when I found it at last, I was astonished that I had not discovered it sooner. William Ferguson had given a first translation of it about sixty years ago in the appendix to his interesting little volume on the Palmyra Palm of Ceylon.

The poem was written by "Arunachalam, a Poet of Terrukkudantei, the same with Combaconam in the Province of Tanjore."

As the poem is a truly Oriental production with the merits and defects of eastern conception, we trust that our readers will not object to our reproducing the poem *in extenso,* though it may contain a good many repetitions of what has been said above. The fact that it has been translated by a Tamil Native accounts sufficiently for the peculiarities of the English style and wording. As we have not been able to procure a copy of the original, we prefer to give it as it stands.

Tala Vilasam—On the Palmyra tree.

Invocation of Ganesa.

'I invoke Ganesa to help in my composition of the work on the Palmyra tree, in the species of poetry called Kali Venpa, and in presenting the same to the people on the sea-girt earth.

'O thou Lady, resembling Laksimy who is seated on the beautiful lotus! Thou of sweet expressions whose breasts are under stays, and whose person resembles a peacock! Hear me tell you in brief an account of one out of the eight hundred items of things connected with the Palmyra tree, which is emphatically the Kalpa-tree of the earth.

'The various productions of earth created by Brahma came short of men's wants; and there was wanting one substance which had an entire power of assuaging hunger, removing disease, feeding the illiterate and enriching the house; and therefore the people of the earth were as unfixed (in all their worldly prospects) as the water on the leaf of a lotus, made poojas and prayed to Sivan for assistance. Sivan heard their prayers and asked of Vishnu with displeasure the reason of his not having daily attended to his duty of preservation. To which Vishnu, in great obeisance, with one arm folded and the fingers of the other put upon his under-lip replied: 'There is no fault in my course of duty, but the present amount of things created on the earth by Brahma is insufficient.' Upon which, Sivan, in great displeasure and anger, looked at Brahma and asked of him the reason of his not having created things to satisfy all the wants of the people of the earth. Brahma trembled and perspired (from fear) and putting his fingers under his under-lip (as a sign of great respect to a superior)

and in faltering language, replied: "My Lord, who is the operative cause and immaculate! What I have already created is all that I knew." Parvathi (Sivan's consort) then said to Sivan, "There is fault neither in Vishnu nor in Brahma," and thus appeased his anger. Sivan, upon this, after meditating in his own mind, said to Brahma: "Hear me tell you something to supply the wants of the people of the earth. Create the Kalpa-tree upon the earth also." At the direction of the crescent-moon-adorned Sivan, Brahma created in abundance Palmyra-trees in the three countries of Panathar, Panyoor and Panangasdoor, and called Palmyra-trees by the names of Pootpady, Ponthy, Panny, and Talam. Let me now tell you the various produce and uses of the Palmyra, much extolled by the people of the earth.

'If you carefully turn up the ground by hoeing, hedge it, and bury Palmyra-stones in rows at the distance of eight spans one stone from the other, they will return favour, and will never fail, just as the renown of the wise of spiritual blessing will not. When the stones sprout and become tender plants, if you take good care of them not to let the goat, sheep, cow and wild cow feed upon the plants, they will grow in strength, and with the swords of their stems, armed with indented jags on both their sides, they will destroy the iron age of poverty and protect the earth. When the Palmyra tree grows to the height of two bones length, the roots of the stem that fastened the tree will get dry and fall off in season. A female child and a Palmyra tree, if carefully nurtured, will become fruitful in their tenth year. The principle of the blossom (of the Palmyra tree) develops during the months of November and December; the blossom shoots forth as hoarded treasure for the time of exigency in the months of January and February; and then the tender fruits are formed; and of these tender fruits some do fall from the trees out of season. People collect and cut them to pieces, and give them to the cows to eat. Sins may thus be removed, and the cows will give plenty of milk. When the tender fruits of the tree have become larger, they are some of them separated from the trees, the integuments and the adjacent parts are pared off, and the pulpy kernel within is drunk by the people. The drink will remove various diseases, *simulque supprimet vires gonorrheæ.* Had the celestials and the anti-celestials ever tasted of the

pulpy kernel, they would never have gone to churn the milky ocean. When the fruits approach towards ripening, they are some of them separated out of the trees, and laid in the sun for a while; the pulp is then pared and boiled in coconut milk mixed with the husked seeds of pulse, and is then eaten. When the fruits have become well ripened, they fall from the trees, give an agreeable odour; the integument is severed, the fruit is then roasted in fire, washed in pure water and the skin is peeled off. Press the fruits with the hands and swallow the pulp of it; even honey, milk and sugar will not resemble the pulp in sweetness: the fruits may also be sprinkled with reserved Palmyra pulp-water and then be used. Also the pulp is expressed, mixed with rice flour, boiled in oil or ghee, and then used as sweet cakes. The pandal is made in a suitable place, and a certain spot near the pandal is nicely daubed with cow-dung. Poojah is offered to Ganesa, his aid is implored, and then the ripe fruits are washed in water, broken by beating with a wooden mallet, and the skin is peeled off; the fruits are then put in kadaca-baskets, reserved Palmyra pulp-water is poured in, well pressed with the hands; the stones are carefully expressed, and put in another kadaca-basket and undergo a similar process a second time; the stones are then thrown out in a heap; the fibres of the fruits that lie blended with the expressed pulp are carefully separated by a brush, made of the twigs of certain shrubs; the pulp is then poured upon a mat about twelve cubits long which is spread on a pandal; well spread over the surface of the mat, and left to dry in the sun during the daytime; in the evening the mat is folded, in the following morning it is unfolded. The above-mentioned process is continued for about eight days, and when the pulp has become well dried and an inch deep, salt and pieces of perandi shrub are sprinkled over, lines are drawn with a weed hook (or sickle), or a like instrument at the distance of a span from one another, the dry pulp is pared off from the mat, and then left to dry for a day more in the sun; the square pieces of dried pulp are then folded, put in a kooday-basket and laid over a paran-shelf, to be smoked and to serve for future use.

'Hear me, O Lady, the process of dried pulp which a rich man would use. In the pulp expressed from good edible Palmyra fruits, powder of Palmyra-jaggery and ghee are put,

and the pulp is then as before spread over the mat, and when the dried pulp gets half an inch deep, it is as before pared off and reserved for time of want. Another process of preserving dried Palmyra-pulp is the following: the dried Palmyra-pulp is cut into small pieces and steeped in Palmyra molasses, mixed with roasted powder of pepper, sesamum seeds, rice, and cummin; preserved in an earthen pot, the mouth of the pot is well luted, and then these sweet cakes are used by the country people in their feasts. Hear me again: the pulp that is expressed out of the Palmyra fruits that fall scantily in the latter part of the fruit season, is spread over the mat for two days and left to dry very well; the dried pulp is then peeled off into sheets. An offering of cakes made of the flower of the edible Palmyra roots and of dried Palmyra pulp, together with other fruits, is made in Palmyra plantations to Ganesa. The dried Palmyra pulp that was preserved is protected without contracting grubs that may spoil it, if the owners are devoted to Ganesa during the time. The dried Palmyra pulp that is thus preserved may better serve the people as food during the rainy season. Griping of the bowels, diarrhœa and lodging of small fish bones in the œsophagus may be removed by eating dried Palmyra pulp. The stones of the Palmyra fruits that are eaten, and of those that are expressed, are divided into four sorts, put in the ground into beds of 4, 5, 6 or 8 layers, covered with earth, watered twice during the months of August and September and the edible Palmyra roots are dug out in the months of January and February. When there is no rain the skin of the root is peeled off, its head is pared away, the root is cloven into halves, its foot is nipped out, left to dry in the sun, the foot is nipped off in the second and third also, the halves are carefully stirred up to dry well, and then collected and preserved. Such dried edible Palmyra roots are powdered and sifted, salt-water is sprinkled upon the flour, fish, herbs, and other fruits are added to it and mixed together; the paste is then put into a conical ola-basket and steamed; the poor people eat much of it and get strength.

'If the flour of the dried edible Palmyra root (Odial) be mixed with coconut milk, salt-water and fish, and if the paste be steamed, the cake when eaten will daily add strength to anybody. The middle pieces of the Odial are cleared of their

outer fibrous skin, soaked in water, then dried and powdered; if the flour be mixed with the coconut milk, salt-water, fish and herbs, and if the paste be steamed and then ghee be added to it, the cake will indeed be very sweet; if certain fruits and pungent substances be added to the above, the cake will be of an agreeable taste. If the Odial flour be mixed with the scrapings of the kernel of the coconut, and powdered rice, cummin, pepper and chilly; if the paste be steamed and the cake be broken and dried, it can be preserved for two months. No other cakes will resemble the above. Sweets are more agreeable to cakes of the above description. If curds, milk, ghee, and coconut milk be added to the paste of the Odial flour, and be steamed, the cake, when used, has the power of *retinendi seminis virilis in corpore sine pollutione, conferendique facultatem horas in thalamo jugali protrahere,* and increasing muscular strength; the person will not be reduced by labour.

'I shall now tell you, Lady, of the different kinds of gruel made of the Odial flour; in the boiling water in which fish, chillies, lobsters, acid, grits of rice, have previously been put, add in proportion, by little quantities, the Odial flour; stir it, and when it gets boiled and reaches a proper consistency, take the vessel out of the hearth and use it; if certain healthful (i. e., that contribute to the improvement of one's health) fruits be added to the above anybody may use it. If in water, salt and grits of rice and small fish be put first, and when they get boiled, if Odial flour, mixed with acid and powdered chillies, be poured in and properly stirred, the gruel infused will be a very healthful one; if herbs and certain fruits be added to the above, the gruel will be a very good one. The people, when they dig the edible Palmyra roots, take some of them and roast in the fire, remove the outer covering and then eat the roots by mastication. If the roasted roots be exposed to the dew and be eaten on the following morning, it will be very nice indeed. The edible Palmyra roots are boiled by steam in water and eaten; also such boiled roots are like the Odial mentioned before, dried in the sun and preserved for future use. The accompaniments that are to be taken with roasted and boiled edible Palmyra roots, are coconut, salt, and pungent substances.

'People may eat the sprout that just shoots forth out of the Palmyra stone; the stone, in a certain stage, may be roasted in

the fire, then be broken and the kernel be eaten. There is no comparison to the curry or broth made of very tender edible Palmyra roots and coconut milk. The kernel that is formed in the Palmyra stone in its advanced stage will be very sweet.

'Hear me now tell you the use of the Palmyra stone shell. It will ever serve as fuel for cooking; if the shell be partially burned and the inner coat of the shell be removed, it will serve as coals to smiths; it will also serve as a powder box, tinder box and a pill-vial.

"When the Palmyra tree puts forth blossom, it is rendered fit for yielding the juice by pressing it between two poles, and by beating it with the handle of a knife; its end is properly incised, a vessel is adjusted to it, and toddy is collected; if the toddy be presented in Poojah to Sacti, excellent boons may be obtained. Toddy if drunk, *excitabit amorem et cupidinem in illis, qui in rem uxoriam incumbent.* If taken daily, it will increase one's muscular strength and give a gloss to his person; if used by children in small quantity it will remove itch and many other diseases. If powdered loadstone and scoria of iron and file be put into the pot that is attached to the incised blossom, and the toddy collected in such a pot be drunk for seven days in the morning, asthmatic affections, bloated cheeks and the like may at once be removed. If, in the morning and evening, the pot that should be attached to the blossom be baked in fire, *qui succum in hac olla collectum bibet diutius in copulatione morabitur.* If shell-lime be put in the pot that should be attached to the blossom, and the toddy be used, hunger, thirst, languor and laziness will be removed, heat in the constitution will be destroyed and coolness be created. Toddy will be very sweet if powdered pepper be put in it and boiled. If toddy be boiled nicely, and if slices of ash-coloured pumpkin be boiled in it, the broth, when it is seasoned and used, will create a wonderful power to the stomach to digest any amount of food. If, when the south-wind blows, toddy be collected, strained and poured in a pot, and be boiled until it gets the consistency and colour of Margosa-oil, then be poured either in a new pot or a vessel of Palmyra leaf, the mouth well covered, and the vessel be then exposed to smoke or buried in the earth, the Palmyra molasses will be candied (*i. e.,* crystallized); these crystals, if taken into the mouth, will suppress asthma and phlegm.

"If the boiled toddy in the above process be still boiled until it sticks a little to the bottom of the vessel and bubbles are formed, you can have Palmyra sugar.

"If toddy be so boiled that, if it be taken in a ladle, it will not be drawn into threads, but will break, take it out of the fire, put a little quantity of rice flour and mix it well with the molasses, and pour the molasses in pots and little ola cases, you will have Palmyra jaggery.

"If, in the above said stage of consistency, powdered cummin, pepper and sesamum seeds, all well roasted, be put in the molasses, and if you steadily continue mixing and agitating the molasses, you will have a powder, which may be used to assuage thirst; such a powder, if it be of the toddy of a male Palmyra tree, may be taken as medical accompaniment; may also be given to motherless babes. If the proper consistency be not pitched, it will get as hard as sugar-candy.

"When toddy ceases to be drawn by the close of March, there will be fruits during the following five months, and during the remaining months there will be dried Palmyra pulp. So, the produce of the Palmyra tree is had in every month of the year. The Palmyra tree is able to bestow bountifully, and one may eat of its produce in the three seasons of meal every day. The mind will ever love it more than any other thing. If a person only with gratitude to the tree eat of its produce twice or more a day, he will have all the benefits of those that spend the day in fasting and devotion and eat only once a day.

"Old Palmyra branches are cut out of the tree every other year, left to dry in the sun a day, made flat by pressing them in a certain manner, and then used for covering and fencing. When the olas get mouldered, they are used for manuring rice-fields, etc. The inner fibrous bark of the Palmyra stem is used in making cords and ropes, etc., but the outer bark is not so strong as the inner. The Palmyra stem is used in making cots, hedging, and covering an ola book. The white tender Palmyra leaves are used for making baskets of several kinds, as for storing paddy, for keeping cloths, betels and arecanuts, sacred ashes and other things, for measuring grain, oil and the like, for making cases of several species, for drawing water, and for making mats of different kinds. The ribs of the Palmyra olas are used for making cords and ropes, winnowing

baskets, and brooms, etc. The tender Palmyra leaves are used for making umbrellas, fans, dolls, vessels to eat from, and rolls for the perforated ears.

"The olas are used in writing the Vedas, Shasters, and Agamas, in making deeds, conveyances, dowries and other presents, in writing interest bonds, in drawing magic diagrams, in writing letters to friends at a distance, in keeping accounts.

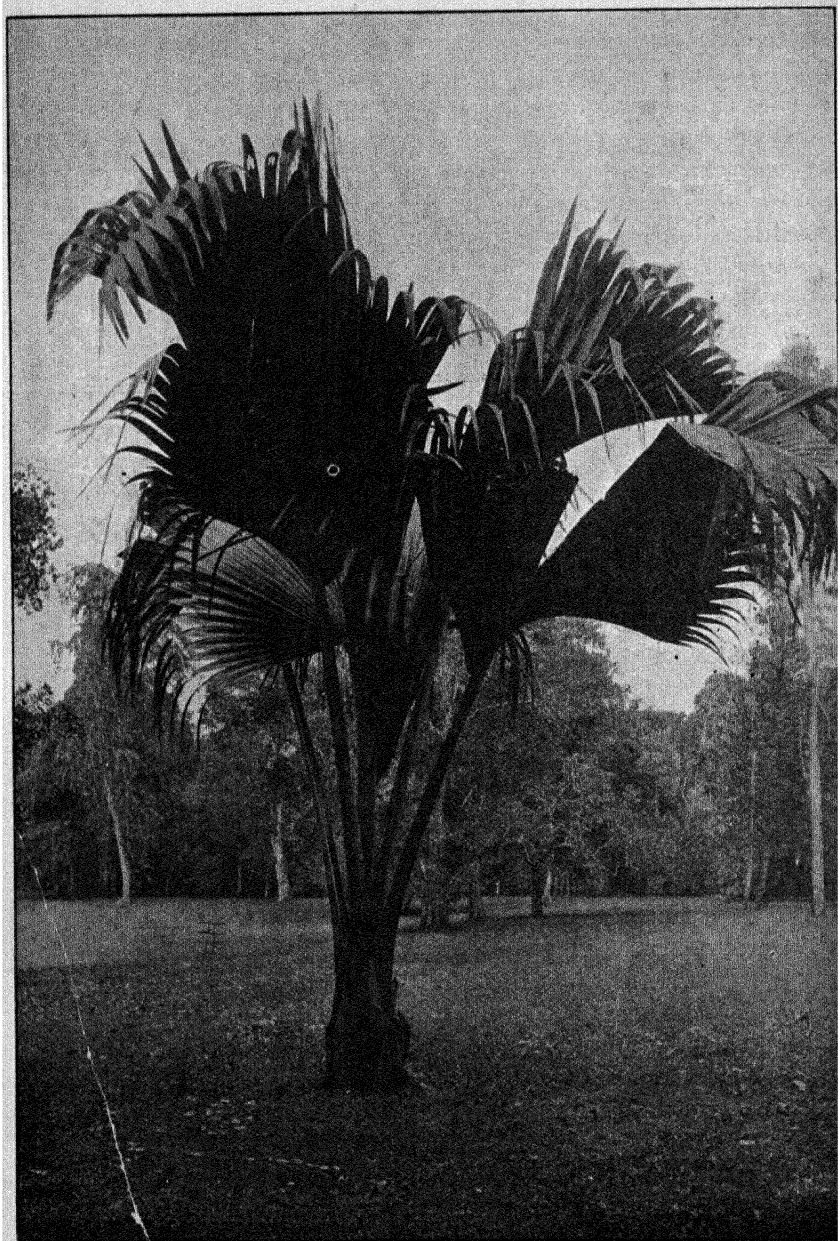
"The names of Palmyra trees are numberless, such as the white, the tall, the short, the black-fruited, etc. The roots of Palmyra branches that attach themselves to the tree, and the webs that lie interwoven between them, fall off in season, and may be used as fuel. If the several ingredients of the male Palmyra tree be all collected, rubbed into a paste and mixed with cow-milk, *et si aliquis, qui vult cum fœmina rem habere, hoc bibet, ille tempus copulationis potrahere poterit.* The tender pith of the Palmyra tree that lies in the top part of the tree is eaten by the people.

"The timber of the tree is used for building temples, palaces, houses, alms-houses and inns; also as wall-plates, beams, posts, door-frames, pegs, laths and the like. The stump of the tree may be made hollow and used for keeping salt. The produce of the tree may procure to some fields, houses, and jewels. Peace of mind may be secured; one may live in prosperity and great renown. The Palmyra stone, though boiled or roasted in fire, will still sprout; it is, therefore, of a superior quality.

"The Pandava kings have regained their lost kingdom, because they have eaten Palmyra fruits when in the wilderness. The Pandya king and others are said as having worn garlands of Palmyra blossoms."

ILLUSTRATIONS.—Plate XXXVIII shows one of the numerous groves of Palmyra Palms in the northern part of Ceylon. In the country round Jaffna the Palmyra is at once the most conspicuous and the most beautiful feature of the landscape. The mature forest reaches a height of one hundred or more feet.

The photograph reproduced on plate XXXIX, which was kindly supplied by Mr. Phipson, shows a group of palms from the Victoria Gardens in Bombay. The leaves of the regular spherical crown of the Palmyra Palm seem to arise from a huge cluster of fruits. At the foot of the Palmyra there is a young specimen of the same species, and to the right of it a Fishtail Palm



A Young Double Coconut Palm (*Lodoicea Seychellarum* Labill.)
in the Botanical Garden of Peradeniya.

(*Caryota urens*) has developed three large bunches of flowers and fruits, of which, however, only one is distinctly visible.

4. *LODOICEA* LABILL. ANN. MUS PARIS IX, 140, t. 13.[1]

(*Lodoicea* is said to be altered from *Laodicea,* so called after Laodice, the daughter of Priam.)

Willd. Sp. Pl. 402.—Kunth Enum. Pl. III, 225.—Mart. Hist. Nat. Palm. III, 221, t. 109, 122.—Baker Fl. Maurit. 379.—Benth. et Hook. Gen. Pl. III, II. 939, 117.—Lurs. Bot. II, 338.

A tall dicœcious palm. Flowers in axillary spadices, surrounded at the base by several obliquely truncate spathes. Male: spikes cylindrical; the flowers in subreniform clusters in hollows of the axis, imbricated in two rows, each flower subtended by a bracteole. Outer segments of the perianth spatulate-cucullate; inner obcuneate. Stamens about 36; filaments monadelphous; anthers linear; rudimentary pistil represented by 1-3 subulate processes. Female: flowers fewer than in the male spikes, contained in cups formed by a pair of bracteoles; ovary ovoid, 3- rarely 2-or 4-celled; stigmas sessile; stamens represented by minute staminodes.

Fruit a drupe, large, olive-green; usually 1-seeded; mesocarp thick, fibrous; pyrene large, bony, firmly attached to the mesocarp, usually 2-lobed; albumen homogeneous, cartilaginous; embryo placed between the lobes.

SPECIES—1.

DISTRIBUTION.—Seychelles.

Lodoicea Seychellarum Labill. in Ann. Mus. Paris IX, 140 t. 13; Spreng. Syst. Veg. II, 622; W. J. Hooker in Curtis Bot. Mag. 2734-38; Mart. Hist. Nat. Palm. III, 221, t. 109, 122, t. X, fig. II et t. Z. V. fig. VIII; Brandis For. Fl. 545; Baker Fl. Maurit. & Seych. 380.—*Cocos maldivica* Gmel. Syst. Nat. II, 69; Willd. Spec. Pl. IV, 402, n. 6.—*Borassus sonnerati* Giseke Prael. Ord. Nat. 88.—*Lodoicea callipyge* sive *Cocos maritima* Commers. Ms. et Palmarium volum. II t. 1-15.—*Lodoicea maldivica* Pers. Enchir. II, 630.—*Nux medica* Clusius Exotic. libri decem (1563).

NAMES.—Tavacarre, Coquinko (Seychelles).

Double Coconut Palm, Sea Coconut Palm, Coconut of the Maldives (English).

[1] "Giseke (Prael. 1792, p. 88) correctly divined its affinities, naming it *Borassus Sonnerati.* Labillardière created for it the genus *Lodoicea.* But this, though maintained, is only distinguished technically from *Borassus* by the numerous stamens and large fruit."—W. T. Thiselton-Dyer.

Coco de mer, Coco de Salomon, Double Coco, Cul de Négresse, Coco des Séychelles, Coco de l'île Praslin, Cocotier des îles Séchelles, Cocotier des Maldives, Cocotier des Séychelles, Lodoice des Maldives, Lodoicée, Lodoicée des Séchelles (French).

Coco das Maldivas, Coco do Mar (Portug.).

Meercocos, Seecocos, Doppelte Cocosnuss, Wundernuss Salomons, Maldivische Nuss, Kokosartige Lodoicee (Germ.).

Dubbele Cocosnoot van de Seychelles, Dubbele Klapper, Maledivische Noot, Seychellennoot, Zeeklapper (Dutch).

Darya-ka-naryal (Hind.).

Darya-ka-narel (Decc.).

Jahari-naral (Bomb.).

Kadat-rengay (Tam.).

Samudrapu-tenkaya (Tel.).

Katal-tenna (Malay.).

Darya-nu-nariyal (Guz.).

Mudu-pol (Sing.).

Penle-on-si (Burm.).

Narjile-bahri (Arab.).

Nargile-bahri (Pers.)

Calappa Laut (called so by the Dutch in the Indian Archipelago).

Djenggi, Djenggli, Kelapa Laut, Kepo djenggi, Pelok djenggi (Java).

DESCRIPTION.—Trunk 60-100 feet high, straight, apparently destitute of bark, annulate, about 1 foot in diameter, with scarcely any difference in size to the very top. Leaves 12-20, large, 8-10 feet long, 5-6 feet broad (sometimes up to 20 feet long and 12 broad), the youngest rising from the centre, at first folded like a shut fan, and then clothed with a downy substance, later on broadly-ovate with a central rib and regular folds diverging from it; margins more or less deeply cut, especially at the extremity; the colour bright yellow green; texture thin and dry.

Spathes sheathing at the base of the spadices, small. Male and female flowers on different trees. Male spadix from the axils of the leaves, amentaceous, from 2-4 feet long, 3-4 inches in diameter in the thickest part, cylindrical, tapering towards the apex, closely covered on all sides with densely imbricated, semicircular, slightly convex scales. When looking externally at these scales, a small aperture will be perceived, from which



A Double Coconut Palm (*Lodoicea Seychellarum* Labill.)
in the Jungle of Praslin Island.

the stamens issue; and this aperture, though near the base, is not in the centre of each scale, but constantly on one and the same side; and as the scale laps over with that side the one next above it, so the aperture and the stamens will be found to pass through both. The flowers in subreniform clusters in hollows of the axis, imbricated in two rows. Sepals and petals oblong, yellowish-brown; the sepals rather larger and more angular than the inner. Filaments united at the base into one body; anthers linear, 2-celled, opening longitudinally, each cell terminating in two globular heads. Female spadix rising from the axils of the leaves, pendent, 2-4 feet long, thick and woolly, tortuose, clothed with large sheathing, red-brown scales, which are singularly fimbriated, or more generally erose at the margin, and support several, more or less distantly placed, female flowers of different ages, at the same time, and of various sizes. Sepals and petals almost hemispherical and 1 inch thick at the base; ovary almost concealed by the perianth, broadly ovate, narrow at the base above the insertion of the perianth.

As we had no opportunity of dissecting the fruit of this palm we borrow the following notes from the interesting paper on the "Germination of the Double Coconut" by W. T. Thiselton-Dyer.[1]

"It is not a little remarkable," he says, "that our detailed knowledge of the morphology of a plant with so singular a history and such striking characteristics should still be very imperfect. But that this is the case is evident from the description given by Bentham and Hooker in the 'Genera Plantarum,' III, 939. . . .

"As long as the Coco-de-mer was only known from sea-borne specimens it was of course assumed that the Double Coconut, as it was called, was the entire fruit. As soon as the palm producing it was discovered, it was at once obvious that this was not the case. The Coco-de-mer is in fact the stone of a gigantic drupe with a fibrous mesocarp. The complete fruit is rarely to be seen in museums[2]; but Kew possesses one, as well as a plaster model which the late General Gordon had made in the Seychelles and presented to it. The fruit is poorly figured

[1] Annals of Botany, Vol. XXIV, No. XCIII, January 1910.

[2] There is a good specimen in the Museum of St. Xavier's College, Bombay.

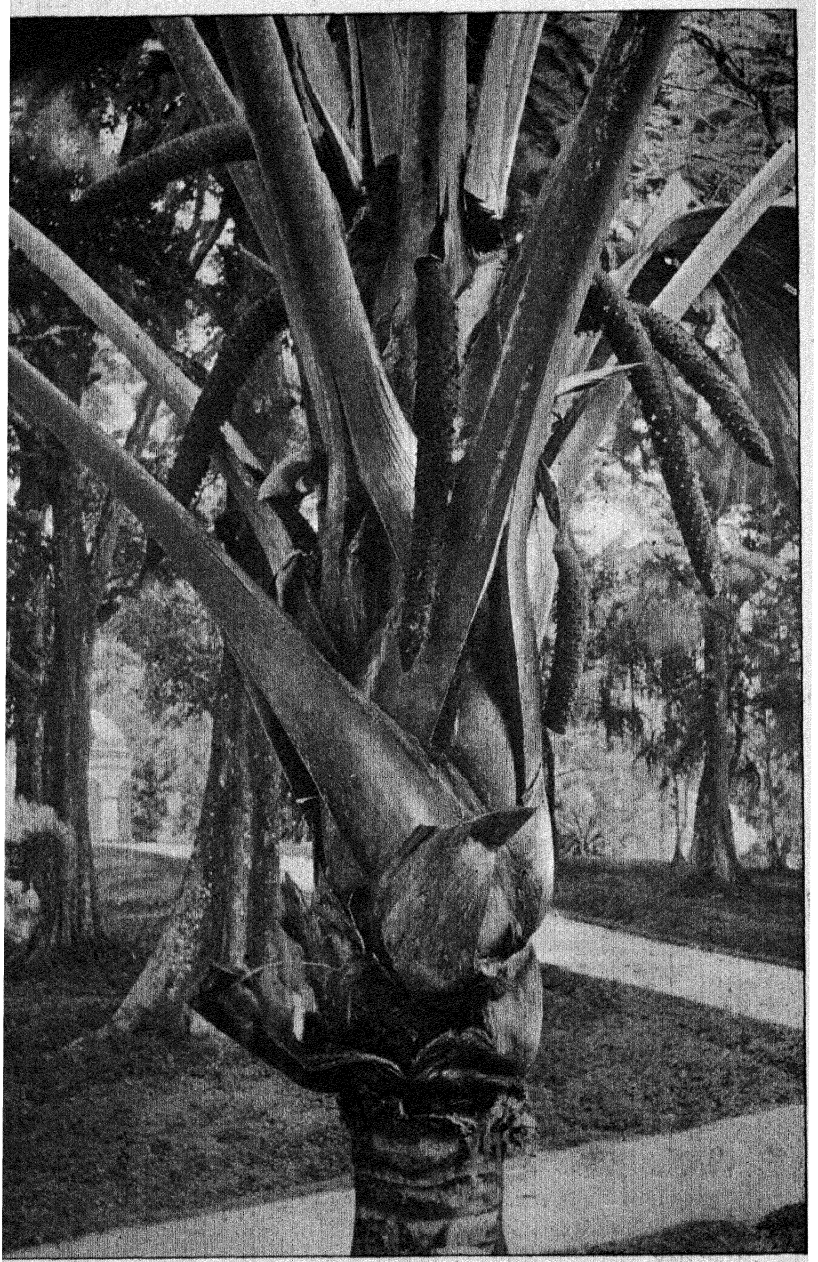
by Sonnerat, but the best representations are in the fine series of pictures (Nos. 474-7 and 479) in the North Gallery at Kew, by Miss North, who visited the Seychelles in 1883 for the purpose of painting. According to Sir William Hooker, it is 'often a foot and a half in length, weighing twenty or twenty-five pounds.'

"Sonnerat figures the drupe as ellipsoidal. This, if it ever occurs, except in the youngest stage, must be exceptional. The 'Genera Plantarum', no doubt correctly, describes it as 'oblique obovoideus.' Miss North, quoted by Sir Henry Yule (Hobson-Jobson, p. 178) says: 'The outer husk is shaped like a mango.' It is clearly therefore usually unsymmetrical; one side is somewhat flattened, and the other rounded. This arises from the fact that in the maturing ovary one carpel only usually develops.

"One point which seems to require further investigation is the number of primary component carpels, or, at any rate, of cells in the ovary. The 'Genera Plantarum' says it is '3—rarius 2-4—loculare.' The whole symmetry of the flower is ternary, with three stigmas in the female. This would imply three component carpels, and therefore a three-celled ovary. It is possible, though the point requires further investigation, that the discrepancy has been produced by the misinterpretation of sections containing the bilobed seed. Sir William Hooker figures in the 'Botanical Magazine' (tab. 2737, fig. 1) a transverse section of an ovary which clearly points to a normal tricarpellary structure.

"The stone or nut, as it is sometimes called, is, as is well-known, deeply bilobed.....The outline of the putamen in a longitudinal section is roughly that of an exaggerated dumb-bell. The cavities of the two lobes communicate in the middle. The upper parts of the lobes are separated by an open sinus, but the lower are more or less united, and if a cross-section be made at this point, the nut would show, as in one of Sonnerat's figures, a bilocular structure.

"Another point which has not been ascertained is the number of ovules in each ovarian cell. Analogy and such evidence as is valuable suggest there being only one. The 'nut', therefore, if developed from one carpel, would be only one-seeded. W. B. Hemsley, in the 'Catalogue to the North Gallery' (p. 74), refers to 'the two-lobed nut, which usually contains only one seed.'



A Male Double Coconut Palm (*Lodoicea Seychellarum* Labill.) in flower in the Botanic Garden of Peradeniya.

But I am not aware of any proof of its ever containing more. It seems probable that the bilobed form of the nut has suggested that it might consist of two coalescing carpels, but there is no evidence of this.

"Juglans affords a familiar instance of ingrowths from the pericarp into the seed cavity. The purpose of such spurious dissepiments, especially when they intrude on the developing seed and modify its form, is difficult to account for. The separation of the cavities at the base of the seed of *Lodoicea* is apparently due to such an ingrowth. But this can only be ascertained by following the development. The free lobes themselves are only lateral inflations in order to provide space for the enormous endosperm. They are much more distended on the dorsal than on the ventral surface, which is somewhat flattened; this produces the corresponding difference in the two surfaces of the fruit, which has already been mentioned. In this case, which seems the most usual, the fruit contains only one nut and one seed. The 'Genera Plantarum' describes the fruit as '1—v. imperfecte 2-3-loculares.' The latter condition can be only due to the more or less complete development of one or both of the other carpels.

"The endosperm is voluminous. According to the 'Genera Plantarum' it is hollow, 'late cavo.' My recollection of a specimen examined at Kew, though unfortunately I made no note at the time, is that it was solid. The account given by Sir William Hooker seems to confirm this. He says: 'The cavity is filled by the almond, which is very hard, white, and corneous, so that it may be rasped with a file, but is with difficulty cut with a knife.' I can only conjecture that this must have been described from an old and desiccated nut. A fresh one which afforded Dr. Walter Gardiner material for a study of the histology of the endosperm must have been immature, for sections were easily cut with a razor, and the consistence was not much harder than that of a turnip.

"Apparently in an earlier stage of development, the endosperm is unconsolidated and gelatinous. Sir William Hooker says: 'Before the fruit has attained its perfect maturity, the interior .....contains a substance like a white jelly, firm, transparent, and sweet to the taste. A single Coconut holds, perhaps, three pints of this substance; but if kept a few days, it turns sour,

thick and unpalatable, giving out a very disagreeable smell.' Miss North gives a more graphic description: 'The outer shell was green and heart-shaped; only the inner shell was double, and full of white jelly, enough to fill the largest soup tureen.'[1] And elsewhere, as quoted by Sir Henry Yule: 'I ate some of the jelly from inside.....of the purest white and not bad.'[2] The late General Gordon, who, as is well known, was deeply interested in the palm, on somewhat mystical grounds, informed me in a note: 'The nut when ripe is black and falls from the tree; the gelatinous jelly is then hard like ivory.' It would be extremely interesting to trace the histological changes which accompany that of the texture..... According to the 'Genera Plantarum' *Lodoicea* has the *embryo basilaris, sinum spectans.* But unless I am mistaken the sinus is the apex of the nut, and the embryo is therefore apical. In any case the sinus, being open, affords the embryo a free path for emergence."

GERMINATION.—According to William Hooker, a year elapses from the period of its falling from the tree before the nut begins to germinate. Button, however, says, that it germinates four or five months after falling from the tree, and sometimes even before. Thiselton-Dyer gives the following description: "The germination morphologically is of an ordinary monocotyledonous type. The apex of the cotyledon remains immersed in the endosperm and develops into a vast suctorial organ, while its petiole, which is about an inch in diameter, emerges from the nut, carrying with it the plumule and 'radicle.'" According to Button, the petiole "enters the ground to the depth of about one or two feet, then continues underground nearly parallel to the surface for a distance of four, five, six feet, sometimes more." "A note of General Gordon's is that it 'comes to sprout out' of the ground twelve feet from nut.' Mr. Button subsequently informed me that it 'runs in the ground, sometimes to a distance of several yards before coming to the surface.'" (Thiselton-Dyer.)[3]

Fauvel[4] draws the attention to an interesting fact which

[1] "Recollections of a Happy Life," II, 289. [2] "Hobson-Jobson," 178.

[3] On the chemical side of germination cf.:
Thiselton-Dyer, l. c., p. 228-229.
Gardiner, in Phil. Trans. & R. S. 1883, p. 848.

[4] Fauvel, A. A. "Note sur quelques points nouveaux de l'anatomie du Cocotier de Mer, *Lodoicea Seychellarum.*" In Bull. Mus. Hist. Nat., XII (1906) 585-592.

came to his notice through Mr. R. Dupont, Director of the Botanic Station of the Seychelles:—

On examining a number of fruits one will discover that they show a distinct dimorphism (cf. fig. 28). Those which have a



FIG. 28.—The first leaves of a Double Coconut Palm, the nut being still visible to the right of the plant.

(Photograph supplied by Col. Gage, I. M. S.)

deep sinus in the middle of the two lobes (which gives them a nasty[1] appearance) are said to be female by the natives of the Seychelles, whilst those with two parallel lobes and not having a sinus are called male. The former are supposed to produce female trees, the latter male.[2]

J. Stanley Gardiner, of the Exploring Mission "Sealark", examined over 300 nuts and found that both kinds of fruit are of about the same number.[3]

FLOWERS.—Lindley and Moore's "Treasury of Botany" states that only 30 years after germination are the first flowers produced.

Waby reports[4] that in March 1907 a thirteen-year-old specimen, kept in the Botanic Gardens of Georgetown, produced a spadix with seven pistillate flowers. Two more spadices were produced in the same year, two during the next, two more in 1909, and one in 1910.[5]

We do not know the source of Seemann's statement, which is to the effect that *Lodoicea* bears only one spadix in each year;

[1] Clusius, in his "Opusculum de Nuce Medica" (Amstelodami, 1634), says of the fruit:—"Facies nucis Medicæ extrema pudendum muliebre et podicem refert non impare magnitudine."

Fauvel tells us that the King of Bantam, who wished to make a present of a nut to the Dutch Admiral, Wolfart Harmansen, took care to remove the upper part of the fruit in order not to offend the modesty of the famous officer, (p. 586, l. c.).

[2] Dupont, R., Curator of the Bot. Garden, Port-Victoria Mahé des Seychelles. Lettre du 22 mai 1906, à son Excellence W. R. Davidson, Governor of the Seychelles transmise par ce dernier a M. Fauvel le 26 juin 1906—published in Fauvel l. c. 591.

[3] "Nature", No. 1891, Vol. 73, January 25, 1906. The Percy Sladen Expedition by H. M. S. "Sealark" to the Indian Ocean. The Seychelles Archipelago. A letter in J. S. Gardiner Zoological Laboratory, Cambridge, January 15, 1906.

For further notes on the fruit, *vide*:—

(*a*) Swinburn Ward, in "Gardner's Chronicle" (1864), p. 294.

(*b*) W. Watson, eod. loco, (1886), p. 557.

(*c*) Van Houtte's "Flore des Serres et Jardins de l'Europe", Vol. XV (1862-65), p. 168, No. 1427: Le Cocotier des Séychelles, avec 2 figures.

[4] Kew Bull. (1910), p. 256.

[5] Short notices of the flowering of these palms have been published in the Reports of the Botanic Gardens, British Guiana, for the years 1906-7, p. 11, 1907-8, p. 10, 1908-9, p. 4.

but what he adds, namely, that it often has above ten spadices in bloom at once, becomes intelligible from Waby's observations.[1]

FRUIT.—The statement as to the time which the fruit takes to reach maturity vary a good deal. William Hooker writes: "Twelve months elapse, from the time of the appearance of the germen, before the fruits are fully ripe; and they have been known to hang three years on the tree before falling to the ground."

C. Button informed Thiselton-Dyer in a letter that the period was much longer: "It remains seven years before arriving to its perfect maturity and falls to the ground. This experience has been several times made by me personally; but the proprietors of Coco-de-mer trees generally break the fruit at about four years of age for commercial purposes, as the shell at that time is sufficiently hard."[2] The same period for ripening the fruit is assigned by Gordon and K. Wald,[3] whilst others, e. g. Trimen, state that from the time of flowering to the maturation of the fruit, a period of nearly 10 years elapses.

Thiselton-Dyer thinks that "the discrepancy had arisen from a confusion between the time at which the fruits are gathered and that at which they are really mature."

HABITAT.—Seychelles: on the Isles of Praslin and Curieuse and Round Island. Endemic.

R. W. Plant, the well-known explorer of Port Natal, has the following note about the native country of the Double Coconut, in a letter, dated Port Natal, April 16, 1855, and addressed to John Smith at Kew[4]:—

"In the Seychelles I more nearly realized my preconceived ideas of tropical vegetation than at any other place — the beach fringed with common Coconuts; the ravines and watercourses overhung with Bananas, Bamboos, and three or four indigenous palms; the open ground full of Pine-apples—miles of them run wild; the tops of the mountains covered with forests of Ebony and Rosewood, interspersed with Tree-Ferns of some twenty to

[1] Cf. ad hoc: Wald, K., "Lebensbaeume." Regensburg, 1906, p. 60. Rothe, K. C., "Palmen-Studien." Wien, 1910, p. 34.

[2] Thiselton-Dyer, W. T., l. c., p. 226.

[3] Wald, K., "Lebensbaeume." Regensburg, 1906, p. 60.
Also: Rothe, K. C., "Palmen-Studien." Wien, 1910, p. 34.

[4] Seemann, B., "History of the Palms." London, 1856, p. 241.

thirty feet high; and then these glorious *Lodoicea* with their leaves of fifteen to twenty feet span, and trunks reaching to the sky; to say nothing of Cinnamon and Cloves and Bread-fruit all new to me in this their natural wildness and beauty; you may believe that I enjoyed it; so much so that I nearly forgot the errand that brought me there. We have many beautiful scenes in this country (Natal), and there is much excitement in travelling over it, but it is altogether of a different character; a savage sternness or monotonous sameness marks the two principal divisions of it, and the really beautiful spots look small by comparison with the vast extent spread around of another character."

On the Seychelles "the tree grows on all kinds of soil, from the sandy shore to the arid mountain-top, but the finest are found in deep gorges, on damp platforms, covered with vegetable soil; in such situations, the great height and slender diameter of the trunk, and the length of its enormous leaves, produce a fine effect, though near the seashore, its leaves, torn by the storms and hanging in long strips, give it a desolate appearance. It is to be regretted that the tree is not cultivated, and that a practice has prevailed of cutting it down in order to get at the fruit and tender leaves. In fact, it is feared that the species will be, ere long, entirely lost."[1]

This danger of complete destruction of the once famous palm has been removed in the meantime. Owing to the suggestion of John Horne, then Director of the Botanic Gardens of Mauritius, the Lodoiceas are, since 1875, under the protection of Government.[2]

It is a striking fact that the seeds, although capable of a wide oceanic dispersal which must have continued over a long period of time, in no case established themselves spontaneously in any new territory. This forms a strange contrast with the ordinary Coconut, which probably originally a native of South America, is now widely distributed throughout the tropics. (W. T. Thiselton-Dyer.)

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[1] Seemann, l. c., p. 245.

[2] Rothe, K. C., "Palmen-Studien." Wien. 1910, p. 34.

Cf. etiam: Ward, Swinburne. "On the preservation of the Coco-de-mer." Journ. Linn. Soc. IX (1867), p. 119-120, 259-261. Page 119-120 contains an answer to a letter of Sir H. Barkly relative to the preservation of the Coco-de-mer. Barkly's letter is printed on p. 118-119 of the same volume.



A Double Coconut Palm (*Lodoicea Seychellarum*, Labill.) in fruit, growing on Praslin Islan

CULTIVATION IN INDIA.—Mr. W. S. Millard has supplied the following notes:—

There appears to be very little recorded on the cultivation of the Coco-de-mer in India.

From information recently received from Major Gage, I. M. S., there is only one plant living at present in the Royal Botanic Garden, Sibpur, Calcutta, from nuts introduced in 1894.

In Bombay, thanks to M. Dupont, the Director of the Botanic Garden, Seychelles Islands, a number of nuts were introduced in 1908, but although two or three germinated by being placed in a damp, dark situation, no specimen survived when planted out. In most cases one leaf was thrown out, but before the second leaf appeared the plant expired, possibly owing to the soil not being suitable.

In 1911 M. Dupont forwarded me some more nuts, and out of these five germinated, but cockroaches attacked the shoots of two whilst in the dark, and these subsequently died. The remaining three are alive. One of them was planted in 1914 on the Queen's Road, Bombay, in the vacant plot next to the B. B. & C. I. Railway Offices, and this plant soon threw out a second leaf. The soil is very sandy, having been reclaimed from the sea, and it is hoped that this plant will survive.

The second nut was planted in the garden of the Ladies' Gymkhana, Malabar Hill, and is growing slowly.

The remaining nut I still have in a tub in my garden, where it is thriving and is now making its second leaf.

Some of the nuts were given to the Victoria Gardens, Bombay, and I hear that one is growing there.

In consequence of so many failures I wrote to M. Dupont asking for his opinion and advice as to their cultivation in India, and I cannot do better than reproduce his remarks on this subject:—

"I am afraid I cannot tell you much about your failure to grow successfully our Coco-de-mer. The symptoms you describe are, however, such as to warrant excess of moisture and subsequent fungoid attack being the cause of the failure of the plant to produce more than one leaf. I saw here the same thing happened in a friend's yard, where he planted a germinating nut on the very spot where he had insufficiently removed a huge stump of a Jack tree. The plant died after the first leaf

and after subsequently planting a second nut, the same thing happened. He then dug a very large hole, removing all dead organic material and putting in lime and good friable soil. He succeeded the third time and the Coco-de-mer is now producing its third leaf. I know little of Bombay soil and rainfall, but I noticed that many parts of the town are waterlogged. If you can, avoid clayey soil for Coco-de-mer, but here we succeed in stiff laterite where particles of quartz reach a large percentage. Have you got any other soil than the clayey soil I came across at the Victoria Gardens? Perhaps not, and this will handicap, with a heavy rainfall, the growth of some of the palm trees. There is no reason why you should not prepare an artificial soil with coarse sand and small stones and allow the tree to make its proper growth during the first three or four years, when it will become very hardy. Here it grows in any stiff soil on mountain slopes."

In a postscript M. Dupont adds an important suggestion: "Avoid putting the nuts deep and flat on the ground, but plant superficially in a slanting or even vertical position to avoid the young stem getting bruised against the nut in sprouting."

Mr. G. T. Lane, the Curator of the Sibpur Botanic Garden, in a letter, dated 26th February, 1913, to Dr. Gage, refers to this danger thus: "I remember also that one or more of these seedlings were strangled through the radicle turning round and trying to push its way through between the lobes of the nut, and thus preventing the plumule from developing. This seems to be the only difficulty about germinating these nuts; if the point of the long radicle be injured, it dies."

Farmer wrote to Thiselton-Dyer: "It may interest you to know that in 1890, when I was at Peradeniya, there was a young plant (of *Lodoicea*) growing in the gardens, which Trimen told me had been planted about five years previously. The 'nut' was still in the ground and connected by the sucker with the plant. The latter bore, I think, about five leaves; the later-formed ones were very large, somewhat resembling those of *Corypha umbraculifera*."[1]

Wald mentions a specimen growing in the Botanic Gardens

[1] Thiselton-Dyer, l. c. p. 230.

of Buitenzorg, which in its thirtieth year had not yet begun to form a stem.[1]

H. W. Cave has an interesting note in his "Book of Ceylon". I first secured a photograph", he says, "of this specimen (a

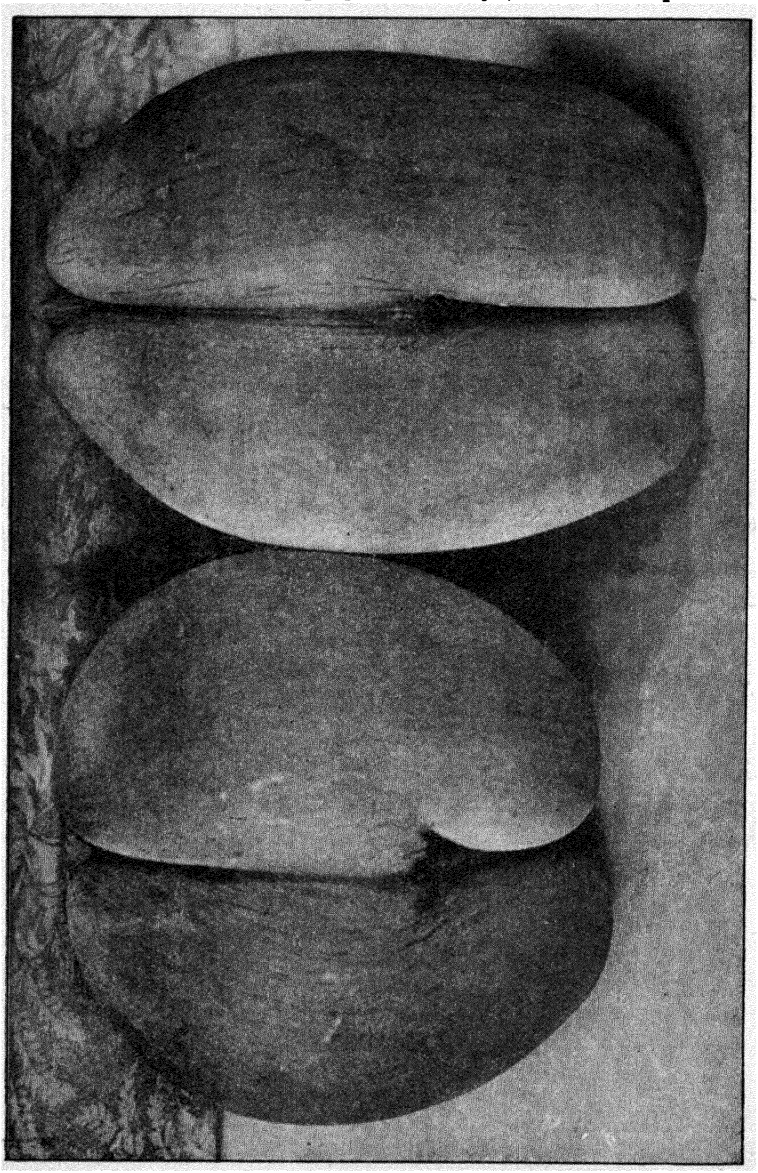


FIG. 29.—Fruits of Double Coconut (*Lodoicea Seychellarum*).

[1] Wald, l. c. p. 62.

Lodoicea in the Botanic Gardens of Peradeniya) in 1892, when it was already forty years old and had not begun to form its stem. In 1907 I took the photograph reproduced in plate 377 (of the "Book of Ceylon"), which will give an exact idea of the fifteen years' growth. The slower growth would appear to characterize its extreme youth, as, after taking forty years to begin exhibiting a stem, it has grown since that time at the rate of about seven inches a year. Unfortunately this specimen is a male, and therefore bears no fruit; but several young plants of the same species are placed so as to form an avenue which may interest future generations. It should certainly be a grand spectacle for posterity in about five hundred years when the trees reach maturity. It is to be hoped that the public of the year 2400 will be acquainted with the Peradeniya records of our time and feel grateful to the present Director and Curator as in flying machines they inspect the noble fruit with which they are provided through the kindly foresight of their ancestors."[1]

CULTIVATION IN EUROPE.—The cultivation of this palm in Europe is still attended with difficulties. Seemann wrote in 1856:—

"After many unsuccessful attempts to introduce this palm into our conservatories, one has at last met with complete success and the plant is now to be seen in the Royal Gardens at Kew. Germinating nuts were disposed of in 1854 at public sales in London for £10 apiece, but all of them have since died."

The same disappointing difficulties were experienced in the Botanic Gardens of Georgetown. Only three plants survived of three dozen nuts which were imported from the Seychelles in the year 1893. "The first dozen", writes Waby,[2] "arrived dead; eight had germinated *en route,* and the others failed to germinate. Having passed by way of England during the winter was probably the cause of the failure. Of the second dozen four germinated in transit, and six did so afterwards, making ten, which arrived in good condition; of the third dozen only five germinated. In 1898 eight were alive, but were reduced to six during the next year. In 1902 five remained, and two subsequently died, leaving only the three present plants."

[1] H. W. Cave. The Book of Ceylon. London, 1908, p. 269.

[2] Kew Bull. (1910), p. 256.

"Frequent attempts have been made to cultivate the Coco-de-mer in European Botanic Gardens, but with little success. For some years a plant, which, I think, was imported, existed in the Liverpool Botanic Garden. And a young plant was raised and perhaps still exists in the Jardin des Plantes. In 1889 I began a prolonged attempt to add it to the rich collection of palms at Kew. I was energetically assisted by Mr. C. Button, who sent us repeated consignments of mature nuts. Many failed to germinate at all: others did so but only imperfectly; others again sprouted satisfactorily, but only to end their existence by disaster almost suicidal.....

"At Kew the nuts were buried in Coconut fibre in a hotbed. Germination, once commenced, proceeded rapidly. Unfortunately in at least one instance it proved abortive. Before the proceeding could be detected, the growing apex managed to insinuate itself in some crevice, with the result that it was irretrievably injured. In a subsequent attempt the petiole did not grow to so great a length, and it was possible to guide its course, and finally establish the young plant in a pot. This grew pretty rapidly, and in 1892 was exhibited in the Victoria Regia House at Kew, still drawing nutriment from the parent seed, a process which may apparently continue for some years." [1]

This palm thrives best in a compost of rich loam and leaf mould in equal parts. Thorough drainage, an abundant supply of water, and very strong heat, are essential elements to success in the culture of this plant. The seeds being very large, one of the chief difficulties in establishing this palm is its peculiar manner of germination. If the first long outgrowth be checked or injured in any way, success cannot be hoped for. The heavy seed can be kept on or in one pot, and the growing radicle allowed to push into another, keeping the whole dark until the development of the young plant, from which the seed should not be separated until the connection between the two falls naturally. (Nich. Dict. of Gard.)

HISTORY OF THE SEA COCONUT.—The most celebrated palm of former days was the Sea Coconut or Double Coconut, and yet there is scarcely any other palm about which so little has been known. The French call it Coco-de-mer, Coco-de-Salomon, and

[1] Thiselton-Dyer, W. T., l. c., pp. 226, 227.

Coco-des-Maldives, and it was known to the writers of the 16th and 17th centuries under the names of Nux Medica and Cocos Maldivicus. Before the exploration of the Seychelles in 1743 by order of Mahé de la Bourdonnais, then Governor of Mauritius, the nuts were only known from having been found floating on the surface of the Indian Ocean, and near the Maldive Islands, whence their French name was derived; and even in the time of Rumphius[1] the nut was spoken of as the "mirum miraculum naturæ, quod princeps est omnium marinarum rerum, quæ raræ habentur."[2]

The first European who described this famous fruit was the Portuguese Garcia d'Orta (Garcia ab Horto).[3] He was Physician to the Viceroy at Goa for about 30 years. In this capacity he found leisure for private study which he spent in the exploration and description of the useful plants and drugs of the country. In 1563 he published the results of his investigations in his "Coloquios da India",[4] which were soon translated into several modern languages, and into Latin by Clusius[5] in the year 1567. This work went through many editions, and it is in that of 1605 that we read the following account of the "Coccus de

[1] Rumphius (Rumpf, George Eberhard) was born at Hanau in 1627 and died in 1702. He is called the "Plinius indicus", because he described and figured a great number of plants whilst stationed in Amboina. His manuscripts and drawings have been published in 6 volumes under the title "Herbarium Amboinense", Amsterdam, 1741-1755.

[2] Cf. Curtis, Bot. Mag., Vol. I. (new series) 2734-38, (1827).

[3] Cf. D. G. Dalgado, Classificaçao Botanica das Plantas e Drogas descriptas nos "Coloquios da India" de Garcia d'Orta, Bombaim, 1894.

[4] Garcia d'Orta. Coloquios da India, Goa, 1563. The latest Portuguese edition was published in Lisbon in 1872.

[5] Clusius, Carolus (De le Cluse, Charles) was born at Antwerp in 1526 and died in 1609. His works were very numerous, for he not only published original descriptions of new plants, but he translated into Latin works from the French, Spanish, and Portuguese, thus rendering a most important service in the diffusion of a knowledge of the plants that were known in his day. Few men have suffered more in following a favourite pursuit than Clusius. He has on this account been called "The Martyr of Botany". As early as in his twenty-fourth year, by excessive fatigue he contracted a dropsical disease. At the age of thirty-nine he broke his right thigh during one of his botanical rambles, and shortly afterwasds his right arm. Whilst at Vienna, he dislocated his left ankle, and eight years after this accident he dislocated his right hip. For this he was treated unskilfully, and ever after he was obliged to use crutches for support. During his exertions in the early part of his life he also contracted a hernia, which troubled him to the end of his days. But his bodily infirmities never diminished his mental activity, and he continued teaching and writing to the very last.

Maldiva".[1] "This nut, and especially the kernel, are recommended by the inhabitants of those islands (Maldive Islands) as a remedy against poison. I have been told by many trustworthy people that it proved useful in colic, paralysis, epilepsy, and other nervous diseases, and that the sick become immune against other diseases if they drink water that has been kept in the shell for some time, and to which has been added a piece of the kernel. But as I have no personal experience I am not inclined to believe in these things. I had no time to make experiments and I prefer to use medicaments whose virtues are known to me and shown by experience, as, e. g., the bezoar stone, theriac, and many other medicines, rather than new ones which are less reliable, because I do not know whether I ought to ascribe solely to imagination what people say about the beneficent effects of that nut. If, however, in the course of time, some facts are verified, I shall not be ashamed to change my opinion. The skin of the nut is black and smoother than that of the common Coconut, mostly ovate and not quite as round as the common nut. The kernel or inner pulp is hard and white when dry, sometimes slightly pallescent, full of cracks and very porous. The dose of the kernel is about 10 grains, taken in wine or water, according to the nature of the disease. The nuts are sometimes very large, sometimes small, but they are always found thrown upon the shore. There is, besides, the common opinion that the Maldive Islands once formed part of a continent,[2] which by an inundation of the sea disappeared, those islands alone being left; the palms, however, that produced those nuts, were buried underground and the nuts themselves became petrified in the way we find them now. Whether those palms belong to the same genus as our nut is difficult to say,

[1] "Aromatum et Simplicium aliquot medicamentorum apud Indos nascentium Historia conscripta a D. Garcia ab Horto, Proregis Indiæ Medico" in "Caroli Clusii Atrebatis Exoticorum Libri Decem", pp. 190-192 (1605).

[2] That India and the southern central parts of Africa were united in Mesozoic times in one great stretch of nearly continuous dry land is now proved by overwhelming evidence, taken from the Jurassic fossils as well as from the Cretaceous deposits. The great revolutions in physical geography, which took place towards the end of the Cretaceous and during early Tertiary times, resulted in the break-up of the old continent, and were followed by the rise of the Himalayan range. It would be highly interesting to trace the origin of the opinion expressed by Garcia d'Orta. Is it not possible that within historic times those islands were shaped into their present form?



A Fruiting Specimen of the Double Coconut Palm
(*Lodoicea Seychellarum* Labill.) from Praslin Island.

as nobody has up to now been able to see either the leaves or the stem of that plant. Only the nuts are washed ashore, sometimes in pairs, sometimes single; but nobody is allowed to collect them on penalty of death, because everything that is carried ashore belongs to the king. This circumstance has added a good deal to the value of these nuts. The pulp or medulla is then removed and dried in the same manner as our 'Copra' till it becomes hard like the one you see in the market. In this condition you might easily mistake it for cheese." To this account Clusius adds the following note: 'I have seen vessels made of this nut in Lisbon as well as in other places; they are usually more oblong and darker than those made of the common Coconut. You can even find the dried medulla of the nut in the market of Lisbon; its virtues are highly praised and it is preferred to almost all other alexipharmics. For this reason it is sold very dear. But you can easily gather from our author, how little faith such fabulous virtues deserve."

Whilst Garcia d'Orta was staying at Goa, a Spaniard, Cristobal da Costa (Christophorus a Costa), of the medical profession, left his home with the sole desire to "observe and study the various plants which God had created for the benefit of man in the different countries and provinces." On his tour he came to Goa, where he met his colleague Garcia d'Orta. From the personal intercourse with him, as well as from d'Orta's book, he received most of the information which some time after was published in Spanish and translated into Latin by Clusius[1] in the year 1572. Regarding the Sea Coconut we read in this book: "The 'Coccus de Maledivа' is in such high esteem with the natives of that island and with the people of Malabar, not only with the lower classes, but also with kings and princes, that in all sickness they put their trust in that fruit as in a sacred anchor. They make of it drinking-cups in which there is a piece of the kernel hanging from a small chain, and they are strongly convinced that whosoever has drunk water from such a cup, is immune against every poison and disease. I saw, however, a good many who drank from those

[1] "Aromatum et medicamentorum in Orientali India nascentium historia, plurimum lucis adferens iis quae a Doctore Garcia de Orta in hoc genere scripta sunt auctore Christophoro a Costa, Medico et Cheirurgo" in "Caroli Clusii Atrebatis Exoticorum Libri Decem" (1605).

cups and fell sick nevertheless. In spite of my careful observations I never noticed that anybody was cured by such a drink. Some even assured me that after a draught from such a cup the spleen and kidneys became inflamed. The price of these nuts is, nevertheless, very great, a single nut without any ornaments being sold for 50 and more gold pieces."

The fame of the Sea Coconut was so great in the 16th century that it found a place in Camoens' famous epic (X. 136):

"Nas ilhas da Maldiva nace a planta
No profundo das aguas soberana
Cujo pomo contra o veneno urgente
He tido por antidoto excellente."

("O'er lone Maldivia's islets grows the plant,
Beneath profoundest seas, of sovereign might,
Whose pome of ev'ry Theriack is confest
By cunning leech of antidotes the best."—BURTON).

Another account of the Sea Coconut and a description of the Maldive Islands is found in the "Itinerario" of John Huyghen Van Linschoten (1596), who had spent five years (1584-89) in Goa and had seen a great part of Eastern Asia. The following quotation is taken from the edition of the "Hakluyt Society":[1] "Right over against the Cape of Comorin, 60 miles into the sea westward, the Ilands called Maldyva doe begin, and from this cape on the northe syde they lie under 7 degrees, and so reach south south-east, till they come under 3 degrees on the south syde, which is 140 miles. Some say they are 11,000 islands, but it is not certainly knowne, they can not be numbered. The inhabitants are like the Malabares: some of these Ilands are inhabited, and some not inhabited, for they are very lowe, like the countrie of Cochin, Cranganor, etc., and some of them are so lowe, that they are commonlie covered with the sea: the Malabares say, that those Ilands in time past joine fast unto the firm land of Malabar, and that the Sea in processe of tyme hath eaten them away. There is no merchandize to be had in them, but only coquen, which are Indian nuttes, and cayro, which are the shell of the same nuts, and that is the Indian hemp, whereof they make ropes, cables and other such like.

[1] The Voyage of John Huyghen Van Linschoten to the East Indies. From the old English translation of 1598. The first book containing his description of the East in two volumes. Vol. 1. 74-76. London, 1885.

Linschoten was born at Haarlem (Holland) about the year 1563 and died on the 8th February, 1611.

"There are some of these nuttes in the said Iland that are more esteemed than all the nuttes in India, for that they are good against all poyson, which are verie faire and great, and blackish: I saw some that were presented unto the viceroy of India, as great as a vessell of 2 cānes measure, and cost above 300 Pardawen, which were to send unto the King of Spaine. Of this tree and her fruites, together with the usage thereof, I will discourse more at large in the declaring of the Indian trees and fruits."

We are looking in vain for a more detailed description of the fruit in the eleventh volume of the Itinerario, where a great number of plants are described.[1]

The best account of the Maldives is that by François Pyrard[2] who was shipwrecked there in 1601. His description contains also the following short note on the Double Coconut: "The king has, besides his revenues, certain rights, e. g., everything that is found on the seashore belongs to the king, and nobody has the courage to touch anything of the kind in order to keep it, but all must bring what they find to the king, whether it be a piece of a wrecked ship, pieces of wood, a box or other things carried to the shore. The same obtains with regard to a certain nut which is sometimes washed ashore. It has the size of a man's head and can be compared with two large melons grown together. People call it Tavarcarre and they believe that it comes from a tree growing at the bottom of the sea. The Portuguese call it 'Coco des Maldives'. It has medicinal properties and carries a high prize. Very often, on account of this Tavarcarre, the servants and officers of the king maltreat a poor man if he is suspected of having found such a nut; if somebody wants to take revenge on his neighbour he accuses him of having a nut in his possession, in order that his house

[1] Gulielmus Piso was so much disappointed at not finding the description promised by Linschoten that he wrote: "Promittens Nucis medicae arborem integra historia enarrare, in quo tamen velut corvos hiantes nos eludit, vulgarem vero pertractare decurrit subsidiis in hanc mentem non excussus." Mantissa Aromatica in Clusius, l. c. p. 215.

[2] Pyrard was born at Laval towards 1575, travelled in the East Indies, was shipwrecked near the Maldives, fell into the hands of a Prince in Bengal, served two years in the Portuguese Army, and published on his return to France his "Discours du voyage des Français aux Indes Orientales," Paris, 1611. A better edition by Bignon and Bergeron appeared in 1615 under the title: "Voyages des Français aux Indes Orientales, Maldives, Moluques, et au Brasil, de 1601 à 1611".—We quote from the edition of 1679, Paris.

may be searched, and if somebody becomes rich on a sudden and within a short time, people begin to say that he found a Tavarcarre, as if this were a great treasure."

More credulous than Clusius and d'Orta as regards the wonderful properties of the Sea Coconut is William Piso, a Dutch physician, who had travelled in Brazil between 1636 and 1641, and who by his writings added considerably to the scientific knowledge of the West Indies. He devotes a whole chapter written in elegant Latin to the "Nux Medica Maldivensium".[1] He first of all excuses himself, because he gives the figure of the fruit only instead of the whole plant; but nobody, he says, can expect the illustration of a plant which has been devoured by the sea and is now growing at a depth of 16 fathoms. The introduction to the chapter gives a vivid idea of the high esteem in which the Sea Coconut was held in former centuries and at the same time, of the way in which scientific subjects were treated 300 years ago. It runs as follows: "Amongst the immense benefits which the Divine Providence has showered upon mankind during the last centuries one of the most valuable is the discovery of so many medicaments destined for the protection of the human race, because, after the welfare of the soul, the health of the human body takes the first place. With regard to the invention of iron machines, of which our present age is boasting so much, I should rather say that they are for the ruin of the nations than for their welfare. Also the art of printing, though it may be especially fit for the preservation of literary monuments, only favours the bad zeal (kakozelia) of incompetent scribblers. Similarly, there is no reason why we should be proud of the booty of the Erythræan Sea or of the gold mines of the Atlantis, because, according to the high-minded poet, the yellow metal is more dangerous than the iron.

> Jamque nocens ferrum, ferroque nocentius aurum
> Prodierat; prodit bellum, quod pugnat utroque.
> (Ovidius Metamorphosios primo.)

But the glory of the European Argonauts can never be too loudly sung; they have discovered a new continent which was hidden for centuries, they have unveiled the secrets of the sea

[1] Gulielmi Pisonis Mantissa Aromatica sive de Aromatum cardinalibus quatuor, et Plantis aliquot Indicis in Medicinam receptis, relatio nova. Caput XIX.

and shown the way to so many islands scattered in the Indian Ocean. By their efforts it has come about that almost

Omnis ferat omnia tellus,

and that foreign medicaments of high and rare value were introduced into our country. Amongst them the Sea Coconut (Nux Medica Maldivensis) occupies the first and foremost rank, whether we consider its rareness or its price and value, or finally its usefulness that has ever been praised."

As to the origin of the nut Piso gives two opinions. The common people say that it grows on trees that are hidden in the sea, or which were covered with water at the time of an inundation, or that had their roots in the water as their natural medium. The more devout hold a different view. They believe that the nut grows on an island called Pallays, which is invisible to those who want to find it, and visible to others who do not know about it. From that island the nuts are carried away by the ocean-currents and washed upon the shores of the Maldives. The inhabitants of the Maldive Islands believe that Pallays is the happiest of all the countries of the world, and that the devils and the malicious genii want to hide it from the eyes of man.

Piso relates that Rudolf II, Emperor of Germany, offered 4,000 florins for a Sea Coconut, but the family of Wolfered, in whose possession the nut was, was not inclined to part with it. In the Maldive Islands the value of one nut was estimated at from 60-120 crowns; but those which measured as much in breadth as in length were the most esteemed; and those which attained a foot in diameter were sold for 150 crowns; some kings have even been so greedy of obtaining these fruits as to have given a loaded ship for a single one.

We can easily understand the great desire of many to become the happy owner of such a nut, if we read the long catalogue of cases drawn up by Piso, in which the Nux Medica is said to have played such an important part in the restoration of the diseased to their former health.

We cannot refrain from reproducing in this place for the benefit of the "sons of Æsculapius" at least two of the many medical prescriptions which were believed in and followed in the 16th and 17th centuries.

'In Peste et Febribus malignis Contagiosis.

'Cocci Maldiviensis ℥j. Seminis Acetosæ mundati ℈j. Syrupi e succo Granatorum acidorum, aut Scabiosæ, aut florum Punicæ ℥j. Diascordii Fracastorii ℥j. Decocti radicum Petasitidis, Scordii et Scorzoneræ, aut aquarum Boraginis, Buglossæ, q. s. F. Potio'.

'In Dysenteria cruenta, et Torminibus: facta ante praeparatione debita per Rheum et Clysteres.

'Corticis intermedii Nucis Medicæ ℥j (si desit, Medulla aut Putamen vicem suppleat). Terræ Leminiæ, Lapidis Bezoarici Orientalis et Bistortæ radicis ana ℥j. Syr. de succo Portulacæ parum, ad consistentiam Bol. F. et insuper adjectis requisitis, Donditum, Potio, et similia'.

The most complete historical account of the Sea Coconut is found in Rumphius (Herbarium Amboinense, VI, 210), who describes the marvellous fruit under the Dutch name "Calappa Laut". The stories are fabulous enough, but in addition to them he tells us that many other tales were related to him respecting it, too absurd to be repeated. The Malay and Chinese sailors used to affirm that it was born upon a tree deep under water, which was similar to the Coconut tree, and was visible in placid bays, upon the coast of Sumatra, but that if they sought to dive after the tree, it instantly disappeared. The Negro priest declared it grew near the island of Java, where its leaves and branches rose above the water, and that in them a monstrous bird, or griffin, had its habitation, whence it used to sally forth nightly, and with its beak tear to pieces elephants, tigers, and rhinoceroses, the flesh of which it carried to its nest. Furthermore they avowed that ships were attracted by the waves which surrounded this tree, and there retained, the mariners falling a prey to this savage bird, so that the inhabitants of the Indian Archipelago always carefully avoided that spot. Rumphius thinks that the Chinese as well as the natives of the Archipelago set, perhaps, too high a value on the medical properties of the nut, considering it an antidote to all poisons. The principal virtue resided in the meat or albumen, which lines the nut, and which is so hard and corneous as to be preserved for a length of time after the embryo is destroyed.

This substance was triturated with water in vessels of porphyry, and, mingled with black and white, or red coral, ebony, and stags' horns, was drunk, all together. The great

men formed of the shell, which possesses fewer medicinal properties, precious vessels, cutting off a transverse slice, which constituted the lid; in this they put their tobacco, betel lime, and whatever else they masticate, believing they could never then be contaminated by anything noxious.[1]

With the discovery of the Seychelles in 1743, a new period began for the Sea Coconut, the object of so many legends and superstitions. La Bourdonnais[2] was the first to discover the tree on one of the Seychelles Islands. He called it "Isle of Palms", now known by the name of Praslin. Later on the tree was also found on Curieuse and Round Island. These are within half a mile of each other, mountainous and rocky. "To behold these trees", remarks Harrison, "growing in thousands, close to each other, the sexes intermingled; a numerous offspring starting up on all sides, sheltered by the parent plants; the old ones fallen into the sear and yellow leaf, and going fast to decay, to make room for the young trees presents to the eye a picture so mild and pleasing, that it is difficult not to look upon them as animated subjects, capable of enjoyment, and sensible of their condition."

Although the tree had been discovered at last, it still took a long time before it was accurately described. Pierre Sonnerat[3] gave a description of it, though not a very scientific one, when on his tour to New Guinea he landed upon the Isle des Palmiers (Praslin). He was the first to introduce the tree into the Isle of France.

The description given by Rochon[4] does not add any new information. It is, however, interesting to hear that it was not uncommon as late as 1759 to see the nuts sold for upwards of four hundred pounds sterling each.

After this several botanists described the palm under different names: Gmelin called it *Cocos maldivica*,[5] Giseke,

[1] Cf. Curtis, Botanical Magazine, 2734-38.

[2] Mahé de la Bourdonnais, born in 1699, died in 1753.

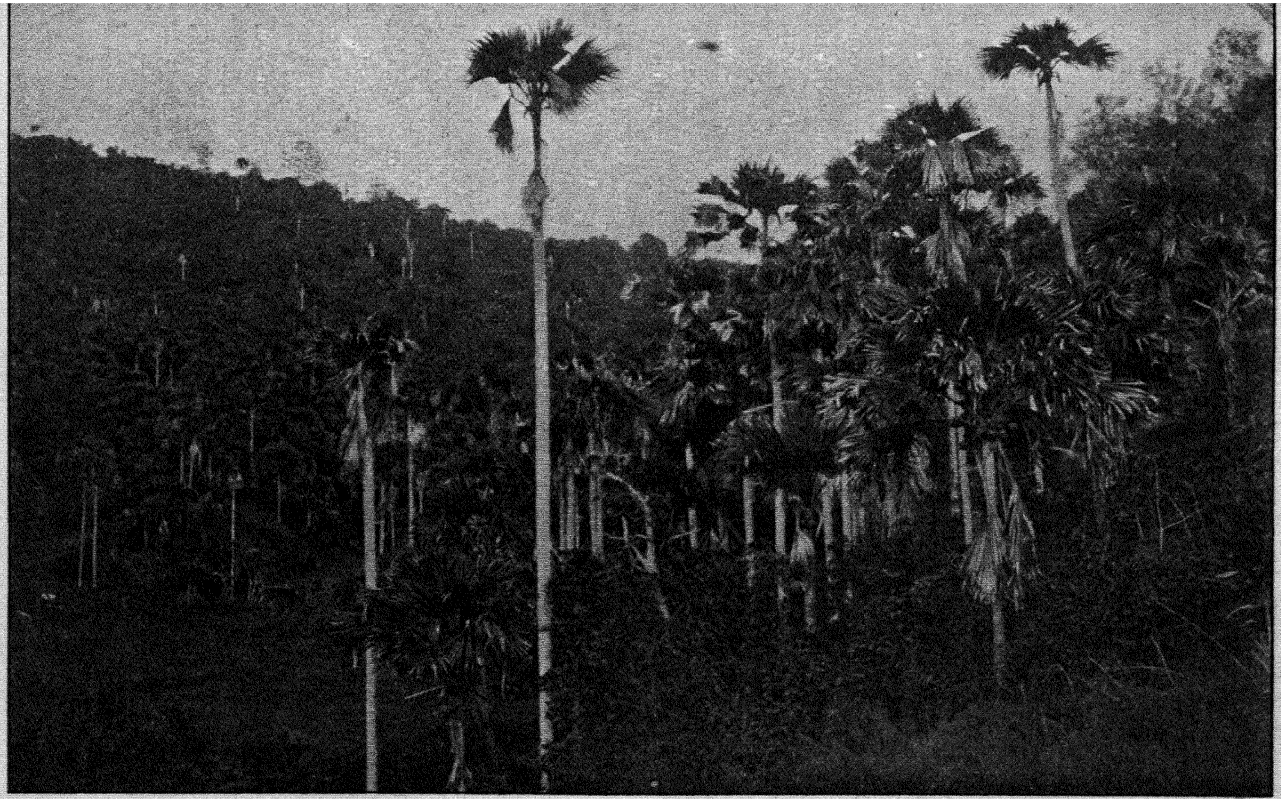
[3] P. Sonnerat, Voyage à la Nouv. Guinée, Paris 1776, I. p. 3-10, t. 3-7. Sonnerat wac born towards 1745, died in 1814, and spent the greater part of his life in travels and scientific observations.

[4] A. M. Rochon, Voyage à Madagascar, II, 146.

Cf. also Bory de Saint Vincent, Voyage dans les îles d'Afrique, III, 156, 246.

[5] Gmelin, J. F., Systema Naturæ, II, p. 569.

Cf. also Wildenow, Species Plantarum, IV, p. 402, n. 6.



A Grove of Double Coconut Palms in the Coco-de-mer Valley of Praslin Island.

Borassus sonnerati,[1] Commerson, *Lodoicea Callipyge* and *Cocos maritima*,[2] Persoon, *Lodoicea maldivica*.[3] At last La Billardière was able to give a botanical description of it under its present name, *Lodoicea Seychellarum*,[4] to which he added figures from specimens preserved in spirits, together with a representation of the tree from a drawing made in the Seychelles Islands by M. Lillet. The description is followed by an account of the uses of the palm, communicated to the Museum of Natural History in Paris by M. Quéau-Quincy, Correspondent et Administrateur Général des Isles Seychelles. The description, however, was still deficient in many points, and it was to be expected that a botanist like W. J. Hooker could find no rest before he had discovered everything about that interesting tree. "These accounts (of La Billardière)", he writes in 1827, "in conjunction with some nuts that Mr. Barclay and myself received from our inestimable friend and correspondent, Charles Telfair, Esq., of the Mauritius, only served to stimulate our curiosity; and we requested Mr. Telfair to procure, either from the palms that he informed us were cultivated in the Isle of France, or from the Seychelles Islands, such specimens as would enable us to publish more satisfactory delineations than had yet appeared.

"The Isle of France palms had not yet fructified; but Mr. Telfair lost no time in begging his friend, J. Harrison, Esq., of the Seychelles, to obtain the necessary specimens. With the utmost promptitude and kindness that gentleman devoted several days to visiting, with a dozen of blacks, the Isles of Praslin and Curieuse; and in the midst of those little-known islands, he not only made drawings from the living trees, but procured and forwarded to us, through Mr. Telfair, the male and female spadices and fruit, in different states, preserved in spirits, with leaves, a seedling plant, and even a portion of the trunk. All these, except the fully ripened fruit, arrived in safety. A perfect representation, therefore, of the mature nut, is still wanting."

This want has been supplied, in the meantime, by various botanists, and the once so mysterious Sea Coconut tree is as well known as any other.

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[1] Giseke, Lin. Prael. Ord. nat., p. 86.

[2] Commerson MS and Palmarium, Vol. II t, 1-15.

[3] Persoon, C. H. Enchir. II, p. 630.

[4] La Billardière in Annales du Mus. d'Hist. Nat., IX. p. 140, t. 13. Cf. also Sprengel, Systema Vegetabilium, II, p. 622.

Uses. – The crown of the trunk, i. e. the heart of the leaves, is eaten like that of the American Cabbage Palm (*Oreodoxa regia*) and often preserved in vinegar; but it is less delicate and slightly bitter. The trunk itself, after being split and cleared of its soft and fibrous part within, serves to make water troughs, as well as palisades for surrounding houses and gardens. The foliage is employed to thatch the roofs of houses and sheds, and even for the walls. With a hundred leaves a commodious dwelling may be constructed including even the partitions of the apartments, the door and windows. The down attached to the young leaves serves for filling mattresses and pillows. Of the ribs of the leaves and fibres of the petiole baskets and brooms are made. The young foliage affords an excellent material for huts. For this purpose only the unexpanded leaves are taken, dried in the sun, and cut into longitudinal strips, two or three lines broad, which are then plaited. Of the nut are made vessels of different forms and uses. When preserved whole and perforated in one or two places the shell serves to carry water. Plates, dishes, and drinking-cups, made of the nuts, are valuable from their great strength and durability, so that this kind of utensil, in the Seychelles Islands, bears the name of "Vaisselle de l'Isle Praslin". Amongst other articles, shaving-dishes, black, beautifully polished, set in silver and carved, are made from them.[1]

The marvellous medicinal properties which are ascribed to the nuts by ancient physicians, both European and Asiatic, have now been recognized as fanciful and due solely to the rarity of the fruit. It is consequently no longer valued by Europeans, but it is (according to Dymock) still in great repute among the Arabs and natives of India as a tonic, preservative and alexipharmic. Ainslie relates that in his time the Vytians occasionally prescribed the kernel given in woman's milk, in cases of typhus fever, the dose being, "a quarter of a pagoda weight twice daily", and adds, "it is also reputed anti-scorbutic and anti-venereal."

Dymock mentions that in Bombay it is prescribed as a tonic and febrifuge in combination with *Lignum colubrinum,* (the small branches of *Strychnos colubrina,* L.). It is also

[1] Cf. Hooker in Curtis Bot. Mag. l. c.

believed to possess several other properties. "'Daryali-naryal'", says S. A. Ravat, "is corrupted in Bombay into 'Jehari-naryal' which means 'poisonous Coconut', and it is believed to be so by the common people. It is, however, non-poisonous, and is commonly given to children, mixed with the root of Nux-vomica, for colic. It seems to act mechanically, like Bismuth." Rubbed up with water, it is given by natives to check diarrhœa and vomiting, especially in cholera. Some believe that the water of the green fruit or its soft kernel is antibilious and antacid when taken after meals.[1]

It is to be regretted that the tree is not cultivated, and that a practice has prevailed of cutting it down in order to get at the fruit and tender leaves, and it is to be feared that this will lead to the extinction of the Sea Coconut, which will become in reality as rare as it was supposed to be by the travellers who picked up the first known specimens of its nuts floating on the sea.

ILLUSTRATIONS.—*Plate XL* shows a young Double Coconut Palm in the Botanic Gardens of Peradeniya. We called it "young", but as a matter of fact, it must be about 40 years old. Cave figures the same specimen in his "Book of Ceylon" (Pl. 376) and the palm is about the same size as the one reproduced in our plate. He took it in 1892, "when it was already 40 years old and had not begun to form its stem." The strong stout leaf-stalks are very remarkable.

The following photographs of the Double Coconut Palm (except *Pl. XLII,* which was supplied by Mr. Macmillan) were kindly presented by Mr. Nigel Kerr.

Plate XLI.—A comparatively young palm growing in the jungle of Praslin Island. The age is between 50 and 60 years. It will be noted that the leaves are not very numerous.

Plate XLII.—This photograph, taken in the Botanic Gardens of Peradeniya, shows a male specimen of *Lodoicea.* From between the stout petioles arise six flowering spadices. The flowers are distinctly visible.

Plate XLIII.—A fruiting specimen of the Double Coconut Palm growing on Praslin Island. The spadices are bent down and rest on the stem on account of the heavy weight of the

[1] Cf. Watt, Dict. of Econ. Prod. of India, Vol. V., 88.

numerous gigantic fruits. The palm seems to develop a much denser crown of leaves when not pressed on all sides by a luxuriant vegetation as in the case of Plate XLI.

Plate XLIV.—The central part of the crown with several female spadices bearing fruits at different stages of development.

Plate XLV.—A grove of *Lodoiceas* in the Coco-de-mer Valley of Praslin Island. The stems are straight and uniformly thick up to a few yards below the crown.

III. LEPIDOCARYINÆ

Spadix branched once or more in a 2-ranked arrangement; flowers in concinni or 2-ranked spikes with bracts and bracteoles round them, carpels 3, fast united, covered with scales; fruit 1-seeded, covered with hard scales; feather or fan leaves, reduplicate.

4. MAURITIEÆ

Leaves fan-shaped with regularly or irregularly divided, slightly reduplicate, segments. Flowers diœcious, dimorphic.

DISTRIBUTION.—Tropical America, east of the Andes between 16° S. Lat. and 12° N. Lat.

Mauritia L., *Lepidocaryum*, Mart. Not represented in India.

5. METROXYLEÆ

Leaves paripinnate with regularly divided spinous pinnæ. Flowers polygamous-hermaphrodite or diclinous.

DISTRIBUTION.—The moist tropics of the Old World.

SUB-TRIBE: RAPHIEÆ

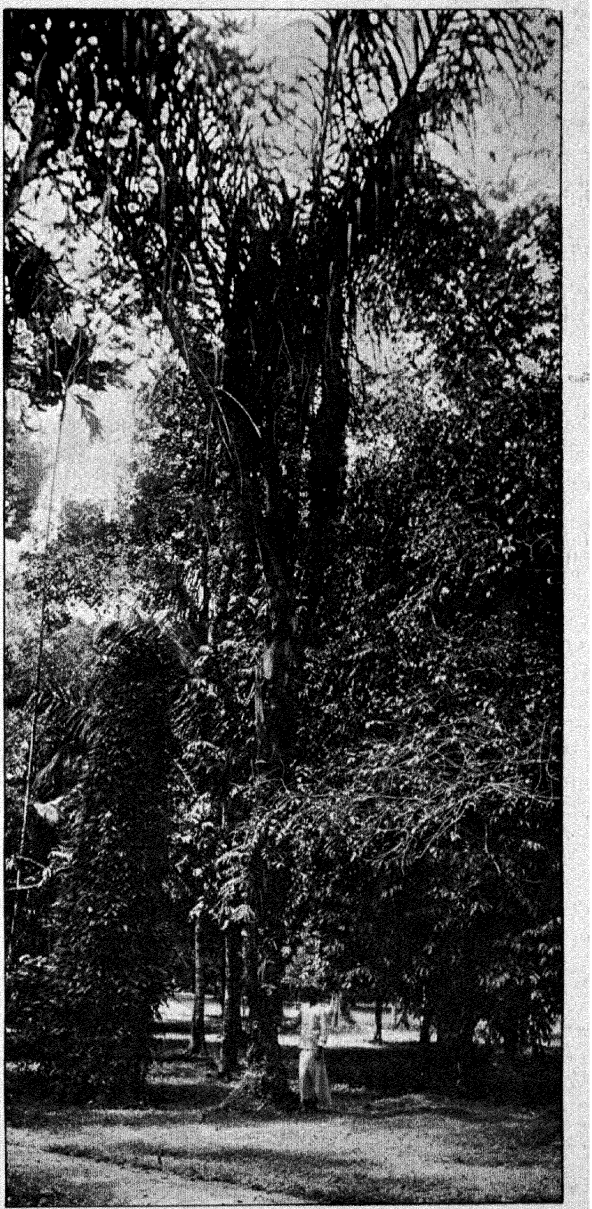
Flowers polygamous-hermaphrodite, or male and female flowers on the same branches of the inflorescence. Ovary completely 3-locular. Embryo horizontal.

DISTRIBUTION.—Africa on the coast of Guinea and inland to the sources of the Nile, also in East Africa on the coast of Zanzibar and perhaps in western Madagascar.

Raphia P. de. B., *Oncocalamus* Wendl. and Mann, *Ancistrophyllum* Hook., *Eremospatha* Wendl. and Mann.

1. *RAPHIA* BEAUV. FL. OWAR. I. 75, t. 44, fig. 1, 45, 46.

Lam. Illustr. t. 771.—Gærtn. Fruct. t. 40, f. 1.—Sprgl. Gen. Pl. 283 (*Metroxylon*).—Mart. Hist. Nat. Palm. II, 53, t. 45, 47, fig. 5, 48 (*Sagus*), III, 216, 343.—Kth. Enum. Pl. III, 216.—Meissn. Gen. Pl. 265.—Griff. Palm. British India, t. 182.—Wallace Palm. Amaz. 42, t. 2, 16.—Mann and Wendl. Trans. Lin. Soc. 24, 437, t. 39, 42.—Œrst. Palm. Centroam. 1858.—Drude in Fl. Brasil. III, II, 286, t. 61, 62.—Benth. and Hook. Gen. Pl. III, II, 935, 110.—Luers. Botan. II, 332.—Becc. in Agricolt. Col. IV. (1910) t. 1—6, in Webbia III (1910) 37—130.



Raffia Palm (*Raphia ruffia* Mart.).

Large trees: stem short, stout, annulated. Leaves gigantic, regular, pinnate; leaflets linear with the midribs and edges spinulose; bases of the petioles sheathing, persistent some way down the stem, the margins fibrous.

Spadices growing from among the leaves about 3½ feet long, much branched. No common spathe, but many small, incomplete sheaths. Flowers monœcious, reddish-brown or greenish, male and female in separate bracts of the same branch. Male flowers: calyx campanulate, truncate; corolla triphyllous; stamens 6—8. Female flowers: calyx 3-dentate, corolla campanulate-infundibuliform, 3-partite half-way down. Ovary 3-locular; stigmas 3, sessile.

Berry with large imbricated scales, unilocular and 1-seeded by abortion. Seed cylindric oval, elongate-erect; embryo horizontal in the middle; albumen ruminate.

Species about 20.—Tropical Africa and America.

1. **Raphia ruffia** Mart Hist. Nat. Palm. III, 217; Kunth. Enum. Pl. III, 217; Wright in Th. Dyer. Fl. trop. Afr. VIII, 104 (*partim*); Drude in Engler Nat. Pflanzenf. I, 46, f. 36; Becc. in Agricolt. Colon. IV (1910) t. I; Webbia III (1910) 47.—*R. pedunculata* P. Beauv. in Desv. Journ. Bot. II, 87, *et in* Fl. d'Oware et de Benin I, 78, t. 44, f. 2, et t. 46, f. 2.—*R. lyciosa et R. polymita* Comm. ex Kunth. Enum. Pl. III, 217.—*R. tamatavensis* Sadebeck in Engl. Bot. Jahrbücher, XXXVI (1905) 354—*R. vinifera* Drude (*non* Palis. de Beauv.) in Mart. Fl. Bras. v. III pt. II, *tantum in* tab. 62, f. I. D.—*R. nicaraguensis* Oersted in Vidensk. Meddel. naturhist. Forening, Kjöbenh. 1858 (1859) 52.—*R. vinifera var. nicaraguensis* Drude in Fl. Bras, l. c.—*Sagus farinifera* Gærtn. Fruct. et Sem. II, t. 120, f. 3.—*Sagus Ruffia* Jacq. Fragm. 7 No. 27, t. 4, f. 2.—*Sagus pedunculata* Lam. Encycl. Suppl. V, 13, et Illustr. III, 357, t. 771, f. 2, a. g.—*Sagus lævis.* Griff. Palms Br. Ind., *tantum in* tab. CLXXXII.—*Metroxylon Ruffia* Spreng. Syst. II, 139.

NAMES OF THE TREE.—*English:* Raffia, Raffia palm, Rafia palm, Raphia palm, Roffia, Roffia palm.
French: Mouffia, palmier de Mayotte, raffia, rafia, raphia.
German: Bambuspalme, Madagaskarische Sagopalme, Raffiabastpalme, Raffiaweinpalme.
Dutch: Madagascarsche Sagoboom, sagodragende palm.

NAMES OF THE FIBRE.—*In Madagascar:* Rafia.
English: Raffia, rafia fibre.
French: Raffia.

German: Bambuspalmenfaser, Raffia, Raffiafaser, Raphiastroh.

Dutch: Rafia, raffiabast, raffiabindbast, rafiavezel, raphia.

DESCRIPTION.—Stem up to 30 feet high and often (in very strong specimens) $3\frac{1}{3}$ feet in diameter, ringed. Leaves rising straight up, reaching 50 feet in length. Petiole very stout, relatively short, abruptly dilated at the base into a short and broad sheath surrounding the stem, deeply excavated on the upper side, convex on the lower; margins very acute, armed with short pale ascending spines, similar to those at the base of the segments. Segments very numerous, biseriate and more or less distinctly geminate on both sides of the rhachis, broadly linear, very slightly restricted towards the base, long-acuminate, very thinly coriaceous, rigid for the greater part of their length, green and shining above, whitish-pulverulent below. The segments vary as to length and breadth on the same leaf according to their position: the lowest are very acuminate, as long as the middle ones, but narrower, about $\frac{4}{5}$ inch broad, and more spinous than these. The central segments are distinctly geminate, the bigger ones 4-$4\frac{2}{3}$ feet long, sometimes up to 6 feet, and $1\frac{1}{5}$-$1\frac{3}{5}$ inch broad, spinulose on the margins, more or less spinulose on the median rib, or also entirely unarmed. The segments near the apex become gradually smaller as to length and breadth, less distinctly geminate and entirely unarmed.

Spadix very large, rising successively from the axils of the highest leaves, first erect, then recurved and turned downwards; the same plant bears several spadices at the same time and of different age; they vary in length from 7 to 11 feet. Spadix cylindric, about 8 inches thick at the time of flowering; peduncle stout, recurved, slightly compressed, about 5 inches broad, sheathed below by 2 coriaceous spathes, about $3\frac{2}{3}$ feet long; the outer spathe acutely bicarinate; then follow other empty spathes which surround the peduncular part; and finally there are many others of which each bears in its axil a partial inflorescence. Partial inflorescences compressed, short and broad, 6-8 inches long, cuneate at the base, getting gradually broader towards the apex, divided into branches or floriferous spikelets of unequal length. Each partial inflorescence arises from the axil of a primary spathe which is rather broader than long and which terminates abruptly in an acuminate apex, being,

on the whole, longer than the corresponding inflorescence. Primary spathes thinly coriaceous, of chestnut colour inside, hazel outside. Each inflorescence has a very short peduncular part which is strongly compressed, $\frac{1}{5}$-$1\frac{3}{5}$ inch long, $\frac{3}{5}$-$\frac{4}{5}$ inch broad, and sheathed by a short secondary spathe; this is narrowly sheathing, narrowly 2-winged, prolonged at the apex to the right and left into a very acuminate subfalcate and acutely carinate apex; the tertiary spathes, from the axils of which rise the spikelets, are close to each other, very shortly infundibuliform truncate at the apex, entire, non-ciliate, with a thin margin. Spikelets bearing perfectly bifarious flowers, vermiform, strongly compressed, slightly sinuose, about $\frac{2}{5}$ inch broad at the base, getting very slightly thinner towards the apex; the lowest ones are larger and measure 3-6 inches in length; the upper ones getting gradually shorter. Female flowers ovate, acute, $\frac{1}{3}$ inch long; involucellum membranaceous, yellow, forming a cupule almost complete or more or less split on the back, narrowly embracing the calyx. Calyx tubular-urceolate, truncate, entire and slightly narrowing at the mouth, from which rise the conical apex of the ovary and the stigmas, which form a pyramidal trigonous, acute point. Corolla invisible externally, being entirely included in, and slightly shorter than, the calyx, divided

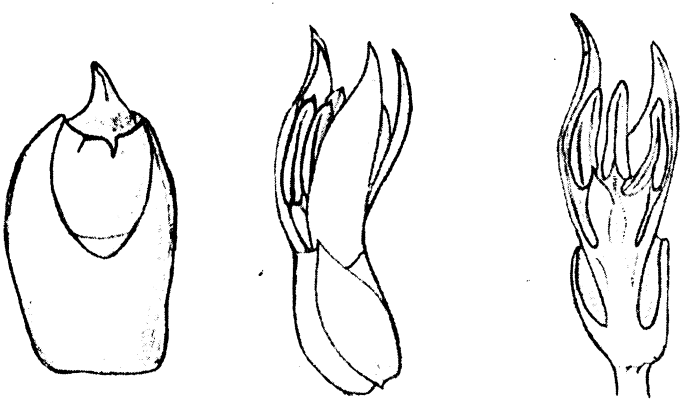


FIG. 30. – *Raphia ruffia* Mart. Left: Female flower without spathellule, seen from the axile side. Middle: Male flower. Right: Median section of male flower. (After Beccari.)

into 3 large, broadly triangular, acuminate lobes. Staminodes forming a membranous cupule which is irregularly sinuous—6-dentate, the teeth being more or less triangular. Ovary ovate,



Wine Palm (*Raphia vinifera* Palis de Beauv.).

stigmas 3, triangular, acute, connivent. Male flowers perfectly distichous and uniseriate, $\frac{3}{8}$ inch long and $\frac{1}{10}$ inch broad. Spathellule of male flower slightly longer than the calyx of its own flower, acutely bicarinate, shortly bidentate at the apex (fig. 30). Calyx tubular-cyathiform, superficially and obtusely 3-denticulate, slightly shorter than the corresponding spathellule. Stamens normally 6, sometimes 7-8, equal; filaments stout, clavate-fusiform, abruptly contracted at the connective, connate at the base; anthers linear, sagittate-auriculate below, obtuse. Corolla about twice as long as the calyx, subterete, divided to its lower fourth into 3 linear-lanceolate, thinly coriaceous segments.

Fruits variable in shape and size, 1-2 inches long, $1\frac{1}{2}$-$1\frac{4}{5}$ inch broad, more or less turbinate, or globose-ovate, and slightly longer than broad, or subglobose, always slightly depressed at the apex and terminated by a very short conical top, more or less attenuate below into an acute and symmetrical base, more rarely rotundate at the base. Scales disposed on 12-13 orthostichies, of chestnut or mahogany red colour, shining, strongly convex, deeply sulcate longitudinally, margin very narrow, scarious, blackish, fimbriate-ciliate, prolonged into an obtuse apex. Pericarp on the average, $\frac{4}{5}$-$\frac{4}{4}$ inch thick. Seed obovate, rotundate at the apex, more or less attenuate and acute below, sometimes $\frac{1}{2}$-$1\frac{1}{2}$ inch thick, and still thicker at the base; albumen very hard, osseous, white and penetrated by intrusions of the integument which render it more or less ruminate. Embryo situated on one side, a little below the middle.

HABITAT.—Indigenous in Madagascar. Extensively cultivated on the Mascarene Islands. Naturalized in America.

ILLUSTRATION.—The specimen of *Raphia ruffia,* shown on plate *XLVI,* grows in the Botanic Gardens of Peradeniya. In the centre of the crown a fruiting spadix is visible. The palm was photographed by Mr. Macmillan.

2. **Raphia vinifera** Palis de Beauv. in Desvaux Journ. de Bot. II (1809) 87, et Fl. d'Oware et de Benin I, 77, t. 44, f. 1. 45 (excl. syn. Gærtn.) et tab. 46, f. l. a. b. c. d.; Martius Hist. Nat. Palm. III, 217 (ed. 1); Beccari in Webbia III (1910) 88.—*Sagus vinifera* Lam. Encycl. Suppl. V, 13 (?)—*Sagus Ruffia var.* β Willd. Sp. pl. IV. 404.—*Metroxylon vinifera* Spreng. Syst. veg. II, 139, n. 2.

NAMES OF THE TREE.—*English:* Bamboo palm, Jupati palm, Pharaoh's date-palm, Wine palm.

French: Bourdon, Palmier à vin, Raphier.

German: Bambuspalme, Echte Weinpalme, Weingebende Sagopalme, Weinpalme.

Dutch: Raphiavezelpalm.

NAMES OF THE JUICE.—*English:* Palm wine, toddy.

French: Vin de palme.

German: Palmwein.

Dutch: Palmwijn.

NAMES OF THE FIBRE.—*English:* African bass, African bass fibre, Lagos bass, Lagos rafia, West African bass, West African bass fibre, West African piassava, West African rafia.

Dutch: West-Afrikaansche raffia.

Of the fibre from the young unopened leaves.—

English: Raphia grass.

DESCRIPTION.—Stem comparatively short. Leaves rising nearly vertically from the stem, bending out on every side in graceful curves, forming a magnificent plume. Spadices very large, compoundly branched and drooping, growing from between the leaves and having numerous bract-like sheaths. Partial inflorescence on the whole ovate, strongly compressed, with the spikelets densely arranged and distichous, about $\frac{3}{6}$ foot long including the peduncular part, which measures about 3 inches and which is sheathed by some tubular spathes, of which the outermost is bi-winged and prolonged on both sides into a falciform acuminate apex. The general spathe of the partial inflorescence is much dilated at the base and ends in a broad and rather long acuminate point, is opaque and hazel outside, shining and chestnut inside. Spikelets slightly arcuate, much compressed, of pectiform appearance on account of the regular arrangement of the flowers; the bigger ones situated on the lower third are 3-3$\frac{3}{5}$ inches long; the upper ones become gradually shorter, about $\frac{1}{2}$ inch thick, including the flowers; the spathellules are distinctly and densely ciliate-paleaceous on the margins. The flowers seem to be perfectly distichous. Male flowers (fig. 31) small, when fully developed, $\frac{1}{3}$ inch long, curved, calyx cyathiform, superficially 3-denticulate and ciliate-paleaceous on the margin, corolla about 2$\frac{1}{2}$ times longer than the calyx, opaque

on the outside, divided almost to the base into 3 linear segments. Stamens 9; filaments stout, subfusiform, free or more or less united at the base of the corolla. Female flowers (fig. 31) about $\frac{2}{5}$ inch long and $\frac{1}{6}$ inch broad, acuminate, slightly attenuate at the base. Calyx not very deeply 3-lobed; lobes obtuse, ciliate-

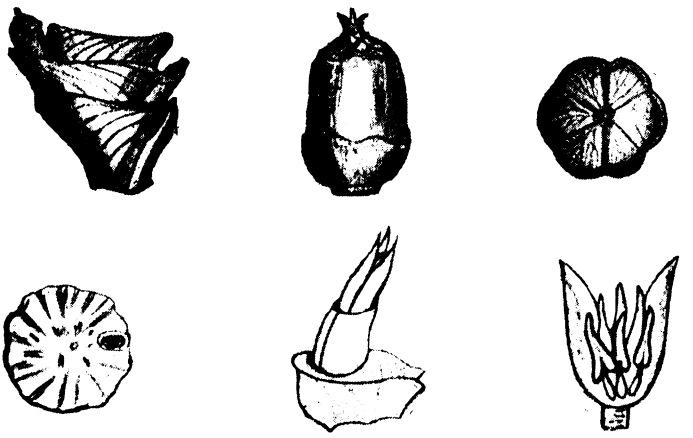


FIG. 31.—*Raphia vinifera.*
Upper row—Left: Two female flowers.
Middle: Single female flower.
Right: Seed seen from below.
Lower row—Left: Transverse section of seed with embryo.
Middle: Male flower with bract and bracteole.
Right: Male flower opened (after Drude).

paleaceous on the margin, especially at the apex. Corolla longer than the calyx, by about $\frac{1}{3}$ divided half-way down into 3 triangular elongate and acuminate segments. Staminodes united into a ring and connate with the corolla tube for the lower third of the latter, divided in the free part into 6 large triangular elongate and subulate teeth. Ovary pyramidal-trigonous; stigmas convergent.

Fruits cylindrical-ellipsoidal, equally broad below and above.

HABITAT.—Lower Nigeria.

USES.—A pleasant wine is obtained from *Raphia vinifera.* It is procured by cutting out the terminal inflorescence as soon as it makes its appearance; the wine is then procured in large quantities.

The petioles of the leaves are employed as poles upon which to carry palanquins. The leaflets are used for roofing.

ILLUSTRATION.—Mr. Macmillan was kind enough to take a photograph of a fine specimen of *Raphia vinifera* growing in the Botanic Gardens of Peradeniya. There arise from between the leaves about 6 flowering and fruiting spadices at different stages of development. (Plate XLVII.)

SUB-TRIBE: CALAMEÆ

Flowers polygamous-monœcious, diclinous-monœcious or diœcious.

Ovary incompletely 3-locular.

DISTRIBUTION.—Scarcely touching tropical West Africa, the *Calameæ* begin with a great number of species on the tropical slopes of the Himalaya, pass through continental India to the Sunda and Malay Archipelago and finally to Polynesia on the one hand, and the tropical coast of Australia on the other.

Eugeissonia Griff., *Metroxylon* Rottb., *Pigafetta* Becc., *Zalacca* Reinw., *Korthalsia* Bl., *Ceratolobus* Bl., *Plectocomia* Mart., *Plectocomiopsis* Becc., *Calamus* L., *Dæmonorhops* Bl.

KEY TO THE GENERA DESCRIBED BELOW

A. Monocarpic palms, flowering once and then dying.
  I. Spadices axillary from the uppermost leaves.
    1. Stem scandent. Spadix with long amentiform branches clothed with large closely imbricating inflated spathels that conceal the spikelets of flowers ... ... *Plectocomia.*
    2. Stem scandent. Spadix much branched, the branches having small infundibular spathels, each containing a small spikelet. Scales of fruit distinct ... ... *Plectocomiopsis.*
  II. Spadix very large, terminal ... ... *Metroxylon.*

B. Polycarpic palms, flowering annually.
  (*a*) Leaflets acuminate, quite entire, nerves parallel.
    1. Stem elongate, spathes tubular, persistent ... ... *Calamus.*

2. Stem elongate; spathes cymbiform or open, deciduous ... ... *Dæmonorhops.*
3. Stem short or absent; spathes many, persistent... ... ... *Zalacca.*

(*b*) Leaflets rhomboid-cuneate or oblanceolate, toothed; nerves flabellate ... ... *Korthalsia.*

1. *METROXYLON* ROTTB. NYE SAMML. DANSK. SELSK. SKRIFT. II, 525, t. 1.

(From the Greek *metra,* the heart of a tree, and *xylon* wood, in allusion to the large proportion of pith contained in the plant.)

Mart. Hist. Nat. Palm. III, 213, 343 (excl. Sect. *Pigafetta*) t. 102, 159; Kunth Enum. Pl. III, 213 (excl. sp.); Griff. Palm. Brit. Ind. 21, t. 181; Miquel Fl. Ind. Bat. III, 139 (excl. Sect. 2); Becc. Malesia I, 91 and in Nuovo Giorn. Bot. Ital. III, 29; Benth. et Hook. Gen. Pl. III, 935; Hook. f. in Fl. Brit. Ind. VI, 481; Drude in Engl. & Prantl Pflanzenf. 1. 47 (with *Cœlococcus* as a sub-genus); Becc. Asiatic Palms, *Lepidocaryeæ* part III, p. 156.—*Sagus* Bl. Rumphia II, 146 (excl. Sect.) t. 86, 126, 127; Turpin Dict. Sc. Nat. (Botanique) t. 32, 33.—*Cœlococcus* H. Wendl. in Bonpl. 1862, 199; Warburg in Bericht Deut. Bot. Gesell. XIV (1896) 140 t. X; Heim. in Bull. Agr. Col. Soc. Franc. de Colonies (extract) 1902, f. 1—5.

DESCRIPTION.—Arborescent, monœcious, more or less spinous palms having a columnar trunk and large pinnate leaves. Leaves with a large broadened base, clasping but not sheathing the trunk, spinous or smooth. Leaflets numerous, ensiform, straight, acuminate, midrib prominent, spinulous or nearly smooth on the upper surface, margins acute spinulous or nearly smooth. Inflorescence very large, terminal, arising from the centre of the leaf crown, usually composed of several main branches issuing from the axils of the uppermost much reduced leaves; the primary branches are sheathed by spathes, tubular in the lower part, open above; the secondary branches bear, alternately and distichally, the spikes, and are provided with tubular spathes. Spikes amentiform, cylindrical, bearing monœcious flowers in pairs, spirally arranged in the axils of broad membranous very approximate bracts or spathels, which are more or less connate; every pair of flowers provided with its special bracteoles, usually densely villose or reduced to tufts of hairs. The flowers of every pair are collateral; one of each

pair is male and the other hermaphrodite in appearance, but physiologically only female; both kinds of flowers are symmetrical and thinly coriaceous; calyx cyathiform campanulate, and more or less deeply 3-lobed; the corolla longer than the calyx, and more or less deeply divided into 3 valvate segments, but always undivided and campanulate or urceolate in its basal part. The male flowers open before the female and have the filaments connate and adnate to the undivided part of the corolla; anthers elongate, dorsifixed, versatile, with parallel cells opening longitudinally and laterally; rudimentary ovary very small, consisting of 3 very small papilliform bodies. Female or pseudo-hermaphrodite flowers opening after the fall of all the male ones; calyx, corolla and stamens as in the male flowers; ovary ovoid or turbinate, narrowing above into a thick acuminate style, unilocular; stigmas small, acute, connivent; ovules 3, basilar, erect, anatropous.

Fruit globose or turbinate, covered with imbricating scales; mesocarp suberose or spongy; endocarp very thin, pellicular. Seed solitary, globose, erect in the cavity; hilum basal, orbicular or elliptical; surface of the seed, divested of the integument, even and not pitted; albumen homogeneous, bony, and, in a vertical section through the embryo, horse-shoe-shaped; embryo basal.

Species about 9.

DISTRIBUTION.—The Indian floral region.

USES.—*Metroxylon* furnishes the best sago. In order to procure it the trunk is split into logs a few feet long, their soft interior extracted, pounded, and thrown into water; the water is then drained off from the pulpy mass, when the starch comes away with it, and, after being allowed to settle, is prepared and purified by successive washings. A tree fifteen years of age will yield from 600 to 800 pounds. The sago-meal, as it is called, is the form in which this starch is procured, although it is not commonly imported to Europe in this state. The usual form in which it is brought to the market is called Pearl Sago. We follow Bennet in the description of the process by which this sago is prepared. The raw sago is a mass of rather soft consistence and of a dirty white colour, being mingled with several impurities. It first undergoes several different washings



Sago Palm (*Metroxylon sagus* Rottb.).

through cloth strainers. When the raw material is sufficiently clean, the masses at the bottom of the vessels are collected, broken into pieces, and placed upon platforms in the sun to dry, being broken into still smaller pieces as the drying proceeds. As soon as the pieces are sufficiently dry, they are pounded and sifted upon long benches through sieves made of the midrib of the leaves of the Coconut Palm, and placed at certain distances in a longitudinal direction, so as to cause the pulverized, or rather broken, masses of sago of the size required to pass through. Having been passed through the sieve, a certain quantity at a time is taken, placed in a large cloth, and tied to crossed sticks, in the form of a bag, hanging by a cord from the roof of the building; the bag is then shaken forwards and backwards and the sago-powder itself must be occasionally shaken. This is continued for about ten minutes, when it is turned out granulated. It is then placed in small wooden hand-tubs, looking beautifully and delicately white, but still so soft as to break instantly with the slightest pressure under the fingers. It has then to undergo the drying process in large iron pans over a fire, where it is constantly stirred about with a wooden instrument. After this it is resifted at another bench and rebaked, when it is considered prepared. It is then of a fine, pure white colour, and, being spread thinly over a long and large bin, in course of time becomes both harder and of a darker colour. The sago is collected just before the tree begins to show its large terminal flower spike. This generally occurs at the age of seven or eight years. When the flower and fruit are allowed to develop, which is in two years from the first appearance, the pith of the centre is found dried up, the leaves have fallen, and the tree perishes.

1. **Metroxylon sagus** Rottb. in Nye Saml. K. Dansk. Vidensk. Schr. II, 527 t. 1; Miq. Fl. Ind. Bat. III, 147; Becc. in Nuov. Giorn. Bot. Ital. III, 29 and in Denkschr. Kais. Ak. Wiss. math. naturw. Kl. Wien LXXXIV (1913) 62, f. 6; Hook. f. Fl. Brit. Ind. VI, 481.—*M. inerme* Mart. Hist. Nat. Pal. III, 215—*M. læve* Mart. l. c. 214—*M. hermaphroditum* Hassk. in Tijdschr. Nat. Gesch. IX, 175 and Cat. Bogor. 65.—*Sagus lævis* Rumph. Herb. Amboi. I, 76; Bl. Rumphia II, 147, t. 86, 126, 127 (*Sagus Rumphii*); Griff. in Calc. Journ. Nat. Hist. V. 20 and Palms Brit. Ind. 24 (not t. CLXXXII).—*S. Kœnigii* Griff. l. c. 22, t. CLXXXI.—*S. inermis* Roxb. Fl. Ind. III, 623.— *S. genuina var. lævis* Giseke Prol. in Ord. Nat. 94

NAMES.—*English:* Common sago palm, Rumphius's sago palm, sago palm, sago tree.

French: Arbre au sagon, palmier du Japon, palmier sagon, sagonier, sagonier farinifore, sagoutier.

German: Echte Sagopalme, Molukkische Zapfenpalme, Rumph's Sagopalme, Sagobaum, Sagopalme.

Dutch: Meelboom, meelgevende palmboom, moluksche palmboom, sagoboom, sagoeboom, sagopalm.

NAMES OF THE FLOUR.—*English*: Sago, sago flour.

French: Farine de sagon.

German: Ostindische Graupen, Ostindische Tapiocca, Ostindischer Sago, Palmenstärke, Sago, Sagostärke.

Dutch: Bloem van sago, oostindische sago, palmensago, sagoe, sago, sagoemeel, sagomel.

DESCRIPTION.—(Typical form) Leaves (leaf sheaths, petiole and rhachis) and spathes, primary and secondary, not spinous. Leaflets linear-ensiform, the largest of the full-grown plant 5 feet long, very gradually acuminate above to a slender and at times filiferous tip; the margins smooth or with a few rudimentary spinules. Spadices exactly as in the next species, but having all the spathels (primary and secondary) quite spineless. Spikes 4-5 inches long and ½ inch in diameter. Male and female flower buds ¼ inch long, obovoid-oblong, slightly narrowing above, but obtuse at apex: calyx tapering below to a narrow base, 3-lobed, the lobes broad, rounded at apex; in the female flower the calyx later splits into 3 parts. Fruit globular, slightly depressed, looks like a small crab-apple, always somewhat broader than high, the upper and lower face equally and slightly concave, the lower umbilicate and the upper acutely mucronate; pericarp of average thickness of ¼ inch in the fresh fruit; mesocarp spongy and succulent; endocarp very thinly membranous; on the walls of the smooth endocarpal cavity are plainly visible the traces of the three rudimentary dissepiments, and exactly at the bottom of the cavity are the remains of two abortive ovules, as only one ovule is developed into seed. Seed globular, depressed; hilum circular; albumen white, bony, in a vertical section through the embryo horse-shoe-shaped; embryo basal, at times slightly remote from the hilum. Scales in 18 vertical series, rhomboidal, the mesials ½ inch broad, shiny and straw-coloured when dry, slightly darker



Rumph's Sago Palm (*Metroxylon rumphii* Mart.).

near the margins, somewhat convex, deeply grooved along the centre; the apices triangular, bluntish or subacute; the margins very narrowly discoloured or scarious and finely erosely toothed.

HABITAT.—In the entire group of the Moluccas, and in Borneo, Sumatra, Java, Philippines, Malay Peninsula, chiefly cultivated.

ILLUSTRATION.—We have to thank Mrs. Burkill for kindly taking the photograph (reproduced on Pl. XLVIII) in the Botanic Garden of Singapore.

2. **Metroxylon rumphii** Mart. Hist. Nat. Palm. III, 214 (2nd ed.), and 313, t. 102, 159; Miq. Fl. Ind. Bat. 140; Becc. in Nuovo Giorn. bot. Ital. III, 30; Malesia I, 91; Asiatic Palms, Lepidoc. part III, in Ann. Roy. Bot. Gard. Calc. 1916, 169; Hook. f. Fl. Brit. Ind. VI, 481.—*Sagus rumphii* Willd. Sp. Pl. IV, 404.—*S. genuina* Rumph. Herb. Amb. I, 75, t. 17, 18 (excl. Sagou duri rottang); Bl. Rumphia II, 150.—*S. spinosus* (Lapia tuni or genuine Sago tree of Rumphius) Roxb. Fl. Ind. III, 623 *excl. syn.*

NAMES.—Rumph's Sago-Palm; Sagu (Malay). See also the names mentioned under foregoing species.

DESCRIPTION.—Stem 25-30 feet high, soboliferous. Leaves 20 feet long and more; leaflets linear-lanceolate, acuminate, 2-4 feet long, 1-several inches broad, on the edges and central nerve setose; sheath coriaceous, 3 feet long, petiole densely covered with spines which are ½-1½ inch long. Spadix 12-15 feet long, the secondary branches 12-18 inches long; spathes of the first and second order coriaceous tubular, obliquely truncate, armed with compressed, blackish spines. The catkin-like spikes cylindric, 2½ inches long, of the size of the little finger, densely compact with bracts and bracteoles; bracts suborbicular or transversely elliptic, 1½ line long, coriaceous-membranous; bracteoles 1 line long, campanulate, compressed. Calyx campanulate, trifid; sepals ovate, acute, longitudinally nervose, corolla trifid below the middle; petals oblong-ovate. Male flowers (fig. 32): Stamens 6, as long as the corolla; filaments united into a subcylindric tube, attached to the base of the corolla, subulate; anthers linear dorsifixed; pistillode slightly shorter than the corolla; styles and stigmas 3. Female flowers (fig. 32): Staminodes forming a membranous, 6-fid urceolus, united with the corolla. Berry depressed-globose, 1½ inch in diameter, crowned with the style, with imbricate scales. Scales rhomboid, convex, with a median vertical furrow, the edges ciliate. Flesh spongy, dry. Seed globose, rugulose.

HABITAT.—Malay Archipelago.

ILLUSTRATION.—Mr. Macmillan has supplied us with the

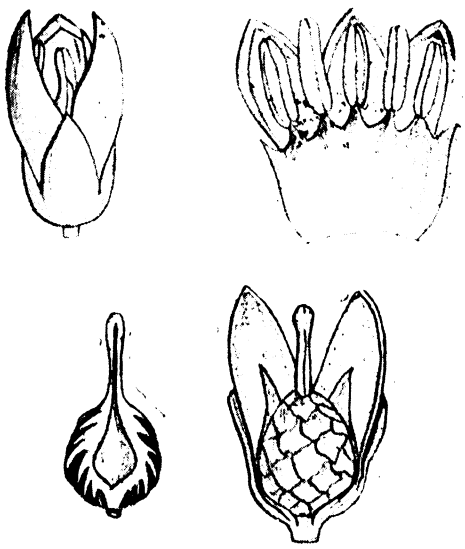


FIG. 32.—*Metroxylon rumphii* Mart.
Upper left: Male flower.
,, right: Corolla of male flower opened.
Lower left: Longitudinal section of pistillode of male flower.
,, right: Part of female flower showing the fertile ovary and two staminodes (after Martius).

photograph of Rumph's Sago Palm which grows in the Botanic Garden of Peradenya. There are two specimens visible on Plate XLIX, both without either flower or fruit.

2. *ZALACCA* REINW. SYLL. PL. SOC. BOT. RATISB. II, 3.

("Zalacca" is said to be the name of this genus in the Moluccas.)

Gærtn. Fruct. I. 139.—Bl. Rumph. II. 158.—Wall. Pl. Asiat. Rar. III, t. 222.—Mart. Hist. Nat. Palm. III, 199, 325, t. 118, 119, 123, 136, 159, fig. 3, 173, 174.—Kunth' Enum. Pl. III, 202.—Walp. Ann. V, 826.—Miq. Fl. Ind. Bat. III, 80.—Griff. Calc. Journ. Nat. Hist. V, 6.—Kurz. For. Fl. II, 511.—Benth. Hook. Gen. Pl. III, II, 932, 103.—Hook. Fl. Brit. Ind. VI, 472.

Stemless, soboliferous, armed palms. Leaves pinnatisect, not flagelliferous. Leaflets narrowly linear-lanceolate.

Spadix interfoliar, pendulous, flowering branches catkin-like. Spathes persistent; lower sheathing, incomplete; bracteoles cupular, 2-celled; flowers coriaceous, densely crowded, polygamous. Male flowers: Calyx tubular, 3-fid; corolla tubular, segments valvate; stamens 6, anthers short. Female flowers larger; perianth accrescent; calyx trifid; corolla-lobes lanceolate, valvate; staminodes 3-6; ovary 3-celled, stigmas 3, subulate; ovules basilar.

Fruit globose or obovoid, 1-3-seeded, clothed with reversed or spreading scales. Seeds 1-3, erect, top excavated; testa crustaceous; outer coat fleshy; albumen equable; embryo subbasilar.

Species 13.—Indo-Malayan.

CULTIVATION IN EUROPE.—The species of this genus are stove plants. They thrive in strong loam and river sand, in moist heat. The pots must be well drained to prevent any stagnation.

1. **Zalacca secunda** Griff. in Calc. Journ. Nat. Hist. V. 12; Palms Brit. Ind. 14, t. 117; Becc. Males. III, 673.—*Calamus collinus* Griff. Palms Brit. Ind. t. 186 (leaf only).

This species is very imperfectly known. Griffith describes the male spadix before the opening of the flowers, and gives the figure of an incomplete leaf, whilst Hooker was in possession of a leaflet, a young fruit, and some ripe fruit in a broken condition.

Leaves 30 feet long; leaflets 33 inches long, nearly 3 inches broad, straight, coriaceous, concolorous, with 3 stout costæ acute on both surfaces and spinulose beneath, margins setulose above the middle.

Male spadix compact, about 2 feet long, slightly curved, closely imbricated with the scarious, striated, split spathes. Spikes stalked, exserted; stalks nearly as long as the spathes, also covered with imbricated spathes, the uppermost of which resemble those of the flowers, except in not producing any villosity. The spikes themselves are 2½ and 3 inches long, and scarcely ½ inch in diameter, the bracts both of the base and apex appearing to be empty.

Female spadix paniculately branched, spikes tomentose. Male flowers: Bracts rounded, distinct, and presenting on the outer side of each flower a tuft of hair. Flowers densely crowded, so that their disposition is not at first apparent, the buds depressed

at the apex. Calyx tripartite to about the middle, scarious, striate, segments oblong, concave. Corolla (which was not seen by Griffith in an expanded state) about the length of the calyx, divided not quite to the middle, segments oblong, concave. Stamens united to the petals as high as the base of the segments. Filaments (free) obsolete. Anthers oblong. Female flowers? Fruit appears to be ovoid, 2 inches? long, ending in a stout cone; pericarp thin, clothed with spreading and ascending subulate-lanceolate, recurved, dark brown scales, ¼ inch long and under; no appearance of a succulent endocarp. Seeds 1-1¼ inch long, various in shape, from subglobose to hemispheric or trigonous with a convex back, and very rounded angles, dark brown, not polished, with a deep, small, apical hollow leading to the canal which extends more than half-way into the dense albumen; embryo above the base dorsal or sublateral, indicated externally by a circular convexity with depressed margins ¼ inch in diameter or less.

HABITAT.—Upper Assam, in forests about Kujoo; the Mishmi Mountains, and on the lower ranges of hills on the borders of Upper Assam.

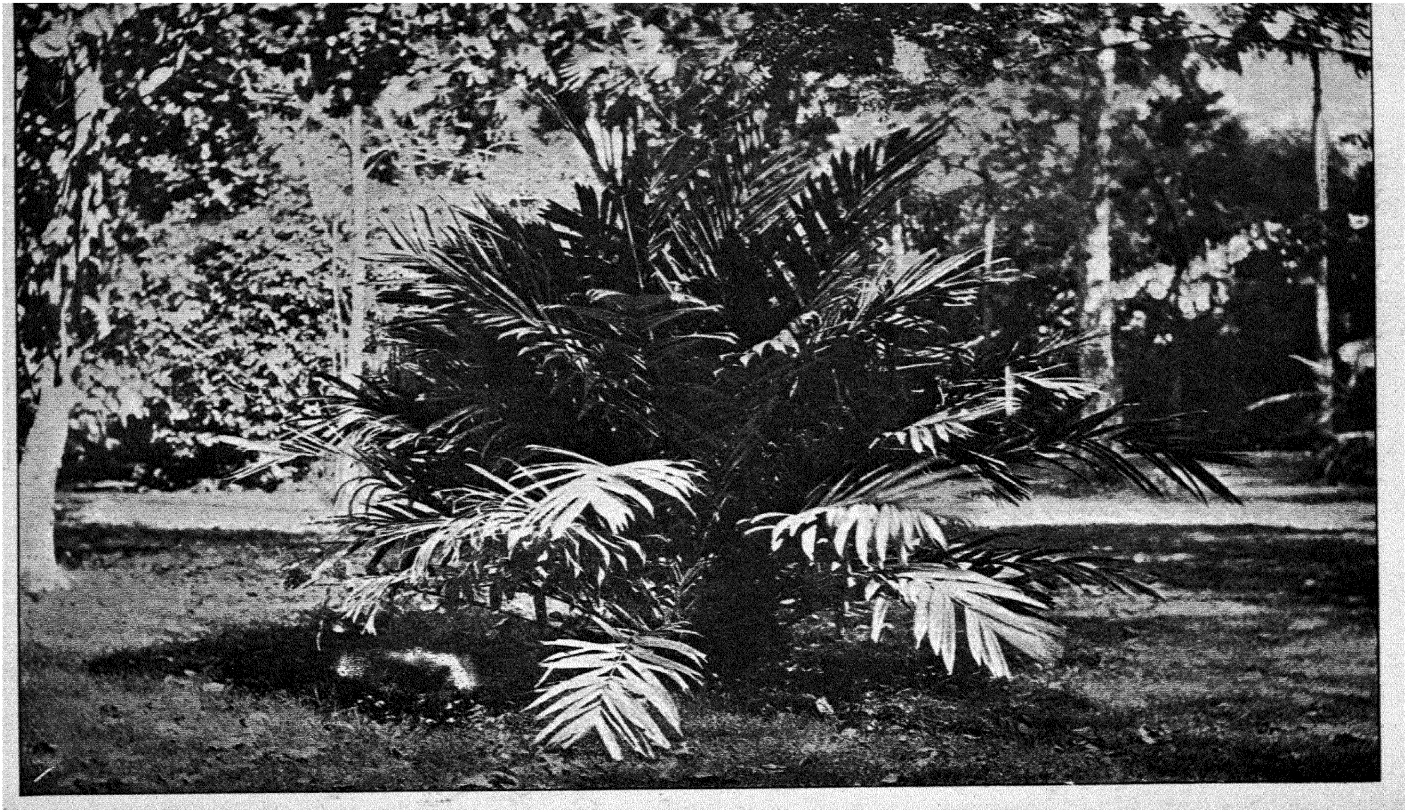
2. **Zalacca wallichiana** Mart. Hist. Nat. Palm. III, 200, 325, t. 118, 119, 136; Kurz in Natuurk. Tijdschr. Ned. Ind. XXVII (1864) 216; For. Fl. II, 511; Becc. Males. III, 66; Hook. Fl. Brit. Ind. VI, 473; Brandis Ind. Trees 649.—*Zalacca edulis*, Wall. Cat. n. 5000; Pl. As. Rar. III, 14, t. 222-224; Griff. in Calc. Journ. Nat. Hist. V, 8; Palms Brit. Ind. 10, t. 175.—*Z. rumphii* Blume Rumphia II, 159.—*Z. macrostachya* Griff. ll. cc. 13 and 15, t. 178, A, B, C; Becc. l. c. 66.

Brandis refers *Z. edulis* Reinw. to *Z. wallichiana*; and in this he is following Griffith (Palms Brit. Ind. 10); Hooker, on the contrary, says: "The Malayan *Z. edulis*, Reinw., not hitherto found in the Malayan Peninsula, has the leaflets white beneath."

Griffith's *Z. macrostachya* has been referred to *Z. wallichiana* by Beccari. He says that it is a much stouter form with oblanceolate leaflets, and spikes 3 inches long and nearly 1 inch in diameter.

NAME.—Yingan (Burm.).

An evergreen, large, tufted, stemless or almost stemless, palm, 12-20 feet high or somewhat higher, all parts glabrous. Leaves 15-20 feet long, pinnate; petiole 8-10 feet long, sheathing at the base, copiously armed with 1-1½ inch long, flat, sharp, somewhat



Zalacca wallichiana **Mart.**

reflexed spines arranged in broken spirals; the rhachis similarly armed, but the spines becoming gradually solitary towards the upper part; leaflets inequidistant and alternate, broad-lanceolate, 3-ribbed, 2-3 feet long, distantly spinulose-ciliate, green on both sides, subulate and almost tendril-like acuminate, the upper leaflets confluent, 2-cleft, with as many lobes as leaflets united.

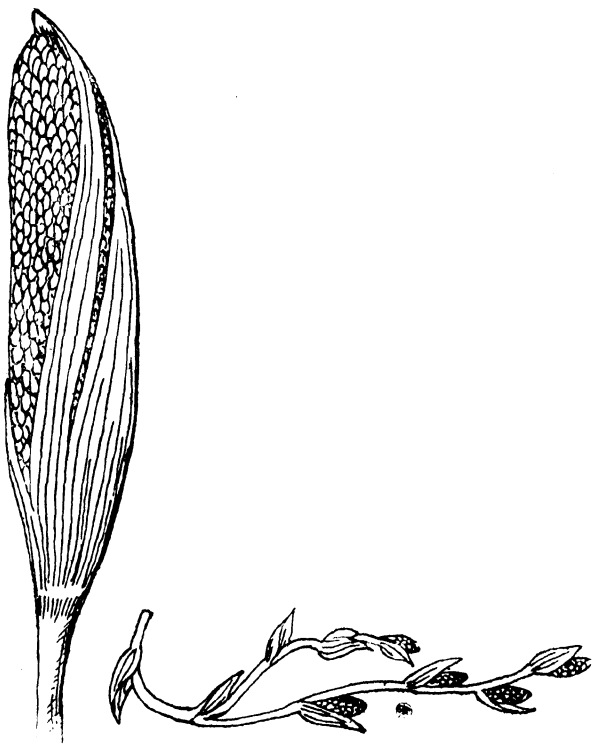


Fig. 33.
To the left: Terminal spike of spadix of *Z. wallichiana* Mart.
To the right: Upper part of spadix of the same (after Griffith)

Spadix elongate, fastigiately branched, dimorphic, one male only, with densely tomentose spikes, the other monœcious, very dense-flowered (fig. 33); each bract seems to correspond to a cluster of 3 flowers, a female between 2 males or neuters, and with 2 densely tomentose bracteoles; rhachis densely but shortly brown-scurfy. Flowers small, rose-coloured, in short, cylindrical, pale rose-coloured villous spikes, about 3 or more times shorter than the narrow, variously ruptured, partial spathes. Calyx

divided to the base, sepals obovate-oblong, about 1¼ lin. long; corolla nearly twice as long, rigid, rose-coloured.

Drupes in dense heads, obovoid, apiculate or almost acuminate, 1 inch long or more, densely retrorsely scaled, 3-1-celled with as many arillate seeds, the scales brown, rather rigid, cordate-ovate, only the upper parts exposed and terminating in a reflexed brittle bristle up to 1½ lin. long.

HABITAT.—Frequent in the tropical forests all over Pegu and Martaban down to Tenasserim, Penang and Singapore; Siam; Banca.

Flowers during the cold season; fruit ripens in June and July.

ILLUSTRATION.—The specimen of *Zalacca wallichiana*, figured on Pl. L. may be seen in the Botanic Gardens of Sibpur. The photograph was supplied by Col. Gage.

3. *KORTHALSIA* BL. IN RUMPH. II, 166, t. 130, fig. 2.

(After Peter Korthals, a botanist of Haarlem, who explored the East Indies.)

Mart. Hist. Nat. Palm. III, 210, 343, t. 172, fig. 1.; Bl. Rumph. III, t. 157, B (*Ceratolobus*); Miq. Fl. Ind. Bat. III, 74, 750, Suppl. 591.; Griff. Palms Brit. Ind. 26, t. 183, 184 (*Calamosagus*); Walp. Ann. III, 492; Kurz For. Fl. II, 512; Wendl. Bot. Zeitg. 1859, 174.; Becc. Males. I, 87; Benth. & Hook. Gen. Pl. III, II, 932, 104; Hook. Fl. Brit. Ind. VI, 474.

Scandent, spinous; leaves pinnatisect; leaflets more or less cuneate or trapezoid and erose; rhachis flagelliferous; petiole short, sheath often produced into a large ligule (ochrea).

Spadix axillary, loosely branched, pendulous, sheathed with tubular persistent spathes; bracts membranous; bracteoles reduced to hairs. Flowers bisexual, crowded in cylindric catkin-like spikes; sepals orbicular or oblong; petals ovate or lanceolate, valvate; stamens 6 or more, filaments short, anthers linear; staminodes 6 or more; ovary imperfectly 3-celled; ovules basilar.

Fruit globose or ovoid, 1-seeded; pericarp thin, tessellate with recurved shining scales. Seed erect, top hollowed, chalaza lateral; albumen ruminate; embryo ventral.

Korthalsia is a very natural genus. It can easily be recognized by the peculiar nature of its leaves. The leaves have leaflets of various shapes, but always with several main nerves, and with a more or less toothed or præmorse extremity, and furnished with a small pedicellar part or "ansa."

BIOLOGICAL NOTE.—"A peculiar character of *Korthalsia*", says Beccari, "is the great development of the appendage at the mouth of the leaf-sheaths (the ochrea) which at times is transformed into a swollen and entirely closed ant-harbouring organ or nidus, of a constant form for every species (*K. scaphigera, scaphigeroides, Echinometra horrida, Cheb, augustifolia, Scortechinii, furcata*). Regarding the biology of *Korthalsia* I refer the reader to my article on the 'Piante ospitatrici' (Malesia, II, p. 62). In *K. robusta* and *K. macrocarpa,* the ochreæ do not form an entirely closed dwelling for ants, but take the shape of large cornets embracing the base of the sheaths immediately above them, and at times attaining the extraordinary length of 30 to 40 cm. In most species, however, the ochreæ are cylindrical, closely sheathing, and often partially disintegrated into a fibrous net. The form and peculiarities of the ochrea afford often the best characters by which to distinguish the species, even if flowers and fruits be wanting. The nature, origin, and function of the ant-harbouring organs, not only in *Korthalsia,* but in numerous myrmecophilous plants, and most of all, in *Myrmecodia* and *Hydnophytum,* have been much discussed. With regard to this subject I retain my old opinion that such organs are now hereditary, but that they owed their origin to the effects of the stimulus exerted by ants on certain organs of the plants, of which the tissues were capable of a reactive power during the remote period of the plasmation epoch, when heredity had not yet acquired its actual conservative power."

Species.—26.

DISTRIBUTION.—Indo-Malayan.

CULTIVATION IN EUROPE.—An elegant genus of stove palms. When young, they are most effective as drawing or dining room decorations; and, when in a more mature condition, they are excellent as stove ornaments and for exhibition purposes. They are easily cultivated in a compost of equal parts of loam and vegetable mould. Plenty of water is required. They are propagated by seeds.

1. **Korthalsia laciniosa** Mart. Hist. Nat. Palm. III, 211; Kurz in Journ. As. Soc. Beng. XLIII,II (1874) 207; Becc. Males. II, 74 (excl. pl. Salangore); Hooker Fl. Brit. Ind. VI, 475.—*K. scaphigera* Kurz l. c. 206 (*excl. omnib. syn.*) t. 20, 21; For. Fl. II, 513 (not of Mart.—*K. andamanensis* Becc.

Males. II, 76.—*Calamosagus laciniosus* Griff. in Calc. Journ. Nat. Hist. V, 23, t. 1; Palms Brit. Ind. 27, t. 183.

NAMES.—Por, Bordah, Parida (Andamans); Shamoa (Nicobars).

Stems slender, ½ inch in diameter. Leaves 2-4 feet; leaflets subapproximate, 4-7 inches long, rhomboid, ovate or trapezoid, about as long as broad, acutely erosely toothed, terminal one broadest, fugaceously white tomentose beneath; ochrea dilacerate, sparingly armed; petiole 1½-2 feet long, with straight spines, angular above, slightly convex below; rhachis and flagellum with reversed claws.

Spadix much branched, and covered with imbricate, smooth spathes, with short, oblique, acute, suberect limbs; branches axillary, widely spreading, similarly covered with spathes, from which the spikes project. Spikes 3-4 inches long, 3-4 lines broad, tawny-tomentose, very compact, the pedicels almost entirely enclosed. Bracts rounded and imbricate, the lowermost empty, a little longer than the villous bracteoles. Flowers appear to be solitary, half immersed in the wool, which is exceedingly dense. Calyx short, with 3 broad, acute teeth. Corolla deeply tripartite, segments oblong, spreading, exserted. Stamens 6, united to the corolla at the base of its segments; free portion of the filaments broad, very short, united into a short annulus; anthers large linear, subsagittate. Ovary occupying the corolla-tube, surrounded by the filaments, covered with toothed scales, after fecundation becoming exserted. Style subulate, rather long, minutely 3-toothed at the apex.

Fruit ½ inch long, obovoid, mucronate, with greenish, brown-margined scales. Seed with a large excavation superiorly, filled with a brown cellular substance; albumen horny, ruminate. Embryo obconical, ventral.

HABITAT.—Tenassérim, Andamans and Nicobars, Sumatra, Indo-China (?).

2. **Korthalsia rogersii** Becc. in Annals Roy. Bot. Gard. Calcutta vol. XII, part II, 131.

DESCRIPTION.—Very slender. Stem sheathed. Leaf-sheaths glabrous, finely striate, quite unarmed. Leaves of the upper part of the fertile plant very small, about 1 foot long, including a slender, finely clawed cirrus, and having 4 leaflets on each side of the rhachis. Ochreæ elongate, cylindrical, very closely

sheathing, thinly membranous and fibrous; petiole very short, broadly channelled above, convex beneath. Rhachis very sparingly and minutely clawed. Leaflets small, 2-2⅔ inch long, 1⅜ inch broad, broadly cuneate-rhomboid with the apex acute or caudiculate, rigid-papyraceous, glabrous and green on the lower surface or else slightly paler than on the upper; the margins, from about the middle or from a little above it, are rather sharply erosely toothed, have 6-7 very fine but acute main nerves: ansæ strongly flattened, about 2 inches long. Inflorescence apparently formed only by a few spreading branches, 6 inches long (in one specimen), each bearing very short branchlets with 1-3 spikes only; primary spathes unarmed, tubular in their lower part, produced above into an ovate acute limb; the spathes of the branchlets tubular-infundibuliform, almost truncate at their mouths. Spikes small, of a very tomentose appearance, the spathels being entirely concealed by the dense wool of the flower-bracteoles. Fruit obovate-turbinate, a little attenuate towards the base, roundish or slightly flattened above, very minutely mucronate, 9-12 inch long, ⅜ inch broad; scales not strongly convex, grooved along the centre, straw-yellowish in colour, apices flattened and of a reddish-brown colour, bluntish or rounded, margins conspicuously ciliate-fringed.

HABITAT.—Andamans.

4. *PLECTOCOMIA* MART. ET BL. SCHULT. SYST. VII, 2, 1333.

(From the Greek "Plectos", plaited, and "comé", hair.)

Mart. Hist. Nat. Palm. III, 198, 325, t. 114, 116, Fig. 11, 12; Bl. Rumph. III, 68, t. 158, 159, 163; Kunth Enum. Pl. III, 202.; Griff. Palms Brit. Ind. 103, app. 20, t. 217-219; Bot. Mag. t. 5105; Miq. Fl. Ind. Bat. III, 78, suppl. 592; Kurz. For. Fl. II, 514.; Walp. Ann. III, 474; Wendl. Bot. Zeitg. 1859, 165; T. Anders. Journ. Linn. Soc. XI, 11; Benth. Hook. Gen. Pl. III, II, 934, 107; Hook. Fl. Brit. Ind. VI, 477.

Scandent, monocarpic, spinous palms; stem very long. Leaves flagelliferous; leaflets linear-lanceolate.

Spadix simply branched; branches very long, pendulous, clothed with closely imbricating distichous, inflated, coriaceous, persistent spathes which conceal the spicate, diœcious flowers. Spikelets short, male many-flowered, female shorter, few-flowered; bracts and bracteoles subulate. Male flowers: Calyx cupular,

3-toothed, petals lanceolate, valvate; stamens 6-12, filaments cuneate below, anthers linear. Female flowers larger, perianth accrescent; corolla 3-fid, lobes valvate; staminodes 6. Ovary 3-celled, ovules basilar.

Fruit globose, 1-, rarely 3-seeded, beaked; pericarp thin, tessellated, with reflexed shining scales. Seed erect; albumen equable; embryo basilar.

Species 12—Himalayan and Malayan.

CULTIVATION IN EUROPE.—Very handsome stove plants and of easy cultivation. A compost of loam and peat, in about equal parts, is suitable. Freely propagated by suckers.

* KEY TO THE SPECIES DESCRIBED BELOW.

A. Calyx of the male flowers campanulate or cyathiform, of the female flowers ovoid-campanulate, coriaceous, with obconical, solid and hard base.

1. Male flowers sessile ... ... *P. elongata.*
2. Male flowers distinctly pedicellate ... *P. griffithii.*

B. Calyx of the male flower shallow, trigonous or 3-toothed, of the female flower thinly cartilaginous, cupular, not thickened at the base

1. Leaflets green on both surfaces ... *P. himalayana.*
2. Leaflets green above and distinctly mealy white beneath ... ...

(*a*) Axis of the spikes and spikelets densely rusty-tomentose. Female flowers having a very short pedicel provided with small bracts, about $\frac{1}{5}$ inch long, and having the divisions of the corolla much longer than the calyx. Fruit slightly conically beaked, densely villous *P. assamica.*

(*b*) Axis of the spikes and spikelets densely rusty-tomentose. Female flowers pedicellate, provided with conspicuous bracts, $\frac{2}{5}$-$\frac{3}{5}$ inch long, and having the calyx split from the base into triangular

acuminate segments, slightly shorter than the corolla. Ovary densely villous ... ... *P. bractealis.*

(*c*) Axis of the spikes and spikelets glabrescent. Fruit of smooth appearance, covered with scales having the margins simply fimbriate and the tip not crisped... ... *P. khasiana.*

*INDIGENOUS SPECIES.

1. **Plectocomia khasyana** Griff. in Calc. Journ. Nat. Hist. V, 106; Palms Brit. Ind. 106, t. 218; Mart. Hist. Nat. Palm. III, 199; Hook. Fl. Brit. Ind. VI, 478.—*P. assamica* Hook. Bot. Mag. t. 1505 (*excl. syn. et fig.* 6-10).

Stem 60-80 feet, as thick as the arm. Leaves 30 feet, including the flagellum; leaflets 8-16 inches long, 2-3 inches broad, broadly lanceolate, strongly 3-ribbed, finely furfuraceous beneath tip, not filiferous; rhachis armed beneath with very short digitate spines.

Male spadix branched from the base; branches 3 feet long by 2 feet across the spathels, which are 1½ inch long, oblong, white, with broad, green, acute or acuminate tips and a broad, brown, interposed band (fig. 35). Spikelets 1-inch, many-flowered; petals ⅓ inch long, elongate lanceolate; stamens 8-12. Female spadix: Spathes of the peduncle with erect, oblong-lanceolate limbs; flower-bearing branches 1-2 feet long, secund, pendulous; spathes at the base half amplectent, rather distant, distichous, and laxly imbricated; outline obovate, towards the apex broadly obcuneate, margins below this part incurved; spikes concealed by the spathes, furfuraceous, 3 or 7-flowered; flowers distichous, large; calyx flat, small, divided almost to the base into 3 triangulur, mucronate, smooth teeth; corolla divided almost to the base into 3 ascending, lanceolate, acuminate segments, 4-4½ lines long; staminodes 6; ovary broadly globose, covered with exceedingly numerous, shortish, very fimbriate scales with multifid points, 3-celled; style very short, stout, with 3 stout, subulate, spreading branches as long as the petals, channelled and stigmatic on their inner faces.

Fruit 1-1¼ inch in diameter, globose, abruptly beaked, surrounded at the base by the calyx, and corolla now flattened out, dark brown; scales very numerous, rather small, either

nearly smooth, or with ciliate margins and recurved, split, fimbriate points. Seed covered with a rather thick, brown, cellular, spongy substance; albumen solid, horny; embryo basilar (fig. 34).

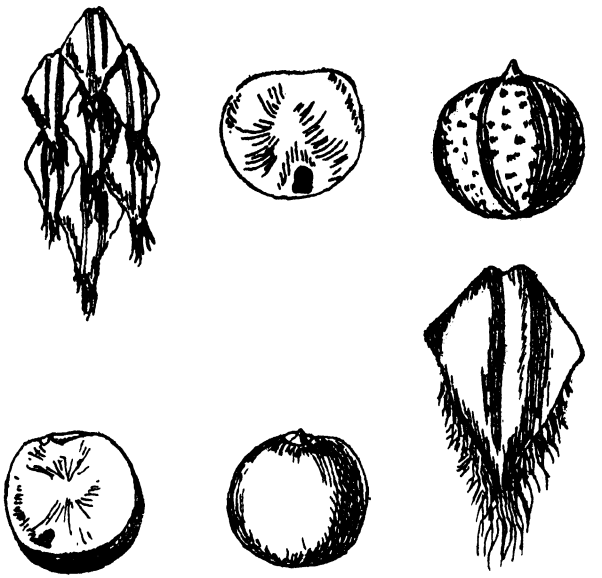


FIG. 34.

Upper row: *Plectocomia khasyana*.
Left: Scales of fruit much magnified,
Middle: Section of seed, natural size.
Right: Seed enclosed in the flesh, natural size.
Lower row: *Plectocomia assamica*.
Left: Section of seed.
Middle: Seed.
Right: Scale of fruit (after Martius).

HABITAT.—Khasia Hills, 4-5,000 feet.

2. **Plectocomia himalayana** Griff. in Calc. Journ. Nat. Hist. V, 100; Palms Brit. Ind. 108, t. 219; Mart. Hist. Nat. Palm. III, 199; T. Anders. in Journ. Linn. Soc. XI, 12; Hooker Fl. Brit. Ind. VI, 478.—*P. montana* Herb. Ind. Or. Hook f. & Th.

NAMES.—Takri Bet (Nep.); Ranul-Runul, Ranol (Lepcha); Rattan Palm (Engl.).

Stem 1 inch in diameter. Leaves 6-8 feet long, including the flagellum; leaflets 12-16 inches long, 1-1½ inch broad, alternate, linear-lanceolate, very acuminate, narrowed into filiform tips, 2-3 inches long, with five prominent veins on the

upper surface, margins with short, sub-appressed spinescent teeth; rhachis scurfy; the pinniferous part of the petiole armed below with stout, hooked prickles, confluent at the base; prickles in increased number on the flagellum; petiole unarmed or margins spiny; sheath tubular, scurfy; spines whorled.

Spadices erect; branches 2-3 feet long, covered with rust-coloured tomentum; spathes almost stem-clasping, conduplicate, coriaceous-scarious; spathels 1-2 inches long, rhomboid, acute; spikelets 3-7-flowered, scurfy, tomentose. Male flowers supported by 3 narrow, bristle-pointed, scarious bracts, sub-distichous; calyx cupular, with 3 short, rounded teeth ending in bristles; petals ¼ inch long, ovate-lanceolate. Stamens 6, united at the base into a short cup; filaments stoutish, subulate; anthers large, linear-oblong, obtusely sagittate. Female flowers?

Fruit ½ inch in diameter, depressed-globose; scales very small, fimbriate, tips appressed.

HABITAT.—Sub-Himalayan ranges about Darjeeling, 4-7,000 feet, common.

USES.—It produces soft canes of very little use except occasionally for tying fences and for rough basket work (Gamble). In fact the cortical part of the stem of this palm is not so strongly silicified as that of the more useful kinds of Rattan canes (Beccari).

3. **Plectocomia macrostachya** Kurz in Journ. Asiat. Soc. Beng. XLIII, II, 207, t. 16, 17; For. Fl. II, 514; Hook. f. Fl. Brit. Ind. VI, 478; Brandis Ind. Trees 650.

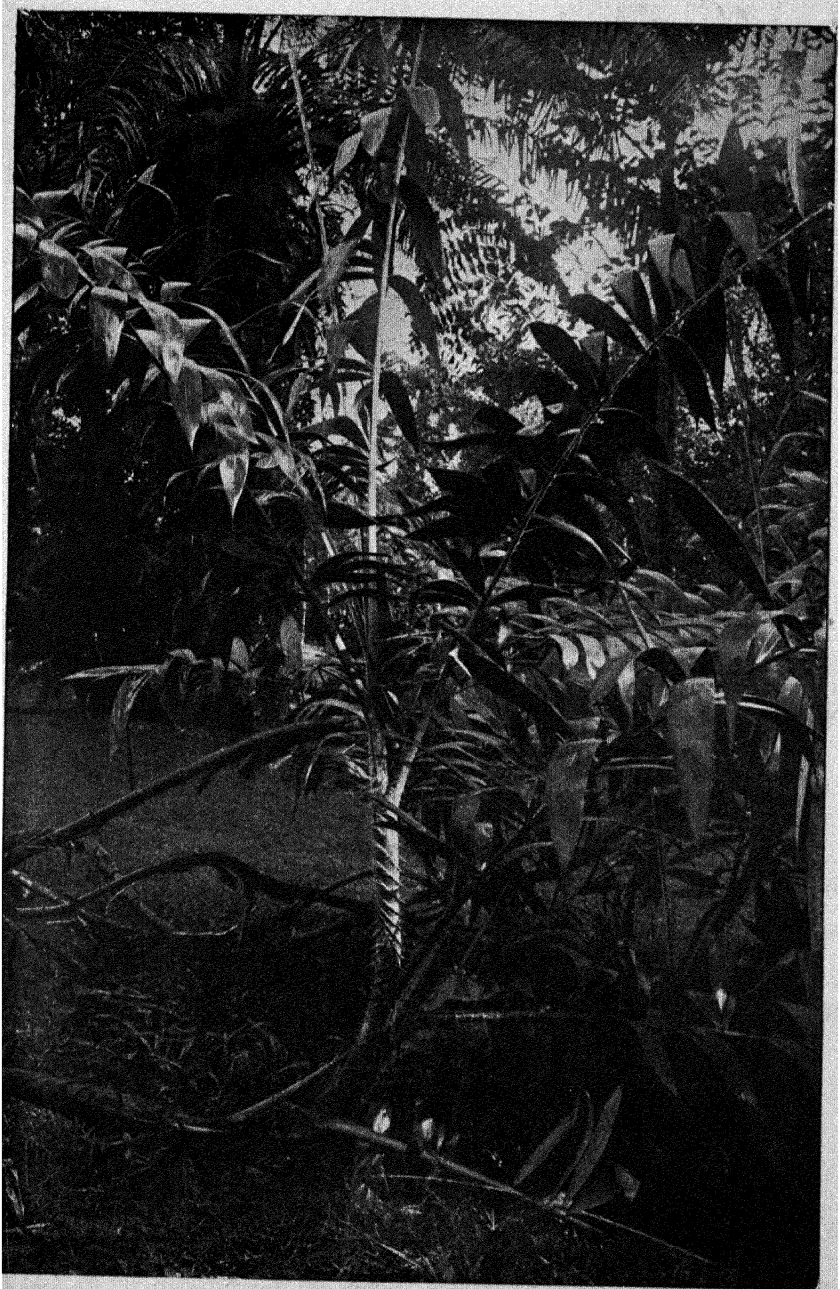
NAME.—Kyeinbam (Burm.).

An evergreen lofty climber, all parts glabrous. Leaves pinnate, the petiole and rhachis spiny, spines straight, up to ¼ inch long; leaflets (median ones) somewhat approximate by pairs, linear-lanceolate, ½-2 feet long, long-acuminate, white-powdery beneath, 3-ribbed, 2 of the ribs marginal, coriaceous, but rather flaccid.

Branches of male spadix 4-5 feet long, pendulous, closely covered with broadly obovate distichous imbricating spathels, brown with black border, in the axils of which are the spikelets, shorter than bracts with alternate, distichous flowers. Male flowers: Calyx wide, cup-shaped, about 1 line deep, shortly 3-toothed, the teeth acute, bordered, especially in their sinuses,



Plectocomia assamica Griff.



Plectocomia elongata Mart.

by a dense, brown, woolly tomentum; petals rigid, falcate, lanceolate, sharply acuminate, about $\frac{1}{3}$ inch long or somewhat longer, sulcate outside; stamens 6.

Drupes $\frac{3}{4}$-1 inch in diameter.

HABITAT.—Tenasserim; Bithoko range, between the Yunzalin and the Salween at Great Rapids, 3,000 feet elevation.

4. **Plectocomia assamica**, Griff. in Calc. Journ. Nat. Hist. V, 97, Palms Brit. Ind. 107, t. 218, a; Mart. Hist. Nat. Palm. III, 199, t. 176 f. 11; Hook. f. Fl. Brit. Ind. VI, 479; Gamble Mon. Ind. Timb. 737 (2nd ed.).

Leaves very large; leaflets 18-24 inches long, 2-2½ inches broad, white, finely furfuraceous beneath, tip not thread-like, ribs slender, lateral ribs marginal; petiole 1½ inch broad, with short, stout, marginal spines, and short, seriate, scattered clusters of more slender, dorsal ones.

Branches of fruiting spadix 4-5 feet long by 4-5 inches across the large, subacute, nearly glabrous spathels, scurfy, rhachis rusty tomentose; spathels 2½-inches long. Spikelets 8-10-flowered. Male calyx cupular, 3-toothed, sepals broadly ovate, $\frac{1}{4}$ inch long, petals lanceolate, $\frac{1}{3}$-$\frac{1}{2}$ inch long. Fruiting sepals broadly ovate, $\frac{1}{4}$ inch long; petals lanceolate, $\frac{1}{2}$ inch long.

Fruits, when dry, of a rich ferruginous brown colour, about 1 inch in diameter, surrounded at the base by calyx and corolla, terminated by a style tripartite almost to the base with subulate connivent branches, one-celled, very villous from the highly ciliate, fimbriate, split, recurved points of the scales. Albumen cartilaginous, solid, its tissue radiating from the centre; embryo basilar (*see* fig. 34).

HABITAT.—Upper Assam.

ILLUSTRATION.—The tuft of *Plectocomia assamica* represented on Pl. LI grows in the Botanical Gardens of Sibpur. We have to thank Colonel Gage for the photograph.

5. **Plectocomia bractealis** Becc. in Annals Roy. Bot. Gard. Calcutta vol. XII, part II, 40.

DESCRIPTION.—This species is very imperfectly known. Beccari founded it upon some spikes with female flowers in the Calcutta Herbarium. The female spikelets have usually 5 flowers, with pedicels $\frac{1}{5}$ inch long, each provided with a lanceolate, long-acuminate bract, $\frac{2}{5}$-$\frac{3}{5}$ inch long and tomentose outside. The female flowers have the calyx split to the base

(often irregularly) into 2-3 elongate-triangular, very acuminate sepals, finely striately veined and puberulous outside; the petals from a broad base are lanceolate, very acuminate, more than $\frac{3}{5}$ inch long; the ovary is coarsely woolly from the crisp laciniate points of the scales; style very short, conical and trigonous with connivent subulate stigmas, not surpassing the sepals in length during the anthesis; the staminodes have very narrowly sagittate sterile anthers. Spathels larger than those of *P. assamica*, 3 inches long, $2\frac{1}{5}$ inch wide, but of exactly the same shape, clothed with a thin, soft indumentum; axis of the spike rusty-tomentose, the internodes slightly clavate, 1 inch long, $\frac{1}{5}$ inch thick.

HABITAT.—Very likely Upper Assam.

** INTRODUCED SPECIES.

6. **Plectocomia elongata** Mart. et Bl. in Rœm. & Sch. Syst. VII, 1333; Hist. Nat. Palm. 199, t. 114 and 116, f. 1.; Kunth Enum. III, 202; Blume Rumphia, III, 68, t. 158 and 163 A; Hook. f. Fl. Brit. Ind. VI, 479.—*C. maximus*, Reinw., ex Blume Cat. Hort. Bogon, 59. *P. sumatrana* Miq. Prodr. Fl. Sum. 255, 592; De Palm. Arc. Ind. 27.

Leaves very large; petiole short; leaflets 1-1½ foot long, 2 inches broad, rather membranous, sparsely white furfuraceous beneath, tip not filiferous, costæ 3, very slender, lateral costæ marginal.

Branches of spadix 3-4 feet long, 2-3 inches across the spreading spathels (fig. 35). Spathels 1½ inch long, sub-3-lobed, acute, glabrous. Flowers very small; calyx of male minute, 3-toothed; petals ¼ inch long, obliquely oblong-ovate, acute. Calyx of female larger, urceolate, 3-toothed, petals small, linear-lanceolate.

Fruit 1 inch in diameter, densely villous from the long lacerate spreading tips of the scales.

HABITAT.—Penang, Sumatra, Java.

ILLUSTRATION.—Mrs. Burkill was kind enough to take a photograph of the specimen of *Plectocomia elongata* which grows in the Botanical Garden of Singapore (Plate LII).

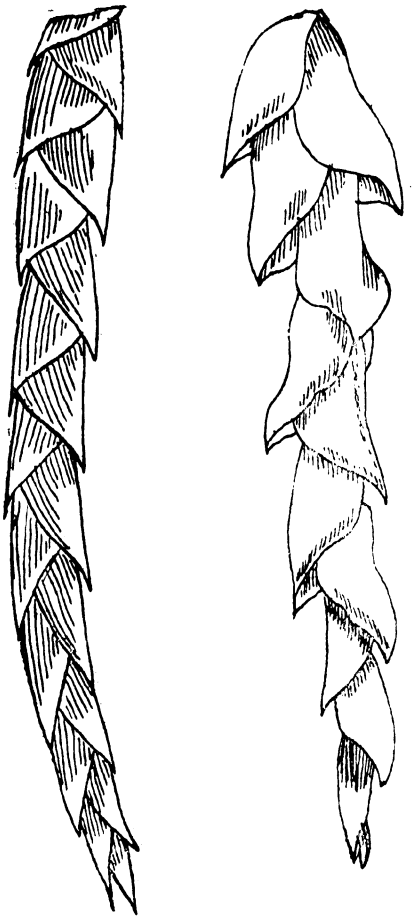


FIG. 35.
Left: Tip of female spike of spadix of *Plectocomia elongata*.
Right: Tip of spike of *Plectocomia khasyana*.

5. *PLECTOCOMIOPSIS* BECC. IN HOOK. F. FL. BRIT. IND. VI, 479.

[From Plectocomia (see foregoing genus), and "opsis" appearance].

Becc. in Ann. Roy. Bot. Gard. Calcutta XII, part II, 46; Ridley Mat. Fl. Mal. Penins. II, 213 (partly).

Large, scandent, calamoid, diœcious, monocarpic palms, with terminal inflorescence formed by several branches, each issuing

from the leaf-sheath of a reduced leaf. Leaves of the adult plant cirriferous; leaf-sheaths not gibbous above and gradually passing into the petiole; the mouth provided with a fugaceous, ochreiform membranous appendage. Leaflets elongate, acuminate, straight, unicostate, sprinkled with microlepidia on the under surface. Male and female partial inflorescences twice branched. Male flowering branchlets elongate, bearing distichally several small few-flowered spikelets. Male flowers: Filaments thick, united in their basal part, and introflexed at the apex; anthers dorsifixed, dehiscing laterally; rudiments of the ovary very small or obsolete. Female spadix: Flower-bearing branchlets elongate, bearing distichally and alternately greatly reduced spikelets, composed of only 2 (rarely 3-4) female flowers, without male or neuter flower, provided with only one disciform involucre. Female flowers of a thickish structure; calyx cupular-campanulate, 3-toothed; corolla undivided and urceolate in the basal part, more or less 3-lobed or 3-parted above stamens; filaments united to form a membranous tube more or less connate with the corolla, 6-toothed in the free part, and bearing anthers apparently well conformed. Ovary oblong, obsoletely 3-locular, 3-ovulate, the dissepiments of the cells soon obliterated; stigmas short, thick. Fruit monospermous, globose, the pericarp fragile, covered with scales arranged regularly in very numerous series. Seed globular, covered with a rather thick fleshy integument; nucleus not pitted; albumen equable; embryo basal.

Species about 5.

DISTRIBUTION.—From Lower Burma down throughout the entire Malay Peninsula, Sumatra, Borneo.

KEY TO THE SPECIES DESCRIBED BELOW.

1. Male and female flowers subcoriaceous *P. geminiflorus.*
2. Male flowers having membranous calyx and cartilaginous corolla ... ... *P. paradoxus.*

1. **Plectocomiopsis geminiflorus** Becc. in Hook. f. Fl. Brit. Ind. VI, 479; in Ann. Roy. Bot. Gard. Calcutta XII, part II, 48.—*Calamus Geminiflorus* Griff. ex Mart. Hist Nat. Palm. III, 338; Griff. Palms Brit. Ind. 70, t. 199A.—*Plectocomia geminiflora* H. Wendl. ex Hook. f. l c.—*Calamus turbinatus* Ridley Mat. Fl. Mal. Penins. II, 212.

NAMES.—Rotang, Rahilang, Rotang Relang (Malay); Kyein Ni (Burm.).

DESCRIPTION.—A strong climber. Sheathed stem of the upper part of the flowering plant 1⅛-1⅜ inch in diameter, in young plants more or less trigonous. Leaf-sheaths obliquely truncate and with thin, dry, lacerated borders at the mouth, sprinkled with scattered conical spines. Intermediate leaves 6-7 feet long, having a short petiolar part, glabrescent or slightly scurfy, sparingly clawed along the centre beneath. Leaflets numerous, equidistant, firmly papyraceous, lanceolate, largest about their middle. Male spadix: A partial inflorescence of a uniform fulvous tint; flower-bearing branchlets all turned to one side; spathes tubular-infundibuliform, closely sheathing, obliquely truncate and ciliate at the mouth. Spikelets reduced to glomerules composed of 5-7 flowers in all, disposed in two series; spathels bracteiform, acute, membranous, striate ciliate; involucre slightly concave, more or less distinctly 3-toothed and striately veined. Male flowers globose-ovoid, very obsoletely 3-gonous, with a broad base and an obscurely pyramidate point; calyx subcoriaceous, thickish, glabrous, shortly and broadly 3-toothed; corolla broadly ovoid; petals cartilaginous, ovate-elliptical, acute; stamens 6; filaments united in their lower part and forming there a small fleshy cup; anthers broadly ovate, blunt, cells opening laterally. Rudimentary ovary none. Female inflorescence consisting of a large leafy panicle, composed of several gradually curtailed and nodding partial inflorescences, each issuing from the bottom of the sheath of a reduced leaf. Spikelets composed of only 2, at times 3 or at most 4 equally developed female flowers, no neuter flowers; each flower furnished with a shallowly cupular truncate involucre; externally to the involucre a short, thickish bracteole. Female flowers broadly ovoid, obtusely trigonous, bluntish; calyx of a thick texture, cupular, broadly 3-toothed, obsoletely keeled, teeth obtuse; corolla twice as long as calyx, parted down below the middle into 3 subcoriaceous broadly ovate acute lobes. Fruit (immature) roundish turbinate, terminated by the small remains of the stigmas; scales very numerous, but regularly arranged in about 35 longitudinal series, with very finely fimbriate whitish edges, non-pitted; albumen equable; embryo basal. Fruiting perianth broadly campanulate.

HABITAT.—South Burma, Malay Peninsula, Sumatra.

2. **Plectocomiopsis? paradoxus** Becc. in Hook. f. Fl. Brit. Ind. VI, 480; Ann. Roy. Bot. Gard. XII, part II, 58.—*Calamus paradoxus* Kurz in Journ. As. Soc. Beng. XLIII (1874) 213, t. XXIX, XXX; For. Fl. Brit. Burma II, 521.

NAME.—Yamatha Khyeing.

DESCRIPTION.—An evergreen extensive climber, all parts glabrous; stem with the sheets 1-2 inches in diameter. Leaves pinnate, 5-7 feet long, terminating in a whip-like hooked-thorny tendril; petiole short, along with the lower part of the rhachis indistinctly puberulous and armed underneath and near both margins with more or less straight sharp thorns; sheaths armed with yellowish, sharp, flat spines arranged into combs; leaflets 1-1½ foot long, up to 1 inch broad, of a thin texture, alternating by pairs and remote marginate, shortly acuminate, inconspicuously and remotely appressed ciliolate. Male spadix bifariously decompound, ample, drooping; spathes all smooth, tubular, with a truncate, shortly acuminate limb; spathules similarly shaped, but much smaller, embracing the base of the very short (1-3 lin.), distichously imbricate bracted male spikelets; bracts spreading, ovate, acute, about 1 lin. long, brown, glabrous. Male flowers: Calyx about 1 lin. long, deeply 3-cleft, striate; petals rigid, connate at the base, nearly 2½ lin. long, oblong, acute; stamens 6; filaments rigid, the lower part linear-oblong, longer and broader than the anthers, terminating in an infracted thread, from which the anther is versatilely suspended; pistillode hardly any.

FLOWERS.—In April.

HABITAT.—Pegu.

6. *CALAMUS* L. GEN. PL. ED. 1764, 173, No. 436.

(From the Greek "calamos", a reed or cane).

Mart. Hist. Nat. Palm. III, 207, 331, t. 112; Gærtn. Fruct. II, t 139; Bl. Rumph. III, 28, t. 146, 154, 163, Griff. Calc. Journ. Nat. Hist. V, 26; Miq. Fl. Ind. Bat. III, 103, 719; Kurz For. Fl. II, 515; Benth. Fl. Austr. VIII, 134; Wendl. Bot. Zeitg. 1859, 158; Drude Bot. Zeitg. 1877, 637; T. Anders. Journ. Linn. Soc. XI, 8; Luers. Bot. II, 331; Hook. f. Fl. Brit. Ind. VI, 436; Becc. in Ann. Roy. Bot. Gard. XI, 61.

Perennial, armed, tufted palms usually climbing by means of hooked spines on the rhachis of the leaves, or by whip-like spinous prolongations (flagella) of the rhachis, or of the spadix,

or of the leaf sheath; stem simple, cylindric, ringed at the nodes, upper internodes clothed with spinous leaf-sheaths. Leaves pinnatisect, rarely digitate, alternate; leaflets few or many, lanceolate, rarely broad, acuminate, nerves parallel; sheath armed, produced into a ligula or ochrea, and with or without a lateral armed flagellum. Spadices axillary, usually elongate, much branched, armed, sometimes produced into a spinous flagellum. Spathes tubular or open, sheathing the peduncle and branches of the spadix, and passing into bracts and bracteoles (spathels and spathellules). Flowers small, usually polygamo-diœcious, in usually distichous often scorpioid spikelets, solitary or binate (a female or male or both) in the bracteoles. Male flowers: Calyx cupular, 3-lobed or 3-toothed, coriaceous; petals 3, acute, coriaceous, valvate, sometimes combined at the base into a stipes; stamens 6, filaments short, anthers dorsifixed, versatile. Female flowers slightly accrescent; calyx as in male; corolla tubular below, 3-fid, valvate; staminodes forming a cup; ovary incompletely 3-celled, clothed with retrorse scales; style short or rather long; stigmas 3; ovule basilar, erect (fig. 36 and 37).

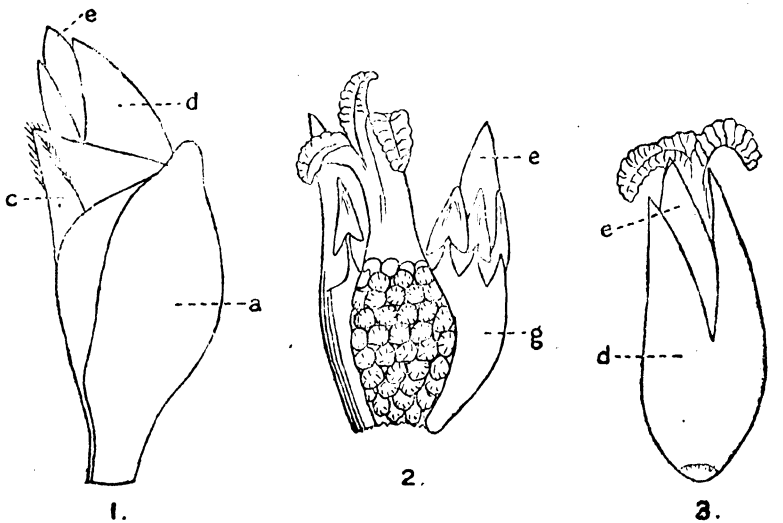


FIG. 36.—*Calamus griffithianus.*

1. Female flower with its involucre still closed; back view of the involucrophorum (*a*).
2. Female flower cut open: g = staminal tube.
3. Female flower without involucre; d = calyx, e = corolla. Enlarged 6 diam. (After Beccari.)

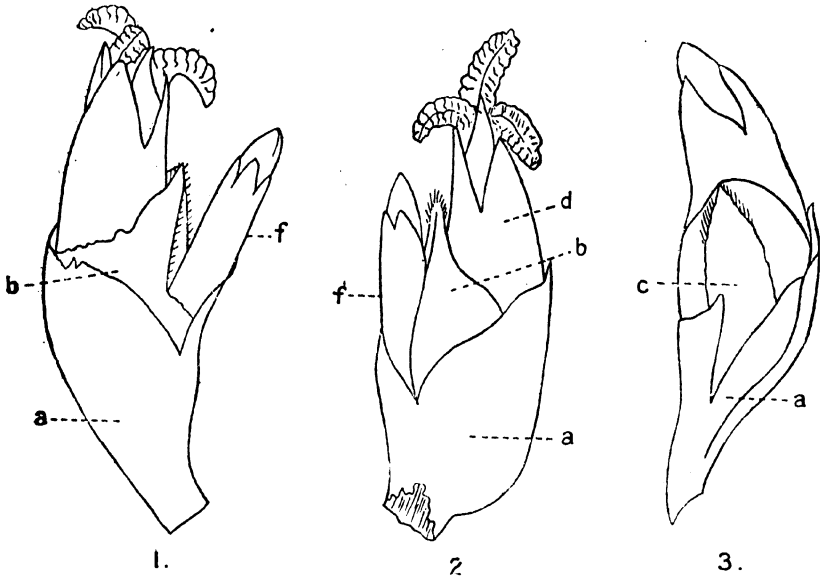


FIG. 37.—*C. griffithianus.*

1. Female flower during anthesis.
   a = involucrophorum, b = involucre, f = neuter flower.
2. Another female flower with its involucres during anthesis.
3. Female flower with its involucre still closed. c = areola.
   Enlarged 6 diam. (After Beccari.)

Fruit globose or ellipsoid, usually strongly beaked; style terminal; pericarp thin, clothed with appressed deflexed closely imbricating polished scales. Seed subglobose or oblong, smooth or pitted; albumen equable or ruminate; embryo ventral or basal.

Species over 200.—Tropical and sub-tropical Asia, Malaya, Philippines, New Guinea, Australia, and a few in tropical Africa.

The *Calami* are mostly leaf-climbers with thin reedy stems. In some species there are hooks on the back of the midrib, but the more common type of leaf is one in which the leaflets at the outer end of the leaf are represented by stout spines pointing backwards.

The leaf shoots almost vertically out of the bud up among the surrounding vegetation, and the hooks take hold. The stem often grows to immense lengths (500-600 feet).

ECONOMIC IMPORTANCE.—"The Forest Departments of the various provinces in India, including Burma, publish annual reports from which it might be gathered that the yearly crop

of canes amounts to about 10,000,000 maunds and the annual revenue therefrom from Rs. 50,000-60,000. The Reports of the Conservators of Forests in Burma for the year 1904-5, for example, show a total revenue from canes amounting to Rs. 37,775. The imports of canes and rattans into India from foreign countries may be said to average from 30,000 to 40,000 cwt., valued at from 2 to 3½ lakhs of rupees (38,436 cwt.) valued at Rs. 3,85,674 in 1906-7). These come mainly from the Straits Settlements and Siam. The exports to foreign countries of Indian canes come to from 1,000 to 3,000 cwt., valued at from Rs. 20,000 to Rs. 50,000 (2,427 cwt., valued at Rs. 38,100 in 1906-7), but in addition there is also a re-export trade formerly of about the same quantity and value as that just mentioned, but showing a considerable diminution in recent years (673 cwt., Rs. 11,291, in 1906-7). It is thus significant that India, with its vast supplies of canes and rattans should not be independent of foreign tropical countries, and the explanation may possibly lie in the cheaper sea, as compared with land, transit. Large towns like Bombay, Calcutta, and Madras find it more economical to obtain their supplies from the Straits than from the inland forests of India." (Watt.)

Popular names for *Calamus* in general and its products:—

OF THE PALM.

English: Canes, Rattan, Rattan Palm, Reed Palm, Rotang.

French: Canne épineuse, Ratan, Rotain, Rotang, Rotin.

German: Binsenhalm, Binsenstengel, Rohrpalme, Rotangpalme, Rottang, Schilfpalme.

Dutch: Palmriet, Rotanpalm, Rotan, Rottangpalm, Rottan, Rottanpalm, Rotting, Rottingriet, Rottinggewas, Spaansch riet.

OF THE CANE.

English: Ratoon, Rattan, Rattan cane.

French: Canne à main, Jonc, Jonc d'Inde, Rotan, Rotin.

German: Handratting, Malaccarohr, Manillarohr, Rohr, Spanisches Rohr, Stockrohr, Zuckerrohr.

Dutch: Rotting, Spaansch riet.

OF THE WOOD.

English: Cable cane, Chair-bottom cane.

French: Liane d'amarrage?, Rotang à cordes, Rotang à meubles.

German: Bindrohr, Bundrohr, Ratang, Rattan, Rohr, Rotang, Rotting Schnürrohr, Stuhlrohr.

Dutch: Bindrottan, Bindrotting.

Of native generic names for *Calamus* we mention the following taken from Beccari:—

In Ternate: Uri.
In Makassar: Boucan.
In Banda and Amboina: Ua.
In the Philippines: Bejuco.
In Java: Penjalin, Hoeh, Hooek.
In China: Khoë, Khoëa.
In Cochin-China: May.
Hindustani: Bet.
Sanskrit: Vetra, Vetus.

CULTIVATION IN EUROPE.—"Although the species of *Calamus,* the cultivation of which has been attempted in the hothouses of extra-tropical countries, are pretty numerous, the number of those which have become permanently established is small, owing to its being very difficult to provide them with conditions of existence like those enjoyed in their native countries. The *Calami* in our hothouses therefore give but a faint and poor idea of the elegance of their foliage as it appears at the summit of a long, slender and climbing stem. Young plants of *Calami* are, however, considerably appreciated by horticulturists on account of their highly ornamental, bright green, graceful, pinnate leaves, so that they are frequently offered for sale in commercial catalogues of living plants.

"In cultivation *Calami* thrive best in a compost of equal parts of sandy loam and vegetable soil formed by decomposed leaves. They require a warm, moist atmosphere and copious watering. I have, however, to observe that *Calami* grow in very different situations, from marshy plains at the level of the sea up to an elevation of 2,000 meters in the mountains, so that in the cultivation of *Calami,* as in that of any other plant, it is necessary to know beforehand the natural conditions of their existence and to modify their cultural conditions accordingly. If this be borne in mind, it may be found that probably not a few of the mountain species of *Calamus,* as for instance those of the Himalayas and Assam, will thrive better in a temperate, than in a warm, hothouse, while others should receive the treatment of aquatic plants in warm water." (Beccari.)

CONSPECTUS OF THE SPECIES.[1]

A.—Leaves never cirriferous.

Group I.—Leaflets many, elongate. Primary spathes elongate-tubular, dilated and lacerate in their upper part. Spadix with their partial inflorescences and spikelets provided with a pedicellar part which remains included in their respective spathes. Fruiting perianth explanate (not forming a pedicel to the fruit). Involucrophorum of the female spikelets short, not pedicelliform. Seed with ruminate albumen; embryo basilar or nearly so:—

(*a*) Stem erect. Leaf-sheaths not flagelliferous.

1. *C. erectus.*

(*b*) Scandent. Leaf-sheaths flagelliferous.

2. *C. flagellum.*

Group II.—Leaflets numerous, elongate. Primary spathes elongate-tubular, more or less lacerate in their upper part. Fruiting perianth explanate. Involucrophorum short, not pedicelliform. Seed (where known) with equable albumen and basilar embryo:

(*a*) Spikelets not inserted at the bottom of their respective spathes and therefore not, or very shortly, pedicellate:—

* Not scandent. Spadix not flagelliform, and armed only with straight spines.

3. *C. arborescens.*

** Scandent. Spadix flagelliform, clawed on the axial parts between the partial inflorescences.

4. *C. longisetus.*

5. *C. thwaitesii.*

6. *C. leptospadix.*

(*b*) Spikelets inserted at the bottom of their respective spathes and provided with a distinct pedicellar part.

7. *C. dilaceratus.*

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[1] In this and the following descriptions of the species of *Calamus* I could not do better than copy from Beccari's admirable monograph on "The Species of Calamus", which appeared as vol. xi of the Annals of the Royal Bot. Gard., Calcutta. It was my intention to omit this genus altogether; but some botanists in Europe advised me to include it. Two reasons induced me to follow their advice: the fact that unfortunately very few people have access to Beccari's work, and the more selfish consideration that my series of the Indian Palms would be incomplete by excluding the genus Calamus, a genus that is better represented in India than any other.

Group III.—Leaflets very few, pinnate, digitate or radiate. Primary spathes very narrow and elongate-cylindric, very closely sheathing. Leaf-sheaths flagelliferous. Spadices (male and female) simply decompound, very slender and flagelliform; partial inflorescences and spikelets inserted at the mouth of their respective spathes (not with a pedicellar part). Fruiting perianth explanate. Involucrophorum not pedicelliform. Seed with equable albumen and basilar embryo.

8. *C. pachystemonus.*
9. *C. digitatus.*
10. *C. radiatus.*

Group IV.—Leaves pinnate. Leaf-sheaths provided in the scandent species (when not bearing spadices) with a long-clawed flagellum; in the non-scandent species the flagellum rudimentary or none. Primary spathes very elongate-tubular, closely sheathing, sometimes split longitudinally in their upper part, but never entirely opened longitudinally and laminar. Spikelets inserted at the mouth of their respective spathes. Involucrophorum not pedicelliform. Seed (where known) not ruminate; embryo basilar.

(*a*) Fruiting perianth (where known) explanate or subcallous at the base, not or slightly pedicelliform.

† Leaves pinnate with few often broad-lanceolate or elliptic or more rarely elongate, 3-5-costulate leaflets, all the costæ reaching the apex.

* The two terminal leaflets highly connate.

11. *C. floribundus.*

** The two terminal leaflets free at the base.

12. *C. kingianus.*

†† Leaves with numerous leaflets, these narrow, often fascicled, usually gradually decreasing towards the apex, the two of the terminal pair the smallest and free at the base.

* Fruiting perianth entirely explanate.

13. *C. viminalis.*
14. *C. concinnus.*
15. *C. rivalis.*
16. *C. pseudo-rivalis.*
17. *C. metzianus.*
18. *C. pseudo-tenuis.*

** Fruiting perianth slightly callous at the base and more or less pedicelliform.

19. *C. hookerianus.*
20. *C. delicatulus.*
21. *C. helferianus.*
22. *C. nicobaricus.*

(*b*) Fruiting perianth distinctly pedicelliform.

* Leaflets numerous, narrow, equidistant, gradually becoming smaller towards the apex of the leaf.

23. *C. tenuis.*
24. *C. rotang.*
25. *C. delessertianus.*

** Leaflets not very numerous, and distinctly fascicled.

26. *C. brandisii.*

*** Leaflets more or less inequidistant, but not fascicled, many-nerved.

27. *C. acanthospathus.*
28. *C. feanus.*

Group V.—Leaflets elongate. Primary spathes very long, tubular and closed at first, later longitudinally split and open, loriform or laminar. Involucrophorum not pedicellate. Seed (where known) not alveolate, with equable albumen.

29. *C. guruba.*
30. *C. nitidus.*
31. *C. platyspathus.*
32. *C. myrianthus.*
33. *C. hypoleucus.*
34. *C. leucotes.*

Group VI.—Leaflets elongate. Leaf-sheaths flagelliferous. Primary spathes at first tubular, later more or less split longitudinally and partly laminar. Involucrophorum distinctly pedicellate. Fruiting perianth pedicelliform.

35. *C. travancoricus.*
36. *C. rheedei.*

Group VII.—Leaflets elongate. Leaf-sheaths flagelliferous. Primary spathes tubular, strictly sheathing, not split or lacerate. Involucrophorum distinctly pedicellate. Fruiting perianth pedicelliform. Seed with deeply ruminate albumen.

37. *C. huegelianus.*
38. *C. gamblei.*

Group VIII.—Leaflets elongate and narrow. Leaf-sheaths flagelliferous. Primary spathes strictly sheathing. Involucrophorum in the female spikelets not pedicelliform. Fruiting perianth pedicelliform. Seed deeply ruminated.

39. *C. gracilis.*
40. *C. melanacanthus.*

B.—LEAVES DISTINCTLY CIRRIFEROUS.

Group IX.—Leaf-sheaths not flagelliferous. Spadix not flagelliferous at its apex, usually shorter than the leaves. Primary spathes elongate-tubular, closely sheathing. Male spadix ultra-decompound. Female spadix simply decompound, differing considerably from the male one. Male and female spikelets stalked or inserted at the base of their respective spathes by means of a distinct pedicel. Fruiting perianth explanate. Seed with ruminate or equable albumen.

41. *C. zeylanicus.*
42. *C. ovoideus.*
43. *C. andamanicus.*

Group X.—Leaf-sheaths not flagelliferous. Spadices usually shorter than the leaves, not or slightly flagelliferous at the apex. Spikelets not stalked, inserted near the mouth of their respective spathes. Fruiting perianth pedicelliform or almost explanate. Seed with more or less superficial intrusions of the integument or distinctly ruminate; embryo basilar or slightly shifted to one side.

44. *C. palustris.*
45. *C. latifolius.*
46. *C. doriœi.*
47. *C. polydesmus.*
48. *C. khasianus.*
49. *C. nambariensis.*
50. *C. inermis.*
51. *C. unifarius.*
52. *C. scipionum.*

1. **Calamus erectus** Roxb. Fl. Ind. III, 774; Mart. Hist. Nat. Palm. III, II H.; Griff. in Calc. Journ. Nat. Hist. V, 35, and Palms Brit. Ind. 43, pl. CXC, A. f. i. (as *C. acanthospathus*); Kurz in Journ. Asiat. Soc. Beng. XLIII, Pt. 2,209, Pl. XXIII and XIV (excl. *C. longisetus* Griff.). and For. Fl. Brit. Bur. II, 516, and Rep. Veg. Pegu 90; Hook. f. Fl. Brit. Ind. VI, 439 (excl. *C. schizospathus*); Becc. in Rec. Bot. Surv. Ind. II, 197, and

Ann. Roy. Bot. Gar., Calcutta, XI, 121.—*C. macrocarpus* Griff. in Mart. Hist. Nat. Palm. III, 333, t. 176, f. X, et t. ZXVIII, f. XXIV; Griff. Palms Brit. Ind. 40, Pl. CLXXXVI, A. f. I-II.—*C. erectus macrocarpus* Becc. in Hook. Fl. Brit. Ind. VI, 439.—*C. collinus* Griff. in Calc. Journ. Nat. Hist. V, 31, and Palms Brit. Ind. 39 (*excl. descr. fol.*) t. CLXXXV (*spadix tantum*); Mart. Hist. Nat. Palm. III, 332.—*C. erectus* var. *collina* Becc. in Hook. f. Fl. Brit. Ind. VI. 439.

NAMES.—Kadam bet (Beng.), Thaing (Burm.), Sun-gutta (in Sylhet).

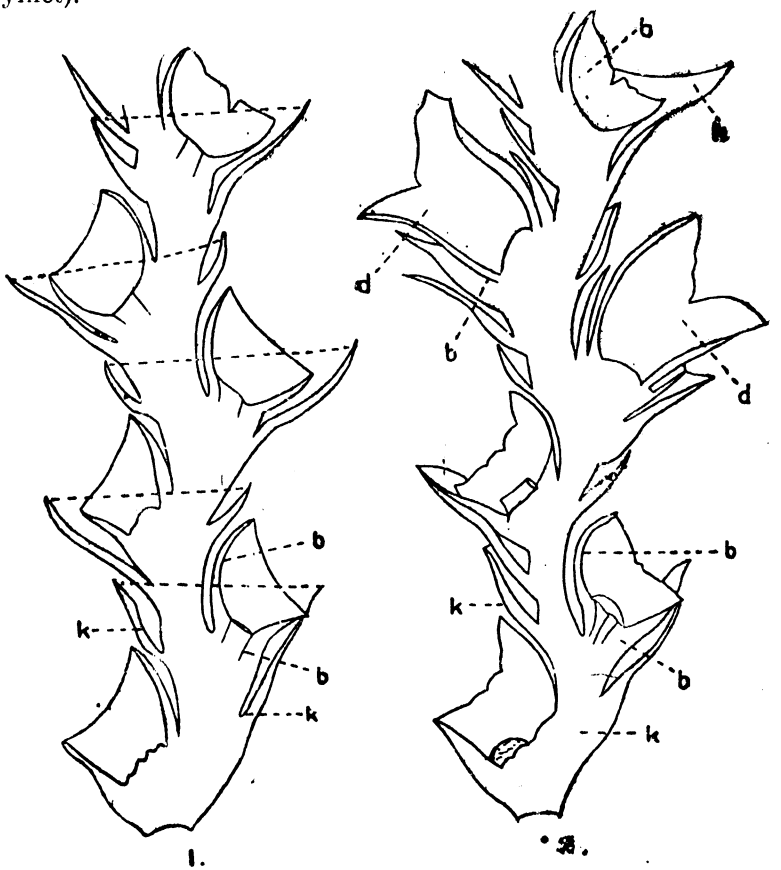


FIG. 38.—*Calamus erectus*

1. Outline of right-hand figure to show the relative position of the spathels (*k*) and of involucre (*b*). The dotted line completes that portion of the margin of the spathel which is not seen in the right-hand figure.
2. Portion of a male spikelet in longitudinal section. The involucres (*b*) are half immersed in the spathels (*k*).
   In the upper part is the calyx (*d*) of two flowers still attached to the involucre. Enlarged 6 diam. (From Beccari).

DESCRIPTION.—Stem erect, robust, with a crown of large leaves. Ochrea very large, divided into two large hispid auricles. Leaves 10-18 feet long. Leaflets very numerous, equidistant, elongate-ensiform, green on both surfaces, midrib sparingly bristly, secondary nerves naked on both surfaces. Leaf rhachis armed beneath with long, straight spines. Spadix not very shortly flagelliferous at its apex (fig. 38). Primary spathes loosely sheathing, speedily lacerated and marcescent. Fr. $1\frac{1}{5}$-$1\frac{3}{5}$ inch long, ellipsoid. Seed oblong or ovoid, circular in transverse section. Embryo basilar, eccentric (fig. 39).

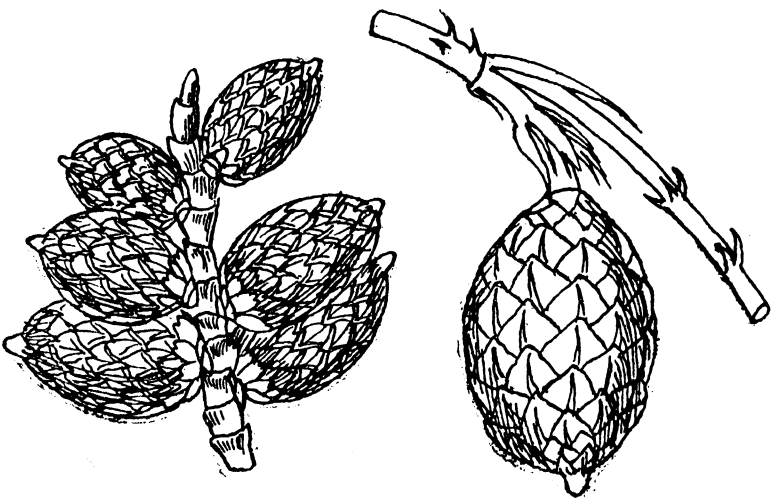


FIG. 39.—*Calamus erectus.*
Left: Top part of branch of spadix.
Right: Part of fruiting spadix with one fruit (After Griffith).

HABITAT.—Sylhet, Khasia Hills, Upper Assam, Chittagong.

USES.—In Sylhet the poorer natives use the seeds as a substitute for that of *Areca* (Roxb.).

(*a*) **Calamus erectus** Roxb. var. **schizospathus** Becc. in Ann. Roy. Bot. Gard. Calc. XI, 125.—*C. schizospathus* Griff. in Calc. Journ. Nat. Hist. V, 32; Palms Brit. Ind. 41, Pl. CLXXXVII; Mart. Hist. Nat. Palm. III, 332; T. Anders. in Journ. Linn. Soc. XI (1869) 71; Gamble Man. Ind. Timb. 423; Becc. in Rec. Bot. Surv. Ind. II, 197.—*C. erectus* Becc. (*partim*) in Hook. f. Fl. Brit. Ind. XI, 438.

NAMES.—Reem (Lepchas), Phekri bet (Sikkim).

DESCRIPTION.—Leaflets with a secondary nerve on each side of the midrib, sparingly bristly beneath and sometimes also above.

Male flower with the calyx half (not almost entirely) projecting from the involucres.

HABITAT.—Sikkim.

USES.—According to Gamble the stem is about 5 cm. in diameter, with hard wood and closely packed fibro-vascular bundles; the canes, however, are useless.

(*b*) **Calamus erectus** Roxb. var. **birmannicus** Becc. in Rec. Bot. Surv. Ind. II, 197, and Ann. Roy. Bot. Gard. Calc. XI, 70 and 126.

DESCRIPTION.—Female spadix more slender than in the type, produced into a rather long (2½ feet) flagelliform aculeate appendix. Fruit smaller.

HABITAT.—Burma, on the Karen mountains at 3,300-4,000 feet.

2. **Calamus flagellum** Griff. in Mart. Hist. Nat. Palm. III, 333, Pl. 176, f. IX, Palms Brit. Ind. 48; T. Anders. in Journ. Linn. Soc. XI (1869) 8; Gamble Man. Ind. Timb. 423; Hook. f. Fl. Brit. Ind. VI, 439; Becc. in Rec. Bot. Surv. Ind. II, 197, and Ann. Roy. Bot. Gard. Calc. XI, 70, 127.—*C. jenkinsianus* Griff. Palms Brit. Ind. 40, Pl. CLXXXVI A. f. iii (non pag. 89).—*C. polygamus* Roxb. Fl. Ind. III, 780.

NAMES.—Rabi Bet (Nepal), Reem (Lepchas), Nagagola Bet (Assam).

DESCRIPTION. Scandent and robust. Leaf-sheaths with very unequal, never seriate, spines. Ochrea marcescent. Leaf-sheath-flagella up to 20-23 feet long. Leaves very large. Leaflets numerous, equidistant, green on both surfaces, broadly ensiform, strongly unicostate; the midrib with a few subspiny bristles, secondary nerves naked on both surfaces. Leaf-rhachis clawed on the back. Spadix elongate, flagelliform. Primary spathes tubular, closely sheathing, lacerated at apex. Fr. about 1⅓ inch long, broadly ovoid. Seed ovoid, circular in transverse section; embryo basilar.

HABITAT.—N.-E. India, Assam, Khasia Hills, Eastern Bengal, Sikkim.

USES.—The fruit is edible (Hooker). The canes are soft and useless (Anders.).

Calamus flagellum Griff. var. **karinensis** Becc. in Ann. Roy. Bot. Gard. Calc. XI, 70, 129.

DESCRIPTION.—Leaf-sheaths armed with very unequal spines, some being large and others small and seriate.

HABITAT.—Burma, Karen mountains at 4,000-4,700 feet.

3. **Calamus arborescens** Griff. in Calc. Journ. Nat. Hist. V, 33, and Palms Brit. Ind. 42, t. CLXXXVIII A. B. C; Mart. Hist. Nat. Palm. III, 332; Miq. Fl. Ind. Bat. III, 113; Kurz in Journ. Asiat. Soc. Beng. XLIII, Pt. II, 208, t. XXII. and For. Fl. Brit. Burm. II, 516, and Rep. Veg. Pegu (1875) 90; Gamble Man. Ind. Timb. 423; Hook. f. Fl. Brit. Ind. VI, 439; Becc. in Rec. Bot. Surv. Ind. II, 198, and Ann. Roy. Bot. Gard. Calc. XI, 70, 131.—*C. hostilis* Hort. Calc.

NAMES.—Thanoung, Danoung, Kyenbankyen, Damon, Danoung Thain (Burm.).

DESCRIPTION.—Cæspitose. Stem erect, robust, 13-20 feet high. Leaves large. Leaf-sheaths, petiole, and leaf-rhachis armed with large, laminar, almost black, shining, seriate spines. Leaflets equidistant, broadly ensiform, green above, white underneath. Male spadix elongate, pendulous. Primary spathes tubular, rather closely sheathing, lacerated and fibrous in their upper part, armed only with straight black spiculæ and never with hooked spines or claws. Secondary spathes clavate, sub-inflated and usually lacerated and blackened. Spikelets large with flatly bifarious flowers.

HABITAT.—Pegu in Burma, common and gregarious in evergreen forests.

4. **Calamus longisetus** Griff. in Calc. Journ. Nat. Hist. V, 36, and Palms Brit. Ind. 44, t. CLXXXIX A. B.; Mart. Hist. Nat. Palm. III, 333; Miq. Fl. Ind. Bat. III, 114; Hook. f. Fl. Brit. Ind. VI, 440; Becc. in Rec. Bot. Surv. Ind. II, 199; Ann. Roy. Bot. Gard. Calc. XI, 71, 134.—*C. tigrinus* Kurz in Jour. As. Soc. Beng. XLIII, Pt. II (1874) 211, t. XXV and For. Fl. Brit. Burm. II, 519.

NAMES.—Leme (Burm.), Umdah, Am (Andam.).

DESCRIPTION.—Scandent. Leaves up to 10-13 feet long. Leaflets not equidistant, often in groups of 2-3, almost equidistant towards the summit, green on both surfaces, ensiform, unicostate, midrib remotely spinulose above with some very long blackish bristles beneath. Male and female spadices simply decompound. Primary spathes elongate-tubular, lacerate in their upper part; secondary ones slightly inflated. Female spikelets very large with flatly bifarious flowers. Fr. ellipsoid-ovate, over $1\frac{1}{5}$ inch long, transversely mottled like a tiger skin. Seed oblong, 5-7 costate.

HABITAT.—Pegu, Andamans.

USES.—The natives of the Andamans eat the fruit cooked. The leaflets are employed for coverings.

5. **Calamus thwaitesii** Becc. in Hook. f. Fl. Brit. Ind. VI, 441; Rec Bot. Surv. Ind. II, 199; Ann. Roy. Bot. Gard. Calc. XI, 71, 137; Trimen Fl. Ceylon IV, 330; Talb. Trees Bomb. ed. 2,344 (*partim*); Brandis Ind. Trees (1906), 652 (*partim*); Cooke Fl. Bomb. Presid. II, 807 (*partim*).—*C. longisetus* Thw. Enum. Plant. Zeyl. 330 (*non* Griff.).

DESCRIPTION.—Leaves large. Leaflets irregularly fascicled, broadly ensiform, green on both surfaces, unicostate. Midrib with black, short, subspiny bristles on both surfaces; secondary nerves naked. Male and female spadices simply decompound, flagelliform, with the axial parts between the inflorescences very elongate and strongly clawed; primary spathes very long, narrow, thinly coriaceous, closely sheathing, lacerated near the mouth. Male and female spikelets very elongate. Fr. ellipsoid or obovate-elliptic, suddenly contracted into a conic beak, about 1 inch long; scales in 12 series, broadly channelled along the middle. Albumen equable; embryo basal.

HABITAT.—Ceylon. Moist low country, below 2,000 ft., rather rare, Kalutara, Kandy, Hantane, Rambukkama, Kurmegala.

FLOWERS.—February to May.

Calamus thwaitesii Becc. var. **canaranus** Becc. in Ann. Roy. Bot. Gard. Calc. XI. 71, 138; Cooke Fl. Bom. Pres. II, 807 (*partim*).

NAME.—Handibet (Kanara).

DESCRIPTION.—Male spikelets with more numerous and more approximate flowers. Seeds more flattened than in the type specimen.

HABITAT.—Kanara, common in the evergreen forests at the foot of the Nilkund Ghat.

FLOWERS.—February to March.

6. **Calamus leptospadix** Griff. in Calc. Journ. Nat. Hist. V, 49; Palms Brit. Ind. 60, t. CXCIV A. B. C.; Mart. Hist. Nat. Palm. III, 339, t 175, f. II, et t. ZXVIII, f. XIII; T. Anders. Journ. Linn. Soc. XI, 8; Gamble Man. Ind. Tim. 423; Hook. f. Fl. Brit. Ind. VI, 441; Becc. in Rec. Bot. Surv. Ind. II, 199; Ann. Bot. Gard. Calc. XI, 72, 142.

NAMES.—Lat (Lepcha), Dangri Bet (Nepal), Rani, Rabi Bet (Kurseong).

DESCRIPTION.—Scandent, forming tangled thickets; stems slender; foliage feathery. Leaves over $3\frac{1}{3}$ feet long. Leaflets numerous, approximate, regularly equidistant, linear-ensiform, $\frac{3}{4}$-1 foot long, 3-costate. Male and female spadices simply decompound and similar, long and slender. Partial inflorescences

not many, very distant, strict, slender, ¾-1½ foot long with 10-20 appressed spikelets on each side. Primary spathes very narrow, cylindrical, closely sheathing. Male spikelets scorpioid, ⅖-⅘ inch long. Fr. globose or globose-ovoid, about ⅔ inch in diameter (fig. 40).

HABITAT.—N.-E. India, Khasia Hills, Naga Hills, Sikkim.

Was found in flower and fruit in November.

Illustration: Plate LIII.

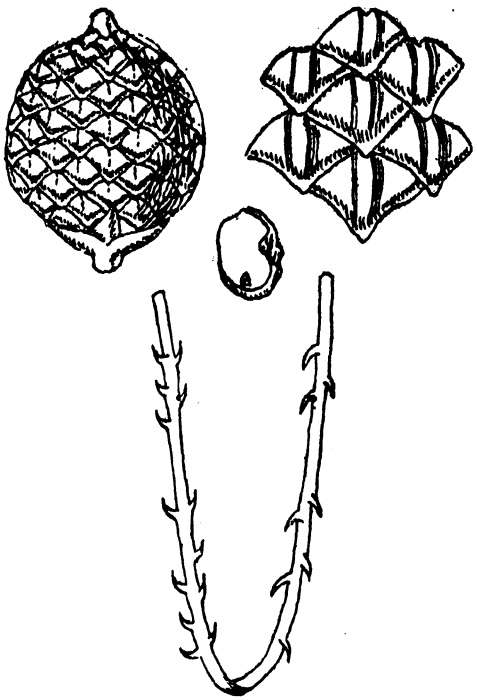


FIG. 40.—*Calamus leptospadix*.

Upper left: Fruit. Enlarged more than two diam.

Upper right: Scales of fruit. Magnified.

Central: Longitudinal section of seed (natural size).

Lower: Part of flagellem of female spadix (After Griffith).

7. **Calamus dilaceratus** Becc. in Rec. Bot. Surv. Ind. II, 198; Ann. Roy. Bot. Gard. Calc. XI, 72, 144.

DESCRIPTION.—Tufted, probably not scandent. Female spadix erect, paniculate. Primary spathes short, membranous, dry, lacerate, armed with fine black spicules; secondary spathes tubular-infundibuliform, dry, thin in texture and much lacerate.



Calamus leptospadix Griff.

Female spikelets with a pedicellar portion $\frac{2}{5}$-$\frac{3}{5}$ inch long. Fruiting perianth of 6 spreading, equal, lanceolate parts. Fr. small, ovate, $\frac{1}{2}$ inch long. Seed subglobose with an even surface.

HABITAT.—Nicobar Islands.

8. **Calamus pachystemonus** Thw. Enum. Pl. Zeyl. Addenda, 431; Hook. f. Fl. Brit. Ind. VI, 422; Becc. in Rec. Bot. Surv. Ind. II, 201; Ann. Roy. Bot. Gard. Calc. XI, 74, 165.—*C. gracilis* Thw. l. c. 330 (*non* Roxb.); Trimen Fl. Ceyl. IV, 333.

DESCRIPTION.—Stem slender, scandent; sheaths sparingly tubercled and armed with small flattened pale spines. Leaves 1-2 feet long, pinnate, upper bifoliate; petiole short, slender; rhachis armed with solitary, stout, recurved spines, rhachis about 3-7 inches long, not flagelliferous; leaflets 4-7, irregularly disposed, 5-12 inches long and $\frac{1}{2}$-$2\frac{1}{2}$ inches broad, oval, subacute, or obtusely accuminate, 3-5-veined, margins and midrib beneath smooth, cross-venules distinct, upper pair sometimes connate with a spinous rhachis. Spathes funnel-shaped, truncate, cuspidate, armed with small prickles; spathels and spathellules cupular or patelliform. Spadix very long, slender, decompound, branches few, spikes many, alternate, $\frac{1}{4}$-$\frac{1}{3}$ inch long, crowded, scorpioidly recurved. Male flowers in many series, $\frac{1}{6}$ inch long, linear, curved; calyx cupular, striate, lobes short, obtuse; petals twice as long, linear-oblong, acute, striate, connate in a column at the base; filaments thickened at the base, then subulate, tip not inflected. Fruit unknown.

HABITAT.—Ceylon. Moist low country below 1,000 feet, rare, Kukl, Korale, Kalutara, Galle.

FLOWERS.—In November and December.

9. **Calamus digitatus** Becc. in Hook. f. Fl. Brit. Ind. VI, 442; Becc. in Rec. Bot. Surv. Ind. II, 201, Ann. Roy. Bot. Gard. Calc. XI, 74, 166.—*C. pachystemonus* Thw. Enum. Pl. Zeyl. 431 (*partim*).

NAME.—Kukula-wel (Singh.).

DESCRIPTION.—Stem very slender, scandent: sheath not flagelliferous (?), copiously beset with long and short, strong, straight, flat spines and conical shorter ones, mouth with a rather large ochrea; petiole 6-8 inches long, slender; rhachis furfuraceous, unarmed, or with a few distant, recurved, large or small spines. Leaves digitately 2-4-foliolate; leaflets 8-12 inches long and 1-3 inches broad, oblanceolate, cuspidately acuminate, 3-7-veined, base scurfy beneath, margins and veins smooth, upper pair

sometimes confluent with a spinous rhachis for half their length. Lower spathe elongate, cylindric, unarmed, upper very slender, mouth truncate, entire, spadix very long, slender, decompound, very sparingly spinous, branches distant; spikes very many, ½-1 inch long, spathels short, patelliform, imbricate. Male flowers ⅛ inch long; calyx tubular, striate, lobes short; petals twice as long or more, narrow, straight or falcately curved; connate at the base; filaments very short, conical, tip subulate, straight. Fr. seated on the slightly enlarged perianth, globose, ⅓ inch in diameter, pale yellow; beak very small; scales 6-7 in a vertical series, very broad with scarious brown margins and an obscure channel in the middle; endosperm subruminate; embryo basilar.

HABITAT.—Ceylon. Moist low country below 1,000 feet, rather rare. Reigaur and Pasdun Korales, Hiniduma, Galle.—Endemic.

FLOWERS.—In March.

10. **Calamus radiatus** Thw. Enum. Pl. Zeyl. Addenda 431 (1864); Hooker f. Fl. Br. Ind. VI, 442; Trim. Fl. Ceyl. IV, 333; Becc. in Rec. Bot. Surv. Ind. II, 20; Ann. Roy. Bot. Gard. Calc. XI, 75, 168.

NAME.—Kukula-wel (Singh.).

Stem very slender, scandent; sheaths flagelliferous, densely armed with short acicular spines which are free or are connate below in transverse ridges mixed with long bristles, upper transversely rugose. Leaves radiately 6-8-foliolate; petiole 2-4 inches long; rhachis rather slender, bearing small scattered recurved spines. Leaflets 8-12 inches long and ⅔ inch broad, linear acuminate, thin, 3-veined, midrib beneath and margins quite smooth. Spathes few, very long, clavately funnel-shaped, cuspidate. Spadix polygamo-diœcious, very long, slender, decompound, armed with small recurved spines; primary branches 2-6, 2-3 feet long; spikes ½-⅔ inch long, rather distant, reflexed, 1-15-flowered, naked. Spathels and spathellules cup-shaped. Male flowers: Calyx short, cylindric, striate; petals much longer, connate below in a short tube; filaments conical, tip subulate, straight; pistillode oblong, 3-fid. Female flowers $\frac{1}{10}$ inch long; calyx cupular, lobes broad, acute, striate; petals short, acute, striate. Fruit seated on the slightly enlarged perianth, globose, ⅓ inch in diameter, shortly beaked; scales about 8 in a vertical series, broadly triangular, dull yellow with narrow red-brown entire margins, and an obscure median channel; endosperm ruminate; embryo basilar.

HABITAT.—Ceylon. Moist low country below 1,000 feet, rather common, Hiniduma, Hewesse, Kalutara—Endemic.

FLOWERS.—In February and March.

11. **Calamus floribundus** Griff. in Calc. Journ. Nat. Hist. V, 56; Palms Brit. Ind. 66, pl. CXCVII; Mart. Hist. Nat. Palm. III, 337; Hook. f. Fl. Brit. Ind. VI, 444, Becc. in Rec. Bot. Surv. Ind. II, 204; Ann. Roy. Bot. Gar. Calc. XI, 79, 191.—*C. mishmiensis* Griff. in Journ. Nat. Hist. V, 55; Palms Brit. Ind. 65; Mart. Hist. Nat. Palm. III, 337.—*C. multiflorus* Mart. in Wallich's list No. 8613 (*vide* Mart. l. c. 337, No. 506).

Climbing; stem as thick as the middle finger; sheaths densely armed with bristles and long spines, rhachis with long spines and short curved prickles. Leaflets few, inequidistant, 10-18 inches long, 1-1½ inch broad, linear-lanceolate, acuminate, uppermost crowded at the end of the rhachis and connate, margins and costæ beneath setulose; petiole and lower spathe armed with very short, stout, and long, scattered, flattened, pale spines; lower spathe 18 inches long, coriaceous, terete, mouth very oblique; spathels acuminate. Flagella with short or long, simple or compound, recurved claws and spines, spadix elongate, where exposed plano-convex, armed on the convex face with hooked prickles; branches distant, supra-decompound, the lowermost deflexed, the upper ones ascending, the internodes concealed by spathes with truncate margins more or less ciliate, grey from whitish filamentous hairs. Branchlets which bear the spikes recurved or spreading, with short, acute, often mucronate spathes. Spikes attached midway between these, short, scarcely more than half an inch long, subscorpioid. Male flowers distichous, ovate, suffulted by a small bract which is ciliate and generally penicillate at the apex, and also by 2 bracteoles less combined than usual, sometimes nearly distinct. Calyx divided to the middle, segments half-ovate, corolla about twice the length of the calyx, divided almost nearly to the base, segments ovate-lanceolate, spreading. Stamens united to the base of corolla; filaments long, subulate, flexuose in the bud; anthers obtusely sagittate, attached above the middle, versatile. Pistillode of 3 rather small, distinct bodies. Female flowers on simply spiked, more elongate, branches. Spikes 2-3 inches long, alternate generally recurved, flexuose, pale ferruginous-tomentose. Flowers rather distant, suffulted by an amplectent bract with a short, acuminate limb, and by 2 bracteoles, of which the inner bears

an incomplete disc on one side. Calyx (in bud) ovate-conical, a good deal longer than that of the male flower, divided to the middle. Corolla (in bud) length of the calyx, otherwise as in the male, but the segments have thin margins. Stamens 6, monadelphous, filaments short, flat; anthers effete. Ovary cylindrical, 3-celled, shorter than the branches of the style, which are lanceolate and papillose; ovules 3. Fruit $\frac{1}{2}$ inch in diameter; scales very pale yellow, channelled down the back.

HABITAT.—Upper Assam; Khasia Hills; Sylhet; Mishmi Hills near Tapan Gam's village.

Found in fruit in November.

Calamus floribundus Griff. *var.* **depauperatus** Becc. in Ann. Roy. Bot. Gard. Calc. XI, 79, 194.

DESCRIPTION.—Small, delicate, $3\frac{1}{2}$ ft. high. Sheathed stem very slender, $\frac{1}{4}$ inch in diameter. Leaf-sheaths armed with very small, short and broad spines. Ochrea densely bristly hispid. Leaves 1-$1\frac{1}{3}$ foot long, with 6-8 leaflets in two groups; leaflets $\frac{1}{2}$-$\frac{2}{3}$ foot long, $\frac{3}{5}$-$1\frac{1}{2}$ inch broad; petiole and rhachis armed with small scattered claws. Male spadix slender, flagelliform, almost simply decompound, with 2-3 small partial inflorescences.

HABITAT.—Assam.

12. **Calamus kingianus** Becc. in Ann. Roy. Bot. Gard. Calc. XI, 80, 197.

DESCRIPTION.—Slender, probably scandent. Sheathed stem $\frac{2}{5}$-$1\frac{1}{2}$ inch in diameter. Leaf-sheaths densely armed with short, horizontal, straight spines. Ochrea inconspicuous. Leaves with petioles about $2\frac{1}{3}$ feet long, petiole $\frac{1}{2}$ foot long, armed with small solitary claws. Leaflets very few, distinctly grouped, 3-sub-5-costate, the 3 largest costæ spinulous on the upper surface, naked beneath. Male spadix elongate, simply decompound. Primary spathes narrow, very closely sheathing, entire; partial inflorescences terminating in a spikelet; side-spikelets horizontal or deflexed, $\frac{4}{15}$-$\frac{3}{10}$ feet long, with remote flowers.

HABITAT.—Assam.

13. **Calamus viminalis** Willd. Sp. Pl. II, I, 203, *var.* **fasciculatus** Becc. in Hook. f. Fl. Brit. Ind. VI, 444; Rec. Bot. Surv. India, II, 203; Ann. Roy. Bot. Gard. Calc. XI, 81, 206.—*C. fasciculatus* Roxb. Fl. Ind. III. 779 (*exl. cit.* Rheede); Kunth Enum. III, 208; Mart. Hist. Nat. Palm. III, 338, t. 116, f. IV; Walp. Ann. III, 488, V. 831; Griff. in Calc. Journ. Nat. Hist. V, 52; Palms Brit. Ind. 62. t. 195B. (not A), t. 190A, f. II; Miq. Fl. Ind. Bat. III., 127; Palm. Archip. Ind. 27; Kurz in Journ. As. Soc. Beng. XLIII.

II. 210, t. 27, B; For. Fl. II, 517.—*C. extensus* Mart. Hist. Nat. Palm. III, 210 (partly), t. 116, f. IV, I.—*C. pseudo rotang* Mart. l. c. 209, t. 116, f. VI; Griff. in Calc. Journ. Nat. Hist. V, 42; Palms Brit. Ind. 53; Kunth. Enum. III, 207; Wall. Cat. 8608, 8611.

NAMES.—English: Chair-bottom cane, rattan cane. French: rotang flexible, rotang osier. Bara Bet (Beng.), Pepa (Tel.), Kyein Ka (Burm.), Umba-vetus (Sansk.).

Stem rather stout, scrambling and climbing. Leaves 2-3 feet long; leaflets many, 4-10 inches long, $\frac{2}{3}$-$\frac{3}{4}$ inch broad, inequidistant or fascicled, 3-costate, margins and costæ beneath spinulose, pale green, rhachis and sheath white-floccose; rhachis very stout; petiole short, with scattered, straight, $\frac{1}{2}$-$1\frac{1}{4}$ inch long, pale, hardly flattened spines; sheath and flagella with scattered, short, hooked spines. Spathes coriaceous, mouth obliquely truncate, flagella with hooked 2-3-fid claws. Spadix 15 feet long, stout, clothed with long spathes, tip flagelliferous; branches paniculate, stout, spikes 4-5 inches long, lower spathes compressed, with subulate spines, upper prickly. Fruit small, $\frac{1}{3}$-$\frac{1}{2}$ inch in diameter, globose, beaked; scales pale yellow, obscurely channelled down the middle.

HABITAT.—Lower Bengal, common in the village Bamboo jungles; Orissa; Ganjam; Chittagong; Mandalay; Andaman Islands; Penang; Malay Peninsula; Cochin China.

Flowers during the rains.

ILLUSTRATION.—Plate LIV.

14. **Calamus concinnus** Mart. Hist. Nat. Palm. III, 332; Kunth Enum. III, 207; Walp. Ann. III, 483, V, 829; Griff. in Calc. Journ. Nat. Hist. V, 49; Palms Brit. Ind. 59; Kurz. in Journ. As. Soc. Beng. XLIII, II, 214, t. 20, C; Hooker f. Fl. Brit. Ind. VI, 444; Brandis Ind. Trees 653; Becc. in Rec. Bot. Surv. India II, 204, Ann. Roy. Bot. Gard. Calc. XI, 81, 210; Wall. Cat. 8607.

Climbing. Leaflets 1-$1\frac{2}{3}$ foot long, 1-$1\frac{2}{5}$ inch broad, many, subequidistant, linar-lanceolate, acuminate, glossy, 4-6 stout nerves on either side of midrib, margins and costæ beneath setulose, rhachis and spadix rusty-tomentose, sparingly armed with short, stout, straight, deflexed spines; male spadix ultra-supra-decompound; primary spathes elongate-tubular; secondary ones infundibuliform, subscarious, loosely sheathing. Fruiting perianth explanate. Female spadix simply decompound; spikelets 3-5 inches long, with 18-20 distichous flowers on each side.



Calamus viminalis Willd.

Fruits small, globose, $\frac{1}{3}$-$\frac{3}{8}$ inch in diameter. Scales in 18 series, deeply channelled along the middle.

HABITAT.—Tenasserim.

15. **Calamus rivalis** Thw. *ex* Trim. in Journ. Bot. XXIII (1885) 268; Hooker f. Fl. Br. Ind. VI, 441; Trim. Fl. Ceyl. IV, 332; Becc. in Rec. Bot. Surv. Ind. II, 199; Ann. Roy. Bot. Gard. Calc. XI, 50, 218.

NAME.—Ela-wel (Singh.).

Stem slender, scandent; sheaths flagelliferous, copiously armed with straight, flat, lanceolate and subulate, pale spines, $\frac{1}{2}$-1 inch long. Leaves about 3 feet long; petiole armed below with flat and above with stout recurved spines; rhachis not produced into a flagellum, scurfy, armed with short recurved spines; leaflets numerous, 12-18 inches long and $\frac{1}{2}$-$\frac{2}{3}$ inch broad, equidistant, linear-lanceolate, coriaceous, margins setulose, 3-costate beneath, smooth, or midrib remotely setulose. Spadix very long, slender, armed with short recurved spines and terminated by a clawed flagellum; lower spathes or all armed with very short spines, mouth of lowest dilated, lacerate. Male spikes recurved; spathels coriaceous, very obliquely cup-shaped, acute. Male flowers distichous, crowded, about $\frac{1}{6}$ inch long; calyx 3-fid to the middle, cupular; petals and stamens confluent in a stipes; filaments filiform; anthers oblong. Female flowers in larger spikes, not as much crowded as the males. Fruit $\frac{1}{3}$ inch long, broadly ellipsoid with a large conical truncate beak, scales broader than long, about 10 in a vertical series, not channelled, pale yellow, bordered with red-brown.

HABITAT.—Ceylon: Moist low country, rare, Pasdun Korale, Colombo.—Endemic.

Flowers in September.

16. **Calamus pseudo-rivalis** Becc. in Ann. Roy. Bot. Gard. Calc. XI, 83, 222.

VERNACULAR NAME.—Pentong (Nicobars).

DESCRIPTION.—Very probably scandent and of moderate size. Female spadix very elongate, flagelliform, the clawed flagellum reaching $6\frac{2}{3}$ feet. Primary spathes elongate, cylindric, often longitudinally split, more or less prickly; partial inflorescences slender, about $3\frac{1}{3}$ feet in length, with 10-12 spikelets on each side; secondary spathes elongate, cylindric. Spikelets $\frac{1}{3}$ foot long, with 18-20 distichous flowers on each side. Fruiting

perianth not pedicelliform. Fruit small, ovate, rounded at both ends, abruptly contracted into a cylindric $\frac{1}{12}$ inch long beak, about $\frac{3}{5}$ inch long including the beak, about $\frac{2}{5}$ inch broad. Scales in 21 series, faintly channelled along the middle.

HABITAT.—Nicobar Islands.

17. **Calamus metzianus** Schlecht in *Linnæa* XXVI (1853) 727; Hook. f. Fl. Brit. Ind. VI, 462; Becc. in Rec. Bot. Surv. Ind. II, 217, Ann. Roy. Bot. Gard. Calc. XI, 82, 221.—*C. rudentum* (*non* Lour.) Mart. Hist. Nat. Palm. III, 340.

DESCRIPTION.—Size of leaves and leaf-sheaths as in *C. rivalis*. Fruit broadly ovoid, distinctly and abruptly contracted into a beak about $\frac{1}{8}$ inch long, $\frac{17}{25}$ inch in length including the beak and perianth, $\frac{11}{25}$ inch broad. Scales channelled along the middle.

HABITAT.—Kanara.

NOTE.—This is a very doubtful species. Beccari thinks it might be a continental form of *C. rivalis*.

18. **Calamus pseudo-tenuis** Becc. in Hook. f. Fl. Brit. Ind. VI (1892) 445; Trim. Fl. Ceyl. IV, 430; Talb. Trees Bomb. ed. 2, 345; Brandis Ind. Trees 652; Cooke Fl. Bomb. Pres. II, 806.—*C. tenuis* Thw. (*non* Roxb.) Enum. 330 (*excl. syn.*).

Stem slender, extensively climbing; sheaths set with many unequal, straight, flat, very sharp spines, reaching sometimes 1 inch. Leaves about 4 feet long; petiole 8 inches long, with a few solitary, short, spreading spines; rhachis without flagellum, armed with scattered slender flat spines, scurfy when young; flagellum of sheath very long, slender, compressed below, thin, cylindric, and set with half rings of deflexed hooked spines; leaflets 50 or more, nearly equidistant, 8-15 inches long and $\frac{3}{4}$-1 inch broad, linear-lanceolate, acuminate, thin, with setulose margins; veins 3-5, remotely setulose on the upper surface. Male spadix with long, slender, decurved spikes; spathels funnel-shaped, acuminate. Male flowers usually 2-3 together, $\frac{1}{10}$-$\frac{1}{8}$ inch long, subglobose, calyx cupular, striate, lobes acute; petals sessile, short, polished; filaments very short. Female flowers: Spadix very long, slender, branches distant, armed with short deflexed spines; spathes flattened, the lower elongate, tubular, 2-edged. Fruit ovoid, $\frac{1}{3}$-$\frac{1}{2}$ inch in diameter; beak stout, $\frac{1}{4}$ inch long, conical; scales 9-12 in a vertical row, rounded, dull yellow with brown scarious margins; endosperm subruminate; embryo basilar.

HABITAT.—Ceylon: Low country, Matale, Lady Horton's Walk. On the Western Ghats from Kanara southwards; Kanara, common in the evergreen forests at the foot of the Nilkund Ghat of N. Kanara. Madras. Cochin.

Flowers from January to April in Ceylon.

19. **Calamus hookerianus** Becc. in Ann. Roy. Bot. Gard. XI, 83, 226.—*C. borneensis* (*non* Miq.). Becc. in Rec. Bot. Surv. Ind. II, 205.

DESCRIPTION.—Apparently high scandent, slender, or of moderate size. Leaflets numerous, equidistant, linear-ensiform, with 3 bristly ribs on the upper side, the largest 1 foot long and ½ inch broad. Female spadix very long and slender, flagelliform; primary spathes long, closely sheathing; partial inflorescences very long (up to 5 feet) with many remote spikelets on each side; spikelets filiform, rigid, zigzag sinuous, with the flowers rather remote and pushed downwards by the very conspicuous axillary callus. Fruiting perianth callous at the base.

HABITAT.—Probably Coromandel Coast.

20. **Calamus delicatulus** Thw. Enum. 330, 431 (1864); Hooker f. Fl. Brit. Ind. VI, 446; Trim. Fl. Ceyl. IV, 332; Becc. in Rec. Bot. Surv. Ind. II, 206; Annals Roy. Bot. Gard. Calc. VI, 86, 246.

NAME.—Nara-wel (Singh.).

Stem slender, scandent; internodes with a tuft of erect, white, hair-like prickles 1-2½ inches long below the nodes, sheaths flagelliferous, sparsely scurfy, beset with many spreading, flattened, white, short and long linear spines up to 4-5 inches long. Leaves 2-3 feet long; petiole of lower 2 feet, of upper very short, both furnished with a few hooked spines; rhachis not produced into a flagellum, scurfy, and with a few straight spines; leaflets many, equidistant, close-set, 8-10 inches long and ½ inch broad, linear-lanceolate, finely acuminate or acute, and hair-pointed, 3-veined, margins and veins on both surfaces with a few long black bristles. Spathes tubular, truncate, unarmed, mouth ciliate; spathels tubular, imbricate, truncate; spathellules cupular, minute. Spadix polygamo-diœcious, very long, filiform, decompound, beset with small hooked spines; flowering branches about 18, 1-5 inches long; spikes very slender. Male flowers rather distant, about ⅛ inch long; calyx urceolate, 5-toothed; petals twice as long, oblong, acute, bases connate;

filaments rather long. Female flowers: Petals hardly longer than the calyx; ovary oblong, seated in a 6-toothed cup. Fruit (immature?) subglobose, ½ inch in diameter, beak conical, not long; scales about 8 in a vertical series, ochraceous, with a very dark brown border, centre not channelled.

HABITAT.—Ceylon: Moist country below 1,000 feet, rather rare, Galle, Hiniduma, Pasdum Korale.—Endemic.

Flowers from December to May.

21. **Calamus helferianus** Kurz in Journ. As. Soc. Beng. XLIII, II, 213; For. Fl. II, 521; Hook. f. Fl. Brit. Ind. VI, 446; Becc. in Rec. Bot. Surv. Ind. II, 206; Ann. Roy. Bot. Gard. Calc. XI, 87, 247.

DESCRIPTION.—Stem slender, scandent. Leaves without flagella; leaflets many, scattered, inequidistant in series of 2-8 on a side, narrowly linear, finely acuminate, 8-12 inches long, ½-⅔ inch broad, uppermost quite free, costæ 3-5, strong beneath, margins and lateral costæ above and median beneath setulose; rhachis slender, trigonous, armed with short, scattered, recurved spines, with naked intervals sometimes 4 inches long. Spadix several feet long, very slender, flexuous, as thick as a sparrow-quill, compound, upper spikes simple, lower panicled, males shorter and more slender. Lower spathe long, narrow, compressed with a short erect limb and short spines on the keels, partial 1½-1 inch long; spathellules of male flowers very short and crowded, of female ⅙ inch long. Male flowers ⅛-⅙ inch long, calyx 3-fid.

HABITAT.—Tenasserim (or the Andaman Islands?).

22. **Calamus nicobaricus** Becc. in Hook. Fl. Br. Ind. VI, 446; Brandis Ind. Trees 654; Becc. in Rec. Bot. Surv. Ind. II, 206; Ann. Roy. Bot. Gard. Calc. XI, 87, 249.

VERNACULAR NAME.—Tchye (Nicobars).

A very slender plant, with varnished internodes, ⅙-¼ inch in diameter. Leaflets very many, 7-8½ inches long, about ¼ inch broad, equidistant, linear-ensiform, long-acuminate, sparsely setose on the median costa only on both surfaces, shining above, lateral costæ slender, naked; petiole channelled above, armed with long, straight, marginal spines and short claws on the back, sheath very pale, at first scurfy, densely armed with very unequal, long, flat spines and short claws. Flagella exceedingly slender. Spadix and fruit unknown.

In Beccari's opinion this species seems to be allied to *C. delicatulus* from which it is distinguished by the leaflets being setose only on the median costa.

HABITAT.—Nicobar Islands.

USES.—It is much used by the natives and is in great demand by ship-traders, who take it to the Straits (*ex* Beccari).

23. **Calamus tenuis** Roxb. Fl. Ind. III, 780; Kunth Enum. III, 211; Mart. Hist. Nat. Palm. III, 335; Griff. in Calc. Journ. Nat. Hist. V, 46; Palms Brit. Ind. 57, t. 193 A, B, C; Walp. Ann. III, 485, V, 830; Miq. Fl. Ind. Bat. III, 118; Kurz in Journ. As. Soc. Beng. XLIII, II, 212, t. 31 B; For. Fl. II, 520; Hooker f. Fl. Brit. Ind. VI. 447; Brandis Ind. Trees 652; Becc. in Rec. Bot. Surv. Ind. II, 206; Ann. Roy. Bot. Gard. Calc. XI, 89, 262.—*C. royleanus* Griff. Il. cc. 40 and 53, t. 191; Mart. l. c. 335; Walp. Il. cc. 485 and 830.—*C. amarus* Lour. I, 210?—*C. heliotropium* Ham.; Mart. l. c. 344; Kunth. l. c. 210; Griff. Il. cc. 51 and 61; Walp. Il. cc. 484 and 830.—*C. rotang* Brandis For. Fl. 559.

NAMES.—Bet, Bent (Hind.), Jatee Bhet (Assam), May dan (Cochin China).

Stems very long, slender, scandent; internodes not thicker than a goose-quill. Leaves oblong, equally pinnate, 1½-2 feet long; leaflets very many, from 20-30 on each side, equidistant, alternate, linear, polished, the lower 8-12 inches long, ⅛-½ inch broad, margins minutely setulose or spinulose, bristles on the nerves ¼ inch long. Petiole pale, stout, short, margined with straight spines; rhachis armed with one row of short, recurved spines; flagella filiform, sheaths flagelliferous, sparingly armed with short, flat spines. Spadix very long, decompound, flagelliferous; primary branches 4-6, remote, flexuose, with about half a dozen alternate, recurved branches on each side. Spathes elongate, tubular, lower 6-10 inches with a short limb and scattered, recurved spines, partial ones short, unarmed, scurfy when young, spathellules densely crowded, cymbiform. Flowers very small; male flowers $\frac{1}{10}$ inch long, not distichous and spreading but secund in 3-4 series, imbricating, suberect. Fruit ½ inch in diameter, subglobose, mucronate; scales pale with a shallow median channel and very narrow discoloured margins. (Fig. 41).

HABITAT.—Tropical Himalaya, from Kumaon eastwards, Bengal, Assam, Sylhet, Chittagong and Burma.—Cochin China.

USES.—The rotang of this species is much used for domestic work.

24. **Calamus rotang** L. Sp. Pl. ed. 2,463 (*planta Ceylonensis tantum et excl. syn.* Hort. Malab. et Herb. Amboin.); Roxb. Fl. Ind. III, 777; Mart. Hist. Nat. Palm. III, 334, t. 116, f. 8, and t. ZXXII, f. XII; Bl. Rumphia III, 33; Miq. Fl. Ind. Bat. III, 117; Gamble Man. Ind. Timb. 423; Hook. f. Fl. Brit. Ind. VI, 447; Becc. in Rec. Bot. Surv. Ind. II, 206, Ann. Roy. Bot. Gard. Calc. XI, 98, 269.—*C. Roxburghii* Griff. in Calc. Journ. Nat. Hist. V, 43; Palms Brit. Ind. 55, t. CXCV A (*Sub C. fascicu-*

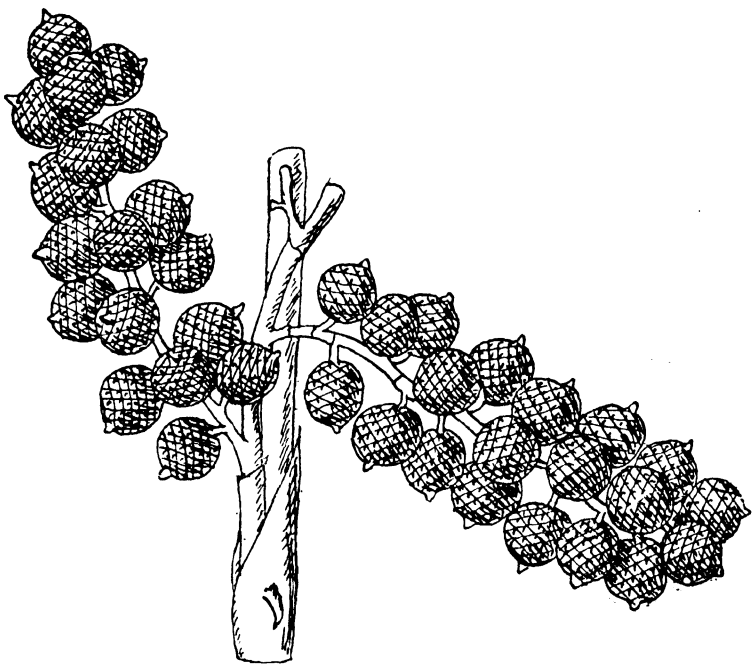


FIG. 41.—*Calamus tenuis.* Some branches of a fruiting spadix.

lato) and t. CXCII (CXII *per errorem*); Thw. Enum. Pl. Zeyl. 330.—*C. monoecus* Roxb. Hort. Beng. 73 *ex* Ind. Kew. Suppl. I.—*C. monoicus* Roxb. Fl. Ind. III, 873; Mart. Hist. Nat. Palm. III, 334 (*excl. descrip.* Wallichii no. 8604); Griff. in Calc. Journ. Nat. Hist. V, 48; Palms Brit. Ind. 58.—*C. scipionum,* Lam. (*partim*) Encycl. Bot. 304 (*excl. syn.* Lour. *et* Rheede).—*Arundo Rotang Zeylanica spinosissima,* etc., J. Burm. Thes. Zeyl. 36; Linn. Fl. Zeyl. 209, 468; Herm. Mus. Zeyl. 59.—*Arundo nucifera Rotang dicta,* etc. Pink. Almag. 53 (*excl. syn.* Clusii).—*Phoenicoscorpiurus s. Heliotropium Palmites spinosum* Pluk. Phytogr. 5,106, f. (*excl. Marcg.*). —*Arundo Rotang dicta* Pison. Ind. Orient. Mant. 188.—*Arundo indica versicolor flexilis* C. Bauh. Pin. 18, IV; J. Bauh. Hist. Pl. II, 489; Raj. Hist. Plant. II, 1277.



Rattan (*Calamus rotang* L.).

NAMES.

English: Cane, chair-bottom cane, common rattan cane, rotang.

French: Canne de Bengale, jonc de l'Inde, ratin, rotang ordinaire, rotin, rottain.

German: Palmriet, Rattangpalme, Rotang, Rottang, Rotting, Spanisches Rohr, Steinrottang, Stuhlrohr.

Dutch: Rotting, rottinggewas, rottingriet ruut, ruutstek, spaansch riet.

Perambu, Priampu (Tam.); Wewel (Singh.); Betamu, Bettapu, Niru Prabba, Pemu, Pepu (Tel.); Bet, Beta, Chachi Bet (Beng. and Hind.); Pepa, Prabba (Central Prov.); Rotan (Malay.); Bed (Pers.).

DESCRIPTION.—Stem very slender, scandent; sheaths flagelliferous, sparingly armed with short, flat spines. Leaves 1½-2 feet long, petiole very short, stout, margined with small straight or recurved spines with conical laterally compressed bases; leaflets very many, equidistant, lower 8-12 inches long and ⅓-½ inch broad, upper gradually smaller, linear-lanceolate acuminate, 3-veined, veins naked above or bearing distant bristles sometimes ¼ inch long, midrib alone setose beneath, margins setulose. Male spadix very long, decompound, flagelliferous, sparingly spinous; spathes elongate, tubular, lower 6-10 by nearly ⅔ inch diameter, sparingly armed with scattered recurved spines, upper unarmed, scurfy; spikes 1-1½ inch, recurved or revolute, bracteoles densely crowded, cymbiform. Male flowers secund in 3-4 series, ½ inch long; calyx cupular, base thickened, striate lobes broad, acute; petals sessile, smooth, acute; filaments very short, subulate. Female flowers $\frac{1}{10}$ inch long, scattered along the slender branches of the spadix; calyx conical, tubular, 3-toothed, base dilated, truncate petals sessile, tips only exserted. Fruit seated on the minute perianth, subglobose, ½ inch in diameter, mucronate, scales many in a vertical series, pale yellow with a very narrow thin, discoloured margin and shallow median channel. (Fig. 42.)

HABITAT.—Central Provinces, the Deccan, Carnatic, Ceylon, (not in Bengal).

FLOWERS.—In February and March.

USES.—*Calamus rotang,* and various other long trailing species, yield the common rattan of commerce, which, though

apparently insignificant, form a considerable article of export. When freshly gathered, the stems are covered with green sheaths,

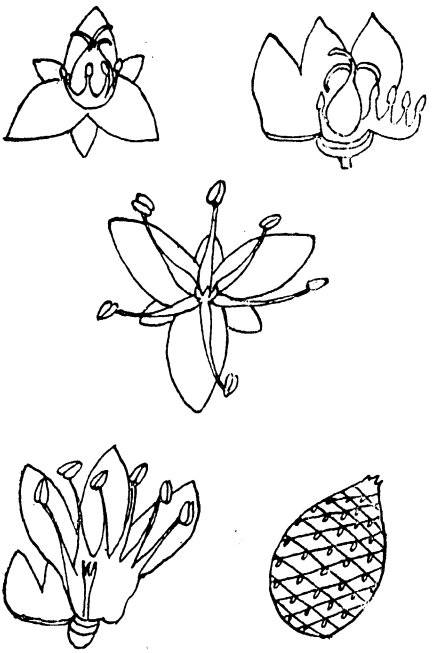


FIG. 12.—Flowers and fruit of *Calamus rotang* (After Griffith).

but are divested of them while yet in a green state, and then dried. They are extensively used as props for plants, as well as for cables, ropes, wicker-work, baskets, chairs, and couches; being very strong, and at the same time flexible, they are admirably adapted for those purposes. Cordage and cables for vessels are sometimes made from the stems twisted together. In fact, their strength is exceedingly great when several are twisted in this way, and will answer all the purposes of the strongest cables. Rattans are occasionally used in India for bridges. Hooker gives a description of such a cane-bridge in his "Himalayan Journals", where he says: "Soon afterwards (after crossing the Rungmo), at a most wild and beautiful spot, I saw, for the first time, one of the most characteristic of Himalayan objects of art, a cane-bridge. All the spurs, round

the bases of which the river flowed, were steep and rocky, their flanks clothed with the richest tropical forest, their crests tipped with pines. On the river's edge, the Banana, *Pandanus* and *Bauhinia,* were frequent, and Figs prevailed. One of the latter projected over the stream, growing out of a mass of rock, its roots interlaced and grasping at every available support, while its branches, loaded with deep, glossy foliage, hung over the water. This tree formed one pier for the canes; that on the opposite bank was constructed of strong piles, propped with large stones, and between them swung the bridge, about eighty yards long, ever rocking over the torrent. The lightness and extreme simplicity of its structure were very remarkable. Two parallel canes, on the same horizontal plane, were stretched across the stream; from them others hung in loops, and along the loops were laid one or two bamboo stems for flooring; cross pieces below this flooring, hung from the two upper canes, which they thus served to keep apart. The traveller grasps one of the canes in either hand, and walks along the loose bamboos laid on the swinging loops; the motion is great, and the rattling of the loose dry bamboos is neither a musical sound nor one calculated to inspire confidence." In Europe rattans are extensively used for caning chairs, for making brooms, and, when dyed black, as a substitute for whalebone, for umbrella-ribs, and for stiffening bonnets. In Japan all sorts of basket-work are made of split cane, and even cabinets with drawers. Cane is also plaited and twisted into cordage, and slender fibres are made to answer the purpose of twine. In Java the cane is cut into fine slips, which are plaited into excellent mats or made into strong, and at the same time neat, baskets. Bennet says in his "Wanderings" that near Macao the rattans are split longitudinally, soaked, and attached to a wheel, which one person keeps in motion, whilst another binds the split rattans together, adding others to the length from a quantity carried around his waist, until the required length of the rope is completed.

CULTIVATION.—When young *Calamus rotang* is a very graceful plant, but when it attains a height of 5-6 feet and develops its whip-like flagella armed with numerous sharp recurved thorns it is generally considered time to cut it down. (Woodrow.)

ILLUSTRATION.—Plate LV.

25. **Calamus delessertianus** Becc. in Ann. Roy. Bot. Gard. Calc. XI, 91, 276.

DESCRIPTION.—Probably scandent and of moderate size. Leaflets numerous, rather closely set and equidistant, elongate-ensiform, sub-5-costulate, the intermediate ones 1-1⅛ foot long and ⅝-1½ inch broad, the 3 main ribs furnished with bulbous bristles on the upper surface, underneath the mid-rib alone bristly; the margins closely spinulous. Female spadix apparently large and elongate; upper primary spathes elongate, cylindric; partial inflorescences with about 13 distichous spikelets on each side; spikelets inserted just at the mouth of their respective spathes with a distinct axillary callus, the lower ones about 2⅔ inches long with 20 flowers on each side; involucrophorum not pedicellate. Female flowers ⅛ inch long; neuter flowers more slender, but as long as the female ones, their corolla twice as long as the calyx.

HABITAT.—Probably S. India.

26. **Calamus brandisii** Becc. in Hook. f. Fl. Brit. Ind. VI, 448; Rec. Bot. Surv. Ind. II, 206; Ann. Roy. Bot. Gard. Calc. XI, 91, 278; Brandis Ind. Trees 651.

Stem slender; leaflets few, fascicled, lanceolate, ensiform, naked beneath, sparsely setose above on the 3 costæ; petiole slender with few very long, slender, straight spines, rhachis with long, stout, solitary, straight and recurved spines; sheath armed with solitary or aggregate, slender, flattened, straight spines, mouth with very long, needle-shaped spinules. Male spadix elongate, shortly flagelliferous, with few partial inflorescences; spathes narrow tubular, upper funnel-shaped, unarmed, embracing the bases of the spikelets; flowers 4-seriate in bud.

HABITAT.—Travancore, near Courtallam, 3-5,000 feet.

27. **Calamus acanthospathus** Griff. in Calc. Journ. Nat. Hist. V, 39; Palms Brit. Ind. 50, t. 190 B. (not A, f. 1); Mart. Hist. Nat. Palm. III, 333, t. 176, f. VI; Walp. Ann. III, 484, V, 830; Hook. f. Fl. Brit. Ind. VI, 448; Becc. in Rec. Bot. Surv. Ind. II, 206; Ann. Roy. Bot. Gard. Calc. XI, 92, 283; Brandis Ind. Trees 651.—*C. montanus* T. Anders. in Journ. Linn. Soc. XI, 9; Gamble Man. Ind. Timb. 242.

NAMES.—Gouri Bet (Nep.); Rue, Rhu (Lepchas).

DESCRIPTION.—Stems slender, scandent, as thick as a swan's quill, forming dense thickets. Leaves 2-3 feet long; leaflets few, large, 10-16 inches long, 2-3 inches broad, inequidistant, elliptic-lanceolate, strongly 5-7-costate, margins naked or spinulose, both surfaces quite naked or very rarely with a few small spines on

the costæ of the upper surface; rhachis and long petiole very stout, scurfy, armed with 2-3 series of very stout, recurved spines; sheath stout, densely armed with long, flattened and short, stout, straight or recurved spines; flagellum of the sheath 10-12 feet long. Spadix 4-6 feet, erect, very stout, flagelliferous; peduncle short, compressed, armed on the edges and lower face with unequal, straight, subulate spines and prickles, those of the edges being the longest. Spathes with obsolete limbs, the lowest about 1 foot long, compressed, keeled along the centre of the back and, excepting the short, erect, half-lanceolate limb, armed with straight

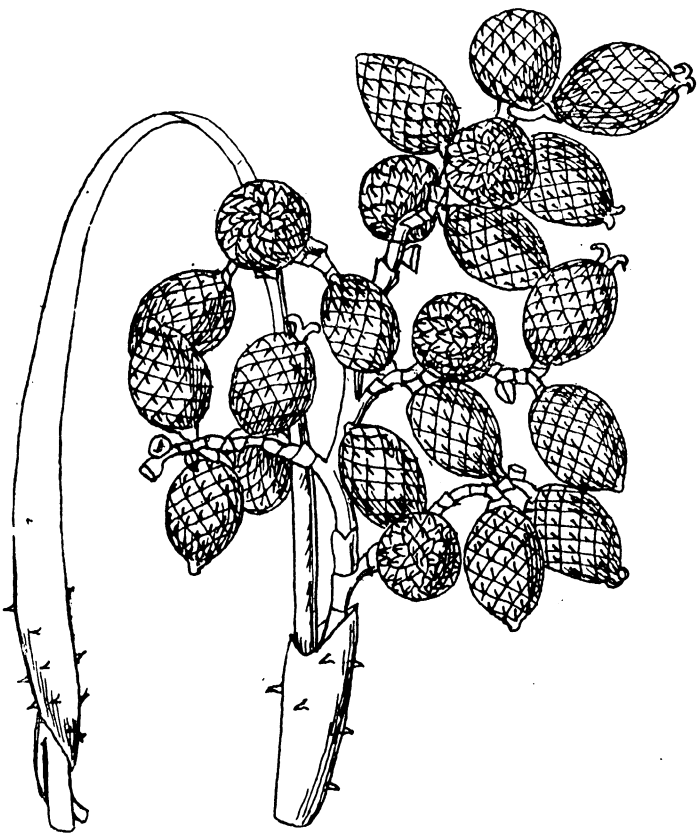


FIG. 43.—Branch of fruiting spadix with part of flagellum of *Calamus acanthospathus* (After Griffith).

prickles having conical bases. The other spathes are shorter, more clavate, without an obvious keel and only slightly armed, or as the uppermost, quite unarmed. Branches of fruiting spadix

very stout; spikes 1-4 inches long, strongly recurved. Fruit obovoid or globose, $\frac{3}{8}$ inch in diameter, shortly beaked; pericarp thin; scales chestnut brown, obscurely channelled, shining; fruiting calyx large, cupular, $\frac{1}{6}$ inch in diameter, lobes very short. Seed deeply pitted. (Fig. 43).

HABITAT.—Eastern Nepal; Sikkim and Bhotan, Himalaya. 3-6,000 feet; Khasia Hills, 2-4,000 feet.

28. **Calamus feanus** Becc. in Hook. f. Fl. Brit. Ind. VI, 448; Rec. Bot. Surv. Ind. II, 206; Ann. Roy. Bot. Gard. Calc. BI, 92, 286.

DESCRIPTION.—Stem scandent; internodes $\frac{1}{3}$-$\frac{1}{2}$ inch in diameter. Leaves rather short, about 3 feet 3 inches long; ochrea very short, truncate; leaflets few, 6-8, remote, subequidistant, the larger 8-12 inches long, 2-2$\frac{3}{4}$ inches broad, elliptic-lanceolate or oblanceolate, 7-9-costate, the terminal one free; petiole very short and rhachis armed with short hooked spines, sheath $\frac{1}{2}$-$\frac{2}{3}$ inch long, flagelliferous, coriaceous, green, marbled with black scurfy spots, strongly armed with scattered, long, spreading, or deflexed and short, stout, reflexed, spines. Male spadix 1$\frac{1}{2}$ inch long, decompound, erect, rigid, with 7 partial inflorescences; lower spathe tubular, 2-keeled, mouth compressed; keels armed with short, stout spines; upper spathe obliquely truncate; spikelets recurved. Fruit broadly ovoid, about $\frac{1}{3}$ inch by $\frac{1}{4}$ inch in diameter; beak conical, acute; scales about 15-seriate, not channelled on the back, where they are opaque and as if pulverulent with a broad, rather discoloured band. Seed deeply pitted.

HABITAT.—Tenasserim, 3-5,000 feet high.

29. **Calamus guruba** Ham. in Mart. Hist. Nat. Palm. III, 206 and 330, t. 175, f. 1.; Griff. in Calc. Journ. Nat. Hist. V, 42; Palms. Brit. Ind. 54; Kunth Enum. III, 210; Kurz in Journ. As. Soc. Beng. XLIII, II, 214. For. Fl. II, 522; Becc. in Hook. f. Fl. Brit. Ind. VI, 449; Rec. Bot. Surv.; Ind. II, 207; Ann. Roy. Bot. Gard. Calc. XI, 93, 299.—*C. mastersianus* Griff. ll. cc. 76 and 84, t. 206; *Daemonorops guruba* var. *Hamiltonianus et* var. *Mastersianus* Mart. ll. cc.; Walp. ll. cc. 479 and 828; Miq. Fl. Ind. Bat. III, 100.

NAMES.—Sundi Bet, Onabi Bhet Quabi Bet. (Ass.); Kyeinn Kyeingnee (Burm.)

DESCRIPTION.—Tall, climbing; stem with the sheaths about $\frac{1}{2}$ inch in diameter. Leaves 5-6 feet long; leaflets 12-15 inches long, $\frac{1}{2}$-$\frac{2}{3}$ inch broad, alternate, equidistant, narrowly linear,

margins and 3 costæ above setose, midrib usually alone setose beneath, the long, slender petiole and rhachis armed with long, brown, recurved, and short, conical spines below and on the margins. Sheaths flagelliferous, covered with long, flattened spines and crowded smaller ones; ligule long, membranous (coriaceous, Griffith), lacerate. Spathes glabrous, tube of lower compressed, margins with long spines, back with short ones, limb recurved; upper spathes nearly unarmed; flagellum very stout and stoutly armed. Male spadix elongate, very slender, decompound, spikes 2-3 inches long, very slender, flexuous spreading, spathellules very small and shallow. Flowers distichous, pointing forwards, $\frac{1}{6}$ inch long; calyx striate; corolla twice as long, polished. Fruit pisiform, $\frac{1}{4}$ inch in diameter, abruptly beaked; scales very pale, obscurely channelled, margin brown.

HABITAT.—Bengal, Assam, the Khasia Hills, Sylhet, Chittagong, Burma.

FLOWERS.—In April.

30. **Calamus nitidus** Mart. Hist. Nat. Palm. III, 334; Kunth Enum. III, 211; Griff. in Calc. Journ. Nat. Hist. V, 49; Palms Brit. Ind. 49; Miq. Fl. Ind. Bat. III, 117; Walp. Ann. III, 484, V, 830; Wall. Cat. 8609; Hooker f. Fl. Brit. Ind. VI, 449; Brandis Ind. Trees 652; Becc. in Ann. Roy. Bot. Gard. Calc. XI, 94,302.

DESCRIPTION.—Probably scandent and slender. Leaves 2-2$\frac{1}{3}$ feet long. Leaflets equidistant, rigidulous, close-set, $\frac{1}{2}$-$\frac{3}{5}$ foot long, linear-lanceolate, acuminate, shining, margins thickened, costæ 3, setulose on both surfaces or on the upper only; rhachis with simple or compound recurved spines.

Male and female spadices very slender with many partial inflorescences and a very slender flagellum at their summit; primary spathes open and flat during the anthesis, broadly linear, somewhat longer than the inflorescences. Fruiting perianth shortly pedicelliform. Fruit very small.

HABITAT.— Tenasserim: Tavoy.

31. **Calamus platyspathus** Mart. Hist. Nat. Palm. III, 210; Griff. in Calc. Journ. Nat. Hist. V, 75; Palms Brit. Ind. 83; Kurz in Journ. As. Soc. Beng. XL, 214; Hooker f. Fl. Brit. Ind. VI, 449; Becc. in Rec. Bot. Surv. Ind. II, 207; Ann. Roy. Bot. Gard. Calc. XI, 94, 304. *Daemonorops platyspathus* Mart. l. c. ed. 2, 206, 329; Miq. Fl. Ind. Bat. III, 99; Walp. Ann. III, 479, V, 828.

DESCRIPTION.—Leaflets few, 10-12 inches long, 1-1¼ inch broad, scattered, alternate, ensiform, acuminate, 5-7-costate, rigid, margins bristly towards the apex, young pale, softly scurfy beneath, margins thickened with obscure distant asperities; rhachis armed with straight and recurved, strong, solitary and binate spines with swollen bases, sheath armed with close-set, straight, subulate spines. Male spadix long, very slender, sparsely shortly armed, inflorescences short, 3-4 inches long, subsessile, paniculately branched; spikelets very short, ¼-½ inch long, few-flowered. Upper spathes with very short sheaths and flat, linear-oblong laminæ, 3-4 inches long, ⅓-⅔ inch broad; spathellules very short, acute. Male flowers $\frac{1}{10}$ inch long, pale, close-set, pointing forwards; calyx sharply toothed, striate; corolla twice as long as the calyx, not striate.

HABITAT.—Tenasserim: Tavoy.

32. **Calamus myrianthus** Becc. in Hook. f. Fl. Brit. Ind. VI, 451; Rec. Bot. Surv. Ind. II, 207; Ann. Roy. Bot. Gard. Calc. XI, 94, 306; Brandis Ind. Trees 653.

DESCRIPTION.—Apparently scandent and of moderate size. Leaflets very long, narrowly elliptic-lanceolate, many-costate, pale, almost white beneath, smooth on both surfaces or with minute bristles on the costæ beneath, margin obscurely aculeolate; rhachis dorsally rounded, shortly spinous. Male spadix very long, slender, sparsely spinous, spathels tubular, truncate. Inflorescences laxly decompound; branches very slender; spike ¼-½ inch long, zigzag, almost filiform; spathellules minute. Flowers minute, pointing forward, closely imbricate, calyx acutely 3-lobed, striate; corolla twice as long, acute, not striate.

HABITAT.—Tenasserim: Mergui.

33. **Calamus hypoleucus** Kurz For. Fl. II, 523, *excl. descr. spad. masc.;* Hook. Fl. Brit. Ind. VI, 451; Brandis, Ind. Trees 653; Becc. in Rec. Bot. Surv. Ind. II, 207; Ann. Roy. Bot. Gard. Calc. XI, 94, 307.—*Daemonorops hypoleucus* Kurz. in Journ. As. Soc. Beng. XLIII, III, 208 *(partim)*, t. XVIII. (*excl.* t. XIX.).

DESCRIPTION.—Stem slender, scandent, as thick as a goose-quill without the sheaths. Leaves 2-3 feet long, not flagelliferous; sheaths flagelliferous; leaflets 6-9 inches long, alternately and interruptedly approximate by twos on each side, oblong-lanceolate, acuminate, ciliate towards the apex, many-costate, white beneath; petiole short, armed with long and short conical,

straight and recurved spines; sheaths densely spiny with unequal spines 1 inch long and less. Female spadix 12 inches long; peduncle about 1 inch long, spinous; spathes oblong-lanceolate, spathels tubular, small, distant. Female flowers distichous; calyx $\frac{1}{2}$-$\frac{1}{4}$ inch long, shortly 3-lobed; corolla twice as long, segments acute.

HABITAT.—Burma: Thoungyeen.

34. **Calamus leucotes** Becc. in Ann. Roy. Bot. Gard. Calc. XI, 95, 309.—*C. hypoleucus* Kurz Fl. Brit. Burm. II, 523 *(quoad spadic. masc. tantum).*—*Daemonorops hypoleucus* Kurz in Journ. As. Soc. Beng. XLIII, ii *(quoad tab.* XIX. *tantum).*

DESCRIPTION.—Probably scandent. Sheathed stem $\frac{1}{3}$ inch in diameter. Leaf sheaths very densely armed with very unequal, small and large, ascendent spines. Ochrea short. Leaves rather robust and large; petiole robust and long. Leaflets few, grouped, with very long vacant spaces interposed, firmly papyraceous, lanceolate or elliptic-lanceolate, up to $1\frac{1}{3}$ foot long and $2\frac{1}{5}$ inches broad, plicate, many-costate, green above, covered with a crustaceous chalky coating beneath. Male spathe elongate, rigid, with a robust axis. Partial inflorescences strict, cupressiform, much shorter than the primary spathes; primary spathes elongate, open, flat. Male flowers $\frac{1}{8}$ inch long, acute.

HABITAT.—Burma: Yoonzuleen.

35. **Calamus travancoricus** Bedd. mss. in Herb. Kew.; Hook. f. Fl. Brit. Ind. VI, 452; Brandis Ind. Trees 653; Becc. in Rec. Bot. Surv. Ind. II, 207; Ann. Roy. Bot. Gard. Calc. XI, 95, 310; Rheede Hort. Mal. XII, t. 64.—*C. gracilis* (*non* Roxb.) Griff. Palms Brit. Ind. 64 *(quoad tab. Rheedeanam tantum).*

NAME.—Tsjeru tsjurel (Mal.).

DESCRIPTION.—Stem very slender, scandent. Leaves 18-24 inches long; leaflets 4-6 inches long, $\frac{1}{2}$-$\frac{2}{3}$ inch broad, broadest about or above the middle and thence tapering to a capillary point, in distant opposite groups of 3-5, narrowly oblanceolate, thin; costæ 3, very slender, naked above, sparsely setulose beneath; rhachis and petiole very slender, armed with small straight and recurved spines; sheath armed with slender, straight, flattened prickles; petiole 4-6 inches long, dorsally rounded, margins acute, much compressed towards the base and there chiefly spiny. Spadix 2-3 feet long, slender, flagelliferous; peduncle short, flattened, young white scurfy, margins shortly spiny. Inflorescences about 2 inches long, shorter than the

membranous flat spathes, male decompound with spreading, very slender branches bearing short, flexuous, almost capillary spikes of flowers ¼ inch long; female inflorescence with simple, distichous, recurved spikes and rather larger flowers. Lower spathes tubular, compressed at the base, with shortly spinous angles produced into a long, membranous, sheathing lamina; upper spathes and spathels tubular, obliquely truncate, spathellules short, acute, calyx strongly striate; corolla twice as long as the calyx, not striate.

HABITAT.—Deccan peninsula: from Malabar to Travancore.

36. **Calamus rheedei** Griff. in Calc. Journ. Nat. Hist. V, 73; Palms Brit. Ind. 36, 83; Hook. f. Fl. Brit. Ind. VI, 452; Brandis Ind. Trees 653; Becc. in Rec. Bot. Surv. Ind. II, 207; Ann. Roy. Bot. Gard. Calc. XI, 95, 313.—*Dæmonorops rheedii* Mart. Hist. Nat. Palm. III, 330; Miq. Fl. Ind. Bat. III, 100; Walp. Ann. III, 479, V, 828; Rheede Hort. Mal. XII, t. 65.

NAME.—Katu tsjurel (Mal.).

DESCRIPTION.—Leaflets in very distant groups of 3 on a long rhachis armed with scattered, short, recurved spines, linear-lanceolate, acuminate. Fruiting spadix with the flat, open, acute spathes longer than the ovoid, dense clusters of ellipsoid or oblong fruits.

This plant is only known from Rheede's plate and has never been described from living or dried specimens.

HABITAT.—Malabar.

USES.—The seed of this *Calamus* dried and powdered '*genuum ulcera sanat*' (Rheede).

37. **Calamus huegelianus** Mart. Hist. Nat. Palm. III, 338; Walp. Ann. III, 488, V, 831; Hook. f. Fl. Brit. Ind. VI, 452; Brandis Ind. Trees 652; Becc. in Rec. Bot. Surv. Ind. II, 207; Ann. Roy. Bot. Gard. Calc. XI, 100, 314.—*C. wightii* Griff. Palms Brit. Ind. 102, t. 216 C.—*C. melanolepis* H. Wendl. in Kerch. Palm. 237.—*Dæmonorops melanolepis* Mart. Hist. Nat. Palm. III, 331, t. 175, f. XI; 342 under *C. dioicus* and t. 116, f. XI; Walp. ll. cc. 481 and 829.

DESCRIPTION.—Leaflets many, equidistant, 12-16 inches long, ⅝-1 inch broad, elongate, ensiform, acuminate, strongly 3-costate, margins smooth, unarmed above, beneath pale and with a very few long bristles on the lateral costæ, the very distant bristles on the lateral nerves beneath sometimes absent, at others nearly ½ inch long; petiole stout, scurfy when young, back rounded

with very stout, short, recurved spines; rhachis pale; sheath armed with very stout, scattered, long and short spines. Female spadix stout, erect; spathes sparingly armed with stout claws, narrowly tubular, truncate. Fruiting branches 6-10 inches long, very stout, spikes recurved, calyx pedicelled, cupular, with spreading lobes. Fruit globose, $\frac{3}{8}$-$\frac{3}{4}$ inch in diameter, very shortly beaked, black, shining; scales subacute, with fimbriate margins, not channelled.

HABITAT.—Nilghiri Hills, 5-6,000 feet high: Sisparah, Naduvatam.

38. **Calamus gamblei** Becc. in Hook. f. Fl. Brit. Ind. VI, 493; Rec. Bot. Surv. Ind. II, 207; Ann. Roy. Bot. Gard. Calc. XI, 96, 316.

DESCRIPTION.—Probably scandent and of moderate size. Leaves large. Leaflets $\frac{1}{3}$ foot apart, ensiform, 2 feet long, 1-1$\frac{1}{8}$ inch broad, with three costæ on both surfaces more or less bristly-spinulous, margins remotely ciliate-spinulous. Female spadix with somewhat arched partial inflorescences $\frac{5}{6}$-1 foot long. Spikelets arched, sub-scorpioid. Female flowers pointing upwards, ovate, $\frac{1}{3}$ inch long. Fruit globose-obpyriform or turbinate-globose, tapering towards the base, up to 1 inch long, $\frac{3}{4}$ inch broad. Scales usually in 21 series, pale yellow, shining, strongly gibbous, distinctly channelled. Seed globose, ovoid.

HABITAT.—Nilghiris, in the Makurti forest at about 5,000 ft.

Calamus gamblei Becc. var. **sphærocarpus** Becc. l. c.

DESCRIPTION.—Fruit spherical, not tapering to the base, $\frac{3}{4}$ inch in diameter. Seed almost spherical.

HABITAT.—Nilghiris.

39. **Calamus gracilis** Roxb. (*non* Blanco *neque* Thw.) Fl. Ind. III, 781 (*excl. Syn.* Hort. Mal. XII, t. 64); Mart. Hist. Nat. Palm. III, 338; Kunth Enum. III, 209; Griff. in Calc. Journ. Nat. Hist. V, 54; Palms Brit. Ind. 64, t. 196; Walp. Ann. III, 488, V, 831; Kurz in Journ. As. Soc. Beng. XLIII, II, 212, t. 31 C; For. Fl. II, 520; Hook. f. Fl. Brit. Ind. VI, 453; Brandis Ind. Trees 653; Becc. in Rec. Bot. Surv. Ind. II, 208; Ann. Roy. Bot. Gard. Calc. XI, 96, 318.

NAME.—Mapuri Bet (Beng.); Oahing Bet (Assam).

DESCRIPTION.—Slender, climbing to a great extent; naked stem not thicker than a quill; all the younger parts included towards their extremities in the armed sheaths of the leaves, and then being about as thick as a man's little finger. Leaves

2-3 feet long, alternate, recurved; leaflets 5-7 inches long, collected in opposite groups of 3-5 on each side of the slender rhachis, elliptic-lanceolate, acuminate, 3-7-costate, costæ very slender and more or less setose above, margins obscurely bristly except at the tip, where the bristles are long; petiole very short and rhachis and sheath armed with short, hooked spines; rhachis fugaciously scurfy; sheaths green, glabrous. Spadix elongate, slender, drooping, flagelliferous. Spathes tubular, acuminate, sparingly spinous, fugaciously brown, scurfy, upper unarmed, spathels not imbricate, unarmed. Corolla thrice as long as the calyx. Fruiting calyx sessile, shortly cylindric, pedicelliform, lobes very short. Fruit oblong, ¾ inch long; scales straw-coloured, with or without a narrow, brown border, channelled. Seed wrinkled.

HABITAT.—The Khasia Hills up to 4,000 feet; Upper Assam; Cachar; Chittagong.

FLOWERS.—In May.

40. **Calamus melanacanthus** Mart. Hist. Nat. Palm. III, 333, t. 116, t. 13 and t. Z. XXII, f. X; Kunth Enum. III, 211; Griff. in Calc. Journ. Nat. Hist. V, 49; Palms Brit. Ind. 59; Walp. Ann. III, 484, V, 830; Miq. Fl. Ind. Bat. III, 119; Palm. Archip. Ind. 27; Kurz in Journ. As. Soc. Beng. XLIII, II, 215, t. XX, B; Hook. f. Fl. Brit. Ind. VI, 453; Brandis Ind. Trees 652; Becc. Rec. Bot. Surv. Ind. II, 208; Ann. Roy. Bot. Gard. Calc. XI, 96, 321; Wall. Cat. 8606 B.

DESCRIPTION.—Scandent. Leaflets many, 6-13 inches long, ½ inch broad, upper ones much shorter (2-3 inches), equidistant, membranous, linear with capillary tips, 3-costate, shortly setose or naked on the costæ beneath, tips sparsely bristly or naked, rhachis with a single row of short, recurved, black spines; sheath with sub-whorled spines. Female spadix decompound, ending in a flagellum. Spathes shortly, sparsely spinous, upper nearly unarmed. Fruiting calyx sessile, campanulate, pedicelliform Fruit ellipsoid, ¾ inch long, shortly beaked, scales greyish-yellow with very narrow brown margins, channelled; albumen deeply ruminate; embryo lateral.

HABITAT.—Tenasserim: Chappedong.

41. **Calamus zeylanicus** Becc. in Hook. f. Fl. Brit. Ind. VI, 455; Rec. Bot. Surv. Ind. II, 210; Ann. Roy. Bot. Gard. Calc. XI, 103, 379; Trim. Flor. Cey. IV, 335.—*C. rudentum* (*non* Lour.) Moon Cat. 26; Thw. Enum. 330 (*excl. omnibus syn. et C. P. exsicc.* No. 2874).

NAMES.—Mamewel, Wanderu-wel (Singh.).

DESCRIPTION.—Stem very stout, scandent; sheaths not flagelliferous. Leaves 4-5 feet long; petiole stout, armed with 3-fid recurved spines; rhachis very stout, its stout flagellum armed with large, broad, decurved, palmately 5-10-cleft, claw-like, woody spines, broader than the rhachis, young scurfy. Leaflets many, equidistant, ½-2 feet long and 1-1½ inch broad, ensiform, long, acuminate; veins 3-5, very sparingly setulose above, naked beneath. Lower spathe acute, armed with very short, scattered spines, upper striate, unarmed or sparingly spinous, uppermost funnel-shaped, truncate. Male spadix decompound, the long, spreading spikes with short spathels bearing short, broad, flat spikelets, ½-1 inch long, of most closely imbricate spathellules. Female spadix very stout, with much longer spikes. Flowers deeply sunk in the truncate spathellules, ovoid, nearly ¼ inch long; calyx deeply 3-lobed; petals broad, connate at the base, both striate. Fruit seated on the enlarged perianth, globose, ¾ inch in diameter, yellow-brown; beak long, stout, conical, scales 8-10 in a vertical series, tumid, with narrow, white furfuraceous margins and a deep central channel; seed globose, endosperm deeply ruminate, embryo lateral.

HABITAT.—Ceylon: moist low country, rather common below 1,500 feet. Kalutara, Sabaragamuwa, frequent. (Endemic in Ceylon.)

42. **Calamus ovoideus** Thw. ex Trim. in Journ. Bot. XXIII (1885) 269; Hook. f. Fl. Brit. Ind. VI, 457; Trim. Fl. Ceyl. IV, 335; Becc. in Rec. Bot. Surv. Ind. II, 211; Ann. Roy. Bot. Gard. Calc. XI, 104, 382.

NAME.—Ta-mbutu-wel (Singh.).

Stem stout, scandent. Leaves 14 feet long, including the flagellum, and more; leaflets 10-24 inches long and ¼-1 inch broad, equidistant, alternate, broadly linear, acuminate, tip bristly, 3-veined, setulose beneath, margins smooth; rhachis fugaciously scurfy, margins prickly, dorsally rounded, with solitary, hooked spines; flagellum armed with short, broad, many-toothed spines; sheath densely armed with rings of flattened, deflexed, often lacerate, black spines. Lower spathes armed with short, black, reflexed spines. Flowers not seen. Fruit seated on the shortly pedicelled, slightly enlarged perianth, ¾ inch long; obovoid, strongly beaked, scales 10-12 in a vertical

series, tumid, deeply channelled in the centre, pale yellowish-grey, bordered with orange-brown.

HABITAT.—Ceylon: moist, low country, rare, Sabaragamuwa. (Endemic in Ceylon.)

43. **Calamus andamanicus** Kurz in Journ. Asiat. Soc. Beng. XLIII, pt. 2 (1874) 211, pl. XXVII-A and XXVIII and Vol. XLV, pt. 2 (1876) 151; For. Fl. Brit. Burm. II, 519; Hook. f. Fl. Brit. Ind. VI, 457; Becc. in Rec. Bot. Surv. Ind. II, 211; Ann. Roy. Bot. Gard. Calc. XI, 104, 385.

VERNACULAR NAMES.—Chowdah, Charab (Andamans), Nat (Nicobars).

DESCRIPTION.—Stem lofty, scandent, as thick as an arm (with the sheaths on). Leaflets 2-2½ feet long, 1 inch broad, alternate, equidistant, linear, subulate-acuminate, 3-costate, margins thickened and costæ setose; petiole and rhachis armed with stout, recurved spines; petiole with blackish, tuberous-based spines mixed with long black ones, sheath red-brown, covered with seriate whorls of capillary black and broad, flat, black spines. Spadix decompound, nodding; spathes subcompressed, armed with strong, reflexed, solitary and ternate spines, partial unarmed. Fruit distichous, elliptic-ovoid, about ½ inch long, uniformly brown; scales rhomboid, greenish, bordered with chestnut-brown, rather flat, not furrowed, tips prolonged into a lanceolate, pale brown, opaque, acute, ciliolate, membranous appendage, longer than the scale itself. Seed semi-convex, grooved; albumen equable.

HABITAT.—Andaman and Nicobar Islands, Coco Isles.

USES.—The radical (not cirriferous) leaves are employed for thatching, and then the plant receives the name of Hok-Neak (*ex* Becc.).

44. **Calamus palustris** Griff. in Calc. Journ. Nat. Hist. V, 62; Palms Brit. Ind. 71, t. 199; Mart. Hist. Nat. Palm. III, 339; Miq. Fl. Ind. Bat. III, 131; Walp. Ann. III, 490, V, 831; Hook. f. Fl. Brit. Ind. VI, 458; Brandis Ind. Trees 654; Becc. in Rec. Bot. Surv. Ind. II, 211; Ann. Roy. Bot. Gard. Calc. XI, 106, 401.—*C. latifolius* Kurz (*non* Roxb.) in Jour. As. Soc. Beng. XLIII, II, 210, t. 31 A; For. Fl. II, 518 *(partim)*.

VERNACULAR NAMES.—Yamata (Burma), Wai (Andamans).

DESCRIPTION.—Stem scandent, glabrous throughout, with the sheaths about 2-3 inches in diameter. Leaves 8-12 feet long, short-petioled; leaflets 1-2 feet long, 3-5 inches broad, rather thin, uniformly green, alternate, the median approximate in

pairs, broadly elongate-lanceolate, acuminate with bristly tips, 3-costate and many-nerved, margins not thickened and costæ smooth; petiole with 1-2 rows of short, very broad, fascicled or simple, hooked spines with swollen bases; sheath green, sparingly armed with short, black or broad, hooked spines. Spadix bifariously decompound, elongate, drooping. Spathes tubular, obliquely truncate, armed with recurved spines; spathels glabrous. Fruiting perianth stellate. Fruit ellipsoid-oblong, about ½ inch long; scales obtuse, slightly bi-convex, hardly channelled, pale brown with a blackish border. Seed almost semi-convex, grooved and irregularly wrinkled.

HABITAT.—Tenasserim, Perak, Andaman Islands, Nicobars.

FLOWERS.—In October.

USES.—This *Calamus* is used by the natives of the Andamans to make knives known by the name of Wai-cho (Man, 'The Andaman Islanders', *ex* Becc.).

45. **Calamus latifolius** Roxb. Fl. Ind. III, 775; Mart. Hist. Nat. Palm. III, 339, t. 160 f. 5; Griff. in Calc. Journ. Nat. Hist. V, 60; Palms Brit. Ind. 68, t. 198 (*excl. cit.* Hort. Malab.); Kurz in Journ. As. Soc. Beng. XLIII, II, (*excl.* t. 31 A); For. Fl. II, 518 *(partim)*; Hook. f. Fl. Brit. Ind. VI, 455, (*excl. C. inermis* T. Anders.); Brandis Ind. Trees 653; Becc. in Rec. Bot. Surv. Ind. II. 211; Ann. Roy. Bot. Gard. Calc. XI, 107, 406.—*C. macracanthus* T. Anders. in Jour. Linn. Soc. XI, 10.—*C. humilis* Roxb. Fl. Ind. III, 773.

NAMES.—Korak Bent (Beng.); Yamata (Burm.); Ruebee Greem and Phekori-Bhet (Lepchas).

DESCRIPTION.—Stem stout, as thick as the thumb. Leaves with the flagellum 10-15 feet; leaflets 1-2 feet long, 1-2½ inches broad, scattered or binate, upper sometimes flabellately clustered or connate at the base, elliptic or elliptic-lanceolate, 3-9-costate, tips setose, margins aculeolate, costæ naked on both surfaces, cross nervules very many and close; petiole short or long, sometimes bearing the leaflets far up the flagellum; rhachis flagelliferous, very stout, variously armed with scattered spines; sheath densely covered with very short, broad, whorled spines and a few very large, straight, flat, solitary or whorled ones. Spadix very large, decompound. Spathes short, subcompressed, sparsely spinous, mouth oblique; spathels short. Male spikes densely imbricate. Fruiting calyx sessile, pedicelliform, broadly campanulate, lobes short. Fruit subglobose, pale dull yellow;

scales convex, deeply channelled, shining, margin very narrowly scarious.

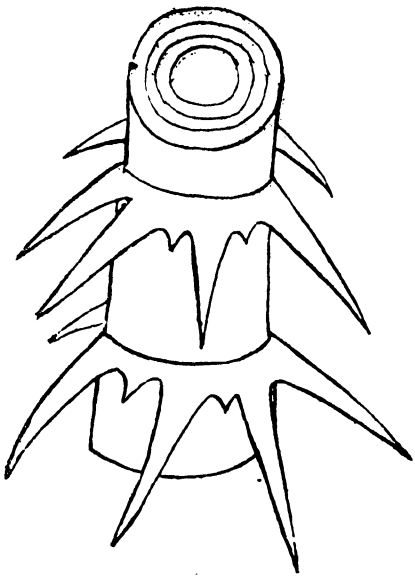


FIG. 44.— Part of stem of *Calamus latifolius*.

HABITAT.—From the Sikkim Himalaya and Assam (2,000 feet) to Tenasserim.

FLOWERS.—In November and December.

Calamus latifolius Roxb. var. **marmoratus** Becc. in Ann. Roy. Bot. Gard. Calc. XII, 107, 409.

VERNACULAR NAME.—Ruebee (Lepchas).

DESCRIPTION.—More slender than the type. Leaf sheaths about $\frac{4}{5}$ inch in diameter, marbled with mealy and dark green spots and armed with verticillate, broad-based and smaller interposed spines. Leaves smaller, with fewer pairs of leaflets; leaflets $\frac{5}{6}$-1 foot long and $\frac{1}{5}$ foot broad at most.

HABITAT.—Sikkim Himalaya.

46. **Calamus dorisei** Becc. in Hook. f. Fl. Brit. Ind. VI, 456; Rec. Bot. Surv. Ind. II, 211; Ann Roy. Bot. Gard. Calc. XI, 111, 430.

DESCRIPTION.—Apparently rather large and scandent. Female spadix with rigid, arched, partial inflorescences, which terminate in a slender, barely spinulous, tail-like appendix. Spikelets spreading, callous at their axils, arched, zigzag sinuous, up to

$\frac{1}{5}$ foot long, with 7-9 horizontal flowers on each side. Fruiting perianth depressedly ventricose. Fruit elongate-ellipsoid, stoutly beaked, $\frac{1}{1}\frac{1}{2}$-1 inch long, $\frac{1}{2}$ inch broad. Scales in 21 series, narrowly and deeply channelled. Seed oblong, sub-cylindric, pitted; albumen superficially ruminate; embryo sub-basilar.

HABITAT.—Burma: Karim Gheccu Mountains.

47. **Calamus polydesmus** Becc. in Ann. Roy. Bot. Gard. Calc. XI, 111, 430.

DESCRIPTION.—Scandent, apparently rather robust. Leaflets distinctly grouped in fascicles of 2-3 on each side of the rhachis, linear-lanceolate, acuminate, $\frac{2}{3}$ foot long, $\frac{3}{1}$-1 inch broad, sub-5-costulate, the costæ quite smooth on both surfaces; margins spinulous-serrulate. Female spikelets spreading, callous at their axils, about $\frac{1}{3}$ foot long with 9 distichous flowers on each side. Fruiting perianth cylindric.

HABITAT.—Central Burma.

FRUIT.—In March.

48. **Calamus khasianus** Becc. in Ann. Roy. Bot. Gard. Calc. XI, 111, 431.

DESCRIPTION.—High scandent and very robust. Sheathed stem 2 inches in diameter, naked canes 1-1$\frac{1}{5}$ inch, the internodes about $\frac{5}{6}$ foot long. Leaf-sheaths armed with very large laminar spines. Leaves very large; petiole very short. Leaflets numerous, 2-4 approximate on each side of the rhachis, with long vacant spaces interposed, lanceolate ensiform, 1$\frac{1}{3}$-1$\frac{2}{3}$ foot long, 1-1$\frac{2}{5}$ inch broad, 3-5-costulate, the costæ almost smooth on both surfaces or sparingly spinulous above; margins spinulous. Female spadix diffuse, 4-5 feet long, with many partial inflorescences, which are arched and spreading with distinct callus at their axils. Spikelets zigzag sinuous, up to $\frac{2}{3}$ foot long, with 15-16 flowers on each side; spathels asymmetrically infundibuliform. Fruiting perianth cylindric. Fruit almost spherical, about 1 inch long. Scales in 18 series, deeply channelled. Seed globular, coarsely pitted; albumen superficially ruminate; embryo basal.

HABITAT.—Khasia Hills.

USES.—Fruit edible.

49. **Calamus nambariensis** Becc. in. Ann. Roy. Bot. Gard. Calc. XI, 111, 433.

VERNACULAR NAME.—Hoka Bhet (Assam).

DESCRIPTION.—Scandent, rather robust. Leaf-sheaths $1\frac{1}{5}$-$1\frac{3}{5}$ inch in diameter, armed with large, broad, sub-seriate, horizontal or deflexed spines intermingled with smaller ascendent ones. Leaves 10 feet long in the pinniferous part; petiole very short. Leaflets spreading, remotely sub-equidistant, lanceolate-ensiform, about $1\frac{2}{3}$ foot long, $1\frac{3}{5}$ inch broad, with 3 or sometimes 5 smooth costæ; margins obsoletely spinulous. Male spadix simply decompound or partially supra-decompound; spikelets callous at their axils, spreading or deflexed, $1\frac{1}{5}$-$1\frac{2}{3}$ inch long, flowers on each side. Spathels closely packed, concave, ovate, bracteiform. Fruit apparently similar to that of *C. Khasianus,* but more ovoid and with scales in 21 series.

HABITAT.—Assam.

50. **Calamus inermis** T. Anders. Jour. Linn. Soc. XI (1869) 11; Gamble Man. Ind. Timb. 424.—*C. latifolius* (*non* Roxb.) Becc. in Hook. f. Fl. Brit. Ind. VI, 455 (*partim*).

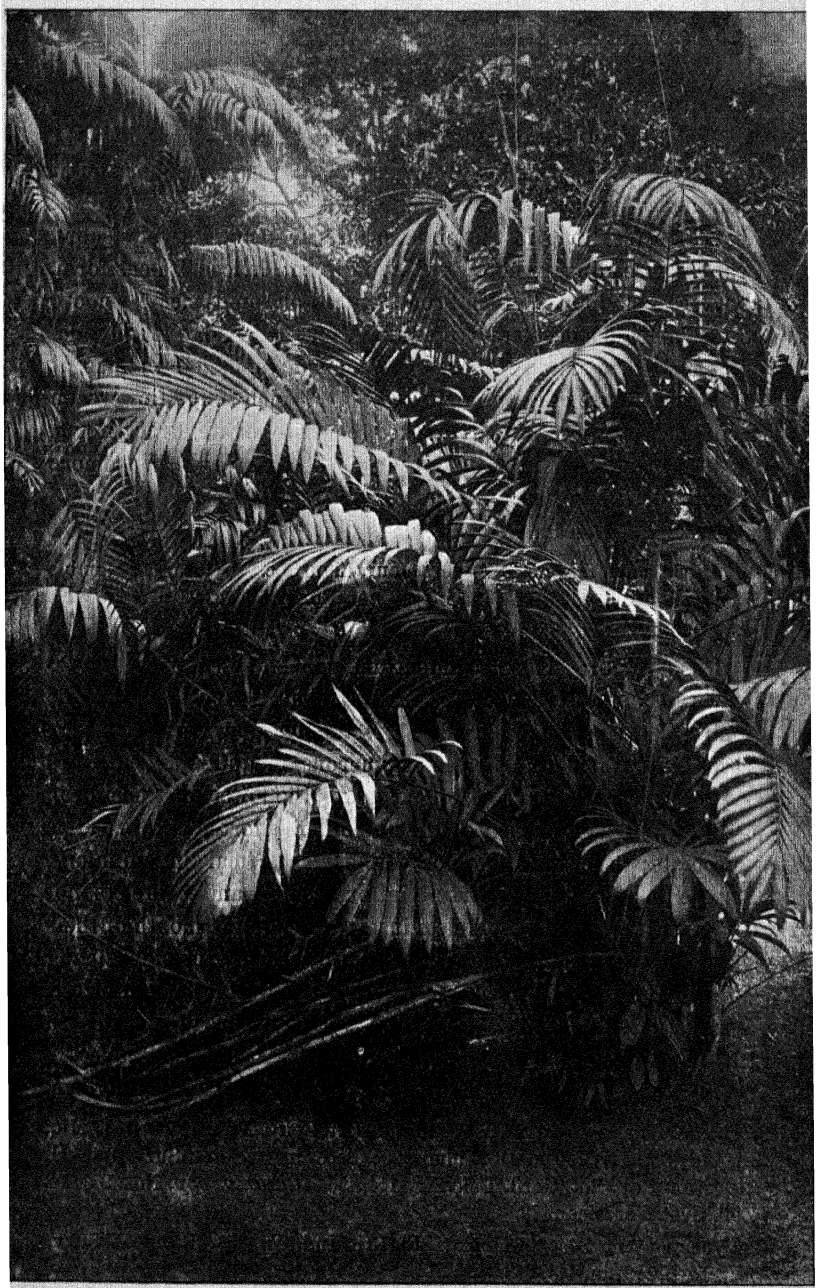
DESCRIPTION.—High scandent and robust. Leaf-sheaths 2-$2\frac{2}{5}$ inches in diameter, smooth. Leaves about 10 feet long in the pinniferous part; the cirrus $6\frac{2}{3}$ feet long, powerfully clawed; petiole short, smooth. Leaflets numerous, inequidistant, in pairs on each side of the rhachis, 3-9-costulate, the lower ones ensiform, $1\frac{1}{3}$-$1\frac{2}{3}$ ft. long, $1\frac{1}{5}$-$1\frac{3}{5}$ inch broad, the others shorter and broader, lanceolate; the costæ smooth on both surfaces; margins spinulous. Female spadix strict; partial inflorescences and spikelets not callous in their axils; spikelets inserted inside the mouth of their spathe, up to 4 inches long, with 8-10 flowers on each side, zigzag sinuous between the flowers. Fruiting perianth ventricose. Fruit ellipsoid, $1\frac{1}{5}$ inch long, up to $\frac{7}{12}$ inch broad. Scales in 18 series, deeply channelled. Seed ovoid, sinuously grooved.

HABITAT.—Hot and damp valleys of the Sikkim Himalaya.

51. **Calamus unifarius** H. Wendl. in Bot. Zeitg. XVII (1859) 158; Miq. Fl. Ind. Bat. III, 749 et De Palmis 28; Becc. in Rec. Bot. Surv. Ind. II, 212; Ann. Roy. Bot. Gard. Calc. XI, 114, 456.—*Calamus spp.* Nos. 9 et 14, Zoll. Syst. Verzeichn. 79.

Var. **pentong** Becc. in Hook. f. Fl. Brit. Ind. VI, 458; Rec. Bot. Surv. Ind. II, 212; Ann. 114, 458.

VERNACULAR NAME.—Pentong (Nicobars).



Calamus scipionum Lour.

DESCRIPTION.—Scandent, robust. Leaf-sheaths $1\frac{1}{5}$-$1\frac{2}{5}$ inch in diameter, armed with long, acicular, bulbous spines. Leaves large, $5\frac{2}{3}$ feet long in the pinniferous part. Leaflets not very

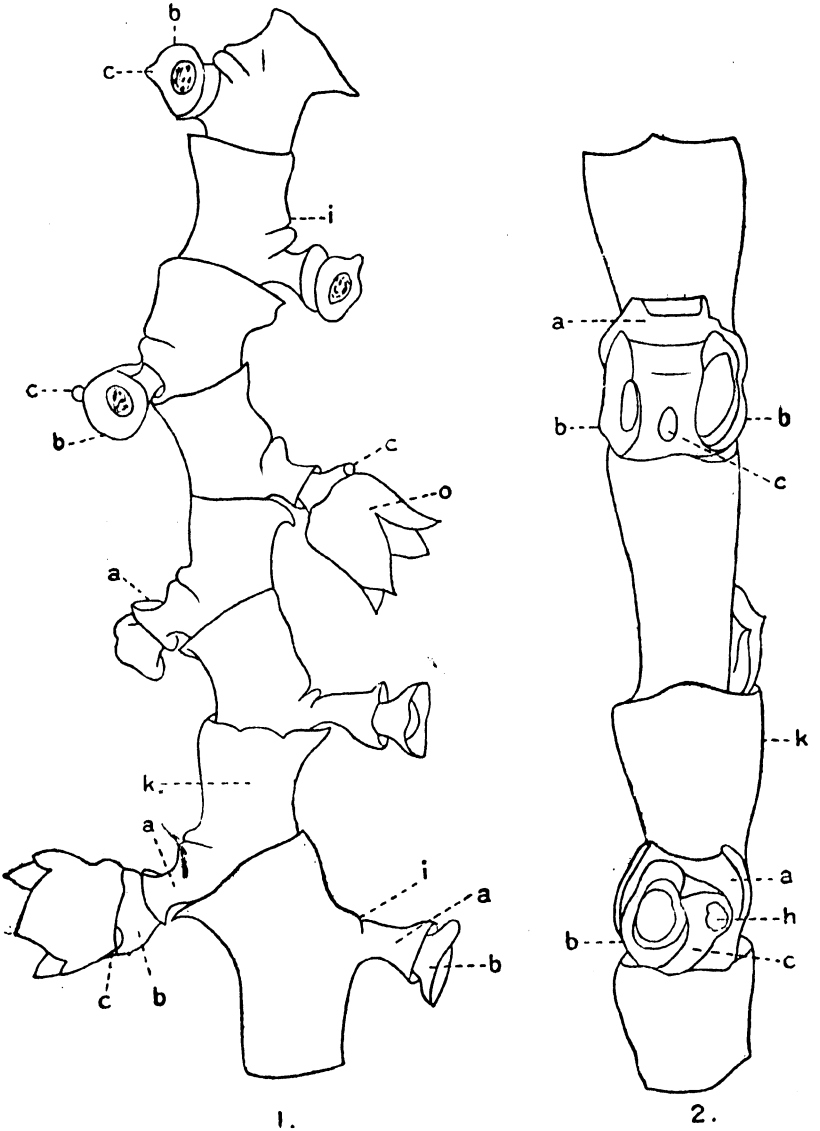


FIG. 45.

1. Portion of flowering spikelet of *C. unifarius* var. *pentony*.
2. Portion of a fruiting spikelet of *C. didymocarpus*; for comparison, *a*=involucrophorum. *b*=involucre. *c*=areola. *h*=scar of areola. *i*=axillary callus. *k*=spathel. (After Beccari.)

numerous, subequidistant, $\frac{1}{5}$-$\frac{1}{3}$ foot apart, lanceolate, or lanceolate-ensiform, with 5-7 slender costæ, which are smooth on both surfaces. Male spadix ultra-decompound with several panicled-pyramidate partial inflorescences. Spikelets (fig. 45) distinctly callous in the axils, very slender, arched, their axes filiform, $\frac{2}{5}$-$1\frac{1}{5}$ inch long, with 5-15 distichous flowers on each side; involucre calyculiform, subtending and not enveloping the flower. Female spadix simply decompound, similar to the male one, terminating in a rather elongate flagelliform appendix; spikelets slender, 2-$3\frac{1}{5}$ inches long with 15-20 bifarious flowers on each side; involucrophorum more or less distinctly pedicellate. Fruiting perianth pedicelliform. Fruit globose, $\frac{2}{5}$ inch in diameter. Scales subsquarrose in 15 series, not distinctly channelled. Seed irregularly globular, coarsely pitted, albumen sub-ruminate; embryo basal.

HABITAT.—Nicobar Islands.

52. **Calamus scipionum** Lour. Fl. Cochinch. 3,210; Lam. Encycl. VI, 304 (*non* Illustr. and *excl. syn.*); Mart. Hist. Nat. Palm. III, 342; Kunth Enum. III, 206; Griff. in Calc. Journ. Nat. Hist. V, 35; Palms. Brit. Ind. 43; Miq. Fl. Ind. Bat. III, 138; Hook. f. Fl. Brit. Ind. VI, 461.—*C. micranthus* Bl. Rumph. III, 53 *(fol. tantum)*, t. 157 (*excl. spad.* and *anal. fl.*).—*Ching* Griff. ll. cc. 37, 46.

DESCRIPTION.—Stem 40-60 feet high, sheath 2-3 inches in diameter. Leaves 4-5 feet long; flagellum 10-12 feet long; leaflets numerous, firm, equidistant, upper gradually smaller, elongate-lanceolate or subensiform, aculeolate, tips bristly; rhachis as thick as the little finger, smooth except from the scattered spines, obtusely trigonous; costæ 5-7, naked on both surfaces or sparsely aculeolate beneath; margins of leaflets nearly smooth, uppermost pair connate at the base; petiole armed with very stout conico-subulate, scattered, recurved spines.

Spadices very long, flagelliferous; lower spathes very long, tubular, unarmed, or their keels armed. Male spadix about 20 feet long, female about 10 feet; spathels 1 inch long, tubular, truncate, smooth, unarmed, or with a few conical tubercles; branches of female spadix long; spikes 2-4 inches, rather distant, spreading and recurved, stout; spathellules and bracts very short imbricate; female flowers sessile.

Fruiting calyx very small, pedicelliform, broadly urceolate, base truncate, intruded, mouth much contracted, lobes very short. Fruit small, ovoid or globose, abruptly mammillate,

brown, scales shining, tumid, with broad, pale, scarious margins. Seed when young subovoid, alveolate, embryo basilar.

DISTRIBUTION.—Malacca, Perak, Borneo. Sometimes found in Indian gardens.

ILLUSTRATION.—Plate LVI.

UNRECOGNISED SPECIES.

C. quinquenervius Roxb. Fl. Ind. III, 777; Kunth Enum. III. 209; Mart. Hist. Nat. Palm. III, 339; Griff. in Calc. Journ. Nat. Hist. V, 61; Palms Brit. Ind. 72; Hook. Fl. Brit. Ind. VI, 460; Brandis Ind. Trees 654; Becc. in Rec. Bot. Surv. Ind. II, 215; Ann. Roy. Bot. Gard. Calc. XI, 503.

NAMES.—Hurnur-gullar (in Sylhet).

DESCRIPTION.—Scandent, stem when cleaned about as thick as a man's finger throughout, the joints from 6-8 inches long. Leaves flagelliferous; leaflets few, remote, alternate, equidistant, narrowly lanceolate, 5-nerved. Spines in belts, distinct, few, short and strong. Spadix decompound. Fruit spherical.

Hooker and Beccari have not been able to recognize this species.

HABITAT.—Sylhet.

7. *DÆMONOROPS* BLUME RUMPH. II, t. 131, III, 2, t. 138-145.

(From the Greek "daimon", an evil spirit, and "rhops", a low shrub.)

Mart. Hist. Nat. Palm. III, 203, 326, t. 117, 125, 175-177; Kunth Enum. Pl. III, 204; Miq. Fl. Ind. Bat. III, 81, suppl. 90, 255, 592; Luers. Botan. II, 329; Hook. f. Fl. Brit. Ind. VI, 452.

The general characters are the same as those of *Calamus*, but the outer sheaths or spathes are cymbiform, deciduous, at first enclosing the inner; the flowers are often more pedicellate (fig. 46.).

SPECIES about 80. DISTRIBUTION.—That of *Calamus*.

1. **Dæmonorops jenkinsianus** Mart. Hist. Nat. Palm. III, 327; Walp. Ann. III. 475, V, 827; Hooker f. Fl. Brit. Ind. VI. 462; Brandis Ind. Trees 650.—*D. nutantiflorus* Mart. l. c. 326; Walp. ll. cc. 474 and 827.—*Calamus jenkinsianus* Griff. in Calc. Journ. Nat. Hist. V, 81; Palms Brit. Ind. 89 (*excl.* fruit *et* t. 186 A. f. 3); T. Anders. in Journ. Linn. Soc. XI. 11—*Calamus nutantiflorus* Griff. in Cal. Journ. Nat. Hist. V, 79; Palms Brit. Ind. 88, t. 208.

NAME.—Gola Bent (Ass.).

DESCRIPTION.—Stem scandent, very stout, with the sheaths 1¾ inch in diameter; young parts grey-pubescent. Leaves large;

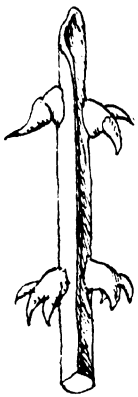


FIG. 46.—Cirrus of a *Dæmonorops*.

leaflets 2 feet by ⅔-¾ inch, equidistant, linear, finely acuminate; costæ 3, all sparsely setose above with very long bristles, only the central beneath, margins setulose. Petiole, rhachis and flagellum with many marginal and dorsal hooked spines or 3-5-fid claws; sheath armed with very long, flat, deflexed and shorter, more slender spines.

Spadix elongate, decompound; outer spathe 1-2 feet long, flattish, 2-keeled, armed with flat spines, narrowed into a long spinescent beak, spines ½-¾ inch, inner spathe 12-18 inches long, lanceolate, long-acuminate, quite smooth. Male spadix thyrsiform, dense-flowered; calyx oblong, 3-dentate, petals and bracts deeply grooved. Female spadix with spreading branches, fruiting erect; calyx cupular, not pedicelliform; petals twice as long.

Fruit globose, apiculate, ⅔ inch in diameter, pale yellow-brown; fruiting calyx nearly flat; scales deeply channelled, margins narrowly scarious. Seeds subglobose, smooth; albumen punctate, or the surface ruminate by very slender channels (fig. 47).

DISTRIBUTION.—Sikkim Himalaya, Assam, Khasia Hills, Bengal, Chittagong.

2. **Dæmonorops manii** Becc. in Hook. f. Fl. Brit. Ind. VI, 463; Brandis Ind. Trees 650.

"Leaflets very many and narrow, naked beneath, setulose on the 3 costæ above; spadix very long, slender; peduncle compressed,

hardly armed; outer spathe very long, gradually narrowed into a long, pale, dorsally keeled beak, spines few, large, flat; inner

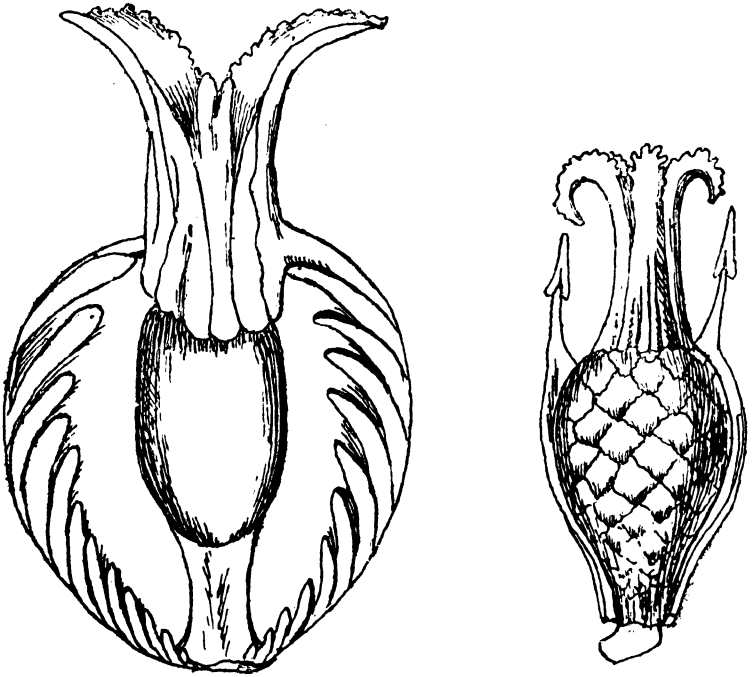


FIG. 47.

Left: Vertical section of fruit of *Dæmonorops jenkinsianus*, magnified.
Right: Young fruit of *Calamus griffithianus*, magnified. (After Martius.)

lanceolate, acuminate. Fruiting spadix erect, glabrous; fruit globose, shortly mammillate; scales pale, slightly channelled, margins pale, tip not discoloured." Hooker.

HABITAT.—Andaman Islands.

3. **Dæmonorops kurzianus** Hook. f. Fl. Brit. Ind. VI, 463; Brandis Ind. Trees, 650—*D. grandis* Kurz in Journ. As. Soc. Beng. XLIII, II, 208 (not Mart.)—*Calamus grandis* Kurz For. Fl. II, 523 (not of Griffith).

A lofty climber, the sheathed stems as thick as the arm, the canes up to 1 inch in diameter. Leaves 4-6 feet long, shortly petioled; leaflets 1-2 feet long, 1-1¼ inch broad, very many, equidistant, elongate, ensiform, acuminate, margins minutely aculeolate, tips ciliate, costæ 3-5, naked or with a few long bristles above; rhachis enormously stout, 1½ inch in diameter, semi-terete, flat above with short, scattered spines on the margins,

dorsally convex and unarmed, ending in a clawed flagellum; petiole very stout, armed below with long, flat and short, recurved spines; sheath with whorled spines. Outer spathe cymbiform, scurfy, with seriate spines; inner linear, unarmed. Fruiting spadix erect, branches very stout. Fruit globose, $\frac{2}{3}$ inch in diameter, very shortly beaked, pale brownish-yellow; scales deeply channelled, margins brownish with a very narrow, scarious edge; fruiting calyx with a very short base and broad, striate lobes; petals twice as long, striate; seed subcompressed; albumen punctate, or the surface ruminate by very slender channels.

HABITAT.—South Andaman Islands.

USES.—*D. kurzianus* is the only species hitherto reported as affording the so-called "East Indian Dragon's-blood". This is for the most part prepared from the fruits of several species of *Calamus,* growing in Eastern Sumatra, South Borneo, and Penang. The gum exudes naturally from between the scales of the fruit, but inferior qualities are obtained by boiling the fruits or by tapping the stems. The false dragon's-blood of the Indian market is imported into Bombay from Sumatra, Penang, etc., in large cakes or compressed in bamboo tubes. The true dragon's-blood is procured from Socotra, and is obtained by tapping the stems of several species of *Dracæna.*

IV. CEROXYLINÆ

Spadix simple or one or several times branched; flowers diclinous, usually dimorphic; when diœcious, solitary with rudimentary bracts, when monœcious usually in cymes of 3 flowers, 2 being male and 1 female, or rarely 8 males and one at the end of the row being female; carpels 3, 3-2-1-locular, fruit smooth, not scaly; feather leaves.

6. ARECINEÆ.

Berry of 3 carpels, united or separating after fertilization; exceptionally a fibrous woody endocarp is formed.

DISTRIBUTION.—In the tropics of all the continents; little represented on the African continent, increasing on the East-African islands, with the greatest number in the Indian region from Assam and Malacca to the south-eastern islands of the Malay Archipelago, the north-eastern coast of Australia and New Zealand, with different sub-tribes in America from Mexico and the Antilles to Rio de Janeiro and Juan Fernandez.

A. SUB-TRIBE: CARYOTEÆ.

Spadix in the axils of living or dead leaves; peduncle clothed with several tubular, incomplete spathes (except *Orania*, which has got 2 spathes); flowers free on the slender branches of the 1st and 2nd order. Male flowers symmetrical, usually with many stamens. Calyx of 3 sepals, imbricate. Corolla 3-partite, valvate. Ovary of 1-3 united carpels, 1-3-locular. Berry with 1-3 seeds; remains of stigma apical (except *Orania*). Embryo dorsal.

DISTRIBUTION.—India, Malay Peninsula.

Caryota L., *Arenga* Labill., *Didymosperma* W. & Dr., *Wallichia* Roxb., *Orania* Zipp.

KEY TO THE GENERA DESCRIBED BELOW.

Male sepals 3. Stamens many. Albumen ruminate ... ... *Caryota.*

Male sepals 3. Stamens many. Albumen equable ... ... *Arenga.*

Male calyx cupular. Stamens many. Albumen equable ... ... *Didymosperma.*
Male calyx tubular. Stamens 6. Albumen equable ... ... *Wallichia.*

OR

Leaves bipinnate ... ... *Caryota.*
Leaves simply pinnate .. ..
Fruit 3-seeded... ... ... *Arenga.*
Fruit 2-seeded... ... ... *Didymosperma.*
Fruit 1-seeded... ... ... *Wallichia.*

1. *CARYOTA* L. GEN. NAT. 1228.

(From the Greek "Caryotos", nut-like, on account of the shape of the fruit; the Greeks first applied this name to their cultivated Date.)

Mart. Hist. Nat. Palm. III, 193, 315, t. 107, 108, 162.—Bl. Rumph. II, 134, t. 162, 163.—Kunth Enum. Pl. III, 198, 504.—Griff. Calc. Journ. Nat. Hist. V, 477.—Miq. Fl. Ind. Bat. III, 37.—Kurz For. Fl. II, 530.—Benth. Fl. Austr. VII, 134.—Wendl. Linn. 39, 191.—Drude Bot. Zeitg. 1877, 638, t. 6, fig. 25, 26.—Becc. Males. I, 69.—Bot. Mag. 5762.—Trim. Journ. Bot. 1879, 174.—Benth. & Hook. Gen. Pl. III, II, 918, 73.—Hook f. Fl. Brit. Ind. VI, 422.

Tall, unarmed palms with annulate, naked or sheathed trunks, soboliferous or not, flowering when full grown from the axils of the leaves, beginning at the upper and then successively downwards, after which the plant dies, usually a male and a female spadix alternately.

Leaves few, very large, broad, bipinnatisect or decompound; leaflets very obliquely dimidiately flabelliform or cuneiform, præmorse or rounded at the tip, their bases swollen at the insertion; nerves and veins flabellate.

Spathes 3-5, incomplete, tubular. Spadices interfoliar, shortly peduncled, much fastigiately branched; branches slender, pendulous. Flowers monœcious, solitary and nude, or ternate with the central flower female. Male flowers symmetric; sepals 3, short, rounded, coriaceous, closely imbricate; petals 3, larger than the sepals, linear-oblong or ovate-oblong, valvate; stamens very many; filaments very short; anthers long; pistillode 0. Female

flowers subglobose, smaller than the male; sepals 3, ovate or orbicular, concave, closely imbricate; petals 3, rounded, valvate; ovary obovoid, 3-gonous, 3-celled; ovule in each fertile cell solitary; stigma sessile, 3-lobed; staminodes 3 or 6 or 0.

Fruit globose, 1-2-(rarely 3-) seeded, crowned by the stigma; sarcocarp full of raphides. Seed erect; albumen ruminate; embryo dorsal.

Species about 12. Tropical Asia, Malaya and Australia.

CULTIVATION IN EUROPE.—The species of this genus form very noble stove palms. When in a young state, Caryotas serve as excellent ornaments for dinner tables, etc. They thrive well in a compost of loam and vegetable mould in equal parts, to which a little sand may be added. Perfect drainage and much water during the growing are necessary. Propagation is easily effected by seeds or by suckers.

* INDIGENOUS SPECIES.

1. **Caryota urens** L. Fl. Zeyl. 187; Gærtn. Fruct. I, 20, t. 7; Roxb. Fl. Ind. III, 625; Mart. Hist. Nat. Palm. III, 193. t. 107 and 108, and 162; Griff. in Calc. Journ. Nat. Hist. V, 479; Palms Brit. Ind. 159; Thw. Enum. 329; Dalz. & Gibbs. Bomb. Fl. 278; Miq. Fl. Ind. Bat. III, 41; Hook. f. Fl. Brit. Ind. VI, 422; Brandis Ind. Trees, 654; Trim. Fl. Ceyl. IV, 324; Talb. Trees Bomb. ed. 2, 341; Prain Bengal Pl. 1093; Cooke Fl. Bomb. Pres. II, 805.—Rheede Hort. Malab. I, t. 11.

NAMES OF THE TREE:—Fish-tail Palm, Hill Palm, Indian Sago Palm, Bastard Sago Palm, East Indian Wine Palm, Jaggery Palm, Kittul Tree, Toddy Palm, Wine Palm, Mhar Palm (English).

Caryote brûlant, faux sagonier de l'Inde, palmier céleri (French).

Bastardsagopalme, Ostindische Brennpalme, Sagopalme (German).

Jagerieboom, Nieboom, Sagueerboom, Wilde Sagueerboom (Dutch).

Mari (Hind.).

Bherawa, berli, bhirli mahad, berli mad, bherla mada, berli mhar, ardhi supari (Mar.).

Birli mhad, birli mhar (Bombay).

Shiwajata, shankar jata (Guj.).

Birli mad (Konk.).

Baini, bagni, beina, bhvni (Kan.).

Mari-ka-jhar (Dec.).
Mhar mardi, mari, jirugu, jilugu, goragu, gorrega (Tel.).
Conda-panna, erin-panna, utalipanna, kundal-panai, thippali (Tam.).
Shunda pana (Mal.).
Minbo, minbaw, kimbo (Burm.).
Bara flawar (Assam.).
Runbong, simong (Lepcha).
Salopa (Uriya).
Kittul, nepora (Sing.).
Hlyamban (Magh.).

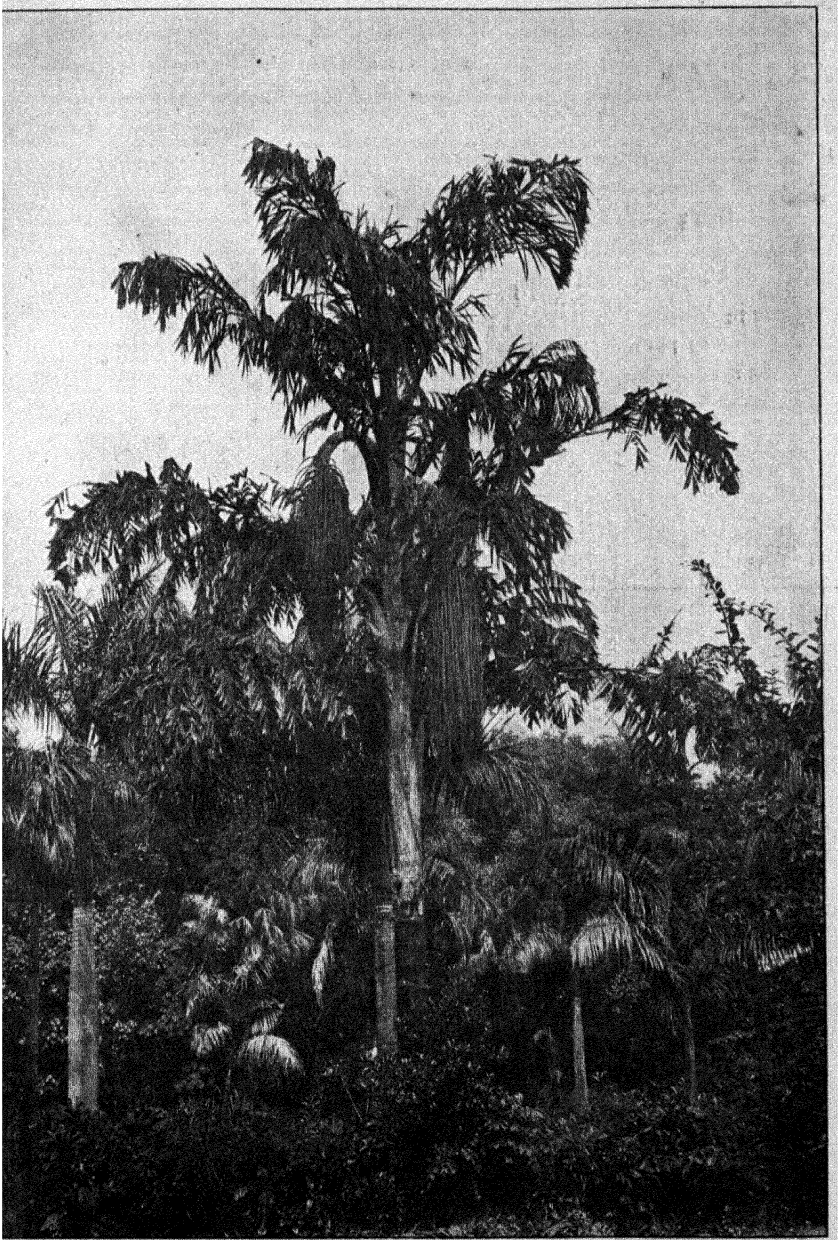
NAMES OF THE SAGO.—Bastard sago or sago (English).
Sagon d'Assam (French).
Palmenstärke, Sago (German).
Sago (Dutch).

NAMES OF THE FIBRE.—Black fibre, Indian Gut, Kitool, Kittool fibre, Kittul fibre, Salopa fibre (English).
Crin végétal (French).
Kitoolfaser, Siamfaser (German).
Kitoolvezel, Kittoelvezel (Dutch).

NAMES OF THE SUGAR.—Jagery, Jaggory, Palm sugar (English).
Jaggery, sucre de palme, sucre de palmier (French).
Palmzucker (German).
Palmsuiker (Dutch).

NAMES OF THE WINE.—Palm wine, toddy (English).
Toddi, vin de palme, vin de palmier (French).
Palmwein, Toddy (German).
Palmwijn, Toddy (Dutch).

DESCRIPTION.—Trunk 40-60 feet high, 1-1½ foot in diameter; cylindric, annulate, not or scarcely soboliferous, smooth, grey, shining, covered with long, shallow cracks with corky edges. The crown is rather thin, consisting of several ascending, gracefully curved bi-pinnate leaves, of great size, being 18-20 feet long and 10-15 broad; the primary divisions 5-6 feet long, arched and drooping; leaflets 4-8 inches long, fasciculate or alternate, cuneiform, obliquely truncate, irregularly serrate-toothed on the truncate margin, the upper margin produced beyond the leaflets into a tail, flabellately veined, glabrous, bright green, shining,



Fish-tail Palm (*Caryota urens* L.) and young plants of *Oreodoxa regia* Mart., in Victoria Gardens, Bombay.

the margins at the base recurved. Petiole very stout, at the base measuring about 3 inches across, the lower foot in its length is naked, and the margins of the sheath continued upon it as an elevated, confluent line. Rete moderate and coarsely fibrous.

Spadix very large, 10-12 feet long. Peduncle curved, stout, entirely covered with large, greyish, coriaceous spathes, 1-1½ foot long, and closely imbricated; branches simple, very long, pendulous, level-topped, resembling a huge, docked horse-tail. Flowers very numerous, placed in threes, the central and lowermost being female, and later than the others in development. Male flowers: Buds narrowly cylindric, ½ inch long; sepals 3, roundish, cordate, ciliate imbricate; petals coriaceous, concave, reddish; stamens about 40; filaments short, white; anthers about as long as the petals, linear, acuminate; pistillode 0. Female flowers much the same as the male, but the sepals broader, more ciliate, the corolla shorter, and of greenish colour; staminodes usually 3, placed opposite the sepals and angles of the ovarium, resembling young anthers. Ovary subtrigonal, roundish, 3-locular; ovule solitary, erect; stigma sessile, 3-lobed.

Fruit ⅔-¾ inch in diameter, reddish; pericarp thin, yellow, acrid; seeds one or two; albumen ruminate, embryo dorsal.

Flowers during most of the year (during the hot and rainy season, according to Brandis).

Habitat.—Sub-Himalayan tract from Nepal eastwards, ascending to 5,000 feet; Assam; Khasi Hills; Manipur; Chittagong; Upper Burma; Pegu; very common in the evergreen forests of the Konkan and Northern Kanara; Coimbatore; Nilgiris; Malabar; Madura; Orissa; the Circars; shady valleys on the east side of the Peninsula; Ceylon; Malaya.

Uses[1].—The most important product of this palm is the fibrous cords or fibro-vascular bundles found naked at the base of the leaf-sheath and within the petioles, flowering stalks and even the stems as well. These constitute the strong kittul-fibre of Ceylon and the salopa of Orissa, a fibre that comes also from Burma and Bombay. It is manufactured into ropes, brushes, brooms, baskets, caps, and similar articles. It has been shipped

[1] We follow Watt, Comm. Prod. of India, 1908, p. 286-87.

as a brush fibre from Ceylon to England since 1860. It has been found that five or more strands, fastened together by

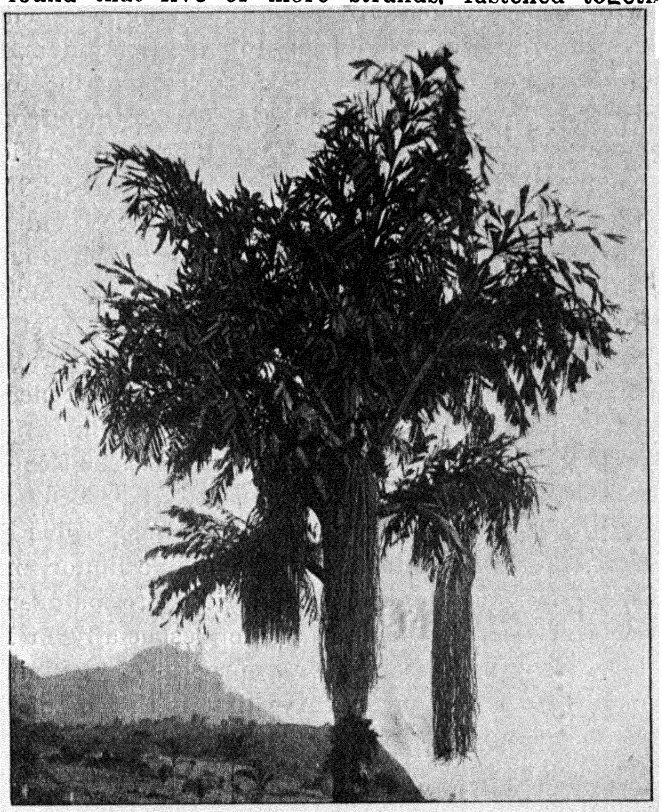


FIG. 48.—A Fish-tail Palm (*Caryota urens*) in flower and fruit.
(Photograph taken at Khandala by Rev. M. Maier, S. J.)

special machinery, make an excellent substitute for whalebone in corsets. It has further been discovered that the kittul-fibre is superior to the Bahia piassava (fibre of *Attalea funifera*), being less brittle. Kittul-fibre, therefore, is in much request, in India as well as in Europe, where it is used in brush-making; some of the finest qualities have been substituted for bristles. For this purpose the fibre is steeped in linseed-oil in order to make it so pliable that it can be used either with or without bristles in the manufacture of soft, long-handled brooms. These have the advantage of being extremely durable and much cheaper than ordinary hair brooms. According to Dodge it is also made up into machine brushes for polishing linen and

cotton yarns, for cleaning scutched flax, brushing velvets, etc. In Ceylon and India fishing-lines are made of the fibre, and strong, wiry ropes, which are used for tying wild elephants. Watt gives the following quotations of the London market on April 20, 1901: For long quality 8½ *d.* to 9 *d.* per lb; for No. 1, 6½-7 *d.*; No. 2, 2¾ *d.* to 3¼ *d.*; No. 3, 1 *d.* The exports from India are unimportant, whilst from Ceylon they are considerable. The maximum till 1909 was for the year 1898, namely, 3,794 cwt.

The pith or farinaceous part of the trunk of old trees is considered to be almost equal to the best sago of commerce; the natives bake it into bread and boil it into a thick gruel. "These form" says Roxburgh, "a great part of the diet of these people; and during the famine they suffered little while those trees lasted. I have reason to believe this substance to be highly nutritious. I have eaten the gruel and think it fully as palatable as that made of the sago we get from the Malay countries."

Toddy is also prepared from these palms. This juice is either fermented and distilled into an alcoholic liquor, or boiled down into a dark syrup, which solidifies into palm-sugar or jaggery, which is an important product, especially in Bombay and Ceylon. Sawyer,[1] describing the process of "training" and "tapping" in North Travancore, says that at the end of the first five days of tapping the yield is about 4 quarts a day, increasing by degrees to 6, 8 and 12 quarts. In strong, healthy individuals even 18 or 20 quarts may be obtained at the end of the course. Sometimes, in an unusually prolific palm, three or even four spathes may be seen being tapped at the same time, while others, in spite of the most careful training, yield no toddy whatever. An average-sized spathe is tapped in about four months, and all the spathes of one palm are exhausted in about two years. Roxburgh mentions that the best trees give as much as 100 pints in 24 hours.

The "cabbage" or terminal bud is edible, like that of most palms. The woolly substance or scurf scraped from the leaf-stalks is used in Burma for caulking boats; it also serves as tinder.

The timber, being strong and durable, is much used for agricultural purposes, water-conduits, beams and rafters.

[1] Ind. For. (1896), XXI. 134-8.

Sometimes it is cut into walking-sticks.

The seeds are used as beads by the Mahomedans.

According to Commelinus[1] the pulp of the fruit is bitter and irritates the tongue. It is probably this circumstance which suggested the specific name of the palm, "urens", i. e. "burning". Watt remarks: "The fruit is certainly very pungent and insipid, but I cannot recollect having observed the tingling property just mentioned, though I have eaten it."

I have never tasted the fruit, but I remember that, some years back, I asked my students in Botany to dissect the fruit of *Caryota*. After a few minutes they gave it up, showing me their hands, which looked, indeed, as if they had been handling nettles. The victims of science felt the irritation for about two hours. Unfortunately I do not remember whether the fruits were fully ripe at the time or not. All I know is that they were still on the tree when I gathered them.

Wald[2] gives quite a different explanation of the name "urens", but he does not say on what authority. He says that the bark of the tree when wetted causes a distinct irritating sensation.

CULTIVATION IN INDIA.—This palm thrives in gardens with ordinary border treatment. It reaches its full size in about 15 years, and about 7 years more are occupied in producing its flowers before it becomes unfit for the garden. The first flowering panicle is of immense size and pendulous from the axil of one of the upper leaves. The second is from a lower axil and somewhat smaller, and so on downwards until the tree is exhausted (Woodrow).

CULTIVATION IN EUROPE.—This species is frequently employed in sub-tropical gardening from June till September.

ILLUSTRATION: PLATE LVII.—The photograph, taken by Mr. Phipson, shows a beautiful group of palms in Victoria Gardens, Bombay. The centre is occupied by a Fish-tail Palm. From the axils of the leaves there rise three gigantic spadices; the largest of them (to the right) is the youngest and has the flowers not yet open, whilst the one to the left bears fruit. The stem below the petioles of the leaves is ringed.

The Fish-tail Palm is surrounded by several young plants of *Oreodoxa regia* Mart.

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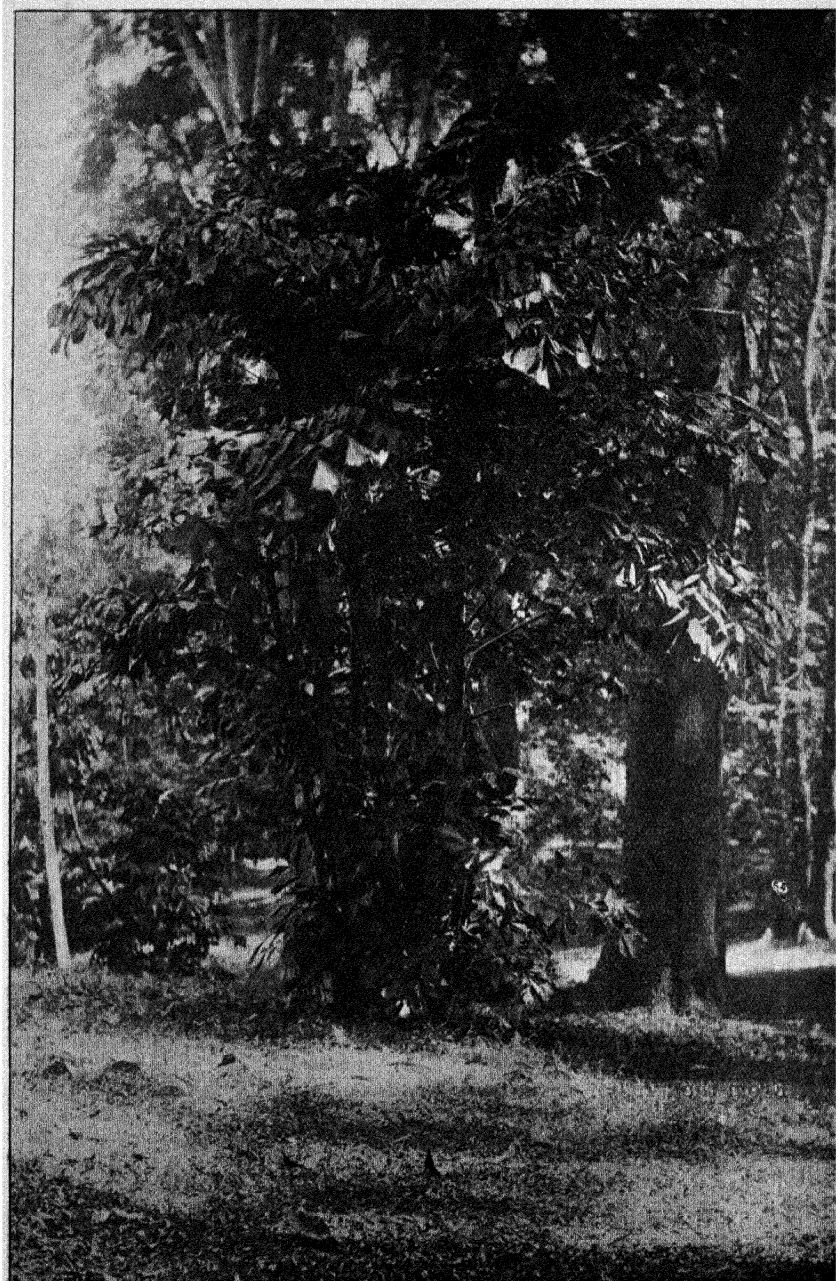
[1] Rheede, Hort. Mal. I, 16, n.

[2] Wald, K. Lebensbäume. Regensburg, 1906, p. 74.



Caryota mitis Lour., in the Botanic Gardens, Calcutta.

2. **Caryota obtusa** Griff. in Calc. Journ. Nat. Hist., V, 480; Palms Brit. Ind. 170; Mart. Hist. Nat. Palm. III, 195; Hook. f. Fl. Brit. Ind. VI, 422; Brandis Ind. Trees, 654.—*C. obtusidentata* Griff. Palms Brit. Ind 236, A. B.

NAME.—Burma Suwar (Ass.). This is also the name for *C. urens.*

DESCRIPTION.—This palm has the habit and stature of *C. urens,* from which it can be at once distinguished by the more rounded and crenate apex of the leaflets and by the shorter, unexpanded male flowers.

Trunk tall, stout, 1½ foot-2 feet in diameter, not soboliferous. Leaves very large; leaflets cuneate, very unequal-sided, coriaceous, when dry, remarkably striato-plicate, the upper margin not caudate; the teeth short and very obtuse.

Branches of the male spadix long, flexuose, scurfy. Flowers distant, 3 together, the central (female) are later in development. Male buds about as long as broad. Male flowers about 5 lines long; sepals rounded, scurfy, and ciliate; petals 2½ times longer than the sepals; stamens indefinite; anthers linear, slightly mucronate. Female flowers: Calyx as in the male; petals much smaller, valvate. Staminodes 3, opposite to the sepals. Ovary 3-celled; ovules solitary, erect; stigma 3-lobed.

Fruit ¾-1 inch in diameter, base not apiculate.

HABITAT.—Upper Assam; Mishmi Mountains about Yen, 3,400 feet.

USES.—The inhabitants of the Mishmi Mountains use the central soft portion of the trunk as food.

3. **Caryota mitis** Lour. Fl. Cochinch. II, 569; Mart. Hist. Nat. Palm. III, 195; Kunth. Enum. III; Hook. f. Fl. Brit. Ind. VI, 423; Brandis Ind. Trees, 654.—*C. sobolifera* Wall. Cat. 8594; Mart. l. c. III, 194, t. 107, f. 2; Griff. in Calc. Journ. Nat. Hist. V, 481; Palms Brit. Ind. 171, t. 236, C; Miq. Fl. Ind. Bat. III, 41; Kurz For. Fl. II, 530—*C. urens* Jacq. Fragm. 20, t. 12, f. 1.—*C. nana* Wall. Cat. 8595.—*C. furfuracea* Bl. in Mart. l. c. 195: Rumphia II, 141 (excl. var. *caudata*).—*C. propinqua* Bl. in Mart. l. c. 195; Rumphia l. c. 138 t. 155 (*partim*), 162.—*C. griffithii* Becc. in Nuov. Giorn. Bot. Ital. III, 15.

NAMES.—Tookkus (Malay); Doodoor (in Penang).

DESCRIPTION.—A very elegant palm, stem 12-40 feet high, 4-5 inches in diameter, soboliferous, forming very thick, compact tufts, greenish, distinctly annulate. Petioles, leaf-sheaths and

spathes scurfily villous. Leaves 4-9 feet long, spreading, nodding towards the apex, glaucescent, greenish; leaflets 4-7 inches long, very obliquely cuneiform erose and toothed, the upper margin acute, regularly and rather obtusely jagged.

Spathes concealing the whole peduncle, almost boat-shaped, at length deciduous. Branches of spadix very numerous, about 1 foot long, the whole resembling the spadix of *C. urens*, but

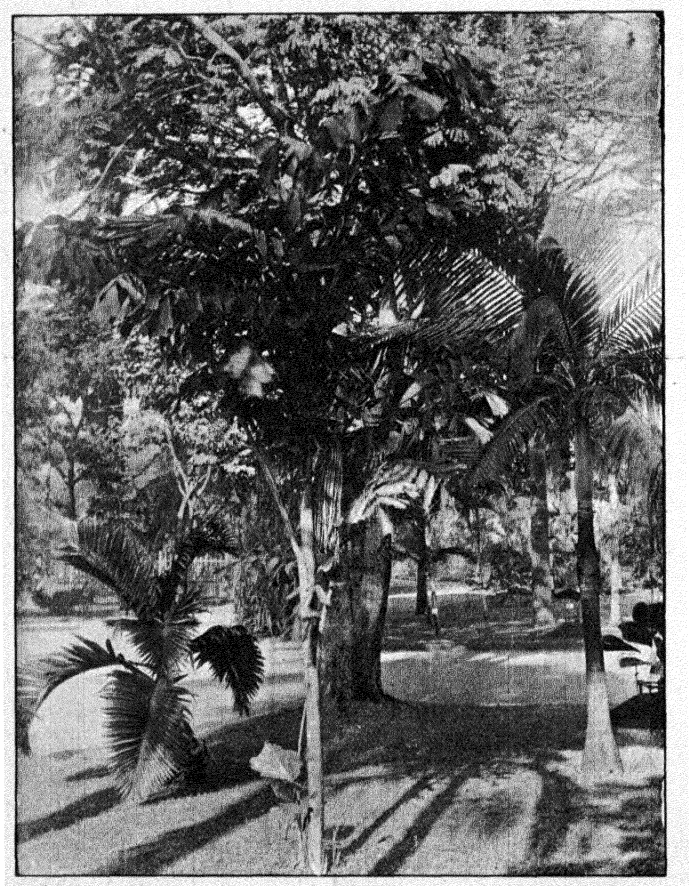


FIG. 49.—*Caryota mitis* Lour. in flower in Victoria Gardens, Bombay.
(Photograph by Rev. M. Maier, S. J.)

much smaller, with fewer unequal scurfy branches and much smaller flowers. Male flowers very numerous, about ¼ inch long, oblong, flesh-coloured, with reddish points; calyx cup-shaped, sepals broad, imbricate; petals 3, coriaceous, striate, almost

distinct; stamens many, 17 according to Brandis, filaments very short, united at the base; anthers linear, adnate, generally slightly mucronate; pollen ovate-lanceolate, 1- or 3-plicate. Female flowers at the time of expansion of the males minute, rudimentary, not developed until after the males of the same spadix have fallen off, smaller than the males, not always solitary, but sometimes 2 or 3 together, or solitary with a scar of one male only; sepals rounded, with a brown intramarginal line, and ciliate edges; petals 3, twice as long as the sepals, valvate, coriaceous, brown; staminodes 3, yellowish, tips glandular; ovary roundish ovate, with 3 obtuse angles.

Fruit ½ inch in diameter, red,[1] surrounded at the base by the perianth, depressed, rather round; epicarp brittle, sub-fibrous. Seed globose; albumen horny, ruminate; embryo dorsal.

HABITAT.—Burma: from Arakan southwards; Martaban; Malay Peninsula; Penang; Andaman Islands; Malay Archipelago.—[De Kerchove de Denterghem[2] says that the original home of *Caryota sobolifera* Wall. (= *C. mitis* Lour.) is Tibet and the Malacca Peninsula. Has this palm ever been observed in Tibet?]

ILLUSTRATION: PLATE LVIII.—The photograph, supplied by Colonel Gage, shows a clump of *Caryota mitis* Lour., growing in the Botanic Gardens of Calcutta. If not disturbed by the gardener's knife, this palm will always form a thick, compact tuft.

** INTRODUCED SPECIES.

4. **Caryota rumphiana** Mart. Hist. Nat. Palm. III (1850) 195; Blume Rumphia II, 140; Miq. Fl. Ind. Bat. III, 40; Becc. Malesia I, 70; Koorders Exkursions Fl. Java (1911) I, 237.—*Caryota maxima* Blume in Mart. l. c. (1850) 195; Miq. l. c. 39.—*Caryota furfuracea*, β *connata* Bl. Rumphia II, 136, tab. 163, C; Miq. Fl. Ind. Bat. III, 39.—*Caryota N?* Becc. in Nuovo Giornale Bot. Ital. III, 12.—*Caryota Alberti* F. v. Muell. in Wendl. et Drude Palm. Aust. in Linnæa (1875), 219.

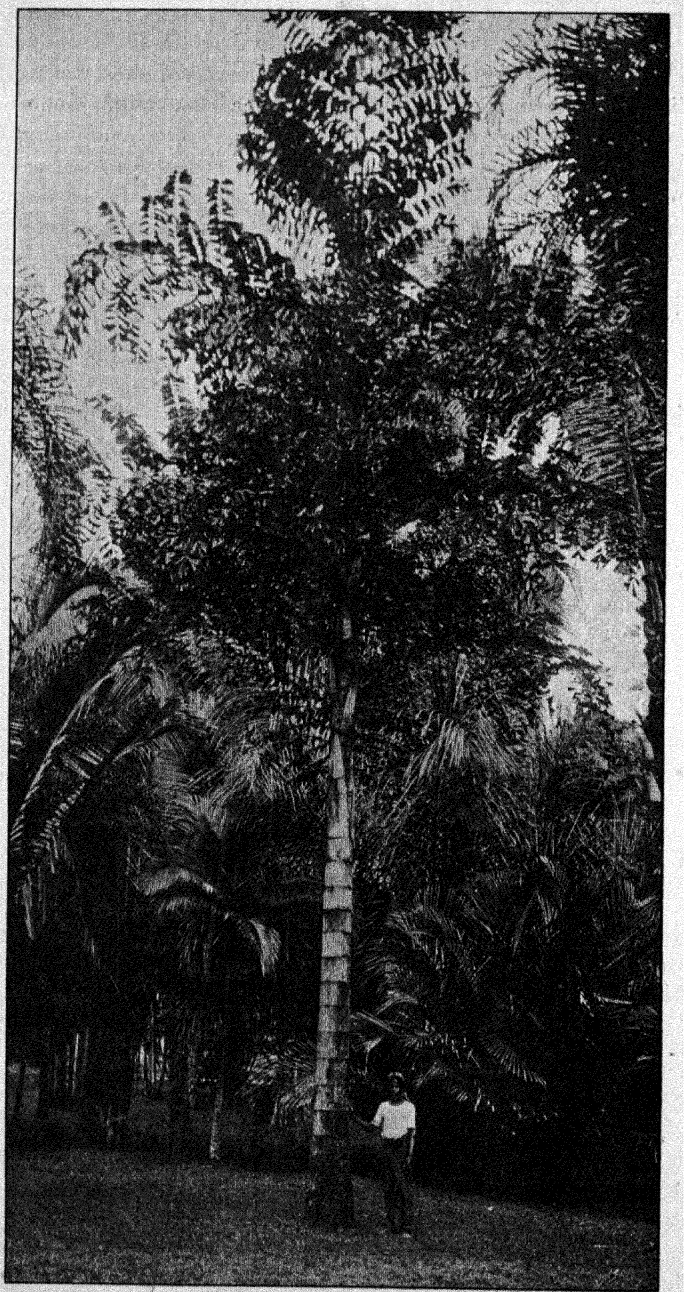
NAMES.—Rumph's Caryota, Albert Palm (English).

Suwangkung, Suwangkung gede, (Sunda Isl.), after Koorders.

DESCRIPTION.—A fine tree, growing more than 60 feet high. Stem columnar, up to 1½ foot in diameter, unarmed, not

[1] Hooker describes the fruit as bluish-black, Griffith as greenish-red or red. Mr. Burkill informs me that a specimen in his garden bears red fruit

[2] Les Palmiers, Paris, 1878, p. 329.



Caryota rumphiana Mart., in the Botanic Garden of Peradeniya.

soboliferous. Crown of leaves broad. Leaves doubly pinnate, 13-20 feet long; leaflets very oblique, half fan-shaped, much plicate, up to 1½ feet long, only 2-3 inches broad at the base, thick, leathery, rigid, irregularly and obtusely toothed, the lower margin sometimes produced into a long, obtuse point, sometimes shorter than the next fold.

Spikes often above 2 feet long. Male flowers about 5 lines or rather more. Stamens above 30.

Fruiting spadix up to 10 feet long. Fruit more or less spherical, more than 1 inch in diameter.

HABITAT.—Western Java between 3,300 and 4,200 feet above sea, in shady, evergreen, mixed forests (Koorders); Malay Archipelago (New Guinea, Borneo, etc.); N. Australia.

ILLUSTRATION: PLATE LIX.—The photograph, taken by Mr. Macmillan, shows a fine specimen of *Caryota Rumphiana* growing in the Botanic Garden of Peradeniya. This palm is much more ornamental than the species described above. Unfortunately it is very rare in Indian gardens.

2. *ARENGA* LABILL. MÉM. INST. PARIS IV, 209.

From the vernacular name used in the Moluccas.

Roxb. Fl. Ind. III. 626 (*Saguerus*).—Spreng. Gen. Nat. 2222 (*Gomutus*).—Mart. Hist. Nat. Palm. III, 191, t. 108, 147, 148.—Kunth. Enum. Pl. III, 196.—Bl. Rumph. II, 124, t. 95, 123-125 (*Saguerus*).—Griff. Palms Brit. Ind. 163, t. 235.—Miq. Fl. Ind. Bat. III, 34.—Becc. Males. I, 78.—Kurz For. Fl. II, 533.—Benth. Fl. Austr. VII, 143.—Drude Bot. Zeitg. 1877, 638, t. 6.—Wendl. & Drude Linn. 39, 229 (*Saguerus*).—Benth. & Hook. Gen. Pl. III, II, 917, 72.—Hook. Fl. Brit. Ind. VI, 421.

Tall, stout palms, flowering first from an upper leaf-axil and successively from lower; trunk densely clothed above with fibrous remains of the leaf-sheaths. Leaves terminal, long, pinnatisect; leaflets long, linear, usually præmorse with a midrib and numerous longitudinal nerves, and one or two auricles at the base.

Spathes many, clothing the peduncle of the spadix. Spadices interfoliar, large, much-branched; branches slender, pendulous; peduncles short, decurved. Male and female flowers usually solitary and on separate spadices, rarely 3-nate, a female between



Sago Palm (*Arenga saccharifera* Labill.) in the Botanic Gardens of Peradeniya.

2 males. Male flowers symmetric; sepals 3, orbicular, imbricate; petals oblong, valvate; stamens numerous; filaments short, anthers apiculate; pistillode 0. Female flowers subglobose; sepals accrescent; petals triangular, valvate; staminodes many or 0; ovary subglobose, 3-celled; stigmas conic.

Fruit obovoidly globose, 2-3-seeded; stigmas terminal. Seeds compressed or plano-convex; albumen equable; embryo dorsal.

Species about 10. Tropical Asia, Malaya, Australia.

Leaflets 4-5-fariously fascicled... ... ... *A. saccharifera.*
Leaflets bifarious ... ... *A. obtusifolia.*
Leaflets alternate ... ... *A. wightii.*

* INDIGENOUS SPECIES.

1. **Arenga saccharifera** Labill. in Mém. Inst. Fr. IV, 209; Mart. Hist. Nat. Palm. 191, t. 108 and 161, f. 4; Miq. Fl. Ind. Bat. III, 35; Kurz For. Fl. II, 534; Griff. in Calc. Journ. Nat. Hist. V, 472; Palms Brit. Ind. 164, t. 135 A; Hook. f. Fl. Brit. Ind. VI, 421; Brandis Ind. Trees, 648.—*A. griffithii* Seem. *ex* H. Wendl. in Kerchov. Palm. 232.—*Saguerus rumphii* Roxb. Fl. Ind. III, 626.—*S. saccharifer* Wurmb. Verh. Bat. Genootsch. I, 350; Blume Rumphia II, 128, t. 123, 124.—*Gomutus saccharifer* Spreng. Syst. II, 622.—*Borassus gomutus* Lour. Fl. Cochinch. II, 759.—*Caryota onusta* Blanco Fl. de Filip. ed. I, 741.

NAMES OF THE TREE.—Sago Palm, Malay Sago Palm, Sugar Palm, Gomuti Palm, Areng Palm (English).

Arbre au sagou, Aren à sucre, Areng, Gomonto, Gomuti, Lantar, Lontar, Palmier areng, Palmier condiar, Palmier à sucre, Rondier (French).

Echte Zuckerpalme, Gomutipalme, Sagwirepalme, Zuckerpalme (German).

Aren, Arenboom, Areng, Arengboom, Arengpalm, Arenpalm, Gamoetoeboom, Gomoetipalm, Gomoetoepalm, Sagoeweerpalm, Sagueer-boom (-palm), Saguweerpalm, Suikerboom (Dutch).

Taung-ong (Burma).

Anan (Malay).

Aren, Duk, Lirang, Kolang kaling, Buwah atap (Java).

Dhuk, Edhuk (Madur).

Kawung (Sunda Isl.).

NAME OF THE SOFT BROWN SCURF AT THE BASE OF THE PETIOLE.—Barum (Malay).

NAMES OF THE FIBRE.—Ejoo fibre, Gomuta fibre, Gomuti fibre, Gomutie, Gomuto fibre, Vegetable bristles, Vegetable horsehair (English).

Baleine végétale, Coir, Crin végétal, Gomoeti, Gomotuh, Gomuti (French).

Eju, Ejufasern, Ejuh, Goafasern, Gomutifasern (German). Doek (in Java).

Gemoeti, Gomoeti(e), Gomoeto(e), Plantaardig plantenhaar, Plantaardige borstels, Plantenhaar (Dutch).

NAMES OF THE SUGAR.—Jaggery, Gomuti Palm Sugar (English).

Gaulaitam (French).

Palmzucker, Sagueerzucker (German).

Arensuiker, Bruine suiker, Jagerij, Javaansche suiker, Zwarte suiker (Dutch).

NAMES OF THE SAGO OR SAGO FLOUR.—Farine de Sagou (French).

Ostindische Graupen, O. Tapiocca, Ostindischer Sago, Palmenstärke, Sago (German).

Bloem van sagoe, Oostindische sago, Palmensago, Sagoe, Sago, Sagoemeel, Sagomeel (Dutch).

NAMES OF PALM WINE OR TODDY.—Vin de palme, Sagouër, Vin de Saguère (French).

Palmenwein, Palmwein, Toddy (German).

Kolwater, Palmwijn, Sagoeweer, Sagoweer, Sagueer (Dutch).

Tuwak, Nera (Malay).

THE LIQUOR OBTAINED BY THE MACERATION OF THE FRUIT IS CALLED—Hell Water, Infernal Water (English).

Eau infernale (French).

Helsch Water (Dutch).

DESCRIPTION.—A beautiful and magnificent palm, trunk 20-40 feet high, very stout. Crown oblong, very dense, of a sombre aspect, leaves many and large, 20-28 feet long and 10 broad, outline oblong-ovate, petiole very stout, channelled at the base, sprinkled with blackish scurf; leaflets up to 115 on each side, 3-5 feet long, subsessile, linear, 4-5-fariously fascicled, coriaceous, variously toothed towards the tip, base 1-2-auricled, dark-green above, white beneath, costa stout, scurfy beneath.

Spadices several, axillary, 6-10 feet long, branched, branches attenuate at the apex, and then furnished with a few rudimentary flowers, slender, pendulous. Male and female flowers together[1]

[1] Brandis (Indian Trees, p. 648) says that most branches bear male and female flowers, whilst Hooker (Flora Brit. Ind. VI, 421) speaks of the "male spadix". Does Hooker call it "male spadix" because the spadix bears only male flowers or because the male flowers preponderate?—Drude (Palmæ, in Pflanzenfamilien II, pt. 3, p. 54) when giving the general characteristics of *Arenga*, says that the spadices are unisexual by abortion. This is often the case, but not always.

on most branches, one sex generally preponderating. Male flowers very numerous, oblong, club-shaped, of a rich purple black colour and a disagreeable smell, of considerable size, often 1 inch long; sepals 3, rounded, broad, imbricate; petals nearly 3 times as long, oblong, valvate; stamens numerous; filaments short, slender; anthers nearly as long as the petals, apiculate; pistillode 0. Female flowers solitary, large, 1 inch in diameter. Sepals 3, very broad; petals 3, cordate-ovate, coriaceous. Staminodes 0; ovary shortly obturbinate, 3-celled, apex 3-lobed, concave in the centre; stigmas 3, tooth-shaped, triangular, erect; down the back of those lobes that are opposite the sepals runs a slight keel.

Fruit 2-2½ inches long, oblong-turbinate, surrounded at the base by the perianth, apex flat or nearly concave, marked with 3 lines, running from the backs of the persistent stigmas to the now nearly obsolete lobes; outer substance coriaceous, thick, inner gelatinous, adhering for the most part to the seeds; seeds black, convex on the outer, bifacial on the inner, face, attenuate at the base; albumen horny, cartilaginous; embryo dorsal.

HABITAT.—Assam; Martaban and Tenasserim; occasionally on the Pegu Yoma; commonly cultivated in India. Malay Peninsula and Archipelago (in Java up to 4,000 feet).

FLOWERS.—The palm flowers about the tenth year. Flowers may be seen throughout the year. The spadices of the uppermost axils flower first, and often have mature fruit when the lowest come into flower.

FRUIT.—Ripens during the year following the appearance of the flowers. After all spadices have matured their seed, the tree dies.

DISSEMINATION.—Of the few animals that are able to eat the corrosive fruit of this tree, there are two mammals in Java: the *Paradoxurus* (Luwak) and *Sus verrucosus*. The Sago Palm seems to owe its wide distribution in Java chiefly to these animals. (Koorders c. I, 238).

USES.—*Arenga saccharifera* is one of the handsomest and most useful palms. The principal production of this tree is:—

(a) The Toddy.—According to Crawfurd it is obtained in the following way: One of the spadices is, on the first appearance of fruit, beaten on three successive days with a small

stick, with the view of determining the sap to the wounded part. The spadix is then cut off a little way from its root, and the liquor which pours out is received in pots of earthenware, in bamboos, or other vessels. The Gomuti Palm is fit to yield toddy when nine or ten years old, and continues to yield it for two years, at the average rate of three quarts a day. When newly drawn, the liquor is clear, and in taste resembles fresh must. In a very short time it becomes turbid, whitish, and somewhat acid, and quickly runs into the vinous fermentation, acquiring an intoxicating quality. In this state great quantities are consumed; a still larger quantity is immediately applied to the purpose of yielding.

(b) Sugar.—With this view the liquor is boiled to a syrup, and thrown out to cool in small vessels, the form of which it takes, and in this shape it is sold in the markets. This sugar is of a dark colour and greasy consistence, with a peculiar flavour. It is the only sugar used by the native population. The wine of this palm is also used by the Chinese residing in the Indian islands in the preparation of the celebrated Batavian arrack. The *Journal of the Indian Archipelago* (Nov. 1849) gives some further interesting details with regard to the manufacture of sugar. "Like the cocoanut tree" it says, "the Gomuti Palm comes into bearing after the seventh year. It produces two kinds of mayams or spadices—male and female. The female spadix yields fruit, but no juice, and the male *vice versa*. Some trees will produce five or six female spadices before they yield a single male one, and such trees are considered unprofitable by the toddy collectors; but it is said that in this case they yield sago equal in quality, though not in quantity, to the *Cycas circinalis*, although it is not always put to such a requisition by the natives; others will produce only one or two female spadices, and the rest male, from each of which the quantity of juice extracted is the same as that obtained from ten cocoanut spadices. A single tree will yield in one day sufficient juice for the manufacture of five bundles of jaggery, valued at two cents each. The number of mayams shooting out at any one time may be averaged at two, although three is not an uncommon case. When sickness or other occupation prevents the owner from manufacturing jaggery, the juice is put into a jar, where, in a few days, it is converted into excellent vinegar,

equal in strength to that produced by the vinous fermentation of Europe. Each mayam will yield toddy for at least three months, often for five, and fresh mayams make their appearance before the old ones are exhausted; in this way a tree is kept in a state of productiveness for a number of years, the first mayam opening at the top of the stem, the next lower down, and so on, until at last it yields one at the bottom of the trunk, with which the tree terminates its existence."

Tschirch observes that "it is not worth while to grow the palm for sugar, because its production per acre is insufficient". He gives the yield for Java at about 8,000 lbs. per hectare (say 2½ acres). The estimate quoted by Simmonds is about 6,600 lbs. to the acre.[1]

(c) Sago. Like the true Sago Palm, *Metroxylon sagu* Rottb., the Gomuti Palm affords a medullary substance, from which a meal is prepared. In the western and poorer part of Java it is used in considerable quantity, and offered for sale in all the markets. It is smaller in quantity than the pith of the true Sago Palm, more difficult to extract, and inferior in quality. It has a certain peculiar flavour from which the meal of the true sago is free.

According to Jumelle,[2] about 400 trees can be planted to the acre, and each tree yields about 154 lbs. of sago. This gives the enormous total of 61,600 lbs. to the acre. Roxburgh says that one palm gave about 150 lbs. of good sago-meal.

(d) The Fruit.—The juice of the fleshy outer covering of the fruit is highly stimulating and corrosive. If applied to the skin it causes great pain and inflammation. It is said that the inhabitants of the Moluccas were in the habit of using in the defence of posts during the war a liquor obtained by the maceration of this fruit, which the Dutch appropriately called "hell-water". From the albumen of the seed, when free from this noxious covering, the Chinese prepare sweetmeat.

(e) Fibre.—At the base of the petioles, and completely embracing the trunk, is found a beautiful black horse hair-like fibre, known as the Eju or Gomuta fibre. This fibrous substance is superior in quality, cheapness and durability to that obtained from the husk of the coconut, and is well known for its power of resisting

[1] Watt, Commerc. Prod. of India, (1908), p. 92.

[2] Jumelle, Les Cultures Coloniales. Pl. Aliment. 27, (1900).

wet. It has been recommended for ropes intended for use under water and even as covering for submarine telegraph cables.

The coarsest fibre, according to Watt, is only fit for brush-making. For this purpose the leaves are first washed and then soaked in an alkaline solution.[1]

The natives of the Indian islands use the fibre for every purpose of cordage, domestic and naval. "The coarser parts" says Seemann, "found with this vegetable horse hair, are used by all the tribes who write on paper as pens, and they are the arrows used by others to discharge, poisoned or otherwise, from blow-pipes or arrow tubes. Underneath this material is found a substance of a soft gossamer-like texture, which is imported into China. It is applied as oakum in caulking the seams of ships, and more generally as tinder for kindling fire; it is for this latter purpose that it is chiefly in request among the Chinese."

The fibrous material mentioned above is also used as a thatch, in the same manner as we use straw, and not infrequently over the bamboo thatch. In this case the roof is so durable as never to require removal, the fibres, of all vegetable substances, being the least prone to decay. For this reason, it is a common practice to wrap a quantity of the fibres round the ends of timbers or posts that are to be fixed in the ground. It is, besides, used, among other purposes, for making ropes, and mixing with mortar. Low mentions that "the hairy filaments are plaited by the natives of Borneo into ornaments for the arms, legs and neck, which are more pleasing in their deep black hue and neat appearance than the beads and brass with which these people are fond of adorning their persons".

(f) Varia.—When the leaves are very young they are eaten, like those of the American Cabbage Palm (*Oreodoxa oleracea* Mart.).

Griffith writes that trees that have died after the ripening of the whole crop of fruit are almost hollow, and particularly adapted for making troughs, spouts or channels for water, and that they last extremely well underground.

From the leaf-sheath sandals are made.

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[1] Morris, Contor. Lect. Journ. Soc. Arts, Oct. 18th (1895), p. 931.

A Legend.—The following Toba legend shows the important place the palm has held in the lives of the Batak from remote antiquity:—

"Si Boeroe Djati, daughter of the chief, was to be married to Si Radja Inda-Inda against her will. To escape from the hated bridegroom she leaped from her window and disappeared into the ground, and from the spot where she sank the sugar palm sprang up. The wine from the tree is her tears, the black fibre her hair, and the leaves her ribs. When tapping the tree the natives often repeat: 'Princess, have pity on us and increase your tears.' The superstition that still clings around this ancient tree, and the reverential esteem in which it is held in Sumatra, are indicated by the fact that, when an altar is set up for the purpose of propitiating evil spirits by offerings, the leaf of the sugar-palm is the most conspicuous item in its construction."[1]

CULTIVATION IN EUROPE.—All the species of the genus *Arenga* require a strong heat. Young specimens, it appears, do not last long when kept free in the drawing-room. Much water, rich mould and good drainage are absolutely necessary.

ILLUSTRATION: PLATE LX.—The specimen of the Sugar Palm, figured on this plate, grows in the Botanic Gardens of Peradeniya. This palm has usually a much denser crown than appears from our illustration.

The photograph has been kindly supplied by Mr. Macmillan.

2. **Arenga wightii** Griff. in Calc. Journ. Nat. Hist. V, 475; Palm Brit. India 167, t. 235, E; Hook. Fl. Brit. Ind. VI, 422; Brandis Ind. Trees 648.

NAMES.—Wight's Sago Palm; Dhudasal (Kan.); Alam panei (Tam.).

DESCRIPTION.—Monoecious. Trunk short, 3-30 feet high, as thick as a man's thigh, soboliferous, forming dense clumps. Leaves 20-28 feet long; the lower naked part of the petiole is 6-8 feet long; leaflets alternate, crowded, linear-ensiform, 3-3½ feet long by 1½ inch-2 inches, white underneath, with 2 large auricles at the base, the lower of which (1½ inch-2 inches long) obliquely overlies the petiole; margins sparingly toothed from the middle upwards; apex narrowed, unequally bi-lobed, erose; the terminal lobe is narrow-cuneate, 2-3-lobed, base shortly 2-auricled, apex truncate, lobulose, jagged-dentate.

[1] Fealy, N. E., Sugar-Producing Palms (New York, 1923), p. 5.

Spadix decurved, pendulous, about 4 feet long; peduncle before branching about 2 feet long, quite concealed by the sheathing imbricate, lacerate spathes; male flowers strongly scented; branches of the spadix about 2 feet long, subfastigiate, slender, with a scaly bract at the base of each; flowers rather distant, rather large, in pairs, with a vertical scale interposed; buds acute; sepals 3, roundish, imbricate, with thick bases; petals 3, oblong, very thick and coriaceous; stamens numerous; filaments short: anthers linear, adnate, apiculate, pistillode 0. Female flowers: branches of spadix alternate towards the ends, where they bear rudimentary flowers; flowers solitary, each in a shallow, entire or bi-lobed cup; sepals small, broadly cordate; petals triangular, acute or cuspidate, valvate; staminodes several (Griffith does not find any shortly after fecundation); ovary roundish, 3-celled; styles 3, short, recurved.

Fruits spirally arranged and crowded on the lower halves of the branches of the spadix (the upper halves being naked), about the size of a crab-apple, globosely turbinate, broader than long, much depressed at the apex, crowned with the remains of the stigmas. Seeds 3, convex on one face, unequally angular on the other, separating easily except at the base, from the black papery endocarp, brown, smooth, marked copiously with slightly branched veins, converging at the apex of the seed. Albumen horny; embryo dorsal.

HABITAT.—Deccan and Western Peninsula: Dense forests on hills about Coimbatore, Nilghiri hills, alt. 3,000 feet; Ankola and Divimana Ghats of Northern Kanara; common on the Mushki Ghat at about 1,500 feet elevation; very common on the Ghats near the falls of Gairsoppa in evergreen forests. Travancore 500-3,000 feet.

FLOWERS.—From November to January.

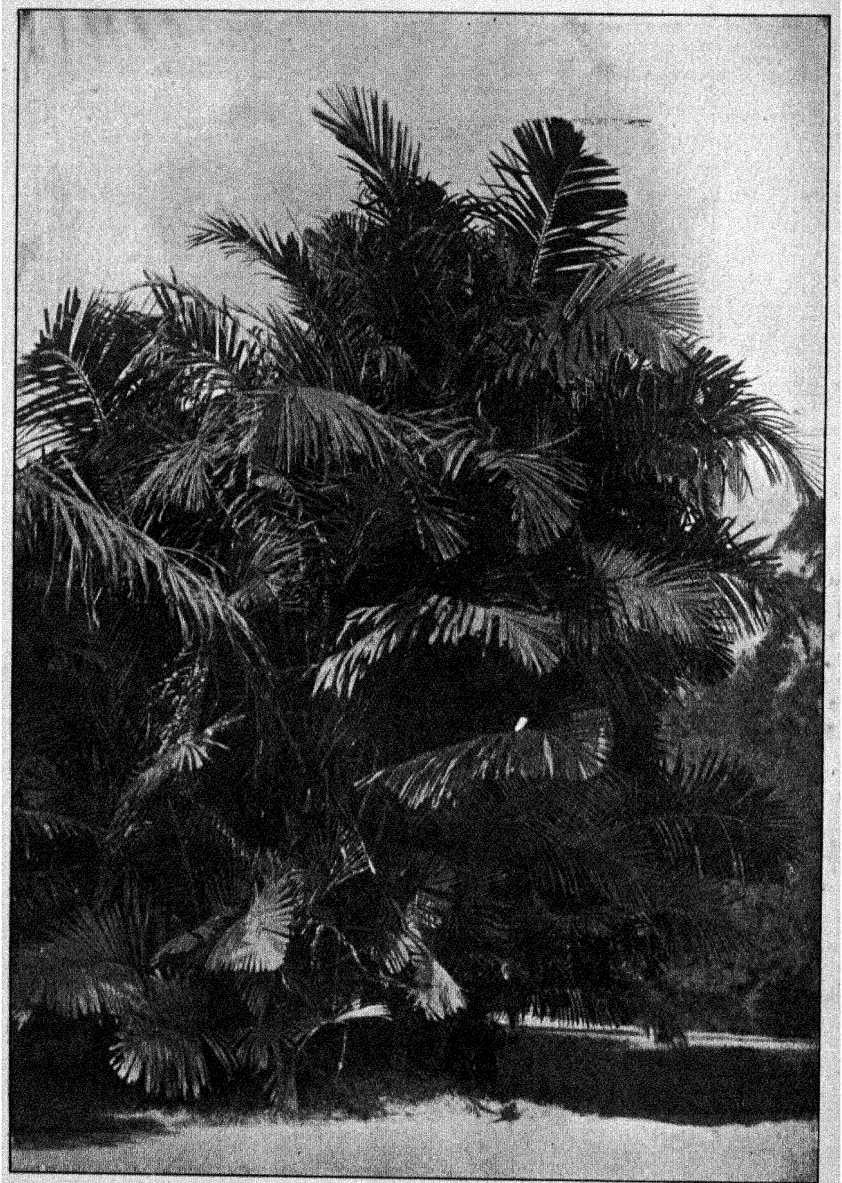
USES.—The cut flower stalks yield toddy.

ILLUSTRATION: PLATE LXI.—A clump of Wight's Sago Palm growing in the Botanic Gardens of Calcutta. This tree, if left alone, never grows an isolated stem, but has a strong tendency towards forming dense tufts.

The photograph was kindly presented by Col. Gage.



Wight's Sago Palm (*Arenga wightii* Griff.) in the Botanic Gardens of Calcutta.



Arenga obtusifolia Mart., in the Botanic Gardens of Calcutta.

** INTRODUCED SPECIES.

3. **Arenga obtusifolia** Mart. Hist. Nat. Palm. III, 191, t. 147, 148-161; Miq. Fl. Ind. Bat. III, 36; Hook. Fl. Brit. Ind. VI, 421. *A. Westerhoutii* Griff. in Calc. Journ. Nat. Hist. V, 474; Palms Brit. Ind. 166, t. 235 B, C, D; Mart. l. c. 192; Miq. l. c. 37—*Saguerus langkab* Blume Rumphia II, 131, t. 96, 125.—*Gomutus obtusifolius* Blume mss.

NAMES.—Langkab (Penang); Anooee kutaree (Malacca.).

DESCRIPTION.—Trunk tall, very stout. Leaves ample, linear-oblong in outline, 20 feet long, 10 feet across in the broadest part; leaflets sessile, about 5 feet in length, 3 inches broad, alternate or sub-opposite, solitary, bifarious, very spreading with deflexed points, alternate towards the base, the upper ones alone auriculate at the lower side, coriaceous, bright green above, white underneath, together with the petiole scurfy towards the base; margin with irregular spinescent teeth; apex praemorse, dentate and erose, sometimes bilobed.

Spadix curved-pendulous. Spathes fibrous, coriaceous, often split. Spikes about level-topped. Male flowers in pairs, without an interposed rudimentary female, or solitary with a rudimentary female; calyx cup-shaped, petals oblong, fuscous-purple. Stamens numerous; filaments short, subulate; anthers with mucronate or aristate ends. Pollen hispid, with a longitudinal fold. Female flowers solitary, sessile, sepals broad, petals 3; cordate, concave, obtusely carinate; ovary roundish, trigonal, depressed at the apex, and there marked with 3 lines running from the angles to the stigma, which are 3 in number, tooth-shaped, and connivent so as to form a cone.

Fruit roundish, about the size of a small apple, with a depressed 3-lobed, trigonal vertex, terminated by the sphacelated stigmas, surrounded at the base by the perianth, 2-3-celled; outer substance thick, fibrous-fleshy. Seed separating with the thick gelatinous cellular endocarp, of black colour; when 3, convex-bifacial; embryo oblique, in the centre of the dorsal face of the horny albumen.

HABITAT.—Malay Peninsula at Naning; Penang. Cultivated in India.

ILLUSTRATION: PLATE LXII.—Several specimens of *Arenga obtusifolia* from the Botanic Gardens of Calcutta. The photograph has been supplied by Col. Gage.

3. *DIDYMOSPERMA* WENDL. & DRUDE IN BENTH. & HOOK. GEN. PL. III, II, 917, 71.

(From the Greek "didymoi", twins, and "sperma", seed, alluding to the frequently 2-seeded fruit.)

Mart. Hist. Nat. Palm. 190, t. 157 *(Wallichia)*.—Miq. Fl. Ind. Bat. III, 32. *(Wallichia)*.—Griff. Palms Brit. Ind. 176, t. 238 A, B *(Harina)*.—Hook. f. Fl. Brit. India VI, 420.

Small, low palms. Leaves terminal, unequally pinnatisect; leaflets few, trapezoid, erose, unicostate; nerves flabellate.

Spathes many, sheathing the peduncle of the spadix. Spadix interfoliar, stout and simple, or slender and branched. Flowers rather large. Male flowers symmetric; calyx cupular, 3-fid, imbricate; petals coriaceous, valvate; stamens 10-30; anthers linear, erect; pistillode 0. Female flowers subglobose; sepals rounded, coriaceous; petals thick, triangular, incurved, valvate; staminodes 0; ovary depressed, 3-gonous, 2-3-celled; stigmas conical; ovules basilar.

Fruit ovoid or oblong, 1-2-celled and -seeded; stigmas terminal. Seeds erect, oblong, plano-convex; albumen equable; embryo dorsal.

Species 8.—Indian and Malayan.

CULTIVATION IN EUROPE.—The species of *Didymosperma* are very ornamental and graceful stove palms. They grow in a compost of loam, peat, and leaf soil, in equal parts, with a liberal addition of sand. When they are fully grown, loam should preponderate to the extent of about two-thirds, and some rotten cow-manure may be added. Propagation is effected by seeds. These should be sown in a compost similar to the one just mentioned, and placed in a moist, gentle heat.

Leaflets 1-3 pairs ... ... *D. nana.*
Leaflets 6-8 pairs ... ... *D. gracilis.*

1. **Didymosperma nana** H. Wendl. & Drude in Kerchov. Palm. 243; Hook. f. in Bot. Mag. t. 6836; Hook. Fl. Brit. Ind. VI, 420; Brandis Ind. Trees 655.—*Wallichia nana* Griff. in Calc. Journ. Nat. Hist. V, 488; Mart. Hist. Nat. Palm. 190, t. 315; Miq. Fl. Ind. Bat. III, 34.—*Harina nana* Griff. Palms Brit. Ind. 176, t. 238 A. B.

DESCRIPTION.—A small erect palm; stem 3-5 feet high, slender, throwing out roots from the base, covered with rusty leaf-sheaths. Leaves pinnatisect, 18 inches to 2 feet long; petiole

short, roundish, obliquely sheathing at the base, with a thin rete, above produced into a bipartite liguliform body; leaflets about 5; lateral ones 7-10 by 3-5 inches, opposite or alternate, obliquely trapeziformly lanceolate, acuminate, irregularly lobed, toothed and spinous serrate; the terminal one flabelliform, striately veined, above green, underneath glaucous white.

Spadices erect, very stout, simple or sparingly branched, rustily scurfy, dense-flowered. Spathes several, distichously imbricate, rusty-furfuraceous, conduplicate, entirely concealing the peduncle. Male flowers: calyx of 3 rounded sub-membranous sepals, imbricate, petals 3, coriaceous, valvate, with almost introflexed points, furrowed inside from the pressure of the stamens. Stamens about 14, inserted on a small prominent torus, rather shorter than the petals: filaments very short; anthers linear, erect; no pistillode. Female flowers white, crowded, calyx tripartite nearly to the base; segments rounded, coriaceous, greenish, spreading. Corolla of 3 broad, ovate, coriaceous petals; no staminodes. Ovary trigonous, 2-celled, of a thick, coriaceous substance; no style; stigma conical; ovules solitary, erect, basilar.

Fruit white, oblong, ½ inch long, base surrounded by the perianth, one-seeded, 2-celled, one cell being almost obliterated. Seed erect, oblong, plano-convex; albumen solid, radiating from a central line; embryo dorsal.

HABITAT.—Assam and the Khasia Hills, ascending to 4,000 feet.

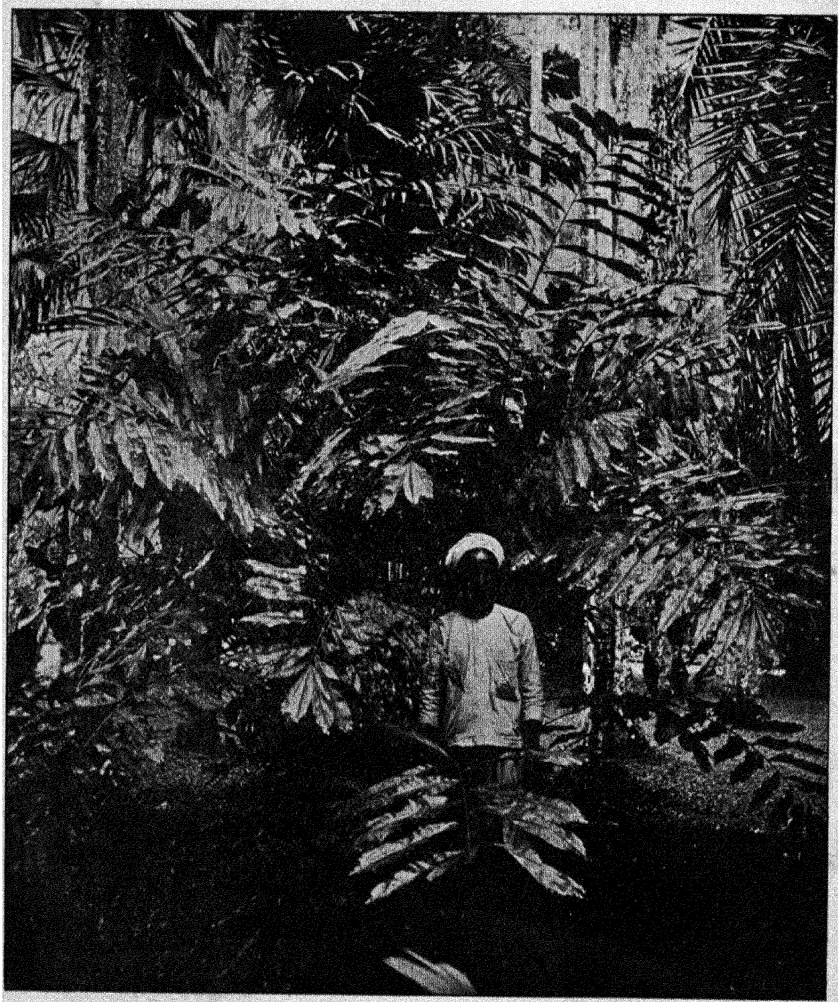
FLOWERS.—In July and August.

2. **Didymosperma gracilis** Hook. f. Fl. Brit. Ind. VI, 420; Brandis Ind. Trees 655.

DESCRIPTION.—Stem very slender, 2 feet high, about as thick as a duck's quill, leafy upwards. Leaves 8-18 inches long; petiole and rhachis very slender; leaflets 6-8, 1-3½ inches long and broad, white beneath; lateral leaflets broadly cuneate below the middle, above it triangular or 3-lobed or truncate and acutely toothed.

Spadix slender, erect, 3-branched. Fruiting spadix 8 inches long, sheathed below the middle with narrow, long, terete, glabrous, striate spathes, lateral branches 3 inches, terminal 4 inches long.

Fruit elongate, ¾ by ⅓ inch in diameter, ovoid, obtuse, base



Wallichia densiflora Mart., in the Botanic Garden of Peradeniya.

rounded. Seed elliptic-oblong, $\frac{3}{5}$ inch long, concavo-convex, equally narrowed at both obtuse ends; raphe very obscure; albumen equable.

HABITAT.—Assam, Daphla Hills.

This palm was discovered by Booth, Nuttall's Collector in Assam.

4. *WALLICHIA* ROXB. COROM. PL. III, t. 295.

(After Nathanael Wallich, Superintendent of the Bot. Gardens, Calcutta, 1786-1854).

Mart. Hist. Nat. Palm. iii, 189, (*excl. sp.* 3), 315, t. 36 (*Harina*).—Kunth Enum. Pl. III, 193, (*Harina*).—Griff. Palms Brit. Ind. 174, 175, 237, A. B. C.—Kurz For. Fl. II, 521 (*excl. sp.* 3).—T. Anders. Journ. Linn. Soc. XI.—Bot. Mag. t. 4584.—Benth. & Hook. Gen. Pl. III, II, 916, 70.—Hook. f. Fl. Brit. Ind. VI, 418.

Stemless or caulescent, rarely simple-stemmed, often soboliferous palms. Leaves pinnatisect; leaflets linear or oblong, irregularly toothed, base cuneate, unicostate, nerves flabellate.

Spathes many, tubular, clothing the peduncle, of the spadix, upper large cymbiform. Spadices interfoliar, monoecious or polygamous; males ovoid, excessively branched and dense-flowered; female looser-flowered. Male flowers symmetric, calyx cylindric or cupular, membranous, truncate; corolla cylindric, deeply 3-lobed, lobes oblong, valvate; stamens 6 on the corolla-tube; filaments short, anthers large; pistillode 0. Female flowers much smaller, sub-globose, sepals orbicular, coriaceous, imbricate, petals triangular, valvate, staminodes few or 0, ovary 2-3-celled, stipitate; stigmas conic, ovules sub-basilar.

Fruit ovoid-oblong, 1-3-celled and -seeded. Seeds erect, plano-convex, albumen equable; embryo dorsal, conical.

Species about 3.

DISTRIBUTION.—India and Malaya.

CULTIVATION IN EUROPE.—Dwarf tufted stove palms, which must be grown in strong, rich soil. They are propagated by seeds or by suckers. These must be gradually separated in order that they may make sufficient roots before they are quite detached.



Wallichia caryotoides Roxb., in the Botanic Gardens of Peradeniya



Wallichia caryotoides Roxb., in the Botanic Gardens of Peradeniya.

1. Male spikes almost filiform ... ... *W. caryotoides.*
2. Male spikes thick and rigid—
   (*a*) Leaves placed in a $\frac{1}{3}$ spiral ... *W. densiflora.*
   (*b*) Leaves strictly distichous ... *W. disticha.*

1. **Wallichia densiflora** Mart. Hist. Nat. Palm. III, 190; Kurz For. Fl. II, 532, Brandis For. Fl. 549.—*Wallichia oblongifolia* Griff. in Calc. Journ. Nat. Hist. V, 486.—*Harina oblongifolia* Griff. Palms. of Brit. Ind. 175, t. 237, A, B, C.—*Wallichia caryotoides* Wall. Cat. 8596 B.

NAMES.—Kala Aunsa, Gor Aunsa (Kumaon); Takoru (Nep.); Ooh (of the Lepchas in Sikkim); Zanoung (Burma).

DESCRIPTION.—An elegant palm, forming thick tufts, stems very short or 0; trunk sheathed, scurfy, sheaths villous, resolving into strong fibres. Leaves 8-10 feet long; leaflets 1-2 feet, very many, alternate or often sub-opposite, or the lower 2-4-nate, oblong or linear-oblong, sinuately lobed, acutely toothed, with a brown midrib and many parallel nerves, bright green above, white beneath; the terminal pinnules are broadly cuneate, 3-lobed, the central lobe being itself 2-lobed and eroso-dentate; sheaths scurfy.

Male spadices axillary, curved, often pendulous; the ends of the lowermost touching the ground, about $1\frac{1}{2}$ foot long. Spathes densely imbricated, the innermost almost membranous, striate, tinged with dark purple, equalling the flower-bearing part of the spadix. Spikes slender, very numerous, level-topped, pendulous, their points projecting beyond the opening of the spathes. Flowers very numerous, yellow, solitary, or the lower in pairs, with a rudimentary female between. Calyx cylindric, nearly entire, corolla as long as the calyx, tripartite nearly to the base; segments reflexed. Stamens 6; filaments adnate to the petals; no pistillode. Spathes of female spadix brown, conduplicate, the outer one sometimes very long and acuminate. Branches very stout, green, variously ascending, tapering at the ends, where they are caudiform and notched, the notches bearing rudimentary flowers. Bracts 2, right and left. Flowers purplish, crowded, occupying the lower part of a flattish areola, bases somewhat immersed. Calyx very short, divided to the middle into 3 broad, rounded teeth. Corolla shorter than the ovary, trifid, segments broadly half-ovate, obtuse, depressed. Stigma an indistinctly emarginate point.

Fruit oblong, about ½ inch long, dull purple, surrounded at the base by the perianth, on the apex presenting a brown spot, the remains of the stigma. Epicarp tough, rather thin; flesh scanty with a mucilaginous acrid juice. Seeds plano-convex. Albumen horny and solid; embryo dorsal.

HABITAT.—Tropical Himalaya from Kumaon eastward up to 4,000 feet; Assam, Khasia Hills; Chittagong.

(Assam, Sikkim, up the Teesta Valley to Chakung, at 4,400 feet, growing side by side with the birch, willow, alder and walnut. Kumaon, in shady and moist valleys, ascending to 3,500 feet, and at times to 4,000 feet, forming extensive thickets in the valleys of the Kali and Sarju; Bamauri Pass, below Naini Tal, and in the Patli Dun, which seems to be its north-west limit—Brandis.)

FLOWERS.—May, June and July.

USES.—In Kumaon the leaves are used as thatch and are said to be imperishable. In Darjeeling the leaves are used as fodder for ponies.

ILLUSTRATION:—Plate LXIII. The photograph, taken by Mr. Macmillan, shows a tuft of *Wallichia densiflora* growing in the Botanic Garden of Peradeniya.

2. **Wallichia caryotoides** Roxb. Cor. Pl. III, t. 295; Mart. Hist. Nat. Palm. III, 180, t. 136; Wall. Cat. 8596 A; Griff. in Calc. Journ. Nat. Hist. V, 485; Kurz For. Fl. II, 532; Miq. Fl. Ind. Bat. III, 34; Hook. Fl. Brit. Ind. VI, 419.—*Wallichia densiflora* Brandis, *non* Mart. *ex* Dammer Palmenz. (1897) 81.—*Harina caryotoides* Ham. in Mem. Wern. Soc. V, 317; Griff. Palms Brit. Ind. 174, t. 237.—*Wrightia caryotoides* Roxb. Hort. Beng. 68; Fl. Ind. III, 621.—*Harina wallichia* Steud. *ex* Salomon, Palmen (1887) 127.

NAMES.—Chilputta, Belputta (Chittagong); Saingpa (Burm.)

DESCRIPTION.—An elegant tufted palm, stemless or short-stemmed. Leaves ascending curved, 8-9 feet long, oblong in outline. Petiole naked and roundish throughout the lower four feet. Leaflets oblong or linear-oblong, panduriformly excised and acutely toothed, white beneath.

Male corolla half as long as the calyx; mouth of calyx 3-toothed. Female spadix terminal, shorter than the leaves, erect or almost nodding. Spathes closely imbricated, concealing the peduncle. Spikes spreading, stout, marked under each flower with a distinct areola, with attenuate points, bearing neuter

flowers with 6 barren stamens and no pistil. Next to these there are some nearly, if not quite, hermaphrodite flowers, with usually 3 full-sized stamens and apparently a well-developed pistil. The other flowers are female, with 3 bracts. Sepals 3, short and rounded. Petals 3, ovately cordate, erect, acute, almost spinously pointed, about twice as long as the ovary, greenish. No staminodes. Ovary with a conical stigma.

Fruit as large as a nutmeg, ovoid-oblong, rarely 2-seeded.

HABITAT.—Chittagong; Upper Burma, hills west of Katha, 2-3,000 feet, in evergreen forests; Martaban and Tenasserim.

ILLUSTRATION: PLATE LXIV.—The specimen, photographed by Mr. Macmillan, grows in the Botanic Garden of Peradeniya. It forms dense tufts. A comparison of the leaflets of this palm with those of the aforementioned species will at once show the difference between the two palms. A few fruiting spikes have been exposed in front.

3. **Wallichia disticha** T. Anders. in Journ. Linn. Soc. XI, 6; Hook Fl. Brit. Ind. VI, 419.—*W. yomae* Kurz For. Fl. II. 533.—*Caryota mitis* Herb. Calc. —*Didymosperma distichum* Hook f.

NAMES.—Minbaw (Upper Burma); Zanaung, Letme (Lower Burma); Katong (Lepcha).

DESCRIPTION.—An evergreen simple-stemmed palm; trunk 10-20 feet high, 6-12 inches in diameter, naked, annulate. Leaves 8-10 feet long, distichous, erect; leaflets narrowing from near the truncate apex to the base and with a large tooth on each side about the middle, 1-2 feet long, 2-2½ inches broad, glaucous beneath; petiole and sheath short, scurfy.

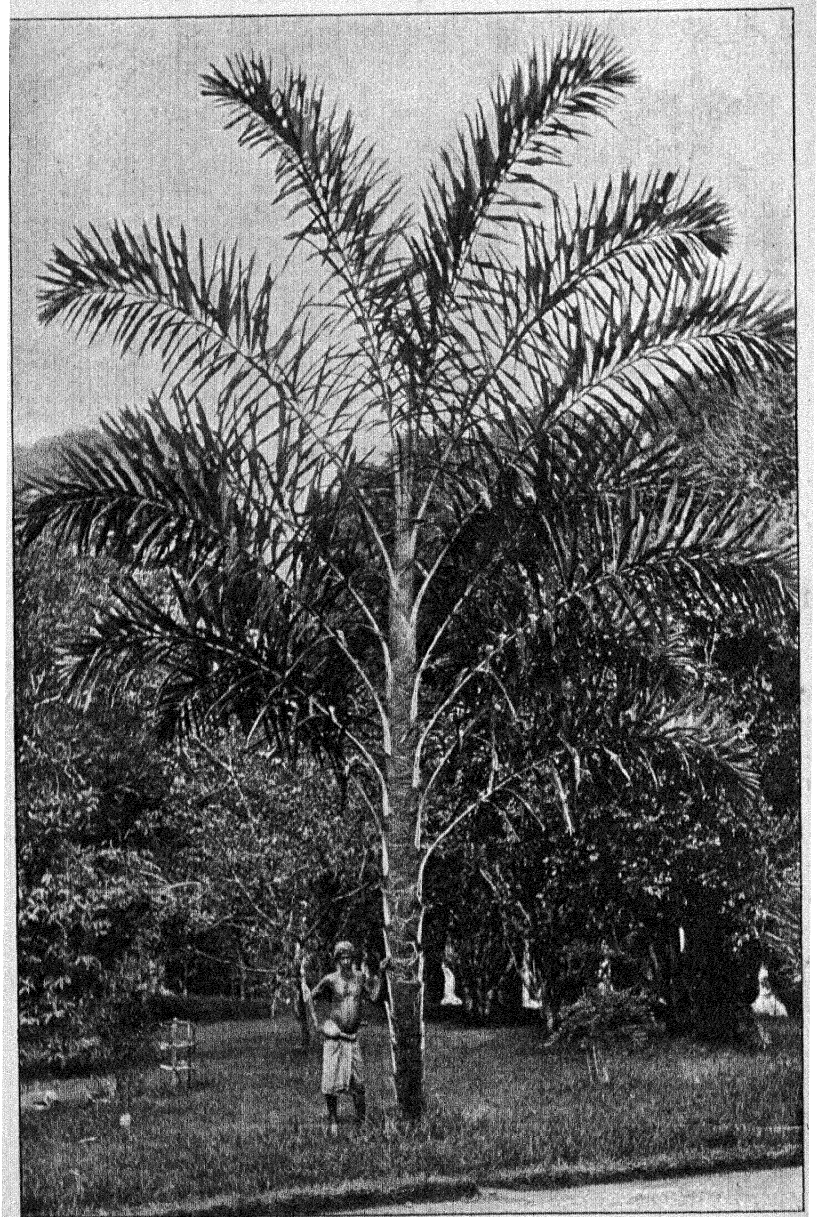
Male spadix 3-4 feet long, very narrow, linear in outline, with innumerable, recurved, slender, crowded branches. Male calyx cupular, 3-lobed, corolla thrice as long. Female spadix 6-8 feet long, pendulous; branches stout, simple. Female flowers disposed in many spiral series, green; corolla longer than the ovary.

Fruit oblong, top obscurely 2-3 lobed, reddish.

FLOWERS.—April.

HABITAT.—Gonda Hills, Oudh; valleys of Sikkim Himalaya to 2,000 feet; Makum forest, Assam; Upper Burma, ascending to 4,000 feet in the hills east of Bhamo; Pegu Yoma, chiefly on the eastern slopes.

USES.—The Lepchas fell the tree to eat the pith of the stem



Wallichia disticha T. Anders., in the Botanic Gardens of Peradeniya.

near its summit. Anderson remarks that the berries and perhaps the leaves irritate the skin (Gamble).

ILLUSTRATION: PLATE LXV.—The photograph, presented by Mr. Macmillan, shows a well-developed specimen of *Wallichia disticha*. The fact that the leaves arise on two diametrically opposite sides of the stem and thus form two rows is a distinguishing character of this species. *Wallichia disticha* is, besides, the only species of its genus which grows a stem of some size.

B. SUB-TRIBE: GEONOMEÆ.

Spadix between or rarely below the leaves, simple or branched. Flowers ternate, sunk in cavities of the stout spadix or its fleshy branches. Calyx of 3 narrow, free leaves, imbricate. Corolla valvate, ovary 3-locular with 3 seeds, or by the abortion of 2 carpels unsymmetrical with 1 cell and 1 seed. Fruit by the abortion of 2 carpels consisting usually of 1 carpel (rarely 3-carpellary with 3 seeds). Embryo basilar (except *Sclerosperma*) in the uniform albumen.

DISTRIBUTION.—Tropical America, tropical West-Africa, India.

Podococcus Wendl. & Mann, *Sclerosperma* Wendl. & Mann, *Bentinckia* Berr., *Manicaria* Gærtn., *Leopoldinia* Mart., *Calyptronoma* Griseb., *Geonoma* Willd., *Asterogyne* Wendl., *Calyptrogyne* Wendl., *Welfia* Wendl. & Hook.

In India only one genus:

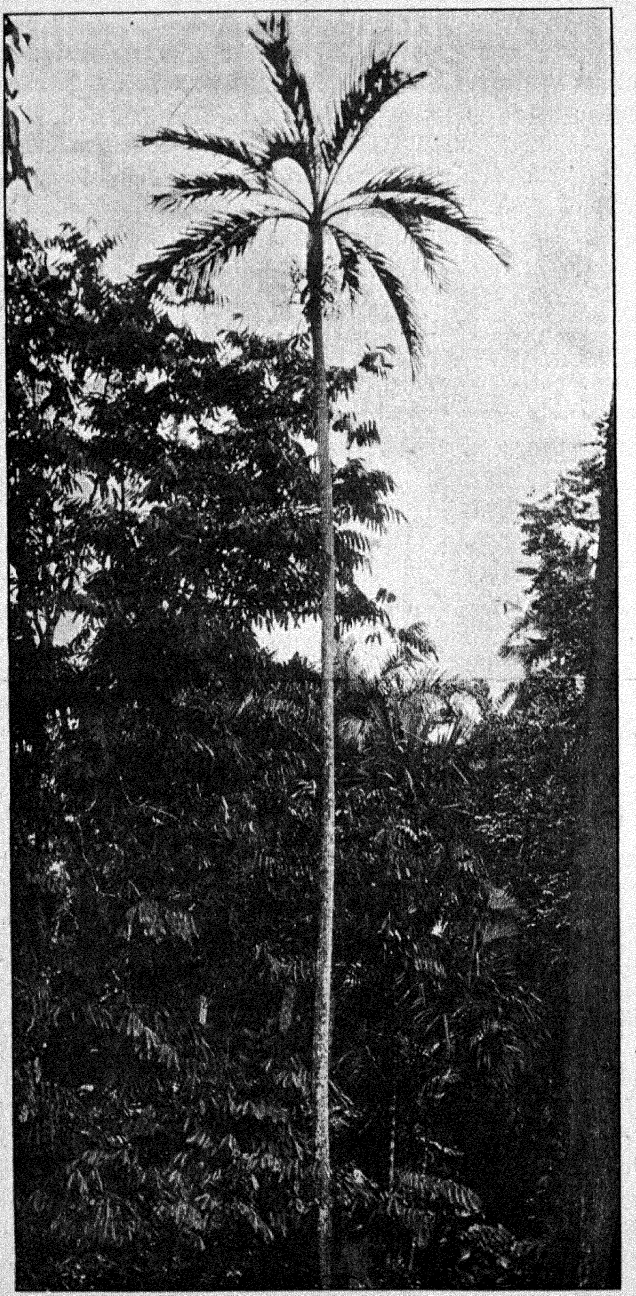
BENTINCKIA BERRY IN ROXB. FL. IND. III, 621.

(After William Henry Cavendish-Bentinck, Governor-General of the East-Indies, 1774-1839.)

Mart. Hist. Nat. Palm. III, 165, 228, t. 189.—Kunth Enum. Pl. III, 227.—Griff. Palms Brit. Ind. 160, Append. XXVI.—Benth. & Hook. Gen. Pl. III, II, 916, 69.—Hook. f. Fl. Brit. Ind. VI, 418.

Unarmed palms. Leaves terminal, equally pinnatisect.

Spathes many, 2 lower short, incomplete, upper 2-fid. Spadix interfoliar, branched; flowers minute, monœcious or polygamous, solitary or ternate with the intermediate female, clustered in spirally arranged pits on the branches; bracts forming a 2-lipped mouth to each pit; bracteoles 2. Male flowers subsymmetric, glumaceous, often reduced to ciliate scales; sepals oblong, obtuse, connate below, imbricate; petals longer, connate below into a stipes, valvate; stamens 6; anthers versatile;



Bentinckia coddapanna Berry, in the Botanic Gardens of Peradeniya.

pistillode conical. Female flowers ovoid; sepals broad, obtuse, imbricate; petals longer, convolute; staminodes 6, minute; ovary 3-celled, 1-ovuled; stigmas minute.

Fruit small, sub-spherical; stigmas sub-basilar. Seed pendulous from the top of the cavity, sinuately grooved or ridged; albumen equable.

Species 2.—Travancore; Nicobar Islands.

Leaves 3-4 feet long... ... ... *B. coddapanna.*
Leaves 5-8 feet long... ... ... *B. nicobarica.*

1. **Bentinckia coddapanna** Berry in Roxb. Fl. Ind. III, 621; Mart. Hist. Nat. Palm. III, 165, 228, t. 139; Kunth Enum. III, 228; Griff. in Calc. Journ. Nat. Hist. V, 467; Palms Brit. Ind. 160, Append. XXVI; Wight in Madr. Journ. Nat. Sc. II, 385; Hook. Fl. Brit. Ind. VI, 418; Brandis Ind. Trees 647.—*Keppleria* Mart. Mss. *ex* Endl. Gen. Pl. 25.

NAMES.—Lord Bentinck's Palm. Varu Kamavu (Mal.); Caddapanna (Teling.).

DESCRIPTION.—Trunk slender, reed-like, about 20-30 feet high and 6 inches in diameter, annulate. Leaves 3-5 feet; leaflets 30-40 pair, 2 feet or more long, and 1½ inch broad, linear, much acuminate, rigid, closely inserted, generally split at the point into two exceedingly narrow triangular portions, two to four inches long, the fissure often bearing a thread; above 2-keeled, keels paleaceous.

Spathes membranous, lower truncate, upper complete. Spadices 1-2 feet long. Common peduncle 2-3 inches long of violet colour towards the base, branches few, each with a membranous broad semi-amplexicaul bract, three or four times divided; of the female simple, generally only with two divisions. Colour of the male spadices scarlet, of the female pale lilac or violet. Spikes 6-10 inches in length, subfastigiate. Male flowers arranged in rather loose spires, immersed in pits, which are at first nearly closed, afterwards opening vertically. In each pit there are 2, 3 or even 4 flowers, with occasionally a female in those towards the base of the spikes, the upper ones opening first. An ovate-triangular bract arises from under the lowermost flower, and a small bracteole bearded on the upper margin is situated on the outer side of the upper ones. Calyx about 1 inch long; sepals glumaceous, oblong, concave, rather obtuse, connate below, imbricate; petals nearly twice as long as the calyx, purplish, ovate, rather acute, valvate. Stamens 6, included;

filaments subulate; anthers ovate, subcordate, versatile; pistillode conical, nearly as long as the stamens. Female flowers ovoid, sepals broad, obtuse, imbricate; petals longer, convolute; staminodes 6, minute; ovary ovate, three-celled, one-ovuled; style almost wanting; stigmas 3, triangular. Fruit bright chocolate coloured, when ripe ovate-globose, rather compressed, ½-⅔ inch in diameter, surrounded at the base by the perianth bearing the stigmata near the base. Seed subglobose, brown, with a rather deep complete furrow, and several other shorter ones. Testa obscurely chestnut-coloured, with veins arising from the groove near the embryo, and converging towards the base on the opposite face. Albumen solid, horny. Embryo basilar, conical, nearly one line long.

HABITAT.—Travancore, 2,500-6,000 feet on precipitous cliffs, local, but very common within its restricted areas.

FLOWERS.—In June; fruit ripens 8-9 months afterwards.

ILLUSTRATION: PLATE LXVI.—The slender, thin-stemmed palm, photographed by Mr. Macmillan, grows in the Botanic Gardens of Peradeniya. In the lower part of the stem the rings are not visible owing to a thick crust of lichens.

2. **Bentinckia nicobarica** Becc. Illustraz. di alc. Palme viv. nel Giard. di Buitenz. 165; Hook. Fl. Brit. Ind. VI, 418; Brandis Ind. Trees 647.—*Orania nicobarica* Kurz in Journ. Bot. IV, p. 331, t. 171, f. 19-25.

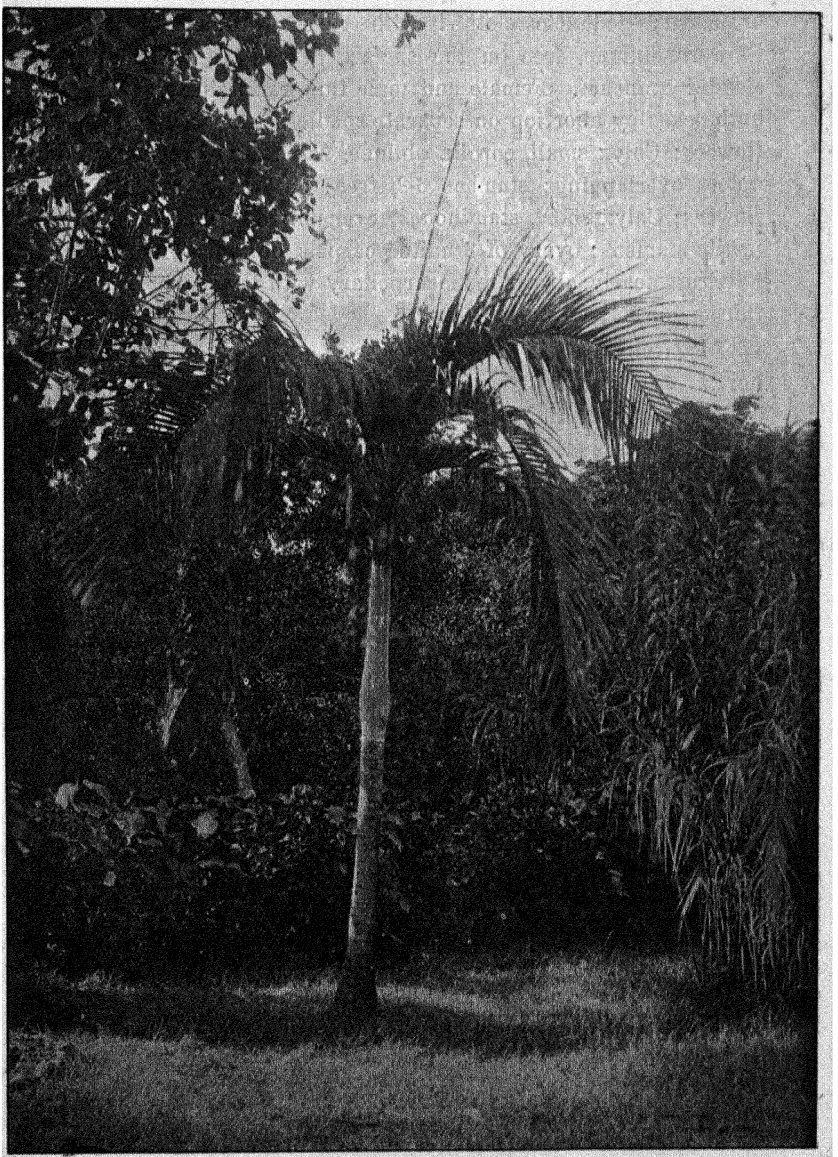
DESCRIPTION.—Trunk tall, 60-70 feet high, 9 inches in diameter, annulate. Leaves 5-8 feet; leaflets ½-2 feet, sessile, linear, coriaceous, tip obtusely 2-lobed; petiole short; rhachis glabrous.

Spadix 1½-2 feet long, decompound, glabrous, branches and branchlets inserted in woolly grooves of the rhachis; bracteoles densely villous within. Female flowers: sepals and petals subsimilar, broadly ovate, obtuse, shining.

Fruits tristichously arranged, globose, 1 inch long, scarlet. Seed ovoid-oblong, ventrally flat, dorsally convex, rugosely ribbed; albumen equable; embryo lateral and apical.

HABITAT.—Nicobar Islands, Kamorta. Common, associated with *Areca catechu, Pinanga manii,* and *Ptychoraphis augusta.*

ILLUSTRATION: PLATE LXVII.—The photograph, taken by Rev. M. Maier, S. J., shows a young plant of *Bentinckia nicobarica* growing at the Lower Gate entrance to Government House Gardens, Malabar Point, Bombay. It was planted by Mr. Millard in 1903.



Bentinckia nicobarica Becc.

C. Sub-tribe: IRIARTEÆ.

Spadix below or rarely between the leaves, simple or branched; peduncle clothed with several tubular spathes. Flowers oblique, free on the surface of the stout rhachis or slender branches. Female and male flowers in clusters of 3, or both sexes by abortion on separate spadices (monoecious). Male flowers: Calyx small, corolla oblique, valvate, or only with the apices overlapping; stamens 6-8, free; anthers erect. Female flowers; Calyx short, staminodes never united, often resembling fertile stamens; ovary of 3 united carpels, oblique, 3-locular.

Fruit nearly always monocarpellary with 1 seed; berry with thin endocarp; raphe branched.

Distribution.—Tropical America, from Costa Rica in the north to Juan Fernandez in the south.

Iriartea R. & Pav., *Catoblastus* Wendl., *Wettinia* Poepp. & Endl., *Ceroxylon* H. B. Kth., *Juania* Dr.

No representatives in India.

D. Sub-tribe: MORENIEÆ.

Spadix below or between the leaves; spathes tubular. Flowers free on the surface or slightly sunk in cavities, symmetrical, unisexual on the spadix or male and female together. Calyx short, 3-lobed or of 3 leaves; petals free or united, valvate (except some species of *Chamædorea* and *Synechanthus* which have an imbricate corolla in the female flowers). In the female flower the ovary completely or incompletely 3-locular.

Fruit a berry of 1-3 separately developing carpels. Leaves regularly paripinnate (rarely pinnately dentate).

Distribution.—All the genera (except *Hyophorbe* and *Chrysalidocarpus*) are American, especially tropical South Mexican.

Chamædorea Willd., *Morenia* R. & P., *Kunthia* Humb. & Bonpl., *Chrysalidocarpus* H. Wendl., *Hyophorbe* Gaertn., *Gaussia* Wendl., *Pseudophœnix* Wendl. & Dr., *Synechanthus* Wendl., *Reinhardtia* Liebm.

Key to the genera described below.

Flowers dioecious	stem cane-like ...	*Chamædorea.*
	stem not cane-like	*Chrysalidocarpus.*
Flowers monoecious		*Hyophorbe.*

1. *CHAMAEDOREA* WILLD. SPEC. PL. IV, 638.

(From the Greek "chamai", on the ground, and "dorea", a gift; alluding to the fruits of the palm being easily reached.)

R. & Pav. Prodr. Fl. Peruv. & Chil. 144, t. 31 (*Nunnezharia*).—Otto Gartenz. 1834, 145, 153, t. 6.—Mart. Hist. Nat. Palm. II, 3, t. 3; III, 157, 307, t. 126-138.—Kunth. Enum. Pl. III, 170.—Wendl. Bot. Zeitg. (1859) 29, 102.—Drude Fl. Brasil. III, II, 527, t. 125.—Rgl. Grtfl. (1880) 101.—Benth. & Hook. Gen. Pl. III, II, 910, 59.

Stem unarmed, slender, cane-like, annulate, rarely climbing, often soboliferous and forming small tufts. Leaves terminal, mostly pinnate with broad-lanceolate pinnæ, in some species only a bifid apex.

Spadix, when in flower, mostly below the crown of leaves, long peduncled, with from 3-7 tubular spathes; male spadix with mostly yellow flowers; female spadix with smaller, greenish flowers. Flowers dioecious, scattered or dense on the simple or oftener on the simple-branched spadix. Male flowers with short, cupular, trilobed calyx; corolla of 3 petals, valvate; stamens 6; pistillode columnar. Female flowers: Calyx tripartite, cupular; corolla tripetalous, tripartite or tridentate, valvate; no staminodes; ovary trilocular, 3-ovuled; style short, stout or elongate.

Berry 1 (-3) consisting of 1 (-3) carpels with the remains of the style at the base, the size of a pea, often brightly coloured. Seed round or elliptic; albumen equable.

Species about 60.—Tropical America.

CULTIVATION IN EUROPE.—The species of *Chamaedorea* are stove palms. In their natural habitats they are invariably growing under the shade of tall forest trees, and never in exposed situations. In the stove, therefore, shade and moisture are essential. They thrive best in a compost of two parts spongy peat, one part loam, and one of sand, the whole well mixed together.

Dammer observes that most species do well in the drawing-room and that some stand a pretty low temperature in winter e. g. *C. concolor* and *C. desmoncoides*. Others are more delicate (e. g. *C. geonomiformis*).

Hybrids are easily produced.

1. **Chamaedorea arembergiana** H. Wendl. Ind. Palm. 66; Kerch. de Denterg. Les Palmiers 75, f. 33.—*C. latifrons* and *latifolia* Hort.—

Spathascaphe aarenbergiana Oerst. Palm. Centramer. in Vidensk. Meddel. Nat. For. Kjöbenhav. (1858) 30, and L' Amérique Centrale t. 7, f. 29-37.

NAMES.—English: Aremberg's Mountain Palm, Merman's Shaving-brush.

German: Aremberg's Bergpalme.

French: Chamaedore, Chamaedorée.

DESCRIPTION.—Stem about 6 feet high, green, ringed at intervals of 2 inches. Leaves 5-6, erecto-patent, pinnate, 6-7 feet long; petiole slender, with a long cylindric sheath; leaflets about 10-15 pair, drooping, 1-1½ foot long, alternate, oblong-lanceolate from a broad, sessile base, gradually narrowed to a very fine point, plicate with about 30 ribs, bright green above, rather pale beneath; petiole nearly terete.

Inflorescence from below the leaves. Spathes many, sheathing, cylindric, 6-10 inches long, forming a tube 1 foot long, which completely covers the peduncle of the spadix, lightly rolled together with sub-acute erect tips, the uppermost far exceeding the spadix, green, or the lower brown. Male spadix sub-umbellately branched within the spathes, the branches effuse, pendulous, 1 foot long and as thick as the little finger, cylindric, pale, straw-coloured, dense-flowered, terminated by the naked subulate tip. Flowers about ⅛ inch in diameter. Calyx very short, 3-toothed. Corolla-lobes rounded, concave, fleshy; stamens 6, filaments very thick, anther-cells divaricate; pistillode columnar, tip 3-lobed. Female spadix simple, erect, six inches long, rather stouter than the branches of the male spadix. Petals transversely oblong, concave; staminodes none; ovary subglobose, 3-lobed, stigmas 3, minute, sessile, trigonous.

HABITAT.—Guatemala.

Cultivated in Indian gardens.

2. *CHRYSALIDOCARPUS* H. WENDL. BOT. ZEITG. (1878) 117.

(Wendland has chosen this name because the fruit, deprived of its epicarp, has the appearance of a chrysalis. The name, therefore, does not mean "golden fruit" as suggested in L. H. Bailey's Cyclopædia of American Horticulture, Vol. 1, 301.)

Benth. & Hook. Gen. Plant. III, II, 882.—Becc. Palme del Madag. p. 3.—Mart. Hist. Nat. Palm. III, 164, t. 143 (*Hyophorbe*).—Drude Palmae, in Nat. Pflanzenf. p. 64.

Stem unarmed, cylindric, soboliferous, annulate. Leaves terminal, pinnate; segments very numerous, straight, or slightly falcate, bifid at the apex. Spadix ramose. Flowers dioecious. Male flowers: Fertile stamens 6, subequal, filaments subulate, anthers versatile; rudimentary ovary conical or columnar, more or less trifid or trilobed at the apex. Female flowers: Ovary globose-ovate or oblong; stigmas stout, triangular, patent at the time of fertilization.

Fruit baccate, ovoid-elliptical; stigmas sub-basilar; epicarp very thin; fibres of mesocarp applanate. Seed oblong-obconical acute at the base; albumen equable; embryo at or below the middle of the back.

Species about 7.

DISTRIBUTION.—Madagascar (elsewhere?).

Two species are cultivated in India:

Segments of leaves 40-60 pairs ... ... *C. lutescens.*

Segments of leaves much more numerous *C. madagascariensis.*

1. **Chrysalidocarpus lutescens** H. Wendl. Bot. Zeitg. (1878) 117; Benth. & Hook. Gen. Plant. III, II, 882.—*Areca madagascariensis* Mart. ex Becc. Palme del Madag. p. 2.—*Areca madagascariensis* Lodd. *ex* Dammer Palmenz. p. 91—*Areca lutescens* Bory *ex* Salomon Palmen, p. 110,—*Areca indica* Hort.—*Areca burbonica* Hort.—*Areca Dicksonii* Hort.—*Areca flavescens* Hort.—*Hyophorbe indica* Hort. *ex* Drude l. c. p. 64.—*Hyophorbe lutescens* Hort. *ex* Drude l. c. p. 64.—*Hyophorbe Commersoniana* Mart. Hist. Nat. Palm. III, 164, t. 143, I, (*non H. Commersonii* Mart. in Herb. Paris.).— *Sublimia vilicaulis* Commers. *ex* Salomon Palmen, p. 110.

NAMES.—Yellow Areca Palm (English).

Arec jaunâtre, Arec poison, Palmiste Marron, Palmiste poison (French).

Gelbliche Puppen-Areka (German).

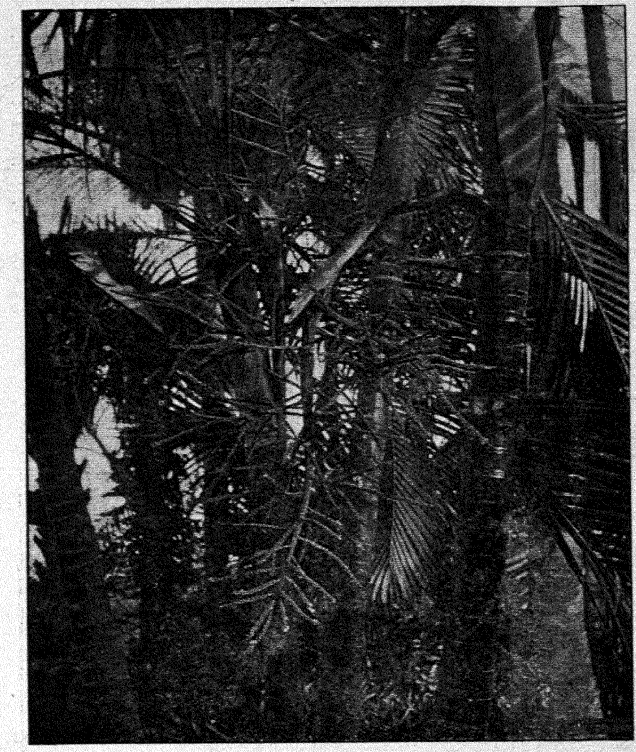
DESCRIPTION.—Stem about 25 feet high, cylindric, about 3 inches in diameter, soboliferous, annulate, rings more or less 4 inches distant from each other. Leaves 6-8, terminal, spreading, more or less 8 feet long, regularly pinnatisect, vagina about 1½ foot long, cylindric; petiole about 2 feet long, narrowly and deeply canaliculate above, margins acute; rhachis about 5 feet long; segments dark green, 40-50 pairs, at base and apex of leaf approximate, the middle ones 2 inches distant from each other, narrowly lanceolate, contracted at the base, long acuminate at the apex and unequally bifid.

PLATE LXVIII A.



Chrysalidocarpus lutescens H. Wendl.

PLATE LXVIII B.



Flowering Spadix of *Chrysalidocarpus lutescens* H. Wendl.

Flowers dioecious, white.

Fruit consisting of one carpel, baccate, black-violaceous, resupinate, ellipsoideo-turbinate. Mesocarp consisting of applanate fibres, adherent to the membranous endocarp. Seed oblong-obconical, acute at the base, branches of raphe about 18, radially ascending and slightly anastomosing on the dorsal side. Albumen equable. Embryo below the middle height of the albumen.

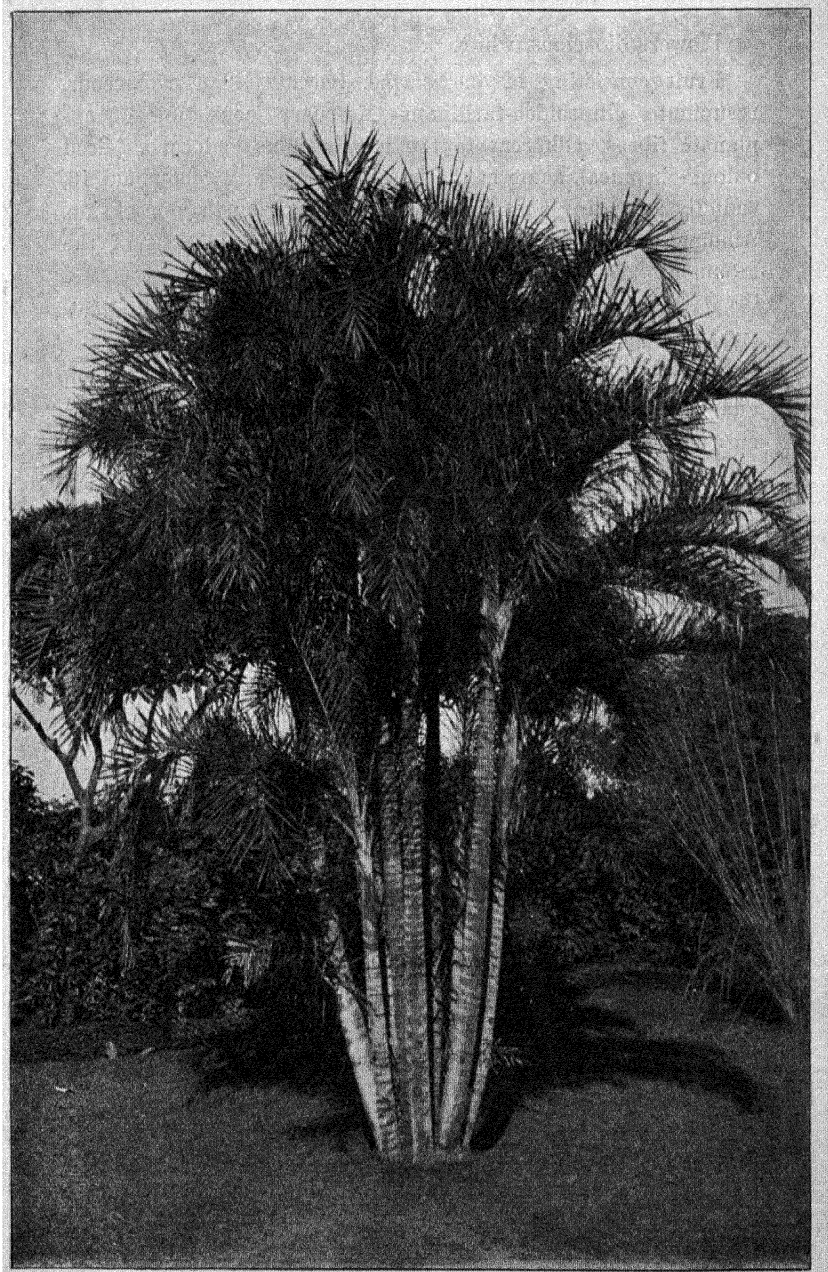
HABITAT.—Madagascar (Salomon, Palacky [1]), Bourbon (Bailey's Cyclop. Americ. Horticult.).

CULTIVATION IN EUROPE.—"In growing *Chrysalidocarpus* in quantity, it will be found a good plan to sow the seeds either on a bench, in boxes or seed pans, so prepared that the seedlings will remain in the soil in which they germinate until they have made two or more leaves. The first leaf made above the soil is small, and if plants are potted off at this stage they must be very carefully watered in order not to sour the soil. In the preparation of the receptacles for the seed, a little gravel in the bottom will be found good, as the roots work very freely through it, and when the time comes to separate the plants previous to potting, it is an easy matter to disentangle the roots without bruising them. Probably the plan which works best is to wash the soil and gravel entirely from among the roots. Pot in soil not too dry, and for the next few days keep the house extra warm and humid, and the plants shaded from the sun without any moisture applied to the soil for the first few days." (Cyclop. Amer. Hort.)

ILLUSTRATIONS.—Plate LXVIII A. shows a characteristic tuft of *Chrysalidocarpus lutescens,* growing in Victoria Gardens, Bombay. There is a marked difference between this species and *Chrysalidocarpus madagascariensis,* represented on the next plate. The beautiful curves of the leaves and the smaller number of leaflets distinguish the former at once.

Plate LXVIII B. shows a spadix of *Chrysalidocarpus lutescens* in flower. The peduncle of the inflorescence is covered by its sheaths, and only a few flowers are open near the tips of the branchlets.

[1] Palacky, J. Catalogus plantarum Madagascariensium. Prague, 1907.



Chrysalidocarpus madagascariensis Becc. (*Dypsis madagascariensis* of Indian Gardens.)

I have to thank the Rev. Fr. Max Maier, S. J., for the two photographs.

2. **Chrysalidocarpus madagascariensis** Becc. Engl. Bot. Jahrb. Vol. 38 (1907) Beibl. No. 87, p. 35.—*Dypsis madagascariensis* Hort. *Areca madagascariensis* Hort.

DESCRIPTION.—Stem about 3 inches in diameter. Leaves interruptedly pinnate, rhachis about 8 feet long; petiole more or less $1\frac{1}{6}$ foot long, canaliculate above; segments very numerous, about 90 pairs, linear, the larger ones $1\frac{1}{3}$-$1\frac{2}{3}$ foot long, $\frac{3}{5}$ inch broad, long-acuminate, slightly bifid at the apex.

Spadix ample, 3-plicate-ramose, first scarcely furfuraceous, then quite glabrous; panicle ample, diffuse, branches patent, the floriferous branchlets filiform, about $1\frac{1}{2}$ inch in diameter and 8-10 inches long. The glomerulate flowers in 5-seriate pits which are narrow, spirally arranged, supported by a very short subdimidiato-cupular bract; bracteoles very narrowly semilunar. Male flowers globose, $1\frac{1}{2}$ inch in diameter; sepals orbicular; petals twice as long as the sepals; anthers oblong; rotundate at the apex and scarcely apiculate, with parallel loculi; pistillode trigonous-pyramidal, acute. Female flowers ovate; sepals orbicular, petals twice as long as the sepals, very broad, shortly apiculate; ovary gibbous-ovate, with triangular stigmas; staminodes 6.

Fruit ovoid-elliptic, at both ends slightly attenuate, straight (not sigmoidal), about $\frac{1}{2}$ inch long, $\frac{1}{4}$-$\frac{7}{4}$ inch broad; remains of stigmas basilar; fibres of mesocarp applanate, uniseriate, spirally sinuose and anastomosing. Seed obovate, acute at the base; embryo about the middle of the back.

HABITAT.—There is scarcely a doubt that the palm comes originally from Madagascar (Beccari).

In Indian gardens the palm is generally known under the names of *Dypsis* or *Areca madagascariensis*.

ILLUSTRATION.—On plate LXIX we reproduce a photograph of *Chrysalidocarpus madagascariensis* taken by Mr. Phipson. The crown of leaves is much denser than in the foregoing species, owing to the greater number of leaves and leaflets. In addition to this, the appearance of this palm is changed considerably by the fact that the tips of the leaflets are hanging over.

3. *HYOPHORBE* GÆRTN. FRUCT. II, 186, t. 120.

(From the Greek "Hys", swine, and "phorbe", food.)

Wendl. Illustr. Hort. 13, t. 462, 463.—Bak. Fl. Maurit. 382.—Benth. and Hook. Gen. Pl. III, II, 912, 62.

Stem of considerable height, often very thick; petiole subterete on the back, grooved or flat on the face with a large, complete, basal sheath; leaves pinnate with slightly reduplicate subopposite pinnæ.

Monoecious. Flowers superposed in linear, spirally-arranged, 3-7-flowered clusters on the branches of a compound spadix, the females 1 or 2 at the base of the cluster. Spathes many, distichous, imbricated. Inner segments of the perianth valvate, twice as long as the outer. Male flowers: Stamens 6, included; filaments connate at the base; pistillode a triquetrous or conical column, shorter than the stamens. Female flowers: Staminodes forming a cup with 6 teeth.

Fruit a purplish drupe; scar of the stigma sub-basal; mesocarp succulent and fibrous; endocarp chartaceous. Seed solitary, ascending; albumen homogeneous; raphe branching, but not anastomosing; embryo subapical or median.

SPECIES 3.—Mascarene Islands.

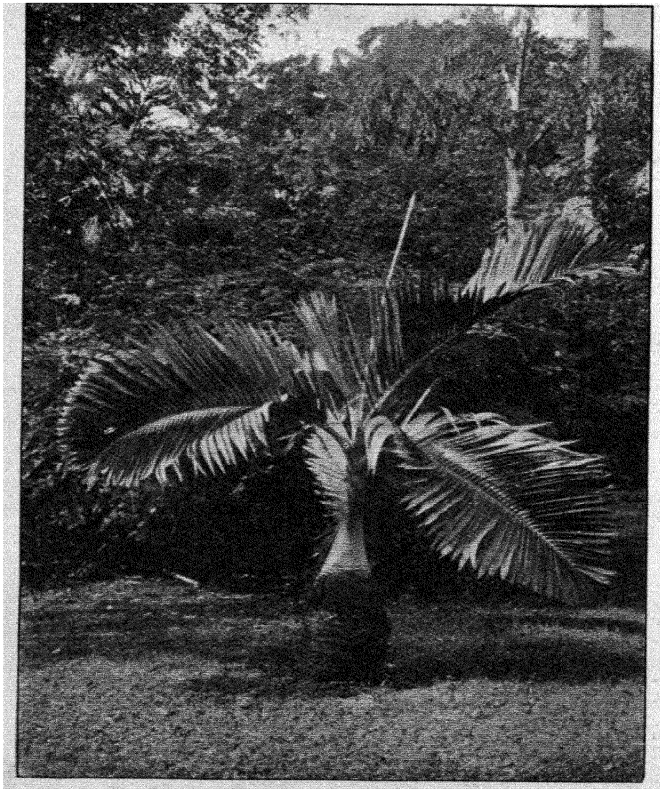
CULTIVATION IN EUROPE.—Ornamental, middle-sized stove palms. They grow well in a compost of loam, peat and leaf soil in equal parts with a liberal addition of sand. When they are fully grown about two-thirds of the compost should consist of loam. Propagation is effected by seeds, which are sown in a compost similar to the one just mentioned and placed in a moist gentle heat.

The following are cultivated in India:—

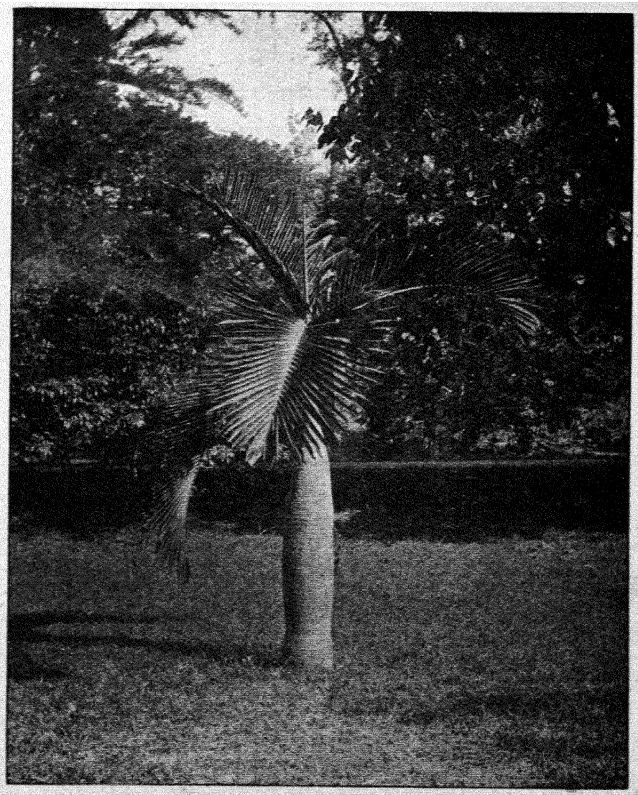
Pinnæ with prominent lateral nerves;
no yellow line on back of petiole ... *H. amaricaulis.*
Pinnæ with no prominent lateral nerves;
a yellow line on back of petiole ... *H. verschaffeltii.*

1. **Hyophorbe amaricaulis** Mart. Hist. Nat. Palm. III, 309; Baker Fl. Maurit. and Seych. 383; O. Drude Palmae 64.—*Sublimia amaricaulis* Commers.—*Hyospathe amaricaulis* Hort.—*Areca speciosa* Hort. and Versch.—*Areca purpurea* Makoy.

NAMES.—Palmiste Gargoulette (French).
Bitterstielige Eberpalme, Viehfutterpalme (German).



Young specimen of *Hyophorbe amaricaulis* Mart.



Hyophorbe amaricaulis Mart.



Young Specimen of *Hyophorbe verschaffeltii* H. Wendl.

DESCRIPTION.—Stem 60 feet high, 15-24 inches in diameter near the base, bottle-shaped, slightly diminishing upwards to the base of the leaf-sheaths, and there abruptly constricted. Leaf-sheath cylindrical; petiole 12-18 inches long, somewhat trigonous, grooved on the face; leaflets in 40-60 pairs, lanceolate, acuminate, 18 inches long, 2 inches broad, with the central and one lateral vein prominent on the upper surface, and several secondary veins also prominent beneath, which are clothed towards the base with sub-rigid, appressed, lanceolate scales.

Spadix with clustered branches; peduncle 1 foot long. Pistillode of the male flowers elongated, grooved.

Fruit elliptic-oblong. Seed elliptical, $\frac{3}{4}$—$\frac{1}{2}$ inch long, with the branches of the raphe diverging a little above the hilum; embryo subapical or median.

HABITAT.—Mauritius; common on Round Island. (Endemic.)

ILLUSTRATIONS.—Plate LXX A shows a young specimen of *Hyophorbe amaricaulis,* growing in the Victoria Gardens, Bombay. The photograph was taken by Mr. Phipson. The specimen figured on plate LXX B is some years older and grows in the Sibpur Botanic Gardens. Both pictures show the characteristic bottle-shape of the stem, and in both we notice a stick-like young leaf just at the time when it begins to unfold.

2. **Hyophorbe verschaffeltii** H. Wendl. Illust. Hort. XIII, t. 462, 463; Baker Fl. Maurit. and Seych. 383.—*Areca verschaffeltii* Lem. and Hort.

NAMES. Palmiste marron (French).
Verschaffelt's Eberpalme (German).

DESCRIPTION.—Stem 25-30 feet high, 6-12 inches in diameter at the base, bulging after a few feet, reaching 12-24 inches in the middle, thence contracting upwards, rarely again bulging. Petiole about 3 inches long, subterete, slightly grooved on the upper surface, with a yellow band extending from the upper part of the leaf-sheath along the face of the petiole to the extremity of the blade; leaflets 30-50 pairs, acuminate, 20-30 inches long, 1 inch broad; the central vein alone prominent, clothed on the under surface towards the base with short linear scales, which are often subrigid at the base.

Spadix with clustered branches; peduncle 8-14 inches long. Perianth orange. Pistillode of the male flower elongated, conical.

Fruit cylindrical-oblong. Seed sub-cylindrical, $\frac{7}{8}$-1 inch

long, $\frac{1}{6}$-$\frac{1}{4}$ inch broad; the branches of the raphe diverging from the middle of the seed, the embryo median and horizontal.

HABITAT.—Rodriguez, not uncommon on the hill slopes. (Endemic.)

ILLUSTRATION.—The young specimen of *Hyophorbe verschaffeltii*, figured on plate LXXI, is growing on Malabar Hill, Bombay. Mr. Millard was kind enough to supply the photograph. The stem is distinctly triangular, and as to the leaves, it is not difficult to find out the differences as regards number, size, shape and structure, which distinguish this species from *Hyophorbe amaricaulis*.

E. SUB-TRIBE: ARECEÆ.

Spadix below or between the leaves, always with 1-3 complete spathes, which open only when the male flowers begin to develop (except *Areceæ iguanureæ*). Flowers free on the surface or in open cavities, monoecious in clusters of 3, the male pair behind the female flower, the upper part of the branches bearing only male flowers. Male flowers: often oblique; calyx small, imbricate; corolla large, valvate; stamens 6-8. Female flowers: calyx and corolla imbricate (exceptions sub (*A*) in the following key: corolla valvate). Ovary of 3 completely united carpels, always 1-locular with one seed by the abortion of 2 seeds, but with 3 apical stigmas.

Fruit a berry of 3 carpels and 1 seed. Leaves pinnate, mostly smooth.

DISTRIBUTION.—In all tropical regions except continental Africa: East-African islands, from India and Ceylon to New Zealand and the Chatham Islands, tropical America from Brazil to the Antilles.

Dypsis Noronh., *Phloga* Hook., *Hyospathe* Mart., *Prestoea* Hook., *Oreodoxa* Willd., *Gigliolia* Becc., *Howea* Becc., *Linospadix* Wendl. & Dr., *Carpoxylon* Wendl. & Dr., *Iguanura* Bl., *Calyptrocalyx* Bl., *Sommieria* Becc., *Clinostigma* Wendl., *Heterospatha* Scheffer, *Jessenia* Karst., *Roscheria* Wendl., *Nephrosperma* Balf., *Verschaffeltia* Wendl., *Phoenicophorium* Wendl., *Acanthophœnix* Wendl., *Oncosperma* Bl., *Euterpe* Mart., *Oenocarpus* Mart., *Ptychandra* Scheff., *Cyphokentia* Brongn., *Hydriastele* Wendl. & Drude, *Kentia* Bl., *Kentiopsis* Brongn., *Veitchia* Wendl., *Drymo-*

phloeus Zipp., *Cyrtostachys* Bl., *Ptychococcus* Becc., *Ptychosperma* Labill., *Loxococcus* Wendl. & Dr., *Actinorhytis* Wendl. & Dr., *Rhopaloblaste* Scheff., *Ptychoraphis* Becc., *Dictyosperma* Wendl. & Dr., *Archontophœnix* Wendl. & Dr., *Nenga* Wendl. & Dr., *Cyphophœnix* Wendl. & Hook., *Mischophloeus* Scheff., *Pinanga* Bl., *Areca* L.

KEY TO THE GENERA DESCRIBED BELOW[1]:- -.

A. ARECEÆ ANOMALÆ.—Spadix between or below the leaves; branching, with two spathes of which at least the upper one is complete. Female flowers with valvate corolla. Ovary unilocular or sometimes with 2-3 ovules. Leaves unarmed, smooth.

Male calyx of rounded imbricate sepals.

Female corolla valvate throughout ... 1. *Oreodoxa.*

B. ARECEÆ IGUANUREÆ.—Spadix simple with a stout rhachis developed between the short-sheathed leaves. Spathes 1-3. The clusters of 3 flowers in open, flat, or lipped cavities of the rhachis. Male flowers with an imbricate calyx. Female flowers with a broadly imbricate corolla. Leaves unarmed:

Seed not erect, albumen not equable ... 2. *Calyptrocalyx.*

Seed erect, albumen equable ... ... 3. *Howea.*

C. ARECEÆ HETEROSPATHÆ.—Spadix branched, between the leaves. Spathes 2, pierced by the spadix, or upper spathe opening completely on the ventral side. Male flowers with an imbricate calyx. Female flowers with a broadly imbricate corolla. Ovary with 1 ovule. Leaves unarmed.

Pericarp smooth, albumen slightly ruminate 4. *Heterospatha.*

D. ARECEÆ ACULEIFERÆ.—Spadix once or twice branched, between or below the leaves. Spathes 2 or several, complete. Male flowers with an imbricate calyx. Female flowers with an imbricate corolla. Ovary with 1 ovule, united laterally with the wall. Leaves with long spines:—

(*a*) Spadix between the short-sheathed leaves. Albumen ruminate:

* Leaves irregularly pinnatisect:

1. Spadix twice branched.
   Stamens 6 ... ... 5. *Roscheria.*
2. Spadix once branched.
   Stamens ∞ ... ... 6. *Nephrosperma.*

[1] We follow in the main Drude, Palmæ, 65.

** Leaves bifid with pinnately dentate margin:

1. Stamens 6 ... ... 7. *Verschaffeltia.*
2. Stamens 15-20 ... ... 8. *Phœnicophorium.*

(*b*) Spadix below the long-sheathed leaves.

1. Albumen equable... ... ... 9. *Acanthophœnix.*
2. Albumen ruminate ... ... 10. *Oncosperma.*

E. ARECEÆ INFRAFOLIACEÆ. Spadix once or several times branched, below the crown, hidden before flowering in the long sheaths of the axils. Spathes 1-3, complete. Calyx of male flowers mostly broadly imbricate. Corolla of female flowers broadly imbricate. Ovary with one central ovule. Leaves unarmed.

I—Ovule and seed laterally more or less united with the endocarp.

(*a*) Albumen uniform.

1. Ovule and seed united with the endocarp to a little beyond the middle of the raphe ... ... 11. *Hydriastele.*
2. Ovule and seed united with the endocarp along the raphe from the base to the apex ... ... 12. *Kentia.*
3. Ovule broadly united with the endocarp near the chalaza and consequently pendulous ... 13. *Cyrtostachys.*

(*b*) Albumen ruminate.

1. Leaflets truncate ... ... 14. *Ptychosperma.*
2. Leaflets truncate-dentate ... 15. *Loxococcus.*
3. Leaflets acuminate.

° Rumination of the albumen deep, radial towards the centre of the seed... ... ... 16. *Actinorhytis.*

°° Rumination of the albumen irregular or flat.

× Stamens 6, albumen deeply grooved along the raphe ... 17. *Ptychoraphis.*

×× Stamens 6, raphe without groove 18. *Dictyosperma.*

××× Stamens 9—24 ... ... 19. *Archontophœnix.*

II—Ovule free, arising from the base of the loculus.

1. Female and male flowers in clusters of 3 reaching high up the branches 20. *Pinanga.*
2. Female flowers at the base of the branches, solitary or few ... ... 21. *Areca.*

1. *OREODOXA* KUNTH IN HUMB. et BONPL. NOVA GEN. et SP. PL. I, p. 244, EDIT. MIN. (1815) 305.

(From the Greek "Oros", the mountain, and "doxa", glory; alluding to the lofty stature of some of the species.)

Mart. Hist. Nat. Palm. III, 166, 310, t. 156, 163.—Jacq. Stirp. Sel. t. 170.—Kunth. Enum. Pl. III, 181.—Walp. Ann. III, 459.—Griseb. Fl. Brit. W. Ind. 517.—Benth. & Hook. Gen. Pl. III, II, 899, 35.—*Roystonea* O. F. Cook in Bull. Torrey Bot. Club (1901) 549.

Stem erect, columnar, unarmed, annulate, thickened at the base or in the middle, leaves terminal, pinnate; pinnæ narrow-lanceolate, bifid at the top: petiole long-sheathing.

Spadix at the base of cylinder formed by the leaf-sheaths, thrice-twice divided, equalling the inner lignescent spathe. Flowers monoecious, small, white or yellowish. Male calyx 3-phyllous, short, imbricate; petals 3; stamens 6-12, long-exserted with versatile anthers. Female calyx as in the male; petals 3, valvate; staminodes forming a 6-dentate cupule; ovary 3-locular; stigmas 3, sessile, suprabasilar in the fruit.

Berry drupaceous, 1-seeded; putamen adnate to the testa; albumen uniform; embryo basilar.

Species 4.—Tropical America: Antilles and neighbouring coast of South America.

CULTIVATION IN EUROPE.—These palms are elegant stove plants and are easily raised from imported seeds, sown in a sandy soil in a mild hotbed. When the seedlings have attained sufficient size they must be potted off singly into small pots with the same kind of soil in which the seeds were sown. Later on, good turfy loam will be better.

The following two species are grown in Indian gardens:

1. The male flowers have the stamens protruding beyond the petals long before the anthesis. Fruit oblong, more or less curved, nearly twice as long as wide *O. oleracea.*

2. The male flowers have when in bud the stamens entirely enclosed in the corolla. Fruit globular-ovoid, more or less gibbous, not more than one-third longer than broad ... ... *O. regia.*

1. **Oreodoxa oleracea** Mart. Hist. Nat. Palm. III, 166, t. 156 fig. 1, 2, t. 163.—Becc. Reliq. Scheff. in Ann. Jard. bot. Buit. II, 150, t. 12; Palms indig. to Cuba in Pomona Journ. Econ. Bot. II (1912) 265.—Drude in Mart. Fl. Bras. III, II, 474.

NAMES of the tree:

American Cabbage Palm, Barbados Cabbage tree, Cabbage Palm, Cabbage tree (English).

Arbre au chou, Arbre chou des Barbades, Arec d'Amérique, Arec légumineux, Arouari des Caraibes, Chou palmiste, Palmier des entourages, Palmiste blanc, Palmiste à chou, Palmiste à colonne, Palmiste franc (French).

Echte Kohlpalme, Kohlpalme, Kohltragende Arekapalme (German).

Amerikaanische Koolpalm, Koolboom, Koolpalm, Palmiet (Dutch).

Names of the cabbage or heart:—

Chou palmiste (French), Palmenkohl (German), Palmkool (Dutch).

DESCRIPTION.—Stem more or less thickened at the base, for the rest equal, 100-130 feet high, annulate. Leaves terminal, up to 20 feet long, patent, forming a graceful crown, pinnatisect; base sheathing; sheath cylindric, slightly attenuate upwards, about 1 foot in diameter, dark green; peduncle 4 inches broad above the sheath, and 20-25 inches long, semi-cylindric and deeply canaliculate with acute margins; rhachis convex below, excavate on the upper side; segments about 200 on each side with a thickened pulvinus at the base, the lowest and uppermost almost equidistant, the middle ones slightly crowded, 3 feet long, 1½ inches broad, lanceolate-linear, acuminate, bright green, slightly glaucescent on the lower surface.

Spadix rising at the base of the cylinder formed by the leaf-sheaths, 2½-3 feet long, decompound. Inner spathe cylindric, attenuate at both ends, cuspidate, lignescent, opening longitudinally on the ventral side, reddish inside; peduncle almost 1 inch in diameter, slightly thickened at the point of branching; branches



Young Avenue of Cabbage Palms in the Botanic Garden of Peradeniya (*Oreodoxa oleracea* Mart.).

furfuraceous-puberulous. Flowers crowded, 3 together, the middle one female; bract at the base of the female flower small, membranous, triangular-subulate, persistent; bracteoles 2, minute, broadly-triangular. Male flowers: sepals minute, scarcely 1 line long, broadly cordate-triangular, imbricate; corolla $2\frac{1}{3}$ lines long; petals oblong-lanceolate, acute, straw-coloured, valvate; stamens 6, more than 1 line long; anthers linear, bifid at the base; pistillode minute, subtriquetrous. Female flowers half the size of the male flowers; calyx 3-phyllous, sepals orbicular-ovate, obtuse, imbricate; petals ovate-sub-triangular, slightly concave, valvate; staminodes forming a six-dentate cupule; ovary ovate; stigmas 3, sessile.

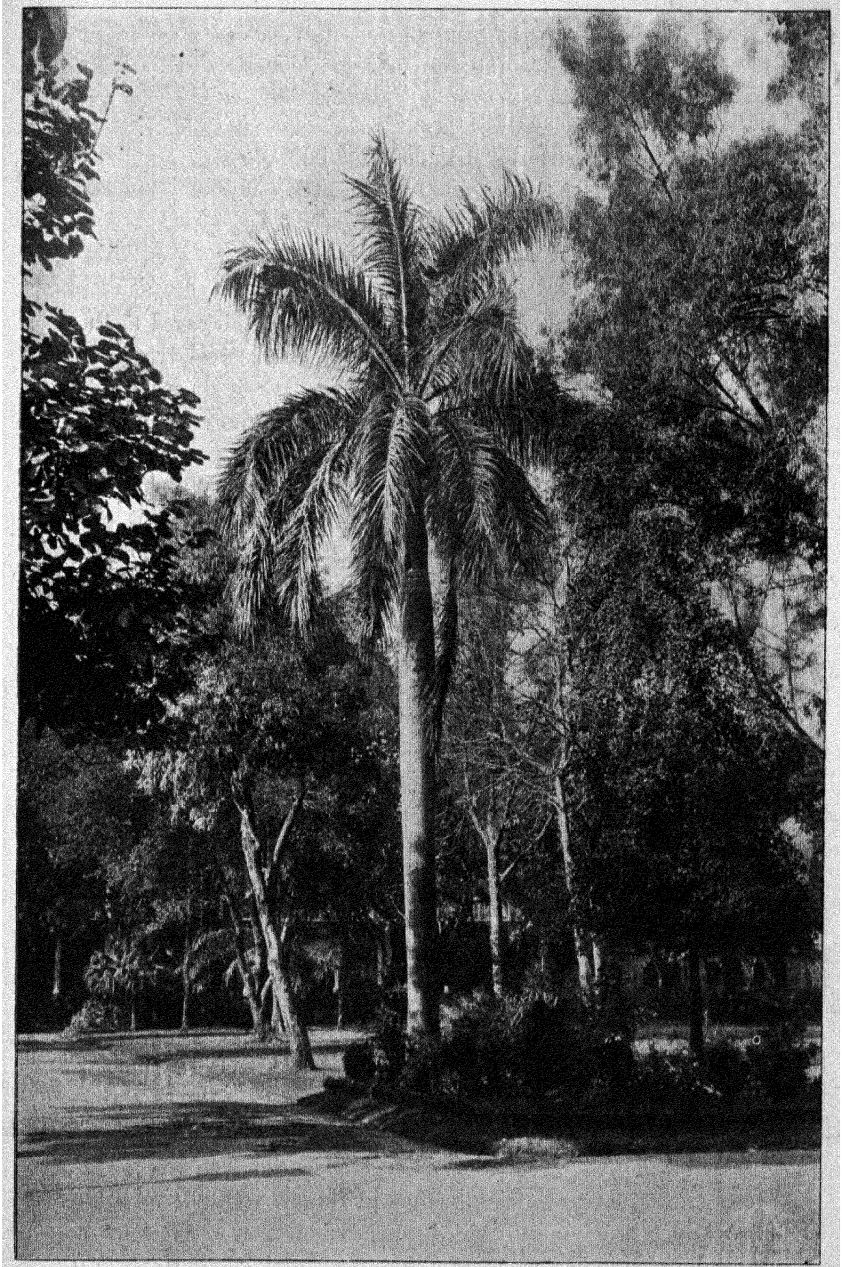
Fruit a berry, incurved, obovoid-oblong, 8-9 lines long; fibres of the mesocarp in an oval area. Seed oblong, 4-5 lines long; albumen homogeneous, horny. Embryo cylindric, slightly obliquely basilar.

HABITAT.—Bahamas; Jamaica, common in the mountains; Trinidad, Cuba, and other Antilles.

USES.—The "heart" is made into pickles, or when boiled is served at table. The trunks serve as gutterings. The pith furnishes a kind of sago, and the nuts yield oil by decoction. The wood is very hard, but so thin that it is only fit for walking-sticks or ramrods. The leaf-sheaths, after falling off, are woody like deal. When the leaves are cut off green, the inside skin of the sheaths, if dried, looks like vellum; this bears ink very well on one side, on the other it seems greasy. Twenty large sheaths may be procured from one trunk. In their native country the broad part of the footstalks forms a hollow trough or cradle for children; when cut up it makes excellent splints for fractures.

ILLUSTRATION. The magnificent avenue of Cabbage palms (*Oreodoxa oleracea*), pictured on Plate LXXII, was photographed by Mr. Macmillan in the Botanic Gardens of Peradeniya. The stems on the right are more characteristic of this species than some on the left as they do not show that thickening about the middle so peculiar to *Oreodoxa regia*.

2. **Oreodoxa regia** Kunth in Humb. et Bonpl. Nova Gen. et Spec. Pl. I, 244; Mart. Hist. Nat. Palm. III, 169, t. 156, f. III, IV, V; Griseb. Cat. Pl. Cub. 222; Sauvalle Fl. Cub. 163; Combs in Trans. Acad. St. Louis VII (1897) 441, t. II; Sargent Silva N. A., X, 31, t. DV; Hemsley in Biol. Centr.



Royal Palm or Mountain Glory (*Oreodoxa regia* Kth.).

Amer. Bot. 401; Becc. Palms indig. to Cuba, in Pomona College Journ. Econ. Bot. II (1912) 257.—*Oreodoxa oleracea* (*non* Mart.) Griseb. Pl. Wright. 531, and Pl. Cub. Wright n. 1467.—*Roystonea regia* O. F. Cook in Bull. Torrey Bot. Club (1901) 531.

NAMES:—English: Royal Palm, Mountain Glory.
French: Chou franc, Chou palmiste de montagne.
German: Koenigspalme.
Dutch: Koningspalm, Palmiet.
In Cuba: Palma real.

DESCRIPTION.[1]—Stem generally more or less thickened at the middle, but sometimes almost regularly cylindrical from the base nearly to the summit, unarmed, annulate, 40-60 feet high. Leaves very large; leaf sheath elongate, tightly enveloping the vegetative cone. Leaflets alternately inserted in contrary ways along the rhachis, standing in four different planes, at least in its lower and intermediate part, but more regularly set and almost in one plane towards the end. Rhachis at first more or less sprinkled with small, appressed, orbicular, tobacco-coloured, deciduous scales, but becoming glabrous by age. Leaflets firmly papyraceous, ensiform, quite straight and very gradually narrow above from below the middle, to a very acuminate, rather rigid, briefly bifid apex, generally more deeply split by age, attached to the rhachis by a narrow base, having here the margins strongly reduplicate, green on both surfaces, on the lower rather densely sprinkled with very numerous, very small dots visible under a strong lens; midrib strong, very prominent above, covered below by an almost continuous line of elongate chaffy scales; secondary nerves 2-3 on each side of the midrib; tertiary nerves very numerous and not very prominent; margins acute, not or very slightly thickened; transverse veinlets obsolete. Intermediate leaflets 2½ to 3½ feet long and 1⅖ to 1⅗ inch broad.

Spathes 2, the exterior one tubular, pervious at its upper end, considerably shorter than the interior one, which completely envelops the spadix before the anthesis, and is at that time flattened-fusiform and biconvex, later deciduous. Spadices 3-4 at the same time, erect when not yet open, at the base of the lowest leaf sheath, spreading when in flower, with a very short, broad peduncular base, twice branched; primary branches conspicuously swollen at their bases and divided into several

[1] We follow almost word for word the description given by Beccari, l. c.

alternate flowering branchlets, which are slender, terete, ½ to ⅝ foot long or shorter, more or less sinuous between the flowers. Flowers light coloured, ternate almost to the end of the branchlets, inserted on very superficial flat orbicular pulvinuli. Male flowers considerably larger than the female, irregularly ovoid, obtuse, ⅕ to ¼ inch long; calyx very small, with slightly imbricate, scarious, subpellucid, subdeltoid, obtuse or acute, and more or less carinate sepals; petals considerably longer than the sepals, concave, thinly pergamentaceous, irregularly ovate-oblong or oblong-elliptical, bluntish or subacute, striately veined, with a nectariferous swelling inside at the base. Stamens usually 6-7, occasionally 8-9, about as long as the petals, also during the anthesis, about ⅕ inch long on the whole: anthers relatively large, erect when in the bud, slightly shorter than the filaments, ovate-elliptical or ovate-sagittate, obtuse, the cells united by a broad conspicuous connective, dark coloured in the dry state, inserted on the filament about their middle; filaments ⅙ inch long, linear subulate at the apex, somewhat flattened; rudimentary ovary globose, with 3 short acute, stigmatic points. Female flowers open a short time after the male, horizontal, ⅛ inch long when full grown, but not yet open, broadly conical and apiculate; sepals reniform, entire, smooth, slightly callous at the base; corolla four times as long as the calyx, urceolate-campanulate when open, divided down to a little below the middle into three triangular briefly acuminate valvate divisions; staminodes forming a cup, lining the undivided part of the corolla, and crowned by 6 obtuse lobes, 3 of them peeping forth between the divisions of the corolla. Ovary globose, usually unicellular, with rudiments of the two other cells, more rarely with two of these perfectly developed, producing then a didynamous fruit; ovule attached along one side of its cell; stigmas fleshy, triangular-subulate, recurved.

Fruit globose-obovoid and somewhat gibbous, ¼ inch long, ⅜ inch broad, with a perfectly round top and with the remains of the stigmas placed a little above the base, on the less convex side; pericarp on the whole about $\frac{1}{24}$ inch thick; epicarp smooth outside, thin and brittle in the dry fruit; mesocarp scanty, softly parenchymatous; endocarp thinly woody and forming a shell or putamen to the seed, its inner wall remaining adherent to and almost connected with a large portion of the antiraphal

side of the seed, brittle and removeable on the side of the hilum. Seed broadly ovoid-elliptical, rounded at both ends, slightly compressed and flattish on the raphal side, about $\frac{1}{3}$ inch long and $\frac{1}{2}\frac{1}{5}$ inch broad; raphal side conspicuously marked by a circular central area in which, a little below the centre, is placed the hilum, whence numerous vascular ramose venations radiate. Albumen homogeneous, very slightly excavate on the raphal side. Embryo obliquely basal, penetrating deeply into the substance of the albumen. Fruiting perianth explanate, not accrescent.

NOTE.—The bulging of the stem cannot be absolutely taken as a specific character. On the whole this palm is rather variable with regard to the shape, size, and small peculiarities of the fruit.

HABITAT.—Cuba, Jamaica, S. Domingo, St. Croix, Panama (Beccari).

2. *CALYPTROCALYX* BL. RUMPHIA II, 103, TAB. 102.

(From the Greek "kalyptra", an extinguisher, and "kalyx", a calyx, in allusion to the form of the outer perianth segments.)

Kunth Enum. Pl. III, 642.—Miq. Fl. Ind. Bat. III, 44.—Benth. & Hook. Gen. Pl. III, II, 902, 42 (*partim*).

Stem annulate, unarmed; leaves terminal, pinnatisect segments reduplicate, linear, acuminate, sometimes bifid at the apex.

Spadix elongate, spicæform, declinate between the bases of the leaves. Spathe longitudinally open, coriaceous, remaining on the peduncle for a long time. Flowers monoecious in cavities of the rhachis which are covered by a persistent scale, glumaceous, surrounded by bracteoles. Each glomerule consisting of two male flowers (one of which opens several days before the other) and one female which develops a long time after the male flowers. Calyx triphyllous, sepals cucullate, narrowly imbricate. Corolla deeply tripartite; segments before opening valvate (according to Blume) but 'segments of female flowers distinctly imbricate' (according to Scheffer). Male flowers: Stamens very numerous; filaments subulate, confluent at the base of the corolla; anthers linear; rudimentary ovary present. Female flowers: Ovary incompletely trilocular; stigma simple, sessile; rudimentary stamens small.

Fruit about $1\frac{1}{5}$ inch long and $\frac{10}{12}$—$1\frac{1}{2}$ inch in diameter, crowned by 3 dentiform patent stigmas. Seed globular, about $\frac{3}{5}$ inch in diameter, often slightly irregular.

SPECIES—About 5[1].

DISTRIBUTION.—Moluccas and New Guinea.

1. **Calyptrocalyx spicatus** Bl. Rumph. II, 103, t. 102, D, 118, 161; Miquel Fl. Ind. Bat. III, et de Palm. Arc. Ind. 25; Scheffer in Ann. Jard. Bot. Buit. I, 131; Kunth Enum. Pl. III, 643; Walpers Ann. III, 468, V, 814; Mart. Hist. Nat. Palm. III, 230, 317; H. Wendl. in Kerch. Palm. 238; Becc. in Ann. Jard. Bot. Buit. II, 142.—*Areca spicata* Lam. Enc. Bot. I, 241, No. 2; Wild. Sp. Pl. IV, 495, No. 4; Spreng. Syst. Veg. II, 139, No. 4; Mart. l. c. 179, No. 13.—*Euterpe globosa* Gærtn. Fruct. I, 24, *quoad Rumphii citatum, non quoad fruct. descriptum et t. g. illustratum* (*fide* Mart.).—*Pinanga globosa* Rumph. Herb. Amb. I, 38, t. 5, f. 1, A.

NAMES.—Nibung, Pinang utan, bezaar (Malay.); Hua niwel, Hua ewan (Amboina); Hena Hena (Ternate ex Blume l. c.); Æhrige Haubenkelch-Palme (German).

DESCRIPTION.—Stem erect, cylindrical, up to 40 feet high, 7-10 inches in diameter, annulate, scars subequidistant. Leaves many, the lower ones spreading, 8-12 feet long, oblong in outline, divided into narrow segments; petiolar sheath elongate-cylindric, narrow, coriaceous, furfuraceous with minute fuscous scales; petiole short, convex on the dorsal side; rhachis triquetrous. Segments numerous, obliquely adnate by means of callosities, subalternately arranged, linear, very acuminate, entire or divided at the apex into short unequal teeth, longitudinally plicate, the median lateral ones elongate, 2-$2\frac{1}{2}$ feet long, 2-$2\frac{1}{2}$ inches broad, the lower ones narrower and shorter, subreclinate, the upper ones gradually more approximate, much narrower than the median ones and not reaching more than 15 inches at the apex.

Spadices arising from between the leaves, solitary, first oblique, then declinate, elongate, cylindrical, spicæform, rigid, virescent, much longer than the spathe; peduncle $1\frac{1}{2}$-2 feet long, compressed-terete, arcuate with scattered ferruginous scales; rhachis reaching 5-7 feet, about one inch thick, attenuate towards the base, sub-angular. Spathe almost as long as the peduncle, narrowly lanceolate, above longitudinally split, coriaceous, rigid,

[1] The four species not mentioned here (*C. Albertisianus* Becc., *C. leptostachys* Becc., *C. pachystachys* Becc., *C. laxiflorus* Becc. have been described by Beccari in Webbia I (1905) 305-313.



Calyptrocalyx spicatus Bl., in the Botanic Garden of Peradeniya.

glabrous on the inner side, on the outer striate, obsoletely ferrugineo-punctate.

Flowers monoecious, unisexual, 3 together in cavities (2 male and 1 female). First, one lateral male flower develops; when this has fallen, a second male flower on the other side of the central female flower opens, and when the second male flower has disappeared, the female flower begins to open. There are, therefore, never 3 open flowers in one glomerule at the same time.

Calyx: Sepals 3, excavate, galeæform, slightly unequal, narrowly imbricate. Corolla turbinate, obsoletely triquetrous, deeply tripartite, slightly fleshy at the base, segments ovate, subacute, sometimes somewhat oblique, plano-convex on the outer side, on the inner concave and striate by the pressure of the stamens.

Male flowers: Fertile stamens about 160, not much shorter than the corolla, glabrous, unequal, the outermost and innermost ones being shorter than those between them, all inserted at the base of the corolla on a nectariferous disc; filaments straight, subulate; anthers linear, as long as the filaments, attached on the middle of the back, slightly retuse at the apex, at the base deeply bifid; rudimentary ovary $\frac{1}{5}$ inch long with 3 patent stigmatic points. Female flowers: Ovary ovoid or subconical, slightly attenuate at the apex, usually oblique at the base, subtriquetrous or variously flattened, strigose, at the base incompletely trilocular, uniovulate; stigma sessile, terminal, simple, obsolete. Rudimentary stamens present.

Fruit mucronate at the apex; endocarp thick-fibrous, crustaceous, orange coloured or red, 1-seeded. Seed free, oval or almost round.

DISTRIBUTION.—Amboina (Rumphius, Zippel); Ternate, Halmaheira (Miquel).

ILLUSTRATION.—Plate LXXIV. Three specimens of *Calyptrocalyx spicatus*, photographed by Mr. Macmillan in the Botanic Gardens of Peradeniya. The rings on the stems, otherwise distinctly visible, are covered in our specimens by a thick growth of lichens.

3. HOWEA BECC. MALES. I (1877) 66.

(After Lord Howe's Island; Lord Howe lived from 1725-1799.)

Becc. in Webbia IV (1713) 156.—Benth. & Hook. Gen. Plant. III, 904.—*Grisebachia* H. Wendl. & Drude in Linnæa XXXIX (1875) 88, 200, t. IV, f. 1-2—*Kentia* Benth. Fl. Austral. VII, 137.

Stem arborescent, erect, annulate. Leaves terminal, regularly pinnate, slender-petioled, bright green, with a sheath completely embracing the stem in their lowest part. Segments numerous, straight, and sigmoidal, 3-sub-5-costulate, acuminate, the upper ones gradually decrescent, the terminal ones free to the base.

Spadix much elongate, inserted at the nodes of fallen leaves, rising solitary or 3-6 from one and the same basilar spathe, compressed, marcescent. Floriferous part strongly alveolate or scrobiculate, first completely enclosed in its proper spathe which opens longitudinally. Flowers ternate in the scrobiculi up to the end of the spadix; the two lateral flowers are male and one of them provided with a special bract; the female flowers develop long after the male flowers have fallen. Male flowers regular; sepals coriaceous, acutely carinate on the back; petals coriaceous; stamens numerous (30-100); anthers linear, basifixed; pistillode 0 or inconspicuous. Female flowers: sepals rotundate, cucullate, coriaceous; corolla slightly longer than the calyx; petals broadly imbricate below, ending in a stout point; staminodes 6, small, dentiform; ovary with one small cell, placed in the lowest part, ovate-elongate, terminated by 3 trigonous, stout, connivent stigmas; ovule anatropous, erect from the base of the cell.

Fruit symmetrical, mucronate-umbonate at the apex; epicarp smooth; mesocarp with few fibres; endocarp very thinly woody, forming a fragile shell to the seed. Seed erect from the base of the cavity of the endocarp, ovoid, marked on both sides by 5-6 ramifications of the raphe; hilum small, basilar; albumen homogeneous, horny; embryo basilar.

SPECIES: 2[1].

DISTRIBUTION.—Lord Howe's Island.

[1] It has been doubtful for a long time whether the two palms described below form one species or two. Beccari has settled the question in his paper; Contribut. alla conoscenza delle palme, in Webbia Vol. IV (1913) 156-168. It is from this paper that we have drawn our descriptions.

CULTIVATION IN EUROPE.—The species of *Howea* are ornamental stove palms. They do well in a compost of loam and peat, in equal proportions, to which may be added a little silver sand. They require plenty of pot room, and plenty of water throughout the summer, both at the roots and overhead. Propagation is effected by seeds, which quickly germinate in a light sandy soil, if placed on a hotbed.

When attacked by red spider or thrips, the plants must be sponged with soapy water.

Both species are grown in Indian gardens.

Leaves 10 feet long and more ... ... *H. forsteriana.*
Leaves about 7 feet long ... ... *H. belmoreana.*

1. **Howea forsteriana** Becc. Malesia I (1877) 66; Webbia IV (1913) 159; Gard. Chron. Dec. 12th, 1885, 748, and March 17th, 1888, 332; Hemsley Fl. Lord Howe Island in Ann. of Bot. X (1896) 255; Riccobono in Boll. Orto Bot. Palermo fasc. 3-4 (Dic. 1906), 120.—*Grisebachia forsteriana* H. Wendl. & Drude in Linnæa XXXIX (1875) 203, t. IV, f. 2; Kerch. Les Palm. 325, t. VII.—*Kentia forsteriana* Moore and Mueller in Mueller in Fragm. Phyt. Austr. VII (1870) 100; Mueller Sec. Syst. census Austr. Pl. 201; Maiden in Proc. Linn. Soc. N. S. Wales ex Gard. Chron. Dec. 24th (1899) 449.—*Kentia belmoreana* (*partim?*) André in Revue Hort. (1896) 76.—*Kentia belmoreana* (*partim?*) Mueller Fragm. Phyt. Austr. VIII, 234.—*Howea belmoreana* (*non* Becc.) Bot. Mag. t. 7018.—*Kentia australis* Hort. ex Gard. Chron. (1873) 6 and Dec. 12th (1885) 748.

NAMES.—English: Thatch Palm, Flat-leaved Palm (according to Mueller).
German: Forster's Lord Howe Palme.

DESCRIPTION.—Stem smooth, annulate, rising to the height of about 60 feet, with a diameter of $1\frac{1}{3}$-2 feet. Leaves (of cultivated specimens) 10-12 feet long; sheath green, yellowish on the median line, elongate, much broadened below, but only for a short distance, and there completely embracing the stem. Petiole stout, about 5 feet long, broad near the base, margins very acute, regularly convex on the lower side, flattened or very slightly concave on the upper; rhachis flat above in its lower part, with a groove on each side where the segments are inserted, the flat upper portion becomes gradually narrower and ends in a very acute angle, the lower side rounded in its lower part, becoming almost flat in its upper part. Segments very numerous, straight (not falcate), ensiform, slightly attenuate towards the base, where they are attached to the rhachis by a

rather broad base and have the margins slightly revolute ending in a very acute point which sometimes is more or less distinctly bifid, more or less distinctly 3-5 costulate, with the median rib rather strong and acute and the lateral ones delicate; the lower surface rather densely covered with minute brown scales which give it the appearnce of being finely punctate; the larger segments (the median ones) about 3 feet long and 1½-1⅔ inches broad; the lowest ones are a little straighter, but about as long as the median ones; towards the apex the segments become smaller, i.e., shorter and straighter; the two terminal ones are not united at the base, more or less one foot long and ½-⅔ inch broad. Spadices infrafoliar; generally several equal spadices arise collaterally above the scars of the fallen leaves, all springing forth from a common membranaceous marcescent spathe; every spadix about 2½ feet long; peduncular part ⅔-1 foot long, subterete or slightly compressed, bearing towards the middle or upper third its own spathe; the axile floriferous part 1⅓-1⅔ feet long, about as thick as a little finger, terete, gradually becoming thinner towards the apex, deeply and very regularly scrobiculate along 6-7 longitudinal series; scrobiculi very deep. Flowers all ternate. In every scrobiculus one of the male flowers is provided (alternately, now on one side and then on the other) with one coriaceous, triangular, acuminate bracteole; the other flower is generally without a special bracteole; in the same scrobiculus there are two imbricate suborbicular concave ciliolate bracts surrounding the female flower. The spathe special to each spadix is thickly cartaceous, covered with a thin soft greyish indument, and ending in a rigid, ½-1⅔ inch long point; it opens longitudinally at the moment when the male flowers begin to open. Male flowers symmetrical, ⅔ inch long; the well developed bud ovate-oblong; calyx on the whole acutely trigonous, about ¼ inch broad; sepals imbricate, coriaceous, concave-cucullate, obtuse, acutely carinate on the back, very densely barbate-ciliate on the margins; petals coriaceous, valvate; stamens very numerous (80-100); anthers linear or linear-lanceolate, much deformed and unequal on account of the mutual pressure, basifixed; filaments very unequal, those of the outer stamens short, those of the innermost even longer than the anthers and slender; pistillode inconspicuous. Female flowers globose in the beginning, then ovate

with a short conical obtuse point, a little smaller than the male flowers; sepals suborbicular, concave-cucullate, ciliolate-barbate on the margins, rotundate on the back; petals subcordate, broadly imbricate below, with a short point, stout, valvate, smooth outside; staminodes 6, unequal, dentiform, short, often confluent; stigmas arcuate, stout.

Fruiting perianth not at all or very slightly accrescent, broadly cyathiform, about $\frac{1}{2}$ inch in diameter at the mouth, attenuate below; corolla by $\frac{1}{3}$ longer than the calyx, petals with a stout broadly triangular opaque point. Fruit $1\frac{2}{5}$ inch long (including the perianth), ovate-elliptical, almost equally attenuate towards the two ends, terminated by the hardened and connivent remains of the stigmas which form a conical papilla; pericarp broadly corrugate when dry, only about $\frac{1}{12}$ inch thick, with a smooth surface finally but little distinctly lineolate-venose; mesocarp consisting of only one layer of rigid fibres, situated immediately under the epicarp, as to the rest parenchymatous, almost dry and containing a few thin fibres; endocarp very thin, brittle, smooth inside. Seed erect, ovate rotundate at the apex, or with a slightly conical point, up to $\frac{4}{5}$ inch long and about $\frac{1}{3}$ inch in diameter; ramifications of raphe very distinct; albumen bony, white-cerulescent, radiating from a central line; embryo basilar, situated in the direction of the axis, $\frac{1}{6}$ inch long.

HABITAT.—Grows abundantly in Lord Howe's Island. The palm prefers the plains or low hills, especially in the neighbourhood of the sea, where the soil is more or less coralliferous (ex Becc.).

FLOWERING AND FRUITING SEASON.—In its native land the tree ripens the fruit one year after the appearance of the flowers.

Beccari tells us, on the authority of Riccobono, that in the Botanic Garden of Palermo the male flowers open in the first year, the female ones in the second, and that the fruit ripens in the third year.

ECONOMIC USES.—For the natives of Lord Howe's Island the seeds of *Howea forsteriana* as well as of *belmoreana* form an important article of export.

CULTIVATION IN EUROPE.—This palm is extensively grown in European gardens. It is very ornamental, especially when

young, the leaves being gracefully curved and the petioles with their sheaths showing a pleasant green.

2. **Howea belmoreana** Becc. Malesia I (1877) 66; Webbia IV (1913) 165; Gard. Chron. Dec. 12th (1885) 748 and March 17th (1888) 332.—Hemsley in Ann. of Bot. X (1896) 255; Riccobono in Boll. Orto Bot. di Palermo V, fasc. 3-4 Decembre (1906) 120.—*Grisebachia belmoreana* H. Wendl. & Dr. in Linnæa XXXIX (1875) 202 t. IV, f. 1; Drude & Wendl. in Nachr. K. Gesellsch. Wiss. Goett. (1875) 58; Drude in Bot. Zeitg. (1877) 636, t. 5, f. 14, 15; Kerch. Les Palm. 325, t. IX.—*Kentia belmoreana* Moore and Mueller Fragm. Phyt. Austr. VII (1870) 99; Mueller Sec. Syst. Cens. Austr. Pl. 201 (*non* Fragm. VIII, 234); Maiden in Proc. Linn. Soc. New S. Wales, ex Gard. Chron. Dec. 24th (1898) 449.

NAMES.—English: Curly Palm, Belmore's Howea. German: Belmore's Lord Howe Palme.

DESCRIPTION.—Smaller than *Howea forsteriana,* stem smooth, annulate. Leaves about 7 feet long (in cultivated specimens), petiole more or less $1\frac{3}{4}$ foot long; rhachis strongly arcuate; segments numerous, equidistant, smaller and narrower than in the foregoing species, tricostulate, sometimes sub-5-costulate, straight (not sigmoidal), ensiform, very acuminate, with the margins more or less thickened, slightly attenuate towards the base; the larger segments (about the middle of the leaf) $2\frac{1}{3}$-$2\frac{1}{2}$ feet long and about 1 inch broad, lower surface without those small brown scales of *H. forsteriana.*

Spadices solitary, $3\frac{1}{4}$-5 feet long, the floriferous part measuring $2\frac{1}{3}$-$3\frac{2}{3}$ feet; the peduncular part slightly compressed with rotundate margins, delicately reddish-tomentose, $\frac{1}{6}$-$\frac{3}{5}$ inch broad. Basilar spathe membranaceous, dry, marcescent, about 1 foot long, strongly compressed, with very acute narrowly winged margins, about one inch broad. Second spathe completely surrounding the floriferous part and inserted on the peduncular part about $\frac{1}{3}$ foot below the lower flower, rigidly cartaceous, dehiscent along its whole length, terminated by a rather long point, more or less densely covered with small reddish-brown scales, as to the rest glabrous; sometimes the scales are confluent and form a very thin adherent indument. The axile floriferous part of the spadix is more or less furfuraceous-reddish and finally glabrous, as thick as a little finger, gradually attenuate towards the end and very deeply scrobiculate, on the whole having the appearance of the same part in *H. forsteriana,* only

much longer; the scrobiculi seem to be more numerous (Beccari found in the specimens studied that they are arranged in 9 longitudinal series); the bract of the male flower in each scrobiculus is broadly triangular, subcordate at the base, acute. Male flowers oblong, in the completely developed bud $\frac{2}{3}$ inch long, $\frac{1}{3}$ inch broad, rotundate above. Calyx acutely trigonous; sepals strongly cucullate, very acutely carinate, ciliate on the margins. Corolla obtusely trigonous, in perfectly developed flowers about twice as long as the calyx; petals oblong, slightly concave; stamens 35—40, almost all equal, filaments very short and only in a few inner stamens more or less elongate; anthers linear, obscurely apiculate with a large connective; cells narrow, laterally dehiscent. Female flowers globular in bud and, if we are allowed to conclude from the fruiting perianth, identical with those of *H. forsteriana.*

Fruit similar to that of *H. forsteriana,* but shorter, ovate-elliptic, a little more attenuate towards the apex than at the base, finely striate outside when dry, $1\frac{1}{3}$-$1\frac{3}{4}$ inch long (perianth included), $\frac{8}{12}$-$\frac{9}{12}$ inch broad, terminated by the remains of the stigmas which form a depressed-conical papilla; colour greenish black; fruiting perianth the same as in the foregoing species. Seed ovate, $\frac{2}{3}$ inch long, $\frac{1}{2}$-$\frac{1}{1}$ inch broad.

HABITAT.—Lord Howe's Island, but always on the mountains and on basalt, never in the coralliferous soil of the plains (ex Beccari).

DISTINGUISHING CHARACTERS OF THE TWO SPECIES OF *Howea:*

Howea forsteriana.	*Howea belmoreana.*
Tall. Leaves 10 feet long and more; segments patently arcuate, the largest ones $2\frac{1}{3}$-$3\frac{1}{6}$ feet long and $1\frac{1}{6}$-$1\frac{1}{3}$ inch broad, very minutely and densely punctate-squamulose on the lower surface.	Smaller. Leaves about 7 feet long; segments in the beginning erect-arcuate on the rhachis, the largest ones $3\frac{1}{3}$-$3\frac{1}{2}$ feet long and about 1 inch broad, not punctate-squamulose on the lower surface.
Spadices inserted above the scars of fallen leaves to the number of 3-6, collateral,	Spadices solitary at the nodes, very long, floriferous part measuring $2\frac{1}{3}$-$3\frac{5}{6}$ feet

arising from the same spathe, floriferous part of spadix 1½-1⅔ feet long; floral alveoli disposed in 7 longitudinal series.	long; floral alveoli disposed in 9 longitudinal series.
Upper spathe softly grey-tomentose, shortly mucronate at the apex.	Upper spathe more or less covered with reddish-brown scales, often confluent, as to the rest glabrous, very long, mucronate at the apex.
Male flowers: sepals densely ciliate-tomentose on the margins; stamens 80-100; anthers very unequal and angular; filaments of the outer stamens short, of the inner ones slender and elongate.	Male flowers: sepals ciliate on the margins; stamens 30-40; anthers linear, subequal; filaments all short.
Fruit ovate-elliptical, 1⅔ inch long (including the perianth). Seed ovate-rotundate at the two ends, up to ⅗ inch long and about ½ inch in diameter. Embryo ⅙ inch long.	Fruit ventricose-ovate or ovate-elliptical, 1⅕-1⅔ inch long (including the perianth) and ⅞-1½ inch broad. Seed ovate, rotundate at both ends, ⅔ inch long and ½-¾ inch broad. Embryo 1½ long (always?).

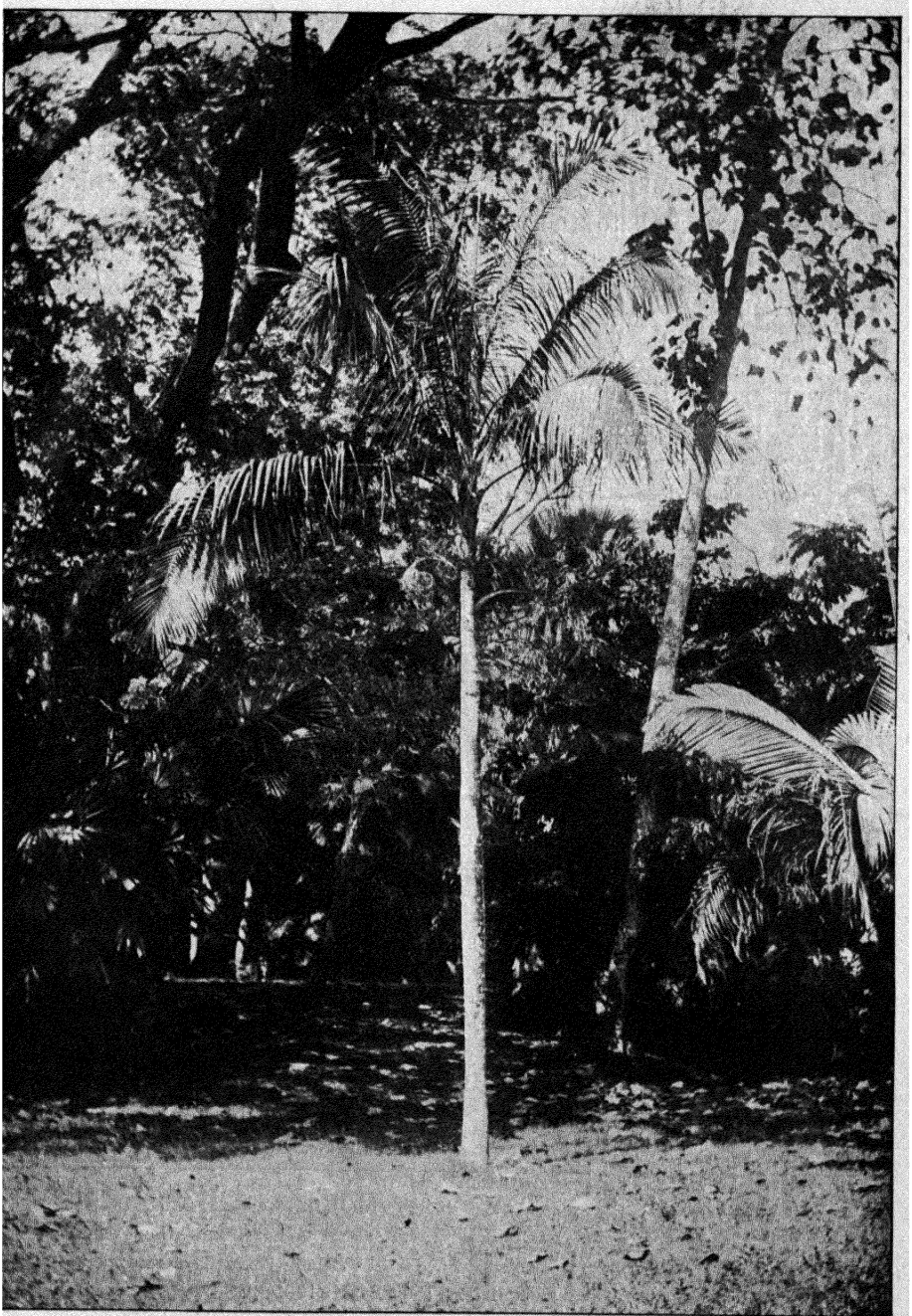
4. *HETEROSPATHA* SCHEFF. IN ANN. JARD. BUITENZ. I, 141, 162.

[From "heteros", variable, and "spathe" a spathe; alluding to the inequality of the spathes.]

Benth. & Hook. Gen., Pl. III, II, 906, 51.

Stem high, unarmed. Leaves terminal, long-petioled, regularly pinnatisect, segments numerous, lanceolate, attenuate towards base and apex, acuminate, 1-nerved, the margins thickened and recurved at the base; sheath short, fibrous, swollen at the base.

Spadix decompound, branches stout, branchlets divaricate. Spathes 2, the lower one 2-cristate, the upper one much longer. Flowers monoecious on the same spadix, spirally arranged, either ternate and then the central one is female, or binate in the



Heterospatha elata Scheff., in the Botanic Garden of Calcutta.

upper part, both being male, obscurely bracteate and bracteolate. Male flowers asymmetrical, compressed. Sepals small, subrotund, gibbous at the base, imbricate. Petals ovate, subacute, valvate. Stamens 6; filaments filiform, connate at the base, with the apices inflexed; anthers linear, dorsifixed, bifid at both ends, versatile. Rudimentary ovary columnar, 3-gonous. Female flowers subequal to the male ones, ovoid. Sepals reniform, broadly imbricate. Petals slightly longer, orbicular, convolute-imbricate. Staminodes 6, setiform. Ovary oblong, 1-locular; stigmas small, recurved; ovule parietal, pendulous.

Fruit pisiform; stigmas excentric; pericarp grumose, not fibrous, smooth on the inner side. Seed globular, erect, free; hilum basilar; raphe elongate, branches descending from the chalaza, reticulate; albumen slightly ruminate; embryo basilar.

SPECIES: 2.

DISTRIBUTION.—Philippines, Solomon Islands?, Amboina.

1. **Heterospatha elata** Scheff. Ann. Jard. Buitenz. I, 162.—*Metroxylon elatum* Cat. Hort. Buitenz. ex Scheffer l. c.

? *Areca elata* Hort. ...
? *Dypsis elata* Hort. ...
? *Hyophorbe elata* Hort.
} ex Salomon Palmen (1887) 82.

NAMES.—Kalapa outan (Amboina); Sagiusi (Visayan language); Erhabene Wechselscheide (German).

DESCRIPTION.—Leaves 13 feet long; sheath broad at the base, but short and fibrous; petiole 5 feet long; segments about 70 on each side, the longest reaching 3 feet.

Lower spathe three times shorter than the upper one, which measures 4 feet. Spadix longer than the spathes.

Fruit globular, about 3 lines in diameter.

HABITAT.—Masbate Island (Philippines) at Mabo, Marintor River (Beccari); Amboina (Scheffer).[1]

CULTIVATION IN EUROPE.—*Heterospatha elata* is an elegant

[1] Scheffer says that the plant which he described in the Ann. Jard. Buitenz. is growing in the Botanic Garden of Buitenzorg and is said to have come from Amboina. Beccari has seen only one specimen cultivated in the Botanic Garden of Singapore, but has never met this palm in its wild state. *Cf.* Webbia I (1905) 328.

A second species, *Heterospatha salomonensis* Becc. Webbia III (1910) 153-156, is indigenous in St. George Island (Solomon Islands).

stove palm with a graceful spreading habit, and remarkable for the length of the tapering segments of its pinnate fronds.

It thrives in rich sandy loam and leaf mould, and may be propagated by imported seeds.

ILLUSTRATION: PLATE LXXV shows a middle-sized specimen of *Heterospatha elata,* growing in the Sibpur Botanic Garden. The photograph was kindly supplied by Col. Gage.

5. *ROSCHERIA* H. WENDL. ILLUSTR. HORT. (1871) t. 54.

[So called after Albrecht Roscher, traveller in southern East Africa, born in 1836 at Ottensee near Hamburg, and killed in 1860 at Hisonguny, a village not far from the Nyassa.]

Bak. Fl. Maurit. 386.—Benth. & Hook. Gen. Pl. III, 913.—Drude Palmæ in Nat. Pfl. II, 3, 69.

Erect slender palms; stem armed with spines. Leaves terminal, pinnate.

Flowers monoecious, minute, solitary or in 2-flowered clusters, one female below and slightly on one side of one male, spirally arranged on the very slender branches of a compoundly-branching spadix in the axil of a leaf with a long compressed glabrous peduncle. Spathes several, smooth, complete. Male flowers: Perianth very minute. Stamens 6, included, united into a ring. Rudimentary ovary a column as long as the stamens, capped by a triquetrous disk. Female flowers: Staminodes forming a minutely-toothed cup or 0. Ovary 1-, rarely 2-3-locular; ovule parietal, pendulous.

Fruit fusiform, 1-, very rarely 2-seeded, stigma subbasilar; pericarp thin-fleshy, fibrous; endocarp crustaceous, seed obliquely ascending, globose or elliptical; hilum small, orbicular, basilar; raphe spreading from the base, its branches anastomosing on the side opposite the hilum; albumen loosely ruminate, embryo basal.

SPECIES.—1.

DISTRIBUTION.—Seychelles.

1. **Roscheria melanochætes** Wendl. ex Baker Fl. Maurit. 387.—*Verschaffeltia melanochætes* Wendl. in Illustr. Hort. (1871) t. 54.—*Dypsis gracilis* Bory ex Mart. Hist. Nat. Palm. III, 181 *in nota sub Dypsis hirtula,* et t. 161, f. 5. *Regelia melanochætes* Hort. ex Salomon Palmen (1887) 111.



Roscheria melanochætes Wendl., in the Botanic Garden of Peradeniya.

NAMES.—German: Schwarzborstige Roscheria—French: Latanier Haubaum (ex Baker).

DESCRIPTION.—Palm 15-25 feet high, with many aerial roots and a stem of 2-3 inches in diameter, with a ring of spines when young below each leaf-scar. Leaves long petioled, 4½-7 feet long, first bifid and then unequally pinnatisect; petiole 1½-2½ feet long, smooth, subtriquetrous, grooved down the face with a pale band running from the top of the sheath down the back of the petiole; leaf-sheath 1½-2½ feet long, with a few fine black spines rising from a compressed cushion; blade pale green, 3-5 feet long, 2-3 feet broad; pinnæ 1-1½ foot long, bifid at the apex, with many primary veins ½-1 inch apart, clothed on the underside with medially-attached scales.

Spadix 2-6 feet long; peduncle elongate, 1-3 feet long, slender, compressed, 1 inch thick; branches very slender, subsimple, divaricate, flattened at their insertion. Spathes several, complete, narrow, compressed, unarmed, the two lower ones persistent, the upper one deciduous. Flowers pale. Male flowers symmetrical; sepals suborbicular, obtuse, concave, imbricate; petals broadly ovate, subacute, valvate; stamens 6; filaments short, triangular, acute, united into a short tube, anthers broadly didymous, dorsifixed; rudimentary ovary obconical-clavate. Female flowers larger than the male ones, subglobose; sepals subreniform, imbricate; petals longer, orbicular, convolutivo-imbricate; staminodes obscure or 0; ovary ovoid or ellipsoidal, attenuate into a 3-fid conoid stigma.

DISTRIBUTION.—Seychelles, in shaded forests above 1,000 feet in elevation, common (Kirk, Horne).

Introduced in Indian gardens.

CULTIVATION IN EUROPE.—Roscheria is a slender, erect stove palm. It requires treatment similar to that recommended for *Phœnix*.

ILLUSTRATION.—The specimen of *Roscheria melanochætes* figured on Plate LXXVI has been photographed by Mr. Macmillan in the Botanic Garden of Peradeniya.

6. *NEPHROSPERMA* BALF. f. IN BAK. FL. MAURIT. 386.

(From the Greek "nephros", kidney, and "sperma", seed; alluding to the shape of the seed.)

Benth. & Hook. Gen. Pl. III, II, 907, 52.—Drude Palmæ 69.

Monoecious. Flowers in 3-flowered clusters, one female between and below two males, spirally disposed and slightly immersed on the branches. Spadix long-peduncled, simply branching, axillary. Peduncle compressed. Spathes 2, complete, outer spiny, 3 hairy bracts surrounding the spadix within. Male flowers: Sepals imbricate; petals valvate, thickened, thrice as long as the sepals. Stamens 40-50, included, connate at the base: outer shorter, with adnate erect anthers; inner with horizontal anthers. Pistillode undivided. Female flowers: Sepals and petals imbricate. Staminodes forming a cup with many short, toothed lobes.

Fruit globular, slightly flattened on one side; stigma subapical on the flattened side; mesocarp fibrous; endocarp thin, crustaceous. Seed ascending, reniform; raphe spreading from the base and anastomosing at the apex; albumen densely ruminate; embryo basal.

SPECIES, 1.—Seychelles.

1. **Nephrosperma van houtteana** Balf. f. in Bak. Fl. Maurit. 386.—*Oncosperma van houtteana* Wendl. MSS.—*Areca nobilis* Hort. ex Salomon 110.

NAME.—German: Nierenpalme.

DESCRIPTION.—Stem 20-35 feet high, 4-6 inches in diameter. Leaves 5-7 feet long; petiole under 1 foot long, green, smooth; sheath 1½-2½ feet long, woolly and sparsely spiny with thin coriaceous edges; blade unequally pinnate; leaflets 3-3½ feet long, glabrous; broad leaflets alternating irregularly with narrow ones, the latter with a single primary vein; veins bearing a few scales towards the base beneath; terminal leaflets confluent.

Spadix 4-8 feet long; peduncle 3-5½ feet; branches 2½-3½ feet long, compressed at the base. Basal spathe attached to the stem.

Fruit orange-red, about ½ inch long.

HABITAT.—Seychelles; not uncommon in open places and by the side of streams, up to 1,000 feet.

CULTIVATION IN EUROPE.—This species is a very elegant stove palm. It thrives in a compost of turfy loam, leaf mould, and sand. Care should be taken not to overpot. When grown with but limited root room, and plentifully supplied with water, the plants are very useful for decorative purposes in a young state.



Young specimen of *Nephrosperma van houtteana* Wendl.,
Victoria Gardens, Bombay.



Verschaffeltia splendida Wendl.

ILLUSTRATION.—We have to thank Mr. Phipson for the photograph reproduced on Plate LXXVII. The young palm grows in Victoria Gardens, Bombay. To the left there are the stems of two specimens of *Oreodoxa regia,* whilst to the right part of the stem and crown and several spadices of a Fishtail-Palm (*Caryota urens*) may be seen.

7. *VERSCHAFFELTIA* WENDL. ILLUSTR. HORT. XII, MISC. 5.

After Ambroise Verschaffelt, Gardener at Ghent (1825-86).

Baker Fl. Maurit. 387.—Benth. & Hook. Gen. Pl. III, II, 908, 55.

Monoecious. Flowers in 3-flowered clusters, one female between and below 2 males, spirally arranged on the short branches of a doubly-branched, slightly amplexicaul, slender, drooping spadix with a glabrous compressed peduncle. Spathes 3. Perianth very minute. Staminodes forming a ring with 6 short 2-lobed teeth.

Fruit globular; scar of the stigma sub-basal; mesocarp spongy; endocarp thick, woody, brittle, with vertical ridges reaching from base to apex. Seed ascending, globular, umbelicate at the base, marked with ridges corresponding to the grooves of the endocarp; raphe branching from the hilum and anastomosing freely over the surface; albumen deeply ruminate; embryo sub-basal.

SPECIES.—1.

DISTRIBUTION.—Seychelles.

1. Verschaffeltia splendida Wendl. in Illustr. Hort. XII, Misc. 5; Baker Fl. Maurit. & Seych. 387.—*Stevensonia viridifolia* Duncan MSS.—*Phœnicophorium viridifolium* Hort.—*Regelia magnifica* Rollis.—*Regelia majestica* Hort.—*Regelia princeps* Hort.

DESCRIPTION.—Stem 80 feet high, 6-12 inches in diameter, with many aërial roots, very spiny when young. Leaf 5-8 feet long; petiole ½-1 foot long, pale green, semiterete, grooved down the face, spiny; leaf-sheath 2½-3½ feet long, white granular, spiny, blade cuneate, obovate, bright green, 4-7 feet long, 3-5 feet broad, bifid, the edges deeply incised, the primary veins prominent on both surfaces, furnished with a few medially-attached scales on the lower one, each primary nerve bordered by 2 inconspicuous veinlets.

Spadix 3-6 feet long, peduncle compressed, 3-4 feet long; flowering branches 7-8 inches long.

Fruit ¾-1 inch in diameter.

HABITAT.—Seychelles; very common amongst rocks on all islands. Cultivated in Indian gardens.

CULTIVATION IN EUROPE.—This species is a noble stove palm. It grows well in a moisture-laden atmosphere and suffers if the temperature falls too low, or the air becomes dry. The mixture best adapted for it is a well-drained, fibrous peat, with pieces of charcoal and turfy loam and sand intermixed. Propagation effected by seeds.

ILLUSTRATION.—The beautiful photograph reproduced on Plate LXXVIII was taken by Mrs. Burkill in the Botanic Garden of Singapore. The aërial roots form a characteristic feature of the palm.

8. *PHŒNICOPHORIUM* WENDL. ILLUSTR. HORT. XII, t. 433.

Dunc. Cat. Hort. Maurit. 87 (*Stevensonia*).—Baker Fl. Maurit. 388 (*Stevensonia*).—Hook. & Benth. Gen. Pl. III. II, 908, 54. (*Stevensonia*).—C. Kch. Berl. Wochenschr. 1859, 401 (*Stevensonia*).

Monoecious. Flowers in 3-flowered clusters, one female between and below 2 males, spirally arranged on the thick branches of a doubly-branched, erect, long-peduncled spadix in the axil of a leaf. Spathes 2; outer persistent, covered with bristles, inner woody, deciduous. Male flowers: inner segments of perianth valvate, many times longer than the outer ones. Stamens 15-20, connate at the base, included. Pistillode a subulate grooved column. Female flowers: staminodes forming a shortly-toothed cup.

Fruit a small ovoid drupe, flattened on the side on which the sub-basilar stigma is placed, furnished with a ridge on the convex side when dry; mesocarp thin, fibrous; endocarp crustaceous, not grooved. Seed ascending, cordate-ovoid, flattened on the side on which it is attached; branches of the raphe spreading from the base and anastomosing near the apex; albumen deeply ruminate; embryo basilar.

SPECIES.—1.

DISTRIBUTION.—Seychelles.

1. **Phœnicophorium sechellarum** Wendl. Illustr. Hort. XII, 433. Misc. 5.—*Stevensonia grandifolia* Duncan Cat. Hort. Maurit. 87 (name only); Baker Fl. Maurit. & Seych. 388.—*Astrocaryum pictum* C. Koch.—*A. aureo-pictum* Versch.—*A. Borsigianum* C. Kch. Berl. Wochenschr. 1859, 401.—*Areca sechellarum* Hort.

NAMES.—Stevensonia (usual name in gardens), Thief Palm. Latanier feuillé (French). Grossblättrige Stevensonia (German).

DESCRIPTION.—Stem 40-50 feet high, very spiny when young, less so when old. Petiole 9-18 inches long, glabrous, pale green, convex below; leaf-sheath 2-3 feet long, hoary, scaly and spiny; blade cuneate-obovate, bifid, oblique at the base, deeply laciniated down the side, with incised segments; primary veins prominent, bordered with two secondary veinlets on each side, clothed with a few medially-attached brown scales beneath.

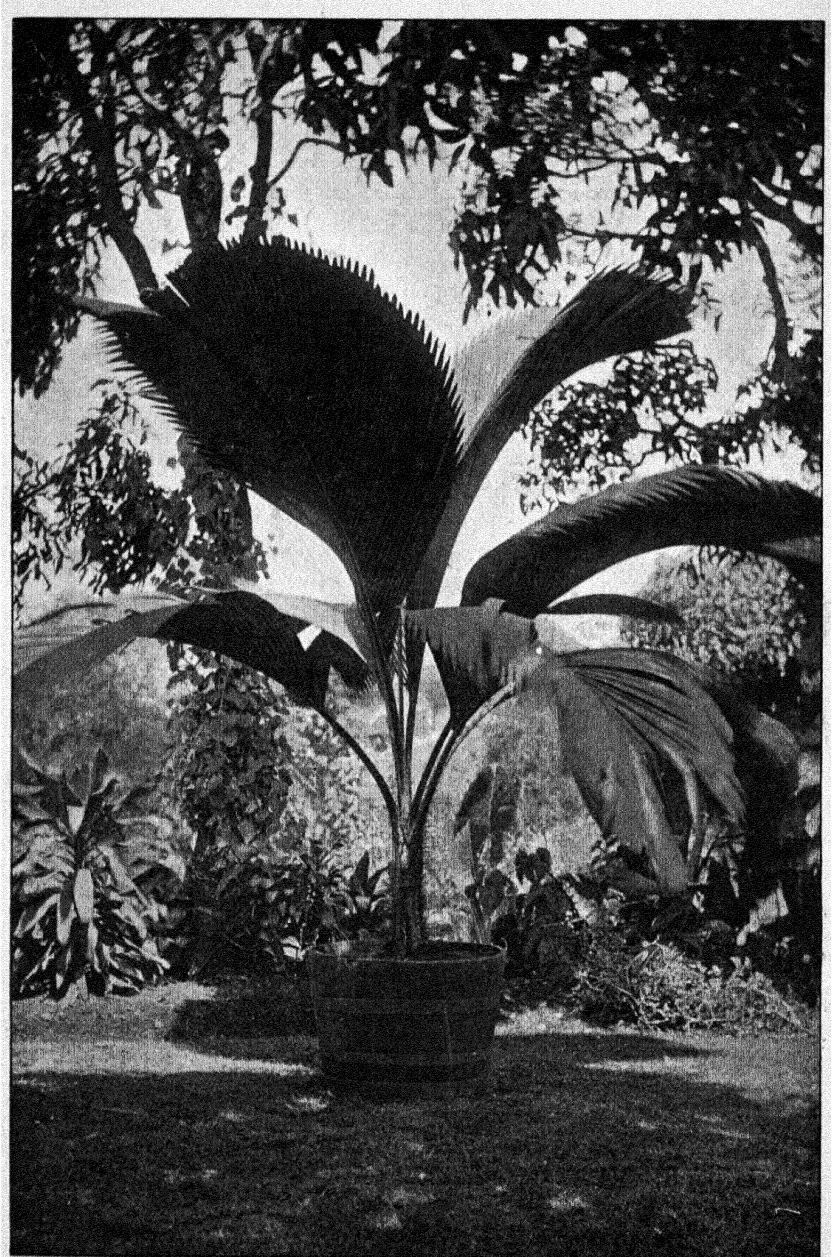
Spadix 3-6 feet long; peduncle 1½-3 feet long, compressed at the base; branches 1-1½ foot long. Lower spathes 15 inches long; upper club-shaped, smooth, 2-3½ feet long.

Fruit orange-red, ½-⅝ inch long. Seed ½ inch long.

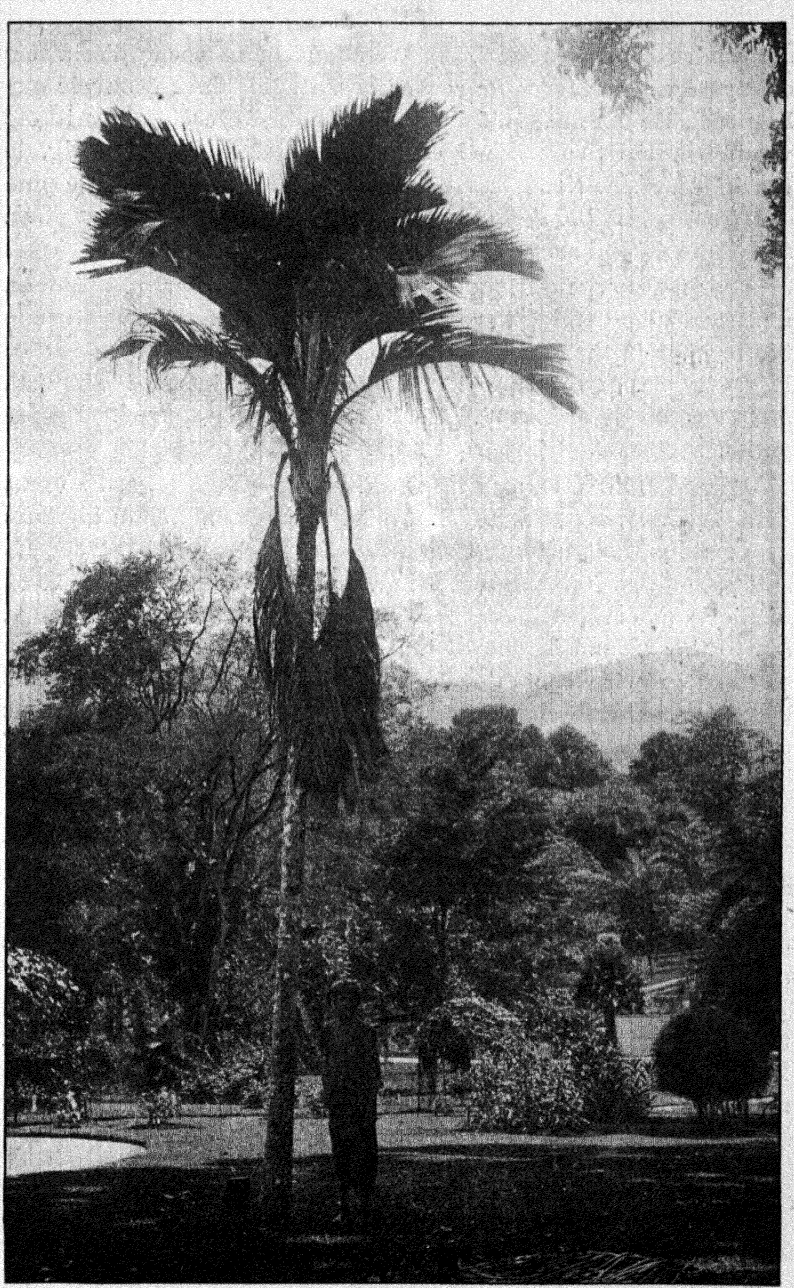
HABITAT.—Seychelles: common in all the islands.

Note: J. B. Balfour wants to retain the name *Stevensonia grandifolia* given to this plant by its discoverer (Duncan), and published by him, though without description. He says: "the name *Phœnicophorium* subsequently given, and invented for the purpose of commemorating the disgraceful fact of a specimen of this palm having been stolen from Kew by a foreign employé, should surely be suppressed." The present laws of nomenclature, however, seem to be in favour of the name given by Wendland.

De Kerchove explains the origin of the name *Phœnicophorium* in this way: "...nous devons rétablir la vérité des faits et révéler la vraie étymologie de ce palmier. M. H. Wendland aurait appelé *Phœnicophorium* (de φοινιξ, dattier, et φώριον, objet volé), par suite d'un vol commis à Kew dans les circonstances suivantes. M. Ambr. Verschaffelt avait, en 1856, introduit à Gand la plante sous le nom d'*Astrocaryum aureo-pictum*. Plus tard, M. Wendland en vit trois pieds cultivés au jardin de Kew sous le nom d'*Areca Sechellarum*. Il voulut en acheter un pour les collections de Herrenhausen. Cette demande ne put être accordée le jour même. Le lendemain, un des pieds avait disparu, et les autorités anglaises ne purent, malgré leurs enquêtes,



Young specimen of Stevensonia (*Phœnicophorium sechellarum* Wendl.), growing on Malabar Hill, Bombay.



Stevensonia (*Phœnicophorium sechellarum* Wendl.), in the Botanic Garden of Peradeniya.

apprendre où il était allé. M. Wendland eut à coeur d'éclaircir ce mystére, et, à force de recherches, il finit par découvrir que la précieuse plante, volée par un employé de Kew, avait été vendue, après avoir passé en diverses mains, à M. Borsig, de Berlin, où M. K. Koch la vit en 1859 et la décrivit sous le nom d'*Astrocaryum Borsigianum.*" De Kerchove de Denterghem. Les Palmiers. Paris, 1878, p. 124-125.

CULTIVATION IN EUROPE.—A noble stove palm. A hot, moisture-laden atmosphere is necessary. If the temperature is too low, or if the air becomes dry, the palm begins to suffer. It grows well in a compost of fibrous peat, pieces of charcoal, and turfy loam and sand. Perfect drainage required. Propagation by means of imported seed.

MYTHOLOGICAL ORIGIN OF *Stevensonia.*—With regard to this palm the natives of the Seychelles narrate that a bird of gigantic proportions took, after the creation, his flight towards the sun and as he was flying too fast he lost one of his feathers. The feather was carried about in space for a long time and, finally, fell to the ground in one of the islands. There it found fertile soil and growing roots developed into a magnificent palm. The leaves of this tree consist of one piece and grow larger towards the top, resembling thus the feather of a gigantic bird of bygone times.

ILLUSTRATION.—Mr. Millard was kind enough to supply us with the photograph of a young specimen of Stevensonia growing in his garden on Malabar Hill. The leaf-sheaths are comparatively very long and covered with long spines. There is only one leaf in our picture which distinctly shows the bifid blade of the plant Plate LXXIX.

Plate LXXX shows a well developed palm of the same species, taken by Mr. Macmillan in the Botanic Garden of Peradeniya. Between and behind the leaves the remains of some old spadices may be seen, whilst in the centre of the crown there is a young spadix still enclosed in its spathes.

9. *ACANTHOPHŒNIX* WENDL. IN FL. DES SERRES, t. 181.

(Etym.: From the Greek 'acantha,' a thorn or prickle, and phœnix,' a palm.)

Balf. f. in Baker Fl. Maurit. 384.—Mart. Hist. Nat. Palm. III, 174, t. 154, 155, fig. 1 (*Areca crinita*) et 176 t. 154, 155, fig. 2 (*A. rubra excl. descript. et ic. fruct.*).—Benth. & Hook. Gen. Pl. III, II, 898, 32.

Palms of moderate height, armed; caudex stout, annulate. Leaves terminal, equally pinnate, with complete, basal, spiny sheaths; midrib grooved on each side above attachment of the pinnæ; pinnæ strongly reduplicate, many-nerved, with scales and fine bristles on the under surface; midvein with a few bristles on the upper surface.

Flowers monoecious in spirally disposed 3-flowered clusters, slightly immersed in the branches of a twice-branching slightly drooping spadix, the female flower below and between two males. Spathes two. Male flowers asymmetrical, trigonous-compressed. Sepals small, orbicular, carinate, imbricate. Petals obliquely ovate or ovate-lanceolate, acuminate, valvate. Stamens 6 or more, exserted, filaments free, elongate, cylindric, acute at the apex, incurved; anthers linear-oblong or globose, dorsifixed, versatile. Pistillode elongate-conical or 2-3-fid. Female flowers smaller, broadly ovate. Sepals ovate-orbicular, concave, broadly imbricate, petals as long as the sepals, orbicular, striate-nervose. Staminodes obscure. Ovary obovoid-oblong, straight, or curved 1-(or 2-3-) locular; stigma subapiculate, ovule parietal, pendulous.

Fruit small, globose or oblong, terete or compressed, stigmas lateral or sub-basilar; mesocarp thin, fibrous; endocarp subcrustaceous. Seed oblong, ascending, laterally slightly compressed; branches of the raphe spreading from the hilum, and anastomosing on the opposite side of the seed; albumen homogeneous; embryo basilar.

SPECIES.—About 4.

DISTRIBUTION.—Mascarene Islands.

Fruit globose... ... ... *A. rubra.*
Fruit oblong-cylindric ... ... *A. nobilis.*

1. **Acanthophœnix rubra** Wendl. in Fl. des Serres XVI, 181; Baker Fl. Maurit. and Seych. 385.—*Areca rubra* Bory Voy. I, 306; Willd. Spec. Pl. IV, 596, n. 9; Poir. Encycl. Suppl. I, 441, n. 10; Spreng. Syst. Veg. II, 139, n. 8; Mart. Hist. Nat. Palm. III, 180 (*excl. descript. fructus*).—*Calamus verschaffeltii* Hort.

NAME.—Palmiste rouge (French). Rote Dornen-Areka (German).

DESCRIPTION.—Stem 60 feet high. Leaf 6-12 feet long; petiole glabrous, 2-4 inches long; leaf-sheath 2½-4½ feet long, thickly covered with long brown-black spines; pinnæ slightly glaucous beneath. (Young plants have dark-green leaves with red veins.)

Spadix 2½-3½ feet long; peduncle 6-10 inches long, like the lower part of the branches armed with straight spines; branches stout, subtended by linear-lanceolate bracts; spathes 1½-2½ feet long, with a few straight spines on the inside near the base. Perianth reddish-brown.

Fruit globose, ½-⅝ inch in diameter, with a prominent ridge extending from the stigma to the base.

HABITAT.—Mauritius, rare, Bourbon. Cultivated in gardens.

CULTIVATION IN EUROPE.—A very elegant stove palm. It requires a light sandy soil and a temperature of 65°—80° in summer, and 55°—65° in winter. Propagation is effected by seeds only, which germinate best in a moist bottom heat, and a well decomposed compost of one part loam, one of peat, one of leaf-mould, and the remainder of sand. They may be left in this soil for two or three years.

2. Acanthophœnix nobilis Benth. & Hook. f. in Gen. Pl. III, II, 398, 32.—*Deckenia nobilis* Wendl. in Gard. Chron. (1870) 561; Balf. f. in Baker Fl. Maurit. 385.

NAMES.—Chou palmiste (French). Vornehme Dornen-Areka (German).

DESCRIPTION.—80-120 feet high, 10-14 inches in diameter. Leaves 9-14 feet long; petiole 1 foot long, pale green, smooth; sheath 3-6 feet long, usually spiny; leaflets hairy beneath, bristly on both surfaces when young; midrib yellow.

Spadix 2-6 feet long, shortly peduncled, slightly amplexicaul; branches very slender, pendulous; peduncle vertically compressed, much thickened at the base. Spathes 2, complete, seldom over 1 foot long, densely covered with flexuose yellow black-tipped spines.

Male flowers: perianth minute, the inner segments ovate, acute, valvate. Stamens 9, connate, equal in length to the inner segments; anthers globose. Pistillode an angular trifid column. Female flowers: segments of perianth imbricate. Stamens represented by a minute toothed cup.



Acanthophœnix nobilis Benth. & Hook. f.

Fruit oblong-cylindric, $\frac{1}{2}$ inch long, $\frac{1}{6}$ inch thick, black. Stigma sub-basilar; mesocarp fibrous; endocarp crustaceous. Seed erect; raphe with 3-5 branches which ascend from the hilum and then spread over the surface; albumen homogeneous; embryo erect, basilar.

HABITAT.—Seychelles.

GARDENING.—*Acanthophœnix nobilis* is an elegant spiny palm with pinnated leaves and linear pointed leaflets, which are gracefully drooping at the point. There is an illustration of this palm in Gard. Chron., 1870, p. 561. The palm had first been called *Deckenia* by Wendland in honour of Baron von der Decken, the African explorer. It should not be confounded with *Deckeria,* a synonym of the American genus *Iriartea.*

ILLUSTRATION.—Plate LXXXI shows a fine specimen of *Acanthophœnix nobilis* Benth. & Hook. f., photographed in a jungle of the Seychelles Islands.

10. *ONCOSPERMA* BL. IN RUMPH. t. 82, 103.

(Etym.: From the Greek 'oncos', a tumour, and 'sperma', seed, alluding to the shape of the seed.)

Mart. Hist. Nat. Palm. III, 112, t. 150, 153, f. 4, 5 (*Areca horrida*).—Meissn. Gen. Pl. 355, Comm. 266 (*Keppleria*).—Griffith Palms Brit. Ind. 157, t. 233 B. C. (*Areca,* sect. *Enoplus*).—Scheff. Ann. Jard. Bot. Buitenz. I, 139, 159, t. 29, f. 3 et t. 30.—Benth. & Hook. Gen. Pl. III, II, 895, 28. Linnæa 39, 186.—Hook. f. Fl. Brit. Ind. VI, 414.

Trunk tall, prickly, stoloniferous or solitary. Leaves terminal, equally pinnatisect, segments equidistant or sub-fasciculate, ensiform, acuminate, entire at the apex; rhachis furfuraceous; sheath elongate.

Spadix short-pedunculate, simply or twice branched, unarmed or aculeate; spathes 2, complete, as long as the spadices, caducous, ensiform, coriaceous, unarmed, or aculeate, the inner one bicristate. Flowers sessile, spirally crowded on the branches, the upper solitary, male, the lower ternate, a female between two males. Male flowers asymmetrical, trigonous, compressed. Sepals small, triangular-rotundate, acute, imbricate at the base. Petals obliquely ovate, acute or acuminate, valvate. Stamens 6-12; filaments short, straight or incurved at the apex; anthers

linear, erect. Pistillode columnar, split at the apex. Female flowers much smaller than the male, obliquely globose. Sepals unequal, rotundate, gibbous at the base, broadly imbricate. Petals slightly longer, orbicular, convolute-imbricate. Staminodes minute, 6. Ovary broadly and obliquely ovoid, 1-or 3-locular, stigmas minute; ovule parietal, pendulous.

Fruit small, globose; stigmas lateral or subbasal; pericarp rumose or subfibrous, endocarp thinly crustaceous. Seed globose or subglobose; raphe broad; albumen deeply ruminate; embryo near the hilum.

SPECIES.—About 6.

DISTRIBUTION.—Tropical Asia.

CULTIVATION IN EUROPE.—Stove Palms. They grow best in a compost of two parts loam, one of peat, and one of sand. A liberal supply of water is required. Propagation is effected by seeds or suckers.

KEY TO THE SPECIES DESCRIBED BELOW.

I. Stem stoloniferous
  1. Stamens 9 ... ... *O. fasciculatum.*
  2. Stamens 6 ... ... *O. filamentosum.*
II. Stem solitary... ... ... *O. horridum.*

* INDIGENOUS SPECIES.

I. **Oncosperma fasciculatum** Thw. Enum. (1864) 328; Hook. Fl. Brit. Ind. VI, 415; Trimen Fl. Ceylon IV, 323; Scheff. in Ann. Jard. Buitenz. I, 160.—*Caryota horrida* Moon Cat. 64 (*non* Willd.).

NAME.—Katu-Kitul (Ceylon).

DESCRIPTION.—Trunk 30-50 feet high, 5-6 inches in diameter, copiously armed with long, flexible, black, compressed spines, base thickened, stoloniferous. Leaves 8 feet long; leaflets 12-18 inches long, 1-1¾ inch broad, fascicled, lanceolate, caudate-acuminate, tips drooping, scurfy beneath; rhachis scurfy; petiole spinous towards the base; sheath 2½ feet, spinous, scurfy.

Spathes sparingly scurfy, unarmed, inner 2-crested. Spadix 2 feet long, unarmed, paniculately branched; peduncle very stout, branches drooping. Male flowers ¼ inch long, densely imbricate; sepals very small; petals acute, striate; stamens 9; filaments short, broad, fleshy; anthers linear. Female flowers

scattered, $\frac{1}{8}$ inch in diameter. Sepals thick, forming a broadly 3-lobed cup; petals hardly longer than the sepals, coriaceous, broader than long.

Fruit globose, $\frac{1}{2}$ inch in diameter, black or purple, like large black currants.

HABITAT.—Ceylon. Steep forests in moist region, 1-5,000 feet; rather common. (Endemic in Ceylon.)

Flowers in February and March.

** INTRODUCED SPECIES.

2. Oncosperma horridum Scheff. in Natuurk. Tijdch. Ned. Ind. XXXII, 189; Ann., Jard. Buitenz. I, 159.—*Areca horrida* Griff. in Calc. Journ. Nat. Hist. V, 455; Palms Brit. Ind. 158, t. 233 C; Mart. Hist. Nat. Palm. III, 312; Hook. Fl. Brit. Ind. VI, 515.—*Areca nibung* Mart. Hist. Nat. Palm. 173, t. 150, f. 4.

NAME.—Bhyass (Malay Peninsula). Bijass-Palme (German).

DESCRIPTION.—Trunk 30-40 feet high, solitary, annulate; spaces between the rings much armed. Crown rather thin. Leaves 14-16 feet long, 5 feet broad, spreading in every direction. Sheaths leathery, 2 feet long, much armed. Petiole bearing leaflets nearly from the base, green, stout, flattened at the base, compressed at the apex, otherwise trigonal, covered with brown irregular scales, armed throughout, but specially underneath, with black-brown flat not very strong spines. Pinnules 2-3 feet long, alternate or sub-opposite, very narrow, subulate-acuminate, coriaceous, dark-green, above keeled along the centre, with 2 lateral plaits on either side, spreading or oblique; a few scales attached by the middle extend along the central vein underneath.

Spathes 2, complete, acutely margined, coriaceous, armed with brown-black spines, outer 1-1½ feet long, of a greenish colour outside when mature, yellow and polished inside, inner cuspidate. Spadix axillary; peduncle stout, yellow, flattened at the base, much armed on the spaces between the insertion of the spathes, above these unarmed; branches 1-2 feet long, pendulous flexuous, about equal, 2 or 3 times branched or simple. Male flowers: sepals 3, imbricate, carinate, submembranous; petals 3, valvate, subulate or almost setaceo-acuminate; stamens 6, sagittate; pistillode rather large of 3, sometimes 2, imperfect carpels. Female flowers: sepals imbricate, roundish-cordate; corolla conical in the bud; staminodes 6; ovary of 1

large complete carpel and 2 incomplete ones; no style; ovule anatropous, parietal.

Fruiting spadix: branches 2-4 feet long, pendulous, without spathes, each suffulted by a coriaceous acuminate broad-based bract; fruit sessile, spherical, ¾-1 inch in diameter, purplish-black, surrounded at the base by the perianth, oblique, the true apex being indicated by a mammilla on one side near the middle; epicarp coriaceous; fibres very few, endocarp membranous, seed round, attached by a broad base, whitish-brown, reticulate with white veins, hilum large; albumen horny, deeply ruminate.

HABITAT.—Malacca; common in densely wooded valleys and ravines, at Ching, and on wooded hills, at Laydang Soobubi, but rare; in woods at the base of Battoo Bakar; Borneo (Griffith); Sumatra.

3. **Oncosperma filamentosum** Bl. Rumphia II, 97, t. 82, 103; Hook. f. Fl. Brit. Ind. VI, 414.—*O. cambodianum* Hance in Journ. Bot. (1876) 261.—*Areca tigillaria* Jack. in Mal. Misc. II, VII, 88; Griff. in Calc. Journ. Nat. Hist. V, 463, et in Palms Brit. Ind. 157, t. 233 B.—*A. nibung* Mart. Hist. Nat. Palm. III, 173, 311, t. 153.—*Areca nibung* Griff. ex. H. Wendl. in Kerch. Palm 231.—*Keppleria tigillaria* Meissn. Gen. (1842) 355.—*Oncosperma tigillaria* Ridley Fl. Singapore in Journ. Asiat. Soc. Straits S. No. 33 (1900) 173.—*Areca spinosa* Hort.

NAMES—English: Nibung Palm. German: Nibungpalme. Jav.: Erang, Handiwung Liwung, Gendiwung. Malay.: Nibong. According to Ridley, the natives of the Malayan Peninsula distinguish several forms under the names of Lenau, Ibas or Ibu and Nibong Padi.

DESCRIPTION.—Stem 30-80 feet high, distinctly annulate, armed with long black spines, stoloniferous. Crown thick, graceful. Leaves pinnate, 10-12 feet long, drooping; petiole roundish, armed, very scurfy upwards; leaflets about 2 feet long, conduplicate at the base, acuminate, pendulous, coriaceous, many-veined, principal keel above excentric, ferruginous scurfy, underneath bearing scales attached by their middle.

Spathes boat-shaped, two-keeled, of a stout texture, outer green, covered here and there with whitish-ferruginous scurf, armed on the back especially about the keels; inner almost unarmed, more scurfy, velvety. Spadices arising from the axils

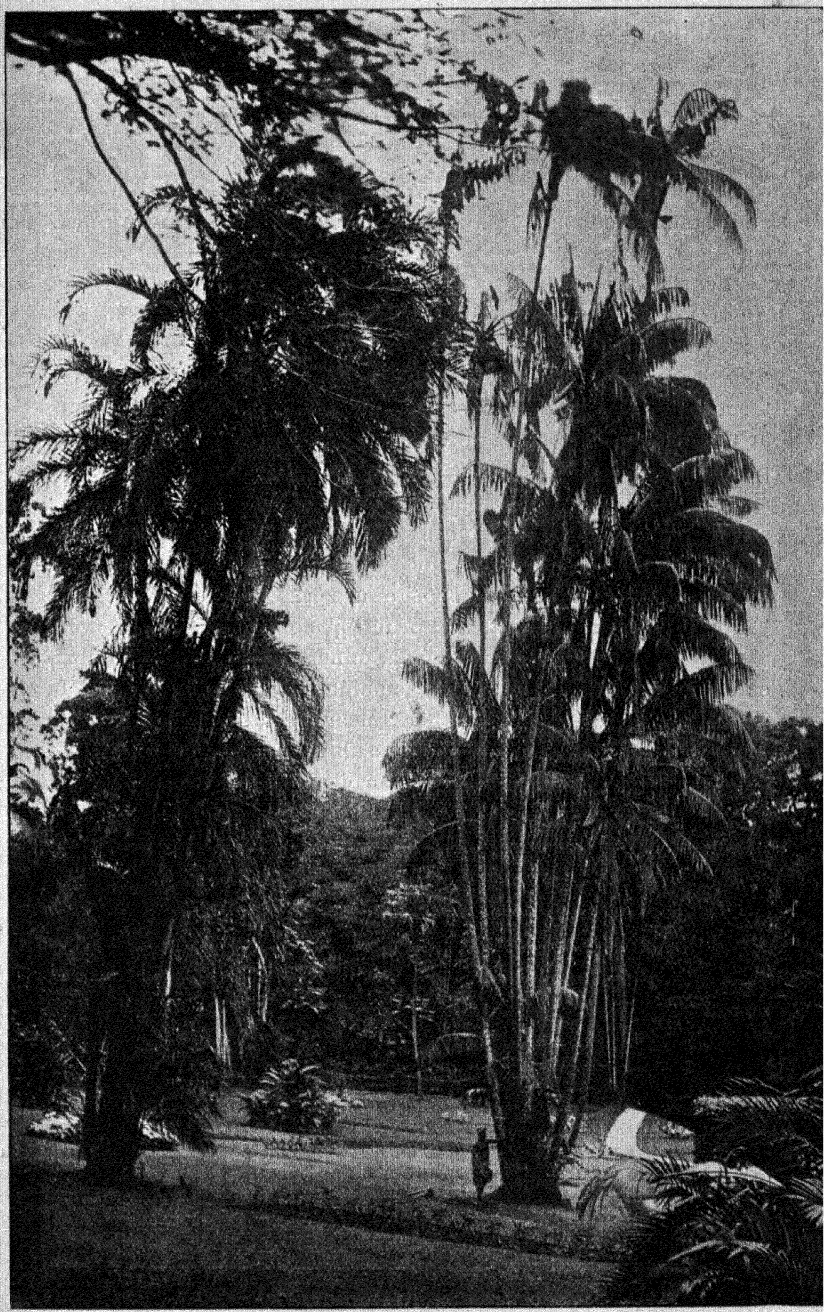
of fallen leaves; peduncle slightly armed; branches many, long, undulato-flexuous, lower ones divided, upper simple. A rudimentary bract at the base of the lower one. Flowers crowded, one female between two males, or in pairs, one male and one female, the former more advanced. Male flowers: sepals subcordate, cuspidate, keeled; petals 3, valvate, coriaceous, suddenly acuminate into subulate bristles, spreading; stamens 6, filaments short, stout, cohering slightly with the petals, anthers large, sagittate, obtuse; pistillode rather large, white, of 3 carpels which are distinct nearly from the base. Female flowers with a broad inconspicuous bract; sepals imbricate, suborbicular, concave, fleshy, coriaceous; petals larger, imbricate; staminodes 3 or none; ovary roundish, of the size of a small pea, 1-celled; style none, stigmas 3, connivent; ovule appense pendulous.

Fruiting spadix: branches 1-2 feet long, pendulous, purplish-sanguineous, with an articulated appearance; berry spherical, surrounded at the base by the perianth, marked towards the apex on one side with an areola, bearing in the centre the remains of the stigmas; endocarp fibrous, thin; seed appense just below the areola; albumen horny, deeply ruminate; embryo oblong-conical, basilar.

HABITAT.—Singapore; Tanglin, Changi; Johor; Malacca; Pringgit and near the town; Cochin China; Borneo. Cultivated in India.

USES.—"The wood of the nibong is used for many purposes, in building for flooring, bridges and such like, also for pig spears. Sharpened spears of it are driven into the ground in Lalang at such an angle that the point is about the level of the breast of the pig. The spears are pointed towards the garden to be protected from the wild pigs and quite concealed in the grass; when the pigs invade the garden the natives startle them by shouts and other noises, the pigs rush out and are impaled on the spears." (Ridley.)

ILLUSTRATION.—Mr. Macmillan has kindly supplied us with the photograph reproduced on Plate LXXXII. The left-hand group consists of *O. fasciculatum* and the one to the right of *O. filamentosum*.



To left: Katu-Kitul (*Oncosperma fasciculatum* Thw.).
To right: Nibung Palm (*Oncosperma filamentosum* Bl.).

11. *HYDRIASTELE* WENDL. & DRUDE IN LINNÆA XXXIX, 180, 190, 208.

(Etym.: From the Greek 'hydria' a water vessel or fountain, and 'stele', a column, in allusion to the tall stems growing near springs.)

Benth. Fl. Austral. VII, 138.—F. Muell. Frag. Phytogr. Austral. VII, 101, 102.—Benth. & Hook. Gen. Pl. III, II, 885, 5.—Bailey Queens. Fl. V, 1673.

Stem straight, high, slender, unarmed, annulate. Leaves terminal, pinnatisect, segments alternate, linear, præmorse-dentate at the apex; rhachis laterally compressed, convex on the back; petiole concave. Spadices shortly and broadly pedunculate, simply branched, branches elongate, pendulous, obtusely quadrate; spathes 2, complete, deciduous; bracts and bracteoles forming an obscure cupule. Flowers monoecious, pale yellow or greenish, disposed in decussately opposite areolæ, three together, the central one female; bracts and bracteoles obsolete. Male flowers asymmetrical, compressed. Sepals minute, acute, scarcely imbricate. Petals ovate-lanceolate, acuminate, valvate. Stamens 6, filaments short, subulate; anthers linear erect, basifixed. Female flowers much smaller than the male, subglobose. Sepals reniform, imbricate. Petals slightly longer, orbicular, convolute-imbricate. Staminodes obsolete. Ovary globose or ovoid; 1-locular, stigmas 3, minute, sessile, patulate, depressed; ovule inserted above the middle of the cell, pendulous.

Drupe small, elliptic, smooth or ribbed; stigmas terminal; pericarp fibrous; endocarp thinly crustaceous. Seed ellipsoidal, erect, free, hilum lateral; albumen equable; embryo basilar.

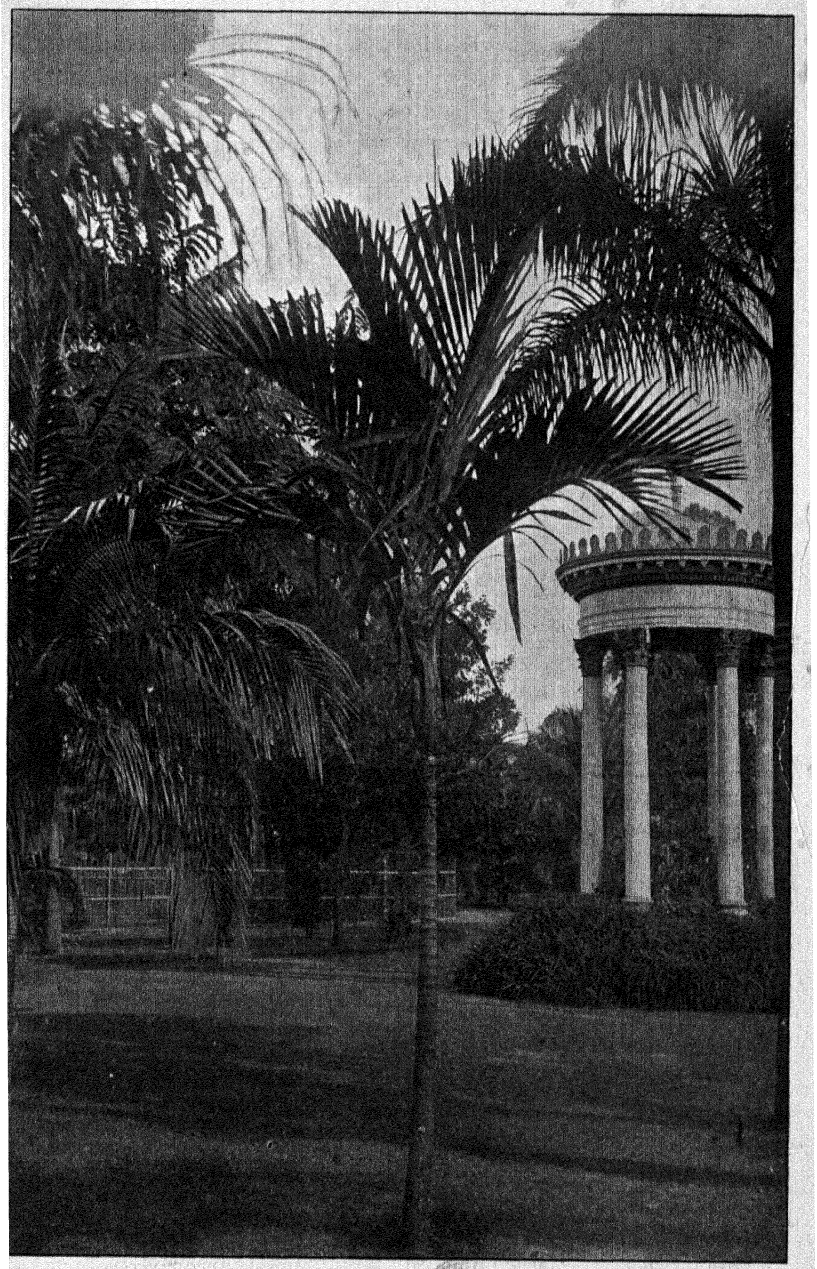
SPECIES—3.

DISTRIBUTION.—Tropical northern coast of Australia.

1. **Hydriastele wendlandiana** Wendl. & Drude in Linnæa XXXIX, 209; Bailey Queens. Fl. V, 1673.—*Kentia Wendlandiana* F. Muell. Fragm. VII, 102; Benth. Fl. Austr. VII, 138.

NAME.—Wendlands Nymphen-Palme (German).

DESCRIPTION.—A tall palm. Leaves many feet long, segments numerous, unequal, the longest 1½ foot long, the upper ones confluent at the base, all or most of them jagged or toothed at the apex.



Hydriastele wendlandiana Wendl. & Drude, in Victoria Gardens, Bombay.

Spadix of numerous slender pendulous spikes of about 1 foot, the common peduncle very short, broad and thick, marked with the scars of the spathe and of two outer bracts, the primary branches very thick, the rhachis of the spikes slender, the notches very little immersed. Female perianth (fruiting) about 2 lines in diameter; the segments all very broad, the inner twice as long as the outer ones.

Fruit ovoid or globular, when dry about 4 lines in diameter and longitudinally striate with prominent ribs, succulent when fresh with a thin endocarp. Seed erect, with an oblong oblique basal hilum, the testa free from the endocarp, the albumen not ruminate.

HABITAT.—N. Australia: Liverpool River, Queensland, Cape York, Cape Sidmouth.

CULTIVATION IN EUROPE.—A stove palm. It grows in a compost of loam and peat, in equal proportions; a little silver sand may be added. They need plenty of pot room, and a liberal supply of water throughout the summer, both at the roots and overhead. The imported seeds germinate quickly in a light sandy soil, if placed on a hotbed; young plants grown from seeds do well in the drawing room. The first leaves are deeply bifid and show already the præmorse-dentate tips.

ILLUSTRATION.—We have to thank Mr. Phipson for the photograph of *Hydriastele wendlandiana*, reproduced on Plate LXXXIII. The specimen may still be seen in Victoria Gardens, Bombay.

12. *RHOPALOSTYLIS* H. WENDL. & DRUDE IN LINNÆA XXXIX, 180, t. 1, f. 2.

(Etym.: From 'rhopalon', a club, and 'stylos', a pillar; alluding to the club-shaped spadix.)

Mart. Hist. Nat. Palm. III, 172, t. 151, 152 (*Areca*) et 312 (*Kentia sapida*).—Hook. f. Fl. Nov. Zel. I, t. 59, 60. (*Areca*).—Drude Bot. Zeitg. 1877, 637, t. 6, f. 18-21.—Bot. Mag. t. 5139, 5735 (*Areca*).—Benth. & Hook. Gen. Pl. III, II, 890, 16.

Unarmed low palms, stem annulate. Leaves terminal, equally pinnatisect; segments numerous, equidistant, narrowly ensiform, acuminate, margins at the base recurved, not thickened; rhachis on the concave side furfuraceous; petiole very short; sheath elongate.

Spadices short, patent, with a very short and stout peduncle; branches subflabellate, dense-flowered; spathes 2, complete, oblong, complanate, the lower one 2-winged; bracts subulate at the apex; bracteoles squamiform. Flowers monœcious on the same infrafoliaceous or fastigiately branched spadix, spirally disposed, ternate with the median one female, or the upper ones solitary and 2-nate male, with bracts and bracteoles. Male flowers asymmetrical, trigonous-compressed. Sepals subulate-lanceolate, scarcely imbricate. Petals obliquely ovate, acuminate, valvate. Stamens 6, filaments subulate-filiform, inflexed at the apex; anthers linear, dorsifixed, versatile. Pistillode columnar. Female flowers smaller than the male, trigonous-globose. Sepals rotundate, concave, broadly imbricate. Petals smaller, scarcely exserted, cochleate at the base, broadly imbricate, suddenly narrowed into triangular valvate tips. Staminodes obsolete. Ovary ovoid, 1-locular; stigma sessile, 3-fid, the trigonous segments erect; ovule parietal.

Fruit ellipsoidal, smooth, umbonate by the terminal stigma; pericarp fibrous; seed ovoid-oblong or ellipsoidal, erect, free, the broad hilum reaching from the base to the apex; albumen equable; embryo basilar.

SPECIES—2.

DISTRIBUTION.—New Zealand, Norfolk Island.—The following grown in Indian gardens:

Flowers purplish lilac, drupe oblong ... ... *R. sapida.*
Flowers white, drupe globose ... ... *R. baueri.*

1. **Rhopalostylis sapida** H. Wendl. & Drude in Kerch. Palm. 255; Cheesman New Zeal. Fl. 740.—*Kentia sapida* Mart. Hist. Nat. Palm. III, 312; Drude Palmæ in Nat. Pflanzenf. II, 3, 73.—*Areca sapida* Soland. ex Forst. Plant. escul. 66; Ferd. Bauer Illustr. plant. Norfolk t. 179, 180, 202, 203, in Museo Caes. Vindobon. asservatæ; Mart. Hist. Nat. Palm. III, 172, t. 151, 152; A. Rich. Fl. Nouv. Zel. 157. A. Cunn. Precur. n. 298; Hook. f. Fl. Nov. Zel. I, 262, t. 59, 60; Handb. N. Z. Fl. 288; Bot. Mag. t. 5139.—*Areca banksii* Allan Cunn. MS.

NAME.—Nikau Palm (English); Schmackhafte Nikau Palme (German).

DESCRIPTION.—Stem rather slender, smooth, 10-25 feet high, 6-9 inches in diameter, rarely more. Leaves 4-8 feet long; rhachis clothed with copious lepidote scales; leaflets very numerous, 2-3 feet long or more, 1-2 inches broad, linear-ensi-

form; midrib and main veins covered with lepidote scales; margins replicate at the base.

Spadix 1-2 feet long, much and closely branched, glabrous; spathes 2 or 3. Flowers very densely crowded, purplish-lilac. Drupe ½ inch long, elliptic-oblong, bright-red.

HABITAT.—New Zealand. North Island, abundant in forests throughout; South Island, in low land districts not far from the coast as far south as Banks Peninsula and Hokitika, rare and local; Chatham Islands, sea-level to 2,000 feet. (The Nikau-palm is the most southern member of its order.)

FLOWERS.—From January to April.

USES.—The unexpanded central bud and the very young spadix are both edible, and were formerly eaten by the Maoris, and even by European settlers.

2. **Rhopalostylis baueri** H. Wendl. & Drude in Bot. Zeitg. XXXV (1877) 638; Cheesem. New Zeal. Fl. 740.— *Kentia baueri* Seem. Fl. Vit. 269; Cheesem. in Trans. N. Z. Inst. XX (1888) 174.—*Areca baueri* Hook. f. in Illustr. Hist. XV (1868) 575; Bot. Mag. t. 5735.—*Areca sapida* Endl. Prodr. Fl. Norfolkicæ 26 (not of Soland).—*Seaforthia robusta* Rollis ex Salomon, Die Palmen.

NAME.—Norfolk Betel Palm (English); Bauers Nikau Palme (German).

DESCRIPTION.—Larger and stouter than the foregoing species, sometimes attaining a height of 50 feet and a diameter of over 12 inches. Leaves larger and more numerous, 6-9 feet long, pinnate; rhachis beneath, costa and nerves at back of the pinnules sparingly clothed with furfuraceous scales. Pinnules close-set, two feet long, 1½ inch broad, stiff, acuminate, usually 3-nerved, ribbed and plaited; rhachis triangular towards the base, convex above.

Spathes 8-10 inches long, white, narrow-oblong, acuminate, flat at the back, 3-4 inches across. Spadix axillary, but, owing to the falling away of the leaf as soon as the spathe is ready to open and the flowers are fully formed, only flowering when infra-axillary, horizontally patent from the stem, 1-3 feet long, sparingly branched; branches stout, divaricating, white in flower, green in fruit. Flowers crowded, white, nearly ½ inch when expanded. Outer perianth-segments broadly ovate in the female, narrower in the male, inner oblong, acute.

Drupe nearly globose, ½-¾ inch in diameter, scarlet, shining.

HABITAT.—Kermadec Islands: Sunday Island, abundant from sea-level to the tops of the hills (1,500 feet). Originally discovered in Norfolk Island.

CULTIVATION IN EUROPE.—This and the foregoing species are ornamental stove-palms. They thrive well in a compost of loam and peat, in equal proportions, to which a little silver sand may be added. Plenty of pot room, and a liberal supply of water, both at the roots and overhead, are essential. The seeds germinate quickly in a light sandy soil, when placed on a hotbed. These palms are liable to be attacked by Red Spider or Thrips; in that case the plants must be sponged with soapy water.

Dammer says that *R. baueri* and *R. sapida* are hardy drawing-room palms which are best kept cool in winter. *R. baueri* sometimes stands several degrees of frost on the Riviera. In its original home *R. sapida* is, for some time of the year, exposed to frost and snow without taking harm. Salomon has observed that in winter this palm thrives much better at 42-46° F. than in a higher or lower temperature. Care should be taken, however, not to place the palm too far away from the light. In summer the plant will do well in the open garden.

To distinguish *R. baueri* from *R. sapida* the following points of difference should be noted:

R. baueri.	*R. sapida.*
Greater height and longer leaves.	
Leaflets of the regularly pinnate leaves more horizontal and, compared with their length, broader than those of *R. sapida.*	Leaflets more erect and comparatively narrower.
	Leaves more reflexed at the top than in *R. baueri.*
Flowers white.	Flowers purplish-lilac.
Fruits scarlet and more spherical.	Fruits bright red, elliptic-oblong.

13. *CYRTOSTACHYS* BL. RUMPH. II, 101, t. 120.

(From the Greek 'cyrtos', curved, bent, and 'stachys', a spike; in allusion to the curved spikes of flowers.)

Mart. Hist. Nat. Palm. 316.—Kunth Enum. Pl. III, 641. (*Bentinckia*).—Walp. Ann. III, 647.—Miq. Fl. Ind. Bat. Suppl. 589 (*Areca erythropoda*).—Scheff. Ann. Jard. Bot. Buitenz. 138, 159.—Benth. & Hook. Gen. Pl. III, II, 892, 20.

Stems slender, caespitose, annulate. Leaves pinnatisect; leaflets linear-lanceolate, acuminate, unicostate.

Spathes 2, complete, caducous. Spadix intrafoliar, shortly peduncled, broadly paniculately branched; branches 1-2 feet long, stout, spreading; flowers in spirally disposed clusters of ♂, a female between 2 males.

Male flowers symmetrical; sepals orbicular, imbricate; petals valvate; stamens 12-15, exserted; anthers short, versatile; pistillode bifid. Female flowers: sepals orbicular; petals longer broadly imbricate, tips valvate; staminodes forming a membranous cup; ovary narrowly ovoid; stigmas subulate; ovule pendulous from the top of the cell.

Fruit small, ovoid; stigma terminal. Seed adherent to the endocarp, globose; hilum apical; albumen equable; embryo basilar.

SPECIES.—About 3.

DISTRIBUTION.—Malayan.

KEY TO THE SPECIES DESCRIBED BELOW.

1. Fruit not abruptly constricted, seed ovoid *C. lakka.*
2. Fruit abruptly constricted, seed round ... *C. rendah.*

1. **Cyrtostachys lakka** Becc. Ann. Jard. Buitenz. II, 141; Hook. Fl. Brit. Ind. VI, 414.— *C. lakka*, var. *singaporensis* Becc. l. c.; Ridley Mat. Fl. Malay. Penin. II, 149.

NAMES.—English: Sealing wax Palm. German: Gruben Rendapalme. Malayan: Pinang Rajah.

DESCRIPTION.—A slender tall soboliferous palm; stem 12-15 feet high, 3 inches in diameter, olive-green, smooth except for the node, internodes 6 inches long. Leaves 4-5 feet long, erect, pinnate; petiole 6 inches long, red; sheath 2 feet long, red; leaflets linear with long points, about 25 pairs, dark-green above, glaucous beneath, 18 inches long, 1½ inch wide; rhachis red.

Spadix long, deflexed, green, finally red, with about 25 branches. Spathes broad-oblong, curved. Flowers spirally arranged, 1 female between 2 males. Male flowers: Sepals ovate, green,



Sealing wax Palm (*Cyrtostachys rendah* Bl.), in the Botanic Garden of Peradeniya.

edged red; petals longer, ovate, green, stamens 11 (12 or 15); filaments slender, bases adnate to the pistillode, longer than the petals, white; anthers small, oblong; pistillode thick; styles 3, base thickened and narrowed upwards, shorter than the stamens. Female flowers: sepals broadly rounded; petals ovate, much larger, green; ovary globose; stigmas short, thick, recurved, brown.

Drupe small, obovoid, $\frac{2}{5}$ inch long by about $\frac{1}{5}$ inch in diameter, black, base scarlet; pulp thin. Seed ovoid, $\frac{1}{4}$ inch long; albumen equable; embryo basilar.

HABITAT.—Singapore: Kranji, Jurong; Pahang: near Pekan; Selangor: Klang; Perak: Teluk Anson (ex Ridley); Borneo.

Cultivated in India.

NOTE.—*C. lakka* is very near the next species, *C. rendah*, which has an ovoid fruit abruptly constricted and a globose seed.

2. **Cyrtostachys rendah** Bl. Rumph. II, 101, t. 120; Kth. Enum. Pl. III, 641; Sheff. in Ann. Jard. Bot. Buit. I, 126, 159; H. Wendl. in Kerch. Palm. 242; List of Palms in Kew Rep. 1882 (1884) 55.—*Bentinckia renda* Mart. Hist. Nat. Palm. III, 316; Miquel Fl. Ind. Bat. III, 42 et Prodr. Fl. Sum. 254; Walp. Ann. III, 467, V, 812.—*Areca erythropoda* Miq. in Journ. bot. neerl. I, 6, et Prodr. Fl. Sum. 253, et 589.—*Ptychosperma coccinea* Hort. Lugd. Bat. Cat. pl. hort. bot. Bog. (1866) 69; Miq. De Palm. 24.—*Pinanga purpurea* Hort. Bog. in Miq. Prodr. Fl. Sum. 590.

NAMES.—Pinang rimbou, Pinang rendah or rende, Pinang Lempianw (Sumatra); Sealing-wax Palm (English); Rotstæmmige Renda-Palme (German).

DESCRIPTION.—A gregarious palm. Stem above 30 feet high, graceful, smooth, annulate. Leaves 5-6 feet long (excluding the leaf-sheath), decrescent-pinnatisect; petiole about 6 inches long. Segments narrow-lanceolate, the longer ones 28 inches long, 2 inches broad, acuminate; the terminal segments shorter, bidentate or shortly bifid, or subobtuse.

Spathes: 2 complete, 2 incomplete. Flowers crowded, 1 female between 2 males. Stamens 12-15. Ovary unilocular, 1-ovuled, sometimes the rudiments of a second or third loculus are found; ovule pendulous from the tip of the cell; stigmas subulate.

Fruit ovoid, at the apex abruptly apiculate, $\frac{2}{5}$ inch long, $\frac{1}{4}$ inch broad. Seed round, about $\frac{1}{5}$ inch in diameter, adherent to the endocarp; hilum apical; albumen equable; embryo basilar.

HABITAT.—Sumatra.

CULTIVATION IN EUROPE.—This and the foregoing species are stove-palms. They grow in a compost of loam, peat, and leaf soil, in equal parts, with a liberal addition of sand. When they are fully grown, they prefer about two-thirds of loam and some rotten cow-manure. The seeds germinate in a compost similar to the one mentioned, when they are placed in a moist gentle heat.

ILLUSTRATION.—Plate LXXXIV shows a fine tuft of Sealing-wax palms (*Cyrtostachys rendah*) in the Botanic Gardens of Peradeniya. The photograph was taken by Mr. Macmillan.

14. *PTYCHOSPERMA* LABILL. IN MEM. INST. PARIS IX (1808) 253.

(Etym.: From the Greek 'ptyche', a fold or winding, and 'sperma', seed; alluding to the ruminated albumen.)

R. Br. Prod. 267 (*Seaforthia*).—Mart. Hist. Nat. Palm. III, 182, t. 128, 129.—Benth. Fl. Austr. VII, 141 (*Ptychosperma* sp. n. 4).—Seem. Fl. Vit. 272, t. 82.—Scheff. Ann. Jard. Buitenz. I, 120, 135, 154.—Wendl. & Drude in Linn. XXXIX, 183, 215.—Becc. Males. I, 47, 99 (*excl. sp.*).—Benth. & Hook. Gen. Pl. III, II, 891, 18.

Stem erect, slender, high, unarmed. Leaves terminal, equally pinnatisect; segments linear or from the base towards the apex dilate, præmorse, membranous, many-nerved, thickened on the margin, recurved at the base, the terminal ones confluent; rhachis trigonous, thin; sheath elongate.

Spadix paniculately branched; spathes 2, complete, caducous; bracts and bracteoles squamiform. Flowers monoecious, spirally arranged, ternate, the median one female, or the upper ones solitary and 2-nate male, all with bracts and bracteoles. Male flowers symmetrical, ovoid or oblong. Sepals orbicular, carinate on the back, gibbous or rotundate, broadly imbricate. Petals ovate or oblong, acute, valvate. Stamens 20-30, fasciculate, filaments short or elongate; anthers oblong or linear, attached on the back or towards the base, versatile. Pistillode styliform. Female flowers often smaller than the male, subglobose. Sepals reniform or orbicular, broadly imbricate. Petals slightly longer, orbicular, convolute-imbricate, at the apex valvate or subvalvate. Staminodes 3 or more, minute.

Ovary oblong or ovoid; stigmas 3, short, sessile; ovule parietal, pendulous.

Fruit ovoid or ellipsoidal, sometimes rostrate, terete or sulcate, 1-locular; stigmas terminal; pericarp thick, fibrous; endocarp thin or crustaceous and smooth; seed erect, ovoid or oblong, terete or deeply 5-sulcate; hilum reaching from the base to the top; branches of raphe obliquely descending; albumen more or less ruminate; embryo basilar.

SPECIES.—About 17.

DISTRIBUTION.—Malay Archipelago, New Guinea, tropical Australia, islands of the Pacific Ocean.

CULTIVATION IN EUROPE.—Elegant stove-palms. They grow best in fibrous loam, leaf mould and sand. Perfect drainage and a liberal supply of water are essential. Propagation is effected by seeds.

1. **Ptychosperma elegans** Bl. Rumph. II, 118; H. Wendl. in Bot. Zeit. (1858) 346; H. Wendl. et Drude in Linnæa XXXIX, 215; Scheffer in Ann. Jard. Bot. Buit. I, 121, 122, 154; Benth. Fl. Austr. VII, 141; F. V. Muell. Fragm. VIII, 222, et Syst. Cens. Austr. Pl. 120; Becc. in Bull. Soc. tosc. ort. 1883, 108; H. Wendl. in Kerch. Palm. 254; Becc. Illustr. di alc. Palme nel Giard. Bot. di Buit. in Ann. Jard. Bot. Buit. II, 87; Bot. Mag. 7345. — *Ptychosperma seaforthia* Miq. Fl. Ind. Bat. III, 21. (*non* Scheffer); B. Seem. in Journ. of Bot. I, 68.—*Seaforthia elegans* R. Br. Prodr. Fl. Nov. Holl. (1810) 267; Hook. Bot. Mag. t. 4961 (*tantum quoad* fig. 9, 10, 11); Spreng. Syst. Veg. II, 623; Mart. Hist. Nat. Palm. III, 181, 313, t. 105, 106, 109; Kth. Enum. Pl. III, 189.—Walp. Ann. III, 462, V. 809.[1]

NAME.—Zierliche Faltennusspalme (German).

DESCRIPTION.—A rather slender palm. Leaves 6½ feet long, recurved, regularly pinnatisect; rhachis semi-lunar in cross section; leaflets 2 feet long, 1-3 inches broad, linear, tip very obliquely truncate and toothed, bright green, paler beneath; sheath 18-24 inches long, 6-7 inches broad.

Spadix 12-18 inches long, inserted below the leaves, very shortly peduncled, broadly triangular, repeatedly divided into strict branchlets; peduncle compressed; branchlets slender, terete. Flowers sessile, ternate, a female between 2 males, protandrous; towards the end of the branchlets glomerules of 2 male flowers only, and close to the apex single male flowers

[1] We include also those species on which Beccari (Ann. Jard. Buitenz. II, 1991) founded the new genera *Balaka*, *Coleospadix* and *Normanbya*.—See also Webbia I (1905) 299-302.

are developed. Male flowers regular, elongate, obtuse, ½ inch in diameter; sepals orbicular; petals oblong, obtuse; stamens 25-30, exserted during the time of flowering; filaments erect; anthers versatile, deeply bifid at the base, bilobed-obtuse at the apex, broadly linear; pistillode well developed, ovate at the base, attenuate into the filiform style, about as long as the stamens. Female flowers globose-oval or ovate-conical, very small; sepals and petals largely imbricate; staminodes 3-6, dentiform minute, some being sometimes larger than the rest; ovary ovate, attenuate at the apex, not perfectly symmetrical, 1-celled; stigmas 3, triangular, acute; ovule parietal, marked with 5 distinct depressions which represent the furrows of the ripe seed.

Fruit seated on the aurescent calyx, ¾ inch long, oblong, crowned with the stigmas; pericarp fleshy; mesocarp finely fibrous; endocarp finely membranous, strongly adherent to the seed. Seed globose, with 3 deep longitudinal furrows, and 2 more superficial ones; albumen much ruminate; embryo basilar.

Habitat.—Northern and Eastern Coasts of tropical Australia, and some of its outlying islands, from Sandy Island in lat. 25° S. to Cape York in lat. 11° N.

This palm was discovered by Sir Joseph Banks during Cook's first voyage in 1770, at the mouth of the Endeavour River.

Uses.—In Queensland the stems are used for the rails of fences. The small stems used sometimes go under the name of "Moreton Bay Canes". The leaves are used by the aborigines for water baskets (Maiden).

15. *LOXOCOCCUS* WENDL. & DRUDE IN LINN. XXXIX (1875) 185.

(From the Greek 'loxos', oblique, and 'coccos', kernel, berry.) Bot. Mag. t. 6358.—Benth. & Hook. Gen. Pl. III, II, 888, 13.

Trunk tall, erect, cylindric, annulate; leaves pinnatisect, leaflets linear, obliquely truncate, reduplicate-plicate.

Spathes 2, cymbiform. Spadix infrafoliar, monoecious, branched. Flowers ternate, mostly in clusters of a female between 2 males spirally arranged round the branches. Male flowers: sepals 3, orbicular, imbricate; petals 3, much larger, ovate, valvate; stamens 9-12; filaments very short; anthers subversatile, pistillode minute, ovoid. Female flowers smaller than the male,

subglobose; sepals orbicular, broadly imbricate, persistent; petals ovate, broadly imbricate, tips valvate, staminodes obsolete; ovary 1-celled, stigmas 3, minute, ovule parietal.

Fruit subglobose, cuspidately beaked; stigmas terminal; endosperm ruminate; embryo subbasilar.

SPECIES.—1. Endemic in Ceylon.

1. **Loxococcus rupicola** Wendl. & Drude in Linnæa XXXIX (1875) 185; Hook. f. in Bot. Mag. t. 6358.—*Ptychosperma rupicola* Thw. Enum. 328, C. P. 2732.—*Caryota mitis* (?) Moon Cat. 64.—*Kentia rupicola* Bull. ex Salomon 78.

NAMES.—Dotalu (Ceylon); Felsen-Krummnuss (German).

DESCRIPTION.—Trunk 30-40 feet high, 4-5 inches in diameter, dull green, base swollen, soboliferous. Leaves about 10, 6-8 feet long, 3-4 feet broad, spreading; petiole 1-1½ foot long with a short green sheathing base; leaflets 12-20 pairs, rather distant, spreading and decurved, sessile, linear, tip obliquely truncate and notched, bright green above, glaucous and sparsely furfuraceous beneath, terminal one or two pairs confluent.

Lower spathe 12 inches long, narrowly cymbiform, coriaceous, pale-brown, dotted with peltate furfuraceous scales. Spadix 12 inches long, triangular in outline, coral red, quite smooth; peduncle short, stout, annulate; branches erecto-patent. Flowers blood-red, male flowers about ½ inch in diameter; filaments stout, equalling the linear anthers, pistillode minute, trifid. Female flowers ovoid; ovary obliquely ovoid; ovule pendulous.

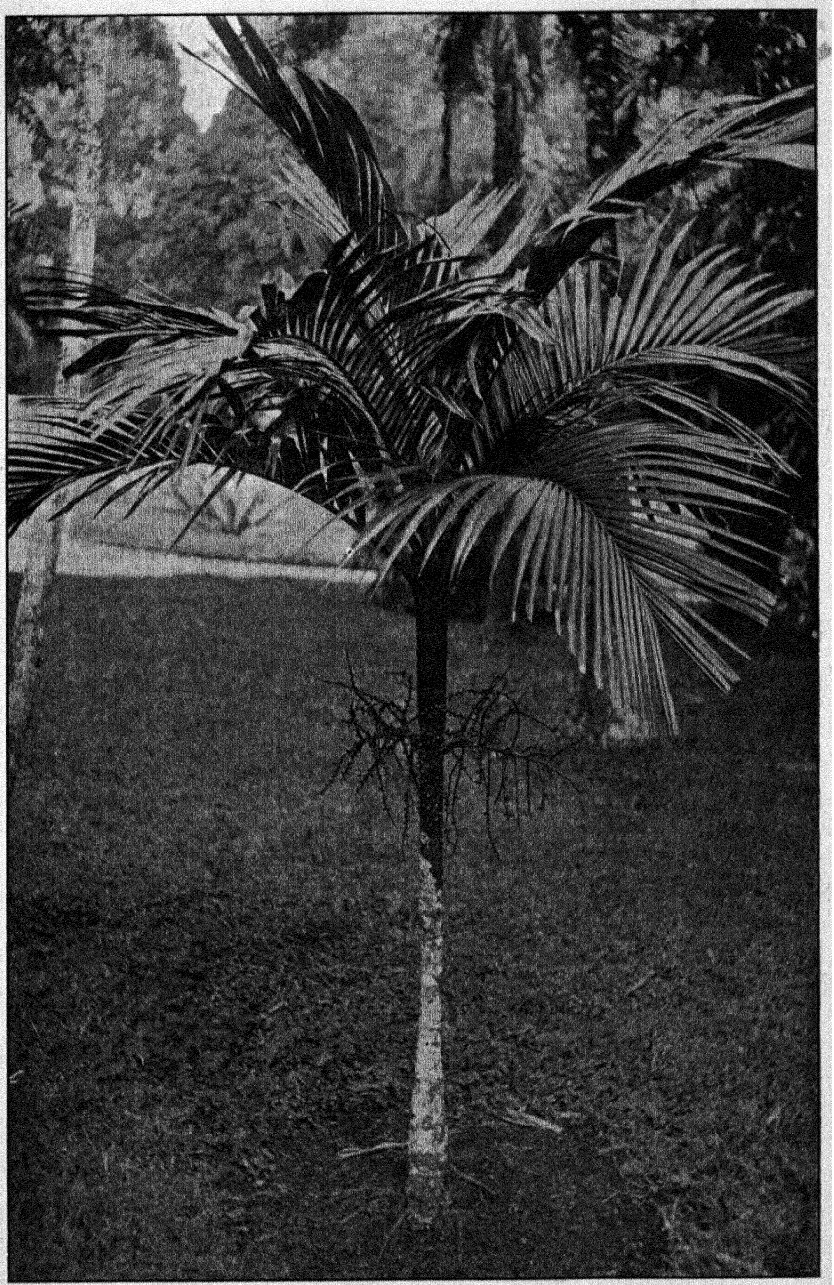
Fruit about ¾ inch in diameter, smooth, blood-red; sarcocarp fibrous.

HABITAT.—On cliffs and rocks in the moist region of Ceylon, from 1,000-5,000 feet; rather common.

FLOWERS in February.

USES.—The seed is used for mastication with betel, like that of the Arecas.

CULTIVATION IN EUROPE.—An elegant stove-palm. It thrives in a compost of loam, peat, and leaf soil, in equal parts, with a liberal addition of sand. When it is fully grown, loam should constitute about two-thirds of the compost; some rotten cow-manure may be added. Propagated by seeds. These require a compost similar to the one mentioned and must be put in a moist gentle heat.



Loxococcus rupicola Wendl. & Dr., in the Botanic Garden of Peradeniya.

This is a most attractive palm from its graceful habit and its coral-like inflorescence. Seeds of this plant were sent to Kew by Dr. Thwaites, Director of the Botanical Gardens of Peradeniya and it flowered for the first time in the Victoria House at Kew in February 1878.

ILLUSTRATION.—We reproduce on Plate LXXXV the photograph of a young specimen of *Loxococcus rupicola* from the Botanic Garden of Peradeniya. The photograph was taken by Mr. Macmillan.

16. *ACTINORHYTIS* WENDL. & Dr. IN LINN. XXXIX (1875) 184.

(From the Greek 'actis', ray, and 'rhytis', a fold.)

Bl. Rumph. II, 68, t. 100, fig. 2 (*Areca*)—Mart. Hist. Nat. Palm. III, 313 (*Seaforthia*)—Miq. Fl. Ind. Bat. III, 20 (*Ptychosperma*). —Scheff. Ann. Jard. Bot. Buitenz. I, 122, 136, 156, t. 22, 23.—Griff. Palms Brit. Ind. 150, t. 230 B.—Benth. & Hook. Gen. Pl. III, II, 889, 14.

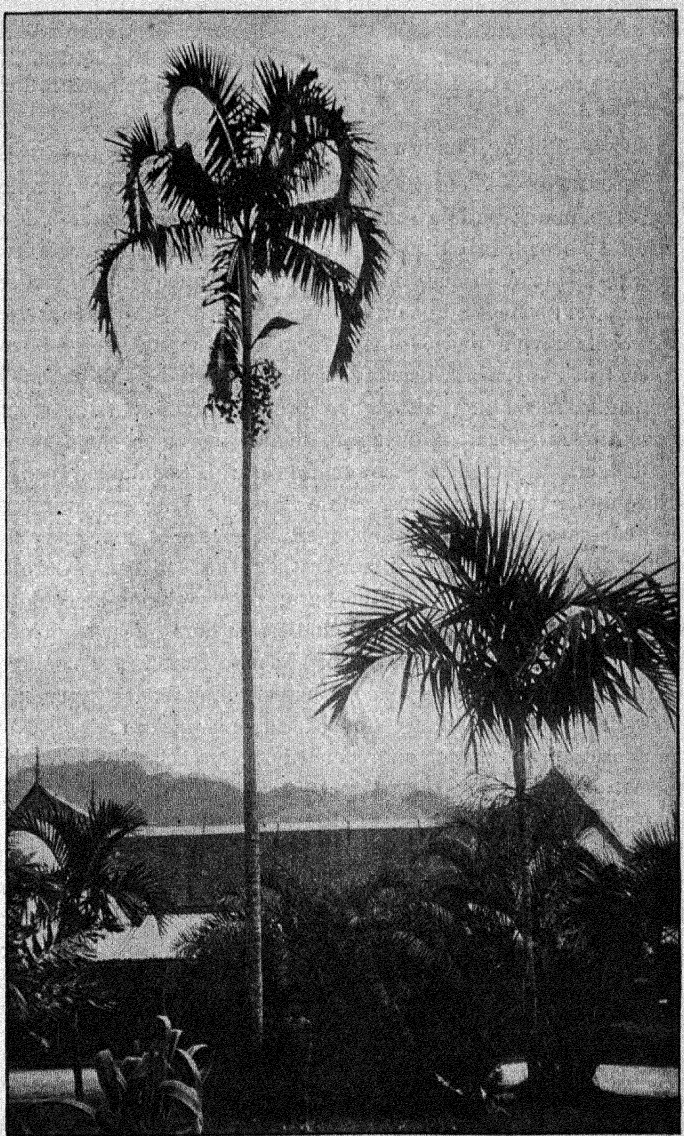
High slender columnar unarmed palms, strongly annulate. Leaves terminal, equally pinnatisect; segments linear-lanceolate, acute, obliquely dentate at the apex, thickened on the margins, recurved at the base; rhachis and plano-convex petiole furfuraceous.

Spadix short-pedunculate with flexuose pendulous branches; spathes 2, complete, complanate, caducous, the lower one elongate, 2-cristate. Flowers monoecious on the same infrafoliaceous spadix, the lower ones ternate with the median one female, or the upper ones male, solitary and binate, all with bracts and bracteoles. Male flowers minute, asymmetrical. Sepals orbicular, compressed-carinate, concave, broadly imbricate. Petals 3, ovate, thickly coriaceous, subequal, valvate. Stamens 24-30. Female flowers much larger, ovoid. Sepals 3, reniform rotundate, broadly imbricate. Petals slightly longer.

Fruit large, roundish-elliptic; remains of stigma vertical; pericarp thick fibrous. Seed large, round, or elliptic; raphe densely branched; albumen ruminate.

SPECIES.—1.

DISTRIBUTION.—Malay Archipelago.



Calappa Palm (*Actinorhytis calapparia* W. & Dr.), growing in the Botanic Garden of Peradeniya.

1. **Actinorhytis calapparia** W. & Dr. in Linnæa XXXIX (1875) 184.—*Pinanga calapparia* Rumph. Amb. I, 28; Valent. Amb. III, 185.—*Areca calapparia* Bl. Rumph. II, 68, t. 100, fig. 2.—*Seaforthia calapparia* Mart. Hist. Nat. Palm. III, 313.—*Ptychosperma calapparia* Miq. Fl. Bat. III, 20.—*Areca cocoides* Griff. Calc. Journ. Nat. Hist. V, 454; Palms Brit. Ind. 150, t. 230 B.

NAME.—Pinang Punowun (Malay); Calappa Palm (English).

DESCRIPTION.—Stem 40 feet high; crown dark green, ample. Leaves pinnate; petiole scurfy, plano-convex; lamina 8-9 feet long, 4-4½ broad, in outline lanceolate-acuminate; pinnæ 2 feet long, 1¼-1½ inches broad, linear, acuminate, unequally bipartite, shining, very smooth, uppermost inequilateral, sub-erose at the top; central vein and 5 others forming as many keels above, the central underneath bearing scales attached by the base.

Spadix ascending, altogether green, branches stiff, stout, above flexuose-torulose owing to niches in which the flowers are lodged. Spathes 2. Lower flowers: 1 female between 2 males, upper males in pairs. Male flowers small; sepals imbricate, carinate, hard, much shorter than the corolla, margins submembranous, denticulate, inner rather the longest. Corolla valvate, hard, tripartite to the base; petals oblong-lanceolate, sub-obtuse. Stamens 24-30, in bundles, anthers linear-sagittate, pistillode small, subulate or none. Female flowers: sepals and petals imbricate with very broad bases. Staminodes 3 or none. Ovary large, white, oblong, 1-celled, sub-compressed, divided at the apex into 3 cuneate, subrecurved lobes, each with a line of stigmatic tissue along the central line of the inner face; ovule 1, attached nearly along its whole length.

Fruiting spadix spreading; branches angular, thickened at the base. Fruit pendulous from its weight, ovate, size of a duck's egg, surrounded at the base by the perianth, at the apex presenting the 3 styles; colour orange-yellow; pericarp thick, firm, of yellow cellular tissue and longitudinal fibres, which are more numerous towards the putamen. Putamen thin, hard, crustaceous. Seed 1, erect; tegument thin, shining, light brown; albumen densely horny, much ruminate; embryo basilar.

HABITAT.—Malay Archipelago.

ILLUSTRATION.—Plate LXXXVI shows a fully developed specimen of the Calappa palm growing in the Botanic Garden of Peradeniya. At the base of the leaf-sheaths an unexpanded

spadix may be seen whilst a little lower down at least four fruiting spadices are visible. The photograph was taken by Mr. Macmillan.

17. *PTYCHORAPHIS* BECC. MALES. I, 53.

(From the Greek 'ptychos,' folded, wrinkled, and 'raphis,' needle, pin.)

Becc. Ann. Jard. Bot. Buit. II, 90; Males. III, 109; Webbia I (1905) 327.

Stem slender, annulate. Leaves pinnatisect; leaflets narrow, caudate-acuminate.

Spathes 2, complete, caducous. Spadix infrafoliar, paniculately branched. Flowers spirally disposed, male only towards the tips of the branches, a female between 2 males towards the base. Male flowers symmetric; sepals suborbicular; petals valvate; stamens 6; anthers versatile; pistillode conical or columnar. Female flowers bibracteolate; sepals rounded, concave; petals longer, tips valvate; stamens 4-6; ovary ovoid; stigmas 3, triangular, acute; ovule parietal.

Fruit small, ovoid; stigmas terminal. Seed ovoid, obtuse, deeply grooved along the long, linear hilum; albumen deeply ruminate; embryo basilar, oblong.

SPECIES.—3.—Malayan.

Leaflets 2-3 feet long ... ... *P. augusta.*
Leaflets about 1 foot long ... ... *P. singaporensis.*

1. Ptychoraphis augusta Becc. in Ann. Jard. Bot. Buitenz. II, 90; Males. III, 110.—*Areca augusta* Kurz. in Journ. Bot. (1875) 331, t. 170.

DESCRIPTION.—Trunk very tall, 80-100 feet high, 1 foot in diameter. Leaves 8-12 feet long; leaflets numerous, 2-3 feet long, sessile, narrowly linear, acuminate, 3-costate; petiole very short; rhachis flat above, furfuraceously tomentose.

Spadix decompound, 2½-3½ feet long. Male flowers: bracts broad, smooth; sepals broadly ovate; petals oblong, obtuse. Female flowers: sepals and petals nearly alike, concave, imbricate.

Fruit 1 inch long, elliptic-oblong, scarlet. Seed oblong.

HABITAT.—Nicobar Islands, frequent, in woods in Kamorta.

ILLUSTRATION.—We reproduce on Plate LXXXVII a middle-sized specimen of *Ptychoraphis augusta.*



Ptychoraphis augusta Becc.

The right side of the background is occupied by a grove of Coconut palms. We have to thank Col. Gage for the photograph.

2. **Ptychoraphis singaporensis** Becc. in Ann. Jard. Bot. Buitenz. II, 90, t. 196; Males. III, 109; Hook. Fl. Brit. Ind. VI, 413; Ridley Fl. Malay Penins. II, 148.—*Ptychosperma singaporensis* Becc. Males. I, 61.—*Rhopaloblaste singaporensis* Hook. f. in Gen. Pl. III, 892.—*Drymophloeus singaporensis* Hook. f. Kew Gard. Rep. (1882) 1884, 55.

NAMES.—In Singapore: Rintin, Kerintin. German: Singapore-Runzel-Areka.

DESCRIPTION.—Stem slender, 6-12 feet high, 1½ inch in diameter, soboliferous, black, ringed.

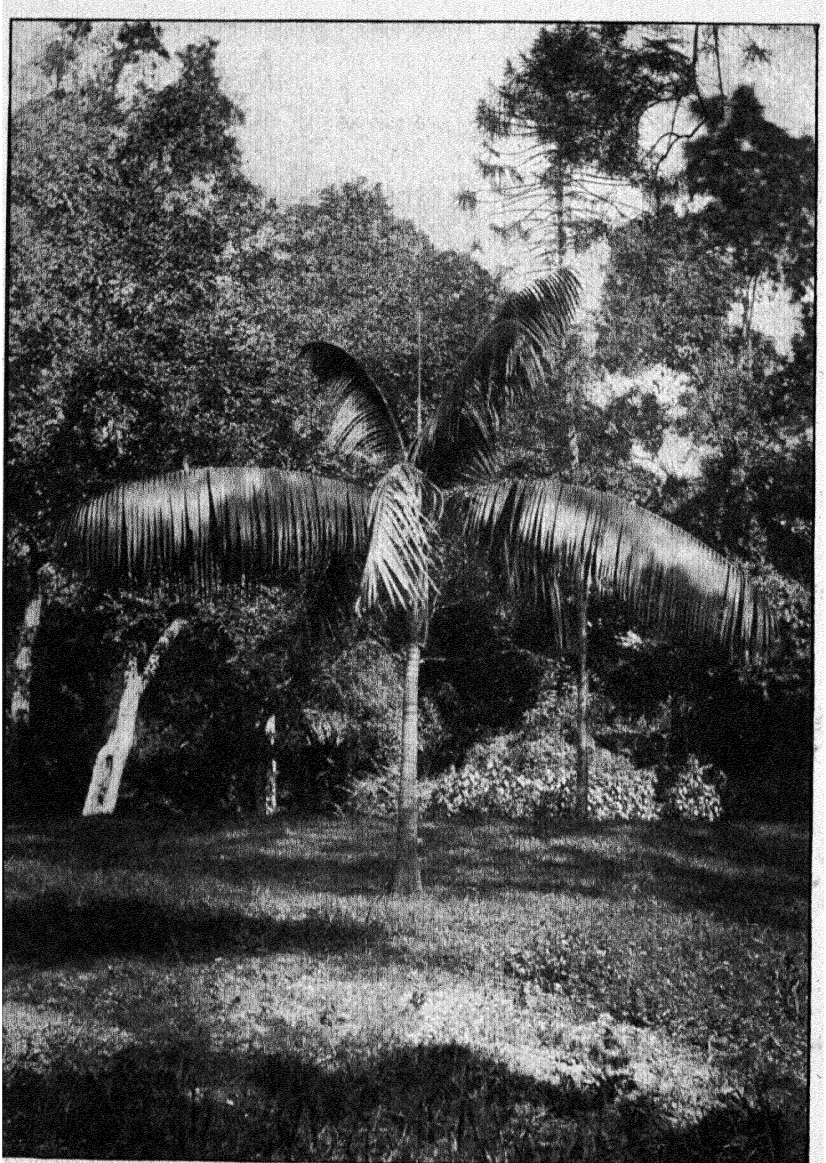
Leaves pinnate; petiole nearly 3 feet long, blade 4 feet, leaflets very many, alternate, narrow linear acuminate, 8-12 inches long, ½ inch wide, 3-nerved, upper shorter, midrib beneath scaly; rhachis scurfy.

Spadix slender, deflexed, about 1 foot long, about 5-7 branched from the base; spikes moderately slender, ⅛ inch thick, rhachis olive green (according to Ridley), rusty furfuraceous (according to Fl. Brit. Ind.). Spathes sword-shaped, apex rounded, convex outside, broadly channelled inside, winged, inner spathe shorter, narrower, not winged, woolly. Flowers in pairs, numerous and close, a male and a female together, or females only at base, males at tip. Male flowers: sepals ovate-orbicular, petals larger, ovate, acute, ⅛ inch long, white or yellow. Stamens 6, filiform, white; anthers small, oblong, dorsifixed. Pistillode large, conic. Female flowers with a transversely oblong bract. Sepals ovate, truncate, gibbous, green, petals shorter, ovate, acute, green. Pistil obovoid. Stigmas minute, triangular.

Drupe nearly ⅔ inch long by ¼ inch in diameter, ovoid or elliptic-ovoid, red, pulpy, tip conical, slightly excentric. Seed free, elliptic-ovoid, rounded at both ends, ⅜ inch long, grooved on one face, branches of raphe descending to the base; albumen ruminate.

HABITAT.—Singapore: Sanglin, Sungei Buluh, Chan Chu Kang, Toas, Kranji. Johor: Gunong Pulai. Dindings: Sumut (ex Ridley). Cultivated in India.

USES.—The stems which are quite black make beautiful walking sticks (Ridley).



Dictyosperma album Wendl. *var. aureum* Balf. f., in the Sibpur Botanic Gardens.

18. *DICTYOSPERMA* WENDL. & DRUDE LINNÆA XXXIX, 181.

(From the Greek 'dictyon,' a net, and 'sperma,' seed, in allusion to the raphe of the seed forming a loose network.)

Mart. Hist. Nat. Palm. III, 175, t. 154, fig. 2, 3 (*Areca*).—Baker Fl. Maurit. 383.—Scheff. Natuurk. Tijdsch. Ned. Ind. 32, 183 (*Ptyschosperma album*).—Benth. & Hook. Gen. Pl. III. II, 890, 1.

Unarmed, of moderate height; leaves equally pinnate; petiole with a complete basal sheath; pinnæ strongly reduplicate at the base, 1-nerved, with a few scales beneath; the terminal pinnæ confluent.

Monœcious. Flowers in spirally disposed 3-flowered clusters on the branches of a simply subfastigiately branched spadix, the female flower between and below two males. Male flowers: inner segments of perianth valvate, thickened, ovate-oblong, acute; stamens 6, included; pistillode a terete column, shorter than the stamens. Female flowers: segments of perianth imbricate; staminodes forming a ring with 6 linear teeth.

Fruit olive-like, persistent; scar of the stigma exactly apical; mesocarp fibrous; endocarp slender, crustaceous. Seed attached to the endocarp on one side throughout its whole length; raphe forming a loose network; albumen ruminate; embryo subbasilar.

SPECIES.—3.

DISTRIBUTION.—Mascarene Islands.

CULTIVATION IN EUROPE.—Stove palms. A compost of loam, peat, and leaf soil, in equal parts, with a liberal addition of sand suits them very well; loam should preponderate to the extent of about two-thirds; when fully developed, some rotten cow-manure may be added with advantage. The seeds should be sown in a similar compost and kept in a moist, gentle heat. The greatest enemy of this palm is dry warm air. Dammer has found that the plants do quite well in a cool room during winter. Young specimens get easier accustomed to the air of a room than older ones. They require much water. The Dictyospermas are great favourites on account of the beautiful colouring (red, yellow) of the leaf-stalks and nerves.

1. **Dictyosperma album** Wendl. in Linnæa XXXIX, 181; Balf. f. in Baker. Fl. Maurit. & Seych. 384; Drude Palmæ 75.—*Areca alba* Bory

Voy. I, 306; Willd. Spec. Pl. IV, 596, n. 8; Poir Encycl. Suppl. I, 441, n. 9; Spreng. Syst. Veg. II, 139, n. 7; Mart. Hist. Nat. Palm. III, 175, t. 154, 155, fig. 2.—*Areca borbonica* Hort.—*Sublimia palmicaulis* Commers. Mss.—*Ptychosperma album* Scheff. Natuurk. Tijdsch. Ned. Ind. 32, 183.

NAMES.—Weisser Netzsame (German). Palmiste blanc, Palmiste commun (French).

DESCRIPTION.—A very variable plant. Stem 40-50 feet high, 8-9 inches in diameter, dilated at the base. Leaves 8-12 feet long; petiole semiterete, 6-18 inches long, grooved down the face; leaflets 2½-3 feet long, 2-3 inches broad, lanceolate, acuminate, cuneate at the base, widely reduplicate, with one prominent median nerve, and 3 lateral secondary nerves on each side, all bearing a few medially attached scales, especially towards the base of the leaflets; veins and margins of leaflets green or reddish.

Spadix 2 feet long, with a very short, often tomentose peduncle; branches erect or slightly reflexed, 6-18 inches long, very zigzag when young; flowers often distichous at the base of the branches; spathes 1-1½ foot long. Inner segments of male perianth ¼ inch long, three times as long as the outer.

Fruit ovoid-oblong, pointed, about ½ inch long, purplish.

HABITAT.—Mauritius, common; Seychelles, not indigenous; Bourbon.

2. **Dictyosperma album** Wendl. *var.* **aureum** Balf. fil. in Baker Fl. Maurit. and Seych. 384—*Areca aurea* Hort.

NAMES:—Goldfarbiger Netzsame (German). Palmiste bon (French).

DESCRIPTION.—Stem about 30 feet high, smaller and more slender than in the type.

Leaves 4-8 feet long; petiole 8 inches long; leaf-sheath 1-2 feet long; pinnæ 1½-2 feet long, 1 inch broad; secondary veins scarcely visible.

Branches of the spadix rigidly erect, 9-11 inches long. Flowers half the size of those of the type.

Fruit cylindrico-conic, ¾-¾ inch long. Young plants bright orange.

HABITAT.—Rodriguez, common.

ILLUSTRATION.—The beautiful specimen of *Dictyosperma album* var. *aureum,* reproduced on Plate LXXXVIII, grows in the Sibpur

Botanic Gardens, and its photograph was kindly supplied by Col. Gage.

19. *ARCHONTOPHŒNIX* WENDL. & DRUDE IN LINNÆA XXXIX, 182, 190, 211, t. 3, f. 6.

(Etym.: From the Greek 'archon,' ruler, king, and 'phœnix,' palm, in allusion to their majestic aspect and their relationship.)

Mart. Hist. Nat. Palm. II, 181 (*non* t. 105, 106, 109 *uti habent* Benth. & Hook. Gen. Pl.).—F. Mueller Frag. Phyt. Austr. V, 47, t. 43, 44 (*Ptychosperma*).—Benth. Fl. Austr. VII, 141 (*Ptychosperma* sp. n. 2, 3).—Bot. Mag. t. 4961 (*Seaforthia*, excl. fig. 9, 10, 11).—Benth. & Hook. Gen. Pl. III, II, 889, 15.—Bailey Queensl. Fl. V, 1674.

Stem high and slender, columnar, unarmed, strongly annulate. Leaves terminal, equally pinnatisect, forming a dense crown; segments linear-lanceolate, acuminate, or bidentate at the apex, the margins recurved at the base; rhachis convex on the back, carinate on the upper side; petiole canaliculate on the upper side; sheath elongate, cylindric.

Spadices shortly pedunculate, thrice divided, branches and branchlets flexuose, slender, pendulous, glabrous; spathes 2, complete, elongate, complanate, caducous; bracts semilunar; bracteoles persistent. Flowers monœcious, spirally arranged, ternate, the median one female, or solitary and binate males, bracteate and obscurely bracteolate. Male flowers asymmetrical. Sepals 3, small, triangular, rotundate, carinate, imbricate. Petals 3, obliquely ovate-oblong, subacute, valvate. Stamens 9-24; filaments slender, connate at the base, inflexed at the apex; anthers linear, bifid at the base, dorsifixed, versatile. Pistillode styliform. Female flowers smaller than the male, subglobose. Sepals 3, orbicular, convolute-imbricate. Petals similar, but smaller. Staminodes 6, subulate; ovary trigonous-ovoid, 1-locular; stigmas 3, minute, recurved; ovule parietal.

Fruit small, globose-ellipsoid, umbonate by the subterminal stigmas; pericarp fibrous; endocarp very thin. Seed erect, closely adhering to the endocarp, smooth; hilum lateral, elongate; branches of raphe reticulate; albumen deeply ruminate; embryo basilar.

SPECIES:— 4.

DISTRIBUTION.—Tropical and subtropical East Australia.



Alexandra Palm (*Archontophœnix alexandræ* W. & Dr.).

CULTIVATION IN EUROPE.—A genus of elegant stove palms. The species thrive best in fibrous loam, leaf mould, and sand. Thorough drainage and an abundant supply of water are important points in their culture. Propagation is effected by seeds.

Leaf-segments glaucous on the underside *A. alexandræ.*
Leaf-segments green on both sides ... *A. cunninghamii.*

1. **Archontophœnix alexandræ** W. & Dr. in Linnæa XXXIX, 212; Bailey Queensl. Fl. V, 1675.—*Ptychosperma alexandræ* F. Muell. Fragm. Phyt. Austr. V, 47, 213, t. 43, 44; Benth. Fl. Austr. VII, 140.

NAMES.—Alexandra Palm (English). Alexandra Herrscherpalme (German).

DESCRIPTION.—A tall palm, stem attaining 70-80 feet. Leaves several feet long; rhachis very broad and thick, glabrous or slightly scurfy; segments numerous, the longer ones 1½ feet long, ½-1 inch broad, acuminate and entire or slightly notched, green above, ashy-glaucous or white underneath.

Spathe 1½ foot long. Panicle when open above 1 foot long and broad; much branched, the rhachis more or less angular and flexuose, the notches scarcely immersed. Male perianth 2-3 lines long; the inner segments very often oblique, pale coloured; the outer segments about 1 line long, slightly imbricate. Stamens usually 9 or 10, but varying from 6-14; filaments very short. Female perianth about 2 lines long, the segments all broad, and about equal in length.

Fruit ovoid-globular, 7-9 lines long.

HABITAT.—Queensland: Rockingham Bay, Mackay, and many other tropical localities (Bailey).

ILLUSTRATION.—Plate LXXXIX represents two elegant, slender-stemmed specimens of the Alexandra Palm. Photograph by Mr. Macmillan in the Botanic Garden of Peradeniya.

2. **Archontophœnix cunninghamii** Wendl. & Drude in Linnæa XXXIX, 214; Bailey Queensl. Fl. V, 1675.—*Seaforthia elegans* Hook. Bot. Mag. No. 4961, excl. fig. 9, 10, 11 (not of R. Br.).—*Ptychosperma Cunninghamii* Wendl. & Drude in Bot. Zeitg. (1858) 346; Benth. Fl. Austr. VII, 140.

NAMES.—English: Cunningham's Seaforthia. German: Cunningham's Herrscherpalme.

DESCRIPTION.—Stem attaining a height of 60 feet, erect,

slender, annulate, dark green, almost glossy, crowned with a spreading tuft of beautifully pinnate leaves. Leaves 8-10 feet long, petioles sheathed at the base. Leaflets numerous, narrow-lanceolate, spreading, 1-1½ foot long, several of them unequally bifid at the apex, one segment being much longer than the rest.

Spadices below the bases of the leaves, fleshy, dull pale-lilac, each surrounded by 2 spathes, drooping, much-branched. Flowers many, scattered, some male, some female. Anthers of male flowers rather oval-oblong than linear. Female flowers with the rudiments of 6 stamens at the base.

Fruit like *A. alexandræ*.

HABITAT.—Queensland: Sunday Island; Rockhampton; N. S. Wales: Illawarra, Woolongong.

ILLUSTRATION.—Visitors to Bombay will at once recognize the spot in which the palms shown on Plate XC are growing. We wish to draw attention to the dense fruiting spadices arising from the base of the leaf-sheath. Mr. Phipson has personally taken the photograph.

20. *PINANGA* BL. IN RUMPH. II, 76, t. 87, 108A, 109-116.

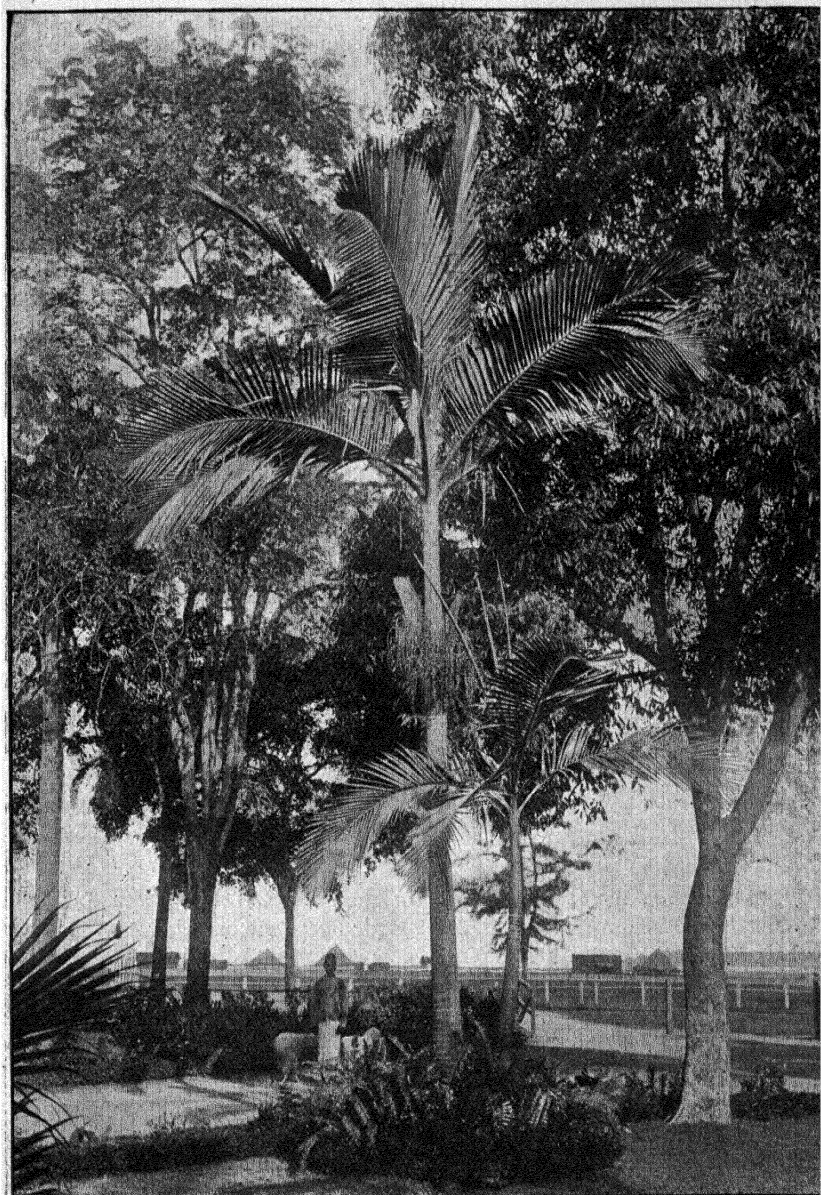
(From the vernacular name 'Pinang'.)

Mart. Hist. Nat.Palm. III, 183.—Griff. Palms Brit. Ind. 146, t. 230 C, 231, 232, A, B, C, 235.—Miq. Fl. Ind. Bat. III, 20 (1, 3, 5-20).—Scheff. Natuurk. Tijdsch. Ned. Ind. 32, 171.—Kurz For. Fl. II, 538.—Wendl. und Drude Linnæa 39, 176.—Drude Bot. Zeitg. 1877, t. 5, fig. 12, 13.—Benth. & Hook. Gen. Pl. III, II, 884, 3.—Hook. f. Fl. Brit. Ind. VI, 406.

Unarmed; stem erect, annulate. Leaves pinnate, with the upper leaflets confluent.

Flowers monœcious, androgynous, ternate, 1 female between 2 males, the clusters in 2 or 4 or 6 series on spadices from the stem below the leaves; spathe solitary. Male flowers obliquely 3-quetrous; sepals 3, acute, keeled, not imbricate; petals 3, ovate or lanceolate, valvate; stamens 6 or more; anthers subsessile, basifixed, erect. Female flowers much smaller than the males, ovoid or globose; sepals 3, orbicular, imbricate; petals 3, orbicular, broadly imbricate; ovary 1-celled; stigmas 3; ovule basilar, erect.

Fruit ovoid or ellipsoid, pericarp fibrous; seed ovoid or ellipsoid; albumen ruminate; embryo basilar.



Cunningham's Seaforthia (*Archontophœnix cunninghamii* W. & Dr.).

Species about 50.—Indo-Malayan.

CULTIVATION IN EUROPE.—The species of this genus are stove palms. They thrive best in a compost of one part loam, two of peat, and a little sand. A liberal supply of water is necessary. Propagated by seeds.

KEY TO THE SPECIES DESCRIBED BELOW:—

A. *Spiranthea* Becc. Flowers in 3 or more spiral series on the spadix or its branches.

I. Spadix simple

1. Male flrs. in 5-6 rows ... ... 1. *P. hexasticha.*
2. Male flrs. in 3 rows .. .. 2. *P. gracilis.*

II. Spadix branched ... ... 3. *P. griffithii.*

B. *Orthostichanthea* Becc. Flrs. in two series on the spadix or its branches.

I. Spadix large, much branched

1. Leaflets 3 ft. long ... . 4. *P. manii.*
2. Leaflets 1-2 ft. long ... ... 5. *P. kuhlii.*

II. Spadix with few distichous branches

1. Stem up to 20 feet ... ... 6. *P. dicksonii.*
2. Stem up to 4 feet ... ... 7. *P. hookeriana.*

III. Spadix unbranched

1. Spathe membranous ... ... 8. *P. hymenospatha.*
2. Spathe not membranous ... ... 9. *P. paradoxa.*

* INDIGENOUS SPECIES.

1. **Pinanga hexasticha** Scheff. in Ann. Jard. Bot. Buitenz. I, 148; Kurz For. Fl. II, 539; Becc. in Ann. Jard. Bot. Buitenz. II, 80, 86; Males. III, 122; Hook. f. Fl. Brit. Ind. VI, 406; Brandis Ind. Trees 647.—*Areca hexasticha* Kurz. in Journ. As. Soc. Beng. XLIII, II, 201, t. 12.

DESCRIPTION.—An evergreen, slender, simple-stemmed, gregarious palm; stem 20-30 feet high, 1½ inch in diameter. Leaves 3-5 feet long, pinnate, with the end-pinnæ confluent; leaflets linear, somewhat falcate, 1-1½ feet long, many, alternate, 2-3-ribbed, many nerved, the lower acuminate, the upper and terminal crenate, lobed and ending into as many bluntish and shortly 2-lobed lobes as there are ribs; petiole short, 3-4 inches long, scaly, sheathing at the base; sheaths thinly scaly-rough, soon turning glabrous.

Spadix stout, simple, reflexed; rhachis as thick as the finger,

fleshy. Male flowers in 5-6 series; female perianth (in young fruit) very much like that of *P. gracilis*, the sepals and petals almost coniform, broad-oval, blunt or bluntish, about a line long or a little longer; staminodes apparently none; unripe fruits fibrous-fleshy, smooth, fusiform and narrowed at the apex.

HABITAT.—In marshy places of the tropical forests of the southern parts of the Pegu Yoma, as, *e. g.* between Kyanzoo and Kya Eng (Pazwoondoung Valley).

2. **Pinanga gracilis** Bl. Rumph. II, 77; Kurz For. Fl. II, 538: Becc. in Ann. Jard. Bot. Buitenz. II, 81, 86; Hook. f. Fl. Brit. Ind. VI, 407; Brandis Ind. Trees 647.—*P. patula* β *gracilis* Scheff. in Natuurk. Tijdsch. Ned. Ind. XXXII, 178.—*Seaforthia gracilis* Mart. Hist. Nat. Palm. III, 185, 313; Kunth Enum. III, 191.—*Areca gracilis* Roxb. Fl Ind. III, 619; Griff. in Calc. Journ. Nat. Hist. V, 460; Palms Brit. Ind. 154, t. 232, A, C, f. 2; Kurz in Journ. As. Soc. Beng. XLIII, II, 201; T. Anders. Journ. Linn. Soc. XI, 5.—*Nenga gracilis* Becc. Males. I, 25.

NAMES.—Ram gua (Beng.); Tawkun (Burm.).

DESCRIPTION.—The stems are slender, usually gregarious, 6-20 feet high, 6-8 lines in diameter, distinctly and distantly annulate, crown of about five or six leaves, which are 3-4 feet long; sheath half a foot long, the naked part of the leaf-stalk being 3 or 4 inches long; petiole and sheath scurfy. Leaves sparingly pinnate; leaflets inserted by a very broad base, about a foot long, lower ones 2-3-ribbed, finely acuminate, upper ones 3-5 inches broad, præmorse, many-ribbed, obcuneate, truncate, bipartite to the middle, about 8-cleft, divisions bidentate, emarginate, or entire and acute. Spathe solitary, bifid. Spadix simple, reflexed. Male flowers in three rows, broad, flat, imbricating; calyx minute, three-cornered; petals 3, obliquely cordate, cuspidately acuminate, many times longer than the calyx. Stamens numerous, shorter than the corolla. Female flowers in large shallow niches with 3-toothed margins, much smaller than the male flowers. Sepals broad, round. Petals like the sepals, but smaller. No rudimentary stamens. Ovary ovate, 1-celled; ovule one, erect. Style very short, stout.

Fruit half an inch long and three or four lines broad, ovate, tapering to the tip, scarlet or orange, smooth. Albumen highly ruminate. Embryo basilar.

HABITAT.—Sikkim, sub-Himalayan tract and valleys up to 2,000 feet, common; Assam; Khasia Hills; Cachar; Chittagong;

Arakan Yoma; Pegu; Martaban; Tenasserim, in damp evergreen forests, ascending to 3,500 feet.

Flowers during the hot and rainy season; fruit ripens the following year.

3. **Pinanga griffithii** Becc. Males. III, 117; Hook. f. Fl. Brit. Ind. VI, 407; Brandis Ind. Trees 647.—*Areca sp.* Griff. in Calc. Journ. Nat. Hist. V, 461 (under *A. gracilis*, fruit only); Palms Brit. Ind. 55, t. 232 (spadix only).

DESCRIPTION.—Stem slender; leaves pinnatisect; leaflets numerous, 3 to many-costate.

Spadix reflexed, subdigitately branched; peduncle of spadix 2 inches long; branches 3-5, spreading, not compressed. Calyx of male flowers shorter than the petals.

Fruits arranged spirally in 4 lines, ovoid, rather more than half an inch long and $\frac{1}{4}$ inch broad, narrowed at the base, mammillate; pericarp thin; albumen deeply ruminate.

This palm is imperfectly known. I have copied the meagre descriptions given by Griffith and Beccari.

HABITAT.—Khasia Hills.

4. **Pinanga manii** Becc. Males. III, 178; Hook. f. Fl. Brit. Ind. VI, 409; Brandis Ind. Trees 647.—*Areca costata* Kurz. in Journ. As. Soc. Beng. XLIII, II, 200 *(excl. omnib. synon.)*.

DESCRIPTION.—Trunk 50 feet high, $5\frac{1}{2}$ inches in diameter. Leaves 15-20 feet long ($6\frac{1}{2}$ feet according to Hooker *l.c.*); leaflets very many, strongly 1-3 nerved, 3 feet long, 3 inches broad, ensiform, straight, pale beneath; leaf-sheaths 4 feet long, clasping the stem.

Spadix 19-20 inches long, shortly peduncled, branches 40-50, spirally arranged, filiform, pendulous. Flowers biseriate. Male sepals about as long as the petals.

Fruit small, $\frac{4}{10}$ by $\frac{2}{10}$-$\frac{3}{10}$ inch, ovoid from an acute base; seed subglobose; raphe reticulate; albumen densely ruminate.

HABITAT.—Nicobar Islands; South Andaman Islands.

5. **Pinanga kuhlii** Bl. in Bull. Néerl. (1838) 65; Rumph. II, 82, t. III and β, t. III, f. 11-13; Kunth Enum. III, 641; Miq. Pl. Jungh. 57; Scheff. in Natuurk. Tijdsch. Ned. Ind. XXXII, 182; in Ann. Jard. Bot. Buitenz. I, 152; Becc. Males. III, 138; Hook. f. Fl. Brit. Ind. VI, 409; Brandis Ind. Trees 647—*P. costata* Bl. in Bull. Néerl. *l.c.*; Rumph. *l.c.* 80, t. 109 and β, t. 109 C.; Kunth. *l.c.*; Miq. *l.c.* 156; Kurz. For. Fl. II, 538, F.—*Seaforthia Kuhlii* Mart. Hist. Nat. Palm. III, 185, 313.—*S. oryzæformis* Mart. *l.c.* 185,



Pinanga kuhlii Bl., in the Botanic Garden of Peradeniya.

ed. I. *(excl. omnib. syn. except.* Gaert.).—*P. noxa* Bl. in Rumphia II, 81, t. 110, A—E.—*P. coronata* Bl. in Rumphia II, 83, t. 112, 113.—*S. costata* Mart *l.c.* 313.—*Ptychosperma kuhlii* Miq. Fl. Ind. Bat. III, 21; De Palm. Archip. Ind. 23.—*P. costata* Miq. *ll. cc.* 25, 23.—*Areca oryzæformis* Gaertn. Fruct. I, 20, t. 7, f. 2, 6 (*non* Rumph.).

DESCRIPTION.—Stem soboliferous, 20-30 feet high (10 feet according to Becc.). Leaves 3-4 feet long, pinnate, with rather narrow confluent end-pinnæ; leaflets 1-2 feet long, linear to linear-lanceolate, somewhat falcate, prominently and strongly 2-3-ribbed above, the lower ones long-acuminate, the upper and terminal ones terminating in as many bluntish 2-lobed lobes; petiole variable in length, subscurfy.

Spadix 1 foot long, refracted, shortly peduncled, robust, simply branched, glabrous; branches elongate. Flowers sessile, distichous, either all females in the same spadix, or each female accompanied by 2 males. Female flowers: sepals and petals almost coniform, nearly 1½ line long, broadly ovate or orbicular, blunt or obsoletely mucronulate.

Fruit nearly ½ inch long, seated on the cup-shaped perianth, obovoid to ellipsoid, smooth, thin fleshy-fibrous; seed adherent to the pericarp; albumen deeply ruminate.

HABITAT.—South Andaman Islands.—Sumatra; Java.

Fruit ripens in June.

ILLUSTRATION.—We have to thank Mr. Macmillan for the photograph reproduced on Plate XCI. It represents a tuft of *Pinanga kulii*, the stems being covered with lichens.

6. **Pinanga dicksonii** Bl. Rumph. II, 85; Scheff. in Natuurk. Tijdsch. Ned. Ind. 174; in Ann. Jard. Bot. Buitenz. I, 149; Becc. Males. III, 138; Hook. f. Fl. Brit. Ind. VI, 409; Brandis Ind. Trees 647; Talb. Trees Bomb. ed. 2, 339; Cooke Fl. Bomb. Presid. II, 803.—*Areca dicksonii* Roxb. Fl. Ind. III, 616; Griff. in Journ. As. Soc. Beng. V, 458; Palms Brit. Ind. 153, t. 231.—*Seaforthia dicksonii* Mart. Hist. Nat. Palm. III, 184, 313; Kunth Enum. III, 190.

DESCRIPTION.—A slender, smooth, green-stemmed palm; stem solitary, tall, 16-20 feet high, of about 2 inches in diameter, soboliferous. Leaves pinnate, forked, about 4 feet long; leaflets numerous, sessile, elongate, 12-24 inches long and ¾-1 inch broad, with numerous parallel veins, apices præmorse, dentate.

Spadix retrofracted, compound; ramifications from 4-8, alternate, simple, equal, distichous, from 6-8 inches long, stout,

clothed with imbricating flowers. Spathe simple, rigid, compressed. Male flowers: Calyx 3-cleft, divisions subulate, nearly as long as the corolla; petals 3, ovate, cordate, valvate, tapering at the tips. Stamens from 20-30; filaments very short; anthers linear; pistillode 0. Female flowers: Spathes 3, reniform; corolla like the calyx; staminodes 6, clavate, penicillate; style short; stigma 3-lobed.

Berry oblong, dry, fibrous, ½-¾ in. long by ⅓ in. in diameter. Seed of the shape of the berry, ruminated. Embryo basilar.

HABITAT.—Found in great abundance on the mountains of Travancore and Malabar; in the evergreen forests near the Gairsoppa and Nilkund Ghats of Northern Kanara, gregarious and locally abundant. Flowers and fruit ripen in August.

USES.—The poorer classes eat the nut as a substitute for the common betel-nut, but no other part of the tree appears to be employed for any useful purpose.

7. **Pinanga hookeriana** Becc. Males. III, 175; Hook. f. Fl. Brit. Ind. VI, 410.

DESCRIPTION.—Stem slender, 3-4 feet high; internodes clavate, young scurfy; petiole and rhachis of leaves scurfy. Leaves 4½ feet long; leaflets numerous, opposite, one foot long, narrowly linear-lanceolate, subfalcate, acuminate, 2-3-ribbed, 3-4-keeled above, terminal lobe bifid; petiole 6 inches long.

Spathe 4 inches long; spadix 3-4 inches long with a slender peduncle and 4-5 slender branches which are compressed, flexuose and crowded with flowers. Male flowers: calyx 3-toothed, membranous; petals unequal, much longer than the sepals; stamens about 15; pistillode 0. Female flowers: sepals and petals sub-equal; stigma large, discoid; staminodes 0. Fruit about ½ inch long by ¼ inch in diameter, ellipsoid, narrowed at the top. (Hooker.)

HABITAT.—Khasia Hills, 2-4000 feet; Nunklow and Churra.

8. **Pinanga hymenospatha** Hook. f. Fl. Brit. Ind. VI, 411.

DESCRIPTION.—Stem slender, as thick as a goose-quill; internodes long. Petiole and rhachis of leaves slender, scurfy. Leaves 12-14 by 4-5 inches; leaflets very numerous, 15-20 pairs, regularly close-set, 3-4 by ¼-⅓ inch, alternate, flat, thin, narrowly ensiform, finely acuminate, unicostate, dark-green above and brownish beneath when dry; rib slender, prominent on both

surfaces; petiole 3 inches long, subterete; sheath 3-4 inches long, striate.

Spathe 1½ inch long, ellipsoidly fusiform, erect, quite membranous, subhyaline. Spadix very short, about as long as the spathe, flowering to the base. Male flowers flat, imbricate, ¼ inch in diameter, trapezoidly orbicular; dorsal sepals twice as long as the others, apiculate; stamens 9, unequal; filaments very short; anthers linear. Female flowers minute, globose; ovary ovoid; stigma pulvinate; ovule erect. (Hooker.)

HABITAT.—Burma, at Moulmein.

Hooker calls this palm 'a very distinct species, remarkable for its membranous spathe and very elegant form.'

** INTRODUCED SPECIES.

9. **Pinanga paradoxa** Scheff. in Natuurk. Tijdsch. Ned. Ind. XXXII, 31; Becc. Males. III, 129, *in nota*; Hook. f. Fl. Brit. Ind. VI, 411; Ridley Fl. Malay. Penins. II, 141.—*Areca curvata* Griff. Notul. III, 164 *(partim)*.—*Areca paradoxa* Griff. in Calc. Journ. Nat. Hist. V, 463; Palms Brit. Ind. 156, *quoad descriptionem fructus et figuram ejusdem in* t. CCXXXVII, C. f. 11.—*Kentia paradoxa* Mart. Hist. Nat. Palm. III, 312.—*Nengella paradoxa* Becc. Males. I, 32.—*Ophiria paradoxa* Becc. in Ann. Jard. Bot. Buitenz. II, 128.—*Cladosperma, n. g.*, Griff. Notul. III, 165.

DESCRIPTION.—Stems very slender, 3-12 feet high, ¼ inch in diameter, internodes 2 inches long. Leaves about 1 foot long, entire and oblong, or with 3-6 pairs of sigmoidly linear-lanceolate acuminate leaflets; leaflets mostly alternate, broad, 5 inches long, 1 wide, lower ones acuminate, terminal one broadly cuneate, deeply cleft, often unequally, margin truncate, toothed; petiole 6 inches long or less, scurfy.

Spadices usually 2 or 3 on a stem, unbranched or with 2 branches 3-4 inches long, undulate. Flowers distichous. Male flowers ¼ inch long. Sepals short, acute. Petals lanceolate with long points. Stamens 6; filaments very short. Female flowers: calyx short, lobes rounded, petals hardly longer.

Drupe red, slender, curved, fusiform, ½ inch long. Seed fusiform, albumen ruminate with 6 long longitudinal lines of rumination (according to Ridley, albumen equable according to Hook. Fl. Brit. Ind.).

HABITAT.—Jahor: Gunong Panti; Malacca: Mount Ophir; Selangor: Bukit Kutu, Bukit Hitam; Perak: Larut Hills; Negri

Sembilam: Gunong Angs; Kedah: Gunong Jerai (ex Ridley). Grown in Indian gardens.

21. *ARECA* L. GEN. NAT. 1225.

Gaertn. Fruct. I, t. 7, fig. 2.—Mart. Hist. Nat. Palm. III, 1169, 311, t. 102, 149.—Kunth Enum. Pl. III. 183, 637 (*excl. sp.*).—Bl. Rumph. II, 64, t. 99, 100, fig. 101, 102, A, B, C, 108; III, t. 160, 163, D.—Griff. Palms Brit. Ind. 146, t. 230 (section *Pinanga*).—Miq. Fl. Ind. Bat. III, 8 (*Arecæ* sect. 1).—Scheff. Ann. Jard. Bot. Buitenz. I, 112, 132, 144, t. 1-8.—Drude Bot. Zeitg. (1877) t. 6, fig. 16, 17.—Becc. Males. I, 17 (*excl.* subg. 3), 97.—Rgl. Gartenfl. (1879) 199.—Benth. & Hook. Gen. Pl. III, II, 833, 1.—Hook. f. Fl. Brit. Ind. VI, 405.

Stem erect, smooth, green in the upper portion, annulate. Leaves pinnate; base of petiole expanding into a smooth, green, amplexicaul sheath; leaflets thin, often confluent, with several midribs, attached to the rhachis in a vertical line.

Spadix androgynous, below the leaves, branched, bearing numerous close-set spikes; spathes several. Male flowers many, minute, occupying the upper portion of the spikes; sepals small; petals much longer, obliquely lanceolate, valvate; stamens 3 or 6; filaments short; anthers basifixed, erect. Female flowers much larger, few at the base of the spikes; perianth accrescent; sepals and petals orbicular, imbricate, the petals with acute valvate tips; ovary 1-celled; stigmas 3, sessile; ovule 1, basal, erect.

Fruit ovoid or oblong, supported by the persistent perianth; mesocarp fibrous. Seed with a truncate base; endosperm deeply ruminate; embryo basilar.

Species about 40.—Tropical Asia and Australia.

CULTIVATION IN EUROPE.—Very ornamental and graceful stove palms. They grow very well in a compost of loam, peat, and leaf soil, in equal parts, with a liberal addition of sand. When fully developed they prefer a compost with about two-thirds of loam and some rotten cow-manure. The seeds germinate in a compost similar to the one first mentioned; they must be placed in a moist gentle heat. These palms are very effective in a young state for the decoration of drawing rooms and dinner tables.

A.—STAMENS 6—

1. Fruit 1½-2 inches, smooth, orange or scarlet *A. catechu.*
2. Fruit 1½ inch, umbonate, reddish yellow ... *A. concinna.*



Pinanga kuhlii Bl., in the Botanic Garden of Peradeniya.

B.—STAMENS 3—

1. Fruit 1 inch, narrowed at both ends ... ... *A. nagensis.*
2. Fruit the size of an olive, tip truncate ... ... *A. triandra.*

1. **Areca catechu** L. Spec. Pl. 1189; Roxb. Corom. Pl. I, 54, t. 75; Flor. Ind. III, 615; Mart. Hist. Nat. Palm. III, 169, t. 102 et 149; Kunth Enum. III, 184; Blume Rumph. III, 65, t. 102 A et t. 104; Griff. in Calc. Journ. Nat. Hist. V, 135; Griff. Palms of Brit. Ind. 147; Miq. Fl. Ind. Bat. III, 8; Kurz For. Fl. II, 536; Gamble Man. Ind. Timb. 421; Scheff. Arec. 9; Scheff. in Ann. Jard. Bot. Buitenz. I, 144, t. I & V, III, f. 2.—*Fifel* et *Fufel* Avicenna L. I, c. 262.—*Avellana indica* Serapion c. 136; Garcia ab Horto Aromat. I, c. 25.—*Areca* Ramusio 1588, I, p. 160 F, p. 312 B.—*Faufel* Lobel Stirp. Observ. 1576, 641; Clus. Exot. (1605) 187, Obs. p. 641.—*Areca* s. *Faufel* s. *Avellana indica, versicolor* Park. Raii. Hist. II, 1363.—*Palma areca* s. *Bonga minor,* Camell Luzon apud Raii. Hist. III, 45.—*Palma arecifera* Pluk. Almag. p. 275, *excluso icone* t. 309, f. 4.—*Areca faufel* Gaertn. Fruct. I, 19, t. 7, f. 2.—*Areca hortensis* Lour. Fl. Cochinch. 568.—*Caunga* Rheede Hort. Mal. I, 9, t. 5-8.—*Pinanga* Rumph. Amb. I, 26, t. 4.

NAMES OF THE TREE.—*English*: Betel* nut palm, areca nut palm, areca palm, betel nut tree, betel palm, cashoo nut tree, catechu palm, catechu tree, drunken date tree, faselnut, faufel nut tree, pinang palm. *French*: Arec, arec cachou, arec de l'Inde, arèque, arèquier, noisette d'Inde. *German*: Arecapalme, Arekapalme, Betelnusspalme, Betelpalme, Katechupalme, Catechupalme, Kaupalme, Pinangpalme.

NAMES OF THE YOUNG LEAVES.—*English*: Palm cabbage. *French*: Chou palmiste. *German*: Palmkohl. *Dutch*: Palmkool.

NAMES OF THE FRUIT.—

English: Areca nut, betel nut, Indian nut.

French: Aveline d'Inde, aveline des Indes, noisette d'Inde, noisette des Indes, noix d'Arec, noix de bétel, pinangue.

German: Arecanuss, Arekanuss, Arekasamen, Bandwurmnüsse, Betelnuss, Indianische Nuss, Indianische Haselnuss, Katechunüsse, Pinangnuss.

Dutch: Arecanoot, areeknoot, betelnoot, pinang, pinangnoot.

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* The name Betel or Betle is Malayan in origin and simply means 'a leaf,' and came to English through the Portuguese Betre.

('By these and other names was originally meant Piper Betel leaf—the Pan—though subsequently these and many other names were appropriated to the nut or to the special preparation of leaf, nut, lime and spices ready to be chewn. This was first designated bira (vira) viti in Sanskrit; but ultimately became pan, the pawn or pan-supari of modern writers.'—Watt.)

Hind. and *Dekk.*: Supari, supyari.
Beng.: Gua, supari.
Ass.: Tambul.
Tel.: Poka-vakka, vakka.
Tam.: Kamugu, pakku, kottai-pakku.
Kan.: Adike.
Guj.: Sopari, hopari, phophal.
Mar.: Supari.
Mal.: Adaka, kavugu, atakka.
Sans.: Puga-phalam, gubak.
Arab.: Fofal, fufal.*
Pers.: Gird-chob, popal.
Singh.: Puwak, puvakka.
Jav.: Bhunghana penang, Jambe, Jebug.
Burm.: Kwam-thee-beng, kunsi, kun, kun-thee-bin.
Andam.: Ah-bud-dah, ah-purrud-dah.
Modern Malay.: Pinang.
Philippines: Bonga, Bunga, Luyos.
New Britain: Bue.
Pelew Islands: Bua.
Duke of York Island, Solomon Group: Boa.
Amboina: Puah, Buah.
Banda: Pua.
Guam.: Pugua.

DESCRIPTION.—Trunk solitary, quite straight, 40-100 feet high, usually about 20 inches in circumference, uniformly thick. Leaves 4-6 feet, leaflets numerous, 1-2 feet, upper confluent, glabrous.

Spathe double, compressed, glabrous. Spadix much branched, bearing male and female flowers. Rhachis stout, compressed; branches with filiform tips. Male flowers very numerous, sessile, without bracts; calyx 1-leaved, small, 3-cornered, 3-parted; petals 3, oblong, rigid, striated; stamens 6, anthers sagittate. Female flowers solitary, or 2 or 3, at or near the base of each ramification of the spadix, sessile, without bracts; sepals 3, cordate, rigid, fleshy, permanent; petals 3, like the sepals, permanent; staminodes 6, connate; style scarcely any; stigmas 3, short, triangular.

Fruit 1½-2 inches long, smooth, orange or scarlet.

* Fufal, a corruption of 'pupal' (Per.), a word cognate with pugi phal (Sansk.).

HABITAT.—The Betel-nut Palm is cultivated exclusively within the moist tropical tracts that fringe the coast of India, and practically within a belt of land that, with a few exceptions, does not extend inland for more than 200 miles. It rarely ascends to altitudes of 3,000 feet and gradually disappears, even from the littoral area, as localities are entered where the duration of the dry hot months equals or exceeds the monsoons. It is usually seen as a garden plant, but occasionally, and in certain localities, especially of Western and Southern India, of Ceylon and of Burma, where the soil and climate may be exceptionally favourable, it is grown in special gardens along with Coconut, Plantain, Orange, Mango, etc., and either with or without the pan (piper betel) climbing on the palm-stems. In Eastern and Northern Bengal, in some portions of Assam, and in Ceylon its cultivation has assumed still greater dimensions. In certain districts of these provinces regular plantations of 5 to 20 or even 100 acres in extent occur and at such frequent intervals that they might almost be said to constitute a distinct agricultural feature scarcely less important than the combined crops raised on the intervening portions of the country. (Watt.)

The exact native country of the Betel-nut Palm is uncertain. It is difficult to trace its original spot as the tree has been extensively cultivated, from time immemorial, in all parts of the East Indies. On the continent of India, in Ceylon, and in Cochin-China the species is always mentioned as cultivated. So in the Sunda Isles, the Moluccas, etc., to the South of Asia. Blume says that the habitat of the species is the Malay Peninsula, Siam, and the neighbouring islands, though he does not seem to have seen the indigenous plants of which he speaks. Bretschneider considers the plant to be a native of the Malay Archipelago, principally of Sumatra, for he says that those islands and the Philippines are the only places where it is found wild. The first of these facts is not confirmed by Miquel, nor the second by Blanco, who lived in the Philippines. To De Candolle, Blume's opinion appears the most probable, but he adds: 'We must still say with Martius, "the country is not proved."'

Mr. C. E. C. Fischer, I. F. S., writes to me:

'Areca catechu is said not to be wild in India, but I have found it growing in the Attapadi valley of Malabar in dense

ever-green jungle where it seemed to me obviously wild. The forest was virgin and not secondary growth after cultivation. The local hill-men, who do not use the fruit of the trees, declared it to be wild. I found it in fruit on 21st May 1911. The soil was a deep rich vegetable loam; elevation 3,000 feet.' (Cf. No. 2776 of Fischer's collection in Herb. Calc.)

HISTORY.—We borrow the following account from Watt:—The betel-nut is a masticatory of great antiquity with all Asiatic races, best known as suvaka, puga, kramaka (Sansk.), fufal (Arab.). The nut is symbolical of festivity; it is accordingly a fit offering for the gods, and is an essential at the betrothal ceremony. From the most ancient times the presentation of pan has been the polite termination of ceremonial visits, hence the expression bira-dena—the dismissal. The best known vernacular names for the nut are—supari, gua gaya, kasaile, mari, tambul, oka, kamuga, adike, kunsi, etc.

It would seem that the earliest historic reference by a European to the habit of chewing betel-nut occurs in the writings of Marco Polo (1298 A. D.). 'All the people,' he wrote, 'have the habit of keeping in the mouth a certain leaf called tembul.' Subsequently Vasco da Gamą (in 1498), Varthema (in 1510), Barbosa (in 1516), Garcia de Orta (in 1563), Abul Fazl (in 1590), Linschotten (in 1598), François Pyrard (in 1601), Roe (in 1615), Jacobus Bontius (in 1629), Bernier (1656-68), Vincenzio Maria (in 1672) give similar accounts. Adams in his translation of Paulus Aegineta refers to the Betel-nut as introduced to Materia Medica by the Arabs. He quotes amongst others the passages referring to it from Avicenna, Haly-Abbas, Ebn Baithar, Elmasudi, Serapion, and others. Ebn Baithar says that it is the fruit of a palm, and observes that it is a gentle purgative, makes the breath fragrant, is a cordial, and strengthens the gums and teeth. Linschotten remarks that 'the Indians goe continually in the streets and waies with Bettele or Bettre and other mixtures in their hands, chawing, especially when they go to speak with any man, or come before a great lord.'

Abul Fazl apparently never saw the palm growing, since he likens it to a cypress tree that sways in the wind till it touches the ground. This circumstance may be accepted as showing that from very ancient times, as at the present day,

the nut has been carried to regions remote from the area of its production.

ECONOMIC USES.—For the medical and economic uses of the plant I quote from Drury: 'The nut is used as a masticatory in conjunction with the leaf of Piper Betel and Chunam. It is considered to strengthen the gums, sweeten the breath, and improve the tone of the digestive organs. The seed, reduced to charcoal and powdered, forms an excellent dentifrice. Dr. Shortt states that the powdered nut, in doses of ten or fifteen grains every three or four hours, is useful in checking diarrhœa arising from debility.

'The dry expanded petioles serve as excellent ready-made splints for fractures.

'The catechu which the nuts yield is of a very inferior quality. There are two preparations of it, which are respectively called by the Tamools, Cuttacamboo and Cashcuttie; in Teeloogoo, Kansée, and in Dukhanie, Bharabcutta and Acha-cutta. The first (Cuttacamboo) is chewed with the betel-leaf.

'Like most of the Palm tribe, the trunk is much used for ordinary building purposes, and in Travancore is especially used for spear-handles, etc. The spathe which stretches over the blossoms, which is called Paak-muttay, is a fibrous substance of which the Hindoos make vessels for holding arrack, water, etc., also cups, dishes, and small umbrellas. It is so fine that it can be written on with ink.

'In Travancore the nuts are variously prepared for use. Those that are used by families of rank are collected while the fruit is tender; the husks or the outer pod is removed; the kernel, a round fleshy mass, is boiled in water; in the first boiling of the nut, when properly done, the water becomes red, thick, and starch-like, and this is afterwards evaporated into a substance like catechu. The boiled nuts being now removed, sliced, and dried, the catechu-like substance is rubbed to the same and dried again in the sun, when they become of a shining black, ready for use. Whole nuts, without being sliced, are also prepared in the same form for use amongst the higher classes, while ripe nuts as well as young nuts in a raw state, are used by all classes of people generally; and ripe nuts preserved in water with the pod are also used.'

Heyne describes the mode of extracting the catechu from

the nuts in Mysore in the following way: 'The nuts are taken as they come from the tree, and boiled for some hours in an iron vessel. They are then taken out, and the remaining water is inspissated by continual boiling. This process furnishes kossa, or most astringent terra japonica, which is black, and mixed with paddy-husks and other impurities. After the nuts are dried they are put into a fresh quantity of water and boiled again, and this water being inspissated like the former, yields the best or dearest kind of catechu, called Coony. It is yellowish brown, has an earthy fracture, and is free from the admixture of foreign bodies.' On account of the large quantity of tannin which these nuts contain, they have been employed in some parts of India for dyeing cotton clothes. In Malabar an inebriating lozenge is prepared from the sap of the tree, and in Khasia, according to J. D. Hooker's statement, the natives measure distances by the number of mouthfuls of betel-nut chewed on the road. It seems that the poorer classes use various substitutes for the betel-nut, *e.g.*, the seeds of *Calamus erectus* Roxb.

In Guam betel chewing is a matter of etiquette at all wedding assemblies, fandangos, and funerals. Nuts deprived of their fibrous envelopes, fresh pepper leaves and quicklime, together with cigars, are passed around to the assembled guests.

According to Jahns, arecaine, the active principle of the areca nut, is a powerful agent for destroying tape-worms, resembling in its action pelletierine, an aromatic, oily alkaloid obtained from the bark of the pomegranate. Like nicotine it is poisonous, half a grain sufficing to kill a rabbit in a few moments. It influences the respiration as well as the heart, causes tetanic convulsions, and has an extraordinary influence in increasing intestinal peristaltis. Locally applied or when given internally it contracts the pupils. In India the nut has long been used as a vermifuge, the dose being a teaspoonful of the freshly grated kernel.

According to G. King the nut is useful in checking the pyrosis of pregnancy. Control experiments made with tincture of catechu have shown the superiority of the nut, and would seem to demonstrate that this is not merely due to astringent action; it is quite possible that its property as a nervine stimulant enhances its utility.

CULTIVATION.—It would be too long to describe the different methods of cultivation adopted in various parts of India and extra-Indian countries. We confine ourselves to reproducing what Watt says on the cultivation in Bengal*; as to the rest of India we refer our readers to the numerous Gazetteers which contain interesting particulars on this subject†.

'In the districts of Backerganj and Noakhali the Areca palms are planted in groves of mandar (*Erythrina indica*). These enrich the soil, afford shade from the intense heat and protection from sudden wind storms. Branches of the mandar, some 6 feet in length, are planted in rows, 12 to 15 feet apart each way. The planting is done in February to April, and from 2 to 6 years later these plantations are ready for the seedling palms. The betel-nuts are sown in October or November, the seeds being deposited 4 or 5 inches apart, and the nurseries are either close to the homesteads in shady places, or if conveniently situated, they are made in the mandar groves themselves. The transplanting is usually done after 2 years, sometimes 3 or 4 years. For high land the seedlings are transplanted in July, for low land in February or April. In the first transplanting the betel-nuts are placed equidistant from the mandar trees and thus 12 to 15 feet apart. But a second regular transplanting takes place when the first have come into bearing. Before this is done the mandar trees are cut down or only a fringe left around the circumference of the grove. The betel-nuts in a fully planted grove are thus about 6 to 7 feet apart each way. A certain amount of irregular planting takes place, however, as vacancies occur, and in selfishly conducted plantations the trees may be found here and there not more than 2 or 3 feet apart. It is probable that there is a certain amount of self-sowing, as it is not unusual to find two or three trees growing in a clump so close to each other that they could not be healthy. In most plantations also a distinct percentage of cocoanuts are interplanted among the betel-nuts, so that an old plantation in many cases has lost all its original regularity and becomes a dense jungle of palms with only a winding footpath leading to the

* Watt, G., Commercial Products of India, p. 84.

† See also N. V. Kelkar. The Betel-nut Palm and its Cultivation in North Kanara. Poona Agricultural College Magazine, Vol. VII, No. 1 (1915).

owner's house. This generally stands on the bank of a tank and near the middle of the holding.

'The seasons of flowering and fruiting may be said to be distributed throughout the year. The flowers that form in January will ripen fruit in October; the flowers formed in March will fruit in December and January. The harvesting period is from October to the beginning or middle of January, but occasionally the new flowers may begin to form in December or January on trees from which last year's fruits have not been collected.

'If a few trees are planted near villages, but not in regular groves, the betel-nut may fruit when it is only 6 or 7 years of age. In plantations they rarely fruit before the tenth or twelfth year. The trees subsequently put out in the plantation (just as the first set begins to flower) do not come into bearing for 20 years. There is no third planting except, as already stated, to fill up vacancies. Land formerly covered with betel-nuts, if replanted with them, even after a rest of several years, in the form of mandar groves, does not, as a rule, yield until the palms are 20 years old. It will thus be seen that it takes at least 30 years before a betel-nut plantation comes into full bearing. The fruiting life of a tree may be put at from 30 to 50 or 60 years after maturity, and the total life of the tree might thus be stated at from 60 to 100 years.

'The soil of the Bengal plantations is the ordinary grey sandy loam on which rice is grown. Occasionally the plantations are surrounded by a ditch and wall made of the soil thrown up from the ditch, but this appears to be more intended for protection than for drainage.'

On an average each tree produces two bunches of fruit, sometimes three or four. But two good bunches yield as much as three or four inferior ones. The manure used and the rainfall determine the size of the bunches. A good bunch gives 200 to 300 nuts and a specially good one about 400. Unfavourable rain or cloudy weather in April or May causes many of the young fruits to fall off and allows only a smaller number of nuts on each bunch to reach maturity.

DISEASES AND PESTS.—E. J. Butler* described in 1906 a

* Butler, E. J., Some Diseases of Palms. Agricult. Journ. India I (1906) 299.

disease of the betel-nut palm which had been known in the Malnad districts of Mysore, particularly near Koppa, for many years. In 1910 a fuller account of the same disease was given by L. C. Coleman.* It is chiefly from the latter paper that we borrow the following details. The reader is referred to the more extended and fully illustrated account which the same author has published as a Bulletin of the Agricultural Department of Mysore.

The disease in question is known in Kanarese, the chief language of the Mysore State, as 'Koleroga,' which means simply 'Rot Disease.'

The disease has been observed with certainty only in the extreme western parts of Mysore. 'The area affected consists of an extent situated in the Western Ghauts and extending practically from the extreme north of the State to a point about 80 miles southward. It has a width in its widest part of about 30 miles. This area coincides pretty closely with the area of heaviest rainfall, the rainfall ranging between approximately 100 and 300 inches in a year..... By far the greater part of the rain falls between the months of June and September and it is during this time that koleroga is prevalent in Mysore.' The disease has, besides, been reported from North Kanara, South Kanara, from a small tract in Malabar adjoining Cochin State, and from Cochin State itself. Mr. Butler informs me that lately the disease has also spread to Dharwar.

'The disease "Koleroga" usually makes its first appearance towards the end of June, about two or three weeks after the beginning of the rains. It restricts itself for the most part to the nuts themselves, but occasionally passes over into the tops of the palms in which case they very speedily succumb. The nuts soon after they are attacked begin to drop from the trees and it is this dropping of diseased nuts which signals the advent of the disease to the garden owners. Its spread is usually remarkably rapid so that within a few weeks an area of many acres may have become badly infected.'

The cause of this disease is a fungus belonging to the genus *Phytophthora*. To Coleman it seems rather doubtful whether this fungus should be considered as a distinct and new species.

* Coleman, L. C., Diseases of the Areca Palm. Ann. Myc. VIII (1910) 591.

He finally decides for placing it with *Phytophthora omnivora,* but as a distinct variety, *viz.,* var. *Arecæ* until such time as he will be able 'to make a thorough search for alternate host plants and until the different *omnivora* forms have been carefully investigated.' This fungus has since been raised to the rank of the species: *Phytophthora Arecæ* (Col.) Pethy.

The owners of betel-nut gardens have themselves invented a method of protection against the disease. They cut covers made of the basal sheaths of the big leaves and tie them over the bunches so as to protect them from the rain. This method is not very satisfactory and the disease may under certain conditions be favoured rather than checked by the coverings. Coleman thought that spraying with Bordeaux mixture might prove successful. The results of a year's spraying which he collected and published show that he was not mistaken.

According to Mullison, a borer does considerable damage to the betel-nut palms. 'It cuts a tunnel from the root upwards and in time reaches to the growing top. The damage there done is so considerable that the top withers and when wind blows breaks off and falls to the ground.'

Of Godavari, it has been said that termites often injure the palm materially by eating the rootlets (Watt).

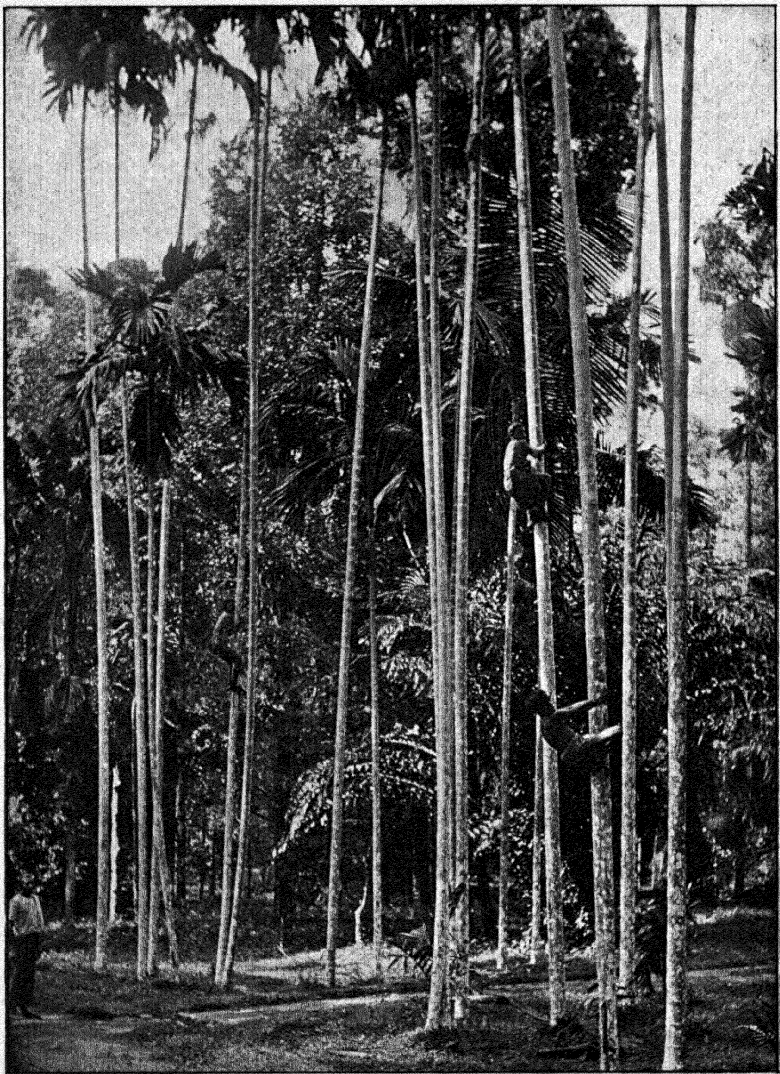
ILLUSTRATION.—Plate XCII shows a group of Betel-nut Palms taken by Mr. Macmillan in the Botanic Garden of Peradeniya.

In appearance the Betel-nut Palm is perhaps the most graceful and elegant of Indian Palms. The erect and slender trunk is of dark-green when young, and of a dark-grey colour when old. The circles formed by the clasping petioles of the leaves are distinctly visible upon the stem. The summit terminates in a tuft of dark-green foliage. The fruit ripens only once during the year. At this period the tree has a beautiful appearance, long bunches of orange oval-shaped fruit hanging from the upper parts of the trunk, contrasted by the dark-green foliage.

2. **Areca concinna** Thw. Enum. (1864) 328; Hook. f. Fl. Brit. Ind. VI, 406; Trim. Fl. Ceyl. IV, 322.—*A. dicksonii* Roxb. (?); Moon Cat. 66, C. P. 620.

NAME—Len-teri (Ceylon).

DESCRIPTION.—Trunk 8-12 feet high, $1\frac{1}{2}$-$1\frac{3}{4}$ inches in diameter,



Betel Nut Palms (*Areca catechu* L.).

cylindric, green. Leaves few, 3-3½ feet long, spreading, subglabrous. Leaflets 2 feet long, 2½ inches broad, lanceolate, falcate, caudate-acuminate, lower simple, 1-costate, upper of 2 or more confluent, acuminate or toothed at the apex, terminal shorter, more or less confluent in toothed laminæ.

Sheath 16 inches long; spadix paniculately branched, a foot or more long, very shortly peduncled; rhachis short, stout, compressed, smooth, branches filiform, terminating in pendulous male spikes. Male flowers biseriate, $\frac{1}{10}$ inch long; sepals oblong, obtuse; petals nearly thrice as long, obliquely ovate-lanceolate, acuminate, striate; stamens 6; anthers subsessile, linear-oblong, acute, cells parallel; pistillode trigonous. Female flowers ½-⅓ inch long; calyx an obscure unequally 3-lobed cup; petals broadly ovate-oblong, obtuse.

Fruit 1½ inch long, subfusiformly ovoid, umbonate, scarlet.

HABITAT.—Forests of the moist low country of Ceylon; Subaragamuwa, Reigam Korale, Pasdun Korale (endemic in Ceylon).

FLOWERS in September.

CULTIVATION IN INDIA.—This palm is occasionally planted; the fruits, however, which are also chewed with betel, like *A. catechu*, are generally obtained from wild trees (Hooker).

ILLUSTRATION.—The dense tuft of *Areca concinna* on plate XCIII grows in the Botanic Garden of Peradeniya. The photograph was kindly supplied by Mr. Macmillan.

3. **Areca nagensis** Griff. in. Calc. Journ. Nat. Hist. V, 156; Palms Brit. Ind. 129; Hook. f. Fl. Brit. Ind. VI, 406.

Name of the palm in Naga, Tal-pat; Singpho name, Tongtau; name of the nut in Naga, Kave; in Assam, Tamul.

DESCRIPTION.—This species is not well known, Griffith deriving the description of it from imperfect specimens of leaves, an imperfect spadix with immature fruit, and a perfect fruit.

The trunk rises from 30-40 feet high and is attached to the soil by innumerable black fibrous roots. The leaf stalk is naked for about three feet, the blade measuring about four. 'Pinnules sub-opposite or alternate, falcate, very acuminate, nineteen or twenty inches long, about one and a half inch broad, above with two or three stout keels; the terminal one deeply bilobed, variously partite, the laciniæ or divisions bidentate; the less divided broader part is obliquely truncate with irregular teeth.'

To this description Griffith has added the note: 'The leaves may be open to doubt, from their resemblance to those of *Areca gracilis*.' (*Pinanga gracilis* Blume.)

The spadix measures about one foot; the compressed peduncle is divided from near the base into stout flexuose branches. The female flowers are on the lower parts of the branches, each with a scale-shaped bract. 'Sepals round, oblong, obtuse; petals larger, sub-cordate with a short obtuse cuspis.

'Fruit oblong-ovate, one inch long and 5 lines wide, attenuated to both ends, base surrounded by the perianth, apex rostrate-mammillate, truncate, with a small mammilla in the centre; fibres numerous, stout, whitish. Seed erect, ovate, half an inch long, marked with many veins arising from the hilum, these are generally dichotomous, anastomosing reticulately on the dorsal face. Albumen cartilaginous, horny, ruminate, opaque white. Embryo basilar.' (Griffith.)

HABITAT.—Naga Hills, up to 800 feet, very scarce, usually on high situations on river sides.

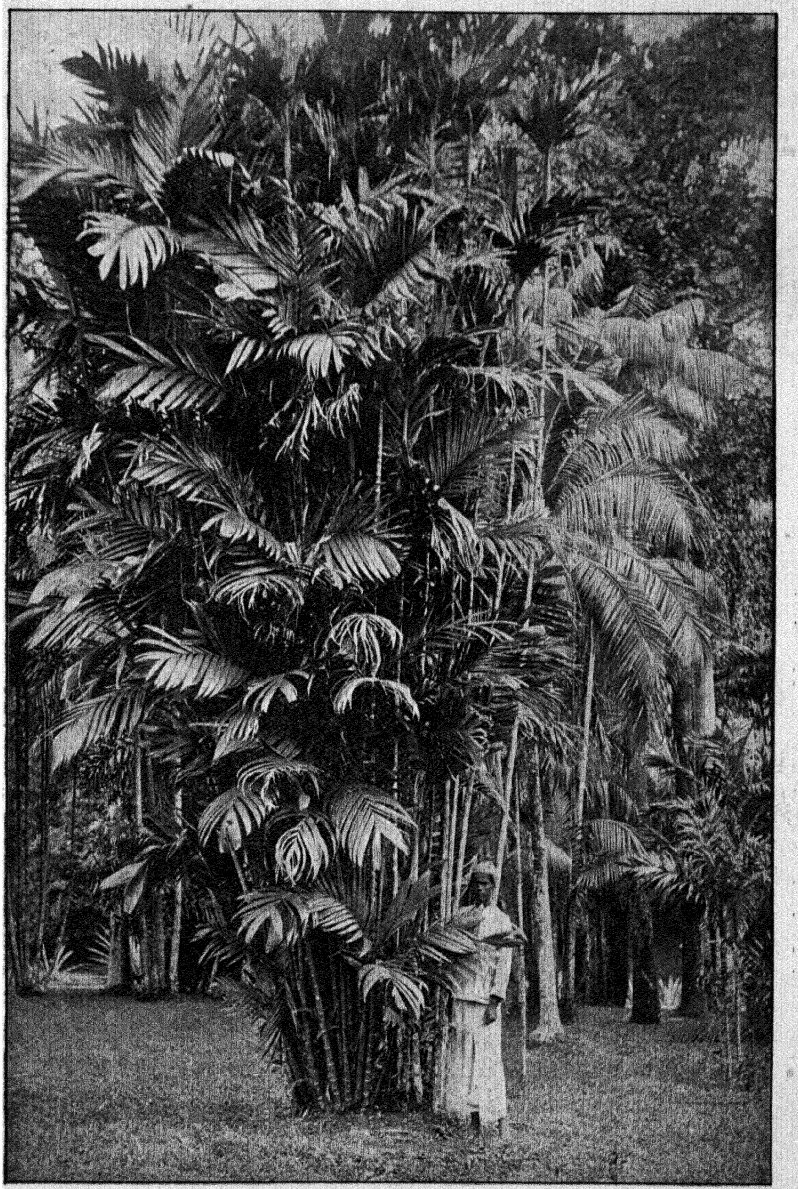
USES.—The Nagas and Abors use it as a substitute for the betel-nut.

4. **Areca triandra** Roxb. Hort. Beng. 68; Fl. Ind. III, 617; Ham. in Mem. Wern. Soc. V, 310; Mart. Hist. Nat. Palm. III, 171, t. 149, fig. 1, 2, 3; Griff. in Calc. Journ. Nat. Hist. V, 154; Palms Brit. Ind. 148, t. 230, A; Kurz. For. Fl. II, 537; Hook. f. Fl. Brit. Ind. VI, 406.

NAMES.—Bungua, Ramgua, Runi Supari (Beng.).

DESCRIPTION.—The palm is shrubby and throws out offsets at the base. The green, distinctly annulate stem grows five to seven feet high and is one inch and a half in diameter. The leaves are bright green and comparatively large, being four to five feet long. The pinnules are alternate, linear-ensiform, often falcate, obliquely acuminate, thirteen to sixteen inches long, one and a half to two inches broad, with one, two or three keels above; the upper ones are more or less split at the apex; the terminal leaflets are broadly cuneate, deeply bipartite, forked, the lobes themselves truncate and having as many bidentate lobes as there are keels on their undersides.

The green smooth spathe has a short blunt point, and is from six inches to a foot long and from two to three inches broad. The peduncle and branches of the much divided spadix are compressed. A linear bract, half an inch in length, is to



'Areca concinna Thw'.

be seen at the base of the lowermost branch. The branches are spreading and much divided; the secondary divisions are stoutish towards the base, where they bear a female flower, close to which they branch into two slender flexuose spikes, from which the male flowers arise, or oftener are attenuated into one. 'Male flowers angular, small, cream-coloured, in pairs pressed together and secund on the outer side of the spikes. Sepals three, minute, ovate-oblong, unequal. Petals oblong, obtuse, valvate, three or four times longer than the sepals. Stamens three, opposite the sepals; filaments stout, short, united at the base; anthers sagittate. Rudiment of the pistillum conical-subulate. Female flowers rather large, generally placed between a pair of rudimentary males, suffulted by two broad, short, pointed bracts. Sepals roundish, green. Petals similar, but smaller and less tough. Six very small rudimentary stamens. Ovary ovate, one-celled, white. Ovule one, ascending. Style 0. Stigma of two, or generally three erect unequal acute lobes. Fruit oblong, of the form of an olive, but longer, distinctly mammillate, smooth, when ripe of a lively orange colour, at length becoming red. Pulp in small quantity, and mixed with many longitudinal strong, ligneous fibres. Seed coniform. Albumen much ruminated. Embryo basilar.' (Griffith.)

HABITAT.—Chittagong, Martaban, Tenasserim, the Andaman Islands, Malay Peninsula.

FLOWERS in the hot and rainy season; fruit ripens the following year.

ILLUSTRATION.—We reproduce on plate XCIV a group of *Areca triandra* which was photographed by Mr. Macmillan in the Botanic Garden of Peradeniya.

7. COCOINEÆ.

Upper spathe of spadix complete, opening on the ventral side at the time of flowering, persistent (in *Elaeis* opening irregularly and caducous); lower one short or rudimentary. Ovary of 3 united carpels (of 3-6 in *Orbignya* and others); each carpel having at its base a seed deeply embedded in the central placenta; the loculi disappear in the fleshy mass of the carpels. Drupe of 3 (-6) strongly united carpels; remains of the stigma apical. Stone 1, formed by 3 syncarpous carpels, mostly with

1 seed (rarely 2 or 3-6). Seed with a rough testa, mostly with a raphe distinctly ascending on the inner side. Leaves paripinnate; leaflets reduplicate.

DISTRIBUTION.—America between 25° N. L. and 35° S. L. One species of *Elaeis* and one of *Cocos* have a wider distribution.

A. SUB-TRIBE: ELAEIDEÆ.

Spadix branched. Flowers solitary, or male flowers in pairs included in deep cavities of the stout branches. Male flowers with the stamens united. Calyx and corolla of the female flowers of about the same length, imbricate; endocarp with 3 pits situated in the upper half or near the apex; radicle of the embryo obliquely ascending.

Barcella Trl., *Elaeis* Jacq.

One species of *Elaeis* is cultivated in India.

1. *ELAEIS* JACQ. STIRP. AMER. 280, t. 172.

Benth. et Hook. f. Gen. Pl. III, 944.—H. B. et K. Nov. Gen. et Sp. I, 306 (*Alfonsia*).

Stem unbranched, erect or decumbent, annulate, clothed with old petiole-bases. Leaves many in a terminal crown, large, pinnate; petiole short, thick, spiny on the margins or unarmed, with a short open sheathing base; leaflets ensiform, acuminate, recurved at the base.

Spadices interfoliaceous, short, thick, peduncle loosely clothed with acute bracts; branches dense, male terminating in a spine, female more robust; spathes 2, complete, at length breaking up into fibres; male bracts very densely imbricate, connate into cupules; male bracteoles scale-like; female bracts large, lanceolate, spinescent, overtopping the flowers; female bracteoles like the sepals. Male flowers: Sepals linear or lanceolate, concave, imbricate. Petals smaller and thinner than the sepals, valvate. Stamens 6; filaments connate into a thick fleshy cylindrical tube below, free and reflexo-patent at the apex; anthers linear-oblong, bilobed at the base, exserted, basifixed. Rudiment of ovary minute. Female flowers much larger than the male, ovoid, sepals ovate, imbricate at the base. Petals a little longer than the sepals, erect, convolute-imbricate, entire or split at the apex. Disk annular. Ovary ovoid or subcylindrical, 3-celled or



Areca triandra Roxb.

by abortion 1-2-celled; style thick, pyramidal; stigmas large, linear, revolute; ovule filling up the cell; micropyle subapical.

Fruit ovoid or obovoid 1-3-seeded, intruded at the base; umbilicate at the apex, stigmas terminal; pericarp spongy and oily, fibrous inside; endocarp thick, long, with 3 pores above the middle. Seed adnate just below the centre of the cell; testa thin; raphe reticulately branched; albumen cartilaginous, homogeneous, hollow; embryo opposite a pore of the endocarp.

Species about 4.—Tropical Africa and Eastern Tropical South America.

1. **Elaeis guineensis** Jacq. Stirp. Amer. 280, t. 172, ed. pict. 136, t. 25f.—Mart. Hist. Nat. Palm. II, 62, t. 54 et 56; Münch. gel. Anzeig. (1838) 639, (1839) 46.—R. Br. Vermischt. Schrift. I, 269.—Schum. & Thonn. Beskr. Guin. Pl. 439.—Tuckey River Congo 455.—Hook. Niger Fl. 13, 526.—Mann and Wendl. in Trans. Linn. Soc. XXIV, 424, 439.—Kirk in Journ. Linn. Soc. IX, 231.—Schweinf. Beitr. Fl. Aethiop. 291.—Guessfeldt and Pechuel—Loesche, Loango Exped. I, 56, with fig., 208, 224 with fig.;—J. Braun in Mitth. Deutsch. Schutzgeb. II (1889) 148.—Engl. Pfl. Ost. Afr. B. 8, C. 131.—Drude in Engl. Jahrb. XXI, 112.—Henriques in Bolet. Soc. Brot. V, 206, 218.—Durand & Schinz Conspect. Fl. Afr. V, 462, and Etudes Fl. Congo I, 274.—*E. Guineensis var. macrosperma* Welw. Apont. 584.—Rendle in Cat. Afr. Pl. Welw. II, 84.

NAMES: OF THE TREE:

English: Oil palm, African oil palm, true oil palm.

French: Aouara d'Afrique, aouara des Caraïbes, aoura de Guinée, arouara des Caraïbes, avoira de Guinée, élaïs de Guinée, éléide, éléide de Guinée, noix de palme, noix de palmier, palmier crocro, palmier épineux, palmier à huile, palmiste épineux.

German: Oelpalme, Afrikanische Oelpalme, Guineische Palme.

Dutch: Afrikaansche awarra, Afrikaansche oliepalm, obepalm, oliepalm van Guinea, oliepalm van West Afrika, oliepalm van de kust van Guinea, palmietboom.

In Guinea: Toehn—Tis.

In Angola: Dihoho.

In the Island of St. Thomas: Denden or Palmeira Andim.

In Surinam: Aaavora, avuara, avoora, avouara, maba, obé.

OF THE YELLOW FAT OIL FROM THE SARCOCARP:

Latin: Butyrum palmæ, Oleum elaeidis, oleum expressum palmæ, oleum palmæ.

English: Macaw fat, palm oil.

French: Beurre de palme, beurre de palmier, beurre de Galam, graisse d'Ashantis, huile de palme, huile de palmier, huile de Sénégal, pumicin.

German: Palmbutter, Palmfett, Palmoel.

Dutch: Afrikaansche palmolie, olie van Senegal, palmboomolie, palmolie, palmvet.

OF THE WHITE FAT OIL MADE FROM THE KERNELS:

English: Palm kernel oil, palm seed oil.

French: Beurre de Galaham, huile de palmiste, huile de pepin de palme.

German: Galahambutter, Palmkernenoel.

Dutch: Palmpittenvet, palmkernvet.

DESCRIPTION.—Stem robust, 20-50 feet high, sometimes reaching 85 feet, always quite straight, usually $\frac{2}{3}$-1 foot in diameter, and about $3\frac{1}{3}$ feet just above the ground, annulate, bearing the remains of old leaves when young, never soboliferous. Leaves show their normal dimensions only after 6 or 8 years. Leaves of adult palm 20-40, forming a terminal crown, 10-17 feet long. Leaflets 100-160 pairs, lanceolate-linear, those in the middle of the leaves 2-4 feet long and $1\frac{1}{2}$-2 inches wide, those on the lower third $1\frac{2}{3}$-$2\frac{1}{3}$ feet long and $\frac{2}{3}$-1 inch wide. Petiole robust, 7-4 feet long, $\frac{1}{3}$-$\frac{2}{3}$ foot broad, suddenly broadened at the base, convex and often white tomentose below, yellowish green, spiny on the margins, spines 50-60 pairs.

Spadices interfoliar, arising below the terminal bud sometimes to the number of 6 or 8 at the same time, the male ones always preceding the female by several weeks or even months; peduncle robust, compressed, $\frac{1}{1}$-$\frac{2}{3}$ foot long, $1\frac{1}{2}$-2 inches broad and $\frac{3}{5}$ inch thick; spathe $\frac{1}{3}$-1 foot long, $\frac{1}{3}$-$\frac{1}{4}$ foot broad, coriacious, floccose-tomentose on the outer surface. Male spadix: Flowering part forming an ovoid mass, rarely oblong or subspherical-compressed, $\frac{1}{2}$-$\frac{5}{6}$ foot long, 5-7 inches broad and $\frac{1}{3}$-$\frac{1}{3}$ foot thick, with many branches bearing densely imbricate flowers. Branches brown, cylindric, subtriquetrous or flattened by mutual compression; $\frac{1}{3}$-$\frac{1}{2}$ foot long. Flowers very numerous, densely arranged in 20 longitudinal lines at least in the upper part. Sepals 3, free to the base, oblong, obtuse, greyish, scarious. Petals of the same size and shape as the sepals. Stamens 6; filaments short, united at the base; anthers sagittate. Rudimentary ovary reduced to

a whitish protuberance. Female spadix: Peduncle shorter than in the male, inflorescence more massive than in the male and sometimes more spherical, though slightly compressed, ½-1⅙ foot long, ⅓-½ foot broad; branches about 100-150, each bearing 6-40 flowers, usually 8-12. Flowers much larger than in the male; bract 1, whitish-yellow or greenish, lanceolate-subulate, about ⅛ inch long and terminated by a spine which reaches beyond the flower; bracteoles small, ovate or ovate-oblong, shorter than the sepals. Sepals 3, oblong, ⅖-⅗ inch long, scarious, subobtuse and often laciniate at the top. Petals 3, of the same shape as the sepals, of the same length or slightly longer; annular disk truncate or very slightly dentate. No rudimentary stamens. Ovary ovoid-cylindric, ¼ inch long, about ⅙ inch in diameter, 1-locular (or exceptionally 2-3-locular); style whitish, about ⅛ inch long, of almost the same diameter as the ovary; stigmas 3, rarely 4; ovule 1 in each loculus, inserted at the base, filling the whole cavity.

Fruiting spadix ⅓-1½ foot long, ⅓-1⅙ foot broad. During the ripening of the fruits the terminal spines of the branches and bracts become longer. Fruit sessile, enclosed in the dry perianth, ovoid, attenuate and then suddenly truncate at the apex, with the dry style often persistent, red, passing into orange, or almost orange or vermilion red, or sometimes black in the upper half, and whitish yellow in the lower. Size variable according to the variety of the plant. Seed occupying the whole cavity of the endocarp.

Habitat.—The geographical limits of the Oil Palm in W. Africa are in the north the Senegal River (16° N. L.), in the south the districts Loanda and Benguela in the Portuguese Congo. Eastwards it stretches from the west coast right across Africa. In Central Africa it has not been observed beyond 18° 45′ N. L.

History.—De Candolle writes about this palm: 'Travellers who visited the coast of Guinea in the first half of the sixteenth century already noticed this palm, from which the Negroes extracted oil by pressing the fleshy part of the fruit. The tree is indigenous on all that coast. It is also planted, and the exportation of palm oil is the object of an extensive trade. As it is also found wild in Brazil and perhaps in Guinea, a doubt arose as to the true origin. It seems the more likely to be

American that the only other species which with this one constitutes the genus *Elaeis* belongs to New Granada. Robert Brown, however, and the authors who have studied the family of palms are unanimous in their belief that *Elaeis guineensis* was introduced into America by the Negroes and slave-traders in the traffic between the Guinea coast and coast of America. Many facts confirm this opinion. The first botanists, who visited Brazil, Piso and Marcgraf and others, do not mention the *Elaeis*. It is only found on the littoral, from Rio de Janeiro to the mouth of the Amazon, never in the interior. It is often cultivated, or has the appearance of a species escaped from the plantations. Sloane, who explored Jamaica in the seventeenth century, relates that this tree was introduced in his time into a plantation which he names, from the coast of Guinea. It has since become naturalized in some of the West India Islands.' (*Origin of Cultivated Plants*, p. 429.)

Uses.—*Elaeis guineensis* is foremost among the useful palms of tropical Western Africa. The oil of the mesocarp of the fruit of this palm constitutes in most parts the chief food of the natives, who hardly ever take a meal in which it is not used in some way or other. It is nutritious and of an agreeable flavour—so much so, indeed, that it generally becomes a favourite dish with Europeans. Besides being used as food, the natives also use it for oiling their bodies, partly to keep away insects and partly as a substitute for clothing. The Bubis of the Island of Fernando Po make an excellent poultice of it which they apply to wounds; they use it especially when the hand of any person, found guilty of adultery, has, in accordance with the usage of these people, been cut off. Among the more civilized natives it is used, as in Europe, in the manufacture of soap; it is also employed for lighting their huts, but the oil extracted from the kernel of the nut is generally preferred for this purpose. The exportation of the fruit of this palm has attained great dimensions.

The toddy of this palm, a drink much liked by the natives, is obtained by cutting off the male flower-spike; this wine is also used by the Europeans instead of yeast in making bread. Besides the oil, the Africans prepare from *Elaeis guineensis* palm-soup, a dish which, when made of boiled palm-nuts only, is very well flavoured. The natives pick the nuts of those young trunks

which have not yet lost any of their leaves, and consider them as superior to the fruit of older plants.

The main nerves of the leaf and the exterior of the petiole are used for basket-work, for the making of brooms, and similar purposes. The fibre at the base of the leaves, and also that of the spathe, is used for stuffing cushions, etc. The soft centre of the upper parts of the stem, consisting of the undeveloped leaves, is much relished as a vegetable. Finger-rings, bracelets, necklaces, and other ornaments are cut from the endocarp of the seed.

CULTIVATION IN EUROPE.—Stove palms. They thrive well in a rich sandy loam. Propagation by seeds. They form excellent decorative plants when in a young state.

LIST OF SYNONYMS.—

Elaeis dybowskii Hua in Bull. du Muséum I (1895) 315=E. guineensis Jacq. var. idolatrica Aug. Chev.

E. macrosperma Welw. Apontamentos 584=E. guineensis var. communis dura Becc?

E. microsperma Welw. Apontamentos 584=E. guineensis var. communis tenera Becc?

E. nigrescens Aug. Chev. Docum. 46 (subsp.). Comprises several varieties of guineensis Jacq.

E. virescens Aug. Chev. Docum. 60 (subsp.). Comprises several varieties of Elaeis guineensis.

ILLUSTRATION.—The specimen figured on Plate XCV was taken by Mr. Phipson in the Victoria Gardens, Bombay. Some fine specimens may be seen on Plate I.

B. SUB-TRIBE: ATTALEEÆ.

Spadix much branched, or little, or not at all; upper spathe complete, woody and persistent. Male and female flowers forming 3-flowered clusters at the base of the branches. The upper part of the branches or, besides, special spadices only male. Stamens of the male flowers free or united at the base. Calyx and corolla of the female flowers of 3 leaves, broadly imbricate, convolute. Endocarp with 3 (-6) pits situated in the lower half. Radicle of embryo obliquely descending. Unarmed; spathe sometimes densely woolly.

Orbignya Mart., *Attalea* H. B. & Kth., *Maximiliana* Karst., *Cocos* L., *Diplothemium* Mart., *Jubœa* Gay.

KEY TO THE GENERA DESCRIBED BELOW:

I. Putamen acute at base:
  A. Male spadix mixed with androgynous flowers:
    (1) Male petals reaching far beyond the stamens ... ... *Attalea.*
    (2) Male stamens protruding beyond the petals ... ... *Maximiliana.*
  B. All the spadices with clusters of 3 flowers or a few female flowers at the base of the branch whose upper part bears only males ... ... *Cocos.*
II. Putamen not acute at base ... ... *Jubœa.*

1. *ATTALEA* H. BPLD. & KTH. NOV. GEN. SPEC. I, 309, t. 95, 96.

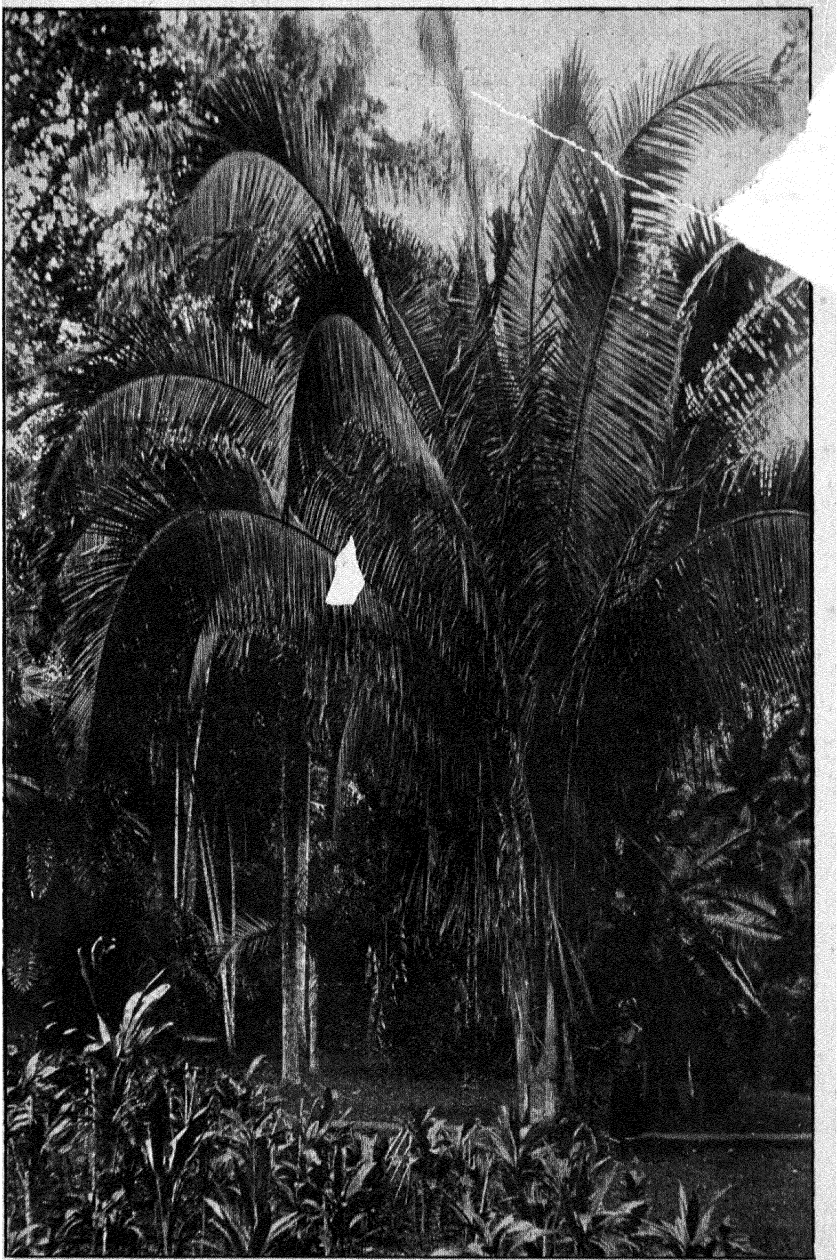
(After 'Attaleia,' the name of several Greek towns, which were called so in honour of Attalus I., King of Pergamum, 241-197 B. C.)

Kunth Enum. Pl. III, 275.—Karst. Linn. 28, 255, 273.—Mart. Hist. Nat. Palm. II, 135, t. 41, 75, 95-97; III, 296, 325, t. 167-169.—Oerst. Palm. Centro-Amer. (1858) 49.—Griseb. Fl. Brit. W. Ind. 522.—Wallace Palm. Amaz. 116, t. 3, fig. 1, 46.—B. Rodr. Enum. Palm. Nov. 42.—Drude in Fl. Brasil. III, II, 434.—Benth. & Hook. Gen. Pl. III, II, 947, 130.

Stems generally lofty, cylindrical, smooth, irregularly annulate; some species stemless. Leaves large, regularly pinnate; petioles with the margins of the sheathing bases more or less fibrous.

Spadix arising from among the lower leaves; spathes double, the inferior one complete and woody. Flowers monœcious or diœcious, yellowish-white. Male flowers: sepals 3, free, or coherent at the base; petals membranous or fleshy, lanceolate, erect. Stamens 6-24; pistillode small. Female flowers: sepals and petals 3, ovate; ovary egg-shaped; style short; stigmas 3; staminodes forming a ring.

Fruit large, ovate or oblong, with a dry fibrous outer covering,



Uauassu Palm (*Attalea speciosa* Mart.).

red or greenish brown. Seeds usually 3, sometimes 4 or 5. Albumen cartilaginous, equable, mostly solid. Embryo basilar.

Species about 23.

DISTRIBUTION.—In various parts of South America, especially in the vicinity of the Amazon and its tributaries, from the level of the sea to a height of 4,000 feet above it.

CULTIVATION IN EUROPE.—Handsome stove palms. They grow well in a compost of peat and loam in equal quantities and require a liberal supply of water; summer temperature from 65°-80°, winter temperature from 55°-60°.

1. **Attalea cohune** Mart. Hist. Nat. Palm. III, 300, t. 167, f. 4; Walp. Ann. I, 1008; Oerst. in Vidensk. Meddel. (1858) 50; Seem. Bot. Voy. Herald 204.—Godm. & Sal. Biol. Centr.-Amer. III, 415.

NAMES: OF THE TREE:

English: Cohune palm, Cohune tree.
German: Cohunepalme.
French: Cohune (de la Guyane).
In Panama: Palma real, Corozo gallinazo.

OF THE NUT:

English: Cohune nut.
German: Cohunenuss.

OF THE OIL:

English: Cohune oil.
German: Cohuneoel.
French: Huile de cohune.
Dutch: Cohuneolie, palmolie.

DESCRIPTION.—Resembles in appearance the Coco-nut Palm, but is not nearly so high as that tree, and the trunk is considerably thicker. Stem unarmed. Leaves erect, ultimately spreading, pinnate, furnished with 3-4 dozen dark green leaflets, sometimes 18 inches in length; petioles rounded, and dark brown below, flat and green on the upper side.

Fruit about the size of a large hen's egg, growing in clusters, each cluster resembling a bunch of grapes. Nut ovoid, 2½ inches long, 1⅓ inch broad, shortly beaked at the top (beak compressed-conical, 4 lines long), brown, roughish; putamen 3-celled;

seeds 2 or 3, oblong, 16 lines long, 7 lines broad, obtuse at both ends.

HABITAT.—Honduras, Panama.—Grown in Indian gardens.

USES.—In the Province of Panama wine is prepared from the trunk. The unexpanded segments are used for wrapping-up cakes of Indian corn (tortillas) previous to boiling them in water. The expanded leaves serve as thatch, and are employed in the religious ceremonies of Palm Sunday. From the fruit an oil is extracted. (Seeman.)

2. **Attalea speciosa** Mart. Palm. Brasil. 138, t. 96, f. III, 3, 4, 5, 6 (*sub nomine A. excelsæ*); Hist. Nat. Palm. III, 298, t. 169, f. IV; Palmet. Orbig. 117; Wallace Palm. Amaz. 117, t. 46; Drude in Fl. Brasil. III, II, 443.

NAMES.—Uauassu Palm (English); Uauassupalme (German). The vernacular Uauassu means 'large fruit.'

DESCRIPTION.—Stem 50-70 feet high, straight, cylindrical, and nearly smooth. Leaves large, terminal, regularly pinnate, 15-20 forming a dense crown, the outer ones patent. Segments elongate, rigid, closely set together, spreading out flat on each side of the midrib, the uppermost deflexed. The sheathing bases of the petioles are persistent for a greater or less distance down the stem, and in young trees down to the ground.

Spadices growing from among the leaves, large, simply branched.

Drupe large, about 3-4 inches long, 2 inches in diameter, supported by the persistent perianth, slowly conical-narrowed towards the apex, fuscous; the epidermis clothed with a dense ferruginous tomentum. The foramina of the putamen $\frac{2}{5}$ inch from the base, hidden in the fibres of the mesocarp; fibres within the putamen solitary, included, densely scattered, running longitudinally. Seeds very narrowly oblong, $2\frac{1}{2}$-3 inches long.

HABITAT.—Brazil, Guiana.—Cultivated in India.

USES.—The foliage is very extensively used for thatching. The young plants produce very large leaves before the stem is formed and it is in this state that they are generally used. The unopened leaves from the centre are preferred as, though they require some preparation, they produce a more uniform thatch. The leaf is shaken till it falls partially open, and then each leaflet is torn at the base so as to remain hanging by its midrib

only, which is however quite sufficient to secure it firmly. They thus hang all at right angles to the midrib of the leaf, which admits of their being laid in a very regular manner on the rafters. They are generally known as 'palha branca' or 'white thatch,' from the pale yellow colour of the unopened leaves, and are considered the best covering for houses in places where Bussu (*Manicaria saccifera* Gaertn.) cannot be obtained.

ILLUSTRATION.—Pl. XCVI. Mr. Macmillan was kind enough to take a photograph of the Uauassu Palm in the Botanic Gardens of Peradeniya.

2. *MAXIMILIANA* MART. HIST. NAT. PALM. I, 131, SP. I. t. 91-93; III. 295 et PALMET. ORBIG. 109 et 113.

(After Maximilian Joseph I, King of Bavaria, 1756-1825.)

Kunth Enum. Pl. III, 291, sp. 1.—Griseb. Fl. Brit. W. Ind. 522.—B. Rodr. Enum. Palm. 41.—Spruce Journ. Lin. Soc. XI, 162.—Wallace Palm. Amaz. 120, t. 3, fig. 2, 3, t. 47.—Drude Fl. Brasil. III, II, 450, t. 104.—Benth. & Hook. Gen. Pl. III, II, 946, 128.—*Scheelea* Karst. (*pro altera parte!*) in Linnæa XXVIII (1856) 264.

Stems of these magnificent palms are tall, erect, and smooth. Leaves very large, irregularly pinnate. Bases of the petioles persistent, often covering the stem down to the ground.

Spadices growing from among the lower leaves, simply branched. Some spadices with only male flowers, others with male and female flowers on the same tree. Spathes large, complete, woody. Male flowers with 6 stamens and a minute pistillode. Female flowers with a short style and 3 stigmas, the staminodes forming a membranous cup.

Fruit ovate, yellow, with a woody, almost fleshy pericarp, 1-3-seeded.

Species about 4.—In tropical Brazil, Guiana, Venezuela, Colombia, Bolivia.

CULTIVATION IN EUROPE.—Handsome decorative stove palms. They thrive in a compost of two parts rich loam, one part peat, and one of sand. During the growing period, water must be given liberally, the quantity of which should be gradually diminished as winter approaches.

1. **Maximiliana regia** Mart. Palm. Brasil. 132, t. 91, 92, 93; Hist. Nat. Palm. III, 296; Palmet. Orbig. 110, t. 15 et 31, f. A; (*exclusa M. Regia* Wallace Palm Trees Amaz. 121, t. 47 et 3=*M. Maripa* Dr. ?); Drude in Fl. Brasil. III, II, 454.—*Maximiliana Martiana* Karst. in Linnæa XXVIII (1856) 279.

NAMES.—Anaja Palm (English); Anajapalme (German); Inaja or Anja (in Brazil).

DESCRIPTION.—Stem lofty, massive, smooth, obscurely annulate, 15-25 feet high, 1-1⅓ foot in diameter at the base, in the upper part about thrice as thick on account of the persistent petioles. Leaves 15-30, densely arranged, over 15 feet long; linear-lanceolate in outline; segments thinly papyraceous, oblanceolate, obtuse, or rotundate-acuminate, the upper ones 1 foot long and 1 inch broad, arranged in groups of 3, 4, 5 or 6, at intervals along the midrib, from which they stand out in different directions, very long and drooping.

Spadices numerous, growing from the bases of the lower leaves, simply branched and very densely clustered, 2 feet and more long; spathes large, spindle-shaped, ventricose, woody, the upper one produced into a long beak which reaches almost 6 inches. Branches of spadix numerous, male ones ⅓-⅔ foot long, densely covered with flowers about 1-1½ inch above the base, androgynous ones stouter, 2-3 inches long, developing above the base 1-3 (rarely more) female flowers and then ending in a short male spike. Male flowers ⅔-½ inch long, calyx ½ inch long, triphyllous; corolla ⅛ inch long, infundibuliform. Stamens 6, exserted; anthers more or less ⅓ inch long. Female flowers more than ⅔ inch long; calyx firmly convolute; corolla included in the calyx.

Drupe about 1⅗ inch long, elongate, beaked, with a tough brown outer skin, beneath which is a layer of soft fleshy pulp of an agreeable subacid flavour, covering a hard stony seed; putamen sometimes ovoid-oblong, acuminate, usually acute at both ends.

HABITAT.—Brazil, Guiana, Bolivia.

USES.—The terminal leaf-bud furnishes a most delicious cabbage. The great woody spathes form ready-made baskets used by the natives for carrying earth, clay, and sometimes for cradles; the hunters use them to cook meat in, as with water in them they stand the fire well. The fruits are often eaten.

3. *COCOS* L.

Species about 30, all American, one of them cosmopolitan in the tropics.

(From 'Coco,' the Portuguese for monkey; alluding to the end of the nut being like a monkey's head.)

CULTIVATION IN EUROPE.—Elegant stove palms. They grow well in a compost of two parts rich loam, one part peat, and one of sand. When growing they must be supplied with plenty of water; as winter approaches the quantity of water should be gradually diminished. They are not so well suited for sub-tropical gardening as many other genera of palms; but in a well-drained and sheltered spot, it is probable several of the species might prove satisfactory.

SUB-GENUS I.—*EUCOCCUS* DRUDE.[1]

Tall, unarmed, monœcious, with smooth annulate stems. Leaves pinnatisect; leaflets narrow.

Spadix erect, at length drooping, simply panicled; branches bearing scattered female flowers, often between two males towards their bases and males above. Spathes 2 or more, lower short, upper fusiform or clavate; perianth coriaceous. Male flowers unsymmetric; sepals small, valvate; petals oblong, acute, valvate; stamens 6; filaments subulate; anthers linear, erect; pistillode minute or absent.

Female flowers much larger; globose; perianth greatly accrescent; sepals imbricate; petals shorter, convolute with imbricate tips; ovary 3-celled, usually 1-ovuled; style short, stigmas recurved; ovules subbasilar.

Fruit large, ovoid, terete or trigonous, 1-seeded; style terminal; pericarp thick, fibrous; endocarp bony, with 3 basal pores, the remains of the 3 cells; seed cohering with the endocarp; albumen hollow, equable, merely lining the endocarp with a thick hard coat; embryo opposite one pore.

Species 1, of American origin, but widely distributed throughout the tropics.

1. **Cocos nucifera** L. Fl. Zeyl. 392; Mart. Hist. Nat. Palm. II, 123 *(exl. descript. flor. masc. et fem.)* t. 62, 75 et t. 78 *tantum quoad* fig. V et

[1] In the arrangement of the species of Cocos I follow O. Beccari; cf. his 'Palme incluse nel genere Cocos' pp. 8-9.

VI, *excl.* fig. III, et IV, *et analys. omn.;* Kunth Enum. III, 285: Roxb. Cor. Pl. I, 52, t. 73; Fl. Ind. III, 614; Thw. Enum. 330; Brandis For. Fl. 556; Kurz For. Fl. II, 540; Hook. Fl. Brit. Ind. VI, 482 (with the above restrictions as to Martius); Brandis Trees of India 648; Cooke Fl. Bomb. II, 812; Blume Rumph. III, 82-88; Miq. Fl. Ind. Bat. III, 64; Hook. Journ. Bot. II (1850) t. 1; Beccari Malesia I, 85-86; Le palme incluse nel genere Cocos 12; Hemsley Bot. in the Voyage of the Challenger III, 103, 202, 249, 278, 297, 306, 809.—*C. nana* Griff. Notul. II, 166.—Rheede Hort. Mal. I, t. 1-4.

NAMES OF THE TREE:

English: Coconut Palm, Coconut Tree, Cocoa Nut, Cocoa Nut Palm.

German: Kokospalme, Echte Kokospalme, Cocospalme, Cocosnussbaum, Kokospalmenbaum, Kokosbaum, Calappabaum, Calappusbaum, Indianischer Nussbaum, Kokosgalen, Wandernde Seeuferpalme.

Dutch: Kokospalm, koko, kokosboom, kokosnootenboom, kokosnootpalm, klapperboom, klapperpalm, klapper, calappusboom, kalappus, cocos, cocosboom, cocospalm.

French: Cocotier, cocotier commun, cocotier des Indes, cocotier nucifère, cocotier ordinaire, cocotier porte-noix, palmier.

Hind.: Narel, nariyal, nariel, nariyel, nariyal-ka-per.

Beng.: Narikel, nariyal, dab, narakel.

Guj.: Nariel, nariyela, nariera, naliyer, naryal.

Bomb.: Maar, naril, mahad, narel, naral-cha-jhada, mar, naural.

Mar.: Narela, narula, naralmad, mad, mada, mahad, varala, narel, narali-cha-jhada, naral, mar, tenginmar.

Tam.: Tenna, tenga, tennan-chedi, tenna-maram, tengay, taynga.

Duk.: Narel-ka-jhar, narel.

Tel.: Nari-kadam, tenkaia, kobbari, goburri-koya, tenkaya, kobri, chullu, kobbari chettu, tenkaya-chettu, erra-bondala, gujju-narchadam.

Kan.: Thenpinna, kinghenna, tengina, tengina-gida, tengina-kaya, tengina chippu, tenginay amne, tengmararu.

Mala.: Tenga, tenn-maram, tenna, nur, kalapa, nyor, kalambir.

Mysore: Nur.

Sanscr.: Nari-kela, nari kera, nari keli, langalin.

Arab.: Jadhirdah, shajratun-narjil, shajratul-jouze-hindi, narjil, jouze-hindi.
Pers.: Darakhte-nargil, darakhte-bandinj, nargil, badinj.
Sing.: Pol, pol-gass, pol-gaha, pol-nawasi, tambili.
Burm.: Ong, ung, ung-bin, on, onsi, onti, ondi.
Java: Kalapa, bhungkana, ijor, bhungkana njijor, enjor, ijor, kerambil, klapa, klendah, njejor, njijor, njor, tangkal kalapa, wii klapa, wit krambil.
Phillippines: Niog.
Polynes.: Niu.
Guam.: Niyog.

OF THE WOOD:

English: Coco wood, porcupine wood.
German: Kokosholz, Stachelschweinholz.

OF THE COTTON OR TOMENTUM:

English: Coconut cotton.
Dutch: Kokosgaren.
Tam.: Tenna maruttu pungie.
Tel.: Tenkaia-chettu-puthie.
Mal.: Tennam-puppa.

OF THE CABBAGE:

English: Coconut cabbage.
German: Palmhirn, Palmkohl.
Dutch: Hersenen van den palmboom, kool van den palm, palmkool.
French: Chou palmiste.
Tam.: Tennam kurtu.
Tel.: Tenkaia gurtu.
Arab.: Naril-ka-krute.

OF THE BROOMS MADE OF THE LEAF-RIBS:

English: Goa brooms.

OF THE GUM:

German: Cocosgummi.
French: Gomme de coco.

OF THE TODDY:

English: Palm wine, toddy.
German: Palmwein, Toddy.
Dutch: Palmwijn, toddy.
French: Vin de palmier, toddy, vin de palmiste, vin soury.
Hind.: Nareli.
Duk.: Narel-ki-sendi, narillie.
Tam.: Tenga-kallu, tennan-kallu, tennang-kallu.
Arab.: Nargilie, nargilli.
Pers.: Tariye-nargil.

OF THE SUGAR:

English: Jagery, jaggery.
German: Palmzucker, Jaggery.
Dutch: Palmwijnsuiker, jagerie.

OF THE NUT:

English: Coconut, cocoanut, cockernut.
German: Cocosnuss, Kokosnuss.
Dutch: Cocosnoot, cokernoot, kalappusnoot, klapper (noot), kokernoot, kokosnoot.
French: Coco, noix de coco, noix d'Inde.

OF THE FIBRE:

English: Coir, coir fibre, coir rope, coconut fibre, khair.
German: Cocosnussfaser, Cocosfaser, Coir, Kair.
Dutch: Coir (vezel), kajar, kokosvezel.
French: Fibre du cocotier, khair, bastin, caire, coir(e).
Mala.: Kayar.
Tam.: Tennam nar.
Tel.: Tenkaia nar.

OF THE HARD FRUIT SHELL:

Dutch: Koker.

OF THE WATER:

English: Coconut water, coconut milk.
German: Cocosmilch, Kokosmilch, Kokosnusswasser.
Dutch: Klapperwater, Kokosmelk, Kokoswei.

French: Eau de coco, lait de coco.
Duk.: Yelnir-ka-pani.
Tam.: Yella-nir.
Tel.: Yella-niru.

OF THE DRY KERNEL:

English: Copra, kopra, copperah.
German: Copra, Kopra, Kopperah.
Dutch: Kopra, copra, coprah, copperah, copperas.
French: Copre, coprah.
Hind.: Khopra.
Guj.: Khopru.
Duk.: Khopra, Khopre, ki-batti.
Tam.: Kobbarait-tengay.
Tel.: Kobbera, kobbera-tenkaya.
Mala.: Koppara.
Kan.: Kobari, kobbari.

OF THE OIL:

Latin: Butyrum cocoidis, oleum cocoinum, oleum cocois, oleum cocos.
English: Coconut oil, cocoa oil, coconut butter.
German: Kokosnussoel, Kokosoel, Cocosoel, Cocosnussoel, Cocosnussfett, Cocosnussbutter, Cocosbutter, Calappusoel, Kalappusbutter, Kopraoel, Vegetalin.
Dutch: Cocosolie, cocosvet, copra-olie, kalapaolie, kalappus-olie, klapperolie, klappusolie, klappusolij, kokernootenolie, kokosboter, kokosnootolie, kokosnootenolie, plantenboter.
French: Huile de coco, huile de palme, beurre de coco.
Hind.: Khopare-ka-tel, nariyal-ka-tel, naril-ka-tel (also in Duk.).
Beng.: Narikel-tail, nariyal-tel.
Guj.: Naryal-nu-tel.
Mar.: Naralicha-tela, naral-tela, kobracha-tela.
Tam.: Tenga-yenney, taynga-nunay, tengai-yenne.
Tel.: Tenkaya-nune, tenkaya-nunay.
Mala.: Tenna-enna, minak, kalapu, minak-nur, nur-minak, kalambir, kalapa minak.

Kan.: Tengina-yanne, cobri.
Sanscr.: Narikela-tailam.
Arab.: Dhonun-narjil, dhonul-jouzehindi.
Pers.: Roghane-nargil, roghane-bandinj.
Sing.: Pot-tel.
Burm.: On-si.
Cochin-chin.: Cay-dua.

DESCRIPTION.—Trunk 40-80 feet high, straight or curved, marked with ring-like leaf scars, which are not prominent, rising from an inclined swollen base which is surrounded by a mass of rootlets. Leaves 6-15 feet long; leaflets equidistant, 2-3 feet long, linear-lanceolate, coriaceous; petioles 3-5 feet long, stout.

Spadix 4-6 feet long, stout, androgynous, simply panicled. Lower spathes 2-3 feet long, oblong, hard, splitting lengthwise. Male flowers unsymmetric; sepals small, valvate; petals ¼ inch long, oblong, acute, valvate. Female flowers larger than the male, 1 inch long, globose, supported by broad bracteoles. Sepals 1 inch in diameter, round, concave, imbricate. Petals shorter than the sepals, convolute, with imbricate tips.

Fruit 8-12 inches long, 3-gonously obovoid or subglobose, green or yellowish; albumen lining the endocarp, the cavity large, filled with a sweet somewhat milky fluid, known as coconut milk.

In germinating the inner end of the embryo, an extension of the cotyledon is developed into a special absorbing organ (the 'apple'). From the outer end of the embryo, situated below one of the openings at the apex of the shell, grow the plumule and the roots. The specialized cotyledon at first attacks and proceeds to digest the part of the kernel adjacent to the embryo. It continues to grow until it fills the entire cavity of the nut, the kernel of which becomes soft. The roots push forth and enter the soil before the kernel is totally absorbed, and finally the union between the young plant and the cotyledon is broken and it begins an independent existence. The function performed by the husk is protective. It is of low specific gravity and keeps the nut afloat if it falls into the sea, so that the nut may be transported from shore to shore by ocean currents.

HABITAT.—The original home of the Coconut tree and the history of its spread are not yet sufficiently known. The



Grove of Coconut Palms on Bombay Island (*Cocos nucifera* L.).

Sanscrit name indicates its ancient cultivation in India; it was, however, not known to classic writers, and it seems certain that it was introduced by the Portuguese into Western Africa and the Cape Verde ands, Island that it did not exist in the West Indies, Guiana, nor Brazil at the time of the discovery of America. It has been supposed to be indigenous in the Indian Archipelago and on the Nicobar and Coco islands of the Bay of Bengal—and this would explain its early cultivation on the coasts of India and Ceylon. But all the other species of the genus *Cocos* are confined to South America, and those that have been said to be indigenous in Mexico, seem to belong to the genus *Attalea*. Considerations of botanical geography would, therefore, point to the west coast of Central America as its home. Martius, indeed, considers it not improbable that the original home of this palm was on the islands near the Isthmus of Panama, and that the nuts were transported thence by westerly currents to Cocos Island, 200 miles west of the coast, which was found densely covered with coconut trees by its first discoverer, without any sign of human habitations. From there it is not difficult to explain the further spread of the nuts by the regular currents and by storms to the Sandwich, Marquesas, and other islands of the Pacific, and to the islands of the Indian Archipelago, whence it may have been introduced into India. A. De Candolle seems inclined to accept the American origin of the coconut, and Griesebach entertains no doubt on the subject. Cook has recently shown that the coconut is in all probability a native of America. At present it is found in every part of the tropics, where it flourishes in the greatest luxuriance in the vicinity of the sea, especially a few feet above high-water mark. Although that is its chief habitat, it cannot be termed an exclusively littoral plant, for it has been met far inland, *e. g.*, at Merida in Yucatan, at Patna in Bengal, at Concepcion del Pao. With regard to the latter place Humboldt remarks: 'I was the more struck with the fact (of finding the coconut tree at this great distance from the sea) because the veracity of those travellers who have asserted the existence of this Palm at Timbuctoo, in the centre of Africa, has been called in question. Bonpland and I saw it repeatedly amid the cultivated spots on the Rio Magdalena, more than a hundred leagues from the coast.' There is, on the other hand, no doubt that the Coconut Palm

refuses to grow in many countries any distance inland, with as much pertinacity as it does in the conservatories of Europe, where, after having attained the age of eight or ten years, it begins to sicken, and soon dies. Seemann affirms, from personal knowledge, 'that numerous trials have been made to cultivate it in the central parts of the Isthmus of Panama, but that all of them have failed,' and he adds: 'The causes therefore which regulate this curious phenomenon are still involved in obscurity, and I should not be surprised to hear that theorists, eager to account for this apparent contradiction in the distribution, had been driven to the necessity of making several species of this Palm, which, as there exist several well-marked varieties, would not be a task attended by great technical difficulties.'—Whenever the Coconut Palm ventures beyond the limits of the tropics, it loses in elegance of aspect and power of productiveness. In the Sandwich Islands, just at the edge of the torrid zone, it has a mean look, and yields fruit in comparatively small quantities.

FLOWERS.—Throughout the year and the nuts require 9-10 months to come to maturity.

USES.—Few of any products of the vegetable kingdom are so valuable to man in those countries where it grows as the Coconut Palm, for there is scarcely any part of the plant which cannot be applied more or less to some use by the inhabitants of tropical climates.

'MILK'.—The nut yields an abundance of a delicious, cooling beverage, to which Madeira wine, brandy, etc., is sometimes added. The water, beautifully clear, has a sweetness, with a slight degree of astringency, which renders it very agreeable. This 'milk' has been erroneously considered as injurious, producing a predisposition to dropsical complaints, and among the Tahitians as one of the exciting causes of féfé, or elephantiasis. This applies, in all probability, to the ripe nut, at which stage the water is unwholesome, and can be drunk only sparingly, as it is strongly diuretic and is apt to produce an irritation of the bladder and urethra. The milk of young nuts, on the contrary, is harmless. 'I have,' says Bennet, 'adopted this cooling beverage during my frequent and long visits to intertropical countries, and have always found it the most cooling and refreshing beverage during my excursions; but when an immoderate quantity is drunk, I have known a slight degree of

strangury produced by it. The ladies, however, who may fear taking it internally, are informed that to the water of the green coconut is ascribed that inestimable property to them, of clearing the face of all wrinkles and imperfections whatever, and imparting to it the rosy tints of youthful days.' The water is used by house-plasterers in preparing a fine whitewash, also in making the best and purest castor-oil, a certain portion of it being mixed with the water in which the seeds are boiled. W. v. Lœwenich made the following analysis of the liquid albumen of the coconut:—

Water	900·88
Sugar	4·43
Gum	17·67
Extractive matters (fat)	28·29
Salts soluble in alcohol	5·44
Salts not soluble in alcohol... ...	6·29

MEAT.—From experiments conducted by Kirkwood and Gies it was found that the fresh meat contains 35-40 per cent. of oil, 10 per cent. of carbohydrate, only 3 per cent. of proteid, 1 per cent. of inorganic matter, and near 50 per cent. of water. The albumen in the young nut is very delicate, easily removed from the shell with a spoon, and may very well be named a vegetable blancmange; in this state it is called Niaa by the Tahitians, who use it, as well as the natives of other of the Polynesian Islands, in several made dishes. After the fruit is suffered to remain a short time longer, and the albumen becomes firmer, the Tahitians change the name to Omate, and the fully ripe nut is called Opaa; in this state it is sometimes, but seldom, eaten, being used principally for making oil, as it contains a small quantity of oily milk; it is in this state the nuts are seen and sold in Europe. In Ceylon, when the nut is fully ripe, it is called Pol, or curry coconut. The kernel, after being reduced to a small size by a certain instrument (hiromane), is placed in a cloth, and water being poured on it, a white juice is extracted by pressure, used invariably, either with or without the grated kernel, in their various curries. A sort of tart, or cheesecake, is made from the kernel of dry nuts rasped or pared down. In New Granada the Negroes boil it with rice. On the Pacific Islands the meat of the ripe coconut, though agreeable to the

taste, is seldom eaten. It is fed to domestic animals of all kinds, even to cats and dogs, and is very fattening. In Guam it is rasped or grated and fed to chickens, but they do not lay so well when living upon a coconut diet as when fed with corn. From the grated meat a rich custard, or 'cream' is expressed, which is extensively used throughout Polynesia as an ingredient for native dishes. One of the most savoury of these, in which it is cooked with tender young leaves of *Caladium colocasia,* is in Sanwa called 'Palu-sami.' This cream contains much oil, as well as carbohydrate and proteid, and is consequently very nourishing as well as pleasant to the taste. In Guam the natives combine it with rice in various forms, and sometimes prepare it like a simple custard. It makes an excellent broth when boiled with a fowl or with other meat, and in the early days of long voyages nuts were carried to sea and used by the sailors for making rice-milk, a dish which they had learned from the natives to prepare (Safford). Another use to which the natives of Guam apply the meat of the coconut is the fattening of the 'robber crab' (*Birgus latro*), which they keep in captivity until fit for the table. The following is a description of the habits of this crab by Charles Darwin: 'The animal is very common on all parts of the dry land of the Keeling Islands, and grows to a monstrous size. The front pair of legs terminate in very strong and heavy pincers, and the last pair are fitted with others weaker and much narrower. It would at first be thought quite impossible for a crab to open a strong coconut covered with the husk; but Mr. Liesk assures me that he has repeatedly seen this effected. The crab begins by tearing the husk, fibre by fibre, and always from that end under which the three eye-holes are situated; when this is completed, the crab commences hammering with its heavy claws on one of the eye-holes till an opening is made; then, turning round its body, by the aid of its posterior and narrow pair of pincers, it extracts the white, albuminous substance. This is certainly a curious case of instinct, and likewise of adaptation in structure between two objects apparently so remote from each other in the scheme of nature as a crab and a coconut tree. The *Birgus* is diurnal in its habits, but every night it is said to pay a visit to the sea, no doubt for the purpose of moistening its branchial. The young are likewise hatched and live for some time on the coast.

These crabs inhabit deep burrows which they hollow out beneath the roots of trees, and where they accumulate surprising quantities of the picked fibres of the coconut husk, on which they rest as on a bed. The Malays sometimes take advantage of this, and collect the fibrous mass as junk. These crabs are very good to eat; moreover under the tail of the larger there is a great mass of fat, which, when melted, sometimes yields as much as a quart-bottle full of limpid oil. It has been stated by some authors that the *Birgus* crawls up the coconut trees for the purpose of obtaining the nuts. I very much doubt the possibility of this; but with the screw-pine (*Pandanus*) the task would be very much easier. I was told by Mr. Liesk that on these islands the *Birgus* lives only on the nuts which have fallen to the ground.'

Oil.—Another valuable production of the coconut is the oil, which is an article of exportation from India, Ceylon and Polynesia. It is procured by first extracting the kernel from its outer integument or shell, and boiling it in water. It is then pounded and subjected to great pressure. This being boiled over a slow fire, the oil floats on the surface. This is skimmed off as it rises, and again boiled by itself. Fourteen or fifteen nuts will yield about two quarts of oil. A somewhat different practice obtains on the Malabar coast. The kernel is divided into two equal parts, which are ranged on shelves made of laths of the Betel-nut Palm, or split bamboo, spaces being left between two laths of half an inch in width. Under them a charcoal fire is then made, and kept up for two or three days, in order to dry them. After this process they are exposed to the sun on mats, and when thoroughly dried are placed in an oil-press, or sicoor. When the oil is well extracted by this method, a hundred nuts will yield about two gallons and a half of oil. This method is usually resorted to when the oil is required for exportation; the former, when merely used for culinary purposes. The application of steam, especially to a press, for the purpose of procuring the oil, has been attended with the greatest advantages. 'At Tahiti they procure the Morii, or oil, from the nuts, by first grating the kernel, then depositing it in the hollow trunk of a tree, or some kind of hollow vessel, which is exposed to the sun during the day. After a few days have elapsed, the grated nut is heaped up in the trough or vessel, leaving a space

between the heaps; the oil exuding drains into the hollow spaces, whence it is collected into Bamboo canes, containing each a gallon or more; in this way it is sold for export; but the indolence of the natives prevents its being so important an article of traffic as it might be in the South Seas. Sometimes the Tahitians, after the oil ceases to collect in the vessel, put the kernel into a bag, and submit it to the action of pressure by a rude lever press; but the oil thus obtained is considered inferior to that procured by the heat of the sun' (Seemann). Coconut oil in India is used chiefly for culinary purposes, burning in lamps, etc. The oil is at first odourless, and with a slight flavour which is agreeable to the taste. It soon turns rancid, however, and in this condition is unfit for food. Coconut oil is perfumed by macerating in it the blossoms of fragrant flowers and substances. 'In the South Seas the natives, though preferring fresh and perfumed oil for anointing the head and body, do not hesitate to make use of rancid oil for these purposes. In Samoa certain kinds of tapa, or bark cloth, are always treated with oil before they are suitable for wearing as clothing, so that to those who have cruised among the islands of the Pacific the smell of rancid coconut oil always brings to the mind visions of brown skinned natives and thatch-roofed huts nestling beneath groves of coconut palms. The natives of Guam still use coconut oil for anointing the hair; but with the custom of wearing clothes that of anointing the body has died out, and the oil is used only for massaging the body in case of sickness. Though the use of petroleum is now general on the island, coconut oil is still sometimes used for illuminating. Until recently certain people paid their taxes partly in oil, which was used for lighting the tribunal. Nearly every house on the island has its little shrine, where before the patron saint a lamp of coconut oil is always kept burning. This lamp consists of an ordinary drinking glass filled with water, upon which the oil is poured. A wick projecting from a float is fed by the oil, and the water keeps the glass cool' (Safford). The oil is also exported to Europe and the United States where it is used for the manufacture of soap and candles. The chief sources of coconut oil are Ceylon and the Madras Presidency, especially the district of Cochin. That which is shipped from Cochin bears generally a higher price than that from Ceylon. Soap

made from coconut oil is more soluble in salt water than that made from other oils or fats, and is consequently much used on seagoing vessels. One objectionable feature of soaps made from this oil is the disagreeable rancid odour which they usually leave on the skin after washing with them. The most serious difficulty encountered by soap makers is the elimination of fatty acids contained in it. To remove these the oil is heated with lye, an emulsion is made and the oil extracted from the mixture by means of a separator and receiver. Coconut oil is not usually employed in soap making but is added to other oils for the purpose of producing quickly solidifying soaps containing a large proportion of water.

Copra.—The dried kernels (copra) as also the Poonac, are sent to Europe and the United States from Ceylon and Cochin. The Poonac is the refuse of the kernel after the oil has been expressed. It is very fattening to fowls and cattle, and forms the best manure to young Coconut trees, as it returns to the soil many of the component parts which the tree has previously extracted for the formation of the fruits. For this reason it has been found worth while to transmit the Poonac to those localities where the Coconut tree grows far inland, away from the saline soil of the coast. The Coconut palm abstracts from the soil chiefly silex and soda, and where these two salts are not in abundance, the trees do not thrive. Copra is used extensively in France, Germany, Spain and England, chiefly in soap making, but also in the manufacture of certain food products resembling butter. This 'cocoa butter,' or 'cocoaline,' should not be confounded with the 'cocoa butter' made from cacao (*Theobroma cacao*), the source of chocolate, which is also an important commercial product. The process of manufacture of coconut butter has been kept secret. The main difficulties to overcome were the tendency to rancidity of the fats and its liquid consistency. The credit for carrying on experiments which finally led to success is due to the firm of Rocca, Tassy and de Roux, of Marseilles, who have also erected a plant at Hamburg. Magnan Frères have more recently succeeded in making a satisfactory butter by independent experiments and some German houses are now doing the same thing. 'The effort to extract an edible grease from an oil produced upon so vast a scale and formerly available only for the manufacture of soap

gave promise of valuable returns if successful; and that this promise was not delusive may be judged from the circumstance that the factory of Rocca, Tassy and de Roux, which produced 25 tons of butter per month in 1900, turned out 600 tons per month in 1902. The butter is not at all a by-product of the manipulation of the oil, as in the factory of Messrs. Rocca, Tassy and de Roux, 7,200 tons of butter are obtained from 8,000 tons of oil per annum in a year of maximum results. The butter is styled 'vegetaline' and 'cocoaline,' the greater demand being for the former. The first named melts at 26° C. and the latter at 31° C., being by that fact better suited for warm climates. In the United States the principal manufacturers of food products from coconut oil are the India Refining Company, of Philadelphia. They have a process by which the rancidity of the oil is eliminated, so that it is sweet, neutral, and adapted for family use and for manufacturing purposes by bakers, confectioners, and perfumers. One brand called 'Kokoreka' consists of the stearine of the coconut oil, having a melting point of about 27·3° C. This is used by manufacturing confectioners in combination with or in place of cocoa-butter. A lighter brand, called 'ko-nut' is used for baking and domestic purposes in place of butter and lard. It has a melting point of about 23° C. Specimens of these products submitted to the Bureau of Chemistry of the Department of Agriculture for analysis, proved to be remarkably free from fatty acids, the 'ko-nut' containing 0·13 per cent. and 'kokoreka', the harder substance, only 0·04 per cent. In consequence of tests made by Dr. Theodor Ternes, of the Royal Imperial Hospital of Vienna, an official report was made, stating that coconut butter meets all hygienic requirements; that it is superior to animal fat and butter; that it is easily digested and is particularly well adapted for the use of patients suffering from impaired digestion' (Safford).

FIBRE.—Coir, or the fibre of the husk of the coconut, is another product of commercial importance. It is imported into Europe and America in the form of coir yarn, coir fibre, coir rope, and bristle fibre, and is principally used in manufacturing matting and brushes. There are several ways of stripping the fibres from the husk. One is by placing a stake or iron spike in the ground, and by striking the nut on the point, the fibres

are easily separated. In this manner, it is said, a man can clear 1,000 nuts daily. In the Laccadives the following method of making coir is employed. 'As the husk gets hard and woody if the fruit is allowed to become quite ripe, the proper time to cut it is about the tenth month. If cut before this, the coir is weak; if later, it becomes coarse and hard, and more difficult to twist, and requires to be longer in the soaking pit and thus becomes darker in colour. When cut, the husk is severed from the nut and thrown into soaking pits. These, in some of the islands, are merely holes in the sand, just within the influence of the salt water. Here they lie buried for a year and are kept down by heaps of stones thrown over them to protect them from the ripple. In others, the soaking pits are fresh-water tanks behind the crest of coral. In these the water not being changed becomes foul and dark coloured, which affects the colour of the coir. When thoroughly soaked the fibrous parts are easily separated from the woody by beating. If taken out of the pits too early, it is difficult to free the coir from impurities. If left too long, the fibre is weakened, as is said to be the case also with that soaked in fresh water' (Robinson). These different modes are also practised in Ceylon. There exists however, no such necessity for steeping the husk so long in water, it having been found that a shorter time is sufficient It has been proved that the fibre from the husk of the ripe fruit is greatly improved in quality and appearance by beating washing, and soaking, and that the old method of steeping in salt water for 18 months or two years is quite unnecessary, and that it produces a harsher and dirtier coir. All these processes have been replaced in many districts by improved methods, in which the fibre is extracted from the husk, either wet or dry by means of machines. The husks are crushed in a mill consisting of two adjustable fluted iron rollers. The pressure here exerted flattens them and prepares them for the 'breaking down,' or extraction of the fibre, performed in an 'extraction composed essentially of a drum or cylinder whose periphery is coated with steel teeth that catch in the fibre and tear it from the husk. The machine is covered with a wooden case to prevent the fibre being scattered. It is then 'willowed' or cleaned graded, and baled for shipment. Coir is much used in India in place of hair for stuffing mattresses, and is certainly preferable

to those stuffed with ox- or cow-hair. It is also employed for stuffing cushions for couches and saddles. Large quantities are annually shipped to Europe, where it is manufactured into brushes, mats, and carpets, and even hats and bonnets. The fibre is rather difficult to twist; still it is made into ropes for ordinary purposes in shipping. It is one of the best materials for cables, on account of its strength, lightness, and elasticity. These cables are further valuable because they are durable, particularly when wetted with salt water. 'Numerous instances have been related of ships furnished with cables of this light, buoyant, and elastic material, riding out a storm in security, while stronger-made though less elastic ropes of other vessels snapped in two, and even when chain cables have given way. Indeed, until chain cables were so largely introduced, most of the ships navigating the Indian seas were furnished with coir cables. Though rough to handle, and not so neat-looking as hemp cordage for rigging, it is yet, when properly made, sufficiently pliable, and being elastic, it is well suited for running rigging, where lightness is an advantage, as for the more lofty sails and sheets; but from its elasticity it is not considered so well adapted for standing rigging' (Royle). According to Wight's experiments coir cordage broke with 224 lb., whilst *Hibiscus cannabinus* bore only 190 lb., but the Moorva, 316 lb. The soft downy fibre produced at the bottom of the fronds is used to stop bleeding from wounds. This fibre is altogether of a more delicate nature and forms a kind of network, which is beautifully white, and even transparent when young. As the fronds grow older, this natural matting becomes coarser, tough, and of a brownish colour. It may be stripped off the tree in large pieces, which are used in both India and Ceylon as strainers for palm wine or coconut oil, or for straining sago or arrowroot. In Ceylon it is manufactured into a course kind of cloth for bags and coverings, and from these bags again a coarse kind of paper is made.

TODDY.—The Palm wine or toddy is obtained from the flower-spathes before the flowers have yet expanded. To procure the toddy the spathe is tied with strips of the young leaves (which are much tougher and stronger than the old ones) to prevent its expansion. It is cut a little transversely from the top, and beaten either with the handle of the toddy-knife, or a small

piece of ebony or iron-wood; this process is continued morning and evening (at dawn of day and just as the sun declines below the horizon) for five or six successive days; then the under part of the spathe is taken off, so as to permit of its being gradually bent, when the toddy-drawers, for the purpose of keeping it in that position, attach it to some neighbouring leafstalk. After a further period of five days, an earthen chatty or calabash is hung to the spathe, so as to receive the toddy that exudes, which is collected every morning and evening, and the spathe cut a little every day; the quantity collected varies much. If the toddy is drawn early in the morning and drunk at once, it forms a pleasant drink, it tastes most delicious, having a slightly stimulating effect, and acting as a gentle aperient, a remedy admirably adapted for constipated habits, particularly those of delicate constitutions. Fermentation takes place in the liquor a few hours after it has been collected, and it is then used by the bakers as yeast, the bread made with it being remarkably light. Toddy is considered by Europeans as highly unwholesome during the rainy season. The fermented liquor is much drunk by the natives. From the fermented liquid a kind of rum is distilled, called arrack in the East Indies. It is said that 100 gallons of toddy will produce 25 of arrack. According to Padre Blanco its immoderate use by the Filipinos caused great harm, resulting in sleepiness, loss of appetite, premature old age, extraordinary obesity, and diseases resembling dropsy and scurvy. Some of those that are addicted to it lose their intellectual faculties, are seized with trembling, or become stupid, absent-minded, or even insane. If toddy is allowed to undergo the acetous fermentation a very good vinegar is produced. The toddy also yields abundance of jaggery or sugar. The toddy being collected in a chatty, as above mentioned, in which a few pieces of the stem of the Allghas (*Alpinia Allughas* Rosc.) had been placed, a supply of sweet toddy is procured mornings and evenings. Particular care is required that the vessels be regularly changed, and that none are employed unless they have been well cleaned and dried. Eight gallons of sweet toddy, boiled over a slow fire, yield two gallons of a very luscious liquid, called Penni, or honey, or jaggery, or sugar-water. If this is boiled again, it yields a kind of coarse brown sugar, called jaggery, which is formed into round

cakes, and dried in the smoke of the huts. In order to preserve it free from humidity, each cake is separately tied in pieces of dried banana leaves, and kept in a smoky place, unless required for family use or the market. (Seeman.)

LEAVES.—When used for thatch the leaves are split down the midrib, the two halves placed together end for end, and the leaflets braided diagonally. Long mats are woven to cover the ridge of the roof, and secured in place by wooden pins passing through them below the ridge pole and projecting on each side. Coconut thatch is not as durable as that of the Nipa Palm, a roof of the Coconut leaves lasting but four years, while one of Nipa will last from ten to twelve. Many of the natives' huts in India and Ceylon, as well as in Polynesia, are almost entirely constructed of materials derived from the Coconut tree. The Tahitians plait the leaves for screens, or as covering for the floors; for similar purposes, and also as a thatch, it is used by the natives of the islands of Rotuma, Tongatabu, and other of the Polynesian Islands. The ribs of the leaflets are slender, strong, and somewhat elastic. They are frequently tied in bunches and used as brooms for sweeping about the fire-places, and in Samoa are used as forks in eating. Indeed, in those islands the word 'tua niu' (coconut leaflet rib) is applied to forks in general, and is also used for wire and as the name of certain pinnate ferns which have a slender stiff midrib. Skewers, knitting needles, and toothpicks are also made of tua-niu, and in the early days the oily kernels of the nuts of *Aleurites moluccana* were strung on them, like pieces of meat on a brochette, and served the Samoans and other Polynesians as candles. On many of the Pacific islands tua-niu, neatly smoothed and pointed, were made into combs both for use and for ornament. In Ceylon and throughout Polynesia the dry leaves are used as torches, both for the natives themselves during the dark nights and to carry before the carriages and palanquins of the Europeans. The washermen of Ceylon burn the foliage for the sake of its alkaline ashes. The leaves formerly played a part in many of the religious ceremonies of the Tahitians, and were also an emblem of authority; they were sent by the chiefs to their dependents when any requisition was made. Through the leaf tied to the sacrifice the god was supposed to enter; and by the same road the evil spirits, who, it was imagined, tormented those afflicted

with diseases, were driven out. Bunches or strings of the segments were also suspended in the temple on certain occasions, and answered the same purpose as rosaries, reminding the worshippers of the order of the prayers.

WOOD, ROOT, CABBAGE, ETC.—The outer wood of the stem is close-grained with dark-brown vascular bundles; it works smooth and takes a good polish. It weighs 70 lbs., value of P. 608. The wood is devoted to various purposes; among the Polynesians it is used for shears, rafters, fences, etc., and converted into charcoal. When the tree has ceased to bear fruit, it is most valuable, and is imported into the European markets under the name of Porcupine wood. It is made into ornaments and fancy articles. Among the Singalese it is used for rafters, laths, shingles, chairs, ladies' work-boxes, etc., but during the period of its most abundant bearing (considered to be between ten and thirty-five years' growth), the heart is of so soft and spongy a nature, that it is merely used for fences, water-pipes, etc. From the trunk the Tahitians extract a gummy substance called Pia Pia; it possesses no fragrant property, but is used by the females to spread over their hair, in the same manner that they are accustomed to use the viscid gum of the Bread-fruit tree. The terminal bud, or cabbage, is an excellent vegetable, either cooked, or dressed in stews, hashes, or ragouts; but as the removal of the bud kills the tree, the natives indulge themselves in eating it only on occasions of festivity. They either select for this purpose a tree which is comparatively sterile or one which too closely crowds a neighbour. The root is occasionally used instead of arecanut by betel chewers. In Samoa coconut shells are the only water vessels of the natives, and are used as vessels for oil. The open eye serves as an orifice, and a small grommet is passed through the other two eyes by which it is suspended. To remove the kernel, the natives, after having poured out the water through the open eye, immerse the nut in the sea, where the kernel soon putrefies and is eaten by marine animals. It is then thoroughly cleansed and the outside is frequently polished. Both in Samoa and Hawaii the shells are made into cups, in which kava is served. These are often highly polished and become lined with a beautiful pearly enamel from the deposit gradually made by the kava. In many islands the natives also make spoons, dishes, beads, and finger

rings of Coconut shell, and use broken shells for keeping up the fires in their houses by night.

MEDICINAL PROPERTIES.—The oil is used as a substitute for cod-liver oil in debility and phthisis; but in such cases it is not the commercial oil in its crude state, but the oleine obtained by pressure, refined by being treated with alkalies, and then repeatedly washed with distilled water. Its prolonged use, however, is attended with disadvantage, inasmuch as it is apt to disturb the digestive organs and induce diarrhœa. An inunction of the oil to the whole body is used in fevers, and to the chest in lung diseases. It is used as an application for the growth of hair and to prevent it from turning grey. The expressed juice or milk of the fresh kernel has been successfully employed in debility, incipient phthisis, and cachexia. In large doses it proves aperient, and in some cases actively purgative, on which account it has been suggested as a substitute for castor-oil. The fresh kernel or the tender pulp is nourishing, cooling, diuretic, and refrigerating. Toddy is refrigerant and diuretic. The juice of the kernel, with kali jiri, is locally applied to freckles with relief. Old and dried kernel is cut into thin slices and used as an aphrodisiac ingredient in confection; also, as an anthelmintic, it is used in removing tape-worms.

CULTIVATION.—'The Coconut Palm is a very beautiful tree for a large garden. It grows very freely on the coast, but inland can be cultivated on a river bank with good alluvial soil, or on a well-drained terrace with made-up soil and abundant water. A Coconut that has been ripened on the tree should be planted with the husk on a bed of old leaf mould in a shady place. In planting lay the large fruit on its side; from 3-6 months is required to germinate. When it has formed three or four leaves it can be transplanted safely. Fruit is produced at ages varying from four to twelve years.

In making a Coconut plantation in the Thana district plants are reared from selected nuts that have been ripened on the tree. They are gathered during the hot season, then hung up in the house for two or three months and afterwards thrown into a well to germinate while floating on the water, or planted in very sandy soil about one foot apart, in a shady place where water can easily be given sufficiently to keep the soil moist. For planting, holes are dug 18 feet apart in both directions, and

a small basket of wood ashes put in to keep off white ants, which might eat up the albumen or kernel from which the young plant should draw nourishment until it has roots of its own. One year seedlings are suitable if strong, but more commonly two year old plants are set out, then shaded with palm leaves, and the intermediate ground cultivated with annual crops that require irrigation. In any case the young Coconut Palms need to have the soil kept moist and well manured until the palms are five years old; after that it will depend on the nature of the soil, whether irrigation is necessary or not. If water is not available at a short distance from the surface, irrigation must be used. After it is 5 years old, if well grown, if not, later by 2 or 3 years, during the rainy season, a ditch is dug round the tree at a distance of 4 feet, cutting some of the roots. Into the ditch a heavy dressing of dry fish or other strong nitrogenous manure is given, and the stem banked up so as to cause the rain-water to soak down near the root instead of running off. If well grown, fruiting begins at 5 years old, but 7 years is a more common age. Growing Coconuts requires much capital, because assuming that sufficient wells exist on the estate, an expenditure of Rs. 1,700 per acre during the first seven years may be necessary. In favourable circumstances an income of Rs. 700 may be expected from annual crops planted between the rows of Coconut Palm during the same period. The coconut is a tree that lends itself to cultivation greatly and flourishes very much in proportion to the soil and cultivation it obtains. I have trees that are equally healthy, some 68 feet high, and others 70 feet high, that were planted on the same day 18 years ago. The annual expenditure may be reduced, but it rarely occurs that the total expenditure required to bring an acre of Coconut trees into full bearing is less than Rs. 7,000.

The value of the produce depends on the proximity of markets; near Bombay it is estimated to be Rs. 510 yearly per acre, from which an annual cost of cultivation and assessment amounting to 187 must be deducted, leaving a yearly profit of Rs. 323 per acre to the cultivating landowner, presumably from established plantations. The proximity of the second city in the British Empire, and the consequent high value of toddy, no doubt, is an important factor in this estimate' (Woodrow).

Legendary Origin of the Coconut Palm.[1]

About half à mile from Belligam, a fishing hamlet on the southern coast of Ceylon, between the towns of Point de Galle and Matura, is, completely overshadowed by groves of trees, a large rock of granite, which displays the representation of a former prince of the interior, about sixteen or eighteen feet in height, called 'Rottah Rajah,' to the attention of the traveller. According to tradition, the discovery of the Coconut tree is attributed to a vision, which communicated to this highly favoured rajah a knowledge of that production. A Cingalese rajah of devout conduct and character, became suddenly afflicted with a cutaneous disease, which covered him with a white scaly substance from head to foot, to so great a degree as almost to deprive him of human appearance. So very rapidly did the loathsome distemper extend its malignant influence over the rajah's person, that sacrifices were resorted to by his people in the hope of thereby appeasing the anger of the supposed author of the rajah's sufferings, the Maha Yaka, or great demon. The Rottah rajah (the image itself is now so styled) objected to assist in person at any such diabolical sacrifices, and however prejudiced his people were in the belief of their eventual efficacy, he himself preferred humbly to submit to the decrees of that superior power from whom alone the Maha Yaka could have derived dominion, if he really possessed any, over the destinies of mankind. At this period the Coconut tree was not known in the interior of Ceylon; and to this day its scarcity is remarked by every traveller who visits the interior of the late Kandian territory. The resigned but suffering rajah having, with all due humility, paid his accustomed devotions, and offered sweet-smelling flowers, according to the Buddhist religion, and repeated the Buddha-Sarana, fell into a sound sleep, which lasted for several days. During his trance, he beheld a large expanse of water, which he tasted, and found it both salt and nauseous, although of a fine green colour near and blue in the distance; having on its margin immense groves of trees of a rare kind, such as he had never before seen. For, instead of branches in various directions, as other trees had in his country, a tuft of

[1] Taken verbatim from B. Seemann, Popular History of the Palms and their Allies. London, 1856, pp. 146-155.

large leaves crowned the lofty summit of each individual tree, which, to an immense height, was totally divested of branches or foliage. The Rottah rajah having awakened from his trance, felt his mind deeply impressed with the unusual nature of his dreams; but in the natural excitement which the hope of his recovery encouraged, he renewed his oblations and prayers, believing that a display of omnipotent mercy would be the result. A cobra di capello, the Naya of the Cingalese (Coluber Naja, Linn.), and sacred snake of the Buddhists, shortly afterwards approached; and having expanded its spectacle-marked hood, raised its head a cubit above the ground, and observed the rajah steadily for some moments; after which the animal, extending his blue forked tongue, and thrice bowing its head, lapped water from the leaf in which it had been reserved for the rajah's particular use. Having thrice repeated the draught, the animal, still keeping its eyes fixed on the rajah, gradually retired to the jungle. This was conviction itself of Buddhoo's favour. Again the prince felt his eyelids grow weary; but in his then state of disease, he had determined to occupy no place of shelter save that which the shady Bogaha (Ficus religiosa), the tree under which he reposed, afforded him. No sooner had sleep a second time exerted its magic influence, than his former vision recurred, with the additional appearance of an aged man, whose face bore the appearance of the moon in all its splendour. It was Maha Sudona, the father of the god Buddhoo, who stood before the astounded rajah, and thus accosted him:—'From ignorance of the sacredness of the ground over which the god's favourite tree casts its honoured shade, thou once didst omit the usual respect due to it from all created beings. Its deeply pointed leaf distinguishes it above all other trees as sacred to Buddhoo; and under another tree of the same heavenly character thou now liest, a mass of sores and ulcers, which the impurity of the red water within the large and small rivers of thy body has, at the great deity's command, brought upon thee externally. But since the snake, the kind snake, the shelterer of the god Buddhoo when on earth, has thrice partaken of thy drink, thou wilt derive health and long life by obeying the commands which I now bear thee. In that direction (pointing towards the south) lies thy remedy. One hundred hours' journey will bring thee to those trees which thou hast seen in thy dream, and which thou

shalt see in reality, and taste their fruits to thy benefit. But as on the top only it is produced, by fire it must be obtained. The inside—partly of transparent liquid, partly of innocent food—must be thy sole diet until thrice the Great Moon (Maha Handah) has given and refused her light. Disease will, at the expiration of that time, leave thee; thou wilt be clean again; but forget not, with the restoration of thy health, sacrifices of sweet flowers and fruits, with much thanksgiving, to that great Brahma of all Brahmas* to whom all other gods, and even demons, pay homage, through whose mercy and forgiveness of thy neglect and transgressions thy bodily vigour will have been restored, and the days of thy enjoyment in the splendour of the mighty and flaming chief ruler of the moon prolonged.' A sound as of ten thousand tomtoms struck at once, seemed to the delighted rajah a manifestation of the messenger's authority. It reverberated on his ear for hours together, after he had awakened from his second trance; and, impressed with a belief that the invisible powers had thus intimated a disposition to take him under their especial protection, and that consequently it was his bounden duty to obey commands so mysteriously conveyed, the rajah, placing the palms of his hands across his forehead, and bending to the ground, prayed for strength to act in obedience to the Ossah Pollah Dewyo, the ruler and creator of all gods and demons, and of the flat world itself. Having summoned his immediate followers from the various resting places which they had constructed with the branches and leaves of the neighbouring trees, by way of temporary shelter, the rajah repeated to them the prophetic words of the divine messenger; and having gone through the ceremony of making a propitiatory offering under the Bogaha-tree, of fruits, betel-leaves (*Piper Betel*), and flowers of sweet perfume, he, attended by his retinue, proceeded in a direct course, through rivers and forests, and over immense mountains, to the southward, as directed by the Maha Sudona. The one hundred hours' journey having been miraculously performed without any perceptible fatigue either to himself or attendants, the anxiously anticipated view of that boundless expanse of blue water, which in his dreams had appeared to him so beautiful yet nauseous to the taste, and on its margin immense

* 'Brahmata-Brahma,' a name of Buddhoo.

groves of trees, with tufts of leaves, as his visions had foretold, gratified his astonished but delighted sight. Beneath the foliage, sheltered from the vertical sun, hung large clusters of fruit, much larger than he had ever seen in his own country of the interior, of green, yellow, and red colours, and others apparently black. There were no human beings on the coast, but a vast number of wild beasts such as leopards, bears, sloths, and elephants. To climb the Coconut tree (the promised source of health) was then unknown, and considered beyond the power of mortal man; but as fire had been pointed out as the means of obtaining its fruit, the rajah's followers made one. Scarcely had an hour elapsed after the fire had been kindled that was to fell the pride of the coast and the most valuable boon of nature to the Indian world, ere, with a tremendous crash, the tree became prostrate upon the earth, whence, from its capacious and verdant crest, crept out creatures innumerable, large blue scorpions, brown and yellow centipedes, snakes of various hues—from the polonga to the less dreadful rat-snake; blue, black, green, and yellow beetles, tarantulas, and other spiders, of all sorts and sizes and colours; whilst, running from leaf to leaf, the detested rat seemed to imitate the motions and equal in agility the beautiful three-striped squirrel, or lena, of this paradise (as the glad rajah and his suite at that time considered it) of the universe. The novel fruit was at first with some difficulty opened; but the rajah's superstitions were more powerful than even the effects of hunger itself. With awe he approached the beach, over which wave followed wave in quick succession; whilst the surf beat with violence against the roots of these stately trees, which seemed to thrive best where no other tree of any utility whatever could survive even a temporary sprinkling from the briny spray. Mute with astonishment at the vast expanse of ocean, which he then for the first time approached, the rajah bent to taste the liquid aliment. It was as his vision prognosticated. Again his wonder was increased, but his faith had kept pace with it, in the full belief that 'ere the great moon had thrice given and refused her light' he would be cleansed from his foul distemper, and his disrespectful demeanour under the sacred Bogaha, which had originally drawn down upon him the anger of the 'All-seeing,' be forgiven. Having once commenced, the rajah and his followers continued

to live on the prescribed diet; the former, in obedience to the commands of Buddhoo, by the Maha Sudona; and the latter from necessity, there being none of their accustomed fruits, rice, or roots to be met with so near the ocean. They found the water within the nuts sweet and delicious, and pure as crystal itself (of which mineral their country produced abundant varieties); whilst the fleshy part of it was a cooling and satisfying food. The prescribed time rolled on; and day after day convinced the delighted followers of their suffering prince that truth came from above. The rajah gradually lost the white and scaly skin which had enveloped him like the armour of the great ant-eater of the interior; whilst the glow of heat which pervaded his extremities convinced him of the near approach of his promised recovery. Thankful to his great preserver, he omitted not to perform the duties which in his visions had been dictated to him; and on the first stone which appeared durable and beyond the reach of the sea, in token of his gratitude, he, with the assistance of his followers, carved on the granite rock ('which you now see' is added by the narrator) a gigantic statue of himself; remarking, that its great height would show the wonderful recovery he had experienced, being a very little man in stature; 'for he had risen, by the blessing of the god of all gods, to an undeserved height of happiness and bodily vigour; the memorial of which would thus be handed down to millions yet unborn.' Numerous families from the high country of the interior soon afterwards emigrated to the sea-coast; for it had become an imperious duty on the part of the rajah, on whom a miraculous cure had been so unexpectedly wrought by the fruit of the Coconut tree, to give publicity to the circumstances which originally introduced to him and his followers a knowledge of that splendid production; whilst the conviction of its transcendent utility pointed out its propagation as a never-failing source of individual advantage and of progressive national prosperity.

ILLUSTRATION.—Plate XCVII shows a characteristic grove of Coconut Palms on Bombay Island. The photograph was taken by Rev. Fr. M. Maier.

SUB-GENUS II.—*GLAZIOVA.*

Syagrus (*partim*) Mart.—*Glaziova et Cocos sectionis Syagri* (*excl. sp. typica*) Drude.

Female flowers ovate-conical, acute; sepals acute, tips in æstivation free (always?); petals at the base convolute-imbricate, with valvate tips.

Fruit small or of medium size, unilocular; pericarp fleshy-fibrous or dry; endocarp woody, bony or stony, not callous on the inner surface, uniform, longitudinally 3-striped, the pores subbasilar; the dissepiments membranous or papery; albumen equable, more or less hollow; embryo basilar.

Species about 17. In tropical South America, except the western region of the Andes.

2. **Cocos oleracea** Mart. Hist. Nat. Palm. II, 117, t. 82 (exl. fig. III?) et tab. Z. f. VIII; Z. II, f. XIV; Z. X. V. f. 1, et vol. III, 324; H. Wendl. in Kerch. Palm. 241; Drude in Mart. Fl. Bras. III p. II, 416 (*excl. syn. Syagri picrophyllæ*, B. R. ?) et var. β *platyphylla (partim)*. Drude l. c. 417?; Barb. Rodr. Les Palm. p. 28, t. III, f. 3 a. b.—*Palma iraiba* Piso Bras. ed. 1658, 129.—Rai Hist. II, 1361.

NAMES.—Cabbage Coconut tree, Iraiba; Coqueiro amargozo (Brazil).

DESCRIPTION.—Stem erect or slightly flexuose, 60-80 feet high, thicker at the base, almost 1 foot in diameter. Leaves dense, 6-8 feet long, arcuate-deflexed; leaflets linear, subfalcate, acute, 1 foot long and more, 3-4 (rarely 5-6) approximate, dark green above, glaucous beneath.

Spadix rising from between the inner leaves, first erect, then patent or nodding, 1½-2 feet long; peduncle terete or slightly compressed, glabrous, greenish-white; rhachis terete-angular, divided into simple branches; bracts membranous, transversely linear, at the base of the single branches and some bigger ones on the peduncle. Spathe 1½-2 feet long, subclavate, linear-lanceolate when open, longitudinally furrowed. Male flowers with small membranous bracts; calyx scarcely 1 line long, triangular; sepals 3, acute-pyramidal, pale. Corolla 4-5 lines long, yellow; petals erect, linear-lanceolate, acute. Stamens included; filaments subulate, white, short, united at the base; anthers linear, obtuse, emarginate at the base. Pistillode minute, subtrigonous. Female flowers conical, fewer than the males, between 2 males or single. Sepals ovate-pyramidal-acuminate,

involute, glabrous. Petals entirely surrounded by the calyx. Ovary ovate, glabrous, attenuate towards the apex; stigmas 3. Drupe about 1½ inch long, ovate.

HABITAT.—Brazil, in the mediterranean region of Minas Geraes.—Cultivated in Indian gardens.

Flowers in August.

SUB-GENUS III.—*ARECASTRUM* DRUDE (*emend.*).

Female flowers ovate; tips of the sepals in æstivation cucullate (always?); petals at the base convolute-imbricate, tips valvate.

Fruit of medium size, ovoid, unilocular; pericarp often fleshy-fibrous, sweet; endocarp large, bony, marked with 3 sub-basilar pores, produced inside to the base of the fertile cell; the traces of the suppressed cells small in the large bony substance of the endocarp. Seed irregular, conform with the cell, gibbous-curved; albumen equable, slightly hollow; embryo obliquely basilar.

Species about 7. In tropical and extratropical South America, extending to 35° Lat., except the western region of the Andes.

3. **Cocos romanzoffiana** Chamisso in Choris Voyage pitt. autour du Monde 5, t. V et VI (1822) et in Flora VI (1823) pt. I, 226; Mart. Hist. Nat. Palm. II, 127, t. 88, f. VII, et III, 321; Kth. Enum. Pl. III, 286; Wendl. in Kerch. Palm. 241; Hook. in Rep. Kew. 1882 (1884) 241; Drude in Mart. Fl. Bras. III, II, 419, t. 92 (*excl. fig.* II); Becc. Le Palm. incluse nel gen. Cocos in Malpighia, anno I, fasc. VIII, 25.

NAME.—Giriba Palm.

DESCRIPTION.—Stem 30-40 feet high, erect. Leaves arcuate-patent and recurved, pinnate; leaflets ensiform, reduplicate.

Spadices growing from between the leaves, 6-8 feet long. Spathes when closed clavate, erect, when open lanceolate, mucronate, pendulous, peduncle of spadix compressed-terete; branches with a coriaceous bract. Male flowers on the lower ⅔ of the branches together with the females, alone on the upper part. Calyx very small, about 1 line long; sepals triangular, acute; petals lanceolate, acute, about 6 lines long, longitudinally striate, sulcate inside on account of the pressure of the stamens. Stamens included; filaments subulate, at the base united into a disc, about 1 line long; anthers basifixed. Female flowers ovate-globose, 2-3 lines long; sepals coriaceous, subobovate-orbicular, very concave, cucullate-imbricate (Martius); petals included in the calyx. Ovary ovate-globose, pubescent.



Feathery Coconut Palm (*Cocos plumosa* Hook. f.).

Drupe the size of a walnut.

HABITAT.—Brazil: Island of Santa Catharina.

4. **Cocos plumosa** Hook. f. in Bot. Mag. t. 5180 (1860) et in Rep. Kew. 1882 (1884) 72 (*non* Lodd.); Arcangeli in Bull. Società Toscana d'Ortic. III (1878) 214; H. Wendl. in Kerch. Palm. 221; Drude in Mart. Fl. Bras. III, pt. II, 412; Becc. Le Palme incluse nel gen. Cocos in Malpighia, anno I. fasc. VIII, 27.—*Cocos comosa* Parlatore (*non* Martius) Les collect. bot. t. II.

NAME.—Feathery Coconut Palm.

DESCRIPTION.—Stem graceful, erect, columnar, about 40 feet high, 10-12 inches in diameter, more slender upwards, jointed as it were with annular scars of the fallen leaf-stalks; these rings are 1 foot to 14 inches apart. Crown of leaves extremely beautiful; leaves 12-15 feet long, petiolate, lanceolate, pinnate, recurved; leaflets numerous, solitary, or more usually two to four aggregated, springing from near each other; petiole subtriangular at the base, very much dilated, of a greyish-brown colour, keeled, at the margin fimbriately fibrous, amplexicaul.

Spadix axillary, substipitate; spathe 2½-3 feet long, ligneous at first, at length bursting open laterally, concave and fusiform, almost woody, very erect, rigid, firm, dark dirty-green externally, within tawny, acute and apiculate; branches numerous, long, gracefully drooping, wax-like, loaded with flowers of two kinds which are sessile; some female, but mostly male.

Flowers in bud conical, sepals completely imbricated, petals ovate, concave, moderately patent, with minute bracts at the base. Male flowers with 6 oblong yellow anthers on short filaments. Female with a short downy ovary, crowned with three stigmas.

Drupe apiculate, about 1 inch long.

HABITAT.—Brazil.

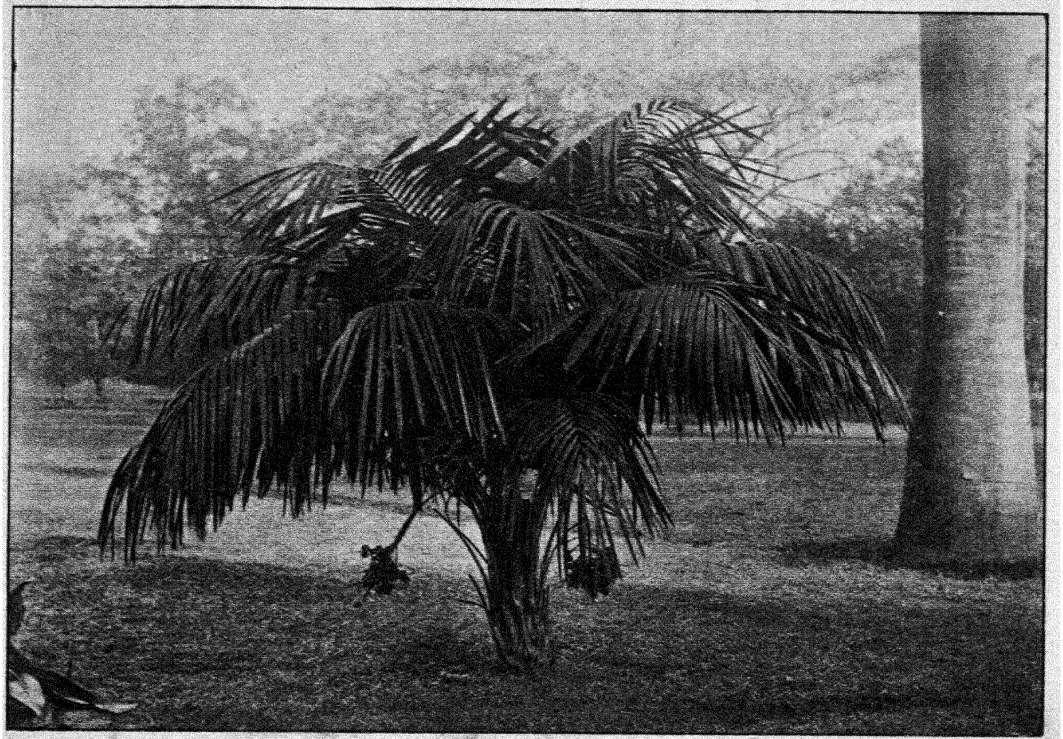
ILLUSTRATION.—Plate XCVIII shows a fine fruiting specimen of the Feathery Coconut Palm growing in a garden on Malabar Hill, Bombay.

SUB-GENUS IV—*BUTIA* BECC.

Arecastrum (partim) Drude.

Female flowers ovate; tips of the sepals cucullate in æstivation (always?); petals convolute-imbricate at the base, valvate at the apex.

Fruit trilocular or by abortion regularly unilocular, ovoid or globose, small; pericarp fleshy; endocarp bony; its pores



Aracuri Palm (*Cocos schizophylla* Mart.).

closed by a superficial, thin, half-woody septum often submedian; dissepiments of suppressed cells bony; seed regular; albumen homogeneous, not hollow; embryo often not basilar.

Species about 5. In South America, especially extra-tropical, except the western region of the Andes.

5. **Cocos schizophylla** Mart. Hist. Nat. Palm. II, 119, t. 84 et 85, T. f. IV, et vol. III, 324; H. Wendl. in Kerch. Palm. 241; Drude in Mart. Fl. Bras. III, II, 422; Hook. in Rep. Kew 1882 (1884) 72. *Cocos aricui* Prinz v. Neuwied Reise in Brasilien I, 272.

NAMES: Aracuri palm (English); ariri, aricuri, alicuri (Brazil).

DESCRIPTION.—A low palm, often almost stemless; caudex 6-8 feet high, subannulate. Leaves 6-8 feet long; leaflets not quite equidistant, subopposite or alternate, erect-patent, linear or subfalcate, 1 inch broad, very reduplicate, apex rounded-obtuse, short-mucronate, the midrib very prominent above.

Spadix from between the leaves, 2-3 feet long; peduncle compressed, whitish-tomentose-pulverulent, with subtriangular coriaceous bracts; rhachis sulcate-angular. Branches many, in the lower part of the spadix about 2 inches distant, in the upper part more approximate. Spathe 3 feet long, with a mucronate top when closed, linear-lanceolate when open. Male flowers 2-3 lines long; calyx 3 or 4 times shorter than the corolla, whitish; sepals lanceolate-acuminate; petals lanceolate or linear-oblong. Stamens $\frac{1}{3}$ of the corolla; filaments subulate, white; anthers linear, emarginate at both ends; pistillode minute or absent. Female flowers subglobose or shortly conical, slightly larger than the males. Sepals broadly triangular or suborbicular, shortly acuminate. Petals suborbicular. Ovary subglobose. Stigmas pyramidal.

Drupe subglobose, the size of a pigeon's egg.

HABITAT.—Brazil: Province of Bahia at Camamu and Bahia, S. Jorge dos Llheos.

USES.—Of the leaflets hats are made. The juice of the unripe fruit is used for inflammation of the eyes.

ILLUSTRATION.—Plate XCIX. The specimen photographed by the Rev. Fr. M. Maier may be seen in the Victoria Gardens Bombay. Two bunches bear half ripe fruits.

6. **Cocos yatai** Mart. Palm. Orbign. 93, t. 1. f. 1. t. 30; Hist. Nat. Palm III, 289, 324; H. Wendl. in Kerch. Palm. 241; Drude in Mart. Fl. Bras

III, pt. II, 421, t. 94, 95; Becc. Le Palme incl. nel gen. Cocos in Malpighia, anno I, fasc. VIII, 32.

NAME.—Yatai.

DESCRIPTION.—Stem covered in the upper part with the bases of the petioles. Leaves surrect, arcuate; petiole spinous-serrate; leaflets concinnous, slightly stiff, narrowly linear, acuminate.

Male flowers: Petals lanceolate, acute. Female flowers: Petals oblong-ovate, obtuse.

Drupe size of a pigeon's egg, acute at the apex; putamen oblong, slightly acute at the base, rotundate at the apex.

HABITAT.—Argentine: in the provinces of Concordia, Corrientes and Entre Riòs, Brazil.—Cultivated in Indian gardens.

USES.—The fruit is an excellent fodder for horses, mules, and cattle. The seeds are eaten and an oil is prepared from them. The heart is eaten as an excellent cabbage. The leaflets are used in the manufacture of hats. The fleshy part of the fruits is anthelmintic.

4. *JUBÆA* H. B. et K. NOV. GEN. et SP. I, 308, t. 96.

(Etym.: Named after Juba, a king of Numidia.)

Mart. Hist. Nat. Palm. III, 294, t. 161, f. 3; Palm. Orbign. 106 (*excl. sp.*).—Kunth Enum. Pl. II, 293.—Philippi Bot. Zeitg. (1859) 362; cat. plant. chil. 301.—Benth. & Hook. Gen. Plant. III, II, 948, 131.

Stem high, unarmed, scaly by the remains of the leaf-stalks. Leaves terminal, pinnatisect; segments patent in all directions, linear-lanceolate, acuminate, rigid, glabrous or pulverulent, the margins recurved, rhachis laterally compressed, convex on the back, acute on the ventral side; petiole unarmed, sheath short, open.

Spadices several; upper spathe complete, fusiform, woody, open on the ventral side, finally bipartite. Flowers on the same interfoliaceous, simply branched spadix, bracteate, male flowers in the upper part, short-pedicellate. Sepals linear-lanceolate, acute, carinate. Petals much larger, ovate or oblong, acute, coriaceous, concave, costate. Stamens 27-30 (according to Benth. & Hook., l. c., 15-30 according to Naudin), inserted at the base of the perianth, included; filaments capillary, longer than the anthers, free; anthers linear, dorsifixed, erect. Female flowers: Sepals broadly imbricate. Petals convolute-imbricate. Urceolus

small, membranous. Ovary ovoid, 3-locular, 2 loculi rudimentary; stigmas 3, subulate, patulate.

Fruit obovoid, 1-seeded, provided with the terminal stigmas; pericarp densely fibrous; endocarp bony, globular, acute at both ends, slightly 3-carinate. Seed globose; albumen cartilaginous, equable, hollow; embryo opposite to one of the three pores.

Species.—2.

DISTRIBUTION.—Chili, Ecuador.

1. **Jubæa spectabilis** H. B. & K. Nov. Gen. et Spec. I, 308, t. 96; Mart. Hist. Nat. Palm. III, 294, t. 161, f. 3; Kunth Enum. Pl. III, 293; Gaud. Voyage Bonite, t. 51.—*Cocos chilensis* Molina ex H. B. et K. l. c. I, 309, *in obs.*—*Molinæa micrococcos* Bert. in Mercurio Chileno 1829, anglice in Silliman American Jour. XX, 251.—*Micrococcos chilensis* Philippi in Bot. Zeitg. XVII (1859) 362; ann. Univ. chil. (1859) 651.

NAMES.—*English*: Coquito Palm of Chili, Coquito nut Palm, Wine Palm of Chili. The fruit: Monkey's coconut, Little coker-nut, Pigmy coconuts, Stanley nuts.

In *Chili*: Palma de coco.

French: Jubée.

German: Syruppalme, Mielpalme, Honigpalme, Chilenische Cocospalme, Coquitopalme.

Spanish: Miel de palmas.

DESCRIPTION.—Trunk stout, swollen in the middle, which in its native country sometimes attains a height of 40-60 feet. The summit surmounted by a crown of large, spreading, pinnate leaves, of a full deep green colour, 6-12 feet long; leaflets 1-1½ foot long, and about 1 inch wide, springing in pairs from nearly the same spot, and standing out in different directions. The leaf-stalks very thick at the base, where they are enclosed in a dense mass of rough brown fibres, which grow upon their lower edges.

Spadices 3-4 feet long, with about 100 branches 1-2 feet long. For details of flower and fruit see description of genus.

HABITAT.—Chili.

According to Watson in the 'Gardener's Chronicle,' 2nd November 1895, there is some danger that this palm will soon be extirpated from Chili, through the wholesale felling of the trunks for the Palm-honey. When Darwin visited Chili in 1832, as recorded in his 'Voyage of the Beagle,' it was very abundant in the country round Valparaiso, he having counted several

hundred thousand trees on one estate alone. The late Mr. John Ball was there in 1882, and although he devotes a considerable portion of his book (Notes of a Naturalist in South America) to the flora of Chili, he does not even mention the *Jubæa*. Miss North visited Chili in 1884, and painted a picture of the *Jubæa*, which is in the Kew collection. 'In a place called Salto, one of the most attractive coast suburbs of Valparaiso, there is a valley full of the native palm, *Jubæa spectabilis*, which used to cover the country forty years ago, but now scarcely a hundred trees remain. They are mis-shapen things, but seem quite in character with the rocky valley they grow in.' (Recollection of a Happy Life.)

According to Seeman, the *Jubæa* is cultivated in Colombia and other parts of South America.

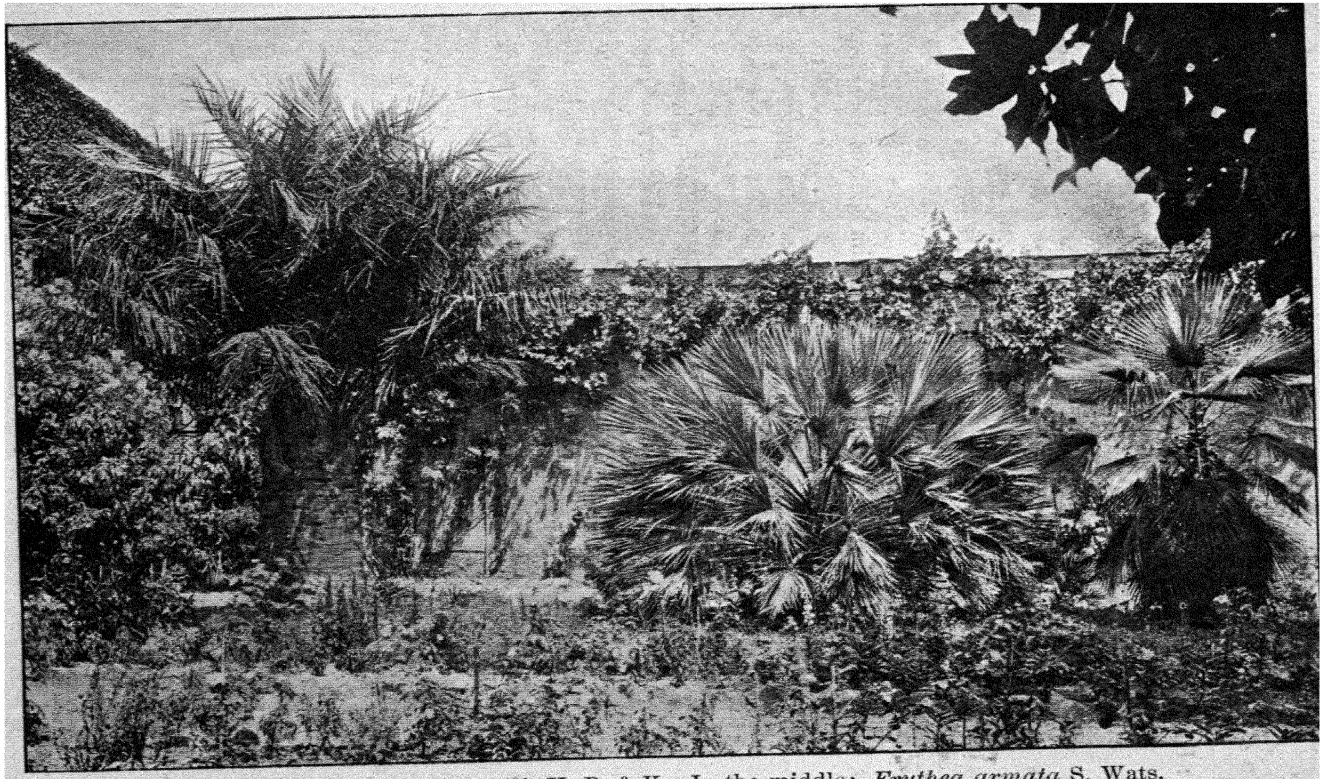
Uses.—'In Chili,' says the Treasury of Botany, 'a sweet syrup, called Miel de Palma, or Palm-honey, is prepared by boiling the sap of this tree to the consistence of treacle, and it forms a considerable article of trade, being much esteemed for domestic use as sugar. The sap is obtained by the very wasteful method of felling the trees, and cutting off the crown of leaves, when it immediately begins to flow, and continues to do so for several months, until the tree is exhausted, providing a thin slice is shaved off the top every morning, each tree yielding about 90 gallons.

'The nuts are used by the Chilian confectioners in the preparation of sweetmeats, and by the boys as marbles.' The seeds are sometimes exported into England, and are known commercially as Monkey's Coconuts or Little Coker-nuts. They are eaten by boys; but no other use seems to be known to which they are put in Europe.

Bertero* wrote as early as 1829: 'I conceive it to be useless to speak of the utility and qualities of this tree, since all are acquainted with its abundant fruit, and the syrup (miel de palma) which is used, as also of the several purposes to which it is applicable.

'The leaves are employed for thatching. Its extraordinary hard and incorruptible wood may afford great resources, since

* List of the plants of Chili, by Dr. C. Bertero; translated from the 'Mercurio chileno', and forwarded by W. S. W. Ruschenberger, M. D., U. S. Navy. In Sillim. American Journal of Science and Arts. Vol. XX, No. 1, pp. 251-52 (1831).



To the left: *Jubœa spectabilis* H. B. & K. In the middle: *Erythea armata* S. Wats.
To the right: *Trachycarpus takil* Becc.

with the trunk ..... may be formed tubes and conduits for water, and sewers, an economical method of replacing those commonly used and whose duration is not so certain.'*

GARDENING IN EUROPE.—The Coquito Nut Palm is one of the most interesting of sub-tropical palms. It is a very handsome plant and well adapted for sub-tropical gardening.

The soil for this palm should be a mixture of one-half rich loam, and one-half a compost of peat, leaf-mould and sand. It withstands the winter in the open air near London, in a poor condition, but, if grown in tubs in the conservatory in winter, and placed in the open air in summer, it will prove an excellent subject for association with the hardier palms.

The 'Gardener's Chronicle' writes in 1895 (Nov. 2nd): 'There is a large healthy specimen of this palm in the temperate-house at Kew. It has a trunk 8½ feet in circumference at the base, and 7 feet at a distance of 5 feet from the ground. It bears a grand head of feather-like leaves, each 17 feet long and 4½ feet wide.'

In an account of the Royal Gardens at Lisbon (given at p. 292, vol. IV, of 'The Garden') mention is made of a specimen growing there in the open air, which has attained a height of 32 feet, and the trunk of which measures 13 feet 8 inches at its base. In 1886, this identical specimen flowered and ripened fruits. It was then 35 years old, and had a trunk over 16 feet high, and 14 feet in circumference at the base. The plant flowered in January and the fruits ripened the following August.

The tree may be seen thriving in the open air in gardens on the Riviera. A specimen in M. Naudin's garden is 16 feet high, and the girth of the tree at a yard high is more than 12 feet. The age of the tree is 36 years.

A plant was tried in the Bamboo Garden at Kew in 1893, but it succumbed to the first severe frost.

Naudin published some interesting notes on the fructification of *Jubæa spectabilis* in a French Revue† from which the 'Gardener's Chronicle' gave the following extracts in February 1895:

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* Philippi says that the wood is utterly useless. I have not been able to find out which statement is correct.

† Naudin Ch. in the 'Revue des Sciences Naturelles Appliquées,' November 20, 1894.

'Experiments in naturalisation lately made in France, with the encouragement and aid of the Société d'acclimatation, yield from time to time results theoretically interesting and likely afterwards to be of practical value. Thus, readers may be interested to learn that this year there has flowered and fruited for the first time in France the great Peruvian and Chilian Palm, *Jubæa spectabilis,* an important sugar producer in its native habitats. The tree which fruited at Antibes is over thirty years old. Its height below the crown of leaves is about 5 metres (or 16 feet) and its mighty stem, glossy smooth from the base of the leaves, measures, at the height of a man, 4 metres (13 feet). The crown of leaves is not in proportion to the thickness of the stem, as it does not exceed that of the Date Palm, and is less widely spreading than that of *Phœnix canariensis.* Our tree, says M. Naudin, produced two flower spikes springing from the axil of last year's leaves, about 1 metre long, and each bearing several hundred flowers, the males with 15 to 20 stamens, and situated on the upper part of the panicle, the females on the lower part. This species is, therefore, monœcious, and needs no artificial fertilisation. The fruits are almost spherical with a short swelling at the summit; they attained maturity about the end of September and beginning of October. Their size is that of a small apricot, and the colour rather pale yellow; they are composed of a stringy, not edible, husk, and a large seed with a hard shell, and rather oily kernel, with a flavour suggesting that of a Hazel-nut. In the seed-covering were noticeable the three holes characteristic of the coconut tribe, and through one of which the radicle emerges. When the seed is ripe the husk splits and the seed escapes. *Jubæa* is one of the hardiest palms known and in this respect is almost equal to the *Chamærops* of Southern Europe. It has also another advantage: it flourishes in dry soil, if this is of a certain depth, and is able, unlike the Date Palm, to dispense with watering, and therefore grows where the Date does not thrive without expensive artificial irrigation.

'The utility of *Jubæa* as a sugar-producer is well-established, and the cultivation of it in its native habitats is an important source of revenue. Unfortunately there is often long to wait, even from twenty to thirty years, and, like other trees, it is planted for posterity. As compensation, it lasts for a century, needing no attention beyond the extraction of the sugary sap,

cutting the racemes before flowering, or harvesting the flowers if the sugar is not extracted. It should be understood that if cultivation is undertaken, it can only be in Algeria and other places of the same latitude and climate. In France the great Chilian Palm is but a curiosity or ornamental tree.'

ILLUSTRATION.—Dr. Beccari was kind enough to send me the photograph reproduced on Plate C. On the left there is a specimen of *Jubæa spectabilis,* in the middle of *Erythea armata* and on the right of *Trachycarpus takil.* The latter was described on p. 53. The palms grow in the garden of the Villa Beccari near Florence.

C. SUB-TRIBE: *BACTRIDEÆ.*

Spadix much branched, or little, or not at all; upper spathe complete, persistent, spiny, bristly or velvety hairy. Male and female flowers united into clusters of 3 at the base of the branches or spadix, whose upper parts are male. Calyx and corolla of the female flowers in *Martinezia* and *Acrocomia* of 3 leaves, imbricate, in the others the leaves are united. Stigma sessile on the ovary. Endocarp with 3 pits situated obliquely, or symmetrically round at the apex; radicle of the embryo obliquely ascending. Leaf-sheaths, midrib, and often the leaflets, spinous.

Martinezia Kth., *Acrocomia* Mart., *Astrocaryum* Mey., *Bactris* Jacq., *Desmoncus* Mart.

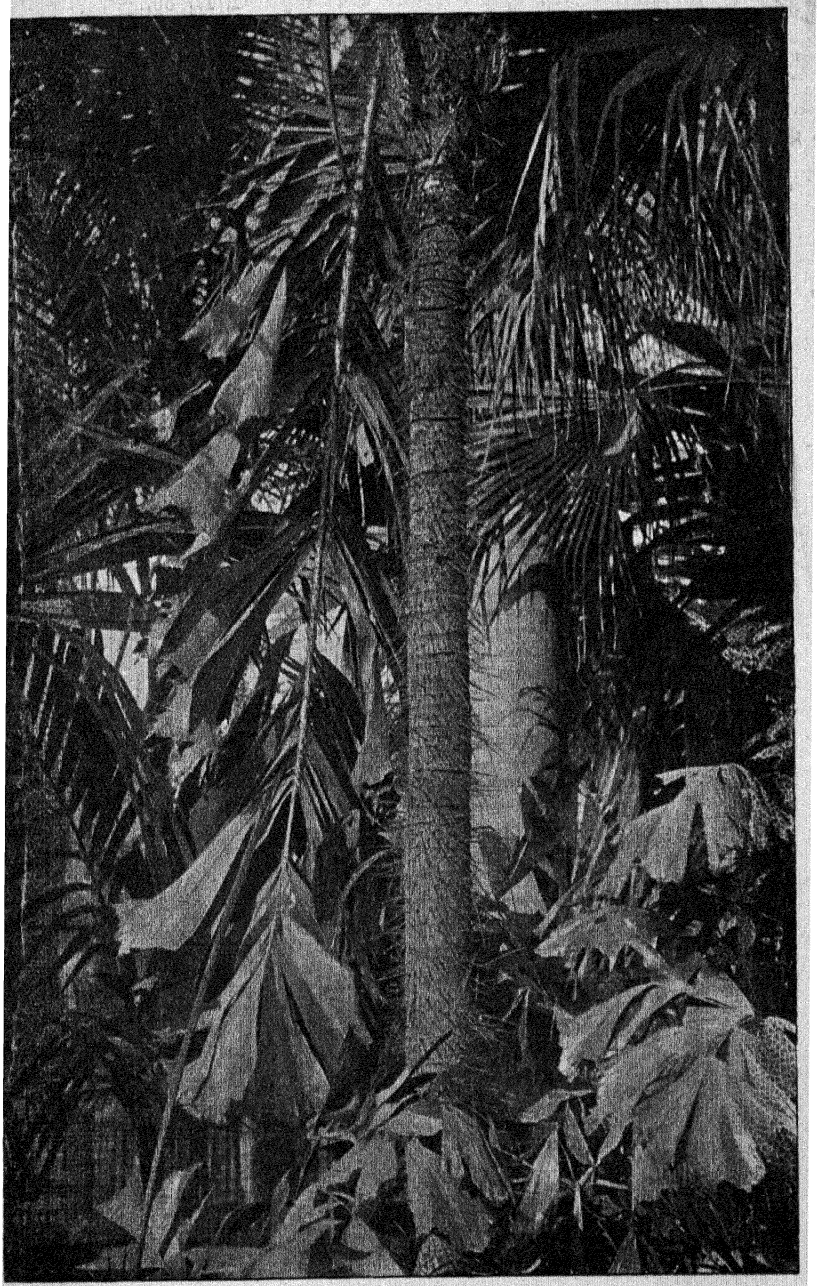
KEY TO THE GENERA DESCRIBED BELOW:

1. Calyx of the female flowers of 3 leaves, imbricate... ... ... *Martinezia.*
2. Calyx 3-dentate ... ... *Bactris.*

1. *MARTINEZIA* R. & PAV. FL. PERUV. & CHIL. PROD. 148, t. 32.

(After Francisco Martinez de la Rosa, a Spanish poet and statesman, 1789-1862.)

Willd. Mem. 1804, 32.—Gærtn. Fruct. II, t. 139, f. 5.—Kunth Enum. Pl. III, 269, 275.—Mart. Hist. Nat. Palm. III, 283, 322, t. 161, f. 1.—Karst. Linn. 28, 388, 397.—Wendl. Linn. 28, 349.—Walp. Ann. I, 100 f.—Griseb. Fl. Brit. W. Ind. 521.—Drude Bot.



Stem and Leaf of *Martinezia caryotaefolia* H. & K.

Zeitg. 1877, 636, t. 5, f. 10; Flora Brasil. III, II, 392.—Benth. & Hook. Gen. Pl. III, II, 944, 124.

Stem spinous, columnar. Leaves terminal, mostly few, pinnate; rhachis and peduncle spinous; leaflets præmorse, more or less aculeate; spadix from between the leaves, simply branched, spinous; branches with glomerules of 3 flowers, upwards only male flowers; spathes 2, spinous. Flowers monœcious, pale, male larger than the female. Male flowers: calyx tripartite; corolla tripetalous; stamens 6; filaments subulate; anthers erect, linear, acuminate. Female flowers: sepals 3, concave, imbricate; petals 3 concave, valvate; staminodes forming a 6-dentate membranous urceolus. Ovary trilocular, 2 loculi abortive; stigmas 3. Drupe globose, 1-seeded, size of a cherry; sarcocarp fleshy; putamen horny, scrobiculate and rugulose, 3 slightly stellate pores. Albumen equable.

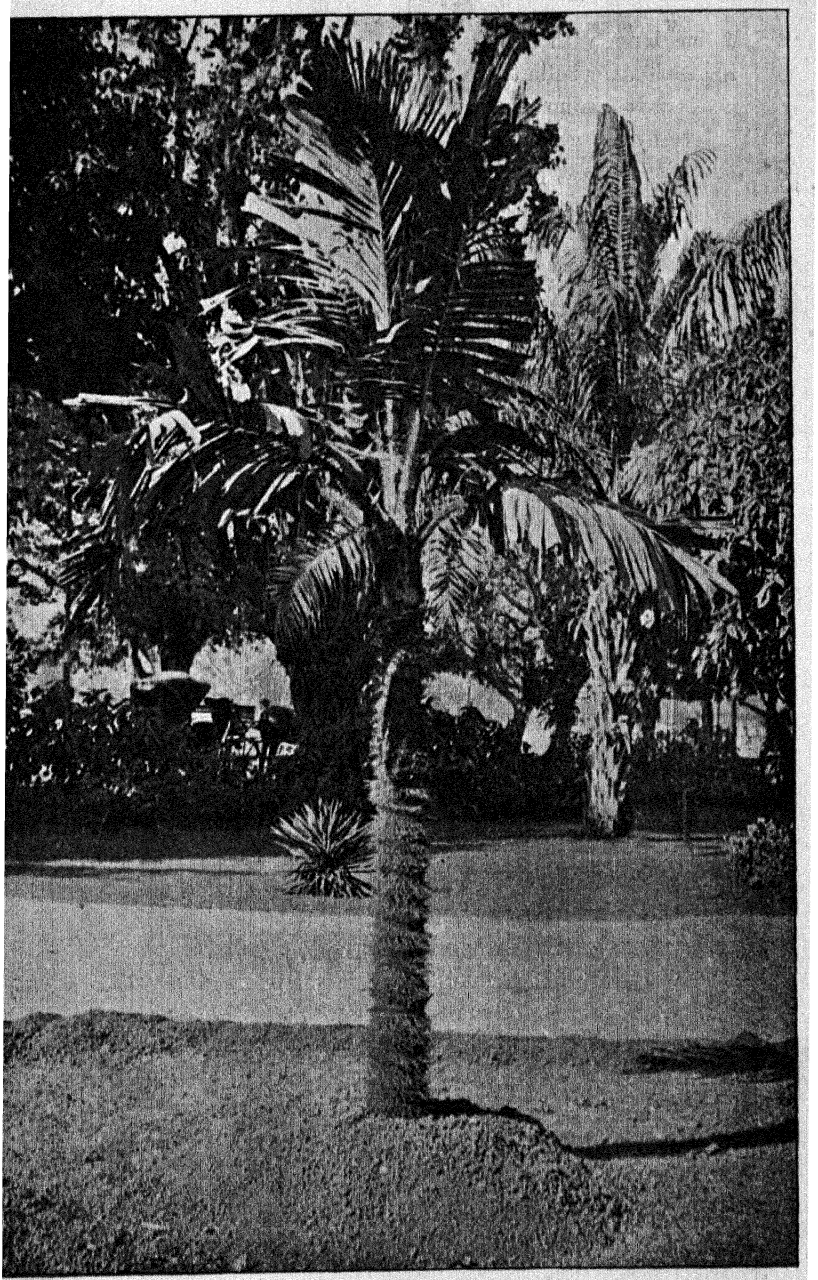
Species 7.—From the Antilles and Colombia to Peru and eastern Bolivia.

CULTIVATION IN EUROPE.—Very ornamental stove palms. They thrive in a compost of sandy loam and peat, in about equal parts, and require a strong heat and an abundance of water. Propagation is effected by seeds.

1. **Martinezia caryotæfolia** Humb. & Kth. Nov. Gen. ed. min. I, 305, VII, t. 699; Kth. Enum. III, 270; Mart. Hist. Nat. Palm. III, 284, t. 161, f. 1.—*Aiphanes caryotoides* Hort.

Vern. name in Brazil: Paxiuba Majerona (*ex* Drude).

DESCRIPTION.—Stem cylindric, 20-30 feet high, 4-5 inches in diameter, annulate, with long, subulate, black spines. Leaves 8-12, slightly arched-patent, 6-8 feet long; petioles at the base broadly lanceolate, semi-amplexicaul, armed with black spines; leaflets straight-patent, cuneiform, lanceolate, margin spinous-ciliate. Spadices growing from between the lower leaves, 1½ foot long; peduncle slightly terete, 4-6 inches long, erect-patent, compressed angular at the base, unarmed, glabrous. Male flowers: calyx small, tripartite; segments ovate-triangular, acute, corolla 4-times as long as the calyx; petals oblong-lanceolate, acute, coriaceous, the inner side longitudinally striate. Stamens 6, included; filaments very short, filiform, white; anthers linear, erect, subsagittate at the base; pistillode minute. Female flowers: calyx triphyllous, membranous; sepals broadly-ovate, scarcely



Martinezia lindeniana H. Wendl.

1 line long with spine; rhachis unarmed; branches many, 3-6 inches long, corolla twice as long, coriaceous; petals ovate, acute, concave; staminodes forming a membranous, 6-dentate urceolus. Ovary ovate, glabrous, trilocular, 2 loculi being abortive. No style; stigmas 3, pyramidal-acute, erect. Drupe globose, size of a cherry, albumen solid, equable, cartilaginous.

HABITAT.—Brazil, Peru, Bolivia.

ILLUSTRATION.—Plate CI shows the most characteristic parts of *Martinezia caryotæfolia*: the stem thickly covered with slender spines, and a leaf resembling very much that of the Indian Caryotas. It was just this resemblance which has given this palm its specific name '*caryotæfolia*.' The photograph was taken by the Rev. M. Maier.

2. **Martinezia lindeniana** H. Wendl. in Linnæa XXVIII (1856) 349.

VERNACULAR NAME.—In New Granada: Alvarico.

DESCRIPTION.—Stem densely covered with spines. Leaves aggregate-pinnatisect; petiole with black spines; rhachis covered with a yellow-brown tomentum, densely intermixed with short black spines; leaflets $\frac{5}{6}$-$1\frac{1}{6}$ foot long, foliaceous, præmorse at the apex, middle nerve bearing 1 or 2 long spines towards the base on the underside, and some on the upper surface towards the apex.

Spadix elongate, simply branched, branches very long, the bases of the lower ones bearing no flowers for a short distance; peduncle with long spines; peduncle, rhachis and branches covered with brown tomentum and small stiff spines.

Fruit a drupe, rose-coloured.

HABITAT.—New Granada.

This palm was discovered by Linden in December 1855 who found it growing in the forests near Florida, New Granada.

ILLUSTRATION.—The palm figured on Plate CII was growing in the garden of the Cama Hospital, Bombay. On the stem only a spiral groove is left free from spines, indicating the place where the leaves were attached.

2. *BACTRIS* JACQ. STIRP. AMER. t. 256.

(From 'baktron,' a cane; the young stem being used for walking sticks.)

Kunth Enum. Pl. III, 261.—Karst. Linn. 28, 397, 405.—Mart.

Hist. Nat. Palm. II, 92, t. 60, 70, 72, 73, 74; III, 279, 321.—Wallace Palm. Amaz. 76, t. 28-35, 45.—Griseb. Fl. Brit. W. Ind. 519.—Oerst. Palm. Centro-Amer. (1858) 40, t. 8, 9.—Trail in Trim. Journ. Bot. (1876) 354; (1877) 1, 40, 75, 132, t. 184.—B. Rodr. Enum. Palm. 26.—Drude Fl. Brasil. III, II, 316.

Usually low palms, often cæspitose, but sometimes reaching as much as 70 feet; stem very thin, or thicker and cane-like, always spinous. Leaves often scattered, but chiefly approximate above, pinnatisect, rarely bifid-entire; segments usually linear, acuminate; spadix according to the thickness of the stem delicate or stout, simply branched or simple, axillary, sessile or peduncled; spathes 2, upper one spinous or bristly-hairy. Flowers monœcious, small, green, rose or dark-yellow, in glomerules of 3 and of 2 males in the upper part. Male flowers: calyx tripartite or trifid, sepals acute; corolla tripetalous, petals acute; stamens 6, 9 or 12, rising from a fleshy disc; filaments subulate; anthers linear, erect. Female flowers globose or cylindric; calyx urceolate or ring-shaped; corolla urceolate or cylindric, staminodes forming a membranous ring. Ovary ovate or prismatic-trigonous, unilocular by the abortion of 2 loculi; stigmas 3, sessile, pyramidal. Drupe ovate or globose, 1-seeded; putamen roundish or elongate, with 3 pores, the one above the embryo differently located than the two others which are closed.

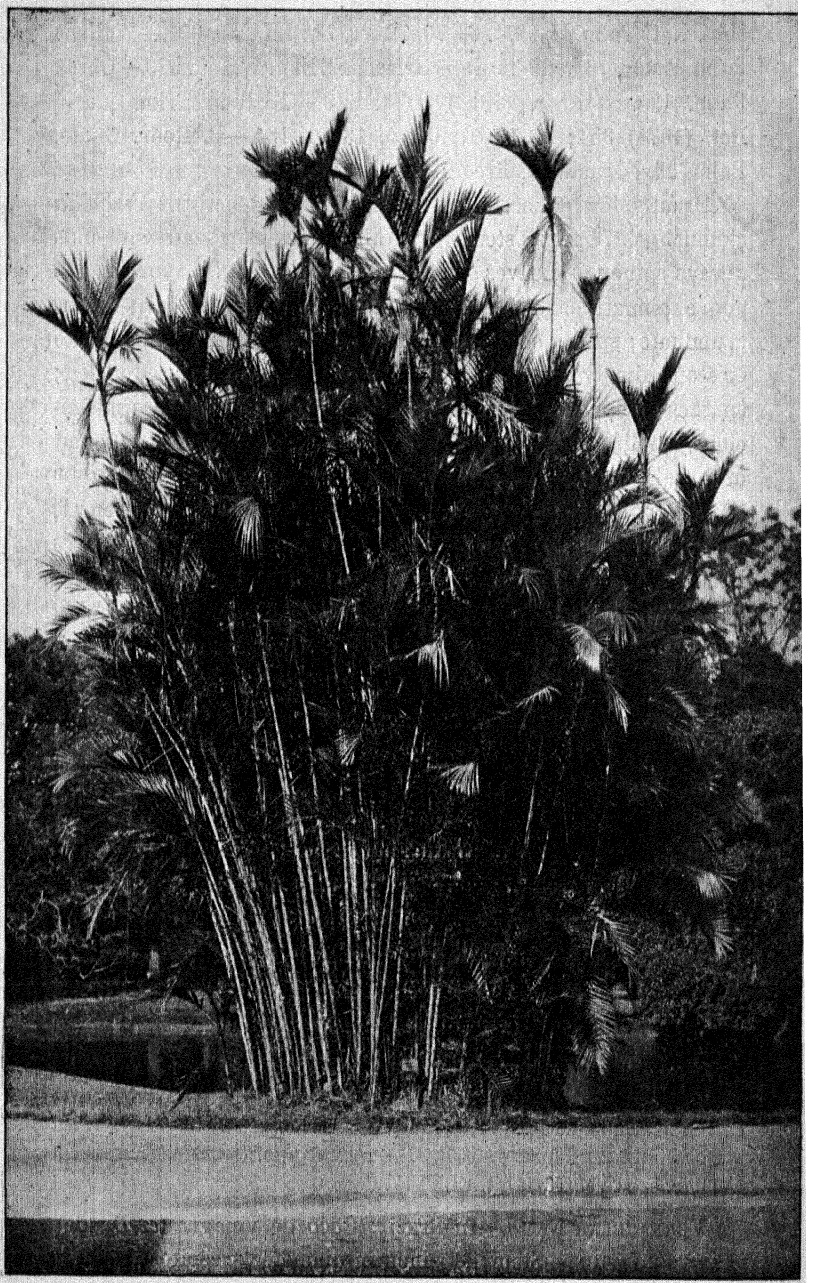
Species about 90.—53 species in Brazil, Peru, Bolivia and Guiana; the rest in the Antilles and Central America.

CULTIVATION IN EUROPE.—Very ornamental, slender growing stove palms. Some of the species are of easy culture in a compost of loam, peat, leaf mould, and sand, in equal parts: but most of them are very difficult to treat. Propagation may be effected by seeds or by suckers, which are very freely produced.

1. **Bactris major** Jacq. Stirp. Amer. 280, t. 171, f. 2; Mart. Palmet. Orbign. 62.—Drude Fl. Bras. III, I, 358, t. LXXIV, f. II.—*B. Achætorhachis* Mart. Palm. Orbign. 61; Trail in Journ. Bot. (1877) 49.—*Augustinea major* Karst. in Linnæa (1856) 395.—*Pyrenoglyphis major* Karst. Fl. Colomb. spec. sel. II, 141, t. CLXXIV.

VERNACULAR NAME.—In Brazil: Coco de vinagre (*ex* Drude).

DESCRIPTION.—Stem 1-1$\frac{3}{5}$ inch in diameter, cæspitose, usually 15 feet high, rarely 20 or more, armed near the rings with black retro-curved spines about 2 inches long. Leaves 6-7 forming a terminal crown, 5-7 feet long, equally pinnatisect; sheath short,



Bactris major Jacq., growing in the Botanic Gardens of Sibpur.

rhachis slender, elongate, both covered with whitish or fuscous tomentum and armed with spines which are $1\frac{1}{5}$-$2\frac{2}{5}$ inches long, black, stout, terete-subulate; petiole much shorter than the rhachis; segments 25-35 on each side, one-nerved (the apical ones sometimes many-nerved), narrowly linear-lanceolate, long acuminate, $\frac{2}{3}$-1 foot long and $\frac{2}{5}$-$\frac{7}{12}$ inch broad, glabrous on both sides, armed along the margins with black bristles, the apex more densely setose.

Spadix $\frac{2}{3}$-1 foot long, patent between the leaves; spathe densely covered with long, thin, black, retro-curved spines; peduncle about $\frac{1}{3}$ foot long, as long as the branches; rhachis very short, $\frac{2}{5}$-$\frac{4}{5}$ inch; branches rigid, few (5-8), $\frac{1}{3}$ ft. long and longer, densely floriferous from base to apex. Male flowers: $\frac{7}{25}$ inch long; calyx trifid; corolla trifid almost half-way down; anthers long; filaments short; pistillode 0. Female flowers slightly smaller than the male ones, ovoid; calyx urceolate, including the urceolate corolla. Drupe ovoid, bluish-black, about $1\frac{3}{5}$ inch long and $1\frac{1}{5}$ inch in diameter; exocarp thinly scabrous; putamen much thickened, obliquely ellipsoidal, $1\frac{1}{5}$ inch long and $\frac{4}{5}$ inch broad; albumen fleshy, excavated.

HABITAT.—New Granada, Guiana, Brazil.

ILLUSTRATION.—The beautiful tuft of *Bactris major*, figured on Pl. CIII, grows in the Botanic Gardens of Sibpur. We have to thank Col. Gage for kindly supplying the photograph.

V. PHYTELEPHANTINÆ

Numerous complete or incomplete spathes. Male and female branches (or spadices) separate. Perianth of one of the sexes absent or rudimentary. Fruits forming a syncarpium, 1-multilocular.—Leaves regularly pinnate; leaflets reduplicate.

Phytelephas R. & P., *Nipa* Wurmb.

1. PHYTELEPHAS R. & P.

(From the Greek 'phyton,' plant, and 'elephas,' elephant, ivory.)

Willd. Sp. Pl. IV, 1158. Gaudich. Voy. Bon. t. 14-16, 29, 30.—Karst. Lin. 28, 275.—Mart. Hist. Nat. Palm. III, 306.—Kunth Enum. Pl. III, 109.—Spruce Journ. Lin. Soc. IV, 186.—Benth. & Hook. Gen. Pl. III, II, 921, 79.

Stemless or low-stemmed palms, up to 20 feet high. Crown very dense. Leaves 12-20, pinnate, 15-20 feet long; leaflets 150-160, alternate at the base, opposite towards the upper end. Spadices growing from between the leaves, diœcious. Male spadix simple, long; spathes 2-4, almost complete. Male flowers with an irregularly cup-shaped, dentate perigone or with crossed leaflets. Stamens numerous (30 and twice or thrice as many); filaments filamentous; anthers linear, attached close to the base; pollen finely spinous. Female spadix simple; spathes comparatively longer. Female flowers in a dense bundle which is covered by many spirally arranged bracts, immediately surrounded by 2 rows of irregular, long-acuminate leaves, the outer shorter row mostly of 3, the inner much longer one of 5-10 leaves; staminodes many, with barren anthers. Ovary globose, with mostly 5 (4-9) loculi; style long-columnar; stigmas as many as there are loculi, long-filamentous; ovule 1 in each loculus; placenta axile. Fruiting spadix consisting of an aggregate of about 6 or more compressed and united berry-like fruits (syncarpium); each fruit commonly with 4-6 seeds in as many loculi, pericarp with hard-woody protuberances. Albumen uniform, very hard, slightly excavated.

Species at least 3, probably more.—Tropical America, between 9° N. L. and 8° S. L., 70-79° W. Long.



Male Ivory-nut Palm (*Phytelephas macrocarpa* R. & P.).

1. **Phytelephas macrocarpa** R. & P.; Syst. Veg. Fl. Peruv. et Chil. 301; Humb. Kth. Nov. Gen. I, 83; Kth. Enum. III, 109; Mart. Hist. Nat. Palm. III, 306; Hook. Journ. of Bot. and Kew Misc. I, 204; Seem. Bot. Herald 208, t. 45, 46, 47, ejusdem Bonpl. III, 270, t. 182; Bot. Mag. 4913, 4914.—*Elephantusia macrocarpa* Willd. Spec. IV, 1156.

NAMES OF THE TREE.

English: Large-fruited Ivory Plant, Ivory Palm, Ivory nut Palm, Vegetable Ivory Plant, Negro's head Palm.
German: Elfenbeinpalme, Taguabaum.
Dutch: Ivoornoot, ivoorpalm.
Spanish: Palma de marfil.
Indians of the Magdalena: Tagua.
Indians of the coast of Darien: Anta.
Peru: Pullipunta, Homero.

NAMES OF THE FRUIT.

English: Negro's head.
German: Negerkopf.

NAMES OF THE KERNELS.

English: Ivory nuts, palm ivory, vegetable ivory.
French: Ivoire végétal, noix de corozo.
German: Corozanuss, Corusconuss, Elfenbeinnuss, Steinnuss, Taguanuss, vegetabilisches Elfenbein.
Dutch: Ivoornooten, palmivoor, plantenivoor.

DESCRIPTION.—Stem always pulled down, partly by its own weight, partly by its ærial roots, thus forming a creeping caudex, frequently 20 feet long, but seldom higher than 6 feet. Leaves 12-20 in number, 18-20 feet long, segments towards the base of the leaf alternate, towards the apex opposite, 3 feet long, 2 inches broad, about 160 in number. Seem to be diœcious, the males being more robust, more erect and higher than the females. The inflorescence of both emits a most penetrating almond-like smell. Male spadix simple, fleshy, cylindrical, which has 3-4 spathes, the flowers of which are densely crowded together and sessile. Each flower furnished with a small bract. Sepals 3. Stamens numerous; filaments filiform; anthers linear, erect, affixed nearly at the base, bilocular; connective mucronulate, pollen elliptical, furrowed lengthways. Female spadix simple,

bearing on the average from 6-7 flowers, forming a dense cluster, surrounded by bracts, placed in a spiral direction, the uppermost five of which, being often much longer than the style, but generally shorter and pure white, have the appearance of petals; staminodes numerous, free, inserted in the torus between the petaloid bracts and the ovary. Ovary 6-9 celled, each cell with a solitary, sessile, erect ovule, attached to an axile placenta; style elongated, splitting into 6-9 branches, stigmatose on the edges. Fruit a collection of from 6-7 drupes, which is as large as a man's head, and stands at first erect, but when approaching maturity it hangs down. A plant bears at one time from 6-7 of these heads, each weighing when ripe about 25 pounds. Drupe covered with hard woody protuberances, contains from 6-9 seeds, but generally seven; testa thick, bony; embryo peripherical and placed near the hilum.

HABITAT.—The ivory plant is confined to the continent of South America, between 9° N. L. and 8° S. L. and 70°-79° W. Long. It inhabits damp localities, such as confined valleys, and banks of rivers. It is found not only on the lower coast region, as in Darien, but also at an elevation of more than 3,000 feet above the sea, as in Ocaña. It is generally found in separate groves, seldom intermixed with other trees or shrubs.

USES.—The albumen of the fruit is almost chemically pure cellulose, the so-called vegetable ivory. In the beginning it is milky and serves as food on account of its flavour, but finally it becomes white and resembles so exactly the ivory obtained from elephants, as to be frequently passed off for such, and even employed by mechanics in place of that article. It has not yet been accurately ascertained when the vegetable ivory first came to be imported into Europe for commercial purposes; but there is reason to believe that it was shortly after the Spanish Colonies obtained their independence (about 1826). At the present day the ivory is largely exported into North America, England, Germany, etc. The Indians cover their cottages with the leaves of this tree; but this is only done when those of other palms are not procurable, as the latter last much longer than the former.

Morren has given a more detailed description of the nut in Vol. I of "Dondonæa, ou Recueil d'Observations de Botanique,"

p. 74, from which we give the following extract as translated by W. J. Hooker*: —

'The external covering of the ivory-nut (seed) is so hard as to be almost stony, yellowish-grey, smooth, and destitute of gloss; it is attached to a second coating, which is brown, porous, and dull, and is incorporated with it. Beneath a hollow, which separates these two integuments, is a third, brown, veined, warted and glossy covering, traversed by numerous fibres, under which lies the albumen, which forms the vegetable ivory. The vegetable ivory is of the purest white, and free from veins, dots, or vessels of any kind, presenting a perfect uniformity of texture, surpassing the finest animal ivory; and its substance is everywhere so hard, that the slightest streaks from the turning-lathe are observable, and cannot be erased till it is newly fashioned.

'When the article is carved, the vegetable ivory may be known by its brightness, and by its fatty appearance, whereon the well-skilled may discern the minute lines which are the beds of cells. Its structure would almost seem to show more analogy with bone than with ivory, but a microscopic investigation quickly proves that vegetable ivory possesses an entirely different structure.

'This structure is among the most curious in the Vegetable Kingdom.

'The external covering of the albumen is composed, as we proceed from the outside to the inside, of—

'I. A layer of ovoid cellules, with brown thick parietes, the elongated centre of each cellule is filled with a darker substance.

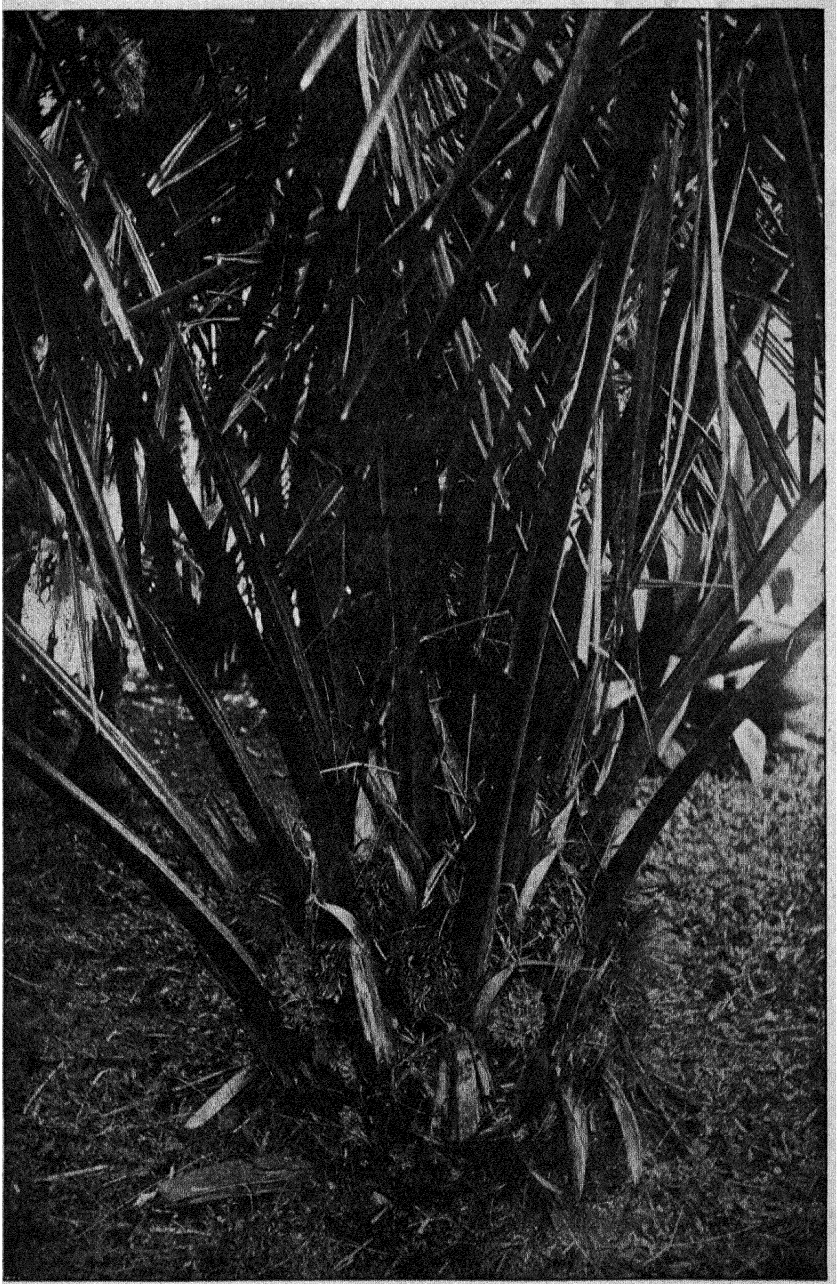
'II. A second layer of ovoid cells, placed perpendicularly on the first, but with the innermost elongated, and approximating towards the structure of the next layer.

'III. A third layer of cells, still more elongated and fusiform, their parietes are thick and brown.

'IV. A fourth layer of smaller and prismatic cells, placed perpendicularly and regularly over the preceding layer; they rest in their turn upon the last, which is

'V. A final layer of very dark and irregular cells, externally coated, on the side towards the albumen, with a brown

* W. J. H. Some account of the Ivory Palm. Kew Journal of Bot. I (1849), 209-211.



Female Ivory-nut Palm (*Phytelephas macrocarpa* R. & P.).

colouring matter, which imparts its hue to the surface of the albumen, or vegetable ivory.'

'All the above-described organization belongs only to the integumentary system.

'The albumen, or vegetable ivory itself, is composed of concentric layers, of which only the most external differ from the most internal. When the albumen is hard, as was that which I examined, it presents a white substance, transparent in water, and which appears continuous, and not to be distinguished into various degrees of growth. It is perforated with an infinity of holes, the sections of so many cavities; the latter are irregularly rounded and also prolonged into arms or tubes, which give a starry appearance to the cavities, many of them being 5, 6, 7, 8 and 10-rayed. Here and there may be seen a little spheroidal cavity; finally the tubes appear to be each tipped with a small swollen head.

'Throughout the albumen the above-described structure is more or less regular, offering a beautiful study to the Vegetable-anatomist.

'Generally speaking, the starry cavities are arranged in a quincunx, so that the interval between two of them corresponds to a third. A little attention also enables the observer to see that those rays, which are terminated by a little head, answer always to one another. The space betwen these heads is largest in a dry slice and least in a moist one. The central cavity is sometimes empty, and sometimes filled with a substance composed of very minute globules, reaching occasionally to the very tips of the rays.

'It is evident that these starry cavities represent so many hollows of cells, which still preserve their radii of communication though the primitive parietes are obliterated; and in some instances, the cavities only remain in the form of ovoidal cells, which still can be restored to their original configuration by immersing the portion of albumen in Canada balsam. I have dried a carefully cut slice of the ivory and then subjected it to the influence of Canada balsam, which rendered it so perfectly diaphanous as to be scarcely discernible by the naked eye from the balsam. This process has the effect of restoring the cells to their normal structure; they become 6-rayed, the tubes correspond exactly with each other and every one is tipped

with a swollen head, and more or less filled with the globular substance of which I have spoken. Thus we see revealed the whole organization of vegetable ivory, which is merely a prismenchyme with thickened cells, in which the rays of communication are preserved. The closest scrutiny has not enabled me to detect in the thick portion of the cells the smallest trace of those layers of growth which have been detected by M. Valentin, especially in the *Hoya carnosa* and *Oreodoxa regia,* etc.

'This substance, which appears continuous, is very analogous to that which MM. Schleiden and Theodore Vogel, in their researches into the nature of the albumen, have found in the albumen of *Phœnix dactylifera;* only that in the latter, there is no starry disposition of the tubes, and the hollows of the cells are elongated into two, or, at most, into three radii of communication.' (Morren.)

CULTIVATION IN EUROPE.—This palm thrives in a compost of two parts of rich loam, one of peat, and one of river sand. Perfect drainage and a liberal supply of water are essential.

ILLUSTRATION.—The two photographs reproduced on Plates CIV and CV were taken by Mr. Macmillan in the Botanic Gardens of Peradeniya, Ceylon.

2. *NIPA* WURMB. ex BL. RUMPH. II, 72; III, t. 164, 165.

(Nipa is the vernacular name of the palm in the Philippines.)

Lam. Illustr. t. 897.—Labill. Mem. V. t. 21, 22.—Kunth Enum. Pl. III, 110, 589.—Mart. Hist. Nat. Palm. III, 305, t. 108.—Miq. Fl. Ind. Bat. III, 150.—Blanco Fl. Filip. 662.—Griff. Ic. Pl. Asiat. 244-247.—Benth. & Hook. Gen. Pl. III, II, 920, 78.—Vidal Fl. Forest. Philip. t.

A prostrate æstuarial gregarious palm; rootstock stout, branched, covered with the sheaths of old leaves, leafing and flowering at the ends of the branches. Leaves pinnatisect; leaflets linear-lanceolate, sides reduplicate in vernation. Spadix short, terminal, erect in flower, fruiting drooping. Flowers monœcious, male in catkin-like lateral branches of the spadix, female crowded in a terminal head, perianth glumaceous. Male flowers minute, surrounded with setaceous bracteoles; sepals linear with broad truncate inflexed tips, imbricate; petals smaller; stamens 3;

filaments connate in a very short column; anthers elongate, basifixed; pistillode 0. Female flowers much longer than the male; sepals 6, rudimentary, displaced; staminodes 0; carpels 3, connate, tips free with an oblique stigmatic line; ovules 3, erect. Fruit large, globose, syncarp of many obovoid, hexagonal, 1-celled, 1-seeded carpels, with pyramidal tips and infra-apical stigmas; pericarp fleshy and fibrous; endocarp spongy and flowery; seed erect, grooved on one side; testa coriaceous, viscid within, adherent to the endocarp; hilum broad; endosperm horny, equable, hollow; embryo basilar, obconic. Species 1.

This genus and Phytelephas are widely different from the other palms, exhibiting affinities to *Pandanaceæ* (Screw-pines) and *Cyclanthaceæ*. 'It is therefore a plant of the greatest interest to the botanist, and also, it may be added, to the geologist, as has been justly remarked by Bowerbank, Lyell, and J. D. Hooker, arising from the fact that nuts of a similar plant abound in the tertiary formations at the mouth of the Thames, where they once floated about in as great a profusion as those of *Nipa fruticans* do at the present day in the rivers of the Indian Ocean, until they became buried in the silt and mud which now forms the island of Sheppey.' (Seeman.)

1. **Nipa fruticans** Wurmb. in Verh. Bat. Genootsch. I (1779) 349; Mart. Hist. Nat. Palm. III, 305, t. 208; Lam. Illustr. t. 897; Kunth. Enum. III, 110, 589; Miq. Fl. Ind. Bat. III, 150; Griff. Notul. III, 168; Ic. Pl. Asiat. 244; Roxb. Fl. Ind. III, 650; Thw. Enum. 327; Kurz. For. Fl. II, 541; Hooker Fl. Brit. Ind. VI, 424; Trimen Flora Ceyl. IV, 325.—*Nipa litoralis* Blanco Fl. de Filipinas 662. -*Cocos nypa* Lour. Fl. Cochinch. 694 (ed. Willd.).

NAMES.

English: Water-coconut, Nipa Palm.
Beng.: Gulga, gabna, golphal (fruits), Golpatta (leaves).
Burm.: Dane.
Andam.: Poothada.
Sing.: Ginpol.
Ceylon: Gim-pol.
Guam and Philippines: Nipa, Sasa.
Ponape: Parran.
Sulu Archipelago: Ballang.

DESCRIPTION.—Rootstock 1½ foot in diameter, rooting along the lower surface. Leaves very many, erect and recurved,



Nipa Palm (*Nipa fruticans* Wurmb.).

15-30 feet long; petiole 4-5 feet long, very stout, sheath short; leaflets innumerable, shortly decurrent on the rhachis, 4-5 feet long, bright green above, glaucous and 3-keeled beneath, tip subulate, midrib scurfy. Spadix 4-7 feet long, peduncle 3-8 feet. Male flowers very small; sepals linear with clavate inflexed tips; petals similar but narrower; ovary densely crowded, cuneate-obovate, angled, top pyramidal. Fruit 1 foot in diameter, nodding; carpels 4-6 inches long, densely packed on a globose, areolate receptacle, compressed, broadly cuneiform, dark brown, crown 3-or more-angled; seed as large as a hen's egg.

HABITAT.—Sunderbunds, Burma, throughout Malay to Queensland; Ceylon, mouth of rivers on south-west coast, Kalutara, Gindura River near Galle; not in Peninsular India. Thousands and thousands of acres of the salt marshes of the islands and coasts of the Indian Ocean may be seen covered with this palm. It seems to reach its western limit in Ceylon.

FLOWERS.—In October.

USES.—The leaves are used for thatch. For this purpose the leaflets are stripped from the rhachis and formed into a thick fringe on a reed. After having been thoroughly dried the thatch is secured to the framework of the roof by lashings of *Pandanus* leaves split up to the middle and deprived of their stiff keel. Two men work at a time on each reed, beginning at the eaves and working towards the ridge, which is covered with a sort of braided matting secured in place by pins passing under the ridge-pole and projecting on each side. The Nipa is far superior to and more durable than coconut thatch. Safford describes the preparations which are made for thatching on the island of Guam in the following way. 'The housewife begins saving up dulces and other good things months beforehand. The nipa leaves are collected, made into fringe, and allowed to dry. *Pandanus* leaves are collected and cured and stripped off their spiny-keeled midrib. When all is ready relatives and neighbours are invited to assist, a pig or a bullock is killed, and the work goes on amid feasting, tuba drinking, and laughter, with occasional pauses during which Areca nuts, fresh Betel leaves, and lime are passed around on a tray, and the host dispenses cigars, made by the ladies of his family, of tobacco leaves in the form of a cylindrical bundle kept together by a wrapping of pineapple fibre or thread.'

In the Philippines toddy or 'tuba' is made of the sap of the Nipa, obtained as in the Coconut from the flowering spadix. 'This spirit,' says Padre Blanco in his "Flora de Filipinos," 'preserves, I am told, the sight, if the eyes are washed with it in the mornings; it also imparts an agreeable odour to tobacco and snuff. The inside of the fruit is edible, like that of the Coconut.' He mentions the pounded leaves of Nipa as a remedy for the bites of centipedes and a cure for ulcers. When the leaves are burnt they yield a supply of salt. Linschoten, the Dutch traveller, who visited India about 300 years ago, saw this palm and mentions that it yields an excellent wine.

From the leaves hats and cigar cases are made. The old fruits are large, the interior being hard like ivory, but transparent. Kurz thinks the seeds might be used for vegetable ivory.

According to Watt the leaf-stalks are used to help in floating sundry logs in the Sunderbunds, also as fishing floats. Gamble states that the trade in golpatta leaves in the Sunderbunds amounts yearly to about 135,000 tons, valued at nearly Rs. 60,000.

CULTIVATION IN EUROPE.—An ornamental stove palm. It is somewhat difficult to grow. Its pot should be partially or nearly submerged in a tank in which tropical aquatics are cultivated.

ILLUSTRATION.—Col. Gage was kind enough to have a photograph taken of the beautiful group of Nipa palms seen on Pl. CVI.

BIBLIOGRAPHY

ABAZA, A. d'. Aperçu sur les Palmiers et sur leurs Espèces Exotiques Cultivées. Alexandria Hort. Soc. Bull. 2 (1907), 1-46.

ADAM, J. Le Palmier à Huile et le Cocotier en Afrique Occidentale Française. In L'Agriculture Pratique des Pays Chauds. Bulletin Mensuel du Jardin Colonial, No. 67, 269-287; No. 68, 380-389; No. 69, 466-475 (1908); No. 70, 35-46; No. 71, 127-158; No. 72, 219-243 (1909).

— Le Palmier à Huile en Afrique Occidentale Française. Paris, 1909.

AGAN, JOSEPH E. Brazilian Fibres. Bull. Pan-Americ. Union 50 (1920), 394-404. (Includes Attalea funifera Mart.)

AHMED BIN HAJI OMAR. Races of the Coconut Palm. Gardens' Bull. Straits Settl. 2 (1919), 143.

ALDABA, V. C. The Pollination of Coconut. Philippine Agric. 10 (1921), 195-207.

ALMEDA, J. J. de. Noticia sobre a Palmeira de Dendem. Lisbonne, 1906. See Journal de l'Agriculture Tropicale No. 77 (1907), and L'Agriculture des Pays Chauds (1908), 466.

ANCONA, C. D'. I Trachycarpus. Bull. R. Soc. Tosc. di Orticultura XI (1906), 102-111.

ANDERSON, GEORGE E. Nipa Palm Sugar in the Philippines. Daily Cons. and Trade Repts. U. S., Year 14, No. 283 (1911), 1137-1143.

ANDERSON, T. In Journal Linn. Soc., Vol. XI (On Indian Palms).

ANDOS, L. E. Vegetable Fats and Oils. (Translated by Ch. Salter.) London, 1897.

ANDRÉ, E. Le Pritchardia Filifera Linden. Ill. Hort. XXIV, 32, 107.

ANNETT, H. E. Some Results of Experiments on the Palm Sugar Industry. Abstract from Agric. Journ. India in Indian Trade Journ., Vol. 44, No. 573 (1917), 371-372.

ANNETT, H. E., C. K. LELE, AND M. BHAILAL, AMIN. The Date Sugar Industry in Bengal: An investigation into its Chemistry and Agriculture. Mem. Dept. Agr. India, Chem. Ser., Vol. 2, No. 6 (1913), 281-389, 12 pl.

ANONYMOUS. Notes on Jubæa Spectabilis. Gard. Chronicle V (1879), 413; Ser. 2, XVIII (1882), 401-2; Ser. 3, XVII (1895), 518, illustr. 89-90.

Garden palms, Nipa Wurmb. Gard. Chron., Ser. 3, Vol. 2, No. 32 (1887), 156.

— The Palm Oil in Labuan. Kew Bull. (1880), 262-264.

— The African Oil Palm. Kew Bull. (1891), 190-2.

— Lagos Palm Oil. Kew Bull. (1892), 200-8.

— Economic Plants of Sierra Leone: Oil Palm. Kew Bull. (1893), 168.

— Coconut Palm Disease in Trinidad. Bull. Dept. Agric. (1907).

— The Varieties of the Oil Palm in West Africa. Kew Bull. No. 2 (1909).

— African Bass or Piassava. Kew Bull. (1910), 169.

ANONYMOUS. Coco de Mer in British Guiana. Kew Bull. (1910), 256.
— Sex of Date Palm Seedlings. Kew Bull. (1914), 159.
— Varieties of Oil Palm in West Africa. Kew Bull. (1914), 285.
Selection of Coconuts for Germination. Kew Bull. (1915), 72.
— Palmyrah Palms: A New Source of Refined Sugar. Trop. Agr., Ceylon, Vol. 47, No. 1 (1916), 14, pl. 1.
— Phœnix Canariensis Hort. Kew Bull. (1916), 107.
— Uses of Phœnix Canariensis. Nature (1916), 387.
The Genus Cocos. Kew Bull. (1917), 331.
Coco-de-mer in the Seychelles. Kew Bull. (1921), 254.
Aren Fiber from Netherlands East Indies. Daily Cons. and Trade Repts. U. S., Year 22, Vol. 1, No. 5 (1919), 85.
Culturas Intercalares entre os Coqueiros. Bol. Agric. (Nova Goa) 1 (1919), 210-212.
— Espaço entre Coqueiros. Bol. Agric. (Nova Goa) 1 (1919), 17-19.
— Metodos de Transplantar Coqueiros. Bol. Agric. (Nova Goa) 1 (1919), 95-97.
— Posiç'ã'o do Côco-semente no Solo. Bol. Agric. (Nova Goa) 1 (1919), 212-214.
— Salt and the Growth of Coastland Plants. Agric. News (Barbados) 18 (1919), 321. (Treats also of Coconut.)
— The Coconut Industry in Malaya and its Future Prospects. Tropical Life 15 (1919), 103.
— The Pacific Islands. Sydney, 1919. (Chiefly on coconuts.)
— A Successful [Cacao and Coconut] Plantation in Trinidad. Agric. News (Barbados) 19 (1920), 249.
Sugar and Alcohol from the Nipah Palm. Planter and Sugar Manufacturer, Vol. 65, No. 22 (1920), 345.
Sugar and Alcohol from the Nipa Palm. Sci. Amer. Monthly 1 (1920), 310. (Extract of an article in Bull. Manila Bur. Sci.)
— The Coconut Raft. Sci. Americ. 122 (1920), 339.
— The Dwarf Coconut in Malaya. Tropical Life 16 (1920), 54-55.
— The Most Valuable Crop. Sci. Amer. Monthly 1 (1920), 316. (On Coconut Palm.)
— The Palm Sugar Industry in Bengal. Planter and Sugar Manufacturer 65 (1920), 3-4.
Coconut Palm. Mo. Bot. Gard. Bull., Vol. 9, No. 10 (1921), 137-146, pl. 30-32.
— Cultivation of the African Oil palm with special reference to the West Indies. Journ. Soc. Chem. Indust. 40 (1921), 42 R-43 R.
The Origin of the Coconut Palm. Agric. News (Barbados) 20 (1921), 209-11.
— Palm Sugar in India. The South African Sugar Journ., Vol. 6, No. 4 (1922), 295.

ARANGO, R. Algunas Plagas de Nuestros Cultivos. Offic. Sanidad Veg. Sec. Agric. Com. y Trab. (Cuba) Bol. 2, 94 p., 23 pl. (1919). (Includes Bud-rot of Coconut.)

ARANGO, R. La Palma Real, su Belleza Ornamental y Utilitad Practica. Rev. Agric. Com. y Trab. 2 (1919), 557-559.

ARBER, A. On the Development and Morphology of the Leaves of Palms. Proc. Roy. Soc. B. 93 (1922), 249-61.

ARCANGELI, G. Sopra una Pianta di Jubæa Spectabilis Coltivata nel R. Orto Bot. Pisano. Boll. Soc. Bot. Ital. (1901), 34.

— Sopra una Pianta di Pritchardia Filifera Wendl. Coltivata nel R. Orto Bot. di Pisa. Boll. Soc. Bot. Ital. (1901).

ASCHERSON. In Verhandl. Ges. Erdk. Berlin V. (On Hyphaene.)

ASHBY, S. F. Bud-rot Disease of Coconuts. Journ. Jamaica Agric. Soc. 22 (1918), 331-33.

— Bud-rot of Coconuts. Journ. Jamaica Agr. Soc. 23 (1919), 23-25.

— Notes on Two Diseases of the Coconut Palm in Jamaica caused by Fungi of the Genus Phytophthora. West. Ind. Bull. 18 (1920), 61-73.

AUBERT, L. The Manufacture of Palm Sugar in Upper Burma. Agr. Journ. India, Vol. 6, No. 4 (1911), 369-376, pl. 41-43.

AUCHINLECK, G. G. The West African Oil Palm and its Products. Dept. Agric., Ceylon Bull. 62 (1923).

BABE, E. Coeficiente de Digestibilidad del Palmiche. Rev. Agric. Com. y Trab. (Cuba) 4 (1921), 474-477.

BABOU, G. Plantes Cultivées à Gabès et dans les Oasis de l'Aradh. Tunis, 1907.

BACCARINI. Attorno all' accrescimento in ispessore dei fusti delle Palme. N. Giorn. Bot. Ital. (nuova serie) XIV (1907), No. 1.

BAILEY, L. H. Nipa. Standard Cyclopaedia of Horticulture, Vol. 4 (1916), 146. New York and London.

— Borassus. Standard Cyclopaedia of Horticulture, Vol. 2 (1914), 521-522, fig. 593. New York and London.

— Jubæa. Standard Cyclopaedia of Horticulture, Vol. 3 (1914), 1721. New York and London.

BAILLON. Monographie des Palmiers. Paris, 1895.

BAKER, HENRY D., and Others. British India, with Notes on Ceylon, Afghanistan and Tibet. 638 (1915), 25 fig. (in text and on 7 pl.) 1 fold. col. map. U. S. Dept. Com. Bur. Foreign and Dom. Com. Spec. Cons. Rpts. 72.

— Sugar from the Date Palms in India. Daily Cons. and Trade Rpts. U. S., Year 16, No. 189 (1913), 906-907.

BAKER, J. G. Flora of Mauritius and the Seychelles. London, 1877.

BAKER, LOUIS. Memorial ..... praying that the necessary steps be taken by Congress to introduce into the Southern States certain Palms for the Production of Sugar and Fruits. 21 pp. 1871. Washington, D. C. (U. S. 42nd Cong., 2nd Sess. Senate Misc. Doc. 11).

BALME, J. El Porvenir de las Frutas Tropicales: El Coco y el Dàtil. Rev. Agric. (Mexico) 5 (1920), 579-581.

BANCROFT, C. K. Diseases in Plants with Special Reference to Fungi Parasitic on Crops in British Guiana. Journ. Board Agric. Brit. Guiana 11 (1918), 47-57. (Includes Coconut.)

BANERJEI, N. N. Manufacture of Date Sugar. Dept. Agr. Bengal Quart. Journ., Vol. 1. No. 4 (1908), 253-255.

— The Date Sugar Palm. Dept. Agr. Bengal Quart. Journ. Vol. 1, No. 3 (1908), 161-164.

BARAKZAI, M. A. F. Cultivation of the Date (Phœnix Dactylifera), etc., as Practised near Shikarpur, Sind, India. Internat. Inst. Agr., Rome, Internat. Rev. Sci. and Pract. Agr., Vol. 12, No. 5 (1921), 574-575.

BAREN, R. Notes on the Economic Plants of Madagascar. Kew Bull. of Miscell. Inf. (1890).

BARGAGLI PETRUCCI, G. Ricerche Anatomiche sopra Chamœrops Humilis, la Phœnix Dactylifera ed i loro pretesi ibridi. Malpigh. XIV.

BARKER, E. E. The Architecture of the Coco Palm. Nat. Study Rev. 18 (1922), 44-50.

BARRETT, O. W. The Sugar Palm. Philippine Agr. Rev. Eng. ed., Vol. 7, No. 5 (1914), 216-221.

— and C. W. HINES. Palms as Sugar Producers. Pt. 2. Internat. Sugar Journ., Vol. 17, No. 198 (1915), 271-272.

BARSICKOW, M. Über das Sekundäre Dickenwachstum der Palmen in den Tropen. Würzburg, 1901.

BARTHE, A. E. La Oficina de Sanidad Vegetal de la Secretaria de Agricultura, Comercio y Trabajo. Resumen de las plagas ya estudiadas y combatidas. Rev. Agr. Com. y Trab. (Cuba) 3 (1920), 290-296. (Includes Bud-rot of Coconut.)

BARTLETT, HARLEY HARRIS. The Manufacture of Sugar from Arenga Saccharifera in Asahan, on the East Coast of Sumatra. 21st Ann. Rept. Mich. Acad. Sci. (1919), 155-165, pl. 3-6. Bibliography, 164-165.

BAUCH, K. Beiträge zur Entwicklungsgeschichte und Physiologischen Anatomie der Palmenblüte. Berlin, 1911.

BECCARI, O. The Palms of the Island of Polillo. Phil. Journ. Sci., C. Bot. VI (1911), 229-230.

Le Palme 'Dum' od 'Hyphæne' e più specialmente quelle dell' Africa Italiana. Agricolt. Colon. Anno II, fasc. III (1908), 137-183. Firenze.

— Studio sui 'Borassus' e Descrizione di un Genere Nuovo Asiatico di 'Borasseæ'. Webbia IV (1913), 293-385.

— The Palms Indigenous to Cuba. Pomona College Journ. of Economic Bot. II (1912), No. 2.

— Contributo alla Conoscenza della Palma a Olio. Estratto da L' Agric. Coloniale. Anno VIII (1914).

— The Palms of the Philippine Islands. Philipp. Journ. Sc. 1 (1919), 295-362.

Asiatic Palms. Lepidocaryeæ, Parts 1-3. Ann. Roy. Bot. Gard., Calcutta, Vol. XII. (Last part published in 1918.)

BECCARI, O. Neue Palmen Papuasiens II. Bot. Jahrb. 58 (1923), 441-462.
— Classification des Palmiers d'Indo-Chine. Bull. Mus. Hist. Nat. Paris (1911), 148-160.
— Systematic Enumeration of the Species of Calamus and Dæmonrops. Rec. Bot. Survey, India, 11, n. 3.
— Le Palme Incluse nel Genere Cocos. Estratto della Malpighia anno 1, fasc. 8.
— Manipolo di Palme Nuove Polinesiane Conservate nell' erbario di Kew. Webbia IV (1913), 253-291.
— Le Specie di Palme raccolte alla Nuova Guinea.
— Illustrazione di Alcune Palme Viventi nel Giardino Botanico di Buitenzorg. Reliquiæ Schefferianæ. 1885.
— Malesia, Vols. I and III. Genova, 1877-1890.
— Palme Nuove Papuane. Estratto dalla publicazione U. Martelli 'Webbia'. Firenze, 1905.
— Le Palme Americane delle Corypheæ. Webbia II (1907).
— Palms of the Philippine Islands Collected and Distributed by A. D. E. Elmer. Leafl. Philippine Bot. 8 (1919), 2297-3067.
— The Origin and Dispersal of Cocos Nucifera. In Philippine Journ. Sci., C. Botany, Vol. 12, No. 1 (1917), 27-43.
— The Palms of the Philippine Islands. Philippine Journ. Sci., Vol. 14, No. 3 (1919), 295-362, 3 pl.
— AND J. F. ROCK. A Monographic Study of the Genus Pritchardia. Mem. Bernice P. Bishop Mus. 8 (1921), 1-77, 24 pl.

BEDDOME. Flora Sylvatica of the Madras Presidency, Madras, 1869-1873.

BELFORT, R. The Pioneer Coconut Manual (1916-17).

BENTHAM, G. Flora Hongkongensis, with supplement. London, 1861-1872.
— AND J. D. HOOKER. Genera Plantarum. London, 1862-1883.

BERGMAN, E. On Jubæa Spectabilis. Journ. Soc. Hort. France, Ser. 3, XII (1890).

BIRDWOOD. Catalogue of the Economic Products of the Presidency of Bombay. Bombay, 1862.

BIRGANTI, VINCENZO. Descrizione di una Nuova Varietà del Cocos Chilensis. Napoli, 1834.

BLANCO, MANUEL. Flora de Filipinas. Gran edicion bajo la direccion cientifica del P. Fr. A. Navos. Text 4 vols., pl. 2 vols. Manila, 1877-1880.

BLANFORD, W. F. H. Palm Weevil in British Honduras. Kew Bull. (1893), 42.

BLATTER, E. The Palms of British India and Ceylon, Indigenous and Introduced. Journ. Bomb. Nat. Hist. Soc., XX, 33, 347, 675, 981; XXI, 66, 343, 912; XXII, 444, 665; XXIII, 269, 516, 737; XXIV, 66, 329, 507, 673; XXV, 52, 207, 386.
— Zur Bionomie der Palmen der Alten Welt. Extrait des Actes du IIIme Congrès International de Botanique. Bruxelles, II (1911), 19-27, 8 pl.

BLATTER, E. History of the Sea-coconut. Journ. Bomb. Nat. Hist. Soc. XIX, 925.

BLUME. Rumphia sive Commentationes Botanicae de Plantis Indiae Orientalis. Leyden, 1835-1848.

— Flora Javae, etc. Brussels, 1828-1829. Nova series. Amsterdam, 1858.

— Enumeratio Plantarum Javae et Insularum Adjacentium. 1830.

BOBISUT, O. Zur Anatomie einiger Palmenblaetter. Sitz.-Ber. Kais. Ak. Wiss. Wien, Math. Naturw. Kl. CXIII (1904).

BOEMER, A., und J. BAUMANN. Beiträge zur Kenntnis der Glyceride der Fette und Oele. IX, Die Glyceride des Cocosfettes. Zeitschr. Untersuch. Nahrungs-und Genussmittel 40 (1920), 97-151.

BOLDINGH, I. Over de Veelvormigheid van de Klapper (Cocos Nucifera L.). Dept. Landb. Nijv. en Handel Nederl. Indië, Meded. Afdeeling Zaadteelt 1 (1920), 1-20.

BONAVIA, EMANUEL. The Date Palm in India. Gard. Chron., Ser. 3, Vol. 23, No. 575 (1898), 2.

BOOMER, J. F. Nipa Sugar and Alcohol Prospects in the Philippines. Daily Cons. and Trade Repts. U. S., Year 18, No. 21 (1915), 362-364.

BORZI, A. Intorno all' Accrescimento Secondario nei Fusti delle Palme. Palermo, 1903.

— e G. CATALANO. Ricerche sulla Morfologia e sull' Accrescimento dello Stipite delle Palme. Reale Ac. Lincei, XXI (1912), 73-81.

BOURQUELOT et HÉRISSEY. Sur la Composition de l'Albumen de la Graine de Phœnix Canariensis Hort., et sur les Phénomènes qui Accompagnent la Germination de cette Graine. C. R. de l' Acad. Sci. CXXXIII (1901), 302.

BRANDEGEE, T. S. The Palms of Lower California. Zoe V, 187-189.

BRANDIS, D. Forest Flora of North-West and Central India. London, 1874.

— Indian Trees. London, 1906.

BRIGGS, LAWRENCE, P. The Production of Palm Sugar in Cambodia. Daily Cons. and Trade Repts. U. S., Year 19, Vol. 2, No. 109 (1916), 516-517.

BRISSEAU DE MIRBEL. Anatomische und Physiologische Untersuchungen über den Stamm der Dattel-palme. Verdeutscht mitgeteilt von Dr. von Martius. Münchner Gelehrte Anzeigen 1843, No. 108, 865.

BRONGNIARD, A. T. Botanique (Phanérogamie) du Voyage Autour du Monde Exécuté sur la Corvette La Coquille Pendant les Années 1822-1825. Paris.

BROWN, J. G. Rot of Date Fruit. Bot. Gaz. 69 (1920), 521-529.

BROWN, R. Vermischte Botanische Schriften, Vol. 1 (1825-1834).

BROWN, W. H., AND A. F. FISCHER. Philippine Mangrove Swamps. Forestry Bur. Philipp. Islands Bull. 17 (1918), 1-132. (Nipa Palm.)

BROWN, W. H., and ELMER D. MERRILL. Philippine Palms and Palm Products. Forestry Bur. Philipp. Islands Bull. 18 (1919), 129 p., 45 pl.

BROOKS, A. J. Report on the Agric. Dept., St. Lucia. Imp. Dept. Agric. West Indies Rept. Agr. Dept. St. Lucia, 1918-19, 1920. (Includes Coconut.)

BRUNER, S. C. Caida de las Nueces e Inclinacion de las Hojas del Cocotero en Cuba. Revist. Agric. Com. y Trab. 2 (1919), 96.

— La Muerte de los Cocoteros. Rev. Agric. Com. y Trab. 5 (1922), 9-10.

BURKILL, I. H. The Coconut Beetles. Gardens' Bull. Straits Settl. I (1913), 176-194.

— The Fertility of Branched Coconut Palms. Gardens' Bull. Straits Settl. 3 (1923), 1-2, 1 pl.

— Branching in Arenga Pinnata. Gardens' Bull. Straits Settl. 3 (1923), 3-4.

BURMANN, J. Thesaurus Zeylanicus. Amsterdam, 1737.

— Flora Malabarica. Amsterdam, 1769.

BURMANN, N. L. Flora Indica. Leyden, 1768.

BURTON, RICHARD E. The Lake Regions of Central Equatorial Africa, with Notices of the Lunar Mountains and the Sources of the White Nile; being the Result of an expedition undertaken under the Patronage of Her Majesty's Government and the Royal Geographical Society of London, in the Years 1857-1859. Journ. Roy. Geogr. Soc., Vol. 29 (1859), 1-464.

BUSCK, A. Report of an Investigation of Diseased Coconut Palms in Cuba. U. S. Dept. Agric., Div. of Entomology, Bull. No. 38 (n. s.), (1902).

BUTLER, E. J. Some Diseases of Palms. Agric. Journ. of India I (Oct. 1906).

— An Account of the Genus Pythium and Some Chytridiaceæ. Mem. Dept. Agric. India I (1907), No. 5.

— The Bud-rot of Palms in India. Mem. Dept. Agric. India. Bot. Series III (1910), No. 5.

— Report on Coconut Palm Disease in Travancore. Agric. Res. Instit. Pusa, Bull. No. 9, March 1908.

CAMERARIUS. Hortus Medicus et Philosophicus. Frankfurt a. Main, 1588.

CANDOLLE, A. DE. Distribution Géographique des Plantes Alimentaires. Geneva, 1836.

— Géographie Botanique Raisonnée. 2 vols. Paris, 1855.

— Origin of Cultivated Plants. London, 1884.

CANDOLLE, A. P. DE. Organographie Végétale, Vol. I. Paris, 1837.

CATALANO, G. Morfologia Interna delle Radici di Alcune Palme e Pandanacee. Annali di Botanica X (1912), fasc. 2°.

CHABAUD, B. Le Jubæa Spectabilis. Provence Agricole et Horticole ill. I (1881), 129-132.

— Le Cocos Botryophora. Provence Agric. et Hortic. ill. II (1882), 133-136.

— Le Groupe des Cocos Spinosa. Rev. Hortic. 77 (1905), 515-517; 78 (1906), 143-144.

— Un Nouveau Palmier: Sabal Uresana. Rev. Hortic. 82 (1910), 58-60.

— Les Cocos Yatay et Australis. Rev. Hortic. 82 (1910), 198-200.

CHARABOT, E. Les Productions Végétales des Colonies Françaises. Paris, 1908.

CHEVALIER, A. Documents sur le Palmier à Huile. In Les Végétaux Utiles de l' Afrique Tropicale Française. Paris, 1910.

CHIOVENDA, E. La Culla del Coco. Webbia 5 (1921), 199-294.

COGHLAN, H. L. The Coconut Industry in Malaya.

— AND J. W. HINCHLEY. Coconut Cultivation and Plantation Machinery. London, 1917.

COOK, O. F. A Synopsis of the Palms of Porto Rico. Bull. Torr. Bot. Club, XXVIII.

— Origin and Distribution of the Cocoa Palm. Contrib. Nat. Herb. VII (1902).

— History of the Coconut Palm in America. Contrib. U. S. Nat. Herb. XIV (1910), 271-342.

— Relationships of the Ivory Palms. Contrib. U. S. Nat. Herb XIII (1910), 133-141.

— Relationships of the False Date Palm of the Florida Keys, with a Synoptical Key to Families of American Palms. Contrib. U S. Nat. Herb. XVI (1913), 243-254, pl. 74-77. (Pseudophœnix.)

— Pseudophœnix Insignis: A New Palm from Haiti, and Two Other New Species from the West Indies. Journ. Washington [D. C] Acad. Sci. 13 (1923), 397-408.

— Opsiandra: A New Genus of Palms Growing on Maya ruins in Petén, Guatemala. Journ. Washington [D.C.] Acad. Sci. 13 (1923), 179-184. (Opsiandra Maya O. F. Cook.)

— AND G. N. COLLINS. Economic Plants of Porto Rico. Contrib U. S. Nat. Herb. VII (1903).

— AND C. B. DOYLE. Three New Genera of Stilt Palms (Iriarteaceæ) from Colombia, with a Synoptical Review of the Family. Contrib. U. S. Nat. Herb. XVI (1913), 225-238.

COOKE, T. Flora of the Bombay Presidency. Vol. II. London, 1908.

COOMBS, G. E. Notes on Economic Botany during 1918. Agric. Bull. Federat. Malay States 7 (1919), 86-88. (Includes Coconut.)

COPELAND, E. B. On the Water Relations of the Coconut Palm. Philipp. Journ. Science Vol. 1 (1906), No. 1.

— The Coconut. London, 1914 and 1921.

CORBETT, G. H. Preliminary Note on the Two-coloured Coconut Leaf Beetle (Plesispa Reichei Chap.). Malayan Agric. Journ. 11 (1923), 64-69.

CORMACK, B. G. On Polystelic Roots of Certain Palms. Trans. Linn. Soc. (2nd Series, Bot.) V (1896), 275-286.

CREMATA, M. Un Fenomeno Curioso. Revista Agric. Com. y Trab. 2 (1919), 509. (Branching of Royal Palm.)

CURTIS, W. The Botanical Magazine, continued by W. J. Hooker and J. D. Hooker. (Descriptions and plates in various volumes.)

DALZELL, and GIBSON. The Bombay Flora. Bombay, 1861.

DAMMER, U. Beiträge zur Kenntnis der Elæis Guineensis Jacq. Engl. Bot. Jahrb. LIII, 320-24.

— Palmenzucht und Palmenpflege. Frankfurt a. Oder, 1897.

DAMPIER, W. A New Voyage round the World. 4 vols. London, 1717.

DANIEL, J. Le Palmier à Huile au Dahomey. Extrait de la Revue Coloniale. Paris, 1902.

DARWIN, C. On the Action of Sea-water on the Germination of Seeds. Journ. Linn. Soc., Vol. 1 (1857).

DE BARY. Über die Verdickungsweise der Palmenstämme. Sitz. d. K. Preuss. Akad. Wiss. Berlin, 1886.

DEINEGA, V. Beiträge zur Kenntnis der Entwicklungsgeschichte des Blattes und der Anlage der Gefässbündel. Flora 85 (1898), 439-98.

DELILO, A. R. Flore d'Egypte. Paris, 1824.

DESFONTAINES, R. L. Flora Atlantica sive Historia Plantarum quae in Atlante, Agro Tunetano et Algerensi Crescunt. Paris, 1798-1800.

DESLANDES. Revue des Cultures Coloniales (1902).

DEVANSAYE, Q. de la. Palmiers Nouveaux Brahea, Pritchardia. Rev. Hort. 48, 373-74.

DOMIN, K. Morphologische und phylogenetische Studien über die Stipularbildungen. Ann. du Jard. Bot. Buitenzorg, 24 (1911), 117-326.

DOWSON, V. H. W. Dates and Date Cultivation of Iraq. Cambridge, 1923.

DRABBLE, E. On the Anatomy of the Roots of Palms. London, 1904.

— Comparison of Palm Fruits from Various Districts on the West Coast. Quart. Journ. Liverpool University Institute of Commercial Research in the Tropics, II (1907), 126-129.

— A Short Note on the Possibilities of the Oil Palm in Cultivation. *Ibid* III (1908), 15-19.

DRAGENDORFF, G. Die Heilpflanzen der verschiedenen Völker und Zeiten. Stuttgart, 1898.

DRUDE, O. Flora Brasiliensis. Vol. III.

— Palmæ, in 'Natuerl. Pflanzenfamilien'.

— Beiträge zur Erleuterung der Fruchtbildung bei Palmen. Bot. Zeitg. (1877).

— Ausgewählte Beispiele der Fruchtbildung bei den Palmen. Bot. Zeit. (1877).

— Die Geographische Verbreitung der Palmen. Petermann's Geograph. Mitteil 1878.

DRUDE, O. Palmæ Brasilienses. Munich, 1881-1882.

— Die Palmenflora des Tropischen Africa. Engler's botan. Jahrb. XXI, 1895.

DRUMMOND, BRUCE. Propagation and Culture of the Date Palm. U. S. Dep. Agric. Farmers' Bull. 1016 (1919).

DRURY, H. The Useful Plants of India. Madras, 1858.

DURAND ET SCHINZ. Conspectus Florae Africae, V. Bruxelles, 1898.

EBERWEIN, R. Zur Anatomie des Blattes von Borassus Flabelliformis. Sitz. Ber. Kais. Ak. Wiss. Wien. CXII (1903).

EICHLER. Blüthendiagramme. 2 vols. Leipzig, 1875-78.

— Zur Entwicklungsgeschichte der Palmenblätter. Abhandl. der Kgl. Preuss. Akad. d. Wissensch. Berlin, 1885.

— Über die Verdickungsweise der Palmenstämme. Sitzungsber. der Kgl. Preuss. Akad. physik-math. Kl. (1886).

ENGLER, A. Hochgebirgsflora des Trop. Afrika. Berliner Akad. Physik. Abt. 1891.

— Die Planzenwelt Ost-Africas u. d. Nachbargebiete. Berlin, 1895.

ERNOULD, MARIA. Recherches Anatomiques et Physiologiques sur les Racines Respiratoires. Mém. Acad. Roy. Belgique, Cl. Sci. 2 Ser. 5, 52 p. (1921). (Includes Metroxylon and Raphia.)

ESPINO, R. B. A Review of the Coconut Investigations at the College of Agriculture. Philippine Agr. 8 (1919), 161-178.

EVANS, A. E. The African Oil Palm. Tropical Life (1907), 146, with illustrations.

FAIRCHILD, E. G. Persian Gulf Dates and their Introduction into America. U. S. Dept. Agric. Bureau of Plant Ind. Bull. No. 54. Washington, 1903.

FALKENBERG, P. Vergleichende Untersuchungen über den Bau der Vegetationsorgane der Monokotyledonen. Stuttgart, 1876.

FAUVEL, A. A. Le Cocotier de Mer des Iles Seychelles. Ann. Musée Colon. Marseille III (1915), 169.

FAWCETT, W. Report on the Coconut Disease at Montego Bay. Bull. Bot. Dept. Jamaica No. 23 (1891), 2.

FEALY, N. E. Sugar Producing Palms. New York, 1923.

FENDLER, G. Zur Kenntnis der Früchte von Elæis Guineensis und der daraus gewonnenen Öle. Berichte d. Deutsch. Pharmaceut. Ges. (1903), No. 4.

FENZI, E. O. Introduction of Pritchardia Filamentosa into European Cultivation, and its Supposed Origin. Bull. Soc. Tosc. Ort. I, 116.

FERGUSON, J. The Palmyra Palm. Reprint from the 'Ceylon Observer', Colombo (1888).

— All About the Areca Palm. Colombo, 1907.

— The Coconut Palm in Ceylon: Beginning, Rise and Progress of its Cultivation. Journ. Ceyl. Branch Roy. As. Soc., 1906. Colombo, 1907.

FERGUSON, J. All About the Coconut Palm. 5th ed. Colombo, 1923.

FESCA, M. Der Pflanzenbau in den Tropen und Subtropen. Berlin, 1904.

FINKS, A. J., and D. BREESE JONES. Growth-promoting Value of the Proteins of the Palm Kernel, and the Vitamin Content of Palm-kernel Meal. Journ. Agric. Res. 25 (1923), 165-169. (Elæis Guineensis.)

FIRMINGER, T. A. C. Manual of Gardening for Bengal and Upper India. 4th ed. Calcutta, 1890.

FIRTSCH. Anatomisch-physiologische Untersuchungen über die Keimpflanze der Dattelpalme. Sitzb. d. Kais. Akad. Wiss. Wien, 1886.

FISCHER, T. Die Dattelpalme, ihre Geographische Verbreitung und Culturhistorische Bedeutung. Ergänzungsheft No. 64 zu Petermann's Mittheilungen. Gotha, 1881.

FLETCHER, F. The Date Palm. Agricult. Ledger, No. 1 (1906).

FLIPPANCE, F. The Cohune Nut. Gardens' Bull. Straits Settl. 2 (1921), 432-35. (Attalea Cohune Mart.)

FORBES, H. O. A Naturalist's Wanderings in the Eastern Archipelago. 2nd ed. London, 1885.

FORSKAL, P. Flora Ægyptiaco-Arabica. Kopenhagen, 1775.

FORSTER, G. De Plantis Esculentis Insularum Oceani Australis Commentatio. Berlin, 1786.

FOWLER, G. J., and F. MARSDEN. The Retting of Coconut Husk for the Production of Coir. Journ. Indian Inst. Sci. 7 (1924), 39-52.

FOXWORTHY, F. W., and D. M. MATHEWS. Mangrove and Nipa Swamps of British North Borneo. Bull. No. 3 Govt. British North Borneo Dept. For. (1917), 19.

FRIEDRICH, K. Über eine Eigenthümlichkeit der Luftwurzeln von Acanthoriza Aculeata Wendl. (Separatum not dated.)

— Studien über Nashornkäfer als Schädlinge der Kokospalme. Berlin, 1919.

FRITEL, P. H. Contributions à l'Étude des Flores Tertiaires. Bull. Mus. Hist. Nat. [Paris] 27 (1921), 471-76. (Contains Nipadites Burtini.)

— Contributions à l'Étude du Genre Nipadites Bowerbank et sur sa Distribution Géographique et Stratigraphique. Bull. Soc. Geol. France 21 (1922), 317-321.

GÄRTNER, J. De Fructibus et Seminibus Plantarum. 2 vols. Stuttgart and Tübingen, 1788-1791.

GADD, C. H. Nut Fall of Coconuts. Dept. Agric. Ceylon Bull. 53 (1922).

GAGE, A. T. On the Anatomy of the Roots of Phœnix Paludosa, Roxb. Calcutta, 1901.

GAMBLE. Manual of Indian Timbers. London, 1902.

GATIN, C. L. Quelques Cas de Poliembryonie chez Plusieurs Espèces des Palmiers. Rev. générale de Bot. XVIII (1905).

— Recherches Anatomiques et Chimiques sur la Germination des Palmiers. Ann. Sci. Nat. Bot. 9me série (1906), 191-314.

GATIN, C. L. Les Palmiers. Histoire Naturelle et Horticole des Différents Genres. Paris, 1912.

— et C. M. BRET. Les Variétés d'Elæis Guineensis Jacq. de la Côte d' Ivoire, et Leurs Fruits Parthénocarpiques. C. R. Ac. Sci. Paris CLVI (1913), 805-807.

GAUDICHAUD-BEAUPRE, C. Botanique du Voyage Autour du Monde, Fait Pendant les Années 1817-1820. Paris, 1826.

— Botanique du Voyage Autour du Monde Executé Pendant les Années 1836 et 1837. Paris, 1844-1866.

GEARE, R. I. The Cocoanut Palm: Its Products and their Uses. Scient. American, Suppl. No. 1851 (1911), 392-93.

GEHRKE, O. Beiträge zur Kenntnis der Anatomie von Palmenkeimlingen. Berlin, 1887.

GEHRMANN, K. Ein Palmenschädling auf Samoa. Der Tropenpflanzer (1911).

GIBBS, H. D., and Others. The Alcohol Industry in the Philippine Islands. Parts I and II. Philippine Journ. Sci. A. Chem. and Geol. Sci., Vol. 6, No. 2, 99-145; No. 3, 147-206, 5 fig., 20 pl., 3 maps (I); Vol. 7, No. 2 (II) (1911-12).

GIES. Nutritive Value and Uses of the Coconut. Journ. N. Y. Bot. Gard. III (1892).

GILLAIN. Beiträge zur Anatomie der Palmen und Pandaneen Wurzeln. Bot. Centralbl. LXXXIII (1900), Nos. 11, 12, 13.

GILMORE, JOHN W. Preliminary Report on the Commercial Fibers of the Philippines. Philippine Bur. Agr. Farmers' Bull. 4 (1905), 58 p., 4 pl.

GLÜCK, H. Die Stipulargebilde der Monocotyledonen. Verhandl. Naturhist. Med. Vereins zu Heidelberg, N. F. VII (1901), 1-96.

GODFRIN. Anatomie Comparée des Cotylédons et de l'Albumen. Ann. Sci. Nat. 6e série, XIV (1884), 1.

GOKHALE, V. G. Palm Gul Manufacture in the Bombay Presidency. Dept. Agr. Bombay Bull. No. 93 (1919).

GOOSSENS, V. Contributions à l'Étude des Plantes Économiques Introduites au Congo Belge, 1. Note sur le Palmier à Sucre (Arenga Saccharifera Labill.). Bull. Agric. Congo Belge 12 (1921), 215-220.

GOSH, M. N. The Palmyra Palm as a Source of Sugar. Trop. Agr. Ceylon, Vol. 45, No. 5 (1915), 351.

GRAHAM, J. A Catalogue of the Plants growing in Bombay and its Vicinity. Bombay, 1839.

GRIFFITH, W. Journal of Travels in Assam, Burma, Bootan, Afghanistan and the Neighbouring Countries. Calcutta, 1847.

— Notulae ad Plantas Asiaticas. Vol. III. Calcutta.

— Palms of British East India. Calcutta, 1850.

GRISARD, JULES, et MAXIMILIEN VAN DEN BERGHE. Les Palmiers Utiles et Leurs Alliés. Usages et Produits. Bull. Soc. Nat. Acclim. France, Ser. 4, t. 4, 357-379, 504-523, 555-578, 684-715, 741-767 (1887); t. 5. 325-342. 686-697, illus. (1887-1888).

GRISEBACH, A. H. R. Flora of the British West Indian Islands. London, 1864.

— Catalogus Plantarum Cubensium. Leipzig, 1866.

— Die Vegetation der Erde nach ihrer Klimatischen Anordnung. Leipzig, 1872.

GRÜSS. Über den Umsatz der Kohlenhydrate bei der Keimung der Dattel. Ber. Deutsch. Bot. Ges. XX (1902), 36.

GRUNER, H. Die Ölpalme im Bezirk Misahohe, Togo. Der Tropenpflanzer VIII (1904), 283-291. A summary of this paper is given by M. J. Adam in 'L'Agriculture des pays chauds' (1908), 467, 468.

GUILLAUMIN, A. Les Chamædorea Cultivés. Journ. Soc. Nation. Hort. France, 24 (1923), 223-244.

GUPPY, H. B. The Dispersal of Plants as Illustrated by the Flora of the Keeling or Cocos Islands. Trans. Viet. Instit. XXIV, 1890-1891.

HABERLANDT, G. Eine Botanische Tropenreise. Leipzig, 1893.

HAEBERLE, A. T. Palm Sugar in Brazil. U. S. Dept. Com. For. and Dom. Com. Rept., Year 22, Vol. 4, No. 54 (1919), 579.

HAECKEL, E. A Visit to Ceylon. (Translated by Clara Bell.) London, 1883.

HAMILTON, A. A. Abnormal Branching in a Palm. Austral. Nat. 4 (1920), 156-57.

HAMILTON (formerly BUCHANAN), FRANCIS. A Journey through the Countries of Mysore, Canara, and Malabar. London, 1807.

HANAUSEK, E. Raphiafasern. Zeitschr. allgem. österr. Apothekerver. (1879), 184-87, 217-220.

— Raphia-Gewebe. Der österr. Kaufmann. Abt.: Allgemeine Warenkunde. No. 12 (1885), 268.

HANAUSEK, J. T. Die Raphiafaser. Deutsche Bot. Ges. III (1885), 152.

HANDOVER, W. P. The Dwarf Coconut. Agric. Bull. Federated Malay States, Nos. 5 and 7 (1919).

HART, J. H. Bud-rot Disease of Coconuts, etc. Trinidad Botanical Dept. Bulletin of Miscellaneous Information (Oct. 1905), 240.

HASSKARL, J. C. Plantæ Javanicæ Rariores. Berlin, 1848.

HEER, O. Flora Fossilis Helvetiæ. Zürich, 1876-77.

— Flora Tertiaria Helvetiæ. 3 vols. Winterthur, 1855-59.

HELLER, A. A. Neowashingtonia Robusta proposed for Washingtonia Robusta Wendl. Cat. N. Am. Pl. 3.

HEMSLEY, W. B. Report on the Botany of Juan Fernandez, the South-Eastern Moluccas, and the Admiralty Islands. 333 p., pl. 54-65. London, Edinburgh, etc. (Gt. Britain. Challenger office. Report on the Scientific Results of the Voyage of H. M. S. Challenger during the Years 1875-76 .... Botany, Vol. 1, No. IV.)

HENZE, G. Des Plantes Alimentaires des Pays Chauds et des Colonies. Paris, 1899.

HICKSON, SIDNEY JOHN. Mythology of the Minahassers. A Naturalist in North Celebes (1889), 238-267.

HILLEBRAND, W. Flora of the Hawaiian Islands. New York, Heidelberg, 1888.

HILLIER, J. M. Economic Notes on Palm Oil and Kernels. Kew. Bull. (1907), 61, 62.

HINES, CLEVE W. Sugar Manufacture. Philippine Agr. Rev. Eng. ed. Vol. 7, No. 2, 73-76; No. 6, 258-265, pl. 1; No. 7, 292-306, pl. 3-5 (1914).

HIRMER, M. Beiträge zur Morphologie und Entwicklungsgeschichte der Blätter einiger Palmen und Cyclanthaceen. Flora, N. F. XI (1919), 178-89.

HOFFMEISTER. Travels in Ceylon and Continental India. Edinburgh, 1848.

— Allgemeine Morphologie der Gewächse. Leipzig, 1868.

HOGG, ROBERT. Palms. The Vegetable Kingdom and its Products. 743-762, fig. 218. London, 1858.

HOOKER, J. D. Himalayan Journals. 2 vols. London, 1854.

— The Botany of the Antarctic Voyage. London, 1844-1860.

— Flora Novæ Zelandiae. 2 vols. London, 1853-55.

— Handbook of the New Zealand Flora. London, 1867.

— Insular Floras. Gardener's Chronicle (1867).

— Flora of British India. Vol. VI. London, 1894.

— 'Botany', being Chapter IV of Vol. 1 of the Imperial Gazetteer of India. Oxford, 1907.

— and THOMSON. Flora Indica. London, 1855.

HOOKER, W. J. H. Some Account of the Ivory Palm. Kew Journ. of Bot. I (1849), 209-11.

HORNE, W. T. The Bud-rot and Some Other Coconut Troubles in Cuba. Estacion Central Agronomica de Cuba. Bull. No. 15, Eng. ed. (July 1908).

HUBERT, PAUL. Le Cocotier. Paris, 1906.

HULME, WILLIAM and R. P. SANGHI. The Improvement of the Indigenous Methods of *Gur* and Sugar Making in the United Provinces. Agr. Research Inst. Pusa, India. Bull. 82 (1918), 22 p., 7 pl.

HUMBOLDT, F. A. De Distributione Geographica Plantarum. Paris, 1817.

— Aspects of Nature in Different Lands and Different Climates. (Translated.) London, 1850.

JACK, H. W. Selection of Coconuts. Malayan Agric. Journ. 10 (1922), 122-27.

— and W. N. SANDS. The Dwarf Coconut in Malaya. Malayan Agric. Journ. 10 (1922), 4-12.

JACKSON, T. P. Report on the Agric. Dept., Antigua. Imp. Dept. Agric. West Indies Rept. Agr. Dept. Antigua 1918-19 (1920). (Includes Coconut.)

JACQUIN. Fragmenta Botanica. 1809.

JÆGER, G. F. De Monstrosa Folii Phœnicis Dactyliferæ Conformatione, a Gœtheo olim observata et figura picta illustrata, nec non de ramo ejusdem arboris intra spadicem contento. 1839.

JESSEN. Über die Keimung der Cocosnuss. Sitzb. Ges. Naturf. Freunde. Berlin, 1878.

JOHNS, C. O., A. J. FINKS AND MABEL S. PAUL. Studies in Nutrition: I. The Nutritive Value of Coconut Globulin and Coconut Press Cake. Journ. Biol. Chem. 37 (1919), 497-502.

JOHNS, C. O., and D. B. JOHNS. Some Amino-acids from the Globulin of the Coconut by the Butyl Alcohol Extraction Method of Dakin. Journ. Biol. Chem. 44 (1920), 283-290.

— Hydrolysis of the Globulin of the Coconut, Cocos Nucifera. Journ. Biol. Chem. 44 (1920), 291-301.

JOHNS. C. O., and C. E. F. GERSDORFF. The Globulin of the Cohune Nut, Attalea Cohune. Journ. Biol. Chem. 45 (1921), 57-67.

JOHNSTON, J. R. The Bud-rot of the Coconut Palm. U. S. Dept. of Agric. Bureau of Plant Industry, Circular No. 36 (July 1909).

— and STEPHEN C. BRUNER. A Phyllachora Disease of the Royal Palm. Mycologia 10 (1918), 33-44.

JOHOW, F. Über die Beziehungen einiger Eigenschaften der Laubblätter zu den Standortsverhältnissen. Pringsh. Jahrbuch XV.

— Über die Chilenische Palme. Verh. Deutsch. Wiss. Vereins Santiago IV (1900), 325-337.

JUMELLE, H. Les Cultures Coloniales: Plantes Alimentaires. Paris, 1901.

— Plantes Industrielles et Médicinales. Paris, 1901.

— Les Dypsis de Madagascar. Ann. Mus. Col. Marseille III, 6 (1918), 21-38.

— Un Grand Palmier du Centre de Madagascar. Compt. Rend. Acad. Sci. Paris. 174 (1920), 9-38.

— Les Huiles Végétales, Origines, Procédés de Préparation, Caractères et Emplois. Encyclopédie Industrielle, 493 p. Paris, 1921.

— Les Chrysalidocarpus, Palmiers de Madagascar. Ann. Mus. Colonial, Marseille 30[3] (1922), 1-32.

— Le Groupe du Chrysalidocarpus Lutescens. Compt. Rend. Acad. Sci. Paris 174 (1922), 1674-1677.

— et H. PERRIER de la BATHIE. Un Nouveau Genre de Palmiers de Madagascar. C. R. Ac. Sc. Paris CLV (1912), 410-11.

JUNGHUHN, F. W. Java, seine Gestalt, Pflanzendecke und innere Bauart. Leipzig, 1852.

JUSSIEU, A. de. Mémoire sur les Embryons Monocotylédonés. Ann. Sc. Nat. 2nd série, XI (1839), 341.

K., J. C. The Sugar Palm of the East Indies. Journ. Roy. Soc. Arts, Vol. 59, No. 3,048, 567-569, 3 figs. Abstract in Internat. Inst. of Agr. Rome.... Internat. Rev. Sci. and Pract. Agr., Year 2, No. 5 (1911), 1064.

KANJILAL, UPENDRANATH. The Date of Sugar Industry. Bengal Indian Forester, Vol. 18, No. 12 (1892), 451-457, 2 pl.

KARSTEN, G. K. W. H. Die Bewurzelung der Palmen. Linnaea, 1856.

— Die Vegetationsorgane der Palmen. Berlin, 1847.

— Floræ Columbiæ Terrarumque Adjacentium Specimina Selecta. Berlin, 1858.

KEARNEY, THOMAS H. and T. H. MEANS. Agricultural Exploration in Algeria. U. S. Dept. Agr. Bur. Plant Indus. Bull. 80 (1905), 98 p., 4 pl.

KEISSLER, K. VON. Über eine seltene Palme des Schönbrunner Palmenhauses. Österr. Gartenz. VIII (1913), 267-69.

KELKAR, G. K. Improved Furnaces for Gur Manufacture. Agr. Journ. India, Vol. 15, Pt. V (1920), 521-524.

KELLER, R. Über Erscheinungen des normalen Haarverlustes an Vegetationsorganen der Gefässpflanzen. Nova Acta d. K. Leop. Karol. Ak., Halle, Vol. LV.

KERCHOVE DE DENTERGHEM, OSWALD. Les Palmiers: Histoire Iconographique. 348 p., 226 fig., 40 pl. (col.). Paris, 1878.

KINNEY, A. Washingtonia Filifera in the Colorado Desert. Rept. Cal. State Board For. I, 51.

KIRK. Palms of East Tropical Africa. Journ. Linn. Soc. XXIV (1863).

KIRKWOOD and GIES. Chemical Studies of the Coconut. Bull. Torrey Bot. Club XXIX (1902).

KLOTZSCH, J. F. und A. GARCKE. Die botanischen Ergebnisse der Reise des Prinzen Waldemar von Preussen in den Jahren 1845-1846. Berlin, 1862.

KOCH, C. Hortus Dendrologicus. Berlin, 1853.

KÖHLER. Medizinal-Pflanzen. Gera, 1886-98.

KOOP, H. Anatomie des Palmenblattes mit besonderer Berücksichtigung ihrer Abhängigkeit von Klima und Standort. Zürich, 1906.

KRAUS. Einiges über Dickenwachstum der Palmenstämme in den Tropen. Sitzb. d. Phys. Medic. Ges. Würzburg XXXII (1899), 62.

KRYSHNOFOVICH, A. A New Fossil Palm and Some Other Plants of the Tertiary Flora of Japan. Journ. Geol. Soc. Tokyo 27 (1920), 1-30, plts. 13-15.

KUTTH, C. S. Enumeratio Plantarum Omnium hucusque Cognitarum. Stuttgart and Tübingen, 1833-1850.

KUR, S. On Various Indian Palms. Journ. Asiat. Soc. Bengal, Vol. 43, 11.

— Forest Flora of British Burma. Calcutta, 1877.

KYN. Bau der Leitbündel der Palmen. Abhandl. des botan. Vereins d. Prov. Brandenburg, XXIII (1881).

LA FLORESTA, P. Sul Meccanismo della Caduta delle Foglie nelle Palme. Contribuzioni alla Biologia Vegetale. Palermo, 1904.

La Floresta, P.—Ricerche sul periderma delle Palme. Estratto delle "Contribuzioni alla Biologia vegetale" edite da A. Borzi. vol. III, fasc. III, Palermo 1905.

Laufer, B.—Sino-Iranica. Chinese contributions to the history of civilization in ancient Iran, with special reference to the history of cultivated plants and products. Field Mus. Nat. Hist. Publ. Anthropol. Ser. 15:IV.+185 630. 1919.

Leefmans, S.—Kenmerken van bliksemslag bij klappers. Mededeel. Lab. Plantenz. Dept. Nijv. en Handel Buitenzorg. 41 (1920), 46-47.

Lewin.—Über Areca Catechu, Chavica Betle und das Betelkauen. Stuttgart, 1889.

Licopoli, G. Ricerche anatomiche e microchimiche sulla Chamaerops humilis L. ed altre Palme. Atti dell' Acad. di Sci. Fis. e Mat. di Napoli. IX (1881).

Lienard. Sur la composition des hydrates de carbone de réserve de l' albumen de quelques Palmiers. C. R. de l' Acad. d. Sci., 13 octobre 1902.

— Etudes des hydrates de carbone de réserve de quelques graines de Palmiers. Paris, 1903.

Lindmann, C. A. M. Beiträge zur Palmenflora Südamerikas. Bihang Till K. Svenska Vet.-Akad. Handlingar, XXVI, Afd. III, No. 5, (1900).

Lommel, V.—Zur Düngung der Kokospalme. Der Pflanzer, 1907.

— Notizen über den Boden und seine Behandlung bei der Kultur der Kokospalme. Der Pflanzer, 1907.

Loureiro, J. Flora Cochinchinensis. Ulyssipone, 1790.

Lyon. The Coconut, etc. Bureau of Agri. (Philippines) Bull. N. 8, 1903.

Lyon William, S. The coconut with reference to its products and cultivation in the Philippines. Philippine Bur. 8, 32 p. 2 fig. 2 pl. 1903.

M(ilsum), J. N. Crop records of oil palms. Agric. Bull. Federat. Malay States 8 (1920), 247-255.

MacCaughey, Vaughan. The endemic palms of Hawaii: Pritchardia. Plant World 21 (1918), 317-28.

Mackenna, J. Annual Report on the progress of agriculture in India, 1918-19. Pusa, 1920. (Includes coconut.)

Macmillan, H. F. The palmyra palm. Trop. Agr. Ceylon, v. 42, no. 5 (1914), 433-436.

Mann, G. and H. Wendland. On the palms of Western Tropical Africa. Trans. Linn. Soc. XXIV, 421-439.

Marcailhou D'Aymeric, A. Analyse d'un vin de palmier ou "laghmi" du Sud-Tunisien. Journ. Pharm. et Chimie 23 (1921), 272-73.

Marquis, R. T. Algunas Palmeras Industriales de la Flora Istmena, 15 p., 8 fig. on 8 pl. (1908).

Martius, C. F. P. Historia naturalis Palmarum, 3 vols. Munich, 1823-1850.

MARTIUS, C. F. P. Die geographischen Vorhältnisse der Palmen mit besonderer Berücksichtigung der Hauptflorenreiche. Münchner gel. Anzeigen, VI (1838), VIII, (1839).

— Bericht über die Morphologie der Palmen. Münchner gel. Anzeigen, 1847, N. 171-179.

MASSALONGO. Synopsis Palmarum fossilium. Prag, 1854.

MASTERS. Garden Palms. Gardener's Chronicle, 1884, 1885, etc.

MATHIEU, E. The oil palm in the East (Elaeis guineensis) Gardens' Bull. Straits Settl. 2 (1920), 217-30.

MCLEAN, E. T. Field studies of the carbon dioxide absorption of coco-nut leaves. Ann. Bot. 34 (1920), 367-89.

MCRÆ, W. The operations against bud-rot of palms in South India. Proc. 10th Ind. Sci. Congress (1924), 188.

MELL, C. D. Unusual coconut trees. Amer. Forest. 29 (1923), 410.

MENEGHINI. Ricerche sulla struttura del caule nelle piante monocotiledoni. Padova, 1836.

MERINO, G. Bud-rot. Philippine Agr. Rev. (1919), 92-96. (Coconut palm).

MERRITT, MELVIN, L. AND WHITFORD, H. N. A preliminary working plan for the public forest tract of the Mindoro Lumber and Logging Company, Bongabon, Mindoro, P. I. Philippine For. Bur. Bul. no. 6 (1906), 55 p. 14 pl., 1 map.

MESTDAGH, M. L'exploitation des palmiers Elæis à la Station Experimentale de Gazi (Stanleyville). Bull. Agric. Congo Belge 12 (1921), 309-313.

MEYER, A. Wissenschaftliche Drogenkunde. Berlin 1891-92.

MICHAEL, W. H. Forecast of sugar from cane and the palm. Mo. Cons. and Trade rpts. U. S., 1907, no. 327, p. 136.

MICHEELS, H. De la présence des raphides dans l'embryon de certain Palmiers. Bull. Acad. Roy. Belg. 3me série, XXII (1891), no. 11, p. 391-92.

— Sur la forme des embryons des Palmiers. Bull. Soc. Bot. Belg. XXXI (1892), 174-78.

MILIGAN, F. M. The Cultivation of the Oil Palm. 1914.

MILLER, HUGO. Philippine Hats. Buri palm straws. Bul. 33, Philippine Bur. Education (1910), 24-40.

MILLER, THEODORE. The industrial fibre plants of the Philippines, N. Y. Bot. Garden, v. 16, no. 184 (1915), 69-79, pl. 157-158.

MILLER, WILHELM, SMITH, JARED G. and TAYLOR, N. Phœnix. Bailey I. H. Standard Cyclopedia of Horticulture, v. 5 (1916), 2591-2594, fig. 2918-2920. New York and London.

MIQUEL, F. A. W. Analecta botanica indica. Amsterdam, 1850-1852.

— Flora Indiae batavae. Amsterdam, 1855-1859.

— Prodromus Florae Sumatranae. Amsterdam, 1860-1861.

— Sumatra, seine Pflanzenwelt und deren Erzeugnisse. Leipzig, 1862.

MIRBEL. Nouvelles notes sur le cambium. Extraites d'un mémoire sur la racine de Dattier. Mém. de l'Institut de France, 1839.

— Sur la structure du dattier. Compt. Rend. Acad. Sci. (1843), 1213-35.

MOEBIUS, M. Die Perianthblätter von Cocos nucifera. Ber. Deutsch. Bot. Ges. 1908.

MOENKEMEYER. Reiseskizzen. Moeller's Deutsche Gärtner-Zeitung, 1886.

MOHL.—Über den Bau des Palmenstammes. Vermischte Schriften (1845).

MOLLISON. Cultivation of Betel Palm, etc. Depart. of Land Rec. and Agric. Ind. Bull. 20.

MONTEROY VIDAL. El Archipelago Filipino y las Marianas. Carolinas y Palaos. Madrid, 1886.

MOORE, J. C. Report on the Agric. Dept., Grenada, April—December 1919. Imp. Dept. Agr. West Indies Rept. Agr. Dept., Grenada, 1918-19. 1920 (Includes coconut).

MORAES, P., DE. The Coconut palm in Brazil. Brazil Indicador, Year 1 (1921) no. 1. p. 9. Review in Internatl. Rev. Sci. and Practice, Agr. Internatl. Inst. Agr. Year 12, no. 4. p. 423.

MORREN. Dondonaea, ou Recueil d'Observations de Botanique, p. 74.

MUELLER, F. VON. Fragmenta Phytographiae Australiae. Melbourne, 1858-1865.

— Végétation indigène et introduite de l'Australie. Melbourne, 1866.

MUKERJI, M. G. Handbook of Indian Agriculture. Calcutta, 1907 and 1923.

MULLAN, J. P. Some notes on the palm Oreodoxa regia. Journ. Bomb. Nat. Hist. Soc. XIX (1910), 1010-11.

MUNRO, R. W. and BROWN, L. C. A Practical Guide to Coconut Planting. London, 1920.

NANNAN.— L'exploitation des palmiers Elaeis à la Station Experimentale de Ganda-Sundi (Bas-Congo). Bull. Agric. Congo Belge 12 (1921), 309-13.

NARDY. On Jubaea spectabilis. Bull. Soc. Acclim. Paris, ser. 4. VI (1889), 754-6.

NAUMANN, A. Beiträge zur Entwicklungsgeschichte der Palmenblätter. Flora LXX, (1887), 193-202, 209-18, 227-42, 250-57.

NAUMANN, F. C. Über den Vegetationscharacter der Inseln des Neu-Britannischen Archipels und der Insel Bougainville. Engler's Jahrb. vol. VI, 1885.

NEWLAND, H. O. The planting, cultivation and expression of coconuts, kernels, cocoa, and edible vegetable oils and seeds of commerce. A practical handbook for planters, financiers, scientists and others. London, 1910.

— The planting, cultivation and expression of Coconuts, Kernels, Cacao etc. London, 1919.

NEWLANDS, JOHN A. H. and NEWLANDS, BENJAMIN E. R. Palm sugar.

— A Handbook for Planters and Refiners p. 361-379, fig. 104-107. London and New York, 1903.

NORTH, MARIANNE.—Chile. Her Recollections of a happy life. v. 2 (1892), 311-327.

NOTER, R. DE.—Les Palmiers de serre froide. Paris, 1895.

NOWELL, W. Root disease of coconut palms in Grenada. Agric. News (Barbados) 17 (1918), 398-99, 414-15.

— A disease of coconut. Imp. Dept. Agric. W. Indies Rept. Agric. Dept. St. Lucia 1918-19. 7, 1920.

— The root-disease or red ring disease of coconut palms. Agric. News (Barbados) 18 (1919), 46.

— The cacao canker fungus as a cause of coconut bud-rot. Agric. News (Barbados) 18 (1919), 414.

— The red ring or root disease of coconut palm. Trop. Agric. 51 (1920), 249-245.

— Red ring disease of coconuts. Agric. News (Barbados) 18 (1919), 398; 19 (1920), 222.

OERSTED, A. S. Palmae Centroamericanae. Videnskabl. Meddelelsor fra den Naturhist. Forening i Kjobenhavn. 1858.

— L' Amérique Centrale. Recherches sur sa Flore. etc. Kopenhagen, 1863.

OLIVER.—Flora of Tropical Africa, vol. VIII. London.

OLIVIER, L.—Appareil tégumentaire des racines. Ann. Sci. Nat., 6e série, XI (1880).

ORBIGNY. Voyage dans l'Amérique méridionale, Palmae (Palmetum Orbignianum) by Martius, vol. VII, part 3, 1839.

ORCUTT, C. R.—Palms at Palm Valley, in northern Lower California. W. Americ. Scientist II, 37.

OSENBRÜG, T.—Über die Entwicklung des Samens der Areca Catechu L. und die Bedeutung der Ruminationen. Marburg, 1894.

OSTINELLI, V.—Fruttificazione della Washingtonia filifera Wendl. Boll. d. R. Soc. Tosc. di Ortic. Anno XVIII (1893), no. 5.

PAERELS, J. J. – Coirvezel. Cultura 34 (1922), 305-308.

PARISH, S. B.—A contribution toward a knowledge of the genus Washingtonia. Bot. Gaz. 44 (1907), 408-434.

— Roezl and the type of Washingtonia. Bot. Gaz. 48 (1909), 462.

PATWARDHAN, V. G.—Gur making from the juice of the date palm in the Thana District of the Bombay Presidency. Jour. Agr. Dept. India, 15. (1920), 625-32. Abstract in Internatl. Sugar Jour., v. 23, no. 267, p. 174-175.

PENA, ANTONIO. — Agricultural Conditions in the Philippines, 1920. Philippine Agr. Rev., v. 14, no. 2 (1921), 133-134. (Includes coconut.)

PETCH, T.—Bud-rot of the Coconut palm. Circulars and Agric. Journal of the Royal Botanic Gardens, Ceylon, Vol. III, No. 15, Apl. 1906.

— Variation in coconuts. Trop. Agric. Ceylon 54 (1920), 1.

PETCH, T. and C. H. GADD. The replacement of the terminal bud in the coconut palm. Ann. Bot. 37 (1923), 445-460. fig. 3.

PFISTER, O. R. Beitrag zur vergleichenden Anatomie der Sabaleenblätter. Zürich, 1892.

PFITZER.—Früchte, Keimung und Jugendzustände der Palmen. Berichte der deutsch. Bot. Gesellsch. 1885.

PHILIPPI, R. A.—Phœnix dactylifera, Jubaea spectabilis und Luma chekon. Gartenfl. XXVIII (1879), 304-5.

PIÈRRE, L.—Flore forestière de la Cochinchine. Paris, 1880-1882.

PILLAI N. K.—Coconut, the wealth of Travancore. Agric. Journ. Ind. 14 (1919), 608-28.

PLIPPANCE, F.—Betel. Gardens' Bull. Straits Settlem. 2 (1920), 294-300. 3 plts. (Areca catechu).

POEPPIG, E. F. Nova genera ac species plantarum, quas in regno Chilensi, Peruviano et in terra Amazonica annis 1827-1832 legit Edwardus Poeppig et cum Stephano Endlicher descripsit iconibusque illustravit. Leipzig, 1835-1845.

POISSON, JUL. & EUG. Note sur le Palmier à huile de la Côte occidentale d'Afrique. Bulletin du Muséum d'Histoire Naturelle, IX (1903), 410-415.

POPENOE, P. B. Date-Growing in the Old and New Worlds. Altadena, California, 1913.

POTONIÈ. Wachsen die Palmen nachträglich in die Dicke? Naturw. Wochenschr. X (1895).

PRAIN, D. Bengal plants. Calcutta, 1903.

PRATT, D. S., ET AL. The nipa palm as a commercial source of sugar. A consideration of the principal difficulties encountered in collecting and preserving the nipa-palm sap. Philippine Jour. Sci. A. Chem. and Geol. Sci., v. 8, No. 6 (1913), 377-398.

PREUSS, P. Die Kokospalme und ihre Kultur. Berlin, 1911.

— Die wirtschaftliche Bedeutung der Oelpalme. Der Tropenpflanzer (1902), 450-476.

PRINSEN-GEERLIGS, H. C. Manufacture of sugar from the sap of palm trees. Planter, v. 57, No. 2 (1916), 29-30: No. 4, 62-63.

PROSCHOWSKY, A. R. Palms of the Riviera. Gard. Chron. 69 (1921), 127-28, 198-199, 211-212.

— Palms of the Riviera, Gard. Chron. (1921), 185-186.

— Palms of the Riviera. Gard. Chron. 71 (1922), 317; 72 (1922), 66 225, 283; 73 (1923), 136.

— Au sujet des fruits comestibles de Chamaerops humilis et d'autres palmiers rustiques. Rev. Hort. 93 (1921), 230.

— Un beau palmier hybride: Butiarecastrum Nabonnandi. Rev. Hort. 93 (1921), 290-91.

PRUDHOMME, E. Le Cocotier, culture, industrie, commerce dans les principaux pays de production, coprah, huile, fibre de coco et dérivés divers. Paris, 1906.

PRÜSSNER, A. H. Date culture in ancient Babylonia. Americ. Journ. Semitic Lang. and Lit. 36 (1920), 213-232.

REGEL, E. Jubaea spectabilis. Gartenfl. XXXIII (1884), 35.

REINKING, O. A. Philippine economic-plant diseases. Philippine Journ. Sci. A, 13 (1918), 165-274, 22 pl. (Includes coconut bud-rot).

— Phytophthora Faberi Maubl.: The cause of coconut bud-rot in the Philippines. Philippine Journ. Sci. 14 (1919), 131-151.

— Coconut bud rot in the Philippines. Phytopathology 12 (1922), 46-47.

REINWARDT, C. G. C. Über den Character der Vegetation auf den Inseln des indischen Archipels. Berlin, 1828.

REISS. Über die in den Samen als Reservestoff abgelagerte Cellulose und eine erhaltene neue Zuckerart, die 'Seminose'. Ber. Chem. Ges, XXII (1889), 609.

REISSECK, S. Die Palmen. Eine physiognomische-kulturhistorische Skizze. Wien, 1861.

RHEEDE, H. VAN. Hortus Malabaricus. Amstelod., 1678-1703.

RICALTON, JAS. The coconut palm. Americ. Forest. 26 (1920), 529-531.

RIDLEY, H. N. The Oil Palm. Agricultural Bulletin of the Straits and Federated Malay States VI (1907), 43-40, with plate.

ROBIN, J. La culture du Cocotier dans l'île de Phu-tuc, Cochinchine. Bull. Agric. Inst. Sci. Saigon 1 (1919), 201-207.

ROBSON, W. Report on the Agric. Dept., Montserrat. Imp. Dept. Agric. West Indies Rept. Agric. Dept. Montserrat 1918-19, 1920. (Includes Corypha umbraculifera).

RODGERS, JULIA ELLEN. At Palm Springs with the Siera Club. Nat. Study Rev. 16 (1920), 195-197.

RODRIGUES, J. BARBOSA. Palmae Mattogrossenses novae vel minus cognitae. Rio de Janeiro, 1898.

— Palmae novae Paraguayenses. Rio de Janeiro, 1899.

— Sertum Palmarum Brasiliensium. Relation des Palmiers nouveaux du Brésil, 2 vols. Paris, 1903.

— Palmae Hasslerianae novae ou Relação das palmeiras encontradas no Paraguay pelo Dr. Emilio Hassler de 1898—1899. Rio de Janeiro, 1900.

— Les noces des Palmiers. Bruxelles, 1903.

ROLF, R. A. On the Flora of the Philippine Islands and its probable derivation. Journ. Linn. Soc. Bot. V.

ROXBURGH, W. Plants of the coast of Coromandel. London, 1795-1819,

— Flora Indica, or description of Indian Plants. Calcutta, 1832.

ROYLE, J. F. Essays on the productive resources of India. London, 1840.

ROYLE, J. F. The fibrous plants of India. London, 1845.

RUMPH, G. E. Herbarium Amboinense (edited by Burmann). Amsterdam, 1741-1755.

RUTGERS, A. A. L. Investigations on oil palms. Exp. Sta. A. V. R. O. S. Medan, Nederland. Indië (1922), 125 p., 19 pl.

RYAN, G. M. Curious growth of the Palmyra palm (*Borassus flabellifer* Linn.). Jour. Bombay Nat. Hist. Soc. v. 20, No. 3 p. 889-892. 3 fig.

SACHS. Zur Keimungsgeschichte der Dattel. Bot. Zeitg. 2 Jahrg. (1862), 241-246, 249-251, t. IX.

SADEBECK, R. Kulturgewächse der Deutschen Kolonien. Jena, 1899.

— Der Raphiabast. Jahrb. Hamb. Wiss. Anst. XVIII (1900).

SAFFORD, W. E. Extracts from the note-book of a naturalist on the Island of Guam. The plant world, vols. 4, 5, 6, Washington, 1902-1904.

— The useful plants of the Island of Guam. Contributed from the U. S. Nat. Herb, vol. IX, Washington, 1905.

SAGE, H. The Royal palm (Oreodoxa regia) Americ. Forestry 28 (1922), 85-88.

SALOMON, C. Die Palmen nebst ihren Gattungen und Arten. Berlin, 1887.

SAMPSON, H. C. The Coconut Palm. London, 1923.

SANDS, W. and others. Report on the Agric. Dept. St. Vincent. Imp. Dept. Agric. West Indies Rept. Agr. Dept. St. Vincent 1918-19. 1920. (Includes coconut.)

SARGENT, C. S. Catalogue of Forest Trees in N. America. 79.

SARGANT, ETHEL. A theory of the origin of the Monocotyledons founded on the structure of their seedlings. Ann. Bot. XVII (1903), No. LXV, 1.

SAVARIAU, N. L'Agriculture au Dahomey, Gouvernment General de l'Afrique occident. Française, Colonie du Dahomey. 1906, p. 64.

— Recherches sur les variétés du palmier à huile au Dahomey. Supple. Journ. Off. de l'Afrique Occidentale Française, No. 3, 1909.

SCHADLER. Technologie der Fette und Öle des Pflanzen und Tierreichs. 1892.

SCHARFETTER, R. Von der Zwergpalme. Deutsche Rundschau Geogr. (1911), 380-84, 6 Abb.

SCHEFFER, R. Énumeration des plantes de la Nouvelle Guinée. Ann. Jard. Bot. Buitenz. vol. 1.

— Sur la groupe des Arecinées. Natuurkundig Tijdschrift voor Nederl. Indie, XXXII, and Annales du Jardin Bot. de Buitenzorg, I, 103. II, 79.

SCHENK. Palaeophytologie in Zittel's Handbuch der Palaeontologie II 367-375.

SCHICK. Überwinterung von Palmen im Freien. Gartenwelt, 23 (1919), 1-2

SCHIMPER. Traité de Paléontologie végétale, vol. II, 1872.

SCHIMPER, A. F. W. - Die Indo-malayische Strandflora. Jena, 1891.

SCHROETER, C. Die Palmen und ihre Bedeutung für die Tropenbewohner. Neujahrsblatt Naturf. Gesell. Zürich, 1901.

SCHULTZE. Zur Chemie der Pflanzenmembranen. Zeitschr. phys. chem. XIV (1889), 227; (1892), 387.

SCHWARZ. Die Wurzelhaare der Pflanzen. Unters. Inst. Tübingen, Heft II (1881), 135-187.

SCHWARZ, M. Zur Bekämpfung der Kokospalmenschildlaus. Der Tropenpflanzer, 1909.

SCHWEINFURTH, G. Im Herzen von Africa.

— Über Pflanzenreste aus alt-aegyptischen Graebern. Berichte deutsch. Bot. Gesellsch. (1884), 351.

— Mitteilungen über die Colonie Eritrea. Verh. Ges. f. Erdk. Berlin, 1892.

SEEMANN, B. Flora of the Isthmus of Panama. In the Botany of the Voyage of H. M. S. "Herald" during the years 1845-1851. London, 1852-1857.

— Popular History of the Palms and their allies. London, 1856.

— Flora Vitiensis. London, 1865-1868.

SEMBER. Die Tropische Agrikultur. Wismar, 1892.

SHORTT, J. Monograph of the Coconut Palm. Madras, 1888.

SIMMONDS, P. L. The Commercial Products of the Vegetable Kingdom. London.

SIMPSON, CHARLES T., and NEHRLING, H. Palm. L. H. Standard Cyclopedia of Horticulture, v. 5, p. 2437-2446, fig., 2725-2739, pl. 83. New York and London.

SIRENA, S. La Chamærops humilis L. Boll. Orto bot. e Giard. col. Palermo IX (1911), 180-91.

SMITH, E. F. Bud rot of the coconut palms in the West Indies. Science, N. S., XXI (1905), 500.

SMITH, JARED G. Caryota. Bailey, I. H. Standard Cyclopedia of Horticulture, v. 2, p. 679. New York and London, 1914.

SMITH, J. J. Nieurve misvormingen bij klappers. Teysmania 30 (1919), 291-297.

SMITH, W. Coconuts: The Consols of the East. London.

SMITH AND PAPE. Coconuts, the consols of the East. 1913.

SOEHRENS, F. Le Jubaea spectabilis dans sa patrie. Illustr. Hortic. XXXV (1888), 8-9.

SOLLA, R. F. Sui cristalli di silice in serie perifasciali nelle palme. Nota preliminare. Nuovo Giorn. Bot. Ital. XVI (1884).

SONNERAT, P. Voyage à la nouvelle Guinée. Paris, 1776.

— Voyage aux Indes orientales et à la Chine. Paris, 1806.

SONNTAG. Landw. Jahrbuch 21 (1892), 839. (On fibres of Cocos).

SOSKIN, S. Die Ölpalme. Ein Beitrag zu ihrer Kultur. Berlin, 1909.

SOUBEIRAN, J. LEON. Du sucre de jagre ou de palmier. Jour. Pharm. et Chim., ser. 3, t. 31, p. 14-20, (1857).

SOULIER-VALBERT, F. The coconut world. Tropical Life 15 (1919), 55.

SOUTH, F. W. Certain host plants of Fomes lignosus and Ustulina zonata. Agric. Bull. Federat. Malay States 8 (1920), 242-243. (On Areca catechu).

SOUTHERN NIGERIA GAZETTE EXTRAORDINARY. No. 46, July 3, 1908. Trade Report for the year 1907, Export of Palm Oil and Kernels, pp. 919-921.

SPON, E. AND F. N. Spon's encyclopaedia of the industrial arts, manufactures and raw commercial products, edited by C. G. W. Lock. London 1882.

SPRUCE, R. On five new palms from Eastern Peru. Journ. Linn. Soc. III (1859), 191.

— Palmae Amazonicae. Jour. Linn. Soc. Bot. XI (1869).

STENZEL. De trunco palmarum fossilium, und Beiträge zur Kenntniss der fossilen Palmen. Nova Acta Leopold. Carol. 1850.

STOCKDALE, F. A. Fungus disease of Coconuts in the West Indies. West Indian Bulletin, vol. IX (1909), 361.

STOCKER. Les palmeraes du district de l'Ubangi. Bull. Agric. Congo Belge 12 (1921), 313-20.

— Les palmeraes d'Elaeis du territoire de Doruma (Haute-Uelé). Bull. Agric. Congo Belge 12 (1921), 321-27.

STRASBURGER, E. Jahrb. Wiss. Bot. 43, 380-628. (Histology of the trunk of Washingtonia filifera.)

— Histologische Beitr. III (1891), 381-82.

— Über die Verdickungsweise der Stämme von Palmen und Schraubenbäumen. Jahrb. Wiss. Bot. XLIII (1906), Heft 4.

STRUNK, L. Zur Ölpalmenkultur. Der Tropenpfl. X (1906), 637-642.

STUART, G. A. D. Mycology and operation against disease. Rept. Dept. Agric. Madras 1917-18, 17-20. 1918 (includes Cocos, Borassus. Areca).

SUNDARARAMAN, S. The Coconut Bleeding Disease Agr. Res. Inst. Pusa, Bull. 127.

SWINGLE, WALTER T. The date palm and its culture, U. S. Dept. Agr. Yearbook, 1900, p. 453-490, fig. 57-63, pl. 54-63.

— The Date Palm and its utilization in the South-Western States. Bull. 54, Bureau of Plant Industry, United States Department of Agriculture, 1904.

SYMONDS, W. A. The palmyra palm and its uses. Dept. Land Records and Agr. Madras, Agr. Branch, Bull. 25 (1892), 337-344.

TALBOT, W. A. List of the Trees, Shrubs, and Woody climbers of the Bombay Presidency. Bombay, 1902, ed. 4.

— Forest Flora of Bombay Presidency and Sind. 2 vols. 1912.

TAYLOR, N. Arenga. L. H. Standard Cyclopedia of Horticulture. I (1914) 389-390. New York and London.

TEVIS, MAY. Cutting the cocoanut cake. Sci. Amer. Monthly I (1920) 404-407.

THEOPHRASTUS. De historia plantarum libri decem, illustré et commenté par Joannes Bodens a Stapel, Julius Cæsar Scagliger et Robert Constatin. Amsterdam, 1644.

THISELTON-DYER, W. T. Germination of the Double Coco-nut. Annals Botany XXIV (1910), 223-230.

THOMPSON, H. N. Notes on the Oil Palm of Southern Nigeria, in supplement to the Southern Nigeria Government Gazette, No. 10, February 5th, 1908.

THONNING. In Videnskabernes Selskabs Afhandl. IV, 1829 (On Phœnix spinosa).

THURSTON, E. The Palmyra Palm, its occurrence, cultivation and uses. Agricul. Ledger No. 20, 1894.

THWAITES, G. H. K. Enumeratio plantarum Zeylaniae. London, 1864.
— Reports on the Royal Botanic Garden, Peradeniya, 1856-1867.

TRÉCUL, A. Mémoire sur la formation des feuilles. Ann. Sci. Nat. Ser. III, Bot. XX (1853). 235-314.

TRELEASE, S. F. Incipient drying and wilting as indicated by movements of coconut pinnae. Amer. Journ. Bot. 9 (1922), 253-265.

TREUB, Le méristème primitif de la racine dans les Monocotylédones. Leyde, 1876.

TRIMEN, H. A. A handbook of the Flora of Ceylon, 5 vols. text, 1 vol. illustr. London, 1893-1908.

U. S. DEPT. AGR. BUREAU of PLANT INDUSTRY. 1905-1922. Seeds and plants imported . . . . Inventory 10; S. P. I. Nos. 5501-9896; No. 27; S. P. I. Nos. 30, 462-31, 370, 1912; Inventory 28; Nos. 31, 371-31, 938, 1912; Inventory 33; S. P. I. No. 34, 420, 1912; Inventory 34; S. P. I- 34, 420-35, 135, 1915; Inventory 59; S. P. I, Nos. 47, 349-47, 864, 1922. Inventory Nos. 10-28 are U. S. Dept. Agr. Bur. Plt. Indus. Bul. 66, 242, and 248.

ULRICH, E. Die Kokospalme, ihre Verbreitung, Kultur und Bedeutung für den Welthandel,—Gartenfl. 65 Jahrg. (1916) 261-71, 298-311.

UPHOF, J. C. TH. Die Dattelpalme im Südwesten der Vereinigten Staaten. Tropenflanzer 24 (1931), 65-72.

VANDERYST, H. Contributions à l'étude du palmier à huile au Congo Belge. Bull. Agric. Congo Belge 11 (1920), 22-36, 37-53.
— Contribution à l'étude du palmier à huile au Congo Belge. 9?— La récolte des régimes de l'Elaeis. Bull. Agric. Congo Belge 12 (1921), 305-309.

VENKATA RAO, M. K. The Pest Act against koleroga and its application. Mysore Agric. Calendar (1919), 17-20. (On Phytophthora arecae).

VISWANATH, B. AND GOVINDAN NAYAR, K. The improvement of the Coconut Jaggery Industry on the West Coast.—Agricultural Journal of India XIX (1924), 485.

VOIGT. Über Bau und Entwicklung von Samen mit ruminiertem Endosperm. Ann. Jardin Buitenz. VII.

VOSSELER. Altes und Neues über Kokosschädlinge. Der Pflanzer. Amani, 1905.

WABY, J. F. Some interesting species of palms. Jour. Bd. Agric. Brit. Guiana 12 (1919), 49-55, 112-115.

WAKEFIELD, E. M. Diseases of the Oil Palm in West Africa. Agric. Bull. Feder. Malay States 8 (1920), 244-46.

— Diseases of the Oil Palm in West Africa.—Kew Bull. (1920), 306.

WALD, K. Lebensbäume. Regensburg, 1906.

WALKER, H. S. Notes on the sprouting coconut, on copra, and on coconut oil. Chemical Lab., Bureau of Sci. Manila P. I.

— The coconut and its relation to the production of coconut oil. Philippine Journ. of Science, vol. 1, No. 1 (1906).

WALLACE, A. R. Palm Trees of the Amazon and their uses. London, 1853.

— Island life. New York, 1881.

— The Malay archipelago. New York, 1869.

WALLICH, N. Plantae asiaticae rariores. London, 1830-1832.

WALPERS, W. G. Annales Botanices systematicae, vol. III et V.

WARBURG, O. Über Verbreitung, Systematik und Verwerthung der polynesischen Steinnuss-Palmen. Ber. der Deut. Bot. Gesellsch. vol. XIV.

WARMING, E. Ökologische Pflanzengeographie. Berlin, 1896.

WATT, G. A dictionary of the economic products of India. Calcutta, 1885-1893.

— The commercial products of India. London, 1905.

WATTS, F. Coconut cultivation in the West Indies. London 1911.

WEISS, J. C. Beiträge zur Kenntnis der Korkbildung. Denkschr. d. K. Bayer. Bot. Ges. z. Regensburg, VI (1893).

WEISSE, A. Über Lenticellen und verwandte Durchlüftungseinrichtungen bei Monocotylen. Ber. d. Deutsch Bot. Gesellsch. XV (1897)-303-319.

WENDLAND, H. L. Die habituellen Merkmale der Palmen mit Fächerförmigem Blatt, der sogenannten Sabalartigen Palmen. Bot. Zeitg. XXXVII (1879), 145-54.

— Über Brahea oder Pritchardia filifera Hort. Bot. Zeitg. XXXVII, 65-68.

— Index Palmarum, et Cycadearum cultura. Hannover, 1854.

— Einige neue Palmen Amerikas. Linnaea, 1857.

WENDLAND, H. L. Die systematische Einteilung der Palmen. der 40. Versam. deutscher Ärzte und Naturforscher. Hannover, 1.

— Über Grisebachia, ein neues Palmengenus. Göttinger Nach richten, 1875.

— Über die Blätter der Palmen. Botan. Zeitung, 1879.

WENDLAND, H. L. et DRUDE, O. Palmae Australasicae. Linnaea, 1875.

WENDLAND, H. and MANN. Palms of Western Africa. Transact. Linn. Society XXIV (1863).

WESTER, P. J. The coconut, its culture and uses Philippine Agric. Rev. 11 (1918), 5-57.

— The coconut palm, its culture and uses. Bur. Agric. Philippine Islds. Bull. 35 (1921), 73 p., 23 pl.

— The Food Plants of the Philippines. The Philippine Agr. Rev., v. 14, No. 3 (1921), 384 p., 35 pl.

WIESNER J. Die Rohstoffe des Pflanzenreiches, 2 vols. Leipzig, 1900-1903.

WHITFORD, H. N. The forests of the Philippines, Part I. Forest types and Products. Philippine Forestry Bur. Bul. 10, pt. 1 (1911), 28 pl.

WIGHT, R. Icones plantarum Indiae Orientalis, or figures of Indian plants, Madras, 1840-1856.

— Illustrations of Indian Botany. Glasgow, 1831; Madras, 1841-50.

— Spicilegium Neilgherrense. Calcutta, 1846-1851.

WIGHT and GEORGE ARNOLD WALKER-ARNOTT. Prodromus Florae Peninsulae Indiae Orientalis. Madras, Calcutta, and London, 1840-1856.

WILDEMAN, E. DE. Les plantes tropicales de grande culture. Bruxelles, 1902.

— Quelques Palmiers Congolais. Ann. Mus. Col. Marseille, 72² (1919), 1-28 (Chiefly Raphia).

WILLIAMS, O. Brahea filamentosa in California. Gard. Chron. (1876), 80.

WINTON. Anatomy of the fruit of Cocos nucifera. Americ. Journ. Sci. ser. 4, vol. XII, 1901.

WITTMACK, L. Washingtonia robusta H. Wendl., eine vorzügliche Kalthauspalme. Gartenfl. XXXVIII, 300.

— Die Keimung der Cocosnuss. Ber. Deutsch. Bot. Ges. XIV (1896), 145-50.

WOLL, F. W. Cocoanut meal as a food for dairy cows and other livestock. California Agric. Exp. Sta. Bull. 335 (1921), 241-258.

WOLK, P. VAN I ER. Onderzoekingen betreffende den Cocospalm. Cultura (1918), 1-34.

WOSSIDLO, P. Über die Structur der Jubaea spectabilis. Ein Beitrag zur Anatomie der Palmen. Leop. Carol. Akad. Naturf. Verh. XXVIII (1861), No. 5.

ZAGOLIN, A. Ricerche sul polimorfismo del frutto della Chamaerops humilis L. Nuov. Giorn. Bot. Ital. 28 (1921), 36-66.

ZAWADA, K. Das anatomische Verhalten der Palmenblätter zu dem System dieser Familie. Karlsruhe, 1890.

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