IMPORTANCE OF ORCHIDS

Medicinal value

ORCHID derived its name not from its spectacular flowers with myriads of forms growing in the tropical world, but from the insignificant underground medicinal tubers possessed by a minority of species. It is derived from the Greek word 'orchis' meaning 'testis' in reference to the paired, testicle-like underground tubers present in majority of the terrestrial species. During ancient period Europeans considered orchids as a symbol of sex due to the aphrodisiac property of their tubers or bulbs. This was supported by Modern system of medicine, and some orchids are now part of some of the modern capsules and tablets meant to increase the sperm count and sexual vigour.

Ashtavarga (a combination of eight drugs) is important ingredient of Ayurvedic polyherbal formulations like *Chavyanprasha*. Out of eight ingredients, four [*Malaxis acuminata*, *M. muscifera*, *Habenaria intermedia* and *Platanthera edgeworthii*] are represented by orchids. This apart, species such as *Dactylorhiza hatagirea*, *Gymnadenia orchidis*, *Eulophia campestris*, *Vanda tessellata, Flickingeria fugax* and *Dendrobium nobile* are under high demand for their medicinal value mentioned in the ancient literature. Several other orchid species are used traditionally by local and indigenous people for curing various ailments.

Ornamental value

Orchid flowers are highly exploited for their extremely beautiful colours, ornamentation, fragrance and most importantly, their long self-life. Further, orchids are highly compatible in making inter and intra-generic hybrids. Several colour combinations with improved vigour and overall quality can be obtained by crossing the suitable parents. Even hybrids are compatible for crossing between themselves. Today orchid cultivation is a multi-million dollar industry. The ornamental value of orchid flowers was recognized more than 2000 years ago by the ancient Chinese during the period of Confucius (551–479 BC). They preferred growing fragrant *Cymbidiums* as indoor plants. Today, *Cymbidium* is the most important genus used for most of the breeding programme. Other genera such as *Vanda*, *Renanthera*, *Phalaenopsis*, *Ascocentrum*, *Esmeralda*, *Arachnis*, *Dendrobium*, *Cattleya*, *Epidendrum*, *Oncidium* and *Paphiopedilum* constitute the core of hybrid industry. The Blue Vanda (*Vanda coerulea*) and Red Vanda (*Renanthera imschootiana*) have become extremely rare because of their use as parent to numerous hybrids. Apart from the beauty, the orchids are exploited for fragrance. The Vanilla essence is harvested from various species of the genus *Vanilla*. Many species of *Coelogyne*, *Dendrobium* and *Cymbidium* are exploited for fragrance.

Botanical curiosity

The complex life history and floral structure of orchids coupled with various ornamentation and adaptation to invite pollinators; their association with mycorrhiza for seed germination; their sensitiveness to the micro-climate and specific habitat requirement has attracted the scientific community, horticulturists, commercial growers and entrepreneurs to take up orchid biology as a separate branch of science. Because of overexploitation, several orchid species have become vulnerable to extinction. Many are known only by their type collections, which in several cases are more than a century old. Due to climate change and other factors, orchids are shifting from their original habitat to some other suitable place. But their chance of survival at the new habitat highly depends on the availability of pollinators and suitable mycorrhiza. The orchids have to offer something to the visiting pollinators to lure and invite to make the pollination happen. For this, they develop specialized structures such as callus, lamellae, spur, and nectarines and guide the pollinators to the pollen mass. Sometimes, they mimic various animal creatures [called spider orchid, bee orchid, pigeon orchid, moth orchid, soldier orchid] to make the pollination possible. It is a botanist's treasure to study the life history, morphology, ecology, conservation biology, pollination biology and reproductive biology of orchids and observe the secret of this huge diversity.

THREATS

Unfortunately, the beauty of the orchid flowers endangering their very existence. The human lust and temptation to exploit orchids coupled with their own complex life history has pushed a large number of species under various threat categories. The threat factors associated with Indian orchids are:

- Overexploitation due to high horticultural and medicinal importance.
- Loss of habitat for urbanization, hydroelectric power projects and construction of roads.
- Development of agricultural land through Jhoom and Terrace cultivation.
- Livestock grazing in their natural habitats (for terrestrial orchids).
- Natural calamities.
- Non-availability of pollinators.
- Climate change and shifting of species to alternate habitat condition.
- Sensitiveness to micro-climatic condition.
- Reproductive barriers.
- Smuggling by orchid traders.
- Over-enthusiastic and un-planned collection by students and researchers.

CONSERVATION

It has been observed that all Indian orchids are included under various legislations for their conservation. Many global and national legislations such as CITES; Negative List of Export, Wildlife Protection Act, to 972, Biological Diversity Act, 2002 and Legal procurement Certificate exist to impart some regulation in collection and trade of orchids from wild. However, a comprehensive assessment on threat status of individual orchid species at global and national level is lacking for implementing an effective conservation initiatives. The assigned threat level is not evaluated as per widely accepted system and not based on the best scientific data available on their taxonomy, population size, threat factors and rate of population decline and range of distribution. The available literature on Indian orchids reveals very little or no information on the population size and rate of population decline. Apart from a few scattered literature available, no comprehensive document available with species specific information on any of the required data to assign the threat status. Thus, a suitable conservation strategy can be framed if we have data on the following aspects.

- Inventory of the orchid diversity of entire country with study on their biology.
- Assessment of the threat status of all Indian orchids as per a widely accepted system with best scientific data available.
- List of horticultural and medicinal species, their natural area of distribution and extent of occurrence.
- Estimation of annual demand and the load on wild population.
- Developed protocol for artificial propagation like seed and tissue culture to conserve the germplasm and fulfill the demand.
- *In situ* conservation.
- *Ex situ* conservation.
- Global and National legislation.

Enquiries

Project Coordinator
ENVIS Centre on Floral Diversity
Botanical Survey of India
CNH Building, Botanic Garden
Howrah – 711 103
West Bengal.
Phone: 033 2668 0667
Fax: 033 2668 6226
E-mail: bsi@envis.nic.in
envis@cal2.vsnl.net.in

EI-Division, MoEF & CC, New Delhi

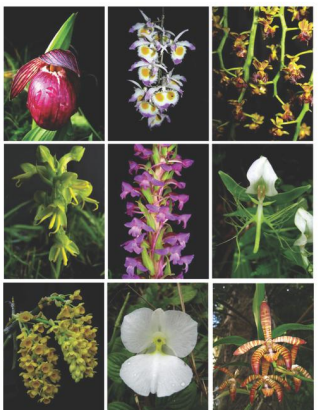
Dr. Anandi Subramanian, Sr. Econ. Advisor
Sri Yashvir Singh, Econ. Advisor
Sri Abhay Kumar, Deputy Econ. Advisor

BSI ENVIS Team

Dr. P. Singh, Director, BSI
Dr. V. Sampath Kumar, Scientist-in-Charge
Dr. S. Gantait, Programme Officer
Sri S. Nandi, Information Officer
Sri T. Chakrabortty, IT Assistant

Text and Photos: Dr. Dinesh Kumar Agrawala, Scientist 'C', Sikkim Himalayan Regional Centre, Botanical Survey of India, Gangtok, Sikkim

ORCHIDS – THE NATURE'S WONDER



ENVIS Centre on Floral Diversity
Botanical Survey of India
Howrah
Website: http:\\www.bsienvis.nic.in

ORCHIDACEAE are probably the largest family of flowering plants in the world with about 28,000 species. The family is cosmopolitan in distribution barring the Arctic and Antarctic regions. In India, it stands behind Poaceae amongst the angiosperms and has nearly 1300 taxa, distributed widely from alpine to coastal regions and islands.

Orchids are known for their extremely beautiful coloured flowers with unique shape and ornamentation. The complex floral structure facilitates biotic cross pollination and makes them evolutionarily more superior from other plants families. The exchange of genetic material by cross pollination leads to development of extreme genotypic variability which can be observed through their phenotypic expression. Presence of a modified third petal (lip/labellum) and union of stamens and pistil (Gynostemium/column) differentiate them from other plants. Their minute, non-endospermic seeds cannot germinate without external supply of nutrients.

The orchids inhabit fragile ecosystems and are extremely sensitive to their micro-environment and their reproduction largely depends on the availability of pollinators and suitable mycorrhiza. They exhibit both sympodial and monopodial growth forms; their size varies from few millimetres to several metres; the optimum variability at species level can be observed in the lip or labellum. No two orchid species in this universe have exactly similar labellum in their flowers. The prolonged self-life of orchid flowers and their compatibility in making beautiful inter and intra-generic hybrids make them one of the most sought after plants by the horticulturists. The orchids are also highly exploited for their therapeutic value by the indigenous people and pharmaceutical industries. Orchids with immense horticultural and medicinal importance, coupled with complex floral structure and life cycle have attracted the scientific community, horticulturists, commercial growers and entrepreneurs to take up orchid biology as a separate branch of science.

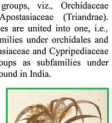
SYSTEMATICS

Orchids belong to monocotyledons and exhibit trimerous floral structure. Based on the number of fertile anthers, they can broadly be divided into three groups, viz., Monandrae, Diandrae and Triandrae. Amongst these, the most diverse and highly proliferated group is Monandrae (with one fertile anther) representing more than 95 % of globally known orchid species. Some workers recognize three separate families corresponding to these three groups, viz., Orchidaceae (Monandrae); Cypripediaceae (Diandrae) and Apostasiaceae (Triandrae). However, in most published works, the three families are united into one, i.e., Orchidaceae. Szlachetko (1995), recognizes three families under orchidales and place all the orchids into ten groups, of which Apostasiaceae and Cypripediaceae as separate families and the remaining eight groups as subfamilies under Orchidaceae. Representatives of all these groups are found in India.

1. Family Apostasiaceae Lindl.

These are regarded as the progenitors of the remaining orchids; characterized by the presence of three fertile anthers (median of the outer whorl and laterals of the inner whorl), free and dry pollen grains, three prominent stigma lobes and fusion of filaments and style restricted to basal part only. The flowers in this group are less zygomorphic and labellum is similar to other petals.

This group is represented in India by one genus, i.e., *Apostasia* with three species and only known by a few historic collections from Himalayan region.



Apostasia odorata Blume

2. Family Cypripediaceae Lindl.

Paphiopedilum fairrieanum (Lindl.) Stein

Commonly known as the "Lady's Slipper Orchids" due to presence of shoe- or sac-like, large labellum; they are characterized by the presence of two fertile anthers (laterals of inner whorl) with sticky pollen grains, which in turn aggregate into waxy pollinia. The median anther of outer whorl forms a large staminode. All three stigma lobes are functional and situated on the apically free style.

These orchids are in high demand for their long lasting, beautiful flowers and compatibility for hybridization. All species of *Paphiopedilums* are included in APPENDIX 1 of CITES thereby regulating their trade.

Two genera, viz., *Cypripedium* (5 species) and *Paphiopedilum* (9 species) are found in India.

3. Subfamily Thelymitroideae (Lindl.) Szlach.

This group is characterized by terrestrial plants with root-stem tuberoids; anther projecting over stigma; staminodes wing-like or fused with column forming various appendages; pollinia occasionally sectile with single viscidium and without caudicles.

In India, this group is confined to Himalayan and northeastern regions and represented by genera such as *Cryptostylis*, *Pantlingia* and *Corybas* with 4 or 5 species in total.

Corybas himalaicus (King & Pantl.) Schltr.

4. Subfamily Orchidoideae Lindl.

Herminium monorchis (L.) R. Br.

This is one of the largest groups of orchids, characterized by plants with root-stem tuberoids; absence of staminodes; auriculate anthers firmly attached with column; pollinia exclusively sectile, with prominent caudicles and two viscidia.

This group represents the maximum number of terrestrial orchids in India with 21 genera and 170–175 species. The dominant genera are *Habenaria*, *Peristylus*, *Platanthera*, *Androcorys* and *Herminium*.

5. Subfamily Tropidioideae (Pfitz.) Szlach.

This is a small group of orchids, characterized by terrestrial habit with plicate leaves; harmulus with sclerenchymatous layer; anther base situated near stigma base or below; rostellum concealing the anther; pollinia sectile.

This group is represented in India by two genera namely *Corymborkis* (1 species) and *Tropidia* (4 or 5 species).

Tropidia angulosa (Lindl) Blume

6. Subfamily Spiranthoideae Dressl.

Goodyera repens (L.) R. Br.

These are characterized by stems with decumbent rhizomes or with fascicle of tubers at base; simple to variously ornamented leaves, often wilting during flowering, hamulus fleshy; anther attached at base to the base of stigma; rostellum concealing the anther; pollinia sectile. Several members of the "Jewel Orchids" belong to this subfamily.

In India, it is represented by 14 genera with 82–85 species. Some of the important genera are *Spiranthes*, *Anoectochilus*, *Odontochilus*, *Goodyera*, *Cheirostylis* and *Zeuxine*.

7. Subfamily Neottioideae Lindl.

This is a group of terrestrial orchids with a cluster of roots at base, no root-stem tuberoids. The anthers are erect, attached near apex of the erect rostellum projecting over the stigma. The viscidium is semi-liquid; pollinia sectile and prominent staminodes are finger-shaped to wing-like.

This group is poorly understood because of their short aerial life span. In India, it is represented by 6 genera with 30 species. Important genera are *Epipactis*, *Aphyllorchis*, *Listera* and *Neottia*.

Epipactis helleborine (L.) Crantz

8. Subfamily Vanilloideae (Lindl.) Szlach.

Galeola lindleyana (Hook.f. & Thomson) Rchb.f.

This group is important source of the highly valuable 'Vanilla'. These are represented by terrestrial herbs or climbers with no root-stem tuberoids; the rostellum and anthers are incumbent; pollinia granular or sectile; viscidium cellular; staminodes fused with the column forming an apical clinandrium which is reduced secondarily to a collar-like structure.

In India, 47–50 species under 10 genera are reported to occur. Important genera are *Vanilla*, *Nervilia*, *Gastrodia*, *Epipogium* and *Galeola*.

9. Subfamily Epidendroideae Lindl.

This is the largest subfamily of Orchidaceae in India, representing about 50 % of total known species. These orchids are characterized by presence of compact, laterally compressed pollinia with long or sticky caudicles; soft viscidium; movable anthers with well-developed partitions.

A total of 56 genera with 640–650 species are found in India. Dominant genera are *Dendrobium*, *Bulbophyllum*, *Eria*, *Oberonia*, *Coelogyne* and *Liparis*.

Bulbophyllum umbellatum Lindl.

10. Subfamily Vandoideae Lindl.

Vanda cristata Lindl.

This group is largely represented by monopodial orchids with lateral inflorescences. The pollinia are compact, superposed, often with stipes; caudicles sticky; tegula lamellar; viscidia lamellar to multi-layered, persistent. Anthers are operculate with reduced partition.

This is another large and horticulturally more important orchid group with 62 genera containing 300–310 species in India. Important genera include *Cymbidium*, *Vanda*, *Phalaenopsis*, *Gastrochilus*, *Cleisostoma* and *Luisia*.

DISTRIBUTION PATTERN

Orchids have a wide range of distribution and found in almost all types of ecosystems except in the extremely dry, cold and hot regions. They prefer to grow in humid and moist condition and are numerous with optimum diversity in the tropical regions as compared to other regions. They are highly adaptable in different environmental conditions and therefore more successful than any other plant group. Amongst the 11 phyto-geographical regions of India as recognized by Chowdhery & Murty (2000), Eastern Himalaya harbours maximum orchid diversity, followed by northeast India, Western Ghats, Western Himalaya, Andaman and Nicobar Islands, Deccan Plateau, Eastern Ghats, Gangetic plains, Coastal regions and Arid zone. No orchid species has so far been reported from Lakshadweep. The orchid species diversity in the Himalayan region decreases gradually from the moist, humid Eastern Himalaya to cold, arid Western Himalaya. India can broadly be divided into three zones based on the distribution of Orchids: (i). The Himalayan Region (including the extra-peninsular region); (ii). The Peninsular Region and (iii). The Andaman and Nicobar Islands, with the gradient of species diversity in the given sequence. About 400 orchid taxa are endemic to the country, i.e., so far known only from India.