

*Trade and Production of Herbal  
Medicines and  
Natural Health Products*



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# *Trade and Production of Herbal Medicines and Natural Health Products*

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## Preface

The recent years have witnessed a great deal of interest in medicinal plants for their potential to yield useful drugs. The increasing popularity of herbal medicinal products in developed countries has given new dimension to the demand of medicinal plants at the international market. The health giving properties of medicinal plants have been scientifically validated in a number of diseases. Their effectiveness in such diseases, where modern drugs are hard to find has fuelled special interest in them. With market balance clearly tilted in favour of products with a tag of 'natural', the developed countries have generated special demand for herbal products. The present trend is expected to continue in the more years to come. Developing countries, which possess a treasure of medicinal plant resources, are to benefit from the arising situation.

Despite the rising demand and soaring imports of medicinal plants by developed countries, the source countries possessing rich biodiversity of medicinal plants have not been able to benefit from the situation. There are many hurdles in developing export of medicinal plants and their products. The international trade in medicinal plants is not well regulated; data is scarce, scattered and inaccessible to those who need it the most; species specific records are hardly available; and true demand, supply, and the price situation is rarely available to the producers.

The present publication was planned to contain information on international trade in comprehensive form touching all-important aspects of the subject. It is expected to help developing countries to understand, penetrate and take benefit from the emerging demand of medicinal plants and their products.

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# 1 Introduction

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Herbal medicinal products have become a subject of increasing global importance, for their health benefits and economic considerations. Some major categories of plant-derived products include phytopharmaceuticals, herbal medicines, natural health products, phyto-cosmetics and personal care products. The global demand for these products is increasing due to reinsured interest of consumers in natural products, as they are considered safer and more cost-effective than synthetic counterparts.

Herbal medicines in most developing countries of Asia, Africa and Latin America have played a central role in health-care since time immemorial. According to a survey of World Health Organization (WHO) about 80 per cent of population in these countries still rely on traditional or herbal medicines for their primary health-care needs (Bannerman, 1982).

Over the last decade, herbal medicines have enjoyed a revival in many developed countries, including the United States (USA), Europe, Australia and Canada. Although data to accurately calculate the global market for herbal medicines is sparse, but it was conservatively estimated at around US\$ 30 billion in 2000. The worldwide sale during last decade has increased with an annual growth rate averaging between 5 to 15 per cent, depending on the region. Europe leads the market, followed by Asia, North America and Japan. The USA is the fastest growing market where annual retail sale of botanical products has increased from US\$ 200 million in 1988, to an estimated US\$ 5.1 billion in 1997. The consumer use of these products in the USA has increased by staggering 380 per cent in the past ten years. The industrial demand for medicinal plants has increased exponentially in the world market since last few decades with the emergence of newer product categories like health foods, natural cosmetics and personal hygiene products. The overall international trade in medicinal plants and their products has been estimated at over US\$ 60 billion in 2000 (Govt. of India, 2000), with average annual growth rate (AAGR) of 7 per cent, and it is expected to reach US\$ 5 trillion by 2050.

The annual volume of global trade in medicinal plant materials in the 1990's amounted to an average of 400,000 metric tonnes, valued at US\$ 1.2 billion (Lange, 2001). China and India were the top exporting countries and Hong Kong, Japan, the USA and Germany were the leading importers. About 80 per cent of medicinal plant material supply in the world market is sourced from the wild collections.

Most of the medicinal plant material in the world market originates from developing countries, although the export volume from most of these countries is small. As world demand for medicinal plants is continuously increasing, there is an ample opportunity for these countries to expand their global export. In this process they should first aim to penetrate early stages of the value chain by supplying unprocessed raw material to manufacturers in the developed countries and then move upward providing value added products and herbal supplements before tackling the highly regulated market for herbal medicines.

Trade in medicinal plants is often unregulated in most part of the world. Lack of species-specific records at national and international level and practice of grouping fresh and dried medicinal plants under one broad category further complicate the problem. Furthermore, there is an insufficient information on sources of demand, dynamics of medicinal plant's trade and supply channels. The developing countries which have rich resources of biodiversity can be benefited from the present state, if the information on the major user groups and international trends in demand and supply is made available. The present report provides an overview of current status and trends in the world market.

Rising global interest in medicinal plants has also created an underground trade in plant materials. The plant material is collected in developing countries in an unregulated manner, resulting in indiscriminate harvesting of wild varieties and serious damage to biodiversity. There is an urgent need to regulate export and allow only sustainable harvest of medicinal plants in these countries.

## 2 Demand for Medicinal Plants

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Medicinal plants play a vital role in the health-care needs of three quarters of the world's population living in the developing countries. The use of medicinal and aromatic plants, whether in most indigenous form to make decoctions, or in most modern form of herbal cosmetics, is steadily increasing. Numerous new avenues have emerged for innovative use of medicinal plants. Therefore, before considering the supply sources of medicinal plants and mechanics of the trade, it is essential to have an understanding of demand points of medicinal plants.

A large number of user groups like pharmaceutical and food industries, traditional or alternative practitioners, folk or household medicine users, cosmetic and flavour industry and many more use these plants for their medicinal, aromatic, and health giving properties. The data on demand from these sectors is sparsely available. Therefore, it is difficult to estimate the exact demand, but only the trends can be deduced from the data available from major user groups, as listed below:

- Phytopharmaceuticals;
- Herbal Medicines;
- Natural Health Products;
- Phyto-cosmetic and Personal Hygiene Products.

### 2.1 Phytopharmaceuticals

Medicinal plants are used to obtain a number of important drug molecules of modern therapeutics. Additionally, they are also a source of precursor molecules for synthesis of important groups of steroidal and other therapeutically used drugs. Presently, about 50 per cent of the total plant-derived drug sale comes from single entities, which are mostly prescription products, while the remaining 50 per cent comes from herbal medicines. Although the latter have greater volumes of consumption, the relatively low volumes of single entities are more than compensated by their higher prices.

#### 2.1.1 World Pharmaceuticals Market

More than 80 per cent of world's production of pharmaceutical active ingredients originates from developed countries like the USA, the European Union (EU) countries and Japan and 20 per cent comes from developing countries. The main developing coun-

tries involved in manufacturing of pharmaceutical active ingredients are Argentina, Brazil, China, Egypt, India, Mexico, Korea, Puerto Rico and Turkey (Uzuner, 1999).

The world consumption of drugs in 1997 amounted to about US\$ 294 billion increasing to US\$ 343 billion in 1999 (The Wall Street Journal, 2000). The consumption of drugs as a percentage of gross national product (GNP) in developed countries has increased from 0.65 to 0.95 per cent during 1975 to 1990, while it has decreased from 0.79 to 0.67 per cent in developing countries during the same period. These figures seem to indicate that the situation in developing countries has not improved but worsened in the last decade.

The average cost of a successful new drug application in the USA has been estimated at US\$ 500 million with a development period of 15 to 20 years (Drews and Ryser, 1997). Such high costs cannot be met by any company unless there is a reasonable expectation that a profit will be gained after the drug is marketed. Therefore, most of the research and development (R&D) investments are made by multinational companies in developed countries like the USA, Japan, Germany, France, the United Kingdom (UK), Switzerland, Italy, and Sweden, which have good market for their products.

High investment for R&D in pharmaceutical sector is not affordable by most of the developing countries. Therefore, they have to devise new ways of developing their own cost-effective medicines preferably from plants. The cost of developing a herbal medicine in early 1990's was estimated at about US\$ 23.56 million (Foster & Tyler, 2000).

### **2.1.2 World Phytopharmaceuticals Market**

The attitude of pharmaceutical industries towards medicinal plants and natural products has changed dramatically over the past two decades. This is owing to increased awareness and interest in medicinal plants and herbal remedies of both general public and scientific community. As a reflection of this, in 1980 a few of the top 250 pharmaceutical companies had research activities involving higher plants, but by the early 1990's more than half of them had introduced such programmes (Anonymous, 1994).

The single entity plant drugs, most of which are prescription drugs and used to treat serious ailments, include atropine, digoxin, morphine, paclitaxel, pilocarpine, quinine, scopolamine, topotecan and vincristine, among many others. Several of the plant compounds have outlived their usefulness in light of better alternatives and they are recording decline in sales. On the other hand, as a consequence of new drug developments from plants, phytopharmaceuticals are projected to increase their market share.

In the USA, some 25 per cent of prescriptions are dispensed with drugs whose active ingredients are extracted or derived from plants. The sale of these plant-based drugs in the USA amounted to nearly US\$ 4.5 billion in 1980 and US\$ 15.5 billion in 1990 (Farnsworth and Soejarto, 1985). A large number of drugs are derived from micro-organisms and some from animals. A comprehensive review of literature on plant-derived drugs identified a total of 119 drugs, obtained from fewer than 90 plant species in

1995 (Farnsworth et al., 1985) and over 130 in 1997 (Sukhdev, 1997), including the examples listed in the Table 1.

Table 1: Drugs from natural sources

Drug molecule	Plant source	Therapeutic category
Vinblastine and vincristine	<i>Catharanthus roseus</i>	Anticancer
Camptothecin	<i>Camptotheca acuminata</i>	Anticancer
Paclitaxel (taxol)	<i>Taxus brevifolia</i>	Anticancer
Quinine	<i>Cinchona</i> spp.	Antimalarial
Artemisinin	<i>Artemisia annua</i>	Antimalarial
Morphine	<i>Papaver somniferum</i>	Hypnotic, CNS depressant
Codeine	<i>Papaver somniferum</i>	Antitussive and hypnotic
Scopolamine	<i>Hyoscyamus niger</i>	Sedative
Caffeine	<i>Camellia sinensis</i> & other sources	CNS stimulant
Digitoxin	<i>Digitalis purpurea</i>	Cardiotonic
Digoxin	<i>Digitalis lanata</i>	Cardiotonic
Ouabain	<i>Strophanthus gratus</i>	Cardiotonic
Thevetin	<i>Thevetia nerifolia</i>	Cardiotonic
Reserpine and deserpidine	<i>Rauvolfia serpentina</i>	Antihypertensive & tranquilizer
Ajmaline	<i>Rauvolfia serpentina</i>	Antiarrhythmic
Quinidine	<i>Cinchona</i> spp.	Antiarrhythmic
Physostigmine	<i>Physostigma venenosum</i>	Anticholinergic
Atropine	<i>Atropa belladonna</i>	Anticholinergic
L-Dopa	<i>Mucuna pruriens</i>	Antiparkinsonism
Emetine	<i>Cephaelis ipecacuanha</i>	Antiamoebic
Pilocarpine	<i>Pilocarpus jaborandi</i>	Antiglaucomic
Ergotamine	<i>Claviceps purpurea</i>	Antimigraine
Ephedrine	<i>Ephedra</i> spp.	Adrenergic
Colchicine	<i>Colchicum autumnale</i>	Antigout
Sennosides	<i>Cassia senna</i>	Laxative
Camphor	<i>Cinnamomum camphora</i>	Rubefacient
Menthol	<i>Mentha</i> spp.	Antipruritic
Tetrahydrocannabinol	<i>Cannabis sativa</i>	Antiemetic and hallucinogen

With increasing demand of natural product medicines and augmented interest of pharmaceutical companies in the discovery of novel molecules it is expected that the share of plant-derived prescription drugs will increase to 30 per cent in the next few decades (Wilkinson, 2000).

The global import of plant alkaloids and derivatives has increased from 1.9 to 11.4 million metric tonnes during 1966 to 1991, and glycosides and their derivatives from 0.3 to 2.9 million metric tonnes during the same period (United Nations Statistical Division, 1992). The total market for plant-derived drugs was valued at US\$ 22.6 billion in 1997 and is projected to reach US\$ 30.6 billion in 2002, representing an average annual growth rate (AAGR) of 6.3 per cent (Table 2).

Terpenoids contribute the most to the sale of plant-derived drugs. They have been valued at US\$ 7.6 billion in 1997 and are expected to reach US\$ 12.4 billion in 2002, at an AAGR of 10.1 per cent. They are estimated to retain dominant position in future sale of plant-derived drugs. As the taxoids gain in the treatment of cancer, the terpenoid category should increase its share in the next several years. Steroids are another key group in this category.

Glycosides are the next in sale to terpenoids. Flavonoids, saponins, anthraquinones and digitalis compounds are among the most important groups within this category. Glycosides sale will increase to US\$ 9.2 billion in 2002 from US\$ 7.3 billion in 1997, with an AAGR of 4.8 per cent.

Table 2: Worldwide sale of plant-derived drugs, 1997-2002

Plant drug category	Sale value (million US\$)		AAGR %
	1997	2002*	
Terpenoids	7,660	12,400	10.1
Glycosides	7,300	9,230	4.8
Alkaloids	3,600	4,045	2.4
Others	4,048	5,013	4.4
TOTAL	22,608	30,688	6.3

\* Estimates

Source: Business Communications Company Inc. 1998

Alkaloids rank third most significant category of plant-derived drugs in terms of sale. This group includes alkaloids from belladonna, cinchona, camptotheca, poppy, rauwolfia, vinca and others. Alkaloids turnover was valued at US\$ 3.6 billion in 1997 and is projected to reach US\$ 4 billion in 2002, representing an AAGR of 2.4 per cent.

All other plant-derived drugs are put under miscellaneous substances and also include plant drugs for which active principles have not been well characterized. Among the important groups within this category are plant-derived vitamins, psoralens, ephedrines, salicylates and various others. This category also includes many substances that have been duplicated through complete synthesis. The turnover of this category was valued at US\$ 4 billion, with expected rise to US\$ 5 billion in 2002.

No single therapeutic category dominates the plant-derived drugs. Among the most significant are those related to neural, respiratory, digestive and skin problems along with pain and cancer. Additional applications include contraception, hormone replacements, cardiovascular, infectious and other diseases.

## 2.2 Herbal Medicines

Herbal medicines are also referred as botanical medicines, or more recently and widely accepted as herbal medicinal product. It makes use of herbs for therapeutic or

medicinal purposes. It is the oldest form of health-care known to mankind and constituted an integral part of development of modern civilization. Primitive man observed and appreciated greatest diversity of plants available to him. He methodically collected information on herbs and developed well-defined herbal pharmacopoeias. During the first half of 20th century most of the pharmacopoeias contained drugs derived from the herbal lore of native peoples. In modern time, many commonly used drugs are of herbal origin.

The World Health Organization (WHO) estimates that 4 billion people of the world population presently use herbal medicines for their primary health-care. Medicinal plants are major component of all indigenous or alternative systems of medicine. They are common element in Ayurvedic, Homeopathic, Naturopathic, Oriental and Native American Indian medicine. WHO notes that about three fourth of plant-derived drugs correlate directly with their traditional uses in native cultures.

### 2.2.1 World Market for Herbal Medicines

The herbal medicine industry is one of the fastest growing industry in the world. Global market for herbal medicines was estimated at US\$ 12.4 billion in 1994, increasing to US\$ 19.6 billion in 1999 (Gruenwald, 1998). The demand for herbal medicines is expected to grow about US\$ 24.2 billion by 2002 (Figure 1). Europe leads the world market with an impressive figure of US\$ 7 billion, followed by Asia, North America, and Japan (Table 3). Latin America and Eastern Europe have a retail sale of US\$ 600 million and 400 million respectively. The share of Africa and Middle East together, and rest of the world is about US\$ 200 million each (Gruenwald, 2000).

The fastest growing market for herbal medicines is found in the USA. In 1999, it had a retail sale of US\$ 3.8 billion, and an estimated sale of US\$ 4.5 billion in 2002. Demand for herbal medicines in Europe was almost static in the late 1990's, while in North America it had steadily increased during this period. In Asia, the demand had almost doubled during the late 1990's, partly from the increasing population pressure.

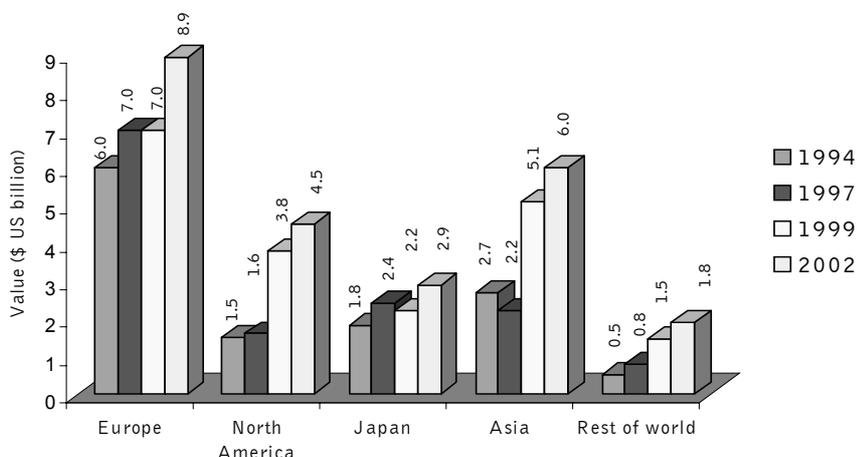


Figure 1: Trends in global demand of herbal medicines

Table 3: Sale of herbal medicines in different regions of the world

Region	Sale value (billion US\$ )			
	1994	1997	1999	2002*
Europe	6.00	7.00	7.00	8.90
North America	1.50	1.60	3.80	4.50
Japan	1.80	2.40	2.20	2.90
Asia	2.70	2.20	5.10	6.00
Austral-Asia	-	-	0.12	0.14
Africa & Middle East	-	-	0.19	0.21
Latin America	-	-	0.60	0.83
Eastern Europe	-	-	0.37	0.40
Rest of world	0.50	0.80	0.20	0.30
TOTAL	12.40	14.00	19.58	24.18

\* Estimates

Source: IMS 1994; Gruenwald, 1997; Gruenwald, 2000

## 2.2.2 European Market for Herbal Medicines

In Europe, the market situation of herbal medicines is well diversified. Herbal medicines are sold as licensed and unlicensed products. Accurate figures for unlicensed herbal products are difficult to locate than regulated licensed products. However, the herbal market has been described as a leading sector within both the dietary supplement (Sauer, 1999) and over-the-counter (OTC) drugs (Wilhelm, 2000).

During 1994, the overall annual sale of OTC herbal medicines amounted to US\$ 6 billion. It increased to US\$ 7.5 billion, at the rate of 10 to 15 per cent per annum in 1997. The European market for licenced herbal medicines in terms of sale stood at more than US\$ 475 million in 1997, and was dominated by products based on ginkgo (*Ginkgo biloba*), which alone accounted for the three top selling preparations. In Germany, where the herbal market is particularly well developed, the sale of ginkgo products has dropped during the last 10 years (from 9.9 million sales in 1993 to 8.5 million in 1997). The sales of some other herbs, especially St. John's wort (*Hypericum perforatum*) increased sharply over the same period from 2.6 to 8.5 million sales (Mertens, 2000). The leading herbal products in demand are from ginkgo, ginseng, garlic, St. John's wort, evening primrose and echinacea (Table 4).

Within Europe, Germany leads the market with sales worth US\$ 3.5 billion, followed by France, Italy, the UK, Spain, Scandinavia and the Netherlands (Table 5). Germany comprises about half of the European market and its per capita consumption of US\$ 42.9 is about ten times of any other European country.

German pharmacies sell almost one third of all non-prescription drugs as herbal medicines (Schwab and Paffrath, 1994). This category is further divided into prescribed and reimbursed semi-ethical herbal medicines (accounting for US\$ 9 million in retail sales) and OTC herbal medicines (US\$ 1.1 billion) (Figure 2).

Table 4: Sale performance of licenced herbal medicinal products in Europe

Herbal product	Botanical source	Manufacturer	Sale value (million US\$)		Rank	
			1992	1998	1992	1998
Tanakin	<i>Ginkgo biloba</i>	Beaufour	82.7	85.6	1	1
Ginkor	<i>Ginkgo biloba</i>	Beaufour	51.3	57.1	3	2
Tebonin	<i>Ginkgo biloba</i>	Schwabe	79.9	44.7	2	3
Endotelon	<i>Vitis vinifera</i>	Sanofi Pharma	41.8	40.9	4	4
Permixon	<i>Serenoa repens</i>	Pierre Fabre	33.3	37.1	5	5
Ultra levure	Yeast	Biocodex	15.2	21.9	6	6
Tadenan	<i>Prunus africana</i>	Fournier/Debat	34.2	22.8	4	7
Jarsin	<i>Hypericum perforatum</i>	Lichtwer Pharma	2.9	24.7	-	8
Sinupret	<i>Gentiana</i> spp.	Bionorica	17.1	22.8	10	7
Kwai	<i>Allium sativum</i>	Lichtwer Pharma	20.0	19.0	9	10
Gingium	<i>Ginkgo biloba</i>	Hexal AG	5.7	19.0	-	10
Roekan	<i>Ginkgo biloba</i>	Intersan GmbH	4.6	18.1	-	13
Gelomyrtol	<i>Mentha piperita</i>	Pohl	18.1	16.2	-	14
Ginkgobil	<i>Ginkgo biloba</i>	RatioPharm	13.3	19.0	11	10
Venostasin	<i>Aesculus hippocastanum</i>	Klinge Pharma	20.9	15.2	8	16
Hepar SL Forte	<i>Cynara scolymus</i>	Serturmer	1.0	16.2	-	14
Klosterfrau melissengeist	<i>Melissa officinalis</i>	Klosterfrau	21.9	10.5	7	17
Euphytose	<i>Passiflora</i> spp., <i>Valeriana</i> spp.	Roche Nicholas	7.6	14.3	-	17

Source: Mertens, 2000

Table 5: Over-the-counter sale of herbal medicines in European Union member states

Country	Annual retail sale value (billion US\$)		Per capita (US\$)
	1994	1996	1996
Germany	3.00	3.58	42.9
France	1.60	1.79	31.2
Italy	0.60	0.82	12.2
United Kingdom	0.30	0.49	6.9
Spain	0.23	0.33	7.6
Netherlands	0.10	0.16	6.4
Belgium	0.04	-	-
Rest of Europe	0.13	0.33	4.5
TOTAL	6.00	7.50	19.5 (mean)

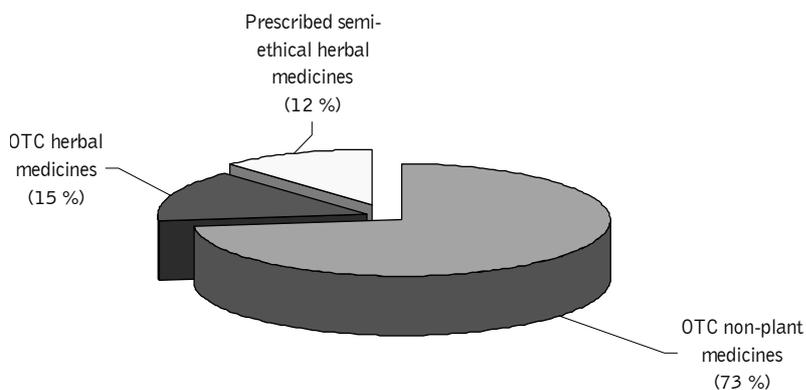


Figure 2: Herbal medicines in German pharmacies

Among the most prescribed herbal mono-preparations in Germany are ginkgo products, which lead with total sales of US\$ 284 million, followed by horse chestnut with US\$ 70 million (Table 6). Under the non-prescription herbal medicines, garlic tablets are the leading product. According to actual surveys, seven million Germans (8 per cent of total population) regularly take garlic supplements. The leading garlic product 'Kwaireg' holds about 50 per cent of market share, with an annual sales value of US\$ 50 million.

Table 6: Most frequently prescribed herbal mono-preparations in Germany, in 1998

Herbal drugs	Botanical source	Therapeutic class	Retail sale value (million US\$)
Ginkgo	<i>Ginkgo biloba</i>	Circulatory agent	284
Horse chestnut	<i>Aesculus hippocastanum</i>	In varicose veins	70
Yeast preparations	Fungal Source	Antidiarrhoeal	36
St. John's wort	<i>Hypericum perforatum</i>	Antidepressant	36
Myrtle	<i>Myrtus communis</i>	Cough suppressant	22
Stinging nettle	<i>Urtica dioica</i>	Urologic	20
Saw palmetto	<i>Serenoa repens</i>	Urologic/Prostrate	19
Milk thistle	<i>Silybum marianum</i>	Urologic	18
Ivy leaf	<i>Hedera helix</i>	Cough suppressant	18
Mistletoe	<i>Viscum album</i>	Cancer treatment	14
Soy beans	<i>Glycine max</i>	Dermatological uses	9
Chamomile	<i>Matricaria chamomilla</i>	Dermatological uses	9
Comfrey	<i>Symphytum officinale</i>	Dermatological uses	8
Kava-kava	<i>Piper methysticum</i>	Tranquillizer	8
Greater celandine	<i>Chelidonium majus</i>	Gastrointestinal treatments	8
Bromelain (from Pineapples)	<i>Ananas comosus</i>	Anti-inflammatory, proteolytic	7
Cineole (essential oil)	<i>Eucalyptus</i> spp.	Cold remedy	7
Black cohosh	<i>Cimicifuga racemosa</i>	Gynaecological uses	6

Source: RIRDC, 2000

The European market for herbal supplements is estimated at over US\$ 2.7 billion and a further US\$ 0.9 billion for herbal remedies. Germany is by far the largest market, growing rapidly at over 4 per cent per annum for herbal remedies and considerably faster for herbal supplements. In Germany and France, with well-established theory of using herbal supplements, annual sales have been forecasted to rise at approximately 5 per cent, whereas in the UK and Scandinavia growth rates of more than 10 per cent are predicted (Wilhem, 2000).

Plant-derived drugs with tranquillizing or sedative actions are likely to continue their popularity, and the demand for herbal products, such as valerian (*Valeriana officinalis*), St. John's wort (*Hypericum perforatum*), hops (*Humulus lupulus*), passion flower (*Passiflora* spp.) and kava-kava (*Piper methysticum*) with these properties is set to continue. The increasing demand for this category can be seen from the case of Jarsin', a licensed product based on St. John's wort. Its sale rose from US\$ 2.9 million in 1992 to US\$ 24.7 million in 1998. Other plant products, such as ginkgo and ginseng are likely to grow rapidly to meet the increasing demand. Ginkgo products such as 'Tanakin' and 'Ginkor' and 'Tebonin' already dominate the European market for herbal medicines, recording annual sale in excess of US\$ 180 million in 1998.

### 2.2.3 North American Market for Herbal Products

The North American market for botanicals is considered to be in its developmental phase as compared to European market, and most of the herbal products are sold as dietary supplements. Demand for medicinal plants has increased significantly during the 1990s and was particularly strong among the aging baby-boomer generation, eagerly seeking preventive treatments for various ailments as opposed to prescription treatments, which are usually available only after a problem has surfaced.

In 1994, the annual sale value of herbal medicines in North America was only US\$ 1.5 billion, which increased to US\$ 3.8 billion in 1999, registering about two and a half fold increase (Gruenwald, 2000).

The USA is the largest market for herbal products in North America. During 1998, the US market at about US\$ 4 billion was 20 per cent higher than the previous year. The most significant growth in the USA has occurred in the mass market of food, drug and merchandise outlets. The mass market for top selling botanicals was US\$ 600 million in 1998. Twelve botanicals accounted for 94 per cent of market sale and all of these exhibited greater than 25 per cent growth in preceding three years (Scimone and Scimone, 1999). Herbal formulas also showed healthy growth rates, reaching 25.1 per cent in the year 1998 (Scimone and Scimone, 1999) and 17 per cent in the following year (Sauer, 1999). The strongest growth within this sector was shown by formulae containing St. John's wort (>1000 per cent annual growth rate), with a number of others showing more than 30 per cent growth.

Many of the top-selling herbal products in the USA are similar to European products, e.g. ginkgo, ginseng and garlic. Six products from herbs ginkgo, St. John's wort, ginseng, garlic, echinacea and saw palmetto accounted for 85 per cent of total sales in 1998. At that time, the products with the fastest growth were St. John's wort (2801 per cent), echinacea (140 per cent), ginkgo (140 per cent) and saw palmetto (138 per cent). Kava-kava and evening primrose registered growth rates of 473 and 104 per cent respectively, but their market share was still very small (Table 7). The sale of natural supplements, herbs and homeopathic remedies is also increasing at faster rate in the USA.

The Dietary Supplement Health and Education Act (DSHEA), 1994, classified medicinal herbs as food supplements as opposed to defining them as medicines or food products. This exempted medicinal herbs from the approval under food and drug standards from official Food and Drug Administration of the United States (USFDA). Consequently, the sale and distribution of medicinal herbs increased at most of the major retail channels (Table 8). The sources indicate that the positive market response is reinforcing, as medicinal plant products are available at trusted retail centres increasing their legitimacy and appeal among consumers.

The fastest growing natural product in the USA has been soy isoflavones, while speciality product like lycopene (from tomato) has also seen a rapid growth. Medicinal

plants used in OTC medicines, for which legal drug claims can be made, enjoy a relatively stable market than dietary supplements. These include *Aloe vera*, *Cassia senna*, *Plantago ovata*, *Rhamnus purshiana*, and *Hamamelis virginiana*.

Table 7: Leading herbals in the USA, in 1998

Herbals	Botanical name	Sale value (million US\$)	Per cent growth 1996-98
Ginkgo	<i>Ginkgo biloba</i>	138	140
St. John's wort	<i>Hypericum perforatum</i>	121	2,801
Ginseng	<i>Panax</i> spp.	98	26
Garlic	<i>Allium sativum</i>	84	27
Echinacea	<i>Echinacea</i> spp.	33	151
Saw palmetto	<i>Serenoa repens</i>	27	138
Grape seed	<i>Vitis vinifera</i>	11	38
Kava-kava	<i>Piper methysticum</i>	8	473
Evening primrose	<i>Oenothera biennis</i>	8	104
Goldenseal	<i>Hydrastis canadensis</i>	8	80
Cranberry	<i>Vaccinium macrocarpon</i>	8	75
Valerian	<i>Valeriana</i> spp.	8	35
Others	-	31	-

Source: RIRDC, 2000

Table 8: Annual market growth of selected plant products, in 1997-98

Category	Annual sale growth (per cent)	
	Natural products stores	Food/drug/mass outlets
Products with glucosamine/chondroitin	31	300
Tranquillizing herbals *	42	183
Herbal formulas for women	78	109
Facial lotions & creams	35	6
Homeopathics (topicals)	18	15
Laundry products	30	n/a

\*Includes Valerian, Kava-kava, and Chamomile  
Source: RAISE, 2001

Industry sources indicate that 1999 was the first year, since 1994, which recorded negative growth in the sale of medicinal plants (Table 9).

Table 9: Sale performance of selected medicinal herbs during 1998-99

Herb	Botanical name	Sale value (million US\$)		Per cent change
		1998	1999	
Ginkgo	<i>Ginkgo biloba</i>	109.30	102.74	6.0
St. John's wort	<i>Hypericum perforatum</i>	101.30	78.09	23.3
Ginseng	<i>Panax</i> spp.	71.25	60.16	15.6
Echinacea/Goldenseal	<i>Echinacea</i> spp., <i>Hydrastis canadensis</i>	44.68	44.59	0.2
Kava-kava	<i>Piper methysticum</i>	10.93	11.59	7.1

Source: RAISE, 2001

Despite the slowdown in sales, there is a wide variation in demand for certain plants and extracts. The overall market for dietary supplements, which was growing at around 6 per cent until 1999, dropped to under 3 per cent in 2000. The herbal segment is generally more sluggish than other sectors of the nutrition industry, such as functional foods, vitamins and minerals. The market for functional foods (foods with specific health benefits) has been growing at more than 9 per cent per year.

The US market of herbal medicinal products is expected to peak at US\$ 6 to 8 billion in the next few years. The present dietary herbal supplement market is estimated at US\$ 4 billion and has been growing at 6 to 8 per cent per annum.

#### **2.2.4 Traditional Medicines and Alternative Practitioners**

The traditional system of medicine refers to ways of protecting and restoring health that existed before the arrival of modern medicine. As the term implies, these approaches to health belong to the traditions of most of developing countries, and have been handed down from generation to generation. Traditional medicines have fulfilled the needs of the local communities since many centuries. China and India, for example, have well-developed and sophisticated systems, such as Traditional Chinese Medicine (TCM) and Ayurvedic medicine respectively.

A large proportion of population in a number of developing countries still rely on traditional practitioners, including birth attendants, herbalists and bone-setters, and use local resources of medicinal plants to satisfy their primary health-care needs. WHO estimates that traditional birth attendants assist up to 95 per cent of all rural births and 70 per cent of urban births in developing countries.

Traditional medicines have maintained their popularity in a number of Asian countries, including China, India, Japan and Pakistan. In China, for example, traditional medicines (herbal preparations) account for 30 to 50 per cent of the total medicinal consumption. In 1993, the total sale of herbal medicines in China amounted to more than US\$ 2.5 billion. In Japan, from 1974 to 1989, there was a 15-fold increase in the sale of Kampo (Chinese method) medicinal preparations in comparison with only 2.6 fold increase for mainstream pharmaceutical products. The per capita consumption of herbal medicines in Japan appears to be highest in the world.

During the last decade, there has been a renewed interest in traditional and alternative systems of medicine in many developed countries. One third of American adults have used alternative treatment and 60 per cent of population in the Netherlands and Belgium, and 74 per cent in the UK are in favour of complementary medicine to be available within the framework of National Health Service. A survey among member states of the EU in 1991, identified about 1,400 herbal drugs used in the European Economic Community (EEC).

The demand for medicinal plants is undoubtedly increasing in all sectors and this growth is fuelling an increase in both the number of species and volume of medicinal plants being traded.

### Traditional Medicine Market in Asia

Alternative systems of plant-based medicine form an important part of the health-care systems in most of the Asian, African, Latin American and some developed countries. Among Asian countries Japan, China and India have the highest per capita consumption of traditional medicine. Most of the population in Africa and Latin America also relies on traditional medicine.

#### *Japan*

Traditional medicines have been used effectively in the Japanese society for more than a thousand years. The Japanese traditional medicine may be divided into folk medicine and Chinese medicine from ancient China, popularly called Kampo medicine, which are extremely popular. Each Kampo drug is a formula usually consisting of 5 to 10 different herbs. Most of the modern ready-to-use forms of the original formulae are produced in granular, powdered or other forms, based on the classical decoction. At present, there are approximately 210 Kampo drugs available as ethical drugs on the market.

Kampo drug market experienced dynamic growth since 1980's. It has enjoyed an annual growth rate of 15 per cent over the last five years. At present the annual production of Kampo drugs is worth about US\$ 1 billion of which the prescription sale accounts for 78.6 per cent and OTC for 21.4 per cent. Sho-saiko-to is the largest Kampo formulation of seven crude ingredients, with annual sale of US\$ 111 million. Hochu-ekki-to, with less than half the sales (US\$ 52 million) is at second place. Table 10 shows the sale values of top ten Kampo formulations on the market.

Table 10: Sale values of top ten Kampo formulations in Japan, in 1999

Kampo formulation	Sale value (million US\$)	Per cent share
Sho-saiko-to	111.0	11.8
Hochu-ekki-to	52.3	5.6
Kami-shoyo-san	26.7	2.8
Sho-seiryu-to	22.7	2.4
Bakumondo-to	21.6	2.3
Saiboku-to	20.3	2.2
Hachimi-jio-san	18.5	2.0
Toki-shakuyaku-san	17.8	1.9
Kakkon-to	16.4	1.7
Rikkunshi-to	16.4	1.7
Total of top ten	323.7	34.5
Others	614.5	65.6
TOTAL	938.2	100.0

Source: *Kampo Today*, 2001

Chinese herbal remedies and manufactured products have a demand in excess of US\$ 840 million a year in Japan, representing 2 per cent of the entire spectrum of market in 2001 (Stephen, 2001). In the last decade, 45 items among the top hundred OTC drugs sold in Japan were herbals. The most common and favoured plants in Japan are ginseng, lingzhi and ginkgo.

### *China*

In China, plant-based medicines are the backbone of the health-care for a billion people. Medicinal plants are used by 40 per cent of Chinese urban patients and over 90 per cent of rural patients for the primary health-care needs. In the traditional medicines as well as in the officially decreed medicines, huge quantities of plant materials are used. Indeed, long back the annual demand had been reported to exceed 700,000 metric tonnes (Xiao, 1991). In 1978 the market for Chinese medicine was US\$ 0.44 billion, which rose to 0.66 billion in 1990 and 1.3 billion in 1992. In 1993, the total sale of herbal medicines amounted to more than US\$ 1.6 billion, excluding US\$ 400 million worth of exports. The demand for medicinal plant material in China has grown annually at 9 per cent. There are over 4,000 composite drugs in 40 different formulations in Traditional Chinese Medicine. The annual average cost of herbal medicines per person was US\$ 0.06 in 1956; US\$ 0.26 in 1978; US\$ 0.56 in 1986, which rose to US\$ 1.57 in 1993.

Chinese herbal medicinal preparations are exported to more than a hundred countries. The production of plant-based medicaments and related products was around US\$ 5.8 billion per annum in 1996. TCM make up to 40 per cent of the market, while western style drugs work out around 60 per cent. The annual output value of TCM industry is around US\$ 1.8 billion with a volume output of more than 200,000 metric tonnes in early 1990's. The export of TCM was around US\$ 480 million in 1992, and US\$ 506 million in 1993. China's current export of herbal medicines totals US\$ 36.6 billion per annum (Trade Daily, 2000).

### *India*

The medicinal plant trade in India is estimated to be around US\$ 11.7 million per year. During 1980s, India was the largest supplier of medicinal plants to EEC with a supply of 10,055 metric tonnes of medicinal plant material and 14 metric tonnes of plant alkaloids and their derivatives. The annual turnover of Indian herbal industry was estimated at around US\$ 300 million in 1995 (Anonymous, 1996). In 1997-1998, the export value of Ayurvedic and Unani medicines was about US\$ 33.5 million, which dropped to US\$ 27.7 million in 1998-1999, and again went up to US\$ 31.7 million in 1999-2000. Psyllium husk, popularly known as isabgol, is a major item with export value of US\$ 23.5 and 19.6 million in 1998-99 and 1999-2000, respectively (Pharmabiz, 2001). Of a total turnover of US\$ 48.9 million of Ayurvedic and herbal products, the major OTC products contribute around US\$ 25.5 million, the ethical formulations around US\$ 13.8 million, and the classical Ayurvedic formulations the remaining US\$ 9.6 million. Realizing India's potential, the Government of India has projected export earnings from these herbal products to be US\$ 63.89 million by 2005, and US\$ 212.92

million by 2010 (Chandrika, 2000). The demand from different countries for Ayurvedic and Unani medicines is given in Table 11.

Table 11: Demand for Ayurvedic and Unani medicines from top 11 countries during 1997-98

Country	Quantity (MT)	Value (million US\$)
France	8.03	0.32
Germany	41.43	0.29
Italy	32.81	0.60
Malaysia	71.06	0.74
Netherlands	73.25	0.46
Russia	157.86	0.48
Singapore	29.14	0.61
Switzerland	26.28	1.14
Ukraine	47.10	0.40
United Arab Emirates	130.06	0.54
USA	61.26	0.49
TOTAL	1,298.62	8.80

Source: Pharmabiz, 2001

### **Malaysia**

The Malaysian herbal industry is estimated at about US\$ 315 million per annum, growing annually at a steady pace of 20 per cent (Bernoma, 1999). Despite being one of the world's 12 mega biodiversity centres, 80 to 90 per cent of the country's herbal products are imported. The import of raw material for traditional medicines is largely from Indonesia, China, Thailand, Taiwan and the USA, and is mostly channelled through Singapore, Philippines, Australia and Hong Kong, while export is largely to Singapore. Preliminary trade statistics show that the total import value of medicinal plant products has increased from US\$ 14 million in 1990 to 16 million in 1992. There was 18 per cent rise in demand for herbal products during these two years. The market value, which was estimated at US\$ 10 million in 1994, grew up to about US\$ 15.8 million in 1996. Today the main products in demand are garlic, echinacea, ginkgo and evening primrose oil. The Malaysian herbal market has the potential to hit US\$ 842 million by the year 2005 and US\$ 1.36 billion by the year 2010 (Bernoma, 1999; Hanim, 2000). There are about 1,000 manufacturers of Malay herbal medicines in Malaysia.

### **Indonesia**

Indonesia is the second largest biodiversity centre after Brazil. It has more than 30,000 plant species, distributed on different Indonesian islands. There are about 1,000 medicinal plants of which 350 are used as potential source of raw material for herbal medicines. Medicinal plants have been used by the people of Indonesia since ancient time and there is a tendency of improving their demand in future. There are different forms of traditional practices in Indonesia, all associated to a greater or lesser degree with different ethnic groups. But the oldest and most widespread is Jammu system of herbal medicine. It is an important constituent of national health-care programmes and economy of rural people. Manufacture of traditional medicine has been growing in Indonesia and correspondingly the number of companies has also increased. According to the data of

Ministry of Health, about 48.98 per cent of herbal medicines are used for preventive purposes, 22.47 per cent for promotion ventures, 21.78 per cent for curative intentions, and rest for birth control, beauty care, personal hygiene and sexual purposes. In general, 40 per cent of Indonesian population utilizes herbal drugs for health-care needs. A part of crude drugs is also imported from other countries. Indonesian herbal medicines are divided into two groups, i.e. Jammu medicine and Phytopharmaca group. The Jammu medicines are based completely on the experiences and their manufacture generally do not comply with the requirements of Goods Manufacturing Practices (GMP). Phytopharmaca medicines comply with the formal GMP requirements and their efficacy is based on tests.

In Indonesia, the development of herbal industry has increased rapidly since last decade. In the year 1992, there were 468 registered industries (448 small and 20 large ones), that increased to 807 (720 small and 87 large ones) in 2000. This increase in number of manufacturing units is the reflection of an increase in the consumption of herbal medicines in Indonesia. The consumption volume of herbal medicines increased from 6,052 metric tonnes in 1995 to 7,685 metric tonnes in 2000. One of the top companies dealing with manufacture of Jammu medicine, namely 'PT Jammu Air Mancur', reported an annual income of US\$ 360 million, mostly from domestic sales and US\$ 9 million from export of Jammu medicines in 1995.

### *Cambodia*

The use of traditional medicine is a rich tradition to maintain health, among the people of Cambodia. The Khamer is the most popular traditional medical system. It is closely linked to the history of its religion. The practice of herbal medicine continues due to its biomedical benefits and place in cultural beliefs through out the country. Cambodia has the potential to source the national requirements of raw material of more than 500 valuable medicinal plants. Usually ground or chopped parts of medicinal plants in decoction, liquor or powder form are used.

### *Lao People's Democratic Republic*

Lao has large reserves of natural resources, including medicinal and aromatic plants. Most of the traditional practitioners in Lao use domestic raw material for preparation of their prescriptions. In Lao no big company undertakes the business on materia medica. There is only one small scale factory in the southern part of the country, which produces raw material of medicine from plants, and another in the central part which produces essential oil from pines. There are some pharmaceutical factories in the capital, from which three belong to government sector, one is a joint venture with China, and rest are private. The country produces only a small quantity of plant-based medicines.

### *Philippines*

Medicinal plants provide basic and alternative health-care to the people of Philippines, especially in remote islands, where there is a lack of modern medicines and medical facilities. The new developments and remarkable progress have taken place in the medicinal and aromatic plant sector in the Philippines since the establishment of the

Asian Network on Medicinal and Aromatic Plants (ANMAP), in June 1993. Many pharmaceutical companies have expanded their business to herbal medicines and body-care products. Among the exported herbal products, the most prominent are herbal teas and herbal cosmetics. There is also a strong movement from folk medicine to pharmaceuticals, and herbal medicine is now considered a strong partner in the health-care delivery system. Medicinal plants which were earlier regarded as for concoctions and poultices dispensed by herbalists, are now available in modern dosage forms such as tablets, capsules, syrups and ointments. Herbal soaps, shampoos, skin and body lotions, powders, colognes are also available, and are quite popular in the market.

### *Thailand*

Thailand is bestowed with rich natural resources of medicinal and aromatic plants. There are more than 10,000 species of plants of which about 1,400 are used as indigenous medicinal and aromatic plants in Thai traditional materia medica. Thailand produces enormous quantities of plant-based raw materials, which are used globally in pharmaceutical, perfumery, cosmetic, aroma-chemicals and related industries. Potential species of export value include: senna, pepper, chili pepper, sweet basil, citronella, jasmine, champa, ylang ylang, and lemon grass. Apart from fulfilling the domestic demand Thailand also exports these plants in the form of raw materials or intermediary chemicals to Europe, the USA, and Japan. In 2000, there were 699 manufacturing units of traditional drugs in Thailand (248 in Bangkok, 451 in the rural areas).

### *Vietnam*

Medicinal plants and herbal drugs have made a tremendous contribution to the national health and development in Vietnam. There is an age-old traditional system of medicine, handed down from one generation to another since time immemorial. Vietnam government has integrated the traditional and modern systems of medicine into a Vietnamese system of medicine. It has been estimated that by the year 2010 Vietnam will produce itself 70 per cent of the needed medicines. Herbal and plant-based drugs using the indigenous raw materials will account for 30 per cent of the total value of produced medicines. At least 3,000 metric tonnes per annum of medicinal plants material is required to fulfill the needs of 20,000 traditional practitioners. According to a survey of medicinal plants resources, 2,000 species and sub-species of medicinal and aromatic plants have been used in traditional medicine.

### *Sri Lanka*

In Sri Lanka traditional medicine systems (i.e. Ayurveda, Siddha, Unani and Deshiya Chikitsa Traditional Ayurveda) are the major users of medicinal plants. Most of the demand of medicinal plants is met through import from India. In 1994 over US\$ 10 million worth medicinal plants were imported from India through the Department of Ayurveda. The rest was locally collected mostly from the wild. The herbal drug and raw material imports to Sri Lanka are controlled by the private sector. The largest buyer is Ayurvedic Drugs Corporation. In addition there are 84 Ayurvedic drug manufacturing companies. According to the figures available at the customs, in 1995 Sri Lanka exported

368 metric tonnes of medicinal plants valued at US\$ 1.53 million, and 65 metric tonnes (US\$ 0.98 million) of medicaments. In 1996 over sixty species were imported at an annual value of US\$ 1.27 million from India and neighbouring countries.

### Traditional Medicine Market in Africa

The traditional system of medicine is an important part of African culture. It varies in different cultures and regions. In the past, African governments largely ignored their importance. However, the diminishing revenues as a result of structural adjustments, programmes and cuts in international aids, have forced many governments to reconsider the advantages of local health-care systems. Moreover, there is a growing evidence of the effectiveness of traditional remedies for the treatment of common ailments, including some HIV/AIDS opportunistic diseases. In Africa, traditional healers enjoy high social status within their communities.

The high cost of western pharmaceuticals make modern health-care services out of reach, especially for those living in rural areas. Therefore, more than 80 per cent of African population relies on medicinal plants for their health-care needs.

In South Africa, the demand for indigenous medicines is considerably higher than for western medicines. In Zambia, 70 per cent of the population relies on traditional medicines and their trade is worth over US\$ 43 million per annum. There are about 78 species of medicinal plants used widely in Zambia. An acute shortage of drugs in Uganda made most of its population to depend on herbal medicines. In Swaziland the ratio of traditional healers to total population is 1:110, in contrast to dismal ratio of 1:10,000 of medical doctors. This indicates that majority of Swaziland population cannot access modern medicine clinics and are catered by traditional healers using indigenous medicinal plants.

Over 90 per cent of Nigerians in rural and about 40 per cent in the urban areas depend partly or wholly on traditional medicine. Virtually all native species of plants are used for the treatment of one or another ailment. Almost all plants in the wild used as food also appear in the list of plants used for traditional medicine. In Namibia, medicinal plants are used greatly by rural people for their health-care needs. More than 80 medicinal plant species have been identified alone in Tsumkwe district of Otjozondjupa region of Namibia that are used to treat 30 different ailments.

Over 80 per cent of the population in Mozambique relies on traditional medicine. The forest area is highly inhabited by traditional healers and sources the supply of medicinal herbs to the practitioners of traditional medicine. The predominant medical system in use in Malawi is traditional, especially in rural areas. Limitations to government health services, such as drug shortages and an insufficient number of hospitals, as well as unfavourable doctor to patient ratio of 1:50,000 have contributed to the reliance on traditional medicines. A variety of medicinal plants are used in traditional medicines.

In Ethiopia, 70 to 90 per cent of the population relies on traditional medicine

especially from medicinal plants for their primary health-care needs. The value and role of traditional health-care systems will not diminish in the future because they are both culturally viable and expected to remain affordable while the modern health-care service is both limited and expensive. In West Africa, a shortage of basic medications, the lack of health services, the high cost of drugs, and cultural practices mean that most of the population, particularly in rural areas is restricted to traditional medicine, healers, and herbalists.

### **Traditional Medicine Market in Latin America**

Traditional medicine has a significant presence in most Latin American countries, with different forms of expression according to the region and the location. One of its natural niches are the rural areas inhabited primarily by indigenous population. Traditional medicine is also expanding to urban zones. About 70 to 80 per cent of the Latin American population relies on traditional medicine for their health-care needs. For example, about 80 per cent of the population of Ecuador depends on the traditional medicine for their health-care needs and, consequently, on the plants or natural products from which these medicines are derived. There is a lack of access to modern drugs among significant part of the population. The increasing control of pharmaceutical industry by international companies and decreasing participation of the national governments in the purchase and distribution of medicaments further complicate the problem.

The consumption of drugs in Latin America was worth US\$ 16.5 billion in early 1990's, slightly less than 5 per cent of the world consumption. The per capita consumption of drugs is approximately US\$ 21. These figures vary among different countries of the region (Argentina US\$ 65, Brazil US\$ 17, Bolivia US\$ 6) and among different regions of the same country, as is the case of Brazil (Northeast less than US\$ 5, South US\$ 70, Sao Paulo US\$ 90), (Gerez, 1993).

The big countries of the region like Argentina, Brazil and Mexico import approximately 10 per cent of their requirement of finished pharmaceutical products, while those in Central America import approximately 80 per cent, and others like Chile, Peru, Venezuela and Bolivia import around 20 to 50 per cent.

### **2.2.5 Regional Differences in Use of Herbal Medicines**

Herbal medicine is considered as a bridging gap between traditional based complementary medicine and the highly scientific conventional medicine.

This link is well established in European medical community, for example, in Germany more than 80 percent of all physicians regularly use plant medications. Even in Europe the trend of complementary medicine is still increasing, especially scientifically documented herbal medicines which are more accepted and appreciated by both the patient and physician.

In Asia, both traditional and conventional medicines are practiced in parallel, but none of the two is regarded as the only therapy being the truth for human health.

The situation in the USA is different from the two above-mentioned cases. Complementary medicine and conventional medicine are far apart like strangers. However, the situation is changing with increasing interest of people in complementary medicine. American health authorities have also realized the importance of herbal medicine. Therefore they formulated the Dietary Supplement Health and Education Act (DHSEA), in 1994, allowing the sale of herbal products as dietary supplements without subjecting them to the complex process of drug evaluation by Food and Drug Administration of the USA.

### **2.2.6 Status of Herbal Medicine in Health-Care Programmes**

There are four different legal categories of herbs: herbal medicines with a product licence, which could be prescription, pharmacy or general sale list medicines; herbal medicines exempt from licensing; herbal products marketed as food supplements; and herbal products marketed as cosmetics.

In Western Europe, the professional use of herbs and herbal medicine enjoys a relatively strong integration with conventional medicine. In the countries of the EU, herbal medicines are generally sold in pharmacies as licensed non-prescription and prescription medicines. According to the EU directive 65/65/EEC, all herbal medicines are treated as drugs, with the exception of the Netherlands and the UK, where botanicals are still sold as food supplements or dietary supplements (Gruenwald, 1998). In Europe, herbal medicines are marketed according to indications. Among the major categories, the largest proportion was spent for herbal drugs useful for cardiovascular problems followed by respiratory (cough and cold), gastrointestinal (digestive improvements), tonics, hypnotics and sedatives, as well as topicals (Nicholas Hall Reports, 1994). Europe is forging a common legal framework for botanical products, which can be sold as drugs with both labels and inserts. They can be legally prescribed by doctors and most importantly, expenses can be reimbursed through various medical insurance plans.

Herbal medicines have long been a part of the established medical practice in Germany. The German Medicines Act of 1978 has permitted the issuing of Standard Licences for botanical products after each has been examined in a published monograph which details qualitative and quantitative information about the product-side effects, interactions, dosages, effects, indications, contradictions, etc. These monographs are created under the jurisdiction of a specially conceived body called Kommission E of the German Federal Health Agency and the focus in the German system is on individual plants. So far, 410 monographs have been created analyzing 324 herbs with recommended dosages and it is expected that this approach will be accepted by the EU. Of all the herbal medicines sold in Germany, about half are OTC products sold for self-treatment and the other half through medical prescription.

The cost of prescribed phytomedicines is also reimbursed in France, but in the UK

many phytomedicines are in a 'General Sales List' category and are sold as food supplements without the possibility of reimbursement. The prescribed St. John's wort costs can be reimbursed in Germany (also sold OTC), while in France it is available only as OTC drug and in the Netherlands as a food supplement. To harmonize these discrepancies, according to the EU directive 65/65, all phytomedicines will be treated as drugs necessitating registrations based on efficacy and safety. The European Scientific Cooperative for Phytomedicines (ESCOP) will prepare the European monographs to be used as the foundation for registration of phytomedicines in Europe.

In the USA, herbal medicines and products are sold as dietary supplements. Nutraceuticals/functional foods may carry either health claims, which are usually FDA pre-approved or structure/function claims depending on the most recent regulations promulgated by FDA, under Dietary Supplement Health and Education Act (DSHEA), 1994. The FDA regulates medical foods somewhat loosely within their own regulatory category.

Nutraceutical Research and Education Act (NREA), 1999, legally defines nutraceuticals as a separate regulatory category, thus allowing them to carry specific disease treatment or prevention claims previously allowed only for drugs.

In Japan, Kampo medicines used for the last 1,000 years had become eligible for reimbursement by the National Insurance Scheme in 1976. In China and India, Traditional Chinese Medicine and Ayurvedic medicine are respectively used as prescription drugs and reimbursed in the respective National Insurance Schemes.

### **2.2.7 Developments in Herbal Medicine Industry**

Europe has a long history of research and processing of botanical extracts, and has strict regulations, established quality control procedures and decades of clinical data to support the products. Overall, the European market is as well regulated as the drug industry and many of the compounds sold in the USA as dietary supplements are marketed as drugs in other countries. The majority of leading companies, specialized in herbal drugs, are located in Germany, France, Italy and Switzerland. Some of them are over 100 years old and many are still privately owned.

In the last decade, it has been observed that there is a tendency of multinational pharmaceutical companies to buy smaller herbal companies in Europe. Table 12 summarizes such acquisitions, where also several American companies, like American Home Products, Bausch and Lomb, Johnson & Johnson, Pfizer and Searle can be found. Other developments in this regard are joint ventures between European herbal medicine companies and American partners. Nature's Way was founded in 1969 and later became Murdock Health Care. In 1988 Madaus Murdock was founded as a joint venture between the German Madaus and Murdock Health Care in the USA. In 1993, Madaus and the German firm Schwabe formed a new entity, Murdock-Madaus-Schwabe (MMS). The new corporate entity markets the Nature's Way and Naturalife brands in the USA. A group of multinational pharmaceutical companies markets herbal medicines in several countries, which are produced by smaller companies, specialized in herbal drugs. Such

collaborations exist, e.g. between the Ciba Geigy's daughter Zyma, which sells a special herbal medicine line called 'Valverde', produced by Zeller AG in Switzerland. Also BASF's daughter Knoll, in Germany, sells products from Zeller AG.

In selected regions, companies like Boehringer Ingelheim (Sweden), Lederle (Australia) and Schering (Belgium and Hungary) sell herbal medicines. In these cases, the garlic product 'Kwaireg' from the German company Lichtwer Pharma is an example.

The interest in phytomedicines by conventional pharmaceutical companies is likely to continue in the near future, as evidenced by the growing acquisitions of companies specializing in phytomedicines. There is an increasing consolidation in the herbal industry at all sales levels. Beginning with the merger of Twin Labs and Nature's Herbs in 1989, many important mergers have taken place (Table 13).

Table 12: Acquisitions of European phytomedicine companies by multinational pharmaceutical companies

Multinational	Phytomedicine company acquired
American Home Products	Dr. Much (Germany)
Boehringer Ingleheim	Pharmaton (Switzerland) and Quest (Canada)
Boots	Kanold (Germany)
Bausch & Lomb	Dr. Mann (Germany)
Degussa	Asta Medica (Germany)
Fujisawa	Klinge (Germany)
Johnson & Johnson/Merck	Woelm Pharma (Germany)
Pfizer	Mack (Germany)
Rhone Poulenc Rohrer	Natterman (Germany)
Sanofi	Plant Organ (Germany)
Searle	Heumann (Germany)
SmithKline Beecham	Fink (Germany)
Solvay	Kali Chemie (Germany)

Source: study data

Table 13: Mergers and acquisitions in the herbal drug industry

Companies	Year of merger/ acquisition
Celestial Seasonings/Botalia	1995
Chattem/Sunsource International	1997
Jones Pharma Inc./Crystal Star Herbs	1997
SmithKline/Abetei	1997
Celestial Seasonings/Mountain Chai	1998
Natrol/Pure Gar	1998
Natrol/Laci le Beau	1998
Quality Botanical Ingredients/Botanical Products International	1998

Herbals are the fastest growing segment in the raw materials market in the USA, valued at over US\$ 600 million. The Martin Bauer Group, a German corporation with

over US\$ 250 million in sales and whose subsidiaries include Finzelberg, Plant Extract, (Plantextrakt), Phyto Lab, and Phytocon, is the market leader. Other major companies include the pharmaceutical giants Trostburg and Madaus in Germany and Schweizerhall in Switzerland, as well as speciality company Indena in Italy, a US\$ 200 million supplier of herbal products for the pharmaceutical, cosmetic and food industries.

The Zuellig Group is also exclusive US agent for Finzelberg. Euromed, the major supplier of standardized extracts of saw palmetto, pygeum, and echinacea, is a wholly owned subsidiary of Madaus in Germany. Madaus generates sales of US\$ 400 million per annum from herbal medicines.

Most of the large pharmaceutical companies have also started the herbal division. Warner Lambert, American Home Products, Bayer and SmithKline Beecham are all introducing herbal products. And this adds respectability to this marginalized market with driving demand for high quality raw material of medicinal and aromatic plants.

The main producers are manufacturers based in the developed countries, including the large multinational pharmaceutical companies. There are also smaller companies that specialize in herbal products and some have emerged to challenge the multinationals for market leadership in this field. The main products sold are based on plants such as St. John's wort that are now well known for their medicinal properties in the consuming countries. The market share of herbal products in developing countries remains comparatively low.

## 2.3 Natural Health Products

Herbs have been used for thousands of years by indigenous people for medicinal and healing purposes. In recent years, with the expansion of consumer's interest in the health benefits of foods and personal care products, more attention is being paid to the health foods (nutraceuticals), cosmetics and personal care products (cosmeceuticals) containing natural ingredients. The major factors for their growing demand are aging population of industrialized countries, growing desire for alternatives to conventional pharmaceutical products, and increased awareness of consumers for health benefits of these products. In the west, health foods are viewed as revolution and represent a fast growing segment of health products industry while in East, these have been a part of culture for centuries. The USA, Europe and Japan are the major producers and consumers of health food products. On the other hand, the increasing interest and popularity of health products in the Asia, Latin America, Africa and Middle East is creating more opportunities at international level than at the domestic level.

Health foods are the food products supplemented with herbal ingredients, vitamins, minerals and nutrients or ingredients isolated/purified from conventional foods. These are demonstrated to have a physiological benefit and reduce the risk of chronic disease. These are either sold at conventional retail outlets or through physicians.

Health foods are known with different names throughout the world i.e. functional foods in Oriental and nutraceuticals in Western region. In literature and media, the terms 'nutraceuticals' and 'functional foods' are used synonymously for health food products.

### 2.3.1 Nutraceuticals

'Nutraceuticals' is a latest term for health foods, first coined in 1996 by Stephen DeFelice, founder of the Foundation for Innovation in Medicine of New Jersey, USA. The term 'nutraceuticals' is an amalgamation of the terms 'nutrition' and 'pharmaceuticals' used as a marking level to distinguish certain foods and food ingredients, usually from natural sources, which confer specific health benefits. Nutraceuticals are more correctly defined as parts of a food or a whole food that have a medical or health benefit, including the prevention and treatment of disease, e.g. oil extracted from flaxseed and sold in capsule. The main three constituents which make up the nutraceuticals are herbal and related extracts, vitamins and minerals & nutrients. Nutraceuticals are the latest products in a succession of health food evolution (Table 14).

Table 14: Evolution of nutraceuticals

Year of evolution	Food health concept	Product type
1950-1960	Refined	Fibre
1970	Green	Pesticide-free natural ingredients
1980	Low and light	Calorie intake
1990	Nutraceuticals	Dietary fibres Oligosaccharides Polyunsaturated fatty acids Cholines/phospholipids Glycosides, etc.
Until 2010	Disease-fighting foods	Genetically engineered plants and fruits (e.g. bananas for pediatrics vaccines; tomatoes with elevated nicotine content to aid smoking cessation)
	Health-optimizing foods	Foods with disease prevention function (e.g. terpenes, carotenes, limonoids, xanthophylls, phytosterols, isoflavones, oligosaccharides and vitamin enriched foods)

### 2.3.2 Major Nutraceutical Products Categories

In the nutraceuticals industry major products include: dietary supplement, such as food-supplements, drinks, herbal extracts, vitamins, and essential oils; fortified foods, such as high carotenoid tomatoes, and vegetables oils modified to improve their fatty acids profiles; foods and beverages with added bioactive ingredients, such as ginseng tea or cholesterol lowering phytosterols; and entire food regimes. Some of the broad categories of nutraceuticals as a result of modifications of food composition are shown in Table 15.

The strongest market driver for nutraceuticals is the baby boomer generation which will be the largest buying consumer group in the years ahead. The health concerns and corresponding nutraceuticals treatments are given in Table 16.

Table 15: Emerging nutraceuticals

Biologically active constituents	Mode of modification	Possible functionality
Phytochemicals	Addition	Antioxidant activity, lower risk of cardiovascular diseases, lower risk of cancer, reduce blood pressure.
Pre/pro biotics	Addition	Improve gastro-intestinal (GI) function, enhance immune system, reduce risk of colon cancer, reduce risk of allergies.
Bioactive peptides/proteins	Addition	Enhance immune function, increase bioavailability of minerals.
Dietary fibres	Addition	Prevention of constipation, reduce risk of colon cancer, reduce blood pressure.
Polyunsaturated fatty acids	Addition	Reduce risk of heart attacks and some cancers, enhance immune system.
Allergens	Removal	Reduce/eliminate risk of specific food allergies.

Table 16: Major health concerns corresponding nutraceuticals in demand

Health concern	Nutraceutical treatment
Cardiovascular diseases	Oat bran, psyllium and soy; omega-3 fatty acids, inulin; extracts of kiwi and other fruits.
Cancer	Isoflavones, lycopene; fruits, vegetables, grains and soy; vitamins and herbals.
Obesity	Fat burners like <i>Garcinia cambogia</i> .
Osteoporosis	Natural phytoestrogens, inulin; soy isoflavones, flaxseed, herbals and others.
Optimal vision	Nutraceutical beverages and products containing anthocyanins, lutein, zeaxanthin, etc.
Mood, behavior and intellectual performance	Valerian, passion flower, chamomile and St. John's wort.
Gut remedies	Creative pre-biotic and pro-biotic products; digestive formulae containing oligosaccharides; traditional herbs like ginger, peppermint, fennel, papaya, chamomile, liquorice, aloe and others.
Harmonals	Soy isoflavones, flaxseed and herbals (for menstrual cramps and menopause symptoms); phytoestrogen products (to improve both calcium absorbability and bone strength).

### 2.3.3 Trends in Global Nutraceuticals Market

The precise market value for nutraceuticals is not clear, due to the difficulty with which the market is defined. But there is a general agreement that the nutraceuticals industry is a promising sector with enormous growth potential. The USA leads the market followed by Western European countries and Japan as both major producer and consumer of nutraceuticals (Table 17). In 1998-99, the herbal supplements and vitamins were the strongest performing sector in the global OTC market, with an annual growth

rate of 16 per cent. This reflects the increasing world wide interest in self medication that goes beyond traditional cold remedies and pain relievers (Sauer, 1999).

In 1999, the global nutraceutical market was valued at US\$ 6.8 billion, almost thrice the value in 1987 (Figure 3, Table 18). It has been projected to rise at over 8.3 per cent per annum to reach US\$ 11.2 billion in 2004 (Freedonia Group Inc., 2001a).

Table 17: Apparent size of major world market for nutraceuticals

Regions	Market size (billion US\$)
United States of America	10-37
Europe Union countries	15-20
Japan	10-14

Source: Lapsley, 1998; Witwer, 1998; Technology Catalysts, 1999

The global demand for herbal and related extracts in nutraceuticals grew to US\$ 2.8 billion in 1999 from US\$ 0.52 billion in 1987, depicting almost four fold rise in demand. It has been predicted that herbal and related extracts will generate the fastest growth in worldwide demand among all nutraceuticals, reflecting their widely perceived health advantages, increased validation and increasing support among medical practitioners.

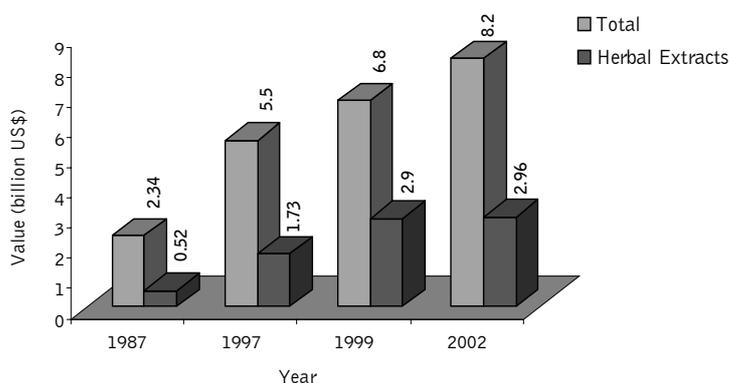


Figure 3: Global nutraceuticals demand

Table 18: Global nutraceuticals demand from 1987 to 2002

Item	Demand value (billion US\$)				Per cent annual growth	
	1987	1997	1999	2002	1987/97	1997/2002
Herbal & related extracts	0.52	1.73	2.9	2.96	12.9	11.3
Vitamins	0.68	1.38	2.3	1.93	7.2	7.0
Minerals & nutrients	1.14	2.39	1.6	3.31	7.7	6.7
TOTAL	2.34	5.50	6.8	8.20	8.9	8.3

Source: Theodore, 1997; Freedonia Group Inc., 2001(a)

If the term nutraceutical is taken in its broadest sense, including health foods, dietary supplements and natural foods, the global market has been put at US\$ 504

billion (James, 1999). This market value is split equally between the US and the European markets. It contrasts with another study valuing the market for functional foods at US\$ 32 billion in 1997, rising to US\$ 45 billion by 2002, shared primarily between Japan (US\$ 14 billion rising to US\$ 19.5 billion), the USA (US\$ 10.5 billion rising to US\$ 15 billion) and Europe (US\$ 7.5 billion rising to US\$ 23 billion), (James 1999).

The market for nutraceutical beverages is difficult to categorize, as it ranges from soft drinks through fortified juices to herbal teas. Functional teas occupy a relatively small market share (annual sales approximately US\$ 75 million). Fortified juices (such as calcium or vitamins enriched orange juices) accounted for approximately US\$ 200 million sales in 1997, while isotonic sports drinks sales in the same year came to US\$ 1.2 billion (Theodore, 1997).

Antioxidants and herbal teas also form an important part of the nutraceuticals market. The leading antioxidant phytochemicals in demand are vitamin A, C, and E, carotenoids and flavonoids. The natural vitamin C market rose to US\$ 0.3 billion in 1998 showing a 9 per cent rise over the previous year. Carotenoid formulae showed an even larger increase of 11.4 per cent during the same period with sales totaling to US\$ 96.8 million, while sales of natural vitamins A, D and K increased by 16.1 per cent to US\$ 11.5 million. The largest increase occurred in the market for natural vitamin E single supplements, which increased by 24.8 per cent to US\$ 0.3 billion from 1997 to 1998 (Kane, 1999).

Functional beverages in 1997 accounted US\$ 92.7 million. Within the functional beverage sector, powder-to-mix products (mainly proteins and fibre based products) accounted for 40 per cent, teas in bags 37 per cent and cultured drinks for less than 10 per cent of the sector. The annual increase in sales were predicted at 3.3 per cent for powder-to-mix products and 27 per cent for teas in the bags (Kroll, 1997). Herbal teas are forecasted to be an area of particularly rapid growth in the next few years. According to Business Communications Company Inc., the global market for functional foods and beverages will rise at approximately 12.4 per cent per annum to reach US\$ 0.3 billion by 2002 (Kroll, 1997).

In 1999, the market for self-medication of coughs, colds and respiratory complaints stood at approximately US\$ 9 billion, growing 2 per cent annually. The most dominant herbal remedies for this market are those based on *Echinacea* spp. (*E. purpurea*, *E. pallida* and *E. angustifolia*), which account for 9 per cent of herbal sales in Europe and 12 per cent in the USA. Total annual sales of *Echinacea* products in the USA alone in 1999 have been put at between US\$ 71 to 109 million (Aarts, 2000, Brevoort, 2000), and there is still considerable potential for commercial development of products from this genus. If high quality herbal products could account for approximately 30 per cent of this market, as has been predicted for pharmaceutical companies (Wilkinson, 2000), the future potential of herbs for cough and cold could be as high as US\$ 3 billion.

Cardiovascular diseases are frequently cited as a key health issue, both by consum-

ers and by manufacturers of functional foods. Herbs like hawthorn, horehound and ginseng are likely to dominate the herbal treatments for this market. Closely related are herbs to lower cholesterol, such as artichoke and garlic. Lichtwer's Kwai, a licensed product based on garlic, had annual sales in Europe of US\$ 20 million in 1998. Unlicensed garlic products accounted for 10 per cent of European herbal sales in 1997, and 16 to 18 per cent of sales in the USA between 1996 to 1999. Considering the emphasis put on cardiovascular diseases as a therapeutic target, these values are very likely to increase over the next years.

Grouped with cardiovascular diseases obesity was cited as a key health concern by 70 per cent of the people in a poll study in the USA. Globally, the market for weight control products has been put at US\$ 64.1 billion in 1997 (Peet, 1999). Diet or healthy foods accounted for the large share of 91 per cent and only 2 per cent being OTC dietary aids. However, even small 2 per cent share is worth over US\$ 1 billion. Herbs, such as *Garcinia* spp. have potential for development as weight loss aids, through their potential to alter lipid metabolism.

The US demand for nutraceuticals increased from US\$ 880 million in 1987 to US\$ 1.7 billion in 1996 and was expected to reach US\$ 2.5 billion in 2001. The herbal and related extracts which forms only 3.40 per cent of nutraceuticals demand in 1987 increased to 18.49 per cent in 1996 (Table 19). The sales of dietary supplements in the USA has tripled to more than US\$ 10 billion per year with thousands of supplements in the retail outlets in 2001.

Table 19: The US bulk nutraceuticals demand and growth from 1987 to 2001

Item	Demand value (billion US\$)			Per cent annual growth
	1987	1996	2001	1996/2001
Herbal & related extracts	0.03	0.32	0.65	15.2
Vitamins	0.29	0.48	0.65	6.0
Minerals & nutrients	0.56	0.93	1.23	-
TOTAL	0.88	1.73	2.53	7.8

Source: Theodore, 1997

Japan is the third largest producer of nutraceuticals in the world and the largest in the Asia-Pacific region. Over half of all patents for nutraceuticals have been developed in Japan. In 1998, the Japanese market for vitamins, nutraceuticals and dietary supplements was estimated to be worth over US\$ 18 billion, which means that it was more than ten times larger than any European market, with an increase of nearly 15 per cent from 1994. Dietary supplements accounted for the largest share of this market, with sales of more than US\$ 14 billion.

### 2.3.4 Future Trends in Global Nutraceuticals Market

In 1998, herbal supplements were part of the fastest growing sector of the US\$ 45 billion global OTC market, with annual growth rates of 16 per cent. Similarly, herbal products dominate the global market for herbal remedies. The areas of most rapid annual

growth (between 50 and 100 per cent) are predicted to come from those countries where the herbal market is relatively poorly developed e.g. the USA, Australia, etc.

Freedonia Group Inc. reports (2001a) have projected that Asia-Pacific, Latin America, Africa and Middle East will provide the fastest growth for nutraceutical industry. China will see the most impressive jump in nutraceuticals consumption and production levels. The USA, Japan and major West European countries will remain the largest global producers and consumers of nutraceuticals due to higher consumer income levels, widespread preferences for speciality nutritional and herbal products, trends promoting preventive medicines and self treatment. The growth in demand will accelerate as new functional food additives continue to flow into the marketplace and expand uses in conventional and speciality products. Soy and fiber nutrients (e.g., isolated soy proteins, oat bran, psyllium) will provide the striking growth opportunities based on consumer preferences to obtain nutritional requirements through normal dietary practices, such as liquid meal substitutes, energy boosting shakes, sports beverages and fortified foods. These applications will also drive up global demand for bulk vitamins, especially antioxidants (i.e., vitamin A, C and E) with scientifically supported health benefits. The US demand for nutraceuticals will increase 6.7 per cent annually to US\$ 2.7 billion in 2004, serving end-use product markets totaling US\$ 34 billion.

### ***Herbal and Related Extracts***

Of the three major constituents of nutraceuticals, herbal and related extracts will see the strongest growth based on expanding scientific evidence of health benefits and the rising popularity of alternative medicines (Freedonia Group Inc. Report, 2001a). Widely perceived health benefits among consumers will drive demand for herbal and related extracts up ten per cent annually to US\$ 350 million in 2004. Ginkgo for estimated cognitive properties, St. John's wort for managing mild depression, ginseng for energy boosting, echinacea for strengthening immunity, and saw palmetto for benign prostatic hyperplasia will provide the best growth prospects among herbs.

### ***Nutrients and Functional Additives***

The second group of nutraceuticals, nutrients and functional additives, will generate above average sales gains, spurred by ongoing advances in the quality of ingredients. Among the nutrients, soy proteins, oat brans and psyllium will continue to comprise the largest selling components due to health and wellness advantages and increasing uses in fortified foods and beverages. Polyunsaturated fatty acids (PUFAs) will emerge as the leading group of functional additives, with demand advancing 30 per cent annually through 2004. The third group of nutraceuticals, vitamins and minerals, will continue to be dominated by antioxidants (vitamins A, C and E). Demand for essential nutrients and functional additives will increase almost nine per cent annually to US\$ 1.2 billion in 2004. Soya proteins and PUFAs will lead growth based on proven health benefits, ongoing advances in formulations and broad adaptability to end-use products. Clinically confirmed cholesterol-reducing actions will drive up demand for oat bran and psyllium.

### 2.3.5 Developments in Nutraceutical Industry

Nutraceuticals are the most promising sector for health food and pharmaceutical industries. Many functional food/nutraceutical companies are part of larger food or pharmaceutical industries. In general, pharmaceutical industry is better positioned to produce functional foods, however there are companies that operate in both areas through strategic alliances. Many pharmaceutical companies have subsidiaries that sell nutritional products. A number of large food and pharmaceutical companies, such as Kellogg, Heinz, Quaker, Unilever, Dupont, Novartis, Cargill, Hormel, Abbott Laboratories, Royal Numico, Amway, and American Home Products are active in the field because they consider that the nutraceuticals market has promising growth potential. The leading companies in the global market for functional foods are given in Table 20. A certain number of these companies may well be interested in contract growing of raw materials for their products, due to the scale of their operations.

Table 20: World's leading functional food companies by turnover during 1997-99

Country	Company	Functional foods (billion US\$)	Total (billion US\$)
United States of America	Abbott Laboratories	1.26	12.48
	Kellog Company	0.90	6.76
	Weider Nutrition International	0.25	0.25
	General Mills	0.20	7.07
	Tropicana Products	0.10	2.00
	Balance Bar Company	0.08	0.08
	Mc Neil Consumer Healthcare	n/a	n/a
	Cooke Pharma	0.05	0.05
	Gum Tech international	0.01	0.01
Germany	Molkerei Alois Moeller	0.18	1.20
	Ehrmann	n/a	0.32
Switzerland	Novartis International	2.40	21.30
	Nestle	0.20	51.99
	Toni	0.06	1.13
France	Groupe Danone	0.50	14.10
	Groupe Lactalis	0.17	5.00
	Groupe Distriborg	0.16	0.25
UK/Netherlands	Campina Melkunie	0.55	3.90
Denmark	MD Foods	0.18	3.60
United Kingdom	SmithKline Beecham	0.76	12.96
Australia	Sanitarium	0.18	0.18
	Goodman Fielder	0.20	
Italy	Parmalat	0.11	5.50
Finland	Raisio Group	0.05	0.90
Belgium	Vandermoortele	0.05	0.85
Sweden	Skaneemejerier/Skane Dairy	0.02	0.30
Japan	Yakult Honsha	1.27	1.27
	Otsuka Pharmaceutical	0.59	3.13
	Calpis Company	0.48	0.80
	Meiji Milk Products	0.41	3.80
	Snow Brand Milk Products	0.33	4.64
	Suntory	0.30	6.70
	Takara Shuzo	0.09	1.60

Source: James, 1999

Celestial Seasonings, one of the largest producers of herbal drinks has recently been acquired by the Hain Food Group for US\$ 390 million, to form the largest natural food company in the USA. The resulting Hain Celestial Group Inc. expects total sales of US\$ 1 billion by 2002 (Plank, 2000).

## 2.4 Phyto-Cosmetics and Personal Care Products

### 2.4.1 Cosmeceuticals

In a similar way to the acceptance of nutraceuticals as a valid sector of the food industry, cosmetic and personal care products containing natural products are also finding an increasingly receptive trend in the market. Beginning in the early 1990's, cosmetic manufacturers began to use the term cosmeceuticals to describe OTC skin care products that claim therapeutic benefits through the addition of active ingredients such as alpha-hydroxy acids and vitamins. Thus, cosmeceuticals are well defined as the products, which lie on the boundary line between drugs and cosmetics which possess desirable physiological activities, such as skin healing, antioxidant, and smoothing or conditioning properties.

### 2.4.2 Major Cosmeceutical Products Categories

Major cosmeceuticals product categories involving botanical ingredients are as below:

- Skin care: age-defying and sun-protecting products;
- Hair care: hair growth retardants and stimulants;
- Professionals: professional products used for appearance-enhancing facial implants, injections, chemical peels and related procedures;
- Other products.

### 2.4.3 Trends in Cosmeceuticals Market

Globally, the market for cosmeceuticals has been estimated at US\$ 22 billion, with the fastest growing sector being anti-aging products. The USA, Japan, Australia, and Europe are the most dominant markets for cosmeceuticals; however, China, Malaysia, Russia, and Latin America have strong potential for long-term growth (Technology Catalysts International, 2001). Baby boomers entering their fifties made anti-aging products the core of the skin-care products. In 2000, cosmeceuticals retail sales grew by 7 per cent to nearly US\$ 4.5 billion, which caps four years of dramatic growth. A plant polysaccharide called galacto-arabinan could possibly become the next big exfoliating ingredient. Manufacturers claim that the protein exfoliates the skin without irritation, reduces water loss, and tightens the skin. Middle aged white women are currently the key cosmeceutical consumers.

In the USA, the market for cosmeceuticals in 1998 was estimated at US\$ 2.5 billion (Brown, 1998). The key markets within this category were products effective in anti-wrinkle treatments, promotion of micro-circulation, sun screens, analgesics, and

promotion of hair growth. In the USA, the market for botanical ingredients for use in cosmetics and toiletries stood at US\$ 345 million in 1998 (Figure 4, Table 21), and was forecasted to increase at 7.9 per cent annually, to reach US\$ 505 million by 2003 (Freedonia Group Inc., 1998).

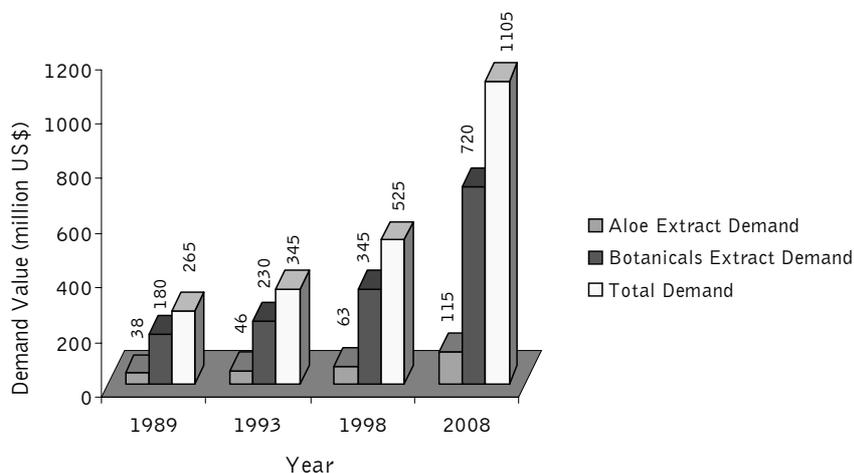


Figure 4: US demand for herbal extracts in cosmetic & toiletries

Table 21: Botanical extract demand in cosmetic and toiletries from 1989 to 2008

Item	Demand value (million US\$)			
	1989	1993	1998	2008*
Aloe extract	38	46	63	115
Botanical extract	180	230	345	720
Others	22	34	67	174
Plant acids/enzymes	19	37	65	173
Essential oils	101	113	150	258
Other natural products	85	115	180	385
TOTAL	265	345	525	1,105

\*Estimates  
Source: Freedonia Group, 1998

The US demand for cosmeceutical products is projected to increase by 7.6 per cent per annum, to reach US\$ 4.3 billion in 2005. The value of chemicals used in these cosmeceutical formulations is expected to advance by 9.2 per cent per annum to reach US\$ 1 billion in 2005. Accordingly, demand for chemicals is expected to grow faster than shipments of end-use preparations, with the cost of chemicals increasing its share of the total production value of cosmeceuticals to 24 per cent in 2005 (Table 22). Growth in cosmeceuticals demand will be driven by increased demand for new appearance enhancing and age-defying products in the market.

Skin care will dominate cosmeceutical product demand, accounting for 60 per cent of the total in 2005 with a healthy annual growth of seven per cent. The fastest growth among cosmeceuticals will be recorded by professional products used for appearance enhancing facial implants, injections, chemical peels and related procedures. The de-

mand of professional products is expected to rise more than 14 per cent annually to reach US\$ 340 million in 2005.

Table 22: Natural extracts demand in the US cosmeceutical industry

Item	Demand value (million US\$)			Per cent annual growth	
	1995	2000	2005*	1995/2000	2000/2005
Cosmeceutical chemicals	360	660	1,025	12.9	9.2
Natural extracts	32	74	138	14.9	13.3
Cosmeceutical products	1,780	2,965	4,275	10.7	7.6
Skin care	1,095	1,820	2,550	10.7	7.0
Hair care	230	452	705	14.5	9.3
Professional	71	175	340	19.8	14.2
Others	384	518	680	6.2	5.6

\*Estimates

Source: Freedonia Group Inc. (2001b)

Introduction of new cosmeceutical chemicals providing unique benefits often initiates a rapid surge in demand. Chemicals, which are projected to record double digit growth through 2005 due to their novel or improved performance, include coenzyme Q 10, which combines antioxidants and exfoliant action; polyhydroxy acid, with a reduced risk of skin irritation; eflornithine hydrochloride, a hair growth retardant with new commercial applications; finasteride, a hair growth stimulant; and a wide range of botanical and herbal extracts which have crossed over from the nutraceuticals industry and bring with them an established reputation of safety and health benefits.

#### 2.4.4 Cosmeceutical Industry

The cosmeceutical market has erupted with the addition of new active ingredients, the discovery of enhanced technologies, and the spreading of cosmeceutical ingredients to the make up and hair-care products. Manufacturers are frequently replacing vitamins with herbal ingredients, such as saw palmetto, ginseng and ginkgo. Indena is one of the world's largest botanical extract suppliers with a wide range of extracts of cosmetic potential in a number of key and emerging cosmeceutical therapeutics areas, as shown in Table 23. The market leaders are Johnson & Johnson, L'Oreal, Unilever, and Proctor & Gamble. Estée Lauder is leading the way in the prestige category with about 60 per cent of the total market.

Table 23: Selected botanical ingredients with their claimed activities used in cosmeceutical industry

Company	Product	Botanical source	Activity
Pierre Fabre, Aubrey Organics	Oats	<i>Avena sativa</i>	Anti-irritating, anti-inflammatory
Bioelements	Echinacea	<i>Echinacea</i> spp.	Reduces lines and wrinkles, improve skin elasticity
Bio-Botanica	Phytolenolin	<i>Centipida cunninghamii</i>	Anti-inflammatory, cellular renewal, sunscreen
	Olive leaf	<i>Olea europea</i>	Anti-fungal, antiviral
Univera Phytochemicals	Aloe	<i>Aloe vera</i>	Skin bleaching

Continued

Company	Product	Botanical source	Activity
Fytokem Products	Rumex	<i>Rumex</i> spp.	Skin toning (tyrosinase inhibitor)
	Willow herb	<i>Salix alba</i>	Anti-irritant
	Canola (Rape seed oil)	<i>Brassica napus</i>	Skin conditioner
Indena	Chamomile dry extract	<i>Matricaria chamomilla</i>	Soothing effect on irritated skin
	Marigold dry extract	<i>Calendula officinalis</i>	
	St. John's wort dry extract	<i>Hypericum perforatum</i>	
	<i>Echinacea</i> dry extract	<i>Echinacea</i> spp.	Anti-aging
	Pygeum purified soft extract	<i>Prunus africana</i>	
	Soybean saponins	<i>Glycine max</i>	
	Silymarin	<i>Silybum marianum</i>	
	Bilberry dry extract	<i>Vaccinium myrtillus</i>	Free radical scavanging
	Pumpkin seed lipophilic extract	<i>Cucurbita pepo</i>	Seboregulation
	<i>Serenoa repens</i> purified extract	<i>Serenoa repens</i>	
	Hawthorn	<i>Crataegus</i> spp.	
	Bladderwrack dry extract	<i>Fucus vesiculosus</i>	"Orange peel" skin
	Butcher's broom dry extract	<i>Ruscus aculeatus</i>	
	Ivy soft extract	<i>Rhus toxicodendron</i>	
	Aescin	<i>Aesculus hippocastanum</i>	
	Ginkgo	<i>Ginkgo biloba</i>	Microcirculation stimulation
	Leaf extract	<i>Centella asiatica</i>	Stimulation of collagen synthesis
	Melilot dry extract	<i>Melilotus officinalis</i>	Micro capillary protection
Peruvian bark fluid extract	<i>Cinchona succirubra</i>	Stimulation of scalp hair	

### 3 Raw Material Supply

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The demand for medicinal plant material has increased in the world market due to rise in interest for natural products and increased acceptance of traditional medical systems around the world. Medicinal plants are traded in a variety of forms, for example: entire plant parts such as leaves, bark, and roots; chopped or sliced plant-parts; derivatives, semi-processed or manufactured material such as powders, extracts, tonics, pills, teas and other products; and finished pharmaceutical products.

It has been said that as many as 35,000 to 70,000 species of plants have been used at one time or another for medicinal purposes (Farnsworth & Soejarto 1991). In India more than 1,000 plant species, 700 species in Nepal, approximately 7,000 species in Peninsular Malaysia and its neighboring islands and over 1,800 species in Vietnam are reported to have medicinal value. However, relatively a very small number of them are used in any significant volume e.g. in Traditional Chinese Medicine, 9,905 botanical materials are used but only an estimated 500 are commonly used in any significant volume (Natural Medicine Marketing, 1996).

In the early 1980s, about 400 species were reported to be used in Europe for their medicinal values (International Trade Center, 1982). More recent findings suggest that this number could be closer to 1,500 including those used in homeopathy (Lange, 1996). In 1980, the eight countries then belonging to the EEC imported 80,738 metric tonnes of 'vegetation plant material used in pharmacy'. The leading importer was Germany (31,452 metric tonnes), followed by France. This import volume has grown to an annual average of 120,000 metric tonnes during 1992 to 1996. The major part, 60 per cent, of raw material supply to the EU originates from developing countries of African and Asian continents.

It has been estimated that 500, and possibly as many as 600 species of medicinal plants are traded through Hamburg, Germany, which lies in the heart of the import business in Europe (Lewington 1992). In 1980, India was the leading exporter of medicinal plants to Europe (10,055 metric tonnes out of total 80,738 metric tonnes imported) followed by Eastern Europe. In the same year, Europe exported about 70,000 metric tonnes of plant material mainly to the USA.

The market for medicinal plants is dynamic and complex. Therefore, it is difficult to obtain precise information about the structure and scale of international trade in medici-

nal plants. The trade statistics and custom records on medicinal plants are inadequate (Lewington 1992). The problem is further complicated with no clear distinction between medicinal, food, spice and aromatic usages of these plants. The place of trade is generally far away from the area of production, and processing often takes place in countries other than country of origin.

The trade in medicinal plants not only takes place from developing to urban industrialized countries, but also among developing countries. For instance, there is a major trade from the Himalayas, including Nepal, to India and beyond, mostly for use in herbal medicine (notably Ayurvedic medicine). The volume of this trade is unknown, because it is believed that the greater part of it passes through unofficial channels.

Understanding the dynamics of the trade in medicinal plants is difficult, because overall volumes and values are not known, and species-specific information is not comprehensive at all. The scarcity of such data is one reason for the lack of attention that countries have directed towards the medicinal plant resource. Insufficient knowledge about the scope of the trade, in particular at national level, has resulted in ineffective implementation of existing regulations and initiatives in producing countries, to the detriment of the resource and those who will depend on it in the years to come. Perhaps most important is that there is little appreciation for the increasingly critical imbalance between supply and demand.

### 3.1 Dynamics of Trade in Medicinal Plants

The term 'Medicinal Plants' is applied to plants that contain a substance or substances of medicinal properties, which have been proven to be useful as drugs or contain drug constituents, used as therapeutic agents, as starting materials for the synthesis of other drugs, as models for new synthetic drugs, and as tools in drug development and testing.

In international trade, medicinal plants have been coded under the Standard International Trade Classification (STIC), and the Harmonized Commodity Description and Coding System (HS) or Customs Cooperation Council Nomenclature (CCCN). HS or CCCN code 1211, which is widely accepted by World Trade Organization (WTO), relates to botanical drugs (plants and plant-parts of a kind used primarily in perfumery, pharmacy, or for insecticidal, fungicidal, or similar purposes) and sub-sections under this code, specifies the categories or a specific single drug. Some selected examples are shown in Table 24, and their sub-categories in Table 25.

Further more these categories do not include the data on trade in glycosides and vegetable alkaloid derivatives, which are important raw materials to the pharmaceutical industry.

Table 24: SITC and HS or CCCN codes for major botanical drug groups in international trade

HS or CCCN code	Commodity	SITC, Rev. 3 code
1211.00	Plants and plant parts of a kind used primarily in perfumery, in pharmacy, or for insecticidal, fungicidal, or similar purposes.	292.40
1211.10	Liquorice roots	292.41
1211.20	Ginseng roots	292.42
1211.90	Others including pyrethrum, tonquin beans, mint linden, verbena, <i>Origanum vulgare</i> and <i>Salvia officinalis</i> .	292.49

Table 25: Sub-categories of CCCN codes 1211.20 and 1211.90

HS or CCCN code	Description
1211.20.00.00	Ginseng root
20	Cultivated ginseng root
40	Wild ginseng root
1211.90.00.00	Other medicinal plants
	Mint leaves:
20.00	Crude or not manufactured
40.00	Others:
40.20	Herbal teas and herbal infusions (single species, unmixed)
40.40	Others
60.00	Tonka beans
80.00	Other substances having anesthetic, prophylactic or therapeutic properties and principally used as medicaments or as ingredients in medicaments:
80.10	Coca leaves
20	Psyllium seed husk
30	Others
40	Basil
50	Sage
80	Herbal teas and herbal infusion (single species, unmixed)
90	Others

### 3.1.1 Trends in Global Trade of Medicinal Plants

It is not possible to assess global trade in all medicinal plants as a substantial part of this trade is not recorded and official trade statistics either do not identify the plants individually, or do not separate their medicinal usage from other uses such as culinary herbs and spices, insecticides, fungicides and sources of perfumes and essential oils.

World demand for medicinal plants is steadily increasing not only from developing countries but also from industrialized countries, where the demand is fuelled first by the interest in products that are natural, and second by the aggressive marketing of herbal medicines. The demand for medicinal plants is increasing as the drug-pharmaceutical products are falling under more strict governmental regulations.

According to the International Trade Center (ITC), as far back as 1967, the total

value of global import of starting materials of plant origin for the pharmaceutical and cosmetic industry was of the order of US\$ 52.9 million. From this amount the total value grew to US\$ 71.2 million in 1971, and then showed a steady annual growth rate of approximately 5 to 7 per cent through to the mid-1980s. From 1987 to 1991, the average value of trade in medicinal plants increased to US\$ 853 million. It generally showed an upward trend except for the year 1990, when it dipped slightly before rising to US\$ 1.08 billion in 1991 (Iqbal, 1993). World trade in medicinal plants and plant-parts averaged US\$ 1.28 billion between 1995 to 1999. During this period, world imports rose slightly from US\$ 1.3 billion in 1995, to nearly US\$ 1.4 billion, but subsequently decreased to US\$ 1.1 billion in 1999. In 1996 the volume of traded material was 440,000 metric tonnes, valued at US\$ 1.3 billion. Above mentioned trends are depicted in Figure 5.

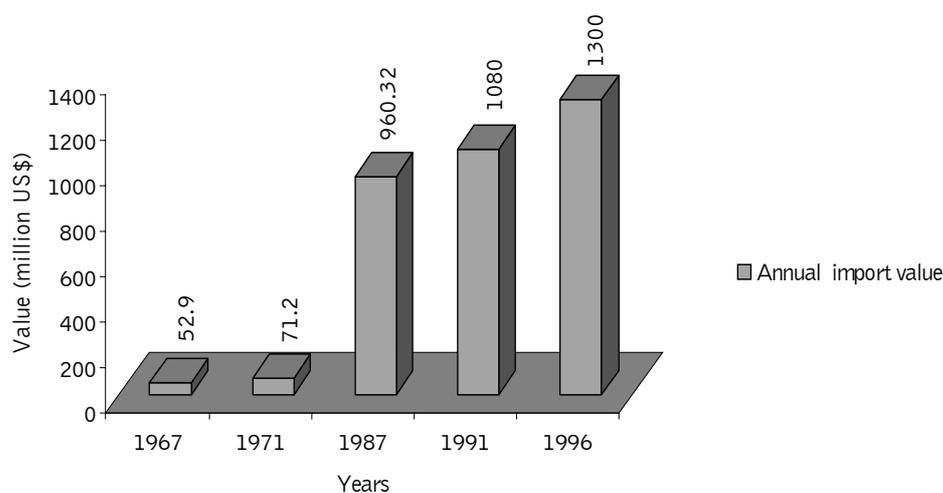


Figure 5: Trends in global trade of medicinal and aromatic plants material

In terms of value, other medicinal plants represented three quarters of the total imports, ginseng roots covered one fifth, and the rest was liquorice roots. The six leading importers (volume-wise) were Hong Kong, Japan, Germany, the USA, South Korea and France during late 1990s. World trade in medicinal plants and their products has now been put at over US\$ 60 billion, with annual average growth rate of 7 per cent (Govt. of India, 2000) to reach US\$ 5 trillion by 2050 (FRLHT, 1996 c.f. IDRC, 2000). The growth is fastest in the EU countries (10 per cent) and the USA (20 per cent).

The major international trade in medicinal plants is from developing to urban-industrial countries. Among developing countries, China is the leading exporter of botanical drugs, having exported on an average about 140,000 metric tonnes during 1991 to 1998. India, the second largest exporter, has exported on an average about one-fourth the volumes exported by China during the same period.

## 3.2 Supply Sources of Medicinal Plants

The supply of medicinal plants generally comes from two sources viz. wild and cultivated. Surprisingly, the bulk of the material traded is wild harvested and constitutes more than 80 per cent of supply. Only a very small number of species are cultivated.

### 3.2.1 Wild Harvested Material

Wild harvesting is the collection of plant material from natural habitats of the species. In many traditions of medicine, wild harvested material is generally considered to have higher therapeutic activity, and therefore fetches higher price.

The wild harvested material of medicinal plants constitutes the major part of trade, which is a matter of concern for source countries. In Asia and Africa more than 80 per cent of medicinal plant supply comes from the wild sources, e.g in China about 60 per cent demand for medicinal plants is met from the wild sources. An estimated 90 per cent of medicinal plants collected in India is from the wild (Vinay, 1996). In Nepal, every year over 15,000 metric tonnes of plant material, representing some 100 species, is harvested from the wild. The traditional medicine in Indonesia still relies to a large extent on plant materials collected from the wild. From the 55 most important medicinal plant species used in Jammu, about 25 per cent are still collected from the wild.

In Latin America, most of the medicinal plant supply comes from wild sources. In Brazil most of the plant material used locally or traded is collected from the wild. The most significant species under exploitation are *Maytenus ilicifolia* (espinheira santa), *Pfaffia paniculata* (Brazilian ginseng), *Phyllanthus niruri* (quebra pedra), *Pilocarpus microphyllus* (jaborandi), *Psychotria ipecacuanha* (ipecac) and *Solanum mauritianum* (cuvitinga), among others (Vieira, 1999).

Although the major part of the wild harvested material is sourced from developing countries, a surprisingly high amount is also gathered in developed countries. Wild collections still play a vital role in trade of medicinal and aromatic plants in Europe particularly in Albania, Turkey, Hungary and Spain. From 1,200 to 1,300 European plant species traded, at least 90 per cent are collected from the wild. In terms of volumes, the wild harvested material accounts for 30 to 50 per cent in Hungary; 50 to 70 per cent in Germany; 70 to 80 per cent in Bulgaria; and almost 100 per cent in Albania and Turkey. The overall volume of wild collected plant material in Europe is estimated to be at least 20,000 to 30,000 metric tonnes annually (Lange, 1998). An estimated 70 to 90 per cent of the medicinal plants, imported into Germany, are wild harvested and only 50 to 100 species among these are currently propagated on a large scale (Lange, 1996).

In the USA, wild harvested plants used for their therapeutic value are marketed either as medicines or dietary supplements. Plants that have been tested for safety and efficacy and meet strict US Food and Drug Administration (FDA) standards are marketed as medicines or drugs. Plants and plant-products that do not meet the FDA standards are marketed as dietary supplements. There are more than 25 tree species, 65

herbaceous plants, and 29 shrubs that have been listed by the United States Pharmacopoeia for their medicinal value (Chamberlain et al., 1998).

### 3.2.2 Cultivated Material

The other source of medicinal plant material is through cultivation, which is infinitely more appropriate to use it in the production of herbal drugs. As quality requirements are becoming more and more stringent, standardization for pure products, extracts or crude drugs is of crucial importance.

The countries like China, India, Spain, Argentina, Hungary and Poland cultivate medicinal plants on a large scale. In China, more than 250 species of medicinal value are being commercially cultivated and among these 60 species have performed well. Since 1980, there has been a rapid increase in the area under cultivation in China with about 380 thousand hectare of land under medicinal plants cultivation in 1984. The output of the cultivation in China was estimated to be between 300,000 and 400,000 metric tonnes in 1994. Among the estimated 1,000 frequently used medicinal plants in China, more than 200 are obtained through cultivation.

In India about 25 species of medicinal value have huge demand and are brought under commercial cultivation. The supply of the raw material to manufacturers of traditional medicines in Indonesia comes from the medicinal plants grown in farmer's fields and gardens. Cultivation includes both mono-cropping and intercropping practices. Farmers growing medicinal plants receive a fixed price for their crop. The price is set, with a contract-like agreement, when the farmers start cultivation for the contracting company.

In Europe about 130 to 140 medicinal and aromatic plants are cultivated on an estimated area of 70,000 hectares. France, Hungary and Spain have the largest area under cultivation.

Several exotic and introduced species of medicinal and aromatic plants are under cultivation in Brazil, such as lemongrass (*Cymbopogon citratus*) and *Aloe* spp. are cultivated in backyard gardens. In Southern Brazil, due to favorable cultural and environmental conditions, several exotic species are cultivated on large areas. These include chamomile (*Matricaria recutita*), calendula (*Calendula officinalis*), rosemary (*Rosmarinus officinalis*), *Duboisia* spp., and Japanese mint (*Mentha arvensis*).

Few medicinal plants are cultivated in South Africa, e.g. *Warburgia salutaris* (pepperbark tree), *Agathosma* spp. (buchu), and *Siphonochilus aethiopicus* (African ginger).

Given the high cost of cultivated material, cultivation is often done under contract. In the majority of the cases, companies would cultivate only those plant species which are used in large quantities or in the production of derivatives and isolates, where quality is critical.

Recently, growers have set up co-operatives or collaborative ventures in an attempt to improve their negotiating power and achieve higher prices. One such co-operative in the Netherlands is Vernigde Ned Kruidencoöperatie (VNK).

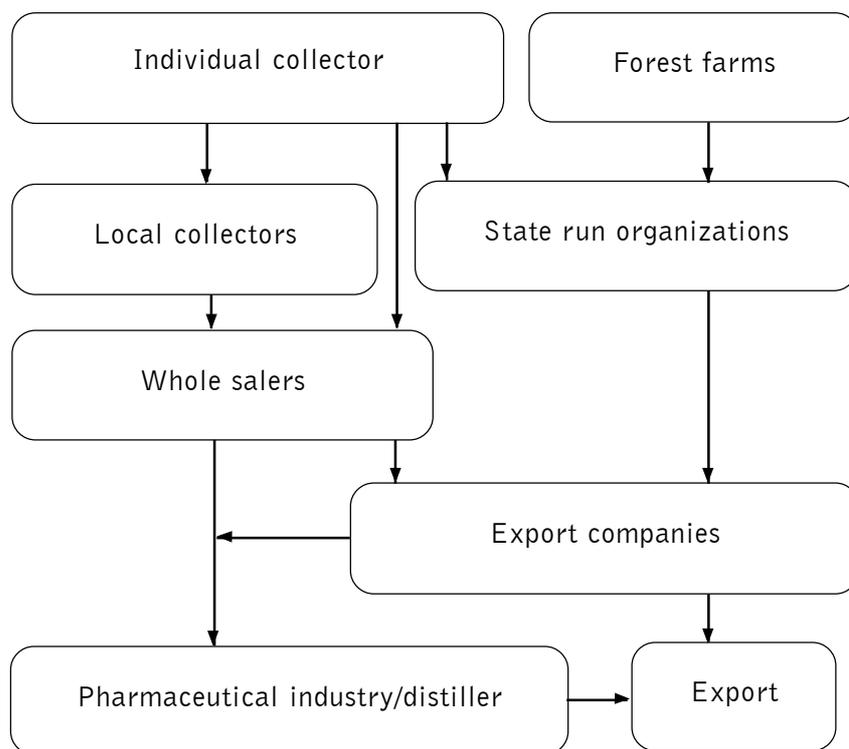
### 3.3 Channels of Supply

Medicinal plants trade generally takes place at three levels:

- ❑ On the first level, there is national trade in medicinal plants which involves hundreds of species. It is undertaken at regional markets. For example in urban markets of Kwa Zulu Natal, South Africa more than 400 species are being traded out of a total 1,000 that are used medicinally in the area. In Vietnam, 70 per cent of the production of medicinal plants in the northern parts is traded by Ninh Hiep market.
- ❑ The second level is informal and consists of trade across national borders but within the same continent. This trade tends to consist of few number of species, although many of these are threatened. For example in Africa, *Warburgia salutaris* and *Siphonochilis aethiopicus*, two species with high demand and scarce supply, are traded to Durban market in South Africa. In Asia, *Nardostachys grandiflora* and *Valeriana jatamansi* are examples of species which are threatened, but still traded from Nepal to India.
- ❑ The third level comprises formal export trade. In Africa, only a limited number of species are traded in significant volumes. For example medicinal plant species like *Prunus africana* (a bark extract of which is used in the treatment of benign prostate hypertrophy) from Cameroon and Madagascar; *Harpagophytum procumbens* from Botswana, Lesotho, Namibia and South Africa; *Hibiscus sabdariffa* from Sudan and Egypt; *Pausinystalia johimbe* from Cameroon, Nigeria, Rwanda; and *Rauvolfia vomitoria* from Madagascar, Mozambique and Zaire are traded to the European and the US markets. Based on the imports of plant material into Germany, a significant number of species are traded internationally in significant volumes.

In most of the developing countries, medicinal plants collections are carried out directly by the consumers, in the case of rural or indigenous people for daily consumption or, in the case of commercialization, after the order of middlemen, suppliers or stores, or by order of researchers. They are used and traded as raw material, in whole or parts, in milled or pulverized form, and also in crude or semi-purified extracts, pure chemical substances or semi-synthetics. The produce is gathered by individual farm households and sold after carrying out first post-harvest treatments to the local collectors/traders which sell the produce to licensed export companies or to pharmaceutical processing factories. Most of the production (80 to 90 per cent) is for direct export in the form of extracts or dried herbs. Only 10 to 20 per cent of the medicinal plants are consumed or processed domestically as traditional medicines and by pharmaceutical industry (Diagram 1).

Diagram 1: Trade structure for medicinal plants in developing countries



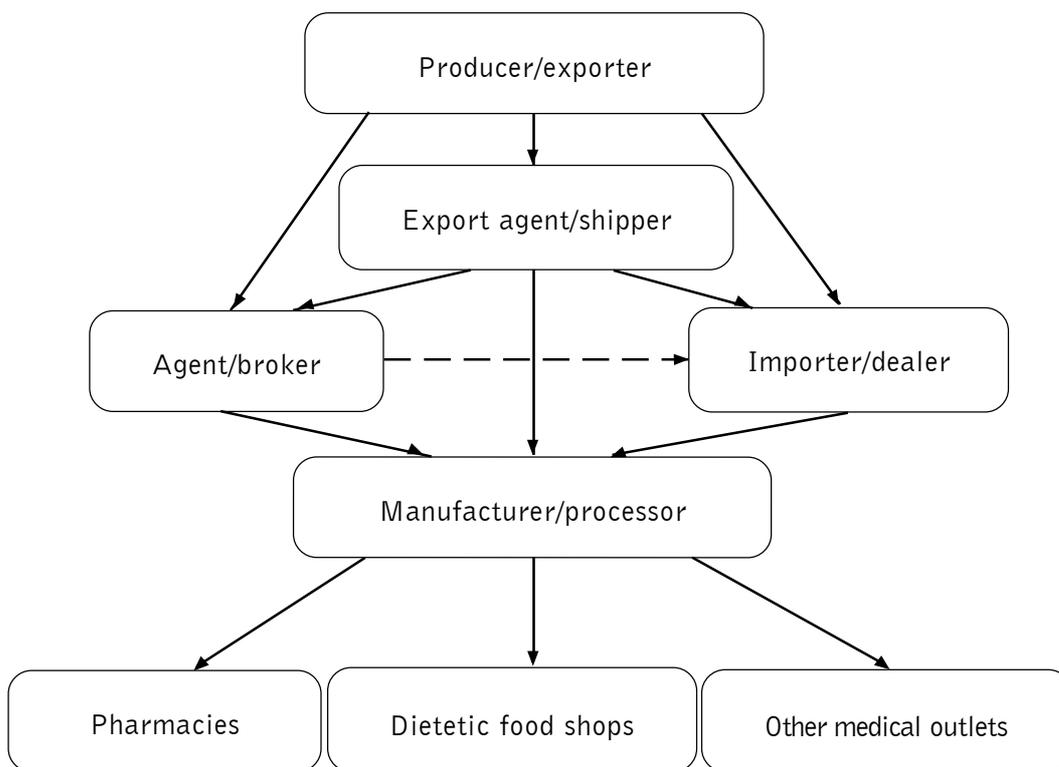
In the developed countries, the supply of plant material passes from the source of collection, through a network of buyers, including collector's and state run organizations, and agents or subsidiaries of the plant traders (Diagram 2).

The major part of material is sold to plant trading companies. These companies hold enormous stocks, and also have the facilities to undertake the quality controls required for raw materials used in the production of drugs. The major trading companies are located in Hamburg, New York, Tokyo and Hong Kong and play an enormously powerful role in the medicinal plants trade by dictating the prices and holding the position of power in trade.

There are also brokers who buy plant material and sell it on adding a commission. In the past they played a more important role as they had the contacts at the purchasing level.

Other traders have been emerging, referred to as the 'ecological trade' (Lange, 1996). They source medicinal plant material generally to the smaller herbal medicine/health product companies and alternative practitioners. They establish their contacts in the source countries and have shorter sales routes involving fewer parties. However, they only deal with raw material.

Diagram 2: Trade structure for medicinal plants in Western European region



### 3.3.1 Major Importing-Exporting Regions and Countries

Volume that passes through the supply channels, needs to be examined to give an overview of the demand-supply situation in medicinal plants trade. Unfortunately, there is few data on the volume of international trade in medicinal plants. The reported annual average international trade in medicinal plants amounted in the 1990's to 400,000 metric tonnes valued at US\$ 1.2 billion, and showed an increase of 100 per cent from 1991 to 1997. The USA, Europe and Japan are the major importers of medicinal plants while Asia, Africa and East European countries are the major exporting regions.

#### Major Importing Regions and Countries

The EU, the USA and Japan are the biggest consumer markets of medicinal plant materials. Europe, Germany, France, Italy, and Spain are the major markets for medicinal herbs. Germany dominates the European trade in medicinal plants as it dominates the European market for phyto-pharmaceuticals. During 1991 to 1997 about 46,000 metric tonnes of botanicals were imported annually from more than hundred countries into Germany, amounting to about US\$ 142 million (Lange, 2001). One-third of the material was re-exported as finished products primarily to Western Europe and the USA.

In North America, the USA is an important market for medicinal plants. In 1988, the annual turnover of the plant-derived pharmaceuticals industry in the USA was US\$

10 billion (The World Conservation Union, 1988). The herbal products' industry in 1994 was US\$ 1.6 billion at retail sales. In the US market the health products are the fastest growing sector and demand for medicinal plant material is significantly high. The major part of the material is sourced from Europe (Eastern Europe) and Asia. Over the last decade, the demand in North America for medicinal plants from Latin America, China and India has increased significantly.

The major importers of medicinal plants in Asia are Hong Kong, Japan, Singapore and Malaysia. The volumes of material used in the traditional systems of medicine, particularly in Asia are of great concern while considering the demand for medicinal plants. China also imports significant volumes of medicinal herbs apart from being largest producer and exporter of medicinal herbs.

Hong Kong, Japan, the USA and Germany were the major importers of this commodity with annual average import volumes of 74,000; 57,000; 51,000 to 72,000; and 46,000 metric tonnes, respectively during 1991 to 1997 (Lange, 2001). Among others, the leading importers are Republic of Korea, France, Pakistan, Italy, Singapore, China, the UK and Spain.

### **Major Exporting Regions and Countries**

China and India were the leading exporting countries of medicinal plant material to the world market with average annual export volumes of 140,000 metric tonnes and about 35,000 metric tonnes respectively, during 1991 to 1997. Other major exporting countries among the top twelve are: Germany, Singapore, Egypt, Chile, the USA, Morocco, Mexico, Pakistan, France and Thailand. The significant volumes of medicinal plants also originate from Albania, Brazil, Bulgaria, Hungary, Korea, Turkey, and smaller market share runs from Kenya, Mauritius and Indonesia. Singapore and Hong Kong are the main re-exporters of medicinal plants to the world market.

Hamburg is the world's leading trade center in medicinal plant materials. The most important exporters to Hamburg are Albania, Argentina, China, Egypt, France, Greece, Hungary, India, the Netherlands, Poland, former Yugoslavia and Zaire.

China's total output of medicinal plants from both cultivated and wild harvested sources was estimated about 1.6 million metric tonnes. In comparison, Germany produces relatively small volume of 40,000 metric tonnes. Ayurvedic and Unani herbs are also traded in large quantities and over a very wide geographical area. For example in 1992, estimated 4,117 metric tonnes were exported, largely to Bangladesh, Japan, Pakistan, Saudi Arabia, the US and the United Arab Emirates (Kuipers, 1995).

According to International Trade Classification System, medicinal plants have been classified into three main categories: i.e., liquorice roots (HS 1211.10), ginseng roots (HS 1211.20), and other medicinal plants (HS 1211.90). Liquorice roots and ginseng roots are in high demand in international market and therefore have been kept under

separate category. All other medicinal plant species have been kept under one broad category 'other medicinal plants'. Trade in each category has been discussed as below:

### ***Liquorice Roots HS (1211.10)***

The genus *Glycyrrhiza* is widely distributed in Eurasia, extending to Australia, North America, and the temperate regions of South America. In Eurasia, around 20 species occur, among them five are confined to Europe. The roots of many species are sources of liquorice, though often only of local importance. Liquorice is used in confectionery, cough mixtures, lozenges, medical remedies, plug tobacco and in brewing stout. In trade, several kinds of liquorice are distinguished with regard to their geographical origin: Spanish, Russian, Persian, and Mongolian liquorice, but not to plant species from which the roots are derived.

A widely used species is *Glycyrrhiza glabra*, a herbaceous perennial native to the Mediterranean region, the Near East, Central Asia, as well as Western Siberia. Other highly exploited species are: *G. uralensis*, that extends from Western to Eastern Siberia, as well as across Central Asia to Mongolia; *G. echinata* with an area extending from the Balkans across Asia Minor to South-Eastern Russia and Western Siberia; and *G. pallidiflora* native to the Far East and China.

In many cases, the plant is cultivated, e.g. in Italy, Southern France and Spain, and also in Central Asia, Australia, and Brazil (Mansfeld, 1986), but liquorice plants growing in the wild also continue to be exploited to a large extent.

The USA was the leading importer of liquorice roots with annual average import volume of about 17,887 metric tonnes, valuing to about US\$ 10.5 million during 1994 to 1997. The main source countries were China, Afghanistan, Pakistan, Azerbaijan and Turkmenistan. The EU annual average import volume during 1994 to 1997 amounted to about 4,562 metric tonnes, valuing to US\$ 3.6 million (Table 26). In 1996, the European countries imported 6,000 metric tonnes of roots, almost all from Asia. Main source countries were Azerbaijan, Turkmenistan, Afghanistan, Iran and Pakistan. Afghanistan exports liquorice roots mainly to the USA, Japan, France and India with an annual export value of US\$ 4.2 million. The EU exports of liquorice roots amounted to 2,700 metric tonnes only, more or less evenly directed to North America, Africa and Asia.

France dominates the import trade in Europe. Turkey is the biggest exporter of liquorice, shipping 3,040 metric tonnes in 1991; 1,684 in 1992; 1,350 in 1993; 1,140 in 1994; 1,560 in 1995 and 1,730 metric tonnes in 1996, according to the UNCTAD Comtrade database (Lange, 1998). In addition, Turkey also exports liquorice extracts to the USA, Egypt, Italy, France, and Israel.

Spain also exports liquorice, however the quantities involved are much less. It is obtained either from wild stock or from cultivation. According to Blanco (Blanco and Breaux, 1997 c.f Lange, 1998) the species is not threatened in Spain. In Bulgaria, liquorice is regarded as being rare (WCMC, 1988). Németh (Németh, 1997 c.f Lange,

1998) reports that this species has been threatened in Hungary owing to its over-exploitation. No law exists to protect this species, or to regulate trade, either nationally, or internationally.

Table 26: The USA and the EU import of liquorice roots (commodity code HS 1211.10) during 1994-97

Source country	Annual average import			
	US		EU	
	Volume (MT)	Value (million US\$)	Volume (MT)	Value (million US\$)
China	5,942	3.3	227	0.4
Afghanistan	4,712	2.1	454	0.3
Pakistan	4,323	2.1	205	0.1
Azerbaijan	966	0.5	753	0.3
Turkemenistan	502	0.3	1,050	0.6
Turkey	453	0.3	474	0.4
Syria	290	0.2	286	0.6
Others	699	1.7	1,111	0.8
TOTAL	17,887	10.5	4,560	3.5

### ***Ginseng Roots HS (1211.20)***

Ginseng (*Panax* spp.) is the most revered medicinal plant in Traditional Chinese Medicine and is quickly becoming one of the most popular herbs in western markets. In the USA, where the market for medicinal botanicals totals US\$ 4 billion and is still growing, ginseng is the top selling herb among first-time herbal users and ranks third, surpassed only by echinacea and garlic, in sales of herbs in the US health food stores. No other plant represents the better cultural and economic value of medicine harvested from the wild in North America than American ginseng (*Panax quinquefolius*). This herbaceous plant grows in Eastern US and Canadian deciduous forests and is sought for its high-value roots, most of which are exported to East Asia, the dominant ginseng market.

There is a continuing strong demand for ginseng in Asia. The herbal products containing ginseng are also appearing to grow in the USA, Canada, and Europe. It has been kept under separate custom category HS 1211.20, which has been further divided into two sub-categories, i.e. cultivated ginseng roots (HS 1211.20.00.20) and wild ginseng roots (HS 1211.20.00.40).

The annual world trade of ginseng roots is between 3,500 and 4,100 metric tonnes. China is the world's leading exporter of ginseng roots followed by Korea, the USA, Canada and Japan. Canada is the world's largest grower of American ginseng (*Panax quinquefolius*), accounting for more than 60 per cent of the world production. It ranks third in the production of all ginseng, next only to China and Korea, and exports almost 90 per cent of its ginseng root overseas (Statistics Canada 1999, USDA, 1999, and Hong Kong Trade Statistics 1998). Ginseng production in Canada has increased 18 fold in 12 years, from 106 metric tonnes in 1987 to 1,864 metric tonnes in 1998.

The USA represents about 30 per cent of total American ginseng production. It is

the world's second largest producer of American ginseng and fourth in terms of all ginseng production. Its production has tapered off since 1994. In 1998, its export of cultivated roots amounted to US\$ 20.9 million and 702 metric tonnes (USDA, 1999).

Hong Kong is the first destination market for American ginseng. Export to Hong Kong represented 84 per cent of all American ginseng exported from Canada in 1998. China and the USA were the second and third at 10 and 2 per cent respectively. Canadian export volume of American ginseng to Hong Kong increased by 29 per cent from 919 metric tonnes in 1997 to 1,299 metric tonnes in 1998.

More than 80 per cent of the American ginseng roots entering Hong Kong is re-exported to China. The Chinese consumers are the ultimate end-users of American ginseng, and statistics of Canada, Hong Kong, US Department of Agriculture show that China imports more than 75 per cent of all American ginseng production. China has also reduced American ginseng tariffs from 45 to 40 per cent (plus 13 per cent VAT). Other markets for American ginseng are Singapore, Taiwan, Malaysia and the member countries of the Association of Southeast Asian Nations (ASEAN). These are the small market niches with significant future potential for the American ginseng industry (Xiao, 2000).

Wildcrafted ginseng fetches higher prices, being considered superior than cultivated ginseng. According to the United States Fish and Wildlife Services (USFWS), approximately 64 metric tonnes of wild ginseng root was harvested in the USA in 1996 out of which 46 metric tonnes (85 per cent) was exported to Hong Kong, and smaller amounts were exported to Taiwan (3.6 metric tonnes), Singapore (2.7 metric tonnes), Malaysia (769 kg) and Canada (459 kg) (Robbins, 1998).

The USA is also a sizable importer of wild ginseng, which may in fact be a variety of ginseng species seeded and grown under wild conditions. According to the US Bureau of the Census (Customs) data, which refers to all species of ginseng, the USA importation values during 1990 to 1996 were: 208 metric tonnes of wild ginseng from China; 59 metric tonnes from South Korea; 34 metric tonnes from Mexico; and 19 metric tonnes from other countries, including Canada. Presumably, the large volume of the US import of wild ginseng from China consists of roots harvested from naturalized populations of ginseng in China, or roots of wild-collected American ginseng that originated in the USA and was re-exported from China. The US import of wild ginseng from Canada, which prohibits the export of wild ginseng, could be *P. quinquefolius* or another ginseng species exported from the USA or elsewhere to Canada for processing, and subsequently re-exported to the USA.

The amount of wild American ginseng harvested and exported has remained relatively constant in recent years, although a growing number of ginseng harvesters in the US national forests suggests that the collection of wild roots is on increase.

### ***Other Medicinal Plants (HS 1211.90)***

The 'Other Medicinal Plants (HS1211.90)' group includes all other medicinal plants except those for which separate commodity code has been assigned as for liquorice and ginseng.

### **Medicinal Plants Trade from Africa**

African continent is endowed with a rich biodiversity of medicinal plants. It exports a significant volume of medicinal plants raw material to the European and the US markets. In 1996, the EU imports amounted to 27,000 metric tonnes of African medicinal plants, which was the second largest export volume after Asia.

The countries which export a significant volume of medicinal plant material out of Africa are: Botswana, Kenya, Madagascar, Mozambique, Namibia, South Africa, Sudan, Tanzania, and Uganda.

African export to Germany averaged to about 7,374 metric tonnes in 1994. Sudan, Egypt, Zaire and Morocco lead the export market with significant trade volume of medicinal plant material (Table 27).

Table 27: African countries exports to Germany (exceeding 500 metric tonnes) for commodity code 1211.90

Country	Volume (MT)						
	1997	1996	1995	1994	1993	1992	1991
Sudan	3,157	2,557	3,005	3,755	2,891	1,949	1,655
Egypt	2,646	1,881	1,637	1,729	1,351	1,687	1,987
Zaire	652	1,938	1,277	912	728	-	-
Morocco	578	531	376	267	285	567	562

The amount of trade in the medicinal plants in some African countries is well documented, but not in all cases. In 1995-96, about 20,000 metric tonnes of medicinal plants material with an approximate value of US\$ 60 million and finished products of worth US\$ 215.6 million were traded from South Africa. About 2,000 metric tonnes of rooibos tea only (*Aspalathus linearis*) alone was exported in 1999 (Hoegler, 2000). Presently 6,000 metric tonnes of rooibos tea, valued at US\$ 3.88 million and 700 metric tonnes of *Aloe ferox* per annum are exported from South Africa.

Medicinal plants from South Africa with a position in the international trade are Cape aloes (*Aloe ferox*), buchu (*Agathosma* spp.), devil's claw (*Harpagophytum procumbens*), umkcaloabo (*Pelargonium sidoides*) and uzara (*Xysmalobium undulatum*). From the African biodiversity, a large number of species containing active components have the potential to play a role in the medicinal market on a global scale. At present, bioprospecting is done on all plants in South Africa to determine their pharmaceutical potential. In South Africa, a domestic phytomedicine company-South African Druggists-has a subsidiary to develop phytomedicines based on traditional knowledge.

Cameroon is the major supplier of *Prunus africana* bark to the world market since 1972. From 1986 to 1991 about 11,537 metric tonnes of the bark, at an average of 700 metric tonnes per annum, was processed in south-west Cameroon by Plantecam Medicam a subsidiary of French company. In addition to Cameroon, Kenya (1,923 metric tonnes), Uganda (193 metric tonnes), Zaire (300 metric tonnes) and Madagascar (78 to 800 metric tonnes) also export *Prunus africana* bark to Europe (Cunningham and Mbenkum, 1993; Cunningham et al, 1997).

It is difficult to establish the scale of trade, but the available information indicates that the total harvest of *Prunus africana* bark ranges between 3,200 to 4,900 metric tonnes per annum. It is exported primarily to France, Italy, and Spain, and also to the USA, Argentina, Brazil, Venezuela, and Japan. *Prunus africana* products are traded in five forms:

- ❑ Unprocessed dried bark (570-580 metric tonnes per year) from Congo, Cameroon, Tanzania, Kenya, and Madagascar;
- ❑ Bark extract (estimated at 14.6 metric tonnes per year extracted from 3,000 metric tonnes of bark) from Cameroon and Madagascar;
- ❑ Herbal preparations sold as brand-name capsules in Europe, South America, the USA, Australia, and other countries and regions;
- ❑ As a component in hair tonic sold in Japan.

Cameroon is the most important source of *Prunus africana* bark. The major exporter companies are Plantecam (Cameroon) and Société pour le Développement Industriel des Plantes (SODIP) (Madagascar). The primary importers being Labatoire Debat/Groupe Fournier (France), and Indena Spa (Italy), (Table 28). Other importing companies are Invermi della Beffa (Italy), Inofarma (Spain) and Muggenburg Extrakt GmbH (Germany). During 1985 to 1991, *Prunus africana* bark made up approximately 88 per cent of export by the Plantecam Medicam factory in Mutengene, South West Province, Cameroon. The annual market for *Prunus africana* bark has been put at US\$ 220 million in Europe and the USA according to the Nairobi based International Center for Research in Agro-forestry (ICRAF) and Washington based Future Harvest. The annual harvest for the bark is 3,500 metric tonnes (Cameroon 2,000, Madagascar 600, others 900 metric tonnes).

Although other herbal medicines, such as saw palmetto (*Serenoa repens*) compete in the market place with *Prunus africana*, the demand does not show signs of decrease, though it needs to be confirmed by market studies.

Another plant species mainly exported from Cameroon are the seeds of *Voacanga africana*, used for the production of the alkaloid tabersonine, a central nervous system (CNS) depressant in geriatric patients. Cameroon exported US\$ 40 million of *Voacanga africana* in 1993.

In Madagascar, the export sale of *Catharanthus roseus* and other plants represent an export earning of US\$ 180 million (Hoyt, 1988).

Table 28: Quantity of some medicinal plants species exported from Cameroon during 1995-97

Medicinal plant species	Company	Volume (thousand MT)	
		1995-96	1996-97
<i>Voacanga africana</i>	Afrimed	-	75.48
	Plantecam	24.37	40.41
	SACO	31.00	-
<i>Prunus africana</i>	Afrimed	-	53.90
	Plantecam	1,911.56	2,194.27
<i>Pausinystalia johimbe</i>	Afrimed	-	36.65
<i>Pausinystalia johimbe</i>	Plantecam	673.98	344.44
<i>Pausinystalia johimbe</i>	ETS Erimon	8.00	-
<i>Pausinystalia johimbe</i>	Mme Tchoukem	10.00	-
<i>Pausinystalia johimbe</i>	I.K. NDI & Bros. Enterprise	-	16.40*
TOTAL		2,658.91	2,745.15

\* Volume in year 1997 only  
Source: Anonymous, 1997

Devil's claw (*Harpagophytum procumbens*) is another plant of interest in international trade from Africa. It grows in the Kalahari deserts of Namibia, Botswana, South Africa, Angola and to a lesser extent, in Zambia and Zimbabwe. The secondary tubers which contain active ingredients harpagosides, used to treat rheumatism and cancerous tumours, have a high demand from Europe. More than a decade ago, Botswana used to export 15 to 20 metric tonnes of Devil's claw roots to Germany. In Namibia, the first large scale export of this plant took place in 1962, with Germany as the destination. Over the years, the annual Namibian export has increased to around 600 metric tonnes to meet the overseas demand. At this level and at current international prices, export is generating an estimated US\$ 1.0 million in foreign exchange. In addition to France, Germany and South Africa, Spain, Switzerland and the UK have also become important importers of this plant. Most of the Devil's claw roots in Namibia are harvested in communal areas and it has been estimated that 10,000 to 12,000 families depend on the local revenues from its biotrade. The harvesters sell their produce to local traders and middlemen who in turn may sell to other traders down the marketing chain, before the produce reaches the exporters. Since last five years, traders in Namibia collect 100 to 200 metric tonnes per annum of roots (Figure 6). In 1998, dried root material exported from Namibia brought a revenue of US\$ 0.83 to 1.15 million. In Omaheke region of Namibia, community members harvest and sell the dried product to exporters at US\$ 1.25 per kg (Hailwa, 1998).

In Nigeria, a joint venture between Bioresources Development and Conservation Programme (BDPC) and the Healers' Collective have Axxon Biopharm which offer standardized and highly purified extracts and botanicals to the international market for phytomedicines, nutraceuticals and personal care products. High quality phytomedicines are manufactured at home, based on the original formulations of the healers but with the state of the art quality control.

The majority of commercial companies operating in the phytomedical, nutraceutical, natural care and cosmetic products are located in Northern countries. Through partnerships and collaborations with high biodiversity countries, these companies can contribute with significant benefits in the form of capacity building, technology transfer, and training for business development that can assist in the development of the domestic industry.

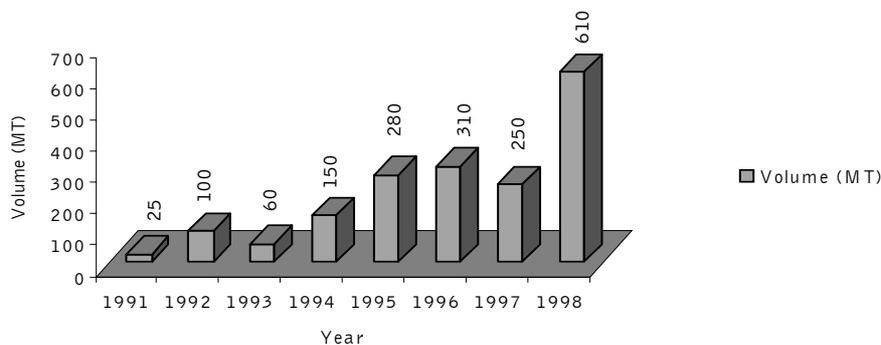


Figure 6: Export of Devils' claw roots from Namibia

### Medicinal Plants Trade From Latin America

Latin America exports significant volumes of crude drugs mainly in the dried form and to limited extent, as simple extracts and pure drug entities. These plants are mainly gathered from wild sources. Only a few countries of the region have large scale cultivation programmes for a selected number of medicinal plants. It is very difficult to estimate the Latin American market of medicinal plants and their derivatives, owing to lack of reliable information or statistics. The pharmaceutical market in Latin America is controlled by international companies. The participation of national companies is small. It varies from 50 per cent in Argentina to 20 per cent in Brazil and Colombia, and 10 per cent in Costa Rica and Ecuador. The processing of raw material for pharmaceutical industry is scarce. Many medicinal plants are also imported from industrialized countries to satisfy the local demand. Pharmaceutical end-products are also imported to some extent. Brazil used to import less than 10 per cent of its needs but with the globalization the situation is changing very fast. Medicinal plants import to the USA and the EU from Latin American and Caribbean countries during 1994 to 1997 are shown in Table 29.

#### *Chile*

In Chile, only a few commercial enterprises are involved in the international trade of medicinal plants. Chile exports over US\$ 20 million of medicinal plants, of which *Quillaja saponaria* amounts to US\$ 80,000. Other important export items are *Peumus boldus*, *Origanum majorana*, *Rosa perruna* and *Smilax medica*. The volume of medicinal and aromatic plants exported during the years 1992 to 1994 reached 10,000 to 11,000 metric tonnes per year (Portilla, 1995). *Quillaja* spp., *Rosa mosqueta* and *Peumus boldus* are collected from wild sources. *Rosa mosqueta* and *Peumus boldus* are exported mainly

to Brazil and Argentina, and *Origanum* and *Quillaja* spp. are exported mainly to Germany.

Table 29: The US and the EU imports from Latin American and Caribbean countries during 1994-97

Country of source	Annual average import for commodity code 1211.90			
	US		EU	
	Volume (MT)	Value (million US\$)	Volume ( MT)	Value (million US\$)
Chile	374	1.1	3,316	8.7
Ecuador	-	-	210	0.3
Brazil	134	0.3	639	2.7
Argentina	-	-	1,885	5.4
Mexico	1,003	1.9	360	1.1
Others	485	1.5	1,059	2.7
TOTAL	1,997	4.8	7,469	20.9

### **Ecuador**

About 500 medicinal plants used in the country are known. According to World-wide Fund For Nature (WWF), 228 species of medicinal plants are most widely used, and out of these, 125 are the most marketed ones. There is not enough basic scientific or technical information nor an ecological profile on most of these species, to know the best conditions for procurement or production of sufficient raw material to satisfy the existing demand. The plants of the Andean region are the best known and demanded on the local and international markets. Ambato, located in the Andean region, is one of the biggest centres of wholesale storage and distribution of medicinal plants in Ecuador (Buitron, 1996).

The local demand is projected to be high, but due to the lack of records and trade statistics a proper estimate cannot be carried out. Official import and export data are based on common global level import tariffs. Plants and parts of plants used in medicine and perfumery are registered as 'others'. Only ginger and ginger oil, cascarilla, red cascarilla, yellow cascarilla, cascarillon and condurango are registered as export products without specifying the species (Table 30), while oregano (*Origanum vulgare*) is the only import product .

Other species, such as dragons blood (*Croton* spp.) and cats claw (*Uncaria tomentosa* and *U. guianensis*), are regionally and globally marketed even if they are not registered under category of others nor under official tariffs . Although, due to the lack of trade monitoring, actual official data on import or export do not exist in Ecuador. Those marketed within the country and from the country are imported mainly from the USA, Japan, Europe, Peru and Colombia. Those exported correspond to national products, as well as products from Peru, Colombia, Argentina, the USA and Europe. The products leave Ecuador wholesale and retail without any official documentation, mainly to the USA and Europe, or as an inter-continental exchange for other products in the borders with Colombia and Peru. The most demanded species and products at local and international levels are the *Croton* spp. (dragons blood), *Uncaria tomentosa* (cat's claw), and *Cinchona pubescens* (cascarilla), among others.

Table 30: Medicinal plants trade from Ecuador

Product	Annual average export									
	1983		1992		1995		1996		1997	
	Volume (MT)	Value (1000 US\$)	Volume (MT)	Value (1000 US\$)	Volume (MT)	Value (1000 US\$)	Volume (MT)	Value (1000 US\$)	Volume (MT)	Value (1000 US\$)
Medicinal plants	-	-	-	0.2	-	-	-	-	1	6.3
Peruvian bark	-	-	5	1.0	25	25.0	-	-	22	8.0
Yellow Cascarilla	-	-	54	54.2	94	82.6	17	15.7	38	15.7
Red Cascarilla	-	-	42	13.3	111	31.3	80	23.9	85	23.8
Cascarillon	-	-	8	2.3	-	-	13	2.8	3	0.6
Condurango	48	48.4	11	6.7	16	9.4	39	22.6	-	-
Jengibre	7	2.4	16	13.4	-	-	563	327.1	-	-
Others	-	-	21	11.7	-	-	-	-	60	29.8
TOTAL	55	50.8	157	102.8	246	125.81	712	392.1	208	84.3

Source: Buitron, 1996

### Colombia

More than 70 per cent of medicinal and aromatic plants trade in Bogota, Colombia is unregulated. The species in trade are not officially registered by the National Institute for Control of Medicines and Food (INVIMA), a regulatory agency of Colombian Government. According to INVIMA, trade is permitted for about 100 medicinal plants species in Colombia, of which only 11 are native. Yet alone in Bogota trade center, at least 200 medicinal plant species are traded regularly in large volume at the local markets. The demand for medicinal plants from natural health centres, hospitals and laboratories has increased in the past years by an estimated 50 per cent. There is also a concern for adequate identification of plants in trade, in order to avoid potential health risks, such as poisoning and allergies.

### Brazil

Brazil is considered the country with the greatest biodiversity on the planet, with nearly 55,000 native species distributed over six major biomes, i.e. Amazon (30,000); Cerrado (10,000); Cattinga (4,000); Atlantic rainforest (10,000); Pantanal (10,000) and the subtropical forest (3,000). The Brazilian Amazon forests constitute about hundreds of medicinal plants (Berg, 1982). The Cerrado is the second largest ecological dominion of Brazil and constitutes about 220 species used in the traditional medicine (Vieira and Martins, 1998). Various medicinal plants have their centres of genetic diversity in Caatinga biome, where the use of local folk medicine is common (Craviero et al, 1994). In Brazil herbal extracts are considered as remedies, and they must be prepared under the supervision of the National Sanitary Agency and be registered. The growth in the botanical extracts sector is growing slowly but consistently.

Brazilian import of medicinal plant extracts, glycosides, alkaloids, essential oils and steroid hormones reaches US\$ 40 to 45 million per year (Perezdias, 1994). Brazilian trade in medicinal plants and their products in early 1990's is shown in Table 31.

Table 31: The Brazilian trade in medicinal plants and related products, during 1991-93

Products	Import		Export	
	Volume (MT)	Value (million US\$)	Volume (MT)	Value (million US\$)
Medicinal plants	1,500	1.6	800	3.5
Plant extracts	600	2.5	200	3.5
Heterosides	20	1.3	300	6.0
Steroid harmones	20	15.0	-	7.0
Alkaloids	25	15.0	20	30.0

### *Argentina*

Argentina exports approximately two metric tonnes of artichoke extract (US\$ 24,000), about 460 metric tonnes of other vegetable extracts (US\$ 300,000) and 11 metric tonnes of heterosides (US\$ 1.5 million). *Matricaria recutita* is exported in large quantities to Germany and Italy in early 1990's (Bandoni, 1993).

### Medicinal plants Trade from Least Developed Countries

Among 162 developing countries throughout the world, 49 have been designated as least developed (LDCs) by the United Nations. African continent alone has 34 countries in the list and rest are from Asia, Caribbean islands and Oceania. The least developed countries have rich resources of biodiversity in medicinal plants. The share of export from the least developed countries is very low and many export small quantities, as illustrated in Table 32.

Table 32: European Union import of medicinal and aromatic plants from some least developed countries

Country	Import value (thousand US\$)		
	1996	1997	1998
Vanuatu	0	0	1,872
Togo	1,315	1,851	1,484
Madagascar	1,676	1,567	844
Western Samoa	298	289	708
Burkina Faso	59	134	665

Source: ITC, 2001

At present, export of medicinal plants from these countries consists of two groups: liquorice root; and other plants and pharmaceutical products. About 12 per cent of annual world import of liquorice and 3 per cent of other medicinal plants between 1995 to 1999 originated from these countries. Total export of medicinal plants from these countries peaked at US\$ 37 million in 1998 before slowing to US\$ 27 million in 1999. It averaged around US\$ 31 million per year for the period 1995 to 1999 (International Trade Centre, 2001).

A large number of least developed countries supply other medicinal plants to the world market. Sudan is the largest exporting country, constituting about 37 per cent of

total export. Its average export was about US\$ 27 million per year during 1995 to 1999. The other exporters by order of importance are Congo, Vanuatu, Myanmar, Madagascar and the Lao People's Democratic Republic.

The EU was one of the largest import markets for these countries. The situation changed, and in 1999 the EU accounted for only 17 per cent of LDCs export. These countries therefore have diversified their exports mainly towards Mexico, Korea, the USA, Poland, Pakistan and other destinations, which have imported around 83 per cent of their exports in 1999.

The demand for medicinal plants is expected to continue to expand rapidly, fuelled by the growth of sales of herbal supplements and remedies. However, there is a little scientific knowledge concerning the range and availability of medicinal plants in these countries. They have the opportunity to expand their global export share of medicinal plants through commercially sustainable production and thereby improving their economy.

### 3.3.2 Plant Extracts

A significant percentage of medicinal plant material is used to make plant extracts. This process is carried out either by the end product manufacturers or by companies specializing in extracts. The sale of plant extracts is undoubtedly increasing as evidenced by the growth of Indena - one of the Europe's leading extract suppliers.

For value addition, several companies dealing with extracts have been set up in the Far East, e.g. QingDao HuanZhong Pharmaceutical Ltd. is a Sino-Japanese joint venture in China producing 240 metric tonnes of extracts, all destined for export to Japan and other international markets. Another example is Southern Herbals, in India, which started production of plant extracts in 1992 and is reported to be supplying companies such as Amgen, Bristol-Myers Squibb and Fujisawa with vincristine and vinblastine from *Catharanthus roseus*.

The US market for botanical extracts is estimated to be approximately US\$ 500 million (Boswell, 1999), which is equivalent to about 25 per cent of the global market. Ground or crushed crude herbs take up the remaining market share. The market of extract is forecasted to grow to US\$ 1.5 billion within five years. The proportion of extract market to crude herbs, is forecasted to rise as much as 75 per cent, reflecting the increased demand for product consistency and quality (Boswell, 1999).

Freedonia Group Inc. report (2001) has projected the demand for phyto-chemicals in the USA to advance at the rate of 7.1 per cent annually to US\$ 2.9 billion by 2005 (Table 33, Figure 7).

The growth in demand of plant-derived chemicals will be governed by the development of new plant based pharmaceuticals and gains in the beverage market, where consumer preferences continue to shift away from carbonated soft drinks towards alternative beverages with higher natural flavor loadings. Newly developed products such as

Table 33: Demand of phyto products in the US market

Item	Demand (billion US\$)				Per cent annual growth	
	1995	2000	2005	2010	1995/2000	2000/2005
Phytochemicals	1,385	2,040	2,880	4,065	8.1	7.1
Essential oils	518	711	943	1,240	6.5	5.8
Botanical extracts	284	511	843	1,380	12.5	10.5

Source: Freedonia Group Inc. (2001)

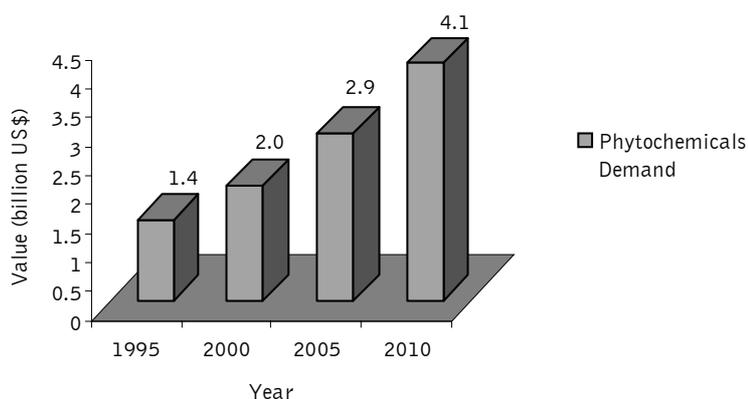


Figure 7: Phytochemicals demand in the US market

extracts, i.e. grape seed and valerian extract, various multifunctional plant derivatives, such as lycopene and anthocyanin) will register growth exceeding 8 per cent per annum through 2005. Established plant derived chemicals, such as essential oils will record more restrained growth, under six per cent per year through 2005. Plant derivatives, especially those with pharmaceutical applications, such as anticancer agent paclitaxel, will register strong growth. The worldwide market for paclitaxel was in excess of US\$ 1.6 billion in 2000.

Other estimates for the extractive industry valued the total market for plant derived chemicals at US\$ 1.89 billion in 1998, with growth rates over 9 per cent. Within this market botanical extracts accounts for 29.62 per cent (US\$ 560 million) of the total market.

### 3.3.3 Prices of Medicinal Plants and Their Products

Despite the fact that herbal products are being exported in large quantities, the obvious economic value of medicinal plants and the true size of the sector is not known. The data are scarce or non-existent, information on medicinal plants production, usage, pricing and financial flows between countries is not available or seldom collected. Only a few medicinal plants of commercial importance are subject to international regulations.

Prices are generally affected by crop conditions, e.g. failure of harvest entails an increase in price. Other factors that contribute to price variation include volume of requested products by the various industries, freight costs, post handling charges and trader's profit.

Medicinal plant prices fluctuate with shifts in supply and demand. The prices listed in Table 34 should be considered indicative only. In addition, great care should be taken in comparing prices of medicinal plants and extracts from different origins, since the form, the structure and the biochemical activity may differ considerably between apparently similar products.

Table 34: Indicative prices for medicinal and aromatic materials during March 2001

Product	Price (US\$/kg)
RAW MATERIAL	
Valerian root	2.0-4.5
Ginger	1.5-1.8
Turmeric	1.2-1.5
Saw palmetto	2.8-3.2
Chillies	1.1-1.2
EXTRACTS	
Ginkgo	50-60
Green tea	20-30
Black cohosh	30-45
Saw palmetto	35-45
St. John's wort	30-40
Chinese ginseng	15-50
Siberian ginseng	30

Source: RAISE, 2001

Price and supply volatility is partly a result of consumer trends. St. John's wort is a prime example of a medicinal product whose popularity soared as a result of positive publicity in 1998. As a result, St. John's wort was heavily cultivated and prepared, which shortly led to over production and a drop in prices.

Another example is the American ginseng. The average price of cultivated ginseng root dropped from US\$ 69.87 per kg in 1992 to US\$ 24.95 per kg in 1998, while the average price of wild crafted root dropped from US\$ 243 per kg to US\$ 127 per kg during the same period. Another source of the American ginseng industry is the wild crafted American ginseng or wood grown ginseng. This product commands on the average 10 times the price of field cultivated material at the retail consumer level. In 1998, the wild crafted ginseng production in the USA amounted to US\$ 13.8 million.

The prices are specific to origin and specifications. Therefore, a price quotation of one region would be of no value. Therefore exporters obtain prices by sending specifica-

tions and characteristics directly to importers accompanied by samples. Price information sources are as follows:

Company	Address	Contacts
Chemical Marketing Reporter	80 Broad Street New York NY 1004-2203 USA	Tel.: +1-212-2484177 Fax: +1-212-2484903 Website: <a href="http://www.chemexpo.com/schnell/cmr.html">http://www.chemexpo.com/schnell/cmr.html</a>
Market New Service	International Trade Center 54-56 Rue de Montbrillant Geneve 1202 Switzerland	Tel.: +41-22-7300111 Fax: +41-22-7337176 E-mail: <a href="mailto:mns@intracen.org">mns@intracen.org</a> Website: <a href="http://intracen.org/mns/medplants.html">http://intracen.org/mns/medplants.html</a>
The Public Ledger	80 Calverley Road Tunbridge Wells Kent TN1 2UN United Kingdom	Tel.: +44-189-2533813 Fax: +44-189-2544895 E-mail: <a href="mailto:marketing@public-ledger.com">marketing@public-ledger.com</a> Website: <a href="http://www.public-ledger.com">www.public-ledger.com</a>
Fuerst Day Lawson Limited	St. Clare House 30-33 Monories London EC3N 1LN United Kingdom	Tel.: +44-071-4880777 Fax: +44-071-4889927
George Uhe Co. Inc.	12 Route 17 N Paramus, NJ 07653 USA	Tel.: +1-201-8434000 Fax: +1-201-8437517

### World's Leading Botanical Raw Material Suppliers

The leading herbal companies which supply botanical raw material to the world market are Martin and Bauer Group, with global turnover of US\$ 250 million, followed by Indena and Schweizerhall, each at US\$ 200 million, SKW Trostberg and Arkopharma, with US\$ 100 million each in 1998.

In parallel with the increase in demand, the whole market for companies involved in supplying medicinal plant materials and extracts is moving into a more mature phase with mergers and acquisitions. According to an estimate on the US market, a company can survive only with annual sales in excess of US\$ 20 million (Boswell, 1999). As shown in Table 35, many of the largest companies in the herbal business have sales well in excess of this amount.

As the international market for herbal ingredients for ultimate use in pharmaceuticals, nutraceuticals and cosmetics grows, the sourcing of raw materials is set to broaden simultaneously, both in terms of increased harvests of existing crops and development of new crops and varieties.

Table 35: Leading suppliers of medicinal plant material

Company	US sale value (million US\$) April 1999
Hauser/Botanical International	>100
Indena	>50
Henkel	30-50
Optipure (Chemco)	
Flachsmann	
Martin Bauer/Muggenberg Extrakt	
AM Todd Botanicals	
Botanicals International Powders	
Schweizerhall	15-20
Euromed (Madaus)	
Mafco Worldwide Corp.	
Triarco Industries	
Sabinsa	
M. W. International	10-15
AYSL/Earth Power	
Quality Botanicals International	
S. K. W. Trostberg	
Pure World Botanicals	
Technical Sourcing International	
Arkopharma	
Starwest Botanicals	
Amway/Trout Lake Farm	

*Source: Boswell, 1999*

## 4 Policies and Regulations in Medicinal Plants Trade

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Medicinal plants are found all over the world and harvested to meet the demand of both local and international markets. The vast majority of medicinal plants used in traditional medical systems and natural product industries are collected from their natural habitats. At present, a serious problem is the over-exploitation of these important resources which threatens not only the future of these species, but also the livelihoods and health status of people relying on these resources throughout the world. Therefore, a regulation for exploitation and exportation is increasingly demanded, along with international co-operation and co-ordination. The knowledge of existing international regulations will be of great help in decision making and effective planning for countries willing to enter the international trade.

### 4.1 International Trade Restrictions in Medicinal Plants

International trade in medicinal and aromatic plants is controlled and regulated by various measures and restrictions varying from country to country. The broad trade restrictions imposed on medicinal plants trade are tariff and non-tariff measures.

#### Tariff Measures

In several countries, most medicinal plants and crude drugs are traded without any tariff restrictions. These are exempted from import duty in Canada, Japan, the EU and the USA, which are major markets for these plants. However, tariff charges in China and South Africa vary between 10 to 20 per cent of the value of goods, depending on product and origin. Japan levies a 5 per cent tax on imports of ginseng roots, sandalwood and some others. The most important tariff measures adopted in medicinal plants trade are import and export tariffs by the importing and exporting countries, respectively. The tariff regulations applicable to drug import in the EU, include associated implications of revenue law, and the conservation legislation. Dried and fresh botanical material are subject to a tariff codex when imported from developing countries into the EU. This codex consists of tariff regulations and the associated implications of revenue law. These comprise Custom Law, Law on Market Organisation and Countervailing Duty Law. Trade within the EU is unrestricted and exempt from custom duties.

### *Import Tariffs*

Import tariffs are imposed to provide protection to domestic products. In case of developed countries this does not hold true, as medicinal plants are not collected and produced in these countries because of high labour cost. These countries tend to maintain low tariffs on import, in order to ensure a sustained supply. The import duties imposed on botanical drugs in the EU, the USA and Japan are summarized in Table 36. In EU markets, special rates apply to products from African, Caribbean and Pacific, less developed Andean, European Free Trade Association (EFTA) and other countries. In the US market, special rates apply to products from Caribbean or other countries in free trade areas; and for Japanese markets consumption tax of 5 per cent is levied on the duty-paid value of the product. However, import tariffs for developing countries are considerably higher. For example, import tariffs in China range from 12 to 65 per cent, and from 30 to 60 per cent in India. Import duty is calculated by adding value equivalent to figure listed in Table 37, unless other wise specified for both the countries. In case of products traded from China the product tax, value added tax, and industry & commerce consolidation tax are also added.

### *Export Tariffs*

Export tariffs are levied on medicinal plants exported from most developing countries. The main objective is to secure revenue for the country. For example, the export duty levied on medicinal plants are 15 per cent in Cameroon (US Department of Commerce, 1999). The Brazil nuts exported from Brazil attracts 12 per cent duty whereas gum Arabic from Sudan carries charges of 40 per cent.

### Non-Tariff Measures

The major non-tariff measures applicable to medicinal plants and their products in trade are: species protection controls; health and safety regulations; and quality and technical standards.

### *Species Protection Controls*

It is the most important measure regulating the international trade in medicinal plants. After recognizing the fact that the threat of extinction of species is directly related to their global market demand, nations of the world worked together to regulate the international trade of rare and endangered species of plants and animals. The proposals of World Union for Conservation (IUCN) presented at the United Nations Stockholm Conference on the Human Environment, in 1972, laid down the foundation of an international treaty known as Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). This treaty came into effect from 1 July 1975 and at present it has 154 signatories.

Table 3.6: Tariff duties applied in the major import markets

HS code	Product description	Tariff measures (rate of duty)										Non-tariff measures			
		EU		USA				Japan				EU	USA	Japan	
		Conventional	GSP	Autonomous	MFN	GSP	Non-MFN	General	GSP	WTO bound					
1211.20.00.00	Ginseng roots, used in pharmacy, perfumery etc.	Free	-	Free	Free	-	Free	-	-	-	-	-	None	None	-
1211.20.00.10	American ginseng	-	-	-	-	-	-	10%	-	5%	-	-	-	-	Health & Safety Regulation
1211.90.10.00	Pyrethrum	3%	Free	Free	-	-	-	-	-	-	-	-	None	-	-
1211.90.30.00	Tonquin beans	8%	Free	3%	-	-	-	-	-	-	-	-	None	-	-
1211.90.40.00	Mint (stems and leaves)	Free	-	Free	-	-	-	-	-	-	-	-	-	-	-
1211.90.50.00	Cinchona bark	Free	-	Free	-	-	-	-	-	-	-	-	None	-	-
1211.90.60.00	Tonka beans, used in perfumery, pharmacy, or for insecticidal, fungicidal purposes	-	-	-	0.066 US\$/kg	Free	0.550 US\$/kg	-	-	-	-	-	-	None	-
1211.90.65.00	Verbena (leaves and tops)	Free	-	Free	-	-	-	-	-	-	-	-	-	-	-
1211.90.70.00	Wild marjoram - <i>Origanum vulgare</i> (branches, stems and leaves)	Free	-	Free	-	-	-	-	-	-	-	-	-	-	-
1211.90.75.00	Sage ( <i>Salvia officinalis</i> ) leaves and flowers	Free	-	Free	-	-	-	-	-	-	-	-	-	-	-
1211.90.80.00	Other	Free	-	Free	-	-	-	-	-	-	-	-	-	-	-

GSP - Generalized System of Preferences  
 MFN - Most Favoured Nations  
 WTO - World Trade Organization  
 Source: UNCTAD Database

Table 37: Import duty applied to medicinal plants in developing countries

HS code	Product description	Tariff measures (rate of duty)						Non-tariff measures	
		China			India			China	India
		MFN	General	Other	Basic duty (MFN)	Basic duty (GEN)	Auxiliary duty of customs		
1211.10.00.00	Liquorice roots	-	-	-	60 %	65 %	45%	-	Negative list
1211.20.00.00	Ginseng roots	-	-	-	60 %	60 %	45 %	-	Negative list
1211.20.00.10	American ginseng roots	45 %	70 %	14 % (0.00)	-	-	-	Import license; Import inspection	-
1211.20.00.40	Wild ginseng roots	65 %	90 %	14 % (0.00)	-	-	-	Import inspection	-
1211.20.00.90	Other ginseng roots, used in perfumery, pharmacy	35 %	50 %	14 % (0.00)	-	-	-	Import inspection	-

MFN - Most Favoured Nations

GEN - General

Source: UNCTAD Database

CITES establishes protocol for regulating the international trade of plants that are facing danger of extinction due to over-exploitation. Each member nation or party to the convention has to designate a Scientific Authority responsible for evaluating research on potentially threatened species, as well as a Management Authority to administer the various bureaucratic efforts needed to enforce the treaty.

Medicinal plant species which have become endangered are listed under three appendices, according to their risk of extinction.

Appendix I includes plant species that are currently 'threatened with extinction'. Trade in Appendix I species is the most heavily restricted, requiring both an export permit from the country of origin, as well as an import permit from the country of destination. CITES does not permit the importation of wild plants for commercial purposes if they are listed in Appendix I. However, CITES can re-designate Appendix I plants under Appendix II if they are cultivated rather than collected from the wild. In these instances, the Management Authority for the country of origin is required to inspect the facilities where the plant is cultivated. In addition, all nurseries must be registered with both the national authority and the CITES secretariat. Among more than a hundred plant species included in Appendix I, *Nepenthes distillatoria* L., *Saussurea costus* (Falc.) Lipschitz and *Stangeria eriopus* (Kunze) Nash are of medicinal value.

Appendix II includes plant species that are 'not necessarily threatened with extinction at present, but may become so if not carefully monitored'. Regulations governing trade of these species are less stringent than those in Appendix I plant species. Both export permits and actual export are monitored carefully by the Scientific Authority to prevent further risk of extinction and the necessity of moving the plant to Appendix I. When there is a significant decline in the wild population of the species, the Scientific Authority advises the Management Authority to take the suitable measures in granting the export permits for that species.

Appendix III includes plant species that individual nations wish to regulate through international cooperation in order to prevent or restrict their exploitation. The regulations for this category are more elastic comparing to Appendix II. The importation of Appendix III plants requires prior presentation of a certificate of origin. When the import is from a state that has included the species in Appendix III, an export permit is also needed. The scientific approval is not required to import or export plant species listed in Appendix III.

At present, about 230 plant species included in CITES are traded for medicinal purposes and they are likely to be traded in future. Recently, a list of forty-seven medicinal and aromatic plants traded in Germany has been included in CITES Appendix II. In India, ten medicinal plant species in trade have been included in Appendix II and one in Appendix I. A few countries have also imposed ban on import or export of wild plants, e.g. Australia has developed a comprehensive system of export control for all its native plants. Some individual countries also control trade in certain species by controlling

their export, e.g. *Harpagophytum procumbens* in Botswana, many wild orchids in Costa Rica, *Rauvolfia serpentina* and wild orchids in India.

Till now, the only international legislation that provides species-specific information on international trade in medicinal plants is CITES. However, it does not have a complete control on the voluminous medicinal plant trade.

### ***Health and Safety Regulations***

Regulatory requirements for health products in many countries are becoming more strict and demanding with the increased health consciousness. Many industrialized countries refuse admission for consignments of plant material that shows signs of pesticide residues. For example, Germany has regulations concerning the maximum allowable residue level in phyto-genic foodstuffs. Exporting countries of medicinal plants and their products are required to furnish phyto-sanitary certificate of pesticide residue free products. It is also essential that plant material in trade should be free from microbial contamination, dirt, dust and other unwanted matter.

Imports of edible fungi (morels, truffles etc.) are also subject to phyto-sanitary regulations as elaborated in the CODEX worldwide standards for dried edible fungi (CODEX STAN 39-1981). Similarly, spices imported to major markets require phyto-sanitary certificate of pesticide and fumigants residue free products.

### ***Quality and Technical Standards***

Quality considerations are of primary importance in the trade of culinary herbs. The important factors considered by importers and buyers are cleanliness, flavour, colour and aroma of the herb. Quality criteria vary from country to country and from herb to herb and are usually imposed by large importing and processing companies.

The regulations and requirements regarding quality control parameters, i.e. identification, medicinal qualities, characteristics and storage of medicinal plants and their derivatives, are well defined in national pharmacopoeias and formulary standards. The EU has unified its national standards into European Pharmacopoeia, while specifications for Japan and the USA are listed in Pharmacopoeia of Japan and the United States Pharmacopoeia, respectively. The developing countries have also developed their national pharmacopoeias (e.g. Ayurvedic Pharmacopoeia of India, Indian Herbal Pharmacopoeia and Pharmacopoeia of the People's Republic of China), which unifies quality and technical standards. The WWF has also drawn up certain principles relating to large international trade in medicinal plants.

## **4.2 Legislations in Medicinal Plants Trade**

Trade in medicinal and aromatic plants in most part of the world is of unregulated nature. This may be due to the fact that medicinal plants have received too little attention in national research and development and export development programmes of most

of the countries. These have been used since ancient time to cure human sufferings being abundantly available in wild. This might be the reason for the scarce attention in regulating their trade and bringing them under cultivation. Presently there is an increased demand in international markets, but the resources are shrinking due to over-exploitation. This has resulted into short supply of plant material and increased threat to species survival. There are very few countries which have national policies and legislations to regulate harvest, trade and conservation of medicinal plants resources. The national and international legislations adopted by some countries are discussed as below:

### *China*

In China, trade in medicinal plants is regulated only by national legislations and there is no specific law to implement CITES. The medicinal plant species in trade are classified into three categories (Category I, II and III) under the Regulations of China on Protection of Medicinal Resources, 1987. According to these Regulations, the major and commonly used wild medicinal species, whose resources are diminishing, are included in category III. The export of these species is subject to quota system under Article 15 of the Regulations.

China's Law of Wild Plant Protection, 1997, provides protection to plant species classified into species of national key significance and those of local key significance. The protected plant species of national key significance are further divided into Category I and Category II protected species. Trade in Category I protected species is not allowed, while trade in plant species listed in Category II is subject to authorization by the relevant government agencies at the provincial/autonomous region level. The State Forestry Administration, the Ministry of Agriculture and other authorized governmental authorities at the provincial/autonomous region level are responsible for enforcing the Law of Wild Plant Protection. A list of 255 species is appended to this law, out of these, fifty plant species are classified as Category I, and 205 species as Category II. From January 1998, China's regulatory system for the export of wild plants was strengthened by the Endangered Species of Wild Fauna and Flora Import and Export Administrative Office (under the State Forest Administration), the designated CITES Management Authority, and the Customs Authority.

### *India*

The trade in botanical drugs, to and from India, is governed by legislations at national and international levels. The medicinal plant species protected internationally are covered under CITES. Those protected nationally are listed in the Schedule VI of Wildlife (Protection) Act, 1972, revised in 1991, and covered under Indian Forest Act, 1927, Forest (Conservation) Act, 1980, Foreign Trade (Development and Regulation) Act, 1992 and Customs Act, 1962.

CITES in India is implemented through a combination of provisions of the Wildlife (Protection) Act, 1972/1991, and the Export and Import Policy (EXIM) under the Foreign Trade (Development and Regulation) Act, 1992, and the Customs Act, 1962. The

Director of Wildlife Preservation of the Government of India is the CITES Management Authority and it oversees CITES's implementation in the country. The Director has four Regional Deputy Directors and four sub-regional offices of wildlife preservation, these serving as assistants to CITES Management Authority.

Out of eleven Indian medicinal plants included in the CITES only one, *Saussurea lappa* (*S. costus*), is listed in Appendix I, while the rest ten medicinal plants species (viz. *Aquilaria malaccensis*, *Dioscorea deltoidea*, *Rauvolfia serpentina*, *Aloe* spp., *Euphorbia* spp., *Podophyllum hexandrum*, *Pterocarpus santalinus*, *Nardostachys grandiflora*, *Picrorhiza kurooa* and *Taxus wallichiana*) are listed in Appendix II.

In the national context, three Acts cover medicinal plant issues in India. These are the Indian Forest Act, 1927, which applies to medicinal plant material collected from the forest. The Forest (Conservation) Act, 1980, and the Wildlife (Protection) Act, 1972/1991, facilitates only the *in-situ* conservation of medicinal plants. Out from the protected areas, the Wildlife (Protection) Act, 1972/1991, provides a regulatory mechanism of six endangered plant species under its Schedule VI. There is no control over the exploitation of medicinal plants outside the protected areas. In 1994, vide public notice 47 (PN)/92-97 dated 30 March 1994, the Ministry of Commerce, Govt. of India, upon recommendations of the Ministry of Environment and Forests, banned around 56 medicinal plant species for export. In 1997, the Ministry of Environment and Forests set up an expert committee to review the 1994 ban notice. This committee recommended the preparation of negative lists at four levels-the first level is to enlist plants for immediate ban. The committee further recommended that such negative lists should be made applicable not only for exports but also for regulating domestic trade because the volume of domestic trade in respect of most of these threatened plant species is higher than their export trade.

The Export Import Policy of India looks at the export as well as import of plants and plant-parts on the basis of the CITES regulations. The policy is announced periodically by the Ministry of Commerce under the provisions of the Foreign Trade (Development and Regulation) Act. It lays down conditions governing the import and export of all goods. Recently, the Ministry of Commerce has banned the trade of 29 medicinal plant species, vide its notification No. 24 (RE-98)/1997-2002, New Delhi.

### *Nepal*

In Nepal, trade controls in medicinal plants are implemented in National Parks, conservation and protected areas through the National Parks and Wildlife Conservation Act, 1973. Elsewhere in the country these are implemented through the Forest Act, 1993, and accompanying Forest Rules, 1995. The Forest Act stipulates rules pertaining to collection of medicinal plants via permits issued by the District Forest Offices specifying the collection area.

At present, there is no specific CITES implementing legislation in Nepal. However, to promote more effective implementation of CITES, a legislation known as Endangered

Species (Trade Control) Act, along with a policy specifying allowable exports and imports has been drafted. The CITES Scientific Authority for Flora is the National Herbarium of His Majesty's Government, Department of Plant Resources, Ministry of Forests and Soil Conservation. The Management Authority issues export permits for plants covered by CITES and /or the Forest Act that are in a processed or semi-processed form. Ministry of Commerce (Customs) and the police assist in the enforcement of import and export controls.

### *Pakistan*

At national level, trade in medicinal plants is regulated by the Pakistan Forest Act, 1927. The collection of medicinal plants is controlled by the Forest Department. The forest areas are leased for one year to the interested parties. The transport permits for the transportation of material collected from wild are issued by local Divisional Forest Officers upon payment of a fixed duty fee. In general, commercial exploitation from reserved forests is forbidden in Pakistan by the order of the Inspector General of Forests, Islamabad.

The CITES Management Authority is represented by the National Council for the Conservation of Wildlife (NCCW), under the authority of the Ministry of Environment, Local Government and Rural Development, Islamabad. CITES permits are issued by the NCCW, which is responsible for formulating countrywide legislation for regulating harvest, national and international trade of CITES listed species and for inter-provincial and international co-ordination of CITES implementation.

### *Bhutan*

In Bhutan, the protection of flora and fauna in the country is provided under the Forest and Nature Conservation Act, 1995. The collection of medicinal plants is allowed under this Act and their transportation within country is controlled under a system of permits through a related regulation. Specific guidelines have also been set by the Royal Government Forestry Services Division for the extraction of medicinal plants from the wild, i.e. restricting collection to less than 30 per cent from any area and covering exposed areas with soil. The export of most of the medicinal plants has been banned. A certificate of origin and a transit permit are required to be presented to customs check posts at the time of export. Bhutan is not a party to CITES.

### *South Africa*

In South Africa, medicinal plants are protected under CITES regulations. The Department of Environmental Affairs and Tourism is responsible for coordinating the implementation of the convention at country-level. The provincial authorities are responsible for implementing the convention in their respective provinces and provincial law enforcement units to enforce the legislation with regard to CITES. The Endangered Species Protection Unit (ESPU) of the South African Police Service deals with law enforcement regarding trade across international boundaries involving crime syndicates. The Chief Directorate of Sea Fisheries is responsible for introductions from the sea.

### *Latin America and Caribbean Countries*

In Latin America and the Caribbean Islands countries, medicinal plants are protected under regulations of CITES. About 30 countries of the region have become signatory of the convention till date. CITES in Brazil is implemented under Decree No. 76.723, which was adopted in July, 1975. It covers all species included in the Appendices. Under Decree No. 120 of 16 November 1996, Brazil authorized the use of 'Autorizacao para Transporte de Produto Florestal (ATPE)' forms, marked with the stamp 'Carimbo de Certificado Origen- CITES' as CITES certificate of origin. Brazil's CITES Management Authority is the Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renovaveis (IBAMA). It is responsible for issuing certificates of origin. In Argentina, the Directorate of Environmental Subjects, Ministry of International Relations, Commerce and Culture has been designated as CITES Management Authority. The permits and certificates of origin are issued by the Division of Fauna and Flora of Sustainable Environmental Development of the Ministry of Social Development, which has been designated as Scientific Authority alongwith Argentina Museum of Natural Sciences.

### *European Union*

Medicinal and aromatic plants trade in Europe is subject to international, European and national legislations. Out of 120 species, fourteen species were specifically included in the Appendices because of the need to regulate trade in medicinal material. Other six species, *Adonis vernalis*, *Camptotheca acuminata*, *Cistanche deserticola*, *Harpagophytum procumbens*, *Harpagophytum zeyheri* and *Panax ginseng*, were proposed for inclusion in Appendix II, at Conference of the Parties (COP)11.

CITES regulates the trade in medicinal and aromatic plants in the EU at international level. All 47 European medicinal plants listed under CITES are included in Appendix II. They require special permits for their trade. At national level, the convention on the Conservation of European Wildlife and Natural Habitats of 1982 (Bern Convention) lists six species of medicinal and aromatic plants in trade, suggesting measures to regulate their trade.

At EU level, CITES is implemented by Council Regulation (EC) No. 338/97 and Commission Regulation (EC) No. 939/97, and its various amendments. In addition to 47 CITES listed species, seven others are listed in Annexe D, which means that their trade within the EU should be monitored. Council Directive 92/43 EEC (EC Habitats, Fauna and Flora Directive) lists ten medicinal plant species with three species in Annexe II, one in Annexe IV (b), and six in Annexe V (b). The Directive aims to promote the conservation of natural habitats of wild flora within the EU for future availability and sustained supply.

The legislation on protection and trade of endangered medicinal and aromatic plant species is present in almost all the European countries. Altogether, 341 plant species are affected by the combined national legislations of Bulgaria, France, Germany, Hungary, Spain and Turkey.

The implementation of convention regulations for species included in the appendices is poor, and in many cases non-existent. Germany has made notable efforts to implement CITES through the publication of the checklist of medicinal and aromatic plants and their trade names covered by CITES and EU Regulation 2307/97. The Plants Committee has examined the trade through the medicinal plant significant trade study. Additional significant plant trade surveys have been undertaken by Trade Records Analysis of Flora and Fauna in Commerce (TRAFFIC). However, these efforts are too scarce, and although member nations have taken domestic measures to conserve native plant populations, still implementation of the convention for medicinal plants is unsatisfactory.

### ***Bulgaria***

The trade in botanical drugs in Bulgaria is governed by legislations at national and international level. The internationally protected species are covered in CITES. In Bulgaria eight species used as botanical drugs are listed in Appendix II, i.e. snowdrop (*Galanthus nivalis*), pyramidal orchid (*Anacamptis pyramidalis*), butterfly orchid (*Orchis papilionacea*), gobose orchid (*Orchis globosa*), military orchid (*Orchis militaris*), provence orchid (*O. provincialis*), *Cyclamen coum*, and ivy-leaved sowbread (*C. hederifolium*).

The species protected nationally are listed in the Bulgarian Ordinance on the Conservation of Species, and/or are subject to legal restrictions and ordinances concerning control of the botanical drug species. Bulgarian Species Conservation Legislation came into force on 21 July 1989, vide ordinance no. 718, dated 20 June 1989. Under this ordinance, cutting, collecting, picking, uprooting, trading and exporting of thirty seven medicinal plant species, either as fresh or dried material, is strictly prohibited. Bulgaria has also set up a quota-system for the collection of 23 plant species.

Trade in botanical drugs in Bulgaria is also subject to different laws and regulations established in 1991 under the Law for the Protection of the Environment. The botanical drug species occurring in the forest comes under the jurisdiction of the Forestry Committee, and its use is subject to forestry laws. Since 1991, wild harvesting and trade in threatened plant species are subject to restrictions and prohibitions, issued by the Ministry of the Environment. For collection from the wild, a fee has to be paid as per Decree No. 202 dated 26 September 1994, published in Official Gazette No. 82, 1994. Import-export certificates for plant drugs are granted as per the Decree No. 132, dated 31 March 1997, published in Official Gazette No. 28 of 3 March 1997.

### ***United States of America***

There is little government legislation concerning the conservation of medicinal plants in the USA. Most efforts being made to protect the sensitive, threatened or endangered species come from private, non-profit organizations. The most prominent legislation concerning the conservation of medicinal plants in the USA is encompassed in the Endangered Species Act, 1973.

The Endangered Species Act (ESA), 1973, was enacted to halt the rapid loss of

plant and animal life, as well as to provide protection for threatened or endangered species. Frequently referred to as the 'crown jewel' of environmental laws, the ESA has played a significant role in saving many species that are on the brink of extinction. The ESA has been effective in preventing actual extinction by acting as a last ditch intensive care unit for those species that have been pushed to the edge of extinction, however it has been significantly less successful in bringing the species to a level at which it no longer requires protection. The recently proposed Endangered Species Recovery Act (H.R. 2351) strengthen and improve this act by protecting imperiled species and their habitats, promoting true species recovery, by offering financial incentives to landowners who promotes recovery of a species (Bagai et al, 2000).

The threatened medicinal herb goldenseal (*Hydrastis canadensis*), included in CITES's Appendix II, is subjected to certain regulations and requires a permit to continue the trade. The listing includes roots, rhizomes, rootstocks, and bulk powdered herb, while finished products will be exempt from CITES control. In the USA, finished products are only regulated by the Federal Trade Commission (FTC).

Another example is the wild American ginseng (*Panax quinquefolius*), which occurs naturally in 34 of the 50 states and it is officially listed as endangered in one state, threatened in four, rare in one, and vulnerable in another. Nine states consider American ginseng a 'species of special concern' or include it in a 'watch list' while seven peripheral range states do not afford any protection to the species. Twenty-four states, in cooperation with the federal government, regulate the harvest and/or the sale of American ginseng (Robbins, 1998).

The commercial trade in the American ginseng has been regulated since 1975 when it was listed in CITES's Appendix II. The US Fish and Wildlife Service (USFWS) is the designated CITES's Scientific and Management Authority. Before issuing a CITES export permit, the USFWS must determine whether ginseng roots being exported were legally acquired and their export will be a decisive factor to the species' survival. In order to make these verifications, the USFWS has established a joint ginseng management programme with states to monitor wild ginseng populations and regulate harvest and commerce. According to the programme requirements, ginseng dealers must register with each state in which they intend to purchase and sell wild and cultivated American ginseng roots and must report their transactions to these states. The single states submit an annual information on ginseng harvest, biology, laws, and regulations to the USFWS, which the Federal Agency uses to approve or disapprove ginseng export on a state-by-state basis. Out of the 24 US states approved by the USFWS for American ginseng export, 19 are authorized to export wild and cultivated roots and five are authorized to export cultivated roots only.

Given the steady rise in the demand for wild American ginseng and its commercial value, it is critical that harvest and trade continue to be monitored, reported, and regulated to identify and avert potential conservation problems. The USFWS administrators should look at the extent to which states are capable of meeting federal criteria. Simi-

larly, states should seek creative partnerships and alternative approaches to manage a high-value resource that is increasingly under pressure from commercial collection and habitat loss.

### *Canada*

Canada became a party to the CITES on 10 April 1975, with enforcement commencing on 3 July 1975. The Canadian Wildlife Service of the Federal Department of the Environment has been designated as the authority to manage and coordinate the application of the convention in Canada. The Canadian Export and Import Permits Act (R. S. 1995, c. E-19) regulates CITES, and protected species are documented in the regulations promulgated through the Act and published in the Canadian Gazette. The Federal Department of Agriculture issues export permits for medicinal plants and their products for all provinces and territories except Québec, where they are issued directly by the Ministry of Environment. The permits for plants from wild are issued only after approval from the province or territory in which the plant originates. The import of plants and their products is controlled by the Plant Protection Act (1990, c.22) of the Federal Department of Agriculture. In Canada, the export of wild American ginseng root is banned under provincial law in Québec and Ontario. The Canadian government has not been obligated by CITES to make a 'no-detriment' finding for exports. However, cultivated ginseng is exported from Ontario and British Columbia, that are together the top North American producers and exporters of cultivated roots.

### *Australia*

In Australia, CITES became enforceable under Australian law on 27 October 1976. The Wildlife Protection (Regulation of Exports and Imports) Act, 1982, provides the legislative basis for meeting Australia's responsibilities under CITES which is administered by the Wildlife Australia Branch of Environment. The Wildlife Permits and Enforcement Section of Environment is the Management Authority for CITES and responsible for the coordination of enforcement matters. The Wildlife Scientific Advice Section of Environment Australia has been designated as the Scientific Authority for CITES. Most investigations are undertaken by the Australian Custom Service or the Australian Federal Police. The Wildlife Protection Act, 1982, controls the export and import of medicinal plants and their products. Strict regulations govern the export of all Australian native plants.

### Legislative Shortcomings

Wherever medicinal plant legislation exists, it tends to have flaws like government inability to enforce limits and regulations. Most of the national legislations do not ban collection of rare or endangered plants on private lands, unless national laws specifically forbid the practice, and many countries do not have such laws. This poses a threat of habitat destruction. A lot of medicinal plants grow outside the protected areas of domain, and since there is no consolidated strategy for medicinal plants, many of them disappear without the knowledge of anyone.

Perhaps the largest legislative obstacle for medicinal plants is the lack of attention that they receive. Over the last years, too little attention has been paid to the conservation of medicinal plants, compared to animals. Although, far more plant species are at risk or threatened due to human activity, only a tiny portion of conservation is devoted to plants. These efforts are widely scattered and minimal.

The international treaties like CITES do not have enforcement power on their own. It is up to the individual member-country to enforce the regulations suggested by CITES. At present, no member-country is bound to CITES trade restrictions. This loophole in the agreement ignores the protection of several threatened species of plants. Undoubtedly, regulations designed to protect endangered or threatened species should be supported, though mere trade restrictions, as most conservationists will agree, will hardly address the real issues. Inevitably, such regulations will increase the market prices, thus encouraging poachers and illegal trade.

## 5 Constraints in Market Development for Medicinal Plants

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Medicinal plants are considered as minor crops and have received low priority in national investment, research and export development programmes in most of the developing countries. Most of the medicinal plants supply to the world market is sourced from these countries. Despite the large import of medicinal plants by developed countries, the growth of export from developing countries is constrained by several factors.

### *Lack of Research and Development Facilities*

Most of the developing countries lack appropriate research and development facilities needed for entering the major markets of Europe and the USA. Their entry into the markets, where herbal medicines are not sold as OTC products is also difficult, as distribution outside food outlets is hard and risks are higher.

### *Lack of Technology*

There is a lack of knowledge on production, extraction and standardization technologies in most of the developing countries. The skill shortages also result most often inadequate post-harvest handling, storage, processing and packaging resulting in poor quality and low unit values for exports.

### *Lack of Quality Control Measures*

The exporters lack knowledge of international standards for hygiene, product specification and quality. They also lack systems of measurement and testing the quality and efficacy of the products.

### *Lack of Knowledge of Supply*

Most of the developing countries have few or no inventory of species of medicinal value. Prospects for cultivation are scarce or yet to be studied. The supply potential is thus virtually unknown. At present, only a few countries have the resources and the institutional capability to advise on policy and regulatory mechanisms to provide consistently high quality products. The know-how in processing technologies is also deficient, as is the availability of sustainable production processes.

### *Limited Knowledge of Medicinal Value*

The limited knowledge of medicinal properties of herbs beyond traditional knowledge and belief restricts the use and marketability of these plants. A systematic process is required to work with end-users in the developed countries to study their use of herbal supplements and remedies to explore the possibility of selling their own traditional herbal supplements and tonics and lastly, to examine the requirements for marketing traditional medicines. The sale of the latter requires regulatory approvals that are usually expensive and time consuming, beyond the resources of most of the exporting countries.

### *Intellectual Property Rights (IPRs)*

The intellectual property rights are an issue of great importance to the source countries. Medicinal plants have been used in traditional medicine for centuries and hence cannot be protected by patent. They can be registered as individual or regional trademarks. The knowledge of the complete system of IPRs field is limited in these countries and hence access to IPR system is limited.

### *Market Access*

The access issues of foreign markets have also constrained export development. Generally, most of the crude drugs are allowed without any tariff restrictions in several countries. They are exempt from import duty in Canada, Japan, the EU and the USA which are the major import markets.

### Strategies for Export Development

In order to improve the export of medicinal plants from developing countries following strategies should be adopted.

#### *Market Knowledge*

The knowledge of consumers, their requirements and preferences, market access conditions, appropriate marketing channels, and marketing techniques should be strengthened. Preliminary knowledge of import requirements and regulations should be given to suppliers and exporters to allow them to obtain the necessary standards of quality and sophistication requested by the international markets. The capacity of the agencies responsible for export promotion and business associations should be strengthened so that they could work efficiently. The producers should be trained in sustainable harvesting techniques, sorting and grading, packaging and shipping to meet customer requirements.

#### *Resource Assessment*

It is necessary to access local resources of medicinal plants before aiming to reach international market. Inventories should be prepared in order to map the areas where the plants occur naturally and in order to estimate available quantities through sustainable harvesting. The available species should be tested for quality parameters to determine their potential in export markets. The estimates of supply potential should be followed by

an active programme of marketing. Agrotechniques should be developed to introduce cultivation if demand exceeds the sustained supply from natural resources.

### *Alternative Sales Techniques*

The practice of e-commerce needs to be popularized in the developing countries for efficient and fast marketing. As an example dietary supplements sales on the Internet reached US\$ 40 million in 1998, with an increase of US\$ 12 million over the preceding year. This accounts for only 0.3 per cent of the total US supplements market of US\$ 13.6 billion in 1998 . However, the rate of sales growth for supplements on the Internet far exceeds that of natural foods stores, mass market stores, and multilevel marketing.

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Aloe (*Aloe vera*),  
Ginkgo (*Ginkgo biloba*) and  
Purple coneflower (*Echinacea purpurea*)