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.
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. Horticulturists 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 km² (Economic Review 2019). The study areas, viz., Kakkad, Kakkyam, 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

| Location       | Altitude (m) | Latitude    | Longitude   |
|----------------|--------------|-------------|-------------|
| Kakkad         | 10           | 11.036082   | 75.940545   |
| Kakkyam        | 772          | 11.550156   | 75.928466   |
| Kuttiyadi      | 81           | 11.659060   | 75.749145   |
| Malabar Wildlife Sanctuary | 1,176        | 11.558230   | 75.958238   |
| Puduppadi      | 82           | 10.789007   | 76.230478   |
| Peruvannamuzhy | 60           | 11.583010   | 75.818076   |
| 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 accessed 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, Luisia macrantha, Oberonia josephi, O. sebastian, O. verticillata, Robiquetta 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
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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| Name of the species | Life form | Flowering & fruiting | Voucher No. (MH) | Locality | Distribution |
|---------------------|-----------|----------------------|-----------------|----------|--------------|
| Acampe ochracea (Lindl.) Hochr. | E | Nov–May | 145445 | Anjulimukku (Peruvannammuzhy) | 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. |
| Acampe praemorsa (Roxb.) Blatt. & McCann | E | Feb–Nov | 145444 | Kuttyadi | India (Andhra Pradesh, Odisha, Goa, Gujarat, Maharashtra, Karnataka, Kerala, Tamil Nadu, Daman & Diu, Dadara & Nagar Haveli, Jharkhand, Chhattisgarh, Madhya Pradesh, and Rajasthan), Sri Lanka, Nepal, Myanmar, and Seychelles. |
| Aerides crispa Lindl. | E | May–Aug | 145414 | Ambalappara (Kakkayam) | India (Goa, Gujarat, Maharashtra, Karnataka, Kerala, Tamil Nadu, and Odisha). |
| Aerides ringens (Lindl.) C.E.C.Fisch. | E | Feb–Nov | 145446 | Kuttyadi | India (Andhra Pradesh, Odisha, Goa, Gujarat, Karnataka, Kerala, and Tamil Nadu) and Sri Lanka. |
| Bulbophyllum aureum (Hook.f.) J.J.Sm. | E | Jan–Feb | 145449 | Athozhi (Kuttyadi) | India (Kerala and Tamil Nadu). Endemic to Western Ghats. |
| Bulbophyllum rheedei Manilal & C.S.Kumar | E | May–Aug | 145411 | Ambalappara (Kakkayam) | India (Kerala). Endemic to Western Ghats. |
| Bulbophyllum sterile (Lam.) Suresh | E | Apr–Nov | 14541 | Sankaranpuzha camp (Kakkayam) | India (Assam, Mizoram, West Bengal, Karnataka, Kerala, and Tamil Nadu). Endemic to Western Ghats. |
| Colunthe sylvatica (Thouars) Lindl. | T | Sep–Nov | 145438 | Sothupara (Kakkayam) | India (Assam, Mizoram, Nagaland, Arunachal Pradesh, Sikkim, West Bengal, Uttar Pradesh, Goa, Maharashtra, Karnataka, Kerala, Tamil Nadu, and Odisha). |
| Cheirostylis parvifolia (Lindl.) Rchb.f. | E | Jan–Dec | 145447 | Pathuppad | India (Goa, Maharashtra, Karnataka, Kerala, and Tamil Nadu). |
| Cleisostoma tenuifolium (L.) Garay | T | Jun–Sep | 145443 | Ambalappara Grass land (Kakkayam) | India (Maharashtra, Karnataka, Kerala, and Tamil Nadu). |
| Coelogyne breviscapa Lindl. | E | Jan–Apr | 145403 | Ambalappara (Kakkayam) | India (Karnataka, Kerala, and Tamil Nadu). |
| Cottonia peduncularis (Lindl.) Rchb.f. | E | Jan–Apr | 145415 | Kakkayam | India (Goa, Maharashtra, Karnataka, Kerala, Tamil Nadu, and Odisha). |
| Cymbidium aloifolium (L.) Sw. | T | Sep–Nov | 145426 | Athikode R.F. (Malabar Wildlife Sanctuary) | India (Andhra Pradesh, Odisha, Goa, Maharashtra, Karnataka, Kerala, and Tamil Nadu). |
| Cymbidium aloifolium (L.) Sw. | E | Mar–Jun | 145439 | Kakkad | India (Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura, Arunachal Pradesh, Sikkim, West Bengal, and Assam). |
| Dendrobium herbaceum Lindl. | E | Oct–Nov | 145415 | Athikode R.F. (Malabar Wildlife Sanctuary) | India (Mizoram, West Bengal, Andhra Pradesh, Odisha, Goa, Maharashtra, Karnataka, Kerala, and Tamil Nadu). |
| Dendrobium heterocarpum Wall. ex Lindl. | E | Feb–Apr | 145410 | Ambalappara (Kakkayam) | India (Assam, Manipur, Meghalaya, Mizoram, Nagaland, Arunachal Pradesh, Sikkim, West Bengal, Uttar Pradesh, Karnataka, Kerala, and Tamil Nadu). |
| Dendrobium heyneanum 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** Dendrobium macrostachyum Lindl.    | E         | Mar–Jun              | 145427           | Athikode 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** Dendrobium nanum Hook.f.           | E         | Sep–Nov              | 145419           | Athikode R.F. (Malabar Wildlife Sanctuary)        | India (Goa, Maharashtra, Karnataka, Kerala, and Tamil Nadu). Endemic to Eastern and Western Ghats. |
| **21** Dendrobium nodosum Dalzell         | E         | Mar–Jun              | 145403           | Ambalappara (Kakkayam)                            | India (Goa, Maharashtra, Karnataka, Tamil Nadu, and Kerala). Endemic to Western Ghats. |
| **22** Dendrobium ovatum (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** Dendrobium salacense (Blume) Lindl.| E         | Sep–Nov              | 145409           | Ambalappara (Kakkayam)                            | India (Assam, Meghalaya, Mizoram, Tripura, Arunachal Pradesh, Sikkim, West Bengal, Odisha, Arunachal Pradesh, Karnataka, Kerala, Tamil Nadu, and Andaman & Nicobar Islands), Sri Lanka, Bhutan, China, Indonesia, Laos, Malaysia, Myanmar, Thailand, and Vietnam. |
| **24** Diplorprora championii (Lindl.) Hook.f. | E         | Aug–Sep              | 145421           | Athikode 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** Eulophia nuda Lindl.               | T         | Sep–Oct              | 145435           | Athikode 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, Maharahstra, Karnataka, Kerala, Tamil Nadu, and Andaman & Nicobar Islands), Sri Lanka, Nepal, China, India, Bangladesh, Thailand, Malaysia, Philippines, and Pacific Island. |
| **26** Eulophia zollingeri (Rchb.f.) J.J.Sm. | T         | Jan–Feb              | 145435           | Athikode 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, and Pacific Island. |
| **27** Geodorum densiflorum (Lamk.) Schlech. | T         | Apr–Nov              | 145440           | Athikode 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** Habenaria diphyllo Dalz.           | T         | Aug–Sep              | 145451           | Athikode 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** Habenaria heyneana 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** Habenaria longicorniculata 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** Habenaria viridiflora (Sw.) R. Br. | T         | Aug–Dec              | 145451           | Athikode 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                                                                 |
|-------------------------------------|-----------|----------------------|------------------|-----------------------------------------------|------------------------------------------------------------------------------|
| Liparis deflexa Hook.f.             | T         | Oct–Nov              | 145440           | Kuttiyadi R.F.                                | India (Assam, Sikkim, West Bengal, Uttarakhand, Andhra Pradesh, Goa, Karnataka, Kerala, Tamil Nadu, and Chhattisgarh), Myanmar, Nepal, Laos, Cambodia, Indo-China, and Vietnam. |
| Liparis elliptica 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. |
| Liparis viridiflora (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, Bangladesh, Myanmar, Bhutan, Malaysia, and southeastern Asia. |
| Luisia macrantha Blatt. & McCann    | E         | Feb–Nov              | 145408           | Ambalappara (Kakkayam)                        | India (Karnataka and Kerala). Endemic to Western Ghats.                      |
| Luisia tristis (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. |
| Oberonia bicornis 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. |
| Oberonia brunoniana Wight           | E         | Aug–Dec              | 145419           | Atthikode R.F. (Malabar Wildlife Sanctuary)   | India (Andhra Pradesh, Goa, Maharashtra, Karnataka, Kerala, and Tamil Nadu). |
| Oberonia ensiformis (Sm.) Lindl.    | E         | Aug–Dec              | 145402           | Sankaranpuzha (Kakkayam)                      | India (Odisha, Maharashtra, Karnataka, Kerala, and Tamil Nadu) Endemic to Peninsular India. |
| Oberonia josephi C.J.Saldanha       | E         | Aug–Dec              | 145424           | Kakkayam R.F.                                | India (Karnataka and Kerala) Endemic to Western Ghats.                      |
| Oberonia proudiaccii King & Pantl.  | E         | Aug–Dec              | 145402           | Sankaranpuzha (Kakkayam)                      | India (Odisha, Maharashtra, Karnataka, Kerala and Tamil Nadu) Endemic to Peninsular India. |
| Oberonia sebastiana B.V.Shetty & Vivek. | E         | Aug–Nov              | 145442           | Anjulimukku (Kuttiyadi)                       | India (Kerala and Tamil Nadu). Endemic to Western Ghats.                    |
| Oberonia verticillata Wight         | E         | Aug–Nov              | 145418           | Atthikode R.F. (Malabar Wildlife Sanctuary)   | India (Goa, Maharashtra, Karnataka, Tamil Nadu, and Kerala). Endemic to the Western Ghats. |
| Peristylus aristatus 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. |
| Peristylus spiralis A.Rich.         | T         | Aug–Sep              | 145432           | Ambalappara Grassland (Kakkayam)              | India (Maharashtra, Karnataka, Tamil Nadu, and Kerala) and Sri Lanka        |
| Phalaenopsis mysorensis C.J.Saldanha | E         | Feb–Apr              | 145407           | Ambalappara (Kakkayam)                        | India (Karnataka and Kerala) and Sri Lanka.                                 |
| Pholidota imbricata Hook.f.          | E         | Jan–Mar              | 145428           | Thamassery                                   | India (Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura, Arunachal Pradesh, Sikkim, West Bengal, Uttarakhand, Andhra Pradesh, Odisha, Goa, Maharashtra, Karnataka, Kerala, Tamil Nadu, and Chhattisgarh), Sri Lanka, and Pacific Islands. |
| Porpax exilis (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 Porphax reticulata Lindl. | E | Jan–Mar | 145413 | Ambalappara (Kakkayam) | India (Goa, Maharashtra, Karnataka, Kerala, and Tamil Nadu), Laos, Thailand, and Vietnam. |
| 50 Rhynchostylis retusa (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 Robiquetia josephiana Manilal & C.S.Kumar | E | Sep–Oct | 145422 | Soothuppara (Kakkayam) | India (Kerala and Tamil Nadu). Endemic to Western Ghats. |
| 52 Sirhookera lanceolata (Wight) Kunze | E | Aug–Nov | 145405 | Ambalappara (Kakkayam) | India (Karnataka, Kerala and Tamil Nadu) and Sri Lanka. |
| 53 Smithsonia maculata (Dalzell) C.Saldanha | E | Jun–Sep | 145429 | Athikode R.F. (Malabar Wildlife Sanctuary) | India (Goa, Karnataka, Kerala, Maharashtra, and Tamil Nadu). Endemic to Western Ghats. |
| 54 Smithsonia straminea C.Saldanha | E | Feb–Apr | 145406 | Athikode R.F. (Malabar Wildlife Sanctuary) | India (Goa, Karnataka, Kerala, and Maharashtra) and Sri Lanka. |
| 55 Taeniophyllum alvisii Lindl. | E | Sep–Mar | 145422 | Athikode R.F. (Malabar Wildlife Sanctuary) | India (Karnataka, Kerala, and Tamil Nadu) and Sri Lanka. |
| 56 Zeuxine gracilis (Breda) Blume | T | Sep–Dec | 145431 | Kuttiyadi | India (Meghalaya, Nagaland, Arunachal Pradesh, Odisha, Karnataka, Kerala, Maharashtra, and Tamil Nadu), Borneo, Indonesia, Myanmar, Malaysia, Thailand, and Vietnam. |
| 57 Zeuxine longilabris (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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