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OF THE

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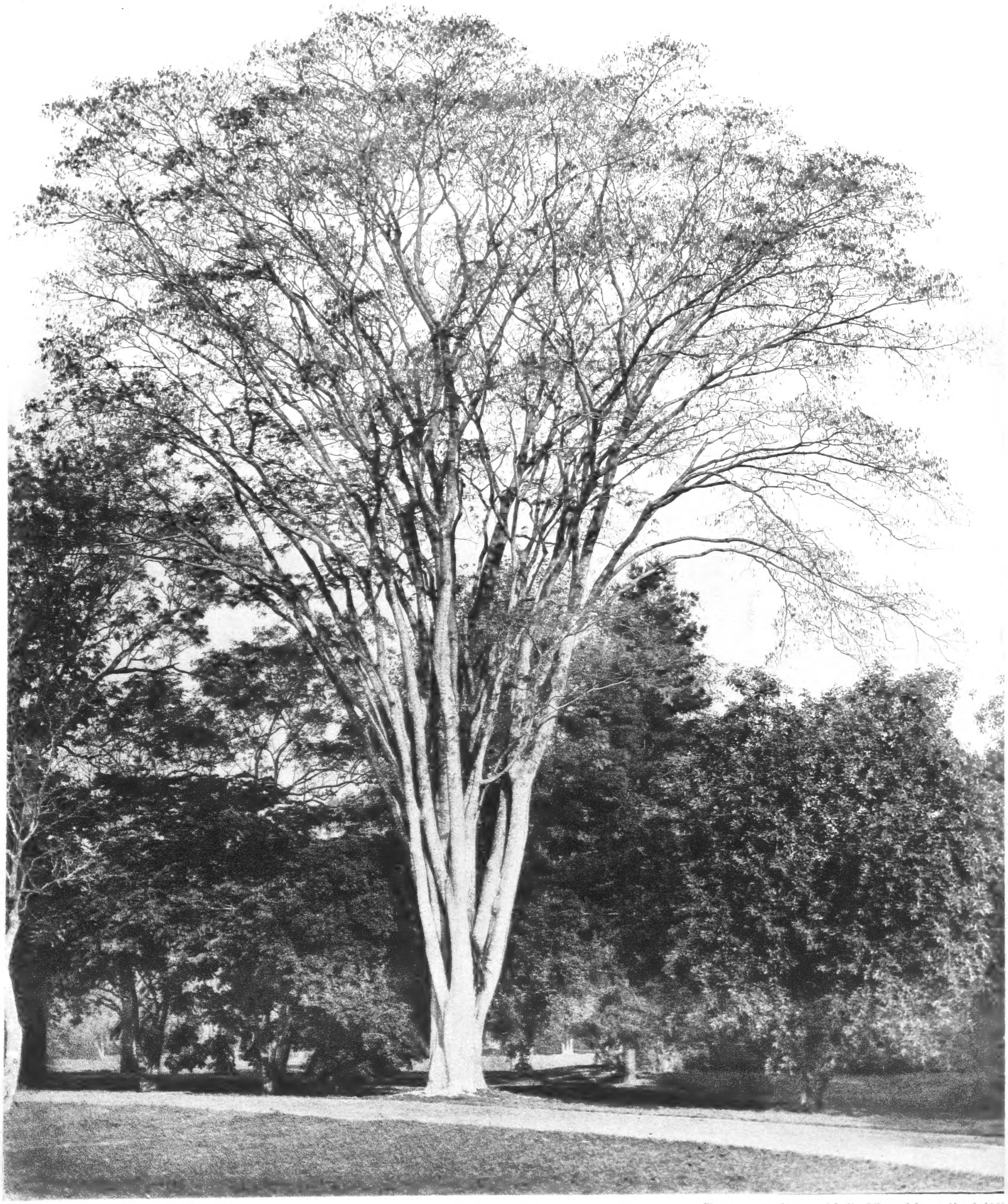

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ANNALS

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ROYAL BOTANIC GARDEN, CALCUTTA.

Vol. IX.

PART I.

A SECOND CENTURY OF NEW AND RARE INDIAN PLANTS

By

Sir G. KING, K.C.I.E., LL.D., F.R.S.,
late Director of the Botanical Survey of India,

J. F. DUTHIE, B.A., F.L.S.,
Director, Botanical Department, Northern India,

and

D. PRAIN,
Superintendent of the Royal Botanic Garden, Calcutta.

PART II.

THE ORCHIDS OF THE NORTH-WESTERN HIMALAYA

By

J. F. DUTHIE, B.A., F.L.S.,
late Director, Botanical Department, Northern India.

CALCUTTA:
Printed at the Bengal Secretariat Press.
1906.

TO THE HONOURABLE

Sir Andrew Henderson Leith Fraser,

M.A., LL.D., K.C.S.I.,

LIEUTENANT-GOVERNOR OF BENGAL,

THE PRESENT CONTRIBUTION TO A KNOWLEDGE OF THE VEGETATION OF INDIA,

THE PUBLICATION OF WHICH HAS BEEN RENDERED POSSIBLE

OWING TO THE LIBERALITY OF HIS GOVERNMENT,

IS VERY RESPECTFULLY DEDICATED

ROYAL BOTANIC GARDEN, CALCUTTA,
October 1904.

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WITH FRONTISPIECE AND NINETY-THREE PLATES.

CALCUTTA:
Printed at the Bengal Secretariat Press.
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NOTE.

The present part of the Annals of the Calcutta Garden is the work of three authors. For the descriptions of twenty species Sir G. King, of fifteen species, Mr. J. F. Duthie, and of forty-seven species, the writer is responsible. For the account here presented of fifteen species Sir G. King and the writer, and of two species Mr. Duthie and the writer are jointly responsible. The preparation of the plates of species for which Sir G. King, or the writer, or Sir G. King and the writer jointly, are responsible, have been prepared under the writer's supervision; Mr. Duthie has supervised the preparation of the plates of those species for which he alone or for which he and the writer are conjointly responsible, except in the case of *Gleadovia ruborum* the main drawing of which is from the pencil of Mr. J. S. Gamble, F.R.S., who also wrote the specific description, the analyses being partly by Mr. Gamble, partly by Mr. Duthie's native artist, partly by the writer. This responsibility is duly indicated by the initials that follow the descriptions throughout the work and appear in the table of contents.

For the supervision of the work of the lithographers and for the editing of the letter-press the writer is responsible.

Royal Botanic Garden, Calcutta;
November 21*st*, 1900.

D. PRAIN.

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DESCRIPTIONS

OF

A SECOND CENTURY

OF

NEW AND RARE INDIAN PLANTS.

PLATE 1.

GONIOTHALAMUS PEDUNCULARIS *King & Prain, in Journ. As. Soc. Beng.* lxvii. 2. 284 (1898).

Natural order Anonaceæ.

A shrub? young branches slender, glabrous; *leaves* thinly coriaceous, oblong, somewhat oblanceolate, shortly acuminate, the base cuneate; both surfaces glabrous, dull, the lower pale-brown when dry; main-nerves 10 to 12 pairs, curved, inter-arching within the edge, somewhat prominent on the lower, obsolete on the upper surface when dry; length 1·5—2·5 dm., breadth 4—6 cm.; *flowers* solitary, erect, slightly supra-axillary, 4 cm. long, their pedicels somewhat exceeding 2·5 cm., adpressed-puberulous and minutely bracteolate near the base; *sepals* fleshy, free, ovate, subacute, spreading, puberulous on both surfaces, 1 cm. long; *petals* fleshy: the outer row obliquely ovate-lanceolate acuminate, contracted and thickened at the base and excavated on the inner surface, adpressed-pubescent externally and at the base internally, otherwise glabrous, 4 cm. long and 2 cm. wide at the broadest part; inner row ovate, acute, narrowed at the base, pubescent on both surfaces but especially on the outer, cohering in the upper half to form a calyptra with three openings at its base; *anthers* numerous, sessile, linear, their apices capitate; *pistils* about 20, the ovaries linear; the styles twice as long, linear, pubescent; *fruit* unknown.

UPPER BURMA: Kachin Hills, road to Sima, 1,000 ft. above sea level; *Collectors of the Bot. Gard., Calcutta!*

Of all the Indian species of this genus those which most resembles this are the Ceylon *G. Gardneri* H. f. & T. and *G. Thwaitesii* H. f. & T.

PLATE 1.—Goniothalamus penduncularis *King & Prain.* 1, flowering branch; 2, flower; 3, flower dissected; 4, essential organs, laid bare; 5, inner petals,—*of natural size;* 6, anthers,—*enlarged.* Specimen from Sima Road, Kachin Hills, 1,000 ft.

G. K. D. P.

PLATE 2.

2. Meconopsis grandis *Prain in Journ. As. Soc. Beng.* lxiv. 2. 320 (1896).

Natural order Papaveraceæ.

A tall, softly hairy herb with a stout rootstock clothed with sheaths, its neck villous; radical *leaves* tufted, numerous, ovate-lanceolate, blades coarsely serrate, 9—18 cm. long, and tapering into petioles 15—24 cm. long; *stem* 4·5—9 dm. high, leafy, cauline *leaves* like radical but short-petioled or sessile passing into bracts, the lower 1—3 scattered, the upper 3—5 collected in a whorl, the lowest shortly petioled, vacant, at times absent; the next 1—2 with axillary flower-buds; *bracts* of the whorl subequal, 12—15 cm. long, 6—8 cm. wide, with 1—2 axillary flowers; main-axis terminating in a 1-fld. scape extending 15—45 cm. beyond whorl; *buds* 4 cm., *flowers* 12 cm. in diam.; *sepals* 2, hirsute; *petals* deep-blue, 5—9, imbricate; *stamens* numerous *ovary* subcylindric, sparingly covered with harsh, spreading, ultimately subdeciduous bristles, placentas usually 5, slightly intruded; style about one-third the length of ovary or less; *capsule* linear, oblong, 6 cm. long; *seeds* rugose.

Sikkim: Jongri on the Nepal Frontier, at 10—12,000 ft.; *King's Collectors! Watt* n. 5435! *G. A. Gammie!*

This is one of the finest of the Indian species of *Meconopsis;* it is evidently, in spite of its great difference in habit, closely related to *M. simplicifolia* Walp. (*Rep.* i. 110; *Hook. f. Ill. Him. Pl.* t. 8), with which it agrees in having tufted, coarsely dentate radical leaves and of which it has exactly the capsules and the seeds. It is also nearly related to *Meconopsis integrifolia* Franch. (*Bull. Soc. Bot. Fr.* xxxiii. 389) which agrees with *M. grandis* in having a stem that, though shorter, has also 1—2 leaves below and a whorl of 5—8 bracts with 2—3 axillary as well as a terminal flower above, but which differs in having all the leaves entire and in having yellow petals.

When first describing this species the writer stated that it "seems confined to the district of Jongri, but is very plentiful there." Mr. G. A. Gammie has very kindly written to say that this is so, but that even in Jongri it is only a cultivated plant, not grown, however, for its beauty but for the oil that is obtained by expression from its seeds. The inhabitants of Jongri say that the plant itself was brought thither from Nepal.

When it was first described the largest number of petals found in a single flower had been seven; in the flower figured, however, which is from a more recent gathering, nine were present.

Plate 2.—Meconopsis grandis *Prain.* 1, base of plant with radical leaves; 2, upper portion of stem with bracts, buds and opened terminal flower; 3, young fruit; 4, ripe capsule,—*of natural size* 5, stamens; 6, ovary, out transversely; 7, seeds,—*enlarged.* Specimen from Jongri, in Western Sikkim, at 12,000 feet above sea-level.

D. P.

PLATE 3.

3. MECONOPSIS PRIMULINA *Prain in Journ. As. Soc. Beng.* lxiv. 2. 319 (1896).

Natural order Papaveraceæ.

A small, almost glabrous herb with a fusiform rootstock 3—10 cm. long, its neck clothed with old sheaths; *stems* short, leafy at the base only; *leaves* linear-oblong, entire, acute, 4—7 cm. long, 7 mm. wide, radical few, spathulate, all narrowed into short petioles and very sparsely strigose on both surfaces; *flowers* pendulous, dark violet-purple, on a terminal scape 18 cm. long and one or two axillary lateral scapes 8—10 cm. long; *sepals* 2, glabrous, 1·25 cm. long; *petals* 6—8, imbricate, narrowly ovate with a distinct claw, 2 cm. long, ·75—1·25 cm. wide, the inner narrower; *stamens* about 50; filaments of the outer series sometimes united into phyllomes with antheriferous fringe, when free filiform, as long as the ovary, anthers orbicular-ovate, golden, yellow; *ovary* glabrous, 4-carpelled, narrowly ovate, 12 mm. long, 5 mm. wide, tapering into a slender style one-third as long; placentas intruded and passing up the substance of the style as two pairs of approximated vascular traces each bearing at the base of the style a projecting papilla inclined laterally so that the 4 papillae form 2 pairs alternating with the placental traces and style-lobes and opposite the clefts of the 2-partite stigma with oblong plano-convex lobes, the outer convex surfaces of each pair stigmatic.

EASTERN HIMALAYA; Bootan, at Do lep; Chumbi, at Sham-chen; *Collectors of the Calcutta Botanic Garden!*

This species is most nearly related to *Meconopsis Henrici* Franch. (*Journ. de Botanique* v. 19), a plant from Szechuen with much the same habit and with the same tendency to cohesion of the stamens of the outer whorl but with a depressed globose ovary, strigose in its upper half, shorter than its style, and without the peculiar epaulettes characteristic of the ovary of *M. primulina*.

PLATE 3.—Meconopsis primulina *Prain*. 1, plant with bud, opened flower and flower with perianth fallen,—*of natural size*; 2, stamen of inner row; 3, phalanx of stamens of outer row; 4, young fruit; 5, another young fruit, cut transversely; 6, young seed,—*all enlarged*; 7, ovule,—*much enlarged*. Specimen from Sham-chen, in Chumbi, probable elevation 11—12,000 feet above sea-level.

D. P.

PLATE 4.

4. MECONOPSIS BELLA *Prain in Journ. As. Soc. Beng.* lxiii. 2. 82 (1894) and lxiv. 2. 321 (1896).

Natural order Papaveraceæ.

A dwarf, perennial, glabrous or sparingly setulose herb with a stout rhizome 12 cm. long, slightly branched below, its neck exserted 2 cm. or more and densely sheathed with old leaf-bases; *leaves* all radical, petioles 6—10 cm. long, widening towards the base into a membranous sheath, blades 2·5 cm. long, 1—1·5 cm. wide, ovate-lanceolate, 2—3-jugately unequally pinnatisect, the segments 3-partite with ovate-obtuse lobules

5 mm. long and 3 mm. wide; *scapes* simple, slender, 1-flowered, the buds at first nodding; *flowers* rather large, 4 cm. across, blue; *sepals* 2, ovate, 12 mm. long, 8 mm. wide; *petals* usually 4, but occasionally 5, 3 cm. long, 2 cm. across, ovate-rotund; *stamens* ∞, about 80, the filaments filiform, 6 mm. long, glabrous, the anthers oblong, apparently golden-yellow, 2·5 mm. long, hardly 1 mm. wide; *ovary* ovate, slightly setose below, glabrous above, 5 mm. long, placentas 4—5, hardly intruded, style distinct, 2—3 mm. long; ripe *capsules* obpyriform, 15 mm. long, tapering below into a false stipe 4 mm. long; *seeds* numerous, 1·25 mm. long, ·3 mm. wide, testa lax, pseudostrophiolate; embryo small, basilar.

Eastern Himalaya: Sikkim, in Jongri at Pey-kiong-la, about 12,000 feet above sea-level and at Nyegu on the Nepalese frontier, about 14,000 feet elev.; *Collectors of Calcutta Botanic Garden!*

A pretty little species, with leaves like those of a *Corydalis*. It flowers in July. All the specimens received up to 1894 had been quite glabrous, but some, obtained in 1896 by the orchid-collectors working for Sir George King and Mr. Pantling, have sparingly setulose scapes and leaf stalks.

Plate 4.—Meconopsis bella *Prain*. 1, flowering plant; 2, fruiting plant,—*of natural size*; 3, stamen; 4, ovary; 5, another ovary, cut transversely; 6, ripe capsule; 7, seed,—*all more or less enlarged*. Specimens from Pey-kiong-la, in Jongri.

D. P.

PLATE 5.

5. Meconopsis superba *King ex Prain in Journ. As. Soc. Beng.* lxiv. 2. 317 (1896).

Natural order Papaveraceæ.

A tall, softly hairy herb probably 15—20 dm. high, *stems* 4 cm. in diam. about 5 dm. from the top, simple, hirsute like the leaves with soft, spreading, flexuous hair and densely clothed with soft, grey pubescence; cauline *leaves* sessile, amplexicaul, obovate-oblong, serrate, acute, 25—50 cm. long, 7—10 cm. wide, passing upwards into similar but smaller bracts; *cymes* simple, rather dense-flowered, pedicels short, never exceeding 3 cm., 2—3 in each axil; *flowers* white, nearly 10 cm. wide; *sepals* 4·5 cm. long; margins of *petals* entire; *ovary* globose, 7—11-valved, densely clothed with adpressed setae and with close stellate pubescence.

Eastern Himalaya: Ho-ko-chu in Chumbi, about 10,000 ft. above sea-level; *Collectors of the Calcutta Botanic Garden!*

This very fine plant has been only once collected; it is perhaps no more than a form of *Meconopsis paniculata* Prain (M. napaulensis *Walp., H. f. & T. but not of DC*). The chief differences are the larger size of all its parts, the white not yellow petals, and the serrate but not lobed cauline leaves. The ovary is quite like that of *M. paniculata*; the fruit is unknown.

Plate 5.—Meconopsis superba *King*. 1, top of flowering stem,—*of natural size*; 2, stamens; 3, ovary,—*enlarged*. Specimen from Ho-ko-chu, Chumbi.

G. K.; D. P.

PLATE 6.

6. MECONOPSIS SINUATA *Prain in Journ. As. Soc. Beng.* lxiv. 2. 314 (1896).

Natural order Papaveraceæ.

A tall, annual herb with a fusiform rootstock 10—16 cm. long, 1 cm. thick, the neck clothed with old leaf-sheaths; *stem* 30—90 cm. high, smooth except for scattered prickles, leafy throughout; *leaves* oblong-lanceolate, obtuse with sinuate margins, 10—18 cm. long, 3—5 cm. wide, sparsely prickly, radical and lower cauline with petioles 4—6 cm. long, upper cauline passing into bracts, sessile, subamplexicaul; *cymes* few-flowered; *flowers* pale blue-purple, 5—7 cm. across, pedicels bracteate, slender, prickly, 6—8 cm. long, fastigiate in fruit; *sepals* 2, prickly; *petals* 4; *capsules* elongated, narrowly obconic, 4—5 cm. long., 1 cm. in diam. towards upper third, sparsely prickly, at length almost smooth, style 5—12 mm. long., stigma small; *seeds* scaberulous, hilum slightly crested.

EASTERN HIMALAYA: Sikkim, at Patang-la, Pey-kiong-la, and Ney-go-la, 10—12,000 ft.; *Collectors of Calcutta Botanic Garden!* Jongri, 12,000 ft.; *G. A. Gammie!* Bootan, in the Dichu Valley, about 11,000 ft.; *Cummins!*

This species has much the habit of *Meconopsis aculeata* Royle, a North-West Himalayan plant, and appears to be the representative of Royle's plant in the Eastern Himalaya: what seems to be a variety of our plant occurs in Szechuen. *Meconopsis sinuata* has, however, leaves that differ from those of *M. aculeata* in being merely sinuate instead of irregularly pinnatifid, and has very dissimilar capsules, those of *M. aculeata* being densely aculeate and short-oblong, only about twice as long as their styles.

PLATE 6. Meconopsis sinuata *Prain.* 1, flowering plant; 2, rootstock; 3, top of fruiting plant,—*of natural size;* 4, stamens; 5, ovary; 6, ripe capsule; 7, the same, cut transversely; 8, seed,—*all enlarged.* Flowering specimen from Pey-kiong-la; fruiting specimen from Dichu Valley.

D. P.

PLATE 7.

7. CATHCARTIA LYRATA *Cumm. & Prain in Journ. As. Soc. Beng.* lxiv. 2. 325 (1896).

Natural order Papaveraceæ.

A small glabrescent herb with a rootstock slender throughout or swollen towards the neck which is clothed with sheaths, 2—3 cm. long; *stems* simple or sparingly branched, 8—25 cm. high, about as thick as a crow-quill or less, glabrous or very sparingly hairy; radical *leaves* few, early withering; cauline 3—4, from hastate-entire to lyrate-pinnatifid, sparingly hirsute on both surfaces, green above, glaucescent beneath, lobes rounded, 2—4 cm. long, 1—2 cm. wide, petioles 2—4 cm. long; *flowers* 1—3 (oftenest solitary), cymose; pedicels slender, 8—10 cm. long; buds nodding, 7 mm. in diam.; full-blown flowers 2·5 cm. across; *sepals* orbicular, glabrous, green; *petals* blue, 4, narrowly to widely lanceolate, rounded or obtuse rarely acute, always faintly crispate at margin; *stamens* 16 in 2 rows of 8 each; *ovary* narrow-ovate, style distinct, stigma small 2—3-lobed, placentas 2—3, distinctly intruded; *capsules* 4 cm. long, very slender, erect, valves membranous, dehiscing from apex downwards towards base; *seeds* smooth, uncrested.

Eastern Himalaya: Sikkim, at 13—14,000 feet, not common; Ta-me-da; *King!* Chiani, Phallut and Jongri; *Calcutta Garden Collectors!* Tankra; *G. Gammie!* near Gnatong; *Cummins!*

This little species was a puzzle to Indian systematic botanists from 1877, when it was first obtained by Sir G. King, till it was met with by Capt. Cummins at Gnatong in 1893. The ripe fruits, dehiscing downwards towards the base and not by valves at the tip only, indicate that it is a *Cathcartia* rather than a *Meconopsis;* the fact that there are often 3 valves, and the placentation, show that it is not a *Stylophorum.*

Plate 7.—Cathcartia lyrata *Cumm.* & *Prain.* 1, plant,—*of natural size;* 2, floral diagram; 3, petal × 2; 4, stamen × 3; 5, 6, ovaries, cut transversely × 2; 7, capsule × 2; 8, seed × 5. Specimen from Chiani, on the Nepal Frontier.

D. P.

PLATE 8.

8. Cathcartia polygonoides *Prain in Journ. As. Soc. Beng.* lxiv. 2. 326 (1893).

Natural order Papaveraceæ.

A glabrescent herb with a slender rootstock clothed with sheaths, 4—5 cm. long; *stems* simple, slender, strigose, 15—35 cm. high, about as thick as a crow-quill or less; radical and subradical *leaves* long-petioled, cauline leaves 2—3, lower long-petioled uppermost sessile stem-clasping, radical and lower cauline petioles 6—10 cm. long, laminae ovate-oblong, obtuse, base cuneate, truncate or slightly cordate, margins entire or slightly incised crenate, sparingly hairy on both surfaces, 4—5 cm. long, 1·5—2 cm. wide; *flowers* solitary, nodding, 2·5 cm. across; *petals* blueish-white, rather narrowly lanceolate, apex acute or rarely obtuse, margin entire; *stamens* 16 in two rows of 8 each; *ovary* narrowly ovate, style distinct, stigma small 2—3-lobed, placentas little intruded, 2—3.

Eastern Himalaya: Chumbi, at Sham-Chen, at Put-lo, and at Ling-moo-tong; *Calcutta Garden Collectors!*

The flowers and unripe capsules of this plant are so like those of *C. lyrata* that there would seem to be little room for doubt as to its generic position. But it is also very like a small form of a plant from Yunnan described and figured by M. Franchet as *Meconopsis betonicaefolia* [*Plantae Delavayanae*, 42. t. 12 (1889)] of which it has all the habit and, though on a smaller scale, exactly the foliage. A final decision as regards both *Cathcartia polygonoides* and *Meconopsis betonicaefolia* can only be given when ripe fruits of both have been received. The *specific* differences between the two plants are the fewer (16) stamens in the Chumbi plant than in the Yunnan one, which has 64; the narrower, much smaller petals; and the smaller ovary and stigma.

Plate 8.—Cathcartia polygonoides *Prain.* 1, plant,—*of natural size;* 2, floral diagram; 3, petal, from the plant figured as fig. 1; and 4, petal, from a plant collected at Put-lo,—*both* × 2; 5, stamen × 3; 6, ovary × 3. Plant from Sham-Chen, Chumbi.

D. P.

PLATE 9.

9. Chelidonium Dicranostigma *Prain in Bull. Herb. Boiss.* iii. 585 (1895).

Natural order Papaveraceæ.

A glaucous, glabrous or puberulous herb with a stout, fusiform, descending root-stock 10—15 cm. long, enlarged at the apex to 1·5 cm. diam. and there densely covered with old sheaths; radical *leaves* many, petioled, 4—6-jugately pinnatifid to -partite, 12—25 cm. long, 3—5 cm. wide, segments usually distant, rhomboid, acutely incised-lobed, terminal lobe 3-fid; petioles 4—5 cm. long; *stems* several, leafless below, 10—25 cm. long before branching, apex of stem and of each branch supporting a terminal flower, branches few, subfastigiate, 6—8 cm. long, in the axils of floral leaves conformable with the radical but sessile and smaller only 3—8 cm. long by 2·5—4 cm. wide, segments 2—4-jugate, and with occasionally 1—2 sterile bracts or, less often, 1—2 flowers near the middle; *flowers* 3—5 cm. across, pedicels ebracteolate, 5—8 cm. long; *sepals* ovate-acute, puberulous, 2 cm. long; *petals* orange; *stamens* about 80; *ovary* narrowly ovate-acute, puberulous with soft weak hairs, style distinct, stigmas mitraeform, lobes large erect acute; *capsule* cylindric 5—6 cm. long, (including style 5 mm. long) tapering, softly puberulous; *seeds* small, numerous, ovate, not scrobiculate and not crested. *Journ. As. Soc. Beng.* lxiv. 2. 327 (1895). Dicranostigma lactucoides *Hook. f. & Thoms. Flor. Ind.* 255 (1855); *Walp. Ann.* iv. 272 (1857). Stylophorum lactucoides *Baill. Hist. des Plantes* iii. 114 (1871); *Hook. f. & Thoms. Flor. Brit. Ind.* i. 119 (1872).

Himalaya: Kamaon; *Strachey and Winterbottom* n. 3! *Duthie* nn. 2699! 3819! 5326! Phari; *King's Collectors!*

Nearly allied to *Chelidonium Franchetianum* Prain and *C. leptopodum* Prain (*Glaucium leptopodum* Maxim.) but differing from both in having large stigmatic lobes, softly hairy capsules, and simple or subsimple cymes. The plant from Phari which is figured on Plate 9 as fig. 1, almost always has one or two flowers on the branches, whereas none of our specimens of the Kamaon plant have other than simple cymes though some of them have a barren bract near the middle; the Phari plant has moreover the angles of the leaf-segments more acute, and is glabrous and smaller in all its parts; to illustrate these features an outline of a leaf of the Kamaon plant and a figure of a capsule with its pedicel, from the Western Himalayan form, are given as figs. 4 and 5 respectively. I do not feel able at present to consider these differences specific; should they prove constant, however, it may ultimately be necessary to recognise the two as distinct, in which case the name *C. Dicranostigma* may be restricted to the Eastern form and the Western may be known as *C. lactucoides*.

Plate 9.—Chelidonium Dicranostigma *Prain*. 1, plant from Phari,—*of natural size*; 2, stamen × 2; 3, seed × 5,—*both from the plant shown in fig. 1*; 4, leaf; 5, capsule,—*both of natural size*; 6, seed × 5; figs. 4, 5 and 6 are from a Kamaon plant.

D. P.

PLATE 10.

10. Capparis Cathcarti *Hemsl. ex Gamble, Darjeeling List* Ed. 2., 6 (1896).

Natural order Capparideæ.

A large scandent shrub, glabrous, the branches armed with strong stipular thorns; *leaves* chartaceous, shining above, dull beneath, ovate-acute the base shortly cuneate, edges slightly incurved when dry, midrib and 8-jugate secondary ascending nerves rather prominent beneath; petiole 1·25 cm. long, lamina 8—12 cm. long, 4—6 cm. wide; *umbels* paniculate towards ends of branches, leafy; *flowers* 3 cm. across, pedicels 2 cm. long; *sepals* ovate-rotund, puberulous externally; *petals* thin, obovate, margin faintly crenulate; *stamens* 28—36, the filaments equal; *gynophore* 3·5 cm. long, as long as filaments; *ovary* ovoid apiculate; *fruit* globular with slightly umbonate tip, 2·5 cm. across; *seeds* 4—5, imbedded in scanty pulp. Capparis (sp. allied to *C. floribunda*) *Hook. f. & Thoms. Flor. Brit. Ind.* i. 180 (1870); *Gamble, Darjeeling List*, 5 (1878). C. sikkimensis *Kurz MSS. in Herb. Calcutta.*

Sikkim: near Darjeeling; *Cathcart* in Herb. Kew. Darjeeling District, 4,000 feet; *Kurz!* Kurseong; *Clarke* 13854! Gyabari, 4,000 ft.; *Gamble* 1037! Badamtam, 3,000 ft.; *Gamble* 9839!

A species most nearly allied to *C. floribunda* Wight, from S. India, the Andamans and the Philippines, but with larger flowers, and more numerous stamens. The plant described in this work, vol. v. p. 119, as *C. andamanica*, is conspecific with *C. floribunda.*

Plate 10.—Capparis Cathcarti *Hemsl.* 1, specimen from Darjeeling District at 4,000 ft., collected by Kurz,—*of natural size;* 2, bud, partly laid open,—*of natural size;* 3, sepal, seen from side,—*of natural size;* 4, sepal from within,—*of natural size;* 5, petal, with stamens of outer row from a young flower; 6, stamens in bud, after removal of perianth; 7, stamens in opened flower,—*of natural size;* 8, ovary with gynophore × 2; 9, fruit,—*of natural size;* 10, fruit, in section,—*of natural size.*

D. P.

PLATE 11.

11. Heritiera dubia *Wall. ex Kurz in Journ. Bot.* xii. 65 (1874).

A tree; *leaves* oblong or oblong-lanceolate or elliptic-oblong, petiole rather stout, lepidote, 12—20 mm. long, base cuneate, rounded or obtuse, apex obtuse or acute or acuminate, 10—15 cm. long, 4—8 cm. wide, when young sparingly beset with tawny hairs but soon quite glabrous above, densely silvery-lepidote and sparingly brown-punctate beneath; *panicles* axillary much shorter than the leaves, pubescent with longish, rusty hairs; *flowers* small, urceolate-campanulate, brownish-green, pedicel slender 4 mm. long; *calyx* 5 mm. long, puberulous externally and internally, shortly 4-lobed, lobes obtuse or subacute; *staminal column* considerably shorter than the calyx, tip slightly angled, anthers 7—10, sessile; *mature carpels* compressed, cuneate-oblong, 4 cm. long, thickly winged towards the tip on one side, smooth, brown.

Khasia Hills; at low elevations, *De Silva* (ic. in Herb. Calcutta)! *Gallatly*, 367!

There is often a curious unwillingness to admit that the genus *Heritiera* includes other than littoral species. As a matter of fact it is, so far as India is concerned, less of a littoral than an inland genus; only two of the five Indian species are littoral.

The right to specific rank was vindicated for *H. macrophylla* Wall. by Kurz in *Journ. As. Soc. Beng.* xlii. pt. 2. 61 (1873) and more emphatically by the same author in *Journ. Bot.* xii. 66 (1874) and again in *For. Flor. Brit. Burma* i. 141 (1877); Kurz's contention was practically admitted in the *Gardener's Chronicle* (1886). i. 81 and since then has been thoroughly established by King, (*Journ. As. Soc. Beng.* lx., 2, 80) by Pierre (*Flor. For. Coch.-Chin.* t. 204) and by Hooker (*Bot. Mag.* t. 7192). This is a purely inland species.

The right to specific rank for another Wallichian inland *Heritiera*—*H. acuminata* Wall.—was equally vindicated by Kurz in *Journ. Bot.* xii. 65 (1874). This species, like *H. macrophylla*, was nominally published in Voigt's *Hortus Suburbanus Calcuttensis* (1845). Kurz, however, was not, in the absence of specimens, in a position to discover that *H. Papilio* Bedd. (*Flor. Sylvat.* t. 218), from Travancore and the Carnatic is the same tree as the earlier published *H. acuminata* Wall., which was originally found by Wallich's Collector DeSilva in Silhet and has since been collected in Cachar, (Bhuban range, *G. Mann!* Naraindar Punji, *N. G. Young!* Jbiri Ghat, *Prazer!*) as well as in the lower Lushai Hills (Lengti, *Prazer!*). It is a large, often lofty tree, 5–6 feet in girth; the vernacular name in Cachar is "Akhar."

The species now described and figured was in 1874 only represented by a manuscript drawing made under Wallich's supervision and named by that botanist *H. dubia*. This also Kurz recognised in 1874 as a valid species, even though no specimens were available. Some years later Gallatly, collecting in the Khasia hills, obtained flowering specimens of a *Heritiera* with leaves in shape like those of *H. acuminata* but differing from those of that species in not being 3-nerved at the base. The leaves of Gallatly's specimens differ from those of *H. dubia* as figured by Wallich in being narrower and acuminate, and the flowers too differ in having subacute, not obtuse, calyx-lobes. The staminal column is however exactly like that of *H. dubia* as figured by Wallich and the calyx-lobes are erect, not reflexed as in *H. acuminata*. In the flowers examined by me the stamens are usually 7—8, very rarely 10. The species has, as Kurz has remarked, a considerable resemblance to *H. littoralis* and is obviously the most nearly related of all the inland, non-saline *Heritieras* to that species.

It may be well to note here that *H. littoralis*, which is the species usually met with on the Indian coasts, has never been found anywhere on the coasts of Bengal although it has been the object of very careful and prolonged search in order, if possible, to verify the statement to the contrary which is made by Masters in *Flor. Brit. Ind.* i. 363. *H. minor* Roxb. (Balanopteris minor *Gaertn.*) named *H. Fomes* in the same work, is stated to occur inland. This is equally not the case—it does not extend beyond the mangrove swamps of the Sundribuns. It is the "Sundri" which gives its name to that characteristic portion of the Gangetic Delta. It appears to be equally common in the corresponding portion of the Irrawaddy Delta, but to occur nowhere else either in India or Burma.

PLATE—11. Heritiera dubia *Wall.* 1, flowering branch; 2, leafy twig; 3, 4, ripe fruit,—*of natural size;* 5, flower; 6, the same, calyx laid open to show staminal column,—*enlarged.* From a Wallichian drawing in Herb. Calcutta.

D. P.

PLATE 12.

12. GREWIA DENTICULATA *Wall. ex Voijt, Hort. Suburb. Calcutt.* 128 (1845).

Natural order Tiliaceæ.

A shrub or small tree; young shoots scabrous with stellate hairs; branches terete, sparsely stellately hairy; *leaves* rather thickly membranous, scabrous, ovate-lanceolate acuminate, finely subequally serrate, base rounded 3-nerved, central nerve with 3—5 pairs of slightly arching nerves; sparsely stellate-hairy above, densely stellate-hairy especially on the nerves beneath; length 10—15 cm., width 6—7 cm.; petiole 6 mm., stellately hairy; *cymes* axillary, peduncled, umbellate, few-flowered; peduncles 8—12 mm. long, pedicels nearly as long, in fruit elongated and attaining 15 mm., bracts triangular lanceolate, 5 mm. long, stellate-hairy outside, striate within; buds obovate, striate, 6 mm. long, 4·5 mm. wide; *sepals* 10 mm. long, lanceolate; *petals* ovate-lanceolate, 4·5 mm. long; *torus* densely adpressed rusty tomentose, cylindric, 3·5 mm. long; *fruit* a 2- or 1-lobed drupe, subtesselately rugose with lenticular swellings each crowned by a stellate hair; lobes suborbicular, 7·5 mm. long and broad and 6 mm. thick. G. scabrida *Wall. Cat.* 1113 E (1832). G. nagensium *Prain in Journ. As. Soc. Beng.* lxix. 2. 168 (1900).

ASSAM: Silhet; *Wallich!* Kala Naga Hills; *Prazer* n. 13! Eastern Naga Hills, at Narazu; *J. W. Masters* 1263! Teock Ghat, near Tingali Bam; *Prain's Collector* n. 128! 262! Margarita; *Prain's Collector!*

The collectors describe the flowers as yellow. The leaves of this species most closely resemble those of the Burmese species *Grewia microstemma*, but the margins are more finely toothed than in that plant. The flowers are quite unlike those of *G. microstemma* and most closely approach those of *G. oppositifolia* though the torus is considerably longer than in that species. The fruits are very distinctive and approach most nearly to, though they are still widely different from, those of *G. umbellifera* Bedd. (*G. capitata* Dalz.), next to which species the present one must be placed. I am indebted to Mr. Duthie for the discovery that this very distinct species is the same as *G. denticulata* Wall., which, after having recognised it as a distinct species its author unfortunately merged in his own G. *scabrida*.

PLATE 12.—Grewia denticulata *Wall.* 1, flowering branch from Teock Ghat in the Jaboca Naga Hills; 2, fruiting twig from Narazu,—*both of natural size;* 3, flower, dissected; 4, stamens; 5, ovary,—*all enlarged.*

D. P.

PLATE 13.

13. EVODIA PILULIFERA *King in Journ. As. Soc. Beng.* lxii. 2. 210 (1894).

Natural order Rutaceæ.

A shrub 10 to 15 feet high; young branches rather slender, flattened at the nodes, minutely tawny-tomentose, the bark pale; *leaves* 3-foliolate, the petiole 7·5—11 cm.

long, terete, grooved in front, deciduously tawny-tomentose ; leaflets thinly coriaceous, petiolulate, oblong-elliptic, tapering to each end, the apex shortly acuminate, the base very narrow; both surfaces glabrous, the lower paler when dry ; main-nerves 9—10 pairs, oblique, interarching boldly well within the edge, prominent on the lower, depressed on the upper surface when dry; length 9—20 cm., breadth 3—7 cm., petiolules 4—10 mm., the middle leaflet rather larger than the lateral ; *cymes* everywhere tawny-tomentose, axillary, on long peduncles, the branches few, opposite, each bearing towards the apex a few dense, subglobose masses of flowers ; *flowers* under 2·5 mm. long ; *sepals* ovate-acute, densely tawny-tomentose ; *petals* glabrous ; *ovary* villous; *fruit* of slightly compressed, ovoid, blunt cocci, minutely tawny-tomentose outside, glabrous within, 5 mm. long; *seed* solitary, shining.

Malayan Peninsula : Perak, Maxwell's Hill; *Scortechini* 360 ! Larut ; *Wray* 2995 ! *Kunstler* 6275 !

This species is readily distinguished by its minutely tomentose, few-branched cymes, each bearing a few densely crowded heads of small flowers.

Plate 13.—Evodia pilulifera *King*. 1, flowering twig, from Maxwell's Hill, Perak; 2, fruiting twig, from Larut, Perak,—*both of natural size;* 3, flower-bud ; 4, petals ; 5, stamen, from in front ; 6, stamen, from behind ; 7, ovary and stamens ; 8, fruit ; 9, seed,—*all enlarged.*

G. K.

PLATE 14.

14. Evodia macrocarpa *King in Journ. As. Soc. Beng.* lxii. 2. 209 (1894).

Natural order Rutaceæ.

A tree 20 to 40 feet high; young branches rather stout, compressed, cinereous-puberulous ; *leaves* 3-foliolate, the petiole 8—10 cm. long, glabrous ; leaflets coriaceous, oblong or elliptic-oblong, acute, narrowed to the slightly unequal-sided base, both surfaces glabrous, the upper shining, the lower dull and paler when dry, main-nerves 14—18 pairs, almost horizontal, faint ; length 15—30 cm., width 5—8 cm., the petiolules 2·5—5 mm., the middle leaflet largest ; *cymes* axillary, pyramidal, shortly pedunculate, olivaceous-tomentose ; the branches opposite, spreading, bracteolate at the base; peduncles 1·5—4 cm. long, puberulous; *flowers* white, 2·5 mm. long, densely crowded, many of them with perfect stamens but an abortive ovary, *sepals* triangular, acute, pubescent ; *petals* puberulous ; *stamens* exserted ; *ovary* villous ; *fruit* of 3—4 cocci to each flower, compressed, obovate, blunt, 1 cm. long, dark-coloured and puberulous externally, lined inside with dense, white hairs ; *seeds* 2, black, shining.

Malayan peninsula: Perak, at Sungie, Larut, Thaipeng ; *Kunstler* 7489 ! *Wray* 2275 ! 2648 ! 3266 !

A very distinct species, recognisable at once by its long and comparatively large leaflets, small cymes and large cocci.

Plate 14.—Evodia macrocarpa *King*. 1, flowering branch from Thaipeng, Perak ; 2, fruiting cyme from Larut, Perak,—*both of natural size;* 3, unopened flower ; 4, flower, laid open ; 5, stamens ; 6, ovary ; 7, the same, cut transversely ; 8, ripe coccus ; 9, seed,—*all enlarged.*

G. K.

PLATE 15.

15. Evodia pachyphylla *King in Journ. As. Soc. Beng.* lxii. 2. 210 (1894).

Natural order Rutaceæ.

A small tree 10—15 feet high; young branches flattened at the nodes, minutely rufous tomentose as are the petioles, midribs beneath, and peduncles of cymes; *leaves* 3-foliolate, the petiole 6—8 cm. long; leaflets very coriaceous, oval to elliptic, obtuse or subacute, the base slightly cuneate, the edges revolute when dry; upper surface glabrous shining, the lower pale, glaucous; main-nerves 8—12 pairs, subhorizontal, curving slightly, interarching within the edge, slightly prominent on the lower surface when dry, the midrib very prominent; length 6—9 cm., breadth 3—6 cm., petiolules 7·5—12·5 mm.; *cymes* axillary, pedunculate, the branches few, short, close together; peduncles 2·5—4 cm. long; *flowers* white, 6 mm. long, in dense subglobular masses; *sepals* broadly ovate, acute, olivaceous-tomentose externally, glabrous internally; *petals* erect, ovate-lanceolate, pubescent on both surfaces, the edges glabrous; *stamens* not exserted; *ovary* glabrous; *fruit* of 2—3 cocci from each flower, sub-compressed, ovate, blunt, pale and puberulous externally, glabrous within; *seed* solitary, shining, black.

Malayan Peninsula: Perak at elevations of 4,500—5,300 ft., on Gunong Batu Pateh; *Wray* 229! on Gunong Bramber Pahang; *Wray* 1571! on Gunong Bubu, near the top, common; *Scortechini* 732! *Kunstler* 7432! *Wray* 3835!

Plate 15. Evodia pachyphylla *King*. 1, flowering branch; 2, fruiting twig,—both from Gunong Bubu, and *both of natural size;* 3, flower; 4, flower laid open; 5, ovary; 6, seed,—*all enlarged.*

G. K.

PLATE 16.

16. Santiria laxa *King in Journ. As. Soc. Beng.* lxii. 2. 254 (1894).

Natural order Burseraceæ.

A tree 50—70 feet high; young branches, rachises of the leaves and the inflorescence densely clothed with rusty, hispidulous, spreading and mostly deciduous hairs; *leaves* 2·5—5·5 dm. long, the stipules, if any, deciduous; leaflets 7—9, oblong to oblong-elliptic, sometimes slightly obovate, shortly and abruptly acuminate, the edges entire, the base often unequal-sided, cuneate; length 12·5—20 cm., breadth 4·5—6·5 cm., petiolule 10—12 mm.; both surfaces reticulate, the upper glabrous, the lower sparsely hispidulous, especially on the midrib and nerves; main-nerves 12—14 pairs, slightly prominent on the lower surface, spreading, curving, interarching near the edge; *panicles* usually much longer than the leaves, terminal, their branches short, lax, rather few-flowered, the ultimate branchlets glabrous, the larger hispidulous-pubescent; *flowers* 8 mm. in diam., glabrous, shorter than the slender, minutely bracteolate pedicels; *calyx* with 3 broad, spreading, very blunt teeth, much shorter than the corolla; *petals* 3, thick, slightly keeled on the back, ovate, obtuse; *stamens* 6, free, about as long as the petals, inserted on the outer margin of the 6-lobed cushion-like disk; anthers ovate, about as long as the thick, rather flattened filaments; rudimentary *ovary* submerged in the disk, small, subcylindric, glabrous, as is the thick fluted style; stigma 3-lobed; female flowers unknown; *ripe drupes* narrowly ellipsoid, trigonous,

one side wider and flatter than the other two, glabrous, 2·5—3·5 cm. long, 1·5—2 cm. in diam., stone thin. Canarium laxum *A. W. Benn. in Hook. f. Flor Brit. Ind.* i, 535; *Engler in DC. Mon. Phaner.* iv, 139.

Malayan Peninsula: Malacca; *Maingay* 366 K. D.! Perak; *Kunstler* 3192! 3516! Penang; *Curtis* 1431! Pahang; *Ridley* 2451!

The drupes in this species have the remains of the stigma terminal and in this respect they agree technically with the diagnosis of *Canarium*. But they are not equally 3-sided as in that genus, one side being wider and much more rounded than the other two. The structure of the flower is not at all that of *Canarium*, and the species is therefore transferred to *Santiria*.

Plate 16.—Santiria laxa *King*. 1, flowering twig from Larut, Perak; 2, fruiting panicle from Pahang,—*both of natural size;* 3, flower, land open; 4, calyx with disk, the stamens removed; 5, rudimentary ovary of male flower,—*all enlarged;* 6, fruit, split open to show the thin stone; 7, seed,—*of natural size.*

G. K.

PLATE 17.

17. Santiria macrocarpa *King in Journ. As. Soc. Beng.* lxii. 2. 256 (1894).

Natural order Burseraceæ.

A glabrous tree, 40—70 feet high; young branches with brown, lenticular bark; *leaves* 1·25—2·25 dm. long, the rachis slightly flattened on the upper surface near the base; leaflets thinly coriaceous, oblong-elliptic to obovate or subrotund, very shortly and bluntly apiculate, the base cuneate, rarely rounded; main-nerves 7—8 pairs, spreading, slightly curved, interarching boldly, slightly depressed on the upper surface when dry, and subprominent on the lower; length 8—12 cm., breadth 5—7 cm.; petiolules 1—1·25 cm., the terminal one 2·5 cm. or more; *panicles* axillary, solitary, shorter than the leaves, with distant lateral branchlets 1·25—2·5 cm. long and bearing at their apices 2—6-flowered bracteolate cymules; *flowers* 5—6 mm. long; *calyx* thick, deeply cupular or subcampanulate, with 3 bold triangular lobes, glabrescent; *petals* twice as long as the calyx, fleshy, glabrous, broadly oblong, very concave, the apex much thickened and deeply inflexed and the sides partly inflexed to form a kind of hood; *stamens* 6, the filaments shorter than the oblong anthers, lanceolate, dilated at the base and inserted outside the quadrate lobes of the thin, ring-like disk; *ovary* ovoid-globose, glabrous, tapering into the short, thick style; stigma discoid; *ripe drupes* obliquely ovoid, flattened on one side, glabrous, 3—4 cm. long, and about 2 cm. in diam.; peduncle slender, 1·25—2·5 cm. long, scar of stigma terminal.

Malayan Peninsula: Perak; *Kunstler* 5304! 5508! 7298!

Plate 17.—Santiria macrocarpa *King*. 1, flowering branch; 2, fruiting twig, from Perak,—*both of natural size;* 3, bud; 4, flower, laid open; 5, stamens; 6, ovary; 7, transverse section of ovary,—*all enlarged;* 8, fruit, laid open; 9, seed; 10, embryo, showing the remarkably laciniate cotyledons,—*of natural size.*

G. K.

PLATE 18.

18. Santiria oblongifolia *Bl. Mus. Bot. Lugd. Bat.* i. 211 (1850).

Natural order Burseraceæ.

A tree, 50—80 feet high; young branches pale, lenticellate, at first scurfy, afterwards glabrous; *leaves* 3—4·5 dm. long, their rachises terete, not winged at the base but slightly flattened, glabrous, the stipules, if any, deciduous; leaflets 7—9, thinly coriaceous, oblong, occasionally ovate-oblong or ovate, slightly inequilateral especially at the base; the apex very shortly, abruptly and bluntly acuminate, edges entire; base in the oblong forms subcuneate, in the ovate forms broad and rounded; upper surfaces glabrous and reticulate, olivaceous when dry, very minutely lepidote; main-nerves 10—13 pairs, in the ovate forms only 7—8 pairs, spreading, interarching near the edge; length 10—15 cm., the ovate forms shorter; breadth 4·5—6 cm., petiolules 1·25—2 cm., the terminal one 4 cm.; *panicles* axillary or terminal, shorter than the leaves, pale-scurfy when young, divaricate, cymose, spreading, the flowers crowded near the extremities of the branches, ebracteolate; *buds* 2·5 mm. in diam., subglobular, about as long as the clavate pedicels; *calyx* campanulate, deeply cut into 3 round-deltoid, subconcave teeth, scurfy outside; *petals* subrotund with a truncate base, slightly concave, longer than the calyx, puberulous outside, glabrous inside; *stamens* 6, anthers oblong about as long as the filaments, the latter flattened, narrow, inserted outside the glabrous, thin, fleshy, lobed disk; *ripe drupes* ovoid, ellipsoid or globose, flattened on one side, oblique, obscurely trigonous, glabrous, 2 cm. long and 1·25 cm. in diam., the scar of the stigma at the apex of the flattened side. *Engler* in *DC. Mon. Phaner.* iv. 162 (1883); *King, Journ. As. Soc. Beng.* lxii. 2. 257 (1894). S. Maingayi *A. W. Benn. in Hook. f. Flor. Brit. Ind.* i. 538 (1875); *Engler in DC. Mon. Phaner.* iv. 165 (1883). Canarium oblongifolium *Miq. Flor. Ind. Bat.* i. 2. 645 (1859). C. Eupteron *Miq. Flor. Ind. Bat.* i. 2. 648 (1859).

Malayan Peninsula: Malacca; *Maingay* 310 K.D.! Perak, Goping; *Kunstler* 4321! Larut; *Kunstler* 5487! 6602! Thaiping; *Kunstler* 8472! Ulu Bubong; *Kunstler* 10265! 10448! 10927! Malay Archipelago: Sumatra; *Forbes* 2981! *Korthals, Diepenhorst!* Java; *Blume.* Borneo; *Mueller.*

Blume's original description, drawn up from specimens from Sumatra, Java and Borneo, suits this plant well. An authentic specimen of *Canarium Eupteron* Miq. shows that that species must be reduced here, as must also *Santiria Maingayi* A. W. Benn., of which a specimen collected by Maingay (310 K. D.) is the type. *Canarium subrepandum* Miq. is, according to its author, closely allied to *C. Eupteron* Miq., and should probably also be reduced here.

Plate 18.—Santiria oblongifolia *Bl.* 1, flowering specimen from Larut, Perak; 2, fruiting panicle from Ulu Bubong; 3, leaflet of the ovate type, from Goping, Perak,—*all of natural size*; 4, flower, laid open; 5, calyx and disk; 6, ovary,—*all enlarged*; 7, fruit, laid open,—*of natural size.*

G. K.

PLATE 19.

19. Santiria longifolia *King in Journ. As. Soc. Beng.* lxii. 2. 258 (1894).

Natural order Burseraceæ.

A tree 10—20 feet high; young branches very stout, 1·25—2 cm. thick, their bark brown, glabrous, lenticellate; *leaves* 6—8 dm. long, glabrous; the rachises stout,

flattened below the lowest leaflets, not winged at the bases; leaflets 6—15 pairs, narrowly oblong, gradually tapering to the acuminate apex, the base oblique or rounded; main-nerves 12—14 pairs, spreading, curved, not prominent; length 2·25—2·75 dm., breadth 4·5—6·5 cm.; petiolules 1·5—2·5 cm., stout, enlarged at each end; *flowers* unknown; *fruiting panicles* much shorter than the leaves, 1—2 in the axil of a leaf, unequal, only 1—1·75 dm. long, glabrous, the branches short; *ripe drupes* ovoid, flattened on one side, the scar of the stigma terminal, glabrous, 2·5 cm. long, 1·5 cm. in diam.

Malayan Peninsula: Perak, Larut; *Kunstler* 3594! 6838!

This is so very unlike any described species of *Santiria* that in spite of the absence of flowers on the only specimens hitherto communicated it seems desirable to name and describe it. The small size of the tree and the large size of its leaves render its recognition in the genus easy.

Plate 19.—Santiria longifolia *King*. 1, branch, with smallest leaf communicated, and with panicles from which flowers have fallen; 2, fruiting panicle, with fruits barely ripe; 3, ripe fruit, laid open; 4, seed,—all from Perak, and *all of natural size*.

G. K.

PLATE 20.

20. Santiria Wrayi *King in Journ. As. Soc. Beng.* lxii. 2. 259 (1894).

Natural order Burseraceæ.

A tree, 20—30 feet high; young branches very thick, 1—1·25 cm. in diam.; *leaves* 3—7·5 dm. long, the rachises trigonous, channelled in the lower part and almost winged at the base, puberulous; leaflets 13—15, membranous, oblong to elliptic-oblong, very shortly and bluntly acuminate; the base rounded, slightly oblique; upper surface shining, olivaceous when dry, the lower pale-brown, both glabrous and reticulate; main-nerves 10—15 pairs, spreading, curved, slightly prominent beneath, length 1·5—3 dm., breadth 6·5—10 cm.; petiolules thickened at both ends, 1·25—2·5 cm. long, the terminal one more than twice as long; *panicles* 8—10 cm. long, several densely crowded in the axil of one leaf, ebracteolate, puberulous or glabrescent below, the ultimate branchlets scurfy rufous-puberulous; *flowers* 2·5—4 mm. long, shorter than the pedicels; *calyx* cupular, the mouth with 3 broad, shallow teeth, glabrous with a few hairs near the edge; *petals* valvate, rotund, glabrous, rather fleshy; *stamens* 6, the anthers ovate, longer than the flattened filaments which are inserted on the outside of the edge of the ring-like, fleshy, glabrous, corrugated disk; *rudimentary ovary* small, ovoid; *female flowers* unknown; *ripe drupes* obliquely ovoid, slightly compressed, blunt at each end, 1·5—2 cm. long, glabrous, the scar of the stigma approximated to the peduncle, peduncle 1·25 cm. long.

Malayan Peninsula: Perak; *Wray* 1423! 2970! *Scortechini* 2095! *Kunstler* 3689!

Allied to *Santiria conferta* A. W. Benn., but has larger leaves and fruit, much less hairy panicles, and perfectly glabrous leaves.

Plate 20.—Santiria Wrayi *King*. 1, flowering twig, from a specimen from Perak; 2, larger leaflet from another specimen; 3, fruiting panicle from a third specimen,—*all of natural size*; 4, flower, the petals detached; 5, disk, stamens and calyx seen from above; 6, rudimentary ovary; 7, fruit, laid open, showing position of immature seed.

G. K.

PLATE 21.

21. SANTIRIA FLORIBUNDA *King in Journ. As. Soc. Beng.* lxii. 2. 254 (1894).

Natural order Burseraceæ.

A tree, 20—30 feet high; young branches stout, scurfy, rusty-pubescent; *leaves* 6—9 dm. long, the rachises flattened and channelled on the upper surface below the lowest leaflets, auricled at the very base, puberulous at first but speedily glabrous; leaflets 13 or 15 or 17, coriaceous, oblong, shortly acuminate, the base rounded, slightly unequal, glabrous on both surfaces, the midrib alone sometimes puberulous on the lower, reticulations minute, main-nerves 20—30 pairs, spreading, curving at the tips, only slightly interarching; length 2·25—5 dm., breadth 7—12·5 cm.; petiolules very stout, 1·25—2 cm. long; *panicle* 6—9 dm. long, slender, much branched, striate, glabrous, bearing numerous, scattered, horizontal branchlets 1·25—4 cm. long, each with 2—3 3—5-flowered cymules; *flowers* 2·5 mm. long, their pedicels longer, unequal, slender, puberulous, with a few subulate bracteoles at the base, *calyx* flat, 3-angled, glabrescent; *petals* erect, deltoid, fleshy, concave, keeled along the middle, glabrous externally; *stamens* 6, the filaments shorter than the oblong anthers, slightly dilated below, inserted on outer surface of the edge of a thick, fleshy, cupular disk; *ovary* small; *style* short, stout, 3-angled like the stigma; ripe *drupes* elliptic, apiculate, glabrous, 2 cm. long and 1·25 cm. in diam., the peduncles slender, 1·25—2 cm. long, stigmatic scar terminal.

MALAYAN PENINSULA: Perak, Larut; *Kunstler* 7510! 7632! 10151!

PLATE 21.—Santiria floribunda *King*. 1, twig, with part of a leaf and of a flowering panicle; 2, part of a fruiting panicle,—*of natural size;* 3, flower, before opening; 4, calyx, seen from above; 5, petals; 6, disk with stamens; 7, two stamens, removed; 8, ovary,—*all enlarged*.

G. K.

PLATE 22.

22. DYSOXYLUM RETICULATUM *King in Journ. As. Soc. Beng.* lxv. 2. 114 (1896).

Natural order Meliaceæ.

A tree, 50 feet high; young branches stout, striate, puberulous; *leaves* 2·25—4·5 dm. long, even-pinnate; the petiole flattened in front, the rachis angled, both puberulous; leaflets 4—7 pairs, opposite or alternate, thinly coriaceous, oblong, slightly unequal-sided, shortly acuminate, the base cuneate and often oblique; both surfaces glabrous and minutely reticulate, the lower glaucous when young, both pale when dry; length 8—18 cm., breadth 2·5—6 cm., petiolules 5—8 mm. long; *racemes* solitary, axillary, 1·5—2 dm. long, tawny-puberulous, bearing flowers from near the base; *flowers* broadly ovoid in bud, about 6·5 mm. long, rather remote, their pedicels about 5 mm. long, each with a subulate basal bracteole; *calyx* cupular, with 4 remote teeth, glabrous, fleshy; *petals* 4, three or four times as long as the calyx, elliptic, subacute, concave, hoary-puberulous on both surfaces; *staminal-tube* cylindric, shorter than the petals, slightly inflated about the middle, the mouth with 8, shallow, emarginate teeth, hoary-puberulous externally, glabrescent internally, anthers 8, oblong, their apices much below the mouth of the tube; *disk* tubular, short, fleshy, glandular-pubescent, the mouth incurved and irregularly toothed; *ovary* depressed hemispheric, 3-angled, 3-celled with 2 ovules in each cell

pubescent, tapering to the stout, subglabrous style; stigma slightly exserted, cylindric with a narrow basal annulus; *ripe fruit* broadly pyriform, the apex depressed, 8 cm. long and 6·5 cm. in diam., rugulose when young, glabrous and smooth when adult, the pericarp crustaceous, 4 mm. thick; seeds 3-angled, the posterior surface concave, 3 cm. long.

Eastern Himalaya: Sikkim, on the banks of the Ryang and Tista; *King!* Cachar: *Prazer!*

The nearest ally of this species is *D. binectariferum* Bedd., from which it differs conspicuously in its smaller flowers, different disk, and minutely reticulated leaflets.

Plate 22.—Dysoxylum reticulatum *King*. 1, flowering twig, from Ryang; 2, fruiting twig, from Tista,—*both of natural size;* 3, bud; 4, opened flower; 5, staminal tube; 6, disk; 7, anthers; 8, ovary,—*all enlarged;* 9, dehiscing capsule; 10, seed,—*both of natural size.*

G. K.

PLATE 23.

23. Lepidopetalum Jackianum *Radlk. in Sitzb. Bayer. Acad.* ix. 623 (1879).

Natural order Sapindaceæ.

A small tree with brittle wood; young branches puberulous, soon becoming glabrous; *leaves* 1·5—3 dm. long, leaflets 2—10, subopposite, oblong or ovate-oblong, subacuminate, the base rounded or cuneate, both surfaces shining, quite glabrous and finely reticulate; main-nerves 7—8 pairs, bold beneath, spreading; length 8—12·5 cm., width 3—5 cm.; petiolules 4 mm. long; *racemes* under 5 cm. long; *flower-buds* oval, pointed; *sepals* ovate-lanceolate, green; *petals* white, minute, cordate, acute, each with a large scale connate to its margins; *stamens* short, hypogynous, 8, filaments glabrous short, anthers oblong hirsute; *ovary* 2-celled; *capsule* not lobed, coriaceous, compressed, obovate, glabrous reddish-brown outside, hirsute bright scarlet within, minutely apiculate, 3 cm. long and about 2 cm. wide, pedicel 5 mm. long; *seed* solitary, black, covered with mucilage and embraced as to the lower third by a pink, cup-shaped, thick, fleshy arillus. *Prain, Proc. As. Soc. Beng.* (1891) 167; *King, Journ. As. Soc. Beng.* lxv. 2. 449 (1896). Connarus? Jackianus *Wall. Cat.* 8552 (1847). Cupania Jackiana *Hiern in Hook. f. Flor. Brit. Ind.* i. 678 (1875).

Nicobars: Car Nicobar; *Jack! Prain!* Kamorta; *Kurz!* Batti Malv; *Prain!*

Plate 23.—Lepidopetalum Jackianum *Radlk.* 1, fruiting branch from the Nicobars; 2, seed,—*both of natural size;* 3, bud; 4, opened flower; 5, calyx and corolla, laid open; 6, stamens and ovary, the perianth removed; 7, sepal; 8, petal; 9, vertical section of petal; 10, stamen; 11, vertical section of ovary,—*all somewhat enlarged.*

G. K.; D. P.

PLATE 24.

24. Acer Papilio *King in Journ. As. Soc. Beng.* lxv. 2. 115 (1896).

Natural order Sapindaceæ.

A small tree; the young branches at first rusty-tomentose, afterwards glabrous and with cinereous exfoliating bark; *leaves* simple, 5-lobed, the lobes caudate-acuminate

and unequally serrate-lobulate; the base in adult leaves subtruncate to subcordate, in the young leaves deeply cordate, the upper surface glabrous except the puberulous middle-nerve, the lower when young densely covered with flexuous hairs deciduous with age except on the nerves, the secondary nerves rather prominent beneath; length 1—1·5 dm., breadth 1—1·25 dm., petiole 8—10 cm. long; *inflorescence* a raceme-like, terminal or axillary rusty-tomentose panicle 8—10 cm. long; the branchlets cymose 2-flowered, about 9 mm. long; flowers 5 mm. in diam., on pedicels slightly longer than themselves; *sepals* 5, oblong, subobtuse, pubescent on the nerves and edges; *petals* 5, oblanceolate-linear, glabrous except the pubescent claw; *disk* fleshy, with 8 large and 2 small quadrate lobes; *stamens* 8, inserted inside and between the lobes of the disk; anthers oblong, minutely warted; the filaments slightly flattened, glabrous; *ovary* rusty-tomentose, styles glabrous 2-fid; *fruit* 3 cm. long and the same in breadth at the apex, the wings obliquely and broadly rhomboid-triangular, the outer side of each the longest and the inner the shortest, slightly puberulous and with bold forking veins, the nucule about 8 mm. in diam.

Eastern Himalaya: Sikkim, Lachung, 11,000—12,500 ft.; *Hooker! G. A. Gammie!* Phalut, 11,500 ft.; *G. A. Gammie!* Jongri, 12,000 ft.; *King's Collectors!*

This species has been confused with *A. pectinatum* Wall. and *A. caudatum* Wall.; it is at once distinguished from both by its paniculate inflorescence—that of *A. caudatum* being fasciculate, while that of *A. pectinatum* is a few-flowered, simple raceme. The wings of the samara of this are also rather broader than those of the other two. The disk of the flower in this species has 8 large square lobes, but at two points which stand opposite to each other the disk has a fold in it and hidden in each of these folds there lies a small lobe. The disk is thus really 10-lobed, although at a superficial glance only 8 lobes are visible.

Plate 24.—Acer Papilio *King*. 1, flowering branch, from Phalut; 2, fruiting twig, from Jongri,—*both of natural size;* 3, bracteole and bud; 4, flower; 5, flower, laid open; 6, stamens; 7, ovary; 8, samara with the faces of each nucule removed; 9, seed, not quite mature,—*all enlarged except fig. 8, which is of natural size.*

G. K.

PLATE 25.

25. Spondias axillaris *Roxb. Hort. Beng.* 34 (1814).

Natural order Anacardiaceæ.

An evergreen tree of the middle hill-forests in the Central and Eastern Himalaya, attaining a height of 30—35 metres, with a clear stem of 12—18 metres, 1—2 metres in diam. at 1·5 metres above level of soil; *bark* brown or reddish, peeling in long flakes; *wood* dark-pink, reddening on exposure, soft but durable; *leaves* alternate, unequally pinnate, 2·5—4 dm. long, leaflets 13—17, opposite except the terminal, ovate-lanceolate, base cuneate on both sides or on lower side only and then rounded on the upper, apex acuminate to caudate, margin in leaves of young trees deeply gash-serrate, in half-grown trees beginning to bear flowers and fruit wide-serrate, in full-grown trees almost entire, 9—10 cm. long., 3—3·35 cm. wide, slightly puberulous on the nerves beneath in young trees, glabrous on both surfaces when full-grown except for a few hairs in the angles of the main-nerves and midrib beneath, dark-green above, rather

paler beneath, nerves 6—8 pairs, not looped; *flowers* axillary or in axils of fallen leaves along branches, solitary, or two more rarely three on same peduncle, 6 mm. across; peduncles 1·5 cm. long, slender, glabrous, pedicels 3 mm.; *calyx* green, 5-fid, lobes acute *petals* 5, white, elliptic, subacute; *stamens* 10, filaments short, subulate; *disc* annular, 10-lobed; *ovary* 5-celled with 5 short erect styles; ovules solitary, pendulous; *drupes* 3 cm. long, 2 cm. in diam., oval, rounded at apex, yellow, edible; putamen 5-celled with 5 eyes at top. *Roxb. Flor. Ind.* ii. 453 (1832); *Hook. f. Flor. Brit. Ind.* ii. 42 (1876). S. acuminata *Gamble, Trees. etc., in the Darjeeling Dist.* Ed. 2. 25 (1896) *not of Roxb.* Cedrela Toona *Gamble, Man. Ind. Timb.* 77 (1881); *in part, not of Roxb.* C. Toona VAR. 3. Lapshi *Gamble, Trees, etc., in Darjeeling Dist.* 17 (1878). Cedrela sp. *Gamble, Trees, etc., in Darjeeling Dist.* Ed. 2, 17 (1896). Poupartia axillaris *Prain MSS.*

HIMALAYA: Nepal; *Hamilton*, fide *Roxburgh.* Sikkim; 1,000—3,000 ft.; *Gammie! Manson! King!* Bootan, at Kalimpong, 4,500 ft.; *Gamble* 7323! Dumsong, 3—4,000 ft.; *Prain!* KACHIN HILLS: Sima, Sadon, etc.; *Prain's collector!*

This has long been a puzzling tree. It was known to have been introduced from Nepal into the Calcutta Garden in 1802 by Dr. Buchanan-Hamilton under the Nepalese name 'Neema,' and though the description given in the *Flora Indica*, ii. 453, is very brief, Roxburgh left an excellent drawing representing a tree very near *Spondias* in the structure of flower, fruit and embryo. Roxburgh calls it "a small beautiful *Melia*-looking tree," a description which the Nepalese name 'Neema,' supplied by Buchanan-Hamilton, would suggest. Sir Joseph Hooker remarks on the fact that though Roxburgh describes the leaflets as 'gash-serrate' he figures them as obtusely serrate. In this we now know there is no real discrepancy; the leaflets of seedlings are deeply 'gash-serrate' and even in a 4-years old plant they deserve to be so described; the leaflet shown on Plate 25, fig. 3, shows what all the leaflets on such a plant in the Calcutta Gardens are like, while the leaflets shown on the same Plate, fig. 2, shows what all the leaflets were like on the tree that yielded the seed from which the plant whose leaflets were 'gash-serrate' was raised. This change in type of leaflet has however probably had a good deal to do with the difficulty there has been in identifying Roxburgh's *Spondias axillaris* in the field; collectors have expected to find a small tree looking very like a 'Nim' (*Melia*), which is what it does look like while it is still young. When full grown, however, it is a lofty tree that looks very like a 'Tún' (*Cedrela*) and, as has been shown by Gamble (*Trees, Shrubs, etc., of the Darjeeling District*, p. 17), is often taken for a variety or perhaps distinct species of 'Tún.'

There have been long known to be one or more trees, very like *Tún* in appearance and qualities, passing under the name *Labshi* or *Lapshi* in the Sikkim Himalaya, whose botanical identity was highly doubtful. Of one of these, which he terms *Labshi*, Gamble has distributed specimens to various herbaria (*Gamble* n. 2412) under the tentative name "*Melia composita* Willd", a species to which they certainly cannot be referred because the leaves, though twice pinnate, have not got the secondary rachises opposed in pairs; moreover all the leaflets are alternate. It has a red wood with the appearance and odour of *Tún* and has an edible fruit, characters that it shares with *Spondias axillaris*, but the foliage makes its

identification with the *Spondias* as impossible as its identification with the *Melia*. What this large tree, represented by Gamble's n. 2412, may be, is as yet not certainly known, though in the *Darjeeling List*, Ed. 2, 16 (1896) it is termed *Melia dubia*. Another tree, which he terms *Lapshi*, Gamble. treats tentatively in his first *Darjeeling List* as a variety of *Tún*; in his *Manual of Indian Timbers*, 78, where he terms it *Labshi*, this is the only *Labshi* that he recognises. This second *Labshi* constitutes, moreover, *Labshi* as it is usually understood by the natives of Sikkim and British Bhutan. In the second edition of the *Darjeeling List* this is, at p. 17, very. justly removed from *Cedrela Toona* and *C. microcarpa*; as the list passed through the press it was added again under *Spondias*, though by a typographical error the name is given as *S. acuminata* instead of *S. axillaris*.

As regards the generic position of Roxburgh's plant there is no doubt possible. It belongs to Commerson's genus *Poupartia*, which is merged in *Spondias* by Bentham and Hooker in *Genera Plantarum*, i. 426, but which Engler in *DC. Mon. Phaner.* has, in our opinion and in that of Hemsley (*Icones Plantarum* t. 2557), justly restored. If the view which we, in common with these distinguished botanists, hold, be correct, the true name for this Roxburghian species is therefore *Poupartia axillaris*. Our present purpose being, however, to make botanists fully acquainted with the plant of Roxburgh, we have deemed it preferable to publish Roxburgh's own figure and give here a full description of the plant under Roxburgh's own name. It should, however, be added that, so far as can be judged from the excellent figure of *Poupartia Fordii* Hemsl., *Icon. Plantar.* t. 2557 (1899), there is no character whereby that plant, which is a native of Hong-Kong, can be distinguished from the Eastern Himalayan *Poupartia axillaris*, and the suspicion that the two may be the same is greatly strengthened by the fact that the native collectors of the Calcutta Garden have recently sent specimens and quantities of seed of the Himalayan tree from the intermediate locality of the Kachin Hills.

PLATE 25.—Spondias axillaris *Roxb.* 1, branch, with leaves and flowers, from Roxburgh's original drawing; 2, single leaflet from a large tree growing on the Cinchona Plantation at Mungpoo, Sikkim; 3, single leaflet, young, from a plant 4 years old in the Calcutta Garden, raised from seed yielded by the tree bearing the leaflet of fig. 2; 4, flower, laid open, from Roxburgh's drawing; 5 and 6, ovary, cut transversely and vertically, from Roxburgh's drawing; 7, fruit; 8, the same, cut transversely; 9, seed—from Roxburgh's drawing. *Figs. 4, 5, 6 are enlarged, the others are of natural size.*

G. K.; D. P.

PLATE 26.

26. TAENIOCHLAENA BIRMANNICA *Prain in Journ. As. Soc. Beng.* lxvii. 2. 285 (1898).

Natural order Connaraceæ.

A shrub with round, puberulous branchlets and minutely lenticelled bark; *leaves* unequally pinnate, 15—20 cm. long, leaflets 2—3 pairs increasing upwards, the terminal the largest 8—12 cm. long, 4 cm. wide, the others 4—7 cm. long, all oblong-lanceolate

with apex caudate-acuminate and emarginate, base of terminal equally of others slightly unequally cuneate, margin entire, firmly subcoriaceous, puberulous above along the somewhat impressed midrib elsewhere quite glabrous, secondary nerves about six pairs, slender but distinct, ascending and looped within margin, intermediate reticulations fine but distinct, especially beneath; rachis about 8 cm. long, puberulous as are the petiolules 4 mm. long; *flowers* in short axillary racemes or congested panicles, 4—5 cm. long, bracts minute, pedicels 10—12 mm. long; *calyx* rounded at base, lobes 5, oblong, acute, valvate, reflexed in fruit, 6 mm. long, 2·5 mm. wide; *petals* not seen; *stamens* 10, alternately short and long, hardly connate at base; *carpels* 5 sessile, style somewhat elongated, puberulous, slightly excentric; *capsules* 1—3 in each flower, sessile, ovoid, slightly apiculate, dull-brown outside, pale-tawny within, glabrous both outside and inside, 1·5 cm. long, 1 cm. wide; *seed* single, oblong, the lower half enclosed within an adnate aril, 12 mm. long, 7 mm. wide, testa claret-red, shining.

KACHIN HILLS: *Calcutta Garden Collector!*

This plant much resembles the only other known species, *Tæniochlæna Griffithi* Hook. f., from Malacca, but that species has differently shaped leaflets and a capsule pubescent externally.

PLATE 26.—Tæniochlæna birmannica *Prain*. 1, twig with flowers and fruits,—*of natural size;* 2, flower × 2; 3, the same, calyx-lobes detached × 2; 4, stamens × 4; 5, ovary × 4; 6, the same, cut open × 4; 7, ovule × 4; 8, fruit,—*of natural size;* 9, capsule cut open, showing seed *in situ*,—*of natural size;* 10, seed, cut vertically,—*of natural size.*

D. P.

PLATE 27.

27. INDIGOFERA SQUALIDA *Prain in Journ. As. Soc. Beng.* lxvi. 2. 355 (1897).

Natural order Leguminosæ.

An undershrub, 1·5—3 feet high, branching only near the base, persistently sparsely adpressed grey-pubescent; *leaves* simple, sessile or subsessile, ovate to ovate-lanceolate, acute or obtuse, stipules linear, subulate, petiole ·5—2 mm. long, lamina chartaceous, 4—5 cm. long, 2 cm. across; *flowers* 12—18, in small, sessile, congested, axillary racemes, 6—15 mm. long; *calyx* 1 mm. long, white, pubescent, teeth long, setaceous; *corolla* purple, twice as long as calyx; standard pubescent; *pod* deflexed, straight, tetragonous, valves slightly adpressed-puberulous, not torulose; *seeds* about 8, smooth, subreniform.

BURMA: Shan Hills, at Koni and Fort Stedman; *Calcutta Collectors!*

The leaves of this species are not unlike those of *I. Brunoniana* Wall., but are much smaller; the habit, inflorescence and pods are practically those of the otherwise very different *I. trifoliata* Linn.

PLATE 27.—Indigofera squalida *Prain*. 1, flowering plant, and 2, fruiting branch,—both from Fort Stedman and *both of natural size;* 3, flower-bud; 4, flower; 5, calyx, laid open; 6, standard; 7, wings; 8, keel; 9, stamens; 10, anther; 11, ovary; 12 and 13, pods; 14, seed,—*all variously magnified.*

D. P.

PLATE 28.

28. INDIGOFERA BELLA *Prain in Journ. As. Soc. Beng.* lxvi. 2. 355 (1897).

Natural order Leguminosæ.

A shrub, 8—12 feet high, branches long, virgate, slender, glabrous, slightly 4-angled; *leaves* odd-pinnate, leaflets 7—9, large, 8 cm. long, 4·5 cm. wide, ovate-acute, apiculate, quite glabrous above, very sparsely puberulous and glaucous beneath, rigidly chartaceous, veins 10—12 pairs, slender but rather conspicuous beneath; stipules linear, deciduous, 2 mm. long, stipels setaceous subpersistent; leaf-rachis deeply channelled above, 10—12 cm. long, petiolules 5 mm. long; *racemes* axillary, 10—20 cm. long, becoming bare at base but not truly peduncled, copiously close-flowered; flowers shortly pedicelled; *calyx* campanulate, 3 mm. long, teeth short, deltoid; *corolla* white, 1·5 cm. long, standard thinly pubescent externally twice as long as broad, claw short base truncate apex obtuse, wings lanceolate; *pod* 5 cm. long, cylindric with thickened sutures 4 mm. thick, glabrous, tip very abruptly upturned; *seeds* many, tessaroid, 2 mm. long, 1·5 mm. wide and thick, testa reddish-brown.

BURMA: Myingyin Hills; *Prazer!* Kalay Hills; *Prazer!* Pegu; *Kurz!*

A very handsome species that ought to prove welcome when introduced into gardens. Its nearest ally is a Chinese plant (*Henry* n. 3865) which does not appear to have received a name.

PLATE 28.—Indigofera bella *Prain.* 1, portion of branch from flowering specimen from Kalay Hills, Upper Burma,—*of natural size;* 2, calyx, laid open × 2; 3, standard × 2; 4, wings × 2; 5, keel × 2; 6 and 7, staminal sheath and vexillary stamen × 2; 8, ovary × 2; 9, portion of branch from specimen in fruit, from South Myingyin Hills,—*of natural size;* 10, seed × 4.

D. P.

PLATE 29.

29. INDIGOFERA HAMILTONII *Grah. in Wall. Cat.* 5465 (1830).

Natural order Leguminosæ.

A low undershrub, burnt down annually by the forest fires, branches 5—8 in., thinly coated with adpressed hairs; *leaves* 2·5—6·5 cm. long, leaflets oblong, usually 3, rarely 5, opposite except the terminal, 1·5—2 cm. long, 1—1·5 cm. wide, membranous, pale-green, sparsely adpressed-pubescent on both surfaces, petiole 1·5 cm. long and rachis glabrous, stipules small, lanceolate, caducous; petiolules 2·5 mm., stipels minute, subulate, very caducous; *racemes* usually all springing from the woody stock, clustered, rather long-peduncled, 20—30 cm. long, flowers throughout scattered, bracts caducous, lanceolate, small, shorter than the very short pedicels; *calyx* 2 mm. long, obliquely wide-campanulate, teeth wide-deltoid; *corolla* under 1 cm. long, pale-purple with darker lines; *pod* ligulate, straight, not turgid, 9—12 seeded, 3·5 cm. long, 4 mm. wide, 2 mm. thick; *seeds* sublenticular, compressed. I. atropurpurea *Baker in Hook. f. Flor. Brit. Ind.* ii. 101 (1876) *in part, not of Ham.* I. juncea *Ham. MSS. not of Del.*

N. W. PROVINCES: Gorakhpur; *Hamilton* in *Wall. Cat.* 5465! *Duthie's Collector!* Oudh, Kheri; *Duthie's Collector!* (Herb. Saharanpur nn. 21518, 21519, 21520.)

This very interesting plant was first collected in the Gorakhpur Dist. by Buchanan-Hamilton in 1814, but was not again communicated till re-discovered by the Saharanpur Collectors in 1898 both in Gorakhpur and in Kheri. Hamilton's specimens, which have no leaves, were referred by Baker to *I. atropurpurea*, with the flowers of which those of Hamilton's plant closely agree. Kurz, however, from a MSS. reference in Herb. Calcutta, was unable to agree with Baker's reduction, and the fine suites of specimens obtained in 1898 show that the reduction is at least premature; Duthie's nn. 21518 and 21519 are both exactly like Hamilton's original specimens; his n. 21520 has longer leafy stems about 1·5 ft. high with the uppermost leaves with 5 leaflets and with racemes in the axils of these leaves that have rather longer peduncles than the racemes springing close from the ground.

This plant adds another to the interesting group including *Grewia sapida* Roxb. (*G. nana* Wall.), *Combretum nanum* Ham., *Erythrina resupinata* Roxb., and others of the same habit, that are burnt down annually by forest fires; it may be that all of them are only modified forms of species which, when allowed to grow freely, have quite another habit and bear another name. In this case, however, it is too soon yet to say what the actual species may be; in any case, to judge from the different bracts and fruits and the leaves with much fewer leaflets, that species would appear *not* to be *I. atropurpurea*.

PLATE 29.—Indigofera Hamiltonii *Grah.* 1, flowering plant from Marha in the Kheri dist., Oudh; 2, plant in fruit from Shurpur in the Gorakhpur dist.,—*of natural size;* 3, flower; 4, standard; 5, 5′, wings; 6, keel; 7, 8, stamens,—*all somewhat enlarged;* 9, pod, opened,—*of natural size;* 10, seed; 11, embryo—*enlarged.*

J. F. D.; D. P.

PLATE 30.

30. MILLETTIA UNIFOLIATA *Prain in Journ. As. Soc. Beng.* lxvi. 2. 93 (1897).

Natural order Leguminosæ.

A handsome spreading tree, 30—40 ft. high, trunk 1 ft. in diam., branches glabrous; *leaves* consisting of a solitary terminal leaflet, petiolulate, ex-stipellate, obovate-oblong or lanceolate, entire, apex acute rarely caudate, base cuneate, thickly membranous, shining above, dull beneath, midrib prominent beneath, main-nerves 6—9 pairs, ascending, hardly more prominent than the distinct secondary nervation; glabrous, petiolule 6 mm. long, directly articulating with branch; *racemes* in very slender axillary panicles, shorter than the leaflets, 7·5—10 cm. long, 6—10 mm. across; individual racemes short, 3—5-fld., separated from each other by intervals 2·5 cm. long; peduncles and pedicels glabrous; *calyx* 5 mm. long, glabrous externally, campanulate, 2-bracteolate at base, bracteoles minute, ovate-lanceolate, teeth hirsute within, shorter than tube; *corolla* pure white, 2 cm long, standard orbicular, 2-auriculate at base of lamina, glabrous externally; *stamens* monadelphous in a sheath split along the vexillary side; *ovary* puberulous; *pod* linear, 15 cm. long, 2·5 cm. wide, flat, rather woody, tapering to both ends, finely pale yellowish-velvety externally. Kraunhia unifoliata *Prain Mss.*

MALAYAN PENINSULA: Perak; very common; *Curtis! Scorteehini! Wray! Kunstler!*

Closely related to *M. albiflora*, but differing from all the hitherto known *Millettias* in having 1-foliolate leaves.

PLATE 30.—Millettia unifoliata *Prain.* 1, flowering branch, from Perak; 2, unopened pod; 3, pod after dehiscence,—*all of natural size;* 4, calyx, laid open; 5, vexillum; 6, alae; 7, carina; 8, staminal sheath; 9, stamens; 10, ovary; 11, the same, laid open; 12, ovules,—*all variously enlarged.*

D. P.

PLATE 31.

31. MILLETTIA ALBIFLORA *Prain in Journ. As. Soc. Beng.* lxvi. 2. 92 (1897).

Natural order Leguminosæ.

A handsome spreading tree, 30—50 ft., sometimes 80—100 ft. high, trunk 2—3 ft. in diam., branches glabrous; *leaves* up to 3 dm. long, leaflets terminal and in 2—3, more rarely 1, opposite pairs, shortly petiolulate, exstipellate, elliptic-lanceolate, entire, apex caudate, base cuneate, 12—24 cm. long., 5—6·5 cm. wide, lowest pair rather smaller, thickly membranous, shining above, dull beneath, nerves 6—9 pairs, ascending, rather prominent, midrib very prominent, quite glabrous, petiolules 5 mm. long; *racemes* in very long, narrow, axillary panicles towards ends of branches, 3—7 dm. long, 6—7 cm. across; the individual racemes subfastigiate, 10—15 cm. long with 10—12 solitary, short-pedicelled flowers; pedicels 4 mm. long, rusty-puberulous like the peduncles and main-rachis; *calyx* 6 mm. long, rusty-puberulous, tube campanulate rather longer than the triangular teeth, the two upper teeth connate, emarginate; *corolla* pure white, 2 cm. long, standard orbicular, 2-auriculate at base of lamina, glabrous externally; *vexillary filament* extending half-way up the sheath or at length free on one side only or on both; *ovary* puberulous; *pod* linear 1·75—3 dm. long, 4—5 cm. wide, straight, flat, rather woody, uniformly soft brown-velvety. Kraunhia albiflora *Prain Mss.*

MALAYAN PENINSULA: Perak, very common; *Scortechini! Kunstler! Wray! Ridley!* Pahang; *Ridley!*

PLATE 31.—Millettia albiflora *Prain.* 1, twig with leaf and flowers; 2, twig with fruit, from Perak—*both of natural size;* 3, calyx, laid open; 4, vexillum; 5, alae; 6, carina; 7, staminal sheath; 8, stamens; 9, ovary; 10, the same, laid open; 11, ovules,—*all enlarged;* 12, seed, unripe, showing the much thickened funiculus—*of natural size.*

D. P.

PLATE 32.

32. MILLETTIA STIPULARIS *Prain in Journ. As. Soc. Beng.* lxvi. 2, 363 (1897).

Natural order Leguminosæ.

A shrub, 8 feet high, with ash-grey bark and with short, conical, raceme-bearing processes in the axils of fallen leaves; *leaves* 6 dm. long with glabrous rachis, clustered at apex of stem, leaflets 17—19, upper oblong, lower ovate, base rounded or of upper cuneate, apex rounded and abruptly narrowly caudate, exstipellate, glabrous on both surfaces, green, shining above, dull beneath, midrib and 8—10 pairs of lateral nerves prominent beneath, lowest leaflets 8 cm. long, 4 cm. wide, terminal and upper pairs 15 -20 cm. long, 6 cm. wide; petiolules 6 mm.; stipules large

obliquely oblong, acute, 2·25 cm. long, 6 mm. wide, persistent; *racemes* 1—3 from each papilla, 7—12 cm. long, 10—15-fld.; *flowers* shortly pedicelled, usually solitary on small produced nodes showing traces of 3—5 abortive or fallen flowers; *calyx* 3 mm. long, rusty-puberulous; *corolla* purple, standard orbicular, 7—8 mm. long, emarginate, externally slightly pubescent, exauriculate; *stamens* monadelphous; *mature pod* quite glabrous, linear-oblong, straight or slightly falcate, rigidly coriaceous, 7—10 cm. long, 1—2 cm. broad.

MALAYAN ARCHIPELAGO: Sumatra, R. Roepit, 200 ft.; *Forbes* 2948!

PLATE 31.—Millettia stipularis *Prain*. 1, apex of stem with leaf; 2, portion of stem with racemes of buds and young fruit; 3, portion of stem with ripe fruits, *of natural size*; 4, bud; 5, calyx, laid open; 6, standard; 7, wings; 8, keel; 9, staminal sheath; 10, ovary; 11, the same, opened; 12, ovule,—*all enlarged*.

D. P.

PLATE 33.

33. URARIA PRUNELLAEFOLIA *Grah. in Wall. Cat.* 5686 (1830).

Natural order Leguminosæ.

A herb with woody base; stems 8—16 in. high, erect, sparsely pubescent; *leaves* 1-foliolate, leaflet oblong or lanceolate, obtuse or acute, rounded or truncate at the base, 6—10 cm. long, 1·5—3 cm. wide, petiole 3—6 mm. long, hirsute on veins and nerves especially beneath; *flowers* in simple terminal racemes of fascicles 5 cm. long; pedicels bristly pubescent, slender, 1—1·25 cm. long, bracts lanceolate, deciduous; *calyx* 3 mm. long, campanulate, bristly teeth lanceolate, lower twice as long as the upper; *corolla* blueish, 5 mm. long, standard shorter than keel; *pod* 5—6-jointed, joints sparsely puberulous, black, opaque, spiral or hamate, not folded within the calyx; *seeds* subreniform. *Bak. in Hook. f. Flor. Brit. Ind.* ii. 157 (1876). Hedysarum hamatum *Herb. Ham. ex Wall. l. c.* (1830).

N.-W. HIMALAYA: Kamaon, Ramganga Bridge, 3,000 ft.; *Thomson* 1152! OUDH: Pilibhit; *Duthie's Collector!* Kheri; *Duthie's Collector!* Gorakhpur; *Duthie's Collector!* E. HIMALAYA: *Griffith.* ASSAM: Brahmaputra Valley; *G. Mann! Fisher!* Khasia, at Nya Bungalow, 3,500 ft.; *Clarke* 38131! KACHIN HILLS: near Myitkyina; *Prain's Collector* 114!

PLATE 33.—Uraria prunellaefolia *Grah.* 1, flowering plant collected in the Pilibhit Dist. (*Duthie* n. 21489); 2, fruiting plant collected in the Gorakhpur Dist. (*Duthie* n. 21490),—*of natural size*; 3, flower; 4, flower, laid open; 5, standard; 6, wings and keel; 7, staminal sheath; 8, ovary and vexillary stamen; 9, part of a pod; 10, joint of pod, laid open; 11, seed, showing hilum; 12, embryo.

J. F. D.; D. P.

PLATE 34.

34. CRUDDASIA INSIGNIS *Prain in Journ. As. Soc. Beng.* lxvii. 2. 287 (1898).

Natural order Leguminosæ.

A climber with slender stems, rather closely covered with a short, reflexed, adpressed, tawny pubescence; *leaves* pinnately 5-foliolate, 20—30 cm. long, petioles 5—10 cm.

and common rachis 4 cm. long, channelled above and closely covered with short, reflexed, adpressed pubescence, petiolules short, adpressed-pubescent, leaflets ovate-lanceolate, apices acute, bases cuneate, margins entire, 8—15 cm. long, 4—7 cm. wide, chartaceous, glabrous above, adpressed-puberulous beneath, reticulately veined between the 12—15 pairs of rather prominent secondary nerves, midrib closely adpressed-pubescent and prominent beneath; stipels filiform, 1·5 mm. long, stipules rigid, spinulose-setaceous, 5 mm. long, developing before the leaves, basifixed, caducous; *flowers* fascicled on axillary racemes 20—30 cm. long, with nodiform rachis; the peduncles 5—8 cm. long, the nodes about 4 mm. apart; bracts and bracteoles minute, caducous; *calyx* 5 mm. long, adpressed-pubescent, tube campanulate as long as the teeth, the two upper teeth connate in a very shortly 2-dentate upper lip, the three lower triangular of equal width but the lateral pair rather shorter than the central; *petals* purplish, 1·25 cm. long, standard suborbicular retuse at apex, silky externally, 1 cm. wide, wings oblong-ovate, slightly adherent at base to cymbiform keel; *stamens* 10, monadelphous, anthers uniform; *ovary* sessile, many-ovuled, densely silky; style inflexed, glabrous except round the capitate stigma where it is shortly sparsely penicillate; *pod* 8 cm. long, 8 mm. wide, flat, coriaceous, slightly adpressed-puberulous, and faintly depressed between the 10—12, suborbicular, compressed, estrophiolate, pale-greenish, smooth seeds with ovate hilum, 6 mm. long. and 4 mm. wide. *Sc. Mem. Med. Off. India* xi. 42 (1898).

Upper Burma: Kachin Hills, 3—5000 feet elev., at Sima, Naku, and elsewhere; *Calcutta Garden Collector!*

This species might with almost equal propriety be referred to the subtribe *Galactieæ*, especially to the section *Collœa* of the genus *Galactia* itself where also the vexillary stamen is connate with the remaining nine, or to the subtribe *Diocleæ*, especially to the genus *Pueraria* of which it exhibits most of the characters though it differs very markedly in having 5-foliolate leaves. From both *Galactia* § *Collœa* and *Pueraria* our plant, however, differs still more markedly in having the style bearded round the stigma after the fashion of certain of the *Euphaseoleæ*, and it seems therefore preferable to treat it as the type of a distinct genus, bearing to the other *Diocleæ* very much the relationship that *Clitoria* bears to the rest of the *Glycineæ*.

Plate 34.—Cruddasia insignis *Prain.* 1, end of a branch with axillary inflorescence; 2, infruitescence—*of natural size;* 3, bud; 4, flower; 5, calyx, laid open; 6, staminal sheath; 7, ovary; 8, the same, laid open; 9, ovule—*all enlarged;* 10, seed—*of natural size.* Specimens from Sima, Kachin Hills.

D. P.

PLATE 35.

35. Kunstleria Kingii *Prain in Journ. As. Soc. Beng.* lxvi. 2. 110 (1897).

Natural order Leguminosæ.

A very extensive climber over 100 feet long, with slender branches; bark brown, lenticular; *leaves* 12—20 cm. long, pinnately 3-foliolate; leaflets ovate-lanceolate, 10—15 cm. long, 4—5 cm. wide, apex acute, bases of lateral leaflets rounded, of contral, rather the longer, shortly cuneate, lateral nerves ascending, 5—6 pairs, rather

prominent like the midrib beneath, margin entire, firmly chartaceous, pale-green, glabrous on both surfaces, petiole glabrous, 4—6 cm. long, petiolules glabrous, 2·5 mm. long, marginally attached; *flowers* in copious terminal and axillary panicles 20—30 cm. long, 12—20 cm. across, rachis and branches rusty-pubescent; nodes not swollen, pedicels solitary, pubescent, 1 mm. long; *calyx* campanulate, densely pubescent, 2 mm. long, the two upper teeth connate in a broadly deltoid lip bifid at tip, the others triangular almost as long as the tube; *corolla* dark-purple, 6 mm. long, standard ovate-oblong, entire, keel boat-shaped the petals slightly cohering; *stamens* 2-adelphous the upper one quite free from those of the keel-sheath and slightly adnate at base to standard claw; anthers versatile, uniform, free portions of filaments alternately long and short; *ovary* sessile, usually 2-ovuled, style slightly incurved, filiform, stigma capitate; *pod* thin, flat, densely brown pubescent and distinctly reticulated, 5—10 cm. long, 1·5 cm. wide, 1—2-seeded; *seeds* oblong, 3·25 cm. long, 1·25 cm. wide, cotyledons thin and leaflike, testa very dark brown, faintly rugose externally, thinly chartaceous.

Malayan Peninsula: Perak, at Larut, *Kunstler* nn. 3830! 6870! 6935!

The genus *Kunstleria* was founded by the writer to accommodate 5 evidently congeneric Malayan species with the habit of *Spatholobus* and with the calyx and almost the corolla of that genus. This new genus however differs from *Spatholobus* in having its flowers solitary instead of fascicled on tumid nodes; in having exstipellate leaflets varying in number in different species from 1—7; in the present species only one of the many specimens sent by Kunstler had a leaf with a solitary leaflet all the other leaves being 3-foliolate. Another point of difference between *Kunstleria* and *Spatholobus* is that the pods of the former are quite indehiscent with the seeds situated centrally and not terminally; in this respect therefore *Kunstleria* is not distinguishable from *Lonchocarpus*. From *Lonchocarpus*, however, *Kunstleria* differs in having unfascicled flowers, in having a toothed calyx and in having diadelphous stamens. As regards inflorescence *Kunstleria* agrees exactly with the species of *Derris* that constitute the section *Aganope* and agrees moreover with that group of species in having the vexillary stamen free. But here again *Kunstleria* differs in having a wingless pod and a toothed calyx, and in having the free stamen slightly adnate to the standard claw. With the calyx of *Spatholobus* therefore we find combined in *Kunstleria* the pod of *Lonchocarpus* and the inflorescence of *Aganope*. The genus is dedicated to the memory of the late Herr H. H. Kunstler.

Plate 35.—Kunstleria Kingii *Prain*. 1, flowering branch; 2, fruiting branch—*both of natural size*; 3, calyx, laid open; 4, standard; 5, 6, wings; 7, keel; 8, stamens; 9, ovary; 10, the same, laid open; 11, ovule—*all enlarged*; 12, pod; 13, seed; 14, vertical section of seed—*of natural size*.

D. P.

PLATES 36—39.

Dysolobium *Prain in Journ. As. Soc. Beng.* lxvi. 2. 425 (1897).

Natural order Leguminosæ.

Twiners, usually woody, with 3-foliolate stipellate leaves; *flowers* in copious axillary racemes, bracteoles inconspicuous, deciduous; *calyx* campanulate, the lower

tooth lanceolate longer than the rest but shorter than the tube, the upper two teeth connate; *corolla* much exserted, keel beaked and sometimes distinctly curved and laterally deflexed; *stamens* diadelphous, anthers uniform; *ovary* sessile, many-ovuled, style filiform bearded below the oblique stigma; *pod* thick, woody, subterete, oblong, villous, very markedly septate, with double partitions between the velvety seeds.—Species 4, Indian.

The firm septate pods and the hirsute seeds mark this as one of the most natural and definite genera within the whole tribe *Phaseolidæ*.

Key to the species.

Flowers large, racemes long-peduncled, lax; pod closely velvety, keeled along suture but not winged; seeds sparsely velvety:—

Leaflets rather firmly chartaceous, hirsute on the nerves beneath; flowers over 1·5 in. long; keel with a long, laterally deflexed beak ... *D. grande.*

Leaflets membranous, glabrescent; flowers ·6 in. long; keel-beak not deflexed ... ... *D. lucens.*

Flowers small, ·3 in. long or less, racemes short-peduncled, dense; pod softly hirsute with long hairs; seeds densely velvety; beak of keel not deflexed:—

Leaflets roundish; pod neither keeled nor winged ... ... *D. dolichoides.*

Leaflets lanceolate; pod subquadrangular, prominently winged along the angles .. .. *D. tetragonum.*

D. P.

PLATE 36.

36. Dysolobium grande *Prain in Journ. As. Soc. Beng.* lxvi. 2. 427 (1897).

A wide-twining woody-stemmed climber; *leaves* 3-foliolate, 3—3·75 dm. long, rachis below lateral leaflets 15—18 cm., beyond them 4 cm. long; leaflets chartaceous, all roundish-cuspidate, acuminate, pubescent on nerves beneath, lateral 12—15 cm. long, 8—9 cm. wide, base oblique, terminal 18—22 cm. long, 11—12 cm. wide, base rounded, 3-nerved at base, stipels 4 mm. long, subulate, petiolules 6 mm. long; *racemes* 2·5—4 dm. long, 20—30-flowered, peduncles woody, terete, 15—18 cm. long; pedicels 4—6 mm. long, bracteoles roundish, minute, adpressed; *calyx* 12 mm. long, finely silky; *corolla* reddish-purple, standard orbicular-cordate, 2·5 cm. wide, keel produced in a narrow, laterally decurved, falcate beak 15 mm. long; *pod* subcylindric, woody, straight, 15—18 cm. long, 2 cm. wide, deeply channelled along both sutures, densely velvety; *seeds* longer than broad, 15 mm. long, 10 mm. wide, sparsely velvety. Phaseolus grandis *Ham. in Wall. Cat.* 5602 (1830); *Benth. in Pl. Jungh.* i. 239, footnote (1855), *not* Phaseolus grandis *Dalz.* P. velutinus *Grah. in Wall. Cat.* 5615 (1830); *Bak. in Hook. f. Flor. Brit. Ind.* ii. 204 (1876). Canavalia grandis [*Wall. Mss.*]; *Kurz in Journ. As. Soc. Beng.* xliii. 2. 185 (1874) *and* xlv. 2. 252 (1877).

Eastern Himalaya: Sikkim, lower hill forests; *Anderson! Prain!* submontane forests of Terai; *Kurz!* and Duars; *Prain!* Assam: Goalpara, etc.; *Hamilton! Jenkins! Masters! Clarke!* Khasia, lower hill forest; *Clarke!* Burma: Shan Hills; *King's Collectors!* Taoung Doung Mts.; *Wallich!* Kachin Hills; *Prain's Collector!* China: Yunnan; *Anderson!*

PLATE 36.—Dysolobium grande *Prain.* 1, twig with leaf and flower, from Shan Hills; 2, raceme with young fruit, from Sikkim; 3, pod, with ripe seeds, from Gauhati, Assam; 4, calyx; 5, standard; 6, wings; 7, keel; 8, staminal sheath; 9, vexillary stamen; 10, ovary; 11, the same laid open; 12, ovules; 13, seed,—*all of natural size.*

D. P.

PLATE 37.

37. DYSOLOBIUM LUCENS *Prain in Journ. As. Soc. Beng.* lxvi. 2. 427 (1897).

A wide-twining perennial climber with woody stem; *leaves* 3-foliolate, 1·5—3 dm. long, rachis below lateral leaflets 5—12 cm., beyond them 1 cm. long, leaflets membranous, ovate-acute, glabrous or nearly so, lateral 8—10 cm. long, 4—5 cm. wide, terminal 10—15 cm. long, 6—9 cm. wide, stipels 3 mm. long, subulate, petiolules 5 mm. long; *racemes* 1—2 dm. long, 12—15-fld., peduncle woody, terete, 5—10 cm. long, pedicels 3—4 mm. long, bracteoles ovate, minute; *calyx* 6 mm. long, glabrescent; *corolla* reddish-purple, standard ovate-cordate, 12 mm. wide, keel produced in a short spur, slightly falcate not laterally decurved, 3 mm. long; *pod* subcylindric, woody, straight, deeply channelled along both sutures, densely velvety, 12—18 cm. long, 2 cm. wide; *seeds* broader than long, 8 mm. long, 12 mm. wide, sparsely velvety. Phaseolus lucens *Wall. Cat.* 5601 (1830); *Benth. in Pl. Jungh.* 239, footnote (1855). Canavalia lucens *Kurz in Journ. As. Soc. Beng.* xliii. 2. 185 (1874) *and* xlv. 2. 252 (1877). Vigna lucens *Bak. in Hook. f. Flor. Brit. Ind.* ii. 207 (1876). Phaseolus grandis *Herb. Ind. Or. H. f. & T.*, not of *Wall.* nor of *Dalz.*

CHITTAGONG: *Hooker & Thomson!* BURMA: Pegu; *Kurz* 2550! Rangoon; *Cleghorn!* Tavoy; *Gomez!*

PLATE 37.—Dysolobium lucens *Prain.* 1, twig with leaf and unripe fruits from Pegu; 2, twig with ripe pod from Rangoon; 3, seeds,—*all of natural size;* 4, bud; 5, full-sized flower before opening; 6, opened flower; 7, the same dissected, 8; stamens; 9, ovary,—all from a Tavoy specimen and *of natural size.*

D. P.

PLATE 38.

38. DYSOLOBIUM DOLICHOIDES *Prain in Journ. As. Soc. Beng.* lxvi. 2. 427 (1897).

A wide-twining climber with woody pubescent stems; *leaves* 3-foliolate, 1·5—2·5 dm. long, rachis below lateral leaflets 5—12 cm., beyond them about 2 cm. long, leaflets membranous, rhomboid-ovate, obtusely pointed, densely hirsute like the rachis, especially below, lateral 7—8 cm. long, 5 cm. wide, base oblique, terminal 8—10 cm. long, 7—8 cm. wide, stipels 3 mm. long, subulate, petiolules 5 mm. long; *racemes* 5—7 cm. long, 12—20-fld., peduncle terete, pubescent, 1—2 cm. long, pedicels 2—3 mm. long, bracteoles ovate, minute; *calyx* 3 mm. long, adpressed-pubescent; *corolla* reddish purple, standard orbicular-cordate, 1 cm. wide, keel prolonged into a distinct beak; *pod* subtorulose, woody, straight, not channelled along the sutures, densely softly hirsute, 7—8 cm. long, 1·5 cm. wide; *seeds* rather broader than long 6 mm. long, 8 mm. wide. Phaseolus dolichoides *Roxb. Hort. Beng.* 54 (1814); *Flor. Ind.* iii. 290 (1832); *Wall. Cat.* 5600 (1830); *Benth. in Pl. Jungh.* 239 (1855).

Mucuna recta *Wall. Cat.* 5626 (1830). Dolichos dasycarpus *Miq. Flor. Ind. Bat.* i. 1. 186 (1855). Canavalia dolichoides *Kurz in Journ. As. Soc. Beng.* xliii. 2. 185 (1874). Vigna dolichoides *Bak. in Hook. f. Flor. Brit. Ind.* ii. 207 (1876).

Assam: Goalpara, etc.; *Jenkins ! Masters ! Simons !* Silhet; *Wallich ! Hooker & Thomson !* Chittagong: *Clarke !* Burma; Arracan; *Kurz !*

Plate 38.—Dysolobium dolichoides *Prain.* 1, flowering twig; 2, fruiting twig, both from Assam,—*both of natural size;* 3, bud; 4, flower, standard and calyx removed; 5, calyx; 6, standard; 7, ovary; 8, seed.

D. P.

PLATE 39.

39. Dysolobium tetragonum *Prain in Journ. As. Soc. Beng.* lxvi. 2. 427 (1897).

A wide-twining climber with woody pubescent branches and stems; *leaves* 3-foliolate, 1·5—2 dm. long, rachis below lateral leaflets 5—6 cm. long, beyond them about 1—1·5 cm. long, leaflets thick, entire, ovate-lanceolate, prominently veined, densely hirsute like the rachis, all 10—14 cm. long, 2·5 cm. wide, stipels 2·5 mm. long, subulate, petiolules 4 mm. long; *racemes* 3—4 cm. long, 12—20-flowered, peduncle very short, pedicels 1·5 mm. long, bracteoles ovate, minute; *calyx* 2·5 mm. long, pubescent; *corolla* purple, standard orbicular, 7·5 mm. wide, keel hardly beaked; *pod* stout, straight, quadrate in section, 5—6 cm. long, 1·2—1·5 cm. wide, densely softly hirsute, all four angles distinctly winged; *seeds* as broad as long, about 6 mm. across. Psophocarpus, sp. *Bak. in Hook. f. Flor. Brit. Ind.* ii. 212 (1876). Canavalia tetragona *Kurz Mss.* Vigna tetragona *Kurz Mss.*

Bengal: Duars; *Heawood !* Assam: *Masters, G. Mann !*

Plate 39.—Dysolobium tetragonum *Prain.* 1, flowering specimen from N. Bengal; 2, specimen in fruit from Lower Assam; 3, bud; 4, calyx, laid open; 5, flower, laid open; 6, staminal sheath; 7, ovary; 8, the same, opened; 9, ovule,—*all enlarged;* 10, part of opened pod showing the transverse septa; 11, transverse section of pod, showing the wings; 12, seed,—*all of natural size.*

D. P.

PLATE 40.

40. Dioclea reflexa *Hook. f. in Hook. Niger Flora,* 396 (1849).

Natural order Leguminosæ.

A strong woody climber 20—30 feet long, with rounded, black, sparsely setose, early glabrescent branches; *leaves* 3-foliolate, 22—24 cm. long; leaflets dull-green above, paler beneath, subcoriaceous, when young sparsely hairy on both surfaces but early becoming glabrous above and glabrous except for a few adpressed hairs on the nerves beneath, ovate, shortly acuminate, with subtruncate base, 12·5 cm. long, 8 cm. wide, petiole 10 cm. long, channelled above, sparingly adpressed-hirsute; petiolules 6 mm. long, rusty-pubescent, stipels 5 mm. long, subulate, stipules lanceolate 6 mm. long,

deciduous; *inflorescence* in dense subspicate racemes 15 cm. long, on axillary pedunules 20—30 cm. long with 2—3 widely separated empty bracts; rachis rusty-tomentose, flowers 2—3 together on rounded alternate nodes 5—6 mm. apart; bracts 1·25 cm. long, linear, reflexed, rusty-pubescent, early deciduous; *calyx* campanulate, 1 cm. long with 2 small obtuse bracteoles at the base; pedicels 4 mm. long, rusty-puberulous, teeth subequal triangular except the upper rather wide-truncate, half as long as tube; *corolla* pale-pink, 2 cm. long, standard-limb orbicular-emarginate; *pods* few, 1—2-seeded, 8—10 cm. long, 5 cm. wide, 1·25 cm. thick along the upper suture, at first sparsely adpressed-rusty-silky, at length glabrescent; *seeds* discoid, dark-brown, 3 cm. in diam. *Bak. in Hook. f. Flor. Brit Ind.* ii. 196 (1876); *Prain in Journ. As. Soc. Beng.* lxvi. 2. 60 (1897). Dolichos hexandra *Roxb. Hort. Beng.* 55 (1814). D. coriaceus *Grah. in Wall. Cat.* 5562 (1830).

Assam: Silhet. Andamans: very common. Malay Peninsula: Perak, etc.

The vexillary stamen in this species is free at the base but not above; it is rather shorter than the others and bears a perfect anther; the anthers of the 9 stamens forming the sheath are alternately perfect and abortive; there are thus 5 perfect anthers on the sheath and a sixth perfect anther on the vexillary stamen. This structure provided Roxburgh with the excellent specific name that has usually been overlooked. Partly on this account, and partly on account of the interesting characters of the plant, a copy is now given of Roxburgh's original figure.

Plate 40.—Dioclea reflexa *Hook. f.* 1, branch with leaf and inflorescence; 2, inflorescence; 3, tip of young branch; 4, details of flower; 5, pod opened to show seed,—*all of natural size, and all taken from Roxburgh's original Mss. drawing of* Dolichos hexandra.

G. K.; D. P.

PLATE 41.

41. Albizzia Gamblei *Prain in Journ. As. Soc. Beng.* lxvi. 2. 513 (1897).

Natural order Leguminosæ.

A tree 50 feet high; *leaves* 8—10 cm. long, 2-pinnate, pinnæ 4—6 with a large gland 5 mm. above the base of the main-rachis and with large projecting glands on each secondary rachis at the bases of the distal pairs of leaflets; leaflets ovate-lanceolate, acute or subacute, 10—14 on the distal 6—8 on the proximal pinnæ, in all cases decreasing slightly downwards, base cuneate from the middle, 1·5—5 cm. long, 1—2·5 cm. wide, pale-green above, glaucescent beneath, sparsely adpressed-puberulous on both surfaces; stipules minute; *heads* many-flowered, panicled, the ultimate branches of the panicle umbellate; *calyx* 2 mm., campanulate, shortly pedicelled, puberulous externally, teeth minute; pedicels ·5 mm. long; *corolla* 4 mm. long, teeth oblong-lanceolate; *filaments* about 25, 7 mm. long, connate in their lower third; *pod* 15—20 cm. long, 2·5—3·25 cm. wide, thin, rather firm, strap-shaped, the base narrow-cuneate, the tip blunt, pale straw-coloured, very faintly reticulate; *seeds* 6—8, irregularly oval, 10 mm. long, 6 mm. wide, 1·5 mm. thick, testa brown, dull, lateral areola faint. Albizzia Lebbek *Gamble, Trees*, etc., *of Darjeeling Dist.* 33 (1878; Ed. 2, 1896) *not of Benth.* A. procera *Clarke, Journ. Linn. Soc.* xxv. 18 (1889) *not of Benth.*

N.-W. Himalaya: Kangra; *Lace!* E. Himalaya: Sikkim; *Gamble* 161! 7486! 9661! Naga Hills: Kohima; *Clarke* 41480! China: Yunnan, near Mengtze; *Henry!*

This species is not very closely related to either of the species to which it has been referred. It agrees with *A. Lebbek* in colour of pod and in having pedicelled flowers, but its leaves and leaflets are altogether different. With *A. procera* it agrees in having the secondary rachises glandular as well as the main rachis, but its leaflets are different in shape and colour while its flowers and pods in no way resemble those of *A. procera*. The nearest ally of the species is *A. tomentella* Miq. of the Malay Archipelago, which has leaflets similar in size, shape and disposition, but has them densely pubescent and not glaucescent beneath. *A. tomentella* has moreover several glands, in place of a single one, on each secondary rachis and has a broader brown pod very differently reticulated.

PLATE 41. Albizzia Gamblei *Prain*. 1, twig from a tree at Phulsering, Darjeeling, 4,000 feet (*Gamble* 9661), in flower, *of natural size;* 2, bud; 3, calyx; 4, corolla; 5, staminal column; 6 and 7, ovary—from the same specimen, *all much enlarged;* 8, twig from a tree above Punkabari, 2,500 feet (*Gamble* 161), in fruit; 9, seed, from the same specimen—*both of natural size.*

D. P.

PLATE 42.

42. ALBIZZIA RICHARDIANA *King & Prain.*

Natural order Leguminosæ.

A tree 80 feet high; *leaves* 6—8 cm. long, 2-pinnate, pinnae 10—14 with a small gland 10 mm. above the base of the main-rachis and another between the bases of the distal pair of pinnae, the pinnae intermediate between the distal and proximal pairs occasionally only subopposed, the tips of main-rachis and of secondary rachises slightly prolonged beyond ultimate pinnae and leaflets; leaflets linear, all slightly curved forwards and decreasing upwards, close-set, 54 on proximal to 100 on distal pinnae, dark-green, glabrous on both surfaces finely sparsely puberulous on the margins, firm midrib removed one-third from anterior subconcave margin, hardly visible above, more distinct beneath as are a few looped veins and two secondary basal nerves on the wider posterior subconvex side, 7 mm. long, 1 mm. wide, base cuneate anteriorly, subauriculate behind, apex subacute, main and secondary rachises finely closely puberulous; stipules linear small; *heads* many-fld., in small rather few-headed panicles, from one-fourth to one-third as long as the leaves, with puberulous main-rachis 1·5—5 cm. and slender peduncles 6 mm. long, the latter with puberulous lanceolate basal bracts 3 mm. long; *calyx* tubular-campanulate, subsessile, green, puberulous externally, 1 mm. long, teeth minute; *corolla* white, 3 mm. long, teeth lanceolate half as long as tube; margins of teeth finely sparsely puberulous, corolla elsewhere glabrous; *filaments* about 25—30, all united in their lower two-fifths and further shortly connate in 5 phalanges of 5—6 filaments each; *pod* 10—12 cm. long, 2 cm. wide, thin, very firm, strap-shaped, the base narrow-cuneate the tip rounded with an abrupt point, the margins somewhat thickened, dull-brownish-grey, hardly visibly reticulate; *seeds* 10—12, oval, testa olive-green, somewhat shining, 6 mm. long, 3 mm. wide, 1 mm. thick, lateral areola very faint. Gagnebina Richardiana *Wall. ex Voigt in Hort. Suburb. Calcutt.* 257 (1845). Albizzia paludosa *T. And. Cat. Pl. Roy. Bot. Gard. Calcutta* 18 (1865).

Cultivated in the Royal Botanic Garden, Calcutta, since 1841; native of Madagascar.

The seeds, sent by Mons. Richard, were received by Dr. Wallich on 20th January, 1841, with the note "Gagnebina spec. Bel arbre de Madagascar." In his manuscript Catalogue Dr. Wallich gave the tree the manuscript name *Gagnebina Richardiana* Wall., which name was duly published by Voigt in the *Hortus Suburbanus Calcuttensis*. This name was however subsequently lost sight of and the origin of the tree forgotten, for Dr. T. Anderson in his *Catalogue* has used the name *Albizzia paludosa*, and has indicated that to him the native country of the tree was unknown. In a subsequent *Catalogue* issued by Dr. G. Henderson the double error is made of citing as the author of the species Mr. Bentham, who probably never saw a specimen, and giving as its native country Mexico, where no *Albizzia* is indigenous This species is evidently near, yet is obviously different from, *A. polyphylla*, a Madagascar plant described by Fournier in *Ann. Sc. Nat.* ser. iv. xiv. 372 (1860) and indeed is rather to be referred to Fournier's group *Falcifoliatae* than to the *Microphyllae* within which *A. polyphylla* is placed. To the kindness of M. Drake del Castillo we are indebted for a comparison of *A. paludosa* with another Madagascar plant tentatively named *A. Bernieri* (Bernier n. 162) *loc. cit.*, a name omitted from the excellent *Index Kewensis*. We have deemed it best, in view of the confusion that has taken place, to conserve the oldest specific name.

PLATE 42.—Albizzia Richardiana *King & Prain*. 1, twig from tree in flower,—*of natural size*; 2, single leaflet, from above and from beneath, × 3; 3, single flower; 4, calyx, laid open; 5, corolla, laid open; 6; staminal tube, laid open; 7, ovary; *3—7 all much enlarged*; 8, twig from same tree in fruit,—*of natural size*; 9; seed,—*of natural size*.

FRONTISPIECE. Albizzia Richardiana in Royal Botanic Garden, Calcutta,—from a photograph by J. H. LACE, Esq., F.L.S.

G. K.; D. P.

PLATE 43.

43. PIPTADENIA OUDHENSIS *Brandis, For. Fl.* 168 (1874).

Natural order Leguminosæ.

A small or medium-sized tree, glabrous except the inflorescence; bark of stem and older branches greyish- or reddish-brown, rough with flat exfoliating woody scales; inner-bark red, fibrous; branches armed with large compressed conical prickles; branchlets drooping; *leaves* abruptly bipinnate; pinnae 4, long-stalked, each of a single pair of leaflets; primary and secondary petioles with a large flat circular gland at the base of each pair of pinnae; leaflets 5—10 cm. long and 4—9 cm. broad, on short, stout, transversely wrinkled stalks, obovate-rhomboid or reniform, entire, subcoriaceous; veins prominent on both surfaces, anastomosing and forming loops within the margin; *flowers* greenish-yellow, sessile or nearly so, in dense cylindric spikes 2·5 to 7·5 cm. long and arranged in short axillary panicles shorter than the leaves; *calyx* 2 mm. long, campanulate, nearly truncate, with 5 short teeth; *petals* 5, three times longer the calyx, lanceolate, fleshy; *stamens* free, slightly exserted; filaments attached to the outer basal edge of an annular disc; anthers dorsifixed, broadly oval, terminal glands globose; *ovary* stalked; style filiform, overtopping the stamens, stigma cupular; *pod* stalked, 2—3 dm. long and about 1 cm. broad; *seeds* 15—20, broadly oval, compressed, brown. *Benth. in Trans. Linn. Soc.* xxx. 366 (1875); *Bak. in Hook. f. Fl. Br. Ind.* ii. 289 (1876).

N.-W. India: Oudh, Gonda; *R. Thompson, Inayat Khán.* E. Kamaon, at 1,200 ft. elev.; *Brown.* Nepal; *Inayat Khán.*

This very local tree was first discovered in 1871 by Mr. Richard Thompson in the forests of the northern portion of the Gonda district in Oudh. It has been found also by Mr. Brown, of the Indian Forest Service, in Eastern Kumaon, at an elevation of 1200 feet. Flowering and fruiting specimens have recently been obtained from the Gonda locality, and from the adjacent hilly portion of Nepal, by Inayat Khán, the head plant-collector of the Botanical Department of N. India.

The trunk of the largest specimens seen by Inayat Khán measured $3\frac{1}{2}$ feet in circumference. The large characteristic prickles were found only on the branches, and not on the trunk. The tree is very abundant on the banks of streams within the Nepal territory. The genus *Piptadenia* contains about 40 species, all of which, except the above and one in New Guinea, inhabit tropical regions of America and Africa.

Plate 43.—Piptadenia oudhensis *Brandis.* Portions of foliage, flowering and fruiting branches,—*of natural size.* Fig. 1, a single flower; 2, ditto, *laid open*; 3, calyx, *laid open*; 4, stamen, *front view*; 5, ditto, *back view*; 6, pistil,—*all enlarged.*

J. F. D.

PLATES 44, 45.

Pahudia *Miq., Flor. Ind. Bat.* i. 1. 85 (1855).

Natural order Leguminosæ.

Trees; *leaves* abruptly pinnate; leaflets few, paired, chartaceous; flowers racemose, in sessile or peduncled terminal panicles; stipules, bracts and bracteoles caducous; *calyx* elongated, the tube lined by the disk, the limb 4-lobed, lobes coriaceous, decussately imbricate; *petal* solitary, short-clawed, posterior, the others rudimentary or absent; *stamens* 7, declinate, united in a declinate sheath split above, filaments free above, unequal, often with 2 small staminodes at the base of the sheath; *ovary* stipitate, the stipe adnate to calyx-tube; style filiform, stigma small, terminal; pod obliquely oblong, 2-valved, valves thickly woody, base rounded, septate between the seeds and lined with a thin spongy pulp; *seeds* more or less compressed transversely, ovate or oblong, with a large basal arillate strophiole; testa crustaceous, albumen 0; cotyledons thick fleshy, radicle inferior, short, straight. Species 3, Malayan and Indo-Chinese.

A very distinct genus, based by Miquel (*Flor. Ind. Bat.* i. 1. 85) on a plant first collected by Horsfield in Java, and very well characterised by its author in the original definition. Unfortunately Miquel added, as a second species (*l. c.* 1080), *P. Hasskarliana* based on Hasskarl's description of *Jonesia monopetala* in *Retzia* i. 199. Kurz (*Journ. As. Soc. Beng.* xlv. 2. 290) pointed out (1876) that Hasskarl's plant could not be a *Pahudia;* he wished, however, to transfer it to the American genus *Macrolobium*, which is neither necessary nor possible, because *Jonesia monopetala* Hassk. is apparently specific with *Jonesia triandra* Roxb. and is probably, as has been pointed out by Koorders and Valeton, *Bijdr.* 2. 27 (1895) the same thing as *Afzelia bijuga* A. Gray. Koorders and Valeton while removing from the genus the plant of Hasskarl, wish, however, to refer to it another species, *Afzelia coriacea* Bak. (Intsia coriacea *Maing.*); this latter species is in reality a *Sindora* [S. coriacea *Prain, Journ. As. Soc. Beng.* lxvi. 2. 206 (1897)].

Baillon [*Hist. des Plantes* ii. 112 (1869)] would reduce *Pahudia* to *Afzelia* § *Intsia*, a proposal that, with our fuller knowledge of the genus *Pahudia*, it is not now possible to entertain. Taubert in Engler's *Naturlich. Pflanzenfam.* iii. 3. 141 (1894) has failed to notice that *P. Hasskarliana* does not belong to this genus.

Kurz in *Journ. As. Soc. Beng.* xlv. 2. 290 (1876) and *For. Flor. Brit. Burm.* i. 413 (1877) founded and described a second species of *Pahudia* (*P. xylocarpa*) on a Siamese plant collected by Teysmann. There is no doubt whatever that Kurz's species really belongs to Miquel's genus, though neither Taubert nor Koorders and Valeton allude to its existence.

The existence of a third species of the genus has now to be recorded and the necessity for providing a suitable diagnosis for this species renders it advisable at the same time to emphasise the existence of Kurz's species and, if possible, to establish the validity of Miquel's genus. Through the kindness of Mr. Willis, Director of the Royal Botanic Garden, Peradeniya, who has generously presented the Calcutta Herbarium with a copy of a drawing from life of *P. javanica*, it is possible to publish an accurate figure of that species; on another plate a leaf and pod of *P. xylocarpa* and of *P. martabanica* respectively are given for purposes of comparison.

Key to the species.

Funiculus arillately prolonged in front and behind on the slightly antero-posteriorly compressed seed	*P. javanica.*
Funiculus arillately cupular with margin horizontal under the seed:—	
Seed much compressed laterally	*P. xylocarpa.*
Seed slightly compressed antero-posteriorly	*P. martabanica.*

D. P.

PLATE 44.

44. Pahudia javanica *Miq.*, *Flor. Ind. Bat.* i. 1. 86 (1855).

A tall unarmed tree, in habit like *Pterocarpus indicus*, with puberulous branchlets; *leaves* 15--20 cm. long; leaflets 4—5-jugate, opposite or the lower pairs subopposite only, ovate or oblong, subequal-sided, base rounded or slightly cordate, apex obtuse or abrúptly shortly apiculate, margin entire, main-nerves 7—8 pairs hardly more prominent than the distinct secondary reticulations, glabrous above, beneath somewhat pubescent especially on the rather prominent midrib, 4—8 cm. long, 2·5—4·5 cm. wide, petiolules puberulous 2—3 mm. long, petiole below lowest leaflets 2—2·5 cm. long; stipules connate at the base between the leaf-stalk and branch, subulate, pubescent and ciliate, deciduous above, their common base persistent, 6 mm. long; *racemes* 5—8 cm. long, usually sparingly panicled, rachis strict, hoary-puberulous, bracts elliptic caducous; *flowers* articulate with the very short pedicels, bracteoles opposite, elliptic, puberulous, herbaceous; *calyx* hoary externally, pubescent within, the segments rounded concave; *petal* red, cordate at the base, acute, about as long as inner and as broad as the outer sepals; *stamens* 4 cm. long, the free filaments rather shorter than the sheath *ovary* densely villous, stipe nearly 1 cm. long, style 5 cm. long; *pod* 7·5—13 cm. long, 6—7 cm. wide, 4 cm. thick, glabrous, 3—8-seeded; *seeds* slightly compressed antero-posteriorly, 28—33 mm. long, 13 mm. wide, 16—22 mm. thick, arillate funicle somewhat

prolonged anteriorly and posteriorly on the seed. *Kurz, Journ. As. Soc. Beng.* xlv. 2. 289 (1876); *Koord. & Valet. Bijdr.* 2. 28 (1895). Intsia puberula *Miq., Flor. Ind. Bat. Suppl.* 290 (1860).

Malay Archipelago: Java, Samarang, etc.; *Horsfield* 147! *Koorders* 4,151! 4,153! 14828!

Plate 44.—Pahudia javanica *Miq.* 1, flowering branch; 2, outline of pod; 3, pod opened to show seeds; 4, seed, seen from one side; 5, the same seen from the other side; 6, seed cut transversely about the middle; 7, seed cut longitudinally,—all from life, and *all of natural size; from a tree grown in* Hort. Peradeniya.

D. P.

PLATE 45A.

45. Pahudia xylocarpa *Kurz in Journ. As. Soc. Beng.* xlv. 2. 290 (1876).

A tall unarmed tree with pruinose branchlets; *leaves* 7—12 cm. long; leaflets, 2—4-jugate, opposite or the lower pairs subopposite only, wide-ovate, subequal-sided, base rounded or slightly cordate, apex obtuse or shortly bluntly acuminate, margin entire, main-nerves 5—6 pairs hardly more prominent than the distinct secondary reticulations, quite glabrous on both sides and slightly glaucescent beneath, midrib rather prominent, 7—8 cm. long, 5—6 cm. wide, petiolules 3 mm. long, quite glabrous as is the main-rachis, petiole below the lowest leaflets 2·5—3 cm. long; stipules connate at the base between leafstalk and branch, subulate, glabrous and deciduous above, their connate bases sparsely pubescent, persistent, 4 mm. long; *racemes* 5—8 cm. long, very sparingly panicled or simple, rachis strict, hoary-puberulous, bracts orbicular, caducous, 6 mm wide, sparsely pubescent; *flowers* articulate with short stout pedicels, bracteoles opposite, shortly ovate, puberulous, herbaceous; *calyx* hoary externally and internally, the segments shortly oblong, concave; *petal* ovate, acute; *ovary* densely villous; *pod* 10—12 cm. long, 6—7 cm. wide, 4 cm. thick, glabrous, 2—3-seeded; *seeds* much compressed laterally, 33 mm. long, 25 mm. wide, 15 mm. thick, arillate funicle at base of seed regularly cupular with a horizontal margin. *Kurz, For. Flor. Brit. Burma*, i. 413 (1877); *Prain, Journ. As. Soc. Beng.* lxvi. 2. 494 (1897).

Indo-China: Siam; *Teysmann!* Shan Hills; *King's Collector!*

The different foliage at once distinguishes this species from *P. javanica.* The inflorescence and the pods are, however, very similar, but the seeds have a quite different funiculus.

Plate 45A.—Pahudia xylocarpa *Kurz.* 1, twig with leaf and pod; 2, seed, side view; 3, seed seen from anterior edge; 4, transverse section of seed,—*all of natural size.*

D. P.

PLATE 45B.

46. Pahudia martabanica *Prain in Indian Forester*, xxvi. 312 (1900).

A tall unarmed tree, in habit like *Pterocarpus macrocarpus*, with glabrous branchlets; *leaves* 20—24 cm. long; leaflets usually 4-jugate, opposite, oblong or obovate, distinctly unequal-sided, base cuneate or rounded, apex obtuse or emarginate, margin entire,

main-nerves 4—5 pairs distinctly more prominent on both sides but especially beneath than the secondary reticulations, quite glabrous on both surfaces, somewhat glaucescent beneath, 10—12 cm. long, 6—7 cm. wide, petiolules 4 mm. long, quite glabrous as is the main-rachis, petiole below lowest pair of leaflets 3 cm. long; *pod* 20 cm. long, 8·5 cm. wide, 5 cm. thick, glabrous, 8—10-seeded; *seeds* cylindric or quadrate or slightly compressed antero-posteriorly, 36—40 mm. long, 16—18 mm. wide, 16—22 mm. thick, arillate funicle at base of seed regularly cupular with a horizontal margin.

INDO-CHINA: Tenasserim, between Sinbyudine and Aungthawara; *Hearsey !*

This fine tree is known to the Burmese as Pyin Padouk, "but it is neither the one nor the other. The trees attain a girth of 10 feet and logs of 20 feet or more in length can be obtained. The seeds when fresh and bright are worn as necklaces by the wild Siamese on the border."

The quotation is from a letter written by Mr. Hearsey, Extra Assistant Conservator of Forests, S. Tenasserim Division. The leaves and pod sent by Mr. Hearsey are unfortunately detached. These leaves have all the appearance of *Pahudia* or *Intsia* leaves. The pod and seeds are undoubted those of a *Pahudia* and the characters of that pod and particularly of its seeds indicate that the tree is specifically distinct from the other two species.

The seeds make this species intermediate between *P. xylocarpa* Kurz and *P. javanica;* it differs however, (if the leaves here described belong to the pod, and there is little room for doubt that they do) in foliage; it differs still more in the seeds; instead of being laterally compressed, these are either cylindric or subquadrate or if compressed have their shorter diameter parallel to the axis of the pod.

PLATE 45B.—Pahudia martabanica *Prain.* 5; leaf; 6, half of a pod; 7, seed, seen from side; 8, seed, seen from anterior edge; 9, transverse section of seed,—*all of natural size.*

D. P.

PLATE 46.

LEUCOSTEGANE, *Prain.*

Natural order Leguminosæ.

Trees; *leaves* abruptly pinnate, stipellate; stipules large, foliaceous, intrafoliar, connate; pedicels bracteate; *calyx* 2-bracteolate, infundibuliform with somewhat fleshy tube, limb 4-partite, lobes obtuse, imbricate, reflexed in flower; *petals* small, much shorter than calyx-lobes, 2, inserted in calyx-throat between upper and lateral sepals, the upper if present a staminode-like process; *stamens* only 2 perfect, opposite the lateral sepals, with large ovoid anthers, decurved plicate in bud, dehiscing longitudinally and with two erect short sterile staminodia between and above the fertile stamens; *ovary* stipitate, exserted, oblong, the stipe adnate to calyx-tube, style filiform, circinate in bud, stigma oblique; *pod* oblong, compressed, apiculate.—Species one, Malayan.

The species on which this genus is founded is a small tree discovered by Mr. H. N. Ridley of Singapore and referred by him in the field to *Saraca.* The presence of two small petals with what appears to be the rudiment of a third, makes this generic position impossible. It is nevertheless very nearly related in other respects to *Saraca,* though it differs in having stipellate leaflets. It also, as regards its

perfect stamens, remarkably resembles the Chinese genus *Lysidice* Hance, with which it obviously has considerable affinity though not sufficiently close to admit of the two being considered congeneric.

D. P.

47. Leucostegane latistipulata *Prain.*

A small tree with slender leafy pubescent branches; *leaves* 20 cm. long, rachis puberulous, leaflets 6-jugate, rigidly coriaceous, ovate-lanceolate, apex acuminate, base somewhat obliquely rounded, 11—15 cm. long, 4 cm. wide, dark-green, dull glabrous above, pubescent on the midrib beneath and puberulous along the margins, petiolules 4 mm. long, pubescent, stipels small, subulate, persistent, pubescent; stipules large, foliaceous, each with a strong midrib, ovate, acute, auriculate at base on their outer free margin, connate between petiole and branch for one-third their length on the inner margin, from 1·25—4 cm. long, from ·75—2·5 cm. wide, usually slightly unequal; *flowers* in few-flowered cymes, sometimes reduced to single pedicels, clustered on rugose woody nodes along thick old branches, under 2 cm. long, with ovate-lanceolate, persistent basal bracts and with 2 subopposite, amplexicaul, triangular, persistent bracteoles midway between bract and calyx-tube, pedicels and bracteoles puberulous; *calyx* white, tube cylindric, 4 mm. long, shorter than the limb of 4 narrow, oblong lobes, pubescent on margin at tips; *petals* small, 2 latera, ovate, acute with truncate base and very short claw, posterior very minute; *stamens* 2 with two rudimentary posterior short staminodes, anthers nearly twice as long as broad, filaments in fully opened flowers twice as long as calyx-lobes, pink; *ovary* pubescent along the margins; *pod* oblong, obliquely obtuse at the apex with a rather prominent beak, obliquely rounded at base, 5 cm. long, 2·5 cm. wide. Saraca latistipulata *Prain, Journ. As. Soc. Beng.* lxvi. 2. 217 (1897).

Malayan Peninsula: Perak, Dindings at Lumut; *Ridley* 3089! 8006!

Plate 46.—Leucostegane latistipulata *Prain.* 1, portion of branch from Lumut, Dindings; 2, portion of old branch with flowers; 3, aestivation of *Lysidice rhodostegia* Hance, for comparison with 4, aestivation of *Leucostegane latistipulata;* 5; bud; 6, young flower, opened; 7, young flower dissected; 8, 9, young stamens from side and front; 10, ovary; 11, pod.

In *Icones Plantarum* t. 1192, Oliver describes the petals of *Lysidice rhodostegia* as remarkable for their convolute aestivation. In twenty flowers of *Lysidice* examined the aestivation found has been as shown in Plate 46, fig. 3.

D. P.

PLATE 47.

48. Crudia Curtisii *Prain in Journ. As. Soc. Beng.* lxvi. 2. 221. (1897).

Natural order Leguminosæ.

A tall tree 80—150 feet high, with spreading crown and densely grey-pubescent branchlets; stem 2—3 feet thick; *leaves* odd-pinnate, rachis 3—4 in. long, petiole articulate on an auricled node with an interpetiolar 2-lobed stipule, leaflets 7—9, alternate, with petiolules 6 mm. long, closely puberulous like the rachis, obovate to oblong, base slightly obliquely rounded or cuneate, apex rounded or tapering to a bluntly caudate tip,

5—9 cm. long, 2·5—4 cm. wide, membranous, green and glabrous above, paler and uniformly sparsely puberulous beneath, lateral nerves ascending, prominently looped within the margin, secondary reticulations indistinct; *flowers* in rather lax, narrow racemes at the ends and bases of new leafy shoots, 1—1·5 dm. long, with angular, densely grey-pubescent rachis; pedicels very slender, at length 1·5 cm. long, grey puberulous, with a caducous subulate bracteole about the middle; buds oblong, 4 mm. long; *calyx*-tube very short, lobes 4, imbricate, reflexed in flower, sparsely pubescent externally, glabrous within; *petals* 0; *stamens* 10, filaments glabrous, free, alternately long and short, anthers broadly oblong, versatile; *ovary* stipitate, densely grey-downy, 1—2-ovuled stalk glabrous longer than the calyx-tube, style glabrous incurved; *pod* oblong, obliquely rounded at base, subequally rounded and apiculate at tip, rusty-puberulous, rather distinctly reticulate, 8 cm. long, 5 cm. wide, 1·25 cm. thick, valves very firmly coriaceous; *seed* solitary, oblong, 3 cm. long, 2·75 cm. wide, ·5 cm. thick.

Malay Peninsula: Penang; *Curtis!* Malacca; *Derry!* Perak; *Kunstler!*
The Malay name in Malacca is given as *Kumpas ruman.*

Plate 47.—Crudia Curtisii *Prain.* 1, flowering branch; 2, twig with fruits—*of natural size;* 3, bud; 4, opened flower; 5, ovary—*all enlarged.*

D. P.

PLATE 48.

49. Rubus fasciculatus *Duthie.*

Natural order Rosaceæ.

An eglandular sarmentose shrub; stems angular, shaggy with long reddish-brown spreading weak bristles mixed with a shorter coating of white downy pubescence; prickles few, stout and somewhat compressed at the base, straight or slightly curved; *leaves* 3-foliolate; petioles 2—3 cm. long, bristly; stipules 15 mm. long, subulate; leaflets thin, cartilaginous, dark-green above and slightly paler beneath, more or less abruptly acuminate, doubly serrate, smooth on both surfaces except on the midrib and veins beneath, the lower portion of the midrib bearing scattered curved prickles and bristles; veins 8—10 pairs, impressed above and prominent beneath; terminal leaflet usually much larger than the basal pair, 8—12 cm. long by 3·5—9 cm. in breadth, its stalk often as long as the common petiole, broadly ovate or obovate, more or less abruptly acuminate, rounded at the base; basal leaflets shortly stalked, suborbicular or oblong, rhomboid; *flowers* in dense terminal or axillary clusters or solitary in the leaf-axils; bracts ovate-lanceolate, equalling the short bristly pedicels; *calyx* velvety pubescent on both sides, more or less bristly outside; lobes 7—8 mm. long, ovate, mucronate, brownish-green with pale margins; *petals* about 8 mm. long, spathulate, white, their claws clothed with long silky hairs on the outside; *stamens* in one series, shorter than the calyx-lobes; filaments dilated; anthers oval, attached to the summit of the filament by a minute slender stalk *fruit* globose, succulent, golden-yellow; drupes on a clavate, hispid receptacle; styles longer than the carpels, bristly towards the base; *stone* rugose.

Western Himalaya: in damp shady ravines leading into the Tons Valley, in Tehri-Garhwál, at an elevation of about 6,000 feet; also at Chakrata and near Mussoorie, in similar situations.

Amongst Indian brambles this plant most resembles *R. ellipticus* Smith; but it may at once be distinguished by the colour and texture of its foliage, the abruptly acuminate leaflets, and the very different inflorescence. The drawing was made from a specimen collected in the Bámsu Valley in Tehri-Garhwál, where I have never observed the fruit becoming succulent, the carpels always remaining dry like achenes, and the styles persistent.

PLATE 48.—Rubus fasciculatus *Duthie*. Portions of plant, *of natural size*. Fig. 1, flower seen from above; 2, side-view of a flower at a later stage; 3, vertical section of a flower; 4, calyx laid open to show the stamens and receptacle; 5, petal; 6, stamen; 7, ripe fruit (from a Mussoorie specimen); 8, ripe achene-like carpel (from a Bámsu Valley specimen); 9, stone of succulent carpel; 10, seed—*all enlarged*.

J. F. D.

PLATE 49.

50. POTTINGERIA ACUMINATA *Prain in Journ. As. Soc. Beng.* lxvii. 2. 291 (1898).

Natural order Saxifragaceæ.

A shrub, with round glabrous slender branches; *leaves* alternate, ovate-acuminate, rigidly coriaceous, glabrous on both sides and punctate beneath, entire, 5—9 cm. long, 2—4 cm. wide, 5-nerved from the base, the marginal pair very slender the others almost as strong as the central, petioles about 5 mm. long; *flowers* in many-flowered, axillary cymes 4—5 cm. long, 2·5 cm. wide, pedicellate, the pedicels 4 mm. long, jointed above the middle and with ovate-acute bracteoles 2 mm. long at the base; *calyx*-tube short, wide-campanulate, adnate to the base of the ovary, 1·5 mm. long, teeth 5, ovate-acute, almost as long as tube, the sinuses wide, rounded; *petals* 5; *stamens* 5, erect, attached to the edge of the perigynous disk, filaments subulate upwards somewhat explanate at the base where each has a median gland on its outer aspect; *ovary* half-superior; *capsule* 5 mm. long, 3·5 mm. wide, superior, oblong, longitudinally slightly 3-grooved, septicidally 3-valved, the style and central axis partible from the base almost to the coherent stigma; placentas fertile only for about one-third, from the middle upwards, and only there contiguous; *seeds* narrowly fusiform, testa crustaceous, slightly reticulated, somewhat prolonged at both ends; embryo cylindric, rather large, in the centre of the fleshy albumen. *Sc. Mem. Med. Off. India* xi. 43 (1898).

KACHIN HILLS: Chesyan, 3700 ft.; *Pottinger!*

This species has been made the type of a new genus of *Saxifragaceae*, in the tribe *Escallonieae* near *Itea*, which it resembles in having a similarly partible style with a similarly half-superior ovary. It differs markedly, however, from *Itea* in having 3 carpels in place of 2 and in the capsule when dehiscing leaving the three filiform placentas persistent. The leaves too, which are like those of a *Cinnamon*, or of a *Melastomaceous* plant, give the plant a facies of its own.

Unfortunately the only specimen brought by Capt. Pottinger has been collected just as the plant was passing out of flower; the petals and anthers have all dropped and though the scars left show that there are 5 petals it is at present impossible to say whether they are imbricate or valvate.

PLATE 49.—Pottingeria acuminata *Prain*. 1, branch;—*of natural size*; 2, capsule, with valves commencing to dehisce, showing persisting placentae, persisting filaments, jointed pedicel and

bracteole × 10; 3, calyx, with persisting filaments, the carpels completely removed × 10; 4, filament removed, seen from outside and showing basal gland × 10; 5, filament, from within × 10; 6, segment of calyx tube, showing attachment and relative position of the placentae after removal of the valves × 10; 7, single placenta, seen from without × 10; 8, the same, central aspect × 10; 9; floral diagram, the petals being unknown are indicated by dotted lines, the ovary is shown in the lower sterile part; 9, ovary in the upper fertile part; 10; seed, from behind × 20; 11, seed, from side × 20; 12, vertical section of seed × 20.

D. P.

PLATE 50.

51. Terminalia bialata *Steud. Nomencl.* ii. 668 (1821).

Natural order Combretaceæ.

A glabrous tree, 80—100 feet high; young branches stout and with large cicatrices; *leaves* crowded at the apices of the branches, alternate, thinly coriaceous, obovate or obovate-oblong, with long petioles, the apex abruptly and shortly cuspidate, narrowed from above the middle to the cuneate and usually oblique base; upper surface shining when dry, the lower dull and paler; the reticulations rather distinct on both sides; main-nerves 7—9 pairs, spreading, rather distinct on both surfaces when dry; length 15—18 cm.; breadth 7—11 cm.; petioles 6—7 cm. long; *spikes* axillary, drooping, solitary, longer than the petioles but rather shorter than the leaves, rusty-puberulous; *flowers* 5 mm. in diam., sessile, the male flowers in the upper part, the hermaphrodite flowers in the lower, each with a minute deciduous bracteole; *calyx* rusty-pubescent outside, densely rusty-villous within, the lobes triangular, reflexed; *stamens* exserted; *ovary* villous; *fruit* ellipsoid, tapering to each end, somewhat flattened on one side, covered with minute dense rusty tomentum and with large, slightly wavy, coriaceous, puberulous, horizontally striate lateral wings; length of fruit 3·5—4·5 cm., breadth of body 1·25—2 cm., the wings 3—4·5 cm. wide. *Kurz, For. Flor. Brit. Burma* i. 45 (1877); *Clarke in Hook. f. Flor. Brit. Ind.* ii. 449 (1878); *King, Journ. As. Soc. Beng.* lxvi. 2. 332 (1897). Pentaptera bialata *Roxb. Hort. Beng.* 34 (1814); *Wall. Cat.* 3986 (1830); *Roxb. Flor. Ind.* ii. 441 (1832).

Andaman Islands: common. Burma: Tenasserim.

This fine species, though provided with 2 lateral wings of the nature of the wings present in the fruits of species of *Terminalia* § *Pentaptera* is really, as Mr. Clarke has pointed out, more nearly allied to § *Catappa* than to the *Pentapteras*. As no figure of the species has ever been published the present opportunity is taken to reproduce the unedited drawing of the plant left by Dr. Roxburgh in the Calcutta Herbarium Collection.

Plate 50.—Terminalia bialata *Steud.* 1, flowering branch; 2, ripe fruit; 3, the same, cut transversely,—*of natural size;* 4, male flower; 5, hermaphrodite flower,—*both slightly enlarged.*

G. K.

PLATE 51.

52. Terminalia Manii *King in Journ. As. Soc. Beng.* lxvi. 2. 379 (1897).

Natural order Combretaceæ.

A tree 20—40 feet high; young shoots slender, deciduously rusty-puberulous, lenticillate; *leaves* thinly coriaceous, almost opposite, not crowded, scattered, elliptic or ovate,

shortly and rather abruptly acuminate, the base rounded or somewhat cuneate and slightly oblique; both surfaces glabrescent or glabrous, minutely reticulate, the reticulations on the lower surface tesselate, main-nerves 9—12, rarely 14 pairs, spreading, curving upwards at the tips; length 8—16 cm., breadth 5—8 cm., petiole 2 cm. long often with 2 sessile oblong glands at the side near the apex; *panicles* lateral and terminal, with numerous spike-like, rusty-puberulous, ultimately glabrous branches shorter than the leaves when in flower, longer when in fruit; *flowers* 4 mm. in diam. at the mouth, each subtended by a linear puberulous bracteole as long as itself; *calyx*-tube narrow, cylindric, thickened and pubescent towards the base, the upper half and the mouth glabrous outside; the mouth cupular with inconspicuous, broad, shallow teeth, woolly inside; *stamens* exserted, glabrous; *fruit* oblong, tapering a little to each end, slightly compressed on one side, obscurely 5-ridged, quite glabrous, 1·5—2 cm. long, ·75—1 cm. in diam.; pericarp crustaceous, hard, thick.

NICOBARS: *King's Collectors!* ANDAMANS: *King's Collectors!*

The nearest ally of this species is probably *T. citrina* Roxb.; it is named in slight recognition of the great assistance for many years afforded to the Calcutta Garden by Mr. E. H. Man, C.I.E., of the Andamans Commission.

PLATE 51.—Terminalia Manii *King*. 1, flowering branch; 2, fruiting twig; 3, fruit; 4, the same cut transversely,—*all of natural size;* 5, bud; 6, opened flower; 7, calyx-mouth, laid open to show staminal insertion; 8, stamens; 9, ovary, split open; 10, ovule,—*all enlarged.*

G. K.

PLATE 52.

53. HEPTAPLEURUM HULLETTII *King in Journ. As. Soc. Beng.* lxvii. 2. 54 (1898).

Natural order Araliaceæ.

A small tree, 10—15 feet high; branches stout, rugulose, deciduously pubescent; *leaves* large, digitate, the common petiole terete, glabrous, 2·5—6 dm. long; leaflets 7—11, coriaceous, oblong or elliptic-oblong, occasionally somewhat broader in the upper than in the lower half, shortly and abruptly acuminate, slightly narrowed to the rounded base, both surfaces glabrous, not reticulate, the midrib prominent; main-nerves 5—8 pairs, distant, slightly curved and ascending, prominent on the lower surface when dry, obsolete on the upper; length 1—3 dm., width 4—8 cm.; petiolules 3—9 cm. long, slender, glabrous; *panicles* 2—3 dm. long, terminal, several together, long and narrow, with short, horizontal, slender branches from 1·25—2·5 cm. long, bearing terminal, 8—12-fld. umbels of small, 6-merous, subglobular flowers 2·5 mm. in diam.; *fruit* elliptic, 6-ridged, 6-celled, crowned by the 6 short distinct styles, glabrous, the pedicels 6—7·5 mm. long.

MALAYAN PENINSULA: Singapore; *Ridley! Wray! Kunstler!* Johore; *King and Hullett!*

A species much resembling *H. divaricatum* Miq., but with leaflets that have fewer nerves and show no reticulations, with much longer panicles and a narrower fruit. It is also allied to *H. longifolium* Seem., but the leaves of that species have many more main-nerves and the panicles are densely clothed with broad scale-like hairs and have longer lateral branchlets.

PLATE 52.—Heptapleurum Hullettii *King*. 1, flowering twig with leaf; 2, fruiting panicle, both from Singapore,—*both of natural size;* 3, flower unopened; 4, flower opened, from outside; 5, the same from above; 6, stamens; 7, fruit; 8, the same, cut transversely; 9, styles, seen from above; 10, seed.

G. K.

PLATE 53.

54. Heptapleurum Ridleyi *King in Journ. As. Soc. Beng.* lxvii. 2. 54 (1898).

Natural order Araliaceæ.

A scandent shrub, young branches stout, glabrous; *leaves* digitate, common-petiole terete, glabrous, 12—24 cm. long, leaflets 5, very coriaceous, oblong, oblong-elliptic or oblanceolate-oblong, acute, slightly narrowed at the base; the edges entire, very slightly revolute when dry; both surfaces glabrous, the reticulations faint when dry; main-nerves very slightly prominent on the lower surface, about 8 pairs, spreading, the intermediate nerves almost as conspicuous; length 10—16 cm., width 5—7 cm., petiolules unequal, 2—6 cm. long; *panicle* terminal, glabrous, 12—15 cm. long, with several spreading branches; the branchlets few, about 1·25 cm. long, each bearing an umbel of 10—20 globular flowers 4 mm. in diam.; *calyx*-tube short, wide-campanulate, the limb narrowed and truncate; *petals* 5, elliptic, glabrous; *fruit* ovoid, somewhat succulent, smooth, faintly 6-ridged, 6 mm. long, 6-celled.

Malayan Peninsula: Singapore; *Ridley* 6336 !

Plate 52.—Heptapleurum Ridleyi *King*. 1, fruiting branch from Singapore,—*of natural size*; 2, fruit; 3, fruit, cut transversely; 4, seed *in situ*; 5, seed removed.

G. K.

PLATE 54.

55. Wardenia simplex *King in Journ. As. Soc. Beng.* lxvii. 2. 60 (1898).

Natural order Araliaceæ.

A shrub 6—8 ft. high, deciduously rufous-pubescent towards the apex, prickly near the base; *leaves* simple, elliptic, coriaceous, tapering gradually to the shortly acuminate apex, not narrowed to the slightly cordate base, both surfaces with minute, scattered, rusty, stellate hairs; length 2—4 dm., breadth 1—2 dm., petiole 1·25—2·5 dm., terete, expanded at the base into a short sheath with 2 minute stipules on its inner surface; *inflorescence* a terminal, shortly branched, compound umbel; *flowers* hermaphrodite, buds 2·5 mm. across, conical; pedicels 1—1·25 cm. long, slender, rusty-pubescent, 10—20 in each umbel; *calyx* slightly rusty-pubescent, tube narrowly campanulate, limb with 5 small, spreading teeth; *petals* 5, glabrous, calyptrate, their edges slightly infolded, valvate below, slightly imbricate near the apex, the midribs prominent on the inner surface; *stamens* 5, alternate with the petals; the anthers versatile, with linear, separate cells each united by its middle to the tip of the short, straight filament; *disk* large, fleshy, convex, covering the whole of the apex of the ovary, slightly 5-lobed; *styles* united to form a short thick column without any stigmatic enlargement; *ovary* 1-celled with 2 parallel, pendulus ovules; *fruit* 2-celled by formation of a false dissepiment, elliptic-globose, subglabrous, 5 mm. long, crowned by calyx and style, 2-seeded; *seeds* compressed.

Malayan Peninsula: Perak, at Ulu Kerling; *Kunstler !*

Plate 54.—Wardenia simplex *King*. 1, fruiting twig; 2, fruit, cut obliquely; 3, the same cut transversely; 4, seed; 5, the same in vertical section.

G. K.

PLATE 55.

56. Dendropanax Listeri *King in Journ. As. Soc. Beng.* lxvii. 2. 294 (1898).

Natural order Araliaceæ.

A small glabrous tree with shrubby habit, 20 feet in height; young branches with coarsely lenticellate bark, pale-brown when dry; *leaves* simple, thinly coriaceous, broadly elliptic, shortly acuminate, the base cuneate, the edges entire or with a few minute distant irregular teeth; both surfaces quite glabrous, the upper dull; the lower reticulate; the nerves and midrib distinct on the lower surface, the latter with 2 bold, ascending, curved nerves rising from its base and running more than half way to the apex, a small pair occasionally rising outside and below these and running close to the margin of the base of the leaf; the midrib giving off above its middle 3 or 4 pairs of curving, lateral nerves; length 9—20 cm., breadth 4—10 cm.; petioles very various in length (from 4 cm. to 15 cm.) very slender; *panicles* axillary, slender, from 10 to 15 cm. long, with few umbellate branches, the alternate umbels with 4 or 5 sub-globular flowers 4 mm. in diam.; their pedicels very slender, 8 mm. long; *calyx*-tube subglobular, its limb narrow and with 5 small teeth; *fruit* globular, 5 mm. in diam., crowned by the short styles, connate below but with recurved apices.

E. Himalaya: At Torupati in the Daphla Hills, Assam; elevation 5,500 feet; *J. L. Lister* 198!

This very distinct species of *Dendropanax* was collected by Mr. J. L. Lister while accompanying the Daphla Hill expedition of 1874.

Plate 55.—Dendropanax Listeri *King.* 1, fruiting branch; 2, larger leaf from another specimen; 3, young fruit; 4, ripe fruit; 5, the same in section; 6, seed.

G. K.

PLATE 56.

57. Tricholepis Stictophyllum *Clarke Comp. Ind.* 241 (1876).

Natural order Compositæ.

A perennial, glabrous, scapigerous herb; *stem* 0, or up to 3 dm. high, sparingly branched from the base; branches angular, grooved, leafy below; *leaves* ·5 to 1·5 dm. long by 3 to 10 mm., sessile, ½-amplexicaul, linear or ligulate, tapering to a mucronate point, entire or obscurely toothed, covered with minute raised points and pellucid-punctate; margin pale, thickened; veins parallel to the slender midrib; *heads* 2—3 cm. in diam., usually solitary at the naked ends of the branches; *involucre bracts* 1—2 cm. long, adpressed, glabrous; outer ovate, acuminate; inner linear-lanceolate, with erect flexuous tips; *receptacle bristles* many, longer than the achenes; *corolla* 1·5 cm. long, light-purple, lower portion of tube very slender; *filaments* papillose; *achenes* 6 mm. long, oblong compressed, truncate, many-ribbed; basal areole very oblique; tip rather dilated; *pappus* 1·5 cm. long; hairs soft, silvery-brown, feathery, slightly united at the base. *Hook. f. Flor. Brit. Ind.* iii. 382 (1881). Stictophyllum glabrum *Edgew. in Trans. Linn. Soc.* xx. 78 (1846). Cnicus angustifolius *Wall. Cat.* 2915 (1830).

Northern India; Submontane tracts: Kánsrao, in Dehra Dun; *Falconer*. Siwalik range, in grassy places; *Edgeworth*. Pilibhit, Northern Oudh, and in the Gorakhpur district; *Duthie's Collectors* (Nos. 22253, 22254). Central India (probably Sagor) *Jerdon*.

Sir. J. D. Hooker in *Flor. Brit. Ind.* l.c. remarks as follows regarding this species:—

"An anomalous plant, with the habit and involucre of *Serratula*, and the pappus of *Jurinea;* the achene is, however, quite that of *Tricholepis tibetica*, and different from that of other species of the genus, with which, however, it agrees in the leaves having raised points (whence the name *Stictophyllum* Edgeworth)."

Plate 56.—Tricholepis Stictophyllum *Clarke*. A plant,—*of natural size*. Fig. 1, a single floret; 2, corolla, laid open; 3, receptacle; 4, pistil; 5, vertical section of achene; 6, transverse section of ditto,—*all enlarged*.

J. F. D.

PLATE 57.

58. Saussurea chitralica *Duthie*.

Natural order Compositæ.

Perennial; *stems* about 6 dm. high, simple below, sulcate; *leaves* mostly towards the base of the stems, dark-green and somewhat scabrous above, clothed beneath with white cottony pubescence; lower 10—12 cm. long by 3—5 cm. wide, lyrate-pinnatifid; upper smaller, lanceolate, acute, dentate; *heads* in terminal corymbs, or solitary in the axils of the much reduced upper leaves, erect or somewhat inclined, 2·5 cm. long and about 2 cm. across, tapering to the base; *involucre bracts* glabrous, tinged with purple; outer ovate, acute; inner lanceolate, acuminate; *corolla* 15 mm. in length, slender, pale-purple; *anther-tails* lacerate; *receptacle* densely bristly; *pappus* white, shorter than the corolla; outer bristles 0; *achenes* 3 mm. long, smooth, 10-ribbed, crowned by a toothed cup.

N.-W. Frontier: near Drosh, at an elevation of about 6,000 feet; found by Inayat Khán, one of the plant collectors of the Botanical Department of N. India, during the Chitral Relief Expedition of 1895 (Herb. No. 16273).

Allied to *S. candicans* Clarke, but with broader and quite glabrous involucre-bracts, and smaller very differently shaped head.

Plate 57.—Saussurea chitralica *Duthie*. A plant,—*of natural size*. Fig. 1, vertical section of a head of flowers; 2, an outer bract of the involucre; 3, inner bract of ditto, 4, single floret; 5, stamens; 6, ditto, laid open; 7, pistil; 8, style-arms; 9, receptacle, with bristles,—*all enlarged*.

J. F. D.

PLATE 58.

59. Agapetes (*Holocalyx*) Pottingeri *Prain in Journ. As. Soc. Beng.* lxvii. 2. 296 (1898).

Natural order Vacciniaceæ.

An epiphytic shrub, the branches adpressed-puberulous and at the same time beset with setaceous spreading hairs; *leaves* sessile, ovate-lanceolate, gradually narrowing from a rounded base to a moderately long acuminate tip, margin entire, firmly coriaceous,

glabrous on both sides, 12—18 cm. long, 4—6 cm. wide, secondary nerves 8—10 pairs, rather more prominent above than below; *flowers* along the branches in few-flowered corymbs 4 cm. long, peduncles pubescent about 5 mm. long, their bases surrounded by small firm scaly bracts, pedicels 1·25 cm. long, slender, pubescent, in the axils of ovate-lanceolate, rigid, striate-reticulate bracts 4—5 mm. long, with puberulous margins but elsewhere glabrous; *calyx*-tube globose, articulate with the slightly enlarged apex of pedicel, clothed with long yellow spreading hairs with glandular tips, 2·5 mm. long, limb campanulate, 8·5 mm. long, reticulate throughout, the margin 5-toothed, teeth triangular, 3·5 mm. long, glabrous within, sparsely covered externally with flaccid hairs; *corolla* tubular, straight, 15 mm. long, slightly inflated in the centre, the mouth shortly bluntly 5-lobed and slightly contracted, pubescent externally with flaccid hairs, the lobes green, the tube red not marked with lines; *stamens* 10, epigynous, free, the filaments almost as long as the anthers and glabrous as are the anthers which are 2-spurred behind their tubes and hardly reach the limb of the corolla; *ovary* 5-locular, style filiform, shortly 5-lobulate at the apex; ovules numerous.

KACHIN HILLS: at Lakham, 4,100 feet; *Pottinger!*

A very distinct species separable from any hitherto described *Agapetes* by its large bracts and large calyx-limb the teeth of which are not partite to the disk as in most other species. It thus deserves to be treated as representative of a new section *Holocalyx*.

PLATE 58.—Agapetes Pottingeri *Prain*. 1, twig with leaves, 2; twig with flowers,—*of natural size;* 3, vertical section of flower; 4, calyx, laid open; 5, corolla; 6, corolla, laid open; 7, 8 and 9, stamen, seen respectively from in front, from behind and sideways.

D. P.

PLATE 59.

DESMOGYNE *King & Prain in Journ. As. Soc. Beng.* lxvii. 2. 297 (1898).

Natural order Vacciniaceæ.

Calyx-tube round, enclosed in the enlarged cup-shaped subglobose pedicel-tip; limb much enlarged, widely campanulate, margin entire, persistent; *corolla* tubular, narrowly funnel-shaped, elongate, tube straight, limb shortly 5-lobed, lobes erect; *stamens* 10, epigynous, as long as the corolla, filaments free below among themselves and from the corolla-tube, anthers elongated, straight, free, muticous behind, with straight slender connate membranous tubes, anther-cells muriculate; *ovary* 5 locular, style filiform, stigma lobulate; ovules in each loculus numerous, attached to the inner angle. Epiphytic shrubs, leaves alternate, persistent, shortly petioled, coriaceous, entire.—Two species or varieties from the Chin and Kachin Hills and from the Hukung valley.

G. K.; D. P.

60. DESMOGYNE NERIIFOLIA *King & Prain in Journ. As. Soc. Beng.* lxvii. 2. 297 (1898).

An epiphytic shrub with slender glabrous branches; *leaves* alternate, oblong-lanceolate, apex caudate-acuminate, base rounded, short-petioled, margin entire, thickly coriaceous, 10—15 cm. long, 2—2·25 cm. wide, midrib prominent below grooved above, secondary

nerves obscure; *inflorescence* corymbose, pedicels clustered in axils of triangular bracts 2·5 mm. long near somewhat swollen apex of peduncle which attains 6 cm. in length; pedicels 3 cm. long., enlarged upwards with cup-like tips; *calyx*-tube globose, 4 mm. long., articulate at the base of the pedicel-cup and covered by it, limb inflated 8 mm. long., wide-campanulate, margin entire, distinctly reticulated throughout; *coroila* elongate, tube 4 cm. long, straight, funnel-shaped limb 1·25 cm. wide, 5-lobed, lobes 5 mm. long, triangular; *stamens* 10, epigynous, free, filaments short, anthers long erect, their tips on a level with corolla-limb, not spurred behind; *ovary* 5-locular, style filiform the tip shortly 5-lobulate, ovules numerous; *fruit* ovate, crowned by the persistent calyx-limb, 1 cm. long, 8 mm. wide.

Upper Burma: Chin Hills; *King's Collector!* Kachin Hills; *King's Collector!*

A second species or variety, *Desmogyne minor*, very similar to *D. neriifolia* but much smaller in all its parts. was obtained by Mr. Wallace, during the Railway Survey Expedition through the Hukung Valley.

Plate 59.—Desmogyne neriifolia *King & Prain*. 1, branch with flowers and fruit; 2, flower in vertical section; 3, calyx-limb, laid open; 4, corolla, laid open; 5, stamens, *in situ*, the corolla removed; 6, stamens, seen from inside; 7, single anther ×2, from inside; 8, the same ×2, from outside; 9, placentation; 10, seed; 11, pedicel, in fruit, showing the cup-like apex; 12, ovary, in transverse section, with the ring-like apex of pedicel surrounding it; 13, floral diagram.

G. K.; D. P.

PLATE 60 A.

61. Androsace Harrissii *Duthie in Rec. Bot. Survey of India*, i. 161 (1898).

Natural order Primulaceæ.

Perennial; *stems* woody, much branched, lower naked portions concentrically leaf-scarred; *leaves* imbricate, in compact squarrose rosettes, 3—4 mm. long, ligulate or somewhat boat-shaped, acute and subspinulose, pale-green turning to a chesnut-brown colour when older, quite glabrous; bases dilated and with membranous edges; *scapes* 1·5 to 2 cm. long, solitary at the ends of the leaf-rosettes, bearing umbels of 2—5 flowers, clothed with short, crisp, glandular hairs; *bracts* 2—5, rather unequal, boat-shaped, entire, hairy; *pedicels* 4—6 mm. long, deflexed after flowering; *calyx* densely glandular-hairy, turbinate, shorter than the pedicels; segments rounded, imbricate, about $\frac{1}{4}$ the length of the tube, smooth inside; *corolla* white, about 5 mm. in diam.; tube globose, membranous, equalling the calyx; mouth constricted by a prominent ring; lobes spreading, broadly obovate or spathulate, emarginate; *stamens* attached $\frac{1}{2}$-way down the corolla-tube, on very short filaments; *anthers* globose; *capsule* turbinate, flattened above; *style* 1 mm. in length; *seeds* 8, oval-oblong.

N.-W. Himalaya: Chitral district, above Ziárat, at an elevation of about 11,000 feet (Herb. No. 16354). Found by Captain Harriss, I.M.S., during the Chitrál Relief Expedition of 1895. Flowers in June.

This plant very much resembles in habit *A. Taxete* Maxim.: it differs, however by the flowers being in umbels, in the glabrous leaves, and in the shape of the corolla-lobes; the seeds also are more numerous. Mr. J. R. Drummond, I.C.S., who kindly undertook, when in England in 1898, to compare specimens of this plant at the Royal Herbarium, Kew, is inclined to regard it and *A. Lehmanni* Wall. as extreme forms of *A. squarrosula* Maxim. I have not seen specimens of the latter.

PLATE 60 A.—Androsace Harriss'i *Duthie*. A portion of plant,—*of natural size*. Fig. 1, rosette of leaves; 2, single flower; 3, calyx, laid open to show the capsule; 4, corolla, laid open; 5, stamens; 6 seed,—*all enlarged*.

J. F. D.

PLATE 60 B.

62. ANDROSACE FRAGILIS *Duthie in Journ. Bomb. Nat. Hist. Soc.* ined.

Natural order Primulaceæ.

Perennial; whole plant excessively glandular-viscid; petioles, peduncles and pedicels slender, wiry, brittle; *leaves* all radical; petioles 2—6 cm. long; blade usually broader than long, 2—3 cm. wide and 1·5 to 2 cm. from base to apex, orbicular or reniform, cordate, deeply lobed, thinly cartilaginous, dark-green above, the lower surface reddish-brown turning to bright-red, glistening on both surfaces; veins prominent; lobes extending almost to the centre of the blade, overlapping at their apices, usually with 3 crenatures at the summit; *peduncles* far-exceeding the leaves, 9—12 cm., usually curving upwards from the base, clothed with short silky pubescence with shorter glandular hairs intermixed; pedicels 2—3 cm. long, slender, spreading; *bracts* cuneate-obovate or spathulate, often trifid at the apex, clothed with long silky hairs and shorter glandular ones; *calyx* broadly campanulate, deeply lobed, enlarging and spreading in fruit; lobes oblong or obovate, cuspidate, prominently veined; *corolla* slightly exceeding the calyx when in flower, deeply lobed; limb at first pure-white turning pink and afterwards bright-crimson; lobes obovate, bifid; tube short, globular, greenish; *stamens* on very short filaments, attached to the corolla-tube $\frac{1}{2}$-way up; *ovary* turbinate; style very short; *capsule* subglobose, usually covered by the marcescent corolla; *seeds* about 20, ·5 mm. long, ovate, flattened at the sides, minutely granular.

WESTERN HIMALAYA; in Jaunsár and Tehri-Garhwál, in the valleys of the Tons and its tributaries, growing in crevices of rocks at elevations of between 3,000 and 7,000 feet.

Judging merely from herbarium specimen of this plant, it might very reasonably be regarded as only a variety of the polymorphous *A. rotundifolia* Hardw. Its peculiar habit, however, when seen in a living state, together with certain very distinctive characters enumerated in the above description, fully entitle it, in my opinion, to specific rank. At all elevations it maintains its habit of confining itself to the crevices of overhanging rocks, nearly always out of the reach of direct sunlight. At the higher elevations, where *A. rotundifolia* becomes abundant, I have failed to detect anything approaching to an intermediate form. It is at once recognized by its rather small glistening dark-green leaves, its minute pure white and crimson flowers, and by the long slender petioles, peduncles and spreading pedicels. It is also a very much more viscid plant than any of the known varieties of *A. rotundifolia*.

PLATE. 60 B.—Androsace fragilis *Duthie*. B. Entire plant; 7, and single leaf,—*of natural size;* 8, flower seen from above; 9, corolla, laid open to show the position of the stamen; 10, calyx, laid open to show the young capsule; 11, ripe fruit; 12, seed,—*all enlarged*.

J. F. D.

PLATE 61.

63. Primula Inayati *Duthie.*

Natural order Primulaceæ.

Perennial; *rootstock* thick; *leaves* all radical, tapering into long slender sheathing petioles, upwards of 3·2 dm. long by 1—3 cm. broad, narrowly oblanceolate, rounded or subacute at the apex, erose or unequally crenate-serrate along the margin, membranous, dark-green above and covered underneath with a lustrous, silvery-green mealiness; petiole and midrib reddish-brown; veins slender, reticulate; *scape* very long, sometimes exceeding the leaves, stout, pilose towards the summit; *flowers* numerous, in umbels; *bracts* 1—1·5 cm. long, linear or lanceolate, acuminate, bases not produced; pedicels varying in length, upwards of 3 cm. when in fruit, clothed with dark-coloured spreading hairs; *calyx* 6 mm. long, divided half-way down into 5 ovate-lanceolate, acuminate lobes, green-mealy inside. enlarging in fruit, and with wide sinuses; *corolla* about 6 mm. across, its tube longer than the calyx; lobes obcordate; *anthers* sessile, attached below the middle of the corolla-tube, ovate, acute; *ovary* globose, depressed at the summit; style longer than the ovary; *capsule* globose, included within the calyx; *seeds* minute, oval, compressed, with a winged appendage at either end.

N.-W. Himalaya: Hazára, on wet rocks in the Siran and Kagán valleys, at elevations between 4,500 and 6,000 feet (Herb. Nos. 19919, 21974); discovered by Inayat Khán, of the Botanical Department of N. India.

A very distinct species, approaching *P. obtusifolia* Royle, and *P. elongata* Watt. Only one specimen was found with the remains of flowers, the colour of which was not recognizable in the dried specimen. Its flowering season is probably during the late autumn. I have much pleasure in naming this species after my head plant collector, Inayat Khán, whose intelligence and enthusiasm have resulted in the discovery of several other new and rare plants in various parts of Northern India. Some diminutive single-flowered specimens, about 4 cm. high only, were gathered in the Siran Valley.

Plate 61. Primula Inayati *Duthie.* Portion of a plant,—*of natural size.* 1, a flower; 2, corolla, laid open; 3, calyx, laid open, showing the young capsule; 4, ripe capsule, enclosed in calyx; 5, seed,—*all enlarged.*

J. F. D.

PLATE 62.

64. Primula hazarica *Duthie.*

Natural order Primulaceæ.

Height of plant up to 13 cm.; *rootstock* perennial; *leaves* 1·2 to 7·5 cm. long and 7 to 19 mm. wide, obovate or spathulate, tapering into the more or less broadly winged petiole, thin, green above, white-mealy beneath, denticulate; veins conspicuous on the under surface, curving upwards in forks and terminating in the marginal teeth; *scape* firm, up to 8 cm. long; *flowers* 1—many, in umbels, di-morphic; *bracts* linear, up to 7 mm. long, erect or reflexed at the apex, their bases not produced, minutely ciliate along the margin; *pedicels* slender, varying in length, up to 25 mm., spreading or recurved and elongating in fruit; *calyx* 5—7 mm. long, cleft to or below the middle; lobes erect, lanceolate, acuminate, minutely ciliate; *corolla* bright-purple, about 17

mm. across; lobes obcordate, longer and narrower and not overlapping in the long-styled form; tube pale-yellow, 2—3 times the length of the calyx; *capsule* included within the calyx, obovate, rounded at the apex; *seeds* many.

Western Himalaya: abundant along the upper portions of the Kagán and Siran Valleys at elevations of between 10,000 and 14,000 feet; *Duthie's Collector*. W. Kashmir; in the Muzaffarabad district; *Duthie's Collector*.

Closely allied to *P. Jaffreyana* King, a very rare Eastern Himalayan species found in the Chumbi Valley at an elevation of about 12,000 feet. It differs in the venation of the leaves, and in the shape of the ovary; the underside of the leaves are persistently coated with a brilliant silvery mealiness.

Plate 62. **Primula hazarica** *Duthie.* A plant of the short-styled form,—*of natural size.* A, *short-styled form.* Fig. 1, single flower; 2, corolla, laid open; 3, calyx, laid open, showing the ovary and style,—*all enlarged.* B, *long-styled form.* Fig. 1, single flower; 2, corolla, laid open; 3, calyx, laid open; 4, ripe capsule; 5, seeds,—*all enlarged.*

J. F. D.

PLATE 63.

65. Sideroxylon longepetiolatum *King & Prain.*

Natural order Sapotaceæ.

A considerable tree with straight stem and rather slender horizontal branches, somewhat buttressed below; innovations with sparse, rusty, caducous tomentum; *leaves* very large, especially on younger trees, glabrous, shining, entire, thinly papery, obovate-lanceolate, acute rarely obtuse, narrowed from the middle to a rather stout, long petiole; nerves very slightly ascending, parallel, looping within the margin, 20—25 pairs, secondary venation finely distinctly reticulate; lamina 8—16 cm. long, 3·5—7 cm. wide, on young trees sometimes 70—75 cm. long, 30 cm. wide; petioles 4—7 cm. long; *flowers* axillary, near apices of branches, usually in fascicles of 6—10, lower down with sparsely pubescent, furrowed peduncles 2—6 cm. long springing from the centre of the axillary fascicle and bearing at intervals, 1 cm. apart, similar fascicles racemosely disposed; pedicels slender, pubescent, ·75 cm. long; bracts and bracteoles minute; *calyx* puberulous externally, glabrous within, lobes 5, suborbicular, much imbricated; *corolla* campanulate, lobes oblong, obtuse, imbricated; *stamens* 5, attached to base of corolla, opposite the lobes; staminodes 5, subulate, attached between corolla-lobes; *torus* annular, pubescent; *ovary* 5-celled, pubescent, subglobose; style conical, short; stigma minute; ovules in each cell solitary, attached near base to inner angle; *fruit* ovoid and 1-seeded, less often globose 2-seeded, with succulent pericarp, indehiscent, at first yellow, when fully ripe of dark-maroon colour; 4 cm. long, 2·5—4 cm. in diameter; *seeds* 1 or 2, compressed subfusiform, 3·25 cm. long, 1·5 cm. wide, 1 cm. thick, testa thick, coriaceous, dark-brown or almost black with a pale-pink hilum extending nearly the whole length of the seed. Gluta longepetiolata *Kurz, Pegu Forest Rep. App. A.* 41 (1875); *Journ. As. Soc. Beng.* lxv. 2. 210 (1876); *For. Flor. Brit. Burma* i. 310 (1877). Sideroxylon ferrugineum *Prain in Journ. As. Soc. Beng.* lxii. 2. 72 (1893) *partim, non H. & A.*

Andamans: near Port Blair; *Kurz! E. H. Man!* Narcondam; *Prain!* Burma: Tenasserim, Mittikit Forest; *Falconer* n. 31!

This species has been somewhat troublesome to deal with. One of us, in working through the material of *Anacardiaceae* in the Calcutta herbarium, had in 1895 to remove from the genus *Gluta* the specimens on which the late Mr. Kurz based his proposed species *Gluta longepetiolata.* Examining them together we recognised that they were undoubtedly conspecific with a tree of which the other had personally collected specimens in the island of Narcondam, and recognising it as a *Sideroxylon*, had tentatively included in his Narcondam list under *S. ferrugineum*, a species that also occurs in Narcondam. Of the same tree there are several examples under cultivation in the Calcutta Garden, raised from seed received from Mr. E. H. Man, C.I.E., of Port Blair. Before formally announcing the reduction of Mr. Kurz's species it seemed to us better to wait till the trees at Calcutta had flowered and fruited. This has now occurred and the drawings given in PLATE 63 have been made from living trees in Hort. Calcutta.

The species is very nearly related to *Sideroxylon nitidum* Bl. of which large suites of specimens have recently been received from Java through the kindness of Dr. Treub and Mr. Koorders. The leaves of our tree are, however, thinner as well as larger than those of *S. nitidum;* its flowers are rather, and its fruits much, larger.

In the *Flora of British India*, iii. 542. and in the *Journal of the Asiatic Society of Bengal*, xlvi. 2. 230, reference is made to a specimen collected by Falconer in the Mittikit Forest, Martaban, which is said to be nearly allied to *Palaquium polyanthum* (*Isonandra* or *Dichopsis polyantha* of the works quoted). Falconer's specimen does not, however, belong to any *Palaquium* but to the species now described.

PLATE 63.—Sideroxylon longepetiolatum *King & Prain.* 1, flowering branch; 2, fruiting branch; 3, flower,—*of natural size;* 4, bud, seen from side; 5, bud, from above; 6, calyx, laid open; 7, the same, in section, to show aestivation; 8, corolla, laid open, showing insertion of stamens and staminodes; 9, stamens; 10, ovary, the calyx removed; 11, very young ovary, showing relation to enlarged annular torus; 12, vertical section of flower; 13, transverse section of ovary,—*all enlarged;* 14, fruit with single seed; 15, fruit with two seeds; 16, seed; 17, seed, cut transversely,—*all of natural size.*

G. K.; D. P.

PLATE 64.

66. HOYA OBRENIFORMIS *King Mss. in Herb. Calcutta.*

Natural order Asclepiadaceæ.

A herb with slender, minutely puberulous, creeping and rooting stem and pendulous branches; *leaves* obcordate or obreniform, sometimes broader than long, lobes rounded, sinus acute, base rounded or subacute, rather thin, opaque, nerves obscurely reticulate, faintly visible above not evident beneath, bright-green above, paler beneath; length 1·25—2·5 cm., width 2·25—2·5 cm.; *flowers* 15—20, in rather loose umbels on peduncles puberulous like the stems, 3·5—6 cm. long, pedicels slender, glabrous; *calyx* pale-green, lobes triangular acute; *corolla* white, 1 cm. wide; lobes triangular obtuse with villous margins and upper surface. H. obcordata *Hook. f. in Flor. Brit. Ind.* iv. 56 (1883) *not of Teysm. & Binnend. Cat. Hort. Bog.* 385 (1866).

Sikkim: Chakoong, 4—6,000 ft.; *Hooker*. Kalit; *T. Thomson!* Yoksum; *Clarke!* Rungbee, Sureil, etc., 5,000—6,000 ft.; *King!*

This species was first described by Sir J. D. Hooker in 1883; the name used being, however, preoccupied it is necessary to provide another. In August 1875, a drawing was made from a living plant to which drawing, and to the specimens that correspond, the Mss. name now used was attached. The figure given on Plate 64 is a reproduction of the drawing alluded to.

Plate 64.—Hoya obreniformis *King*. 1, portion of plant from Rungbee, Sikkim,—*of natural size;* 2, calyx-limb; 3, corolla, from above; 4, the same, from below; 5, pollen-masses; 6, ovary,—*all enlarged.*

G. K.

PLATE 65.

67. Ceropegia kachinensis *Prain in Journ. As. Soc. Beng.* lxix. 2. 170 (1900).

Natural order Asclepiadaceæ.

A slender tuberous-rooted rather extensive climber; *leaves* membranous, quite glabrous on both surfaces, dark-green above, pale beneath, elliptic-ovate or ovate-lanceolate, acuminate, 10—12 cm. long, 4—5 cm. wide, petiole glabrous, 1·25—2 cm. long; peduncles glabrous 2·—2·5 cm. long, 8—12-fld., pedicels glabrous, slender, 1·25—1·5 cm. long; *calyx*-teeth lanceolate; *corolla* slightly curved, 3 cm. long, base very slightly swollen, tube slightly dilated at mouth and funnel-shaped, lobes oblong, half the length of the tube, their margins ciliate with purple hairs in the upper third, tube externally pale yellowish-green with fine purple lines on the lower two-thirds and faint purple spots on the upper third, internally purple with dark close-set lines in the lower two-thirds, rather bright-green in the upper third, lobes bright-green in lower and pale-yellow in upper half on both sides; *coronal lobes* lanceolate, ciliate, reddish-purple, less than half as long as clavate straight processes; *follicles* 9—10 cm. long, 6 mm. thick, with discontinuous pale-purple streaks; *seeds* ovate, compressed, 1 cm. long, 4 mm. wide, 2 mm. thick. C. pubescens *Prain in Rec. Bot. Surv. Ind.* i. 252 (1898) *not of Wall.*

Upper Burma: Kachin Hills, near Myitkyina; *Prain's Collector.*

A very distinct species, nearest among Indian ones to *C. Thwaitesii* Hook. but with smaller flowers.

Plate 65.—Ceropegia kachinensis *Prain*. 1, portion of flowering stem; 2, tip of young branch,—*of natural size;* 3, single flower; 4, corolla, laid open,—*of natural size;* 5, corona, from side; 6, corona, from above; 7, corona, laid open; 8, pollen masses; 9, calyx, with pistil; 10, pistil, laid open; 11, ovule,—*all enlarged;* 12, ripe fruit; 13, half of a single follicle; 14, placenta with seeds; 15, ripe seed,—*all of natural size.* The drawings are from life, from a plant sent from Myitkyina, which flowered and fruited in the Royal Botanic Garden, Calcutta.

D. P.

PLATE 66.

68. Cotylanthera paucisquama *Clarke in Hook. f. Flor. Brit. Ind.* iv. 94 (1883).

Natural order Gentianaceæ.

A small glabrous parasitic herb, 6—10 cm. high; stems white, fleshy; *leaves* reduced to 1—2 pairs of opposite elliptic-lanceolate scales, 4 mm. long, white;

flowers solitary terminal; *calyx* deeply 4-lobed, lobes triangular with thickened midrib, white, 3 mm. long; *corolla* divided nearly to the base into 4 linear-oblanceolate, obtuse segments 8 mm. long, dark-blue; *stamens* 4, filaments linear, flattened, white, 3·5 mm. long, anthers yellow, oblong, innate, dehiscence by a terminal pore; *ovary* globose; style cylindric, pinkish-purple, 6 mm. long, stigma small, capitate, yellow.

Eastern Himalaya: Sikkim; *King*. British Bhutan; *Gammie*.

The above description is taken from a manuscript account of the living plant written by Sir George King and from a drawing, also from life, made at the same time by his native artist. The elevation given in the *Flora of British India* is 6,000 ft. but the original note reads "Sikkim, ? 6,000 feet, July 1875." It has been carefully searched for since but has never again been found in Sikkim and has only once been found again at all,—in British Bhutan and at a low elevation.

Plate 66.—Cotylanthera paucisquama *Clarke*. 1, plant,—*of natural size;* 2, corolla, laid open; 3, stamens; 4, ovary,—*all slightly enlarged.*

G. K.; D. P.

PLATE 67.

69. Gleadovia ruborum *Gamble & Prain in Journ. As. Soc. Beng.* lxix. 2. 489 (1900).

Natural order Orobanchaceæ.

A fleshy, leafless herb about 6 in. high, of which only about one-half epigeal; *root-stock* very thick especially where attached to host; *scales* ovate, the lower rounded, the uppermost sometimes 2-fid; *flowers* paniculate, bracts solitary, 2 cm. long, sheathing, rounded, pedicel stout, 1 cm. long, bracteoles 2, 2—3 cm. long, spathulate, acute, concave; *calyx* light-red, tubular, somewhat inflated, regularly 5-lobed, 3—3·5 cm. long, lobes pale; *corolla* red with darker veins, tube as long as calyx, slightly curved, distinctly 2-lipped, upper lip of 2 connate lobes, rounded, slightly dentate, lower of 3 narrow, spathulate, subequal lobes, acutely dentate; *stamens* 4, geniculate at point of insertion, anthers elongate, spurred, connective produced in a 2-fid cone, hairy above; *ovary* cylindric; style long, incurved at apex; stigma of 2 broad semi-orbicular lobes depressed in the centre; ovary 1-celled; placentæ 2 pairs, central, partly united, partly free, ovules very many; *fruit* subglobose; *seeds* very many, minute, with loose reticulate testa.

N.-W. Himalaya: Bodyar, Jaunsar, 8,000 ft., in shady woods of fir and deodar on roots of wild raspberry (*Rubus niveus*), very scarce; *Gleadow & Gamble! Duthie!*

Plate 67.—Gleadovia ruborum *Gamble & Prain*. 1, plant, from Bodyar Jaunsar; 2, single flower, front view, unopened; 3, single flower, from side, fully open; 4, corolla, laid open to show insertion of stamens; 5, bracteoles; 6, calyx, laid open, showing lobes; 7, ovary with stigma; 8, vertical section of the same; 9, transverse section of ovary near middle; 10, the same halfway between middle and base, showing the placentæ discrete; 11, the same, near base, showing the placentæ further separated by a partial false dissepiment, this becomes more marked in fruit; 12, fruit,—*of natural size;* 13, seeds, seen from side and in front; 14, the same, half of the loose testa cut away; 15, body of seed covered by tegmen; 16, the same in vertical section with embryo; 17, floral diagram.

The whole of the analyses are from fresh or spirit specimens.

J. S. G., D. P.

PLATE 68.

70. DIDYMOCARPUS ELATIOR *Prain in Journ. As. Soc. Beng.* lxvii. 2. 299 (1898).

Natural order Gesneraceæ.

A small undershrub, the young branches rufescent with spreading hairs, at length glabrous; *leaves* opposite, of each pair unequal, ovate-lanceolate, slightly unequal-sided, base cuneate, apex acuminate, margin finely serrate, lamina sparsely adpressed puberulous above, pubescent especially on the nerves beneath, 4—8 cm. long, 2·5—3·5 cm. wide, petioles rufous-pubescent, 2 cm. long; *cymes* few-flowered, axillary, with slender, elongated, puberulous peduncles 3 cm. long, bracts lanceolate; pedicels 1 cm. long, slender; *calyx* 6 mm. long, campanulate, split to the middle or rather lower into 5 ovate-acute teeth; *corolla* pale-purple, subsymmetric, tubular, almost straight, very sparingly puberulous without, 3 cm. long; *capsule* 2·5—3 cm. long, 4 mm. wide, erect on the pedicel.

BURMA: Kachin Hills, near Sima, on banks of streams, at 5,000 ft. elev.; *King's Collector !*

A very distinct species unlike any other northern one, and in habit most resembling *D. corchorifolia* Wall., a native of Penang and Malacca. The peduncles are oftenest 3-flowered but are not infrequently 5-flowered owing to the lateral flowers of the cyme being geminate instead of solitary.

PLATE 68.—Didymocarpus elatior *Prain.* 1, flowering branch; 2, fruiting branch; from Kachin Hills,—*of natural size;* 3, flower, corolla removed; 4, corolla of same, laid open; 5, stamen and staminode; 6, ovary;—*all somewhat enlarged.*

D. P.

PLATE 69A.

71. PLECTRANTHUS PHARICUS *Prain in Journ. As. Soc. Beng.* lix. 2. 297 (1890).

Natural order Labiatæ.

A dwarf tomentose or puberulous undershrub; *stems* woody and rounded below, 4-angled above, 15—30 cm. high; *leaves* small, sessile or subsessile, ovate or rounded, crenate, glabrate above, tomentose at least on the nerves beneath, 1—1·25 cm. long, under 1 cm. wide; *cymes* few-flowered, rather dense, racemosely set on axillary peduncles 5—7·5 mm. long; *calyx* pedicellate, narrow, sub-bilabiate, subhispid, strongly nerved, enlarging in fruit, 4 mm. (in fruit 7 mm.) long, 2·5 mm. wide; teeth acute, the two lower one-half longer than the three upper, the tube contracted above the nutlets in fruit, the pedicels 2—3 mm. long; *corolla* 9 mm. long, tube short (only 4 mm. long) and wide (2·5 mm.), lips large the lower 5 mm. long; *nutlets* pale, faintly reticulated, smooth, oblong, 2·5 mm. long, 1·5 mm. broad.

EASTERN HIMALAYA: Phari; SOUTH TIBET: Wei; *King's Collectors !*

An exceedingly distinct species, a member of the group which includes *Plectranthus melissoides* Benth., and *P. rugosus* Wall., between which it stands in some respects intermedaite.

PLATE 69 A.—Specimen of Plectranthus pharicus *Prain*, from Phari;—*of natural size*. 1, flower × 2; 2, fruiting calyx × 2; 3, half of corolla, showing staminal insertion × 2; 4, nutlets × 4.

D. P.

PLATE 69B.

72. PLECTRANTHUS KURZII *Prain in Journ. As. Soc. Beng.* lix. 2. 296 (1890).

Natural order Labiatæ.

A herb with simple, ascending, glabrous, rather flaccid, somewhat bluntly 4-angled stems 30—40 cm. high; *leaves* broadly orbicular, obtuse, 4—4·5 cm. long and 4—5 cm. wide, base cuneate, entire, narrowed gradually into a petiole proper 1—3 cm. long, beyond the middle with 3—7 wide serrations increasing forward, the terminal always largest, sometimes ·75 cm. long and 1·5 cm. wide, always blunt; *cymes* disposed in a narrow, solitary, terminal panicle shorter than stem or with also a few axillary racemes shorter than the leaves, the longest 6—10 cm. long, lax-flowered; *calyx* glabrous, 2 mm. long, teeth subequal, acute; *corolla* 7 mm. long, tube nearly straight, cylindric, gibbous at base above; *stamens* not exserted; *nutlets* minute, broadly ovoid, about 1 mm. long.

SIKKIM: between Ratong and Yoksum; *T. Anderson! Kurz!*

This species most resembles *Plectranthus excisus* Maxim., from China, but is smaller in all its parts.

PLATE 69 B.—Specimen of Plectranthus Kurzii *Prain*, from Sikkim,—*of natural size*. 5, flower × 2; 6, calyx, laid open, showing ovary and style × 2; 7, half of corolla, showing staminal insertion, × 2; 8, upper lip × 2; 9, lower lip × 2; 10, anthers × 6; 11, nutlets × 4.

D. P.

PLATE 70.

73. PLECTRANTHUS KUNSTLERI *Prain in Journ. As. Soc. Beng.* lxvi. 2. 521 (1897).

Natural order Labiatæ.

A stout herb, almost shrubby, 30—60 cm. high, everywhere finely puberulous; *leaves* pale-green especially beneath and there sparsely glandular-puberulous, darker and faintly puberulous above, lamina ovate-acute with entire cuneate base and short entire sub-acuminate tip, margin elsewhere regularly crenate, 8—12 cm. long, 4—5 cm. wide, petiole 4—5 cm. long; *flowers* in stout, branched panicles with ascending branches; *calyx* 2·5 mm., in fruit enlarging 5 mm. long, gland-dotted, two lower teeth subulate, lateral pair ovate-acute, upper orbicular-ovate; *corolla* pale-green, faintly dotted, 10 mm. long, tube decurved and gibbous at base, one and-a-half times as long as the boat-shaped lower lip, upper lip short; *filaments* free from each other from the point where they become free from the corolla-tube; *nutlets* oblong, brown with darker tips, hardly shining.

MALAYAN PENINSULA: Perak, at Kuala Dipong; *Kunstler* 8240!

A very distinct species, nearest, on the whole, to *P. urticifolius* H. f.

PLATE 70.—Plectranthus Kunstleri *Prain.* 1, flowering stem,—*of natural size;* 2, flower; 3, corolla, laid open, showing staminal insertion; 4, ovary and style; 5, nutlet; 6, the same, opened, showing seed; 7, seed,—*all enlarged.*

D. P.

PLATE 71A.

74. SCUTELLARIA ANDAMANICA *Prain in Journ. As. Soc. Beng.* lix. 2. 307 (1890).

Natural order Labiatæ.

A glabrous herb; *stems* woody and subterete below, 4-angled above and grooved, 20—25 cm. high, rather numerous from a woody rootstock with clustered rootlets, erect, simple or branched, rigid; *leaves* few, long-petioled, oblong-lanceolate, obtuse, crenate-dentate except at the entire tapering cuneate base, lamina 4—4·5 cm. long, 1—1·5 cm. across, crenatures 7—8 on each side, petioles 3—4 cm. long; *flowers* opposite or in whorls of threes except the uppermost scattered, in racemes 8—10 cm. long, bracts 3 mm. long equalling the pedicels; *calyx* 3 mm. long; *corolla* blue with centre of lip white, 16 mm. long; *nutlets* pale-brown, scabrid, 1 mm. long.

ANDAMANS: South Island, on rocks in stream-beds a few feet above sea-level, *Prain! King's Collectors! E. H. Man!*

This species is somewhat nearly allied to *S. discolor* Colebr. of which it has quite the corolla and has also, near the top of the spike, the scattered flowers. In foliage it, on the other hand, imitates *S. oblonga* Benth., a species growing at elevations of 5,000 feet in Ceylon. It has, however, a calyx which in ripe fruit is only one-third the size of that of *S. oblonga* and which is not longer even then than its pedicel, whereas the ripe calyx of *S. oblonga* considerably exceeds its pedicel in length. The plant now described has proved a welcome addition to Indian horticulture; its neat compact habit and its dark green leaves with a purplish tinge beneath render it useful, particularly in planting rockwork.

PLATE 71 A.—Plant of Scutellaria andamanica *Prain,* from South Andaman,—*of natural size.* 1, flower with bract × 2; 2, half of corolla, showing staminal insertion × 2; 3, portion of style and stigma × 4; 4, calyx in fruit × 2; 5, nutlets × 10.

D. P.

PLATE 71B.

75. SCUTELLARIA PETIOLATA *Hemsl. & Lace ex Prain in Journ. As. Soc. Beng.* lix. 2. 308 (1890).

Natural order Labiatæ.

Glabrous, stems slender, round, 13—25 cm. long., hardly as thick as crow-quills, tufted from a woody rootstock 1 cm. thick; *leaves* petioled, ovate acute, base truncate entire, margins with 2—3 shallow crenations on each side, anterior third entire, petioles ·75—3 cm. long, lamina 2—3 cm. long, 1·5—2 cm. across; both surfaces quite glabrous; *flowers* in long, narrow racemes, bracts ovate, entire, petioled, 8 mm. long, 3 mm. across,

hardly leafy, only the lowest exceeding pedicels and calyx; pedicels 2 mm. long; *calyx* 4 mm. long, 3 mm. wide; *corolla*-tube 22 mm. long, limb 5 mm. across, upper lip notched 4 mm. long, lower 6 mm.; *nutlets* elliptic, 2 mm. long, granulate. *Journ. Linn. Soc.* xxviii. 326 (1891).

Biluchistan: Quetta district, *Duthie's Collectors! Lace* 1006!

Plate 71B.—Specimen of Scutellaria petiolata *Hemsl. & Lace*, from Biluchistan. 6, flower with bract × 2; 7, half of corolla showing staminal insertion × 2; 8, fruiting calyx × 2; 9, nutlets × 6.

D. P.

PLATE 71C.

76. Scutellaria Kingiana *Prain in Journ. As. Soc. Beng.* lix. 2. 308 (1890).

Natural order Labiatæ.

Stems puberulous, slender, decumbent, 15—18 cm. long, several together from a creeping slender rootstock; *leaves* pubescent, petioled, ovate-orbicular, obtuse, crenate except the rounded base, lamina 18 mm. long, 14 mm. wide, crenatures few (8—11) rather wide, petioles 5—6 mm. long; *flowers* axillary, few, shortly pedicelled; *calyx* puberulous, twice as long as pedicels, 4 mm. long, 3 mm. wide at mouth; *corolla* puberulous, white, 30 mm. long, the tube 22 mm. long, the limb 5 mm. wide; *filaments* glabrous; *nutlets* not seen.

Tibet: Kang-ma, 60 miles north of Phari on the banks of the Pe-na-mong Chu, *King's Collector!*

This very beautiful species has only once been collected; it flowers in August.

Plate 71C.—Scutellaria Kingiana *Prain*. Specimen from Kang-ma in Southern Tibet—*of natural size;* 10, flower—*of natural size;* 11, half of corolla, showing staminal insertion × 2; 12, portion of style and stigma × 4; 13, lateral half of corolla, showing gynophore, ovary and base of style × 2; 14, calyx—left hand, posterior; right hand, anterior, internal faces of calyx × 2.

D. P.

PLATE 72A.

77. Molucella otostegioides *Prain in Journ. As. Soc. Beng.* lix. 2. 311 (1890).

Natural order Labiatæ.

An erect perennial with slender, green, glabrous, 4-angled branches; *leaves* 4 cm. long; narrowed at the base, lanceolate, acute but hardly pungent at the tip, entire, nerveless; *flowers* in distant many-flowered axillary whorls, bracts 3-partite, subulate, all spinescent; *calyx* obliquely campanulate, 9—11-toothed and 2-lipped, the limb prolonged behind as an erect spinescent tooth and spreading in front as a 3-partite lip with smaller radiating marginal lateral spines, glabrous, rigidly coriaceous, tube 8 mm. long exceeding the bracts, the upper half externally distinctly reticulate-veined, throat naked, upper lip 6 mm. long, lower 3 mm. long, 4 mm. across; *corolla*-tube included, 7 mm. long, obliquely annulate within, upper lip erect, concave, entire, villous externally, lower 3-fid, midlobe obcordate; *stamens* 4 ascending, exserted, anterior longer, anthers connivent 2-locular; *style* 2-lobed, arms subequal; *ovary* and *nutlets* truncate.

Waziristan: Zam defile in the Suleiman range, 3,500 feet; *J. L. Stewart* n. 138! Wána, 4,500 feet; *Duthie's Collector* n. 15788.

This curious species has all the facies of *Otostegia limbata* and *O. Aucheri*, the leaves being in shape like those of the latter, but like those of the former in not haing pungent tips. The ovary, however, makes its reference to *Otostegia* or to the adjacent genera *Roylea* or *Ballota* impossible, while its glabrous anthers exclude it from *Lagochilus*. It is therefore necessary to refer the species to *Molucella* in spite of the fact that it is very unlike the other species of the genus. The calyx of this plant is, though on a smaller scale, exactly that of *Molucella spinosa* Linn.; the species is therefore referable to § *Chasmonia*.

Plate 72A.—Plant of Molucella otostegioides *Prain*, from the Zam defile,—*of natural size*. 1, single flower with bract × 2; 2 and 3, calyx, from behind and in front × 2; 4, corolla, laid open, showing staminal insertion × 2; 5, ovary and style × 2; 6, ovary (immature nutlets) × 6.

D. P.

PLATE 72B.

78. Leucas Collettii *Prain in Journ. As. Soc. Beng.* lix. 2. 313 (1890).

Natural order Labiatæ.

Rootstock perennial, woody; *stems* densely softly silky with spreading hairs, simple, short, about 8—15 cm. long, rather stout, bluntly angled and distinctly grooved; *leaves* all sessile, small, 1·25—1·5 cm. long, 1—1·25 cm. wide, close-set, thick, ovate-acute, base truncate or subcordate entire, margin elsewhere coarsely serrate, softly silky on both surfaces; *whorls* many-flowered, bracts short, linear; *calyx* 5 mm. long, mouth truncate with ten very short erect teeth and these very closely villous but elsewhere glabrous within; *corolla* 7 mm. long, tube not exserted and not annulate.

Upper Burma: Popah Hill, 5,000 feet; *Collett* n. 29.

This species in externals resembles very closely the densely woolly form of *Leucas lanata* Benth. from the dry hills of the Deccan (*L. collina* Dalz.), but on closer examination is readily distinguished by the calyx which is densely villous within at the mouth only, and not, as in all the forms of *L. lanata*, sparsely hirsute throughout the upper third; the corolla too is very different in showing no trace of an annulus within the tube.

Plate 72B.—Twig of Leucas Collettii *Prain*, from Popah Hill in Burma,—*of natural size*; 7, flower, with bract × 2; 8, calyx, laid open, seen from within × 2; 9, corolla, laid open, from within × 2; 10, upper lip of corolla, from outside × 2; 11, ovary and style × 2; 12, anthers × 4.

D. P.

PLATE 72C.

79. Stachys cordifolia *Prain in Journ. As. Soc. Beng.* lix. 2. 310 (1890).

Natural order Labiatæ.

Herb, *rootstock* slender creeping; *stems* ascending, 4-angled, sparsely hirsute with long spreading white hairs, 25—30 cm., simple or branching at the base; *leaves* long-petioled, radical very small, 1 cm. long, ·75 cm. wide, petioles as long, cauline 2·5 cm.

long, 2 cm. wide, petioles 1·5—2 cm., all ovate, obtuse or subacute, deeply cordate, crenate, hispid on both surfaces with long simple hairs, those on petioles spreading, floral leaves ovate, subsessile, the uppermost shorter than calyx; *whorls* 4—6-flowered, distant, bracts minute; *calyx* glandular-pubescent, widely campanulate, slightly oblique, tube 3·5 mm. long, teeth triangular, acute, 1·5 mm.; *corolla* pale-pink, 12 mm. long, tube 7 mm. long, exserted.

Taping valley on the North-Eastern Frontier of Burmâ: at Mawyne and Momien; *J. Anderson !*

Plate 720.—Plant of Stachys cordifolia *Prain*, from Mawyne,—*of natural size;* 13, flower with bract × 2; 14, calyx, laid open × 2; 15, corolla, laid open and showing staminal insertion × 2; 16, ovary with style × 2.

D. P.

PLATE 73.

80. Phlomis oblongifolia *O. Kuntze, Rev. Gen. Plant.* ii. 529 (1891); *Prain in Ann. Roy. Bot. Gard., Calcutta,* iii. 231 (1891).

Natural order Labiatæ.

Shrubby, stems 60—90 cm. high, at first hirsute with deflexed soon deciduous hairs; *leaves* oblong-ovate, acuminate, distinctly wide-toothed except at the cuneate base glabrous beneath, sparingly hispid above, 15—20 cm. long, 6—8 cm. wide, petioles very slender, 5—10 cm. long; *flowers* in small, densely hirsute, distant axillary whorls; bracts filiform, hirsute, rather shorter than calyx; *calyx* obconic-campanulate, tube slightly curved forward, hirsute throughout, membranous, 1·25 cm. long, teeth subulate from a shortly triangular base, two-thirds the length of the tube; *corolla* light-yellow, 2 cm. long, densely pubescent outside on both lips, upper lip narrow, subtruncate at apex, one-fourth as long as tube, lower lip with subequal rounded lobes; annulus distinct; *stamens* without appendages on posterior pair; posterior style-arm much shorter than the anterior. Leonurus oblongifolius *Blume, Bijdr.* 828 (1826); *Benth. Lab. Gen. & Sp.* 552 (1833) *and DC. Prodr.* xii. 502 (1848); *Walp. Rep.* iii. 812 (1845). Gomphostemma macrophyllum *Miq. Flor. Ind. Bat.* ii. 988 (1856).

Malaya: Java; Celebes.

This species closely resembles and is nearly related to *Phlomis (Paraphlomis) rugosa* but is sufficiently distinguished by the longer hirsute calyx, the much shorter corolla-lips, the lower of which has in this species rounded instead of lanceolate lateral lobes. The style-arms are in this species of very unequal length, the lower being much the longer; in *P. rugosa* they are subequal. Another nearly related species is *Phlomis javanica* Prain (Leonurus javanicus *Blume, Bijdr.* 828: Gomphostemma petiolare *Miq. Flor. Ind. Bat.* ii. 987) of which no complete description has yet been given. Dr. Otto Kuntze, who has independently come to the same conclusion as the writer, referred to this plant under the same name in the same year, a fact of which the writer was unaware till Kuntze's work reached Calcutta, some months after the third part of vol. iii of the *Annals* had been published. While it is doubtful whether Kuntze or the writer happened to be the first to publish the species as a *Phlomis*, there is little doubt that Kuntze must have been the earlier of the two to form

this opinion as to its affinities and the writer would therefore wish the name to be cited on Kuntze's authority rather than on his own.

PLATE 73.—Phlomis oblongifolia *Kuntze*. 1, flower; 2, calyx, laid open; 3, half of corolla, showing staminal insertion and annulus; 4, ovary and style—*of natural size;* 5, lower lip, inside × 2; 6, upper lip, *a.* inside, *b.* back × 2; 7, anthers × 4. Flowering branch from Pangerango, in Western Java, 4,500 feet elevation.

D. P.

PLATE 74.

81. PHLOMIS RUGOSA *Benth. in Wall. Cat.* 2067 (1828), *in Pl. As. Rar.* i. 63 (1830), *in Lab. Gen. & Sp.* 634 (1834) and *in DC. Prodr.* xii. 545 (1848).

Natural order Labiatæ.

Shrubby; stems 60—90 cm. high, stout or slender, minutely hirsute with deflexed hairs; *leaves* elliptic or oblong-ovate, acuminate, shortly toothed, base cuneate or truncate, glabrous or with minute scattered hairs above, 15—20 cm. long, 8—10 cm. wide, petioles slender, 5—10 cm. long; *flowers* in small, distant or crowded whorls, often many below the leaves, 1·5—3 cm. in diam.; bracts filiform, glabrescent, rather shorter than calyx; *calyx* obconic-campanulate, tube slightly curved forward, glabrous above, usually hispid towards the base, coriaceous below, thickly membranous above, 1·25 cm. long, teeth slender, lanceolate from a triangular membranous base, two-thirds the length of the tube; *corolla* light-yellow or white, 2·5 cm. long, pubescent externally on both lips, upper lip narrow, rounded at apex, half as long as tube, lower lip with oblong midlobe and lanceolate lateral lobes, annulus distinct; *stamens* without appendages on posterior pair; style arms sub-equal; *nutlets* 6 mm. long, obovoid, acute below and triquetrous, rounded above, glabrous. *Walp. Rep.* iii. 889 (1845); *Hook. f. Flor. Brit. Ind.* iv. 693 (1885); *Prain, Ann. Roy. Bot. Gard., Calcutta,* iii. 231 (1891). Gomphostemma membranifolium *Miq. Flor. Ind. Bat.* ii. 988 (1856).

EASTERN HIMALAYA: Sikkim; *Kurz! King! Clarke!* Bootan; *Cummins!* Mishmi; *Griffith!* Khasia; *Wallich! Clarke! Hooker & Thomson!* MALAYA: Perak; *Kunstler! Scortechini!* Java; *Horsfield!* Philippines; *S. Vidal!*

This species is so different in appearance and so distinct in its characters from every species of *Phlomis* except *P. oblongifolia* and a third Malayan species (*P. javanica*), which is as yet somewhat incompletely known, that it would probably be advisable to treat them as three representatives of a genus distinct from *Phlomis.* They must at least be accommodated in a distinct section, which may be defined as follows:—

PARAPHLOMIS *Prain;* corollæ galea erecta extus barbata, intus glaberrima, staminibus posticis inappendiculatis.

If the generic rank to which the group is almost certainly entitled be recognised, the constituent species will be known as *Paraphlomis oblongifolia, Paraphlomis rugosa* and *Paraphlomis javanica.*

PLATE 74.—Phlomis rugosa *Benth.* 1, flower; 2, calyx, laid open; 3, half of corolla, showing staminal insertion and annulus,—*all of natural size;* 4, lower lip × 2; 5, upper lip, *a.* inside, *b.* back × 2, 6, anthers × 4; 7, ovary and style,—*of natural size;* 8, nutlets, *a.* inner face, *b.* back view,—*of natural size;* 9, seed, and 10, embryo—*of natural size.* Flowering branch from a Sikkim example.

D. P.

PLATE 75.

82. EURYSOLEN GRACILIS *Prain in Sc. Mem. Med. Off. India* xi. 41 (1898).

Natural order Labiatæ.

A slender scandent shrub with cylindric slender branches, puberulous with close-set, adpressed, reflexed hairs; *leaves* ovate-acute, their bases cuneate entire tapering into a short petiole 2—5 mm. long, their anterior two-thirds rather coarsely toothed with 5—8 serrations on each side, membranous, pale-green, above with at first a sparse adpressed pubescence at length glabrescent, below puberulous on the midrib and main-nerves elsewhere glabrous, secondary nerves 3—4 pairs; *flowers* small, condensed in axillary and terminal spikes 2·5—4 cm. long, 1 cm. across; bracts hardly exceeding the 1·5 mm. long pedicels; *calyx* tubular-campanulate, 4 mm. long, 10-nerved, 5-toothed, the two anterior teeth rather exceeding the other three but hardly 2-lipped, glabrous within, sparsely puberulous externally, in fruit the teeth erect and the tube slightly urceolate; *corolla* 7 mm. long, tube exserted, annulate within, below the annulus slender and straight, gibbous in front above the annulus; the limb 2-lipped, the upper lip erect slightly concave and retuse at the tip, the lower longer spreading 3-fid, the side lobes much smaller than the median; *stamens* 4, didynamous, the lower longer, all ascending under the upper lip and all exserted, the anthers ovate-reniform, 1-locular, those of the upper stamens rather smaller than the others, the filaments puberulous with whitish hairs; *disc* uniform; *ovary* substipitate, style subequally 2-fid, lobes acute; *nutlets* (only seen young) smooth towards periphery of pistil, papillose-glandular on their upper and mesial aspects.

KACHIN HILLS: Sadon; *Prain's Collector!*

This plant forms the type of a genus that it has seemed to the writer best to place tentatively among the *Prasieæ* near *Gomphostemma*. The anthers appear to be 1-celled from a very early stage. From its unfortunately not yet having been collected in ripe fruit it is not possible to be absolutely certain as to its tribal position. The writer's difficulty in the matter led to his submitting a specimen of the plant, with a copy of the description, to Mr. Briquet of Geneva, whose masterly account of the natural order *Labiatæ* in Engler's *Naturlichen Pflanzenfamilien* marks him as the greatest living authority on this difficult family. Mr. Briquet has very courteously examined the specimen and has written the following valuable note on the plant:—

"As concerns the *Eurysolen* I have examined the specimen you sent to me closely and quite agree with you that it cannot be placed in any of the genera known up to date.

"I am very puzzled as to its place and must frankly confess that I do not dare to place it precisely in any of the tribes without knowing the ripe fruit. The nutlets are too young to allow saying if the fruit will be partite or only 4-lobed, viz:—if the surface of insertion will be basilar and small or lateral and larger. They are too young also to allow saying if the pericarp will be thick and more or less fleshy, or thin and dry. If we had a dry (often thick) pericarp with lateral surface of insertion we should have to do with a genus of *Ajugoideæ-Ajugeæ*. In that tribe we have plants with 1-celled anthers, looking exactly like the anthers of your specimen. These are, without doubt, due to the fusion of the two cells. This manner of speaking has a purely phylogenetic meaning, for in many instances the cells appear coherent from the beginning! The way in which the anther rests on the top of the filament (in the middle instead of the top of the anther) is very decisive in this respect. Among the *Ajugeæ* your genus would be readily distinguished by the organisation of the corolla and of the androecium.

"If the nutlets have a thick and fleshy pericarp and a basilar surface of insertion then the position you give to the genus would be very good.

"At all events, the plant represents a new genus and your description gives a good idea of it."

PLATE 75.—1, branch of Eurysolen gracilis *Prain*, from the Kachin Hills,—*of natural size;* 2, cyme, one flower fully opened × 4; 3, calyx, laid open × 4; 4, half of corolla, showing annulus, saccate pouch and staminal insertion × 5; 5, ovary with style × 5; 6, anthers, and 7, vertical section through base of flower,—*both considerably enlarged.*

D. P.

PLATE 76.

83. GOMPHOSTEMMA INOPINATUM *Prain in Journ. As. Soc. Beng.*, lxix. 2. 172 (1900).

Natural order Labiatæ.

A stout herb; stems about 30 cm. high, ascending, rooting below, 4-grooved, with rounded angles, several from a woody stock, with dense, ash-grey, stellate tomentum and with copious, lax, spreading, white pubescence intermixed; *leaves* 4—6 pairs, the lowest small, the pairs 8—10 cm. apart, petioles 2·5—4 cm. (occasionally as much as 5 cm. long), pubescent like the stems but with fewer long lax white hairs in proportion to the stellate pubescence; lamina broadly ovate-acute, 8—12 cm. long, 4·5—7·5 cm. wide, the base of the lower leaves slightly cuneate, of the upper rounded; margin finely crenate except the basal fifth; nerves about six pairs ascending; upper surface finely velvety with a soft, ash-grey, stellate pubescence interspersed with longer simple subadpressed tomentum, under surface softly velvety with a felted, whitish-grey, stellate pubescence; *flowers* densely whorled, in radical spikes 5 cm. long, 3 cm. wide, on erect peduncles 8—15 cm. long with sometimes a pair of small foliaceous bracts about 6 mm. below the spike; peduncles pubescent like the stem but terete and more slender; floral bracts obovate, dentate, sparsely stellate-pubescent, tinged with pink, the lowest 1·25 cm. long, ·6 cm. wide; *calyx* wide-campanulate, glabrous within, tube rather closely stellate externally, limb with 5 equal, wide-triangular, claret or purple lobes sparsely stellate on the strongish central and weaker marginal nerves, 1·25 cm. long, 1 cm. wide, the lobes ·5 cm. long; bracteoles obovate-lanceolate, 5—6 mm. long, reddish; *corolla* 2 cm. long, upper lip subentire, lower 3-lobed with slightly emarginate mid-lobe and inflated throat, hairy (apparently annulate) within; *stamens* exserted, filaments hirsute at their insertion; *ovary* and style glabrous; *nutlets* usually 4, sometimes 2—3, reddish, quite glabrous, wall very thickly coriaceous when dry.

UPPER BURMA: Kachin Hills at Langkon, 3,000 feet elevation; *Prain's Collector!*

Only one of the specimens had a few rather shrivelled corollas, from two of these, soaked as carefully as possible, the above description is given. Their colour is not particularly noted by the native collector, who simply remarks "flowers red," with reference doubtless to the purple or claret-coloured calyx. Further examination of less advanced specimens will be required in order to confirm the existence of a distinct annulus. Its other characters however amply justify its title to specific rank. It is not very like any of the hitherto described Indian *Gomphostemmata*. The fact that the flowers occur on independent leafless stems or scapes recalls the habit of *G. chinense* Oliv., and the fact that the calyx and less markedly the bracteoles are purple-coloured recalls also *G. Curtisii*, and *G. pedunculatum* which are the other members of the group

Pedunculata to which *G. chinense* belongs. The general facies of the species nevertheless rather recalls the *Strobilina* group of the § *Pogosiphon* to which, from the presence of hairs within the corolla tube, it must necessarily be referred. If, however, we are right in supposing that these hairs form a distinct annulus, instead of being scattered as in the other *Strobilina*, it must be considered in this respect as linking that group with the hitherto somewhat isolated *G. Hemsleyanum*.

This is the second new species recorded since the publication by the writer in 1891 of *An Account of the genus Gomphostemma* (Ann. Roy. Bot. Gard., Calcutta, iii. 227 *et seq.*). The other species, *Gomphostemma furfuraceum* Hallier fil., has been very fully and accurately described and figured by its author, after comparison with the material in the Calcutta Herbarium, in *Bull. de l'herbier Boissier* vi. 351, 622 t. 9, f. 1 a—c (1898) It is a species of § *Eugomphostemma*, group *Melissifolia*, and as its bracts are not longer than the calyx it comes nearest to *G. velutinum* and *G. Mastersii*. The outer bracts are however in shape like those of *G. ovatum* and *G. melissifolium* so that it stands, as its author has already indicated, intermediate between *G. ovatum* and *G. Mastersii*. It is a native of Eastern Sumatra.

PLATE 76.—Gomphostemma incpinatum *Prain*. 1, plant from the Kachin Hills,—*of natural size;* 2, flower, with bract and bracteoles; 3, corolla, laid open; 4, calyx, in fruit, laid open to show nutlets in position; 5, single nutlet; 6, the same laid open showing seed within,—*all enlarged*.

D. P.

PLATE 77.

84. NEPETA PRAINII *Duthie*.

Natural order Labiatæ.

Whole plant 3—4·5 dm. high, glandular-pubescent; *rhizome* woody; *stems* many, simple or branched, erect, rigid, scabrous, the lower portions hispid with stiff spreading hairs; *leaves* ovate-lanceolate, obtuse, rounded or cordate at the base, coarsely crenate, rugose on the upper surface, prominently veined beneath; lower leaves distinctly petioled, the upper smaller and subsessile; *floral leaves* linear-lanceolate, acuminate, about 6 mm. long; *verticillasters* many-flowered; the lower ones distant and peduncled, the upper sessile; *flowers* hermaphrodite; *bracts* about $\frac{1}{2}$ the length of the calyx, linear-lanceolate or setaceous, clothed with stiff spreading hairs; *calyx* strongly 15-nerved, hispid with spreading hairs; tube cylindrical, curved, reddish-purple; mouth oblique; teeth lanceolate acuminate, $\frac{1}{4}$ the length of the tube; *corolla* distinctly 2-lipped, exceeding the calyx; upper lip erect, obcordate; lower deeply 3-lobed, hairy inside towards the base; side-lobes rounded; terminal bifid at the apex, its sides 3-lobulate; *stamens* slightly exserted, about equal in length, the anterior pair attached lower down on the corolla-tube than the posterior pair; filaments hairy towards their bases; *style* about as long as the stamens; *nutlets* under 2 mm. long, oblong-oval, muriculate.

N.-W. FRONTIER: Kurram Valley; *Duthie's collector* (No. 15432); Samána range, *E. C. Hare*.

This very distinct species falls, by its characters, into the section *Stenostegia* Boiss. 2, *b* (*Flor. Orient.* iv, 638).

PLATE 77.—Nepeta Prainii *Duthie*, Portion of a plant;—*of natural size.* Fig. 1, side view of a single flower; 2, corolla laid open; 3, calyx laid open, showing the style and ovary; 4, ripe nutlet,—*all enlarged.*

J. F. D.

PLATE 78.

AFRIDIA *Duthie in Journ. Bomb. Nat. Hist. Soc.* xi. 696 (1898).

Natural order Labiatæ.

Calyx tubular, 15-nerved, slightly curved, mouth oblique, entire; *corolla*-tube slender towards the base, exserted, without a ring of hairs within; limb 2-lipped, posterior erect, concave, bifid; lower spreading, 3-fid; mid-lobe larger than the lateral ones, bifid; *stamens* 4, nearly equal, ascending beneath the posterior lip, exserted or included; *anthers* 2-celled, lobes diverging and at length divaricate; *disk* divided into four equal lobes; *style* included or exserted, bifid; lobes subulate, nearly equal; *nutlets* obovoid, minutely tuberculate, with a V-shaped areole at the base.—Suffruticose, with many branching stems; *flowers* in densely packed verticillasters forming compact terminal spikes, or with the lower clusters more or less interrupted; *corolla* pale-yellow tinged with lilac.

This genus is most nearly related to *Nepeta*, both as to its habit and in its general structure; but the truncate mouth of the calyx distinguishes it from all other genera of the tribe *Nepeteæ*. The dimorphism of the flowers might suggest an affinity with *Oxynepeta* of Bunge (a section of *Nepeta*), but the tendency in *Afridia* is towards a dicœcious condition.

85. AFRIDIA NEPETÆFORMIS *Duthie.*

A hoary-pubescent undershrub; *stems* 3—6 dm.; *leaves* shortly stalked, 1·5 to 5 cm., by ·7 to 2·5 cm., ovate or ovate-lanceolate, obtuse, cordate, crenate, rugose on upper surface, prominently veined beneath; *spikes* of long-styled form shorter and more compact than those of the short-styled one; *lower bracts* leaf-like; *bracteoles* membranous, shorter than the calyx, ovate, acute or acuminate, 3-nerved; *calyx* 6 mm. long, clothed with spreading hairs and more or less tinged with reddish purple; *corolla* 1 cm. in length, exserted, hairy outside; tube slender, curved; *stamens* of short-styled form exserted, nearly equal in length, the posterior pair slightly overtopping the anterior, *filaments* clothed with spreading hairs towards their bases, *anther-lobes* divaricate; *stamens* of long-styled form included, *filaments* very short, the posterior pair attached to corolla a little higher up, *anther-lobes* remaining confluent; *style* slender, included or exserted. Nepeta suavis *Stapf, Kew Bulletin* (Dec. Kewens. xxiii. 227) for 1896, 19.

AFGHANISTAN: *Griffith* (No. 4060); Kurram Valley, at an elevation of 7,500 feet; *Aitchison*, 1879 (Nos. 634 and 643 "Nepeta sp."); at 8,000 feet, 1894; *Harsukh* (plant collector, Bot. Dept., N. India); Samána range and Tirah, at elevations of between 4,500 and 8,500 feet; *Inayat Khan* (plant collector, Bot. Dept., N. India), 1897, No. 20921.

PLATE 78.—Afridia nepetæformis *Duthie.* A—portion of plant of short-styled form,—*of natural size.* B—portion of plant of long-styled form,—*of natural size.* Fig. 1, side-view of single flower of A; 2, corolla of ditto, laid open; 3, side-view of single flower of B; 4, corolla of ditto, laid open; 5, calyx and pistil of B; 6, single stamen of B; 7, four-lobed disk; 8, ripe nutlets; 9, single nutlet; 10, seed,—*all enlarged.*

J. F. D.

PLATE 79.

86. GYMNOSTACHYUM LISTERI *Prain in Journ. As. Soc. Beng.* lxix. 2. 171 (1900).

Natural order Acanthaceæ.

A small undershrub, a foot high or less; *leaves* oblanceolate, acute or acuminate, tapering gradually in the posterior half to a petiole 1—2 cm. long, margins entire, nerves 12—14 pairs slightly arched forward, minutely puberulous on both surfaces, attaining 20 cm. long by 8 cm. wide, broadest at junction of anterior and middle third; *panicles* chiefly from the axils of the lower leaves and the scars below these, 4—6 cm. long, branchlets subspicate; *flowers* solitary or clustered; bracts small linear; *sepals* 5 mm. long, linear; *corolla* puberulous; *anthers* spurred at base, linear-oblong; *style* puberulous; *capsule* 1·25 cm. long, narrow, glabrate; *seeds* ovoid, compressed, muriculate.

CHITTAGONG: Demagiri, in rocky places; *Lister!*

Very closely related to *Gymnostachyum latifolium* T. And. and, along with that species, standing markedly apart from the other Indian species of *Gymnostachyum.* It is, however, very distinct from *G. latifolium* in the different folliage, the smaller flowers with different anthers, and the smaller capsules.

PLATE 79.—Gymnostachyum Listeri *Prain.* 1, flowering plant; 2, fruiting twig,—*of natural size:* 3, flower; 4, calyx; 5, flower-bud, opened; 6, corolla, laid open; 7, 8, stamens; 9, ovary; 10 capsule, opened; 11, 12, seeds seen from either face; 13, seed, seen edgewise,—*all enlarged.*

D. P.

PLATE 80.

87. PERISTROPHE LONGIFOLIA *King & Prain in Journ. As. Soc. Beng.* lxix. 2. 171 (1900.)

Natural order Acanthaceæ.

An erect spreading herb; *leaves* narrowly lanceolate, margin undulate, finely lineate on both surfaces, glabrous except the puberulous midrib both above and below, apex long acuminate, base cuneate, tapering to the petiole 1·25 cm. long, length 10—13 cm., width 1—2·5 cm.; *panicles* compact, bracts 2 cm. long, 4 mm. wide, minutely ciliate; *calyx*-teeth narrow lanceolate, short; *corolla* pale-pink to nearly white, 3·5 cm. long, tube slightly exceeding limb; *stamens* with puberulous filaments; anther-cells linear, equal, but one more than half its length higher than the other.

UPPER BURMA: Kachin Hills, near Sadon, 3,500 ft.; *Prain's collector!* UPPER ASSAM: Jaboca Naga Hills, near Baligan; *Prain's collector.*

This species, which was not previously represented at Kew or Calcutta, appears to come nearest the group of forms aggregated in the *Flora of British India* under the common name *Peristrophe acuminata,* but the larger corolla and different stamens

seen to distinguish it sufficiently from all of them. As to leaves it most resembles the Tavoy specimens of *P. acuminata* (type) as understood by Mr. Clarke. In the Kew collection the plant most like this in foliage is Henry n. 4153 from Ichang, C. China, and there noted by Mr. Hemsley as "*P. tinctoria* Nees *var.*, vel *species propria.*" The Chinese plant has, however, much broader bracts than ours though it has a similarly condensed inflorescence. *Hypoestes salicifolia* O. Kuntze, represented at Kew by an authentically named, but flowerless, scrap, also resembles this somewhat in foliage and inflorescence as well as in bracts.

PLATE 80.—Peristrophe longifolia *King & Prain.* 1, branch of plant from Sadon, Kachin Hills,—*of natural size;* 2, calyx, opened; 3, corolla, laid open to show staminal insertion; 4, anther cells, front view; 5, the same, from behind; 6, ovary, with style and stigma; 7, ovary, laid open; 8, ovule,—*all enlarged.*

G. K.; D. P.

PLATE 81.

88. PERISTROPHE FERA *C. B. Clarke in Hook. f. Flor. Brit. Ind.* iv. 556 (1885), var. GAGEI *King & Prain.*

Natural order Acanthaceæ.

An erect rather rigid shrub; *leaves* ovate-lanceolate, long petioled, acuminate, margin entire or very shallowly crenate, quite glabrous on both surfaces, raphides distinct, base cuneate, 9—12 cm. long, 4·5—5 cm. wide; *panicles* compact, bracts ovate-acute, finely puberulous, distinctly nerved, eciliate, 1 cm. long, 4 mm. wide; *calyx*-teeth lanceolate, short; *corolla* pink, 3 mm. long, tube as long as limb; *stamens* with pubescent filaments, anther-cells linear, the upper rather smaller and nearly half its length higher than the lower; *capsule* puberulous, 1·75 cm. long, ellipsoid, stipitate, 4-seeded, seed-bearing portion 4 mm. across; *seeds* suborbicular, compressed, minutely papillose.

SOUTHERN LUSHAI HILLS: Lungleh; *Gage!* KHASIA HILLS, 2,000—4,000 ft. elev.; *Hooker & Thomson.*

This very distinct plant was on examination considered by one of us to be a new species of *Peristrophe* nearly related to *P. fera* Clarke. Specimens were sent from Calcutta to England and in compliance with our request Mr. C. B. Clarke, whose knowledge of the *Acanthaceæ* is very great, kindly compared them with the *Peristrophe* material preserved in the Herbarium of the Royal Gardens, Kew. Mr. Clarke finds this plant apparently identical with *some* of the examples of his "*P. fera*" collected by Hooker and Thomson in Khasia at 2—4,000 feet elev. and named, in their *Herb. Ind. Or.*, "*P. tinctoria,*" of which *P. fera* is perhaps only the wild state. Mr. Clarke deprecates the separation of the present plant as still another species. With this feeling we agree; the form is, however, so distinct, both from what has been described as typical *P. fera* and from what has been distinguished as *P. fera* VAR. *intermedia*, that it is here accorded the rank of a new variety.

PLATE 81.—Peristrophe fera *Clarke* VAR. Gagei *King & Prain.* 1, branch with flower and fruit, from Lungleh, Lushai Hills; 2, calyx, laid open; 3, corolla, laid open; 4 stamens × 2; 5, ovary; 6, fruit; 7, the same, laid open × 2; 8, seed.

G. K.; D. P.

PLATE 82.

89. Polygonum virginianum *Linn. Sp. Pl.* 360 (1757).

Natural order Polygonaceæ.

A tall sparsely hispid herb with perennial root; *stem* up to 15 dm. in height; branches hollow; *leaves* shortly petioled, 7·5 to 20·5 cm. long, elliptic-ovate or ovate-lanceolate, acuminate, strigose on both surfaces or only on the veins beneath, sparingly ciliate on the margins, thin, pale beneath; *stipules* tubular, varying in length up to 1·5 cm., hispid, the mouth truncate and ciliate; *racemes* very slender and long-peduncled, terminal and axillary; *bracts* tubular, ciliate; *bracteoles* oblong or obovate when spread out, hyaline, ciliate; *pedicels* shorter than the perianth, rigid and stout in fruit; *perianth* 4-partite, eglandular, thin, greenish or rose-coloured; *stamens* 5, alternating with glands; *styles* 2, exserted, rigid, persistent, at length hooked; *stigmas* simple; *nut* flattened, as long as the styles, smooth and shining, dark brown or cream-coloured. *Meisn. Monog. Polyg.* 81 (1826); *DC. Prod.* xiv. i. 112 (1857); *Hook. f. in Flor. Brit. Ind.* v. 31 (1886); *Britton & Brown, Ill. Fl. N. States and Canada* i. 561 (1896). P. filiforme *Thunb. Fl. Jap.* 163 (1784); *Meisn.* l. c. 75 (1826); *DC. Prod.* l. c. (1857). P. muticum *Moench. Suppl.* 266 (1802). Persicaria virginiana *Gærtn. Fruct.* ii. t. 119, f. 3 (1791).

Western temperate Himalaya: Hazára in the Kagán Valley, and at Dara Panjál *Duthie's Collector*; Kashmir; in the Jhelam Valley, and on the Pir Panjál; *Stewart;* Sikkim: on the Balesan river, at elevations between 7,000 and 8,000 feet, *King;* Assam: Naga Hills, Piphema, at an elevation of 3,000 feet; *C. B. Clarke;* Burma: Kachin Hills, Soma, at an elevation of 3,000 feet, *Prain's Collector.*

Sir Joseph Hooker, in *Flor. Brit. Ind.* l. c., remarks that the long persistent styles free to the base, serving to attach the fruit to foreign bodies, is unique in this genus, and that it indicates that the species should form a separate section; he also alludes to the singularity that though provided with so obvious a means of transport the species should be so rare in India.

Plate 82.—Polygonum virginianum *Linn.* Portion of a plant,—*of natural size.* Fig. 1, a stipule laid open; 2, flower with 2 bracteoles; 3 & 4, bracteoles separated and laid open; 5, single stamen with alternating glands; 6, nut, enclosed in the persistent perianth; 7, ditto, with the perianth removed; 8, section of ditto, to show the single basilar seed,—*all enlarged.*

J. F. D.

PLATE 83.

90. Machilus Duthiei *King in Hook. f. Fl. Brit. Ind.* v. 861 (1890).

Natural order Laurineæ.

A medium-sized evergreen tree with spreading branches; younger portions often finely silky; *leaves* 12—25 cm. long, oblong or elliptic-lanceolate, acuminate, often subfalcate, with 12—20 pairs of nerves, dark-green above, pale and glaucous beneath, very coriaceous, becoming reflexed as the fruit ripens; petioles about 14 mm. long; *flowers* in axillary panicles, 14 mm. in diam.; peduncles and pedicels elongating in fruit, tinged with bright red; *sepals* linear-oblong, finely silky, reflexed in fruit;

flaments glabrous; *fruit* globose, 10—15 mm. in diam., of a dark sage-green colour turning to blue.

Western Himalaya: from Chamba to Kumaon at elevations between 2,000 and 8,000 feet; ?Sikkim and Khasia: *J. D. Hooker*, &c. (without flowers or fruit).

This handsome evergreen tree is very abundant in Tehri-Garhwál and Jaunsár, often forming nearly pure forest on the northern slopes of the hills, and in shady valleys at elevations between 6,000 and 8,000 feet. The flowers open in May; and the fruit, which remains for a long time on the tree, ripens in August and September. This tree is termed "Bhadrao" in Garhwál, whilst *M. odoratissima* is known by the name of "Kaul." The latter, which is a rarer tree than *M. Duthiei* and without its gregarious habit, is easily distinguished by its smaller leaves and flowers, by its slender green peduncles and pedicels, and by the oval-shaped berries.

Plate 83.—Machilus Duthiei *King*. Portions of a flowering branch and of a fruiting branch,—*of natural size*. 1, single flower; 2, two perfect stamens and a staminode,—*both enlarged*.

J. F. D.

PLATE 84.

91. Apostasia Wallichii *R. Br. in Wall. Pl. As. Rar.* i. 75, t. 84 (1830).

Natural order Apostasieæ.

A terrestrial, erect, glabrous herb 2 to 6 dm. high, with a short rhizome; the stem cylindric, unbranched, about as thick as a goose-quill, often sending out near its base a few wire-like aerial roots, enveloped in its lower part by blunt sheaths of unequal length and in its upper part by the sheaths of the leaves; *leaves* 8 to 10, scattered, membranous, spreading and decurved, linear-lanceolate, acuminate, slightly dilated at the sheathing base, 5- to 7-nerved, entire, 12 to 20 cm. long and 1 to 1·5 cm. broad; *racemes* several, often branched, from the axils of the upper leaves, spreading, deflexed, 5- to 10-flowered, subsecund, half as long as the leaves; the peduncle short, naked; *flowers* about 2 cm. long (including the ovary), erect, each with a minute, keeled, lanceolate bract at its base; *perianth* uniformly yellow, fragrant, regular, about 5 to 6 mm. long, its 6 segments uniform, spreading, narrowly lanceolate, sub-acute, their apices deflexed; perfect *anthers* two, slightly longer than the style, closely adpressed together, erect, oblong, sub-acute, 2-celled; each attached by a short subulate filament to the sigmoid fleshy receptacle: their cells unequal at the base and slightly cordate, dehiscing introrsely and longitudinally; pollen-grains free, ellipsoidal; *staminode* solitary, elongate, semi-cylindric, slightly thickened towards the base, tapering somewhat to the sub-acute apex, originating from the same receptacle as the perfect stamens, but cohering to the style for nearly its whole length, free only near its apex; *style* somewhat shorter than the perianth segments, cylindric, erect, slightly larger than the staminode; stigma discoid, truncate-crenate, obscurely 3-lobed; *ovary* inferior, on a short pedicel, narrowly cylindric, obscurely 3-angled, 3-celled, the three placentas axile, continuous throughout its whole length, multiovulate; *capsule* 2 to 2·5 cm. long, slender, sub-cylindric and slightly tapered upwards, obscurely 3-ridged, smooth, shining, brown, crowned by the withered perianth; *seeds* very numerous, minute, ellipsoid to obovoid, with a minute white process at one

end, the body pale-brown and rugulose. *Wall. Cat.* 4448 (1832); *Blume in Ann. Sc. Nat.* ser. 2, ii. 93 (1834); *Miquel Fl. Ind. Bat.* iii. 748 (1855); *Thwaites Enum. Pl. Ceyl.* 315 (1861); *Rolfe in Journ. Linn. Soc.* xxv. 237, t. 48, fig. 22 to 24 (1889); *in Orchid Review* iv. 329 (1896); *Hook. fil. Fl. Br. Ind.* vi. 175 (1890). Mesodactylus deflexa *Wall. ex Pl. As. Rar.* l. c. 74 (1830).

Nepal, Sikkim, Khasia Hills, Assam, Ceylon, Malay Peninsula, Penang.

This plant was excluded by Mr. Pantling and myself from the eighth volume of these Annals (*The Orchids of the Sikkim Himalaya*) on the ground that the genus *Apostasia* is doubtfully Orchidaceous. The regular perianth, the free, unmodified anthers, style and stigma, the free pollen, trilocular ovary and hard ellipsoidal seeds characteristic of the genus contrast strongly with the same organs in the conventional Orchidaceous flower. The balance of authority is, however, undoubtedly in favour of the view that both *Apostasia* and the allied genus *Neuwiedia* represent aberrant, or rather very ancient, forms of *Orchideæ*. According to the latter view the "ancestral" characters of an orchid are in these two genera little, if at all, masked by the later adaptations which we are accustomed to associate with the flowers of that natural order. A *résumé* of the arguments in favour of this view will be found in Mr. Allen Rolfe's excellent papers in vol. xxv of the *Journal of the Linnean Society*, and in vol. iv of the *Orchid Review*. In the meantime the figure originally prepared for the volume on the *Orchids of Sikkim* is here given, accompanied by a description in which are used none of the terms peculiar to orchidologists, in the hope that thay may be of some use to botanists who have opportunities of examining living specimens of *Apostasia*.

PLATE 84.—A plant,—*of natural size*. 1, a flower showing the perianth, anthers, back of staminode, ovary and floral bract; 2, side view of a flower after removal of the sepals, petals and one of the anthers; A, the remaining anther, B, staminode, C, filament; 3, three-fourths view of both anthers (A) as they lie closely adpressed in the flower, of the sigmoid receptacle, and of the apex of the ovary; 4, the flower after removal of the anthers (which are shown separately at the side), B, staminode, C, filaments, D, stigma, E, style,—*all enlarged*.

G. K.

PLATE 85.

92. HITCHENIA GLAUCA *Wall. Trans. Med. Phys. Soc. Calcutta*, vii. 215 (1834).

Natural order Scitamineæ.

An erect herb; rhizome small, emitting slender long fibres bearing ovate-oblong tubers 5—8 cm. long; *stem* 9—12 dm. high; *leaves* large, oblong-oblanceolate, 2—3, rarely 4, cuspidate-acute, very glaucous, 3—4 dm. long, 1—1·5 dm. wide; *spike* terminal erect, 12—18 cm. long, 6 cm. wide, cylindric oblong, bracts all floriferous, crowded, orbicular-cuneate, 3—4 cm. long, upper third spreading, pale-green less glaucous than the leaves; *flowers* white; *calyx* thin, membranous, 1 cm. long, cylindric, limb 3-toothed slightly expanded, in the axil of a short oblong obtuse bracteole; *coroila*-tube very slender, tubular, 10 cm. long, segments small oblong, 1·5 cm. long, concave; *staminodes* as long as corolla-segments; *lip* ovate not clawed, acute, obscurely emarginate; *stamen* as long as the corolla-segments, filament short, anther

erect oblong, obtuse, fleshy, white; *capsule* oblong-trigonous, dehiscent; *seeds* few, oblong cylindric, obtuse, arillate; *arillus* lax, laciniate, white; testa coriaceous, shining. *Horan. Prodr.* 24 (1862); *Bak. in Hook. f. Flor. Brit. Ind.* vi. 224 (1890). Curcuma glaucophylla *Wall. Cat.* 6594 (1832).

BURMA: Prome; *Wallich.*

PLATE 85.—Hitchenia glauca *Wall.* 1, rhizome and base of stem reduced ½ from Wallich's original drawing; 2, inflorescence, of natural size, from the same; 3, flower, with buds of a single bract; 4, corolla lobes, stamens and staminodes, dissected; 5, calyx, opened; bract, and ovary; 6, anther with upper part of style *in situ*; 7, the same, upper part of style removed; 8, apex of style, and stigma; 9, capsule; 10, the same fully dehiscent; 11, 12, 13, seeds, with arillus; 14, seed greatly enlarged; 15, the same, in vertical section, embryo *in situ*; 16, the same, embryo removed; 17, embryo.

G. K.; D. P.

PLATE 86.

93. HEDYCHIUM LUTEUM [*T. Thoms. MSS.*] *in Herb. Calcutt.*; *Bak. in Hook. f. Flor. Brit. Ind.* vi. 232 (1892).

Natural order Scitamineæ.

A rather slender herb; *leaves* narrowly oblong-lanceolate, acuminate, 25 cm. long, 5—6 cm. wide, medium-green above, pale-green beneath; *spike* short, 6 cm. long, bracts ovate, medium-green with pale margin, closely imbricate, 2·5 cm. long, 2 cm. wide; *calyx* 3 cm long, just overtopping the bracts, bracteoles half as long as calyx; *corolla*-tube 5 cm., pale greenish-yellow below, rather darker upwards, segments linear, 3 cm., pale-yellow; *staminodes* ovate-lanceolate, lemon-yellow; *lip* lemon-yellow, orbicular, 2 cm. wide, bifid to one-third its diameter, the lobes slightly angled, abruptly narrowed to a rounded base above a distinct claw 7·5 mm. long; *stamen* lemon-yellow, 1 cm. long, filament paler yellow, 2·5 cm.; *stylodes* short, obtuse, subconical.

ASSAM: *Oldham.*

This very distinct species is only known from an excellent coloured drawing made at Calcutta under the supervision of Dr. T. Thomson, when Superintendent of the Royal Botanic Garden. Whether, in attaching the name *H. luteum* to the drawing, Thomson supposed that this plant is the *Hedychium luteum* of English gardeners to which reference is made by Link in *Enum. Hort. Berol.* i. 443 (1821), or whether the name, which is sufficiently appropriate, was intended to indicate a previously unknown species, cannot now be satisfactorily determined. The date of the drawing is November 1854. As the species has been described by Mr. Baker from a copy of this drawing and as the plant seems to be rare—at all events it has not been again collected in Assam—we have thought it advisable to publish a copy of the drawing.

PLATE 86.—Hedychium luteum *T. Thoms.* 1, upper portion of flowering stem; 2, flower and bud from axil of one bract; 3, 4, bracteoles,—*of natural size*; 5, stamen and stigma; 6, ovary,—*both enlarged*; 7, tranverse section of ovary,—*much enlarged.*

G. K.; D. P.

PLATE 87.

94. Zingiber pardocheilum *Wall. ex Voigt, Hort. Suburb. Calcutt.* 562 (1845).

Natural order Scitamineæ.

A stout leafy herb; *rootstock* horizontal, composed of a series of close-set subspherical tubers with numerous stout roots; leafy *stem* 40 cm. long 1·5 cm. thick; *leaves* oblong-lanceolate, acute, 30 cm. long, 7—8 cm. wide, mouth of the sheath with pale, oblong, obtuse auricles 3·5 cm. long, sheath outside and leaves above dark-green, paler beneath, glabrous; *flowers* in dense, obconic, subturbinate, hardly peduncled spikes, flattened or rounded at the top, 8 cm. long, 6 cm. wide; bracts much imbricated, obovate-cuneate, truncate or emarginate, dark-red, the outer 2·5 cm. long; *calyx* reddish, 1·75 cm. long; *corolla*-tube almost white, as long as the outer bracts, segments lanceolate, acute, 1·75 cm. long, dark-red at the tips, rather paler below; *lip* 1·5 cm. long, deeply 3-lobed, the midlobe wide-oblong, the lateral lobes orbicular, closely uniformly tesselate with wide dark-lilac or purple lines on a pale-yellow ground; *stamen* with narrow-oblong, subsessile anther; cells close, parallel, introrse, connective produced as a cobalt-blue, incurved, narrowly lanceolate, erect crest 5 mm. long; *ovary* hirsute, subturbinate; style somewhat dilated at the top, with a fringe of short hairs surrounding the stigma; *stylodes* short, obtuse. *Bak. in Hook. f. Flor. Brit. Ind.* vi. 245 (1892).

Burma: *Wallich.*

This beautiful species is only known from a fine coloured drawing in the Calcutta Herbarium made, under the supervision of Dr. Wallich, from a living plant grown in the Royal Botanic Garden; of this figure Plate 87 is a copy. It is published now in the hope thereby of attracting attention to the species and perhaps facilitating its re-discovery.

Plate 87.—Zingiber pardocheilum *Wall.* 1, plant,—*of natural size;* 2, flower × 3; 3, outer bract; 4, inner bract; 5 and 6, corolla-lobes; 7, corolla-tube, lip and stamen; 8, ovary and style,—*all enlarged.*

G. K.; D. P.

PLATE 88.

95. Zingiber Clarkei *King ex Benth. in Benth. & Hook. f. Gen. Plant.* iii. 646 (1883).

Natural order Scitamineæ.

A stoutish herb; leafy *stem* 15—18 dm. high; *leaves* oblong or oblong-lanceolate, 30—45 cm. long, 5—10 cm. wide, the under surface finely pubescent; *flowers* in lateral, oblong-cylindric spikes 8—10 cm. long, 3·5—4 cm. in diam., on nodding pubescent peduncles 8—10 cm. long, springing from the side of the leafy stem; main-bracts oblong, 2·5 cm. long, obtuse or retuse, in flower green, in fruit pale-red, each 2—4-fid; *calyx* yellowish, subtruncate; *corolla*-tube as long as the bracts, pale-yellow, segments 2·5 cm. long, pale-yellow, the uppermost widest; *lip* as long as the corolla-segments, irregularly ovate-oblong, yellow, the margins suffused with close-set brownish-purple streaks; *stamen* pale-yellow, nearly as long as the lip, crest almost filiform *capsule* subglobose, greenish, herbaceous, shorter than the

bract, 1·75 cm. across; *seeds* dark-blue, 6 mm. across, irregularly pisiform; *aril* small, white, laciniate. *Bak. in Hook. f. Flor. Brit. Ind.* vi. 248 (1892).

Eastern Himalaya: Sikkim, 2,500—4,500 ft.; *Hooker, Clarke, King, Prain.*

This species is the type of § *Pleuranthesis* Benth., which is characterised by having the flower-spikes lateral on the leafy stem. As no figure of this section has been published, the present opportunity is taken of reproducing an original drawing of the only species, made from a living plant in 1874.

Plate 88.—Zingiber Clarkei *King.* 1, rhizome and base of stem; 2, top of leafy stem; 3, 4, 5, & 6, main and secondary bracts and flowers, of one group; 7, single flower; 8, corolla segments; 9, lip; 10, anther; 11, ovary, with style and stigma; 12, fruiting spike; 13, single fruit; 14, capsule cut transversely; 15, seeds.

G. K.

PLATE 89.

96. Pancratium longiflorum *Roxb. Hort. Beng.* 23 (1814).

Natural order Amaryllidaceæ.

A bulbous herb; *bulb* globose, 3—5 cm. in diam., neck cylindric, 1 cm. wide, 3—4 cm. long; *leaves* narrowly lanceolate, 20—30 cm. long, 1—2·5 cm. wide; *scape* shorter than leaves or perianth-tube, compressed, 1-fld., 8 cm. long; spathe solitary, acuminate, 4 cm. long; *perianth* with greenish tube, 12—14 cm. long, 6—7 mm. wide throat obconic, lobes lanceolate, white, 5—6·5 cm. long; *staminal*-cup 3—3·5 cm. deep, 2·5—3 cm. wide, white, with large, 2-fid teeth 1—1·25 cm. long, between the pale-green filaments 1·25—1·5 cm. long; anthers 1—1·25 cm. long, yellow. *Roxb. Flor. Ind.* ii. 125 (1832); *Kunth. Enum.* v. 663 (1850); *Herb. Amaryllid.* 208, t. 42, f. 2? (1837); *Bak. Handb. Amaryll.* 119 (1888); *Hook. f. Flor. Brit. Ind.* vi. 286 (1892).

Malayan Archipelago: Moluccas, *C. Smith, fide Roxburgh.* India; N.-W. Provinces, at Lucknow, *Rose!* Oudh, Kheri; *Rose!* C. India, Raipur; *J. Martin!* Deccan, *Rottler.*

This interesting plant had long been lost to the Calcutta garden when in 1888 Mr. Rose, then Postmaster-General for Oudh, sent a number of bulbs from the compound of his residence at Lucknow. His house is believed to have been that occupied by the well-known Gen. C. Martin while in the service of the Nawab of Oudh. As Gen. Martin communicated rather freely with Dr. Roxburgh, our first impression was that the plants sent by Mr. Rose might be descendants of some presented by Dr. Roxburgh to Gen. Martin. Our plate, which is drawn from life, from one of the plants received from Lucknow, shows that the Lucknow plant agrees in every respect with the Moluccas plant as figured by Roxburgh, *Icon. Ined.* vii. 9 (serial No. 1959), except that the Moluccas plant is slightly larger in all its parts. Mr. Rose, to whom this opinion was communicated, was able a year later to show that, though a possible one, ours was not a necessary explanation of the existence of the plant in a Lucknow compound. He communicated other plants of the same species, undoubtedly wild, obtained by himself while on tour in Oudh.

Since then Mr. J. Martin, of the Indian Forest Dept., has kindly sent living plants from the district of Raipur in C. India, and Sir Joseph Hooker records, in

the *Flora of British India* vi. 286, the existence of specimens from the Deccan collected by Rottler. Apparently no one has sent it from the Malay Archipelago since Mr. C. Smith originally gave it to Dr. Roxburgh.

The plant is well worthy of more attention horticulturally than it has hitherto received.

There is something unsatisfactory regarding the citations under this species. Herbert, who had seen specimens of this name in the Banksian Herbarium—apparently original Roxburghian ones from the Moluccas—has given a figure (*Amaryllid.* t. 42, f. 2) which agrees well with the plant originally figured by Roxburgh as to leaf, spathe, length of tube and form of staminal cup, but differs very markedly in not showing the large 2-fid interstaminal teeth on the margin of the cup. Sir J. D. Hooker has suggested that Herbert's plant may rather be *P. biflorum* Roxb. than *P. longiflorum*, but has cited it under both species. It is on the whole more probable that Herbert's drawing is intended for Roxburgh's *P. longiflorum* and that a mistake has been made as regards the month of the staminal tube. Hooker has without question referred *P. cambayense* Herb. to *P. longiflorum* but as regards this citation there is the same difficulty in connection with the mouth of the staminal tube, with the further difficulty that the leaves of *P. cambayense* are obtuse. We have therefore omitted the citation *P. cambayense* Herb. altogether, and only cite the *P. longiflorum* of Herbert as doubtfully referable here.

PLATE 89.—Pancratium longiflorum *Roxb.* 1, plant; 2, flower; 3, portion of perianth-tube; 4, transverse section of perianth-tube; 5, ovary, in vertical section, with part of perianth-tube and style; 6, transverse section of ovary; 7, young fruit,—*all of natural size*, and all from a living plant received from Lucknow and grown in the Royal Botanic Garden, Calcutta.

G. K.; D. P.

PLATE 90.

97. CRYPTOCORYNE CRUDDASIANA *Prain in Journ. As. Soc. Beng.* lxix. 2. 174 (1900).

Natural order Aroideæ.

An aquatic herb, with tuberous, stoloniferous rootstock; *leaves* linear-lanceolate, 12—20 cm. long, ·75—1 cm. wide, rather abruptly acute, lower fourth to third sheathing; midrib distinct; *flowers* on very short scapes; tube of spathe narrow, 8 cm. long, limb shorter than tube, 3·25 cm. long, lanceolate-acuminate, not twisted, purplish and with irregular but very distinct transverse folds, 2·5 mm. apart, crossing the whole of the inner surface.

UPPER BURMA: Kachin Hills, by the Keju River, near Sima; *Prain's Collector!*

This very distinct species is in habit a small edition of *C. ciliata;* it thus does not closely resemble any other Indian species. The limb of the spathe is however longer and narrower in proportion to the tube and the tube is not fimbriate as in *C. ciliata.* It has, moreover, many transverse rugae as in *C. spiralis* Fisch.; *C. spiralis,* however, has very different leaves and a spathe with a twisted limb, this limb being longer than the tube.

PLATE 90.—Cryptocoryne Cruddasiana *Prain*. 1. Plant from Keju river, Kachin Hills; 2, spathe with short peduncle; 3, spathe laid open,—*all of natural size;* 4, male inflorescence; 5, female inflorescence; 6, ovule,—*all enlarged.*

D. P.

PLATE 91.

98. ERIOPHORUM MICROSTACHYUM *Bœck. in Linnæa*, xxxviii. 399 (1874).

Natural order Cyperaceæ.

A cæspitose perennial herb, 5—15 cm. high; *stems* slender, from the axils of broad, membranous, brownish-coloured sheaths; *leaves* equalling or not much exceeding the flowering stems, glaucous, linear, rigid, channelled above, margins serrulate; *spikelets* subcapitate, 5—8 mm. long, many-flowered; *bracts* 1—3, twice or three times longer than the spikelets; *glumes* ovate-lanceolate, acute or acuminate, exposed portions dark chesnut-brown; *bristles* many, about as long as the stamens and styles; *stamens* 1—3; anthers oblong, abruptly mucronate; *styles* 3-fid, its branches rather shorter than the connate portion, papillose; *nut* trigonous or somewhat plano-convex, about as long as the style, obovate, with the apex attenuated. *Hook. f. Flor. Brit. Ind.* vi. 664 (1893). E. comosum *Wall.* β. nanum *Nees in Wight. Contrib.* 110 (1834).

WESTERN HIMALAYA: abundant in rock-crevices of the Deoban limestone range in Jaunsár, at elevations of between 8,000 and 9,000 feet; head of the Jumna Valley; *Jacquemont.* Naini Tal; *Thomson.* BHUTAN: Chupcha; *Griffith.*

A much smaller plant than *E. comosum*, of which it has been regarded as a depauperated alpine form. The inflorescence, however, is very different, and the leaves and bracts are relatively very much shorter. Figures B1 and B2, representing a spikelet and a flower of E. *comosum*, indicate other important differences, such as the shape of the glumes, the length of the bristle, and the very different shape of the nut.

PLATE 91.—Eriophorum microstachyum *Bœck.* Plant,—*of natural size.* A1, a spikelet; A2, a flower. B1, spikelet of *E. comosum;* B2, single flower of ditto,—*all enlarged.*

J. F. D.

PLATE 92.

99. TRIPOGON PURPURASCENS *Duthie.*

Natural order Gramineæ.

AN erect densely tufted annual or perennial grass, up to 20 cm. in height; *leaves* many, setaceous, convolute, scabrid, margins ciliate towards their bases, sheaths short; ligules minute, pilose; *spikes* simple, erect, flattened, 5 to 7·5 cm. long, on rather short, brittle, sulcate scapes; rachis scabrid; *spikelets* about 4 mm. long, glabrous, arranged bifariously in the excavations of the rachis, usually 2-flowered with occasionally a third male floret at the summit; *glume* I very minute and narrow, sunk in the hollow of the rachis and attached obliquely, hyaline, 1-nerved; *glume* II lanceolate acuminate, 1-nerved, keeled on the back, edges hyaline; *glume* III (flowering glume) about as long as II, hyaline, 3-nerved, obliquely bifid, and with a minute slender awn from the base of the sinus; *pale* truncate or bifid,

hyaline, 2-nerved; *lodicules* minute, cuneate-oblong; *filaments* shorter than the elongate anthers; *ovary* obovate, glabrous; styles long, their bases remote.

Western Himalaya: in the Tons Valley, Tehri-Garhwál, at elevations between 3,000 and 5,000 feet, also up to 7,000 feet on the open hillsides from Lambatách to Bámsu and Kulni, on the northern side of the Tons river. At the higher elevations this plant forms compact masses of turf over considerable areas, and the peculiar purple tinge of its foliage produces a marked feature from a long distance. In the sandy bed of the Tons river it has been found in some abundance, endeavouring to maintain a foothold.

This species is closely allied to *T. abyssinicus* Fl. Brit. Ind. (not of Nees), from which it differs by its more compact habit of growth, its purple tinge, and by its shorter leaves and spikes. The spikelets are more crowded and contain fewer florets, usually only two. When first detected in 1897, in the Tons Valley, it was distributed under the name of *Lepturus Roxburghianus*, and this determination was accepted at the Royal Herbarium at Kew. A more careful examination of the structure of the florets, necessitated for the preparation of above description and the accompanying plate, raised a doubt in my mind as to the correctness of this name, even generically. The frequent presence of 3 florets in some of the spikelets, coupled with a habit of inflorescence resembling that of a *Tripogon*, were indications of a closer affinity to that genus than to *Lepturus*. I should also mention that through the kindness of Major Prain I had an opportunity of examining Roxburgh's unpublished drawing of *Rottbœllia biflora*, which in the Fl. Brit. Ind. is included under *Lepturus Roxburghianus* Steud., and this confirmed my opinion in regarding these two grasses as generically distinct. Specimens of the Tons Valley grass were therefore again sent to Kew with a note expressing my doubt as to the correctness of the former name. I received in reply a very interesting communication from Dr. Otto Stapf, who after a careful re-examination of the material representing *Lepturus Roxburghianus* in the Royal Herbarium, has very obligingly favoured me with his views on the subject. In the first place he is of opinion that *Lepturus Roxburghianus* should be regarded as an *Oropetium*, and secondly that this genus should be removed from the tribe of *Hordeæ* to that of *Chlorideæ*, and next to *Microchloa* (see *Flora Capensis*, vii. 742, where this latter opinion is recorded by Dr. Stapf). The affinity of *Rottbœllia biflora* (*Lepturus Roxburghianus*), as well as of *Oropetium Thomæum*, to *Microchloa* had already been indicated by Roxburgh, who, in his "Flora Indica," included all three under the genus *Rottbœllia*. In Dr. Stapf's opinion *Lepturus Roxburghianus* is represented at Kew by specimens collected by Law in Bombay, and by King on Mt. Abu. They agree exactly with Roxburgh's figure, except that in the former the florets are minutely silky-pubescent, whereas Roxburgh represents the florets of his plant as glabrous. A specimen collected by Mr. J. R. Drummond in the Hissar district, and quoted under *Lepturus Roxburghianus* in the *Flor. Brit. Ind.* vii. 365, has also pubescent florets, and the leaves and spikes are longer than in Roxburgh's plant, though quite similar in other respects. Regarding the probable position of *Tripogon purpurascens* in the genus, I take the liberty of quoting the following extract from Dr. Stapf's note:—

"*Tripogon*, as it stands at present (it has not been worked up monographically), is a somewhat heterogeneous assemblage. The species on which the genus was founded is *T. bromoidee*, and this type is repeated in *T. filiformis* and with slight modifications in *T. capillatus*, *Wightii* and *trifidus*,

and perhaps *T. pauperculus*. They form the nucleus of the genus, and Mr. Duthie will agree with me if I say that the structure of their spikelets differs too much from those of his No. 23532 to place the latter immediately with the former. A second group of species described under *Tripogon* (viz., *T. Lisboæ, Jacquemontii*), and approaching in some respects to the section *Plagiostachys* of *Eragrostis*, differs equally well. There is, however, another species enumerated under *Tripogon* in Fl. Brit. Ind. 287, namely *T. abyssinicus*, which Mr. Duthie will have to compare very carefully with his plant from the Tons Valley. Some of the specimens placed in this species in the Kew Herbarium I take to be identical with Duthie No. 23532, though the leaves are not so purple. Such specimens are: Jacquemont No. 932, 'ab Adjalta ad Tahnao, inter valles Tonsa et Simla'; Thomson, Simla, Aug. 1847; Thomson, Satlej Valley near Rampore, Aug. 1847; Thomson, Punjab Himalaya, 1848 (Chamba); Thomson, Kashmir, 1848; Aitchison, Rawul Pindi, No. 1136. Other specimens from Afghanistan, Kashmir, and one from the Satlej Valley (Thomson, below Kotgarh, 1847) are taller and have more slender and flexuous spikes, leading to an extreme shade form collected near Simla (Duthie No. 10149), which was referred to *T. Jacquemontii* in Fl. Brit. Ind. as a variety '*submuticus*,' although the author remarks that the 'habitat is far removed from that of all other species' (of the *Jacquemontii* group). Whether this is really a distinct species or only an extreme variety of the *T. abyssinicus* of the Fl. Brit. Ind., Mr. Duthie will be better able to judge, knowing as he does the ground. I must, however, remark that the latter is not identical with the Abyssinian plant named so by Hochstetter and Steudel, which is more like a typical *Tripogon* of the *bromoides* group. The Indian *T. abyssinicus*, inclusive of Duthie No. 23532, might be regarded as a much reduced form of the typical *Tripogon*; but in this case the definition of *Oropetium* would have to be reconsidered. *Oropetium* is a comparatively little-known genus, and no doubt, a much reduced type; and as reduction often is accompanied by the obliteration of characters which help us otherwise in establishing the affinity of more fully developed species, the question is too difficult to be solved without a comprehensive study of all the allied genera."

Plate 92.—Tripogon purpurascens *Duthie*. Plant,—*of natural size*. Fig. 1, the two outer glumes; 2, a two-flowered spikelet; 3, stamens and pistils (one lodicule also shown),—*all enlarged*.

J. F. D.

PLATE 93.

100. Festuca lucida *Stapf in Hook. f. Fl. Br. Ind.* vii. 355 (1897).

Natural order Gramineæ.

Stem 6—9 dm., rather stout, smooth and shining; internodes 2, elongate; *leaves* 1·5 to 3 dm. by ·5 to 1 cm., finely acuminate, flat except the involute scaberulous margins, firm, smooth, glaucous, many-nerved; basal sheaths of innovations very long and loose; cauline tighter, pale, glaucous; ligule 6—8 mm. long, white, split to the middle into fine fibres; *panicle* 1·2 to 1·8 dm., lax, broadly ovate; branches simple to beyond the middle, scabrid; lowest 1 dm. long, lateral pedicels 9—13 mm.; *spikelets* 1 to 1·5 cm. long, pale-green, glistening; rachilla scabrid; outer empty *glume* 1-nerved, ovate, acute, hyaline except at the base; inner empty *glume* a little longer than the outer, 3-nerved, side nerves very short; *flowering glume* 5—7-nerved, oblong, acute or acuminate or trifid at the apex, membranous, scaberulous, side-nerves prominent; tips and margins hyaline, white; *palea* linear-oblong, keels scabrid; *lodicules* obliquely ovoid; *anthers* 5 mm. long, linear; *ovary* with a slightly oblique hispidulous top; styles just below the apex.

WESTERN HIMALAYA: on steep rocky slopes near Mandáli, in Jaunsár, at elevations of between 7,000 and 9,000 feet; *Duthie* (No. 14481).

This is a much smaller plant than *F. modesta*, to which it is most nearly allied. The glaucous tint of the foliage, and the polished and glistening appearance of the stems and spikelets, at once distinguish this grass from the former, with which it is sometimes associated.

PLATE 93.—Festuca lucida *Stapf.* Entire plant,—*of natural size.* 1, single spikelet; 2, empty glumes; 3, flowering glume; 4, palea, stamen and pistil; 5, lodicules; 6, ovary and styles,—*all enlarged*

J. F. D.

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C. A. P.—Reg. No. 53-6J—260—8-6-1901.
„ „ 44J of 1901-02.

Drawn by A. D. Molla.

Lith. by Centre Slip '98

GONIOTHALAMUS PEDUNCULARIS King & Prain.

Drawn by K. P. Dass

Lith. by Chitra Silpa Co.

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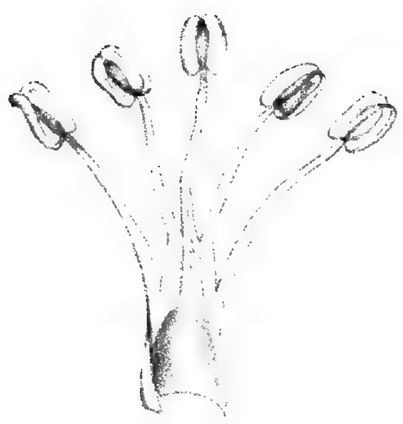

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Drawn by K. P. Dass.

Lith. by Chitra Silpi Cº

MECONOPSIS PRIMULINA Prain.

Drawn by K.P. Dass.

MECONOPSIS BELLA Prain.

Litho. at Indian Survey Office

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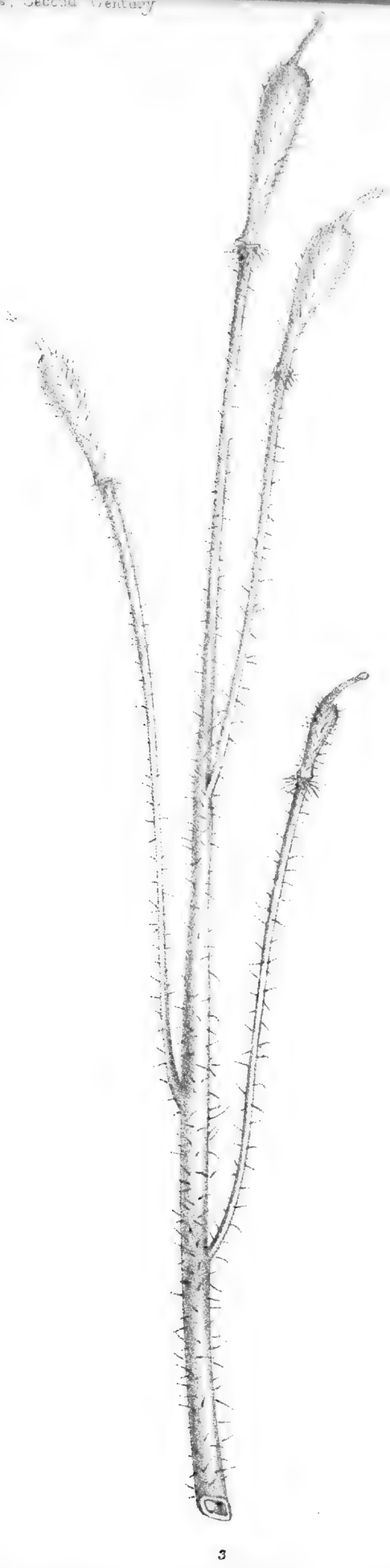
Drawn by K. P. Dass. Lith. by Chitra Silpi Cº

MECONOPSIS SUPERBA King.



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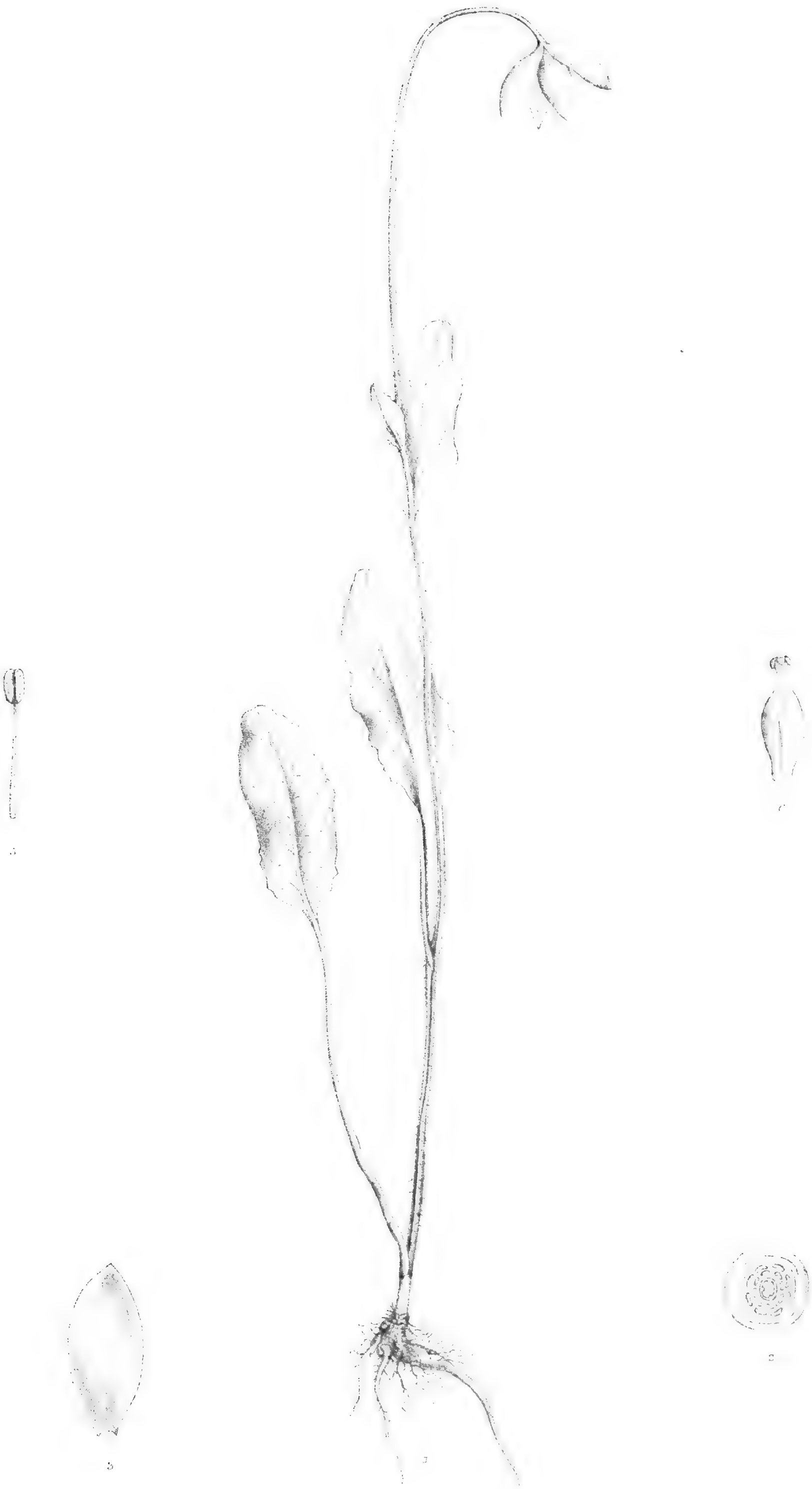
Drawn by K. F. Dass

Lith. by Chitra Silpi C.S.

MECONOPSIS SINUATA Prain

CALTHARCA LYRATA Lamm. & Prain.



Drawn by K. P. Dass.

Litho. at Ghosh Steam Co.

CATHCARTIA POLYGONOIDES Prain.

Drawn by K. P. Dass

Lith. by Chitra Silpi Co

CHELIDONIUM DICRANOSTIGMA Fram.

CATHCARTI HEMSL.
CAPPARIS ~~SIKKIMENSIS Kurz~~.

Drawn by A. L. Singh.

Lith. by A. C. Mukerjee

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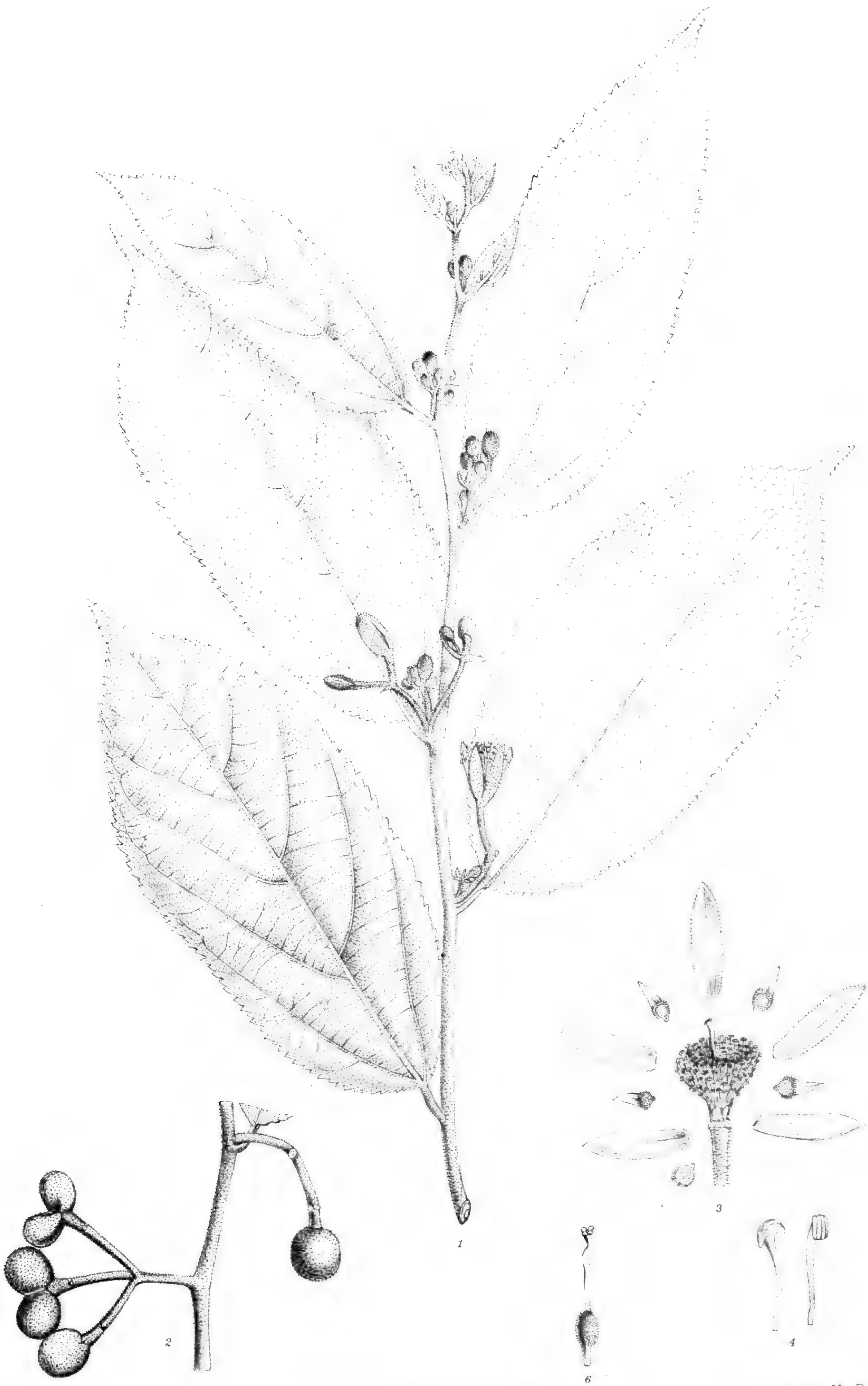


Drawn by K. P. Dass.

GREWIA ~~NAGENSIUM Prain~~ **DENTICULATA Wall.**

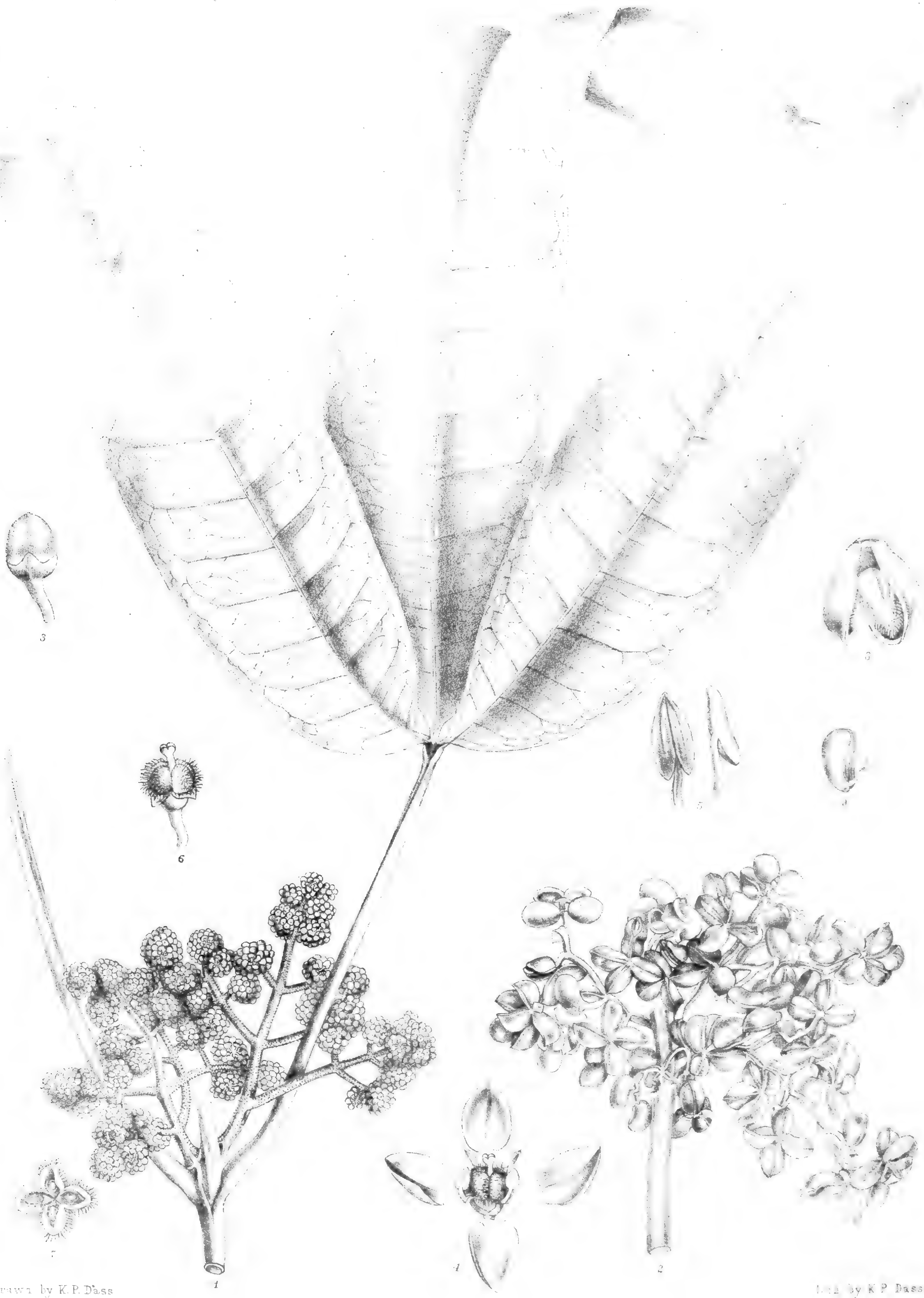
Lith: by K. D. Chandra.

Drawn by A. D. Molla.

Lith. by A. C. Singha.

EVODIA PILULIFERA King.

New Indian Plant, Second Century.



Drawn by K. P. D'ass

EVODIA MACROCARPA, King.

Lith by K P Dass.

Drawn by K. P. Dass.

Lith. by S. B. Ghose.

EVODIA PACHYPHYLLA King.

Bot. Gard. Calcutta.

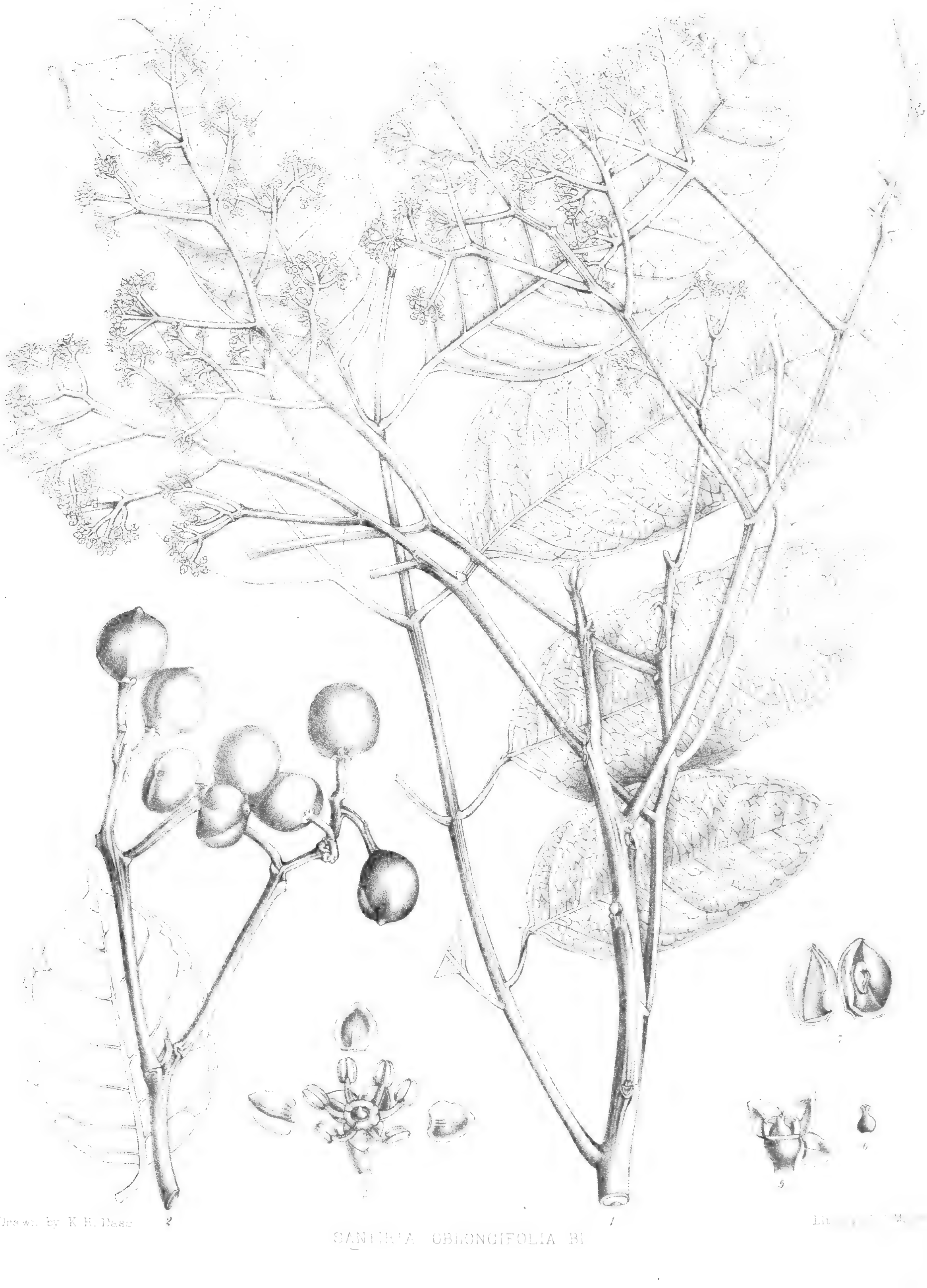
Drawn by K. P. Jose.

SANSEVIERIA LAXA, Wall.

Drawn by A. D. Molla.

SANTIRIA MACROCARPA King.

Lith. by A. C. Chowdhary.



SANICULA OBLONGIFOLIA Bl

Drawn by A. D. Mukt

SANJIVIA

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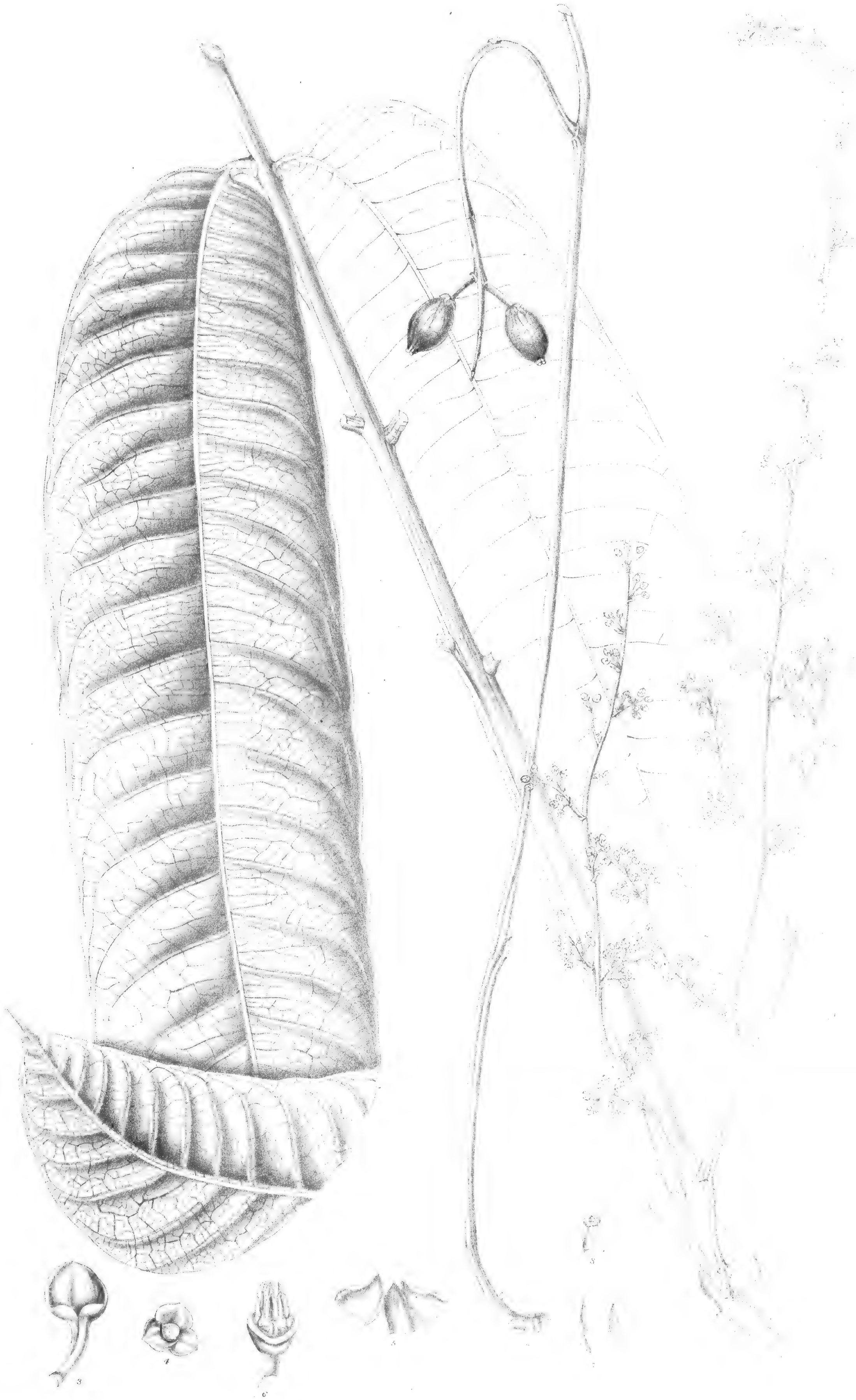


Drawn by A. B. Mallik.

SANTIRIA FLORIBUNDA King.

Lith. by A. C. Mukerjee.

Drawn by A. D. Molla.

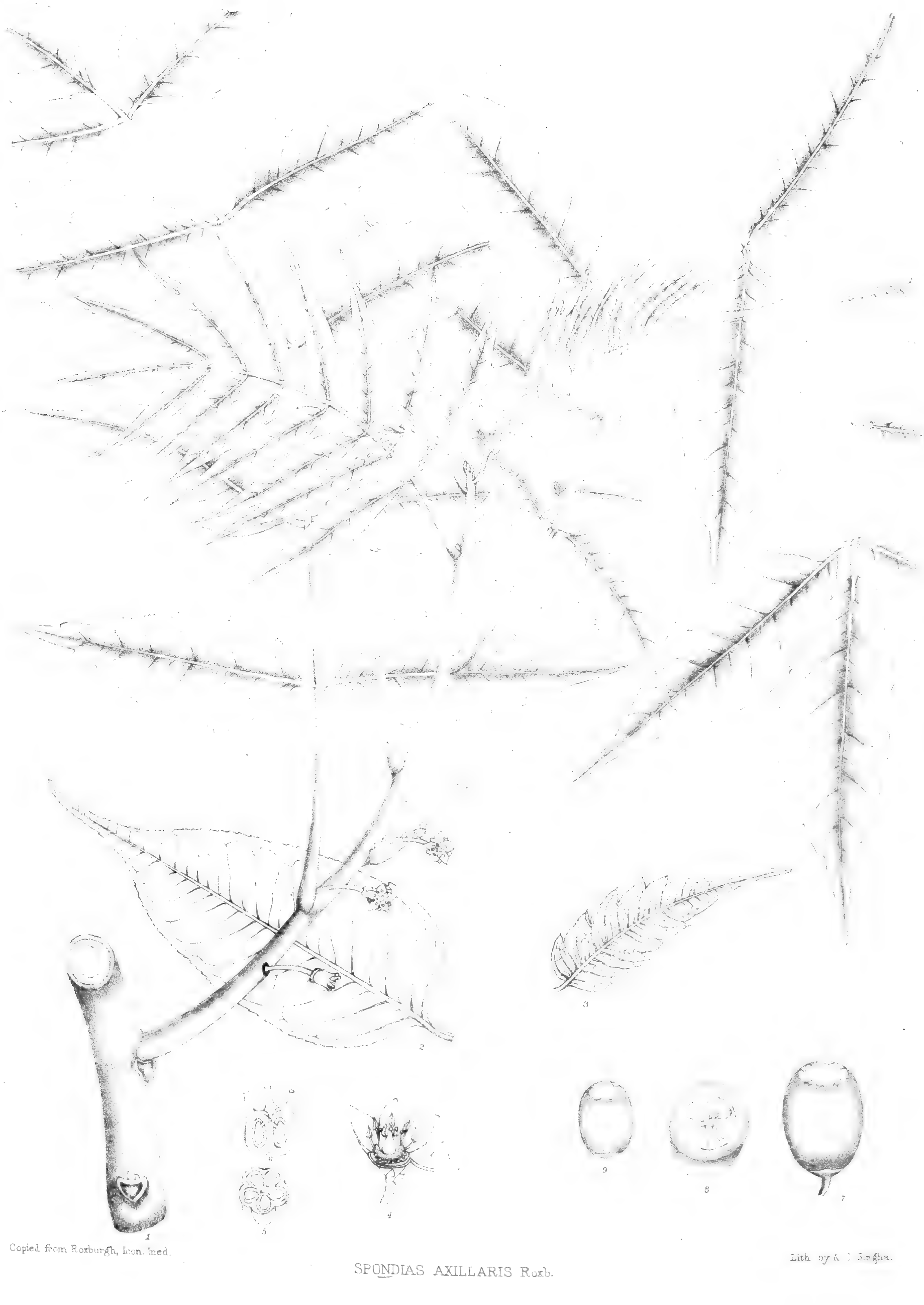
DYSOXYLUM RETICULATUM King.

Lith. by A. C. Singha.

PASSIFLORA JACQUINIANA Radlk.

Drawn by D. N. Chaudhuri

ACER PAPILIO King.



Copied from Roxburgh, Icon. Ined.

SPONDIAS AXILLARIS Roxb.

Lith. by A. C. Sinha.

Drawn by D. N. Chaudhuri.

TAENIOCHLAENA BIRMANICA Prain.

Lith. by Chitra Silpi Co

Drawn by A. D. Molla.

Lith. by Chitra Silpi Co

INDIGOFERA SQUALIDA Prain.

Drawn by K. P. Dass.

Lith: by Chitra Silpi Co

INDIGOFERA BELLA Prain.

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Drawn by H Hormusji

INDIGOFERA HAMILTONII Grah

Lith: by K.D. Chandra.

Drawn by K. P. Dass.

MILLETIA UNIFOLIATA Prain.

Lith. by K. P. Dass

Drawn by A. M. Banerji

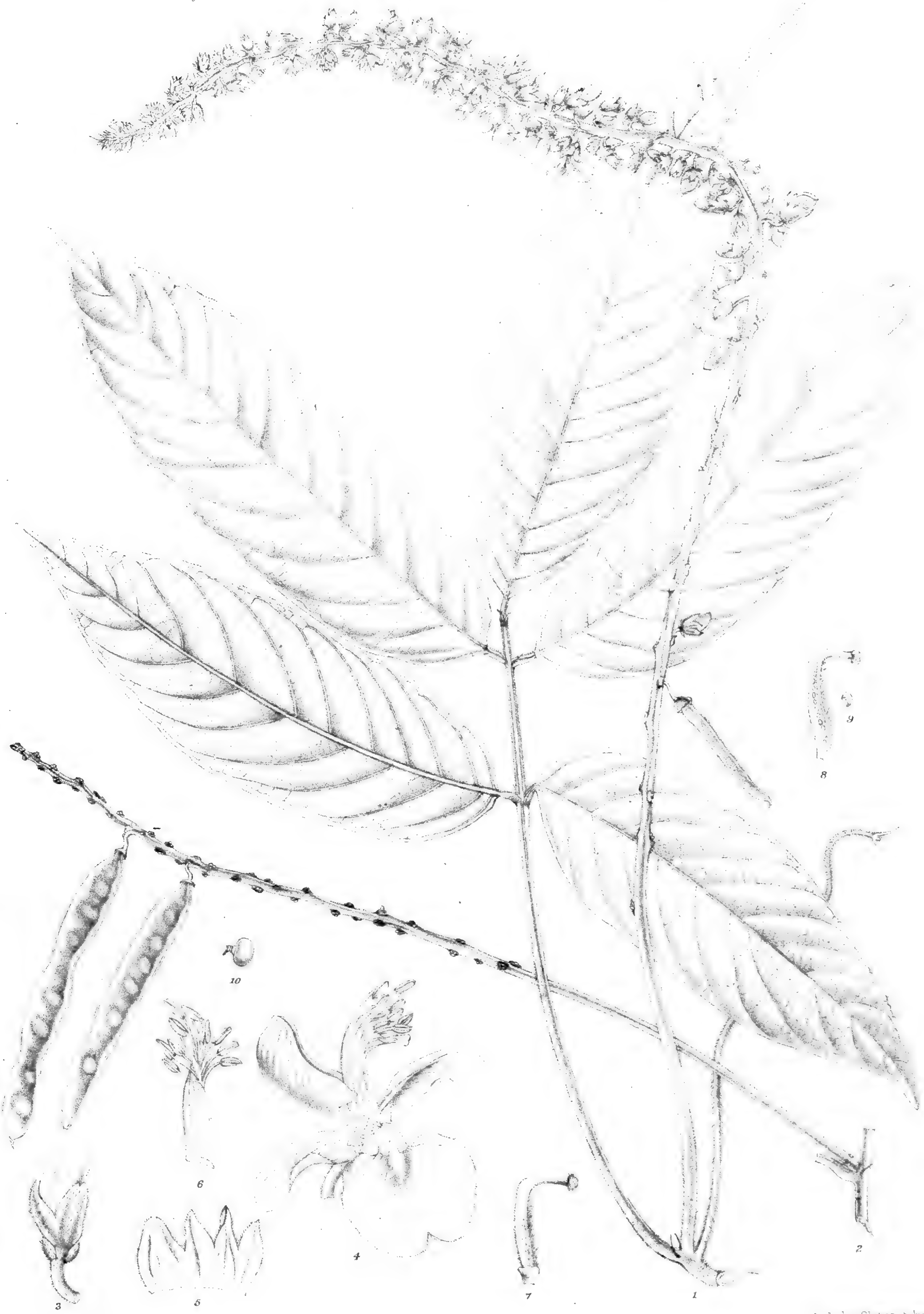
MILLETTIA ALBIFLORA Prain

Lith. by Calcutta Stat. Co.

Lith. by Cintra Sons Co.

MILLETTIA STIPULARIS Prain.

Drawn by H. Gomes.

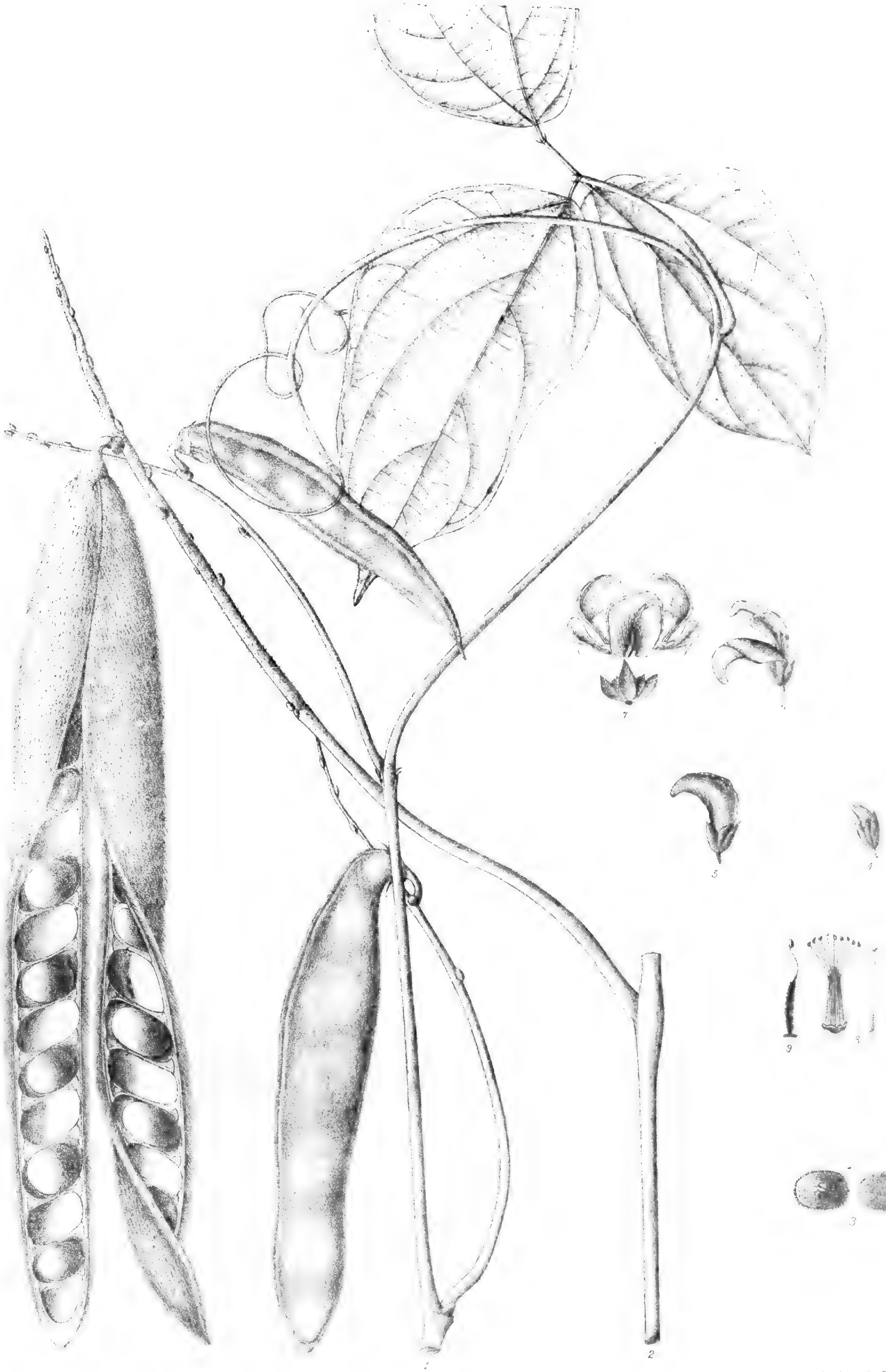


Drawn by D. N. Chowdhury.

Lith by Cintra Silpi Co

CRUDDASIA INSIGNIS Prain.

DYSOLOBIUM GRANDE Prain.



Drawn by S. B. Ghose.

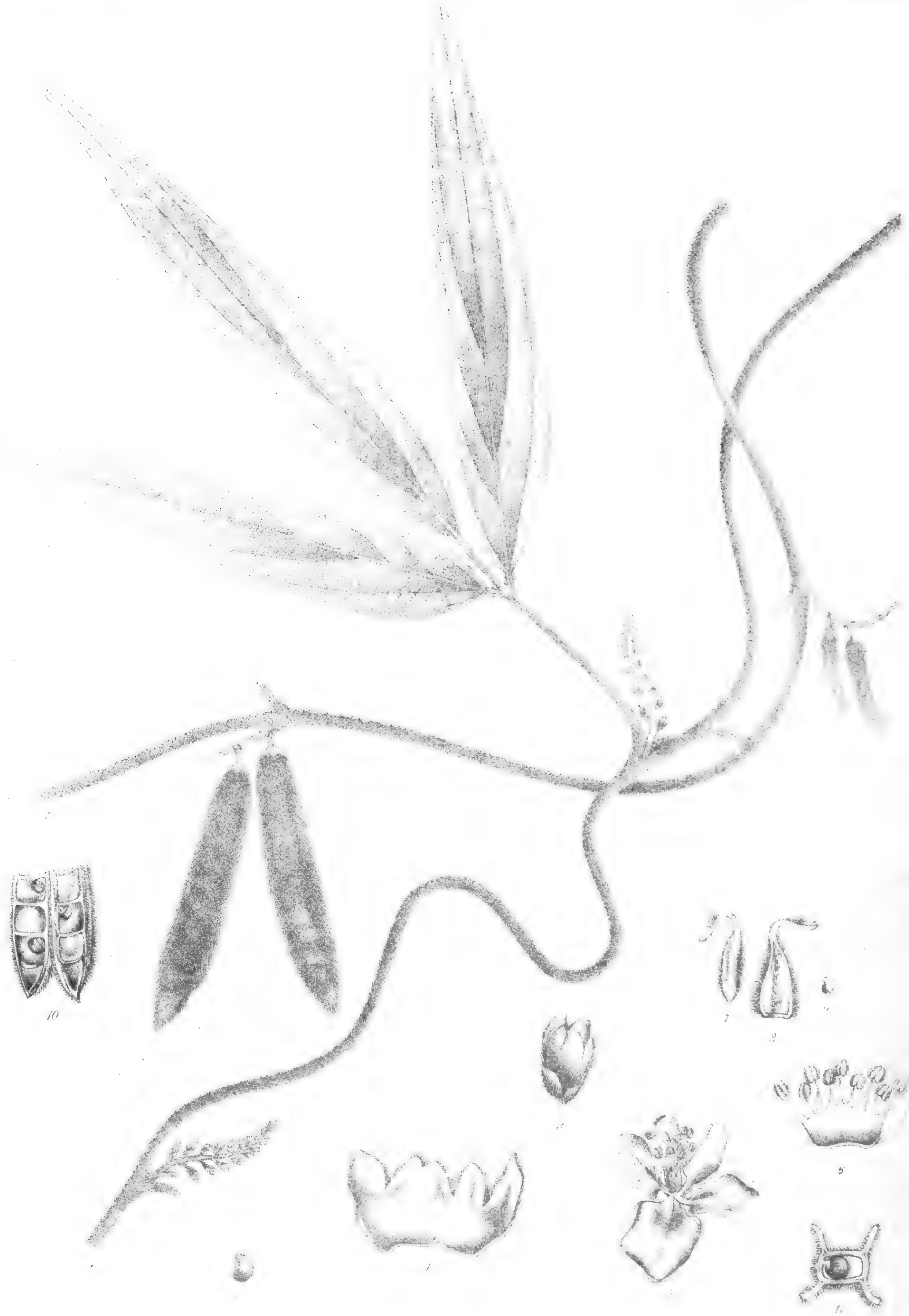
DYSOLOBIUM LUCENS Prain.

Lith. by S. B. Ghose.

Drawn by S. B. Ghose.

Lith by Chitra Silpi Co

DYSOLOBIUM DOLICHOIDES Prain.



Drawn by A. D. Prain

Dyodolobium tetragonum Prain.

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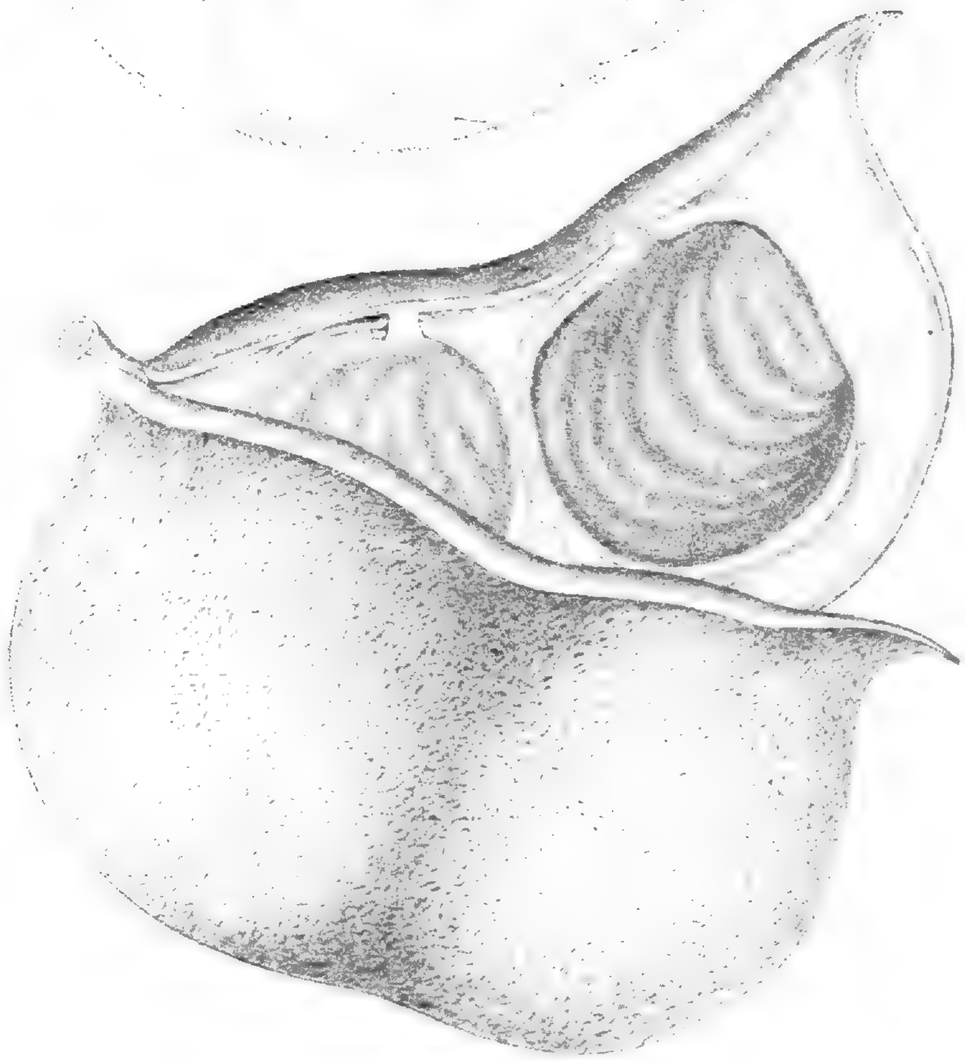

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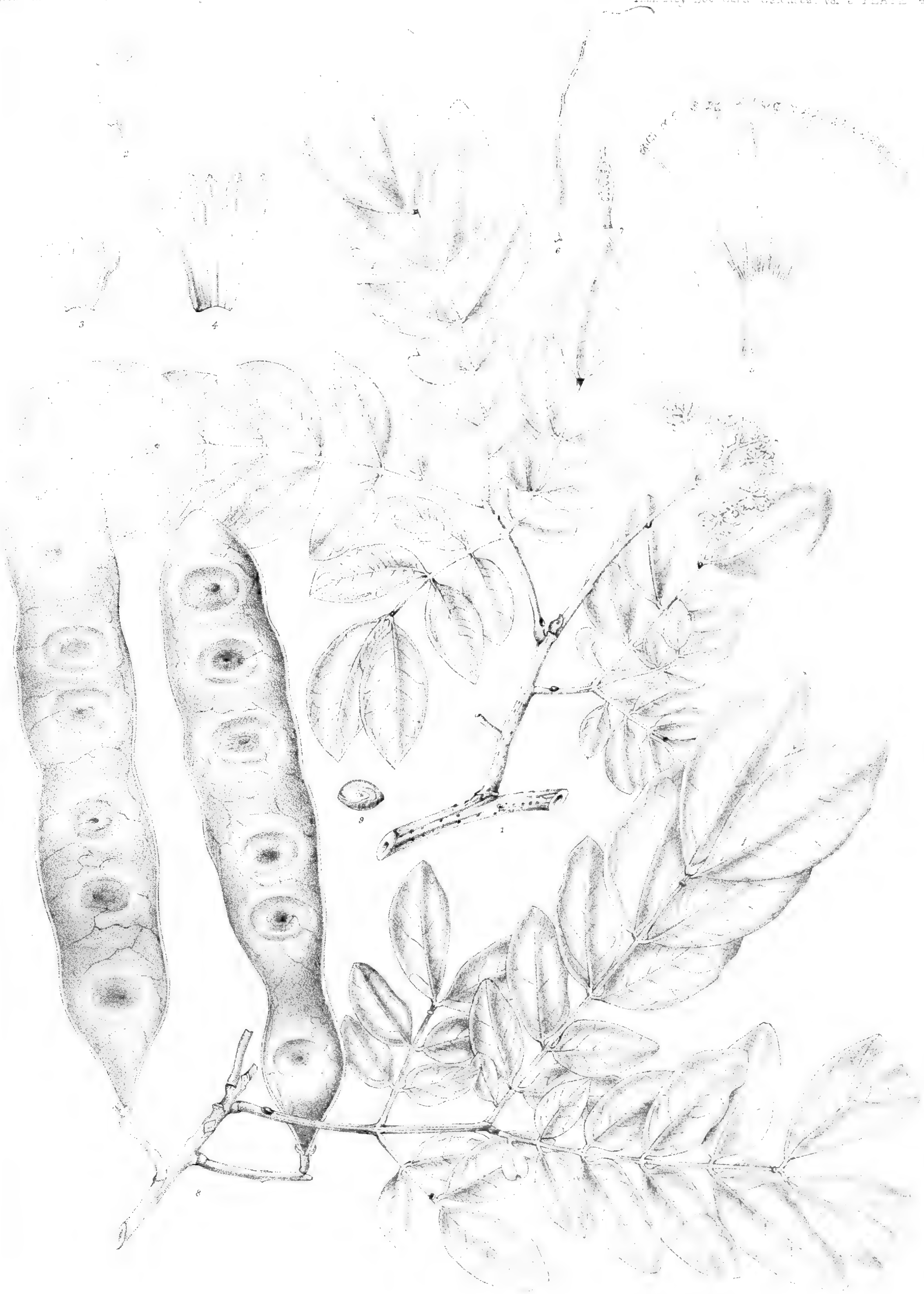
Lith. by Chitra Silpi C°

Fox - Iconn. inea

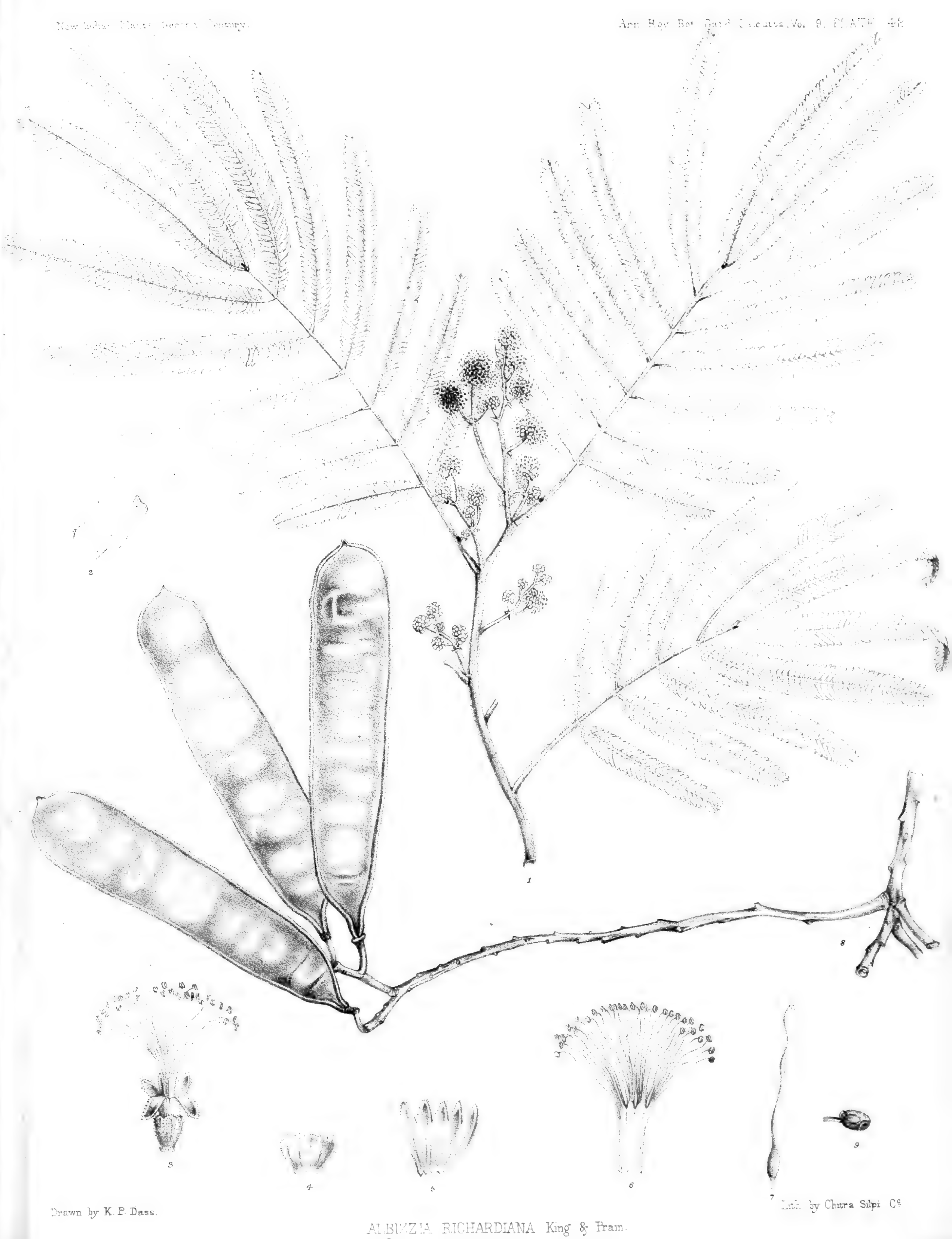
DIOCLEA REFLEXA Hook. f.



Drawn by A. L. Singh.

Lith. by Chitra Silpi C.

ALBIZZIA GAMBLEI Prain.



Drawn by K. P. Dass.

Lith. by Chitra Silpi Cº

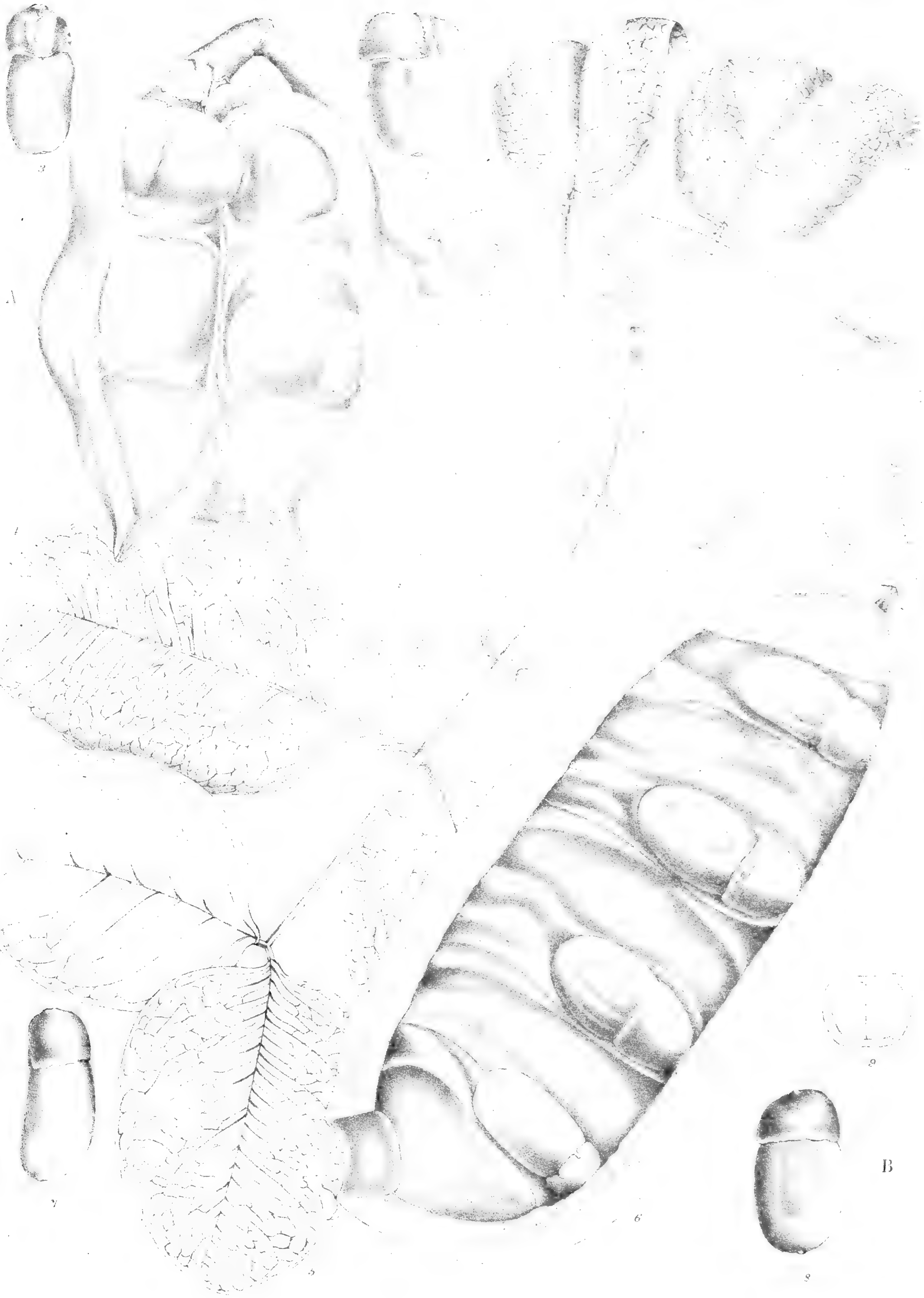
ALBIZZIA RICHARDIANA King & Prain.

FIPTALENIA CUPHENSIS. Brand.

Drawn by A de Alwis.

Lith by Chitra Kumi Dey

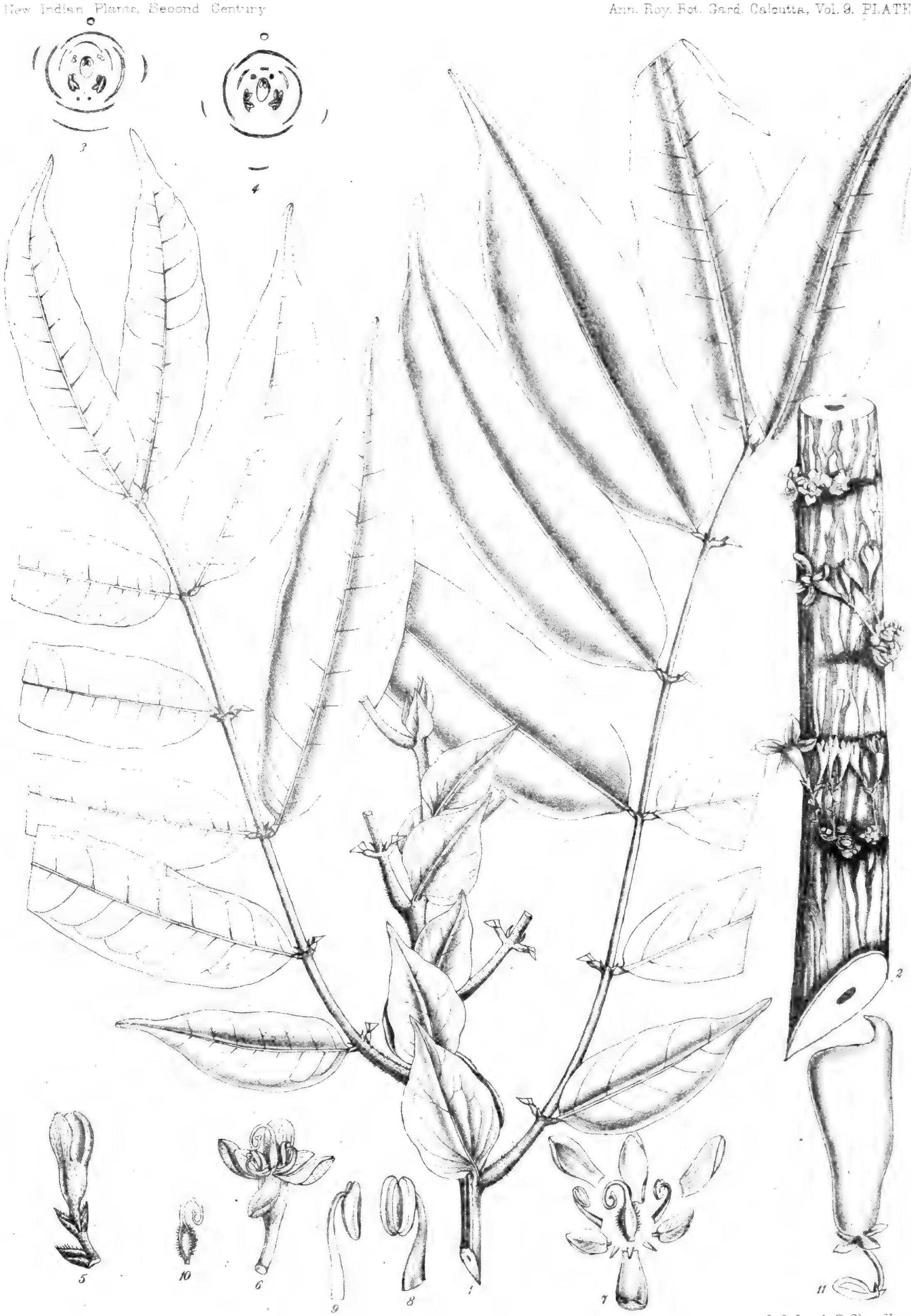
PAHUDIA JAVANICA Miq



Drawn by K P Dass

Lith. at the Office Surv. Gen.

A. PAHUDIA XYLOCARPA Kurz. B. P. MARTABANICA Prain.



Drawn by A. D. Molla.

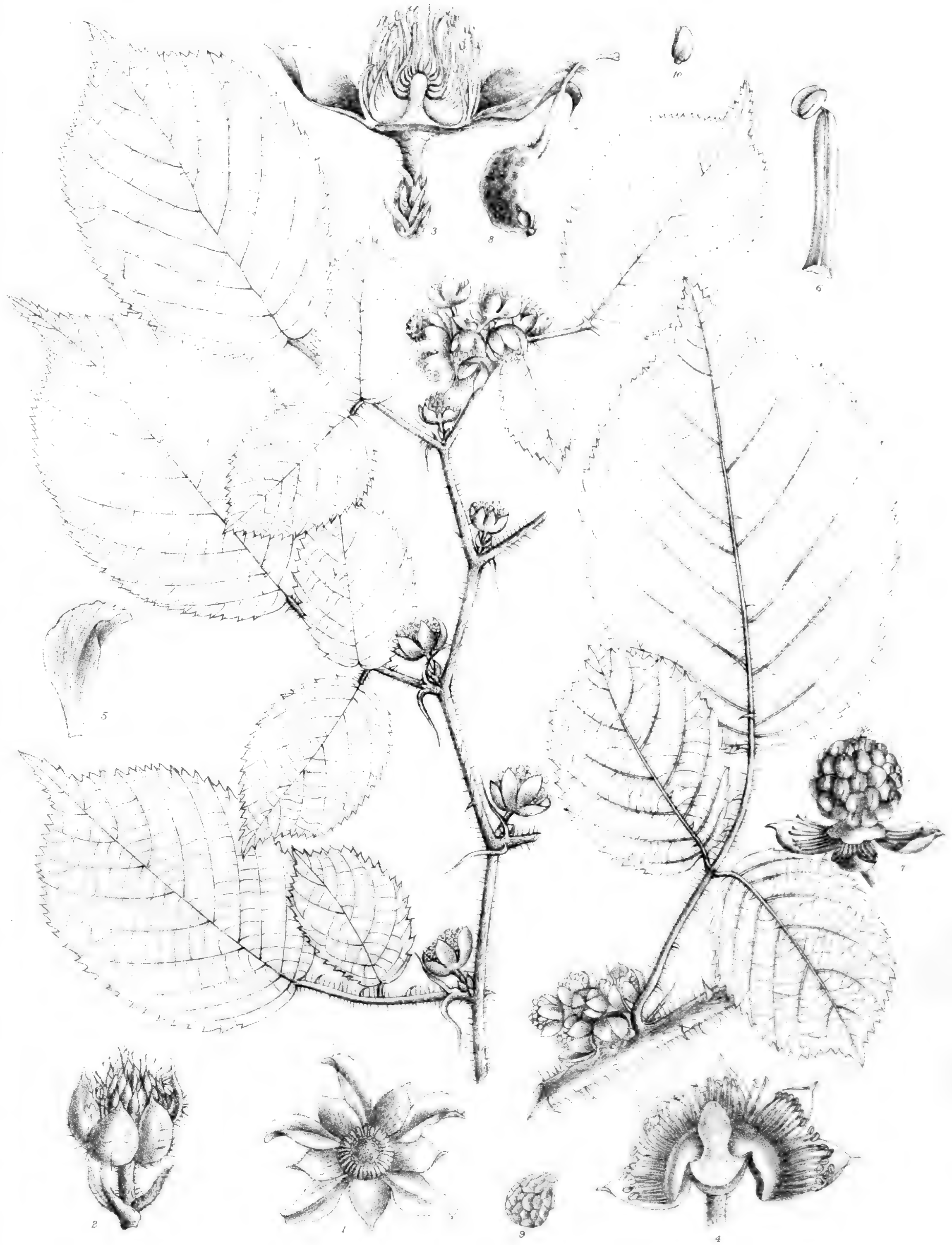
LEUCOSTEGANE LATISTIPULATA Prain.

Lith. by A. C. Chowdhary.

Drawn by S. B. Ghose

Lith. by Chitra Silpi Co.

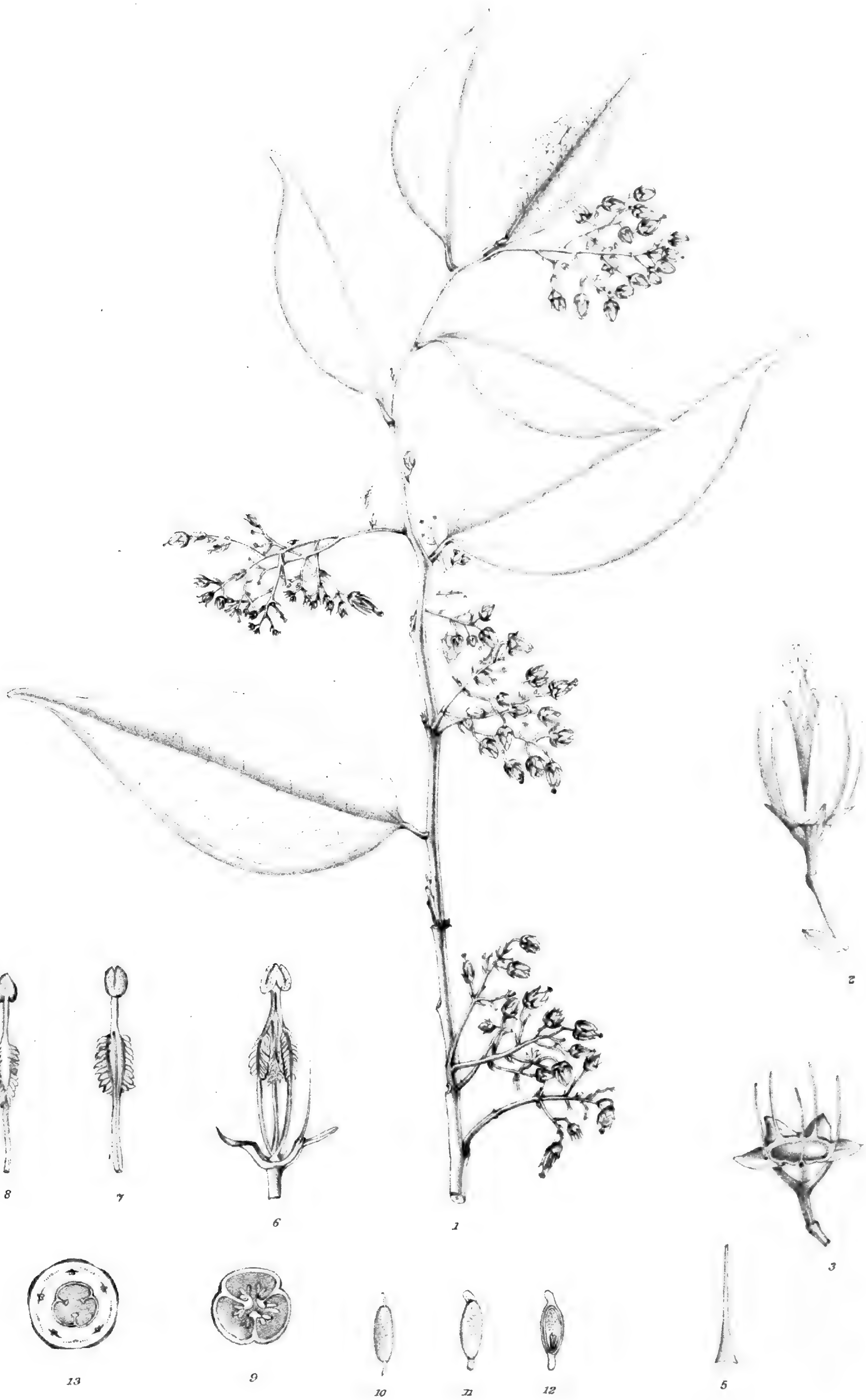
CRUDIA CURTISII Prain



Drawn by H. Hormusji

Lith by A. C. Singha.

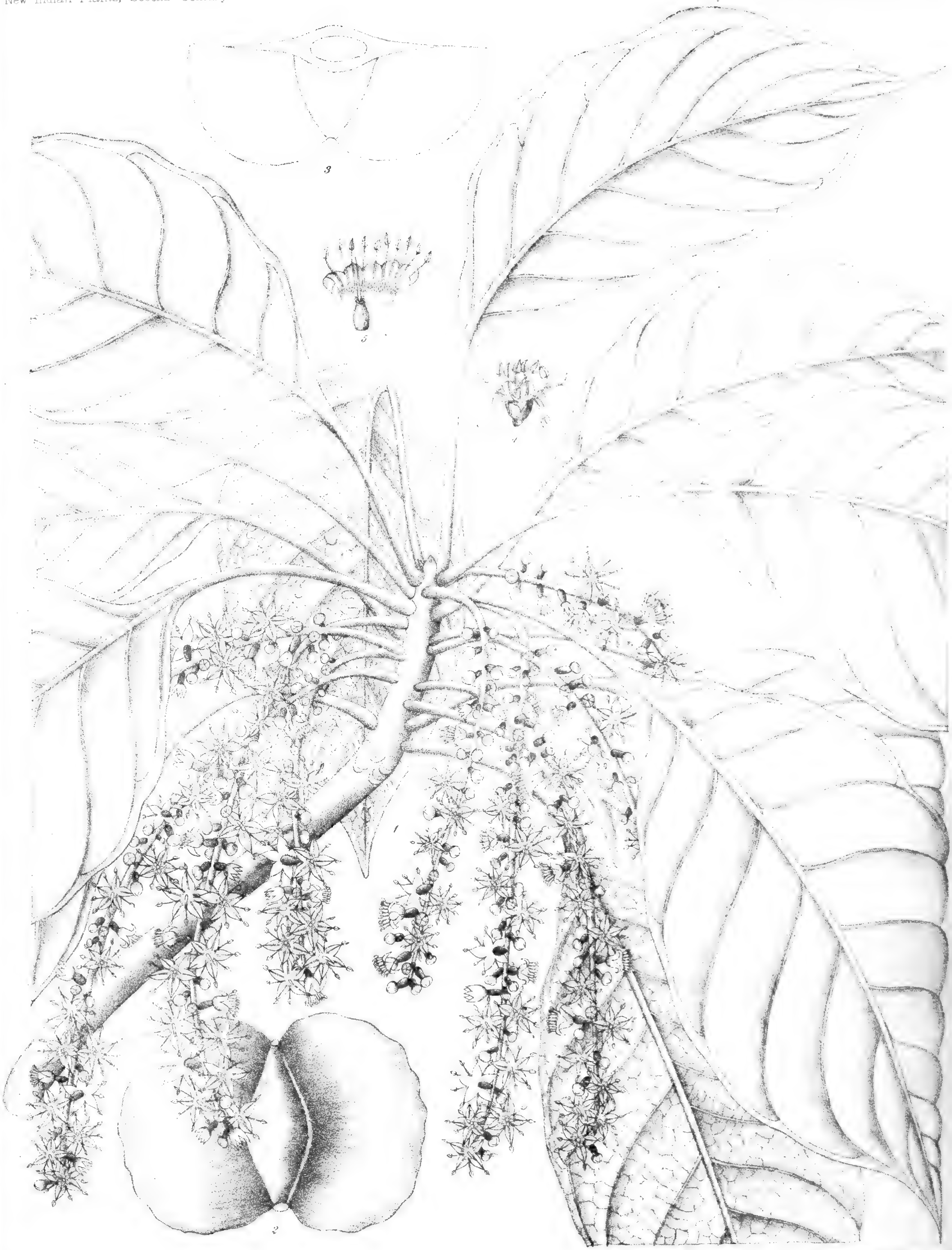
RUBUS FASCICULATUS Duthie.



Drawn by D. Prain.

Lith: by Chitra Silpi Cº

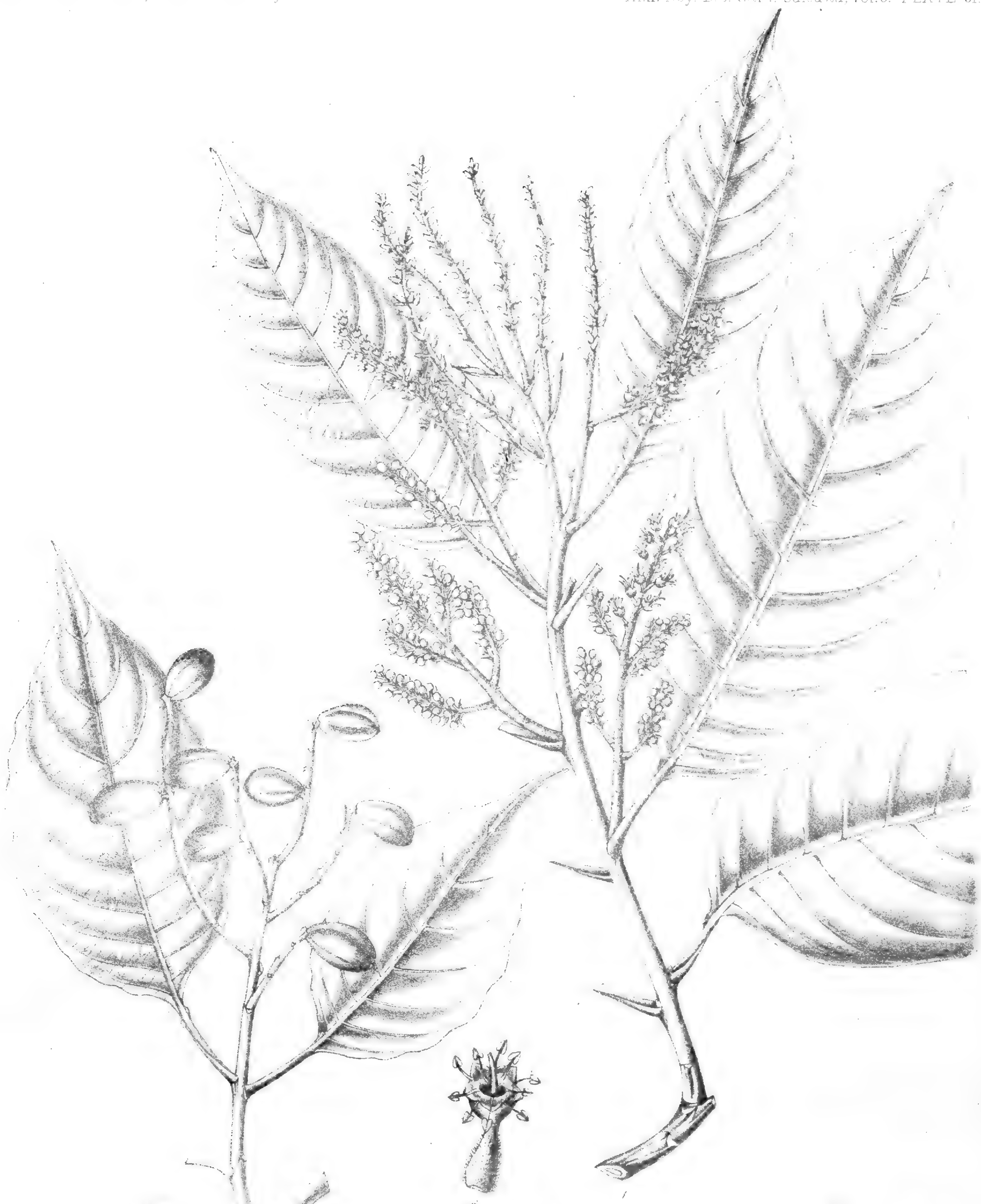
POTTINGERIA ACUMINATA Prain.



Roxb. Icon. Ined.

Lith. by S. J. Mondul.

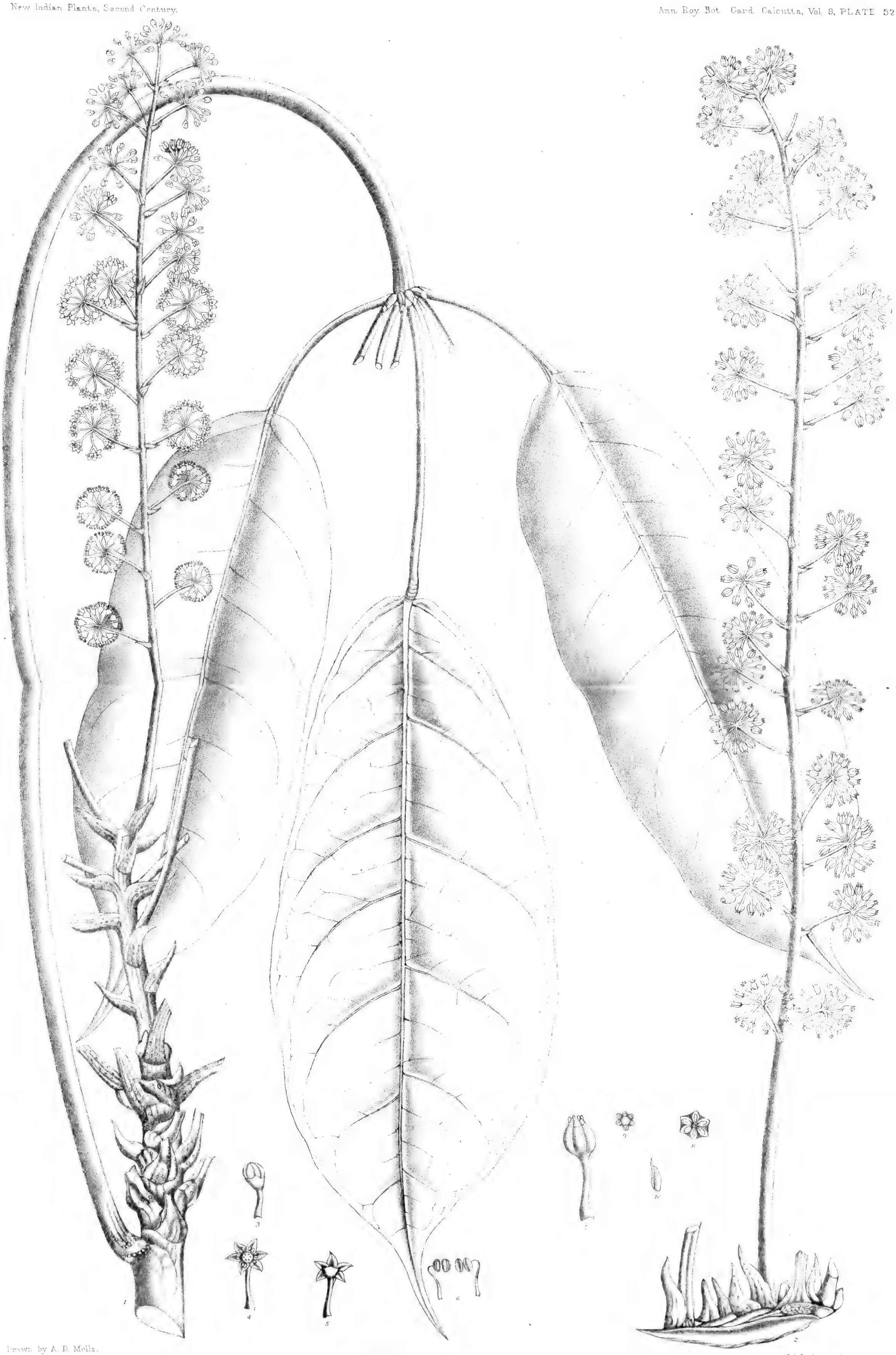
TERMINALIA BIALATA Steud.



Drawn by A. D. Molla.

TERMINALIA MANII King.

Lith. by A. C. Chowdhary.



Drawn by A. D. Molla.

HEPTAPLEURUM HULLETTII King.

Lith. by A.C. Singha.

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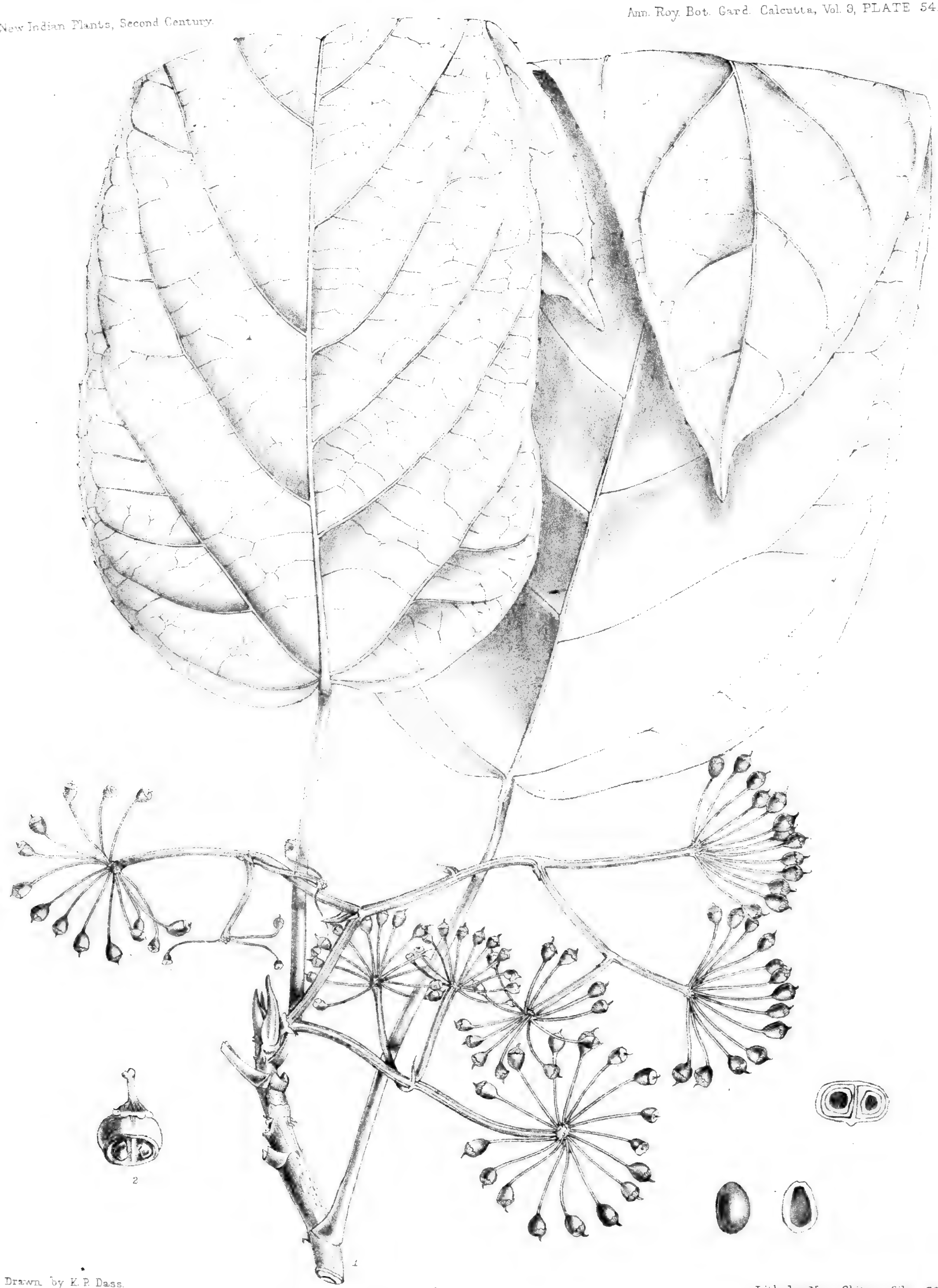
Drawn by K. P. Dass.

HEPTAPLEURUM RIDLEYI King.

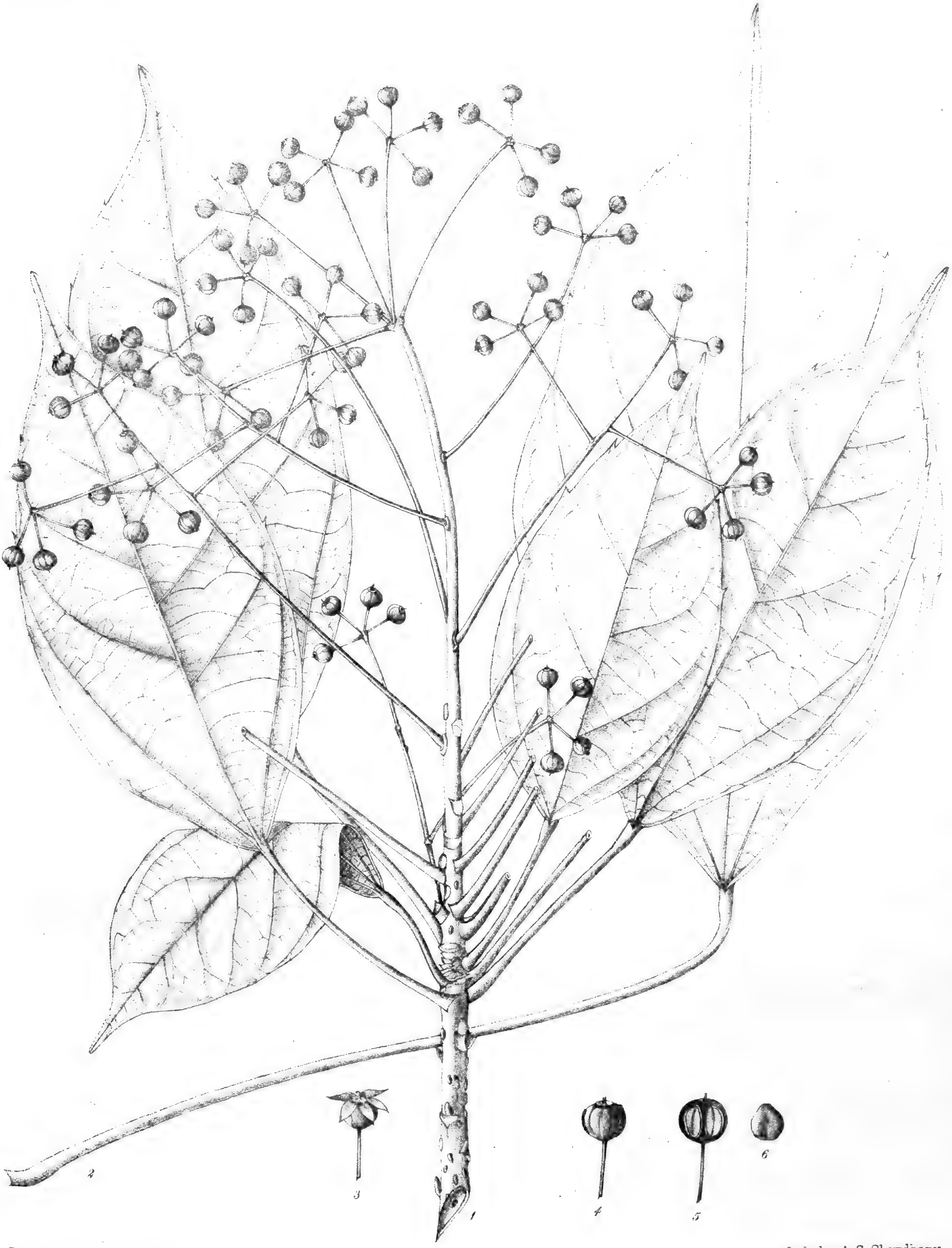
Lith by New Chitra Silpi Co.



Drawn by K. P. Dass.

WARDENIA SIMPLEX King.

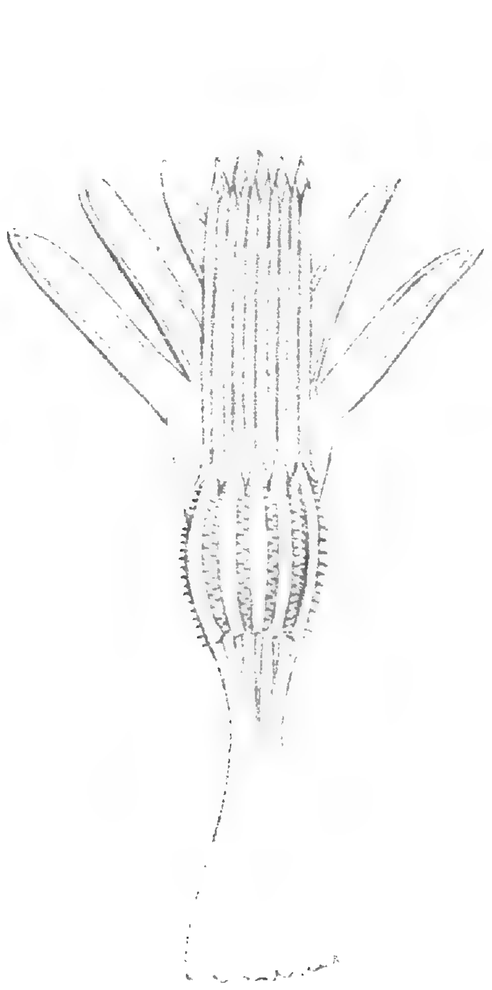
Lith by New Chitra Silpi Cº.

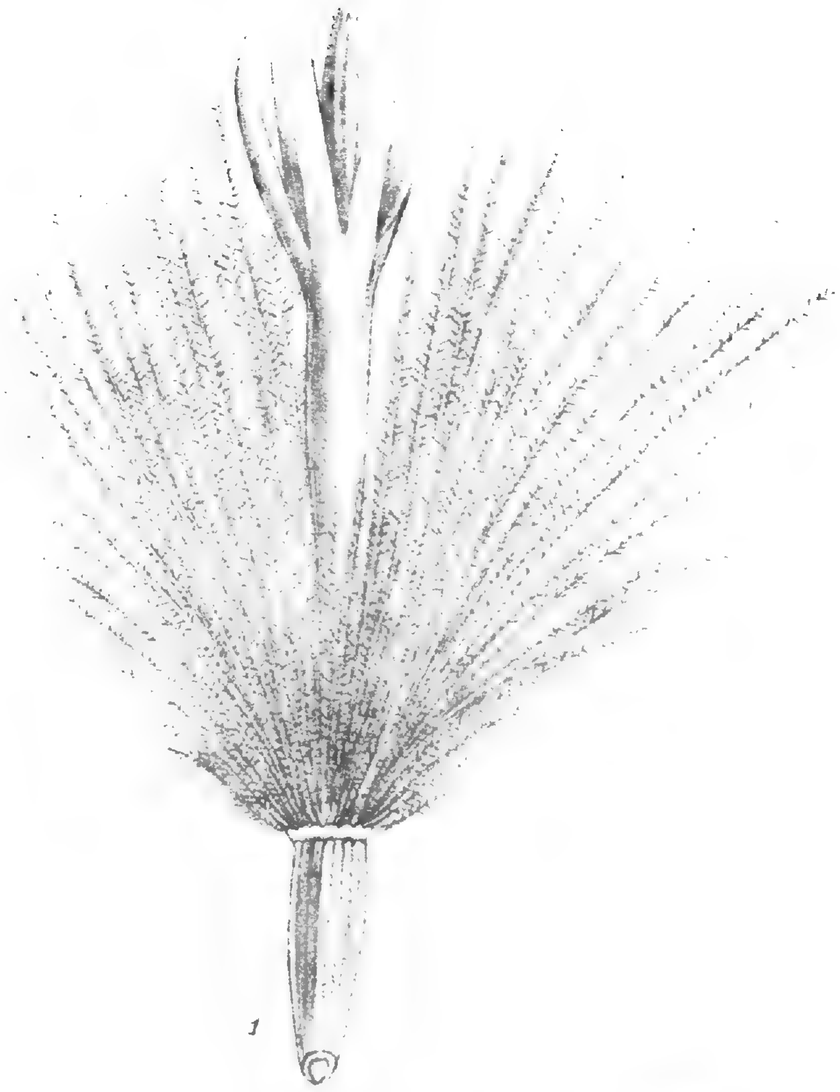


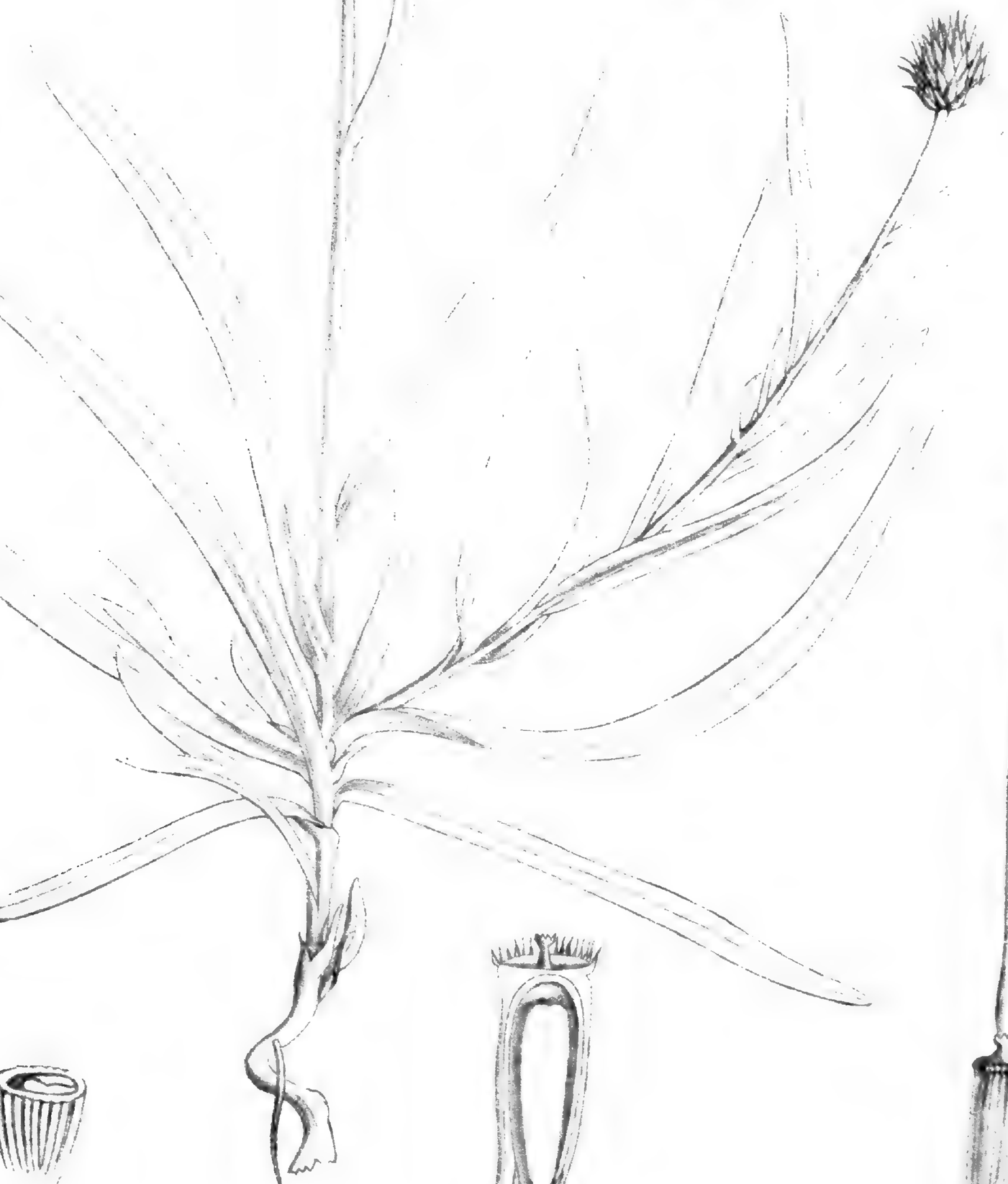
Drawn by S. B. Ghosh.

Lith. by A. C. Chowdhary.

DENDROPANAX LISTERI King.







3

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5

4

Drawn by H. Horinusji

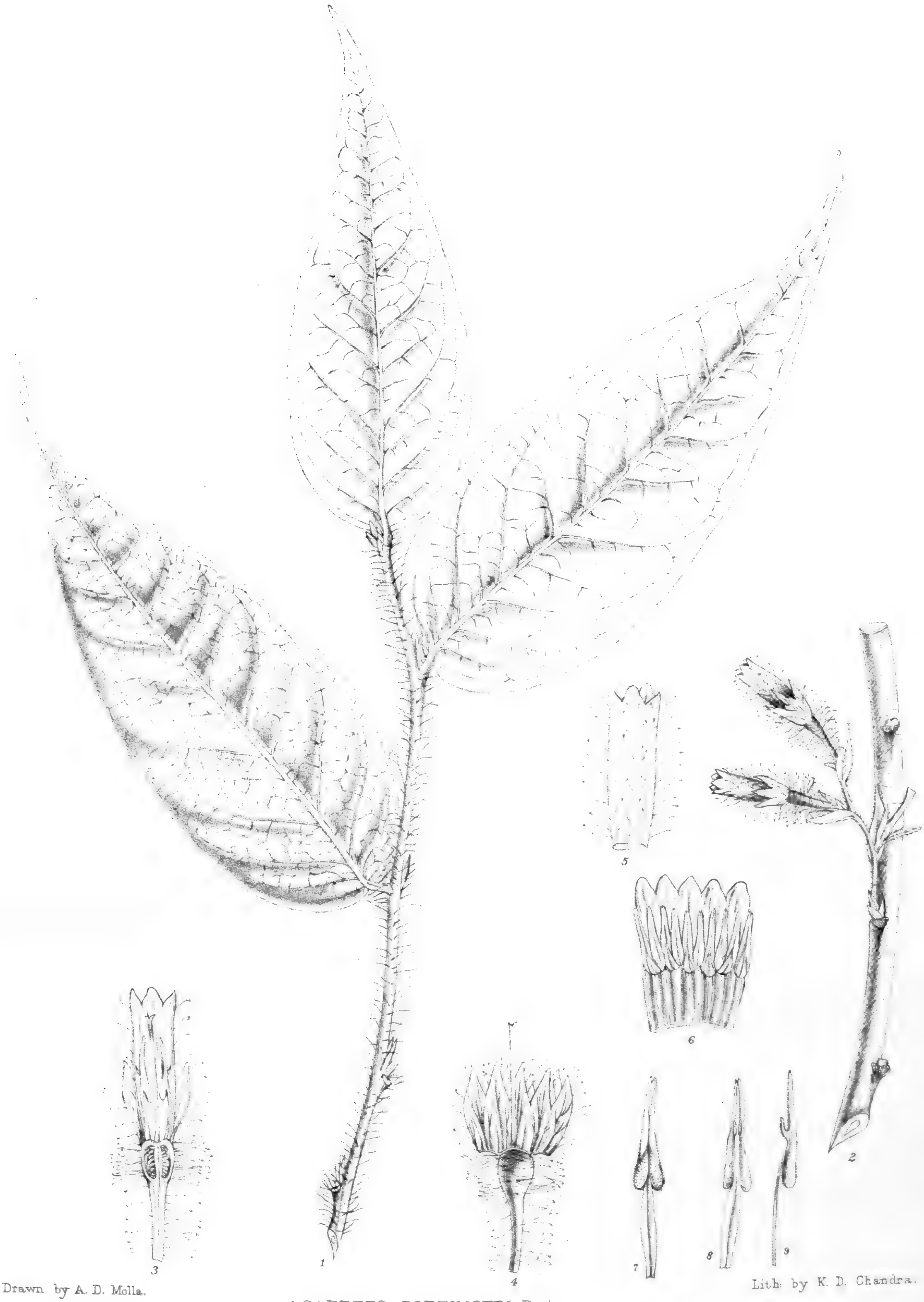
TRICHOLEPIS STICTOPHYLLUM Clarke.

Lith. by A. C. Singha.

Drawn by H. Hormusji.

SAUSSUREA CHITRALICA Duthie.

Lith. by S. C. Mondul.



Drawn by A. D. Molla.

Lith: by K. D. Chandra.

AGAPETES POTTINGERI Prain.

Drawn by K. P. Bass

Lith by Cuitze Silpr &c

PTISMOGYNE NEBULOLI. King & Fram.

4

A

1

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3

6

5

B

12

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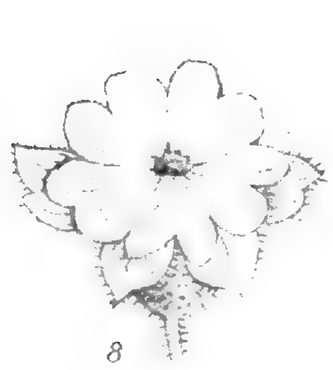

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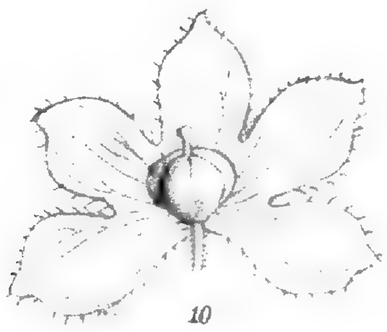


10

11

Drawn by H. Hormusji

A. ANDROSACE HARRISSII Duthie. B. A. FRAGILIS Duthie

Lith by K. P. Dass.

Drawn by H. Hara, del.

PRIMULA INAYATI Duthie.

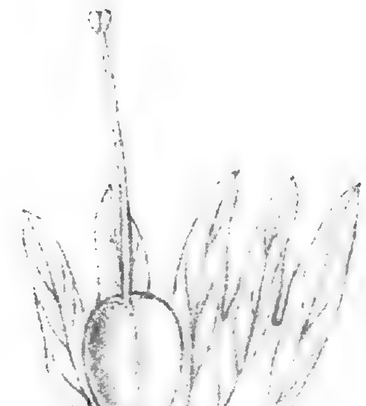
Lith by A. L. Chandra.

A 1

A 2

B 1

B 2



B 3

B 4

B 5

Drawn by H. Hormusji

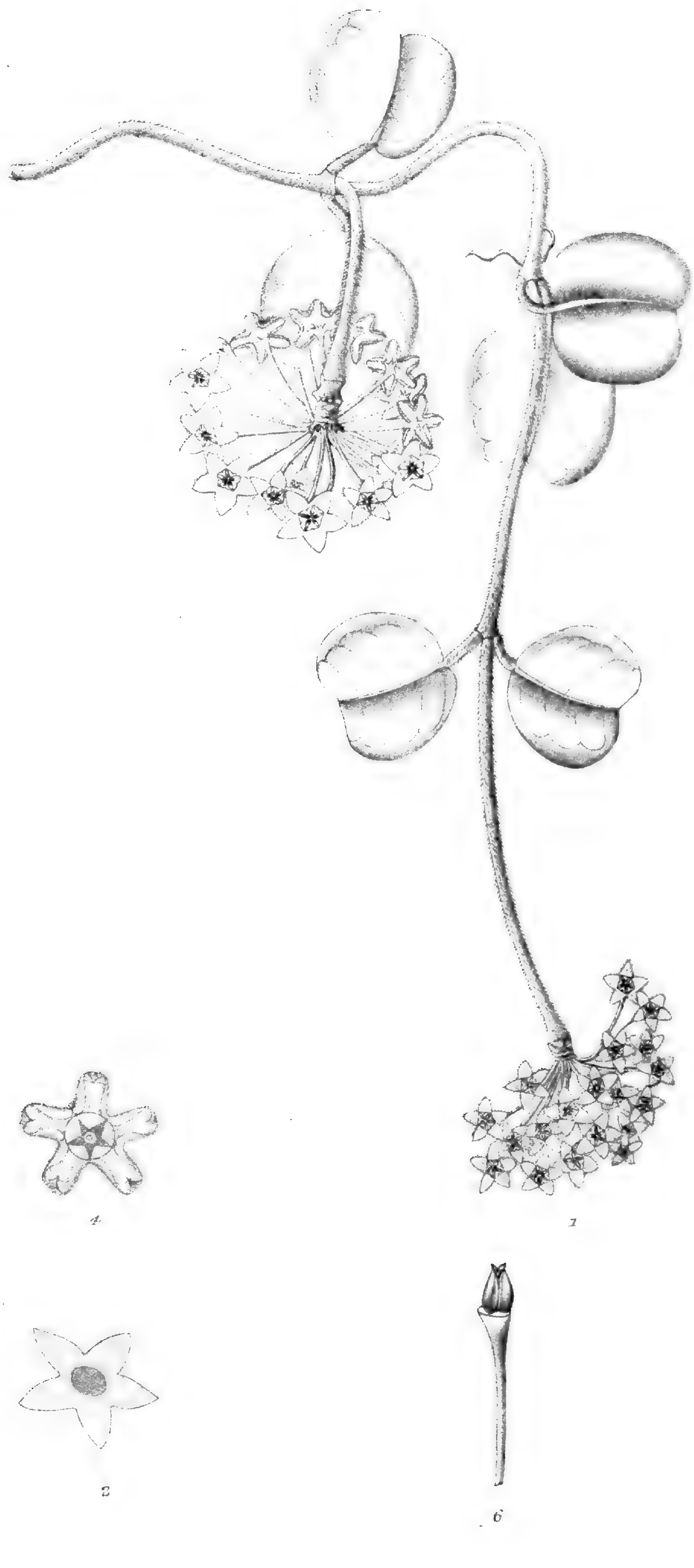
Lith. by A. C. Singha.

PRIMULA HAZARICA Duthie.

Drawn by K. P. Dass

Lith. by Ghitra Chpr. Cal.

SIDEROXYLON LONGEPETICLATUM King & Hsm.



Drawn by G. C. Dass

Lith: by Chitra Silpi Co

HOYA OBRENIFORMIS King.

Drawn by D. N. Chaudhuri

Lith: by Chitra Silpi Co

CEROPEGIA KACHINENSIS Prain

4

2

3

Drawn by G. C. Dass.

Lith by Chitra Silpi Co

COTYLANTHERA PAUCISQUAMA C. B. Clarke.

3

11

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7

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12

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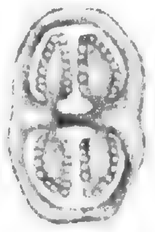

11

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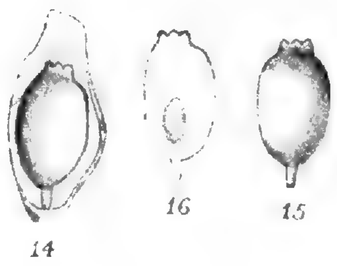
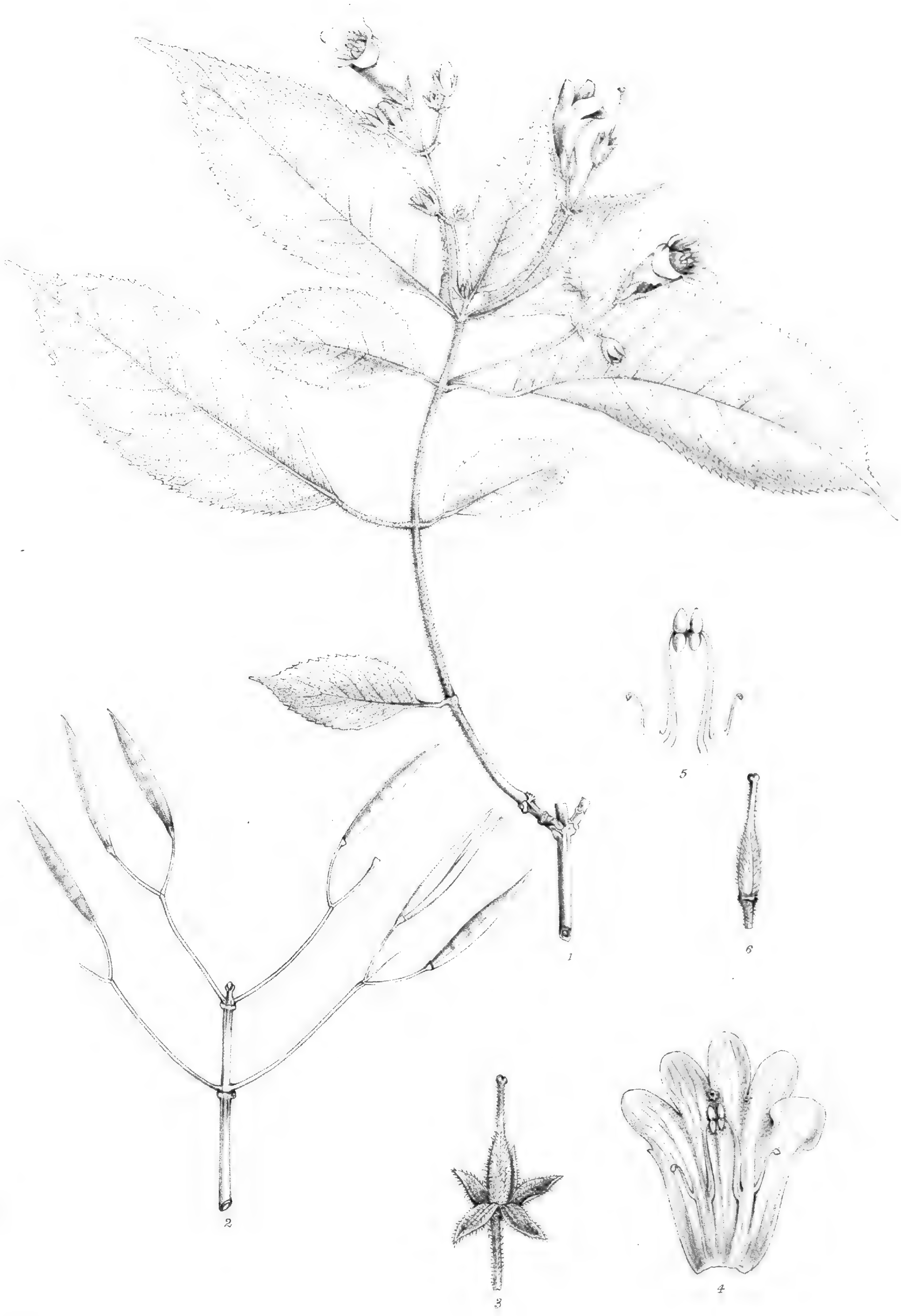


14 16 15

Drawn by J. S. Gamble.

GLEADOVIA RUBORUM Gamble. & Prain.

Lith. by K. P. Dass.



Drawn by K P Dass

Lith by Chitra Silpi Co

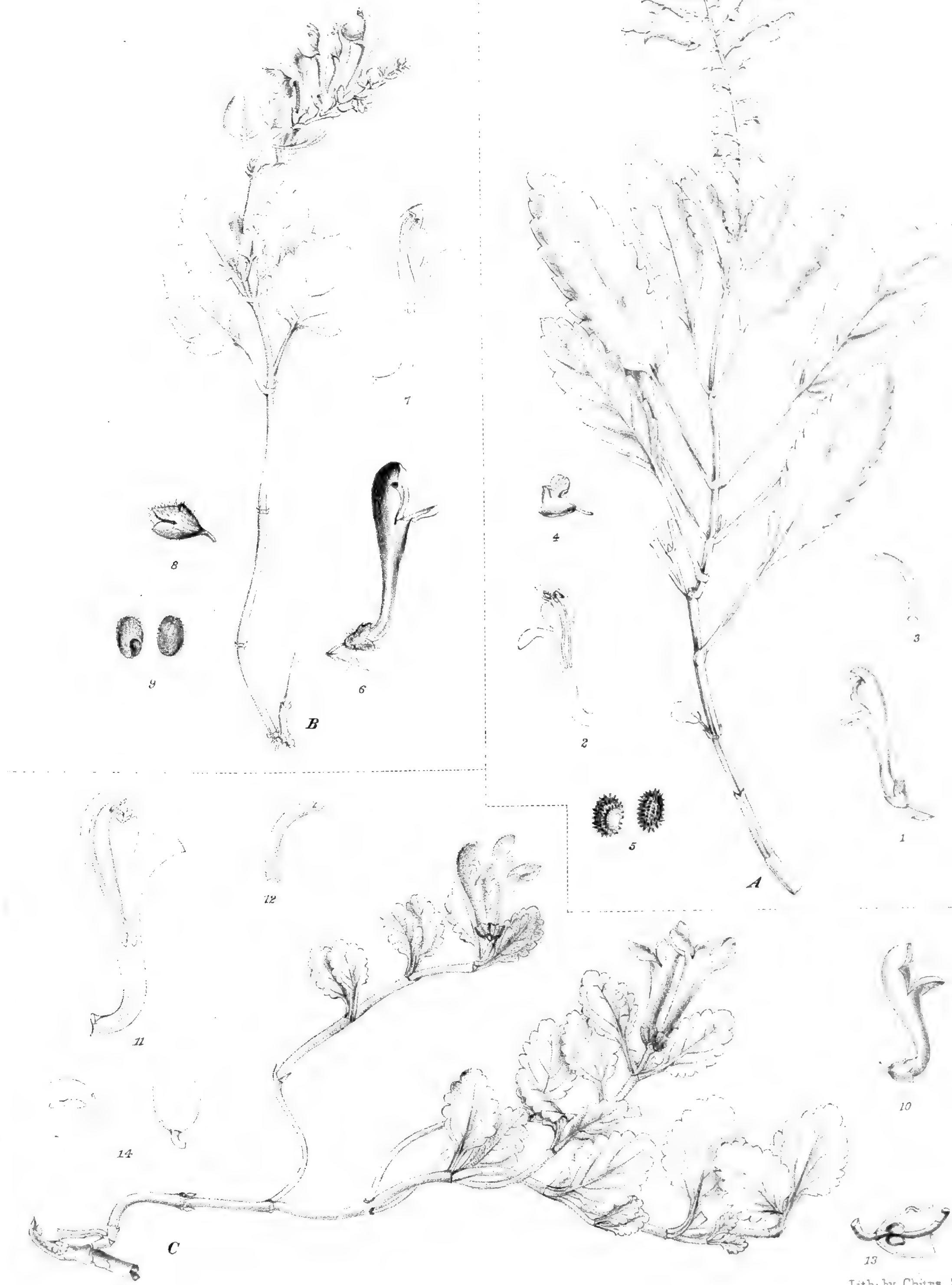
DIDYMOCARPUS ELATIOR Prain.

A PLECTRANTHUS PHARICUS Prain

PLECTRANTHUS KUNSTLERI Prain.

Drawn by K P Lace.

Lith. by A C Brownbery



Drawn by K. P. Dass, anal by D. Prain.

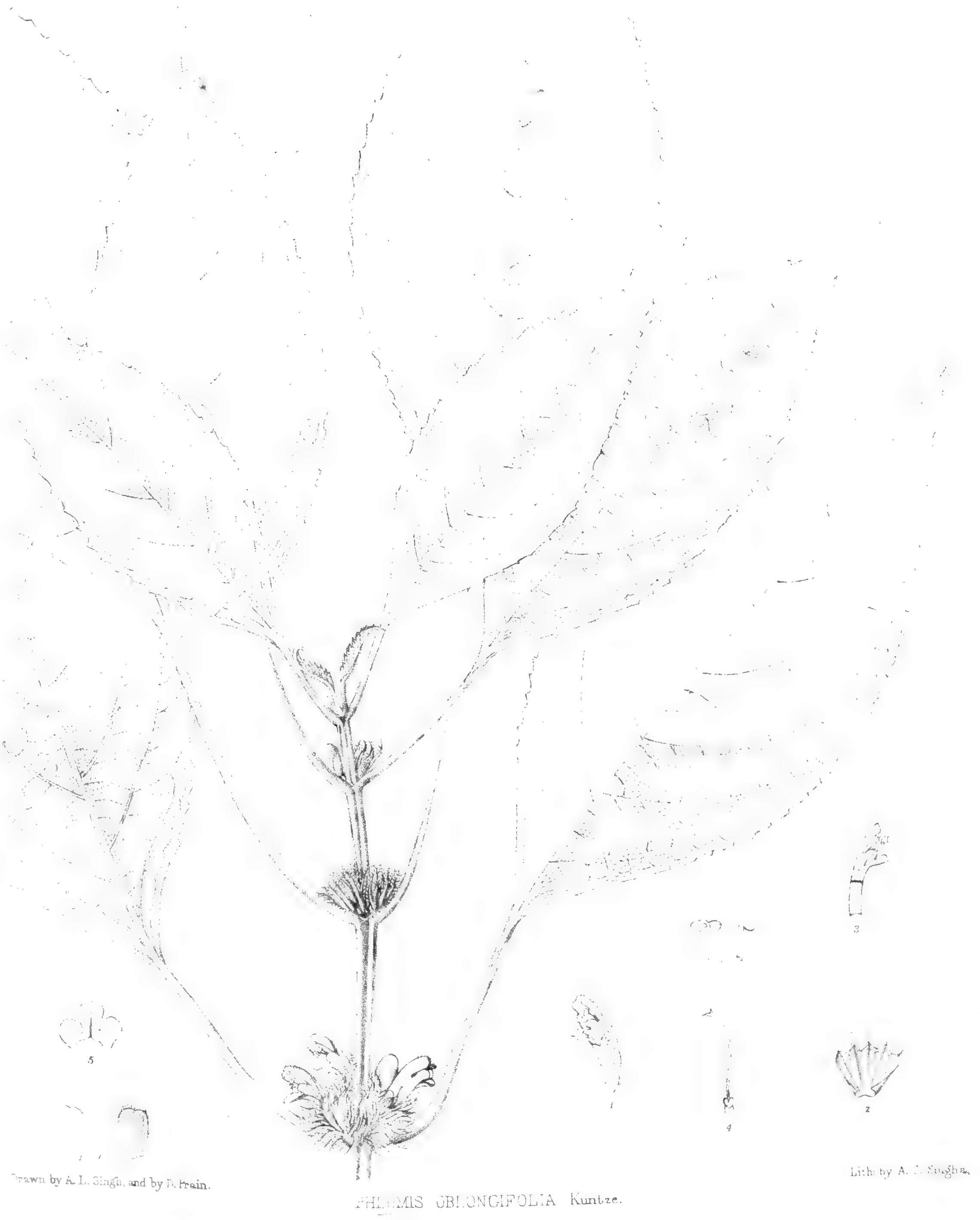
Lith: by Chitra Silpi Cº

A. SCUTELLARIA ANDAMANICA Prain. B. S. PETIOLATA Hemsl. & Lace.
C. S. KINGIANA Prain.

Drawn by A. D. Motta anal. by D. Prain

Lith. by K. D. Chandra.

A. MOLUCCELLA OTOSTEGIOIDES Prain. B. LEUCAS COLLETTII Prain.
C. STACHYS CORDIFOLIA Prain.



Drawn by A. L. Singh, and by H. Prain.

Lith. by A. L. Singha.

PHLOMIS OBLONGIFOLIA Kuntze.

Drawn by G. C. Dass; anal. by D. Prain.

PHLOMIS RUGOSA Benth.

Lith. by A. C. Mukerjea.

Drawn by A. D. Molla.

EURYSOLEN GRACILIS Prain.

Litho by A. C. Singha.

Drawn by A. D. Molla

GOMPHOSTEMMA INOPINATUM Prain.

Litho by Chitra Silpi Co

Drawn by H Hormusji

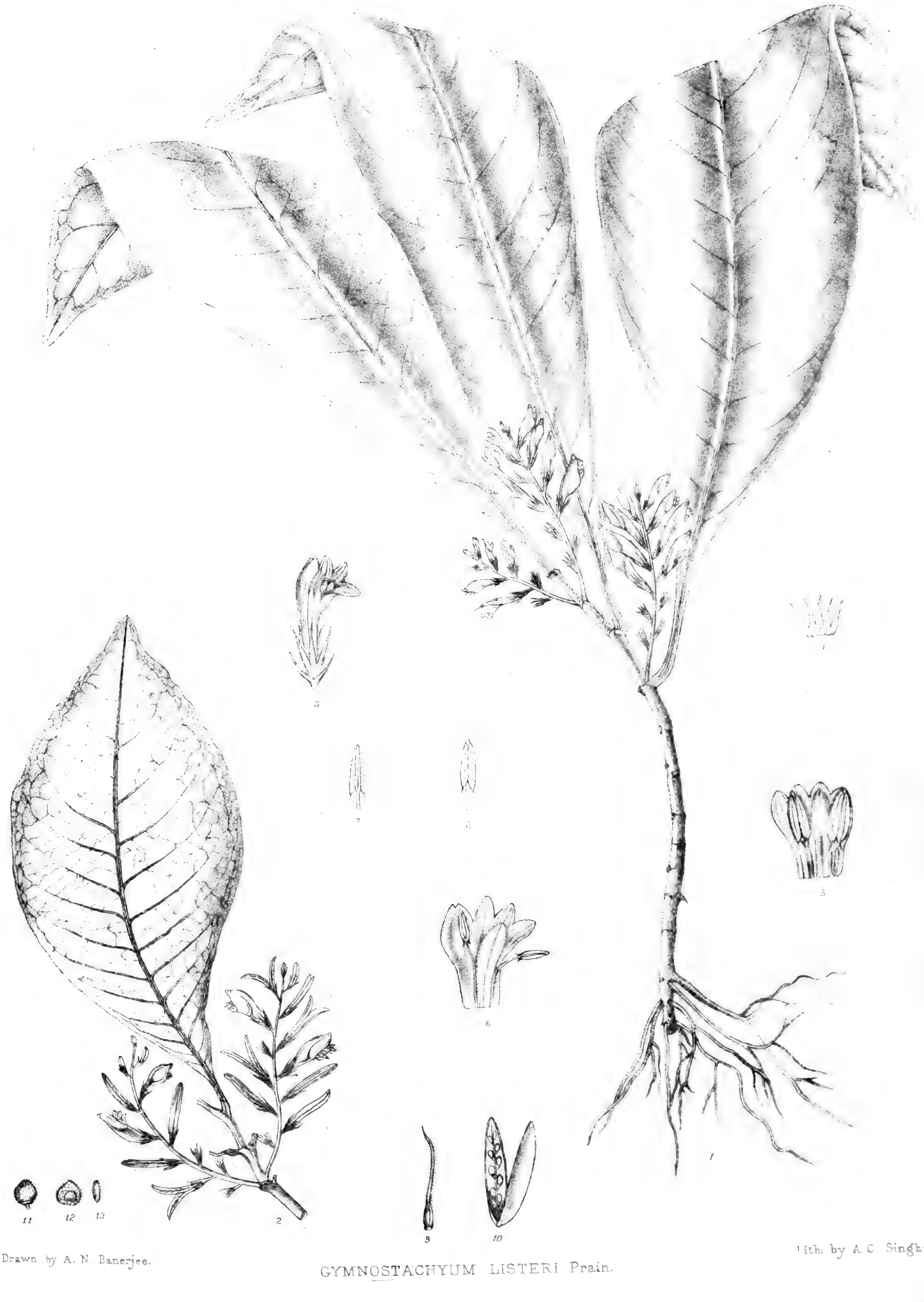
Lith by Chitra Schp. Cal

NEPETA PRAINII Duthie.

Drawn by H. Hormusji.

Lith. by A. C. Singha.

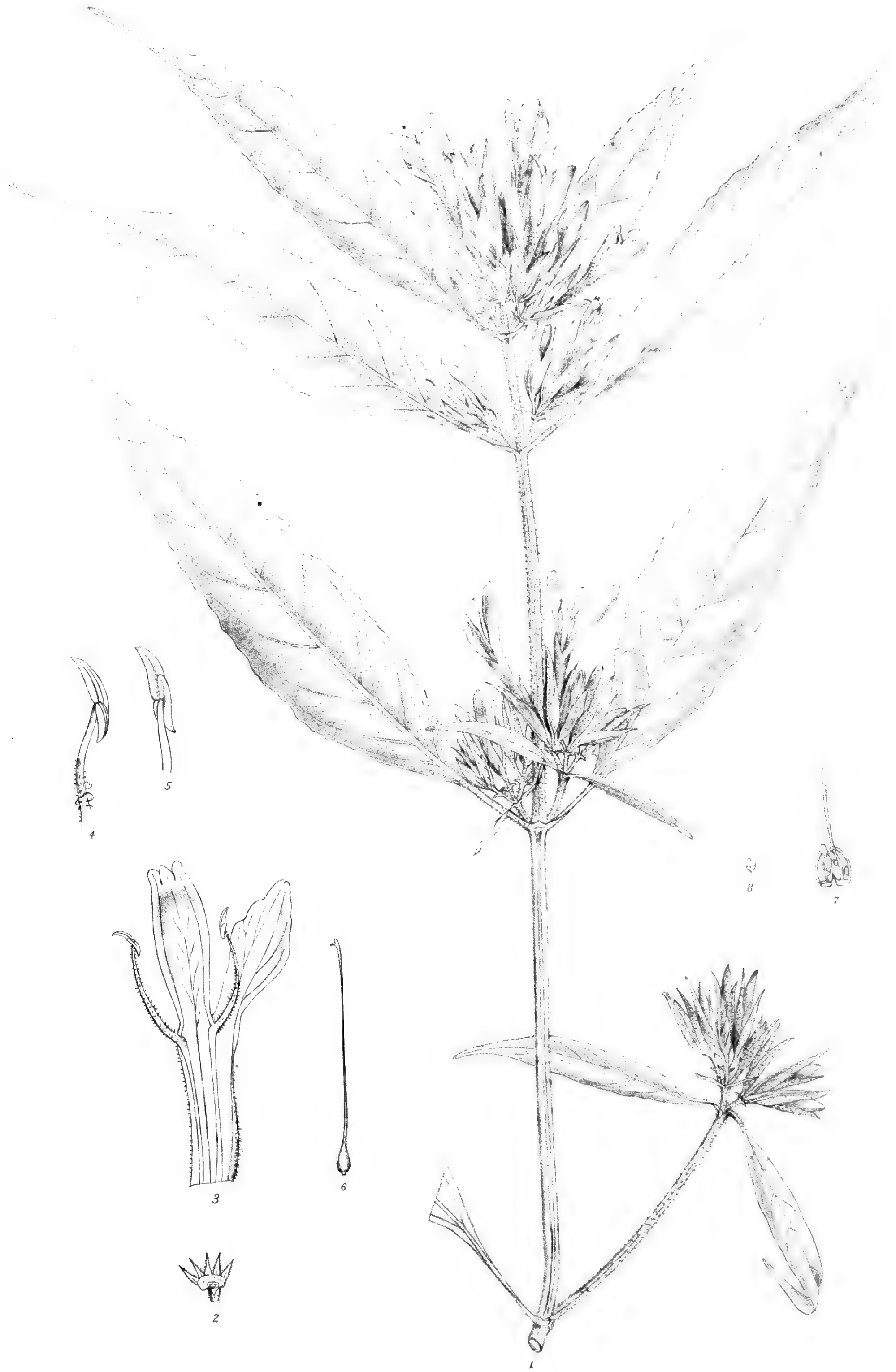
AFRIDIA NEPETAEFORMIS Duthie.



Drawn by A. N. Banerjee.

GYMNOSTACHYUM LISTERI Prain.

Lith. by A. C. Singha.



Drawn by K. P. Dass.

Lith. by A. C. Singha.

PERISTROPHE LONGIFOLIA King & Prain.

Drawn by K. P. Dass

Lith by Chitra Silpi Co

PERISTROPHE FERA Clarke VAR GAGEI King & Pram.

Drawn by H Hormusje

Lith by Chitra Ship C?

POLYGONUM VIRGINIANUM Linn.

MACHILUS DUTHIEI King

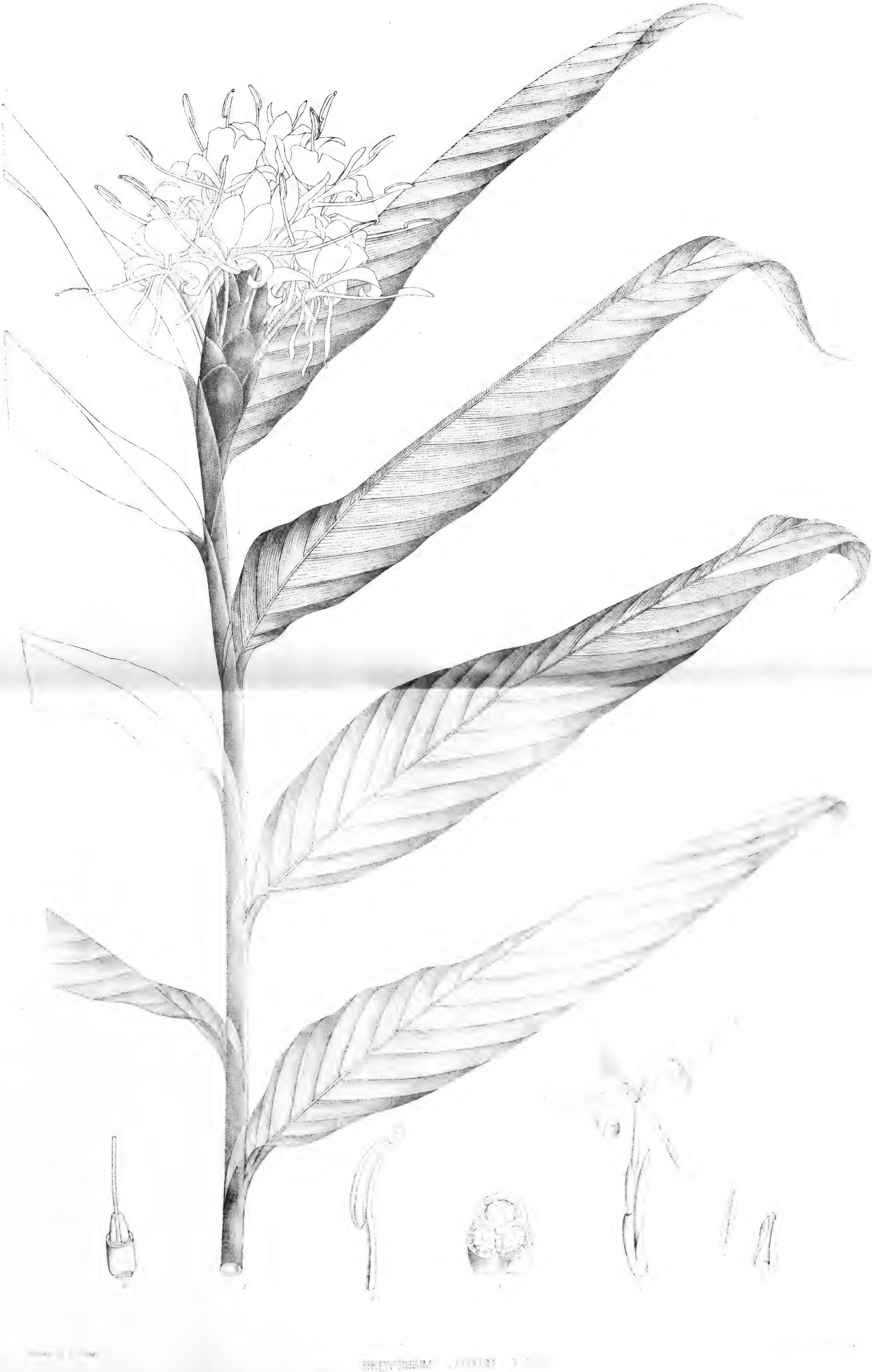
Drawn by R. Pentling.

Lith. by Chitra Silpi Co

APOSTASIA WALLICHII, Br

HITCHENIA GLAUCA Wall

Lith. by Chitra Salpi &c.



Wall. del. et lith.

Lith: by Chitra Silpi C?

ZINGIBER PARDOCHEILUM Wall.

Drawn by G C Bass

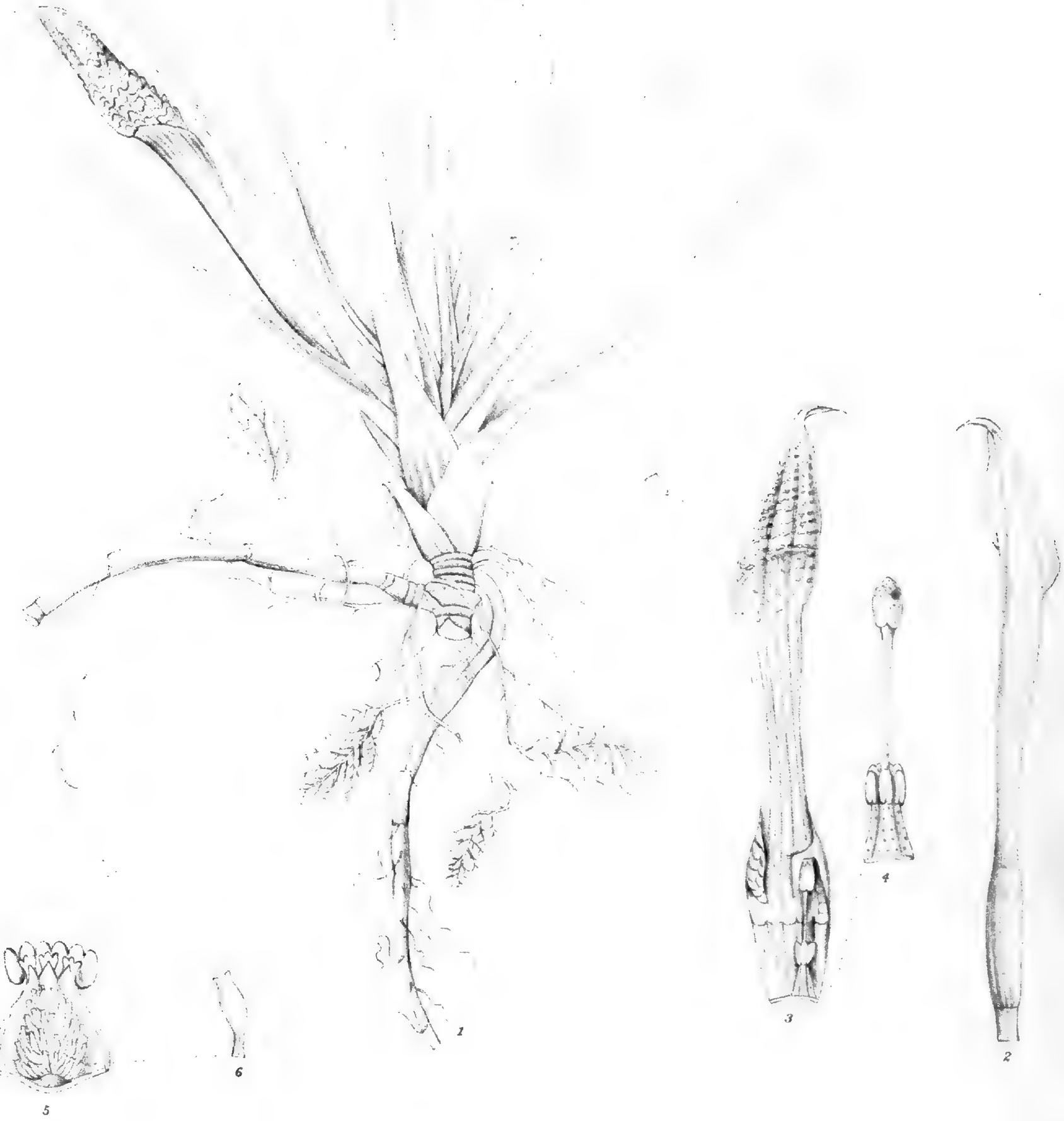
Lith by Chitra Engr

ZINGIBER CLARKEI King.

Drawn by A. L. Singh.

PANCRATIUM LONGIFLORUM Roxb.

Lith by K. P. Das



Drawn by A. D. Molla.

CRYPTOCORYNE CRUDDASIANA Prain.

Lith. by K. D. Chandra.

A 1

A 2

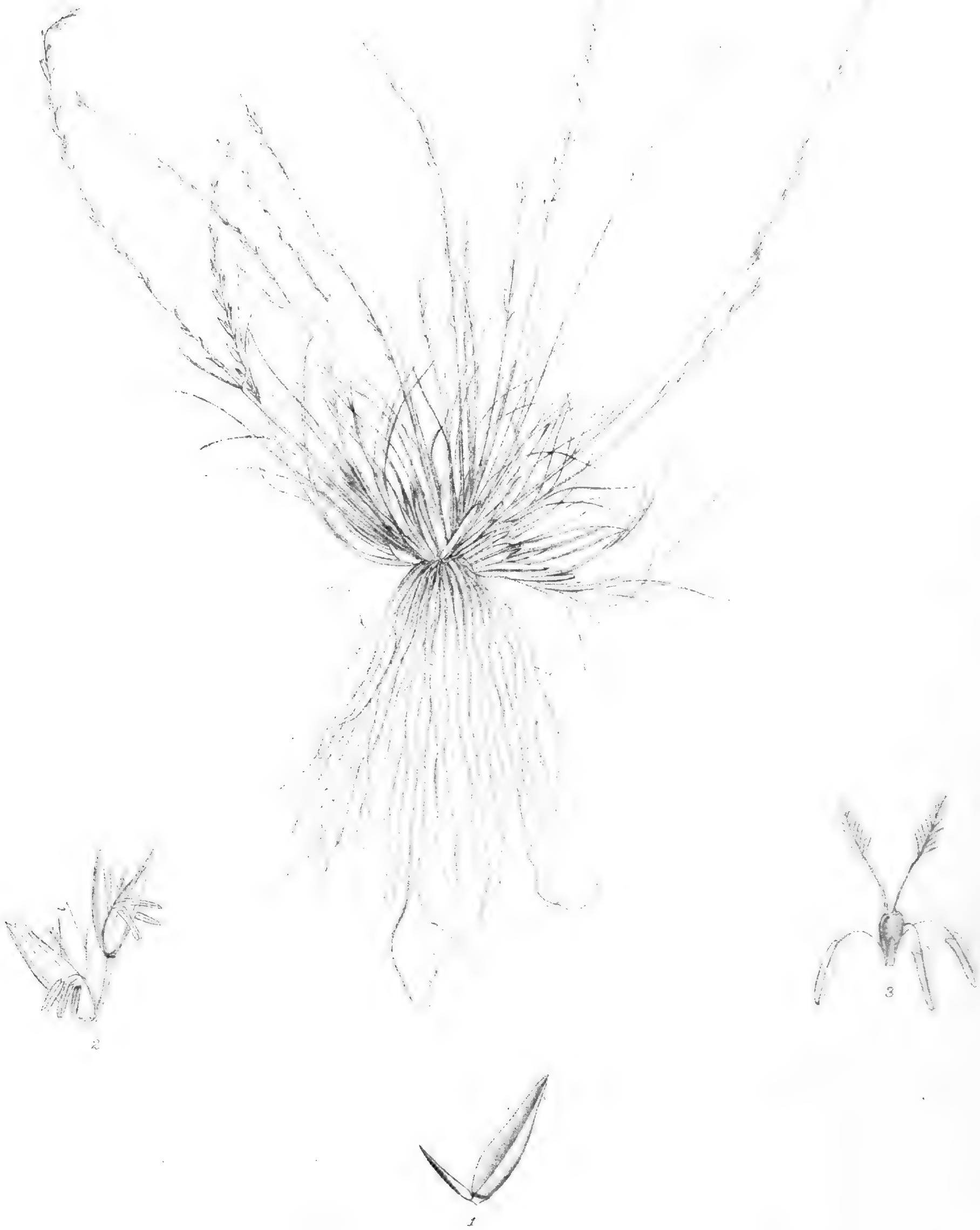
B 2

B 1

Drawn by H. Hormusji

ERIOPHORUM MICROSTACHYUM Boeck.

Litho by Chitra Silpi Co



Drawn by H. Hermann.

Lith. by Chitra Silpi Co.

TRIPOGON PURPURASCENS Duthie

Drawn by H. Hormusji

Lith by Chitra Sabha Co

FESTUCA LUCIDA Stapf.

ANNALS

OF THE

ROYAL BOTANIC GARDEN, CALCUTTA.

Vol. IX, Part II.

ANNALS

OF THE

ROYAL BOTANIC GARDEN, CALCUTTA.

Vol. IX.

PART II.

THE ORCHIDS OF THE NORTH-WESTERN HIMALAYA

By

J. F. DUTHIE, B.A., F.L.S.,

late Director, Botanical Department, Northern India.

CALCUTTA:

Printed at the Bengal Secretariat Press.

1906

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THE

ORCHIDS OF THE NORTH-WESTERN HIMALAYA

By

J. F. DUTHIE, B.A., F.L.S.,
late Director, Botanical Department, Northern India.

WITH FIFTY-EIGHT PLATES.

CALCUTTA:
Printed at the Bengal Secretariat Press.
1906.

PREFACE.

The attempt here made to give an account of the Orchids of the Western Himalaya may be regarded as a supplement to the splendid work by Sir George King and Mr. R. Pantling on the Orchids of the Sikkim Himalaya, which was published in 1898 as Volume VIII of the Annals of the Royal Botanic Garden, Calcutta. With Sir Joseph Hooker's monograph of the Orchids of British India as a basis, and Sir George King's Sikkim Orchids as a model for a local orchid-flora, the preparation of the present contribution has been very greatly facilitated.

Of the many eminent botanists who contributed largely in by-gone years to the orchidology of the Western Himalaya, the following names should be especially mentioned:—Govan, Royle, Wallich, Jacquemont, Vicary, Falconer, Griffith, Edgeworth, Thomson, Madden, Strachey, Winterbottom, Fleming and Lady Dalhousie. The collections made during more recent years by Aitchison, Brandis, Davidson, C. B. Clarke, Mackinnon, Gamble, Lace and others have been the means of adding considerably to our knowledge of the subject.

Since the publication of Sir Joseph Hooker's monograph of the Orchids of British India, in 1890 further important additions have been made to the Orchid-flora of the Western Himalaya. Many interesting species were collected during my two botanical tours through Kashmir in 1892 and 1893, and in subsequent years by specially trained native collectors, who were sent to Hazara, Kashmir, Chitral, Pangi, Garhwál, Kumaon and to the Sub-Himalayan tracts of Rohilkhand and N. Oudh.*

In a privately printed list of Simla plants collected by Mr. Babington Smith and Lady Elisabeth Smith thirty-two species of orchids are recorded; and four years later (in 1903) Sir Henry Collett's most excellent book, the "Flora Simlensis," appeared, in which thirty-eight species are described, and seven of these are figured.

The drawings for the fifty-eight plates contained in the present work were prepared under my supervision by H. Hormusji, for many years artist to the Botanical Department of Northern India. These plates represent only such species as have not already been figured in the Sikkim work, with one exception, viz., *Habenaria latilabris*, a species which has been so frequently confused with what is now known under the name of *H. Edgeworthii* Hook. f. (Platanthera acuminata

* I am glad of this opportunity of being able to bring to notice the services of one of these men, viz., Inayat Khan, not only because of his remarkable aptitude as a collector and of his skill in the selection and preservation of herbarium specimens, but chiefly by reason of his genuine enthusiasm in his work, by means of which he has acquired a very extensive and practical knowledge of botany.

Lindl.) that it was considered advisable to have plates of each side by side in this volume for the sake of comparison. It should also be mentioned that plate No. 223 of the Sikkim Orchids does not represent *Calanthe tricarinata* of Lindley (see plate No. 103 of this volume), and that plate No. 406 of the Sikkim Orchids represents *Habenaria ensifolia* Lindl., a species quite distinct from *H. pectinata* Don (see plate No. 130 of this volume).

In conclusion I wish briefly but cordially to express my thanks to all those who have kindly assisted me during the preparation of this work. I am especially glad to avail myself of this opportunity of saying how very much I am indebted to my friend, Mr. Philip Mackinnon, F. L. S., whom I have known in India for many years as an enthusiastic botanist. To turn attention more particularly to the practical results of the interest he has taken in the subject of this memoir, I may mention that no less than nine undescribed species were discovered by him and his native collectors in the neighbourhood of Mussoorie, also several other rare and interesting species, which had not previously been recorded as Western Himalayan.

I am very much obliged to all those who have kindly aided me with orchid specimens from various parts of the Western Himalaya, and trust that I may not have failed to mention them by name throughout the pages of this book. From Sir Joseph D. Hooker, who has always taken a great interest in my botanical work in India, I have received very great help and encouragement. To Sir William T. Thiselton-Dyer I am much indebted for having kindly allowed me, when in India, to consult Mr. R. A. Rolfe, the well-known orchid specialist at Kew, concerning some of the more critical species. I wish also to acknowledge the great assistance I have received from Mr. Rolfe since my return to England, as well as from Mr. W. Botting Hemsley, the Keeper of the Royal Herbarium. Lastly, I desire to thank my friend, Major D. Prain, for his willing and valuable help on many occasions, and for the trouble he has taken in supervising the preparation of the lithographs and the printing of the letterpress.

HERBARIUM, ROYAL BOTANIC
GARDENS, KEW;
10*th February* 1904.

J. F. DUTHIE.

INTRODUCTION.

The tract of the Western Himalaya lies between 28° 45′ to 36° N. lat. and between 71° 30′ to 80° 40′ E. long.* It extends from Kumaon on the east to the North-West Frontier territories of Gilgit, Chitral and Hazara, and its total area nearly equals that of California (United States). The outer ranges rise abruptly from the great tropical plain of North-West India, and usually to elevations within the limits of the Temperate Zone; whilst on the higher inner ranges, which extend up to above the level of forest growth, a rich Alpine flora is met with. Beyond, and in the neighbourhood of the main axis of the chain of the West Himalaya, are the lofty snow-clad peaks, some of which, such as Nanda Devi in Kumaon, and Nanga Parbat between Kashmir and Gilgit, attain an altitude of over 25,000 feet above the sea.

The number of species at present known to occur within the limits of the Western Himalaya is 173. Of these fifty-nine are epiphytes and 114 are terrestrial, and there are 24 endemic species. Forty-five genera are represented, none of which are endemic.

The following table shows the distribution of the genera in other parts of the world:—

Genera of West Himalaya.	Regions.								Distribution in other parts of the world.
	Sikkim.	China and Japan.	Ceylon.	Malaya.	Burma.	Deccan Peninsula.	Australia.	Trop and South Africa.	
1. Oberonia	1	1	1	1	1	1	1	1	Pacific and Mascerene Islands.
2. Microstylis	1	1	1	1	1	1	...	1	Europe, North and Tropical America, West Indies.
3. Liparis	1	1	1	1	1	1	1	1	Cosmopolitan in temperate and tropical regions.
4. Dendrobium	1	1	1	1	1	1	1	...	Polynesia to New Zealand.
5. Bulbophyllum	1	1	1	1	1	1	1	1	Throughout the tropics.
6. Cirrhopetalum	1	1	1	1	1	1	...	...	Polynesia and Mascerene Islands.
7. Pachystoma	1	1	...	1	...	1	1	1	
8. Phaius	1	1	1	1	1	1	1	1	Pacific and Mascerene Islands.
9. Eria	1	1	1	1	1	1	1	...	Pacific Islands.
10. Cœlogyne	1	1	1	1	1	1	...	...	Ditto.
11. Pholidota	1	1	1	1	1	1	1	...	Ditto.
12. Calanthe	1	1	1	1	1	1	1	1	Mascerene Islands, Mexico, West Indies.
13. Eulophia	1	1	1	1	1	1	1	1	Ditto, Brazil.
14. Geodorum	1	1	1	1	1	1	1	...	Polynesia.
15. Oreorchis	1	1	...	...	...	...	...	...	North Asia.
16. Corallorhiza	...	1	...	...	...	...	...	...	Europe, North America, Mexico.
17. Cymbidium	1	1	1	1	1	1	1	...	Madagascar.
18. Doritis	1	1	1	1	1	1	...	...	
19. Ornithochilus	1	1	...	1	1	...	...	...	
20. Luisia	1	1	1	1	1	1	...	...	Polynesia.
21. Sarcochilus	1	1	1	1	1	1	1	...	Do.
22. Ærides	1	1	1	1	1	1	...	...	
23. Rhynchostylis	1	...	1	1	1	1	...	...	
24. Vanda	1	1	1	1	1	1	1	...	
25. Saccolabium	1	1	1	1	1	1	1	1	Polynesia, Mascerene Islands.
26. Cleisostoma	1	1	1	1	1	1	1	...	Do.
27. Sarcanthus	1	1	1	1	1	1	...	...	Do.
28. Epipogum	1	...	1	...	...	1	1	1	Europe.
29. Listera	1	1	...	...	...	...	...	...	Europe, North America.
30. Gastrodia	1	1	1	1	...	...	1	...	New Zealand.
31. Aphyllorchis	1	...	1	1	...	...	...	...	
32. Galeola	1	1	1	1	1	...	1	...	Polynesia.
33. Pogonia	1	1	1	1	1	1	1	1	North America and in tropical and sub-tropical region of the world.
34. Cephalanthera	1	1	...	...	...	...	...	...	North Asia, Europe, North Africa, North America.
35. Epipactis	1	1	...	...	...	...	...	1	Ditto, ditto
36. Spiranthes	1	1	1	1	...	1	1	...	Afghanistan, New Caledonia, New Zealand, Nort and Tropical America.
37. Goodyera	1	1	1	1	1	1	1	...	New Caledonia, Mascerene Islands, California.
38. Zeuxine	1	1	1	1	1	1	...	1	
39. Anæctochilus	1	1	1	1	1	1	...	...	Sandwich Islands.
40. Orchis	1	1	...	...	...	...	...	...	North Asia, Europe, North Africa, North America Mascerene Islands.
41. Habenaria	1	1	1	1	1	1	1	1	Cosmopolitan.
42. Herminium	1	1	...	...	1	...	...	...	North Asia, Europe.
43. Hemipilia	...	1	...	...	1	...	...	...	
44. Satyrium	1	1	1	...	..	...	...	1	Mostly African and Mascerene.
45. Cypripedium	1	1	...	1	1	1	...	...	Mountains of North and Central America.
	43	42	34	35	33	32	23	14	

* This does not include the narrow sub-montane tract of North Oudh extending eastwards from the district of Kheri.

The following list gives the number of species contained in each of the forty-five genera:—*Habenaria* 31; *Dendrobium* 15; *Liparis* and *Eulophia* 9; *Calanthe*, *Cymbidium* and *Herminium* 7; *Cœlogyne* and *Goodyera* 6; *Listera* and *Orchis* 5; *Microstylis*, *Oreorchis*, *Luisia*, *Vanda* and *Pogonia* 4; *Oberonia*, *Bulbophyllum*, *Cirrhopetalum*, *Eria*, *Saccolabium* and *Epipactis*, 3; *Pholidota*, *Ærides*, *Epipogum*, *Spiranthes* and *Cypripedium*, 2. The remaining eighteen genera are represented by a single species:—*Pachystoma*, *Phaius*, *Geodorum*, *Corallorhiza*, *Doritis*, *Ornithochilus*, *Sarcochilus*, *Rhynchostylis*, *Cleisostoma*, *Sarcanthus*, *Gastrodia*, *Aphyllorchis*, *Galeola*, *Cephalanthera*, *Zeuxine*, *Anœctochilus*, *Hemipilia* and *Satyrium*.

The number of W. Himalayan species found in Sikkim is 105, and the following, thirty-five species extend to China:—*Microstylis cylindrostachya*, *Liparis longipes*, *Dendrobium chrysanthum*, *D. clavatum*, *Cœlogyne elata*, *Calanthe puberula*, *C. tricarinata*, *Eulophia flava*, *E. nuda*, *Oreorchis foliosa*, *Corallorhiza innata*, *Cymbidium pendulum*, *C. longifolium*, *Ornithochilus fuscus*, *Luisia teretifolia*, *Ærides odoratum*, *Epipactis consimilis*, *E. gigantea*, *Spiranthes australis*, *Goodyera repens*, *G. procera*, *Zeuxine sulcata*, *Anœctochilus Roxburghii*, *Orchis Chusua*, *O. spathulata*, *Habenaria Susannæ*, *H. ensifolia*, *H. intermedia*, *H. viridis*, *H. goodyeroides*, *H. galeandra*, *Herminium augustifolium*, *H. Monorchis*, *Satyrium nepalense*, *Cypripedium himalaicum*.

Twelve species are found in Ceylon, viz.—*Liparis longipes*, *Pholidota imbricata*, *Eulophia nuda*, *Rhynchostylis retusa*, *Luisia teretifolia*, *Vanda parviflora*, *V. Roxburghii*, *Goodyera procera*, *Zeuxine sulcata*, *Spiranthes australis*, *Habenaria plantaginea* and *Satyrium nepalense*.

The following ten species extend to Britain:—*Listera ovata*, *Corallorhiza innata*, *Goodyera repens**, *Spiranthes autumnalis*, *Epipogum aphyllum**, *Epipactis latifolia**, *Cephalanthera ensifolia**, *Orchis latifolia*, *Herminium Monorchis* and *Habenaria viridis*.

Pholidota imbricata and *Spiranthes australis* extend to Australia, and *Epipactis gigantea* and *Goodyera repens* occur in North America.

The following twenty-four species are not at present known to occur outside the area of the Western Himalaya:—

† *Microstylis Mackinnoni*—Dehra Dun and Mussoorie.
Liparis diodon—Dehra Dun.
———*rostrata*—Kumaon to Simla.
Oreorchis indica—Garhwál to Simla.
† ———*Rolfei*—Garhwál.
‡ *Dendrobium Gamblei*—Dehra Dun.
† *Cirrhopetalum Hookeri*—Garhwál.
Eria alba—Kumaon to Chamba.
§ *Eulophia Hormusjii*—Dehra Dun and Garhwál to Hazara.
———*obtusa*—Sub-Himalayan.
† ———*Mackinnoni*—Sub-Himalayan.
† *Cymoidium Mackinnoni*—Mussoorie range.
§ *Epipogum tuberosum*—Kashmir.
† *Listera Inayati*—Hazara.

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* Also in Sikkim.
† Published in Journ. As. Soc. Beng. lxxi (1902), Part i, pp. 37—45.
‡ Published in Journ. As. Soc. Beng. lxvi (1897), Part i, 584
§ Not previously published.

* *Listera kashmiriana*—Kashmir.
† ——— *microglottis*—Mussoorie range.
† *Aphyllorchis Gollani*—Garhwâl.
† *Pogonia Mackinnoni*—Mussoorie range.
Gastrodia orobanchoides—Garhwál to Kashmir.
Orchis Stracheyi—Kumaon.
Herminium Duthiei—Kumaon and Brit. Garhwál.
Habenaria longifolia—Dehra Dun.
————*pubescens*—Dehra Dun and Garhwál.
———————*arcuata*—Kumaon.

Information regarding the distribution of the Western Himalayan orchis at different altitudes above the level of the sea will be found under each species. The following is an abstract giving the number of species found within each zone:—

Restricted to the sub-tropical zone	85
Extending from the sub-tropical into the temperate zone ...	16
Restricted to the temperate zone	59
Extending from the temperate to the alpine zone ...	10‡
Restricted to the alpine zone	3§

In regard to the flowering seasons of the W. Himalayan species, although there is no single month of the year during which one or more species may not be found in flower, there are, however, three distinct flowering periods, viz., (1) before the rainy season, *i.e.*, from March to June; (2) during the rainy season; (3) after the rainy season, *i.e.*, from the middle of September and onwards. The species which come into flower during the first period are:—*Dendrobium amœnum* and *candidum*; *Bulbophyllum polyrhizum*; *Cirrhopetalum maculosum*; *Pachystoma senile*; *Eria flava*; *Cœlogyne cristata*, *ochracea* and *elata*; *Calanthe tricarinata*, *Mannii* and *plantaginea*; *Eulophia explanata*, *campestris* and *Hormusjii*; *Doritis tœnialis*; *Luisia trichorhiza* and *teretifolia*; *Vanda pariflora* and *cristata*; *Saccolabium calceolare* and *distichum*; *Pogonia Mackinnoni* and *Gammieana*; *Cephalanthera ensifolia*; *Epipactis consimilis*; *Spiranthes australis* (at the lower elevations) and *autumnalis*; *Zeuxine sulcata*; *Habenaria Griffithii*; *Cypripedium cordigerum*. Those of the third period, which come into flower after the rainy season, are:—*Oberonia Falconeri*, *ensiformis* and *pachyrachis*; *Liparis cordifolia* and *longipes*; *Cœlogyne ovalis*; *Cymbidium Mackinnoni*, *cyperifolium* and *giganteum*; *Habenaria plantaginea*. The flowering of *Cymbidium Mackinnoni* in mid-winter near Mussoorie at an elevation of about 5,000 feet, and within the region of heavy snowfall, is remarkable. An allied species, *C. cyperifolium*, is found also in similar situations but always under the shelter of trees, where it comes into flower during March and April, though in Sikkim this species is said to flower in November. *C. giganteum* flowers during November and December. I am, therefore, inclined to regard both *C. cyperifolium* and *Mackinnoni* as late-flowering species of the previous season.

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* Not previously published.

† Published in Journ. As. Soc. Beng. lxxi (1902), Part i, pp. 37—45.

‡ *Microstylis muscifera*; *Goodyera repens*; *Orchis latifolia*, *O. Chusua*, *O. spathulata*; *Habenaria Aitchisoni* var. *Josephi*, *H. Elisabethæ*; *Herminium Monorchis*, *H. Duthiei*, *H. congestum*.

§ *Goodyera fusca*, *Habenaria urceolata*, *Herminium pugioniforme*.

The remaining 130 species belong to the second or rainy season period. A large number of the terrestrial kinds may be said to form a portion of that curious sub-tropical herbaceous vegetation which suddenly makes its appearance on the advent of the moist monsoon weather, and as rapidly withers and disappears as soon as the rains are over and the air becomes drier and colder. The most conspicuous examples of this monsoon herbaceous flora are the epiphytic ferns, which clothe the trunks and branches of the trees, and more especially the oaks, with a profuse lace-work of brilliant green. Many of the *Scitamineæ*, such as species of *Hedychium*, *Cautleya*, &c., are frequently found as epiphytes, whilst the rocks and steep banks are gay with the flowers of begonias and gesneraceous species belonging to *Chirita*, *Platystemma*, *Didymocarpus* and *Rhynchoglossum*. These conditions prevail, of course, to a much greater extent in the Eastern Districts of Kumaon and Garhwál where the rainfall is heavier, and more so, and for a similar reason, on the outer than on the inner ranges. Some of the rainy season terrestrial species appear to prefer an epiphytic habit of growth. *Habenaria latilabris*, for instance, is more frequently to be found on the trunks of trees than on the ground, whilst *H. Edgeworthii* is invariably a ground orchid and is usually found growing in open places away from the shelter of trees. *Habenaria Elisabethæ* is very often met with on the branches of trees, whilst *Herminium Mackinnoni* has not as yet been seen growing on the ground either at Mussoorie or in its Sikkim locality.

TRIBE I.—MALAXIDEÆ.

Pollinia usually 4, waxy, without appendages, free or rarely attached by their bases to a ball of translucent matter.

Sepals and petals widely spreading, lip deflexed or decurved from the base, column not prolonged into a foot :—
- Lip superior, column very short:—
  - Leaves equitant, fleshy . . . . . 1. *Oberonia.*
  - Leaves not equitant, membranous . . . . . 2. *Microstylis.*
- Lip inferior, column long . . . . . 3. *Liparis.*

Sepals and petals more or less connivent, lip erect from the base, column prolonged into a foot :—
- Lip not articulate on the foot . . . . . 4. *Dendrobium.*
- Lip articulate on the foot:—
  - Lateral sepals not much exceeding the dorsal . . . . . 5. *Bulbophyllum.*
  - Lateral sepals much exceeding the dorsal . . . . . 6. *Cirrhopetalum.*

1. **Oberonia** Lindl.

Epiphytes with usually very short, often tufted, stems. *Leaves* coriaceous or fleshy, usually ensiform (rarely terete), always distichous and ensiform. *Flowers* minute, many, sometimes whorled, arranged in a long erect or deflexed spike-like or raceme-like inflorescence, but expanding centrifugally. *Sepals* subequal, ovate or oblong. *Petals* as wide as or narrower than the sepals. *Lip* larger than the sepals, sessile, rarely entire, usually lobed and often erose-lobular, the hypochile more or less concave or with a nectar-secreting pit near its base. *Column* very short, stout, rarely winged. *Anther* terminal, incumbent; *pollinia* 4, cohering in pairs.—Species about 60, distributed in the Indo-Malayan region, but extending also to China, Australia and the islands of the Pacific.

- Lip without lateral lobes or basal auricles ... ... *1. O. pachyrachis.*
- Lip with lateral lobes :—
  - Lip oblong, with small lateral lobes ... ... *2. O. Falconeri.*
  - Lip obcordate, with large broad lateral lobes ... ... *3. O. ensiformis.*

1. Oberonia pachyrachis Reichb. f. in Herb. Kew ex Hook. f. Fl. Br. Ind. v., 681.

Stems very short, tufted. *Leaves* ensiform, slightly falcate, acute, 3—10 cm. long and 7—18 mm. broad. Peduncle of *inflorescence* short, broad, compressed, adnate to a leaf nearly to its apex ; the flower-bearing rachis fleshy, terete, tapering, erect, equalling or slightly longer than its leaf ; *floral bract* ovate-rotund, irregularly but deeply serrate. *Flowers* minute, pale brown, sunk singly in rather distant pits in the fleshy rachis, the sepals and lip lying flat on its surface. *Sepals* elliptic, obtuse, glandular on the back, not reflexed. *Petals* smaller, linear-oblong, obtuse, subentire. *Lip* orbicular-elliptic, obtuse,

concave, entire or slightly erose at the apex, and with a deep depression at the base just under the column. *Capsule* short, turgid, often gibbous. King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii, p. 4, plate 3.

Common on the trunks of trees in Dehra Dun, and on the outer ranges from Mussoorie to Kumaon, up to 4,000 feet; extending eastwards to Sikkim and the Khasia Hills. It flowers during the cold season.

2. Oberonia Falconeri Hook f. Ic. Plant. t. 1780; Fl. Br. Ind. v, 678.

Stems short. *Leaves* 2·5—7 cm. long, straight or falcate, acute, coriaceous. Peduncle of *inflorescence* much shorter than the leaves, terete, bracteate. *Racemes* erect or decurved, overtopping the leaves; the rachis stout, deeply grooved in fruit. *Floral bract* longer than the ovary, oblong or ovate-lanceolate, acuminate, serrulate, membranous, very pale green. *Flowers* very small, shortly pedicelled. *Sepals* ovate, acute, reflexed. *Petals* falcately lanceolate, obtuse, a little longer and narrower than the sepals, spreading. *Lip* oblong or subquadrate, upper surface glistening with many scattered gland-like specks; lateral lobes small, with truncate or emarginate tips, the apex with two small incurved obtuse lobes separated by a broad sinus. *Anther* obovate, its lip emarginate. *Capsules* shortly pedicelled. *O. iridifolia* Wall. Cat. 1948 (1 and 3).

Common in Dehra Dun, chiefly on mango trees, and on the outer ranges between the Jumna and the Ganges up to 3,500 feet; flowering during September. It extends eastwards to Sikkim and the Khasia Hills, and occurs also in Behar, Chota Nagpur and in the Konkan.

The sepals and petals are brownish-yellow, and the lip is green. According to Sir Joseph Hooker this species is nearly allied to *O. pyrulifera* Lindl., but is more robust, with shorter and broader leaves, and with short lateral lobes or shoulders to the lip, the terminal lobes of which are short and distant.

Plate 94. Oberonia Falconeri *Hook. f.*—A plant,—*of natural size.* Fig. 1, front view of a flower; 2, lip; 3, anther; 4, pollinia;—*all enlarged.*

3. Oberonia ensiformis Lindl. Fol. Orch. Oberonia, p. 4.

Stems 7—8 cm. *Leaves* linear-ensiform, acuminate, falcate, 7—22 cm. long and 1—2 cm. broad. *Inflorescence* erect, shorter than the leaves, subtruncate; its peduncle 5—7·6 cm. long and bearing numerous minute lanceolate appressed pale bracteoles; *raceme* about twice as long as the peduncle, its rachis thick, fleshy, terete; *floral bract* longer than the ovary, convolute, ovate-rotund, sub-acute, erose. *Flowers* 2 mm. long, pale brown, not at all sunk in the rachis. *Sepals* subequal, broadly ovate, sub-acute, entire, not ciliolate reflexed. *Petals* ovate, sub-acute, 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 the lip, except the smooth mesochile, clothed with stiff hairs. Hook. f. Fl. Br. Ind v, 679; King & Pantl. in Ann. Roy. Bot. Gard. Calc. Vol. viii, p. 9, plate 9.

O. acaulis Hook. Bot. Mag. 5056 (not of Griff.). *O. trilobata* Griff. Notul. iii, 273. *Malaxis ensiformis* Smith in Rees' Encycl.; Reichb. f. in Walp. Ann. vi, 212 (excl. syn.).

Dehra Dun, chiefly on sâl trees, *Falconer*, *King*, *Mackinnon;* and up to 3,000 feet on the adjacent Himalaya, flowering during November. It extends eastward to Nepal, Sikkim and the Khasia Hills, and has recently been discovered on the Nilgiris by Mr. R. Proudlock.

2. **Microstylis** Nutt.

Terrestrial or epiphytic, rarely saprophytic, often pseudo-bulbous. *Leaves* one or more, rarely absent, membranous, plicate, continuous with their sheaths. *Flowers* small, resupinate, in terminal racemes. *Sepals* spreading or recurved, subequal. *Petals* narrower than the sepals but about as long. *Lip* adnate to the base of the column, usually flat, basal lobes large, sagittate, produced upwards, or cup-shaped with small lobes, or without basal lobes; the apex emarginate, 2—3-lobed, erose or entire. *Column* usually very short (long in *M. congesta*), with two short spreading arms. *Anther* subterminal, bilocular; *pollinia* 4, ovoid or obovoid.—Species about 60, in temperate and tropical regions.

Lip slightly convex, basal auricles sagittate and projecting upwards:—	
Leaves 3—4, ovate-lanceolate, acuminate	*1. M. Wallichii.*
Leaves usually 2, at the base of the scape, ovate or suborbicular, obtuse	*2. M. Mackinnoni.*
Lip concave, entire, its apex produced into a beak, basal auricles absent:—	
Leaf one	*3. M. cylindrostachya*
Leaves two	*4. M. muscifera.*

1. Microstylis Wallichii Lindl. in Wall. Cat. 1938.

Stem about 7·5 cm. long, with a few sheaths below. *Leaves* three or four, 7·5 to 11·5 cm. in length and 3·5 to 6·5 cm. broad, thinly membranous, ovate-lanceolate, acute or acuminate, narrowed to the sheathing base, the upper ones sessile, the lower with sheathing petioles, edges undulate. *Inflorescence* 2—3 dm. long; peduncle shorter than the raceme, ribbed; *raceme* laxly many-flowered; *floral bracts* lanceolate, half the length of the stalked ovaries. *Flowers* yellowish-green, often tinged with purple, about 13 mm. long. *Sepals* oblong, the dorsal subacute, the lateral broader and obtuse. *Petals* linear, obtuse, with recurved margins like those of the sepals. *Lip* slightly convex, narrowly ovate in general outline; basal lobes or auricles lanceolate, their inner edges straight, and with an intervening space. *Lip* not constricted so as to form a distinct anterior lobe, its apex flat or slightly incurved at the notch. *Column* with very fleshy rounded arms. Lindl. Gen. and Sp. Orch. 20; Hook. f. Fl. Br. Ind. v, 686; in Ann. Roy. Bot. Gard. Calc. vol. v, part 1, t. 2, figures 1 and 2 (excl. syn. *M. biloba*); King & Pantl. in Ann. Roy. Bot. Gard. Calc. vol. viii, p. 16, plate 18; Collett in Fl. Siml. 491, fig. 162. *Malaxis acuminata* Don Prod. 29.

Western Himalaya from Pángi to Kumaon between 4,000 and 7,000 feet, becoming more abundant eastwards, flowering during the rainy season. It extends eastwards to Sikkim and the Khasia Hills, and is found also in Ceylon.

Var. BILOBA Hook. f. Fl. Br. Ind. l. c.; in Ann. Roy. Bot. Gard. Calc. vol. v, part 1, p. 2, plate 2, fig. D.

Basal lobes of lip slightly falcate, converging and sometimes overlapping, apical portion of lip abruptly bent forward and forming an obovate-oblong or subquadrate apical lobe divided at the extremity into two rounded parallel oblong blunt lobules; arms of the column only slightly fleshy; anther with a small subacute emarginate lip; leaves thicker in texture than in typical *M. Wallichii*, less acute and less undulate. *M. biloba* Lindl. in Wall. Cat. 1940; Gen. and Sp. Orch. 20; Ridl. in Journ. Linn. Soc. xxiv. 337; King & Pantl. l.c., plate 19.

Simla, *Barclay;* N.-W. India, *Herb. Royle;* Garhwál, *King;* extending eastwards to Nepal, Sikkim and the Khasia Hills.

2. MICROSTYLIS MACKINNONI Duthie in Journ. As. Soc. Beng. lxxi, part 2, p. 37.

Whole plant 1—1·7 dm. high. *Stem* swollen below and rising from the base of the previous year's pseudo-bulb; lower portion enclosed within the leaf-sheaths. *Leaves* 2 or 3, horizontal, unequal in size, the larger one about 6 cm. long and 4 cm. broad, ovate, obtuse, cordate and amplexicaul at the base, fleshy; upper surface dark brownish green; main nerves 3—7, prominent beneath; lower surface purple-coloured, the inter-spaces raised above and giving the leaf a bullate appearance. *Scape* reddish-purple, sharply quadrangular. *Raceme* shorter than the scape; *bracts* subulate, persistent, reflexed, longer than the ovary. *Flowers* sessile, very small, reddish purple. Dorsal *sepal* ovate-lanceolate, subacute; lateral shorter, subfalcate, edges of all reflexed. *Petals* linear, shorter than the sepals, much reflexed. Basal and apical portions of *lip* divided by a raised rim; basal lobes falcately ovate-lanceolate, often contiguous or overlapping at the tips; apical portion of lip deeply bifid and protruded, crimson-purple. *Column* with fleshy rounded arms. *Anther* with a truncate or emarginate lip. *Ovary* clavate, not twisted.

Near Mussoorie on southern slopes, 5,500 to 6,000 feet, *Mackinnon* Nos. 21,779 and 22974; Dehra Dun on the Kalanga Hill, 2-3,000 feet, *Mackinnon's collector* No. 25429; flowering in July.

Although most nearly related to *M. Wallichii*, the very different leaves at once distinguish this plant from any of the numerous forms of that species. It has also much smaller flowers and a very differently shaped lip.

PLATE 95. Microstylis Mackinnoni *Duthie.*—Entire plant,—*of natural size.* Fig. 1, a single flower, *front view;* 2, ditto, seen from behind; 3, column and ovary with sepals, petals and half the lip removed; 4, column and upper portion of ovary; 5, anther; 6, pollinia;—*all enlarged.*

3. MICROSTYLIS CYLINDROSTACHYA Reichb. f. in Walp. Ann. vi, 207.

Stem proceeding from the base of the small conical tuber of the previous year, up to 15 cm. long, and bearing one or two wide-mouthed sheaths. *Leaf* solitary, 3·5 to 10 cm. long and 2 to 4 cm. wide, elliptic, subacute, attached to a long

tubular petiole. *Inflorescence* 7·6 to 25·4 cm.; peduncle long, ebracteate; *raceme* cylindric, bearing many crowded yellowish-green flowers. *Floral bract* lanceolate, shorter than the ovary. *Sepals* subequal, ovate, acuminate. *Petals* linear-lanceolate, acute. *Lip* fleshy, broadly ovate, excavated, the margins thickened, angled and denticulate, the apex produced into a fleshy point; upper surface with a raised central line from base to apex, and two convexities immediately under the column. *Pollinia* divergent, subovoid, their points convergent under the corners of the stigma. Ridl. in Journ. Linn. Soc. xxiv, 333; Hook. f. Flor. Br. Ind. v, 689; King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 20, plate 24; Collett Flor. Siml. 492. *Dienia cylindrostachya* Lindl. in Wall. Cat. 1934; Gen. and Sp. Orch. 22; Wight, Ic. 1630.

Kashmir, *C. B. Clarke* No. 31478; Simla 7-8,000 feet, *Lady Dalhousie*, *T. Thomson*, *Barclay*, *Collett* and others; Bashahr, *Lace;* Garhwál 6-7,000 feet; *Falconer*, *Duthie* No. 4430, *Mackinnon* No. 21777; Kumaon 7-8,000 feet, *Strachey & Winterbottom* No. 4 (Dienia), *Col. Davidson;* Káli Valley 12,000 feet, *Duthie* No. 341. Eastwards to Nepal, Sikkim and Bhutan, and thence to China, occurring usually at higher elevations. It has been found also in Central India by Hope, fide C. B. Clarke under his number 16879. Flowers in July and August.

4. Microstylis muscifera Ridley in Journ. Linn. Soc. xxiv. 333.

Stem 2·5 to 12·8 cm. long, from the apex of a small ovoid pseudo-bulb, bearing one or more tubular sheaths. *Leaves* usually two, approximate, unequal, ovate-rotund to ovate-lanceolate, obtuse or subacute, somewhat narrowed at the base to the sheathing petiole; blade 5 to 10 cm. in length. *Inflorescence* 7·5 to 25·5 cm.; peduncles terete, ebracteate; *raceme* about equalling the peduncle, rather lax. *Flowers* minute, yellowish-green; *floral bract* shorter than or equal to the pedicelled ovary. *Sepals* subequal, broadly oblong-lanceolate, subacute, longer than the linear petals. *Lip* broadly ovate, fleshy and excavated at the base; side lobes obscure, convex, thickened. *Column* very short, fleshy. Hook. f. Flor. Br. Ind. v, 689; King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii, p. 20, t. 25; Collett Fl. Siml. 491. *Dienia muscifera* Lindl. in Wall. Cat. 1935; Gen. and Sp. Orch. 23.

Abundant on the outer ranges from Hazara to Kumaon, between 8,000 and 12,000 feet flowering during July and August. It extends eastwards to Nepal and Sikkim, and it is also found in the Kurram Valley.

3. Liparis Richard.

Terrestrial or epiphytal, pseudo-bulbous. *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. *Lip* adnate to the base of the column, usually broad, flat, or deflexed from the middle, sometimes concave, often with calli near the base. *Column* elongate, often arched, usually winged near the apex, and tumid and compressed at the base. *Anther* terminal; *pollinia* 4.—Species about 100, in temperate and tropical regions.

Leaves large, membranous, contracted at the base into and continuous with a long sheath:—

Lip abruptly deflexed from the very base:—

Leaf solitary, cordate; bracts minute . . . . . 1. *L. cordifolia.*

Leaves 2, bracts deflexed . . . . . 2. *L. deflexa.*

Lip deflexed from about the middle:—

Leaf solitary:—

Leaf thin, bracts long and slender . . . . . 3. *L. Glossula.*

Leaf fleshy, bracts minute . . . . . 4. *L. diodon.*

Leaves 2; bracts very minute; lip broadly obcordate, apiculate, crenulate 5. *L. rostrata.*

Leaves 2-5; lip cuneately obovate, 2-tubercled at the base:—

Leaves 2-3; floral bract ovate-lanceolate . . . . . 6. *L. paradoxa.*

Leaves 4 or 5; floral bract minute . . . . . 7. *L. bituberculata.*

Leaves coriaceous or subcoriaceous, jointed to the sheath or pseudo-bulb:—

Pseudo-bulb elongate; leaves 2 . . . . . 8. *L. longipes.*

Pseudo-bulb short, ovoid; leaf solitary . . . . . 9. *L. Duthiei.*

1. LIPARIS CORDIFOLIA Hook. f. Ic. Plant. t. 1811.

Terrestrial, the whole plant of a uniform deep green colour. *Pseudo-bulbs* crowded, much compressed, ovoid, pointed, with a few scattered fibres at the base, 3·5 cm. long. *Stem* short, stout, enveloped by the leaf-sheath. *Leaf* 5 to 12·5 cm. long and 3·5—10 cm. broad. *Inflorescence* about as long as the leaf; peduncle elongate, ebracteate. *Raceme* 2·5 to 5 cm.; *floral bract* triangular, minute, the pedicelled ovary long and filiform. *Flowers* 1·5 cm. long. *Sepals* linear-lanceolate, acute; the dorsal spreading, the lateral pair lying under the lip and almost concealed by it. *Petals* linear, spreading. *Lip* broadly triangular or obovate-deltoid, flat, with a slight concavity at the base, and with a minute tooth on each side, a central grooved ridge and two lateral branching nerves; the edges minutely erose-crenulate; the apex broad, subtruncate and apiculate. *Column* curved, much swollen at the base, and produced into two polished knobs, apex with two short rounded wings. *Pollinia* elongate, 3-angled, each pair resting on a distinct rostellum which is tipped with a ball of transparent viscus. Hook. f. Flor. Br. Ind. v, 692; King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii, p. 24, plate 28.

Dehra Dun, *Royle;* extending eastwards to Sikkim and the Khasia Hills, up to 6,000 feet. Royle's specimens were in flower in October.

2. LIPARIS DEFLEXA Hook. f. Flor. Br. Ind. v, 697.

Terrestrial. *Stem* cylindric, as thick as a goose-quill, 5 to 6·5 cm. long, covered by two or three tight short subacute sheaths, springing from a cylindric tuber. *Leaves* two, from near the top of the stem, subopposite, and with short unequal petioles, elliptic, acuminate, membranous, plicate, 7-nerved, 15 to 18 cm. long, and about 6 cm. broad. *Inflorescence* longer than the leaves, erect, striate; the peduncle with a few lanceolate deflexed bracts. *Raceme* lax; *floral bract* half as long as the pedicelled ovary, reflexed. *Flowers* about 8 mm. across, yellow. *Sepals* narrowly oblong, the dorsal acute, the lateral ones obtuse. *Petals* narrowly oblong, obtuse and, like the sepals, reflexed and with recurved margins. *Lip* flat, orbicular-reniform, contracted at its junction with the column, the margins minutely erose except near the base; apex broad, lightly

emarginate and mucronate; the upper surface with a narrowly oblong mesial glistening and nectar-exuding patch extending from the base to the middle; calli two, just under the column. *Column* slightly curved, with narrow rounded wings near the apex, the base somewhat swollen. Hook. f. Ic. Plant. 2008; King & Pantl. in Ann. Roy. Bot. Gard. viii, 25, plate 31.

Kumaon, in the Káli Valley, *Duthie's Collector* No. 24113; flowering in August. Previously known only from Sikkim.

3. LIPARIS GLOSSULA Reichb. f. in Linnæa xli, 43.

Terrestrial. *Pseudo-bulbs* ovoid, tufted, 3·5 to 5 cm. long. *Leaf* solitary, oblong, subacute, suddenly contracted into a sheath at the base, sometimes stalked, 5 to 10 cm. long, and up to nearly 2·5 cm. broad. *Inflorescence* erect, longer than the leaf; *raceme* lax-flowered; *floral bract* linear, obtuse, shorter than the pedicelled ovary. *Flower* 1·9 cm. long, green, the lip purplish. *Sepals* oblong-lanceolate, acute, dorsal spreading, the lateral ones lying parallel under the lip, all with revolute margins. *Petals* linear, reflexed. *Lip* oblong, with a broad rounded ciliolate cuspidate apex, deflexed about the middle, concave and with a shining fluted line running from base to apex, without calli at the non-deflexed base, the whole lip veined and purple with olive-green edges. *Column* with two short wings near the apex, the base dilated into two large purple knob-like convexities. *Anther* with a beaked apex. Ridl. in Journ. Linn. Soc. xxii. 268; Hook. f. Ic. Plant. 1809; Flor. Br. Ind. v, 693; King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii. 26, t. 33.

Mussoorie range, 6,000 to 7,000 feet, *Mackinnon*, *Duthie*, Nos. 21772, 22734, 24179; Landour, 5,000 to 7,000 feet, *Edgeworth;* British Garhwál, 6,000 to 7,000 feet, *Duthie* No. 4427(*a*); Kumaon, 7,000 to 8,000 feet, *Strachey & Winterbottom* No. 1, *Colonel Davidson*, *Duthie*. Flowers in August. It extends eastwards to Nepal and Sikkim.

4. LIPARIS DIODON Reichb. f. in Linnæa xli, 43.

Leaf elongate, spathulate, obtuse, membranous, fleshy. *Scape* angled, naked; *bracts* minute. *Sepals* linear. *Petals* filiform. *Lip* cuneate and angled on both sides at the base, then dilated, sub-quadrate and crenulate at the end, apiculate. *Column* slender, curved, 2-toothed at the base. *Anther* not rostrate. Ridl. in Journ. Linn. Soc. xxii, 278; Hook. f. Flor. Br. Ind. v, 693.

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

5. LIPARIS ROSTRATA Reichb. f. in Linnæa xli, 44.

Terrestrial. *Pseudo-bulb* ovoid, sulcate, 12—20 mm. long, tufted on a short rootstock. *Stem* from the base of the pseudo-bulb, bearing two obtuse sheaths. *Leaves* two, opposite, sub-sessile or petioled, broadly ovate, subacute, about 1 dm. long and 3—5 cm. broad, tapering gradually into sheathing petioles. *Scape* a little longer than the leaves; peduncle quadrangular, angles winged; *raceme* laxly flowered, 5—15 cm. long; *bracts* small, broad-based. *Flowers* 19 mm. across. *Sepals* 3-nerved, narrowly lanceolate or

spathulate, dorsal with a cordate base. *Petals* linear, reflexed. *Lip* flat, quadrate, obcordate, with a minute mucro in the sinus, green tinged with lilac, margins minutely crenulate, claw channelled above. *Column* long, slender, winged on the sides. *Anther* with a broad triangular beak. Hook. f. Ic. Plant. 1813; Fl. Br. Ind. v, 694; Collett Fl. Siml. 492. *L. olivacea* (in part) Herb. Ind. Or. Hook. f. & Thoms. (not of Lindl.); Royle Ill. 364. *L. rupestris* (in part) Ridl. in Journ. Linn. Soc. xxii, 145 (not of Griffith).

Simla to Kumaon at elevations between 5 and 8,000 feet. Simla, *T. Thomson*, *Gamble;* Jaunsar, *Gamble* No. 27163, *Osmaston* (*Duthie's* No. 21774); N.-W. India, *Royle* (*L. olivacea*); Mussoorie, *Falconer*, *Mackinnon*, *Duthie* Nos. 637(*a*), 21773, 21774, 22971. In flower during July.

Plate 96. Liparis rostrata *Reichb. f.*—A plant,—*of natural size.* 1, front view of flower; 2, back view of ditto; 3, column; 4, anther; 5, pollinia;—*all enlarged.*

6. Liparis paradoxa Reichb. f. in Walp. Ann. vi, 218.

Terrestrial. *Pseudo-bulbs* narrowly ovoid. *Stems* about 15 cm. high, slightly bulbous at the base, bearing several sheaths. *Leaves* two or three, 12—13 cm. long and about 2·5 cm. broad, alternate, narrowly elliptic-lanceolate, acute, narrowed to the amplexicaul sheath, plicate, 5-nerved. *Inflorescence* longer than the leaves, the peduncle finely striate with one or two linear spreading bracts; *raceme* as long as or longer than its peduncle few-flowered; *floral bract* ovate-lanceolate, shorter than the twisted stalked ovary. *Flowers* 1·3 cm. long, green, the lip dull-purple. Dorsal *sepal* linear, blunt, spreading, its margins recurved; lateral broadly ovate, 5-nerved, recurved. *Lip* quadrate, abruptly deflexed from the middle, concave, and bearing two erect tooth-like calli; the edges entire; apex broad, emarginate, erose, and shortly apiculate. *Column* not curved, its upper half hood-like from the large rounded crenulate wings. *Anther* acuminate. Ridl. in Journ. Linn. Soc. xxiio, 261; Hook. f. Fl. Br. Ind. v, 698; King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 27, plate 34; Collett Fl. Siml. 492. *L. odorata* Lindl. Gen. and Sp. Orch. 26; Thwaites Enum. Pl. Ceyl. 295. *Empusa paradoxa* Lindl. in Wall. Cat. 1937A (in part); Bot. Reg. sub. t. 825; Gen. and Sp. Orch. 17; Royle Ill. 364; Miq. Prolus. Fl. Japon. 135; Thwaites Enum. Pl. Ceyl. 426. *Malaxis lancifolia* Smith in Rees' Encycl.

Abundant on the outer ranges from Simla to Kumaon, up to 7,000 feet, flowering during the rainy season. This species extends eastwards to Nepal, Sikkim, the Naga and Khasia Hills and Bengal, and southwards through Central and Southern India to Ceylon; it occurs also in Burma, Siam, China, Japan and Java.

7. Liparis bituberculata Lindl. Bot. Reg. sub. 882.

Terrestrial. *Stems* tall, tufted, erect, robust, fleshy, 2 to 2·5 dm. *Leaves* four or five, 1 to 2 dm. long, obliquely ovate or elliptic-lanceolate, shortly acuminate, 7-nerved, plicate, membranous, polished, the base tapering into the broad sheathing petiole. *Inflorescence* erect, stout, striate, much longer than the leaves; peduncle without bracts; *raceme* about 15 cm. long, rather few-flowered; *floral bract* minute, cordate, acute,

deflexed. *Flowers* about 8 mm. long, brownish-purple. Dorsal *sepal* linear-oblong, obtuse, reflexed; lateral pair similar in shape but broader and spreading. *Petals* linear spreading, their margins, like those of dorsal sepal, recurved. *Lip* oblong, very concave, deflexed from about the middle, revolute, bearing two sharp tooth-like calli at its base; edges entire or slightly crenulate, the apex blunt with a small triangular apiculus. *Column* curved, slightly winged near the apex. Ridl. in Journ. Linn. Soc. xxii, 263; Hook. f. Fl. Br. Ind. v, 693; King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 28, plate 35. *Empusa paradoxa* Wall. Cat. 1937 B; Lindl. Gen. and Sp. Orch. 17. *Cymbidium? bituberculatum* Hook. Exot. Fl. t. 116. *Sturmia bituberculata* Reichb. f. in Bonplandia ii, 22.

Kumaon, *Blinkworth;* extending to Nepal, the Sikkim Himalaya and the Khasia Hills. Flowers in July.

8. LIPARIS LONGIPES Lindl. in Wall. Pl, As. Rar. i, 31, t. 35.

Epiphytal. *Pseudo-bulbs* close together in a row, cylindric and stem-like, or swollen at the base, 7·5 to 15 cm. long, with a few vertical striæ and tightly clasping sheaths. *Leaves* two, oblanceolate-oblong, subacute to acuminate, sometimes aristate, 10 to 15 cm. long and 2 cm. broad. *Inflorescence* erect, shorter or longer than the leaves; peduncle slender, terete, ebracteate; *raceme* twice as long as the peduncle, many-flowered; *floral bract* linear-lanceolate, shorter than the pedicelled ovary. *Flowers* 7 mm. long, pale yellowish-green. *Sepals* linear-oblong, subacute. *Petals* shorter than sepals, linear, obtuse, reflexed and with recurved edges as are the sepals. *Lip* broadly oblong, recurved from about the middle, the inner margins at the base much thickened so as to form triangular processes; no true calli, sides entire, the apex broad and shortly apiculate. *Column* slightly curved, with very small rounded wings. Wall. Cat. 1943 (in part); Lindl. Gen. and Sp. Orch. 40; Wight Ic. t. 906; Thwaites Enum. Pl. Ceyl. 295; Benth. Fl. Hongkong 352; Ridl. in Journ. Linn. Soc. xxii, 293 (excl. *L. elegans* Lindl.); Hook. f. Fl. Br. Ind. v, 703; King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 29, plate 37 Rolfe in Journ. Linn. Soc. xxxvi, 7 *L. pendula* Lindl. in Bot. Reg. 1838, Misc. 180. ?*L. nesophila* Reichb. f. Ot. Hamb. i, 56. *L. spathulata* Lindl. in Bot. Reg. 1842, Misc. 189, p. 81. *Liparis longipes* var. *spathulata* Ridley l. c.; King & Pantl. l. c. 30, plate 38.

Tropical Himalaya, from Dehra Dun to Kumaon, up to 3,000 feet, flowering in September and October. This species extends eastwards to Sikkim, Bhutan and the Khasia Hills, and southwards to the Nilgiris and Ceylon; it is also found in China and in the Malay and Pacific Islands.

L. longipes is a widely distributed and polymorphic species. The Dehra Dun plant agrees best with Lindley's *L. spathulata*, which has shorter and thicker pseudo-bulbs, rather broader leaves and shorter racemes than in the type. Sir Joseph Hooker observes (in Fl. Br. Ind. l. c.) that it occurs everywhere along with the form having long pseudo-bulbs, and that intermediates abound.

9. LIPARIS DUTHIEI Hook. f. Ic. Plant. 1857B.

Epiphytal. *Pseudo-bulbs* tufted, ovoid, 8 to 12 mm. long. *Leaf* linear-oblanceolate tapering to the base, petioled or sessile, 2·5 to 7·5 cm. long by 5 to 10 mm. broad. *Inflorescence* as long as the leaf, peduncle winged, a little longer than the raceme,

ebracteate. *Raceme* rather laxly flowered; *floral bract* linear-lanceolate, equal to or exceeding the stalked ovary. *Flowers* minute, pale green. *Sepals* elliptic-oblong, blunt, reflexed. *Petals* linear, recurved, longer than the sepals. *Lip* quadrate, slightly narrowed to the base, decurved about the middle, the edges near the base with two thickened processes; true calli none, the sides of the lip entire, apex broad, subtruncate, slightly emarginate, minutely erose. *Column* slightly curved, rather long, obscurely winged, not thickened at the base. Hook. f. Fl. Br. Ind. v, 701; King & Pantl. in Ann. Roy. Bot. Gard. Calc., viii, 32, plate 42.

Gori Valley in Eastern Kumaon, 2-3,000 feet, *Duthie* Nos. 5991, 24111; flowering in August. It was subsequently found by Mr. Pantling in the Teesta Valley, Sikkim Himalaya, at an elevation of 1,000 feet.

4. **Dendrobium** Swartz.

Epiphytal. *Pseudo-bulbs* short and fleshy or elongate and stem-like, usually tufted. *Leaves* never plicate, usually sessile and with sheathing bases. *Flowers* solitary, or in fascicles or racemes, often large. *Sepals* subequal, the lateral pair obliquely adnate to the foot of the column and forming with it a sac or mentum. *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; the terminal lobe broad or narrow, flat, convex, concave or saccate; disk sometimes lamellate. *Column* short, with a long or short foot which usually has a nectar-secreting cavity at its extremity, the apex angled or 2-toothed; *anther* 2-celled. *Pollinia* 4, equal in length, sometimes in free pairs but usually all slightly coherent, ovoid or oblong, slightly compressed.—Species about 300, in Tropical Asia, Australasia and Polynesia.

§ 1. **Breviflores.**—*Stems* tufted, long, terete or clavate. *Leaves* membranous, persistent. *Flowers* small, in short racemes or heads, yellow, often dingy; *mentum* large, saccate; *lip* very short, deeply concave or urceolate, truncate or with short lobes.

1. *D. bicameratum.*

§ 2. **Stachyobium.**—*Pseudo-bulbs* short, tufted, with 2 or 3 leaves, or stems elongate and leafy. *Leaves* narrow, membranous, deciduous or persistent. *Flowers* in slender terminal or lateral racemes, small or medium-sized, pale green or yellowish, or white with red veins; *mentum* rather long, conical, incurved, or short and obtuse; *lip* often with a flat keel on the disk terminating in a truncate crenate callus on the mid-lobe.

Racemes many-flowered, drooping . . . . . 2. *D. denudans.*
Scape short, erect, 3—5-flowered . . . . . 3. *D. alpestre.*

§ 3. **Eudendrobium.**—*Stems* elongated, stout or slender, cylindric, clavate or nodose. *Leaves* membranous or coriaceous, persistent or deciduous. *Flowers* usually large, in lateral pairs, fascicles or racemes, rarely solitary, variously coloured, white, yellow or purple.

Lip not forming a pouch:—
Flowers pale yellow, or white with yellow, lilac or purple markings:—
Posterior portion of lip convolute:—
Lip about as broad as long, without side lobes:—
Lip strongly ciliate on the margins, apical portion pale yellow . . . . . 4. *D. primulinum.*
Lip minutely ciliate on the anterior margin, pale yellow with purple radiating lines . . . . . 5. *D. Pierardi.*
Lip longer than broad, with convolute side lobes:—
Mentum swollen at the apex, bracts small, sepals obtuse . . 6. *D. amœnum.*
Mentum conical, bracts large, sepals acute . . . . . 7. *D. transparens.*
Lip convolute throughout its length, pale yellow with reddish-purple veins . . . . . 8. *D. Gamblei.*
Lip not convolute:—
Lip without side lobes . . . . . 9. *D. crepidatum.*
Lip with short erect side lobes . . . . . 10. *D. candidum.*
Flowers large, yellow, often with purplish blotches on the lip:—
Petals and lip not fimbriate on the margins, stems erect:—
Lip convolute at the base, and with a large purple blotch on the disk . . . . . 11. *D. clavatum.*
Lip not convolute; petals and lip all similar and concolorous . 12. *D. normale.*
Petals and lip with fimbriate margins:—
Stems erect:—
Lip concolorous . . . . . 13. *D. fimbriatum.*
Lip with a large patch of reddish-brown on the upper surface . . . . . 13(*a*). *D. fimbriatum* var. *oculata.*
Stem pendulous, lip with 2 large suborbicular spots of brownish-purple . . . . . 14. *D. chrysanthum.*
Lip forming a distinct pouch, flowers dull yellow with orange or reddish veins . . . . . 15. *D. moschatum.*

1. Dendrobium bicameratum Lindl. in Bot. Reg. 1839, Misc. 85.

Stems clavate or fusiform, 7·5 to 45 cm. long. *Leaves* elliptic-oblong to elliptic-lanceolate, 3·6 to 7·5 cm. long and 2 to 2·5 cm. broad; apex acute, obliquely and minutely bifid. *Flowers* about 1 cm. across, yellow marked with red, densely clustered on a short rachis and forming a capitate lateral or subterminal raceme; *floral bract* sheathing the shortly stalked ovary. Dorsal *sepal* broadly ovate-oblong; lateral pair triangular, all concave and subacute. *Petals* broadly elliptic, obtuse, about as long as the sepals. *Lip* small, fleshy, very concave, broadly triangular (when flattened out) and 3-lobed; side lobes triangular, acute, erect; terminal very short, truncate; the disk fleshy and smooth. *Column* very short, with two large oblong nectar-secreting cells. *Mentum* urceolate. *Anther* fleshy. Saunder's Refug. Bot. t. 143; Hook. f. Fl. Br. Ind. v, 729; King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 42, t. 56. *D. breviflorum* Lindl. in Journ. Linn. Soc. iii, 14. *D. bulboflorum* Falc. Mss. ex Hook. f. in Fl. Br. Ind. l.c.; Ic. Plant. t. 2028.

On the southern slopes of the outer ranges; below Mussoorie between 3,000 and 4,000 feet, *Mackinnon*, No. 21744; above Dehra Dun in Garhwál, *Gamble;* Lansdowne in

Brit. Garhwál, *Capt. Roberts*; Thákil Hill in E. Kumaon, *Inayat Khán* (*Duthie's* No. 24092). Flowers in August. It extends eastwards to the Sikkim Himalaya and Upper Burma, and south to the hilly parts of the Ganjam district.

2. Dendrobium denudans Don Prod. Fl. Nepal. 34.

Stems 15 to 25·5 cm. long, terete, suberect, many-leaved, the lower leaves often early deciduous. *Leaves* narrowly oblong, acute or subacute, sometimes obliquely notched, not narrowed to the sheathing base, 5 to 10 cm. long. *Racemes* leaf-opposed, slender, decurved, longer than the leaves, many-flowered. *Flowers* 12 to 20 mm. long; *floral bract* minute. *Sepals* subequal, not wide-spreading, linear, acuminate, falcate. *Petals* like the sepals, but smaller. *Lip* much shorter than the sepals, decurved from the base, lower part subquadrate (when spread out), with two long narrow laciniate side lobes; terminal lobe strongly recurved, serrate and crisped; apex triangular; the disk with an obscurely 3-lined smooth surface. *Column* rather long, the margin of the clinandrium denticulate; foot of column long, curved, stout, concave, hispid near its extremity, without a nectary. *Anther* with its lower margin ciliolate. Wall. Cat. 2014 (in part); Lindl. Gen. and Sp. Orch. 84; Bot. Reg. 1838, Misc. 156, and 1844, 61; Journ. Linn. Soc. iii, 19; Hook. f. Fl. Br. Ind. v, 715; King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 45, plate 62.

British Garhwál, 5-6,000 feet, on rocks, *Duthie* No. 4416(a); Kumaon, 4-5,000 feet, *Strachey & Winterbottom* No. 5; *Duthie* Nos. 3403, 5992, 8019, 24094. Flowers towards the end of the rainy season. It extends eastwards to Sikkim.

The flowers are pale green or whitish, the lip is veined with red, and the foot of the column is tinged with red.

3. Dendrobium alpestre Royle Ill. Him. Bot. 370, t. 88, fig. 2.

Pseudo-bulbs elongate, polynodal, tapering from the base, 3-4 cm. long. *Leaves* 3-5 cm. long and 5-10 mm. in breadth, linear-lanceolate, acuminate, often notched just below the apex, many-nerved, thinly coriaceous. *Racemes* 3-7-flowered, leaf-opposed, slender, erect. *Flowers* about 16 mm. across; *floral bract* subulate, subpersistent, less than half the length of the stalked ovary. Dorsal *sepal* 9-10 mm., lanceolate, acuminate, 3-nerved, erect; the lateral pair a little longer and broader, falcately lanceolate, acuminate, 5-nerved, spreading. *Petals* about 8 mm. long, linear-lanceolate, acuminate, 3-nerved, erect. *Lip* decurved, concave, oblong-obovate beyond the narrow claw (when flattened out), yellowish-green with dark purple veins, side lobes erect, acuminate, deeply inciso-serrate along the edges; mid-lobe small, triangular, acute, much recurved, with undulate edges; disk with a thickened 3-lamellate mesial crest extending from the base of the lip to the insertion of the terminal lobe. *Column* long, its foot elongating to a right angle, anterior surface more or less blotched with purple, edges minutely papillose, the excavation at its apex partially concealed by a truncate inflated plate. *Mentum* short, obtuse. *Anther* with a denticulate lip. *Stigma* a viscid orbicular cavity below the anther. Lindl. in Bot. Reg. 1844, Misc. 61; Walp. Ann. vi, 300; Hook. f. Fl. Br. Ind. v, 715. *D. denudans* Wall. Cat. 2014 (in part). ? *D. pusillum* Don Prod. 35.

Not uncommon in Garhwál and Kumaon at elevations between 4,000 and 6,000 feet, usually on rocks, flowering during the latter part of the rainy season. It extends eastwards to Nepal.

PLATE 97. Dendrobium alpestre *Royle*.—Portion of plant,—*of natural size*. 1, a single flower; 2, ditto with sepals and petals removed; 3, lip, *flattened out;* 4, column; 5, summit of column with anther removed; 6, front view of anther; 7, side view of ditto; 8, pollinia;—*all enlarged*.

4. DENDROBIUM PRIMULINUM Lindl. in Gard. Chron. 1858, 223.

Stems up to 3 dm. long and about 1·5 cm. in diam., pendulous. *Leaves* about 1 dm. long, the upper ones smaller, broadly oblong, coriaceous. *Flowers* solitary from the nodes of the leafless stems, shortly pedicelled, 6·5 cm. across; *floral bract* minute, emarginate. *Sepals* and *petals* white or pink. *Sepals* narrowly lanceolate, acuminate, spreading or reflexed. *Petals* rather smaller, linear-lanceolate, acute, erect or spreading. *Lip* broadly oblong (when spread out), very shortly clawed, about 3 cm. in length and nearly as broad, convolute towards the base, strongly ciliate on the margins, the basal portion white, the apical portion pale primrose-yellow and puberulous. *Column* with two horn-like processes at the apex. *Mentum* rounded. *Anther* puberulous, its lip toothed. *Capsules* sessile or nearly so. Lindl. in Journ. Linn. Soc. iii, 12; Trans. Russ. Hort. Soc. 1861, 268, t. 52; Regel Gartenfl. 1861, 158, t. 326; Williams' Orch. Alb. vi, t. 286; Veitch Man. Dendrob. 70, with fig. and var. *gigantea* 71; Hook. f. Fl. Br. Ind. v, 735. *D. nobile* var. *pallidiflora* Hook. Bot. Mag. t. 5003.

Dehra Dun at Nálapáni; and on the southern face of Budráj near Mussoorie, up to 3,000 feet, *Mackinnon* (*Duthie's* No. 25405); Garhwál, *Falconer*; in the Rámganga Valley, British Garhwál, *Duthie* No. 25841. Flowers in April.

There has been considerable misconception in regard to the distribution of this species. Under *D. crepidatum* in the Fl. Br. Ind. v, 740, Sir Joseph Hooker remarks. "A specimen in Hort. Kew, marked 'Garhwál, Falconer,' is perhaps a cultivated one." This evidently refers to the two specimens of *D. crepidatum* glued down on the same sheet with Falconer's specimens of *D. primulinum*, and all of them named *D. cretaceum* on the Kew Distrib. ticket No. 1005 by Reichenbach f. subsequently. There is also on the same sheet an original ticket of Falconer's 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 in Garhwál, 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.

PLATE 98. Dendrobium primulinum *Lindl.*—Portion of plant,—*of natural size*. 1, a single flower; 2, ditto with sepals and petals removed; 3, lip, *flattened out;* 4, column; 5, summit of column; 6, front view of anther; 7, side view of ditto; 8, pollinia;—*all enlarged*.

5. DENDROBIUM PIERARDI Roxb. in Hook. Exot. Flora t. 9.

Stems slender, pendulous, 6-12 dm. long. *Leaves* sessile, 5-10 cm. long and 2·5 to 3·5 cm. broad, lanceolate to ovate-lanceolate, subacuminate, caducous. *Flowers* 3-4 cm. across,

solitary or two or three together from 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 lines at the base. *Sepals* subequal, oblong-lanceolate, subacute. *Petals* as long as the sepals but much broader, elliptic, blunt. *Lip* suborbicular (when spread out), without side lobes, the claw very short; edges shortly ciliate on the anterior half; posterior portion convolute, upper surface pubescent. *Column* and its foot about equal in length, the latter with a nectary at its extremity. *Anther* with a curved erose lip. *Capsule* 5 cm. long, clavate. Roxb. Fl. Ind. iii, 483; Lindl. Gen. and Sp. Orch. 79; in Bot. Reg. t. 1756; Wall. Cat. 2007; Bot. Mag. t. 2584; Wight Ic. t. 908; Lodd. Bot. Cab. t. 750; Veitch Man. Dendrob. 69; Hook. f. Fl. Br. Ind. v, 738; King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 51, plate 72.

Eastern parts of Dehra Dun, in forests by the banks of the Song river, *Gamble* and *Mackinnon*; flowering in May. Extends to Nepal, Sikkim and China; it is also found in Assam, in Bengal, and southwards to Tenasserim and S. India.

6. DENDROBIUM AMŒNUM Wall. in Lindl. Gen. and Spec. Orch. 78 (exl. syn. *D. aphyllum*).

Stems slender, pendulous, up to 7·5 dm. long, slightly thickened at the nodes. *Leaves* 6·5 to 10 cm. long, oblong-lanceolate with an obliquely acute apex. *Flowers* about 3·5 cm. across, 2 or 3 from very short bracteate peduncles springing from the nodes of leafless stems. *Sepals* oblong-lanceolate, obtuse or acute. *Petals* larger, ovate. *Lip* equalling the sepals, oblong-obovate (when spread out), shortly clawed; side lobes broad, rounded, convolute; terminal lobe orbicular with undulate edges, disk villous. *Column* broad at the apex; nectary large, its upper margin erose, and its lower with two calli, the centre occupied by a thickened line. *Anther* minutely papillose. Lindl. in Bot. Reg. 1844, 49; Journ. Linn. Soc. iii, 12; Bot. Mag. t. 6199; Reichb. f. in Gard. Chron. 1875, i, 305, figs. 57 and 58; 1881, ii, 625, fig. 126; Veitch Man. Dendrob. 17; Hook. f. Fl. Br. Ind. v, 738; King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 49, plate, 69. *D. mesochlorum* Lindl. in Bot. Reg. 1847, under t. 36; Paxt. Fl. Gard. i, 63, fig. 43. *D. Egertoniæ* Lindl. l. c.; Paxt. l. c., fig. 44.

Dehra Dun, *Gamble;* southern slopes of Mussoorie hills up to 5,000 feet, *Falconer, Mackinnon;* Garhwál, *Duthie* Nos. 25842 to 25848; Kumaon, *Col. Davidson.* Usually on trees May and June. It extends eastwards to Sikkim, Bhutan, Sylhet and Burma.

The flowers of this beautiful species are violet-scented. The sepals and petals are white tipped with violet, the lip is white tinged with yellow and has a purple spot near the apex, and the lower portion of the column and the mentum are violet-colured.

7. DENDROBIUM TRANSPARENS Wall. Cat. 2008-1.

Stems slender, erect, 3—6 dm. long, slightly thickened at the nodes. *Leaves* linear-lanceolate, 7·5 to 10 cm. long and up to 1·3 cm. broad, the apex oblique and acute. *Flowers* about 3·5 cm. across, in pairs from the nodes of the leafless stems; *floral bract*

broadly lanceolate, scarious, much shorter than the stalked ovary. *Sepals* subequal, lanceolate, acute. *Petals* about as long as the sepals, but ovate and not so acute. *Lip* as long as the sepals, broadly elliptic-obovate (when spread out), clawed; side lobes broad, erose, convolute, terminal suborbicular, undulate; the upper surface pubescent. *Column* with two horn-like processes at the apex, the foot narrowed and with a small nectar-secreting cavity at its apex. *Mentum* short, conical, obtuse. Lindl. Gen. and Spec. Orch. 79; Bot. Reg. 1844, Misc. 62; in Journ. Linn. Soc. iii, 12; Bot. Mag. t. 4663; Paxt. Fl. Gard. i, 134, t. 27; Veitch Man. Dendrob. 81; Hook. f. Fl. Br. Ind. v, 738; King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 50, plate 70. *D. Henshalli* Reichb. f. in Bonplandia iii, 226. *Dendrob.* Griff. Notul. 198, No. 1135, p. 198.

Kumaon, near Naini Tál, up to 3,000 feet; flowering in May. It extends eastwards to Nepal, Sikkim and the Khasia Hills.

The flowers are white or pinkish, the lip is blotched with purple down the centre and has purple lines towards the base.

8. Dendrobium Gamblei King & Pantl. in Journ. As. Soc. Beng. lxvi, part 2, 584.

Stems pendulous, slender, 3-6 dm. long, with short scarious sheaths at the nodes. *Leaves* sessile, 3-8 cm. long and 1 to 2·5 cm. broad, subfalcately ovate-lanceolate subacuminate, thick, caducous, veins obscure. *Peduncles* solitary or in pairs from the nodes of the leafless stems; *floral bracts* very small, lanceolate, acuminate. *Flowers* 1·5 cm. across, inodorous. *Sepals* and *petals* about equal, lanceolate, acuminate, with reflexed tips, pale greenish-yellow, 5-nerved. *Lip* 1·9 cm. long, convolute throughout its entire length, the edges fimbriate-serrate except towards the base and at the very apex, subquadrate when flattened out, blunt at the apex and narrowing into a long claw at the base; upper surface with a broad grooved thickened band from base to apex, densely villous on its apical half; veins reddish-purple, bifurcating towards the margin *Column* 10 mm. long, its foot elongated and with a small ovate-lacerate nectary at it base. *Mentum* elongate, slightly curved and spur-like. *Anther* minutely papillose outside, its lip denticulate.

Dehra Dun, *Gamble*, *Mackinnon* (*Duthie's* Nos. 22983 and 24156); flowering from June to August. It has been found also on the Nilgiris by Mr. Proudlock.

This species is nearly related to *D. macrostachyum* Lindl., but the peduncles of the latter are much branched, the lip is convolute at the base only and is not ciliate on the margins, the leaves are membranous, and the flowers are scented.

Plate 99. Dendrobium Gamblei *King & Pantl.*—A plant,—*of natural size.* 1, side view of single flower; 2, side view of lip; 3, lip flattened out; 4, column with ovary attached; 5, front view of column; 6, side view of ditto; 7, anther; 8, pollinia; —*all enlarged.*

9. Dendrobium crepidatum Lindl. in Paxt. Fl. Gard. i, 63, fig. 45.

Stems pendulous, 1·5 to 4·5 dm. long, tapering to the base, striated green and white, covered when dry with the long scarious sheaths of fallen leaves. *Leaves*

linear-lanceolate, acuminate, 5—10 cm. long. *Flowers* 2 to 2·5 cm. across, solitary or two or three together on very short bracteate peduncles from the slightly swollen nodes of the leafless stems, white or pinkish, with a large yellow blotch on the lip; pedicels 3·5 cm. long. *Sepals* subequal, broadly oblong, subobtuse. *Petals* not exceeding the sepals, broadly ovate. *Lip* broadly obovate, pubescent, the edges undulate; apex broad, often retuse; base narrowed to a short claw, with a short transverse ridge in front of it and a small pit behind. *Column* very short and broad; *mentum* short, obtuse. *Anther* very convex. *Ovary* long-peduncled, divergent, purple. *Capsule* clavate, 4 cm. long. Bot. Mag. tt. 4993, 5011; Veitch Man. Dendrob. 33; Hook. f. Fl. Br. Ind. v, 740; King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 48, plate 66. *D. Lawanum* Lindl. in Journ. Linn. Soc. iii, 10; Dalz. & Gibs. Bomb. Fl. 261. *Dendrochilum roseum* Dalz. in Hook. Kew Journ. iv (1852), 291.

Dehra Dun near Rajpur, *W. Gollan* (*Duthie's* No. 25404); Garhwál, *Falconer*. In flower during May. It extends eastwards to Sikkim, Assam, the Khasia Hills and Upper Burma; it is also found in the Bombay Presidency and in S. India.

The flowers of the Sikkim form are less attractive than those of the form found in Assam and on the Khasia Hills, and Sir George King has reason to believe that this species is usually self-fertile, and that it may represent a stage in the transition towards cleistogamy.

10. Dendrobium candidum Wall. in Lindl. Bot. Reg. 1838, 36; 1844, Misc. 32.

Stems erect, slender, 1·5 to 3 dm. long, cylindric. *Leaves* 5 to 7·5 cm., narrowly lanceolate; apex obtuse, obliquely bifid. *Peduncles* with short hyaline sheaths, 1–3 flowered, from the nodes of the leafless stems. *Flowers* white, 2·5 cm. long. *Sepals* broadly lanceolate, obtuse or subacute. *Petals* like the sepals, but more acute. *Lip* as long as the sepals, oblong-lanceolate; the apex suddenly acute; side lobes rounded, incurved, the disk between them with an elongated callus. *Column* short, with a very broad and deeply excavated foot. *Mentum* short, broad and rounded. *Anther* large, suborbicular, papillose. Paxt. Fl. Gard. i, 63, fig. 41; Walp. Ann. vi, 286; Hook. f. Fl. Br. Ind. v, 735, in Ann. Roy. Bot. Gard., Calc. v, part 1, 12, t. 19; King and Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 49, t. 68. *D. spathaceum* Lindl. in Journ. Linn. Soc. iii, 15; Hook. f. Fl. Br. Ind. v, 737.

Garhwál near Tehri at about 5,000 feet, *Mackinnon's collector* (*Duthie's* No. 24155); Kumaon at 3,000 feet, *Strachey & Winterbottom;* flowering in April and May. It extends eastwards to Nepal, Sikkim and the Khasia Hills.

With the exception of a yellow spot near the base of the lip the flowers are pure white. In other respects it closely resembles *D. amœnum*.

11. Dendrobium clavatum Wall. Cat. 2004.

Stems stout, slightly clavate, 4·5 to 7·5 dm. long, the leaf-bearing ones smooth, the leafless sulcate. *Leaves* 9 to 12 cm. long, narrowly oblong, coriaceous, the apex blunt or subacute, slightly notched. *Peduncle* 5 to 7·5 cm. long, bearing many

tubular membranous sheaths. *Raceme* twice or three times as long as the peduncle, horizontal or decurved. *Flowers* four to six on each peduncle, rather distant, 5 to 7·5 cm. across; *floral bract* membranous, oblong, subacute, shorter than the slender pedicelled ovary. *Sepals* oblong, obtuse or subacute. *Petals* broadly ovate, subacute. *Lip* narrowed to the convolute base; anterior portion expanded, concave, orbicular-reniform, its margins near the base slightly fimbriate; apex undulate; upper surface tomentose. *Column* and its foot short, the latter with a nectary near the base; *mentum* short. Lindl. in Paxt. Fl. Gard. ii, 104, fig. 189; Bot. Mag. t. 6993; Reichb. f. in Walp. Ann. vi, 293; Hook. f. Fl. Br. Ind. v, 746; King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 53, t. 60.

Kumaon, *Strachey & Winterbottom, Stewart;* Gori Valley, *Duthie* No. 24096; flowering in May and June. It extends eastwards to Nepal, Sikkim, the Khasia Hills, Upper Burma and China, but is not abundant anywhere.

The flowers are dark yellow, and near the centre of the lip there is a large reddish-brown blotch, the edges of the lip being of a paler colour than the rest of the flower.

12. DENDROBIUM NORMALE Falconer in Ann. Nat. Hist. iii, 196 (name only); Proc. Linn. Soc. i (1839), 14.

Stems 3 to 4 dm. long, erect, terete, sulcate; internodes 2·5 to 3·5 cm. long. *Leaves* linear-lanceolate, acuminate, 7·5 to 12·5 long, thin; sheaths tubular. *Flowers* 6·5 cm. in diam., subracemose on a lateral peduncle, golden yellow, sweet-scented; peduncle 2·5 to 3·5 cm. long, with tubular sheaths at the base; *bracts* embracing the slender ovary, about half its length. *Sepals* equal in length, their margins entire; dorsal acute, lateral obtuse or emarginate, all three mucronate just below the apex on the outside. *Petals* and *lip* similar and about as long as the sepals, but a little broader, their margins minutely serrulate except towards their bases. *Column* short, rotundate, divided at the apex into six divisions, of which the larger ones are subobovate subcarinate, tooth-like and opposite the petals. *Anther* firm, with a slender filament (occasionally there are three anthers unequally developed, the largest being anticous). *Pollinia* 4, connate in pairs. Griff. Notul. iii, 255; Ic. Pl. As. t. 284; Lindl. in Journ. Linn. Soc. iii, 10; Royle Ill. Him. Bot. 363; Hook. f. Fl. Br. Ind. v, 748.

Mussoorie range, in shady ravines on the southern slopes, 3,000 to 6,000 feet *Vicary, Falconer, Edgeworth, Mackinnon* (*Duthie's* Nos. 22707, 24157); British Garhwál near Paori, *T. Thomson*. Flowers in June.

This remarkable plant which, as Lindley pointed out, is no doubt a peloriate state or variety of some allied species, has given rise to much discussion as to the normal position of the supplementary anthers in the orchid family. Falconer, in his note published in the Proceedings of the Linnean Society, vol. i., p. 14, says:—"In my plant it is most distinctly evident both by a decurrent ridge on each filament and by transverse sections of the column at all heights down to its base, that the supplementary anthers have the same relative position as the usual fertile one, and in harmony with Lindley's formula." It was suggested by Lindley that *D. normale* might prove to be a monstrous condition of *D. fimbriatum*, but the inflorescence of the former is more like that of *D. clavatum*, whilst the leaves almost exactly resemble those of *D. chrysanthum*.

PLATE 100. Dendrobium normale *Fulc.*—Portions of leafy and flowering stems,—*of natural size.* Fig. 1, single flower; 2, column; 3, ditto, *with anther partially detached;* 4, anther; 5, pollinia;—*all enlarged.*

13. DENDROBIUM FIMBRIATUM Hook. Exot. Fl. t. 71.

Stems suberect, 7·5 to 15 dm. long, tapering upwards from the base, sulcate, slightly thickened at the nodes. *Leaves* 9 to 15 cm. long, oblong-lanceolate, acuminate, narrowed to the base. *Racemes* usually on the leafy stems, lateral, pendulous, 7-12-flowered, 15 to 20 cm. long, the peduncle with several sheathing bracts at the base. *Flowers* 5 to 7·5 cm. across, yellow; *floral bract* minute. *Sepals* broadly oblong, blunt, entire. *Petals* broader than the sepals, their apices slightly emarginate, erose. *Lip* orbicular, with an undulate deeply fringed margin, the base shortly clawed. *Column* with its foot short and broad and with a suborbicular nectary near the base of the former. *Anther* obliquely and bluntly conical; pollinia compressed. Wall. Cat. 2001; Lindl. Gen. and Sp. Orch. 83 (not 76); Paxt. Mag. ii, 172; Floral Cab. t. 109; Veitch Man. Dendrob. 42, with fig.; Walp. Ann. vi, 293; Hook. f. Fl. Br. Ind. v, 745; King & Pantl. in Ann. Roy. Bot. Gard. viii, 58. *Dendrobium* sp. Griff. Notul. iii, 113.

Near Lansdowne in British Garhwál, collected by *Captain Roberts;* flowering in May. This plant was originally discovered in 1820 by Wallich, or by one of his collectors, on one of the outer ranges of the Nepal Himalaya.

Var. OCULATA Hook. Bot. Mag. t. 4160.

Flowers bright yellow, with a large round reddish-brown patch on the lip. Ill. Hortic. i, t. 15; Warner Sel. Orch. ii, t. 19; Paxton Fl. Gard. iii, t. 84; Jard. Fleur. 314; Hook. f. Fl. Br. Ind. v, 745; King & Pantl., l. c. 59, t. 82. *D. Paxtoni* Paxt. Mag. vi, 169 (not of Lindl.); Fl. des Serres vii, t. 725.

Outer ranges of the Garhwál and Kumaon Himalaya up to 5,500 feet; Mussoorie range, *Vicary*, *Mackinnon* and others; Kumaon, *Strachey & Winterbottom* No. 6. Flowers in April and May. It extends eastwards to Nepal, Sikkim, Bhutan, Assam and Khasia Hills, Chittagong, Upper Burma, and also in Perak. In consideration of its much wider distribution it might very properly be regarded as the type instead of a variety of the so-called type.

14. DENDROBIUM CHRYSANTHUM Wall. Cat. 2012.

Stems pendulous, 6 to 9 dm. long, tapering towards the base and apex, dark green, clothed with scarious white-lined tubular sheaths. *Leaves* 7·6 to 16·5 cm. long, and from 2·5 to 3·5 cm. wide, lanceolate, acuminate, the base rounded and sheathing. *Flowers* 3·4 cm. in diam., rather fleshy, arranged in fascicles of 2 to 4 on very short bracteolate peduncles from leafy or leafless stems. *Sepals* subequal, broadly ovate, obtuse, concave, keeled, fleshy, the lateral pair slightly falcate. *Petals* a little longer than the sepals, concave, ovate-orbicular, entire or minutely erose. *Lip* transversely orbicular-oblong or reniform (when flattened out), concave, tomentose towards the fimbriate margin, abruptly clawed at the base. *Column* broad, concave, the foot

with a transverse ridge towards the lower end, and a large nectary below it; *stigma* emarginate at the lower edge. *Mentum* short and blunt. *Anther* 3-ridged on the anterior surface; *pollinia* oblong. *Capsule* subovoid or pyriform, 3·5 to 5 cm. long. Lindl. Gen. and Sp. Orch. 80; in Journ. Linn. Soc. iii, 8; in Bot. Reg. t. 1299; Gartenfl. t. 446; Veitch Man. Dendrob. 28; Hook. f. Fl. Br. Ind. v, 747; King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 55, t. 77. *D. Paxtoni* Lindl. in Bot. Reg. 1839 (Misc. 56), Fl. des Serres vii, t. 725.

Garhwál, *Duthie* No. 25807; Kumaon, in the Rámganga Valley, 4-5,000 feet, *Duthie* No. 3404; Gori Valley, *Duthie* No. 24095. Flowers during August and September. It extends to Nepal, Sikkim, Bhutan, the Khasia Hills, Burma and China.

The flowers are yellow, and the lip has two suborbicular spots of brownish-purple.

15. Dendrobium moschatum Wall. in Don Prod. (1825), 34.

Stems stout, erect, tufted, 9 to 18 dm. long, terete, striate. *Leaves* 7·5 to 15 cm. long and 3 to 5 cm. broad, oblong ovate-oblong or lanceolate, acute or minutely and obliquely notched, slightly narrowed to the base. *Racemes* one or two from near the apex of a leafless or leafy stem, 2·3 to 3 dm. long, deflexed, laxly 8- to 16-flowered; base of peduncle stout and covered with many sheathing imbricate bracts. *Flowers* 5 to 7·5 cm. across, usually dull yellow, tinged with pink, and with orange or reddish veins; *floral bract* lanceolate. *Sepals* subequal, up to 5 cm. long, oblong-elliptic, obtuse, sheathing. *Petals* larger than the sepals, broadly ovate, obtuse. *Lip* shorter than the petals, forming a subglobular or pyriform open-mouthed pouch with incurved margins, outer surface and edges pubescent, often with two large brownish-purple spots inside the cup. *Column* short and broad, the foot widening downwards, nectary transversely oblong. *Anther* with an erose lip. *Capsule* 5 cm. long, fusiform. Wall. Pl. As. Rar. ii, 83, t. 195; Lindl. Gen. and Sp. Orch. 82, in Bot. Reg. 1844, Misc. 37; in Journ. Linn. Soc. iii, 8; Bot. Mag. t. 3837; Paxt. Mag. ii, t. 241 (excl. syn. *clavatum*); Veitch Man. Dendrob. 61; Warner Orch. Alb. t. 165 (var. *cuprea*) Walp. Ann. vi, 296; King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 60, t. 84. *D. Calceolaria* Carey in Hook. Exot. Fl. t. 184; Lindl. Gen. and Sp. Orch. 83; Hook. f. Fl. Br. Ind. v, 744. *D. cupreum* Herb. in Bot. Reg. t. 1779. *Epidendrum moschatum* Buch. & Banks in Syme's Embassy to Ava, ed. 1 (1800); 478 with fig.; ed. 2, vol. iii, 315 with fig.

Kumaon, *Strachey & Winterbottom* No. 9. Flowers during the early part of the rainy season. It extends eastwards to Sikkim, Bhutan, Assam, the Khasia Hills and Chittagong, also in Tenasserim.

5. Bulbophyllum Thouars.

Epiphytal; *pseudo-bulbs* from a creeping rhizome, rarely none. *Leaves* solitary, thick, persistent (deciduous in *B. polyrhizum*), or in pairs and thin and deciduous. *Scape* from the rhizome near the base of the pseudo-bulb, rarely distant from it. *Flowers*

solitary, capitate, umbellate, spicate or racemose. *Sepals* subequal or the lateral pair longer than the dorsal (rarely twice as long); the lateral pair adnate to the foot of the column. *Petals* various, usually much smaller than the dorsal sepal. *Lip* jointed on the foot of the column, mobile, usually small and strongly recurved. *Column* very short, often 2-aristate at the apex. *Anther* 2-celled; *pollinia* 4, the two inner reduced in size.—Species about 250, tropical and subtropical, chiefly Asiatic, a few in Africa, Australia and America.

Flowers solitary, on a long pedicel, scape very short . *1. B. affine.*
Flowers racemose or spicate:—
Rhizome short, pseudo-bulbs usually crowded, leafless when in flower . . . . . *2. B. polyrhizum.*
Rhizome slender, with distant pseudo-bulbs, flowers and leaves coëtaneous . . . . . *3. B. reptans.*

1. BULBOPHYLLUM AFFINE Lindl. in Wall. Cat. 1982.

Rhizome long, stout, densely rooting. *Pseudo-bulbs* about 7·5 cm. apart, 3 to 4 cm. long, cylindric, slightly thickened at the base. *Leaf* narrowly oblong, obtuse, tapering to the base, 7·5 to 17·75 cm. long, shortly petioled. *Scape* very short, bracteate, from the sides of the base of a pseudo-bulb, or from the rhizome between the pseudo-bulbs, bearing a single flower. *Flowers* 2 to 2·5 cm. long, pedicelled, pale green streaked with red, smooth. *Sepals* subequal, lanceolate, subacute, 5-nerved, not reflexed, the lateral pair falcate. *Petals* a little shorter than the sepals, 3-nerved. *Lip* shorter than the petals, lanceolate, thickened and concave at the base, the margins of the upper surface dark purple. *Column* greenish-yellow, rather stout, its foot short. *Anther* conical, scabrid; *pollinia* curved. Lindl. Gen. and Sp. Orch. 48; Reichb. f. in Walp. Ann. vi, 246; Hook. f. Fl. Br. Ind. v, 756; King & Pantl. in Ann. Roy Bot. Gard. Calc. viii, 67, t. 91. *Sarcopodium affine* Lindl. in Paxt. Fl. Gard. i, 155; Fol. Orch., *Sarcopodium* 5.

Kumaon, in the Gori Valley between 4,000 and 5,000 feet; *Duthie* No. 24101; flowering in June and July. It extends eastwards to Nepal, Sikkim and the Khasia and Naga Hills.

2. BULBOPHYLLUM POLYRHIZUM Lindl. Gen. and Sp. Orch. 53.

Rhizome thread-like, branching; *pseudo-bulbs* crowded or distant, globular or ovoid, with a broad base, smooth. *Leaf* 6·5 cm. long, narrowly oblong, subacute, slightly narrowed to the sessile base, deciduous before the flowers open. *Scape* filiform, about 1 dm. long, its suberect peduncle longer than the raceme, bearing one or two minute bracts, raceme inclined. *Flowers* about 6, distant, secund, pale yellow, 8 mm. long; *floral bract* minute, oblong, about equalling the short stalk of the ovary. *Sepals* spreading, subacute; the dorsal ovate, concave; the lateral pair longer, oblong-lanceolate, subacute, 3-nerved. *Petals* much shorter than the sepals, broadly ovate, acute, 1-nerved. *Lip* stipitate, deflexed from the base, oblong, obtuse, scaberulous, the basal

half grooved. *Column* with very short sharp teeth; its foot short, slightly curved. *Anther* papillose, its lip acute. Hook. f. Fl. Br. Ind. v, 767; in Ann. Roy Bot. Gard. v, pt. 1, 15, t. 23; King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 70, t. 95.

Dehra Dun, *Gamble*, *Mackinnon* (*Duthie's* No. 24147); Garhwál, up to 4,000 feet, *Mackinnon;* flowering in March. It was found by Wallich in Nepal, and occurs also in Sikkim in the valley of the Teesta at an elevation of 1,500 feet.

3. BULBOPHYLLUM REPTANS Lindl. in Wall. Cat. 1988.

Rhizome thin, wiry, naked, branching; *pseudo-bulbs* distant, obpyriform, smooth, up to 2 cm. in length. *Leaf* 9 to 15 cm. long, linear-oblong, subacute, obliquely notched at the apex, slightly narrowed at the base to the very short petiole. *Scapes* shorter or longer than the leaves, often in pairs, slender and more or less decurved; *peduncle* sheathed at the base, bracteate, longer or shorter than the laxly-flowered raceme; *floral bract* of the lower flowers of the spike longer than those of the upper, oblong-lanceolate, usually longer than the shortly-stalked ovary. *Flowers* 7—9 mm. long, yellowish with purple spots. *Sepals* subequal, lanceolate, 3-nerved, sperading, the lateral pair with dilated bases. *Petals* much shorter than the sepals, oblong, blunt, 1-nerved, spreading. *Lip* about as long as the petals, stipitate, deflexed from the middle, oblong, expanded and grooved at the base, apex narrowed and subacute, margins more or less winged. *Column* with filiform apical processes and short lateral wings; the foot short and curved, tumid near the stigma. *Pollinia* subglobose, the two inner small. Lindl. Gen. and Sp. Orch. 51; Hook. f. Fl. Br. Ind. v, 768; King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 77, t. 106. *B. Clarkei* Reichb. f. in Journ. Linn. Soc. xxv, 72. *Tribrachia reptans* Lindl. Coll. Bot. t. 41A.

Garhwál, east of Tehri, at about 5,000 feet, *Mackinnon;* flowering at the beginning of the cold season. The species extends eastwards to Nepal, Sikkim and the Khasia and Naga Hills.

6. Cirrhopetalum Lindl.

Epiphytal. *Rhizome* creeping, but sometimes cæspitose; *pseudo-bulbs* 1- rarely 2-leaved. *Leaves* coriaceous and persistent, rarely membranous and deciduous. *Scape* rising from the base of a pseudo-bulb. *Flowers* usually in whorled umbels, or capitate, rarely racemose, often dorsally compressed. Dorsal *sepal* concave, short, rarely half as long as the lateral pair, usually much shorter; lateral *sepals* usually much elongate and acuminate, oblique, often cohering by their edges, the bases adnate to the sides of the column or of its foot. *Petals* shorter than the dorsal sepal. *Lip* small, tumid, usually entire, always shorter than the dorsal sepal, jointed to the end of the foot of the column and more or less mobile. *Column* short; its apex with two (rarely four) tooth-like appendages; the foot more or less produced. *Anther* 2-celled; *pollinia* 4, cohering in a single mass and sometimes attached by their lower ends to a mass of viscid tissue: the inner two usually small and lamelliform.—Species about 40, chiefly Indo-Malayan.

This genus is best distinguished from *Bulbophyllum* by the shortness of the dorsal sepal and the great length of the lateral sepals; also by the flowers being usually in umbels, rarely in racemes or heads.

Pollinia attached to a viscus; lateral sepals quite free, umbels erect	1. *C. maculosum.*
Pollinia without a viscus, lateral sepals cohering:—	
Lateral sepals cohering at their bases, umbels erect .	2. *C. Hookeri.*
Lateral sepals cohering except at their bases, racemes drooping	3. *C. refractum.*

1. CIRRHOPETALUM MACULOSUM Lindl. in Bot. Reg. 1841, Misc. 81; 1843 under t. 49.

Rhizomes with fibrous sheaths and many roots; *pseudo-bulbs* contiguous or as much as 1·3 cm. apart, ovoid, wrinkled at flowering time, 2 to 2·5 cm. long. *Leaf* sessile, 11·5 to 15 cm. long, narrowly oblong, obtuse and notched at the apex, narrowed at the base, thick. *Scape* about twice as long as the pseudo-bulb, with a sheath at the base, the umbel 2-4-flowered; *floral bract* lanceolate, shorter than the stalked ovary. *Flowers* about 5 mm. long. *Sepals* and *petals* cream-coloured and spotted with red. Dorsal *sepal* free at its base from the lateral pair, broadly ovate, acute, sub-depressed; lateral sepals about twice as long as the dorsal, free, ovate-lanceolate from a broad base, sub-acute, falcate, their upper margins curved inwards. *Petals* broadly ovate, very obtuse. *Lip* oblong with a broad base, tapering to the sub-acute apex, green, the upper surface grooved. *Column* broadly winged, short; the apical teeth short, curved, blunt; its foot narrowed, rectangularly curved below the apex. *Pollinia* all cohering to a viscus, the outer two much the longer. Hook. f. Fl. Br. Ind. v, 776; King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 95, t. 132. *C. bootanense* Griff. Notul. iii, 297; Ic. Pl. t. 299. *Bulbophyllopsis maculosa* Reichb. f. in Walp. Ann. vi, 243. *B. morphologorum* Reichb. f. in Bot. Zeit. 1852, 933.

Below Mussoorie, *Duthie;* Garhwál, *Falconer, Mackinnon* (*Duthie's* No. 24151); Knmaon, 3-4,000 feet, *Strachey & Winterbottom.* Flowers in May. It extends eastwards to Nepal, Sikkim and the Khasia Hills.

2. CIRRHOPETALUM HOOKERI Duthie in Journ. As. Soc. Beng. lxxi, part 2, 38.

Cæspitose. *Pseudo-bulbs* crowded, 1·5 to 1·7 cm. long, ovoid, obtuse, grooved, greyish-green, one-leaved. *Leaf* 3 to 4 cm. long and 1 to 1·2 cm. broad, elliptic-oblong or lanceolate, often subfalcate, very shortly petioled, notched at the obliquely obtuse or acute apex, coriaceous, dark green above, paler beneath, narrowly hyaline along the margins. *Peduncle* slender, equalling or exceeding the leaves, bracteate. *Umbel* 3-10-flowered; *floral bracts* 5 mm. long, whorled, lanceolate, acuminate, membranous, shorter than the pedicelled ovary, margins incurved. *Dorsal sepal* 5 mm. long, quite free at its base from the lateral pair, ovate, emarginate, concave and embracing the column, pale yellow, and with three broad reddish-purple veins; *lateral sepals* 2·1 cm. long, cohering at their base and adnate to the foot of the column, auricled at the base linear-lanceolate, acuminate and with cucullate tips, yellow with three to four reddish veins, which become indistinct upwards. *Petals* shorter than the dorsal sepal, broadly

and obliquely ovate, rounded at the apex, yellow tinged with reddish-purple at the base. *Lip* deflexed from about the middle, oblong, with the margins incurved and forming a deep furrow on the upper surface, thick and fleshy, yellow with reddish-purple spots on the raised margins of the basal portion. *Column* with a long incurved foot; apical processes two, triangular, setaceous. Hook. f. in Bot. Mag. t. 7869.

Garhwál near Tehri, epiphytic on *Rhododendron arboreum* at elevations between 5 and 6,000 feet, *Mackinnon's collector* (*Duthie's* No. 25402).

This species is most nearly related to *C. cæspitosum* Wall., a native of the Sikkim Himalaya and the Khasia Hills, from which it differs by its larger size, more rounded pseudo-bulbs and much longer scapes. The lateral sepals adhere at the base only, and the petals are obtuse and quite entire; the shape of the lip is also different. The Botanical Magazine plate, alluded to above, was prepared from living specimens sent to Kew early in 1902.

PLATE 101. Cirrhopetalum Hookeri *Duthie*.—Portion of plant,—*of natural size*. Fig. 1, single flower, *side view;* 2, the same, *seen from the front;* 3, dorsal sepal; 4 and 5, lip; 6, column and ovary *with lip attached;* 7, column *with lip removed;* 8, anther; 9, pollinia;—*all enlarged*.

3. CIRRHOPETALUM REFRACTUM Zollinger in Flora (1847), 456.

Cæspitose; *pseudo-bulbs* crowded, conical and with broad bases, short, wrinkled at flowering time. *Leaves* in pairs from the apex of a pseudo-bulb, deciduous at flowering time, 3·5 to 12·5 cm. long, narrowly oblong, acute, contracted at the base, sessile. *Peduncle* 10 to 15 cm. long, erect, slender, sheathed at the base and with two ovate-acuminate bracts; *raceme* drooping, 3·5 to 9 cm. long, 4—12-flowered; *floral bract* ovate-acuminate, much longer than the short subsessile ovary. *Flowers* 4 to 6·5 cm. long, decurved. Dorsal *sepal* free at the base from the lateral pair, lanceolate, apex awned; margins ciliate, depressed; lateral pair about five or six times as long as the dorsal, cohering except at the base. *Petals* rather fleshy, triangular, more densely ciliate than the dorsal and about half as long. *Lip* shorter than the dorsal sepal, oblong, obtuse, very fleshy; lower surface convex, the upper smooth, deflexed from below the middle, the basal half with upturned edges, the anterior half with tufts of purple glandular hairs. *Column* short, with slender decurved apical teeth, the foot short and abruptly contracted about the middle. *Anther* papillose; *pollinia* obovoid, subequal. Walp. Ann. i, 776; Hook. f. Fl. Br. Ind. v, 779; in Ann. Roy. Bot. Gard. Calc. v, 19, t. 28; King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 87, t. 119. *C. Wallichii* Lindl. in Wall. Cat. 1980; Bot. Reg. 1839, Misc. 72; and 1843 sub. t. 49 (not of Wall. Pl. As. Rar.). *C. tripudians* Par. & Reichb. f. in Gard. Chron. 1876, 816. *Bulbophyllum refractum* Reichb. f. in Walp. Ann. vi, 259. *B. tripudians* Par. & Reichb. f. in Trans. Linn. Soc. xxx, 154.

Kumaon, in the Sarju valley at 3,700 feet, *Strachey & Winterbottom* No. 11; flowering after the rainy season is over. It extends eastwards to Sikkim, and is found also in Burma and Java.

The lateral sepals, which form the most conspicuous part of the flower, are pale green when young and become brownish with age. The dorsal sepal and the petals and lip are pale yellow, spotted with purple.

TRIBE II.—EPIDENDREÆ.

Pollinia 4 or 8, waxy, attached by their bases or by their backs to a single or double granular or translucent appendage, but without any gland derived from the stigma.

Terrestrial, without pseudo-bulbs:—
- Scapes from a stout rhizome, flowering before the leaves appear . . . . . 7. *Pachystoma.*
- Stems leafy; flowers large, appearing with the leaves . . 8. *Phaius.*

Epiphytal, pseudo-bulbous or with jointed stems:—
- Column with a long foot, pollinia 8 . . . . . 9. *Eria.*

Column without a foot, pollinia 4:—
- Pseudo-bulbous, flowering bracts deciduous . . . . . 10. *Cœlogyne.*
- Stems composed of elongate pseudo-bulb-like joints . 11. *Pholidota.*

7. **Pachystoma** Blume.

Terrestrial, with thick rhizomes. *Leaves* solitary or in pairs, appearing after the flowers, long, narrow, many-nerved. *Scapes* pale, with many sheaths. *Flowers* in crowded racemes, rather small, white or pale purple, puberulous. *Lip* sessile on the base of the column, erect, with oblong acute side lobes and a small terminal lobe. *Column* short, dilated at the apex. *Anther* dorsal. *Pollinia* 8, pyriform, adhering to a single membrane.—Species 6 to 8, Asiatic or African.

PACHYSTOMA SENILE Reichb. f. in Bonplandia iii, 251.

Terrestrial, leafless at flowering time. *Rhizome* rather stout; producing leaves at intervals of 2 to 5 cm. *Leaf* succeeding the flowers, solitary, longer than the scape, linear, membranous, 4- or 5-nerved. *Scapes* about 3 dm. high, clothed with many pale membranous clasping striate sheaths, each 2·5 to 5 cm. long; *raceme* many-flowered. *Flowers* about 13 mm. across, greenish-white tinged with pink or purple, glandular-puberulous; *floral bract* longer than the curved stalked pubescent ovary, erect, lanceolate, acuminate. *Sepals* unequal; the dorsal oblong, rounded at the apex; the lateral pair spreading, oblong-lanceolate, subacute. *Petals* narrowly spathulate, recurved, puberulous like the sepals. *Lip* sessile on the base of the column, 3-lobed, erect, broadly oblong, gibbous at the base, pubescent, side lobes with acute falcate apices, the terminal lobe suborbicular recurved and abruptly acuminate at the apex, disk of whole lip with 5 stoutly-crested ridges extending from base to apex. *Column* dilated at the apex, puberulous. *Anther* on the back of the column, indistinctly 8-celled. *Pollinia* 8, subclavate, cohering to a single cylindric appendage. Reichb. f. in Walp. Ann. vi, 463; Hook. f. Fl. Br. Ind. v, 812; King & Pantl. in Ann. Roy. Bot. Gard. Calc.

viii, 101, t. 140. *P. Smithianum*, *P. montanum* and *P. Lindleyanum* Reichb. f. l.c.; and in Walp. Ann. vi, 462, 463. *P. Edgeworthii* Reichb. f. in Walp. Ann. vi, 463. *Apaturia senilis*, *A. Smithiana* and *A. montana* Lindl. in Wall. Cat. 3739, 3737, 3738; Gen. and Sp. Orch. 130, 131. *A. Lindleyana* Wight Ic. 1662.

Dehra Dun, *T. Thomson*, *Mackinnon*; Garhwál, *Falconer*; flowering in April. It is found also in many places within the northern border of the Gangetic Plain from the Jumna to Moradabad and N. Oudh, and extends southwards to the hilly parts of the Peninsula and Ceylon. Eastwards it extends to Sikkim, the Khasia Hills, Manipur, the Nicobar Islands, the Malay Archipelago and S. China.

8. **Phajus** Lour.

Terrestrial or epiphytal, with or without pseudo-bulbs, usually of large size. *Leaves* membranous, usually plicate. *Flowers* large, racemose on a scape rising from the base of the stem or pseudo-bulb, or from the axil of a leaf or at the apex of the stem. *Sepals* and *petals* subequal, suberect, rarely spreading. *Lip* adnate to the base of the long footless column, gibbous or spurred. *Anthers* incompletely 4-celled. *Pollinia* 8, attached by fours to a granular membrane.—Species about 30, in the tropics of Asia and of the Pacific.

PHAJUS ALBUS Lindl. in Wall. Cat. 3749.

Pseudo-bulb none. *Stems* stout, erect, tufted, 3 to 9 dm. long, bearing many tubular sheaths at the base and numerous leaves. *Leaves* distichous, sessile, 1·5 to 3 dm. long, narrowly elliptic-lanceolate or oblong-lanceolate, acuminate, membranous, glaucous beneath. *Raceme* terminal, drooping, 4-6-flowered, 10 to 15 cm. long, on a short peduncle with a single elongate sheath. *Flowers* 5 to 6·5 cm. long, the bract equalling or exceeding the long-stalked ovary, oblong, cymbiform, acute, nearly white. *Sepals* free, subequal, narrowly oblong, acute. *Lip* broadly oblong-panduriform when spread out; lower half convolute into a tube; the anterior cucullate, forming a rounded shell-like mouth slightly acuminate, the edges undulate and unequally dentate, the upper surface with seven to nine dentate crested ridges; spur short, horizontal, slightly bifid. *Column* somewhat winged near the apex, with a very short foot. *Pollinia* 8, unequal, elongate. *Capsule* 3 cm. long, narrowly elliptic. Wall. Pl. As. Rar. ii, t. 198; Lindl. Gen. and Sp. Orch. 128; Bot. Reg. 1838, t. 33; Paxt. Mag. v, t. 125; Bot. Mag. t. 3991; Grah. Cat. Bomb. Pl. 205; Blume Mus. Bot. Lugd. Bat. ii, 181; Hook. f. Fl. Br. Ind. v, 818; King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 110, t. 153. *P. Marshalliana* Reichb. f. in Linnæa xli, 65; Regel Gartenfl. t. 1098. *Thunia alba* Reichb. f. in Bot. Zeit. 1852, 764. *T. pulchra* Reichb. f. in Gard. Chron. 1881, ii, 166. *Limodorum bracteatum* Roxb. Fl. Ind. iii, 466.

Dehra Dun, often epiphytal on *sál* trees, *Gamble*, *Mackinnon*; Garhwál, *Falconer*, *T. Thomson*; Mussoorie range up to 4,600 feet, *Vicary*, *Edgeworth*; Kumaon at 3,200 feet, *Strachey & Winterbottom* No. 18. Flowers in June. It extends eastwards to Sikkim, the Khasia Hills and Burma, and is found also on the Western Ghats. A very handsome species, with pure white sepals and petals, and usually a yellow or orange-coloured lip.

9. **Eria** Lindl.

Epiphytes, usually pseudo-bulbous, the *pseudo-bulbs* often elongated and stem-like. *Flowers* never large, rarely bright-coloured, often pubescent or tomentose, in racemes spikes or heads, or on 1-2-flowered pedicels. *Sepals* free, adnate to the long foot of the column, and with it forming a spur-like or saccate mentum. *Lip* sessile on the foot of the column and incumbent. *Column* short and straight, or long and somewhat curved. *Anther* imperfectly 4- or 8-celled. *Pollinia* 8, pyriform or broadly obovoid, attached in fours by their bases to a granular membrane, or the whole occasionally attached to a single viscus.—Species about 160, all tropical Asiatic.

Flowers glabrous or pubescent, not woolly :—
- Flowers subglobose, in dense spikes . . . . . *1. E. convallarioides.*
- Flowers few, in lax spikes . . . . . *2. E. alba.*

Flowers woolly externaliy . . . . . *3. E. flava.*

1. Eria convallarioides Lindl. in Wall. Cat. 1975.

Pseudo-bulbs tufted, flattened, 7·5 to 17 cm. long, covered when young with large loose sheaths. *Leaves* four to six, 10 to 17·5 cm. long, elliptic-lanceolate or oblanceolate, acute, subcoriaceous, many-nerved, not plicate. *Spikes* produced on the young growths and proceeding from the axils of the bracts and leaves, cylindric, decurved, the peduncles short and naked. *Flowers* many and densely crowded, subglobose, 7 mm. in diam., inodorous; *floral bract* equalling the sessile pubescent ovary, ovate-lanceolate, concave, those at the base of the spike largest. *Sepals* broadly ovate, obtuse, the lateral pair very concave. *Petals* oblanceolate-oblong, spreading, nearly as long as the sepals, but much narrower. *Lip* obscurely 3-lobed, cuneate, concave, apex subacute, the disk without lamellæ. *Column* rather slender, with a long much-curved foot. *Pollinia* clavate, attached to a large translucent viscus. *Capsule* oblong, obtuse, not winged. Lindl. Gen. and Sp. Orch. 70; in Bot. Reg. 1841, t. 62, Misc. 58; in Journ. Linn. Soc. iii, 53; Reichb. f. in Walp. Ann. vi, 276; Hook. f. Fl. Br. Ind. v, 791; King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 118, t. 161. *Octomeria spicata* Don. Prod. 31. *O. convallarioides* Wall. MSS. *Pinalia alba* Herb. Ham.

Dehra Dun, *Mackinnon;* Mussoorie range up to 4,000 feet; Garhwál, *Duthie* No. 25813; Lansdowne in Brit. Garhwál, *Capt. Roberts;* Kumaon at 4,000 feet, *Strachey & Winterbottom* No. 13; Gori Valley 2-3,000 feet, *Duthie* No. 5990. Flowers in August and September. It extends eastwards to Nepal, Sikkim, the Khasia and Naga Hills; also in Tenasserim.

The flowers are white or straw-coloured, the lip being tinged with yellow and the column with red. Sir George King remarks that specimens growing at low elevations have often more slender pseudo-bulbs, narrower leaves and laxer flower-spikes than those from cooler places.

2. Eria alba Lindl. Gen. and Sp. Orch. 67.

Pseudo-bulbs about 3 cm. long, crowded, ovoid, tapering at each end, not elongating; marked (when fresh) with many distinct vertical lines and a few concentric scars. *Leaves* 3-5, overtopping the flowering spikes, 1·5 to 2 dm. long and 2 to 2·5 cm. broad, oblanceolate, acute, strongly nerved, rather rigid. *Scape* 4-6-flowered, pubescent.

Flowers sweet-scented; *floral bract* lanceolate, acuminate, shorter than the pubescent ovary. *Sepals* 10-12 mm. long, ovate-lanceolate, 3-5-nerved, glabrescent. *Petals* a little shorter than the dorsal sepal, narrowly lanceolate, acute, 3-nerved. *Lip* oblong, with a broad sharply curved claw; side lobes pointing forwards, rounded, tinged with reddish-purple; midlobe orbicular, apiculate, yellow; disk with usually two thick obtuse ridges between the side lobes and a central one extending along the rough midlobe. *Column* short, about 2 mm. in length. *Mentum* rounded, somewhat curved and spur-like. *Pollinia* clavate, attached to a single small viscus. *Capsule* about 2 cm. long, linear-oblong and tapering to the base. Lindl. in Journ. Linn. Soc. iii, 53, *var.* B; Royle Ill. Him. Bot. 364; Hook. f. Ic. Pl. t. 1845; Fl. Br. Ind. v, 795. *Octomeria alba* Wall. MSS.

Plentiful along the outer ranges of Garhwál and Kumaon at elevations between 3,000 and 7,000 feet; *Edgeworth*, *Royle*, *Strachey & Winterbottom*, &c.; found abundantly on oak trees in the neighbourhood of Mussoorie; also on the Punjab Himalaya in Chamba, *Duthie* No. 23345. Flowers during June and July.

This species is closely allied to *E. excavata* Lindl., with which it has often been confounded. The pseudo-bulbs of the former are stouter and more distinctly marked with vertical lines; the lip is contracted at the base, so that the side lobes are not basal, and the mentum is more prolonged. The sepals and petals are white with a tinge of red externally towards their bases; the side lobes of the lip are tipped with a broad band of reddish-purple, and the upper surface of the terminal lobe is yellow spotted with red.

PLATE 102. Eria alba *Lindl.*—A plant,—*of natural size.* Fig. 1, side view of flower; 2, ditto with sepals and petals removed; 3, lip *spread out;* 4, front view of column; 5, pollinia;—*all enlarged.*

3. ERIA FLAVA Lindl. in Wall. Cat. 1973 (in part).

Rhizome stout, clothed with imbricating tubular sheaths. *Pseudo-bulbs* vertically furrowed, sheathed at the base, much compressed, 7·8 to 10 cm. long and 3 cm. in diam. *Leaves* three to five, more or less narrowly oblong, acuminate, tapering to the base, 1·5 to 2·3 dm. long and 2 to 3 cm. broad. *Raceme* from the base of the pseudo-bulb, about as long as the leaves, covered with dense pale soft tomentum and with several sheaths at the base. *Flowers* distant, yellow, 1·5 cm. long; *floral bract* lanceolate, much shorter than the tomentose, stalked ovary, shrivelled when the flowers open. *Sepals* tomentose outside, the dorsal one small and lanceolate; the lateral pair much larger, triangular, spreading. *Petals* smaller than the dorsal sepal, lying parallel over the column, narrowly oblong, tapering to the base and the apex. *Lip* oblong, 3-lobed; side lobes narrow, with truncate apices, puberulous and with two long tapering ridges at their junction with the disk; terminal lobe oblong, acute, deflexed, slightly 2-ridged, glabrous. *Column* erect, its foot at right angles to and longer than its body. *Lip* of *anther* with a small quadrate appendage. *Pollinia* small, compressed, attached to two granular membranes. *Capsule* 3·5 to 4 cm. long, narrowly cylindric. Lindl. Gen. and Sp. Orch. 65; in Journ. Linn. Soc. iii, 49 (excl. var. B.); Hook. f. Fl. Br. Ind. v. 801; King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 126, t. 175. E. *lanceps* Reichb. f. in Hamb. Gartenzeit. xix, 10. *Dendrobium pubescens* Hook. Exot. Fl. t. 124. *Octomeria flava* Wall. MSS. *O. pubescens* Spreng. Syst. iv, 210

Dehra Dun and up to 4,000 feet towards Mussoorie, *Mackinnon* No. 24158; Garhwál Hills, *Duthie's collector* Nos. 25804, 25805, 25806. Flowers in April. It extends eastwards to Bengal, Sikkim and Bhutan.

10. Cœlogyne Lindl.

Epiphytes; *pseudo-bulbs* cœspitose or attached to a rhizome, 2- (or rarely 1-) leaved. *Leaves* coriaceous, or membranous and plicate. *Inflorescence* racemose, from the apex or base of the adult pseudo-bulb. *Flowers* with neither mentum nor spur; *floral bract* large, deciduous. *Sepals* subequal, spreading, more or less lanceolate or oblong. *Petals* narrower, sometimes linear. *Lip* sessile on the base of the column, rarely clawed, sometimes saccate at the base, oblong and 3-lobed or suborbicular and without lateral lobes. *Column* long erect, straight or curved, winged and often hooded in its upper part, foot none. *Anther* more or less 2-celled. *Pollinia* 4, cohering in pairs to a single 2-lobed granular appendage.—Species about 90, Indian, Malayan and one in China.

I.—**Eucœlogyne.** Lip oblong, 3-lobed; flowers and leaves contemporaneous, the latter persistent; flowers in racemes.

Inflorescence from the base of the pseudo-bulb; leaves in pairs, petals lanceolate or oblong:—

Racemes erect . . . . . 1. *C. ochracea.*

Racemes drooping . . . . . 2. *C. cristata.*

Inflorescence from between the pairs of leaves on the apex of a fully developed pseudo-bulb; petals linear:—

Flowering axis bracteate at its base; lip fimbriate . . . . . 3. *C. ovalis.*

Flowering axis naked below; edges of lip erose . . . . . 4. *C. elata.*

II.—**Pleione.** Lip more or less orbicular or reniform, without side lobes.

Flowers and solitary leaf contemporaneous . . . . . 5. *C. Hookeriana.*

Flowers and leaves not contemporaneous, the latter in pairs and deciduous . . . . . 6. *C. præcox.*

1. Cœlogyne ochracea Lindl. in Bot. Reg. 1846, t. 69.

Pseudo-bulbs on a stout rhizome, ovate-oblong to cylindric, furrowed, 7·5 to 10 cm. long. *Leaves* narrowly oblong, acute, narrowed to the channelled petiole, 15 to 20·5 cm. long. *Raceme* from the base of the previous year's pseudo-bulb, erect, shorter than the leaves (elongating in fruit), 6—8-flowered; its peduncle stout and with several large imbricating sheaths. *Flowers* white, 3·5 cm. long; *bract* oblong, convolute, sheathing, longer than the slender stalked ovary, caducous. *Sepals* subequal, oblong-lanceolate to ovate-lanceolate, obtuse, spreading. *Petals* narrower. *Lip* oblong, constricted near the middle; lateral lobes large, rounded, incurved, edges serrulate; terminal lobe broadly ovate, obtuse, entire or very slightly notched at the apex, the disk with two ridges. *Column* broadly winged towards the apex. *Pollinia* broadly oblong, compressed. *Capsule* narrowly clavate, 4 cm. long. Lindl. Fol. Orch. 5 Bot. Mag. t. 4661; Walp. Ann. vi, 226; Hook. f. Fl. Br. Ind. v, 831; King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 132, t. 182.

Tehri Garhwál 5-6,000 feet, *Mackinnon;* Brit. Garhwál, *Capt. Roberts;* also in Kumaon, *Edgeworth;* flowering in May. It extends eastwards to Nepal, Sikkim, Bhutan and the Assam hill ranges.

The flowers are fragrant. The sepals and petals are pure white; the upper surface of the lip has clearly defined blotches of yellow margined with red, and the side lobes are marked with reddish oblique lines; the face of the column is yellowish-brown.

2. Cœlogyne cristata Lindl. Coll. Bot. t. 33.

Pendulous. *Pseudo-bulbs* from a long stout rhizome, rather distant, ovoid-cylindric, polished, sheathed at the base, 5 to 7·8 cm. long. *Leaves* in pairs, 15 to 25·5 cm. long, linear-oblong, acute, narrowed to the sessile base. *Racemes* from the base of the pseudo-bulbs, pendulous, about as long as the leaves, few-flowered, with many small sheathing bracts at their bases. *Flowers* large, pure white, 5 to 8 cm. long; *bract* oblong, concave, acute, about as long as the long-stalked ovary. *Sepals* and *petals* sub-equal, erecto-patent, obtuse or sub-acute, with entire undulate edges. *Lip* oblong, with large rounded lateral lobes, terminal lobe distinct, short, broad, crenate, with two broad square yellow lamellæ on its upper surface; disk between the lateral lobes with four yellow fimbriate lamellæ. *Column* long, its apex hooded and crenate. *Anther* with a sub-acute lip. *Pollinia* 4, narrowly oblong, compressed. *Capsule* narrowly clavate, 5 cm. long. Lindl. in Wall. Cat. 1958; Gen. and Sp. Orch. 39; Bot. Reg. 1841, t. 57; Fol. Orch. 8; Walp. Ann. vi, 229; Paxt. Fl. Gard. iii, 171, f. 312; Fl. des. Serres t. 1807; Pescatoria i, t. 25; Warner's Sel. Orch. i, t. 35; Orch. Alb. t. 54; Jennings' Orch. t. 7; Gartenfl. viii, t. 245; Hook. f. Fl. Br. Ind. v, 829; King & Pantl. in Ann. Roy. Bot. Gard. viii, 133, t. 184.

Not uncommon on the outer ranges of Garhwál and Kumaon between 4,000 and 6,000 feet, usually on damp rocks and especially in the vicinity of waterfalls; flowering in March and April. It extends eastwards to Nepal, Sikkim, Bhutan and the Khasia Hills.

3. Cœlogyne ovalis Lindl. in Bot. Reg. 1838, Misc. 91.

Pseudo-bulbs long, cylindric, rather stouter towards the sheathed base, polished, rising at intervals of 5 to 10 cm. from a rather stout imbricately sheathed rhizome. *Leaves* in pairs, 10 to 12·5 cm. long, elliptic-oblong, acute, tapering at the base into the short petiole, thinly coriaceous. *Inflorescence* terminal, bearing three flowers which expand singly. *Flowers* 5 cm. across, pale brown; *floral bract* 3 cm. long, ovate-lanceolate, convolute, coriaceous, caducous. *Sepals* sub-equal, ovate-lanceolate, acute, spreading. *Petals* linear, blunt, spreading or reflexed. *Lip* oblong; lateral lobes narrow; terminal lobe broadly oblong, with stiff black hairs on its upper surface and edges; disk with two crisped lamellæ from base to apex. *Column* curved, broadly winged along its upper half. *Pollinia* dimidiately obovate. Lindl. Fol. Orch. 12; Walp. Ann. vi, 232; Hook. f. Fl. Br. Ind. v, 836; Ann. Roy. Bot. Gard. Calc. v, 28, t. 41; King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 135, t. 187. *C. fimbriata* Lindl. in Wall. Cat. 1957. *C. fimbriata*? Griff. in Notul. iii, 281; Ic. Pl. As. 291, fig. 1? *C. pilosissima* Planch. Hort. Donat. 104. *Broughtonia linearis* Wall. MSS.

Dehra Dun, *Wallich*, *Gamble* No. 23142; below Mussoorie, up to 3,500 feet, *Mackinnon*; Brit. Garhwál, *Duthie's collector* Nos. 25808, 25819, 25820, 25821; Kumaon in the Gori Valley, *Duthie's collector* Nos. 24099, 24100; flowering in October. Extends eastwards to Nepal, Sikkim and the Khasia Hills.

4. Cœlogyne elata Lindl. in Wall. Cat. 1959.

Pseudo-bulbs oblong-cylindric, rising at distances of about 5 cm. from a very stout sheathed rhizome, 7·8 to 12·8 cm. long and 3·8 to 7 cm. broad, polished and sheathed at the base. *Leaves* in pairs, the blade 1·75 to 3·5 cm. long, narrowly elliptic-oblong, acute, tapering into the long petiole, thinly coriaceous. *Peduncle* from the apex of the adult pseudo-bulb between the leaves and rather shorter than them, bearing many short imbricate sheaths just under the raceme. *Racemes* 10 to 15 cm. long, distichous, laxly many-flowered. *Fowers* 3 cm. across, rather fœtid; *floral bract* subrhomboid, acute, conduplicate, slightly longer than the stalked ovary, caducous. *Sepals* subequal, oblong, sub-acute, spreading. *Petals* as long as the sepals, but much narrower, sub-acute. *Lip* elongate, the lower part oblong and with narrow entire side lobes; terminal lobe suborbicular, undulate and irregularly erose; disk with two erose-crenulate lamellæ from the base nearly to the apex. *Column* winged above, the wing erose at the apex. *Pollinia* dimidiately ovate. *Capsule* clavate, 3·5 cm. long. Lindl. Gen. and Sp. Orch. 40; in Wall. Pl. As. Rar. iii, 12, t. 218; Bot. Reg. 1839, Misc. 92; Fol. Orch. 9; Bot. Mag. t. 5001; Walp. Ann. vi, 230; Hook. f. Fl. Br. Ind. v, 838; King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 136, t. 188; Rolfe in Journ. Linn. Soc. xxxvi, 22. *Cœlogyne* sp., Griff. Ic. Pl. As. t. 290.

Garhwál 4-5,000 feet, *Falconer*, *Mackinnon;* Kumaon in the Sarju Valley 3-4,000 feet, *Strachey & Winterbottom* No. 14, *Duthie's collector* Nos. 24131, 24132; flowering during April and May. Eastwards to Nepal, Sikkim, Upper Burma and China.

5. Cœlogyne Hookeriana Lindl. Fol. Orch. 14.

Pseudo-bulbs cœspitose, oval, with a few lax sheaths, smooth, not mottled, 2 to 2·5 cm. long. *Leaf* solitary, from the base of the adult pseudo-bulb, petioled; the blade 5 to 6·5 cm. long, narrowly elliptic; *petiole* 2 to 3 cm. long, enclosed in tubular imbricate sheaths. *Peduncle* enveloped in the same sheaths which surround the base of the undeveloped leaf and longer than the latter. *Flower* solitary, 5 cm. across, pale rose-purple or white; *floral bract* about as long as the stalked ovary, broadly obovate-elliptic, very obtuse, convolute, persistent. *Sepals* spreading, sub-equal, elliptic-oblong, blunt; the dorsal one narrower than the lateral pair. *Petals* spreading, as long as the sepals, oblanceolate, obtuse. *Lip* white tinged with yellow towards the apex and blotched with reddish-brown, sub-reniform, cordate at the base and entire, somewhat lobulate and minutely erose along the apical portion, apex retuse; disk with five to seven slender ciliate ridges from the base nearly to the apex. *Column* long, curved, broadly winged in its upper half, its apex truncate and erose. *Pollinia* obliquely elliptic. Bot. Mag. t. 6388; Hook. f. Fl. Br. Ind. v, 842; King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 139, t. 193.

Dwáli in Kumaon at 9,000 feet, *Collett;* flowering in June. Eastwards to Sikkim.

6. Cœlogyne præcox Lindl. Coll. Bot. 37.

Pseudo-bulbs cœspitose, flask-shaped, turbinate or shortly cylindric, umbonate, surface mottled with brown or purple, and loosely sheathed by a network of brown fibres.

Leaves in pairs, 1 to 2 dm. long, elliptic or elliptic-oblong or sometimes oblanceolate, sub-acute, many-nerved; petiole 2·5 to 5 cm. long. *Peduncle* from the base of and about as long as the mature pseudo-bulb; its lower half enveloped in tight tubular mottled sheaths, 1- or 2-flowered. *Flowers* 7·8 to 10 cm. across, rose-coloured or occasionally white; *floral bract* obovoid, very obtuse, as long as or longer than the stalked ovary, convolute. *Sepals* sub-equal, spreading, oblanceolate. *Petals* as long as, but narrower than the sepals, spreading. *Lip* ovate-orbicular, without side lobes, convolute round the column at the base, anterior portion concave, the open wide repand mouth with lobulate laciniate edges, the apex slightly bifid; disk with a white patch traversed by five yellow crested lamellæ. *Column* very long, with a short sac at the base, the apex expanded into a wide undulate irregularly lobulate hood. *Pollinia* clavate. Lindl. in Wall. Cat. 1965; Fol. Orch. 16; Bot. Mag. t. 4496; Paxt. Mag. t. 7; Hook. f. Fl. Br. Ind. v, 840; King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii 141 t. 196. *C. Wallichiana* Lindl. Gen. and Sp. Orch. 43; in Wall. Pl. As. Rar. i, 46, t. 54; Bot. Reg. xxiv, Misc. 85 Paxt. Mag. vi, t. 25; Gartenfl. t. 283; Jennings' Orch. t. 47; Griff. Notul. iii, 402. *Pleione præcox* Don. Prod. Fl. Nep. 37. *P. Wallichii* Lindl. in Paxt. Fl. Gard. sub. t. 51. *P. birmanica* Reichb. f. in Gard. Chron. 1882, ii, 840. *Epidendrum præcox* Smith Exot. Fl. t. 97.

Garhwál and Kumaon at 5 to 8,000 feet (fide Fl. Br. Ind.), but I have seen no specimens from the Western Himalaya. It extends eastwards to Nepal, Sikkim, Bhutan, the Khasia Hills and Burma.

11. **Pholidota** Lindl.

Epiphytes with jointed, often branching stems with internodes like pseudo-bulbs, or with tufted pseudo-bulbs. *Leaves* usually in pairs (solitary in *P. imbricata*), membranous, many-nerved. *Racemes* on ebracteate peduncles, terminal or from the base of a pseudo-bulb or sometimes from below the leaves, usually drooping and distichous; *floral bract* large and persistent. *Flowers* small, subglobose, expanding from above downwards. *Sepals* concave. *Petals* narrower than the sepals. *Lip* usually without side lobes, more or less cymbiform and saccate. *Column* short, the apex shortly hooded or winged. *Anther-cells* subglobose. *Pollinia* 4, subglobose or clavate, cohering by pairs to one or two membranes.—Species about 20, Indian, Malayan or Chinese.

Leaf solitary	*1. P. imbricata.*
Leaves in pairs:—	
Floral bract acute	*2. P. articulata.*
Smaller in all parts, floral bract obtuse . .	*2. P. articulata* var. *Griffithii.*

1. Pholidota imbricata Lindl. in Hook. Fl. Exot. t. 138.

Pseudo-bulbs cæspitose, cylindric, thickened at the base, 5 to 7·5 cm. long, or shorter and more ovoid, usually partly enveloped in large fibrous sheaths. *Leaf* solitary, 1·5 to 3 dm. long, elliptic-oblanceolate or lanceolate-acute, tapering to the stout petiole. *Inflorescence* from the base of a pseudo-bulb, drooping, 2 to 2·5 dm. long, lengthening in fruit. *Peduncle* slender, as long as or longer than the dense many-flowered distichous raceme. *Flowers* 13 mm. long, pale brown; *floral bract* large, convolute, subrotund, minutely apiculate, many-nerved, longer than the slender stalked ovary, persistent.

Dorsal sepal orbicular; the lateral pair connate at the base, cymbiform, with a winged keel. *Petals* oblong, sub-acute. *Lip* 3-lobed; the lateral lobes large and rounded; terminal lobe divided at the apex into two small oblong lobules separated by a broad sinus. *Column* broad, its upper half winged. *Pollinia* clavate, attached by pairs to two small membranes. *Capsule* ellipsoid, about 2 cm. long. Lindl. in Wall. Cat. 1991; Gen. and Sp. Orch. 37; in Bot. Reg. tt. 1213 and 1777; Lod. Bot. Cab. t. 1934; Wight Ic. 907; Dalz. & Gibs. Bomb. Fl. 262; Hook. f. Fl. Br. Ind. v, 845; King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 144, t. 201. *P. pallida* Lindl. in Bot. Reg. xxi, sub. t. 1777. *Cœlogyne imbricata* and *C. pallida* Reichb. f. in Walp. Ann. vi, 238. *Ptilocnema bracteatum* Don. Prod. 33. *Cymbidium imbricatum* Roxb. Fl. Ind. iii, 460. *Ornithidium imbricatum* Wall. MSS.

Dehra Dun and up to 4,000 feet on the Mussoorie range, *Mackinnon* (*Duthie's* No. 24192); Kumaon, in the Gori and Kali Valleys 2-4,000 feet, *Duthie* No. 5988; *Duthie's collector* Nos. 24123 and 24124; Ramganga Valley at 3,500 feet, *Strachey & Winterbottom* No. 16. Flowers from June to August. It extends eastwards to Nepal, Sikkim, Bhutan, Khasia Hills, Chittagong, Burma; also to the Deccan Peninsula and southwards to Ceylon, the Andaman Islands, Malay Peninsula, Pacific Islands and Australia.

2. PHOLIDOTA ARTICULATA Lindl. in Wall. Cat. 1992.

Stem jointed, branching; internodes terete, furrowed, 5 to 10 cm. long, the nodes with a few short scarious sheaths. *Leaves* 7·6 to 10·5 cm. long, narrowly oblong, tapering to each end, many-nerved, thickly membranous. *Raceme* from the top of the pseudo-bulb between the leaves and about equal in length to the latter, drooping, many- and densely-flowered. *Flowers* 7 mm. long; *bracts* longer than the flowers, rhomboid-ovate, acute, convolute, caducous. *Dorsal sepal* suborbicular; lateral ovate, keeled. *Petals* ovate-orbicular, blunt. *Lip* about as long as the sepals, broadly cymbiform, with five lamellate nerves on its disk; the midlobe transversely oblong, 2-lobed, involute at the base. *Column* slightly winged towards the apex, the clinandrium irregularly toothed; *rostellum* large, erect, acuminate. *Pollinia* subglobose, attached to a cuneiform membrane. *Capsule* about 2 cm. long. Lindl. Gen. and Sp. Orch. 38; in Journ. Linn. Soc. i, 173; in Bot. Reg. for 1839, Misc. 44; Hook. f. Fl. Br. Ind. v, 844; King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 146, t. 205. *P. khasiana* Reichb. f. in Walp. Ann. vi, 238; in Bonplandia iv, 329. *Cœlogyne articulata* Reichb. f. in Walp. Ann. vi., 238. *C. khasiana* Reichb. f. l. c. 238.

Below Mussoorie up to 4,500 feet, *Edgeworth, Vicary;* Lansdowne in Brit. Garhwál, *Capt. Roberts;* below Naini Tal in Kumaon at 3,000 feet, *Strachey & Winterbottom* No. 17. Flowers in July and August. It extends eastwards to Sikkim, Bhutan, the Khasia Hills and Burma.

The inodorous flowers are white tinged with brownish-pink, and the floral bracts are pale brown.

Var. GRIFFITHII King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii., 147, t. 204. Like the type in most respects, but smaller in all its parts, the internodes less furrowed and with narrower leaves; flowers much smaller; floral bract and dorsal sepal suborbicular, blunt; petals elliptic-lanceolate. *Pholidota Griffithii* Hook. f. Ic. Pl. 1881; Fl. Br. Ind. v, 845; Wall. Cat. No. 1992 (in part).

Dehra Dun, on sâl trees, *Gamble* No. 27039, *Mackinnon;* Mussoorie range up to 4,000 feet, *Duthie* No. 21780. It extends eastwards to Sikkim and the Khasia Hills.

TRIBE III.—VANDEÆ.

Pollinia 2, 4, or rarely 8, attached singly or in pairs or in fours by a caudicle (rarely by two caudicles) to a viscid gland derived from the stigma (in a few doubtfully from the stigma).

Terrestrial, leaves (when present) plicate:—
- Pollinia 8 . . . . . 12. *Calanthe.*
- Pollinia 2:—
  - Lip saccate or spurred at the base . . . . . 13. *Eulophia.*
  - Lip broadly ventricose at the base; inflorescence decurved when in flower . . . . . 14. *Geodorum.*
- Pollinia 4:—
  - Pseudo-bulbous; leaves 1 to 3, long, narrow, plicate; anther 1-celled . . . . . 15. *Oreorchis.*
  - A leafless parasite with a jointed coralloid rhizome; anther 4-celled . . . . . 16. *Corallorhiza.*

Epiphytal, rarely terrestrial or leafless, usually with long linear sheathing leaves on a large fleshy pseudo-bulb; scapes racemose, flowers elongate, column without a foot or with a very short one; lip never spurred; leaves coriaceous . . . . . 17. *Cymbidium.*

Epiphytal, with very short stems; leaves few, closely clustered, flat, coriaceous, pendulous, often solitary; racemes pendulous, longer than the leaves; sepals and petals united to the foot of the column; lip spurred, with forked appendages on its disk . . . . . 18. *Doritis.*

Epiphytal, with a short stem and a few broad pendulous coriaceous leaves; flowers in long sometimes branching racemes, column with a very short foot; lip with a large claw, a bent spur and a 2-lobulate apical lobe, the lateral lobes fimbriate . . . . . 19. *Ornithochilus.*

Epiphytal, with fleshy elongated stems (except *Sarcochilus usneoides* and *Saccolabium calceolare*); *pseudo-bulbs none;* leaves coriaceous and flat or terete and fleshy; inflorescence racemose or panicled, lip spurred or not:—
- Lip not spurred:—
  - Leaves terete; flowers few, in very short racemes or solitary; stems elongate . . . . . 20. *Luisia.*
  - Leaves (when present) flat; stems 0; flowers in long racemes . . . . . 21. *Sarcochilus.*
- Lip spurred (gibbous in *Vanda alpina*):—
  - Column with a long foot produced into a long spur which has no callus or septum inside . . 22. *Ærides.*
  - Column without a foot or with only a short one:—
    - Spur without callus or septum inside:—
      - Spur deep, much compressed laterally, pubescent at the mouth; lip without side lobes . . . . . 23. *Rhynchostylis.*

Base of lip usually with a widely funnel-shaped spur (gibbous in *Vanda alpina*), glabrous at the mouth, not compressed, side lobes large; apical lobe fleshy, with many glabrous caruncled ridges, flowers large, caudicle of pollinia broad . . . 24. *Vanda.*

Base of lip with a long narrow cylindric or short wide saccate spur, not compressed, side lobes not present (in the W. Himalayan species) or small; apical lobe either small and smooth or large and carunculate or fimbriate, flowers small, caudicle of pollinia narrow . . . . . 25. *Saccolabium.*

Interior of spur occluded by a dorsal scale or by calli on the front and back walls, but with no septum . . . . . 26. *Cleisostoma.*

Interior of spur with calli and a vertical septum dividing it into two vertical chambers 27. *Sarcanthus.*

12. **Calanthe** Lindl.

Terrestrial, usually pseudo-bulbous. *Pseudo-stems* variable in length, often tall, sometimes absent. *Leaves* membranous, plaited. *Inflorescence* usually from the leaf-axils, or from the side of the stem or pseudo-bulb. *Flowers* in erect racemes, usually conspicuous. *Sepals* sub-equal, usually spreading, rarely connivent. *Petals* usually narrower than the sepals. *Lip* variously attached to the column either to its base or to its whole length, usually 3-lobed, the apical lobe often bifid, the disk usually lamellate. *Column* short, sometimes dilated at the base or apex. *Anther* usually conical, with an acuminate lip, 2-celled. *Pollinia* 8, waxy, often unequal, cohering in fours to a granular caudicle or all of them inserted on a single caudicle and attached to a gland. *Capsules* ellipsoid, drooping.—Species about 80, tropical or subtropical.

Flowers without a spur:—

Sepals and petals green; lip orange-red, its apical lobe with 3 prominent ridges . . . . . 1. *C. tricarinata.*

Flowers lavender-coloured; apical lobe of lip without ridges . . . . . 2. *C. puberula.*

Flowers with a very short straight conical spur:—

Lip attached to whole length of column; flowers small, sepals and petals chocolate-brown . . . . . 3. *C. Mannii.*

Lip attached to column for half its length; flowers large, dull purple . . . . . 4. *C. brevicornu.*

Spur as long or nearly as long as the ovary:—

Lateral lobes of lip incumbent on the terminal lobe; flowers white, the lip with a violet blotch at the base, spur shorter than the ovary . . . . . 5. *C. alismæfolia.*

Lateral lobes of lip spreading, not incumbent on the apical one; spur slender as long as the ovary:—

Flowers small, crowded, greenish-yellow . . . 6. *C. pachystalix.*

Flowers larger, distant, violet-coloured . . . . 7. *C. plantaginea.*

1. CALANTHE TRICARINATA Lindl. in Wall. Cat. 7339.

Pseudo-bulb 2 to 2·5 cm., broadly ovoid, marked with distinct concentric rings. *Leaves* two to four, 2 to 3·8 dm. long and 5 to 7·5 cm. in breadth, oblanceolate, acute, usually stalked. *Inflorescence* from the developing pseudo-bulb, sheathed by the young leaves, and rising from the axil of one of them, longer than the adult leaves; *raceme* laxly flowered, shorter than the peduncle; *rachis* and stalked ovaries puberulous. *Flowers* 2 to 2·5 cm. across; *bracts* about half as long as the ovary with pedicel. *Sepals* lanceolate, acuminate, 5—7-nerved, green, spreading. *Petals* clawed, lanceolate, acuminate, a little smaller than the sepals. *Lip* adnate to the whole length of the column, 3-lobed, broadly oblong, decurved, saccate at the base, the mouth of the sac clothed with long white deflexed hairs; basal lobes suborbicular or obliquely spathulate, white tinged with orange-red towards their apices; terminal lobe 10 mm. long, orange-red, margins deflexed, much undulate and erose; the disk with a fleshy callus divided into three prominent crenulate ridges. *Column* short, thick, anterior surface hispid. Lindl. Gen. and Sp. Orch. 18; Fol. Orch. 2; Walp. Ann. vi, 912; Hook. f. Fl. Br. Ind. v, 847; King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 166 (excl. t. 223); Collett Fl. Siml. 494; Rolfe in Journ. Linn. Soc. xxxvi, 26. *C. occidentalis* Lindl. Fol. Orch. 3; Walp. Ann. l. c. 848.

Abundant in the temperate parts of the Western Himalaya from Hazára to Kumaon, at elevations between 5,000 and 9,000 feet, especially in forests. Flowers April to June. It extends eastwards to Nepal, and is also found in China.

PLATE 103. Calanthe tricarinata *Lindl.*—Inflorescence and one leaf,—*of natural size.* Fig. 1, lower portion of plant (reduced); 2, single flower; 3, ditto with sepals and petals removed; 4, lip; 5, column; 6, anther; 7, pollinia;—*all enlarged.*

2. CALANTHE PUBERULA Lindl. in Wall. Cat. 7342.

Pseudo-bulb small, conical from a broadly ovoid base, about 2·5 cm. long. *Leaves* five to seven, very unequal in size, the lower often reduced to sheaths; upper ones elliptic or elliptic-oblong, acuminate, slightly narrowed to the broad loosely sheathing base, 10 to 15 cm. long. *Inflorescence* much longer than the leaves, the peduncle with many scattered lanceolate acuminate bracts; *raceme* 7·5 to 15 cm. long, laxly flowered, the *rachis* puberulous. *Flowers* 2·75 cm. across, lavender-coloured, puberulous externally; *bract* lanceolate, acuminate, not longer than the stalked ovary. *Sepals* spreading, ovate-lanceolate. *Petals* spreading, narrowly falcate, acute. *Lip* adnate to the base of the column, 3-lobed, shortly clawed; basal lobes flat, falcately oblong, blunt, with two narrow calli on the disk between them, their apices pointing forward; terminal lobe without calli, connected with the basal by a straight narrow isthmus, ovate-orbicular, apiculate, its edges coarsely erose. *Column* short, thick. *Anther* pointed; *pollinia* 8, clavate, attached in fours to two caudicles and these to a triangular gland. *Capsule* narrowly elliptic, 3 cm. long. Lindl. Gen. and Sp. Orch. 352; Fol. Orch. 2; Walp. Ann. vi, 912; Hook. f. Fl. Br. Ind. v, 848; King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 166, t. 224; Collett Fl. Siml. 494; Rolfe in Journ. Linn. Soc. xxxvi, 26. *Bletia* sp., Griff. Ic. Pl. As. t. 313A.

Simla Hills; below Nágkanda, *T. Thomson;* Cháchpur Valley 5-6,000 feet, *Duthie* No. 21076; Jaunsár, *Osmaston;* Garhwál, *Falconer;* Kulni Valley, *Duthie;* Bok Hill,

Duthie's collector No. 24150; mostly in damp shady forests at elevations between 4,000 and 6,000 feet. Flowers during July and August. I have seen no specimens from Kumaon or Nepal, but it is found in Sikkim, Bhutan, on the Khasia and Naga Hills, in Assam and eastwards to China.

3. Calanthe Mannii Hook. f. Fl. Br. Ind. v, 850.

Pseudo-bulb small; *pseudo-stem* about 7·5 cm. long. *Leaves* two or three, oblanceolate-oblong, acute, tapering gradually into the long petiole, the lowermost one sheathed at the base; length of adult blade up to 2·55 dm., its breadth 3·5 to 5 cm. *Peduncle* from the axil of a young leaf, pubescent, about 2·3 dm. long; *raceme* half as long as the peduncle, few-flowered, lax. *Flowers* only about 13 mm. long, deflexed after expansion; *floral bract* minute, lanceolate, shorter than the pedicel of the stalked ovary. *Sepals* and *petals* chocolate-brown. *Sepals* sub-equal, connivent, ovate-lanceolate, sub-acute, concave, pubescent externally. *Petals* linear-spathulate, not spreading, glabrous. *Lip* yellow with a blotch of red at the apex of the terminal lobe, a little shorter than the sepals, adhering to the column almost to its apex and forming with it a long sac, 3-lobed; basal lobes erect, large, broad, truncate; terminal lobe sub-reniform, entire; upper surface with three or four continuous tubercled ridges extending from the base to the middle of the terminal lobe; *spur* very short. *Column* short, dilated towards the apex. *Anther* pointed; *pollinia* clavate, attached in fours to two caudicles and these to a triangular gland. King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 167, t. 225.

In the neighbourhood of Tehri in Garhwál at 6,000 feet, *Mackinnon's collector*; below Ranikhet in Kumaon, 5-6,000 feet, *Duthie* No. 5996. Flowers in May. It is found also in Sikkim and on the Khasia Hills between 4,000 and 7,000 feet.

The pollinia, described above, were obtained from young flowers. This species may, as Sir George King suggests, be self-fertile.

4. Calanthe brevicornu Lindl. in Wall. Cat. 7338.

Pseudo-bulbs small, ovoid, pointed, about 2·5 cm. long. *Pseudo-stem* 5 to 10 cm. stout, with wide sheaths. *Leaves* usually three, sub-equal, oblong-elliptic, shortly acuminate, slightly tapering to the wide sheathing base, stalked when adult; length of blade 2·3 to 3 dm., breadth 6·5 to 9 cm. *Inflorescence* longer than the leaves, the *peduncle* with a few short scattered bracts; *raceme* 3 dm. long, laxly flowered; rachis, ovaries and outside of sepals puberulous. *Flowers* 3·5 to 4 cm. across; *floral bract* narrowly lanceolate, half as long as the stalked ovary. *Sepals* sub-equal, oblong lanceolate, acute, spreading. *Petals* shorter than the sepals, lanceolate. *Lip* 3-lobed, attached to the lower half of the column; basal lobes oblong, blunt, diverging; terminal lobe sub-obovate with a broad emarginate apiculate apex and irregularly toothed edges, contracted at its junction with the basal lobes; upper surface with three tubercled fleshy lamellæ running from the base and increasing in height to near the apex; *spur* short, broad, blunt, straight, its mouth lined with retroflexed hairs. *Column* short. *Anther* beaked; *pollinia* clavate, attached to a common pedicel and gland. Lindl. Gen. and Sp. Orch. 251; Sert. Orch. t. 9; Fol. Orch. 3; Walp. Ann. vi, 912;

Hook. f. Fl. Br. Ind. v, 848; King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 168, t. 227.

Garhwál at 5,000 to 6,000 feet, *Duthie* No. 1265 (1879); *Mackinnon's collector* [*Duthie's* No. 24150 (*a*)]; Bok Hill, *Duthie's collector* No. 24150; Kumaon, *T. Anderson*. Flowers during May and June. Extends eastwards to Nepal, Sikkim, Bhutan and the Naga Hills.

The colour of the flowers is dull purple or brick red, relieved by lines of white on the midribs of the sepals and petals and on the edges of the lip, the lamellæ of the lip are streaked with yellow. The outer surfaces of the parts of the perianth are all strongly flushed with white.

5. Calanthe alismaefolia Lindl. Fol. Orch. 8.

Pseudo-bulbs thin, cylindric, tapering to the apex, marked with several concentric rings, somewhat curved, 2·5 to 5 cm. long. *Leaves* 1·2 to 1·8 dm. long. broadly elliptic, acuminate, rather abruptly narrowed into the long channelled petiole, edges undulate. *Scape* about as long as the leaves, clothed with a few distant sheathing bracts. *Inflorescence* corymbose in flower and becoming racemose as the fruit ripens, puberulous. *Flowers* 2 cm. long, *floral bract* large, ovate, acuminate, shorter than the shortly stalked ovary. *Sepals* sub-equal, suborbicular erecto-patent, clothed outside with short coarse purple hairs. *Petals* about as large as the sepals, subrhomboidal, subacute. *Lip* obovate, adnate by its base to the whole length of the column, 3-lobed; basal lobes narrowly oblong-oblanceolate, obtuse, somewhat falcate, resting on the terminal lobe and pointing forwards; terminal lobe broad and with a large yellow callus at its base; its apex bilobulate, the lobules broad, rounded, and with crenulate edges, the sinus deep and apiculate at its base; *spur* nearly as loug as the ovary and lying parallel to it, cylindric. *Column* very short, with the callosities of the lip closely applied to it. *Anther* acuminate; *pollinia* clavate, attached directly to an ovate acute gland. *Stigma* divided into two halves by the entrance to the spur. *Capsule* with pedicel 4 cm. long, clavate, prominently ridged. Walp. Ann. vi, 918; Hook. f. Fl. Br. Ind. v, 849; King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 170, t. 230.

Below Mussoorie in hot valleys, *Falconer* Nos. 1055, 1056 (Kew Distrib.), *Duthie* No. 24148. Flowers during July and August. Found eastwards in the Sikkim Terai and on the Khasia Hills.

The colour of the perianth is white, except for a tinge of green on the tips of the sepals outside and a patch of pale violet at the base of the lip.

6. Calanthe pachystalix Reichb. f. in Hook. f. Fl. Br. Ind. v, 850.

Stem short, swollen at the base, giving off many stout fibrous roots. *Leaves* many, 3—6 dm. long, linear-lanceolate, acuminate, tapering gradually into the sheath, plicate, nerves prominent. *Inflorescence* from the axil of a sheath, usually overtopping the leaves, the flowering portion 2—3 dm. long, rachis and pedicels puberulous; *bracts* lanceolate, deflexed, about 8 mm. long, the upper ones smaller. *Flowers* in rather dense racemes, 2 cm. across, greenish yellow, subsecund, deflexed after expansion. *Calyx* lobes reflexed; dorsal 5-nerved, broader than the lateral ones and the petals. *Petals* spathulate, obtuse, 3-nerved, 9 mm. long. *Lip* adnate to the whole length of

the column, 3-lobed; basal lobes falcately ovate, obtuse; midlobe rather shorter, deeply bifid, with three rows of prominent warts on its disk: *spur* cylindric, a little longer than the pedicelled ovary, puberulous and with a few white hairs at its entrance. *Column* broad. *Pollinia* 8, cohering in fours to a granular viscus. *Stigma* divided into two segments at the entrance to the spur. *Ovary* minutely pubescent.

Western Himalaya, *Falconer* (Kew Distrib. No. 1054); near Mussoorie in shady forest at about 6,000 feet, *Mackinnon* (*Duthie's* Nos. 21742 and 22714).

Falconer's specimen in the Kew Herbarium is very imperfect and in bud only.

Plate 104. Calanthe pachystalix *Reichb. f.*—A plant,—*of natural size*. Fig. 1, a single flower *seen from above;* 2, ditto with the sepals and petals removed; 3, the lip; 4, column; 5 and 6, back and front views of anther; 7, pollinia;—*all enlarged.*

7. Calanthe plantaginea Lindl. in Wall. Cat. 7346.

Stem 7·5 to 25 cm., enclosed within long tubular sheaths. *Leaves* 2—3 dm. long and 4 to 9 cm. broad, usually enlarging as the fruit ripens, oblanceolate or elliptic-lanceolate, tapering below into the long petioles. *Peduncle* from the axil of one of the developing leaves and overtopping them, stout, many-flowered; pedicel with ovary about 2·5 cm., very slender; *bracts* small, lanceolate. *Flowers* drooping, about 3 cm. across, lilac or white, sweet-scented. *Sepals* oblanceolate, acuminate, 3—5-nerved, glabrous. *Petals* similar to the sepals but smaller, 3-nerved. *Lip* about as long as the sepals, purple, the disk with 3 slender lamellæ; side lobes rhomboid-obovate, subfalcate; midlobe cuneately reniform, apiculate. *Spur* very slender, as long as or longer than the ovary. *Rostellum* of two projecting plates. Lindl. Gen. and Sp. Orch. 250; Sert. Orch. t. 24; Fol. Orch. 9; Walp. Ann. vi, 920; Royle Ill. Him. Bot. 366; Hook. f. Fl. Br. Ind. v, 853; Collett Fl. Siml. 494.

Punjab Himalaya in Chamba at 7,000 feet, *Lace* No. 1328; Garhwál at 9,000 feet, *Royle Herb.;* Mussoorie range, *Falconer*; in shady forest below Mussoorie from 4,000 to 6,000 feet, *Mackinnon* (*Duthie's* Nos. 21741, 22716); Tonse Valley at 6,500 feet, *Duthie* 24149; Kumaon at 9,000 feet, *Strachey & Winterbottom* No. 17. Flowers in March and April. It extends eastwards to Nepal and Bhutan.

Plate 105. Calanthe plantaginea *Lindl.*—A plant,—*of natural size*. Fig. 1, a single flower; 2, lip; 3, column with lower part of lip and upper portions of ovary and spur attached; 4, pollinia;—*all enlarged.*

13. Eulophia R. Brown.

Terrestrial glabrous herbs with fleshy tubers or rhizomes, rarely pseudo-bulbous. *Leaves* appearing with or after the flowers, usually plaited. *Scape* generally lateral. *Flowers* in racemes, rarely panicled. *Sepals and petals* free, spreading, often sub-equal. *Lip* adnate to the base of the column or to its foot, saccate or shortly spurred at the base, usually 3-lobed, the lateral lobes erect and embracing the column, disk usually ridged or crested. *Column* with or without a foot, its apex entire and often oblique, the margins sometimes winged or lobed. *Anther* terminal, often with two apical processes, and its lip often toothed, 2-celled. *Pollinia* 2, globose, attached by

a caudicle to the flat gland of the rostellum.—Species about 100, tropical or sub-tropical, chiefly Asiatic.

Column not or only slightly produced into a foot:—
  Leaves and flowers coetaneous or nearly so:—
    Lip with a short geniculate spur, bracts as long as or longer than the ovary:—
      Sepals spreading, linear-lanceolate, acuminate, green — 1. *E. herbacea.*
      Sepals erect, ovate-oblong, obtuse, yellowish . . . — 2. *E. Mackinnoni.*
    Lip saccate at the base, bracts shorter than the ovary . . . . . — 3. *E. explanata.*
  Flowers appearing before the leaves:—
    Flowers in condensed racemes, terminal lobe of lip yellow . . . . . — 4. *E. Hormusjii,*
    Flowers smaller, in lax racemes . . . . . — 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 2·5 cm. in diam., greenish-yellow tinged with purple . . . . . — 7. *E. bicarinata.*
    Flowers large, bright yellow:—
      Terminal lobe of lip half as long as the basal lobes, 3-lamellate; spur saccate, blunt . . . . — 8. *E. flava.*
      Terminal lobe of lip twice as long as the rounded basal obes, many-lamellate; spur short, curved, acute . . . . . — 9. *E. obtusa.*

1. EULOPHIA HERBACEA Lindl. Gen. and Sp. Orch. 182.

Pseudo-bulbs 4 cm. long, broadly ovate. Pseudo-stem 1 to 1·5 dm. long. *Leaves* 1·5 to 2 dm. long, linear-lanceolate, variable in breadth, many-nerved, plicate. *Scape* 6—9 dm., with a few sheathing bracts towards the base. *Flowers* appearing with the leaves, 5·5 cm. across, fragrant; *floral bract* long, often exceeding the ovary, lanceolate, acuminate, scarious. *Sepals* linear-lanceolate, acuminate, spreading, green with pale margins, the lateral ones adnate to the base of the column. *Petals* shorter than the sepals, pure white, elliptic or lanceolate, obtuse or acute. *Lip* obovate-oblong, white with a tinge of green towards the base; nerves many, the median ending in five fimbriate lamellæ within the terminal lobe; side lobes small, rounded; midlobe oblong and rounded at the apex when flattened out. *Spur* very short, somewhat geniculate. rounded. *Column* stout, curved, slightly winged. *Auther* retuse at the apex, and with a small linear projection on each side of its lip; *pollinia* 2, transversely oblong, attached by a short broad caudicle to a triangular gland. Lindl. in Journ. Linn. Soc. iii, 24; Royle Ill. Him. Bot. 366; Dalz. & Gibs. Bomb. Fl. 265; Hook. f. Fl. Br. Ind. vi, 2. *E. brachypetala* Lindl. in Journ. Linn. Soc. iii, 24. *E. bicolor* Lindl. in Journ. Linn. Soc. iii, 24 (not of Dalz.). *Limodorum bicolor* Roxb. Fl. Ind. iii, 469.

Dehra Dun, *Mackinnon;* Siwalik range, *Visary;* Giri Valley west of the Jumna, *Royle;* Mussoorie range up to 5,000 feet, *Mackinnon;* Garhwál 4-7,000 feet, *Holye,*

Falconer, *Edgeworth*, &c.; Lansdowne in Brit. Garhwál, 5-6,000 feet, *Capt. Roberts;* Kumaon below Naini Tál, *Colonel Davidson.* Flowers during June and July. It extends eastwards to Bengal, and southwards to Kanara, the Konkan and Mysore.

The specimens from Western and S. India have usually much smaller flowers, the petals often have purple veins, and the spur is longer. This is no doubt Lindley's *E. bicolor*.

Plate 106. Eulophia herbacea *Lindl.*—An entire plant;—*reduced to half size.* Portion of a flowering stem,—*of natural size.* Fig. 1, single flower; 2, ditto with sepals and petals removed; 3, lip *spread out*; 4, column front view; 5, side view of ditto; 6, front view of anther; 7, side view of ditto; 8 and 9, pollinia;—*all enlarged.*

2. Eulophia Mackinnoni Duthie in Journ. As. Soc. Beng. lxxi, pt. ii, 40.

Rhizome composed of a series of flattened triangular-shaped tubers. *Pseudo-stem* about 2 dm. long, proceeding from the summit of the bulb-like current year's tuber (pseudo-bulb). *Leaves* usually two, appearing with the flowers, 7 to 8 dm. long and 5 to 8 cm. broad, broadly lanceolate, acuminate, tapering into long sheaths and with a few leafless sheaths below, prominently nerved and plicate. *Scape* shorter than the leaves, arising from the side of the pseudo-bulb, bearing three or four loosely sheathing bracts. *Flowers* rather large, spreading or deflexed; *floral bract* 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* 1·7 cm. long, ovate, obtuse, subcordate at the base, 9-veined, the margin at the apex inflexed; lateral a little longer than the dorsal, unequal at the base. *Petals* shorter than the sepals, oblong-obovate, obtuse, their margins overlapping and reflexed at the apex. *Lip* 3-lobed, with long erect rather shallow side lobes, its body with 5—7 parallel purple-coloured ridges which extend into a carunculate area within the terminal lobe; terminal lobe broad, rounded and with undulate edges. *Spur* short, geniculate. *Column* short, broadly winged, its foot very slightly produced. *Anther* bicornute at the apex, its lip 2-toothed; *pollinia* transversely oval, attached by a broad caudicle to a shallow crescent-shaped gland. *E. bicolor* Falc. MSS. (not of Lindl. nor of Dalz.).

N.-W. India, *Royle* (named *E. bicolor* Falc. MSS.); Siwalik range, Vicary; Dehra Dun, *Mackinnon*, *Duthie's collector* Nos. 21748, 22723, 24161; Pátli Dun in Garhwál, *Duthie's collector* No. 25789; Bahraich district in N. Oudh, *Duthie's collector* No. 22799. It has also been found by Mr. J. Marten of the Forest Survey Dept. in the Raipur district of the Central Provinces. It flowers during July and August.

This plant appears to be most nearly related to *E. geniculata* King & Pantl., an extremely rare Sikkim species. It differs, however, in the shape of the rhizome, the very much broader leaves, and in the shape and colour of the lip. It also resembles *E. bracteosa* Lindl., but the bracts are not so long, the leaves are much broader, and the lip is distinctly 3-lobed.

Plate 107. *Eulophia Mackinnoni* Duthie.—An entire plant,—*one-fifth of natural size.* A leaf and portion of flowering scape,—*of natural size.* Fig. 1, single flower seen from below; 2, side view of ditto, with sepals and petals removed; 3, column and spur; 4. lip; *flattened out;* 5, lip and anther *in situ* seen from above; 6, front view of anther; 7, back view of ditto; 8, pollinia;—*all enlarged.*

3. Eulophia explanata Lindl. Gen. and Sp. Orch. 180.

Height of plant 2 to 2·5 dm. *Pseudo-bulb* ovoid, about 5 cm. long, annulated. *Pseudo-stem* 4 to 5 cm. long. *Leaves* young at the time of flowering, lanceolate, acuminate, plicate, attaining 3 dm. in length and 1 dm. in breadth when fully grown, broadly elliptic-lanceolate, acuminate, tapering into a short petiole, 7-veined. *Scape* 2 to 2·5 dm., arising from below the summit of the pseudo-bulb and bearing two loose sheaths at its base. *Raceme* laxly many-flowered; flowering bract shorter than the slender ovary, lanceolate, acuminate. *Flowers* about 2·5 cm. across. *Sepals* and *petals* about equal in length, spreading, yellow with purple lines and blotches, 5-nerved, the nerves with transverse connecting veinlets. *Sepals* spathulate-lanceolate, acute. *Petals* broader, oblong and rounded at the apex. *Lip* a little shorter than the sepals and petals, 3-lobed, subpanduriform when flattened out, adnate by its base to the lateral sepals; basal lobes rounded, erect and forming a conical sac at their base; terminal lobe oblong, with a rounded emarginate apex, the edges deflexed; *disk* with two very prominent crenate lamellæ and with a shorter interposed one, all three abruptly terminating within the margin of the apical lobe. *Column* short, its foot very slightly produced. *Anther* emarginate at the apex; *pollinia* 2, subglobose, attached to a short broad caudicle, and this to a conical gland. Hook. Ic. Pl. 1882; Hook. f. Fl. Br. Ind. vi, 3. *Dipodium scariosum* Herb. Ham.

N.-W. India, *Falconer;* Dehra Dun and up to 3,000 feet on the Mussoorie range, *Mackinnon* (*Duthie's* No. 22710); Sub-Himalayan tracts of Pilibhit and N. Oudh, *Duthie's collector* Nos. 22794, 22801, 23859, 23860; Nepal Terai, *Duthie's collector* No. 23858; Garhwál, *Duthie's collector* Nos. 25791, 25792. Flowers during May. Also in Nepal at Maghada in the Morung, *Buchanan-Hamilton.*

Sir Joseph Hooker regards this plant as an anomalous species with the habit of an Australian *Dipodium.* The upper surface of the lip is white tinged with yellow and beautifully marked with reddish-purple veins.

Plate 108. Eulophia explanata *Lindl.*—An entire plant and a full-grown leaf,—*of natural size.* Fig. 1, a single flower; 2, ditto, *with the sepals and petals removed;* 3, lip, *flattened out;* 4, column; 5, anther; 6 and 7, pollinia;—*all enlarged.*

4. Eulophia Hormusjii Duthie.

Pseudo-stem about 1 dm. long, bearing two tightly-fitting sulcate subacute sheaths. *Leaves* two, developing late, 3 to 3·6 dm. long and 1·5 to 3 cm. in breadth, narrowly elliptic-lanceolate, acuminate, plicate. *Scape* stout, 2 to 3·3 dm. long, rising from the summit of a depressed tuber, clothed at intervals with loose membranous lanceolate acuminate sheathing bracts, many and rather densely flowered. *Flowers* about 2·5 cm. across, spreading and at length deflexed; *floral bract* variable in length, lanceolate, acuminate, membranous, brownish. *Sepals* and *petals* attached to the column, erecto-patent, 12 mm. long, narrowly oblong or oblanceolate, bluntly mucronate, pale green with purple veins. *Lip* with spur a little longer than the sepals and petals; basal portion and side lobes deep purple; side lobes erect, rounded, entire; terminal lobe orbicular, obscurely bifid, yellow, with an undulate erose margin; basal portion of

disk with three parallel lamellæ ending in a coarsely fimbriate patch on the terminal lobe; *spur* slender, curved, cylindric, obtuse, about half as long as the column. *Column* without a foot, curved, constricted in the middle, grooved in front. *Pollinia* oval, attached by a short stout conical caudicle to a small flat gland.

Dehra Dun, *Mackinnon* (*Duthie's* Nos. 22708(*a*), 22724); Kheri district of N. Oudh, *Duthie's collector* No. 22797; Mussoorie range up to 6,000 feet, *Mackinnon* (*Duthie's* No. 22708); common in the pine forests of Jaunsar and Tehri-Garhwál up to 6,000 feet; Bashahr at 7,000 feet, *Lace* No. 880; banks of the Siran river near Abbottabad in Hazára at about 3,000 feet, *Colonel Barrett;* Gujar Valley in the Chitral district, found by Sir W. Gatacre in 1895. It flowers during March and April.

This species is closely allied to *E. campestris*. It differs chiefly by its shorter scapes, larger flowers and the shorter and more dense racemes; the shape of the lip and the general colouring of the flower are also very different. *E. campestris* is essentially a species of the plains of India, whereas *E. Hormusjii* extends up to the temperate region of the Himalaya, where the climatic conditions are more favourable for leaf development. I have named this species after Mr. H. Hormusji Deboo, who has worked for many years as artist in the Botanical Department of Northern India, and by whom all the drawings for this volume have been prepared.

PLATE 109. Eulophia Hormusjii *Duthie*.—A flowering plant,—*of natural size;* a plant with leaves, *reduced to* ½ *size*. Fig. 1, single flower; 2, ditto, *with sepals and petals removed;* 3, lip *spread out;* 4, column and upper portion of ovary; 5, summit of column with anther; 6, side view of anther; 7, pollinia;—*all enlarged*.

5. EULOPHIA CAMPESTRIS Wall. Cat. 7367.

Tuber irregularly oblong, often lobed. *Leaves* two, developing if at all long after the flowers, linear, acuminate, plicate, 2·5 to 4 dm. long, rising from the apex of a slender sheathed pseudo-stem. *Scape* 2·5 to 3 dm., stout or slender, sheathed at intervals by loose membranous acute bracts; *raceme* laxly many-flowered. *Flowers* subsecund, drooping, pink, about 2·5 cm. across; *bract* 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, yellow or green striped with pink. *Petals* narrower, spreading, oblanceolate, 3—5-nerved. *Lip* as long as the sepals, cuneate-obovate or oblong; side lobes short, rounded or subacute, incurved round the column, the margins of a deep rose colour; midlobe orbicular quadrate or oblong, crenulate, usually purple; basal portion of disk with three median lamellate nerves 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* about 2 cm. long, ellipsoid. Lindl Gen. and Sp. Orch. 185; in Journ. Linn. Soc. iii, 24 (excl. syn. Wight); Royle Ill. 366; Reichb. f. in Walp. Ann. vi., 647; Hook. f. Fl. Br. Ind. vi, 4; King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 178, t. 241. *E. rupestris* and *ramentacea* Lindl. in Wall. Cat. 7368, 7370; Gen. and Sp. Orch. 185; in Journ. Linn. Soc. iii, 25. *E. hemileuca* Lindl. in Journ. Linn. Soc. iii, 25. *E. vera* Royle Ill. 370. *Limodorum ramentaceum* Roxb. Hort. Beng. 63; Fl. Ind. iii, 467. *L. dubium* Ham. MSS. *Bletia Dabia* Don Prod. Fl. Nep. 30.

Abundant in many places along the base of the Western Himalaya, Flowers from March till May. It extends throughout the plains of Upper India, southwards to the Deccan and eastwards to Nepal, Sikkim, Bengal and Upper Burma. It occurs also in Afghanistan and Baluchistan.

The wide distribution of this species in India, extending, as it does, from the arid districts of the N.-W. Frontier to the moist regions of Bengal, Sikkim and Upper Burma, accounts for the great variety of forms met with throughout its area. As a rule the specimen from N.-W. India are altogether more robust than those met with farther east. Plate 24 of the Sikkim Orchids represents the more slender condition of the species, and the plant is figured as producing leaves, which rarely develop in the drier parts of India. The tubers of this plant are largely collected in N.-W. India, and are believed to form the bulk of the commercial product known as *Salep-misri*.

6. EULOPHIA NUDA Lindl. in Wall. Cat. 7371.

Tubers large, spherical, smooth. *Leaves* from the side of a tuber, forming by their sheaths a short pseudo-stem, elliptic-lanceolate, acute, 2·5 to 3·5 dm. long, the breadth variable, many-nerved, sheath long and tubular. *Scape* 6 to 9 dm. long, fro mthe base of the pseudo-stem, with a few wide sheaths at the base and several distant ones above. *Raceme* long, laxly flowered. *Flowers* about 3 cm. long, usually pale green variegated with brown and pink; *floral bract* lanceolate, half the length of the stalked ovary. *Sepals* erect, oblong, acute, the lateral pair falcate. *Petals* shorter than the sepals, ovate-oblong, blunt, the outer nerves branching. *Lip* as long as the sepals, deflexed from below the middle, oblong; basal lobes obscure, terminal lobe oblong, obtuse, undulate, the upper surface with many vertical thickened lines disappearing towards the apex; *spur* short, flattened, its mouth ribbed. *Column* short, produced at the base into a long foot dilated at the margins. *Anther* small, its apex with two small conical processes and a third depressed one in front; *pollinia* 2, transversely oblong, attached by a very broad caudicle to a narrow gland. Lindl. Gen. and Sp. Orch. 180; Hook. f. Fl. Br. Ind. vi, 5; in Ann. Roy. Bot. Gard. Calc. v, 32, tt. 47 to 50; King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 180, t. 243; Rolfe in Journ. Linn. Soc. xxxi, 29. *E. bicolor* Dalz. in Hook. Kew Journ. Bot. iii (1851), 343; Dalz. & Gibs. Bomb. Fl. 264; Walp. Ann. vi. 647. *Cyrtopera fusca* Wight Ic. 1690; Lindl. in Journ. Linn. Soc. iii, 31; Thwaites Enum. 429; Walp. Ann. l. c. 668. *Cyrtopera plicata* Lindl. in Wall. Cat. 7362; Gen. and Sp. Orch. 190. *C. nuda* Reichb. f. in Flora (1872) 274. *C. Gardneri* Thwaites Enum. 302. *C. mysorensis* Lindl. in Journ. Linn. Soc. iii., 32. *C. laxiflora* Gard. MSS. ex Thwaites Enum. 302. *Dipodium Roniata* and *D. plicatum* Herb. Ham.

Northern Oudh, in the districts of Kheri and Gonda, *Duthie's collector* Nos. 22793, 24143, 24144. Flowers April to June. It extends southwards to Bombay, Central and S. India and Ceylon, and eastwards to Sikkim, Assam, Burma and China; it is found also in Moulmein.

7. EULOPHIA BICARINATA Hook. f. Fl. Br. Ind. vi, 6.

Tuber oblong, irregularly lobed, compressed, about 5 cm. long. *Leaves* absent at the flowering time, linear, acuminate, long-petioled, length of blade 1·8 to 3 dm. long.

Scape erect, ·5 to 5 dm. high with two tubular closely-fitting sheaths at the base and two shorter loose ones higher up. *Raceme* 7·5 to 12·5 cm. long, rather densely flowered. *Flowers* 2·5 cm. in diam., pale yellowish-green, the lip tinged with pale purple; *floral bract* membranous, lanceolate, shorter than the stalked ovary. *Sepals* oblong, acute, keeled, their edges reflexed; lateral pair wider than the dorsal and free from it at their bases. *Petals* elliptic, subacute, shorter but wider than the sepals. *Lip* adnate to the foot of the column, longer than the sepals, slightly saccate at the base, 3-lobed; lateral lobes shallow, with blunt apices; terminal lobe transversely oblong, emarginate, the edges slightly crisped; the disk between the side lobes with two short smooth thickened lines half as long as the latter and ending in a free triangular tooth in front of which rise five carunculate unequal ridges extending to the base of the terminal lobe. *Column* with a foot half as long as itself and at right angles, edges lobed opposite the stigma. *Anther* apiculate in front; *pollinia* broadly triangular, divergent, attached by a broad caudicle to a thin angular gland. King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 180, t. 244. *Cyrtopera bicarinata* Lindl. in Wall. Cat. 7363; Gen. and Sp. Orch. 189; Journ. Linn. Soc. iii, 31 (excl. cit. Ic. Griff.). *Epipactis bicarinata* Buch.—Ham. ex Wall. Cat. 7363. *Cymbidium sp.* Griff. Notul. iii, 343, No. 9.

In the Sub-Himalayan tracts of Pilibhit in Rohilkhund, and of the Kheri district of N. Oudh, *Duthie's collector* Nos. 22798 and 25803. Flowers during March and April. It extends eastwards to Sikkim, the Khasia Hills, Assam, Manipur and Upper Burma.

8. EULOPHIA FLAVA Hook. f. Fl. Br. Ind. vi, 7.

A tall robust plant with a tuberous rhizome. *Leaves* about 3, forming when young a short pseudo-stem by their sheathing bases, developing later than the flowers, attaining when fully grown 12 dm. in length and about 10 cm. in width. *Scape* stout, 6 to 15 dm. high, clothed at the base with a few distant close-fitting sheaths, emerging from a tuber alongside the leaf-bearing pseudo-stem. *Raceme* 3 to 6 dm.; *bracts* much shorter than the ovary, 1 to 2 cm. long, ovate-lanceolate, acuminate. *Flowers* numerous, large, drooping, lemon-coloured. *Sepals* about 3 cm. long, oblong-lanceolate, acuminate. *Petals* a little shorter than the sepals and much broader, obtuse or emarginate, many-nerved. *Lip* as long as the sepals; side lobes large, rounded, spotted with purple at the base, their margins recurved; midlobe oblong, the disk with two small pyriform basal calli and three crenate lamellæ. *Spur* a short blunt sac. *Column* about 2 cm. long, produced at the base into a short foot. *Anther* with an emarginate apex and a long anterior process; *pollinia* obtusely angled, attached by a stout broad-based caudicle to a broad shallow gland. *Cyrtopera flava* Lindl. in Wall. Cat. 7364; Gen. and Sp. Orch. 189; Royle Ill. 370, t. 88, fig. 1; Reichb. f. in Gard Chron. (1870), 1407; Rolfe in Journ. Linn. Soc. xxxvi. 28. *C. Culleni* Wight Ic. 1754; Walp. Ann. vi, 667. *Dipodium flavum* Herb. Ham.

Dehra Dun, *Royle*, *Mackinnon* (*Duthie's* No. 22725); Sub-Himalayan tracts in Rohilkhand and N. Oudh, *Duthie's collector* Nos. 22795, 24142; outer ranges of Garhwál, *Duthie's collector* Nos. 25790, 25804, 25805, 25806; Kumaon, below Almora 4,500 feet, *Strachey & Winterbottom* No. 20; Sarju Valley, *T. Thomson*. Flowers in June and July. It extends eastwards to Nepal, and is found also in Travancore and Hongkong.

PLATE 110. Eulophia flava *Hook. f.*—Entire plant, *reduced to* $\frac{1}{5}$ *in size.* Portion of inflorescence,—*of natural size.* Fig. 1, single flower; 2, ditto, *with sepals and petals removed;* 3, lip, *spread out;* 4, front view of column; 5, front view of anther; 6, side view of ditto; 7, pollinia;—*all enlarged.*

9. EULOPHIA OBTUSA Hook. f. Fl. Br. Ind. vi, 3.

Height of plant 9 to 15 dm., the leaves and scape rising from a horizontal oblong tuber. *Pseudo-stem* formed by the sheaths enclosing the bases of the leaves and scape. *Leaves* two or three, 3 to 4·5 dm. long, linear, acuminate, plicate, veins sharply prominent. *Scape* exceeding the leaves, with a few long tight-fitting acuminate sheaths towards the base. *Flowers* 6 to 10, in a lax raceme, appearing with the leaves, 2·5 cm. across, erect in bud, drooping and campanulate when open; *floral bract* lanceolate, acuminate, less than half the length of the ovary. *Sepals* and *petals* prominently veined on the back, bright yellow outside and pale lemon-coloured within. Dorsal *sepal* obovate acute, 2 cm. long; lateral rather shorter, falcately oblong, obtuse or subacute, adnate to the base of the column. *Petals* obovate, obtuse, about as long as the lateral sepals. *Lip* 3-lobed, longer than the sepals, with a short curved subacute spur at the base; side lobes large, erect, rounded, pale yellow tinged with lilac; midlobe bent upwards, and with a reflexed undulate margin, suborbicular when flattened out; disk with 5 to 8 prominent ridges terminating within the margin of the apical lobe in an oblong grooved callus, and prolonged at the base into two sets of finger-like projections. *Column* about 1 cm. long, oblong, narrowly winged, curving into a short foot at the base. *Anther* with a rounded or slightly emarginate apex and a long anterior projection; *pollinia* subglobose, attached by a cylindric caudicle to a subfimbriate triangular gland. *E. arundinacea* Falc. Ic. No. 46 (ined,) in Herb. Kew. *E. campanulata* Duthie in Journ. As. Soc. Beng. lxxi, part 2 (1902), 39. *Cyrtopera obtusa* Lindl. Gen. and Sp. Orch. 190.

Valleys in the neighbourhood of Mussoorie, *Royle;* Dehra Dun in swamps, *W. Bell, Mackinnon* (*Duthie's* No. 22722), *Duthie;* Pilibhit district in Rohilkhand, *Duthie's collector* Nos. 25793 to 25801; Chandanpur in the Gonda district of N. Oudh, *Duthie's collector* 22793. Flowers during July and August.

Since my return from India this year, I have had an opportunity of examining at the Royal Herbarium, 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*, and I have now no hesitation in referring to it the *E. campanulata* Duthie, published last year in the *Journal of the Asiatic Society of Bengal.* Lindley described the column correctly as having a produced foot, and I have therefore placed it here in the *Cyrtopera* section of the genus. It is closely allied to *E. flava*, differing chiefly by its much narrower leaves, smaller flowers and in the shape of the spur. It somewhat resembles *E. Mannii* Hook f., which, in regard to the length of the foot of the column, might well have been placed in the *Cyrtopera* section. In both of these species the narrow leaves, the short, acute spur, as well as the anther, pollinia and gland are very similar. The locality "ad ripas fluminis Tonse prope Deokhutal," mentioned in Lindley's Gen. and Sp. Orch. 190, refers to *E. flava* and not to *E. obtusa.*

PLATE 111. Eulophia obtusa *Hook. f.*—Entire plant, *reduced to* $\frac{1}{4}$. Portion of flowering stem,—*of natural size.* Fig. 1, single flower; 2, ditto, *with sepals and petals removed;* 3, lip, *spread out ;* 4, column; 5, anther, *front and side views;* 6, pollinia, *front and back views ;—all enlarged.*

14. Geodorum Jackson.

Terrestrial herbs with underground subglobose rhizomes. *Leaves* elliptic, plicate, their sheaths forming a pseudo-stem. *Scape* from the base of the pseudo-stem, stout, erect, sheathed, bearing a decurved corymbose raceme. *Flowers* rather crowded and narrow, about 15 mm. long. *Sepals* equal, oblong, subacute, erect. *Petals* as long as the sepals, but broader and blunt. *Lip* sessile on the base of the column, broadly ventricose at the callus-bearing base, without side lobes; apex broad, rounded bifid or emarginate. *Column* shorter than the lip. *Anther* broad, 2-celled; *pollinia* 2, broadly and dimidiately ovoid, attached by a slender tapering caudicle to a small orbicular gland.—Species about 10; Indian, Malayan, Chinese and Australian.

GEODORUM PURPUREUM R. Brown in Ait. Hort. Kew. ed. 2, v, 207.

Tuber globose, apiculate, about 3 cm. in diam. *Pseudo-stem* 7·5 to 15 cm. long. *Leaves* broadly elliptic, acute, tapering to the long sheath, 1·5 to 3 dm. long and 7·5 to 10 cm. broad. *Inflorescence* shorter than the leaves; *raceme* short, corymbose, drooping when in flower, but erect in fruit; *floral bract* large, lanceolate, longer than the ovary. *Flowers* white or pale purple about 15 mm. long. *Sepals* linear-oblong, acute, 3-nerved. *Petals* broader, 5-nerved, with thickened midribs. *Lip* very ventricose at the base and much thickened, the rounded minutely notched apical lobe also much thickened; disk with a conspicuous yellow callus at the base from which extends a broad channelled ridge towards the granulated apex. *Anther* with a 3-lobed apex, puberulous; *pollinia* 2, with elongate pits on their posterior surface, caudicle broad. Lindl. Gen. and Sp. Orch. 475; Dalz. & Gibs. Bombay Fl. 266; Hook. f. Fl. Br. Ind. vi, 16; King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 181, t. 245. *G. dilatatum* Wall. Cat. 7376. *Limodorum nutans* Roxb. Cor. Pl. i, t. 40; Fl. Ind. iii, 470. *Malaxis nutans* Willd. Sp. Pl. iv, 93.

Dehra Dun, *Mackinnon's collector.* Flowers during June and July. It extends eastwards to Nepal, Sikkim and Bhutan, and south to Malabar and the Konkan, also in the Andaman Islands and the Malay Peninsula.

15. Oreorchis Lindl.

Terrestrial; *pseudo-bulb* corm-like, broadly ovoid, 1- or 2-leaved. *Leaves* long, narrow. *Scape* tall, slender, produced from the side of the pseudo-bulb. *Flowers* rather small, in racemes. *Sepals* ovate-lanceolate. *Petals* subsimilar and slightly spreading or subconnivent. *Lip* more or less oblong, attached to the base of the column by a short narrow claw, gibbous at the base or not, anterior part 3-lobed; side lobes short, entire; terminal lobe broad, more or less bifid. *Column* elongated, stout, ore mor less curved, the apex subtruncate. *Anther* 1-celled. *Pollinia* 4, globose,

united to a short common caudicle ending in a gland derived from the stigma (sessile in *O. indica*).—Species 5; all inhabiting Northern Asia.

Leaf solitary, flowers reddish :—
- Flowers stalked, lip saccate at the base . . . . 1. *O. foliosa.*
- Flowers larger and sessile, lip not saccate at the base 2. *O. indica.*

Leaves 2 or 3, flowers white or pale yellow :—
- Lip not saccate at the base, basal callus linear . . 3. *O. micrantha.*
- Lip saccate at the base, basal callus oval . . . . 4. *O. Rolfei.*

1. Oreorchis foliosa Lindl. in Journ. Linn. Soc. iii, 27.

Pseudo-bulb about 1·5 cm. long, broad-based and bearing a few lax root-fibres. *Leaf* solitary, terminal, 1 to 2·3 dm. long, oblong-lanceolate, acuminate, narrowed at the base to a short petiole, with two or three prominent nerves and a few slender ones between. *Scape* 3 to 4½ dm. long, the peduncle with two or three tubular closely-fitting sheaths 2·5 to 5 cm. long. *Raceme* 7·5 to 20 cm. long, laxly few-flowered; *floral bract* small, equalling the short pedicel of the ovary. *Flowers* 13 mm. across, subsecund, yellowish tinged with red. *Sepals* ovate-lanceolate, subacute, the lateral pair produced at the base on to the sac of the lip. *Petals* shorter but broader than the sepals, all more or less connivent. *Lip* longer than the sepals, deflexed from below the middle, clawed and shortly saccate at the base; side lobes broadly and obliquely oblong, obtuse, entire, 3-nerved, terminal lobe subreniform (when flattened out), shortly bifid, the margin thickened and erose; disk with five stout branching nerves, but not lamellate. *Column* slightly curved; the sides thickened, especially towards the base and passing into the short sac of the lip. Hook. f. Fl. Br. Ind. v, 709; King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 183, t. 137; Collett Fl. Siml. 493; Rolfe in Journ. Linn. Soc. xxxvi, 9. *Corallorhiza sp.* Lindl. in Royle Ill. Him. Bot. 362.

Simla Hills 7—9,000 feet, *Stoliczka*, *Gamble* Nos. 4429, 6251; *Lace* No. 2160, *Collett;* Jaunsar, *Osmaston* (*Duthie's* No. 24188), *Gleadow;* Garhwál, *Royle;* flowering in July. It extends eastwards to Sikkim, and occurs also in China, in Western Szechuen and on the Tibetan frontier.

2. Oreorchis indica Hook. f. Fl. Br. Ind. v, 709.

Rhizome bearing one or two ovoid annulated pseudo-bulbs from the bases of which several stout fibrous roots are given off. *Leaf* solitary, narrowly lanceolate, about 2·5 cm. broad, developing later than the flowers. *Scape* about 2 dm. long, rather stout, the peduncle bearing a few loose acuminate sheaths; *floral bract* lanceolate, acuminate, shorter than the ovary. *Flowers* many, sessile, about 17 mm. long. *Sepals* and *petals* yellow veined and blotched with reddish-purple. Dorsal *sepal* linear-lanceolate, 11 mm. long, lateral subfalcately lanceolate, 10 mm. long. *Petals* a little shorter than the sepals, subfalcately blong, obtuse. *Lip* deflexed from the middle, clawed, not saccate at the base; side lobes ear-shaped, incurved, obtuse; midlobe rounded, entire or 2-lobed; the disk with a raised lamella midway between the side lobes. *Column* dilated at the base and apex, curved, shorter than the lip, yellow with reddish-purple spots. Lip of *anther* with two projecting teeth; *pollinia* sessile on the gland, obovoid,

subcompressed. Collett Fl. Siml. 493. *Corallorhiza indica* Lindl. in Journ. Linn. Soc. iii, 26 (not of Dcne.).

Hattu near Simla 7,000 feet, *T. Thomson* No. 1724, *Gamble;* Chachpur Valley the Simla Hills 6,000 feet, *Duthie* No. 21074; Jaunsar 8-9,000 feet, *Edgeworth* No. 61; 6-7,000 feet, *Duthie* No. 14592; Garhwál 8-9,000 feet, *Royle.* Flowers in August.

The shape of the pollinia in this species and the absence of a caudicle are remarkable. The claw of the lip and the lamella are pale yellow, the side lobes are marked with purple lines and spots, and the apical lobe is white and often tinged with pale purple.

PLATE 112. Oreorchis indica *Hook. f.*—A plant,—*of natural size.* Fig. 1, single flower; 2, ditto *with lip removed;* 3, flower *with sepals and petals removed;* 4, lip *spread out;* 5, anther; 6, pollinia;—*all enlarged.*

3. OREORCHIS MICRANTHA Lindl. Journ. Linn. Soc. iii, 27.

Pseuao-bulb about 2 cm. long, ovoid-conic, the base with a few fibres. *Leaves* two or three, 1·5 to 3 dm. long, linear, prominently 1- or 2-nerved. *Scape* from the side of the pseudo-bulb, the peduncle with two or three tubular sheaths; *raceme* few-flowered, lax, 5 to 10 cm. long; *floral bract* minute, subulate, hairy, much shorter than the ovary. *Flowers* almost sessile, 1 cm. in length, pale yellow, the lip being white spotted with purple. *Sepals* linear-lanceolate, acute, slightly spreading, the lateral pair a little shorter and broader than the dorsal and subfalcate. *Petals* shorter than the lateral sepals, sometimes spotted with purple. *Lip* obovate-oblong, not saccate at the base, deflexed from the top of the very short claw; side lobes narrowly oblong, erect; terminal lobe broadly obovate, 2-lobulate; disk with a thick, linear channelled callus. *Column* much curved, the base dilated and concave. *Pollinia* globular, united to a short thick caudicle. Hook. f. Fl. Br. Ind. v, 709; King & Pantl. in Ann. Roy. Bot. Gard. Calc. 183, t. 138; Collett Fl. Siml. 493.

Simla Hills 7 to 8,000 feet, *Gamble* Nos. 4427, 6250, *Lace* 2159, *Babington-Smith;* Jaunsar, *Osmaston;* Mussoorie Hills 5 to 6,000 feet, *King*, *Mackinnon;* Kumaon, *T. Thomson* No. 214, *Strachey & Winterbottom* No. 56. Flowers during June.

4. OREORCHIS ROLFEI Duthie in Journ. As. Soc. Beng. lxxi, part 2, 38

Pseudo-bulb globose. *Leaves* two or three, about 2 dm. long, linear-lanceolate, deflexed at the tips, 3—5-nerved, plicate. *Scape* about as long as the leaves, rising from near the top of the pseudo-bulb; *peduncle* firm, clothed with three or four closely-fitting tubular sheaths. *Raceme* many-flowered, 6 to 7 cm. long. *Flowers* sessile, rather crowded, about 1·4 cm. across; *floral bract* minute, less than half the length of the ovary. *Sepals* about equal, 1·4 cm. long, lanceolate, subacute, pale yellowish-green, slightly spreading *Petals* as long as the sepals but narrower, oblanceolate, subacute, pure white with a few dark purple blotches. *Lip* obovate-oblong (when spread out), narrowed at the base into a sac-like claw; side lobes linear, fleshy, white, half the length of the midlobe and free almost to their bases; midlobe deflexed, white and blotched like the petals with dark

purple spots, the apex with a shallow sinus, the disk with a prominent fleshy oval callus at its base. *Column* curved, dilated at the base, concave in front. *Pollinia* globular, united to a short thick conical caudicle.

Nág Tiba in Tehri-Garhwál at an elevation of about 8,000 feet, *Mackinnon's collector*. Flowers in June.

This species is most nearly allied to *O. micrantha*, but the lip is saccate at the base, and the basal callus is oval and not linear; both the lip and the petals are pure white spotted with purple, and the side lobes of the lip are free to the base. The spike is shorter and the flowers are more crowded. At present this plant is known only from a single locality, in the neighbourhood of Mussoorie.

PLATE 113. Oreorchis Rolfei *Duthie*.—Plant,—*of natural size*. Fig. 1, single flower; 2, ditto, *with sepals and petals removed;* 3, lip, *spread out;* 4, column, *with portion of ovary;* 5, front view of ditto; 6, anther; 7, pollinia;—*all enlarged*.

16. Corallorhiza R. Brown.

Leafless reddish-brown erect terrestrial herbs with jointed coralloid rhizomes. *Scape* simple, sheathed. *Flowers* small, whitish or pale yellow, in a terminal spike or raceme. *Sepals* and *petals* subequal, linear; *petals* ascending incurved. *Lip* clawed, adnate to the base of the column, erect, entire or 3-lobed; *spur* minute or absent. *Column* erect, incurved. *Anther* 4-celled; *pollinia* 4 ovoid, soft, cohering by a viscus.—Species about 12, in N. temperate regions.

CORALLORHIZA INNATA R. Brown in Hort. Kew. v, 209.

A rootless parasite with a flattened reddish-brown succulent rhizome. *Scape* 6-10 in long, slender, few-flowered, clothed with loose sheaths. *Flower* nearly sessile, about 7 mm. long; *bracts* minute. *Sepals* ovate-lanceolate, the lateral ones deflexed. *Lip* deflexed, 3-lobed, with a shallow nectary at the base; side lobes narrow, mid-lobe retuse. *Anther* dehiscing transversely, each cell containing an unequal pair of waxy pollinia. *Capsules* large, deflexed. Lindl. Gen. and Sp. Orch. 533; Reichb. Ic. Pl. Germ. xiii, 490; Hook. f. Fl. Br. Ind. v, 710; Rolfe in Journ. Linn. Soc. xxxvi, 9. *C. Jacquemontii* Dcne. in Jacquem. Voy. Bot. 165, t. 165.

Kashmir; *Jacquemont, C. B. Clarke* No. 28943, up to 11,500 feet, extending to Europe, N. Asia & N. America.

17. Cymbidium Swartz.

Epiphytes, rarely terrestrial or with an elongated leaf-bearing stem. *Leaves* usually very long, narrow and coriaceous, rarely none or rudimentary at the time of flowering. *Inflorescence* from the side of the pseudo-stem; *scape* loosely sheathed. *Flowers* one to many, often large, in suberect or drooping racemes. *Sepals* and *petals* subequal, free, spreading or erect. *Lip* adnate to the base of the column and embracing it by its convolute side lobes; apical lobe decurved, often with undulate edges, the disk usually with two ridges or lamellæ. *Column* long, without a foot. *Anther* 1- or imperfectly 2-celled; *pollinia* 2, ovoid pyriform cuneiform or globular, more or less

partite, sessile on a small or large often strap-shaped gland.—Species about 60, in temperate, tropical or subtropical Asia, a few in Africa and in Australia.

Terrestrial :—	
Leafless and parasitic	*1. C. macrorhizon.*
Leaves linear, their bases forming a short pseudo-stem :—	
Flowers solitary	*2. C. Mackinnoni.*
Flowers in racemes	*3. C. cyperifolium.*
Epiphytal, inflorescence decurved :—	
Flowers not exceeding 3·5 cm. across :—	
Inflorescence less than half the length of the leaves, leaves entire at the apex	*4. C. pendulum.*
Inflorescence nearly as long as the leaves, leaves notched at the apex	*5. C. aloifolium.*
Flowers much larger :—	
Leaves narrowly linear	*6. C. longifolium.*
Leaves lanceolate, acuminate	*7. C. giganteum.*

1. Cymbidium macrorhizon Lindl. Gen. and Spec. Orch. 162.

A terrestrial parasite without leaves. *Rootstock* as thick as a goose-quill, creeping, branched and jointed. *Scape* very short, basal sheaths short, or elongating to 5 cm. and narrowly subfoliaceous. *Raceme* 6—8-flowered, 1·5 to 2·3 dm. long; *bracts* 7 to 12 mm., narrow, membranous. *Flowers* 3 to 4 cm. in diam. *Sepals* about 2 cm. long, linear-lanceolate, acuminate, pale yellow tinged with pink, spreading or reflexed. *Petals* erect, slightly shorter and broader, whitish streaked with pink. *Lip* 1·7 cm., white spotted with crimson; side lobes narrow, erect, rounded and with inflexed margins; midlobe oblong or subpanduriform; disk with two thick ridges between the side lobes. *Column* elongate, curved, about 12 mm. long, inner surface streaked with crimson. *Anther* papillose outside; *pollinia* 4, plano-convex, sessile on the crescent-shaped gland. Royle Ill. Him. Bot. 366; Hook. f. Fl. Br. Ind. vi, 9.

N.-W. India; *Royle, Falconer*; Dehra Dun; on Kalanga Hill, *Mackinnon's collector*; Mussoorie on Banog Hill 7,500 feet, *Mackinnon* (*Duthie's* No. 22717); Garhwál east of Tehri, *Mackinnon's collector* (*Duthie's* No. 25403); Sarju Valley in Kumaon, *Duthie's collector* No. 24098; reported also from Kashmir. Flowers during July and August. It extends eastwards to Assam and to the Khasia and Naga Hills. In Sikkim it has been collected in the Ranjit Valley, but not since 1879.

Plate 114. Cymbidium macrorhizon *Lindl.*—A plant,—*of natural size.* Fig. 1, single flower 2, column and lip; 3, lip; 4, front view of column; 5, anther; 6 and 7, pollinia; —*all enlarged.*

2. Cymbidium Mackinnoni Duthie in Journ. As. Soc. Beng. lxxi, pt. 2, 41.

Terrestrial, cœspitose. *Pseudo-stem* short, emitting many thick spongy roots. *Leaves* linear, acuminate, 3 to 4 dm. long and about 1·3 cm. broad, the lowest reduced to membranous sheaths, margins not serrulate. *Scape* 1-flowered, much shorter than the leaves, clothed to the base with loose lanceolate acuminate cymbiform hyaline sheaths. *Floral bract* longer than the much curved ovary, pale yellow with purple veins. *Flowers*

about 5 cm. across, nodding. Sepals and petals spreading, green. *Sepals* lanceolate, obtuse, a little longer than the petals. *Petals* elliptic-lanceolate, obtuse, 5-nerved. *Lip* about as long as the petals, obovate-oblong (when spread out), 3-lobed, saccate at the base, pale yellow, blotched with purple; lateral lobes narrow, erect; the terminal one abruptly deflexed, rounded at the apex and nearly entire; disk with two raised incurved smooth lamellar flaps extending from the base to a little beyond the side lobes, their edges nearly parallel but not meeting. *Column* short, stout, auricled at the base, concave in front marked with purple blotches like the lip. *Pollinia* 4, obliquely obovoid, plano-convex, attached to a hemispherical gland. Ripe *capsule* 1·5 dm. long (including the long pedicel), ellipsoid clavate, prominently ribbed.

Discovered by Mr. P. W. Mackinnon, near Mussoorie, at an elevation of about 5,500 feet, growing under trees and flowering during the month of February; *Duthie's* Nos. 22709, 24152.

This species is very nearly allied to *C. virescens* Lindl., a native of Japan. In the latter, however, the margins of the leaves are distinctly serrulate, the flowers are larger and the bracts on the scape are more numerous and more tinted; the lamellæ on the disk of the lip are much curved and nearly parallel to the margins of the lateral lobes. Of Indian species it most nearly resembles *C. cyperifolium*. The latter, however, is a much larger plant, the scape is more than 1-flowered, and the colouring of the lip and the shape of the pollinia and that of gland are very different; also the margins of the leaves are serrulate, and the sheaths on the scape as well as the floral bract are green.

PLATE 115. Cymbidium Mackinnoni *Duthie*.—Portion of plant,—*of natural size*. Fig. 1, side view of flower, *with sepals and petals removed;* 2, lip and column; 3, pollinia;—*all enlarged;* 4, ripe capsule,—*of natural size*.

3. CYMBIDIUM CYPERIFOLIUM Wall. Cat. 7353 (in part).

Terrestrial; *pseudo-stem* thin, short. *Leaves* up to 7·5 dm. long, linear, finely acuminate, slightly expanded towards the sheathing base, the lowest ones short and sheath-like, margins serrulate. *Inflorescence* from the base of the pseudo-stem, erect, about 3 dm. long, the peduncle clothed with long acuminate sheaths up to the base of the raceme. *Flowers* green, with dull purple markings on the lip and column, 2·5 cm. long, and about 3·5 cm. across; *floral bract* green, lanceolate, acuminate, longer than the stalked ovary. *Sepals* subequal, linear-lanceolate, acute, spreading. *Petals* rather shorter and somewhat broader. *Lip* as long as the petals, oblong (when spread out), glabrous, 3-lobed; lateral lobes long, narrow, erect; terminal lobe abruptly deflexed, ovate or oblong-ovate, entire, the disk between the side lobes with two smooth lamellar incurved flaps, their edges parallel but not touching. *Column* rather stout. *Anther* broad; *pollinia* obliquely ovoid, divergent, cleft nearly to the base, sessile on a very narrow elongate gland. *Capsule* ellipsoid-clavate, about 6 cm. long. Lindl. Gen. and Sp. Orch. 163; in Journ. Linn. Soc. iii, 28; Hook. f. Fl. Br. Ind. vi, 13 (excl. syn. *Limodorum longifolium* Roxb.); King & Pantling in Ann. Roy. Bot. Gard. Calc. viii, 186, t. 248. *C. viridiflorum* Griff. Itin. Notes 126, No. 454.

Near Mussoorie, growing amongst dense undergrowth at about 6,000 feet, *Mackinnon* (*Duthie's* Nos. 21743, 22719), flowering during March and April; Garhwál and Kumaon at 5,000 feet, *Edgeworth*. It extends eastwards to Sikkim, the Khasia and Naga Hills, Manipur and Upper Burma, and is found also in Perak and Java.

4. Cymbidium pendulum Swartz in Nov. Act. Upsal. vi, 73.

Pseudo-stem stout, 7·6 cm. long. *Leaves* linear-oblong, acute, not notched, up to 7·5 dm. long and from 1·5 to 2 cm. broad, expanding into basal sheaths. *Inflorescence* 2·5 to 3 dm., decurved from the base, the peduncle about 7·5 cm., clothed with many imbricate sheaths. *Flowers* many, not crowded, dark purplish-brown, about 3 cm. across; *floral bract* minute, triangular, the ovary with stalk 1·3 cm. *Sepals* equal, oblong, slightly dilated near their blunt apices. *Petals* nearly as long as the sepals and a little wider, margined with yellow as are the sepals. *Lip* adnate to the short foot of the column, oblong, dilated and subsaccate at the base; side lobes narrow, their apices blunt and directed forwards; terminal lobe oblong, blunt, emarginate, much decurved; disk between the side lobes with two parallel continuous lamellæ divergent at the base, meeting in the middle and slightly separating at their clavate apices. *Column* erect, narrower above, with a very short foot. *Anther* broad, depressed, minutely papillose; *pollinia* ovoid, acute, diverging, essile on a broad thin shallow gland. Roxb. Fl. Ind. iii, 458; Lindl. Gen. and Sp. Orch. 165; Walp. Ann. vi, 642 (excl. cit. Bot. Reg.); King & Pant. in Ann. Roy. Bot. Gard. Calc. viii, 188, t. 251; Rolfe in Journ. Linn. Soc. xxxvi, 31. *C. aloifolium* Hook. f. Fl. Br. Ind. vi, 10 (in part). *C. crassifolium* Wall. Cat. 7357. C. *Mannii* Reichb. f. in Flora 1872, 274. *Epidendrum pendulum* Roxb. Cor. Pl. i, 35, t. 44.

Káli Valley in Kumaon at a low elevation, *Duthie's collector* No. 24097. Flowers in May or June. It extends eastwards to Bengal, Sikkim, Assam, Sylhet, Burma and China; and is found also in S. India, the Andaman Islands and Perak.

5. Cymbidium aloifolium Swartz in Nov. Act. Upsal. vi, 73.

Pseudo-stem short. *Leaves* 3 to 5·5 dm. long and about 3 cm. broad, linear-oblong, curved, obtuse, fleshy, obliquely notched at the apex, slightly expanded at the sheathing base. *Inflorescence* from the base of the small pseudo-stem, somewhat shorter than the leaves, peduncle 7·5 to 10 cm. long, bearing several tubular acute scarious sheaths near the base; *raceme* many-flowered, decurved, 3 to 4 dm. long. *Flowers* 3·5 cm. across; *floral bract* minute, ovate, the stalked ovary about 12 mm. long. *Sepals* subequal, oblong or slightly oblanceolate, blunt. *Petals* as long as the sepals, ovate-oblanceolate, blunt. *Lip* as long as the sepals, oblong, 3-lobed, its upper surface with two lamellæ broken and disconnected in the middle; the lateral lobes long, narrow, their apices blunt, entire, pointing forwards; apical lobe ovate-oblong, much decurved. *Column* slightly thickened at the apex. *Anther* subquadrate, papillose, the gland of the pollinia small. *Capsule* elliptic, 8 to 9 cm. long. Swartz in Schrad. Journ. Bot. 1779, ii., 218; Roxb. Fl. Ind. iii, 458; Lindl. Gen. and Sp. Orch. 165; Lodd. Bot. Cab. t. 967; Walp. Ann. vi, 624 (excl. Ic. Wight); Hook. f. Fl. Br. Ind. vi, 10; King & Pantl. in Ann. Roy. Bot Gard. Calc. viii, 189, t. 252. *Epidendrum aloifolium* Linn. Sp. Pl. 953. ? *Aerides Borassi* Smith in Rees Cyclop. Suppl. (in part). *Epidendrum aloides* Bot. Mag. t. 387.

Bahraich district of N. Oudh near the Nepal frontier, *Duthie's collector* No. 23865: flowering during April and May. It extends eastwards to Bengal, Sikkim and Assam, and occurs also in S. India, Ceylon, the Andaman Islands and Perak.

6. CYMBIDIUM LONGIFOLIUM Don Prod. 36.

Pseudo-stem short. *Leaves* 6 to 9 dm. long and only 13 to 15 mm. wide, linear, acuminate, channelled below, dilated and equitant at the very base. *Inflorescence* very stout, sub-erect in the lower but decurved in the upper half, shorter than the leaves, the peduncle sheathed nearly to the apex, sheaths larger upwards, all loose and acute. *Raceme* 10- to 15-flowered. *Flowers* 6·4 to 7·6 cm. across; *floral bract* minute, triangular. *Sepals* subequal, oblong, subacute, thedorsal broader and incurved, lateral pair spreading. *Petals* as long as the sepals, but narrower, spreading. *Lip* oblong, shortly clawed; side lobes long, narrow, acute, directed forwards; terminal lobe decurved, orbicular, acute, the edges slightly undulate, pubescent on its upper surface. *Column* erect, slightly saccate at the base. *Anther* broad, dome-like; *pollinia* ovate, diverging, sessile on a quadrate gland the lower corners of which are elongated into narrow points. *Ovary* stalked, about 2·5 cm. long. Wall. Cat. 1356; Lindl. Gen. and Sp. Orch. 163; in Journ. Linn. Soc. iii, 29; Reichb. f. in Gard. Chron. 1874 i, 14; Hook. f. Fl. Br. Ind. vi, 13; King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 191, t. 254; Rolfe in Journ. Linn. Soc. xxxvi, 31. *C. erythræum* Lindl. in Journ. Linn. Soc. iii, 30. *Limodorum angustifolium* Herb. Ham.

Kumaon at 5 to 6,000 feet, *Blinkworth*. Eastwards to Sikkim, Bhutan and the Khasia and Naga Hills; also in China. In Sikkim it flowers during September and October.

In this plant the sepals and petals are brownish-purple on a pale green ground, the dorsal sepals being dark green outside and faintly striped with purple; the disk and apical lobe of lip are pure white spotted with purple, the side lobes being of a dull yellow closely lined with purple.

7. CYMBIDIUM GIGANTEUM Wall. Cat. 7355.

Pseudo-stem very short. *Leaves* 4 to 6 dm. long, and 2 to 3 cm. broad, linear-oblong, acute, entire, narrowed towards the base and then dilated and equitant. *Inflorescence* from the base of the pseudo-stem, as long as or longer than the leaves, decurved; peduncle stout, enveloped at the base in numerous imbricate acuminate sheaths; *raceme* laxly 10- to 20-flowered. *Flowers* 6·4 to 7·6 cm. across; *floral bract* minute, broad. *Sepals* subequal, elliptic-oblong, subacute, the dorsal one incurved, lateral pair spreading. *Petals* as long as the sepals but narrower, oblong, subacute. *Lip* shorter than the sepals, 3-lobed, more or less puberulous; lateral lobes large, their apices elliptic and directed forward; apical lobe deflexed, ovate-oblong, subacute, the edges undulate-crenate; upper surface with two parallel ridges running from the base nearly to the apex, hairy and separated by a small groove. *Column* somewhat curved, its base below the insertion of the lip with a small nectar-bearing sac. *Anther* slightly scabrid. *Pollinia* ovoid, acute, diverging, sessile on a quadrate gland. *Capsule* 7·5 cm. long, elliptic, pointed at each end, prominently ridged. Lindl. Gen. and Sp. Orch. 163; Sert. Orch. t. 4; Bot. Mag. t. 1844; Paxt. Mag. Bot. 241, and Fl. Gard. ii, 14, fig. 143; Griff. Notul. iii, 341: Walp. Ann. vi, 626; Warner Orch. Alb. vi, t. 284; Hook. f. Fl. Br. Ind. vi, 12; King & Pantl. in Ann. Roy. Bot. Gard., Calc. viii, 191, t. 255. *Iridorchis gigantea* Blume Orch. Archipel. Ind. 76, t. 26. *Limodorum longifolium* Ic. Ham.

Garhwál at 4,000 feet, *Mackinnon;* Kumaon 4,000 feet, *Strachey & Winterbottom* No. 26, flowering from October to December. It extends eastwards to Nepal, Sikkim, Bhutan and the Khasia Hills.

The flowers are of a dingy yellow colour with vertical lines of brown, and the lip has broad transverse dark brown blotches; the sepals are greenish externally.

18. Doritis Lindl.

Epiphytic, with short stems and no pseudo-bulbs. *Leaves* flat, coriaceous. *Inflorescence* from the side of the stem or axillary, erect or pendulous. *Flowers* in loose racemes. *Sepals* and *petals* widely spreading. *Lip* clawed or sessile, adnate to the foot of the column, spurred, more or less lobed, side lobes erect, disk usually with a forked plate or callus. *Column* narrowly winged, its foot long and forming with the sides of the lip a conical sac bearing the lateral and apical lobes at its mouth.—Species 5, Indian, Chinese and Malayan.

Doritis tænialis Benth. in Gen. Plant. iii, 574.

Roots numerous, long and flat, forming large tufts. *Leaves* few, pendulous, often solitary, sometimes absent, 7·6 to 12·6 cm. long, narrowly elliptic-oblong, acute, tapering to the sessile base. *Racemes* 6- to 8-flowered, longer than the leaves, pendulous. *Flowers* about 2 cm. across, purple or occasionally pure white; *bract* minute, broadly triangular. *Sepals* unequal, blunt, the dorsal one oblong or slightly oblanceolate; lateral pair broader, elliptic, blunt. *Petals* shorter than the sepals, obovate, blunt. *Lip* adnate to the foot of the column, shorter than the petals; *hypochile* produced below into a stout subcylindric spur, and sending upwards two long narrow falcate backward-pointing lobes; *epichile* spathulate-oblong, entire, attached to the hypochile near its base, parallel to it for part of its length and then curving forwards, its upper surface with a forked appendage. *Column* dilated towards the long foot; *stigma* large, *rostellum* long and narrow. *Pollinia* subglobose, attached by a long curved tapering flat caudicle to a small triangular gland. Hook. f. Fl. Br. Ind. vi, 31; King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 199, t. 266. *D. Braceana* Hook. f. in Ann. Roy. Bot. Gard. Calc. v, 40, t. 60. *Ærides tæniale* Lindl. Gen. and Sp. Orch. 239; in Journ. Linn. Soc. iii, 41, *Æ. carnosum* Griff. Notul. iii, 265; Ic. Pl. As. t. 338A.

N.-W. Himalaya, *Madden;* Dehra Dun, *Gamble* No. 22786; Jaunsar, *Gamble* No. 25788; Garhwál in the Tonse Valley 5,000 feet, *Duthie;* Tehri Garhwál *Mackinnon;* Kumaon near Ranikhet 5-6,000 feet, *Duthie* No. 5997; near Almora at 3,500 feet, *Strachey & Winterbottom* No. 23. Flowers during April and May. It extends eastwards to Nepal, Sikkim, Bhutan, Khasia Hills, Manipur and Burma.

19. Ornithochilus Wall.

Epiphytic, without pseudo-bulbs. *Stem* very short. *Leaves* few, crowded, broadly oblong, flat, softly coriaceous. *Inflorescence* supra-axillary, racemose or panicled. *Sepals*

subequal, spreading, incurved at the apex, lateral obliquely obovate. *Petals* smaller, cuneate-oblong, blunt. *Lip* much longer than the sepals, adnate to the foot of the column by a long broad claw, the claw with a rectangularly bent sub-cylindric spur at its junction with the apical lobe; side lobes shallow, sub-quadrate; apical lobe with three lobules, the two lateral recurved and pectinate, the central triangular, entire or infolded; the mouth of the spur closed by two calli projecting from its back and front walls, the latter hairy. *Column* short, cylindric, stout, with a short foot; *rostellum* forked; *stigma* circular, surrounded by a hairy rim. *Anther* oblong; *pollinia* 2, sub-globose, caudicle very broad, obcuneate, gland large.—Species 1 or 2, Indian or Chinese.

ORNITHOCHILUS FUSCUS Wall. in Lindl. Gen. and Sp. Orch. 242.

Leaves 7·5 to 15 cm., 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* two or three times longer than the leaves. *Flowers* 1 cm. across; *floral bract* lanceolate, much shorter than the long-stalked ovary. *Sepals* and *petals* greenish-yellow, the former with four, and the latter with two, broad brown vertical bands. The two pectinate lateral lobules of the mid-lobe of the lip are also brown passing into purple below. *Capsule* fusiform, 2·5 cm. long. Hook. f. Fl. Br. Ind. vi, 76; King & Pantling in Ann. R. Bot. Gard. Calc. viii, 200, t. 268; Rolfe in Journ. Linn. Soc. xxxvi, 38. *O. eublepharon* Hance in Journ. Bot. xxii (1884), 364. *Aerides difforme* Wall. in Lindl. Gen. and Sp. Orch. 242; Sert. Orch. frontisp. fig. 7; Reichb. f. in Gard. Chron. (1865), 698; Lindl. in Journ. Linn. Soc. iii, 41; Walp. Ann. vi, 899. *A. Hystrix* Lindl., in Journ. Linn. Soc. iii, 42 (not of Gen. and Sp. Orch.).

Dehra Dun and up to 3,000 feet on the adjacent Mussoorie range, *Mackinnon's, collector* (Duthie's No. 24190); near the village of Chamussoorie below Landour, *Vicary*; Garhwál, *Falconer;* Gori Valley in Kumaon, *Duthie's collector* No. 24121. Flowers in July. It extends eastwards to Sikkim, Bhutan, the Khasia Hills and Burma. It is found also in Moulmein and in China.

20. Luisia Gaud.

Epiphytes with rigid terete sheathed stems woody below and usually erect. *Leaves* terete, fleshy, distant, spreading. *Flowers* usually small and dull coloured, in short extra-axillary spikes with stout axes; *floral bract* short, scarious, persistent. *Sepals* sub-equal, 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; the *hypochile* saccate concave or flat; the *epichile* decurved, broad and ridged, entire crenate or undulate, more or less blunt. *Column* much shorter than the lip, stout. *Stigma* usually large. *Anther* broad, 2-celled; *pollinia* 2, ovoid or subglobose, attached by a broad caudicle to a sub-quadrate or elongate gland. *Capsule* narrow, ridged, suberect.—Species about 15, mostly in Tropical Asia, a few Australian:—

Leaves long and stout, about 5 mm. in thickness.
- Flowers 10 mm. long . . . . . 1. *L. trichorhiza.*
- Flowers 6 mm. long . . . . . 2. *L. teretifolia.*

Leaves slender, 3 mm. or less in thickness.
- Flowers 7 mm. long, lip nearly flat . . . . . 3. *L. brachystachys.*
- Flowers 4 mm. long, lip with a saccate hypochile . . . . . 4. *L. inconspicua.*

1. Luisia trichorhiza Blume Mus. Bot. Lugd. Bat. i., 63.

Stem 1 to 2·5 dm. long, very stout, not branched. *Leaves* fleshy, very slightly tapering to the apex, 1 to 1·8 dm. long and about 5 mm. thick. *Spikes* 4- or 5-flowered, stout. *Flowers* 1 cm. long, placed on short thick tubercles; *floral bract* broad, with an acuminate point, persistent. *Sepals* unequal, green with faint purple lines; the dorsal one oblong, blunt; lateral pair shorter, obliquely ovate, acute, keeled. *Petals* longer and narrower than the lateral sepals, oblong, blunt, all spreading. *Lip* larger than the sepals, dark dull purple on a greenish ground, basal half deeply concave and with erect rounded edges, the apical portion broadly cordate, 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. Lindl. Fol. Orch. 2; Reichb. f. Xen. Orch., t. 77, figs. 8 to 18; Hook. f. Fl. Br. Ind. vi, 23; King & Pantling in Ann. R. Bot. Gard. Calc. viii, 202, t. 270. *Vanda ? trichorhiza* Hook. Exot. Fl. i, t. 72.

Dehra Dun chiefly on *sal* trees, *Gamble* No. 25695, *Mackinnon* No. 24182; Garhwál, *Falconer*, *Mackinnon* (Duthie's Nos. 23004, 55428), *Duthie's collector* Nos. 25836, 25837. Flowers during March and April. It extends eastwards to Sikkim.

A much stouter plant than *L. teretifolia* and with blunter leaves.

2. Luisia teretifolia Gaud. Bot. Freyc. Voy. 426, t. 37.

Stem 1·5 to 3 dm. long, stout, sometimes branching. *Leaves* 6·5 to 15 cm. long and from 4 to 5 mm. thick, terete, spreading. *Spikes* very short, 2- or 3-flowered. *Flowers* 7 mm. long; *floral bract* broad, pointed. *Sepals* and *petals* subequal, green, the petals slightly longer, narrowly oblong, blunt, spreading. *Lip* longer and broader than the sepals, with a square sub-saccate base; apical lobe deflexed, rhomboid, sub-truncate, its upper surface witn five or six vertical lines. *Column* very short and stout. *Anther* depressed; *pollinia* 2, ovoid, attached by a stout caudicle to a broadly oblong gland. Blume Rumphia iv, t. 194, t. 197D; Mus. Bot. Lugd. Bat. i, 63; Lindl. Fol. Orch. 2 (excluding from all the synonym *Ep. triste*); Hook. f. Fl. Br. Ind. vi., 22; King & Pantling in Ann. Roy. Bot. Gard. Calc. viii, 202, t. 270; Rolfe in Journ. Linn. Soc. xxxvi, 33. *L. brachystachys*, var. *flaveola*. Par. & Reichb. f. in Trans. Linn. Soc. xxx, 144. *L. burmanica* Lindl. Fol. Orch. 3. *L. platyglossa* Reichb. f. in Walp. Ann. vi, 622. *L. zeylanica* Lindl. Fol. Orch. 3. *Cymbidium triste* Roxb. Fl. Ind. iii, 461; Bot. Mag. t. 3648; Wight Ic. 911 (text only); Griff. Notul. iii, 340 (the Mergui plant). *C. tenuifolium* Wight Ic. 1689 (excl. text).

Garhwál 4,000 feet, *Mackinnon*. Flowers in April. It extends eastwards to Sikkim, the Khasia Hills, Bengal (in the Sunderbuns), Burma, the Andaman Islands and China; it is found also in the Western Ghats, Ceylon and Malaya.

The flowers are smaller and the stem and leaves are more slender than in *L. trichorhiza*.

3. Luisia brachystachys Blume Rumphia iv, 50.

Stem long, branching. *Leaves* slender, 7 to 18 cm. long. *Flowers* 7 mm., on slender pedicels. *Sepals* and *petals* subequal; the *petals* narrowly oblong, blunt, spreading. *Lip*

obovate-oblong, nearly flat, grooved, hardly constricted at the base of the broadly ovate epichile, dark purple with a yellow base. *Column* very short. *Pollinia* oval, attached to a conical caudicle. *Capsule* 2·5 to 3 cm. long. Blume Mus. Bot. i., 64; Reichb. f. Xen. Orch. i, 204, t. 78, fig. 1; Lindl. Fol. Orch. 3; Hook. f. Fl. Br. Ind. vi, 23. *Mesoclastes brachystachys* Lindl. in Wall. Cat. 1994; Gen. and Sp. Orch. 45.

Garhwál, *Falconer;* Kumaon 2,600 to 2,800 feet, *Stewart* No. 641. It extends eastwards to Sylhet and the Khasia Hills, and to Bengal at Jessore, Dacca and the Sunderbuns; it is found also in Tenasserim. It flowers during March and April.

Mr. C. B. Clarke describes the sepals as green outside and rose-purple within; the petals as greenish at the apex and base and rose-purple in the middle, and the lip black-purple with a yellow base.

4. Luisia inconspicua Hook. f. MSS. in Herb. Hort. Calc.

Stem 1 to 1·5 dm. long, slender, not branching. *Leaves* 3 to 6·5 cm. long and about 3 mm. in diam. *Spikes* 1- to 3-flowered, 4 to 5 mm. long. *Flowers* pale yellowish-green, 4 mm. long; *floral bract* membranous, triangular, acuminate. *Sepals* ovate-lanceolate, subacute, spreading. *Petals* oblong, tapering slightly to the blunt apex. *Lip* as long as the sepals, the hypochile hemispherically saccate, green spotted with purple; epichile decurved, flat, sub-reniform, notched at the apex, its upper surface minutely hispid and with 5 or 6 vertical lines. *Column* half as long as the lip, purple. *Anther* depressed, *rostellum* large; *pollinia* broadly ovoid, attached by a slender caudicle to an oblong-quadrate gland. *Capsule* 1 cm. long. King & Pantling in Ann. R. Bot. Gard. Calc. viii, 203, t. 272. *Saccolabium? inconspicuum* Hook. f. Fl. Br. Ind. vi, 56; in Ann. R. Bot. Gard. Calc. v, 46, t. 69. *Cymbidium inconspicuum* Wall. MSS.

Garhwál, east of Tehri, *Mackinnon's collector* (Duthie's No. 25427); Tejam in Kumaon, *Duthie's collector* No. 24114; Sarju Valley in Kumaon, *Duthie's collector* No. 24114(*a*). It extends eastwards to Sikkim and Assam, at low elevations, flowering during June and July.

This species resembles *L. brachystachys*, but is more slender and smaller in all its parts.

21. Sarcochilus R. Brown.

Epiphytal. *Stem* none or very short. *Leaves* narrowly oblong or absent. *Flowers* usually in pendulous racemes. *Sepals* and *petals* subequal, free, spreading; the dorsal sepal concave, the lateral pair broader and partly adnate to the foot of the column. *Lip* jointed or adnate to the long produced foot of the column, without a spur; the side lobes very large, erect; the apical lobe minute, tooth-like; the disk with hairy ridges and calli. *Column* thick, shorter than its foot, wingless, rostellum short. *Anther* terminal, depressed, shortly beaked in front, sometimes bearing two lateral setæ; *pollinia* 4, in pairs, compressed; the caudicle slender, flattened, the gland small.—Species about 10, Indian, Chinese and Australian.

Sarcochilus usneoides Reichb. f. in Walp. Ann. vi, 497.

Roots densely tufted, tortuous. *Stem* none. *Raceme* 7·5 to 15 cm. long, many-flowered; peduncle brownish, bearing a few amplexicaul ovate acute membranous

deciduous bracts; the rachis flexuous. *Flowers* 13 mm. in diam., white or rose-coloured. *Sepals* spreading, oblong, obtuse. *Petals* broader, spreading. *Lip* gibbous or slightly saccate at the base, with a long claw; side lobes linear-oblong, obtuse, disk between the side lobes pubescent; midlobe truncate, emarginate. *Column* very short; *rostellum* indistinct. *Anther* broadly ovate, furnished with 2 or 3 slender setæ; *pollinia* two, 2-lobed, caudicle very short, gland large. *Capsule* 3·5 cm., slender, slightly curved, glabrous. Hook. f. Fl. Br. Ind. vi, 37. *Chiloschista usneoides* Lindl. in Wall. Cat. 7330; Gen. & Sp. Orch. 219; Bot. Reg. under t. 1522; Sert. Orch. frontisp. f. 4; in Journ. Linn. Soc. iii, 43; Gard. Chron. (1846), 135. *Thrixspermum usneoides* Reichb. f. Xenia ii, 120. *Epidendrum usneoides* Don. Prod. 37.

On oak trees near the village of Chamassoorie in Garhwál at an elevation of about 5,000 feet, found by Colonel Vicary in 1833. Previously discovered in Nepal by Dr. Wallich.

22. Ærides Lour.

Epiphytic, with leafy stems. *Leaves* linear or terete, coriaceous. *Flowers* usually numerous and brightly coloured, in decurved racemes, sometimes solitary; *floral bract* minute. *Sepals* and *petals* broad, spreading, the lateral sepals adnate to the base or foot of the column. *Lip* adnate to the column, spurred; the side lobes large or small, sometimes absent; the mid-lobe larger than the side lobes, or smaller and incurved. *Column* short, its foot short or long; *rostellum* short or long, bifid. *Anther* 2-celled, with or without a beak; *pollinia* 2, globose, sulcate; caudicle long or short, gland various.—Species about 50, Eastern Asiatic.

Terminal lobe of lip large, hastate, acute.	1. Æ. *multiflorum*.
Terminal lobe of lip small, narrowly oblong.	2. Æ. *odoratum*.

1. Ærides multiflorum Roxb. Corom. Pl. iii, 63, t. 271.

Stem 1 to 2·5 dm. long, stout. *Leaves* 1·5 to 2·5 dm. long and 2 to 3 cm. broad, 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* 2 cm. across, rose-coloured. *Sepals* and *petals* subequal, oblong, blunt. *Lip* twice as long as the sepals, triangular, entire, adnate to the base of the column, acute or obtuse at the apex, margins erose, its basal portion thick and with a retrorse tooth or callus across the mouth of the rectangularly bent spur. *Column* without a 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. Roxb. Fl. Ind. iii, 475; Belg. Hortic. (1876), 286; Reichb. f. in Walp. Ann. vi, 897; Hook. f. Fl. Br. Ind. vi, 44; King & Pantling in Ann. R. Bot. Gard. Calc. viii, 212, t. 283. *Æ. affine* Wall. Cat. 7316; Lindl. Gen. and Sp. Orch. 239; Sert. Orch. t. 15; in Journ. Linn. Soc. iii, 41; Bot. Mag. t. 4049; Warner Sel. Orch. Ser. i, t. 21. *Æ. roseum* Lodd. ex Paxt. Fl. Gard. ii, 109, t. 60; Regel Gartenfl. viii, 253, t. 267 *Æ. Lobbii* Hort. ex Ill. Hort. (1868) t. 559. *Æ. Veitchii* Hort. ex Morren in Belg. Hortic. (1876), 291. *Æ. trigonum* Klotzch in Otto. & Diet. Allgem. Gartenz (1835), 177.

Siwalik range, *King;* Dehra Dun, very common on mango trees; plentiful up to 4,000 feet on the outer ranges of the Western Himalaya, from the Kangra Valley in the Punjab to Kumaon, flowering during June and July. It extends eastwards to Nepal Sikkim and Assam.

2. Ærides odoratum Lour. Fl. Cochin. 525.

Stem very stout. *Leaves* 1·5 to 3 dm. long and 4 to 5·5 cm. broad, 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 2·5 cm. long, white spotted with pink, very fragrant; *floral bract* broad, sheathing, blunt, much shorter than the stalked ovary. *Sepals* unequal, obtuse, spreading, the dorsal one elliptic-ovate; the lateral pair somewhat larger. *Petals* oblong, falcate, shorter than the sepals. *Lip* adnate to the short foot of the column; *spur* large, funnel-shaped, curved forwards; lateral lobes very shallow, truncate, erose; terminal lobe linear, emarginate, lying between the edges of the lateral lobes. *Anther* triangular, depressed, beaked; *pollinia* globose, caudicle linear, gland quadrate. *Capsule* fusiform, about 3 cm. long. Lindl. Gen. & Sp. Orch. 239; in Journ. Linn. Soc. iii, 41; Bot. Mag. 4139; Walp. Ann. vi, 898; Lindenia t. 14 (var.); Hook. f. Fl. Br. Ind. vi, 47; King & Pantling in Ann. R. Bot. Gard. Calc. viii, 212, t. 282; Rolfe in Journ. Linn. Soc. xxxvi, 35. *Ærides cornutum* Roxb. Hort. Beng. 63; Fl. Ind. iii, 472; Bot. Reg. t. 1485.

Western Himalaya, *T. Thomson;* Dehra Dun, *King*, *Gamble*, *Mackinnon;* sub-montane tract of Bahraich district in N. Oudh, *Duthie's Collector* No. 23868; Garhwál, *Falconer*, *Duthie's collector* Nos. 25810, 25818; Kumaon, *Colonel Davidson.* Flowers during June and July. This species extends eastwards to Nepal, Sikkim and E. Bengal; it is found also in Malaya and China.

23. Rhynchostylis Blume.

Epiphytic. *Stem* elongate, stout, leafy. *Leaves* very coriaceous, linear-oblong, truncately or bluntly bilobed at the apex. *Racemes* pendulous, many-flowered. *Flowers* brightly coloured. *Sepals* and *petals* spreading, broad, obtuse, the petals narrower than the sepals. *Lip* adnate to the short foot of the column, the *hypochile* forming a deep wide pubescent sac without side lobes; the *epichile* obovate, acute, concave, the margins erect. *Column* short, stout, dilated at the base and with a very short foot. *Stigma* small. *Anther* terminal, rounded; *pollinia* 2, elliptic, attached by a slender long caudicle to a small oblong gland.—Species 2 or 3, Indian and Malayan.

Rhynchostylis retusa Blume. Bijdr. 286, t. 49.

Stem stout 1 to 2 dm. long, enveloped in the sheaths of decayed leaves. *Leaves* 1·5 to 4·5 dm. long and about 2·5 cm. broad, curved, keeled, præmorse or bluntly bilobed. *Racemes* longer than the leaves, cylindric, densely flowered; peduncle short with a few small scattered sheaths. *Flowers* 2 cm. across, white or pink with purple or pink markings. Lateral sepals broadly ovate, obtuse or apiculate, the dorsal one oblong.

Lip very variable in shape; *spur* compressed, as long as the lip. *Capsule* clavate, 2·5 to 3·5 cm. long. Hook. f. Fl. Br. Ind. vi, 32; King & Pantling in Ann. R. Bot. Gard. Calc. viii, 213, t. 284. *R. præmorsa* Blume Bijdr. 286. *R. guttata* Reichb. f. in Bonplandia ii, 93. *R. garwalica* Reichb. f. in Walp. Ann. vi, 888. *Saccolabium guttatum* Lindl. in Wall. Cat. 7308; Gen. & Sp. Orch. 220; in Journ. Linn. Soc. iii, 32; Bot. Mag. t. 4108; Wight Ic. tt. 1745-6; Dalz. & Gibs. Bomb. Fl. 263; De Vriese Orch. t. 14; Griff. Ic. Pl. Asiat. Notul. 22, t. 8 & 9. *S. præmorsum* Lindl. Gen. & Sp. Orch. 221. *S. Rheedii* Wight Ic. v, 19. *S. retusum* Fl. des Serres tt. 1463-4. *S. Heathii* Hort. ex Gard. Chron. (1885), ii, 369. *S. Blumei* Lindl. Sert. t. 47; Bot. Reg. (1841), misc. 55. *S. gurwalicum* Lindl. in Journ. Linn. Soc. iii, 32; in Gard. Chron. (1879), ii, 102. *Sarcanthus guttatus* Lindl. in Bot. Reg. t. 1443. *Ærides guttatum* Roxb. Fl. Ind. iii, 471; Regel Gartenfl. (1863), 415. *Æ. retusum* Swartz in Schrad. Dar. (1799), 130; Willd. Sp. Pl. iv, 130; Grah. Cat. Bomb. Pl. 264. *Limodorum retusum* Swartz in Nov. Act. Upsal. vi, 80. *Epidendrum retusum*, Linn. Sp. Pl. 953.

Kangra Valley, Punjab Himalaya, *Edgeworth;* Siwalik range, *Royle;* Dehra Dun, *King*, *Mackinnon*, &c., and up to 4,000 feet on the Mussoorie range; Garhwál, *Falconer*, *Duthie's collector* Nos. 25828, 25830, 25840; Sub-Himalayan tract in the Gonda district of N. Oudh, *Duthie's collector* No. 22800; Kumaon, *T. Thomson*, *T. Anderson*, &c. Flowers in June and July. It extends eastwards to Nepal, Sikkim, Bhutan, Assam, the Khasia Hills and Burma, and occurs also in S. India, Ceylon and the Malay Archipelago.

24. **Vanda** R. Brown.

Epiphytes with leafy stems. *Leaves* thickly coriaceous or fleshy, flat and keeled or terete. *Flowers* usually large and handsome, in axillary simple racemes, sometimes solitary; *floral bract* much smaller than the ovary. *Sepals* and *petals* subequal, spreading or connivent, narrowed at the base. *Lip* large, its base usually saccate or spurred, the side lobes large or small, rarely absent, adnate to the short foot of the column or to the sides of the sac or spur; apical lobe fleshy, varying in shape, the disk usually ridged or lamellate, sometimes carunculate. *Column* short, stout, foot short or none. *Anther* 2-celled, *rostellum* small; *pollinia* 2, didymous, subglobose or obovoid; caudicle broad and short, or long and geniculate, gland usually large.—Species about 30, in Tropical Asia and Australia.

Lip spurred at the base:—
Sepals and petals spreading:—
Flowers small, disk of lip without ridges . . . . . *1. V. parviflora.*
Flowers 3·5 to 5 cm. in diam., disk of lip with fleshy ridges . . . . . *2. V. Roxburghii.*
Sepals and petals incurved . . . . . *3. V. cristata.*
Lip gibbous, not spurred or saccate at the base . . . . . *4. V. alpina.*

1. VANDA PARVIFLORA Lindl. in Bot. Reg. xxx (1844), Misc. 45.

Stem stout, 1 to 3 dm. long, enveloped in the sheath-bases of fallen leaves. *Leaves* 7·5 to 10 cm. long and 1 to 1·3 cm. broad (when flattened out), linear-oblong,

conduplicate, keeled, unequally and obtusely 2-lobed at the apex, not narrowed at the base. *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 bract* ovate, acute, deciduous. *Flowers* 1·5 cm. in diam. *Sepals* and *petals* yellow. *Sepals* spathulate, obtuse, spreading, the lateral pair shorter than the dorsal. *Petals* spathulate-oblong, falcate, as long as the lateral sepals, spreading. *Lip* adnate to the foot of the column, spurred; side lobes erect, oblong, rounded or subacute; terminal lobe decurved, fleshy, oblong or cuneate-obovate, with a dilated truncate or retuse erose apex; the upper surface blue, caruncled and with a deep groove down the centre; *spur* slender, conical, half as long as the lip. *Column* short and thick, with a very short foot. *Anther* depressed, slightly beaked in front; *pollinia* subglobose, bifid, attached to a short caudicle. *Capsule* about 2 cm. long, fusiform, with winged ridges. Wight Ic. 1669; Reichb. f. in Gard. Chron. 1877, ii, 166; Hook, f. Fl. Br. Ind. vi, 50; King & Pantling in Ann. R. Bot. Gard. Calc. viii, 215, t. 286. *Ærides Wightianum* Lindl. in Wall. Cat. 7320; Gen. and Sp. Orch. 238; in Journ. Linn. Soc. iii, 40; Bot. Mag. 138; Wight Ic. v, p. 8; Dalz. & Gibs., Bomb. Fl. 265.

Debra Dun, *Mackinnon;* and along the bases of the outer ranges of Garhwál and Kumaon, *Edgeworth, Duthie's collector* Nos. 25824 to 25826. Flowers in May. This species extends eastwards to Nepal, Sikkim, Assam and Burma; also southwards through Central, W. and S. India to Ceylon.

2. VANDA ROXBURGHII R. Br. in Bot. Reg. t. 506.

Stem climbing, 3·6 dm. long, emitting many thick white fleshy roots. *Leaves* bifarious, approximate, 1·5 to 2 dm. long, narrow, complicate, keeled, the apex præmorse. *Racemes* 3-10-flowered, longer than the leaves; peduncle 6·5 to 2 dm. long. *Flowers* 3·5 to 5 cm. in diam. *Sepals* and *petals* subequal, spreading, clawed, obovate, undulate, yellowish-green or bluish tessallated with brown, their claws and outer surfaces white. *Lip* about half as long as the sepals; side lobes small, acute; apical lobe panduriform, with a purple dilated truncate 2-lobed apex, the margins deflexed; disk convex, with fleshy ridges. *Spur* conical, hairy inside. *Pollinia* globose; caudicle broad, attached to a subquadrate gland. *Capsule* clavate, sharply ridged. Lindl. Gen. & Sp. Orch. 215; Fol. Orch. 3; Wight Ic. t. 916; Fl. des Serres ii, t. 11; Paxt. Fl. Gard. t. 42, f. 2; Reichb. Fl. Exot. t. 121; Ill. Hort. t. 185 (var.); Hook. f. Fl. Br. Ind. vi, 52. *V. tesselloides* Reichb. f. in Walp. Ann. vi, 864. *Cymbidium tesselloides* Roxb. Fl. Ind. iii, 463. *C. tessellatum* Swartz in Nov. Act. Upsal. vi, 75; Willd. Sp. Pl. iv, 102; Roxb. Fl. Ind. l. c. *C. Allagnatea* Herb. Ham. *Epidendrum tessellatum* Roxb. Cor. Pl. i, 34, t. 42. *Aerides tessellatum* Wight in Wall. Cat. 7318; Lindl. Gen. & Sp. Orch. 240. *Vanda* Jones in Asiat. Res. iv, 302.

Forests in the Sub-Himalayan tracts of Oudh, *R. Thompson;* Bahraich district near the Nepal frontier, *Duthie's collector* No. 23867 (a & b); northern portion of the Gonda district, *Duthie's collector* Nos. 22792 & 23867. Often found on the branches of mango trees and of *Bassia latifolia*. Flowers during the rains. It is also found in Bengal, Behar, the Central Provinces and westwards to Guzerat and the Konkan, extending southwards to Travancore, Ceylon and Tenasserim. In the Chanda district the roots, called *rasna* or *nai*, are used medicinally.

PLATE 116. Vanda Roxburghii *R. Br.* Portion of plant,—*of natural size*. Fig. 1, a flower; 2, ditto with sepals and petals removed; 3, vertical section of column and lip; 4, front view of column; 5, anther; 6, pollinia;—*all enlarged*.

3. VANDA CRISTATA Lindl. in Wall. Cat. 7328.

Stem 7·8 to 1·5 cm., stout, covered with the remains of old sheaths. *Leaves* bifarious, crowded, 7·5 to 10 cm. long, narrowly oblong, conduplicate, truncately and unequally bilobed at the apex, dilated at the sheathing base. *Racemes* not exceeding the leaves, axillary, 2–5-flowered. *Flowers* 3·5 to 5 cm. across. Sepals and petals incurved, pale olive-green or yellowish. *Sepals* subequal, oblong, obtuse. *Petals* narrower than the sepals, oblong. *Lip* adnate to the base of the column, longer than the sepals, green blotched with dull purplish-brown, basal lobes erect, triangular, terminal lobe oblong, with two divaricate oblong lobules and a horn-like fleshy beak pointing downwards from under the apex, upper surface with five carunculate ridges. *Column* short, without a foot. *Anther* depressed, with a prominent central ridge, *pollinia* ovoid, attached by a short broad caudicle to a quadrate gland. *Capsule* narrowly clavate, 5 to 6·5 cm. long. Lindl. Gen. & Sp. Orch. 216; Sert. Orch. frontisp. fig. 3; in Bot. Reg. (1842), t. 48; Fol. Orch. 10; Bot. Mag. 4304; Walp. Ann. vi, 869; Warner's Orch. Alb. vii, t. 290; Gartenfl. t. 680; Hook. f. Fl. Br. Ind. vi, 53; King & Pantling in Ann. R. Bot. Gard. Calc. viii, 216, t. 287. *Ærides cristatum* Wall. MSS. *Æ.* sp. Griff. It. Notes, 203, No. 1188.

Dehra Dun and Mussoorie range up to 4,000 feet, *Mackinnon* (*Duthie's* No. 21785); Garhwál, *Duthie's collector* No. 25827; Kumaon 3 to 4,000 feet, *Strachey & Winterbottom* No. 21, *Colonel Davidson*. Flowers in May. It extends eastwards to Sikkim, Bhutan and Sylhet.

4. VANDA ALPINA Lindl. Fol. Orch. 10.

Stem and *leaves* as in *V. cristata*. *Racemes* much shorter than the leaves. *Flowers* solitary or in pairs, nodding, about 2 cm. long. *Sepals* and *petals* subequal, connivent, oblong, blunt, the colouring as in *V. cristata*. *Lip* adnate to the column, gibbous but not saccate or spurred at the base; side lobes shallow, rounded; terminal lobe retuse, its upper surface with shallow ridges. *Column* short, stout, with no foot. *Anther* flattened; *pollinia* ovoid, caudicle subquadrate, gland transversely oblong. *Capsule* 7·5 cm. long, narrowly clavate. Hook. f. Fl. Br. Ind. vi, 53; King & Pantling in Ann. R. Bot. Gard. Calc. viii, 217, t. 289. *V. Griffithii* Lindl. in Paxt. Fl. Gard. ii, 22; Fol. Orch. 10 (excl. cit. Griff.). *Luisia alpina* Lindl. in Bot. Reg. 1838 Misc. 56.

Garhwál, *T. Thomson*; Kumaon 3,500 feet, *Strachey & Winterbottom* No. 22. Flowers during June and July. It extends eastwards to Nepal, Sikkim and the Khasia Hills.

25. Saccolabium Blume.

Epiphytes without pseudo-bulbs. *Leaves* coriaceous, flat or conduplicate, often keeled. *Flowers* usually small, in leaf-opposed or supra-axillary racemes corymbs umbels or panicles, *floral bract* minute. *Sepals* and *petals* adnate to the column, subequal, spreading or reflexed. *Lip* sessile on the footless column, consisting of a cylindric or saccate spur, without calli and non-septate, with or without small lateral

lobes; the apical lobe small, without a scale or callus under the short broad truncate column, often hairy. *Anther* 1- or imperfectly 2-celled; *pollinia* 2, entire or bipartite. Species about 55, inhabiting Eastern Asia.

Spur cylindric, straight	1. *S. papillosum.*
Spur short, wide, saccate, at right angles to the ovary.	
Apex of leaves not setulose, terminal lobe of lip papillose-hairy	2. *S. calceolare.*
Apex of leaves setulose, terminal lobe of lip fleshy and glabrous	3. *S. distichum.*

1. SACCOLABIUM PAPILLOSUM Lindl. in Bot. Reg. t. 1552 (excl. syn.).

Stems erect, clustered, rigid, stout, bearing many nearly horizontal leaves. *Leaves* coriaceous, 7·5 to 10 cm. long. and about 1·5 cm. broad (when flattened out). conduplicate, curved, the apex truncate or deeply notched. *Peduncle* leaf-opposed, about 13 mm. long, bearing a sub-corymbose 4- to 8- flowered raceme. *Flowers* 9 mm. across, *oral bract* triangular. Sepals and petals yellow, barred and blotched with brown. *Sepals* subequal, oblong, subacute, spreading. *Petals* narrower than the sepals, subspathulate. *Lip* longer than the 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* half as long as the ovary and parallel to it, cylindric or slightly tapering, pale yellow, hairy within. *Column* short. *Anther* broadly conical; *pollinia* 2, deeply bipartite, subovoid; caudicle slender, tapering downwards to the small oblong gland. *Capsule* about 3 cm. long, fusiform, ridged, Lindl. Gen. and Sp. Orch. 222; Hook. f. Fl. Br. Ind. vi, 63; King & Pantling in Ann. R. Bot. Gard. Calc. viii, 219, t. 290. *S. carinatum* Griff. Notul. iii, 354. *Acampe papillosa* Lindl. Fol. Orch. 2; Walp. Ann. vi, 873.

Dehra Dun in the Narkaunda swamp, *Gamble* No. 23272, *Mackinnon*; Garhwál, *Duthie's collector* Nos. 25815, 25823; Kumaon, *Duthie's collector* No. 24126. Flowers during the cold season. It extends eastwards to Sikkim, Khasia, Assam, Chittagong, the Bengal Sunderbuns and Burma.

2. SACCOLABIUM CALCEOLARE Lindl. in Wall. Cat. 7302.

Stem short, pendulous. *Leaves* 1 to 2·8 dm. long, narrowly oblong, unequally bifid at the apex, slightly narrowed to the base. *Racemes* much shorter than the leaves, corymbose, many-flowered, the peduncle bearing several short sheaths. *Flowers* 1·6 cm. across, crowded; *floral bract* small, broad and blunt. Sepals and petals pale green with large roundish brown spots. *Sepals* unequal, spreading; the dorsal one obovate-oblong; the lateral pair oblong, falcate, narrower than the dorsal. *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 absent; 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. Lindl. Gen. and Sp. Orch. 223; Sert. Orch., *Frontisp.* 6; in Bot. Reg. 1838, Misc. 139; in Journ. Linn. Soc. iii., 33 (*excl. syn.*); Griff. Notul.

iii, 356; Itin. Notes 170; No. 869; Ic. Pl. As. t. 334; Walp. Ann. vi, 883; Hook. f. Fl. Br. Ind. vi, 60; King & Pantling in Ann. R. Bot. Gard. Calc. viii, 225, t. 300. *Ærides calceolare* Smith in Rees Cyclop., Suppl. *Æ. leopardorum* Wall. MSS. *Gastrochilus calceolaris* Don. Prod. 32. *Sarcochilus nepalensis* Spreng. Syst. Veg. iii, 721. *Epidendrum calceolare* Ham. MSS.

Dehra Dun, *Gamble* No. 25689, *Mackinnon;* Garhwál, *Falconer*, *Duthie's collector* No. 25814. Flowers during April and May. It extends eastwards to Nepal, Sikkim and the Khasia Hills.

3. Saccolabium distichum Lindl. in Journ. Linn. Soc. iii, 64.

Stems 1·5 to 2·5 dm. long, pendulous, branching, slender, leafy. *Leaves* 2 to 2·5 cm. long, narrowly lanceolate, acuminate, with two, rarely three, fine setæ; the base sessile and slightly oblique. *Peduncles* leaf-opposed, about equalling the leaves in length. *Flowers* two to four in a lax raceme, 12 mm. across, green, irregularly spotted with brown; *floral bract* oblong, subacute. *Sepals* and *petals* subequal, oblong-elliptic, obtuse. *Lip* about as long as the sepals, adnate to the lower half of the 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, its margins deflexed, the base with two blunt conical calli. *Column* broad; *rostellum* short, broad. *Anther* shortly beaked in front; *pollinia* 2, elliptic; caudicle long, slender, cylindric; gland elongate, bifid. *Capsule* fusiform, about 1·5 cm. long. Reichb. f. in Ot. Hamb. 43; Hook. f. Fl. Br. Ind. vi, 64; in Ann. R. Bot. Gard. Calc. v, 49, t. 73 (in part); King & Pantling in Ann. R. Bot. Gard. Calc. viii, 227, t. 303.

Garhwál, near Tehri, 6,000 feet, *Mackinnon's collector* (Duthie's No. 24196); Sub-Himalayan tract of the Bahraich district in N. Oudh, *Duthie's collector* No. 23869. Flowers in April and May. It extends eastwards to Sikkim and Manipur.

26. Cleisostoma Blume.

Epiphytes without pseudo-bulbs. *Stems* more or less elongated, leafy. *Leaves* coriaceous or fleshy, flat or semiterete. *Inflorescence* leaf-opposed, racemose or paniculate. *Sepals* and *petals* adnate to the column, subequal, spreading. *Lip* sessile on the footless column, the base with a large saccate or infundibuliform spur, sometimes dilated at the apex, its cavity more or less closed by two calli the posterior of which is often bifid, and sometimes also by a dorsal scale, but never by a septum; lateral lobes small or absent; apical lobe thickened, concave. *Column* short, thick, without a foot. *Anther* depressed; *pollinia* 2, often bifid, caudicle single.—Species about 40, Eastern Asiatic and Australian.

Cleisostoma micranthum King & Pantling in Ann. R. Bot. Gard. Calc. viii, 234, t. 312.

Stem stout, compressed, 7·5 to 20 cm. long, enveloped in leaf-sheaths. *Leaves* 6·5 to 9 cm. long, narrowly oblong, keeled, obliquely truncate and slightly bifid, the base shortly sheathed. *Racemes* leaf-opposed, longer than the leaves, peduncle and rachis stout. *Flowers* many, 5 mm. across; *floral bract* broad, blunt, less than half as long as

the short sessile ovary. Sepals and petals white with large purple spots. *Sepals* broadly ovate, obtuse, spreading. *Petals* smaller than the sepals, oblong, spreading. *Lip* fleshy, pink or purple, as long as the sepals; the base with a wide blunt spur adpressed to and as long as the ovary, its interior with two calli near the mouth, one on the back wall and a larger one on the anterior wall; dorsal scale absent; lateral lobes small; the terminal lobe oblong, convex, blunt, its edges thin and erose, upper surface smooth. *Column* very short, stout, without a foot, but with a large protuberance on either side of the rostellum. *Anther* depressed, with a long pointed beak; *pollinia* 2, obovoid, caudicle triangular, cordate or oblong, attached to a small triangular gland. *Saccolabium micranthum* Lindl. in Wall. Cat. 7300; Gen. and Sp. Orch. 220; Saunder's Refug. Bot. t. 110; Hook. f. Fl. Br. Ind. vi, 59.

Dehra Dun, *Vicary*, *Mackinnon*; Garhwál *Falconer*, *Duthie's collector* No. 25809; Kumaon in the Gori Valley 2-3,000 feet, *Duthie*. Flowers during June and July. It extends eastwards to Sikkim, the Naga and Khasia Hills; also in Tenasserim.

27. **Sarcanthus** Lindl.

Epiphytes without pseudo-bulbs. *Stems* usually elongate. *Leaves* fleshy, terete or flat. *Inflorescence* extra-axillary, racemose or paniculate. *Sepals* subequal, all spreading or reflexed, or the dorsal concave and connivent over the column. *Petals* smaller than the sepals, spreading. *Lip* adnate to the base of the column or of its foot, rarely jointed; the base with an infundibuliform spur sometimes dilated at the apex, the interior with a callus both on the anterior and posterior wall, 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 Eastern Tropical Asia.

SARCANTHUS INSECTIFER Reichb. f. in Bot. Zeit. (1857), 159.

Stem 3 dm. or more in length, scandent, robust, flexuous, giving off on all sides elongate fibres. *Leaves* crowded and almost imbricate, 3·5 to 5 cm. long, distichously spreading, oblong, amplexicaul, obtusely 2-lobed, rigidly coriaceous. *Racemes* nearly sessile, shorter than the leaves, few-flowered, decurved, rachis thick; *floral bracts* minute, deciduous. *Flowers* 13 mm. across. Sepals and petals 3-nerved, yellowish-green striated with red. *Sepals* ovate-oblong, obtuse or subacute. *Petals* oblong. *Lip* broadly funnel shaped, with a ring of hairs at its mouth, tapering into a conical spur, white to rose or purple; side lobes short; terminal lobe larger than the sepals, triangular-ovate or cordate, thickened under the attenuated apex; *spur* septate. *Column* very short. *Anther* hemispheric; *pollinia* sulcate, attached to a short quadrate stipe broader than long; gland transverse membranous. Hook. f. Fl. Br. Ind. vi, 68.

Outer Garhwál hills near the Rámganga Valley, *Duthie's collector* No. 25817; Sub-Himalayan tract of the Bahraich district of N. Oudh, *Duthie's collector* No. 23869. Flowers in September. It extends eastwards to Behar, Cachar and Chittagong and is found also in Tenasserim.

TRIBE IV.—LISTEREÆ.

Anther terminal (dorsal in *Epipactis*), pollinia 2 or 4, cohering by their sides, without candicles (except in *Epipogum*), pollen powdery.

Anther terminal.
- Pollinia 2, with caudicles, lip spurred ... ... 28. *Epipogum.*
- Pollinia 2 or 4, without caudicles, lip not spurred.
  - Lip flat, pendulous (except in *Listera microglottis*), sepals and petals free, leaves 2 or none ... 29. *Listera.*
  - Lip concave or convolute, not pendulous, sepals united or free.
    - Leafless saprophytes or parasites with brown or yellowish stems.
      - Sepals and petals united into a ventricose tube ... ... 30. *Gastrodia.*
      - Sepals and petals free.
        - Stem simple, flowers in terminal racemes ... ... 31. *Aphyllorchis.*
        - Stem branched, flowers in panicles, bright yellow ... 32. *Galeola.*
    - Not saprophytic or parasitic, stems and leaves green.
      - Leaf solitary, radical, appearing after the flowers, pollinia 2 or 4 ... 33. *Pogonia.*
      - Leaves several; pollinia 4, in pairs ... 34. *Cephalanthera.*

Anther dorsal, pollinia 4, in pairs ... ... 35. *Epipactis.*

28. **Epipogum** Gmelin.

Terrestrial leafless brown-coloured saprophytes with tuberous or coralloid roots. *Scape* erect, bearing a few sheathing membranous bracts. *Flowers* few, laxly racemose. *Sepals* and *petals* subequal, free, narrowly oblong, erect or connivent. *Lip* adnate to the base of the column, ovate, entire or 3-lobed, the base broad and spurred, disk with papillose ridges. *Column* short, without a foot. *Stigma* broad, prominent. *Anther* thickened, convex, 2-celled; *pollinia* 2, broad, bifid, each attached to a short rudimentary caudicle, gland none. Species 3, all found in India.

- Root coralloid, lip 3-lobed ... ... 1. *E. aphyllum.*
- Root tuberous, lip entire ... ... 2. *E. tuberosum.*

1. E. APHYLLUM Swartz Sumn. Veg. Scand. 32.

Whole plant 1 to 2 dm. high, glabrous. *Root* branching, coralloid. *Scape* stout often swollen above the base, bearing two or three unequal sheathing bracts. *Raceme* 3·5 cm. long, 3- to 6-flowered. *Flowers* about 2 cm. across, pale yellow, *floral bract* longer than the stalked tumid ovary, concave, oblong-elliptic, membranous. *Sepals* and *petals* erect, connivent, narrowly oblong-lanceolate, subacute. *Lip* large, 3-lobed; side lobes large, rounded, erose at the apex; terminal lobe deflexed, ovate, acute, concave, its upper surface with line of red gland-like warts. *Spur* as long as the lip, thick, blunt, dorsally

flattened. *Column* stout, curved, the edges of the clinandrium lobulate. *Stigma* very large, occupying the anterior face of the column. *Anther* globose; *pollinia* obliquely obovoid, compressed, caudicles very slender. Boiss. Fl. Or. v, 93; Reichb. Ic. Fl. Germ. xiii, t. 468; Hook. f. Fl. Br. Ind. vi, 124; King & Pantling in Ann. R. Bot. Gard. Calc. viii, 252, 334; Collett Fl. Siml. 497. *E. Gmelini* Rich. Orch. Eur. Annot. 36; Lindl. Gen. & Sp. Orch. 383; in Journ. Linn. Soc. i, 176; Bot. Mag. 4821. *Satyrium Epipogium* Linn. Syst. Veg. 676; Jacq. Fl. Austr. i, t. 84.

Kashmir in the Liddar Valley 8-9,000 feet, *C. B. Clarke* No. 31102, *Duthie's collector* No. 25385 and A; Sind Valley 8,500 feet, *C. B. Clarke* No. 30960; on the Chor near Simla 8,000 feet, *T. Thomson* No. 124, *Collett*; near Gangotri in the Bhagirathi Valley, *Duthie's collector* No. 1194; near Naini Tal in Kumaon, *Colonel Davidson*. Flowers during September. It is found also in Sikkim and extends westwards to Europe and W. Asia.

2. Epipogum tuberosum Duthie, new species.

Whole plant 1 to 3 dm. high, glabrous. Root tuberous, not coralloid. Scape usually swollen above the base and tapering upwards, bearing a few membranous broad-based bracts. Raceme laxly 3–5-flowered, floral bract ovate-lanceolate, acuminate, entire, longer than the slenderly stalked subglobose ovary, 5-nerved. *Sepals* and *petals* 8 mm. long, broader than those of *E. aphyllum*, all 3-nerved. *Lip* without side lobes, 9 mm. long, its upper surface with three carunculate ridges, margins not erose. *Spur* as in *E. aphyllum*, but more slender and with a less rounded apex. *Stigma* occupying a deep cavity on the anterior face of the column. *Pollinia* globose, with caudicles equal to them in length, glands minute globular.

Kashmir, in the Sind Valley at 6,000 feet, *C. B. Clarke* No. 31230; Liddar Valley 8-9,000 feet, *Duthie's collector* No. 25386 & A. Flowers in September.

Very similar to the preceding in general appearance, but specifically distinct by reason of its tuberous non-coralloid root, its entire lip and by the very different pollinia and column.

29. Listera R. Brown.

Terrestrial, erect, 2-leaved or leafless herbs, with fibrous roots. *Leaves* when present opposite or subopposite, rarely alternate, membranous, sessile or subsessile. *Flowers* small, racemose. *Sepals* and *petals* subequal, free, spreading or reflexed. *Lip* adnate to the base of the column, usually pendulous and longer than the sepals, narrow, the apex usually bifid, sometimes 3-fid. or entire (erect and similar to the petals in *L. microglottis*). *Column* stout, cylindric, usually curved forwards. *Anther* depressed, its lip obtuse; *pollinia* 2 or 4, cohering in pairs, *rostellum* short. Species about 20, inhabiting N. temperate regions and high elevations on the Himalaya.

Leaves 2, large, sub-opposite ... ... *1. L. ovata.*

Leaves none.

Lip much longer than the sepals and petals.

Lip pendulous.

Petals spathulate, subacute; ovary subglobose ... *2. L. Inayati.*

Petals small, linear; ovary obliquely obovate ... *3. L. Lindleyana.*

Lip spreading almost parallel with the curved column ... ... *4. L. kashmiriana.*

Lip erect and similar to the petals ... ... *5. L. microglottis.*

1. Listera ovata R. Brown in Ait. Hort. Kew. ed. 2, v, 201.

Rhizome short, giving off numerous thick root-fibres. *Stem* 1 to 1·5 dm. long, enclosed within the leaf-sheaths, and with one empty sheath at the base. *Leaves* sessile, sub-opposite, 5 to 10 cm. long, broadly elliptic, apiculate, many-nerved. *Scape* terete, 1 to 1·5 dm. long, puberulous, bearing a few scattered ovate acuminate bracts below the raceme. *Raceme* 8 to 15 cm. long, laxly many-flowered; *floral bract* about as long as the pedicel, ovate, acuminate. *Flowers* 13 mm. long. Sepals and petals subequal in length, connivent. *Sepals* ovate, subacute, deep green. *Petals* linear-oblong, pale green. *Lip* sharply deflexed, twice as long as the sepals, yellowish, linear-obovate, deeply bifid, with a minute apiculus in the sinus, upper surface with a linear nectar-secreting groove towards the base. *Column* stout, arching forward over the back of the anther. *Rostellum* prominently projecting between the anther and the fertile stigma. Lindl. Gen. and Sp. Orch. 455; Boiss. Fl. Or. v, 92; Ledeb. Fl. Ross. iv, 80; Reichb. Ic. Fl. Germ. xiii, 147, t. 479; Hook. f. Fl. Br. Ind. vi, 104. *Ophrys ovata* Linn. Sp. Pl. 1340. *Epipactis ovata* Swartz Act. Holm. 232. *Neottia latifolia* Rich. Orch. Annot. 37.

Mozae Juyen in Hazara, *Falconer's collector;* Gurais Valley in Kashmir, 7 to 8,000 feet, *Duthie's collector* No. 25389; Sind Valley in Kashmir, *Duthie's collector* No. 25389(*a*). Flowers during June and July. Distributed throughout Europe to the Ural and Caucasus Mts.

Falconer's Hazara specimens were gathered on the 10th of June 1838, and sixty-three years afterwards this species was rediscovered by Inayat Khan of the Botanical Department of N. India.

Plate 117. Listera ovata *R. Brown.* A plant,—*of natural size.* Fig. 1, single flower; 2, lip; 3, side view of column with ovary and bract; 4, front view of column with ovary; 5, anther; 6, pollinia;—*all enlarged.*

2. Listera Inayati Duthie in Journ. As. Soc. Bengal lxxi, part 2, 41.

Whole plant 1·5 to 2 dm. high, yellowish-brown. *Rootstock* emitting from its base many upturned wiry rather stout fibres. *Stem* stout, bearing four to six large loose blunt sheaths, those of the upper pair opposite and sub-foliaceous but not green. *Raceme* 6 to 9 cm., densely flowered, its rachis glandular-pubescent; *floral bract* longer than the pedicel, lanceolate, acuminate, with involute margins. *Sepals* and *petals* about 2 mm. long, connivent; dorsal *sepal* oval, concave, the lateral pair slightly longer than the dorsal one, obliquely ovate, tapering to an obtuse apex. *Petals* about as long as the dorsal sepal, spathulate, subacute. *Lip* pendulous, twice as long as the lateral sepals, narrowly obovate-oblong, deeply cleft into two slightly spreading obtuse lobes; upper surface with a raised linear callus extending to the sinus. *Column* short and stout, dilated above and below. *Rostellum* projecting over the fertile stigma. *Anther* suborbicular, its apex bifid; *pollinia* narrowly obovoid. *Ovary* subglobose, about as long as its stalk, glandular-pubescent.

Discovered in 1897 by Inayat Khan at Bhurj in the Kagan Valley, Hazara, No. 22596. It flowers during July.

A shorter and much stouter plant than *L. Lindleyana*, and with shorter and more densely flowered racemes; the structure of the flower is also very different. The sub-opposite position and leaf-like appearance of the upper sheaths of this plant suggest an affinity towards *Listera* proper.

PLATE 119. Listera Inayati *Duthie*. Single plant,—*of natural size*. Fig. 1, single flower, side view; 2, front view of flower, with lip removed; 3, side view of ditto with sepals and petals removed; 4 and 5, column; 6, anther; 7, pollinia;—*all enlarged*.

3. LISTERA LINDLEYANA King & Pantling in Ann. R. Bot. Gard. Calc. viii, 258, t. 343.

Whole plant 2 to 3·5 dm. high. *Root-fibres* rather stout and brittle, often forming a congested mass at the end of the root-stock. *Stem* longer than the raceme, stout or slender, bearing three or four loose blunt sheaths about 2·5 cm. long, nearly glabrous below, its upper portion together with the raceme glandular-pubescent. *Leaves* none. *Flowers* dull yellowish-green, 8 to 12 mm. long, lax; *floral bract* ovate-oblong, varying in length. *Sepals* elliptic-ovate, subacute, concave, the lateral ones somewhat falcate. *Petals* much narrower. *Lip* two or three times as long as the sepals, narrowly obovate-oblong, brown, the apex cleft into two oblong or lanceolate acute lobules; the sinus broad and with a small triangular process at its apex; upper surface minutely puberulous, and with a greenish-coloured linear groove which forms a ridge on the back. *Column* much curved, dilated at the base and apex. *Capsule* 8 mm. long, broadly elliptic, often obliquely so, its pedicel about as long. *Neottia listeroides* Lindl. in Royle Ill. Him. Bot. 368, Gen. & Sp. Orch. 458; in Journ. Linn. Soc. i, 176; Hook. f. Fl. Br. Ind. vi, 103; Collett Fl. Siml. 495. *N. Lindleyana* Dcne in Jacquem. Voy. Bot. 163, t. 163.

Distributed throughout the Western Himalaya from Hazara to Kumaon at elevations between 5,000 and 11,000 feet, flowering from July to September. It extends eastwards to Nepal and Sikkim, and north-westwards to the district of Chitral.

4. LISTERA KASHMIRIANA Duthie.

Whole plant about 3·6 dm. high. *Root-fibres* stout, crowded and intricate. Lower portion of glabrous stem stout, enveloped by three or four large loose blunt sheaths. *Leaves* none. *Raceme* laxly many-flowered, with a few linear-oblong acute bracts below the lowest flowers, its rachis minutely puberulous. *Flowers* spreading, 8 mm. long from the base of the slender pedicel to the summits of the sepals and petals, yellowish-brown; *floral bract* broadly ovate, acute, longer than the pedicel, clothed with minute spreading hairs. *Sepals* and *petals* 2 mm. in length, connivent, sparsely hairy. Lateral *sepals* obliquely ovate, acuminate. *Petals* rather obliquely spathulate, rounded at the apex. *Lip* twice as long as the sepals, spreading almost parallel with the much-curved ovary and column, divided at the apex into two divergent obtuse lobules, the margins ciliate except towards the tapering base; upper surface with a stout central callus projecting into the sinus. *Column* 1 mm. long, arched forwards and overlapping the base of the anther. *Rostellum* wide and prominent, projecting over the fertile stigma. *Anther* sub-quadrate, 2-celled, the dividing

septum projecting beyond the emarginate apex; *pollinia* each with a small globular basal gland. *Ovary* curved, ovate, glandular-hairy.

Liddar Valley in Kashmir between 8,000 and 9,000 feet, *Inayat Khan* No. 25372, flowering in August.

This plant has the general appearance of *L. Lindleyana*, but the shape of the petals and the direction of the lip is very different. It agrees with *L. Inayati* as regards the shape of the sepals, and petals, but the raceme is not nearly so dense, the ovary is not globose, and the rostellum is very different. As to the existence of the polliniar gland in this species I should mention that fig. 7 of the plate is an exact representation of a pollinium after removal from the anther, in which the impressions of both glands may be seen on referring to fig. 5 of the same plate.

PLATE 118. Listera kashmiriana *Duthie*. Entire plant,—*of natural size*. Fig. 1, side view of single flower; 2, ditto with sepals and petals removed; 3, a petal; 4, column with anther and rostellum; 5, front view of anther; 6, anther seen from behind; 7, pollinium;—*all enlarged*.

5. LISTERA MICROGLOTTIS Duthie in Journ. As. Soc. Beng. lxxi, part 2, p. 42.

Whole plant 2 to 3·3 dm. high. *Root-fibres* thick, cylindrical, brittle, pale yellowish-brown. *Stem* firm, stout, pale yellow or white, bearing 2 to 4 loose obtuse pale sheaths. *Leaves* none. *Raceme* 1 to 2 dm. long; its rachis and the bracts and pedicels glandular-pubescent. *Flowers* crowded, about 7 mm. in diam., pale green; *pedicel* a little longer than the ovary; *floral bract* equalling or exceeding the pedicel, oblong, obtuse or subacute. *Sepals* 4 mm. long, ovate, subacute, sparsely clothed with stiff spreading hairs, the lateral pair somewhat oblique. *Petals* as long as the sepals, linear-spathulate, margins reflexed. *Lip* erect, linear-oblong, equalling the petals in length, apex entire, margins reflexed. *Column* erect, a little shorter than the petals, dilated at its base and apex, overlapping he anther, *rostellum* prominent. *Pollinia* 2, obliquely obovate-oblong. *Ovary* with pedicel 8 mm. long. *Capsule* obovate, sparsely hairy; its ridges thick and often denticulate.

Discovered by Mr. Mackinnon's collector in Garhwál on the eastern side of Tehri, growing under *rhododendrons* and *oaks* at elevations between 5,000 and 6,000 feet, (Duthie's Nos. 24181, 25426 (*a*); also on the wooded hillsides below Mussoorie at similar elevations (No. 25426). Flowers during August and September.

This plant differs from any known species of the *Neottia* section by its erect and very remarkably restricted lip. It bears a certain resemblance to *N. micrantha* Lindl., but the sepals, petals and lip are quite different.

PLATE 120. Listera microglottis *Duthie*. A plant,—*of natural size*. Fig. 1, a single flower; 2, ditto with the sepals and petals removed; 3 and 4, the petals flattened out; 5, lips flattened out; 6, front view of column showing the anther in situ and the rostellum; 7, side view of ditto; 8, empty anther; 9, pollinia;—*all enlarged*.

30. Gastrodia R. Brown.

Terrestrial leafless parasitic herbs of a brownish colour, with rhizomes and elongated roots. *Stem* erect, sheathed. *Flowers* in a lax raceme. *Sepals* connate with the petals into a ventricose 5-lobed tube slit anteriorly. *Lip* short, its base

adnate to the foot of the column and to the perianth, blade entire. *Column* usually long, narrowly winged, its foot short or none; *rostellum* small, *stigma* large. *Anther* terminal, convex, tumid; *pollinia* 2, subclavate, without caudicle or gland.—Species 9, Asiatic and Australian.

GASTRODIA OROBANCHOIDES Benth. in Gen. Pl. iii, 617.

Root a large oblong or ellipsoid often annulate tuber, parasitic by a small fibrous base to the roots of other plants. *Stem* 2·5 to 6 dm. long, usually very stout; *sheaths* distant, short, loose, the lowest one almost truncate, the upper acute or acuminate *Raceme* 2 to 3 dm. long, laxly many-flowered; *floral bract* linear-lanceolate, acuminate, often longer than the ovary, 3-nerved. *Flowers* sub-erect, light reddish-brown tinged with yellow. *Perianth* about 12 mm. long, ventricose and slightly gibbous, slit half-way down in front on either side of the lip to the level of the insertion of the latter. *Sepals* all equal, obtuse. *Petals* sub-orbicular, inserted within the sinuses of the sepals and a little shorter than them. *Lip* longer than the sepals and about half the length of the perianth, ovate, its edges undulate, the apex concave and reflexed. *Pollinia* obovate. bipartite, coarsely granulate. *Capsule* about 2 cm. long, erect, turgid. Hook. f. Ic. Pl. t. 1852; Fl. Br. Ind. vi, 122; Collett Fl. Siml. 497. *Gamoplexis* Falc. in Royle Ill., 364; Lindl. Gen. and Sp. Orch. 384. *G. orobanchoides* Falc. in Trans. Linn. Soc. xx, 293, t. 13.

Kashmir and on the Murree Hills at about 7,000 feet, *Aitchison;* Chenab Valley, *Baden-Powell;* Bashahr Hills at about 7,000 feet, *Lace* No. 978; Simla Hills 7,000 to 8,000 feet, *T. Thomson*, Gamble No. 6217; *Babington-Smith;* Kángra district, *Duthie's Collector* No. 23343; Deoban in Jaunsar at 9,000 feet, *Gamble* No. 27284; Garhwál, *Falconer;* Mussoorie Hills, *Mackinnon* (Duthie's No. 22984), *Duthie's collector* No. 24163; near Naini Tal in Kumaon, *F. W. Seers.* Flowers in July and August.

PLATE 121. Gastrodia orobanchoides *Benth.* Upper and lower portions of plant,—*of natural size.* Fig. 1, single flower; 2, perianth, spread out; 3, side view of column and ovary; 4, front view of ditto; 5 and 6, anther; 7, pollinia; 8, capsule; 9, transverse section of ditto;—*all enlarged.*

31. Aphyllorchis Blume.

Terrestrial leafless herbs with rhizomes and thick roots. *Stem* simple, sheathed. *Flowers* in racemes, brown-coloured. *Sepals* subequal, free, erect or spreading. *Petals*, smaller than the sepals. *Lip* sessile on the base of the column, or attached to it by a short claw, as long as the sepals, oblong, sometimes auricled at the base, entire or 3-lobed. *Column* usually rather long, not winged. *Stigma* anticous, concave, ovate or oblong or clavate.—Species about 6, Indian and Malayan.

APHYLLORCHIS GOLLANI Duthie in Journ. As. Soc. Beng. lxxi, part 2, p. 42.

A tall scapigerous parasite. *Rhizome* with far-extending thick fleshy roots, not scaly *Scape* 4 to 5 dm. high, erect, stout, bearing several unequal tubular blunt sheaths *Raceme* about 1 dm. long. *Flowers* 8 to 10, crowded, 3·3 cm. long; *floral bract* longer

than the slender clavate ovary, elliptic-lanceolate, acuminate, 5—7-nerved, at first deflexed, but afterwards erect. *Sepals* as long as the bracts, erect, ovate-lanceolate, acuminate, with spreading tips, their nerves dark reddish-brown on a pale-green ground. *Petals* shorter than the sepals, lanceolate, acuminate, pale-green veined with purple, the midribs thickened on the back. *Lip* slightly shorter than the petals, pale yellowish-green, attached to the base of the column by the concave winged claw; its apical portion ovate and bluntly acuminate, the margins towards the base reflexed, erosel the apex without any concavity. *Column* 1·2 cm. long, stout, curved and narrowed towards the base. *Anther* 2-celled, its cells parallel. *Pollinia* ovate-oblong, *stigma* with an overlapping irregularly lobulate border.

Tehri-Garhwál on Nág Tiba at elevations between 8,000 and 10,000 feet, *W. Gollan* (*Duthie's* No. 2062), *Duthie's collector* No. 23000. Flowers in August.

The original specimens discovered in 1881 by Mr. W. Gollan, after whom I have named the species, were in too young a condition even for determining the genus. Its nearest known ally is *A. alpina* King & Pantling, a high-level Sikkim species. It differs from the Sikkim plant in the rhizome not being scaly, the bracts become erect as the flowers expand, the racemes are much shorter, the lip is attached to the base of the column and does not form a pouch, and the epichile has no concavity at its apex.

Plate 122. Aphyllorchis Gollani *Duthie*. A plant,—*of natural size*. Fig. 1, floral bract; 2, side view of flower; 3, ditto, with the sepals and petals removed; 4, lip; 5, front view of column; 6, side view of ditto; 7, anther; 8, pollinia;—*all enlarged*.

32. Galeola Lour.

Leafless, yellow or brown, climbing or erect herbs. *Flowers* rather large, in racemes or panicles on the ends of the stem-branches. *Sepals* subequal, concave, free, connivent or spreading. *Petals* as large as the sepals, or narrower or broader. *Lip* adnate to the base of the column and convolute round it, broad, concave, with or without lateral lobes; apical lobe large, broad. *Column* dilated towards the apex. *Anther* conical, 2-celled; pollinia 2, broad, often compressed, powdery.—Species 12; Indian, Chinese, Malayan and Australian.

Galeola Falconeri Hook. f. Fl. Br. Ind. vi, 88.

Rhizome 3·5 to 6·5 cm. thick, branching, bearing large fleshy triangular scales. *Stems* 18 to 30 dm. in height and about 6·5 cm. thick at the base, clothed at intervals with large ovate-lanceolate acute bracts. *Panicle* 6 to 9 dm. long, with lax drooping branches. *Flowers* bright yellow, about 4·5 cm. across, of a spongy texture; *floral bract* shorter than the short stalk of the ovary, lanceolate, concave. *Sepals* subequal, broadly ovate, subacute, sparsely furfuraceous like the ovary. *Petals* ovate, acute, edges erose. *Lip* sessile, without side lobes, deeply concave, with a small fold under the column, apex rounded, the margins undulate and ciliolate; the upper surface papillose, but with a broad glabrous patch near the centre. *Column* stout, slightly bent forward. *Anther* fleshy, glabrous, its lip entire; pollinia 2, much compressed, obliquely ovate. *Capsule* oblong, subfalcate, sharply angled, 2·2 dm. long, somewhat furfuraceous. King & Pantling in Ann. R. Bot. Gard. Calc. viii, 265, t. 353. Pogochilus sp. Falc. in Hook. Journ. Bot. (1842), 73.

Garhwál, *Falconer;* below Mussoorie at about 6,000 feet in wet ground, *Mackinnon* (Duthie's No. 22726); Jaunsar in the Tonse Valley at 4,000 feet, *Gleadow*. Flowers in July. Found also in Sikkim, but rare.

33. Pogonia Juss.

Terrestrial 1-leaved herbs; the *flower-scapes* from the same tuber as the leaf and appearing before it or contemporaneously; *tuber* emitting, just below the surface of the ground, 2 or 3 runners, each producing at its extremity a tuber smaller than that of the parent. *Leaf* broadly cordate or orbicular, strongly plicate. *Flowers* solitary or in racemes, often pendulous. *Sepals* and *petals* subequal, narrow, connivent or spreading. *Lip* sometimes saccate at the base, adnate to the base of the column, rather narrow, the lower part convolute round the column; the lateral lobes small, usually triangular; the terminal lobe flat, ovate or orbicular, entire or fimbriate. *Column* elongate, clavate upwards; *stigma* anticous, oblong to orbicular. *Pollinia* 2 or 4, elongate, often cohering, but without either caudicle or gland.—Species about 70, in Asia and America, and a few West Indian.

Scape 1-flowered	*1. P. Mackinnoni.*
Flowers in racemes.	
Leaves many-nerved, floral bracts deflexed.	
Leaves glabrous; sepals and petals large, pink	*2. P. Gammieana.*
Leaves hairy on the veins, flowers smaller; sepals and petals green with purplish veins	*3. P. flabelliformis.*
Leaves 7—9-nerved, floral bracts erect ...	*4. P. carinata.*

1. Pogonia Mackinnoni Duthie in Journ. As. Soc. Beng. lxxi, part 2, p. 43.

Tuber globose, annular and warted, about 1·2 cm. in diam. Leaf and scape frequently from the same tuber, but not contemporaneous. *Leaf* about 5 cm. long and broad, with a cordate base, 7-lobed; terminal lobe acute, the others rounded; principal veins terminating at the ends of the lobes, with many less conspicuous intermediate ones; *petiole* 2·5 cm. long. *Scape* 1-flowered, about 10 cm. long when in flower, elongating till fruiting, enclosed within two or three rather loose tubular sheaths. *Flowers* spreading, shortly pedicelled, 18 mm. long; *bract* erect, shorter than the cylindrical truncate ovary. *Sepals* 17 mm. long, linear-lanceolate, acuminate, light green blotched with reddish-brown outside. *Petals* very similar to the sepals, but a little shorter and not so acute at the apex. *Lip* shorter than the petals, oblong when spread out, strongly 3-nerved, white tinged with green towards the base; side-lobes erect, acute; terminal lobe irregularly spotted with purple. *Column* slender, 7 mm. long. *Anther* broad, margins of cells toothed. *Pollinia* 2, narrowly clavate, connate above their slender tapering bases.

Near Mussoorie between 5,000 and 6,000 feet, *Mackinnon* (Duthie's Nos. 21781, 22705). Flowers during May and June, and the leaves appear about three weeks later.

This species is very similar in habit to *P. macroglossa* King & Pantling, but the leaves are more distinctly lobed; the flowers are smaller and spreading, and the shape of the lip is ver different.

PLATE 123. Pogonia Mackinnoni *Duthie.* A flowering plant and a leaf-bearing plant, —*of natural size.* Fig. 1, a flower; 2 ditto, with sepals and petals removed; 3 lip, spread out; 4 column and ovary; 5 anther; 6 pollinia;—*all enlarged.*

2. POGONIA GAMMIEANA Hook. f. in Bot. Mag. t. 6671.

Tuber about 3 cm. in diam., globular, warted. *Leaf* 1·2 to 1·5 dm. in length and breadth, reniform, abruptly apiculate, glabrous, many-nerved, its edges much undulate; petiole about as long as the blade, sheathed at the base. *Scape* 1·5 to 2 dm. high, stout, bearing two or three long tubular bracts with acute and sometimes bifid apices. *Raceme* laxly 5 to 8-flowered. *Flowers* 2·5 cm. long, drooping, pink streaked with white, *floral bract* deflexed, longer than the truncate stalked ovary, linear-lanceolate, acuminate; stalk and ridges of ovary winged. *Sepals* and *petals* subequal, spathulately oblanceolate, acuminate, sub-connivent. *Lip* slightly saccate at the base, elliptic-obovate when spread out, pale green; lower half convolute round the column and with two short triangular forward-pointing side lobes, the disk bearing two parallel ridges; *epichile* spreading, its edges deeply crenulate, the disk hairy and bearing three parallel central ridges. Hook. f. Fl. Br. Ind. vi, 120; King & Pantling in Ann. R. Bot. Gard. Calc. viii, 269, t. 359.

Siwalik range, *Duthie's collector* No. 24194; Dehra Dun, *Mackinnon, Duthie's collector* No. 24195; Garhwál, *Falconer, Duthie's collector* No. 25829. Below Mussoorie at about 3,000 feet, *Mackinnon* (Duthie's No. 22975); Kumaon at Bagesar 3,500 feet, *Strachey & Winterbottom* No. 19 (Eulophia). Flowers in May and the leaves are full grown during July. It is found also in Sikkim, in hot valleys.

3. POGONIA FLABELLIFORMIS Lindl. in Wall. Cat. 7400.

Tuber globose, about 2 cm. in diam., annulated, often warted. *Leaf* 4 to 10 cm. in diam., appearing after the flowers, orbicular-cordate, cuspidate, many-nerved, often blotched with reddish-purple, hairy on the veins when young; margin undulate, petiole 1 to 2 dm. long, sheathed at the base. *Scape* stout, 1·5 to 3 dm. high, its lower portion enclosed within loose tubular blunt hyaline sheaths. *Raceme* laxly 4–6-flowered; *floral bract* linear-lanceolate, acuminate, more than twice as long as the ovary, reflexed, persistent, hyaline. *Flowers* about 2·2 cm. long, pedicelled, drooping. *Sepals* and *petals* linear-lanceolate, acuminate, somewhat recurved, pale green veined with reddish-purple; the *petals* rather shorter than the sepals. *Lip* 15 mm. long, 3-lobed near the middle, white tinged with yellow towards the base and conspicuously veined with purple; the upper surface with many hairs on the raised central ridges; side lobes erect, obtuse; terminal lobe deflexed, ovate, obtuse, the margins slightly undulate. *Column* 7 mm. long, curved from near the base, dilated upwards. *Ovary* 4 mm. long, oval-oblong. *Capsule* about 13 mm. long, the ridges winged. Lindl. Gen. and Sp. Orch. 415; in Journ. Linn. Soc. iii, 45; Hook. f. Fl. Br. Ind. vi, 121. *P. Nervilia* Blume Mus. Bot. i, 32. *P. carinata.* Wight Ic. 1720 (not of Lindl.). *Nervilia Aragoana* Gaud. in Freyc. Voy. Bot. 422, t. 35.

Near Mussoorie at elevations between 4,000 and 6,000 feet, *Mackinnon*, *Duthie* Nos. 21782, 22704, 22976; Tehri-Garhwál 4 to 5,000 feet, *Falconer*, *Duthie* No. 586. Flowers during June and July. It extends eastwards to Parasnath in Bengal and to Burma, and is found also in the Marianne Islands and in Timor

The plant mentioned by Dalzell and Gibson in Bomb. Fl. 270 under the name of *P. flabelliformis* as growing "in the densest and shadiest thickets of the Konkan, as well as near Dharwár" is probably *P. carinata*.

Plate 125. Pogonia flabelliformis *Lindl.* A flowering plant and a foliage plant,—*of natural size*. Fig. 1, side view of single flower; 2, ditto, with the sepals and petals removed; 3, lip, spread out; 4, column and ovary; 5, upper portion of column; 6, anther; 7, pollinia;—*all enlarged*.

4. Pogonia carinata Lindl. Gen. and Sp. Orch. 414.

Tuber globose or obovate, about 1·7 cm. in diam., annulated and warted. *Leaf* 3·5 to 6·5 cm. in diam., ovate, acute or cuspidate, cordate or cuneate at the base, 7–9-nerved, glabrous; *petiole* 2·5 to 5 cm. long, sheathed at the base. *Scape* up to 3 dm. high, bearing three or four loose tubular acute or acuminate sheaths. *Raceme* laxly few- or many-flowered, *floral bract* twice as long as the pedicelled ovary, erect, lanceolate, acuminate, 5-nerved. *Flowers* about 2·5 cm. long. *Sepals* and *petals* about equal, spreading, linear-lanceolate, acuminate, green. *Lip* 18 mm. long, straight, trough-shaped, not saccate at the base, 3-lobed above the middle, white tinged with yellowish-green, veins pink; upper surface hairy on the central ridges and veins; side lobes erect, rather shallow, terminal lobe not deflexed, ovate, acuminate, its margin irregularly toothed. *Column* 6 mm. long, very slightly curved, dilated at its apex. *Anther* triangular, beaked in front. Lindl. in Journ. Linn. Soc. iii, 45 (excl. syn. Griff.). *P. flabelliformis* Dalz. and Gibs. Bomb. Fl. 270 (not of Lindley). *Epipactis carinata*, Roxb. Fl. Ind. iii, 454.

In the Sub-Himalayan tracts of Northern Oudh in the districts of Bahraich and Gonda, *Duthie's collector* Nos. 23864, 23864(*a*), Rámganga Valley in Kumaon, *T. Thomson*. Flowers during May, and the leaves appear about a month later. This species extends eastwards to Bengal and Burma and southwards to Bombay and S. India.

Plate 124. Pogonia carinata *Lindl.* A flowering plant and a foliage plant,—*of natural size*. Fig. 1, side view of flower; 2, lip, spread out; 3, side view of lip and ovary; 4, column and ovary; 5, upper portion of column, with the anther in situ; 6, anther;—*all enlarged*.

34. Cephalanthera Richard.

Terrestrial leafy herbs with fibrous roots, or leafless and with tuberous roots. *Leaves* sessile, plicate. *Flowers* in spikes or racemes, suberect. *Sepals* and *petals* subsimilar, free, connivent. *Lip* shorter than and concealed by the sepals and petals, adnate to the base of the column, the basal portion concave or saccate and embracing the column; anterior portion short and ribbed. *Column* semiterete; *rostellum* short or almost obsolete. *Anther* erect; *pollinia* 2, bipartite. *Stigma* anticous. *Capsule* erect.—Species about 10, in temperate regions of the Northern Hemisphere.

CEPHALANTHERA ENSIFOLIA Rich. Orch. Annot. 29.

Stem rising from a thin creeping rhizome, 1·5 to 4 dm. high, sheathed at the base. *Leaves* lanceolate or ovate-lanceolate, conduplicate, 5 to 10 dm. long, upper longer and narrower than the lower. *Peduncle* 2·5 to 3·8 cm. long. *Raceme* longer than the peduncle, 8- or more-flowered, glabrous. *Flowers* white, about 12 mm. long; *floral bract* ovate-lanceolate, acuminate or acute, shorter than the ovary. *Sepals* ovate-lanceolate, acute. *Petals* somewhat smaller, elliptic, obtuse. *Lip* oblong, white with yellow spots, distinctly divided across the middle by an oblique sinus into a hypochile and epichile, the former convolute and slightly ribbed; the latter concave and prominently ribbed. *Column* long, terete. *Pollinia* linear-oblong, grooved. Lindl. Gen. and Sp. Orch. 412; in Journ. Linn. Soc. i, 172, 175; Boiss. Fl. Or. v, 85; Hook. f. Fl. Br. Ind. vi, 125; King & Pantling in Ann. R. Bot. Gard. Calc. viii, 271, t. 362; Collett Fl. Siml. 497. *C. Xyphophyllum* Reichb. Ic. Fl. Germ. xiii, t. 470. *C. acuminata*, Lindl. in Wall. Cat. 7405; Gen. and Sp. Orch. 412; Wight Ic. 1721; Dene in Jacquem. Voy. Bot. 164, t. 164.

Abundant all over the Western Himalaya from Kashmir to Kumaon at elevations between 6,000 and 12,000 feet. It flowers from May to July, and extends eastwards to Nepal, Sikkim and Bhután.

35. Epipactis Adans.

Terrestrial herbs with green leaves and fibrous roots. *Leaves* sessile, plicate. *Flowers* racemose, drooping; *floral bracts* elongating and often leafy. *Sepals* and *petals* broadly lanceolate, acuminate, strongly nerved. *Lip* adnate to the base of the column, distinctly divided into hypochile and epichile, the hypochile strongly deflexed, concave or saccate, jointed to the epichile at a right angle, both entire. *Column* short; *stigma* large, anticous; *rostellum* broad, prominent. *Anther* erect, obtuse, its cells contiguous; *pollinia* 2, bipartite, very narrow.—Species about 10, in the Northern Temperate Hemisphere.

Flowers usually in dense racemes, hypochile globular-saccate, epichile ovate-cordate	*1. E. latifolia.*
Flowers distant.	
Hypochile trough-shaped, epichile lanceolate	*2. E. consimilis.*
Hypochile broadly saccate, epichile ovate-lanceolate, acuminate ...	*3. E. gigantea.*

1. EPIPACTIS LATIFOLIA All. Fl. Pedem. ii, 152.

Stem up to 9 dm. in height, slender, glabrous below, the upper portion including the peduncle and raceme puberulous. *Leaves* 7·5 to 13 cm. long and from 5 to 7·5 cm. in breadth, smaller upwards, orbicular to ovate-lanceolate or ovate-elliptic, acute, many-nerved, glabrous, but the margins often ciliolate. *Raceme* 1 to 3 dm. long, many-flowered, usually dense. *Flowers* subsecund, 1·3 to 2 cm. across, green; *floral bracts* linear-lanceolate, acuminate, the lowermost large and leaf-like. *Sepals* lanceolate, acuminate. *Petals* like the sepals but smaller. *Lip* shorter than the petals; the *hypochile* forming a subglobose sac, reddish-brown inside; *epichile* broadly cordate, with erose edges, upper surface with usually two globose calli near its base. *Column* short and broad, white; *stigma* broad. *Staminodes* triangular. Swartz in Act. Holm. for 1800, 232; Lindl. Gen.

and Sp. Orch. 461; Boiss. Fl. Or. v, 87; Reichb. Ic. Fl. Germ. xiii, p. 146, tt. 184-186; Hook. f. Fl. Br. Ind. vi, 125; King & Pantling in Ann. R. Bot. Gard. Calc. viii, 271, t. 363. *E. macrostachya* Lindl. in Wall. Cat. 7404. *E. consimilis* Don. Prod. Fl. Nep. 28, not of Wall. *E. Dalhousiæ* Wight Ic. 1723.

Common throughout the Western Himalaya at elevations between 5,000 and 11,000 feet. Flowers during July and August. It extends eastwards to Nepal and Sikkim, and is found also in N. Asia, Japan, Hongkong, Europe and N. Africa.

Var. 1. *herbacea* Hook. f. in Fl. Br. Ind. l.c.; smaller; leaves elliptic, acute; raceme, short, dense-flowered; flowers 1·3 cm. in diam., glabrous, pale greenish-white. *E. herbacea* Lindl. in Royle Ill. 368; Gen. and Sp. Orch. 462.

Near Mussoorie, *Royle;* also in Upper Burma.

Var. 2. *Thomsoni* Hook. f. in Fl. Br. Ind. vi, 126; a small slender plant with lanceolate leaves, the margins not ciliolate; raceme lax, floral bracts deflexed; flowers 13 mm. in diam., glabrous. *E. macrostachya* Wight l.c. 1722 (not of Lindl.).

Western Tibet 10 to 11,000 feet, *T. Thomson;* near Naini Tal in Kumaon, *Duthie's collector* No. 24088.

2. Epipactis consimilis Wall. Cat. 7403 (not of Don).

Height of whole plant 3·5 to 6 dm. *Stem* glabrous. *Leaves* 1·5 to 2 dm. long, lanceolate, acuminate, the uppermost shorter and much narrower, nerves prominent. *Raceme* 1 to 1·5 dm. long, laxly flowered, its rachis tomentose. *Flowers* 2 to 2·5 cm. across; *floral bract* ovate or linear-lanceolate, varying in size. *Sepals* spreading and pubescent outside, unequal, concave; the dorsal one lanceolate, acute; lateral pair much wider. *Petals* ovate, acute, tomentose outside on the thickened midrib. *Lip* a little shorter than the sepals; *hypochile* trough-shaped, bearing granular unequal calli inside, with two larger obtuse semi-transparent nectar-exuding ones near the apex; *epichile* lanceolate, with erect lobes, the upper surface with a median ridge terminating below the white apex. *Column* stout, much curved. *Stigma* large, subrotund, with two glands on the lower margin. *Anther* tumid. Hook. f. Fl. Br. Ind. vi, 126; King & Pantling in Ann. R. Bot. Gard. Calc. viii, 272, t. 364; Rolfe in Journ. Linn. Soc. xxxvi, 48. *E. veratrifolia* Boiss. & Hohen. Diagn., Ser. 1, xiii, 11; Boiss. Fl. Or. v, 87; Lindl. in Journ. Linn. Soc. i, 174.

Gilgit district, *Winterbottom* No. 956; Chitral district, *Duthie's collector* Nos. 16673, 16674; Bashahr, *Lace* No. 352; near Simla, 3,000 feet, *Collett;* N.-W. India, *Royle;* Garhwál, *Falconer;* below Mussoorie, *Mackinnon* (Duthie's No. 22720); Dehra Dun, *Duthie* Nos. 10783, 22720, *Gamble, Mackinnon;* Kumaon 3,000 feet, *Strachey & Winterbottom* No. 51. Flowers during February and March. It is found in Nepal and Sikkim at low elevations and occurs also on the Shan Hills in Upper Burma. In the Gangetic Plain it is met with along the banks of the Jumna Canal distributaries near Saharunpur. It grows also in the Peshawar Valley and in the Kurram Valley, and extends through Afghanistan westwards to Syria, and is also found in China.

The sepals of this plant are clothed with white hairs on a deep lavender-ground; inside they are green, as are both surfaces of the petals, and are marked with broad bands of reddish-brown; the hypochile of the lip is purple, and the epichile is pale brown, the apex being pure white.

3. Epipactis gigantea Dougl. in Hook. Fl. Bor. Amer. ii, 202, t. 202.

Stem 3 to 6 dm., clothed at the base with broad loose sheaths. *Leaves* 1 to 1·5 cm. long, ovate-lanceolate to linear-lanceolate, the margins and nerves beneath scabrous. *Racemes* 1 to 2 dm. long, the rachis pedicels and ovaries puberulous. *Flowers* drooping, distant, pedicelled, 2·5 cm. in diam.; *bracts* longer than the flowers, lanceolate, acuminate, the lower ones large and leaf-like. Sepals and petals about 2 cm. long, connivent. *Sepals* green veined with red; dorsal sepals erect, broadly ovate; the lateral pair ovate-lanceolate, subacute. *Petals* rather shorter, obliquely ovate, obtuse, often veined with red. *Lip* longer than the sepals; *hypochile* large, saccate, much broader than the ovate or ovate-lanceolate epichile. *Column* stout with two bluish lateral horns below the clinandrium. *Capsule* 2-3 cm. long, obovate-oblong. S. Watson Bot. King's Exped. 341; Bot. Calif. ii, 137; Coulter Bot. Rocky Mt. Flora 243; Hemsl. Biol. Cent. Amer. Bot. iii, 304; Lindl. in Benth. Pl. Hartweg. 53; Bot. Mag. Pl. 7690; Rolfe in Journ. Linn. Soc. xxxvi, 49. *E. americana* Lindl. in Ann. Sc. Nat. iv, 385; Gen. and Sp. Orch. 462. *E. Royleana* Lindl. in Royle Ill. 368; Gen. and Sp. Orch. 461; in Journ. Linn. Soc. i, 174; Hook. f. Fl. Br. Ind. vi, 126; Collett Fl. Siml. 499. *Cephalanthera Royleana* Regel in Act. Hort. Petrop. vi, 490; Boiss. Fl. Or. v, 85.

Kagán Valley in Hazara between 8,000 and 12,000 feet, *Duthie's collector*; Baltistan at 8,000 to 9,000 feet, *T. Thomson*, *Duthie* No. 12075; plentiful also in Kashmir and eastwards to Kumaon at elevations between 7,000 and 11,000 feet. Flowers during July. It extends eastwards to Nepal and Sikkim, and beyond the N.-W. Frontier it is found in Waziristan, and in the neighbourhood of Gilgit and Samarkand. It occurs also in China and in N. and Cent. America.

TRIBE V.—GOODYEREÆ.

Anther posticous, vertical but inverted; pollinia two, or four in two pairs, attached to a single gland either by one or by two caudicles, or without a caudicle; pollen granular or sectile.

Stigma single, anticous; pollinia 2, or 4 in two pairs
  Spike spirally twisted, lip not saccate, pollinia 4 . . 36. *Spiranthes*.
  Spike not twisted, lip saccate, pollinia 2 . . . . . 37. *Goodyera*.
Stigmas 2, distant, lateral pollinia 2, bipartite (4 in *Anœctochilus Roxburghii*)
  Lip saccate or cymbiform at the base . . . . . 38. *Zeuxine*.
  Lip spurred, its apex deeply 2-lobed . . . . . 39. *Anœctochilus*.

36. Spiranthes Richard.

Terrestrial herbs with tuberous or fibrous roots. *Stem* leafy. Leaves (in the Indian, species) linear. *Flowers* small, secund, in a spiral spike. *Sepals* subequal, free or sometimes cohering with the petals to form an erect hood, the lateral pair gibbous at the base. *Lip* erect, entire or 3-lobed, the base concave, but neither saccate nor spurred, the disk bearing lamellæ or calli. *Column* short, terete. *Stigma* single, broad, anticous; *rostellum* erect, obtuse or elongate and bifid. *Anther* erect, 2-celled; *pollina* 4, united in pairs, sessile on a small gland. Species about 80, in temperate and tropical regions.

Roots fibrous, leaves lanceolate, radical and cauline . . . . . 1. *S. australis*.
Roots tuberous, leaves ovate all radical . . . . . 2. *S. autumnalis*.

1. Spiranthes australis Lindl. in Bot. Reg. sub. t. 823.

Whole plant 1·5 to 4·5 dm. high. *Root-fibres* thick and fleshy. *Stem* stout or slender. *Leaves* alternate, clustered near the base of the stem, 3·5 to 10 cm long, shortly sheathing, linear or oblanceolate, acute or acuminate. *Peduncle* with a few distant very acuminate bracts. *Spike* 7·5 to 15 cm. long, rachis glandular-pubescent. *Flowers* very small, crowded, secund, arranged in a spiral, white or pink; floral *bract* ovate, longer than the sessile ovary; *perianth* 3 to 5 mm. long. *Sepals* subequal, ovate-oblong, with broad bases and acute reflexed tips. *Petals* smaller than the sepals, linear, obtuse, their apices reflexed. *Lip* oblong, crisped, its base saccate and biglandular, the apex sub-quadrate, truncate, erose. *Column* short. *Rostellum* pointed. *Stigma* broad *Capsule* about 12 mm. long, fusiform, ridged, pubescent. Lindl. Gen. and Sp. Orch. 464; in Journ. Linn. Soc. i, 178; Dalz. & Gibs. Bomb. Fl. 270; A. Rich. in Ann. Sc. Nat., Ser. 2, xv, 78; Hook. f. Fl. Br. Ind. vi, 102; King & Pantling in Ann. R. Bot. Gard. Calc. viii, 278 t. 369; Collett Fl. Siml. 495; Rolfe in Journ. Linn. Soc. xxxvi, 41. *S. flexuosa* and *S. parviflora* Lindl. in Bot. Reg. under t. 823. *S. amœna* Bunge Enum. Pl. China 63. *S. novæ-Zelandiæ* Hook. f. Fl. New Zeal. 243. *Neottia australis* R. Br. Prod. 319; Don Prod. Fl. Nep. 27. *N. crispata* Blume Bijdr. 406

N. flexuosa and *N. parviflora* Smith in Rees' Cyclop. *N. sinensis* Pers. Syn. ii, 511. *N. amœna* Bieb. Fl. Taur. Cauc. iii, 606. *Gyrostachys australis* Blume Fl. Jav. 107, tt. 37, 38. *Spiranthes* Griff. Notul iii, 384; Ic. Pl. As. t. 348.

Throughout the Western Himalaya up to 10,000 feet. It flowers all through the summer. Eastwards, in India, it extends to Nepal, Sikkim and Assam. It is found over the greater portion of Peninsular India, and beyond the N.-W. Frontier it extends through Afghanistan to Europe, N. Asia and China; it occurs also in N. America, Java, Australia and New Zealand.

2. Spiranthes autumnalis Rich. in Mém Mus. Par. iv (1818), 59.

Glandular-pubescent. *Root* of two fleshy fusiform or subcylindric tubers 1·5 to 3·5 cm. long. *Leaves* in a tuft at the side of the flowering stem, arranged on a very short lateral stem that flowers in the following year, 2·5 to 3·5 cm. long, ovate, acute, cuneate at the base. *Spike* stout, twisted, its length with peduncle 1 to 1·5 dm.; *floral bract* ovate-lanceolate, acuminate, longer than the ovary. *Flowers* secund, greenish-white, variable in size, but usually larger than those of *S. australis*. *Sepals* and *petals* connivent, hairy outside. *Lip* oblong-panduriform, glabrous, with two glands at the base, crenulate along the apical margin. Reichb. Ic. Pl. Germ. xiii, 150, t. 474; Lindl. Gen. and Sp. Orch. 469; in Journ. Linn. Soc. i, 277; Boiss. Fl. Or. v, 90. Hook. f. Fl. Br. Ind. vi, 103. *Ophrys spiralis* Linn. Sp. Pl. 945. *Neottia spiralis* Swartz Act. Holm. 226.

Lohuaghát in Kumaon between 4,000 and 5,000 feet, *T. Thomson*, flowering in May. This species was collected in Afghanistan by Griffith, and is found in many parts of Europe between the Caucasus and the Atlantic Ocean.

37. Goodyera R. Br.

Terrestrial leafy herbs. *Stem* decumbent below, erect above. *Leaves* usually rather thick, with wide sheaths and usually petioled. *Flowers* small, numerous, in terminal and sometimes secund spikes or racemes. *Sepals* subequal, often pubescent outside; the dorsal concave and, with the petals, forming a hood over the column, the lateral pair free, subconnivent or spreading. *Lip* attached to the base of the column, entire, saccate or cymbiform at the base; apical lobe small, usually acute and decurved, the basal sac with setæ calli or ridges inside, rarely smooth. *Column* short, the *rostellum* projecting. *Anther* usually pyriform, with a long erect beak; *pollinia* usually 2, clavate, sessile on a large or small gland. *Stigma* undivided, anticous.—Species about 36, in Europe, Asia, N. America, New Caledonia and the Mascerene Islands.

Stem tall; up to 7·5 dm. in length, leafy upwards; flowers in dense spikes . . . . . *1. G. procera.*

Stem not exceeding 3 dm. in length, flowers in more or less lax racemes.

Lip not setose within, leaves basal.

Sac of lip quite smooth within, not projecting beyond the bases of the sepals . . . . . *2. G. repens.*

Sac of lip with 2 ridges inside, projecting beyond the bases of the sepals . . . . . *3. G. fusca.*

Lip setose within.
Leaves more or less distant on the stem, not cordate at the base.
Stem elongate, floral bracts much exceeding the erect flowers . . . . . *4. G. foliosa.*
Stem short, floral bracts shorter than the very large secund flowers . . . . . *5. G. biflora.*
Leaves subradical, cordate at the base . . . . . *6. G. cordata.*

1. GOODYERA PROCERA Hook. Exot. Flora t. 39.

Stem 2·5 to 7·5 dm., glabrous, enveloped in the wide lax leaf-sheaths. *Leaves* many, long-petioled; petiole 3·5 to 7·5 cm. long, stout and with a broadly sheathing base; blade 7·5 to 15 cm. long, elliptic or ovate-elliptic, tapering at each end, acute or acuminate. *Peduncle* bearing many lanceolate acuminate bracts, glabrous below, pubescent above, *spike* 7·5 to 20 cm. long, many and densely flowered, the rachis pubescent. *Flowers* minute, subglobose, white tinged with green; *floral bract* ovate-lanceolate, acuminate, pubescent at the edges, equalling the glabrous ovary. *Sepals* subequal, broadly ovate, obtuse, sub-connivent, glabrous. *Petals* cuneately obovate, clawed. *Lip* a little longer than the sepals, with a large saccate base; its apex decurved, triangular, acute, 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 anticous stigma. *Anther* broadly pyriform, obtuse; *pollinia* clavate-cylindric, sessile on the small oblong gland. Lindl. Gen. and Sp. Orch. 493; in Journ. Linn. Soc. i, 183; Royle Ill. 368; Don Prod. Fl. Nep. 28; Wight Ic. 1729; Hook. f. Fl. Br. Ind. vi, 111, King & Pantling in Ann. R. Bot. Gard. Calc. viii, 282, t. 378; Rolfe in Journ. Linn. Soc. xxxvi, 45. *G. carnea* A. Rich. in Ann. Sc. Nat. ser. 2, xv, 80. *Cionisaccus lanceolatus* Breda Orch. Kuhl. et Hassk. t. 1. *Cordylestylis foliosa* Falc. in Hook. Journ. Bot. iv (1842), 75. *Neottia procera* Ker. in Bot. Reg. t. 639.

Dehra Dun, *Mackinnon's collector;* in the Sub-Himalayan tract of the Bahraich District in N. Oudh, *Duthie's collector* No. 23862; Outer hills of Garhwál and Kumaon up to 3,000 feet. Flowers during May. It extends eastwards to Nepal, Sikkim, Bhutan, Assam, Sylhet and to the Khasia and Naga Hills; southwards it is found in Central and S. India; it occurs also in China, Honkong and Java.

2. GOODYERA REPENS R. Brown in Ait. Hort. Kew, ed. 2, v, 198.

An evergreen stoloniferous herb, 1 to 2 dm. high. *Stem* glabrous, leafy below and bracteate above. *Leaves* elliptic or ovate-elliptic, subacute, petioles sheathing in the lower half, blade 1·2 to 2·5 cm. long, green reticulated with white. Bracts of upper part of stem and on the peduncle linear, convolute. *Raceme* 2·5 to 5 cm. long, subsecund, its rachis and the bracts and ovaries sparsely pubescent or nearly glabrous. *Flowers* globular, 3·5 mm. across, white flushed with brownish-pink; *floral bract* linear-lanceolate, longer than the ovary. *Sepals* subequal, ovate, acute, connivent. *Petals* about as long as the sepals, obliquely cuneate—oblong, falcately acute at the apex, the edges slightly erose-dentate. *Lip* about as long as the sepals, saccate at the base, apical lobe short, ovate, subacute, concave, the edges somewhat undulate;

the sac not setose within. *Column* short, without processes; *stigma* orbicular, *rostellum* shield-shaped. *Anther* obovate, beaked; *pollinia* clavate, sessile on the large oblong—quadrate gland. Lindl. Gen. and Sp. Orch. 492; in Journ. Linn. Soc. i, 183; Reichb. Ic. Pl. Germ. xiii, 155, t. 482; Ledeb. Fl. Ross. iv, 86; Boiss. Fl. Or. v, 90; Hook. f. Fl. Br. Ind. vi, 111; King & Pantling in Ann. R. Bot. Gard. Calc. viii, 279, t. 370; Collett Fl. Siml. 496; Rolfe in Journ. Linn. Sec. xxxvi, 45. *G. marginata* Lindl. in Wall. Cat. 7394, Gen. and Sp. Orch. 493, in Journ. Linn. Soc. i, 183. *Satyrium repens* Linn. Sp. Pl. 1339.

Widely distributed throughout the Western Himalayan area at elevations between 7,000 and 10,000 feet, flowering during July and August. It extends eastwards from Kashmir to Sikkim, E. Tibet and China, and through Afghanistan to Europe and N. Asia, occurring also in N. America.

In *G. marginata* of Lindley the leaves are uniformly green, the raceme is longer and more compact and the slenderly acuminate floral bracts are much longer than the flowers. I am inclined to believe that it will prove to be a distinct species. *G. repens* (proper) enters India from the direction of Europe through Afghanistan to Kashmir, and is found again in Sikkim, whence it extends to China, whereas *G. marginata* occupies the intermediate area of the Himalaya between Simla and Nepal.

3. Goodyera fusca Lindl. in Wall. Cat. 7395.

Whole plant 2·3 to 3 dm. high. *Stem* glabrous, with the leaves clustered near the base and bearing upwards several oblong acute leaf-like bracts 2 to 2·5 cm. long. *Leaves* thick, 2·5 to 3·8 cm. long, 5-nerved, veins anastomosing, edges sub-revolute; *petiole* broad, widely sheathing at the base. *Peduncle* longer than the stem, pubescent. *Raceme* many-flowered, not secund, its rachis and the bracts pubescent. *Flowers* white tinged with green and yellow, *floral bract* ovate-oblong, subacute, longer than the pubescent ovary. *Sepals* connivent, subequal, oblong, subacute. *Petals* falcately linear-oblong, subacute. *Lip* as long as the sepals, its subglobose sac exserted beyond the bases of the sepals, smooth within; apical lobe suddenly narrowed into a deflexed linear beak which is strongly ridged within. *Column* very short; the *stigma* broad, orbicular, convex. *Anther* convex, shortly apiculate; *pollinia* broadly ovoid, caudicle none, gland orbicular. Hook. f. Ic. Pl. 2181, Fl. Br. Ind. vi, 112; King & Pantling in Ann. R. Bot. Gard. Calc. viii, 280, t. 371. *Ætheria fusca* Lindl. Gen. and Sp. Orch. 491; in Journ. Linn. Soc. i, 184. *Cystorchis fusca* Benth. in Gen. Pl. iii, 569.

Harung in the Upper Sutlej valley, *Munro* No. 2117; Kuári Pass in British Garhwál at 13,000 feet, *Duthie* No. 4432; N. Kumaon, *Duthie's collector* No. 24084. Flowers in August and September. It extends eastwards to Nepal and Sikkim.

4. Goodyera foliosa Benth. ex Hook. f. Fl. Br. Ind. vi, 113.

Stem decumbent at the base, 1·5 to 3 dm. long, leafy upwards. *Leaves* distant, green, 6·5 to 9 cm. long, ovate-lanceolate, acute, often very oblique, tapering to the slightly expanded sheathing petiole, 3-5 nerved; margins undulate. *Peduncle* 2·5 to 5 cm. long, pubescent, bearing many lanceolate acuminate sheathing bracts. *Raceme* 4 to 7·5 cm. long, the rachis, floral bracts and ovaries glandular-pubescent. *Flowers*

many, pink or tinged with orange, much shorter than the narrowly lanceolate, acuminate, 3-nerved floral bracts. *Sepals* 6 to 10 mm. long, connivent, subequal, ovate-oblong, subacute, connate at the base. *Petals* very obliquely rhomboid, acute clawed. *Lip* as long as the sepals, saccate at the base and tapering into the subacute orange and white apical lobe, sac hispid within. Column and rostellum rather long. *Anther* erect, oblanceolate; *pollinia* narrowly clavate, grooved, united below and sessile on a long oblanceolate gland. *Stigma* concave. Hook. f. in Ann. Bot. Gard. Calc. v, 61, t. 91. *Georchis foliosa* Lindl. Gen. and Sp. Orch. 496. *Goodyera* sp. Griffith. Itin. Notes 36, No. 591. Notul. iii, 396, No. 11; Ic. Pl. As. 346, f. 1.

Near Mussoorie, in oak forests on northern slopes, at about 5,500 feet, *P. W. Mackinnon;* in flower during November. Found also in Sikkim, Assam, on the Naga and Khasia Hills, and in Burma and Perak.

5. GOODYERA BIFLORA Hook. f. Ic. Pl. 2188.

Roots thick and cord-like. *Stem* 5 to 7·5 cm. long, stout, leafy upwards, usually tinged with red, sometimes decumbent and rooting from the nodes. *Leaves* 2·5 to 5 cm. long, ovate, obtuse or subacute, dark bluish-green on the upper surface finely veined with white, the lower surface paler and with a tinge of red; the petiole 6 to 12 mm. long, dilated. *Spike* 2 to 8-flowered, not much longer than the leaves; *rachis* stout, pubescent; *floral bract* 2·2 cm. long, exceeding the slender pubescent ovary, reddish tipped with green, puberulous above. *Flowers* large, secund, white tinged with yellow and pink. *Sepals* narrowly lanceolate, 3-nerved; the dorsal one 2·5 cm. long, recurved at the apex; lateral pair a little shorter than the dorsal, nearly straight, connate at the base. *Petals* linear-lanceolate, falcate, closely applied to the dorsal sepal. *Lip* white tinged with yellow, shorter than the sepals, saccate at the base and with a long recurved beak twice as long as the sac; margins membranous, undulate; sac setose within. *Column* concave in front. Rostellar arms and anther very long and slender. *Pollinia* on long slender connate caudicles; gland linear, nearly half as long as the combined caudicles. *Capsule* 2·5 cm. long. Hook. f. Fl. Br. Ind. vi, 114; Collett Fl. Siml. 496. *Georchis biflora* Lindl. in Wall. Cat. 7379; Gen. and Sp. Orch. 496.

Song in the Upper Sutlej Valley, *Brandis;* Simla Hills at about 6,000 feet, *Brandis, Gamble* No. 4649; between Mussoorie and Simla 4,000 to 5,000 feet, *Edgeworth;* Mussoorie range 6,000 to 7,000 feet, *Mackinnon, Duthie* Nos. 24164, 25408. Flowers in August. It has been found also in Nepal by Wallich.

PLATE 127. Goodyera biflora *Hook. f.* A plant,—*of natural size.* Fig. 1, single flower; 2, petals; 3, side view of young flower, with sepals and petals removed; 4, vertical section of lip; 5, apical portion of lip, spread out; 6, ovary and column, showing the anther in situ; 7, rostellum; 8, anther; 9 and 10, pollinia;—*all enlarged.*

6. GOODYERA CORDATA Benth. ex Hook. f. Fl. Br. Ind. vi, 114.

A rather slender plant, 1 to 3 dm. high, sometimes decumbent, quite glabrous except the scape and bracts. *Roots* thick, cord-like. *Leaves* four or five, sub-radical, 2·5 to 6·5 cm. long, ovate, cordate, acute, rather fleshy, glaucous-green, paler beneath,

nerves impressed on the upper surface; *petiole* dilated, the free portion about half the length of the blade. *Spike* puberulous, 4- to 6-flowered, the lower portion bearing a pale narrow sheathing cuspidate bract. *Flowers* suberect, about 2·4 cm. long, green tinged with brownish-yellow or red; *flowering bract* overtopping the buds, lanceolate, acuminate, edges papillose. *Sepals* fleshy, boat-shaped, and with cucullate tips; the dorsal one erect, 13 mm. long, lanceolate and gradually tapering to the blunt apex, 3-nerved; the lateral pair deflexed, a little shorter than the dorsal, 3-nerved. *Petals* thin, equalling and appressed to the dorsal sepal, dimidiate-lanceolate, acute, 3-nerved. *Lip* about as long as the dorsal sepal, rhomboid-ovate, many-nerved, setose on the broad sub-saccate base; terminal lobe reflexed, triangular, acute. *Column* stout, with projecting cheeks. Arms of *rostellum* and *anther* long and slender. *Pollinia* elongate, tapering below into the long slender connate caudicles; gland linear adnate to the caudicles. Hook. Ic. Pl. 2187. *Georchis cordata* Lindl. Gen. & Sp. 496 (excl. habitat); Reichb. f. in Gard. Chron. 1879, ii, 520.

Near Mussoorie on wooded slopes facing the north at about 6,000 feet, *Mackinnon's collector* No. 25409. Flowers in September. Previously known only from the Khasia and Naga Hills, and in Perak.

Plate 126. Goodyera cordata *Benth.* A plant,—*of natural size.* Fig. 1, single flower; 2, ditto, with the sepals and petals removed; 3, lip; 4 column, showing the rostellum and stigma; 5, back view of ditto, showing the anther in situ; 6, pollinia; *all enlarged.*

38. Zeuxine Lindl.

Terrestrial herbs with succulent glabrous stems, decumbent at the base. *Flowers* small, in racemes or spikes. *Sepals* subequal, the dorsal one concave and forming a hood with the petals, the lateral pair free. *Lip* adnate to the base of the column, cymbiform or saccate; apical lobe shortly clawed or sessile, entire 2-lobed or with narrow decurved lobules, the sac at the base with calli or laminæ inside. *Column* very short, anterior surface with lamellar or conical processes. *Stigmas* 2, lateral, distant, rarely united. *Anther* membranous, its cells contiguous; *pollinia*, pyriform, attached by an oblong gland to the erect rostellum.—Species about 15, in Tropical Asia and Africa.

Zeuxine sulcata Lindl. Gen. and Sp. Orch. 485.

Whole plant 5 to 25 cm. high. *Stem* and *peduncle* glabrous. *Leaves* 2 to 7 cm. long, linear, acuminate, sessile on the hyaline truncate sheaths, gradually passing into the linear bracts higher up. *Raceme* 1·5 to 5 cm. long, densely flowered, glabrous; *floral bract* ovate-lanceolate, acuminate, much longer than the ovary. *Flowers* about 1 cm. long, white or pink. *Sepals* unequal; the dorsal one ovate, concave; the 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, bearing inside the sac two inward-pointing teeth and two narrow lamellæ uniting at the mid rib; terminal lobe short, sub-quadrate 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, covered by the wings of the column; *pollinia* attached within the tip of a linear appendage of the gland. *Capsule* ellipsoid, about 13 mm. long. Lindl. in Journ. Linn. Soc. i, 186; Griff. Notul. iii, 396; Ic. Pl. As. t. 349; Blume Fl. Javæ 55; Miquel Fl. Ind. Bat. iii, 723; Hook. f. Fl. Br. Ind. vi, 106; King & Pantling in Ann. R. Bot. Gard. Calc. viii, 286, t. 381; Tokutaro Ito in Bot. Mag. Tokyo xiv, t. 2. *Zeuxine bracteata*, *Z. brevifolia* and *Z. robusta* Wight Ic. 1724 bis, 1725, 1726. *Z. membranacea* Lindl. Gen. and Sp. Orch. 486; in Journ. Linn. Soc. i, 186; Blume Fl. Javæ 56. *Z. Tripleura* Lindl. in Journ. Linn. Soc. i, 186. *Z. integerrima*, Lindl. Gen. and Sp. Orch. 486; Blume Fl. Javæ 55, t. 19 and 23C; Miq. Fl. Ind. Bat. iii, 723. *Z. emarginata* Lindl. Gen. and Sp. Orch. 185. *Z. procumbens* Blume Fl. Javæ 56, t. 22, f. 3 and t. 23B. *Tripleura pallida* Lindl. in Wall. Cat. 7391; Gen. and Sp. Orch. 452. *Adenostylis emarginata* and *A. integerrima* Blume Bijdr. 414, t. 17. *Pterygodium sulcatum*, Roxb. Fl. Ind. iii, 452.

Dehra Dun in wet ground, *Mackinnon* (Duthie's No. 22977), *Gamble* No. 26478. Below Mussoorie at about 5,000 feet, *Proudlock*. Flowers during February and March. Abundant in grassy places throughout the greater portion of India. It is found also in Afghanistan, Ceylon, China, Japan, Java, and in the Philippines.

39. Anœctochilus Blume.

Terrestrial herbs with succulent stems decumbent at the base and with stout hairy roots. *Leaves* thick, ovate or lanceolate, with petioles sheathed at the base, peduncle and rachis of spike or raceme glandular-pubescent. *Sepals* free, unequal; the dorsal smaller, ovate, and with the beaked petals forming a hood over the column; lateral pair free or united at the base, spreading, larger than the dorsal. *Lip* adnate to the end of the column by a long-toothed or pectinate rarely entire claw, saccate or spurred at the base, the sac produced beyond the bases of the sepals or quite covered by them, its interior with two tooth-like or laminar calli; terminal lobe with two large diverging lobules. *Column* short, appendaged in front. *Anther* 2-celled; rostellum twisted; *pollinia* 2 and bifid, rarely 4, clavate, lamellate, narrowed into pseudo-caudicles, or attached to true caudicles and inserted on a narrow gland. *Stigmas* usually two, one on either side of the rostellum, or united into a transverse band on the column beneath it, rarely single and undivided.—Species about 40, natives of India, China and of the Malayan and Pacific Islands.

Anœctochilus Roxburghii Lindl. in Wall. Cat. 7387.

Height of plant not exceeding 3 dm. *Stem* decumbent at the base. *Leaves* several, near the base of the stem, 3 to 6·5 cm. long, ovate or ovate-oblong, acute, glabrous, shortly stalked, purplish-red with a velvety lustre, tinged along the centre with yellow and pink, and veined with yellow. *Peduncle* glandular-pubescent, bearing three to five short oblong acuminate bracts. *Raceme* much shorter than the peduncle. *Flowers* two to five, about 3 cm. long, resupinate; *floral bract* about half as long as the sessile cylindric ovary, and like the ovary glandular-hairy. *Sepals* unequal, pale-pink, glandular-hairy, dorsal one broadly ovate, acuminate, its apex recurved; the lateral pair oblong,

acute. *Petals* smaller than the sepals, obliquely oblanceolate, pale pink or white their apices hooked. *Lip* adnate by its base to the face of the column, and with two calli; claw unequally fimbriate; terminal lobes linear-oblong, blunt, spreading and recurved. *Spur* conical, as long as the lateral sepals, with two large wart like processes inside. Appendages on the front of the column large, parallel, extending from the ovate fleshy rostellum to the spur. *Stigmas* two, small, elliptic. *Anther* acuminate; *pollinia* four, clavate, in two pairs, united at their bases and both attached to a lanceolate gland. Lindl. Gen. and Sp. Orch. 499; Royle Ill. 388; Blume Flor. Javæ 41, t. 12 B, fig. 2; Hook. f. Fl. Br. Ind. vi, 95; King & Pantling in Ann. R. Bot. Gard. Calc. viii, 293, t. 390; Collett. Fl. Siml. 494; Rolfe in Journ. Linn. Soc. xxxvi, 42. *Chrysobaphus Roxburghii* Wall. Tent. Fl. Nep. 37, t. 27.

Below Simla at about 5,000 feet, *Madden*, *Collett*; on the Chur near Simla, *Royle*; Kedarkanta in Tehri-Garhwál, *Royle*. Flowers during July and August. It extends eastwards to Nepal, Sikkim, Bhutan, Assam, Sylhet, Manipur and China.

TRIBE VI.—OPHRYDEÆ.

Anther-cells sessile on the column, anticous or (in the Indian species of *Satyrium*) lateral, free or contiguous, but always distinct, parallel or diverging, often with tubes from their bases, each with a staminode on its outer surface; *pollinia* two, rarely four, usually with *caudicles* and always with glands; *glands* naked or enclosed in the same pouch or in two distinct pouches. *Stigmas* two, distinct or united below the *anther-cells*; *pollen* granular or sectile, not waxy.

Lip inferior; spur single, rarely none.
  Rostellum not prominent (except in *Herminium gramineum*).
    Lip with usually a long spur (very short in a few species of *Habenaria*).
      Flowers purple, pink or occasionally white; polliniar glands often enclosed in a pouch . . . . . 40. *Orchis.*
      Flowers green or yellowish-green, rarely white; anther-cells often with long tubes, polliniar glands naked . . . . . 41. *Habenaria*
    Lip with no spur or with a very short one; flowers green, rarely white; anther-cells with long tubes, polliniar glands naked. (Usually diminutive plants) . . . . . 42. *Herminium.*
  Rostellum very prominent (see also *Herminium gramineum*); leaf solitary, radical, broad; flowers purple or white, lip spurred . . . . . 43. *Hemipilia.*
Lip superior, spurs two . . . . . 44. *Satyrium.*

40. Orchis Linn.

Terrestrial erect leafy herbs with oblong or digitately lobed tubers, or with fleshy fibrous roots. *Leaves* sheathing, not plicate. *Flowers* medium-sized, usually pink or purple, in spikes or racemes; *floral bract* small, or leaf-like and exceeding the flower. *Sepals* subequal, the dorsal one conniving to form a hood with the *petals*, the lateral pair spreading. *Petals* like the *sepals* or smaller. *Lip* adnate to the base of the column, spreading or pendulous, entire or 3-lobed, rarely 4-or 5-lobed, always spurred. *Column* very short. *Anther-cells* two, anticous, parallel, contiguous, without tubes; *pollinia* usually attached to caudicles; *glands* two, distinct or united, lying in a common pouch or naked. *Staminodes* rugulose, attached to the outer surfaces of the anther-cells or to the column by their sides. *Stigmas* united into a transverse band lying across the column for its whole breadth, or distinct and at the margins of the column (as in *O. habenarioides*).—Species about 80, in Europe, and in the temperate parts of Asia and N. Africa; also in N. America and in the Mascerene Islands.

Stem stout, leaves three or more, lip entire or obscurely 3-lobed.
  Flowers large, purple lilac or occasionally white, polliniar glands enclosed in a pouch . . . . . 1. *O. latifolia.*
  Flowers much smaller, pink or occasionally white, polliniar glands free and exposed . . . . . 2. *O. habenarioides.*
Stem slender, leaves one to three, lip distinctly 3-lobed . . . . . 3. *O. Chusua.*
Stem slender, leaf usually solitary and near the base of the stem.
  Stigmas united, lip 3-lobed, spur longer than the ovary . . . . . 4. *O. Stracheyi.*
  Stigmas distinct, lip entire, spur shorter than the ovary . . . . . 5. *O. spathulata.*

1. Orchis latifolia, Linn. Sp. Pl. 941.

Tubers palmate. *Stem* 3-9 dm. high, usually fistular, leafy upwards. *Leaves* many, erect, up to 12 cm. long, oblong linear-oblong or lanceolate, tip concave. *Spike* 2·5 to 15 cm. long, cylindric, dense-flowered. *Flowers* about 1·8 cm. from the apex of the dorsal sepal to the tip of the lip, purple (occasionally lilac or white); *floral bract* linear-lanceolate, acuminate, usually much exceeding the flowers. *Sepals* and *petals* acute or obtuse; the lateral pair of sepals ovate, reflexed. *Lip* oblong or rhomboid, entire crenate or very obtusely 3-lobed, usually spotted with darker purple, sides deflexed; spur stout, equalling or shorter than the ovary, straight or curved. Royle Ill. 367; Reichb. f. Fl. Germ. xiii. t. 50; Boiss. Fl. Or. v, 71; Hook, f. Fl. Br. Ind. vi, 127; Collett Fl. Siml. 499; Krnzl. Orch. Gen. and Sp. i, 146. *O. latifolia* β *indica* Lindl. Gen. and Sp. Orch. 260. *O. Hatagirea* Don. Prod. 23; Wall. Cat. 7062.

Abundant throughout the Western Himalaya at elevations between 8,000 and 12,000 feet. Flowers from June to September according to the elevation and aspect. It extends as far East as Nepal, and westwards from Afghanistan to N. Africa and Europe; also in N. Asia.

According to Lindley, *O. Hatagirea* represents the Indian form of this variable species. It has entirely the habit of the European *O. latifolia* and, like it, produces a smaller-flowered form, which may be compared to *O. cruenta*. Its lip is sometimes rounded and not at all lobed, and sometimes slightly 3-lobed. It also varies considerably in the shape of the leaves and in the colour of the flowers. The leaves of the Himalayan form are usually not at all spotted.

2. Orchis habenarioides, King & Pantling in Ann. R. Bot. Gard. Calc. viii, 302, t. 401.

Height of plant 3 to 5 dm.; *tuber* digitate. *Stem* clothed at the base with unequal tubular sub-acute sheaths. *Leaves* four or five, scattered, sessile, 5 to 12·5 cm. long, elliptic-oblong to linear-oblong, sub-acute, slightly narrowed to the rather long sheath. *Spike* 4 to 12 cm. long, cylindric, densely flowered. *Flowers* about 7 mm. across, pink or occasionally white; *floral bract* longer than the curved beaked ovary, herbaceous. *Sepals* sub-equal, broadly ovate, puberulous, the dorsal forming a hood with the petals; lateral pair spreading and somewhat reflexed, acute. *Petals* shorter than the sepals, rhombic-orbicular, minutely apiculate. *Lip* adnate to the base of the columu; the apex broad and with a shallow terminal lobe, the upper surface quite smooth; *spur* as long as the ovary, laterally compressed, curved and slightly clavate, puberulous inside. *Column* broad. *Anther-cells* parallel; *pollinia* obliquely elliptic-obovate; *caudicles* short, without pouches; *glands* ligulate, truncate. *Staminodes* large, suborbicular, rugulose, lying on either side of the caudicles. *Stigmas* united into a narrow transverse band beneath the opening to the spur. *Capsule* 1 cm. long, ovate-oblong. *Gymnadenia cylindrostachya* Lindl. in Wall. Cat. 7056; Gen. and Sp. Orch. 278; Royle Ill. 367. *G. Orchidis* and *violacea* Lindl. Gen. and Sp. Orch. 272. *Platanthera Orchidis* Lindl. in Wall. Cat. 7039A. *Habenaria Orchidis* Hook. f. Fl. Br. Ind. vi, 142. *Peisrtylus Orchidis* Krnzl. Orch. Gen. and Sp. i, 515.

Hazára at 11,800 feet, *Duthie's collector* No. 20192; Kashmir, *Clarke* No. 29239; Liddar Valley in Kashmir 10,000 to 12,000 feet, *Duthie* Nos. 13147, 13185, *Duthie's collector* No. 21373; Upper Chenab Valley at 10,000 feet, *Baden-Powell* No. 319; Lahul, *Hay;* Pángi, *Stolickza*, *Duthie's collector* No. 23341; Chansil range in Tehri Garhwál between 12,000 and 13,000 feet, *Osmaston* (Duthie's No. 24187); Jumna Valley between 8,000 and 9,000 feet, *Duthie* No. 525; Káli Valley in N. Kumaon between 10,000 and 11,000 feet, *Duthie* No. 6008; Rálam Valley, *Duthie's collector* No. 24120. Flowers during August. It extends eastwards to Nepal, Sikkim and Bhutan.

3. Orchis Chusua Don Prod. Fl. Nep. 23.

Whole plant 1 to 4 dm. high, *tuber* small, elliptic, entire. *Stem* with two blunt tubular sheaths at the base, upper portion above the leaves naked. *Leaves* 3·5 to 7·5 long, linear-oblong or linear-lanceolate, acute or acuminate, not narrowed to the sheathing base. *Spike* 2·5 to 10 cm. long, few- or many-flowered, secund. *Flowers* purple or white, 10 to 18 mm. across (vertically); *floral bract* green, lanceolate, acuminate, equalling the fusiform ovary. *Sepals* oblong, obtuse; dorsal erect; the lateral pair recurved. *Petals* broadly and obliquely ovoid, their bases truncate. *Lip* longer than the sepals, deeply 3-lobed, the lobes equal, oblong, obtuse, the lateral ones diverging; *spur* stout, cylindric or clavate, as long as the ovary. *Column* short. *Anther-cells* parallel; *pollinia* ovoid-globose, slightly narrowed to the long tapering caudicle; *glands* small, each lying in a small pouch. *Staminodes* large, ovate, pointed. *Stigmas* united into a large concave surface under the anther-cells. Hook. f, Fl. Br. Ind. vi, 127; King & Pantling in Ann. R. Bot. Gard. Calc. viii, 303, t. 402; Krnzl. Orch. Gen. and Sp. i, 153; Rolfe in Journ. Linn. Soc. xxxvi (1903), 49. *Gymnadenia Chusua* Lindl. in Wall. Cat. 7058; Gen. and Sp. Orch. 280. *G. puberula* Lindl. in Wall. Cat. 7059.

Punjab Himalaya, Chamba State, at 11,000 feet, *Lace* No. 1992; near Mussoorie, *King;* Byans in N. Kumaon between 11,000 and 12,000 feet, *Duthie* No. 5998(*a*). Flowers during July and August. It extends eastwards to Nepal, Sikkim, Eastern Tibet and China.

Lace's Chamba specimens represent a slender form of this variable species. The leaves are solitary and linear-lanceolate, and the flowers are solitary or in pairs. It differs from the type chiefly in the shape of the lip, the lobes of which are much broader than usual.

4. Orchis Stracheyi Hook. f. Ic. Pl. 2197B; Fl. Br. Ind. vi, 128.

Height of plant 6 to 12 cm. *Rhizome* without tubers (as in *O. spathulata*). *Leaf* solitary, radical, petioled, elliptic or obovate. *Scape* naked, few-flowered. *Floral bract* large, ovate-oblong, obtuse, longer than the ovary. *Sepals* and *petals* spreading. *Lip* longer the sepals, broadly cuneate, trifid to the middle, the lobes obtuse, *spur* equalling or longer than the ovary, incurved, obtuse. Krnzl. Orch. Gen. and Sp. i, 154.

Rogile in Garhwál between 9,000 and 10,000 feet, *Strachey & Winterbottom* (No. 35 *Gymnadenia puberula*).

This species which appears to be intermediate between *O. spathulata* and *O. Chusua*, may possibly, as Sir Joseph Hooker suggests, be a hybrid, with the solitary leaf of the former and the flowers of the latter.

5. Orchis spathulata Reichb. f. ex Hook. f. Fl. Br. Ind. vi, 127.

Whole plant 5 to 20 cm. high. *Stem* proceeding from a thin rhizome, with one or two loose blunt tubular sheaths at the base. *Leaf* usually solitary and at the base of the stem, with rarely a second one higher up, oval to narrow-elliptic or spathulate, tapering into a long petiole; blade 2·5 to 7·5 cm. long. *Scape* rather stout. *Spike* short, 1-4 flowered. *Flowers* purple or occasionally white, about 13 mm. in diam.; *floral bract* longer than the flower, leaf-like, lanceolate, sub-acute. *Sepals* sub equal; the dorsal ovate, obtuse, conniving with the petals to form a hood; lateral pair oblong, sub-acute, spreading. *Petals* shorter than the sepals, falcately elliptic, obtuse. *Lip* equalling the sepals, broadly elliptic or obovate, entire or obscurely 3-lobed, the edges crenulate; upper surface slightly pubescent, with many shallow grooves extending from the base nearly to the apex; *spur* stout, obtuse, about half as long as the ovary. *Pollinia* pyriform, a little longer than the rather stout tapering caudicles; glands elliptic enclosed in a pouch formed from the rostellum. *Staminodes* small, rugulose. *Stigmas* distinct, elliptic, widened at the lower end and attached to the margins of the column. Hook. f. Ic. Pl. t. 2197A; King & Pantling in Ann. R. Bot. Gard. Calc. viii, 301, t. 400; Krnzl. Orch. Gen. and Sp. i, 155; Rolfe in Journ. Linn. Soc. xxxvi (1903), 50. *Gymnadenia spathulata* Lindl. Gen. and Sp. 280; Royle Ill. Him. Bot. 367.

Kedarkánta in Garhwál 11,000 to 12,000 feet, *Royle;* Ganges Valley below Gangotri between 12,000 and 13,000 feet, *Duthie* Nos. 194, 515; Káli Valley in N. Kumaon at 13,000 feet, *Duthie* No. 5998. Flowers from June till August. Found also on the Sikkim Himalaya and extending through E. Tibet to China.

41. Habenaria Willd.

Terrestrial leafy herbs with undivided or lobed tubers or fleshy root-fibres. *Leaves* not plaited, their bases sheathing. *Flowers* in racemes or spikes. *Sepals* subequal, the dorsal often connivent with the petals to form a hood over the column; the lateral pair spreading, reflexed or deflexed, or sometimes erect. *Petals* smaller or larger than the sepals, entire or 2-cleft. *Lip* adnate to the base of the column, entire, 3-lobed or 3-partite, its base spurred. *Anther-cells* adnate to the front of the short and usually broad column, discrete, rarely touching, parallel or divergent below, their bases often prolonged into tubes containing the caudicles. *Staminodes* represented by two granular more or less conspicuous projections on the outer side of each anther-cell, rarely elongate. *Pollinia* two, clavate or pyriform, usually grooved, sometimes 2-partite; *caudicles* varying in length, sometimes absent; *glands* exposed, flat and discoid, or elliptic or globular, or elongate with truncate ends (conjoined and enclosed within processes of the 2-lobed rostellum in *H. secundiflora*). *Stigmas* two, distant from each other or united to form

a belt across the face of the column.—Species about 400, cosmopolitan in temperate and tropical regions.

Sect. I. ATE.—Petals bipartite, lip 3-partite.
- Spur equalling the ovary, slender, upturned ... *1. H. stenopetala.*
- Spur shorter than the ovary, clavate, deflexed ... *2. H. digitata.*

Sect. II. PLATYGLOSSA.—Petals entire; lip 3-lobed or 3-partite; side lobes broad, apical lobe narrow.
- Side lobes of lip deeply pectinate.
  - Stigmas not produced; flowers large, white, spur 2½ times longer than ovary ... ... *3. H. Susanna.*
  - Stigmas prominent, flowers medium-sized.
    - Anther-tubes short, spur about as long as the ovary.
      - Petals and lip white, spur stout, funnel-shaped, its apex clavate and curved outwards ... ... *4. H. pectinata.*
      - Dorsal sepal and petals greenish-white, lip white; spur slender, clavate, curved inwards ... ... *5. H. ensifolia.*
    - Anther-tubes long, slender, upright, spur longer than the ovary.
      - Stigmas linear-lanceolate, spreading, petals gibbous on outer edge at the base ... ... *6. H. arietina.*
      - Stigmas long, slender, cylindrical, curved upwards and inwards ... ... *7. H. intermedia.*
- Side lobes of lip entire.
  - Spur twice as long as the ovary ... ... *8. H. longifolia.*
  - Spur equalling the ovary.
    - Leaves radical ... ... *9. H. plantaginea.*
    - Scape leafy upwards ... ... *10. H. triflora.*

Sect. III. TRIMEROGLOSSA.—Petals entire; lip 3-partite, the side lobes very narrow and often filiform.
- Anther-tubes long.
  - Spur much exceeding the ovary ... ... *11. H. commelinifolia.*
  - Spur equalling the ovary ... ... *12. H. pubescens.*
- Anther-tubes short.
  - Leaves 3 or more.
    - Leaves not margined, flowers green ... *13. H. furcifera.*
    - Leaves pale-margined, flowers yellow ... *14. H. marginata.*
  - Leaves 2.
    - Leaves radical, orbicular, cordate, margined ... *15. H. diphylla.*
    - Leaves not radical, sub-opposite, orbicular, cuspidate, not margined ... ... *16. H. Aitchisoni.*

Sect. IV. HOLOGLOSSA.—Petals entire; lip narrow, entire or with minute basal lobes (tridentate at the apex in *H. viridis*).
- Stigmas conjoined.
  - Flowers secund, staminodes as long as the anther-cells ... ... *17. H. orbiculata.*
  - Flowers not secund, staminodes much shorter than the anther-cells ... ... *18. H. stenantha.*

Stigmatic processes distinct,		
Spur longer than the ovary, flexuous.		
Petals yellow, erect; spur rather stout, usually upturned	19.	*H. Edgeworthii.*
Petals green, spreading; spur slender, usually deflexed	20.	*H. latilabris.*
Spur much shorter than the ovary, clavate ...	21.	*H. densa.*
Stigmatic processes none.		
Lip linear, spur much longer than the ovary ...	22.	*H. arcuata.*
Lip oblong, its apex tridentate; spur much shorter than the ovary	23.	*H. viridis.*

Sect. V. PERISTYLUS.—Petals entire, lip slightly or not at all longer than the sepals, 3-lobed; spur very short, often sub-globose.

Flowers green.		
Leaf solitary, lip flat	24.	*H. fallax.*
Leaves 2 or 3, lower half of lip trough-shaped ...	25.	*H. Elisabethæ.*
Flowers white, leaves clustered above the middle of the stem.		
Leaves narrowly lanceolate or elliptic, acute, tubers glabrous	26.	*H. Lawii.*
Leaves ovate or ovate-elliptic, tubers hairy.		
Flowers in a lax subsecund spike ...	27.	*H. goodyeroides.*
Flowers in a dense cylindrical spike ...	28.	*H. constricta.*

Sect. VI. PHYLLOSTACHYA.—Flowers large, in the axils of sheathing leaves, petals entire; lip broad, entire, petaloid, spur conico-infundibular; stigmatic processes none, rostellum obscure ... ... 29. *H. galeandra.*

Sect. VII. DIPYLA.—Flowers small, secund, lip 3-fid., spur inflated, pollinia sessile on a single large obcordate gland seated in a sinus of the broad 2-lobed rostellum, stigmatic process small ... ... 30. *H. secundiflora.*

Sect. VIII. DITHRIX.—Flowers small, secund, tubular, sepals petals and lip coherent at the base; lip oblong, 3-fid, base saccate; staminodes 2, filiform, capitate, inserted on the back of the anther, stigma a transverse cushion, rostellum a transverse plate below the anther ... 31. *H. Griffithii.*

1. HABENARIA STENOPETALA Lindl. Gen. and Sp. Orch. 324.

Height of whole plant 3 to 10·5 dm.; basal third of stem clothed with tight fitting sheaths. *Leaves* distributed over the upper two-thirds of the stem, 7·5 to 20 cm. long, oblong-lanceolate to ovate-lanceolate, acute, the edges undulate, amplexicaul or sheathing and usually broad at the base, membranous; the upper ones much smaller and bract-like. *Raceme* 1 to 2·3 dm., densely flowered. *Flowers* 2 to 2·5 cm. across, pale green; *floral bract* lanceolate, acuminate, about as long as the slender stalked ovary. *Sepals* subequal, oblong-lanceolate, acuminate, spreading or reflexed. *Petals* shorter than the sepals, linear, their bases produced downwards below the point of insertion. *Lip* 3-partite, as long as the petals, brown; segments narrow, fleshy, the central one horizontal; basal pair usually shorter, deflexed; *spur* slender, as long as the

stalked ovary, compressed, 2-ridged, upturned. *Column* stout. *Anther-cells* erect, distant, parallel, narrow, with long tubes; *pollinia* oblong, with long slender curved caudicles attached to minute glands. *Staminodes* ovate, rugulose, on the outside of each anther-cell and stigma. *Stigmas* two, oblong, with slightly divergent blunt apices, placed below the anthers and at the margins of the month of the spur. *Capsule* linear-oblong. Hook. f. Fl. Br. Ind. vi, 134; in Ann. R. Bot. Gard. Calc. v, t. 95; King & Pantling in Ann. R. Bot. Gard. Calc. viii, 308, t. 404. Krantzlin in Engl. Bot. Jahrb. xvi, 162; Orch. Gen. and Sp. i, 358.

N.-W. India, *Royle;* Mussoorie 5 to 6,000 feet, *Duthie*, *Mackinnon* [Duthie's No. 22980(*a*)]; below Mussoorie 4,000 feet, *Gollan;* below Naini Tal 3,000 feet, *C. W. Hope.* Flowers in September. It extends eastwards to Bengal, Sikkim, Assam and the Naga Hills.

2. HABENARIA DIGITATA Lindl. Gen. and Sp. Orch. 307.

Height of plant 3 to 5 dm. *Stem* stout, cylindrical, lower portion clothed with close-fitting sheaths. *Leaves* 4 to 6 cm. long by 3 to 4 cm. broad, collected chiefly towards the middle of the stem, broadly lanceolate or ovate-lanceolate, acuminate, 3-nerved, the edges much undulate. *Raceme* laxly many-flowered, about 1 dm. long, elongating in fruit. *Flowers* subsecund, about 13 mm. in diam., green; *floral bract* narrowly lanceolate, longer than the slender ovary, pale-margined. *Sepals* unequal, the dorsal one erect, suborbicular, its apex bluntly acuminate and recurved, minutely pustulate on the back; lateral pair rather longer, deflexed, subfalcate, with slender filiform recurved tips. *Petals* deeply 2-partite; segments linear, fleshy, white towards the base and with slender recurved green tips. *Lip* 3-partite, the lateral segments a little longer than the petals; midlobe linear, straight, longer than the decurved lateral, ones. *Spur* shorter than the ovary, laterally compressed and clavate towards the apex. *Anther-cells* distant, divaricate, with prominent incurved tubes. *Staminodes* globose, tuberculate, bright green, placed outside and at the base of each anther-lobe; *pollinia* 2, obliquely ovate in outline; *caudicles* slender, dilated towards their bases and attached to small ovate brownish-yellow glands. *Stigmatic processes* subcylindrical, blunt, recurved, the entrance to the spur lying between their bases. Dalz. & Gibs. Bomb. Fl. 267; Krantzlin in Engl. Jahrb. xvi, 67; Orch. Gen. and Sp. i, 270; Hook. f. Fl. Br. Ind. vi, 134 (excl. H. trinervia Wight). *H. Gibsoni* Hook. f. Ic. Pl. 2319; Fl. Br. Ind. vi, 135. *Bonatea punduana* Lindl. in Wall. Cat. 7063. *B. benghalensis* Griff. in Calc. Journ. Nat. Hist. iv, 382; *B. herbacea* Wall. MSS.

Kashmir, *Falconer;* Dehra Dun in sâl forests, *Mackinnon* (Duthie's No. 22728), Kansrao (Dehra Dun), *Duthie's collector* No. 24177; Mussoorie Hills, *Hugel*, *Duthie*, 637 (1877), *Mackinnon* (Duthie's Nos. 21758, 21178); Bageswar in Kumaon, *Duthie's collector* No. 24063. Flowers during July. It extends eastwards to Bengal and Assam and southwards to Bombay and S. India and Tenasserim; also found in N. Australia.

H. trinervia Wight, which in the "Flora of British India" has been reduced to this species, although closely allied, differs sufficiently to justify its separation. The leaves of the former are more scattered and extend higher up the stem towards the raceme; the lateral sepals are erect and have not the slender almost filiform tips of *H. digitata;* the lobes of the petals are not decurved, and the three lobes of the lip are nearly parallel and about equal in length. The flowers of H. *digitata* have a peculiarly pungent odour resembling that of *Valeriana Wallichii.*

PLATE 128. Habenaria digitata *Lindl.* A plant,—*of natural size.* Fig. 1, front view of a flower; 2, back view of ditto; 3, side view of ditto, with the perianth removed; 4, column, showing the anther, the pollen tubes and the staminodes; 5, pollinia;—*all enlarged.* In the plate the name *Habenaria digitata* has been scored out in error.

3. HABENARIA SUSANNÆ R. Brown Prod. 312.

Height of whole plant 6 to 8 dm. *Tubers* elongate, 6 to 9 cm. long. *Stem* stout, with many blunt funnel-shaped sheaths on its lower portion. *Leaves* mostly on the middle portion of the stem, 5 to 15 cm. long and 3 to 6 cm. broad, ovate-oblong, obtuse; the upper ones bract-like, acuminate, imbricate. *Raceme* 3 to 5—flowered, *floral bract* longer than the ovary, cucullate, acuminate. *Flowers* sessile, 7 to 10 cm. in diam., white tinged with greenish-yellow, fragrant. *Sepals* spreading, very broad; the dorsal one suborbicular, about 4 cm. in length and breadth; lateral pair sub-quadrately oblong, obtuse. *Petals* linear-falcate, acute, thick. *Lip* about as long as the sepals, fleshy; side lobes very broad, truncate, deeply pectinate; midlobe linear, spathulate, with recurved edges. *Spur* very long, more than twice the length of the elongate ovary. *Anther* very broad and large; cells divergent; tubes long, adnate to the sides of the column; *pollinia* linear, curved, about as long as their flexuous caudicles; *glands* ovoid, fleshy, white. *Staminodes* linear, prominent. *Stigmatic processes* large, blunt, not projecting; *rostellum* confluent with the face of the column.

Royle Ill. 367; Blume Bijdr. 402; Hook. f. Fl. Br. Ind. vi, 137; Collett Fl. Siml. 501. *H. gigantea* Don Prod. 24; Bot. Mag. t. 3374; Grah. Cat. Bomb. Pl. 201. *Platanthera Susannæ* Lindl. Gen. and Sp. Orch. 295; Wight Ic. 920; Dalz. & Gibs. Bomb. Fl. 269; Krnzl. Orch. Gen. and Sp. i, 601; Rolfe in Journ. Linn. Soc. xxxvi (1903), 57. *P. gigantea* Lindl. in Wall. Cat. 7052. *P. robusta* Lindl. in Wall. Cat. 7036; Gen. and Sp. Orch. 295. *Orchis Susannæ* Linn. sp. Pl. 939. *O. gigantea* Smith Exot. Bot. t. 100. *O. altissima* Herb. Ham.

Simla Hills below 6,000 feet, *Lady Dalhousie, Collett;* Siwalik range, *Royle;* Mussoorie range below 6,000 feet, *Falconer, Mackinnon, Duthie* No. 22981; Garhwál, 3,000 to 5,000 feet, *Duthie* Nos. 1195, 2066; Kumaon 5,000 to 6,000 feet, *Strachey & Winterbottom* No. 39; near Naini Tal, *Colonel Davidson;* Kali Valley in E. Kumaon, *Duthie* Nos. 3410, 24062. Flowers during September. It occurs in the hilly districts of Bombay and S. India, also on the Naga and Khasia Hills, extending eastwards to Upper Burma and China.

PLATE 129. Habenaria Susannæ, *R. Br.* Upper portion of plant,—*of natural size;* an entire plant,—*reduced in size.* Fig. 1, side view of flower, with the sepals and lateral lobes of lip removed; 2, front view of column; 3, pollinia;—*all enlarged.*

4. HABENARIA PECTINATA Don Prod. Fl. Nep. 24.

Height of whole plant up to 3 dm. *Stem* stout, quadrangular, the angles more or less winged. *Leaves* 6 to 8 cm. long and 1·5 to 2 cm. broad, ovate-lanceolate, acutemine, often recurved at the apex, strongly 3-nerved. *Flowers* 2·5 cm. across

arranged in a compact secund raceme; *bracts* leaflike, longer than the flowers. *Sepals* green, their margins pale; dorsal erect, broadly lanceolate, obtuse, 3-nerved; the lateral pair narrower, spreading, subfalcate, mucronate on the back below the reflexed tips. *Petals* forming a hood with the dorsal sepal, falcately oblong, obtuse, white. *Lip* longer than the lateral sepals, 3-partite, pure white; midlobe linear, a little longer than the deeply pectinate side lobes. *Spur* longer than the ovary, stout, funnel-shaped at the base, its apex curving outwards. *Anther-cells* distant; *pollinia* bipartite, each attached by a short slender caudicle to the flat oval gland, the caudicles supported by vertical flattened hyaline projections of the rostellum *Stigmatic processes* 4 mm. long, linear-clavate, stout, tilted upwards, grooved along their upper surfaces. *Capsule* sessile, fusiform, strongly ribbed. Lindl. Gen. and Sp. Orch. 321; Hook. f. Fl. Br. Ind. vi, 137 (in part); Krnzl. in Engl. Jahrb. xvi, 193 (in part); Orch. Gen. and Sp. i, 405 (in part, and excl. var. *arctina*); King & Pantling in Ann. R. Bct. Gard. Calc. viii, 310 (in part, and excl. t. 406). Collett Fl. Siml. 501. *H. Gerardiana* Wall. Cat. 7031. *Orchis pectinata* Smith Exot. Bot. ii, 77, t. 99.

Chamba district of the Punjab Himalaya at about 4,000 feet, *Lace* No. 1815; Simla Hills, *Lady Dalhousie*, *T. Thomson*, *Collett*, etc.; Mussoorie Hills 5,000 to 7,000 feet, *Duthie* Nos. 527, 21753, *Mackinnon;* Lansdowne in British Garhwál 4,000 to 5,000 feet, *Roberts;* Kumaon between 5,000 and 7,000 feet, *Strachey* & *Winterbottom* No. 45, *Colonel Davidson*, *Duthie* Nos. 3409, 24056. Flowers during July and August. It extends eastwards to Nepal.

This is rather a rare species, as compared with *H. ensifolia*. Both these species turn black when dried, and are then sometimes rather difficult to distinguish, but when fresh they should not be confounded.

PLATE 130. Habenaria pectinata *Don*. Portion of plant,—*of natural size*. Fig. 1, front view of single flower; 2, side view of ditto, with the sepals and petals removed; 3, front view of column; 4, anther (spread out), showing the stigmatic and rostellar processes; 5. pollinia;—*all enlarged*.

5. HABENARIA ENSIFOLIA Lindl. in Wall. Cat. 7030.

Tubers elongate. *Stem* 6 to 7·5 dm. high, robust, leafy, lower portion bearing several long acute tubular sheaths. *Leaves* distributed chiefly towards the upper portion of the stem, 7·5 to 15 cm. long, oblong to linear-lanceolate, acuminate, amplexicaul at the base, strongly 3-nerved, diminishing in size upwards. *Raceme* 1 to 2 dm. long. *Flowers* green, 3·1 to 3·8 cm. across; *floral bracts* leaflike, linear-lanceolate, acuminate, much longer than the rather slender and straight ovaries. *Sepals* unequal, erect, their tips recurved; dorsal lanceolate; the lateral pair rather wider, subfalcate and acute. *Petals* forming a hood with the dorsal sepal, narrowly and falcately oblong, obtuse or acute, pale green, ciliolate on their outer margins. *Lip* a little longer than the sepals, 3-lobed pale green; margins of side lobes deeply pectinate; midlobe rather shorter, linear; *spur* laterally compressed, dilated towards the apex, about as long as the ovary, sigmoid or geniculate. *Anther-cells* divergent, elongate. *Pollinia* narrowly elliptic, grooved, their caudicles as long as themselves, slender and curved; glands minute, discoid. *Stigmatic processes* linear, elongate, divergent. *Capsule* nearly sessile, fusiform, thickly ribbed. Lindl. Gen. & Sp. Orch. 321; Collett Fl. Siml. 504, fig. 165;

Rolfe in Journ. Linn. Soc. xxxvi (1903), 58. *Habenaria pectinata* Hook. f. Fl. Br. Ind. vi, 137 (in part and not of Don); Krnzl. in Engl. Bot. Jahrb. xvi, 193 (in part); Orch. Gen. and Sp. 405 (in part and excl. var. *arietina*); King & Pantling in Ann. R. Bot. Gard. Calc. viii, 310 (in part), t. 406.

Near Dalhousie, *Dr. Clark;* Simla Hills from 6,000 to 8,000 feet, *Stoliczka, Lady Dalhousie, Gamble, Collett;* Bashahr at 7,000 feet, *Lace* No. 1036; Mussoorie range between 6,000 and 7,000 feet, *Mackinnon, Duthie* Nos. 21764, 22986, 22993, 24167; Garhwál between 5,000 and 6,000 feet, *Duthie* No. 527; Lansdowne in Brit. Garhwál, *Roberts;* Kumaon between 5,000 and 6,000 feet, *Strachey & Winterbottom* No. 46, *Colonel Davidson, Duthie* No. 3409. Flowers during July and August. It is found also in Sikkim, and on the Khasia Hills.

This is taller and altogether a much more robust plant than *H. pectinata,* and it is also much more abundant.

6. Habenaria arietina Hook. f. Fl. Br. Ind. vi. 138.

Habit and general appearance of *H. ensifolia*, but leaves much broader. *Raceme* 1·25 to 2 dm. long. *Flowers* green. *Sepals* narrowly oblong-elliptic; the lateral pair sub-falcate, with ciliolate margins. *Petals* erect and adpressed to the dorsal sepal, gibbous at the base externally, bluntly acuminate, puberulous. *Lip* as in *H. ensifolia*, but the side lobes with fewer teeth; *spur* laterally compressed, much longer than the ovary. *Anther* retuse and mucronate at the apex, their tubes long and upright as in *H. intermedia*. *Stigmas* large, linear-lanceolate, spreading, green, their margins ciliolate. Hook. f. in Ann. R. Bot. Gard. Calc. v 64, t. 97. *H. pectinata* Lindl. (not of Wallich); Gen. and Sp. Orch. 341; Wall. Cat. 7029B (in part) and C.; *H. pectinata* var. *arietina* Krnzl. Orch. Gen. and Sp. i, 405.

Eastern Kumaon, *Duthie's collector* No. 24055. Flowers during July and August. It extends eastwards to Nepal, Sikkim and the Khasia Hills.

This species has a much greater resemblance generally to *H. ensifolia* than it has to *H. pectinata;* and, as it also turns black when dried, the difficulty in distinguishing them in that condition is increased. The long upright anther-tubes as well as the pollinia and glands are very similar to those of *H. intermedia,* to which it is evidently closely allied. The Simla locality given in the Flora of Brit. India for this species refers to the specimens of *H. ensifolia* collected by Lady Dalhousie. *H. arietina* is therefore not at present known to occur westward of Kumaon.

7. Habenaria intermedia Don Prod. Fl. Nep. 24.

Stem 2 to 5 dm., terete; sheaths at the base two or three, upper sub-foliaceous. *Leaves* scattered, 8 to 18 cm. long and 2 to 6 cm. broad, ovate-oblong, acuminate, rounded or cordate at the base; nerves 5—7, impressed above, strongly prominent beneath. *Racemes* 2—6-flowered; *floral bracts* leaf-like, broadly lanceolate acuminate, equalling or exceeding the ovary. *Flowers* about 5 cm. across. *Sepals* persistent and enlarging after flowering: dorsal 2·5 cm. long, ovate-lanceolate, acute, recurved at the apex, the inner surface almost white; lateral sepals spreading, falcately lanceolate, acuminate, 5 to 7-nerved, tips reflexed. *Petals* pure white, overlapping at their apices, as long as the dorsal sepal and tightly pressed against it, dimidiate-falcate, obtuse, margins minutely ciliolate

Lip 3-lobed, longer than the sepals, green except the longer white claw, papillose towards the base; side lobes deeply pectinate, midlobe linear, 3 to 5 cm. long. *Spur* stout, 6·5 cm. long, exceeding the ovary, tapering towards the apex, more or less curved. *Anther-cells* with very long erect filiform tubes; *pollinia* 6 mm. long, elongate, often bipartite, with slender caudicles as long as the pollinia and minute glands at the base. *Stigmatic processes* 1·5 cm. long, slender, incurved, white, with spreading green tips, minutely papillose. *Rostellum* adnate to the face of the column between the anther, cells. *Capsule* pedicelled, 3 to 5 cm. long, fusiform, beaked. Lindl. Gen. and Sp. Orch. 322; Wall. Cat. 7030; Reichb. f. in Gard. Chron. (1879), 136; Hook. f. Fl. Br. Ind. vi, 138; Krnzl. in Eng. Bot. Jahrb., xvi, 161; Orch. Gen. and Sp. i, 403; Collett Fl. Siml. 502, fig. 164; Rolfe in Journ. Linn. Soc. xxxvi (1903), 59.

Abundant from Kashmir to Kumaon at elevations between 5,000 and 7,000 feet, flowering in August. It extends eastwards to Nepal and the Khasia Hills, but there is no record of its occurrence in Sikkim.

PLATE 131. Habenaria intermedia, *Don*. A plant,—*of natural size*. Fig. 1, side view of single flower; 2, one of the petals; 3, side view of column showing the erect filiform anther-tubes and the long incurved stigmatic processes; 4, pollinia;—*all enlarged*.

8. HABENARIA LONGIFOLIA Ham. in Lindl. Gen. and Sp. Orch. 324.

Stem slender, leafy, 2·5 to 4·5 dm. long. *Leaves* 7 to 12 cm., scattered, erect, linear, acuminate, diminishing in size upwards. *Spike* 5 to 7 cm., many-and laxly flowered; *floral bract* linear, acuminate, longer than the slender beaked ovary. *Ovary* 1·3 to 2 cm., curved. *Flowers* white. *Sepals* minute, the lateral pair 5 mm. long, oblong—anceolate, 3-nerved, a little larger than the dorsal. *Petals* gibbously ovate, as long as the dorsal sepal, 3-nerved. *Lip* flabelliform, 1·3 to 1·5 cm. broad, twice or thrice as long as the lateral sepals; midlobe linear, shorter than the side lobes; side lobes semi-circular, quite entire; *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, subulate. Hook. f. Fl. Br. Ind. vi, 141; Krnzl. in Engl. Bot. Jahrb. xvi, 202; Orch. Gen. and Sp. i, 420. *Gymnadenia longifolia* Lindl. in Wall. Cat. 7060. *Habenaria trapezoidea* Falc. MSS.

Mohand Pass on the Siwalik range, *Royle;* near Mussoorie, *Falconer*. Found also by Buchanan-Hamilton at Nathpur in Nepal. I have seen no living specimens. The flowers are usually larger than those of *H. plantaginea*, but it may be easily distinguished from the latter by its very narrow leaves.

9. HABENARIA PLANTAGINEA Lindl. Gen. and Sp. Orch. 323.

Tubers ellipsoid, about 3 cm. long. *Leaves* about three or four, radical, horizontal, 7·5 to 15 cm. long, narrowly oblong, acute or obtuse, membranous. *Scape* slender, 2 to 4 dm. high, bearing many lanceolate acuminate bracts, the lowest often large and leaflike. *Spike* 5 to 15 cm. long, laxly flowered. *Flowers* sub-secund, white; *floral bract* lanceolate, acuminate or setaceous, half as long as the curved beaked ovary. *Sepals* sub-equal, about 7 mm. 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* flabelliform, clawed, twice as long as the lateral sepals, puberulous; side lobes semi-ovate, entire or toothed, often overlapping at their apices; midlobe a little shorter, linear-oblong, deflexed; *spur* equalling the ovary, slender. *Anther* broad, cells divergent; tubes short, upcurved; *pollinia* globose to ellipsoid; caudicles curved, linear-cuneate, glands falcately ovate-acuminate, combined when young. *Stigmatic processes* large, fleshy, oblong; *rostellum* triangular, broad. Staminodes prominent. *Capsule* fusiform, curved, its beak short and slender. Wight Ic. 1710; Hook. f. Fl. Br. Ind. vi, 141; Krnzl. in Engl. Bot. Jahrb. xvi, 197; Orch. Gen. and Sp. i, 413. *Gymnadenia platyphylla* Lindl. Wall. Cat. 7053. *Orchis platyphyllos* Roxb. Fl. Ind. iii, 609. *O. tenuis* Herb. Rottl.

Dehra Dun, *Falconer* (Kew Distrib. No. 1032), *Duthie* Nos. 7654, 24174, *Mackinnon's collector* (Duthie's No. 25417); below Mussoorie, *Duthie's collector* No. 23002; Binsar in Kumaon at 7,500 feet, *Strachey* & *Winterbottom* No. 36; below Naini Tal, *Colonel Davidson*, *C. W. Hope*. Flowers during September and October. It extends eastwards to Sikkim and Chota Nagpur and southwards to Central and S. India and Ceylon.

Plate 132. Habenaria plantaginea *Lindl.* A plant,—*of natural size.* Fig. 1, single flower; 2, ditto, with the sepals removed; 3, column ovary and spur; 4, front view of column; 5, pollinia; 6, ditto, taken from a bud and showing the connate glands;—*all enlarged.*

10. Habenaria triflora Don Prod. Fl. Nep. 25.

Stem 4·5 dm. high, leafy throughout, rather stout, terete, sheaths at the base loose-fitting. *Leaves* 2·5 to 7·5 cm. long, ovate-lanceolate, acute, the upper narrower and acuminate. *Floral bracts* leaflike, embracing the ovaries of the large erect flowers, keeled on the back, membranous. *Flowers* 1 to 3, shortly pedicelled, white. *Sepals* about 2 cm. long, suberect with recurved apices, strongly veined; dorsal ovate, rounded; lateral pair falcately lanceolate. *Petals* very small, linear-subulate, 1-nerved. *Lip* flabelliform, about 3 cm. long, 3-partite to about the middle, gibbous at the base; side lobes semi-oblong or hatchet-shaped, the margins crenulate; midlobe a little shorter, linear; *spur* slender, straight, as long as the ovary, flattened near the tip. *Anther* very broad, quadrate, truncate, cells marginal; tubes short, free; *pollinia* semi-ovate; caudicles a little longer, curved, dilated above, glands minute. *Staminodes* triangular, spreading. *Stigmas* inconspicuous. *Rostellum* broad. Hook. f. Fl. Br. Ind. vi, 142. *Platanthera candida* Lindl. in Wall. Cat. 7035; Gen. and Sp. Orch. 295; Krnzl. Orch. Gen. and Sp. i, 610.

Jaunsar, in the Tonse and Mautar Valleys, 4,000 to 5,000 feet, *Osmaston* (Duthie's No. 23102); near Tehri in Garhwál, *Mackinnon's collector* (Duthie's No. 25419); Kumaon near Loha-thal 5,000 feet, *Strachey* & *Winterbottom* No. 44; near Askot in E. Kumaon 4,000 to 5,000 feet, *Duthie* No. 5995. Flowers in August. It extends eastwards to Nepal and Lower Bengal.

Plate 133. Habenaria triflora *Don.* A plant,—*of natural size.* Fig. 1, single flower; 2, ditto, with sepals removed; 3, lip; 4, front view of column, with petals attached; 5, pollinia;—*all enlarged.*

11. HABENARIA COMMELINIFOLIA Wall. in Lindl. Gen. and Sp. Orch. 325.

Whole plant 6 to 9 dm. high. *Tubers* ellipsoid or cylindrical. Lower portion of stem bearing a few loose sheaths. *Leaves* scattered, 8 to 15 cm. long and 2 to 3 cm. in breadth, oblong or oblong-lanceolate, sub-coriaceous, acute and often sub-spinescent at the apex, margins white. *Bracts* between the leaves and the spike linear-lanceolate, acuminate, ciliolate. *Spike* 1 to 2 dm. long, many- and laxly-flowered; *floral bracts* erect, nearly equalling in length the long beaked ovary, scaberulous on both surfaces and ciliolate along the edges. *Flowers* 1·4 to 2 cm. in diam., white, inodorous. *Sepals* scaberulous; dorsal small, saccate, with a short recurved beak; lateral pair much shorter, hatchet-shaped, beaked, with the veins deeply looped or arched. *Petals* unequally oblong, smaller than the lateral sepals. *Lip* divided into three long slender filiform segments, 2·5 cm. from its base to the tip of the mid-segment; lateral segments 3 cm. long, curved downwards; mid-segment channelled, longer than the lateral pair, spreading, scaberulous; *spur* 6 to 7 cm. long, slender and curved downwards; its upper portion funnel-shaped and nearly white, the apex clavate and green. *Anther-cells* elongate, distant, diverging at the base; the tubes long and 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. *Ovary* including the long slender beak 3 cm. long. Griff. Notul. iii, 372; Ic. Pl. As. t. 339; Hook. f. Fl. Br. Ind. vi, 143; Krnzl. in Engl. Bot. Jahrb. xvi, 137; Orch. Gen. and Sp. i, 322. *Platanthera commelinifolia* Lindl. in Wall. Cat. 7037. *Orchis commelinifolia* Roxb. Fl. Ind. iii, 451; Grah. Cat. Bomb. Pl. 201. *O. stylosanthes* Herb. Ham.

Kangra Valley, *Edgeworth;* near Simla, 6,000 feet, *Collett;* Siwalik range, *Duthie's collector* No. 24166; Dehra Dun in open grassy spots, *Duthie* No. 2067 (1881,) *Mackinnon* (Duthie's No. 21751); Garhwál 3,000 to 5,000 feet, *Falconer*, *Duthie* No. 521; Kumaon, *Wallich*, *Royle*, *Strachey* & *Winterbottom* No. 43; Káli Valley, *Duthie's collector* No. 24054. Flowers during August and September. It extends eastwards to Parasnath and Upper Burma, and southwards to Central and S. India.

PLATE 134. Habenaria commelinifolia *Wall.* A plant (upper and lower portions),—*of natural size.* Fig. 1, side view of single flower; 2, ditto with the lateral sepals, the petals and lip removed; 3, front view of column; 4, pollinia;—*all enlarged.*

12. HABENARIA PUBESCENS Lindl. Gen. and Sp. Orch. 322.

Tubers elongate, stout, often divided, with a few thick and fleshy fibres from their bases. *Stem* about 4 dm. long, clothed at the base with two or three tight-fitting sheaths, pubescent. *Leaves* crowded towards the base of the stem, about 1 dm. long and 4 cm. broad, lanceolate, acuminate, tapering to their bases, 7 to 9-nerved, nerves not prominent; margins undulate, ciliolate. *Raceme* with a few empty leaf-like bracts at its base, 1·3 dm. long, many-flowered, lax, pubescent; *floral bracts* shorter than the long-beaked ovary, ovate, acuminate, ciliolate. Flowers small. Dorsal *sepal* 3-nerved, erect, broadly ovate, a little shorter than the dimidiate ovate obtuse reflexed lateral ones. *Petals* narrowly falcate, longer than the dorsal sepal, and forming an arch with it. *Lip* 3-partite, longer than the sepals; segments linear, the lateral ones with filiform tips; the midlobe about as long as the lateral ones, blunt, keeled beneath. *Spur* about as long as

the ovary, slender, curved. *Anther-tubes* long, flexuous; *pollinia* ovate, obliquely attached to the long slender flexuous caudicles; discs small, flat. *Staminodes* large and prominent. *Stigmatic processes* globose. *Capsule* with a long slender beak, curved, ridges thick and prominent. Hook. f. Fl. Br. Ind. vi, 141; Krantzlin in Engler's Bot. Jahrb. xvi, 202; Orch. Gen. and Sp. i, 421.

Dehra Dun, *Mackinnon* (Duthie's No. 21765); Garhwál and Kumaon, up to 5,500 feet, *Royle*, *Falconer*, *Duthie*, *Mackinnon*, etc.

Plate 135. Habenaria pubescens *Lindl.* A plant,—*of natural size.* Fig. 1, a single flower; 2, back view of ditto; 3, front view of column, showing the base of the lip, the stigmas, the staminodes and the glands of the pollinia; 4, pollinia;—*all enlarged.*

13. Habenaria furcifera Lindl. Gen. and Sp. Orch. 319.

Whole plant 2·5 to 4·5 dm. high. *Stem* sheathed at the base; leafy below the middle, bracteate above. *Leaves* 6·5 to 11·5 cm. long, elliptic, acute or acuminate, slightly narrowed to the sheathing base. *Bracts* on the upper portion of the stem lanceolate, acuminate, diminishing in size upwards. *Raceme* 12·5 to 17·5 cm. long, many- but laxly-flowered. *Flowers* about 13 mm. across from base to apex, green; *floral bract* linear-lanceolate, acuminate, about equalling the ovary. *Sepals* unequal, the dorsal ovate-oblong, obtuse, concave; the lateral pair rather 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* longer than the sepals, trifurcate to the base; the lateral segments filiform, diverging, curved, longer than the stouter blunt middle one. *Spur* slender, longer than the ovary, laterally compressed, curved at the apex. *Anther-cells* contiguous, diverging at their bases, their tubes rather short; *pollinia* falcately ovoid, their caudicles slender, slightly curved, attached to narrowly oblong glands. *Staminodes* rather large and broadly oblong. *Stigmatic processes* short. *Capsule* fusiform, decurved, shortly beaked and with thick ribs. Hook. f. Fl. Br. Ind. vi, 149; Krnzl. in Engl. Bot. Jahrb. xvi, 161; Orch. Gen. and Sp. i, 356; King & Pantling in Ann. R. Bot. Gard. Calc. viii, 313, t. 410. *H. hamigera* Griff. in Calc. Journ. Nat. Hist. iv, 380, t. 20. *H. tenuicornis* Wall. MSS.

Dehra Dun, *Mackinnon*, *Duthie* Nos. 2314, 2323, 21754, *Gamble* No. 23178, Siwalik range, *Duthie's collector* No. 24168; Mussoorie hills 4,000 to 6,000 feet, *Royle*, *Edgeworth*, *Mackinnon*, *Duthie* Nos. 21754, 22992. Flowers during August. It extends eastwards to Bengal, Sikkim, Bhutan and Upper Burma.

14. Habenaria marginata Colebr. in Hook. Fl. Exot. t. 136.

Subscapigerous. *Tubers* small, narrow, cylindric. *Leaves* few, subradical, sessile, 2 to 12·5 cm. long, oblong or linear-oblong, obtuse, margins pale yellow. *Scape* 1 to 15 dm. long; *sheaths* erect, lanceolate. *Spike* 5 to 15 cm. long, many-flowered; *floral bract* nearly equalling the ovaries, with pale ciliolate margins. *Flowers* 1·5 cm. in diam., greenish-yellow. Dorsal *sepal* erect, broadly ovate; lateral falcately oblong-lanceolate spreading or deflexed, 3—5-nerved. *Petals* falcately oblong, erect, forming a hood with the dorsal sepal, 2-nerved. *Lip* longer than the sepals, 3-partite; lateral segments narrowed and with filiform points, mid-segments shorter and broader, with the margins

reflexed. *Spur* about as long as the curved ovary, laterally compressed at the apex. *Anther-clels* distant; tubes funnel-shaped, short, spreading. *Pollinia* with short geniculate caudicles, *glands* rather large, triangular, flattened. *Staminodes* elongated. *Stigmatic processes* long, adnate to the base of the column for two-thirds of their length. *Capsule* 1·4 cm., fusiform, turgid, curved. Lindl. Gen. and Sp. Orch. 320; Dalz. & Gibs. Bomb. Fl. 268; Griff. Notul. iii, 371; Ic. Pl. As. t. 341; Calc. Journ. Nat. Hist. iv, 382; Hook. f. Fl. Br. Ind. vi, 150; Kräntzlin in Engler's Bot. Jahrb. 164; Orch. Gen. and Sp. i, 360; Collett Fl. Siml. 504. *Platanthera marginata* Lindl. in Wall. Cat. 7038. *Habenaria promensis* Wall. Cat. 7033; Lindl. Gen. and Sp. Orch. 320. *Orchis mysorensis* and *clavata* Herb. Heyne.

Simla, 6,000 feet, *Collett*; Siwalik range and Dehra Dun, *Duthie's collector* No. 24172; Garhwál and Kumaon up to 11,000 feet, *Falconer*, *Strachey & Winterbottom* No. 38, *Duthie*, *Mackinnon*, etc., flowering in August. It extends westwards to Simla, Chamba and Kashmir, and eastwards to Bengal, and grows as a weed in the Calcutta Botanic Garden; it is also found in Burma and in Western and Southern India.

Plate 136. Habenaria marginata *Colebr.* A plant,—*of natural size.* Fig. 1, side view of single flower; 2, front view of ditto with the sepals removed; 3, *lip* seen from below; 4, side view of column with spur and ovary; 5, pollinia;—*all enlarged.*

15. Habenaria diphylla Dalz. in Hook. Journ. Bot. ii (1850), 262.

Tubers small, elongate or globose. *Leaves* radical, usually two, 2·5 to 5 cm. in diam., orbicular, cordate, margined, rather fleshy. *Scape* 1 to 2·5 dm., slender, many-flowered, the peduncle with distant sheathing lanceolate acuminate bracts; *floral bract*, much shorter than the slender curved ovaries. *Flowers* distant, spreading, white, tinged with green. *Sepals* subequal; dorsal erect, 5 mm. long, ovate, concave, acute; lateral pair deflexed, obliquely ovate, acuminate, 3-nerved. *Petals* linear, white, as long as, and forming a hood with, the dorsal sepal. *Lip* much longer than the sepals, 3-partite, segments filiform, the lateral pair spreading and spirally twisted at the tips, mid-segment shorter, deflexed; *spur* 8 mm. long, shorter than the ovary, inflated towards its acute apex. *Anther* broad, its cells distant, tubes very short; *pollinia* dimidiate-ovate, obliquely attached to caudicles, equal to them in length; glands small, subglobose; *staminodes* large, petaloid, sub-patent, with incurved tips. *Stigmatic processes* elongate, clavate, adnate to the mouth of the spur. *Rostellum* obscure. Dalz. & Gibs. Bomb. Fl. 268; Hook. f. Fl. Br. Ind. vi, 151; Krnzl. in Engl. Bot. Jahrb. xvi, 154; Orch. Gen. and Sp. i, 346. *H. Jerdoniana*, Wight Ic. 1715. *H. Sutleri* Reichb. f. in Linnæa xxv, 229. *Platanthera canarensis* Lindl. in Pl. Hohen. exsicc. No. 142. *Liparis diphyllos* Nimmo in Grah. Cat. Bomb. Pl. 252.

Dehra Dun, *Mackinnon* (Duthie's No. 25411); Garhwál, *Falconer*. Flowers during August. It is found also in Eastern Bengal and Chota Nagpur, and from the Konkan to Malabar.

Plate 137. Habenaria diphylla *Dalz.* A plant,—*of natural size.* Fig. 1, single flower; 2, ditto, with sepals, petals and portion of lip removed; 3, front view of column;—*all enlarged.*

16. Habenaria Aitchisoni Reichb. f. in Trans. Linn. Soc. Ser. 2, Bot. iii, 113.

Tubers about 2 cm. long, rather narrow, often divided at the ends. *Leaves* two, near the base of the tall scape, subopposite, 4—6 cm. long and about as wide, suborbicular, with cordate sheathing bases, cuspidate at the apex, not margined, thick, dark green above and with pale-coloured blotches, uniformly paler beneath. *Spike* 5—8 cm. long; *bracts* of peduncle small, lanceolate, acuminate; *floral bracts* shorter than the ovary, lanceolate, acuminate. *Flowers* crowded, subsecund, erect, 8 mm. in diam., yellowish-green. *Sepals* and *petals* about equal in length; dorsal *sepal* erect, concave, ovate, obtuse, 3-nerved; the lateral ones reflexed, obliquely lanceolate, acute. *Petals* erect, falcately ovate-lanceolate, 1-nerved, auricled at the base in front. *Lip* a little longer than the sepals, 3-partite above the base; segments filiform, the two lateral ones spreading and recurved, narrower than the deflexed mid-segment. *Spur* variable in length, but always much shorter than the ovary. *Anther* broad, cells nearly parallel; *tubes* very short, incurved. *Pollinia* obovate, caudicles very short, *glands* small. *Stigmatic processes* thick and prominent. *Rostellum* minute. *Ovary* fusiform, curved. Hook. f. Fl. Br. Ind. vi, 152; Boiss. Fl. Or. Suppl. 370; Kräntzlin in Engler's Bot. Jahrb. xvi, 154; Orch. Gen. and Sp. i, 345. *H. brachyphylla* Aitch. & Hemsl. in Journ. Linn. Soc. xix, 118 (not of Kräntzlin).

Mussoorie range, between 6,000 and 7,000 feet, *Mackinnon* [Duthie's Nos. 21752 and 22991 (*b*)]; Nag Tiba in Garhwál, 9 to 10,000 feet, *Duthie's collector* No. 22991 (*a*); Kumaon, 9 to 10,000 feet, *Duthie*; flowering during July and August. This species extends westwards to Murree, Kashmir, the Kurram Valley, Afghanistan and Waziristan.

Var. *Josephi* Hook. f. Fl. Br. Ind. vi, 152. Much smaller than the type. Leaves 2·5 to 3·5 cm. long, not cuspidate at the apex. Spike few-flowered. Flowers greenish. King & Pantling in Ann. R. Bot. Gard. Calc. viii, 311, t. 408. *H. Josephi*, Reichb. f. in Trans. Linn. Soc. lc. 114.

Northern Kumaon in the Kali Valley 9 to 11,000 feet, *Duthie* Nos. 3419, 6002, flowering during July and August. Found also in W. Nepal in the Nampa Gadh up to 12,000 feet *Duthie* No. 6002(*a*), extending eastwards to Sikkim up to elevations between 12 and 14,000 feet.

Plate 138. Habenaria Aitchisoni *Reichb. f.* A plant,—*of natural size.* Fig. 1, front view of flower; 2, side view of ditto; 3, column, showing the anther, staminodes, rostellum and stigmatic processes; 4, pollinia;—*all enlarged.*

17. Habenaria stenantha Hook. f. Fl. Br. Ind. vi, 153.

Height of plant 3 to 6 dm., with no tuber, the roots thick and fleshy. *Stem* stout, sheathed at the base. *Leaves* three or more, 1 to 2·25 dm. long, the lower ones larger, obovate to oblong-lanceolate, acute or subacute; upper part of stem bearing lanceolate acuminate bracts 1 to 2 cm. long. *Spike* 1·25 to 2·25 dm. long, laxly many-flowered. Flowers 1·6 to 2 cm. across, green; *floral bract* linear-lanceolate, equalling or shorter than the shortly stalked ovary. *Sepals* unequal, 3 nerved; the dorsal erect, concave, broadly ovate, blunt; lateral pair smaller

reflexed ovate-elliptic, subacute. *Petals* longer than the dorsal sepal, erect, linear, blunt, 1-nerved. *Lip* longer than the sepals, lanceolate, blunt, entire, 3-nerved; *spur* spreading, slender, cylindric, longer than the slender beakless ovary, dilated towards the apex and slightly curved. *Anther-cells* diverging at the base, tubes none; *pollinia* broadly elliptic-clavate, faintly grooved, the caudicles rather short; glands large, elongate, placed on either side of the entrance to the spur and reaching to the stigma. *Stigmas* conjoined into a small transversely oblong body situated on the upper margin of the entrance to the spur. *Capsule* 10 to 11 mm. long. King & Pantling in Ann. R. Bot. Gard. Calc. viii, 314, t. 412.

Sosa forest in E. Kumaon between 9,000 and 10,000 feet, *Duthie* No. 3405. Flowers during July and August. Found also in Sikkim, and at Chumbi in Tibet.

This species bears a close general resemblance to *H. latilabris*, but the column is quite different, the stigma being single and transverse; the polliniar glands are also very differently shaped.

18. HABENARIA URCEOLATA Clarke in Journ. Linn. Soc. XXV. 73, t. 30.

Whole plant 5 to 15 cm. high. *Tubers* narrow, elongate. *Stem* slender, curved, with a single sheath at the base. *Leaf* usually solitary, from below the middle of the stem, 5 to 10 cm. long, narrowly elliptic-oblong, obtuse or subacute, tapering to the long narrow tubular sheath. *Peduncle* with several distant bracts, the lowermost often leaflike. *Raceme* 1·6 to 5 cm. long, decurved, rather laxly flowered, secund. *Flowers* 8 mm. long, longer than the ovaries, narrowly campanulate, white; *floral bract* longer than the shortly stalked tumid ovary. *Sepals* erect, nearly equal, dorsal not connivent with the petals, elliptic, blunt, lateral pair oblong, subacute. *Petals* as long as the sepals, free, falcately oblong, blunt, tapering slightly to the base. *Lip* about as long as the sepals and petals, decurved beyond the middle, oblong, slightly concave, tapering and becoming thicker towards the apex, minutely hispid near the base; *spur* shorter than the sepals, inflated above the constricted neck. *Anther-cells* elongate, approximate but not touching, parallel; *pollinia* ellipsoid, composed of large granules; glands about as long as the short caudicles, acute at one end. *Staminodes* filiform, parallel to the anther-cells and exceeding them in length, their apices free. *Stigmas* conjoined, large, occupying the whole of the anterior surface of the column below the glands of the pollinia. Hook. f. Fl. Br. Ind. vi, 165; King & Pantling in Ann. R. Bot. Gard. Calc. viii, 316, t. 415. *Diphylax urceolata* Hook. f. Ic. Pl. 1865; Krnzl. Orch. Gen. and Sp. i, 599.

Northern Kumaon in the district of Byáns 11,000 to 12,000 feet. *Duthie* No. 6003. Flowers during August. Found also in Sikkim and on the frontiers of Nepal and Tibet.

19. HABENARIA EDGEWORTHII Hook. f. ex Collett Fl. Siml. 504, fig. 166.

Height of plant 3 to 7·5 dm. *Tubers* oblong or sub-globose. *Stem* rather stout, leafy, its base clothed with a few short loose sheaths, of which the upper one is usually sub-foliaceous. *Leaves* 3·7 to 10 cm. long, the upper ones diminishing in size, ovate or oblong-lanceolate, acute or acuminate, usually rather fleshy, the main nerves prominent beneath. *Spike* 7·5 to 25 cm. long, many-flowered, rachis stout. *Flowers* rather crowded,

9 to 12·5 mm. across, deflexed in bud; *floral bracts* lanceolate, acuminate; the lower ones longer and the upper shorter than the curved beaked ovary. *Sepals* green, pubescent, their edges minutely ciliolate; the dorsal erect, broadly ovate or sub-orbicular, concave; the lateral pair larger, deflexed, obliquely ovate, obtuse. *Petals* erect, yellow, thick, obliquely triangular from a broad base, their apices curving inwards and forming a hood with the dorsal sepal, turning black when dried. *Lip* yellow, longer than the lateral sepals; anterior portion thick and strap-shaped, deflexed abruptly from the end of the wider channelled claw; *spur* much longer than the ovary, curving upwards, yellowish-green. *Anther-cells* distant, parallel; *pollinia* obliquely pyriform, bipartite; caudicles short, curved, each attached to a small bipartite gland. *Staminodes* elongate. *Stigmatic processes* oblong, nearly parallel, situated below the opening to the spur; rostellum triangular. *H. latilabris* Hook. f. Fl. Br. Ind. vi, 153 (in part). *Platanthera acuminata* Lindl. in Wall. Cat. 7040; Gen. and Sp. Orch. 289.

Throughout the Western Himalaya from Hazára to Kumaon at elevations between 6,000 and 10,000 feet. It is the most abundant terrestrial orchid on the Simla and Mussoorie ranges, and is very often found in company with *Satyrium nepalense* on open hillsides. It commences to flower during July, but always a little later than *H. latilabris*.

The upturned position of the spur in *H. Edgeworthii* may be explained by the fact that the flowers, when in bud, are deflexed, and the spurs are then directed upwards. The flowers, as they begin to open, curve up and become sub-erect, but by this time the elongated spurs have not sufficient space in the crowded raceme in which to alter their position.

PLATE 139. Habenaria Edgeworthii *Hook. f.* A plant,—*of natural size.* Fig. 1, side view of flower; 2, front view of ditto, with the lateral sepals removed; 3, side view of flower, the sepals and petals removed; 4, pollinia;—*all enlarged.*

20. HABENARIA LATILABRIS Hook. f. Fl. Br. Ind. vi 153 (in part).

Tubers fusiform. *Stem* 2 to 4·5 dm., with a few loose sheaths near the base, of which the upper ones are often sub-foliaceous. *Leaves* scattered, three to five, 5 to 10 cm. long, elliptic-oblong, acute or acuminate, tapering into the broad sheaths; bracts below the raceme about 2·5 cm. long, lanceolate, acuminate. *Spike* 7·5 to 13 cm., laxly flowered. *Flowers* 12 to 14 mm. long (from the base to the tip of the dorsal sepal), the sepals dark green and the petals and lip yellowish-green; *floral bract* lanceolate, acuminate, those of the lower flowers longer than the curved beaked ovary, of the upper flowers shorter. *Sepals* unequal, their edges ciliolate; dorsal erect, 4 mm. long, broadly ovate or sub-orbicular, concave; the lateral pair reflexed, 5 mm. long, obliquely ovate, obtuse. *Petals* slightly longer than the lateral sepals, spreading, lanceolate or linear from a broad triangular base, gibbous on their outer edges near the base. *Lip* rather longer than the petals, deflexed from the apex of the short broad claw, sub-terete or linear-oblong with reflexed edges, tapering slightly to the apex; *spur* about 15 mm. long, slender, curved but not upturned as in *H. Edgeworthii*, cylindric or compressed and with the apex often bifid or trifid. *Column* short. *Anther-cells* parallel, distant, each with a rounded rugulose staminode on its outer side near the base; tubes short, curved forwards; *pollinia* obliquely pyriform, almost bipartite, tapering into the short stout caudicles; glands small, elliptic. *Stigmas*

two, oblong, blunt, separated by the entrance into the spur. Hook. f. in Ann. R. Bot. Gard. Calc. v, 66, t. 100; King & Pantling in Ann. R. Bot. Gard. Calc. viii, 321, t. 423; Krnzl. Orch. Gen. and Sp. i, 442. *Platanthera latilabris* Lindl. Gen and Sp. Orch. 289. *P. Orchidis* Wall. Cat. 7039B.

Not uncommon on the Western Himalaya from Dalhousie to Kumaon at elevations between 5,000 and 9,000 feet; specimens have, however, been gathered by Mr. C. W. Hope as low down as Dehra Dun. It becomes more abundant eastwards, but in no portion of the area is it as plentiful as *H. Edgeworthii*, which extends as far west as Hazara. *H. latilabris* is more of a shade-loving plant, and is very often found as an epiphyte on the trunks of trees. Flowers during July and August. It extends eastwards to Nepal, Sikkim and E. Tibet.

In the living state this species can be easily distinguished from *H. Edgeworthii* by the nearly uniform greenish tint of its flowers, the spreading petals and by the shorter and much more slender spur, which is usually not curved upwards.

PLATE 140. Habenaria latilabris *Hook f.* A plant,—*of natural size.* Fig. 1, side view of single flower; 2, front view of ditto, with the lateral sepals removed; 3, side view of flower with the sepals and petals removed; 4, pollinia;—*all enlarged.*

21. HABENARIA DENSA Wall. in Lindl. Gen. and Sp. 326.

Tubers oblong. *Stem* stout, 3 to 7·5 dm., with a few loose blunt sheaths at its base, *Leaves* many, scattered, 6 to 10 cm. long, ovate or oblong, acuminate, tapering very little to the long sheath, diminishing in size upwards. *Spike* 2 to 3·5 dm. long, many-flowered, rachis stout. *Flowers* crowded, erect, 7 mm. across, green; *floral bract* longer than the short curved slender-beaked ovary, lanceolate, acuminate, the edges ciliolate. *Sepals* sub-equal, elliptic-oblong, obtuse, thick, ciliolate, 3-nerved; dorsal erect, concave; lateral pair narrower, reflexed. *Petals* nearly as long as the sepals, obliquely elliptic-oblong, obtuse, fleshy. *Lip* equalling the sepals, linear, obtuse, with a transverse callus at its base close to the column; *spur* half as long as the ovary, clavate, pendulous, compressed laterally. *Column* short, broad. *Anther-cells* distant, parallel, without tubes; *pollinia* broadly elliptic, caudicles short; glands discoid, guarding the entrance to the spur. *Staminodes* large, each consisting of two united elongate processes, the upper pair rugulose and parallel to the sides of the anther-cells; lower pair smooth, their apices converging inwards below the stigmas and almost meeting over the base of the lip. *Stigmas* two, small, sub-orbicular, placed between the polliniar glands and the staminodes. Hook. f. Fl. Br. Ind. vi, 153; King & Pantling in Ann. R. Bot. Gard. Calc. viii, 319. t. 420; Krnzl. in Engl. Bot. Jahrb. xvi, 216; Orch. Gen. and Sp. i 443; Collett Fl. Siml. 504. *Platanthera densa* Lindl. in Wall. Cat. 7046. *P. clavigera* Lindl. Gen. and Sp. Orch. 289.

Not uncommon on the Western Himalaya at elevations between 7,000 and 10,000 feet; Dalhousie, *Dr. Clark;* Simla, *Lady Dalhousie, Edgeworth, Gamble* (No. 1390) etc.; Garhwál, *Falconer, Edgeworth, Royle, Mackinnon, Duthie* Nos. 525, 24175, 22410, 22988; Kumaon at Kalimundi 8,500, *Strachey & Winterbottom;* F. Kumaon, *Blinkworth, Duthie* No. 3411, *Duthie's collector* Nos. 24066, 24067, 24070. Flowers during July and August. It extends eastwards to Nepal, Sikkim and Bhutan.

22. Habenaria arcuata Hook. f. Fl. Br. Ind. vi, 155.

Stem very thick, leafy. *Leaves* 7·5 to 10 cm., oblong-lanceolate, subacute, with sheathing bases, upper lanceolate, or linear-lanceolate. *Spike* broad, many-flowered; *floral bracts* herbaceous, linear-lanceolate, the lower ones much longer than the slender curved ovaries. *Flowers* large, white. Sepals 9 mm. long; dorsal cucullate, beaked; lateral pair larger, oblong, obtuse, 3-nerved, deflexed. *Petals* small, linear, 1-nerved, membranous. *Lip* twice as long as the sepals, auricled at the base, puberulous, margins reflexed. *Spur* 5 to 6·3 cm. long, incurved, acute. *Anther* large, broad, cells divergent, tubes erect; *pollinia* with short stout caudicles; glands very large, ovate; *rostellum* broad, flat, acute. *Platanthera arcuata* Lindl. Gen. and Sp. Orch. 289; Krnzl. Orch. Gen. and Sp. i, 633.

Mussoorie, *Royle;* Naini Tal, *Colonel Davidson.* The single specimen in the Kew Herbarium representing this species is the Naini Tal one, and this was gathered in the month of June.

23. Habenaria viridis R. Br. in Ait. Hort. Kew. ed. 2, v, 192.

Tubers ovoid, often lobed. *Stem* 7·5 to 10 cm. high. *Leaves* usually three or four narrowly oblong, acute or obtuse, smaller upwards, many-nerved. *Flowers* 9 to 13 mm. long. *Spike* lax; bracts green, exceeding the ovaries, oblong-lanceolate, acuminate. Sepals and petals green striped with dark red. *Sepals* sub-connivent, ovate-oblong, concave, obtuse and cucullate at their apices. Dorsal 7-nerved, the lateral pair obliquely ovate. *Petals* erect, linear-oblong, equalling the dorsal sepal. *Lip* linear-oblong, pale brown, widening towards the tridentate apex, the central tooth often very small; *spur* very short, obtuse. *Anther* with an emarginate apex, the cells diverging; *pollinia* broadly ellipsoid, composed of large grains; caudicles short, attached to minute glands, each of which is concealed in a pouch formed by the rostellum, as in the genus *Orchis.* Syme in Engl. Bot. (ed. 3), ix 105, t. 1462; Hook. f. Student's Fl. Brit. Islands 376. *Peristylus viridis* Lindl. Syn. Brit. Fl., ed. 2, 261; Gen. and Sp. Orch. 299; Rolfe in Journ. Linn. Soc. xxxvi (1903), 54. *Satyrium viride* Linn. Sp. Pl. 944. *Orchis viridis* Crantz Stirp. Austr., ed. 2, 491. *Gymnadenia viridis* A. Rich. in Mém. Mus. Par. iv 57. *Platanthera viridis* Lindl. Syn. Brit. Fl., ed. i, 261; Reichb. Fl. Germ. xiii, 129, t. 434. *Himantoglossum viride* Reichb. Fl. Germ. Excurs. 120. *Cœloglossum viride* Hartm. Handb. Skand. Fl., ed. 1, 329.

This interesting addition to the flora of British India was discovered in July 1901 at Nai Gund near the Kamri Pass in N. Kashmir, by Inayat Khán, formerly Head Plant collector to the Botanical Department of N. India, No. 25387. It was previously known from Northern Europe (including Britain), Siberia, Dahuria, China and N. America.

Plate 141. Habenaria viridis *R. Br.* A plant,—*of natural size.* Fig. I, side view of single flower; 2, dorsal sepal; 3, front view of flower, with the sepals removed; 4, side view of ditto, with sepals and petals removed; 5, pollinia;—*all enlarged.*

24. Habenaria falax King & Pantling in Ann. R. Bot. Gard. Calc. viii,, 325, t. 428.

Whole plant 1 to 3 dm. high. *Tubers* small. *Stem* with two tublar bulunt sheaths at the base. *Leaf* solitary, 3·5 to 15 cm. long, narrowly elliptic or lanceolate, acute or acuminate, tapering slightly to the short sheath. *Peduncle* long, with a single linear. lanceolate acuminate bract. *Spike* 3·5 to 10 cm. long, laxly or densely flowered; *floral bract* equalling or shorter than the slightly decurved ovary. *Flowers* small, green *Sepals* about equal, oblong or ovate-lanceolate, the dorsal connivent with the petals to form a hood; lateral pair erect, not connivent. *Petals* ovate-oblong, obtuse, variable as to size. *Lip* not much longer than the sepals, flat, rather fleshy, hastately 3-lobed from about the middle; side lobes oblong, obtuse, diverging; apical lobe longer than the side lobes, oblong, obtuse, deflexed; *spur* saccate, much shorter than the sepals, 2-ribbed inside. *Column* rather long. *Anther-cells* nearly parallel, but diverging at the base, without tubes. *Pollinia* obovoid or clavate; caudicles short, tapering to the small cordate glands. *Staminodes* small, globular, attached about half-way up on the outer sides of the anther-cells. *Stigmas* two, transversely oblong, touching by their ends and forming a band below the anther-cells. *Herminium fallax* Lindl. in Wall. Cat. 7412; Hook. f. Ic. Pl. 2198; Fl. Br. Ind. vi, 129. *Peristylus fallax* Lindl. Gen. and Sp. Orch. 298; Krnzl. Orch. Gen. and Sp. i, 512.

Near Mussoorie 6,000 to 7,000 feet, *Duthie* No. 21770; Nág Tiba in Garhwál 8,000 to 9,000 feet, *Mackinnon*, *Duthie* Nos. 21769, 22987; Gori Valley in Kumaon, *Duthie's collector* No. 24058. Flowers during July and August.

25. **Habenaria Elisabethæ**, Duthie in Journ. As. Soc. Beng. lxxi, part II, 44.

Height of plant 2 to 4·5 dm., glabrous. *Tubers* ovoid. *Leaves* 2 or 3, approximate towards the base of the stem, with one or two loose sheaths below, and a few lanceolate and finely acuminate bracts above them, 6 to 12 cm. long and 1 to 2 cm. in breadth, lanceolate, acuminate or the lowest one often obtuse, amplexicaul at the base, midrib prominent beneath. *Spike* long, slender, many-flowered. *Flowers* small, sessile, rather crowded, deflexed, green; *floral bract* lanceolate. acuminate, about half as long the curved beaked ovary. *Sepals* and *petals* erect, connivent; dorsal ovate, concave; the lateral pair obliquely ovate, obtuse. *Petals* a little longer than the sepals, obliquely ovate, obtuse. *Lip* longer than the sepals, 3-lobed to the middle, fleshy, the basal portion trough-shaped; lateral lobes linear, spreading, their margins gibbous at the base; midlobe oblong, obtuse, as long as the lateral pair but broader. *Spur* one-fifth the length of the ovary, ovate or obovate. *Anther-cells* parallel; *pollinia* obovate, curved, attached by a short caudicle to an oval gland. *Stigmatic processes* clavate. *Staminodes* rather large. *Cybele* Falc. in Lindl. in Veg. Kingd. 193c. *C. alpina* Falc. MSS.

Simla Hills between 9,000 and 10,000 feet, *Edgeworth*, *Lady E. Babington-Smith*; Mussoorie Hills from 6,000 to 9,000 feet, *Edgeworth*, *Mackinnon*, *Duthie* Nos. 21766, 22990; Jumna Valley in Garhwál, *Duthie* No. 524; Pharkia at 11,000 feet, *Edgeworth*; Naini Tal at 7,000 feet, *Strachey & Winterbottom* No. 32, *Colonel Davidson*; Rálam Valley at 12,000 feet, *Strachey & Winterbottom* (named *Herminium fallax*). Flowers in August. It has been found also on the Eastern Himalaya at Chumbi, and in E. Tibet.

This species is very similar at first sight to *H. fallax*, with which it has often been confounded. The leaves, however, are never solitary, the flowers are smaller, more crowded and they are deflexed;

the shape of the lip also is very different. I have named this plant after Lady Elisabeth Babington Smith, who kindly sent me specimens from near Simla in 1898.

PLATE 142. Habenaria Elisabethæ *Duthie.* A plant,—*of natural size.* Fig. 1, side view of single flower; 2, front view of ditto (spread out), with the sepals removed; 3, side view of lip and spur; 4, pollinia;—*all enlarged.*

26. HABENARIA LAWII Hook. f. Fl. Br. Ind. vi, 162.

Tubers ellipsoid or globose. *Stem* 1·5 to 2·5 dm., slender, with a few short loose sheaths below the leaves. *Leaves* 3 to 5, clustered above the middle of the stem, 7·5 to 10 cm. long, narrowly lanceolate or elliptic, acute, membranous. *Spike* 5 to 7·5 cm. long, slender, narrow. *Flowers* very small, spreading, white; *floral bract* ovate-lanceolate acuminate, longer than the ovary, membranous. Sepals and petals sub-equal, connivent, obtuse. *Dorsal sepal* elliptic, the lateral sub-falcately linear-oblong. *Petals* fleshy. *Lip* as long as the sepals, broadly and obtusely 3-fid., its claw concave, and with a short ciliate ridge at its base; *spur* small, globose. *Anther-cells* parallel, tubes none; *pollinia* obovate, the caudicles as long as the pollinia and attached to minute globular glands. *Staminodes* large, petaloid, green tipped with white. *Ovary* slender, 6 mm. long, curved forward at the apex. *Peristylus Lawii* Wight Ic. 1695; Dalz. & Gibs. Bomb. Fl. 270; Krnzl. Orch. Gen. and Sp. 510.

Dehra-Dun, *Mackinnon* and *Duthie's collectors* Nos. 21767, 22727, 23101; below Landour (Herb. Calc.). Flowers during July and August. Found also on Parasnath Hill in Behar at an elevation of 4,200 feet, and in the Chánda district of the Central Provinces, extending southwards to the Konkan and Mysore.

PLATE 143. Habenaria Lawii *Hook f.* A plant,—*of natural size.* Fig. 1, side view of single flower; 2, ditto with the sepals and petals removed; 3, column, with lip attached; 4, lip, spread out; 5, anther and staminodes (the latter spread out); 6, pollinia;—*all enlarged.*

27. HABENARIA GOODYEROIDES Don. Prod. Fl. Nep. 25.

Height of plant 3 to 6 dm. *Tubers* ellipsoid or oblong, hairy. Lower portion of stem with many loose blunt sheaths. *Leaves* clustered above the middle of the stem but not whorled, 5 to 10 cm. long, ovate or ovate-elliptic, acute, slightly narrowed to the shortly sheathed base. *Spike* 1 to 2 dm., densely flowered, its peduncle bearing a few lanceolate acuminate bracts. *Flowers* subsecund, 8 mm. in diam. at the mouth, deflexed by reason of the curved apex of the ovary, white, sweet-scented; *floral bract* narrowly lanceolate, acuminate, about as long as the slender ovary. *Sepals* unequal, tinged with brown, the dorsal broadly ovate-lanceolate, concave, conniving with the petals and forming a hood; lateral pair oblong, involute, apiculate. *Petals* as long as the sepals, trapeziform, blunt. *Lip* longer than the petals, broadly triangular in general outline, the sides rounded, 3-lobed for one-third of its length; side lobes linear-oblong, falcate, acute and diverging at the apex, slightly longer than the broad blunt midlobe; upper surface with a small elongate depression at the base and in front of the minute opening into the spur; *spur* nearly globular, much sherter than the sepals. *Column* short and broad. *Anther-cells* parallel but not contiguous, without tubes; *pollinia* pyriform, caudicles very short, the glands small

and obovoid. *Staminodes* large, oblong, spreading outwards at right angles to the anther. *Stigmas* two, large, lying beneath and parallel to the staminodes, spreading. Hook. f. Fl. Br. Ind. vi, 161 (in part); King & Pantling in Ann. R. Bot. Gard. Calc. viii, 326, t. 430; Collett Fl. Siml. 505. *H. ornithoides* Wall. MSS., *Peristylus grandis* Blume Bijdr. 405. *Herminium goodyeroides* Lindl. in Wall. Cat. 7066A (in part).

Below Deoban in Jaunsar at 7,600 feet, *Osmaston;* Dehra Dun, *Mackinnon;* Mussoorie range up to 6,000 feet, *Mackinnon*, *Duthie* Nos. 2315, 21756; Bok Hill in Garhwál, *Duthie's collector* No. 24169; near Almora in Kumaon at 4,000 feet. *Strachey & Winterbottom* No. 33, *Duthie's collector* Nos. 24059, 24065. Flowers during July and August. It extends eastwards to Nepal, Parasnath in Bengal, Sikkim, Assam, the Khasia Hills and Manipur.

Var. *affinis* Lindl. Gen. and Sp. Orch., 300. Much smaller in all its parts than the type; the lip is rather longer, gibbous at the base, and with broader side lobes. King & Pantling in Ann. R. Bot. Gard. Calc. viii, 327, t. 430 bis. *H. affinis* Don. Prod. 25. *H. goodyeroides* in Hook. f. Fl. Br. Ind. (in part). *H. saccuata* Wall. MSS. *Peristylus goodyeroides* Lindl. Gen. and Sp. Orch. 299; Royle Ill. Him. Bot. t. 87, fig. 2; Rolfe in Journ. Linn. Soc. xxxvi, 54 (in part).

In the Chamba State, Punjab Himalaya at 4,000 feet, *Lace* No. 1814; Mussoorie range common between 6,000 and 7,000 feet, *Mackinnon*, *Duthie* Nos. 17826, 21757, 22729; Garhwál, *Royle*, *King*; British Garhwál at Lansdowne between 4,000 and 5,000 feet, *Roberts*. Flowers during August. It extends eastwards to Nepal, Sikkim, and to the Khasia and Naga Hills.

28. HABENARIA CONSTRICTA Wall. ex Hook. f. Fl. Br. Ind. vi, 161.

Tubers oblong, hairy. *Stem* stout, 5 to 7·5 dm. high, clothed at the base with wide blunt sheaths. *Leaves* five or six, at the upper portion of the stem, more or less whorled, 7·5 to 17·5 cm. long, ovate-elliptic, acute or acuminate, much narrowed towards the long sheaths; bracts on upper part of stem linear-lanceolate, acuminate. *Spike* broadly cylindric, 2 to 4 dm. long, many- and densely-flowered. *Flowers* spreading, white, sweet-scented, 1·9 to 2·3 cm. across; *floral bract* erect, lanceolate, acuminate, about as long as the erect ovary. *Sepals* about equal, oblong, obtuse, ciliolate-the dorsal conduplicate; the lateral pair spreading, their margins involute. *Petals* larger than the sepals, obliquely ovate-lanceolate, bluntly acuminate, somewhat gibbous on the lower side, spreading upwards in front of the dorsal sepal, but not conniving with it to form a hood. *Lip* as long as the petals, oblong, 3-lobed to about the middle; lateral lobes linear, acuminate, somewhat diverging at their apices; midlobe shorter, oblong, tapering to a blunt point. *Column* very short and broad. *Anther-cells* close together but not contiguous, without tubes; *pollinia* obovoid; the caudicles short, tapering to the oblong-elliptic gland. *Staminodes* oblong, obtuse. *Stigmas* two, obovate-oblong, spreading. King & Pantling in Ann. R. Bot. Gard, Calc. viii, 325, t. 429. *Platanthera constricta* Lindl. in. Wall. Cat. 7043. *Hab. goodyeroides* Lindl. in Wall. Cat. 7066B. (not of Don). *Herminium constrictum* Lindl. in Bot. Reg. under 1449. *Peristylus constrictus* Lindl. Gen. and Sp. Orch. 300; Krnzl. Orch. Gen. and Sp. I, 508. *Orchis leucantha* Herb. Ham.

Dehra Dun in *sâl* forest, *Mackinnon;* Siwalik range, *Duthie's collector* No. 24176; Sarju Valley in Kumaon, *Duthie's collector* No. 24060. Flowers during July and August. Found also in Sikkim, on the Khasia Hills, Assam, Chittagong, and in Upper and Lower Burma.

29. HABENARIA GALEANDRA Benth. Fl. Hongk. 363.

Tubers small, globose or oblong. *Stem* 1·5 to 3 dm. high, slender, glabrous or puberulous, usually tinged with purple, the lower portion bearing a few loose tubular sheaths. *Leaves* 3 to 5·5 cm. long, oblong-lanceolate, blunt or sub-acute, narrowed to the base and amplexicaul, dark green above, and usually with a bright purple band down the centre. *Spike* 1 to 1·5 dm., many-flowered; *floral bracts* leaflike, much longer than the flowers, diminishing upwards. *Flowers* about 12 mm. in diam., pale purple. *Sepals* and *petals* ovate-lanceolate, acuminate. Dorsal sepal erect, the lateral pair spreading, sub-falcate. *Petals* rather shorter than the sepals, conniving with the dorsal one. *Lip* broad, cuneiformly obovate or obcordate, often mucronate, shortly clawed, sides erect, upper surface puberulous at the base; *spur* stout, about half as long as the ovary. *Anther-cells* approximate; *pollinia* narrowly obovate, caudicles short, tapering into the elongate flat glands. *Staminodes* distinct, curving forward and in front of the anther-tubes. *Ovary* curved, the ribs brownish purple and puberulous. Hook. *f.* Fl. Br. Ind. vi, 163; Collett Fl. Siml. 506. *Platanthera obcordata* Lindl. in Wall. Cat. 7050; Gen. and Sp. Orch. 290; Rolfe in Journ. Linn. Soc. xxxvi, 56. *P. galeandra* Reichb. f. in Linnæa xxv, 226. *P. Championi* Lindl. in Hook. Journ Bot. vii, 38. *Gymnadenia obcordata* and *galeandra* Reichb. f. Ot. Bot. Hamb. 32, 33. *Orchis obcordata* Buch.-Ham. in Don Prod. 230. *O. Susannæ*, Herb. Heyne.

Simla Hills, *Stoliczka, Collett;* Mussoorie range between 5,000 and 7,000 feet, *Vicary, Mackinnon, Duthie* Nos. 2575, 21755, 22732; Garhwál, *Falconer, Royle;* British Garhwál near Lansdowne, *Roberts;* Kumaon 7,000 feet, *Strachey & Winterbottom* No. 40; *T. Thomson, Colonel Davidson, Duthie's collector* No. 24064. Flowers in August. It extends eastwards to Nepal, Khasia and Naga Hills, Upper Burma and China. No record from Sikkim.

PLATE 144.—Habenaria galeandra *Benth.* A plant,—*of natural size.* Fig. 1, side view of flower; 2, front view of column, with lip attached (the latter spread out); 3, front view of column, *further enlarged;* 4, pollinia;—*all enlarged.*

30. HABENARIA SECUNDIFLORA Hook. f. Ic. Pl. 2321.

Plant 1 to 2·5 dm. high; *tubers* ellipsoid. *Stem* with a few small sheaths at the base. *Leaves* two or three, distant 5 to 12·5 cm., linear, acuminate, scarcely narrowed to the tubular sheath. *Bracts* below the raceme linear, acuminate. *Raceme* up to 1 dm. in length. *Flowers* secund, rather crowded, 9 mm. long, pink; *floral bract* lanceolate, acuminate, the margins ciliolate, the lower ones much longer than the curved tumid subsessile ovary. *Sepals* sub-equal, lanceolate. *Petals* linear, sub-acute, falcate, minutely papillose, connivent with the three sepals to form a hood over the column. *Lip* as long as the sepals, deflexed, widening towards the 3-lobed apex; lateral lobes triangular, not diverging; midlobe larger, oblong, acute; *spur* shorter than the ovary, rather

broadly conical from a contracted base, its apex blunt. *Column* long. *Anther-cells* parallel, contiguous; *pollinia* oblong-obovoid; caudicles short, stout; glands large, lanceolate, acuminate, united for half their length by their inner edges. *Staminodes* oblong, rugulose. *Infertile stigma* large, erect, 2-lobed, each lobe falcately oblanceolate and covering the base of the anther. *Fertile stigmas* united, transversely oblong, forming a horizontal band below the infertile one. Hook f. Fl. Br. Ind. vi, 165; King & Pantling in Ann. R. Bot. Gard. Calc., viii, 330, t. 433. *Peristylus secundiflorus* Krnzl. Orch. Gen, and Sp. i, 518.

In a forest near Sosa in Eastern Kumaon between 9,000 and 10,000 feet, *Duthie* No. 3421. Flowers in September. It has been collected also in Sikkim, Bhutan and in E. Tibet.

This species bears a striking resemblance to *H. urceolata;* moreover, in both of them, the stigmas are united and the inflorescence is secund. In *H. secundiflora* the sepals and petals are connivent, and together form a hood over the blunt column; the lip is 3-lobed, and the polliniar glands are united. This cohesion of the glands occurs also in *H. plantaginea;* but, as has been pointed out under that species, they ultimately separate.

31. HABENARIA GRIFFITHII Hook. f. Fl. Br. Ind. vi, 197; Ic Pl. 2322.

Tubers small, oblong. *Stem* 1·5 to 3 dm. high, slender, straight or flexuous, few-leaved. *Leaves* 2·5 to 6 cm. long, elliptic or linear-oblong, acute or obtuse, membranous, the lower subpetioled. *Spike* secund, 2·5 to 6 cm long, densely flowered. *Flowers* very small, white, deflexed; *floral bract*, ovate-lanceolate, variable in length. Sepals and petals 3 mm. long, spreading at their tips. *Dorsal sepal* ovate-lanceolate, obtuse, the lateral pair obliquely linear-oblong. *Petals* linear-lanceolate. *Lip* 4 mm. long, oblong, 3-fid. at the apex; side lobes divaricate, obtuse; midlobe longer and broader; *spur* very short, and slightly curved outwards. *Anther* broad, rounded or retuse at the apex, cells diverging at the base; *pollinia* obovate, the caudicles short and very slender, glands minute. *Staminodes* two, filiform, usually longer than the anther, attached to the base and back of each cell. *Rostellum* forked, its branches diverging beneath the anther-cells. *Capsule* 8 mm. long, oval, shortly stalked, the ribs thick. *H. decipiens* Hook. f. Fl. Br. Ind. vi, 165 (not of Wight). *Diphylax Griffithii* Krnzl. Orch. Gen. and Sp. i, 599. *Herminium* Griff. Notul. iii, 270; Ic. Pl. As. t. 285, fig. 1.

Bundai in the Chitral district at 4,000 feet, *Harriss* (Duthie's Nos. 1667, 1668) Jhelam Valley in Kashmir between 5,000 and 6,000 feet, *Duthie* No. 10926; Lahul between 4,000 and 5,000 feet, *T. Thomson;* below Simla at 3,000 feet, *Edgeworth;* Tutwa Gádh in Jaunsar between 3,000 and 4,000 feet, *Gleadow;* Asno in T. Garhwál, *Gamble* No. 25490 (under *Goodyera*); Mussoorie range 6 to 7,000 feet, *King* (under *Zeuxine*), *Mackinnon* (Duthie's Nos. 22733, 24170). Flowers from March to May.

This remarkable species was found originally by Griffith in Afghanistan (Kew Distrib. No. 5326). It was collected many years afterwards by Dr. Aitchison in the Kurram Valley (his number 322). The difficulty in determining its floral structure from herbarium specimens was the cause of this species having been referred at different times to no fewer than eight genera. It tears a strong outward resemblance to *Spiranthes*, under which genus Griffith's specimens were provisionally placed. In Gleadow's specimens, collected in Jaunsar, the staminodes are not longer than the anther, and the branches of the rostellum, instead of spreading laterally, are directed forwards; also they are flat with wide bases and incurved at their apices.

PLATE 145. Habenaria Griffithii *Hook. f.* A plant,—*of natural size*. Fig. 1, side view of flower; 2, lip; 3, front view of column, showing the anther, the two filiform staminodes and the forked rostellum; 4, column, seen from behind; 5, pollinia;—*all enlarged*.

42. Herminium Linn.

Erect terrestrial tuberous-rooted herbs of small size. *Leaves* solitary or few, cauline or radical, sheathing at the base. *Flowers* in spikes, green or green and white. *Sepals* subequal, free, or the dorsal conniving with the petals to form a hood, the lateral pair spreading, sometimes fleshy, always entire. *Lip* adnate to the face of the column, as long as or longer than the sepals, often fleshy, broad or narrow, entire or 3- or 5-fid., the base concave or very shortly saccate, the upper surface sometimes with calli or pits near the base. *Column* very short; *anther-cells* adnate to its face, parallel or slightly divergent below; *pollinia* two, the caudicles usually short or sometimes absent; the glands small and orbicular or elliptic, or large hollow and horn-like. *Staminodes* two, rugulose, attached outside the anther-cells. *Stigmas* 2, distant or conjoined. Species about 14, in the temperate and alpine regions of Europe and Asia.

Lip 3-lobed.
  Petals subconnivent with the dorsal sepal, flowers green.
    Spike short, leaves broadly lanceolate . . . . . 1. *H. Monorchis.*
    Spike long and narrow, leaves linear-lanceolate . . . 2. *H. angustifolium.*
  Sepals and petals spreading.
    Petals and lip white, the lip obscurely saccate . . 3. *H. Mackinnoni.*
    Flowers altogether green, lip distinctly saccate . . 4. *H. congestum.*
Lip entire.
  Leaves two or three . . . . . 5. *H. Duthiei.*
  Leaf solitary.
    Leaf short, oblong-lanceolate, petals green, subrotund 6. *H. pugioniforme.*
    Leaf linear-lanceolate, petals yellow, linear . . . . . 7. *H. gramineum.*

1. HERMINIUM MONORCHIS, R. Br. in Ait. Hort. Kew. ed. 2, v, 191.

Plant 7·5 to 15 cm. high. *Tubers* globose or ellipsoid. *Stem* with one or two sheaths at the base, the upper one often leaflike. *Leaves* two or three, near the base of the stem, 2·5 to 10 cm. long, oblong-lanceolate, acute, shining. *Peduncle* bearing one or two lanceolate acuminate bracts. *Spike* 2·5 to 5 cm. long, densely flowered, cylindrical or sub-secund. *Flowers* decurved, 4 mm. in diam., yellowish-green, musk-scented; *floral bract* lanceolate, acuminate, shorter than or equalling the ovary. *Sepals* 3 mm. long, oblong, obtuse or sub-acute, the lateral pair narrower. *Petals* connivent with the sepals and a little longer, obliquely oblong-ligulate, tips fleshy. *Lip* as long as the petals, 3-fid., concave at the base, lobes narrow, obtuse, the middle one the longest. *Anther-cells* diverging above; *pollinia* globose, caudicles very short and slender, glands concave. Staminodes sub-globose, rugulose. *Rostellum* prominent at the base of the anther-cells. *Capsule* 7 mm. long, turgid, twisted, its beak curved downwards. Lindl. Gen. and Sp. Orch. 305; Reichb. Fl. Germ. xiii, t. 415; Boiss. Fl. Or. v, 82; Hook. f.

Fl. Br. Ind. vi, 128; Krnzl. Orch. Gen. and Sp. i, 531; Rolfe in Journ. Linn. Soc. xxxvi (1903), 51. *Ophrys Monorchis* Linn. Sp. Pl. 947.

Throughout the Western Himalaya at elevations between 9,000 and 14,000 feet. Hazara, *Duthie's collector* Nos. 21316, 23170; Baltistan, *T. Thomson*, *Duthie* No. 12010; Kashmir, *C. B. Clarke* Nos. 30737, 31509; Lahul, *Jaeschke*; Pangi, *Duthie's collector* No. 23391; Hattu near Simla, *T. Thomson;* Gangotri Valely, *Duthie* No. 516; Kumaon *Strachey & Winterbottom* No. 34, *Duthie* Nos. 3415, 6009, *Duthie's collector* No. 24106 Flowers during July and August. It is found also in Sikkim and in China, and is widely diffused in N. Asia and Europe.

PLATE 146. Herminium Monorchis *R. Br.* A plant,—*of natural size.* Fig. 1, side view of flower; 2, ditto, with the sepals removed; 3, column, with lip attached; 4, pollinia;—*all enlarged.*

2. HERMINIUM ANGUSTIFOLIUM Benth. ex Hook. f. Fl. Br. Ind. vi, 129.

Tubers small, oblong or ellipsoid. *Stem* tall, 2·5 to 7·5 dm., clothed at the base with acute tubular sheaths. *Leaves* usually three, up to 2·5 dm. long, linear, acuminate, with long sheaths. *Spike* 6 to 25 cm. long, narrow, cylindric, many-flowered. *Flowers* crowded, very small, green; *floral bract* linear-lanceolate, acuminate, shorter than or equalling the ovary. *Sepals* sub-equal, oblong, obtuse, the dorsal one connivent with the petals to form a hood; lateral pair spreading. *Petals* linear, as long as the sepals. *Lip* much longer than the sepals, deflexed from the base, auricled on its lower half and with a small concavity at the base, apical portion 3-fid; midlobe much shorter than the slender curved filiform side lobes. *Anther-cells* parallel, contiguous; *pollinia* pyriform, with truncate bases, caudicles very short and slender; glands minute, discoid. *Staminodes* large. *Stigmas* two, transversely oblong, lying close together below the anther-cells. King & Pantling in Ann. R. Bot. Gard. Calc. viii, 332, t. 434; Collett Fl. Siml. 499, t. 163; Krnzl. Orch. Gen. and Sp. i, 533; Rolfe in Journ. Linn. Soc. xxxvi (1903), 50. *Aceras angustifolia* Lindl. in Wall. Cat. 7061; Gen. and Sp. Orch. 282; Bot. Reg. under t. 1525; in Journ. Linn. Soc. iii, 43; Royle Ill. Bot. Him. t. 87; Wight Ic. 1691. *H. longicruris*, Wright in Mem. Amer. Acad. Ser. 2, vi, 141. *Thisbe* Falc. in Lindl. Veg. Kingd. 183c (name only).

Abundant throughout the Western Himalaya from Kashmir to Kumaon at elevations between 4,000 and 10,000 feet, flowering during July and August. It extends eastwards to Nepal, Sikkim, Bhutan, the Khasia and Naga Hills, also in Tenasserim, China, Japan, Java and Timor.

3. ♀ HERMINIUM MACKINNONI Duthie in Journ. As. Soc. Beng. lxxi (1902), part 2, 44.

Whole plant up to 2·5 dm. *Tubers* narrowly oblong. Lower portion of the stem clothed with a few close-fitting tubular subacute sheaths. *Leaves* two, 12 to 14 cm. long and 1 to 2 cm. in breadth, oblong or linear-lanceolate, acute or acuminate, with loosely amplexicaul tubular bases, 3-5 veined. *Spike* cylindric, about 11 cm. long, many-flowered.

Flowers spreading, crowded, about 10 mm. across, *floral bract* 5 mm. long, broadly lanceolate, acuminate, a little shorter than the ovary. *Sepals* sub-erect, ovate-oblong, acute, green. *Petals* and lip white, slightly tinged with green. *Petals* as long as the sepals, linear-lanceolate, divergent. *Lip* longer than the petals, trifid, deflexed from near its base, the margins reflexed; lower portion very thick and with a small concavity at the base; midlobe lanceolate, obtuse, nearly as long as the curved filiform side lobes. *Anther-cells* parallel, *pollinia* obovate-ellipsoid, caudicles very short glands discoid, reddish-brown, seated on the diverging arms of the branched rostellum. *Staminodes* large, spreading. *Stigmas* 2, lying beneath the rostellum, obovate, obliquely converging downwards and towards the concavity of the lip. *Ovary* about 6 mm. long ovate-oblong, beaked. *H. laxiflorum* Lindl. in Herb.

Near Mussoorie at an elevation of about 6,500 feet, found growing on oak trees, but very rare, *Mackinnon* (Duthie's Nos. 22993, 25421). Flowers in August. Discovered previously by Sir Joseph Hooker at Senchal in Sikkim at an elevation of 7,000 feet (No. 279).

A very distinct species, its nearest Indian ally being *H. angustifolium*, which it rather closely resembles when dried; in fact, it was amongst the specimens of the latter at Kew that a single specimen of Hooker's Senchal plant was detected. In Lindley's Orchid herbarium are two other specimens from the same gathering. In the Kew collection of drawings there is a coloured one of this Senchal plant received from the Calcutta gardens in 1876. It agrees in all essential particulars with the plate here given of *H. Mackinnoni*. It is smaller and altogether a more delicate plant than *H. angustifolium*, with fewer shorter and broader leaves; the flowering spike also is shorter and broader, the petals and lip are white, and the midlobe is much longer. The shape of the ovary is also very different.

PLATE 149. Herminium Mackinnoni *Duthie*. A plant,—*of natural size*. Fig. 1, front view of flower, with the sepals removed; 2, side view of flower; 3, front view of column, with lower portion of lip attached; 4, ditto, seen more from below; 5, pollinia; —*all enlarged*.

4. HERMINIUM CONGESTUM Lindl. in Wall. Cat. No. 7068.

Plant 1 to 2 dm. high. *Tuber* sub-globose, hairy. Lower portion of stem clothed with one or two short wide sheaths. *Leaves* two or three, near the base of the stem, 3·7 to 10 cm. long, narrowly oblong-elliptic or oblanceolate, sub-acute or obtuse. Peduncle stout, naked, or with a single linear or leaf-like bract. *Spike* rather narrow, 5 to 10 cm. long, many- and densely-flowered. *Flowers* green, minute, decurved; *floral bract* ovate, acute, much shorter than the beaked ovary. *Sepals* sub-equal, obtuse, the dorsal broadly ovate; lateral pair narrower, slightly spreading, oblong and acute. *Petals* a little longer than the sepals, obliquely lanceolate, acute. *Lip* longer than the sepals, fleshy, triangularly ovate-lanceolate, obtuse; side lobes very narrow, crenulate, apical lobe entire; upper surface with two small calli at the base; *spur* saccate. sub-globose. *Anther-cells* diverging towards the base; *pollinia* sub-globose, caudicles very short, attached obliquely to the horn-like glands. *Staminodes* elongate, tapering at the ends. *Stigmas* two, placed behind the caudicles of the pollinia and above the entrance to the spur. Lindl. Gen. and Sp. Orch. 305; in Journ. Linn. Soc. iii, 43; Hook. f. Fl. Br. Ind. vi. 130; King & Pantling in Ann. R. Bot. Gard. Calc.

viii, 335, t. 440; Krnzl. Orch. Gen. and Sp. i, 930. *H. unalaschcense* Reichb. f. Ic. Fl. Germ. xiii, 107, t. 417. *H. Schischmareffiana* Chamiss. in Linnæa iii, 29. *Platanthera Schischmareffiana* Lindl. Gen. and Sp. Orch. 286. *Neottia macrophylla* Don. Prod. 27. *Spiranthes macrophylla* and *unalaschcensis* Spreng. Syst. iii. 708.

Tishung Pass in the Astor District of Baltistan, *J. E. Winterbottom* No. 742, Rálam Valley in Kumaon between 8,000 and 9,000 feet, *Duthie's collector* No. 24103. Flowers during July and August. It extends eastwards to Nepal and Sikkim, and is found also in the Aleutian Islands.

5. Herminium Duthiei Hook. f. Ic. Pl. 2199A; Fl. Br. Ind. vi, 130.

Whole plant 1 to 2·5 dm. *Tubers* ellipsoid. Lower portion of stem bearing a single very loose sheath. *Leaves* two or three, from below the middle of the stem, 5 to 12·5 cm. long, linear or oblanceolate, acuminate. *Scape* overtopping the leaves, rather stout curved, naked. *Spike* 5 to 10 cm., sub-secund, many-flowered. *Flowers* deflexed, pale green, 4 mm. in diam.; *floral bract* much shorter than the curved and beaked ovary *Sepals* obtuse, dorsal broadly oblong, the lateral pair smaller sub-falcate. *Petals* ovate to ovate-lanceolate, acute or acuminate, fleshy. *Lip* as long as the sepals, triangular or orbicular-ovate, entire, obtuse or sub-acute, with a small globose saccate spur at the base. Upper surface with two small elliptic calli near the base. *Anther* oblong, the cells parallel; *pollinia* sub-globose, caudicles short, slender, inserted within the conical truncate horn-like glands. *Staminodes* large, spreading. *Stigmatic processes* large, clavate; *rostellum* erect, subulate. Krnzl. Orch. Gen. and Sp. i, 535.

Western Himalaya 8,000 to 12,000 feet, *T. Thomson;* Laka, *Edgeworth;* Garhwál, *King;* Badrinath, Herb. Saharanpur; Kuari Pass in British Garhwál 11,000 to 12,000 feet, *Duthie* No. 4424; Rálam Valley in Kumaon 8,000 to 9,000 feet, *Duthie* No. 3413; Káli Valley above Budhi 10,000 to 11,000 feet, *Duthie* No. 6001, 24104; Gori Valley, *Duthie's collector* No. 24105. Flowers during August and September.

Plate 147. Herminium Duthiei *Hook. f.* A plant,—*of natural size.* Fig. 1, side view of flower; 2, ditto, with the sepals removed; 3, column, with lip attached; 4, flowers, seen from above and with the sepals removed; 5, pollinia;—*all enlarged.*

6. Herminium pugioniforme Lindl. MSS. ex. Hook. f. Fl. Br. Ind. vi, 130.

Height of whole plant 5 to 17·5 cm. *Tuber* small, globose. *Stem* with one or two loose sheaths at the base. *Leaf* solitary, sub-radical, shorter than the scape, 2 to 6 cm. long, oblong to linear-lanceolate, rounded or sub-acute at the apex. *Scape* naked, firm and rather stout towards the base. *Spike* 1 to 5 cm. long, laxly flowered. *Flowers* minute, few, sub-erect, green; *floral bract* sub-orbicular, much shorter than the ovary. *Dorsal sepal* orbicular, forming with the petals a hood over the column; lateral pair very broad, obtuse. *Petals* smaller, concave, the edges crenulate. *Lip* as long as the lateral sepals, fleshy, base dilated and with two deep oval pits, anterior portion dagger-shaped. *Anther-cells* divergent towards their bases, the tubes spreading, *pollinia* obliquely elliptic, caudicles obscure, glands elliptic. *Staminodes* oblong, obtuse. *Stigmas* united. King & Pantling in Ann. R. Bot. Gard. Calc. viii, 333, t. 437; Krnzl. Orch. Gen. and Sp. i, 534.

Above Gulmarg in Kashmir at about 12,000 feet, *Aitchison*; Garhwál, on the northern slopes of Srikánta in the Bághiráthi Valley at elevations between 14,000 and 15,000 feet, *Duthie* No. 517. Flowers in August. Found also in Sikkim.

7. HERMINIUM GRAMINEUM Lindl. in Wall. Cat. 7413.

Height of plant 5 to 20 cm. *Tubers* unequal, oblong or sub-globose. *Stem* with a single loose sheath at its base. *Leaf* solitary, linear or narrowly oblanceolate, acute, very variable in length, but shorter than the inflorescence. *Scape* naked, slender but firm. *Spike* 3 to 9 cm. long, laxly many-flowered; the rachis striated and somewhat hispid. *Flowers* minute, secund, yellowish-green; *floral bract* about 5 mm. long, equalling or shorter than the curved beaked ovary, subulate from a broad clasping base, entire or occasionally more or less trifid. *Dorsal sepal* oblong or broadly ovate; the lateral pair ovate, obtuse, spreading. *Petals* erect, as long as the sepals, sub-falcately linear, obtuse, thick, yellow. *Lip* entire, shorter than the petals, ovate-acuminate, slightly saccate at the base; basal portion pale yellow, curved forwards, concave, the margins ciliate; terminal portion bright yellow, tilted upwards and with reflexed edges. *Anther-cells* parallel; *pollinia* sub-globose, white tinged with lilac, caudicles very short; glands large, shining, green or tinged with brown. *Staminodes* large, rugulose. *Stigmatic processes* short. *Rostellum* large, recurved, retuse, fleshy. Lindl. Gen. and Sp. Orch. 305; Royle Ill. t. 87, fig. 3; Hook. f. Fl. Br. Ind. vi, 131; Krnzl. Orch. Gen. and Sp. i, 535. *Neottia monophylla* Don. Prod. 27. *Spiranthes monophylla* Spreng. Syst. Veg. iii, 709.

N. W. India, *Royle*; Garhwál, *Falconer*; Mussoorie range, very common on limestone rocks at elevations between 5,000 and 7,000 feet, *Edgeworth*, *Mackinnon*, *Duthie* Nos. 17828, 21770, 22713; Kumaon at about 8,500 feet, *Strachey & Winterbottom* No. 31; Sarju and Káli Valleys in Kumaon, *Duthie's collector* No. 24107. Flowers during July and August. It extends into Nepal.

This species is not included in Collett's Flora of Simla, where it no doubt occurs. Owing probably to its small size and inconspicuous colouring, it has as yet escaped notice.

PLATE 148. Herminium gramineum *Lindl.* A plant,—*of natural size.* Fig. 1, side view of flower; 2, ditto, with the sepals and petals removed; 3, a trifid bract; 4, column showing the anther-cells, staminodes, stigmatic processes and the prominent rostellum; 5, pollinia;—*all enlarged.*

43. Hemipilia Lindl.

Terrestrial 1-leaved tuberous-rooted herbs. *Leaf* radical, broad. *Flowers* laxly racemose. *Sepals* equal in length, lateral spreading. *Petals* broadly ovate, entire. *Lip* continuous with the column, broad, obscurely 3-lobed, spreading; spur trumpet-shaped. *Column* very short; *rostellum* broad, projecting from between the anther cells, complicate; stigmatic processes none; *anther-cells* diverging, tips produced into grooves of the rostellum; *pollinia* 2, caudicles long; glands distant, exposed.—Species 6—one Himalayan, one in Burma, and four in China.

HEMIPILIA CORDIFOLIA Lindl. Gen. & Sp. Orch. 296.

Plant 1·5 to 2 dm. high, glabrous. *Tubers* ovoid or subglobose. *Leaf* fleshy, amplexicaul, 5 to 10 cm. long, ovate-cordate obtuse or acute, many-nerved. *Raceme*

lax-flowered, 5 to 6 cm. long; the peduncle bearing one to three lanceolate, acuminate bracts. *Flowers* about 1·5 cm. in diam., purple; *floral bracts* lanceolate, acuminate, shorter than the slender curved beaked ovaries. *Dorsal sepal* erect, 13 mm. long, ovate-lanceolate, with a blunt inflexed tip; lateral pair spreading, equalling the dorsal in length, falcately oblong. *Petals* a little shorter than the sepals, obliquely ovate, sub-acute, erect and forming a hood with the dorsal sepal. *Lip* continuous with the column, 3-lobed, the lateral lobes rounded and reflexed; mid-lobe broad, subcrenate bluntly acuminate, pubescent; *spur* trumpet-shaped, deflexed, shorter than the ovary, often lobed at the apex. *Anther-cells* nearly parallel, distant. *Pollinia* obliquely clavate; caudicles dilated above, curved; glands minute, discoid, bifid. *Capsule* 2·5 cm. long. Royle Ill. Him. Bot. 367; Hook. f. Fl. Br. Ind. vi, 167; Krnzl. Orch. Gen. and Sp. i, 650; Collett Fl. Siml. 506, fig. 167. *Platanthera cordifolia* Lindl. in Wall. Cat. 7049.

Simla at 6,000 feet, *Gamble* Nos. 4650, 6441; Mussoorie range, *Falconer*, *Edgeworth*, *Mackinnon*, *Duthie* No. 21768; Kumaon at 7,000 feet, *Strachey & Winterbottom* No. 37; below Naini Tal 5,000 to 6,000 feet, *Colonel Davidson*, *Duthie* No. 4425. Flowers during August and September. It extends eastwards to Nepal.

PLATE 150. Hemipilia cordifolia *Lindl.* A plant,—*of natural size.* Fig. 1, side view of flower; 2, front view of ditto, deprived of the sepals and petals and with the lip spread out; 3, front view of column; 4, pollinia;—*all enlarged.*

44. Satyrium Swartz.

Terrestrial erect leafy herbs with undivided oblong tubers. *Leaves* (in the Indian species) large, fleshy, with wide sheaths. *Flowers* in dense spikes. *Sepals* and *petals* subsimilar, free, spreading or reflexed. *Lip* superior (the ovary not being twisted), adnate to the base of the column, erect, broad, hood-shaped, 2-spurred or 2-saccate. *Column* much arched, terete. *Stigma* single, convex or concave, borne on the upper lobe of the column. *Anther-cells* dorsal or lateral, tumid, sub-parallel, their tubes at a lower level than the stigma, pointing forward; *pollinia* 2, caudicles curved, ending in two large sometimes connate glands.—Species about 100, mostly in extra-tropical S. Africa.

SATYRIUM NEPALENSE, Don. Prod. Fl. Nep. 26.

Whole plant 5 to 7·5 dm. high; *tuber* oval, producing stolons each with a small tuber at its end. *Stem* glabrous, bearing several broad imbricating sheaths at the base. *Leaves* two or three, fleshy, 1 to 2·5 dm. long and 3·5 to 9 cm. broad, narrowly elliptic, subacute, their bases broad and sheathing. *Peduncle*, clothed with many sub-tubular lanceolate-oblong acute or acuminate bracts. *Spike* 5 to 17 cm. long, densely flowered. *Flowers* 8 mm. across at the mouth, pink or white, sweet-scented; *floral bract* oblong-lanceolate, acuminate, deflexed, much longer than the turgid ovary. *Sepals* linear-oblong, obtuse, recurved, ciliolate. *Petals* narrower than the sepals, obtuse, entire. *Lip* superior, hooded, broadly oblong, keeled on the back; *spurs* usually twice as long as the ovary. *Column* curved, expanded at the apex. *Stigma* projecting forwards above the anther, convex, anticous. *Anther-cells* turgid, distant and subparallel on the sides of the column below the stigma; *pollinia* 2, pyriform, bipartite; *caudicles* slender, curved, directed downwards and forwards, each ending in a thick discoid gland. *Staminodes* rugulose, placed above the anther-cells; *rostellum* broadly and bluntly

triangular. Lindl. Gen. and Sp. Orch. 340; in Journ. Linn. Soc. iii, 44; Wight Ic. 929; Bot. Mag. 6625; Wall. Cat. 7025; Hook. f. Fl. Br. Ind. vi, 168; King & Pantling in Ann. R. Bot. Gard. Calc. viii, 338, t. 444; Krantzlin Orch. Gen. and Sp. i, 714; Collett Fl. Siml. 507 fig. 168; Rolfe in Journ. Linn. Soc. xxxvi (1903), 63. *S. Perrottetianum* A. Rich. in Ann. Sc. Nat., Ser. 2, xv, 76, t. 53; Wight Ic. 1716. *S. albiflorum* A. Rich. l.c.; Wight Ic. 1717. *S. pallidum* A. Rich. l.c.

Abundant throughout the Western Himalaya on open hillsides at elevations between 4,000 and 10,000 feet. Flowers during September and October. It extends eastwards to Nepal, Sikkim, Bhutan and the Khasia Hills; and is found also in the hilly parts of S. India and in Upper Burma to Tibet and China. A form with larger and much thicker leaves and bracts is occasionally met with.

TRIBE VII.—CYPRIPEDIEÆ.

Perfect anthers two, one on each side of the conjoined stigmas. Staminode single, large, fleshy; lip large, saccate.

45. Cypripedium Linn.

Terrestrial herbs, stemless or with a leafy annual stem. *Leaves* coriaceous, evergreen, smooth and often coloured; or membranous, deciduous and plicate. *Flowers* large, usually solitary (rarely in pairs), borne on a scape or at the apex of a leafy stem. *Sepals* spreading, valvate or imbricate in aestivation; the dorsal large, erect; the lateral pair smaller, narrower and usually connate under and behind the lip. *Petals* free, varying in shape, often very long. *Lip* sessile with small narrow auricle-like, often inflexed side lobes and a large inflated saccate mid-lobe. *Column* short, terete *Anthers* 2, subglobose, the cells parallel, contiguous; *pollen* viscid or glutinous. *Stigma* forming a convex often rugulose disk, deflexed and hidden by the large disciform, fleshy staminode. *Ovary* 1-celled.—Species about 80, in temperate and tropical Asia and America, also in Europe.

Sepals and petals green or pale yellow, lip white . .	1. *C. cordigerum.*
Flowers smaller, sepals and petals streaked with red, lip purplish	2. *C. himalaicum.*

1. Cypripedium cordigerum Don Prod. Fl. Nep. 37.

Stem 2·5 to 6 dm. in height, stout or slender, puberulous. *Leaves* several, approximate or scattered, 7·5 to 15 cm. long and 5 to 10 cm. wide, from nearly orbicular to lanceolate; acute or acuminate, membranous, plaited. *Flowers* solitary; *bract* leaflike, 2·5 to 10 cm. long. Sepals and petals spreading, longer than the lip, green varying to pale yellow or white. *Dorsal sepal* ovate-acuminate; lateral pair slightly longer, connate, entire or split at the apex. *Petals* equalling the dorsal sepal in length, narrowly lanceolate, acuminate. *Lip* oblong, white often with a few purple spots outside and near the base. *Column* yellow. *Staminode* 10 mm. long, ovate or oblong-cordate, yellow with reddish-brown blotches near the apex. *Ovary* fusiform, glandular-pubescent. *Capsule* erect, clavate, about 3·8 cm. long. Lindl. Gen. and Sp. Orch. 527; Dcne in Jacquem. Voy. Bot. 165, t. 166; Fl. Br. Ind. vi, 170; Krnzl. Orch. Gen. and Sp. i. 17; Collett Fl. Siml. 508.

Widely distributed throughout the Western Himalaya from Hazara to W. Nepal at elevations between 8,000 and 12,000 feet, usually found in openings or on the outskirts of forests. It flowers during the month of June.

Plate 151. Cypripedium cordigerum *Don.* Upper portion of plant,—*of natural size.* Fig. 1, side view of flower, with the sepals and petals removed; 2, the connate lateral sepals; 3, staminode; 4, side view of column;—*all enlarged.*

2. Cypripedium himalaicum Rolfe in Journ. Linn. Soc. xxix (1892), 319.

Height of plant 2 to 4 dm. *Stem* clothed at the base with three or four loose tubular acute sheaths. *Leaves* usually three, up to 8·5 cm. long, ovate-elliptic or oblong, acute, slightly narrowed to the sheathing base, puberulous; the lower and upper ones smaller and narrower. *Peduncle* pubescent, bearing a solitary flower. *Flower* reddish- or purplish-red, 6·2 cm. in vertical diam.; *floral bract* longer than the flower, narrowly elliptic, acute or acuminate, slightly concave, many-nerved. *Dorsal sepal* broadly ovate, acute, somewhat concave; lateral pair narrower and slightly longer, connate under the lip. *Petals* spreading, longer than the dorsal sepal, narrowly oblong, subacute. *Lip* subglobose, many-nerved, pendent, its mouth wide and crenate. *Staminode* broadly ovate, obtuse, slightly cordate at the base. Franch. in Journ. de Bot. viii (1894), 249; Bot. Mag. t. 2938; King & Pantling in Ann. R. Bot. Gard. Calc. viii, 342, t. 448; Rolfe in Journ. Linn. Soc. xxxvi (1903), 65; *C. macranthon* Hook. f. Fl. Br. Ind. vi, 170 (in part and not of Swartz). *C. macranthos* Sw., var. *himalaicum* Krnzl. Orch. Gen. and Sp. I. 26.

On the Chor mountain near Simla, ? *Royle* (Herb. Saharanpur). Above Jhála in the Bághirathi Valley between 12,000 and 13,000 feet, *Duthie* No. 192; Byáns district of N. Kumaon in birch forests between 11,000 and 12,000 feet, *Duthie* No. 5994. Flowers during July and August. Found also in Sikkim and Bhutan and beyond the British frontier in E. Tibet and China.

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„ *emarginata*, Lindl. 169
„ *integerima*, Lindl. 169
„ *membrancea*, Lindl. 169
„ *procumbens*, Blume 169
„ *robusta*, Wight 169
„ sulcata, *Lindl.* 168
„ *Tripleura*, Lindl. 169

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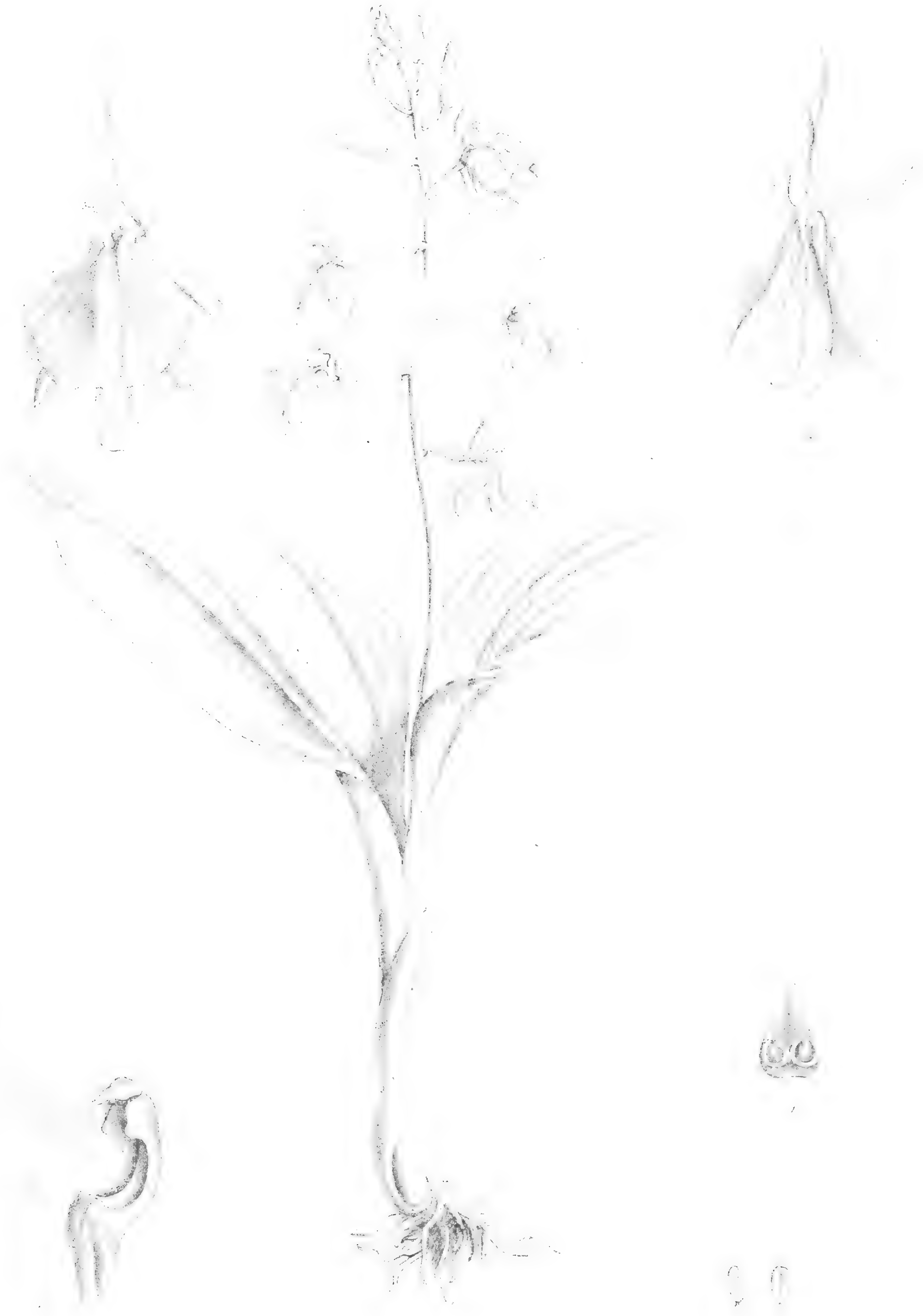

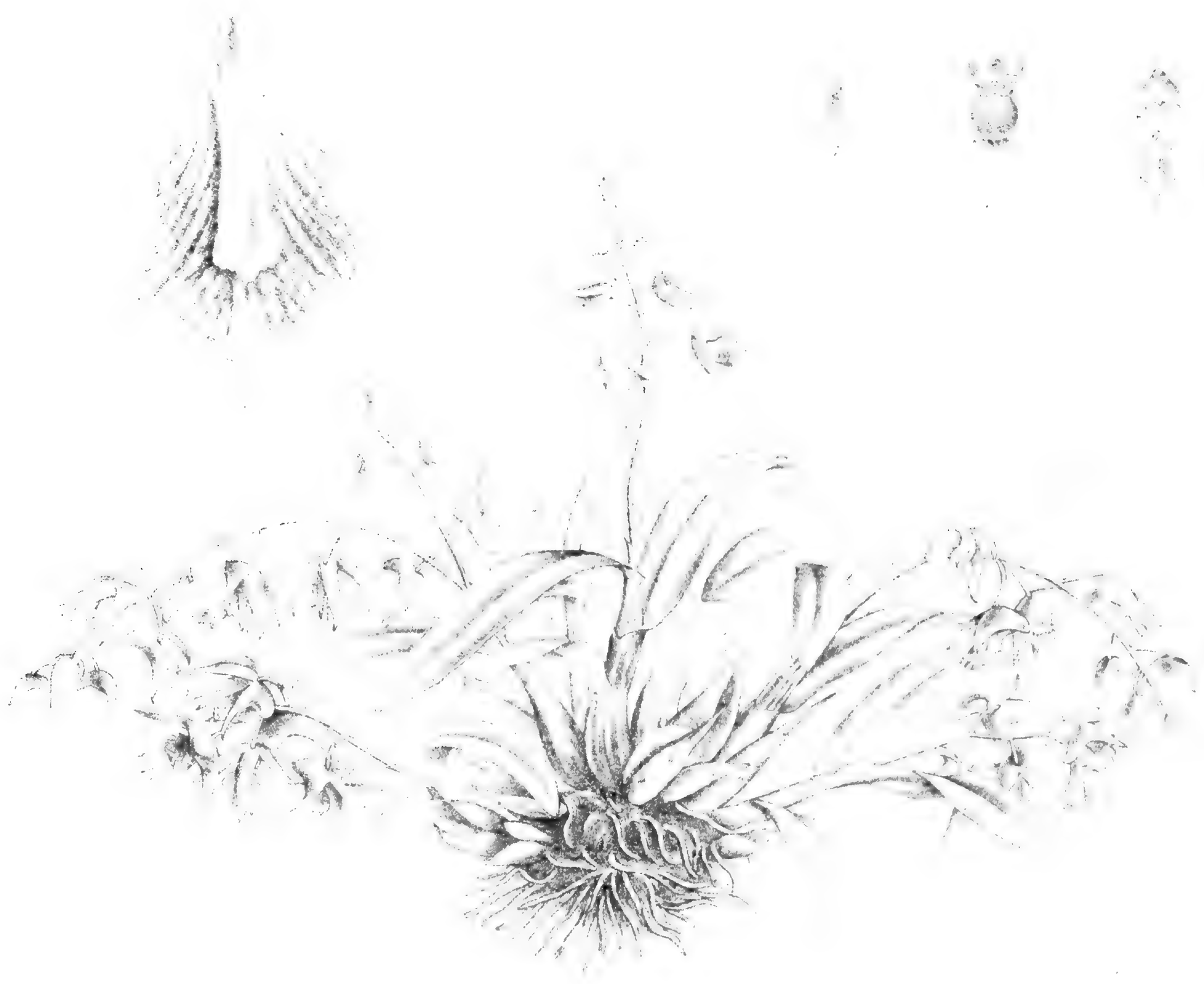

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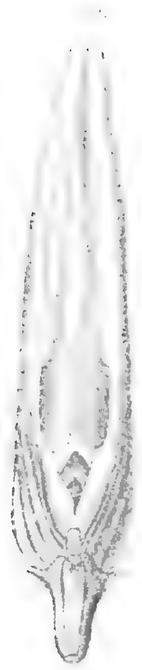

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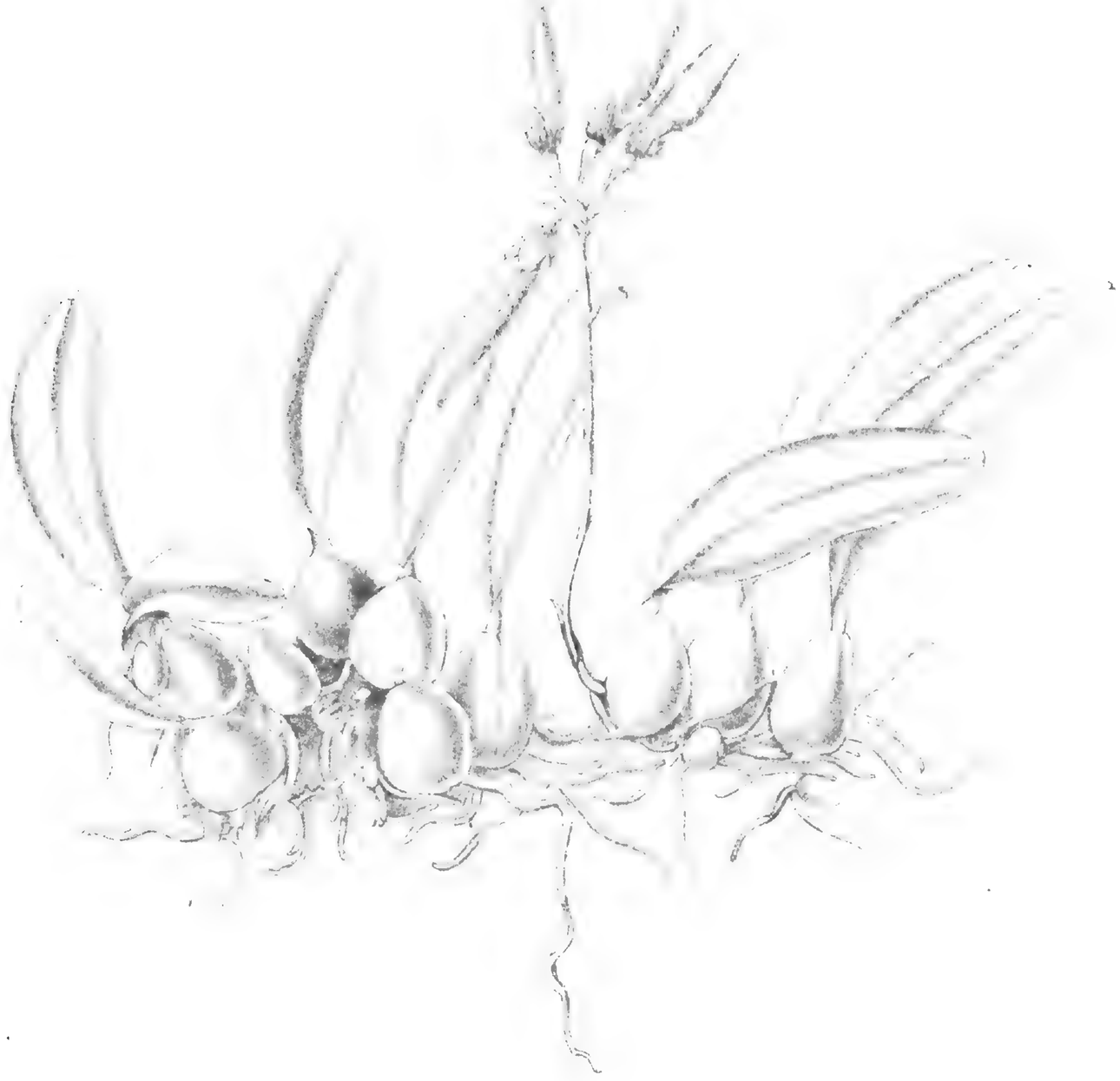

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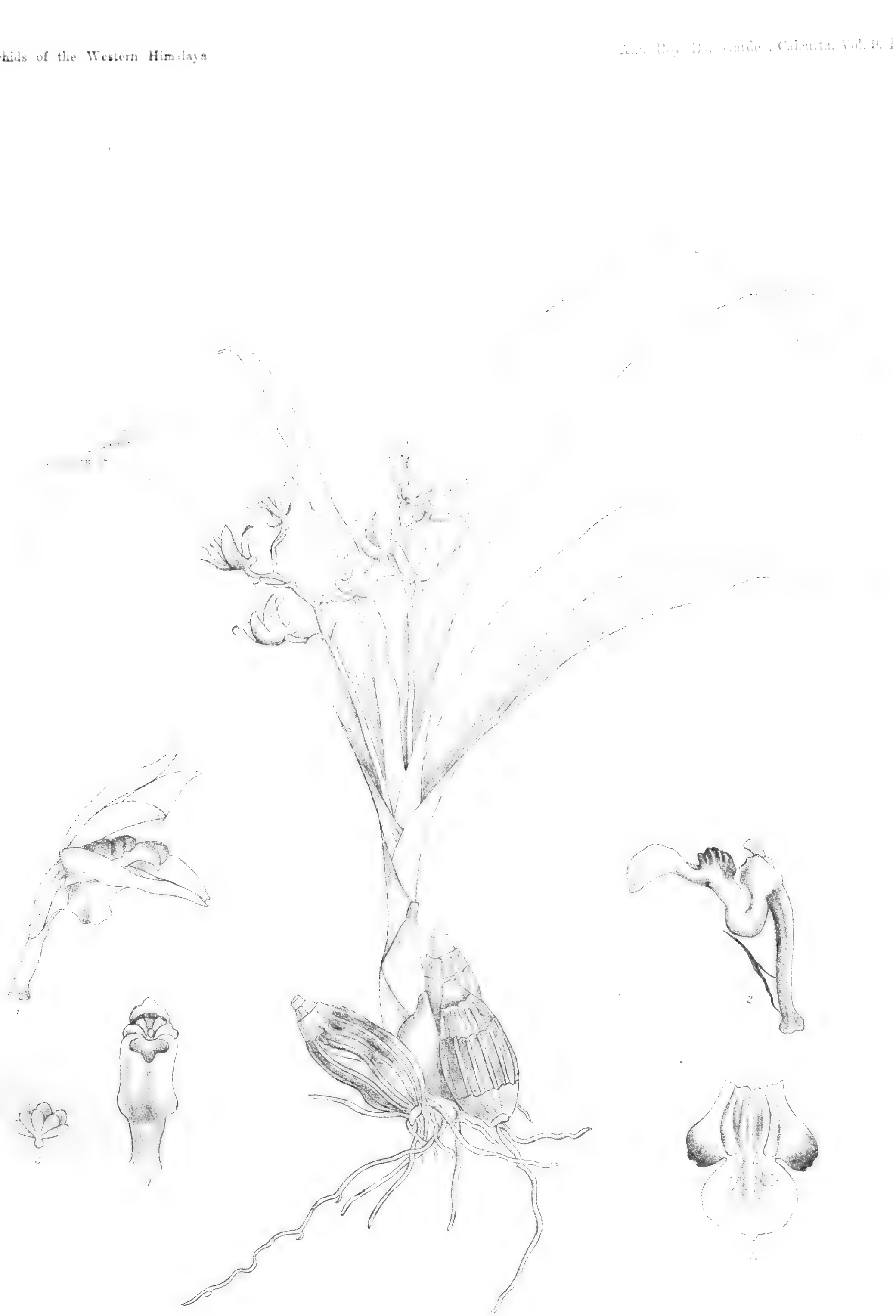

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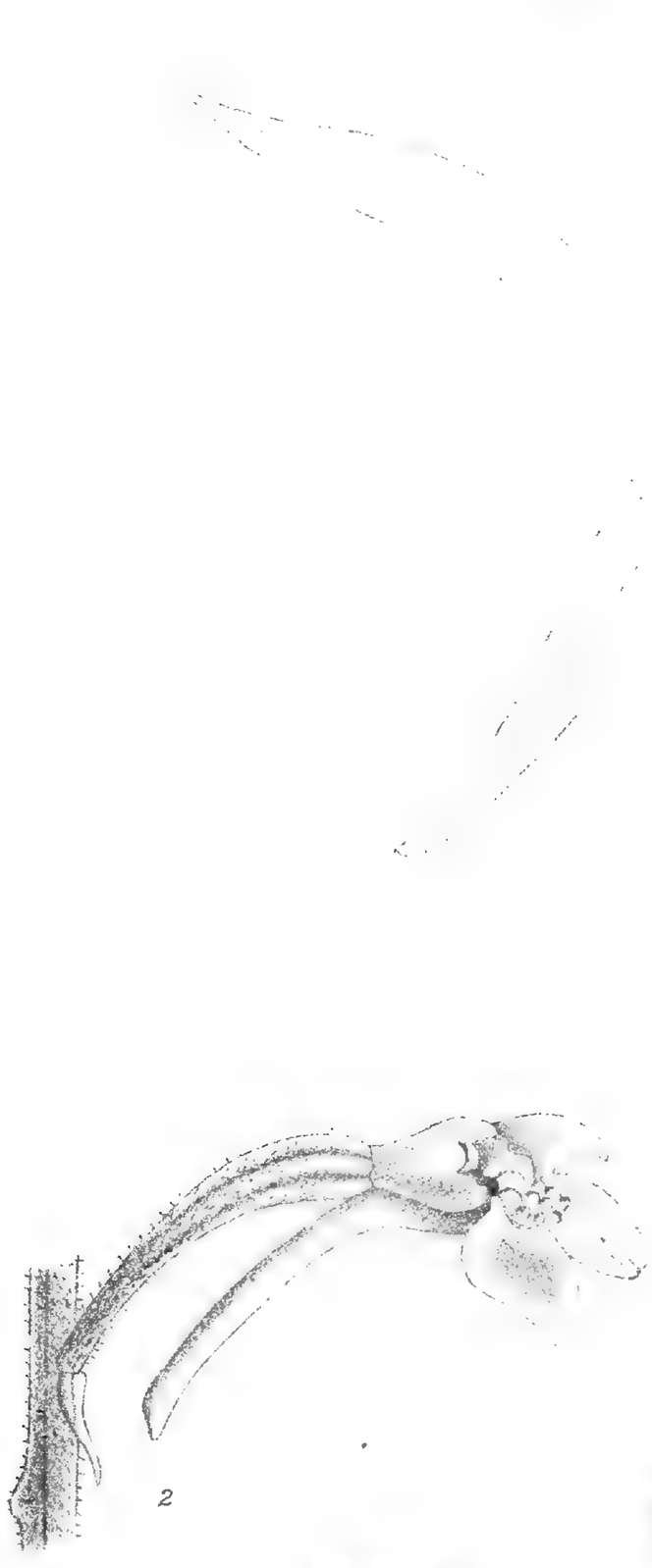

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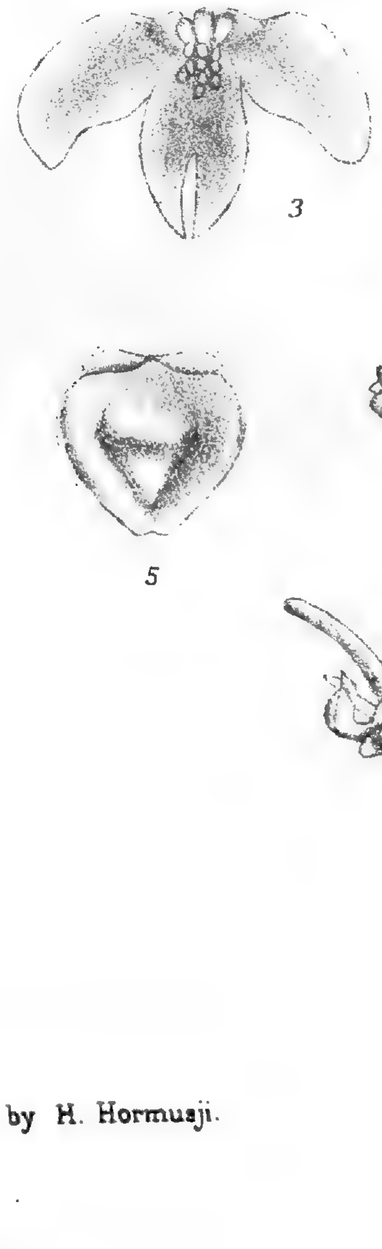

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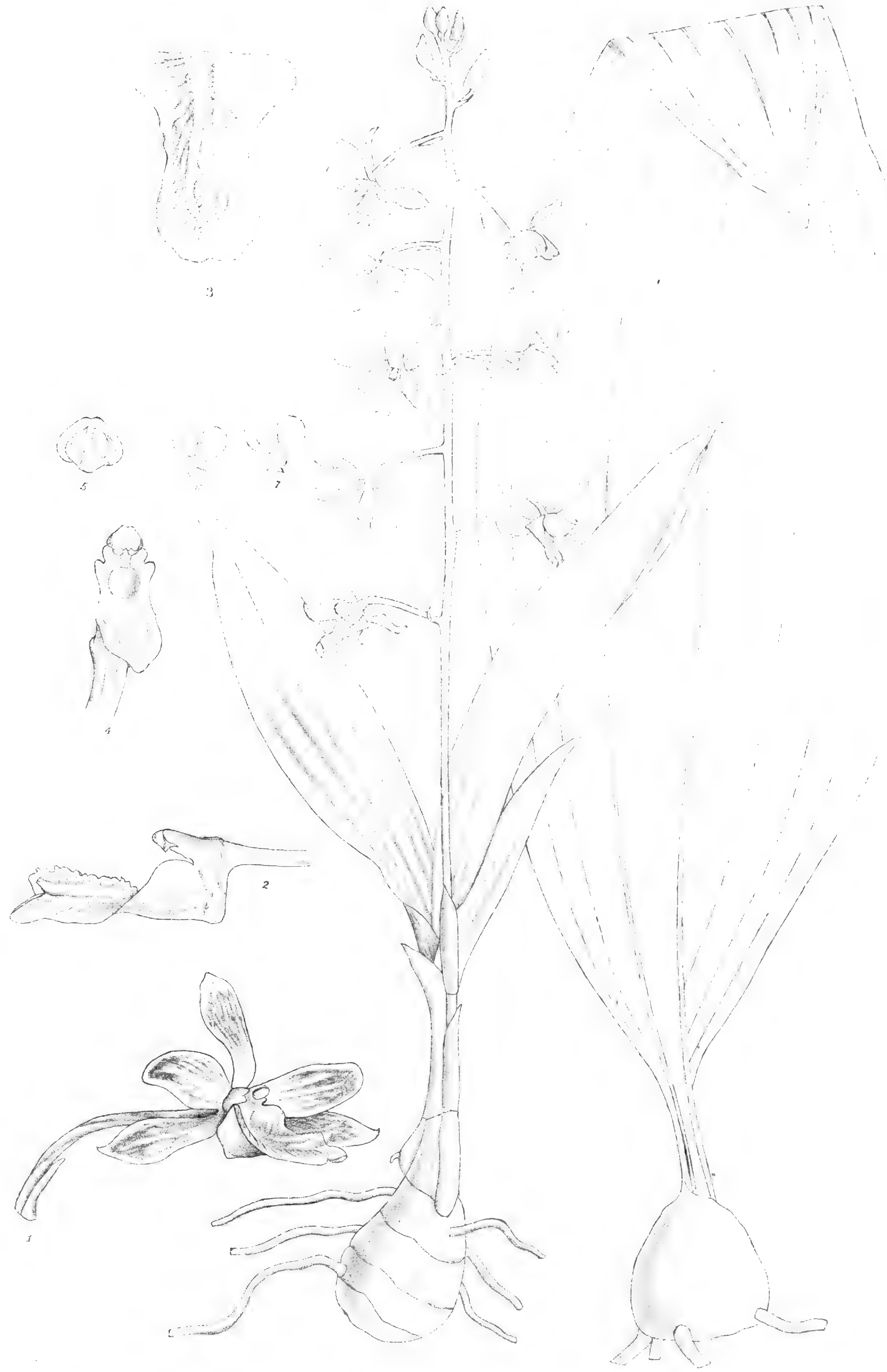

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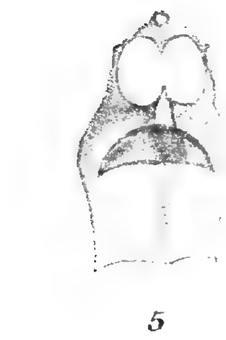

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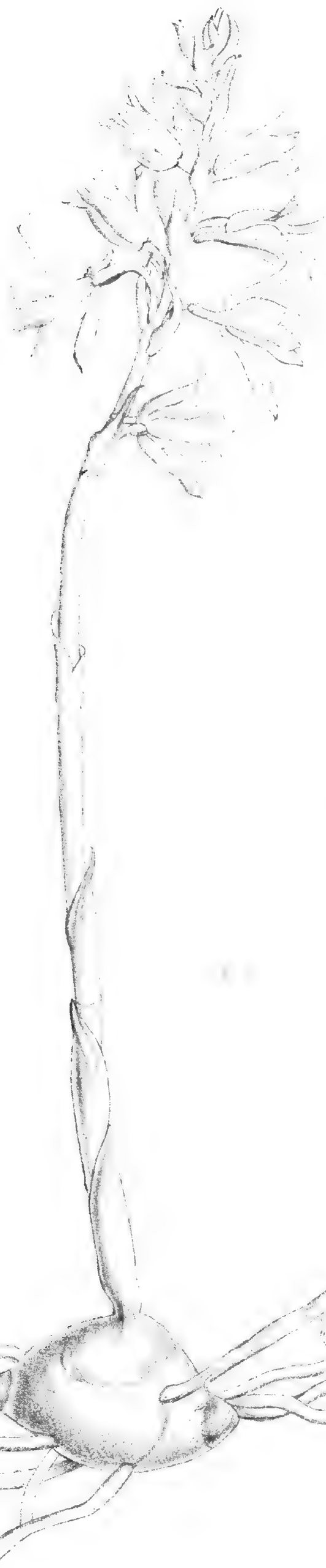

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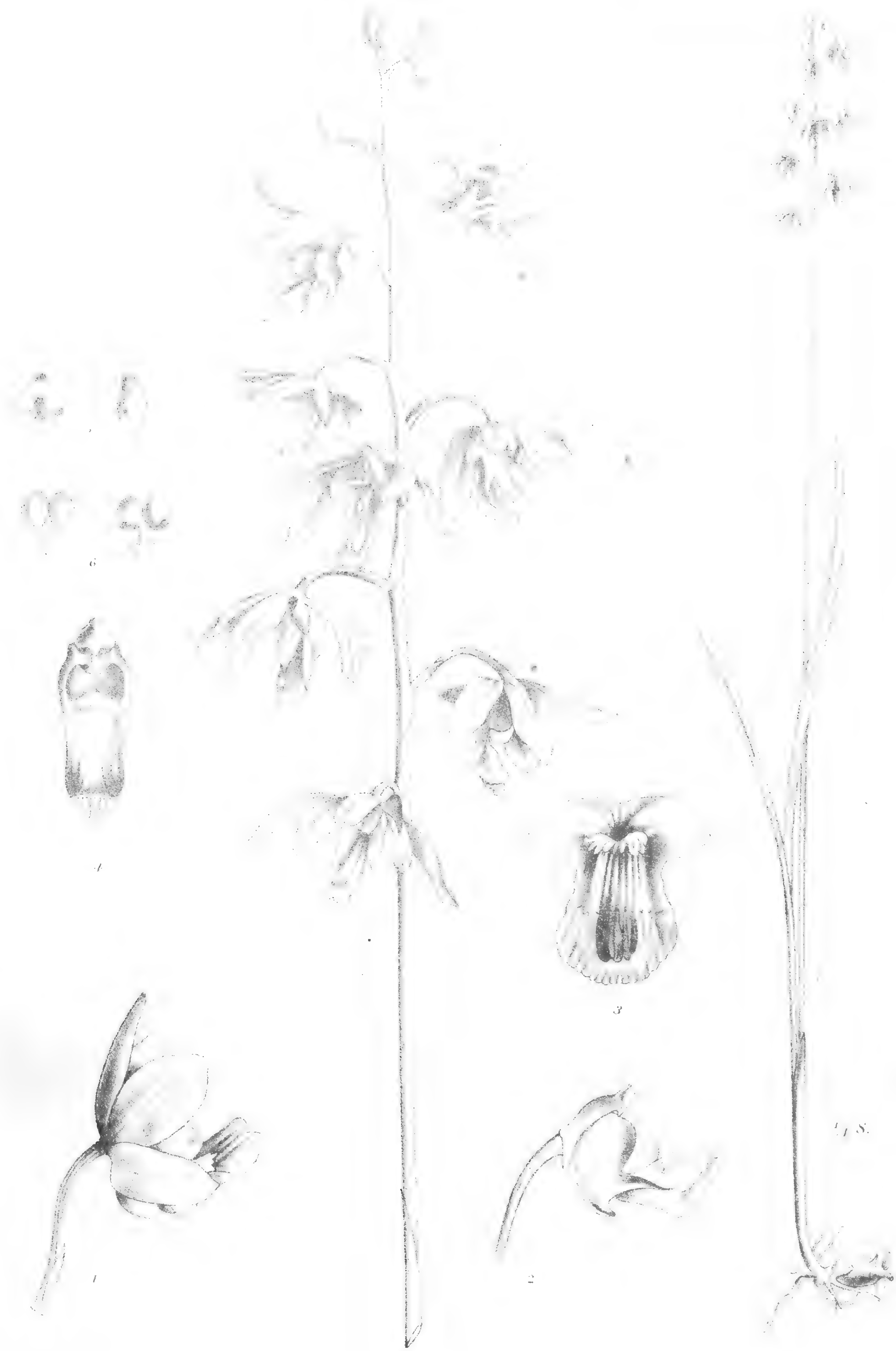

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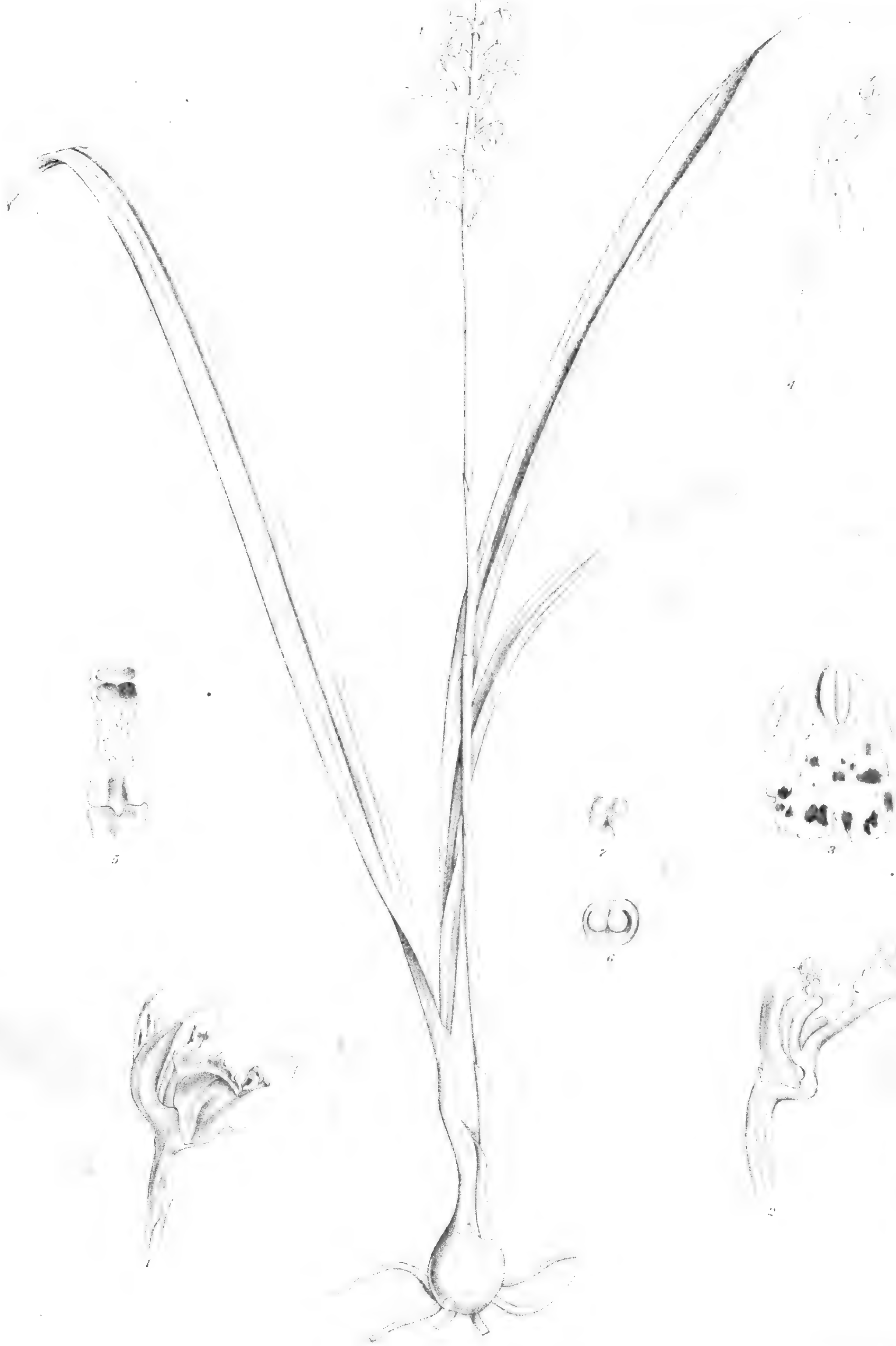

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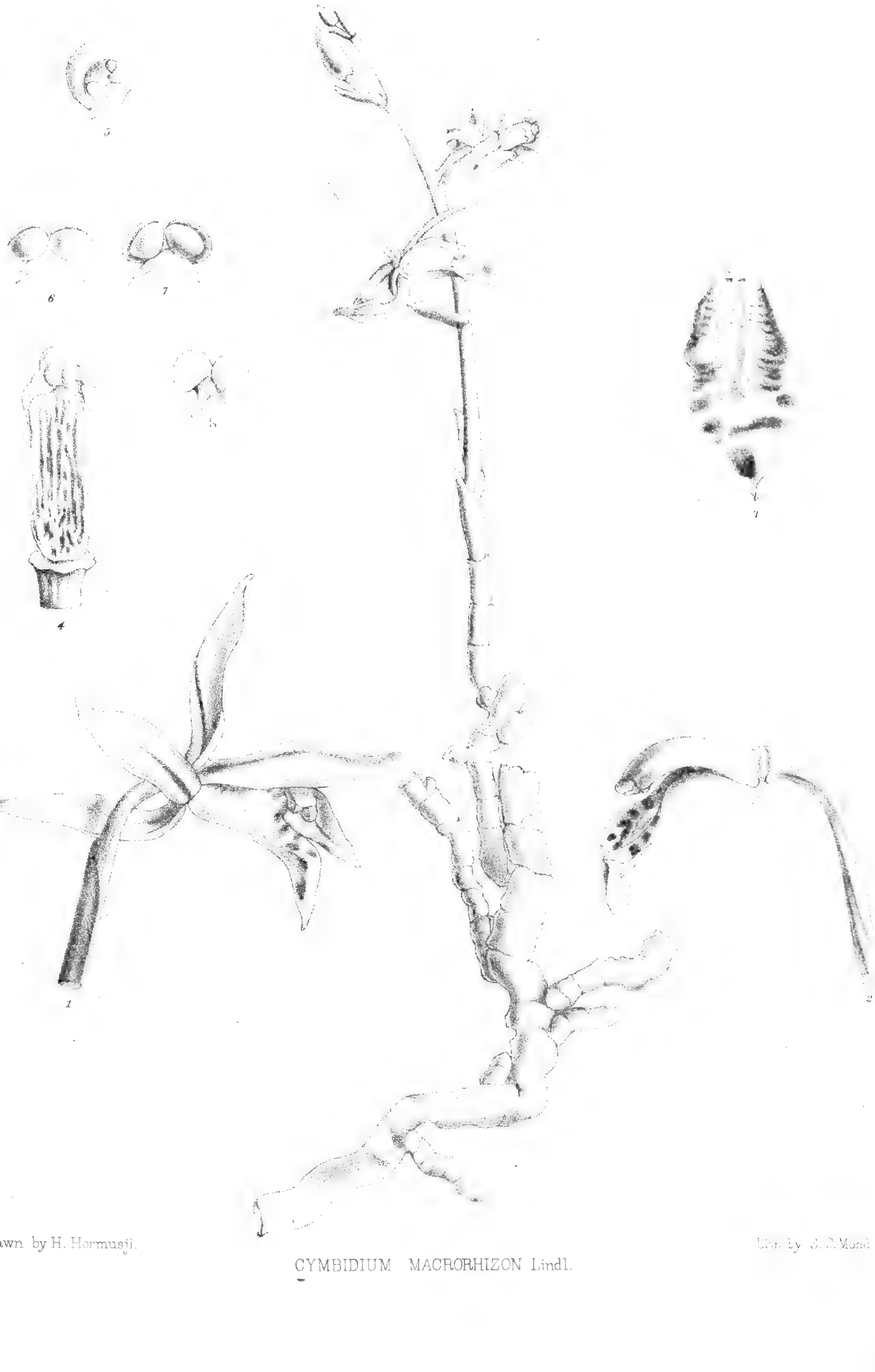

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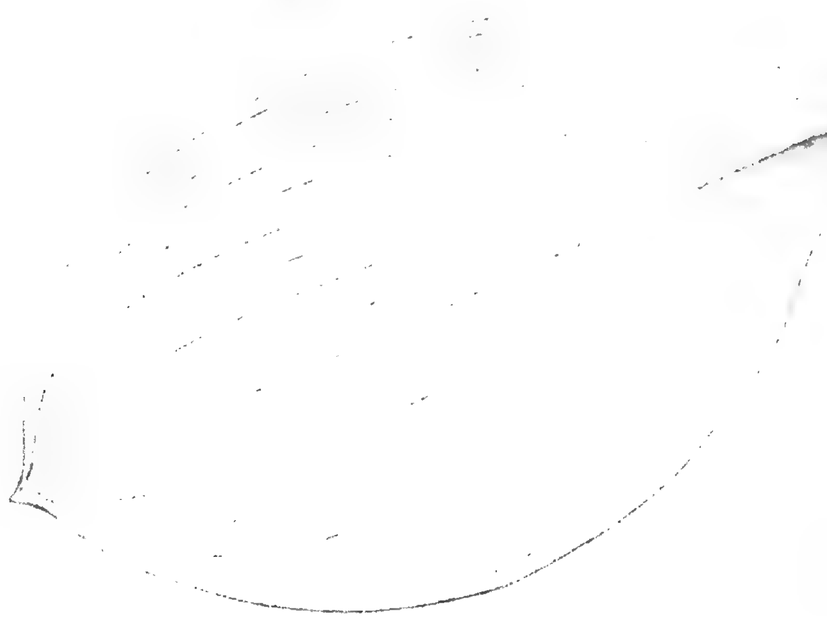

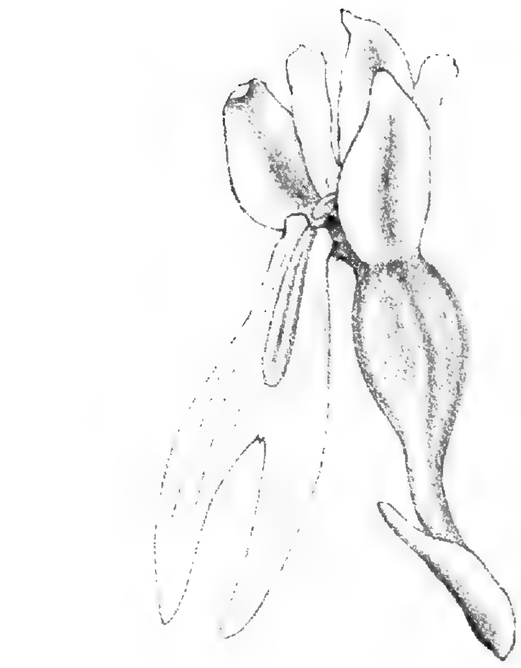

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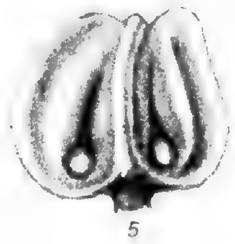

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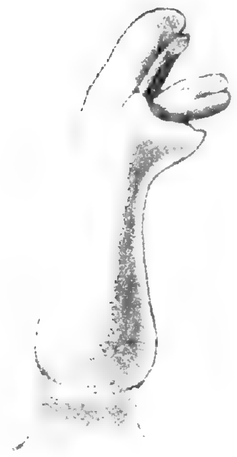

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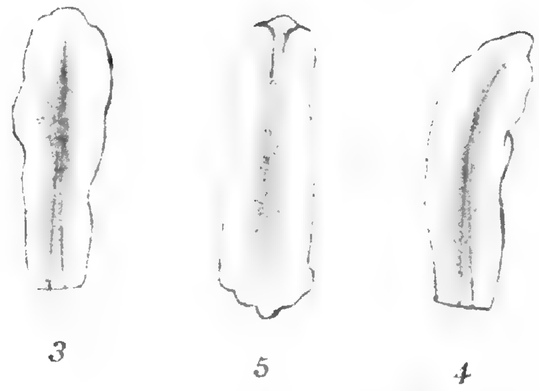

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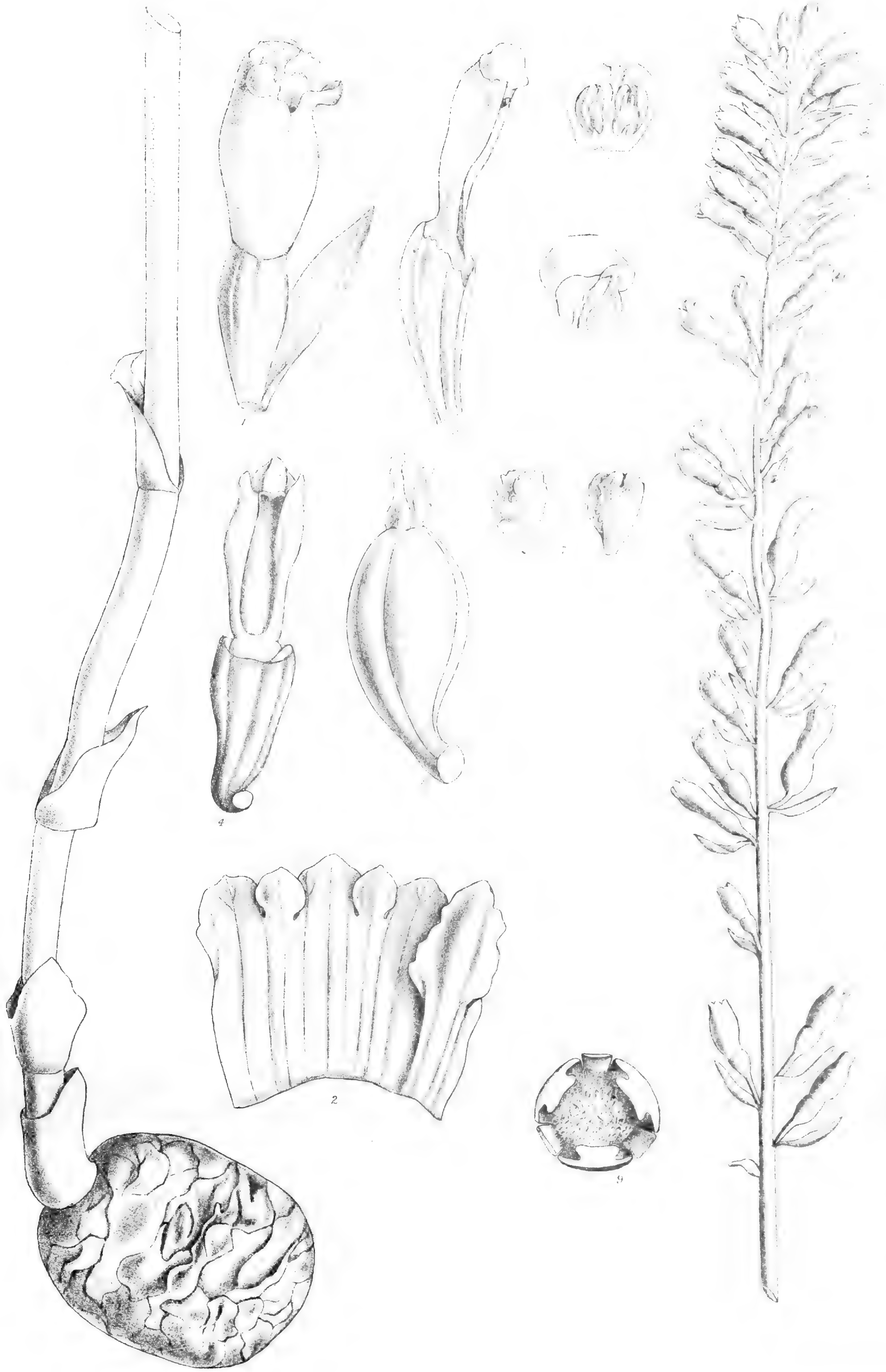

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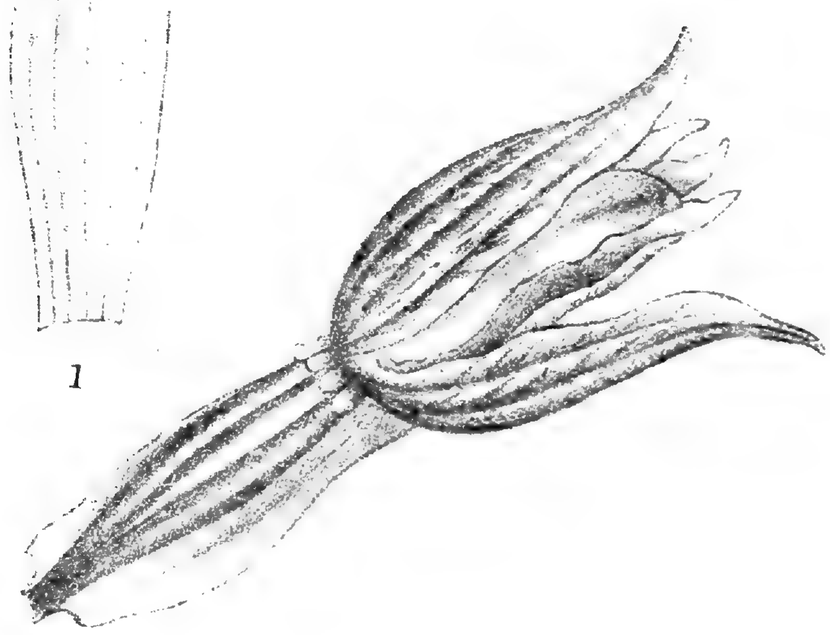

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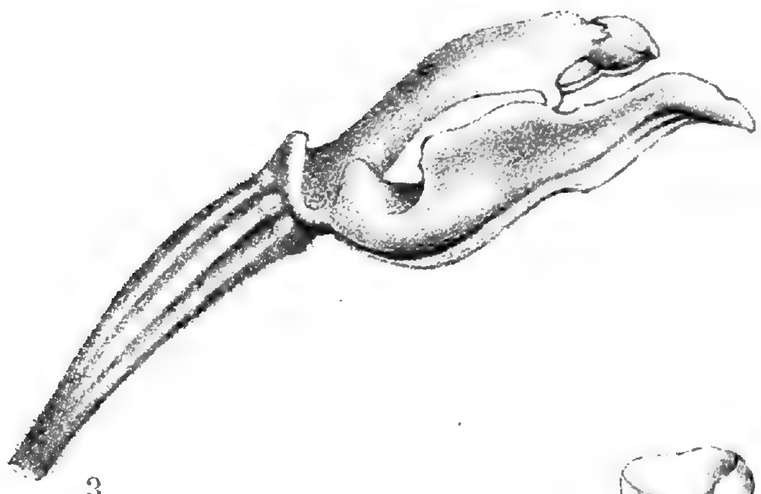

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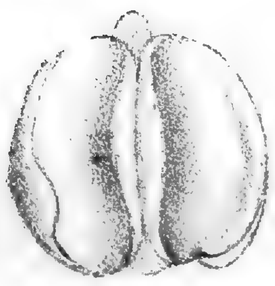

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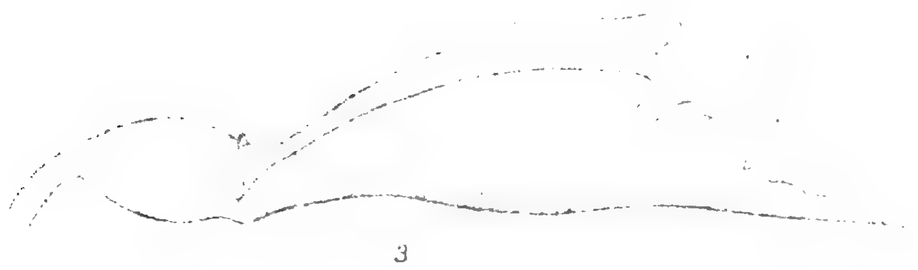

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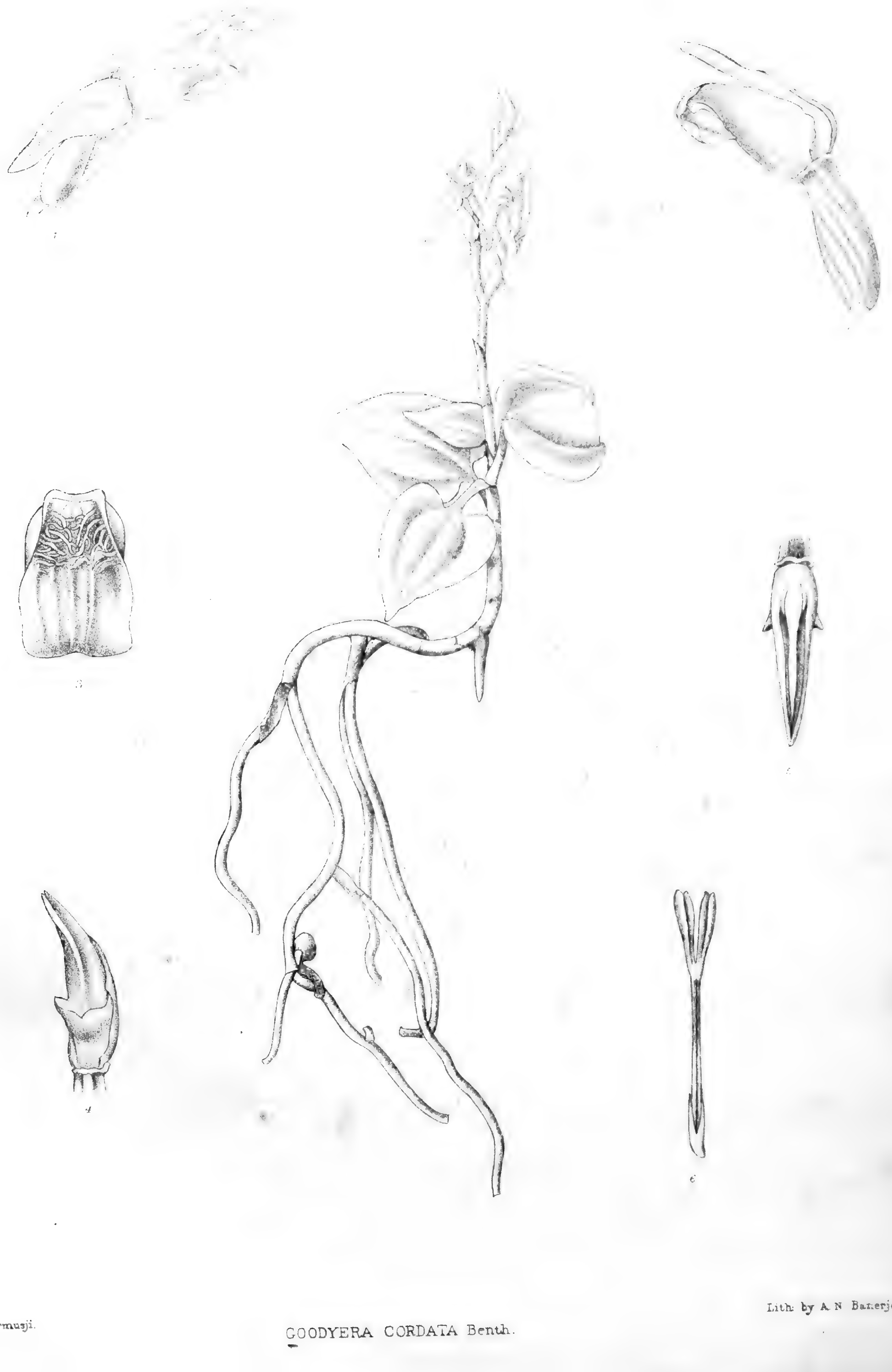

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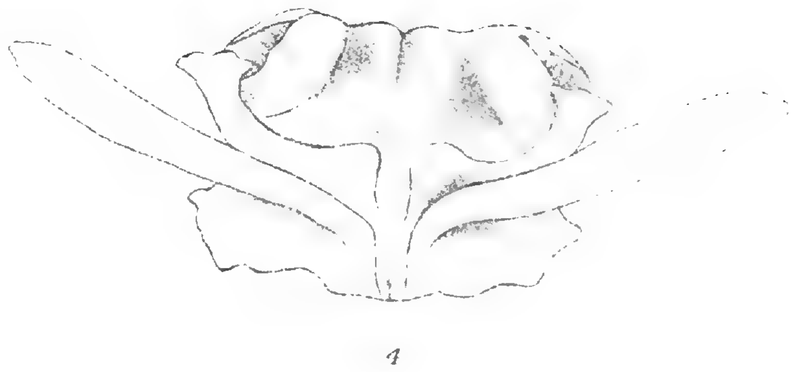

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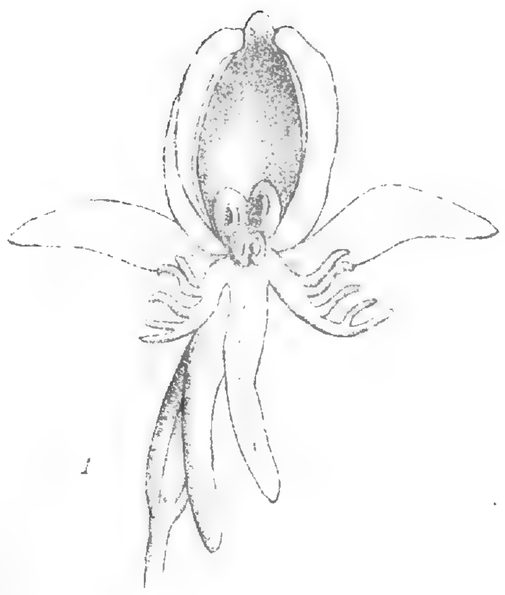

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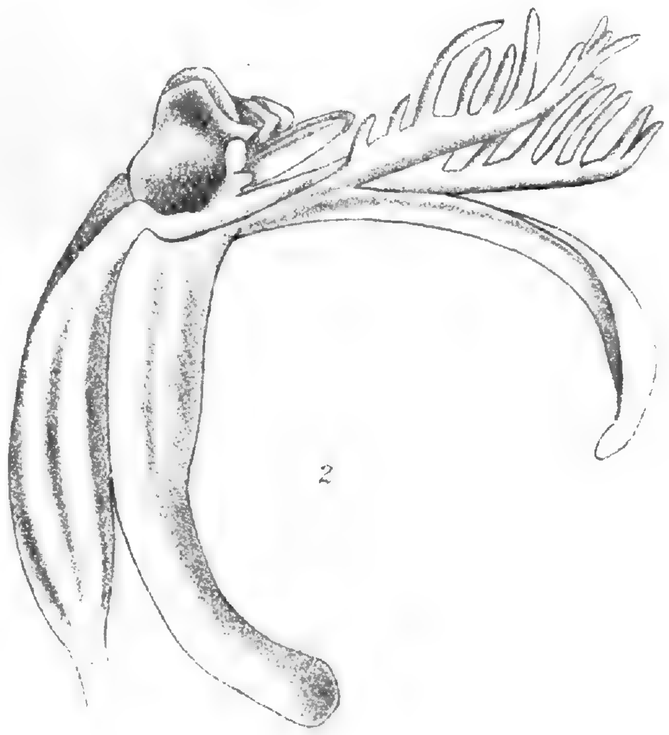

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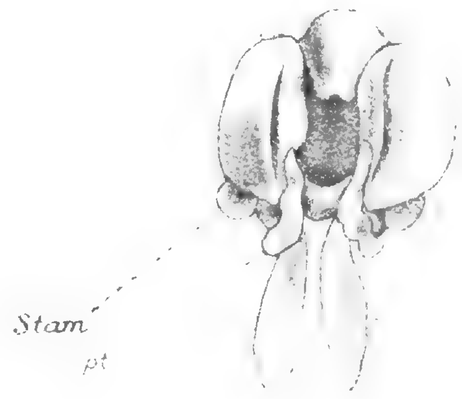

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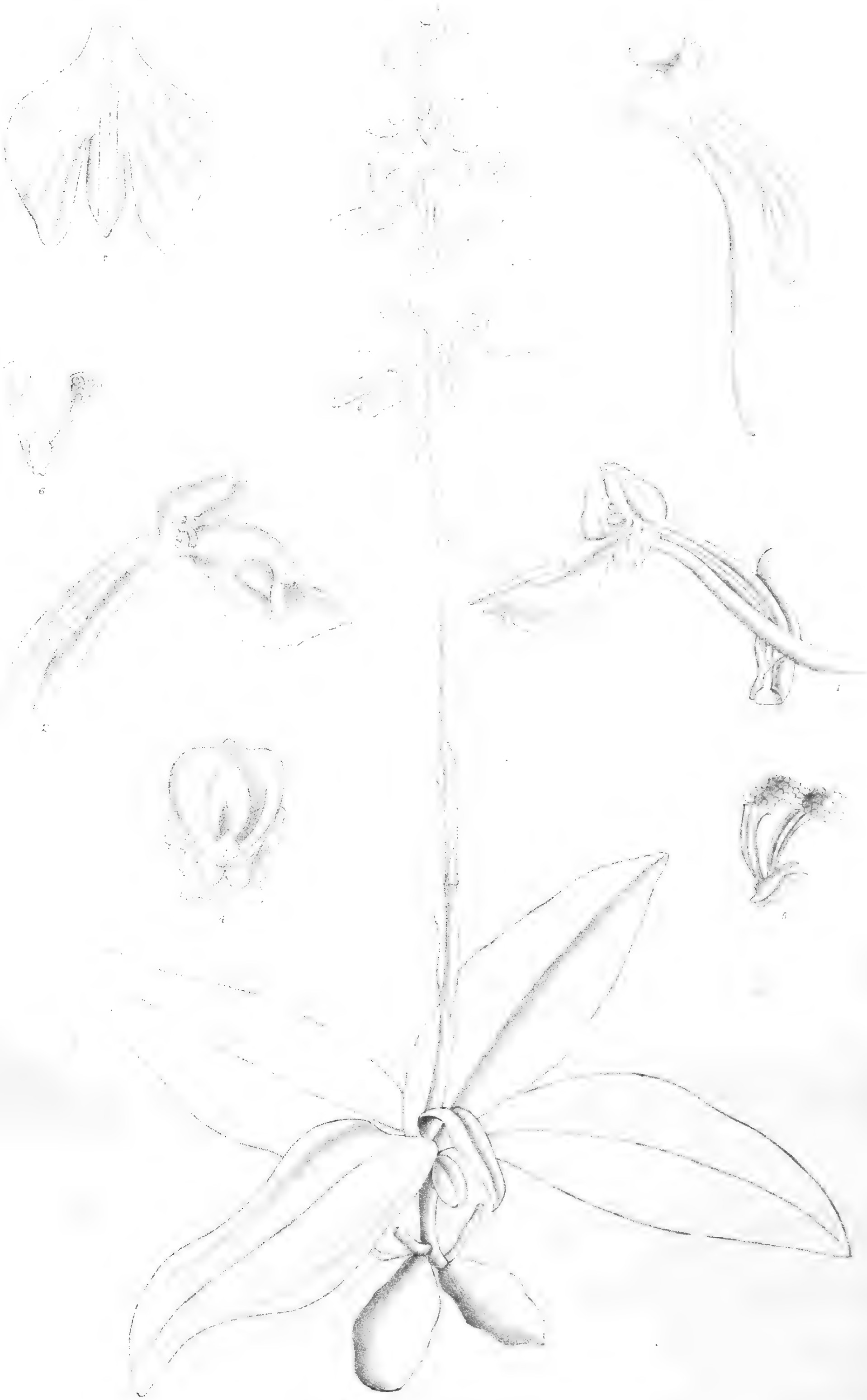

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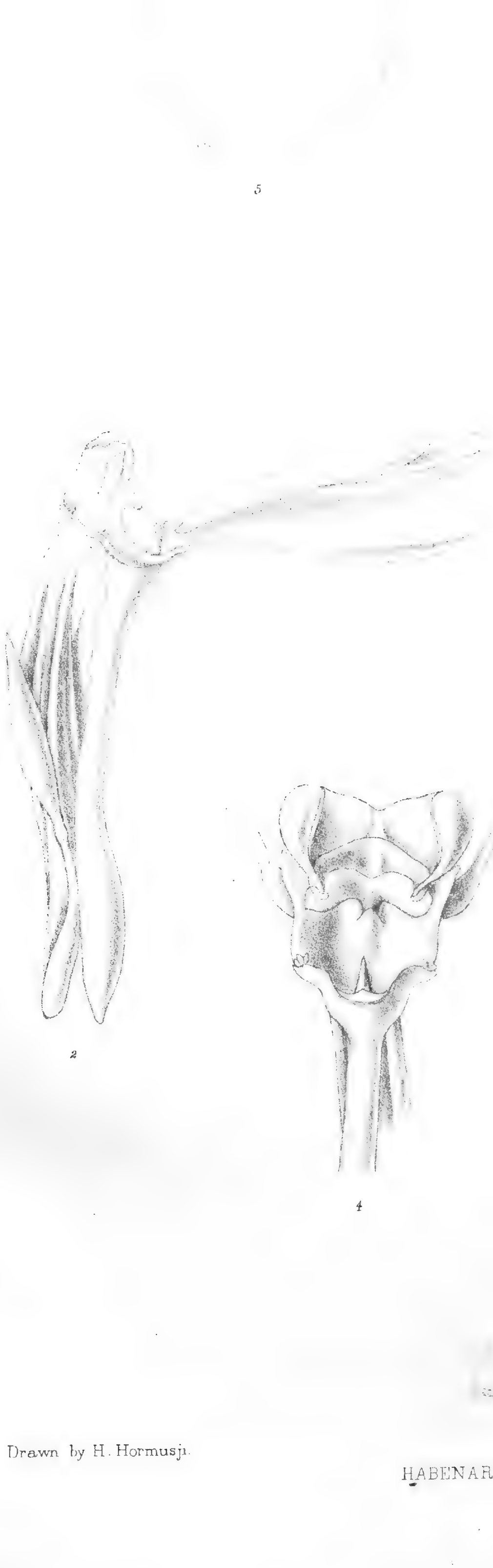

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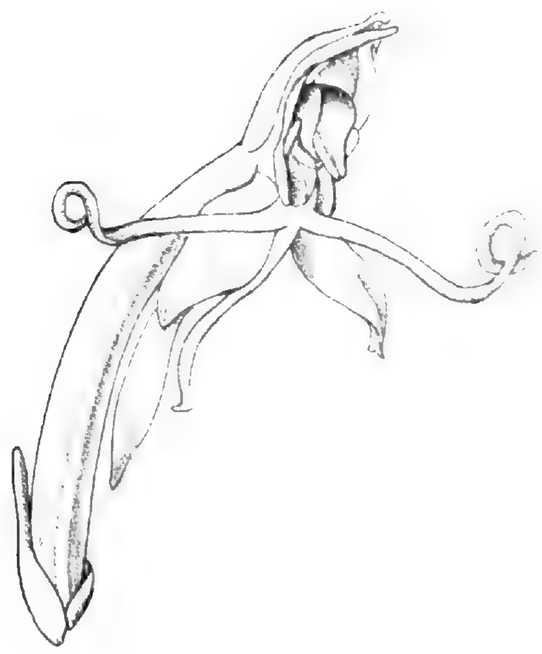

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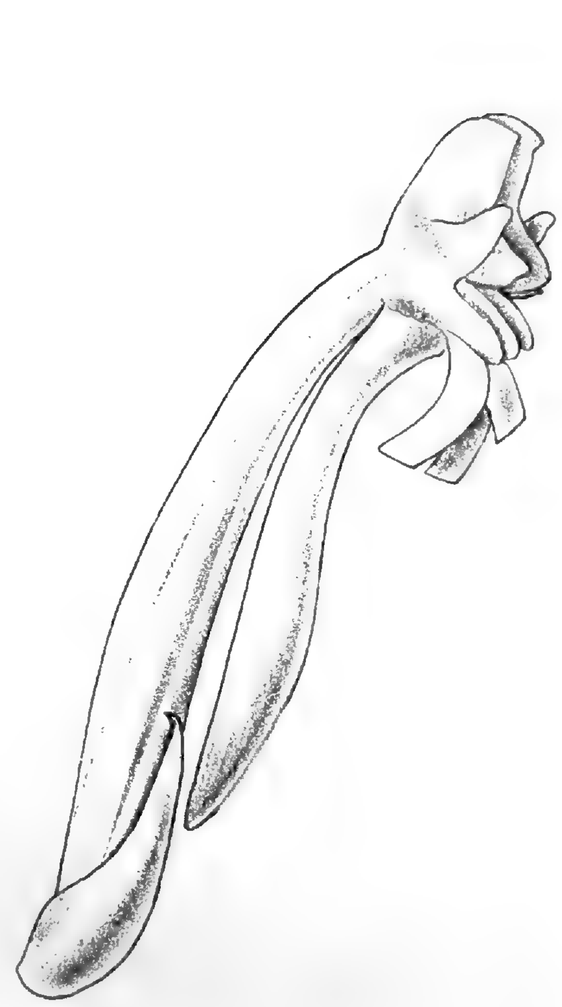

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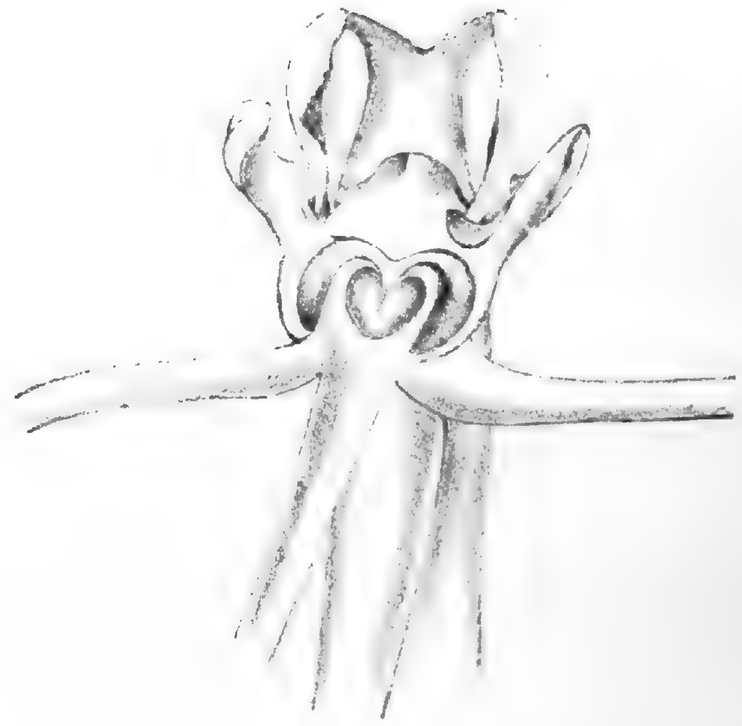

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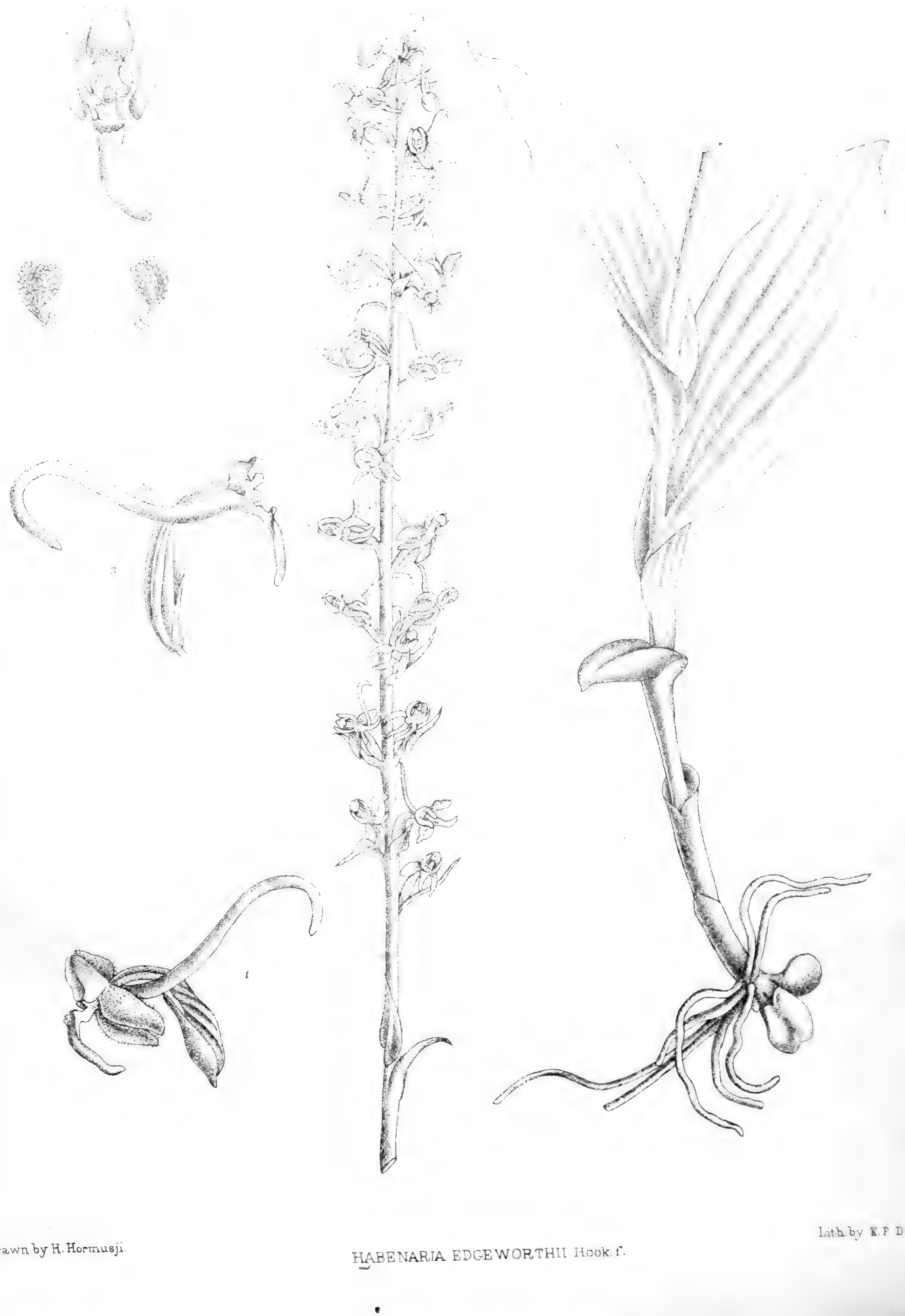
HABENARIA AITCHISONI Reichb. f.

Lith. by A.C. Chowdhary.



Drawn by H. Hormusji.

HABENARIA EDGEWORTHII Hook. f.

Lith by K.P Dass

Drawn by H. Hormusji

HABENARIA LATILABRIS Hook. f.

Lith. by P. P. Dass.

Drawn by H. Hormusji.

HABENARIA VIRIDIS R.Br.

Lith. by A. C. Singha.

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Drawn by H. Hormuzd.

HABENARIA ELISABETHÆ Duthie

Lith. by Dhitra Sdpr. Cal.

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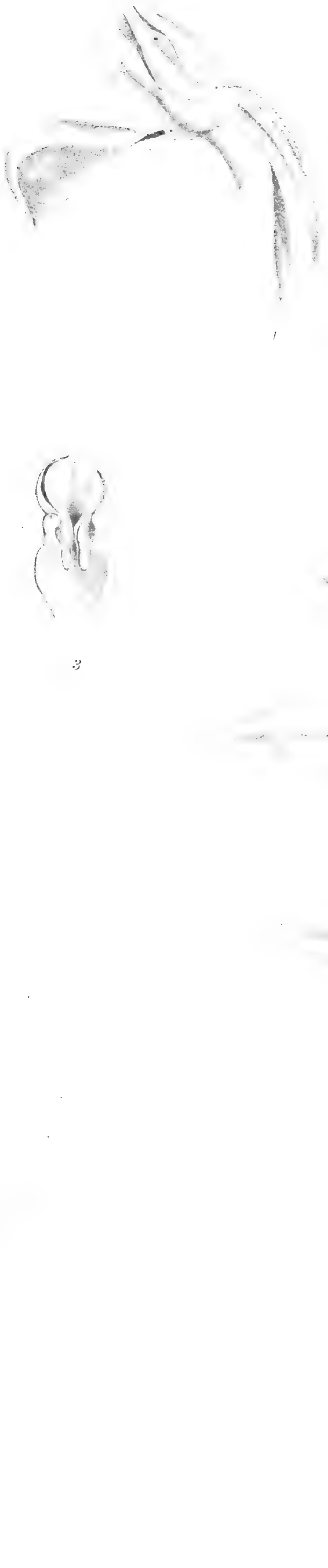
Drawn by H. Hormusji

HABENARIA LAWII Hook. f

Lith. by A. C. Singha.



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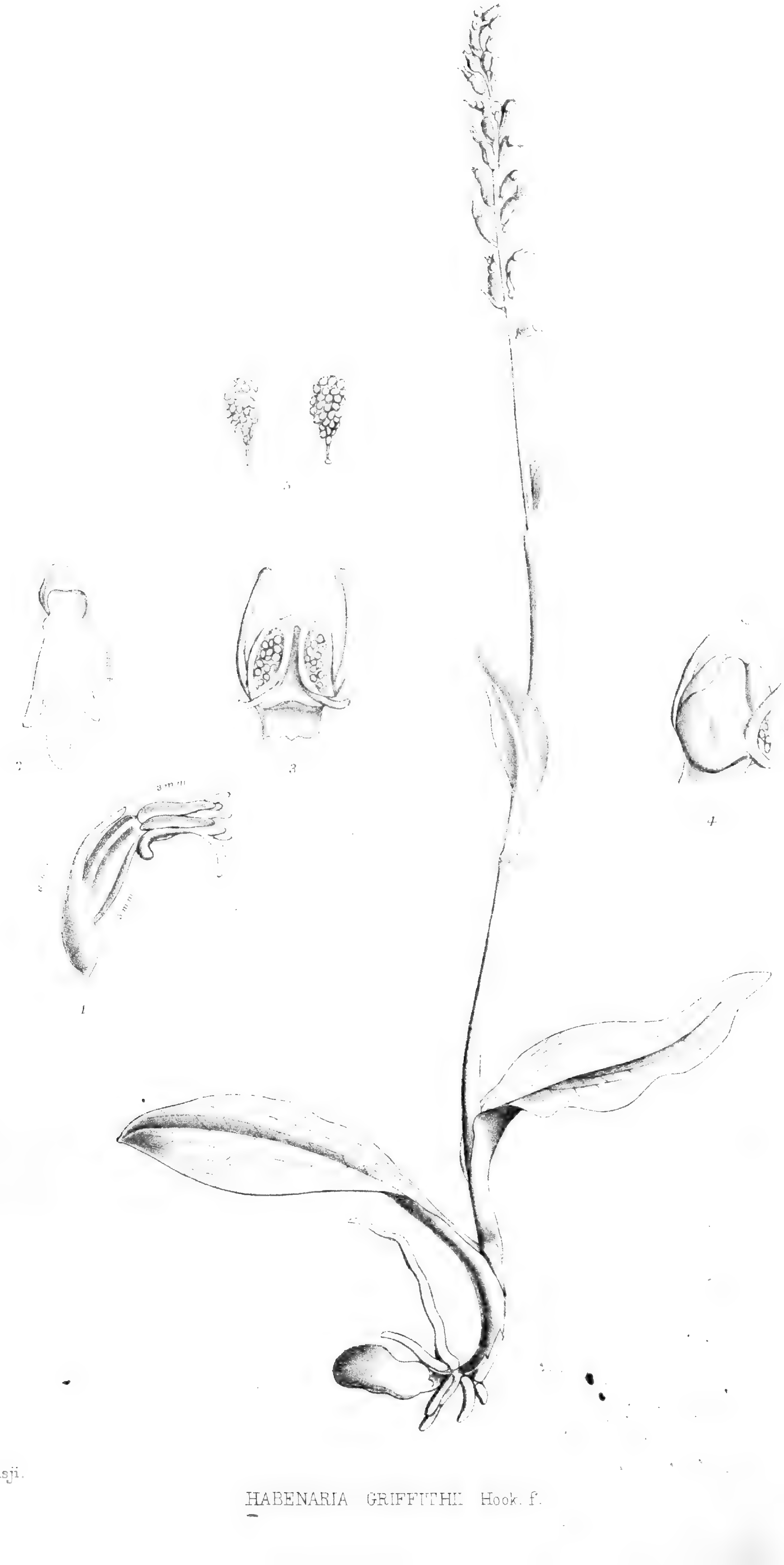
Drawn by H. Hormuzji.

HABENARIA GALEANDRA Benth.

Litho by Calcutta Sch. Soc.



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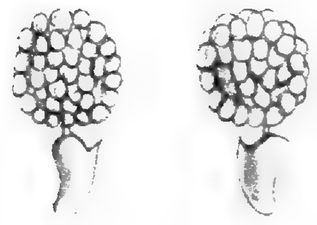
HABENARIA GRIFFITHII Hook. f.

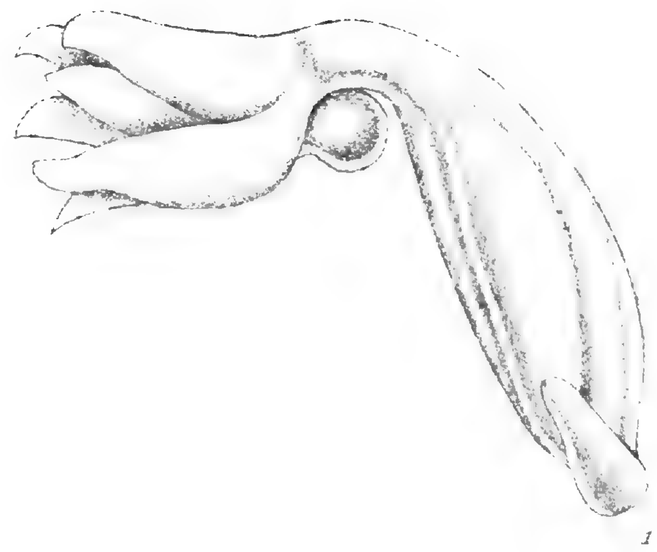
Lith: by Chitra Salpi Co



Drawn by H. Hormusji.

Lith: by Chitra Silpi Co

HERMINIUM MONORCHIS R Br



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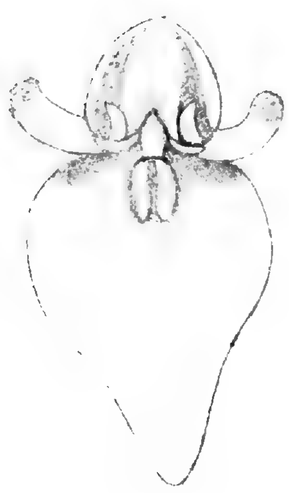

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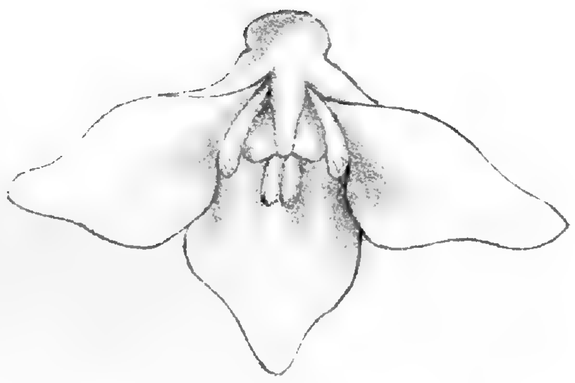

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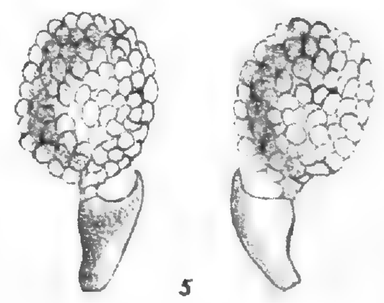

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Drawn by H. Hormusji.

HERMINIUM DUTHIEI Hook. f.

Lith by A. N. Banerjee.

Drawn by H. Hormusji.

HERMINIUM GRAMINEUM Lindl.

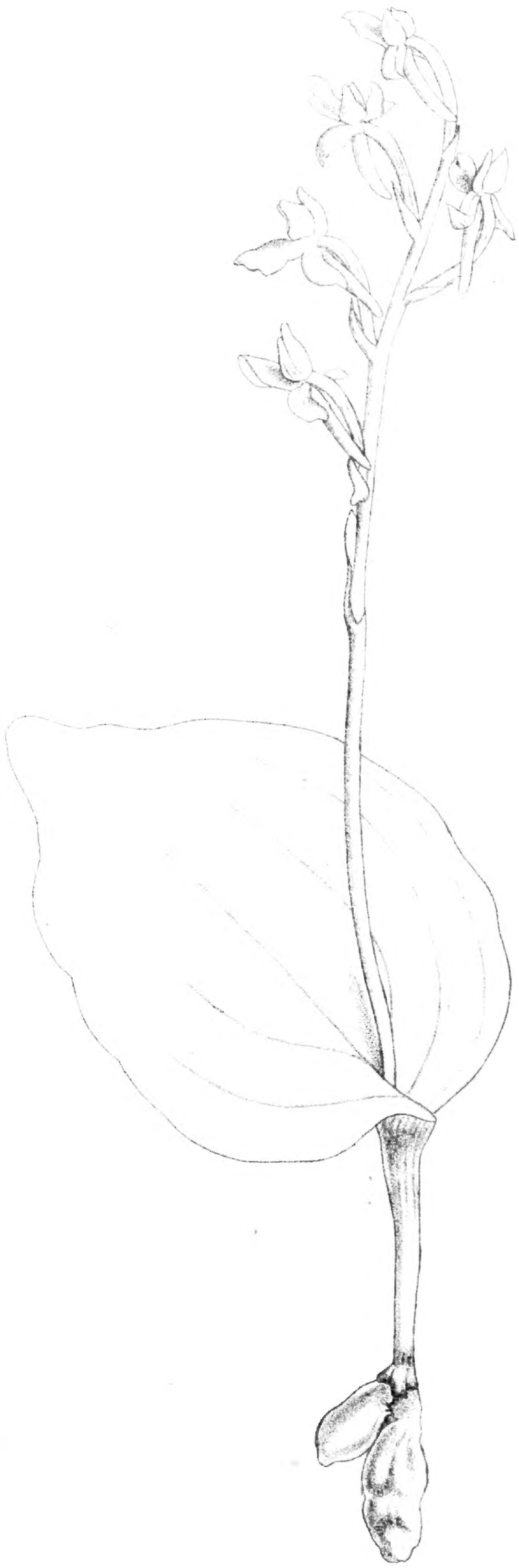
Lith. by K. P. Dass.

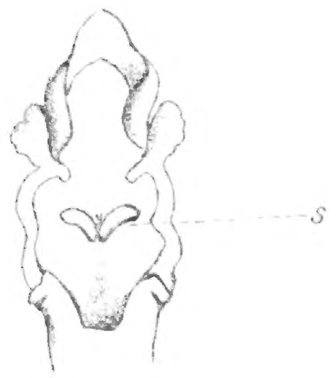
Drawn by H. Hormusji.

HERMINIUM MACKINNONI Duthie.

Lith by K. P. Dass.

4





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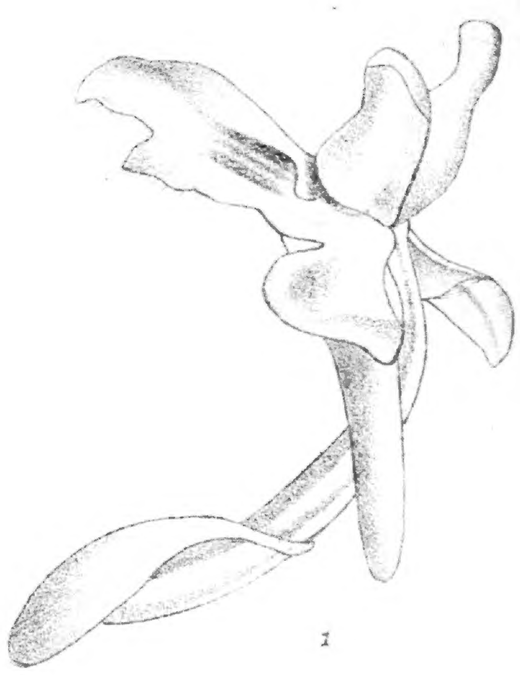

1

Drawn by H. Hormusji.

HEMIPILIA CORDIFOLIA Lindl.

Lith. by K. P. Dass.

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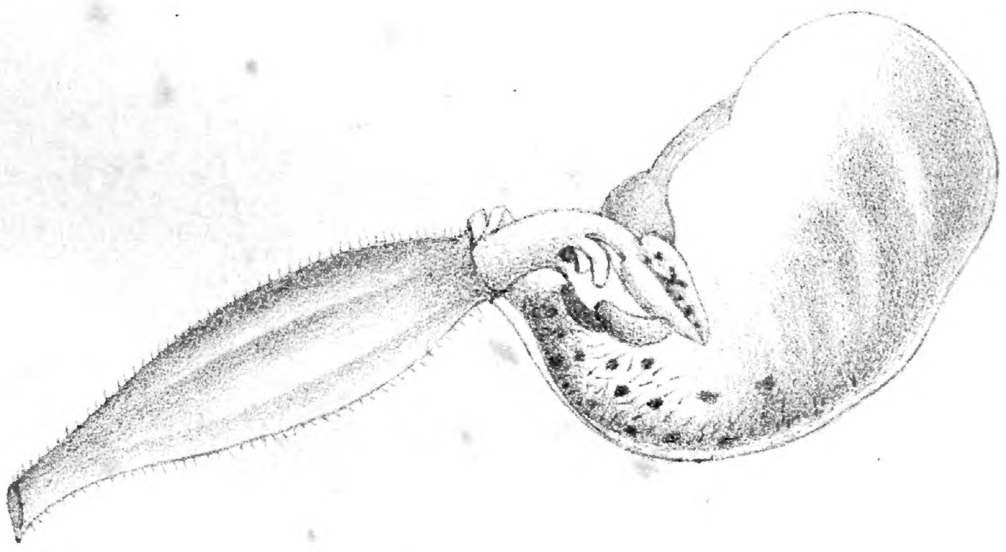

1

Drawn by H. Hormusji

CYPRIPEDIUM CORDIGERUM Don.

Lith by A. C. Singha.