PGR Diversity and Economic Utilization of Orchids

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Abstract

Orchids are one of the highly commercial crops in floriculture sector and are robustly exploited due to the high ornamental and economic value. ICAR-NRC for Orchids Pakyong, Sikkim, India, majorly focused on collection, characterization, evaluation, conservation and utilization of genetic resources available in the country particularly in north-eastern region and developed a National repository of orchids. From 1996 to till date, several exploration programmes carried across the country and a total of 351 species under 94 genera was collected and conserved at this institute. Among the collections, 205 species were categorized as threatened species, followed by 90 species having breeding value, 87 species which are used in traditional medicine, 77 species having fragrance and 11 species were used in traditional dietary. Successful DNA bank of 260 species was constructed for future utilization in various research works. The collected orchid germplasm which includes native orchids was successfully utilized in breeding programme for development of novel varieties and hybrids. This paper aims that the status of collection and conservation, utilization of indigenous orchid germplasm resources at this institute reflecting ITPGRFA and CBD guidelines.

Keywords: Orchids, Collection, Conservation, Utilization

Introduction

Orchidaceae is one of the most ecologically and morphologically diverse families of flowering plants. It is the second largest family of flowering plants in the world, comprising of nearly 800 genera and 22,500 species (Mabberley, 2008; Meitei, 2019; Singh, 2019). Orchids are one such group of plants which grow in a variety of habitats throughout the globe, but they are very sensitive to habitat change. Understanding the prospects, horticultural and medicinal value, and the family is gaining much attention throughout the world to unfold the biology, evolution, taxonomy, cytology, chemistry, hybridization and cultivation etc. In North East India, many orchids are used for different
purposes such as ornamentals, medicine, food, also in socio-cultural events (Deb and Imchen, 2008; Deb, 2009; Medhi and Chakrabarti, 2009). Orchids are used as cut flowers, bouquet, loose flowers, dried flowers, as single flower mountings, potted plant display, in perfumery industries and by products in handicrafts (Singh, 2019).

ICAR- NRC for Orchids, Pakyong exclusively working on orchid breeding as well as production of quality planting materials which are considered as major bottlenecks in the development of orchid industry (Meitei et al., 2019). This institute plays a crucial role for with an aim that of research was on collection, characterization, evaluation, conservation conserving the indigenous orchid resources and utilization of genetic resources available in the country particularly in north-eastern region. And carry out research in identification, isolation, characterization of novel genes from native species, development of hybrids for commercial cultivation. And the institute is one of the National Active Germplasm Sites (NAGS) units in the Indian Plant genetic resource information system. This paper aims that the status of collection and conservation, utilization of indigenous orchid germplasm resources at this institute.

**Materials and Methods**

Several exploration programmes were carried since 1996 for collecting the valuable orchid germplasm various parts of the country (Fig. 1). Structural and well planned explorations conducted in the orchid rich biodiversity hotspots. Plant material in the form of plantlets, bulbs, capsule fruits, seeds and floral parts were collected and these plant materials was acclimatized and conserved in ICAR-NRCO polyhouses and used for breeding programmes. The collected orchids were identified up to the species to tribe level with the help of published literature such as, Hooker (1888–1890), Blatter (1928), Pradhan (1976), Bose and Bhattacharjee (1980), Rao (1998), Ahmedullah and Nayar (1987), Ansari and Balakrishnan (1990), Kumar and Manilal (1994), Lakshminarasimhan (1996), Nayar (1996), Karthikeyan (2000), Singh (2001), Pearce and Cribb (2002) Mishra (2007), Lucksom (2007, 2011), Mabberley (2008) Rampal and Singh (2016) and Singh (2019). The online databases, namely, Govaerts (2012) http://apps. Kew.org/wcsp, Tropicos (2018) www.tropicos.org, IPNI (2018) www.ipni.org, eFloras (2018) www.efloras.org, ThePlantList.org (2018) were also consulted for recent updates on the plant names and distribution. The species were confirmed with the help of herbaria of The Botanical Survey of India, (CAL) and Regional Centre (BHSC), Gangtok, Sikkim, Sikkim University, Sikkim (SKM) and were visited and data on habitat, locality, altitude and flowering were gathered. Based on this information past localities from where the species were collected were also visited, to know the present status and changes in population-size if any. The RET orchid species are listed based on IUCN red list category, the economic importance and mode of utilization of the species such as medicinal, dietary and breeding purposes are also provided (Table 1). Ex-situ conservation of orchids in the institute poly houses and new techniques developed for conservation of orchids through indigenous technologies and DNA barcoding for few species were carried.

**DNA barcoding of Indian orchids**

The conservation of orchids is carried out considering their status in the habitat. The basis of conservation is laid on the basis of certain objectives such as conservation of threatened species, Molecular approaches, such as DNA-based methods have transformed understanding and appreciation of conservation issues associated with orchids.
Molecular data provide an empirical framework through which conservation practitioners are in a more informed position to define priorities, reduce costs and optimize management decisions (Zaman, 1998). In particular, molecular data enable conservationists to address questions of genetic variation within and between populations, species or provenance delimitation and the maintenance of evolutionary processes (Fay and Krauss, 2003).

Results and Discussion

A total of 351 species from 94 genera were collected through several explorations carried across the country. Among the collections, 205 species were categorized as threatened species, followed by 90 species having breeding value, 87 species which are used in traditional medicine, 77 species having fragrance and 11 species were used in traditional dietary (Table 1). The genus Dendrobium representing highest number of species (68), followed by Bulbophyllum (30), Cymbidium (21), Coelogyne (19), Calanthe (12), Liparis (11), Vanda (10), Eria (9), Pinalia (8), Paphiopedilum (7), Aerides, Gastrochilus, Oberonia, Pholidota (6), Cleistostoma, Goodyera (5), Luisia, Papilionanthe, Phalaenopsis, Pleione, Sunipia (3), Agrostophyllum, Crepidium, Epidendrum, Micropera, Otochilus, Phaius, Thunia, Zeuxine (3), Acampe, Ascochilum, Callophyllis, Ceratostylis, Cryptochilus, Esmeralda, Habenaria, Herminium, Panisea, Phreatia, Thelasis and 45 genus representing single species respectively (Fig. 1–5).

Importance of orchids

Breeding value

Plant Breeders carry out the hybridization program based on various objectives such as better flower colour, shape and size, length of inflorescence, increasing number of flowers, producing miniature forms, blooming season and period, fragrant harbouring, suitable potted plants, hybrids for different temperature and light regimes; resistant lines for biotic and abiotic stresses etc. A total of 90 species having potential breeding value which was conserved at the institute in the following genera viz., Calanthe, Cymbidium, Dendrobium, Phalaenopsis, Cattleya, Oncidium, Platanthera, Masdevallia, Paphiopedilum and Vanda were utilized in breeding programmes to develop hybrids or improve lines. Subsequent milestones have been marked in the field of hybrid development throughout the globe using modern technologies and approaches. Extensive researches viz. species compatibility, apomixis, genetic engineering, mutation breeding, ploidy breeding etc., have been done by utilizing the natural species and hybrids in the orchid improvement programmes. Populations were developed viz., intergeneric combination (1 no.), primary species hybrid combinations (5 no.), secondary hybrid (10 no.), tertiary hybrid combinations (11 no.) and somaclonal mutants (2 no.) using existing germplasm collections. Of which, 18 breeding lines/ genetic stocks are registered with national register for IC numbers with national gene back ICAR-NBPGR, New Delhi and 45 breeding lines were submitted. The State flower of Mizoram and endangered species, Renanthera imschootiana known as ‘Red Vanda’ was registered with NBPGR (IC 566525/INGR 10113) for floral characters in 2010. In the year 2012, the breeding cycle of orchids was re-invented in India after the flowering of primary hybrid from first indigenous cross, PBX-05-56/2012 (C. lowianum x C. tigrinum), which was earlier bred by R.I. Measures in 1903 from United Kingdom. Two scented lines PBX-05-772 ad PBX-05-751 were developed by 2013 using native scented.
species, *Cymbidium iridiodes* as male parent. The three varieties *viz.*, ‘B. S. Basnet’(*Cymbidium*) from *C. lowianum* x *C. tigrinum*, ‘Kunga Gyatso’ (*Aranda*) from (*Arachnis clarkii* x *Vanda coerulea*) and ‘V. Nagaraju’ (*Dendrobium*) were identified at institution level for cultivation based on VCU basis. In 2016, *Paphiopedilum* variety (*Lady’s Slipper Orchid*) ‘Sheetal 1’ (IC 614753) was filed with PPVFRA, New Delhi for legal protection and received acknowledgement (No: REG/2016/1534 date: 16.09.2016). Cross variability in Moth Orchid (*Phalaenopsis*) breeding lines (PBX-12-99) derived exotic varieties as parents was established during 2016. Promising *Vanda* breeding lines (PBX-12-169) using native bred species with commercial hybrid resulted from cross breeding was established by 2017.

Behavior pattern of Asiatic *Dendrobium* species at both intra and inter-sectional compatibility at species level and with modern hybrids was established and reported (Devadas 2016). High compatibility nature among Indian *Cymbidium* species and as well as with modern Cymbidium hybrids was reported (Devadas, 2013, 2014) and *Vanda* species was proven (in press). High level of incompatibility was observed *Phaius* genera with other Orchid genera, like similar sympodial orchids like *Calanthe*, *Coelogyne*, *Phalaenopsis*, *Lycaste*, *Dienia*, *Cymbidium*, *Thunia*, *Paphiopedilum*, *Coelogyne*, *Eria* and monopodial orchids like *Paphlomanthe*, *Dendrobium*, *Arundina* and *Vanda*. However, primary species hybrid was made with *Phaius* using native species in both direct (PBX-11-22) and reciprocal combinations (PBX-11-25), where the natural hybrid was never reported earlier (Devadas, 2019).

**Socio-cultural importance**

The beautiful fox-tail orchid (*Rhynchostylis retusa*) locally called ‘Kopou Phul’in Assam is worn by ladies on their head as ornament during different festival especially during ‘Bihu’ festival in Assam. It symbolizes youthfulness during springtime a symbol of love by the youth of the Ahom community (Deb 2013; Medhi and Chakrabarti, 2009). In Nagaland, *Dendrobium hookerianum*, *Dendrobium nobles* symbolizes purity and holiness. *Dendrobium acinaforme* plant is worn by the head hunting community with the belief giving courage and good luck in their hunt (Deb and Imchen, 2008). In Manipur (erstwhile *Kangleipak*), orchids origination are defined in many historic mentioned and ceremony. The flowers of orchids such as *Vanda tessellata* and *Coelogyne nitida* are used during local festivals in Assam and Arunachal Pradesh and *Papilionanthe teres* flowers are used by the *Tai* ethnics of Assam and Arunachal Pradesh for offerings to Lord Budha and spirits (Medhi and Chakrabarti, 2009). This species are conserved and used in breeding programmes at this institute.

**Orchids used in medicine**

The medicinal value of orchids is found to be recorded as early as 250 – 300 B.C. by *Susruta* and *Vagbhata* respectively, from ancient Sanskrit. Many orchids are used in traditional medicine treatment as a remedy for several ailments since ancient times. Orchid genera which were used for medicinal purpose Medicinal orchids mainly belong to genera: *Calanthe*, *Coelogyne*, *Cymbidium*, *Cypipedium*, *Dendrobium*, *Ephemerantha*, *Eria*, *Galeola*, *Gastrodia*, *Gymnadenia*, *Habenaria*, *Ludisia*, *Luisia*, *Nevilia* and *Thunia* (Gutierrez, 2010). In India, some orchids like *Eulophia campestris*, *Orchis latifolia*, *Vanda roxburghii* have drawn the attention of scientific community because of their medicinal properties (Singh *et al.*, 2009). *Dendrobium macraei* and *D. nobile* are another important orchids from Ayurvedic point of view as it is reported to be source of Jivant (Kasera 2001; Meitei 2019).
| S. No. | Botanical Name                                      | RET status | Medicinal value | Dietary supplement | Fragrant Breeding value | Remarks                  |
|--------|----------------------------------------------------|------------|-----------------|--------------------|-------------------------|--------------------------|
| 1      | *Acampe praemorsa* (Roxb.) Blatt. and McCann       | √          |                 | √                  |                         |                          |
| 2      | *Acampe rigida* (Buch.-Ham. ex Sm.) P.F.Hunt       | √          |                 | √                  |                         |                          |
| 3      | *Acanthephippium sylhetense* Lindl.                | √          |                 |                    |                         |                          |
| 4      | *Acrochaene punctata* Lindl.                       | √          |                 |                    |                         |                          |
| 5      | *Aerides crispa* Lindl.                            | √          |                 |                    |                         |                          |
| 6      | *Aerides maculosa* Lindl.                          | √          |                 | √                  |                         | Endemic                  |
| 7      | *Aerides multiflora* Roxb.                         | √          |                 | √                  |                         |                          |
| 8      | *Aerides odorata* Lour.                            | √          |                 | √                  |                         |                          |
| 9      | *Aerides rosea* Lodd. ex Lindl. and Paxton         | √          |                 | √                  |                         |                          |
| 10     | *Agrostophyllum brevipes* King and Pantl.          | √          |                 |                    |                         |                          |
| 11     | *Agrostophyllum callosum* Rchb.f.                  | √          |                 |                    |                         |                          |
| 12     | *Agrostophyllum planicaule* (Wall. ex Lindl.) Rchb.f. | √          |                 |                    |                         |                          |
| 13     | *Anthogonium gracile* Wall. ex Lindl.              | √          |                 |                    |                         |                          |
| 14     | *Anthogonium gracile* Wall. ex Lindl. (White variant) | √          |                 |                    |                         | Variant                  |
| 15     | *Arachnis labrosa* (Lindl. and Paxton) Rchb.f.     | √          |                 |                    |                         |                          |
| 16     | *Arundina graminifolia* (D.Don) Hochr.            | √          |                 | √                  |                         |                          |
| 17     | *Asccentrum ampullaceum* (Roxb.) Schltr.           | √          |                 |                    |                         |                          |
| 18     | *Asccentrum aurantiacum* Schltr.                   | √          |                 |                    |                         |                          |
| 19     | *Bulbophyllum affine* Wall. ex Lindl.              | √          |                 |                    |                         |                          |
| 20     | *Bulbophyllum careyanum* (Hook.) Spreng.          | √          |                 | √                  |                         |                          |
| 21     | *Bulbophyllum caudatum* Lindl.                     | √          |                 |                    |                         |                          |
| 22     | *Bulbophyllum cauliflorum* Hook. f.                | √          |                 |                    |                         |                          |
| 23     | *Bulbophyllum crassipes* Hook.f.                   | √          |                 |                    |                         |                          |
| 24     | *Bulbophyllum cylindraceum* Wall. ex Lindl.        | √          |                 |                    |                         |                          |
| 25     | *Bulbophyllum eublepharum* Rchb.f.                | √          |                 |                    |                         |                          |
| 26     | *Bulbophyllum fimbriatum* (Lindl.) Rchb.f.         | √          |                 |                    |                         |                          |
| 27     | *Bulbophyllum fischeri* Seidenf.                   | √          |                 |                    |                         |                          |
| 28     | *Bulbophyllum guttulatum* (Hook.f.) N.P.Balakr.   | √          |                 |                    |                         |                          |
| 29     | *Bulbophyllum gymnopus* Hook.f.                    | √          |                 |                    |                         |                          |
| 30     | *Bulbophyllum hirtum* (Sm.) Lindl. ex Wall.        | √          |                 | √                  |                         |                          |
| 31     | *Bulbophyllum interpositum* J.J.Verm., Schuitt. and de Vogel | √          |                 |                    |                         |                          |
| No. | Species                                                                 | Author                          | Status       |
|-----|------------------------------------------------------------------------|---------------------------------|--------------|
| 32  | *Bulbophyllum jejosephii* J.J.Verm., Schuit. and de Vogel              |                                 |              |
| 33  | *Bulbophyllum leopardinum* (Wall.) Lindl. ex Wall.                     | √                               |              |
| 34  | *Bulbophyllum mysorensae* (Rolfe) J.J.Sm.                              | √                               |              |
| 35  | *Bulbophyllum nodosum* (Rolfe) J.J.Sm.                                 | √                               |              |
| 36  | *Bulbophyllum odoratissimum* (Sm.) Lindl. ex Wall.                     | √                               |              |
| 37  | *Bulbophyllum polyrrhizum* Lindl.                                      | √                               |              |
| 38  | *Bulbophyllum protractum* Hook.f.                                      | √                               |              |
| 39  | *Bulbophyllum refractum* (Zoll.) Rchb.f.                              |                                 |              |
| 40  | *Bulbophyllum repens* Griff.                                           | √                               |              |
| 41  | *Bulbophyllum reptans* (Lindl.) Lindl. ex Wall.                        | √                               |              |
| 42  | *Bulbophyllum rigidum* King and Pantl.                                 | √                               |              |
| 43  | *Bulbophyllum roxburghii* (Lindl.) Rchb.f.                             | √                               |              |
| 44  | *Bulbophyllum sarcophyllum* (King and Pantl.) J.J.Sm.                 |                                 |              |
| 45  | *Bulbophyllum sterile* (Lam.) Suresh                                   | √                               | Endemic     |
| 46  | *Bulbophyllum striatum* (Griff.) Rchb.f.                              | √                               |              |
| 47  | *Bulbophyllum trichocephalum* (Schltr.) Tang.&F.T.Wang var trichocephalum |                                 |              |
| 48  | *Bulbophyllum triste* Rchb.f.                                         | √                               |              |
| 49  | *Bulbophyllum umbellatum* Lindl.                                       |                                 |              |
| 50  | *Bulbophyllum viridiflorum* (Hook.f.) Schltr.                          | √                               |              |
| 51  | *Bulbophyllum wallichii* Rchb.f.                                       | √                               |              |
| 52  | *Bulleyia yunnanensis* Schltr.                                         | √                               |              |
| 53  | *Calanthe biloba* Lindl.                                               | √                               |              |
| 54  | *Calanthe brevicornu* Lindl.                                           | √                               |              |
| 55  | *Calanthe chloroleuca* Lindl.                                          | √                               |              |
| 56  | *Calanthe davidii* Franch.                                             | √                               |              |
| 57  | *Calanthe herbacea* Lindl.                                             | √                               |              |
| 58  | *Calanthe mannii* Hook.f.                                              | √                               |              |
| 59  | *Calanthe plantaginea* Lindl.                                          | √                               |              |
| 60  | *Calanthe puberula* Lindl.                                             | √                               |              |
| 61  | *Calanthe sylvatica* (Thouars) Lindl.                                  | √                               |              |
| 62  | *Calanthe triplicata* (Willemet) Ames                                  | √                               |              |
| 63  | *Calanthe trulliformis* King and Pantl.                                |                                 |              |
| 64  | *Calanthe yuksomnensis* Lucksom                                        | √                               | Endemic     |
| 65  | *Callostylis bambusifolia* (Lindl.) S.C.Chen and J.J.Wood              | √                               |              |
| 66  | *Callostylis rigida* Blume                                             |                                 |              |
|   | Scientific Name | Common Name | Status |
|---|-----------------|-------------|--------|
| 67 | Cephalantheropsis obcordata (Lindl.) Ormerod | | √ |
| 68 | Ceratostylis himalaica Hook.f. | | |
| 69 | Ceratostylis subulata Blume | | √ |
| 70 | Chiloschista parishii Seidenf. | | |
| 71 | Chrysoglossum ornatum Blume | | √ |
| 72 | Cleisocentron pallen (Cathcart ex Lindl.) N.Pearce and P.J.Cribb | | | Endemic |
| 73 | Cleisostoma appendiculatum (Lindl.) Benth. and Hook.f. ex B.D.Jacks. | | √ |
| 74 | Cleisostoma filiforme (Lindl.) Garay | | |
| 75 | Cleisostoma linearlobatum (Seidenf. and Smitinand) Garay | | |
| 76 | Cleisostoma subulatum Blume | | |
| 77 | Cleisostoma tenufolium (L.) Garay | | √ |
| 78 | Coelogyne barbata Lindl. ex Griff. | | √ | √ | √ |
| 79 | Coelogyne breviscapa Lindl | | √ | |
| 80 | Coelogyne corymbosa Lindl. | | √ | √ | √ | √ |
| 81 | Coelogyne cristata Lindl. | | √ | √ | √ |
| 82 | Coelogyne elata Lindl. | | |
| 83 | Coelogyne fimbriata Lindl. | | √ |
| 84 | Coelogyne flaccida Lindl. | | √ | √ | |
| 85 | Coelogyne fuscenscens Lindl. | | √ | |
| 86 | Coelogyne hitendrae S.Das and S.K.Jain | | √ | Endemic |
| 87 | Coelogyne longipes Lindl. | | √ | √ | √ |
| 88 | Coelogyne nitida (Wall. ex D.Don) Lindl. | | √ | √ | |
| 89 | Coelogyne occultata Hook.f. | | √ | | |
| 90 | Coelogyne ovalis Lindl. | | √ | √ | |
| 91 | Coelogyne pempahisheyana H.J.Chowdhery | | |
| 92 | Coelogyne prolifera Lindl. | | √ | √ |
| 93 | Coelogyne punctulata Lindl. | | √ | |
| 94 | Coelogyne stricta (D.Don) Schltr. | | √ | √ |
| 95 | Coelogyne suaveolens (Lindl.) Hook.f. | | √ |
| 96 | Coelogyne viscosa Rchb.f. | | √ | |
| 97 | Conchidium muscicola (Lindl.) Rauschert | | √ |
| 98 | Cottonia peduncularis (Lindl.) Rchb.f. | | |
| 99 | Cremastra appendiculata (D.Don) Makino | | √ | |
| 100 | Crepidium acuminatum (D.Don) Szlach. | | √ | √ |
| 101 | Crepidium bidentiferum (J.J.Sm.) Marg. and Szlach. | | |

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|   | Scientific Name                                      | Status   |
|---|-----------------------------------------------------|----------|
| 102 | *Crepidium khasianum* (Hook.f.) Szlach.             |          |
| 103 | *Cryptochilus luteus* Lindl.                        |          |
| 104 | *Cryptochilus sanguineus* Wall.                     |          |
| 105 | *Cymbidium aloifolium* (L) Sw.                      | ✓        |
| 106 | *Cymbidium bicolor* Lindl.                          | ✓        |
| 107 | *Cymbidium cochleare* Lindl.                        | ✓        |
| 108 | *Cymbidium cyperifolium* Wall. ex Lindl.            | ✓        |
| 109 | *Cymbidium dayanum* Rchb.f.                         | ✓        |
| 110 | *Cymbidium devonianum* Paxton                       | ✓        |
| 111 | *Cymbidium eburneum* Lindl.                         | ✓        |
| 112 | *Cymbidium elegans* Lindl.                          | ✓        |
| 113 | *Cymbidium ensifolium* (L.) Sw.                     | ✓        |
| 114 | *Cymbidium erythraeum* Lindl.                       | ✓        |
| 115 | *Cymbidium gammieanum* King and Pantl.              | ✓        |
| 116 | *Cymbidium hookerianum* Rchb.f.                     | ✓        |
| 117 | *Cymbidium iridioides* D.Don                        | ✓        |
| 118 | *Cymbidium lancifolium* Hook.                       | ✓        |
| 119 | *Cymbidium lowianum* (Rchb.f.) Rchb.f.              | ✓        |
| 120 | *Cymbidium macrorhizon* Lindl.                      | ✓        |
| 121 | *Cymbidium mastersii* Griff. ex Lindl.              | ✓        |
| 122 | *Cymbidium munronianum* King and Pantl              | ✓        |
| 123 | *Cymbidium tigrinum* C.S.P.Parish ex Hook.          | ✓        |
| 124 | *Cymbidium tracyanum* L.Castle                      | ✓        |
| 125 | *Dendrobium acinaciforme* Roxb.                     | ✓        |
| 126 | *Dendrobium aduncum* Lindl.                         | ✓        |
| 127 | *Dendrobium amoenum* Wall. ex Lindl.                | ✓        |
| 128 | *Dendrobium amplum* Lindl.                          | ✓        |
| 129 | *Dendrobium anceps* Sw.                             | ✓        |
| 130 | *Dendrobium aphyllum* (Roxb.) C.E.C.Fisch.          | ✓        |
| 131 | *Dendrobium aqueum* Lindl.                          | ✓        |
| 132 | *Dendrobium bellatulum* Rolfe                       | ✓        |
| 133 | *Dendrobium bensoniae* Rchb.f.                      | ✓        |
| 134 | *Dendrobium bicameratum* Lindl.                     | ✓        |
| 135 | *Dendrobium capillipes* Rchb.f.                     | ✓        |
| 136 | *Dendrobium chrysanthum* Wall. ex Lindl.            | ✓        |
| 137 | *Dendrobium chryseum* Rolfe                         | ✓        |
| 138 | *Dendrobium chrysothamn* Lindl.                     | ✓        |
| 139 | *Dendrobium crepidatum* Lindl. and Paxton           | ✓        |
| 140 | *Dendrobium crumenatum* Sw.                         | ✓        |
| 141 | *Dendrobium cumulatum* Lindl.                       | ✓        |
| No. | Species                                      | Endemic | Variant |
|-----|---------------------------------------------|---------|---------|
| 142 | Dendrobium densiflorum Lindl.               | ✓       | ✓       |
| 143 | Dendrobium denudans D.Don                   | ✓       | ✓       |
| 144 | Dendrobium devonianum Paxton                | ✓       | ✓       |
| 145 | Dendrobium draconis Rchb.f.                 | ✓       | ✓       |
| 146 | Dendrobium eriiflorum Griff.                | ✓       | ✓       |
| 147 | Dendrobium falconeri Hook.                  | ✓       | ✓       |
| 148 | Dendrobium farneri Paxton                   | ✓       | ✓       |
| 149 | Dendrobium fimbriatum Hook.                 | ✓       | ✓       |
| 150 | Dendrobium fimbriatum var. oculatum         | ✓       | ✓       |
| 151 | Dendrobium formosum Roxb. ex Lindl.         | ✓       | ✓       |
| 152 | Dendrobium fugax Rchb.f.                    | ✓       | ✓       |
| 153 | Dendrobium gratiosissimum Rchb.f.           | ✓       | ✓       |
| 154 | Dendrobium herbaeum Lindl.                  | ✓       | ✓       |
| 155 | Dendrobium heterocarpum Wall. ex Lindl.     | ✓       | ✓       |
| 156 | Dendrobium hookerianum Lindl.               | ✓       | ✓       |
| 157 | Dendrobium infundibulum Lindl.              | ✓       | ✓       |
| 158 | Dendrobium jenkinsii Wall. ex Lindl.        | ✓       | ✓       |
| 159 | Dendrobium kingianum Bidwill ex Lindl.      | ✓       | ✓       |
| 160 | Dendrobium lindleyi Steud.                  | ✓       | ✓       |
| 161 | Dendrobium lituiflorum Lindl.               | ✓       | ✓       |
| 162 | Dendrobium loddigesii Rolfe                 | ✓       | ✓       |
| 163 | Dendrobium longicornu Lindl.                | ✓       | ✓       |
| 164 | Dendrobium macraei Lindl.                   | ✓       | ✓       |
| 165 | Dendrobium macrostachyum Lindl.             | ✓       | ✓       |
| 166 | Dendrobium moniliforme (L.) Sw.             | ✓       | ✓       |
| 167 | Dendrobium moschatum (Buch.-Ham.) Sw.       | ✓       | ✓       |
| 168 | Dendrobium nanum Hook.f.                    | ✓       | ✓       |
| 169 | Dendrobium nobile Lindl.                    | ✓       | ✓       |
| 170 | Dendrobium nobile Lindl. (White-albus)      | ✓       | ✓       |
| 171 | Dendrobium nobile Lindl. (Var. schroderianum) | ✓       | ✓       |
| 172 | Dendrobium nodosum Dalzell                  | ✓       | ✓       |
| 173 | Dendrobium ochreatum Lindl.                 | ✓       | ✓       |
| 174 | Dendrobium ovatum (L.) Kraenzl.             | ✓       | ✓       |
| 175 | Dendrobium parishii Rchb.f.                 | ✓       | ✓       |
| 176 | Dendrobium pendulum Roxb.                   | ✓       | ✓       |
| 177 | Dendrobium plicatile. (Lindl.)              | ✓       | ✓       |
| 178 | Dendrobium polyanthum Wall. ex Lindl.       | ✓       | ✓       |
| 179 | Dendrobium porphyrochilum Lindl.            | ✓       | ✓       |
| 180 | Dendrobium praecinctum Rchb.f.              | ✓       | ✓       |
| No.  | Species                                      | Authors                                      | Status   |
|------|---------------------------------------------|----------------------------------------------|----------|
| 181  | Dendrobium primulinum Lindl.               |                                              |          |
| 182  | Dendrobium pulchellum Roxb. ex Lindl.      | √                                             |          |
| 183  | Dendrobium rotundatum (Lindl.) Hook.f.     |                                              |          |
| 184  | Dendrobium ruckeri Lindl.                  |                                              | √        |
| 185  | Dendrobium salaccense (Blume) Lindl.       | √                                             |          |
| 186  | Dendrobium stuporum Lindl.                 | √                                             |          |
| 187  | Dendrobium sulcatum Lindl.                 | √                                             |          |
| 188  | Dendrobium terminale E.C.Parish and Rchb.f.| √                                             |          |
| 189  | Dendrobium thyrsiflorum B.S.Williams       | √                                             |          |
| 190  | Dendrobium transparens Wall. ex Lindl.     | √                                             |          |
| 191  | Dendrobium wardianum R.Warner              | √                                             |          |
| 192  | Dendrobium williamsonii Day and Rchb.f.    | √                                             |          |
| 193  | Dienia ophrydis (J.Koenig) Seidenf.        |                                              |          |
| 194  | Diplocentrum recurvum Lindl.               | √                                             |          |
| 195  | Diplomeris hirsuta (Lindl.) Lindl.         | √                                             |          |
| 196  | Epidendrum ellipticum Graham               |                                              | Exotic   |
| 197  | Epidendrum radicans Pav. ex Lindl.         | √                                             | Exotic   |
| 198  | Epidendrum xanthinum Lindl.                | √                                             | Exotic   |
| 199  | Epipogium roseum (D.Don) Lindl.            | √                                             |          |
| 200  | Eria clausa King and Pantl.                |                                              |          |
| 201  | Eria coronaria (Lindl.)Rchb.f.             | √                                             |          |
| 202  | Eria ferruginea Lindl.                     |                                              |          |
| 203  | Eria globulifera Seidenf.                  |                                              |          |
| 204  | Eria javanica (Sw.) Blume                  | √                                             |          |
| 205  | Eria lasiopetala (Willd.) Ormerod          | √                                             |          |
| 206  | Eria porteri Seidenf. and A.D.Kerr         |                                              |          |
| 207  | Eria sutepensis Rolfe ex Downie            | √                                             |          |
| 208  | Eria tomentosa (J.Koenig) Hook.f.          |                                              |          |
| 209  | Eria vittata Lindl.                        |                                              |          |
| 210  | Esmeralda catheartii (Lindl.) Rchb.f.      | √                                             |          |
| 211  | Esmeralda clarkei Rchb.f.                  | √                                             |          |
| 212  | Eulophia pulchra (Thouars) Lindl           | √                                             |          |
| 213  | Gastrochilus acutifolius (Lindl.) Kuntze   | √                                             |          |
| 214  | Gastrochilus calceolaris (Buch.-Ham. ex Sm.) D.Don | √ |          |
| 215  | Gastrochilus dasypogon (Sm.) Kuntze        | √                                             |          |
| 216  | Gastrochilus distichus (Lindl.) Kuntze     | √                                             |          |
| 217  | Gastrochilus inconspicuos (Hook.f.) Kuntze | √                                             |          |
| 218  | Gastrochilus pseudodistichus (King and Pantl.) Schltr. | √ |          |
|   | Scientific Name                                                                 | Status          | Note             |
|---|---------------------------------------------------------------------------------|-----------------|------------------|
| 219| Geodorum densiflorum (Lam.) Schltr.                                               | √               |                  |
| 220| Goodyera foliosa (Lindl.) Benth. ex C.B.Clarke                                   |                  |                  |
| 221| Goodyera hispida Lindl.                                                           |                 |                  |
| 222| Goodyera hemsleyana King and Pantl.                                              |                 |                  |
| 223| Goodyera procera (Ker Gawl.) Hook.                                               | √               |                  |
| 224| Goodyera schlechtendaliana Rchb.f.                                               |                 |                  |
| 225| Guarianthe bowringiana (O'Brien) Dressler and W.E.Higgins                         |                 | Exotic           |
| 226| Habenaria arietina Hook.f.                                                        | √               |                  |
| 227| Habenaria furcifera Lindl.                                                        | √               |                  |
| 228| Herminium lanceum (Thunb. ex Sw.) Vuijk                                           |                 |                  |
| 229| Herminium mackinnonii Duthei                                                      | √               |                  |
| 230| Herpsysma longicaulis Lindl.                                                       |                 |                  |
| 231| Holcoglossum amesianum (Rchb.f.) Christenson                                      |                 |                  |
| 232| Hygrochilus parishii (Veitch and Rchb.f.) Pfizer                                 | √               |                  |
| 233| Liparis bistriata E.C.Parish and Rchb.f.                                          |                 |                  |
| 234| Liparis bootanensis Griff.                                                        |                 |                  |
| 235| Liparis cespitosa (Lam.) Lindl.                                                    |                 |                  |
| 236| Liparis cordifolia Hook.f.                                                        |                 |                  |
| 237| Liparis deflexa Hook.f.                                                           |                 |                  |
| 238| Liparis elliptica Wight                                                           |                 |                  |
| 239| Liparis odorata (Wild.) Lindl.                                                     |                 |                  |
| 240| Liparis latifolia Lindl.                                                           |                 |                  |
| 241| Liparis plantaginea Lindl.                                                         |                 |                  |
| 242| Liparis resupinata Ridl.                                                           |                 |                  |
| 243| Liparis viridiflora (Blume) Lindl.                                                | √               |                  |
| 244| Luisia brachystachys (Lindl.) Blume                                               | √               |                  |
| 245| Luisia filiformis Hook.f.                                                         |                 |                  |
| 246| Luisia trichorrhiza (Hook.) Blume                                                 |                 |                  |
| 247| Luisia tristis (G.Forst.) Hook.f.                                                 | √               |                  |
| 248| Lycaste cruenta (Lindl.) Lindl.                                                    |                 | Exotic           |
| 249| Malaxis rheedii B. Heyne ex Wallace                                               |                 |                  |
| 250| Masdevallia ignea Rchb.f.                                                          |                 | Exotic           |
| 251| Micropera mannii (Hook.f.) Tang and F.T.Wang                                     |                 |                  |
| 252| Micropera obtusa (Lindl.) Tang and F.T.Wang                                       |                 |                  |
| 253| Micropera pallida (Roxb.) Lindl.                                                   |                 |                  |
| No. | Species                                                                 | Authors                                      | Status 1 | Status 2 | Status 3 | Status 4 |
|-----|------------------------------------------------------------------------|----------------------------------------------|----------|----------|----------|----------|
| 244 | Mormolyca rufescens (Lindl.) M.A. Blanco                               |                                              |          |          |          |          |
| 245 | Mycaranthes floribunda (D.Don) S.C. Chen and J.J. Wood                |                                              |          |          |          |          |
| 246 | Neogyna gardneriana (Lindl.) Rchb.f.                                  |                                              |          |          |          |          |
| 247 | Nervilia macroglossa (Hook.f.) Schltr.                                |                                              | √        |          |          |          |
| 248 | Oberonia acaulis Griff.                                                |                                              |          |          |          |          |
| 249 | Oberonia cylindrica Lindl.                                             |                                              |          |          |          |          |
| 250 | Oberonia emarginata King and Pantl.                                    |                                              |          |          |          |          |
| 251 | Oberonia obcordata Lindl.                                              |                                              |          |          |          |          |
| 252 | Oberonia pachyrachis Rchb.f. ex Hook.f.                                |                                              |          |          |          |          |
| 253 | Oberonia priniana King and Pantl.                                      |                                              | √        |          |          |          |
| 254 | Odontochilus lanceolatus (Lindl.) Blume                                |                                              |          |          |          |          |
| 255 | Ornithochilus difformis (Wall. ex Lindl.) Schltr.                      |                                              |          | √        |          |          |
| 256 | Otochilus albus Lindl.                                                 |                                              |          |          | √        |          |
| 257 | Otochilus fuscus Lindl.                                                |                                              |          |          |          |          |
| 258 | Otochilus porrectus Lindl.                                             |                                              |          |          |          |          |
| 259 | Panisea demissa (D.Don) Pfitzer                                       |                                              |          |          |          |          |
| 260 | Panisea uniflora (Lindl.) Lindl.                                       |                                              |          |          | √        |          |
| 261 | Paphiopedilum fairrieanum (Lindl.) Stein                              |                                              | √        |          |          |          |
| 262 | Paphiopedilum hirsutiissimum (Lindl. ex Hook.) Stein                   |                                              | √        |          |          |          |
| 263 | Paphiopedilum insigne (Wall. ex Lindl.) Pfitzer                       |                                              | √        |          | √        |          |
| 264 | Paphiopedilum spicerianum (Rchb.f.) Pfitzer                           |                                              |          | √        |          |          |
| 265 | Paphiopedilum venustum (Wall. ex Sims) Pfitzer                        |                                              | √        |          |          |          |
| 266 | Paphiopedilum villosum (Lindl.) Stein                                 |                                              | √        | √        |          |          |
| 267 | Paphiopedilum villosum var. boxallii (Rchb.f.) Pfitzer                |                                              | √        |          |          |          |
| 268 | Papilionanthe subulata (Willd.) Garay                                 |                                              |          |          | √        |          |
| 269 | Papilionanthe teres (Roxb.) Schltr.                                    |                                              | √        | √        |          |          |
| 270 | Papilionanthe uniflora (Lindl.) Garay                                  |                                              |          |          |          |          |
| 271 | Papilionanthe vandarum (Rchb.f.) Garay                                |                                              | √        |          |          |          |
| 272 | Pelatantheria insectifera (Rchb.f.) Ridl.                              |                                              | √        |          |          |          |
| 273 | Phaius flavus (Blume) Lindl.                                           |                                              | √        |          |          |          |
| 274 | Phaius mishmensis (Lindl. and Paxton) Rchb.f.                          |                                              |          |          | √        |          |
| 275 | Phaius tankervilleae (Banks) Blume                                     |                                              | √        |          |          |          |
| 276 | Phalaenopsis deliciosa Rchb.f.                                         |                                              | √        |          |          |          |
| 277 | Phalaenopsis lobbii (Rchb.f.) H.R. Sweet                              |                                              | √        |          |          |          |
|   | Species                                      | Author(s)                          | Status |
|---|---------------------------------------------|------------------------------------|--------|
|278 | *Phalaenopsis mannii* Rchb.f.                |                                    | √      |
|279 | *Phalaenopsis taenialis* (Lindl.) Christenson and Pradhan |                                    | √      |
|280 | *Pholidota articulata* Lindl.                |                                    | √      |
|281 | *Pholidota imbricata* Lindl.                 |                                    | √      |
|282 | *Pholidota pallida* Lindl.                   |                                    | √      |
|283 | *Pholidota protracta* Hook.f.                |                                    |        |
|284 | *Pholidota recurva* Lindl.                   |                                    |        |
|285 | *Phreatia elegans* Lindl.                   |                                    |        |
|286 | *Phreatia laxiflora* (Blume) Lindl.          |                                    |        |
|287 | *Pinalia acervata* (Lindl.) Kuntze           |                                    | √      |
|288 | *Pinalia amica* (Rchb.f.) Kuntze             |                                    |        |
|289 | *Pinalia bipunctata* (Lindl.) Kuntze         |                                    |        |
|290 | *Pinalia bractescens* (Lindl.) Kuntze        |                                    |        |
|291 | *Pinalia excavata* (Lindl.) Kuntze           |                                    |        |
|292 | *Pinalia graminifolia* (Lindl.) Kuntze       |                                    |        |
|293 | *Pinalia pumila* (Lindl.) Kuntze             |                                    | √      |
|294 | *Pinalia spicata* (D.Don) S.C.Chen and J.J.Wood |                                    | √      |
|295 | *Platanthera clavigera* Lindl.               |                                    | √      |
|296 | *Pleione hookeriana* (Lindl.) Rollisson      |                                    | √      |
|297 | *Pleione humilis* (Sm.) D.Don                |                                    | √      |
|298 | *Pleione maculata* (Lindl.) Lindl. and Paxton |                                    | √      |
|299 | *Pleione praecox* (Sm.) D.Don                |                                    | √      |
|300 | *Podochilus cultratus* Lindl.                |                                    |        |
|301 | *Podochilus malabaricus* Wight               |                                    |        |
|302 | *Polystachya concreta* (Jacq.) Garay and H.R.Sweet |                                    | √      |
|303 | *Pomatocalpa armigerum* (King and Pantl.) Tang and F.T.Wang |                                    |        |
|304 | *Pteroceras teres* (Blume) Holttum           |                                    | √      |
|305 | *Renanthera imschootiana* Rolfe              |                                    | √      |
|306 | *Rynchostylis retusa* (L.) Blume             |                                    | √      |
|307 | *Satyrium nepalense* D.Don                   |                                    | √      |
|308 | *Schoenorhchis gemmata* (Lindl.) J.J.Sm.     |                                    | √      |
|309 | *Schoenorhchis smeana* (Rchb.f.)             |                                    | √      |
|310 | *Sirhookera latifolia* (Wight) Kuntze        |                                    |        |
|311 | *Smitinandia micrantha* (Lindl.) Holttum     |                                    | √      |
|312 | *Spiranthes sinensis* (Pers.) Ames           |                                    | √      |
|313 | *Staurochilus ramosus* (Lindl.) Seidenf.     |                                    | √      |
|   | Species                                      | Endemic | Exotic |
|---|---------------------------------------------|---------|--------|
|314| *Sunipia bicolor* Lindl.                   | □       |        |
|315| *Sunipia cirrhata* (Lindl.) P. F. Hunt     | □       |        |
|316| *Sunipia scariosa* Lindl.                  |         |        |
|317| *Taeniophyllum retrospiculatum* (King and Pantl.) King and Pantl. |         |        |
|318| *Tainia minor* Hook.f.                     | □       |        |
|319| *Thelasis longifolia* Hook.f.              | □       |        |
|320| *Thelasis pygmaea* (Griff.) Lindl.         |         |        |
|321| *Thrixspermum musciflorum* A.S.Rao and J.Joseph | □       |        |
|322| *Thunia alba* (Lindl.) Rchb.f.             | □ □ □  |        |
|323| *Thunia alba* var. *bracteata* (Roxb.) N. Pearce and P.J. Cribb | □       |        |
|324| *Thunia alba* var. *marshalliana* (Rchb.f.) |         |        |
|325| *Uncifera obtusifolia* Lindl.              | □       |        |
|326| *Vanda alpina* (Lindl.) Lindl.             | □ □ □  |        |
|327| *Vanda coerulaea* Griff. ex Lindl.         | □       |        |
|328| *Vanda cristata* Wall. ex Lindl.           | □       |        |
|329| *Vanda griffithii* Lindl.                  | □       |        |
|330| *Vanda motesiana* Cholico                  |         |        |
|331| *Vanda pumila* Hook.f.                     | □       |        |
|332| *Vanda tessellata* (Roxb.) Hook. ex G.Don | □ □ □  |        |
|333| *Vanda testacea* (Lindl.) Rchb.f.          | □ □ □  |        |
|334| *Vanda thwaitesii* Hook.f.                 | □       |        |
|335| *Vanda wightii* Rchb.f.                    | □       |        |
|336| *Vandopsis undulata* (Lindl.) J.J.Sm.      | □       |        |
|337| *Vanillaaphylla* Blume                     | □       |        |
|338| *Zeuxine affinis* (Lindl.) Benth. ex Hook.f. |         |        |
|339| *Zeuxine flava* (Wall. ex Lindl.) Trimen   |         |        |
|340| *Zeuxine goodyeroides* Lindl.              |         |        |
|341| *Zygopetalum maculatum* (Kunth) Garay      | □ □ □  |        |

**Total** 205 87 11 77 90
Fig. 1 Orchid germplasm collecting states across the country
**Fig. 2** List of rare species which are conserved at ICAR-NRCO

*Diplomeris hirsuta* (Lindl.) Lindl.

*Dendrobium draconis* Rchb.f.

*Vanda coerulea* Griff.ex Lindl.

*Paphiopedilum villosum* (Lindl.) Stein

*Dendrobium praecinctum* Rchb.f.

*Renanthera imschootiana* Rolfe

*Phalaenopsis lobbii* (Rchb.f.) Sweet

*Paphiopedilum fairrieanum* (Lindl.) Stein

*Paphiopedilum hirsutissimum* (Lindl. ex Hook.) Stein

*Dendrobium ruckeri* Lindl.

*Vanda pumila* Hook.f.

*Pleione maculata* (Lindl.) Lindl. & Paxton
Fig. 3 List of important medicinal orchids

- Acampe rigida (Buch.-Ham. ex Sm.) P.F. Hunt
- Calanthe sylvatica (Thouars) Lindl.
- Callostylis bambusifolia
- Dendrobium crepidatum Lindl. & Paxton
- Dendrobium densiflorum Lindl.
- Dendrobium fugax Rchb.f.
- Dendrobium moschatum (Buch.-Ham.) Sw.
- Dendrobium nobile Lindl.
- Phaius tankervilleae Blume
- Pleione maculata (Lindl.) Lindl. & Paxton
- Vanda cristata Lindl.
- Vanda testacea (Lindl.) Rchb.f.
**Fig.4** List of important fragrant orchids

- **Aerides crispa** Lindl.
- **Aerides odoratum** Reinw. ex Blume
- **Dendrobium heterocarpum** Wall. ex Lindl.
- **Dendrobium primulinum** Lindl.
- **Dendrobium williamsonii** Day and Rchb.f.
- **Papilionanthe uniflora** (Lindl.) Garay
- **Phalaenopsis lobbii** (Rchb.f.) Sweet
- **Zygopetalum maculatum** (Kunth) Garay
- **Rhynchostylis retusa** (L) Blume
- **Eria javanica** (Sw.) Blume
- **Cephalantheropsis obcordata**
- **Gastrochilus dasypogon** (Sm.) Kuntze
**Fig.5** Important conservation methods (Field gene bank and DNA bank)

National Active Germplasm Site (NAGS) – Germplasm Polyhouse

Vertically arrangement of germplasm

*Dendrobium eryflorum* and *Gastrochilis dasypogan* on wooden logs

DNA Repository

DNA are stored under -80°C
In Ayurveda, a rejuvenating herbal formulation ‘Astavarga’ (Chief component of ayurvedic tonic ‘Chyavanprash’) is derived from a group of 8 herbs, 4 of them are orchids namely Jivak (Malaxis muscifera), Rishbhaka (Malaxis acuminata), Riddhi (H. intermedia) and Vriddhi (H. edgeworthii) (Uniyal, 1975).

Orchids as food

Orchid’s importance comes into account in traditional food as a side dishes or a supplement in many parts of the world. There are many wild orchid species which are being used as food by the tribal people of North East India (Duggal, 1972). Many tribes of the Nagaland state used leaves of Cymbidium species as food. The new shoots of Cymbidiums are used with cereals to make sauce, the pseudobulbs of their orchids in combination of common vegetables such as potato, tapioca etc. (Medhi and Chakrabarti, 2009). Pseudobulb, root and rhizome of many orchid species, are reported to use as food viz. Habenaria acuminata, H. susannae, Orchis latifolia, Pholidata articulata, Satyrium species are used as foods which play an important role in the nutrition of the people of this Nagaland region (Deb 2013).

Endemism

The endemism in the flora of a country or geographical region provides an important insight into the biogeography of that region and also to the centers of diversity and adaptive evolution of the floristic components of that region (Nayar 1996). In India, the Himalayan region has a high degree of endemism making it the richest endemic centre. There are about 307 orchid species are belongs to endemic category (Singh 2019). At present we collected rare and endemic orchid species such as Diplomeris hirsuta, Lecanorchis sikkimensis, Phalaenopsis lobbii, Renanthera imschootiana etc. These species are very specific to habitat and sensitive to micro environment.

A number of species are rare and threatened throughout the India, owing to habitat degradation and fragmentation as a result of various anthropogenic influences such as land development activities, building of dams, constructions of roads, commercial exploitation of the species, overgrazing and frequent forest fires. Some orchid species require unique habitat and microhabitats so they are confined to particular elevations and forest types. Some are naturally rare; others are so because of geographic distribution, narrow habitat requirements, and low-density populations.

Conservation

Conservation of orchids through ex-situ and in-situ methods, in the ex-situ mode, the orchid species are collected from the native location and conserved in the by tying the plants on wooden logs. While in the in-situ approach, the plants are attached with the help of mosses and knotted them tightly with the help of coir ropes. Due to the non-endospermic seeds, the species are normally conserved in the form of field genebanks. Second method is conserving DNA in the form of leaf samples at -80°C in deep freezer. DNA Bank and NCBI Deposits: Genomic DNA have been isolated from 260 species and stored. 65 DNA barcode sequences (using ITS, matK, rbcL, trnH-psbA primers) were submitted to NCBI.

DNA repository of orchids: The DNA of native orchids is being preserved under -80°C. Nearly 250 species samples are preserved carefully.

North Eastern Himalaya is opulent in orchid resources and indigenous livelihood traditions,
therefore under the framework of proper policy and guidelines, these resources can be more effectively utilized for horticultural crop improvement programmes, sustainable utilization and conservation strategies. The increased number of species at risk as a result of the changing climatic conditions will force the National Active Germplasm Sites (NAGS) which is responsible for plant specific to refocus, to strengthen their conservation policies and to increase their participation in recovery programs for trait specific orchid germplasm and including threatened species. Developments of techniques using both RET and non-RET species, which may have conservation applications which concerning the initiation of plant tissue into culture, multiplication, rooting, weaning, storage (including cryopreservation), are helpful to achieve this conservation programme. Orchids should be one of the premier groups of flowering plants for evolutionary studies, and the massive amounts of DNA data now accumulating are revolutionizing our ideas about these wonderful plants. Conservation through establishing botanic gardens, orchid biosphere reserves, orchid corridors and cryopreservation will helps for sustainable utilization for future generations.

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