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VOL. III PART II

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FLORA
OF
THE UPPER GANGETIC PLAIN
AND OF THE
ADJACENT SIWALIK AND SUB-HIMALAYAN TRACTS

BY
J. F. DUTHIE, B.A., F.L.S.,
FORMERLY DIRECTOR OF THE BOTANICAL DEPARTMENT OF
NORTHERN INDIA,

CONIFERÆ TO JUNCACEÆ.

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CALCUTTA
SUPERINTENDENT GOVERNMENT PRINTING, INDIA
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CLASS II.

GYMNOSPERMS.

CV.—CONIFERÆ.

Trees or shrubs, wood-cells studded with disks. *Leaves* usually alternate, rigid, linear or subulate, rarely broad, solitary or fascicled in membranous sheaths. *Flowers* monœcious or diœcious; males in deciduous catkins; females solitary or in cones. *Perianth* none. **MALE** flowers: *stamens* many, filaments connate in a globose ovoid oblong or cylindric column; anthers 1- or more-celled, shortly stipitate or sessile round the axis of the column. **FEMALE** flowers: ovules one or more, sessile, naked, usually orthotropous, seated on a scale (an open carpel) which is free or adnate to the scale (bract) of a cone. *Seeds* often winged, testa thick or thin; albumen dense, fleshy; embryo axile, straight; cotyledons 2 or more; radicle terete, often attached to a crumpled thread-like suspensor.—Species about 350, chiefly in cold regions, rare in Trop. Africa and America, absent in the W. Peninsula of India and in Ceylon.

PINUS, Linn.; Fl. Brit. Ind. 651.

Evergreen monœcious trees. *Leaves* dimorphic, the primary consisting of small membranous scales; secondary linear, in clusters of 2 or 3 or 5 in the axils of the primary, clusters girt at the base by a sheath of hyaline scales. **MALE** flowers in spikes. *Staminal column* ovoid, oblong or cylindric; anthers in many series, shortly stipitate, 2-celled, connective produced at the apex. **FEMALE** cones globose or ovoid, bracts spirally imbricate, ovuliferous scale much larger than the bracts; ovules 2, at the base of the scale, reflexed. *Ripe cone* ovoid or oblong, bracts obsolete or small; scales persistent, formed of the enlarged thickened usually woody ovuliferous scales the tips of which are often square and with a boss. *Seeds* 2, reversed, usually winged, the wing formed by the adhesion of the hard testa to a thin separable layer of the scale,

cotyledons 2 or more.—Species about 70, confined to the N. Hemisphere.

P. longifolia, Roxb. *Fl. Ind.* iii, 651; *Royle Ill.* 353, t. 85, f. 1; *Brandis For. Fl.* 506; *Ind. Trees* 690; *F. B. I.* V, 652; *Watt Comm. Prod. Ind.* 889; *Kanjilâl For. Fl.* (ed. 2). 431; *Gamble Man.* 706; *Collett Fl. Siml.* 485, fig. 158.—Vern. *Chir, chil* (W. Him.), *dhup* (Oudh).—Long-leaved pine.

A large more or less deciduous tree with symmetrical branches high up on the trunk and forming a rounded head of light foliage. *Bark* rough, reddish-brown outside, dark-red within, cut by deep fissures into large irregular thin plates. *Leaves* in clusters of three, 9-12 in. or longer, linear, slender, subtriquetrous. *Sheaths* persistent, fimbriate, greyish-brown. *Male-spikes* ovoid, cylindric, about $\frac{3}{4}$ in. long. *Fertile cones* on short stiff stalks, spreading or recurved, solitary or in whorls of 3-5, ovoid-conical, 4-7 in. long when mature and about 3 in. in diam. above the base. *Scales* $1\frac{1}{2}$ -2 in. long and $\frac{3}{4}$ in. broad; apex much thickened and with a 4-6-lobed tip which is beaked in the centre. *Seeds*, including wing, $\frac{1}{2}$ -1 in. long; its wing obliquely oblanccolate, obtuse; cotyledons about 12.

Wild on the Saharanpur Siwalik range at 2-3,000 ft. It is cultivated in Dehra Dun and in many other places within the northern portion of the Upper Gangetic Plain. The tree flowers February to April, and the seeds are shed during the hot weather of the following year. The cones remain on the branches long after the seeds have been shed. **DISTRIB.**: Outer Himalayan ranges and in the valleys of the principal rivers from the Indus to Bhutan at elevations between 2,000 and 7,500 ft., reaching its highest altitude in Kumaon. In Sikkim and Bhutan it rarely rises to over 3,000 ft. The tree is gregarious in the Western Himalaya, where it forms pure forests over very extensive areas. The resin obtained from the sapwood of this tree is the most important of its products, which include tar, turpentine, colophony and charcoal as bye-products. The quantity of resin obtained per individual tree is much larger as compared with that of the 'Blue pine' (*Pinus excelsa*), but the quality is somewhat inferior. The timber is largely used by the hill men for building and other purposes. It is not very durable, especially when exposed to wet, and it is very liable both to insect and fungoid attacks, and is altogether inferior to that of the 'Blue pine.' This latter tree (*P. excelsa*) occurs abundantly in the Temp. Himalaya at elevations between 6,000 and 12,500 ft., extending from Kafiristan on the west to Sikkim and Bhutan eastwards, except for certain gaps in Central and N.-W. Kumaon.—For

further particulars regarding these two Himalayan pines see Gamble's "Manual of Indian Timbers" and Brandis' "Forest Flora of N.-W. and Central India."

The following non-indigenous conifers are met with in gardens within the area of the Upper Gangetic Plain :—

THUYA ORIENTALIS, *L.*—A small evergreen tree of China and Japan, and sometimes known as the *Chinese Arbor-Vitæ*.

CUPRESSUS SEMPERVIRENS, *L.*—A tall evergreen tree, indigenous in Persia, Syria and Asia Minor.—Cypress. Vern.—*Sarás* (Hind.) Largely cultivated in the plains of N.-W. India, especially the fastigate variety.

JUNIPERUS MACROPODA, *Boiss.*—Himalayan Pencil Cedar. A small or medium sized tree of the inner dry ranges of the Western Himalaya, ascending to 14,000 ft. in Ladák, and found as low down as 5,000 ft. on the Indus. It has been cultivated in the Saharanpur Garden, where it appears to thrive.—Vern. *Dhup*.

ARAUCARIA CUNNINGHAMII *Ait.*—A tall handsome evergreen tree, introduced from Queensland. There used to be a fine specimen of this tree in the Saharanpur Garden.

ARAUCARIA BIDWILLI, *Hook.*—The *Bunya-Bunya* pine of N.-E. Australia. This tree also thrives at Saharanpur and in other gardens of North-West India.

Belonging to the allied and remarkable family of *Cycadaceæ* some mention should be made of *Cycas revoluta*, Thunb., a Japanese species introduced into India, and often grown in gardens within the area of the Upper Gangetic Plain. It is a small palm-like evergreen tree with linear pinnately divided leaves arranged in terminal crowns.

CLASS III.

MONOCOTYLEDONS.

CVI.—HYDROCHARITACEÆ.

Aquatic usually submerged herbs. *Leaves* undivided, usually narrow and ribbon-like, rarely with a distinct lamina. *Flowers* regular, monœcious or diœcious, rarely 2 sexual, enclosed in an

entire or 2-leaved spathe; **MALE** flowers: *stamens* 3-12, in 1-4 series, anthers 2-celled. **FEM.** flowers: Solitary. *Perianth* superior. *Sepals* 3, green or petaloid. *Petals* membranous or none. *Ovary* 1-celled, inferior; placentas 3-6, parietal or intruded and sometimes almost meeting at the axis; styles or style-arms 3-12; ovules many on each placenta, anatropous or orthotropous. **Fruit** globose or ovoid, dry or pulpy, rarely dehiscent. **Seeds** few or many, albumen none, embryo smooth or lineate.—Species about 50, in tropical and temperate regions of the world, some of them marine.

Stems branching, leafy; leaves small; spathes small, sessile :—

Leaves whorled or the lower ones opposite;
styles undivided; ovules anatropous . 1. *Hydrilla*.

Leaves scattered, fascicled or somewhat whorled;
styles notched; ovules orthotropous . 2. *Lagarosiphon*.

Stems none, or with stolons only, or a creeping rootstock :—

Leaves all long, narrow and sessile; male scapes several-fl. :—

Perianth single 3. *Vallisneria*.

Perianth double 4. *Blyxa*.

Leaves mostly or all petioled :—

Ovary not beaked; fruit without wings;
leaves all petioled; male scapes 2-3-fl. . 5. *Hydrocharis*.

Ovary beaked; fruit winged, submerged;
leaves narrow, the floating ones long-petioled; flowers solitary 6. *Ottelia*.

1. **HYDRILLA**, Rich.; Fl. Brit. Ind. v, 659.

A submerged leafy freshwater herb. *Leaves* short, usually opposite below, 3-4-nately whorled above. *Flowers* minute, diœcious, the males shortly pedicelled, solitary in a subglobose muricate spathe; females sessile, 1-2 in a tubular 2-toothed spathe. **MALE** flowers: *Sepals* 3, ovate or obovate, green. *Petals* 3, oblong or cuneiform. *Stamens* 3; anthers large, reniform, opening elastically. *Pistillode* minute. **FEM.** flowers: *Sepals* 3, linear, green,

Petals 3, narrow. *Ovary* produced beyond the spathe in a filiform beak, 1-celled; styles 2-3, linear, undivided, stigmas fimbriate. ovules anatropous. *Fruit* subulate, smooth or muricate. *Seeds* 2-3, minute, oblong, testa shortly produced at each end.—A single species found throughout India and in Ceylon extending to Britain and C. Europe, Mauritius, Madagascar, Trop. Asia and Australia.

H. verticillata. Royle Ill. 376; F. B. I. V, 659; Watt E. D.; Prain Beng. Pl. 995; Cooke Fl. Bomb. ii, 668. *Serpicula verticillata*, Linn. f.; Roxb. Fl. Ind. iii, 578. *Vallisneria verticillata*, Roxb. Fl. Ind. iii, 751.

Stems slender, 1 ft. or more long, branching, flaccid, often rooting at the nodes; branches with a short sheathing leaf at the base. *Leaves* sessile, 4-8 in a whorl, the lowest often opposite, $\frac{1}{4}$ - $\frac{3}{8}$ in. long, linear or linear-oblong, apiculata, entire or serrulate, midrib prominent. *Flowers* $\frac{1}{6}$ - $\frac{1}{4}$ in. long. *Perianth-segments* very variable. *Fruit* smooth or muricate.

Abundant throughout the area of this flora in still or slowly running water; common also in all India and in Ceylon. **DISTRIB:** See under the genus. The small membranous spathes of the male-flowers ultimately split and liberate the flowers which rise to the surface of the water, where they float, expand and scatter their pollen. Sugar-refiners in India use this plant, whilst moist, for covering the surface of their sugar in order to produce a slow percolation of moisture (See Royle Ill. l. c.).

2. LAGAROSIPHON, Harv.; Fl. Brit. Ind. v, 659.

Submerged fresh-water herbs. *Leaves* scattered, fascicled or somewhat whorled; lower opposite, serrulate. *Flowers* dioecious. **MALE** flowers minute, many in an ovoid 2-fid. axillary spathe. *Sepals* petaloid. *Petals* rather shorter. *Stamens* 2 or 3, filaments short, anthers ovate, with often 2 or 3 *staminodes*. *Pistillode* none. **FEM.** flowers: *Staminodes* none. *Ovary* oblong, produced into a filiform beak; styles 3, stout, notched; ovules many, orthotropous. *Fruit* ovoid oblong or linear, pericarp membranous. *Seeds* many, testa with a mucous coat.—Species about 12, in India, Africa and Madagascar.

L. Roxburghii, Benth. in Gen. Pl. iii, 451; F. B. I. V, 659; Prain Beng. Pl. 995; Cooke Fl. Bomb. ii, 669. *Vallisneria alternifolia*, Roxb. Fl. Ind. iii, 750.

Stems filiform, 2-3 ft. long; roots fibrous; upper branches floating. *Leaves* sessile, alternate and opposite, 3-4 in. long, oblong-lanceolate, acute, minutely serrulate. *MALE flowers*: *Spathe* ovoid, at length 2-valved, enclosing many minute shortly stalked flowers. *Sepals* shortly oblong, pink. *Petals* about as long as sepals, white. *Stamens* 2; anthers opening transversely. *FEM. flowers*: *Spathe* $\frac{1}{2}$ in. long, tubular, 2-fid. *Ovary* lanceolate, tipped with a filiform flexuous beak.

Common within the area in tanks and streams. **DISTRIB.**: Throughout the plains of India and in Ceylon, extending to China and Japan.

3. VALLISNERIA, Linn.; Fl. Brit. Ind. v, 660.

Sulmerged tufted stemless stoloniferous herbs. *Leaves* very long, linear. *Flowers* dioecious, the males numerous, minute, in an ovoid 3-lobed shortly peduncled spathe, the females solitary in a tubular 3-toothed spathe terminal on a very long filiform spiral scape; *sepals* 3, *petals* 3, minute or none. *MALE flowers*: *Stamens* 1-3, filaments rather thick, anthers didymous. *Pistillode* none. *FEM. flowers*: *Staminodes* 3, each 2-fid. *Ovary* narrow, not produced upwards; stigmas 3, broad, notched, ovules numerous. *Fruit* linear, included in the spathe. *Seeds* numerous, oblong, testa membranous.—Species about 4, in the warmer regions of both hemispheres.

V. spiralis¹, Linn. Sp. Pl. 1015; F. B. I. V., 660; Watt E. D.; Prain Beng. Pl. 996; Cooke Fl. Bomb. ii, 669. *V. spiraloïdes*, Roxb. Fl. Ind. iii, 750.

Leaves radical, narrowly linear, varying in length with the depth of the water, translucent, entire, or serrulate at the tips. *MALE flowers* many, minute, in shortly stalked spathes; when ready to open they become detached and rise to the surface of the water, the expanded perianth acting as a float. *FEMALE flowers* solitary within a 3-toothed spathe and borne on a long spiral stalk, the uncoiling of which brings the flower to the surface to be fertilized by the floating males, after which the female scape coils up again into a close spiral

dragging the young fertilized female flower to within a small distance of the muddy bottom of the water to ripen.

Abundant within the area. **DISTRIB.** :—More or less throughout India and in Ceylon, extending westwards to Spain, and in most warm regions of the World.

4. BLYXA, Thouars ; Fl. Brit. Ind. v, 660.

Annual, submerged, tufted, scapigerous herbs. *Leaves* linear, acute, entire or minutely serrulate. *Flowers* 2-sexual or diœcious ; scapes long or short ; males pedicelled, several in a tubular 2-toothed spathe, long-peduncled ; 2-sexual or fem. flowers solitary, sessile within a tubular 2-toothed spathe. *Sepals* 3, linear. *Petals* 3, linear, longer than the sepals. **MALE** flowers : *Stamens* normally 3-seriate, 1 or more often reduced to staminodes ; anthers narrow, erect. *Pistillodes* 3, slender. **FEM.** flowers solitary. *Staminodes* none or minute. *Ovary* linear, 1-celled, beaked ; style very short ; stigmas 3, filiform, ovules many. *Fruit* linear, included in the ribbed narrow ventricose spathe ; pericarp membranous. *Seeds* many, oblong, smooth or tubercled, often tailed.—Species 7 or 8, in Trop. Asia, Madagascar, Australia and in Sumatra.

Leaves not serrulate ; flowers diœcious ;
stamens 8 1. *B. Roxburghii*.

Leaves serrulate ; flowers 2-sexual ; stamens 3 2. *B. oryzetorum*.

1. B. Roxburghii, Rich. in *Mem. Inst. Fr.* (1881) 77, t. 5 ; *F. B. I. V.*, 660 ; *Prain Beng. Pl.* 996 ; *Cooke Fl. Bomb. ii*, 670. *Vallisneria octandra*, Roxb. ; *Fl. Ind. iii*, 572.—Vern. *Syal* (Beng.).

A submerged tufted annual. *Leaves* radical, 8-24 in. long, linear, entire, broad at the base, finely acuminate at the apex. *Flowers* diœcious, white. **MALE** flowers : *Scape* straight, as long as or longer than the leaves. *Stamens* 8 ; filaments unequal, shorter than the petals. **FEM.** flowers : *Scape* shorter and thicker than in the males. *Fruit* 2-4 in. long. *Seeds* $\frac{1}{4}$ in. long, distinctly tuberculate, shortly tailed.

I have seen no specimens from the Upper Gangetic Plains, but being widely distributed in Bengal in still water it has in all probability been overlooked. It is said to be plentiful throughout the Bombay Presidency, and is found also in Malay Peninsula and in Australia.

2. *B. oryzetorum*, Hook. f. in *F. B. I. V*, 661; *Prair Beng. Pl.* 997. *Diplosiphon oryzetorum*, *Dcne. in Jacquem. Voy. Bot.* 167, t. 167.

A submerged tufted annual. *Leaves* 4-6 in. long, with serrulate edges. *Scape* very short. *Flowers* 2 sexual. *Stamens* 3. Capsule 1-1½ in. long by ½ in. wide. Seeds ¼ in., sparsely tubercled; tails none or very short.

Bundelkhand (Edgeworth, No. 9002). **DISTRIB.:** Kashmir (Jacquemont), also on the Khasia Mountains.

5. *HYDROCHARIS*, Linn. ; Fl. Brit. Ind. v, 662.

Aquatic floating herbs. *Leaves* petioled, orbicular or reniform, entire. *Flowers* monœcious; males 2-3 in a peduncled 2-foliate spathe; females solitary within a spathe. *Sepals* 3, herbaceous. *Petals* 3, white, membranous. **MALE flowers.** *Stamens* 6 or 9; staminodes 6 or 3; filaments forked, anther-cells basifixed. **FEMALE flowers.** *Staminodes* 6, in pairs. *Ovary* ovoid, 6-celled; ovules many; stigmas 6, linear, 2-fid. *Fruit* an ovoid or oblong fleshy berry, 6-celled. *Seeds* numerous; testa pulpy, filled with spiral vessels; embryo ovoid.—Species 2 or 3, in Europe and Asia.

***H. cellulosa*, Buch.-Ham.** in *Wall. Cat.* 5042; *Prair Beng. Pl.* 997. *H. Morsus-Ranæ*, *F. B. I. V*, 662 (in part); *Royle Ill.* 377.

Prair in his *Beng. Plants* follows Buchanan-Hamilton in considering this plant as specifically distinct from the European *H. Morsus-Ranæ*, to which it has been referred in the *Fl. Brit. Ind.* The reniform leaves are much less deeply lobed at the base, and after flowering they become very much enlarged. The male flowers contain 12 antheriferous stamens, 3 of which are sterile. Within the area of this flora specimens of this plant were collected by Buchanan-Hamilton in the Gorakhpur district, and by the present writer in the N. Oudh district of Bahraich. The plant appears to be common also in N. and Central Bengal.

6. *OTTELIA*, Pers. ; Fl. Brit. Ind. v, 662.

Submerged or partially floating fresh-water herbs with fibrous roots. *Leaves* radical, crowded, the submerged narrow and shortly

petioled, the floating long-petioled, ovate-lanceolate oblong or cordate. *Flowers* solitary, 2-sexual, sessile within a tubular long-peduncled spathe. *Sepals* 3, linear or oblong. *Petals* 3, longer than the sepals, obovate or orbicular, with fleshy basal appendages. *Stamens* 6-15, in 2-5 series, anthers erect. *Ovary* oblong, beaked, almost 6-celled; styles 6, linear, 2-fid.; ovules many, placentas diffuse. *Fruit* oblong, 6-valved, enclosed in the spathe, 3-6-winged. *Seeds* many, oblong, testa pulpy.—Species 6 or 7, in tropical or subtropical regions of the world.

O. alismoides, Pers. Syn. i, 400; F. B. I. V, 662; Prain Beng. Pl. 997; Cooke Fl. Bomb. ii, 671. *Damasonium indicum*, Willd; Roxb. Fl. Ind. ii, 216.

A succulent flaccid herb, submerged or partially floating. *Leaves* variable, 2-6 in. long, oblong or orbicular, cordate, membranous, undulate, 7-11-nerved; petioles trigonous. *Spathe* 1-1½ in. long, 1-flowered, 5-6-winged; peduncles varying in length with the depth of the water; wings of spathe unequal, undulate; mouth 5-6-toothed. *Sepals* small, oblong, green. *Petals* suborbicular, about 1 in. broad, white with yellow base, reticulate-veined. *Ovary* narrowly oblong; placentas 6-12. *Fruit* 1-1½ in. long, ellipsoid, crowned by the persistent perianth.

Abundant within the area of this flora, in tanks and slow-running water. **DISTRIB.:** Throughout India and in Ceylon, extending to Australia.

CVII.—ORCHIDACEÆ.

Herbs of various habit, rarely shrubby, of two principal forms: either (1) terrestrial tuberous-rooted herbs with annual herbaceous simple stems and solitary or spicate or racemose flowers; or (2) epiphytes with perennial stems or branches variously thickened and often forming a pseudobulb, flowering from the top sides or base of the pseudobulb; bracts usually present. *Flowers* 2-sexual, irregular, often showy. *Perianth* superior, of 6 free or variously combined segments in two series; 3 outer segments (*sepals*) more or less alike, the 2 lateral sometimes connate in a short or long sac or spur-like base (mentum); 3 inner (*petals*) dissimilar, the 2 lateral alike, the other (*lip*) usually very differently shaped. *Stamens* and style united in a column opposite the lip; fertile anthers usually

one (2 in *Cypripediæ*), on the front or top or back of the column and free or adnate to it, 2-celled or by subdivision 4-celled; top of the column sometimes produced towards the lip into a beak (*rostellum*); pollen-grains usually coherent in each cell into 1, 2, or 4 pairs of oblong globose or pyriform waxy or powdery masses (*pollinia*), which are free or attached by pairs or fours immediately, or by a stalk (*caudicle*) to a gland. *Ovary* inferior, 1-celled, usually linear or twisted; stigma one or two viscid spots on the top or concave face of the column, opposite the lip and below the anther, rarely discoid and above the two anthers (in *Cypripediæ*); ovules many, minute. *Fruit* a capsule, usually opening by 3 or 6 longitudinal fissures, rarely fleshy and subindehiscent. *Seeds* many, minute, with a lax hyaline testa enclosing a homogeneous nucleus.—*Species* about 5,000, in temperate and tropical regions, rarely arctic.

Anther single :—

Pollinia waxy :—

Pollinia free, or those of each cell held together at the base by a viscid appendage, not attached by their bases or by a caudicle to the rostellum :—

Pollinia 4 :—

Leaves equitant, coriaceous or fleshy.

Epiphytic herb 1. OBERONIA.

Leaves not equitant. Usually terrestrial herbs —

Leaves membranous, rarely coriaceous :—

Lip superior, with basal auricles ; column very short 2. MICROSTYLIS.

Lip inferior, without basal auricles ; column long 3. LIPARIS.

Epiphytic herbs with coriaceous leaves :—

Stems solitary or caespitose, or composed of discrete pseudobulbs basally attached on a long or short rhizome ; column prolonged into a foot :—

Lip not articulate on the foot of the column 4. DENDROBIUM.

Lip articulate on the foot of the column and mobile . 5. BULBOPHYLLUM.

Stems jointed, composed of elongated pseudobulbs attached to a woody core; leaves solitary or in pairs, chartaceous; column without a foot 6. PHOLIDOTA.

Pollinia 8

Terrestrial herbs without pseudobulbs :—

Scapes from a stout rhizome, flowering before the leaves appear . 7. PACHYSTOMA.

Stems leafy; flowers large, appearing with the leaves 8. THUNIA.

Pseudobulbous epiphytes; column with a long foot 9. ERIA.

Pollinia attached singly or in pairs or fours through one or rarely two caudicles to a stigmatic gland :—

Pollinia 2, rarely 4 in *Cymbidium* :—

Terrestrial glabrous herbs with fleshy tubers or rhizomes, rarely pseudobulbous; flowers in peduncled racemes; leaves chartaceous or membranous, plicate —

Lip distinctly 3-lobed, saccate or spurred at the base; inflorescence straight 10. EULOPHIA.

Lip obscurely 3-lobed, widely ventricose at the base, but not spurred; inflorescence at first decurved 11. GEODORUM.

Epiphytic herbs, rarely terrestrial or leafless, usually with long linear coriaceous leaves sheathing on a large fleshy pseudobulb; scapes racemose, column footless or very slightly produced; lip not spurred 12. CYMBIDIUM.

Epiphytic herbs, never terrestrial;
pseudobulbs none :—

Stem very short, leaves few,
crowded, pendulous, broad, flat
and softly coriaceous; flowers in
long, often branching, racemes;
lip with a long claw; midlobe
2-lobulate; lateral lobes fimbri-
ate; spur bent 13. *ORNITHOCHILUS*.

Stems more or less elongate; leaves
coriaceous, flat, or fleshy and
terete :—

Lip not spurred; leaves terete . 14. *LUISIA*.

Lip spurred, adnate to the
column or its foot; leaves flat,
lorate :—

Column with a long foot . 15. *ÆRIDES*.

Column slightly produced into
a foot :—

Spur with neither calli nor
septum within :—

Spur compressed laterally,
deep, pubescent at the
mouth; side-lobes of lip
none 16. *RYNCHOSTYLIS*.

Spur not compressed,
rarely (in *Vanda*)
reduced to a gibbous
swelling :—

Side-lobes of lip usually
large (small in *Vanda*
Roxburghii), spur
widely funnel-shaped,
glabrous at the
mouth; flowers usu-
ally large (small in
Vanda parviflora)
caudicle of pollinia
short and broad . 17. *VANDA*.

Side-lobes of lip small
or none; spur narrow
and cylindric, or short
and widely saccate;
mouth naked or fim-
briate; caudicle of
pollinia very narrow

18. **SACCOLABIUM.**

Spur within partially or
completely occluded by
calli:—

Spur occluded by a dorsal
scale or by calli on
the anterior or posterior
walls, but without a
septum . . .

19. **CLEISOSTOMA.**

Spur within partially
occluded by calli and
divided by a vertical
antero-posterior septum
into two lateral
chambers . . .

20. **SARCANTHUS.**

Pollinia powdery or lamellate, not waxy:—

Anther terminal, pollinia 2 or 4; leaf solitary,
radical, appearing after the flowers . . .

21. **POGONIA.**

Anther dorsal; pollinia 2, bipartite;
leaves several, appearing with the flower,
racemes drooping; lip with a concave
or saccate much depressed hypophylla
jointed at a right angle to the epichile . . .

22. **EPIPACTIS.**

Stigma single, antecus; lip saccate, the
sac usually setose within . . .

23. **GOODYERA.**

Stigmas two, distant, lateral; pollinia
bipartite; lip saccate, the sac with
calli of laminæ within . . .

24. **ZEUXINE.**

Anthers two, each with one perfect cell; cells
sessile on the column, remote or contiguous,
always separate; pollinia 2, often bipartite,
adnate with or without caudicles to separate
glands; leaves flat, membranous. Terrestrial
herbs . . .

25. **HABENARIA.**

1. OBERONIA, Lindl. ; Fl. Brit. Ind. v, 675.

Epiphytic herbs, with usually very short often tufted stems. *Leaves* coriaceous or fleshy, usually ensiform distichous and equitant, very rarely terete. *Flowers* minute, in dense sub-cylindric spikes, or racemes, expanding centrifugally. *Sepals* broadly ovate or oblong, subequal. *Petals* as wide as or narrower than the sepals. *Lip* larger than the sepals, 2-4-lobed, the hypochile more or less concave. *Column* very short and stout, rarely winged. *Anther* terminal or incumbent ; pollinia 4, cohering in pairs, waxy.—Species about 60, Indo-Malayan region, extending to China, Australia and the Pacific Islands.

Lip without lateral lobes or basal auricles . . . 1. *O. pachyrachis*.

Lip with lateral lobes :—

Lip oblong, with small lateral lobes . . . 2. *O. Falconeri*.

Lip obovate, with large broad lateral lobes . . . 3. *O. ensiformis*.

1. *O. pachyrachis*, Reichb. f. in Herb. Kew. ex Hook. f. in F. B. I. V, 681 ; King and Panl. in Ann. R. Bot. Gard. Calc. viii, 4, t. 3 ; Duthie id., ix, pt. 2, 85.

Stems very short, tufted. *Leaves* 3-4 in. long, narrowly ensiform and slightly falcate, acute. *Peduncle* of inflorescence, short, broad, compressed, adnate to a leaf nearly to its apex. *Spike* 4-5 in. long, equalling or a little longer than its leaf. *Flowers* minute, pale-brown, sunk singly in rather distant pits in the fleshy rhachis ; bracts ovate-rotund, irregularly serrulate. *Sepals* elliptic, obtuse, glandular on the back, not reflexed. *Petals* smaller, linear-oblong, obtuse, subentire. *Lip* without lateral lobes or basal auricles, orbicular-elliptic, obtuse, concave, entire or slightly erose at the apex and with a deep depression at the base. *Capsule* short, turgid, often gibbous ; ribs not prominent.

Dehra Dun, on trunks and branches of trees (Vicary, Falconer, Duthie, etc.). Flowers after the rainy season. **DISTRIB.** : Outer ranges of Himalaya from Garhwal eastwards to Sikkim, up to 4,000 ft. ; also on the Khasia Hills.

2. *O. Falconeri*, Hook. f. in F. B. I. V, 678 ; Ic. Pl. t. 1780 ; Prain Beng. Pl. 1004 ; Duthie in Ann. R. Bot. Gard. Calc. ix, pt. 2, 86, t. 94 ; Cooke Fl. Bomb. ii, 676. *O. iridifolia*, Wall. (not of Lindl.).

Stems short. *Leaves* 1-2½ in. long, broadly ensiform, straight or falcate, acute, coriaceous. *Peduncle* of inflorescence, stout, shorter than the leaves, terete, bracteate. *Racemes* erect or decurved, longer than the leaves; rhachis stout, deeply grooved in fruit. *Flowers* minute, shortly stalked; floral bract longer than ovary, ovate-lanceolate, acuminate, the margins serrulate. *Sepals* and *petals* brownish-yellow. *Sepals* ovate, acute, reflexed. *Petals* spreading, falcately lanceolate, obtuse, longer and narrower than the sepals. *Lip* oblong or subquadrate, green, the upper surface glistening with many gland-like specks; lateral lobes small, with truncate emarginate tips; the apex with two small incurved obtuse lobes separated by a broad sinus. *Anther* obovate, its lip emarginate. *Capsule* ½-¾ in. long, shortly stalked.

Dehra Dun (Wallich, Falconer, Duthie, etc.). Common as an epiphyte on mango trees. Flowers in Sep. **DISTRIB.** : Outer ranges of Himalaya from the Jumna to Sikkim, up to 3,500 ft.; also on the Khasia Hills and in Chota Nagpur and in the Konkan.

3. *O. ensiformis*, Lindl. *Fol. Orch. Oberon*, 4; *F. B. I.* V, 679; King and Pantl. in *Ann. R. Bot. Gard. Calc.* viii, 9, t. 9; Duthie *id.* *ib.*, pt. 2, 86.

Stems 2½-3½ ft. long, *Leaves* 10-18 in. long and up to ¾ in. wide, linear-ensiform, acuminate, falcate. *Inflorescence* erect, shorter than the leaves, subtruncate, its peduncle 2-2½ in. long, bearing many minute lanceolate appressed pale bracteoles; raceme about twice the length of the peduncle; its rhachis thick, fleshy, terete; floral bracts longer than the ovary, convolute, ovate-rotund, subacute, erose. *Flowers* ⅓ in. long, not sunk in the rhachis, pale-brown. *Sepals* reflexed, subequal, broadly ovate, subacute, entire not ciliolate. *Petals* ovate, subacute, stiffly pubescent, the edges entire and ciliolate. *Lip* twice as long as the sepals, 3-lobed, with two large rounded entire basal lobes; mesochile subquadrate, smooth, slightly concave, bearing on its edges two large projecting blister-like processes; terminal lobe obreniform, with two rounded lobules separated by a broad subquadrate apical sinus, the whole surface and margins of lip, except the smooth mesochile, clothed with stiff hairs.

Dehra Dun, chiefly on sal trees (Falconer, King, Mackinnon, Duthie). Flowers during Nov. **DISTRIB.** : Up to 3,000 ft. on the adjacent Himalaya, extending eastwards to Nepal, Sikkim and the Khasia Hills; recorded also from the Nilgiris.

2. MICROSTYLIS, Nutt. ; Fl. Brit. Ind. v, 686.

Terrestrial or epiphytic, rarely saprophytes, often pseudo-bulbous. *Leaves* one or more, membranous, plicate, continuous with their sheaths. *Flowers* small, in terminal racemes, resupinate. *Sepals* spreading or recurved, subequal. *Petals* narrower than the sepals and about as long. *Lip* adnate to base of column, usually flat, with or without basal lobes ; apex emarginate or 2-3-lobed. *Column* usually very short with two short spreading arms. *Anther* subterminal, or accumbent, 2-celled ; pollinia 4, ovoid or obovoid, waxy.—Species about 70, in temperate and tropical Asia and America.

M. Mackinnoni. *Duthie in Journ. As. Soc. Beng. lxxi, pt. 2, 37 ; Ann., R. Bot. Gard. Calc. ix, pt. 2, 88, t. 95.*

Terrestrial, whole plant up to 7 in. high. *Stem* short, swollen below, rising from the base of the previous year's pseudo-bulb. *Leaves* two or three, horizontal, unequal, the large t 2½ in. long by 1 in. broad, ovate, obtuse, cordate and amplexicaul at the base, fleshy ; upper surface dark brownish-green ; the lower surface purplish ; nerves 3-7, reddish-purple, prominent beneath, the interspaces bullate. *Scape* about 3 in. long, sharply 4-angular. *Receptacle* about as long as the scape ; bracts subulate, longer than the ovary, reflexed, persistent. *Flowers* sessile, about ½ in. long, dull-yellowish and reddish-purple. *Dorsal sepal* ovate-lanceolate, subacute ; lateral shorter, subfalcate, edges of all reflexed. *Petals* linear, shorter than the sepals, reflexed. *Lip* with a prominent transverse rim dividing its basal and apical portions ; basal lobes falcately ovate-lanceolate, often continuous or overlapping at the tips ; apical portion deeply bifid and protruded, crimson-purple. *Column* with fleshy rounded arms. *Anthers* with a truncate or emarginate lip. *Ovary* clavate, not twisted.

Dehra Dun, on Kalanga hill, at 2-3,000 ft. (P. W. Mackinnon). *Flowers* July and Aug. **DISTRIB.** : Outer ranges of Garhwal Himalaya, up to 6,000 ft., easily distinguished from *M. Wallichii* by its leaf-coloration ; also the flowers are smaller and the lip is very differently shaped.

3. LIPARIS, Rich. ; Fl. Brit. Ind. v, 691.

Terrestrial or epiphytic herbs, with or without pseudobulbs. *Leaves* one or more, membranous or coriaceous, continuous with the sheath or thickened and jointed at the base. *Flowers* small,

in terminal racemes, resupinate or not. *Sepals* spreading or recurved, the margins usually revolute. *Petals* much narrower than the sepals and about as long. *Lip* adnate to the base of the column, usually broad, flat or deflexed from the middle, sometimes concave and with calli near the base. *Column* elongate, often arched, usually winged near the apex and tumid, or dilated and compressed at the base. *Anther* terminal; *pollinia* 4.—Species about 120, in temperate and tropical regions.

Leaf solitary, membranous	1. <i>L. diodon</i> .
Leaves two, coriaceous	2. <i>L. longipes</i> .

1. *L. diodon*, Reichb. f. in *Linnaea* xli, 43; Ridley in *Journ. Linn. Soc.* xxii, 285; F. B. I. V, 695; Duthie in *Ann. R. Bot. Gard. Calc.* ix, part 2, 97.

Leaf solitary, elongate, spatulate, obtuse, membranous. *Scape* angled, naked; bracts minute. *Sepals* linear. *Petals* filiform. *Lip* cuneate, angled on both sides at the base, then dilated, subquadrate, crenulate, apiculate. *Column* slender, curved, 2-toothed at the base. *Anther* not beaked.

Dehra Dun (Hort. W. Sanders). I have seen no specimens of this plant.

2. *L. longipes*, Lindl. in *Wall. Pl. As. Rur.* i, 31, t. 35; F. B. I. V, 703; K. & P. in *Ann. R. Bot. Gard. Calc.* viii, 29, t. 37; Duthie *id.* ix, part 2, 97. *L. spathulata*, Lindl.

Epiphytic. Pseudobulbs close together in a row, cylindrical and stem like or swollen at the base, 3-6 in. long, with a few vertical striae and with tightly clasping sheaths. *Leaves* 2, jointed at the base upon the leaf-sheath or on pseudobulbs, 4-6 in. long, oblanceolate-oblong, subacute, to acuminate, sometimes aristate. *Inflorescence* erect, shorter or longer than the leaves; peduncle slender, terete, strigulate; raceme twice as long as the peduncle, many-flowered; floral bracts linear-lanceolate, shorter than the pedicelled ovary. *Flowers* about $\frac{1}{4}$ in. long, pale yellowish-green. *Sepals* 1-nerved, linear-oblong, subacute. *Petals* shorter than the sepals, linear, obtuse, reflexed, and with recurved margins as are the sepals. *Lip* about as long as the lateral sepals, broadly oblong, recurved from about the middle, inner margins at the base much thickened so as to form triangular processes but without true calli; margins entire, the apex broad and shortly apiculate. *Column* slightly curved and with small rounded wings.

Dehra Dun (Falconer, Mackinnon, Duthie). Flowers in. Sep. **DISTRIB.** : Subtrop. Himalaya in Garhwal and Kumaon, up to 3,000 ft., and eastwards to Sikkim, Bhutan and the Khasia Hills, also on the Nilgiris and in Ceylon, extending to China and to the Malay and Pacific Islands. A widely distributed and polymorphic species. The Dehra Dun plant agrees best with Lindley's *L. spathulata*, which has shorter and thicker pseudobulbs, rather broader leaves and shorter racemes than in the type. Hooker observes that it occurs frequently in company with the form having long pseudobulbs, and that intermediates abound.

4. **DENDROBIUM**, Swartz ; Fl. Brit. Ind. v, 710.

Epiphytic herbs. *Pseudobulbs* short and fleshy or elongate and stem-like, usually tufted. *Leaves* usually sessile and with slender bases, never plicate. *Flowers* solitary or in fascicles or racemes, often large and showy. *Sepals* subequal, the lateral pair obliquely adnate to the foot of the column and forming with it a sac or mentum. *Petals* usually similar to the sepals. *Lip* sessile or clawed at the base, adnate to and incumbent on the foot of the column ; side-lobes embracing the column, or spreading, or absent ; terminal lobe broad or narrow, flat convex concave or saccate, the disk sometimes lamellate. *Column* short, with a long or short foot and with usually a nectar-secreting cavity at its extremity, the apex angled or 2-toothed. *Anther* 2-celled ; pollinia 4, equal in length, usually all slightly coherent but sometimes in free pairs. ovoid or oblong, slightly compressed, waxy.—Species 700 or more, in Temp. and Trop. regions of both hemispheres.

Flowers small, not exceeding $\frac{1}{2}$ in. across, dull-yellow with stripes of red spots 1. *D. bicameratum*.

Flowers about $1\frac{1}{2}$ in. across or larger :—

Basal portion of lip convolute :—

Apical portion of lip pale-yellow, basal portion white 2. *D. primulinum*.

Lip pale-yellow with purple veins at the base 3. *D. Pierardi*.

Lip convolute throughout its length, pale-yellow with reddish-purple veins 4. *D. Gamblei*.

1. **D. bicameratum**. Lindl. in *Bot. Reg.* (1839), *Misc.* 85 ; *F. B. I.* V, 729 ; *K. & P. Ann. R. Bot. Gard. Calc.*, viii, 42, t. 56 ; *Duthie id.* ix, part 2, 95 ; *Prair Beng. Pl.* 1,009. *D. breviflorum* Lindl.? *D. bulbiflorum*, *Falc. mss.* in *F. B. I. l. c.* ; *Id. Pl.* t. 2028.

Stems 12-18 in. long, clavate or fusiform. *Leaves* coriaceous, 3-4 in. long, linear-lanceolate to elliptic-oblong, obliquely and minutely 2-fid. at the apex. *Flowers* about $\frac{1}{2}$ in. across, dingy-yellow speckled with stripes of red, densely crowded on a short sheathed peduncle ; flowering bract sheathing the shortly stalked ovary. *Dorsal sepal* ovate-oblong, subacute ; lateral pair triangular, concave, subacute. *Petals* about as long as the sepals, broadly elliptic, obtuse. *Lip* fleshy, concave, 3-lobed ; side lobes small, erect, triangular, acute ; mid-lobe very short, truncate, the disk fleshy and smooth. *Column* very short, with two large oblong nectar-secreting cells. *Mentum* urceolate. *Anther* fleshy.

Dehra Dun (Gollan, Gamble). Flowers in Aug. **DISTRIB.** : Outer Himalayan ranges of Garhwal and Kumaon, up to about 4,000 ft., and eastwards to Sikkim, the Khasia Hills, and Burma ; it occurs also on Parasnath in Behar.

2. **D. primulinum**, Lindl. in *Gard. Chron.* (1858) 223 ; *Journ. Linn. Soc.* iii, 12 ; *F. B. I.* v, 735 ; *Duthie in Ann. R. Bot. Gard. Calc.* ix, pt. 2, 97, t. 98.

Stems 10-12 in. long, pendulous. *Leaves* about 4 in. long, broadly oblong, coriaceous, the upper ones smaller. *Flowers* solitary from the nodes of the leafless stems, shortly pedicelled, $2\frac{1}{2}$ in. across ; floral bracts minute, emarginate. *Sepals* and *petals* white, or tinged with pink or pale-blue. *Sepals* narrowly lanceolate, acuminate, spreading or reflexed. *Petals* smaller, linear-lanceolate, acute, erect or spreading. *Lip* broadly oblong (when spread flat), very shortly clawed, about $1\frac{1}{2}$ in. long and nearly as broad, convolute towards the base, with a broad central lamellate band, margins strongly ciliate ; basal portion white ; apical portion pale primrose-yellow, puberulous ; mentum rounded. *Column* produced into a rather long foot and with 2 horn-like processes at the apex, pale-blue. *Anther* puberulous, its lip toothed.

Dehra Dun, at Nalapani (Gamble). Flowers in April. **DISTRIB.** Outer Himalayan ranges of Garhwal up to about 3,000 ft. There has been some confusion in regard to the distribution of this species. Under *D. crepidatum* in the *Fl. Brit. Ind.* V, 740 Sir Joseph Hooker remarks. "A specimen in Herb. Kew, marked 'Garhwal, Falconer'

is perhaps a cultivated one." This evidently refers to the two scraps of *D. crepidatum* glued down on the same sheet with Falconer's specimens of *D. primulinum*. There is also on the same sheet Falconer's original ticket referring to the specimens of *D. primulinum* and bearing the manuscript name of *D. petrocarpum*. Both *D. primulinum* and *D. crepidatum* were found by Falconer, and they were no doubt cultivated in the Saharanpur Garden and sent thence to Kew under one name. The supposition that *D. primulinum* was ever found wild in Sikkim is probably an error.

3. *D. Pierardi*, Roxb. in Hook. Exot. Fl. t. 9; Fl. Ind. iii, 483; F. B. I. V, 738; Prain Beng. Pl. 1009; K. & P. in Ann. R. Bot. Gard. Calc. viii, 51, t. 72; Duthie id. ix, pt. 2, 97.

Stems slender, pendulous, 2-3 ft. long. *Leaves* sessile, 2-5 in. long, lanceolate to ovate-lanceolate, sub-acuminate, caducous. *Flowers* about 1½ in. across, solitary or 2-3 together, on very short minutely bracteate peduncles which proceed from the slightly swollen nodes of the leafless stems, rose-coloured or pale-purple, the lip yellow with purple radiating veins at the base. *Sepals* subequal, oblong-lanceolate, subacute. *Petals* elliptic, obtuse, as long as the sepals, but broader. *Lip* sub-orbicular (when spread out), without side-lobes, the claw very short, edges shortly ciliate on the apical half, basal portion convolute, upper surface pubescent. *Column* about equalling its foot in length the latter with a nectary at its extremity. *Anther* with a curved erose lip. *Capsule* about 2 in. long.

Dohra Dun, on the banks of the Song river and in the adjacent forests (Gamble, Mackinnon). Flowers in May. **DISTRIB.:** Outer ranges of the Kumaon Himalaya up to about 3,000 ft., extending eastwards to Nepal, Sikkim and the Khasia Hills; also in Assam, Bengal, Chota Nagpur and southwards to S. India and Tenasserim, and extending to China.

4. *D. Gamblei*, King and Pantl. in Journ. As. Soc. Beng. LXVI, part 2, 584; Duthie in Ann. R. Bot. Gard. Calc. ix, part 2, 99, t. 99.

Stems slender, pendulous, 1-2 ft. long, with short scarious sheaths at the nodes. *Leaves* sessile, up to 3 in. long, subfalcately ovate-lanceolate, subacuminate, thick, caducous; veins obscure. *Peduncles* solitary or in pairs from the nodes of the leafless stems; floral bract very small, lanceolate, acuminate. *Flowers* about 1½ in. across, inodorous. *Sepals* and *petals* subequal, lanceolate, acuminate, with reflexed tips, pale greenish-yellow, 5-nerved. *Lip* about ¾ in. long,

convolute throughout its length, broadly elliptic-oblong or subquadrate when spread out; margins fimbriate-serrate except at the cuneate and clawed base; apex obtusely cuspidate; upper surface with a broad central grooved band villous towards the apex; veins reddish-purple, bifurcating within the margin. *Column* nearly $\frac{1}{2}$ in. long, its narrow elongate foot with a small ovate laciniate nectary at its base; mentum elongate, slightly curved; and spur-like. *Anther* minutely papillose outside, its lip denticulate.

Delhra Dun (Gamble) on trees. Flowers June-August. **DISTRIB.:** Garhwal Himalaya, up to 3,000 ft. Recorded also as occurring on the Nilgiri Hills. It is closely allied to *D. macrostachyum*, Lindl a species of S. India and Ceylon.

5. BULBOPHYLLUM, Thouars; Fl. Brit. Ind. v, 752.

Epiphytic herbs. *Pseudobulbs* from a creeping rhizome, rarely none, 1 (rarely 2)-leaved. *Flowers* on scapes from the rhizome and usually close to the pseudobulbs, solitary, capitate, umbellate, or in spikes or racemes. *Sepals* subequal or the lateral pair rather longer than the dorsal one and free or connate under the lip. *Petals* usually smaller than the dorsal sepal. *Lip* jointed on the foot of the column, mobile, small and usually much recurved. *Column* very short, often 2-aristate at the apex. *Anther* 2-celled; pollinia 4, free, the two inner smaller (rarely suppressed).—Species nearly 200, chiefly in tropical and sub-tropical Asia, a few in Africa, America and Australia.

B. polyrhizum, Lindl. *Gen. and Spec. Orch.* 53; *Hk. in F. B. I.* v, 767; *Ann. R. Bot. Gard. Calc.* V, pt. 1, 15, t. 23; *K. and P. id.* viii, 70, t. 95; *Duthie id.* ix, pt. 2, 105.

Rhizome thread-like, branching; pseudobulbs crowded or distant, globular or ovoid, smooth, base broad. *Leaf* $2\frac{1}{2}$ in. long, narrowly oblong, subacute, slightly narrowed to the sessile base, deciduous before the flowers open. *Scape* filiform, about 4 in. long, the suberect peduncle longer than the raceme, bearing 1 or 2 minute bracts; raceme inclined. *Flowers* about 6, distant, secund, pale-yellow, $\frac{1}{2}$ in. long; floral bracts minute, oblong, about as long as the short stalk of ovary. *Sepals* spreading; dorsal one ovate, concave; lateral pair longer, oblong-lanceolate, subacute, 3-nerved. *Petals* much shorter than the sepals, broadly ovate, acute, 1-nerved. *Lip* stalked, deflexed, oblong, obtuse, scaberulous. *Column* shortly toothed, its foot short and slightly curved. *Anther* papillose, its lip acute.

Dehra Dun (Gamble); flowers during June and July. **DISTRIB.:** Kumaon in the Gori Valley, up to 4,500 ft. (Duthie), and from Nepal eastwards to Sikkim and on the Khasia and Naga Hills.

6. PHOLIDOTA, Lindl. ; Fl. Brit. Ind. v, 844.

Epiphytes with jointed and often branching stems, the internodes resembling pseudobulbs, or with tufted pseudobulbs. *Leaves* in pairs or solitary, membranous, many-nerved. *Flowers* small, racemose, subglobose, expanding from above downwards, usually drooping and distichous; peduncles ebracteate, terminal or from the base of the pseudobulb; floral bracts large, persistent. *Sepals* concave. *Petals* narrower than sepals. *Lip* more or less cymbiform, usually without side-lobes. *Column* without a foot, short, hooded or winged at the apex. *Anther* subglobose; pollinia 4, waxy, subglobose or clavate, cohering in pairs to one or two membranes.—Species about 20, in India, Malaya and China.

- | | |
|---------------------------|--|
| Leaf solitary | 1. <i>P. imbricata</i> . |
| Leaves in pairs | 2. <i>P. articulata</i> , var. <i>Griffithii</i> . |

1. *P. imbricata*, Lindl. in Hook. *Fl. Exot.* t. 138; *Gen. & Spec. Orch.* 37; *F. B. I.* v, 845; *K. & P. in Ann. R. Bot. Gard. Calc.* viii, 144, t. 201; *Duthie id.* ix, pt. 2, 115; *Prair. Beng. Pl.* 1012; *Cooke Fl. Bomb.* ii, 688. *Ptilocnema bracteatum*, Don *Prod.* 33. *Cymbidium imbricatum*, Roxb. *Fl. Ind.* iii, 460

A pendent epiphyte. *Pseudobulbs* caespitose, cylindric, thickened at the base, 2-3 in. long, or shorter and more ovoid, usually partly enveloped in large fibrous sheaths. *Lea* solitary, 6-12 in. long, elliptic-oblanccolate or lanceolate, acute, tapering to the stout petiole, strongly 3-5-nerved. *Inflorescence* from the top of a pseudobulb, drooping, 8-10 in. long, lengthening in fruit; peduncle slender, as long as or longer than the dense many-flowered distichous raceme. *Flowers* about $\frac{1}{2}$ in. long, white tinged with pink or yellow; fl. bract longer than the slender stalked ovary, convolute, subrotund, minutely apiculate, many-nerved, persistent, pale-brown. *Sepals* $\frac{1}{4}$ in. long; dorsal sepal orbicular, 3-nerved; lateral pair connate at the base, cymbiform, winged along the keel. *Petals* linear-oblong, subacute. *Lip* 3-lobed, saccate between the large rounded lateral lobes; terminal lobe divided at the apex into two small oblong lobules. *Column*

broad, its upper half winged. *Pollinia* clavate, attached in pairs to two small membranes. *Capsule* about $\frac{1}{2}$ in. long, ellipsoid.

Dehra Dun (Mackinnon, Gamble, Duthie). Flowers June-Aug. **DISTRIB.:** Outer ranges of the Garhwal and Kumaon Himalaya up to 4,000 ft., and eastwards to Nepal, Sikkim and Bhutan; also on the Khasia Hills, in Chota Nagpur, Chittagong, Konkan and Kanara, and south to S. India and Ceylon; extending to the Andaman Islands, Burma, Malay Pen., China, Pacific Islands and Australia.

2. *P. articulata*, Lindl. in Wall. Cat. 1992, VAR. *Griffithii*, K. & P. in Ann. R. Bot. Gard. Calc. viii, 147, t. 204; Duthie id. ix, pt. 2, 116. *P. Griffithii*, Hook. f. Ic. Pl. t. 1881; F. B. I. v, 845.

Internodes of pointed stems terete, slightly furrowed, 3-5 in. long, the nodes bearing a few short broad scarious sheaths. *Leaves* 2, narrowly oblong-lanceolate, 3-4 in. long, tapering at each end. *Racemes* 1-2 in. long, decurved; peduncles from the top of the pseudobulbs; rhachis flexuose; floral bracts $\frac{1}{2}$ in. long, oblong, obtuse, pale-brown. *Flowers* white tinged with brown and pink. *Sepals* $\frac{1}{2}$ in. long, the dorsal one broadly ovate or suborbicular; lateral ovate-lanceolate, 5-nerved. *Petals* elliptic-lanceolate. *Lip* cymbiform, with a didymous terminal lobe; side-lobes none; base with 5 lamellate nerves. *Column* suborbicular; rostellum ovate-acuminate. *Pollinia* subglobose.

Dehra Dun, on sal trees (Mackinnon Gamble). **DISTRIB.:** Outer ranges of Garhwal Himalaya up to 4,000 ft. and eastwards to Sikkim and the Khasia Hills. This plant is similar in most respects to the type, but smaller in all its parts, and the leaves are much narrower.

7. *PACHYSTOMA*, Flume; Fl. Brit. Ind. v, 811.

Terrestrial herbs with rather thick rhizomes. *Leaves* solitary or in pairs, usually appearing after the flowers, long, narrow, many-nerved. *Flowers* rather small, pendulous, white or pale-purple, puberulous, in racemes or on long pale scapes with clasping striate sheaths; bracts often large and scarious. *Sepals* unequal, the dorsal one blunt, lateral subacute. *Petals* narrow, spatulate. *Lip* sessile on the footless column, erect; side-lobes oblong, acute; terminal small; disk with 3-5 deeply crested and fimbriate ridges. *Column* slender, clavate above. *Anther* dorsal; *pollinia* 8, pyriform, waxy, adhering to a single membrane.—Species 6-8, in India, Malaya and Africa.

P. senile, Reichb. f. in Bonpl. iii, 251; F. B. I. v, 812; K & P. in Ann. R. Bot. Gard. Calc viii, 101, t. 140; Duthie id. ix, pt. 2, 108; Prain Beng. Pl. 1014.

An erect terrestrial herb, leafless when in flower. *Rhizome* rather stout, producing scapes and solitary leaves at intervals of about 2 in. *Leaf* longer than the scapes, linear, membranous, 4-5-nerved. *Scapes* about 12 in. high, clothed with many pale striate sheaths 1-2 in. long. *Racemes* many-flowered. *Flowers* about $\frac{1}{2}$ in. across, greenish-white tinged with pink or purple, gland-puberulous; floral bract longer than the curved stalked pubescent ovary, erect, lanceolate, acuminate. *Sepals* unequal; dorsal oblong, rounded at apex; lateral pair spreading oblong-lanceolate, subacute. *Petals* narrowly spatulate, re-curved puberulous as are the sepals. *Lip* sessile on the base of the column, 3-lobed, broadly oblong, gibbous at the base, pubescent; side-lobes acutely falcate; terminal one suborbicular, recurved and abruptly acuminate at the apex; upper surface of disk with 5 stout crested ridges extending from base to apex. *Column* dilated upwards, puberulous. *Anther* on the back of the column, indistinctly 8-celled.

Dehra Dun (T. Thomson, Mackinnon); also in many localities within the area of this flora from the Jumna eastwards to Moradabad and N. Oudh. Flowers in April. **DISTRIB.**: Outer Himalayan ranges from Garhwal to Sikkim; also on the Khasia Hills, and eastwards to the Nicobar Islands, and the Malay Archipelago to S. China. It occurs also in N. Bengal and Chota Nagpur and extends southwards to S. India and Ceylon.

8. THUNIA, Reichb.; included under *Phaius* in Fl. Brit. Ind. v, 816.

Terrestrial, rarely epiphytic herbs. *Stems* slender or equally thickened along their entire length, elongate, leafy, with many foliaceous sheaths below. *Leaves* distichous, lanceolate, glaucous. *Flowers* appearing with leaves, large, showy, in terminal drooping racemes; bracts large, scarious. *Sepals* erecto-patent, subequal, lanceolate, acute. *Petals* like the sepals. *Lip* adnate to the base of the footless column, shortly spurred; side-lobes short, involving the column; mid-lobe fringed. *Anther* narrow, pendulous, incompletely 4-celled; pollinia 8, waxy, attached in fours to a granular membrane; rostellum 3-lobed.—Species about 9, in tropical and temperate regions of the Old World.

T. venosa, Rolfe in *Orch. Rev.* (1905)206; Cooke *Fl. Bomb.* ii, 692. *Phaius albus*, Lindl. in *Wall. Pl. As. Rar.* ii (1831), 85 t. 198; *Bot. Reg.* (1838), t. 33 (not of Lindl.); *Bot. Mag.* t. 3991; *Paxt. Mag. Bot.* xv, 125; *F. B. I.* v, 818 in part; K. & P. in *Ann. R. Bot. Gard. Calc.* viii, 110, t. 153; Duthie *id.* ix pt. 2, 109; *Prair. Beng. Pl.* 1014. *Limodorum bracteatum*, Roxb. *Fl. Ind.*, iii., 466.

Pseudobulbs none. *Stems* stout, erect, tufted, 1-3 ft. long, bearing many tubular sheaths at the base. *Leaves* many, sessile, 1½-3 ft. long, narrowly elliptic-lanceolate or oblong-lanceolate, acuminate, membranous, glaucous beneath, usually plicate. *Racemes* 4-6-fl. 4-6 in. long, shortly peduncled and with a single elongated sheath. *Flowers* 2-2½ in. long; bracts equalling or exceeding the long-stalked ovary, oblong, cymbiform, acute, pale-coloured. *Lip* broadly oblong-panduriform when spread out; lower half convolute into a tube; upper portion cucullate, forming a rounded shell-like mouth slightly acuminate, the margins undulate and unequally dentate; upper surface with 7-9 crested ridges. *Spur* horizontal, slightly bifid. *Column* with a short foot, somewhat winged at the apex. *Pollinia* unequal, elongate. *Capsule* 1½ in. long, narrowly elliptic.

Dehra Dun (Gamble, Mackinnon), sometimes found as an epiphyte on sal trees. Flowers in June. **DISTRIB.:** Outer Himalayan ranges of Garhwal and Kumaon, up to about 4,000 ft. It extends eastwards to Sikkim, Assam, the Khasia Hills and Burma, and occurs also in Chota Nagpur. A variety with shorter and more congested racemes is mentioned by Cooke as having been found by Dalzell on the Matheran Hill in Konkan.

9. ERIA, Lindl.; Fl. Brit. Ind. v, 785.

Epiphytic and usually pseudobulbous. *Pseudobulbs* often elongated and stem-like. *Flowers* never large, rarely showy, arranged in racemes spikes or heads or on 1-2-flowered pedicels, often pubescent or tomentose. *Sepals* free from each other, adnate to the long foot of the column and with it usually forming a spur-like or saccate mentum. *Petals* similar to the sepals. *Lip* sessile on the foot of the column and incumbent. *Column* short and straight or long and somewhat curved, prolonged below as a foot. *Anther* accumbent, imperfectly 4-celled or 8-celled; pollinia 8, pyriform or broadly obovoid, waxy, attached in fours by their

bases to a granular membrane, or sometimes all attached together to a single viscus.—Species over 300, chiefly in Tropical Asia.

Flowers in dense spikes, glabrous or sparsely hairy, not woolly 1. *E. convallarioides*.

Flowers distant, sessile, on scapes, densely woolly outside 2. *E. flava*.

1. *E. convallarioides*, Lindl. in Wall. Cat. 1975; Gen. & Sp. Orch. 70; F. B. I. v, 791; K. & P. in Ann. R. Bot. Gard. Calc. viii, 118, t. 161; Duthie id. ix, pt. 2. 110. *Octomeria spicata*, Don Prod. 31.

Pseudobulbs tufted, flattened, 3-7 in. long, covered when young with large loose sheaths. *Leaves* four to six, subcoriaceous, 4-7 in. long, elliptic-lanceolate or oblanceolate, acute, many-nerved, but not plicate. *Spikes* produced on the young growths, cylindric, decurved; peduncle about 1 in. long, stout, naked below. *Flowers* many, white tinged with yellow, densely crowded, subglobose, about $\frac{1}{4}$ in. across, inodorous; floral bracts equalling the sessile pubescent ovary, ovate, lanceolate, concave. *Sepals* broadly ovate, obtuse; lateral pair deeply concave. *Petals* oblanceolate-oblong, spreading, nearly as long as the sepals but narrower. *Lip* obscurely 3-lobed, cuneate, concave, apex subacute, the disk without lamellæ. *Column* rather slender, with a long curved foot. *Pollinia* clavate, attached to a large translucent viscus. *Capsule* oblong, obtuse, not winged.

Dehra Dun (P. W. Mackinnon), flowering during Aug. and Sep. **DISTRIB.**: Outer Himalayan ranges from Garhwal eastwards to Nepal and Sikkim, up to 4,000 ft., also in Tenasserim.

2. *E. flava*, Lindl. in Wall. Cat. (in part); Gen. & Sp. Orch. 65; F. B. I. v, 801; K. & Pantl. in Ann. R. Bot. Gard. Calc. viii, 126, t. 175; Duthie id. ix, pt. 2, 111; Prain Beng. Pl. 1013.

Rhizome stout, clothed with imbricating tubular sheaths. *Pseudobulbs* large, stem-like, of 4-6 nodes, 3-5 in. long, much compressed, sheathed at the base. *Leaves* 6-10 in. long, narrowly oblong, acuminate, tapering to the base, subcoriaceous. *Scapes* from the base of the pseudobulbs, about as long as the leaves, clothed with dense pale tomentum and with many sheaths at the base. *Flowers* distant, yellow, $\frac{3}{4}$ in. across, densely white-woolly outside; floral bracts lanceolate, pilose, shorter than the pinkish pilose stalked ovary, shrivelling as the flowers open. *Dorsal sepal* small, lanceolate; lateral pair $\frac{3}{4}$ in. long, triangular, spreading. *Petals* smaller than the dorsal

sepal, lying parallel over the column, narrowly oblong, tapering to the base and apex. *Lip* oblong, 3-lobed, tumid; side-lobes narrow, truncate at the apex, puberulous and with two long tapering ridges at their junction with the disk; terminal lobe oblong, acute, recurved, slightly 2-ridged, glabrous. *Column* erect, its foot at right angles to and longer than its body. *Ovary* pinkish and densely pilose. *Pollinia* small, compressed, attached to two granular membranes. *Capsule* cylindric, $1\frac{1}{2}$ -1 $\frac{3}{4}$ in. long.

Dehra Dun (Duthie, Mackinnon); flowering in April. **DISTRIB.:** Outer Himalayan ranges of Garhwāl up to 4,000 ft. and eastwards to Bhutan; also in Chota Nagpur. In Sikkim specimens the base of the lip, on both surfaces, and the foot of the column are often blotched with reddish-purple.

10. EULOPHIA, R. Br.; Fl. Brit. Ind. vi, 1.

Terrestrial glabrous herbs with fleshy tubers or rhizomes rarely pseudobulbous. *Leaves* appearing with or after the flowers, long narrow and usually plicate. *Flowers* in racemes, rarely paniced, on a tall erect sheathed usually lateral scape. *Sepals* free, spreading, subequal. *Petals* somewhat similar to the sepals. *Lip* adnate to the base of the column or to its foot, saccate or shortly spurred at the base; side-lobes erect, embracing the column, rarely suppressed; midlobe spreading or recurved; disk usually ridged or crested. *Column* with or without a foot, its apex entire and often oblique, the margins occasionally winged or lobed. *Anther* terminal, 2-celled, sometimes with two apical processes; pollinia 2, globose, attached by a caudicle to the flat gland of the rostellum.—Species over 300, in tropical or subtropical Asia and Africa.

Column not or only slightly produced into a foot:—

Leaves appearing with the flowers:—

Lip with a short bent spur; bracts as long or longer than the ovary:—

Sepals spreading, linear-lanceolate, acuminate, green 1. *E. herbacea*.

Sepals erect, ovate-obtuse, yellowish-brown 2. *E. Mackinnoni*.

Lip saccate at the base; bracts shorter than the ovary 3. *E. explanata*.

Leaves appearing after the flowers have opened :—

Terminal lobe of lip yellow 4. *E. Hormusjii*.

Terminal lobe of lip purple 5. *E. campestris*.

Column produced into a distinct foot :—

Lateral sepals inserted on the spur; basal lobes of lip obscure 6. *E. nuda*.

Lateral sepals inserted on the foot of the column; lip with distinct basal lobes :—

Flowers not exceeding 1 in. diam., greenish-yellow tinged with purple . . 7. *E. bicarinata*.

Flowers large, exceeding $1\frac{1}{2}$ in. in diam., lemon-yellow, often spotted or streaked with lilac :—

Terminal lobe of lip $\frac{1}{2}$ as long as the rhomboid-oblong basal lobes; spur saccate, blunt 8. *E. flava*.

Terminal lobe of lip twice as long as the rounded basal lobes; spur short, curved, acute 9. *E. obtusa*.

1. *E. herbacea*, Lindl. Gen. & Spec. Orch. 182; Royle Ill. 366; F. B. I. vi, 2; Duthie in Ann. R. Bot. Gard. Calc. ix, pt. 2, 123, t. 106; Cooke Fl. Bomb. ii, 693. *E. bicolor*, Lindl. in Journ. Lim. Soc. iii, 24 (not of Dalz.). *Limodorum bicolor*, Roxb. Fl. Ind. iii, 469.

Root tuberous, the tubers about $1\frac{1}{2}$ in. long, broadly ovate. *Pseudostem* 4-6 long. *Leaves* 6-10 in. long, linear-lanceolate, variable in breadth, many-nerved, plicate. *Flowering stem* stout, 2-3 ft. high, with a few sheathing bracts towards the base. *Raceme* short, 8-10-fl.; floral bracts about as long as the ovary, linear-lanceolate, acuminate, scarious. *Flowers* appearing with the leaves, about 2 in. across, white, tinged with green, fragrant. *Sepals* $\frac{7}{8}$ - $1\frac{1}{2}$ in. long, spreading, linear-lanceolate, acuminate, green with pale margins; lateral pair adnate to the base of the column. *Petals* shorter than the sepals, pure white, elliptic or lanceolate, obtuse or acute. *Lip* $\frac{3}{4}$ in. long, white tinged with green at the base; side-lobes small oblong, rounded at the apex; midlobe oblong, rounded at apex, margins crenate; disk with five median fimbriate lamellæ; spur very short subgeniculate, obtuse. *Column* stout, $\frac{1}{4}$ in., curved and without a foot,

slightly winged. *Pollinia* transversely oblong, attached by a short broad caudicle to a triangular gland. *Capsule* about $1\frac{1}{2}$ in., ellipsoid, slightly ribbed.

Dehra Dun (Mackinnon); Siwalik range (Vicary). Flowers during June and July. **DISTRIB.**: Outer ranges of W. Himalaya up to about 5,000 ft.; also found in the Bombay Presidency and in Mysore.

2. E. Mackinnoni, Duthie in Journ. As. Soc. Beng. lxxi, pt. 2 (1902), 40; Ann. R. Bot. Gard. Calc. ix, pt. 2, 124, t. 107. E. bicolor Falc. mss. in Herb. Saharanpur (not of Lindl. nor of Dalz.).

Rhizome composed of a series of flattened triangular-shaped tubers. *Pseudostem* up to $7\frac{1}{2}$ in., proceeding from the summit of the bulb-like current year's tuber. *Leaves* usually two, appearing with the flowers, up to $2\frac{1}{2}$ ft. long and 2-3 in. wide, broadly lanceolate, acuminate, tapering into long sheaths and with a few leafless sheaths below, prominently nerved and plicate. *Flowering stem* much shorter than the leaves, rising from the side of the current year's tuber and bearing 3 or 4 loosely sheathing bracts. *Flowers* 8-10, in a lax raceme, spreading or at length deflexed, $\frac{1}{2}$ - $\frac{3}{4}$ in. long; floral bracts equalling or exceeding the ovary, linear-lanceolate, acuminate, persistent. *Sepals* and *petals* erect, fleshy, yellow tinged with reddish-brown, the veins prominent outside; dorsal sepal $\frac{3}{4}$ in. long, ovate, obtuse, subcordate at the base, the margin inflexed at the apex; lateral pair rather longer, unequal at the base. *Petals* shorter than the sepals, oblong-ovate, obtuse, their margins overlapping and inflexed at the apex. *Lip* 3-lobed, with long erect rather shallow side-lobes; its body streaked with purple on a yellow ground and with three prominent white lamellæ which extend into a carunculate area to within the base of the terminal lobe; terminal lobe broad, yellow rounded and with undulate edges. *Spur* short, geniculate. *Column* short, broadly winged, its foot very slightly produced. *Anther* yellow, with two short purple horns at the apex, its lip bifid. *Pollinia*, transversely oval, attached by a broad caudicle to a shallow crescent shaped gland.

Dehra Dun (Mackinnon, Duthie); Siwalik range (Vicary); N. Oudh in the Bahraich district (Duthie); N. W. India Royle. Flowers in July and Aug. **DISTRIB.**: Cent. Prov. in the Raipur district (J. Marten). This plant appears to be most nearly related to *E. geniculate*, King and Pantl., a very rare Sikkim species, but differing in the shape of the rhizome, the much broader leaves and in the shape and colouring of the lip.

3. *E. explanata*, Lindl. *Gen. & Sp. Orch.* 180; *F. B. I.* vi, 3; Duthie in *Ann.* ix, part 2, 125, t. 108. *Dipodium scariosum*, *Herb. Ham.*; Hook. *Ic. Pl.* 1882.

Pseudobulb about 2 in. long, ovoid, annulated. *Pseudo-stem* $1\frac{1}{2}$ -2 in. long. *Leaves* young when the plant is flowering, attaining, when fully developed, about 10 in. in length and 4 in. in width, broadly elliptic-lanceolate, acuminate, tapering below into a short petiole 7-veined. *Flowering stem* about 10 in. long, arising from below the summit of the pseudobulb, bearing a few loose sheaths at its base. *Raceme* 5-6 in. long, laxly many-fl'd.; flowering bract lanceolate, acuminate, much shorter than the slender ovary. *Flowers* about 1 in. across. Sepals and petals subequal, spreading, white or yellowish streaked with reddish-purple. *Sepals* spatulate-lanceolate, acute. *Petals* broadly oblong, rounded at the apex. *Lip* a little shorter than sepals and petals, 3-lobed, subpanduriform when flattened out, adnate by its base to the lateral sepals; basal lobes rounded, erect, white with reddish-purple branching veins, forming at the base a short conical sac; terminal lobe yellow with purplish veins terminating within the margin, oblong, with a rounded emarginate apex, the margins reflexed; disk with two prominent crenate lamellæ and a shorter interposed one, all three abruptly terminating within the margin of the apex. *Column* short, its foot slightly produced. *Anther* emarginate at the apex. *Pollinia* subglobose, attached to a short broad caudicle; gland conical.

Dehra Dun (Mackinnon); N. W. India (Falconer); Sub-Himalayan tracts of Rohilkhand and of the districts of Kheri and Gonda in N. Oudh (Duthie). Flowers in May. *DISTRIB.*: Outer Himalayan ranges of Garhwal, and in Nepal at Maghada in the Morung district (Buch.-Hamilton). This plant was regarded by Sir J. Hooker as an anomalous species with the habit of an Australian *Dipodium*.

4. *E. Hormusjii*, Duthie in *Ann. R. Bot. Gard. Calc.* ix, part 2, 125, t. 109.

Tuber depressed, transversely oval, about $1\frac{1}{2}$ in. across; *Pseudo-stem* about 4 in. long, bearing two tightly fitting sulcate subacute sheaths. *Leaves* two, developing later than the flowers, narrowly elliptic, acuminate, plicate. *Flowering stem* stout, 8-12 in. long, rising from the summit of the tuber, clothed at intervals with a few loose membranous lanceolate acuminate sheathing bracts. *Flowers* 8-10 forming a rather lax raceme about 3 in. long, and about 1 in. across, at first spreading, at length deflexed; floral bracts variable in length, lanceolate, acuminate, membranous, brownish. *Sepals* and *petals*

subequal in length, nearly $\frac{1}{2}$ in. long, narrowly oblong or oblanceolate, acuminate or abruptly mucronate, white with pink veins and tinged with pale-green at the apex. *Lip* including spur a little longer than the sepals and petals; side-lobes deep-purple, erect, rounded, entire; between the side-lobes are three prominent whitish lamellæ; midlobe orbicular, yellow spotted with purple, and with a coarsely fimbriate disk, the margin undulate and irregularly erose. *Spur* cylindric, curved, obtuse, white, grooved in front. *Column* about half as long as the lip, with a very slightly produced foot. *Pollinia* oval, attached by a short stout caudicle to a shallow crescent-shaped gland.

Dehra Dun (Mackinnon); N. Oudh, in the Kheri district (Duthie). Flowers during April. **DISTRIB.:** Outer ranges of the W. Himalaya up to 5,000 ft. from Garhwal westwards to Hazara and the Chitral district, often in pine forests. This species is nearly related to *E. campestris*, differing chiefly by its shorter scapes, larger flowers and more congested racemes. The shape of the lip and the general colouring of the flowers are also very different. *E. campestris* is essentially a species of the plains, whereas *E. Hormusjii* extends up to the temperate region of the W. Himalaya where the climatic conditions are more favourable for leaf development.

5. *E. campestris*, Wall., Cat. 7367; Royle Ill. 366; F. B. I. vi, 4; K. & P. in Ann. R. Bot. Gard. Calc. viii, 178, t. 41; Duthie id. ix, part 2, 126; Prain Beng. Pl. 1016. *E. ramentacea* and *E. rupestris*, Lindl. *E. hemileuca*, Lindl. in Journ. Linn. Soc. iii (1859), 25. *Limodorum ramentaceum*, Roxb.; Fl. Ind. iii, 467. *Bletia Dabia*, Don Prod. 30.—Vern. *Sang-misri* (Beng).

Tubers irregularly oblong, often lobed. *Leaves* two, rising from the apex of a slender sheathing pseudostem, developing long after the plant has flowered, 10-16 in. long, linear, acuminate, plicate. *Scape* 6-12 in. long, sheathed at intervals by loose membranous bracts; raceme laxly many-fl. *Flowers* drooping, subsecund, yellowish or green with pink or purple markings, about 1 in. across; floral bracts, membranous, linear or lanceolate, acuminate, usually longer than the slenderly stalked ovary. *Sepals* slightly attached to the base of the lip, linear-lanceolate, acute or acuminate, 5-7-nerved. *Petals* spreading, narrower than the sepals, oblanceolate. 3-5-nerved. *Lip* as long as the sepals, cuneate-obovate or oblong; side-lobes short, rounded or subacute, incurved round the column; midlobe orbicular quadrate or oblong, crenulate, usually purple; basal portion of disk with three median lamellæ ending in a fimbriate or tubercled patch on the terminal lobe. *Spur* short, conical subclavate or

subacute. *Column* as long as the lip, slender, without a foot. *Pollinia* broad; caudicle stout; gland elongate. *Capsule* in. long, ellipsoid.

Sub-Himalayan tracts of Rohilkhand and N. Oudh (Wallich, Duthie). Flowers Mar. to May. **DISTRIB.:** Nepal, Sikkim, Chittagong, Bengal and Upper Burma, extending to Baluchistan and Afghanistan.

6. *E. nuda*, Lindl. in Wall. Cat. 7371; F. B. I. vi, 5; Hook. f. in Ann. R. Bot. Gard. Calc. v, 32, tt. 47—50; K. & P. id. viii, 180, t. 243; Duthie id. ix, pt. 2, 127; Cooke Fl. Bomb. ii, 694.

Tuber large, spherical, smooth. *Leaves* 10-14 in. long, rising from the side of a tuber and forming by their sheaths a short pseudo-stem, elliptic-lanceolate, acute, plicate, many-nerved, narrowed at the base into a long tubular sheath. *Flowering stem* stout, erect, firm, 2-3 ft. high, rising from the base of the pseudostem, with a few loose sheaths near the base and other more distant ones higher up. *Racemes* lax, about 1½ in. long, many-fl'd. *Flowers* usually pale-green or white with purple or pink or brownish markings; floral bracts lanceolate, acute, about half as long as the stalked ovary. *Sepals* about ¾ in. long, erect, greenish-purple, linear-oblong, acute, 7-nerved; lateral pair slightly falcate, inserted on the spur of the lip, the dorsal one rather narrower. *Spur* very short, conical, obtuse, purplish-green, ribbed at the mouth. *Petals* shorter than the sepals, white, obtuse, many-nerved. *Lip* as long as the sepals, white or pale yellow flushed with pink or purple, oblong; side-lobes short, rounded; midlobe, oblong, obtuse, with a crisped margin; disk with about 9 strong prominent nerves. *Column* short, with a distinct foot, dilated at the margins. *Anther* small, its apex with two small conical processes and a third depressed one in front. *Pollinia* transversely oblong, attached by a broad caudicle to a shallow gland. *Capsule* 1½ in. long, fusiform.

N. Oudh, in the districts of Kheri and Gonda (Duthie's Collector). Flowers April-June. **DISTRIB.:** Trop. Himalaya from Nepal eastwards to Sikkim; also in Chota Nagpur, Assam, Khasia Hills, Manipur and Burma, and south to Bombay Presidency and Ceylon.

7. *E. bicarinata*, Hook. f. in F. B. I. vi, 6; K. & P. in Ann. R. Bot. Gard. Calc. viii, 180, t. 244; Duthie id. ix, pt. 2, 127; Prain Beng. Pl. 1016. *Cyrtopera bicarinata*, Lindl.

Tuber about 2 in. long, compressed, irregularly lobed. *Leaves* usually undeveloped at the time of flowering, 7-12 in. long, linear, acuminate, narrowed below into the long petiole. *Scape* erect, 10-20 in. high, with two tubular inflated sheaths at the base and a few shorter ones

higher up. *Racemes* 3-5 in. long, oblong, rather densely flowered. *Flowers* pale yellowish-green tinged with purplish-brown, 1 in. in diam.; floral bracts shorter than the stalked ovary, membranous, lanceolate. *Sepals* linear-oblong, acute, keeled, their edges reflexed and undulate; lateral pair inserted on the foot of the column, wider than the dorsal one and free from it at their bases. *Petals* narrowly elliptic, subacute, shorter and wider than the sepals. *Lip* adnate to the foot of the column, longer than the sepals, slightly saccate at the base, 3-lobed; side-lobes shallow, obtuse; veins reddish-purple, branching within the margin; terminal lobe tinged with yellow, transversely oblong, emarginate; disk with two short smooth ridges half as long as the side-lobes and ending in a free triangular tooth, in front of which rise five unequal carunculate ridges extending to the terminal lobe. *Anther* apiculate in front. *Pollinia* broadly triangular, attached by a broad caudicle to a thin angular gland.

Sub-Himalayan tract in Pilibhit and in the Kheri district of N. Oudh (Duthie). Flowers in March and April. **DISTRIB.** : N. Bengal, Sikkim, Assam, Khasia Hills, Manipur and Upper Burma.

S. E. flava, Hook. f. in *F. B. I.* vi, 7; *Prairie. Beng. Pl.* 1016; *Duthie in Ann. R. Bot. Gard. Calc.* ix, part 2, 128, t. 110. *Cyrtopera flava*, Lindl.; *Royle Ill.* 370, t. 88, fig. 1.

A tall robust herb with a tuberous rhizome. *Leaves* about three forming when young a short pseudostem by their sheathing base appearing later than the flowers, attaining 4 ft. in length and about 4 in. in width when fully developed. *Flowering stem* stout, unbranched, 2-5 ft. high, clothed at the base with a few distant close-fitting sheaths and rising from a tuber beside the leaf-bearing pseudostem. *Raceme* 1-2 ft. long, bracts much shorter than the ovary, $\frac{1}{2}$ in. long, ovate-lanceolate, acuminate. *Flowers* many, large, drooping, lemon-yellow. *Sepals* 1-1 $\frac{1}{4}$ in. long, oblong-lanceolate, acuminate. *Petals* rather shorter than the sepals and much broader, obtuse or emarginate, many-nerved. *Lip* equalling the sepals in length, 3-lobed; side-lobes large, rounded or oblong, whitish towards the apex and spotted with purple at their yellow bases; midlobe oblong, yellow, the disk with two small pyriform basal calli and three crenate lamellæ; spur a short blunt sac. *Column* about $\frac{1}{2}$ in. long, produced at the base into a short foot. *Anther* emarginate at the apex and with a long anterior process. *Pollinia* obtusely angled, attached by a stout caudicle to a broad shallow gland.

Dehra Dun (Royle, Mackinnon); sub-Himalayan tracts of Rohilkhand and in the Kheri district of N. Oudh (Duthie). Flowers in June and July. **DISTRIB.** : Outer Himalayan ranges of Garhwal and

Kumaon to Nepal, up to 5,000 ft. ; also in Chota Nagpur and Travancore, extending to Hongkong and China.

E. obtusa, Hook. f. in *F. B. I. vi.*, 3; Duthie in *Ann. R. Bot. Gard. Calc. ix*, part 2, 129, t. 111. *E. campanulata*, Duthie in *Journ. As. Soc. Beng. lxxi. part 2* (1902) 39. *Cyrtopera obtusa*, Lindl. *Gen. and Sp. Orch.* 190.

Height of plant 3-4 ft. ; the leaves and scape rising from a horizontal oblong tuber. *Pseudostem* formed by the sheaths enclosing the bases of the leaves and scape. *Leaves* two or three, 12-18 in. long, linear, acuminate, plicate ; veins sharply prominent. *Flowering stem* exceeding the leaves, with a few long tight-fitting acuminate sheaths towards the base. *Flowers* six to ten, in a lax raceme, appearing with the leaves, $1\frac{1}{2}$ in. across, erect in bud, drooping and campanulate when open ; floral bracts acuminate, less than half the length of the ovary. *Sepals* and *petals* prominently veined on the back, bright-yellow outside, pale-lemon within ; dorsal sepal obovate, acute, $\frac{1}{2}$ in. long ; lateral pair rather shorter, falcately oblong, obtuse or subacute, adnate to the foot of the column. *Spur* short, curved subacute. *Petals* obovate, obtuse, about as long as the lateral sepals. *Lip* 3-lobed, longer than the sepals ; side-lobes suborbicular, erect, whitish or pale-yellow, with lilac-coloured streaks at the base ; midlobe bent upwards, the margin undulate. *Disk* with 5-8 prominent white ridges terminating within the margin of the apical lobe in a dull-yellow oblong grooved callus and prolonged towards the base into two sets of free fimbriate projections. *Column* about $\frac{2}{3}$ in. long, oblong, narrowly winged curving forward into a distinct foot at the purple-streaked base. *Anther* with a rounded or slightly emarginate apex and a long anterior projection. *Pollinia* subglobose, attached by a cylindric caudicle to a crenulated obconical gland.

Dehra Dun, in swamps (W. Bell, Mackinnon, Duthie) ; Rohilkhand in the Pilibhit district, and at Chandanpur in the Gonda district of N. Oudh (Duthie's collector). Flowers during July and August
DISTRIB. : Warm valleys in the vicinity of Mussoorie (Royce). After examining in the Royal Herbarium at Kew the single type specimen of Lindley's *Cyrtopera obtusa*, as well as Falconer's excellent drawing of the same plant under his manuscript name of *Eulophia arundinacea*, I had no hesitation in referring to it the *E. campanulata* which was described by me in the *Journ. As. Soc. Beng. l.c.* as a distinct species. Lindley was correct in his description of the column and its distinctly produced foot characteristic of the *Cyrtopera* section of the genus.

11. GEDORUM, Jackson; Fl. Brit. Ind. vi., 16.

Terrestrial herbs with underground subglobose rhizomes. *Leaves* elliptic, plicate, their sheaths forming a pseudostem. *Flowers* rather crowded, narrow, forming a decurved corymbose raceme on a stout sheathed scape arising from the base of the pseudostem. *Sepals* erect, equal, oblong, subacute. *Petals* as long as the sepals but broader and blunt. *Lip* sessile on the base of the column; side-lobes suppressed; terminal lobe broad, rounded, bifid or emarginate; disk with a forked basal callus. *Column* less than half the length of the lip. *Anther* broad, 2-celled; pollinia 2, broadly ovoid, attached by a slender tapering caudicle to a small orbicular gland.—Species about 9 or 10 in India, Malaya and Australia.

G. dilatatum, R. Br. in Ait. Hort. Kew ed. 2, v, 207, Prain. Beng. Pl. 1017; Cooke Fl. Bomb. ii, 695. **G. purpureum**, R. Br. l.c. F. B. I. vi. 16 (in part)-K. and P. in Ann. R. Bot. Gard. Calc. viii, 181, t. 245; Duthie id. ix, part 2, 130. *Limodorum recurvum*, Roxb. Fl. Ind. iii, 469.

Tuber globose, apiculate, 1½ in. in diam. *Pseudo-stem* 3-6 in. long. *Leaves* 6-20 in. long, broadly elliptic, tapering at the base to a long sheath. *Flowers* about ½ in. long, pale-purple or rose-coloured, in racemes which are short corymbose and drooping when in flower, but elongate and erect in fruit; floral bract lanceolate, acute, exceeding the pedicelled ovary. *Sepals* ¾ in. long, oblong, acute, 3-nerved, *Petals* as long as the sepals, oblong, obtuse. *Lip* pale-purple with darker markings, ¾ in. long, ventricose at the base, and much thickened, subpandurate; side-lobes none; mid-lobe rounded, 2-fid. or emarginate; disk with a channelled ridge ending in raised yellow calli. *Pollinia* with elongate pits on their posterior surface.

Dehra Dun (Mackinnon). Flowers during June and July. **DISTRIB.:** Eastwards to Nepal, Sikkim and Bhutan; also in Assam, Bengal, Chota Nagpur, Burma, Malay Pen., Andaman Islands, extending to W. and S. India and Ceylon.

12. CYMBIDIUM, Swartz; Fl. Brit. Ind. vi, 8.

Epiphytes with a short stout pseudstem, rarely terrestrial or with an elongated leafy stem. *Leaves* coriaceous, usually long and

narrow, rarely rudimentary at the time of flowering. *Flowers* rather large, in many- or few-flowered suberect or drooping racemes, rarely 1-flowered; scape loosely sheathed; floral bracts various. *Sepals* and *petals* subequal, erect or spreading. *Lip* adnate to the base of the column and embracing it more or less by its convolute side-lobes; terminal lobe decurved; disk usually with two ridges. *Column* long, without a foot. *Anther* 1- or (imperfectly) 2-celled; *pollinia* 2, rarely 4, ovoid, pyriform cuneiform or subglobose, more or less partite, sessile on a small or large often strap-shaped gland.—Species about 50, in temperate subtropical and tropical Asia, a few in Africa and Australia.

A terrestrial almost leafless parasite;

pollinia 4 1. *C. macrorrhizum*.

An epiphyte, with long strap-shaped

leaves; pollinia 2 2. *C. aloifolium*.

1. *C. macrorrhizum*, Lindl. *Gen. and Sp. Orch.* 162; *Royle Ill.* 366; *F. B. I.*, vi, 9; *Duthie in Ann. R. Bot. Gard. Calc.* ix, part 2, 134, t. 114.

A terrestrial almost leafless parasite. *Rootstock* as thick as a goose quill, creeping branched and jointed. *Scape* very short, basal sheath up to 2 in. long. *Raceme* up to 6 in. long, 6-8-flowered; floral bracts $\frac{1}{2}$ – $\frac{1}{4}$ in. long. *Flowers* $1\frac{1}{2}$ in. across; pedicel with ovary 1 in. long. *Sepals* about $\frac{3}{4}$ in. long, linear-lanceolata, acuminate, pale-yellow, tinged with pink, spreading or reflexed. *Petals* shorter and broader than the sepals, whitish streaked with pink. *Lip* about $\frac{3}{4}$ in. long, white with crimson or purple blotches along the margin; side-lobes narrow, erect, margins inflexed; midlobe oblong or subpan-duriform, acute at the apex; disk with two thick whitish ridges between the side-lobes. *Column* about $\frac{3}{4}$ in. long, curved, inner surface streaked with crimson. *Anther* papillose outside. *Pollinia* 4, sessile on the crescent-shaped gland.

N. W. India (Royle, Falconer); Dehra Dun, Kalanga Hill (Mackinnon). Flowers during July and August. *DISTRIB.*: Outer Himalayan Ranges of Garhwal and Kumaon, up to 7,000 ft.; eastwards to Sikkim (but very rare); also in Assam and on the Khasia and Naga Hills. There is also a record of its having been found in Kashmir.

2. *C. aloifolium*, Swartz in *Nov. Act. Upsal.* vi, 73; *Roeb. Fl. Ind.* iii, 458; *F. B. I.* vi, 10; *K. & P. Ann. R. Bot. Gard. Calc.* viii, 198, t. 252; *Duthie id.* ix, part 2, 136; *Cooke Fl. Bomb.* ii, 696.

Pseudostem short. *Leaves* 12-18 in. long, linear-oblong, obtuse, fleshy, obliquely notched at the apex, slightly expanded at the sheathing base. *Inflorescence* shorter than the leaves; peduncle 3-4 in. long, bearing several tubular acute scarious sheaths near the base. *Flowers* yellowish-red, in many-flowered drooping racemes 9-15 in. long; floral bracts ovate, $\frac{1}{8}$ - $\frac{1}{4}$ in. long; pedicels with ovary $\frac{1}{4}$ - $\frac{1}{2}$ in. *Sepals* subequal, oblanceolate-oblong, obtuse; lateral pair subfalcate. *Petals* as long as sepals, obtuse. *Lip* purplish, equalling the sepals, 3-lobed, its upper surface with two stout lamellæ broken and disconnected in the middle; lateral lobes narrow, blunt, entire; midlobe ovate-oblong, decurved. *Column* slightly thickened at the apex. *Anther* subquadrate, papillose. *Pollinia* 2, small; gland crescent-shaped.

N. Oudh, in the Bahraich district (Duthie). Flowers during April and May. **DISTRIB.:** Nepal Terai and Trop. Himalaya eastwards to Sikkim and Assam; also in W. and S. India, extending to Ceylon, Tenasserim, the Andaman Islands and Malay Peninsula.

13. ORNITHOCHILUS. Wall.; Fl. Brit. Ind. vi, 76.

Epiphytic, without pseudobulbs. *Stem* very short. *Leaves* few, crowded, broadly oblong, softly coriaceous. *Inflorescence* supra-axillary, racemose or in panicles. *Sepals* subequal, spreading, incurved at the apex, lateral ones obliquely obovate. *Petals* smaller, cuneate-oblong, blunt. *Lip* much longer than sepals, adnate to foot of the column by a long broad claw with a rectangularly bent subcylindric spur at its junction with the terminal lobe; side-lobes shallow, subquadrate; terminal with three lobules; the two lateral recurved and pectinate; the central one triangular, entire or infolded; mouth of spur closed by two calli projecting from its back and front walls, the latter hairy. *Column* short, cylindric, with a short foot; rostellum short; stigma circular, surrounded by a hairy rim. *Anther* oblong; pollinia 2, subglobose caudicle broad, obcuneate; gland large.—Species 1 or 2, Indian and Chinese.

O. fuscous, Wall. in Lindl. Gen. and Spec. Orch. 242; F. B. I. vi, 76; K. & P. in Ann. R. Bot. Gard. Calc., viii, 200, t. 268; Duthie id ix, part 2, 139.

Leaves 3-7 in. long, oblong or ovate-lanceolate, obliquely tapering to the acute apex and narrowed to the sessile sheathing base, fleshy,

shining on both surfaces when young; nerves inconspicuous. *Inflorescence* much longer than the leaves; racemes simple or sparingly branched; floral bracts lanceolate, much shorter than the long-pedicelled ovary. *Flowers* $\frac{3}{4}$ - $\frac{1}{2}$ -in. across. *Sepals* and *petals* greenish-yellow and streaked with red, the former with four, and the latter with two, broad brown vertical bands. *Lip* with two pectinate lobules, brown passing into purple. *Capsule* 1 in. long, fusiform.

Dehra Dun (Mackinnon), flowering in July. **DISTRIB.:** Outer Himalayan ranges of Garhwal and Kumaon up to 3,000 ft., extending eastwards to Sikkim, Bhutan, Khasia Hills, Burma and China.

14. **LUISIA**, Gaud.; Fl. Brit. Ind. vi, 22.

Epiphytes with rigid terete sheathed usually erect stems, woody below. *Leaves* terete, fleshy, distant, spreading. *Flowers* usually small and dull-coloured, in short extra-axillary spikes; rhachis stout; floral bracts short, scarious persistent. *Sepals* subequal, or the decurved dorsal one smaller. *Petals* equalling the sepals or much longer, spreading. *Lip* sessile on the base of the column, divided into two parts, basal portion (hypochile) concave or flat; apical portion (epichile) decurved, broad and ridged, entire or crenate or undulate and with a more or less blunt apex. *Column* stout, much shorter than the lip; stigma usually large. *Anther* broad, 2-celled; pollinia 2, ovoid or subglobose, attached by a broad caudicle to a subquadrate or elongate gland. *Capsule* suberect narrow, ridged.—Species about 15, chiefly in Tropical Asia, a few in Australia.

L. trichorhiza, Blume Mus. Bot. Lugd. Bat. i, 63; F.B.I. vi, 23; K. & P. in Ann. R. Bot. Calc. viii, 202, t. 270; Duthie id. ix, part 2, 140.

Stem 4-9 in. long, very stout, not branched. *Leaves* fleshy, 4-6 in. long and about $\frac{1}{2}$ in. thick, slightly tapering to the apex. *Spikes* stout, 4 or 5-flowered. *Flowers* $\frac{2}{3}$ in. long, on short thick tubercles; flowering bracts broad, acuminate, persistent. *Sepals* unequal, green with faint purple lines; dorsal sepal oblong, blunt; lateral pair shorter, obliquely ovate, acute, keeled. *Petals* longer and narrower than the lateral sepals, oblong, blunt, all spreading. *Lip* longer than sepals, dull purple on a greenish ground; basal portion (hypochile) deeply concave and with erect rounded edges; epichile broadly cordate and tapering to the subtruncate emarginate apex; upper

surface with short blunt vertical ridges. *Column* stout, half as long as the lip, purple. *Anther* subquadrate, compressed. *Rostellum* broad. *Pollinia* ovoid, attached by a broad caudicle to the quadrate gland.

Dehra Dun, epiphytic chiefly on sál trees (Gamble, Mackinnon). Flowers during March and April. *DISTRIB.*: Tropical Himalayan Valleys from Garhwal to Sikkim. It occurs also in Chota Nagpur.

15. ÆRIDES, Lour.; Fl. Brit. Ind. vi, 43.

Epiphytes with leafy stems; pseudobulbs none. *Leaves* lorate rarely terete. *Flowers* usually many and showy, in dense or lax decurved racemes, sometimes solitary; floral bracts minute. *Sepals* broad, spreading; lateral ones adnate to the base or foot of the column. *Petals* like the sepals. *Lip* adnate to the column, spurred; side-lobes large or small or none; midlobe longer than the side-lobes or smaller and incurved between them. *Column* short with a short or long foot. *Anther* 2-celled, beaked or not; *pollinia* 2, globose, sulcate; caudicle long or short; gland various. —Species about 20, in E. Asia.

Terminal lobe of lip large, hastate-ovate;
flowers pink with purple spots . . . 1. *Æ. multiflorum*.

Terminal lobe of lip small, linear or narrowly
oblong; flowers white, spotted with lilac,
very fragrant 2. *Æ. odoratum*.

1. *Æ. multiflorum*, Roxb. *Cor. Pl.* iii, 63, t. 271; *Fl. Ind.* iii, 475; *F. B. I.* vi, 44; *K. & P. in Ann. R. Bot. Gard. Calc.* viii, 212, t. 283; *Duthie id.* ix, part 2, 142; *Prair Beng. Pl.* 1020.

Stem stout, 4-10 in. long. *Leaves* 6-8 in. long, narrowly oblong, conduplicate, recurved, slightly tapering to the oblique bifid apex, not narrowed to the base, often tinged with red. *Racemes* longer than the leaves, simple, axillary, densely many-flowered; peduncle long, clothed with short distant sheaths. *Flowers* $\frac{3}{4}$ -1 in. across, deep-pink and with darker spots. *Sepals* and *petals* about equal, oblong, blunt. *Lip* twice as long as the sepals, triangular, adnate to the base of the column, acute or obtuse at the apex, margins erose; basal portion thick and with a retrorse tooth or callus across the mouth of the short rectangularly bent spur. *Column* with a short foot, its margins thickened and slightly winged near the base.

Anther depressed and with a long curved beak in front. *Pollinia* globular, caudicle filiform, gland narrow. *Capsule* up to 2 in. long subclavate, stoutly pedicelled.

Dehra Dun and Siwalik range, common on mango trees. Flowers during June and July. **DISTRIB.**: Outer ranges of Himalaya from Kangra to Nepal and Sikkim, up to about 4,000 ft.; also found in Assam, Chota Nagpur and N. Bengal.

2. *Æ. odoratum*, Lour. *Fl. Coch.* 525; *F. B. I.* vi. 47; *K. & P. Ann. R. Bot. Gard. Calc.* viii, 212, t. 282; *Duthie id.* ix cart 2, 143; *Prain Beng. Pl.* 1020; *Cooke Fl. Bomb.* ii, 701. *Æ. ornutum*, Roxb.; *Fl. Ind.* iii, 272.

Stem 4-12-in. long, very stout. *Leaves* 6-12 in. long and 1-1½ in. wide oblong, flat, keeled, tapering slightly to the blunt unequally bilobed apex, not contracted at the sheathing base. *Racemes* supra-axillary, deflexed, as long as or longer than the leaves, many-flowered; peduncle short, stout, with short distant sheaths. *Flowers* about 1 in. long, white, spotted with pink, fragrant; floral bract broad, sheathing, blunt, much shorter than the stalked ovary. *Sepals* unequal, obtuse, spreading, the dorsal one elliptic-ovate, the lateral pair larger. *Petals* oblong, falcate, shorter than sepals. *Lip* adnate to the short foot of column; side-lobes larger than the incurved almost linear emarginate midlobe. *Anther* triangular, depressed, beaked. *Pollinia* globose, caudicle linear, gland quadrate. *Capsule* about 1½ in. long, fusiform.

Dehra Dun (King, Gamble, Mackinnon); N. Oudh, in the Bahraich district (Duthie). Flowers during July and August. **DISTRIB.**: Trop. Himalaya in Garhwal and Kumaon and eastwards to Nepal and Sikkim; also in E. Bengal, Chota Nagpur and the Circars; extending to Tenasserim, Malaya and China.

16. *Æ. RHYNCHOSTYLIS*, Blume; *Fl. Brit. Ind.* vi, 32.

Epiphytes, without pseudobulbs. *Stems* elongate, stout, leafy. *Leaves* very coriaceous, linear-oblong, truncate or bluntly 2-lobed at the apex. *Flowers* in long drooping densely cylindric racemes, showy. *Sepals* spreading, broad, obtuse. *Petals* similar to the sepals but narrower. *Lip* adnate to the short foot of the column, the hypophyll forming a deep wide pubescent sac without side-lobes; epichile obovate, acute, concave with erect margins. *Column* short, stout, dilated at the base and with a very short

foot; stigma small. *Anther* terminal, rounded; pollinia 2, elliptic, attached by a long slender caudicle to a small oblong gland.—Species 2 or 3, Indian and Malayan.

R. retusa, *Blume Bijdr.* 286, t. 49; *F. B. I.* vi, 32; *K. & P. Ann. R. Bot. Gard. Calc.* viii, 213, t. 284; *Duthie id.* ix, part 2, 143; *Prair Beng. Pl.* 1020; *Cooke Fl. Bomb.* ii, 698. *Saccolabium guttatum*, *Lindl.*; *Royle Ill.* 366. *Ærides guttatum*, *Roxb. Fl. Ind.* iii, 471. *Epidendrum retusum*, *Linn.*

Stems stout, 3-8 in. long, clothed with the sheaths of decayed leaves and emitting many stout branching roots. *Leaves* 6-18 in. long and $\frac{1}{2}$ -1 $\frac{1}{2}$ in. wide, strap-shaped, spreading and recurved, obliquely præmorse or bluntly and unequally 2-lobed at the apex. *Racemes* dense, cylindric, longer than the leaves. *Flowers* about $\frac{3}{4}$ in. across, white or pale-pink, dotted with darker-coloured spots; bracts $\frac{1}{8}$ - $\frac{1}{4}$ in. long, ovate, acute, persistent. *Sepals* veined, about $\frac{1}{2}$ in. long; lateral pair obliquely obovate-orbicular; dorsal one obovate, rounded. *Petals* as long as the sepals, elliptic-oblong, subobtusely. *Lip* dark-pink, with a saccate flattened spur; epichile variable in shape, $\frac{1}{2}$ in. long, oblong or cuneate-oblong at the base, widening towards the apex. *Capsule* 1-1 $\frac{1}{2}$ in. long, acutely 3-angled and 6-ribbed, its pedicel short and stout.

Dehra Dun (King, Mackinnon, etc.); Siwalik range (Royle); N. Oudh, in the Gonda district (Duthie). Flowers during June and July. **DISTRIB.:** Trop. Himalaya from the Punjab eastwards to Nepal, Sikkim and Bhutan, up to 4,000 ft., also in Assam, the Khasia Hills, Chota Nagpur, Konkan and Kanara; extending to Burma, S. India, Ceylon and the Malay Islands.

17. VANDA. R. Br.; Fl. Brit. Ind. vi, 49.

Epiphytes with leafy stems. *Leaves* thickly coriaceous or fleshy, flat and keeled or terete. *Flowers* usually large and often showy, in simple lax or dense racemes, sometimes solitary; floral bracts much shorter than the ovary. *Sepals* and *petals* subequal, spreading or connivent, narrowed at the base. *Lip* large, usually saccate or spurred at the base; side-lobes large or small, rarely absent, adnate to the short foot of the column or to the sides of the sac or spur; midlobe fleshy, various; disk usually ridged or amellate, sometimes carunculate. *Column* short, stout, the foot

short or none. *Anther* 2-celled; rostellum small; pollinia 2, didymous, subglobose or obovoid; caudicle short and broad or long and geniculate; gland usually large. Species about 20, in Tropical Asia and Australia.

Sepals and petals spreading :—

Flowers small, less than 1 in. across, yellow except the bluish caruncles on the lip . . . 1. *V. parviflora*.

Flowers 1½-2 in. across; sepals and petals greenish-yellow mottled with brown; mid lobe of lip with purple caruncles . . . 2. *V. Roxburghii*.

Sepals and petals incurved . . . 3. *V. cristata*.

1. *V. parviflora*, Lindl. in Bot. Reg. xxx (1844) Misc. 45; F. B. I. vi, 50; K. & P. Ann. R. Bot. Gard. Calc. viii, 215, t. 286; Duthie id. ix, part 2, 144; Prain Beng. Pl. 1021; Cooke Fl. Bomb. ii, 703.

Stem stout, 3-6 in. long, enveloped in the sheathing bases of fallen leaves. *Leaves* 3-8 in. long by $\frac{3}{8}$ - $\frac{1}{2}$ in. wide (when flattened out), linear-oblong, conduplicate, keeled, unequally and obtusely 2-lobed at the apex. *Inflorescence* from below the leaves and about as long; peduncle as long as the raceme, bearing a few small scattered sheaths. *Raceme* few-flowered; floral bracts ovate, acute, deciduous. *Flowers* yellow except the blue fleshy ridges on the lip, less than $\frac{3}{4}$ in. across. *Sepals* and *petals* spreading. *Sepals* spathulate, obtuse; the lateral pair shorter than the dorsal one. *Petals* as long as the lateral sepals, falcately spathulate-oblong, falcate. *Lip* $\frac{1}{3}$ in. long, adnate to the short foot of the column, spurred; side-lobes erect, oblong, rounded, rising from the mouth of the spur; midlobe fleshy, obovoid; tip dilated, crenulated; disk with two broad bluish ridges. *Column* short, with a short thick foot. *Anther* depressed, slightly beaked in front. *Pollinia* subglobose, attached to a short broad caudicle. *Capsule* 1-1½ in. long, fusiform, with winged ridges.

Dehra Dun (Mackinnon). Flowers May and July. **DISTRIB.:** Outer ranges of Himalaya, up to 4,000 ft., from Carhwal eastwards to Nepal and Sikkim; extending to Assam and Burma; also in Chota Nagpur, the Konkan and S. India to Ceylon.

2. *V. Roxburghii*, R. Br. in Bot. Reg. t. 506; F.B.I. vi, 52; Watt. E. D.; Duthie Ann. R. Bot. Gard. Calc. ix, part 2, 145, t. 116; Prain Beng. Pl. 1021; Cooke Fl. Bomb. ii, 704. *Cymbidium*

tessallatum, Sw.; Roxb. *Fl. Ind.* iii, 462. C. tessalloides, Roxb. l. c. 463.—Vern. *Rasna, nai*.

Stem climbing, 1-2 ft. long, emitting many thick white fleshy roots.

Leaves bifarious, approximate, 6-8 in. long, narrow, complicate, keeled; apex præmorse. *Racemes* longer than the leaves; peduncle 6-10 in. long. *Flowers* $1\frac{1}{2}$ -2 in. across. *Sepals* and *petals* subequal, spreading, clawed, obovate, undulate, yellowish (rarely bluish), tessellated with brown, their claws and outer surfaces white. *Lip* $\frac{5}{8}$ in. long, bluish streaked with purple; side-lobes small, acute, rising from the mouth of the spur, $\frac{1}{4}$ in. long, ovate, acute, erect; terminal lobe panduriform, with a purple dilated truncate 2-lobed apex, the margins deflexed; disk convex, with fleshy ridges; spur conical, obtuse, straight, hairy within. *Column* very short. *Capsule* 3-3½ in. long, shortly stalked, clavate, sharply ridged.

Forests of Dehra Dun and in the Sub-Himalayan tracts of Rohilkhand and N. Oudh (R. Thompson, Duthie). Often climbing on the branches of mango trees and *Bassia latifolia* (mahua). Flowers during the rains. **DISTRIB.**: Konkan, Gujarat and Kanara in the Bombay Provs.; also in Bengal, Behar, Chota Nagpur and Central Provs., extending south to Travancore and Ceylon. The roots are used medicinally in the Chānda district of C. Provinces for rheumatism and fever, and for allaying the pain caused by the stings of scorpions.

3. V. cristata, Lindl. in Wall. *Cat.* 7328; *F. B. I.* vi, 53; *K. & P. Ann. R. Bot. Gard. Calc.* viii, 216, t. 287; *Duthie id.* ix, part 2, 146.

Stem 3-6 in. long, clothed with the remains of old leaf-sheaths. *Leaves* bifarious, crowded, 3-4 in. long, conduplicate, unequally bilobed at the truncate apex, dilated at the sheathed base. *Raceme* not exceeding the leaves, axillary, 2-5-fld. *Flowers* $1\frac{1}{2}$ -2 in. across. *Sepals* and *petals* incurved, pale olive-green or yellowish. *Sepals* unequal, oblong, obtuse. *Petals* narrower than sepals, oblong. *Lip* adnate to base of column, longer than sepals, green blotched with dull purplish-brown; basal lobes erect, triangular; terminal lobe yellow streaked with purple, oblong, with two divaricate oblong lobules and a horn-like, deflexed fleshy beak; upper-surface with five carunculate ridges. *Spur* short, conical, obtuse. *Column* short, without a foot. *Pollinia* ovoid, attached by a short broad caudicle to a large quadrate gland. *Capsule* narrowly clavate, 2-2½ in. long.

Dehra Dun (Mackinnon). Flowers during May. **DISTRIB.**: Outer ranges of Himalaya in Garhwal and Kumaon, up to 4,000 ft.; extending eastwards to Sikkim, Bhutan and Sylhet.

18. **SACCOLABIUM**, Blume ; Fl. Brit. Ind. vi, 54.

Epiphytes, without pseudobulbs. *Leaves* coriaceous, flat or conduplicate, often keeled. *Flowers* usually small, in leaf—opposed or supra-axillary racemes corymbs umbels or panicles ; floral bracts minute. *Sepals* and *petals* adnate to the column, subequal, spreading or reflexed. *Lip* sessile on the footless column, forming a cylindric or saccate spur ; lateral lobes small or none ; terminal one small, often hairy. *Anther* 1- or imperfectly 2-celled ; pollinia 2, entire or bipartite.—Species 50, in E. Asia.

Spur cylindric, straight 1. *S. papillosum*.

Spur short, at right angles to the ovary, widely saccate :—

Apex of leaves not setulose ; terminal lobe of

lip papillose-hairy 2. *S. calccolare*.

Apex of leaves setulose ; terminal lobe of lip

fleshy and glabrous 3. *S. distichum*.

1. *S. papillosum*, Lindl. in Bot. Reg. t. 1552 (excl. syn.) ; F. B. I. vi, 63 ; K. & P. Ann. R. Bot. Gard. Calc. viii, 219, t. 290 ; Duthie id. ix, part 2, 147 ; Prain Beng. Pl. 1022.

Stems 2-3 ft., stout, erect, clustered, bearing many nearly horizontal leaves. *Leaves* coriaceous, 3-4 in. long, conduplicate, curved ; apex truncate or deeply notched. *Peduncle* 1-2 in. long, leaf-opposed, about $\frac{1}{2}$ in. long, bearing a subcorymbose 4-8-flowered raceme. *Flowers* $\frac{1}{2}$ in. in. diam. ; bracts triangular. *Sepals* and *petals* yellow barred and blotched with brown. *Sepals* subequal, oblong, subacute, spreading. *Petals* narrower than sepals, subspathulate. *Lip* longer than sepals, adnate to the base of the column ; side-lobes none ; terminal lobe decurved, ovate-oblong, obtuse, crenate ; upper surface transversely rugulose, white with transverse purple bars. *Spur* cylindric, straight, half as long as the ovary and parallel to it, cylindric or slightly tapering, pale-yellow, hairy within. *Column* short. *Anther* broadly conical. *Pollinia* subovoid, deeply bipartite ; caudicle slender, tapering to the small oblong gland. Capsule $1\frac{1}{4}$ in. long, fusiform, ridged.

Dehra Dun, in swamps (Gamble, Mackinnon). **DISTRIB.** : Outer ranges of Himalaya in Garhwal and Kumaon and eastwards to Sikkim ; also in Assam, Bengal, Circars and Burma.

2. S. calceolare, Lindl. in Wall. Cat. 7302; F. B. I. vi. 60; K. & P. Ann. R. Bot. Gard. Calc. viii, 225, t. 300; Duthie id. ix, part 2, 147. *Gastrochilus calceolaris*, Don Prod. 32.

Stem short, pendulous. *Leaves* 4-10 in. long, narrowly oblong, unequally bifid at the apex, slightly narrowed towards the base. *Racemes* much shorter than the leaves, corymbose, many-flowered; peduncle stout, bearing several short sheaths. *Flowers* crowded, $\frac{3}{4}$ in. across; floral bracts small, broad and blunt. *Sepals* and *petals* pale-green with large brownish spots. *Sepals* unequal, spreading, the dorsal one obovate-oblong; lateral pair falcately oblong, narrower. *Petals* shorter than the sepals, oblong-obovate. *Lip* adnate to the lower half of the column, the base forming a short wide yellow sac about half as long as the ovary; side-lobes none; terminal lobe at right-angles to the sac, semicircular; its upper surface, except a triangular yellow patch at the base, pure white and covered with hair-like papillæ. *Column* very short and thick. *Anther* depressed, shortly beaked. *Pollinia* broadly ovoid-elliptic, attached by a slender caudicle to a small cordate gland.

Dehra Dun (Mackinnon). Flowers in April and May. **DISTRIB.:** Outer Himalayan ranges from Garhwal eastwards to Sikkim and Bhutan; also on the Khasia Hills, extending to Burma and the Malay Peninsula.

3. S. distichum, Lindl. in Journ. Linn. Soc. iii, 4; F. B. I. vi, 64; K. & P. Ann. R. Bot. Gard. Calc. viii, 227, t. 303; Duthie id. ix, part 2, 148.

Stems pendulous, 5-10 in. long, branching, slender, leafy. *Leaves* 1 in. long, narrowly lanceolate, acuminate, with two or three fine setæ from the apex; base sessile and slightly oblique. *Peduncles* leaf-opposed, about equalling the leaves in length. *Flowers* 2-4, in a lax raceme, about $\frac{1}{2}$ in. in diam., green, irregularly spotted with brown; floral bracts oblong, subacute. *Sepals* and *petals* subequal, oblong, elliptic, obtuse. *Lip* about as long as the petals, adnate to lower half of column, the base with a wide blunt sac at right angles to the ovary, its inner surface without hairs or calli; side-lobes none; terminal lobe yellow, semicircular, entire, smooth, fleshy; margins deflexed, the base with two blunt conical calli. *Column* short, broad. *Anther* shortly beaked in front. *Pollinia* elliptic; caudicle long, slender, cylindric, the gland elongate, bifid. *Capsule* fusiform, about $\frac{2}{3}$ in. long.

Northern Oudh, in the Bahraich district (Duthie's collector). Flowers during April and May. **DISTRIB.:** Outer Himalayan ranges in

Garhwal, up to 6,000 ft., and eastwards to Sikkim, the Khasia Hills and Manipur.

19. CLEISOSTOMA, Blume ; included under *Saccolabium* in Fl. Brit. Ind. vi, 59.

Epiphytic herbs. *Stems* more or less elongate. *Leaves* coriaceous or fleshy, flat or semiterete. *Flowers* in leaf-opposed racemes or panicles. *Sepals* adnate to the column, subequal, spreading. *Petals* like the sepals. *Lip* sessile on the footless column, the base with a large saccate or funnel-shaped spur which is sometimes dilated at the apex ; its opening more or less occluded by 2 calli, the posterior of which is frequently 2-fid., and also sometimes by a dorsal scale, but never septate ; the lateral lobes small or obsolete ; apical lobe thickened, concave. *Column* short, thick, footless. *Anther* depressed ; pollinia 2, often 2-fid. ; caudicle single.—Species about 40 in. E. Trop. Asia and Australia.

C. micranthum, K. & P. *Ann. R. Bot. Gard. Calc.* viii, 234, t. 312 ; *Duthie id.* ix, part 2, 148 ; *Prain Beng. Pl.* 1023. *Saccolabium micranthum*, Lindl. ; *F. B. I.* vi, 59.

Stem stout, compressed, 3-8 in. long, enveloped in the leaf-sheaths. *Leaves* 2½-3½ in. long., narrowly oblong, keeled, obliquely truncate, obtusely bifid, tapering to the shortly sheathed base. *Flowering stem* equalling or longer than the leaves ; racemes many-flowered ; peduncle and rhachis stout. *Flowers* about ½ in. across ; bracts broad, blunt, much shorter than the short sessile ovary. *Sepals* and *petals* spreading, white with large purple spots. *Sepals* broadly ovate, obtuse. *Petals* smaller than the sepals, oblong. *Lip* fleshy, pink or purple, as long as the sepals. *Spur* addressed to and as long as the ovary, wide, blunt ; lateral lobes of lip small ; terminal one convex, oblong, blunt, margins thin, erose ; upper surface smooth. *Column* very short and stout, with a large protuberance on either side of the rostellum. *Anther* with a long pointed beak. *Pollinia* obovoid ; caudicle triangular, shallowly cordate, attached to a small orbicular gland.

Dehra Dun (Vicary, Mackinnon). Flowers during June and July. **DISTRIB.** : Outer ranges of Trop. Himalaya in Garhwal and Kumaon, up to 3,000 ft., and eastwards to Sikkim, Bhutan, Assam, and on the Naga and Khasia Hills ; also in Chota Nagpur and in Tenasserim.

20. SARCANTHUS, Lindl. ; Fl. Brit. Ind. vi, 66.

Epiphytic herbs, with usually elongate stems. *Leaves* fleshy, terete or flat. *Flowers* in extra-axillary racemes or panicles. *Sepals* subequal, spreading or reflexed, or the dorsal one concave and connivent over the column. *Petals* smaller than the sepals, spreading. *Lip* adnate to the base of the column, or to its foot, rarely jointed, the base with a funnel-shaped spur sometimes dilated at its apex, the opening more or less occluded by calli on its anterior and posterior walls, and always divided into two lateral compartments by a vertical antero-posterior septum ; lateral lobes small more or less triangular and acute ; apical lobe small, triangular or hastate. *Column* short, stout, often with a foot as long as or longer than itself. *Anther* depressed ; pollinia 2, bifid.—Species about 35, in E. Trop. Asia.

S. insectifer. *Reicht. f. in Bot. Zeit.* 159 ; *F. B. I.* vi, 68 ; *Duthie Ann. R. Bot. Card. Calc.* ix, part 2, 149 ; *Prain Beng. Pl.* 1023.

Stem 1 ft. or more in length, robust, scandent, flexuous, emitting many elongate fibres. *Leaves* firmly coriaceous, crowded, almost imbricate, $\frac{1}{2}$ -2 in. long, distichously spreading, oblong, amplexicaul, apex obtusely 2-lobed. *Racemes* shorter than the leaves, subsessile, few-flowered, decurved ; rhachis stout ; bracts minute, deciduous. *Flowers* about $\frac{1}{2}$ in. across ; sepals and petals 3-nerved, yellowish-green, striated with red. *Sepals* ovate-oblong, obtuse or subacute. *Petals* oblong. *Lip* white and pink, or purple ; side-lobes short ; terminal lobe larger than the sepals, triangular-ovate or cordate. *Spur* vertically septate, its mouth with a pubescent ridge. *Column* very short. *Anther* hemispheric. *Pollinia* sulcate, attached to a short caudicle broader than long ; gland transverse, membranous.

N. Oudh, in the Bahraich district (Duthie). *Flowers* in Sep. **DISTRIB.** : Garhwál, in the Rámanga valley, also in Chota Nagpur, Behar, Cachar, Chittagong, Sundribans, extending to Tenasserim.

21. POGONIA, Juss. ; Fl. Brit. Ind. vi, 118.

Terrestrial unifoliate tuberous-rooted herbs ; tuber stoloniferous, each stolon bearing at its tip a tuber smaller than that of the parent. *Leaf* broadly cordate or orbicular, strongly plicate, rising from the same tuber as the flowers, but usually after the

appearance of the flower-scape, occasionally coetaneous. *Flowers* solitary few or several, racemose, often pendulous, on scapes rising from the tuber. *Sepals* subequal, narrow, connivent or spreading. *Petals* like the sepals. *Lip* adnate to the base of the column, sometimes slightly saccate at the base, rather narrow, the lower portion convolute round the column; lateral lobes small, usually triangular; apical lobe flat, ovate or orbicular, entire, or fimbriate. *Column* elongate, clavate upwards; stigma anticus, oblong or orbicular. *Anther* more or less incumbent, substipitate; pollinia 2 or 4, elongate, powdery, often coherent, without caudicle or gland. Species about 80, in Trop. Asia, America and Africa.—The above characters apply only to the section *Nervilea*, to which all the Old World species of *Pogonia* belong, and which differ by flowering before the leaves appear. All the other species, except one in Japan, are found in the New World, and their flowering stems bear leaves.

Leaves many-nerved; floral bracts longer
than ovary, deflexed; lip slightly saccate
at the base

1. *P. GAMMIEANA*.

Leaves 7-9-nerved; floral bracts erect; lip
not saccate at the base

2. *P. CARINATA*.

1. *P. Gammieana*, Hook. f. in Bot. Mag. t. 6671; F. B. I. VI, 120; K. & P. Ann. R. Bot. Gard. Calc. viii, 269, t. 359; Duthie id. ix, part 2, 158.

Tuber globular warted, about $1\frac{1}{2}$ in. in diam. *Leaf* glabrous, 5-6 in. across, reniform, abruptly acuminate, many-nerved, its margin much undulate; petiole about as long as the blade, sheathed at the base. *Flowering stem* stout, 3-12 in. long, peduncle bearing two or three long tubular acute and often bifid bracts. *Raceme* laxly 5-8 fld. *Flowers* about 1 in. long, drooping, pink streaked with white; floral bracts deflexed, longer than the truncate stalked ovary, linear-lanceolate, acuminate. *Sepals and petals* subequal, oblanceolate, connivent. *Lip* pale-green, as long as the sepals, saccate at the base, elliptic-obovate (when spread out); lower half convolute and with two short side-lobes pointing forwards; epichile spreading, the margin deeply crenulate; disk hairy, with three parallel central ridges.

Dehra Dun (Mackinnon, Duthie); Siwalik range, in the Timli Pass (Duthie). Flowers in May, and the leaves appear about two months later. **DISTRIB.**: Trop. Himalaya in Garhwal and Kumaon, up to 3,000 ft.; also in Sikkim.

2. *P. carinata*, Lindl. Gen. & Spec. Orch. 414; F. B. I. vi, 121; Prain Beng. Pl. 1026; Duthie Ann. R. Bot. Gard. Calc. ix, part 2, 159, t. 124; Cooke Fl. Bomb. ii, 707. *Epipactis carinata*, Roxb. Fl. Ind. iii, 454.

Tubers globose or obovate, $\frac{1}{2}$ - $\frac{3}{4}$ in. in diam., annulated and warted. *Leaf* $1\frac{1}{2}$ - $2\frac{1}{2}$ in. wide, ovate, acute or cuspidate, cordate or cuneate at the base, 7-9-nerved, glabrous; petiole 1-2 in. long, sheathed at the base. *Flowering stem* up to 1 ft. high, bearing 3 or 4 loose tubular acute or acuminate sheaths. *Raceme* laxly flowered; floral bracts twice as long as the stalked ovary, erect lanceolate, acuminate, 5-nerved. *Flowers* about 1 in. long. *Sepals* and *petals*, subequal, spreading, linear-lanceolate, acuminate, green. *Lip* $\frac{3}{4}$ in. long, straight, trough-shaped, not saccate at the base, 3-lobed above the middle, white tinged with yellowish green and with conspicuous pink-coloured veins usually bifurcating within the margin; upper surface hairy especially on the ridges and veins; side-lobes erect, margins entire, terminal lobe not deflexed, ovate, bluntly acuminate, its margin irregularly creminate. *Column* $\frac{1}{2}$ in., slightly curved, dilated at the apex. *Anther* triangular, beaked in front.

Sub-Himalayan tracts of Rohilkhand and North Oudh, in the districts of Pilibhit, Bahraich and Gonda. Flowers in May, the leaves appearing about one month later. **DISTRIB.:** Ramganga valley in Kumaon (T. Thomson); common in Bengal and eastwards to Burma; also in the Bombay Pres. and southwards to S. India.

22. *EPIPACTIS*. Andans.; Fl. Brit. Ind. vi, 125.

Terrestrial herbs with fibrous roots and leafy stems. *Leaves* sessile, plicate. *Flowers* in racemes, drooping; floral bracts elongating and often leaf-like. *Sepals* and *petals* broadly lanceolate, acuminate, strongly nerved. *Lip* adnate to the base of column, distinctly divided into hypochile and epichile; hypochile much deflexed, concave or saccate, jointed to the epichile at a right angle, both with entire edges. *Column* short; stigma large, anticonic; rostellum broad, prominent. *Anthers* erect, obtuse, its cells contiguous; pollinia 2, bipartite, very narrow. Species about 12, in the North Temp. Hemisphere.

***E. consimilis*, Wall. Cat. 7043 (not of Don); F. B. I. vi, 126; K. & P. Ann. R. Bot. Gard. Calc. viii, 272, t. 364; Duthie id. ix, part 2, 161; Collett Fl. Siml. 498.**

Height of plant 1-2 ft. *Stem* leafy, slender, glabrous. *Leaves* 4-7 in. long, lanceolate, acuminate; uppermost shorter and much narrower; nerves prominent. *Raceme* 4-6 in. long, laxly fld., rhachis tomentose. *Flowers* 1-1½ in. across; flowering bracts ovate or linear-lanceolate, varying in size. *Sepals* spreading, unequal, concave, clothed with white hairs on a deep-lavender ground, green inside as are both surfaces of the petals, and marked with broad bands of reddish-brown; dorsal sepal lanceolate, acute; lateral pair much broader. *Petals* ovate, acute, tomentose on the stout midrib beneath. *Lip* rather shorter than the sepals; hypochile purple, trough-shaped, bearing granular unequal calli inside, with two larger obtuse nectar-exuding ones near the apex; epichile pale brown, lanceolate and with erect lobes; upper surface with a median ridge terminating within the white apex. *Column* stout, curved; stigmas large, subrotund and with two glands on the lower margin. *Anther* tumid.

Dehra Dun (Gamble, Mackinnon); banks of canal near Saharanpur (Duthie). Flowers during Feb. and March. **DISTRIB.** : W. Himalaya from the Simla Hills to Kumaon, up to 3,000 ft. and eastwards to Nepal and Sikkim, extending to upper Burma and China; it is found also on the N. W. frontier of India in the districts of Gilgit and Chitral, and extends to Afghanistan and Syria.

23. GOODYERA, R. Br. ; Fl. Brit Ind, vi, 110.

Terrestrial leafy herbs; stem decumbent below. *Leaves* usually rather thick, with wide sheaths and often distinct petioles. *Flowers* small, numerous, in terminal, sometimes secund, spikes or racemes. *Sepals* subequal, often pubescent outside; lateral pair free, subconnivent or spreading; dorsal concave. *Petals* like the dorsal sepal and forming with it a hood over the column. *Lip* adnate to base of column, entire saccate or cymbiform at the base; apical lobe small, usually acute and decurved; basal sac with setæ calli or ridges inside, rarely smooth. *Column* short, with projecting rostellum; stigma anticous, undivided. *Anther* usually pyriform, with a long erect beak; pollinia 2, clavate, sessile on a large or small gland.—Species about 25, in Europe, Temp. and Trop. Asia, North America, New Caledonia and the Mascarene Islands.

G. procera, Hook, *Exot. Flora*, t. 39; *Don Prod.* 28; *Rogley Ill.* 384; *F. B. I.* vi, 111; *K. & P. Ann. R. Bot. Gard. Calc.* viii, 282, t. 378; *Duthie id. ix. part 2*, 165; *Prain Beng. Pl.* 1027.

Stem 10-30 in. in length, very leafy below, glabrous, loosely enveloped by the wide leaf-sheaths. *Leaves* many, long-petioled; blade 4-8 in. long, elliptic or ovate-elliptic, tapering at each end, acute or acuminate; petiole stout, 1½-3 in. long. *Peduncle* bearing many lanceolate acuminate bracts which are hairy above and glabrous beneath. *Spike* 3-8 in. long, many-and densely fld.; rachis pubescent. *Flowers* minute, subglobose, white tinged with green; fl. bract as long as ovary, ovate-lanceolate, acuminate, pubescent on the margin. *Sepal* glabrous, subequal, broadly ovate, obtuse. *Petals* clawed, cuneately obovate. *Lip* longer than sepals, with a large saccate base, its apex decurved, triangular, entire; interior of basal sac with two rows of long setæ on the sides and an oblong callus at the apex of each row. *Column* very short, with a transverse depression below the broad anticeous stigma. *Anther* pyriform, obtuse. *Pollinia* clavate-cylindric, sessile on a small oblong gland.

Dehra Dun (Mackinnon); N. Oudh in the Bahraich district (Duthie). Flowers in May. **DISTRIB.**: Outer Himalayan ranges of Garhwal and Kumaon, up to 3,000 ft., and eastwards to Sikkim and Bhutan; also in Assam and on the Khasia and Naga Hills; found also in Bengal, the C. Prov. and S. India, extending to China, Hongkong and Java.

24. ZEUXINE, Lindl.; Fl. Brit. Ind. vi, 106.

Terrestrial herbs with succulent glabrous stems. *Leaves* membranous, sometimes withering at the time of flowering. *Flowers* small, in racemes or spikes. *Sepals* subequal; lateral pair free, the dorsal one concave. *Petals* like the dorsal sepal, and with it forming a hood to the column. *Lip* adnate to base of column, cymbiform or saccate at the base; apical lobe shortly clawed or sessile, divided into two subquadrate more or less truncate diverging lobules, or entire, or with narrow decurved lobules, the basal sac with calli or laminae within. *Column* very short, its anterior face with lamellar or conical processes; stigmas 2, lateral, distinct. *Anther* membranous, sometimes ridged, the cells contiguous; pollinia pyriform, attached by an oblong gland to the erect rostellum. Species about 30, in Trop. Asia and in Trop. and S. Africa.

Z. sulcata, Lindl. *Gen. and Sp. Orch.* 485; *Royle Ill.* 368; *F. B. I.* vi, 106; *Watt E. D.*; *K. & P. Ann. R. Bot. Gard. Calcutta*, viii, 286, t. 381; *Duthie id.*, ix, part 2, 168; *Prain Beng. Pl.* 1029; *Cooke Fl. Bomb.* ii, 708. *Pterygodium surcatum*, Roxb. *Fl. Ind.* iii, 452.

Whole plant 2-10 in. high. *Stem* and peduncle glabrous. *Leaves* 1-2 in. long, linear, acuminate, sessile on the hyaline truncate sheaths, gradually passing into linear bracts higher up. *Raceme* $\frac{1}{2}$ -2 in. long, densely fld., glabrous; fl. bract $\frac{1}{2}$ in. long, ovate-lanceolate, acuminate, much longer than the ovary. *Flowers* about $\frac{1}{2}$ in. long, white or pink. *Sepals* unequal, the dorsal one ovate, concave, lateral pair obliquely lanceolate, connivent. *Petals* falcately oblong, obtuse, forming with the dorsal sepal a hood over the column. *Lip* yellow, as long as the sepals, cymbiform and saccate at the base; terminal lobe short, subquadrate, entire or bifid. *Column* very short, with two wings at its apex covering the anther; rostellum with two short stout parallel arms. *Anther* depressed, very shortly beaked. *Pollinia* attached within the tip of a linear appendage of the gland. *Capsule* ellipsoid, about $\frac{1}{2}$ in. long.

Common within the area in open turf and usually moist ground. Flowers during February and March. **DISTRIB.:** Abundant in grassy places throughout the greater portion of India, ascending to about 5,000 ft. on the outer Himalayan ranges; found also in Afghanistan, Ceylon, China, Japan, Java and the Philippines.

25. HABENARIA, Willd.; Fl. Brit. Ind. vi, 131.

Terrestrial leafy herbs with undivided or lobed tubers or fleshy root-fibres. *Leaves* flat, with sheathing bases. *Flowers* small or large, in racemes or spikes. *Sepals* subequal, the lateral pair spreading reflexed or deflexed, or sometimes erect. *Petals* smaller or larger than the sepals, entire or 2-cleft, often connivent with the dorsal sepal to form a hood over the column. *Lip* adnate to base of column, entire, 3-lobed or 3 partite, its base spurred. *Column* short, usually broad; stigmas 2, distant or conjoined across the face. *Anther-cells* adnate to the front of the column, discrete, rarely touching, parallel or divergent below, their bases often prolonged into tubes containing the caudicles; staminodes rugulose, one on the outer side of each anther-cell, rarely filiform; pollinia 2, clavate or pyriform, usually grooved, sometimes 2-partite; caudicles long, short or obsolete; glands exposed, flat and discoid or elliptic and globular, or elongate with truncate ends. Species about 500, widely distributed in temp. subtrop. and trop. regions of the world.

Petals 2-partite, segments filiform; lateral
sepals deflexed, tips filiform; flowers
 greenish

1. *H. graveolens*.

Petals entire; lip 3-partite or lobed—

Side-lobes of lip petaloid, truncate, much wider than the narrow linear midlobe; flowers white :—

Side-lobes of lip pectinate to the middle; petals small; spur slender, twice as long as the ovary or longer . . . 2. *H. Susannæ*.

Side-lobes of flabelliform lip not pectinate :—

Stem leafy upwards; spur slender, twice as long as the ovary . . . 3. *H. longifolia*.

Leaves all radical; spur equalling or longer than the ovary . . . 4. *H. plantaginea*.

Petals entire; lip 3-partite, the side-lobes very narrow and usually filiform :—

Spur filiform, fusiform or long-clavate, as long as or longer than the ovary :—

Anther-tubes long :—

Leaves distinctly pale-margined; spur usually much longer than the ovary, funnel-shaped at the mouth and clavate at the apex . . . 5. *H. commelinifolia*.

Leaves not margined; spur about as long as the ovary . . . 6. *H. pubescens*.

Anther-tubes short :—

Leaves three or more :—

Leaves not margined; flowers green . . . 7. *H. turcifera*.

Leaves pale-margined; flowers yellow . . . 8. *H. marginata*.

Leaves two, radical, orbicular, cordate, margined; spur shorter than ovary . . . 9. *H. diphylla*.

Spur small, globose ellipsoid or shortly clavate, much shorter than the ovary :—

Leaves narrowly lanceolate or elliptic; flower small, white tinged with yellow and green; tubers glabrous . . . 10. *H. Lawii*.

Leaves ovate or ovate-elliptic; tubers hairy :—

Flowers in lax subsecund spikes, white, fragrant 11. *H. goodyeroides*.

Flowers in dense cylindric spikes, white or pale-yellow, fragrant 12. *H. constricta*.

1. *H. graveolens*, Duthie, (n. sp.). *H. digitata* (not of Lindl.) Duthie, Ann. R. Bot. Gard. Calc. ix, part 2, 178, t. 128.

Stem 1-2 ft. high, stout, cylindric, lower portion clothed with closely fitting sheaths. *Leaves* 1½-3 in. long, broadly lanceolate or ovate-lanceolate, acuminate, 3-5-nerved; apex acuminate and with reflexed tips; margins undulate and coarsely toothed. *Raceme* laxly many-flowered, about 6 in. long, elongating in fruit; floral bracts subfoliaceous, narrowly lanceolate, acuminate, longer than the slender ovary, pale-margined. *Flowers* subsecund, about ¼ in. in diam. *Sepals* unequal, the dorsal one erect, suborbicular, its apex bluntly acuminate, green on both surfaces, minutely pustulate on the back; lateral pair longer than the dorsal one, deflexed, subfalcately lanceolate, white towards the base and tapering into short filiform tips. *Petals* deeply partite; segments filiform, fleshy, white, with slender recurved green tips. *Lip* 3-partite, lateral lobes resembling the segments of the petals, but rather longer; midlobe linear, straight, longer than lateral ones. *Spur* shorter than the ovary, laterally compressed, white towards the dilated mouth and with a green clavate apex. *Anther-cells* separate, with prominent diverging tubes. *Staminodes* herbaceous, oblong or orbicular, margins erose. *Pollinia* obliquely ovate; caudicles slender, attached by the dilated base to small brownish glands. Stigmatic processes subcylindric, blunt, recurved, the entrance to the spur lying between their bases.

Dehra Dun, at Kansrao, in sal forest (Duthie, Mackinnon). Flowers during July. *DISTRIB.*: W. Himalaya in Garhwal and Kumaon in warm valleys. The flowers have a peculiarly pungent odour resembling that of *Valeriana Wallichii*. This plant is, I now consider, quite distinct from *H. digitata* of Lindley, under which name it was described and figured in the second part of Vol. IX of the Annals of R. Bot. Gard. Calo. p. 178, t. 128. In *H. graveolens* the leaves are mostly collected at about the middle of the stem; the lateral sepals are deflexed longer and with filiform tips, and the filiform segments of the 2-partite petals are recurved at the apex.

2. *H. Susanna*, R. Br. Prod. 312; Royle Ill. 367; F. B. I. vi, 137; Collett Fl. Siml. 501; Prain Beng. Pl. 1032; Duthie Ann.

R. Bot. Gard. Calc. ix, part 2, 178, t. 128. H. gigantea, Don. Prod. 24. Platanthera Susannæ, Lindl.; Cooke Fl. Bomb. ii, 713. Orchis Susannæ, Linn.

Height of plant about 2 ft. *Tubers* elongate, 3-4 in. long. *Stem* stout with many blunt funnel-shaped sheaths on its lower portion. *Leaves* 2-6 in. long, ovate-oblong, obtuse, the upper ones bract-like, acuminate, imbricate. *Raceme* 3-5-fld.; floral bracts longer than the ovary, cucullate, acuminate. *Flowers* subsessile, 3-4 in. in diam. white tinged with greenish-yellow, fragrant. *Sepals* very broad, spreading, the dorsal one suborbicular, about $1\frac{1}{2}$ in. long and broad; lateral pair $1\frac{1}{2}$ in. long, obliquely oblong, obtuse. *Petals* $\frac{1}{2}$ in. long, linear falcate, acute, fleshy. *Lip* 3-lobed, about as long as the sepals, fleshy; side-lobes very broad, truncate, deeply pectinate; midlobe linear-spathulate, with recurved margins. *Spur* slender more than twice the length of the elongate ovary. *Anther* very broad, cells divergent; tubes long, adnate to the sides of the column. *Pollinia* linear, curved, yellow, about as long as their white flexuous caudicles; glands ovoid, white. *Staminodes* linear-oblong, with crisped margins. *Stigma* on the front of the column. *Capsule* with pedicel 2 in. long, ellipsoid, beaked.

Siwalik range (Royle). Flowers July-Sep. **DISTRIB.:** Outer Himalayan ranges in Garhwal and Kumaon up to 6,000 ft.; Chota Nagpur and in the hilly districts of Bombay and S. India, extending to Burma, China and the Malay Archipelago.

S. *H. longifolia*. *Buch.-Ham. in Lindl. Gen. & Sp. Orch. 324; F. B. I. vi, 141; Prain Beng. Pl. 1032; Duthie Ann. R. Bot. Gard. Calc. ix, part 2, 181. H. trapezoidea, Falc. mss.*

Stem 10-18 in. high, slender, leafy. *Leaves* 3-5 in. long, scattered erect, linear, acuminate, smaller upwards. *Spike* 2-2 $\frac{1}{2}$ in. long, few and laxly fld.; floral bracts linear, acuminate, longer than the slender beaked ovary. *Flowers* medium-sized, white. *Sepals* minute, the lateral pair $\frac{1}{2}$ in. long, oblong-lanceolate, 3-nerved, larger than the dorsal one. *Petals* gibbously ovate, as long as the dorsal sepal, 3-nerved. *Lip* flabelliform, $\frac{1}{2}$ - $\frac{3}{4}$ in. long and broad; side-lobes semicircular, entire; midlobe linear, shorter than the side-lobes. *Spur* slender, twice as long as the ovary, green. *Anther* beaked, cells parallel; tubes incurved. *Stigmatic processes* short, clavate, incurved towards the mouth of the spur. *Rostellum* long, erect, spathulate.

Siwalik range, on the Mohand Pass ("Portus Kheree") Royle. **DISTRIB.:** N. Bengal at Nathpur in Purnea (Buch.-Hamilton). I have seen no living or herbarium specimens of this plant.

4. *H. plantaginea*, Lindl. *Gen. & Sp. Orch.* 323; Hook. *f. F. B. I.* vi, 141; Prain. *Beng. Pl.* 1032; Duthie *Ann. R. Bot. Gard. Calc.* ix, part 2, 181, t. 132; Cooke *Fl. Bomb.* ii, 718. *Orchis platyphyllos*, Roxb. *Fl. Ind.* iii, 609.

Tubers ellipsoid, about $1\frac{1}{2}$ in. long. *Stem* scapigerous. *Leaves* about three or four, radical, horizontal, 3-6 in. long, elliptic-oblong, sub-obtuse, membranous. *Scape* slender, 8-12 in. high, bearing many lanceolate acuminate bracts, the lowest often larger and leaflike. *Spike* 2-5 in. long, laxly flowered. *Flowers* subsecund, white; floral bracts lanceolate, acuminate or setaceous, half as long as the curved beaked ovary. *Sepals* subequal, about $\frac{1}{2}$ in. long, strongly 3-nerved, white tinged with green; dorsal erect, ovate-oblong; the lateral pair falcately oblong, spreading. *Petals* linear-lanceolate, adpressed to and forming a hood with the dorsal sepal. *Lip* 3-lobed, flabelliform, clawed, twice as long as the lateral sepals, puberulous; side-lobes semiovate, entire or with undulate margins, often overlapping at their tips; midlobe a little shorter, linear-oblong, deflexed. *Spur* equal to or longer than the ovary, tapering to the apex, greenish-yellow. *Anther* broad, cells divergent; tubes short, upcurved. *Pollinia* globose or ellipsoid; caudicles curved, widening upwards from a narrow base; glands falcately ovate, connate when young. *Stigmatic processes*, large, fleshy, oblong; rostellum triangular, broad. *Staminodes* prominent with sinuate margins. *Capsule* $\frac{3}{4}$ in. long, turgid, curved.

Dehra Dun (Falconer, Duthie). *Flowers* Sep. and Oct. **DISTRIB.:** Outer Himalayan ranges of Garhwal and Kumaon up to 7,000 ft.; also in Sikkim and Bengal and southwards to the Konkan and Deccan to Ceylon.

5. *H. commelinifolia*, Wall. in Lindl. *Gen. & Sp. Orch.* 325; Hook. *f. F. B. I.* vi, 143; Prain *Beng. Pl.* 1032; Duthie *Ann. R. Bot. Gard. Calc.* ix, part 2, 183, t. 134; Cooke *Fl. Bomb.* ii, 719. *Orchis commelinifolia*, Roxb. *Fl. Ind.* iii, 451.

Stem 2-3 ft. high, loosely sheathed at the base. *Tubers* ellipsoid or cylindrical. *Leaves* scattered, 3-6 in. long; oblong or oblong-lanceolate, subcordate, acute and often subspinescent at the tips, margins pale. *Spike* 4-8 in. long, many- and loosely flowered; flowering bracts erect, nearly equalling the long-beaked ovary, scaberulous on both surfaces and ciliolate on the margins. *Flowers* $\frac{1}{2}$ - $\frac{3}{4}$ in. in diam., white, inodorous. *Sepals* scaberulous; dorsal small, saccate, with a short curved beak; lateral pair spreading, much shorter, hatchet-shaped, beaked,

the veins deeply looped or arched. *Petals* unequally oblong, smaller than the lateral sepals. *Lip* divided into three long filiform segments, about 1 in. long from its base to the tip of the mid-segment; lateral ones $1\frac{1}{2}$ in. long, curved downwards; mid-segment channelled above, spreading, spaberulous; spur $1\frac{1}{2}$ - $2\frac{1}{2}$ in. long, slender and curved downwards, its upper portion funnel-shaped and white, its apex clavate and green. *Anther-cells* elongate, distant, diverging at the base; tubes long, straight. *Pollinia* small, oval; caudicles very long, dilated upwards, translucent; glands minute. *Staminodes* seated on the long arms of the column and curving round in front of the anther tubes. *Stigmatic* processes large, clavate, incurved; rostellum triangular.

Dehra Dun and Siwalik range, usually in open grassy places (Mackinnon, Duthie). Flowers during Aug. and Sep. **DISTRIB.**: Outer ranges of W. Himalaya from the Punjab to Kumaon, up to 5,000 ft., extending eastwards to Parasnāth, Chota Nagpur and Upper Burma, and south to Cent. W. and S. India.

6. *H. pubescens*, Lindl. *Gen. & Sp. Orch.* 322; Hook. f. *F. B. I.* vi, 144; Duthie *Ann. R. Bot. Gard. Calc.* ix, part 2, 183, t. 135.

Tubers elongate, stout, often divided, and with a few thick fleshy fibres from their summits. *Stem* 12-18 in. high, clothed at the base with a few tight-fitting pubescent sheaths. *Leaves* crowded towards the middle or base of the stem, 4-6 in. long, lanceolate, acuminate, tapering to the base, 7-9 nerved, undulate, not margined. *Raceme* with a few empty leaflike bracts at its base, 8-10 in. long, lax, many-fld., pubescent; floral bracts longer than the long-beaked ovary, ovate lanceolate, acuminate, ciliolate. *Flowers* small, greenish-yellow. *Dorsal sepal* $\frac{3}{4}$ - $\frac{1}{2}$ in. long, broadly ovate, a little shorter than the dimidiate-ovate obtuse deflexed lateral ones. *Petals* narrowly falcate, longer than the dorsal sepal and forming with it a hood over the column. *Lip* 3-partite, longer than the sepals; segments linear with filiform tips; midlobe shorter, obtuse, keeled beneath. *Spur* slender, about as long as the curved ovary. *Anther-tubes* long, flexuous. *Pollinia* ovate, obliquely attached to the long slender flexuous caudicles; glands flat; staminodes prominent. *Stigmatic processes* globose. *Capsule* curved and with a long beak, prominently ridged.

Dehra Dun (Mackinnon). **DISTRIB.**: Outer ranges of W. Himalaya in Garhwal and Kumaon, up to 5,500 ft. (Royle, Falconer, Duthie).

7. *H. fureifera*, Lindl. *Gen. & Sp. Orch.* 319; Hook. f. *F. B. I.* vi, 149; K. and P. *Ann. R. Bot. Gard. Calc.* viii, 313, t. 410. Duthie *id.* ix part 2, 184.

Stem stout, 10-18 in. high, sheathed at the base, leafy below the middle bracteate above. *Leaves* 3-4½ in. long, elliptic, acute or acuminate. *Racemes* 5-7 in. long, laxly many-flid. *Flowers* about ½ in. across from base to apex, green; floral bracts about as long as the ovary, lanceolate, acuminate. *Sepals* unequal; dorsal one ovate-oblong, obtuse, concave; lateral pair shorter, broadly and falcately lanceolate, acute or acuminate, spreading. *Petals* as long as the dorsal sepal and with it forming a hood over the column, oblong, retuse. *Lip* 3-partite, longer than the sepals; lateral segments filiform, diverging, curved, longer than the stouter blunt midlobe. *Spur* slender, longer than the ovary, laterally compressed, curved at the apex. *Anther-cells* contiguous, diverging at their bases, the tubes rather short, up-curved. *Pollinia* falcately ovoid; caudicles slender, slightly curved; glands narrowly oblong. *Staminodes* large, broadly oblong. *Stigmatic processes* short. *Capsule* fusiform, decurved, shortly beaked, prominently ribbed.

Dehra Dun and Siwalik range (Mackinnon, Duthie). Flowers during Aug. and Sep. **DISTRIB.** : Outer ranges of W. Himalaya in Garhwal, up to 6,000 ft., and eastwards to Sikkim and Bhutan; also in Bengal, Assam, Orissa, and extending to Upper Burma.

S. H. marginata, Colebr. in Hook. Flor. Exot. t. 136; Hook. f. F. B. I. vi, 150; Collett Fl. Siml. 504; Prain Beng. Pl. 1033; Duthie Ann. R. Bot. Gard. Calc. ix, part 2, 184, t. 136; Cooke Fl. Bomb. ii, 721.

Subscapigerous, glabrous. *Tubers* small, narrowly cylindric. *Leaves* few, subradical, sessile, ½-5 in. long, oblong or linear-oblong, obtuse, 3-5-nerved; margins pale-yellow. *Scape* 4-10 in. long; sheaths erect, lanceolate, acuminate. *Spike* 2-6 in. long, many-flid.; floral bracts nearly as long as the ovary, lanceolate, acuminate, with pale ciliolate margins. *Flowers* ½ in. across. *Sepals* green; dorsal one ½ in. long, erect, broadly ovate; lateral longer, falcately oblong-lanceolate, spreading or deflexed, 3-5 nerved. *Petals* ½ in. long, falcately oblong, closely adpressed to the dorsal sepal. *Lip* nearly ½ in. long, 3-partite nearly to the base, lateral segments narrowed into filiform tips; midlobe shorter and broader; the margins inflexed. *Spur* about as long as the curved ovary, laterally compressed at the fusiform apex. *Anther-cells* distant; tubes funnel-shaped, short, spreading. *Pollinia* obovate, with short geniculate caudicles; glands triangular. *Staminodes* elongate. *Stigmatic processes* long, adnate to the base of the column. *Capsule* about ½ in. long, fusiform, turgid.

Dehra Dun and Siwalik range (Duthie). Flowers during August
DISTRIB. : Western Himalaya from Kashmir to Kumaon, up to 7,000 ft.; also in Bengal, and found as a weed in the Bot. Gard. Calcutta, extending to Burma and to W. and S. India.

9. *H. diphylla*, Dalz. in Hook. Journ. Bot. ii (1850), 262; F. B. I. vi, 151; Prain Beng. Pl. 1033; Duthie Ann. R. Bot. Gard. Calc. ix, part 2, 185, t. 137; Cooke Fl. Bomb. ii, 722.

Tubers small, elongate or globose. *Leaves* radical, usually two, 1-2 in. in diam.; orbicular cordate, margined, rather fleshy. *Scape* 4-10 in. high, with a few distant lanceolate acuminate bracts. *Flowers* many, distant, spreading, about $\frac{1}{2}$ in. diam., white tinged with green; floral bract much shorter than the slender curved ovary. *Sepals* about $\frac{1}{2}$ in. long; dorsal erect, ovate, concave, acute, obscurely nerved; lateral pair slightly longer, deflexed, obliquely ovate, acuminate, 3-nerved. *Petals* linear, white, as long as the dorsal sepal and forming a hood with it. *Lip* much longer than the sepals, 3-partite; segments filiform, white with green tips, lateral pair spreading and with spirally twisted tips; midlobe shorter, deflexed. *Spur* shorter than the ovary, inflated towards the acute inflated apex. *Anther* broad, the cells distant; tubes very short. *Pollinia* dimidiate-ovate, obliquely attached to caudicles equalling them in length; glands very small, flat, circular. *Staminodes* large, petaloid. *Stigmatic processes* elongate, clavate, adnate to the mouth of the spur. *Rostellum* obscure.

Dehra Dun (Mackinnon). Flowers during Aug. DISTRIB. : Outer ranges of W. Himalaya in Garhwal (Falconer); eastwards to Bengal and Chota Nagpur, and southwards from Konkan and Kanara to Malabar.

10. *H. Lawii*, Hk. f. in F. B. I. vi, 162; Prain Beng. Pl. 1033; Duthie Ann. R. Bot. Gard. Calc. ix, Part 2, 192, t. 143. *Peristylus Lawii* Wight Ic. t. 1695; Cooke Fl. Bomb. ii. 712.

Tubers ellipsoid or globose. *Stem* 6-12 in. high, slender, with a few short loose sheaths below the leaves. *Leaves* 3-5, clustered above the middle of the stem, 3-4 in. long, narrowly lanceolate or elliptic, acute, membranous. *Spike* 2-3 in. long, slender, narrow, many-fl. *Flowers* small, crowded, spreading, white tinged with yellow and green; floral bracts ovate-lanceolate, acuminate, longer than the slender curved ovary. *Sepals* and petals $\frac{1}{2}$ in. long, white tinged with yellow at the base, connivent, obtuse; dorsal sepal elliptic, concave; lateral subfalcately linear-oblong. *Petals* oblong, obtuse, fleshy. *Lip* as

long as the sepals, broadly and obtusely 3-fid.; lobes rounded at the apex; midlobe twice as long as the lateral pair, its claw green tinged with yellow, and with a short ciliate ridge at its base. *Spur* small, globular, dark-green. *Anther-cells* parallel, tubes none. *Pollinia* obovate; caudicles nearly as long, attached to minute globular glands. *Staminodes* large, green, with broad white margins. *Stigmatic processes* short, clavate. *Rostellum* short, triangular, acute.

Dehra Dun (Mackinnon, Duthie). Flowers during July and August. **DISTRIB.** : W. Himalaya, in Garhwal (Herb. Calc.); Bengal and Bihar; C. Prov., in the Chanda district, and extending to S. India from the Konkan.

11. *H. goodyeroides*, Don *Prod. Fl. Nep.* 25; *F. B. I.* vi, 161 (in part); *K. & P. Ann. R. Bot. Gard. Calc.* viii, 326, t. 430; *Duthie id. ix, part 2*, 192; *Collett Fl. Siml.* 505; *Prairie Beng. Pl.* 1039 *Peristylus goodyeroides*, *Lindl. Gen. & Sp. Orch.* 299.

Tubers ellipsoid or ovoid, hairy. *Stem* stout, 1-2 ft. high, its lower portion clothed with many loose blunt sheaths. *Leaves* clustered above the middle of the stem, but not in whorls, 6-10 in. long, ovate or ovate-elliptic, acute, narrowed to the shortly sheathed base. *Spike* 4-8 in. densely flowered, its peduncle bearing a few lanceolate acuminate bracts. *Flowers* subsecund, white, fragrant, about $\frac{1}{2}$ in. across; floral bracts narrowly lanceolate, acuminate, about as long as the slender curved ovary. *Sepals* unequal, tinged with brown the dorsal one broadly ovate-lanceolate, concave, conniving with the petals and forming a hood; lateral pair oblong, involute, apiculate. *Petals* as long as sepals, trapeziform, blunt. *Lip* longer than the petals, 3-lobed; side lobes linear-oblong falcate, acute, slightly longer than the broad blunt midlobe, *Spur* minute, subglobose, much shorter than the sepals. *Column* short, broad. *Anther-cells* parallel, not contiguous, tube none. *Pollinia* pyriform, caudicles very short, the glands small, obovoid. *Staminodes* large, oblong, spreading, *Stigmatic processes* short, lying beneath and parallel to the staminodes.

Dehra Dun (Mackinnon). Flowers during July and August. **DISTRIB.** : Outer Himalayan ranges from Garhwal to Sikkim and Bhutan; also in Assam, Khasia Hills and south to Bengal, extending to China.

12. *H. constricta*, Hook. f. in *F. B. I.* vi, 161; *K. & P. Ann. R. Bot. Gard. Calc.* viii, 325, t. 429; *Duthie id. ix, part 2*, 193; *Prairie Beng. Pl.* 1033. *H. goodyeroides*, *Lindl. in Wall. Cat.* 7066

(not of Don). *Platanthera constricta*, Lindl. in Wall. Cat. 7043. *Herminium constrictum*, Lindl. in Bot. Reg. under t. 1449. *Peristylus constrictus*, Lindl. Gen. and Sp. Orch. 300.

Tubers oblong, hairy. *Stem* stout, 2-3 ft. high, clothed at the base with wide blunt sheaths. *Leaves* five or six, on upper portion of stem, more or less whorled, 4-7 in. long, ovate-elliptic, acute or acuminate, narrowed towards the long sheaths; bracts on the peduncle linear-lanceolate, acuminate. *Spike* broadly cylindric, 4-8 in. long, many- and densely-flowered. *Flowers* spreading, white or pale yellow, sweet-scented; floral bracts large, erect, lanceolate, acuminate, about as long as the ovary. *Sepals* subequal, $\frac{1}{2}$ - $\frac{3}{4}$ in. long, oblong, obtuse, ciliate; lateral pair spreading, with involute edges. *Petals* larger than the sepals, obliquely ovate-lanceolate, somewhat gibbous on the lower side, spreading upwards in front of the dorsal sepals, but not connivent to form a hood. *Lip* as long as the petals, 3-lobed to about the middle; lateral lobes linear, acuminate, somewhat diverging at their tips; midlobe shorter, oblong, tapering to a blunt point. *Column* very short and broad. *Anther-cells* close together but not contiguous; tubes none. *Pollinia* obovoid, caudicles short, tapering to the large oblong-elliptic glands. *Staminodes* oblong, obtuse. *Stigmatic processes* clavate, spreading. *Rostellum* erect, 2-fid.

Siwalik range (Duthie); Dehra Dun, in sal forests (Mackinnon). Flowers during July and August. **DISTRIB.**: Outer Himalayan valleys in Kumaon and in Sub-tropical Sikkim; also in Assam, Chota Nagpur and Chittagong, extending to Upper and Lower Burma.

CVIII. SCITAMINEÆ.

Herbs, often large, frequently with a pseudostem of convolute leaf-sheaths, rarely with a woody caudex. *Leaves* radical or cauline, usually membranous; sheaths generally large, clasping the stem; lamina with a strong midrib; secondary nerves close pinnate, parallel. *Flowers* 2-sexual, rarely 1-sexual (as in *Musa*), irregular, solitary or spicate; bracts membranous or herbaceous, bracteoles membranous or none. *Perianth* 2-seriate, superior; outer segments 3, calycine, rarely petaloid, free and imbricate or connate in an entire toothed or spathaceous tube; inner segments petaloid, connate in a long or short corolla-tube, free or adnate to the petaloid staminodes; limb 3-partite, the segments

free or connate. *Stamens* only 1 perfect, the rest replaced by petaloid staminodes, or 5 perfect, and a sixth imperfect or obsolete; anthers linear, 2-celled, rarely of one cell on the margin of a petaloid connective. *Ovary* inferior, 3-rarely 2-or 1-celled; style usually slender, with 2 short stylodes crowning the ovary, stigma entire or subentire; ovules usually many, axile, rarely parietal, anatropous. *Fruit* a loculicidally 3-valved capsule or indehiscent and membranous or fleshy, usually crowned by the remains of the perianth. *Seeds* often arillate, albumen floury, embryo small.—Species 400-500, chiefly tropical.

Stamen only one perfect, others reduced to staminodes or wanting:—

Anther 2-celled; calyx tubular or spathaceous; style slender, embraced below the stigma by the anther:—

Ovary 1-celled; placentas 3, parietal; cor-tube long; flowers yellow . . . 1. GLOBBA.

Ovary 3-celled; placentas axile:—

Lateral staminodes broad:—

Connective not spurred at the base; cor-tube long, slender:—

Filament short; connective broad, crested; stigma turbinate . . . * KEMPFERIA.

Filament long, narrow; connective very narrow, not crested; stigma subglobose . . . 2. HEDYCHUM.

Connective spurred at the base; cor-tube funnel-shaped; stigma 2-lipped, the lips ciliate; bracts forming a cone-like spike . . . 3. CURCUMA.

Lateral staminodes small or none, rarely narrow and adnate to the lip; cor-tube cylindric:—

Flowers in a dense cone-like spike:—

Filament short; anther-cells contiguous, parallel; connective produced as a narrow appendage as long as the anther; stigma small, subglobose; spikes usually

produced direct from the root-stock, sometimes at the top of a leafy stem 4. ZINGIBER.

Filament forming with the produced connective an oblong petaloid process, with the contiguous linear anther-cells placed in its middle; stigma with a semilunar pit ciliate round the margin; spikes usually at the top of leafy stems 5. COSTUS.

Flowers in racemes or panicles at the top of leafy stems; filament long; anther-cells divergent at apex; stigma subglobose * ALPINIA.

Anther 1-celled, laterally adnate to a petaloid filament; calyx of free sepals:—

Staminal tube with 5 subsimilar slightly unequal petaloid segments, the 1-celled anther adnate to one of the smaller segments; ovary 3-celled; placentas many-ovuled * CANNA.

Stamens 5 perfect, free, the 6th imperfect or absent; sepals united in a split spathe-like tube; corolla short, included and enveloping the stamens and style; fruit fleshy, indehiscent; leaves very large * MUSA.

The genera marked with an asterisk in the above key are not truly indigenous within the area of this flora.

1. GLOBBA, Linn. ; Fl. Brit. Ind. vi, 201.

Herbs with creeping rhizomes and erect stems. *Leaves* oblong or oblong-lanceolate. *Flowers* in terminal panicles, rarely in spikes, bracts usually deciduous, buds often replaced by bulbils. *Calyx* funnel-shaped, 3-lobed. *Corolla* 3-lobed, longer than calyx; lobes ovate, subequal. *Stamen* 1, filament long, incurved, with 2 dorsal appendages; anther oblong; connective simple, winged or spurred, produced beyond the cells. *Ovary* 1-celled; style filiform, placed in a groove of the filament, stigma turbinate; ovules many, on 3 parietal placentas. *Fruit* a globose capsule,

tardily dehiscent. *Seeds* many, small, ovoid, with a small white lacerate aril.—Species 60 to 70, in India, Malaya, China, Philippines and New Guinea.

G. orizensis, Roxb. in *Asiat. Res.* xi, 358; *Fl. Ind.* i, 78; *F. B. I.* vi. 201; *Prain Beng. Pl.* 1037.

Herb with perennial rootstock and annual leafy stems, 1-2 ft. high. *Leaves* 8-10 in. long, glabrous beneath. *Panicle* long, narrow; lower branches 2-3-fid. at tip; bulbils none; bracts small, deciduous. *Flowers* deep-orange. *Corolla* segments staminodes and lip equal in length. *Lip* spotted with reddish brown at the throat. *Capsule* warted.

Dehra Dun and on the Siwalik range. Flowers during the rains.—**DISTRIB.**: Bengal, Chota Nagpur, Bihar, Sikkim, N. Circars (Roxburgh).

2. HEDYCHIUM, Kœnig; *Fl. Brit. Ind.* vi, 225.

Herbs with perennial horizontal tuberous rootstocks; root-fibres not much thickened; stem elongate, leafy. *Leaves* distichous, oblong or lanceolate. *Flowers* usually in terminal spikes; bracts oblong, subcoriaceous, 1-or more-flowered. *Calyx* tubular, 3-toothed. *Corolla-tube*, long, slender; lobes equal, linear, spreading. Perfect *stamen* 1; filament long, slender, anther-cells contiguous, connective not produced; lateral staminodes linear or cuneate-oblong; lip large, bifid. *Ovary* 3-celled; style long, filiform, stigma subglobose; ovules many, superposed on axile placentas. *Fruit* a globose 3-valved capsule. *Seeds* many, small, with a lacerate aril.—Species 38, chiefly Indian and Malaya.

H. coronarium, Koen. in *Retz. Obs. Bot. fasc.* iii, 173; *Roxb. Fl. Ind.* i, 10; *F. B. I.* VI, 225; *Prain Beng. Pl.* 1039; *Cooke Fl. Bomb.* ii, 728.

A tall herb with erect leafy stems, 4-6 ft. high; rootstock $\frac{1}{2}$ -2 in. in diam., fleshy, jointed. *Leaves* sessile, 9-14 in. long, lanceolate, finely acuminate, glabrous above, glabrous or sparsely pubescent beneath; base narrowed; sheath smooth; ligule membranous. *Flowers* pure white, fragrant, in dense oblong spikes 4-8 in. long; bracts closely imbricate, 3-4-fid.; the outer ones $1\frac{1}{2}$ -2 in. long, ovate, obtuse; bracteoles 3, membranous. *Calyx* $1\frac{1}{4}$ in. long, cylindric, green, shorter than the bracts. *Corolla-tube* 3 in. long; segments half as long as the tube, reflexed. *Lateral staminodes* $1\frac{1}{2}$ in. long,

subobtus, white. *Lip* $1\frac{1}{2}$ -2 in. broad, suddenly contracted into a short claw; lobes short, rounded. *Stamen* $1\frac{1}{2}$ in. long; anther about $\frac{1}{2}$ in. *Capsule* oblong, glabrous, the valves orange-yellow within. *Seeds* with a crimson aril.

Dehra Dun (Duthie). Flowers during the rains. **DISTRIB.**: Throughout India from the Himalaya and the Khasia Hills southwards to Chittagong, Bengal, Kanara, Konkan and Ceylon, extending to Malay Pen. and Islands. See Kew Bulletin (No. 9, 1912) for an account of the fibre yielded by this and allied species of *Hedychium*, and of its value as a material for paper-making. See also Watt's "Comm. Products of India" p. 776.

3. CURCUMA. Linn.; Fl. Brit. Ind. vi, 209.

Stemless herbs with tuberous rootstocks bearing sessile and long-stipitate tubers. *Leaves* usually oblong, often very large. *Flowers* usually in dense compound spikes, vernal or æstival and preceding the leaves or autumnal and coetaneous, crowned by a coma of enlarged coloured bracts; lower bracts ovate, membranous, enclosing several bracteolate fugitive flowers which open in succession. *Calyx* short, cylindric, minutely toothed. *Corolla-tube* funnel-shaped; segments usually ovate or oblong; upper longer, somewhat concave. *Stamen* 1, perfect, filament short, anther not crested; cells contiguous, spurred at the base; lateral staminodes oblong, petaloid, connate with the filament; lip orbicular, with a deflexed tip. *Ovary* 3-celled, style filiform; stigma 2-lipped, the lips ciliate; ovules many, on axile placentas. *Fruit* a tardily dehiscent globose membranous 3-valved capsule. *Seeds* ovoid or oblong, usually arillate.—Species about 40, mostly in S. E. Asia.

C. angustifolia, Roxb. in *As. Res.* xi, 338, t. 3; *Fl. Ind.* i, 31. Royle *Ill.* 357, 359; *F. B. I.* vi, 210; Watt *E. D.*; Collett *Fl. Siml.* 512; Prain *Beng. Pl.* 1041. Vern. *Tikhur*.—E. Indian Arrow-root.

Rootstock small, emitting long fleshy fibres terminating in pale oblong pendulous tubers. *Leaves* (with petiole) $1-1\frac{1}{2}$ ft.; blade lanceolate, acute $\frac{1}{2}$ -1 ft. long. *Fl. spike* lateral, apart from and usually appearing earlier than the leafy spike, crowned by several enlarged empty pink bracts. *Flowers* yellow, longer than their bracts, 3 or 4 together in the axil of each bract opening in succession and quickly

fading; sheaths of pseudostem pale-green. *Calyx* 3-toothed. *Corolla-tube* $\frac{3}{4}$ in. long, somewhat gibbous; upper lobe erect, concave, ovate, longer than the two lateral ones. *Lateral staminodes* oblong, united to the filament; the lower large, broad, spreading, notched; connective produced at the base in a fork. *Capsule* ovoid, ultimately opening by 3 valves. *Seeds* many, small.

Abundant in Dehra Dun and in the Sub-Himalayan tracts of Rohilkhand and N. Oudh. Flowering during the rains. *DISTRIB.*: Outer ranges of Central Himalaya, also in W. Behar and N. Bengal; extending to Bombay and S. India. A kind of starch resembling arrowroot is prepared from the tubers.

C. LONGA, L. Sp. Pl. 2; Roxb. Fl. Ind. i, 32; Royle Ill. 358; F. B. I. vi, 214; Duthie in Field and Gard. Crops iii, 41, t. 77; Watt E.D.; Comm. Prod. Ind. 445; Prain Beng. Pl. 1042; Kanjilal For. Fl. (ed. 2) 405; Cooke Fl. Bomb. ii, 732. Vern. Haldi—Turmeric. —A tall herb. *Rootstock* large, ovoid, with sessile cylindric tubers orange-coloured inside. *Leaves* very large, in tufts up to 4 ft. or more long, including the petiole which is about as long as the blade, oblong-lanceolate, tapering to the base. *Flowers* in autumnal spikes, 4-6 in. long; peduncle 6 in. or more, concealed by the sheathing petiole; flowering bracts pale-green; bracts of coma tinged with pink.—This plant is much cultivated throughout India chiefly for the yellow dye obtained from the tubers, which also used as a condiment. The plant was probably introduced originally from China, though having all the appearance of being wild in Behar and Ch. Nagpur.

4. ZINGIBER, Adans.; Fl. Brit. Ind. vi, 243.

Herbs with elongated leafy stems and horizontal tuberous rootstocks. *Leaves* oblong-lanceolate. *Flowers* in spikes, usually radical, less often terminal, rarely lateral on the leafy stems; peduncle short or long; bracts persistent, usually 1-fld. *Sepals* 3, connate in a cylindric shortly 3-lobed calyx. *Petals* 3, connate in a corolla with cylindric tube; lobes lanceolate, the upper concave. *Stamen* 1 perfect; filament short; anther 2-celled; cells contiguous, with a narrow crest as long as themselves; lateral staminodes none, or adnate to the obovate-cuneate lip. *Carpels* 3, connate in a 3-celled ovary; ovules many, superposed; placentas axile; style filiform; stigma small, subglobose. *Fruit* an oblong capsule, tardily dehiscent. *Seeds* large, globose, arillate.—Species about 30 or more, in tropical regions of the Old World.

Z. capitatum, Roxb. in *Asiat. Res.* xi, 348; *Fl. Ind.* i, 55; *F. B. I.* vi, 248; *Prain Beng. Pl.* 1045.—Vern. *Jangli-adrak*.

Rootstock of many long-stalked oval tubers with a spicy fragrance. *Stems* slender, leafy, 3-4 ft. high. *Leaves* 12-18 in. long, linear, acuminate, ascending, usually pubescent beneath. *Spike* terminal, sessile, or somewhat prolonged beyond the sheaths of the upper leaves, erect or oblong-cylindric, 3-6 in. long; bracts closely imbricate, $1\frac{1}{2}$ in. long, ovate, green with a narrow brown edge. *Corolla-tube* as long as the bract, segments pale-yellow. *Lip* pale-yellow, not spotted; midlobe $\frac{1}{2}$ in. broad, orbicular, emarginate; basal auricles large, oblong, obtuse. *Capsule* bright-red, size of small olive, valves ovate. *Seeds* black, shining; aril large, lacerate, white.

Dehra Dun (Duthie), Banda (Edgew.), Gorakhpur (Burkill). Flowers in rains. **DISTRIB.**: Central Himal. from Kumaon to Sikkim; also Khasia Hills, Sylhet, Ch. Nagpur, and Chánda in Cent. Prov.

Z. OFFICINALE, *Rosc.*; *Roxb. Fl. Ind.* i, 47; *F. B. I.* vi, 246; *Watt E. D.*; *Comm. Prod. Ind.* 1139; *Duthie in Field and Gard. Crops*, part iii, 47, t. 100; *Kanjilál For. Fl.* (ed. 2) 405; *Prain Beng. Pl.* 1045; *Cooke Fl. Bomb.* ii, 736.—Vern. *Adrak* (fresh root), *sunt* (when dry)—Ginger.—A herb, with horizontal jointed tuberous rhizomes. *Stems* slender, 3-4 ft. high. *Leaves* 6-12 in. long, lanceolate, glabrous beneath. *Bracts* suborbicular, cuspidate. *Corolla-lobes* green. *Lip* and stamen purplish-black.—The ginger plant is much cultivated in Dehra Dun and throughout the Sub-Himalayan tracts of Rohilkhand and N. Oudh, and elsewhere in India. It has also been extensively introduced in the tropics of both hemispheres. The plant is known to have been grown in India and China for many centuries, but there is no record of its having been found in a truly wild condition. The usual vegetative mode of cultivating the ginger plant has brought about a tendency to cause sterility as in *Musa* and *Citrus*.

5. **COSTUS**, Linn.; *Fl. Brit. Ind.* vi, 249.

Herbs with long leafy stems; rootstock tuberous, horizontal. *Leaves* oblong, with broad sheaths. *Flowers* in dense globose or ovoid usually terminal spikes. *Calyx* short, funnel-shaped; teeth 3, ovate. *Corolla-tube* not longer than the calyx; segments large, oblong, subequal. *Lip* large, obovate with incurved margins. *Stamen* 1 perfect, filament forming with the connective an oblong petaloid process with the contiguous linear anther-cells situated in its middle; lateral staminodes minute or obsolete. *Ovary* 3-celled;

style filiform, stigma with a semilunar marginally ciliate foveola; ovules many, superposed. *Fruit* a globose or ovoid capsule, finally dehiscent on one side between the ribs. *Seeds* obovoid or subglobose, aril short.—Species nearly 100, in the tropics of both hemispheres. Many of them are cultivated for their handsome flowers.

C. speciosus, *Smith in Trans. Linn. Soc. i*, 249; *Roxb. Fl. Ind. i*, 18; *F. B. I. vi*, 250; *Watt E. D.*; *Prain Beng. Pl.* 1045; *Cooke Fl. Bomb. ii*, 736; *Kanjilal For. Fl. (ed. 2)* 406.—*Vern. Kust.*

An erect herbaceous plant, 4-6 ft. high. *Stem* somewhat woody at the base. *Leaves* subsessile, arranged spirally, 6-12 in. long, oblong or oblanceolate, acute or acuminate, often cuspidate, glabrous above, silky-pubescent beneath, base rounded; sheaths coriaceous: ligule none. *Flowers* many, in dense terminal spikes 2-5 in. long; bracts bright red, $\frac{3}{4}$ -1 $\frac{1}{4}$ in. ovate, acuminate or pungently mucronate; bracteole solitary, $\frac{5}{8}$ in. long. *Calyx* 1 $\frac{1}{4}$ in. long, deltoid-ovate, cuspidate. *Corolla-tube* as long as calyx; lobes ovate-oblong, apiculate, lateral lobes about 1 $\frac{3}{4}$ in. long, dorsal one rather shorter; lip suborbicular, white with a yellow centre, 2 in. or more in diam.; concave, plicate, crisped; disk pubescent and with a tuft of hairs at the base. *Stamen* 1 $\frac{1}{2}$ -1 $\frac{3}{4}$ in. long, with a tuft of hairs at the base of the filament; connective petaloid, $\frac{1}{2}$ in. broad, pubescent, produced into two glabrous appendages about as long as the linear anther-cells. *Style* slender, 1 $\frac{1}{2}$ in. long; stigma with a semilunar ciliate mouth. *Capsule* $\frac{3}{4}$ in. in diam., globosely trigonous, red. *Seeds* black, with a white aril.

Dehra Dun and Siwalik range, common in sal forest, and eastwards along the Sub-Himalayan tracts of Rohilkhand and N. Oudh, usually in moist shady places. Flowers during the rainy season. **DISTRIB.**: Outer ranges of Himalaya, up to 4,000 ft., and more or less throughout India; also in Ceylon, Malay Pen. and Islands and in China.

The following non-indigenous plants belonging to this family are occasionally cultivated within the area of this flora:—

KEMPFERIA GALANGA, *Linn. Sp. Pl. 3*, *Roxb.*; *Fl. Ind. 15*; *F. B. I. vi*, 219; *Watt E. D.*; *Prain Beng. Pl. 1038*; *Cooke Fl. Bomb. ii*, 726.—*Vern. Chandra-mula*. A stemless herb. *Leaves* appearing with the flowers, sessile, suborbicular, 3-6 in. long, spreading flat on the ground. *Corolla-segments* lanceolate; lip white with lilac throat. *Lateral staminodes* cuneate-obovate. More or less through-

out India, wild or cultivated, extending to the Malay Pen. and Islands, also in China. It is often grown in gardens within the area of this flora. The tubers are employed in perfumery and in Hindu medicine.

K. ROTUNDA, *Linn. Sp. Pl.* 3; *Roxb. Fl. Ind.* i, 16; *F. B. I.* vi, 222; *Watt E. D.*; *Prair. Beng. Pl.* 1038; *Cooke Fl. Bomb.* ii, 727.—Vern. *Bhui-Champa*.—A stemless herb. *Leaves* petioled, erect, oblong, 12 by 3 in., appearing after the flowers. *Corolla-segments* long, linear. *Lip* lilac or reddish. *Staminodes* oblong, acute.—Wild or cultivated throughout India, extending to Malay Pen. and Islands. Flowers very fragrant.

ALPINIA NUTANS, *Roscoe*; *Roxb.*; *Fl. Ind.* i, 65; *F. B. I.* vi, 256; *Watt E. D.*; *Gamble Man.* 723; *Cooke Fl. Bomb.* ii, 738.—*Stems* up to 10 ft. high. *Leaves* 1-2 ft. long by 3-6 in., oblong-lanceolate. *Flowers* very handsome, in panicles 6-12 in. long, the rhachis very hairy; bracts large, concave, ivory-white tinged with pink and variegated with red and yellow.—Mr. Gamble states that this planted in Dehra Dun at Rájawala, where it affords good fodder for elephants. It is also much grown as an ornamental plant in gardens. It is a native of the E. Himalaya and Burma, extending to the Malay Pen. and Islands.

CANNA INDICA, *Linn.*; var. *ORIENTALIS* *Rosc*; *F. B. I.* vi, 260. *Prair. Beng. Pl.* 1047. *C. indica*, *Linn.*; *Roxb.*; *Fl. Ind.* i, 1; *Watt E. D.*; *Cooke Fl. Bomb.* ii, 744.—*Rootstock* tuberous, with many fibres. *Stems* 3-4 ft. high. *Leaves* 6-18 in. long, oblong or elliptic-lanceolate, caudate-acuminate. *Flowers* distant. 2½ in. long, scarlet or yellow. The seeds are black and shining and are known under the name of *Indian shot*. This species is much grown in Indian gardens for its handsome flowers.

MUSA, *Linn.*—Tree-like herbs with stout stems composed of convolute leaf-sheaths. *Leaves* very large, oblong, spirally arranged. *Flowers* in an erect or decurved subterminal spike, practically 1-sexual, the lower female, the upper male; bracts large, spathaceous, ovate or orbicular. *Calyx* tubular, spathaceous, 3-5-lobed, slit to the base on one side. *Petals* connate, forming a unilateral corolla as long as the calyx or shorter, convolute round the stamens and style. *Stamens* 5, perfect, the 6th rudimentary or obsolete; filaments stout, filiform; anthers linear, erect, 2-celled. *Carpels* 3, connate in a 3-celled ovary; ovules many; style filiform from a thickened base; stigma 6-lobed, subglobose. *Fruit* oblong or fusiform, 3-gonous, fleshy, indehiscent. *Seeds* subglobose or angled by pressure, in cultivated forms often obsolete.—Species about 40, in tropical

regions mostly of the Old World. As a cultivated plant *Musa* has spread extensively throughout the warmer regions of both hemispheres, and more especially the kinds which yield the well-known and highly valued *banána* and *plaintain* fruit (*M. paradisiaca* and its subspecies *sapientum*).

M. PARADISIACA, L. *Sp. Pl.* (1753) 1043; K. Schum in *Engl. Pflanzenreich* iv, pt. 45 (1900), 19; Cooke *Fl. Bomb.* ii, 742; Rendle *Fl. Pl.*, part 1, 331. *M. paradisiaca*, var. *normalis*, O. Kuntze *Revis. Gen.* ii, (1891) 692. *M. sapientum* var. *paradisiaca*, Baker in *F. B. I.* vi (1893) 262; Watt *E. D.* and in *Comm. Prod. Ind.* 786; Prain *Beng. Pl.* 1050; Kanjilál *For. Fl.* (ed. 2), 405; Gamble *Man.* 723.—Vern. *Kach-kela*. The *Plantain*.—Male *fls.* and *bracts* subpersistent. Fruit cylindric, up to 12 in. long, usually yellowish-green when ripe, pulp hardly sweet and rather firm, only edible when cooked.—A variety of the above (var. *sylvestris* of Prain) is found apparently wild in Dehra Dun in the Khairi swamp and in shady ravines of Nágsidh Hill, also at Sahánsra-dhára. It is frequently met with at low elevations on the outer ranges of the Himalaya, and has been recorded also from Chota Nagpur and Chittagong. The fruit of this plant contains many seeds and is not edible.

M. PARADISIACA, subsp. *SAPIENTUM*, K. Schum in *Engl. Pflanzenreich* iv, pt. 45 (1900) 20; Cooke *Fl. Bomb.* ii, 742; Rendle *Fl. Pl.* part 1, 331. *M. paradisiaca*, var. *sapientum*, O. Kunze *Rev. Gen.* ii, 692. *M. sapientum* (sp.), L.; Baker in *F. B. I.* vi, 262; Watt *E. D.*; *Comm. Prod. Ind.* 786; Prain *Beng. Pl.* 1050.—Vern. *Kela*. The *Banana*.—Male *fls.* and *bracts* deciduous. Fruit oblong, usually 3-gonous, yellowish or reddish when ripe, the pulp is soft and sweet and is edible uncooked.—Numerous forms or varieties of this subspecies are cultivated throughout the warmer parts of India, the quality of the fruit differing according to the climate. For further particulars see Watt's *Comm. Prod. India*.

MUSA CHINENSIS. Sweet in *Hort. Brit.* ed. 2 (1830) 596; Cooke *Fl. Bomb.* ii, 742. *M. Cavendishii*, Lambert.—Chinese or Dwarf *banána*.—Whole plant 4-6 ft. Leaves 6-8, forming a dense-rosette, 2-3 ft. long and about 1 ft. broad, spreading, oblong; petioles short, stout, deeply channelled, with broad crisped green edges. Spikes dense, 1-2 ft. long; bracts reddish-brown. Male *fls.* persistent. Fruit 4-5 in. long, 6-angled, yellow, with a thick skin, the flavour insipid until dead ripe. A native of S. China and much cultivated in India and other tropical countries. In the Saharanpur district the fruit is ripened underground in earthenware vessels.

CIX.—AMARYLLIDACEÆ.

Perennial herbs, rarely shrubs or undershrubs; rootstock a bulb tuber or corm, rarely an erect stock. *Leaves* radical, few or many. *Flowers* few or solitary, on terminal leafless scapes, often umbellate; bracts membranous or coloured, rarely herbaceous, the outer under the umbel 1-3, rarely many, the inflorescence occasionally racemose or paniced with scattered bracts. *Perianth* regular or irregular, 2-seriate, 6-lobed or partite, sometimes with a corona on the limb. *Stamens* 6, adnate to the base of the perianth-segments, rarely epigynous; filaments free or connate, anthers erect or versatile. *Ovary* inferior, 3-celled, style slender, stigma simple or 3-cleft; ovules many, 2-seriate on the inner angles of the cells, anatropous. *Fruit* inferior, usually a loculicidal capsule, rarely fleshy and bursting irregularly. *Seeds* few or many; albumen fleshy, enclosing the small embryo.—Species about 650, in temperate and tropical regions.

Leaves large, thick and fleshy, densely clustered at the top of a rootstock or a simple stem, spiny at the tip and usually armed along the edges; scape long, terminal, simple or branching towards the apex :—

Inflorescence simple and spicate or compound and thyrsoid; stamens in bud inflexed under the tips of the per-segments, much longer than the perianth; filaments filiform or flattened at the base; style filiform

1. AGAVE.

Inflorescence loosely paniced; stamens about equalling the perianth; filaments thickened at the base; style thickened in the middle

2. FURCRAEA.

Leaves thin and flat or, if somewhat fleshy, unarmed :—

Rootstock tuberous; leaves strongly nerved flat or plicate; flowers in spikes or racemes; perianth yellow not showy :—

Fruit opening by 3 valves or circumscissile

3. HYPOXIS.

Fruit a succulent berry

4. CURCULIGO.

Rootstock a tunicate bulb; leaves not strongly nerved, flat, smooth; flowers usually umbellate at the apex of a scape; perianth white or pink, large and showy :—

Filaments attached to the perianth-lobes, but not connate.

5. CRINUM.

Filaments united towards their base by an intervening petaloid membrane

6. PANCRACTIUM.

1. AGAVE, Linn.—The following key to the species of *Agave* which are cultivated or have become naturalized in N. India is based on a paper in the Agricultural Ledger of 1906, No. 7, by Mr. J. R. Drummond and Sir David Prain :—

Leaves in section flat to concave, but never channelled throughout :—

Teeth minute, close set *Agave species* under letter A in D. & P. page 83.

Teeth larger, more or less remote :—

Leaves in a lax rosette or tufted, never less than 3 ft. long :—

Perianth-segments not constricted towards the tips :—

Leaves broadest in the middle, tapering to both ends :—

Leaves oblong-lanceolate, neck sharply constricted

Agave americana, L. under letter B. in D. & P. page 84.

Leaves linear-oblong, neck not constricted :—

Marginal prickles of upper portion of leaf pointing upwards, leaf deeply trough-shaped in upper fourth.

Agave species, under letter C. in D. & P. page 85.

Marginal prickles pointing uniformly downwards; leaf flat-tish throughout

Agave Vera-Cruz, Miller, under letter D in D. & P. page 86.

Leaves hardly widened in the middle,
very narrow in proportion to
length :—

Leaves linear-lanceolate, curving
outwards throughout their
length, terminal spine acicular .

Agave Cantala,
Roxb. under letter
E in D. & P. page
87.

Leaves narrowly oblong, not
curving, stiff, erect; terminal
spine conical from a stout base .

Agave species under
letter F in D. & P.
page 88.

Perianth-segments narrowed from the
middle to the ligulate tip :—

Leaves straight

Agave sisalana,
Per. under letter G
in D. & P. page 89.

Leaves drooping from their upper
 $\frac{1}{2}$ or less

Agave species under
letter H in D. & P.
page 90.

Leaves in a close globose rosette, never
exceeding 3 ft.

Agave Wightii *D.*
& *P.* under letter
J, page 91.

Leaves in section channelled throughout. .

Agave decipiens,
Baker under letter
K in D. & P. page
92.

1. AGAVE.

Agave sp. (A) *D. & P. in Agril. Ledger No. 7 (1906), p. 84.*

† This is supposed to be the same as a plant cultivated in the Saharanpur Bot. Garden under the erroneous name of "*A. Ixtilli*." A plant reported to be naturalized in Burma seems to be very near to this, and is perhaps allied to *A. Keratto*, Miller. No information regarding the fibre is available, nor is the native country known.—Leaves deep-green with a glaucous bloom; marginal prickles minute, sharp, ruby-coloured when young, pointing both upwards and downwards; terminal spine brown, subulate.

A. americana, Linn. *Sp. Pl.* (ed. I), i, 323; *Bot. Mag.* t. 3654; *D. & P. l. c.* under *B.* page 84; *Cooke Fl. Bomb.* ii, 754.

The American Aloe. Planted in parks and large gardens throughout India, but not naturalized, nor grown for its fibre. Outside India it is cultivated as an ornamental plant in gardens in N. Europe and N. America. Its native country is not known. The plant widely naturalized and commonly termed *A. americana* in S. Europe, is believed by D. & P. to be *A. Vera-Cruz* of Miller.—Trunk prostrate or ascending; leaves deep-green often variegated with white or pale-yellow stripes or borders, sometimes rather glaucous; marginal prickles mostly pointing downwards; terminal spine dull-brown, 1-2 in. long; perianth-lobes obtuse, amber-coloured.

A. sp. (c), *D. & P. l. c.* page 85.—

Considered to be closely allied to *A. Vera-Cruz*, Miller. It was formerly cultivated in the Saharanpur Bot. Gard. under the erroneous name of *A. Jacquiniiana*. The plant was sent to Saharanpur from Europe but its native country is not known. The freshly cut leaves smell like rhubarb stalks, and their juice soon ferments.—Leaves oblong-linear from a very thick caudex, dark-green, glaucous; tips stiffly recurved; blade 6 ft. long or more and 8-12 in. at the widest part some way above the middle and there forming a deep trough by the bending of the leaf and the inward rolling of the margins; prickles very stout and black, those above the trough-like portion of the leaf spreading or ascending, the rest pointing downwards; terminal spine about $\frac{3}{4}$ in. long, dark-coloured.

A. Vera-Cruz, *Miller Gard. Dict.* (ed. 8), No. 7; *D. & P. l. c.* (under D) p. 86. *A. lurida* Zucc.; *Baker in Gard. Chron.* N. S. viii (1877), 264 excl. var. *Jacquiniiana* and ref. *A. Vera-Cruis*, Haw, *A. Cantula*, *Prain Beng. Pl.* 1057 (not of Roxb.).—

The common Grey Aloe of India.—Cultivated in Bot. Gardens from Calcutta as far as Lahore, also planted in hedges throughout the greater portion of India, and sometimes on the sides of railways, and it is said to be naturalized in Mysore. **DISTRIB.**: naturalized throughout S. Europe, in S. France and Mediterranean Islands, also in N. W. Africa and the Atlantic Islands (not recorded from S. E. Europe or the Orient). Extending to S. Africa, Mauritius and Ceylon. Its native country is probably Mexico.—Leaves linear-oblong, many from a short stout trunk which is hidden by their thickened bases, sage-green and often very glaucous, early curving upwards, the ends usually more or less recurved or drooping, 4-6 ft. long, often

rather concave at the widest part which is above the middle, neck hardly constricted; marginal prickless broad, stout, blackish, spreading or decurved; terminal spine $\frac{1}{2}$ -1 in. long, dark-brown.

A. Cantala, Roxb. Hort. Beng. 25; D. and P. (under E.), page 87. *A. Cantula*, Roxb. Fl. Ind. ii, 167; not of Dalz. and Gibs. which is *A. Wightii*, nor of Prain which is *A. Vera-Cruz*, Miller.

Naturalized in many parts of India, extending from C. India to both E. and W. coasts to the N. W. Gangetic Plain and to the Sub-Siwalik tracts as far as the Ravi, absent in the arid strip between Gwalior and Delhi, where another species, the so-called *A. mexicana*, has found its way. (See under letter F in D. & P. I. c. p. 88.) It is also found in Burma. Its native country is not known for certain. This appears to be the first *Agave* to reach India, and it came probably from the Pacific coast of C. America. The fibre exported from Bombay with that of other species is often wrongly named *A. vivipara*. The freshly cut leaves smell like rhubarb.—Leaves linear-lanceolate in a lax but even tuft from a short ascending rootstock, pale-green or sometimes glaucous, very narrow in proportion to their length (4 ft. or more), the greatest width just above the middle being about 3 in., curving outwards gradually from their bases or bent over almost from their origin; upper surface more or less concave, sometimes trough-shaped in lower portions; marginal prickles large, alate, always ascending. $\frac{1}{2}$ in. or more long, very sharp, pale-brown or garnet-coloured, from a small light-coloured cushion; terminal spine, acicular, cylindrical, reddish or dark brown $\frac{1}{2}$ in. long.

A. sp. (F) D. and P. l. c. pages 88 and 101.

According to D. and P. this species seems to be intermediate between *A. Cantala* and the *Sisalana* series. It differs from the former species by its stiff upright leaves which are never involute and hardly concave, do not bend outwards and are seldom recurved, even at the tips; also the flowers are more delicate in texture. Specimens were sent by Mr. Gamble to the Calcutta Bot. Gard. from Dehra Dun under the name of *A. mexicana*. It is planted and has become naturalized in many places within the Upper Gangetic Pl., and is often found in railway hedges in N. W. India. Its native country is not known. Further information is required regarding the quality of its fibre. Leaves tufted on a very short caudex, never forming a rosette, stiff erect, 4-5 ft. long, of uniform breadth and ending in the suddenly acuminate tip; marginal prickles distant, chestnut or garnet-coloured, their hooks sharp and ascending; terminal spine stout, conical, $\frac{1}{2}$ in. long or more, brown.

A. sisalana, Ferrine : *D. and P. l. c.* (under letter G), p. 89.
True Sisal.—

The sisal-hemp was first known as a cultivated plant in Yucatan in 1834, whence it was introduced to Florida and there naturalized. From Florida it was brought to the W. India Islands and thence to India during the years 1885-1892. Its native country is not known for certain. It is cultivated in many parts of India as far north as Lahore, also in C. India, Bombay, Bengal, Mysore and Madras, also in Burma. Outside India it is grown in Australia, Fiji, Hawaii and E. Africa. Leaves 20-35, oblong-lanceolate, deep-green or sometimes glaucous, up to 6 ft. long, never forming a rosette, but closely tufted on the rhizome or on a short ascending caudex, neck not at all constricted; margins with or without prickles which, if present, are weak scattered and pale-coloured; terminal spine not channelled, glossy, purple or dark-brown.

A. sp. *D. and P. l. c.* page 90 (under letter H).

The finest of the naturalized Indian species of *Agave*. It is the large species which was wrongly named *A. lurida* at Saharanpur. Vern. *Rambanskora*. It is regarded by D. and P. as closely allied to the *Sisalana* group. It occurs in many parts of Bengal and in the Gangetic Plain as far north as Saharanpur where it has run wild in the Botanical Gardens. It flourishes under the same condition as *A. Wightii* and is often found with it in the same hedge. It is cultivated also in Dehra Dun, Lucknow, Madras and Burma and often becomes naturalized in hedges. Its native country is not known. The freshly cut leaves have the scent of rhubarb. More information is required as to the quality of the fibre. Leaves oblong-lanceolate, not forming a rosette, the inner ascending from the stout caudex, the ends recurved for about $\frac{1}{4}$ of the total length and drooping, dull dark-green, often glaucous, reaching 7 ft. in length and 10 in. in breadth at the widest part; marginal prickles distant, stout, falcate, yellow-brown from a broad pale cushion; terminal spine not decurrent, stout, slightly recurved.

A. Wightii, *D. and P. l. c.* page 91 (under letter J) *A. vivipara*, *Wight l. c.* 2024; *Baker Gard. Chron. N. S. VIII* (1877), 780 *excl. all syn. except Wight, not of Linn. nor of others*). *Agave Cantula*, *Dabz. & Gibs. Bomb. Fl.* (not of Roxb.).—

Vern. *Bánskeora* (Saharanpur). Small Aloe of India. Cultivated and naturalized in the Upper Gang. Pl. at Moradabad, in Dehra Dun, Saharanpur Bot. Gard., and from Delhi northwards to Ludhiana. It is the only *Agave* in N. India which develops a conspicuous trunk.

Its native country is not known. A variegated form is often cultivated in gardens. D. and P. say that *A. Wightii* will doubtless hold its own as a hedge plant, especially in the drier provinces. The fibre is reported as good, but shorter than that of *A. sisalana*.—Leaves ensiform, linear-lanceolate, very many, 2½-3 ft. long, and up to 3½ in. at its widest part, inserted in a compact series on a stout usually conspicuous trunk which is partly procumbent or throughout ascending, forming a stiff even rosette 3-5 ft. in diam., pale green or often tinged with ashy grey; base thin, broadly amplexicaul; marginal prickles rather weak, about ¼ in. apart, usually consisting of a small brown cushion carrying a semi-transparent garnet-coloured spine which is often sharply recurved parallel to the leaf edge, but ending in a finely barbed hook pointing upwards; terminal spine about ½ in. long, pale, slightly decurrent.

A. decipiens, Baker in Kew Bull. July-Aug. 1893, No. cclvii D. & P. l. c. under letter K, p. 92.

False Sisal. Cultivated only in Bot. and Horticultural Gardens at Calcutta, Saharanpur and Lahore; naturalized in Florida with *A. sisalana*, Perrine; native country not known. Very near to *A. Ixili*, Karwinski, a native of Yucatan.—Leaves fleshy, linear, stiff, in section canaliculate, glossy apple-green, 2-4 ft. long, widest just below the middle, forming a compact radiating tuft, of which the outer leaves are nearly at right angles with the axis, the inner ones making gradually an acuter angle; marginal prickles reddish brown small but sharp; terminal spine ½ in. long or more, not decurrent, blackish, very sharp, inclining backwards.

2. FURCRAEA, Vent.

Only one species of this genus has shown any tendency to become naturalized in India. This has usually been identified with *F. gigantea*, Vent. but its exact identification with that species has not been satisfactorily determined by Drummond and Prain for want of specimens of the inflorescence. It is planted and has become naturalized within the area of this flora and in most of the public gardens of India. It is often grown as a hedge plant and sometimes on the sides of railway lines. In Southern India it is known as the "Mauritius Hemp." The fibre is much used in N. India, but it is not known to what extent it is in cultivation for this purpose. (D. and P. l. c. pages 105 and 147.)

3. **HYPOXIS**, Linn.; Fl. Brit. Ind. vi, 277.

Herbs with a tuberous rootstock, or a tunicate membranous or fibrous corm. *Leaves* radical, narrow, strongly nerved. *Flowers* solitary, or racemed, or in umbels. *Perianth* rotate, 6-partite, sessile on the top of the ovary and persistent. *Stamens* 6, adnate to the base of and shorter than the perianth-segments, filaments short; anthers erect, dorsifixed. *Ovary* 3-celled; style short, columnar; stigmas 3, erect, stout, distinct or connate; ovules 2-seriate in each cell. *Fruit* a globose or oblong capsule, opening by 3 valves or circumscissilely. *Seeds* subglobose; testa crustaceous, shining, beaked at the tip.—Species about 50, chiefly in S. Africa.

H. aurea, Lour. *Fl. Cochinch.* 200; *F. B. I.* vi, 277; *Prain Beng. Pl.* 1058; *Collett Fl. Siml.* 516; *Cooke Fl. Bomb.* ii, 747. *H. minor*, Don. *Prod.* 53; *Royle Ill. t.* 91, f. 3.

A small dioecious herb. *Rootstock* subglobose or elongate, crowned with the fibrous remains of the old leaves. *Leaves* 6-12, subcoriaceous, keeled, 4-14 in. long, narrowly linear. *Scapes* 1-4, filiform, or 2-flowered, subglabrous or thinly clothed with pale-brown hairs; bracts setaceous. *Perianth-segments* $\frac{1}{2}$ - $\frac{3}{4}$ in. long, slightly hairy and yellow, the outer ones green outside. *Anthers* sagittate. *Ovary* clavate, $\frac{1}{2}$ - $\frac{3}{4}$ in. long, clothed with short shining golden-brown hairs. *Capsules* with thin walls, ultimately 3-valved, crowned with the erect per-segments. *Seeds* black, finely tuberculate.

Abundant within the area of this flora along the Sub-Himalayan tracts of Pilibhit and N. Oudh; also in Bundelkhand.—**DISTRIB.:** Outer Himalaya from Kashmir to Sikkim up to 7,000 ft., and southwards through the hilly parts of Peninsular India; extending to Java, China, Japan and the Philippines.

4. **CURCULIGO**, Gœrtn; Fl. Brit. Ind. vi, 278.

Herbs with a tuberous rootstock, or a tunicate fibrous corm. *Leaves* often large, lanceolate and plicate or linear and flat. *Flowers* often 1-sexual, the lower flowers usually 2-sexual, spicate racemose or subcapitate. *Perianth* 6-partite, usually produced above the ovary as a solid stipe and bearing the rotate limb. *Stamens* 6, adnate to the base of the perianth-lobes, filaments short; anthers linear, erect. *Fruit* a berry. *Seeds* subglobose, testa crustaceous, black, often beaked. Species about 12, in tropical and sub-tropical regions.

C. orchoides, Gaertn. *Fruct. i*, 63, t. 13; Roxb.; *Fl. Ind. ii*, 144; *F. B. I. vi*, 279; *Watt E. D.*; *Prain Beng. Pl.* 1059; *Cooke Fl. Bomb. ii*, 748.—Vern. *Musali-kand* (Oudh), *Mushali* (Hind).

Rootstock tuberous, stout, with many fleshy root-fibres. *Leaves* membranous, sessile or stalked, 6-18 in. long, linear or linear-lanceolate plicate, glabrous or sparsely and softly hairy, the tips sometimes rooting when reaching the ground. *Scape* very short, clavate, flattened. the pedicels bracts and ovary hidden by the leaf and sheaths. *Flowers* bright yellow, distichous. *Per-segments* $\frac{1}{2}$ - $\frac{3}{4}$ in. long, elliptic-oblong, acute, hairy on the back. *Ovary* lanceolate; cells 6-8-ovuled. *Berry* $\frac{1}{2}$ in. long, hypogaeous. *Seeds* $\frac{1}{4}$ in. long; testa deeply grooved. black, shining.

Abundant in the Sub-Himalayan tracts of Pilibhit and N. Oudh, also in Merwara (Duthie, Burkill, etc.). **DISTRIB.**: Outer Him. ranges from Kumaon eastwards, Khasia Hills, Manipur, south to Bengal. W. Ghats, Konkon and Nilgiri Hills extending to Java, China and the Philippines. The black root, a kind of *musali* is ground and eaten like flour at Balrampur in N. Oudh (Burkill). The roots are also much used medicinally.

5. CRINUM, Linn. ; Fl. Brit. Ind. vi, 280.

Herbs with large tunicate bulbs. *Leaves* long, ensiform or lorate. *Flowers* large, umbellate, sessile or nearly so, with 2 spathe-like bracts at the top of a long solid scape; bracteoles linear. *Perianth* funnel-shaped or almost salver-shaped; tube long, straight or incurved, cylindric or with a wide mouth; lobes 6, recurved or spreading or conniving. *Stamens* 6, adnate to the throat of perianth-tube; filaments free. *Ovary* 3-celled; ovules 2—many in each cell; style filiform; stigma small. *Fruit* a subglobose membranous or coriaceous capsule, bursting irregularly. *Seeds* few, large, testa thick; albumen copious. Species about 75, in Trop. Asia, Africa, Australia, and America, mostly on sea-coasts, and in India often found wild in rocky beds of rivers.

Perianth-tube straight, erect; lobes stellately patent; *stamens* spreading;—

Leaves 5 in. wide or wider; umbels 15-50 fld.; per-tube 3-4 in. long, equalling the linear lobes; neck of the very large bulb 4 in. or more across

1. **C. ASIATICUM.**

Leaves 2 in. wide or less; umbels 6-12 fld.;
neck of bulb 2.5 in. or less across:—

Bulb. with a fusiform stoloniferous base;
per-tube $2\frac{1}{2}$ -3 in. long, equalling the
linear lobes, which much exceed the
stamens 2. C. DEFIXUM.

Bulb not stoloniferous; per-tube 3.5-4
in.; lobes lanceolate, about as long as
the stamens.

Leaves obtuse or subacute; per-lobes
3.5-4 in. long, about as long as the
tube 3. C. PRATENSE.

Per-tube curved, declinate; lobes ascending;
stamens declinate:—

Leaves 3-5 in. wide, margin scabrous,
hardly waved; per-lobes oblong, almost
white; anthers grey 4. C. LATIFOLIUM.

Leaves 1.5-2 in. wide; linear lanceolate,
margin smooth, distinctly undulate; per-
lobes lanceolate, pinkish; anthers
brown C. LATIFOLIUM var.
ZEYLANICA.

Leaves $\frac{3}{4}$ -1 in. wide; umbels 6-12-fld.;
perianth $2\frac{1}{2}$ -3 in. long 2 C. defixum.

Perianth-lobes lanceolate; leaves 1-2 in.
wide; flowers subsessile; bracts 2-3 in.
long 3 C. pratense.

Perianth funnel-shaped; tube curved; lobes
ascending, oblong or lanceolate; stamens
declinate; style longer than the filaments . . . 4 C. latifolium.

1. C. ASIATICUM, L.; F. B. I., vi, 280; Prain Beng. Pl. 1061;
Cooke Fl. Bomb. ii, 749. C. toxicarium, Roxb. Fl. Ind. ii, 134.—
Cult., within the area of this flora and throughout trop.
India. Wild on the Chittagong coast and in the Sundribuns.

2. C. DEFIXUM, Ker. Gawl., F. B. I. vi, 281; Prain Beng. Pl.
1061; Cooke l. c. 749. C. asiaticum, Roxb. l. c. 127 (not of Linn.).—
Cultivated within the area of this flora and in other parts of India.
Probably wild in Bengal and in the Central Prov. in swamps
and rocky beds of rivers.

3. *C. PRATENSE*, *Herbert*; *F. B. I.* vi, 282; *Prain l. c.* 1061; *Cooke l. c.*, 750. *C. longifolium*, *Roxb. l. c.* 130.—Plains of India and in Burma. Cult. only in Upp. Gang. Plain.

4. *C. LATIFOLIUM*, *Linn.*; *Roxb.*; *l. c.* 137; *F. B. I.* vi, 283; *Prain l. c.* 1061.—Gardens generally in India, perhaps wild in Orissa and Chota Nagpur. VAR. *zeylanica*, *Herb.*; *C. zeylanicum*, *Roxb. l. c.* 138.—In gardens in India, perhaps wild in Orissa.

6. *PANCRATIUM*, *Linn.*; *Fl. Brit. Ind.* vi, 285.

Herbs with tunicate bulbs. *Leaves* linear or lanceolate, often 2-farious. *Flowers* large, solitary or umbellate, sessile or stalked within 1 or 2 membranous spathes; bracteoles linear, hyaline. *Perianth* funnel-shaped; tube usually long, widened at the mouth; lobes 6, narrow, suberect, subequal. *Stamens* 6, shorter than perianth, adnate to the throat; filaments, connate below in a petaloid membranous cup; anthers dorsifixed. *Ovary* 3-celled; ovules many, 2-seriate in each cell; style long, filiform; stigma small. *Fruit* a large subglobose 3-cornered loculicidally 3-valved capsule. *Seeds* many, angular; testa thick, lax, black.—Species about 12, in S. Europe, Africa, and a few are cultivated in Indian gardens, and are often apparently wild within the area of this flora.

Zephyranthes tubispatha *Herbert*; *F. B. I.* vi, 277; *Prain Beng. Pl.* 1060. A bulbous plant with white flowers. It was introduced into India from Peru, and is much grown in gardens, and has become naturalized as an escape in many parts of India. Another species, *Z. rosea* *Lindl.*, is also met with in Indian gardens, and in Dehra Dun it occurs as an escape from cultivation. It is wild in Cuba, and the flowers are red.

Polianthes-tuberosa, *Linn.*; *Watt, E. D.*; *Cooke Fl. Bomb.* ii, 753. A well-known garden plant within the area of this flora and in other parts of India. Roots tuberous; flowering stems 3-4 ft. high; flowers white and fragrant, in terminal racemes. Introduced from Mexico and known in India as the *Tuberose*.

CX. DIOSCOREACEÆ.

Large usually climbing herbs and generally with a thick fleshy tuberous underground rootstock, rarely a cluster of tuberous

roots, or with sometimes an epigæal and often woody tuber. *Leaves* alternate or opposite, simple or compound, costate and reticulate; petioles often angular and twisted at the base, sometimes articulate. *Flowers* small, usually 1-sexual, arranged in spikes or racemes, diœcious or monœcious in separate spikes, regular; bracts often minute, sometimes obsolete; male spikes or racemes simple or paniced; female simple, sometimes reduced to 1-2 flowers; perianth superior, MALE flowers: *Perianth* campanulate or rotate, deeply 6-fid or urceolate with narrow mouth and short spreading lobes. *Stamens* 6, inserted at the base of the perianth, all perfect or 3 reduced to staminodes, or only 3 and no staminodes, filaments incurved or recurved; anthers small, 2-celled, globose, oblong or didymous, or with the cells discrete on branches of the filament. *Pistillode* thick, columnar, 3-fid. or entire or obsolete. FEM. flowers: *Perianth* smaller than in male, 6-fid. or-partite, persistent. *Staminodes* 3, 6 or none. *Ovary* inferior, 3-quetrous, usually 3-celled; styles 3, very short; stigmas entire or 2-fid., recurved; Ovules 2 in each cell, superposed, pendulous. *Fruit* a berry or a 3-valved capsule. *Seeds* flat or globose; embryo small, enclosed in the fleshy and rather hard albumen.—Species about 160, in tropical and subtropical regions.—*Tamus communis*, L., the Black bryony, is a climbing plant with tuberous roots, and is frequently met with in hedges in many parts of Britain.

DIOSCOREA, Linn.; Fl. Brit. Ind. vi, 288.

Herbs with slender climbing, rarely procumbent, stems; tuber solitary, often large, underground or rarely epigæal, very rarely with clustered long-peduncled tubers at the base of stem. *Leaves* alternate or sometimes opposite, entire or lobed or digitately 3-9-foliolate. *Flowers* 1-sexual and usually diœcious. MALE flowers: *Perianth* campanulate rotate or urceolate; lobes short, spreading. *Stamens* 6, free round a pistillode, or connate in a central column, or 3 alternating with 3 staminodes, or 3 without staminodes; anthers small, the cells contiguous or discrete. *Pistillode* thick and fleshy or none. FEM. flowers: *Perianth-segments* 6, small, free. *Staminodes* 6, 3 or none. *Ovary* 3-celled, stigmas reflexed above the style. *Fruit* a 3-cornered loculicidal capsule, the angles laterally flattened and almost winged. *Seeds* compressed, often with a large membranous wing; albumen fleshy or hard, 2-

laminate, embryo between the laminae with a suborbicular cotyledon.—Species about 150, in tropical and subtropical regions.—The tubers of *Dioscorea*, known as yams, contain much starch, and are largely cultivated in India and in other tropical countries.

The following key to the species of *Dioscorea* which occur either wild or cultivated within the area of this flora is based on Prain and Burkill's Synopsis of the Dioscoreas of the Old World (Africa excluded) and was published in Journ. and Proc. As. Soc. Beng. (N. S.) Vol. X No. 1, 1914.

Stems twining to the left :—

Section COMBILIMUM. Tubers produced in a bunch, spreading, edible. Leaves simple, cordate. Male flowers 1-2 together on a long spike-like raceme (when the 2nd flower is present it is placed cymosely on the pedicel of the 1st); perianth saucer-shaped, the stamens inserted near the margin. Seeds unknown :—

1. *D. aculeata*.

Section LASIOPHYTON. Tubers vertical. Leaves generally compound. Male flowers in spikes or spike-like racemes which are generally compound; perianth-lobes just united at the base, with the stamens inserted on them; filaments simple. Seeds winged on one side only, in elongated, reflexed or horizontal capsules :—

Male flowers not densely packed; stamens
3; leaflets 3 or 5

2. *D. pentaphylla*.

Male flowers densely packed; stamens
6; leaflets 3

3. *D. triphylla*.

Section OPSOPHYTON. Tubers vertical. Leaves simple, cordate. Male flowers in characteristic dependent spikes; perianth-lobes with the stamens inserted at their bases; filaments free. Seeds with the wing developed on one side only, in elongated reflexed capsules :—

Leaves alternate, ovate-cordate, drying
green; flower-spikes long; tubers some-
times slightly elongating

4. *D. bulbifera*.

Stems twining to the right; seeds with the
 * wing developed all round :—

Section ENANTIOPHYLLUM. Tubers vertical,
 usually edible. Leaves simple. Male
 flowers sessile, on short axes, opening but
 a little way; perianth-lobes free, with the
 stamens inserted at their bases; filaments
 simple. Seeds in capsules which are not
 reflexed but face forwards :—

Male flowers in spikes arranged on elongate
 leafless branches :—

Flowers of male plant on axes which
 are never zigzag alive or dry; buds
 usually flattened at the base :—

Special flowering branches conspicu-
 ously shorter than the leaves; cap-
 sules often rather glaucous . . . 5. *D. Wallichii*.

Special flowering branches, when well-
 grown, longer than the leaves :—

Pubescence abundant on the leaf-
 less axes which bear the spikes
 of the closely packed male
 flowers which are covered with
 hairs, stamens 6 . . . 6. *D. anguina*.

Pubescence absent entirely :—

Leaves hastate, network con-
 spicuous below . . . 7. *D. belophylla*.

Leaves cordate or ovate-cordate,
 thin, curling up on the midrib
 when drying; the first lateral
 pair of nerves rather close to
 the midrib . . . 8. *D. glabra*.

Flowers of male plant on axes which
 become zigzag either in life or when
 dry; stems acutely angled or winged 9. *D. alata*.

Section COMBILIMUM.

1 *D. aculeata*. Linn. *Amœn. Acad.* iv (1754), 131; Prain
 and Burkill in *Journ. As. Soc. Beng. (N.S.)*, Vol. x (1914); *D.*

fasciculata, Roxb. Fl. Ind. iii, 801; F. B. I. vi, 296. *D. sativa*, Linn. Sp. Pl. (1753), 1033 (in small part). *D. spinosa*, Roxb. ex Wall. Cat. (1832) 5103, letters A, D, E.

VAR. *spinosa*, P. and B. Syn. Diosc., page 20.

Leaves more or less hairy; flowers rarely produced; tubers few, unequal, mixed with many fibrous roots, the uppermost of which are armed with spines which protect the tubers from the ravages of pigs and other animals.—This variety is widely cultivated within the area of this flora, and is often found wild.

VAR. *fasciculata*, P. and B. l.c. p. 20.

Leaves almost glabrous; flowers not developed; tubers ellipsoid, crowded, without spines.—Cultivated in the districts of Lucknow, Allahabad, Fyzabad, Jaunpur, Azamgarh, Ballia, Ghazipur and Benares. It is also grown in Java and in other of the Malay Islands.

Section LASIOPHYTON.

2. *D. pentaphylla*, Linn. Sp. Pl. (1753), 1032; Prain Beng. Pl. 1066; Cooke Fl. Bomb. ii, 757; Prain and Burkill l. c. p. 23. *D. Jacquemontii*, F. B. I. vi (1892), 290. *D. triphylla*, Linn. Sp. Pl. (1753), 1032.

From Western India to the remotest parts of the Pacific, from the Himalaya and Yunnan southwards to Ceylon and to the islands in the Torres Straits.

VAR. *Sull*, Prain and Burkill l. c. page 23.

Leaves grey, not shining.—Dehra Dun, Siwalik range, N. Oudh, Bundelkhand. DISTRIB.: Himalaya in Garhwal and Kumaon at low elevations, extending to the Khasia and Naga Hills.

VAR. *Cardoni*, P. and B. l. c. page 23.

Leaves sparsely clothed with reddish hairs; flowers small.—N. Oudh, Gorakhpur, Mirzapur. DISTRIB.: Ch. Nagpur, in the hilly portions.

VAR. *communis*, P. and B. l. c. page 23.—Vern. *Kánta-dlu* (Hind).

Tubers short, stiff, armed; flesh insipid, firm; leaflets 3 or 5, clothed with reddish hairs.—Common within the area of this flora, also in Burma.

3. *D. triphylla*, Linn. Amæn. Acad. iv (1754), 131; Lamk-Encycl. Method. iii (1789), 234; Prain and Burkill l. c. p. 25 *D. dæmona*, Roxb.; Fl. Ind. iii, (1832) 805; F. B. I. vi, 289; Watt, E. D.; Prain Beng. Pl. 1066; Cooke Fl. Bomb. ii, 756.

From India to New Guinea, occurring just within S. W. China and in Formosa. Linnæus in 1853 applied the name "*triphylla*" to a form of *D. pentaphylla*; in 1754 he applied it as Prain and Burkill use it here.

VAR. *dæmona*, P. and B. l. c. page 26.

A pubescent plant, common in India. Within the area of this flora it has been recorded by Burkill from Saharanpur Government Garden, Siwalik range in the Mohand Pass, N. Oudh, Gorakhpur, Mirzapur, Gwalior and Bundelkhand. DISTRIB.: Central India and C. Provinces, extending to the less rainy portions of Java. Roxburgh says of *D. dæmona* that the roots are dreadfully nauseous, even after being boiled.

Section OPSOPHYTON.

4. *D. bulbifera*, Linn. Sp. Pl. (1753), 1033; Prain Beng. Pl. 1066; Cooke Fl. Bomb. ii, 758; Prain and Burkill l. c. p. 26. *D. crispata*, Roxb.; Fl. Ind. iii, 802. *D. heterophylla*, Roxb.; Fl. Ind. iii, 804. *D. oppositifolia*, Campbell Econ. Prod. Chutia Nagpur (1886) p. 7. *D. pulchella*, Roxb.; Fl. Ind. iii, 801. *D. sativa*, Thunb. Fl. Jap. 191; F. B. I. vi, 295; Duthie in F. and G. Crops pt. iii, 11. Plate lxxx.

From India to the remotest parts of the Pacific, ascending the Himalaya to 5,000 ft., and in S. China, in S. Japan, and in N. Australia. Introduced into Trop. America and Africa.

VAR. *vera*. P. and B. l. c. page 26; *D. pulchella*, Rox b., l. c. 801:

Tuber and bulbils short, acid; leaves shining on upper surface.—very common in Upper Gang. Plain.—Vern, *Rât-álu*.

VAR. *sativa*. P. and B. l. c.—Vern. *Rât-álu* (Hind).—

Tuber very small; bulbils large, nearly smooth, greenish-brown; leaves large, broadly ovate.—Cult. in India and on the shores of Pacific. —(Otaheite Potato).

Var *suavior*, P. and B. l. c. p. 26.

Tuber and bulbils scarcely acrid.—Cult. in India, and recorded from Jhansi.

VAR. crispata, *Prain Beng. Pl.* 1066 ; *Roxb. l. c.*, 802 ; *F. B. I.* vi, 296 ; *Watt E. D.*—Vern. *Zamin-kand.*—Cultivated in N. India and on Himalaya up to 5,000 ft.

Section ENANTIOPHYLLUM.

5. D. Walliohii, *Hook f. F. B. I.* vi, 295 ; *Prain and Burkill l. c. p.* 31. *D. aculeata*, *Linn. Sp. Pl.* (1753), 1033 in small part ; *Prain Beng. Pl.* 1067. *D. sativa*, *Wall. Cat.* (1832) 5108, letters A, B, and F.

India in hilly parts of Malabar Coast ; thence inland to Tapti river and through Bundelkhand and Ch. Nagpur to the Circars, extending to Burma.

VAR vera, *P. and B. l. c.* page 31.

Capsule slightly glaucous.—Bundelkhand at Lalitpur (Duthie No. 15245) ;
DISTRIB. : See above, and exclude Burma.

6. D. anguina, *Roxb. ; Fl. Ind.* iii, 803 ; *Prain and Burkill l. c. p.* 32. *D. spinosa*, *Wall. Cat.* (1832) 5103, letters G and H.

India, in the Himalaya from C. Nepal eastwards ; general where the moisture is sufficient on the south of the Ganges as far as Travancore (but not in Ceylon) ; Assam, northern Burma, Sumatra and Java.—I am indebted to Mr. Burkill for the following localities within the area of the Upper Gang. Plain : Gorakhpur dist. ; N. Oudh : in the Bahraich dist. ; Bundelkhand : in the Jhansi and Banda districts ; C. India : in the Bhopal and Indore districts.

7. D. belophylla, *Voigt Hort. Suburb. Calc.* (1845) 652 ; *Prain Beng. Pl.* 1067 ; *Prain and Burkill l. c. p.* 36. *D. deltoides*, *Baden-Powell Punj. Prod.* i, 259 (in part). *D. glabra*, *Hk. f. in F. B. I.* vi, 294 (in part) ; *Collett Fl. Siml.* 519. *D. sagittata*, *Royce ex Voigt l. c.* 653. *D. sp. Aitch. Cat. Punj. and Sind Pl.* 148.

A species demanding less rain than most of the others ; met with along the Himalaya towards the west as far as the Kashmir Valley, and found also on the Salt Range ; eastwards, as far as is known, its distribution terminates in Sikkim ; southwards it occurs on hill crests as far as the Nilgiri Range ; and it has once been recorded from the Khasia Hills. It is common within the area of this flora, especially in Dehra Dun and on the Siwalik range, also in N. Oudh, Bundelkhand and in the Mirzapur district.—Vern. *Turhur*, *toree*. The tubers are much eaten.

8. *D. glabra*, Roxb. ; *Fl. Ind.* iii, 803 ; *F. B. I.* vi, 294 (in chief part) ; *Prain and Burkill.* l. c. p. 37. *D. nummularia*, Roxb. ; *Fl. Ind.* iii, 803. *D. Wallichii*, Hk. f. in *F. B. I.* vi, 295 (in small part).—

India, south of the Ganges in the moister parts, the Himalaya from C. Nepal eastwards, the plains of Bengal and Assam, also in Burma and Siam, extending to the Malay Pen. and Islands eastwards to Java.

VAR. *vera*, B. and P. l. c. page 38.

Leaves ovate, thin, very glaucous on lower surface, tinged with red in drying.—Recorded from Dehra Dun (Duthie), and from the Kheri district of N. Oudh (Duthie's collector No. 22827 (a), and from the Gorakhpur district (Duthie's collector No. 22827).

9. *D. alata*, Linn. *Sp. Pl.* (1753), 1033 ; *F. B. I.* vi, 296, Watt *E. D.* ; *Prain Beng. Pl.* 1067 ; *Prain and Burkill* l. c. p. 39. *D. atropurpurea*, *globosa*, *purpurea*, and *rubella*, Roxb. *Fl. Ind.* iii, pp. 797-800.

Cultivated throughout the Tropics, wherever the rainfall is sufficient. It is certainly of eastern origin and was perhaps derived from *D. Hamiltonii*. In the W. Himalaya races exist, here classed under var. *Tarri*, which appear as if *D. belophylla* may possibly enter their composition. A plant widely cultivated is commonly polymorphic as regards the parts subjected to man's influence, and *D. alata* is no exception ; it shows a great variety of forms of tuber * * * *D. alata* sometimes flowers and very rarely fruits (Prain and Burkill). Vern. Khám (Beng.).

VAR. *Tarri*, P. and B. l. c. p. 39.

Veins on lower surface of leaves conspicuous. Cult. in Kumaon and in the adjacent parts of the Himalaya.

VAR. *vera*, P. & B. l. c.

Veins less conspicuous.

CXI.—LILIACEÆ.

Herbs, rarely shrubs or small trees, with fibrous roots, or with a creeping rootstock or a bulb or corm. Leaves cauline or radical, sometimes none. Flowers usually 2-sexual, axillary or terminal, solitary or geminate or arranged in umbels, spikes, racemes,

panicles or fascicles; bracts usually small and scarious, or spathe-like when the flowers are in umbels. *Perianth* herbaceous or petaloid, usually 6-merous in 2 series, rarely, 4- or 8- or 10-merous, imbricate or rarely valvate in bud. *Stamens* 6, rarely 3 or fewer, hypogynous or adnate to the perianth, filaments free or connate; anthers oblong or linear, often dorsifixed. *Ovary* 3-celled, usually simple, often long, rarely short on none or with 3 styles; ovules 2 or more, on the inner angles of the cells, anatropous rarely orthotropous. *Fruit* a capsule or berry, usually 3-celled. *Seeds* 1 or more, globose or flattened; embryo small, terete, surrounded by the horny or fleshy albumen.—Species about 2,500, in all climates and countries.

Shrubs with perennial stems above ground;
fruit berry-like :—

Stems climbing or straggling; leaves replaced by linear or needle-shaped scales (cladodes) 1. ASPARAGUS.

Stems leafy, usually climbing; leaves 3-5-nerved, reticulate-veined 2. SMILAX.

Herbs with annual stems or scapes rising usually from underground perennial rootstocks corms or bulbs, rarely (in *Asphodelus*) the plant wholly annual :—

Underground perennial stems large in proportion to the roots :—

Aerial annual stem climbing, leafy;
/ leaves broad, with tendril-like tips;
perianth large, showy; rootstock tuber-like, naked 3. GLORIOSA.

Aerial annual stems or scapes erect;
leaves narrow; rootstock a globose coated corm or bulb :—

Perennial stem a solid corm covered with brown sheaths; annual stem leafy; flowers solitary or corymbose 4. IPHIGENIA.

Perennial stem a tunicated bulb;
annual scape simple, naked; leaves radical; flowers racemose :—

Seeds sub-globose; perianth stellate 5. SCILLA.

Seeds flattened; perianth campanulate 6. URGINEA.

Underground perennial stem very small or (in *Asphodelus*) sometimes none; root-fibres large, many, usually some or all fleshy or tuberous; leaves radical; capsule loculicidal:—

Ovules 2 in each cell; capsule 3-quetrous; leaves $\frac{1}{2}$ -terete or terete and fistular 7. ASPHODELUS.

Ovules 4 or more in each cell; capsule deeply 3-winged; leaves flat 8. CHLOROPHYTUM.

1. ASPARAGUS. Linn.; Fl. Brit. Ind. vi, 314.

Undershrubs with a stout creeping rootstock. *Stems* erect, straggling or climbing, terete, grooved. *Leaves* minute, scale-like, bearing in their axils tufts of needle-like or flattened axillary cladodes. *Flowers* usually 2-sexual, small or minute, axillary, solitary fascicled or in racemes, pendulous; pedicels jointed, bracts minute or obsolete. *Perianth* petaloid, 6-partite, campanulate or funnel-shaped. *Stamens* 6, adnate to the base of the perianth-segments, filaments free, anthers oblong. *Ovary* 3-gonous; style columnar; stigmas 3, recurved; ovules 2 or more in each cell. *Fruit* a globose pulpy berry. *Seeds* few or solitary by abortion; testa black, brittle, embryo dorsal, albumen hard.—Species about 100, in Europe Temp. and Trop. Asia and in Africa.

Branches 3-quetrous, smooth; spines suberect or subrecurved, $\frac{1}{4}$ - $\frac{1}{2}$ in. long; cladodes $\frac{1}{2}$ -1 in. long, in tufts of 2-6, slender falcate, acuminate, channelled beneath; ovules 6-8 in each cell.—A tall climbing much branched undershrub 1. *A. racemosus*.

Stem tall, stout, smooth; branches ashy-white, grooved and angled, the angles minutely scabrid; spines stout, straight, $\frac{1}{2}$ - $\frac{3}{4}$ in. long; cladodes in dense tufts of 6-20, slender, terete, filiform, soft; ovules many in each cell.—A suberect shrub 2. *A. adscendens*.

1. *A. racemosa*, Willd. *Sp. Pl.* ii, 152; Roxb. *Fl. Ind.* ii, 151; *F. B. I.* vi, 316; *Watt E. D.*; *Collett Fl. Siml.* 523; *Prair Beng. Pl.* 1070; *Kanjilal For. Fl.* (ed. 2) 409; *Gamble Man.* 724; *Brandis Ind. Trees* 642.—Vern. *Satmuli* (Hind.), *Satrawal* (Dehra Dun), *Chatawal* (Rohilkhand), *Sahasmur* (N. Oudh).—Wild Asparagus.

A tall much-branched scandant spinous undershrub with tuberous roots. *Stem* woody, terete; branches 3-quetrous, smooth, striate; spines suberect or subrecurved, $\frac{1}{4}$ - $\frac{1}{2}$ in. long. *Cladodes* $\frac{1}{2}$ -1 in. long. in tufts of 2-6, spreading, falcate, acuminate, channelled beneath. *Racemes* solitary or in fascicles, 1-2 in. long, simple or branched; pedicels very slender, $\frac{1}{2}$ in. long, jointed at the middle. *Perianth* $\frac{1}{4}$ - $\frac{1}{2}$ in. in diam.; lobes spreading. *Anthers* minute, purplish. *Ovules* 6-8 in each cell. *Berry* $\frac{1}{4}$ - $\frac{1}{2}$ in. in diam.

Very common within the area of this flora, flowering after the rains, when it becomes conspicuous by its masses of white fragrant flowers. **DISTRIB.**: Throughout trop. and subtrop. India, and in Ceylon, and up to 4,000 ft. on the Himalaya from Kashmir eastwards. It occurs also in Trop. Africa, Java and Australia. The white tuberous roots of this plant are collected for food and constitute a kind of white *musali*. They are also used medicinally.

2. *A. adscendens*, Roxb. *Fl. Ind.* ii, 153; *Royle Ill.*, 393; *F. B. I.* vi, 317; *Watt E. D.*; *Collett Fl. Siml.* 523; *Kanjilal For. Fl.* (ed. 2) 409.—Vern. *Satāwa*, *sat-muli*.

A suberect prickly shrub, with white tuberous roots. *Stems* tall, stout, suberect, terete, smooth, white, much branched; branch-lets ascending, ashy-white grooved and angled, the angles minutely scabrid; *spines* $\frac{1}{2}$ - $\frac{3}{4}$ in. long, stout, straight. *Cladodes* in dense tufts of 6-20, $\frac{1}{2}$ -2 in. long, slender, filiform, terete, soft, suberect or curved. *Racemes* 1-2 in. long, many-fl'd.; pedicels jointed above or below the middle; bracts minute. *Flowers* 1 in. in diam. *Perianth*—segments spreading. *Ovules* many in each cell. *Berry* $\frac{1}{4}$ - $\frac{1}{2}$ in. diam. 1-seeded.

Dehra Dun, in Sal forests; Rohilkhand (T. Thomson) N. Oudh, in the districts of Kheri and Gonda (Duthie). **DISTRIB.**: Western Himalaya from Kumaon eastwards to Hazara, extending to Afghanistan. The tuberous roots are pickled, and the young shoots are eaten as a vegetable.

3. SMILAX, Linn. ; Fl. Brit vi, 302.

Climbing shrubs rarely erect herbs, *Leaves* alternate, rarely opposite, persistent, 3-5-nerved and reticulate; petiole with

usually 2 tendrils above its base. *Flowers* small, diœcious, umbellate. *Perianth* of 6 free segments, incurved or recurved. **MALE** flowers: *Stamens* 6 or more, free from the base of the perianth; anthers oblong, 2-celled, didymous, cells contiguous or separated on a forked connective. *Pistillode* none. **FEM.** flowers: *Staminodes* 6 or 3. *Ovary* 3-gonous, style short or none; stigmas 3, stout, recurved; ovules 1 or 2 in each cell, orthotropous, pendulous. *Fruit* a globose berry. *Seeds* solitary, globose, oftener 2 and hemispheric, rarely 3; albumen horny, embryo small.—Species about 180, in temperate and tropical regions

Umbels 2-3, very rarely more, alternate on a common peduncle:—

Petiole stout, always narrowly sheathing but not auriculate below the middle . . . 1. *S. macrophylla*.

Petiole rather slender, with 2 large, thickly coriaceous, indistinctly reticulate auricles below the middle . . . 2. *S. Roxburghiana*.

Umbels 7-20, ternate or whorled on a common peduncle; petiole stout, with, in all except the uppermost leaves, 2 large leaf-like distinctly reticulate auricles below the middle . . . 3. *S. prolifera*.

1. *S. macrophylla*. Roxb.; *Fl. Ind.* iii, 793 (no. of Willd.); *F. B. I.* vi, 310; *Watt E. D.*; *Prair. Beng. Pl.* 1071; *Kanjilal For. Fl.* (ed. 2) 407; *Brandis Ind. Trees* 641; *Cooke Fl. Bomb.* ii, 763. *S. retusa*, Roxb. *Fl. Ind.* iii, 793. *S. ovalifolia*, Roxb. l. c. 794.—Vern. *Ramlatun*

A large more or less prickly climber. *Stems* smooth, striate, armed with a few small distant prickles or almost unarmed. *Leaves* alternate, 3-8 in. long or sometimes much larger, broadly ovate or sub-orbicular, acuminate or cuspidate, glabrous, shining; main nerves usually 5, with reticulate venation between; petioles $\frac{1}{2}$ -1 in. long, stout, narrowly sheathing, but not auriculate below the middle, tendrils very long and slender. *Umbels* 2-3, rarely more, alternate on a common peduncle, many fld.; peduncles $\frac{1}{2}$ - $\frac{3}{4}$ in. long; bracts below the peduncles ovate, acute, $\frac{1}{10}$ - $\frac{1}{8}$ in. long; pedicels of both male and female flowers arising from a mass of numerous minute bracts. **MALE flowers:** Pedicels $\frac{1}{8}$ in. *Perianth* $\frac{1}{2}$ - $\frac{3}{4}$ in. long; segments linear, obtuse, erect when young, afterwards reflexed, the 3 outer ones broader. *Stamens* about as long as the perianth. **FEM. flowers:** *Perianth* as in male; pedicels elongating in fruit. *Berry* about the size of a large pea, smooth, green and turning to red when ripe.

Sub-Himalayan tracts from Dehra Dun eastwards to Rohilkhand and N. Oudh and Gorakhpur; also in Sal forests on the Siwalik range. Flowers in the rainy season. **DISTRIB.:** Trop. Him. eastwards from Kumaon to Assam, Bengal and Burma, and south to Central Provinces and Konkan, extending to Java. The root of this plant is pounded and the flour is made into bread at Bulrampur in N. Oudh (Burkill). The stem yields a strong fibre suitable for making brushes, and the thinner stems are much used as tooth-sticks (Kanjilal).

2. S. Roxburghiana, Wall. *Cat.* 5115; *F. B. I.* vi, 311; *Prair Beng. Pl.* 1071.

A large prickly climber with smooth terete branches, branchlets 4-angled. *Leaves* 5-8 in. long, oblong ovate or ovate-lanceolate, rounded cordate or cuneate at the base and with a bluntly acuminate tip, 3-5-costate from above the base; petiole rather slender, with 2 large coriaceous broad indistinctly reticulate auricles below the middle; the auricles of the old leaves 1-1½ in., produced behind into rounded lobes embracing the branch. *Umbels* many-flowered, 2-3 on a common peduncle, which is bracteate at the base. *Pedicels* of female flowers ½ in. long, slender. *Staminodes* 3. *Stigmas* long, recurved. *Berries* ½ in. in diam. *Seeds* 2, hemispheric, or solitary and globose.

Sub-Himalayan tracts of Rohilkhand and N. Oudh (Duthie). **DISTRIB.:** Trop. Himalaya from Garhwal eastwards; also in Bengal on Paras-náth, in Chota Nagpur, Chittagong and on the Khasia Hills.

3. S. prolifera, Roxb. *Fl. Ind.* iii, 795; *F. B. I.* vi, 312; *Watt E. D.*; *Prair Beng. Pl.* 1071; *Kanjilal For. Fl.* (ed. 2), 407; *Gamble Man.* 724; *Brandis Ind. Trees* 641. *S. laurifolia*, Roxb. l. c. 793. *S. ovalifolia*, A. DC. *Mon.* i, 199 (not of Roxb.).—Vern. *Rámdatoun* (Dehra Dun), *Kumári* (Behar).

A stout climbing shrub with prickly stem. *Leaves* variable, 4-5 in. long, oblong ovate or orbicular, coriaceous, nerves 3-7 from above the rounded or subcordate base; petiole 1-2 in. long, its sheath auricled at the base and amplexicaul round the stem; tendrils 2-4 in. long. *Umbels* 10 or more, many-flowered; peduncles ½-1½ in. long; pedicels about ½ in. long. *Sepals* ½ in. long, oblong-lanceolate. *Petals* as long but narrower. *Stamens* as long as sepals. *Staminodes* of female flower 3. *Ovary* oblong; stigmas deciduous. *Berry* oblong or globose, red when ripe.

Common on the Siwalik range in the Dehra Dun and Saharanpur divisions and abundant in the Sub-Himalayan tracts eastwards chiefly in sal forests. Flowers in September and October, and the fruit

ripens from December to February.—**DISTRIB.**: Outer ranges of Himalaya in Kumaon; also in Bengal, Behar, Central India, Ceylon and Burma. The stems yield a strong fibre sometimes used for making brushes, and the thinner stems as tooth-sticks.

3. GLORIOSA, Linn.; Fl. Brit. Ind. vi, 358.

Climbing herbs with leafy stems springing from a naked tuberous rootstock. *Leaves* alternate opposite or 3-nately whorled, lanceolate, strongly nerved and with a long spiral tendril-like apex. *Flowers* large, showy, solitary, axillary, pedicels reflexed. *Perianth* petaloid, persistent; segments 6, subequal, spreading or reflexed, margins undulate or crisped. *Stamens* 6, hypogynous; filaments filiform; anthers linear, dorsifixed, versatile, extrorse. *Ovary* 3-celled; style filiform, deflexed, with 3 subulate arms. *Fruit* a large coriaceous septicidal capsule. *Seeds* few, subglobose; testa spongy, wing-like, embryo cylindric.—Species 3 or 4, in Trop. Asia and Africa.

G. superba, Linn. *Sp. Pl.* 305; Roxb. *Fl. Ind.* ii, 143; F. B. I. vi, 358; Watt *E. D.*; Prain *Beng. Pl.* 1073; Collett *Fl. Siml.* 530; Cooke *Fl. Bomb.* ii, 766.—Vern. *Kulhári*, *languli*, *râjah-rar* (Ajmir).

A tall branching glabrous herbaceous climber. *Rootstock* a chain of arched fleshy cylindric tubers, 6-12 in. long, budding from the convex upper side; roots fibrous. *Stem* annual, leafy, 10-20 ft. long. *Leaves* sessile or nearly so, scattered or opposite, or sometimes ternately whorled, 3-8 in. long, ovate-lanceolate, acuminate, tip spirally twisted to form a tendril, base cordate. *Flowers* solitary or subcorymbose towards the ends of the branches, 3-4 in. across, persistent; pedicels 3-6 in. long, deflexed from the tip; perianth segments up to 2½ in. long, linear-lanceolate with crisply undulate margins, at first erect and greenish, afterwards becoming reflexed and turning to yellow or orange and finally scarlet. *Filaments* golden-yellow, 1½-1¾ in., spreading; anthers nearly ½ in. long. *Style* up to 2 in. long, the arms ½ in. *Capsule* linear-oblong, about 1½ in. long.

Common in Dehra Dun among bushes and eastwards along the Sub-Himalayan tracts of Rohilkhand and N. Oudh, usually in the outskirts of forests, also in Bundelkhand and Merwara. Flowers June to October. **DISTRIB.**: Throughout Trop. India and in Ceylon, ascending to 5,000 ft. on the W. Himalaya, and extending to Malaya, Cochin China and Trop. Africa.

4. *IPHIGENIA*, Kunth. ; Fl. Brit. vi, 357.

Herbs with small tunicate corms and erect leafy slender stems. *Leaves* few, scattered, linear, the upper bract-like. *Flowers* small, erect, solitary or corymbose. *Perianth* petaloid, 6-partite, stellately spreading, deciduous ; segments equal, narrow, clawed. *Stamens* 6, hypogynous ; filaments short, flat ; anthers oblong, versatile, introrse. *Ovary* sessile, 3-celled ; styles 3, shortly connate below, linear, recurved, stigmatic within ; ovules many in each cell. *Fruit* a loculicidal capsule. *Seeds* subglobose ; testa thin ; albumen fleshy ; embryo small—species 4, in India, Africa, Australia and the Philippines.

I. indica. *A. Gray in Kunth. Enum. iv, 213 ; F. B. I. vi, 357 ; Watt E. D. ; Collett Fl. Siml. 529 ; Prain Beng. Pl. 1074 ; Cooke Fl. Bomb. ii, 766.*

Corm $\frac{1}{2}$ – $\frac{3}{4}$ in. in diam., narrowed into a short neck, tunicate with pale-brown sheaths. *Stems* up to 10 in. high. *Leaves* sessile, alternate, few, coriaceous, the lower ones 6-8 in. long, becoming smaller upwards, all linear, sheathing at the base ; nerves obscure. *Flowers* appearing before the leaves, purple, few or many, in a terminal erect raceme ; pedicels $\frac{1}{2}$ –1 in. long ; bracts linear or subulate, the lower leaf-like. *Perianth-segments* $\frac{3}{4}$ in. long, narrow, clawed, spreading, at length reflexed. *Stamens* $\frac{1}{2}$ in. long. *Ovary* oblong, about as long as stamens. *Capsule* oblong or subovoid, $\frac{3}{8}$ – $\frac{1}{2}$ in. long, obtuse, 3-grooved. *Seeds* $\frac{1}{16}$ in. in diam., brown.

Siwalik range (Duthie). **DISTRIB.** : Throughout India from the N.-W. Frontier to Burma, ascending Himalaya up to 7,000 ft. and to 4-5,000 ft. on Khasia hills ; also in Ceylon and extending to Australia and the Philippines.

5. *SCILLA*, Linn. ; Fl. Brit. Ind. vi, 348.

Herbs with tunicate bulbs. *Leaves* radical, linear, lorate or oblong. *Flowers* racemose, on a simple leafless scape ; bracts small. *Perianth* petaloid, persistent, stellate or campanulate ; segments 6, subequal, often recurved. *Stamens* 6, adnate at or near the base of the perianth-segments ; filaments usually filiform ; anthers ovate or oblong, introrse. *Ovary* 3-celled ; ovules few in each cell ; style filiform, stigma small, capitate. *Fruit* a globose 3-lobed loculicidal capsule ; cells 1-2-seeded. *Seeds* obovoid or subglobose ; testa thin, black ; embryo shorter than the firm albumen.—Species about 80, in Europe and Temp. Asia.

S. indica, Baker in Saund. Ref. Bot. iii, App. 12; F. B. I. vi, 348; Watt E. D.; Prain Beng. Pl. 1074; Cooke Fl. Bomb. ii, 767. *Ledebouria hyacinthina*, Roth; Bot. Mag. 3226.

Bulb ovoid or subglobose, 1-1½ in. in diam. *Leaves* appearing with the flowers, 3-6 in. long, oblong to lanceolate or oblanceolate, subacute, narrowed into a sheathing petiole, rather fleshy, undulate, obtusely keeled, sometimes rooting at the tips, dull-green above and often with darker blotches, paler and glaucous beneath. *Scape* 2-5 in. long, rather stout. *Flowers* greenish-purple, in cylindric many-flowered racemes 2-4 in. long. bracts minute, scarious; pedicels filiform, ¼ to ⅓ in. *Perianth-segments* ⅓-½ in. long, linear-oblong, obtuse. *Filaments* ½ in., purple; *anthers* ⅙ in. long, ellipsoid; *style* ⅓-½ in. long. *Capsule* ½ long, membranous.

Bundelkhand (Royle); Gwalior (Maries). **DISTRIB.**: Behar, Chota Nagpur, Bombay Presidency and S. India to Ceylon; extending to Abyssinia.

6. URGINEA, Steinh.; Fl. Brit. Ind. vi, 347.

Herbs with tunicate bulbs. *Leaves* radical, linear or lorate. *Flowers* racemose or on a long leafless scape, often appearing before the leaves; pedicels short or long, articulate, bracts small. *Perianth* petaloid, campanulate; segments 6, subequal. *Stamens* 6, adnate at or near the base of the perianth-lobes, included; filaments filiform or thickened at the base; anthers oblong or linear, introrse. *Ovary* 3-celled, often, 3-gonous, style tapering towards the base, ovules many in each cell. *Fruit* an oblong 3-quetrous loculicidal capsule. *Seeds* usually many in each cell, compressed; testa black, marginally winged, embryo rather large, albumen fleshy.—Species about 24, in S. Europe, W. Asia and Africa.

U. indica, Kunth. Enum. iv, 333; F. B. I. vi, 347; Watt E. D.; Prain Beng. Pl. 1075; Collett Fl. Siml. 526. *Kanjial For. Fl.* (ed. 2) 410; Cooke Fl. Bomb. ii, 768. *Scilla indica*, Roxb. ii, 147.—Vern. *Kanda* (Saharanpur), *jangli-piyáj*, *uskil*.—Indian Squill.

Bulb 2-4 in. long, ovoid. *Leaves* appearing after the flowers, 6-18 in. long, linear, acute, nearly flat. *Scape* erect, 12-18 in. long, brittle. *Flowers* distant, drooping or spreading, greenish-white; or dingy-brown; bracts minute, soon falling. *Perianth* campanulate; segments ⅔ in. long, oblong-lanceolate, obtuse, with 2 or 3 strong approximate median nerves. *Stamens* ½ in. or longer; filaments flattened.

7. ASPHODELUS, Linn. ; Fl. Brit. Ind. vi, 332,

Style obconic. *Capsule* ellipsoid, $\frac{1}{2}$ - $\frac{3}{4}$ in. long; cells 6-9 seeded. *Seeds* $\frac{1}{4}$ in. long flattened, elliptic, black.

Sivalik range (Stewart), also plentiful eastwards in the Sub-Himalayan tracts of Pilibhit and N. Oudh. **DISTRIB.**: W. Himalaya up to 7,000 ft.; salt range of Punjab, and south to Konkan; also in Burma, and Behar and in Chota Nagpur, extending to Trop. Africa. The bitter and nauseous bulbs are used as a substitute for the true *squill* (*U. maritima*), also by weavers in N. India to give substance to their thread.

Annual or perennial herbs with slender fleshy root-fibres. *Leaves* radical, linear, 3-quetrous or terete, fistular. *Flowers* racemose on a simple or branched leafless scape. *Perianth* petaloid, marcescent; segments 6, free or shortly connate below. *Stamens* 6, hypogynous, shorter than the perianth-lobes; filaments dilated at the base and embracing the ovary, the summit of the filament inserted in a pit on the back of the connective, anthers versatile. *Ovary* 3-celled, style filiform, stigma somewhat 3-lobed; ovules 2, collateral in each cell. *Fruit* a globose loculicidal capsule with rugose partitions. *Seeds* usually solitary in each cell; testa black, rugose, albumen cartilaginous, embryo rather large.—Species 6 or 7, in S. Europe and eastward to India.

A. tenuifolius, Cav. in *Anal. Cienc. Nat.* iii, 46, t. 27, fig. 2; *F. B. I.* vi, 332; *Watt E. D.*; *Collett Fl. Siml.* 524; *Prairie Beng. Pl.* 1076; *Cooke Fl. Bomb.* ii, 770. **A. clavatus**, Roxb. *Fl. Ind.* ii, 148. **A. fistulosus**, Linn.—Vern. *Bokat-piāzi*.

Annual. *Leaves* 6-12 in. long, terete, acute, sheathing at the base finely puberulous. *Scapes* several from the root, much branched above, 1-2 ft. *Flowers* white, laxly racemose, solitary in each bract; pedicels $\frac{1}{2}$ - $\frac{1}{4}$ in., jointed below the middle; bracts $\frac{1}{2}$ in., broadly ovate, boat-shaped, scarious, with a strong brownish keel. *Perianth* $\frac{1}{2}$ - $\frac{1}{4}$ in. long; segments oblong, obtuse, with a brownish costa. *Stamens* $\frac{1}{2}$ in. long, acutely 3-gonous black.

Abundant within the area as a weed of cultivation and often becoming a pest. *Flowers* during the cold season. **DISTRIB.**: Plains of India in fields, and extending westwards to the Canary Islands and the Mediterranean region. The plant and seeds are sometimes eaten in India by famine-stricken people. (See *Agricultural Ledger*, No. 7, of 1902, p. 155.)

S. CHLOROPHYTUM, Ker. ; Fl. Brit. Ind. vi, 333.

Herbs with a short hard rootstock emitting many fascicled roots, often thick and fleshy or tuber-like. *Leaves* radical, clustered, often broad, rarely linear or lorate. *Flowers* laxly racemed on a simple or branching leafless scape ; pedicels usually fascicled in the axils of small scarious or large membranous bracts. *Perianth* petaloid, marcescent or persistent, rarely deciduous ; lobes free, rotate. *Stamens* 6, hypogynous, free or the 3 inner adnate to the perianth-lobes, included ; filaments filiform, often widened above the middle, anthers oblong or linear, introrse, the filament inserted in a pit on the back of the connective. *Ovary* 3-quetrous, style filiform, stigma small, ovules 4 or more in each cell. *Fruit* a coriaceous truncate 3-quetrous loculicidal capsule. *Seeds* broad, usually compressed, rugose, testa black, albumen rather hard ; embryo often curved and rather large.—Species about 40, in tropical and sub-tropical regions.

C. tuberosum, Baker in *Journ. Linn. Soc. XV*, (1876), 332 ; *F. B. I.*, vi, 334 ; *Prain Beng. Pl.* 1077 ; *Cooke Fl. Bomb.* ii, 772. *Anthericum tuberosum*, Roxb. *Fl. Ind.* ii, 149.

Root-fibres cylindric, with ellipsoid tubers hanging from them. *Leaves* sessile, membranous, usually ensiform, falcate, acuminate, recurved, 8 in. long or more ; margins crisped or undulate. *Scape* terete, naked, usually longer than the leaves. *Flowers* white, in simple or shortly branched racemes 2-4 in. long, bracts lanceolate, acuminate, the lower ones $\frac{1}{2}$ - $\frac{3}{4}$ in. long ; pedicels ascending, $\frac{1}{4}$ - $\frac{1}{2}$ in. long, jointed below the middle. *Per-segments* less than $\frac{1}{2}$ in. long, oblong-lanceolate subacute, 7-9-nerved. *Stamens* shorter than the perianth ; anthers narrowly linear, afterwards twisted. Capsule $\frac{3}{8}$ in. long, obovoid, emarginate, shining, transversely veined ; cells 4-6-seeded. *Seeds* black.

Gorakhpur (Vicary) : N. Oudh, in the districts of Gonda and Bahraich (Duthie). **DISTRIB.** : Behar and W. Bengal ; Central India and from the Konkan and N. Circars to Travancore, also in Burma and extending to Abyssinia.

Altium, Linn. ; *Fl. Brit. Ind.* vi, 337.—This genus contain over 250 species and is distributed in northern Temperate regions. The 27 species recorded in the *F. B. I.* as growing wild in India are nearly all confined to the Himalayan ranges. The cultivated kinds about 5, are briefly mentioned below.

Leaves fistular :—

Leaves basal only ; heads dense with flowers only *A. ascalonicum*.

Leaves subdistichous ; heads dense, with flowers and bulbils *A. Cepa*.

Leaves flat :—

Heads bearing flowers only ; bulb long, cylindric, simple :—

Heads lax ; filaments simple, linear . . . *A. tuberosum*.

Heads dense ; filaments 2-toothed . . . *A. ampeloprasum*.

Head lax, bearing both flowers and bulbils ; bulb short, compound . . . *A. sativum*.

1. *A. ascalonicum*, Linn. ; Roxb. *Fl. Ind.* ii, 142, *F. B. I.* vi, 337 ; *Watt E. D.* ; *A. DC. L'Orig. Pl. Cult.* 55 ; *Prain Beng. Pl.* 1075 ; *Cooke Fl. Bomb.* ii, 775.—Vern. *Piyáj*, *Palandu* (The Shallot). Root consisting of a fascicle of several small ovate-oblong bulbils. Leaves basal only, fistular, shorter than the scapes. Scapes 1-2 ft. long, tapering from the swollen base. Umbels globular, dense, with flowers only.

2. *A. Cepa*, Linn. ; Roxb. *l. c.* ii, 142 ; *F. B. I.* vi, 337 ; *Watt E. D.* ; *A. DC. l. c.* 52 ; *Duthie in F. and G. Crops Pl.* iii, p. 5 ; *Prain Beng. Pl.* 1075 ; *Cooke Fl. Bomb.* ii, 775.—Vern. *Piyáj* (Onion).—Leaves fistular, bifarious. Umbels dense, with both flowers and bulbils—An important cold-season crop of Northern India.

3. *A. tuberosum*, Roxb. *l. c.* 141 ; *F. B. I.* vi, 343 ; *Watt E. D.* ; *Prain Beng. Pl.* 1076.—Vern. *Banga gandina* (Hind.) (Indian Leek). Bulb long, cylindric, simple. Leaves flat. Umbels lax, bearing flowers only. Filaments simple, linear. The plant is much cultivated in Bengal. Roxburgh states that the Hindus use it as an article of diet as leeks are in Europe.—Regel cites *A. tuberosum* as a synonym of *A. odorum*, L. and Sir Joseph Hooker has suggested that it might possibly be the cultivated form of that plant.

4. *A. ampeloprasum*, Linn. ; *F. B. I.* vi, 337 ; *Prain Beng. Pl.* 1076 ; *Cooke Fl. Bomb.* ii, 775. *A. Porrum*, L. ; Roxb. *l. c.* 141 ; *Watt E. D.* *A. ampeloprasum*, var. *Porrum*, *A. DC. L'Orig.*

Pl. Cult. 81.—Vern. *Gandina*—(The Leek). Leaves flat. Umbels dense, bearing flowers only. Filaments 2-toothed. Bulb long, cylindric, simple.

5. *A. sativum*, Linn. ; Roxb. l. c. 142 ; F. B. I. vi, 337 ; Watt E. D. ; Duthie in F. and G. Crops Pt. iii, 34, t. 66 ; Prain Beng. Pl. 1076 ; Cooke Fl. Bomb. ii, 775.—Vern. *Lasun* or *rasun* (Garlic). Leaves flat, Bulb short, compound. Umbels lax, bearing both flowers and bulbils.

CXII.—PONTEDERIACEÆ.

Fresh-water and marsh herbs, erect or floating. Leafy stems 1-foliate, springing from the buried rootstock or from the joints of the floating stem ; basal leaves long-petioled, blade floating or upraised. *Flowers* 2-sexual, slightly irregular, arranged in racemes or spikes, rarely fascioled or in panicles at the ends of 1-leaved stems or branches ; bract under the inflorescence spathe-like, bracts under the flowers minute or obsolete. *Perianth* inferior, petaloid, marcescent, usually tubular ; lobes 6, sub-2-seriate, similar or the 3 inner smaller. *Stamens* 6 or 3, unequally adnate to the perianth tube or to the base of the perianth-lobes, usually declinate, the upper shorter, filaments free ; anthers usually oblong, with 2 parallel distinct cells, dehiscence introrse, longitudinal or porous. *Ovary* free, 3-celled and with axile placentas, or 1-celled and with 3 parietal placentas, each placenta with many 2-seriate ovules, sometimes with only one fertile ovule in each cell, anatropous, pendulous or suspended, style filiform or columnar ; stigma terminal, entire or lobed. *Fruit* a dry membranous loculicidally 3-valved capsule. *Seeds* ovoid or ellipsoid, small, testa longitudinally ribbed, albumen horny or floury ; embryo central, cylindric.—Species about 36, found chiefly in Trop. Africa and America.

MONOCHORIA, Presl. ; Fl. Brit. Ind. vi, 362.

Aquatic herbs. *Rootstock* short or long, clothed with leaf-sheaths. *Leaves* radical and solitary at the top of the emerging stem or branches ; radical long-petioled, all cordate-ovate, sagittate or lanceolate. *Flowers* in a raceme, sessile within the axil of the cauline leaf and fasciculately long-pedicelled, or pedunculate

and subspicately short-pedicelled; spathe complicate below the raceme. *Perianth* campanulate, tube none; lobes 6, distinct, sub-equal. *Stamens* 6, adnate to the base of the perianth-lobes or hypogynous, one normally larger than the others and with its filament toothed on one side; anthers basifixed, dehiscing by a terminal ultimately elongated slit. *Ovary* ovoid, sessile, 3-celled, with many ovules in each cell, style filiform, stigma minutely 3-lobed. *Fruit* an oblong membranous loculicidal capsule. *Seeds* many, ovoid, obtuse, many-ribbed, embryo cylindric in the centre of floury albumen.—Species about 6, in the tropics of the Old World.

Rootstock elongate, creeping; leaves hastate, sagittate or cordate; flowers on long stalks, subumbellate or racemose; inflorescence centrifugal 1. *M. hastæfolia*.

Rootstock short, suberect; flowers on short stalks subspicate; inflorescence centripetal:—

Leaves ovate or ovate-cordate; flowers rather numerous 2. *M. vaginalis*.

Leaves linear or narrowly ovate; flowers few *M. vaginalis*, VAR. *plantaginea*.

1. *M. hastæfolia*, Presl. *Reliq. Hoenk. i*, 128; *F. B. I. vi*, 362; *Prain Beng. Pl.* 1079; *Cooke Fl. Bomb. ii*, 777. *Pontederia hastata*, Linn.; *Roxb.*; *Fl. Ind. ii*, 121. *P. sagitata*, *Roxb. l. c.* 124. *P. dilatata*, *Andr.*; *Roxb. l. c.* 123. *Vern. Laukia*.

Rootstock stout, creeping and rooting below, spongy, clothed with the remains of the old leaf-sheaths. *Leaves* 4-8 in. long, sagittate, hastate or cordate, smooth and glossy, many-nerved; petioles of floral leaves tumid above and embracing the short stout peduncle; petioles of radical leaves 1½-2 ft. long with a broad sheathing base. *Inflorescence* centrifugal. *Flowers* in racemes or subumbellate, crowded, bright purplish-blue; pedicels up to 1 in. long. *Perianth-segments* ½ in. long, becoming twisted round the fruit when withering; the 3 inner ones obovate and wider than the 3 oblong outer ones, all with 3 strong parallel median nerves and reticulately veined between them and towards the margins. Filament of large anther ¼ in. long, with an acute horn at one side; anthers linear-oblong, the large one

blue, the others yellow. *Ovary* ovoid, $\frac{1}{2}$ in. long; stigma obscurely 3-lobed. *Capsule* $\frac{3}{8}$ in. long, ellipsoid. *Seeds* $\frac{1}{10}$ in. long, rounded at each end, pale, with many fine brown ribs.

Abundant within the area in streams and tanks. **DISTRIB.**: Throughout India and in Ceylon, extending to the Malay Islands and China.

2. M. vaginalis, Presl. *Reliq. Hoenk. i*, 128. *F. B. I. vi*, 363; *Prain Beng. Pl.* 1079; *Cooke Fl. Bomb. ii*, 777. *Pontederia vaginalis*, Burm.; *Roxb. Fl. Ind. ii*, 121.

Rootstock short, suberect, spongy. *Leaves* very variable, 2-4 in. long, from linear to ovate or ovate-cordate, usually acuminate; petioles of lower leaves long, stout, terete; the peduncles emerging from the sheaths of the uppermost leaves. *Flowers* blue, usually spotted with red, in sub-spicate racemes globose in bud and then elongating as the flowers expand, the terminal flower opening first; pedicels $\frac{1}{2}$ - $\frac{1}{3}$ in. *Perianth* campanulate; segments about $\frac{3}{8}$ in. long, three of them narrowly obovate, the other three much narrower. Filament of large anther $\frac{1}{2}$ in. long, with an acute horn on one side, those of the smaller anthers filiform. *Ovary* $\frac{3}{10}$ in. long, ellipsoid, glandular; stigma 3-lobed. *Fruit* less than $\frac{1}{2}$ in. long, glandular outside. *Seeds* rounded at each end, pale, and with many brown ribs.

Abundant within the area in rice-fields, and on the margins of tanks. **DISTRIB.**: Throughout India from Kashmir to Assam and south to Travancore; also in Ceylon and extending to the Malay Islands, China, Japan and Trop. Africa.

VAR. plantaginea, Solms-Laub.; *F. B. I. vi*, 363; *Prain Beng. Pl.* 1079. *Pontederia plantaginea*, Roxb. *Fl. Ind. ii*, 123. A much smaller plant with narrower leaves and fewer flowers on the racemes. Found at Moradabad by T. Thomson and by Mrs. Bell at Banda, but is probably plentiful within the area and in other parts of India. Outside India it occurs in Java and China.

CXIII.—COMMELINACEÆ.

Herbs, prostrate or erect, rarely climbing or shrubby. *Leaves* costate, with sheathing bases, nerves parallel. *Flowers* more or less irregular, usually 2-sexual, often cymose; cymes scorpioid, straight or reduced to one flower, sometimes paniced, often enclosed in spathe-like bracts; floral bracts usually small, opposite the pedicels or obsolete, sometimes herbaceous and distichously im-

bricate. *Perianth* inferior, 6-partite; the 3 outer segments herbaceous, often persistent, the inner petaloid, free or united below in a tube, spreading above, marcescent. *Stamens* 6, adnate to the base of the perianth-segments, all perfect or 2 or more reduced to staminodes; filaments often bearded with jointed hairs; anthers oblong or globose, often dissimilar. *Ovary* free 3-or 2-celled, style terminal, stigma small; ovules solitary or few, orthotropous, on the inner angles of the cells. *Fruit* a loculicidal capsule or indehiscent. *Seeds* angled, testa smooth or rugose, albumen floury; embryo minute, far from hilum.—Species about 300, in tropical and subtropical regions.

Stamens 2 or 3, perfect, with 1-3 staminodes:—

- | | |
|--|-----------------|
| Cymes enclosed in spathaceous bracts | . 1. COMMELINA. |
| Cymes panicled; bracts not spathaceous | . 2. ANEILEMA. |

Stamens 6, perfect:—

- | | |
|---|------------------------|
| Petals united below into a tube; cymes
scorpioid | 3. CYANOTIS. |
| Petals free; cymes secund, in thyrsoid
panicles | 4. FLOSCOPA. |

1. Commelina, Linn.; Fl. Brit. Ind. vi, 368.

Herbs, usually slender or creeping below. *Leaves* ovate-lanceolate, or linear, with lax sheaths, petioled or not. *Flowers* in usually 2-fid cymes emerging one at a time from a terminal complicate or funnel-shaped or hooded spathe; flowers of the upper cyme-branch small, deciduous, of the lower fertile; fruiting pedicel and capsule retracted within the spathe. *Sepals* 3, membranous, the 2 inner often connate at the base. *Petals* 3, longer than the sepals, one larger than the others and often clawed. *Stamens* 3, perfect, with 2-3 imperfect; anthers oblong, one usually longer than the others. *Ovary* 3-rarely 2-celled, two of the cells 1 or 2-ovuled, third cell, if present, 1-ovuled or empty. *Fruit* a loculicidal capsule hidden in the spathe by the decurving of the pedicel after flowering, the posticous cell indehiscent or obsolete, or the 2 anticous cells empty indehiscent and connate as a ligulate body, from which the posterior cell falls away. *Seeds* ellipsoid or angled; testa reticulate pitted

or rugose. Species about 100, in tropical and subtropical regions.

Anterior pair of cells of ovary 2-ovuled; posterior cell 1-ovuled or obsolete :—

Capsule 3-celled, the two anterior cells loculicidally dehiscent and each usually 2-seeded; posterior cell keeled, 1-seeded and deciduous at length dehiscent :—

Leaves lanceolate; spathes complicate, the margins free, or connate only at the very base :—

Seeds reticulate, cylindric; branches of cyme 1-3 fld.; spathe sometimes cordate at base

1. *C. nudiflora*.

Seeds smooth, truncate at one end; spathe always rounded at base :—

Branches of cyme equal, 1-2 fld.; seeds appendaged, globose at the unflattened end

2. *C. salicifolia*.

Branches of cyme unequal, upper 2-4 fld., lower 1-2 fld.; seeds with out appendages, subacute at the unflattened end

3. *C. Hasskarlii*.

Leaves elliptic-ovate; spathe turbinate; capsule always 5-seeded; seeds rugose .

4. *C. bengalensis*.

Capsule 1-celled, with 2 superposed seeds truncate and appendaged at both ends, or with one subglobose seed; leaves linear; spathes deeply cordate at base

5. *C. attenuata*.

All the cells of the ovary 1-ovuled; capsule 3-celled, subequally 3-valved; seeds free in the cells; spathe sessile or nearly so; capsule 3-gonous-obovoid

6. *C. obliqua*.

1. *C. nudiflora*, Linn. *Sp. Pl.* 41; Clarke in DC. *Mon.* iii, 144; F. B. I. v., 369; Watt *E.D.*; Prain *Beng. Pl.* 1082; Cooke *Fl. Bomb.* ii, 781. *C. caespitosa*, Roxb. *Fl. Ind.* i, 174.

Diffuse, nearly glabrous; root fibrous. Stems 2-3 ft. or more long-branching from the base; branches prostrate or subscandent, often rooting at the rather distant nodes. Leaves sessile, 1½-3 in. lanceo-

late or ovate-lanceolate, acute or acuminate; sheaths loose, glabrous, usually with ciliate margins. *Peduncles* $\frac{1}{2}$ - $\frac{3}{4}$ in. long, spreading or erect. *Spathes* $\frac{3}{4}$ or $1\frac{1}{4}$ long; base rounded or cordate, with rounded lobes. *Cymes* usually two, 1-3 fld. *Flowers* $\frac{1}{2}$ - $\frac{3}{4}$ in. across, the two interior petals obovate with long claws, dark blue; the exterior one subsessile, orbicular, pale blue or white, sometimes obsolete. *Ovary* 3-celled, of which two cells are 2-ovuled and the third 1-ovuled. *Capsule* $\frac{1}{2}$ in. long, broadly oblong, acuminate, coriaceous, 5-seeded. *Seeds* oblong-cylindric, brown, tubercled and reticulate.

Abundant within the area. **DISTRIB.:** Throughout the hotter parts of India from the Punjab to Ceylon, extending to China, S. Africa and other tropical and subtropical countries.

2. C. salicifolia, Roxb.: *Fl. Ind. i, 172; Clarke in DC. Mon. iii, 157; F. B. I. vi, 370; Watt E.D.; Prain Beng. Pl. 1082; Cooke Fl. Bomb. ii, 781.*

Stems slender, glabrous, decumbent, sometimes rooting from the nodes. *Leaves* 3-6 in. long, linear-lanceolate, glabrous or nearly so; sheaths $\frac{1}{2}$ in. to 1 in., ciliate. *Spathes* 1-2 in., axillary ovate-lanceolate, acute or acuminate, rounded at base. *Peduncles* $\frac{1}{2}$ - $1\frac{1}{4}$ in. long, slender. *Flowers* polygamous; branches of cyme equal, usually 1-2-fld. *Sepals* free, ovate, obtuse, the two inner connate below, larger than the outer. *Petals* dark blue, the two larger ovate with undulate margins and long claws, the smaller one broadly ovate, entire, subsessile or with a very short claw. *Staminodes* 3, clavate. *Capsule* $\frac{1}{2}$ in. long, quadrate, membranous. *Seeds* $\frac{1}{2}$ in. long, black, powdered with white, smooth, ovoid or subglobose, with a whitish membranous appendage at one end.

Dehra Dun, on the Siwalik range; Sub-Himalayan tracts of N. Oudh; Merwara in Rajputana; Bundelkand. **DISTRIB.:** Eastwards to Assam, Burma and Bengal and southwards to the Konkan and S. India, extending to Java.

3. C. Hasskarlii, Clarke Comm. and Cyrt. Beng. 13, t. 3; in DC. Mon. iii, 157; F. B. I. vi, 370; Prain. Beng. Pl. 1082; Cooke Fl. Bomb. ii, 781.

Stem much branched, glabrous or pubescent, sometimes scaberulous. *Leaves* 1-3 in. long, narrowly lanceolate, subacute; sheaths $\frac{1}{2}$ in. long, with a broad base, ciliate. *Spathes* $\frac{1}{2}$ in. long, axillary, ovate-lanceolate, cordate at the base and with rounded lobes, glabrous scabrid or hispid; peduncles $\frac{1}{2}$ -1 in. long. *Flowers* in pubescent unequal cymes, the uppermost branch 2-4-fld., the lower 1-2-fld. *Capsule* $\frac{1}{2}$ in. long, quadrate, apiculate, membranous. *Seeds* $\frac{1}{2}$ - $\frac{3}{4}$ in.

long, cylindric, truncate at one end, subacute or rounded at the other, without an appendage.

From Delhi to N. Oudh, apparently not common. **DISTRIB.** : Kumaon, Bengal, Assam ; and from Mt. Abu south to Konkan and Poona.

4. *C. benghalensis*, Linn. Sp. Pl. 41 ; Clarke in DC. Mon. iii, 159 ; Roxb. Fl. Ind. 1, 171 ; F. B. I. vi, 370 ; Watt E. D. ; Collett Fl. Siml. 532 ; Prain Beng. Pl. 1082 ; Cooke Fl. Bomb. ii, 782.

Stems 2-3 ft. long, slender, dichotomously branched from the base ; branches diffuse, glabrous or pubescent, creeping and rooting below. **Leaves** 1-3 in. long, ovate or oblong, obtuse, sessile or shortly stalked, pubescent or villous on both surfaces ; base unequal-sided, rounded cuneate or cordate ; nerves 7-11 pairs ; sheaths hairy ; margins ciliate with rufous hairs. **Spathes** 1-3 together, funnel-shaped or turbinate, auricled on one side. **Sepals** small, oblong, hairy. **Petals** blue, the larger one orbicular or transversely oblong. **Ovary** 3-celled, two of the cells 2-ovuled, the third cell 1-ovuled. **Capsule** $\frac{1}{2}$ in. long, pyriform, membranous, 5-seeded. **Seeds** closely pitted.

Moradabad (T. Thomson), Pilibhit (Duthie) ; Bundelkhand (Edgeworth). **DISTRIB.** : Throughout India, and up to 6,000 ft. on the Himalaya, extending to China and Trop. Africa. In this species ripe seeds are sometimes matured underground from abnormal flowers borne on leafless branches coming from the lower nodes of the stems. These flowers are white and smaller than the blue aërial ones, which often fail to produce fertile seeds.

5. *C. attenuata*, Koen. ex Vahl. Enum. ii, 168 ; Clarke in DC. Mon. iii, 172 ; F. B. I. vi, 372 ; Prain. Beng. Pl. 1083 ; Cooke Fl. Bomb. ii, 784.

Stem 1-3 ft. long, slender, much branched, glabrous or sparsely hairy. **Leaves** $1\frac{1}{2}$ -3 in. long, linear or linear-lanceolate, acute or subobtuse ; sheaths ciliate, often hardly distinct from the leaf-blade, spathes $1-1\frac{1}{2}$ in., narrowly ovate-lanceolate, acute or caudate-acuminate, glabrous ; base deeply sagittately cordate and with large auricles. **Peduncles** $\frac{3}{4}$ - $1\frac{1}{2}$ in., glabrous or pubescent. **Flowers** small, blue. **Capsule** $\frac{1}{2}$ in. long, 1-celled, with 2 superposed seeds truncate and appendaged at both ends, or with one subglobose seed.

Bundelkhand (Mrs. Bell) and probably in other localities within the area. **DISTRIB.** : Chota Nagpur, Behar, Central India and South to Ceylon.

6. *C. obliqua*, Buch-Ham. in Don. Prod. 45 (not of Vahl), Clarke in DC. Mon. iii, 178 ; F. B. I., vi, 372 ; Watt E. D. ; Collett Fl.

Siml. 532 ; *Prain Beng. Pl.* 1083 ; *Cooke Fl. Bomb.* ii, 784. *C. communis*, *Roxb. Fl. Ind.* i, 171 ? *C. gelatinosa*, *Edgew.*

A tall branching herb. *Stems* 2-3 ft. high, stout. *Leaves* 4-7 in. long, very variable, sessile or stalked, lanceolate or elliptic-lanceolate, acute or caudate-acuminate, membranous, glabrous scabrous or villous ; sheaths about 1 in. long, the mouth bearded with long hairs. *Spathes* sessile or nearly so, $\frac{3}{4}$ -1 in. long and as broad as long, solitary or crowded in terminal heads, acute, funnel-shaped, glabrous or somewhat scabrous, usually filled with a clear, glutinous liquid. *Flowers* blue, about $\frac{3}{4}$ in. across, in simple racemes ; large petal orbicular, clawed. *Ovary* 3-celled, the cells 1-ovuled. *Capsule* $\frac{3}{4}$ in. long, 3-celled and subsequently 3-valved, 3-gonous-obovoid. *Seeds* $\frac{1}{4}$ in. long, oblong or ellipsoid, smooth, puberulous, lead-coloured.

Very common within the area. **DISTRIB.:** Throughout India and in Ceylon, and up to 6,000 ft. on the Himalaya ; it extends also to the Malay Islands.

2. ANEILEMA, R. Br. ; *Fl. Brit. Ind.* vi, 374.

Herbs with simple or branched stems ; roots often tuberous. *Leaves* usually alternate, sometimes all radical, occasionally clustered under the inflorescence, usually narrow and sessile. *Flowers* in axillary and terminal panicles : bracts not spathaceous ; bracteoles small. *Sepals* 3, free, membranous. *Petals* 3, obovate, equal. *Stamens* 2 or 3, filaments naked or bearded ; anthers oblong, one usually smaller or longer than the others. *Staminodes* 2-4 ; rarely with minute anthers. *Ovary* sessile, 2-3-celled. *Fruit* a loculicidal capsule. *Seeds* 1 or more in each cell, with a thick hard rugose or pitted testa.—Species about 60, in tropical and subtropical regions, chiefly in Asia.

Cells of ovary containing 2 or more ovules, of the capsule 2-or more-seeded :—

Seeds 1-seriate in each cell ; flowers in terminal or subterminal panicles :—

Cells of the ovary with 3 or more ovules, of the capsule 3-7-seeded :—

Panicles terminating an erect leafless scape with large sheathing bracts ; leaves all radical, narrowly ensiform ; root tuberous

1. *A. scapiflorum*.

Panicles terminating leafy stems;
 root fibrous; stem slender; leaves
 sessile, small, oblong, auricled; pani-
 cle small, leafy below

2. *A. spiratum*.

Cells of ovary with 2 ovules, of capsule
 usually 2-seeded; panicles subterminal
 rarely axillary; leaves linear or
 lanceolate

3. *A. nudiflorum*.

Seeds 2-seriate (16 or more in each cell);
 pedicels axillary or terminal; stem stout,
 sparingly branched, creeping and rooting
 at the nodes, leafy; leaves linear-oblong .

4. *A. Hamiltonianum*.

Cells of ovary 1-ovuled, those of capsule 1-
 seeded; pedicels 1-3 in the axils of distant
 lanceolate bracts; stem slender, decumbent
 and rooting at the lower nodes; leaves long,
 linear; roots fibrous

5. *A. vaginatum*.

1. *A. scapiflorum*, Wight *Ic. t. 2075*; *F. B. I. vi 375*; Clarke in *DC. Mon. iii, 207*; Watt *E. D.*; Prain *Beng. Pl. 1084*; Cooke *Fl. Bomb. ii, 786*. *Commelina scapiflora*, Roxb. *Fl. Ind. i, 175*. *Murdannia tuberosa* Royle *Ill. 403, t. 95*.—Vern. *Siyah musli* (Hind.).

A tufted herb, with elongate fusiform tubers. *Leaves* all radical, erect, 4-8 in. long, narrowly ensiform, finely acuminate and slightly narrowed to the base. *Flowers* in erect elongate panicles on terminal leafless scapes; scape with panicle 8-18 in. long; sheaths on scape below the panicle $\frac{3}{4}$ -2 $\frac{1}{4}$ in. embracing the scape, finely acuminate with an oblique mouth; upper bracts amplexicaul, often spotted. * *Sepals* $\frac{1}{4}$ in. long, elliptic-oblong, subacute, purple-green. *Petals* blue, $\frac{3}{8}$ in. long, obovate. *Stamens* 3, perfect, all bearded with blue hairs. *Capsule* $\frac{1}{4}$ in. long, obovoid. *Seeds* 5 or 6 in each cell, superposed, sharply 3-gonous.

Siwalik range, on the Mohand Pass and in Sub-Himalayan tracts from Rohilkhand to Gorakhpur (Duthie). **DISTRIB.:** Temp. and Trop. Himalaya from the Ganges eastwards to Bhutan; also in Bengal and southwards to Travancore and Ceylon, extending to Burma and China.

2. *A. spiratum*, R. Br. *Prod. 271*; Clarke in *DC. Mon. 207*; *F. B. I. vi, 377*; Prain *Beng. Pl. 1084*; Cooke *Fl. Bomb. ii, 787*. *A nanum*, Kunth.; Clarke *Comm. and Cyrt. Beng. t. 18*. *Commelina nana*, Roxb. *Fl. Ind. i, 173*. *C. pumila* Herb Royle.

A dwarf annual, with fibrous roots, branching from the base ; branches 6-10 in., decumbent and rooting below. *Leaves* sessile, the lower ones broadly linear-lanceolate ; the upper oblong ; cordate, amplexicant, $\frac{1}{2}$ -1 in. long, acute ; sheaths very short. *Flowers* about $\frac{1}{2}$ in. across, in dichotomously branched few-fl. panicles ; peduncles terminal and from the upper axils ; pedicels longer than the capsules ; bracts minute, ovate, amplexicaul, persistent. *Stamens* 3, perfect ; anthers blue, filaments bearded ; staminodes 3, shorter than stamens, usually naked. *Ovary* 3-celled, cells many-ovuled. *Capsule* 3-gonous, the cells 3-7-seeded. *Seeds* 1-seriate, minute, pale.

Banda (Edgeworth, under *Commelina nana*). **DISTRIB.** : Throughout India and in Ceylon, extending to Malaya and China, flowering during the rains. This plant will probably be found in other localities within the area of this flora. It appears to be common in Bengal as a field weed.

3. A. nudiflorum, R. Br. *Prod.* 271 (in note) ; Clarke in DC. *Mon.* iii, 210 ; F. B. I. vi, 378 ; Collett *Fl. Siml.* 538 ; Prain *Beng. Pl.* 1084 ; Cooke *Fl. Bomb.* ii, 788. *A. radicans*, Don *Prod.* 45 (in part). *Commelina nudiflora*, L. *Mant.* 177 (not of *Sp. Pl.*) ; Roxb. *Fl. Ind.* i, 173.

Roots fibrous. *Stem* simple or branched from the base ; branches 6-12 in., procumbent and often rooting at the nodes. *Leaves* 2-5 in. long, linear-oblong or lanceolate, acute or acuminate, flat, glabrous or sparingly villous, base cordate rounded or narrowed into the sheath ; sheaths hairy, the margins and mouth strongly ciliate. *Flowers* in subglobose or subcorymbose cymes at the ends of the branches of a terminal (rarely axillary) panicle ; pedicels $\frac{1}{2}$ - $\frac{3}{4}$ in. long ; bracts boat-shaped, caducous. *Sepals* $\frac{1}{2}$ in. long, oblong, obtuse. *Petals* equal, suborbicular, blue or purple. *Stamens* 2 perfect, 2-4 sterile, filaments or perfect stamens only or all bearded with moniliform blue hairs. *Ovary* 3-celled ; cells 2-ovuled. *Capsule* $\frac{1}{2}$ in. long, subglobose, mucronate, 3-celled, with 3 seeds in each cell. *Seeds* 1-seriate, tuberculate, dark brown, truncate at one end, rounded at the other ; inner face angular, outer face convex.

Dehra Dun and Saharanpur districts ; Bundelkhand (Edgeworth), flowering during the rains. **DISTRIB.** : Throughout India and on the W. Himalaya up to 6,000 ft. ; Khasia Hills and Burma, and from Bengal and Bombay southwards to Ceylon, extending to China and the Malay Islands.

4. A. Hamiltoniana, Wall. *Cot.* 5222 ; F. B. I. vi, 380 ; Prain *Beng. Pl.* 1084 ; *Dichæsperrum Blumei*, Hassk ; Clarke *Comm. and Cyrt. Beng.* t. 27.

Stem 6-12 in. long, creeping and rooting at the nodes, leafy, sparingly branched. *Leaves* sessile, flat, $1\frac{1}{2}$ -2 in. long, linear-oblong, acute or subacute, glabrate, base cuneate. *Peduncles* $\frac{1}{2}$ - $\frac{1}{2}$ in., rigid; pedicels axillary or terminal. *Petals* white or pink. *Filaments* all naked. *Capsule* linear-oblong, acute, $\frac{1}{2}$ - $\frac{1}{2}$ in. long. *Seeds* 2-seriate, about 16 or more in each cell, scabrid or flocculent.

Upper Gangetic Plain, usually in wet ground; Moradabad (T. Thomson).
DISTRIB.: Eastwards to Bengal and Assam and extending to Java.

5. *A. vaginatum*, R. Br. Prod. 271; Clarke in DC. Mon. iii, 216; F. B. vi, 381; Prain Beng. Pl. 1084; Cooke Fl. Bomb. ii, 79.

Root fibrous, the fibres stout and almost fleshy. *Stem* decumbent, 6-18 in. long, rooting at the lower nodes, very slender, flaccid; branches suberect, ending in filiform peduncles with distant bracts. *Leaves* 3-8 in. long, linear, acuminate, flat; sheaths short, open, ciliate. *Flowers* small, 1-3, fascicled in the axils of distant bracts along the filiform terminations of the branches; bracts $\frac{1}{2}$ - $\frac{1}{2}$ in. long, strongly ribbed; pedicels very slender, puberulous, usually twice-jointed. *Sepals* $\frac{1}{2}$ in. long, obtuse. *Petals* orbicular, blue. *Stamens* 2, perfect, and with bearded filaments; sterile stamens 3-4, usually naked and shorter. *Ovary* 2-celled; cells 1-ovuled. *Capsule* globose, cuspidate; cells 1-seeded or empty. *Seeds* 3-gonously conic, truncate at one end narrowed at the other, slightly rugose, black.

Common in rice fields and wet places. DISTRIB.: Throughout Trop. India and in Ceylon, extending to China.

3. **CYANOTIS**, Don; Fl. Brit. Ind. vi, 384.

Herbs, prostrate or creeping. *Leaves* small. *Flowers* in axillary and terminal scorpioid cymes, formed of large imbricate 2-seriate secund foliaceous falcate bracteoles, the petals and stamens alone exerted, rarely with the corolla-tube exerted; flowers sometimes in exposed racemes or fascicled in the ochreate leaf-sheath. *Sepals* 3, subequal, free or connate below. *Petals* 3, subequal, often united in a tube below, limb orbicular. *Stamens* 6, all perfect, subequal, hypogynous or epigynous; filaments usually bearded, often inflated towards the apex, anthers oblong. *Ovary* 3-celled; ovules 2 in each cell, collateral, one erect the other pendulous. *Fruit* a 3-celled loculicidal capsule. *Seeds* usually 2 in each cell, superposed, cubical or pyramidal, usually rugose.—Species 35,

in the warmer regions of the Old World, from Africa and through India to S. China and N. Australia.

Flowers in cymes, enclosed in 2-seriate falcate imbricating bracteoles :—

1. Roots fibrous ; stem and branches slender ; leaves ovate-oblong, glabrous or with spreading hairs 1. *C. cristata*.

Roots tuberous ; stem and branches stout ; radical leaves ensiform ; cauline lanceolate, hirsute 2. *C. tuberosa*, VAR. *adscendens*.

Flowers axillary, enclosed in the sheaths of the leaves ; bracteoles small, slender, not imbricating 3. *C. axillaris*.

1. *C. cristata*, Schult. f. *Syst.* vii, 1150 ; Clarke in DC. *Mon.* iii, 247 ; F. B. I. vi, 385 ; Collett *Fl. Siml.* 534 ; Prain *Beng. Pl.* 1085 ; Cooke *Fl. Bomb.* ii, 794. *Tradescantia imbricata*, Roxb. *Fl. Ind.* ii, 120.

A slender branching herb with fibrous roots. Stem branched from the base ; branches 6-18 in. long, creeping and rooting below, glabrous or with spreading hairs. Leaves sessile, ovate-oblong, flat, glabrous or sparsely hairy, the margins softly ciliate, base rounded or cordate ; sheaths short, hairy. Flowers in scorpioid recurved cymes which are longer than the bracteoles ; peduncles $\frac{1}{2}$ -4 in. long ; bracts leaflike, $\frac{3}{4}$ -1 $\frac{1}{2}$ in. long, ovate, cordate, acuminate, ciliate ; bracteoles $\frac{1}{2}$ in. long, glabrous or ciliate with long hairs. Sepals lanceolate, acuminate. Filaments bearded above. Style naked. Capsule $\frac{1}{10}$ - $\frac{1}{8}$ in. oblong, 3-gonous, truncate, nearly glabrous. Seeds $\frac{1}{10}$ in. long, striate and with 2 large pits on two of the faces, black.

Bundelkhand (Edgeworth under *C. imbricata*). **DISTRIB.** : Throughout Trop. India, in hilly districts, and up to 4,000 ft. on the W. Himalaya ; also in Burma, Ceylon, and Malay Islands, extending to Trop. Africa.

2. *C. tuberosa*, Schult. f. *Syst.* vii, 1153, VAR. *adscendens*, Clarke in DC. *Mon.* iii, 249 ; F. B. I., 386 ; Watt *E. D.* ; Prain *Beng. Pl.* 1085 ; Cooke *Fl. Bomb.* ii, 793. *Tradescantia tuberosa*, Roxb. *Fl. Ind.* ii, 119.

A creeping herb, with proliferous rooting nodes. Root of fusiform tubers. Stem up to 3 ft. long, swollen and hairy at the base. Leaves sessile, the radical and lower cauline 6-10 in. long, linear or ensiform

villous, often purple beneath; upper cauline leaves much shorter; sheaths of radical leaves about 1 in. long, glabrous, those of cauline leaves shortly silky. *Cymes* $\frac{1}{2}$ -1 in. densely hairy, in the axils of short falcately decurved ovate acute bracts; bracteoles many, imbricate in 2 series. *Sepals* $\frac{1}{4}$ in. long, linear-lanceolate, acute, densely villous and ciliate. *Corolla* $\frac{1}{4}$ in. long, bluish-purple; lobes $\frac{1}{6}$ - $\frac{1}{8}$ in. ovate, subacute. *Filaments*—spirally twisted, densely bearded with blue hairs. *Style* thickened and with a tuft of hairs at the tip. *Capsule* $\frac{1}{4}$ in. long, ellipsoid, hairy on its upper half. *Seeds* brown, obscurely rugose.

Agra (Jacquemont). **DISTRIB.**: Chota Nagpur; Bombay Pres. to S. India and Ceylon. A smaller and more glabrous plant than the type; flowers blue. The type occurs in W. India from the Konkan and southwards to Travancore.

3. *C. axillaris*, Schult. f. *Syst.* vii, 1154; Clarke in DC. *Mon.* iii, 244; F. B. I. vi, 388; Watt E. D.; Prain Beng. Pl. 1085; Cooke *Fl. Bomb.* ii, 795. *Tradescantia axillaris*, Linn.; Roxb.; *Fl. Ind.* ii, 118.

Roots fibrous. *Stem* annual, 6-18 in. long, stout or slender, diffusely branched, leafy, glabrous; branches suberect or creeping below or prostrate, glabrous or sparsely hairy, often coloured. *Leaves* sessile, 2-6 in. long, narrowly linear or linear-lanceolate, acute or acuminate, flat, more or less hairy; sheaths $\frac{1}{4}$ to $\frac{3}{8}$ in., inflated, ciliate. *Cymes* reduced to axillary fascicles of violet-blue flowers clustered in the inflated sheaths; bracteoles small, almost concealed in the leaf-sheaths. *Sepals* $\frac{3}{8}$ in. long, lanceolate, acuminate. *Corolla-lobes* broadly ovate, subacute. *Filaments* fusiform below the tip, bearded. *Capsule* about $\frac{1}{4}$ in. long, oblong-ellipsoid, beaked, glabrous except the beak. *Seeds* $\frac{1}{10}$ in. long, oblong, compressed, truncate at base rounded at the apex and with a very short conical tip, mottled with dark-brown and shining.

Bundelkhand, in marshy ground (Edgeworth); *Agra* (Munro); Rohilkhand, Cawnpore and N. Oudh (Duthie), etc. **DISTRIB.** Throughout India, in the plains, and in Ceylon, extending to Trop. Australia.

4. *FLOSCOPA*, Lour.; *Fl. Brit. Ind.* vi, 390.

Erect or subscaudent herbs. *Leaves* lanceolate. *Flowers* in terminal or axillary panicles of secund but not scorpioid cymes, bracts minute. *Sepals* 3, oblong, free. *Petals* 3, obovate, free. *Stamens* 6, all perfect or 1 imperfect; filaments filiform,

glabrous. *Ovary* 2-celled, style simple, ovules solitary in each cell. *Fruit* a compressed or didymous loculicidal 2-celled capsule. *Seeds* solitary in each cell, hemispheric.—Species about 12, in the warmer regions of the world.

F. scandens, Lour. *Fl. Cochinch.* 193; Clarke in DC. *Mon.* 265; *F. B. I.* vi, 390; Prain *Beng. Pl.* 1086; Cooke *Fl. Bomb.* ii 796. *Tradescantia paniculata*, Roxb.; *Fl. Ind.* ii, 119. *Aneilema hispidum*. Don. *Prod.* 45.

Root fibrous. *Stem* rather slender; erect or subscandent, often creeping and rooting below; internodes long; branches ascending leafy below, glabrous or hairy. *Leaves* subsessile, 2-4 in. long, elliptic-lanceolate, acuminate, much narrowed at the base, scaberulous above; sheaths loose, short, glabrous or villous, the mouth fringed with long hairs. *Panicles* shortly stalked, pyramidal, with long erect or ascending many-fl. branches. *Flowers* small, pedicelled, subglobose, the lower ones bracteate, the upper without bracts. *Sepals* $\frac{1}{8}$ - $\frac{1}{2}$ in. long, rotund-ellipsoid, villous. *Petals* longer than sepals, broadly obovate, white lilac or pink. *Filaments* equal, longer than petals, purplish; anthers yellow. *Ovary* glabrous. *Capsule* $\frac{1}{8}$ - $\frac{1}{2}$ in. in diam., rather broader than long, abruptly acute at both ends, shining. *Seeds* transversely wrinkled on the back.

Dehra Dun, at Nala Páni, and probably elsewhere in marshy ground, within the area of this flora. *DISTRIB.*: Throughout Trop. India and in Ceylon, extending to China and Trop. Australia.

CXIV.—JUNCACEÆ.

Erect usually perennial herbs. *Stems* tufted or with a creeping rootstock. *Leaves* flat, terete or reduced to sheaths. *Flowers* small, in axillary cymes, 2-sexual, green or whitish and membranous, or brown and coriaceous, bracts small. *Perianth* inferior, segments or lobes 6, more or less 2-seriate, persistent, imbricate. *Stamens* 6, rarely 3, hypogynous or on the bases of the perianth segments, occasionally those of the inner series obsolete, filaments filiform, anthers basifixed. *Ovary* superior, 3 or 1-celled; style simple, with 3 brush-like stigmas; ovules 3, basilar in the 1-celled ovaries or many on the inner angles of the 3-celled ovaries, anatropous. *Fruit* a 1-3-celled capsule, loculicidally 3-valved. *Seeds*

erect; testa membranous, often produced at each end, albumen dense; embryo small, near the hilum.—Species about 200, cosmopolitan, but chiefly in damp cold regions.

JUNCUS, Linn.; Fl. Brit. Ind. vi, 392.

Perennial, rarely annual, glabrous herbs. *Stems* simple under the inflorescence. *Leaves* radical or few near the base of the stem, linear or terete or reduced to sheaths. *Flowers* small, usually clustered in fascicles or 2-fid. cymes, either sessile or capitate or unequally peduncled and paniculate, the whole inflorescence terminal or sub-terminal on the scape-like stems, with 1-3 leafy bracts. *Perianth* with 6 free lanceolate or oblong glume-like segments, often with scarious edges, the 3 outer keeled or with a thickened midrib. *Stamens* 6, rarely 3, hypogynous or nearly so, anthers oblong or linear, erect, with longitudinal introrse dehiscence. *Ovary* free, 3 or 1-celled, style filiform; stigmatic arms 3, often spirally twisted. *Fruit* a capsule, dehiscing by 3 valves with mesial placentas, rarely by 3 valves leaving the placentas persistent or connate in a central column. *Seeds* small, ovoid; testa striate reticulate or transversely lineate; embryo small, near the base of the fleshy albumen.—Species about 160, in temp. or arctic regions, rarely tropical.

Annual, leaves not septate; stems much branched; cymes scattered, few-flowered; lateral flowers 6-androus, terminal 3-androus 1. *J. bufonius*.

Perennial, leaves indistinctly and distantly septate; cymes terminal; flowers densely clustered in small heads, flowers all 3-androus 2. *J. prismatocarpus*.

1. *J. bufonius*, Linn. Sp. Pl. 328; Royle Ill. 401; F. B. I. i, 392; Collett Fl. Siml. 535; Prain Beng. Pl. 1088.

A small pale-green tufted annual, up to 12 in. high. *Stems* erect or ascending, slender, much dichotomously branched from the base. *Leaves* few, chiefly radical, not septate, channelled above. *Cymes* many, scattered on the stem; bracts scarious. *Flowers* solitary or clustered, $\frac{1}{4}$ – $\frac{1}{2}$ in. long; the lateral ones open, 6-androus, terminal closed, 3-androus. *Sepals* and *petals* unequal lanceolate, acuminate, the margins broadly membranous. *Stamens* half as long as the

petals. *Capsule* shorter than and closely embraced by the perianth, obovoid, mucronate. *Seeds* very minute, finely reticulate.

Dehra Dun, Saharanpur, Etáwah, and Merwára (Duthie); Agra (Munro); Moradabad (T. Thomson); Bundelkhand (Mrs. Bell). *DISTRIB.*: Plains of N. India and up to 13,000 ft. on the Himalayan ranges; extending to China, S. Africa, Europe (including Britain) to the Arctic regions.

J. J. prismatocarpus, *R. Brown Prod.* 259; *F. B. I.* vi, 395; *Collett Fl. Siml.* 536; *Prain Beng. Pl.* 1088. *J. indicus*, *Royle ex Don in Trans. Linn. Soc. xviii*, 323.

A perennial caespitose herb; rootstock very short. *Stem* erect, 18-24 in. long, terete or compressed, sometimes decumbent and rooting at the nodes. *Leaves* few, 2-10 in. long, shorter than the stem, soft, terete or flat or sometimes tubular and indistinctly externally septate. *Cymes* erect, irregularly compound; heads hemispheric, densely 6-10-fld.; lower bract leaflike, erect, shorter than the cyme; floral bracts hyaline, lanceolate-acuminate. *Flowers* green or brown, in small sessile clusters in the axils and at the ends of the unequal branches of an erect terminal panicle. *Sepals* glume-like, $\frac{1}{2}$ - $\frac{1}{3}$ in. long. *Stamens* 3, much shorter than the perianth. *Style* short, stigmas long. *Capsule* equalling or longer than the perianth, prismatic or conical. *Seeds* minute, reticulate.

N. Oudh, in the Kheri district, Merwára, in tanks (Duthie); also probably in many other localities within the area of this flora, in wet ground. *DISTRIB.*: Common in the plains of Bengal and the Punjab and up to 10,000 ft. on the Himalaya; also on the Bombay Gháts and the Khasia Hills and extending to Ceylon, Burma and Australia.

