Epiphytic orchids of Nepal

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This paper includes a list of 207 species of epiphytic orchids from Nepal that belong to 49 genera including 5 endemic species (*Bulbophyllum ambrosia, Eria baniai, E. nepalensis, Oberonia nepalensis* and *Pleione coronaria*). Phytogeographical distribution along with altitudinal ranges of all of these epiphytic species, phenology of flowering of 199 species and host plant(s) of 148 species have been reported herewith. The aim of this paper is to assess the distribution patterns, host-epiphyte relationship and phenology of flowering of Nepalese epiphytic orchids.

Key words: Epiphytic orchids, host range, phenology, Nepal

Floral diversity of Nepal is disproportionally rich owing to its geographical and climatic variations. These variations result in a number of ecological zones and a wealth of habitats. The habitat types, which favor this floral diversity, range from dense tropical monsoon evergreen forest of the Terai to deciduous forest of subtropical, mixed broad-leaved forest of temperate region, followed by coniferous alpine scrub and snow covered Himalayan peaks. Regarding the Nepalese floral diversity, there are 5856 species of flowering plants (Annon, 2006) that have so far been documented.

Orchids represent one of the largest, successful and diverse groups of flowering plants which belong to family Orchidaceae, in the plant group the Monocotyledon. Orchids differ from other plants by the mode of growth and morphological characters possessed by its members. There are two major modes of growth: i. Sympodial growth: refers to the pseudobulbs or stem being jointed by a rhizome, and ii. Monopodial growth : refers to the plant having no pseudobulb and have a single shoot producing leaves alternately. The special morphological characters of orchid flowers that are not shown by other group of plants are as follows:

- modification of a petal into plate-form like structure the "labellum" or "lip" for the visiting pollinators.
- union of male reproductive organ, the stamens and female reproductive organ, the pistil to form a single structure called 'column' or gynostegium.
- arrangement of pollen in a group called 'pollinia'
- usually presence of a single fertile stamen and always on one side of flower.
- lip always on lower side of the flower and the column on upper side.
- presence of numerous tiny seeds without endosperm or organized embryo
- symbiotic association of mycorrhiza is important for seed germination.

Epiphytic orchids are those found growing upon the bark of other trees or shrubs at least part of their life cycle and always have drooping inflorescence.

Epiphytism is shown simply by plants that grow upon another plant usually a shrub or tree at least for part of its life cycle. This habit of growth is by no means limited to the orchid, though it is one of the best known characteristics of the orchidaceae family. Epiphytism occurs in 65 different families of vascular plants, involving about 850 genera and nearly 30,000 species of which about 500 genera and 20,000 species belong to orchid alone (Madison, 1977).

Epiphytism is for support and exposure to sunlight, water and nutrients being absorbed through their absorbing roots which are provided with green tissue surrounded by velamen and epidermis acting as sponge. There are several important differences between epiphytes and terrestrial habitats. Light and moisture availability is one important difference. Other factors, such as better exposure to pollinators, greater seed dispersal and avoidance of slugs and other terrestrial herbivores, may also be favorable aspects of the epiphytic habitat (Madison, 1977). On the other hand, mineral nutrients are usually in short supply for epiphytes and most orchids are tolerant of low substrate fertility (Benzing, 1973). Most of

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the tropical species have epiphytic habit and are characterized by long roots. They used their roots to hold them to their host and to collect nutrients from around their root system and also moisture from the air. Some epiphytes are provided with fleshy pseudobulbs, which are considered as store house since they help in perennation during dry season.

In Nepal, Orchidaceae is the largest family in term of species richness comprising 377 species under 100 genera (Rajbhandari and Dahal, 2004). Rajbhandari *et al.* (1999) reported about 185 species of epiphytic orchids from Nepal. Press *et al.* (2000) recorded 323 species including 175 epiphytic orchid species from Nepal. Hara *et al.* (1978) noted 313 species under 89 genera of orchid from Nepal. However, numbers of epiphytic species were not distinguished.

Orchids are very beautiful and fascinating plants. Most of the epiphytic orchids have very beautiful and attractive flowers, variously shaped pseudobulbs and shiny green leaves. Due to their beautiful flowers, long blooming period, orchids have become great favorites in the horticultural trade and for internal decoration. The greatest threat to the conservation of Nepalese orchids is due to habitat loss, forest destruction and degradation. These orchids are collected for medicinal purposes in large quantities from their natural habitat. Due to over exploitation of these orchids for various purposes, many orchids have become rare. Due to these reasons, the orchids have been categorized in the group of endangered plants, and are legally protected. Despite the ban imposed by Government of Nepal for collection and trade, orchid species that have high medicinal values are being collected illegally.

The paper provides a glimpse of the distribution and status of 207 epiphytic orchid species together with their flowering time and their host plant(s) for most of these species.

West. = West Nepal, i.e., from western boarder to 83° E.
Cent. = Central Nepal, i.e., from 83° E to 86° 30' E.
East. = East Nepal, i.e., from 86° 30' E to eastern boarder.
KATH = (National Herbarium and Plant Laboratories, Kathmandu, Nepal)

Objective

The main objective of this paper is to assess the diversity of all epiphytic orchids from Nepal along with their distribution pattern, phenology of flowering, and host-orchids relationship. It is hoped that this article will help to highlight the need and importance of the study of epiphytic orchid flora of Nepal, and it will serve as baseline data for further research in this field.

Materials and methods

The following methods were utilized for the achievement of the above objective:

- Field surveys carried out in different parts of Kathmandu valley to explore orchids in the natural habitat.
- Study of Orchids specimens collected from various parts of Nepal and deposited at National Herbarium (KATH) with specific focus on host plant(s) and flowering time
- Use of information from secondary sources like Hara *et al.* (1978), Banerji and Thapa (1978), Banerji and Pradhan (1984), Malla *et al.* Ed.(1986), Paudyal (1982), Rajbhandari *et al.* (1999), Press *et al.* (2000), White and Sharma (2000), Bajracharya (2005), Rajbhandari and Bhattarai (2001), Rajbhandari and Dahal (2004), Ghimire and Pant (2006), etc.

Results and discussion

A total of 207 species of orchids belonging to 49 genera were reported and enumerated as epiphytes (Annex-1). *Bulbophyllum* is the largest epiphytic genus comprising 34 species. *Dendrobium*, *Eria* and *Oberonia* are second, third and fourth largest genus comprising 26, 22, and 19 epiphytic species, respectively. Phyto-geographical distribution of all 207 species, phenology of flowering for 199 species and host plants of 148 species are also provided.

Among the 207 epiphytic species, 81 species were reported from Central Nepal alone; similarly, 47 species are limited to East Nepal. Besides these, 69 species are found distributed in East and Central Nepal; 9 species (*Otochilus lancilabius, Ione bicolor, Gastrochilus calceolaris, Dendrobium denudans, D. transparens, Cymbidium bicolor, Coelogyne nitida, C. cristata* and *Bulbophyllum reptans)* are distributed throughout the country from East to West. Only one species *Coelogyne ovalis* is reported from West and Central Nepal (Fig.1).

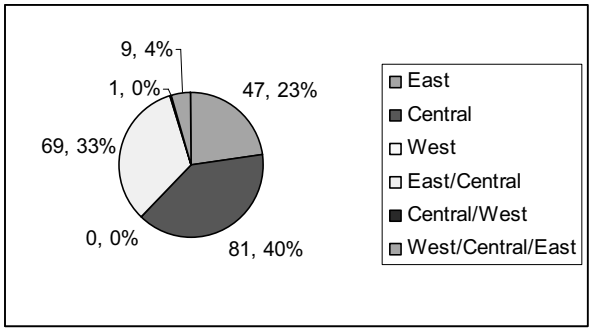

Fig.1: Regional distribution of Epiphytic Orchid species.

Among 207 epiphytic orchid species, flowering time of 199 species were reported. The highest number of 64 species were found blooming in summer season (May-August), similarly 13 species in spring (March-April), 12 species in Autumn(12) and the least number 6 species during winter season (November-February), (Annex-1). Many species are not limited to one particular season for flowering as, 48, 36, 14 and 6 species bloom during spring-summer, autumn-winter, summer-autumn and winter- spring season respectively (Fig.2).

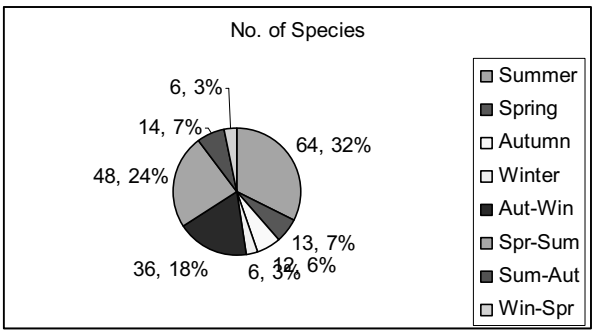

Fig.2: Flowering time of Epiphytic orchid species

Of the total 207 epiphytic orchid species, host(s) plant of only 148 species were reported. *Schima wallichii, Quercus sp.(Q. glauca, Q.semicarpifolia, Q.lanuginosa and other Qurecus species), Rhododendron sp.(R. arboreum, R. barbatum and other Rhododendron species), Shorea robusta, and Castanopsis sp. (C. indica, C. tribuloides, and other Castanopsis species*) are the major top five host(s) plant and represent 65, 42, 20, 18 and 18 epiphytic orchid species respectively (Annex-1). This study shows that epiphytic orchids prefer to grow on the tropical to temperate tree accessories.

Epiphytic orchid species show the intermixed type of distribution in term of their phyto-geographical diversity (Fig 3.). Among the 207 epiphytic species, 77 species are found below 1500 m, similarly, without overlapping with previous data, 44 species are distributed in tropical and subtropical belts (upto 2000 m.). About 22 species are found only in between 900 m-3000 m. Similarly, 56 species are found only in between 1500 m.-3000 m. About 6 species (*Eria excavata, Liparis viridiflora, Pholidota articulata, P. imbriata, P. protracta* and *Odontochilus crispus)* are found distributed in tropical to temperate region (500-2400 m.). *Pleione hookeriana* is found extended from 2200-4200 m, whereas *Diphylax urceolata* is found in between 3000-4200 m. It indicates that epiphytic orchids are more concentrated in tropical and subtropical (upto 2000 m) region and slightly decreases towards temperate (2000-3000 m) and sub-alpine (3000-4000 m) region, and nearly nil in the alpine (above 4000 m) region.

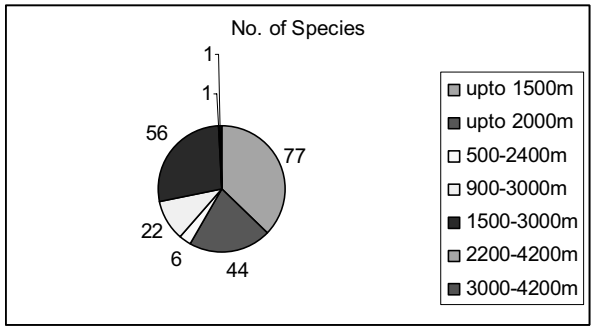

Fig. 3: Phytogeographical distribution of Epiphytic orchid species.

Nepal has a tremendous diversity of natural communities and several major vegetations type. The family Orchidaceae in Nepal consists of about 377 species under 100 genera (Rajbhandari and Dahal, 2004) and is the largest family in terms of species richness. Among them, this paper enumerates a total of 207 epiphytic orchid species from Nepal. Rajbhandari *et al.* (1999) reported 185 epiphytic species from the whole of Nepal. However he did not mention the name of epiphytic species. Press *et al.* (2000), mentioned 175 epiphytic species out of total 323 species of orchid that belonged to 89 genera. Press *et al.* included all the species of Genus *Cymbidium* under epiphytic habit, while some genera like *Diphylax, Liparis* etc. did not include epiphytic habit. But this study did not match with the reports of Press *et al.* Only 8 species of *Cymbidium* out of 10 were reported as epiphytic, while genera *Diphylax* and few species of *Liparis* and many more were also reported as epiphytic.

Many more species remain to be explored further. In context to distribution of Nepalese epiphytic orchids, central and eastern part of Nepal harbors the majority of the orchid species. Central Nepal alone represents 81 species of epiphytic orchids, whereas East Nepal represents 47 species. Besides

these, 69 species are distributed from East to Central Nepal. About 9 species (*Bulbophyllum reptans (*2000-2200 m)*, Coelogyne cristata* (1000-2450 m)*, C. nitida* (1300-2400 m)*, Cymbidium bicolor* (900-1500 m)*, Dendrobium denudns* (1000-2200 m)*, D. transparens* (700-2000 m)*, Gastochilus calceolaris* (900-2700 m)*, Ione bicolor* (1500-2500 m) *and Otochilus lancilabius* (1400-2500 m)), are distributed throughout the country from East to West. One species *Coelogyne ovalis* (1300-1700 m) is limited to Central and Western Nepal.

The largest number (121 species) of epiphytic orchids are found limited to tropical and subtropical regions (upto-2000 m) of Nepal, whereas 22 species (900-3000 m) and 6 species (500-2400 m.) are extended from tropical to temperate regions of Nepal. Similarly 56 species (1500-30000 m.) are found distributed from subtropical to temperate regions. Tropical, Subtropical to Temperate regions show the intermix distribution and represent the best place for epiphytic orchid diversity. Sub-alpine (3000-4000 m) and alpine (above 4000 m) zones show poor distribution of epiphytic orchids, consists of only 2 species, *Diphylax urceolata* (3000-4200 m, E./C.), *Pleione hookeriana* (2200-4200 m, E./C.).

The present study reports the host(s) plant of 148 species of epiphytic orchid. Of them, 65 species of orchid select *Schima wallichii* for the host. Other host(s) plant species more important for epiphytic orchid are *Quercus spp (Q. glauca, Q. semicarpifolia, Q. lanuginosa, Q. griffithii etc.), Rhododendron spp.* (*R. arboreum, R. barbatum etc.) Shorea robusta,* and *Castanopsis spp. (C. indica, C. tribuloides* etc.) and they represent about 42, 20, 18, and 18 species of epiphytic orchid respectively. *Chiloschista parishii and C. usneoides* are two leafless orchids, that select the smooth tree trunk of *Pyrus pashia* and *Quercus glauca* as their hosts. Many species of *Bulbophyllum* love to grow upon the inclined tree trunk of *Schima wallichiii* with mossy bark. Most of the species of the genus *Dendrobium* grow on the tree trunk of *Schima wallichii, Shorea robusta, Quercus glauca, Castanopsis indica, Rhododendron* sp. with roughed mossy bark. *Diphylax urceolata,* a subalpine species selects *Rhododendron barbatum* for their host. It also shows the lithophytic habit. Some epiphytic species like *Gastrochilus affine* and *Pleione hookeriana* select some gymnosperm species like *Tsuga dumosa, Abies spectabilis.* Likewise *Thrixspermum pygmaeum* hosted upon the *Pinus roxburghii. Ione bicolor* was found growing on the small branch of *Quercus semicarpifolia* with crustose and fructicose lichens. Hence the report shows that *Ione bicolor* was always associated with the lichen species. The Genus *Vanda* loves to grow upon the *Dalbergia sissoo* and *Madhuca latifolia*, *Schima wallichii. Aerides multiflora* and *Rhynchostylis retusa* are some of the most beautiful orchids, that showed diverse host(s) ranges like *Schima wallichii, Ficus sp., Albizzia sp., Madhuca latifolia, Mangifera indica, Lagerstroemia sp., Eugenia formosa, Bauhinia sp., Mallotus philippensis, Rhododendron arboreum.* Other important plants useful for epiphytic host are *Terminalia sp., Artocarpus sp., Cinnamomum tamala, Dalbergia sissoo, Lyonia ovalifolia, Daphniphyllum himalense* etc.

The phenology of flowering of orchids species are variable throughout the year. Of the implicated epiphytic orchid species, flowering time of only 199 species are recorded. Of them, about 64 species were found blooming only in summer season. Similarly 13 and 12 species found blooming only in spring and autumn season respectively, whereas at least 6 species (*Bulbophyllum hirtum, Cleisostoma simondii Coelogyne fuliginosa, Dendrobium peguanum, Eria baniai* and *Otochilus fuscus*) are found blooming only in winter season, as they required low temperature, rainfall and humidity. High temperature, rainfall and high humidity favor the orchid flowering. In the case of epiphytic orchids, many species are not confined in one particular season for flowering. But, altogether 48 species are found flowering during summer and spring season. Similarly, 36 species are found flowering in autumn-winter season. Though, summer-autumn and winter-spring seasons are less favorable for orchid flowering, represent 14 and 6 species respectively.

Many epiphytic orchid species have high ornamental and medicinal values. They are highly extracted from their natural habitat for commercial purpose. However, those epiphytic orchids with no economic important are also exploited and their population has decreased day by day due to habitat loss. Cutting of one individual tree in the forest is not a major problem but a serious concern is that, it is a loss of habitat of many epiphytic plants especially epiphytic orchids.

There is the global demand of many orchid species with high medicinal value. Developed countries pay an attention toward the developing countries like Nepal with rich biodiversity. They knowingly or unknowingly import our valuable natural resources like medicinal orchids species in the form of raw material from our country day by day, using local traders. Nowadays, many orchid species *like Coelogyne cristata, Dendrobium aphyllum, Dendrobium candidum, Dendrobium chrysanthum, Dendrobium cripidatum,*

Dendrobium dedudans, Dendrobium heterocarpum, Dendrobium transparens etc., with high medicinal value, are being collected in large amount by local people from various parts of country. Traders collect them in large amount for commercial purpose and ultimately export them outside the country illegally. Though, the family Orchidaceae is under CITES Appendix II, many orchids species with high global demand due to their medicinal values are extracted day by day from their natural habitats.

Conclusion

This study documents a preliminary list of 207 species of epiphytic orchids that belong to 49 genera. It represents about 55% of the total existing species of family Orchidaceae in Nepal. Phyto-geographical distribution of all species, phenology of flowering of 199 species and host plants of 148 species were also reported. Orchids are cosmopolitan in distribution. Most of tropical and subtropical species have epiphytic habit and hosted upon the tropical and subtropical vegetation accessories like *Shorea robusta, Schima wallichii, Castanopsis indica, Quercus semicarpifolia, Rhododendron* sp. etc, whereas, subalpine and alpine region show the very poor distribution of epiphytic orchids. Epiphytic orchids are mostly concentrated in Central (81 species) and Eastern (47 species) Nepal alone, whereas 9 species are found distributed throughout the country. The western part of country represents very poor diversity of epiphytic orchids. Tropical, subtropical to temperate regions (upto 3000s) are the best place for the epiphytic orchid diversity, as these belts represent almost all 205 species, among the total 207 epiphytic orchid species from the Nepal. Only two species *Diphylax urceolata* and *Pleione hookeriana* are found extended to subalpine region. Summer and spring seasons are most favorable for orchid flowering as most of the epiphytic orchid species (125) were found blooming during summer-spring seasons whereas autumn and winter season is less favorable for orchid flowering. Therefore, only 54 species were found blooming during autumn-winter season. Of the remaining species reported, twenty were reported to bloom during summer-autumn and winter-spring seasons. Many epiphytic orchids with high ornamental and medicinal value were found being extracted to a large extent. Therefore, their status is being threatened day by day and required strict conservation measured from the concerned agency.

Recommendations

Based on the findings of this study following recommendations are proposed:

- A systematic study of Nepalese orchids should be undertaken in order to understand their natural habitat, which will provide the ecological requirements of different species.
- Detailed study on Nepalese orchid flora should be done from the conservation point of view.
- Control illegal collection and trade of orchid species.
- Protection of natural forest, habitat of epiphytic orchid should be done, by preventing deforestation.
- Tissue culture technique for a regeneration of valuable orchids can be applied in order to fulfill its demands in local level.
- Promotion of local Nursery should be done in order to increase orchid population by vegetative methods to fulfill the demand of selected orchid species.

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Annex-1

Scientific Name	Distriution	Flowering time	Host plants
Acampe papillosa	E/C.200-1200 m	Sept.-Oct.	*Shorea robusta, Terminalia chebula*
			Semicarpus anacardium, Schima wallichii
Acampe rigida	E/C.200-1500 m	Sept.-Nov.	*Schima wallichii, Mitragyna parviflora,*
Aerides multiflora	E/C.200-1100 m	May-June	*Schima wallichii, Madhuca latifolia, Ficus religiosa,*
			Eugenia formosa, Albizzia sp., Cleistocalyx operculata,
			Lagerstroemis sp., Ficus bengalensis, Mangifera indica, Alnus sp.
Aerides odoratum	E/C.200-1200 m	May-July	*Castanopsis indica, Shorea robusta, Mitragyna parviflora,*
			Schima wallichii, Sapium insigne, Albizzia sp
Agrostophyllum callosum	E/C.2100-2200 m	May-Aug.	*Quercus glauca, Lyonia ovalifolia, Schima wallichii*
Agrostophyllum planicaule	E.500-800 m	Sept.-Dec.	*Terminalia sp.*
Ascocentrum ampullaceum	E/C.150-900 m	March-May	*Shorea robusta,*
Bulbophyllum affine	E/C.600-1800 m	June-July	*Sapium insigne, Rhododendron arboreum, Schima wallichii, Castanopsis indica*
B. ambrosia	C.1400 m	__	__
B. bisetum	C.1500-2000 m	Sept.-Oct.	__
B. careyanum	E/C.600-2100 m	Oct.-Dec.	*Quercus glauca, Q. lanata, Schima wallichii*
B. cariniflorum	C.1300-1800 m.	__	__
B. cylindraceum	E/C.1600-2400 m	Sept.-Oct.	*Pyrus pashia*
B. elatum	C.900-1500 m	May-June	*Schima wallichii*
B. eublepharum	E.2000-2500 m	July-Aug.	__
B. gamblei	E.200-2000 m	June-July	__
B. guttulatum	C.1100-2300 m	July-Aug.	*Schima wallichii*
B. helenae	E.900-1200 m	May-Aug.	__
B. hirtum	C.1000-2600 m	Jan.-Feb.	*Schima wallichii, Quercus lanuginosa*
B. leopardinum	E/C.1500-3200 m	July-Aug.	*Quercus sp.*
B. moniliforme	C.1450 m	__	__
B. muscicola	C.2100-2400 m	Feb.-March	*Rhododendron sp.*
B. odoratissimum	C.1000-2000 m	June-July	*Quercus semicarpifolia, Schima wallichii*
B. otoglossum	E.2400-2800 m	April	__
B. polyrhizum	C.900-2100 m	May-June	*Englehardtia spicata*
B. reptans	WCE2000-2200 m	March-April	*Quercus semicarpifolia, Rhododendron arboreum*
B. retusiusculum	E/C.2100-3000 m	Sept.-Oct.	*Rhododendron arboreum, Quercus semicarpifolia, Lyonia ovalifolia*
B. rigidum	C.1000-1500 m	Oct.-Nov.	*Quercus semicarpifolia,*
B. rolfei	E/C.2000-2500 m	June-July	__
B. roxburghii	E.300-500 m	May-June	*Shorea robusta*
B. sarcophyllum	E.1000-1200 m	May-June	__
B. scabratum	E.2000-2200 m	March-May	__
B..secundum	C.2000-2200 m	July-Aug.	*Quercus glauca*
B. sterile	C.500-2000 m	Oct.-Nov.	*Engelhardtia spicata, Schima wallichii, Mangifera indica*
B. striatum	C.2000-2300 m	Oct.-Nov.	__

B. triste	E/C.1200-1400 m	June-July	*Engelhardtia spicata*
B. umbellatum	E/C.300-1800 m	March-April	*Quercus glauca, Castanopsis indica*
B. viridiflorum	E/C.1500-2200 m	June-Aug.	*Castanopsis indica, Schima wallichii*
B. wallichii	C.1000-2500 m	April-May	*Schima wallichii*
B. xylophyllum	E.910 m	Sept.-Oct.	—
B. yoksunense	C.2000-2600 m	Sept.-Oct.	*Quercus sp.*
Ceratostylis himalaica	E.1700-1900 m	June	*Quercus griffithii*
Chiloschista parishii	E.1000-1800 m	March-April	*Pyrus pashia*
Chiloschista usneoides	C.1500-1700 m	Feb.-April	*Quercus glauca*
Cleisostoma aspersum	E.600-1800 m	April-Aug.	—
Cleisostoma filiforme	E/C.150-1300 m	Aug.-Sep.	*Schima wallichii, Ficus sp.*
Cleisostoma racemiferum	E.1400-2000 m	July-Aug.	*Litsea sp., Zyzyphus incurva*
Cleisostoma simondii	C.500-600 m	Nov.-March	—
Coelogyne corymbosa	E.1500-2900 m	March-May	*Quercus semicarpifolia, Lyonia ovalifolia, Rhododendron sp.*
Coelogyne cristata	WCE.1000-2450 m	Feb.-April	*Castanopsis indica, Schima wallichii,*
			Quercus glauca,
			Eriobotriya dubia
Coelogyne flaccida	C.900-1100 m	April-June	*Schima wallichii*
Coelogyne fuliginosa	C.900-1500 m	Dec.-Jan.	*Schima wallichii*
Coelogyne fuscescens	C.1200-1800 m	Oct.-Dec.	*Castanopsis tribuloides, Schima wallichii, Rhododendron sp.*
Coelogyne longipes	E.1500-2300 m	May-june	*Quercus sp.*
Coelogyne nitida	WCE.1300-2400 m	April-June	*Schima wallichii, Lyonia ovalifolia, Rhododendron sp.*
		—	*Daphniphyllum himalense,*
Coelogyne ovalis	W/C.1300-1700 m	Sept.-Dec..	*Rhododendron sp., Schima wallichii*
Coelogyne prolifera	E/C.1000-2300 m	April-June	*Schima wallichii, Sapium insigne, , Quercus sp, Rhododendron sp., Castanopsis indica, Ficus sp., Engelhardtia spicata*
Coelogyne punctulata	E.200-2000 m	March-April	—
Coelogyne stricta	E/C.1400-2000 m	April-June	*Schima wallichii*
Cryptochilus lutea	E/C.1200-2300 m	July-Sep.	*Lyonia ovalifolia*
C. sanguinea	E/C.1600-2400 m	May-July	*Castanopsis sp.*
Cymbidium aloifolium	E/C.300-1600 m	May-June	*Artocarpus sp., Shorea robusta, Mangifera indica, Engelhardtia spicata*
			Lagerstroemis sp., Ehretia sp.
			Woodfordia sp., Butea minor
Cymbidium bicolor	WCE.900-1500 m	April-may	*Terminalia sp.*
C. devonianum	E.1500-1800 m	April-June	*Quercus sp.*
C. eburneum	E.300-1700 m	March-May	*Mangifera indica*
C. erythraeum	E/C.1500-2400 m	Sept.-Nov.	*Quercus sp.*
C. hookerianum	E.1600-2600 m	Jan.-April	*Schima wallichii*
C. longifolium	E/C.1500-2500 m	Oct.-Dec.	*Rhododendron sp., Daphniphyllum himalense*
C. iridioides	E/C.1500-2800 m	Sep.-Dec	*Schima wallichii*
Dendrobium anceps	E.200-1400 m	April-May	*Schima wallchii, Mitragyne sp.*
D. aphyllum	E/C.200-1500 m	April-June	*Castanopsis indica, Schima wallichii, Sapium insigne, Alnus nepalensis, Acer sp., Dalbergia sp*
			Engelhardtia spicata, Bischofia javanica,
D. bicameratum	C.1400-2400 m	July-Aug.	*Quercus glauca, Lyonia ovalifolia,*
D. candidum	E/C.1500-2500 m	Sep.-Oct	*Quercus glauca*

D. chrysanthum	C.1300-2000 m	June-Oct.	*Shorea robusta*
D. chryseum	C.1200-2100 m	April-June	*Castanopsis sp.*
D. crepidatum	C.1200-1400 m	April-May	—
D. cumulatum	E.150-700 m	June-July	—
D. densiflorum	E/C.900-2900 m	April-June	*Schima wallichii, Machilus gambeli,*
D. denudans	WCE.1000-2200 m	April-Aug.	*Schima wallichii, Shorea robusta*
D. eriiflorum	E/C.1500-2100 m	Sep.-Oct.	*Quercus glauca, Berberis sp, Schima wallichii, Alnus nepalensis*
D. farmeri	E.150-700 m	April-May	—
D.fimbriatum	E/C.200-2100 m	April-May	*Schima wallichii, Shorea robusta*
D. formosum	E/C.500-1500 m	April-June	*Shorea robusta, Schima wallichii*
D. gibsonii	E.900-2000 m	May-June	—
D. heterocarpum	E/C.1000-1600 m	April-May	*Schima wallichii, Quercus glauca, Rhododendron sp.*
D .hookerianum	E.300-2000 m	June-July	*Schima wallichii*
D. longicornu	E/C.1300-2900 m	Sep.-Nov.	*Quercus glauca, Rhododendron arboreum*
D. monticola	C.2400-2700 m	July-Oct.	—
D. moschatum	C.200-1200 m	May-July	*Shorea robusta, Schima wallichii*
D nobile	E/C.400-1500 m	April-May	*Schima wallichii, Ilex excelsa*
D. peguanum	C.300-1200 m	Nov.-Jan	*Shorea robusta*
D. porphyrochilum	E/C.1800-2500 m	May-June	—
D .primulinum	C.1200-1400 m	April-May	—
D. pulchellum	E/C.1200-1800 m	—	—
D. transparens	WCE.700-2000 m	May-June	*Shorea robusta*
Diphylax urceolata	E/C.3000-4200 m	Sep.-Nov.	*Rhododendron barbatum*
Epigenium amplum	E/C.1300-2000 m	Sep.-Nov.	*Schima wallichii*
E. fuscescens	E.600-1800 m	March-April	*Quercus semicarpifolia*
E. rotundatum	E.1500-2000 m	April-may	*Rhododendron arboreum*
Eria acervata	E.300-1300 m	Oct.-Dec.	*Schima wallichii*
Eria alba	C.1500-2500 m	April-june	*Quercus griffithii, Pinus roxburghii*
Eria amica	C.600-2100 m	April-June	*Schima wallichii*
Eria apertiflora	C.1600 m	Aug.-Sep.	*Quercus semicarpifolia, Q. glauca,*
Eria baniai	C.1600 m	January	—
Eria biflora	C.500-1000 m	Sep.-Nov.	—
Eria bipuncata	C.1100-1700 m	June-July	*Quercus glauca*
Eria bractescens	E/C.300-1100 m	April-May	*Mangifera indica*
Eria carinata	C.1300-1500 m	Oct.-Dec.	*Eugenia sp.*
Eria concolor	E.500 m	June	—
Eria coronaria	E/C.1500-2300 m	Oct.-Dec.	*Quercus glauca, Schima wallichii*
Eria discolor	C.150-1600 m	April-June	*Shorea robusta, Schima wallichii*
Eria excavata	C.500-2400 m	May-July	*Maesa chisia, Quercus semicarpifolia, Shorea robusta*
Eria extinctoria	C.500-600 m	March-April	*Dalbergia sissoo, Shorea robusta*
Eria graminifolia	E/C.1500-2500 m	June-Aug.	*Quercus semicarpifolia, Colebrokia oppositifolia*
Eria lasiopetala	E.1300-1600 m	March-May	*Shorea robusta, Schima wallichii, Madhuca latifolia*
Eria muscicola	E/C.1500-1800 m	June-July	*Schima wallichii, Ilex sp.*
Eria nepalensis	C.200 m	Aug.	—
Eria obesa	E.500 m	Aug.	—
Eria paniculata	C.600-1800 m	Feb.-June	*Schima wallichii,*
Eria spicata	E/C.900-2200 m	July-Aug.	*Schima wallichii, Quercus glauca, Cinnamomum tamala*

Eria stricta	C.300-1800 m	Nov.-April	*Schima wallichii*
Esmeralda cathcartii	E.600-2000 m	March-July	*Rhododendron sp, Lyonia ovalifolia*
Esmeralda clarkei	E.1500-1700 m	Oct.-Nov.	*Rhododendron sp.*
Flickineria fugax	C.800-1600 m	May-July	*Duabanga grandiflora, Schima wallichii*
Gastochilus acutifolius	C.1200-2100 m	Oct.-Dec.	*Castanopsis indica, Ficus sp.*
G. affinis	E/C.2700-2900 m	July	*Tsuga dumosa*
G. calceolaris	WCE.900-2700 m	Feb.-March	*Quercus glauca, Ficus nenoralis*
G.dasyopogon	C.100-1000 m	__	*Dillenia indica*
G. distichum	E/C.1700-2800 m	March-July	*Quercus sp.*
G.inconspicus	C.1000-1500 m	May-July	__
G. obliquus	C.600-1800 m	Oct.-Dec.	*Shorea robusta*
Ione bicolor	WCE.1500-2500 m	Oct.-Dec.	Lichen covered *Quercus semicarpifolia*
Ione cirrhata	C.1600-2200 m	Oct.-Nov.	__
Liparis caespitosa	E/C.1000-1400 m	July-Aug.	*Ehretia sp,*
Liparis resupinata	E.1500-2600 m	Oct.-Nov.	*Eugelhardtia spicata, Quercus sp., Viburnum sp.*
Liparis viridiflora	E.700-2500 m	Sep.-Nov.	*Lyonia ovalifolia, Schima wallichii*
Luisia brachystachys	C.1300-1900 m	March-April	__
Luisia trichorhiza	E/C.1000-1400 m	March-May	__
Luisia zeylanica	C.300-1400 m	April-June	*Schima wallichii*
Monomeria barbata	C.1400-1500 m	Oct.-Dec.	*Schima wallichii*
Oberonia acaulis	E/C.600-2000 m	Sep.-Dec.	*Schima wallichii, Engelhardtia spicata*
Oberonia bracystachys	E.200-800 m	April-May	__
Oberonia caulescens	E/C.1600-2400 m	July-Aug.	*Schima wallichii, Eurya acuminata*
Oberonia emarginata	E.1600-2000 m	Sep	__
Oberonia ensiformis	C.1400-1700 m	Oct.-Dec.	*Schima wallichii, Mallotus philippensis*
Oberonia falcata	E/C.1300-2100 m	June-July	*Castanopsis sp.*
Oberonia falconeri	C.550-1000 m	April-May	*Sapium insigne, Alnus nepalensis, Eugenia sp.*
Oberonia jenkinsiana	C.400-1200 m	Sep.-Nov.	__
Oberonia mucronata	E.200-1800 m	Sep.-Dec.	*Shorea robusta, Schima wallichii*
Oberonia myosurus	C.1000-1500 m	Aug.-Oct.	__
Oberonia nepalensis	C.750-1600 m	March-April	__
Oberonia obcordata	C.1100-1600 m	Sep.-Oct.	*Castanopsis indica, Ficus sp.*
Oberonia pachyphylla	E.200-800 m	March-April	
Oberonia pachyrachis	E/C.1000-1500 m	March-April	*Schima wallichii, Mallotus philippensis*
			Alnus nepalensis, Ficus sp.
Oberonia parvula	C.450-1500 m	Feb.-March	__
Oberonia prainiana	E.500-1500 m	June-July	*Ficus sp*
Oberonia pyrulifera	E.300-800 m	June-July	__
Oberonia recurva	C.200-1500 m	Oct.-Feb.	__
Oberonia rufilabris	C.300-1500	Feb.-March	__
Odontochilus abbreviatus	C.500-1000 m	__	__
Odontochilus crispus	C.400-2400 m	Aug.-Oct.	*Quercus sp.*
Odontochilus lanceolatus	E/C.1400-1700 m	Aug.-Sep.	__
Ornithochilus difformis	E/C.1400-1800 m	June-July	*Schima wallichii, Mallotus philippensis,*
Otochilus albus	E/C.1500-2400 m	June-July	*Rhododendron arboreum,*
Otochilus fuscus	C.1100-2000 m	Dec.-Jan.	*Myrsine sp., Lyonia ovalifolia, Eurya acuminata , Castanopsis sp.*
Otochilus lancilabius	WCE.1400-2500 m	Oct.-Dec.	*Quercus sp.*
Panisea demissa	C.1500-2400 m	Oct.-Feb.	*Quercus glauca, Lyonia ovalifolia, Pyrus pashia, Eurya acuminata*

			Daphniphyllum himalense,
Panisea uniflora	C.1000-2300 m	April-June	*Shorea robusta, Zizyphus incurva, Schima wallichii, Eugenia formosa*
Papilionanthe teres	E/C.200-2100 m	March-June	*Mitragyne parviflora, Eugenia formosa, Shorea robusta*
Papilionanthe uniflora	C.1500-2100 m	July-Oct.	—
Papilionanthe vandarum	E.1600-1700 m	May	—
Pelatantheria insectifera	C.200-1000 m	Oct.-Dec.	—
Phalaenopsis deliciosa	E.200-500 m	July-Aug.	—
Phalaenopsis mannii	E.150-600 m	April-June	*Shorea robusta, Schima wallichii*
Phalaenopsis taenialis	E/C.1500-2300 m	April-June	*Castanopsis indica, Ficus sp.*
Pholidota articulata	E/C.500-2300 m	April-July	*Schima wallichii, Shorea robusta, Quercus glauca Mahonia nepaulensis, Dalbergia sissoo*
Pholidota imbricata	E/C.600-2900 m	June-July	*Castanopsis tribuloides, Schima wallichii*
Pholidota protracta	E/C.500-2200 m	Oct.-Dec.	*Quercus semicarpifolia*
Pholidota recurva	C.700-1800 m	Aug.-Sep.	—
Pleione coronaria	C.2850 m	—	—
Pleione hookeriana	E/C.2200-4200 m	May-June	*Alnus nepalensis, Abies spectabilis, Tsuga sp*
Pleione humilis	C.1800-3000 m	Feb.-March	*Quercus sp.*
Pleione maculata	C.1400-2700 m	Oct.-Nov.	—
Pleione praecox	E/C.1500-2500 m	Sep.-Nov.	*Rhododendron sp., Quercus sp.*
Podochilus cultratus	C.400-800 m	Sep.-Oct.	*Schima wallichii*
Porpax elwesii	E/C.8001800 m	April-Aug.	*Schima wallichii*
Pteroceras teres	C.200-800 m	June	*Litsea sp., Shorea robusta*
Rhynchostylis retusa	E/C.300-1800 m	May-July	*Quercus glauca, Schima wallichii, Mangifera indica, Rhododendron arboreum , Quercus lanuginosa, Bauhinia sp., Mallotus philippensis*
Schoenorchis gemmata	E.1400-1800 m	May-June	—
Smitinandia micrantha	E/C.500-1400 m	May-July	*Sapium insigne, Schima wallichii.,*
			Bauhinia sp., Engelhardtia spicata
Sunipia scariosa	E/C.1200-1800 m	Oct.-Jan.	*Rhododendron arboreum, Lyonia ovalifolia*
Taeniophyllum scraberullum	C.600-800 m	Sep.-Oct.	—
Tainia minor	E.2000-2300 m	June-Aug.	—
Thelasis longifolia	C.800-1300 m	—	—
Thelasis pygmaea	C.800-1100 m	Aug.-Sep.	—
Thrixspermum pygmaeum	C.1300-2000 m	April-May	*Pinus roxburghii*
Thunia alba	E/C.500-1800 m	March-Aug.	*Schima wallichii, Quercus lanuginosa*
Trichotosia dasyphylla	C.850-1500 m	April-June	*Shorea robusta*
Trudelia alpina	C.1100-1800 m	May-July	*Quercus lanuginosa, Prunus cerasoides*
			Engelhardtia spicata, Pyrus pashia
Trudelia cristata	E/C.1200-2300 m	March-May	*Prunus cerasoides, Eurya acuminata, Schima wallichii, Ficus neriifolia Acacia catechu, Quercus glauca, Shorea robusta, Mangifera indica*
Trudelia pumila	C.500-1500 m	May	—
Uncifera acuminata	E.1200-1600 m	July-Sep.	—
Uncifera lancifolia	E.2000-2200 m	June-July	—
Uncifera obtusifolia	C.900-1100 m	Aug.-Sep.	—
Vanda tessellata	E/C.200-600 m	July-Aug.	*Dalbergia sissoo, Madhuca latifolia*
Vanda testacea	E/C.200-500 m	April-July	*Dalbergia sissoo, Madhuca latifolia*
Vandopsis undulata	E/C.300-2100 m	April-May	*Schima wallichii, Mangifera indica, Castanopsis indica,*