ANNALS

OF THE

ROYAL BOTANIC GARDEN, CALCUTTA.

Vol. IX, Part II.

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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

PRICE (Uncoloured Rs. 22, or £1-13. Half-coloured Rs. 28, or £2.

Published at the Bengal Secretariat Book Depot, Writers' Buildings, Calcutta.

OFFICIAL AGENTS.

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THE SUPERINTENDENT, AMERICAN BAPTIST MISSION PRESS, Rangood.

MES. RADHABAI ATMABAM SAGOON, Bombay.

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ORCHIDS OF THE NORTH-WESTERN HIMALAYA

Ву

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 Orchidflora 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.

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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.

HEBBABIUM, ROYAL BOTANIC GARDENS, KEW;
10th 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:—

		;	Regions.				
GENERA OF WEST HIMALAYA.	Sikkim. China and	Ceylon.	Mainys. Burms.	Decen Penin- sula.	Australia,	Trop and South Africa.	DISTRIBUTION IN OTHER PARTS OF THE WORLD.
1. Oberonia 2. Microstylis 3. Liparis. 4. Dendrobium 5. Buthophrhum 7. Buthophrhum 8. Phalus 8. Phalus 9. Eria 10. Ceelogyne 11. Pholidota 12. Calanthe 12. Calanthe 13. Rulophia 14. Geodorum 15. Rolophia 16. Corallorhiz 17. Cymbidium 18. Doritis 19. Ornithochilus 10. Unusia 19. Ornithochilus 20. Rulophia 21. Sarcochilus 22. Erides 22. Erides 23. Runde 24. Erides 25. Sanda 26. Geodorum 27. Sarcanthus 28. Epipogum 29. Listera. 30. Gastrodia 31. Aphyllorchis 32. Gascot 33. Pogonia 34. Aphyllorchis 35. Spiranthes 36. Spiranthes 37. Spiranthes 38. Cophalanthera 38. Epipogum 39. Aphyllorchis 39. Spiranthes 39. Spiranthes 39. Spiranthes 39. Aphyllorchis 39. Spiranthes 39. Aphyllorchis 39. Spiranthes 39. Aphyllorchis 39. Aphyll	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	"1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Pacific and Maccerene Islands. Europe, North and Tropical America, West Indies. Costropolitus in empericand tropical regions. Polynesia to New Zesland. Throughout the tropics. Polynesia and Mascerene Islands. Pacific Islands. Ditto. Ditto. Ditto. Hrazil. Polynesia. North Asia. Europe, North America, Mexico. Madagascar. Polynesia. Do. De. Europe. Polynesia, Mascerene Islands. Do. De. Europe. Polynesia, Mascerene Islands. Do. All Ditto. All Ditto. Brazil. Polynesia, Mascerene Islands. Do. Do. All Ditto. Brazil. Polynesia, Mascerene Islands. Do. Do. All Ditto. All Ditto. Brazil. Polynesia, Mascerene Islands. Do. Do. Brazil. Rorth America. New Zealand. North America. New Zealand. Alghanishan. Alghanishan. Alghanishan. New Caledonia, New Zealand, Nort and Trepton merica. New Caledonia, Mascerene Islands, North Affrica, North America. Sandwich Islands. North Asia, Europe, North Africa, North America. Mascerene Islands. Cosmopolitan. North Asia, Europe, North Africa, North America Mascerene Islands. Cosmopolitan. North Asia, Europe. Mostly African and Mascerene. Mountains of North and Central America.

^{*} 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; Dendrobiam 15; Liparis and Eulophia 9; Calanthe, Cymbidium and Herminum 7; Cælogyne 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, Galcola, Cephalanthera, Zeucine, Anaectochilus, 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, Cælogyne 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, Anæctochilus Roxburghii, Orchis Chusua, O. spathulata, Habenaria Susannæ, H. ensifolia, H. intermedia, H. viridis, H. goodyeroides, H. galeandra, Herminium ungus/ifolium, 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*, Epipoctis 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:—

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† 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.

† Cymoidium Mackinnoni—Sub-Himalayan.

† Cymoidium Mackinnoni—Mussoorie range.

§ Epipogum tuberosum—Kashmir.

† Listera Inayati—Hazara.
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⁴ A160 in Sikkim.

⁺ Published in Journ. As. Soc. Beng. Ixxi (1902), Part i, pp. 37-45.

¹ Published in Journ. As. Soc. Beng. lxvi (1897), Part i, 584

[§] Not previously published.

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* Listera kashmiriana—Kashmir.
† —— microglottis—Mussoorie range.
† Aphyllorchis Gollani—Garhwál.
† 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.
—— accuata—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 amanum and candidum; Bulbophytlum polyrhizum; Cirrhopetalum maculosum; Pachystoma senile; Eria flava: Cælogyne cristata, ochracea and elaia; Calanthe tricarinata, Munnii and plantaginea; Eulophia explanata, campestris and Hormusjii; Doritis tanialis; 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; Calogyne 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.

^{*} Not previously published.

⁺ Published in Joun. As. Soc. Beng. lxxi (1902), Part i, pp. 37-45.

[†] Microstylis muscifera; Goodyera repens; Orchis latifolia, O. Chusua, O. spathulata; Habenaria Aitchiseni var.

Josephi, H. Elisabethæ; Herminium Monorchis, H. Duthiei, H. congestum.

[§] Goodyera fusca, Habenaria urceolata, Herminium pugioniforme.

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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 Scitaminea, 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 These conditions prevail, of course, to a much greater extent in and Rhynchoglossum. the Eastern Districts of Kumaon and Garhwal 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. 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 Elisabetha 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.

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 aurioles 1. 0. pachyrachis.

Lip with lateral lobes:—

Lip oblong, with small lateral lobes 2. 0. Falconeri.

Lip obcordate, with large broad lateral lobes 3. 0. 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,

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concave, entire or slightly crose 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. acaults 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 ou 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.

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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 suborbioular, obtuse ... ... ... ... ... ... ... ... ... 2. M. Mackinnoni.

Lip concave, entire, its apex produced into a beak, basal auricles absent:—

Leaf one ... ... ... ... ... ... ... ... 3. M. cytindrostachya
Leaves two ... ... ... ... ... ... ... 4. M. muscifera.
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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. Gev. and Sp. Orch. 20; Hook. f. Fl. Br. Iud. 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. Simt. 491, fig. 162. Malaxis acuminata Don Prod. 29.

Western Himalaya from Pangi 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; Garhwal, 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 reddishpurple, 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, subscute, attached to a long

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tubular petiole. Inflorescence 7.6 to 25.4 cm.; pedunclo 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, Strackey & Winterbottom No. 4 (Dienia), Col. Davidson; Káli Valley 12,000 feet, Duthie No. 341. Eastwards to Nepal, Sikkim and Bhutau, 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. Fluwers 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 le	gao	sneath: —
Lip abruptly deflexed from the very base:— Leaf solitary, cordate; bracts minute	1. 2.	L. cordifolia L. deflexa.
Lip deflexed from about the middle: -		
Leaf solitary: Leaf thin, bracts long and slender	4.	L. diodon.
Leaves 2-3; floral bract ovate-lanceolate	6.	L. paradoxa
Leaves 4 or 5; floral bract minute	γ.	L. bituber- culata.
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. Duthies.

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

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emarginate and mucrouate; 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 Linnæn 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-lunceolate, 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 Garhwal, 6,000 to 7,000 feet, Duthie No. 4427(a); Kumaon, 7,000 to 8,000 feet, Strackey & 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. *I seudo-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; *bracis* 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; ruceme 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. 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,

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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 Sepals linear-oblong, subacute. Petals shorter than sepals, linear, yellowish-green. 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. Cevl. 295; Benth. Fl. Hongkong 352; Ridl. in Journ. Linn. Soc. xxii, 293 (excl. L. clegans 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 flowers; floral bract linear-lanceolate, equal to or exceeding the stalked ovary. Flowers minute, palegreen. 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, *Duthic* 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; tip 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.

§ 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, lilae 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	-
purple radiating lines	D. Pierardi.
Lip longer than broad, with convolute side lobes:— Mentum swollen at the apex, bracts small, sepals obtuse 6.	D. amænum.
Mentum conical, bracts large, sepals acute	D. transparens.
purple veins	D. Gamblei.
Lip not convolute: Lip without side lobes	•
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	. 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	. D. fimbriatum.
surface	(a). D. fimbriatum var. oculata.
Stem pendulous, lip with 2 large suborbicular spots of brownish-	
purple	. D. chrysanthum.
reddish veins	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

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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; foral 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, Strackey & 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 III. 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. Fetals about 8 mm. long, linear-lanceolate, acuminate, 3-nerved, crect. Lip decurved, coucave, oblong-obovate beyond the narrow claw (when flattened out), yellowishgreen with dark purple veins, side lobes creet, 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 Garliwal 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 castwards 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 (Duthic's No. 25405); Garhwál, Falconer; in the Rámganga Valley, British Garhwál, Duthic 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 'Garhwal, 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 Garhwal, 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 Sikkin 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.

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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 Amenum 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; Garhwal, 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 every. 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-servate 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 pedunoles 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.

Garhwal near Tehri at about 5,000 feet, Mackinnon's collector (Duthie's No. 24155); Kumaon at 3,000 feet, Strackey & 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. amount.

11. DENDROBIUM CLAVATUM Wall. Cat. 2004.

Stems stont, 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 & Pautl. in Ann. Roy. Bot. Gard. Calc. viii, 53, t. 60.

Kumaon, Strackey & Winterbottom, Stewart; Gori Valley, Duthic 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. Fowers 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, counate 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, Mackinson (Duthie's Nos. 22707, 24157); British Garhwal 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. normals might prove to be a monstrous condition of D. fimbriatum, but the inflorescence of the former is more ike that of D. claratum, whilst the leaves almost exactly resemble those of D. chrysanthum.

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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 FIMERIATUM 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 Garhwal, 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 suborbioular 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 16flowered; 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; fioral bract lanceolate. Sepals subequal, up to 5 cm. long, oblongelliptic, 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 brownishpurple 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, Strackey & 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.

1. BULBOPRYLLUM 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 marrowed to the sessile base, deciduous before the flowers open. Scape filiform, about 1 dm. long, its subcreet 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. Senals 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.

Garhwal, 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 Lindi.

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.

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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.

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, nerrowly 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, subdepressed; lateral sepals about twice as long as the dorsal, free, ovate-lanceolate from a broad base, sub-acute, falcate, their upper margins curved inwards. Petuls 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; Garhwal, Falconer, Mackinnon (Duthie's No. 24151); Knmaon, 3-4,000 feet, Strackey & 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.

Garhwal 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. caspitosum* 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 overy 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 ovateacuminate bracts; raceme drooping, 3.5 to 9 cm. long, 4-12-flowered; floral brack 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. Bullophyllum refractum Reichb. f. in Walp. Ann. vi, 259. B. tripudians Par. & Reichb. f. in Trans. Line. Soc. xxx, 154.

Kumaon, in the Sarju valley at 3,700 feet, Strackey & 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.

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.

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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; Garhwal, 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 Column somewhat winged near the apex, with a very short foot. Pollinia 8, unequal, elongate. Capsule 3 cm. long, narrowly elliptic. Wall. Pl. As. Ror. 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, Strackey & 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 tomeotose, 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.

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. Spites 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; foral 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 Lip obscurely 3-lobed, cuneate, concave, apex subacute, the sepals, but much narrower. 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, chianceolate, acute, strongly nerved, rather rigid. Scape 4-6-flowered, pubescent.

ERIA.

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. Capsulz 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, Strackey & 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 pseudobulb, 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

I.—Encologyne.

Dehra Dun and up to 4,000 feet towards Mussoorie, Mackinnon No. 24158; Garhwal Hills, Duthic's collector Nos. 25804, 25805, 25806. Flowers in April. It extends eastwards to Bengal, Sikkim and Bhutan.

10. Cœlogyne Lindl.

Epiphytes; pseudo-bulbs coespitose 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. Pollina 4, cohering in pairs to a single 2-lobed granular appendage.—Species about 90, Indian, Malayan and one in China.

Lip oblong, 3-lobed; flowers and leaves contemporaneous, the latter persist-

Flowering axis bracteate at its base; lip fimbriate 3. C. ovalis.

Flowering axis naked below; edges of lip erose . . . 4. C. elata.

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 soveral 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.

CŒLOGYNE. 113

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 pseudobulbs, 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, erectopatent, 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 vellow lamellæ on its upper surface; disk between the lateral lobes with four yellow fimbriate 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; Percatoria 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 Garhwal 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.

Pscudo-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. Garhwal, Duthic's collector Nos. 25808, 25819, 25820, 25821; Kumaon in the Gori Valley, Duthic's collector Nos. 24099, 24100; flowering in October. Extends castwards 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 preudo-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 feetid; 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. Liv 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 crose at the apex. Pollinia dimidiately ovate. Capsula 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. Cælogyne sp., Griff. Ic. Pl. As. t. 290.

Garhwal 4-5,000 feet, Falconer, Mackinnon; Kumaon in the Sarju Valley 3-4,000 feet, Strackey & 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 coespitose, 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.

Dwali in Kumaon at 9,000 feet, Collett; flowering in June. Eastwards to Sikkim.

6. CŒLOGYNE PRÆCOX Lindl. Coll. Bot. 37.

Pseudo-bulbs coespitose, flask-shaped, turbinate or shortly cylindric, umbonate, surface mottled with brown or purple, and loosely sheathed by a network of brown fibres.

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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 overy, convolute. Sepals sub-equal, spreading, oblanceolate. Petals as long as, but narrower than the sepals, 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 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; Hock. 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 pracox 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.

Garhwal 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. Anthercells subglobose. Pollinia 4, subglobose or clavate, cohering by pairs to one or two membranes.—Species about 20, Indian, Malayan or Chinese.

1. PHGLIDOTA IMBRICATA Lindl. in Hook. Fl. Exot. t, 138.

Pseudo-bulbs coespitose, 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. Cælogyne 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.

Debra 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, Strackey & 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 sepuls, 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. Cælogyne 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. Garhwal, Capt. Roberts; below Naini Tal in Kumaon at 3,000 feet, Strackey & Winterbettom 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. 1831; Fl. Br. Ind. v, 845; Wall. Cat. No. 1992 (in part).

Dehra Dun, on sål 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).

0 ,		
Terrestrial, leaves (when present) plicate:— Pollinia 8	19	Calanthe.
	12.	Catanine.
Pollinia 2:- Lip saccate or spurred at the base	13	Fulanti-
Lip broadly ventricose at the base; inflorescence	10,	Batopata.
decurved when in flower	14	Geodorum
Pollinia 4:-		Ground Bills.
Pseudo-bulbous; leaves 1 to 3, long, narrow, plicate;		
anther 1-celled	15.	Orearchie
A leafless parasite with a jointed coralloid rhizome;		O' to to the la.
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.	Doritie
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		
usucoides and Saccolabium calceolare); pseudo-bulls none; leaves		
coriaceous and flat or terete and fleshy; inflorescence racemose or panioled, lip spurred or not:—		
Lip not spurred:— Leaves terete; flowers few, in very short racemes or		
solitary; stems elongate	90	Tutata
Leaves (when present) flat; stems 0; flowers in long	20.	Luisia.
racemes	21.	Sarcochiles
Lip spurred (gibbous in Vanda alpina):-		
Column with a long foot produced into a long		
spur which has no callus or septum inside	22.	Erides.
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	00	7 0
lobes	23.	Rhynchostylis.

Base of lip usually with a widely funnelshaped spur (gibbous in Vanda alpina). glabrous at the mouth, not compressed, side lobes large; apical lobe fleshy, with many glabrous carunoled ridges, flowers large, caudiole 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 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	C. tricarinata.
Flowers lavender-coloured; apical lobe of lip without	_
ridges	C. puberula.
Flowers with a very short straight conical spur:-	·
Lip attached to whole length of column; flowers small,	
sepals and petals chocolate-brown	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 overy 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.	
Flowers larger, distant, violet-coloured γ.	C. plantaginea.

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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 stulked ovaries puberulous. Flowers 2 to 2.5 cm. across; bracts about half as long as the ovary with pedicel. Senals 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, orangered, 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. 491; 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, Petals spreading, narrowly falcate, acute. Lip adnate to the base ovate-lanceolate. 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, Duthic 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 75 cm. long. Leaves two or three, oblanceolateoblong, 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 vellow 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 Garhwal at 6,000 feet, Mackinnon's collector; below Ranikhet in Kumaon, 5-6,000 feet, Duthic 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-fortile.

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 bairs. 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;

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Hook. f. Fl. Br. Ind. v, 848; King & Pantl. in Ann. Roy. Bot. Gard. Calc. viii, 168, t. 227.

Garhwal at 5,000 to 6,000 feet, Duthis 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 periole, edges Scape about as long as the leaves, clothed with a few distant sheathing Inflorescence corymbose in flower and becoming racemose as the fruit ripens, bracts. 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 Mussocrie 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, Strackey & 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-colled. Pollinia 2, globose, attached by

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a caudicle to the flat gland of the rostellum.—Species about 100, tropical or sub-tropical, chiefly Asiatic.

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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,
       Column produced into a distinct foot:
    Lateral sepals inserted on the spur, basal lobes of lip
     obsoure. . . . . . . . . . . . . . . . . . 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 sacoate, blunt : . . . 8. E. flava.
           Terminal lobe of lip twice as long as the rounded
             basal obes, many-lamellate; spur short, curved,
             acute . . . . . . . . . . . . . . . 9. E. oblusa,
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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; foral 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. Linu. Soc. iii, 24 (not of Dalz.). Limodorum bicolor Roxb. Fl. Ind. iii, 469.

Dehra Dun, Mackinnon; Siwalik range, Visary; Giri Valley west of the Jumns, Royle; Mussoorie range up to 5,000 feet, Mackinnon; Garhwal 4-7,000 feet, Holye,

Falcener, Edgeworth, &c.; Lansdowne in Brit. Garhwal, 5-6,000 feet, Capt. Roberts; Kumaon below Naini Tal, 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 MACKINNOMI 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 (pseudobulb). 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, vellow 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, 21161; 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.

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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, Fulconer; 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, erectopatent, 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-Garhwal up to 6,000 feet; Bashahr at 7,000 feet, Lace No. 880; banks of the Siran river near Abbottabad in Hazara at about 3,000 feet, Colonel Barrett; Gujar Valley in the Chitral district, found by Sir W. Gataere 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 Duthic.—A flowering plant,—of natural size; a plant with leaves, reduced to \(\frac{1}{2}\) size. Fig. 1, single flower; 2, ditto, with sepals and petals removed; 3, lip spread out; 4, column and upper portion of overy; 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 tubereled patch on the terminal lobe; spur short, conical subclavate or subacute. Column as long as the lip, slender, without a foot. Poilinia 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 ramentace a Lindl. in Wall. Cat. 7368, 7370; Gen. and Sp. Orch. 185; in Journ. Linn. Soc. iii, 25. E. hemileuca Lindl. in Journ. Linu. 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.

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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. Scrals erect, oblong, acute, the lateral pair falcate. Petals shorter than the sepals, ovateoblong, 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 flavam Herb. Ham.

Dehra Dun, Royle, Mackinnon (Duthic's No. 22725); Sub-Himalayan tracts in Rohil-khand and N. Oudh, Duthic's collector Nos. 22795, 24142; outer ranges of Garhwal, Duthic's collector Nos. 25790, 25804, 25805, 25806; Kumaon, below Almora 4,500 feet, Strackey & Winterbottom No. 20; Sarju Vulley, T. Thomson. Flowers in June and July. It extends eastwards to Nepal, and is found also in Travancore and Hongkong.

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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 subscute spur at the base; side lobes large, erect, rounded, pale vellow 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, Machinnon (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. fiava, 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 Deckhutal," 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 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. 175; 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. Malazis 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. C. 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; Garhwal, 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; pollima sessile on the gland, obovoid,

subcompressed. Collett Fl. Siml. 493. Corallorhiza indica Lindl. in Journ. Linn. Soc. iii, 26 (not of Dene.).

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; Garhwal 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, Strackey & 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

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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 neighbour-bood of Mussocrie.

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 succeient 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 Done. 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 parasitio	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 om. 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			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 111. 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 Yalley 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; —ule entargea

2. CYMBIDIUM MACKINNONI Duthie in Journ. As. Soc. Beng. lxxi, pt. 2, 41.

Terrestrial, coespitose. 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. Florat bract longer than the much curved ovary, pale yellow with purple veins. Flowers

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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, succate 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 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 overy. 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, C. viridisorum Griff. Itin. Notes 126, No. 454. 186, t. 248.

Near Mussoorie, growing amongst dense undergrowth at about 6,000 feet, Mackinnon (Duthie's Nos. 21743, 22719), flowering during March and April; Garhwal 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; foral 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 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 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. (10 part). Epidendrum aloides Bot. Mag. t. 387.

Bahraich district of N. Oudh near the Nepal frontier, Duthic's collector No. 23865: Sowering during April and May. It extends eastwards to Bengal, Sikkim and Assam, and occurs also in S. India, Ceylon, the Andaman Islands and Perak.

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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. Sepuls 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. Volumn 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, linearoblong, 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 inumerous imbricate acuminate sheaths; raceme laxly 10- to 20-flowered. Flowers 6.4 to 7.6 cm. across; floral bract Sepals subequal, elliptic-oblong, subacute, the dorsal one incurved, minute, broad. 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. Lizdl. Gen. and Sp. Orch. 163; Sert. Orch. t. 4; Bot. Mag. t. +844; 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. 1nd. 76, t. 26. Limodorum longifolium Ic. Ham.

Garhwal at 4,000 feet, Mackinnon; Kumaen 4,000 feet, Strackey & 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. Le ves 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 creet, 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 Tanialis 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 backwardpointing 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 glaud. 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. Erides taniale 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, Mudden; 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. Interescence supra-axillary, racemose or panieled. Sepals

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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 topering 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. Sepuls and petals greenish-yellow, the former with four, and the latter with two, broad brown vertical bands. The two pectinate lateral lobules of the midlobe 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; Garhwal, 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-colled; pollinia 2, ovoid or subglobose, attached by a broad caudicle to a subquadrate or elongate gland. Copsule narrow, ridged, subcrect.—Species about 15, mostly in Tropical Asia, a few Australian:—

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, Machinnon No. 24182; Garhwal, Falconer, Machinnon (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 with 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).

Garhwal 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 obleng, 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. Polinia 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. Meso-clastes brachystachys Lindl. in Wall. Cat. 1994; Gen. and Sp. Orch. 45.

Garhwal, 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, sub-ucute, spreading. Petals oblong, taporing 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. Copsule 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, Machinnon'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. Etem 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 seta; politic 4, in pairs, compressed; the caudicle sleuder, 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 amplexical ovate acute membrano

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; restellum indistinct. Anther broadly ovate, furnished with 2 or 3 slender setæ; pollinia two, 2-lobed, caudicle very short, gland large. Capsuæ 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 Garhwâl 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 brack 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.

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. Riemes longer than the leaves, simple, axillary, densely many-flowered; peduncle long, clothed with short distant sheaths. Flowers 2 cm. across, rose-coloured. Sepals and retals 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 tiliform, 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. A. 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. A. rossum Lodd. ex Paxt. Fl. Gard. ii. 109, t. 60; Regel Gartenfl. viii, 253, t. 267 A. Lobbii Hort. ex Ill. Hort. (1868) t. 559. Æ. Veitchii Hort. ex Morven in Belg. Hortic. (1876), 201. Æ. trigonum Klotzch in Ctto. & Diet. Allgem. Gartenz (1885), 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; Garhwall, 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.

RHYNCHOETILIS RETUSA Blume. Bijdr. 286, t. 49.

Stem stout 1 to 2 dm. long, enveloped in the sheaths of decayed leaves. Leaves it 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 dorsel 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 & Pautling 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, Duthic's collector Nos. 25828, 25830, 25840; Sub-Himalayan tract in the Gonda district of N. Oudh, Duthic'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. Indía, 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.

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. Laeves 7.5 to 10 cm. long and 1 to 1.3 cm. broad (where flattened out), linear-oblong,

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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; roceme 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.

Dehra Dun, Mackinnon; and along the bases of the outer ranges of Garhwal and Kumaon, Edgeworth, Duthic'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, 36 dm. long, emitting many thick white fleshy roots. Leaves bifarious, approximate, 1.5 to 2 dm. long, narrow, complicate, keeled, the apex præ-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. 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 lutifolia. 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.

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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. 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; Garteufl. 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); Garhwal, Duthie's collector No. 25827; Kumaon 3 to 4,000 feet, Strackey & 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, caudiele 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.

Garhwal, T. Thomson; Kumaon 3,500 feet, Strackey & 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 cylindrio, 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. calcolare.

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 papiilosa Lindl. Fol. Orch. 2; Walp. Ann. vi, 873.

Dehra Dun in the Narkaunda swamp, Gamble No. 23272, Mackinnon; Garhwal, 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.

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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; Garhwal, 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. Ilowers 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 crose, 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; Gurhwál 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. Racenes 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 subscute. 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 Garhwal hills near the Ramganga 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. ... 28. Epipogum. Pollinia 2, with caudicles, lip spurred Pollinia 2 or 4, without caudioles, 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 30. Gastrodia. Sepals and petals free. Stem simple, flowers in terminal 31. Aphyllorchis. ... branched, flowers Stem 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, covalloid. Scape stout often swollen above the base, bearing two or three unequal sneathing 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 cblong-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. Nour as long as the lip, thick, blunt, dorsally

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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. 4321. 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. 30980; 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. Sepuls 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. ophyllum, 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, Inthu'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 subsected, 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 Himalays.

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Leaves 2, large, sub-opposite ... ... ... 1. L. ovala.

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. Lindwyana.
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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, subscute, 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 1833, 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 INAVATI 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 Inayet Khan at Bhurj in the Kagan Valley, Hazara, No. 22596. It flowers during July.

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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 Done 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 antiner. Restellum wide and preminent, projecting over the fertile stigma. Anther sub-quadrate, 2-celled, the dividing

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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 Duthic. 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 Garhwal 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. Sepuls 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; Kangra district, Duthie's Collector No. 23343; Deoban in Janusar at 9,000 feet, Gamble No. 27284; Garhwal, 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. 43.

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

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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. Pctals 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.

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Garhwal, 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 Duthic. 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 overy; 5 anther; 6 pollinia;—all calarged.

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. Srpals 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, Duthis'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; Hock, f. Fl. Br. Ind. vi, 121. P. Nervilia Blume Mus. Bot. i, 32. P. carinata. . Wight lc. 1720 (not of Lindl.). Nervilia Aragoana Gaud. in Freye. Voy. Bot. 422, t. 35.

Near Mussoorie at elevations between 4,000 and 6,000 feet, Mackinnon, Duthie Nos. 21782, 22704, 22976; Tehri-Garhwal 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 Dharwar" 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 potals removed; 3, lip, spread out; 4, column and overy; 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, Duthic's collector Nos. 23864, 23864(a), Rámganga Vulley in Kumaon, T. Thomson. Flowers during May, and the leaves appear about a mouth later. This species extends eastwards to Bengal and Burma and southwards to Bombay and S. India.

PLATE 124. Pogonia carinata Lind. 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. Flow rs in spikes or racemes, suberect. Sepals and petals subsimilar, free, connivent. Lip shorter than and concealed by the sepals and petals, aduate 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 enticous. 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; Done 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, manynerved, glabrous, but the margins often ciliolate. Raceme 1 to 3 dm. long, manyflowered, 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.

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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, Strackey & 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.

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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 ovatelanceolate, 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.

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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. Goodysra.

Stigmas 2, distant, lateral pollinia 2, bipartite (4 in

Anactochilus Roxburghii)

Lip saccate or cymbiform at the base ... 38. Zeuxine.

Lip spurred, its apex deeply 2-lobed ... 39. Anactochilus.

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, brond, 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.

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, ovateoblong, 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. amæna Bunge Enum. Pl. China 63. S. novæ-Zelandiæ Hook. f. Fl. New Zeal. 243. 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. amæna 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.

Lohuaghat 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.

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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 Anther broadly pyriform, obtuse; pollinia clavate-cylindric, sessile on anticous stigma. 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 Garhwal 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 subrevolute; 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, 519.

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. Peduncic 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, lenfy 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. Spike 2 to 8-flowered, not much longer than the leaves; rachis stout, pubescent; floral bract 2.2 cm. long, exceeding the slender pubescent overy, reddish tipped with green, puberulous above. Flowers large, secund, white tinged with vellow 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.

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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, subquadrate entire or bifid. Column very short, with two wings at its apex covering

the anther. Rostellum with two short stout parallel arms. Anther depressed, very shortly beaked, 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. Orcn. 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. Ancectochilus 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.

ANGECTOCHILUS 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,

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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 recuived. 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. 3.8; 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 Tehni-Garhwál, Royle. Flowers during July and August. It extends eastwards to Nepal, Sikkim, Bhutan, Assam, Sylhet, Manipur and China.

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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.	Orchia.
Flowers green or yellowish-green, rarely white; anther-cells often		
with long tubes, polliniar glands neked	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.	Sat yrium.

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; pollinic 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 0. 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	O. latifolis.
Flowers much smaller, pink or occasionally white, polliniar glands free	
and exposed	O. habenarioides.
Stem slender, leaves one to three, lip distinctly 3-lobed 3.	O. Chusun.
Stem slender, leaf usually solitary and near the base of the stem.	
Stigmas united, lip 3-lobed, spur longer than the ovary 4.	O. Stracheui.
Stigmas distinct, lip entire, spur shorter than the ovary 5.	O. muthulata.
Singmes distinct, tip entire, sput shorter than the others	

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 1.5 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 & 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 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 column; 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.

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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, Duthic 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 scpals, 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 Garhwal between 9,000 and 10,000 feet, Strackey & 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. Scaps 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. Polinia 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, 153; 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, Duthic Nos. 194, 515; Káli Valley in N. Kumaon at 13,000 feet, Duthic 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 clongate. 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

HABENARIA.

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a belt across the face of the column.—Species about 400, cosmopolitan in temperate and tropical regions.

side lobes broad, apical lobe narrow. Side lobes of lip deeply pectinate. Stigmas not produced; flowers large, white, spur 2½ times longer than ovary	Side lobes of lip deeply pectinate. Stigmas not produced; flowers large, white, spur 2\frac{1}{3} times longer than ovary	4. H.	. peolinata. . eneifolia.
Petals and lip white, spur stout, funnel- ehaped, its apex clavate and curved outwards	Petals and lip white, spur stout, funnel- shaped, its apex clavate and curved outwards Dorsal sepal and petals greenish-white, lip white; spur slender, clavate, curved inwards Anther-tubes long, slender, upright, spur longer than the ovary. Stigmas linear-lanceolate, spreading, petals gibbous on outer edge at the base Stigmas long, slender, cylindrical, curved	б. Н	. 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, oylindrical, 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 redical 9. H. plantaginea. Scape leafy upwards 10. H. triftora. Sect. 111. 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.	inwards Anther-tubes long, slender, upright, spur longer than the ovary. Stigmas linear-lanceolate, spreading, petals gibbous on outer edge at the base Stigmas long, slender, cylindrical, curved		·
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. Loaves redical 9. H. plantaginea. Scape leafy upwards 10. H. triflora. Sect. 111. 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. furci/era. Leaves pale-margined, flowers yellow 14. H. marginala. Leaves 2. Leaves radical, orbicular, cordate, margined 15. H. diphylla.	petals gibbous on outer edge at the base Stigmas long, slender, cylindrical, curved	6. H	
Side lobes of lip entire. Spur twice as long as the ovary	-t ·· ·· · · · · · · · · · · · · · ·	7, <i>H</i>	
Leaves redical 9. H. plantaginea. Scape leafy upwards 10. H. triflora. Sect. 111. 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. furci/era. Leaves pale-margined, flowers yellow 14. H. marginala. Leaves 2. Leaves radical, orbicular, cordate, margined 15. H. diphylla.	Spur twice as long as the overy		
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. furci/era. Leaves pale-margined, flowers yellow 14. H. marginala. Leaves 2. Leaves radical, orbicular, cordate, margined 15. H. diphylla. Leaves not radical, sub-opposite, orbicular, cuspi-	Leaves radical Scape leafy upwards 1		-
Spur equalling the ovary 12. H. pubescens. Anther-tubes short. Leaves 3 or more. Leaves not margined, flowers green 13. H. furci/era. Leaves pale-margined, flowers yellow 14. H. marginata. Leaves 2. Leaves radical, orbicular, cordate, margined 15. H. diphylla. Leaves not radical, sub-opposite, orbicular, cuspi-	side lobes very narrow and often filiform. Anther tubes long.	•• D	
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, cuspi-	Spur equalling the ovary 1 Anther-tubes short.		-
Leaves pale-margined, flowers yellow 14. H. marginala. Leaves 2. Leaves radical, orbicular, cordate, margined 15. H. diphylla. Leaves not radical, sub-opposite, orbicular, cuspi-	Leaves 3 or more. Leaves not margined, flowers green 1	13. H.	furcifera.
Leaves radical, orbicular, cordate, margined 15. H. diphylla. Leaves not radical, sub-opposite, orbicular, cuspi-	Leaves pale-margined, flowers yellow 1	14. H .	marginala.
	Leaves radionl, orbicular, cordate, margined Leaves not radioal, sub-opposite, orbicular, cuspi-		
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 author-	date, not margined 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. wrosolata. Flowers not secund, staminodes much shorter than the anther-cells 18. H. stenantha.	Flowers not secund, staminodes much shorter than		

Stigmatio 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 overy	22.	H. arcuata.
Lip oblong, its apex tridentate; spur much shorter		
than the overy	<i>23</i> .	H. viridis.
Sect. v. PeristylusPetals entire, lip slightly or not at all		
longer than the sepals, 3-lobed; spur very short, often		
sub-glohose.		
Flowers green.		
Leaf solitary, lip flat	24.	H. fallax.
Leaves 2 or 3, lower half of lip trough-shaped		
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		$m{H}$. constricta.
Sect. VI. PHYLLOSTACHYA.—Flowers large, in the axils of sheath-		
ing leaves, petals entire; lip broad, entire, petaloid,		
spur conico-infundibular; stigmatic processes none,		
rostellum obsoure	29.	H. galeandra.
Sect. vII. DIPYLA.—Flowers small, seound, lip 3-fid., spur in-		
flated, pollinia sessile on a single large obcordate gland		
seated in a sinus of the broad 2-lobed rostellum,		
	30.	H. secundiflora.
• •	٥٠.	11. Socumayiva.
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, amplexicall 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 authers 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 overy, 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 overy, 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 author-lobe; pollinia 2. obliquely ovate in outline; caudicles slender, dilated towards their bases and attached to small ovate brownish-vellow 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 sål 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, 24178); Bageswar in Kumaon, Duthie's collector No. 24063. Flowers during July. It extends eastwards to Bengal and Assam and southwards to Bombiy and S. India and Tenusserim; 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 Valcriana W allichii.

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

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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. arietina); King & Pantling in Ann. R. Bot. 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 Garhwal 4,000 to 5,000 feet, Roberts; Kumaon between 5,000 and 7,000 feet, Strackey & 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 pectinala 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 25 cm. long, ovate-lanceolate, acute, recurved at the apex, the inner surface almost white; lateral sepals spreading, falcately lanceolate, acuminate, 5 to 7-nerved, typs reflexed. Petals pure white, overlapping at their apices, as long as the dorsal sepal and tightly pressed against it, dimidiate-faicate, obtuse, margins minutely ciliolate.

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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, Strackey & 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 overy 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. Stammodes 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, Strackey & 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 mivute. 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, Faiconer, Duthie No. 521; Kumaon, Wallich, Royle, Strackey & 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. Ling 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); Garhwal 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 buse; 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. Stignatic 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; Garhwal and Kumaon up to 11,000 feet, Falconer, Strackey & 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 overy; 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, manyflowered, 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); Garhwal, 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., yellow-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. Stignatic 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

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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 stigms. 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, Duthic 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. Linu. 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; foral bract longer than the shortly stalked turnid 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 spices 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 Byans 11,000 to 12,000 feet. *Duthic* 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 Salyrium 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, ourve 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 louger 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

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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 Dalbousie 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, manyflowered, 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 ellipticoblong, 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. Celc. 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.; Garhwal, Falconer, Edgeworth, Royle, Mackinnon, Duthie Nos. 525, 24175, 22410, 22988; Kumaon at Kalimundi 8,500, Strachey & Winterbottom; F. Kumaon, Blinkworth, Duthie No. 3411, Duthic's collector Nos. 24066, 24067, 24070. Flowers during July and August. It extends eastwards to Nepal, Sikkim and Bhutan.

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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 evoid, 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 Vourn. 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. Cwloglossum 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.} HATENARIA FA'LAX King & Pantling in Ann. R. Bot. Gard. Calc. viii, 325, t. 428.

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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 overy. 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 fallaz 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, amplexicall 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, Strackey & Winterbottom No. 32, Colonel Davidson; Rálam Valley at 12,000 feet, Strackey & 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. fallar, 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 cbovate, 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; Kinzl. Orch. Gen. and Sp. 510.

Debra-Dun, Machinnon 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 sizs. 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, sweetscented; 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 HABENARIA. 193

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. II. 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 Garbwál, Duthie's collector No. 24169; near Almora in Kumaon at 4,000 feet, Strackey & 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, Duthic Nos. 17826, 21757, 22729; Garhwál, Royle, Kirg; 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. Snike 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, ciliolatethe 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. Sligmas 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 leucentha Herb. Ham.

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Dehra Dun in sal 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 amplexicall, 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, cunciformly obovate or obcordate, often nucronate, 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 auther-tubes. Ovary curved, the ribs brownish purple and puberulous. Hook, f. Fl. Br. Ind. vi, 163; Collett Fl. Siml. 506. Plutanthera obvordata Lindl. in Wall. Cat. 7050; Gen. and Sp. Orch. 290; Rolfe in Journ. Linn. Soc. xxxvi, 56. P. galeandra Reichb. f. in Linnæa xxv, 236. P. Championi Lindl. in Hook. Journ Bot. vii, 38. Gymnideniu obcordata and galeandra Reichb. f. Ot. Bot. Hamb. 32, 33. Orchis obcordita 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, Strackey & Winterbottom No. 40; T. Thomson, Colonel Davidson, Duthie's collector No. 21064. 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 racemo 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

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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 auther. 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.

Tuters 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. Auther broad, rounded or retuse at the apex, cells diverging at the base; politinia obovate, the caudicles short and very slender, glands minute. S'aminodes 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. deceptions Hook. f. Fl. Br. Ind. vi, 165 (not of Wight). Diphylax Griffithii Krnzl. Orch. Gen. and Sp. i, 599. Herminum Griff. Notul. iii, 270; Ic. Pl. As. t. 285, fig. 1.

Bundai in the Chitral di trict 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 staminoles and the forked rostellum; 4, column, seen from behind; 5, pollinia;—all enlarged.

42. Herminium Linu.

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 ar 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.

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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.
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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 Strackey & 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 anthercells. 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. Accras 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 lc. 1691. H. longicruris, Wright in Mem. Amer. Acad. Ser. 2, vi, 141. This be 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 amplexical tubular bases, 3.5 veined. Spike cylindric, about 11 cm. long, many-flowered.

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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, pullmia 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. laxiforum 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, cronulate, 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. II. unalascheense Reichb. f. Ic. Fl. Germ. xiii, 107, t. 417. II. Schischmareffiana Chamiss. in Linnæa iii, 29. Platanthera Schischmareffiana Lindl. Gen. and Sp. Orch. 286. Neottia macrophylla Don. Prod. 27. Spiranthes macrophylla and unalascheensis 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, Duthic'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 steet 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; Garhwal, on the northern slopes of Srikanta in the Baghirathi Valley at elevations between 14,000 and 15,000 feet, Duthic 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. Rostelium 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, Strackey & 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, amplexicall, 5 to 10 cm. long, ovate-cordate obtuse or acute, many-nerved. Raceme

SATYRIUM 201

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. Polliniz 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, Strackey & Winterbotton 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 arcned, 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 Lin 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

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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. Perrottekianum A. Rich. in Ann. Sc. Nat., Ser. 2, xv, 76, t. 53; Wight Ic. 1716. S. albiforum 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.

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; Dene 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.

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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 reddishor 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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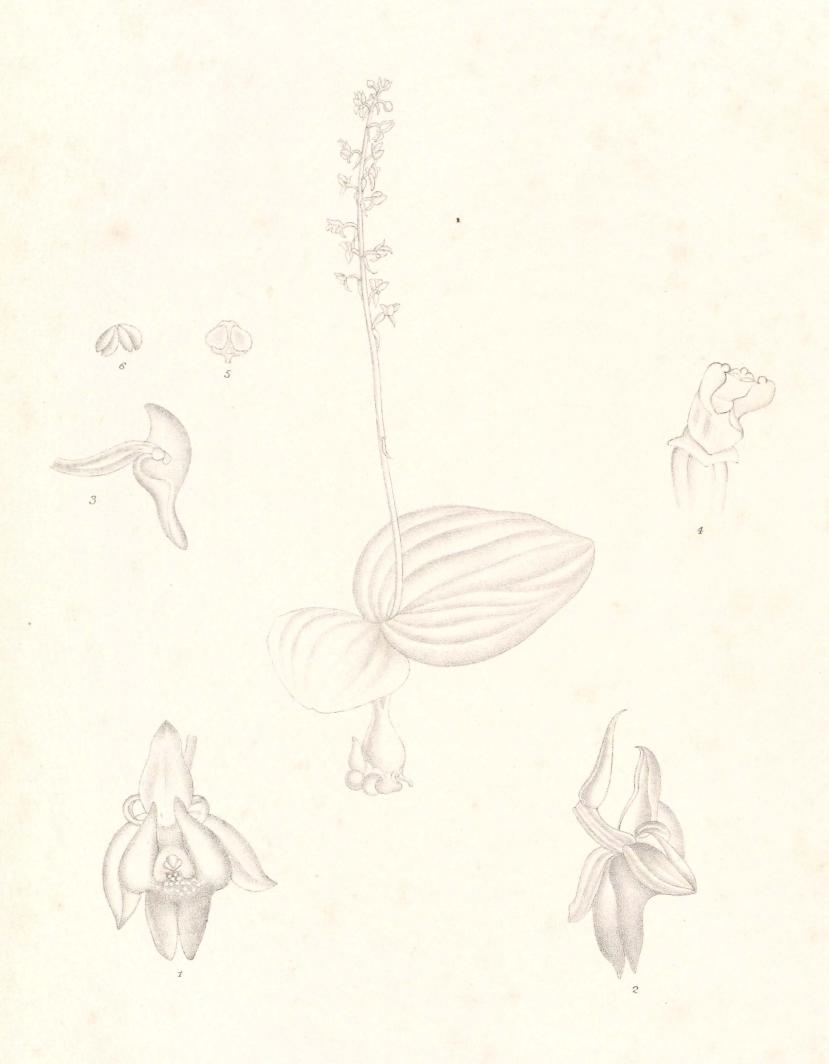
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(Peloriate state.)

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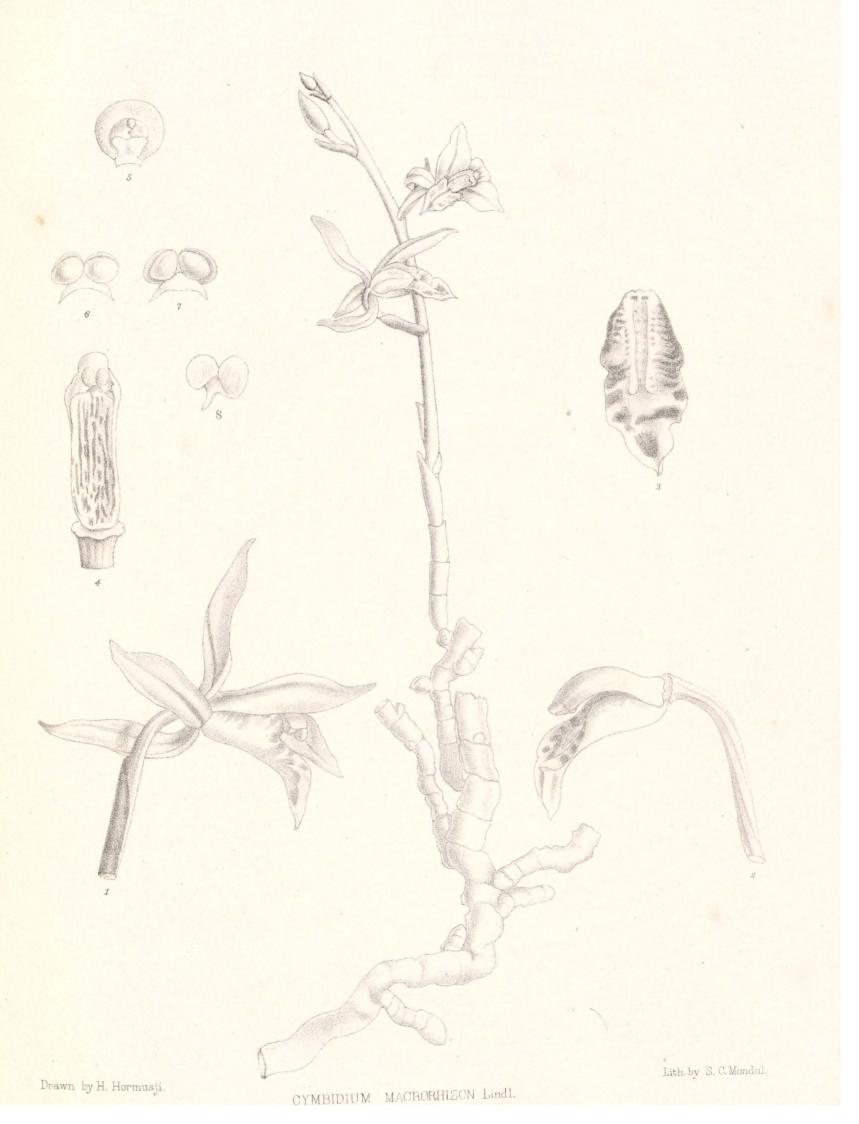




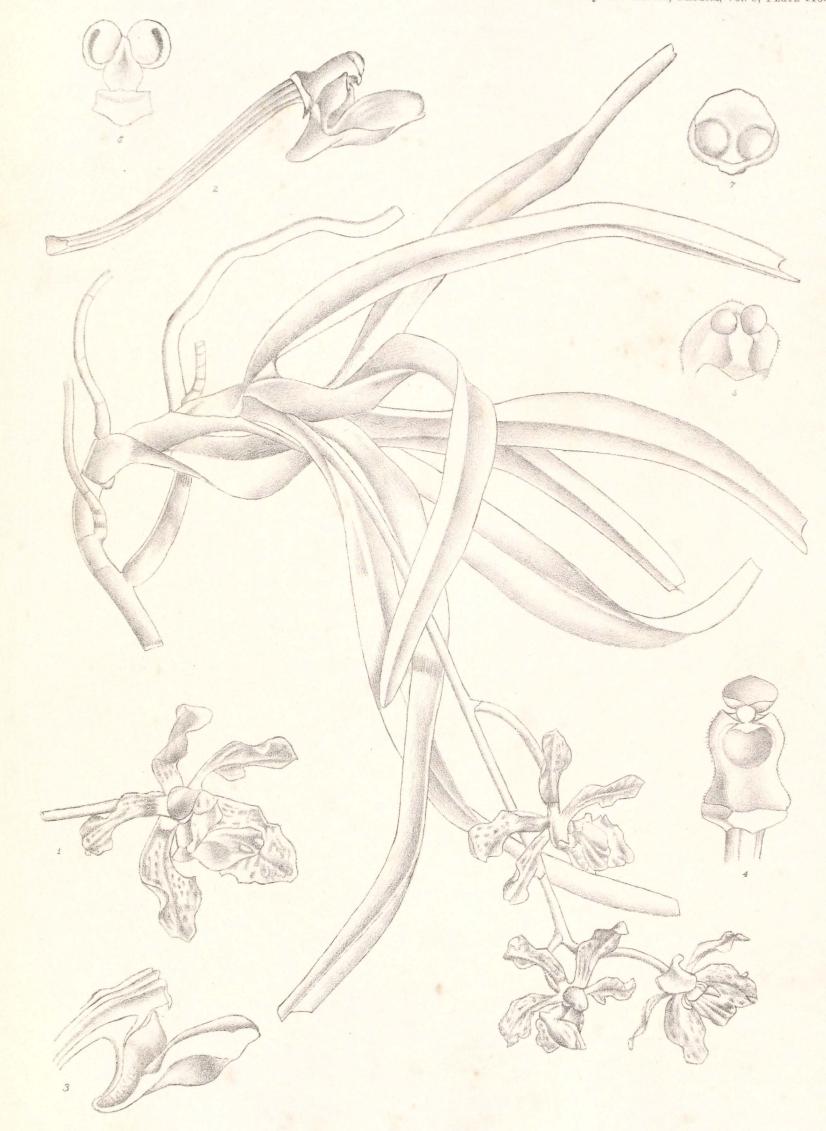
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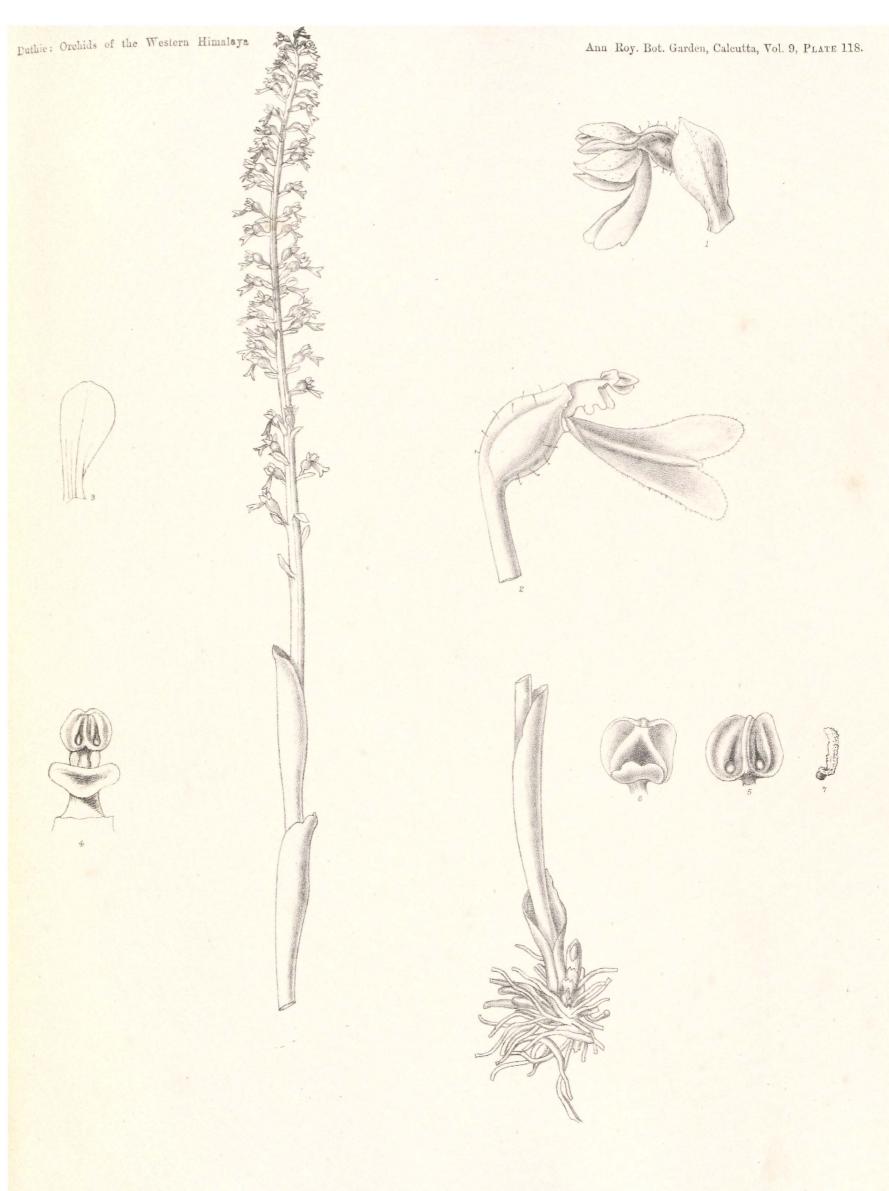


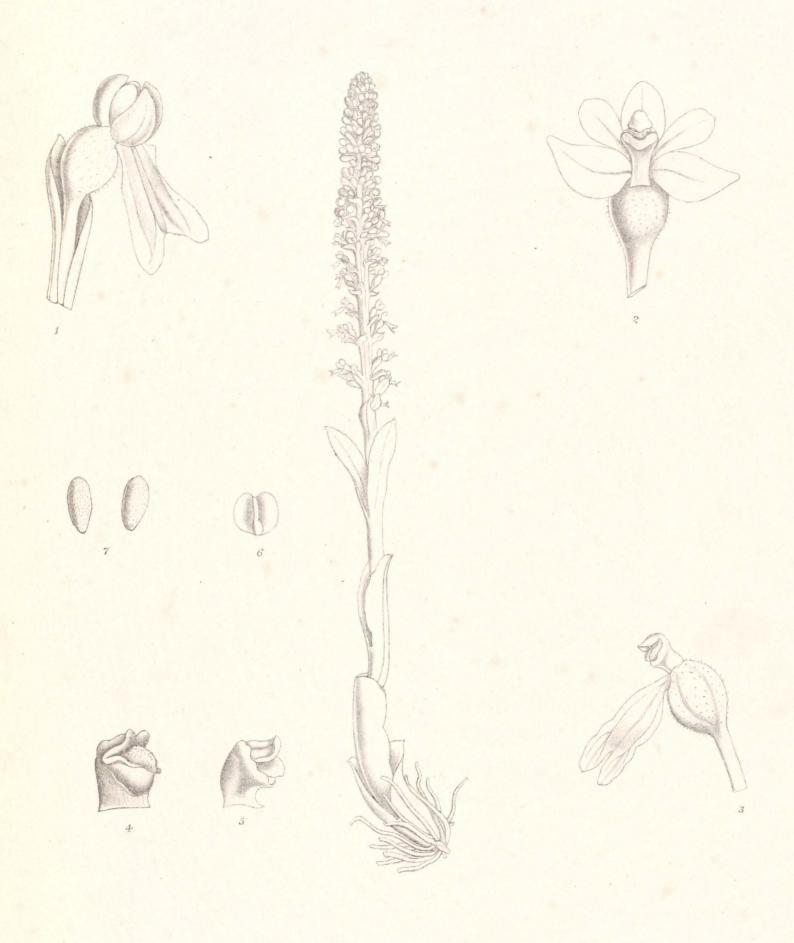


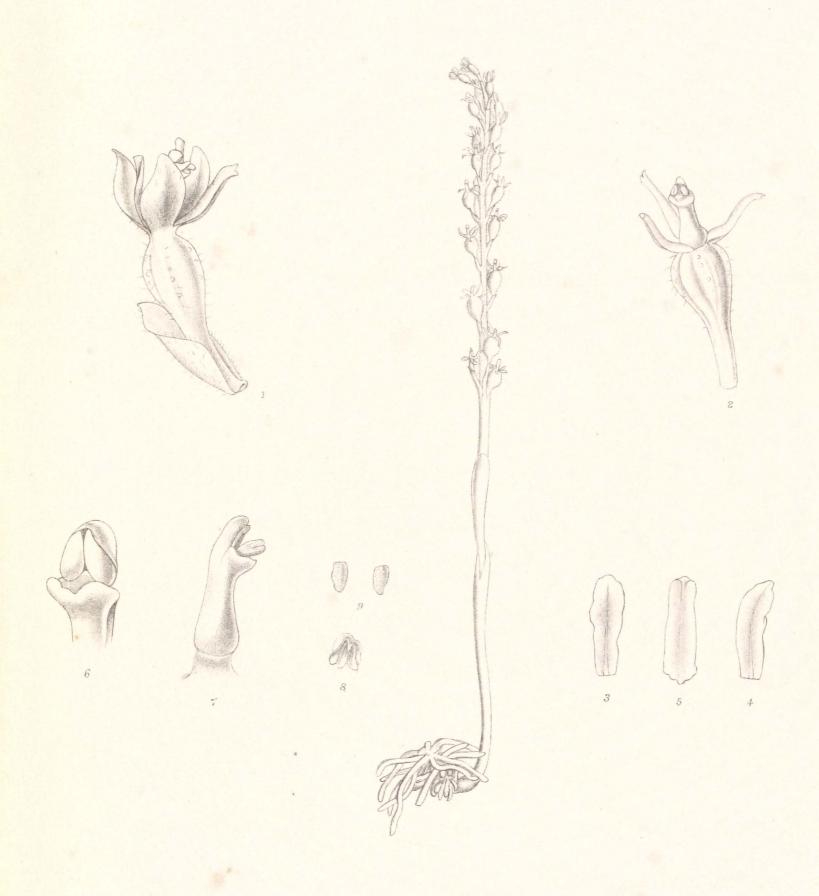


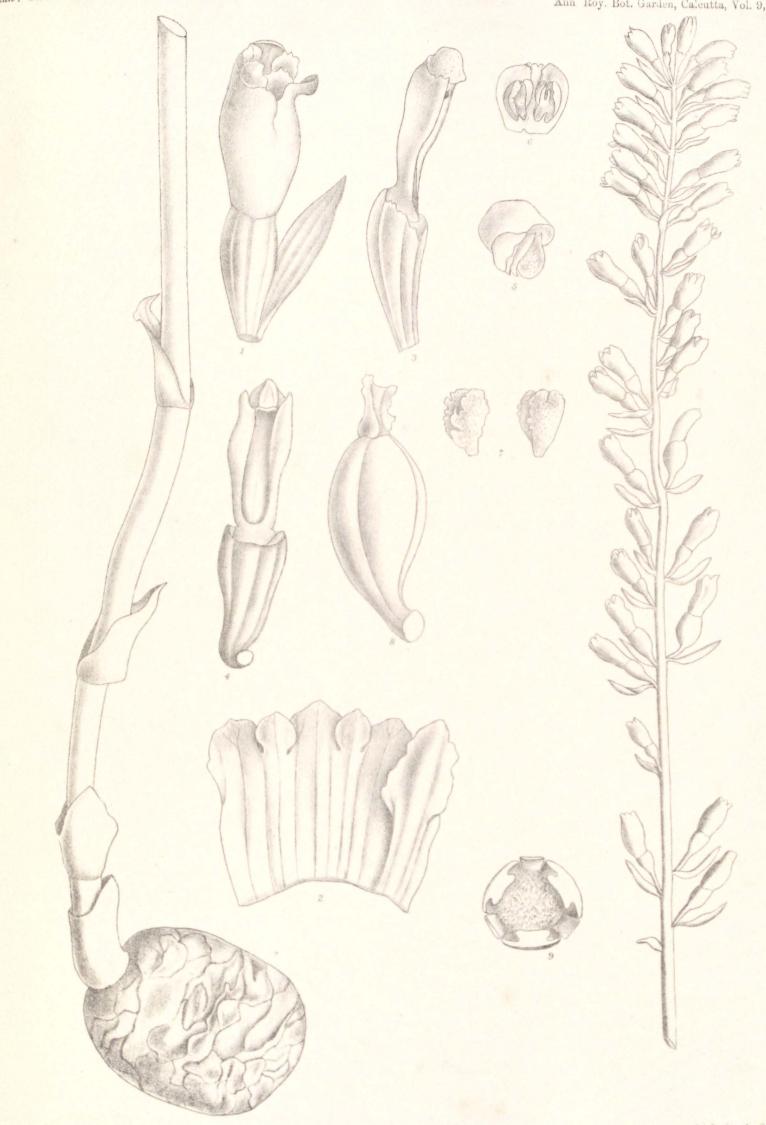
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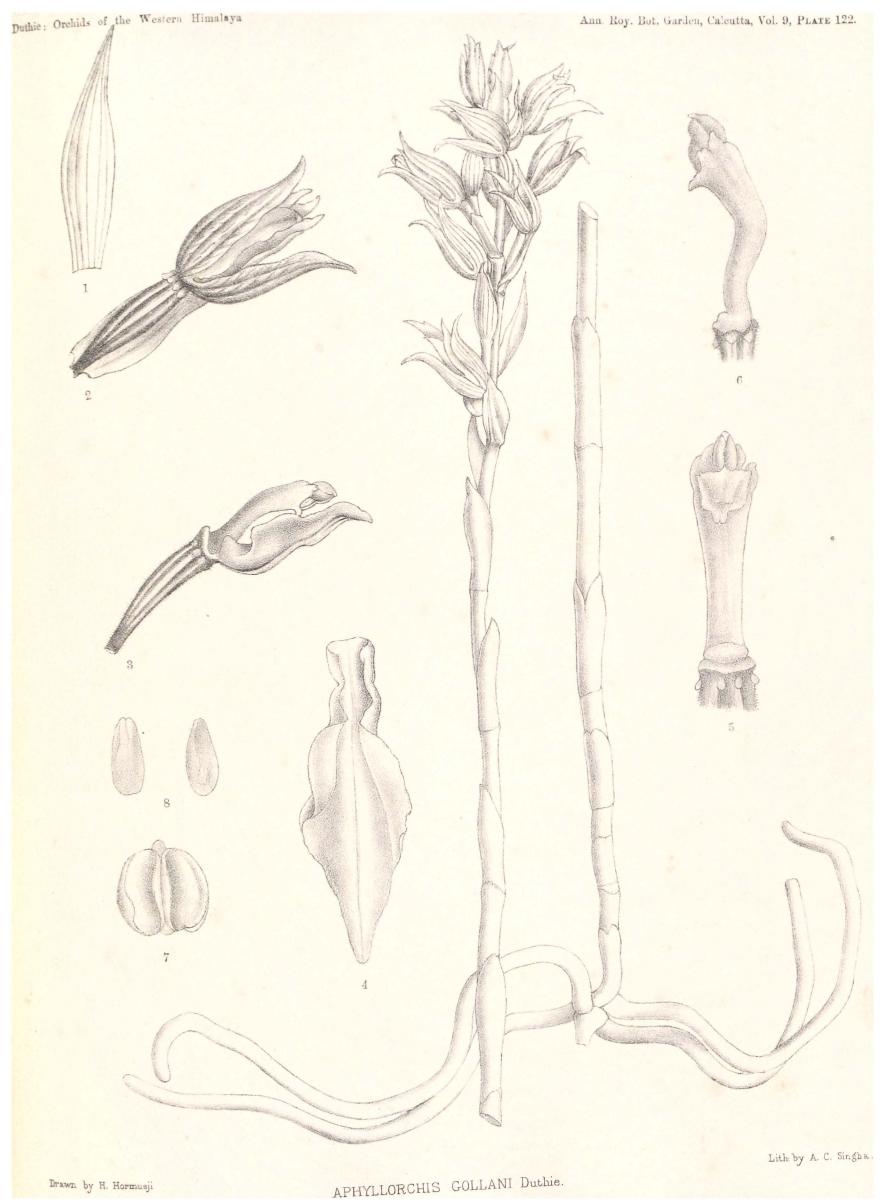
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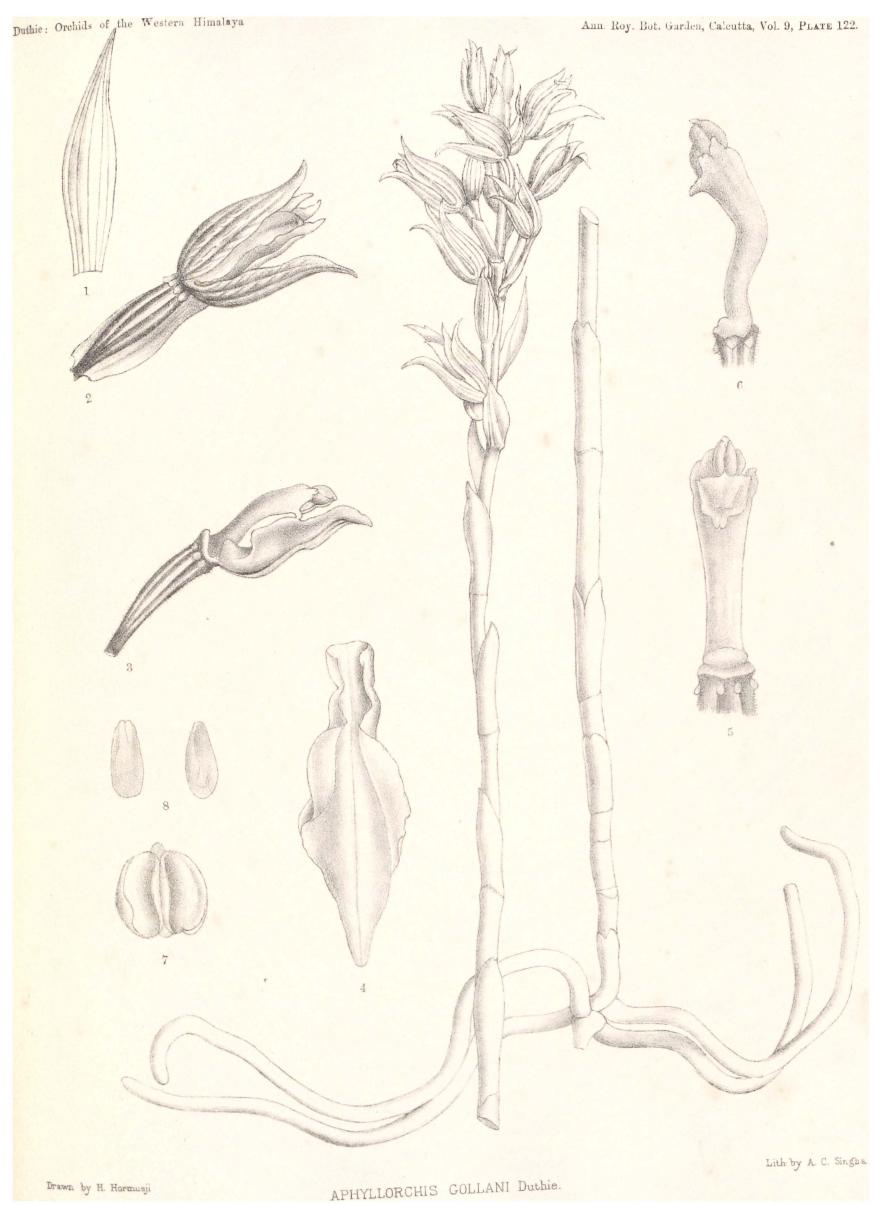


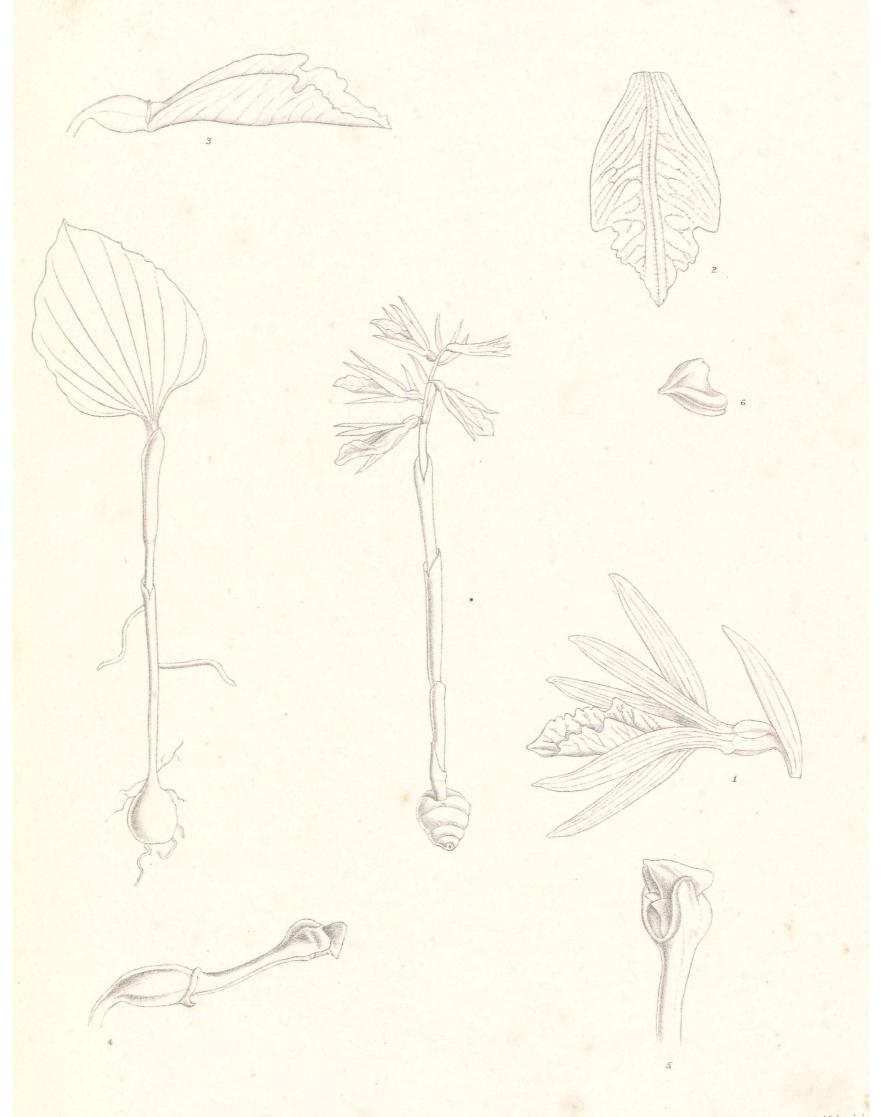
















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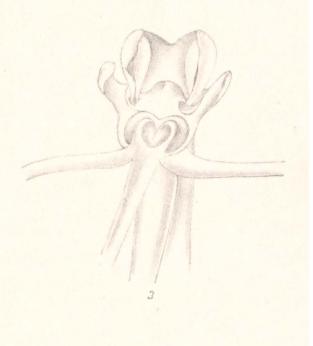




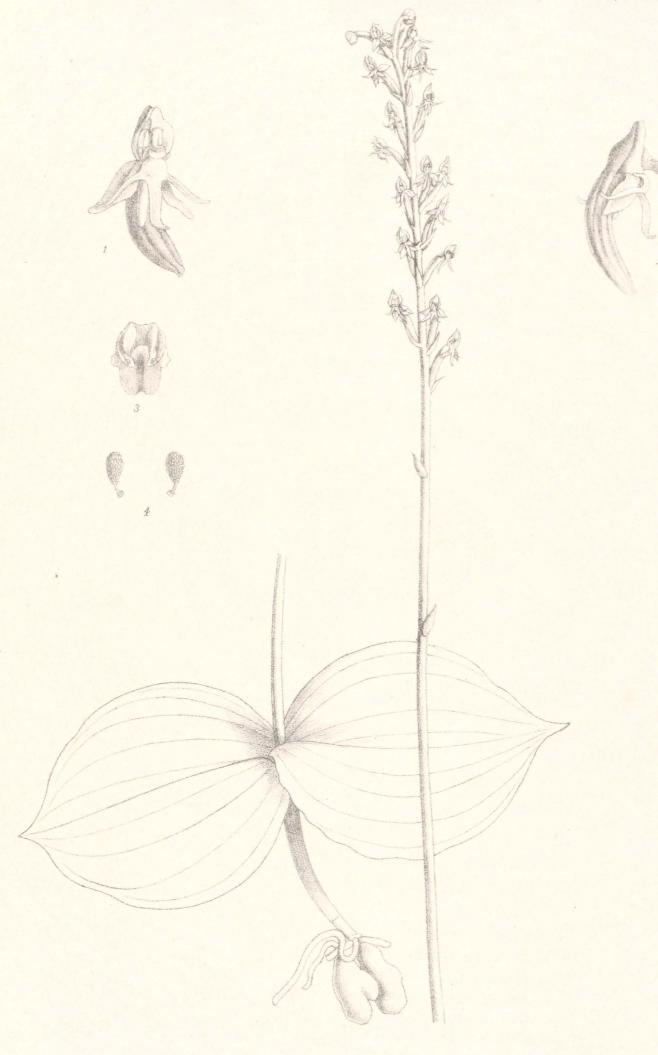








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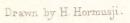












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