

***Research Paper***

**ORCHID- A DIVERSIFIED COMPONENT OF FARMING SYSTEMS FOR PROFITABILITY AND LIVELIHOOD SECURITY OF SMALL AND MARGINAL FARMERS**

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**Abstract**

Orchids comprise the largest family of flowering plants with 25,000 to 35,000 species belonging to 600-800 genera and covers 6.8% of the flowering plants in India.. They are prized for their incredible diversity in the size, shape, forms and colour and attractiveness of their flowers and high keeping qualities even up to 10 weeks. Indian species of *Aerides*, *Bulbophyllum*, *Calanthe*, *Coelogyne*, *Cymbidium*, *Dendrobium*, *Paphiopedilum*, *Rhyncostylis*, *Renanthera* and *Vanda* are used as breeding materials as well as pot plants. They are adapted to diversified climate grown both epiphytically and terrestrially. Orchids respond organically with locally available potting mixtures. Many orchids can be grown on rocks and logs for placing in the landscape. A beautiful colour scheme can be developed with *Cymbidium* and *Dendrobium* orchids. Orchid hybrids of *Cymbidium*, *Dendrobium*, *Vanda*, *Phalaenopsis*, *Oncidium*, *Cattleya*, *Paphiopedilum*, *Mokara*, *Aranda*, *Renantanda* etc. with different colour and forms are highly remunerative and used as cut flowers, floral display and as exhibits. Tribal people of North -Eastern Hill Region of India use wild orchids for a variety of folk medicine as orchids are rich in alkaloids, flavonoids, glycosides, carbohydrates and other phytochemicals. Fragrant orchids like *Aerides multiflorum*, *Aerides odoratum*, *Cattleya maxima*, *Coelogyne cristata*, *Coelogyne ochracea*, *Dendrobium chrysotoxum*, *Lycaste*, *Oncidium sphaceolatum*, *Rhyncostylis retusa* and *Zygopetalum intermedium* are delightful in outdoor living areas. Leaves, tubers and pseudobulbs of different orchid species are used for edible purposes. Vanilla- a major spice crop and source of vanillin comes from *Vanilla planifolia*. *Anoectochilus* leaves are used as vegetables in Indonesia and Malayasia. Pseudobulbs of *Cymbidium maladimum* and *Dendrobium speciosum* and tubers of *Microtis uniflora* and *Caladenia carnea* eaten. Miniature cymbidiums can be used as value added packed items. Bright flowers of orchid genera like *Dendrobium*, *Cymbidium*, *Paphiopedilum* *Cattleya*, *Pholidota* etc. are beautiful items for drying.

**INTRODUCTION**

Orchids comprise the largest family of flowering plants with 25,000 to 35,000 species belonging to 600-800 genera and covers 6.8% of the flowering plants in India. They are prized for their incredible diversity in the size, shape, forms and colour and attractiveness of their flowers and high keeping qualities even up to 10 weeks. Most of the orchids have originated from tropical humid forests of Central and South America, India, Sri Lanka, Burma, South China, Thailand,

Malayasia, Philippines, New Guinea and Australia. Brazilian Cattleya, Mexican Laelia and Indian Cymbidium, Vanda and Dendrobium have played a major role in developing present day beautiful hybrid orchids which numbers more than 200000. In the international trade, among top ten cut flowers, orchids rank the sixth position and among orchids Cymbidium ranks the first position and in floricultural crops it accounts for 3% of the total cut flower production.

In India, it comprises 158 genera and 1331 species which grow upto an elevation of 5000m. Indian terrestrials are commonly located in humus rich moist earth under tree shades in North Western India. Western Ghats harbour the small flowered orchids. Epiphytic orchids are common in North eastern India which grow upto an elevation of 2000m from sea level. Indian orchid species with high ornamental values and used as breeding materials are *Aerides multiflorum*, *Aerides odoratum*, *Arundina graminifolia*, *Arachnis*, *Bulbophyllum*, *Calanthe masuca*, *Coelogyne elata*, *Coelogyne flavida*, *C. corymbosa*; *Cymbidium aloifolium*, *Cym. lowianum*, *Cym. devonianum*, *Cym. hookerianum*, *Cym. lancifolium*; *Dendrobium aphyllum*, *Den. nobile*, *Den. chrysanthum*, *Den. farmeri*, *Den. chrysanthum*, *Den. densiflorum*, *Den. moschatum*, *Den. fimbriatum*, *Den. jenkinsii*; *Paphiopedilum venustum*, *P. spicerianum*, *P. hirsutissimum*, *P. insigne*, *Phaius wallichii*, *Pleione praecox*, *Renanthera imschootiana*, *Rhyncostylis retusa*, *Thunia alba*, *Vanda cristata*, *Vanda coerulea* and *Vanda coerulescens* (Singh, 1990). In India, some of native genera like *Cymbidium*, *Paphiopedilum*, *Vanda*, *Arachnis* and *Dendrobium* are cultivated on a large scale for cut flower production. The *Cymbidium* is mainly grown in NEH Region, Sikkim, Darjeeling hills, Arunachal Pradesh and Assam. Tropical orchids are cultivated in Kerala and some parts of Tamil Nadu. We should prefer those species which flower during winter and spring months to export flowers to temperate regions from December to May. The orchids have taken a significant position in cut flower industry due to its attractiveness, long shelf life, high productivity, right season of bloom, easy in packing and transportation.

**Table 1. Present Status of orchid distribution in India** (Hazra and De, 2010)

Region	States	Genera	Species
Eastern Himalayas and North Eastern India	Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura	159	870
North -Western Himalayas	J& K, Himachal Pradesh, Urrarakhand	75	288
Peninsular India	M.P., Orissa, Andhra Pradesh, Gujrat, Central India, Eastern Ghats and Western Ghats	89	379
Andaman And Nicobar Islands	319 Islands and islets in the Bay of Bengal	53	115

**Ten orchid species under Indian Wildlife Protection Act, 1972 (Schedule VI, Sec.2)**

- *Paphiopedilum charlesworthii* (Rolf.) Pfitz.
- *Paphiopedilum druryi* (Bedd.)
- *Paphiopedilum fairrieianum* (Lindl.)
- *P. hirsutissimum* (Lindl.) Stein
- *Paphiopedilum insigne* (Wall ex Lindl.)
- *Paphiopedilum spicerianum* (Rchb.f.ex Mast & Moor)
- *Paphiopedilum villosum* (Lindl.)
- *Paphiopedilum wardii* (Summerh)
- *Vanda coerulea* Griff. Ex Lindl)
- *Renanthera imschootiana* (Rolfe)



*Paphiopedilum spicerianum* –an orchid species under Wild Life Protection Act



*Vanda coerulea*- an orchid species under Wild Life Protection Act

### Orchids in international cut flower trade

The orchids have taken a significant position in cut flower industry due to its attractiveness, long shelf life, high productivity, right season of bloom, easy in packing and transportation. Orchid accounts for a large share of global floriculture trade both as cut flowers and as potted plants and is estimated around 10% of international fresh cut flower trade. The value of fresh cut orchids and buds trade during 2007-2012 with the average trade value was US \$ 483 million. In 2012, there are more than 40 exporting orchid countries and 60 importing orchid countries around the world, and the total size of the global trade is US \$ 504 million (Table 2).

**Table 2. Value of fresh cut orchids and buds global trade (2007-2012) (Unit : Million US\$)**

Year	2007	2008	2009	2010	2011	2012
Import	233,734,023	252,647,645	232,568,129	251,445,523	265,702,077	267,196,847
Export	230,470,421	238,702,950	217,781,745	227,389,789	244,996,271	237,543,797
Total	464,204,444	491,350,595	450,349,874	478,835,312	510,698,348	504,740,644

Source: Department of Foreign Trade, Thailand (2013)

The Netherlands is the top most orchid exporting country (39.67%) followed by Thailand (28.41%), Taiwan (10%), Singapore (10%) and New Zealand (6%), respectively. Importing countries are mainly Japan (30%), UK (12%), Italy (10%), France (7%) and the USA (6%), respectively. The total orchid cut flower trade of the world mostly consists of 85% *Dendrobium* species and 15% *Phalaenopsis* and *Cymbidium* species and Asia is the main source of orchid to enter the world (Cheamuangphan *et al*, 2013).

Major markets in Asia are occupied by Japan and Singapore. Total imports of orchids by Japan accounted for US\$ 57.4mn in 2008 making it the largest importer of the orchids in the world. The main sources of imports include Thailand, Taiwan, New Zealand and Malayasia together accounting for as much as 96.5% of the total imports of the orchids by Japan in 2008. Imports by Singapore of fresh orchids amounted at US \$ 6.5mn in 2007 with Malayasia, Thailand and Taiwan being the main sources of imports for the country. Imports of fresh orchids by Singapore from India was only US\$ 1379.3 representing a share of 0.02% of the country's total imports of the product in 2007. This clearly indicates that there is vast scope of increasing India's exports to Singapore particularly considering the proximity of the country and India's East Policy.

### **Orchids- a component adapted to the diversified climate**

Orchids are found in nearly every environment in the world. Most of the orchids grown in the home are native to the tropical and subtropical areas of South America. They are usually epiphytic and they grow on the sides of trees, or lithophytic, meaning they grow on rocks. Orchids originating from temperate regions of the world are generally terrestrial and they grow in the soil. Orchids are quite resilient, and can survive many years in the home with proper care. Epiphytic orchids like *Thunia*, *Coelogyne*, *Cattleya*, *Laelia*, *Dendrobium*, *Calanthe*, *Bulbophyllum*, *Aerides*, *Phalaenopsis*, *Aranda* and *Aranthera* with thick leaves and succulent stems have CAM and are drought tolerant with higher water use efficiency.

### **Orchids-organically viable**

Each orchid genus has different requirements for potting media collected from locally available organic sources. It is very important to have the correct medium for each type of orchid, depending on whether it is terrestrial or epiphytic. Growing media commonly include fir bark, coconut husk, sphagnum moss, tree fern fibres, coco peat, leaf mould, saw dust and perlite, and frequently a mixture of two or three of these materials. All orchids potted in a typical bark medium need to be repotted every 18 to 24 months, depending on the needs of the individual plant. Orchids respond well to liquid cowdung manure or fish meal.

### **Landscaping with Orchids**

Orchidscaping is the use of orchids permanently planted into specially prepared beds or attached to trees, shrubs or rocks in the appropriate spot in the garden. These plants can be combined with other traditional ornamentals such as palms, ferns, flowering perennials, shrubs, trees and herbs etc. It is easy to create some of the most interesting and beautiful gardens imaginable, depending upon the cost involvement and microclimatic factors. Many orchids can be grown on rocks and logs for placing in the landscape. They are attached to either cut wooden logs, coconut logs or living trees and shrubs. Once the orchids are established they will attach to the trees and logs (Teoh, 2005). Terrestrial orchids such as *Phaius*, *Spathoglottis* etc. are grown directly in soil. Areas around pools are very suitable for landscaping with orchids. They should be attached to trees surrounding the pool and planted in rockeries in close proximity to the pools. Pools increase their humidity in their vicinity and help to maintain a more even air temperature. Schomburgkias, cattleyas and their hybrids will grow well in well drained rockeries. Standard size cymbidiums provide eye catching feature in the large rockeries and planted particularly as mass plantings in garden beds.

### **Orchids –genetic materials for breeding and species trade**

Several local species of *Vanda*, *Cymbidium*, *Ascocentrum*, *Paphiopedilum*, *Phalaenopsis*, *Calanthe*, *Coelogyne*, *Dendrobium* etc are in great demand in international market for breeding materials (Table 3). In breeding programme, selection of good and healthy plant and flower by visual observation accounts to a great extent. Evidences of natural hybridizations occurring among wild species were reported (Abraham and Vatsala, 1981). Hundreds of natural inter-generic, inter-specific or intra-specific natural hybrids of *Dendrobium* are found in nature. Most of Indian species of *Cymbidium*, *Dendrobium* and *Vanda* studied have been recognized in breeding programme specially to produce primary hybrids due to their inherent attractiveness coupled with their ability to transmit these characters to hybrids. In *Dendrobium*, offspring's of reciprocal crosses show variations in characters like cane length and flower colour, flower size, flowering season and flower yield (Kamemoto *et al.*, 1989). Selection of flower size and flower colour are effective in *Dendrobium* improvement programme (Bobisud and Kamemoto, 1982). In *Cymbidium*, fragrance is the most important character sought after by breeders. *Cymbidium munronianum* has been used as parent in several breeding programmes (Singh, 1984). The higher order hybrid, *Paphiopedilum* F.C. Puddle with six species in parentage plays a predominant role in breeding for white flower colour in the genus (Rogersen, 1991). An extensive breeding programme in *Phalaenopsis* using 29 wild species and 873 varieties were studied by a group of workers (Chen *et al.*, 1995) for development of new hybrids. They

succeeded in developing 35 new hybrids and studied protoplast fusion, isozyme electrophoresis and DNA finger printing to assist in varietal identification. Inter-group hybridization between *Phalaenopsis* type *Dendrobiums* extends flowering season, expands the range of flower colours and shapes and increases the flowering (Davidson, 1994). Majority of commercially grown orchids today are hybrids derived from *Arachnis*, *Vanda*, *Renanthera*, *Ascocentrum*, *Cymbidium*, *Cattleya*, *Dendrobium*, *Oncidium*, *Phalaenopsis* and *Paphiopedilum* (Mercy and Dale, 1997). *Vanda sanderiana* and *V. coerulea* are the two important vandaceous species found in the back ground of most of the vandaceous hybrids (Fuchs, 1997). Polyploidy and intro-gressive hybridization have played an important role in the development of orchid hybrids. Genera like *Cattleya*, *Cymbidium*, *Paphiopedilum*, *Vanda*, *Dendrobium* etc., have given maximum number of man-made hybrids. Most orchids have two basic sets (diploid, 2x) of chromosomes. Tetraploid plants are more fertile bearing flowers of better texture, bigger and more intense colouration (Kumar and Sheela, 2007).

Many Indian species have earned world wide recognition in breeding program due to their inherent attractiveness coupled with their ability to transmit these characters to hybrids. Some of the leading species are *Aerides multiflorum*, *Cymbidium devonianum*, *C. lourianum*, *C. tracyanum*, *C. elegans*, *Dendrobium aggregatum*, *D. chrysotoxum*, *D. formosum*, *D. nobile*, *Paphiopedilum venustum*, *Vanda coerulea* etc. (Bose and Bhattacharjee, 1980).

**Table 3. Orchid species suitable for breeding** (Bose and Bhattacharjee, 1980; Kumar and Sheela, 2007)

<i>Arachnis cathcartii</i>	<i>Ascocentrum ampullaceum</i>	<i>Bulbophyllum leopardinum</i>	<i>Bulbophyllum putidum</i>
<i>Calanthe chloroleuca</i>	<i>Calanthe herbacea</i>	<i>Calanthe masuca</i>	<i>Calanthe plantaginea</i>
<i>Calanthe triplicata</i>	<i>Coelogyne barbata</i>	<i>Coelogyne corymbosa</i>	<i>Coelogyne cristata</i>
<i>Coelogyne fuscescens</i>	<i>Coelogyne nitida</i>	<i>Coelogyne ochracea</i>	<i>Cymbidium devonianum</i>
<i>Cymbidium eburneum</i>	<i>Cymbidium hookerianum</i>	<i>Cymbidium iridioides</i>	<i>Cymbidium lancifolium</i>
<i>Cymbidium longifolium</i>	<i>Cymbidium lowianum</i>	<i>Cymbidium munronianum</i>	<i>Cymbidium tigrinum</i>
<i>Cymbidium tracyanum</i>	<i>Cymbidium whiteae</i>	<i>Dendrobium bensoniae</i>	<i>Dendrobium candidum</i>
<i>Dendrobium densiflorum</i>	<i>Dendrobium farmeri</i>	<i>Dendrobium formosum</i>	<i>Dendrobium gibsonii</i>
<i>Dendrobium infundibulum</i>	<i>Dendrobium nobile</i>	<i>Dendrobium parishii</i>	<i>Dendrobium pendulum</i>
<i>Dendrobium primulinum</i>	<i>Dendrobium wardianum</i>	<i>Dendrobium williamsonii</i>	<i>Paphiopedilum fairrieanum</i>
<i>Paphiopedilum hirsutissimum</i>	<i>Paphiopedilum insigne</i>	<i>Paphiopedilum spicerianum</i>	<i>Paphiopedilum venustum</i>
<i>Paphiopedilum villosum</i>	<i>Papilionanthe teres</i>	<i>Pecteilis gigantea</i>	<i>Phaius flavus</i>
<i>Phaius tankervillea</i>	<i>Phalaenopsis decumbens</i>	<i>Phalaenopsis lobii</i>	<i>Phalaenopsis mannii</i>
<i>Pleione hookeriana</i>	<i>Pleione humilis</i>	<i>Pleione maculata</i>	<i>Pleione praecox</i>
<i>Renanthera imschootiana</i>	<i>Spathoglottis plicata</i>	<i>Thunia alba</i>	<i>Thunia marshalliana</i>
<i>Thunia venosa</i>	<i>Vanda coerulea</i>	<i>Vanda corulescens</i>	<i>Vanda cristata</i>
<i>Vanda pumila</i>	<i>Vanda stangeana</i>	<i>Vanda tessellata</i>	<i>Vandopsis undulata</i>





*Cymbidium lowianum*- a genetic resource for breeding



*Renanthera imschootiana*- a genetic resource for breeding

### Orchid species and hybrids for Cut flower

Orchid species like *Cymbidium iridoides*, *Paphiopedilum fairreanum*, *Papahiopedilum hirsutissimum*, *Paphiopedilum insigne*, *Paphiopedilum spicerianum*, *Paphiopedilum venustum*, *Paphiopedilum villosum*, *Renanthera imschootiana*, *Vanda coerulea*, *Vanda stangeana*, *Vanda tessellata* and *Zygopetalum intermedium* can be directly used as cut flowers. Among hybrids, *Cymbidium*, *Dendrobium*, *Phalaenopsis*, *Odontoglossum*, *Oncidium*, *Cattleya*, *Paphiopedilum*, *Vanda*, *Aeridovanda*, *Aranda*, *Mokara*, *Arachnis*, *Vascostylis*, *Renanthera*, *Rhyncicentrum*, *Rhyncovanda* etc. are important as cut flowers.

### Trend in growth of commercial orchids

*Cymbidium* has been considered as top commercial orchids in Europe since many years. They fetch the highest price in the international markets of which major Asian markets of Singapore and Japan or the Dutch market. In India, Arunachal hills, Sikkim and Darjeeling hills with cool summer night and monsoonal summer rain are ideal for *cymbidium* cultivation. The growth of orchid exports from north eastern hill region especially Sikkim would provide opportunities for employment and also for development of supporting industries like packaging, cold storage and transportation. East Sikkim has been declared as Agri Export Zone exclusively for production of *cymbidium* orchids. In Sikkim, more than 350 hybrids of *cymbidium* orchids are commercially cultivated in an around 25 ha of land and about 5 lakhs spikes are produced annually. 'Levis Duke Bella Vista', 'Madrid Forest King', 'Sparkle Late Green', 'Angelica December Gold', 'Sleeping Nymph', 'Pine Clash Moon Venus', 'Soul Hunt', 'Dr. H. C. Aurora', 'Susan Hughes', 'Tia Gaig Suther Land', 'Miss Sanders', 'Amesbury', 'Kenny Wine', 'Red Star', 'Red Princess', 'Show Gir'l', Jungfrau 'Snow Queen', Jungfrau 'Dos Pueblos', Lilian Stewart 'Coronation', Lilian Stewart 'Party Dress', Orkney 'Pink Heather', Ensikhan 'Alpha Orient', 'Winter Beach Sea Green', 'Fire Storm Ruby' are popular hybrids of *Cymbidium*. A *Cymbidium* grower can earn Rs. 20 lakhs in 10 years from an area of 500 m<sup>2</sup> accommodating 1500 plants after investing 10 lakhs and saling of 55000-60,000 cut spikes (Table 4).

**Table 4. Economics of Cymbidium orchid cultivation**

Plant Population: 1500 Plants / 500 m<sup>2</sup>

Profit: Rs. 30 lakhs in 10 years

Period	Cost of cultivation	No of spikes /plant	Total number of spikes	Price /spike	Year wise net profit
1st Year	Rs. 2.36 lakhs	-----	-----	----	-----
2nd Year	Rs. 11,300/-	-----	-----	-----	-----
3rd Year	Rs. 2.4 lakhs	-----	-----	-----	----
4th Year	Rs. 20,600/-	2	3000	Rs. 50/-	Rs. 1.29 lakhs
5th Year	Rs. 26,150/-	4	6000	Rs. 60/-	Rs. 3.34 lakhs
6th Year	Rs. 26, 150/-	6	9000	Rs. 60/-	Rs. 5.14 lakhs
7th Year	Rs. 26,150/-	6	9000	Rs. 60/-	Rs. 5.14 lakhs
8th Year	Rs. 26,150/-	6	9000	Rs. 60/-	Rs. 5.14 lakhs
9th Year	Rs. 26,150/-	6	9000	Rs. 60/-	Rs. 5.14 lakhs
10th Year	Rs. 26,150/-	6	9000	Rs. 60/-	Rs. 5.14 lakhs
Total	Rs. 6.64 lakhs				Rs. 30.33 lakhs

Dendrobiums are popular flowering potted plants and cut flowers around the world due to their floriferousness, wide range in flower color, size and shape, year round availability and lengthy vase life. Hawaii, California and Florida are major potted Dendrobium growing regions in the United states. Dendrobium hybrids 'Snow White', 'Pagoda White', 'Emma White', 'Big White 4N', 'White Jumbo', 'White 5N', 'Vorawit Blue', 'Lee Chong Blue', 'Kultana Blue', 'Madam Pink', 'Sonia - 16', 'Ear Sakul', 'Candy Stripe Pink', 'Sonia-17', 'Sonia -28', 'Daangsaard', 'Little Lolita', 'Cleopatra', 'Diamond Star', 'Fireball', and 'Little Lolita' are used as cut flowers. From an area of 500m<sup>2</sup> containing 3000 plants a Dendrobium grower can earn 5 lakhs in three years after saling of 3000 number of cut spikes and 3000 mother plants (Table 5).

**Table 5: Economics of Dendrobium cultivation (500m<sup>2</sup>-3000 plants)**

Period	Cost of cultivation.	No of spike /plant	Total no of spikes	Gross income @Rs.10	Total number of keikies	Gross income @ 30/-	Value of mother plant stock @ Rs.300/-
1st Yr.	310000	0	0	0	0	0	-
2nd Yr.	45000	0	0	0	0	0	-
3rd Yr.	50000	1	3000	30000	0	0	9, 00000
Total	4,05, 000	1	3000	30000	0	0	9,00000

#### Orchids- as potted plants/hanging baskets/ trays

Potted orchids last for longer than cut flowers, their shelf life being three weeks to four months depending upon species and hybrids. Tall growing monopodial orchids are best grown in large clay pots upto 30cm in diameter. Terrestrial and semi-terrestrial plants like *Paphiopedilum* and *Cymbidium* perform better in deep pots. Orchid plants as a rule grow to be near one another to aid a microclimate higher in humidity. Basket culture is useful for those orchids like *Vanda*, *Rhyncostylis*, *Arachnis* with pendent flower spikes and long dangling roots. Clay pots are best suitable for terrestrial orchids. Plastic pots are used for epiphytes. Slabs or logs of tree fern are effective for cool growing orchids.

A potting media of terrestrial orchids should have equal parts of leaf mould, soil and sand. Clay soil, bone meal, sawdust, charcoal dust, manure, wood savings etc are also used in various

proportions for satisfactory growth of terrestrial orchids. A potting medium consisting of charcoal, brick pieces and coconut fibre in equal proportions is ideal for vegetative growth and flowering of epiphytic orchids like *Aerides*, *Dendrobium* etc. Under low humid conditions (30%), plastic pots with a mixture of bark/perlite/sphagnum moss or osmunda are used. Under average humidity (35-50%), it is advisable to use plastic pots with a mixture of bark and sphagnum moss. Under high humidity (55% and above), clay pots are used with bark, stone culture, charcoal or tree fern. Important orchid genera used as potted plants in the international market are *Phalaenopsis*, *Oncidium*, *Miltonia*, *Cymbidium*, *Paphiopedilum*, *Dendrobium*, *Cattleya*, *Ascocenda*, *Vanda*, *Brassia* and *Epidendrum* (Lopez and Runkle, 2005).



*Dendrobium densiflorum*- a potted orchid



*Phalaenopsis lobbii*-for wooden tray and tree logs

### Orchids –as herbal medicine and aromatic products

Tribal people of North eastern hill region use wild orchids for a variety of folk medicine as orchids are rich in alkaloids, flavonoids, glycosides, carbohydrates and other phytochemicals (Table 6).

**Table 6 : Common medicinal orchids** (Rao, 2004)

Name of species	Parts used	Uses
<i>Acampe papillosa</i>	Root	Rheumatism, Sciatica and uterine diseases
<i>Aerides odorata</i>	fruit, leaves	The ground fruit used for healing wounds. Juice of leaves is used to heal boils in ear and nose
<i>Cymbidium aloifolium</i>	whole plant	Ground plant to cure chronic illness, weakness of eyes, vertigo and paralysis
<i>Dendrobium nobile</i>	Stems	Fresh and dried stems used in preparation of chinese drugs for longevity and as aphrodisiac, stomachic and analgesic
<i>Habenaria acuminata</i>	Roots	Roots are used as tonic
<i>Phaius tankervilleae</i>	Pseudobulbs	Pseudobulb is used to heal swellings of hands and legs, poultice to soothe pain of abscess
<i>Pholidota imbricata</i>	Pseudobulbs	Pseudobulbs are mixed with mustard oil and applied on joints for rheumatic pain
<i>Rhyncostylis retusa</i>	Roots	Roots are effective against rheumatism, asthma, tuberculosis, cramps, epilepsy, vertigo, kidney stone, menstrual disorder
<i>Arundina graminifolia</i>	Stems	Bulbous stems are used to heal cracks
<i>Dendrobium densiflorum</i>	Leaves	Leaves crushed to paste with salt and applied on fractured area to set bones
<i>Vanda coerulea</i>	Leaves	Leaf juice is used against diarrhea, dysentery



		and external application for skin diseases
<i>Vanda teres</i>	Leaves	Leaf paste to reduce temperature in fever
<i>Vanda cristata</i>	Leaves	Leaves are used as tonic and expectorant
<i>Dendrobium moschatum</i>	Leaves	Leaf juice is used as ear drop
<i>Aerides multiflorum</i>	Tubers	Anti-bacterial
<i>Anoectochilus formosanus</i>	Tubers	Hepatitis, hypertension, cancer
<i>Bletilla striata</i>	Pseudobulbs	Anti-bacterial, anti-inflammatory, demulcent, skin styptic
<i>Cypripedium pubescens</i>	Roots	Anti-spasmodic, diaphoretic, hypnotic, sedative, tonic
<i>Orchis latifolia</i>	Roots	Aphrodisiac, expectorant, nervine tonic, diabetes, diarrhea, dysentery
<i>Eulophia nuda</i>	Tubers	Worm infestation, Scrofula
<i>Habenaria edgeworthii</i>	Leaves and roots	Blood diseases
<i>Habenaria intermedia</i>	Leaves and roots	Blood diseases
<i>Habenaria pectinata</i>	Leaves and tubers	Arthritis
<i>Malaxis acuminata</i>	Pseudo-bulb	Bleeding diathesis, burning sensation, fever
<i>Orchis laxiflora</i>	Bulb	Diarrhoea, bronchitis, convalescence
<i>Vanda spathulata</i>	Flowers	Consumption, asthma, mania
<i>Vanda tessellata</i>	Whole Plant	Fever, arthritis, rheumatism, bronchitis
<i>Calanthe discolor</i>	Whole plant	Hair restoring
<i>Dendrobium chrysanthum</i>	Leaves	Antipyretic, Immunoregulatory, skin diseases
<i>Dendrobium loddigessii</i>	Leaves	Stomach tonic
<i>Habenaria repens</i>	Tubers	Aphrodisiac
<i>Pholidota chinensis</i>	Pseudobulbs	Scrofula, toothache and stomachache
<i>Vanilla planifolia</i>	Sheath	Hysteria, fever, impotence, rheumatism
<i>Cymbidium aloifolium</i>	Rhizomes	Salep; used as nutrient and demulcent; as emetic and purgative
<i>Cym. ensifolium</i>	Rhizomes & Flowers	Eye sores
<i>Cym. longifolium</i>	Pseudobulb	As emetic and demulcent
<i>Cym. giganteum</i>	Leaf juice	Blood clotting

**Common Aromatic Orchids** include *Aerides multiflorum*, *Aerides odoratum*, *Aeranthus Bulbophyllum odoratissimum*, *Cattleya maxima*, *Coelogyne cristata*, *Coelogyne ochracea*, *Cymbidium ensifolium*, *Dendrobium nobile*, *Epidendrum cristatum*, *Epidendrum floribundum*, *Epidendrum nocturnum*, *Lycaste*, *Oncidium spaceolatum*, *Phaius tankervilleae*, *Rhyncostylis retusa*, *Vanda cristata*, *Vanda tessellata*, *Zygopetalum intermedium*

### Orchids-as source of phytochemicals

Many medicinal orchids are rich in alkaloids. Experimental evidences have reported on the isolation of a number of alkaloids like anthocyanins, stilebnoids and triterpenoids from orchids. Orchinol, hircinol, cypripedin, jibantine, nidemin and loroglossin have been reported from orchids.

Some of phytochemicals isolated from orchids along with active ingredient are listed below (Table 7).



**Table7 : Phytochemicals from orchid species**

Sl.No.	Name of orchid	Phyto-Chemical class	Name of phytochemical
1	<i>Aerides crispum</i>	Phenanthropyran	Aeridin
2	<i>Agrostophyllum brevipes</i>	Triterpenoid	Agrostophyllinol
3	<i>Agrostophyllum callosum</i>	Triterpenoid	Isoagrostophyllol
4	<i>Agrostophyllum callosum</i>	Stilbenoids	Orchinol, 6-methoxycelonin, imbricatin, flaccidin, oxoflaccidin, oxoflaccidin, isooxoflaccidin, flaccidin, agrostophyllin, callosin, callosinin, callosumin, callosuminin, callosumidin
5	<i>Arundina graminifolia</i>	Stilbenoids	Arundinan
6	<i>Cypripedium calceolus pubescens</i>	1-4 phenanthrenequinone	Cypripedin
7	<i>Orchis latifolia</i>	Glucoside	Loroglossin
8	<i>Dendrobium macraei</i>	Alkaloid	Jebantine
9	<i>Dendrobium nobile</i>	Bibenzyl	Gigantol
10	<i>Dendrobium nobile</i>	Bibenzyl	Moscatin
11	<i>Dendrobium nobile</i>	Alkaloid	Dendrobine
12	<i>Dracula chimaera</i>	Anthocyanins	---
13	<i>Eulophia nuda</i>	Phenanthrene	Nudol
14	<i>Vanda roxburghii</i>	Glycoside	Melianin
15	<i>Nidema boothii</i>	Triterpenoid	Nidemin
16	<i>Anoectochilus formosanus</i>	Glycoside	Kinsenoside
17	<i>Dendrobium moschatum</i>	Phenanthrene	Rotundatin and moscatin
18	<i>Bulbophyllum gymopus</i>	Phenanthrene	Gymopsin

### Orchids – used as foods

Leaves, tubers and pseudobulbs of different species are used for edible purposes. Vanilla- a major spice crop and source of vanillin comes from *Vanilla planifolia*. *Anoectochilus* leaves are used as vegetables in Indonesia and Malayasia. Pseudobulbs of *Cymbidium maladimum* and *Dendrobium speciosum* and tubers of *Microtis uniflora* and *Caladenia carnea* eaten. The popular beverage called as ‘Faham’ or ‘Madagascar Tea’ on the islands of Mauritius and Madagascar is prepared from orchid *Jumellea fragrans*. The tubers from the orchid genera like *Acianthus*, *Dipodium*, *Glossodia*, *Lyperanthus*, *Prasophyllum* and *Thelymitra* have been used as food by the inhabitants of Australia. In Africa, the tubers of *Cynorchis*, *Eulophia*, *Disa*, *Habenaria* and *Satyrium* are used as food or to extract juice from them. Roots, tubers or rhizomes of *Eulophia*, *Gastrodia*, *Habenaria*, *Orchis*, *Pholidota*, *Platanthera* and *Spiranthes* are used as food in Asia. Tubers of *Disa engleriana*, *D. robusta* and *D. zambica*, *Habenaria clavata*, *Satyrium ambylosacco*, *S. buechananii* and *S. carsonii* used as foods in Malayasia. In Bhutan, the inflorescence or the flowers and pseudobulbs of *Cymbidium* spp. are eaten (Bhattacharjee and Das, 2008).

### Orchids- a special item for value addition:

	
<p>Cilindra - a gift of a glass flute containing a flowering mini Cymbidium.</p>	<p>Stylish setting- Festive packaging for special occasions like Birthday</p>

### Orchids- for festivals and special uses



People of Assam and Arunachal Pradesh use *Rhyncostylis retusa*, *Papilionanthe teres*, *Vanda roxburghii*, *Aerides odoratum* and many *Dendrobium* species in their religious and cultural festivals. In Assam, the flowering spike of *Rhyncostylis retusa* known as 'Kopou Phul' is used by the girls to adorn their hair during the spring festival. The flowers of some other orchids like *Vanda roxburghii* and *Coelogyne nitida* are also used to adorn hair of girls of Assam and Arunachal Pradesh in local festival. The flowers of *Papilionanthe teres* is offered to Lord Buddha and spirits by the Khamtis and other Tai ethnics of Assam and Arunachal Pradesh. In Kameng district of Arunachal Pradesh, *Dendrobium hookerianum*, *Dendrobium nobile*, *Dendrobium gibsonii* are considered as the symbol of purity and sanctity by the local people. Monpas consider the flowers of *Cymbidium grandiflorum* important for holy worship. The young naga women of Manipur wore the orange flowers of *Dendrobium densiflorum* behind their ears. Similarly, the flowers of *Vanda coerulea* are used by the women of Manipur in hair during the autumn puja festival. In several countries orchid species and hybrids are used as National Flowers. For example, Vanda 'Miss Joaquim' in Singapore, *Peristeria elata* in Panama and *Lycaste skinneri* var. *alba* in Guatemala. Orchids are depicted on stamps of several countries like Venezuela, USA, New Zealand, Australia, Indonesia, India, Singapore, Japan, Russia, Thailand, Malaysia and many others (Bhattacharjee and Das, 2008).

### Orchids for dry flowers

Orchids are highly attractive, delicate and available in variety of colours and they can be preserved by drying for use in flower arrangement and dried flower craft. Orchids can be dried best using silica gel for microwave drying or by freeze drying. Drying orchids is a challenging task as these flowers are considered difficult to be preserved. Dried orchids are used for different purposes such as the dried orchids, for use in vases and baskets and sometimes in shadow boxes. Bright flowers of orchid genera like *Dendrobium*, *Cymbidium*, *Paphiopedilum*, *Cattleya*, *Pholidota* etc. can be used for drying.

### Orchid Flower Arrangements

Orchids symbolize wealth, beauty and social status. Orchids flower arrangements are good table decorations and weddings. Among orchids, *Cymbidium*, *Dendrobium* and *Phalaenopsis* are excellent for wedding counter pieces.

	
Dendrobium in flower arrangement	Phalaenopsis in flower arrangement

An arch decorated with chic white silk combined with white orchids can be considered as an admirable orchid flower arrangement. In home, they can be displayed in three ways viz. single flower vases, plants in pots and traditional mixed flower arrangements.

#### Other uses

In Philippines and New Guinea, the stem of some *Dendrobium* species is used to make baskets and bracelets. In some tribes, *Cattleya labiata* var. *autumnalis*, sap is used as glue for musical instruments. In Central America, the Schomburgkias empty pseudobulbs are used to make horn.

#### Impact of climate change on productivity of orchids

Orchids are the most complex, advanced and successful family of flowers on the planet. Epiphytic orchids usually grow on tree trunks or branches and survive through nutrients from decaying organic matter that accumulates around the root zone and on their leaves and are usually distributed in tropical areas. Terrestrial orchids are originated from temperate regions and can tolerate adverse climatic conditions. Climate change due to global warming interacts with habitat loss and fragmentation, introduced and invasive species and population growths and many ecosystems are likely to undergo severe modification. In Asia, climate change is projected to compound the pressures on natural

resources and the environment associated with rapid urbanization, industrialization and economic development. In Latin America, there is a risk of significant biodiversity loss through species extinction in many areas. Semi-arid vegetation will tend to be replaced by arid vegetation. Levels of precipitation are likely to change radically in many areas of the world. Increasing temperature may result in vegetational zones gradually moving vertically up mountain sides, both permitting tropical species to subtropical areas, subtropical species to temperate areas and eliminating the species in the highest zones (Liu *et al*, 2010). Epiphytic orchids may be affected in various ways by changes in the availability of light, nutrients and moisture. Climate change is major threat to pollination services and there is a need to conserve plant communities in which orchids live. The combination of higher temperatures and lower rainfall may make forests more susceptible to fire and it may lead to extinction of local species. During 1984, World Orchid Conference held in Miami, it was proposed that the orchid community should start banking orchid seed as an insurance against possible losses of species from their habitats in the wild. Majority of orchid species are capable of tolerating dry storage for many decades when stored at -20°C. Liquid nitrogen storage may produce further extensions of life spans of orchid seeds. Living collections are recently underutilized as a conservation tool and there is a need to do more to induce members of the wider orchid community.

**Conservation of orchid biodiversity:** Habitat loss, Deterioration and Fragmentation, introduction of exotic species, Overexploitation, Environmental Pollution, Global Warming,

Commercialization of Agriculture and Forestry, Jhum cultivation, Tea plantations, Timber Felling, Forest Fires, Unscientific method of harvesting, Hunting, Soil Erosion, Encroachment Problem, Construction of reservoirs and dams, Charcoal making, Grazing are the causes for loss of diversity. India has strengthened its hold on biodiversity conservation by implementing the Indian Forest Act, 1927; the Wildlife (Protection) Act, 1972; the Forest (Conservation) Act, 1980; the Environment (Protection) Act, 1986; the Biodiversity Act, 2002; the Biodiversity Rule, 2004, etc. India became a party to Convention on International Trade in Endangered Species (CITES) since 1976. India is also a signatory of the Convention on Biological Diversity (CBD) since 1992. A network of protected areas – biosphere reserves, sanctuaries, national parks, arborata, botanical gardens etc. have been established throughout the country. Presently, India has 86 National Parks, 480 Wildlife Sanctuaries, 17 Biosphere Reserves, 13 Botanical Gardens, 13928 Sacred Grooves, Cryo-bank at NBPGR, New Delhi.

Using Satellite Remote Sensing and Geographic Information System by the Indian Institute of Remote Sensing and Department of Space (IIRS), Government of India priority sites identified in all the states of the region and accordingly, actions and strategies have been taken up.

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