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Orchids: An Emerging Floriculture Enterprise in India and its Scope in Himachal Pradesh

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ABSTRACT

Orchids are most fascinating and beautiful of all flowers. Orchids comprise the largest family of flowering plants with 25,000 species belonging to 600-800 genera. The orchids are one of the distinctive plants of nature and highly priced in the international flower trade. Out of 1300 species of orchids of India, 800 species are found in North Eastern Hill Region. Orchid is very climate specific. Himalayas have a total of 200 species, Western Ghats about 300 species and north eastern region harbors about 800 species. The major input constraint is the non-availability of quality hybrids and planting material in large scale. This necessitates an urgent initiation of a strong breeding program based on sound methodologies to develop varieties of internationally accepted quality. R&D support is also necessary to save the valuable genetic resources in a scientific manner. Molecular breeding should also be made an integral part of the crop improvement program.

1. Introduction

In the western world, the first reference to orchids was by Theophrastus considered by many as the Father of Botany. In his study 'Inquiry into Plants' around 300 B.C. he coined the term 'Orchids' to describe some of terrestrial species of orchids. 'Orchids' is a Greek word meaning testicles. Orchids are most fascinating and beautiful of all flowers. They exhibit a wide range of diversity in form, size, colour and texture of flowers beyond the imagination of human mind. This manifold and perplexing range of floral structures arouse our highest admiration. Orchids constitute an order of royalty in the world of ornamental plants and they are of immense horticulture importance and play very useful role to balance the forest ecosystem. The orchids are one of the distinctive plants of nature and highly priced in the international flower trade due to their incredible range of diversity in size, colour, shape, forms, appearance and long lasting qualities of flowers. They are considered as high value flowering plants as cut flowers well as potted plants. Orchids comprise the largest family of flowering plants with 25,000 species belonging to 600-800 genera. They are prized for their incredible diversity in the size, shape 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, Malaysia, 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. Orchids have emerged

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as an important item in the global cut flower trade. In the international trade, orchid genera mainly Cymbidium, Dendrobium, Paphiopedilum, Phalaenopsis, Vanda, Cattleya and Oncidium are used for cut flower production.

In India, flowers are grown in an area of 1.91 lakh hectares (Anon., 2011), out of which 45,000 hectares is under modern cut flowers such as rose, chrysanthemum, gladiolus, carnation, tuberose and orchids. Cultivation of traditional flowers such as jasmine, marigold, champaka and crossandra still dominate the floricultural scenario in our country. Out of 1300 species of orchids of India, 800 species are found in North Eastern Hill Region due to their congenial climatic conditions, diversified topography and altitudinal variation. Among flower crops, orchids contribute 10% share in international trade. In addition, the Sikkim Himalayan region is the centre of origin of an important species like Cymbidium. Other valuable genera of commercial importance available in the region are Coelogyne, Dendrobium, Paphiopedilum, Pleione, Rhyncostylis, and Vanda etc. Varied Agro-climatic conditions of our country is highly favourable for cultivation of commercial orchids like Cattleya, Vanda, Dendrobium, Arachnis and Aerides in tropical areas, Cymbidium hybrids, Paphiopedilum, Dendrobium hybrids and Phalaenopsis in subtropical areas and Cypripediums, Cymbidiums etc in temperate areas. Among orchids, Cymbidiums, Dendrobiums, Phalaenopsis, Cattleyas, Vandas, Arandas, Arachnis etc. used as cut flowers whereas Aerides, Arachnanthe, Bulbophyllum, Calanthe, Coelogyne, Eria, Phaius, Phalaenopsis, Pleione, Rhyncostylis are used as potted orchids.

Though India possesses climatic advantage in comparison to the European countries, it failed to exploit this potential due to lack of required research support to this area. Orchid is very climate specific and requires constant monitoring for the management of temperature, light, humidity, water and nutritional requirements. Every item should be always perfect to make it a success story. So it is necessary to standardize the production technologies to the perfection. Another major input constraint is the non-availability of quality hybrids and planting material in large scale. This necessitates an urgent initiation of a strong breeding program based on sound methodologies to develop varieties/ hybrids of internationally accepted quality. Molecular breeding should also be made an integral part of the crop improvement program to incorporate noble characters in an accurate and rapid fashion. Mass multiplication of quality hybrids or lines through tissue culture is another priority. Standardization of post-harvest management in another major concern and is to be addressed on urgent basis. Research on integrated pest and disease management is also a need of hour. Proper research support is also necessary to save the valuable genetic resources in a scientific manner.

Trade of Orchids in the World Market:

The expert committee set up by Govt. of India for promotion of export oriented floriculture units has identified Bangalore, Pune, New Delhi and Hyderabad as the major areas suitable for such activity especially for cut flowers. APEDA (Agricultural and Processed Food Products Export Development Authority) is the registering authority for such units. Cultivation of orchids has become a very profitable occupation as it is one of the most important ornamental plants. Development of new hybrids and commercial production of cut flowers in orchids has expanded tremendously. Presently, orchids are grown as subsidiary crop in major producing areas. So there is vast market potential in the domestic and export market which is yet to be tapped. There is tremendous scope for orchid improvement and development of industry based on these wonderful plants.

India accounts for nearly 7% of worlds orchid biodiversity contributing 1300 species which are distributed in five major phyto-geographical regions viz. North eastern Himalayas, Peninsular region, Western Himalayas, Western Ghats and Andaman and Nicobar Islands (Table 1).

India's exports of floriculture products comprising cut flowers, loose flowers, saplings, potted plants, seeds and bulbs, micropropagated plants, floral oil and concretes, natural dyes from flowers and plants, dry flowers and plant parts, ornamental plants for interior decoration and landscaping increased from US $ 22.0 million in 2005 to US$ 29.6 million in 2008 recording a CAGR of 10.4% (Table 2). The main markets for India’s exports of cut flowers were largely the developed countries like Japan, USA, Netherlands, UK and Germany.

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 4).

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. In the total orchid cut flower trade of the world Dendrobium species constitute 85% share followed by Phalaenopsis and Cymbidium species having 15% share. Asia is the main source of orchid to enter the world market.

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 Malaysia 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 Malaysia, 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 (Source: International Enterprise Singapore).

2. Major Orchids and their growth trends:

Cymbidium:

Cymbidiums are among the most popular winter and spring blooming semi-terrestrial orchids originated from tropical and subtropical Asia covering North Eastern India, China, Japan, Malaysia, the Philippines, Borneo islands and North Australia, usually grown in cooler climates at high elevations. Cymbidiums are highly valued for genetic resources, cut flowers, hanging baskets, potted plants and herbal medicines. 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. Cymbidiums imported from the Netherlands fetched as much as 11.18 US$ per stem in Singapore those imported by Japan from New Zealand fetched US $ 3.33 per stem. As per Dutch Auction market is concerned, the cymbidiums fetched highest value averaging Euro cents 331 per stem during 2003-2007 period (Source: CBI Market Survey, Cut Flowers and Foliage Market in the EU).

Table 1: State wise distribution of orchids in India

State	Orchids (Number)		State	Orchids (Number)	
	Genera	Specie		Genera	Specie
A & N islands	59	117	Maharashtra	34	110
Andhra Pradesh	33	67	Manipur	66	251
Arunachal Pradesh	130	600	Meghalaya	98	352
Assam	81	191	Mizoram	74	246
Bihar	36	100	Nagaland	63	241
Goa, Daman & Diu	18	29	Orissa	48	129
Gujarat	10	25	Punjab	12	21
Haryana	3	3	Rajasthan	6	10
Himachal Pradesh	24	62	Sikkim	115	496
Karnataka	52	177	Uttarakhand	77	237
Kerala	77	230	Uttar Pradesh	19	30
Tripura	34	52	West Bengal	82	322

Source: NRC for Orchids, Pakyong, Sikkim

Table 2: India's export markets of cut flowers (US $ million)

Country	2005	2006	2007	2008	CAGR (%)
Japan	3.21	12.15	63.84	7.79	34.4
USA	4.22	4.56	3.23	4.55	2.5
Netherlands	3.23	2.38	3.17	3.71	4.7
UK	2.32	2.62	2.26	2.77	6.1
Germany	1.76	1.84	2.74	1.99	4.2
UAE	0.71	0.78	1.18	1.05	13.9
Italy	1.16	1.08	0.92	0.85	-9.8
Spain	0.2	0.46	0.58	0.64	47.4
Poland	0.17	0.03	0.33	0.57	49.7
Malaysia	0.14	0.19	0.22	0.54	56.8
Australia	0.53	0.43	0.55	0.52	-0.6
World Total	**22.01**	**31.46**	**90.45**	**29.59**	**10.4**

The recent export scenario of orchids in Indian context is given below in table 3

Table 3. Export of orchids from India (Rs. in lacs & quantity in MT)

Country	2010-2011		2011-12		2012-13	
	Quantity	Value	Quantity	Value	Quantity	Value
Bahrain					0.20	1.43
Maldives	0.04	0.18	0.13	0.56	0.27	0.96
Kenya	0.00	0.00	0.04	0.05	0.06	0.09
Sri Lanka	0.00	0.00	0.00	0.00	0.02	0.03
Qatar	0.00	0.00	0.01	0.02	0.00	0.00
Singapore	4.77	3.08	0.00	0.00	0.00	0.00
UAE	0.04	0.06	0.20	0.35	0.00	0.00

Source: DGCIS Annual report

Table 4. Value of fresh cut orchids and buds global trade (2007-2012) (US$Million)

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
Exports	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)

Dendrobium:

Dendrobiums are popular flowering potted plants and in the world market these are famous as cut flowers due to having 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. In the Netherlands, production of potted orchids is now 40 to 50 million units with increasing demand of Dendrobium. Imports from Thailand, the world's largest exporter of tropical cut orchids and second largest supplier to the EU, accounted for 22% of supplies to the EU. Thailand holds a particularly strong position in Dendrobium orchids.

Phalaenopsis:

Phalaenopsis is the second most valuable and popular flowering potted plant and cut flower around the world due to their easy cultural practices, diversity in flower colour , size and shape, year round availability, delicacy and longer vase life. It is commercially grown in Germany, Japan, The Netherlands, Taiwan and United States. In the United States, 75% of all orchids purchased are Phalaenopsis and about 13,500,000 Phalaenopsis were sold in 2005 in United States. The export value of Phalaenopsis from Taiwan to the United States increased from $8 million in 2005 to $ 13 million in 2006. Worldwide turnover of Taiwanese Phalaenopsis increased from $ 27. 5 million to $ 35.4 million from 2005 to 2006.

Other Tropical Orchids:

Vanda is widely distributed throughout Australasia from China through the Philippines, Indonesia, Malaysia, New Guinea and Australia, Myanmar, Thailand, India and Sri Lanka. In the world tropical orchid trade, Dendrobium is the most dominant crop in addition to Mokara, Oncidium, Aranthera, Aranda, Vanda, Arachnis, Renanthera , Ascocenda, Phalaenopsis, Cattleya and Paphiopedilum which are being grown as cut flowers and potted plants. Thailand is the largest world exporters of tropical orchids. China is the largest consumer of orchid cut flowers from Thailand 7,493 tons followed by Japan, USA, Italy, India, Taiwan, Vietnam and the Netherlands at 4,407, 2892, 2395, 1830, 983, 793 and 689 tons, respectively. Other significant orchid genera being exported from Thailand were Mokara, Aranthes, Aranda, Oncidium, Vanda, Arachnis and Ascocenda with the market share of 3.69, 0.52, 0.48, 0.44, 0.13, 0.01 and 0.01 % of total export value respectively.

Scope of Orchids in Himalayas

Himalayas have a total of 200 species, Western Ghats about 300 species and north eastern regionharbors about 800 species. The varied altitudinal variations starting from foot hills to high Himalaya's mountain range and deep river valleys with high monsoonal rain and humidity, distinguished soil characteristics have played a vital role to develop a rich biodiversity of orchids in the north eastern hill region.

In India, Arunachal hills, Sikkim and Darjeeling hills as well as hills of north western Himalayas with cool summer night and monsoonal summer rain are ideal for cymbidium cultivation. The growth of orchid exports from these areas 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 250 hybrids of cymbidium orchids are commercially cultivated in an around 25 ha of land and about 5 lakhs spikes are produced annually.

Ornamental orchids: There are certain ornamental species found in India especially belonging to the genera Aerides, Ascocentrum, Calanthe, Cymbidium, Dendrobium, Epidendrum, Pephiopedilum phaius, Renathera, Rhynchostylis, Vanda, etc. Some of them are epiphytic and others are terrestrial requiring different techniques for growing.

Rhynchostylis retusa, an epiphytic herb is the state flower of Arunachal Pradesh and is found in abundance in the foothills of Arunachal Pradesh and throughout the plains of Assam. The inflorescences of this orchid are used as adornment by the young girls of Arunachal Pradesh, Assam, Tai ethnic and other Tibeto-Burman tribes in Myanmar, China, Northern Thailand, Laos and Northern Vietnam.

Medicinal Value of Orchids:

From ancient times orchids are being used in the traditional systems of medicine like Ayurveda, Siddha, Yunani, Homeopathy, Traditional Chinese Medicine (TCM) etc. Chinese described *Bletilla striata* and a Dendrobium species in *Materia Medica* of Shen-nung (28th Century B. C.) and many orchids in Chinese culture are also considered as symbol of friendship, perfection, numerous progeny, noble and elegant (Reinikka, 1995). In India, there are nearly 1600 species which constitute about 9% of the total flora (Medhi and Chakrabarti, 2009). Therapeutic importance of Indian orchids in treating ailments like nervous disorders (Cymbidium elegans, Cypripedium pubescens), hypertension and allergy (Gastrodia elata), rheumatism (*Acampe papillosa*), burns (*Coelogyne punctulata*), dermal problems (*Dendrobium monticola*), tuberculosis (*Coelogyne henryi, Malaxis acuminata*) and malignancy (*Vanda testacea*) is well documented in literature (Lawler, 1984 and Handa, 1986). There are certain other additional uses of orchids such as aphrodisiac and restorative drugs, as a source of food, gums, narcotics and poisons, etc. *Vanilla planifolia* and related species of orchids are cultivated as plantation crops to source 'Vanillin'. Even today, number of ethnic communities in India and other parts of the world use several species of orchids in their traditional system of medicines (Table 5).

In Ayurveda, a group of 8 medicinal plants called 'Astavarga' is used in the preparation of different types of rejuvenating tonics including 'Chyavanprash' and 4 of these (*Habenaria edgeworthii, H. Intermedia, Malaxis acuminata, M. muscifera*) are orchids. The therapeutic importance of orchids is due to presence of phytochemical contents such as alkaloids, glycosides, flavonoids etc. (Hossain, 2011); they are however, mainly used as nutraceuticals because the active principles responsible for their medicinal properties are yet to be identified with further accuracy. Himachal Pradesh, a mountainous Indian state in the Northwestern

Himalaya, is rich in orchid resources; about 78 species (Vij et al., 2011) including many of ornamental (*Aerides multiflora*, *Calanthe sp.*, *Rhynchostylis retusa*, *Vanda cristata*, etc.) and therapeutic (*Dactylorhiza hatagirea, Eulophia dabia, Habenaria edgeworthii, H. intermedia, Malaxis acuminata, M. muscifera, Satyrium nepalense, Vanda testacea,* etc.) importance occur here. Present communication deals with 4 of such therapeutically important orchids (Table 6) that constitute the integral part of "Astavarga" herbs.

Literature studies reveal that all of the above mentioned 4 orchids are the integral constituents of Chyavanprash which is a general energy booster and thought to strengthen immune system of the body. It is used as an antioxidant and against chronic respiratory diseases. Antioxidant property of Chyavanprash helps in coping with stress and different types of health problems faced by man in the present time. As compared to other traditional polyherbal drugs like geriforts, septilin, mentat, Gingko biloba and triphala, Chyavanprash has been found to be most effective against nitric oxide whose accumulation in body may prove carcinogenic beyond certain limit (Jagetia et al., 2004). Presently, the demand of these orchids has been increased many folds especially in Himachal Pradesh and Uttarakhand where a large number of pharmaceutical units have been established recently by various companies such as Divya, Dabur, Himalaya, etc. These plants are becoming so rare that different ayurvedic formulations are now using other substitutes at their place. The species like *H. Intermedia* (Chauhan et al., 2007) and *M. muscifera* (Chauhan et al., 2008) have been exploited at such a level, that they have been considered as endangered species. Similarly the other 2 species, *M. acuminata* and *H. edgeworthii* are also facing the survival threats. Thus, there is an urgent need to take every possible measure to conserve the gradually declining natural population of these valuable plants both by in-situ and ex-situ means.

a) For in-situ conservation, plants can be conserved in their natural habitats with least disturbances in their microclimatic requirements:
   - There is urgent need to make local people aware about the importance of biodiversity that sustain their life. This could be possible through organizing seminars, workshops and discussions.
   - Tourists should be strictly instructed not to tamper with local flora and fauna. They should avoid littering with non-biodegradable objects such as polythene bags, wrappers and plastic bottles in natural habitats
   - Grazing should be regulated. Same area should not be used for grazing during every year as young plants mortality is very high where grazing is frequent. Grazing animals not only eat away the young inflorescences and/ or fruits (thereby affecting seed production) but also unroot the pseudobulbs and tubers, thereby adversely affecting their natural increment in wild population
   - Illegal collection of the plant germplasm should be checked.

b) For ex-situ conservation: Cost effective and highly reproducible protocols need to be developed for the mass multiplication by means of in vitro micropropagation where only very small amount of plant material is required. It will help to conserve these highly valuable plants and fulfil their increasing demand in the pharmaceutical companies. It will also help in reducing the collection pressure on the wild population. Also, the micro propagated plants should be subjected to effective acclimatization procedures, so as some of these could be rehabilitated back to their natural abodes

Moreover, there is an urgent need to link the indigenous knowledge of medicinal plants including orchids to modern research activities so as to accelerate the rate of drug discovery. Studies are required to be search alternative synthetic molecules as done in Vanillin (4-hydroxy-3-methoxybenzaldehyde) that can successfully substitute the growing demand of herbal orchids so as to aid in their conservation.

Potential of Himachal Pradesh for Cultivation of Orchids:

Trade in floriculture is developing rapidly and the trends are shifting fast in favour of orchids which command a high price and demands in trade. Himachal Pradesh is having congenial climatic conditions for the cultivations of cymbidium orchids. There is good demand for orchid cut-flower in cosmopolitan cities like Delhi, Kolkata and Mumbai and once the cut-flower reach the dealers, they are distributed to the retailers spread over the cities. Today Cymbidium cut-flowers are sold by the retailers at a cost ranging from Rs. 45/- to Rs. 120/- each depending upon the quality, colour, number and size of cut-flower spikes. Once the cut-flowers reach the market place, best quality cut-flowers are separated out and then exported to various countries like Europe, USA, Japan, Singapore and Thailand etc. New Zealand produces cut-flower in the

summer months from May to August, whereas orchids of India are available from October to March. Hence, there is a good export market potential for Cymbidiums. R&D institutes like CSIR-IHBT, Palampur, Dr. YS Parmar University, Solan and CSK HPKVV, Palampur can play a vital role for the establishment of this flower industry in the state. Further, there are abundant opportunities to strengthen the linkages among different national and international agencies engaged with the improvement of flower crops like orchids. Expansion of orchid based floriculture to non-traditional and tribal areas can generate employment opportunities. The floriculture enterprise especially orchids are most suitable for marginal and small farmers of Himachal Pradesh. Cultivation of orchids is most economical as it gives maximum return per unit area and ensures financial security to the farmers. Above all, flowers like orchid growing offer more employment opportunity to the growers and exporters. Internationally orchid hybrids are in great demand in cut flower industry. There is need to generate talented manpower in Himachal Pradesh with an aim to produce hybrids with ideal ideotypes.

But since orchids are considered as rare and endangered plant group, it has been regulated under the Convention on International Trade in Endangered Species of wild flora and fauna (CITES) and Wild Life Protection act of Government of India, it is mandatory to register the orchid farms under Wild Life Preservation offices. Any orchid to be traded must be nursery propagated in the nursery or in vitro cultured. Trade of orchids collected from the wild is totally prohibited. Noting the global importance and realizing the export potentials, Government of India has also initiated assistance schemes under various organizations like Agricultural and Processed Food Products Export Development Authority (APEDA), National Horticulture Board, National Agricultural Bank for Rural Development (NABARD), North Eastern

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Table 5. Orchids with medicinal values.

Botanical name	Parts used	Therapeutic use
Acampa anthropophora	Plant	Anti malaria
Acampa papillosa	Root	Rheumatism
Aerides odoratum	Plant	Anti tuberculosis
Cymbidium aloifolium	Plant, Pod	Emetic
Cypripedium clegans	Plant	To cure nervous disorder
Dendrobium nobile	Seeds	Wound healing and cure nervous system
Goodyera pubesecus	Roots	Antidotes for smoke and mad dog bites
Goodyera oblongifolia	Entire Plant	To cure gout
Ryncostylis retusa	Plants	As emollient for softening/ soothing
Vanda testacca	Leaves and flowers	Rheumatism, nervous disorder and scorpion bite.

Source: Orchid Research and Development Center (ORDC), Tipi.

Table 6. Orchids of Astavarga group and their distribution range in Himachal Pradesh (H. P.), India.

S. No.	Botanical name	Ayurvedic name	Part used	Distribution range in H.P.	Flowering period
1	*Habenaria edgeworthii* Hook. f. ex Collett	Vriddhi	Tuberous root	1500-3000 m	July - August
2	*Habenaria intermedia* D. Don	Riddhi	Tuberous root	1500-2800 m	July - August
3	*Malaxis acuminata* D. Don	Rishbhaka	Pseudobulb	1750-2300 m	July - August
4	*Malaxis muscifera* (Lindl.) Kuntze	Jeevak	Pseudobulb	1800-3650 m	July - August