

## **Orchids of Nagaland, propagation, conservation and sustainable utilization: a review**

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### **Abstract**

Orchids are known to mankind for their multipurpose uses and they grow in diverse habitat conditions. Since 'Vedic Period' orchid are used as ornamentals, curative and for therapeutic purpose. About 9 % of Indian flora are orchids and are represented by over 1,300 species. The North-Eastern region of India is home for ca 800 orchid species. Due to favorable climatic conditions, Nagaland becomes a home for 396 species belonging to 92 genera of which 54 having horticultural and medicinal importance. Many of these are threatened in their natural habitat owing to various anthropogenic activities. Though the state has the potentiality to boast rural economy through commercial cultivation of orchids, but there are almost no entrepreneur due to lack of awareness and non-availability of proper planting material and cultivation procedures. In the recent past some initiatives have been taken towards the documentation of orchid wealth, evaluation of their potential in horticultural industry, conservation, reproductive biology and development of *in vitro* protocols for propagation, development of low cost protocols to popularize the tissue culture technique amongst the commercial orchid growers.

**Key words:** Orchids, Nagaland, Conservation, Rural economy, Propagation.

### **INTRODUCTION**

Orchids, the most beautiful flowers in god's creation, comprise a unique group of plants. Taxonomically, they represent the most highly evolved family among monocotyledons with over 1000 genera and 25,000-35,000 species (Deb & Imchen 2008; Medhi & Chakrabarti 2009; Akhter *et al.* 2011). Orchids exhibit an incredible range of diversity in size, shape and color of their flowers. They are most pampered plants and occupy top position among all the flowering plants valued for cut flower production and as potted plants. They are known for their long lasting and bewitchingly beautiful flowers which fetch a very high price in national and international markets. *Theophrastus*, gave the name "ORCHIDS" to the group of plants on the basis of the resemblance of paired underground tubers of these plants to masculine anatomy (the testes). This resemblance was also responsible for the mistaken belief that the orchid posses' aphrodisiac properties and eating of underground tubers may beget male children. In the Indian *Vedic* scriptures there is mention about the use of orchids for therapeutic purpose and still continue to be used in local medicines to cure a variety of fertility and virility related problems.

## Orchid Diversity in India

India is rich in orchid resources representing ~9% of our flora. India is home for over 1,300 wild species from over 140 genera with Himalayas as their main home. The North-Eastern region of the country is considered to be the richest reservoir of orchids which accounts for ca. 1000 species. Table 1 shows the orchid distribution of North East India. Nagaland is a hilly state with only few square kilometers stretch of plain along with the foot-hills in the

**Table 1.** Numerical distribution of orchids in Northeastern states\*

States	Total geographical area (Km <sup>2</sup> )	Forest cover (Km <sup>2</sup> ) (%) forest cover)	Orchid genera	Orchid species
Arunachal Pradesh	83743	51540 (61.5)	126	550
Assam	78438	30708 (39.2)	81	193
Manipur	22327	15154 (67.9)	69	251
Meghalaya	22429	15935 (75.6)	98	532
Mizoram	21087	8629 (52.0)	75	244
Nagaland	16579	9494 (42.3)	92	396
Sikkim	7096	6292 (60.0)	137	525
Tripura	10491	2656 (37.3)	33	48

\* Source: State forest reports of N. E. states, Deb & Imchen, 2008 and Medhi & Chakrabarti, 2009.

Western part of the state. The state is blessed with a condition of tropical to alpine, humid forest with heavy rainfall and high humidity which provide a unique natural heritage. The altitude varies from 300 – 3848 m above the mean sea level. Due to this wide altitudinal variation and topographical features coupled with favorable climatic condition, Nagaland becomes a home for large number of orchid species. There are 396 species of orchids belonging to 92 genera are present in Nagaland (Deb & Imchen 2008) (Table 2). Amongst these as many as 54 species are identified as horticultural importance and many of them are of ethnobotanical interest (Deb *et al.* 2009; Deb & Imchen 2011).

### Threats to Orchids Diversity

Though the state is the home for good number of orchids including horticultural and medicinal importance, most of the species are either threatened or under threat in the state in their natural habitat owing to habitats destruction through removal of forest cover, burning of forest for ‘*Slash and Burn Cultivation*’ and other anthropogenic activities. Besides above, ‘*Local Healers / Medicine Men*’ collect orchids from the wild for medicine and injudicious collection by the people from the wild and sell them in throughway price adds significantly to this (Deb *et al.* 2009; Yonzon *et al.* 2011). Progressive loss of orchid diversity under the duress of unregulated collection and habitat destruction pressures is an added constraint. Commercial cultivation of orchids on sound scientific lines is almost absent in the state mainly due to lack of awareness and non availability of proper planting materials and cultivation procedures. Management and sustainable development of states’ orchid heritage into a rewarding resource is thus obligatory to development of improved genotypes, cost-effective propagation and cultivation systems, and conservation strategies.

### Utility of Orchids

Orchids are known to mankind for the last several centuries for their beautiful attractive flowers and as medicinal plants to Indians from the *Vedic* period. The medicinal value of

orchids is found recorded as early as 250 – 300 B.C. by *Susruta* and *Vagbhata* respectively from ancient Sanskrit. In North East India in general and Nagaland in particular orchids are used for different purposes (Deb & Imchen 2008; Deb *et al* 2009).

**Orchids as Ornamentals and Religio-Cultural Significance:** Orchid occupies a prominent position in floriculture industry in the world trade due to its diverse range of colours, shape and long shelf life. Besides this, its amenability to cross breeding has led to hybrids of thousands of large number of orchids under cultivation for their flowers. According to a recent study Deb & Imchen (2011) identified 54 horticultural importance orchid species from Nagaland. In Nagaland the natives uses the mature yellow skin of *Dendrobium* species for decorating and ornamenting the sash and Dao-holder. The beautiful fox-tail (*Rhynchosylys retusa*) endearingly called ‘Kopou Phul’ is worn by ladies on their head as ornament during different festival especially during ‘Bihu’ festival in Assam. It symbolizes youthfulness during springtime. *Dendrobium hookerianum*, *D. nobile* symbolizes purity and sanctity. *Dendrobium acinaforme* plant was worn by the head hunting community with the belief that it will provide the courage and good luck in their hunt (Deb & Imchen 2008; Yonzon *et al* 2011).

**Medicinal uses:** Traditional knowledge has been used for centuries by indigenous and local communities and plays a vital role in the area of medical treatment. Today, the local people of Northeastern region use many orchids are rich in alkaloids, flavonoids, glycosides, carbohydrates and other phytochemical contents which have great importance in medical field (Duggal 1972; Handa 1986; Chowdhery 1998; Medhi & Chakrabarti 2009; Yonzon *et al* 2011). Over times the people of North East India in general and Nagaland in particular developed a great deal of knowledge on the use of plants and plant products in curing various diseases which clearly reflects the wealth of traditional knowledge of people on orchid diversity and herbal health care. The indigenous remedies have originated from the folklore’s rituals, magic and superstitions. Orchids also find a frequent mention about their curative and aphrodisiac properties and a symbol of sanctity. In Nagaland many orchids are used by the local healers for curing many ailments (Deb *et al* 2009).

**Traditional food:** There are many wild orchid species which are used a food by the tribal people of North East India (Duggal 1972). Many tribes of the region use leaves of *Cymbidium* species as food. The new shoots of *Cymbidiums* are used with cereals to make sauce (Medhi & Chakrabarti 2009). The pseudobulbs of these orchids are eaten like potatoes with curry or boiled and eaten with salt. Pseudobulb, root and rhizome of many orchid species, viz. *Habenaria acuminata*, *H. susannae*, *Orchis latifolia*, *Pholidata articulata* etc are used as foods which play an important role in the nutrition of the people of this region.

### Propagation of Orchids

Most of the orchids in nature grow protected from the tropical sun by the shades of trees while some species grows in open. One can find thick population of orchids in the primary forest and on old tree trunks with canopy cover. Deforestation through burning and felling of trees for timber has been the major cause for the depletion of Indian orchid wealth. A large number of orchid species which were present in plenty in Indian forest are now at the verge of extinction. Orchids are inherent slow growers. Orchids like other horticultural crops may be propagated either sexually or asexually. Most of the orchids are highly heterozygous and are propagated through vegetative means to get true-to-type plants. Conventional methods like cuttings, division of shoots or *keikis*, are followed along with mericlone through tissue culture techniques.

**Vegetative propagation through cuttings:** Many orchids like *Aerides*, *Arachnis*, *Dendrobium*, *Phalaenopsis*, *Renanthera*, *Vanda* etc. can be propagated by cutting. The propagation of orchids through cuttings is getting popular among the orchid growers. Many sympodial orchids like *Coelogyne*, *Cymbidium*, *Dendrobium* etc are propagated through this method by splitting the clumps. Clumps with less than 8-10 pseudobulbs should not be splitted (Chowdhery 1998; Deb & Imchen 2008).

**Off-shoots and Keikis:** In some monopodial orchids like *Ascocenda*, *Phalaenopsis*, keikis or off-shoots emerge frequently on the main stem. This is usually observed when the apical shoot loses its effectiveness in apical dominance and axillary buds sprouts. Keikis can be induced by topping the stem and many a times through the use of cytokinins which force dormant buds to develop into keikis (Deb & Imchen 2008).

**Aerial shoots:** Many orchids like *Dendrobium* produce shoots or bulbs on old back leafless bulbs. These aerial shoots take ~90-100 days to develop roots. At this stage they are detached from the mother plants and potted separately (Deb & Imchen 2008).

**In vitro techniques or plant tissue culture:** The physiology of seed germination of Orchidaceae is very interesting and unique in several respects. The seeds are exceedingly small and dust like and produced in large numbers. About 1400 to 4,00,000 seeds per capsules are produced which may vary from species to species. The seeds are of different colours and diverse shapes and consist of relatively undifferentiated and isodiametric cell with dense granulated cytoplasm and lose their viability very fast. Under natural conditions, the orchid seeds germinate after being infected by fungus, the orchid mycorrhiza (Deb & Temjensangba 2005).

Orchid seeds cannot utilize their own reserve or do so very slowly, they can also not hydrolyze large molecules like starch or cellulose. As a result asymbiotic germination in the absence of sugar proceeds only to the early protocorm stage, after which they wait for external supply of simple sugars through the help of mycorrhizal fungi. Due to this problem germination of orchid seeds in natural condition is not an attractive option. For commercial orchid growers *in vitro* asymbiotic germination of mature and immature seeds is a viable proposition where seeds are planted on a nutrient medium enriched with simple sugars improves the germination. In many cases almost 100 % germinations are recorded. Besides improvement in per cent rate of germination, it also reduces the germination time (Deb & Temjensangba 2005; Deb & Pongener 2013a).

Besides seeds cultures other resident meristems could be successfully cultured for regeneration of plants in commercial scale. For horticultural crops producing genetically uniform plants freed from pathogens are desired. Morel (1960) documented the possibility of raising virus free plants of *Cymbidium* species by shoot apices culture. Since then this technique is being carefully exploited by commercial growers for the rare and hybrids which while could not be propagated by any other means.

### **Orchids of Nagaland, Their Propagation and Conservation**

Since 1844 (Griffith 1884) several groups/workers made extensive orchid collections from North-Eastern part of India. Clarke (1889) collected good number of orchid species including other plant species from the region and for many years his collection remained the only source of information about the flora of Nagaland. Griffith reported 18 genera and 22 species only from Nagaland while, Hooker (1888, 1890) reported 24 genera and 49 species. In the recent past several workers reported the orchid status from Nagaland. Changkija *et al* (1992) recorded 360 species of 85 genera, while Hynniewta *et al.* (2000) reported 241

species of 63 genera. In 2003 Deb *et al.* (2003) reported 386 species of 88 genera but in 2008 Deb and Imchen revised the status of orchid diversity and described 396 species from 92 genera. During recent orchid collection from Nagaland University a number of orchids are collected from different parts of Nagaland where few species are found new to Nagaland and which further add to the species numbers (unpublished work).

Though the state is the home for a large number of orchid species many are of horticultural and ethnobotanical importance (Deb & Imchen 2008; Deb *et al.* 2009), most of the species are under threat in their natural habitats due to various anthropogenic activities and ruthless exploitation and collection of wild orchid species. Community based wild orchid conservation in most of the states of Northeastern region has a long history as orchids are closely associated with the socioeconomic culture of the local people. The people of this region conserve orchids in their natural habitats in sacred groves. A range of traditions and cultural values of the local people helps in protecting the groves with the beliefs in nature worship inherited from their ancestors' generation after generations. In Nagaland though there are several sacred groves and reserve forests, but there are no reserved forests especially for orchids. Local people collect orchids from the forest and sell them in through away price. These are no concerted efforts in establishing centers for propagation of orchids in commercial scale or establish orchid based horticultural industry.

In the recent past some initiatives have been taken towards the documentation of orchid wealth of the state, studies on pollination and reproductive biology (Chaturvedi 2008, 2009; Chaturvedi & Chaturvedi 2010), evaluation of their potential as horticultural industry, conservation and development of protocols for *in vitro* propagation of some of the species (Deb & Imchen 2011). In Nagaland University considerable amount work is being done on pollination and reproductive biology. In the 'Plant Tissue Culture Laboratory', Nagaland University protocols for *in vitro* propagation are developed for some rare and threatened and economically important species viz. *Arachnis labrosa*, *Cleisostoma racemiferum*, *Coelogyne suaveolens*, *Cymbidium aloifolium*, *C. iridioides*, *Dendrobium primulinum*, *D. densiflorum*, *Malaxis acuminata*, *M. khasiana*, *Taenia latifolia*, *Vanda bicolor* etc (Arenmongla & Deb 2012a, b; Deb & Arenmongla 2013a, b; Deb & Pongener 2011, 2012a, b, 2013b; Deb & Sungkumlong 2010; Deb & Temjensangba 2005, 2006a, b, 2007a,b) while works are in progress for some other species. Table 3 shows the details of *in vitro* protocols developed for orchid species. Besides *in vitro* protocols, efforts are also put into to develop low cost regeneration protocols for popularizing the tissue culture technique amongst the commercial orchid growers.

## CONCLUSION

Though some initiatives have been taken towards propagation and conservation of orchids, more concerted efforts are required for conservation, commercial scale propagation/production of orchids. Development of 'Orchid House of Nagaland' for housing all the orchid species from the state, tissue culture laboratory for commercial scale production, development of market links, initiating awareness program etc. are the need of the hour. Conservation of wild orchids is now a matter of universal concern and need to protect the valuable orchid species in their natural habitat as orchids are very sensitive to ecological disturbances. Conservation measures have to be strengthened based on traditional knowledge and value systems with which the local communities could identify the revival of the sacred grove concept to protect the forests which help to conserve the orchid diversity present in this area as nature's gift.

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