Introduction

1.INTRODUCTION

Orchids comprise a unique and distinctive group of plants. Taxonomically, these plants belong to the most highly evolved family orchidaceae in the plant group monocotyledons with 750 genera and 18000 species (Heywood, 1993) or 788 genera and 18500 species (Mabberley, 1998) constituting second largest family of flowering plants in the world. Orchid species are found in almost all regions of the world but their greatest diversity occurs in the tropical and subtropical climate where positive factors for growth, thick vegetation and high humidity prevail. India accounts for nearly 7% of the world's orchid genetic diversity contributed 1300 species in 184 genera. Out of 1300 species known to exist in India, 675 species are known to occur in north east and 730 species in eastern Himalaya. Pradhan (1976, 1979) described 130 genera and 810 species of orchids form India. In Sikkim and Darjeeling Himalaya, total number of orchid genus is more or less 115 and 496 species. Out of 675 species of north eastern India, 76 species are endemic, 18 are extinct or nearly extinct and 105 species are endangered.

Orchids occupy a special position in the plant kingdom due to its specialization and modification in their vegetative and floral characters. They are perennial, herbaceous epiphytic and occasionally terrestrial plants with long lasting flowers in myriad varieties of colors, shapes, sizes, architecture and fragrance. Approximately 60% of the orchids of Indian origin are epiphytic while the rest are terrestrial. However, certain genera like *Cymbidium* and *Liparis* have both epiphytic and terrestrial species. Amongst the terrestrial orchid species some are saprophytic in nature but few species are also adapted to saprophytic mode of life. The genus *Dendrobium* with 104 known species constitute largest genus of orchid in India. The endemicity in Indian orchids is very high and nearly 29% recorded taxa are endemic. Economically, orchids can be divided into two major categories under one category most of the orchids are horticultural and floricultural important plants that can spin cash in the international market, generate jobs and create an eco-friendly industry while medicinally important group of orchids having inherent therapeutic value constitute the second category and are used to cure many simple and complex diseases. Raj Bhandari & Bhattarai (2001) documented 53 species having medicinal value from north eastern region of India. The most significant use of orchid is ornamental because of their exquisitely attractive flowers or inflorescences remain fresh for longer period of time in comparison to other flowers. These qualities have made

orchid growing a high profitable industry all over the world. So, orchids are cultivated in a large scale for cut flowers and potted plants. On the other hand a large number of species bear attractive flowers and their capacity for inter specific as well as intergeneric breeding has generated tremendous possibilities producing hybrids or diverse floral characters. There are about 70 species of Indian orchids that have been used in breeding programs for producing hybrids in and outside the country for example *Dendrobium nobile*, an Indian orchid species extensively used in hybridizing over 77 hybrids registered so far in which it was parent. Today more than 1.2 lakh hybrids are known all over the world. The wild native orchids are likely to play a unique role in the development of new cultivars or hybrids and also restructing or existing with one or more attributes. India constitutes invaluable reservoir of these genes or germplasm of orchids that are needed for the development of new varieties.

The therapeutic value of orchids is related to variety of phytochemical constitutes including alkaloids, flavonoids, tarpens, carbohydrates and glycosides present in them. The ethno botanic studies carried out in the country showed that many orchids were used in medicines, so; the Indian orchids have also been used in various indigenous system of medicines since time immemorial. In the ayurvedic system of medicines, Indian orchids are used in the preparation of various rejuvenating formulations and tonics. Orchids also show immense evolutionary diversity in a response to different conditions particularly in the tropics like India. Some species are epiphyte growing on trees and others grow on rocks, while the majority of the temperate species are terrestrial. Many orchids perform a vital role in natural eco-systems and have complex interactions with insects and other animals which act as pollinators. In some cases the orchid provides a source of food or shelter for insects, most species also form relationships with mycorrhizal fungi which enable their tiny seeds to germinate.

In the present study a preliminary survey of Himalayan orchid biodiversity was done on the basis of their importance and status of availability in Darjeeling and Sikkim Himalaya. The list of total orchids has been presented in Table-1. List was made from the collection of orchids from the orchid growers of different places of the present study area.

Table 1- List of orchids found in Darjeeling and Sikkim Himalaya

Name of the orchids	Habitat	Status
Acampe papillosa	Epiphyte	Medicinal/Ornamental
Acanthephippium striatumu	Terrestrial	Ornamental/Horticultural
Acanthe phipiure	Terrestrial	Ornamental/Horticultural
Acrochaene punctata	Terrestrial	Ornamental/Horticultural
Acanthophippium striatumu	Terrestrial	Ornamental/Horticultural
Aerides biswasiana	Terrestrial	Ornamental/Horticultural
A.odorata	Epiphyte	Medicinal/Ornamental
A.vandara	Terrestrial	Ornamental/Horticultural
Anoectochilus brevilabris	Terrestrial	Vulnerable/Endangered
A.crispus	Terrestrial	Ornamental/Horticultural
A.elwesis	Terrestrial	Ornamental/Horticultural
A.grandiflora	Terrestrial	Ornamental/Horticultural
A.lanceolatus	Terrestrial	Ornamental/Horticultural
A.parviflora	Epiphyte	Scarce/Rare
A.regalis	Terrestrial	Medicinal/Scarce/Rare
A.roxburghii	Terrestrial	Scarce/Rare
A.tetrapterus	Terrestrial	Ornamental/Horticultural
A.tortus	Epiphyte	Ornamental/Horticultural
Anthogonium gracile	Lithophyte	Ornamental/Horticultural
Arachnanthe cathcartii	Terrestrial	Ornamental/Horticultural
Arundina graminifolia	Terrestrial	Medicinal/Ornamental
Ascocerntrum ampullaceum	Epiphyte	Ornamental/Horticultural
Biermannia bimacuiata	Terrestrial	Ornamental/Horticultural
Bulbophylum affine	Epiphyte	Ornamental/Horticultural
B.cylindraceum	Terrestrial	Ornamental/Horticultural
B.ebulbum	Epiphyte	Ornamental/Horticultural
B.helenae	Epiphyte	Ornamental/Horticultural
B.hirtum	Epiphyte	Ornamental/Horticultural
B.polyrizum	Terrestrial	Ornamental/Horticultural
B.putidum	Terrestrial	Ornamental/Horticultural
B.sikkimense	Terrestrial	Ornamental/Horticultural
C.labrosa	Terrestrial	Ornamental/Horticultural
C.keshabii	Terrestrial	Ornamental/Horticultural
C.mannii	Terrestrial	Ornamental/Horticultural
C.masuca	Terrestrial	Ornamental/Horticultural

Contd...

Table 1- (Contd.) List of orchids found in Darjeeling and Sikkim Himalaya.

C.plantaginea	Terrestrial	Ornamental/Horticultural
C.puberula	Terrestrial	Ornamental/Horticultural
C.tricarinata	Terrestrial	Ornamental/Horticultural
C.trulliformis	Terrestrial	Ornamental/Horticultural
C.whiteana	Terrestrial	Ornamental/Horticultural
C.yuksomensis	Terrestrial	Ornamental/Horticultural
Chilochista lunifera	Epiphyte	Ornamental/Horticultural
Cirrhopetalum ornaticimum	Lithophyte	Ornamental/Horticultural
C.walichii	Lithophyte	Ornamental/Horticultural
Cleisoscentron trichromum	Epiphyte	Ornamental/Horticultural
Cleisostoma filiforme	Epiphyte	Ornamental/Horticultural
Coelogyne barbata	Epiphyte	Ornamental/Horticultural
C.corymbosa	Epiphyte	Medicinal/Ornamental
C.cristata	Epiphyte	Medicinal/Ornamental
C.elata	Lithophyte	Medicinal/Ornamental
C.flaccida	Epiphyte	Medicinal/Ornamental
C.flavida	Epiphyte	Ornamental/Horticultural
C.fuscescens	Epiphyte	Ornamental/Horticultural
C.graminifolia	Lithophyte	Ornamental/Horticultural
C.hookerianum	Epiphyte	Ornamental/Horticultural
C.nitida	Epiphyte	Ornamental/Horticultural
C.occulata	Epiphyte	Ornamental/Horticultural
C.ochracea	Epiphyte	Ornamental/Horticultural
C.oracea	Epiphyte	Ornamental/Horticultural
C.ovalis	Epiphyte	Medicinal/Rare
C.punctulata	Lithophyte	Ornamental/Horticultural
C.rossiana	Epiphyte	Vulnerable/Endangered
C.treutleri	Epiphyte	Ornamental/Horticultural
Cremastra appendiculata	Terrestrial	Medicinal/Ornamental
C.wallichiana	Lithophyte	Ornamental/Horticultural
Cryptochilus lutea	Terrestrial	Ornamental/Horticultural
C.sanguinea	Epiphyte	Ornamental/Horticultural
C.cochleare	Epiphyte	Ornamental/Horticultural
C.devonianum	Epi/Lithophyte	Ornamental/Horticultural
Cymbidium aloifolium	Epiphyte	Medicinal/Ornamental

Contd...

Table 1- (Contd.) List of orchids found in Darjeeling and Sikkim Himalaya.

C. euburneum	Epi/Lithophyte	Ornamental/Horticultural
C.elegans	Terrestrial	Scarce/Rare
C.ensifolium	Epiphyte	Ornamental/Horticultural
C.hookerianum	Epiphyte	Medicinal/Rare/Ornamental
C.nitida	Epiphyte	Ornamental/Horticultural
C.occulata	Epiphyte	Ornamental/Horticultural
C.ochracea	Epiphyte	Ornamental/Horticultural
C.oracea	Epiphyte	Ornamental/Horticultural
C.ovalis	Epiphyte	Medicinal/Rare
C.punctulata	Lithophyte	Ornamental/Horticultural
C.rossiana	Epiphyte	Vulnerable/Endangered
C.treutleri	Epiphyte	Ornamental/Horticultural
Cremastra appendiculata	Terrestrial	Medicinal/Ornamental
C.wallichiana	Lithophyte	Ornamental/Horticultural
Cryptochilus lutea	Terrestrial	Ornamental/Horticultural
C.sanguinea	Epiphyte	Ornamental/Horticultural
C.cochleare	Epiphyte	Ornamental/Horticultural
C.devonianum	Epi/Lithophyte	Ornamental/Horticultural
Cymbidium aloifolium	Epiphyte	Medicinal/Ornamental
C. euburneum	Epi/Lithophyte	Ornamental/Horticultural
C.elegans	Terrestrial	Scarce/Rare
C.ensifolium	Epiphyte	Ornamental/Horticultural
C.hookerianum	Epiphyte	Medicinal/Rare/Ornamental
C. insigne	Terrestrial	Ornamental/Horticultural
C.lancifolium	Terrestrial	Ornamental/Horticultural
C.longifolium	Epiphyte	Ornamental/Horticultural
C.lowianum	Lithophyte	Ornamental/Horticultural
C.tigrinum	Epiphyte	Ornamental/Horticultural
C.traceyanum	Lithophyte	Ornamental/Horticultural
C.whiteae	Epiphyte	Vulnerable/Endangered
Cypripedium elegans	Terrestrial	Ornamental/Horticultural
C.himaliacum	Terrestrial	Scarce/Rare
Dediciea cunning hamii	Terrestrial	Vulnerable/Endangered
Dendrobium alba	Lithophyte	Ornamental/Horticultural
D. arachnites	Epiphyte	Ornamental/Horticultural

Contd...

Table 1- (Contd.) List of orchids found in Darjeeling and Sikkim Himalaya.

D. aurantiacum	Epiphyte	Ornamental/Horticultural
D.cathcartii	Epiphyte	Ornamental/Horticultural
D.crepidatum	Epiphyte	Ornamental/Horticultural
D.chrysanthum	Epiphyte	Medicinal/Ornamental
D. chryxotoxum	Lithophyte	Ornamental/Horticultural
D. crassinod	Epiphyte	Ornamental/Horticultural
D.denudans	Epiphyte	Ornamental/Horticultural
D.densiflorum	Epiphyte	Medicinal/Rare/Ornamental
D.falcorni	Epiphyte	Scarce/Rare
D.farmeri	Epiphyte	Scarce/Rare
D.fimbriatum	Epi/lithophyte	Scarce/Rare
D. formosum	Epiphyte	Scarce/Rare
D.gibsoni	Lithophyte	Ornamental/Horticultural
D.hirsute	Lithophyte	Ornamental/Horticultural
D.jenkinsii	Epiphyte	Medicinal/Ornamental
D.longicornu	Epiphyte	Medicinal /Ornamental
D.moschatum	Epiphyte	Ornamental/Horticultural
D.nobile	Epi/Lithophyte	Medicinal/Rare
D.primulinum	Epiphyte	Ornamental/Horticultural
D.rotundatum	Lithophyte	Ornamental/Horticultural
Diplomeris hirsuta	Lithophyte	Vulnerable/Endangered
D.pulchella	Lithophyte	Vulnerable/Endangered
Doritis tatenialis	Lithophyte	Ornamental/Horticultural
Eria bambusifolia	Epiphyte	Ornamental/Horticultural
E. conboleris	Lithophyte	Ornamental/Horticultural
E.convallarioides	Epiphyte	Ornamental/Horticultural
E. coronaria	Epiphyte	Ornamental/Horticultural
E.paniculata	Epiphyte	Ornamental/Horticultural
E. spicata	Epiphyte	Ornamental/Horticultural
E. stricata	Lithophyte	Ornamental/Horticultural
Gastrochilus acutifolius	Epiphyte	Ornamental/Horticultural
G.affinis	Lithophyte	Ornamental/Horticultural
G.dasypogon	Epiphyte	Ornamental/Horticultural
G. pseudodisticus	Epiphyte	Ornamental/Horticultural
Goodyera hemsleyana	Terrestrial	Ornamental/Horticultural
G. hispida	Terrestrial	Ornamental/Horticultural
G.schlechtendaliana	Terrestrial	Medicinal/Ornamental
G. vitata	Epiphyte	Ornamental/Horticultural
Habenaria arietina	Terrestrial	Ornamental/Horticultural

Contd...

Table 1- (Contd.) List of orchids found in Darjeeling and Sikkim Himalaya.

H. pectinata	Terrestrial	Ornamental/Horticultural
Herpysma longicaulis	Lithophyte	Ornamental/Horticultural
Hetaeria rubens	Lithophyte	Ornamental/Horticultural
Liparis dongchenii	Epiphyte	Ornamental/Horticultural
L.resupinata	Lithophyte	Ornamental/Horticultural
Luisia filiformis	Epiphyte	Ornamental/Horticultural
Malaxis calophylla	Terrestrial	Ornamental/Horticultural
M.saprophyllum	Epiphyte	Ornamental/Horticultural
Masdevalla herisonii	Epiphyte	Ornamental/Horticultural
Monomeria barbata	Epiphyte	Ornamental/Horticultural
Nephelaphyllum pulchrum var.sikkimensis	Terrestrial	Scarce/Rare
Nervilia macroglossa	Lithophyte	Ornamental/Horticultural
Oberonia micrantha	Terrestrial	Ornamental/Horticultural
Octochilus albus	Epiphyte	Ornamental/Horticultural
O. fuscus	Epiphyte	Ornamental/Horticultural
Paphiopedilum farrieanum	Terrestrial	Scarce/Rare/Medicinal
P. insigne	Terrestrial	Vulnerable/Endangered
P.maculates	Epiphyte	Ornamental/Horticultural
P. spicerianum	Terrestrial	Vulnerable/Endangered
P. teres	Epiphyte	Ornamental/Horticultural
P. venustum	Terrestrial	Vulnerable/Endangered
P.villosum	Terrestrial	Vulnerable/Endangered
P.wallichi	Epiphyte	Ornamental/Horticultural
P.wardii	Lithophyte	Vulnerable/Endangered
Papilionanthe biswasiana	Lithophyte	Ornamental/Horticultural
P. subulata	Epiphyte	Ornamental/Horticultural
P.teres	Epiphyte	Medicinal/Ornamental
P. uniflora	Epiphyte	Ornamental/Horticultural
P. vandarum	Terrestrial	Ornamental/Horticultural
Peristylus constrictus	Terrestrial	Ornamental/Horticultural
Phaius flavus	Terrestrial	Scarce/Rare
Phalaenopsis decumbens	Epiphyte	Ornamental/Horticultural
P. lobbii	Epiphyte	Ornamental/Horticultural

Contd....

Table 1- (Contd.) List of orchids found in Darjeeling and Sikkim Himalaya.

P. manii	Epiphyte	Ornamental/Horticultural
P.parishii	Epiphyte	Scarce/Rare
Pholidata watti	Epiphyte	Ornamental/Horticultural
Phreatia elegans	Epiphyte	Ornamental/Horticultural
Pleione hookeriana	Epiphyte	Ornamental/Horticultural
P. humilis	Epiphyte	Medicinal/Ornamental
P. lagenaria	Epiphyte	Scarce/Rare
P. maculata	Epiphyte	Medicinal/Rare/Ornamental
P. praecox	Epi/Lithophyte	Ornamental/Horticultural
Renanthera imschootiana	Epiphyte	Ornamental/Horticultural
Rhynchostylis retusa	Epiphyte	Medicinal/Ornamental
Risleya atro purpurea	Lithophyte	Ornamental/Horticultural
Ritia himalaica	Terrestrial	Ornamental/Horticultural
Sarcanhus pallidus	Epiphyte	Ornamental/Horticultural
Saturopsis undulates	Epiphyte	Ornamental/Horticultural
Satyrium alba	Terrestrial	Ornamental/Horticultural
S.nepalense	Lithophyte	Medicinal/Ornamental
Sobralia amesiana	Epiphyte	Ornamental/Horticultural
Spathoglottis ixioides	Terrestrial	Ornamental/Horticultural
Spiranthes sinensis	Epiphyte	Ornamental/Horticultural
T. cepidiforme	Epiphyte	Ornamental/Horticultural
Thrixpermum pygamaeum	Epiphyte	Ornamental/Horticultural
Thunia alba	Epiphyte	Ornamental/Horticultural
T. marshalliana	Epiphyte	Ornamental/Horticultural
T. venosa	Epiphyte	Ornamental/Horticultural
Trudelia cristata	Epiphyte	Ornamental/Horticultural
Uncifera lancifolia	Lithophyte	Ornamental/Horticultural
Vanda alpine	Epiphyte	Scarce/Rare
V.corulea	Epiphyte	Medicinal/Ornamental/Rare
V. cristata	Epiphyte	Medicinal/Ornamental
V. odoratum	Epiphyte	Ornamental/Horticultural
V passiflora	Epiphyte	Ornamental/Horticultural
V. pumila	Epiphyte	Ornamental/Horticultural
V. roxbugi	Lithophyte	Ornamental/Horticultural
V. stangeana	Epiphyte	Ornamental/Horticultural
V. suruila	Epiphyte	Scarce/Rare
V. testacea	Epiphyte	Ornamental/Horticultural
V. teres	Epiphyte	Ornamental/Horticultural
Vandopsis undulate	Epiphyte	Ornamental/Horticultural
Zeuxine goodyeroides	Epiphyte	Ornamental/Horticultural
Z.pulchra	Lithophyte	Ornamental/Horticultural

*List has been made from the collection of orchids from the orchid growers of several places of the present study area.

OBJECTIVES:

The orchid seeds generally do not germinate in nature and the common practice is to reproduce asexually by pseudobulbs or cuttings. Thus, huge commercial demand of planting materials is difficult to achieve. The plantlets developed through embryo culture or seed culture is generally subjected to micropropagation for rapid multiplication. This technique is helpful for commercialization of orchids. Micropropagation when done from a plantlet developed through any technique of plant tissue culture, it is called clonal micropropagation. Clonal micropropagation is very popular in commercial horticultural plants and orchids. The major advantages of micropropagation are i) propagation can be carried out under disease free conditions throughout the year, ii) sub-culturing of *in vitro* plantlets can be done after a defined intervals and each time one plantlet can give at least 3 to 4 nodal cuttings. This was necessary for meeting the huge demand of planting materials and also for survival of some wild orchids *in vitro* and for mass multiplication. After the survey of the orchids in the present study area twenty plants were selected for seed culture and also for micropropagation. Hence the objectives of the present study were set forth as:

- Production of plants in large scale through *in vitro* seed culture.
- Micropropagation of the plants developed through *in vitro* seed culture.