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Caption: *Cyrtodactylus myintkyawthurai*, endemic to Myanmar. Medium: Water colours on watercolor sheet. © Aakanksha Komanduri



## An inventory of new orchid (Orchidaceae) records from Kozhikode, Kerala, India

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**Abstract:** Orchidaceae is one of the largest families in the plant kingdom. It has high diversity within the tropical and subtropical parts of the world, and is considered as a characteristic feature to measure forest richness. This study explores the orchid diversity in Kozhikode District, Kerala, India. A total of 57 species belonging to 28 genera were identified within the study region. Among the total, 42 were epiphytic species and 15 species were terrestrial. Additionally, 16 species were identified as endemic to India, of which, 10 species were exclusive to the Western Ghats, four species to the Western and Eastern Ghats, and two species to peninsular India. Previous studies conducted within this region, only recorded 10 species. The present study, however, adds new records of 47 species to the orchid diversity of Kozhikode.

**Keywords:** Conservation, diversity, epiphytes, new distribution, Western Ghats.

**Editor:** Anonymity requested.

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**Author contributions:** The first author surveyed, collected specimens for identification and prepared the manuscript; while the second and third authors validated the manuscript.

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## INTRODUCTION

Orchids are abundant in the humid tropics and subtropics of the world. They are known for their attractive colour, beautiful structure, and long vase life of the flowers. Orchids play an important role in horticulture trade due to their aesthetic appeal. Horticulturalists show a huge interest in orchid hybrids, which are among the most highly valued horticultural plants in mass-market trade (USDA 2019). Besides the floriculture importance, the orchids face over-exploitation for medicinal practices and are included in the threatened categories (Jalal et al. 2014). Due to the threatened status of orchids, different frameworks and acts are established by international agencies and the Indian Government with the aim to provide legal protection to conserve native orchid diversity. The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) has included native orchids in Appendix I & II to prevent the illegal trade. Similarly, orchids are placed under Schedule VI of Wildlife Protection Act, 1972 amended in 1992 to regulate the trade activities of orchids within India (Wildlife Protection Act 1972; Nagrare 2006).

India is widespread with biogeographic regions with varied topography, climate and habitat providing the floristic wealth of country with 21,730 taxa under 2,774 genera and 268 families (Mao & Dash 2020). Within India, orchids are documented with 1,256 taxa belonging to 155 genera and 305 endemic species (Singh et al. 2019). Latest records from the Western Ghats indicated the presence of 305 orchid species under 77 genera. Additionally, just in the state of Kerala, 265 orchid species belonging to 77 genera have been listed so far (Nayar et al. 2014). Moreover, the Western Ghats and the state of Kerala have been reported to host a high level of orchid endemism with 111 endemic species in the Western Ghats, and 22 species that are exclusively endemic to Kerala (Singh et al. 2015).

Kerala is known to be rich in orchid diversity. The first research study that aimed to create an inventory of orchid species in Kozhikode District, Kerala was 32 years ago. The study resulted in recording only 10 species (Manilal & Sivarajan 1982). Ever since, most researchers have mainly focused on identifying new species. Thus the present work aims to build upon the study that was conducted by Manilal & Sivarajan (1982) and bring out a more comprehensive inventory of orchid species in Kozhikode District, Kerala.

As the natural ecosystem is highly threatened by multiple anthropogenic stressors, it is imperative to

periodically estimate the floral wealth in a region. The orchids are adapted to live in a specialized environment because of their specialized requirement and many species are very restricted in distribution and endemism is very high (Nagrare 2006). Any destruction or degradation of natural habitat beyond a tolerable limit cause threat for their survival. Hence the present study also necessitates to survey and study the orchid diversity and distribution of an area in regular period.

## Study Area

Kozhikode is one of the coastal districts in Kerala. It is bound by Kannur district in the north, Wayanad district in the east, Malappuram district in the south, and the Lakshadweep Sea in the west. It lies between north latitudes 11.140–11.835 and east longitudes 75.508–76.137. It has a forest cover of 1,493 km<sup>2</sup> (Economic Review 2019). The study areas, viz., Kakkad, Kakkayam, Kuttiyadi, Malabar Wildlife Sanctuary, Puduppadi, Peruvannamuzhy, and Thamarassery were selected as they are composed of different forest types such as: tropical semi-evergreen forest, tropical evergreen forest, and grasslands (Table 1). In the year 2019, Kozhikode recorded an annual rainfall of 3,205 mm. The minimum temperature in this region ranges between 22 and 25.8°C and the maximum between 28.2 and 32.9°C. The temperature reaches its peak in the month of April. The zonal relative humidity ranges 74–92 % during the morning hours and 64–89 % in the evening hours (Figure 1).

## METHODS

### Field survey

Explorations on orchids at Kozhikode were carried out from January 2018 to December 2019. The random survey succeeded through frequent visits in all seasons

**Table 1. Geographic location of orchid diversity, Kozhikode District.**

	Location	Altitude (m)	Latitude	Longitude
1	Kakkad	10	11.036082	75.940545
2	Kakkayam	772	11.550156	75.928466
3	Kuttiyadi	81	11.659060	75.749145
4	Malabar Wildlife Sanctuary	1,176	11.558230	75.958238
5	Puduppadi	82	10.789007	76.230478
6	Peruvannamuzhy	60	11.583010	75.818076
7	Thamarassery	55	11.423630	75.946984

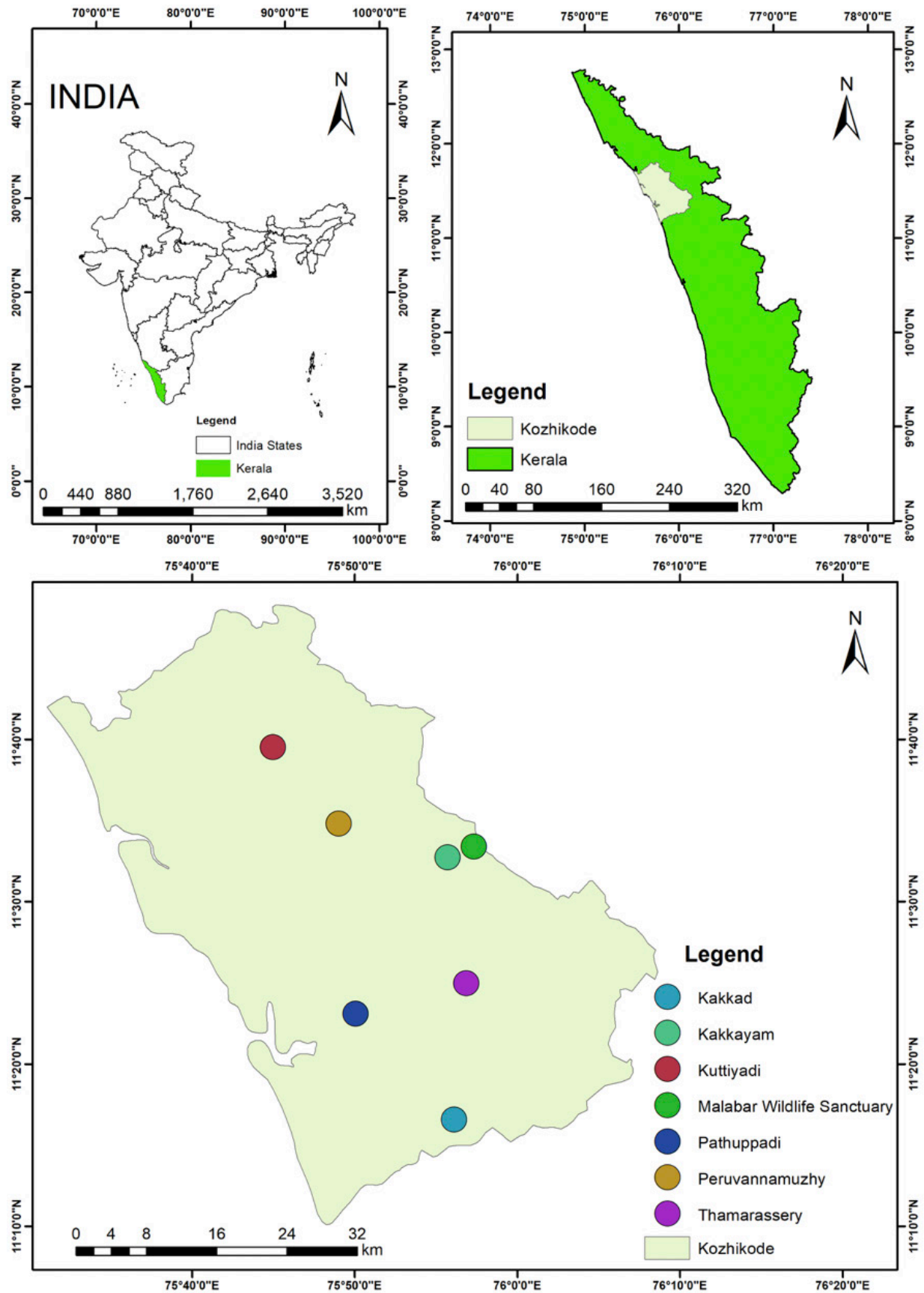


Figure 1. Study area.

and locating the orchids in tropical semi-evergreen forest, tropical evergreen forest, and grasslands of Kozhikode, Kerala. Normally about three specimens were collected with reproductive structures while single specimen was collected for the orchids with least population or an uncommon species. The terrestrial or ground orchids were collected leaving the tuber or rhizome for regeneration and epiphytes were collected using sticks without disturbing its population. The non-flowered orchids were collected and planted in the botanical garden of the Botanical Survey of India, Coimbatore and upon flowering of the species the identification was carried out.

The field notes included names of the flora, habit, habitats, species name, family, flowering, fruiting, date of collection, collection number, collectors, and remarks. In addition, the geo-coordinates and elevation of the orchids were recorded using GPS-Garmin and digital photos were taken using a Nikon D300s Camera for future reference.

After gathering the plant materials, herbarium was prepared using standard herbarium techniques such as poisoning, drying, mounting, and labelling (Jain & Rao 1976). The specimens were identified using relevant literature, regional and national floras (Abraham & Vatsala 1981; Ansari & Balakrishnan 1990; Gamble 1928; Kumar & Manilal 2004; Misra 2007; Sasidharan 2013; Singh et al. 2015, 2019), as well as specimens examined at regional and national herbaria, namely, Madras Herbarium (MH), Tropical Botanic Garden and Research Institute (TBGT), Kerala Forest Research Institute (KFRI), and University of Calicut (CALI). The mounted specimens were labelled with accession number and deposited in the Madras Herbarium (MH), Botanical Survey of India, Southern Regional Centre, Coimbatore, Tamil Nadu.

## RESULTS

### Floristic diversity

This study was conducted as an attempt to create an inventory of orchid species from Kozhikode. A total of 57 species of orchids, belonging to 28 genera were identified as a part of this study (Table 2). The orchids were categorized based on habitat type, and it is noted that, among the total, 42 species are observed to be epiphytic and 15 species are terrestrial. The above collection also included 16 orchid species which are endemic to India. Of these 16 endemic species, 10 species are exclusively found in Western Ghats, viz.: *Bulbophyllum aureum*, *B. rheedei*, *Dendrobium heyneanum*, *D. nodosum*,

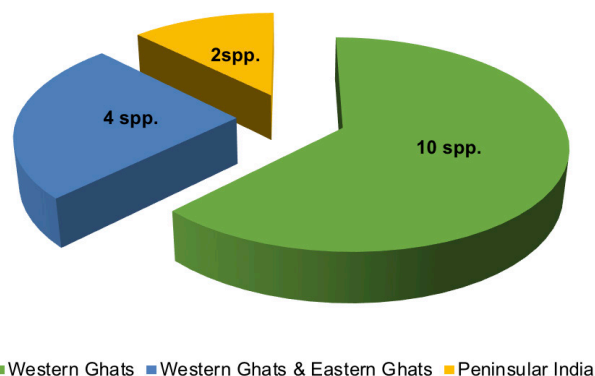


Figure 2. Distribution of endemic orchids from Kozhikode.

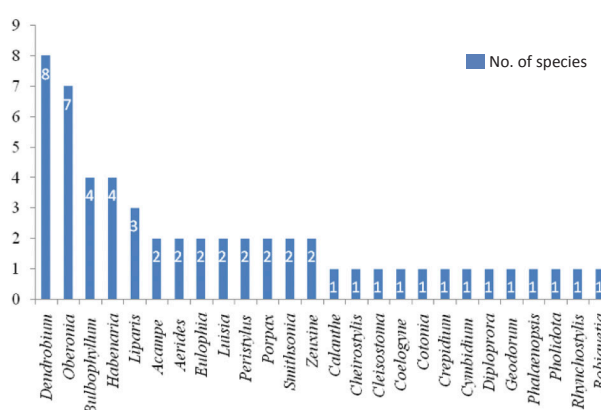


Figure 3. Distribution of dominant orchid genera from Kozhikode.

*Luisia macrantha*, *Oberonia josephi*, *O. sebastiana*, *O. verticillata*, *Robiquetia josephiana*, and *Smithsonia maculata*; four species are endemic to the Eastern and Western Ghats, viz.: *Dendrobium nanum*, *D. ovatum*, *Habenaria heyneana*, and *Porpax exilis*; and two species are endemic to peninsular India, viz.: *Oberonia brunoniana* and *O. proudlockii* (Figure 2).

The most dominant orchid genera in Kozhikode are *Dendrobium* (8 spp.), *Oberonia* (7 spp.), *Bulbophyllum* and *Habenaria* each (4 spp.), and *Liparis* (3 spp.). Eight genera are represented by two species each, while the 13 genera have one species each. (Figure 3).

## DISCUSSION

The land of Kozhikode is endowed with forests, wetlands and beaches. In the past, many academics, botanists, and scientists have conducted expeditions to explore the floristic diversity of this region (Ellis et al. 1967; Manilal & Sivarajan 1982; Chandra & Azeez 2010). The results of those expeditions include, discoveries of



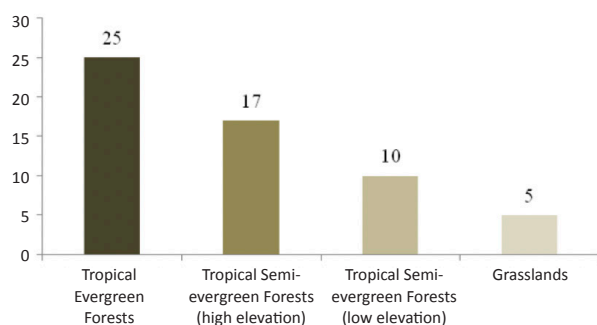


Figure 4. Distribution of Orchids in Forest Types from Kozhikode.

new species, new distribution records, rediscoveries of species, checklist of endemic species, medicinal plants, and lower plants (Nair & Madhusoodanan 2006; Udayan et al. 2008; Ambily et al. 2010).

The present study confirmed the new distribution of 57 orchid species including 10 species that were earlier documented in the region by Manilal & Sivarajan (1982), viz: *Acampe ochracea*, *Bulbophyllum sterile*, *Crepidium versicolor*, *Dendrobium macrostachyum*, *Geodorum densiflorum*, *Habenaria diphylla*, *H. viridiflora*, *Luisia tristis*, *Rhynchostylis retusa*, and *Zeuxine longilabris*. On comparison of orchid diversity in neighboring districts of Kannur and Wayanad resulted in high number of orchids with 46 and 165, respectively (Ramachandran & Nair 1998; Ratheesh 2009); while Kozhikode was documented with less number (Manilal & Sivarajan 1982). Upon analyzing the study area, same level of plant richness was observed. Besides, it is also noted that previous researchers has focused more on floristic aspects rather than concentrating on specific groups like Orchidaceae.

The new distributional findings of the 48 orchid species were mainly found in Kakkayam (tropical evergreen forests), Malabar Wildlife Sanctuary (tropical semi-evergreen forests, tropical evergreen forests, and grasslands), Kakkad & Pathuppadi (tropical semi-evergreen forests), and Kuttiyadi, Peruvannamuzhy, & Thamarassery (tropical semi-evergreen forests and tropical evergreen forests) (Image 1–4). A majority of the species from the survey was found in tropical evergreen forests (25 species). At high elevations the tropical semi-evergreen forests hosted the second highest diversity of 17 species, while in comparison, at lower elevation the diversity of orchids was relatively less, i.e., 10 species. Orchid diversity within grasslands was the lowest with five species (Figure 4).

The high number of orchid flowerings are observed between the months of August to December and others

between the months of January to June. The endemic genus for the Western Ghats of *Smithsonia maculata* and *S. straminea* are excellent collections from the study area. *Oberonia josephii*, previously known only from Wayanad, is now included in this collection as a secondary addition. An interesting species, *Eulophia zollingiri* known for its rare blooming was recorded and conserved with other orchids as ex situ conservation at the botanical garden, Botanical Survey of India, Coimbatore. Hence, this work also highlights the presence and distribution of species is the first step in determining areas of conservation and conservation strategies.

## CONCLUSION

The present findings resulted in recording the new distributions for 47 species of orchids in Kozhikode; as the earlier records has indicated only 10 species. This study also confirms the importance of conducting repeated field surveys in the study area to bring out a comprehensive inventory of orchid species. In addition, it also helps in documenting the changes happening in forest cover and land use finally identifying the threat factors of the vegetation. Thus it is concluded that inventory of any floristic elements is quite essential to assess the diversity of a given area and it act as a baseline data to suggest the appropriate conservation measures in the future timescale.

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**Table 2. Orchid enumeration of Kozikode district, Kerala.**

	Name of the species	Life form	Flowering & fruiting	Voucher No. (MH)	Locality	Distribution
1	<i>Acampe ochracea</i> (Lindl.) Hochr.	E	Nov–May	145445	Anjulimukku (Peruvannamuzhy)	India (Assam, Manipur, Meghalaya, Mizoram, Nagaland, Arunachal Pradesh, Sikkim, Karnataka, Kerala, and Tamil Nadu), Sri Lanka, Bhutan, Bangladesh, Myanmar, China, Thailand, Laos, Cambodia, and Vietnam.
2	<i>Acampe praemorsa</i> (Roxb.) Blatt. & McCann	E	Feb–Nov	145444	Kuttiyadi	India (Andhra Pradesh, Odisha, Goa, Gujarat, Maharashtra, Karnataka, Kerala, Tamil Nadu, Daman & Diu, Dadara & Nagar Haveli, Jharkhand, Chhattishgarh, Madhya Pradesh, and Rajasthan), Sri Lanka, Nepal, Myanmar, and Seychelles.
3	<i>Aerides crispa</i> Lindl.	E	May–Aug	145414	Ambalappara (Kakkayam)	India (Goa, Gujarat, Maharashtra, Karnataka, Kerala, Tamil Nadu, and Dadara & Nagar Haveli), Sri Lanka, Myanmar, and Bangladesh.
4	<i>Aerides ringens</i> (Lindl.) C.E.C.Fisch.	E	Feb–Nov	145446	Kuttiyadi	India (Andhra Pradesh, Odisha, Goa, Gujarat, Karnataka, Kerala, and Tamil Nadu) and Sri Lanka.
5	<i>Bulbophyllum aureum</i> (Hook.f.) J.J.Sm.	E	Jan–Feb	145449	Athozhi (Kuttiyadi)	India (Kerala and Tamil Nadu) Endemic to Western Ghats.
6	<i>Bulbophyllum rheedei</i> Manilal & C.S.Kumar	E	May–Aug	145411	Ambalappara (Kakkayam)	India (Kerala) Endemic to Western Ghats.
7	<i>Bulbophyllum sterile</i> (Lam.) Suresh	E	Apr–Nov	14541	Sankaranpuzha camp (Kakkayam)	India (Andhra Pradesh, Goa, Maharashtra, Karnataka, Kerala and Tamil Nadu), Nepal, Bangladesh and Myanmar.
8	<i>Bulbophyllum stocksii</i> (Benth. ex Hook.f.) J.J.Verm., Schuit. & de Vogel	E	Sep–Nov	145412	Ambalappara (Kakkayam)	India (Maharashtra, Karnataka, Kerala and Tamil Nadu), Myanmar and Bangladesh.
9	<i>Calanthe sylvatica</i> (Thouars) Lindl.	T	Sep–Nov	145438	Sothupara (Kakkayam)	India (Assam, Mizoram, West Bengal, Karnataka, Kerala, and Tamil Nadu), Bhutan, Nepal, Sri Lanka, China, Myanmar, Indonesia, Japan, Malaysia, Thailand, Indo-China, Madagascar, and Africa
10	<i>Cheirostylis parvifolia</i> Lindl.	T	Jun–Sep	145431	Ambalappara Grass land (Kakkayam)	India (Maharashtra, Karnataka, Kerala, Tamil Nadu, and Odisha) and Sri Lanka.
11	<i>Cleisostoma tenuifolium</i> (L.) Garay	E	Jan–Dec	145447	Pathuppadi	India (Goa, Maharashtra, Karnataka, Kerala, and Tamil Nadu), Sri Lanka, and Thailand.
12	<i>Coelogyne breviscapa</i> Lindl.	E	Jan–Apr	145403	Ambalappara (Kakkayam)	India (Karnataka, Kerala, and Tamil Nadu) and Sri Lanka.
13	<i>Cotonia peduncularis</i> (Lindl.) Rchb.f.	E	Jan–Apr	145415	Kakkayam	India (Goa, Maharashtra, Karnataka, Kerala, Tamil Nadu, and Odisha) and Sri Lanka.
14	<i>Crepidium versicolor</i> (Lindl.) Sushil K.Singh, Agrawala & Jalal	T	Sep–Nov	145426	Atthikode R.F. (Malabar Wildlife Sanctuary)	India (Andhra Pradesh, Odisha, Goa, Maharashtra, Karnataka, Kerala, and Tamil Nadu) and Sri Lanka.
15	<i>Cymbidium aloifolium</i> (L.) Sw.	E	Mar–Jun	145439	Kakkad	India (Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura, Arunachal Pradesh, Sikkim, West Bengal, Uttarakhand, Goa, Maharashtra, Karnataka, Kerala, Tamil Nadu, Bihar, Chhattishgarh, Jharkhand, Madhya Pradesh, and Andaman & Nicobar Islands), Sri Lanka, China, Myanmar, Bangladesh, Laos, Cambodia, Vietnam, Malaysia, and Indonesia.
16	<i>Dendrobium herbaceum</i> Lindl.	E	Oct–Nov	145415	Atthikode R.F. (Malabar Wildlife Sanctuary)	India (Mizoram, West Bengal, Andhra Pradesh, Odisha, Goa, Maharashtra, Karnataka, Kerala, Tamil Nadu, Bihar, Chhattishgarh, Jharkhand, and Madhya Pradesh) and Bangladesh.
17	<i>Dendrobium heterocarpum</i> Wall. ex Lindl.	E	Feb–Apr	145410	Ambalappara (Kakkayam)	India (Assam, Manipur, Meghalaya, Mizoram, Nagaland, Arunachal Pradesh, Sikkim, West Bengal, Uttarakhand, Karnataka, Kerala and Tamil Nadu), Sri Lanka, Nepal, Myanmar, Thailand, Malaysia, Philippines, and Indonesia.
18	<i>Dendrobium heyneanum</i> Lindl.	E	Sep–Nov	145430	Ambalappara (Kakkayam)	India (Karnataka, Kerala, and Tamil Nadu). Endemic to Western Ghats.



	Name of the species	Life form	Flowering & fruiting	Voucher No. (MH)	Locality	Distribution
19	<i>Dendrobium macrostachyum</i> Lindl.	E	Mar–Jun	145427	Atthikode R.F. (Malabar Wildlife Sanctuary)	India (Arunachal Pradesh, West Bengal, Uttarakhand, Odisha, Goa, Maharashtra, Karnataka, Kerala, Tamil Nadu, and Jharkhand), Sri Lanka, Nepal, Bangladesh, Indonesia, Thailand, and Vietnam.
20	<i>Dendrobium nanum</i> Hook.f.	E	Sep–Nov	145419	Atthikode R.F. (Malabar Wildlife Sanctuary)	India (Goa, Maharashtra, Karnataka, Kerala, and Tamil Nadu). Endemic to Eastern and Western Ghats.
21	<i>Dendrobium nodosum</i> Dalzell	E	Mar–Jun	145403	Ambalappara (Kakkayam)	India (Goa, Maharashtra, Karnataka, Tamil Nadu, and Kerala). Endemic to Western Ghats.
22	<i>Dendrobium ovatum</i> (L.) Kraenzl.	E	Jan–Dec	145448	Thamarassery	India (Andhra Pradesh, Gujarat, Goa, Maharashtra, Karnataka, Kerala, and Tamil Nadu). Endemic to Eastern and Western Ghats.
23	<i>Dendrobium salaccense</i> (Blume) Lindl.	E	Sep–Nov	145409	Ambalappara (Kakkayam)	India (Assam, Meghalaya, Mizoram, Tripura, Arunachal Pradesh, Sikkim, West Bengal, Odisha, Karnataka, Kerala, Tamil Nadu, and Andaman & Nicobar Islands), Sri Lanka, Bhutan, China, Indonesia, Laos, Malaysia, Myanmar, Thailand, and Vietnam.
24	<i>Diploprora championii</i> (Lindl.) Hook.f.	E	Aug–Sep	145421	Atthikode R.F. (Malabar Wildlife Sanctuary)	India (Meghalaya, Arunachal Pradesh, Sikkim, West Bengal, Odisha, Karnataka, Kerala, and Andaman & Nicobar Islands), Sri Lanka, China, Bangladesh, Myanmar, Thailand, and Vietnam.
25	<i>Eulophia nuda</i> Lindl.	T	Sep–Oct	145435	Atthikode R.F. (Malabar Wildlife Sanctuary)	India (Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura, Arunachal Pradesh, Sikkim, West Bengal, Uttarakhand, Uttar Pradesh, Jharkhand, Bihar, Madhya Pradesh, Chhattisgarh, Punjab, Odisha, Andhra Pradesh, Maharashtra, Karnataka, Kerala, Tamil Nadu, and Andaman & Nicobar Islands), Sri Lanka, Nepal, China, Myanmar, Bangladesh, Thailand, Malaysia, Philippines, and Pacific Island.
26	<i>Eulophia zollingeri</i> (Rchb.f.) J.J.Sm.	T	Jan–Feb	145435	Atthikode R.F. (Malabar Wildlife Sanctuary)	India (Assam, Meghalaya, Nagaland, Arunachal Pradesh, Sikkim, West Bengal, Karnataka, Kerala, and Andaman & Nicobar Islands), Bhutan, Nepal, Sri Lanka, China, Japan, Malaysia, Philippines, Thailand, Papua New Guinea, Australia, and Vietnam.
27	<i>Geodorum densiflorum</i> (Lamk.) Schlech.	T	Apr–Nov	145440	Atthikode R.F. (Malabar Wildlife Sanctuary)	India (Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura, Arunachal Pradesh, Sikkim, West Bengal, Uttarakhand, Andhra Pradesh, Odisha, Goa, Karnataka, Maharashtra, Kerala, Tamil Nadu, Bihar, Chhattisgarh, Jharkhand, and Madhya Pradesh) New Guinea, Thailand, Indo-China, southeastern Asia, Pacific Islands, Australia, and Fiji.
28	<i>Habenaria diphylla</i> Dalz.	T	Aug–Sep	145451	Atthikode grass land (Malabar Wildlife Sanctuary)	India (Meghalaya, Sikkim, West Bengal, Himachal Pradesh, Uttarakhand, Odisha, Andhra Pradesh, Goa, Karnataka, Kerala, Maharashtra, Tamil Nadu, Bihar, Jharkhand, and Chhattisgarh), Bangladesh, Bhutan, Nepal, Myanmar, Thailand, China, and Philippines.
29	<i>Habenaria heyneana</i> Lindl.	T	Aug–Sep	145433	Ambalappara grass land (Kakkayam)	India (Andhra Pradesh, Goa, Karnataka, Kerala, Maharashtra, and Tamil Nadu). Endemic to Eastern and Western Ghats.
30	<i>Habenaria longicorniculata</i> J.Graham	T	Aug–Sep	145423	Athikode grass land (Malabar Wildlife Sanctuary)	India (Andhra Pradesh, Odisha, Gujarat, Goa, Maharashtra, Karnataka, Kerala, Tamil Nadu, Jharkhand, Chhattisgarh, Madhya Pradesh, and Rajasthan) and Sri Lanka.
31	<i>Habenaria viridiflora</i> (Sw.) R. Br.	T	Aug–Dec	145451	Atthikode grass land (Malabar Wildlife Sanctuary)	India (Assam, Karnataka, Kerala, Maharashtra, and Tamil Nadu), Sri Lanka, Thailand, Bangladesh, Indo-China, Thailand, and Vietnam.

	Name of the species	Life form	Flowering & fruiting	Voucher No. (MH)	Locality	Distribution
32	<i>Liparis deflexa</i> Hook.f.	T	Oct–Nov	145440	Kuttiyadi R.F.	India (Assam, Sikkim, West Bengal, Uttarakhand, Andhra Pradesh, Goa, Karnataka, Kerala, Tamil Nadu, and Chhattishgarh), Myanmar, Nepal, Laos, Cambodia, Indo-China, and Vietnam.
33	<i>Liparis elliptica</i> Wight	E	Sep–Oct	145427	Kakkayam R.F.	India (Manipur, Meghalaya, Arunachal Pradesh, Sikkim, Odisha, Andhra Pradesh, Karnataka, Kerala, and Tamil Nadu), Sri Lanka, Nepal, Myanmar, China, Thailand, Taiwan, Indonesia, Philippines, Vietnam, and Pacific Islands.
34	<i>Liparis viridiflora</i> (Blume) Lindl.	E	Aug–Dec	145428	Atthikode R.F. (Malabar Wildlife Sanctuary)	India (Assam, Meghalaya, Manipur, Mizoram, Nagaland, Tripura, Sikkim, West Bengal, Uttarakhand, Andhra Pradesh, Odisha, Karnataka, Kerala, and Tamil Nadu), Sri Lanka, China, Nepal, Bhutan, Taiwan, Myanmar, Bangladesh, Malaysia, Philippines, Indonesia, Thailand, and Pacific Islands.
35	<i>Luisia macrantha</i> Blatt. & McCann	E	Feb–Nov	145408	Ambalappara (Kakkayam)	India (Karnataka and Kerala). Endemic to Western Ghats.
36	<i>Luisia tristis</i> (G.Forst.) Hook.f.	E	Mar–Jun	145441	Athozhi (Kuttiyadi)	India (Assam, Meghalaya, Manipur, Nagaland, Arunachal Pradesh, Maharashtra, Karnataka, Tamil Nadu, Kerala, and Andaman & Nicobar Islands), Sri Lanka, Nepal, China, Bangladesh, Myanmar, Bhutan, Malaysia, and southeastern Asia.
37	<i>Oberonia bicornis</i> Lindl.	E	Aug–Nov	145420	Atthikode R.F. (Malabar Wildlife Sanctuary)	India (Manipur, Mizoram, Meghalaya, Maharashtra, Karnataka, Kerala, and Tamil Nadu), Sri Lanka, and Bangladesh.
38	<i>Oberonia brunoniana</i> Wight	E	Aug–Dec	145419	Atthikode R.F. (Malabar Wildlife Sanctuary)	India (Andhra Pradesh, Goa, Maharashtra, Karnataka, Kerala, and Tamil Nadu). Endemic to peninsular India.
39	<i>Oberonia ensiformis</i> (Sm.) Lindl.	E	Aug–Dec	145402	Sankaranpuzha (Kakkayam)	India (Manipur, Meghalaya, Mizoram, Nagaland, Arunachal Pradesh, Sikkim, West Bengal, Uttarakhand, Andhra Pradesh, Odisha, Maharashtra, Karnataka, Kerala, Tamil Nadu, and Andaman & Nicobar Islands), Nepal, China, Myanmar, Thailand, Laos, and Vietnam.
40	<i>Oberonia josephi</i> C.J.Saldanha	E	Aug–Dec	145424	Kakkayam R.F.	India (Karnataka and Kerala) Endemic to Western Ghats.
41	<i>Oberonia proudlockii</i> King & Pantl.	E	Aug–Dec	145402	Sankaranpuzha (Kakkayam)	India (Odisha, Maharashtra, Karnataka, Kerala and Tamil Nadu) Endemic to Peninsular India.
42	<i>Oberonia sebastiana</i> B.V.Shetty & Vivek.	E	Aug–Nov	145442	Anjulimukku (Kuttiadi)	India (Kerala and Tamil Nadu). Endemic to Western Ghats.
43	<i>Oberonia verticillata</i> Wight	E	Aug–Nov	145418	Atthikode R.F. (Malabar Wildlife Sanctuary)	India (Goa, Maharashtra, Karnataka, Tamil Nadu, and Kerala). Endemic to the Western Ghats.
44	<i>Peristylus aristatus</i> Lindl.	T	Aug–Sep	145434	Atthikode R.F. (Malabar Wildlife Sanctuary)	India (Goa, Karnataka, Kerala, Maharashtra, and Tamil Nadu), Nepal, Pakistan, Myanmar, Malaysia, and Indonesia.
45	<i>Peristylus spiralis</i> A.Rich.	T	Aug–Sep	145432	Ambalappara Grass land (Kakkayam)	India (Maharashtra, Karnataka, Tamil Nadu, and Kerala) and Sri Lanka
46	<i>Phalaenopsis mysorensis</i> C.J.Saldanha	E	Feb–Apr	145407	Ambalappara (Kakkayam)	India (Karnataka and Kerala) and Sri Lanka.
47	<i>Pholidota imbricata</i> Hook.f.	E	Jan–Mar	145428	Thamarassery	India (Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura, Arunachal Pradesh, Sikkim, West Bengal, Uttarakhand, Andhra Pradesh, Odisha, Goa, Maharashtra, Karnataka, Kerala, Tamil Nadu, Jharkhand, Chhattishgarh, Madhya Pradesh, and Andaman & Nicobar Islands), Sri Lanka, tropical & subtropical Asia, and Pacific Islands.
48	<i>Porpax exilis</i> (Hook.f.) Schuit., Y.P.Ng & H.A.Pedersen	E	Feb–Apr	145404	Ambalappara (Kakkayam)	India (Goa, Karnataka, Kerala, Maharashtra, and Tamil Nadu). Endemic to Eastern and Western Ghats

	Name of the species	Life form	Flowering & fruiting	Voucher No. (MH)	Locality	Distribution
49	<i>Porpax reticulata</i> Lindl.	E	Jan–Mar	145413	Ambalappara (Kakkayam)	India (Goa, Maharashtra, Karnataka, Kerala, and Tamil Nadu), Laos, Thailand, and Vietnam.
50	<i>Rhynchostylis retusa</i> (L.) Blume	E	Apr–Nov	145443	Kakkad	India (Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura, Arunachal Pradesh, Sikkim, West Bengal, Himachal Pradesh, Jammu & Kashmir, Uttarakhand, Andhra Pradesh, Odisha, Gujarat, Goa, Maharashtra, Karnataka, Kerala, Tamil Nadu, Jharkhand, Chhattisgarh, Haryana, Madhya Pradesh, and Andaman & Nicobar Islands), Sri Lanka, Bhutan, Myanmar, Nepal, Bangladesh, China, Thailand, Laos, Cambodia, Vietnam, Malaysia, Philippines, and Java.
51	<i>Robiquetia josephiana</i> Manilal & C.S.Kumar	E	Sep–Oct	145422	Soothuppara (Kakkayam)	India (Kerala and Tamil Nadu). Endemic to Western Ghats.
52	<i>Sirhookera lanceolata</i> (Wight) Kuntze	E	Aug–Nov	145405	Ambalappara (Kakkayam)	India (Karnataka, Kerala and Tamil Nadu) and Sri Lanka.
53	<i>Smithsonia maculata</i> (Dalzell) C.J.Saldanha	E	Jun–Sep	145429	Atthikode R.F. (Malabar Wildlife Sanctuary)	India (Goa, Karnataka, Kerala, Maharashtra, and Tamil Nadu). Endemic to Western Ghats.
54	<i>Smithsonia straminea</i> C.J.Saldanha	E	Feb–Apr	145406	Atthikode R.F. (Malabar Wildlife Sanctuary)	India (Goa, Karnataka, Kerala, and Maharashtra) and Sri Lanka.
55	<i>Taeniophyllum alwisii</i> Lindl.	E	Sep–Mar	145422	Atthikode R.F. (Malabar Wildlife Sanctuary)	India (Karnataka, Kerala, and Tamil Nadu) and Sri Lanka.
56	<i>Zeuxine gracilis</i> (Breda) Blume	T	Sep–Dec	145431	Kuttiyadi	India (Meghalaya, Nagaland, Arunachal Pradesh, Odisha, Karnataka, Kerala, Maharashtra, and Tamil Nadu), Borneo, Indonesia, Myanmar, Malaysia, Thailand, Vietnam
57	<i>Zeuxine longilabris</i> (Lindl.) Trimen	T	Aug–Dec	145430	Ambalappara (Kakkayam)	India (Assam, Tripura, Arunachal Pradesh, West Bengal, Odisha, Goa, Karnataka, Kerala, Maharashtra, Tamil Nadu, and Bihar), Sri Lanka, Bangladesh, Myanmar, Thailand, and Cambodia.

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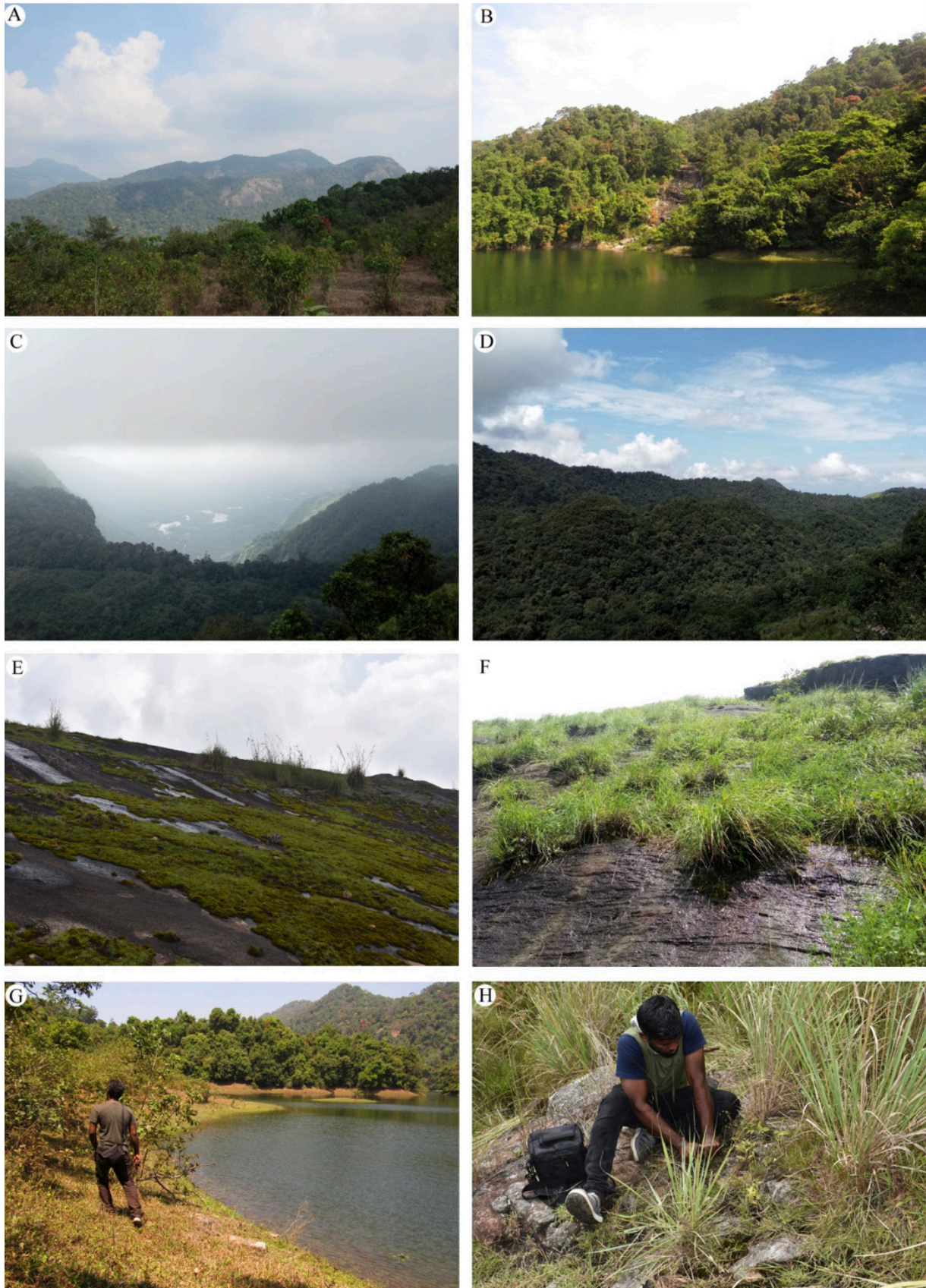


Image 1. Forest vegetations, survey and collection: A—Tropical Semi-evergreen forests | B—Tropical Wet evergreen forests | C & D—Southern hill top evergreen forests | E & F—Grass lands | G—Survey | H—Collection. © M. Sulaiman



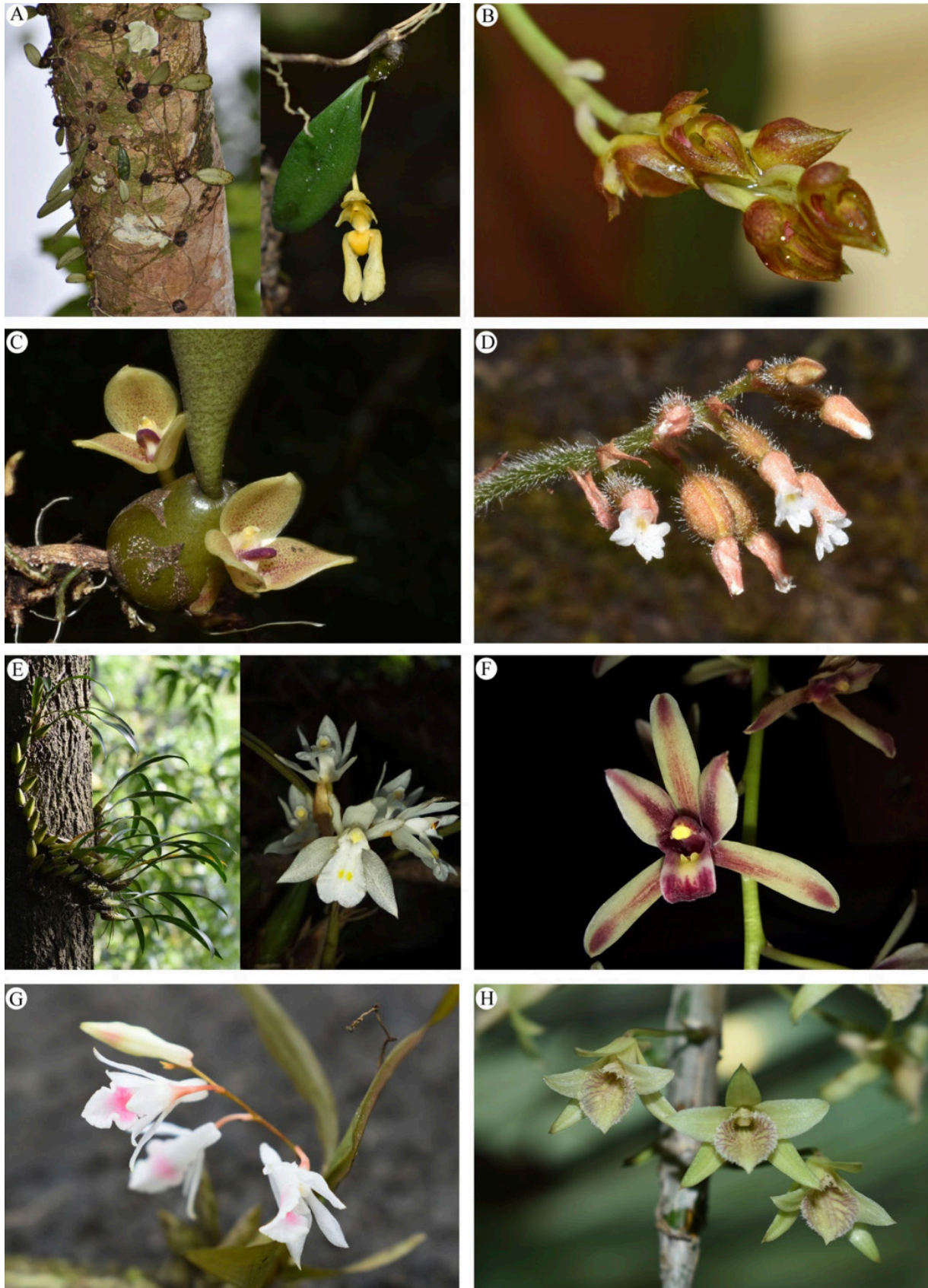


Image 2. A—*Bulbophyllum aureum* | B—*Bulbophyllum sterile* | C—*Bulbophyllum stocksii* | D—*Cheirostylis parvifolia* | E—*Coelogyne breviscapa* | F—*Cymbidium aloifolium* | G—*Dendrobium heyneanum* | H—*Dendrobium macrostachyum*. © M. Sulaiman





Image 3. A—*Dendrobium nanum* | B—*Dendrobium nodosum* | C—*Dendrobium ovatum* | D—*Dendrobium salaccense* | E—*Diploprora championii* | F—*Eulophia nuda* | G—*Eulophia zollingeri* | H—*Habenaria heyneanum*. © M. Sulaiman





Image 4. A—*Luisia macrantha* | B—*Oberonia josephi* | C—*Oberonia proudlockii* | D—*Peristylus aristatus* | E—*Peristylus spiralis* | F—*Phalaenopsis mysorensis* | G—*Zeuxine gracilis* | H—*Zeuxine longilabris*. © M. Sulaiman



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