THE ORCHID DIVERSITY IN SIKKIM AND EFFECT OF CHANGE OF ENVIRONMENT ON THE DISTRIBUTION OF NATIVE ORCHIDS IN SIKKIM HIMALAYA, INDIA

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ABSTRACT

The orchid diversity in Sikkim has remained a hot topic ever since the subject came in the fore front in the context of its exploration, conservation and propagation. It was Sir Joseph Dalton Hooker who during 1870s pioneered floral studies in the Sikkim Himalaya. Thereafter Sir George King and Robert Pantling carried out detailed studies and brought out their exhaustive work in a beautiful book titled "The Orchids of the Sikkim Himalaya" during 1898. The present study carried out over the last three decades, documents not only the distribution of native orchids of Sikkim but also the anthropogenic and climate change related impacts. Of the total 1229 orchid species estimated in the country, Sikkim alone harbours 523 species and is only next to Arunachal Pradesh having 620 species. The present study covers all the 523 species (including subspecies) which are fully documented with illustrations. Of these 20 are monophytic orchid genera and 22 are endemic to the state. This study resulted in the discovery of 12 new species, 6 rediscoveries, 4 sub-species and 6 new reports. Though the state is very small in size (7096 sq km), it harbours a high diversity of orchid species due to a large variation in macro and micro-climatic conditions. Also thickly wooded habitats were not found to support the growth of most orchids and open canopy forests were found to be ideal hosts for both terrestrial and epiphytic orchids. It was also observed that orchids adapt to the changing environment by shifting to favourable habitats either horizontally, vertically or both. Species found earlier at lower elevations, were observed to grow naturally now at higher elevations. Recently the Sling Dong Tinkitam Fairrieanum Conservation Reserve has been notified in South Sikkim, for the protection of orchid *Paphiopedilum fairrieanum*. Detailed scientific studies and field surveys will help us in better understanding the location, distribution and status of the orchid flora and how they are responding to the changing environment and climate at the micro-level, which will equip us better to take up initiatives for their long term conservation.

KEYWORDS: *Eastern Himalaya, endemism, climate change, distribution*

Spathoglottis sp. in the Khangchendzonga National Park

Dendrobium jenkinsii

INTRODUCTION

Orchid Habitat in Sikkim

Sikkim Himalaya under Eastern Himalaya biodiversity hotspot is a biogeographic region with magnificent reservoir of diversity and is almost a rectangular piece of land, covered with extremely rugged hills and mountains, wedged in between the Himalayan kingdom of Nepal in the west and Bhutan in the east. It lies between 27°5" and 28°9" Latitude and 87°59" and 88°56" Longitude. It shares a common boundary in the whole of the north and more than half in the east with Tibetan Autonomous Region of China. Now the Chumbi valley of China separates Sikkim from Bhutan in the east. In north, the southern part of Tibetan plateau has a similar type of cold desert climate. This vast land is characterized by having broader valleys and small hillocks situated far between. The area shares the similar type of floral and faunal composition with its neighboring counterparts. There are further two extreme north-south directed continuous mountain ranges i.e. the Singalila Range in the west separating Sikkim from Nepal and the Chola Range in the east separating from Bhutan and China. In addition there is a another low north south directed mountain ridge in the middle of the state whose southernmost end culminates at Maenam ridge. This ridge separates Teesta water basin in the East and the Rangit water basin in the west. The whole watershed is a horseshoe type and plays a major role in the distribution of species within Sikkim. The southern aspect of this table top Tibetan plateau forms the windward side of the State and here lies the sharp steep formidable mountains ranges arresting monsoon rain from crossing over to the plateau. The lofty sharp steep mountains with deep valleys and gorges are the characteristic feature of North Sikkim, while the broader hill top with gentler slopes are the characteristic feature of the south. Because of which Sikkim receives maximum rainfall during monsoon along with some occasional winter rains.

The altitudinal variation ranges from 380 m at Melli to 8598 m at the top of Mount Khangchendzonga. The average annual rainfall ranges from 2000 to 2500 mm in the temperate areas of Sikkim, but south district receives comparatively less rainfall and remains almost dry for most part of the year. In North Sikkim the horizontal ranges like Donkiala and other such ranges prevents monsoon from reaching the other side and thus in the leeward side of the area a cold desert type of climate prevails. Thus Sikkim enjoys multitude of micro-climatic niches differing from one hill to the other.

The total number of orchid species in India is estimated to be around 1229. Out of which 523 number of orchid species is from Sikkim alone, only next to Arunachal Pradesh having 620 species of orchids. But when land to species ratio is considered, Sikkim perhaps is the world's richest orchid diversity hot spot.

Depending upon the various forest types of Sikkim, the orchid habitats can be broadly categorized into 4 zones. These are:

1. Tropical Zone (between 380 - 1000 m)
2. Sub-tropical Zone (between 1000 - 2000 m)
3. Temperate Zone (between 2000 - 3500 m)
4. Alpine Zone (between 3500 - 5000 m)

1. Tropical Zone:

This type of forest is characterized by dense tree cover with rich floral and faunal diversity with annual rainfall lying in between 2500 - 3000mm. The humidity is usually between 90 - 100% and the temperature ranges from 30 - 35°C. During winter the temperature ranges from 20 - 25°C. Here the forests are multistoried. The uppermost strata trees that

Dendrobium thyrsiflorum

provide the topmost canopy to the forest in this area are *Shorea, Duabanga, Gmelina, Terminalia, Albizzia* and *Tetrameles*. The lower strata consists of *Callicarpa, Schima, Stereospermum* and *Dendrocalamus*. This combination with their close canopy form a dense, dark-humid environment, which forms an ideal habitat to support the luxuriant growth of many epiphytes. Some of the common epiphytic orchids are *Dendrobium formosum* Roxb., *D. farmerii* Paxt, *D. jenkinsii* Wall. ex Lindl., *D. aphyllum* (Roxb.) C.E.C Fischer, *D. moschatum* (Buchanan-Hamilton) Sw., *Ascocentrum ampullaceum* (Roxb.) Schltr., *Aerides multiflora* Roxb., *Acampe rigida* (Buch.-Ham. ex J.E.Smith) P.F. Hunt, *Vanda testacea* (Lindl.) Rchb. f., *V. pumila* Hook. f., *Papilonanthe teres* (Roxb.) Schltr., *Cymbidium aloiflolium* (L.) Sw., *Bulbophyllum andersonii* (Hook. f.) J.J.Smith, *Flickingeria fugax* (Rchb. f.) Seidenf., and many other species of the various genera.

The lower vegetation supports the orchid species of *Bulbophyllum roxburghii* (Lindl.) Rchb.f., *Bulbophyllum leptanthum* Hook. f., B. *cornu*-cervi King & Pantl., *B. tortuosum* (Bl.) Lindl., *Smitinandia micrantha* (Lindl.) Holttum, *Mastigion appendiculatum* (Rolfe) Garay, Hamer & Siegerest, *Micropera obtusa* (Lindl.) T. Tang & F.T. Wang, *Cleisoscentron pallens* (Cathcart ex Lindl.) N. Pearce & P.J. Cribb, *Phalaenopsis mannii* Rchb. f., *P. lobbii* (Rchb. f.) H.R. Sweet., *Porpax elwesii* (Richb. f.) Rolfe, and *P. fibuliformis* (King & Pantl.) King & Pantl..

The shady thick humus forest floor of this zone supports the growth of orchid like- *Nervillia plicata* (Andrew) Schltr., *N. macroglossa* (Hook. f.) Schltr., *Corymborkis veratrifolia* (Reinw.) Blume, *Acanthephippium sylhetense* Lindl., *Galeola cathcartii* Hook. f., *G. nudiflora* Lour.; *Tropidia angulosa* (Lindl.) Blume and *T. curculigioides* Lindl.

The shady river banks are rich with jewel orchids like *Anoectochilus roxburghii* Lindl., *Goodyera hispida* Lindl., *Zeuxine affinis* (Lindl.) Benth. ex Hook. f. The land slide areas and the sandy sloppy areas are colonised by *Goodyera procera* (Ker Gawler) Hook. The sandstone rocks support the growth of *Diplomeris hirsut*a Lindl., *Paphiopedilum venustum* (Wall.) Pfitzer., *Arundina graminifolia* (D.Don) Hochr. and *Eulophia graminea* Lindl.

Paphiopedilum venustum

Dendrobium moschatum

Sub-tropical Zone

It is comparatively a cooler zone but the floristic composition in its southern aspects occupies much higher altitude than its cooler northern aspects. In this zone the summer precipitation is heavy and the day temperature lies between 25 - 30°C. The night temperature drops below 20°C. The forest types in this zone are either evergreen or semi evergreen. Here the trees are shorter and bushy in appearance and stratification is not well marked. The undergrowth is heavy. The common trees are *Schima, Castanopsis, Engelhardtia, Symingtonia, Betula, Magnolia, Chukrasia, Cedrela, Dysoxylum, Evodia, Echinocarpus, Elaeocarpus, Bombax, Evodia, Ehreti, Ficus, Eurya, Garcinia, Machilus, Mahonia, Camellia, Saurauia, Rhus, Bauhinia, Prunus, Terminalia, Nyssia, Maesa, Fraxinus, Cinnamomum, Daphniphyllum* etc.

Most common epiphytic orchids are *Bulbophyllum reptans* (Lindl.) Lindl., *B. guttulatum* (Hook. f.) Balakrishnan., *B. hirtum* (J.E. Smith) Lindl., *Eria musicicola* (Lindl.) Lindl., *E. graminifolia* Lindl., *Esmeralda cathcartii* (Lindl.) Rchb., *E. clarkei* Rchb. f., *Gastrochilus affinis* (King & Pantling) Schltr., *G. calceolaris* (Buchanan-Hamilton ex J.E. Smith) D.Don., *Coelogyne elata* Lindl., *C. flaccida* Lindl., *C. cristata* Lindl., *Dendrobium moschatum* (Buch.-Ham.) Sw., *D. densiflorum* Lindl., *D. chrysanthum* Wall.ex Lindl., *Eria amica* Rchb. f., E. confusca Hook. f., *E. graminifolia* Lindl., *Kingidium taeniale* (Lindl.) P.F. Hunt, *Ornithochilus difformis* (Wall. ex Lindl.) Schltr., *Pteroceras teres* (Bl.) Holttum, *Podochilus khasianum* Hook. f., *P. cultratus* Lindl., *Oberonia pachyrachis* Rchb. f., *O. auriculata* King & Pantling, *O. obcordata* Lindl., *O. micrantha* King & Pantling etc. Here the forest floor is rich in humus and supports the growth of *Epipogium roseum* (D. Don.) Lindl., *Nervilia gammieana* (Hook. f.) Schltr., *N. aragona* Gaudichaud; *N. hookeriana* (King & Pantl.) Schltr., *Cheirostylis moniliformis* (Griff.) Seidenfaden, *C. yunbanensis* Rolfe., *Anoectochilis brevilabris* Lindl., *A. lanceolata* (Benth.) King & Pantl., *Cymbidium macrorhizon* Lindl., *Goodyera clavata* N. Pearce & P.J. Cribb, *Malaxis maximowicziana* (King & Pantling) Tang & Wang, *M. latifolia* J.E. Smith, *M. khasiana* (Hook. f.) Kuntze, *Calanthe puberula* Lindl., *C. plantaginea* Lindl., *C. manii* Hook. f., etc. Stiff rocky crevices of dolomite and limestone origin support the growth of orchids like *Paphiopedilum venustum* (Wall.ex Lindl.) Pfitzer, *P. fairrieanum* (Lindl.) Stein, *Diplomeris hirsuta* (Lindl.) Lindl. etc. Land slide areas, river banks and sandy loam hills are rich with orchids like *Goodyera procera* (Ker Gawler) Hook., *Anthgonium gracile* Wall. ex Lindl. *Malaxis acuminata* D. Don. etc.

Temperate Zone

Long spell of heavy summer rainfall, presence of heavy fog and mist almost through the year and a severe winter with occasional winter snow along with scanty rain fall during January and February are the main characteristics of this zone. Its summer temperature hardly exceeds 20°C. Depending on the altitudinal variation the floral composition differs.

Liparis cordifolia

Calanthe densiflora

The broad leaved forest occupies the lower temperate zone. The natural occurring species are *Castanopsis*, *Quercus*, *Lithocarpus*, *Betula*, *Prunus*, *Michelia*, *Machilus*, *Echinocarpus*, *Juglans*, *Engelhardtia*, *Symngtonia*, *Litsia*, *Elaeocarpus*, *Eurya* and *Acer* Species. The common epiphytic orchids are *Gastrochilus affinis* (King & Pantl.) Schltr., *G. distichus* (Lindl.) Kuntze, *G. sonamii* S.Z. Lucksom, *Bulbophyllum reptans* (Lindl.) Lindl., *B. eublepharum* Rchb. f., *B. hymenanthum* Hook. f., *Pleione humilis* (J.E. Smith) D.Don., and *P. hookeriana* (Lindl.) B.S. Williams.

The humid shady forest floor supports the growth of *Galeola lindleyana* (Hook. f. & Thomson) Rchb. f., *G. falconeri* Hook. f., *Spiranthes sinensis* (Persoon) Ames, *Stigmatodactylus paradoxus (Prain) Schltr.*, *Aphyllorchis alpina* King & Pantling, *A. montana* Rchb. f., and *Cephalantheropsis longipes* (Hook. f.) Ormerod etc.

Pleione humilis

Calanthe yuksomnensis

Upper Temperate Zone

This zone is characterized by dominance of conifer trees in the top canopy and the *Rhododendron* sharing the middle canopy with other broad leaved trees. The common tree species are *Corylus, Carpinus, Pyrus, Betula, Magnolia, Acer, Tsuga, Larix, Picea, Pyrus* and *Taxus*. In this zone the distribution of epiphytic orchids is very less. As the terrain gains higher altitude the epiphytic orchids are slowly replaced by ground orchids. The only epiphytic orchid species like *Pleione hookeriana* (Lindl.) B.S. Williams, are seen blooming upto 3200 m altitude.

The common epiphytic orchids are *Cirrhopetalum wallichii* Lindl., *Bulbophyllum hymenanthum* Hook. *f., B. dyeranum* (King & Pant.) Seidenf., *B. griffithii* (Lindl.) Rchb. f., *Dendrobium candidum* Wall. ex. Lindl., *Eria pusilla* (Griff.) Lindl., *Liparis perpusilla* Hook. f. etc. The common ground orchids found are *Calanthe tricarinata* Lindl., *C. alpina* Hook. f. ex .Lindl., *Orchis foliosa var. indica*., *Listera alternifolia* King & Pantling, *L. dentata* King and Pantl., *L. pinetorum* Lindl., *Neottia listeroides* Lindl., *N. pantlingii* (W.W. Smith) T.Tang & F. T. Wang, *Habenaria stenopetala* Lindl., *Platanthera biermanniana* (King & Pantl.) Kranzlin, *Satyrium nepalanse* D. Don etc.

Alpine Zone

In this zone the precipitation is in the form of snow and the region remains under snow cover almost for nearly 6 months. The rainfall is less and the light intensity high. Soil type is sandy to sandy loam. The soil depth is shallow with exposed boulders. These factors coupled with freezing temperature support the dwarf growth of vegetation.

Diphylax urceolata

Herminium orbiculare

The Subalpine zone lies just above the upper temperate zone and is characterized by the growth of dwarf *Abies*, *Rhododendrons* along with *Hydrangea*, *Pyrus*, *Sorbus*, *Hypericum*, *Ribes*, *Sambucus* etc. Here the soil type is sandy to sand-loam. These species do not support the growth of epiphytic orchids. Only ground orchids are found above this level. Some of the orchids found in this zone are *Malaxis muscifera* (Lindl.) Kuntze, *M. cylindrostachya* (Lindl.) Kuntze, *Risleya atropurpurea* King & Pantling, *Didiciea cunninghamii* King & Prain ex King & Pantling, *Tipularia josephi* Rchb. f. ex Lindl., *Oreorchis foliosa* Lindl.) Lindl., *O. indica* (lindl.) Hook. f., *Diphylax urceolata* (C.B. Clarke) Hook. f. and *Corybas himalaicus* (King & Pantling) Schltr. on moss covered rocks or on rocky crevices.

The alpine zone can be divided in two portions. Hilly well drained slopes and wet flat valleys. The vegetation on hilly slopes are *Salix, Rhododendron setosum* D.Don., *R.nivale* Hook. f., *R. anthopogon* D. Don., *Juniperus recurva* Buch.- Ham. Ex D. Don., *J. sqamata* Buch.-Ham.ex D. Don., and *Ephedra gerardiana* Wallich ex Stapf., with *Primula sikkimensis* Hook., and *Rheum nobile* Hook. f. The orchid species like *Cypripedium himalaicum* Rolfe., *C. tibeticum*

King ex Rolfe., *C. elegans* Rchb. f., *Gymnadenia orchidis* Lindl., *Habenaria diphylla* Dalzell, *Goodyera fusca* (Lindl.) Hook. f. etc.

The alpine flat valleys support the growth of orchids like *Aorchis spathulata* (Lindl.) vermeulen, *Androcorys puioniformis* (Lindl. ex Hook. f.) K.Y. Lang, *A. gracilis* (King & Pantling) Schltr., *Chusua nana* (King & Pantling) Pradhan, *C. pauciflora* (Lindl.) P.F. Hunt, *Diphylax urceolata* (C.B. Clarke) Hook. f., *Herminium josephi* Rchb. f., *H. macrophyllum* (D.Don) Dandy, *H. monophyllum* (D.Don) P.F. Hunt & Summerhayes, and *H. monorchis* (L.) R. Br.

Field survey

The actual study on Orchid flora of Sikkim started as a simple hobby even before 1986, when I was posted as Assistant Conservator of Forest-Soil Conservation in Gyalzing west Sikkim. This posting gave me a rare opportunity to visit various parts of west Sikkim as well of south Sikkim, starting from low lying Melli RF of 350 m altitude to the top of Dzongri at 4000 m. Then in1986, I was promoted as Field Director Khangchendzonga National Park and the area was vast and challenging and it included most of the North and West part of the State. For going from one part of the park to the other one has to pass through both south and east Sikkim. In this way I could survey all the four districts of the State. Besides that I had the opportunity to make visits to the interior most areas of the Khangchendzonga National Park and thoroughly enjoyed the natural beauty. I took the opportunity presented by the ideal environment of this park to immediately enter into the world of orchids and study the different aspects about them. Thus, I decided to concentrate on the studies of plants belonging to the family of *Orchidaceae*. The regular visits to the wild habitat of these rare plants, studying the different features of the plants, measuring the flowers and drawing sketches of the live plants *in situ* etc., soon became a way of my life. Once a species of interest was located in a virgin area, several consecutive visits were required, to study the physical features and behaviourial aspects of the species. When I came across orchids of interest I studied them, drew sketches and recorded their measurements. Often the business of photographs and herbarium preparation was kept for future. Unfortunately in the case of some species I could not retrieve them later from nature. Though I have their detail descriptions with field drawn sketches yet with no herbarium and photographic evidences, otherwise the number of new discovery would have been more. The first thing necessary to be done after encountering a plant is to draw sketches of the live plant. In the beginning I had thought of engaging some artists to draw the sketches. I found this arrangement unsatisfactory. The sketches drawn by me from the live plants gave better representation than those drawn by artists on the basis of verbal descriptions of the plants. Hence I started with determination to draw the sketches myself, often to be met with disheartening results. Nevertheless, I continued relentlessly, invariably rejecting the drawn sketches to redraw, till I found that the features of the plants being drawn are well represented. Finally, I felt that my efforts had succeeded when my hand drawn sketches of eight plants sponsored for display by my cousin Ms. Bethsheba Hartrey of Yorkshire, at the 'Royal Horticultural Society London Flower show' in February, 2005 and were rewarded with bronze medal.

FINDINGS OF THE RESEARCH WORK

Owing to my long and intimate association with these plants in nature, I have been able to study their character and behavior intimately. Orchids are very sensitive to the ever changing environment and adapt themselves to the new environment. Though Sikkim has a very small area of 7096 sq.km only, yet it harbours more orchid species than Bhutan which is six times the size of Sikkim. Besides that, the State has a unique horseshoe type of physical feature, varied altitudinal zonation starting from alpine meadows to hot tropical valleys. The Sikkim Himalaya in particular possesses the maximum variation in the macro-climatic environments. The hot tropical valley penetrates deep inside the heart of the mountainous state with warmer southern and cooler northern aspects. All these factors attribute to form pockets of many micro-climatic environments congenial for species speciation. If we take India as a whole, then the tremor theory (Joseph 1982) seems to hold good for maximum orchid speciation in North Eastern India having tropical warm humid climate conducive for holding maximum number of epiphytes as compared to South India. Then the state of Meghalaya situated on the active tremor zone among the other North Eastern states should have the maximum number of orchid speciation. Interestingly Sikkim tops the list of having maximum orchid diversity in the world which is not in consonance with the tremor theory. However Sikkim's flowers are dull coloured, not showy, very short lived and comparatively of

lesser commercial value. As we move more towards the eastern realm of the country the orchid flowers become showier and remain intact in the inflorescence for longer period, adding more value for their commercial exploitation.

EFFECT OF ENVIRONMENTAL CHANGES ON ORCHID DISTRIBUTION

During these long years of study, I observed many interesting behaviourial changes displayed by some of the orchids in nature. With change in the environment, the orchids modify their physiological characters and try to adapt to their new environment. If they fail to adjust, then they ultimately shift to areas of favourable environment. The shift may be horizontal, vertical or both. However, most of the terrestrial and even some epiphytes cannot shift even if the environment becomes too harsh. They remain dormant for a long period hoping the return of congenial environment, failing which, they become extinct.

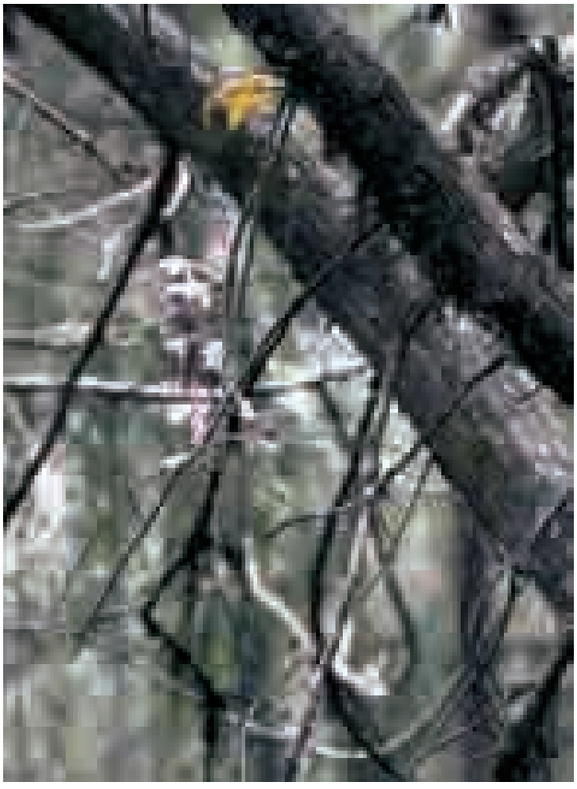
a) **Most of the *Dendrobium* species require open tree canopy**

There is an area called Pabong, at an altitude of 600 m in South Sikkim, through which I had to pass often during my two official tenures in west district of Sikkim, during1980-85 and 1994-98. The whole area is a narrow valley with sparse vegetation of *Schima wallichi* (DC.) Korth., as the dominant tree species. Till 1986 each and every tree of the valley was profusely laden with *Dendrobium aphyllum* (Roxb.) C.E.C. Fischer and *Dedrobium moschatum* (Buchanan-Hamilton) Sw. I was surprised to find in 1994, that within a short span of eight years, the area had become completely devoid of *Dedrobium aphyllum* and the predominance of *Dedrobium moschatum* had reduced considerably. What I observed was that the tree species had become denser and the canopies were almost touching. This had brought changes in the microclimatic environment of that area forcing the orchids to abandon their home and find a new suitable home for survival. Singtam a small flourishing town, situated at the confluence of river Teesta and Rongnichu, having the same altitude as that of Pabong had previously no *Dendrobium aphyllum*. Here the trees are not that dense making them suitable as *Dendrobium aphyllum* hosts. In recent years, the trees here carry a lot of *Dendrobium aphyllum*. Even the newly planted trees of *Azadirachta* indica Juss. are full of hanging *Dendrobium aphyllum*. This is an example of horizontal shift. Likewise, *Dendrobium hookerianum* at 1800-2000 m altitude exhibits similar kind of shift from a habitat of increased density of trees and canopy. As expected, thickly wooded area does not support the growth of most orchids both on the trees as epiphytes and on the ground as terrestrial. In close canopy forest, the epiphytic orchids are either totally absent or found to grow at the highest canopy branches where there is enough light but the dark shaded floor with thick clumps of Bamboos like *Sinarundinaria*, *Phyllostachys*, *Schizostachyum* and *Dendrocalamus* spps; the ferns like *Dryopteris* and *Polystichum* and various shrubs and herbs, however, supports the growth of saprophytic orchid species of *Galeola* Loureiro., *Epipogium* S.G. Gmelin ex Borkhausen and *Aphyllorchis* Bl. Some epiphytic orchids like *Eria* prefer to grow with thickets of moss wrapping the branches of *Vibernum* species.

b) **In support of global warming**

The natural home for *Dendrobium aphyllum* lies between 400-500 m altitude, but now it is found to occupy upto 1700 m altitude. This slow vertical climb demonstrated by this species is in consonance with the warming of the surrounding climate. During 1995, I was surprised to observe it flowering in 6th Mile Tadong at 1000m altitude, and subsequently during 2000, I found it flowering profusely on a *Lagerstromia parviflora* tree at 5th Mile Tadong. I was more curious and started to locate the plants in higher altitude and again during 2002, I came across some of its plants on the trees of *Cupressus cashmiriana* trees planted on the left side of Animal Husbandry compound. During 2005, I found a good population of the plant at 1500 m altitude, flowering on the *Cupressus cashmiriana* planted above Deorali area.

Similarly, the *Dendrobium amoenum* Wall. ex Lindl., the orchid species found below 1000 m altitude was a very common epiphytic orchid growing on the trees of *Alnus nepalensis* of Kabi and Phensong area is now seen to grow naturally at Gangtok which has an altitude of 1900 meters. Now the tall trees of *Alnus nepalensis* in the campus of Botanical Survey India (Gangtok) is laden with the species. Interestingly, King and Pantling failed to collect *Cleistostma linearilobulatum* (Seidenfaden & Smitinand) Garay., from Sikkim, which is now common between 500 m and 2000 m altitude. The species were very common at 1500m altitude but are now seen to move upwards crossing over 2000 m

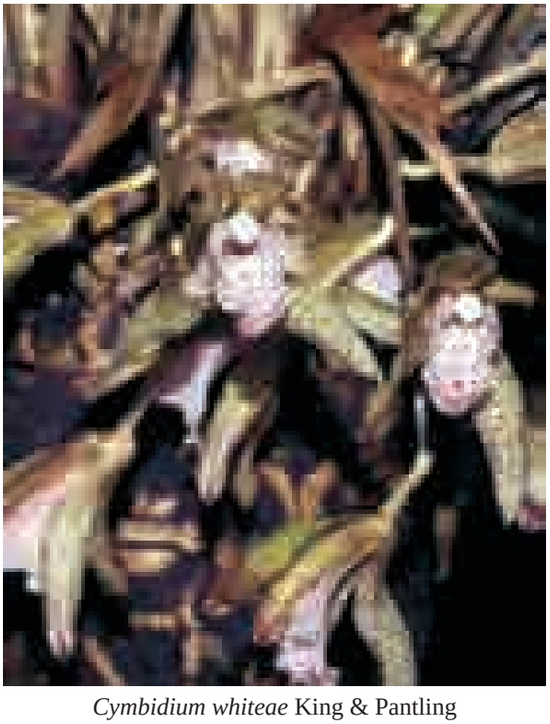


Dendrobium aphyllum at the altitude 1700m

altitude. The *Uncifera obtusifolia* Lindl., an epiphytic orchid of altitude between 800 - 1000 m is now crossing above 1800 m altitude. This slow vertical shift supports the theory of global warming.

c) **The effect of air Pollution**

Among all the orchid species in Sikkim, *Cymbidium whiteae* King & Pantling., an endemic species of Gangtok town has shown a unique remarkable behaviour. King and Pantling's new species from Gangtok proper is named after Mrs. Claude white, wife of the than political officer of Sikkim, who for the first time discovered it from Gangtok. A few people



Cymbidium whiteae King & Pantling

who knew the plant claimed to see them in nature till early sixties but the sudden disappearance from Gangtok has remained a great puzzle to the naturalist, botanist and as well to the interested individuals. Some are of the opinion that it is because of felling of more and more trees for making room for extension of township. But even today in Gangtok, apart from the main town area, there are a reasonably good population of natural indigenous trees. Recently, I came across a small population of the plant in nature at Rumtek Botanical Garden situated at the same altitude of Gangtok and where tree density is similar to the wooded area of Gangtok. Pollution level at Rumtek is almost zero, whereas it is high at Gangtok, due to increased vehicular emission and human concentration. This, in my opinion, may be the main cause for disappearance of the species from Gangtok. The species seems to be sensitive to vehicular emissions, however this needs further studies and investigation.

d) **The other behavioural changes shown by some orchids**

The species like *Cymbidium aloefolium* (L.) Sw; *C. pendulum* King & Pantling; *Acamphe papillosa* (Lindl.) Lindl; *Aerides multiflorum* Roxb., and *Rhyncostylis retusa* (L.) Bl., having thick cuticled leaves is very resistant to any kind of pollution. The species like *Rhyncostylis retusa* (L.) Bl., and *Aerides multiflorum* Roxb., prefer some specific host plants and their related families. During the months of April and May, the trees of *Mangifera indica* Linn., near Siliguri are seen laden with profuse flowers of these orchids. As soon as we move on towards Sikkim side and enter into the area devoid of the above host plants, not a single plant of orchid is seen even on tall trees like the tree of *Shorea rubusta* Gaertn. Soon after crossing the interstate border, one reaches a small wooded area at Baghey in the Sikkim side situated at a higher altitude than Siliguri. Here one comes across these two species of the plants growing naturally. It is observed that here also the host trees are of the same families as those at Siliguri. Besides that the *Rhyncostylis retusa* (L.) usually a low altitude plant is found growing at 1800 m, altitude near Sang Bazar. This far and wide vertical distribution of these two species is again very interesting. Both of these species are found to grow in areas having altitude upto 1400 m on the warm southern aspect.

It has been observed that the predominance of all the epiphytic orchids slowly diminishes with the increase in altitude, and beyond an altitude of 3500 m no vegetation supports the growth of any orchid. The dominance of ground orchids appears with altitude but they too disappear beyond an altitude of 5500 m. It has been discovered that some ground orchids act as an indicator plant for a particular type of forest. *Calanthe brevicornu* Lindl., is an example. Ninty percent of the floral diversity (vegetation combination) of different areas supporting *Calanthe brevicornu* are found to be similar though the areas of studies are far and wide. This needs further studies for confirmation. If this is the case, then endemic species will indicate the status of the microclimate environment. It is also an area of study to find out why the species *Bulbophyllum sterile* which is found commonly in Sikkim in 400-2000 m altitude is conspicuously absent in Bhutan.

I have written a book on the orchids of Sikkim to document the rich biodiversity of Sikkim that I have come across. The other objective of writing this book is to encourage future research workers to carry out further research works on detail inventorisation of orchid repository of Sikkim, horizontally/vertical trans-boundary migration of different species, factors controlling the species speciation, orchid species as indicator plants for particular forest types etc. It took me twenty years of hard work to bring out a part of the rich orchid biodiversity of Sikkim in a book form. Sikkim due to its unique microclimate diversity still holds many mysteries of the orchid world. I cannot claim that I have sampled all the forest areas of Sikkim. I worked within my own limitations and there still remains a large chunk of areas in Sikkim which holds hidden treasures to give surprise and joy to the future researchers.

In the course of my long research, I encountered flowers not discovered before. I also came across many new species of known genera, hitherto not reported from anywhere, and also a few new variations of existing species. The latter two have been published in scientific journals. Some species encountered were those which were yet to be conclusively confirmed as distinct species. Every feature of such plants has been given in my book to confirm them as distinct species like in the case of *Calanthe densiflora* and *Calanthe calvata*, *Calanthe whiteana* and *Cymbidium whiteae* are two examples of rediscovery reported in the book and details have been given to corroborate the earlier finding in such cases. My humble endeavours of twenty years have resulted into the discovery of twelve new species, six rediscoveries, four

sub-species and six new reports. In the year 2000, I came across a very rare orchid of Sikkim *Nervilia hookeriana* (King & Pantling) Schltr., in good population, in the warm valley of South Sikkim. Since then I am trying to find the plants in flowering condition but have failed to do so.

My present work includes 557 species (inclusive of sub-species) which are fully treated with 541 detail diagrammatical illustrations. In support, I have given 340 colour photographs. Out of 557 species 523 are from Sikkim only.

Pecteilis susannae (L.) Rafin.

Calanthe keshabii S.Z.Luksom

Coelogyle viscosa Reichb.

Acanthephippium striatum Lindl.

Table 1. Monophytic orchid genera in Sikkim

1. *Acrochaene* Lindl.
2. *Anthogonium* Wall. ex Lindl.
3. *Arundina* Bl.
4. *Bulleyia* Schltr.
5. *Cleisocentron* Bruhl.
6. *Corymborkis* Thou.
7. *Diglyphosa* Bl.
8. *Diplopora* Hook. f.
9. *Herpysma* Lindl.
10. *Mischobulbum* Schltr.
11. *Monomeria* (Lindl.) Bl.
12. *Ornithochilus* (Lindl.) Wall. ex Lindl.
13. *Pennilabium* J.J. Smith.
14. *Risleya* King & Pantling.
15. *Ritaia* King & Pantling.
16. *Saccolabiopsis* J.J. Smith.
17. *Tipularia* Nutt.
18. *Tylostylis* Hook. f.
19. *Vendopsis* Piftz.
20. *Didiciea cunninghamii*

Table 2. Endemic orchids of Sikkim and the altitudinal distribution range

Sl.No. Name of the Species	Habitat	Altitudinal Range
1. *Bulbophyllum trichocephalum* var. *sikkimnense* S.Z. Lucksom.	Lithophytic	800 1000 m
2. *Calanthe anjanii* S.Z.Lucksom.	Terrestrial	2000 2500 m
3. *Calanthe keshabii* S.Z.Lucksom.	Terrestrial	2000 2600 m
4. *Calanthe yuksomnensis* S.Z.Lucksom.	Terrestrial	1000 2700 m
5. *Coelogyne pantlingii* S.Z. Lucksom.	Epiphyte	2100 2500 m
6. *Epigeneium treutleri (Hook.f.) Ormerod*	Epiphyte	Tropical valley
7. *Cremastra appediculata* var. *sonamii* S.Z.Lucksom.	Terrestrial	920 1000 m
8. *Cymbidium whiteae* King & Pantling.	Epiphyte	800 2000 m
9. *Dendrobium eriiflorum Griff.*.	Epiphyte	800 1000 m
10. *Tipularia cunninghamii (King & Prain) S.C.Chen, S.W.Gale & P.J.Cribb*	Terrestrial	4000 m
11. *Goodyera dongchenii* S.Z.Lucksom	Epiphyte	2000 2300 m
12. *Gastrochilus sonamii* S.Z.Lucksom	Epiphyte	2300 - 2700 m
13. *Neottia alternifolia (King & Pantl.) Szlach.*	Terrestrial	3000 3500 m
14. *Liparis chungthangnensis* S.Z.Lucksom	Lithophyte	1800 2000 m
15. *Liparis dongchenii* S.Z.Lucksom	Terrestrial	1500 2000 m
16. *Liparis lydiae* S.Z.Lucksom	Epiphyte	1000 1300 m
17. *Liparis platyrachis* Hook.f.	Epiphyte	1500 2000m
18. *Liparis pygmaea* King & Pantling	Lithophyte	4350 m
19. *Crepidium saprophytum (King & Pantl.) A.N.Rao*	Terrestrial	1800 m
20. *Oberonia kingii* S.Z. Lucksom	Epiphyte	1000 m
21. *Stigmatodactylus paradoxus (Prain) Schltr.*	Terrestrial	2000 m
22. *Peristylus pseudophrys* (King & Pantling) Kranzlin	Terrestrial	1800 m

The author's addition to the orchid flora of Sikkim

1. *Liparis lydiaii*	sp nov. by S.Z.Lucksom	vol.89 (1):105 106, 1992, Journal of Bombay Natural History Society.
2. *Cleisostoma sikkimensis*	sp. nov S.Z.Lucksom	vol.15 (1):27- 29, 1992 Indian Journal of Forestry
3. *Calanthe keshabii*	sp. nov.S.Z.Lucksom	vol. 15(2): 136-138, 1992 Indian Journal of Forestry.
4. *Bulbophyllum pantlingii*	sp. nov. S.Z. Lucksom	vol. 90 (1): 71, 1993. Journal of Bombay Natural History of Society.
5. *Calanthe anjanii*	sp.nov.S.Z.Lucksom	vol. 16(4): 306-308 1993 Indian Journal of Forestry
6. *Goodyera dongchenii*	sp.nov. S.Z.Lucksom	vol. 72191-192 1993 Journal of Indian Botanical Society.
7. *Liparis sikkimensis*	sp. nov S.Z.Lucksom	vol. 73: 159-160-1994 and S.Kumar. Journal of Indian Botanical Society
8. *Cheirostylis pabongnensis*	sp.nov. S.Z.Lucksom	vol. 20 (3): 305- 307 1997 Journal of Indian Botanical Society
9. *Calanthe yuksomnensis*	sp.nov. S.Z.Lucksom	vol.95 (2): 319-321, 1981 Bombay Natural History Society
10. *Liparis dongchenii*	sp. nov. S.Z.Lucksom	vol. 23(1): 113-115, 2000, Indian Journal of Forestry.
11. *Oberonia kingii*	sp. nov. S.Z. Lucksom	Vol.110,1248:346-348 2002. The Orchid Review. London.
12. *Gastrochilus sonamii*	sp. nov. S.Z. Lucksom	Vol.111.1253:278 280,2003. The Orchid Review, London.
13. *Liparis chungthangnensis*	sp. nov. S.Z. Lucksom	Vol.112.1255:14-15,2004. The Orchid Review London.
14. *Coelogyne pantlingii*	sp. nov. S.Z. Lucksom	Vol.113.1262:108-109, 2005. The Orchid Review. London.
15. *Cymbidium whiteae* King & Pantl.	rediscovery from Rumtek	published in Sikkim Herald 24th Oct. 1992.
16. *Calanthe whiteana* King & Pantl.	rediscovery from Lachen Valley	published in Dec. 1993 in American Orchid Society Bulletin.1269.
17. *Ceologyne barbata*, Griff.	a new record for Sikkim Himalaya	Vol. 16(2): 113-185, 1993 Indian Journal of Forestry
18. *Oberonia obcordata Lindl.*	Rediscovery	Vol. 17(2): 182 - 183, 1994 Indian Journal of Forestry.
19. *Cypripedium himalaicum* Rolfe.	Rediscovery	Vol. 173: 337-338, 1994 Journal of Indian Botanical Society.

20. *Cypripedium elegans* Rchb.	Rediscovery	Vol. 173: 337-338, 1994, Journal of Indian Botanical Society.
21. *Eria pusilla* (Griff)	a new record for Sikkim.	Vol. 17(1-2): 27-29, 2003. Journal of Orchid society of India.
22. *Zeuxine seidenfadenii* S.Deva and Naithani	a new record for Sikkim.	Vol. 27(2): 179-180, Indian Journal of Forestry.
23. *Cremastra appendiculata* Var. sonamii S.Z. Lucksom.	a variation from Sikkim.	Page 326 327, 2007, The Orchids of Sikkim and North East Himalaya.
24. *Dendrobium eriiflorum* var. *sikkimensis*.	a variation from Sikkim.	Page 631,2007,The Orchids Of Sikkim and North East S.Z. Lucksom. Himalaya.

Names of Species	**Flowering Times**	**Status of the Plant**
1. *Acampe ochracea* (L.) Hochr.	December January	R
2. *A. papollosa* (Lindl.) Lindl.	December January	C
3. *A. rigida* (Buch.-Ham. ex J.E. Smith) P.F. Hunt	April May	N.C
4. *Acanthephippium striatum* Lindl.	May June	E, R
5. *A. sythetense* Lindl.	April May	R
6. *Acriopsis lilifolia* (Konig) Ormerod	April	eR,E,T
7. *Acrchaene punctata* Lindl.	April May	C
8. *Aerides multiflorum* Roxb.	Mach June	R
9. *A. odoratum* Lour.	March May	R, T
10. *A. roseum* Loddiges ex Lindl. & Paxton.	May	eR
11. *Agrostophyllum brevipes* King & Pantling	June July	R
12. *A. callosum* Rchb.f.	July August	C
13. *A. myrianthum* King & Pantling	August	N.C.
14. *A. planicaule* (Wall. ex Lindl.) Rehb.f.	August	eR
15. *Androcorys gracilis* (King & Pantling) Schltr	July	R
16. *A. pugioniformis* (Lindl. ex Hook.f.) K.Y. Lang	August September	eR
17. *Ania penangiana* (Hook.f.) summerhayes	February March	rC
18. *A. viridifusca* (Hook.) T. Tang & F.T. Wang ex summerhayes	January May	eR
19. *Anoectochilus brevilabris* Lindl.	August - September	E, R
20. *A. roxburghii* (Wall.) Lindl.	September October	E,R
21. *Anthogonium grcile* Wall. ex Lindl.	August September	vC
22. *Aorchis spathulata* (Lindl.) Vermeulen	June July	nC
23. *Aphyllorchis alpina* King & Pantling	July	nC
24. *A. montana* Rchb.f.	June August	R
25. *Apostasia wallichii* R. Br.	April	R
26. *Appendicula cornuta* Bl.	August September	E, R
27. *Arachnis labrosa* (Lindl. & Paxton) Rehb. f.	March April	eR
28. *Arundina graminifolia* (D.Don) Horchreutiner.	June July	vC
29. *Ascocentrum ampullaceum* (Roxb.) Schltr.	May June	R
30. *Bhutanthera abomarginata* (King & Pantling) Renz.	June July	R
31. *Biermannia bimaculata* (King & Pantling) King & Pantling	May July	R
32. *Bulbophyllum affine* Lindl.	June July	mC
33. *B. apodum* Hook. f.	May June	R
34. *B. bisetum* Lindl.	September	nC
35. *B. careyanum* (Hook.) Sprengel	June July	mC
36. *B. careyanum* var. sikkimense S.Z. Lucksom.	October March	R
37. *B. cariniflorum* Rchb. f.	July	R
38. *B. cauliflorum* Hook.f.	June July	nC
39. *B. cauliflorum* var. sikkimense N. Pearce & P.J. Cribb	June August	R

40. *B. cournu-cervi* King & Pantling	April July	E,T,R
41. *B. cylindracium* Lindl. Wall. ex.	October January	nC
42. *B. elatum* (Hook.f.) J.J. Smith	May - August	R
43. *B. emarginatum* Lindl.	October December	eR
44. *B. eublepharum* Rehb.f.	July August	E, R
45. *B. gamblei* (Hook.f.) Hook.f.	June August	nC
46. *B. gracilipes* King & Pantling.	September - October	eR
47. *B. griffithii* (Lindl.) Rchb. f.	August October	E, eR
48. *B. hirtum* (J.E. Smith) Lindl.	October January	nC
49. *B. guttulatum* (Hook.f.) N.P. Balakrishnan	July - September	nC
50. *B. hymenanthum* Hook.f.	May - June	R
51. *B. khasyanum* Griff.	October January	nC
52. *B. leopardinum* (Wall.) Lindl	July	mC
53. *B. leptanthum* Hook.f.	July	E, R
54. *B. odoratissimum* (J.E. Smith) Lindl	May - August	R
55. *B. penicillium* Parish & Rchb.f.	August September	E, eR
56. *B. piluliferum* King & Pantling	May June	eR
57. *B. polyrhizum* Lindl.	April	eR
58. *B. protractum* Hook.f.	March December	R
59. *B. reptans* (Lindl.) Lindl	May June	nC
60. *B. rigidum* King & Pantling	May June	R
61. *B. rolfe* (Kuntze) Seidenfaden	August - September	E, R, T
62. *B. sarcophyllum* (King & Pantling) J.J. Smith	June September	R,T
63. *B. scabratum* Rchb. f.	April	nC
64. *B. secundum* Hook.f.	June	R
65. *B. stenobulbon* parish & Rchb.f.	June	eR
66. *B. sterile* (Lamark) Suresh	June August	mC
67. *B. striatum* (Grift.) Rchb.f.	October	nC
68. *B. thomsonii* Hook.f.	September	mC
69. *B. tortousosum* (Bl.) Lindl	March April	R
70. *B. trichocephalum* var racemosum (Balakrishnan) Lucksom.	June July	R
71. *B. trichcephalum* var capitatum S.Z. Lucksom.	August	R
72. *B. triste* Rchb. f.	March	E,R
73. *B. umbellatum* Lindl.	May	nC
74. *B. viridiflorum* (Hook.f.) Schltr.	October November	R.T
75. *B. yoksunense* J.J. Smith	September October	nC
76. *Bulleyia yunnanensis* Schltr	June - July	eR
77. *Calanthe alismifolia* Lindl.	May June	R
78. *C. alpina* Hoo.f. ex Lindl.	May August	E, eR, t
79. *C. odora* Griff.	April	eR
80. *C. anjanii* S.Z. Lucksom	May June	R
81. *C. biloba* Lindl.	September November	E, T
82. *C. brevicornu* Lindl.	May July	R
83. *C. chloroleuca* Lindl.	April - May	E,T
84. *C. clavata* Lindl.	October November	R
85. *C. densiflora* Lindl.	October - November	R
86. *C. herbacea* Lindl.	June August	R,T
87. *C. Keshabii* S.Z. Lucksom	May July	vR
88. *C. manii* Hook.f.	May June	nC
89. *C. odora* Griff.	April	eR
90. *C. plantaginea* Lindl.	March April	eR,T
91. *C. puberula* Lindl.	July August	C
92. *C. sylvatica* (Thouars) Lindl.	July September	nC
93. *C. tricarinata* Lindl.	May June	R
94. *C. trulliformis* King & Pantling	July	R
95. *C. whiteana* King & Pantling	May June	eR,T
96. *C. yuksomensis* S.Z. Lucksom	March April	R
97. *Cephalanthera longifolia* (L.) Fritsch	June August	R.
98. *Cephalantheropsis longipes* (Hook.f.) Ormerod	September October	E,T,R
99. *Ceratoslylis himalaica* Hook.f.	May June	eR
100. *C. subulata* Bl.	May June	R.T
101. *Cheirostylis griffithii* Lindl	November December	vR.
102. *C. moniliformis* (Griff.) Seidenfaden	March May	R
103. *C. pabongnensis* S.Z. Lucksom	March	eR
104. *Chiloschista parishii* Seidenfaden	May	R
105. *C. usneoides* (D. Don) Lindl.	May	R
106. *Chrysoglossum ornatum* Bl.	June	vR

107. *Chusua puberula* (King & Pantling) N. Pearce & P.J. Cribb	June July	R
108. *C. nana* (King & Pantling) Pradhan	August	E,eR
109. *C. pauciflora* (Lindl.) P.F. Hunt	July	E,R
110. *Cirrhopetalum andersonii* Hook.f.	May	vR
111. *C. sikkimense* King & Pantling	May	T,E,eR
112. *C. wallichii* Lindl.	August	R
113. *Cleisotocentron pallens* (Catheart & Lindl) N. Pearce & P.S. Gibb	July August	T,eR
114. *C. filiforme* (Lindl.) Garay	July August	C
115. *Cleisostoma aspersum* (Rehb.f.) Garay	July August	E,T,eR
116. *C. linearilobulatum* (Seidenfaden & Smitinand) Garay	May June	C
117. *C. racemiferum* (Lindl.) Garay	June July	C
118. *C. simondii* (Gagnepain) Seidenfaden	August	R
119. *C. subulatum* Bl.	March July	E,T,R
120. *C. striatum* (Rehb.f.) N.E. Brown.	August	vR
121. *Coelogyne barbata* Lindl ex griff	October November	R,T
122. *C. corymbosa* Lindl.	May June	R
123. *C. cristata* Lindl.	March April	E,T
124. *C. fimbriata* Lindl.	September November	R
125. *C. flaccida* Lindl.	February May	T,R
126. *C. fusescens* Lindl.	October November	nC
127. *C. longipes* Lindl.	May July	E, R
128. *C. nitida* Lindl.	April June	mC
129. *C. occultata* Hook.f.	March July	E,T,R
130. *C. ovalis* Lindl.	October December	R,T
131. *C. pantlingii* S.Z. Lucksom	June July	R,T,E
132. *C. prolifera* Lindl.	May July	mC
133. *C. punctulata* Lindl.	October November	eR,T
134. *C. raizadae* S.K. Jain & S. Das	May June	R
135. *C. schultesii* S.K. Jain & S. Das	March June	eR,E,T
136. *C. stricta* (D.Don) Schltr	September December	R,T
137. *C. viscose* Reichb	March April	eR,T
138. *Corybas himalaicus* (King & Pantling) Schltr.	June July	eR,T
139. *Corymborkis veratrifolia* (Reinwardt) Bl.	September November	eR,E,T
140. *Cremastra appendiculata* (D.Don) Makino	April May	R,T
141. *Cremastra appendiculata* var. sonamii S.Z. Lucksom.	April May	eR, T
142. *Crepidium acuminatum* (D.Don) Szlach	June August	R,T
143. *C. aphyllum* (King & Pantling) A. Nageswara Rao	June July	eR,T
144. *C. bilobum* (Lindl.) Szlach	July August	nC
145. *C. calophyllum* (Reichenb.f.) Szlach	July	eR,T,E
146. *C. josephaianum* (Reichenb.f.) Hanna B. Margonska	May	R,T
147. *C. khasianum* (Hok.f.) Szlachetko	July August	nC
148. *C. maximowiczianum* (King & Pantling) Szlach	July	R,E,T
149. *C. saprophytum* (King & Pantling) A. Nageswara Rao	July	eR,T,E
150. *Cryptochilus Lutea* Lindl.	June August	nC
151. *C. sanguinea* Wall	June July	nC,T,E
152. *Cymbidium aloi* folium (L.) Sw	April May	nC
153. *C. cochleare* Lindl.	October November	R,T,E
154. *C. cyperifolium* Lindl.	October November	R,T,E
155. *C. dayanum* Rchb.f.	August November	eR,T,E
156. *Cymbidium devonianum* Lindl ex. Paxion	April June	nC,E,T
157. *C. eburneum* Lindl.	March May	eR,T,E
158. *C. erythraeum* Lindl.	August - October	R,T
159. *C. gammieanum* King & Pantling	September October	R,T,E
160. *C. hookerianum* Rchb.f.	February May	R,T,E
161. *C. iridioides* D.Don, Prodr.	October November	E, eR, T
162. *C. lancifolium* Hook.f.	March - April	nC

163. *C. longifolium* D.Don.	October November	nC
164. *C. macrorhzon* Lindl	May August	E, R, T
165. *C. mastersii* Giff.ex. Lindl.	October December	E, R
166. *C. munronianum* King & Pantling	December May	eR
167. *C. pendulum* Swartz.	April June	E,T,R
168. *C. whiteae* King & Pantling	November	eR,T
169. *Cypripedium elegans* Rchb.f.	July	eR,E,T
170. *C. himalaicum* Rolfe.	July	eR,E,T
171. C. tibeticum King ex Rolfe.	June July	eR,E,T
172. *Dendrobium aduncum* Wall. ex Lindl.	March August	eR, T
173. *D. amoenum* Wall. ex Lindl.	May June	C
174. *D. anceps* SW	April - May	nC
175. *D. aphyllum* (Roxb.) C.E.C. Fischer	March June	nC
176. *D. bicameratum* Lindl.	July August	R,T,E
177. *D. candidum* Wall. ex Lindl.	May - June	R,T.E
178. *D. cathcartii* Hook.f.	March September	R,T
179. *C. chrysanthum* Lindl.	August - October	C
180. *D. chryseum* Rolfe.	May June	eR,T,E
181. *D. crepidatum* Lindl.	May	R,T,E
182. *D. cumulatum* Lindl.	June July	eR,T
183. *D. darjeelingense* Pradhan	October	eR
184. *D. densiflorum* Lindl.	April July	C
185. *Dendrobium thyrsiflorum* Rchb.f ex E.Andre	April	eR
186. *D. denudans* D.Don	September October	nC
187. *D. devonianum* Paxton.	April May	nC,E,T
188. *D. eriiflorum* Griff.	September October	nC
189. *D. eriiflorum* var. sikkimense S.Z. Lucksom.	September October	R,T
190. *D. farmeri* Paxton	April May	eR
191. *D. fimbriatum* Hook.	April May	eR,E, T
192. *D. fimbriatum* var. occultatum Hook.	April May	nC,E,T
193. *D. formosum* Roxb. ex Lindl.	May	eR,ex-?
194. *D. gibsonii* Lindl.	May - August	E, R, T
195. *D. heterocarpum* Lindl.	February - April	nC,E,T
196. *D. hookerianum* Lindl.	September	nC,E,T
197. *D. jenkinsii* Wall. ex Lindl	April May	eR,E,T
198. *D. longicornu* Lindl.	August December	nC
199. *D. moschatum* (Buchanan-Hamilton) Sw.	May - June	E, R, T
200. *D. nobile* Lindl.	April June	nC, E, T
201. *D. peguanum* Lindl.	November January	mEx
202. *D. pendulum* RChb. f.,	March April	R,E,T
203. *D. porphyrochilum* Lindl.	May July	R,E,T
204. *D. pracecinctum* Rchb. f.,	June July	eR,E,T
205. *D. ruckeri* Lindl.	April May	eR,E,T
206. *D. stuposum* Lindl.	June	R,E,T
207. *D. sulcatum* Lindl.	April May	eR,E,T
208. *Dendrobium terminale* Parish & Rchb. f.	September October	R,E,T
209. *D. transperens* Wall. ex Lindl.	April - May	R,E
210. *Tipularia cunninghamii*	July	eR,E,T
211. *Didymoplexis pallens* Griff	April May	eR,E,T
212. *Dienia ophrydis* (Koen) Ormerod & Seidenf.	May July	R,E,T
213. *Diglyphosa latifolia* Bl.	May	eR,E,T
214. *Diphylax urceolata* (C.B. Clarke) Hook.f.	September October	R,E,T
215. *Diplomeris hirsute* (Lindl.) Lindl.	June - August	R,E,T
216. *Diploprora championii* (Lindl. ex Bentham) Hook.f.	July August	R,E,T
217. *Drymoda gymnopus* (Hook.f) Garay, Hamev & Siegerist.	November December	E,R,T
218. *Epigeneium amplum* (Lindl.) Summerhayes.	October	C
219. *E. fuscescens* (Griff.) Summerhayes.	October	eR,E,T
220. *E. rotundatum* (Lindl.) Summerhayes.	March April/ Sept Oct	mC
221. *Epigenium treutleri* (Hook.f.) Ormerod	May	Ex
222. *E. navicularis* (N.P. Balakrishnan & S. Chowdhury) A.N. Rao	September October	eR,E,T
223. *Epipactis helleborine* (L.) Crantz	June September	R,E,T

224. *E. mairei* Schltr.	June August	R,E,T
225. *E. royleana* Lind.	June August	R,T
226. *E. veratrifolia* Boissier & Hohenacker	July September	nC
227. *Epipogium aphyllum* Sw	September	eR,E,T
228. *E. roseum* (D.Don) Lindl.	May July	nC
229. *Eria acervata* Lindl.	June July	R,E,T
230. *E. alba* Lindl.	April June	R,E.T
231. *E. amica* Reinchb.f.	March May	R
232. *E. bambusifolia* Lindl.	October December	R
233. *E. biflora* Griff	September October	R,E,T
234. *E. bractescens* Lindl.	April	R
235. *E. carinata* Lindl.	September October	eR,E,T
236. *E. clausa* King & Pantling.	February May	eR,E,T
237. *E. coronaria* (Lindl.) Reichb.f.	October January	nC
238. *E. excavata* Lindl.	May June	C
239. *E. gamminifolia* Lindl.	June August	R
240. *E. javanica* (Sw.) Bl.	July August	R, E, T
241. *E. lasiopetala* (Willdenow) Ormerod	April July	eR,E,T
242. *E. muscicola* (Lindl.) Lindl.	July August	nC
243. *E. paniculata* Lindl.	November April	C
244. E. pannea Lindl.	May July	R,E.T
245. *E. pumila* Lindl.	March August	R,E,T
246. *E. pusilla* (Griff.) Lindl.	August September	R
247. *E. spicata* (D. Don) Handel-Mazzetti	February August	nC
248. *E. stricta* Lindl.	November April	nC
249. *E. vittata* Lindl.	February April	R
250. *Erythrodes hirsute* (Griff.) Ormerod.	March April	R,E,T
251. *Esmeralda cathcartii* (Lindl.) Rchb.f.	March April	R, T
252. *E. clarkei* Rchb.f.	October November	nC
253. *Eulophia bicallosa* (D.Don) P.F. Hunt & Summerhayes	February March	R,T,E
254. *E. bicallosa* var. major (King & Pantling) U.C. Pradhan	May	R,T
255. *E. dabia* (D.Don) Hochreutiner	March	R,E
256. *E. densiflora* Lindl.	April July	R,E
257. *E. graminea* Lindl.	March - April	R,E
258. *E. manni* (Rehb.f.) Hook.f.	June August	R,E
259. *E. promensis* Lindl.	July August	R
260. *E. spectabilis* (Eennstedt) Suresh.	June July	R
261. *E.zollingeri* (Rchb.f.) J.J. Smith.	May	R
262. *Flickingera fugax* Rchb.f.	May - June	R,E,T
263. *Galeola cathcartii* Hook.f.	June	eR
264. *G. falconeri* Hook.f.	May July	R
265. *G. lindleyana* (Hook.f. & Thomson) Rchb.f.	June July	R
266. *G. nudiflora* Loureiro.	April July	eR
267. *Gastrochilus acutifolius* (Lindl.) Kunze	November December	nC
268. *G. affinis* (King & Pantling) Schltr.	July	R
269. *G. calceolaris* (Buchanan-Hamilton ex J.E. Smith) D. Don.	March May	nC
270. *G. dasypogon* (J.E. Smith) Kuntze.	October November	eR,E,T
271. *G. distichus* (Lindl.) Kuntze	March May	R,E
272. *G. inconspicuous* (Hook.f.) Kuntze.	June July	R,E,T
273. *G. linearifolius* Z.H. Tshi & Garay.	August	eR
274. *G. pseudodistichus* (King & Pantling) Schltr.	August October	nC
275. *G. sonamii* S.Z. Lucksom.	October November	R,E,T
276. *Gastrodia dyeriana* King & Pantling.	August	R
277. *G. elata* Bl.	June July	eR,E,T
278. *Geodorum densiflorum* (Lam.) Schltr.	April July	nC
279. *Goodyera clavata* N. Pearce & P.J. Cribb	July August	eR,T
280. *G. dongchenii* S.Z. Lucksom.	August October	R,E
281. *G. fumata* Thwaites.	March	R,E,T
282. *G. fusca* (Lindl.) Hook.f.	August September	R,E
283. *G. hemsleyana* King & Pantling.	July August	R,E,T
284. *G. hispida* Lindl.	September	R,E,T

285. *G. foliosa* (Lindl.) Bentham ex C.B. Clarke	September November	R,T
286. *G. repens* (L.) R. Br	August October	nC,T
287. *G. schlechtendaliana* Rhb.f.	August September	C
288. *G. vittata* (Lindl.) Bentham er Hook.f.	July September	R,E,T
289. *G. procera* (Ker Gawler) Hook	March June	mC
290. *Gymnadenia orchids* Lindl.	July - September	nC
291. *Gymnadenia orchids* var. pantlingii Renz.	July September	R
292. *Habenaria aitchisonii* Rchb.f.	July August	R,E
293. *H. arietina* Hook.f.	July August	nC
294. *H. dentata* (S.w.) Schltr.	September October	R,E,T
295. *H. diphylla* var. josephi N. Pearce & P.J. Cribb.	July August	R,E,T
296. *H. furcifera* Lindl.	July August	R,E,T
297. *H. pantlingiana* Kranzlin	July August	R,T
298. *H. pectinata* (J.E. Smith) D.Don	July	eR
299. *H. malleifera* Hook.f.	August September	eR
300. *H. stenopetala* Lindl.	July September	R
301. *Herminium angustalabre* King & Pantling	July August	R,E
302. *H. jaffreyanum* King & Pantling	July August	R,E
303. *H. Josephi* Rchb.f.	July October	R
304. *H. lanceum* (Thunberg ex Sw)	July August	mC
305. *H. mackinnonii* Duthie.	July August	eR
306. *H. macrophyllum* (D. Don) Dandy.	July August	nC
307. *H. monophyllum* (D.Don) P.F. Hunt Summerhayes.	July August	R
308. *H. orbiculare* Hook.f.	July August	eR
309. *H. monorchis* (L.) R. Br.	July August	R
310. *H. quinquelobum* King & Pantling	August	eR
311. *Herpysma longicaulis* Lindl.	September November	R,E,T
312. *Hetaeria affinis* (Griff.) Seidenf. & Ormerod.	February March	R,E,T
313. *Ione andersonii* King & Pantl.	April	R
314. *I. bicolor* (Lindl.) Lindl	October December	R
315. *I. cirrhata* Lindl.	October November	nC
316. *Kingidium deliciosum* (Rchb.f.) Sweet.	July August	eR,E,T
317. *K.taenialis* (Lindl.) P.F. Hunt	April - May	C
318. *Licanorchis sikkimensis* N.Pearce & P.J. Cribb	May - June	R,E,T
319. *Liparis bistriata* Par & Rchb. f.	August September	nC
320. *L. bootanensis* Griff.	June August	nC
321. *L. cathcartii* Hook.f.	April July	R
322. *L. cepitosa* (Lamark) Lindl.	July October	nC
323. *L. cordifolia* Hook.f.	October Noveber	R
324. *L. delicatula* Hook.f.	August September	eR
325. *L. gamblei* Hook.f.	June	R,E,T
326. *L. glossula* Rchb. f.	July	eR
327. *L. lydiaii* S.Z. Lucksom	November	R
328. *L. nervosa* (Thunb.) Lindl.	June July	nC
329. *L. perpusilla* Hook.f.	July August	R,E,T
330. *L. petiolata* (D.Don) P.F. Hunt	June July	R
331. *L. plantaginea* Lindl.	June September	R,E,T
332. *L. platyrachis* Hook. F	August September	R,E,T
333. *L. dongchenii* S.Z. Lucksom	June	R,E,T
334. *L. pygmaea* King & Planting	June July	eR,eX?
335. *L. resupinata* Ridley.	October March	nC
336. *L. resupinata* var. ridleyi (Hook. f.) King & Pantl.	November December	nC
337. *L. chungthangnensis* S.Z. Lucksom.	June	vR
338. *L. somai* Hayata	October December	R
339. *L. stricklandiana* Rchb. f.	September December	R
340. *L. longipes* Lindl.	October	R,E,T
341. *L. spathulata* Lindl.	October	eR
342. *L. duthiei* Hook.f.	August September	R
343. *L. mannii* Rxhb.f.	December	vR

344. *L. odorata* (Willd.) Lindl.	July	nC
345. *L. deflexa* Hook. f.	July	eR
346. *L. viridifolia* (Bl.) Lindl.	October - November	nC
347. *Neottia alternifolia* (King & Pantl.) Szlach.	July	eR,E,T
348. *Neottia brevicaulis*	July	R
349. *Neottia dentata*	July	R,E,T
350. *Neottia longicaulis* (King and Pantl.) Szlach.	July	R,E,T
351. *Sarcoglottis grandiflora* (Hook.) Klotzsch.	July August	R.
352. *Neottia ovata* (L.) Bluff & Fingerh.	May July	R,T
353. *Neottia pinetorum* (Lindl.) Szlach.	June July	R
354. *Neottia teunis* (Lindl.) Szlach.	July August	R,E
355. *Luisia brachustachys* (Lindl.) Bl.	March April	R
356. *L. filiformis* Hook. f.	March April	vR
357. *L. trichorrhiza* (Hook.f.) Bl.	March May	R,E,T
358. *Lusia zeylanica* Lindl.	June July	nC
359. *Malaxiz cylindrostachya* (Lindl.) Kuntze	July August	R,E,T
360. *M. muscifera* (Lindl.) Kuntze	June August	R,T
361. *Mastigion appendiculatum* (Rolfe) Garay, Hamer & Siegerist	September October	vR,E,T
362. *Mastigion rothschidianum* (O' Brien) S.Z. Lucksom.	October November	eX?
363. *Micropera mannii* (Hook.f.) T. Tang & F.T. Wang.	June September	nC
364. *M. obtusa* (Lindl.) T. Tang & F.T. Wang	June August	nC
365. *Mischobulbum megalanthum* T. Tang & F.T. Wang.	March	vR,E,T
366. *Monomeria barbata* Lindl.	November February	C
367. *Myrmechis pumila* (Hook.f.) T. Tang & F.T. Wang.	July September	R,E,T
368. *M. franchetiana* (King & Pantling) Schltr.	August	eR
369. *Neottia acuminata* Schltr.	June July	R,T,E
370. *N. listeroides* Lindl.N. pantlingii (W.W. Smith) T. Tang & F.T. Wang.	July	R,E.T.
371. *Neottianthe cucullata* var calciola (W.W. Smith) Soo	June	vR
372. *N. secundiflora* (Hook.f.) Schltr	August September	R,T
373. *Nephelaphyllum cordifolium* (Lindl.) Bl.	June	vR,T
374. *N. pulchrum* vr Sikkimensis Hook.f.	June July	vR,T
375. *Nervilia crociformis* (Zollinger & (Moritzi) Seidenfaden.	June	R,E,T
376. *N. falcata* (King & Pantling) Schltr.	April	eR.E,T
377. *N. aragona* Gaudichaud.	April	R,E,T
378. *N. gammieana* (Hook.f.) Schltr.	April June	R,E,T
379. *N. hookeriana* (King & Pantling) Schltr.	Not Known	eR,E,T
380. *N. macroglossa* (Hook.f.) Schltr.	May June	R,T
381. *N. plicata* (Andrews) Schltr.	May June	R,T,E
382. *Oberonia acaulis* Griff.	October- December	C
383. *O. auriculata* king & Pantling.	May	R,E,T
384. *O. emarginata* King & Pantling.	June September	nC
385. *O. ensiformis* (J.E. Smith) Lindl.	October	vR,E,T
386. *O. brachystachys* Lindl.	July	eX?
387. *O. caulescens* Lindl.	July August	vR,T
388. *O. croftiana* King & Plantling.	October	nC,T
389. *O. falcata* King & Pantling.	July October	C
390. *O. jenkinsiana* Griff.	September October	vR,E,T
391. *O. lobulata* King & Pantling.	October	eR,E,T
392. *O. falconeri* Hook. f.	September October	vR,E,T
393. *O. mucronata* (D.Don) Ormerod & Seidenfaden	October	nC,E,T
394. *O. micrantha* King & Pantling	July	nC
395. *O. obcordata* Lindl.	September November	R,E,T
396. *O. orbicularis*. Hook. f.	October December	R,E,T
397. *O. longilabris* King & Pantling.	July	R,T

398. *O. pachyphylla* King & Pantling.	February	vR,E,T
399. *O. pachyrachis* Rehb. f. ex Hook. f.	October November	C
400. *O. pyrulifera* lindl.	October	R,T,
401. *O. prainiana* King & Pantling	April- May	eX?
402. *O. rufialbris* Lindl.	October February	vR,E,T
403. *O. parvula* King & Pantling	February	C
404. *O. kingii* S.Z. Lucksom	October November	vR,E,T
405. *Odontochilus crispus* (Lindl.) Hook.f.	August October	R,T
406. *O. clarkei* Hook. f.	August	R
407. *O. elwesii* E.B. Clarke ex Hook.f.	August September	R,E,T
408. *O. grandiflorus* (Lindl.) Bentham & Hook. f. ex Hook. f.	July	R
409. *O. lanceolatus* (Lindl.) Bl.	August September	R
410. *O. torus* King & Pantling.	November December	vR
411. *Oreorchis foliosa* (Lindl.) Lindl.	June July	R,E,
412. *O. foliosa* var. indica (Lindl.) N. Pearce & P.J. Cribb.	June August	R,T
413. *O. micrantha* Lindl.	June July	vR
414. *Ornithochilus difformis*	June Jult	nC
415. *Otochilus fuscus* Lindl.	November June	C
416. *O. lancilabius* Seidenfaden.	October April	C
417. *O. albus* Lindl.	June July	C
418. *Pachystoma pubescens* Bl.	November May	vR
419. *Panisea demissa* (D.Don) pfitzer.	October November	C
420. *P. uniflora* (Lindl.) Lindl.	April June	R,E,
421. *Pantlingia paradoxa* Prain.	September	vR
422. *Paphiopedilum fairrieanum* (Lindl.) Stein.	October December	eR,T,V
423. *P. venustum* (Wall.) Pfitzer ex Stein.	February March	R,T,V
424. *Papilionanthe teres* (Roxb.) Schltr.	May July	R,T,E
425. *P. uniflora* (Lindl.) Garay.	July October	nC
426. *P.vandarum* (Rchb.f.) Garay.	February March	vR,T
427. *Pecteilis susannae* (L.) Rafinesque.	August September	eR,T,E
428. *Peristylus affinis* (D. Don) Seidenfaden.	June	vR,T
429. *P. constrictus* (Lindl.) Lindl.	June August	nC,T,E
430. *P. fallax* Lindl.	July August	R,E,T
431. *P. goodyeroides* (D.Don) Lindl	June July	nC,T,E
432. *P. elizabethae* (Duthie) R.K. Gupta	July August	vR,T
433. *P. lacertiferus* (Lindl.) J.J. Smith	September	vR,T,E
434. *P. nematocaulon* (Hook.f) M.L. Banerji & P. Pradhan	August	R,T
435. *P. parishii* Rchb.f.	June July	R,T
436. *P. prainii* (Hook.f.) Kranzlin.	July	vR
437. *P. superanthus* J.J. Wood.	August	R,TE
438. *P. pseudophrys* (King & Pantling) Kranzlin	July	eR,T,E
439. *Peristylus tipuliferus* (Parish &	May July	R,T
440. *Mukerjee* (Rchb.f.)		
441. *Phaius flavus* (Bl.) Lindl.	April	nC
442. *P. mishmensis* (Lindl. & Paxton) Rchb. f.	September October	R,T
443. *P. nanus* Hook. f.	February	vR,T
444. *P. tankervilleae* (Banks ex I' Heritier) Bl.	April May	mC
445. *Phalaenopsis lobbii* (Rchb.f.) H.B. Sweet	May	R,T
446. *P. manii* Rchb.f.	May	eR
447. *Pholidota articulata* Lindl.	April September	nC
448. *P. articulata* var. griffithii (Hook.f.) King & Pantling.	April August	R,T,E
449. *P. imbricata* Hook.	March July	C
450. *P. pallida* Lindl.	May August	nC
451. *P. protracta* Hook.f.	September November	nC
452. *P. recurva* Lindl	August September	C
453. *P. rubra* Lindl.	October December	R,E,T
454. *Phreatia elegans* Lindl.	August September	R
455. *Plantanthera bakeriana* (King & Pantling) Kranzlin	September October	R,E,T

456. *P. clavigera* Lindl.	August September	R
457. *P. cumminsiana* (King & Pantling) Renz.	July August	R
458. *P. biermanniana* (King & Pantling) Kranzlin.	July October	R
459. *P. edgeworthii* Hook.f. ex collett) R.K. Gupta.	July September	R
460. *P. excelliana* Soo.	June July	nC
461. *P. latilabris* Lindl.	July September	R
462. *P. leptocaulon* (Hookf.) Soo.	July August	nC
463. *P. pachycaulon* (Hook.f.) Soo.	June July	R
464. *P. sikimensis* (Hook.f.) Krantzlin	July	R
465. *P. stenantha* (Hook.f.) Soo.	July September	R
466. *P. dyeriana* (King & Pantling) Kranzlin.	July	R
467. *Pleione hookeriana* (Lindl.) B.S. Williams.	May July	nC
468. *P. hmilis* (J.E. Smith) D.Don.	January March	nC
469. *P. maculata* (Lindl.) Lindl.	October November	nC,E,T
470. *P. praecox* (J.E. Smith) D. Don	September December	mC,T
471. *Podochilus cultratus* Lindl.	September October	R,T
472. *P. khasianus* Hook.f.	March May	R,E,T
473. *Pomatocalpa armigerum* (King & Pantling) T. Tang & F.T. Wang.	August September	R,T
474. *P. bambusarum* (King & Pantling) Garay.	May	eR,E
475. *P. spicatum* Breda	May June	eR
476. *P. undulatum* (Lindl.) T. Tang & F.T. Wang.	March	R,E,T
477.*Porpax elwesii* (Rchb.f.) Rolfe.	December January	R,E,T
478. *P. fibuliformis* (King & Pantling) King & Pantling.	July October	vR,E,T
479. *Pteroceras teres* (Bl.) Holttum.	May June	R,E,T
480. *Rhomboda lanceolata* (Lindl.) Ormerod.	August September	R,E,T
481. *R. longifolia* Lindl.	Not Kown	eR,eX?
482. *Rhynchostylis retusa* (L.) Bl.	May July	C
483. *Rhytionanthos cornutum* (Lindl.) Garay, Hamer & Siegerist.	May July	R,E,T
484. *R. spathulatum* (Rolfe ex Cooper) Garay, Hamer & Siegerist.	February April	eR,E,T
485. *Risleya artopurpurea* King & Pantling.	June July	eR,E,T
486. *Robiquetia spatulata* (Bl.) J.J. Smith.	June	R,E,T
487. *R. succisa* (Lindl.) Seidenfaden & Garay.	May June	R,E,T
488. *Saccolabiopsis pusilla* (Lindl.) Seidenfaden and Garay	March April	vR,T
489. *Satyrium nepalense* D.Don	October November	R,E,T
490. *S. nepalense* var. ciliatum (Lindl.) Hook. f.	July October	C
491. *Schoenorchis gemmata* (Lindl.) J.J. Smith	May June	nC
492. *Smitinandia micrantha* (Lindl.) Holtum.	March May	R,E,T
493. *Spathoglottis ixioides* (D.Don) Lindl.	July August	R,E,T
494. *Spiranthes sinensis* (Persoon) Ames.	March October	nC
495. *Staurochilus ramosus* (Lindl.) Seidenfaden.	May	vR
496. *Stereochilus hirtus* Lindl.	May June	R,E,T
497. *Sunipia intermedia* (King & Pantling)	June	A,E,T
498. *S. scariosa* Lindl	April May	R,E,T
499. *Taeniophyllum crepidiforme* (King & Pantling) King & Pantling.	September	R,E,T
500. *T. retrospiculatum* (King & Pantling) King & Pantling.	June	R
501. *Tainia latifolia* (Lindl.) Rchb. f.	March April	R,E,T
502. *T. minor* Hook. f.	March May	R
503. *Thilasis lougifolia* Hook.f.	October	nC
504. *Thilasis pygmae* (Grift.) Bl.	August September	nC

505. *Thrixpermum centipeda* Loureiro.	September	vR,E,T
506. *T. muscaeflorum* A.S. Rao & Joseph.	July November	vR,E,T
507. *T. pygmaeum* (King & Pantling) Holttum	April May	vR,E,T
508. *Thunia alba* (lindl.) Rchb.f.	June August	R,E,T
509. *Thunia bracteata* (Roxb.) Schltr N. Pearce & P.J. Cribb	May June	nC
510. *Tipularia josephi* Rchb. f. ex Lindl.	July	eR,E,T
511. *Trichostosia dasyphylla* (Paris & Rchb.f.) Kranzlin	April June	vR,E,T
512. *T. pulvinata* (Lindl.) Kranzlin	March May	vR,E,T
513. *Tropodia angulosa* (Lindl.) Bl.	September October	R,T
514. *T. curculigioides* Lindl.	May	R,E,T
515. *Tylostylis discolor* (Lindl.) Hook.f.	Febuary June	C
516. *Uncifera acuminata* Lindl.	November December	R
517. *Uncifera lancifolia* (King & Pantl.) Schltr.	July	vR
518. *U. obtusifolia* Lindl.	July September	C
519. *Vanda alpina* (Lindl.) Lindl.	May July	eR,E,T
520. *V. cristata* Lindl.	April June	mC,E,T
521. *V. griffithii* Lindl.	May June	vR,E,T
522. *V. pumila* Lindl.	May	eR,E,T
523. *V. cristata* var. multiflora Pradhan	May June	vR,E,T
524. *Vanda testacea* (Lindl.) Rchb.f.	May June	R,E,T
525. *Vandopsis undulata* (Lindl.) J.J. Smith.	April May	nC,T
526. *Yoania prainii* King & Pantling.	July	eR,T,E
527. *Zeuxine affinis* (Lindl) Bentham. ex Hook.f.	October January	R,T
528. *Z. flava* (wall. Ex Lindl.) Trimen.	March May	vR,E,T
529. *Z. glandulosa* King & Pantling.	March	vR, E,T
530. *Z. goodyeroides* Lindl.	September October	R,E,T
531. *Z. nervosa* (Wall. ex Lindl.) Bentham ex C.B. Clarke.	February March	R,T
532. *Z. pulchra* King & Pantling.	August	R,T
533. *Z. relfexa* King & Pantling.	March April	vR,T
534. *Z. seidenfadenii* Deva & Naithani.	April	vR,E,T
535. *Z. strateumatica* (L.) schltr.	January February	vR,E,T

C - Common; mC - Most common; nC - No so uncommon; E - endangered; eX - Extinct; eX - Possibly extinct, R - Rare; eR - Extremely rare; vR - Very Rare; T - Threatened

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REFERENCES

Ansari, A.A., Diwakar & Dwarakan, (1994). Occurrence of *Taeniophyllum alwisii* Lindl.- A tiny Rare and Little known orchid from Shevoroy & Kolli Hills of Tamil Nadu. *Indian Journal of forestry* 17(3): 260 261.

Ansari, R. & Balakrishnan, N.P. (1990). A revision of the Indian species of *Oberonia* (Orchidaceae). *Orchid*

Balakrishnan, N.P. (1978). Notes on some orchids from Bhutan. *J. Bombay Nat. Hist. Soc.* 75 (1) : 157-163.

Balakrshnan & B. Krishna 1970(1972): Bulbophyllum piluliferum King & Pantling. A new record for Assam. *Ibid.* 12: 287-289. P. Chakraborty 1978 (1979): Descriptive notes on some little known Orchids of Nicobar Islands.

Bull. Bot. surv. India 20: 80-90. S. Chaudhury 1966 (1967): Notes on Orchids of Bhutan I. Epigeneum Gagnep. and Katherinea Hawkes.

Banerji, M.L. 1982: Orchids of Nepal. Dehra Dun. Banerji, M.L. & Pradhan, P. (1984). *The Orchids of Nepal Himalaya.* Vaduz: J.Cramer.

Bhattacharyya, U.C. C.M. Arora & C.L. Malhotra 1982. The danger of vanishing Orchid Species in North West Himalaya *The vegetational Wealth of Himalaya* 249-255 Delhi.

Bose, T.K. & Bhattacharjee, S.K. (1990). *Orchids of India.* Revised edition. Calcutta: Naya Prokash.

Das, A.P. & Chandra, S. (1988). Two new taxa of the family Orchidaceae from Darjeeling Hills, West Bengal (India). *J. Econ. Tax. Bot.* 12 (2): 401-404.

Das, A.P. & Dorjay, L. (1992). *Liparis breviscapa* A.P. Das & Dorjay a new species of Orchidaceae from the Darjeeling Hills, West Bengal (India). *J. Econ. Tax. Bot.* 16 (1): 226-227.

Unpublished Ph.D. Dissertation, University of Reading.

Deva, S. & Naithani, H.B. (1986). *The Orchid Flora of North West Himalaya.* New Delhi: Print & Media Associates.

Devendra M., Bajracharya A., Dressler, R.L. (1981). *The Orchids: Natural History and Classification.* Cambridge: Harvard University

Dressler, R.L. (1993). *Phylogeny and Classification of the Orchid Family.* Cambridge: Cambridge University Press.

Garay, L.A. (1974). On the systematics of the monopodial orchids II: *Bot. Mus. Leaf.* 23(10):369-375.

Garay, L.A., Hamer, f. & Siegerist, E.S. (1994). The genus *Cirrhopetalum* and the genera of the *Bulbophyllum* alliance. *Nordic* J. Bot. 14(6): 609-646.

Ghose, G. (1964). New orchids of Sikkim Himalaya. *Orchid Rev.* 72: 282-283. Gilbert, P.A. (1985).

Gurung, P.B., Kumar Y. & Tripathy R.S. (1991). First report on type locality and Rediscovery in nature of a rare Indian Orchid species, *Bubophyllum rothschildianum* (O'Brien) J.J.Smith. *Journal, Bombay Natural Hist. Society* 88(1): 139-140.

Hajra, P.K. 1984. Leopard orchid from Pithoragarh district, Utter Pradesh Indian Forester 110: 686.

Hanna B. Margonka. (2002). A new species of *Crepidium* (Orchidaceae, Malaxidinae) from Sabah, Borneo). *Ann. Bot.Fennici* 39: 63-66.

Hanna B. Margonska & Dariusz L. Szlachetko. (2001). Materials to the revision of the Genus *Seidenfia* (Orchidaceae, Malaxidinae), with a description of a new species. *Polish Botanical Journal* 46(1): 47-62.

Hanna B. Margonska & Dariusz L. Szlachetko (2001). Notes on the Genus *Crepidium* (Orchidaceae, Malaxidinae). Polish Botanical Journal 46(1): 43-45.

Hara, H. (ed.) (1966). *The Flora of Eastern Himalaya*. Tokyo: University of Tokyo Press.

Hara, H. (ed.) (1971). *Flora of Eastern Himalaya. Second Report.* Tokyo: University of Tokyo.

Hegde, S.N. (1984). *Orchids of Arunachal Pradesh.*

Hynniewta, T.M. (1979*)*. Some additions to our knowledge of terrestrial orchids of Nagaland *J. University Gauhati* xxvi xxvii: Science 48-50.

King, G & Pantling, R. (1898). The Orchids of the Sikkim-Himalaya. *Ann. Roy. Bot. Gard. (Calcutta)* 8(1-4): 1- 342, t. 1-448.

Nageswara A. Rao. (2000). Notes on some new addition and nomenclatural changes in two orchids of Arunachal Pradesh. J.Orchid Soc. India, 14 (12): 61-66.

Nageswara A.Rao., Haridasan K & Hegde S.N. (1989). *Eria lohhitensis*-A new species of Orchid from Arunachal Pradesh, India. *Journal, Bombay Natural Hist. Society* 86(2) 229-230.

Pearce, N. & Cribb, P. (1997). A revision of the genus *Oreorchis* (Orchidaceae). *Edinb. J. Bot.* 54(3): 289-328.

Pearce, N. & Cribb, P.J. & Renz, J. (2001). Notes relating to the Flora of Bhutan: XLIV. Taxonomic notes, new taxa and additions to the Orchidaceae of Bhutan and Sikkim (India). *Edinb. J. Bot.* 58(1): 99-122.

Pradhan, M. (1996). *Paphiopedilum farrieanum* (Lindl.) Pfitz. in Sikkim. *S. African Orchid* J. 27(4): 109-112.

Pradhan, U.C. (1976). *Indian Orchids: Guide to Identification and Culture. Volume I.* Kalimpong.

Seidenfaden, G. (1986). Orchid genera in Thailand XIII. Thirty-three epidendroid genera. *Opera Bot.* 89:1 216.

Seidenfaden, G. (1988). Orchid genera in Thailand XIV. Fifty-nine vandoid Genera. *Opera Bot.* 95: 1 398.

Summerhayes, V.S.(1955). *Brachycorythis. Kew Bull.* 2: 221-264.