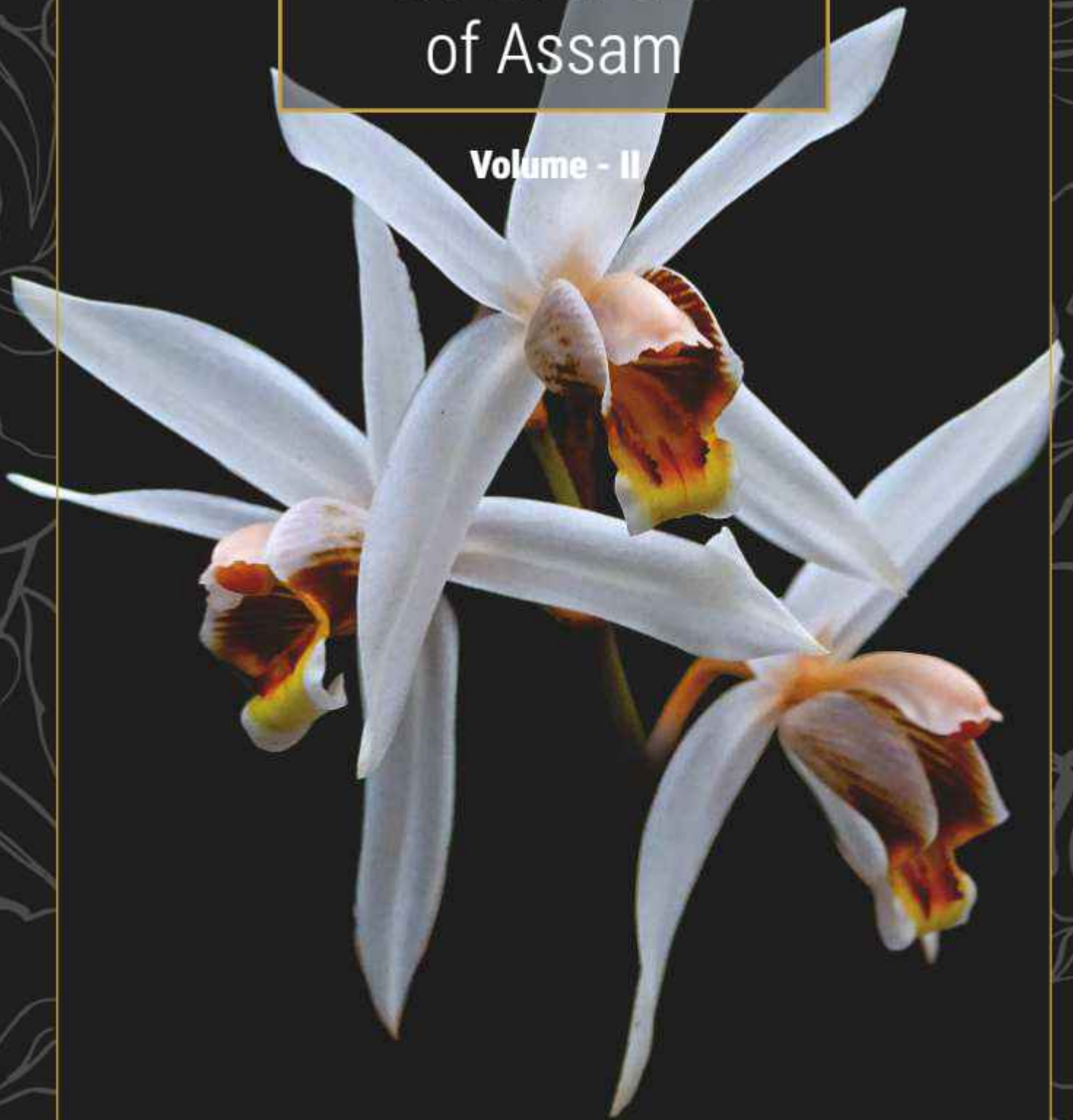


An illustrated guide to the
orchids
of Assam

Volume - II



BALIPARA FOUNDATION
Assam • India

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Hussain A. Barbhuiya
Durgesh Verma
Santanu Dey
C. K. Salunkhe

BALIPARA FOUNDATION
Assam • India

1-A, Nabin Enclave, Mother Teresa Road,
Guwahati-781021, Assam, India
2021

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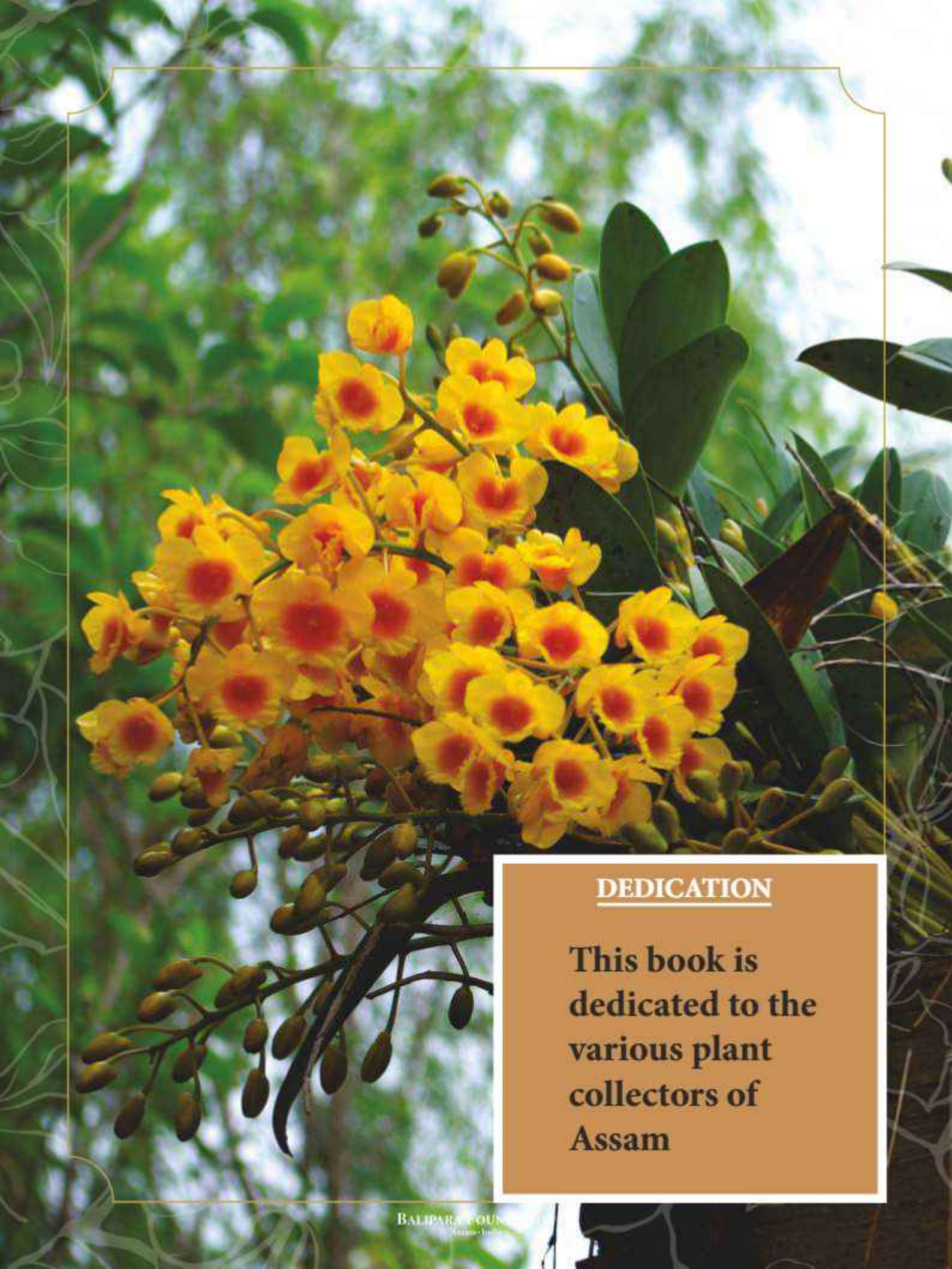


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DEDICATION

**This book is
dedicated to the
various plant
collectors of
Assam**



Habenaria dentata (Sw.) Schltr.



A. M. Singh, IFS

প্রধান মূখ্য বন সংৰক্ষক ও বন বল মুৰব্বী, অসম
**Principal Chief Conservator of Forests
& Head of Forest Force, Assam**

MESSAGE

Orchids are highly evolved and the most diverse group of plants but at the same time very sensitive to even the slightest change in their habitat. In the backdrop of tremendous human and biotic pressure on natural resources, particularly forest resources, orchids are always under threat. With about 28,000 species, the family Orchidaceae occupies the second position among flowering plant families, accounting for about 8% of angiosperms worldwide. Although individual orchid species are often narrowly distributed, the family itself is widespread, as orchids are present in every continent except Antarctica. They occur in a variety of habitats including forests, wetlands, shrublands and grasslands, and include terrestrial, epiphytic and lithophytic growth forms. Orchid flowers exhibit a high degree of speciation, with wide variations in floral features such as morphology, colour, size and fragrance to attract pollinators. Northeast India is counted among one of the world's most biodiversity-rich areas and it is a hot spot of orchid. The state of Assam contributes a significant amount of orchid diversity.

I am very happy that the authors have put their great efforts to document the orchid flora of Assam by extensive field survey and herbarium study. They have recorded about 477 orchid taxa (469 species, 3 subspecies, and 5 varieties) belonging to 107 genera from the ambit of the political boundary of Assam and presented in the form of a beautiful guidebook. Majority of the orchid species are superbly illustrated with coloured photographs and Lankester Composite Dissection Plates. In addition, lucid taxonomic keys and descriptions have been given at various hierarchy levels (e.g. Subfamily > Tribe > Genera > Species > Variety) for easy and precise identification of taxon by avoiding confusion. This book indeed offers a complete and comprehensive account of Assam's orchid flora.

I hope this guidebook will be an asset for amateur orchid lovers, students and researchers, field botanists and foresters for precise identification of orchid species as well as in formulating any pertinent conservation action.

(A. M. Singh)

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Aerides odorata Lour.



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FOREWORD

It is always a pleasure to see a new geographical treatment of orchids presented with such great detail and obvious enthusiasm provided by the authors. This treatment of the orchids of Assam sets a very high standard for other such publications, which I hope will be followed by authors of many orchid-rich areas of the World. There are not only the orchids here but also a great deal of other information about orchids, so this volume is in a general sense educational and provides an easy entrance into the world of orchids, helping the novice with terminology, ecology and conservation. The orchid flora of Assam is a mixture of tropical and subtropical elements, and these elements are wonderfully captured in photos, line drawings and descriptions. The authors are to be commended for the high quality of this work, which will be enjoyed by many.

(Mark W. Chase)



Dendrobium devonianum Paxton

A TAPESTRY WOVEN WITH ORCHIDS – A CALL TO CONSERVATION OF THE EASTERN HIMALAYAS

As we close this exploration into the captivating world of Eastern Himalayan orchids, a sense of awe lingers. These botanical marvels, draped across the slopes of Assam and cradled in the valleys of neighbouring nations, are not mere aesthetic delights. They are vibrant threads woven into the very fabric of the region's biodiversity and ecological health.

Many of my beliefs and thoughts are strongly influenced by the works of Frank Kingdon Ward. He was a renowned botanist and daring adventurer who made a lasting impression on the search for the Eastern Himalayan region's botanical treasures. His writings introduced me to the works of J.D. Hooker and encouraged me to delve deeper into the past in order to comprehend the history of biodiversity in the Himalayan region. In the 1980s, he wrote works about the flora of North Eastern India, such as *Rhododendron* of Sikkim-Himalaya and *Flora of British India*. It dawned on me, after reading these articles, exactly how priceless these natural resources are, and what a significant cultural and generational impact they have had and continue to have. This ignites a desire within me to protect this abundance of natural resources for future generations.

From a biodiversity standpoint, the Eastern Himalayas boast a staggering number of orchid species, many endemic – found nowhere else on Earth. Assam, a state cradled in the embrace of these mighty mountains, is a hotspot of this floral richness. Here, over 477 taxa, encompassing 469 species, 3 subspecies, and 5 varieties, thrive in a symphony of colours and shapes. Each orchid, with its specialised adaptations and intricate relationships with pollinators, plays a vital role in the intricate web of life. They are like the keystone species, holding the ecological balance in place.

I've always found the documentations showcasing the amazing natural assets produced by Naresh Swami to be rather captivating. His famous book on terrestrial orchids, published in April 2016, not only chronicles several rare orchid species but also reports on 12 species that have never been reported previously, demonstrating his accomplishment with his meticulous research and exceptional knowledge and comprehension of their habitats.

Consider the staggering diversity. In India alone, the Northeastern region cradled in the Eastern Himalayas is a hotspot of orchid biodiversity. Sikkim, a land of towering peaks and vibrant valleys, harbours over 500 orchid species, including the incredible *Paphiopedilum Fairrieanum*, also known as the Venus Slipper orchid, with its captivating pouch-like flower. Neighbouring Arunachal Pradesh boasts an even greater number, exceeding 560 species. Here, the *Coelogyne Corymbosa*, with its cascading clusters of fragrant white flowers, adds its own touch of magic.

Bangladesh, though smaller in area, contributes significantly to the region's orchid wealth. The misty hills of Chittagong are home to the rare *Luisia Teretifolia*, with its cascading chains of white, star-shaped blooms. Nepal, the land of Mount Everest, offers a treasure trove of orchid diversity as well. The cool, moist forests of its lower Himalayas shelter the elusive *Cypripedium Himalaicum*, the Himalayan Lady's Slipper, a marvel with its deep maroon pouch and delicate yellow petals.

Beyond their individual contributions, orchids serve as ecosystem engineers. Epiphytic orchids, clinging to the branches of towering trees, create miniature ecosystems within themselves. These 'sky gardens' provide a haven for a diverse range of insects, small animals, and even other epiphytes, fostering a vibrant microcosm of life.

high above the forest floor. Terrestrial orchids, carpeting the understory, contribute to healthy soil structure and nutrient cycling, ensuring the continued vitality of the entire ecosystem. However, the future of this orchid haven is far from certain. Habitat loss due to deforestation, encroachment, and unsustainable extractive resource use threatens to unravel this delicate tapestry. Climate change, with its unpredictable weather patterns and rising temperatures, poses another significant threat. The Eastern Himalayas are experiencing a shift in climatic conditions. Rising temperatures are disrupting the delicate balance that allows orchids to flourish. Many species rely on specific temperature ranges for optimal flowering and seed production. Deviations from these ranges can lead to earlier or later blooming, throwing off the synchronised dance with their pollinators. This can lead to failed reproduction and population decline.

Erratic rainfall patterns further complicate matters. Orchids, especially the epiphytic varieties, depend on a consistent level of moisture for survival. Droughts can yet leave them parched and vulnerable, while intense downpours can lead to erosion and damage to their delicate root systems. The loss of even a single orchid species can have cascading effects. Many orchids have specific pollinators, often insects with specialised mouthparts adapted to reach the orchid's nectar. The decline of an orchid species can lead to the decline of its pollinator, further disrupting the ecological balance.

This breathtaking Venus Slipper orchid (*Paphiopedilum Fairrieanum*) found in Sikkim and other parts of the Eastern Himalayas, relies on a specific pollinator – a moth with a long, slender proboscis perfectly adapted to reach the deep nectar pouch within the orchid's unique slipper-shaped flower. If the *Paphiopedilum Fairrieanum* were to decline due to habitat loss or climate change, its specialised moth pollinator would also be at risk. The moth's long proboscis wouldn't be effective in reaching nectar from other orchid species, leading to a decline in its population. This, in turn, could disrupt the reproduction of other plants that rely on this particular moth for pollination, creating a ripple effect throughout the ecosystem.

Protecting these exquisite flowers is not merely about safeguarding beauty - it's about preserving the very lifeblood of the Eastern Himalayas, with Assam serving as a crucial piece of this ecological mosaic. We must move beyond a narrow appreciation of orchids as ornamental pieces and recognise their intrinsic worth. Conservation efforts must shift focus to protecting ecosystems and habitats - the very foundation upon which orchid diversity thrives. This requires a multi-pronged approach. Sustainable forestry practices, community-based conservation initiatives, and responsible tourism are all crucial steps. Fostering a sense of value for these natural treasures, not just for their aesthetic appeal but for their ecological significance, is equally important.

The Eastern Himalayas, adorned with a breathtaking array of orchids, stand as a symbol of verdant and unique biodiversity. Assam, a state blessed with this floral richness, serves as a microcosm of this ecological wonder. The sheer richness of orchid species, from the miniature jewel orchids carpeting the forest floor to the flamboyant orchids adorning the trees, speak volumes about the health and complexity of the ecosystem. Their intricate relationships with pollinators, their role in soil health, such as through their association with mycorrhizal fungi that enhance nutrient uptake, and their contribution to the creation of micro-habitats within the forest canopy, all paint a picture of a vibrant and interconnected web of life.

The Malay Archipelago, by Alexander Russel Wallace, which details the natural and geological history of the Malay Archipelago, and Uncovering the World Columbus Created, by Charles C. Mann, are the books that have had a significant influence on my philosophical views regarding the commonality of the human role in nature. Imagine a future where the vibrant tapestry of the Eastern Himalayas remains intact. Visitors continue to be awestruck by the cascading sprays of Cymbidium orchids or the delicate blooms of the slipper orchids. Local communities benefit from sustainable practices that protect these ecological wonders, fostering a harmonious relationship between people and nature. Let us strive to be the generation that ensures this breathtaking symphony of life continues to flourish, a testament to the enduring beauty and irreplaceable value of the Eastern Himalayan orchid haven.

RANJIT BARTHAHAKUR

Founder Trustee, Balipara Foundation Sonitpur, Assam

PREFACE

The “*Flora of Assam*” was compiled between 1934 to 1940 by U.N. Kanjilal, with his son P.C. Kanjilal and co-workers A. Das, C. Purkayastha and R.N. De, (Vol. I-IV) which covers the dicotyledons but chiefly woody tree species and the fifth volume of the series was on family Poaceae, which was done by N.L. Bor. As far as documentation of the monocotyledonous flora of Assam is concerned, A.S. Rao and D.M. Verma had published a series of papers in the “*Bulletin of the Botanical Survey of India*” during 1970 to 1976 under the heading “*Materials towards Monocot flora of Assam*”. But unfortunately, they were unable to compile the family *Orchidaceae*. Now about eight decades elapsed since the last volume of the *Flora of Assam* been appeared. To date, no comprehensive work on the Orchid flora of the state is available, which warrants the compilation of a book on this magnificent group of plant.

During our preliminary field visits, we encountered many fascinating orchid species, especially from the peripheral boundary of the state, but they were likely to be vanishing rapidly from such areas due to various anthropogenic activities. For example, *Paphiopedilum spicerianum* - a beautiful lady's slipper orchid was known to inhabit at the steep river gorges and steep, rocky, cliff faces of streams that run down to meet the Sonai and Barak Rivers in Cachar district of Assam, but nowadays this species is almost disappeared from these places. On the other side, many endemic orchid species (e.g. *Dendrobium assamicum*, etc.) have been described from Assam, but after their first report, no one has been able to relocate or collect them either from the type locality or from anywhere else. We started realizing that a considerable number of orchid species might be vanishing from Assam before they are being described scientifically. The above circumstances have provoked us to compile a detailed account on Orchid Flora of Assam. We started our journey in an organized manner from January 2010 and made several field explorations across the length and breadth of the state. During this journey, we got many nobilities including plenty of new distributional records. It is worthwhile to mention here that, while conducting a field explorations at southern part of Assam, the first author had discovered a new orchid species viz. *Ornithochilus cacharensis* (now, *Phalaenopsis cacharensis*), which was found at critically endangered condition i.e. only a single mature individual was located in entire field explorations. Similarly, *Geodorum appendiculatum*, a terrestrial orchid is rediscovered after 169 years; *Dendrobium darjeelingensis*, a miniature epiphytic orchid is collected for the first time from North-East Indian (Assam) phytogeographical province; *Lecanorchis taiwaniana*, a mycoheterotrophic orchid is reported for the first time from India.

In the present book, our main focus is to provide a complete and comprehensive taxonomic account of family *Orchidaceae* in Assam with special emphasis on its subfamilies, tribes, genera, individual orchid species, and variety. The book is supplemented with lucid taxonomic keys at various hierarchy levels, coloured photographs, Lankester Composite Dissection Plates, and conventional black and white line drawings. So, anyone who is not an expert in this field can easily recognize orchid flora of his/her surroundings. Besides above, detailed distributional data for individual species, nature of the habitat, time of blooming, and regional conservation status have also been provided. Hope this book will throw light on diversity, distribution, habitat specificity and rarity of wild orchids of Assam and can be helpful for students, amateur orchid lovers, foresters, field botanists, conservationists and researchers for authentic identification as well as in formulating any pertinent plan for the conservation of threatened orchid species of the state.

Hussain A. Barbhuiya
Durgesh Verma
Santanu Dey
C. K. Salunkhe



Gastrochilus obliquus var. *suavis* (Seidenf.) Z.H.Tsi

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Hussain A. Barbhuiya
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Santanu Dey
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ABBREVIATIONS USED

- acc. no. = accession number
alt. = altitude
auct. non = the name has been used by one author in the wrong sense
B.R. = Biosphere Reserve
ca. = *circa*: about
cm = *centimetrum*: centimetre
diam. = *diametro*: diameter
e.g. = *exempli gratia*: for example
et al. = *et alia*: and others things
etc. = *et cetera*: and the rest
ide = with faith: used when quoting another person's observation
ig. = *igura*: igure(s)
F.V. = Forest Village
herb. = herbarium
i.e. = *id est*: that is
Is. = Island
ined. = *ineditus*: unpublished
liv. mat. = living material
l.c. = *loco citato*: at the place cited
m = *metere*: meter
mm = *millimetrum*: millimetre
no. (s) = number (s)
nom. Illeg. = *nomen illegitimum*: illegitimate name
nom. nud. = *nomen nudum*: name unaccompanied by the description or reference to a published description
N.P. = National Park
n.v. = *non vidi*: I have not seen
op. cit. = *opera citato*: in the work cited
pers. obs. = personal observation
p.p. = *pro parte*: meaning partly
R.F. = Reserve Forest
sensu auct. = as used by the cited author, but excluding the original name
s.coll. = *sine collector*: without the collector's name.
sp. / spp. = species / more than one species
s.l. = *sensu lato*: in the broad sense
sine loc. = *sine loco*: without a place
s.n. = *sine numero*: without the collector's number.
sq. km. = square kilometer
subsp. = Subspecies
syn. nov. = *synonymon novum*: new synonym
t. = *tabula*: igure.
T.E. = Tea Estate
var. = *varieta*: variety
viz. = *videlicet*: namely
W.L.S. = Wildlife Sanctuary
! = seen / examined
** = occurrence doubtful

CONTENTS

I. Systematic account	1-2
II. Introduction for Subfamily: Epidendroideae	3-4
III. SUBFAMILY: EPIDENDROIDEAE	5-183
Tribe: Neottieae	5-9
1. <i>Aphyllorchis</i> Blume	5
2. <i>Cephalanthera</i> Rich	7
Tribe: Tropidieae	11-14
3. <i>Corymborkis</i> Thouars	11
4. <i>Tropidia</i> Lindl	13
Tribe: Gastrodieae	16-18
5. <i>Didymoplexis</i> Grif	16
Tribe: Nervilieae	20-27
6. <i>Nervilia</i> Comm. ex Gaudich	20
7. <i>Epipogium</i> J .F. Gmel. ex Borkh	26
Tribe: Arethuseae	29-87
8. <i>Anthogonium</i> Wall. ex Lindl	30
9. <i>Arundina</i> Blume	32
10. <i>Coelogyne</i> Lindl	36
11. <i>Neogyna</i> Rchb.f	60
12. <i>Otochilus</i> Lindl	61
13. <i>Panisea</i> Lindl	67
14. <i>Pholidota</i> Lindl	72
15. <i>Pleione</i> D.Don	80
16. <i>Thunia</i> Rchb.f	84
Tribe: Cymbidieae	89-127
17. <i>Cymbidium</i> Sw	89
18. <i>Eulophia</i> R.Br	109
19. <i>Geodorum</i> Jacks	122
Tribe: Epidendreae Kunth	128-133
20. <i>Cremastra</i> Lindl	128
21. <i>Agrostophyllum</i> Blume	130

Tribe: Collabieae	135–183
22. <i>Acanthephippium</i> Blume	135
23. <i>Ania</i> Lindl	139
24. <i>Calanthe</i> R.Br	144
25. <i>Cephalantheropsis</i> Guillaumin	158
26. <i>Chrysoglossum</i> Blume	162
27. <i>Collabium</i> Blume	165
28. <i>Nephelaphyllum</i> Blume	166
29. <i>Pachystoma</i> Blume	168
30. <i>Phaius</i> Lour	170
31. <i>Spathoglottis</i> Blume	176
32. <i>Tainia</i> Blume	179
 IV. LIST OF EXCLUDED AND DOUBTFUL TAXA	 185–186
V. CHECKLIST OF SPECIMENS	187–193
VI. GLOSSARY	194–205
VII. REFERENCES	206–212
VIII. INDEX OF BOTANICAL NAMES	213–220
IX. THE AUTHORS	221–222



Coelogyne viscosa Rchb.f.

SYSTEMATIC ACCOUNT

Orchid flora of Assam comprises 477 taxa (469 species, 3 subspecies, and 5 varieties) belonging to 107 genera, distributed in 5 subfamilies, 15 tribes, and 15 subtribes. They are classified according to Chase *et al.* (2015). The subfamilies are keyed out with their prominent characteristic features. Under each subfamily, different tribes are keyed out and are described in alphabetical order. Similarly, under each tribe different genera and species are keyed out and described in alphabetical order. The species with an uncertain/doubtful occurrence in Assam are marked with ** at the key to the species. For each species taxonomic citation followed by detailed description, habitat, flowering time, distribution, and conservation status has been provided.

Key to the Subfamily

- 1a. Pollen mealy or paste-like, not forming well-defined pollinia2
- 1b. Pollen coherent, forming definite pollinia4
- 2a. Fertile anther 1, incumbent; stem leaves without sheathing bases *Vanilloideae*
- 2b. Fertile anthers normally 2 or 3; leaves with sheathing bases3
- 3a. Lip similar to petals, fertile anthers lance-linear; staminodium finger-like *Apostasioideae*
- 3b. Lip saccate, fertile anthers oblong to ovate, staminodium shield-like *Cypripedioideae*
- 4a. Anther distinctly incumbent *Epidendroideae* [in part]
- 4b. Anther erect or bent back5
- 5a. Leaves convolute but not strongly plicate, roots often tuberous or fleshy *Orchidoideae*
- 5b. Leaves usually distinctly plicate; roots fleshy *Epidendroideae* [in part]

Systematic overview: The number of species known from Assam and the total number of species in the genus are indicated between brackets.

Subfamily: **APOSTASIOIDEAE**

Genus: *Apostasia* (3/6).

Odontochilus (4/25), *Vrydagzynea* (1/43), *Zeuxine* (12/74).

Subfamily: **VANILLOIDEAE**

Tribe: **Vanilleae**

Genus: *Cyrtosia* (1/5), *Erythrorchis* (1/2), *Galeola* (1/6), *Lecanorchis* (1/20), *Vanilla* (1/105).

Subtribe: **Spiranthinae**

Genus: *Spiranthes* (1/34).

Tribe: **Diurideae**

Subtribe: **Cryptostylidinae**

Genus: *Cryptostylis* (1/23).

Subfamily: **CYPRIPEDIOIDEAE**

Genus: *Paphiopedilum* (3/86).

Tribe: **Orchideae**

Subtribe: **Orchidinae**

Subfamily: **ORCHIDOIDEAE**

Tribe: **Cranichideae**

Subtribe: **Goodyerinae**

Genus: *Anoectochilus* (2/43), *Cheirostylis* (2/53), *Erythrodes* (2/26), *Goodyera* (8/98), *Herpysma* (1/1), *Hetaeria* (2/29),

Genus: *Brachycorythis* (3/36), *Diplomeris* (1/3), *Habenaria* (14/835), *Herminium* (1/19), *Pecteilis* (2/8), *Peristylus* (6/103), *Platanthera* (1/136), *Satyrium* (1/86).

Subfamily: **EPIDENDROIDEAE**

Tribe: **Neottieae**

Genus: *Aphyllorchis* (1/22),
Cephalanthera (1/19).

Tribe: **Tropidieae**

Genus: *Corymborkis* (1/6), *Tropidia* (2/31).

Tribe: **Gastrodieae**

Genus: *Didymoplexis* (1/17).

Tribe: **Nervilieae**

Subtribe: Nerviliinae

Genus: *Nervilia* (4/67).

Subtribe: Epipogiinae

Genus: *Epipogium* (1/3).

Tribe: **Arethuseae**

Subtribe: Arethusinae

Genus: *Anthogonium* (1/9), *Arundina* (1/2).

Subtribe: Coelogyninae

Genus: *Coelogyne* (17/200), *Neogyna* (1/1),
Otochilus (4/5), *Panisea* (3/11),
Pholidota (6/39), *Pleione* (2/21),
hunia (1/5).

Tribe: **Malaxideae**

Subtribe: Dendrobiinae

Genus: *Bulbophyllum* (53/1867),
Dendrobium (64/1509).

Subtribe: Malaxidinae

Genus: *Crepidium* (4/260), *Dienia* (1/6),
Liparis (16/426), *Oberonia* (18/323).

Tribe: **Cymbidieae**

Subtribe: Cymbidiinae

Genus: *Cymbidium* (14/71).

Subtribe: Eulophiinae

Genus: *Eulophia* (11/200), *Geodorum* (4/12).

Tribe: **Epidendreae**

Subtribe: Calypsoinae

Genus: *Cremastra* (1/4).

Subtribe: Agrostophyllinae

Genus: *Agrostophyllum* (3/100).

Tribe: **Collabieae**

Genus: *Acanthephippium* (2/13), *Ania* (3/7),
Calanthe (10/216), *Cephalantheropsis*
(2/4), *Chrysoglossum* (2/4), *Collabium*
(1/14), *Nephelaphyllum* (1/11),
Pachystoma (1/3), *Phaius* (4/45),
Spathoglottis (2/48), *Tainia* (3/28).

Tribe: **Podochileae**

Genus: *Appendicula* (1/146), *Bryobium* (1/8),
Callostylis (2/5), *Ceratostylis* (3/147),
Conchidium (1/10), *Cryptochilus* (1/5),
Eria (8/237), *Mycaranthes* (2/36),
Phreatia (1/211), *Pinalia* (10/105),
Podochilus (2/62), *Porpax* (1/13),
helasis (3/26), *Trichotosia* (3/78).

Tribe: **Vandaeae**

Subtribe: Aeridinae

Genus: *Acampe* (3/8), *Aerides* (3/25), *Arachnis*
(2/14), *Biermannia* (1/11), *Chiloschista*
(1/20), *Cleisocentron* (1/6),
Cleisostoma (11/88), *Diploprora* (1/2),
Gastrochilus (5/56), *Luisia* (6/39),
Micropera (4/21), *Papilionanthe* (3/11),
Pelatanthera (1/8), *Pennilabium* (2/15),
Phalaenopsis (10/70), *Pomatocalpa* (3/25),
Pteroceras (1/27), *Renanthera* (1/20),
Rhynchostylis (1/3), *Robiquetia* (2/45),
Saccolabiopsis (1/14), *Schoenorchis* (1/25),
Smitinandia (1/3), *Stereochilus* (2/7),
Taeniophyllum (3/185), *hrixspermum* (7/161),
Uncifera (2/6), *Vanda* (10/73),
Vandopsis (1/4).

SUBFAMILY: EPIDENDROIDEAE LINDL.

Epiphytic, lithophytic or terrestrial, perennial herbs, or rarely scrambling climbers, either sympodial or monopodial, with short to long rhizomes; plants rarely heteromycotrophic, achlorophyllous and with leaves absent or reduced to scales. Roots slender and wiry to stout, terete to dorsiventrally flattened, velamen 1- to several-layered, smooth to warty; aerial roots adventitious. Stems usually leafy, but leaves often reduced in number and rarely reduced to bractlike scales, 1 or more internodes at base often swollen to form a pseudobulb. Leaves entire, alternate or occasionally opposite, often distichous, frequently fleshy or leathery, rarely terete or canaliculate, with a basal sheath, sometimes articulated at base. Inflorescences erect to pendulous, spicate, racemose, or paniculate, 1- to many flowered, basal, lateral, or terminal. Flowers small to large, often quite showy, usually pedicellate, mostly resupinate, glabrous to hairy; ovary inferior, 1-locular. Sepals usually free but sometimes variously adnate, dorsal often dissimilar to laterals, laterals sometimes adnate to column foot to form a saccate, conic or spurlike mentum. Petals free or rarely partly adnate to sepals, similar or not to sepals, often showy. Lip entire or variously lobed, or 2-3-partite, ornamented or not with calli, ridges, hair cushions, or crests, with or without a basal spur or nectary, margins entire to lacinate. Column short to long, with or without a basal foot, occasionally winged or with lobes or arms at apex or ventrally; rostellum usually transverse, less commonly elongate and 1-3-lobed. Anther 1, terminal on column, caplike, attached to column apex by a short filament; pollen in tetrads, usually in discrete pollinia; pollinia mealy or waxy, 2, 4, 6, or 8, sessile on viscidium or attached by stipe or stipes to 1-2 sticky viscidia; stigma 3-lobed, concave, usually viscous. Fruit a capsule, opening laterally by 3 or 6 slits. Seeds fusiform to discoid, numerous, dustlike, lacking endosperm, sometimes markedly winged; elaters often present.

The subfamily comprises 16 tribes, ca. 600 genera and 18,000 species; distributed worldwide except Antarctica; 11 tribes represents 81 genera, 393 species, 3 subspecies and 5 varieties in Assam.

Key to the Tribes

- 1a. Anther erect, terminal with an apical viscidium; seeds with intercellular gaps present *Tropidieae*
- 1b. Anther bent, dorsal, without a viscidium or with a non-apical usually ventral viscidium; seeds without intercellular gaps 2
- 2a. Plants without velamen, often achlorophyllous without leaves or with non-articulated leaves; typically no corms or pseudobulb present 3
- 2b. Plants green with velamen and leaves articulated; corms or pseudobulb often present 5
- 3a. Pollen shed as monads or tetrads *Neottieae*
- 3b. Pollen sectile or coherent, not shed as monads or tetrads 4
- 4a. Plants not green; column more than half as long as petals, winged; seeds thread-like, ca. 1.5 mm long *Gastrodieae*
- 4b. Plants sometimes green, if green then column as above, otherwise much less than half as long as petals, not winged; seeds usually shorter than the above *Nervilieae*
- 5a. Pollinia without accessory structures or with minute viscidia *Malaxideae*
- 5b. Pollinia with one or more accessory structures, viscidia not minute 6
- 6a. Stipe present 7
- 6b. Stipe absent 8
- 7a. Plants mostly monopodial, without pseudobulbs; pollinia mostly 2, but also 4 or 8; silica bodies conical; elaters present if sympodial *Vandeae*
- 7b. Plants mostly sympodial, with pseudobulbs; pollinia 2 or 4; silica bodies spherical; elaters absent *Cymbidieae*

- 8a. Velamen of the Epidendrum and Pleurothallis-types; 8 pollinia rare; seeds of the Epidendrum and Pleurothallis-types (testa cells all of the same length, the latter type with soluble warts) *Epidendreae*
- 8b. Velamen of Calanthe- or Coelogyne-type; 8 pollinia common; seeds of other types 9
- 9a. Pollinia 2, always hard; silica bodies not conical *Collabieae*
- 9b. Pollinia 2, 4 or 8, sometimes soft; spherical silica bodies sometimes present 10
- 10a. Column without a foot, apex often with expanded margins; caudicles often massive; silica bodies conical *Arethuseae*
- 10b. Column mostly with a foot, apex and caudicles not as above; silica bodies spherical *Podochileae*



Aphyllorchis montana Rchb.f.: a portion of inflorescence

TRIBE: NEOTTIEAE LINDL.

Herbs, terrestrial or often mycoheterotrophic. Roots clustered and coraloid, fleshy, without velamen. Stem occasionally tough and reedlike. Leaves if present, spiral, occasionally sub-distichous, scattered along stem, convolute, plicate, non-articulate. Inflorescence terminal, racemose, occasionally lateral, of few to many spiral flowers, simple, flowers variously coloured, resupinate. Sepals and petals free. Lip free or occasionally partially united with column along midline, often divided into a hypochile and epichile, midlobe often hinged to a more or less saccate base or spur, sometimes with a shallow, superficial nectary; disc often with keels or lamellae. Column with or without a foot; anther dorsal, tilted downward, suberect or terminal and incumbent, extending beyond or subequal to the rostellum; stigma entire, rostellum poorly developed, sometimes sensitive and extruding a drop of adhesive when touched; pollinia 2 or 4, soft and mealy, pollen grains shed as monads or tetrads, porate or tennate, usually reticulate, viscidium indistinct or absent.

Comprises 6 genera and 178 species; distributed in tropical and temperate regions of old and new worlds; 2 genera and 2 species in Assam.

Key to the Genera

- 1a. Plants lacking green leaves and stems *Aphyllorchis*
1b. Plants normally autotrophic with green leaves and stems *Cephalanthera*

Aphyllorchis Blume

Terrestrial, leafless, holomycotrophic herbs. Rhizome short; roots fascicled, spreading, fleshy. Stem erect, fleshy, unbranched, usually pale brown, with loose cymbiform or cylindric sheaths enclosing proximal nodes and scalelike sterile bracts at distal nodes. Inflorescence terminal, racemose, few to many flowered; floral bracts membranous. Flowers resupinate, small to medium-sized, often with long pedicel and ovary. Sepals similar, free, often weakly concave-cymbiform. Petals similar to but shorter and narrower than sepals. Lip adnate to base of column, 2-partite; hypochile often winged; epichile hinged at junction with hypochile and often deflexed, entire or lobed. Column arcuate, long, slender; anther borne at anterior margin of clinandrium, suberect, 2-locular; filament extremely short; staminodes 2, one on either side of column, apical, white, spotted with silver; pollinia 2, granular-farinaceous, caudicles absent; viscidium large; stigma concave, near apex of column; rostellum very small. Capsule usually pendulous.

About 22 species; distributed from Himalayas, through E and SE Asia to Australia; 3 species in India and 1 species in Assam.

Aphyllorchis montana Rchb.f., Linnaea 41: 57. 1876; Hook.f., Fl. Brit. India 6: 116. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 262. 1898; C.E.C.Fisch., Fl. Madras 3: 1019. 1956; Katagi, Orchids Meghalaya 207. 1986; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 71. 1998; N.Pearce & P.J.Cribb, Orchids Bhutan 37. 2002; Lucksom,

Orchids Sikkim N.E. Himalaya 24. 2007. *Aphyllorchis prainii* Hook.f., Fl. Brit. India 6: 117. 1890. **Fig. 27 (A-F).**

Plant 40–60 cm high. Rhizome short, creeping; roots spreading. Stem with 6–10 unequal short, blunt tubular sheaths near the base; upper part with few

distant ovate-lanceolate, acute sheaths. Inflorescence with 8–14 well-spaced flowers; rachis 10–20 cm long; floral bracts reflexed, linear-lanceolate, $6.0\text{--}14.0 \times 2.0\text{--}2.5$ mm, shorter than pedicel and ovary. Flowers yellow or yellowish brown, spreading, *ca.* 2 cm in across, usually becoming pendulous; ovary glabrous or sometimes slightly puberulent. Dorsal sepal cymbiform, oblong or obovate, $9\text{--}11 \times 3\text{--}4$ mm, 3-veined, apex obtuse; midrib of dorsal sepal scabrous near apex on abaxial surface; lateral sepals curved, spreading, sub-acute. Petals slightly longer than the sepals, oblong, blunt, spreading. Lip 7–9 mm long, fleshy, contracted into epichile and hypochile toward base; hypochile slightly concave, *ca.* 2 mm long, irregularly verrucose inside, with 2 triangular or triangular-lanceolate wings; epichile ovate, 5–7 mm long, obscurely 3-lobed, margin slightly undulate.

Column slightly arcuate, 7–10 mm, apex dilated. Anther erect; pollinia 4, oblong, united in pairs.

Habitat: Mycoheterotrophic, grows on the floors of broadleaved evergreen forest.

Flowering: June–August.

Occurrence: Karbi Anglong: Nambor W.L.S.; North Cachar Hill: Haflong; Udalguri: Khalingduar R.F.; West Karbi Anglong: Sirtiso *ca.* 587 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal, Andhra Pradesh, Kerala, Tamil Nadu), China, Japan, Sri Lanka, Myanmar, Thailand, Cambodia, Vietnam, Malaysia, Indonesia, Philippines, New Guinea.

Regional Conservation Status & Criteria: Vulnerable, VU B2b(iii)c(iii).



Aphyllorchis montana Rchb.f.: plants in their natural habitat (left) and closeup of a flower (right)

***Cephalanthera* Rich.**

Terrestrial, autotrophic or holomycotrophic herbs. Rhizome creeping, terete, slender; roots fasciculate, filiform, fleshy. Stem erect, unbranched, leafy, with 1 to a few subcymbiform or cylindric basal sheaths. Leaves alternate, plicate, sessile, directly sheathing stem at base, reduced to membranous sheaths in holomycotrophic species. Inflorescence terminal, racemose, many or few flowered, rarely 1-flowered; proximal floral bracts foliaceous and usually longer than flowers, distal ones much shorter. Flowers resupinate, suberect, weakly spreading and campanulate, or rarely widely spreading, white, pink, or yellow; ovary slightly twisted, glabrous. Sepals free, similar to each other, subequal. Petals slightly shorter than sepals, connivent with sepals. Lip adnate to base of column, bi-partite or rarely simple, sometimes not distinct from petals; hypochile with erect lateral lobes embracing column, saccate or with a short spur at base; epichile spreading, ovate-elliptic, apex obtuse or acute; disk with 3–7 longitudinal lamellae, or unornamented in peloric forms. Column erect, usually with 2 narrow lateral wings; stigma concave, rounded; rostellum inconspicuous or absent. Anther erect, hinged, 2-locular; pollinia 2, each 2-partite, granular-farinaceous, lacking caudicles and viscidia. Capsule erect.

About 25 species; distributed from Himalayas, E & SE Asia, Europe, N Africa, extending to the west coast of North America; 2 species in India and 1 species in Assam.

***Cephalanthera longifolia* (L.) Fritsch, Oesterr. Bot. Z. 38: 81 1888; Lucksom, Orchids Sikkim N.E. Himalaya 24. 2007. *Serapias helleborine* var. *longifolia* L., Sp. Pl. 950. 1753. *Cephalanthera ensifolia* Rich., De Orchid. Eur. 38. 1817; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 271. 1898.**

Fig. 27 (G–N).

Plants leafy, autotrophic, 15–45 cm high, raising from a thin creeping rhizome. Stem slender to somewhat robust, with 3–5 loosely clasping basal sheaths. Leaves 4–7, elliptic, lanceolate, or oovate-lanceolate, 5–10 × 1–3 cm, apex acuminate. Inflorescence racemose, glabrous; peduncle 2.5–4.0 cm long; rachis 2–6 cm long, subdensely 8–20-flowered; floral bracts linear-lanceolate to narrowly triangular. Flowers weakly spreading, white, 1.0–1.5 cm long; pedicel and ovary 0.6–1.0 cm long. Sepals narrowly rhombic-elliptic or narrowly elliptic-lanceolate, 1.1–1.6 × 0.3–0.5 cm, 5-veined, apex acuminate or subacute. Petals elliptic, 7–8 × ca. 4 mm, 5–7-veined, apex acute or mucronate. Lip oblong, 5–7 × 6–9 mm, bi-partite; hypochile saccate, enclosed within bases of lateral sepals, with a small

orange patch in middle of disk; hypochile lobes erect and embracing column, subovate-triangular, 3–4 mm long, apex subacute; epichile triangular-cordate, 3–4 × 5–6 mm, with 3–5 orange lamellae, densely papillose toward apex, apex obtuse to acute. Column 4–6 mm long, with 2 small oblong wings; anther 2.0–2.5 mm; stigma stalked. Capsule elliptic, 1.7–2.0 × 0.6–0.8 cm.

Habitat: Terrestrial, grows on forest floors, hill slopes or on the banks of streams.

Flowering: May–August.

Occurrence: Karbi Anglong: Dambukso ca. 840 m; North Cachar Hills: Leike ca. 1262 m, Thenbung ca. 1000 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Uttarakhand, Jammu & Kashmir), Bhutan, Nepal, China, Pakistan, Afghanistan, Myanmar, other parts of temperate and tropical Asia, Europe, Africa.

Regional Conservation Status & Criteria: Vulnerable, VU B2b(iii)c(iii).

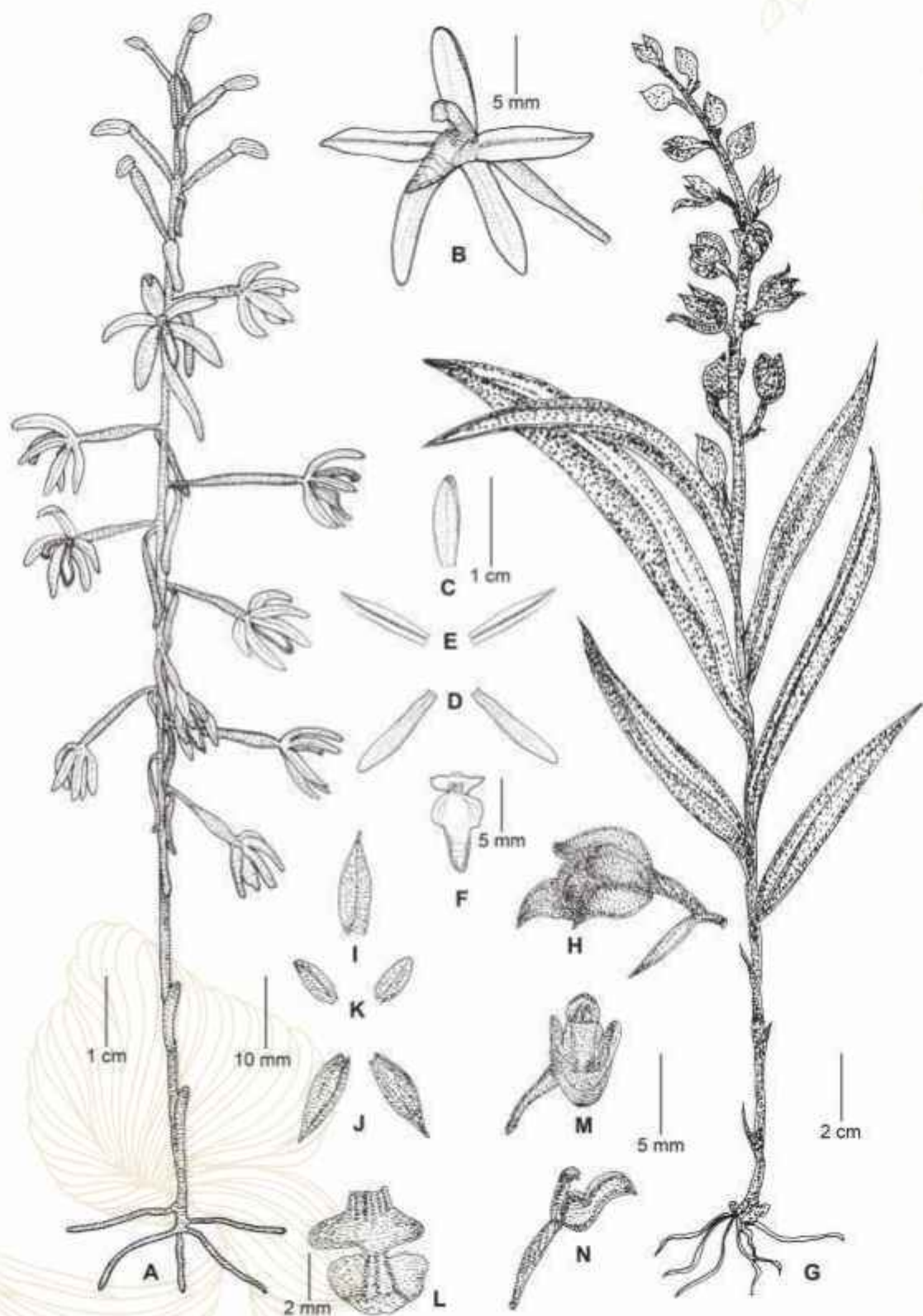


Figure 27. A–F: *Aphyllorchis montana* Rchb.f.: A. Habit; B. Flower; C. Dorsal sepal; D. Lateral sepals; E. Petals; F. Lip. G–N: *Cephalanthera longifolia* (L.) Fritsch: G. Habit; H. Flower; I. Dorsal sepal; J. Lateral sepals; K. Petals; L. Lip; M–N. Lip with column, pedicel and ovary.



Cephalanthera longifolia (L.) Fritsch: plant habit (left) and closeup of inflorescence (right)



Corymborkis veratrifolia (Reinw.) Blume

TRIBE: TROPIDIEAE DRESSLER

Terrestrial, rhizomatous herbs; roots wiry. Stems erect, reed-like or shrubby, essentially ligneous. Leaves not articulate, convolute, plicate, ovate or lanceolate, rarely linear, acuminate, the holomycotrophic species leaves represented with scale only. Inflorescence axillary or terminal, few- to many-flowered, racemose or paniculate. Flowers with the perianth basally connate in some species. Lip spurred or not, with a cymbiform or narrow, more-or-less keeled hypochile and apically flattened and often reflexed epichile. Column straight, not exceeding the labellum in length. Anther erect, dorsal, elongate, with two bipartite, sectile pollinia, rostellum erect, forming an apical viscidium connected to the pollinia by a long, slender hamulus, bipartite after removal of the viscidium. Capsule oblong, often topped with remnants of the withering perianth.

Comprises 3 genera and 39 species; distributed throughout tropics; 2 genera and 3 species in Assam.

Key to the Genera

- 1a.** Lip not spurred or saccate. Column much longer than twice the length of the anther *Corymborkis*
1b. Lip spurred or saccate. Column shorter than twice the length of the anther *Tropidia*

Corymborkis Thouars

Terrestrial rhizomatous herbs; rhizome short; roots slender, wiry. Stem single or several arising from same rhizome, unbranched, slender, reedlike. Leaves many, distichous, often large, ovate to elliptic, papery, plicate, base contracted into amplexicaul sheaths. Inflorescence an axillary raceme or panicle, conspicuously shorter than leaves, few to many flowered; peduncle often enclosed in leaf sheaths. Flowers scented, distichously arranged, resupinate or non resupinate, usually greenish white to yellow; pedicel short. Sepals and petals subequal, rather long and narrow, spreading, connivent or connate at base. Petals slightly wider than sepals. Lip about as long as petals or slightly shorter, embracing column, with 2 longitudinal ridges. Column erect, slightly shorter than lip, slender, apex dilated and with 2 auricles; stigma with 2 outwardly curved lobes; rostellum bifid, prominent, longer than anther. Anther inserted on dorsal side of column, erect, suboblong or ovate-oblong; pollinia 2, granular-farinaceous, sectile; caudicle slender; viscidium subpeltate. Capsule strongly 6-ridged, apex with persistent column.

About 8 species; distributed throughout the tropics; 1 species in India as well as in Assam.

Corymborkis veratrifolia (Reinw.) Blume, Coll. Orchid. 125. 1859; C.E.C.Fisch., Fl. Madras 3: 1015. 1956; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 246. 1998; N.Pearce & P.J.Cribb, Orchids Bhutan 69. 2002; Lucksom, Orchids Sikkim N.E. Himalaya 72. 2007. *Hysteria veratrifolia* Reinw., Syll. Pl. Nov. 2: 5. 1825. *Corymbis disticha* (Breda) Lindl., Fol. Orchid. 5: 1. 1854. *Corymborkis assamica* Blume, Coll. Orchid. 126. 1859. *Corymbis veratrifolia* (Reinw.)

Rchb.f., Flora 48: 184. 1865; Hook.f., Fl. Brit. India 6: 91. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 274. 1898.

Plant up to 1 m high. Stem erect, subterete, 7–10 mm in diam., with many leaves. Leaves elliptic-lanceolate, 30.0–45.0 × 7.6–10.0 cm, abaxially often brown scurfy, basal sheaths 5–9 cm long, apex caudate-acuminate. Inflorescence a panicle,

7.6–10.0 cm long, 2–6-branched, 10–30- or more flowered; bracts at branch base lanceolate, 1.0–1.5 cm long; floral bracts ovate, 2–4 mm long, shorter than sessile ovary. Flowers fragrant, 3.0–3.8 cm long, not opening widely, white, tubular or campanulate; pedicel and ovary 4–6 mm. Sepals similar, linear-oblongate or narrowly spatulate, $3.2\text{--}3.8 \times 0.2\text{--}0.6$ cm. Petals similar to sepals, but flat and slightly shorter. Lip about as long as sepals, long clawed, apically dilated; apical lobe orbicular or broadly ovate-elliptic, *ca.* 1×1 cm, with 2 longitudinal ridges, margin undulate, apex acute and recurved. Column subcylindric with dilated apex, shorter than lip; rostellum bifid, *ca.* 3 mm long; stigma with 2 deflexed lobes. Anther fleshy; pollinia attached by a slender caudicle to an elliptic gland.

Habitat: Terrestrial, grows on shady forest floors.

Flowering: May–July.

Occurrence: Dibrugarh: Jokai R.F., Jeypore R.F.; Karbi Anglong: Bokajan; Kokrajhar: Haltugaon, Ultapani; North Cachar Hills: Shimtilong.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal, Kerala, Tamil Nadu, Andaman & Nicobar Is.), Bangladesh, China, Japan, Sri Lanka, Myanmar, Thailand, Laos, Cambodia, Vietnam, Malaysia, Singapore, Indonesia, Philippines, Bismarck Archipelago, New Guinea, Solomon Is., Australia, Caroline Is., Marianas, Society Is., Fiji, Samoa, Santa Cruz Is., Tonga, Vanuatu.

Regional Conservation Status: Near Threatened.



Corymborkis veratrifolia (Reinw.) Blume: closeup of flowers (left) and fruits (right)

Tropidia Lindl.

Terrestrial, rhizomatous, autotrophic herbs; rhizome ascending, stout; roots wiry, fibrous. Stem erect, rigid, branched or unbranched, noded, with sheaths at nodes. Leaves 2 to many, plicate, ovate to narrowly lanceolate, base contracted into amplexicaul sheaths. Inflorescence racemose or paniculate, terminal or arising from leaf axils near apex of stem, several or many flowered. Flowers resupinate or non resupinate. Dorsal sepal free; lateral sepals free or connate to form a synsepal and embracing base of lip. Petals free, similar to sepals or slightly smaller. Lip cymbiform, slightly shorter than sepals, entire, with or without a short spur, sometimes constricted at middle, base loosely embracing column, distally dilated, apex acuminate and reflexed. Column short; rostellum prominent, erect, bifid after viscidium removed. Anther dorsal, erect; pollinia 2, granular-farinaceous, sectile, with slender caudicle and peltate viscidium.

About 30 species; distributed mainly in tropical and subtropical Asia, with a few species extending to Australia and the Pacific islands and one in Central and North America; 4 species in India and 2 species in Assam.

Key to the Species

- 1a. Leaves 1–5. Lateral sepals connate for almost their entire length, forming a synsepal *T. angulosa*
 1b. Leaves many, distichous, usually more than 10. Lateral sepals connate only at base *T. curculigoides*

Tropidia angulosa (Lindl.) Blume, Coll. Orchid. 122. 1859; Hook.f., Fl. Brit. India 6: 92. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 275. 1898; C.E.C.Fisch., Fl. Madras 3: 1015. 1956; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 676. 1998; A.De & Hajra, J. Orchid Soc. India 15: 50. 2001; N.Pearce & P.J.Cribb, Orchids Bhutan 71. 2002; Lucksom, Orchids Sikkim N.E. Himalaya 73. 2007. *Decaïsnea angulosa* Lindl. in Wall. Numer. List 7388. 1832. *Cnemidia angulosa* Lindl., Edwards's Bot. Reg. 19: t. 1618. 1833.

Plant 20–30 cm high. Stem slender, erect, solitary or 2 arising from same rhizome, unbranched or 1-branched, internodes 3.0–6.5 cm long; nodes enclosed in tubular sheaths, 1.5–3.0 cm long. Leaves 2, apical, subopposite, elliptic or ovate-elliptic, 10.0–13.0 × 2.5–7.6 cm, papery, base contracted into amplexicaul sheaths, apex long acuminate. Inflorescence a terminal raceme 5–8 cm long, bears 10 or more flowers; floral bracts narrowly lanceolate, 6–8 mm long, midvein conspicuous. Flowers resupinate, greenish white *ca.* 1.6 cm long; pedicel and ovary 6–9 mm long. Dorsal

sepal linear-lanceolate, 8.0–9.0 × *ca.* 1.5 mm, apex acuminate or acute; lateral sepals almost completely connate and forming a synsepal; synsepal suboblong, 8.0–10.0 × 2.0–2.5 mm, apex shallowly bi-lobed, embracing lip and connected to spur at its base. Petals linear-lanceolate, 8.0–9.0 × *ca.* 1.5 mm. Lip suboblong, 6–7 × *ca.* 2 mm, with 2 slightly thickened longitudinal ridges from middle to base, base spurred; spur cylindric, *ca.* 4.0 × 1.0–1.5 mm, apex obtuse. Column *ca.* 6 mm high; rostellum erect, lanceolate, *ca.* 5 mm long. Anther erect, ovoid-lanceolate, *ca.* 3.5 mm long. Capsule clavate-cylindric, boldly ridged, *ca.* 2 cm long.

Habitat: Terrestrial mostly in broad-leaved evergreen and semi-evergreen forests.

Flowering: September–November.

Occurrence: Baksa and Chirang: Manas B.R.; Cachar: Borail W.L.S.; Golaghat: Dhekial, Doigrung; Karbi Anglong: Sarhed *ca.* 600 m; Kokrajhar: Chirang R.F.; North Cachar Hills: Patherkot, Ngalsung; Sonitpur: Sonai Rupai W.L.S., Balipara Forest.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Tripura, Sikkim, West Bengal, Orissa, Chhattishgarh, Madhya Pradesh, Maharashtra, Andhra Pradesh, Karnataka, Kerala, Tamil Nadu, Andaman & Nicobar Is.), Bangladesh, Bhutan, China, Myanmar, Thailand, Vietnam, Malaysia, Indonesia, Philippines.

Regional Conservation Status: Least Concern.

Tropidia curculigoides Lindl., Gen. Sp. Orchid. Pl. 497. 1840; Hook.f., Fl. Brit. India 6: 93. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 275. 1898; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 676. 1998; A.De & Hajra, J. Orchid Soc. India 15: 52. 2001; N.Pearce & P.J.Cribb, Orchids Bhutan 73. 2002; Lucksom, Orchids Sikkim N.E. Himalaya 73. 2007.

Tropidia assamica Blume, Coll. Orchid. 124. 1859.
Tropidia formosana Rolfe ex Hemsl., Ann. Bot. (Oxford) 9: 158. 1895; K.Gogoi, L'Orchidophile 47: 335. 2016.

Plant 30–60 cm high. Stem slender, erect, unbranched, or sometimes branching, bears 10 or more well spaced leaves, proximally often naked, distally enclosed in leaf sheaths; internodes 2–4 cm long. Leaves distichous, narrowly elliptic-lanceolate to narrowly lanceolate, 9.0–15.0 × 1.6–3.0 cm, papery, base contracted into amplexicaul sheath, apex long acuminate-caudate. Inflorescence racemose, terminal or axillary, 2.0–2.5 cm long, with several to 10 crowded flowers; floral bracts imbricate, lanceolate, 4–8 mm long, conspicuously with longitudinal veins. Flowers not resupinate,



Tropidia angulosa (Lindl.) Blume



Tropidia curculigoides Lindl.



Didymoplexis pallens Grif.

TRIBE: GASTRODIEAE LINDL.

Achlorophyllous, holomycotrophic herbs. Rhizome condensed, unbranched, tuberous; tubers composed of several internodes. Roots lacking velamen. Stem erect, with a few sheaths near the base. Leaves scale-like. Inflorescence terminal, racemose, glabrous, with a series of membranous sheaths near the base. Flowers usually resupinate. Sepals and petals often partially fused at the base to form a floral tube, or sometimes with only the lateral sepals fused. Lip free, entire or weakly bi- or tri-lobed, spurless, clawed, often with two basal calli. Column with or without a distinct foot, distally often winged laterally along the ventral margins, with a pair of apical appendages; rostellum transverse, shelf-like; stigma entire, directly below rostellum or situated near the base of column. Anther dorsal, incumbent, hardly or not extending beyond rostellum, frequently flattened dorsiventrally; pollinia 2 or 4, sectile or granular, either attached to a common viscidium or a pair of viscidia.

Comprises 5 genera and ca. 91 species; distributed from Siberia to Australia and Pacific Islands via South East Asia, also present in tropical Africa; 1 genus and 1 species in Assam.

Didymoplexis Griff.

Holomycotrophic terrestrial herbs. Rhizome fusiform, tuberous, fleshy, neck sometimes with a few filiform roots. Stem erect, slender, leafless, with a few scale like sheaths near base, glabrous. Inflorescence erect, terminal, racemose, with 1 to several flowers; floral bracts small. Flowers spreading, resupinate, often ephemeral, white or pale yellowish brown; pedicel elongating in fruit. Sepals and petals connate at base and forming a short tube; dorsal sepal and petals connate for about half of their length and forming a porrect hood; lateral sepals usually connate for more than half of their length, deflexed distally. Lip adnate with column foot at base, free from sepals and petals, not spurred, entire or weakly 3-lobed. Column elongated, dilated and with 2 wings at apex, wings forming short, toothlike stelidia, with distinct column foot at base; rostellum erect, transverse; stigma broad, placed directly below rostellum. Anther subterminal, borne on a short filament; pollinia 4, in 2 pairs, granular-farinaceous, ecaudiculate, each pair directly attached to a sticky viscidium. Capsule erect, fusiform.

About 17 species; distributed in Himalayas, NE India, SE Asia to Papua New Guinea, tropical Australia, and the SW Pacific islands, also in SW Africa and Madagascar; 3 species in India and 1 species in Assam.

Didymoplexis pallens Griff., Calcutta J. Nat. Hist. 4: t. 17. 1844; Hook.f., Fl. Brit. India 6: 122. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 260. 1898; C.E.C.Fisch., Fl. Madras 3: 1021. 1956; Sud.Chowdhury *et al.*, J. Assam Sci. Soc. 14(2): 132. 1971; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 329. 1998; I.Barua, Orchid Fl. Kamrup Distr. Assam 39. 2001; N.Pearce & P.J.Cribb, Orchids Bhutan 30. 2002; Lucksom, Orchids Sikkim N.E. Himalaya 20. 2007.

Plant 10–25 cm high. Rhizome fusiform 0.8–2.5 × 0.5–0.8 cm, light brown; roots wiry, often with small globose thickenings. Stem 7.5–15 cm long, with 3–5 pale brown scale lik. Racemes 4–8-flowered; rachis 0.4–3 cm long; floral bracts ovate, ca. 2 mm, apex acute. Flowers ca. 9 mm long, opening in succession, white, campanulate; pedicel and ovary erect, brown, 0.5–0.7 mm long; pedicel extending up to 15 cm in fruit. Dorsal sepal and petals 4–7 mm, usually united for more than half of their length, free portion

Fig. 28 (A–F).

ovate-triangular, shallowly 3-lobed, each lobe ovate-deltoid and with an obtuse apex; lateral sepals 3–4.5 mm, connate with each other for up to half of their length, and with petals for 1/3 of their length, free portion bi-lobed, each lobe ovate and with an obtuse apex, reflexed. Lip broadly obovate, 4.5–5 × 6–7 mm, erose-crenate, lateral margins erect or incurved, apex subtruncate; disk with a dense row of warty papillae along midvein. Column slightly curved, clavate, ca. 4 mm high, apex dilated and with 2 oblong wings; column foot slightly curved, 2–3 mm long; anther orbicular. Capsule cylindric-fusiform, 2–2.5 cm long.

Habitat: Grows on grassy hill slopes, often found in bamboo forest, holomycotrophic.

Flowering: April–May.

Occurrence: Baksa and Chirang: Manas B.R.;

Dibrugarh: Jokai R.F., Jeypore R.F.; Golaghat: Nambor W.L.S., Pulibor, Jonaki Nagar; Jorhat: Gibon W.L.S.; Kamrup: Japorigog Forest Near to Assam State Zoo; North Guwahati-Madankamdev, Jalukbari Gauhati University Campus, Jorabat; Karbi Anglong: Dipu-Lumparpan Village; Kokrajhar: Chirang R.F.; North Cachar Hills: Thenbung ca. 1000 m; Tinsukia: Namphoi F.V.; West Karbi Anglong: Khainduli ca. 834 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal, Orissa, Karnataka, Kerala, Tamil Nadu), Bangladesh, Nepal, Afghanistan, China, Japan, Myanmar, Thailand, Vietnam, Malaysia, Indonesia, Philippines, New Guinea, Australia, Niue, Vanuatu.

Regional Conservation Status: Least Concern.



Didymoplexis pallens Griff.: a plant in its natural habitat

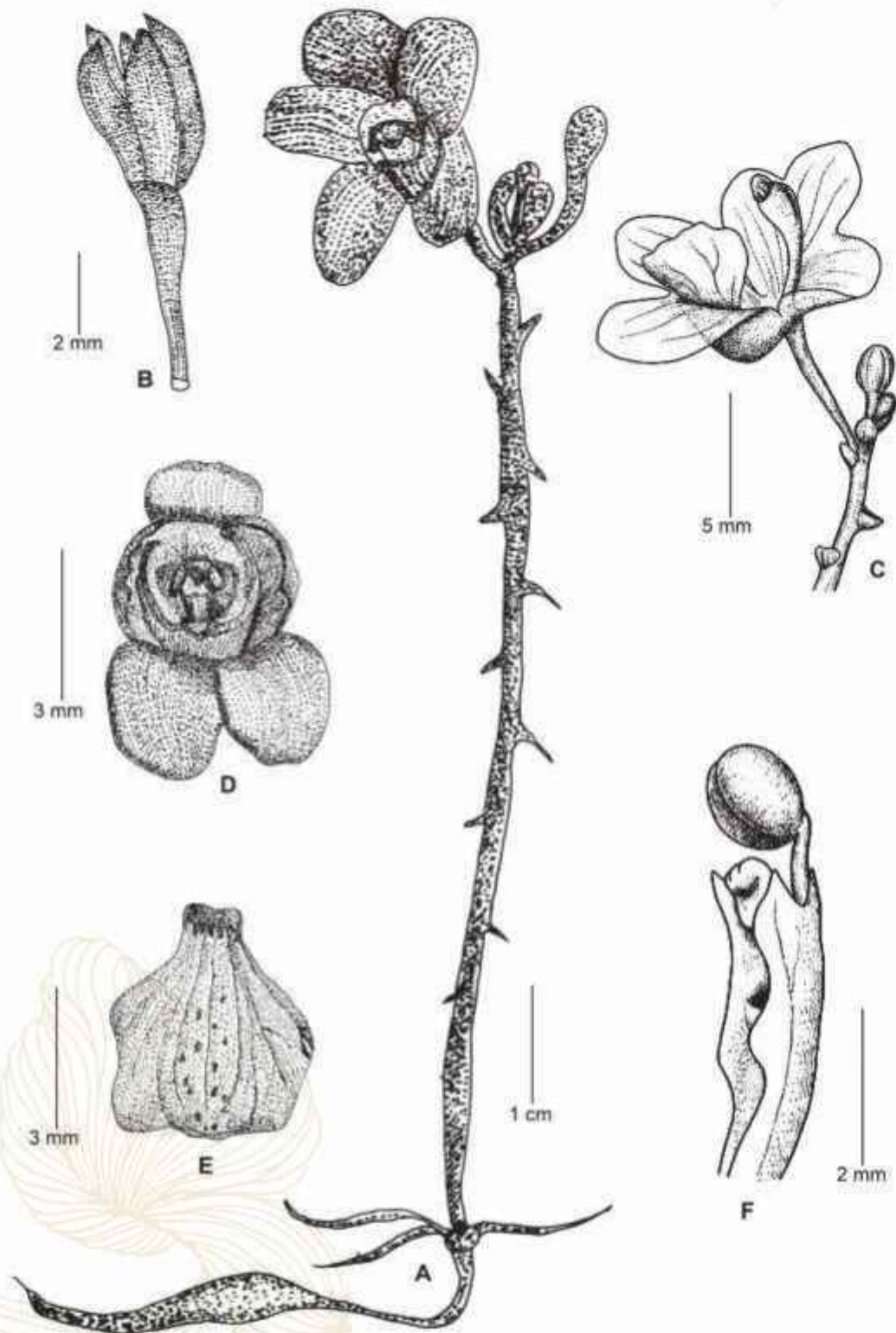


Figure 28. A–F: *Didymoplexis pallens* Griff.: A. Habit; B. An unopened flower; C. Apex of the inflorescence showing flower; D. Front view of flower; E. Lip; F. Column (C & F after Seidenfaden 1978).



Nervilia concolor

TRIBE: NERVILIEAE DRESSLER

Photosynthetic or holomycotrophic, terrestrial, herbs emerge out from underground tubers, tuberous rhizomes or coralloid underground stems. Tubers spherical to ellipsoid, several noded. Roots without a velamen. Leaf solitary, plicate, non-articulate, usually appears after flowering, erect or borne parallel to the substrate, either adpressed to the substrate or above it, glabrous or hairy or reduced to scale like and achlorophyllous. Inflorescence terminal, erect, racemose; floral bracts persistent. Flowers spirally arranged on rachis, short-lived, resupinate or not, subcampanulate, erect, spreading or pendent. Sepals free, not spreading widely, linear lanceolate. Petals free, similar to sepals but smaller. Lip often free, more or less embracing the column, entire to 3-lobed, bearing a lamellate or hairy callus, rarely spurred at base. Anther incumbent, 2-celled, pollinia 2, bipartite, sectile, lacking caudicles or viscidia. Column clavate; stigma entire, ventral; rostellum flap-like. Ovary 6-ribbed.

Comprises 2 subtribes, 3 genera and ca. 71 species; distributed in tropics and subtropics of Old world; 2 genera and 5 species in Assam.

Key to the Genera

- 1a. Leaf solitary, usually developing and senescing before the flowering shoot appears *Nervilia*
1b. Leaves reduced to scales or absent *Epipogium*

Subtribe: *Nerviliinae* Schltr.

Nervilia Comm. ex Gaudich.

Terrestrial tuberous herbs; tubers globose or ovoid, cormlike, fleshy, few to several noded. Stem arising from apex of tuber and giving rise to an inflorescence and a leaf in succession. Leaf solitary, usually emerging after anthesis, usually horizontal, cordate, orbicular, reniform, or elliptic, palmately veined, often plicate, membranous or fleshy, glabrous or pubescent, base cordate, apex acute, obtuse, or rounded, borne on an elongate, erect or prostrate petiole-like stalk. Inflorescence erect, terminal, usually slightly fleshy, glabrous; peduncle with 1 to several tubular sheaths; rachis one to few flowered; floral bracts usually small, lanceolate. Flowers erect or nodding, resupinate or non resupinate, opening widely or not; pedicel becoming erect and elongating in fruit in 1-flowered species. Sepals and petals similar, narrowly ovate or elliptic. Lip 3-lobed or occasionally simple, base spurless or spurred, apex entire or fimbriate. Column elongate, clavate; rostellum broad, entire, sometimes absent; stigmatic surface shield-shaped to orbicular, lying below rostellum. Anther terminal, incumbent, usually ovoid, 2-locular; pollinia 2, cleft, granular-farinaceous, sectile; caudicle absent; viscidium reduced or prominent.

About 67 species; distributed across India, through Himalayas to Japan, SE Asia, New Guinea, N Australia, and the SW Pacific islands, also in tropical and subtropical Africa, Madagascar, and parts of the Arabian Peninsula; 15 species in India and 4 species in Assam.

Key to the Species

- 1a. Leaf long petioled, usually 10–18 cm long. Inflorescence many flowered *N. concolor*
1b. Leaf shortly petioled usually below 4 cm long. Inflorescence 1–2 flowered 2

- 2a. Leaf hairy on nerves. Inflorescence 2-flowered. Lip obscurely 3-lobed *N. plicata*
 2b. Leaf glabrous. Inflorescence single flowered. Lip distinctly 3-lobed 3
 3a. Sepals and petals 1.3–1.5 cm long; midlobe of lip obovate-oblong, glabrous *N. infundibulifolia*
 3b. Sepals and petals 2.5–3.5 cm long; midlobe of lip rhomboid-ovate or -lanceolate, hairy within
 *N. juliana*

Nervilia concolor (Blume) Schltr., Bot. Jahrb. Syst. 45: 404. 1911; Vij *et al.*, Orchids Himachal Pradesh 223. 2013. *Cordyla concolor* Blume, Bijdr. 416. 1825. *Nervilia aragoana* Gaudich., Voy. Uranie 422. 1829; C.E.C.Fisch., Fl. Madras 3: 1020. 1956; Santapau & Kapadia, Orchids Bombay 134. 1966; Katak, Orchids Meghalaya 210. 1986; Sud.Chowdhury, J. Assam Sci. Soc. 30(1): 27. 1987; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 526. 1998; I.Barua, Orchid Fl. Kamrup Distr. Assam 61. 2001; N.Pearce & P.J.Cribb, Orchids Bhutan 61. 2002; S.Misra, Orchids Orissa 259. 2004; Sud.Chowdhury, Assam's Fl. 317. 2005; Lucksom, Orchids Sikkim N.E. Himalaya 57. 2007. *Pogonia flabelliformis* Lindl., Gen. Sp. Orchid. Pl. 415. 1840. *Pogonia scottii* Rchb.f., Flora 55: 276. 1872; Hook.f., Fl. Brit. India 6: 120. 1890; King & Pantl., Ann. Roy. Bot. Gard.

(Calcutta) 8: 269. 1898. *Nervilia scottii* (Rchb.f.) Schltr., Bot. Jahrb. Syst. 45: 404. 1911.

Fig. 29 (A–E).

Plant 25–35 cm high; tuber small, globose, 2–2.5 cm across. Leaf petiolate; blade ovate or almost orbicular, 8–16 × 7.5–16 cm, apex apiculate or shortly acuminate, base cordate; petiole elongated, 12–18 cm long. Inflorescence hysteroanthous, erect, subdensely many-flowered, 9–23 cm long; peduncle enclosed in inflated sheaths below, distantly bracteolate above; rachis 7–10 cm long; floral bracts linear-lanceolate, acuminate, reflexed, 1.5–2.5 cm long. Flowers 1.4–3 cm long; sepals and petals greenish-yellow, lip white or pink veined with purple; pedicel and ovary 0.6–1.5 cm long. Sepals and petals similar, oblong-linear to linear-lanceolate, acuminate, 1.5–3 cm long. Lip 3-lobed, base cuneate,



Nervilia concolor (Blume) Schltr.: a flowering shoot (left) and closeup of flowers (right)

1.5–3 cm long; lateral lobes ovate-triangular, acute or obtuse; mid-lobe ovate to ovate-triangular, acute, obtuse or rounded in front with undulate margins; disc more or less pubescent in middle. Column straight, clavate, 5–6 mm high. Capsule spindle-shaped, ribbed, $1.2\text{--}1.5 \times 0.5\text{--}0.6$ cm.

Habitat: Terrestrial, grows on shady forest floors.

Flowering: March–April.

Occurrence: Baksa and Chirang; Manas B.R.; Cachar: Borail W.L.S.; Kamrup: Japorigog Forest, on a hillock behind the staff quarters of Assam State Zoo; Karbi Anglong: Dambukso ca. 840 m; Kokrajhar: Chakrasila W.L.S., Jamagra; North Cachar Hills: Near Haflong; West Karbi Anglong: Kseh Kynthang ca. 859 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal, Bihar, Jharkhand, Uttarakhand, Himachal Pradesh, Orissa, Chhattishgarh, Maharashtra, Goa, Andhra Pradesh, Karnataka, Kerala, Tamil Nadu, Andaman & Nicobar Is.), Bangladesh, Bhutan, Nepal, Pakistan, China, Japan,

Myanmar, Thailand, Laos, Vietnam, Indonesia, Philippines, New Guinea, Australia, Caroline Is., Marianas, Cook Is., Society Is., Fiji, New Caledonia, Niue, Samoa, Tonga, Vanuatu, Wallis-Futuna Is.

Regional Conservation Status: Least Concern.

Nervilia infundibulifolia Blatt. & McCann, J. Bombay Nat. Hist. Soc. 35: 725. 1932; Santapau & Kapadia, Orchids Bombay 127. 1966; H.J. Chowdhery, Orch. Fl. Arunachal Pradesh 529. 1998; S. Misra, Orchids Orissa 238. 2004. *Nervilia hallbergii* Blatt. & McCann, J. Bombay Nat. Hist. Soc. 35: 726. 1932. *Nervilia calcicola* Kerr, J. Siam Soc., Nat. Hist. Suppl. 9: 242. 1933.

Tubers sub-spherical, slightly flattened, 0.6–1.2 cm in diam. Leaf flat on the ground or slightly above the surface, broadly ovate-cordate, $2\text{--}3 \times 3\text{--}4$ cm, glabrous, margins brown-maroon, crimped, irregularly and minutely dentate-crenulate, apex obtuse or slightly retuse; petiole 2–4 cm long, dark brownish-purple. Inflorescence single-flowered; peduncle 6–15 cm long, terete; floral bract ovate-



Nervilia infundibulifolia Blatt. & McCann: a leafy shoot (left) and closeup of flower (right)

oblong, 3–7 × 2–3 mm, apex acute. Pedicel and ovary pale-purple, 1.0–1.5 cm long, curved. Flower greenish-purple. Sepal's similar, linear-lanceolate, 1.3–1.5 × 0.3–0.4 cm, slightly concave, 3-nerved. Petals similar to sepals, 1.2–1.4 × 2.0–2.5 cm. Lip saccate at the base, 1.5–1.7 × 0.5–0.6 cm, 3-lobed; lateral lobes more or less embracing the column, ca. 8 × 2–3 mm, apex acute or sub-obtuse; midlobe broadly obovate-oblong to sub-orbicular, 9–10 × 6–7 mm, margins somewhat wavy, deflexed on the sides, minutely denticulate, apex rounded or rarely sub-retuse. Column white ca. 8 × 2 mm. Capsules elliptic, ca. 1.8 × 0.6 cm.

Habitat: Terrestrial, grows on forest floors.

Flowering: March–April.

Occurrence: Kamrup: North Guwahati - Madankamdev (*vide* Kalita 2006).

Distribution: India (Assam, Arunachal Pradesh, Orissa, Maharashtra, Karnataka), Thailand, Laos.

Regional Conservation Status: Data Deficient.

Nervilia juliana (Roxb.) Schltr., Bot. Jahrb. Syst. 45: 402. 1911; Santapau & Kapadia, Orchids Bombay 131. 1966; Sud.Chowdhury, J.Assam Sci. Soc. 30(1): 24. 1987; H.J.Chowdhury, Orch. Fl. Arunachal Pradesh 529. 1998; I.Barua, Orchid Fl. Kamrup Distr. Assam 63. 2001; N.Pearce & P.J.Cribb, Orchids Bhutan 63. 2002. *Epipactis juliana* Roxb., Fl. Ind. 3: 453. 1832. *Pogonia juliana* (Roxb.) Wall. ex Trimen, Handb. Fl. Ceylon 4: 225. 1898; Hook.f., Fl. Brit. India 6: 119. 1890. **Fig. 29 (F–H).**

Plant small delicate; tuber single, whitish, rounded, 1–2 cm in diam., with 2–3 transverse bands. Leaf usually solitary, rarely up to three, appears after flowering, shortly petioled, ovate-cordate, ca. 5 × 5 cm, 5–7-nerved, glabrous, green above, purple beneath. Scape filiform, single flowered, 7.5–15 cm long, with few remote smooth sheaths; floral bract, oblong, 1.2–1.5 cm long, somewhat cymbiform. Pedicel and ovary 4–5 mm long, purplish-green or purplish-brown. Flowers purple-green, 3.0–3.5 cm long. Sepals and petals similar, pale-green, narrowly oblanceolate, acuminate, 2.5–3.3 × 0.2–0.3 cm. Lip

white, rhombiform, mottled with pink, 2.2–3.2 cm long, saccate at base, distinctly 3-lobed; side lobes narrow, falcate and longer; midlobe, concave, with a fleshy median ridge, rhomboid-ovate to rhomboid-lanceolate, hairy at base. Anther fleshy, ca. 3.5 × 2.5 mm, winged at apex; pollinia 2, linear-oblong. Column erect, slender, clavate, 6–7 mm high, white with few pink spots; rostellum elliptic, wavy, thick. Capsule oblong, six-ribbed.

Habitat: Terrestrial, grows on moist places often occurs in open and loose soils, occasionally found at the edges of wetlands. Sometimes it grows in association with *Chrysopogon aciculatus* (Retz.) Trin., *Imperata cylindrica* (L.) Raeusch., *Kyllinga brevifolia* Rottb. and *Ophioglossum reticulatum* L.

Flowering: April–May.

Occurrence: Baksa and Chirang: Manas B.R.; Cachar: Borail W.L.S.; Darrang: Orang N.P.- ½ Camp; Dibrugarh: Dehing-Patkai W.L.S.; Kamrup: Jalukbari-Gauhati University Campus, Japorigog; North Cachar Hills: Near Kalachand; Tinsukia: Jagun F.V.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, West Bengal, Karnataka), Bangladesh, Myanmar, Sri Lanka.

Regional Conservation Status: Near Threatened.

Nervilia plicata (Andrews) Schltr., Bot. Jahrb. Syst. 45: 403. 1911; C.E.C.Fisch., Fl. Madras 3: 1020. 1956; Sud.Chowdhury, J.Assam Sci. Soc. 30(1): 25. 1987; N.Pearce & P.J.Cribb, Orchids Bhutan 60. 2002; S.Misra, Orchids Orissa 250. 2004; Lucksom, Orchids Sikkim N.E. Himalaya 56. 2007; Vij *et al.*, Orchids Himachal Pradesh 227. 2013. *Arethusa plicata* Andrews, Bot. Repos. 5: 321. 1803. *Pogonia plicata* (Andrews) Lindl., Gen. Sp. Orchid. Pl. 415. 1840; Hook.f., Fl. Brit. India 6: 119. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 268. 1898. *Pogonia velutina* E.C.Parish & Rchb.f., Trans. Linn. Soc. London 30: 142. 1874; Hook.f., Fl. Brit. India 6: 119. 1890. *Nervilia discolor* (Blume) Schltr., Bot. Jahrb. Syst. 45: 403. 1911.

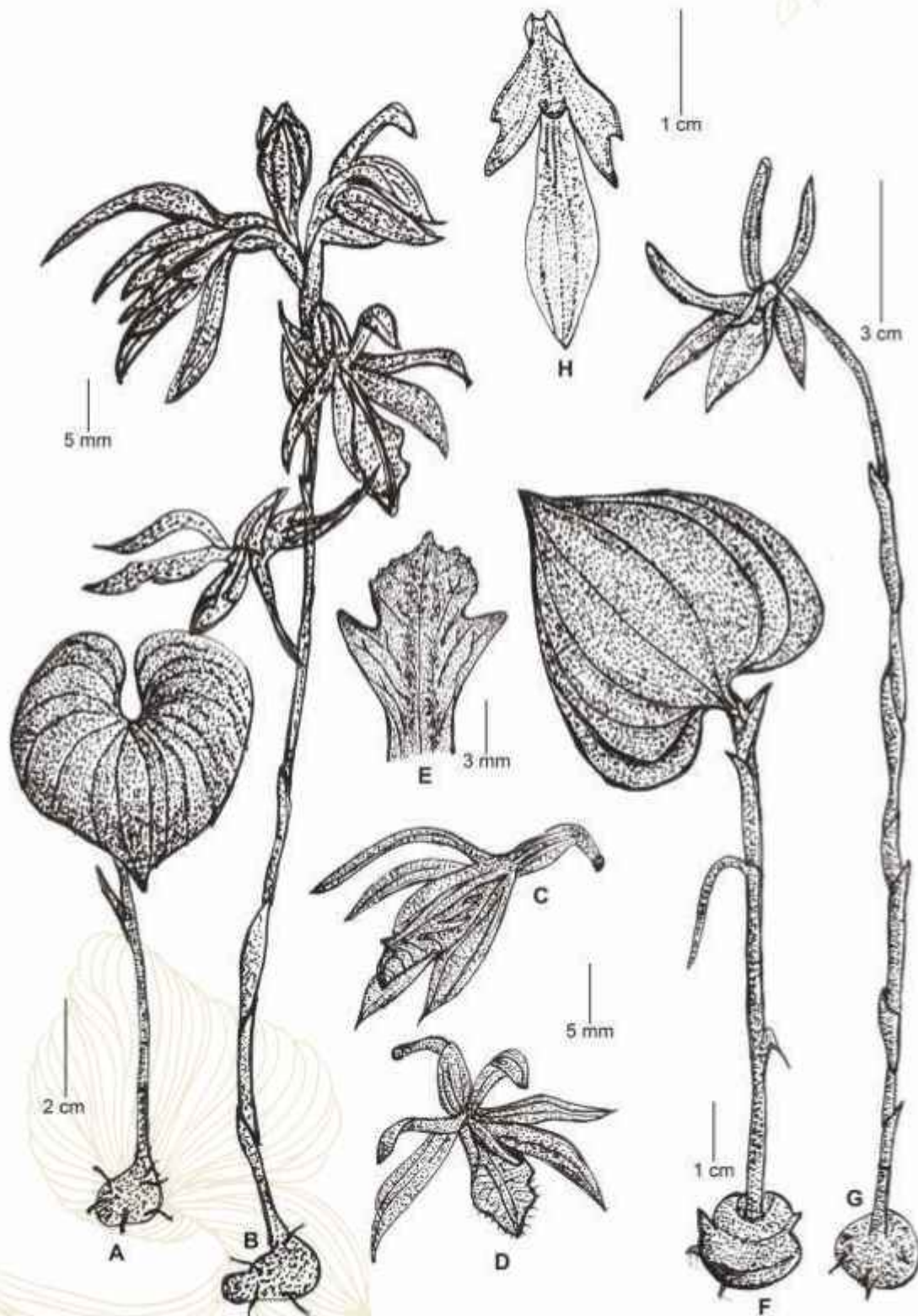


Figure 29. A–E: *Nervilia concolor* (Blume) Schltr.: A. Leafy shoot with tuber; B. Flowering shoot with tuber; C–D: Flowers in different angles; E. Lip. F–H: *Nervilia juliana* (Roxb.) Schltr.: F. Leafy shoot with tuber; G. Flowering shoot with tuber; H. Lip.



Nervilia plicata (Andrews) Schltr.: a flowering shoot (left) and closeup of flowers (right)

Plant 7–25 cm high; tuber whitish, globose or subglobose, 0.5–2.2 cm in diam. Leaf abaxially green or dark purple, adaxially pale to dark green and sometimes with purple or yellowish blotches; lamina orbicular-cordate, 8–14 × 7–14.5 cm, plicate, pubescent primarily on veins, many veined, base cordate, apex acute; petiole erect, purple or dark green, 1.5–3 cm long. Inflorescence 10–28 cm high, 2-flowered on top; peduncle dark green or purple, with 2 or 3 tubular sheaths; floral bracts lanceolate, 5–7 × 1–2 mm, apex acuminate. Flowers nodding, resupinate, 4–5 cm in across, usually opening widely; pedicel and ovary 1.0–1.5 cm long, ridged. Sepals brownish yellow or purple with purplish red venation, spatulate, 1.5–2.5 × 0.3–0.4 cm, apex acute. Petals brownish yellow or purple with purplish red venation, linear-oblongate, 1.4–2.2 × 0.2–0.3 cm, apex acute. Lip brownish tinged yellow at center and with purplish brown venation, or pale purple tinged dark purple at center and with purplish red venation, rhombic to ovate, 1.3–2.0 × 1.0–1.3 cm, spurless, obscurely 3-lobed above middle; lateral lobes erect and loosely enclosing column, small, rounded; mid-

lobe subsquare or ovate, longitudinally folded at apex, apex truncate-obtuse when flattened or sometimes slightly emarginate; disk glabrous, with a ridge running from near base almost to apex of mid-lobe. Column white, 0.7–1.1 cm high, apex dilated; stigma deep-seated, white, broadly oblong; rostellum decurved. Anther subquadrate, white or pinkish-white; pollinia pyriform, 2.5–3 mm long, pale yellow.

Habitat: Terrestrial, grows on black alluvial soil under bamboo grove or often found in mixed-evergreen forests and amidst grasses.

Flowering: April.

Occurrence: Baksa and Chirang: Manas B.R.; Kamrup: Japorigog Forest, Rani R.F., outside the western side of the Assam State Zoo; Karbi Anglong: Nambor W.L.S.; North Cachar Hills: Shimtilong; Sonitpur: Tezpur near Agnigarh; West Karbi Anglong: Umpanai.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal, Bihar, Uttarakhand, Himachal Pradesh, Jammu & Kashmir, Orissa, Gujrat,

Maharashtra, Andhra Pradesh, Karnataka, Kerala, Tamil Nadu, Andaman & Nicobar Is.), Bangladesh, Bhutan, Nepal, Pakistan, China, Myanmar, Thailand,

Laos, Vietnam, Malaysia, Indonesia, Philippines, New Guinea, Australia.

Regional Conservation Status: Least Concern.

Subtribe: *Epipogiinae* Schltr.

***Epipogium* J.F. Gmel. ex Borkh.**

Terrestrial, holomycotrophic herbs. Rhizome tuberous fleshy. Stem erect, fleshy, with short, scalelike sheathing bracts at nodes, white or pale yellowish white, leafless, glabrous. Inflorescence terminal, racemose, several to many flowered, ephemeral; floral bracts ovate-lanceolate, membranous. Flowers usually pendulous, resupinate or non resupinate, yellowish white with violet or reddish brown markings; pedicel slender, often elongate; ovary dilated. Sepals and petals similar, connate or free, lanceolate. Lip broadly ovate when flattened, fleshy, concave, spurred at base, entire or 3-lobed; disk papillate and with longitudinal ridges or lamellae; spur broad, shortly saccate to elongate, straight or slightly curved, apex obtuse. Column short, fleshy, foot absent; stigma placed at base of column; rostellum broad, sometimes reduced and obscure. Anther incumbent or suberect; pollinia 2, each deeply cleft, clavate, loosely granularfarinaceous, each with a slender caudicle and attached to a viscidium. Capsule ellipsoid or ovoid.

About 3 species; distributed in tropical temperate and tropical Asia, NE Australia, SW Pacific islands, Africa, Europe; 2 species in India and 1 species in Assam.

Epipogium roseum (D.Don) Lindl., J. Proc. Linn. Soc., Bot. 1: 177. 1857; Kataki, Orchids Meghalaya 212. 1986; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 343. 1998; N.Pearce & P.J.Cribb, Orchids Bhutan 34. 2002; Lucksom, Orchids Sikkim N.E. Himalaya 22. 2007; Vij *et al.*, Orchids Himachal Pradesh 193. 2013. *Limodorum roseum* D.Don, Prodr. Fl. Nepal. 30. 1825. *Epipogium nutans* (Blume) Rchb.f., Bonplandia (Hannover) 5: 36. 1857; Hook.f., Fl. Brit. India 6: 124. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 253. 1898; C.E.C.Fisch., Fl. Madras 3: 1021. 1956. *Epipogium indicum* H.J.Chowdhery, G.D.Pal & G.S.Giri, Nordic J. Bot. 13: 419. 1993.

Plants 15–50 cm high. Rhizome tuberous, narrowly fusiform to ovoid, 2–5 × 1–1.6 cm, many noded. Stem erect, glabrous, sheathed, 10–25 cm tall; sheaths amplexicaul, white, broadly ovate, 0.8–1.5 cm long, membranous. Inflorescence pale pink;

rachis 6–12 cm long, laxly to subdensely 2–16-flowered, sometimes pendulous toward apex; floral bracts ovate-lanceolate, 0.9–1.2 × 0.4–0.7 cm. Flowers resupinate, pendulous, opening widely or not, pale pink to pale yellow or white with faint purple spots on lip; pedicel and ovary 6–8 mm long. Sepals weakly spreading, linear-lanceolate, 0.8–1.1 × 0.2–0.3 mm, 3-veined, margin undulate, apex subacute. Petals similar to sepals, weakly spreading, often slightly shorter and wider than sepals, slightly oblique, 0.7–1.0 × 0.2–0.3 cm, apex acute to acuminate. Lip elliptic-ovate when flattened, concave, 0.8–1.2 × 0.6–0.7 cm, spurred at base, margins erose-denticulate; disk with 2 longitudinal densely papillose ridges; spur projecting backward, nearly parallel to ovary, cylindric, 3–5 × 1.5–2.5 mm, shorter than ovary, apex obtuse. Column 2.5–4.5 mm long. Anther subglobose; pollinia 0.1–0.2 mm long. Capsule ovoid-ellipsoid, 5–7 × 3–5 mm.

Habitat: Grows in damp evergreen forest floors or on moist places, holomycotrophic.

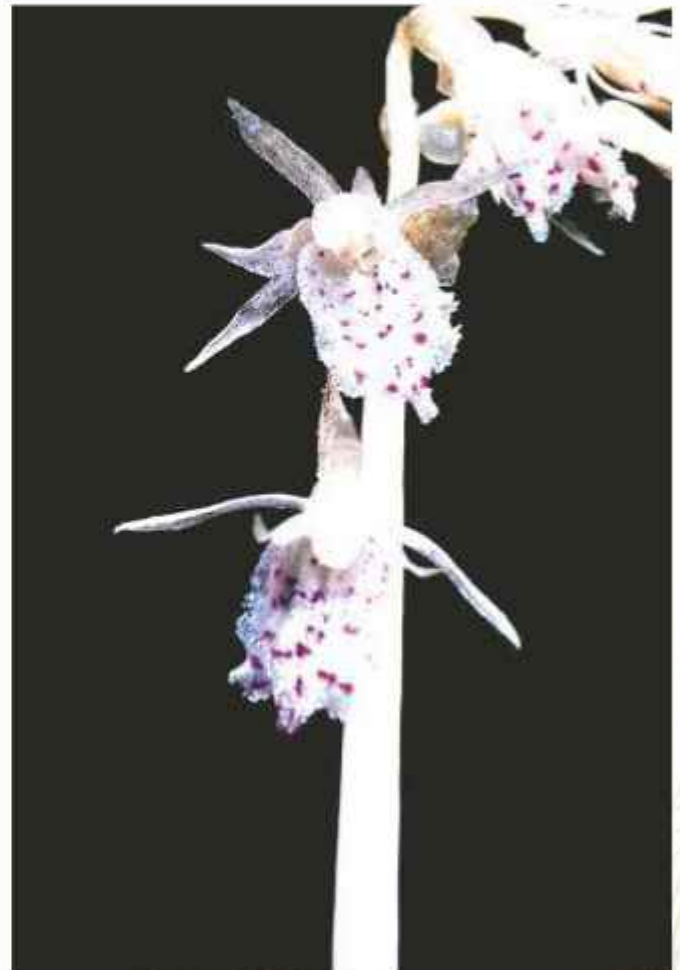
Flowering: May–July.

Occurrence: Baksa and Chirang: Manas B.R.; Dibrugarh: Jeypore R.F.; Karbi Anglong: Nambor W.L.S.; Lakhimpur: Dullung R.F. and Kakoi R.F.; North Cachar Hills: Thenbung ca. 1067 m; West Karbi Anglong: Sirtiso ca. 587 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim,

West Bengal, Uttarakhand, Himachal Pradesh, Jammu & Kashmir, Madhya Pradesh, Maharashtra, Karnataka, Kerala, Tamil Nadu), Nepal, Pakistan, China, Japan, Sri Lanka, Myanmar, Thailand, Laos, Vietnam, Malaysia, Indonesia, Philippines, New Guinea, Solomon Is., Australia, Fiji, New Caledonia, Vanuatu, Kenya, Uganda, Angola, Malawi, Ghana, Guinea, Nigeria, Cameroon, Central African Republic, Congo, Gulf of Guinea Is., Zaire.

Regional Conservation Status: Least Concern.



Epipogium roseum (D.Don) Lindl.: lower portion plant showing tuber (left) and inflorescence (right)



Pleione maculata (Lindl.) Lindl. & Paxton

TRIBE: ARETHUSEAE LINDL.

Epiphytic, lithophytic, or rarely terrestrial herbs, often with distinct rhizomes. Roots variously velamentous. Stems reed-like, pseudobulbous or rarely cormous, one- to many-leaved, when young enveloped in cataphylls. Leaves one to many, distichous, conduplicate or more frequently convolute, often plicate, often petiolate, deciduous, when inserted on top of a pseudobulb lacking a sheathing base, otherwise with a tubular sheathing base. Inflorescence terminal, proteranthous, synanthous, or hysternanthous, or seemingly lateral, but in fact heteranthous, i.e. arising on specialized, reduced shoots that do not develop normal pseudobulbs and leaves, usually a few- to many-flowered raceme, rarely a panicle, sometimes reduced to a single flower; peduncle consisting of a single internode; floral bracts caducous or persistent, ovate to linear, acute to acuminate. Flowers resupinate or not. Sepals entire, usually free, lateral sepals rarely connate or all three sepals connate in Glomera, often keeled outside, lateral sepals similar to dorsal sepal but often oblique. Petals free or not, lanceolate, ovate, obovate to oblanceolate, minimally spreading to strongly reflexed. Labellum usually basally inserted on the column, usually rigidly so, sometimes hinged and mobile, sometimes with the sides adnate to column, often more or less saccate at base, sometimes with a distinct tubular spur, entire or trilobed, often clear divided into a concave basal part, the hypochile, and a flat convex apical part, the epichile, often with lamellate keels various wart-like callosities (the latter mainly in the genus *Coelogyne*), often ornamented with coloured trichomes and papillae, margins of lobes entire to crenate, the hypochile (or if this is absent, a small basal concavity) nectariferous. Column often conspicuously dilated and winged, often hood-like flattened in the apical part, sometimes with lateral arms, column foot absent or present; anther helmet-shaped, bilocular, pollinia four or eight, usually pyriform, soft, waxy, with thick, granular, coherent or connate or membranous caudides, viscidium absent or indistinct, semiliquid; stigma often prominent with raised margins, appearing cup-shaped, upper margin produced into a rostellum. Ovary glabrous or more or less densely covered with hairs. Capsule ellipsoid to subglobose, sometimes winged or triangular in cross-section, without endocarpic elaters.

Comprises 2 subtribes, 26 genera and ca. 762 species; distributed from Himalayas to Philippines and Southwest Pacific Islands, also in North and South America; 2 subtribes, 9 genera, 36 species and 2 varieties in Assam.

Key to the Genera

- 1a. Plant terrestrial, without pseudobulbs; if stems cane-like, then flowers showy with petals much broader than sepals; if subterranean corms present, the inflorescence not terminal; labellum not spurred2
- 1b. Plant terrestrial, epiphytic or lithophytic, with or without pseudobulbs; if stems cane-like, then flowers not showy and petals not broader than sepals; if subterranean corms present, then inflorescence terminal; labellum spurred or not3
- 2a. Stem cormous, partly buried in soil, 2–5 leaved; inflorescence axillary; flowers non-resupinate*Anthogonium*
- 2b. Stems erect, cane-like, above-ground, with over 10 distichous leaves; inflorescence terminal; flowers resupinate*Arundina*
- 3a. Stems elongated, many-leaved*Thunia*
- 3b. Stems short, 1 to 4 leaved4
- 4a. Lateral sepals saccate at base5
- 4b. Lateral sepals not saccate at base6

- 5a. Labellum base not saccate or spurred, sigmoid *Panisea*
 5b. Labellum base saccate or spurred, not sigmoid *Neogyna*
 6a. Pseudobulbs annual, hence plant not forming a rhizome; leaves plicate; inflorescence 1 or 2 flowered
 *Pleione*
 6b. Pseudobulbs lasting more than 1 year, hence plant forming a rhizome; leaves plicate or not; inflorescence
 1 to many flowered 7
 7a. Labellum not clearly divided into 2 parts, or if so, epichile trilobed; labellum not cup-shaped
 *Coelogyne*
 7b. Labellum divided into a saccate or cup-shaped hypochile and a entire or bilobed epichile; sometimes
 epichile highly reduced, then whole labellum cup-shaped 8
 8a. Column long and slender *Otochilus*
 8b. Column short and stout *Pholidota*

Subtribe: *Arethusinae* Benth.

***Anthogonium* Wall. ex Lindl.**

Terrestrial herbs. Stems partially buried in soil. Leaves 2–5, linear-lanceolate, plicate, sheathing. Inflorescences erect, emerging above leaves; rachis with several tightly appressed brownish bracts; floral bracts loosely attached. Flowers non resupinate, few to many, basally gibbous, perianth reflexed downward, pink to nearly white; ovary suberect. Sepals spreading, oblanceolate, basally connate forming a tube, apically free. Petals spreading or strongly reflexed, elongate, spatulate, obtuse, connate at base, free at apex. Lip basally adnate to column, 3-lobed, with longitudinal red to purple lines and spots. Column whitish to pink, apex dilated and abruptly incurved, foot absent. Anther cap pale yellow, bi-locular; pollinia 4, without caudicle and viscidium. Capsule fusiform.

One species; distributed from Himalayas to S and SE Asia; same in India as well as in Assam.

Anthogonium gracile Wall. ex Lindl., Intr. Nat. Syst. Bot. 2: 341. 1836; Hook.f., Fl. Brit. India 5: 822. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 96. 1898; Katak, Orchids Meghalaya 108. 1986; H.J. Chowdhery, Orch. Fl. Arunachal Pradesh 65. 1998; Hynn. *et al.*, Orchids Nagaland 45. 2000; N. Pearce & P.J. Cribb, Orchids Bhutan 279. 2002; Lucksom, Orchids Sikkim N.E. Himalaya 394. 2007. *Anthogonium griffithii* Rchb.f., Bonplandia (Hannover) 2: 90. 1854. **Fig. 30 (A–P).**

Plant 38–52 cm high. Pseudobulb ovoid, partly buried in soil, 1–2 cm in diam. Leaves 2–5, narrowly lanceolate, 15–30 × 1–2 cm, papery, acuminate at apex, base sheathing; sheaths forming a slender pseudostem 10–20 cm long. Inflorescence erect; peduncle slender, glabrous, with several tubular

sheaths; rachis 7.5–15 cm long, laxly 4–8-flowered; floral bracts ovate-lanceolate, small, 4–5 mm long, apex acute. Flowers purplish, 1.5–2 cm long; pedicel and ovary 1.5–2 cm long. Sepals connate in basal half forming a 7–8 mm long tube, with apical half free; dorsal sepal oblong-lanceolate, 1.5–1.6 × 0.2–0.3 cm, apex obtuse; lateral sepals falcate, recurved, *ca.* 1.5 × 4.5 mm, apex acute. Petals narrowly oblong-spatulate, *ca.* 1.6 × 0.2 cm, apex obtuse. Lip rose-pink or white and tinged with red, 1.5–1.6 cm long, cuneate-clawed at base, apical part 3-lobed; lateral lobes ovate-triangular, apex obtuse; mid-lobe subovate, nearly as large as lateral lobes, apex obtuse. Column *ca.* 1.6 cm long.

Habitat: Terrestrial, grows on grassy hill slope exposed to sun.

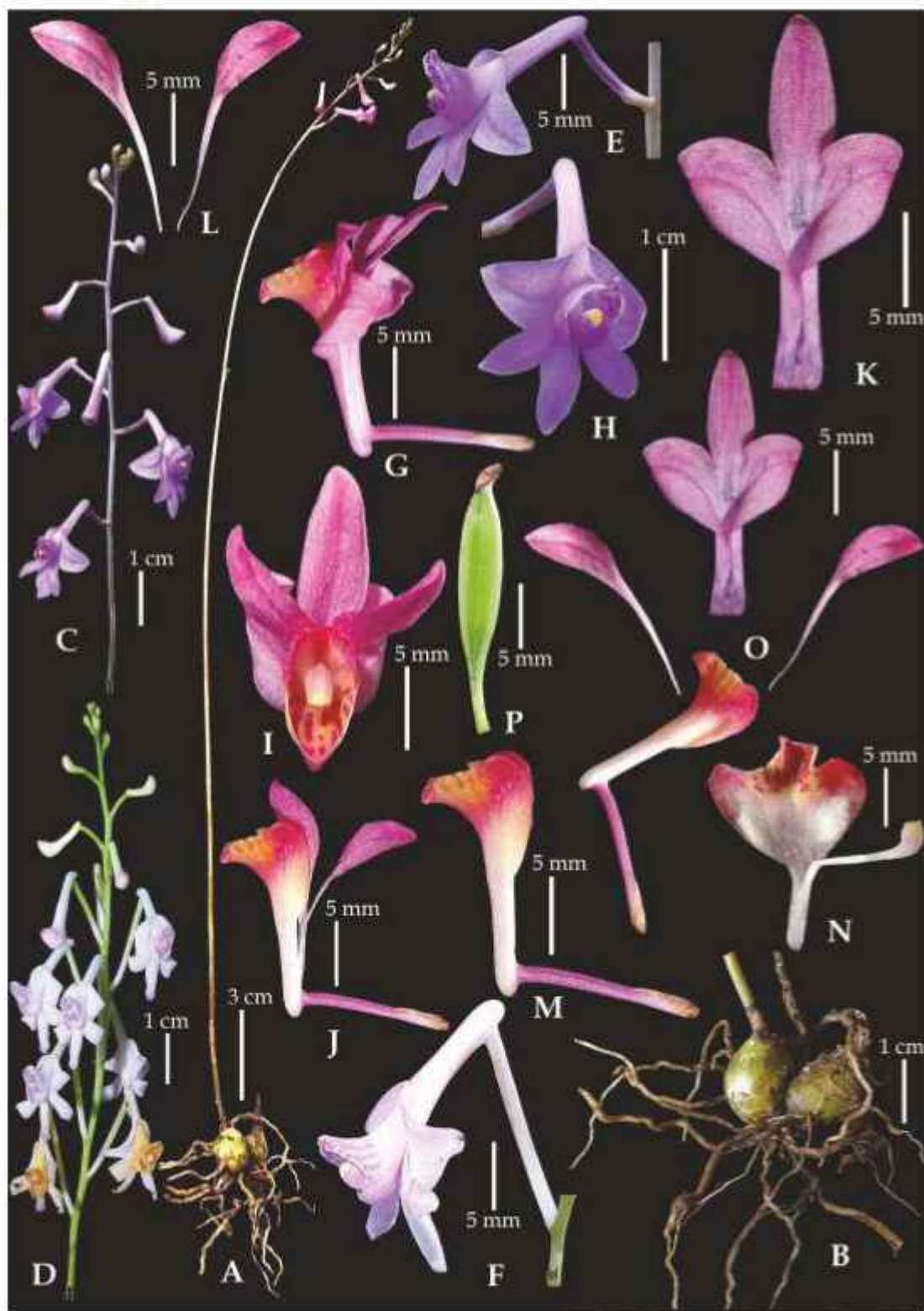


Figure 30. A–P: *Anthogonium gracile* Wall. ex Lindl.: A. Habit; B. Pseudobulbs; C–D. Inflorescence (colourforms); E–G. Flower (lateral view); H–I. Flower (front view); J. Flower-sepals removed (lateral view); K. Sepals; L. Petals; M. Labellum, column, pedicel & ovary (lateral view); N. Labellum and column (dorsal view); O. Floral analysis; P. Fruit.

Flowering: July–September.

Occurrence: Karbi Anglong: Dambukso *ca.* 840 m, Dili Terang *ca.* 548 m.; North Cachar Hills: Hangrum *ca.* 854 m, Ngalsung, Saiding, Thenbung *ca.* 1000 m; West Karbi Anglong: Kseh Kynthang *ca.* 859 m, Sirtiso *ca.* 587 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal,) Bangladesh, Bhutan, Nepal, China, Myanmar, Thailand, Laos, Cambodia, Vietnam.

Regional Conservation Status: Least Concern.



Anthogonium gracile Wall. ex Lindl.: a plant in its natural habitat (left) and closeup of a flower (right)

***Arundina* Blume**

Terrestrial herbs, often lithophytic. Rhizome ovoid, stout; roots many, filiform, slender, fibrous. Stem erect, tufted at base, reedlike, usually unbranched, leafy. Leaves distichous, linear-lanceolate, conduplicate and sheathing at base, apex acute. Inflorescence terminal, unbranched or occasionally shortly branched, few to several flowered; floral bracts persistent, triangular, small. Flowers resupinate, opening one at a time, large; pedicel and ovary elongate, slender. Sepals similar, elliptic or lanceolate, apex acute; lateral sepals usually connate below lip. Petals spreading, ovate-elliptic or obovate, apex acute. Lip adnate to base of column, obovate, not spurred, 3-lobed; disk with 3 longitudinal pubescent lamellae; lateral lobes erect, embracing column, rounded; mid-lobe spreading, apex notched. Column long, straight, dilated and narrowly winged toward apex; stigma transversely oblong, broad. Anther terminal, incumbent; pollinia 8, in 2 groups, waxy, with short caudicles, attached to sticky viscidia. Capsule cylindric-fusiform, large, ridged.

One species; distributed from Himalayas to SE Asia, introduced and naturalized in the Pacific islands and the Neotropics; 1 species and 1 variety in India as well as in Assam.

Arundina graminifolia (D.Don) Hochr., Bull. New York Bot. Gard. 6: 270. 1910; C.E.C.Fisch., Fl. Madras 3: 1002. 1956; Kataki, Orchids Meghalaya 142. 1986; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 74. 1998; Hynn. *et al.*, Orchids Nagaland 47. 2000; N.Pearce & P.J.Cribb, Orchids Bhutan 319. 2002; Sud.Chowdhury, Assam's Fl. 325. 2005; Lucksom, Orchids Sikkim N.E. Himalaya 434. 2007. *Bletia graminifolia* D.Don, Prodr. Fl. Nepal. 29. 1825. *Arundina bambusifolia* Lindl., Gen. Sp. Orchid. Pl. 125. 1831; Hook.f., Fl. Brit. India 5: 857. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 113. 1898. *Arundina chinensis* Blume, Bijdr. 402. 1825. *Arundina speciosa* Blume, Bijdr. 401. 1825. *Cymbidium bambusifolium* Roxb., Fl. Ind. 3: 460. 1832.

Plant 0.4–3 m high. Stem rigid, enclosed by leaf sheaths. Leaves numerous, linear-lanceolate, 8–24 × 0.5–2 cm, leathery or papery, apex acuminate; sheaths 2–5 cm long. Inflorescence 10–20 cm long, racemose or 1- or 2-branched at base and paniculate, 2–10-flowered, flowers opening in succession; floral bracts broadly ovate-triangular, 2–5 mm, sheathing at base. Flowers white or pink, labellum tinged with purple; pedicel and ovary 1.5–3 cm long. Sepals narrowly elliptic to narrowly elliptic-lanceolate, 2–5 × 0.5–1.0 cm. Petals ovate-elliptic, 2.2–4.0 × 0.6–1.5 cm. Lip 2.5–6 × 1.2–3.6 cm, apical margin undulate; lateral lobes incurved, embracing column, rounded; mid-lobe subsquare to semi-circular, 0.8–1.6 × 0.9–1.6 cm, apex shallowly divided; disk yellow or white, with 3–9 lamellae. Column slightly arcuate, 1.0–2.5 cm long. Capsule cylindrical, longitudinally ridged, 2.2–7 × 0.5–1.5 cm.

Key to the Variety

- 1a. Leaf margin not revolute. Flower large, up to 8 cm long; lip disk whitish, with purple spots
.....*A. graminifolia* var. *graminifolia*
- 1b. Leaf margin revolute. Flower small, up to 3.5 cm long; lip disk yellowish
.....*A. graminifolia* var. *revoluta*

Arundina graminifolia var. *graminifolia*

Fig. 31 (A–R).

Plant up to 3 m high. Stem erect, cane-like, placed at an interval of 0.7–1.3 cm apart on rhizome. Leaves linear-lanceolate, up to 24 cm long and 2 cm wide, margins not revolute; sheaths 2–5 cm long. Inflorescence 12–23 cm long; rachis few to many flowered. Flowers usually large, up to 8 cm long. Sepals narrowly ovate to ovate-lanceolate, 3.4–5 × 0.5–1 cm. Petals spreading, broadly elliptic, obtuse, 3.3–4.1 × 1.3–1.6 cm. Lip 4–6 × 2.5–3.6 cm; disk white, with 3–5 lamellae. Column slender erect, angular 2–2.5 cm long. Fruit long-ellipsoid 3.5–7 × 0.8–1.5 cm.

Habitat: Terrestrial, grows on grassy hill slope exposed to sun.

Flowering: May–July.

Occurrence: Baksa: Manas B.R.-Doimari, Rabnag; Cachar: Borail W.L.S., East Block, Nimatrapahar, Hawaithang, Jirighat, Near Mizoram Border-Virangti & Maruacherra; Chirang: Manas B.R.; Darrang: *sine loc.*; Golaghat: Kaziranga N.P., Rengma, Norongi on Goruchora Beel; Hailakandi: Innerline R.F.; Kamrup: Gauhati University Campus, Kholihoi R.F.; Karbi Anglong: Jengpata ca. 737 m, Sarhed ca. 600 m; Karimganj: Akbarpur; Kokrajhar: Chirang R.F.-Ultapani, Kuwori; Lakhimpur: Dullung R.F., Chaldhuwa, Kakoi R.F., Ronga R.F., Seajuli; North Cachar Hill: Near Dittokchora, Harangajao ca. 149 m; Sibsagar: Kaziranga N.P.; Sonitpur: Nameri N.P.; Tinsukia: Digboi, Lekhapani, Deopani R.F.; Udalguri: Barnadi W.L.S., Nunai-Bhutan Road, near Bhutan Border; West Karbi Anglong: Hamren ca. 430 m, Umpanai.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Tripura, Sikkim, West Bengal, Uttarakhand, Kerala, Tamil Nadu), Bangladesh, Bhutan, Nepal, China, Sri Lanka, Myanmar, Thailand, Laos, Cambodia, Vietnam, Malaysia, Indonesia, Philippines, New Guinea. It is introduced into Réunion, Hawaii,

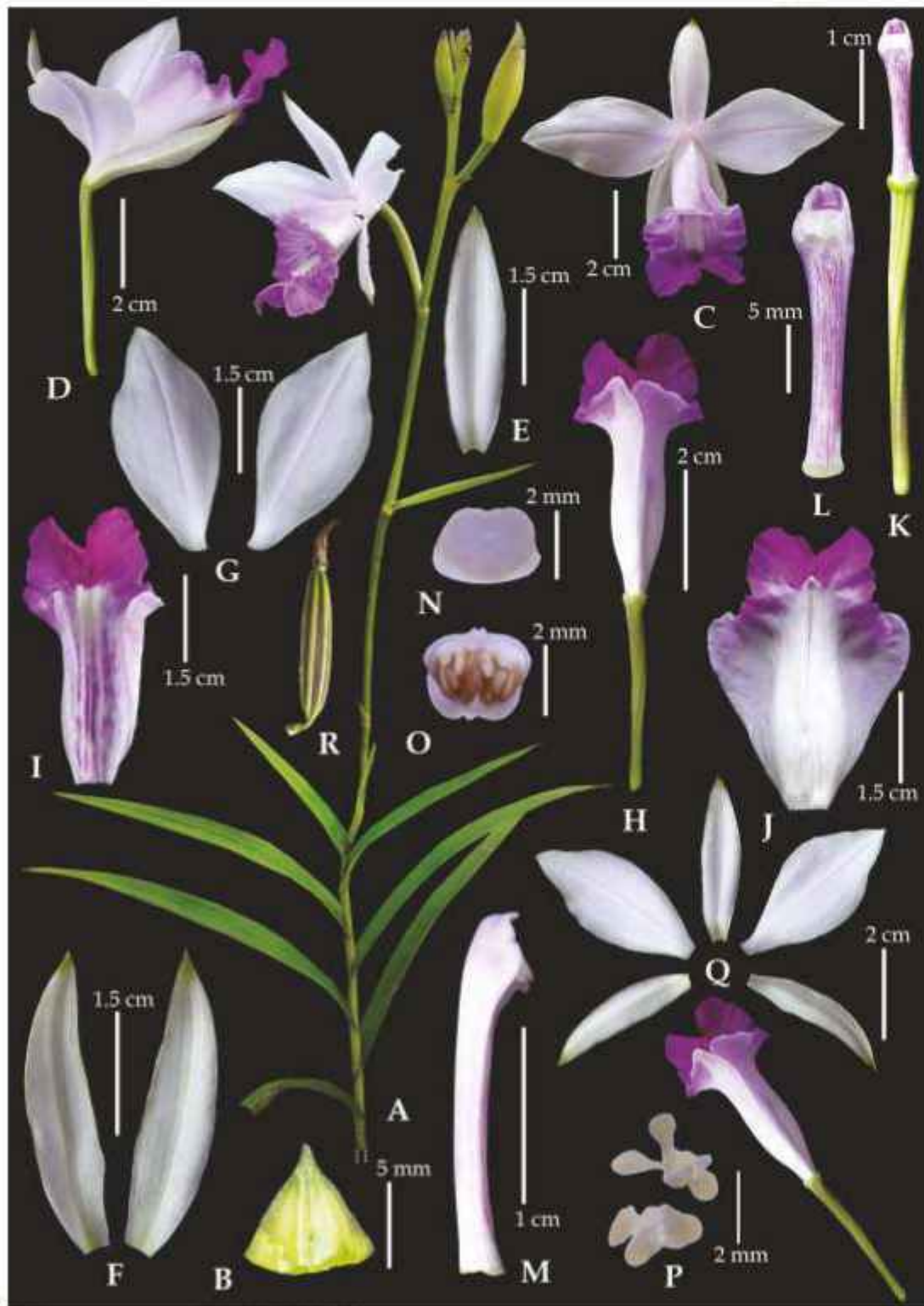


Figure 31. A–R: *Arundina graminifolia* (D. Don) Hochr. var. *graminifolia*: A. Flowering twig; B. Floral bract; C. Flower (front view); D. Flower (lateral view); E. Dorsal sepal; F. Lateral sepals; G. Petals; H. Labellum, column, pedicel & ovary; I. Labellum (dorsal view); J. Labellum-flattened out (ventral view); K. Column, pedicel & ovary (ventral view); L. Column (ventral view); M. Column (lateral view); N. Anther cap (dorsal view); O. Anther cap (ventral view); P. Pollinia; Q. Floral analysis; R. Fruit [A & R, not to scale].



Arundina graminifolia (D.Don) Hochr. var. *graminifolia*: plant habit (left) and closeup of a flower (right)

Marianas, Society Is., Fiji, Jamaica, Leeward Is., Puerto Rico and Costa Rica.

Regional Conservation Status: Least Concern.

Note: This species is locally known as “Nol-Phul” (Assamese).

Arundina graminifolia var. *revoluta* (Hook.f.) A.L.Lamb, Orchids Borneo 1: 66. 1994; Ram. Kumar *et al.*, Richardiana 15: 129. 2014. *Arundina revoluta* Hook.f., Fl. Brit. India 5: 858. 1890. *Arundina affinis* Griff., Not. Pl. Asiat. 3: 330. 1851.

Plant up to 0.6 m high. Stems dense caespitose, placed at an interval of 0.3–0.5 cm apart on rhizome. Leaves linear, up to 16 cm long and 0.9 cm wide, margins revolute; sheaths 0.9–3.0 cm long. Inflorescence 10–18 cm long; rachis 1–3-flowered.

Flowers usually small, up to 3.5 cm long. Sepals narrowly ovate, 2.0–2.7 × 0.6–0.8 cm. Petals oblongelliptic, 2.2–2.6 × 0.6–0.7 cm; disk yellow with 7–9 lamellae. Column slightly curved inwards, 1.0–1.2 cm long. Fruit cylindrical, longitudinally ridged, 2.2–3.0 × 0.5–0.8 cm.

Habitat: Lithophytic or terrestrial, grows on hill slopes.

Flowering: March–April.

Occurrence: Lakhimpur: Dullung R.F., Kakoi R.F.; West Karbi Anglong: Kseh Kynthang *ca.* 859 m, Umpanai.

Distribution: India (Assam, Arunachal Pradesh, Meghalaya), Sri Lanka, Thailand, Laos, Cambodia, Vietnam, Malaysia, Indonesia.

Regional Conservation Status: Least Concern.



Arundina graminifolia var. *revoluta* (Hook.f.) A.L.Lamb: plant habit (left) and closeup of a flower (right)

Subtribe: *Coelogyinae* Benth.

***Coelogyne* Lindl.**

Epiphytic, rhizomatous herbs. Pseudobulbs ovoid to cylindric, closely or distantly placed along rhizome, generally covered with sheaths, usually 2-leaved at apex but sometimes with only 1 leaf. Leaves oblong to elliptic, usually petiolate at base. Inflorescence either terminal or lateral to pseudobulbs and either heteranthous, proteranthous, or synanthous, erect or pendulous, several flowered, rarely more than 20-flowered or reduced to single flowered; floral bracts caducous, often large. Flowers opening successively or simultaneously, large or medium-sized. Sepals similar, often concave. Petals often linear, much narrower than sepals. Lip often concave at base, 3-lobed or rarely unlobed; lateral lobes somewhat erect and embracing column; callus with longitudinal lamellae. Column rather long, winged on both sides and around top, foot absent; stigma concave; rostellum rather large. Anther terminal, incumbent; pollinia 4, in 2 pairs, waxy, attached to a sticky substance. Capsule medium-sized, often ribbed or narrowly winged.

About 200 species; distributed in tropical and subtropical Asia to Oceania; 42 species in India and 17 species in Assam.

Key to the Species

- 1a. All flowers are not opening at the same time, but only one or few at a time, the top of the rachis a long time covered by white bracts2
- 1b. All flowers opening at the same time7
- 2a. Inflorescence with imbricate sterile bracts mainly at base of peduncle; lip with 3 lamellae, margin of mid-lobe fimbriate3
- 2b. Inflorescence with imbricate sterile bracts at junction of peduncle and rachis4
- 3a. Lip mid-lobe ovate, callus with 3 lamellae, median lamella indistinct, lateral lamellae terminating near tip of mid-lobe, undulate (dorsal sepal 3 cm or more long) *C. ovalis*
- 3b. Lip mid-lobe orbicular, fimbriate, callus with 3 lamellae, median lamella virtually a brown vein, lateral lamellae terminating at tip of mid-lobe, initially diverging then converging at tip of mid-lobe (dorsal sepal around 2 cm) long *C. fimbriata*
- 4a. Rachis extending with new imbricate bracts to produce further annual sets of flowers *C. schultesii*
- 4b. Rachis producing single set of flowers5
- 5a. Lip with 5 lamellae *C. griffithii*
- 5b. Lip with 2 or 3 lamellae6
- 6a. Lip with crenulate lamellae, mid-lobe suborbicular or cordate, margin erose, 2 crenulate lamellae terminating at base of mid-lobe *C. stricta*
- 6b. Lip with fimbriate lamellae *C. barbata*
- 7a. Scape naked from base to just below rachis where there are many close distichous glumae8
- 7b. Scape naked between pseudobulbs (or un-developed pseudobulbs) and the lowest flower bract, or only with a single or few bracts9
- 8a. Pseudobulbs globular ovoid, the leaves with insignificant petioles; flowers usually brownish to orangeyellow *C. prolifera*
- 8b. Pseudobulbs slender, nearly cylindric, 7.5-10 cm long, leaves distinctly petioled. Keels on epichile laminate converging, column much broadening towards apex. Flowers greenish-yellow *C. longipes*
- 9a. Margins of sepals and petals undulate; lip lamellae fimbriate *C. cristata*
- 9b. Margins of sepals and petals not undulate; lip lamellae not fimbriate10
- 10a. Scape usually with a single or few bracts, rarely naked between pseudobulb and lowermost flower bract. Lip coloured with eyes, or with lacinate or warty keels, rarely with undulate or whole insignificant keels *C. nitida*
- 10b. Scape naked between pseudobulbs and the lowermost flower bract. Lip without keels or with unbroken undulate or crenulate keels11
- 11a. Dorsal sepal larger than lateral sepals, close to the column12
- 11b. Dorsal sepal same size or smaller than lateral sepals, open free from column13
- 12a. Lip 30-40 mm long, flower bracts caducous, 3 keels on lip of about equal length, their distal ends acuminate thinning on the epichile *C. fuscescens*
- 12b. Lip less than 30 mm, usually 25-27 mm long, flower bracts persistent, median keel shorter than the lateral, all 3 keels flat and broad, the distal ends fattening with round obtuse apex *C. assamica*
- 13a. Lip with thin membranous margins *C. suaveolens*
- 13b. Lip with firm edges14
- 14a. 3 wavy keels on lip continue far out on the epichile where they often split up in close gatherings of wavy or papillous growth filling most of the disc except the rather thin mostly half-moon shaped more or less upturned sides *C. trinervis*
- 14b. 3 wavy keels on the lip all stop near the base of the epichile15

- 15a. Leaves grass-like, 12 mm or less wide *C. viscosa*
 15b. Leaves not linear, wider 16
 16a. Mid-lobe of lip suboblong, margin slightly crisped, apex strongly recurved; all the 3 lamellae runs parallelly, more or less equal in length *C. flaccida*
 16b. Mid-lobe of lip ovate-lanceolate, margin not crisped, apex nor strongly recurved; lamellae doesn't runs parallelly, median lamellae shorter in length *C. punctulata*

Coelogyne assamica Linden & Rchb.f., Allg. Gartenzeitung 25: 403. 1857; N.Pearce & P.J.Cribb, Orchids Bhutan 328. 2002. *Coelogyne fuscescens* var. *assamica* (Linden & Rchb.f.) Pfitzer, Pflanzenr. IV, 50 IIB 7: 43. 1907.

Pseudobulbs fusiform, clustered, 6–7 × 1.5–2 cm. Leaves 2, elliptic-lanceolate, 15–25 × 3.5–6 cm, 3–5 veined; petiole ca. 3 cm long. Inflorescence proteranthous; peduncle enclosed with convolute bracts at base, 10–12 cm long; rachis slightly zigzag, 20–25 cm long, usually 8 flowered, opening simultaneously; floral bracts deciduous. Flowers pale yellow, ca. 7 cm in across, lip darker yellow with intricate brown veins on lateral lobes, veins on mid-lobe orange-brown. Dorsal sepal oblong, ca. 3.2 × 0.9 cm, 7–9 veined, apex acuminate to slightly acute;

lateral sepals linear, falcate, ca. 2.8 × 0.6 cm, acute. Petals narrowly linear, 2.5–3.0 × 0.2–0.25 cm, 3-veined. Lip obovate with deep recess on each side, ca. 2.6 × 1.2 cm, 3-lobed; lateral lobes not spreading, triangular; mid-lobe somewhat orbicular, ca. 1.2 × 1.3 cm, shortly clawed, acute or subacute; callus with 3 lamellae but median lamella shorter. Column clavate, ca. 2 cm long, apex ca. 0.6 cm in diam., acuminate.

Habitat: Epiphytic on tree trunks.

Flowering: September–November.

Occurrence: Cachar: Borail W.L.S., Durbin Tilla; North Cachar Hills: Saitap ca. 793 m, Patherkot ca. 800 m.

Distribution: India (Assam, Manipur, Nagaland), Bhutan, China, Myanmar, Thailand, Laos, Vietnam.

Regional Conservation Status & Criteria: Vulnerable, VU B2b(iii)c(ii).

Coelogyne barbata Lindl. ex Griff., Itin. Pl. Khasyah Mts. 72. 1848; Hook.f., Fl. Brit. India 5: 839. 1890; Katak, Orchids Meghalaya 119. 1986; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 216. 1998; Hynn. *et al.*, Orchids Nagaland 107. 2000; N.Pearce & P.J.Cribb, Orchids Bhutan 333. 2002; Sud.Chowdhury, Assam's Fl. 314. 2005; Lucksom, Orchids Sikkim N.E. Himalaya 480. 2007.

Pseudobulbs ovoid, 5–10 cm long, 2–3 cm apart on a stout creeping rhizome, 2-leaved at apex, sheathed at base; sheaths ovate-lanceolate, 6–8 cm long. Leaves elliptic-lanceolate, 16–30 × 3.5–6.5 cm, 5-veined, apex acuminate; petiole 5–12 cm long. Inflorescence hysteranthous, 18–25 cm long; rachis sheathed at base, 9–12-flowered; floral bracts caducous, broadly ovate-rhombic. Flowers white, with brown spots on lip, ca. 6 cm in across. Sepals narrowly ovate-oblong



Coelogyne assamica Linden & Rchb.f.: lower closeup



Coelogyne barbata Lindl. ex Griff.: plant habit (left) and closeup of flowers (right)

or suboblong, 3.3–3.5 × 0.8–1.0 cm, 7–9-veined, acute; lateral sepals often slightly narrower than dorsal sepal. Petals linear-lanceolate, 3.0–3.4 × 0.5–0.25 cm, 3-veined. Lip subovate, 2.5–3.0 × 2.4–2.8 cm, 3-lobed; lateral lobes erect, nearly suborbicular; mid-lobe ovate to suboblong, 0.9–1.0 × 0.7–0.8 cm, margin long fimbriate; disk with 3 lacerate-fimbriate lamellae extending to middle or near apex of mid-lobe; fimbriate hairs up to 2 mm long. Column arcuate, 1.9–2.2 cm long, both sides winged; wings widened from base to apex, upper part 2.5–3 mm wide on either side, apex irregularly finely toothed. Capsule obovoid, ca. 4 × 1.5 cm, slightly 3-ridged.

Habitat: Epiphytic on tree trunks or often lithophytic.

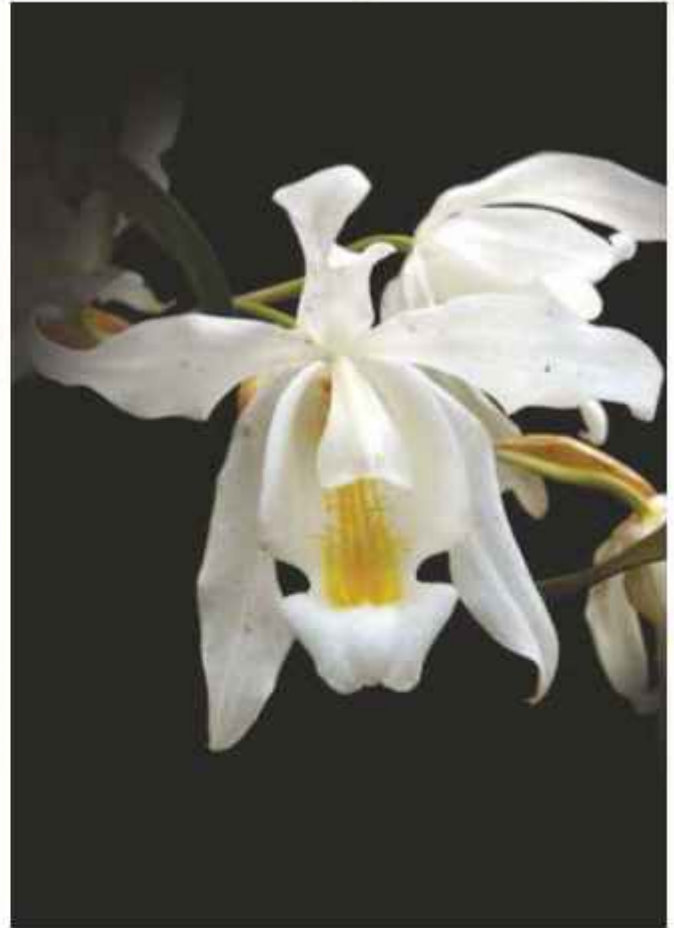
Flowering: August–October.

Occurrence: North Cachar Hills: Shongkai ca. 756 m; West Karbi Anglong: Umwang ca. 843 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal), Bangladesh, Bhutan, Nepal, China, Myanmar.

Regional Conservation Status & Criteria: Vulnerable, VU B2b(i,ii)c(iii).

Coelogyne cristata Lindl., Coll. Bot. t. 33. 1824; Hook.f., Fl. Brit. India 5: 829. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 133. 1898; Katak, Orchids Meghalaya 122. 1986; H.J. Chowdhery, Orch. Fl. Arunachal Pradesh 216. 1998; Hynn. *et al.*, Orchids Nagaland 108. 2000; N. Pearce & P.J. Cribb, Orchids Bhutan 332. 2002; P.B. Mazumder & S. Paul, J. Orchid Soc. India 16(1-2): 42. 2002. Lucksom, Orchids Sikkim N.E. Himalaya 475. 2007; Vij *et al.*,



Coelogyne cristata Lindl.: plant habit (left) and closeup of flowers (right)

Orchids Himachal Pradesh 171. 2013.

Pseudobulbs ovoid or oblong, 4–6 cm long, 2–3 cm apart on a scaly rhizome, 2-leaved at apex, sheathed at base; sheaths ovate or ovatelanceolate, 2–6 cm long, leathery. Leaves linearlanceolate, 10–20 × 1–2.5 cm, papery, base attenuate to inconspicuous petiole, apex long acuminate. Inflorescence heteranthous, 10–15 cm long, basal half covered with sheaths; raceme 5–7 cm, 2–10-flowered; floral bracts ovate-lanceolate, cymbiform, 2.5–3.5 cm long, brown, not caduceous; pedicel and ovary 2.0–2.5 cm long. Flowers white, *ca.* 5 cm in across. Sepals lanceolate or oblonglanceolate, 3.0–4.0 × 1.0–1.5 cm, margins undulate, apex acute. Petals similar to sepals, 0.9–1.1 cm wide. Lip ovate, concave, nearly as long as sepals, 3-lobed; lateral lobes erect, subovate, nearly entire; mid-lobe sub-orbicular, 1.2–1.5 cm long, margin

nearly entire, apex obtuse or emarginate; callus with 5 fimbriate lamellae extending from base of lip to base of mid-lobe, 2 inner lateral lamellae continuing to apex of mid-lobe. Column slightly arcuate, 2–3 cm, winged at both sides; wings widened from base to apex, *ca.* 1.5 mm wide on either side in upper part, apex emarginate or subtruncate.

Habitat: Epiphytic on tree trunks or occasionally lithophytic.

Flowering: February–May.

Occurrence: Karimganj: Cheragi (*fide* Mazumder & Paul *l.c.*); North Cachar Hills: Songkhai, Thingje *ca.* 1400 m; West Karbi Anglong: Kseh Kynthang *ca.* 859 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim,

West Bengal, Uttarakhand, Himachal Pradesh, Karnataka), Bangladesh, Bhutan, Nepal, Bhutan, China.

Regional Conservation Status & Criteria:

Vulnerable, VU B2b(iii)c(iii).

Coelogyne fimbriata Lindl., Edwards's Bot. Reg. 11: t. 868. 1825; Hook.f., Fl. Brit. India 5: 836. 1890; Katakai, Orchids Meghalaya 117. 1986; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 219. 1998; Hynn. *et al.*, Orchids Nagaland 110. 2000; N.Pearce & P.J.Cribb, Orchids Bhutan 326. 2002.

Pseudobulbs ovoid-oblong to nearly cylindric, 2.5–3 cm long, 2–5 cm apart on a slender scaled, 2-leaved at apex, with 2–3 sheaths at base; sheaths ovate, 1–2 cm long, deciduous when old. Leaves oblong or oblong-lanceolate, 5–10 × 1.5–2.5 cm, papery, apex acute; petiole 1–1.5 cm long. Inflorescence heteranthous;

peduncle 5–10 cm long, base covered with tubular sheaths; sheaths equitant, closely embracing inflorescence; rachis 1–2 flowered, opening successively, apex of rachis enclosed in bracts; floral bracts caducous; pedicel and ovary 1–1.2 cm long. Flowers pale yellow or nearly white, *ca.* 2 cm in across, lip with chocolate brown stripes. Sepals oblong-lanceolate, 1.5–2.0 × 0.5–0.8 cm. Petals narrowly linear, 1.5–2.0 × *ca.* 0.1 cm. Lip ovate, 1.4–1.8 cm long, 3-lobed; lateral lobes erect, narrow; mid-lobe nearly elliptic, 0.5–0.8 × 0.5–0.6 cm, margin fimbriate, apex obtuse; disk with 2 irregularly undulate lamellae extending from base to near apex of mid-lobe and between them a short lamella is present. Column slightly arcuate, 1.0–1.3 cm long, winged at both sides; wings widened toward column apex, either side 1–1.3 mm wide, apex irregularly



Coelogyne fimbriata Lindl.: plant habit (left) and closeup of a flower (right)

incised or dentate. Capsule obovoid, $1.8-2.0 \times ca. 1$ cm.

Habitat: Epiphytic on tree trunk or lithophytic on moss covered rocks.

Flowering: September–November.

Occurrence: Dibrugarh: Jeypore R.F.; Karbi Anglong: Dili Terang *ca.* 548 m; Lakhimpur: Dullung R.F.; North Cachar Hills: Laisong *ca.* 1000 m; Tinsukia: Bishnupur.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal), Bhutan, Nepal, China, Myanmar, Thailand, Laos, Cambodia, Vietnam, Malaysia, Indonesia.

Regional Conservation Status: Least Concern.

Coelogyne flaccida Lindl., Gen. Sp. Orchid. Pl. 39 1830; Hook.f., Fl. Brit. India 5: 829. 1890; King &

Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 133. 1898; Katakai, Orchids Meghalaya 121. 1986; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 219. 1998; Hynn. *et al.*, Orchids Nagaland 110. 2000; N.Pearce & P.J.Cribb, Orchids Bhutan 329. 2002; P.B.Mazumder & S.Paul, J. Orchid Soc. India 16(1-2): 43. 2002; Lucksom, Orchids Sikkim N.E. Himalaya 475. 2007.

Fig. 32 (A–R).

Pseudobulbs ovoid-cylindric, 6–12 cm long, 2–3 cm apart on rhizome, bright yellow when dried, base sheathed, 2-leaved at apex; sheaths 5–8 cm long, leathery. Leaves oblong-lanceolate to elliptic-lanceolate, $10-18 \times 2-3.5$ cm, leathery, apex abruptly acuminate; petiole 4–8 cm long. Inflorescence heteranthous, 15–25 cm long, basal half enclosed in sheaths; rachis 10–18 cm long, sparsely 8–10-flowered; floral bracts caducous, obovate-elliptic, *ca.*



Coelogyne flaccida Lindl.: plant habit (left) and closeup of a flower (right)



Figure 32. A–R: *Coelogyne flaccida* Lindl.: A. Habit; B. Inflorescence; C. Floral bud; D. Flower (ventrolateral view); E. Flower (front view); F. Dorsal sepal; G. Lateral sepals; H. Petals; I. Labellum (dorsal view); J. Labellum-flattened out (dorsal view); K. Labellum-flattened out (ventral view); L. Column, pedicel & ovary (ventral view); M. Column, pedicel & ovary (lateral view); N. Column (ventral view); O. Anther cap (dorsal view); P. Anther cap (ventral view); Q. Pollinia; R. Floral analysis.

2.5 cm long; pedicel and ovary 1.6–2.0 cm long. Flowers pale yellow to whitish, with yellow and pale reddish brown spots on lip. Dorsal sepal oblong-lanceolate, $2.1\text{--}2.4 \times 0.6\text{--}0.7$ cm; lateral sepals narrower. Petals linear-lanceolate, $2.0\text{--}2.2 \times 0.2\text{--}0.3$ mm. Lip subquadrangular, $1.6\text{--}2.0 \times \text{ca. } 1.5$ cm, 3-lobed; lateral lobes erect, subovate, apex obtuse; mid-lobe suboblong, $0.6\text{--}0.8 \times 0.4\text{--}0.5$ cm, margins undulate; disk with 3 crisped-incised lamellae extending from base of lip to basal half of mid-lobe. Column slightly arcuate, 1.2–1.3 cm long, both sides winged; wings widened toward column apex, *ca.* 1.5 mm wide on either side in upper part.

Habitat: Epiphytic on tree trunks.

Flowering: February–May.

Occurrence: Karimganj: Cheragi (*vide* Mazumder & Paul *l.c.*); Karbi Anglong: Jengpata *ca.* 737 m; North Cachar Hill: Ngalsung, Molkon *ca.* 1300 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal, Uttarakhand), Bangladesh, Bhutan, Nepal, China, Myanmar, Thailand, Laos, Vietnam.

Regional Conservation Status: Near Threatened.

Coelogyne fuscescens Lindl., Gen. Sp. Orchid. Pl. 41. 1830; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 132. 1898; Kataki, Orchids Meghalaya 123. 1986; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 223. 1998; Lucksom, Orchids Sikkim N.E. Himalaya 473. 2007.

Pseudobulbs long cylindric, furrowed at age, rather clustered on rhizome, 2-leaved at apex, sheathed at base; sheaths brown, 1.5–2 cm long. Leaves oblong-ob lanceolate, $10\text{--}25 \times 3\text{--}9$ cm, contracted at base into a short petiole 1–2 cm long, apex obtuse or subacute. Inflorescence proteranthous, rarely



Coelogyne fuscescens Lindl.: plant habit (left) and closeup of a flower (right)

synanthous, 12–15 cm long, initially enclosed in sheaths at base; rachis 4–6 cm long, usually 2-flowered; floral bracts oblonglanceolate, cymbiform, 2–2.5 cm long, membranous; pedicel and ovary 2–2.5 cm long. Flowers palebrown, *ca.* 4 cm in diam. Sepals suboblong, 2.5–2.8 × 0.7–0.9 cm, 5-veined, apex acuminate or shortly cuspidate. Petals linear, 2.2–2.5 × 0.2–0.3 mm. Lip ovate, 2.5–2.8 cm, concave at base, 3-lobed; lateral lobes small recurved; mid-lobe ovate, 1.0–1.3 × 0.6–0.7 cm, slightly apiculate at apex; disk with 3 fleshy, undulate longitudinal lamellae extending to base of mid-lobe. Column *ca.* 2 cm long, both sides narrowly winged.

Habitat: Epiphytic on tree trunks or rarely lithophytic.

Flowering: October–December.

Occurrence: North Cachar Hill: Bara Nenglo *ca.* 1274 m, Thingje *ca.* 1400 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal), Bhutan, Nepal, China, Myanmar, Thailand, Vietnam.

Regional Conservation Status: Near Threatened.

Coelogyne griffithii Hook.f., Fl. Brit. India 5: 838. 1888; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 226. 1998; Hynn. *et al.*, Orchids Nagaland 112. 2000; N.Pearce & P.J.Cribb, Orchids Bhutan 337. 2002.

Pseudobulbs oblong, 4–10 cm long, sulcate, 2-leaved at apex, several sheathed at base. Leaves elliptic-lanceolate, 10–25 × 5–8 cm, leathery, acuminate at apex; petiole *ca.* 5 cm long. Inflorescence hysteranthous; peduncle green, 5–15 cm long, slender, glabrous; rachis zigzag, 10–20 cm long, 6–18 flowered, opening in succession; imbricate sterile bracts at the junction between



Coelogyne griffithii Hook.f.: plant habit (left) and a portion of inflorescence (right)

peduncle and rachis. Flowers light brownish, *ca.* 2.5 cm in across. Sepals broadly oblong, $1.0\text{--}1.3 \times ca. 0.6$ cm, glabrous, 3-veined, acuminate. Petals $1.0\text{--}1.3 \times ca. 0.1$ cm, very slender, glabrous, 1-veined, obtuse. Lip 3-lobed; lateral lobes rounded with broad crenulations; mid-lobe rectangular, truncate at apex, entire, undulate, recurved; callus with 5 prominent, short lamellae, outer ones broader. Column *ca.* 5 mm long, narrowly winged at both sides, wings slightly serrate. Capsule ellipsoid, *ca.* 3.5×1.5 cm.

Habitat: Epiphytic on tree trunks or lithophytic on moss covered rocks.

Flowering: June–August.

Occurrence: North Cachar Hills: Semkhor *ca.* 770 m; Tinsukia: Dehing Patkai W.L.S.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland), China, Myanmar.

Regional Conservation Status & Criteria: Endangered, EN B2b(iii)c(iii).

Coelogyne longipes Lindl., Fol. Orchid. 5: 10. 1854; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 136. 1898; Kataki, Orchids Meghalaya 120. 1986; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 226. 1998; Hynn. *et al.*, Orchids Nagaland 113. 2000; N.Pearce & P.J.Cribb, Orchids Bhutan 335. 2002; Lucksom, Orchids Sikkim N.E. Himalaya 483. 2007.

Fig. 33 (A–Y).

Pseudobulbs cylindric or narrowly ovoid, ribbed, 4–7 cm long, 3–4 cm apart on rhizome, 2-leaved at apex, sheathed at base. Leaves oblong-lanceolate $10\text{--}20 \times 2\text{--}3$ cm, base cuneate, apex acuminate; petiole 3–5 cm long. Inflorescence hysteranthous, slender 10–15 cm long, imbricate sterile bracts are



Coelogyne longipes Lindl.: plant habit (left) and closeup of flowers (right)

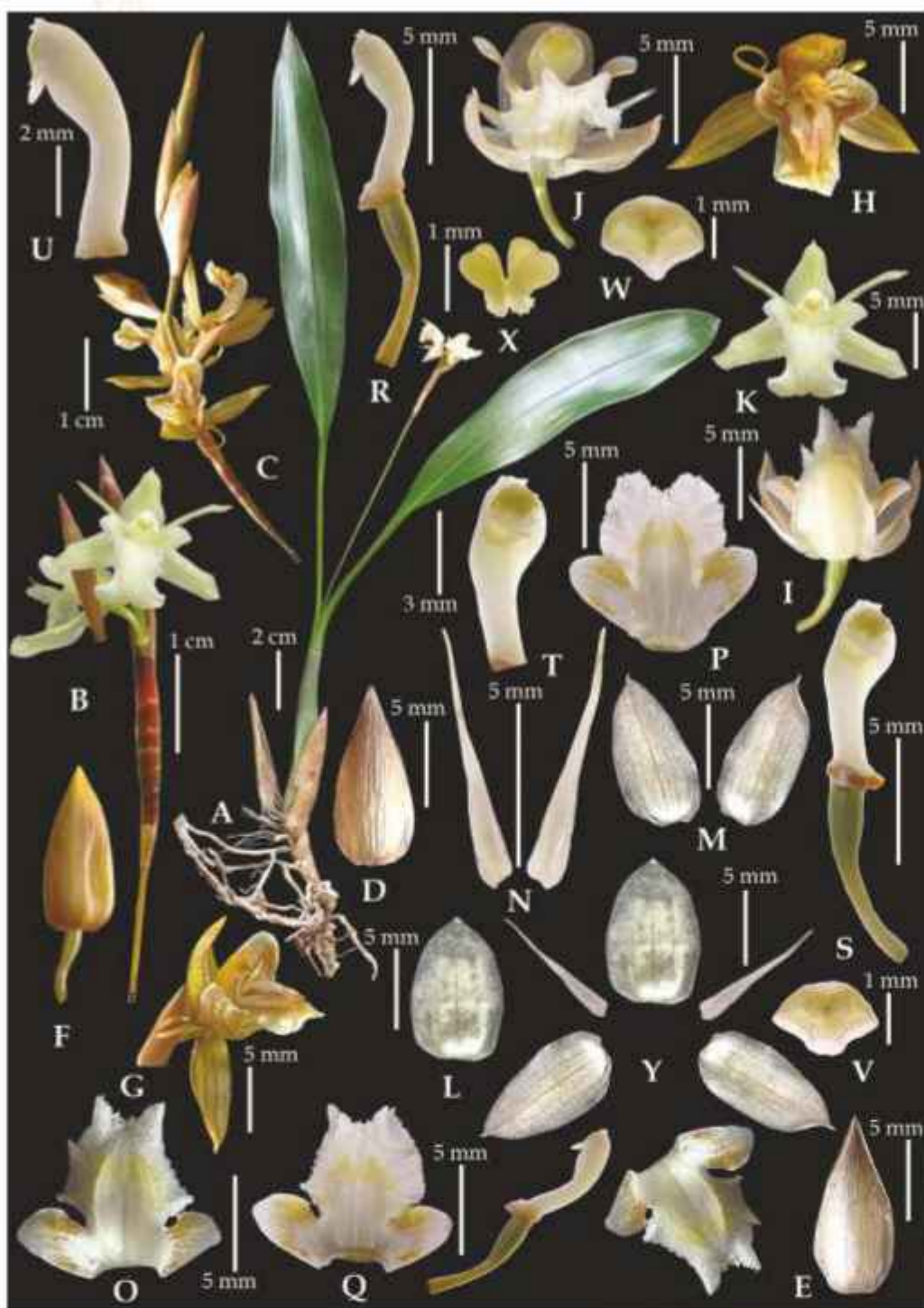


Figure 33. A–Y: *Coelogyne longipes* Lindl.: A. Habit; B & C. Inflorescence; D. Floral bract (dorsal view); E. Floral bract (ventral view); F. Floral bud; G. Flower (lateral view); H. Flower (front view); I. Flower (dorsal view); J. Flower (ventral view); K. Flower (front view); L. Dorsal sepal; M. Lateral sepals; N. Petals; O. Labellum (dorsal view); P. Labellum-flattened out (dorsal view); Q. Labellum (ventral view); R. Column, pedicel & ovary (lateral view); S. Column, pedicel & ovary (ventral view); T. Column (ventral view); U. Column (lateral view); V. Anther cap (dorsal view); W. Anther cap (ventral view); X. Pollinia; Y. Floral analysis [F, not to scale].

present at the junction of peduncle and rachis; rachis thickened at lower part, 5–7-flowered; floral bracts deciduous, 1.8–2 cm long; pedicel and ovary 0.8–1.0 cm long. Flowers yellowish brown, ca. 1.5 cm in across. Sepals ovate, concave 1.0–1.5 × 0.5–0.6 cm, 5–7-nerved, apex shortly acuminate. Petals linear ca. 1.0 × 0.1 cm, attenuate toward apex. Lip nearly broadly ovate, 1.0–1.2 × 0.8–0.9 cm, 3-lobed; lateral lobes short rounded; mid-lobe broadly oblong ca. 0.6 × 0.5 cm, margins undulate, apex truncate and emarginate; disk with 2 narrow longitudinal lamellae extending from base of lip to near middle of mid-lobe. Column slightly arcuate, 5–6 mm long, both sides winged, wings up to 4 mm wide. Capsule narrowly obovoid-oblong, ca. 2 × 0.6 cm.

Habitat: Epiphytic on tree trunks.

Flowering: April–June.

Occurrence: Cachar: Borail W.L.S., Riangpunji;

North Cachar Hills: Patherkot ca. 727m, Purana Paiza, ca. 888 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Nagaland, Sikkim, West Bengal), Bhutan, Nepal, China, Myanmar, Thailand.

Regional Conservation Status: Near Threatened.

Coelogyne nitida (Wall. ex D.Don) Lindl., Coll. Bot. t. 33. 1824; Katak, Orchids Meghalaya 124. 1986; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 230. 1998; Hynn. *et al.*, Orchids Nagaland 114. 2000; N.Pearce & P.J.Cribb, Orchids Bhutan 330. 2002; Sud.Chowdhury, Assam's Fl. 321. 2005; Lucksom, Orchids Sikkim N.E. Himalaya 476. 2007. *Cymbidium nitidum* Wall. ex D.Don, Prodr. Fl. Nepal. 35. 1825. *Coelogyne ochracea* Lindl., Edwards's Bot. Reg. 32: t. 69. 1846; Hook.f., Fl. Brit. India 5: 831. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 132. 1898.



Coelogyne nitida (Wall. ex D.Don) Lindl.: plant habit (left) and closeup of flowers (right)

Pseudobulbs oblong-ellipsoid, 2–4 cm long, deeply sulcate, sheathed at base, 2-leaved at apex. Leaves oblong-lanceolate, 15–22 × 1.5–2.5 cm, leathery, base attenuate into a petiole *ca.* 2 cm long, apex acuminate. Inflorescence arises from the base of pseudobulbs, erect, *ca.* 15 cm long, lower part enclosed in sheaths; rachis many flowered; floral bracts caducous; pedicel and ovary 1.5–1.6 cm long. Flowers white, *ca.* 2.5 cm in across, lip with 2 eyelike blotches. Sepals spreading oblong-lanceolate, 1.8–2.0 × 0.5–0.7 cm, apex acuminate. Petals linearoblong, 1.5–2.0 × 0.3–0.5 cm. Lip ovate, 1.5–2.4 × 1.0–1.2 cm, 3-lobed; lateral lobes erect, subobovate; mid-lobe nearly elliptic, 5–8 × 4–5 mm, with 3 longitudinal inconspicuous lamellae. Column slightly arcuate, 1.2–1.3 cm long, winged at both sides; wings widened from base to apex, upper side *ca.* 1 mm wide on either side.

Habitat: Epiphytic on tree trunks.

Flowering: May–June.

Occurrence: North Cachar Hills: Hangrum *ca.* 854 m; West Karbi Anglong: Umwang *ca.* 843 m; Upper Assam (*vide* Chowdhury *L.c.*).

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal, Uttarakhand), Bangladesh, Bhutan, Nepal, China, Myanmar, Thailand, Laos, Vietnam.

Regional Conservation Status: Near Threatened.

Coelogyne ovalis Lindl., Edwards's Bot. Reg. 24(Misc.): 91. 1838; Hook.f., Fl. Brit. India 5: 836. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 135. 1898; Katak, Orchids Meghalaya 118. 1986; H.J. Chowdhery, Orch. Fl. Arunachal Pradesh 234. 1998; Hynn. *et al.*, Orchids Nagaland 116. 2000; N. Pearce & P.J. Cribb, Orchids Bhutan 327. 2002; Lucksom, Orchids Sikkim N.E. Himalaya 472. 2007;



Coelogyne ovalis Lindl.: plant habit (left) and closeup of a flower (right)

P.S.Das *et al.*, Fl. Barak Valley 1: 376. 2013.

Pseudobulbs cylindric-fusiform, 4–8 cm long, placed at an interval of 5–8 cm on rhizome, 2-leaved at apex, sheathed at base. Leaves ovate-lanceolate, 9–14 × 2.5–3.5 cm, apex sub-acute to obtuse; petiole short. Inflorescence arising from the apex of pseudobulb; peduncle 5–8 cm long, base covered with tubular sheaths; rachis 1–3 flowered, flowers opening successively, apex of rachis enclosed in several white bracts; floral bracts caducous; pedicel and ovary 0.6–1.0 cm long. Flowers greenish yellow, with purplish red stripes on lip. Sepals oblong-lanceolate, 1.8–2.0 × 0.5–0.6 cm. Petals filiform or narrowly linear, nearly as long as sepals, *ca.* 1 mm wide. Lip ovate, 2–3 × 1.5–1.8 cm, 3-lobed; lateral lobes erect, subovate; mid-lobe ovate-elliptic, 1.0–1.5 × 0.9–1.5 cm, margins fimbriate; disk with 3 longitudinal lamellae. Column slightly arching, 1.3–1.4 cm high, both sides winged; wings widened toward column apex; rostellum *ca.* 2 mm long. Capsule subobovoid, *ca.* 2.5 × 1.2 cm.

Habitat: Epiphytic on tree trunks and branches in evergreen forests or often lithophytic on moss covered rocks.

Flowering: October–December.

Occurrence: Baksa and Chirang: Manas B.R.; Dibrugarh: Jeypore R.F.; Karbi Anglong: Longkamgaon *ca.* 530 m; Karimganj: Badarpur, Jhumbasti (*vide* Das *et al. l.c.*); North Cachar Hills: Boro Mulkoi, *ca.* 906 m, Mahur *ca.* 592 m; Sivsagar: Naphook R.F.; Tinsukia: Digboi, Upper Dihing R.F., West Block, Borjan area; Udalguri: Nunai-Bhutan Road, 340–396 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Tripura, Sikkim, West Bengal, Uttarakhand), Bhutan, Nepal, China, Myanmar, Thailand, Vietnam.

Regional Conservation Status: Least Concern.

Coelogyne prolifera Lindl., Gen. Sp. Orchid. Pl. 40. 1830; Hook.f., Fl. Brit. India 5: 838. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 137. 1898;

Kataki, Orchids Meghalaya 121. 1986; H.J. Chowdhery, Orch. Fl. Arunachal Pradesh 234. 1998; Hynn. *et al.*, Orchids Nagaland 117. 2000; N.Pearce & P.J.Cribb, Orchids Bhutan 335. 2002; Sud.Chowdhury, Assam's Fl. 329. 2005; Lucksom, Orchids Sikkim N.E. Himalaya 484. 2007. *Coelogyne flavida* Hook.f. ex Lindl., Fol. Orchid. 5: 10. 1854; P.C.Nath & D.R.Das, Pleione 7(1): 296. 2013.

Pseudobulbs narrowly ovoid-oblong, 2.5–4 cm high, placed at an interval of 2.5–4.0 cm on rhizome, 2-leaved at apex, sheathed at base. Leaves oblong-lanceolate, 9–14 × 1.5–2.2 cm, apex acuminate; petiole 2–3 cm long. Inflorescence hysteroanthous, 10–15 cm long, imbricate bracts are present at the junction of peduncle and rachis; rachis 4–6-flowered, lower part often slightly thickened; floral bracts deciduous; pedicel and ovary 0.8–1.0 cm long. Flowers yellowish green, *ca.* 1 cm in across. Sepals subsimilar, ovate-oblong, 6–7 × 2.5–3.0 mm, 3-veined, apex sub-acute or obtuse. Petals linear, 5–6 × 0.5–0.6 mm, 1-veined. Lip subovate, 6–7 × 5–6 mm, base concave and shallowly saccate, 3-lobed; lateral lobes erect, narrowly-ovate; mid-lobe nearly elliptic, *ca.* 4 × 3 mm, margin crisped, apex obtuse or emarginate; disk with 2 longitudinal lamellae extending from base to near apex of midlobe. Column almost erect, subclavate, 5–6 mm high, apex narrowly winged and irregularly notched. Capsule oblong, 1.3–1.5 × 0.5–0.7 cm.

Habitat: Epiphytic on trunks of *Albizia lebbeck* (L.) Benth., *Lagerstroemia speciosa* (L.) Pers., *Schima wallichii* Choisy, *Shorea robusta* C.F.Gaertn. etc.

Flowering: May–July.

Occurrence: Cachar: Sonai R.F.; Dibrugarh: Jeypore R.F.; Karbi Anglong: Erdangkramso *ca.* 500 m; North Cachar Hills: Thingbung *ca.* 1100 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal), Bhutan, Nepal, China, Myanmar, Thailand, Vietnam.

Regional Conservation Status: Least Concern.



Coelogyne prolifera Lindl.: plant habit (left) and closeup of inflorescence (right)

Coelogyne punctulata Lindl., Coll. Bot. t. 33. 1824; Katakai, Orchids Meghalaya 116. 1986; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 234. 1998; Hynn. *et al.*, Orchids Nagaland 119. 2000; N.Pearce & P.J.Cribb, Orchids Bhutan 332. 2002; Lucksom, Orchids Sikkim N.E. Himalaya 480. 2007. *Cymbidium nitidum* Roxb., Fl. Ind. 3: 459. 1832. *Coelogyne ocellata* Lindl., Gen. Sp. Orchid. Pl. 40. 1833. *Coelogyne goweri* Rchb.f., Gard. Chron. 1869: 443. 1869; Sud.Chowdhury, Assam's Fl. 329. 2005. *Coelogyne nitida* (Roxb.) Hook. f., Fl. Brit. India 5: 837. 1890.

Pseudobulbs narrowly ovoid-oblong, 2.5–4 cm high, closely spaced on rhizome, 2-leaved at apex, sheathed at base; sheaths ovate-oblong, 2–5 cm long. Leaves lanceolate 9–15 × 1.5–2.5 cm, adaxially often with dense raised transverse veinlets, apex acuminate; petiole 2–3.5 cm long. Inflorescence

hysteranthous, slightly recurved, 10–15 cm long; rachis 2–4-flowered; floral bracts caduceous; pedicel and ovary 1.4–1.8 cm long. Flowers white, with deep-yellow eyelike blotches on lip. Sepals lanceolate 1.8–2.0 × 0.4–0.5 cm, apex acute. Petals linear similar in length to sepals but narrower. Lip ovate, 1.7–1.9 × 0.8–1.1 cm, 3-lobed; lateral lobes erect, suborbicular, apex rounded; mid-lobe ovate, 6–7 × 5–6 mm, with 2 longitudinal, dentate lamellae extending from base of lip to mid-lobe and a short median lamella between them. Column slightly arcuate, 1.1–1.2 cm high, both sides winged; wings widened from base to apex, apex subtruncate or obtuse. Capsule obovoid-oblong, 2.2–2.5 × 0.8–0.9 cm.

Habitat: Epiphytic on tree trunks or lithophytic on moss-covered rocks.

Flowering: March–April.



Coelogyne punctulata Lindl.: plant habit (left) and side view of a flower (right)

Occurrence: Kamrup: Garbhanga R.F.; North Cachar Hills: Longkai-Saitap, ca. 894; West Karbi Anglong: Umpanai.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal), Bangladesh, Bhutan, Nepal, China, Myanmar, Thailand, Vietnam.

Regional Conservation Status & Criteria: Vulnerable, VU B2b(i,ii)c(iii).

Coelogyne schultesii S.K.Jain & S.Das, Proc. Indian Acad. Sci., B 87(5): 121. 1978; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 241. 1998; Hynn. *et al.*, Orchids Nagaland 121. 2000; N.Pearce & P.J.Cribb, Orchids Bhutan 336. 2002; Lucksom, Orchids Sikkim N.E. Himalaya 483. 2007. **Fig. 34 (A–R).**

Pseudobulbs ovoid to ellipsoid, 3–6 cm high, sheathing at base, 2-leaved at apex. Leaves oblong to

elliptic-lanceolate 8–17 × 1–2 cm, leathery, narrowed toward both ends, apex acuminate; petiole 3–7 cm long. Inflorescence hysteranthous, 15–30 cm long, with imbricate, bracts at the junction between peduncle and rachis; rachis 4–9-flowered, slightly flexuose; floral bracts caducous; pedicel and ovary 1.0–1.2 cm long. Flowers dark green-yellow, with brown lip, ca. 1.5–3.0 cm in across. Sepals narrowly ovate-oblong, 1.2–1.5 × 0.5–0.9 cm, 5–7-veined, apex acute. Petals filiform or linear-lanceolate, 1.0–1.1 × 0.1–0.2 cm, 1-veined, narrowed from base to apex. Lip ovate-oblong, 1.0–1.8 × 0.4–0.6 cm, 3-lobed; lateral lobes subovate; mid-lobe orbicular to subquadrate, apex undulate and emarginate; disk with 2 longitudinal lamellae. Column arcuate, 1.0–1.2 cm high, upper part with suborbicular wings. Capsule ellipsoid, 1.5–2.0 × 0.5–0.6 cm, long beaked.

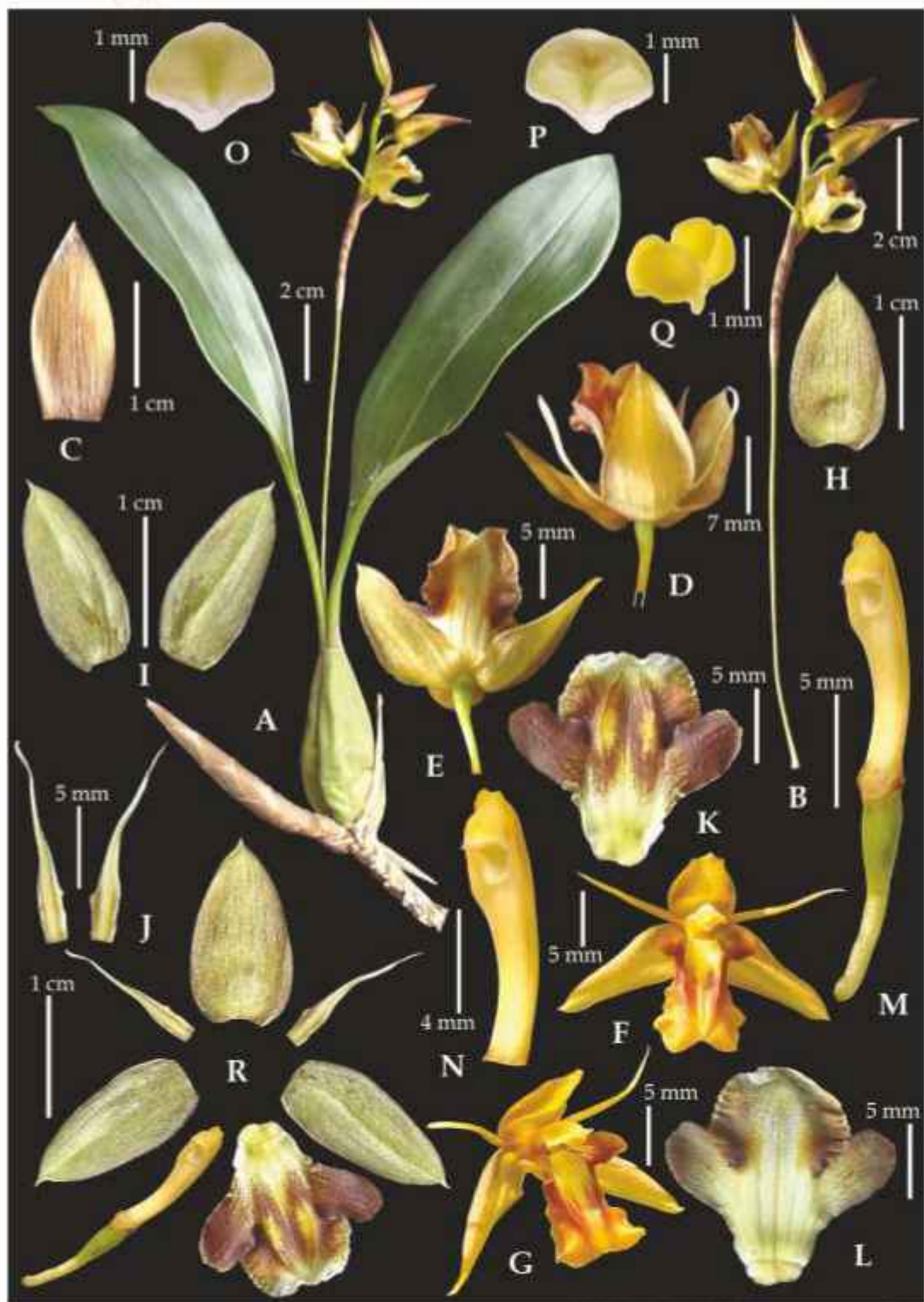


Figure 34. A–R: *Coelogyne schultesii* S.K.Jain & S.Das: A. Habit; B. Inflorescence; C. Floral bract; D. Flower (dorsal view); E. Flower (ventral view); F. Flower (front view); G. Flower (ventrolateral view); H. Dorsal sepal; I. Lateral sepals; J. Petals; K. Labellum-flattened out (dorsal view); L. Labellum-flattened out (ventral view); M. Column, pedicel & ovary (ventral view); N. Column (ventral view); O. Anther cap (dorsal view); P. Anther cap (ventral view); Q. Pollinia; R. Floral analysis.



Coelogyne schultesii S.K.Jain & S.Das: plants in their natural habitat (left) and inflorescence (right)

Habitat: Epiphytic in evergreen forests or often lithophytic.

Flowering: April–June.

Occurrence: North Cachar Hills: Thingje *ca.* 1400 m; West Karbi Anglong: Umwang *ca.* 843 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Nagaland, Sikkim), Bhutan, Nepal, China, Myanmar, Thailand, Laos, Vietnam.

Regional Conservation Status: Near Threatened.

Coelogyne stricta (D.Don) Schltr., Repert. Spec. Nov. Regni Veg. Beih. 4: 184. 1919; Katak, Orchids Meghalaya 119. 1986; H.J.Chowdhury, Orch. Fl. Arunachal Pradesh 241. 1998; Hynn. *et al.*, Orchids Nagaland 122. 2000; N.Pearce & P.J.Cribb, Orchids Bhutan 333. 2002; Sud.Chowdhury, Assam's Fl. 329. 2005; Lucksom, Orchids Sikkim N.E. Himalaya 481. 2007; N.Basumatary *et al.*, J. Adv. Pl. Sci. 5(1&2): 83. 2010. *Cymbidium strictum* D.Don, Prodr. Fl. Nepal.

35. 1825. *Coelogyne elata* Lindl., Gen. Sp. Orchid. Pl. 40. 1830; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 136. 1898.

Pseudobulbs oblong or narrowly ovoid, 5–8 cm long, placed at an interval of 3–5 cm along rhizome, 2-leaved at apex, sheathed at base. Leaves lanceolate, 15–25 × 4–5 cm, leathery; petiole 3–6 cm long. Inflorescence hysteranthous, 15–20 cm long, with imbricate bracts at the junction between peduncle and rachis; rachis 8–12 cm long, few-flowered; floral bracts caducous. Flowers white, lip with yellow spots, *ca.* 3.5 cm in across. Sepals subequal, oblong-lanceolate, 1.5–2.5 × 0.5–0.8 cm, acute; lateral sepals keeled abaxially. Petals narrowly oblong, 1.4–2.3 × 0.4–0.6 cm, acute. Lip ovate-oblong, *ca.* 2.3 cm long, 3-lobed; sidelobes short, embracing the column; mid-lobe ovate, margins irregularly undulate-dentate; disk with 2 longitudinal lamellae



Coelogyne stricta (D.Don) Schltr.: plant habit (left) and inflorescence (right)

extending from base to mid-lobe; lamellae crisped and slightly crenulate. Column slightly arcuate, 1.4–1.5 mm high, apex undulate.

Habitat: Epiphytic on tree trunks.

Flowering: April–June.

Occurrence: Baksa and Chirang: Manas B.R. (*vide* Basumatary *et al. l.c.*); Karbi Anglong: Dambukso *ca.* 840 m; North Cachar Hills: Leike *ca.* 1262 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal), Bhutan, Nepal, China, Myanmar, Laos, Vietnam.

Regional Conservation Status & Criteria: Vulnerable, VU B2b(i,ii)c(iii).

Coelogyne suaveolens (Lindl.) Hook.f., Fl. Brit. India 5: 832. 1890; Kataki, Orchids Meghalaya 123. 1986; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 241.

1998; I.Barua, Orchid Fl. Kamrup Distr. Assam 182. 2001; N.Pearce & P.J.Cribb, Orchids Bhutan 338. 2002; P.B.Mazumder & S.Paul, J. Orchid Soc. India 16(1-2): 43. 2002. *Pholidota suaveolens* Lindl., Gard. Chron. 1856: 312. 1856.

Pseudobulbs ovoid, 6–7 cm high, ribbed, placed at an interval *ca.* 6 cm along rhizome, 2-leaved at apex. Leaves elliptic or oblong-ob lanceolate, 20–30 × 5–6 cm, many-nerved, margins undulate, base contracted into a petiole, 5–10 cm long, apex acuminate. Inflorescence synanthous, *ca.* 20 cm long, enclosed in sheaths initially except the flowering part; rachis flexuous, *ca.* 10 cm long, many-flowered; floral bracts caduceous, oblong-ovate, cymbiform, *ca.* 2 cm long; pedicel and ovary 1.5–1.8 cm long. Flowers white, with yellow spots on lip, *ca.* 0.8 cm in across. Sepal's broadly-lanceolate, 1.2–1.5 × 0.4–0.5 mm, apex acuminate. Petals



Coelogyne suaveolens (Lindl.) Hook.f.: inflorescence (left) and closeup of a flower (right)

oblong-lanceolate, ca. 1.2×0.3 cm. Lip suboblong-ovate, ca. 1 cm long, 3-lobed; lateral lobes small, rounded; mid-lobe oblong-ovate; disk with 4–5 longitudinal lamellae. Column 0.5–0.6 cm high, both sides narrowly winged.

Habitat: Epiphytic in sal forests, occasionally found on *Artocarpus heterophyllus* Lam., *Ficus benghalensis* L., *Lagerstroemia speciosa* (L.) Pers., *Tamarindus indica* L. etc.

Flowering: May–July.

Occurrence: Baksa and Chirang: Manas B.R.; Cachar: Katakhal R.F.; Hailakandi: Innerline R.F.; Karbi Anglong: Sikaribasti ca. 477 m; Karimganj: Longai R.F., Cheragi and Churaibari (*fide* Mazumder & Paul l.c.); Kamrup: Chandubi, Rajapara, Garbhanga, Barduar R.F.; Morigaon: Mayang R.F.; North Cachar Hills: Maibong ca. 516 m.

Distribution: India (Assam, Arunachal Pradesh,

Manipur, Meghalaya, Nagaland, West Bengal), China, Myanmar, Thailand.

Regional Conservation Status: Least Concern.

Coelogyne trinervis Lindl., Gen. Sp. Orchid. Pl. 41. 1830; Hook.f., Fl. Brit. India 5: 832. 1890; B.Grant, Orchids Burma 183. 1895; Sud.Chowdhury, Assam's Fl. 325. 2005. *Coelogyne rossiana* Rchb.f., Gard. Chron. n.s., 1884(2): 308. 1884; I.Barua, Orchid Fl. Kamrup Distr. Assam 181. 2001.

Pseudobulbs ovoid, 5–7 cm high. Leaves oblong-lanceolate, $15-30 \times 2.5-5.0$ cm, 3-nerved; petiole 5–7 cm long. Inflorescence arising from the base of pseudobulbs, 10–20 cm long, sheathed at base; rachis 4–6 flowered; floral bracts lanceolate, caduceus. Flowers creamy-white, with yellowishbrown border on lip. Sepals lanceolate, $1.5-2.2 \times 0.6-0.9$ cm. Petals linear-lanceolate, 1.5–2.0 cm long, narrower than



Coelogyne trinervis Lindl.: closeup of flowers

sepals. Lip oblong-ovate, 1.4–1.8 × 1.0–1.2 cm, 3-lobed; lateral lobes short broad; midlobe broadly clawed subreniform retuse at apex, bordered with white; disk with 3 narrow ridges extending to the base of midlobe. Column slightly arching, 1.0–1.4 cm high, winged at both sides. Capsule narrowly pyriform, 3.5–3.8 cm long, 6-ribbed.

Habitat: Epiphytic on tree trunks, often on *Shorea robusta* Gaertn.

Flowering: September–November.

Occurrence: Kamrup: Chandubi, Sal Forest, Rajapara; North Cachar Hills: near Haflong; West Karbi Anglong: Umanai.

Distribution: India (Assam, Manipur, Andaman and Nicobar Is.), Myanmar, Thailand, Laos, Cambodia, Vietnam, Malaysia, Indonesia.

Regional Conservation Status: Near Threatened.

Coelogyne viscosa Rchb.f., Allg. Gartenzeitung 24: 218. 1856; Hook.f., Fl. Brit. India 5: 832. 1890; Katak, Orchids Meghalaya 122. 1986; H.J. Chowdhery, Orch. Fl. Arunachal Pradesh 245. 1998; Sud. Chowdhury, Assam's Fl. 329. 2005; Lucksom, Orchids Sikkim N.E. Himalaya 474. 2007. *Coelogyne graminifolia* E.C. Parish & Rchb.f., Trans. Linn. Soc. London 30: 146. 1874; Hook.f., Fl. Brit. India 5: 831. 1890.

Fig. 35 (A–S).

Pseudobulbs ovoid, 3.5–5 cm high, placed at an interval of 1–1.5 cm on rhizome, 2-leaves at apex, sheathed at base. Leaves linear, grasslike, 20–30 × 0.8–1.2 cm, leathery, midrib prominent, base attenuate, petiole not distinct, apex subacute or obtuse. Inflorescence arising from the base of pseudobulb, basal portion sheathed; rachis 2–4-flowered; floral bracts caducous; pedicel and ovary ca. 1.5 cm long. Flowers white, tinged with brown

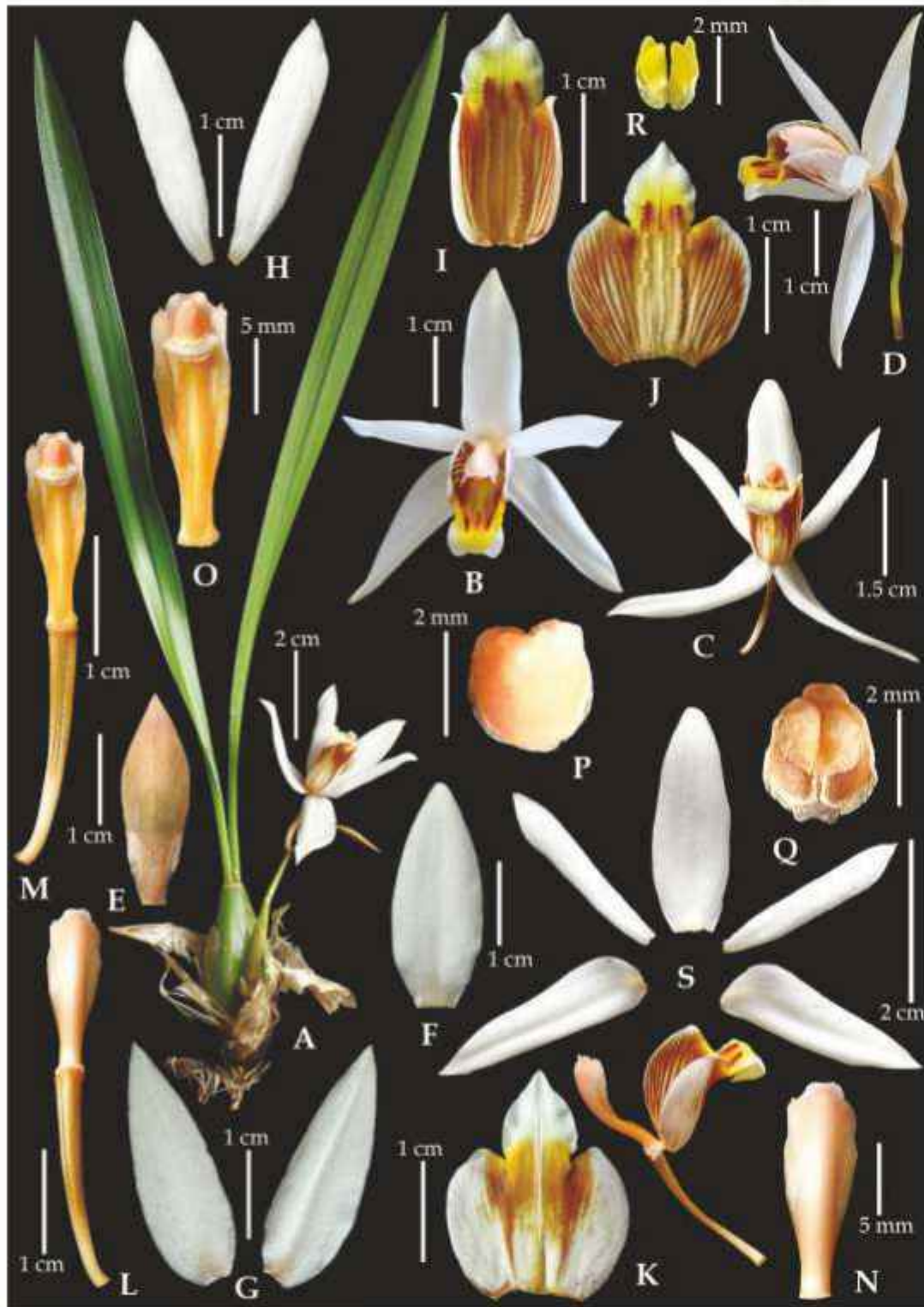


Figure 35. A–S: *Coelogyne viscosa* Rchb.f.: A. Habit; B. Flower (front view); C. Flower (ventral view); D. Flower (lateral view); E. Floral bract; F. Dorsal sepal; G. Lateral sepals; H. Petals; I. Labellum (dorsal view); J. Labellum-flattened out (dorsal view); K. Labellum-flattened out (ventral view); L. Column, pedicel and ovary (dorsal view); M. Column, pedicel and ovary (ventral view); N. Column (dorsal view); O. Column (ventral view); P. Anther cap (dorsal view); Q. Anther cap (ventral view); R. Pollinia; S. Floral analysis.



Coelogyne viscosa Rchb.f.: inflorescence (left) and closeup of a flower (right)

and with yellow spots on lip. Dorsal sepal oblong, *ca.* 2.4×0.8 cm, apex subacute; lateral sepals slightly narrower, *ca.* 5 mm wide, slightly keeled abaxially. Petals slightly narrower than lateral sepals. Lip ovate, *ca.* 2.0×1.5 cm, 3-lobed; lateral lobes small, erect, rounded, with brown streaks; mid-lobe subovate, $0.7\text{--}0.8 \times ca. 0.5$ cm, apex acuminate; disk with 3 crisped-incised, longitudinal lamellae, median lamella slightly shorter. Column slightly arching, *ca.* 1.3 cm high, winged at both sides; wings widened toward column apex, *ca.* 1.5 mm wide on either side in upper part. Capsule narrowly obovoid-oblong, $3.5\text{--}4 \times 0.8\text{--}1.2$ cm.

Habitat: Epiphytic on tree trunks or often lithophytic.

Flowering: March–May.

Occurrence: Cachar: Barak R.F.; North Cachar Hills: Bara Mulkai *ca.* 640 m; West Karbi Anglong: Umwang *ca.* 843 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Tripura, Sikkim, West Bengal), Bangladesh, China, Myanmar, Thailand, Laos, Vietnam, Malaysia.

Regional Conservation Status: Near Threatened.

Neogyna Rchb.f.

Epiphytic or lithophytic herb. Pseudobulbs caespitose, ovoid-cylindric, sheathed at base, 2-leaved at apex. Leaves elliptic-lanceolate, petiolate. Inflorescence racemose, proteranthous or hysteroanthous, pendulous; peduncle covered with cymbiform sheaths; floral bracts persistent, relatively large. Flowers resupinate, not opening widely; pedicel and ovary cylindric, 3-ridged. Sepals similar, fleshy, campanulate at base. Petals shorter and narrower than sepals. Lip oblong-canaliculate, 3-lobed near apex, spur absent, lateral lobes erect, embracing column, base saccate and enclosed in basal sac of lateral sepals. Column curved, rather long, winged; stigma concave; rostellum triangular. Anther cap incumbent, oblong; pollinia 4, in 2 pairs, waxy, oblong-pyriform; Capsule with 6 longitudinal ridges, apex with persistent column.

One species; distributed from Himalaya via N.E. India to Indo-china; same species is in India and Assam as well.

Neogyna gardneriana (Lindl.) Rchb.f., Bot. Zeitung (Berlin) 10: 931. 1852; N.Pearce & P.J.Cribb, Orchids Bhutan 340. 2002; Lucksom, Orchids Sikkim N.E. Himalaya 506. 2007. *Coelogyne gardneriana* Lindl., Pl. Asiat. Rar. 1: 33. 1830; Hook.f., Fl. Brit. India 5:

828. 1890; Katak, Orchids Meghalaya 122. 1986. *Coelogyne trisaccata* Griff., Not. Pl. Asiat. 3: 400. 1851.

Pseudobulbs narrowly ovoid to subcylindric, 8–12



Neogyna gardneriana (Lindl.) Rchb.f.: plant habit (left) and closeup of flowers (right)

cm long, clustered or borne at an interval 1–2 cm apart. Leaves narrowly elliptic-lanceolate, 28–40 × 4–8 cm, apex acuminate; petiole 4–5 cm long. Peduncle 10–20 cm long; rachis straight or sometimes slightly flexuous, 8–12 cm long, severalflowered; floral bracts broadly ovate-elliptic to suborbicular, 2–4 × 2–3 cm, apex obtuse. Flowers white, keels yellow; pedicel and ovary 1.5–1.8 cm long. Sepals similar, suboblong, 4.0–4.5 × 1.0–1.2 cm, abaxially carinate, basally saccate. Petals linear, similar in length to petals but much narrower. Lip obovate, 4–4.5 × 2.5–3 cm, 3-lobed near apex; lateral lobes subovate, obtuse-rounded; mid-lobe small, subreniform, margin erose; disk with 2 or rarely 3 longitudinal lamellae extending from base to base of mid-lobe. Column 3.5–4 mm long. Capsule

obovoid-ellipsoid, ca. 3.5 × 2 cm, 6-ribbed, ribs ca. 3 mm high.

Habitat: Epiphytic on tree trunks or lithophytic on shaded rocks.

Flowering: December–January.

Occurrence: Karbi Anglong: Jengpata ca. 737 m; North Cachar Hills: Hajuchok ca. 1382 m, J. Hebran, ca. 721 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland), Bangladesh, Bhutan, Nepal, China, Myanmar, Thailand, Laos.

Regional Conservation Status & Criteria:

Vulnerable, VU B2ab(iii)c(iii).

Otochilus Lindl.

Epiphytic herbs. Pseudobulbs superposed, subcylindric, 2-leaved. Leaves petiolate, plicate, linear to elliptic, papery, acute. Inflorescence proteranthous or synanthous, pendulous, racemose, many flowered; rachis straight or weakly flexuose; floral bracts caducous at or after anthesis. Flowers resupinate, often white, with or without brown markings, small. Sepals free, narrowly lanceolate to linear-lanceolate. Petals linear-lanceolate to linear. Lip with a saccate, bilobed hypochile and a much longer, narrow epichile, ecallose; lateral lobes of hypochile embracing base of column. Column incurved and dilated apically, without stelidia, foot absent; stigma cup-shaped; rostellum large. Pollinia 4, caudicles present. Capsule ellipsoid.

About five species; distributed from Himalaya via N.E. India to Indochina; four species in India as well as in Assam.

Key to the Species

- 1a. Flowers small, dorsal sepal less than 1 cm long. Floral bracts with broad obtuse apex2
- 1b. Flower larger, dorsal sepal 1.2–2 cm long. Floral bracts ovate lanceolate with triangular apex3
- 2a. Leaves linear lanceolate. Lateral lobe of lip longer than broad, edges somewhat erose*O. fuscus*
- 2b. Leaves ovate lanceolate. Lateral lobe of lip small not much longer broad, finely papillose on the outside*O. albus*
- 3a. Epichile of the lip ovate-lanceolate; lateral lobes of hypochile truncate with erose edges*O. porrectus*
- 3b. Epichile of lip lanceolate; lateral lobes of hypochile obtuse*O. lancilabius*

Otochilus albus Lindl., Gen. Sp. Orchid. Pl. 35. 1830; Hook.f., Fl. Brit. India 5: 843. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 143. 1898; Katak, Orchids Meghalaya 131. 1986; Seidenf., Opera Bot. 89: 91. 1986; H.J. Chowdhery, Orch. Fl. Arunachal Pradesh 557. 1998; Hynn. *et al.*, Orchids Nagaland

228. 2000; N. Pearce & P.J. Cribb, Orchids Bhutan 342. 2002; Lucksom, Orchids Sikkim N.E. Himalaya 509. 2007.

Fig. 37 (A–F).

Pseudobulbs sub-cylindric, 7–10 × 0.6–0.8 cm, grooved, usually with roots at joints. Leaves ovate

lanceolate, 15–20 × 2–4 cm, acuminate; petiole 1–2 cm long. Inflorescence synanthous; peduncle 3–5 cm long, sheathed; rachis 8–12 cm long, slender, weakly flexuose, laxly 8–9-flowered; floral bracts caducous, ovate-lanceolate, *ca.* 5 × 5 mm. Flowers uniformly white, 1.2–1.8 cm in across; pedicel and ovary 5–6 mm long. Sepal subequal, narrowly oblong, concave, 7–8 × 1.5–1.6 mm, 3-veined, acuminate; lateral sepals slightly oblique. Petals narrowly oblong-lanceolate, 6–7 × 1.2–1.5 mm, 3-veined, acute. Lip 3-lobed; lateral lobes small, not much longer than broad, finely papillous on outside, embracing base of column; mid-lobe oblong, 6–7 mm long, adaxially slightly papillate, apex apiculate; sac with a thickened longitudinal ridge inside. Column 5–6 mm high flattened at front though most of its length.

Habitat: Epiphytic on tree trunks.

Flowering: December–February.

Occurrence: North Cachar Hill: Leike *ca.* 1262 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal), Bangladesh, Nepal, China, Myanmar, Thailand, Vietnam.

Regional Conservation Status & Criteria: Vulnerable, VU B2b(i,ii)c(iii).

Otochilus fuscus Lindl., Gen. Sp. Orchid. Pl. 35. 1830; Hook.f., Fl. Brit. India 5: 844. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 143. 1898; Katak, Orchids Meghalaya 130. 1986; Seidenf., Opera Bot. 89: 90. 1986; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 557. 1998; Hynn. *et al.*, Orchids Nagaland 229. 2000; N.Pearce & P.J.Cribb, Orchids Bhutan 342. 2002; Sud.Chowdhury, Assam's Fl. 333. 2005; Lucksom, Orchids Sikkim N.E. Himalaya 508. 2007. *Otochilus lancifolius* Griff., Not. Pl. Asiat. 3:



Otochilus fuscus Lindl.: plants in their natural habitat (left) and inflorescence (right)

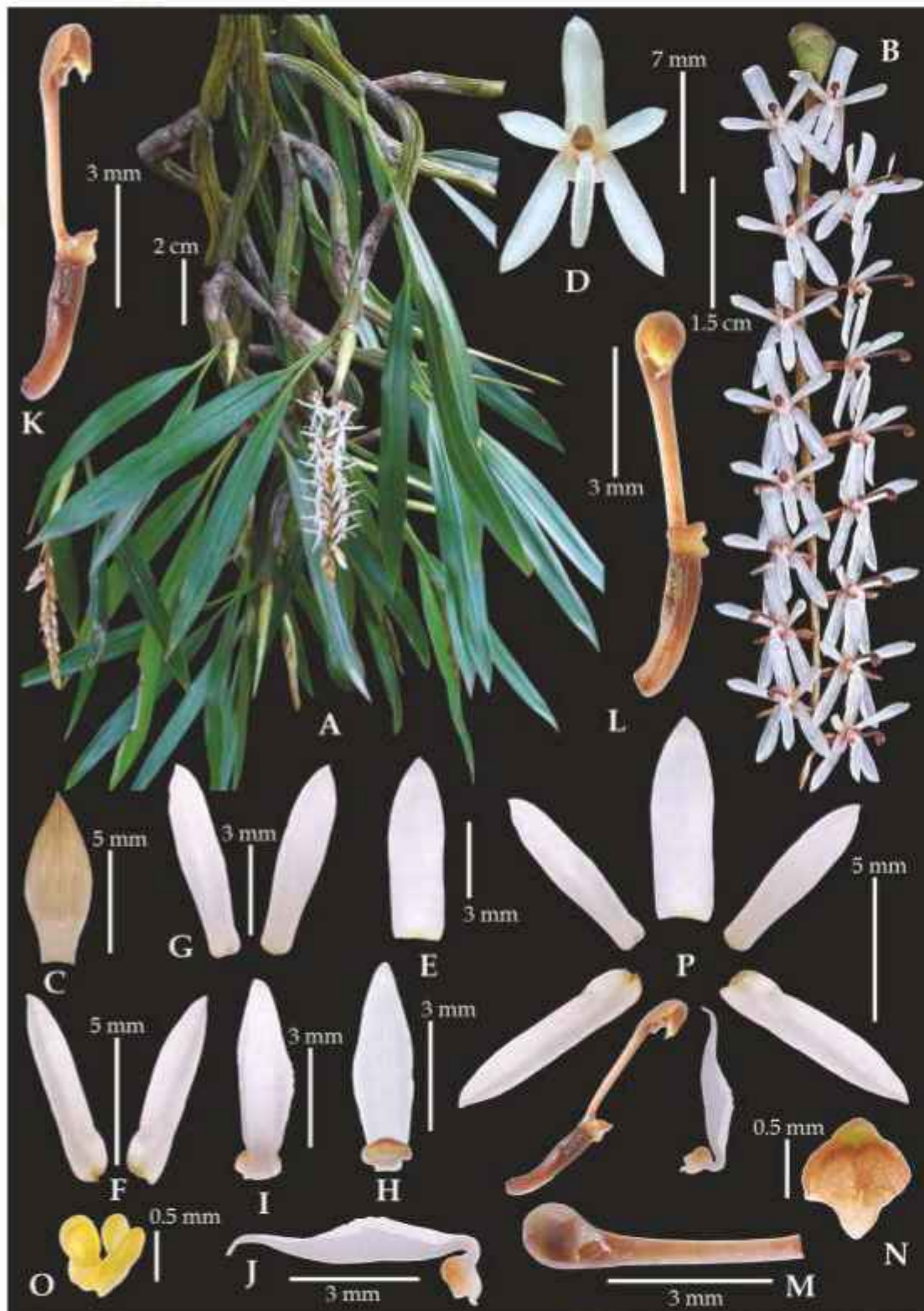


Figure 36. A–P: *Otochilus fuscus* Lindl.: A. Habit; B. Inflorescence; C. Floral bract; D. Flower (front view); E. Dorsal sepal; F. Lateral sepals; G. Petals; H. Labellum (dorsal view); I. Labellum (ventral view); J. Labellum (lateral view); K. Column, pedicel & ovary (lateral view); L. Column, pedicel & ovary (ventral view); M. Column (ventral view); N. Anther cap (dorsal view); O. Pollinia; P. Floral analysis.

278. 1851. *Coelogyne fusca* (Lindl.) Rchb.f., Ann. Bot. Syst. 6: 236. 1862. **Fig. 36 (A–P).**

Pseudobulbs cylindric 3.5–6 × 0.7–1.5 cm, rugose, covered with fibrous sheaths. Leaves linear-lanceolate, 14–20 × 0.7–1.1 cm, 5-nerved, acuminate; petiole 1.5–3 cm long. Inflorescence proteranthous; peduncle short, 3–5 cm long; rachis slender 8–12 cm long, laxly many flowered; floral bracts persistent, pale brown, lanceolate, 0.8–1.1 × 0.2–0.3 cm, apex acuminate. Flowers fragrant, white or tinged with pale brown, 1.2–1.5 cm in across; pedicel and ovary 5–8 mm long, slender. Sepals lanceolate, acute, *ca.* 1.3 × 0.3 cm. Petals linear *ca.* 1.2 × 0.2 cm. Lip 3-lobed, *ca.* 1.2 cm long; lateral lobes longer than broad, erose at apex; mid-lobe narrowly elliptic to suboblong, 4.5–5.5 × *ca.* 1.7 mm, base contracted and slightly clawed, apex acuminate. Column 5–6 mm high, slender, base slightly exserted, upper part

winged. Capsule obovoid-ellipsoid, 0.7–1.0 × 0.5–0.6 cm.

Habitat: Epiphytic on tree trunks.

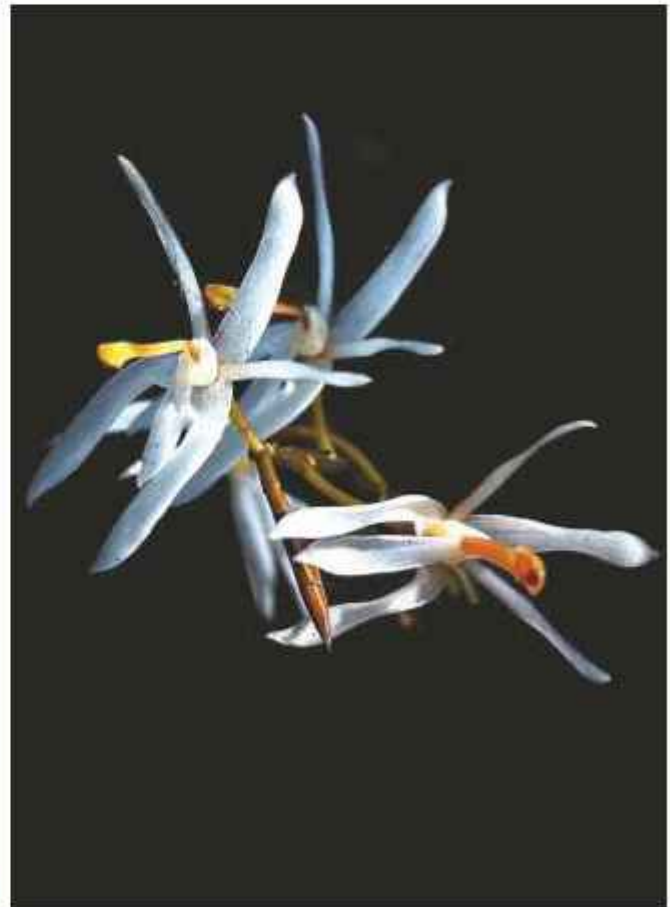
Flowering: November–January.

Occurrence: Karbi Anglong: Dili Terang *ca.* 548 m; North Cachar Hills: Thenbung *ca.* 1000 m; West Karbi Anglong: Umwang *ca.* 843 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal), Bhutan, Nepal, China, Myanmar, Thailand, Vietnam.

Regional Conservation Status: Least Concern.

Otochilus lancilabius Seidenf., Opera Bot. 89: 94. 1986; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 559. 1998; Hynn. *et al.*, Orchids Nagaland 230. 2000; N.Pearce & P.J.Cribb, Orchids Bhutan 343. 2002; Sud.Chowdhury, Assam's Fl. 323. 2005; Lucksom,



Otochilus lancilabius Seidenf.: plant habit (left) and closeup of flowers (right)

Orchids Sikkim N.E. Himalaya 508. 2007. *Otochilus porrectus sensu auct.* Hook.f., Fl. Brit. India 5: 844 p.p. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 142 p.p. 1898.

Pseudobulbs subcylindric, 5–10 × 0.6–2.0 cm, sheathed at base, sparsely wrinkled. Leaves, ellipticlanceolate to oblong-lanceolate, 12–20 × 2.5–4.3 cm, apex acuminate or shortly cuspidate; petiole 1.5–3 cm long. Inflorescence proteranthous; rachis laxly several flowered; floral bracts caducous, linear, acute. Flowers white, 1.5–2.2 cm in across; pedicel and ovary 1–1.2 cm long. Dorsal sepal linear-oblong, cymbiform, 1.3–1.5 × ca. 0.2 cm, ventrally slightly carinate, 5-nerved, acute; lateral sepals somewhat oblique. Petals linear, ca. 1.5 × 0.1 cm, 3-nerved, acute. Lip 3-lobed; lateral lobes erect, embracing base of column, ovate, 1.5–2.0 × ca. 0.06 cm, apex outuse; mid-lobe oblong-lanceolate, 1.0–1.2 × 0.2–0.3 cm, base shortly clawed, apex acuminate; sac with 3–4 short thickened ridges. Column subclavate, 1.3–1.4 cm high, upper part winged; rostellum ligulate, ca. 0.7 mm long. Anther cap ellipsoid, ca. 1 mm long. Capsule subobovoid-ellipsoid, 1.5–2 cm long.

Habitat: Epiphytic on tree trunks.

Flowering: October–December.

Occurrence: Karbi Anglong: Sikaribasti ca. 477 m; Lakhimpur (*fide* Chowdhury *l.c.*); North Cachar Hill: Nakoja ca. 1150 m.

Distribution: India (Assam, Arunachal Pradesh, Nagaland, Sikkim, West Bengal, Uttarakhand), Bhutan, Nepal, China, Laos, Vietnam.

Regional Conservation Status: Near Threatened.

Otochilus porrectus Lindl., Gen. Sp. Orchid. Pl. 36. 1830; Seidenf., Opera Bot. 89: 91. 1986; H.J. Chowdhury, Orch. Fl. Arunachal Pradesh 559.

1998; Hynn. *et al.*, Orchids Nagaland 230. 2000; N. Pearce & P.J. Cribb, Orchids Bhutan 345. 2002. *Otochilus latifolius* Griff., Not. Pl. Asiat. 3: 279. 1851.

Fig. 37 (G–J).

Pseudobulbs sub-cylindric to sub-clavate, 5–10 × 1–2 cm, sparsely wrinkled. Leaves narrowly ellipticlanceolate, 18–25 × 4–6 cm, apex shortly acuminate; petiole 1–2.5 cm long. Inflorescence synanthous, arching, 15–20 cm long; peduncle short, sheathed; rachis 8–10 cm long, laxly several flowered; floral bracts caducous. Flowers white, sometimes slightly tinged with yellowish on abaxial surface of sepals and lip, ca. 2.5 cm in across; pedicel and ovary 5–8 mm long. Sepals subequal, lanceolate, ca. 2.5 × 0.6 cm, obtuse at apex. Petals sublinear, 1.1–1.3 × ca. 0.1 mm, 3-veined. Lip 3-lobed; lateral lobes erect, embracing base of column, oblong, 3–4 × 1.5–2 mm apex oblique or truncate, slightly erose; midlobe ovate-elliptic, 6–7 × 4–5 mm, base narrowed into a claw ca. 1 mm long, apex acute; sac with 3 thickened and 2 shorter ridges extending nearly to base of mid-lobe. Column ca. 1 cm, upper part winged; anther with long beak to 2 mm; rostellum narrowly lanceolate, 1.5–2 mm. Capsule obovoidellipsoid, ca. 2 × 0.9 cm.

Habitat: Epiphytic on tree trunks.

Flowering: October–December.

Occurrence: Karbi Anglong: Near Manja; Lakhimpur: Kakoi R.F.; North Cachar Hill: Semkhor ca. 798 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal), Bangladesh, Nepal, China, Myanmar, Thailand, Laos, Vietnam.

Regional Conservation Status: Least Concern.

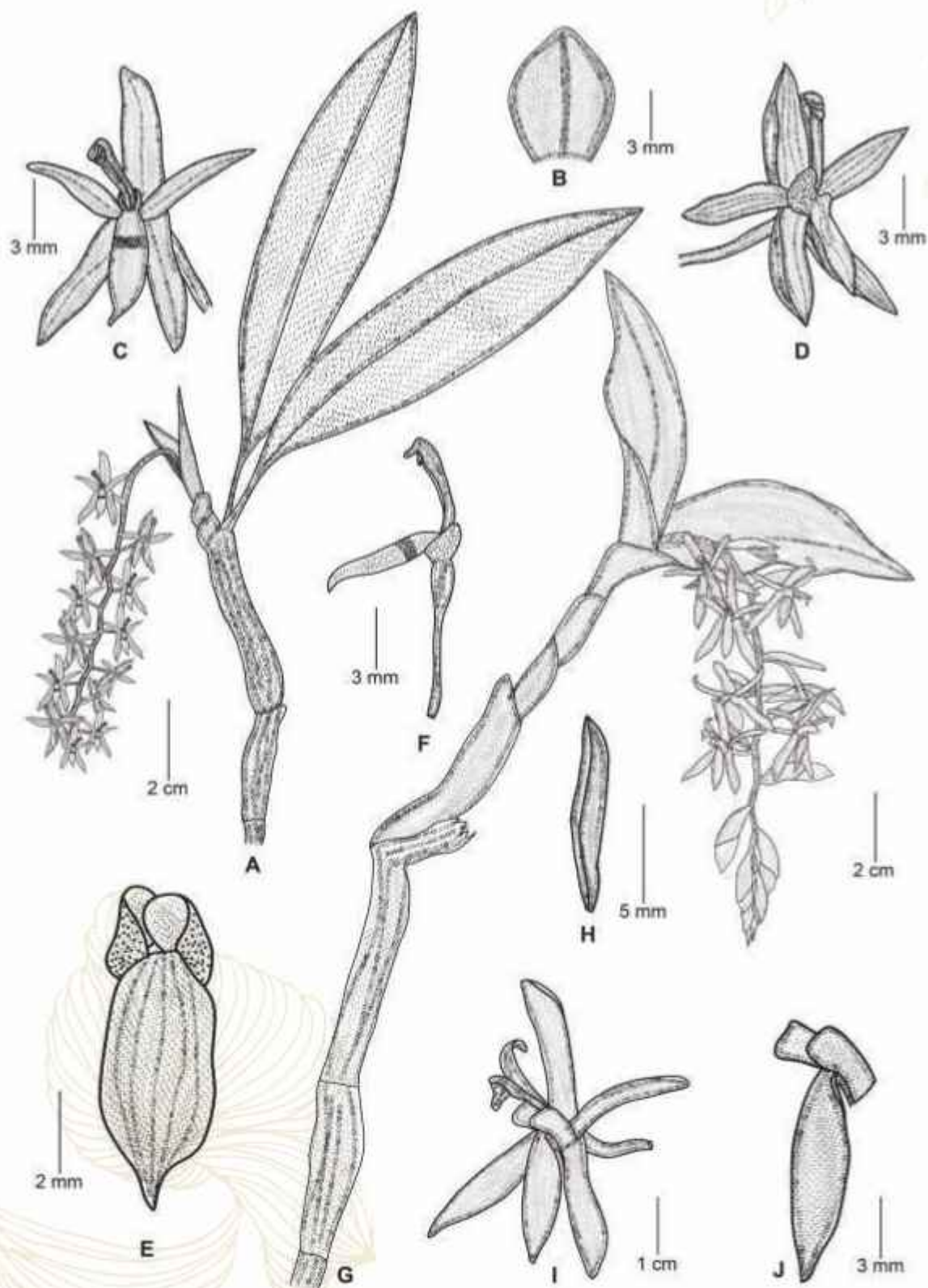


Figure 37. A–F: *Otochilus albus* Lindl.: A. Habit; B. Floral bract; C–D. Flower; E. Lip; F. Lip with column, pedicel and ovary. G–J: *Otochilus porrectus* Lindl.: G. Habit; H. Floral bract; I. Flower; J. Lip.

Panisea Lindl.

Epiphytic or lithophytic herbs with creeping rhizome. Pseudobulbs caespitose, ovoid-globose or cylindric, 1–2-leaved at apex. Leaves conduplicate, petiolate to subsessile, linear-lanceolate, leathery, apex acute to acuminate. Inflorescence synanthous, proteranthous, or heteranthous, one to several-flowered; floral bracts persistent, shorter than ovary. Flowers resupinate, white or pale green. Sepals free, similar, lateral sepals often oblique or slightly narrower and longer. Petals similar to sepals, often shorter and narrower. Lip entire or 3-lobed; lateral lobes small, sometimes basally sigmoid, often with short keels or lamellae. Column equal or shorter than lip, with or without steldia; stigma cup-shaped; rostellum large. Anther overhanging; pollinia 4, obliquely obovoid, with caudicles. Capsule ellipsoid.

About 11 species; distributed in Himalaya via NE India to Indo-china; 4 species in India and 3 species in Assam.

Key to the Species

- 1a. Lip with 2 distinct falcate side-lobes ***P. uniflora***
 1b. Lip without side-lobes 2
 2a. Inflorescence 1 or 2 flowered ***P. tricallosa***
 2b. Inflorescence several flowered ***P. demissa***

Panisea demissa (D.Don) Pfitzer, Pflanzenr. IV, 50(32): 141. 1907; Katak, Orchids Meghalaya 129. 1986; I.D.Lund, Nord. J. Bot. 7(5): 517. 1987; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 565. 1998; N.Pearce & P.J.Cribb, Orchids Bhutan 345. 2002; Lucksom, Orchids Sikkim N.E. Himalaya 439. 2007. *Dendrobium demissum* D.Don, Prodr. Fl. Nepal. 34. 1825. *Coelogyne parviflora* Lindl., Gen. Sp. Orchid. Pl. 44. 1833. *Panisea reflexa* Lindl., Fol. Orchid. 5: 1. 1854. *Panisea parviflora* (Lindl.) Lindl., Fol. Orchid. 5: 1. 1854; Hook.f., Fl. Brit. India 5: 783. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 142. 1898.

Fig. 38 (A–I).

Pseudobulbs narrowly ovoid to ovoid, 1.5–3.5 × ca. 0.6 cm. Leaves 2, rarely 3, elliptic-lanceolate, 5–8 × 0.6–1.5 cm, acute; petiole 4–8 mm long. Inflorescence heteranthous, decurved, laxly 5–7-flowered; peduncle slender, sheathed at base, 1–2 cm long; rachis 2–4 cm long; floral bracts lanceolate, 6–7 × 1–1.8 mm, acute, membranous, persistent. Flowers 1–1.3 cm in across, white; pedicel and ovary slender, 6–9 mm long. Sepals keeled, the dorsal one linear-oblong, 1.0–1.2 cm long; the lateral pair falcate, acute, gibbous at the base, ca. 1.1 cm long. Petals

oblong, blunt, ca. 1.1 cm long. Lip ca. 1.1 × 0.16 cm, without side-lobes; above the sigmoid claw narrowly lanceolate, sub-acute, with 3-nerves, without calli. Column winged, 0.9–1.0 cm high, foot absent. Capsule elliptic, turgid.

Habitat: Epiphytic on tree trunks, sometimes on *Quercus* sp.

Flowering: October–November.

Occurrence: North Cachar Hills: Kapila ca. 1350 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Nagaland, Sikkim, West Bengal), Bhutan, Nepal, China, Myanmar, Thailand, Laos, Vietnam.

Regional Conservation Status & Criteria: Vulnerable, VU B2b(iii)c(iii).

Panisea tricallosa Rolfe, Bull. Misc. Inform. Kew 1901: 148. 1901; I.D.Lund, Nord. J. Bot. 7(5): 520. 1987; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 565. 1998; Hynn. *et al.*, Orchids Nagaland 232. 2000; N.Pearce & P.J.Cribb, Orchids Bhutan 346. 2002. *Sigmatogyne pantlingii* Pfitzer, Pflanzenr. IV, 50(32): 134. 1907. *Sigmatogyne tricallosa* (Rolfe) Pfitzer, Pflanzenr. IV, 50(32): 133. 1907.

Fig. 38 (J–O) & Fig. 39 (A–N).

Pseudobulbs globose, ovoid or oblongcylindric $0.8\text{--}3.5 \times 0.4\text{--}2.7$ mm, wrinkled when dry, 1–2-leaved at apex. Leaves narrowly elliptic or suboblong, $3\text{--}6 \times 1\text{--}2.3$ cm, acute at apex; petiole $0.5\text{--}2.5$ cm long. Inflorescence proteranthous, 1-flowered, $4.5\text{--}6.5$ cm long; peduncle $2\text{--}3$ cm long; floral bracts ovate, $0.5\text{--}1 \times 0.2\text{--}0.4$ cm, scarious. Flowers pale yellow or greenish, $2\text{--}2.5$ cm in across, lip with 3 small spots at base, calli on disk orange, column pale yellow; pedicel and ovary *ca.* 1 cm long. Sepals similar narrowly ovate-lanceolate, $1.2\text{--}1.9 \times \text{ca. } 0.5$ cm, dorsally carinate, 5-veined, apex acuminate; lateral sepals slightly oblique. Petals oblong-lanceolate, $1.3\text{--}1.8 \times 0.4\text{--}0.5$ mm, 5-veined, shortly acuminate at apex. Lip obovate-oblong or spatulate, $1\text{--}2 \times 0.6\text{--}0.7$ cm, sigmoid at base, entire, margins slightly undulate, apex truncate, apiculate, or sub-

rounded; disk with 3-longitudinal lamellae. Column $5\text{--}7$ mm high, both sides winged; wings widened at upper part, *ca.* $1\text{--}1.5$ mm wide, apex irregularly incised; foot inconspicuous. Capsule subobovoid-ellipsoid, *ca.* $2 \times 1\text{--}1.3$ cm, each ridge $1.5\text{--}2$ mm high.

Habitat: Epiphytic on tree trunks or often lithophytic on moss covered rocks.

Flowering: March–June.

Occurrence: North Cachar Hills: Bara Nenglo *ca.* 1274 m, Thoi Nagar, *ca.* 1213 m, Thumjang; West Karbi Anglong: Kseh Kynthang *ca.* 859 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal), Bhutan, Nepal, China, Thailand, Laos, Vietnam, Malaysia.

Regional Conservation Status: Near Threatened.



Panisea tricallosa Rolfe: plants in their natural habitat (left) and closeup of flowers (right)

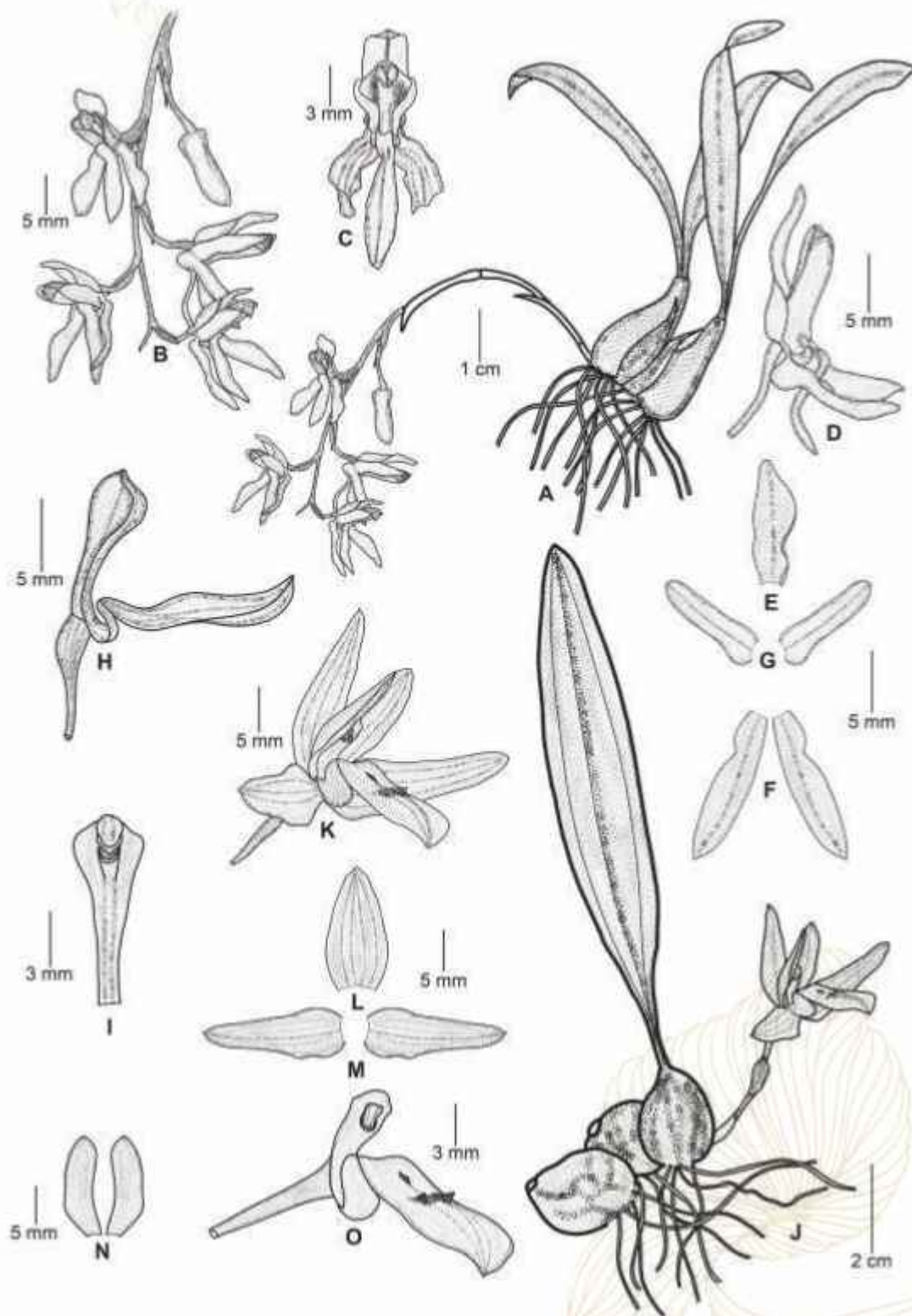


Figure 38. **A–I: *Panisea demissa*** (D.Don) Pfitzer: A. Habit; B. A portion of the inflorescence; C. Flower – front view; D. Flower – side view; E. Dorsal sepal; F. Lateral sepals; G. Petals; H. Lip with column, pedicel and ovary; I. Column. **J–O: *Panisea tricallosa*** Rolfe: J. Habit; K. Flower; L. Dorsal sepal; M. Lateral sepals; N. Petals; O. Lip with column, pedicel and ovary.

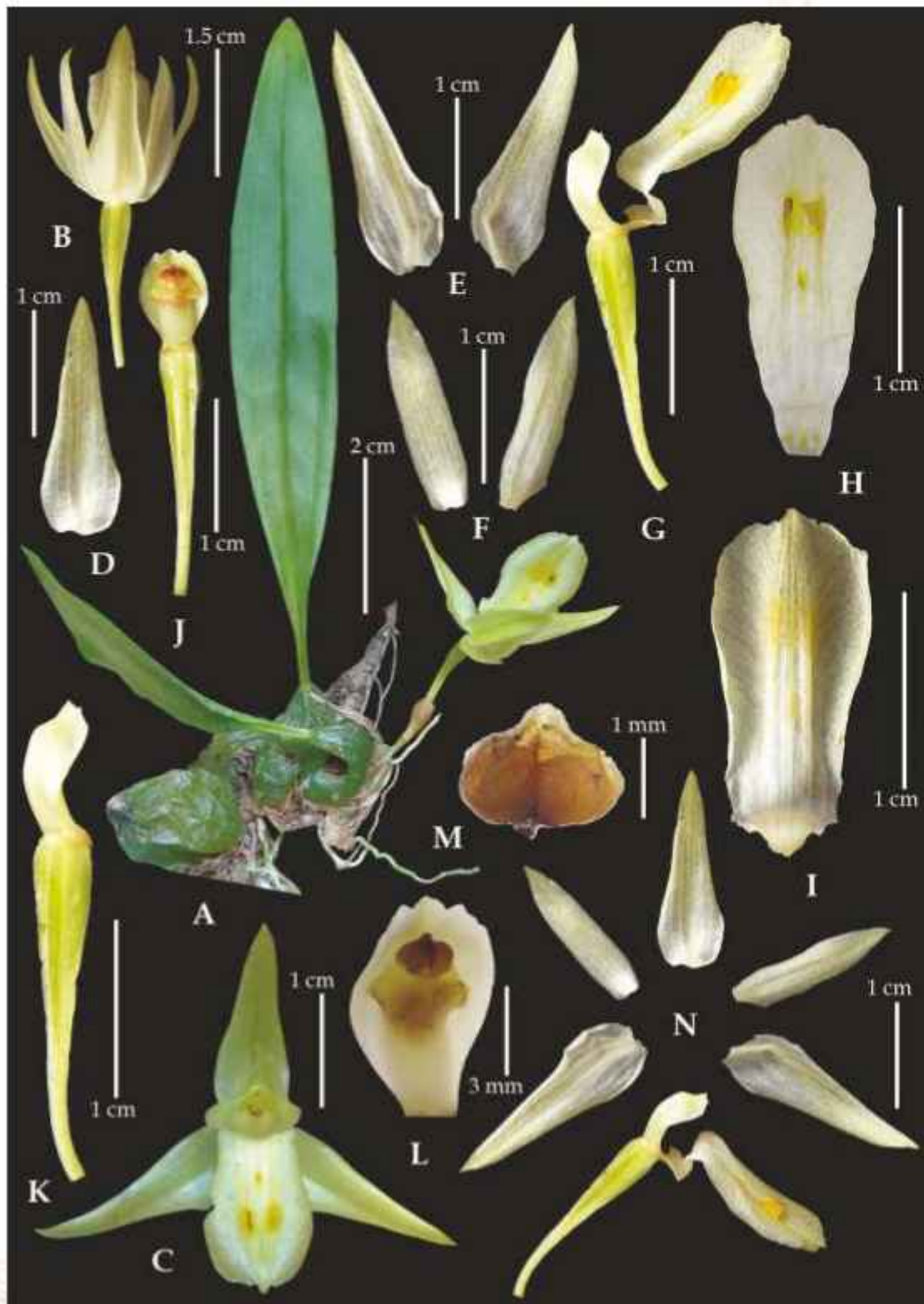


Figure 39. A–N: *Panisea tricallosa* Rolfe: A. Habit; B. Flower (dorsal view); C. Flower (front view); D. Dorsal sepal; E. Lateral sepals; F. Petals, G. Labellum, column, pedicel and ovary (lateral view); H. Labellum (dorsal view); I. Labellum (ventral view); J. Column, pedicel & ovary (ventral view); K. Column, pedicel & ovary (lateral view); L. Column with anther cap & pollinia; M. Anther cap (ventral view); N. Floral analysis.

Panisea uniflora (Lindl.) Lindl., Fol. Orchid. 5: 2. 1854; Katak, Orchids Meghalaya 129. 1986; I.D.Lund, Nord. J. Bot. 7(5): 525. 1987; N.Pearce & P.J.Cribb, Orchids Bhutan 346. 2002; Lucksom, Orchids Sikkim N.E. Himalaya 438. 2007. *Coelogyne uniflora* Lindl., Gen. Sp. Orchid. Pl. 42. 1830; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 138. 1898; C.E.C.Fisch., Fl. Madras 3: 1000. 1956. *Coelogyne falcata* T.Anderson ex Hook.f., Ann. Roy. Bot. Gard. (Calcutta) 5: 29. t.43. 1895.

Pseudobulbs ovoid or narrowly ovoid, 1.7–3.5 × 0.4–1.5 cm, base sheathed, 2-leaved at apex; sheaths oblong-lanceolate, acuminate, scarious, 1.7–4 × 1–1.3 cm. Leaves linear-oblong, 6–15 × 0.6–2 cm acute to acuminate, coriaceous, 3–5 veined, subsessile; petiole grooved, 0.5–0.8 cm long. Inflorescence proteranthous or heteranthous, erect, lateral, 1 or rarely 2-flowered; peduncle ca. 1.8 cm

long; floral bract ovate, acute, persistent, 4–5 mm long. Flower 2–2.5 cm in across, pale apricot to yellowish, lip with 3–7 orange spots on lateral lobes; pedicel and ovary 0.8–1.6 cm long. Sepals subsimilar, oblong-lanceolate, acuminate, spreading, 3–5 veined; dorsal sepal 1.4–1.8 × ca. 0.3 cm; lateral sepals 1.3–1.7 × ca. 0.4 cm. Petals lanceolate-elliptic, acuminate, 1.2–1.8 × 0.2–0.7 cm. Lip 3-lobed, 1.3–1.7 × 0.8–1 cm; lateral lobes short, falcate, weakly saccate at base, 7–9 × ca. 2 mm; mid-lobe 1–1.2 × 0.7–1 cm; disc with 2 or 3 obscure keels. Column arching 0.7–1.1 × 0.2–0.4 cm, with triangular wings on each side; foot ca. 2 mm long. Capsule ellipsoid winged 1.5–2.5 × 0.9–1.4 cm.

Habitat: Epiphytic on tree trunks.

Flowering: April–May.

Occurrence: Cachar: Barak R.F., Bhuban Hill; Karbi Anglong: Dambukso ca. 840 m; North Cachar Hills:



Panisea uniflora (Lindl.) Lindl.: plants in their natural habitat (left) and closeup of a flower (right)

Borail Hill Ranges; West Karbi Anglong; Sirtiso *ca.* 587 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim,

West Bengal, Kerala, Tamil Nadu), Bhutan, Nepal, China, Myanmar, Thailand, Laos, Cambodia, Vietnam.

Regional Conservation Status: Least Concern.

Pholidota Lindl.

Epiphytic or lithophytic herbs. Pseudobulbs either superposed or well spaced on creeping rhizomes, ovoid to subcylindric, 1- or 2-leaved at apex. Leaves narrowly elliptic, ovate, or oblong-lanceolate, leathery, shortly petiolate. Inflorescence terminal, emerging from apex of pseudobulb, distichous, pendulous, slender, racemose, laxly or densely many flowered; rachis often slightly flexuose; floral bracts persistent or deciduous, distichous, large, concave. Flowers resupinate, often not opening widely, white, small, fleshy. Dorsal sepal concave or convex, broadly ovate to elliptic; lateral sepals ovate to ovate-oblong, concave or convex, often carinate. Petals ovate or linear, often smaller than sepals. Lip sessile, with saccate basal hypochile, subentire or 3-4-lobed; epichile deflexed; disk sometimes with thick veins or lamellae. Column short, upper part winged or hooded, foot absent; rostellum rather large. Anther incumbent; pollinia 4, waxy, subequal in size, in 2 pairs, connected by inconspicuous caudicles to sticky material. Capsule relatively small, often ribbed.

About 39 species; distributed from mainland Asia via SE Asia to Australia, New Guinea, and the Pacific islands; 12 species in India and 6 species in Assam.

Key to the Species

- 1a. Pseudobulb superposed at apex of another *P. articulata*
- 1b. Pseudobulb not superposed at apex, arising from base of the last one 2
- 2a. Pseudobulb 1-leaved 3
- 2b. Pseudobulb 2-leaved 4
- 3a. Mature leaves thick-textured, coriaceous; floral bracts with many, dense, fine veins; lateral sepals free at base *P. imbricata*
- 3b. Mature leaves thin-textured, herbaceous; floral bracts with few, coarse veins; lateral sepals connate at base *P. pallida*
- 4a. Pseudobulb ovoid up to 5 cm long *P. convallariae*
- 4b. Pseudobulb cylindric or fusiform narrowed at both ends, usually more than 5 cm long 5
- 5a. Inflorescence longer than 15 cm, usually more than 30-flowered *P. rubra*
- 5b. Inflorescence less than or up to 15 cm, not more than 30-flowered *P. wattii*

Pholidota articulata Lindl., Gen. Sp. Orchid. Pl. 38. 1830; Hook.f., Fl. Brit. India 5: 844. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 146. 1898; Katak, Orchids Meghalaya 133. 1986; H.J. Chowdhery, Orch. Fl. Arunachal Pradesh 589. 1998; Hynn. *et al.*, Orchids Nagaland 245. 2000; I. Barua, Orchid Fl. Kamrup Distr. Assam 188. 2001; N. Pearce & P.J. Cribb, Orchids Bhutan 349. 2002; Lucksom, Orchids Sikkim N.E. Himalaya 512. 2007;

Vij *et al.*, Orchids Himachal Pradesh 237. 2013. *Pholidota khasyana* Rchb.f., Bonplandia (Hannover) 4: 329. 1856. *Coelogyne khasyana* (Rchb.f.) Rchb.f., Ann. Bot. Syst. 6: 238. 1862. *Pholidota griffithii* Hook.f., Hooker's Icon. Pl. 19: t. 1881. 1889 & in Fl. Brit. India 5: 845. 1890; Katak, Orchids Meghalaya 134. 1986; Hynn. *et al.*, Orchids Nagaland 249. 2000; I. Barua, Orchid Fl. Kamrup Distr. Assam 187. 2001. *Pholidota articulata* var. *griffithii* (Hook.f.) King &

Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 147. 1898.

Pseudobulbs superposed, sub-cylindric, 4–10 × 0.5–1.0 cm, branching or not, sometimes rooting at joints, 2-leaved. Leaves elliptic-lanceolate 6–11 × 2.5–4 cm, veins plicate, apex sub-acute or obtuse; petiole 1–2 cm long. Inflorescence arising from apex of new pseudobulb, 6–15 cm long; rachis slightly flexuous, many flowered; floral bracts caducous, narrowly ovate-oblong, 1.5–2.5 × 0.5–0.7 cm. Flowers greenish white or white and slightly tinged with reddish, ca. 1 cm in across; pedicel and ovary 6–7 mm long. Dorsal sepal oblong or elliptic, concave, 0.9–1.0 × 0.4–0.5 cm, dorsally carinate, 5-veined; lateral sepals ovate, oblique, slightly wider than dorsal sepal. Petals oblong-ovate ca. 0.7 × 0.3 mm, 5-veined. Lip broadly oblong in outline, contracted half way from middle into epichile and hypochile; hypochile cymbiform, slightly wider than

epichile, with 5 longitudinal lamellae near base; epichile sub-reniform, 3–4 mm wide, notched at apex. Column 2.5–3 mm high, winged at apex; rostellum broadly ovate, 1.4–1.8 mm long. Capsule obovoid-ellipsoid, 1.8–2 cm long, slightly 3-ribbed.

Habitat: Epiphytic on tree trunks, often found on *Albizia* sp., *Artocarpus chama* Buch.-Ham., *Bombax ceiba* L., *Ficus elastica* Roxb. ex Hornem., *Schima wallichii* Choisy, *Shorea robusta* C.F.Gaertn. in tropical evergreen and semi-evergreen forests.

Flowering: July–September.

Occurrence: Baksa and Chirang: Manas B.R.; Cachar: Barak R.F., Bhuban Hill; Katakhal R.F., Borail W.L.S.; Dibrugarh: Jokai R.F., Jeyapore R.F.; Golaghat: Nambor W.L.S.; Hailakandi: Lala and Katlicherra; Kamrup: Mataikhar R.F., Loharghat, South Kamrup, Rajapara, Ukium; Karbi Anglong: Nambor W.L.S.; Karimganj: Duhalia Part-II;



Pholidota articulata Lindl.: plants in their natural habitat (left) and closeup of inflorescence (right)

Kokrajhar: Ripu R.F.; Lakhimpur: Dullung R.F. and Kakoi R.F.; North Cachar Hills: Kayeng Khasia, ca. 327 m, Near Langting ca. 153 m; Sibsagar: Janaki F.V., Naganadi F.V.; Tinsukia: Deopani R.F.; Udalguri: Numri Beat House to Bhutan Border along Nunai Kalanadi area; West Karbi Anglong: Umpanai.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Tripura, Sikkim, West Bengal, Uttarakhand, Himachal Pradesh), Bangladesh, Bhutan, Nepal, China, Myanmar, Thailand, Laos, Cambodia, Vietnam, Malaysia, Indonesia.

Regional Conservation Status: Least Concern.

Pholidota convallariae (E.C.Parish & Rchb.f.) Hook.f., Hooker's Icon. Pl. 19: t. 1880. 1889 & in Fl. Brit. India 5: 846. 1890; Kataki, Orchids Meghalaya 135. 1986; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 589. 1998; Hynn. *et al.*, Orchids Nagaland

247. 2000. *Coelogyne convallariae* E.C.Parish & Rchb.f., Flora 55: 277. 1872.

Pseudobulbs ovoid, 2.5–5 × 1–1.5 cm, 0.5–1.0 cm apart on rhizome, 2-leaved at apex. Leaves narrowly elliptic-lanceolate, 15–20 × 1.6–2.5 cm, shortly acuminate at apex; petiole 1–2 cm long. Inflorescence arising from young pseudobulb and young leaves from base of last pseudobulb, 15–20 cm long; rachis many flowered; floral bracts caducous, linear, 1–1.5 cm long. Flowers fragrant, white or creamy white, sometimes with a pale green centre, 0.6–1 cm in across; pedicel and ovary 5–6 mm long. Dorsal sepal suboblong or elliptic, ca. 5 × 2–2.5 mm, obtuse; lateral sepals obliquely ovate, slightly wider than dorsal sepal. Petals ovate-elliptic, 4–4.5 × ca. 2.5 mm, obtuse at apex. Lip shallowly saccate, 4–5 mm long, apex emarginate, base with 3 longitudinal lamellae 1–1.5 mm long. Column ca. 2 mm long, stout, apex with a broad wing ca. 1.4 mm



Pholidota convallariae (E.C.Parish & Rchb.f.) Hook.f.: plant habit (left) and inflorescence (right)

high; rostellum nearly transversely oblong, ca. 1.5 mm wide.

Habitat: Epiphytic on tree trunks.

Flowering: May–July.

Occurrence: North Cachar Hills: Hajuichok ca. 1382 m; West Karbi Anglong: Umwang ca. 843 m. **Distribution:** India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, West Bengal), China, Myanmar, Thailand, Vietnam, Indonesia.

Regional Conservation Status & Criteria: Vulnerable, VU B2b(iii)c(ii).

Pholidota imbricata Lindl., Exot. Fl. 2: t. 138. 1825; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 144. 1898; C.E.C. Fisch., Fl. Madras 3: 1000. 1956; Kataki, Orchids Meghalaya 136. 1986; H.J. Chowdhery, Orch. Fl. Arunachal Pradesh 589. 1998; Hynn. *et al.*, Orchids Nagaland 249. 2000; I. Barua, Orchid Fl. Kamrup Distr. Assam 191. 2001; N. Pearce & P.J. Cribb, Orchids Bhutan 352. 2002; Lucksom, Orchids Sikkim N.E. Himalaya 510. 2007. *Pholidota calceata* Rchb.f., Bonplandia (Hannover) 4: 329. 1856; Hook.f., Fl. Brit. India 5: 846. 1890; Kataki, Orchids Meghalaya 135. 1986; Hynn. *et al.*, Orchids Nagaland 245. 2000. *Pholidota bracteata* (D. Don) Seidenf., Opera Bot. 89: 100. 1986. *Pholidota assamica* Regel, Gartenflora 39: 607. 1890. *Pholidota imbricata* var. *coriacea* Hook.f., Fl. Brit. India 5: 846. 1890.

Pseudobulbs ovoid or suboblong, 4–7 × 1.5–1.5 cm, obscurely obtusely 4-ridged, apex 1-leaved. Leaves elliptic-lanceolate, 15–35 × 2.5–8.5 cm, thinly leathery, many nerved, base cuneate, apex shortly acuminate; petiole 2–5 cm long. Inflorescence a raceme, arising from the base of pseudobulb, drooping 15–40 cm long; rachis nodding, 20–30 cm long, slightly flexuose, densely many flowered; floral bracts persistent, ovate, 4–7 × 4–8 mm, concave. Flowers white or slightly tinged with red, 6–7 mm in across; pedicel and ovary 4–5 mm long. Dorsal sepal ovate or orbicular 3–4.5 × 3–4.5 mm; lateral sepals free, ovate, cymbiform, 4–6 × 3.5–4 mm, dorsally strongly keeled. Petals sublinear, falcate, 3–4.5 ×

1–1.5 mm, 1-veined. Lip saccate, 4–6 mm long, slightly 3-lobed; lateral lobes erect, embracing column, 2.5–3 × ca. 2 mm; mid-lobe suboblong, 3–4 mm wide, margin slightly undulate, apex emarginate; disk with 2–3 longitudinal lamellae or thickened veins near base. Column 3–4 mm high, thick, both sides with wings; rostellum broad. Capsule obovoid-ellipsoid, 1–1.5 cm long.

Habitat: Epiphytic on tree trunks.

Flowering: May–August.

Occurrence: Baksa and Chirang: Manas B.R.; Bongaigaon: Kalamati; Cachar, Borail W.L.S., East Block, West Block, Near Gumra, Malidar & Kalaincherra, Kathkhal R.F., near Nuxatilla village, 2–3 miles from Loharband Rest house, 50–100 ft.; Dibrugarh: Jokai R.F., Jeypore R.F.; Golaghat: Kaziranga N.P., Uriamghat; Hailakandi: Near Gharmura; Jorhat: Gibon W.L.S.; Kamrup: Rajapara, Barduar R.F.; Karbi Anglong: Diphu; Karimganj: Cheragi, Churaibari, Durganagar; Kokrajhar: Ripu R.F., Chirang R.F.-Ultapani, Raimana; Lakhimpur: Kakoi R.F., Dullung R.F., 2 mile inside the forest Bagjan Bridge No.8; Majuli: Dakshinpat Satra; Morigaon: Pabitora W.L.S., Guvali, Mayang R.F.; Nagaon: Burapahar; Sibsagar: Charaidew, Janaki F.V.; Sonitpur: Sonai-rupai W.L.S.; Tinsukia: Digboi, Khatangpani (Tingkopani) R.F., Deopani R.F., Dibru-Saikhowa N.P., Sadiya-Dikrong Forest; Udalguri: Nunai–Kalanodi area; West Karbi Anglong: Umpanai, Hamren ca. 430 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Tripura, Sikkim, West Bengal, Bihar, Uttarakhand, Jharkhand, Orissa, Chhattisgarh, Maharashtra, Andhra Pradesh, Karnataka, Kerala, Tamil Nadu, Andaman and Nicobar Is.), Bangladesh, Bhutan, Nepal, China, Sri Lanka, Myanmar, Thailand, Laos, Cambodia, Vietnam, Malaysia, Indonesia, Philippines, New Guinea, Solomon Is., Australia, Fiji, New Caledonia, Santa Cruz Is., Vanuatu.

Regional Conservation Status: Least Concern.

Pholidota pallida Lindl., Edwards's Bot. Reg. 21:



Pholidota imbricata Lindl.: plants in their natural habitat (left) and a portion of inflorescence (right)

t. 1777. 1835; I.Barua, Orchid Fl. Kamrup Distr. Assam 193. 2001; N.Pearce & P.J.Cribb, Orchids Bhutan 353. 2002; Lucksom, Orchids Sikkim N.E. Himalaya 510. 2007. *Pholidota imbricata* var. *sessilis* Hook.f., Fl. Brit. India 5: 846. 1890. *Pholidota pallida* var. *sessilis* (Hook.f.) P.K.Sarkar, J. Econ. Taxon. Bot. 5: 1008. 1984.

Pseudobulbs ovoid 2.5–6 cm long, sheathed at base, 1-leaved at apex. Leave elliptic-oblongate, 10–25 × 2.5–6 cm, herbaceous, apex acuminate; petiole 1–4 cm long. Inflorescence synanthous, 10–25 cm long; rachis nodding, densely many flowered; floral bracts broadly ovate-sagittate, concave, 3–5 mm long, pubescent on margin, acute to obtuse at apex. Flowers white, slightly tinged with reddish, fragrant, 5–6 mm in across; pedicel and ovary 3–4 mm long. Dorsal sepal broadly elliptic, concave, 4–5 × 2.5–3 mm, dorsally keeled, apex acute; lateral sepals

broadly ovate-oblong, oblique, 5–6 × 3–3.5 mm, dorsally keeled, connate at base. Petals weakly falcate 3–5 × 2–2.5 mm. Lip shallowly saccate, 4–6 mm long, 3-lobed; lateral lobes ovate, 1.5–2 mm long; mid-lobe transversely oblong, ca. 3 × 4 mm, apex emarginate; saccate disk with 2–3 thick veins near base. Column 2–3.5 mm high, both sides winged. Capsule sub-obovoid, 1–1.5 × 0.5–0.6 cm.

Habitat: Epiphytic on tree trunk or often lithophytic. Flowering: June–August.

Occurrence: Baksa: Manas B.R., Mathanguri; Golaghat: Kaziranga N.P.; Karbi Anglong: Nambor W.L.S.; Kamrup: Digaru; North Cachar Hills: Near Umrangshu, Mahur; Sonitpur: Sonai Rupai W.L.S.; West Karbi Anglong: Khainduli ca. 834 m.

Distribution: India (Assam, Arunachal Pradesh, Meghalaya, Nagaland, Sikkim, West Bengal, Jharkhand, Maharashtra, Karnataka), Bhutan,



Pholidota pallida Lindl.: plant habit (left) and closeup of flowers (right)

Nepal, China, Myanmar, Thailand, Laos, Cambodia, Vietnam.

Regional Conservation Status: Least Concern.

Pholidota rubra Lindl., Gen. Sp. Orchid. Pl. 37. 1830; Hook.f., Fl. Brit. India 5: 847. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 145. 1898; Kataki, Orchids Meghalaya 134. 1986; N.Pearce & P.J.Cribb, Orchids Bhutan 351. 2002; Lucksom, Orchids Sikkim N.E. Himalaya 513. 2007; K.Gogoi, Wild Orchids Assam 356. 2017. *Pholidota undulata* Wall. ex Lindl., Gen. Sp. Orchid. Pl. 37. 1830; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 598. 1998; Hynn. *et al.*, Orchids Nagaland 255. 2000; P.B.Mazumder & S.Paul, J. Orchid Soc. India 16(1-2): 44. 2002. *Coelogyne rubra* (Lindl.) Rchb.f., Ann. Bot. Syst. 6: 238. 1862.

Fig. 40 (A–E).

Pseudobulbs cylindric, bulging below the centre, tapering at each end, 3–9 cm long, 0.5–1.8 cm apart

on rhizome, sheathed at base, 2-leaved at apex. Leaves linear-lanceolate, 12–23 × 1.8–4 cm, 3–5 veined, apex acuminate; petiole 2–3 cm long. Inflorescence proteranthous to synanthous, 30–60 flowered; peduncle wiry, 0.5–3 cm long; rachis nodding, pendent, straight to curved, 12–22 cm long; internodes 3–7 mm long; floral bracts ovate to elliptic, acute, inrolled, reflexed, *ca.* 1 × 0.5 cm. Flower opening widely, non-resupinate; sepals dull red, greenish-yellow to pale brownish-yellow, lip light green, yellow, pinkish to white; pedicel and ovary angular, 3–6.5 mm long. Dorsal sepal ovate, acute to acuminate, 4.3–5.5 × 2–3.6 mm; lateral sepals ovate to obliquely elliptic, acute at apex, 4.5–6 × 2.5–3.2 mm. Petals linear-lanceolate, obtuse to subacute, 1-veined, *ca.* 4.5 × 0.6 mm. Lip 4–5.5 mm long; hypochile broadly ovate, 2.3–3.5 × 1.5–2.5 mm, disc 3–5-nerved, the nerves slender; epichile



Pholidota rubra Lindl.: inflorescence (left) and closeup of flowers (right)

reflexed to recurved, ovate, apex apiculate, ecallose, 1.7–2.3 × 1.5–2.3 mm. Column slender, hooded, 3–4 mm long. Capsule ellipsoid, 1.1–1.4 × 0.6–0.7 cm.

Habitat: Epiphytic on tree trunks.

Flowering: October–December.

Occurrence: Cachar: Sonai R.F. (*fide* Bhattacharjee 2009); Karbi Anglong: *sine loc.* (*fide* Gogoi *l.c.*); Karimganj: Churaibari (*fide* Mazumder & Paul *l.c.*).
Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal), Bhutan, Myanmar, Vietnam.

Regional Conservation Status & Criteria: Endangered, EN B2b(iii)c(iii).

Pholidota wattii King & Pantl., J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 66: 590. 1897; de Vogel, Orchid Monogr. 3: 76. 1988; H.J. Chowdhery, Orch. Fl. Arunachal Pradesh 598. 1998; Sud. Chowdhury,

Assam's Fl. 318. 2005; C.R. Deb & T. Imchen, Orchid Diversity Nagaland 182. 2008.

Fig. 40 (F–J).

Pseudo-bulbs narrowly-fusiform, 5–13 cm long, 3.5–8.0 mm wide, placed along the rhizome *ca.* 2.5 cm apart, 2-leaved at apex. Leaves narrowly oblongelliptic, 12–15 × 3.0–4.5 cm, apex shortly acuminate, base attenuate; petiole short, 1.0–1.5 cm long and 2–3 mm in diam. Inflorescence 12–15 cm long; the peduncle sub-erect, *ca.* 5 cm, entirely clothed with imbricate bracts; rachis much decurved, *ca.* 10 cm long. Floral bracts broadly ovate, 8–10 mm long, sub-acute, cymbiform, longer than the stalked ovary. Flowers secund, distichous, somewhat crowded, *ca.* 2 cm in across; sepals and petals are straw-coloured tinged with pale green, side lobes of the lip and column are pale brown. Sepals somewhat unequal, all spreading; dorsal one broadly elliptic, *ca.* 6 × 3

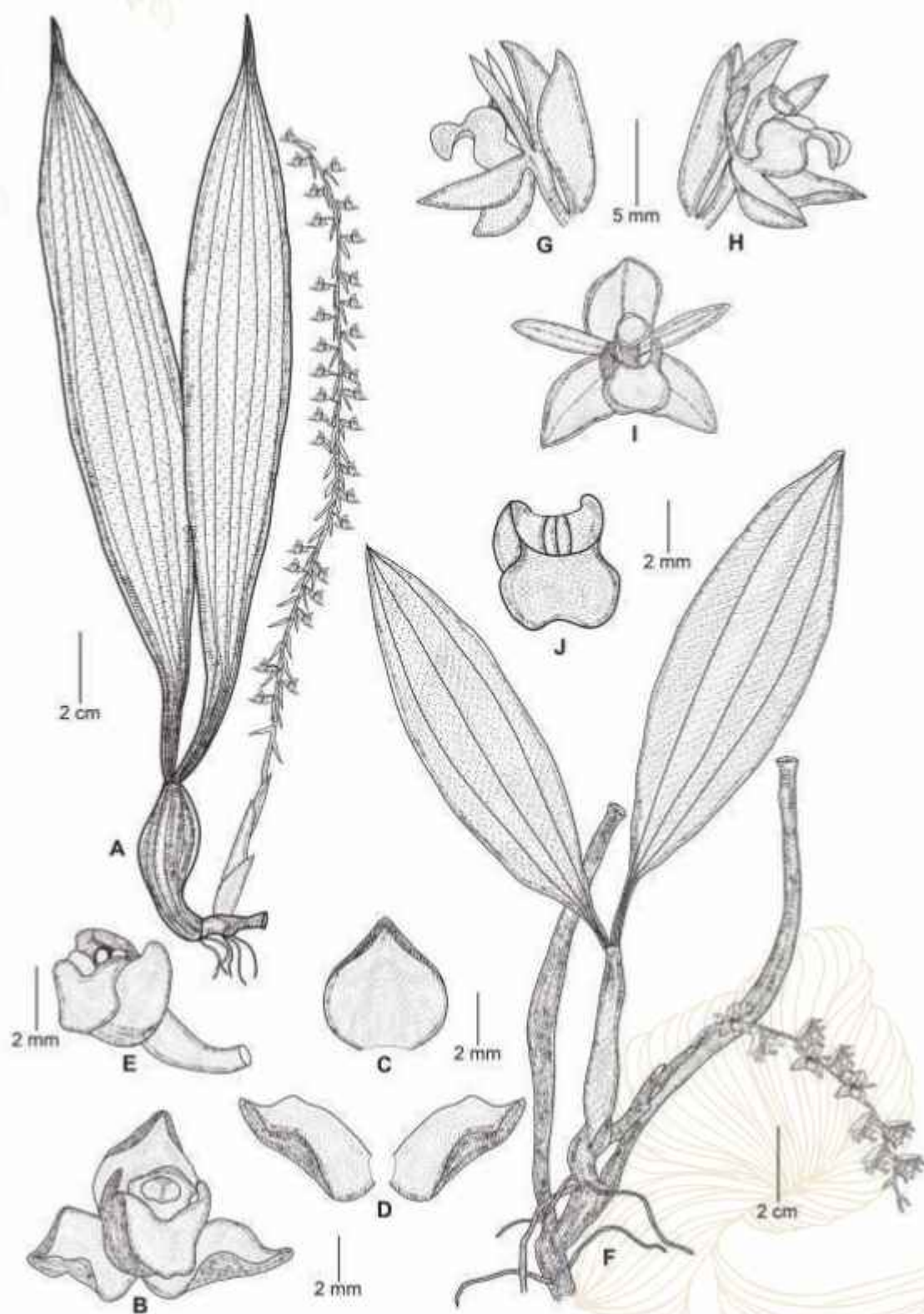


Figure 40. A–E: *Pholidota rubra* Lindl.: A. Habit; B. Flower; C. Dorsal sepal; D. Lateral sepals; E. Lip with column, pedicel and ovary. F–J: *Pholidota wattii* King & Pantl.: F. Habit; G–H: Flower – side view; I. Flower – front view; J. Lip.

mm, obtuse at apex; the lateral pair narrower, ca. 6 × 2.3 mm, subacute at apex. Petals linear, acuminate, 1-veined, spreading, about as long as the sepals. Lip 3-lobed; hypochile deeply saccate and with 3 shallow lamellae, side-lobes erect rounded narrow; epichile transversely oblong, entire, much recurved, disc smooth. Column stout, slightly winged near the apex.

Habitat: Epiphytic on tree trunks.

Flowering: June–July.

Occurrence: North Cachar Hills (*vide* Chowdhury *l.c.*).

Distribution: India (Assam, Arunachal Pradesh, Nagaland) ENDEMIC.

Regional Conservation Status & Criteria: Critically Endangered, CR B2b(iii)c(i,ii).

Pleione D. Don

Epiphytic or lithophytic, herbs. Pseudobulbs annual, often clustered, ovoid, conic, pyriform, or turbinate, gradually narrowed toward apex to form a distinct neck, 1–2-leaved at apex. Leaves plicate, usually contracted at base into a short petiole-like stalk, usually deciduous or falling in winter. Inflorescences 1 or 2, arising from base of an old pseudobulb, erect, appearing either before or after leaves, 1–2-flowered; floral bracts often colorful, persistent. Flowers usually showy, opening widely, sometimes fragrant. Sepals usually free, similar. Petals similar to but usually slightly narrower than sepals. Lip conspicuously larger than sepals, entire or obscurely 3-lobed, sometimes basally adnate to column base, apical margin erose or lacerate; disk with a callus consisting of 2 to several lamellae or rows of papillae extending along central veins. Column slightly arcuate, slender, winged above, apex usually erose; pollinia 4, in 2 pairs, waxy, often obovoid and bilaterally flattened. Capsule fusiform, with 3 longitudinal ribs.

About 26 species; distributed from mainland Asia to SE Asia; 6 species in India and 2 species in Assam.

Key to the Species

- 1a. Sepals and petals white; margins of lip-midlobe strongly blotched and shallowly dentate *P. maculata*
 1b. Sepals and petals pinkish purple; margins of lip-midlobe not blotched but fimbriate dentate *P. praecox*

Pleione maculata (Lindl.) Lindl. & Paxton, Paxton's Fl. Gard. 2: 5. 1851; Katak, Orchids Meghalaya 127. 1986; H.J. Chowdhery, Orch. Fl. Arunachal Pradesh 615. 1998; Hynn. *et al.*, Orchids Nagaland 256. 2000; N. Pearce & P.J. Cribb, Orchids Bhutan 357. 2002; Phukan, Bull. Bot. Surv. India 47: 3. 2005; Lucksom, Orchids Sikkim N.E. Himalaya 505. 2007. *Coelogyne maculata* Lindl., Gen. Sp. Orchid. Pl. 43. 1830; Hook.f., Fl. Brit. India 5: 841. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 140. 1898. *Pleione diphylla* Lindl. & Paxton, Paxton's Fl. Gard. 2: 66. 1851.

Fig. 41 (A–T).

Pseudobulbs green, turbinate to pyriform, 2–3 ×

1–1.5 cm, with a short, indistinct neck, often enclosed in persistent, smooth sheaths, 2-leaved at apex. Leaves lanceolate 10–15 × 2–3.5 cm, papery, apex acute. Inflorescence appearing after leaves have fallen, erect; peduncle completely enclosed in several membranous sheaths, 5–6 cm long; floral bract convolute, emerginate, ca. 2 cm long, enveloping the pedicelled ovary. Flower solitary, white, ca. 6 cm in across, lip with a yellow center and purple blotches on apical margins. Dorsal sepal oblong-lanceolate, 3–4 × 0.7–0.9 cm, apex sub-acute; lateral sepals broadly lanceolate, falcate, slightly oblique, 3–4 × 0.8–1.0 cm, apex sub-acute. Petals oblanceolate, slightly falcate, 3.0–4.2 × 0.7–0.8 cm,

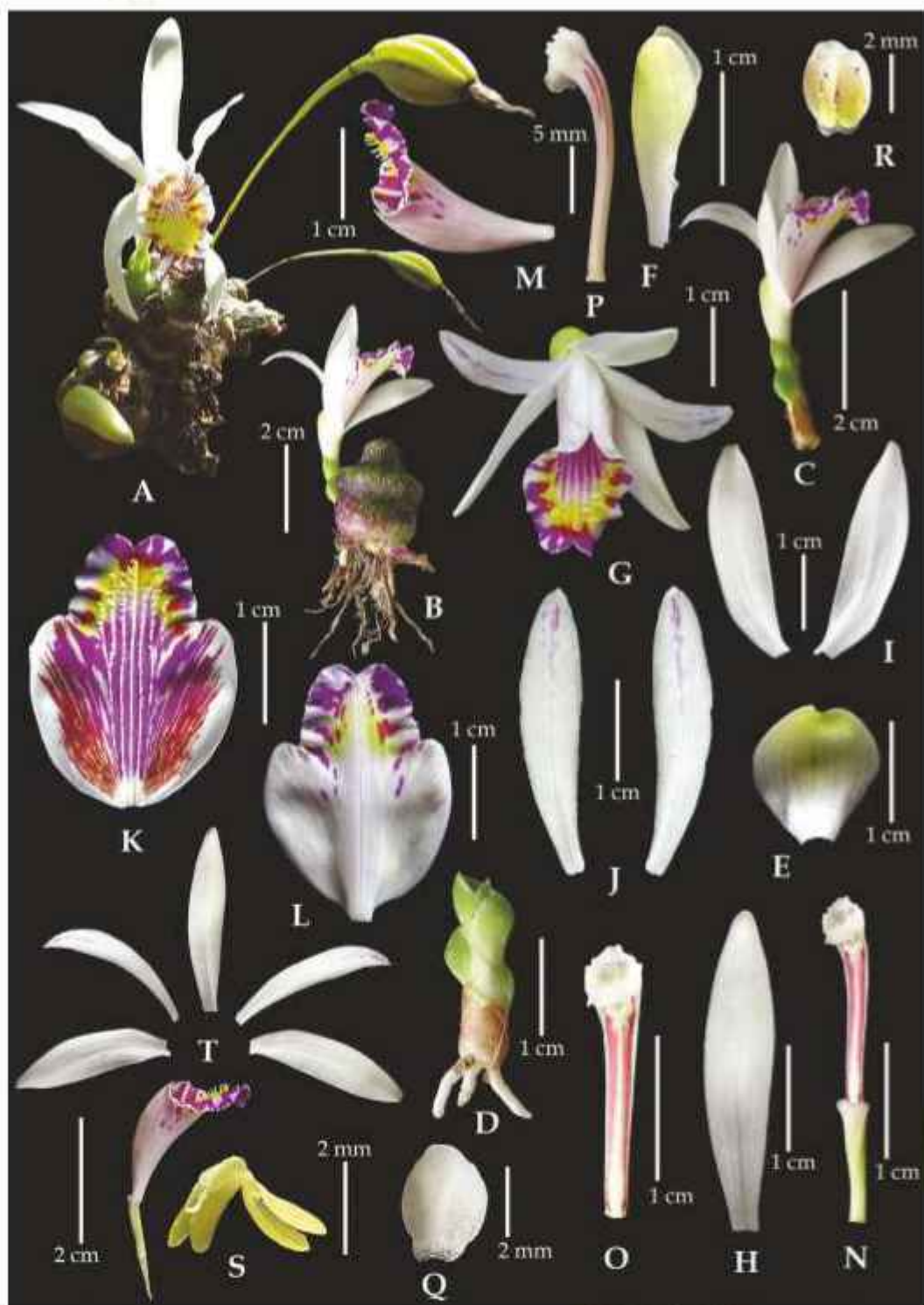


Figure 41. A–T: *Pleione maculata* (Lindl.) Lindl. & Paxton: A & B. Habit; C. Inflorescence; D. Peduncle (enclosed in membranous sheaths); E. Membranous sheath; F. Floral bract; G. Flower (front view); H. Dorsal sepal; I. Lateral sepals; J. Petals; K. Labellum-flattened out (dorsal view); L. Labellum-flattened out (ventral view); M. Labellum (lateral view); N. Column, pedicel & ovary (ventral view); O. Column (ventral view); P. Column (lateral view); Q. Anther cap (dorsal view); R. Anther cap (ventral view); S. Pollinia; T. Floral analysis [A, not to scale].



Pleione maculata (Lindl.) Lindl. & Paxton: plants in flowering and fruiting condition (left) and closeup of a flower (right)

apex acute. Lip ovate-oblong, 2.5–4.0 × 2.0–2.5 cm, conspicuously 3-lobed at or below middle; lateral lobes small; mid-lobe 1.0–1.5 cm long, margin shallowly dentate, apex emarginate; disk with 5–7 papillate-toothed lamellae; central 2 or 3 lamellae arising at base of lip, all extending almost to apex of lip. Column slightly arcuate, 1.8–2.0 cm long, apex irregularly erose-dentate.

Habitat: Epiphytic on tree trunks or lithophytic on moss covered rocks.

Flowering: October–November.

Occurrence: North Cachar Hill: Kapila ca. 1350 m, Thingje ca. 1400 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal), Bangladesh, Bhutan, Nepal, China, Myanmar, Thailand, Laos, Vietnam.

Regional Conservation Status & Criteria: Vulnerable, VU B2b(iii)c(i,ii).

Pleione praecox (Sm.) D. Don, Prodr. Fl. Nepal. 37. 1825; Katak, Orchids Meghalaya 127. 1986; H.J. Chowdhery, Orch. Fl. Arunachal Pradesh 615. 1998; Hynn. *et al.*, Orchids Nagaland 257. 2000; N. Pearce & P.J. Cribb, Orchids Bhutan 358. 2002; Phukan, Bull. Bot. Surv. India 47: 5. 2005; Lucksom, Orchids Sikkim N.E. Himalaya 504. 2007. *Epidendrum praecox* Sm., Exot. Bot. 2: 73. 1806. *Coelogyne praecox* (Sm.) Lindl., Coll. Bot. t. 37. 1826; Hook.f., Fl. Brit. India 5: 840. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 141. 1898. *Pleione praecox* var. *candida* Pfitzer, Pflanzenr. IV, 50: 126. 1907.

Pseudobulb green, mottled with purplish brown,



Pleione praecox (Sm.) D. Don: plants in their natural habitat

usually turbinate, $1.5-4 \times 1-2.5$ cm, apex abruptly contracted into a conspicuous neck, outer sheaths warty, 2- or rarely 1-leaved at apex. Leaves elliptic or elliptic-oblongate $10-20 \times 3.5-6.7$ cm, papery, base attenuate into a petiole-like stalk $3-6.5$ cm long, apex acuminate. Inflorescence appearing after leaves have fallen, erect; peduncle $5-10$ cm long, with 3 papillate sheaths; floral bract oblong-oblongate, $2.5-3.0 \times 1.5-2.0$ cm, exceeding ovary, apex acute. Flower solitary or rarely 2, pink to purplish red, with a yellow callus and occasionally with purple spots on lip *ca.* $5-9$ cm in across. Dorsal sepal oblong-oblongate, $5.5-6.0 \times 0.7-0.8$ cm, apex acute; lateral sepals slightly oblique, slightly wider at base than dorsal sepal, apex acute. Petals linear-lanceolate, slightly falcate, $5-7 \times 0.4-0.6$ cm, apex acute. Lip obovate-elliptic $4-5 \times 3-3.5$ cm, obscurely 3-lobed; lateral lobes inconspicuous; mid-lobe fimbriate

dentate on apical margin, apex emarginate; disk with 3-5 rows of papillae extending from base of lip to midway along mid-lobe. Column slightly arcuate, $3.5-4.5$ cm long, apex irregularly toothed.

Habitat: Epiphytic on tree trunks.

Flowering: September–November.

Occurrence: North Cachar Hills: Hajuichok *ca.* 1382 m; West Karbi Anglong: Umwang *ca.* 843 m
Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal, Uttarakhand), Bangladesh, Bhutan, Nepal, China, Myanmar, Thailand, Laos, Vietnam.

Regional Conservation Status & Criteria:

Vulnerable, VU B2b(iii)c(i,ii).



Thunia alba (Lindl.) Rchb.f. var. *alba*: a plant in its natural habitat



Thunia alba (Lindl.) Rchb.f. var. *alba*: closeup of flowers

Regional Conservation Status & Criteria:

Vulnerable, VU B2b(iii)c(i,ii).

Thunia alba var. *bracteata* (Roxb.) N.Pearce & P.J.Cribb, Edinburgh J. Bot. 58: 116. 2001 & in Orchids Bhutan 323. 2002; Vij *et al.*, Orchids Himachal Pradesh 245. 2013; K.N.Reddy *et al.*, Natl. Acad. Sci. Lett. 37 (2): 199. 2014. *Limodorum bracteatum* Roxb., Fl. Ind. 3: 466. 1832. *Thunia venosa* Rolfe, Orchid Rev. 12: 206. 1905; C.E.C.Fisch., Fl. Madras 3: 998. 1956. *Thunia bracteata* (Roxb.) Schltr., Repert. Spec. Nov. Regni Veg. Beih. 4: 205 1919; S.Misra, Orchids Orissa 517. 2004; Lucksom, Orchids Sikkim N.E. Himalaya 437. 2007.

Fig. 42 (A–U).

Plant pendulous up to 60 cm long. Stem stout, leafy, 20–40 × 0.5–1.0 cm, terete, bearing 5–7 progressively longer, loose tubular sheaths at swollen



Thunia alba var. *bracteata* (Roxb.) N.Pearce & P.J.Cribb: plant habit (left) and closeup of a flower (right)

base; sheaths ovate-elliptic, $1.5-3.0 \times 1.0-1.5$ cm, acute at apex. Leaves elliptic-lanceolate or oblonglanceolate, $10.5-25 \times 1.5-3.5$ cm, 3-5 veined, membranous, glaucous beneath, acuminate at apex, deciduous. Inflorescence pendent, 4-8-flowered; peduncles 2-5 cm long, sheathed; sheath tubular, lanceolate, acute at apex, *ca.* 4 cm long; rachis 2-4 cm long; floral bracts boat-shaped, acute at apex, $4-5.5 \times 1-1.2$ cm. Flowers 4-5 cm long; sepals and petals white; lip white; pedicel and ovary 1-1.5 cm long. Sepals subequal, narrowly oblong-ovate, $4.5-6 \times 1-1.2$ cm, acute to obtuse at apex. Petals oblong, $4.5-5.5 \times 0.8-1$ cm, acute at apex. Lip broadly oblong-pandurate, $4.5-5 \times 2.5-4.5$ cm, spurred, strongly purple-nerved; basal half convolute into a tube; apical half-hooded, margins undulate-dentate; disc with 5-9 dentate-fimbriate ridges; spur *ca.* $1.5 \times$

0.3 cm. Column 1.3-1.4 cm long, winged at apex; foot short. Capsule narrowly ellipsoid, $3-3.5 \times ca. 1$ cm.

Habitat: Epiphytic on tree trunks.

Flowering: August-September.

Occurrence: Baksa & Chirang: Manas B.R.; Cachar: Barak R.F., Riangpunjii (*vide* Bhattacharjee 2009); Lakhimpur: Dullung R.F., Kakoi R.F.; West Karbi Anglong: Kseh Kynthang *ca.* 859 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal, Uttarakhand, Himachal Pradesh, Jharkhand, Orissa, Chhattisgarh, Maharashtra, Andhra Pradesh, Karnataka, Kerala, Tamil Nadu, Andaman & Nicobar Is.), Bhutan, Nepal, China, Myanmar, Thailand.

Regional Conservation Status : Near Threatened.



Figure 42. A–U: *Thunia alba* var. *bracteata* (Roxb.) N.Pearce & P.J.Cribb: A. Flowering twig; B. Flower with bract (lateral view); C. Floral bract (ventral view); D. Floral bract-flattened out (dorsal view); E. Floral bract-flattened out (ventral view); F. Flower (ventral view); G. Flower (front view); H. Dorsal sepal; I. Lateral sepals; J. Petals; K. Labellum, column, pedicel & ovary (dorsal view); L. Labellum (dorsal view); M. Labellum (ventral view); N. Labellum-flattened out (dorsal view); O. Labellum-flattened out (ventral view); P. Column, pedicel & ovary (ventral view); Q. Column, pedicel & ovary (lateral view); R. Column (ventral view); S. Anther cap (dorsal view); T. Anther cap (ventral view); U. Floral analysis.



Dendrobium infundibulum Lindl.

TRIBE: CYMBIDIEAE PFITZER

Terrestrial, epiphytic or lithophytic, sympodial or less commonly monopodial herbs, leafless mycotrophs. Rhizome creeping. Stems erect, simple, flexible to stiff, terete to laterally compressed, pseudobulbous, one- to several-noded. Leaves one to several, rarely absent or reduced to scales, plicate or conduplicate, often distichous, alternate, stiffly herbaceous to hard-coriaceous, blade dorsiventrally flattened, rarely laterally flattened or semi-terete, articulation present or absent, linear, lanceolate, ovate, obovate or elliptic; sheaths present or absent, rarely tubular, clasping the stem, imbricate. Inflorescence basal, lateral or rarely subapical, racemose or paniculate; floral bracts often imbricate, sometimes alternating in two rows, usually persistent. Flowers one to many, usually resupinate, opening in succession or simultaneously, sometimes gregarious, long-lived to ephemeral, bisexual bilaterally symmetrical. Sepals free, thin to fleshy, lateral sepals asymmetrical, carinate or not. Petals free, elliptic or oblong to linear-lanceolate or lanceolate, asymmetrical, usually thinner textured than sepals. Lip firmly attached or hinged to the column or column foot, simple, trilobed or bi- or tripartite, usually lacking a spur, sometimes shortly spurred or saccate, lateral lobes variable in size, pronounced in front mesochile tubular and sometimes fluted, and epichile bucket-shaped; when present, callus ligulate, more pronounced at the top, composed of ridges, keels or hairs. Column curved, sometimes with wing-like lateral auricles or wings; Anther cap hinged at base, pollinia 2 of equal size or 4, usually of unequal sizes, porate or cleft, flat, lanceolate-ovoid to triangular-ovoid; stipes usually 1, rarely 2, sometimes clastic, viscidium present; stigma cupulate; rostellum 1–3-lobed. Capsule with six longitudinal ribs, perianth persistent.

Comprises 10 subtribes and 168 genera; widely distributed in both Old and New World, particularly in the tropical Americas, tropical and southern Africa, Madagascar, the Mascarenes, tropics and subtropical India, China, Japan, Indonesia, Australia and South West Pacific Islands; 2 subtribes, 3 genera, 27 species and 2 subspecies in Assam.

Key to the Genera

- 1a. Lip not saccate or spurred at base; leaves with neither long petiole nor forming pseudostem at base *Cymbidium*
- 1b. Lip saccate or spurred at base; leaves long petiolate; petioles often forming a pseudostem 2
- 2a. Inflorescence erect; anther cap with 2 dark projections; lip conspicuously 3-lobed *Eulophia*
- 2b. Inflorescence nodding; anther cap without projections as above; lip often unlobed or inconspicuously 3-lobed *Geodorum*

Subtribe: *Cymbidiinae* Benth.

Cymbidium Sw.

Epiphytic, lithophytic, or terrestrial, herbs, usually autotrophic, pseudobulbous. Pseudobulbs ovoid, ellipsoid, or spindle-shaped, rarely absent or stem like, often enclosed in leaf bases. Leaves several to many, distichous, usually lorate or linear, rarely oblanceolate to narrowly elliptic, often articulate toward base. Inflorescence arising from base of pseudobulb or rarely from axils of leaves, erect to pendulous; rachis several to many flowered, rarely reduced to a solitary flower; floral bracts persistent. Flowers large or medium-sized. Sepals and petals free, subsimilar. Lip free or basally fused for 3–6 mm to base of column,

usually 3-lobed; lateral lobes erect, often clasping column; mid-lobe often recurved; disk usually with 2 longitudinal lamellae extending from base of lip to base of mid-lobe; lamellae sometimes inflated toward apex or broken in middle. Pollinia 2 and deeply cleft, or 4 and in 2 unequal pairs, waxy, commonly attached by a very short or indistinct caudicle to a usually broad viscidium. Column rather long, often slightly arcuate, often narrowly winged.

About 83 species; distributed in tropical and subtropical Asia, south to Papua New Guinea and Australia; 25 taxa in India and 12 species and 2 subspecies in Assam.

Key to the Species

- 1a. Pollinia 42
- 1b. Pollinia 26
- 2a. Plant holomycotrophic leaf-less*C. macrorhizon*
- 2b. Plant autotrophic, leaf-bearing3
- 3a. Leaves elliptic-lanceolate*C. lancifolium*
- 3b. Leaves linear4
- 4a. Sepals and petals greenish, not dotted with pink lines*C. cyperifolium*
- 4b. Sepal and petals not greenish or rarely pale green, dotted with pink lines5
- 5a. Inflorescence 3–8 flowered; lip mid-lobe almost as broad as the side lobes when pressed*C. ensifolium* subsp. *haematodes*
- 5b. Inflorescence 8–13 flowered; lip mid-lobe much narrower than the side lobes when pressed*C. munronianum*
- 6a. Lip attached to base of column only or to a short column-foot, hinged-moveable7
- 6b. Lip attached to base and side of column, not moveable9
- 7a. Leaves linear with triangular acute tips*C. dayanum*
- 7b. Leaves obliquely 2-lobed at apex8
- 8a. Midlobes of lip with pink to purple longitudinal stripes; side-lobes with rather narrow triangular acute tips, longer than column*C. aloifolium*
- 8b. Midlobe of lip with purple dots; side-lobes obtuse or broad triangular acute, shorter than column*C. bicolor* subsp. *obtusum*
- 9a. Inflorescence pendulous, 13–35-flowered10
- 9b. Inflorescence erect or arching, 1–11 flowered11
- 10a. Flowers cream-yellow to pale yellow-green*C. elegans*
- 10b. Flowers tawny-brown*C. cochleare*
- 11a. Inflorescence arising from leaf axils; leaves usually 10–18, bilobed at apex12
- 11b. Inflorescence arising from base of pseudobulb; leaves usually 3–9, unlobed at apex13
- 12a. Pseudobulb stem like, continuously elongating, 10–30 cm*C. mastersii*
- 12b. Pseudobulb not stem like, generally less than 10 cm*C. eburneum*
- 13a. Sepals and petals green lacking prominent lining*C. hookerianum***
- 13b. Sepals and petals yellow or yellowish-green having prominent red-brown lining14
- 14a. Leaves 2–5 cm wide; lip yellowish, margin strongly undulate; central line of cilia present*C. iridioides*
- 14b. Leaves 0.7–2 cm wide; lip white or creamy yellow with irregular red spots, margin weakly undulate; central line of cilia absent*C. erythraeum*

***Cymbidium aloifolium* (L.) Sw.**, Nova Acta Regiae Soc. Sci. Upsal. 6: 73. 1799; Hook.f., Fl. Brit. India 6: 10. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 189. 1898; C.E.C.Fisch., Fl. Madras 3: 1004. 1956; Katak, Orchids Meghalaya 150. 1986; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 253. 1998; Hynn. *et al.*, Orchids Nagaland 126. 2000; I.Barua, Orchid Fl. Kamrup Distr. Assam 129. 2001; N.Pearce & P.J.Cribb, Orchids Bhutan 259. 2002; Sud.Chowdhury, Assam's Fl. 281. 2005; Lucksom, Orchids Sikkim N.E. Himalaya 368. 2007; S.R.Talukdar & C.Deori, Indian Forester 141 (11): 1165. 2015. *Epidendrum aloifolium* L., Sp. Pl. 953. 1753. *Cymbidium pendulum* (Roxb.) Sw., Nova Acta Regiae Soc. Sci. Upsal. 6: 73. 1799. *Cymbidium simulans* Rolfe, Orchid Rev. 25: 175. 1917.

Pseudobulbs ovoid, bilaterally flattened, 3–8 × 2.5–4.5 cm, usually enclosed in leaf bases. Leaves 4–5, lorate, 40–90 × 1.5–4 cm, thickly leathery, articulate 8–16 cm from base, apex obtuse and unequally 2-lobed. Inflorescence arising from within sheaths at base of pseudobulb, pendulous, 25–60 cm long; rachis many-flowered; floral bracts 2–5 mm long. Flowers slightly fragrant, medium sized; pedicel and ovary 1.2–2.0 cm long; sepals and petals pale yellow to cream-yellow, with a broad, central maroon-brown stripe; lip white or cream-colored, with dense, maroon venation on lateral lobes and longitudinal maroon stripes on mid-lobe. Sepals spreading, narrowly oblong to narrowly elliptic, 1.5–2.0 × 0.4–0.6 cm, apex obtuse. Petals narrowly elliptic, 1.4–1.8 × 0.4–0.6 cm, apex obtuse or acute. Lip subovate, 1.3–2.0 cm long, not fused to basal margins of column, base slightly saccate, 3-lobed; lateral lobes acute, loosely clasping column and exceeding column and anther; mid-lobe recurved; disk minutely papillate or puberulent, with 2 sigmoid lamellae; lamellae usually broken in middle and inflated toward base and apex. Pollinia 2. Column slightly arcuate, 1.0–1.2 cm long. Capsule oblong-ellipsoid, 3.5–6.5 × 2–4 cm.

Habitat: Epiphytic on tree trunks in lowland evergreen forests, often found on *Albizia lebbek* (L.)

Benth., *Artocarpus heterophyllus* Lam., *Barringtonia acutangula* (L.) Gaertn., *Bischofia javanica* Blume, *Bombax ceiba* L., *Dillenia indica* L., *Engelhardtia spicata* Lechen ex Blume, *Ficus benghalensis* L., *F. elastica* Roxb. ex Hornem., *F. religiosa* L., *Gmelina arborea* Roxb., *Lagerstroemia speciosa* (L.) Pers., *Mangifera indica* L., *Stereospermum chelonoides* (L.f.) DC., *Tamarindus indica* L., *Tectona grandis* L.f. etc.

Flowering: April–June.

Occurrence: Baksa and Chirang: Manas B.R., Mathanguri, Bansbari; Barpeta: Kayakuchi; Bongaigaon: Jogighopa; Cachar: Borail W.L.S., Near Sindhura, Near Kalaincherra, Bhuban Hill; Bongaigaon: East of Dhaknabari; Darrang: Patharughat; Dibrugarh: Jeypore, Nagapallo-niagaon; Jokai R.F.; Goalpara: Ajagar Pahar ca. 367 m; Golaghat: Kaziranga N.P., Nambor W.L.S.; Hailakandi: Janki Bazar, Inner Line R.F.; Jorhat: Hollongapar; Kamrup: Phullung, Michamari, Loharghat, Kalipur; Karbi Anglong: Garampani W.L.S., Diphu–Lumarpan Village; Karimganj: Kamalpur; Kokrajhar: Chakrasila W.L.S., Kuwori, Chirang R.F.-Jharbari, Ultapani, Holtugaon, Raimana; Lakhimpur: Dullung R.F., Kakoi R.F.; Majuli: Dakshinpat Satra; Morigaon: Pabitora W.L.S., Thengbanga; North Cachar Hill: Throughout; Sibsagar: Naphook R.F.; Sonitpur: Tezpur, Kumargaon, Burachapori W.L.S.; Tinsukia: Deopani R.F., Dibru-Saikhowa N.P.; Udalguri: Barnadi W.L.S., Khalingduar R.F., Nunai-Bhutan Road; West Karbi Anglong: Hamren.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Tripura, Sikkim, West Bengal, Bihar, Jharkhand, Uttar Pradesh, Uttarakhand, Orissa, Chhattisgarh, Maharashtra, Goa, Andhra Pradesh, Karnataka, Kerala, Tamil Nadu, Andaman & Nicobar Is.), Bangladesh, Nepal, China, Sri Lanka, Myanmar, Thailand, Laos, Cambodia, Vietnam, Malaysia, Indonesia.

Regional Conservation Status: Least Concern.

Note: This species is remarkably abundant and commonly found throughout Assam. It is locally called “*Mota-Kopow-Phul*” (Assamese).



Cymbidium aloifolium (L.) Sw.: plant habit (left) and closeup of flowers (right)

Cymbidium bicolor subsp. *obtusum* Du Puy & P.J.Cribb, Genus *Cymbidium* 70. 1988; N.Pearce & P.J.Cribb, Orchids Bhutan 260. 2002; H.A.Pedersen *et al.* in Santisuk *et al.* (eds.), Fl. Thailand 12(2): 448. 2014. *Cymbidium crassifolium* Wall., Numer. List 7357. 1832. *Cymbidium crassifolium* Wall. ex Herb., Gard. Mag. & Reg. Rural Domest. Improv., n.s., 5: 205. 1839. *Cymbidium mannii* Rchb. f., Flora 55: 274. 1872. *Cymbidium pendulum sensu auct.* King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 188. 1898. *Cymbidium bicolor* [auct. non Lindley 1833] sensu auct. P.B.Mazumder & S.Paul, J. Orchid Soc. India 16(1-2): 43. 2002; Sud.Chowdhury, Assam's Fl. 281. 2005; K.Gogoi, Wild Orchids Assam 151. 2017.

Fig. 95 (A-R).

Pseudobulbs narrowly ovoid, bilaterally flattened, 3–5 × 2–3 cm, enclosed in leaf bases. Leaves linear 25–50 ×

2–3 cm, thickly leathery, apex acute and unequally bilobed at apex. Inflorescence arising from within sheaths at base of pseudobulb, pendulous 20–30 cm long; rachis laxly 10–20-flowered; floral bracts subtriangular, 1.5–4.5 mm long. Flowers medium-sized, 3–4 cm in across; pedicel and ovary 1.0–1.5 cm long; sepals and petals yellowish at margins, with a central purplish maroon-brown longitudinal stripe, lip creamyyellow, heavily tinged purple-red. Sepals spreading, narrowly oblong, 1.4–2.0 × 0.3–0.5 cm, apex subacute. Petals narrowly subelliptic, 1.2–1.8 × 0.3–0.4 cm, apex obtuse to subacute. Lip subovate, 1.2–1.5 cm long, 3-lobed; lateral lobes short obtuse; midlobe oblong recurved; disk minutely papillate with 2 longitudinal lamellae slightly inflated toward base and apex. Column slightly arcuate, 0.8–1.2 cm, base with a very short foot. Capsule sub-ellipsoid, 3–5 × 2–3 cm.

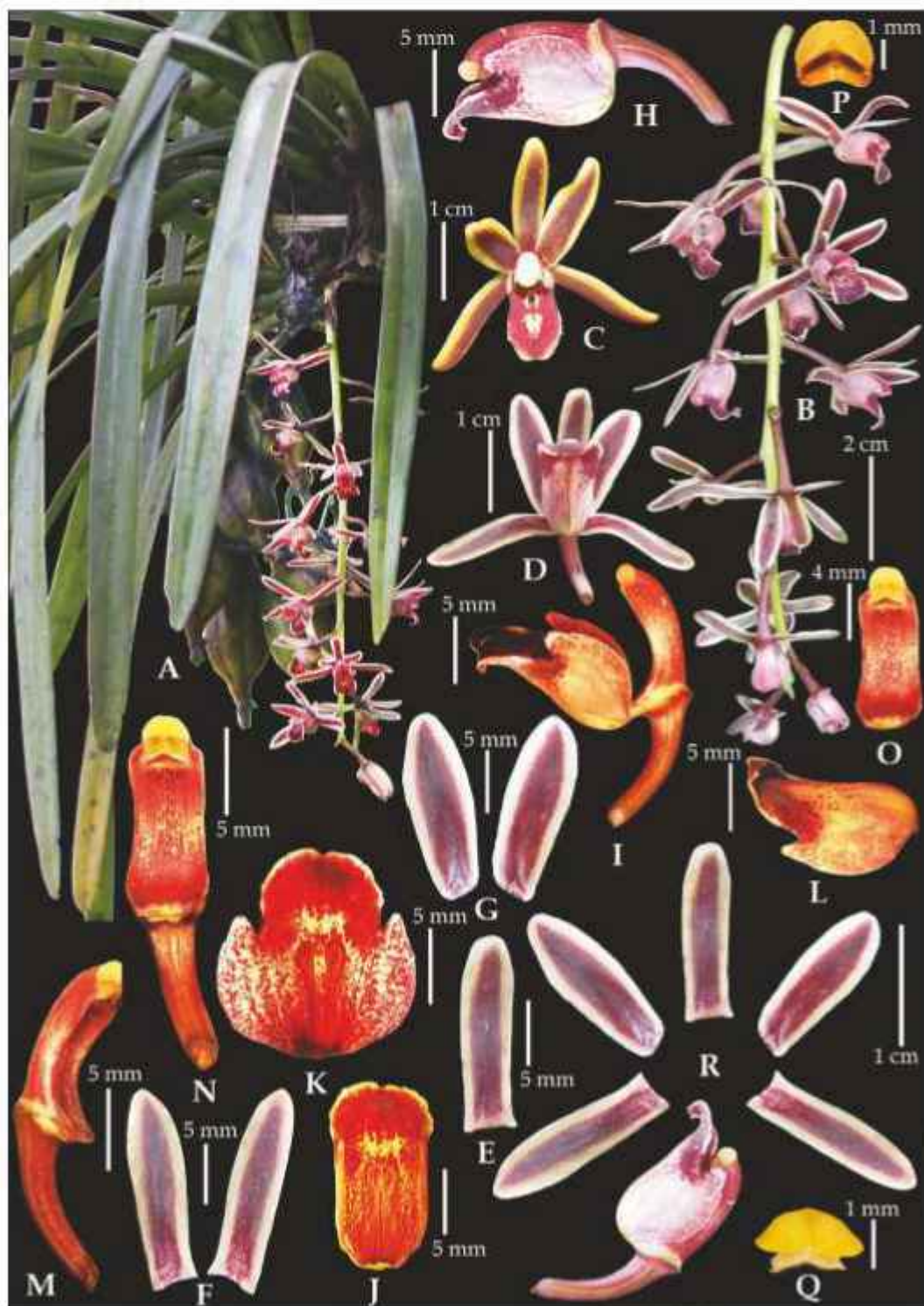


Figure 95. A–R: *Cymbidium bicolor* subsp. *obtusum* Du Puy & P.J.Cribb: A. Habit; B. Inflorescence; C. Flower (front view); D. Flower (ventral view); E. Dorsal sepal; F. Lateral sepals; G. Petals; H–I. Labellum, column, pedicel & ovary (lateral view); J. Labellum (dorsal view); K. Labellum-flattened out (dorsal view); L. Labellum (lateral view); M. Column, pedicel & ovary (lateral view); N. Column, pedicel & ovary (ventral view); O. Column (ventral view); P. Anther cap (ventral view); Q. Pollinarium; R. Floral analysis [A, not to scale].

Habitat: Epiphytic on tree trunks in dense jungles.

Flowering: March–April.

Occurrence: Baksa and Chirang: Manas B.R.; Dibrugarh: Jokai R.F., Jeyapore R.F.; Karbi Anglong: Garampani W.L.S.; Karimganj: Cheragi (*vide* Mazumder & Paul *l.c.*); Lakhimpur: Dullung and Kakoi R.F.; North Cachar Hills: Lankri; Sibsagar: Charaipung; Tinsukia: Deopani R.F., Dibru-Saikhowa N.P.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Nagaland, Sikkim, West Bengal, Andaman & Nicobar Is.), Bangladesh, Bhutan, Nepal, China, Myanmar, Thailand, Laos, Cambodia, Vietnam.

Regional Conservation Status: Least Concern.

Cymbidium cochleare Lindl., J. Proc. Linn. Soc., Bot. 3: 28. 1858; King & Pantl., Ann. Roy. Bot. Gard.

(Calcutta) 8: 194. 1898; Katak, Orchids Meghalaya 155. 1986; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 256. 1998; Hynn. *et al.*, Orchids Nagaland 127. 2000; N.Pearce & P.J.Cribb, Orchids Bhutan 265. 2002; Sud.Chowdhury, Assam's Fl. 321. 2005; Lucksom, Orchids Sikkim N.E. Himalaya 375. 2007. *Cyperorchis cochleare* (Lindl.) Benth., J. Linn. Soc., Bot. 18: 318. 1881; Hook.f., Fl. Brit. India 6: 15. 1890.

Pseudobulbs slightly fusiform, bilaterally flattened, 3–5 × 1–2 cm, enclosed in leaf bases. Leaves linear 40–60 × 0.8–1.5, margin slightly revolute, apex acuminate. Inflorescence interfoliar, 30–50 cm long, pendulous; peduncle dark brown, slender, terete, sheathed, 10–15 cm long; sheathes widely spaced, narrowly lanceolate, 3–4.5 cm long, apex acuminate; rachis slender, drooping 13–15 flowered; floral bracts whitish, *ca.* 3 mm long.



Cymbidium cochleare Lindl.: plant habit (left) and closeup of flowers (right)

Flowers greenish-brown, bell-shaped, *ca.* 4 × 1.2 cm, not opening widely; pedicel and ovary 1.5–1.8 cm long. Sepals oblanceolate-spathulate, 4.0–4.5 × 0.6–0.7 cm, apex acute. Petals oblanceolate, 4.0–4.2 × 0.5–0.6 cm, apex acute. Lip obovate, *ca.* 4.3 × 2.6 cm, base fused to basal margins of column, 3-lobed; side lobes erect and clasping column, triangular, 1.0–1.2 cm wide; mid-lobe deflexed, sub-orbicular, 0.7–0.8 cm long, margin undulate; disk with a dense patch of short hairs at center of mid-lobe, with 2 lamellae; lamellae inflated and white hairy toward apex. Pollinia 2, deeply cleft. Column *ca.* 3.5 cm long, slender.

Habitat: Epiphytic on tree trunks in primary forests.

Flowering: November–January.

Occurrence: North Cachar Hills: Thenbung *ca.* 1000 m; Sonitpur: Tezpur (Tezpor) (*fide* Hooker *l.c.*);

West Karbi Anglong: Umwang *ca.* 843 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal), Bangladesh, China, Myanmar, Vietnam.

Regional Conservation Status & Criteria:

Vulnerable, VU B2ab(ii)c(iii).

Cymbidium cyperifolium Wall. ex Lindl., Gen. Sp. Orchid. Pl. 163. 1833; Hook.f., Fl. Brit. India 6: 13. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 186. 1898; Kataki, Orchids Meghalaya 154. 1986; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 256. 1998; Hynn. *et al.*, Orchids Nagaland 127. 2000; N.Pearce & P.J.Cribb, Orchids Bhutan 267. 2002; Lucksom, Orchids Sikkim N.E. Himalaya 366. 2007; Aver., Taiwania 57(2): 130. 2012; K.Gogoi *et al.*, NeBio 4(5): 86. 2013. *Cymbidium carnosum* Griff.,



Cymbidium cyperifolium Wall. ex Lindl.: plant habit (left) and closeup of flowers (right)

Not. Pl. Asiat. 3: 339. 1851.

Pseudobulbs narrow, $1-3 \times ca. 1$ cm, enclosed in leaf bases. Leaves linear $25-50 \times 1-1.4$ cm, base distichous-equant, often dilated, articulate $4-5$ cm from base, apex finely acuminate. Inflorescence arising from near base of pseudobulb, erect or sub-erect, $30-40$ cm long; peduncle terete, $ca. 10$ cm long, sheathed; sheaths $2-9$ cm long; rachis $4-7$ -flowered; floral bracts linear-lanceolate, $ca. 2.8$ cm long. Flowers green, sweet-scented, $5-6$ cm in across, lip purple-spotted; pedicel and ovary $1.2-2.5$ cm long. Sepals oblong-lanceolate, $2.0-3.7 \times 0.4-0.8$ cm, apex acuminate. Petals narrowly ovate, $1.6-3.0 \times 0.5-0.9$ cm, apex acuminate. Lip ovate or oblong, $1.4-2.3$ cm long, slightly 3-lobed; lateral lobes short, erect, round at apex; mid-lobe strongly recurved, broadly ovate-elliptic, $1-1.5 \times 0.8-1.2$ cm, margin finely crenulate; disk with 2 longitudinal lamellae extending from base of lip to near base of mid-lobe. Pollinia 4, in 2 pairs. Column slightly arcuate, $1.1-1.5$ cm long, narrowly winged.

Habitat: Terrestrial on shady hill slopes.

Flowering: November–January.

Occurrence: Karbi Anglong: Habang; North Cachar Hills: Ngalsung $ca. 800$ m; West Karbi Anglong: Umpanai.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal, Uttarakhand), Bangladesh, Bhutan, Nepal, China, Myanmar, Thailand, Cambodia, Vietnam, Philippines.

Regional Conservation Status: Least Concern.

Cymbidium dayanum Rchb.f., Gard. Chron. 1869: 710. 1869; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 256. 1998; N.Pearce & P.J.Cribb, Orchids Bhutan 261. 2002; Sud.Chowdhury, Assam's Fl. 329. 2005; Lucksom, Orchids Sikkim N.E. Himalaya 370. 2007; H.A.Pedersen *et al.* in Santisuk *et al.* (eds.), Fl. Thailand 12(2): 451. 2014. *Cymbidium eburneum* var. *dayanum* (Rchb.f.) Hook.f., Fl. Brit. India 6: 12 1891. *Cymbidium simonsianum* King & Pantl., J. Asiat. Soc.

Bengal, Pt. 2, Nat. Hist. 64(2): 239. 1895; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 188. 1898.

Fig. 96 (A–R).

Pseudobulbs slightly fusiform, bilaterally flattened, $3-5 \times 1.5-2.5$ cm, enclosed in leaf bases. Leaves linear, $35-60 \times 0.7-1.5$ cm, mid-vein conspicuous beneath, apex acuminate. Inflorescence arising from base of pseudobulb, pendulous, $20-35$ cm long; rachis laxly $5-10$ -flowered; floral bracts subtriangular, $ca. 0.5$ cm long. Flowers, $4-5$ cm in across; sepals and petals white or cream-yellow, with a central maroon stripe; lip maroon, tinged with white and yellow; pedicel and ovary $1-2$ cm long. Sepals correct, narrowly oblong-elliptic, $2.2-2.7 \times 0.5-0.7$ cm, apex acute. Petals narrowly ovate-oblong, $1.7-2.2 \times 0.4-0.6$ cm, apex acute. Lip subovate, $1.5-1.9$ cm long, 3-lobed; lateral lobes nearly as long as column; mid-lobe recurved, $0.7-0.9$ cm long; disk densely glandular-papillose, with 2 longitudinal lamellae extending from base of lip to base of mid-lobe. Pollinia 2. Column slightly arcuate, $0.9-1.0$ cm long. Capsule ellipsoid, $4-5 \times 2-3$ cm.

Habitat: Epiphytic on tree trunks or on fallen rotting wood logs.

Flowering: June–August.

Occurrence: Dibrugarh: Jeypore R.F.; Karbi Anglong: Jengpata $ca. 800$ m; North Cachar Hills: Tarigaon $ca. 720$ m; Tinsukia: Dibru-Saikhowa N.P. Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal), Bhutan, Nepal, China, Japan, Myanmar, Thailand, Laos, Cambodia, Vietnam, Malaysia, Indonesia, Philippines.

Regional Conservation Status: Near Threatened.

Cymbidium eburneum Lindl., Edwards's Bot. Reg. 33: t. 67. 1847; Hook.f., Fl. Brit. India 6: 11. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 196. 1898; Katakai, Orchids Meghalaya 150. 1986; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 260. 1998; Hynn. *et al.*, Orchids Nagaland 128. 2000; N.Pearce & P.J.Cribb, Orchids Bhutan 264. 2002; Sud.Chowdhury, Assam's Fl. 281. 2005;

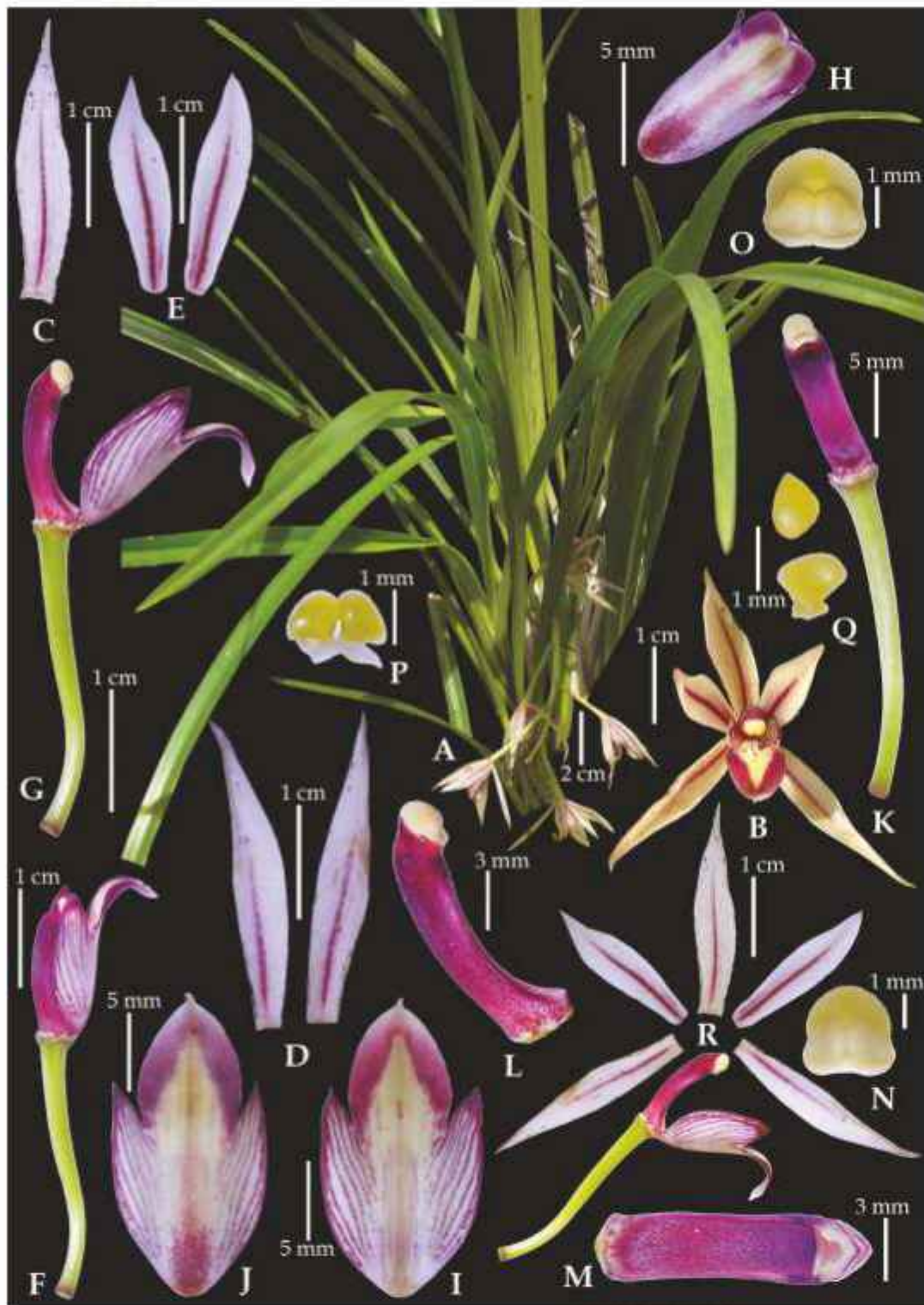


Figure 96. A–R: *Cymbidium dayanum* Rchb.f.: A. Habit; B. Flower (front view); C. Dorsal sepal; D. Lateral sepals; E. Petals; F–G. Labellum, column, pedicel & ovary (lateral view); H. Labellum (ventral view); I. Labellum-flattened out (dorsal view); J. Labellum-flattened out (ventral view); K. Column, pedicel & ovary (ventral view); L. Column (lateral view); M. Column (ventral view); N. Anther cap (dorsal view); O. Anther cap (ventral view); P. Pollinarium; Q. Pollinia; R. Floral analysis.



Cymbidium eburneum Lindl.: plant habit and closeup of a flower showing colour variation (below)

Lucksom, Orchids Sikkim N.E. Himalaya 373. 2007.
Cymbidium syringodorum Griff., Not. Pl. Asiat. 3:
 338. 1851.

Pseudobulbs bilaterally flattened, 4–8 × 2.5–4 cm, enclosed in leaf bases. Leaves many, linear, 40–60 × 1.5–2 cm, apex acute and slightly 2-lobed. Inflorescence arising from leaf axils, erect or suberect, 20–30 cm long; rachis 1–2-flowered; floral bracts ovate-triangular, 0.7–1 cm long. Flower white, slightly fragrant, 5–8 cm in across; pedicel and ovary terete, 3.5–5 cm long. Sepals oblongobovate, 5.5–7.0 × 1.5–2.0 cm, apex sub-acute. Petals narrowly obovate, 5.5–7.0 × 1.3–1.8 cm, apex acute. Lip broadly elliptic, sessile at the base of column, ca. 5.5 cm long, 3-lobed; lateral lobes erect, loosely clasping column; mid-lobe slightly recurved,



ovate-triangular, margin undulate with a V-shaped puplish line at apex; disk with a densely hairy patch on basal half of mid-lobe, with 2 converging lamellae extending from base of lip to near base of mid-lobe. Pollinia 2, subsquare; viscidium with filiform appendages at base. Column 3.5–4.5 cm long, narrowly winged, subglabrous. Capsule subellipsoid, 5–7 × 3–4 cm.

Habitat: Epiphytic on tree trunks, occasionally lithophytic.

Flowering: March–May.

Occurrence: Karbi Anglong: Dili Terang ca. 548 m; North Cachar Hill: Haflong ca. 650 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal, Uttarakhand), Nepal, China,

Myanmar, Vietnam.

Regional Conservation Status & Criteria:

Endangered, EN B2ab(ii)c(iii).

Cymbidium elegans Lindl., Gen. Sp. Orchid. Pl. 163. 1833; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 194. 1898; Kataki, Orchids Meghalaya 154. 1986; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 260. 1998; Hynn. *et al.*, Orchids Nagaland 129. 2000; S.R.Talukdar & C.Deori, Indian Forester 141 (11): 1165. 2015. *Cymbidium densiflorum* Griff., Not. Pl. Asiat. 3: 337. 1851. *Cymbidium longifolium* D.Don, Prodr. Fl. Nepal. 36. 1825; Hook.f., Fl. Brit. India 6: 13. 1890; Sud.Chowdhury, Assam's Fl. 281. 2005. *Cyperorchis elegans* (Lindl.) Blume, Rumphia 4: 47. 1849; Hook.f., Fl. Brit. India 6: 14. 1890.



Cymbidium elegans Lindl.: plant habit (left) and closeup of inflorescence (right)

Pseudobulbs subovoid, bilaterally flattened, $5-9 \times 2-3$ cm, enclosed in leaf bases. Leaves linear, $30-55 \times 1-2$ cm, apex acuminate, bifid. Inflorescence arising from base of pseudobulb, as long as leaves; peduncle stout, sheathed up to the base of rachis; rachis pendulous densely many-flowered; floral bracts small, 2–3 mm long. Flowers straw coloured, slightly fragrant, pendulous, narrowly bell-shaped, $ca. 4 \times 1.5$ cm, not opening widely; pedicel and ovary 1.2–2.0 cm long. Sepals oblong-ob lanceolate, $3.5-4.3 \times 0.7-1.1$ cm, apex acute. Petals broadly linear-ob lanceolate, $3-4 \times 0.5-0.8$ cm, apex obtuse. Lip ob lanceolate-triangular, $3-4 \times 0.4-0.8$ cm, 3-lobed; lateral lobes loosely clasping column; midlobe small, $0.6-1.0 \times 0.5-0.8$ cm, margin slightly undulate, apex slightly bilobed and incurved; disk densely pubescent at center of midlobe, with 2 longitudinal lamellae extending from base of lip to near base of mid-lobe. Pollinia 2, subclavateobovoid. Column 2.8–3.2 cm long, puberulent toward base, narrowly winged.

Habitat: Epiphytic on tree trunks or lithophytic.

Flowering: October–November.

Occurrence: Bongaigaon: Abhayapuri; North Cachar Hills: Nerpung *ca.* 941 m; Tinsukia: Digboi-Lekhapani; Udalguri: Barnadi W.L.S. (*vide* Talukdar & Deori *l.c.*); West Karbi Anglong: Umbormon.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal, Uttarakhand), Bhutan, Nepal, China, Vietnam.

Regional Conservation Status: Least Concern.

Cymbidium ensifolium subsp. *haematodes* (Lindl.) Du Puy & P.J.Cribb ex Govaerts, World Checklist Seed Pl. 3(1): 20. 1999; H.A.Pedersen *et al.* in Santisuk *et al.* (eds.), Fl. Thailand 12(2): 455. 2014. *Cymbidium haematodes* Lindl., Gen. Sp. Orchid. Pl. 162. 1833. *Cymbidium ensifolium* var. *haematodes* (Lindl.) Trimen, Syst. Cat. Fl. Pl. Ceylon 89. 1885. *Cymbidium ensifolium* *sensu auct.* Hook.f., Fl. Brit. India 6: 13. 1890; Katakai, Orchids Meghalaya 153. 1986; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 263. 1998. 1986.

Fig. 97 (A–S).

Pseudobulbs ovoid, $1.5-2.5 \times 1-1.5$ cm, enclosed in leaf bases. Leaves linear, $30-60 \times 1.0-1.3$ cm, apex acute. Inflorescence arising from base of pseudobulb, erect, 25–40 cm long; rachis 3–8-flowered; floral bracts, lanceolate, 1–3 cm long. Flowers fragrant, variable in colour, usually pale-greenish, dotted with pink lines, *ca.* 4–5 cm in across; pedicel and ovary 2.5–3.5 cm long. Sepals narrowly elliptic, $2.3-3.2 \times 0.5-0.8$ cm, apex acute; lateral sepals usually oblique. Petals narrowly ovate-elliptic, $1.5-2.4 \times 0.5-0.8$ cm, apex acute. Lip sub-oblong, 1.5–2.5 cm long, obscurely 3-lobed; lateral lobes erect and loosely clasping column; mid-lobe recurved, ovateoblong, $0.8-1.2 \times 0.7-1.0$ cm, as broad as the side lobes when flattened; disk minutely papillate, with 2 fleshy lamellae; lamellae extending almost to base of mid-lobe, converging in their apical half and forming a short tube. Pollinia 4, broadly ovoid, in 2 pairs. Column slightly arcuate, 1.0–1.4 cm long, narrowly winged. Capsule narrowly ellipsoid, *ca.* 5×2 cm.

Habitat: Terrestrial, grows among tall grasses, on shady forest floors or lithophytic on moss covered rocks.

Flowering: December–February.

Occurrence: Baksa and Chirang: Manas B.R.; Karbi Anglong: Dambukso *ca.* 840 m; North Cachar Hills: Guilong *ca.* 950 m; West Karbi Anglong: Sirtiso *ca.* 587 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Chhattisgarh, Karnataka, Kerala, Tamil Nadu) Sri Lanka, China, Japan, Myanmar, Thailand, Laos, Cambodia, Vietnam, Philippines, Indonesia.

Regional Conservation Status: Least Concern.

Cymbidium erythraeum Lindl., J. Proc. Linn. Soc., Bot. 3: 30. 1858; N. Pearce & P.J. Cribb, Orchids Bhutan 262. 2002; Lucksom, Orchids Sikkim N. E. Himalaya 372, t. 233. 2007. *Cymbidium longifolium sensu auct.* Lindl., Gen. Sp. Orchid. Pl.: 163. 1833; King & Pantl. in Ann. Roy. Bot. Gard. Calcutta 8: 191, t. 254. 1898; Pradhan, Ind. Orch. Guide Ident. Cult. 2: 476. 1979; Katakai, Orchids Meghalaya 153.

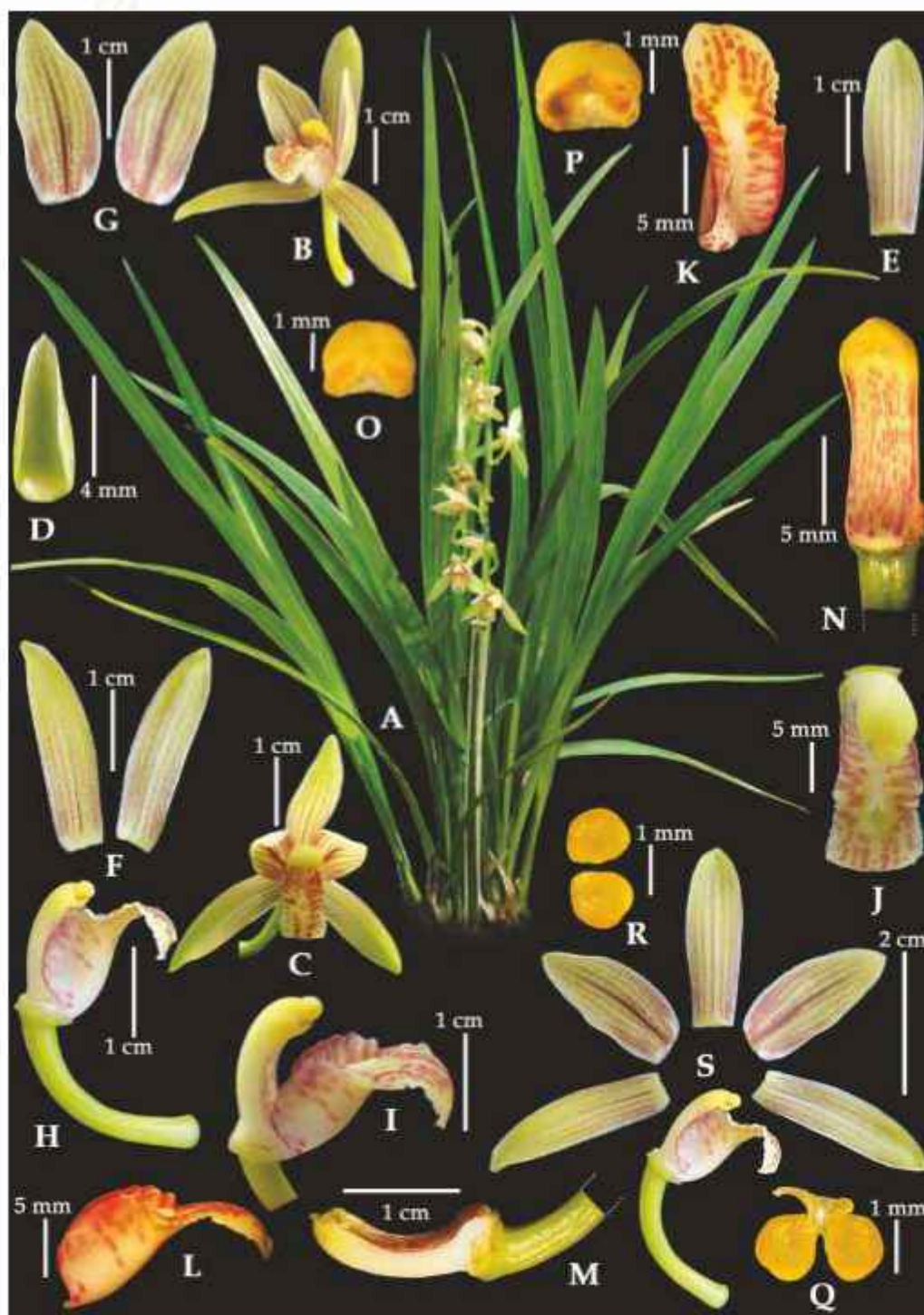


Figure 97. A–S: *Cymbidium ensifolium* subsp. *haematodes* (Lindl.) Du Puy & P.J.Cribb ex Govaerts: A. Habit; B. Flower (ventrolateral view); C. Flower (front view); D. Floral bract; E. Dorsal sepal; E. Lateral sepals; G. Petals; H. Labellum, column, pedicel & ovary (lateral view); I. Labellum, column with a portion of pedicellate ovary (enlarged); J. Labellum & column (front view); K. Labellum (dorsolateral view); L. Labellum (lateral view); M. Column with a portion of pedicellate ovary (lateral view); N. Column with a portion of pedicellate ovary (ventral view); O. Anther cap (dorsal view); P. Anther cap (ventral view); Q. Pollinarium; R. Pollinia; S. Floral analysis [A, not to scale].



Cymbidium erythraeum Lindl.: a portion of inflorescence (left) and closeup of a flower (right)

1986; Hynn. *et al.*, Orchids Nagaland 131. 2000. *Cymbidium hennisianum* Schltr., Orchis 12: 46 1918. *Cyperorchis hennisiana* (Schltr.) Schltr., Repert. Spec. Nov. Regni Veg. 20: 107. 1924.

Pseudobulbs ovoid, bilaterally compressed, 5–8 × 2–5 cm, obscurely 4-angled, sheathed. Leaves narrowly linear-elliptic, 35–90 × 0.7–2.0 cm, entire, apex acute-acuminate, base channelled, articulated. Inflorescence 35–75 cm long, raceme, arising from within sheaths at base of pseudobulb, sub erecto-horizontal, drooping at apical half; peduncle 15–35 cm long, covered with 5–7 scarious sheaths; sheaths up to 9.5 cm long at base; rachis 20–40 cm long, slender, laxly 3–15 flowered. Floral bracts 2–6 mm long, triangular. Pedicel and ovary 1.0–4.2 cm long, glabrous. Flowers large, 6–8 cm in across, spreading, fragrant; sepals and petals pale-green, striped and

spotted with red-brown; lip white to yellowish white spotted with red-brown on mid-lobe; mid-lobe with one pair of median central lamellae, lamellae white or creamy-white, spotted with red-brown, between lamellae one median red-brown line. Dorsal sepal oblong, elliptic to narrowly obovate, 3.0–4.5 × 0.7–1.3 cm, hooded over the column, concave, porrect, acute; lateral sepals slightly shorter, elliptic, falcate, spreading. Petals falcately oblong-elliptic, 3.2–5.0 × 0.5–0.8 cm, ligulate, narrow, spreading, entire, apex acute. Lip oblong-oval in outline when pressed, 2.4–4.0 × *ca.* 1.8 cm, recurved from the middle, fused to the column by 2–4 mm long, 3-lobed; sidelobes short 7–12 mm broad, erect, triangular, acute, covering the column, densely covered with short hairs at front, base with papillose hairy, margin entire, weakly pubescent; mid-lobe ovate, orbicular or cordate-reniform acute-obtuse, recurved from

middle, margin strongly undulate sometimes entire weakly covered with short hairs; disc with 2, long parallel hairy lamellae, running from base up to the base of mid lobe, densely covered with short hairs at and between the lamellae. Column 2.3–3.5 cm high, thick, curved, winged, base sparsely hairy. Capsules fusiform-ellipsoidal, $4-6 \times 2-3$ cm, shortly stalked, beak up to 1.5 cm long.

Habitat: Epiphytic on tree trunks or lithophytic on moss covered rocks.

Flowering: October–December.

Occurrence: Bongaigaon: Abhayapuri, R.F., 4 mile from Naphak; Karbi Anglong: Sikaribasti ca. 477 m; North Cachar Hills: Khunti 1100 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Nagaland, Sikkim,

Uttarakhand, West Bengal) Bhutan, Nepal, China, Myanmar, Vietnam.

Regional Conservation Status & Criteria:

Vulnerable, VU B2ab(ii)c(iii).

Note: This species is allied to *Cymbidium iridioides* D.Don but differ in having smaller pseudobulbs, narrower leaves and smaller flowers. The lip of *C. erythraeum* is white with few brownish-red spots whereas, lip of *C. iridioides* is creamy-yellow with more brown-red spots. The lip of *C. erythraeum* is small, less undulate with minute hairs on side-lobes as compared to *C. iridioides* (Kumar 2015).

Cymbidium iridioides D.Don, Prodr. Fl. Nepal. 36. 1825; Katak, Orchids Meghalaya 152. 1986; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 267. 1998; Hynn. *et al.*, Orchids Nagaland 129.



Cymbidium iridioides D.Don: plants in their natural habitat

2000; N.Pearce & P.J.Cribb, Orchids Bhutan 263. 2002; Sud.Chowdhury, Assam's Fl. 281. 2005; Lucksom, Orchids Sikkim N.E. Himalaya 371. 2007. *Cymbidium giganteum sensu auct.* Wall. ex Lindl., Gen. Sp. Orchid. Pl. 163. 1833; Hook.f., Fl. Brit. India 6: 12. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 191. 1898; S.K.Jain & Hajra, Amer. Orchid Soc. Bull. 45: 1106. 1976.

Pseudobulbs narrowly ovoid, bilaterally flattened, 5–10 × 3–5 cm, enclosed in leaf bases. Leaves linear-oblong 40–55 × 2–3 cm, midrib distinct, apex acuminate. Inflorescence arising from within sheaths at base of pseudobulb, suberect or arched, 35–50 cm long; rachis laxly many-flowered; floral bracts subtriangular, 2–3 mm long. Flowers reddish-purple, fragrant, 8–10 cm in across, lip white with dark blotches at apex, sidelobe yellowish; pedicel and ovary 3–4.5 cm long. Sepals narrowly obovate-oblong, 3.5–4.5 × 1.2–1.5 cm, apex acute. Petals slightly falcate, narrowly ovate-oblong, 3.5–4.6 × 0.7–1.0 cm, apex acute. Lip ovate-triangular, slightly shorter than petals, 3-lobed; lateral lobes shortly ciliate; mid-lobe strongly recurved, margin undulate; disk sparsely hairy, with 2 central lamellae extending to base of mid-lobe. Pollinia 2, subtriangular. Column arcuate, 2.5–3.0 cm, shortly hairy at base on ventral surface. Capsule subellipsoid, 7–11 × 3–4.5 cm.

Habitat: Either epiphytic on tree trunks or lithophytic.

Flowering: September–October.

Occurrence: North Cachar Hills: Leike ca. 1262 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal, Uttarakhand), Bhutan, Nepal, China, Myanmar, Vietnam.

Regional Conservation Status & Criteria:

Endangered, EN B2ab(i,ii)c(iii).

Cymbidium lancifolium Hook., Exot. Fl. 1: t. 51. 1823; Hook.f., Fl. Brit. India 6: 9. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 185. 1898; A.S.Rao & D.M.Verma, Bull. Bot. Surv. India 11 (3&4): 411.

1969; Kataki, Orchids Meghalaya 149. 1986; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 270. 1998; Hynn. *et al.*, Orchids Nagaland 131. 2000; N.Pearce & P.J.Cribb, Orchids Bhutan 269. 2002; Sud.Chowdhury, Assam's Fl. 281. 2005; Lucksom, Orchids Sikkim N.E. Himalaya 367. 2007; H.A.Pedersen *et al.* in Santisuk *et al.* (eds.), Fl. Thailand 12(2): 459. 2014. *Cymbidium gibsonii* Lindl. & Paxton, Paxton's Fl. Gard. 3: 144. 1852. *Cymbidiopsis lancifolia* (Hook.) H.J.Chowdhery, Indian J. Forest. 32: 157. 2009.

Pseudobulbs cylindric fusiform, slightly bilaterally flattened, 5–8 × 0.5–1.5 cm, many-noded. Leaves few, elliptic-lanceolate 8–15 × 1.5–3 cm, base contracted into petiole, apex acuminate; petiole 5–10 cm long. Inflorescence 1–2, lateral, erect, 8–15 cm; rachis few-flowered; floral bracts lanceolate, 1.0–1.5 cm. Flowers 3–4 cm in across, sepals and petals white or pale green, midvein purplish brown, lip white with purplish brown stripes; pedicel and ovary 2.0–2.5 cm long. Sepals oblanceolate-oblong, 2.2–3.0 × 0.5–0.7 cm, apex acute. Petals ovate, 1.5–2.3 × 0.5–0.7 cm, apex acute. Lip ovate-oblong, 1.5–2.0 cm, obscurely 3-lobed; lateral lobes erect and loosely clasping column; mid-lobe recurved, ovate-oblong, 0.6–1.2 × 0.6–1.1 cm; disk with 2 longitudinal lamellae extending from base of lip to base of mid-lobe; lamellae convergent toward their apices and forming a short tube. Pollinia 4, in 2 pairs. Column ca. 1.5 cm long. Capsule narrowly ellipsoid, ca. 5 × 1.5 cm.

Habitat: Terrestrial, found near streams in damp humus filled crevices.

Flowering: May–August.

Occurrence: Baksa and Chirang: Manas B.R.; Karbi Anglong: Dambukso ca. 840 m; Lakhimpur: North Lakhimpur (*vide* Rao & Verma *l.c.*); North Cachar Hills: Thingje ca. 1400 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal), Bangladesh, Bhutan, Nepal, China, Japan, Korea, Myanmar, Thailand, Laos, Cambodia, Vietnam, Malaysia, Indonesia, New Guinea.

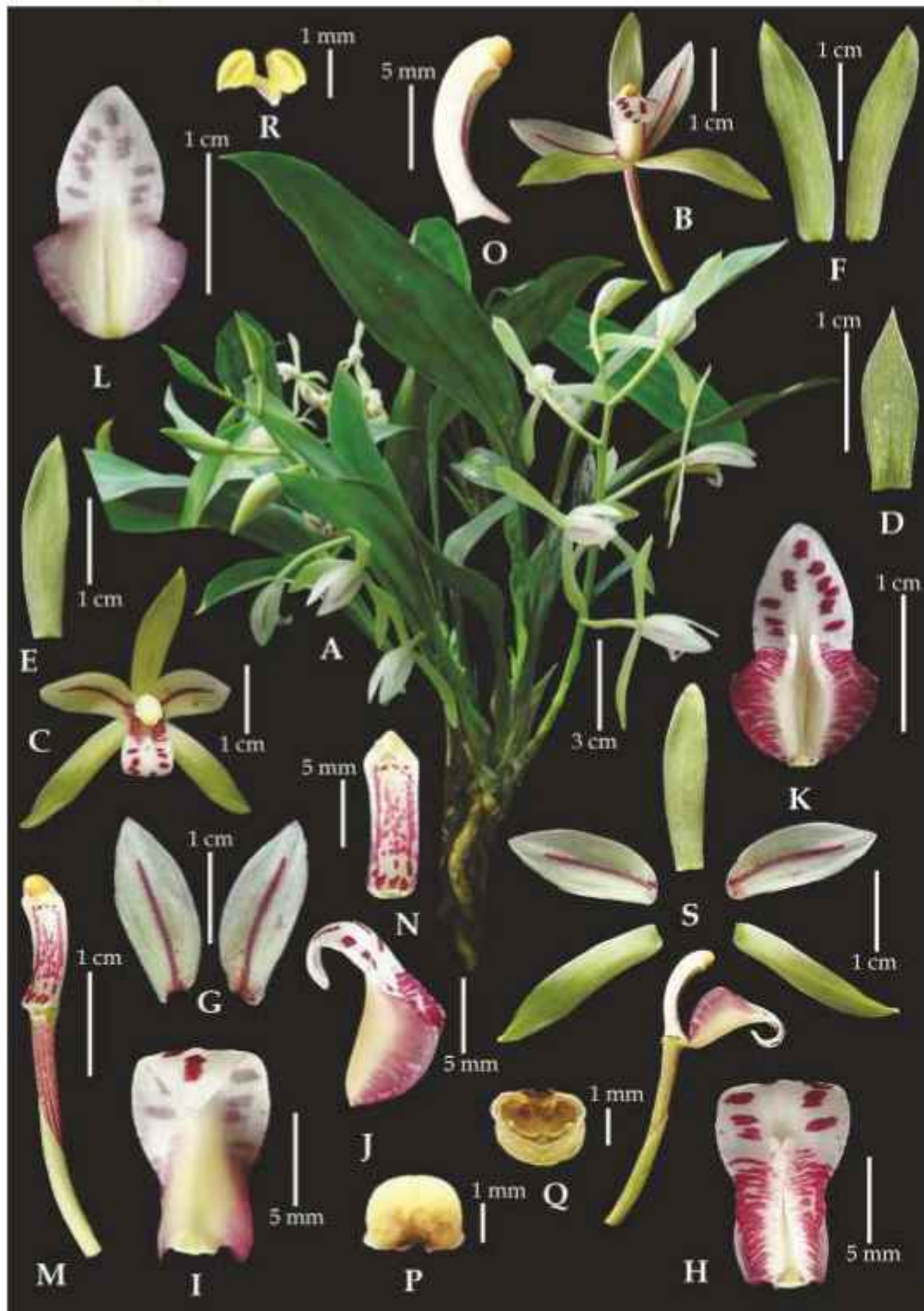


Figure 98. A-S: *Cymbidium lancifolium* Hook. A. Habit; B. Flower (ventral view); C. Flower (front view); D. Floral bract; E. Dorsal sepal; F. Lateral sepals; G. Petals; H. Labellum (dorsal view); I. Labellum (ventral view); J. Labellum (lateral view); K. Labellum-flattened out (dorsal view); L. Labellum-flattened out (ventral view); M. Column, pedicel & ovary (ventral view); N. Column (ventral view); O. Column (lateral view); P. Anther cap (dorsal view); Q. Anther cap (ventral view); R. Pollinarium; S. Floral analysis.



Cymbidium macrorhizon Lindl.: a plant in its natural habitat (left) and closeup of a flower (right)

Regional Conservation Status: Near Threatened.

Cymbidium macrorhizon Lindl., Gen. Sp. Orchid. Pl. 162. 1833; Hook.f., Fl. Brit. India 6: 9. 1890; Katak, Orchids Meghalaya 148. 1986; H.J. Chowdhery, Orch. Fl. Arunachal Pradesh 270. 1998; Hynn. *et al.*, Orchids Nagaland 133. 2000; N.Pearce & P.J.Cribb, Orchids Bhutan 271. 2002; Sud.Chowdhury, Assam's Fl. 281. 2005; Lucksom, Orchids Sikkim N.E. Himalaya 366. 2007; Vij *et al.*, Orchids Himachal Pradesh 177. 2013; H.A.Pedersen *et al.* in Santisuk *et al.* (eds.), Fl. Thailand 12(2): 463. 2014. *Cymbidiopsis macrorhiza* (Lindl.) H.J. Chowdhery, Indian J. Forest. 32: 155. 2009.

Plant lacking green leaves and pseudobulbs. Rhizome branched, subterranean, 5-20 cm long, 0.5-1.2 cm in diam. Inflorescence usually arising

from apex of rhizome, erect, 15-25 cm high; peduncle usually purplish red or pale-yellow; rachis 2-5-flowered; floral bracts linear-lanceolate, 1.0-1.8 cm long. Flowers white with pink lines on sepals and petals, spotted on lip, 3-4 cm in across; pedicel and ovary 2.0-2.5 cm long. Sepals narrowly oblanceolate-oblong, 2.0-2.2 × 0.4-0.5 cm, apex acute. Petals narrowly elliptic, 1.5-1.8 × 0.5-0.6 cm, apex acute. Lip subovate, 1.3-1.5 cm long, obscurely 3-lobed; lateral lobes erect; mid-lobe slightly recurved, triangular-ovate, 0.5-0.7 × 0.4-0.6 cm; disk papillate, with 2 longitudinal lamellae extending from base of lip to base of mid-lobe; lamellae convergent at their apices and forming a short tube. Pollinia 4, in 2 pairs, broadly ovoid. Column slightly arcuate, *ca.* 1 cm, narrowly winged. Capsule erect, green.



Cymbidium mastersii Griff. ex Lindl.: plant habit (left) and closeup of flowers (right)

Habitat: Terrestrial holomycotroph, found in humus filled crevices or shady forest floors.

Flowering: June–August.

Occurrence: Darrang: Orang N.P.-Sagunpukhuri (*vide* Nath, 1999); Golaghat: Tamera; North Cachar Hills: Shimtilong *ca.* 1230 m; West Karbi Anglong: Umwang *ca.* 843 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal, Jharkhand, Chhattisgarh, Uttarakhand, Himachal Pradesh, Jammu & Kashmir), Bhutan, Nepal, Pakistan, China, Japan, Korea, Myanmar, Thailand, Laos, Vietnam.

Regional Conservation Status: Near Threatened.

Cymbidium mastersii Griff. ex Lindl., Edwards's Bot. Reg. 31: t. 50 1845; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 195. 1898; Kataki, Orchids

Meghalaya 151. 1986; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 274. 1998; Hynn. *et al.*, Orchids Nagaland 133. 2000; N.Pearce & P.J.Cribb, Orchids Bhutan 264. 2002; Sud.Chowdhury, Assam's Fl. 281. 2005; Lucksom, Orchids Sikkim N.E. Himalaya 374. 2007; H.A.Pedersen *et al.* in Santisuk *et al.* (eds.), Fl. Thailand 12(2): 464. 2014. *Cymbidium affine* Griff., Not. Pl. Asiat. 3: 336. 1851. *Cymbidium micromeson* Lindl., J. Proc. Linn. Soc., Bot. 3: 29. 1858. *Cyperorchis mastersii* (Griff. ex Lindl.) Benth., J. Linn. Soc., Bot. 18: 318. 1881; Hook.f., Fl. Brit. India 6: 15. 1890.

Pseudobulbs more or less compressed, 10–15 cm long, covered by equitant leaf bases. Leaves linear, 30–50 × 1.5–2.5 cm, subleathery, apex unequally bilobed. Inflorescences arising from leaf axils, suberect, 30–40 cm long, laxly few-flowered; floral

bracts triangular, 3–5 mm long. Flowers white, slightly flushed with and a yellow spot on lip, 6–6.5 cm in across; pedicel and ovary 2.5–4.5 cm long. Sepals broadly lanceolate-oblong, concave, 4.5–5.5 × 1.0–1.5 cm, apex acute. Petals linear, 4.2–5.0 × 0.7–1.0 cm, apex acute. Lip oblong-ovate, 4.0–4.5 cm, 3-lobed; lateral lobes erect and loosely clasping column, ca. 0.8 cm wide; mid-lobe ovate, small, ca. 1.2 × 1.1 cm, margin undulate; disk puberulent and with a densely hairy patch at center of mid-lobe, with 2 longitudinal lamellae; lamellae convergent at their apices. Column 3.5–4 cm long. Capsule fusiform-ellipsoid, ca. 4 × 2.5 cm.

Habitat: Epiphytic on tree trunks or rarely lithophytic.

Flowering: October–December.

Occurrence: North Cachar Hills: Kapila ca. 1350 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal), Bangladesh, Bhutan, China, Myanmar, Thailand, Vietnam.

Regional Conservation Status & Criteria:

Endangered, EN B2b(i,ii)c(iii).

Cymbidium munronianum King & Pantl., J. Asiat. Soc. Bengal 64: 238. 1895; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 187. 1898; Kataki, Orchids Meghalaya 151. 1986; N. Pearce & P.J. Cribb, Orchids Bhutan 267. 2002; Lucksom, Orchids Sikkim N.E. Himalaya 367. 2007; K. Gogoi, Wild Orchids Assam 164. 2017. *Cymbidium ensifolium* var. *munronianum* (King & Pantl.) T. Tang & F.T. Wang, Acta Phytotax. Sin. 1(1): 91. 1951.

Pseudobulbs small, ovoid, ca. 3 × 2 cm. Leaves broadly linear, erect, 40–60 × 1.7–2.6 cm, apex acuminate, tapering towards base, midrib distinct. Inflorescence arising from the base of pseudobulb, stout, as long as leaves; peduncle sheathed; sheaths lanceolate ca. 5 cm long; rachis 15–25 cm long, laxly 8–13-flowered; floral bracts lanceolate, 0.8–1.2 cm long. Flowers fragrant, 2.5–3.5 cm across; sepals and petals pale green, lined with purple-brown, lip pale yellow with pink lateral lobes, margins red and midlobe blotched with red; pedicel and ovary 1.2–2.5 cm long. Sepals subsimilar, oblong-elliptic, obtuse, erect, 1.6–3 × 0.5–0.6 cm; lateral sepals spreading. Petals ovate, 1.5–2.2 × 0.6–0.9 cm, subacute at apex. Lip 1.5–2.5 cm long; lateral lobes erect, prominent, minutely pubescent; mid-lobe narrowly oblong, reflexed, minutely papillose, margin entire or weakly undulate, 0.7–0.8 × 0.4–0.6 cm, much narrower than the side lobes when flattened; disk 2-ridged, converging to a small tube at base of mid-lobe. Column slightly arcuate, 0.7–1.2 cm long, narrowly winged. Capsule fusiform, ca. 5 cm long.

Habitat: Terrestrial, on hill slopes.

Flowering: March–May.

Occurrence: Karbi Anglong: *sine loc.* (fide Gogoi l.c.); Lakhimpur: Dullung R.F. and Kakoi R.F.; North Cachar Hill: Purana Hmarlushei ca. 1300 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Nagaland, Sikkim, West Bengal), Bhutan.

Regional Conservation Status & Criteria:

Vulnerable, VU B2b(ii)c(iii).

Subtribe: *Eulophiinae* Benth.*Eulophia* R.Br.

Terrestrial herbs, usually autotrophic or rarely heteromycotrophic. Pseudobulbs cormlike, tuberous, or rhizomatous, usually subterranean. Leaves one to many, appearing at or after anthesis, basal, base tapering or contracted into a petiole-like stalk, reduced to scales in heteromycotrophic species; petiole-like leaf base sometimes overlapping and forming a pseudostem. Inflorescence erect, lateral, racemose or rarely paniculate, laxly to subdensely many flowered or occasionally reduced to single flowered. Flowers resupinate, small to large; pedicel and ovary slender. Sepals free, similar; lateral sepals usually slightly oblique, sometimes adnate to column foot. Petals similar to dorsal sepal or slightly wider. Lip slightly erect, usually 3-lobed, lateral lobes erect and embracing column, rarely entire, base usually spurred or saccate; disk usually with a callus consisting of lamellae, ridges, or fringes. Anther terminal, incompletely bi-locular, anther cap often with 2 projections; pollinia 2. Column short to long, usually winged; foot usually present, rarely absent.

About 201 species; distributed in tropical and subtropical regions, of Africa, Asia, Australia and the SW Pacific islands; 24 species in India and 11 species in Assam,

Key to the Species

- 1a. Plant holomycotrophic, leaf-less *E. zollingeri*
- 1b. Plant autotrophic, with green leaves 2
- 2a. Hypochile of lip is not saccate nor spurred *E. spectabilis*
- 2b. Hypochile of lip either saccate or spurred 3
- 3a. Plant with green pseudobulbs above ground 4
- 3b. Plant with subterranean pseudobulbs 5
- 4a. Disk of lip with 3-keels terminating on epichile, not papillate *E. andamanensis*
- 4b. Disk of lip with 3–5 keels forking towards epichile, densely papillate *E. graminea*
- 5a. Lip with 2 distinct keels *E. bicallosa*
- 5b. Lip with 3 or more keels or generally many-veined 6
- 6a. Leaves absent during flowering *E. dabia*
- 6b. Leaves present during flowering 7
- 7a. Leaf solitary *E. kamarupa*
- 7b. Leaf not solitary, usually two or more 8
- 8a. Flowers uniformly yellow *E. mannii*
- 8b. Flowers not uniformly yellow 9
- 9a. Sepals and petals completely white *E. obtusa*
- 9b. Sepals and petals green to pale green or cream coloured 10
- 10a. Lip apex acuminate *E. bracteosa*
- 10b. Lip apex usually truncate *E. herbacea*

Eulophia andamanensis Rchb.f., Flora 55: 276. 1872; Hook.f., Fl. Brit. India 6: 8. 1890; B.Grant, Orchids Burma 216. 1895; Aver., Turczaninowia 9(3) : 66. 2006; H.A.Pedersen *et al.* in Santisuk *et al.* (eds.), Fl.

Thailand 12(2): 502. 2014; K.Gogoi, Pleione 12(1): 112. 2018. *Eulophia keithii* Ridl., J. Linn. Soc., Bot. 32: 333 1896; Holttum, Orchids Malaya 536. 1964.

Fig. 99 (A–F).



Eulophia andamanensis Rchb.f.: plant habit (left) and closeup of flowers (right)

Plant autotrophic up to 50 cm high. Pseudobulbs *ca.* 10 cm long, green, shining, *ca.* 5-leaved. Leaves short during flowering, linear lanceolate, *ca.* 30 × 1 cm, narrowed at base, acute at apex. Inflorescence racemose, 30–40 cm long; rachis laxly 10–15 flowered; floral bracts shorter than the pedicel and ovary. Flower pale greenish; sepals and petals green with brownish nerves; lip pale green on side-lobes and margins of mid-lobe and the rest white with brown nerves. Sepals linear-lanceolate, *ca.* 1.5 × 0.4 cm, 3–5-nerved, apex acuminate; lateral sepals spreading horizontally. Petals slightly shorter than sepals, ovate-lanceolate, 3-nerved, sub-acute at apex. Lip 3-lobed; side-lobes erect, rather small, obtuse; midlobe large, broadly clawed, orbicular, reflexed, margins crisped; basal part of lip with 3-white warty keels. Column short, thick; foot distinct as long as column; spur conic, *ca.* 4 mm long, dilated and

obtuse at apex.

Habitat: Terrestrial on hill slopes or often lithophytic on limestone rocks.

Flowering: March–April.

Occurrence: Chirang: Manas B.R.-Bhutan border (*fide* Gogoi *l.c.*); North Cachar Hills: Near Haflong.

Distribution: India (Assam, Andaman & Nicobar Is.), Myanmar, Thailand, Laos, Cambodia, Vietnam, Malaysia, Indonesia.

Regional Conservation Status & Criteria:

Endangered, EN B2ab(i,ii)c(iii).

Eulophia bicallosa (D.Don) P.F.Hunt & Summerh., Kew Bull. 20: 60. 1966; Katakai, Orchids Meghalaya 144. 1986; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 391. 1998; Hynn. *et al.*, Orchids Nagaland 185. 2000; N.Pearce & P.J.Cribb, Orchids Bhutan 252. 2002; Sud.Chowdhury, Assam's Fl. 283. 2005;

Lucksom, Orchids Sikkim N.E. Himalaya 353. 2007; H.A.Pedersen *et al.* in Santisuk *et al.* (eds.), Fl. Thailand 12(2): 506. 2014. *Bletia bicallosa* D.Don, Prodr. Fl. Nepal. 30. 1825. *Eulophia bicarinata* (Lindl.) Hook.f., Fl. Brit. India 6: 6. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 180. 1898. *Eulophia candida* (Lindl.) Hook.f., Fl. Brit. India 6: 6. 1890.

Plants autotrophic, 50–68 cm high. Pseudobulb subglobose to cylindric, 5–10 cm long, single leaved. Leaf linear, 25–45 × 0.5–1.2 cm, appears after anthesis, gradually tapering at base into a petiole, apex acute or acuminate; petiole 15–30 cm long. Inflorescence racemose, 45–60 cm high, slender, with 3–5 scattered tubular sheaths; rachis 10–15 cm long, subdensely few to 20-flowered; floral bracts lanceolate, 0.8–1.4 × 0.2–0.3 cm, shorter than ovary, apex acuminate. Flowers slightly spreading, 2–3 cm in across, pale yellowish-green with purple-red stippling or veining; pedicel and ovary linear, 1.0–1.5 cm long. Sepals sub-similar, lanceolate; dorsal sepal 1.0–1.5 × 0.2–0.3 cm, apex acute; lateral sepals 1.3–1.9 × 0.3–0.5 cm, adnate at base to column foot, apex acute. Petals lanceolate to narrowly elliptic, 1.0–1.5 × 0.6–0.8 cm, base contracted, apex acute. Lip subovate, 1.5–2.0 cm long, 3-lobed, spurred at base; lateral lobes erect, triangular, oblique; mid-lobe recurved, broadly ovate, clawed at base, apex retuse; disk with 3 purplish red ridges; spur subconical, 3–4 × ca. 1 mm, apex obtuse. Column slender, ca. 6 mm long, foot distinct, ca. 3 mm long.

Habitat: Terrestrial, grows among grasses on moist places.

Flowering: March–May.

Occurrence: Baksa and Chirang: Manas B.R.; Sonitpur: Gohpur R.F.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Tripura, Sikkim, West Bengal, Uttar Pradesh, Uttarakhand), Bangladesh, Nepal, China, Myanmar, Thailand, Malaysia, Indonesia, Philippines, Bismarck Archipelago, New Guinea, Australia.



Eulophia bicallosa (D.Don) P.F.Hunt & Summerh.: plants in their natural habitat

Regional Conservation Status & Criteria:

Vulnerable, VU B2b(ii)c(iii).

Eulophia bracteosa Lindl., Gen. Sp. Orchid. Pl. 180. 1833; Hook.f., Fl. Brit. India 6: 3. 1890; Kataki, Orchids Meghalaya 144. 1986; Sud.Chowdhury, Assam's Fl. 283. 2005. *Eulophia grandiflora* Lindl., Gen. Sp. Orchid. Pl. 181. 1833. **Fig. 99 (G–L).**

Plants autotrophic, 45–70 cm high. Pseudobulb cylindrical 1.5–2 cm in diam., subterranean, sheathed, 2–3-leaved. Leaves narrowly oblong-lanceolate, 40–60 × 2.5–5 cm, present at anthesis, papery, base contracted into a long petiole, apex acuminate; petiole 20–35 cm long, partially enclosed in several basal sheaths and forming a pseudostem. Inflorescence racemose or very rarely paniculate, 30–50 cm long; peduncle terete, sheathed; sheaths tubular, 4–5 cm long, apex acute;

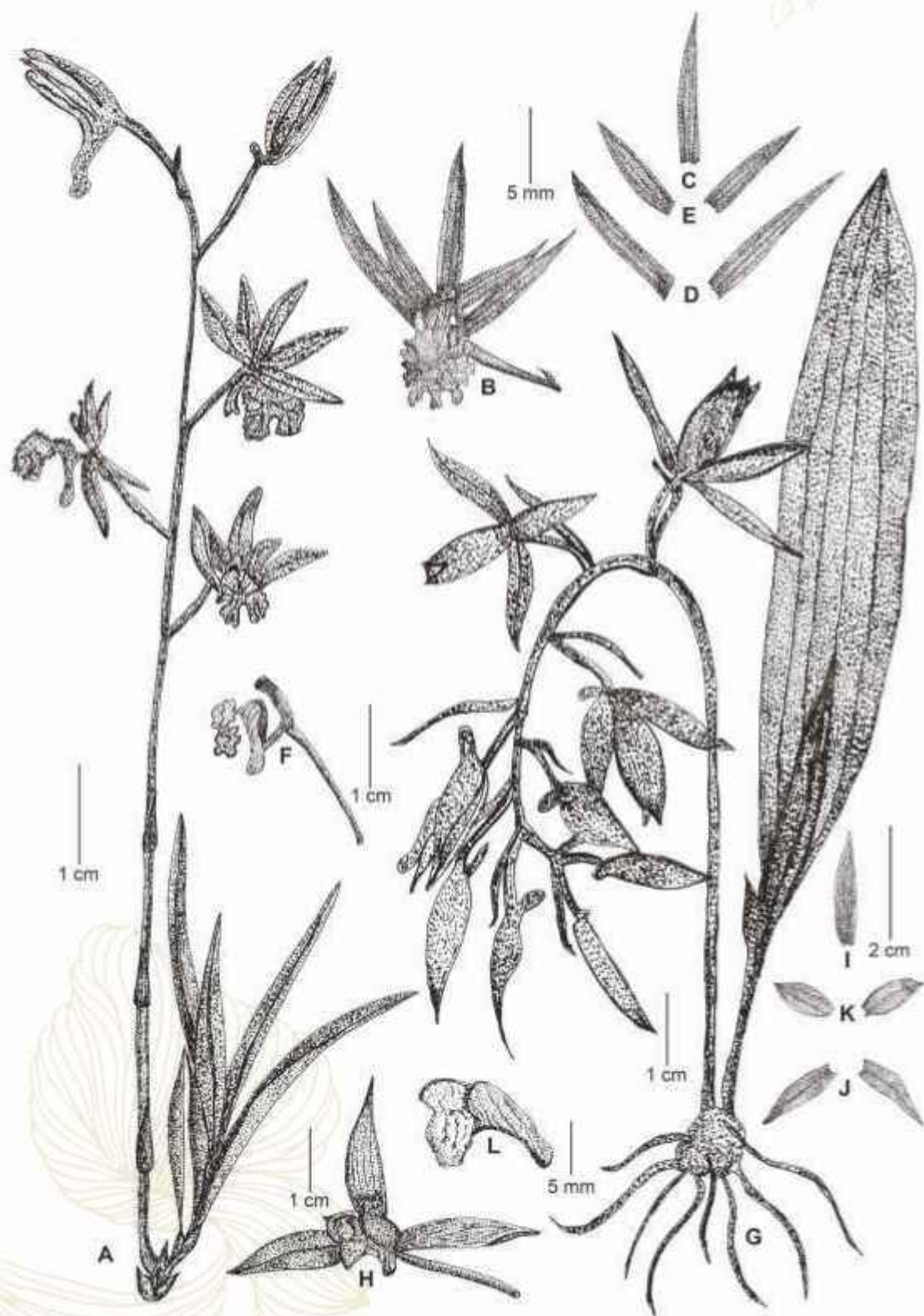


Figure 99. A–F: *Eulophia andamanensis* Rchb.f.: A. Habit; B. Flower; C. Dorsal sepal; D. Lateral sepals; E. Petals; F. Lip with column pedicel and ovary. G–L: *Eulophia bracteosa* Lindl.: G. Habit; H. Flower; I. Dorsal sepal; J. Lateral sepals; K. Petals; L. Lip.

rachis 7–10 cm long, subdensely many-flowered; floral bracts linear-lanceolate, $2.5\text{--}5.0 \times 0.4\text{--}0.8$ cm, apex acuminate. Flowers yellowish-white, 2.3–2.5 cm long; pedicel and ovary 1.5–2.5 cm long. Sepals similar, obovate-elliptic, $1.7\text{--}2.0 \times 0.8\text{--}0.9$ cm, apex obtuse. Petals obovate-elliptic, $1.1\text{--}1.5 \times 0.9\text{--}1.0$ cm, membranous, apex rounded. Lip obovate-oblong, $1.5\text{--}2.0 \times 0.7\text{--}0.8$ cm, obscurely 3-lobed near apex, spurred at base, apical margin undulate, apex usually acuminate; disk with thickened central veins, with 5 irregularly fimbriate lamellae extending from midway along lip almost to apex of mid-lobe; spur short, conical, 3–5 mm long, apex obtuse, curved forward. Column 5–6 mm long; foot absent.

Habitat: Terrestrial, grows on hill slopes exposed to light.

Flowering: February–April.

Occurrence: Karbi Anglong: Garampani W.L.S.; North Cachar Hills: Aiongbung; Udalguri: Nunai Beat House to Bhutan Border.

Distribution: India (Assam, Meghalaya, Mizoram, Sikkim, West Bengal), Bangladesh, China, Myanmar.

Regional Conservation Status & Criteria:

Vulnerable, VU B2b(i,ii)c(iii).

Eulophia dabia (D.Don) Hochr., Bull. New York Bot. Gard. 6: 270. 1910; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 391. 1998; N.Pearce & P.J.Cribb, Orchids Bhutan 247. 2002; Sud.Chowdhury, Assam's Fl. 283. 2005; Lucksom, Orchids Sikkim N.E. Himalaya 352. 2007; Vij *et al.*, Orchids Himachal Pradesh 195. 2013. *Bletia dabia* D.Don, Prodr. Fl. Nepal. 30. 1825. *Limodorum ramentaceum* Roxb., Fl. Ind. 3: 467. 1832. *Eulophia campestris* Wall. ex Lindl., Gen. Sp. Orchid. Pl. 185. 1833; Hook.f., Fl. Brit. India 6: 4. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 178. 1898. *Eulophia hormusjii* Duthie, Ann. Roy. Bot. Gard. (Calcutta) 9(2): 125. 1906; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 393. 1998.

Plant 20–40 cm high. Pseudobulb irregularly cylindric-globose, 1–2 cm in diam., subterranean, 2–3 leaved. Leaves linear, $15\text{--}20 \times 0.4\text{--}0.8$ cm,

emerges after flowering, lamina gradually tapering at base into a petiole, apex acuminate; petiole enclosed in basal sheaths and forming a pseudostem ca. 10 cm long. Inflorescence racemose, terminal, 20–35 cm long, slender to stout; rachis 6–13 cm long, laxly to subdensely 5–14-flowered; floral bracts ovate-lanceolate, $0.6\text{--}1.5 \times 0.3\text{--}0.5$ cm, membranous, apex acuminate. Flowers pale pink to maroon, 1.7–2.5 cm in across; pedicel and ovary 1.0–2.2 cm long. Sepals similar, narrowly oblong, $0.8\text{--}1.5 \times 0.3\text{--}0.5$ m, apex acute; lateral sepals slightly oblique. Petals linear-oblong, $0.8\text{--}1.4 \times 0.2\text{--}0.3$ cm, apex acute. Lip 3-lobed, broadly oblong-obovate, $0.9\text{--}1.5 \times 0.6\text{--}1.2$ cm, spurred at base; lateral lobes erect and loosely embracing column, broadly ovate-triangular, apex obtuse; mid-lobe oblate $3\text{--}4 \times 2\text{--}4$ mm, margin undulate, apex truncate; disk with 3 longitudinal fimbriate lamellae extending from base of lip to midway along mid-lobe; spur cylindric, $5\text{--}8 \times 0.8\text{--}1.5$ mm, apex obtuse. Column $0.7\text{--}0.9$ cm long; foot absent. Capsule oblong-ovoid, $1.8\text{--}2.3 \times 0.5\text{--}1.0$ cm, pendulous.

Habitat: Terrestrial, grows on open hill slopes.

Flowering: January–March.

Occurrence: Baksa and Chirang: Manas B.R.; Darrang: Orang N.P.-Katachali range, Pachnoi river bed; Dibrugarh: Jokai R.F.; Golaghat: Debraj Roy College Campus, Pulibor; Karbi Anglong: Nambor W.L.S.; Tinsukia: Dibru-Saikhowa N.P.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Nagaland, Sikkim, West Bengal, Bihar, Jharkhand, Uttar Pradesh, Uttarakhand, Himachal Pradesh, Jammu & Kashmir, Punjab, Haryana, Chandigarh, Maharashtra, Andaman & Nicobar Is.), Bangladesh, Bhutan, Nepal, China, Myanmar, Pakistan, Afghanistan, Kazakhstan, Tajikistan, Turkmenistan, Uzbekistan.

Regional Conservation Status: Least Concern.

Eulophia graminea Lindl., Gen. Sp. Orchid. Pl. 182. 1833; Hook.f., Fl. Brit. India 6: 2. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 176. 1898; C.E.C.Fisch., Fl. Madras 3: 1003. 1956; Kataki, Orchids Meghalaya 144. 1986; N.Pearce & P.J.Cribb,

Orchids Bhutan 249. 2002; Sud.Chowdhury, Assam's Fl. 283. 2005; Lucksom, Orchids Sikkim N.E. Himalaya 350. 2007; H.A.Pedersen *et al.* in Santisuk *et al.* (eds.), Fl. Thailand 12(2): 511. 2014.

Plants autotrophic, 45–65 cm high. Pseudobulb ovoid, conic or subglobose, 3–7 × 2.5–4 cm, borne above ground, 3–5 leaved. Leaves linear-lanceolate, 15–30 × 0.8–1 cm, present at or emerging after anthesis, base sheathing, apex acuminate. Inflorescence racemose or occasionally paniculate, 40–60 cm long, slender, with several scattered sheaths; rachis 15–30 cm long, laxly few to several-flowered; floral bracts linear-lanceolate, 0.8–1.0 × 0.2–0.3 cm, apex acuminate. Flowers 1.5–3.0 cm in across; sepals and petals olive-green with dark green venation, lip white with purplish red lamellae; pedicel and ovary 1.5–2.0 cm long. Sepals subsimilar, oblong to oblanceolate, 1.1–1.5 × 0.2–0.3 cm, apex shortly acuminate; lateral sepals slightly longer and oblique than dorsal one. Petals narrowly ovate, 0.9–1.0 × 0.2–0.3 cm, reflexed, apex shortly acuminate. Lip subobovate-oblong, 0.9–1.0 × 0.4–0.5 cm, spurred at base, 3-lobed; lateral lobes small; mid-lobe orbicular, 0.4–0.5 cm in diam., apex with an acute mucro; disk with 5 longitudinal lamellae, extending from base of lip almost to apex of mid-lobe, divided at apex; spur cylindric 3–3.5 mm long, apex slightly clavate, usually curving forward. Column 4–5 mm long; foot absent. Capsule ellipsoid, 2.5–3.0 × 1.0–1.5 cm.

Habitat: Terrestrial, grows on hill slopes.

Flowering: April–May.

Occurrence: Baksa and Chirang: Manas B.R.; Kamrup: Sonapahar; Karbi Anglong: Chenghehishon ca. 548 m; North Cachar Hills: Darangbra ca. 530 m.

Distribution: India (Assam, Arunachal Pradesh, Meghalaya, Mizoram, Nagaland, Tripura, Sikkim, West Bengal, Uttarakhand, Punjab, Bihar, Jharkhand, Madhya Pradesh, Orissa, Maharashtra, Andhra Pradesh, Kerala, Tamil Nadu, Andaman & Nicobar Is.), Bangladesh, Bhutan, Nepal, Pakistan,



Eulophia graminea Lindl.: closeup of flowers

China, Japan, Sri Lanka, Myanmar, Thailand, Laos, Cambodia, Vietnam, Malaysia, Singapore, Indonesia, Philippines, Marianas.

Regional Conservation Status: Least Concern.

Eulophia herbacea Lindl., Gen. Sp. Orchid. Pl. 182. 1833; C.E.C.Fisch., Fl. Madras 3: 1003. 1956; Santapau & Kapadia, Orchids Bombay 111. 1966; Vij *et al.*, Orchids Himachal Pradesh 197. 2013; H.A.Pedersen *et al.* in Santisuk *et al.* (eds.), Fl. Thailand 12(2): 514. 2014; K.Gogoi, Wild Orchids Assam 241. 2017. *Limodorum bicolor* Roxb., Fl. Ind. 3: 469. 1832.

Plants autotrophic, 30–60 cm high. Pseudobulb ovoid to broadly conical, ca. 2 × 1 cm, borne above ground, with transverse circular markings, 2–5 leaved. Leaves elliptic-lanceolate, 10–30 × 3–8 cm, present at anthesis, lamina tapering at base into



Eulophia herbacea Lindl.: plants in their natural habitat (left) and closeup of flowers (right)

a long petiole, apex acuminate; petiole 8–20 cm long, enclosed in several basal sheaths and forming a pseudostem up to 15 cm long. Inflorescence erect, racemose, 25–55 cm long, arising from an intermediate node of pseudobulb, slender, with 2 or 3 scattered sheaths; rachis 8–15 cm long, laxly 6–10-flowered; floral bracts linear-lanceolate, 2.0–3.3 cm, apex acuminate. Flowers 3–5 cm in across; sepals pale green, petals and lip white flushed yellowish green at base; pedicel and ovary 2–3 cm long. Sepals similar, linear-lanceolate 2.2–3.0 × 0.4–0.5 cm, apex acuminate; lateral sepals slightly oblique. Petals oblong-elliptic, 1.5–2.0 × 0.6–0.7 cm, apex obtuse. Lip 3-lobed, ovate-oblong, 1.8–2.0 × 0.7–1.0 cm, spurred at base; lateral lobes incurved and loosely embracing column, subovate; mid-lobe strongly deflexed, broadly oblong, 0.7–1.0 × 0.5–0.7 cm, apex truncate-rounded; disk with several tall fimbriae rows of extending up to midway along mid-lobe;

spur green, saccate-cylindric, 2–3 mm long, apex rounded. Anther 2-celled, light maroon. Column ca. 1 cm long; foot absent.

Habitat: Terrestrial, grows on hill slopes.

Flowering: July.

Occurrence: Karbi Anglong: *sine loc.* (fide Gogoi l.c.); North Cachar Hills: Thingram ca. 689 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Tripura, Sikkim, West Bengal, Bihar, Jharkhand, Uttarakhand, Chhattisgarh, Madhya Pradesh, Gujarat, Maharashtra, Andhra Pradesh, Karnataka, Andaman & Nicobar Is.), Bangladesh, Nepal, China, Myanmar, Thailand, Laos.

Regional Conservation Status: Least Concern.

Eulophia kamarupa Sud.Chowdhury, J. Orchid Soc. India 7: 49, 1993 & in Assam's Fl. 80, 2005; K.Gogoi,



Eulophia kamarupa Sud.Chowdhury: plants in their natural habitat (left) and closeup of a flower (right)

Wild Orchids Assam 242. 2017. **Fig. 100 (A–E).**

Plant 25–30 cm high. Pseudobulb discoid, 1.5–1.8 cm in diam., subterranean, single-leaved. Leave oblanceolate, 13–15 × 0.7–0.8 cm, present at anthesis, plicate, margins entire, slightly notched at the apex, base narrowed. Inflorescence lateral raceme, 20–22 cm long; peduncle 18–19 cm long, purple, with 5 tubular imbricate bracts; rachis 2.0–2.5 cm long, greenish purple, 6–7 flowered. Flowers showy, resupinate, 1.9–2.4 × 3.7–3.8 cm, light purplish-white tinged with green, nerves dark purple, pendant; floral bracts light purplish brown, ovate lanceolate, 1.5–1.9 × 0.3–0.4 cm, 3-nerved, acute at apex; pedicel with ovary 5–8 mm long, dark purple. Sepals subequal, oblanceolate, spreading, reflexed, light greenish-purple, 5-nerved; dorsal sepal 2–3 cm long, gradually narrowed from middle to the base, apex acute, light purple outside and light

greenish purple inside, margins white; lateral sepals ca. 2.1 × 0.5 cm slightly falcate, obtuse at the apex; mentum 5–6 mm long. Petals oblanceolate, ca. 1.9 × 0.5 cm, apex acute, 5-nerved. Lip adnate to the base of column, ca. 2.2 × 1.1 cm, shallowly undulate; disc with 3 sub-parallel smooth lamellate-nerves at the base, setose, at the anterior half. Anther cap ovateoblong, ca. 2.5 × 2 mm, greenish tinged with purple; pollinia 2, obovoid to subglobose. Column ca. 7 × 2.5 mm, grooved at front, purplish green.

Habitat: Terrestrial, grows on damp loose soil.

Flowering: December–January.

Occurrence: Baksa and Chirang: Manas B.R.; Kamrup: Jalukbari, Gopinath Bordoloi Nagar, ca. 11 km away from township of Guwhati within Greater Guwhati area towards west, in the premises of Girls Hostel No. 3, Gauhati University Campus.

Distribution: India (Assam). ENDEMIC.

Regional Conservation Status & Criteria:

Endangered, EN B2ab(ii)c(iii).

Eulophia mannii (Rchb.f.) Hook.f., Fl. Brit. India 6: 4. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 177. 1898; A.S.Rao & Hajra, Bull. Bot. Surv. India 16(1-4): 156. 1974; I.Barua, Orchid Fl. Kamrup Distr. Assam 46. 2001; N.Pearce & P.J.Cribb, Orchids Bhutan 249. 2002; Sud.Chowdhury, Assam's Fl. 283. 2005; Lucksom, Orchids Sikkim N.E. Himalaya 351. 2007. *Cyrtopera mannii* Rchb.f., Flora 55: 274. 1872; Vik.Kumar *et al.*, Richardiana 15: 92. 2014.

Plant autotrophic, 1–1.5 m high. Pseudobulbs transversely fusiform, 3–5 × 1.5–3.5 cm, rhizomatous, 2-leaved. Leaves linear-lanceolate, 3-veined, 75–90 × 1.5–3 cm, usually present at anthesis.

Inflorescence axillary, racemose; peduncle 30–40 cm long; sheaths greenish, 10–30 cm long; rachis 9–15-flowered, 10–17 cm long; floral bracts oblanceolate, acute, 0.6–1 × 0.1–0.2 cm. Flowers 2–4 cm in across, uniformly yellow to yellowishgreen; pedicel and ovary greenish, *ca.* 2 cm long. Dorsal sepal oblanceolate, 1.8–2 × 0.7–1 cm, acute, 9-veined; lateral sepals subequal, oblanceolate, *ca.* 1.8 × 0.7 cm, acute at apex, adnate to column. Petals broadly obovate, 1.2–1.7 × 0.8–1 cm, 11-veined. Lip broadly 3-lobed, 1.6–2 cm long, saccate at base, spurred, 10–11-veined; lateral lobes erect, rounded; mid-lobe orbicular, margins crenate-undulate; disc with 3-thickened lamellae reaching up to base of midlobe and forked and veinlets runs up to the apex of midlobe, forming an warty callus; spur obtuse, 3–4 mm long. Column broad; foot 1.5–2 mm long.



Eulophia mannii (Rchb.f.) Hook.f.: a plants in its natural habitat (left) and closeup of flowers (right)

Habitat: Terrestrial, grows among grasses, often in association with *Saccharum* sp.

Flowering: June–August.

Occurrence: Baksa and Chirang; Manas B.R., Mathanguri.

Distribution: India (Assam, Manipur, Meghalaya, Nagaland, Sikkim, West Bengal). ENDEMIC.

Regional Conservation Status & Criteria:

Vulnerable, VU B2b(i,ii)c(iii).

Eulophia obtusa (Lindl.) Hook.f., Fl. Brit. India 6: 3. 1890; Duthie, Ann. Roy. Bot. Gard. (Calcutta) 9: 129. 1906; K.K.Sarmah & Borthakur, Pleione 3(2): 198. 2009; U.Dutta & G.C.Sarma, Global Res. Analysis 2(5): 10. 2013; M.S.H.Sourav, et al., Kew Bulletin 72: 19. 2017. *Cyrtopera obtusa* Lindl., Gen. Sp. Orchid. Pl. 190. 1833. *Eulophia campanulata* Duthie, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 71: 39. 1902.

Fig. 100 (F–K).

Plant autotrophic, up to 70 cm high. Pseudobulbs subterranean, white, ellipsoid, 3.5–5.5 × 2.5–3.0 cm. Leaves 1–5, present while flowering, linear, 35–50 × 0.2–0.5 cm, base sheathing, apex acuminate. Inflorescence erect, 40–60 cm high; peduncle green, terete usually with few sterile bracts; rachis 8–10 cm long, sparsely flowered; floral bracts lanceolate, 1.3–1.5 cm long. Pedicel and ovary greenishpurple, ca. 2.5 cm long, curved, slightly ribbed. Flower 3–4 cm in across; sepals and petals white, lip white with numerous purplish branching veins. Sepals sub-similar, oblong-lanceolate, 1.8–2.0 × 0.4–0.5 cm, apex acute, shallowly keeled at back. Petals oblanceolate, ca. 1.8 × 0.6 cm, apex acute. Lip somewhat hastate, 3-lobed, ca. 2.2 × 1.8 cm; sidelobe basal, sub-orbicular; midlobe large elliptic, margins undulate; disk with 5 longitudinal ribs; spur short, conic, 6–7 mm long, appressed on the ventral surface of the lip. Column 7–8 mm high slightly curved forward, somewhat dilated at apex; foot short.

Habitat: Terrestrial, grows on the bank of streams and swamps, in sandy alluvial soil among grasses.

Flowering: June–July.

Occurrence: Baksa and Chirang; Manas B.R.,

Bansbari; Kokrajhar; Chirang R.F.

Distribution: India (Assam, Uttarakhand, Uttar Pradesh, Chhattisgarh?), Bangladesh, Nepal.

Regional Conservation Status & Criteria:

Endangered, EN B2ab(ii)c(iii).

Eulophia spectabilis (Dennst.) Suresh, Interpret. Van Rheede's Hort. Malab. 300. 1988; N.Pearce & P.J.Cribb, Orchids Bhutan 253. 2002; Lucksom, Orchids Sikkim N.E. Himalaya 352. 2007; H.A. Pedersen et al. in Santisuk et al. (eds.), Fl. Thailand 12(2): 521. 2014. *Wolfia spectabilis* Dennst., Schlüssel Hortus Malab. 38. 1818. *Eulophia nuda* Lindl., Gen. Sp. Orchid. Pl. 180. 1833; Hook.f., Fl. Brit. India 6: 5. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 180. 1898; C.E.C.Fisch., Fl. Madras 3: 1003. 1956; Katak, Orchids Meghalaya 145. 1986; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 393. 1998; Hynn. et al., Orchids Nagaland 186. 2000; Sud.Chowdhury, Assam's Fl. 315. 2005. *Cyrtopera nuda* (Lindl.) Rchb.f., Flora 55: 274. 1872.

Plants autotrophic, 30–60 cm high. Pseudobulb subglobose, 4–6 cm in diam., subterranean, 2–3 leaved. Leaves oblong-lanceolate, 20–35 × 2.5–6 cm, present at anthesis, lamina narrowed at base into a petiole, apex acuminate; petiole enclosed in several basal sheaths and forming a pseudostem 15–30 cm long. Inflorescence stout, racemose, 30–50 cm long, with several tubular sheaths below middle; rachis 8–20 cm, laxly 5–15-flowered; floral bracts lanceolate, 1.5–2.0 cm long, apex acuminate. Flowers 2.0–3.5 cm in across, purplish red, lip tinged yellow at center; pedicel and ovary 1.5–2.5 cm long. Dorsal sepal linear or narrowly oblong, 1.8–2.5 × 0.3–0.6 cm long, apex obtuse or acute; lateral sepals similar to dorsal sepal but slightly larger, up to 1 cm wide, oblique, adnate to column foot. Petals suboblong, 1.5–1.7 × 0.5–0.9 cm, apex obtuse. Lip obscurely 3-lobed or almost entire, ovate-oblong, 1.2–1.6 × 0.8–1.2 cm, spurred at base, margin crisped, apex subtruncate or emarginate; disk with slightly thickened veins; spur broadly conic, 6–9 mm long, apex acute. Column 6–8 mm long; foot distinct,

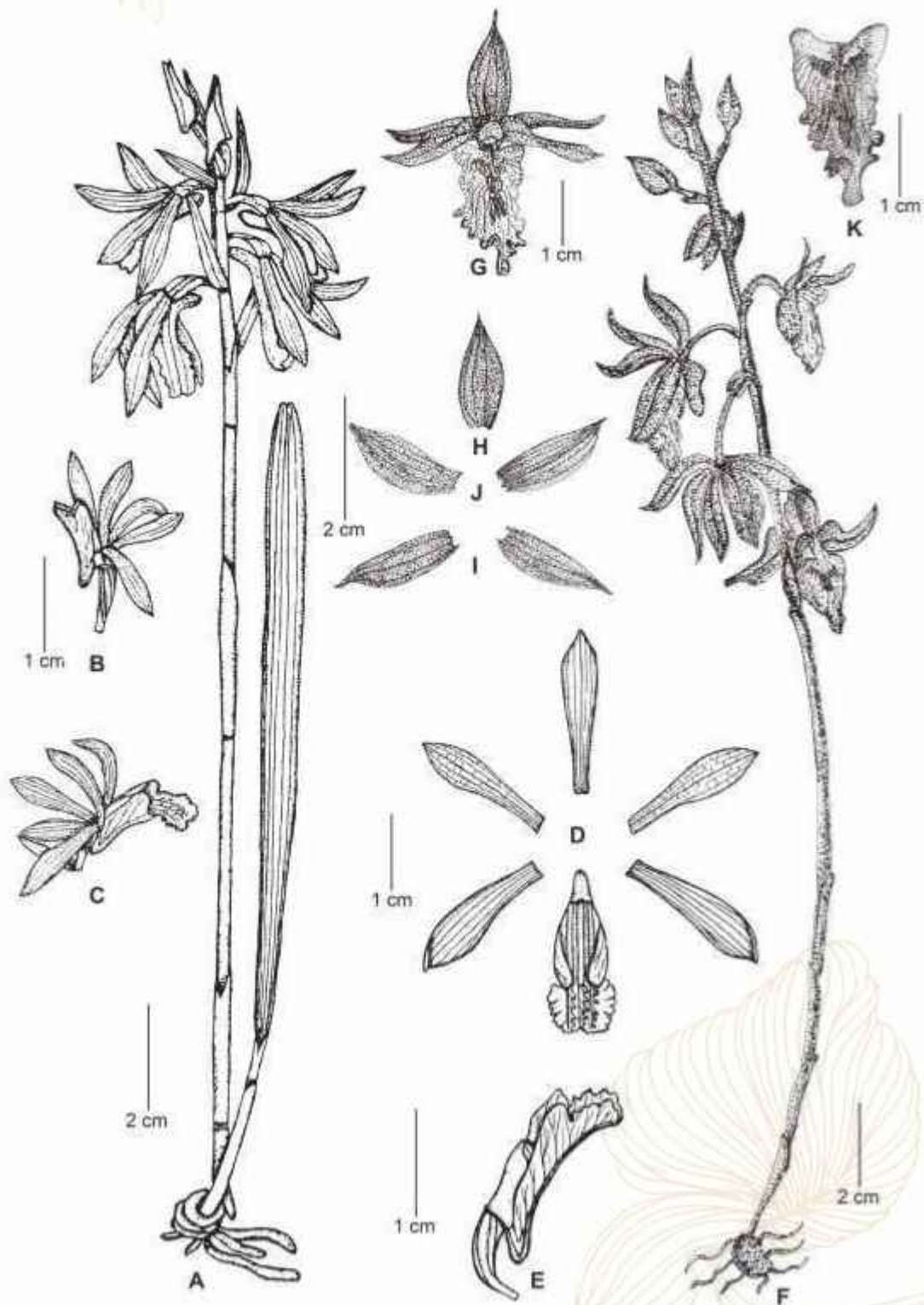


Figure 100. A–E: *Eulophia kamarupa* Sud.Chowdhury: A. Habit; B–C. Flowers; D. Floral analysis; E. Lip with column, pedicel and ovary (after Chowdhury 1993). F–K: *Eulophia obtusa* (Lindl.) Hook.f.: F. Habit; G. Flower; H. Dorsal sepal; I. Lateral sepals; J. Petals; K. Lip.



Eulophia spectabilis (Dennst.) Suresh: a plant in its natural habitat (left) and closeup of a flower (right)

curved, 0.6–1.0 cm long.

Habitat: Terrestrial, grows on hill slopes.

Flowering: April–June.

Occurrence: Baksa: Manas B.R.; Kamrup: Garbhanga R.F; Karbi Anglong: Sikaribasti ca. 477 m; North Cachar Hills: Pidik ca. 525 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal, Bihar, Jharkhand, Uttar Pradesh, Uttarakhand, Orissa, Chhattisgarh, Madhya Pradesh, Maharashtra, Andhra Pradesh, Karnataka, Kerala, Tamil Nadu, Andaman & Nicobar Is.), Bangladesh, Bhutan, Nepal, China, Sri Lanka, Myanmar, Thailand, Laos, Cambodia, Vietnam, Malaysia, Indonesia, Philippines, New Guinea, Solomon Is., Caroline Is., Marianas, Fiji, Tonga, Vanuatu.

Regional Conservation Status: Least Concern.

Eulophia zollingeri (Rchb.f.) J.J.Sm., Orch. Java 228. 1905; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 398. 1998; N.Pearce & P.J.Cribb, Orchids Bhutan 254. 2002; Lucksom, Orchids Sikkim N.E. Himalaya 354. 2007; K.Gogoi, J. Non-Timber Forest Prod. 19(1): 59. 2012; H.A.Pedersen *et al.* in Santisuk *et al.* (eds.), Fl. Thailand 12(2): 524. 2014; Y.Nanda *et al.*, Nelumbo 56: 248. 2014. *Cyrtopera zollingeri* Rchb.f., Bonplandia (Hannover) 5: 38. 1857. *Cyrtopera sanguinea* Lindl., J. Proc. Linn. Soc., Bot. 3: 32. 1858. *Eulophia sanguinea* (Lindl.) Hook.f., Fl. Brit. India 6: 8. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 179. 1898; Kataki, Orchids Meghalaya 145. 1986; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 398. 1998.



Eulophia zollingeri (Rchb.f.) J.J.Sm.: early inflorescence (left) and underground tuber (right)

Plants mycotrophic, leafless, 45–75 cm high. Pseudobulb tuberous, suboblong, 4–15 × 1.5–3 cm, subterranean, many noded. Inflorescence stout, racemose, 40–65 cm long; rachis 5–15 cm long, laxly 6–25-flowered; floral bracts linear-lanceolate 1–2 cm long, apex acuminate. Flowers reddish-purple to yellowish-brownish, 2–3 cm in across; pedicel and ovary 1.05–2.5 cm long. Dorsal sepal ovate-lanceolate, 1.5–2.5 × 0.5–0.8 cm, apex acuminate; lateral sepals obliquely ovate, 1.6–2.5 × 0.6–0.9 cm, adnate to column foot, apex acuminate. Petals obovate, 1.5–2 × 0.5–0.7 cm, apex apiculate. Lip 3-lobed, sub-obovate, 1.5–1.7 × 1.5–1.8 cm, adnate to column foot, shortly saccate-spurred at base; lateral lobes erect and loosely embracing column, small obtuse, 3–4 × ca. 4.5 mm; mid-lobe ovate, 4–7 × 3–5 mm, with 5–7 thickened, papillose veins, margin

undulate, apex apiculate; disk sparsely papillose, with 2 central, suborbicular lamellae; spur broad, conic, 2–3 mm long. Column 5–8 mm long, winged at apex; foot 3–4 mm long.

Habitat: Terrestrial holomycotroph, grows on humus rich soil in primary forests.

Flowering: May–July.

Occurrence: Karbi Anglong: Jengpata ca. 800 m; North Cachar Hill: Umrangso ca. 600 m; West Karbi Anglong: Thangmo ca. 690 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal, Karnataka, Kerala, Andaman & Nicobar Is.), Bhutan, China, Japan, Sri Lanka, Thailand, Vietnam, Malaysia, Indonesia, Philippines, New Guinea, Australia.

Regional Conservation Status: Least Concern.

***Geodorum* Jacks.**

Terrestrial herbs. Pseudobulbs usually globose, corm-like or tuberous, subterranean, with few nodes, leaves arising from basal nodes. Leaves ovate-lanceolate or oblong-ovate, uppermost largest, base contracted into a long petiole, plicate; petiole usually equitant and forming a pseudostem. Inflorescence arising from basal node of pseudobulb, racemose; peduncle erect at base, drooping toward apex; rachis pendulous but becoming erect in fruit, short, usually densely many flowered. Flowers not opening widely, non resupinate. Sepals and petals similar, petals slightly broader, free, not spreading. Lip unlobed or obscurely 3-lobed, base usually saccate, without a distinct spur; disk usually with a callus composed of ridges or wart-like projections. Anther terminal, one locular or incompletely two locular; pollinia 2, usually cleft, waxy, attached to a broad stipe and a large viscidium. Column short, concave in ventral view; foot short.

About 12 species distributed from tropical Asia, as far north as S Japan to Australia and the SW Pacific islands; 5 species in India and 4 species in Assam.

Key to the Species

- 1a. Lip disc with a flat elevated crest terminating in a toothed or denticulate manner *G. appendiculatum*
- 1b. Lip disc not as above 2
- 2a. Inflorescence 25–45-flowered; flowers opening centripetally *G. densiflorum*
- 2b. Inflorescence 6–12-flowered; flowers almost opening simultaneously 3
- 3a. Petals obovate, usually exceeding 10 mm in width; lip apex pink *G. laxiflorum*
- 3b. Petals ovate-oblong, never exceeding 10 mm in width; lip apex not pink *G. recurvum*

Geodorum appendiculatum Griff., Calcutta J. Nat. Hist. 5: 357. 1845; Seidenf., Opera Bot. 72: 59. 1983; Barbhuiya *et al.*, McAllen Int. Orchid Soc. J. 15(5): 12. 2014.

Fig. 101 (A–O).

Plant up to 35 cm tall. Pseudobulbs depressed globose *ca.* 4 cm in diam., with two annular rings, surface smooth, partially covered with fibrous sheath, 3-leaved. Leaves broadly elliptic or oblong-ovate, 21–25.5 × 7.5–8 cm, well developed at anthesis, papery, apex shortly acuminate or acute; petioles enclosed in several sheaths and forming a pseudo stem to *ca.* 14 cm high. Inflorescence 23–25 cm long, arising in lateral position from the base of shoot, with drooping corymbose raceme; peduncle 18–19 cm long, smooth, nodes usually three with 3–4 contiguously placed sheaths; sheaths linear-lanceolate, tubular, 4–8 cm long, membranous; rachis

5–6 cm long, drooping, smooth, *ca.* 10-flowered; floral bracts linear-lanceolate, 17–20 × 3–3.5 mm, apex acute to acuminate. Flowers not opening widely, white; pedicel and ovary 6–7 mm long and *ca.* 1.3 mm in diameter. Sepals linear-oblong, nearly equal; dorsal sepal *ca.* 10 × 3 mm, acute at apex; lateral sepals 10–11 × 3.8–4 mm, apex acute. Petals ovate-oblong, 10.5–11 × 4.8–5 mm, obtuse at apex. Lip broadly ovate 10–11 × 8–9 mm, with a median longitudinal callus which is most distinct on the epichile where it terminates in 3–4 raised teeth, epichile retuse, not very much narrower than the hypochile. Column white, 4–5 mm long; foot short.

Habitat: Terrestrial, grows on hill slopes exposed to light.

Flowering: June–July.

Occurrence: Cachar: Dargakona, inside Assam

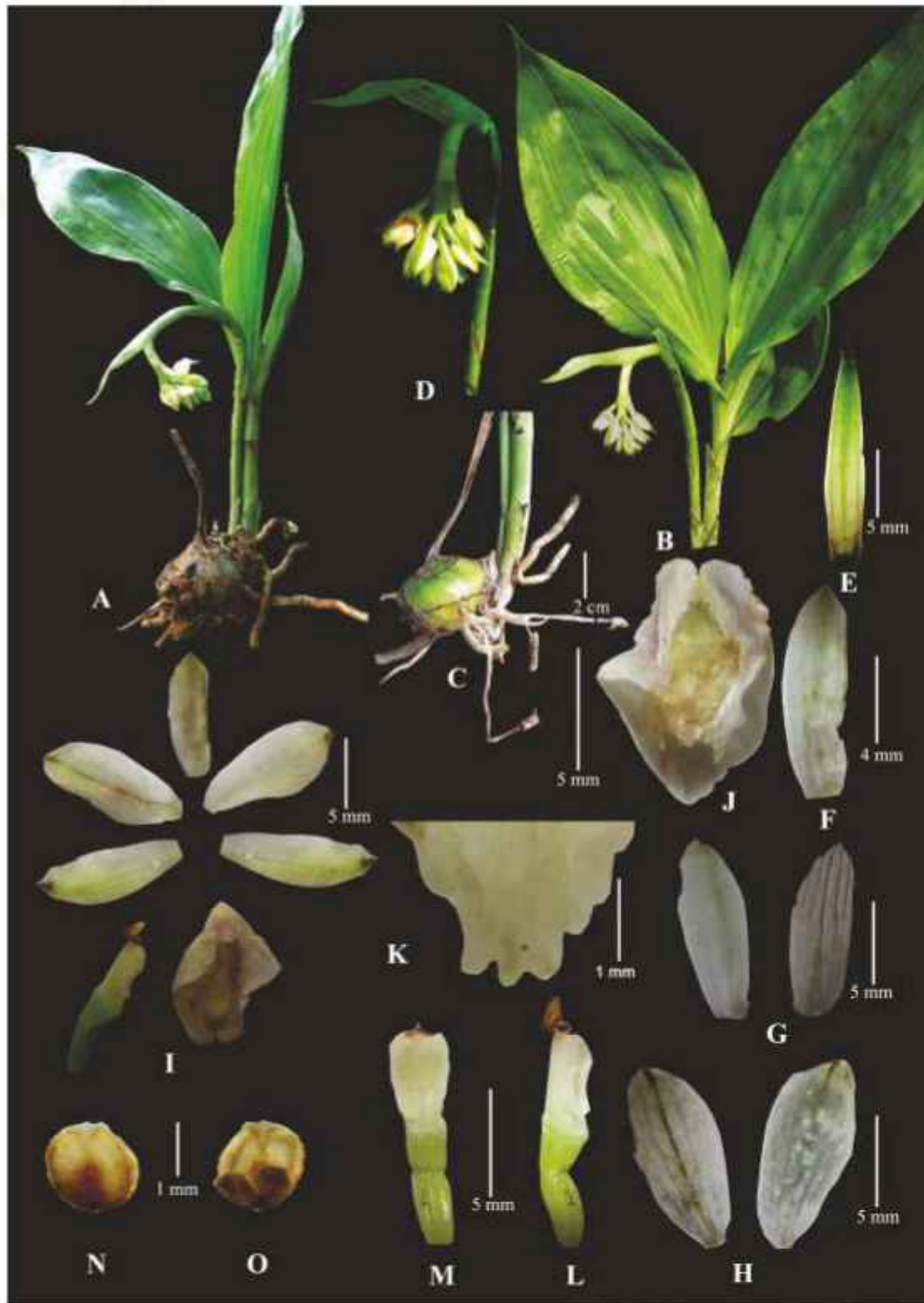


Figure 101. A–O: *Geodorum appendiculatum* Griff.: A–B. Habit; C: Pseudobulb; D. Inflorescence; E. Floral bract; F. Dorsal sepal; G. Lateral sepals; H. Petals; I. Floral perigone; J. Lip; K. Apex of the elevated crest of lip disc; L. Column, side view; M. Column, ventral view; N. Dorsal view of anther cap; O. Ventral view of anther cap.



Geodorum appendiculatum Griff.: a plant in its natural habitat

University Campus, ca. 46 m.

Distribution: India (Assam), Thailand.

Regional Conservation Status & Criteria: Critically Endangered, CR B2ab(ii)c(iii).

Geodorum densiflorum (Lam.) Schltr., Repert. Spec. Nov. Regni Veg. Beih. 4: 259. 1919; Katak, Orchids Meghalaya 156. 1986; H.J. Chowdhery, Orch. Fl. Arunachal Pradesh 418. 1998; I. Barua, Orchid Fl. Kamrup Distr. Assam 74. 2001; N. Pearce & P.J. Cribb, Orchids Bhutan 255. 2002; Lucksom, Orchids Sikkim N.E. Himalaya 355. 2007. *Limodorum densiflorum* Lam., Encycl. 3: 516. 1792. *Geodorum purpureum* R.Br., Hortus Kew. 5: 207. 1813; Hook.f., Fl. Brit. India 6: 16. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 181. 1898; Sud. Chowdhury, J. Assam Sci. Soc. 30(1): 28. 1987. *Geodorum pallidum* D. Don, Prodr. Fl. Nepal. 31. 1825; Griff., Calcutta J. Nat. Hist. 5: 358. 1845. *Limodorum*

candidum Roxb., Fl. Ind. 3: 470. 1832. *Geodorum candidum* (Roxb.) Lindl., Fol. Orchid. 6: 8. 1854. *Geodorum rariflorum* Lindl., Fol. Orchid. 6: 2. 1854.

Plant 30–45 cm high. Pseudobulbs tuberous, ovoid-conical, 1.5–2 cm in diam., few noded, usually partially covered in fibrous sheaths. Pseudostem formed by the leaf base up to 8 cm long, terete, sheathed. Leaves 2–3, elliptic, narrowly elliptic, or oblong-lanceolate, 15–30 × 6–9 cm, well developed at anthesis, papery, apex acuminate; petiole up to 15 cm long. Inflorescence 30–40 cm long; peduncle with 3–5 widely spaced sheaths; sheaths tubular, 4–7 cm long, membranous; rachis pendulous, 3–6 cm long, densely 5–10-flowered; floral bracts linear-lanceolate, 0.5–0.9 × 0.2–0.3 cm, apex acute to acuminate. Flowers not opening widely, white to pinkish, lip with a central yellow callus and crimson-purple venation and streaks; pedicel and ovary 0.7–0.8 cm long. Sepals oblong-lanceolate, 1.0–1.5 × 0.3–0.4 cm, apex acute; lateral sepals slightly oblique. Petals oblanceolate, 1.0–1.3 × 0.4–0.5 cm, apex sub-acute. Lip unlobed, broadly ovate-oblong, 1.0–1.5 × 0.9–1.0 cm, shallowly saccate at base, lateral margins erect, apex subtruncate and slightly emarginate; disk with a central callus composed of a cluster of irregular, fleshy wartlike projections or a pair of short, fleshy longitudinal ridges. Column 3–5 mm long; foot short. Capsule oblong, 3.5–5 × ca. 1.5 cm.

Habitat: Terrestrial, grows on hill slopes, at the edges of ponds on black porous soils and at dense shady forest floors.

Flowering: April–June.

Occurrence: Baksa: Manas B.R., Mathanguri, Bansbari; Bongaigaon: Khagarpur; Cachar: Borail W.L.S.; Chirang: Sisubari ca. 111 m; Darrang: Orang N.P.- Gandarmara Pukhuri, Satsimul; Dibrugarh: Jeypore R.F.; Golaghat: Numaligarh, Pulibor, Debraj Roy College Campus; Kamrup: Liki R.F., Boko Range, Japorigong Forest on a hillock behind the staff quarters of Assam State Zoo towards west, Jarasal



Geodorum densiflorum (Lam.) Schltr.: a plant in its natural habitat (left) and closeup of inflorescence (right)

R.F., Mandakata; Karbi Anglong: Garampani W.L.S., Dipu–Lungkachari Basti, Mikir Hills, Khanbanan Hillm Selami, Near Lungi River, Habe Tokbi, Kaja Kramsa; Karimganj: Singla R.F.; Kokrajhar: Chirang R.F.-Jharbari, Kachugaon; Lakhimpur: Dullung and Kakoi R.F.; North Cachar Hills: Haflong Circuit House; Sibsagar: Janaki F.V. ca. 178 m; Sonitpur: Nameri N.P., Hugrajuli; Tinsukia: Sadaya Frontier, Kerimpani, Namphoi F.V.; Udalguri: Barnadi W.L.S., Nunai, Khalingduar R.F.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal, Bihar, Uttarakhand, Jharkhand, Orissa, Chhattisgarh, Madhya Pradesh, Maharashtra, Andhra Pradesh, Karnataka, Kerala, Tamil Nadu, Andaman & Nicobar Is.), Bangladesh, Bhutan, Nepal, China, Japan, Sri Lanka, Myanmar, Thailand, Laos, Cambodia,

Vietnam, Malaysia, Indonesia, Philippines, Bismarck Archipelago, New Guinea, Solomon Is., Australia, Caroline Is., Marianas, Fiji, New Caledonia, Niue, Samoa, Tonga, Vanuatu.

Regional Conservation Status: Least Concern.

Note: This species is locally known as “*Ghukusaphul*” (Assamese).

Geodorum laxiflorum Griff., Calcutta J. Nat. Hist. 5: 356. 1845; Hook.f., Fl. Brit. India 6. 18. 1890; S.Misra, Orchids Orissa 560. 2004; Sud.Chowdhury, Assam's FL 330. 2005; M.R.Bhatt *et al.*, Richardiana 15: 335. 2015.

Plant 30–50 cm high. Pseudobulb corm like, ovoid, slightly compressed, 4.5–5 cm in diam. Pseudostem 10–12 cm tall, terete, formed by 4 imbricating leaf sheaths. Leaves 3–5, ovate-lanceolate, 20–30 × 8–12 cm, conduplicate, margins undulate, apex abruptly



Geodorum laxiflorum Griff.: inflorescence (left) and closeup of flowers (right)

sub-acuminate, 5–10-nerved. Inflorescence 20–30 cm long, arising from the base of newly developed pseudostem; peduncle erect, terete, 20–25 cm long, with 4 membranous tubular sheaths, green, decurved at apex; rachis drooping, ca. 2.5–4 cm long, laxly 8–10 flowered; floral bracts green, oblong-lanceolate, ca. 1.1 × 0.3 cm, 3-veined, apex acute; pedicel and ovary 1.3–1.5 cm long, ribbed. Flowers white, 1.5–2.5 cm in across, lip with purple apex and yellowish disk. Sepals subequal, oblong-lanceolate, 2.1–2.2 × 0.6–0.8 cm, 5-veined. Petals obovate, ca. 2.3 × 1–1.2 cm, apex acute, 7-veined. Lip broadly obovate, 2.0–2.2 × 1.5–1.7 cm, shallowly emerginate at apex; margins of hypochile erect; epichile with 2 irregular rows of thick warts runs from the base to near apex, apical margins undulate. Column stout, short, 5–6 × ca. 3 mm.

Habitat: Terrestrial, grows on hill slopes.

Flowering: May–July.

Occurrence: West Karbi Anglong: Hamren ca. 430 m.

Distribution: India (Assam, Jharkhand, Chhattisgarh, Orissa, Gujarat) ENDEMIC.

Regional Conservation Status & Criteria: Vulnerable, VU B2b(i,ii)c(iii).

Geodorum recurvum (Roxb.) Alston, Handb. Fl. Ceylon 6(Suppl.): 276. 1931; N.Pearce & P.J.Cribb, Orchids Bhutan 257. 2002; H.A.Pedersen *et al.* in Santisuk *et al.* (eds.), Fl. Thailand 12(2): 535. 2014. *Limodorum recurvum* Roxb., Pl. Coromandel 1: t. 39 1795. *Geodorum dilatatum* R.Br., Hortus Kew. 5: 207. 1813; Hook.f., Fl. Brit. India 6: 17. 1890.

Plant 15–30 cm high. Pseudobulb ovoid, 1.5–2.5 cm in diam., few noded. Leaves 2–3, ovatelanceolate, 12–25 × 5–8 cm, well developed at anthesis, apex shortly acuminate; petiole enclosed in several sheaths and forming a pseudostem 10–16 cm long. Inflorescence 12–15 cm long; peduncle

with 2–3 tubular, membranous sheaths; rachis pendulous, 3–4 cm long, densely many-flowered; floral bracts linear-lanceolate, 0.6–1.2 cm long, apex acute. Flowers not opening widely, white, lip with purplish streaks and a yellowish callus at center; pedicel and ovary 5–6 mm long. Sepals ovate-elliptic, 1.0–1.2 × 0.2–0.3 cm, apex subacute; lateral sepals slightly wider than dorsal sepal. Petals ovate-oblong, 0.9–1.1 × 0.3–0.4 cm, apex obtuse or subacute. Lip broadly oblong-ovate, *ca.* 8 × 5 mm, shallowly concave at base, unlobed, lateral margins erect, apical margins slightly crisped, apex obtuse and usually slightly emarginate; disk with a central callus composed of 2 fleshy, crest-like longitudinal ridges

extending from midway along lip almost near to apex. Column 3–3.5 mm long; foot short.

Habitat: Terrestrial, grows along forest margins.

Flowering: April–June.

Occurrence: Kamrup: Garbhanga R.F.; North Cachar Hill: Garampani; Udalguri: Nunai forest.

Distribution: India (Assam, Manipur, Mizoram, West Bengal, Bihar, Jharkhand, Orissa, Andhra Pradesh), Bangladesh, China, Myanmar, Thailand, Cambodia, Vietnam.

Regional Conservation Status & Criteria:

Vulnerable, VU B2ab(ii)c(iii).

TRIBE: EPIDENDREAE KUNTH

Plants terrestrial or epiphytic rarely holomycotrophic. Root velamen of the Epidendrum and Pleurothallis-types. Pseudobulbs corm-like or absent. Stem slender, generally of several internodes. Leaves none, one or two on the apex of pseudobulbs or many distichous on stem, plicate or conduplicate, membranous to fleshy, articulate, base sheathing, petiole short or long. Inflorescences usually terminal, racemose or in compact globose heads. Flowers resupinate, ascending or pendulous. Sepals and petals free. Lip 3-lobed, saccate at base, divided from blade by a transverse partition, forming hypochile and epichile, margins involute. Anther terminal, incumbent; pollinia 4–8, with one or more accessory structures, viscidia not minute. Column short or elongate, foot present or absent; rostellum conspicuous.

Comprises 6 subtribes and ca. 99 genera; distributed in tropics and subtropics of New and Old World; 2 subtribes, 2 genera and 4 species in Assam.

Key to the Genera

- 1a. Plants terrestrial; pseudobulbs corm-like *Cremastra*
- 1b. Plants epiphytic or lithophytic; pseudobulbs absent *Agrostophyllum*

Subtribe: *Calypsoinae* Chase *et al.*

Cremastra Lindl.

Terrestrial herbs. Pseudobulbs cormlike, ovoid or cylindric, noded, with many fibrous, roots at base. Leaves 1–2, or rarely absent, arising directly from apex of pseudobulb, green, narrowly ovate to narrowly elliptic, plicate, gradually contracted at base into a long petiole-like stalk, glabrous, apex acute. Inflorescence erect, long, racemose, arising from apex of pseudobulb, with 2 or 3 tubular sheaths below middle, glabrous; rachis subdensely to densely few or many flowered; floral bracts narrowly elliptic to lanceolate, small, apex acute. Flowers resupinate, ascending or pendulous, narrowly tubular; pedicel and ovary usually arcuate, elongate, slender. Sepals and petals subsimilar, free, narrowly elliptic to linear. Lip narrowly oblong-obovate, elongate, 3-lobed above middle, lateral margins involute, base shallowly saccate, spur absent; lateral lobes linear or narrowly oblong; mid-lobe oblong or obovate, with a fleshy callus at base. Anther terminal, incumbent; pollinia 4, in 2 pairs, slightly laterally compressed, waxy, attached to a viscidium. Column elongate, slightly dilated toward apex.

Four species; distributed in Himalayas via NE India to Russia, Japan and Indochina; 1 species in India as well as in Assam.

Cremastra appendiculata (D.Don) Makino, Bot. Mag. (Tokyo) 18: 24. 1904; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 246. 1998; Lucksom, Orchids Sikkim N.E. Himalaya 326. 2007. *Cymbidium appendiculatum* D.Don, Prodr. Fl. Nepal. 36. 1825. *Cremastra wallichiana* Lindl., Gen. Sp. Orchid. Pl. 173. 1833; King & Pantl., Ann. Roy. Bot. Gard.

(Calcutta) 8: 182. 1898.

Fig. 102 (A–F).

Plant 30–65 cm high. Pseudobulb ovoid or subglobose, 1.5–3 × 1–3 cm, few noded. Leaves usually 2, narrowly elliptic to oblanceolate-elliptic, 15–30 × 7.5–13 cm, mainly 3-veined, sometimes spotted, plicate, base subcuneate, apex acute

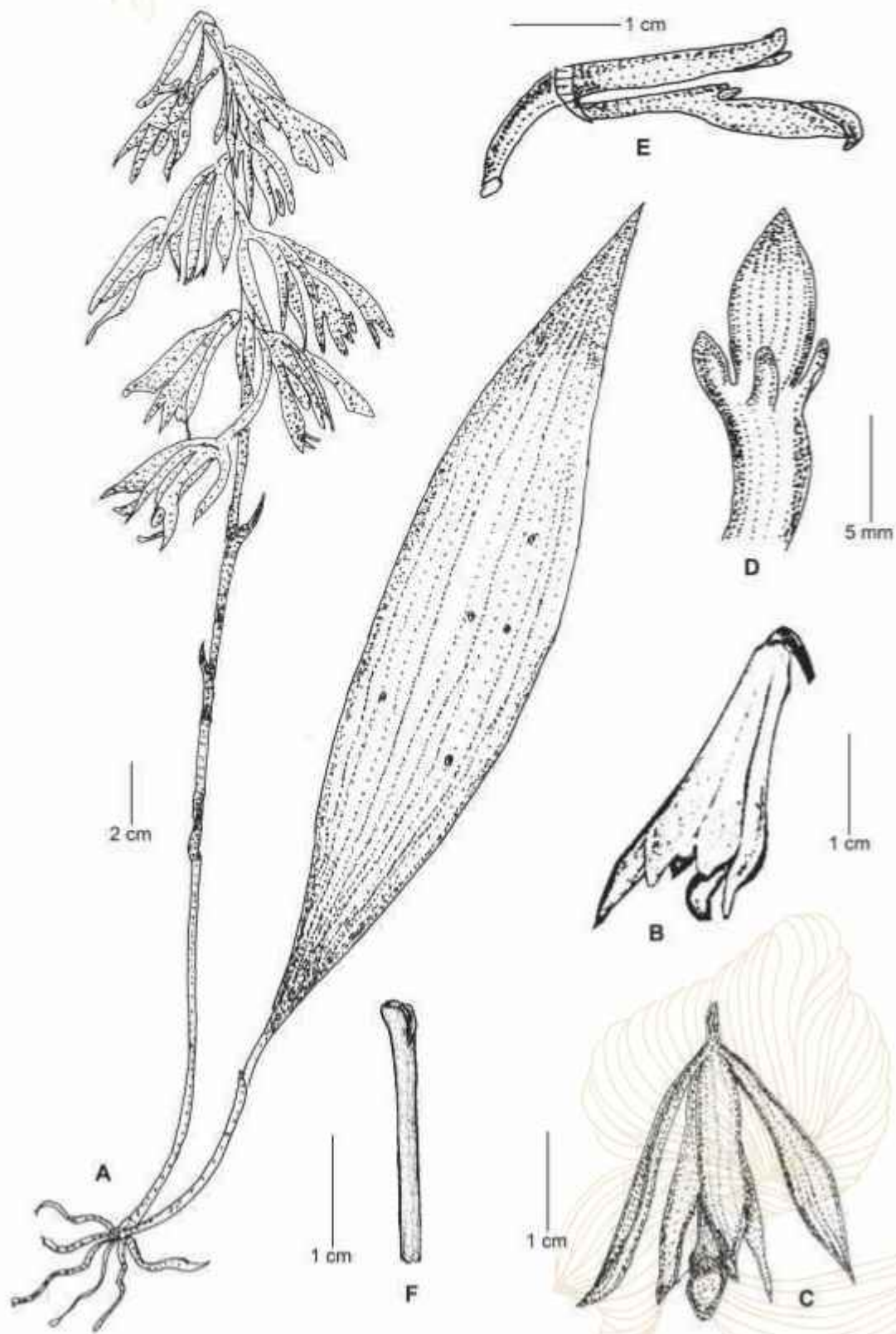


Figure 102. A–F: *Cremastra appendiculata* (D. Don) Makino: A. Habit; B. Flower – side view; C. Flower – dorsal view; D. Lip; E. Lip with column, pedicel and ovary; F. Column.

or acuminate; petiole-like base 8–15 cm long. Inflorescence 25–60 cm long; rachis 10–20 cm long, subdensely to densely many-flowered; floral bracts lanceolate to ovate-lanceolate, 0.5–1.0 cm. Flowers fragrant, pendulous, *ca.* 3.0–3.5 cm long, pale purple to orange-brown, narrowly campanulate, not opening widely, petals and lip with darker spots; pedicel and ovary 0.5–1.5 cm long. Sepals narrowly oblanceolate-spatulate, 2.0–3.5 × 0.2–0.5 cm, apex acute; lateral sepals slightly oblique. Petals narrowly oblanceolate, 1.8–3.2 × 0.2–0.3 cm, apex acuminate. Lip linear, 2.0–3.5 × 0.2–0.4 cm, saccate at base, 3-lobed at apex; lateral lobes linear to narrowly oblong, 4–6 × *ca.* 1 mm, apex obtuse; mid-lobe ovate to narrowly oblong, 6–8 × 3–5 mm, apex acute or

obtuse; disk with a fleshy callus at base of mid-lobe. Column 1.8–2.6 cm long, slender, slightly dilated at apex. Anther 1–3 mm long. Capsule pendulous, ellipsoid, 2.5–3.0 × 0.8–1.3 cm.

Habitat: Terrestrial, grows on moist humus rich forest floors.

Flowering: April–June.

Occurrence: Karbi Anglong: Dambukso *ca.* 840 m; North Cachar Hills: Thingje *ca.* 1400 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Nagaland, Sikkim, West Bengal), Nepal, China, Japan, Korea, Russia, Thailand, Vietnam.

Regional Conservation Status & Criteria: Vulnerable, VU B2ab(ii)c(iii).

Subtribe: *Agrostophyllinae* Szlach.

Agrostophyllum Blume

Epiphytic herbs. Stems clustered, pseudobulbs absent, erect or pendulous, slender, bilaterally flattened, with many internodes, leafy. Leaves distichous, usually twisted at base to lie in one plane, usually narrowly oblong to linear-lanceolate, with imbricate sheaths at base. Inflorescence terminal, usually globose heads on an elongate axis, or in a panicle, surrounded by bracts, often densely many flowered, rarely reduced to a few flowers or solitary. Flowers resupinate, white or yellow, occasionally reddish, small. Sepals and petals free. Lateral sepals forming a mentum containing saccate lip base. Petals narrower than sepals. Lip entire or 3-lobed, saccate base divided from blade by a transverse partition, forming hypochile and epichile; hypochile saccate at base, often with callus inside. Anther incumbent; pollinia 8, waxy, usually with short caudicle, commonly attached to a solitary viscidium. Column short or long, foot rudimentary; stigma suborbicular, concave, large; rostellum conspicuous, subtriangular.

About 102 species; distributed from Old World tropics from the Seychelles and tropical Asia east to the Pacific islands and New Guinea; 5 species in India and 3 species in Assam.

Key to the Species

- 1a. Leaves 1.5–2.2 cm broad. Petals narrow triangular to linear. Epichile of lip without lateral conical calli *A. planicaule*
- 1b. Leaves 1.0–1.1 cm broad. Petals broadly-ovate. Epichile base with two lateral conical calli 2
- 2a. Stem short, clavate with few lanceolate leaves at apical part. Sepals and petals white *A. brevipes*
- 2b. Stem long slender with many narrow linear leaves. Sepals and petals reddish or with purple markings *A. callosum*

Agrostophyllum brevipes King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 156. 1890; Kataki, Orchids Meghalaya 110. 1986; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 51. 1998; Hynn. *et al.*, Orchids Nagaland 32. 2000; N.Pearce & P.J.Cribb, Orchids Bhutan 360. 2002; Lucksom, Orchids Sikkim N.E. Himalaya 532. 2007; K.Gogoi, Wild Orchids Assam 35: 2017. *Agrostophyllum callosum* sensu auct. Hook.f., Fl. Brit. India 5: 824 p.p. 1890.

Fig. 103 (A–E).

Plant 15–35 cm tall. Stems 2.5–3 cm apart on rhizome, 8–18 cm high, covered with overlapping sheaths; sheaths lanceolate, acute, 1–3.5 cm long. Leaves 3–4, arising from apex of stem, alternate, linear-oblong, 5.5–16 × 0.2–1.0 cm apex emarginate, subacute, margins entire, base sessile, sheathing. Inflorescence globose heads, surrounded by leaf bases, densely many-flowered, 1–1.5 cm long; floral bracts clustered and overlapping at base of inflorescence, lanceolate to ovate-lanceolate, 5–7 × 1–2 mm, apex acute. Flowers 0.5–1 cm in across; sepals, petals and lip white, column and anther dark crimson; pedicel and ovary *ca.* 0.5 cm long. Sepals subsimilar, lanceolate-ovate, acute, *ca.* 3 × 1.5 mm. Petals suborbicular to ovate, acute, *ca.* 3 × 1.5 mm. Lip 3-lobed, oblong, concave, not spurred, *ca.* 3 mm long; lateral lobes broad, rounded; mid-lobe oblong, emarginate, smooth; disc with a central callus and 2 smaller, conical, boss-like calluses below. Column short, shortly winged at apex; foot short. Capsule narrowly ellipsoid

Habitat: Epiphytic on tree trunks.

Flowering: May–July.

Occurrence: Karbi Anglong: Jengpata *ca.* 800 m; North Cachar Hills: Hajuichok *ca.* 1382 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal), Bhutan, Nepal, China, Myanmar, Thailand, Laos, Cambodia, Vietnam.

Regional Conservation Status & Criteria:

Vulnerable, VU B2b(ii)c(iii).

Agrostophyllum callosum Rchb.f., Fl. Vit. 296. 1868; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 155. 1898; Kataki, Orchids Meghalaya 110. 1986; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 53. 1998; Hynn. *et al.*, Orchids Nagaland 34. 2000; N.Pearce & P.J.Cribb, Orchids Bhutan 360. 2002; Lucksom, Orchids Sikkim N.E. Himalaya 533. 2007; K.Gogoi, Wild Orchids Assam 36: 2017.

Fig. 103 (F–J).

Plants 30–60 cm high. Stems erect, slender, terete below middle, slightly compressed above, borne 1–2 cm apart on rhizome, unbranched, with many distichous leaves. Leaves linear-oblong, 8–15 × 0.4–0.8 cm, attenuate gradually from base to apex, unequally bilobed at apex, sheathing at base; sheaths tubular, 2–3.5 cm long, margin black membranous. Inflorescence terminal, subcapitate, 1–2 cm in across, densely many-flowered; floral bracts cymbiform, suboblong, 0.5–2 cm long. Flowers reddish or white and tinged with purplish red; pedicel and ovary 5–6 mm long. Dorsal sepal ovate-orbicular, *ca.* 4 mm long; lateral sepals broadly ovate-orbicular, *ca.* 4 × 5 mm, base embracing lip. Petals ovate-spathulate, *ca.* 2.5 × 3 mm. Lip subquadrangular, *ca.* 3.5 mm long, slightly contracted at middle, base shallowly saccate, inside with a callus; callus laterally 2-branched. Column *ca.* 2 mm high. Capsule ellipsoid, *ca.* 5 × 3.5 mm.

Habitat: Epiphytic on tree trunks or sometimes lithophytic.

Flowering: May–July.

Occurrence: Karbi Anglong: Bar Dambuk *ca.* 593 m; North Cachar Hills: Purana Hmarlushei *ca.* 1300 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal), Bhutan, Nepal, China, Myanmar, Thailand, Vietnam.

Regional Conservation Status: Near Threatened.

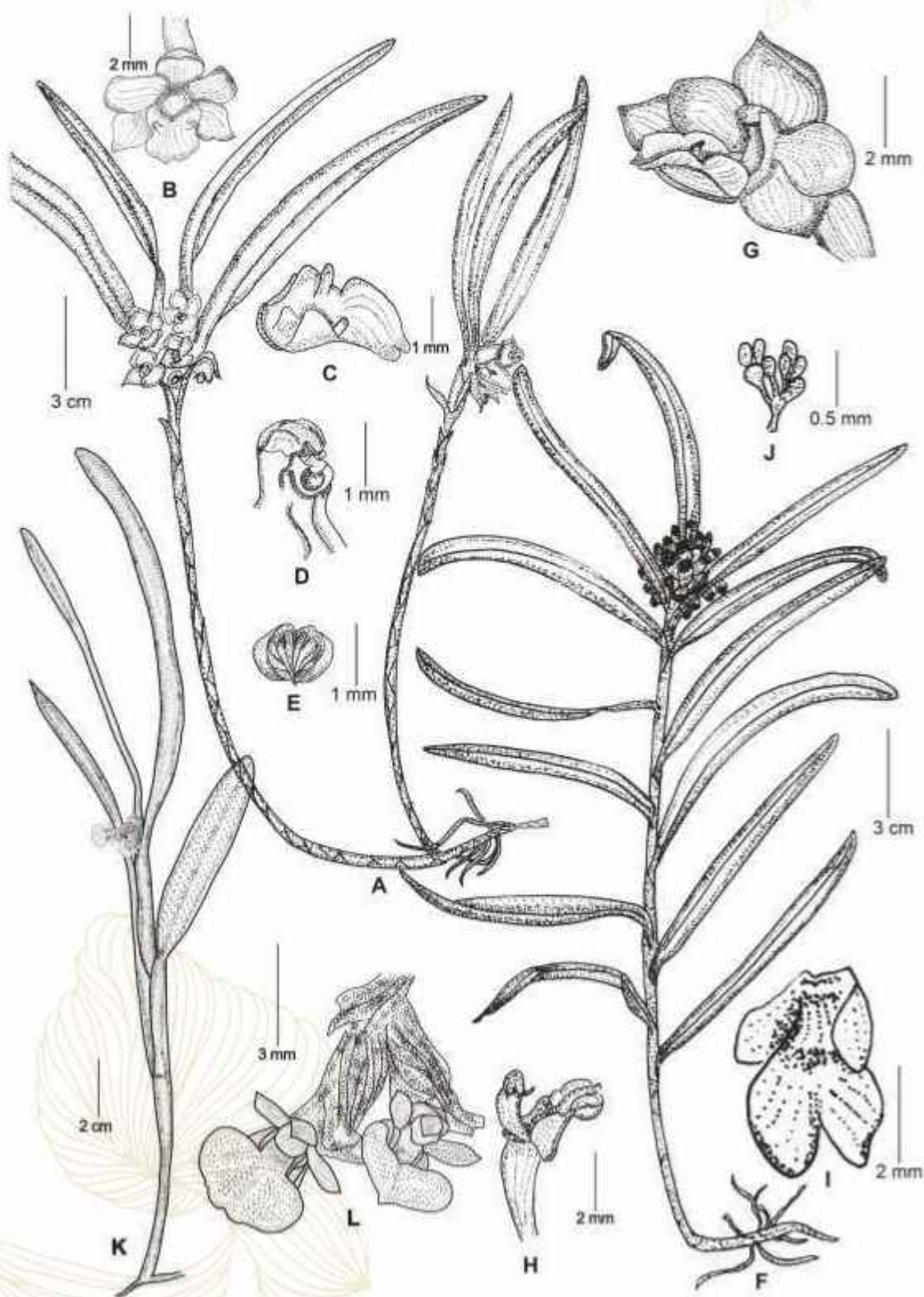


Figure 103. A–E: *Agrostophyllum brevipes* King & Pantl.: A. Habit; B. Flower; C. Lip; D. Column; E. Anther cap and Pollinia. F–J: *Agrostophyllum callosum* Rchb.f.: F. Habit; G. Flower; H. Lip with column; I. Lip; J. Pollinia. K–L: *Agrostophyllum planicaule* (Wall. ex Lindl.) Rchb.f.: K. Habit; L. Inflorescence.

Agrostophyllum planicaule (Wall. ex Lindl.) Rchb.f., Ann. Bot. Syst. 6: 909. 1864; N.Pearce & P.J.Cribb, Orchids Bhutan 362. 2002; Lucksom, Orchids Sikkim N.E. Himalaya 531. 2007; K.Gogoi, Wild Orchids Assam 37: 2017. *Agrostophyllum khasianum* Griff., Calcutta J. Nat. Hist. 4: 376. 1844; Hook.f., Fl. Brit. India 5: 824. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 154. 1898; Kataki, Orchids Meghalaya 110. 1986; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 53. 1998; Hynn. *et al.*, Orchids Nagaland 34. 2000; Sud.Chowdhury, Assam's Fl. 71. 2005.

Fig. 103 (K–L).

Plant 20–35 cm high. Stems fusiform, compressed laterally, covered by overlapping sheaths; sheaths ovate, acuminate. Leaves 3–4, arising from apex of stem, distichous, alternate, narrowly ovate-oblong, tapering to each end, obtuse to minutely emarginate, shordy petiolate, erect, 7–19 × 1.5–2.3 cm; petiole grooved, sheathing at base, 1–4 cm long. Inflorescence globose-capitate, *ca.* 2 cm across, densely many-flowered; peduncle short; floral bracts fibrous-membranous, lanceolate, 6–7 × 1.5–2.5 mm, subacute at apex. Flowers 3–4 mm in across; sepals, petals and lip cream-white, with patches of pale yellow on mid-lobe of lip, mentum and column

ochre; pedicel and ovary 6–8 mm long. Sepals subsimilar, ovate-oblong, *ca.* 2.5 × 1.5 mm, apex acute to acuminate; lateral sepals suboblique. Petals narrowly linear-oblong, *ca.* 2 × 1.2 mm, apex acute, margins recurved. Lip simple, clawed, *ca.* 2.5 mm long; base saccate; apical lobe broadly reniform, minutely emarginate at apex, margins undulate; mentum spur-like. Column broad, with 2 fleshy, horn-like projections at base, *ca.* 1 mm long, foot absent. Capsule clustered, ellipsoid, 4–7 mm long.

Habitat: Epiphytic on tree trunks or rarely lithophytic

Flowering: June–August.

Occurrence: Baksa and Chirang: Manas B.R.; Cachar: Barak R.F.; Dibrugarh: Jokai R.F., Jeypore R.F.; Hailakandi: Innerline R.F.; Karbi Anglong: Sikaribasti *ca.* 477 m; Karimganj: Churaibari, Longai R.F.; North Cachar Hills: Shongkai *ca.* 756 m; Sibsagar: Janaki F.V.; Tinsukia: Dehing Patkai W.L.S.; Udalguri: Nunai-Bhutan Road.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Nagaland, Sikkim, Andaman Is.), Bangladesh, Bhutan, Nepal, China, Myanmar, Thailand, Laos, Cambodia, Vietnam, Malaysia.

Regional Conservation Status: Least Concern.



Phaius flavus (Blume) Lindl.

BALIPARA FOUNDATION
Assam - India

TRIBE: COLLABIEAE PFITZER

Terrestrial herbs. Stem cylindrical, cormous or pseudobulbous, of several internodes. Leaves distichous, plicate, convolute, usually articulated. Inflorescence lateral or rarely terminal, simple, with spirally arranged flowers. Flowers resupinate, flat to campanulate or urceolate, often showy. Sepals and petals free, usually subsimilar and spreading, occasionally porrect. Lip usually 3-lobed, sometimes saccate or prominently spurred, callus usually present. Anther terminal, incumbent, pollinia 8 or 4, or rarely 2, clavate, often laterally flattened; viscidium usually present. Column often with a prominent foot; stigma ventral, entire; rostellum flap like.

Comprises 20 genera and ca. 453 species; mainly distributed in Old World, a few entering North Temperate regions of Asia; 11 genera and 31 species in Assam.

Key to the Genera

- 1a. Flowers urceolate *Acanthephippium*
- 1b. Flowers not urceolate 2
- 2a. Pollinia 2, free 3
- 2b. Pollinia 4 or 8, connected by strands of adhesive matter or a viscidium 4
- 3a. Flowers sometimes asymmetrical; lip not mobile, claw with straight margins, column lacking fleshy keels at base *Collabium*
- 3b. Flowers bilaterally symmetrical; lip mobile, claw with distinctly pleated margins; column with 2 fleshy keels at base *Chrysoglossum*
- 4a. Plant with underground, swollen, fusiform to irregularly shaped, horizontal, tubers; leaves grasslike *Pachystoma*
- 4b. Plant with pseudobulbs or erect stems, cylindrical in cross-section; leaves not generally grass like 5
- 5a. Stems or pseudobulbs 1-leaved 6
- 5b. Stems or pseudobulbs 2 or more leaved 7
- 6a. Labellum with spur *Ania*
- 6b. Labellum lacking a spur *Tainia*
- 7a. Leaf blade ovate-cordate *Nephelaphyllum*
- 7b. Leaf blade not ovate-cordate 8
- 8a. Flowers not turning blue when damaged, pedicels ramentaceous; column foot elongate *Spathoglottis*
- 8b. Flowers turning blue when damaged, pedicels not ramentaceous; column foot absent or obscure 9
- 9a. Column completely fused to base of labellum *Calanthe*
- 9b. Column partly fused to labellum or free to base 10
- 10a. Labellum spurred at the base *Phaius*
- 10b. Labellum not spurred at base *Cephalantheropsis*

Acanthephippium Blume

Terrestrial herbs. Rhizome short. Roots few, short, unbranched. Pseudobulbs closely placed, conical to cylindrical, more or less covered by persistent sheath fibres, upper half covered by leaf-sheaths. Leaves articulate, plicate, ovate to ovate-lanceolate; petioles sheathing, long or short. Inflorescence lateral from a lower node pseudobulb, erect, short, peduncle more or less covered by sheaths, few-flowered; floral bracts

foliaceous, cymbiform, often pale purple. Flower resupinate, fleshy, the sepals connate at the base forming an obliquely urceolate body, free at the top. Dorsal sepal oblong to obovate, concave, apex rounded to obtuse. Lateral sepals obliquely oblong, recurved and obtuse at apex. Petals elliptic to spatulate, free, appressed to the sepaline tube. Lip more or less mobile, articulate on the apex of the long column-foot, 3-lobed; lateral lobes usually hatchet-shaped, erect; midlobe triangular to oblong, usually reflexed from the middle; disc with a varying number of longitudinal keels or thickening of the veins. Mentum formed by the lateral sepals and the column-foot, globose or spur-like. Column straight, broad, sometimes narrowly winged at the margin towards the apex; column-foot long, inflexed in the middle and slightly recurved towards the apex; stigma broadly obovate. Anther 2-celled; pollinia 8, ellipsoid, in two groups of 4, two of these larger, and two smaller. Ovary grooved, often sparsely and finely pubescent. Capsule attached on long, erect stalks, ellipsoid, ridged.

About 13 species; distributed in India, Bangladesh, Bhutan, Nepal, China, Japan, throughout SE Asia, extended up to New Guinea and SW Pacific islands; 3 species in India and 2 species in Assam.

Key to the Species

- 1a. Mentum spur-like, tapering towards apex *A. striatum*
 1b. Mentum not spur-like, with an obtuse-rounded apex *A. sylhetense*

Acanthephippium striatum Lindl., Edwards's Bot. Reg. 24(Misc.): 41. 1838; Hook.f., Fl. Brit. India 5: 816. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 112. 1898; S.A.Thomas, Orchid Monogr. 8: 131. 1997; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 43. 1998; Hynn. *et al.* Orchids Nagaland 29. 2000; N.Pearce & P.J.Cribb, Orchids Bhutan 274. 2002; Sud.Chowdhury, Assam's Fl. 313. 2005; Lucksom, Orchids Sikkim N.E. Himalaya 395. 2007.

Plant up to 50 cm high. Pseudobulb ovoid to cylindrical, 7–12 × 2–3 cm, 3–5-noded, more or less covered by persistent sheath fibres, 1- or 2-leaved. Leaf elliptical to obovate, 19–25 × 6–10 cm, with 3–5 prominent veins on underside, apex acute; petiole sheathing, ribbed, 3–6 cm long. Inflorescence 10–12 cm long; peduncle with several scale like membranous sheaths; rachis *ca.* 5 cm long, densely 3–10-flowered; floral bracts ovatelanceolate, cymbiform, 1.5–3.0 × 2.0–2.6 cm, apex acute. Flowers creamy white with parallel red venation, tubular, 3.5–4.5 cm long; pedicel and ovary 3–4 cm long, sparsely pubescent. Dorsal sepal oblong, 1.5–2.8 × 1.0–1.4 cm, 5-veined, basal half adnate to

lateral sepals, apex obtuse; lateral sepals obliquely-oblong, 3.0–3.8 × 1.5–2.0 cm, 5–7-veined, apex rounded and recurved. Petals oblong-obovate, 2.0–2.8 × 0.8–1.1 cm, fleshy, 7-veined, apex obtuse or acute. Lip membranous, 3-lobed; midlobe small, triangular, *ca.* 6 × 4 mm; sidelobes erect, 0.8–0.9 × 1.0–1.1 cm; disc rectangular, *ca.* 4 × 8 mm; callus on disc consisting of one low median keel starting from the base and ending near apex. Mentum formed by lateral sepals and column-foot, longer than the column, narrow, spur-like. Column straight, 1.0–1.4 cm long, 4–5 mm in diam.; column-foot *ca.* 4 cm long, slightly recurved towards the apex, united to the lateral sepals for about half of its length; stigma broadly obovate, *ca.* 4 mm long; rostellum rounded, broadly obovate, *ca.* 2 × 3 mm. Anther *ca.* 3 × 4 mm, with a long rounded attachment on the adaxial side, the front margin drawn out into an acute triangular flap; pollinia 8, *ca.* 1.6–2.4 × 0.6–1.6 mm. Capsule 4–6 cm long.

Habitat: Terrestrial, grows on shaded forest floors or on the banks of streams.

Flowering: May–July.

Occurrence: Dibrugarh: Jeypore R.F.; Golaghat and



Acanthephippium striatum Lindl.: base of the plant showing pseudobulb and inflorescence (left) and closeup of a flower (right)

Karbi Anglong: Nambor W.L.S.; North Cachar Hills: Semkhor ca. 798 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal, Bihar, Jharkhand, Madhya Pradesh), Bhutan, Nepal, China, Myanmar, Thailand, Vietnam, Malaysia, Indonesia.

Regional Conservation Status & Criteria: Vulnerable, VU B2ab(ii)c(iii).

Acanthephippium sylhetense Lindl., Gen. Sp. Orchid. Pl. 177. 1831; Hook.f., Fl. Brit. India 5: 815. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 111. 1898; Sud.Chowdhury *et al.*, J. Assam Sci. Soc. 14(2): 130. 1971; Kataki, Orchids Meghalaya 100. 1986; S.A.Thomas, Orchid Monogr. 8: 133. 1997; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 43. 1998; N.Pearce & P.J.Cribb, Orchids Bhutan 276. 2002; Sud.Chowdhury, Assam's Fl. 324. 2005;

Lucksom, Orchids Sikkim N.E. Himalaya 396. 2007. *Acanthephippium ringiflorum* Griff., Not. Pl. Asiat. 3: 347. 1851.

Plant up to 50 cm high. Pseudobulb 2–3-leaved, ovoid-cylindrical, up to 16 cm long, 1.5–3 cm in diam., lower half more or less covered by persistent sheath fibres, upper half sheathed by leaf-petioles. Leaves elliptic to oblong-elliptic, 24–40 × 7–10 cm, 5-veined, apex acuminate or acute; petioles sheathing, 5–15 cm long. Inflorescence lateral from new shoot, arising from axil of lower sheaths, 3–6-flowered; peduncle more or less covered by leaf sheaths, 3–9 cm long; rachis 1–3 cm long; floral bracts cymbiform, pale purple, foliaceous, ovatelanceolate, 2.0–2.9 × 1.7–2.2 cm, acute, 9–11-veined. Flower fleshy; pedicel and ovary grooved, sparsely and finely pubescent, 3–4 cm long. Dorsal sepal oblong, 2.5–3.0 × 1.3–1.5 cm,



Acanthephippium sylhetense Lindl.: plants in their natural habitat (left) and closeup of flowers (right)

apex obtuse, 5-veined, adnate to lateral sepals for about 3/4 length. Lateral sepals obliquely oblong, 3.8–4.5 × 1.8–2.0 cm, 5-veined, recurved and obtuse at the apex. Petals obovate, 2.7–3.0 × 1.4–1.5 cm, fleshy, 5-veined. Lip 3-lobed; midlobe linear, 6–8 × 4–5 mm, thick, tongue-like, dilated at the apex, strongly reflexed about the middle, surface uneven with lateral grooves in apical half; sidelobes hatchet-shaped, 0.7–0.8 × 0.5–0.6 cm, slightly constricted, proximal edge erect; disc ca. 5 × 6 mm; callus on disc consisting of 3 or 5 keels clearly toothed at each end. Mentum obtuse at apex, as long as the dorsal sepal. Anther ca. 4 × 3 mm, with a short rounded attachment on the adaxial side; pollinia 8, 1–2 × ca. 1 mm. Column straight, 1.3–1.4 cm long, 5–7 mm in diam.; column-foot 4.0–4.5 cm, slightly recurved towards apex, united to the lateral sepals for about 1/2 of its length; stigma broadly obovate, ca. 5 mm long. Capsule up to 6 cm long.

Habitat: Terrestrial, grows on shaded forest floor.

Flowering: May–June.

Occurrence: Cachar: Barak R.F., Riangpunji; Dibrugarh: Jeypore R.F.; Golaghat and Karbi Anglong: Nambor and Garampani W.L.S.; Kokrajhar: Ripu R.F., Kochugaon; Lakhimpur: Dullung and Kakoi R.F.; North Cachar Hills: Patherkot ca. 727 m; Tinsukia: Dehing Patkai W.L.S.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal, Jharkhand, Orissa, Chhattisgarh), Bangladesh, China, Japan, Myanmar, Thailand, Laos, Malaysia, Philippines.

Regional Conservation Status: Near Threatened.

Ania Lindl.

Terrestrial rhizomatous herbs. Pseudobulb 1-leaved, erect, rarely prostrate, with 1 or few internodes. Leave deciduous, articulate, petiolate or not, petiole not sheathing, convolute, plicate or not, glabrous; blade elliptic to ovate, base decurrent along petiole, margin straight, undulate to crenulate. Inflorescence an erect raceme arising heteranthous on a leafless shoot or lateral from base of pseudobulb, often alternating with fertile shoots; peduncle with few internodes, scaly; scales tubular; floral bracts persistent. Flowers resupinate, often simultaneously opening. Sepals and petals ovate, elliptic, or obovate to linear, entire; lateral sepals broader than petals. Lip immobile, entire or 3-lobed, spur present, saccate; keels 3–5. Anther cap with 2 thecae, usually 4-locular; pollinia unequal in size or shape, with two pairs of caudicles of unequal length. Column porrect or slightly arcuate; foot indistinct.

About 7 species; distributed in India, China, Myanmar, Thailand, Vietnam, Malaysia, Indonesia, and Philippines; 3 species in India as well as in Assam.

Key to the Species

- 1a. Lip with 3 keels *A. penangiana*
- 1b. Lip with 5 keels raising lamellately distally 2
- 2a. Lip almost same length as sepals; sidelobes very small with triangular acute apex; keels continuing to apex of midlobe *A. angustifolia*
- 2b. Lip shorter than the sepals; sidelobes conspicuous with obtuse apex; keels continuing one third into the midlobe *A. viridifusca*

Ania angustifolia Lindl., Gen. Sp. Orchid. Pl. 129. 1831; H. Turner, Orchid Monogr. 6: 51. 1992. *Tainia angustifolia* (Lindl.) Benth. & Hook.f., Gen. Pl. 3: 515. 1883; Hook.f., Fl. Brit. India 5: 819. 1890; K. Gogoi, J. Orchid Soc. India 26: 19. 2012 & in J. Non-Timber Forest Prod. 19(1): 62. 2012; L.R. Meitei *et al.*, McAllen Int. Orchid Soc. J. 16(3): 1. 2015.

Fig. 104 (A–Z).

Stem of sterile shoots with 1–4 internodes, 1.1–2.0 cm long, 1.2–2.4 cm in diam. Pseudobulbs consisting of several internodes, erect conical, obliquely ellipsoid, 1.1–2.0 × 1.2–2.4 cm, ovoid, covered with sheaths. Leaf blade elliptic to slightly obovate, 20–35 × 3–6.5 cm, apex shortly acuminate; petiole slender, 20–30 cm long, articulate near middle, base with 2 tubular sheaths. Inflorescence erect, arising from the base of pseudobulb, 32–70 cm long; peduncle 25–40 cm long, with 3–5 tubular sheaths below; rachis 9–30 cm long, laxly 4–19-flowered; floral bracts lanceolate, 0.5–1.3 cm long, membranous. Flowers

not opening widely, yellowish green; lip whitish, tinged with dark purple, mid-lobe dark purple, apical margin white, lamellae deep purple, column whitish, upper part purplish, anther cap brownish green; pedicel and ovary 0.5–1.3 cm long. Sepals similar, oblong, 1.5–2.3 × 0.3–0.5 cm, 5-veined, acute; lateral sepals adnate to column base. Petals obliquely elliptic, 1.4–2.3 × 0.3–0.5 cm, 5-veined, acute. Lip slightly obovate 1.2–1.7 × 0.4–0.7 cm, 3-lobed; lateral lobes erect, embracing column, triangular-lanceolate, *ca.* 1 mm wide, acuminate; mid-lobe nearly oblate, *ca.* 4 mm wide, rounded; disk with 5 lamellae extending to mid-lobe; lamellae parallel to each other, highly raised and undulate or denticulate on mid-lobe; spur slightly flattened, 2–4 mm long, obtuse and slightly concave. Column 7–9 mm long, apex truncate; wings broadly seam-like, extending up to the apex of foot; foot *ca.* 1.5 mm long.

Habitat: Terrestrial or often lithophytic on rock

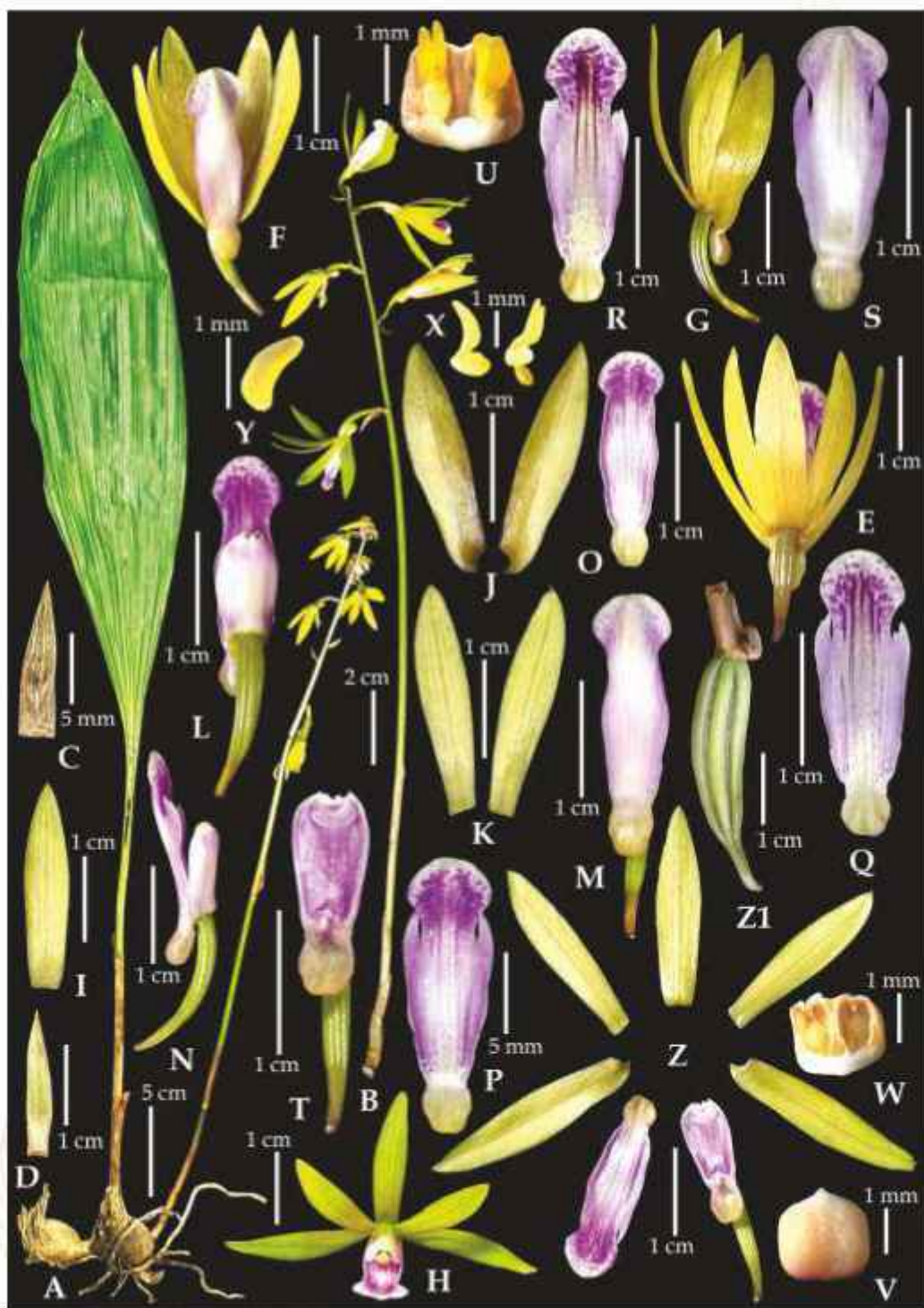


Figure 104. A-Z: *Ania angustifolia* Lindl. A. Habit; B. Inflorescence; C-D. Floral bract; E. Flower (dorsal view); F. Flower (ventral view); G. Flower (lateral view); H. Flower (front view); I. Dorsal sepal; J. Lateral sepals; K. Petals; L. Labellum, column, pedicel & ovary (dorsal view); M. Labellum, column, pedicel & ovary (ventral view); N. Labellum, column, pedicel & ovary (lateral view); O. Labellum (dorsal view); P-R. Labellum-flattened out (dorsal view); S. Labellum-flattened out (ventral view); T. Column, pedicel & ovary (ventral view); U. Anther cap with pollinia; V. Anther cap (dorsal view); W. Anther cap (ventral view); X & Y. Pollinia; Z. Floral analysis; Z1. Fruit.



Ania angustifolia (Lindl.) Benth. & Hook.f.: plants in their natural habitat

crevices.

Flowering: July–September.

Occurrence: Karbi Anglong: Jengpata *ca.* 800 m; North Cachar Hills: Shimtilong *ca.* 1230 m.

Distribution: India (Assam, Manipur, Meghalaya), China, Myanmar, Thailand, Vietnam.

Regional Conservation Status & Criteria: Vulnerable, VU B2ab(ii).

Ania penangiana (Hook.f.) Summerh., Bot. Mag. 161: t. 9553. 1939. *Tainia penangiana* Hook.f., Fl. Brit. India 5: 820. 1890; H.A. Pedersen *et al.*, in Santisuk *et al.* (eds.), Fl. Thailand 12(2): 642. 2014. *Tainia hookeriana* King & Pantl., J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 64(2): 336. 1895.

Fig. 105 (A–G).

Pseudobulbs conical or ovoid 2.5–3.0 cm in diam. Leaf blade oblong-lanceolate, 14–46 × 2–7 cm, apex

acuminate; petiole 7–32 cm long. Inflorescence arising from the node of pseudobulbs up to 1.3 m long; peduncle up to 60 cm long and 4–5 mm in diam., covered with 3–4 membranous sheaths at base; rachis 15–50 cm long, 5–17-flowered; floral bracts narrowly lanceolate, usually 6–15 mm, membranous. Flowers greenish-brown to yellow, with reddish-brown stripes, lip white. Pedicel and ovary *ca.* 15 mm long. Sepals sub similar, oblong-lanceolate, 17.5–21 × 3–5 mm, 7-veined, acuminate. Petals narrowly oblanceolate, 16–22 × 3–4 mm, slightly falcate. Lip 3-lobed; lateral lobes suberect, ovate-oblong, obtuse and slightly incurved; midlobe orbicular or ovate-triangular, apex acute; disk with 3 lamellae extending to mid-lobe; spur exserted beyond base of lateral sepals, 3–5 mm, obtuse. Column subcylindric *ca.* 10 mm long;

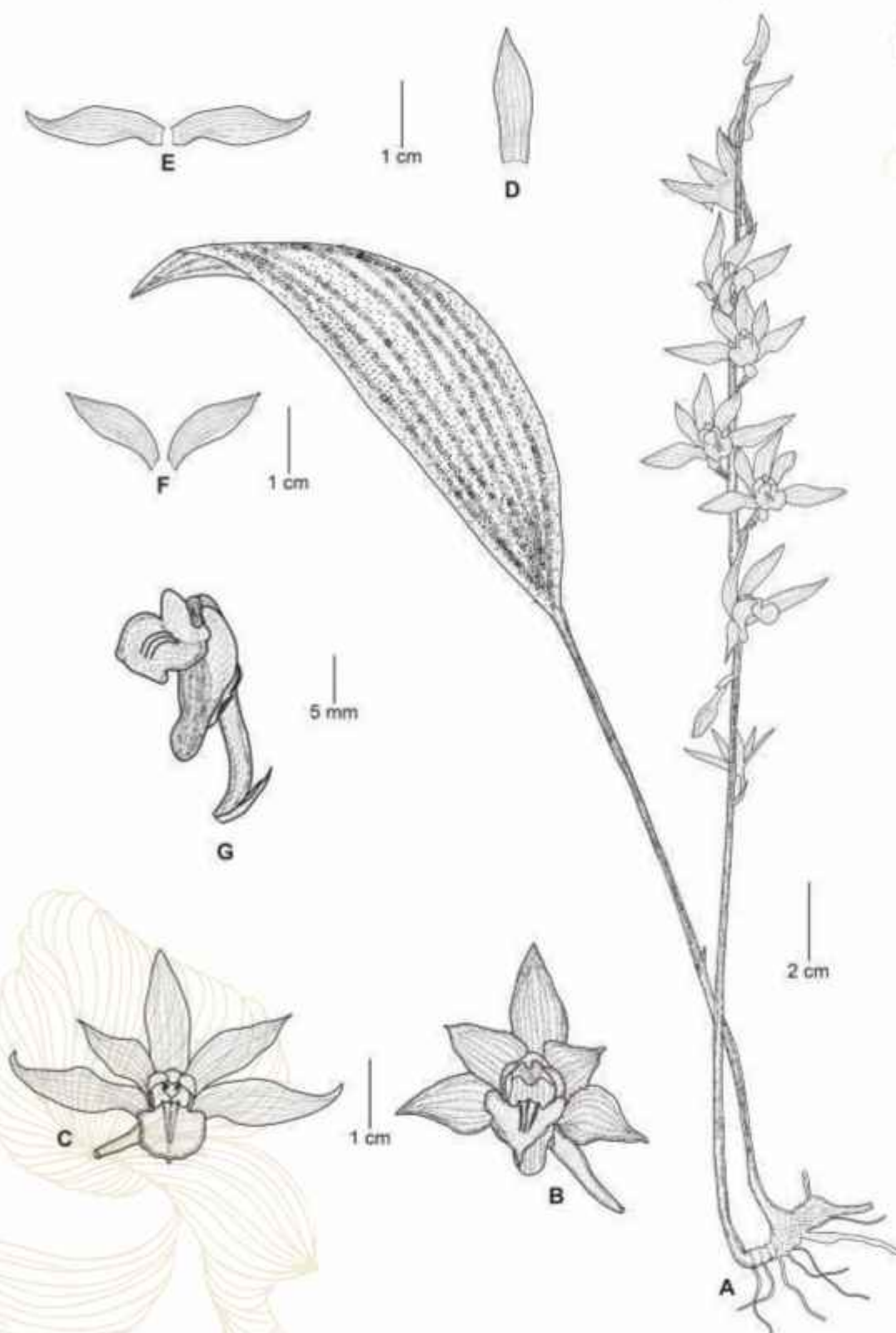


Figure 105. A–G: *Ania penangiana* (Hook.f.) Summerh.: A. Habit; B–C. Flowers; D. Dorsal sepal; E. Lateral sepals; F. Petals; G. Lip with column, pedicel, ovary and floral bract.

rostellum nearly ligulate, unlobed; anther cap without appendages.

Habitat: Terrestrial, grows on shaded tropical evergreen forests floors.

Flowering: February–March.

Occurrence: Karbi Anglong: Dambukso ca. 840 m; North Cachar Hills: Hegbung ca. 1000 m.

Distribution: India (Assam, Arunachal Pradesh, Sikkim), China, Thailand, Vietnam, Malaysia.

Regional Conservation Status & Criteria: Vulnerable, VU B2ab(ii).

Ania viridifusca (Hook.) Tang & F.T.Wang ex Summerh., Bot. Mag. 161: t. 9553. 1939; H.Turner, Orchid Monogr. 6: 60. 1992; Lucksom, Orchids Sikkim N.E. Himalaya 400. 2007. *Calanthe viridifusca* Hook., Bot. Mag. 78: t. 4669. 1852. *Tainia*

viridifusca (Hook.) Benth. ex Hook.f., Fl. Brit. India 5: 820. 1890; Kataki, Orchids Meghalaya 106. 1986; Hynn. *et al.*, Orchids Nagaland 269. 2000.

Stem of sterile shoot with 5–6 internodes, ca. 3.7 cm long and ca. 0.6 cm in diam. Pseudobulbs consisting of several internodes, erect or prostrate, obliquely ovoid to elliptic, 2.2–5.0 × 3.2–10 cm. Leaf blade oblong or narrowly elliptic, plicate, 46–55 × 4–8.2 cm, with long petiole at base, apex long acuminate; petiole ca. 39 cm long, without an articulation. Inflorescence arising laterally from the pseudobulb, erect; peduncle purplish at lower part, 30–70 cm long, 5–8 mm in diam., with 3–4 sheaths; rachis laxly 20–30-flowered; floral bracts yellowish green, narrowly lanceolate, 1–1.5 cm, long acuminate. Flowers opening widely, brownish green or purplish brown, lip and column white,



Ania viridifusca (Hook.) Benth. ex Hook.f.: a plant in its natural habitat (left) and closeup of flowers

anther cap with 2 purple spots at apex; pedicel and ovary 1.1–2.3 cm long. Sepals similar, elliptic to obovate, 2.0–3.2 × 4–5 mm, acute and aristate; lateral sepals sometimes with midvein extending keel-like beyond tip abaxially, base mostly adnate to column foot. Petals similar to sepals, and smaller, acute and aristate. Lip elliptic to obovate, 1.1–1.4 × 0.8–0.9 cm, 3-lobed; lateral lobes erect, ovateoblong, obtuse; mid-lobe orbicular, base without conspicuous claw, mucronate; disk with 3–5 lamellae extending to mid-lobe and becoming 5-undulate or crestlike there;

spur saccate-conic, 3–4 mm long, obtuse. Column subcylindric, 8–10 mm long; foot 1–2 mm long.

Habitat: Terrestrial on humus rich soils.

Flowering: April–June.

Occurrence: Karbi Anglong: Sarhed ca. 600 m; North Cachar Hills: Thingje ca. 1400 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim), China, Myanmar, Thailand, Vietnam.

Regional Conservation Status & Criteria: Vulnerable, VU B2ab(ii).

Calanthe R.Br.

Terrestrial herbs. Pseudobulbs small, conic, ovoid, or subglobose, rarely inconspicuous or cylindric. Leaves usually ovate-lanceolate, rarely linear, sometimes not well developed at the time of flowering, plicate, base contracted into a petiole or subsessile, sheathing, articulate or not. Scape arising from leaf axil or from base of pseudobulb, rarely from apex of leafless pseudobulb, erect, usually densely puberulent; inflorescence a terminal raceme, few to many flowered; floral bracts persistent or caducous. Flowers resupinate, small to medium-sized, sometimes not opening widely. Sepals similar, free. Petals often smaller than sepals. Lip adnate to base of column wings and forming a tube, or adnate only to base of column, or to column foot and free from column itself, lobed or unlobed; disk often lamellate or ridged, sometimes with callose appendages; spurred present or absent. Pollinia waxy, 8, in 2 groups, nearly equal or unequal in size; caudicle conspicuous or inconspicuous, commonly adherent to a sticky viscidium. Column often short and thick, winged; foot present or absent; rostellum lobed or unlobed; stigma lateral.

About 220 species; distributed in tropical and subtropical Asia, Australia, New Guinea, and SW Pacific islands, as well as in tropical Africa and South America; 32 species in India and 10 species in Assam.

Key to the Species

- 1a. Flower not opening widely, yellow; bracts deciduous; lip small, obscurely 3-lobed2
- 1b. Flower opening widely; bracts persistent; lip 3–4 lobed, rarely 2-lobed4
- 2a. Lip with very minute sidelobes*C. lyroglossa*
- 2b. Lip with distinct, sidelobes 2–5 mm long3
- 3a. Inflorescence short and dense; spur straight, slender*C. densiflora*
- 3b. Inflorescence long, not dense; spur clavate, curved, inflated at the apex*C. clavata*
- 4a. Spur absent in lip*C. puberula*
- 4b. Spur present in lip5
- 5a. Spur <4 mm6
- 5b. Spur ≥ 7 mm7
- 6a. Lip pale-violet, deeply 2-lobed at apex, lateral lobes absent*C. biloba*
- 6b. Lip yellow, not 2-lobed at apex, lateral lobes present*C. mannii*
- 7a. Midlobe of lip fan-shaped, emarginated at apex*C. masuca*
- 7b. Midlobe truly 2-lobed, lobules longer than broad8

- 8a. Sepals and petals green; spur 2–3 cm long *C. herbacea*
 8b. Sepals and petals white; spur 0.7–1.5 cm long 9
 9a. Leaves <6 cm wide; scape arising from previous year's leafless pseudobulb *C. odora*
 9b. Leaves ≥6 cm wide; scape arising from leaf axil of current year's growth *C. triplicata*

Calanthe biloba Lindl., Fol. Orchid. 6: 3. 1855; Hook.f., Fl. Brit. India 5: 848. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 169. 1898; A.S.Rao & D.M.Verma, Bull. Bot. Surv. India 11 (3&4): 411. 1969; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 162. 1998; Hynn. *et al.*, Orchids Nagaland 83. 2000; N.Pearce & P.J.Cribb, Orchids Bhutan 284. 2002; Lucksom, Orchids Sikkim N.E. Himalaya 422. 2007; S.R.Talukdar & C.Deori, Indian Forester 141 (11): 1164. 2015. *Calanthe biloba* var. *diptera* Hook.f., Fl. Brit. India 5(2): 848. 1890.

Plant 45–65 cm high. Pseudobulbs cylindric, 5–11 ×

0.6–0.8 cm. Leaves 2–4, broadly-elliptic, 12–25 × 7–10 cm, margins undulate, apex caudate-acuminate; petiole sheathing, 8–15 cm long. Inflorescence erect, terminal, arising from leaf axil, pubescent; peduncle 20–35 cm long, with 2 tubular sheaths below middle; rachis 15–20 cm long, subdensely to densely many-flowered; floral bracts persistent, linear-lanceolate, 2–4 cm long, glabrous, apex acuminate. Flowers 2–3.5 cm in across; sepals and petals yellow-ochre, spotted with purple-brown, lip pale-violet, whitish at base, spur pink; pedicel and ovary 1.5–2.5 cm long, densely puberulent. Dorsal sepal broadly ovate, 1.4–1.5 ×



Calanthe biloba Lindl.: inflorescence (left) and closeup of a flower (right)

0.8–1.0 cm, abaxially puberulent, 5-veined, apex aristate; lateral sepals falcate, $1.5\text{--}1.7 \times 0.7\text{--}0.9$ cm, puberulent abaxially, 5-veined. Petals oblong, $1.0\text{--}1.2 \times 0.4\text{--}0.5$ cm, glabrous, 3-veined, apex aristate. Lip broadly ovate-oblong, 1.3–2.0 cm long, clawed at base, spurred, deeply 2-lobed at apex; lobes subrhombic, margin erose, apex acute; spur narrowly conical ca. 2 mm long, apex slightly obtuse. Column 2–5 mm long, thick, slightly dilated toward apex, glabrous; rostellum 2-lobed. Capsule ellipsoid $2.5\text{--}3 \times 1.5\text{--}1.8$ cm.

Habitat: Terrestrial, grows on shady forest floors.

Flowering: August–October.

Occurrence: Golaghat and Karbi Anglong: Nambor W.L.S.; Lakhimpur: North Lakhimpur, Pathalipam; Morigaon: Pabitora W.L.S., Haduk, Jugdal; North Cachar Hills: Hangrum ca. 854 m; Udalguri: Barnadi

W.L.S.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Nagaland, Sikkim, West Bengal), Bhutan, Nepal, China, Myanmar, Thailand.

Regional Conservation Status & Criteria:

Vulnerable, VU B2b(i,ii)c(iii).

Calanthe clavata Lindl., Gen. Sp. Orchid. Pl. 251. 1833; Hook.f., Fl. Brit. India 5: 854. 1890; N.Pearce & P.J.Cribb, Orchids Bhutan 295. 2002; Lucksom, Orchids Sikkim N.E. Himalaya 419. 2007.

Fig. 106 (A–G).

Plant 40–60 cm high. Rhizome stout, 0.5–1 cm in diam. Pseudobulbs very small, completely enclosed in sheaths. Leaves 2–3, basal, oblongelliptic, $30\text{--}50 \times 4\text{--}9$ cm, apex acute; petiole 10–15 cm long. Inflorescence arising from base of



Calanthe clavata Lindl.: inflorescence (left) and closeup of flowers (right)

pseudobulb, erect, 30–40 cm long; peduncle 0.7–1.3 cm in diam., with several scattered tubular sheaths; rachis 6–10 cm, densely many flowered; floral bracts caducous, lanceolate, 0.7–3.5 cm long, membranous, glabrous. Flowers yellow, 1–2 cm in across; pedicel and ovary *ca.* 1.5 cm long, glabrous. Sepals similar, elliptic-lanceolate, 0.8–1.0 × 0.2–0.3 cm, acute to acuminate. Petals lanceolate, 0.8–1.0 × 0.2–0.4 cm, 5-veined, apex acute. Lip adnate to entire length of column wings, 6–8 × 4–5 mm, 3-lobed; lateral lobes short, erect, sub-triangular; mid-lobe ovate *ca.* 4 × 5.5 mm, apex truncate and emarginate; disk with 2 triangular lamellae at base; spur straight, clavate, 7–9 × *ca.* 3.5 mm. Pollinia subequal, subclavate or narrowly obovoid; caudicles short; viscidium subcordate, thick. Column 5–7 mm long, thick, dilated at apex; rostellum triangular, *ca.* 0.8 mm, unlobed.

Habitat: Terrestrial, grows on humus rich soils.

Flowering: September–November.

Occurrence: Dibrugarh: Jeypore R.F.; Karbi Anglong: Phangchogaon *ca.* 300 m; North Cachar Hills: Pidik *ca.* 500 m; Tinsukia: Makum.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal), Bangladesh, China, Myanmar, Thailand, Vietnam, Malaysia.

Regional Conservation Status & Criteria:

Vulnerable, VU B2b(ii)c(iii).

Calanthe densiflora Lindl., Gen. Sp. Orchid. Pl. 250. 1833; Hook.f., Fl. Brit. India 5: 855. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 174. 1898; Katakai, Orchids Meghalaya 138. 1986; H.J. Chowdhery, Orch. Fl. Arunachal Pradesh 165. 1998; N.Pearce & P.J.Cribb, Orchids Bhutan 295. 2002; Lucksom, Orchids Sikkim N.E. Himalaya 420. 2007.

Fig. 106 (H–J).

Plants 45–55 cm high. Rhizome creeping. Pseudobulbs inconspicuous, enclosed in basal leaf sheaths. Leaves 2–3, narrowly elliptic, 20–35 × 3–6 cm, glabrous, apex acute; petiole *ca.* 10 cm long. Inflorescence racemose, arising from rhizome;

peduncle erect, 15–18 cm long, 3–4 mm in diam., with 3–5 tubular sheaths toward base; rachis 2–3 cm long, densely many flowered; floral bracts caducous, narrowly lanceolate, 1.5–2.5 cm long, glabrous. Flowers pale yellow, *ca.* 2 cm long; pedicel and ovary *ca.* 1 cm long, glabrous. Sepals similar, oblong, 1.3–1.4 × *ca.* 0.5 cm, 3–5-veined, apex aristate. Petals sub-spatulate, 1.3–1.4 × *ca.* 0.4 cm, 3-veined, apex acute. Lip adnate to base of column wings, ovateorbicular, 0.9–1.1 × 0.5–1.0 cm, 3-lobed above middle; lateral lobes ovate-triangular, *ca.* 0.5 × 0.3 cm, apex obtuse; mid-lobe subsquare, *ca.* 0.5 × 0.4 cm, apex emarginate; disk with 2 lamellae; lamellae deltoid, *ca.* 2 × 3 mm; spur straight, cylindric, 1.2–1.6 × 0.2–0.3 cm, apex obtuse. Anther cap beaked; pollinia obovoid, subequal, *ca.* 1.2 mm long, caudicles short. Column slender, 1.0–1.2 cm long, slightly dilated at base; rostellum broadly ovate-triangular, *ca.* 1.2 mm long, unlobed; Capsule nearly pendulous, ellipsoid-globose, 1.3–1.5 × 0.8–0.9 cm.

Habitat: Terrestrial, grows on hill slopes.

Flowering: September–October.

Occurrence: Dibrugarh: Jeypore R.F.; Karbi Anglong: Dili Terang *ca.* 546 m; North Cachar Hills: Hatikhali *ca.* 300 m; Sibsagar: Bimalapur; Tinsukia: Dehing Patkai W.L.S.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal), Bangladesh, Bhutan, Nepal, China, Myanmar, Thailand, Vietnam.

Regional Conservation Status & Criteria: Least Concern.

Calanthe herbacea Lindl., Fol. Orchid. 6: 10. 1855; Hook.f., Fl. Brit. India 5: 852. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 172. 1898; Katakai, Orchids Meghalaya 140. 1986; H.J. Chowdhery, Orch. Fl. Arunachal Pradesh 167. 1998; Hynn. *et al.*, Orchids Nagaland 87. 2000; N.Pearce & P.J.Cribb, Orchids Bhutan 287. 2002; Lucksom, Orchids Sikkim N.E. Himalaya 428. 2007. *Calanthe erytroglossa* Rchb.f. ex Hook.f., Fl. Brit. India 5: 853. 1890.

Fig. 109 (A–B).

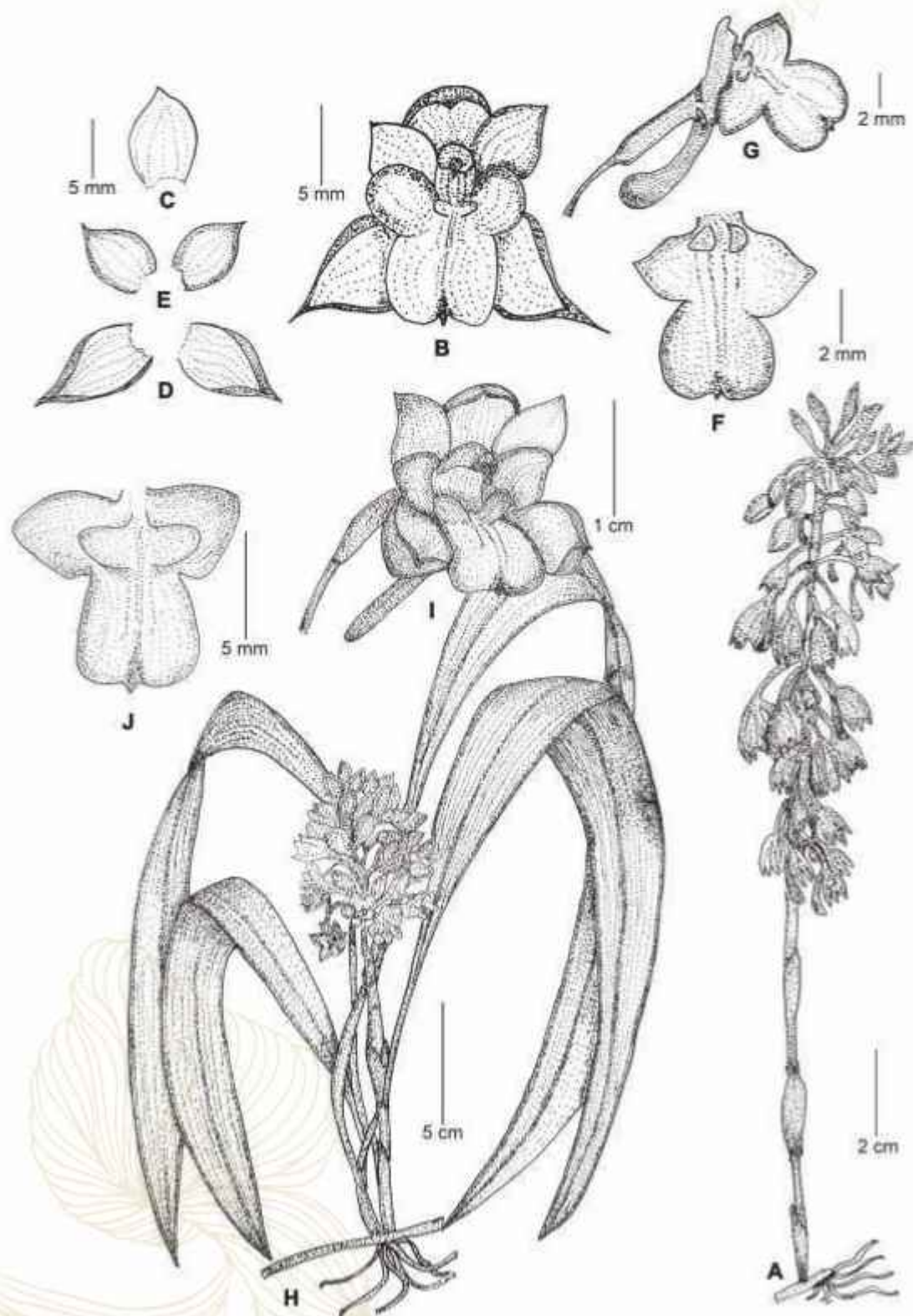


Figure 106. A–G: *Calanthe clavata* Lindl.: A. Inflorescence; B. Flower; C. Dorsal sepal; D. Lateral sepal; E. Petals; F. Lip; G. Lip with column, pedicel and ovary. H–J: *Calanthe densiflora* Lindl.: H. Habit; I. Flower; J. Lip.

Plants 35–65 cm high. Pseudobulbs narrowly oblong-ovoid 1.5–2.5 × 0.5–1.5 cm, with 2 sheaths. Leaves 3–4, elliptic-lanceolate, 15–25 × 7–9 cm, abaxially puberulent, many-nerved, apex acute or acuminate; petiole slender, 10–20 cm long. Inflorescence racemose, erect, 30–60 cm long, arising from leaf axil; rachis 8–14 cm long, laxly many-flowered; floral bracts persistent, lanceolate, 1.0–1.5 cm long, abaxially pubescent. Flowers with green sepals and petals and white lip, 1.5–2 cm in across; pedicel and ovary 2.5–3.0 cm long, pubescent. Sepals subequal, elliptic-lanceolate, ca. 2 × 0.8 cm, spreading, acute at apex. Petals subspatulate, 12–1.8 × 2–2.5 mm, glabrous, apex obtuse. Lip adnate to column wings, deeply 3-lobed; side-lobes oblong, falcate, 0.6–0.7 × ca. 5 mm, apex obtuse; mid-lobe divided by a deep sinus into 2 lobules, sinus apiculate; lobules divergent; disk with a cluster of yellow wartlike calli at base; spur slightly arcuate, slender, 2–3 cm long, yellowish green, pubescent outside, apex obtuse. Anther cap white; pollinia clavate, subequal in size, ca. 2 mm long; viscidium subsquare. Column white, 6–7 mm long, subglabrous, dilated at apex; rostellum 2-lobed.

Habitat: Terrestrial, grows on shady hill slopes.

Flowering: June–August.

Occurrence: North Cachar Hills: Hajuichok ca. 1382 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Nagaland, Sikkim, West Bengal), China, Myanmar, Thailand, Vietnam.

Regional Conservation Status & Criteria:

Endangered, EN B2ab(ii).

Calanthe lyroglossa Rchb.f., Otia Bot. Hamburg. 53. 1878; Seidenf. & J.J.Wood, Orchids Penins. Malaysia Singapore 175. 1992. *Calanthe foerstermannii* Rchb.f., Gard. Chron. n.s., 1883: 814. 1883; C.R.Deb & T.Imchen, Orchid Diversity Nagaland 68. 2008.

Fig. 109 (C–E).

Plants 25–45 cm high. Pseudobulbs cylindriclavate, 2–3 cm long. Leaves 3–5, oblanceolate, 30–60 × 4–8 cm, plicate, glabrous, apex acuminate; petiole sheathing, 5–8 cm long, articulate. Inflorescence racemose, erect,

ca. 45 cm long, arising from base of pseudobulb; rachis 8–12 cm long, densely many flowered; floral bracts caducous, lanceolate, 3–4 cm long, membranous, glabrous. Flowers small, pale-yellow; pedicel and ovary ca. 1 cm long, glabrous. Sepals similar, elliptic-lanceolate, 6–9 × 2.5–3 mm, 3-veined, acuminate at apex. Petals ovate-elliptic, 6–7 × ca. 3 mm, 3-veined, apex acute. Lip adnate to base of column wings, ca. 5 × 5 mm, obscurely 3-lobed; side lobes short, blunt; mid-lobe reniform ca. 3 × 5 mm, notched at apex; disk with 2 triangular lamellae at base; spur clavate, 4–5 mm long, apex slightly 2-lobed. Anther cap beaked; pollinia obovoid or clavate, subequal in size, ca. 1.2 mm long, with a conspicuous caudicle; viscidium peltate. Column short, thick, 3–4 mm long, slightly dilated at apex; rostellum ovate-triangular, large,



Calanthe lyroglossa Rchb.f.: plants in their natural habitat

unlobed. Capsule ellipsoid-globose, *ca.* 1.0 × 0.7 cm, pendulous.

Habitat: Terrestrial, grows on damp places on riversides.

Flowering: December–February.

Occurrence: Dibrugarh: Jeyapore R.F.; Lakhimpur: Dullung R.F.; Tinsukia: Dehing Patkai W.L.S.

Distribution: India (Assam, Nagaland), Myanmar, Thailand, Laos, Cambodia, Vietnam, Malaysia, Indonesia, Philippines.

Regional Conservation Status & Criteria:

Vulnerable, VU B2b(ii)c(iii).

Calanthe mannii Hook.f., Fl. Brit. India 5: 850. 1890; Hook.f., Fl. Brit. India 5: 850. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 167. 1898; Katak, Orchids Meghalaya 139. 1986; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 167. 1998; Hynn. *et al.*, Orchids Nagaland 89. 2000; N.Pearce & P.J.Cribb, Orchids Bhutan 288. 2002; Lucksom, Orchids Sikkim N.E. Himalaya 425. 2007; Aver., Taiwania 57(2): 129. 2012.

Fig. 107 (A–U).

Plant 30–40 cm high. Pseudobulbs conical, *ca.* 1 cm in diam., sheathed. Leaves 2–3, young while flowering, lanceolate, 15–30 × 3–4 cm, plicate, puberulent abaxially, base attenuate into a petiole, apex acute; petiole 5–10 cm long. Inflorescence erect, arising from leaf axil, as long as or longer than the leaves; peduncle stout, terete, pubescent, sheathed; rachis 5–10 cm long, laxly few-flowered; floral bracts persistent, ovate-lanceolate, 2–4 mm long, glabrous. Flowers small, pale-brown, with golden yellow lip, *ca.* 8 mm in across; pedicel and ovary 5–7 mm long, densely puberulent. Sepals subequal, ovate, 7–8 × 3–4 mm, abaxially densely puberulent, 5-veined, apex acute; lateral pair slightly oblique. Petals oblanceolate, 6–7 × 1.2–2 mm, glabrous, 1-veined, apex acute. Lip adnate to column wings, 4–6 × 2.5–3.5 mm, 3-lobed; sidelobes ovate, oblique, 1.5–2 × 1–1.5 mm, apex obtuserounded; mid-lobe sub-reniform, 1.5–2 × 2.5–3 mm, margin slightly undulate, apex emarginate and mucronate in sinus; disk with 3 ridges; ridges extending from base of lip to

apex of mid-lobe; spur short, conical, 2–3 × *ca.* 1 mm, pubescent outside. Pollinia narrowly ovoid, subequal in size, *ca.* 0.8 mm long; viscidium suborbicular. Column white, *ca.* 3 mm long, dilated at apex, ventrally puberulent; rostellum small, 2-lobed.

Habitat: Terrestrial, grows on dense forests floors.

Flowering: May–June.

Occurrence: North Cachar Hills: Bara Nenglo *ca.* 1274 m; Sibsagar: Charaipung; West Karbi Anglong: Khainduli *ca.* 834 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Uttarakhand), Bhutan, Nepal, China, Japan, Myanmar, Vietnam.

Regional Conservation Status & Criteria:

Vulnerable, VU B2b(ii)c(iii).

Calanthe masuca (D.Don) Lindl., Gen. Sp. Orchid. Pl. 249. 1833; Hook.f., Fl. Brit. India 5: 850. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 173. 1898; C.E.C.Fisch., Fl. Madras 3: 1001. 1956; Katak, Orchids Meghalaya 140. 1986; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 167. 1998; Hynn. *et al.*, Orchids Nagaland 89. 2000. *Bletia masuca* D.Don, Prodr. Fl. Nepal. 30. 1825. *Calanthe purpurea* Lindl., Gen. Sp. Orchid. Pl. 249. 1833; Hook.f., Fl. Brit. India 5: 851. 1890.

Fig. 108 (A–S).

Plants 50–70 cm high. Pseudobulb conical, 2–5 × 1–3 cm. Leaves 3–6, elliptic-ovate to lanceolate, 20–35 × 8–10 cm, apex acuminate; petiole 10–20 cm long. Inflorescence erect, arising from leaf axil, 45–55 cm long, stout, with 2 tubular sheaths below middle; rachis 5–8 cm long, laxly to subdensely many flowered; floral bracts persistent, ovatelanceolate, 1.0–2.5 cm long. Flowers purple, *ca.* 4 cm in across; pedicel and ovary *ca.* 3.5 cm long, densely pubescent. Sepals elliptic-lanceolate, *ca.* 1.7 cm long, acute, 3-nerved; lateral pair slightly longer. Petals oblanceolate, *ca.* 1.5 × 0.9 cm, 3-veined, subacute at apex. Lip adnate to column wings, 1.3–1.5 × 0.6–1.1 cm, 3-lobed; side-lobes oblong, falcate, *a.* 5 × 2 mm; mid-lobe flabellate, 1.0–1.4 cm wide,

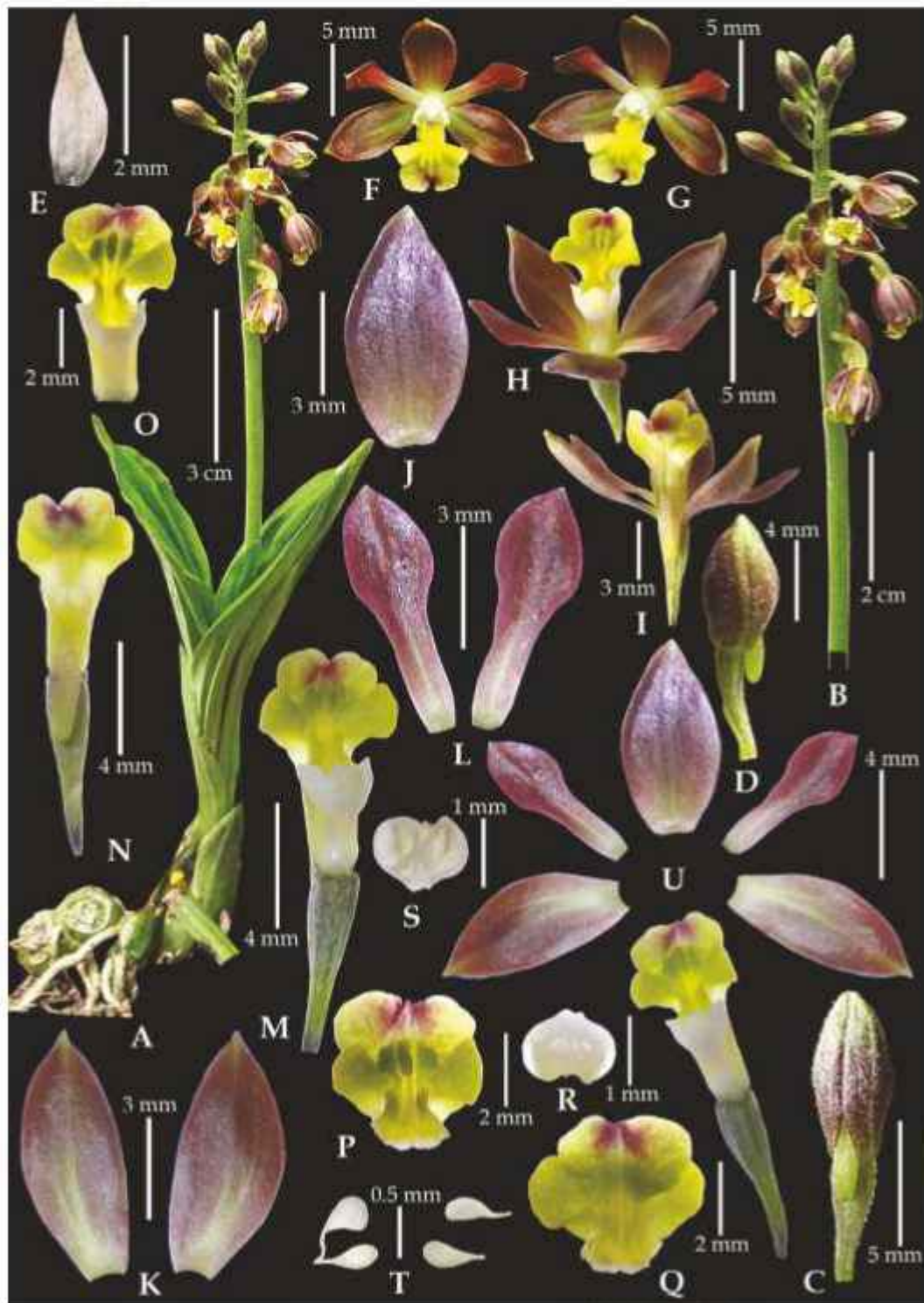


Figure 107. A–U: *Calanthe mannii* Hook.f.: A. Habit; B. Close-up of inflorescence; C. Floral bud (ventral view); D. Floral bud (lateral bud); E. Floral bract; F. Flower (front view); G. Flower (ventrolateral view); H. Flower (dorsal view); I. Flower (ventral view); J. Dorsal sepal; K. Lateral sepals; L. Petals; M. Labellum, column, pedicel & ovary (dorsal view); N. Labellum, column, pedicel & ovary (ventral view); O. Labellum & column (dorsal view); P. Labellum (dorsal view); Q. Labellum (ventral view); R. Anther cap (dorsal view); S. Anther cap (ventral view); T. Pollinia; U. Floral analysis.

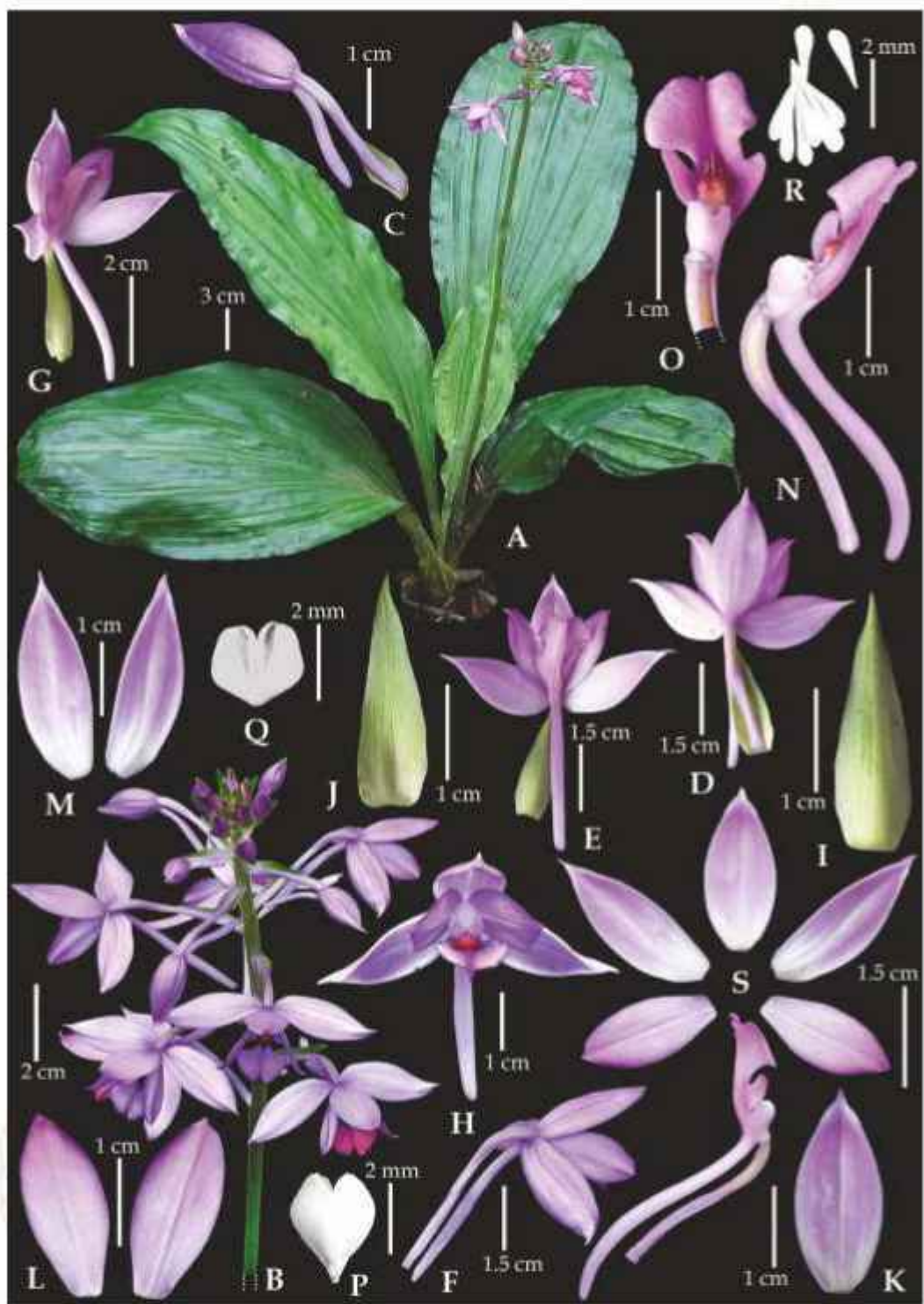


Figure 108. A–S: *Calanthe masuca* (D. Don) Lindl.: A. Habit; B. Close-up of inflorescence; C. Floral bud; D. Flower (dorsal view); E. Flower (ventral view); F. Flower (dorsolateral view); G. Flower (ventrolateral view); H. Flower (front view); I. Floral bract (dorsal view); J. Floral bract (ventral view); K. Dorsal sepal; L. Lateral sepals; M. Petals; N. Labellum, column, pedicel & ovary (lateral view); O. Labellum and column with a portion of pedicellate ovary (ventral view); P. Anther cap (dorsal view); Q. Anther cap (ventral view); R. Pollinia; S. Floral analysis.

base shortly clawed, apex emarginate or shallowly 2-lobed; disk with 3 rows of small, yellow, crested warts at base; spur cylindric, 2.5–5.0 cm long, sparsely pubescent outside, apex obtuse. Pollinia narrowly obovoid, equal in size, *ca.* 2 mm in diam; viscidium suboblong, small. Column *ca.* 5 mm long, dilated at apex; rostellum 2-lobed.

Habitat: Terrestrial, grows on damp forest floors.

Flowering: June–August.

Occurrence: Baksa and Chirang: Manas B.R.; Cachar: Borail W.L.S.; Darrang: Orang N.P.; Dibrugarh: Jokai R.F., Jeypore R.F.; Golaghat: Nambor (N) R.F., Jamuguri; Jorhat: Hollangapar; Karbi Anglong: Garampani W.L.S., Nambor W.L.S.; Kokrajhar: Ultapani, Chirang R.F.; Nagaon: Doboka R.F.; North Cachar Hill: Halflong 650 m; Lakhimpur: N.Lakhimpur; Sibsagar: Charaipung; Sonitpur:

Batasipur; Tinsukia: Dehing Patkai W.L.S.; West Karbi Anglong: Umpanai *ca.* 570 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal, Karnataka, Kerala, Tamil Nadu), Bhutan, Nepal, China, Japan, Sri Lanka, Myanmar, Thailand, Vietnam, Malaysia, Indonesia.

Regional Conservation Status: Least Concern.

Note: This species is locally known as “*Mati-bhataw*” (Assamese).

Calanthe odora Griff., Not. Pl. Asiat. 3: 365. 1851; Hook.f., Fl. Brit. India 5: 853. 1890; N.Pearce & P.J.Cribb, Orchids Bhutan 288. 2002; Lucksom, Orchids Sikkim N.E. Himalaya 427. 2007. *Calanthe angusta* Lindl., Fol. Orchid. 6: 7. 1855; Hook.f., Fl. Brit. India 5: 849. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 171. 1898; Kataki, Orchids



Calanthe odora Griff.: plants in their natural habitat (left) and closeup of inflorescence (right)

Meghalaya 141. 1986; H.J. Chowdhery, Orch. Fl. Arunachal Pradesh 158. 1998; Hynn. *et al.*, Orchids Nagaland 83. 2000; I. Barua, Orchid Fl. Kamrup Distr. Assam 80. 2001. *Calanthe vaginata* Lindl., Fol. Orchid. 6: 7. 1855; Hook.f., Fl. Brit. India 5: 849. 1890.

Plants 30–55 cm high. Pseudobulbs subconical, ca. 0.5 cm in diam., sheathed. Leaves 2–3, not fully developed at the time of flowering, elliptic-lanceolate or lanceolate, 15–20 × 5–8 cm, apex acuminate. Inflorescence racemose, erect, 30–47 cm long, arising from previous year's leafless pseudobulb, puberulent; rachis 5–8 cm long, densely many flowered; floral bracts persistent, lanceolate, 0.8–1 cm long, abaxially puberulent. Flowers white, 2–3 cm in across; pedicel and ovary 1.0–1.5 cm long, puberulent. Sepals similar, ovate-elliptic, 1.0–1.3 × 0.5–0.8 cm, abaxially puberulent, 5-veined, apex acute. Petals sub-spatulate, 0.9–1.1 × 0.3–0.5 cm, glabrous, 3-veined, apex truncate and slightly mucronate. Lip adnate to column wings, 0.8–1.5 × 0.6–0.8 cm, deeply 3-lobed; side-lobes suboblong, apex rounded; mid-lobe obovate, deeply 2-lobed; lobules divergent, subobovate; disk with a semicircular cluster of many tubercles, wartlike calli at base; spur straight, cylindric, 0.7–0.8 cm long, sparsely pubescent outside. Pollinia subclavate, ca. 1.5 mm; viscidium suborbicular, small. Column ca. 3 mm long, dilated toward apex, sparsely puberulent; rostellum 2-lobed.

Habitat: Terrestrial, grows on damp forest floors.

Flowering: March–May.

Occurrence: Baksa and Chirang: Manas B.R., Bansbari; Darrang: Orang N.P.; Golaghat: Nambor (N&S) R.F., Kalioni; Karbi Anglong: Dili Terang ca. 548 m; Kokrajhar: Chirang R.F.-Jharbari, Ultapani; Sonitpur: Sonai Rupai W.L.S., Hugrauli, Panbari; Tinsukia: Sadiya; Udalguri: Khalingduar R.F.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Nagaland, Sikkim, West Bengal), Bangladesh, China, Thailand, Laos, Cambodia, Vietnam.

Regional Conservation Status: Least Concern.

Calanthe puberula Lindl., Gen. Sp. Orchid. Pl. 252. 1833; Hook.f., Fl. Brit. India 5: 848. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 166. 1898; Kataki, Orchids Meghalaya 138. 1986; H.J. Chowdhery, Orch. Fl. Arunachal Pradesh 171. 1998; Hynn. *et al.*, Orchids Nagaland 90. 2000; N. Pearce & P.J. Cribb, Orchids Bhutan 289. 2002; Lucksom, Orchids Sikkim N.E. Himalaya 421. 2007; Vij *et al.*, Orchids Himachal Pradesh 165. 2013.

Fig. 109 (F–H).

Plant 30–60 cm high. Pseudobulb conical, ca. 2.5 × 1.5 cm, enclosed in leaf sheaths. Leaves 4–5, elliptic 15–20 × 4–6 cm, many-nerved, apex acuminate; petiole ca. 10 cm long. Inflorescence arising from near apex of pseudobulb, erect, 25–40 cm long, slender, with several lanceolate sterile bracts; rachis 8–15 cm long, laxly few-flowered; floral bracts lanceolate, 1.5–2.0 cm long, abaxially puberulent, apex acuminate. Flowers purplish-white, ca. 2.5 cm in across; pedicel and ovary 1.5–2.0 cm long, densely pubescent. Sepals similar, ovate-lanceolate, 1.2–1.8 × 0.5–0.6 cm, abaxially puberulent, 5-veined, apex cuspidate; lateral pair slightly oblique. Petals linear, 1.1–1.2 × 0.1–0.2 cm, 3-nerved, apex acuminate. Lip adnate to column wings, 1.2–1.4 × 0.8–1.1 mm, 3-lobed; spur absent; side-lobes oblong-falcate, 0.7–0.9 cm in across near the apex, margin entire, apex obtuse; mid-lobe rhombic, ca. 1 cm long, apical margin irregularly dentate or fringed, apex acute; disk without lamellae. Anther cap narrowly ovate-cordate, ca. 4 mm long; pollinia clavate, ca. 2 mm, caudicles conspicuous; viscidium linear. Column ca. 6 mm long, glabrous; rostellum 3-lobed.

Habitat: Terrestrial, in broad-leaved wet evergreen forests or on moss covered rocks.

Flowering: July–August.

Occurrence: North Cachar Hills: Molkon ca. 1300 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal, Uttarakhand, Himachal Pradesh), Bangladesh, Bhutan, Nepal, China, Japan, Korea, Myanmar, Thailand, Vietnam.



Figure 109. A–B: *Calanthe herbacea* Lindl.: A. Habit; B. Flower. C–E: *Calanthe lyroglossa* Rchb.f.: C. Habit; D. Flower; E. Lip with column, pedicel and ovary. F–H: *Calanthe puberula* Lindl.: F. Habit; G. Flower; H. Lip with column, pedicel and ovary.



Calanthe puberula Lindl.: plant habit (left) and closeup of inflorescence (right)

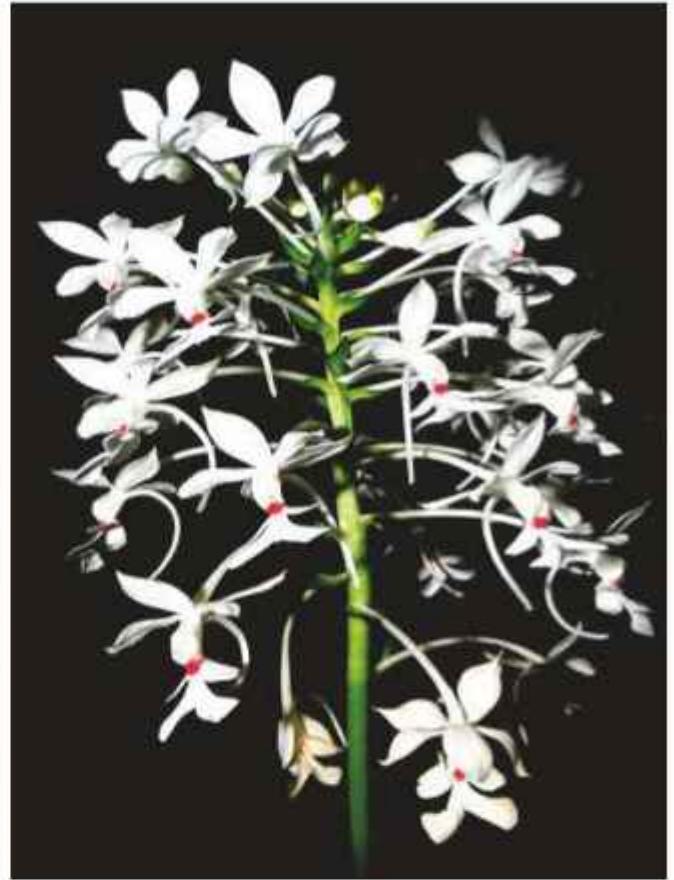
Regional Conservation Status & Criteria:

Vulnerable, VU B2ab(ii)c(iii).

Calanthe triplicata (Willemet) Ames, Philipp. J. Sci., C 2: 326. 1907; H.J. Chowdhery, Orch. Fl. Arunachal Pradesh 176. 1998; N. Pearce & P.J. Cribb, Orchids Bhutan 293. 2002. *Orchis triplicata* Willemet, Ann. Bot. (Usteri) 18: 52. 1796. *Calanthe veratrifolia* R.Br. ex Ker Gawl., Bot. Reg. 9: t. 720. 1823; Hook.f., Fl. Brit. India 5: 851. 1890; C.E.C. Fisch., Fl. Madras 3: 1001. 1956.

Plant 45–90 cm high. Pseudobulbs ovoid-conic, 1.5–3.0 × 1–2 cm, with 2–3 sheaths. Leaves 3–4, ovate-lanceolate, 30–55 × 5–12 cm, plicate, glabrous, apex acuminate; petiole 10–16 cm long. Inflorescence erect, arising from leaf axil, 30–60 cm long, puberulent; rachis 8–20 cm, sub-densely many flowered; floral bracts persistent, ovate-lanceolate,

1–2 cm. Flowers white; pedicel and ovary 3–4 cm long, pubescent. Dorsal oblong-lanceolate 1.0–1.2 × 0.4–0.5 cm, abaxially puberulent, 5-nerved, apex acute; lateral sepals obovate-lanceolate, 1.0–1.3 × 0.5–0.6 cm slightly oblique, 5-nerved. Petals recurved, obovate-lanceolate, 0.8–1.0 × 0.3–0.4 cm, abaxially puberulent, 3-nerved, base clawed. Lip adnate to column wings, 1.5–2.0 × 1.4–1.5 cm, deeply 3-lobed; lateral lobes oblong to narrowly obovate-cuneate, ca. 7 × 3 mm, apex obtuse; mid-lobe deeply 2-lobed; lobules divergent, linear-oblong, nearly as large as lateral lobes, ca. 3 mm wide, sub-truncate at apex; disk with 3–4 rows of small, golden or orange-red, wartlike calli at base; spur straight, white, cylindric, 1.2–1.5 cm long, slender, sparsely pubescent outside, apex obtuse. Pollinia clavate, unequal in size, 2–4 mm long; caudicles conspicuous; viscidium



Calanthe triplicata (Willemet) Ames: a plant in its natural habitat (left) and closeup of inflorescence (right)

subelliptic, small. Column *ca.* 5 mm long, dilated at apex, sparsely puberulent; rostellum 2-lobed.

Habitat: Terrestrial, in tropical wet evergreen forests.

Flowering: April–May.

Occurrence: Baksa and Chirang: Manas B.R., Bansbari; Karbi Anglong: Dili Terang *ca.* 546 m; Karimganj: Ramkrishna Nagar; Kokrajhar: Chirang R.F.; Lakhimpur: Dullung and Kakoi R.F.; North Cachar Hills: Nerpung.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim,

West Bengal, Orissa, Andhra Pradesh, Karnataka, Kerala, Tamil Nadu, Andaman Is.), Bhutan, China, Japan, Myanmar, Thailand, Laos, Cambodia, Vietnam, Malaysia, Indonesia, Philippines, Bismarck Archipelago, New Guinea, Solomon Is., Australia, Caroline Is., Marianas, Society Is., Tubuai Is., Fiji, New Caledonia, Samoa, Tonga, Vanuatu, Wallis-Futuna Is.

Regional Conservation Status: Least Concern.

Cephalantheropsis Guillaumin

Terrestrial herbs with creeping rhizome. Stem erect, many noded, cylindric, usually enclosed in tubular sheaths toward base, leafy above. Leaves many, plicate, base narrowed into an amplexicaul sheath, articulate. Inflorescences usually 1–3, arising laterally from nodes in lower half of stem, erect or ascending, racemose; peduncle with several amplexicaul sterile bracts at base; rachis many flowered; floral bracts caducous, lanceolate. Flowers small to medium-sized, opening widely or not. Sepals and petals similar, free, spreading to reflexed; petals sometimes broader than sepals. Lip adnate to base of column, 3-lobed above middle, spurless but base shallowly saccate or concave; lateral lobes erect, loosely embracing column; mid-lobe expanding from a short claw, usually 2-lobulate, apical margin usually strongly crisped; disk sometimes with a callus composed of 2 lamellae. Anther terminal, incumbent; pollinia 8, in 2 groups of 4, equal in size, narrowly obovoid, waxy, borne on a globose viscidium. Column stout, winged, slightly dilated at base; foot absent; rostellum ovate, small; stigma subterminal, suborbicular.

Four species; distributed from NE India through China, Japan, Indochina to Indonesia and eastward up to Philippines; 2 species in India as well as in Assam.

Key to the Genera

- 1a. Sepals and petals green; lip white with orange-yellow spots, side-lobes with terminal auricles *C. obcordata*
 1b. Sepals and petals white, lip with yellow at centre; side-lobes of lip without terminal auricles *C. longipes*

Cephalantheropsis longipes (Hook.f.) Ormerod, Orchid Digest 62: 156. 1998; N.Pearce & P.J.Cribb, Orchids Bhutan 298. 2002; Lucksom, Orchids Sikkim N.E. Himalaya 431. 2007. *Calanthe longipes* Hook.f., Fl. Brit. India 6: 195. 1890. *Phaius longipes* (Hook.f.) Holttum, Gard. Bull. Singapore 11: 286. 1947; Katakai, Orchids Meghalaya 103. 1986; H.J.Chowdhury, Orch. Fl. Arunachal Pradesh 582. 1998; Sud.Chowdhury, Assam's Fl. 317. 2005.

Plant 30–50 cm high. Stem erect, cylindric, base slightly swollen bearing several tubular sheaths 5–8-leaved above. Leaves elliptic to elliptic-oblong, 6–22 × 1.8–5.0 cm, apex shortly acuminate, base sheathing, subsessile or petiolate. Inflorescences erect, 10–20 cm long, arising from about half-way up stem, slender, pubescent; peduncle with 3–4 scattered sheaths; rachis 3–9 cm, laxly few to manyflowered; floral bracts caducous, lanceolate. Flowers ca. 1 cm in across, sepals and petals white, lip white with a yellow band at centre, all parts turning orange with age; pedicel and ovary

clavate, 1–2 cm long, pubescent. Sepals similar, lanceolate, 7–9 × 2.5–3 mm, pubescent outside, apex acuminate. Petals ovate, 5–7 × 2–3 mm, glabrous, margin erose, apex acute. Lip ovate-oblong, 5–6 × 3–4 mm, 3-lobed above middle; side-lobes erect, triangular-ovate, ca. 1.5 mm long, without any terminal auricles, apices subtruncate and irregularly incised; mid-lobe oblong-flabelliform, ca. 1.5 × 3 mm, shortly clawed at base, margin strongly undulate-crenulate, apex emarginate; disk with 2 yellow keels extending from base of lip to base of mid-lobe. Column ca. 3 mm long, hirsute at apex. Capsule ellipsoid, ca. 1.2–1.4 × 0.5–0.6 cm.

Habitat: Terrestrial, grows on shady forest floors.

Flowering: September–November.

Occurrence: Baksa and Chirang: Manas B.R.; Kokrajhar: Chirang R.F.; North Cachar Hills: Laisong ca. 870 m; Tinsukia: Parbatia (*vide* Chowdhury l.c.).

Distribution: India (Assam, Arunachal Pradesh,



Cephalantheropsis longipes (Hook.f.) Ormerod: a plant in its natural habitat

Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal), China, Myanmar, Thailand, Vietnam, Malaysia, Indonesia, Philippines.

Regional Conservation Status & Criteria:

Vulnerable, VU B2b(ii)c(iii).

Cephalantheropsis obcordata (Lindl.) Ormerod, Orchid Digest 62: 157. 1998. *Bletia obcordata* Lindl., Gen. Sp. Orchid. Pl. 123. 1831. *Calanthe gracilis* Lindl., Gen. Sp. Orchid. Pl. 251. 1833; Hook.f., Fl. Brit. India 5: 855. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 165. 1898; H.J. Chowdhery, Orch. Fl. Arunachal Pradesh 165. 1998. *Limatodis gracilis* (Lindl.) Lindl., Fol. Orchid. 6: 1. 1855. *Cephalantheropsis gracilis* (Lindl.) S.Y. Hu, J. Taiwan Mus. 25: 213. 1972. **Fig. 110 (A–Q).**

Plants 40–90 cm high. Stem erect, cylindric, many

noded, base with tubular membranous sheaths, 5–9-leaved above. Leaves oblong or oblong-lanceolate, 15–35 × 3–8 cm, base narrowed into a short petiole, apex acuminate. Inflorescences erect, 30–50 cm long, usually unbranched or rarely with 1 or 2 branches near base; peduncle densely pubescent, with a few scattered sheaths; rachis 6–20 cm long, laxly many-flowered; floral bracts narrowly lanceolate, 2–4 cm long, membranous, apex acuminate. Flowers slightly fragrant, opening widely; sepals and petals green to pale-green, lip white with a central orange-yellow spots, all parts turning orange-brown with age; pedicel and ovary 1–2 cm long, densely pubescent. Sepals similar, elliptic-lanceolate 0.9–1.1 × 0.3–0.4 cm, pubescent outside, inner surfaces glabrous or sparsely pubescent, 3–5-veined, apex strongly recurved, apiculate. Petals ovate-elliptic, 0.8–1.0 × 0.3–0.4

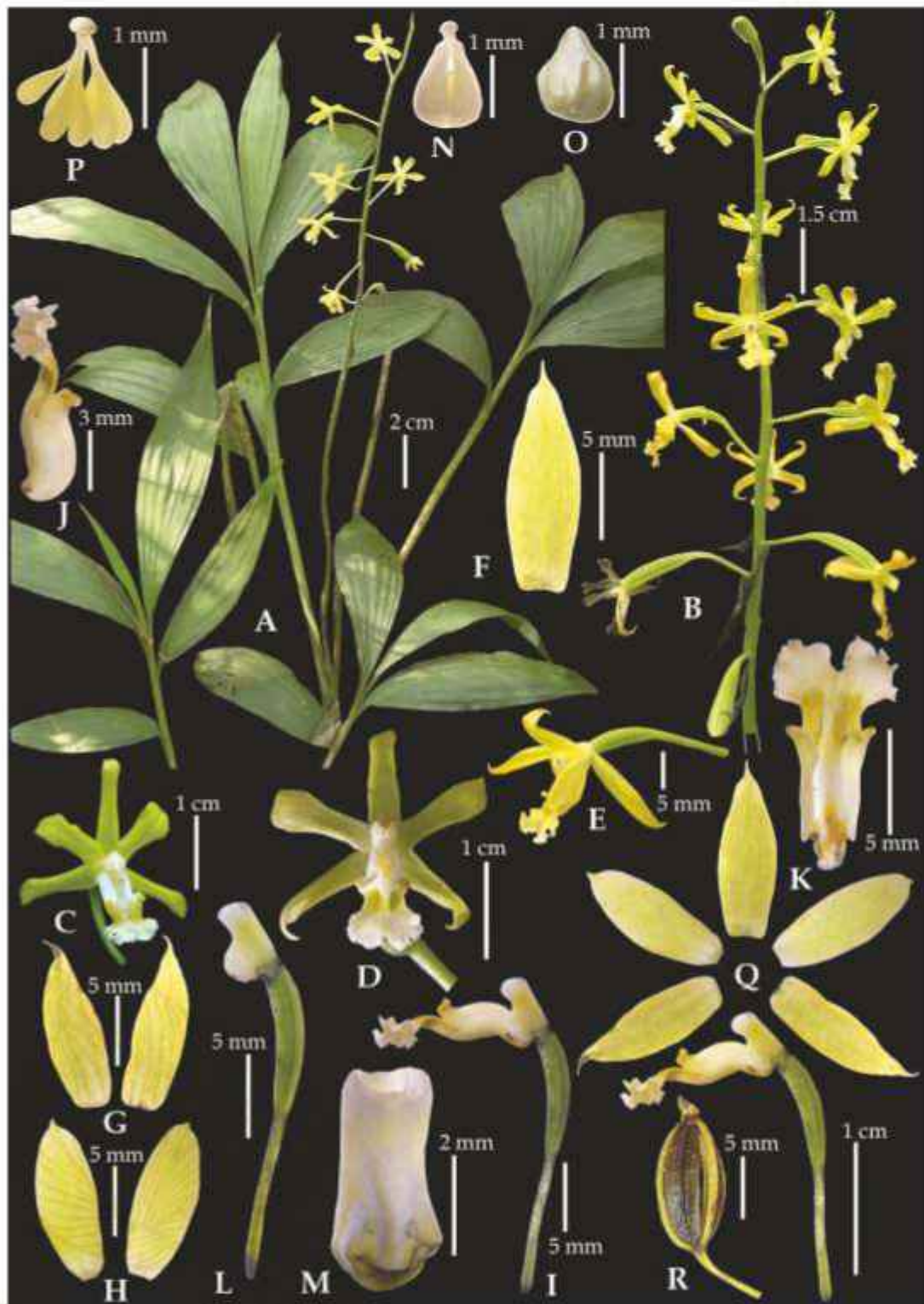


Figure 110. A–Q: *Cephalantheropsis obcordata* (Lindl.) Ormerod: A. Habit; B. Close-up of Inflorescence; C. Flower (ventrolateral view); D. Flower (front view); E. Flower (lateral view); F. Dorsal sepal; G. Lateral sepals; H. Petals; I. Labellum, column, pedicel & ovary (lateral view); J. Labellum (lateral view); K. Labellum (dorsal view); L. Column, pedicel & ovary (lateral view); M. Column (ventral view); N. Anther cap with pollinia; O. Anther cap; P. Pollinia; Q. Floral analysis.



Cephalantheropsis obcordata (Lindl.) Ormerod: a plant in its natural habitat (left) and closeup of inflorescence (right)

cm, pubescent outside, 3-veined, apex recurved, apiculate. Lip suboblong, $0.9\text{--}1.2 \times 0.5\text{--}0.7$ cm, slightly saccate at base, 3-lobed above middle; sidelobes suberect, firmly embracing column, with distinct subtriangular-falcate auricles projecting forward with acute apices; mid-lobe subreniform, $2\text{--}3 \times 5\text{--}7$ mm, shortly clawed at base, margin strongly crisped, apex emarginate; disk with 2 yellow keels extending from near base of lip onto claw of mid-lobe and with many orange-red papillae in between. Pollinia ca. 0.8 mm. Column 3–5 mm long, slightly dilated at base, hairy; rostellum ovate-triangular, small. Capsule cylindric, $1.5\text{--}2.0 \times 0.8\text{--}1.0$ cm, ribbed.

Habitat: Terrestrial in broad-leaved and mixed evergreen forests.

Flowering: November–December.

Occurrence: Cachar: Borail W.L.S.; Karbi Anglong: Longkangaon ca. 530 m; Kokrajhar: Ultapani; North Cachar Hills; Haflong, Bara Mulikai.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim), Bangladesh, China, Japan, Myanmar, Thailand, Laos, Vietnam, Malaysia, Philippines.

Regional Conservation Status: Near Threatened.

Chrysoglossum Blume

Terrestrial herbs. Rhizome creeping, terete, unbranched. Pseudobulbs alternately 1–6 bearing a leaf and 1 bearing an inflorescence, ascending, more or less clearly articulated at the junction with petiole or scape. Leaf 1 per pseudobulb, convolute, petiolate; petiole semiorbicular, channelled; main nerves prominent. Inflorescence an erect raceme; peduncle terete with few tubular, persistent, scales; rachis terete. Flowers resupinate, more or less widely opening. Lateral sepals inserted on the column foot, equal in size and shape. Petals equal in size and shape. Lip mobile, narrowly attached on the column foot, 3-lobed, more or less fleshy; hypochile with the claw on either side more or less strongly pleated; front part on either side with an erect lateral lobe; lateral keels 2; median keel starting at the base as a little lobe, continuing as a much lower ridge, between the lateral lobes high again; epichile recurved, more or less concave, lateral margins incurvate to inrolled. Anther 2-celled, elliptic to rectangular in outline; top obtuse to truncate, with an acute, narrowly triangular tip; pollinia conical, waxy, without appendages. Column erect, slightly curved, semi-orbicular in cross-section; starting between the front lobes with 2 large, lateral, fleshy keels which continue upwards on the column where they end and fuse; on the margin of the column laterally on either side with a narrow seam which is drawn out into a distinct, flat wing, continuing upwards as a narrow seam which ends laterally of the stigma; column foot distinct, with a saccate spur with a narrow entrance; the front of the column foot with a small lobe.

Four species; distributed in tropical Asia to New Guinea and the Pacific islands; 2 species in India as well as in Assam.

Key to the Species

- 1a. Margins of the claw of the lip with one pleat, and one shallow wave which can be absent, glabrous.
Spur of the column foot short and wide, less than 1.5 times as long as broad, 0.5–2.5 mm long. Margin of the stigma entire *C. ornatum*
- 1b. Margins of the claw of the lip with 2 shallow pleats and once folded downwards; very finely papillose.
Spur of the column foot slender, more than twice as long as broad, 2.5–3.3 mm long. Base of the margin of the stigma laterally on either side with a distinct protruding point *C. assamicum*

Chrysoglossum assamicum Hook.f., Fl. Brit. India 5: 784. 1890; W.Burgh & de Vogel, Orchid Monogr. 8: 140. 1997; Sud.Chowdhury, Assam's Fl. 79. 2005. *Collabium assamicum* (Hook.f.) Seidenf., Opera Bot. 72: 24 1983. *Chrysoglossum sinense* Mansf., Repert. Spec. Nov. Regni Veg. 27: 295 1930. **Fig. 111 (A–G).**

Pseudobulbs alternately 1 bearing a leaf and 1 bearing an inflorescence, borne 2–4 cm apart on rhizome, cylindric-conic, 4–6 × 0.4–1.2 cm, base slightly dilated, covered with membranous tubular sheaths. Leaf blade elliptic-lanceolate, 20–35 × 4.5–12 cm, papery, 5-nerved, prominent below, base attenuate, apex shortly acuminate; petiole 9–12 cm

long. Inflorescence erect; peduncle up to 1 m long, glabrous, covered with 4–5 sheaths; rachis 15–20 cm long, laxly 8–12-flowered; floral bracts narrowly lanceolate, 0.9–1.5 × 0.2–0.3 cm. Flowers white; pedicel and ovary 2.0–2.5 cm long, slender. Dorsal sepal narrowly oblong, 1.4–1.8 × ca. 0.3 cm, with inconspicuous veins, apex slightly obtuse; lateral sepals falcate-oblong, 1.4–1.8 × 0.3–0.4 cm, with 3 inconspicuous veins, apex obtuse, base adnate to apex of column foot; mentum spurlike, ca. 4 mm long. Petals similar to lateral sepals, 1.3–1.7 × ca. 0.2 cm. Lip obovate-cuneate, ca. 1 cm long, 3-lobed; lateral lobes subovate, ca. 1 cm wide (when flattened), apex obtuse; mid-lobe broadly obovate,

4–6 × 5–7 mm, concave, apex subtruncate; disk with 3 lamellae, median shorter. Column *ca.* 1 cm long, winged, with conspicuous foot; wings with 1 decurved toothlike arm on either side of middle part; stigma ligulate.

Habitat: Terrestrial, grows on hill slopes.

Flowering: April–May.

Occurrence: North Cachar Hills: Shimtilong *ca.* 1230 m; Tinsukia: Sadiya (*vide* Chowdhury *l.c.*).

Distribution: India (Assam, Arunachal Pradesh, Nagaland), Bangladesh, China, Thailand, Vietnam.

Regional Conservation Status & Criteria:

Endangered, EN B2b(ii)c(iii).

Chrysoglossum ornatum Blume, Bijdr. 338. 1825; Seidenf., Opera Bot. 72: 20. 1983; W.Burgh & de Vogel, Orchid Monogr. 8: 143. 1997; N.Pearce & P.J.Cribb, Orchids Bhutan 308. 2002; Lucksom, Orchids Sikkim N.E. Himalaya 435. 2007. *Chrysoglossum erraticum* Hook.f., Fl. Brit. India 5: 784. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 97. 1898; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 197. 1998. **Fig. 111 (H–N).**

Pseudobulbs alternately 1–6 bearing a leaf and 1 bearing an inflorescence, borne 1–2 cm apart on rhizome, cylindric-conic, 2.8–5.3 × 0.4–1.0 cm. Leaf blade lanceolate, strongly plicate, 17–32 × 5.0–7.5 cm, papery, 5-veined, base cuneate, apex shortly acuminate; petiole 6–21 cm long. Inflorescence a raceme; peduncle up to 50 cm long, glabrous, with 4–5 sheaths; rachis up to 34.5 cm long, 1–3 mm in diam., laxly 10–25-flowered; floral bracts lanceolate, 1.0–1.3 cm long, acuminate. Flowers green with reddish brown spots, lip white or yellowish spotted with purple, column white; pedicel and ovary up to 2 cm long. Dorsal sepal linear-lanceolate, 1.0–1.9 × 0.2–0.4 cm, 5-veined, apex acute; lateral sepals falcate-oblong, 1.0–1.6 × 0.2–0.35 cm, 5-veined, apex acute; mentum conic, *ca.* 2 mm long. Petals falcate, 1.0–1.6 × 0.3–0.45 cm, apex acute, 5-nerved, nerves not prominent. Lip somewhat fleshy, 0.8–1.0 cm long, 3-lobed near

middle; lateral lobes erect, ovate-triangular, rounded; mid-lobe broadly elliptic or orbicular, concave; disk with 3 lamellae, lateral 2 incurved at middle, median shorter. Column slender to rather stout, upper part strongly curved, 6–8 mm, winged, near middle with 2 auricles, base dilated, foot 1.5–3 mm long.

Habitat: Terrestrial on shaded forest floors.

Flowering: June–August.

Occurrence: Dibrugarh and Tinsukia: Dehing Patkai W.L.S.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal), Bhutan, Nepal, China, Sri Lanka, Myanmar, Thailand, Laos, Cambodia, Vietnam, Malaysia, Indonesia, Philippines, New Guinea, Fiji, New Caledonia, Samoa, Vanuatu.

Regional Conservation Status & Criteria:

Vulnerable, VU B2ab(ii)c(iii).



Chrysoglossum ornatum Blume: closeup of flowers

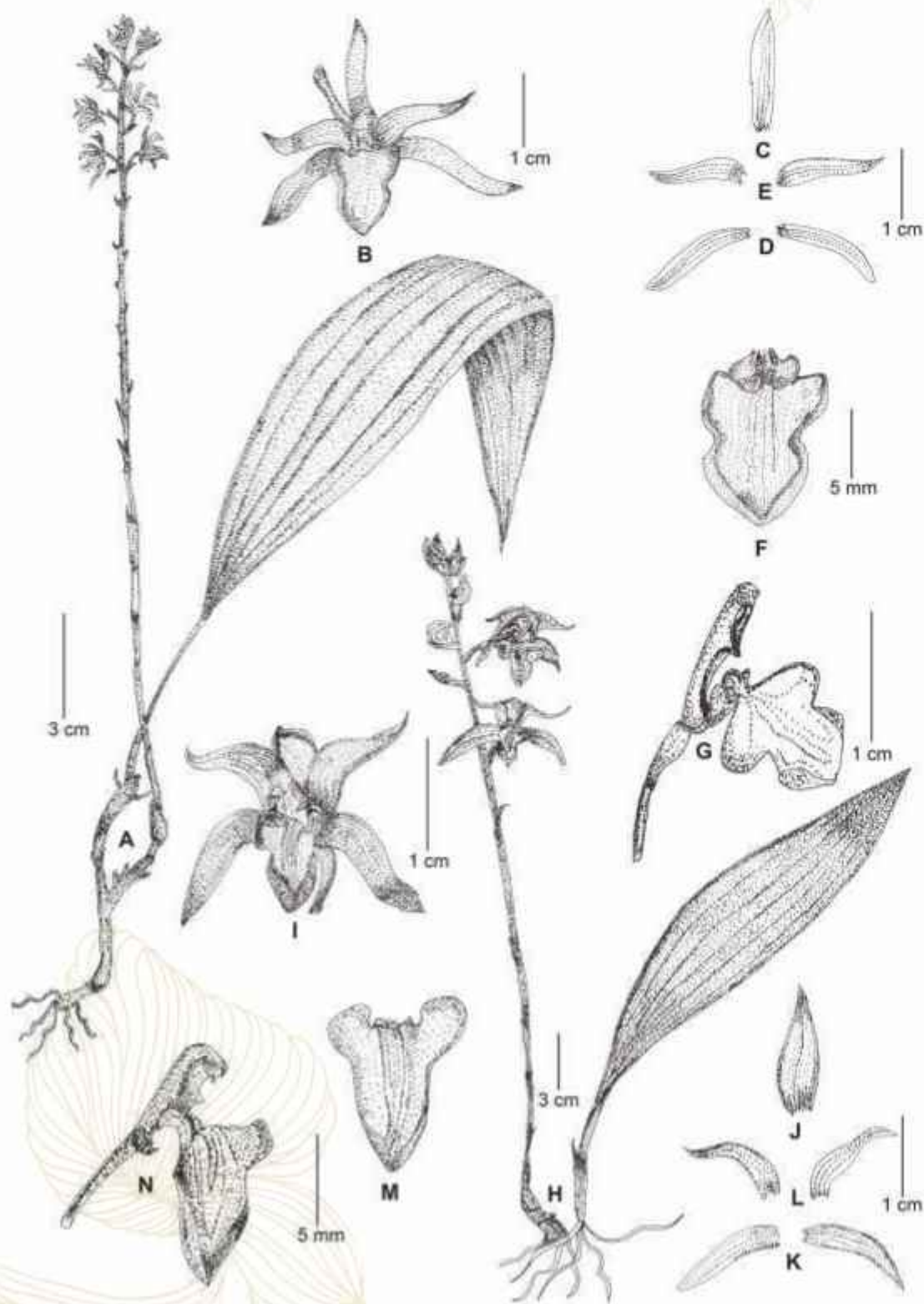


Figure 111. A–G: *Chrysoglossum assamicum* Hook.f.: A. Habit; B. Flower; C. Dorsal sepal; D. Lateral sepal; E. Petals; F. Lip; G. Lip with column, pedicel and ovary. H–N: *Chrysoglossum ornatum* Blume: H. Habit; I. Flower; J. Dorsal sepal; K. Lateral sepals; L. Petals; M. Lip; N. Lip with column, pedicel and ovary.

Collabium Blume

Terrestrial sympodial herbs. Rhizome branching or not, creeping, more or less terete; scales tubular, membranous, soon caducous, rarely persistent. Pseudobulbs alternately 1–6 bearing a leaf and 1 bearing an inflorescence, ascending, more or less clearly articulated at the junction with petiole or scape. Leaf 1 per pseudobulb, convolute, petiolate. Inflorescence an erect raceme, unbranched. Flowers resupinate, opening widely. Lateral sepals inserted on column foot. Lip immovable, narrowly attached to column foot, usually 3-lobed, without spur; basal portion of hypochile clawlike with parallel margins, front part usually with side-lobes, lateral keels 2, from base elevating into an entire lobe or into an oblique structure hollow in front, from there continuing to front, median keel absent or present, simple; epichile recurved. Anther 2-locular; pollinia 2, hard, waxy, without appendages, obliquely conic with an obtuse top and a hollow base. Column sub-orbicular in cross-section, with a seam in front laterally on either side, foot with a spur. Capsule reflexed, fusiform, column and back wall of column foot persistent when mature, with an irregular row of unicellular hairs inside along margins.

About 14 species; distributed from the Himalayas via NE India to China, Indochina, Malaysia, Indonesia, Philippines, to New Guinea and the Pacific islands; 1 species in India as well as in Assam.

Collabium chinense (Rolfe) Tang & F.T.Wang, Fl. Hainan. 4: 217. 1977; W.Burgh & de Vogel, Orchid Monogr. 8: 153. 1997; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 245. 1998. *Nephelaphyllum chinense* Rolfe, Bull. Misc. Inform. Kew 1896: 194. 1896. *Chrysoglossum robinsonii* Ridl., J. Fed. Malay States Mus. 5: 157. 1915; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 197. 1998. **Fig 112 (A–G).**

Rhizome unbranched, terete, up to 15 cm long, 3–4 mm in diam. Pseudobulbs alternately 1–6 bearing a leaf and 1 bearing an inflorescence, cylindric to quadrangular, 2–4 × 0.3–0.5 cm, clearly articulated at the junction with petiole or scape. Leaf blade ovate to ovate-lanceolate, 10–18 × 3.2–8.5 cm, papery, base subrounded, apex acute to acuminate, main nerves 5–7, prominent below; petiole 1–2 cm. Inflorescence a raceme; peduncle 7.5–15 cm long, glabrous, with 2–4 membranous tubular sheaths; rachis 5–8 cm long, laxly 5–10-flowered; floral bracts ovate-oblong, 1.2–1.8 cm long, acuminate. Flowers medium-sized, sepals and petals green, lip white, column pale yellow; pedicel and ovary 1.0–1.5 cm long. Dorsal sepal lanceolate to linear-lanceolate 0.9–12 × 0.2–0.3

cm, 5-veined, acuminate; lateral sepals similar to dorsal one, but slightly falcate, base adnate to column foot, apex acuminate; mentum spurlike, cylindric, ca. 6 × 2.5 mm. Petals lanceolate, 8.5–13 × 0.2–0.3 cm, acuminate. Lip obovate, 0.9–1.3 cm long, clawed at base, 3-lobed; lateral lobes broadly subovate, 1.5–3 × 4–5 mm, obtuse; mid-lobe nearly oblate to subsquare, 8–9 mm wide, rounded, apical margin slightly denticulate; disk with 2 lunar lamellae running to basal claw. Column slender 5–7 mm long; spur 4–7.5 mm long, apex obtuse, more or less shallowly cleft; wings slightly dilated into triangular teeth on both sides near apex. Capsule reflexed, 2.7–3 × 0.8–1 mm.

Habitat: Terrestrial, grows on shaded forests floors.

Flowering: June–August.

Occurrence: Dibrugarh: Jeypore R.F; Karbi Anglong: Sikaribasti ca. 477 m; North Cachar Hills: Wadangdishia ca. 572 m; Tinsukia: Dehing Patkai W.L.S.

Distribution: India (Assam, Arunachal Pradesh, Nagaland), China, Thailand, Laos, Vietnam.

Regional Conservation Status: Least Concern.

Nephelaphyllum Blume

Terrestrial rhizomatous herbs. Pseudobulbs ascending, articulate at junction with petiole and peduncle, scales tubular, membranous, caducous. Leaf 1 per pseudobulb, convolute, petiolate; blade ovate to cordate, main veins prominent, often mottled; petiole sub-terete, channeled, not sheathing. Inflorescence racemose 2-16-flowered; peduncle with few internodes, scales persistent, tubular; rachis erect; floral bracts sessile. Flowers non resupinate, mostly opening simultaneously. Sepals reflexed or not, linear to lanceolate. Petals reflexed or not, lanceolate to linear, falcate or not. Lip fixed at column foot, parallel to column, blade flat or shallowly concave, or basal half tubular, entire or 3-lobed; disk with central 3 veins either keeled or with a plate like appendage or 1 or more rows of fleshy papillae or laciniae, adaxially glabrous, velvety hairy or with patches of hairs or both; spur clavate, cylindric, or saccate. Anther cap imperfectly 4-locular, with 2 horns; pollinia 8 in 2 groups of 4, solid, with caudicles, stipe and viscidium absent. Column with a flat foot. Capsule with persistent perianth.

About 11 species; distributed from Himalayas via NE India, China, Japan, Indochina, eastward through Malaysia and Indonesia to the Philippines; 3 species in India and 1 species in Assam.

Nephelaphyllum cordifolium (Lindl.) Blume, Fl. Javae Nov. Ser. 1: t. 61.3. 1858; Hook.f., Fl. Brit. India 5: 818. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 106. 1898; Katakai, Orchids Meghalaya 105. 1986; N. Pearce & P.J. Cribb, Orchids Bhutan 314. 2002; Lucksom, Orchids Sikkim N.E. Himalaya 398. 2007. *Cytheris cordifolia* Lindl., Gen. Sp. Orchid. Pl. 129. 1831. **Fig 112 (H-M).**

Plant 15–20 cm high. Rhizome creeping, fleshy. Pseudobulbs elongate, 6–7 cm long. Leaf blade ovate-cordate, 5–10 × 4.0–7.5 cm, apex acute, 5 -veined, green, mottled with purple, base petiolate; petiole 1–3 cm long. Inflorescence terminal, erect; peduncle glabrous, sheathed, 6–7 cm long; sheaths membranous, lanceolate, 1.5–2 cm long; rachis glabrous, 3–4 cm long, laxly 3–6-flowered; floral bracts linear, 4–7 × 0.5–1.0 mm, caducous. Flowers 1.5–2.0 cm in across; sepals and petals green, striped

purple, lip white or pale yellow, column pale yellow; pedicel and ovary 7–9 mm long. Sepals subequal, free, narrowly oblong, ca. 1 × 0.2 cm, acute to acuminate, spreading to recurved. Petals narrowly oblong, acute, gibbous at base, ca. 0.8 cm long. Lip 3-lobed, elongate to wedge-shaped, spurred, ca. 1.1 × 0.35 cm; lateral lobes narrow, diverging, margins erose; mid-lobe broad, retuse; disc with 3 stout, spine-like, undulate lamellae; spur blunt, 2-lobed, ca. 3 × 2 mm. Column ca. 4 mm long.

Habitat: Terrestrial, grows on dense hill slopes.

Flowering: June–July.

Occurrence: North Cachar Hills: Kapila ca. 1350 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal), Bangladesh.

Regional Conservation Status & Criteria:

Vulnerable, VU B2b(ii)c(iii).

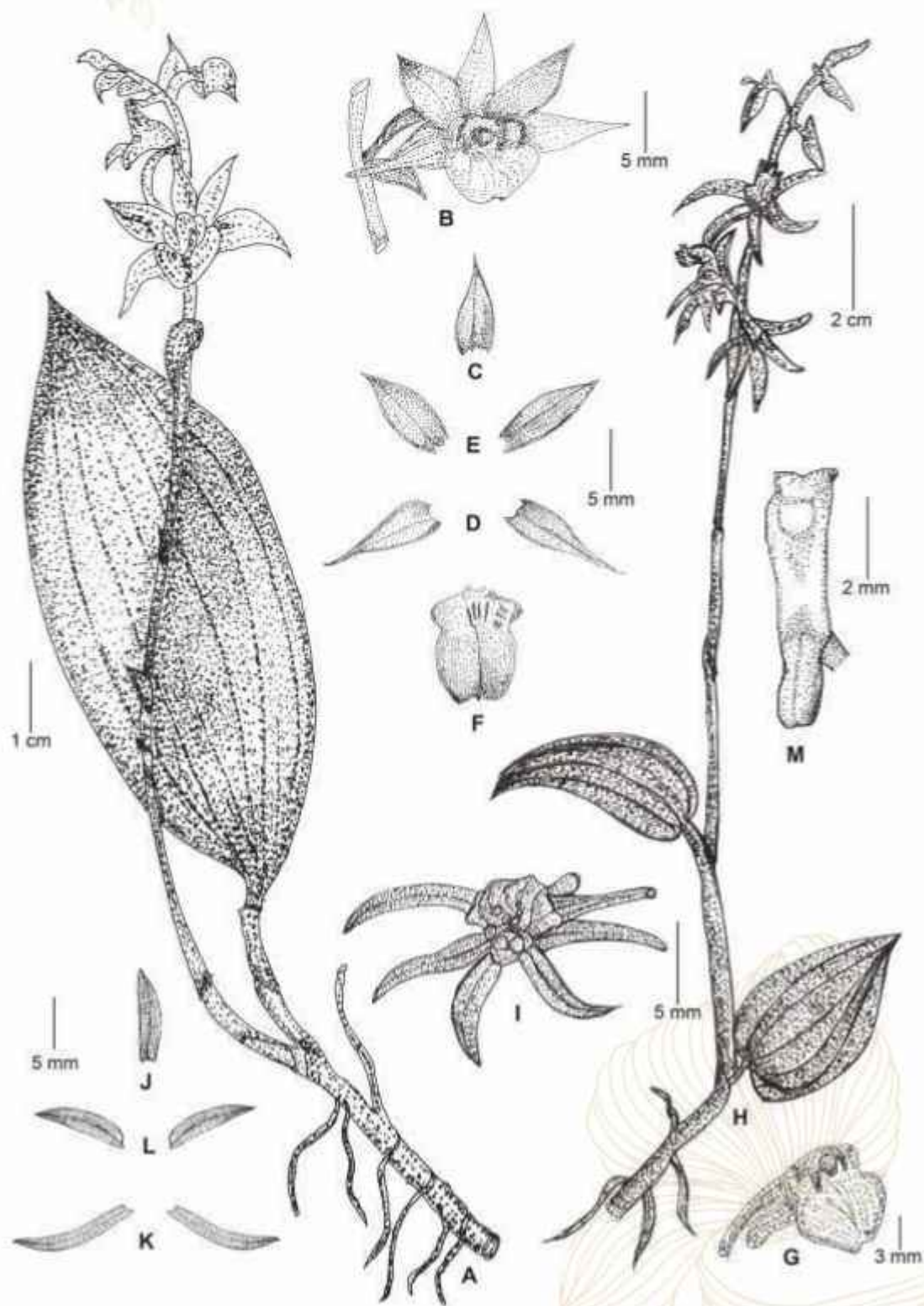


Figure 112. A–G: *Collabium chinense* (Rolfe) Tang & F.T.Wang: A. Habit; B. Flower with bract; C. Dorsal sepal; D. Lateral sepals; E. Petals; F. Lip; G. Lip with column. H–M: *Nephelaphyllum cordifolium* (Lindl.) Blume: H. Habit; I. Flower; J. Dorsal sepal; K. Lateral sepals; L. Petals; M. Column with spur.

Pachystoma Blume

Terrestrial rhizomatous herbs, with a distinct dormant period. Pseudobulb fleshy, cylindric or tuberous with distinct fertile and vegetative shoots. Leaves 1–2, erect, linear, plicate-venose, papery, subtended by a few sterile sheaths. Inflorescence racemose, erect, leafless; floral bracts persistent, lanceolate. Flowers subnutant, hairy; ovary hairy. Sepals subequal, not widely spreading, pubescent on both surfaces; dorsal sepal free; lateral sepals with oblique bases surrounding saccate lip base to form a blunt mentum. Petals free, linear, narrower than sepals, both surfaces pubescent. Lip attached to apex of column foot, fleshy, porrect, 3-lobed in apical half, subgibbous or saccate at base but lacking a spur; disk papillose; lateral lobes erect; mid-lobe recurved at blunt apex; callus of several papillose or verrucose linear ridges from base to apex of blade. Anther cap terminal, pubescent; pollinia 8, clavate, waxy, without conspicuous viscidium and stipe. Column clavate, incurved and winged at apex, pubescent; stigma transversely reniform-elliptic or dumbbell-shaped; rostellum obtuse. Capsule oblong, rostrate, ridged.

Three species; distributed from tropical Asia, Malay Archipelago, via Australia to New Guinea and New Caledonia; 1 species in India as well as in Assam.

Pachystoma pubescens Blume, Bijdr. 376, t. 3, f. 29. 1825; N. Pearce & P.J. Cribb, Orchids Bhutan 300. 2002; Lucksom, Orchids Sikkim N.E. Himalaya 397. 2007; Vij *et al.*, Orchids Himachal Pradesh 235. 2013; S.R. Talukdar & C. Deori, Indian Forester 141 (11): 1168. 2015. *Apaturia smithiana* Lindl., Gen. Sp. Orchid. Pl. 131. 1831. *Apaturia senilis* Lindl., Gen. Sp. Orchid. Pl. 130. 1831. *Pachystoma senile* (Lindl.) Rchb.f., Bonplandia (Hannover) 3: 251. 1855; Hook.f., Fl. Brit. India 5: 812. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 101. 1898; C.E.C. Fisch., Fl. Madras 3: 997. 1956; Katakai, Orchids Meghalaya 97. 1986; H.J. Chowdhery, Orch. Fl. Arunachal Pradesh 562. 1998; Sud. Chowdhury, Assam's Fl. 323. 2005.

Fig 113 (A–I).

Plant 35–60 cm high. Rhizome tuberous, subcylindric. Leaves 1–2, linear-lanceolate, 25–45 × 0.8–1 cm, narrowing at both ends. Inflorescence erect; peduncle whitish, slender, 30–50 cm long, with 6–8 membranous scale-like sheaths of 3–8.5 cm long; rachis 8–15 cm long, laxly 10–20-flowered; floral bracts erect, narrowly lanceolate, 1.5–2.5 cm long, membranous, abaxially sparsely pubescent, apex long acuminate. Flowers pinkish, 1–1.2 cm long, not widely opening, lip disc green; pedicel and ovary 0.8–1 cm long, densely pubescent; ovary slightly clavate. Dorsal sepal elliptic or ovate-lanceolate, 1.0–1.1 × 0.3–0.5 cm,

abaxially densely hairy, 5-veined, apex acute or subobtusely; lateral sepals oblong-lanceolate, 1.0–1.1 × 0.3–0.4 cm, abaxially densely hairy, 5-veined, apex acuminate or acute. Petals narrowly spatulate or oblanceolate, 1.0–1.1 × 0.1–0.2 cm, 3–5-veined, apex subobtusely or acute. Lip obovate, 1.0–1.1 × 0.5–0.6 cm, adnate to column foot, 3-lobed above middle; lateral lobes erect, suboblong, ca. 3 mm wide, obtuse; mid-lobe obovate, obtuse and mucronulate at apex; disk with 3–5 longitudinal papillate ridges running from base to apex of mid-lobe. Column slender, slightly curved, 0.8–1.0 cm long, densely hirsute, 2-winged at apex, base with a short foot.

Habitat: Terrestrial, grows on grassy hill slopes.

Flowering: February–April.

Occurrence: Cachar: Borail W.L.S.; Karbi Anglong: Dili Terang ca. 546 m; Karimganj: Uligapur T.E., Kaliganj; North Cachar Hills: Bara Arkap ca. 251 m; Sonitpur: Gahpur; Udalguri: Barnadi W.L.S.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Tripura, Sikkim, West Bengal, Bihar, Uttarakhand, Himachal Pradesh, Orissa, Chhattisgarh, Madhya Pradesh, Maharashtra, Karnataka, Tamil Nadu, Andaman & Nicobar Is.), Bangladesh, Bhutan, Nepal, China, Sri Lanka, Myanmar, Thailand, Laos, Cambodia,

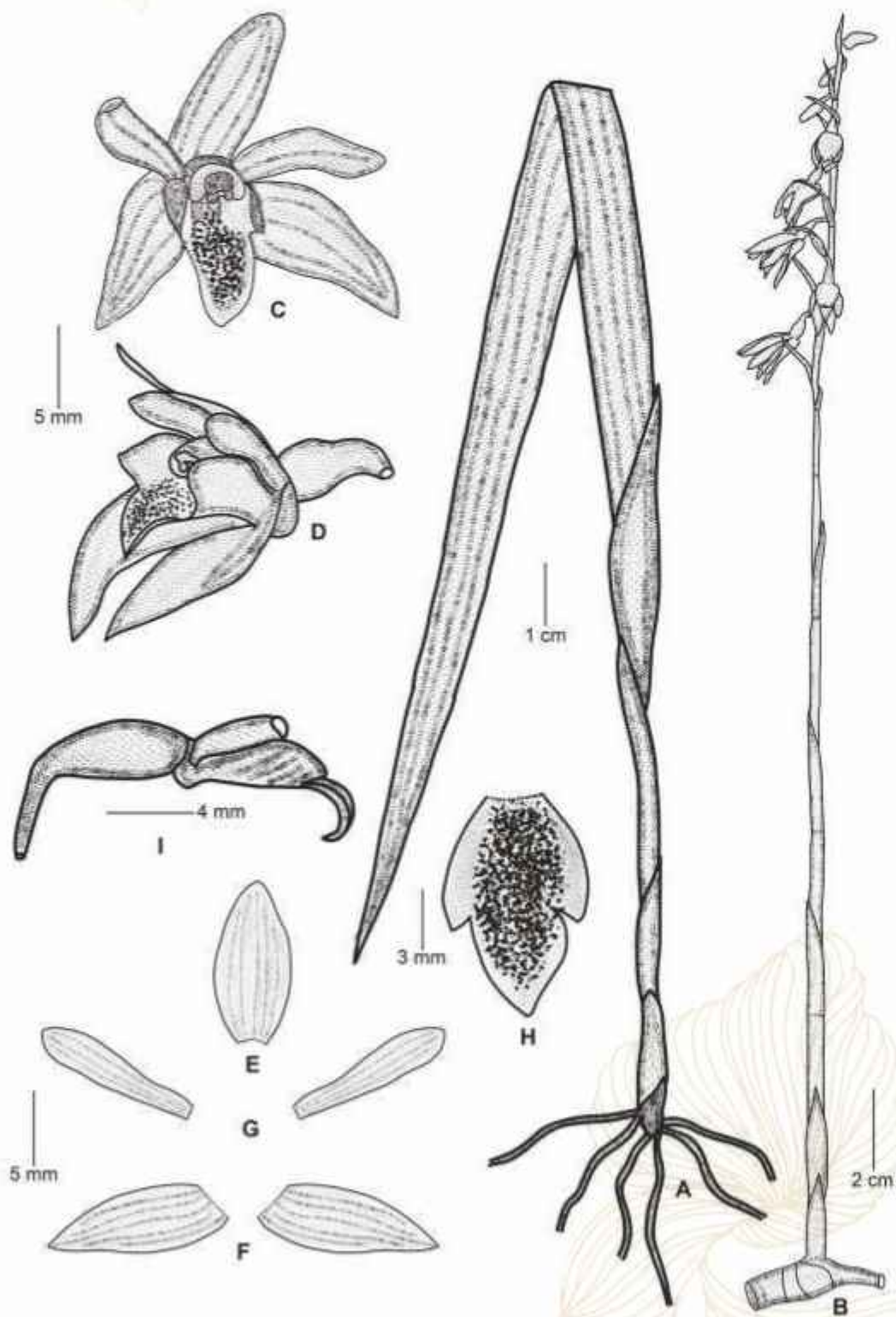


Figure 113. A–I: *Pachystoma pubescens* Blume: A. Leafy shoot; B. Flowering shoot; C. Flower – front view; D. Flower – side view; E. Dorsal sepal; F. Lateral sepals; G. Petals; H. Lip; I. Lip with column, pedicel and ovary.

Vietnam, Malaysia, Indonesia, Philippines, New Guinea, Australia, New Caledonia.

Regional Conservation Status: Least Concern.



Pachystoma pubescens Blume: plants in their natural habitat (left) and closeup of flowers (right)

***Phaius* Lour.**

Terrestrial herbs. Stem long, cylindric or short, pseudobulbous, many-noded; nodes long or short, sheathed. Leaves large, plicate, petiolate, apex acuminate to acute, with long, tubular sheath tightly embracing stem. Inflorescences 1–2, lateral on nodes of pseudobulb, higher or lower than leaves; peduncle with a few sparse sheaths; raceme with a few sparse or with many dense flowers, unbranched or rarely with a few branches at base; floral bracts large, apex acute; flowers ascending on raceme, often large. Sepals and petals sub-similar. Lip sessile, enveloping the column, erect, 3-lobed. Anther terminal, 2-locular; pollinia 8, waxy, in 2 groups, attached by caudicles to a sticky substance. Column long and stout, dilated at apex, usually winged; rostellum large or inconspicuous, unlobed; stigma lateral.

About 45 species; distributed in tropical and subtropical Asia to Oceania, also in tropical Africa and Madagascar; 6 species in India and 4 species in Assam.

Key to the Species

- 1a. Scape from leaf axis halfway up the stem *P. mishmensis*
- 1b. Scape from base of stem or side of pseudobulb 2
- 2a. Flowers mostly yellow; sepals and petals erecto-patent *P. flavus*
- 2b. Flowers not yellow; sepals and petals widely spreading 3
- 3a. Flowers nutant or subnutant; sepals and petals rather blunt with brown inner surfaces and white outer surfaces; lip deep purple or purple with a white fringe and small, blunt, not deflexed midlobe; spur short, 0.4–0.8 cm long, obtuse *P. tankervilleae*
- 3b. Flowers spreading; sepals and petals ochre-coloured, acuminate; lip with a yellow and purple-marked throat and a large, white, cuspidate, deflexed midlobe; spur slender, 1–2 cm long, distinctly bifid at the tip *P. wallichii*

Phaius flavus (Blume) Lindl., Gen. Sp. Orchid. Pl. 128. 1831; Kataki, Orchids Meghalaya 101. 1986; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 582. 1998; Hynn. *et al.*, Orchids Nagaland 243. 2000; N.Pearce & P.J.Cribb, Orchids Bhutan 303. 2002; Sud.Chowdhury, Assam's Fl. 317. 2005; Lucksom,

Orchids Sikkim N.E. Himalaya 433. 2007. *Limodorum flavum* Blume, Bijdr. 375. 1825. *Phaius maculatus* Lindl., Gen. Sp. Orchid. Pl. 127. 1831; Hook.f., Fl. Brit. India 5: 817. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 107. 1898.



Phaius flavus (Blume) Lindl.: inflorescence (left) and closeup of flowers (right)

Plants 45–95 cm high. Pseudobulb broadly ovoid, 5–12 × 3–5 cm, sheathed. Leaves 4–8, elliptic-lanceolate, 25–40 × 4–7 cm, many-nerved, glabrous, base tapering into a petiole, sometimes yellow-spotted, apex acuminate. Inflorescences arising from basal or lower nodes of pseudobulb, 15–20 cm long, 8–25-flowered; floral bracts persistent, ovate-lanceolate, 2.5–4 × 0.5–0.7 cm, glabrous. Flowers yellow, not widely opening, 4–6 cm in across; pedicel and ovary 2–3 cm, glabrous. Sepals subsimilar, oblong-obovate, 2.5–3.5 × 0.7–1.4 cm, glabrous, apex obtuse to subacute. Petals oblong-elliptic, 2.5–3.5 × 0.7–1.5 cm, apex subacute. Lip obovate, 2.5–4.5 × 2.2–4.5 cm, yellow with orange-brown marks at apex, shallowly 3-lobed; side-lobes subobovate, apex rounded-truncate; mid-lobe orbicular, undulate-crisped, apex emarginate; disk with 3–4 brown ridges, glabrous; spur conical, straight, ca. 1.5 cm long, apex obtuse. Column white, 1.5–2 cm long, densely white pubescent ventrally; rostellum suborbicular.

Habitat: Terrestrial in evergreen forests or on moss covered wood logs.

Flowering: February–April.

Occurrence: Dibrugarh: Jeypore R.F.; Karbi Anglong: Bar Dambuk ca. 593 m; North Cachar Hills: Ngalsung ca. 800 m; Tinsukia: Upper Dihing R.F.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Tripura, Sikkim, West Bengal), Bhutan, Nepal, China, Japan, Myanmar, Thailand, Laos, Vietnam, Malaysia, Indonesia, Philippines, New Guinea, New Caledonia, Samoa, Vanuatu.

Regional Conservation Status & Criteria:

Vulnerable, VU B2b(ii)c(iii).

Phaius mishmensis (Lindl. & Paxton) Rchb.f., Bonplandia (Hannover) 5: 43. 1857; Hook.f., Fl. Brit. India 5: 817. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 109. 1898; Kataki, Orchids Meghalaya 102. 1986; H.J. Chowdhery, Orch. Fl. Arunachal Pradesh 583. 1998; N. Pearce & P.J. Cribb, Orchids Bhutan 303. 2002; Sud. Chowdhury, Assam's

Fl. 326. 2005; Lucksom, Orchids Sikkim N.E. Himalaya 432. 2007. *Limatodis mishmensis* Lindl. & Paxton, Paxton's Fl. Gard. 3: 36. 1852.

Plant 50–150 cm high. Pseudobulb stemlike, cylindric, 30–70 × 0.6–1.5 cm, many noded; internodes ca. 4 cm long. Leaves 4–7, alternate, elliptic-lanceolate, 20–30 × 10–15 cm, glabrous, apex acute. Inflorescences arising from middle nodes of pseudobulb or axils of upper leaves above middle, 35–45 cm long, laxly 2–10-flowered, glabrous; floral bracts caducous, lanceolate, 2.3–4 cm long, glabrous. Flowers pink, not opening widely, 6–7 cm long, 2.5–3 cm in across; pedicel and ovary 2–3 cm long, glabrous; sepals and petals pale pink to purplebrown. Sepals similar, oblong-lanceolate, 2.5–3.5 × 0.5–1.2 cm, glabrous, apex subacute. Petals linear oblong, 2–3.5 × 0.4–0.7 cm, apex obtuse. Lip white with densely pink, obovate-quadrangular, 2–3.5 × 1.8–2.5 cm, 3-lobed at apex; lateral lobes ovate, margins entire, apex obtuse or rounded; mid-lobe subsquare, margin undulate, apex emarginate; disc with 3–4 densely hirsute-pubescent ridges extending to mid-lobe; spur slightly curved, near apex, yellowgreen, narrowly cylindric, 1.2–1.7 × 0.2–0.3 cm, apex obtuse. Column whitish, 2.2–2.5 cm long, densely villous ventrally; rostellum triangular.

Habitat: Terrestrial on moist hill slopes.

Flowering: September–November.

Occurrence: Dibrugarh: Jeypore R.F.; Karbi Anglong: Jengpata ca. 800 m; Lakhimpur: N. Lakhimpur; North Cachar Hills: Leike ca. 1262 m; Tinsukia: Digboi.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal, Bihar), Bhutan, China, Myanmar, Thailand, Laos, Vietnam, Philippines.

Regional Conservation Status & Criteria:

Vulnerable, VU B2b(ii)c(iii).

Phaius tankervilleae (Banks) Blume, Mus. Bot. 2: 177. 1856; Kataki, Orchids Meghalaya 102. 1986; H.J. Chowdhery, Orch. Fl. Arunachal Pradesh 583. 1998; Hynn. et al., Orchids Nagaland 243.



Phaius mishmensis (Lindl. & Paxton) Rchb.f.: plants in their natural habitat (left) and closeup of a flower (right)

2000; N.Pearce & P.J.Cribb, Orchids Bhutan 305. 2002; P.J.Cribb *et al.*, Kew Bull. 59(4): 549. 2004; Sud.Chowdhury, Assam's Fl. 326. 2005; Lucksom, Orchids Sikkim N.E. Himalaya 433. 2007. *Limodorum tankervilleae* Banks, Icon. t. *Limodorum tankervilleae* 1788. *Phaius blumei* Lindl., Gen. Sp. Orchid. Pl. 127. 1831; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 108. 1898. *Phaius veratrifolius* (Roxb.) Lindl., Gen. Sp. Orchid. Pl. 127. 1840; Hook.f., Fl. Brit. India 5: 816. 1890. *Phaius blumei* var. *assamica* Rchb.f., Gard. Chron. n.s., 17: 558. 1882. *Phaius blumei* var. *pulchra* King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 109. 1898. *Phaius wallichii* Lindl. var. *assamicus* (Rchb.f) King & Pantl., Ann. Roy. Bot. Gard (Calcutta) 8: t. 151. 1898.

Plant 60–150 cm high. Pseudobulbs ovoid to obliquely ovoid, 3–4 × 3–3.5 cm, sheathed by leaf

bases, Leaves 5–6, elliptic-lanceolate, 19–55 × 3.5–10 cm acuminate, thin-textured; petiole 15–25 cm long. Inflorescence lateral, laxly 10–20-flowered; peduncle stout, terete, sheathed, *ca.* 50 cm high; sheaths elliptic-lanceolate, 4–6 cm long; rachis *ca.* 18 cm long; floral bracts spathe-like, caducous, 4–5 cm long. Flowers 10–12.5 cm across; sepals and petals white on outer surface, chestnut-brown to cinnamon-brown within, lip dull purple with darker venation and a pinkish mauve apical rim; pedicel and ovary 4.5–4.9 cm long. Sepals and petals similar, spreading, lanceolate to oblanceolate, 4.0–6.5 × 1.0–1.5 cm, apex acuminate. Lip tubular below, 3-lobed, spurred, obovate, 3.5–5 × 2–4.5 cm, acute or apiculate margin crisped-undulate, recurved; midlobe broadly oblong-ovate, 2.0–2.5 cm wide, apex obtuse; callus obscurely 3-ridged,



Phaius tankervilleae (Banks) Blume: plant habit (left) and closeup of a flower (right)

usually extending from base to apex; spur slender, 3–6 mm long, slightly cleft at apex. Column clavate, white streaked with purple at the base, 2.0–2.2 cm long, winged at apex, sparsely pilose on back; stigma *ca.* 4 mm long and wide. Capsule ellipsoid, 5–7 × 1.5–3 cm long beaked.

Habitat: Terrestrial, grows on shaded forest floors.

Flowering: March–May.

Occurrence: Baksa and Chirang: Manas B.R.; Bongaigaon: Kakoijana R.F.; Cachar: Borail W.L.S.; Dhemaji: Arunachal border; Dibrugarh: Jeypore R.F.; Golaghat and Karbi Anglong: Nambor W.L.S.; Kamrup: Garbhanga R.F.; Kokrajhar: Chirang R.F.-Ultapani; Lakhimpur: Dullung R.F., Kakoi R.F., Khamti Gaon; Majuli: Dakshinpat Satra; Morigaon: Kholahat R.F.; North Cachar Hills: Maibang; Sonitpur: Nameri N.P., Charduar; Tinsukia: Dehing

Patkai W.L.S.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Tripura, Sikkim, West Bengal, Bihar, Uttarakhand, Jharkhand, Maharashtra), Bangladesh, Bhutan, Nepal, China, Japan, Myanmar, Thailand, Laos, Cambodia, Vietnam, Malaysia, Indonesia, Philippines, New Guinea, Solomon Is., Cook Is., Fiji, New Caledonia, Niue, Samoa, Tonga, Vanuatu, Wallis-Futuna Is.

Regional Conservation Status: Least Concern.

Phaius wallichii Lindl., Pl. Asiat. Rar. 2: 46. 1831; Hook.f., Fl. Brit. India 5: 816. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 108. 1898; P.J.Cribb *et al.*, Kew Bull. 59(4): 549. 2004. *Phaius bicolor* Lindl., Gen. Sp. Orchid. Pl. 128. 1831.

Plants *ca.* 90 cm high. Pseudobulb ovoid,



Phaius wallichii Lindl.: plant habit (left) and closeup of flowers (right)

fusiform to sub-cylindrical, 10–14 × 4.5–5.7 cm. Leaves 4, elliptic, 50–70 × 15–24 cm, glabrous, apex acuminate. Inflorescences arising from middle of pseudobulb, 4–15-flowered, glabrous; sheathing bracts many, slightly pilose; floral bracts caducous, ovate-lanceolate, 3–5 cm long, glabrous. Flowers widely opening, 10–12 cm in across; pedicel and ovary 4.0–5.5 cm long, glabrous; sepals and petals reddish-brown within, yellowish green on outer surface. Sepals subsimilar, oblong-lanceolate, 4.6–7 × 1.2–1.5 cm, glabrous, apex shortly acuminate. Petals oblong to elliptic-lanceolate, ca. 6.3 × 1.2 cm, apex shortly acuminate. Lip white with a red disc and yellow veins, 4.5–6.5 × 2.7–5.3 cm, broadly ovate-triangular, shallowly 3-lobed; lateral lobes short, margin slightly undulate, apex rounded; mid-lobe ovate-triangular, 2.5–3 cm wide, margin slightly undulate, apex acute; disk with yellow veins; spur

yellow, narrowly cylindric, bowlike, 1–2 cm, cleft at apex. Column pale yellowish green, 1.6–1.8 cm long, pubescent on dorsal surface in upper half; stigma broadly oblong, ca. 5.5 × 4–5 mm.

Habitat: Terrestrial, grows on shaded and moist places.

Flowering: May–June.

Occurrence: Baksa: Manas B.R.; Cachar: Borail W.L.S.; Dibrugarh and Tinsukia: Dehing Patkai W.L.S.; Karbi Anglong: Kohora ca. 353 m; Lakhimpur: Dullung R.F.; North Cachar Hills: Baralokha ca. 650 m.

Distribution: India (Assam, Meghalaya, Sikkim), Bangladesh, Bhutan, China, Sri Lanka, Myanmar, Thailand, Vietnam, Indonesia.

Regional Conservation Status & Criteria: Vulnerable, VU B2b(ii)c(iii).

Spathoglottis Blume

Terrestrial herbs. Pseudobulbs ovoid or globose, with a few leaves. Leaves plicate, narrow, base contracted into a long petiole, not articulate, apex acuminate. Inflorescence terminal, erect, racemose, arising from base of pseudobulb; peduncle with several sheaths; rachis laxly few flowered; floral bracts shorter than pedicel and ovary. Flowers opening widely, medium-sized. Sepals similar. Petals similar to sepals but usually wider. Lip not spurred, adnate to base of column, 3-lobed; lateral lobes suberect; midlobe clawed at base; disk and claw of midlobe often with keels or other appendages. Pollinia 8, in 2 groups, narrowly obovoid, subequal, waxy, commonly attached to a solitary triangular viscidium. Column curved, slender, dilated at apex, winged; foot absent; rostellum not lobed.

About 49 species; distributed from tropical Asia to Australia and the Pacific islands; 3 species in India and 2 species in Assam.

Key to the Species

- 1a. Flowers lilac, rose or purple; floral bracts and ovary glabrous *S. plicata*
 1b. Flowers yellow; floral bracts and ovary pubescent *S. pubescens*

Spathoglottis plicata Blume, Bijdr. 401. 1825; Hook.f., Fl. Brit. India 5: 813. 1890; H.J.Chowdhery, Orch. Fl. Arunachal Pradesh 643. 1998; I.Barua, Orchid Fl. Kamrup Distr. Assam 82. 2001; N.Pearce & P.J.Cribb, Orchids Bhutan 308. 2002; Lucksom, Orchids Sikkim N.E. Himalaya 403. 2007.

Pseudobulbs ovoid-conic, 3–4 × 1–2 cm, enclosed in sheaths. Leaves 3–5, linear-lanceolate, 40–85 × 5–8 cm; petiole 10–20 cm long. Inflorescence up to 1 m long, with many tubular sheaths; rachis 8–15 cm long, 9–16-flowered; floral bracts reflexed, purple, ovate, 1.5–2 cm long. Flowers opening successively, lilac, rose-coloured or purple, ca. 2.5 cm in across; pedicel and ovary purplish, 2.5–3.5 cm long. Sepals similar, ovate, concave, 1.5–1.7 × 0.8–0.9 cm, sparsely pubescent, apex acute; lateral sepals oblique. Petals sub-elliptic, ca. 1.8 × 1.3 cm, apex acute. Lip 3-lobed, 1.6–2.3 cm long, with 2 small, triangular, pubescent auricles at base of claw; disk with 2 short keels arising from base of lip; lateral lobes falcate, ca. 6 × 3 mm, apex dilated and truncate; mid-lobe dilated toward apex and flabellate, ca. 1 cm long, apex subtruncate and often shallowly 2-lobed, with a distinct claw at base; keels expanded toward apex into 2 large, fleshy, erect, rounded extensions

terminating near base of claw, extensions pubescent adaxially. Column ca. 1.5 cm long. Capsule oblong 3–5 cm long, ribbed.

Habitat: Terrestrial.

Flowering: May–August.

Occurrence: Often cultivated as an ornamental plant, sometimes escape.

Distribution: India (Assam, Arunachal Pradesh, Nagaland, Andaman & Nicobar Is.), Bangladesh, China, Sri Lanka, Myanmar, Thailand, Laos, Cambodia, Vietnam, Malaysia, Singapore, Indonesia, Philippines, Bismarck Archipelago, New Guinea, Solomon Is., Australia, Marianas, Cook Is., Fiji, New Caledonia, Niue, Samoa, Santa Cruz Is., Tonga, Vanuatu, Wallis-Futuna Is. It is introduced to Seychelles, Florida, Hawaii, Marquesas, Society Is., Nauru, Cayman Is., Cuba, Dominican Republic, Leeward Is., Puerto Rico and Windward Is.

Regional Conservation Status: Least Concern.

Spathoglottis pubescens Lindl., Gen. Sp. Orchid. Pl. 120. 1831; Hook.f., Fl. Brit. India 5: 814. 1890; Katakai, Orchids Meghalaya 98. 1986; Hynn. *et al.*, Orchids Nagaland 262. 2000; N.Pearce & P.J.Cribb, Orchids Bhutan 308. 2002. *Spathoglottis parvifolia*



Spathoglottis plicata Blume: plant habit (left) and closeup of a flower (right)

Lindl., Edwards's Bot. Reg. 31: t. 19. 1845.

Fig 114 (A–R).

Pseudobulbs dorsiventrally compressed, globose, usually 1.0–2.5 cm in diam., covered with leathery scale-like sheaths. Leaves 1–3, linear-lanceolate, 20–43 × 1–3 cm, base acute. Inflorescence 20–50 cm long, densely pubescent, lower part covered with several amplexicaul tubular sheaths; rachis 2–10 cm, laxly 2–8-flowered; floral bracts lanceolate to ovate-lanceolate, 5–9 mm long, pubescent, apex acute. Flowers yellow, base of lip spotted violet; pedicel and ovary 2.0–2.5 cm long, densely pubescent. Sepals ovate-elliptic, 1.2–1.9 × 0.5–0.8 cm, outer surface pubescent, with 5–7 main veins, apex acute. Petals ovate-oblong, 1.2–1.7 × 0.8–1.0 cm, with 5–6 inconspicuous veins, apex obtuse. Lip 1.3–1.8 cm long, saccate at base, 3-lobed; lateral lobes oblong,

deeply incised, apex rounded or truncate; mid-lobe obovate-cuneate, ca. 1.3 cm long, base with a distinct claw, apex subtruncate and emarginate; disk with 3 keels; central keel low, running from middle of claw to midway along mid-lobe; 2 outer keels erect, fleshy, triangular, terminating at base of midlobe. Column 0.8–1.0 cm long.

Habitat: Terrestrial, grows on grassy hill slopes.

Flowering: July–September.

Occurrence: Karbi Anglong: Dambukso ca. 840 m; North Cachar Hills: Thingje ca. 1400 m; West Karbi Anglong: Umwang ca. 843 m.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland), Bangladesh, China, Myanmar, Thailand, Laos, Cambodia, Vietnam.

Regional Conservation Status: Least Concern.

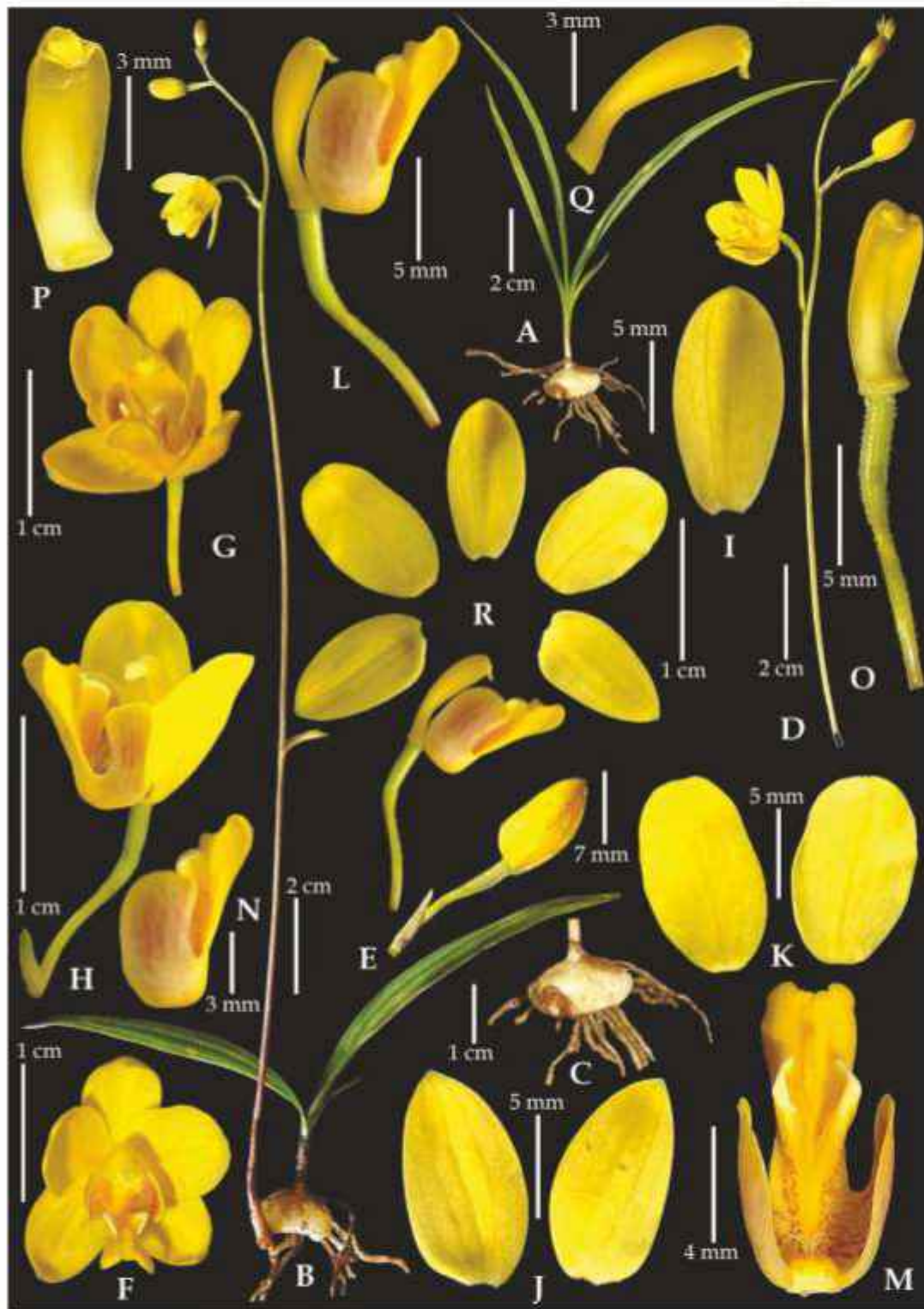


Figure 114. A–R: *Spathoglottis pubescens* Lindl.: A. Habit (vegetative); B. Habit (flowering); C. Pseudobulb; D. Close-up of inflorescence; E. Floral bud; F. Flower (front view); G. Flower (ventrolateral view); H. Flower-sepals removed (lateral view); I. Dorsal sepal; J. Lateral sepals; K. Petals; L. Labellum, column, pedicel & ovary (lateral view); M. Labellum (dorsal view); N. Labellum (lateral view); O. Column, pedicel & ovary (ventral view); P. Column (ventral view); Q. Column (lateral view); R. Floral analysis.



Spathoglottis pubescens Lindl.: a plant in its natural habitat (left) and closeup of flowers (right)

***Tainia* Blume**

Terrestrial rhizomatous herbs. Pseudobulb 1-leaved, erect, rarely prostrate, with 1 or few internodes. Leave deciduous, articulate, petiolate or not, petiole not sheathing, convolute, plicate or not, glabrous; blade elliptic to ovate, base decurrent along petiole, margin straight, undulate to crenulate. Inflorescence an erect raceme arising heteranthous on a leafless shoot or lateral from base of pseudobulb, often alternating with fertile shoots; peduncle with few internodes, scaly; scales tubular; floral bracts persistent. Flowers resupinate, often simultaneously opening. Sepals and petals ovate, elliptic, or obovate to linear, entire; lateral sepals usually narrower than petals. Lip immobile, entire or 3-lobed, spur absent, saccate; keels 3–5. Anther cap with 2 thecae, usually 4-locular; pollinia 8, in 4 pairs, subequal, hard, caudicles present, stipe and viscidium absent. Column slightly arcuate; foot short. Capsule ellipsoid.

About 28 species; distributed from India to New Guinea and the Pacific islands, via China, Japan, Indochina and Sri Lanka; 3 species in India as well as in Assam.

Key to the Species

- 1a. Lip with 5 keels raising lamellately distally ***T. minor***
 1b. Lip with 3 keels 2

- 2a. Lip distinctly 3-lobed *T. latifolia*
 2b. Lip entire or shallowly 3-lobed *T. wrayana*

Tainia latifolia (Lindl.) Rchb.f., Bonplandia (Hannover) 5: 54. 1857; Hook.f., Fl. Brit. India 5: 820. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 103. 1898; Kataki, Orchids Meghalaya 106. 1986; H. Turner, Orchid Monogr. 6: 78. 1992; H.J. Chowdhery, Orch. Fl. Arunachal Pradesh 657. 1998; Hynn. *et al.*, Orchids Nagaland 268. 2000; N. Pearce & P.J. Cribb, Orchids Bhutan 318. 2002; Lucksom, Orchids Sikkim N.E. Himalaya 401. 2007. *Ania latifolia* Lindl., Gen. Sp. Orchid. Pl. 129. 1831. *Eulophia hastata* Lindl., J. Proc. Linn. Soc., Bot. 3: 25. 1858. *Eria angulata* Rchb.f., Flora 55: 275. 1872. *Tainia cordata* Hook.f., Fl. Brit. India 6: 193. 1890. *Tainia khasiana* Hook.f., Fl. Brit. India 5: 821. 1890. *Tainia hastata* (Lindl.) Hook.f., Fl. Brit. India 5: 821.

1890.

Stem of sterile shoot with 4–5 internodes, 5.1–15 cm long, 2–6 mm in diam. Pseudobulbs close, cylindric-ovoid, slightly swollen towards base, 2.7–9.2 × 0.3–1.2 cm, usually covered with membranous sheaths. Leaf blade elliptic or elliptic-lanceolate, plicate, 8.4–40 × 2.2–9.7 cm, apex acuminate; petiole slender, 8–25 cm long. Inflorescence terminal, erect, 35–100 cm long; peduncle 29–64 cm long, with 3 tubular sheaths 5–8 cm; rachis deep brown, 5.8–29 cm long, laxly 7–38-flowered; floral bracts narrowly lanceolate, 1.2–2 mm long. Flowers fragrant, mostly opens simultaneously; sepals, petals, pedicel and ovary dark brown, lip yellow, column yellow,



Tainia latifolia (Lindl.) Rchb.f.: inflorescence (left) and closeup of a flower (right)

anther cap with 2 purplish red appendages; pedicel and ovary 0.6–1.9 cm long, ovary dilated, clavate. Dorsal sepal elliptic to obovate, 10–18.5 × 0.15–0.25 cm, 3-veined, apex obtuse; lateral sepals narrowly falcate-oblong, 0.9–1.2 × 0.2–0.3 cm, base adnate to column foot forming a short mentum. Petals obliquely elliptic to obovate 0.9–1.8 × 0.2–0.3 cm, 3-veined, apex subacute. Lip elliptic to ovate, 0.8–1.8 × 0.4–0.9 cm, normally 3-lobed; lateral lobes erect, ovate-triangular, 5–7 mm wide when flattened, acute; mid-lobe suborbicular or obovate, 4–5 mm wide, apex emarginate; disk with 3 lamellae extending to apex of mid-lobe. Column 5–9 mm long, apex truncate or triangular, wings seam-like, extending up to the lip of foot; foot 1–2.5 mm long.

Habitat: Terrestrial, grows on hill slopes in tropical evergreen forests.

Flowering: February–April.

Occurrence: Cachar: Katakhal R.F.; Dibrugarh: Jeypore R.F.; Golaghat and Karbi Anglong: Nambor W.L.S.; Lakhimpur: Dullung, Kakoi and Ranga R.F.; North Cachar Hills: Lodi Cachari ca. 207 m; Tinsukia: Makum forest.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal), Bangladesh, Bhutan, China Myanmar, Thailand, Laos, Vietnam, Malaysia, Indonesia. Regional Conservation Status: Least Concern

Tainia minor Hook.f., Fl. Brit. India 5: 821. 1890; Hook.f., Fl. Brit. India 5: 821. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 102. 1898; Katak, Orchids Meghalaya 107. 1986; H. Turner, Orchid Monogr. 6: 84. 1992; H.J. Chowdhery, Orch. Fl. Arunachal Pradesh 661. 1998; N. Pearce & P.J. Cribb,



Tainia minor Hook.f.: a plant in its natural habitat (left) and closeup of flowers (right)

Orchids Bhutan 318. 2002; Lucksom, Orchids Sikkim N.E. Himalaya 401. 2007.

Stem of sterile shoot with 4–5 internodes, 7.5–11.2 cm long, 3–4 mm in diam. Pseudobulbs cylindrical, slightly swollen towards the base, 2.5–6.5 × 0.3–0.6 cm, covered with membranous tubular sheaths. Leaf blade elliptic, 15–23 × 2.6–5.5 cm, 3-veined, base truncate or suborbicular, apex acute; petiole slender, 7–8 cm long. Inflorescence terminal, erect, 22–48 cm long; peduncle 15–32 cm long; rachis 7–18 cm long, pale purplish brown, laxly 5–16-flowered; floral bracts narrowly ovate-lanceolate, 3–5 cm long. Flowers mostly open simultaneously; sepals and petals pale green with deep purple lines and spots, lip yellow lateral lobes of lip tinged with purplish brown spots, anther cap pale-green; pedicel and ovary shorter than floral bracts. Dorsal sepal elliptic to obovate, 1.2–1.6 × 0.2–0.3 cm, 3-veined, apex slightly obtuse; lateral sepals narrowly falcate-oblong, 1.0–1.5 × 0.15–0.25 cm, base adnate to column foot forming a short mentum. Petals obliquely elliptic to obovate, slightly falcate, 1.1–1.6 × 0.25–0.35 cm, 3-veined, acute. Lip elliptic, 0.9–1.4 × 0.6–0.8 cm, 3-lobed; side-lobes erect, obliquely triangular, 1.5–2.5 mm long, apex obtuse to sub-acute; mid-lobe suborbicular, 3–5.5 × 4–6 mm, apex rounded and emarginate; disk with 5 lamellae. Column 6.5–8 mm long, apex suborbicular to truncate; foot 1.5–2 mm long.

Habitat: Terrestrial, in dense tropical evergreen forests, sometimes in bamboo grove.

Flowering: May–July.

Occurrence: Dibrugarh: Jeypore R.F.; North Cachar Hills: Purana Hmarlushei ca. 1300 m; Tinsukia: Dehing Patkai W.L.S.

Distribution: India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Nagaland, Sikkim, West Bengal), Bhutan, Nepal, China, Myanmar.

Regional Conservation Status: Near Threatened.

Tainia wrayana (Hook.f.) J.J.Sm., Bull. Jard. Bot. Buitenzorg II, 8: 6. 1912; H.J. Chowdhery, Orch. Fl. Arunachal Pradesh 661. 1998. *Ipsea wrayana* Hook.

f., Fl. Brit. India 5: 812. 1890. *Nephelaphyllum grandiflorum* Hook.f., Fl. Brit. India 6: 192. 1890; King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 104. 1898. *Mischobulbum wrayanum* (Hook.f.) Rolfe, Orchid Rev. 20: 127. 1912; H. Turner, Orchid Monogr. 6: 71. 1992. *Tainia grandiflora* (Hook.f.) Gagnep., Bull. Mus. Natl. Hist. Nat. II, 4: 706. 1932.

Fig. 115 (A–C).

Stem of sterile shoot with 5 internodes, 7–10 cm long, 2–3 mm in diam. Pseudobulb 6–9 × 0.2–0.3 cm. Leaves ovate, 7–16 × 4–9.5 cm, 7–9-veined, base deeply cordate, apex acuminate, margins undulate. Inflorescence arising from the base of the pseudobulb, 17–23 cm long; peduncle 12–20 cm long, 4–6 mm diam.; rachis 2–13-flowered, 4–10 cm long, 1–3 mm in diam; floral bracts patent, 0.6–1.1 cm long; pedicel and ovary 0.6–1.3 cm long. Flowers drooping, greenish, flushed with red, ca. 2.5 cm across. Dorsal sepal elliptic, 1.6–1.7 × 0.3–0.4 mm, apex acute, mid-vein thickened abaxially. Lateral sepals 1.7–1.8 × 0.6–0.8 cm, apex acute. Petals elliptic, 1.4–1.7 × 0.6–0.7 cm, apex acute, mid-vein thickened abaxially. Lip entire or slightly 3-lobed, ovate, 1.4–1.8 × 1.3–1.6 cm; mid-lobe where present triangular, 0.7–1.0 × 1.0–1.1 cm, apex acute, fleshy; margins entire, glabrous to minutely papillose; adaxial surface glabrous to minutely papillose; lateral lobes where present obliquely triangular, 1.0–1.5 mm long; tip rounded; disc with 3 keels. Anther 1.5–2.0 × 1.5–2.0 mm. Column 8.0–9.5 mm long; apex triangular; wings seam-like, extending up to apex of the column foot; foot 6–10 mm long.

Habitat: Terrestrial, grows on shaded forest floors of tropical wet evergreen forests.

Flowering: June–July.

Occurrence: Dibrugarh and Tinsukia: Dehing Patkai W.L.S.; Lakhimpur: Dullung R.F. Distribution: India (Assam, Arunachal Pradesh, Sikkim), Thailand, Vietnam, Malaysia, Indonesia.

Regional Conservation Status & Criteria: Vulnerable, VU B2b(ii)c(iii).

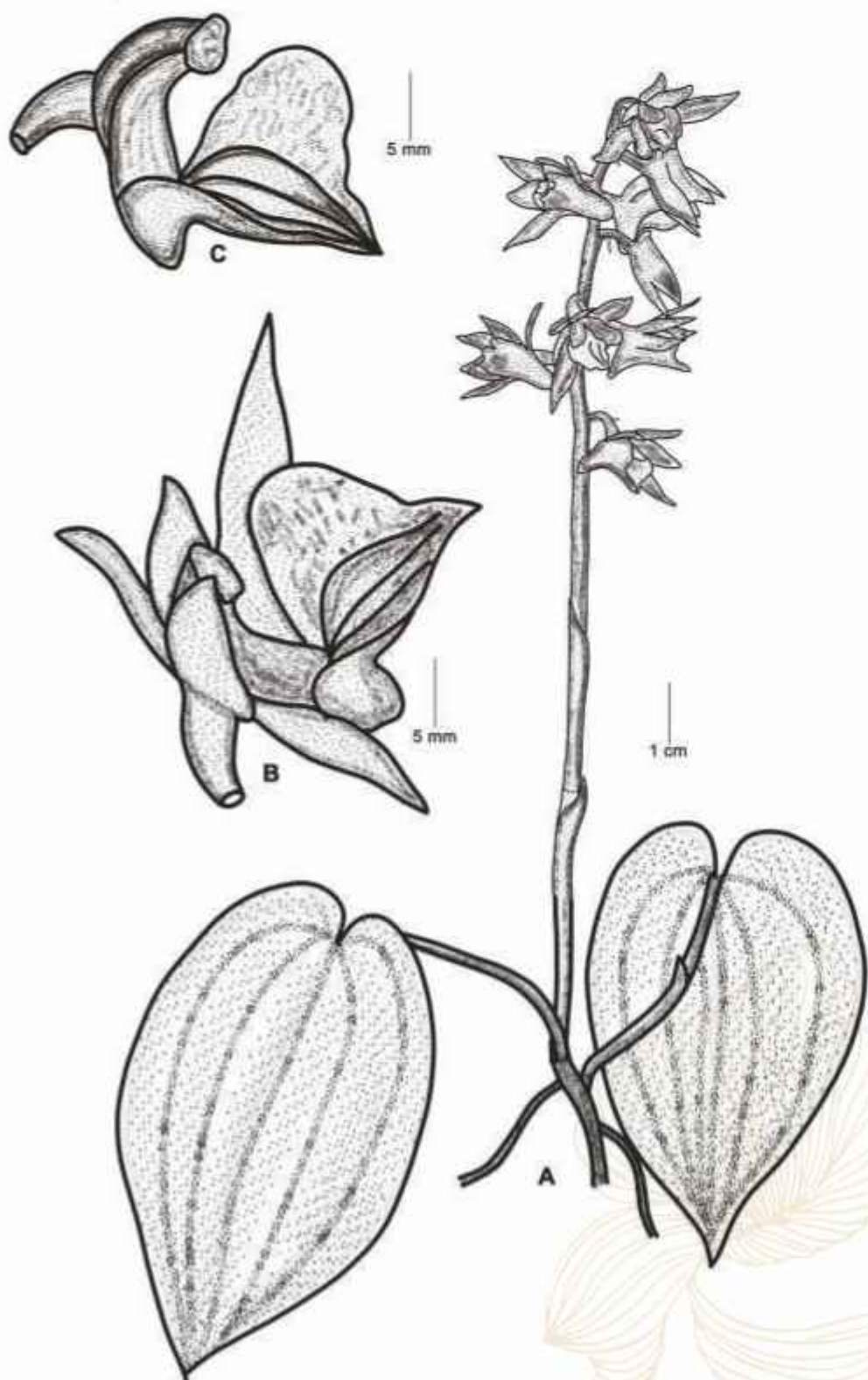


Figure 115. A–C: *Tainia wrayana* (Hook.f.) J.J.Sm.: A. Habit; B. Flower; C. Lip with column, pedicel and ovary.



Pinalia amica (Rchb.f.) Kuntze

LIST OF EXCLUDED AND DOUBTFUL TAXA

Acampe praemorsa (Roxb.) Blatt. & McCann var. *praemorsa*

This species is not present in Assam. The report of Gogoi (2012, 2017) is an error for *Acampe carinata* (Griff.) Panigrahi

Aerides falcata Lindl. & Paxton**

Hajra & De (2011) included this species in their list on Orchids of Assam. But, we could not trace any herbarium collection from Assam, nor any specific location of occurrence mentioned in any published work.

Anoectochilus setaceus Blume

This species is not present in India. The report of Hajra & De (2011) may be an error for *Anoectochilus setaceus* Lindl. which is now a synonym of *Anoectochilus roxburghii* (Wall.) Lindl.

Arachnis flos-aeris (L.) Rchb.f.

Seidenfaden (1988) considered that the occurrence of this species in India is doubtful. Hajra & De (2011) included this species in their checklist. We have not seen any material from Assam.

Brachycorythis iantha (Wight) Summerh.

It is a South Indian species, not found in Assam. The report of Barooah *et al.* (2014) from Assam is rather erroneous.

Brachypeza pallida (Blume) Kocyan & Schuit.

This species is restricted to Indo-China and Malesia. The report of Rao & Verma (1969) as *Pteroceras pallidum* (Blume) Holttum from Lakhimpur district of Assam is rather erroneous.

Bulbophyllum auratum (Lindl.) Rchb.f.**

[syn.=*Cirrhopetalum auratum* Lindl.]

The occurrence of this species in Assam is doubtful.

Bulbophyllum iners Rchb.f.

Probably described from erstwhile Assam. No herbarium specimen in extant. Hence, the identity of the species still unresolved.

Chiloschista lunifera (Rchb.f.) J.J.Sm.

This species is not present in Assam. Barua (2001) and various other authors had misreported the

species in error for *Chiloschista parishii* Seidenf.

Coelogyne tomentosa Lindl. [syn.=*Coelogyne massangeana* Rchb.f.]

This species is native to Thailand and Malesia. Hooker (1890) doubtfully included its distribution in Assam.

Cymbidium assamicum Linden [nom. nud.].

A naked name only, the existence of this species is uncertain.

Cymbidium hookerianum Rchb.f.** [syn. = *Cymbidium grandiflorum* Griff.]

Hajra & De (2011) and Gogoi (2017) reported this species from Assam. But, we could not trace any herbarium collection from Assam, nor any specific location of occurrence mentioned in any published work.

Dendrobium acinaciforme Roxb.

This species is native to Indonesia. All previous report from Assam was error for *D. spatella* Rchb.f.

Dendrobium kentrophyllum Hook.f.

This species is not present in Assam. Nath & Das (2013b) and various other authors had misidentified the plant in error for *D. parviflorum* Rchb.f. ex Lindl.

Dendrobium macrostachyum Lindl.** [syn. = *Dendrobium gamblei* King & Pantl.]

There is an unlocalized specimen at Kew (K-000482589), which belongs to erstwhile Assam. Its occurrence in present-day Assam remains doubtful.

Didymoplexis himalaica Schltr.

This species is not found in Assam. The reports of Hajra & De (2011) and Barooah *et al.* (2014) is rather erroneous.

Habenaria mandersii Collett & Hemsl.

This plant is native to Indo-China. The report of Hajra & De (2011) from Assam is rather erroneous.

Liparis wightiana Thwaites

This plant is native to Southern India, Sri Lanka, Peninsula Thailand to Jawa. The report of Gogoi & Yonzon (2013) is rather erroneous.

***Luisia psyche* Rchb.f.**

This species is not present in Assam. The report of Hajra & De (2011) is rather erroneous.

Peristylus hamiltonianus* (Lindl.) Lindl.*

[syn.= *Herminium hamiltonianum* Lindl.,
Habenaria hamiltoniana (Lindl.) Hook.f.]

Hajra & De (2011) included this species in their list on Orchids of Assam. But, we could not trace any herbarium collection from Assam, nor any specific location of occurrence mentioned in any published work.

***Peristylus parishii* Rchb.f.** [syn.= *Habenaria parishii* (Rchb.f.) Hook.f.]**

Hajra & De (2011) included this species in their list on Orchids of Assam. But, we could not trace any herbarium collection from Assam, nor any specific location of occurrence mentioned in any published work.

***Phaius luridus* Thwaites**

This species is restricted to Southern India and Sri Lanka. Gogoi *et al.* (2012) misidentified the species in error for *Phaius wallichii* Lindl.

***Phalaenopsis parishii* Rchb.f.**

This species is not present in Assam. All previous reports from Assam are due to misidentification of *Phalaenopsis lobbii* (Rchb.f.) H.R.Sweet.

***Pholidota corniculata* (Rchb.f.) Pfitzer & Kraenzl. [syn.= *Coelogyne corniculata* Rchb.f.]**

Reichenbach (1865) described the species as "This bears a long pendulous raceme with great sheathing bracts and sweet yellow-green or honey-coloured flowers, the lip of which is of a deeper yellow, with brownish borders to the lateral segments. In its lax racemes it reminds one of *Coelogyne* (*Pholidota*) *undulata* (Wall. ex Lindl.) Rchb.f., but the flowers are very different, and very curious in the angular centre of the lip. It is one of Mr. Day's numerous Indian importations, most probably from Assam". Although, de Vogel (1988) considered that the plant as an aberrant form of *Pholidota chinensis* Lindl., but also acknowledges the differences with *P.*

chinensis "the backside of the lip: outside a wide groove is present which is on section V-shaped and projects inside at the back of the hypochilium as a broad high keel, laterally of this on either side a low, swollen keel is present". Further, the scales of the young shoot are *ca.* 10 cm long and the rachis up to 30 cm long as against up to 7 cm and 23 cm in *P. chinensis*. Due to unavailability of fresh specimen the identity of the species could not be confirmed.

***Pinalia sharmae* (H.J.Chowdhery, G.S.Giri & G.D.Pal) A.N.Rao [syn.= *Eria sharmae* H.J.Chowdhery, G.S.Giri & G.D.Pal]**

This species was described from Arunachal Pradesh. The report of Hajra & De (2011) from Assam is not authentic.

***Rhinerrhiza divitiflora* (F.Muell. ex Benth.) Rupp [syn.= *Thrixspermum freemanii* (Rchb.f.) Rchb.f.; *Rhinerrhiza freemanii* (Rchb.f.) Garay].**

This species is native to Australia. Hooker's (1890) report from Assam as *Thrixspermum freemanii* is doubtful.

***Spathoglottis tricallosa* J.J.Sm.**

This species is native to Indonesia. The report of Hajra & De (2011) from Assam is not authentic.

***Trichotosia ferruginea sensu auct.* K.Gogoi**

The above combination does not exist. Gogoi (2017) used the combination in error for *Eria ferruginea* Lindl.

***Vanilla walkeriae* Wight**

This species is native to peninsular India and Sri Lanka. The report of Hajra & De (2011) from Assam is not authentic.

***Vrydagzynea nuda* Blume**

This species is native to Indonesia. The report of Gogoi (2016, 2017) from Assam is an error for *Vrydagzynea viridiflora* Hook.f.

***Zeuxine cordata* (Lindl.) Ormerod**

This species is distributed from Maluku to New Guinea. The report of Chowdhury (2005) from Assam is rather erroneous.

CHECKLIST OF SPECIMENS

Note: The name of the collectors and binomials are given in italics. Herbarium acronyms according to Thiers (2020). Asterisked (*) herbariums are not listed at Index Herbariorum. In some cases where specimens are few or not available, then reference(s) of the report of individual species or variety from Assam is provided.

Aerides odorata Lour.: A.Meebold 6636 (K); B.Baruah 62842, 62850, 73916, 73930 (ASSAM); D.F.O. Cachar 22880 (ASSAM); G.K.Deka s.n. acc. no. 36121 (ASSAM); G.Panigrahi 5330, 5350, 9261 (ASSAM); H.A.Barbhuiya 58, 590, 692, 807 (ASSAM); I.C.Barua 0756 (ASSAM); M.L.Saikia s.n. acc. no. 36123, 36124 (ASSAM); N.P.Balakrishnan 39362 (ASSAM); P.Chakrabarty 75383 (ASSAM); R.B.Majumdar 84281A (ASSAM); R.Daimary 110651 (ASSAM); S.K.Jain 57283 (ASSAM); W.G.Craib s.n. (K).

Arundina graminifolia (D.Don) Hochr.: Chowdhury (2005); B.K.Nath 13329 (ASSAM); D.M.Verma 46573 (ASSAM); I.C.Barua 1500, 3299 (ASSAM) n.v.; H.A.Barbhuiya 909 (ASSAM); J.N.Sarmah 3118 (GUBH); Masters s.n. (L-0265487); M.M.Srinivasan 22075 (ASSAM); N.N.Rabha 108231 (ASSAM); R.B.Majumdar 73418 (ASSAM); R.Daimary 110681 (ASSAM); T.M.Hynniewta 51822 (ASSAM); U.N. Kanjilal 7077 (ASSAM).

Dendrobium aphyllum (Roxb.) C.E.C.Fisch.: A.C.Chatterjee s.n. (P-00386094); A.N.Rao 62328 (ASSAM); B.Baruah 62843, 73914, 73919, 73913, 73941, 74013, 74028 (ASSAM); B.Bhattacharjee & B.K.Dutta 20 (Herbarium, Department of Ecology and Environmental Science, Assam University, Silchar*) n.v.; C.Deori 101107 (ASSAM); D.B. Deb 34999 (ASSAM); G.K.Deka 23525 (ASSAM); I.C.Barua 209, 1514 (ASSAM); I.C.Barua 2075 (CAL); H.A.Barbhuiya 902 (ASSAM!), 1813 (HBARC-00005920!); J.N.Sarmah 2788 (GUBH); M.Bhaumik 109987 (ASSAM); P.K.Hajra 57323A (ASSAM); P.R.Dutta 20935 (ASSAM); R.Daimary 118996 (ASSAM); R.R.Rao s.n. (ASSAM); R.S.Rao 9998 (ASSAM); S.Chowdhury 70, 591 (GUBH); S.K.Jain 57281 (ASSAM); S.K.Kataki 12828 (ASSAM); S.M.Nath 481 (GUBH).

Dendrobium chrysotoxum Lindl.: B.Bora s.n. (liv. mat. only); Chowdhury (2005); H.A.Barbhuiya 112215 (ASSAM).

Dendrobium darjeelingensis Pradhan: B.Bhattacharjee & B.K.Dutta 23 (Herbarium, Department of Ecology and Environmental Science, Assam University, Silchar*) n.v.; H.A.Barbhuiya 846 (ASSAM).

Dendrobium moschatum (Buch.-Ham.) Sw.: A.C.Chatterjee 5812 (CAL); B.Baruah 62816, 74004 (ASSAM); B.Bhattacharjee & B.K.Dutta 30 (Herbarium, Department of Ecology and Environmental Science, Assam University, Silchar*) n.v.; D.B. Deb 34991 (ASSAM); F.Jenkins s.n. (K); G.K.Deka 23537, 23543 (ASSAM); G.Panigrahi 9323, 11528, 27790 (ASSAM); I.C.Barua 0758 (ASSAM); I.C.Barua 2285 (CAL) n.v.; J.N.Sarmah 3341 (GUBH); N.E.Parry 715 (K); P.Gogoi 446 (GUBH); P.K.Hajra 57323B (ASSAM); W.Griffith 1325 (BM).

Gastrochilus obliquus (Lindl.) Kuntze var. *obliquus*: B.Bora s.n. (liv. mat. only); Chowdhury (2005) as *Saccolabium obliquum* Lindl.; G.Panigrahi 5530, 5550, 11517 (ASSAM); M.F.Tessier-Yandell 13 (Spirit) (K-33853.000); S.K.Kataki 41573 (ASSAM).

Gastrochilus obliquus var. *suavis* (Seidenf.) Z.H.Tsi: H.A.Barbhuiya s.n. (liv. mat. only); Gogoi (2017).

Geodorum appendiculatum Griff.: H.A.Barbhuiya 904 (ASSAM).

Lecanorchis taiwaniana S.S.Ying: J.Sarma 1499 (HBARC-00006382, 00006387!).

Paphiopedilum spicerianum (Rchb.f.) Pfitzer: B.Bhattacharjee 9 (Herbarium, Department of Ecology and Environmental Science, Assam University, Silchar*) n.v. fide Bhattacharjee *et al.* (2005); Chowdhury (2005); cult. Veitch ex Spicer Herb. no. 5380 (W); J.Renz 2710 (RENZ); M.F.Tessier-Yandell 20 (Spirit) (K-29520.000); Pradhan (1975).

Phalaenopsis cacharensis (Barbhuiya, B.K.Dutta & Schuit.) Kocyan & Schuit.: H.A.Barbhuiya 665 (ASSAM!).

Dendrobium assamicum Sud.Chowdhury: Chowdhury (2005); S.Chowdhury 354 (ASSAM, CAL, K-000943859).

Dendrobium devonianum Paxton: Chowdhury (2005); D.M.Verma 46316, 46670 (ASSAM); H.A.Barbhuiya

Acanthephippium sylhetense Lindl.: B.Baruah s.n. (ASSAM); B.Bora s.n. (liv. mat. only); S.Chowdhury 485 (GUBH); R.L.Keenan s.n. (K); P.K.Hajra 65139, s.n. acc. no. 52468 (ASSAM); S.Phukan 102824 (ASSAM).

Calanthe masuca (D.Don) Lindl.: Chowdhury (2005); C.S.Purkayastha 13567 (ASSAM); J.N.Sarmah 2720 (GUBH); M.L.Saikia s.n. acc. no. 35967 (ASSAM); N.P.Balakrishnan 39449 (ASSAM); P.Chakraborty 78955 (ASSAM); P.Gogoi 1640 (GUBH); R.N.De 20313 (ASSAM); W.G.Craib 241 (P-00378983); T.M.Hynnwieta 53041, 53070 (ASSAM).

Calanthe odora Griff.: Chowdhury (2005) as *Calanthe angusta* Lindl. and *Calanthe vaginata* Lindl.; F.Jenkins s.n. (K-000810908); G.K.Deka s.n. acc. no. 35951, 35952 (ASSAM); J.N.Sarmah 3358 (GUBH); P.Gogoi 1850 (GUBH); P.K.Hajra s.n. (ASSAM); s.coll. s.n. (W-0061988); S.Dey s.n. (liv. mat. only).

Coelogyne ovalis Lindl.: B.K.Nath 13283 (ASSAM); Chowdhury (2005); G.Panigrahi 18853 (ASSAM); H.A.Barbhuiya 1072 (ASSAM); J.N.Sarmah 3241 (GUBH).

Coelogyne suaveolens (Lindl.) Hook.f.: B.Bhattacharjee & B.K.Dutta 17 (Herbarium, Department of Ecology and Environmental Science, Assam University, Silchar*) n.v.; B.Baruah 74031; Chowdhury (2005); I.C.Barua 164, 339 (ASSAM) n.v.; S.Das 60150 (ASSAM). (ASSAM).

Cymbidium aloifolium (L.) Sw.: B.Baruah 62838, 75416 (ASSAM); B.K.Nath 13338 (ASSAM); D.B.Deb 34863 (ASSAM); D.Nath 19805 (ASSAM); G.K.Deka 15796, 22023, 22614 (ASSAM); H.A.Barbhuiya 11, 612 (ASSAM); I.C.Barua 236, 375 (ASSAM); J.N.Sarmah 2244 (GUBH); M.Bhaumik 109986 (ASSAM); M.F.Tessier-Yandell 15 (spirit) (K-41332.000); M.M.Srinivasan 22399 (ASSAM); P.K.Hajra 57514 (ASSAM); R.B.Majumdar 73076 (ASSAM); R.Daimary 118025 (ASSAM); R.L.Keenan s.n. (K); S.Chowdhury 69 (GUBH).

Didymoplexis pallens Griff.: Chowdhury (2005); C.E.C.Fischer s.n. (CAL); I.C.Barua 0873, 0890 (ASSAM) n.v.; J.N.Sarmah 2454 (GUBH); P.Gogoi 679, 867 (GUBH); S.Chowdhury 59, 473 (GUBH); S.N.Baruah 358 (GUBH).

Epipogium roseum (D.Don) Lindl.: B.Bora s.n. (liv. mat. only); S.Dey s.n. (liv. mat. only); Basumatary *et al.* (2010); Gogoi (2017).

Eulophia kamarupa Sud.Chowdhury: Chowdhury (2005); R.Kalita 453 (ASSAM, CAL).

Eulophia mannii (Rchb.f.) Hook.f.: Chowdhury (2005); G.Mann 6 (K-000078321); G.Mann 21 (W-0047167); P.K.Hajra 57799 (ASSAM).

Geodorum densiflorum (Lam.) Schltr.: A.N.Rao 62337 (ASSAM); B.Baruah 73918, 73928, 73928 (ASSAM); D.B.Deb 35274 (ASSAM); G.K. Deka 20311, 22598, 35274 (ASSAM); G.Mann s.n. (DD); G.Panigrahi 9484 (ASSAM, CAL); Goswami 48 (GUBH); I.C.Barua 0872 (ASSAM); J.N.Sarmah 2085 (GUBH); P.Gogoi 13 (GUBH); P.K.Hajra 57608 (ASSAM); M.M.Srinivasan 22398 (ASSAM); N.Laskar 413 (CAL); R.N.De 20312 (ASSAM); S.Chowdhury 360, 361 (GUBH); S.M.Nath 301 (GUBH); S.Phukan 103350 (ASSAM); W.G.Craib 124 (CAL).

Geodorum laxiflorum Griff.: Chowdhury (2005); F.Jenkins s.n. (K, L).

Nervilia concolor (Blume) Schltr.: Chowdhury (2005) as *Nervilia aragoana* Gaudich.; I.C.Barua 870 (ASSAM) n.v.; R.Daimary 111456, 110600 (ASSAM); S.Chowdhury 593, 594, 595 (GUBH).

Pachystoma pubescens Blume: C.J.Simons s.n. (CAL); D.Prain 88 (CAL); H.Bruce 3739A (E-00394125); Marten s.n. (CAL, K); Menzis s.n. (CAL); Ouden 3737 (E-00394123); R.N.De 19777A (ASSAM); W.Griffith s.n. (K); Talukdar and Deori (2015).

Pholidota articulata Lindl.: B.Baruah 62215, 62819 (ASSAM); B.Bhattacharjee & B.K.Dutta 49 (Herbarium, Department of Ecology and Environmental Science, Assam University, Silchar*) n.v.; B.K.Nath 13410 (ASSAM); Chowdhury (2005); G.K.Deka s.n. (ASSAM); H.A.Barbhuiya 1055, 112284 (ASSAM); I.C.Barua 0950, 2072 (ASSAM); R.S.Rao 9140 (ASSAM).

Pholidota imbricata Lindl.: B.Barua 62807, 73969, 76821 (ASSAM); B.Bhattacharjee & B.K.Dutta 53 (Herbarium, Department of Ecology and Environmental Science, Assam University, Silchar*) n.v.; B.K.Nath 13410 (ASSAM); Chowdhury (2005); G.K.Deka s.n. acc. no. 35943 (ASSAM); G.Panigrahi 9310, 11403, 18930, 27741 (ASSAM); H.A.Barbhuiya 577, 613, 688 (ASSAM); I.C.Barua 340, 748 (ASSAM); J.N.Sarmah 3207 (GUBH); P.Gogoi 696 (GUBH); P.K.Hajra 55052 (ASSAM); R.B.Majumdar 61057 (ASSAM); R.S.Rao 9031 (ASSAM); W.G.Craib 266 (MH).

Tainia latifolia (Lindl.) Rchb.f.: Chowdhury (2005); D.Brandis s.n. (K); G.Mann s.n. (ASSAM); G.Panigrahi 27925, 27730 (ASSAM); Masters s.n. (K-000387849); W.Griffith s.n. (K-000974198).

Dendrobium treutleri (Hook.f.) Schuit. & Peter B.Adams: N.Odyuo & D.K. Roy 126286 (ASSAM).

Cymbidium bicolor subsp. *obtusum* Du Puy & P.J.Cribb: B.Bora s.n. (liv. mat. only); Chowdhury (2005); G.Mann s.n. Herb. no. 45878 (W); s.coll. 10479 (CAL).

Dendrobium infundibulum Lindl.: S.Dey s.n. (liv. mat. only).

Calanthe biloba Lindl.: Chowdhury (2005); S.K.Kataki 41528 (ASSAM); Talukdar and Deori (2015).

Calanthe clavata Lindl.: Chowdhury (2005); G.Mann s.n. (E-00694006); G.Panigrahi 21991 (ASSAM).

Cephalantheropsis longipes (Hook.f.) Ormerod: Chowdhury (2005) as *Phaius longipes* (Hook.f.) Holttum; R.Das 0012 (ASSAM) n.v., fide Das et al. (2010); Basumatary et al. (2010).

Acanthephippium striatum Lindl.: Chowdhury (2005); Gogoi (2017); J.B. Comber s.n. (image at RENZ-2047550).

Agrostophyllum brevipes King & Pantl.: H.A.Barbhuiya s.n. (liv. mat. only).

Agrostophyllum callosum Rchb.f.: H.A.Barbhuiya s.n. (liv. mat. only).

Agrostophyllum planicaule (Wall. ex Lindl.) Rchb.f.: B.Bhattacharjee & B.K.Dutta 6 (Herbarium, Department of Ecology and Environmental Science, Assam University, Silchar*) n.v.; B.K.Nath 13205 (ASSAM); Chowdhury (2005) as *Agrostophyllum khasianum* Griff.; R.L.Borah 132 (GUBH).

Ania angustifolia Lindl.: Gogoi (2012b, 2017).

Ania penangiana (Hook.f.) Summerh.: Gogoi (2017).

Ania viridifusca (Hook.) Tang & F.T.Wang ex Summerh.: Chowdhury (2005) as *Tainia viridifusca* (Hook.) Benth. ex Hook.f.; C.J.Simons s.n. (K-000387855).

Anthogonium gracile Wall. ex Lindl.: H.A.Barbhuiya 1058 (ASSAM).

Aphyllorchis montana Rchb.f.: D.Prain 304 (CAL); W.G.Craib 171 (CAL).

Arundina graminifolia var. *revoluta* (Hook.f.) A.L.Lamb: H.A.Barbhuiya 2279 (HBARC-00006386!); B.Bora s.n. (liv. mat. only).

Calanthe densiflora Lindl.: G.Panigrahi 21991 (ASSAM).

Calanthe herbacea Lindl.: Chowdhury (2005).

Calanthe lyroglossa Rchb.f.: B.Bora s.n. (liv. mat. only); Chowdhury (2005); J.Sarma s.n.

Calanthe mannii Hook.f.: Nath and Das (2012); Gogoi (2017).

Calanthe puberula Lindl.: W.Griffith s.n. (E-00694081).

Calanthe triplicata (Willemet) Ames: B.Bora s.n. (liv. mat. only); Chowdhury (2005); K.K.Sarmah 1247 (GUBH).

Cephalanthera longifolia (L.) Fritsch: Hajra and De (2011); Barooah et al. 2014; Gogoi (2017).

Cephalantheropsis obcordata (Lindl.) Ormerod: H.A.Barbhuiya 1076 (ASSAM); M.F.Tessier-Yandell 215 (K).

Chrysoglossum assamicum Hook.f.: Chowdhury (2005); W.Griffith 1233/1322 (K-000387859).

Chrysoglossum ornatum Blume: Gogoi (2017).

Coelogyne assamica Linden & Rchb.f.: Chowdhury (2005); Linden s.n. (K); R.B.Majumdar 73162 (ASSAM).

Coelogyne barbata Lindl. ex Griff.: Chowdhury (2005); W.Griffith s.n. (P-00385538).

Coelogyne fimbriata Lindl.: Chowdhury (2005); S.Dey s.n. (liv. mat. only); Gogoi (2012a, 2017).

Coelogyne flaccida Lindl.: Mazumdar and Paul (2002); Gogoi (2017).

Coelogyne fuscescens Lindl.: H.A.Barbhuiya s.n. (liv. mat. only).

Coelogyne griffithii Hook.f.: Chowdhury (2005); W.Griffith 5091 (K); S.Dey s.n. (liv. mat. only).

Coelogyne longipes Lindl.: B.Bhattacharjee & B.K.Dutta 15 (Herbarium, Department of Ecology and Environmental Science, Assam University, Silchar*) n.v.; H.A.Barbhuiya 1029 (ASSAM).

Coelogyne nitida (Wall. ex D.Don) Lindl.: Chowdhury (2005); Gower s.n. (W); H.A.Barbhuiya 2276 (HBARC-00006383!)

Coelogyne prolifera Lindl.: B.Bhattacharjee & B.K.Dutta 16 (Herbarium, Department of Ecology and Environmental Science, Assam University, Silchar*) n.v.; Chowdhury (2005); P.C.Nath & D.R.Das 064 (GUBH) n.v.

Coelogyne punctulata Lindl.: Assam Bot. Exp. 67 (Spirit) (K-38150.000); Chowdhury (2005) as *Coelogyne goweri* Rchb.f.; H.A.Barbhuiya 1018 (ASSAM); Williams s.n. (W).

Coelogyne schultesii S.K.Jain & S.Das: Chowdhury (2005); G. Mann s.n. acc. no. 454642 (CAL).

Coelogyne stricta (D.Don) Schltr.: Chowdhury (2005); Basumatary et al. (2010); Gogoi (2017).

Coelogyne trinervis Lindl.: A.S.Rao 42486 (ASSAM); B.Baruah 74009 (ASSAM); Chowdhury (2005); S.Das 60151, 60174, 60176 (ASSAM).

Coelogyne viscosa Rchb.f.: B.Bhattacharjee & B.K.Dutta 14 (Herbarium, Department of Ecology and Environmental Science, Assam University, Silchar*) n.v.; Chowdhury (2005); G.Mann s.n. (K).

Collabium chinense (Rolfe) Tang & F.T.Wang: B.Bora s.n. (liv. mat. only); Gogoi (2012a, 2017).

Corymborkis veratrifolia (Reinw.) Blume: Chowdhury (2005); D.B.Deb 35240 (ASSAM); F.Jenkins 5325 (K-000387660); G. K.Deka 22320 (ASSAM).

Cremastra appendiculata (D.Don) Makino: S.Dey s.n. (liv. mat. only).

Cymbidium cochleare Lindl.: Chowdhury (2005); G.Mann s.n. (K); Hooker (1890).

Cymbidium cyperifolium Wall. ex Lindl.: K.Gogoi et al. 0711 (ASSAM) n.v.; Gogoi (2017).

Cymbidium dayanum Rchb.f.: Chowdhury (2005); J.Day s.n. Herb. no. 45964 (W).

Cymbidium eburneum Lindl.: Chowdhury (2005); M.F.Tessier-Yandell 14 (Spirit) (K-33346.000).

Cymbidium elegans Lindl.: Chowdhury (2005) as *Cymbidium longifolium* D.Don; T.M.Hynniewta 51850 (ASSAM); Talukdar and Deori (2015).

Cymbidium ensifolium subsp. *haematodes* (Lindl.) Du Puy & P.J.Cribb ex Govaerts: Basumatary et al. (2010); Gogoi (2017).

Cymbidium erythraeum Lindl.: S.K.Kataki 41606 (ASSAM).

Cymbidium iridioides D.Don: Jain and Hajra (1976) as *Cymbidium giganteum sensu auct.* Wall. ex Lindl.; Chowdhury (2005); Gogoi (2017).

Cymbidium lancifolium Hook.: D.M. Verma s.n. (ASSAM).

Cymbidium macrorhizon Lindl.: Chowdhury (2005); J.N.Sarmah 3412 (GUBH); S.M.Nath 399 (GUBH).

Cymbidium mastersii Griff. ex Lindl.: H.A.Barbhuiya 426, 434 (ASSAM).

Cymbidium munronianum King & Pantl.: B.Bora s.n. (liv. mat. only); Gogoi (2017).

Eulophia andamanensis Rchb.f.: M.F.Tessier-Yandell 91 (Spirit) (K-37095.000).

Eulophia bicallosa (D.Don) P.F.Hunt & Summerh.: A.C.Chatterjee s.n. (BSI); Chowdhury (2005); R.N.De 19777B (ASSAM).

Eulophia bracteosa Lindl.: Chowdhury (2005); B.K.Nath 13320 (ASSAM); G.K.Deka s.n. acc. no. 36001 (ASSAM).

Eulophia dabia (D.Don) Hochr.: Chowdhury (2005); J.N.Sarmah 2047 (GUBH); P.Gogoi 2042, 2063 (GUBH); S.Chowdhury 325 (GUBH); S.M.Nath 328 (GUBH).

Eulophia graminea Lindl.: Chowdhury (2005); G.V.Subba Rao 28517 (ASSAM).

Eulophia herbacea Lindl.: Gogoi (2017).

Eulophia obtusa (Lindl.) Hook.f.: K.K.Sarmah 956 (GUBH) n.v.

Eulophia spectabilis (Dennst.) Suresh: Chowdhury (2005) as *Eulophia nuda* Lindl.; R.L.Macalpine 1355 (DD); s.coll. 7371 (K).

Eulophia zollingeri (Rchb.f.) J.J.Sm.: Baruah s.n. (ASSAM).

Geodorum recurvum (Roxb.) Alston: D.B.Deb 35163 (ASSAM); G.K.Deka 022598 (ASSAM); R.N.De

Neogyna gardneriana (Lindl.) Rchb.f.: H.A.Barbhuiya 1014 (ASSAM).

Nephelaphyllum cordifolium (Lindl.) Blume: Chowdhury (2005); F.de Silva 3750 (K-000974208).

Nervilia infundibulifolia Blatt. & McCann: P.C.Kalita 1099 (GUBH) fide Kalita (2006).

Nervilia juliana (Roxb.) Schltr.: Chowdhury (2005); I.C.Barua 3289 (ASSAM) n.v.; J.Mazumdar 357, 370 (GUBH) n.v.; S.Chowdhury 379, 470 (GUBH) n.v.; S.M.Nath 314 (GUBH).

Nervilia plicata (Andrews) Schltr.: Chowdhury (2005); G.Sarma 712 (GUBH); I.C.Barua 1098 (ASSAM) n.v.; S.Chowdhury 492, 523, 583 (GUBH).

Otochilus albus Lindl.: H.A.Barbhuiya s.n. (liv. mat. only).

Otochilus fuscus Lindl.: Hooker (1890); King and Pantling (1898); Chowdhury (2005); Gogoi (2017).

Otochilus lancilabius Seidenf.: Chowdhury (2005); Gogoi (2017).

Otochilus porrectus Lindl.: G.Panigrahi 11412 (ASSAM).

Panisea demissa (D.Don) Pfitzer: W.Griffith s.n. (K).

Panisea tricallosa Rolfe: Chowdhury (2005) as *Sigmatogyne pantlingii* Pfitzer and *Sigmatogyne tricallosa* (Rolfe) Pfitzer; G.Watt 571 (K-000387891); G.Watt s.n. (K-000387892); H.A.Barbhuiya 1024 (ASSAM).

Panisea uniflora (Lindl.) Lindl.: B.Bhattacharjee & B.K.Dutta 47 (Herbarium, Department of Ecology and Environmental Science, Assam University, Silchar*) n.v.; H.A.Barbhuiya 1003 (ASSAM).

Phaius flavus (Blume) Lindl.: Chowdhury (2005); Gogoi (2017).

Phaius mishmensis (Lindl. & Paxton) Rchb.f.: Chowdhury (2005); G.K.Deka 48207, s.n. acc. no. 22472 (ASSAM); W.Griffith s.n. (K).

Phaius tankervilleae (Banks) Blume: B.Bora s.n. (liv. mat. only); C.B.Clarke 37835 (BM); Chowdhury (2005); G.K.Deka 19803 (ASSAM); F.Jenkins s.n. (CAL); F.Jenkins 642 (BM); H.A.Barbhuiya 1903 (HARC-00006010!); U.N.Kanjilal 3715 (ASSAM); W.Griffith s.n. (W).

Phaius wallichii Lindl.: S.Dey s.n. (liv. mat. only).

Pholidota convallariae (E.C.Parish & Rchb.f.) Hook.f.: G.K.Deka 18143 (ASSAM).

Pholidota pallida Lindl.: B.Bora s.n. (liv. mat. only); I.C.Barua 3294 (ASSAM) n.v.; P.K.Hajra 57297 (ASSAM).

Pholidota rubra Lindl.: B.Bhattacharjee & B.K.Dutta 54 (Herbarium, Department of Ecology and Environmental Science, Assam University, Silchar*) n.v.; S.Dey s.n. (liv. mat. only); Mazumdar and Paul (2002); Gogoi (2017).

Pholidota wattii King & Pantl.: Chowdhury (2005); G.Watt 623 (CAL-0000000400).

Pleione maculata (Lindl.) Lindl. & Paxton: C.J.Simons s.n. (K) n.v.; H.A.Barbhuiya s.n. (liv. mat. only).

Pleione praecox (J.E.Sm.) D. Don: s.coll., s.n. (Spirit) (K-17533.000).

Spathoglottis plicata Blume: Chowdhury (2005); H.A.Barbhuiya 2274 (HARC-00006381!); I.C.Barua 3290 (ASSAM) n.v.

Spathoglottis pubescens Lindl.: Kings Collector (P-00404777).

Tainia minor Hook.f.: Gogoi (2012a, 2017).

Tainia wrayana (Hook.f.) J.J.Sm.: Gogoi (2017).

Thunia alba (Lindl.) Rchb.f. var. *alba*: H.A.Barbhuiya (liv. mat. only).

Thunia alba var. *bracteata* (Roxb.) N.Pearce & P.J.Cribb: B.Bhattacharjee & B.K.Dutta 60 (Herbarium, Department of Ecology and Environmental Science, Assam University, Silchar*) n.v.; B.Bora s.n. (liv. mat. only); G.K.Deka 10136 (CAL).

Tropidia angulosa (Lindl.) Blume: Chowdhury (2005); G.K.Deka s.n. 36220, 36221 (ASSAM); G.Mann s.n. (CAL).

Tropidia curculigoides Lindl.: Chowdhury (2005); G.K.Deka 17716, G.K.Deka s.n. acc. no. 36223 (ASSAM); W.Griffith 5340 (K), W.Griffith s.n. (L-0062638).

GLOSSARY

*Few definitions were adapted from Beentje (2010).

A

Abaxial: a surface directed away from the axis e.g. the lower surface of a leaf.

Aberrant: differing from the normal form.

Abbreviated: shortened.

Abscission: detaching from the stems that bear them at a predetermined place.

Acaulescent: without a stem.

Acicular: needle-shaped.

Acuminate: tapering to a long tip.

Acute: sharply pointed.

Adnate: attached along the entire length of two different floral parts i.e. the petal to a column.

Adpressed: lying flat for its whole length.

Aggregate: clustered together.

Aerial: exposed to the air.

Alternate: inserted at different levels of the axis.

Amplexicaul: embracing or clasping the stem.

Annular: ring forming.

Annulate: ring shaped.

Anterior: the front side.

Anther: the part of the stamen that holds the pollina.

Anther cap: a lid formed from the dry outer wall of an anther.

Anthesis: time of fertilisation of the flower, used more loosely for the time when the flower fully opens.

Apex: the tip or distal end.

Apical: at or pertaining to the tip of any part of a plant.

Apiculate: ending in an abrupt, short point.

Apicule: short, sharp point or acute tip.

Appressed: lying close and flat.

Approximate: close to, very similar to.

Arcuate: arched.

Aristate: having a long, narrow bristle-like projection.

Articulate: jointed.

Ascending: growing upward.

Asymmetrical: irregular in outline or shape, in a flower that is incapable of being bisected into two equal halves in any direction.

Attenuate: gradually narrowing over a long distance.

Auricle: ear-like lobe.

Auriculate: furnished with auricles.

Awn: bristle like projection.

Axil: the angle between the stem and the leaf.

Axillary: arising from the axil of a leaf.

Axis: the central stem or column from which the organs originate

B

Basal: at or near the base.

Beak: a long pointed projection, like the beak of a bird.

Bicallose: with two callosities or two hard/leathery thickenings on an organ.

Bicaudate: two-tailed.

Bidentate: having two teeth.

Bifid: divided into two distinct parts with a deep cleft.

Bifurcate: forked or divided into two sharp branches.

Bilateral: having two planes.

Bilobed: having two lobes.

Bipartite: divided into two parts.

Bisexual: having both sexes in the same flower.

Blade: the expanded part of a leaf or petal.

Blunt: not sharp, ending in a rounded tip.

Bract: a modified leaf in the inflorescence, standing below the peduncles or pedicels.

Bracteate: having bracts.

Bulbous: swollen at the base.

Bullate: bearing blister like swellings.

C

Caducous: soon falling off.

Caespitose: growing in dense tufts.

Calcarate: having a spur.

Callose: having a hard-thickened surface.

Callosity: a hard bump.

Callus (plural **Calli**): a hard protuberance or a swelled area especially of the labellum.

Calyculus: a small cup or circle of bract-like structures outside of the sepals.

Campanulate: bell shaped.

Canaliculate: with a longitudinal groove.

Capillary: very slender, hair like.

Capitate: having flowers arranged in a dense head like cluster.

Capsule: a dry dehiscent fruit composed of two or more united carpels, opening by valves, slits or pores.

Carinate: having a keel.

Caudate: abruptly ending in a long tail-like tip.

Caudicle: an extension of tissue derived from the anther and connecting the pollinia to the stipe or, in orchids without a stipe, directly to the viscidium.

Caulescent: having a well-developed stem.

Cauline: attached to or arising from the stem.

Channeled: grooved longitudinally.

Cilia: short, hair-like appendages.

Ciliate: fine hairs around the edges of organs.

Ciliolate: having a marginal fringe of fine hairs.

Clasping: denoting a leaf whose base partially or completely surrounds a stem.

Clavate: club-shaped.

Claw: the stalk like base of sepal, petal, or labellum.

Clinandrium: the depression where the pollina sets at the head of the column.

Coherent: attached to each other.

Column: an organ of the orchid flower representing the fusion of filaments and style.

Column foot: an extension at the base of the column in some orchids, to which the lip and sometimes the lateral sepals are attached.

Compressed: flattened laterally.

Conduplicate: folded together lengthwise with the adaxial surfaces facing each other.

Confluent: merging together.

Congested: crowded.

Conical: cone shaped.

Connate: united, used when structures or organs of the same kind are joined margin to margin.

Connivent: merging but not fused.

Conspecific: belonging to the same species.

Conspicuous: easily visible, prominent.

Constricted: abruptly narrowed or contracted.

Contiguous: adjacent and touching.

Contracted: narrowed or shortened.

Convergent: coming into contact yet not fused.

Convex: with a rounded surface, like the outside of a bowl.

Convolute: each segment enveloping the next, like a closed umbrella.

Cordate: heart shaped.

Coriaceous: leathery texture.

Corm: an underground storage organ formed from a swollen stem base.

Corymb: a racemose inflorescence that has the lower flowers at the same height as the upper, the outermost flowers open first.

Corymbose: having a corymb shape.

Corymbiform: having a corymb shape.

Crenate: margins with round teeth.

Crenulate: margins with small crenate teeth.

Crest: a dentate elevation or ridge.

Critically Endangered (CR): A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered (Sec. V, IUCN 2012a), and it is therefore considered to be facing an extremely high risk of extinction in the wild.

Cucullate: arched into a hood.

Cuneate: tapering gradually, wedge-shaped.

Cuneiform: wedge shaped.

Cupulate: cup-shaped.

Cusp: a short, stiff, abrupt point.

Cuspidate: ending in a sharp hard point.

Cymbiform: boat shaped.

D

Data Deficient (DD): A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status.

Deciduous: falling seasonally.

Decumbent: when the stem lays close to the ground but with the distal part upright.

Decurrent: extending outwards.

Decurved: curved downward.

Deflexed: bent abruptly downward.

Dehiscent: bursting or splitting open at maturity.

Deltoid: triangular.

Dentate: prominently toothed with acute projections.

Denticulate: finely toothed.

Depressed: flattened down as if pressed from above.

Descending: tending to go gradually downwards.

Dichotomous: forked in pairs, or repeatedly divided into branches.

Diffuse: spreading out widely.

Digitate: spreading like the fingers of a hand.

Dilated: broadened, expanding.

Dimidiate: divided into two parts, but with one part small so that only the other one seems present.

Dimorphic: occurring in two different shapes or forms.

Disc or disk: area in between lateral lobes in the basal half of the lip, the place where the callus is usually placed.

Disciform: circular and flattened.

Discoid: disc-shaped.

Distal: furthest from the place of attachment.

Distant: widely spaced.

Distichous: in two opposite rows, one on each side of the stem.

Distinct: separate, not connate, easily distinguishable, evident or obvious.

Divaricate: widely spreading.

Divergent: gradually spreading from the centre.

Dorsal: upper or adaxial surface.

Dorsal sepal: the upper-most sepal in nonresupinate orchid flowers.

Dorsifixed: any organ that is attached with the dorsal surface to another.

Dorsiventral: with two surfaces, upper (dorsal) and lower (ventral).

Duplicate: double.

E

Ebracteate: bractless.

Ecallose: without calli.

Ellipsoid: a compressed sphere.

Elliptic: oblong with regular rounded ends.

Elongate: stretched or extended.

Emarginate: notched usually at the apex.

Embracing: clasping at the base.

Endangered (EN): A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered (Sec. V, IUCN 2012a), and it is therefore considered to be facing a very high risk of extinction in the wild.

Endemic: confined to a particular area.

Ensiform: sword shaped.

Entire: not divided, smooth.

Ephemeral: very short-lived.

Epichile: terminal lobe of a lip.

Epidermis: the outermost layer of cells.

Epiphyte: plant growing on and attached to another plant without deriving nourishment from it.

Equitant: with the base of one leaf clasping the base of the next leaf up and opposite, which in turn clasps the base of the next.

Erose: irregularly toothed.

Exserted: extended beyond.

Extinct (EX): A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual.

Extra-axillary: growing from above or below the axils.

Extrorse: facing outward, away from the central axis.

F

Falcate: sickle shaped.

Farinaceous: resembling flour.

Farinose: covered with a meal-like powder.

Fasciculate: in close bundles.

Ferruginous: rust coloured.

Fibrose: containing fibres or woody and stringy texture.

Fibrous: composed of, or including, fibres.

Fide: from the Latin 'with faith', used when quoting another person's observation; according to

Filament: a thread-like hair, organ or appendage.

Filiform: thread like.

Fimbria: slender, hair-like processes.

Fimbriate: fringed with hair or thread like growths.

Flabellate: fan-shaped.

Flabelliform: fan shaped.

Flexuose, Flexuous: zigzag.

Foliaceous: leaf like.

Free: separate, not fused, distinct.

Fringed: having hairs or outgrowths around the margin.

Furcate: forked into two.

Furrowed: channelled or grooved longitudinally.

Fused: joined together into a whole.

Fusiform: spindle shaped.

G

Geniculate: bent as a knee.

Genus: group containing related species (usually of similar appearance) and bearing the same first name of the binomial.

Gibbous: more convex on one side than on the other.

Glabrous: hairless or having a smooth surface.

Glandular: covered with glands.

Glaucous: covered with a waxy bluish grey or seagreen bloom, that easily wipes off.

Globose: almost round.

Gynostemium: column formed by the fusion of

androecium and gynoecium.

H

Hamate: hooked apically.

Hastate: spear-shaped or arrow-shaped.

Hemispherical: half of a sphere.

Herbaceous: soft and pliable, without woody tissue

Hermaphroditic: having both male and female sexual organs in the same flower.

Heteranthous: flowering from special shoots that do not produce pseudobulbs or foliage leaves.

Hinged: a joint that holds two parts together so that one can swing relative to the other.

Hirsute: covered with rather coarse stiff hairs.

Hispid: with long stiff hairs or bristles.

Homoblastic: having pseudobulbs of several internodes.

Hooded: forming a hood or cucullate.

Horn: an outgrowth that is shaped like an animal's horn.

Hyaline: transparent or translucent.

Hypochile: basal lobe of a lip.

Hysteranthous: The inflorescence develops on the top of a fully developed pseudobulb with a fullygrown leaf or leaves.

I

Imbricate: overlapping.

Immobile: not capable of movement.

Imperfect: with one of the usual parts absent.

Incised: cut deeply.

Included: enclosed within.

Incumbent: resting, or leaning upon a support.

Incurved: curved inwards.

Indigenous: native.

Indumentum: covering of hair or scales.

Inferior: applied to an ovary when the other organs of the flower are inserted above it.

Inflated: blown up or swollen, bladder-like.

Inflexed: turned or bent inwards.

Inflorescence: the part of the plant that bears the flowers.

Infundibular / Infundibuliform: funnel-shaped.

Inrolled: rolled inwards on the upper side.

Inserted: attached to or placed upon.

Internode: the space on a stem in between two nodes.

Inverted: turned upside down.

Involute: rolled inwards on the upper side

K

Keel or Keeled: an obvious ridge that runs longitudinally down the center of a leaf, petiole, bract, petal, sepal or lip.

L

Labellum: the median, modified petal of an orchid flower.

Lacerate: irregularly lobed at the margin, as if torn.

Lacinate: finely and irregularly cut as if slashed.

Lamella: thin plate, membrane.

Lamellate: composed of thin plates.

Lamina: a flattened expansion of an organ, i.e. the broad middle part of the labellum.

Laminate: blade like.

Lanceolate: broad, but tapering to a point at both ends, like the blade of a lance.

Lateral: at the side.

Lax: loose - as in flower placement on an inflorescence

Least Concern (LC): A taxon is Least Concern when it has been evaluated against the criteria (Sec. V, IUCN 2012a) and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.

Leathery: coriaceous, tough.

Ligneous / lignose: woody.

Ligulate: with a ligule.

Ligule: a distal projection of the leaf sheath.

Linear: long and narrow.

Lined: striated.

Lip: labellum or lowest petal, usually larger and different in shape from the two lateral ones.

Lithophyte: plant growing on rock.

Lithophytic: growing on rock.

Lobe: a division or segment in an organ.

Lobulate: having small lobes.

Lobule: a small lobe.

Lorate: strap-like.

Lunate: half-moon-shaped.

M

Marginal: at the edge of an organ.

Mealy: with many small grains, as of flour.

Median: situated in the middle.

Membranaceous: thin and semi-translucent.

Mentum: a spurlike or chinlike extension of the flower composed of the variably united column foot, lip, and lateral sepals.

Meristem: a group of plant cells that are capable of dividing indefinitely.

Mesial: towards or on the middle of a part.

Mesochile: the middle lobe of a lip.

Midrib: the central or primary vein of a leaf, most often in the center as a continuation of the petiole.

Moniliform: like a string of beads.

Monocot: a plant with a single seed-leaf.

Monopodial: referring to a growth habit in which new leaves develop from the same meristem or growing point as all previous leaves.

Motile: capable of moving.

Mucro: a sharp, abrupt terminal point.

Mucronate: having a mucro or sharp point.

Mycoheterotrophic: achlorophyllous plant that derives its food from fungi.

Mycorrhiza: the association of fungi and roots of higher plants.

N

Navicular: boat-shaped.

Near Threatened (NT): A taxon is Near Threatened when it has been evaluated against the criteria (Sec. V, IUCN 2012a), but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.

Nectary: a gland that secretes nectar.

Nerved: with the veins in a pinnate pattern.

Node: the area of a stem where a leaf is attached or used to be attached.

Non-resupinate: holding the lip of the flower at the top and the median sepal is held below.

Nutant: nodding.

O

Obclavate: club shaped, widest at the base.

Obcordate: heart-shaped, with the narrow end near the base and the wider, notched end near the apex.

Obcuneate: obversely wedge-shaped.

Ob lanceolate: having a rounded apex and a tapering base.

Oblate: a sphere that is compressed dorsally and ventrally.

Oblique: with unequal sides, asymmetrical.

Oblong: longer than broad, with the margins parallel for most of their length.

Obovate: applied to a leaf or any floral part that has the stalk at the narrow end, widening towards the tip.

Obovoid: egg-shaped with the broadest part towards the apex.

Obpyriform: like an inverted pear, i.e. broadest at base and narrowing apically.

Obscure: less visible or unclear.

Obtuse: bluntly pointed or rounded at the apex.

Occluded: closed off.

Operculate: having a cap or lid.

Operculum: anther cap.

Orbicular: circular.

Ovary: the ovule-bearing part of the gynoecium.

Ovate, Ovoid: egg-shaped.

Ovule: an unfertilized seed in the ovary.

P

Palmate: lobed and radiating like fingers.

Pandurate, panduriform: fiddle-shaped.

Panicle: an inflorescence that has the axis divided into branches both bearing a group of flowers.

Paniculate: with the inflorescence a panicle.

Papilla: small wart like glands or protuberance.

Papillose: bearing many small soft wart-like projections.

Parallel: veins running along longitudinally at fairly close intervals.

Patent: spreading.

Pectinate: like the teeth of a comb.

Pedicel: the stalk of an individual flower on an inflorescence.

Peduncle: stalk of an inflorescence.

Pedunculate: possessing a peduncle or stalk.

Peltate: round and stalk is attached at or near the centre.

Pendulous: hanging.

Perianth: collective term for the calyx and corolla.

Persistent: does not wither or fall off.

Petals: any of the whorl of flower parts generally just inside the sepals, usually colourful and showy.

Petaloid: resembles a petal.

Petiolate: having a petiole.

Petiole: the leaf stalk.

Pilose: covered with short thin hairs.

Piercing: a small hole made in the body.

Plane: a flat surface.

Pleated: folded like a fan.

Plicate: with parallel folds, pleated.

Pollinarium: the functional unit of pollen transfer in orchid pollination, consisting of two or more pollinia, sometimes with caudicles, often a stipe, and a viscidium.

Pollinium (plural **pollinia**): a coherent mass of pollen grains.

Polymorphic: having more than one distinct form.

Porrect: directed forwards and downwards.

Posterior: at or towards the back.

Process: a projecting appendage.

Procumbent: trailing over the ground without rooting.

Projecting: extended outward.

Prominent: standing out from the surface.

Prostrate: lying on or trailing over the ground.

Proteranthous: producing flowers before the new leaves sprout, or after the leaves have fallen.

Protocorm: the ephemeral structure resulting from the germinated orchid seed and from which the first true shoot and root differentiate.

Protruding: extending beyond the edge.

Proximal: part nearest to the axis.

Pseudobulb: the variously thickened portion of an aerial orchid stem.

Puberulent: minutely pubescent or covered with very soft, fine hairs.

Pubescent: with dense fine, short, soft hairs.

Pulvinate: cushion shaped, swollen or convex.

Punctate: applied to any structure that is marked by pores or by very small, point like depressions.

Pungent: ending in a rigid and sharp long point.

Pyramidal: shaped like a pyramid.

Pyriform: pear shaped.

Q

Quadrangular: four-angled.

Quadrata: rectangular or square.

Quaquaversal: directed or bending in every direction.

R

Raceme: inflorescence in which the flowers are borne on pedicels along a central axis, with the terminal flowers being the youngest and last to open.

Racemose: in the form of a raceme, resembling a raceme.

Rachis: the axis of an inflorescence, that bears flowers.

Radical: arising so close to the base of the stem as to appear to come from the root.

Ramentaceous: possessing thin chaffy scales.

Recurved: curved backwards or downwards.

Reflexed: curved backwards or downwards at a sharp angle.

Remote: distant.

Reniform: kidney shaped.

Resupinate: with the pedicel twisted so that the lip is always in the same position (usually at the bottom of the flower) regardless of the position of the inflorescence.

Retrorse: turned, bent or curved away from the apex

Retuse: a shallow dent or notch in a rounded apex.

Revolute: the edges of the leaves rolled back towards the mid-rib.

Rhizome: a prostrate or underground stem, from which the pseudobulbs arises.

Rhombic: of the lamina, nearly square with petiole at one of the acute angles.

Ribbed: possessing raised veins or nerves.

Ridged: having a ridge or shaped like a ridge.

Rosette: a cluster of radiating leaves.

Rostellum: beaklike projection on the orchid column, derived from the median stigma lobe, that separates the fertile stigmatic surface from the anther, thereby preventing autogamy and aiding in gluing the pollinia to the pollinator.

Rostrate: beaked or having a rostrum.

Rotund: rounded or curved as in an arc.

Rudimentary: imperfectly developed.

Rugose: wrinkled.

Rugulose: finely wrinkled.

S

Saccate: pouch-shaped.

Sagittate: arrowhead shaped.

Saprophyte: plant that obtains some or all of its nutrition from the substrate through mycorrhizal fungi.

Saprophytic: obtaining all nutrition from decaying matter.

Scabrous: rough to the touch, with small pointed protrusions.

Scandent: climbing.

Scape: inflorescence-stalk arising from ground level, naked peduncle.

Scarious: dry, transparent, thin.

Scrotiform: pouch shaped.

Scurfy: covered with tiny scale-like particles.

Sectile: the condition in which soft, granular pollinia are subdivided into small packets, these usually connected by elastic material.

Secund: all organs or flowers are positioned to one side.

Sepal: a calyx segment of which orchid flowers have three.

Sepaline: pertaining to the sepals.

Septate: partitioned.

Sequentially: occurring in a sequence, one at a time

Serrate: saw-like.

Serrulate: minutely serrate.

Sessile: stalk less.

Seta: stiff hair or bristle.

Setae: plural of seta.

Setaceous: bristly.

Setose: covered with sharp, pointed bristles.

Sheath: tubular organ enveloping another organ e.g. the tubular part of the leaf enveloping the stem.

Sigmoid: s-shaped.

Simple: an unbranched inflorescence.

Sinus: cavity between two lobes.

Solitary: occurring singly.

Spathe: a large sheathing bract, usually either the prophyll or a peduncular bract, surrounding the inflorescence or spadix.

Spatulate: spoon-shaped.

Species: group of populations of similar morphology and constant distinctive characters, thought to be capable of

interbreeding and producing fertile offsprings.

Speckled: having a pattern of dots.

Spicate: resembling a spike.

Spike: a racemose inflorescence with the flowers alternate and sessile along a common unbranched axis.

Spinescent: having spines, ending in a spine-like tip.

Spreading: opening outwards.

Spur: tubular extension at the base of a petal or lip

Stalk: a stem like support of any organ.

Stamen: the male organ of a flower made up of the pollen bearing anther and a sterile filament.

Staminode: sterile or abortive stamen.

Stellate: star-like.

Stelidium (plural **stelidia**): a discrete arm or projection borne on each side of the column, near the apex, middle, or base, often slender and elongated.

Stigma: the pollen receptor on the gynoecium.

Stigmatic: related to the stigma.

Stipe: stalked part of the pollina.

Stolon: a running stem that forms roots.

Striate: having parallel lines.

Subacuminate: almost acuminate.

Subnutant: having top slightly bent downward.

Subopposite: opposite yet slightly alternate.

Subquadrate: almost square.

Subsessile: with a partial or very short stalk.

Subspecies: subdivision of species, each subspecies being geographically or ecologically isolated from each other and with fewer distinguishing characters than demarcate a

species.

Subtend: being immediately below something.

Subterranean: below ground.

Subulate: shaped like an awl, thin and tapering to a small point.

Subumbellate: a partial or seeming to be an umbel but not quite.

Succulent: plant with thick, fleshy and swollen stems and/or leaves, adapted to dry environments.

Sulcate: grooved or furrowed.

Superposed: Placed upon another.

Supra-axillary: growing above the axil.

Sympodial: type of branching in which an apparent main axis is made up of many lateral branches, each arising from the one before; i.e., each is an extension growth from lateral axes, not from the original tip.

Synanthous: with flowers and leaves appearing simultaneously.

Synsepal: formed by the fusion of more than one sepal.

T

Taxon (plural **Taxa**): a general term denoting a named group of any rank (e.g. genus, species or family).

Taxonomy: the scientific classification of organisms.

Teeth: small sharp projections.

Tepal: perianth of those flowers where there is no distinction between calyx and corolla.

Terete: cylindrical or tube-like.

Terminal: at the end.

Terrestrial: grows in the ground.

Tessellate: crisscross pattern, like a mosaic.

Tetragonal: four-sided.

Throat: the opening in a tubular lip.

Tinged: coloured lightly.

Tomentose: densely covered with short soft hairs, somewhat matted.

Tortuous: twisted in different directions.

Trapezoid: four sided figure with two sides parallel.

Trapeziform: shaped like a four sided object with two parallel sides

Trichome: an epidermal outgrowth of diverse form, structure and function but without vascular tissue.

Tridentate: three toothed.

Trimerous: having three each of the sepals and petals

Tripartite: divided into three parts.

Truncate: ending abruptly in a more or less straight line, as if cut off.

Tuber: swollen underground stem that stores food for the plant.

Tuberculate: having wart-like protuberances.

Tuberous: shaped like a tuber.

Tumid: swollen.

Turbinate: top-shaped, obconical and narrowed towards the point.

Turgid: swollen or inflated, sometimes with fluid.

Type: mostly the specimen upon which the species is originally described.

U

Umbel: an inflorescence with branches arising from more or less the same point on a

common peduncle.

Umbellate: with umbels.

Umbo: a small blunt protuberance.

Uncinate: hooked at the apex or tip.

Undulate: having wavy margin.

Unguiculate: clawed, narrowed into a petiole-like base.

Unilocular: single cavity or chamber.

Urceolate: pitcher like.

V

Variegated: having various colours or colour forms.

Variety: infraspecific taxon below the rank of subspecies and above that of form with one or several distinguishing characters, not geographically disjunct from other conspecific taxa.

Vein: an externally visible strand of vascular tissues.

Velamen: the spongy outer layer of an orchid root, consisting of dead cells at maturity.

Venation: the pattern of vein arrangement.

Venose: having veins.

Ventral: relating or attached to the inner side of an organ.

Ventricose: unequally swollen.

Verrucose: having a warty appearance.

Villous: having long soft hairs.

Viscid: sticky.

Viscidium: the gland to which the pollinia are attached.

Vulnerable (VU): A taxon is Vulnerable when the best available evidence indicates that it meets

any of the criteria A to E for Vulnerable (Sec. V, IUCN 2012a), and it is therefore considered to be facing a high risk of extinction in the wild.

W

Whorl: arranged in a circular pattern.

Wings: extensions that are wing like.

Z

Zygomorphic: with bilateral symmetry, i.e. either side of an (imaginary) central line being mirror image of the other

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INDEX OF BOTANICAL NAMES

Note: The bold italic name indicates the valid name of the taxon occurring within the ambit of Assam; the bold number indicates taxon is described on that page.

A

Aphyllorchis montana Rchb.f. 4, 5, 6, 8

C

Calanthe R.Br. 144

Calanthe angusta Lindl. 153

Calanthe biloba Lindl. 145

Calanthe biloba var. *diptera* Hook.f. 145

Calanthe clavata Lindl. 146, 148

Calanthe erytroglossa Rchb.f. ex Hook.f. 147

Calanthe foerstermannii Rchb.f. 149

Calanthe gracilis Lindl. 159

Calanthe herbacea Lindl. 147, 155

Calanthe longipes Hook.f. 158

Calanthe lyroglossa Rchb.f. **149, 155**

Calanthe mannii Hook.f. 150, 151

Calanthe masuca (D.Don) Lindl. 150, 152

Calanthe odora Griff. 153

Calanthe puberula Lindl. 154, 155, 156

Calanthe purpurea Lindl. 150

Calanthe triplicata (Willemet) Ames 156, 157

Calanthe vaginata Lindl. 154

Calanthe veratrifolia R.Br. ex Ker Gawl. 156

Calanthe viridifusca Hook. 143

Callostylis Blume 2

Calypsoinae Chase *et al.* 2, 128

Cephalanthera Rich. 7

Cephalanthera ensifolia Rich. 7

Cephalanthera longifolia (L.) Fritsch **7, 8, 9**

Cephalantheropsis Guillaumin 158

Cephalantheropsis gracilis (Lindl.) S.Y.Hu 159

Cephalantheropsis longipes (Hook.f.) Ormerod **158, 159**

Cephalantheropsis obcordata (Lindl.) Ormerod 159, 160, 161

Ceratostylis Blume 2

Cheirostylis Blume 1

Chiloschista Lindl. 2

Chrysoglossum Blume 2, 135

Chrysoglossum assamicum Hook.f. **162, 164**

Chrysoglossum erraticum Hook.f. 163

Chrysoglossum ornatum Blume 163, 164

Chrysoglossum robinsonii Ridl. 165

Chrysoglossum sinense Mansf. 162

Cleisocentron Brühl 2

Cnemidia angulosa Lindl. 13

Coelogyne Lindl. 2, 4, 36

Coelogyne assamica Linden & Rchb.f. 38

Coelogyne barbata Lindl. ex Griff. 38, 39

Coelogyne convallariae E.C.Parish & Rchb.f. 74

Coelogyne cristata Lindl. 39, 40

- Coelogyne elata* Lindl. 54
- Coelogyne falcata* T.Anderson ex Hook.f. 71
- Coelogyne fusca* (Lindl.) Rchb.f. 64
- Coelogyne fuscescens* Lindl. 44
- Coelogyne goweri* Rchb.f. 51
- Coelogyne graminifolia* E.C.Parish & Rchb.f. 57
- Coelogyne griffithii* Hook.f. 45
- Coelogyne khasyana* (Rchb.f.) Rchb.f. 72
- Coelogyne longipes* Lindl. 46, 47
- Coelogyne maculata* Lindl. 80
- Coelogyne nitida* (Roxb.) Hook. f. 51
- Coelogyne nitida* (Wall. ex D.Don) Lindl. 48
- Coelogyne ocellata* Lindl. 51
- Coelogyne ochracea* Lindl. 48
- Coelogyne ovalis* Lindl. 49
- Coelogyne praecox* (Sm.) Lindl. 82
- Coelogyne prolifera* Lindl. 50, 51
- Coelogyne punctulata* Lindl. 51, 52
- Coelogyne rossiana* Rchb.f. 56
- Coelogyne rubra* (Lindl.) Rchb.f. 77
- Coelogyne schultesii* S.K.Jain & S.Das 52, 53, 54
- Coelogyne stricta* (D.Don) Schltr. 54, 55
- Coelogyne suaveolens* (Lindl.) Hook.f. 55, 56
- Coelogyne trinervis* Lindl. 56, 57
- Coelogyne trisaccata* Griff. 60
- Coelogyne viscosa* Rchb.f. 57, 58, 59
- Coelogyneinae* Benth. 36
- Collabieae* Pfitzer 2, 4
- Collabium* Blume 165
- Collabium assamicum* (Hook.f.) Seidenf. 162
- Collabium chinense* (Rolfe) Tang & F.T.Wang 165, 167
- Conchidium* Griff. 2
- Cordyla concolor* Blume 21
- Corymbis disticha* (Breda) Lindl. 11
- Corymbis veratrifolia* (Reinw.) Rchb.f. 11
- Corymborkis assamica* Blume 11
- Corymborkis veratrifolia* (Reinw.) Blume 10, 11, 12
- Cremastra* Lindl. 2, 128
- Cremastra appendiculata* (D.Don) Makino 128, 129
- Cremastra wallichiana* Lindl. 128
- Cymbidieae* Pfitzer 2, 3
- Cymbidiinae* Benth. 2, 89
- Cymbidiopsis lancifolia* (Hook.) H.J.Chowdhery 104
- Cymbidiopsis macrorhiza* (Lindl.) H.J.Chowdhery 106
- Cymbidium* Sw. 2, 89
- Cymbidium affine* Griff. 107
- Cymbidium aloifolium* (L.) Sw. 91, 92
- Cymbidium appendiculatum* D.Don 128
- Cymbidium bambusifolium* Roxb. 33
- Cymbidium bicolor* subsp. *obtusum* Du Puy & P.J.Cribb 92, 93
- Cymbidium carnosum* Griff. 95
- Cymbidium cochleare* Lindl. 94
- Cymbidium crassifolium* Wall. 92

Cymbidium crassifolium Wall. ex Herb. 92
Cymbidium cyperifolium Wall. ex Lindl. 95
Cymbidium dayanum Rchb.f. 96, 97
Cymbidium eburneum Lindl. 96, 98
Cymbidium eburneum var. *dayanum* (Rchb.f.) Hook.f. 96
Cymbidium elegans Lindl. 99
Cymbidium ensifolium subsp. *haematodes* (Lindl.) Du Puy & P.J. Cribb ex Govaerts 100, 101
Cymbidium ensifolium var. *haematodes* (Lindl.) Trimen 100
Cymbidium ensifolium var. *munronianum* (King & Pantl.) T. Tang & F.T. Wang 108
Cymbidium erythraeum Lindl. 100, 102
Cymbidium gibsonii Lindl. & Paxton 104
Cymbidium haematodes Lindl. 100
Cymbidium hennisianum Schltr. 102
Cymbidium iridiodes D. Don 103
Cymbidium lancifolium Hook. 104, 105
Cymbidium longifolium D. Don 99
Cymbidium macrorhizon Lindl. 106
Cymbidium mannii Rchb. 92
Cymbidium mastersii Griff. ex Lindl. 107
Cymbidium micromeson Lindl. 107
Cymbidium munronianum King & Pantl. 108
Cymbidium nitidum Roxb. 51
Cymbidium nitidum Wall. ex D. Don 48
Cymbidium pendulum (Roxb.) Sw. 91
Cymbidium simonsianum King & Pantl. 96

Cymbidium simulans Rolfe 91
Cymbidium strictum D. Don 54
Cymbidium syringodorum Griff. 98
Cyperorchis cochleare (Lindl.) Benth. 94
Cyperorchis elegans (Lindl.) Blume 99
Cyperorchis hennisiana (Schltr.) Schltr. 102
Cyperorchis mastersii (Griff. ex Lindl.) Benth. 107
Cyrtopera mannii Rchb.f. 117
Cyrtopera nuda (Lindl.) Rchb.f. 118
Cyrtopera obtusa Lindl. 118
Cyrtopera sanguinea Lindl. 120
Cyrtopera zollingeri Rchb.f. 120
Cytheris cordifolia Lindl. 166

D

Decaisnea angulosa Lindl. 13
Dendrobium demissum D. Don 67
Dendrobium infundibulum Lindl. 88
Didymoplexis Griff. 2, 16
Didymoplexis pallens Griff. 15, 16, 17, 18
Dienia Lindl. 2
Diplomeris D. Don 1
Diploprora Hook.f. 2
Diurideae (Endl.) Lindl. 1

E

Epidendreae Kunth 2, 4

Epidendroideae Lindl. 1, 2
Epidendrum aloifolium L. 91
Epidendrum praecox Sm. 82
Epipactis juliana Roxb. 23
Epipogiinae Schltr. 2, 26
Epipogium J.F. Gmel. ex Borkh. 2, 20, 26
Epipogium indicum H.J. Chowdhery 26
Epipogium nutans (Blume) Rchb.f. 26
Epipogium roseum (D. Don) Lindl. 26, 27
Eria Lindl. 2
Eria angulata Rchb.f. 180
Eria bambusifolia Lindl. 560
Erythodes Blume 1
Erythrorchis Blume 1
Eulophia R.Br. 2, 89, 109
Eulophia andamanensis Rchb.f. 109, 110, 112
Eulophia bicallosa (D. Don) P.F. Hunt & Summerh. 110, 111
Eulophia bicarinata (Lindl.) Hook.f. 111
Eulophia bracteosa Lindl. 111, 112
Eulophia campanulata Duthie 118
Eulophia campestris Wall. ex Lindl. 113
Eulophia candida (Lindl.) Hook.f. 111
Eulophia dabia (D. Don) Hochr. 113
Eulophia graminea Lindl. 113, 114
Eulophia hastata Lindl. 180
Eulophia herbacea Lindl. 114, 115
Eulophia hormusjii Duthie 113
Eulophia kamarupa Sud. Chowdhury 115, 116, 119

Eulophia keithii Ridl. 109
Eulophia mannii (Rchb.f.) Hook.f. 117
Eulophia nuda Lindl. 118
Eulophia obtusa (Lindl.) Hook.f. 118, 119
Eulophia sanguinea (Lindl.) Hook.f. 120
Eulophia spectabilis (Dennst.) Suresh 118, 120
Eulophia zollingeri (Rchb.f.) J.J. Sm. 120, 121
Eulophiinae Benth. 2, 109

G

Galeola Lour. 1
Gastrochilus D. Don 2
Gastrodieae Lindl. 2, 3
Geodorum Jacks. 2, 89, 122
Geodorum appendiculatum Griff. 122, 123, 124
Geodorum candidum (Roxb.) Lindl. 124
Geodorum dilatatum R.Br. 126
Geodorum pallidum D. Don 124
Geodorum purpureum R.Br. 124
Geodorum recurvum (Roxb.) Alston 126
Goodyera R.Br. 1
Goodyerinae Klotzsch 1

H

Habenaria Willd. 1
Herminium L. 1
Herpysma Lindl. 1

Hetaeria Blume 1

I

Ipsea wrayana Hook. f. 182

L

Lecanorchis Blume 1

Limatodis gracilis (Lindl.) Lindl. 159

Limatodis mishmensis Lindl. & Paxton 172

Limodorum bicolor Roxb. 114

Limodorum bracteatum Roxb. 85

Limodorum candidum Roxb. 124

Limodorum ramentaceum Roxb. 113

Limodorum recurvum Roxb. 126

Limodorum roseum D. Don 26

Limodorum tankervilleae Banks 173

Liparis Rich. 2

Luisia Gaudich. 2

M

Malaxideae Lindl. 2, 3

Malaxidinae Benth. & Hook. f. 2

Micropera Lindl. 2

Mischobulbum wrayanum (Hook. f.) Rolfe 182

Mycaranthes Blume 2

N

Neogyna Rchb. f. 2, 30, 60

Neogyna gardneriana (Lindl.) Rchb. f. 60

Neottieae Lindl. 2, 3

Nephelaphyllum Blume 2, 135

Nephelaphyllum chinense Rolfe 165

Nephelaphyllum cordifolium (Lindl.) Blume 166, 167

Nervilia Comm. ex Gaudich. 2, 20

Nervilia aragoana Gaudich. 21

Nervilia calcicola Kerr 22

Nervilia concolor (Blume) Schltr. 21, 24

Nervilia discolor (Blume) Schltr. 23

Nervilia hallbergii Blatt. & McCann 22

Nervilia infundibulifolia Blatt. & McCann 22

Nervilia juliana (Roxb.) Schltr. 23, 24

Nervilia plicata (Andrews) Schltr. 23, 25

Nervilia scottii (Rchb. f.) Schltr. 21

Nervilieae Dressler 2, 3

Nerviliinae Schltr. 2, 20

O

Oberonia Lindl. 2

Odontochilus Blume 1

Orchideae Dressler & Dodson 1

Orchidinae Dressler & Dodson 1

Orchidoideae Lindl. 1

Orchis triplicata Willemet 156

Otochilus Lindl. 2, 30

Otochilus albus Lindl. 61, 66

Otochilus fuscus Lindl. 62, 63

Otochilus lancifolius Griff. 62

Otochilus lancilabius Seidenf. 64

Otochilus latifolius Griff. 65

Otochilus porrectus Lindl. 65, 66

Otochilus porrectus auct. non Lindl. 65, 66

P

Pachystoma Blume 2, 135

Pachystoma pubescens Blume 168, 169, 170

Pachystoma senile (Lindl.) Rchb.f. 168

Panisea Lindl. 2, 30

Panisea demissa (D.Don) Pfitzer 67, 69

Panisea tricallosa Rolfe 67, 68, 69, 70

Paphiopedilum Pfitzer 1

Papilionanthe Schltr. 2

Pecteilis Raf. 1

Pelatantheria Ridl. 2

Pennilabium J.J.Sm. 2

Peristylus Blume 1

Phaius Lour. 2, 135

Phaius albus Lindl. 84

Phaius bicolor Lindl. 174

Phaius blumei Lindl. 173

Phaius blumei var. *assamica* Rchb.f. 173

Phaius blumei var. *pulchra* King & Pantl. 173

Phaius longipes (Hook.f.) Holttum 158

Phaius maculatus Lindl. 171

Phaius mishmensis (Lindl. & Paxton) Rchb.f. 172, 173

Phaius tankervilleae (Banks) Blume 172, 174

Phaius veratrifolius (Roxb.) Lindl. 173

Phaius wallichii Lindl. 174, 175

Phaius wallichii Lindl. var. *assamicus* (Rchb.f.) King & Pantl. 173

Phalaenopsis Blume 2

Pholidota Lindl. 2, 30, 72

Pholidota articulata Lindl. 72, 73

Pholidota articulata var. *griffithii* (Hook.f.) King & Pantl. 72

Pholidota assamica Regel 75

Pholidota bracteata (D.Don) Seidenf. 75

Pholidota calceata Rchb.f. 75

Pholidota convallariae (E.C.Parish & Rchb.f.) Hook.f. 74

Pholidota griffithii Hook.f. 72

Pholidota imbricata Lindl. 75, 76

Pholidota imbricata var. *coriacea* Hook.f. 75

Pholidota imbricata var. *sessilis* Hook.f. 76

Pholidota khasyana Rchb.f. 72

Pholidota pallida Lindl. 75, 77

Pholidota pallida var. *sessilis* (Hook.f.) P.K.Sarkar 76

Pholidota rubra Lindl. 77, 78, 79

Pholidota suaveolens Lindl. 55

Pholidota undulata Wall. ex Lindl. 77

Pholidota wattii King & Pantl. 78, 79

Phreatia Lindl. 2

Pinalia Lindl. 2

Platanthera Rich. 1

Pleione D. Don 2, 30, 80

Pleione diphylla Lindl. & Paxton 80

Pleione maculata (Lindl.) Lindl. & Paxton 28, 80, 81, 82

Pleione praecox (Sm.) D. Don 82, 83

Pleione praecox var. *candida* Pfitzer 82

Podochileae Pfitzer 2, 4

Podochilus Blume 2

Pogonia juliana (Roxb.) Wall. ex Trimen 23

Pogonia plicata (Andrews) Lindl. 23

Pogonia scottii Rchb.f. 21

Pogonia velutina E.C. Parish & Rchb.f. 23

Pomatocalpa Breda 2

Porpax Lindl. 2

Pteroceras Hasselt ex Hassk. 2

R

Renanthera Lour. 2

Rhynchostylis Blume 2

Robiquetia Gaudich. 2

S

Saccolabiopsis J.J.Sm. 2

Satyrium L. 1

Schoenorchis Reinw. ex Blume 2

Serapias helleborine var. *longifolia* L. 7

Sigmatogyne pantlingii Pfitzer 67

Sigmatogyne tricallosa (Rolfe) Pfitzer 67

Smitinandia Holttum 2

Spathoglottis Blume 2, 135, 176

Spathoglottis plicata Blume 176, 177

Spathoglottis pubescens Lindl. 176, 178, 179

Spiranthes Rich. 1

Spiranthinae Lindl. 1

Stereochilus Lindl. 2

T

Taeniophyllum Blume 2

Tainia Blume 2, 135

Tainia angustifolia (Lindl.) Benth. & Hook.f. 139

Tainia cordata Hook.f. 180

Tainia hastata (Lindl.) Hook.f. 180

Tainia hookeriana King & Pantl. 141

Tainia khasiana Hook.f. 180

Tainia latifolia (Lindl.) Rchb.f. 180

Tainia minor Hook.f. 181

Tainia penangiana Hook.f. 141

Tainia viridifusca (Hook.) Benth. ex Hook.f. 143

Tainia wrayana (Hook.f.) J.J.Sm. 182, 183

Trichotosia Blume 2

Tropidia Lindl. 2, 11, 13

Tropidia angulosa (Lindl.) Blume 13, 14

Tropidia assamica Blume 14

Tropidia curculigoides Lindl. 14

Tropidia formosana Rolfe ex Hemsl. 14

Tropidieae Dressler 2, 3

U

Uncifera Lindl. 2

V

Vanda Jones ex R. Br. 2

Vandaeae Lindl. 2, 3

Vandopsis Pfitzer 2

Vanilla Plum. ex Mill. 1

Vanilleae Blume 1

Vanilloideae Szlach. 1

Vrydagzynea Blume 1

Z

Zeuxine Lindl. 1

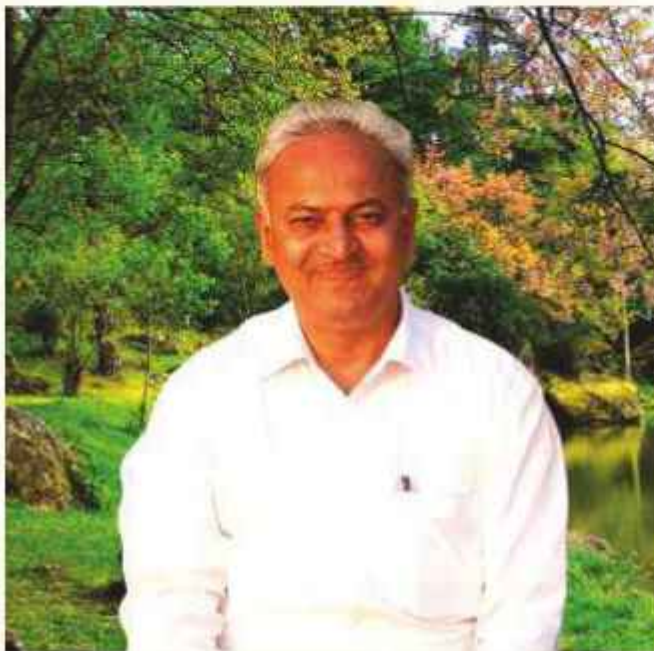
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Hussain Ahmed Barbhuiya is a young taxonomist and conservationist, holds a Ph.D. degree in Botany from Assam University, Silchar. He made extensive field explorations in different parts of Assam. Currently, focusing on the documentation and conservation of threatened and endemic plants of North East India and the Western Ghats, orchids in particular. So far, he published 53 research papers in various journals of National and International repute. He discovered eight new species and two new varieties of plant, three of them are orchids. He is a member of IUCN Species Survival Commission's Orchid Specialist Group (OSG) and Seed Conservation Specialist Group (SCSG); also, the life member of the Indian Association for Angiosperm Taxonomy (IAAT). He is having excellent skills in nature photography. Besides, he has the passion to make short films/documentary on plants and their conservation. In addition, he acts as a voluntary reviewer of many taxonomic journals.



Durgesh Verma is a doctorate in Botany from the University of Lucknow, has worked on the plant systematics of North-East India. He has done extensive field exploration especially in the protected areas of Meghalaya and Mizoram. Four new species (including three orchids) and a variety have been discovered by him. So far, he has published 2 books and 36 research papers in various journals of National and International repute. Recently, he has received the Birbal Sahni Research award (2019) for the best research work in Botany by the University of Lucknow. He is also an active reviewer of many leading journals of plant taxonomy. In addition, he is a nature lover, travel enthusiast, and amateur photographer.

Santanu Dey holds a Ph.D. degree in Botany from Nagaland University. He worked on the flora of Nagaland particularly on Tuensang district, a remote place in Indo-Myanmar border and various other protected areas of Assam e.g. Kaziranga National Park, Manas Biosphere Reserve, Borail Wildlife Sanctuary, etc. He is an avid tracker and has a hobby of camping in remote hills and valleys. He made extensive field explorations in different parts of North East India, Assam and Nagaland in particular. He has published more than 30 research papers in various scientific journals of national and international repute. So far, he discovered 8 new species of plants and reported several new distributional records for India as well as for Assam and Nagaland. Currently, he is involved in the documentation of wild Bananas of Nagaland.



Chandrakant Krishnaji Salunkhe is a horticulturist, holds a Ph.D. degree in Botany from the University of Mumbai. He is having a keen interest in plant introduction, cultivation, and propagation of rare and threatened plants having ornamental value. He is the chief horticulturist of Bhabha Atomic Research Centre, Mumbai, also the visiting faculty of Centre for Extra-Mural Studies, University of Mumbai. Besides, he is an elected expert member of the Tree Authority, Brihanmumbai Municipal Corporation, and associated with many societies actively involved in plant conservation e.g. National Society of the Friends of Trees, Mumbai Rose Society, Indian Rose Federation, etc.



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