14

Potential of Floriculture in the Hindu-Kush Mountains

Vishnu Swarup

Introduction

The beauty of the Hindu-Kush mountains, including the Himalaya and the neighbouring hills, lies in its woods where exquisite wildflowers of every conceivable colour and hue occur. These mountains have a wide range of altitudes from the foothills to the alpine region, and a variety of climates varying from tropical and sub-tropical at the foothills with mostly deciduous species, to temperate evergreen forests, to the alpine belt with extremely low temperatures and stress conditions.

Of the 6700 endemic plant species and 134 genera comprising 61 per cent of the total Indian flora, approximately 3000 species occur in the Himalaya and the Khasi hills in the northeastern regions. The northeastern Himalaya and the southeastern provinces of Yunnan and Szechuan in China are the centres for the evolution of several important ornamental plants, such as *Rhododendron, Camellia, Magnolia, Maconopsis, Buddleia, Prunus, Primula denticulata, Primula roses, Sorbus, Viburnum, Paeonia, Eremerus himalaicus, Clematis montana, Iris nepalensis, Jasminum,* rose species and many species of orchid—(*Aerides rosea, Coelogyne cristata, Cymbidium* sp. *Dendrobium aggregatum D. chrysotoxium, D. nobile, Paphiopedilum insigne, P. villosum; Phalaennoosus* sp. *Pleione maculata, Spathoglottis plicata,* and *Vanda coerulea*

The Himalaya mountains have attracted many plant collectors from various parts of the world. An important collector was Frank Kingdom-Ward from Great Britain who visited Assam and Burma about five to seven times from 1938 to 1956. He discovered the blue poppy (*Meconop-*

sis aculeta) for the first time. Ludlow and Sheriff, also from England, explored the Kashmir area during the years 1939–1941, as also Tibet and Bhutan. There were similar expeditions to the northeastern Himalayas, Nepal, Sikkim, and Bhutan, from the United Kingdom, other European countries, the United States, and Japan. Many species of orchid and rhododendron of the Himalayan region have been extensively used to breed new varieties and hybrids in the United Kingdom, Europe, the United States and other countries. Unfortunately, many species of *Rhododendron, Meconopsis,* orchid, *Magnolia,* and *Primula* have either become extinct or are considered rare and endangered. The conservation of these endangered species and other useful flora has become a matter of great concern to all the countries of this region. To protect the endangered species, some countries have established biosphere reserves, plant or gene sanctuaries, and germplasm banks. There is also a ban or control on the movement of wild species from one country to another by the Convention on International Trade in Endangered Species (CITES, 1973), which has been ratified by 43 countries of the world.

Research and Development of Floriculture in India

For the last two decades there has been an awareness of the potential of floriculture in India. In the year 1960, some ad hoc research projects were started by the Indian Council of Agricultural Research (ICAR), New Delhi. Later, with the establishment of the Indian Institute of Horticultural Research (IIHR) at Bangalore in 1968, research on floriculture was intensified in its newly started Division of Floriculture and Landscaping. From 1970/71 onwards, multidisciplinary research on floriculture at several locations, representing different agroclimatic conditions, was taken up at the agricultural universities in various states and the central research institutes of ICAR. The National Botanical Research Institute (NBRI) in Lucknow (Uttar Pradesh) and the complex at Palampur (Himachal Pradesh) of the Council of Scientific and Industrial Research are also engaged in research on ornamentals. The expenditure on floriculture research is approximately Rs. 30 million annually.

The main emphasis is on evolving improved varieties by breeding, improvement of agro-techniques, including control of diseases and insect pests, and post-harvest technology. Research is concentrated on the rose, carnation, chrysanthemum, orchid, gladiolus, tuberose, jasmine, bougainvillaea, and a few other seasonal flowers. Varietal testing and selection, standardization of agro-techniques of cut flower crops, pretreatment, handling, and packaging of cut flowers for export are receiving special attention. The important research centres for rose are located at Delhi (IARI) and Pune, for gladiolus at Bangalore (IIHR), Delhi (IARI), and Lucknow (NBRI), for jasmine at Coimbatore, for chrysanthemum

at Lucknow (NBRI), for carnation at Ludhiana (Punjab), for orchid at Bangalore (IIHR) and Kalimpong (West Bengal), and for bougainvillaea at Delhi (IARI), Bangalore (IIHR), and Lucknow (NBRI).

More than 300 varieties of rose have been evolved in India by research scientists, nurserymen, and amateur rose breeders. The agro-techniques of growing roses in the open for cut flowers and their packaging for export have been standardized. Similarly, several varieties of chrysanthemum were developed for garden display, for cut flowers and also for flowering in the off-season (summer and rainy season). Dwarf and compact chrysanthemum varieties which do not require pinching have been developed for pot culture. Both standard and spray type of carnation varieties have been selected for cut flowers, bedding, and pot culture. At IIHR, Bangalore, orchid species and hybrids are being multiplied by meristem culture and a few hybrids have also been evolved. Many attractive varieties of gladiolus suitable for cut flowers were developed at IIHR (Bangalore), IARI (New Delhi), and NBRI (Lucknow). Several bougainvillaea varieties have been developed at NBRI (Lucknow), IIHR (Bangalore), and IARI (New Delhi), and by private nurserymen and amateurs. Commendable work has been done on improvement and agro-techniques of jasmine at Coimbatore. High plant density was recommended for commercial cut flower crops of roses (62,000 plants per hectare), gladiolus (60 plants per sq/m.), and carnation (4,40,000 plants per hectare for standard and 330,000 per hectare for spray types).

The contribution of private nurserymen and amateurs to the improvement of rose, orchid, bougainvillaea, croton, hibiscus, chrysanthemum, dahlia, and other ornamentals is also praiseworthy. A couple of nurseries in Kalimpong propagate orchid species and hybrids by meristem culture and by seeds in flasks in the laboratory. The production of quality plants, particularly indoor plants, is a speciality of nurseries at Bangalore, Calcutta, Trivandrum, and Cochin. Kalimpong and Sikkim are famous for cacti and succulents, gerbera, and corms or bulbs of gladiolus, amaryllis, crinum, sucharis, hemerocallis, haemanthes, zephyranthes, and lilies. Srinagar, Nainital, and Almora are other good sources for gladiolus corms. Srinagar is also important for bulbs of temperate flowers like narcissus, daffodil, hyacinth, and lily. A leading nursery, Indo-American Hybrid Seeds in Bangalore, produces hybrid seeds of flowers for domestic sale and export. It has also started propagation of ornamental plants by tissue culture for both export and local markets. Another company, A.V. Thomas at Cochin, also produces tissue-cultured plants of ornamentals, cashewnut, cardamom, banana, and other kinds of plants for export and domestic markets.

Floriculture Industry in India

The domestic floriculture trade comprises cut flowers and its products, such as vani, floral ornaments, garlands, bouquets, floral baskets, live plants, bulbs, corms, tubers, and seeds. There are two kinds of flower markets: the traditional market dealing with loose and destalked flowers of jasmine, fragrant rose, small chrysanthemum, crossandra, marigold, aster, and tuberose, and florist shops selling long-stalked and better quality of rose, carnation, chrysanthemum, gladiolus, tuberose, lily, narcissus, daffodil, peony, gypsophila, goldenrod, orchid, and other seasonal flowers, bouquets, and flower baskets.

It is estimated that about 34,000 hectares are under flowers and ornamental plants, including 24,000 hectares for traditional flowers and 10,000 hectares under modern cut flowers. At the retail level the floriculture industry is worth Rs. 205 crores, comprising traditional flower sales valued at Rs. 105 crores and florists' cut flowers valued at Rs. 100 crores. About Rs. 15 million worth of seeds, bulbs, and live plants are traded in the domestic market.

The hilly areas are important sources for the supply of cut flowers, bulbs, and plants to the plains. Cut flowers are sent to the plains during the off-season. Cut flowers of rose, gladiolus, lily, narcissus, daffodil, peony, carnation, and chrysanthemum are supplied regularly from Srinagar to Delhi and Bombay markets during the summer months. Gladiolus comes to Delhi from the Kumaon hills (Nainital and Almora district, Uttar Pradesh). Similarly, Kalimpong and Gangtok (Sikkim) send gladiolus, gerbera, and orchids to Calcutta. Gladiolus, rose, and other flowers are supplied from the Ooty hills to Bangalore, Madras, and Bombay markets. Carnation and chrysanthemum in small pots are transported from the Shimla hills to Delhi and Bombay. Orchids from Kalimpong, Darjeeling, and Gangtok are supplied to Calcutta and Delhi markets. The plants of gerbera, geranium, fuchsia, azalea, camellia, magnolia, juniper, begonia, iris, and other temperate species are available from Srinagar, Darjeeling, Gangtok, and Kalimpong.

Potential of Floriculture in the Hills

Floriculture is a promising enterprise in the hilly regions. There is potential to develop floriculture dealing with cut flowers, cut foliage, bulbs, tubers, corms, seeds, live plants, dry flowers and foliage, and perfumes. Flowers are high-value crops with a higher income per unit of growing area than other horticultural crops (14.1).

TABLE 14.1
Income from flowers per unit growing area

Flower	Cost of production (Rs.)	Profitability (Rs.)	Return % of cost (Rs.)
Orchid	2,16,000	88,000	41
Gladiolus	85,000	34,000	40
Carnation	38,000	12,000	33
Chrysanthemum	23,000	8,000	34
Rose	58,000	20,400	33

Cut Flowers

For cut flowers, orchid, gladiolus, carnation, chrysanthemum, rose, tulip, hyacinth, iris, daffodil, narcissus, gerbera, amaryllis, tuberose, peony and lily are the most important plants grown in the hills. There is a great demand from the florists in the big cities. Some of these flowers are described here:

ORCHID

Among flowers, the orchid is one of the most fascinating, long lasting and expensive, both in domestic and in foreign markets. The price of a single spray of orchid is Rs. 20–30 in Delhi and Bombay markets. In Kalimpong the price ranges from Rs. 36 to Rs. 360 for a dozen, depending upon species. An orchid plant in a small pot costs Rs. 18–20. The Himalayan region is the natural habitat of the orchid species. It is estimated that in India there are about 1300 orchid species, of which 800 species occur wild in the northeastern Himalaya, 200 species in the northwestern Himalaya, and 300 species in the Western Ghats and Deccan peninsula. (Tables 14.2 and 14.3).

The important wild orchids of the northeastern Himalaya are *Cymbidium, Paphiopedilum, Dendrobium, Vanda, Pleione,* and *Phaleonopsis.* These have attractive flowers and many hybrids have been evolved using them in hybridization with other genera and species by orchid breeders of the world. It is not difficult to produce plants and cut flowers of *Cymbidium* and *Paphiopedilum* in the northeastern Himalayan region. Plantlets of species and also hybrids raised from seeds in flasks and by merciloning in a tissue culture laboratory are already being produced successfully by nurserymen in Kalimpong. At present, production is limited, but it can be increased by providing assistance to the nurseries in the form of bank loans on lower rates of interest with longer period of repayment, improving infrastructural facilities, and giving subsidies on agro-inputs. Financial assistance will be helpful in the export of orchids. The important

TABLE 14.2
Distribution of orchid species

Region	No. of species
Northeastern region	
Assam	150
Arunachal Pradesh	368
Meghalaya	300
Manipur	250
Nagaland	150
Tripura	100
Southern region	
Western Ghats, Deccan peninsula	300
Karnataka	170
Tamil Nadu, Andhra Pradesh	200
Maharashtra	130
Bihar, Orissa, West Bengal	200
Andaman and Nicobar	70
Northwestern Region	
Jammu and Kashmir, Haryana, Himachal Pradesh, Punjab, Uttar Pradesh hills	200

TABLE 14.3
Important natural habitats of orchids

Assam	Rani, Kaki, Garampani, Orang, Digdoi
Meghalaya	Kawphlong, Cherrapunji, Jarain
Arunachal Pradesh	Rupa valley, Salbeli Kameng, Subansiri, Sian, Tirap
Sikkim	Rabongola, Mangan, Tsunythang, Gangtok
Uttar Pradesh	Kumaon hills, Valley of flowers and Govind Ghat, Chamoli district, Thaiaskot, Pithoragarh district
Nilgiri ranges	Kodaikanal, Papanasam, Kannikaddi and Yercaud hills, Western Ghats

commercial orchid-growing areas are located in Kalimpong, Darjeeling, Sikkim, Shillong, Arunachal Pradesh, Calcutta, Bangalore, Pune, Bombay, and Trivandrum.

GLADIOLUS

Gladiolus is very popular in the cut flower industry in India. It has

a majestic spike with a dozen or more florets of attractive colours and varying shapes and sizes and good keeping quality. The gladiolus spikes are commonly used in flower arrangements and bouquets. It is grown both in the plains and the hills. The important commercial gladiolus-growing areas are located in Srinagar (Jammu and Kashmir), Delhi, Ludhiana and Chandigarh (Punjab), Pune and Nasik (Maharashtra), Bangalore (Karnataka), Lucknow, Ghaziabad, and Muradnagar (Uttar Pradesh), Baga (Haryana), Kumaon and Garhwal hills in Uttar Pradesh (Nainital, Almora, Dehra Dun, Mussoorie, Haldwani, Srinagar), Gangtok (Sikkim), Darjeeling and Kalimpong (West Bengal). In the plains it flowers from October to March, while in the hills it flowers during May-June and August-September. Gladiolus flowers from Shimla, Nainital, and Srinagar are supplied to florists in the big cities in the plains during the off-season (June to September), when local production is not available. The price ranges from Rs. 12.48 for a dozen spikes, depending upon variety, season, and market.

The popular gladiolus varieties are White Friendship, Oscar, Ratna Butterfly, Carmine, Mary Housley, Apple Blossom, Friendship, Sylvia, George Mazure, Happy End, Fay, Garland, Patricia, Geoff Whitemen, Yellow Stone, Sancere, Jo Wagneaar, G.G. Porter, Nobel, Snow Princess, Peter Pears, Hunting Song, Vinks' Glory, Eurovision, and Rose Supreme (Table 14.4). Corm production is also remunerative in the hills where the rate of corm multiplication is higher and faster than in the plains. The price of a corn varies from Rs. 1 to Rs. 5 or more according to its size and variety. The gladiolus crop gives a higher percentage of return than rose, carnation, and chrysanthemum.

Carnation

Although carnation is one of the three most important cut flowers in the international market, ranking second to roses, it has not become popular in India yet. It is grown on a small scale in northern and western areas of the country. In northern India it is cultivated for cut flowers in and around Delhi, Chandigarh, Ludhiana, Lucknow, Calcutta, and the hills of Srinagar and Shimla (Dochi). It is also grown in Bangalore, Pune, and Nasik. Flowering in Bangalore and Nasik is from September to April and from February to September respectively.

The two types of carnation used for cut flowers are the standard and the spray. The commonly grown standard carnations are William Sim, Arthur Sim, Lena Scania, Dusty Sim, Laddie, White Sim, Clear Yellow Sim, Harvest Moon, Shocking Pink, Alec Red, Dusty Yellow, Tangerine, Dusty Pink, and New Arthur Sim. The popular spray types include orange Elf, Goldilocks, Scarlet Eleganca, Nero, Exquisite, Silvery Pink, and Madonna (Table 14.5). Standard and other perpetual flowering carnations are propagated mainly by cuttings and other varieties from seed.

TABLE 14.4
Gladiolus varieties

Domestic market	Export market
Friendship	Vink's Glory
Oscar	Hunting Song
Ratna Butterfly	Carmine
Sylvia	Spic and Span
Carmine	Happy End
Mayur	Peter pears
Mary Housley	Friendship
Apple Blossom	White Friendship
George Mazure	Yellow Stone
Happy End	Sancere
Fay	Oscar
Garland	Eurovision
Patricia	Rose Supreme
Geoff Whiteman	
Snow Princess	
Jo Wagneaar	
G.S. Porter	
Nobel	

However, in the northern plains it is difficult to propagate carnation from cuttings as the rate of mortality is quite high. It is more economical to propagate it from cuttings in the hills, which could be brought to the plains to raise plants for cut flowers. A few florists in Delhi have adopted this procedure for the multiplication of carnation plants.

TABLE 14.5
Carnation varieties for export market

Standard type (Sim's varieties)	Spray types
White Sim (white)	Sam's Pride (deep pink)
Scania Red	Scarlet Elegance
Arthur Sim	Silvery Pink
William Sim	Mini Star (yellow with red streaks)
	Tony (yellow)
	Red Baron (red)
	Gold Star (yellow)
	White Lily Ann (white)

ROSE

In both domestic and international markets, the rose is one of the three top-ranking cut flowers in the floriculture trade. It is also one of the most popular plants grown in the garden. Its use is very common

in bouquets, floral baskets, garlands, and flower arrangements. Loose flowers of fragrant roses like Edouard, Damask de Hollande, Crimson Glory, and Gruss en Teplitz are used to make garlands and for religious offerings and floral decorations. The damask rose (*Rosa damascena*) is cultivated for extraction of rose oil or rose attar and concentrates from its flowers for perfume. Rose water and gulkand are prepared from the flowers of the Eduoard rose (*Rosa bourboniana*).

It is estimated that about 2280 hectares are under commercial roses of which Karnataka has 841 hectares, Maharashtra 620 hectares, Tamil Nadu 419 hectares, West Bengal 400 hectares and Delhi 60 hectares. The production is about 875 million cut flowers annually, while the sale of loose flowers is 7200 tons each year. The rose varieties commonly grown for cut flowers (Table 14.6) include Mr. Lincoln (red), Happiness (red), Christian Dior (red), Angelique (orange), Montezuma (orange-scarlet), Golden Giant (yellow), Landora (yellow), Gladiator (red), Century Two (pink), Peter Frankenfeld (deep pink), Queen Elizabeth (light pink), Sea Pearl (light pink), Sonia Meilland (salmon-pink), and White Masterpiece (white).

Rose oil extracted from the damask rose is the most expensive essential oil. Both rose and jasmine oils are a principal ingredient in all high quality perfumes. Rose oil is used extensively by the cosmetics and food flavour industry.

The fragrant rose is cultivated in an area of about 600 hectares in Uttar Pradesh, Tamil Nadu, Karnataka, Punjab, and Rajasthan. The damask rose can be profitably grown for essential oil in Kashmir valley and other similar areas of the Himalayas which have the most suitable climate for its growth, high yield and the quality of its essential oil.

CHRYSANTHEMUM

In India, chrysanthemum flowers are sold both in traditional markets and in florists' shops. Stalkless, the flowers are used for decoration, religious offerings, garlands, and 'venis'. The long-stemmed flowers required for bouquets and flower arrangements are marketed by florists. The dwarf and compact plants commonly known as pot mums are sold by florists. Commercially, the chrysanthemum is cultivated in Tamil Nadu, Karnataka, Maharashtra, Andhra Pradesh, Madhya Pradesh, Rajasthan, Bihar, and West Bengal. Cut flowers for florists are grown in Calcutta, Delhi, Lucknow, Chandigarh, Ludhiana, Bangalore, Pune, and other places. A private firm in Dochi, near Shimla (Himachal Pradesh), produces pot mums in polythene houses for marketing during summer months in Delhi, Chandigarh, Bombay, and other cities. The chrysanthemum is grown in an area of about 2000 hectares with a total annual production of more than 12000 tons. There is not much scope to develop the cut flower trade in chrysanthemum in the hills as it can be

TABLE 14.6
Rose varieties

Domestic Market	Export Market	
	Large Flowered	Small Flowered
Mr. Lincoln (red)	Sonia (salmon-pink)	Mercedes (red)
Happiness (red)	Ilona (red)	Red Garnette (red)
Super Star (orange)	Red Success (red)	Belinda (orange)
Montezuma	Diana (yellow)	Carol (pink)
(Orange-scarlet)	Carlita (pink)	
Golden Giant	Whilte Masterpiece	Golden Times
(Yellow)	(white)	(deep yellow)
Landora (yellow)	Motrea (red)	Jack Frost (white)
Gladiator (red)	Prive (red)	
Century two (pink)	Madelon (orange)	
Peter Frankenfeld		
(deep pink)		
Eiffel Tower		
(light pink)		
Royal Highness		
(light pink)		
Blue Moon		
(lavender)		
Lady X		
(lavender or mauve)		
Paradise		
(deep mauve)		
Queen Elizabeth		
(light pink)		

easily grown in the plains where it is possible to produce flowers almost throughout the year by growing different varieties under different agroclimatic conditions.

OTHER FLOWERS

The mountainous regions are ideally suited to growing temperate flowers, such as daffodil, narcissus, lily (Easter lily, Tiger lily), iris, peoni, hyacinth, and tulip. Unfortunately, tulips have not become popular in the Indian hilly regions, perhaps because of lack of availability of varieties suitable for these areas. Selection of suitable sites and varieties and the standardization of agro-techniques for growing tulips in the hills should receive priority in floriculture development projects.

Lavender (*Lavendula angustifolia* ssp. *angustifolia*), which grows successfully on slopes in Jammu and Kashmir, produces lavender oil used by the cosmetic industry. It is also an important crop for the Himalayan region.

Exports

There is an increasing demand for floricultural products in the world. Cut flowers and live plants are important items of import and export in present-day international trade. The consumption of flowers and plants per caput is highest in Switzerland, followed by Holland and the Federal Republic of Germany (Table 14.7). Nevertheless, this consumption is considered to be low and is expected to continue to rise in future. The production of cut flowers and plants in most of the European and North American countries cannot meet the domestic demand, which has to be met by imports. In all the European markets, the demand for cut flowers is at its peak during the winter months (November to May), particularly during Christmas, Valentine's Day, Mother's Day, All Saint's Day, and Easter. In the cold season, when production is in glasshouses, the limitation of space and high cost of labour and energy result in limited production and higher cost of production than in the summer. A few developing countries of the tropical and sub-tropical areas have taken up the export of flowers during winter when it is possible for them to produce flowers at lower cost than in Europe. Unfortunately, the share of developing countries in this export is very low. The Federal Republic of Germany is the biggest consumer of cut flowers and the Netherlands ranks the highest in exports, its share being as high as 66 per cent in cut flowers and 45 per cent in plants. The total world imports of floricultural products, including cut flowers, cut foliage, and live plants in 1985 was US$ 2488.17 million and the total exports were $ 2269.20 million (Table 14.8). The total world imports and exports of cut flowers in 1985 were $ 1297.10 million, and $ 1149.59 million respectively. Live plants valued at $ 1035.29 million were imported in 1985, while exports amounted to $ 989.31 million.

TABLE 14.7

Per caput consumption, 1984 (in US$)

Country	Cut flowers	Plants	Total
Switzerland	32	32	64
Holland	39	21	60
West Germany	35	23	58
Austria	23	22	45
France	19	17	36
United states	20	15	35
United Kingdom	9	6	15

TABLE 14.8
World imports and exports of floricultural products, 1985

Product	Imports	Exports
Cut flowers	1297.10	1149.59
Cut foliage	155.78	130.30
Live plants	1035.29	989.31
Total	2488.17	2269.20

CUT FLOWERS

Among the top three cut flowers in the international market, carnation ranks first (U.S.$ 212.7 million), followed by rose ($ 178.6 million) and chrysanthemum ($ 126.3 million). The Netherlands is the leading exporter of roses ($ 102.8 million), followed by Colombia ($ 36.6 million) and Israel ($ 15.0 million). The four largest exporters of carnation are Colombia ($ 70.6 million), the Netherlands ($ 65.7 million) Israel ($ 27.0 million), and Italy ($ 18.3 million). Chrysanthemums are supplied mainly by the Netherlands ($ 74.7 million) and Colombia ($ 42.1 million). Colombia sends its supplies mostly to the United States and to some European countries. The maximum import is by West Germany, about 36 per cent of the total world imports, while the United States, France, the United Kingdom, Netherlands, having 65 per cent share in the total world exports. The other leading supplier is Colombia (12 per cent), which exports mainly carnation, rose, gypsophyla, and other flowers like lily, gladiolus, gerbera, and statice. Among the main orchid suppliers, Thailand is next to the Netherlands and it exports mainly Dendrobiums. Recently, it has started diversifying by growing carnation and rose for export in the cooler areas of the northern part of the country. Kenya ranks eighth among the exporting countries and its exports include rose, carnation, chrysanthemum, alstroemeria, and statice. The other developing countries which supply cut flowers are Taiwan, Singapore, Peru, Mexico, Costa Rica, Brazil, Ethiopia, Zimbabwe, Mauritius, and Malaysia. Both Singapore and Malaysia export orchids and Mauritius supplies anthurium. The South American countries (Peru, Mexico, Costa Rica, and Brazil) export rose, carnation, chrysanthemum, and other flowers. The Netherlands obtains roses and gladioli from Zimbabwe during winter and gladioli from Ethiopia in winter.

While analysing the market opportunities of cut flowers in foreign markets, it has been observed that carnation, orchids, and chrysanthemum from developing countries may have favourable markets in Europe. France is a good market for exporting rose, spray carnations, chrysanthemum in winter and orchids, particularly new varieties and species. The long-distance shipment of cut flowers to the United States from Asian

and African countries may not be competitive with supplies from the South American countries.

Live Plants

The world imports and exports include a large variety of plants, both ornamental foliage and flowering. Among the foliage plants the most important ones are dieffenbachia, dracaena, ficus, philodendron, aglaonema, maranta, croton, yucca, begonia, saintpaulis kalanchoe, pelargonium, cordyline, scindapsus, syngonium, ananas, schefflera, bromeliads, palmas, spathiphylum.

The total world imports and exports of live plants are US$ 1035.29 million and $ 989.31 million respectively. The largest buyer is the Federal Republic of Germany (23.6 per cent), followed by France, the United Kingdom, Italy, and the Netherlands. The leading exporter (44.3 per cent) is the Netherlands and the other large exporters are Denmark, Belgium, West Germany, France, and the United States.

The live plants exported to Europe include rooted and unrooted cuttings, large 'finished' plants, and 'semi-finished' plants. During the last five or six years, large-scale propagation of foliage plants by tissue culture has been taken up in the Netherlands, the United states, and Belgium. The tissue-cultured plants with better rooting, superior quality, uniformity, and freedom from disease have proved advantageous, in spite of higher prices than of those propagated by conventional methods.

Exports from India

The export of floriculture products from India is not substantial. It amounted to Rs. 2.4 million in the first year, 1976/77, and 5.4 million in 1985/86. It reached as high as Rs. 8.0 million in 1978/79 and Rs. 8.4 million in 1980/81 but decreased in later days (Table 14.9). About 50 per cent of the exports are of live ornamental plants, 35 per cent of cut flowers, and 15 per cent of seeds and bulbs. The live plants, are sent mainly to the Gulf countries United Arab Emirates and Oman and cut flowers to the Federal Republic, Holland, Italy, and the United States (Table 14.10). A few nurseries in Kalimpong export orchid plants propagated from seeds or meristem culture in flasks worth about Rs. 0.5 million and bulbs valued at Rs. 2.5 million annually.

Packaging of Cut Flowers and Live Plants

The packaging of cut flowers and live plants should be lightweight, sturdy, and functional. The type and quality of packaging adopted in India is poor and results in post-harvest losses, during transport and storage adversely affecting the keeping quality of cut flowers and plants. Traditional

TABLE 14.9
Export of floriculture items from India

Year	Value (Rs. million)
1976/77	2.4
1978/79	8.0
1979/80	5.6
1980/81	8.4
1981/82	6.0
1982/83	6.0
1983/84	5.8
1984/85	5.8
1985/86	5.4

TABLE 14.10
Commodity-wise export of floriculture products and fruit plants from India, 1981/82

Items	Value (Rs. '000)
Cut flowers	588.3
Flowering plants	425.9
Other live plants	3276.8
Bulbs	731.7
Cactus	139.3
Cut foliage	310.4
Fruit plants	133.6

flowers, small-flowered chrysanthemum, jasmine, marigold, crossandra, stalkless rose, and loose rose petals are packed in gunny bags or baskets with a gunny cover. Long-stemmed, non-traditional flowers for the florist trade are sent to distant markets in cardboard cartons or rectangular bamboo or palmleaf boxes with lids. Live plants have their earthballs wrapped in polythene and/or old newspaper and are packed in baskets with gunny cover and are supported along the edges by long, vertical, slit-bamboo stakes which are criss-crossed at the top and tied with hessian string rope. Corrugated cardboard cartons are also used to pack live plants.

The Indo-American Hybrid Seeds Co. has pioneered in India the standardized packaging of live plants for export, as well as for long-distance transport within the country. The dimensions of the telescopic boxes made of corrugated cardboard used for packaging of live plants are $90 \times 45 \times 25$ cm and 60×45 cm $\times 25$ cm. First, a layer of paper is placed at the bottom of the box with its sides overhanging the edges of the box. Each plant, grown in a plastic pot, is carefully packed individually with

a sleeve of newspaper or thin paper over the top, covering the foliage up to the base of the stem. The soil or peat in the pot is covered with thick rolls of wet newspaper and the pot is then wrapped in polythene up to the stem end, the top of which is fastened with rubber bands or thread. The packed plants are placed inside the box horizontally, keeping the pot end towards the edge of the box. On the opposite side also the plants are arranged in a similar way. More than one layer of plants can be packed depending upon the size of plants and pots. A sheet of newspaper is spread between layers of plants.

Care must be taken to ensure that the packing is not loose and gaps should be tightly filled with newspaper or shredded paper so as to avoid movement of the plant or flower bundles inside the box during transport. Finally, the flap of the bottom layer of newspaper left hanging outside the box is folded inside to cover the top of the packed plants. The box is then covered with the lid. The carton is fastened tightly with plastic straps using a strapping machine. The address label is pasted at the top of box and other shipping and product details are also marked on the box, such as name and address of despatcher, nature of product minimum stem lengths, and number or net weight. Each box is marked perishable in bold capital letters.

Packaging Requirements of Cut Flowers in European Markets

Flowers are harvested in the early morning or late in the afternoon. The stage of development or opening at which the flower is harvested depends upon the species and variety. However, the stage of opening should be such that a cut flower can continue developing without any treatment. Soon after harvesting the flowers are placed in a clean bucket filled with clean water and kept in the shade. The bucket, when full of flowers, is taken to the grading hall. Flowers such as rose, carnation, gladiolus and chrysanthemum, which require pre-cooling, can be cooled in an hour by suction, unlike the normal cold treatment of 12–24 hours. The optimum pre-cooling temperature varies with different kinds of flowers, but generally it is between 2° and 4°C. In many cases, a flower preservative (silver thiosulphate or any other proprietary product) is put in the bucket of water in which cut flowers are kept in cold store. Grading is done on a grading table that has graduations marked on it. More expensive automatic grading tables are also available. On the grading table, the flowers are graded for stem length, and defective, damaged, or bruised flowers are rejected. The graded flowers are generally bunched with 5 or 10 stems in each bunch depending upon the kind of flower and market preference.

In many cases, the bunches are sleeved in paper or plastic film, with or without perforation according to the requirement of the importing country. The bunches are then packed in telescopic boxes of specific sizes made of corrugated cardboard. Usually the flowers are packed dry, but during summer exporters in some countries use ice packs kept in sealed polythene bags, wrapped in paper, or deep-frozen liquid packs which are placed in the box to keep the flowers fresh during transport.

Packaging requirements vary with the kind of cut flowers and market. The commonly adopted packing practices for different kinds of cut flowers are mentioned in Annex 1. The product must confirm to market requirements of quality, stem length, and packaging. The produce should be cut or picked at an appropriate stage of growth and meet the requirements of a specific class. Class II may have slight malformation, bruising, damage by disease or insects, weaker stems, and small pesticide residues and the quality tolerance may not exceed 10 per cent from the requirements of the class. In Class I, not more than five per cent of cut flowers may have slight defects. There may be an Extra Class which qualifies for Class I without any quality tolerance.

The stem length of cut flowers (including flower head) is coded from 0 to 120 at intervals of five each, designating the stem length of each code. In code 0 the stem length is less than 5 cm, or flowers that are marketed without stems; code 5 has 5–10 cm stem length, code 10 has 10–15 cm, code 15 has 15–20 cm, and so on. Code 120 is for stems longer than 120 cm. The maximum and minimum lengths of flowers in each unit may not exceed 2.5 cm in codes 15 and below, 5.0 cm in codes 20 to 50, and 10.0 cm in codes 60 and above.

The packaging and presentation are also specified. A unit of presentation, either bunch or box, must contain 5, 10 or a multiple of 10 pieces. However, this does not apply to flowers sold singly or by weight. There must be uniformity of the product in each box with regard to species, variety, quality, and stage of development. The packaging should protect the produce adequately and all packages must be marked carefully, giving all the particulars required by the market. All consignments must be accompanied by phytosanitary certificate, CITES (Convention of International Trade in Endangered Species) certificate, Forest Department certificate, and other relevant customs and forwarding documents. As soon as the air cargo booking is confirmed, the importer or importing agency must be informed by telex or fax of the details of shipping, such as date, airline and flight number, flight route, scheduled arrival date, time, number and weight of boxes, contents (cut flowers, live plants, seeds, bulbs) and airway bill number. Such information and documents will enable the importer take the consignment without delay.

Conclusion

The Hindu-Kush mountains have immense potential to develop a floriculture industry. Cut flowers, cut foliage, dried flowers and foliage, live plants, bulbs, corms, tubers, and seeds can be produced profitably for supply to domestic markets. In the case of cut flowers, priority may be given to orchid, rose, carnation, chrysanthemum, tuberoses, tulips, iris, gladiolus, and peonies. Multiplication of the corms of gladiolus and the bulbs of amaryllis, crinum, hyacinth, tulip, narcissus, daffodil, iris, begonia, lily (Easter lily, Tiger lily), and tuberoses can also be remunerative. Rooted cuttings of carnation, chrysanthemum, and geranium and plants of orchid, African violet, fuchsia, and azalea, are in great demand in big cities. The cultivation of the damask rose and lavender for rose and lavender oil may also be taken up in the valleys.

There is also good scope to develop an export trade in floricultural products, like the cut flowers of orchids, carnation, chrysanthemum, and rose, and live orchid plants propagated by tissue culture. The bulbs of tropical flowers, amaryllis, crinum, eucharis, haemerocallis, haemanthes, and zephyranthes can also find markets abroad. These bulbs can be multiplied in the open at a comparatively low cost of production and are easily transported to distant markets. However, good quality and consistent supply at scheduled dates are essential to the export trade.

Annex 1

Packaging requirements of cut flowers in European markets

Flower	Colour preference	Stem length	Bunch	Pre-treatment	Box size
Rose	Varying with country and season	60–90 or 100 cm (top grade)	10–20	Pre-cooling and preservative	105 × 45 cm (200–300 stems, stem length 40–50 cm)
	Pink and red	40–60 cm	Sleeved with thick paper or plastic film		135 × 35 × 20 cm (200–300 stems, stem length 60–100 cm)
Carnation (Standard)	Pink, white, red	70–75 cm (top grade)	10–20	Pre-cooling and preservative (silver thiosulphate)	105 m × 95 m × 80 cm (20 bunches, 400 flowers)
		40–60 cm (at least half open)	Sleeved with perforated thick paper or plastic film		
Carnation (Spray)		40–60 cm (a minimum of 3 buds showing colour)	5–10	Pre-cooling and preservative	105 × 45 × 25 cm
Chrysanthemum (Spray)	White, yellow, pink	75–90 cm, Bottom 10 cm without foliage	5–10	Pre-cooling, No preservative	100 × 40 × 20 cm
Chrysanthemum (Standard)	White, yellow	75–90 cm	10	Pre-cooling, no preservative	100 × 40 × 20 cm
Gladiolus	Red, peach	90–150 cm	10	Pre-cooling and preservative	135 × 35 × 20 cm
Orchid	Nil	No specific stem length	Generally not bunched	Flower conditioned in water at 27°C,	As per requirement

		Each stem and kept in a vial filled with water or preservative or a wad of wet cotton wool at the stem end	Sometimes spray types are bunched and sleeved	24 hours before shipping. Storage temperature between 8° and 15°C	of the importer
Gerbera	3 distinct types: single, double, black-centred	At least 40 cm Uniform flower size, maximum deviation 10%	Not required	Pre-cooling and preservative	100 × 30 cm × 10 cm or 12 cm (50–60 flowers/box, large flowers 12 cm and above 40 flowers/box)
Lily (Asiatic hybrids)	Yellow, orange	Not specific. Variation not more than 10% Bottom 10 cm without leaves. Graded on number of buds. One flower must show colour and be fully developed or opened	10	Flower preservative	100 × 40 × 20 cm or 100 × 35 × 23 cm
Lily (Large-flowered)	White, yellow	50 cm (minimum)	20	Flower preservative	120 × 33 × 25 cm or 100 × 35 × 23 cm
Anthurium	Red, orange	45–60 cm	No bunching	A piece of tissue paper or shredded tissue paper placed in between spathe and spadix. Each stalk and wrapped with a wad of wet cotton and covered with polythene	70 × 35 × 15 cm (30–50 stems/box)