NMHS
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Monograph

Orchids of *Prakriti-kunj*

(Him-Nature Learning Centre, Sikkim)

GB Pant National Institute of Himalayan Environment
Sikkim Regional Centre, Pangthang, Gangtok, Sikkim

Monograph on Orchids of *Prakriti-kunj*-
Him-Nature Learning Centre, Sikkim

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Coelogyne ovalis

FOREWORD

Orchidaceae being one of the world's largest group of flowering plants and having secret life with diverse range of floral morphology has fascinated nature enthusiast for ages in the context of its exploration, conservation and propagation. After, pioneering work of Sir Joseph Dalton Hooker on floral studies in the Sikkim Himalaya, several exhaustive work documenting different aspects related to orchids has been brought forward and yet, the subject remains inexhaustible.

The Sikkim state is home for several thousands of floral species among which orchids are not only the centre of attraction for botanists, scholars, florists, horticulturists and other enthusiasts, but also as a source for effective livelihood option because of their horticultural, floricultural and medicinal significance .

The Sikkim Regional Centre (SRC) of GBPNIHE under the Him-NLC-Sikkim has established an "Orchidarium" and developed "Orchid trail" in the arboretum "Prakriti-Kunj" of SRC. Nearly 17% of orchid diversity of the state of Sikkim has been conserved in the Orchid trail and Orchidarium of SRC by rescuing and collecting the orchid germplasm from different locations. This monograph on Orchid Diversity in the NLC is an sincere attempt to document the orchid species in order to provide information such as accepted names, elevation range, habit, flowering season, etc. to help the reader to have easy and ready references.

The effort of establishing "Orchidarium" and "Orchid Trail" is supported under the NMHS funded Him-Nature Learning Centre (Him-NLC) in collaboration with department of Forest and Environment, Government of Sikkim , particularly to initiate this activity

The efforts of the NMHS-project team as well as Editors of the monograph are highly appreciable. I congratulate them for bringing out this useful document for nature conservationists, taxonomists, researchers and orchid lovers.

Prof. Sunil Nautiyal
Director, GBPNIHE

Odontochilus lanceolatus

PREFACE

The biological diversity-the species, ecosystems and ecological processes makes up the web of life. Therefore, changing ecological and climate regime are important aspects of rearticulating human development. We cannot be developed unless our lives becomes reconnected and in balance and harmony with nature. Also, the lack of awareness on the rich biodiversity causes problems in management of bio resources and hence it is required to educate and create awareness among diverse stakeholders, particularly the young minds needs to be sensitized and made aware about the rich bio-resources to protect, conserve and effectively utilize the available resources. Realizing this, a Nature Learning Centre (NLC) is being developed jointly by the Institute and Forest and Environment Department, Government of Sikkim at Pangthang with the support of National Mission on Himalayan Studies (NMHS) under the aegis of Ministry of Ministry of Environment, Forest & Climate Change (MoEF&CC), Government of India. The objectives of the NLC include (i) Development of easy learning module and knowledge module products for school students & teacher, conservation workers, etc. (ii) Capacity building of different stakeholders-government, non-government and community level on building ecosystem resilience, (iii) Awareness programme and dissemination of knowledge on nature and biodiversity conservation, (iv) Sensitization programmes and conservation clubs for school and college students on regional and local biodiversity, (v) Development and demonstration of live models for conservation of natural resources, etc.

To address the objectives of the project, and Sikkim being the treasure house of Orchids, harbors nearly 560 orchid species, taking advantage of the opportunity Sikkim Regional Centre of the Institute with support from BSI, SHRC, Gangtok and Forest and Environment Department, Government of Sikkim had developed an Orchid trail and Orchidarium in *Prakriti-Kunj*. The Him-NLC is supported by the Ministry of Environment, Forest and Climatic change, Government of India under National Mission on Himalayan Studies (NMHS). This Monograph is enumerate and describe the orchids that has been rescued and collected over past two years in the Nature Learning Centre of the Institute with an aim to introduce the luxuriant diversity of Orchids in the state and to create awareness on orchid conservation among students, research scholars, academics, tourist and other stakeholders. This monograph provides comprehensive introduction on Orchids and its and richness in Nature Learning Centre of the Institute. Orchid species listed in the monograph are arranged alphabetically in two groups based on growth habit i.e. epiphytes and terrestrial, with its botanical name, habit, elevation range, flowering season.

Editors

Goodyera hemsleyana

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Otochilus lancilabius

BACKGROUND

Prakriti-Kunj: Nature Learning Centre

Sikkim state being located in the adobe of Eastern Himalayan biodiversity hotspot, which is rich in floristic biodiversity. The tremendous diversity of plants as well as a host of other life forms is yet to be explored. The lack of awareness on the rich biodiversity causes problems in management and hence it is required that the local public and diverse stakeholders be sensitized and made aware of rich bio-resources for its protection and conservation. Under these contexts, there is a need to focus on transforming knowledge from diverse sources, across areas of scientific research and traditional knowledge into dissemination for conservation action. Realizing this, the Ministry of Environment, Forest and Climate Change (MoEF&CC), Government of India under National Mission on Himalayan Studies (NMHS) promoted establishment of the state-of-art Himalayan-Nature Learning Centre (Him-NLC) in all Himalayan states including Sikkim. In Sikkim, Forest and Environment Department, Government of Sikkim working as a project implementing agency, while GBPNIHE, SRC is an implementing partner entrusted with the development of state of art Nature Learning Centre.

A *Prakriti-Kunj* an arboretum of institute along with the Rural Technology Centre serves as a study and implementation

site for Him-NLC. *Pakriti-kunj* with an area of 10 acres located near the periphery of Fambonglho Wildlife Sanctuary is rich in oaks, bryophytes, ferns, orchids, rhododendrons, medicinal plants and many other angiosperm species. *Prakriti-Kunj* has ample potential, which on one hand ensures to be *ex situ* conservation of the representative plant species and on the other gives the visitors to the area enriching and educational experiences through hands on experience of natural elements. Besides, NLC include development of easy learning module and knowledge products for school children, teacher, conservation workers, SHGs, JFMC, BMC, young researchers, etc.

The broad objectives of Him-NLC Sikkim includes capacity building trainings for different stakeholders for conservation and livelihood generation; awareness programme and dissemination of knowledge on nature and biodiversity conservation through various means; development of conservation and demonstration site for different representative taxa of the region; promotion of citizen science approach for conservation education; and create a cadre of nature enthusiasts and conservation workers in the state through capacity building. Further NLC serves as a model for conservation of sensitive flora and fauna and serve as a field laboratory for conservation of biodiversity and interactive through promotion and highlight of flagship plant species and its habitats. NLC strengthens biodiversity knowledge base of the state and creates awareness amongst young minds, officials, tourists and locals.

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The Orchid family, Orchidaceae, consisting of about 28,000 accepted species and 800 subspecies distributed in about 763 genera, is one of the two largest families of flowering plants, after Asteraceae. Many people have a fuzzy idea about orchid, but is likely that most would not recognize all the species. So what is an orchid?

An orchid are divided into five sub families, Apostasioidae, Vanilloideae, Cypripedioideae, Epidendroideae and Orchidoideae based on DNA studies and morphology and reflects major differences in vegetative features and flower construction. The largest genera of family Orchidaceae are *Bulbophyllum* (2,000 species), *Epidendrum* (1,500 species), *Dendrobium* (1,400 species) and *Pleurothallis* (1,000 species). In many ways orchids are enigmatic, attracting many generations of mankind with its incredible shapes and colours of their flowers.

Orchids are found growing in a wide range of habitats with different growth habits thus, all of them being perennial, mostly, partial shade loving and few total shades loving. A large population of orchids are found growing near the surface of the ground and are known as terrestrial. Some are found growing on branches and stem of shrubs and tall trees and are known as epiphytic. Interestingly, epiphytic orchids do not draw food from their host plant but only hold on to them for anchorage, and they draw moisture or nourishment from the air and humus collected in the bifurcated pits of branches or crevices of the bark. Some other are found growing completely on bare rocks or moss covered rocks and are known as lithophytes. Mostly, orchids are autotrophic but few species occurs as saprophytes growing on dead and decaying organic matters/stems.

Orchids are exclusive and thus, require specific habitats for their growth and development. Indeed, their vulnerability towards habitat loss and environmental degradation, consider them as an ecological indicator. Thus, their disappearance indicating a change in the quality of soil and air of the region. Also, wild orchid's species are used as traditional food and for a

variety of folk medicines and cures by the local tribes of north-eastern region of India. While, Sikkim has a long history of wild orchid conservation in their natural habitats in sacred groves, as orchids are closely associated with the socio economic culture of the local community. Sikkim occupies second position in terms of orchid diversity in India. *Dendrobium nobile* being one of the most commonly grown orchid species, is important both for ornamental and medicinal value, is declared as state flower.

Figure: Orchids under different sub families viz.
a) Apostasioideae b) Cypripedioideae c) Epidendroideae d) Orchidoideae e) Vanilloideae

Orchid's diversity in - Prakriti Kunj

Orchids are flagship plant species, with immense ecological and economic value. They act as a good bio-indicators as they have low tolerance for change in environmental conditions and require mycorrhizal association for germination. Thus, the number of orchid species and their habitat are declining at accelerating pace due to changing climatic condition, habitat destruction and insensitive extractions. Under the Him-NLC, *Prakriti-Kunj* has been established in the heart of arboretum, with an aim to create an enabled environment for conservation of orchids and to spread awareness amongst researchers, academicians and nature conservationists.

Up to date, *Prakriti-Kunj* houses 70 epiphytic and 24 terrestrial orchid species, belonging to 41 genera. Out of these, some species were rescued from the sites of road widening and construction, landslide sites from different territorial and private forests of Sikkim, few are natives of the campus and the rest through generous contribution by Botanical Survey of India, Sikkim Himalayan Regional Centre.

The germplasm of acquired orchid species are planted at suitable substrate in established in trail and orchidarium for conservation and demonstration. The collected species belongs to 13 *Dendrobium*, 11 *Bulbophyllum,* 9 *Coelogyne* , 4 *Cymbidium, Crepidium, Liparis*, 3 *Goodyera* and *Otochilus*, 2 each of *Agrostophyllum, Calanthe*, *Cryptochilus*, *Dendrolirium*, *Epigeneium, Habenaria, Nervilia, Oberonia*, *Pholidota* and *Pleione* and 1 each of *Acampe*, *Acanthephippium*, *Anthogonium*, *Arundina, Cleisostoma*, *Eria*, *Gastrochilus*, *Micropera, Odontochilus, Peristylus, Phalaenopsis*, *Pinalia*, *Podochilus*, *Porpax*, *Rhynchostylis*, *Schoenorchis, Spiranthes*, *Tainia*, *Thelasis*, *Thunia*, *Uncifera*, *Vanda and Vandopsis.*

The established *Prakriti-Kunj* represents the orchid diversity of the region and is important *ex-situ* conservation site for conservation education and demonstration. The orchid trail and orchidarium, thus plays a key role in conservation of Orchids and spreading awareness among diverse stakeholders towards nature preservation through environmental education programme. This monograph provides an inventory of orchid

species found in the orchid trail and Orchidarium of *Prakriti-Kunj* at GBPNIHE with its pictorial identification. This information would help to improve understanding and to address the gap in knowledge of orchid diversity of Sikkim Himalaya.

Morphological Diversity of orchids

Habit: Orchids are distinguished from one another by their way of life: Orchids are either terrestrial with roots that have permanent contact to soil such as *Calanthe*, *Tainia*, *Habenaria* or epiphytes, which have roots that never touch the ground and therefore are called aerial roots, such as *Bulbophyllum*, *Dendrobium*. Some orchids are termed lithophytes as they are found grown completely on bare rocks or moss covered rocks such as *Arundina graminifolia*, *Anthogonium gracile*. However, few other grows on dead and decaying organic matters and lack chlorophyll which is termed as saprophytes such as *Galeola falconeri*.

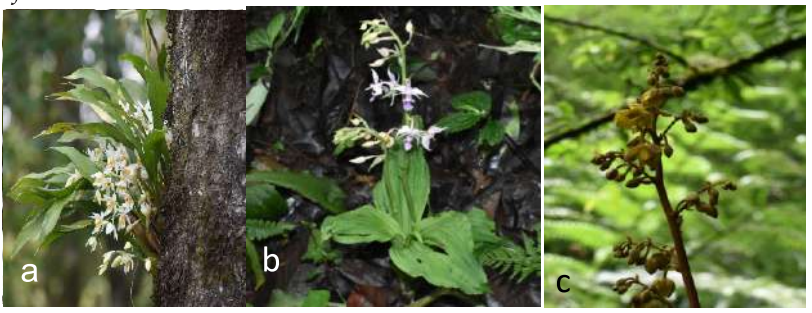


Figure: a. epiphyte b. terrestrial and c. saprophytic orchids

Foliage: Orchids are monocots generally having simple leaves with parallel veins. Orchids with a single leaf are called unifoliates and orchids with two occasionally three leaves are called bifoliates. The surface range from simple to plicate, pubscent to glabrous. Some orchid leaves are grayish-green, mottled with white as in *Paphiopedilum venustum*, some are dark velvety-green in colour. Epiphytic orchids are characterized by thick and succulent leaves with thick cell walls, cuticles and small sub-stomatal chamber whereas those of terrestrial species are thin. Mature leaves are photosynthetically active. In monopodial orchids, the number of leaves on stem depends on the age of the plant while the orchid like *Cattleya* has one leaf per pseudobulb and *Dendrobium* has 5-20 leaves per pseudobulb.

Figure: Morphological variations in orchid leaves

Homoblastic pseudobulbs consist of two or more internodes e.g. *Eria* and *Dendrobium*. It may be rounded and globular as in *Bulbophyllym*, oblong and thumb shaped as in *Eria*, flat and button shaped as in *Porpax*, elongated cane and club shaped as in *Dendrobium*, conical, round to ovoid in *Cymbidium*, clavate in *Cattleya* and grooved in *Onicidium*.

Figure: Pseudobulb morphology in epiphytes

Roots: Orchids have roots system mainly meant for establishment, anchorage and manufacturing of their own food. The roots of terrestrial orchids in higher and cold region produce finer root stream, whereas in the warmer region the terrestrial orchids often produce stoloniferous roots. Its aerial roots are stoloniferous and velamen at its tips. Velamens are the outer layers of spongy cells on the root tips made to absorb and store moisture from the air. The sources for epiphytic plants are atmospheric inputs (rain, dust and intercepted mist).The roots of genera like *Phalaenopsis* become flat and help the plant creep over the surface, while those of *Aerides* and *Vanda* help the plant to trail. Some orchid roots even provide a home for ants that supplement orchid nourishment.

Flower: The range of size in orchids flower varies from 0.15 cm across *Oberonia* sp. to 10 cm across *Pecteilis gigantean* . The shades are white, yellow, green and purple occurring in pure state or in different other possible combination. The Orchid flower mimics spiders, dancing girls, bees, ladies slipper or insects. Orchids flowers are zygomorphic and bisexual or very rarely unisexual. Labellum is the most prominent and distinctive part of the orchid flower and its habit of mimicry facilitate pollination. On the basis of one or more fertile anther present, orchids are called as monandrae or Pleonandrae.

Growth forms

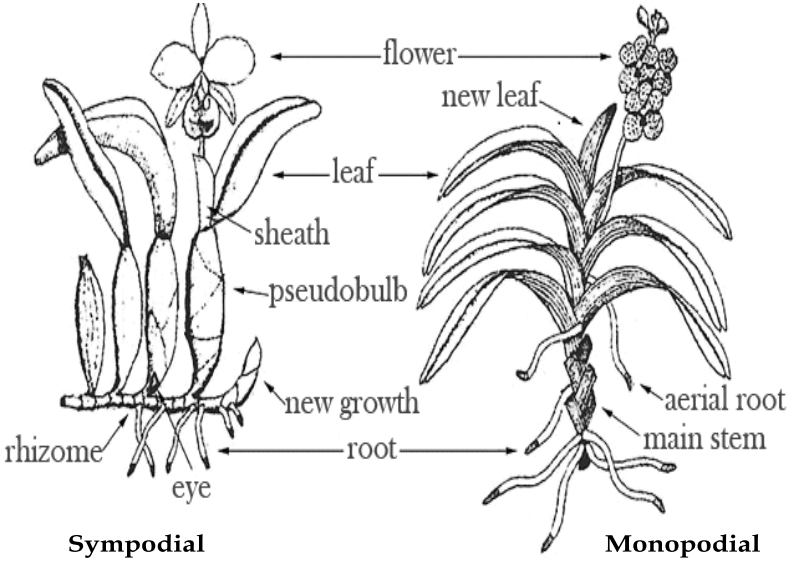
An orchid follows two distinct growth habits i.e. sympodial and monopodial

➢ **SYMPODIAL ORCHIDS:**

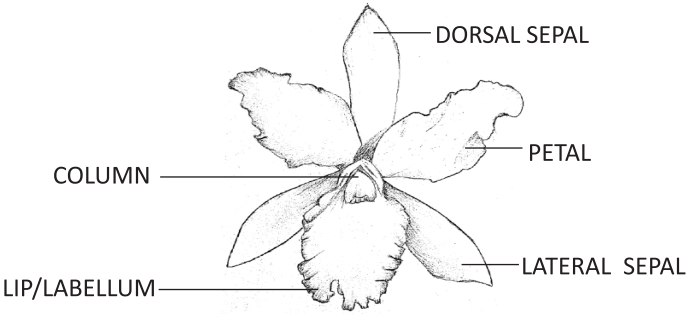
Sympodial orchids have a lateral growth pattern in which each new shoot arises from the apical renewal bud or eye on the basal, rhizomatous part of the plant. The new growth enlarges into a swollen stem, the pseudo bulbs, which are no true bulb, but are modified thickened stem adapted to store moisture and food. It has multiple growths and usually grows one or more new growth per year.

➢ **MONOPODIAL ORCHIDS:**

The monopodial orchids grows continuously upward, sprouting new leaves from the apex of the plant and inflorescences form from bud primordial in the leaf axils. These orchids grow from a horizontal stem. Thus, new growth being an extension of the growth of previous years. These usually have short, thick, joined and are produced alternately on either side of central axis (stem).



Flower morphology



SEPALS: Orchid flower consists of two rings, outer ring simply known as sepal, the uppermost symmetrical sepal called dorsal sepal and the two lateral sepals at the bottom of the flower.

PETALS: Petals are inner alternating rows of sepals, consisting of the two petals on either side of the flower and the lip or labellum usually at the base of the flower.

LIP: The lip (labellum) is a modified petal (one of three) that sits opposite from the fertile anther and usually highly modified from the other perianth segments. This serves variously as a landing platform, a flag to attract the prospective pollinators

COLUMN: It is a reproductive structure known as gynostemium, or column produced by the fusion of both male (stamen) and female (stigma) parts in the flower. It consists of male organ anther that bears the pollinia or pollen pellets and the female receptive organ, the stigma.

POLLINIA: Pollinia are two or four soft fluffy masses which are bound together by "viscin" an elastic, somewhat viscid material derived from the tissues of the anther.

FLOWER MORPHOLOGY AND POLLINATION

More than 99% of all described orchid species have only one stamen in the flower, which makes orchids flower unique from the rest. Most orchid flowers have the basic reproductive structures. A central structure known as the column houses both the male (anther) and female (stigma) parts of the flower. Orchid flower has a column at its centre; the anther is located at the distal end of the column and the stigma is located near the distal end and just on the underside of the column. The labellum, or lip, a modified petal lies directly below the column, that acts as a landing area for pollinators. The floral nectarines (nectar producing tissue on the plant) are typically located at the base of the labellum or as a nectar spur behind the flower. Orchid pollen grains are fused together into compact structures called pollinia. The pollinia (two to eight knob like packets of pollen) attached with stipe or caudicle to a sticky viscidium forming pollinarium, which finally gets stick with the body of pollinator and to the stigma of the next or same flower.

HOW ARE ORCHIDS POLLINATED

Orchids are mainly entomophilous species (insect pollinated), and there pollinators ranges from insects, birds and rodents. However, Hymenoptera (bees and wasps) are common pollinators of orchids. Pollination rewards include nectar (insects and birds), floral fragrance, resins (used by bees for nest building), and oils (used by anthropoid bees to feed larvae). Orchids exhibit exclusive relationship with their pollinator as majority of the orchid flowers are non-rewarding and there resemblance of their flowers to those of particular rewarding species. Therefore, develops various deceptive mechanisms such as food, sexual deception with their pollinators. Orchids are referred to as ever evolving as to achieve such deception (i.e an absence of floral rewards for pollinators). In some cases orchids show a combination of two or three types of deception

The orchid flowers have evolved various special structural features.

Food deception: Orchids exploit the innate food-foraging behaviour of pollinators. *Polystachya,* certain species of *Eria* and *Dendrobium*. The bright yellow tufts of hairs on the lips attract pollen-foraging bees in *Cephalanthera longifolia,* Food deceptive *Bulbophyllum* sp. emits a characteristic odour simulating rotting meat in order to attract male *Bactrocera* species.

Batesian floral mimicry: Deceptive orchids that achieve pollination through the resemblance of their flowers to those particular rewarding species

Sexual deception: Deceptive orchids attract male insects as pollinators by mimicking the reproductive signals emitted by the targeted female sp. sex pheromones and subsequently attempt copulation with female flowers unintentionally taking up the orchid's pollen masses (pollinia) in the process. *Cephalanthera longifolia* develops deceptive morphological marker such as brightly coloured tuft of hairs to attract hunter bees. The orchid blossoms mimic female insects and emanate mating signals like pheromones. Insects use chemo-receptors (olfactory sensilla) on their antenna to receive pheromonal signals. Contrasting spots on petals can lure pollinators that oviposit on florivorous insects. The genus C*ryptostylis* mimics the sex pheromone or the morphology of the female wasp to draw the male wasps of *Lissopimpla excelsa*

Table 1.1.List of Epiphytic orchids in *Prakriti-Kunj*

Sl. No.	Species	Flowering time	Elevation Range (m)
1	*Acampe praemorsa* (Roxb.) Blatt. & McCann	Oct - Jan	300-600
2	*Agrostophyllum callosum* Rchb.f.	June - July	660-2300
3	*Agrostophyllumplanicaule* Rchb.f .	June -Aug	Up to 1800
4	*Bulbophyllum affine* Lindl.	May - July	800-1500
5	*Bulbophyllum careyanum* (Hook.) Spren.	Oct -March	500-2000
6	*Bulbophyllum cauliflorum* Hook.f.	June -July	500-2000
7	*Bulbophyllum crabro* (C.S.Parish & Rchb.f) J.J.Verm.,Schuit.& de Vogel	Nov -Feb	1200-1830
8	*Bulbophyllum guttulatum* (Hook.f.) N.P.Balakr.	June-Sep	800-2500
9	*Bulbophyllum leopardinum* (Wall.) Lindl.	July- Oct	1200-3000
10	*Bulbophyllum moniliforme* C.S.Parish& Rchb.f.	September	1500-1800
11	*Bulbophyllum odoratissimum var. odoratissimum.*	May - July	800-2500
12	*Bulbophyllum reptans* (Lindl.) Lindl. Ex Wall	Oct - Dec	1200–2500
13	*Bulbophyllum roseopictum* J.J.Verm., Schuit. & de Vogel	Oct -Dec	1000-2500
14	*Bulbophyllum scabratum* Rchb.f.	June -Aug	1000-2000
15	*Cleisostoma linearilobatum* (Seidenf. & Smitinand) Garay	June -July	500–2000
16	*Coelogyne barbata* Lindl. Ex Griff.	Sep -Dec	1000-2500
17	*Coelogyne corymbosa* Lindl.	March-July	1800-2800
18	*Coelogyne cristata* Lindl.	Jan-May	1500-1800
19	*Coelogyne flaccida* Lindl.	March-April	1500-1800
20	*Coelogyne fuscescens* Lindl.	Oct-Jan	1200-1800
21	*Coelogyne nitida* (Wall. Ex D.Don) Lindl.	March-June	1500-3000
22	*Coelogyne ovalis* Lindl.	July-Dec	200-3000

Sl. No.	Species	Flowering time	Elevation Range (m)
23	*Coelogyne prolifera* Lindl.	May- June	1000-2200
24	*Coelogyne stricta* (D.Don) Schltr.	March-June	1000-2200
25	*Cryptochilus sanguinea* Wall.	June-August	1500-2200
26	*Cryptochilus strictus* (Lindl.) Schuit.,Y.P.Ng & H.A.Pedersen	Nov-Jan	300-1900
27	*Cymbidium elegans* Lindl.	Oct-Jan	1000-2800
28	*Dendrobium amoenum* Wall. ex Lindl.	May-June	1000-2500
29	*Dendrobium aphyllum* C.E.C.Fisch.	April-June	340-1660
30	*Dendrobium bicameratum* Lindl.	July-Sep	1200-2500
31	*Dendrobium chrysanthum* Wall.	May-Oct	500-2100
32	*Dendrobium densiflorum* Lindl. ex Wall.	April-June	400-1500
33	*Dendrobium fimbriatum var. occulatum* Hook.f.	April-June	300-2200
34	*Dendrobium hookerianum* Lindl.	April-May or Sept-Oct	1000-2300
35	*Dendrolirium lasiopetalum* (Willd.) S.C.Chen & J.J.Wood	April-June	400-1700
36	*Dendrobium longicornu* Lindl.	Aug-Nov	1200-2500
37	*Dendrobium nobile* Lindl.	March-May	500 -1700
38	*Dendrobium ochreatum* Lindl.	April-May	1000-1500
39	*Dendrobium rotundatum* Hook.f.	April-May	1200-2000
40	*Dendrobium stuposum* Lindl.	June-Aug	400-1800
41	*Dendrobium treutleri* (Hook.f.) Schuit. & Peter B.Adams	Sep-Oct	1400-2400
42	*Dendrolirium tomentosum* (J.Koenig) S.C.Chen & J.J.Wood	Sep-Nov	800-1500
43	*Epigeneium amplum* (Lindl. Ex Wall) Summerth	Oct-Dec	1000-2000
44	*Epigeneium fuscescens* (Griff.) Summerh.	Sep-Nov	1200-2000
45	*Eria coronaria* (Lindl.) Rchb.f	Oct-Dec	1400-2500
46	*Gastrochilus calceloris* (Buch.-Ham. ex Sm.) D.Don	April-May or Sep- Dec	1000-2500
47	*Liparis bistriata* C.S.Parish & Rchb.f.	July-Aug	800-1800

Sl. No.	Species(Epiphytic)	Flowering time	Elevation Range (m)
48	*Liparis elliptica* Wight	Oct-Nov	1200-1800
49	*Liparis resupinata* Ridl.	Oct-Dec	1300-2500
50	*Micropera mannii* (Hook.f.) Tang & F.T. Wang	June-July	500-1200
51	*Oberonia falcata* King & Pantl.	June-Aug	1300-2500
52	*Oberonia emarginata* King & Pantl.	July-Sep	1600-2000
53	*Otochilus albus* Lindl.	June-July	1300-1500
54	*Otochilus fusca* Lindl.	March	1200-2100
55	*Otochilus lancilabius* Seidenf.	Oct-Jan	1500-2800
56	*Phalaenopsis taenialis* (Lindl.) Christenson & Pradhan	April-May	1000-2000
57	*Pholidota articulata* Lindl.	July-Aug	700-1800
58	*Pholidota pallida* Lindl.	May-Aug	800-2700
59	*Pinalia spicata* (D.Don) S.C.Chen & J.J.Wood	Aug-Sep	800-2500
60	*Pleione maculata* Lindl. & Paxton	Oct-Nov	700-1500
61	*Pleione praecox* D.Don	Oct-Nov	1200-3000
62	*Podochilus cultratus* Lindl.	July-Aug	400-600
63	*Porpax muscicola* (Lindl.) Schuit., Y.P.Ng & H.A.Pedersen	Aug-Sep	500-1800
64	*Rhynchostylis retusa* (L.) Blume	May-July	300-1500
65	*Schoenorchis gemmata* J.J.Sm.	April-June	500-2000
66	*Thelasis perpusilla* (C.S.P.Parish & Rchb.f.)	July-Aug	Up to 2800
67	*Thunia alba* Rchb.f.	June-Aug	600-2000
68	*Uncifera obtusifolia* Lindl.	July-Oct	900-1400
69	*Vanda cristata* Lindl.	May-July	1000-2000
70	*Vandopssis undulata* J.J.Sm	April-May	1200-2000

Table 1.2.List of Terrestrial orchids in *Prakriti-Kunj*

Sl. no.	Species	Flowering time	Elevation Range (m)
1	*Acanthephippium striatum* Lindl.	April - Aug	Upto 2000
2	*Anthogonium gracile* Wall. Ex Lindl.	Aug - Sep	1000-1500
3	*Arundina graminifolia* (D.Don) Hochr.	May - Aug	Upto 1500
4	*Calanthe puberula* Lindl	July - Aug	1200-3000
5	*Calanthe mannii* Hook.f.	May - June	600-2500
6	*Crepidium acuminatum* (D.Don) Szlach	June - Sep	500-2000
7	*Crepidium khasianum* (Hook.f.) Szlach	July - Oct	1000-1500
8	*Crepidium mackinnonii* (Duthie) Szlach	July - Sep	Up to1500
9	*Crepidium purpureum* (Lindl.) Szlach.	July - Sep	700-1800
10	*Cymbidium erythraeum* Lindl.	Sep - Nov	1400-2800
11	*Cymbidium gammieanum* King & Pantl.	Aug - Oct	Up to 1800
12	*Cymbidium insigne* Rolfe	Nov - Dec	1000-2000
13	*Goodyera foliosa* Benth. Ex Hook.f.	Aug - Sep	900-2800
14	*Goodyera hemsleyana* King & Pantl.	July - Sep	1500-3500
15	*Goodyera vittata* Benth. Ex Hook.f.	July - Sep	500-2500
16	*Habenaria dentata Schltr.*	Sep - Oct	500-2000
17	*Habenaria furcifera* Lindl.	July - Aug	1100-1200
18	*Liparis odorata* Lindl.	May - Aug	600-3000
19	*Nervilia macroglossa* Schltr.	June - Sep	800-2000
20	*Nervilia plicata* Schltr.	March - June	600-1000
21	*Odontochilus lanceolatus* Blume.	Aug - Sep	1000-2000
22	*Peristylus tipuliferus* (C.S.P.Parish & Rchb.f.) Mukerjee	May - July	1000-2000
23	*Spiranthes sinensis* (Pers.) Ames	May - Sep	500-2000
24	*Tainia minor* Hook.f.	May	900-2000

PHOTO PLATE - 1

Acampe praemorsa

Agrostophyllum callosum

Agrostophyllum planicaule

Bulbophyllum affine

Bulbophyllum careyanum

Bulbophyllum cauliflorum

Bulbophyllum guttulatum

Bulbophyllum leopardinum

PHOTO PLATE - 2

Bulbophyllum moniliforme

Bulbophyllum odoratissimum var *odoratissimum*

Bulbophyllum reptans

Bulbophyllum scabratum

Cleisostoma linearilobatum

Coelogyne barbata

Coelogyne corymbosa

Coelogyne cristata

PHOTO PLATE - 3

Coelogyne flaccida

Coelogyne fuscescens

Coelogyne nitida

Coelogyne ovalis

Coelogyne prolifera

Coelogyne stricta

Cryptochilus sanguineus

Cryptochilus strictus

PHOTO PLATE - 4

Cymbidium elegans

Cymbidium tracyanum

Dendrobium amoenum

Dendrobium aphyllum

Dendrobium bicameratum

Dendrobium chrysanthum

Dendrobium densiflorum

Dendrobium fimbriatum var. oculatum

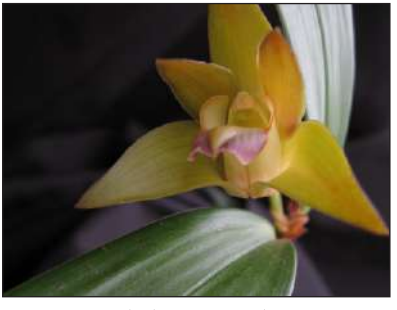
PHOTO PLATE - 5

Dendrobium hookerianum

Dendrobium longicornu

Dendrobium nobile

Dendrobium ochreatum



Dendrobium rotundatum

Dendrobium stuposum

Dendrobium treutleri

Dendrolirium lasiopetalum

PHOTO PLATE - 6

Dendrolirium tomentosum

Epigeneium amplum

Epigeneium fuscescens

Eria coronaria

Gastrochilus calceolaris

Liparis bistriata

Liparis elliptica

Liparis resupinata

PHOTO PLATE - 7

Micropera manii

Oberonia emarginata

Oberonia falcata

Otochilus albus

Otochilus fusca

Otochilus lancilabius

Phalaenopsis taenialis

Pholidota articulata

PHOTO PLATE - 8

Pholidota pallida

Pinalia spicata

Pleione macculata

Pleione praecox

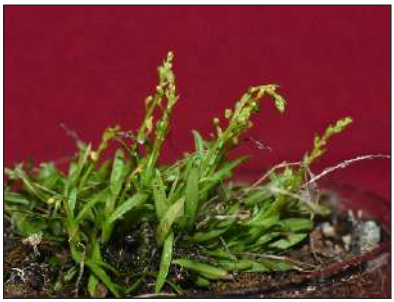
Podochilus cultratus

Porpax muscicola

Rhynchostylis retusa

Schoenorchis gemmata

PHOTO PLATE - 9



Thelasis purpusilla

Thunia alba

Uncifera obtusifolia

Vanda cristata

Vandopsis undulata

PHOTO PLATE - 10

Acanthephippium striatum

Anthogonium gracile

Arundina graminifolia

Calanthe mannii

Calanthe puberula

Crepidium acuminata

Crepidium khasianum

Crepidium mackinnonii

PHOTO PLATE - 11

Crepidium purpureum

Cymbidium erythraeum

Cymbidium gammieanum

Cymbidium insigne

Goodyera foliosa

Goodyera hemsleyana

Goodyera vittata

Habenaria dentata

PHOTO PLATE - 12

Habenaria frucifera

Liparis odorata

Nervilia plicata

Nervillia macroglossa

Odontochilus lanceolatus

Peristylis tipuliferus

Spiranthes sinensis

Tainia minor

Way Forward

Orchids are exquisitely vibrant and ecologically vital element of biodiversity. The economic value of the orchids as cut flowers that run into multibillion-dollar in the international trade is well known. The rise in this recent decade has been tremendous. The ecological role of orchids in the ecosystem has not drawn the attention, which it deserves and is often undermined. Orchids, known to be highly advanced plants, developing various contrivances to attract pollinators, and are the indicators of the health of the ecosystem. India, with its orchid wealth of 1,256 species, has tremendous potential to make an impact in the international scenario of trade, and at the same time focus on conservation issues. The orchid conservation is paramount so as to leave to future generations the rich and wildly fascinating orchaid legacy will enjoy today.

Due to their complex life histories, orchids are liable to be severely affected by habitat destruction and climate change, and unsustainable harvest presents a major additional threat to some groups of orchids. To conserve orchid effectively, there is need to understand their biology, conserve habitat especially for orchid-rich environments, conservation planning for groups of species (e.g. those that are closely related, affected by similar threats or growing sympatrically) and ensuring sustainable harvesting.

As conservation of wild orchid species in their natural habitat is now a matter of universal concern as orchids are very sensitive to ecological disturbances. The Nature Learning Centre aims to conserve the orchid species and promote the conservation knowledge and importance of biodiversity in general and orchids of Sikkim in particular, through the development of trail and Orchidarium. Development of orchid trail and Orchidarium can be very helpful in conservation and exhibition of orchids, both *in situ* or *ex situ* depending on the availability of orchid species in the area or rescue and collection from other sites. The trial and Orchidarium developed at GBPNIHE, SRC will encourage the diverse stakeholders, specially the school and college students, scholars, tourists, officials and local communities to visit and learn more on orchid diversity and conservation.

This monograph serves to fulfill the purpose of knowledge dissemination by highlighting the rich orchid diversity of the State and enhance ex-situ conservation to strengthen the orchid diversity present in this area. Assuredly, this thoughtfully crafted monograph will serve as the need of an hour to facilitate knowledge networking on Orchid conservation amongst researchers, academicians, departments, nature conservationists and enthusiast. The pictorial representation of the orchids along with general information will make the understanding of orchids in the Prakriti-Kunj more relevant for the visitors. Therefore, to bring about a relational understanding of orchids with the nature and human itself, this booklet is tailored with utmost consideration and simplicity.s

Bulbophyllum affine

Further Reading

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About the G.B. Pant National Institute of Himalayan Environment

GB Pant National Institute of Himalayan Environment (NIHE) was established in 1988 to devise suitable R&D strategies to maintain intricate balance between socio-cultural, ecological, economic and physical systems that could lead to enhance quality of life and ecological sustainability of the ecosystem. The Institute carried out in-depth research in most of these priority areas, with keeping a sharp focus on its social linkages. The Institute has emerged as focal agency to advance scientific knowledge; to evolve integrated management strategies; demonstrate their efficacy for the conservation of natural resources; and to ensure environmentally sound development in the entire Indian Himalayan Region (IHR). The Planning Commission, the Ministry of Environment & Forests, Government of India and many International Organizations have recognized the Institute as a Nodal Agencies fro R&D programmes in IHR.The mandate of the Institute:Undertake in-depth research and development studies on environmental problems of the IHR. Identify and strengthen the local knowledge of the environment and contribute towards strengthening Research of regional relevance in the scientific institutions, Universities/ NGOs/ Voluntary agencies working in the Himalayan region, through interactive networking. Evolve and demonstrate suitable technology packages and delivery systems for sustainable development of the region, in harmony with local perceptions.

About the Sikkim Regional Centre (SRC)

The Sikkim Regional Centre (SRC) was established in Gangtok, Sikkim in the year 1989. In the year 2004, a campus covering a land area of 17 acres made functional at Pangthang (2000 m, amsl), at a distance of about 15 km from Gangtok town facing the mighty Mt. Khangchendzonga, having with the main office building, laboratories, a gamut of nurseries, herbal garden, arboretum, residential quarters, rural technology centre, etc. The functional arboretum (10 acre) houses over 100 native tree species, besides numerous shrubs and herbs, bamboo grooves, rhododendron conservatory, medicinal plants and multi purpose tree habitat zones, with over 100 inhabiting and visiting birds, butterflies, snakes, and mammals. The broad faocal area of SRC covers Biodiversity Conservation and Management, Biotechnology Application, Sustainable, Environmental Development, Knowledge Base Development, and Capacity Building, Climate Change Studies, Ecosystem Services, etc. SRC of the institutre has been taking up activities with research and development on the environment and development in Sikkim state and Hilly region of West Bengal (Kalimpong and Darjeeling districts). Over the years, this centre has brought out several knowledge products, as peer reviewed papers in reputed scientific journals, popular articles, books/booklets, technical reports, etc. The centre is now attempting to build a strong network of partners for delivering R&D products that serves policy and planning process in the state of Sikkim.

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