ANALYSIS OF MARKET ECONOMY OF MEDICINAL PLANTS IN KERALA

By

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THESIS

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DECLARATION

I hereby declare that the thesis entitled **"Analysis of Market Economy of Medicinal Plants in Kerala "** is a bonafide record of research work done by me during the course of research and that the thesis has not previously formed the basis for the award to me of any degree, diploma, fellowship or other similar title, of any other University or Society.

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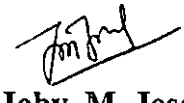

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Certified that the thesis entitled "**Analysis of Market Economy of Medicinal Plants in Kerala**" is a record of research work done independently by **Mr. Joby. M. Joseph.,** under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship or associateship to him.

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Dedicated
to
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Introduction

1. INTRODUCTION

Man's relationship with medicinal plants is as old as man himself and the practice of using herbs as medicine also dates back to the earliest periods of human history. Ancient Egyptians, Indians, Chinese, Greeco-Romans and others used a variety of plant forms and products for curing all types of ailments and for the revitalisation of the body system.

Developing countries are the major source of medicinal plants and plant parts in the world market. Among them India is a traditional exporter of medicinal plants for the past several decades. According to the World Health Organisation there are 20,000 plants that can be used for curative purposes and many of them are found in India. However the development of modern medicine coupled with the introduction of pharmaceuticals saw the decline of phytotherapy in the industrialised world during 20^{th} century.

In the present context of "back to nature" in health care, Ayurveda after years of neglect is in the path of resurgence. Advance in phytochemistry and identification of plant compounds effective against a wide spectrum of diseases have renewed the interest in herbal medicine especially during the last two or three decades. The health tourism is another area gaining momentum today where Ayurveda is increasingly being linked to tourism. Along with

entertainment tourism, health tourism also has a definite mission, which is growing year by year. India is the hub of health tourism and the state of Kerala taking the lion's share of the earnings, which have been facilitated mainly by the active efforts of the department of the tourism of the state.

India with its varied agroclimatic conditions and topography has been considered as botanical garden of the world and India's herbal wealth constitutes more than 8000 types of known medicinal and aromatic plants. Indian system of medicines uses over 1100 medicinal plants and most of them are collected from the forest. Increase in population, rapid expansion of area under food and commercial crops, deforestation, expansion of urban area and establishment of industries in rural areas resulted in considerable depletion of our herbal wealth and many of the medicinal plant species are in the process of extinction.

Keeping in mind the various hurdles affecting the medicinal plants trade, present study was taken up with a vision to bring out the existing system of medicinal plants trade in the state so that it can form the basis for formulating suitable regulatory measures and conservation strategies. This study is a modest attempt to analyse the issues in the marketing of medicinal plants in Kerala.

1) Identify the most important medicinal plants (in value and quantity) terms of pharmaceutical use in Kerala.

2) The major forms in which it is demanded and the source and extent of supply.

*** History of plant based medicines in India.**

India has a long history of local health traditions, which are backed by thousands of scriptures left behind by practitioners of this system of medicine. Earliest evidence of the use of plants for medicinal purpose is documented in the '*Oushadha suktha*' of the Rigveda. It mentioned the use of hallucinogenic mushroom *Amonita muscaria* and *Rauvolfia serpertina* used to treat snake bite, epilepsy, mental disorder and other illnesses. '*Charakasamhita*' an encyclopaedia of Indian medicine published at Varanasi between 1000 BC and 100 AD is a comprehensive record of medicinal plants and their uses. The first historical evidence of the establishment of a medicinal plant garden in India dates back to the reign of Emperor Ashoka who established a garden of medicinal plants in India between 260 – 258 BC.

***Plant kingdom with medicinal property.**

The forests of India are estimated to harbour 90 per cent of India's medicinal plant diversity. Only 10 per cent of the known medicinal plants are

found in the non-forest habitats. It is estimated that 22 per cent of 47600 plant species of India (10472) are identified to have medicinal use. It accounts for more than one fourth of the world's known medicinal plants.

The botanical survey of India has classified the plant kingdom to highlight that 47 percent of flowering plants and 41 per cent of lichens have medicinal properties (Table.1.1).

Table 1.1. Members of plant kingdom with medicinal properties

No.	Group	Total of species	No. of species with medicinal value	Percentage of species with medicinal properties
1	Flowering plants	17000	8000	47
2	Lichens	1600	650	41
3	Algae	2500	650	26
4	Pteridophytes	1022	200	20
5	Bryophytes	2564	150	6
6	Fungi	23000	750	3
	Total	**47686**	**10400**	**22**

(Source: Boaz, A.A.,)

***Global trade of medicinal plants.**

Medicinal and aromatic plants have been used from time immemorial for their medicinal properties. World trade of medicinal plants is worth about 60 billion US dollars per year, which is growing at the rate of seven per cent per annum (Ghosh, 2000). Products that relate to 20000 higher plant species are being marketed world over and about 120 chemical compounds of plant origin have been developed in to modern pharmaceuticals. About 90% of the raw drug materials are obtained in Asia, Africa and Latin America and the rest in Europe and USA. About 60% of the raw drug materials are imported into and processed in USA, UK, Canada, Australia, Germany, France, Italy, Switzerland and Japan. Fifty percent of the processed products are used there itself and the rest is exported in to the raw materials producing countries to be sold at higher prices. The benefits obtained from the drugs developed from the third world countries have mostly gone to the multinational corporate and the third world countries have received only little return in terms of money.

***Medicinal plants trade in India.**

India is a veritable emporium of medicinal plants and there is a vast potential for exports of medicinal plants from India. India is one of the world's top 12 mega diversity centres, enriched with 25% of the biodiversity. Over 8000

species of plants found in different ecosystems are said to be used for medicine in our country. The total turnover of Ayurvedic and herbal products in India is around Rs.2300 crores. Of these over the counter products (OTC) contributes around Rs. 1200 crores, ayurvedic ethical formulation constitute around Rs. 650 crores and ayurvedic chemical formulation constitute remaining Rs. 450 crores. At present, India exports herbal materials and medicine to the tune of Rs. 446 crores and the recent estimate shows that it can be raised to 3000 crores by 2005 (Ghosh, 2000). USA, Germany, Italy, France, Belgium, Netherlands, Switzerland and U.K. are the major importers of crude drugs from India.

***Ayurvedic medicine manufacturing in Kerala.**

People of Kerala have traditionally been using plant based medicine even though their per capita income are rising and opportunities for standard of living similar to western style are increasing, their tradition has not diluted substantially. At present there are about 10000 plant-based outlets compared to 50000 allopathic outlets in Kerala. Even with this tough competition from Allopathy, the Ayurvedic industry is growing 10 percent per annum. At present, the total turnover of Ayurvedic medicine and herbal products are in the tune of Rs. 200 crores in Kerala.

***Scarcity of medicinal plants.**

Increased demand for the raw drugs have led to the problem of unsustainable – over harvesting from the wild sources, which resulted in the loss of biodiversity and finally the extinction of certain important medicinal plants. There has been a global realisation regarding the potential extinction of these plants and it becomes important in this millennium to conserve medicinal plants both *in situ* and *ex situ.* Directorate of Arecanut and Spices Development, Government of India (1997-00) have brought out a red list indicating plants which are becoming rare, endangered or threatened (Appendix.1.).

***Cultivation of medicinal plants**

Considering the increase in human population and their encroachments on forests for their survival, it appears to be necessary to cultivate important medicinal plants to meet the increased demand of medicinal plants. Cultivation of medicinal plants ensures the uniform supply of raw materials to the pharmaceutical industry, conservation of natural resources, supply of authentic materials and at the same time it entails manipulation of medicinal plants both genetically and agronomically.

***Limitations of the study**

The study was concentrating on the purchased plant/plant parts rather than actual use. Some of the producers have gardens of their own, producing several plants for their use. That part is not accounted here.

Every effort was taken to collect time series data of at least ten years from the major pharmacies accounting for lion's share of market. But the co-operation from certain manufactures was not encouraging and some of them declined to provide the information fully, even after repeated efforts. However, the help and attitude of some of them is to be highlighted.

The marketing scenario (traders) of medicinal plants maintained much more secrecy compared to production sector, owing to, perhaps, stiff competition and unfair trade practices.

Considering the time and resource constraints, this study can be regarded as a curtain raiser to the trade scene of medicinal plants in Kerala, which warrants a deeper and wider research emphasis.

All the sample Ayurvedic pharmacies were running consultancy and or health centers. The returns of the pharmacies from such economic activities are

not readily available as most of the firms concentrated chiefly on details of purchase of medicinal plants and other raw material, that too since the last two to five years, i.e. from 1996-2001.

The trade in medicinal plant is not regulated. Considering the existing secrecy about source and other type of imperfections in the trade of medicinal plants, the data on the arrival of raw material, price variations, demand and other related marketing aspect in medicinal plants needs a long term study in the major markets in order to account for seasonal variation and the dynamics involved in the trade.

Review of literature

2. REVIEW OF LITERATURE

In this chapter a review of related studies are attempted. However studies on certain crops (eg. pepper, cardamom, ginger) which have medicinal properties and are commercially produced are excluded from this study. A critical review on socio- economic studies on medicinal plants reveals that there is comparatively higher concentration of research on production aspects than on the marketing aspects. Out of the total literature surveyed, sixty per cent deals exclusively on production, thirty per cent on marketing and the rest on both.

The studies on the economics of production of kacholam, koduveli, (Devi, 1996) and solanum, thippali, sarpagandha (Thomas, 2000) are a few to cite from the production economics part. In this study however only marketing studies are highlighted to suit the objectives.

2.1. The International scene

The volume of world trade in medicinal plants exhibits an increasing trend. A few studies on these aspects to understand the various aspects of the world markets are attempted here.

Though medicinal plant cultivation/ occurrence is more concentrated in countries like China and India, USA is the major consumer of medicinal plant based drugs. Duke *et al* (1993) studied the medicinal plants and the pharmaceutical industry in USA. They reported the current and future trends of medicinal plant production and utilisation and their role in the American pharmaceutical industry with reference to the data on plant derived products used in the preparation of major products.

Report of United Nations Development Programme (1994) estimated the annual value of medicinal plants marketed from developing countries as 32 billion US dollars (Kumar). There are 47 major modern plant based drugs already in the world pharmaceutical market and it was predicted that 328 drugs in the pipeline have a market potential of 147 billion dollars. The sale of the anticancer drug taxol from *Taxus sp* has been more than 200 billion US dollars worth.

The study by Abu and Ismail (1995) on the foreign trade of aromatic and medicinal plants in Egypt showed a positive growth rate in certain species while some showed a decline.

Brevoort (1996) studied the US botanical market. In his study the medicinal herbal market is discussed with reference to the comparative costs of

herbal medicines, cost compared with pharmaceuticals, the natural food shopper, the medicinal herb buyer, the US medicinal herb industry, type of herb products, top selling herbs in US commerce, medicinal herb import statistics, Market surveys and future market trends are also discussed in the paper.

Suran and Narayan (1996) reported that the sale of herbal medicines in European community accounted for 2.25 billion US dollars in 1990. In the European community market for phytomedicines, Germany has the largest share at 1.5 billion US dollars (65 percent of the total). The size of the French market for herbal medicines is 0.21 billion US dollars which is less than 1 per cent of the European community market. The share of UK market is 104 million US dollars and US market is 425 million dollars. The share of Indian market for phytomedicines is about 1375 crores in 1992-93,1848crores in 1993-94 and 2220 crores in 1994-95.

Tsutsui and Saiprasert (1996) studied the socio-economic implication of medicinal plants grown by Hill tribes in northern Thailand. The prospect of replacing opium poppy cultivation with new and high value medicinal plants (spice plants) in northern Thailand, in order to improve the living conditions of hill tribes, was analysed. Some aspects of the marketability of these medicinal plants, their growing and trading locations, the marketing channel, seasonal price variation and sales were also attempted.

An overview of medicinal and aromatic plant industries studied by Verlet (1996) in France describes the market for spices, aromatic plants, medicinal plants and essential oils and the demand these market place on producers.

Hersh (1997) reported the dynamic exchange of wild medicinal plants between different physiographic areas in Mexico through the study of two regional trade warehouses. These warehouses receive medicinal species not only from their own botanical environments (31per cent) but also from other remote places of gathering (69 per cent). He observed that ecological diversity allows the configuration of a commercial network between the regional traders and the market produce varies according to the physiographic zones involved. He reported that regional warehouses and traders are the basic units in this network and linked diverse economies, natural environments and cultures.

Cunningham (1999) from South Africa presented an overview of the medicinal plants trade highlighting areas for concern in the international trade of *Brunus africana* bark and the other species in the national trade. He highlighted conservation concerns and the opportunities that exist, through co-ordinated action between conservation and the commercial trades.

Hindustan Times report (2000) on marketing of Asian medicinal plants identifies two stages in the marketing of medicinal plants in Asia. The first is processing in to semi finished products while the second is processing in to finished products. The former include simple drying, grinding, semi processing, and in the markets these products are cleaned, sorted, graded, packed and dispatched to dealers on secondary markets who supply to pharmaceutical manufactures or export the materials. Second stage consists of the production of finished products/medicines after complete processing.

Being a biodiversity rich zone, Asian market for medicinal plants attracted much attention of researchers. Ghosh (2000) reviewed that 90 per cent of the raw drug material is produced in Asia, Africa and Latin America and the rest 10 per cent in Europe and USA. More than 90 per cent of the marketed materials are collected from the wild resources and there is some cultivation in China, India, USA, Germany, France, Italy and Eastern Europe. More than 60 per cent of the collected material is imported to and processed in USA, Canada, UK, Australia, Germany, France, Italy, Switzerland and Japan and about 50 per cent of the products are used there itself and the rest is exported to the raw materials producing countries to be sold at high rates.

Kambog (2000) reviewed that the herbal medicine market in the countries of European union are worth around 6 billion dollars in 1991 (it is around 20

billion in 2000) with Germany accounting for 3 billion dollars, France accounts for 1.6 billion dollars, Italy accounting for 0.6 billion dollars and others accounting for 0.8 billion dollars. In Germany and France herbal extracts are sold as prescription drugs and are covered by national health insurance. In 1996 the US herbal medicines market was about 4 billion dollars. The world market for herbal medicines is worth around 30-60 billion dollars and the export of herbal crude extract is about 80 million dollars.

2.2. Indian scene

Kapathi and Srivastava (1995) studied minor forest produce of Jammu& Kashmir State. Sixty three medicinal and aromatic plant species (found in forests) classified as minor forest produce are briefly described in this study with information on botanical names, local names, part used, ecology and time of collection in the year.

Bhatnagar *et al* (1996) studied the prospects of marketing *Cassia tora* under different institutional set up in MadyaPradesh. They observed the improvements in the marketing structure for *Cassia tora*, a gregarious annual under shrub whose leaves are used medicinally. Improvements in the marketing structure from the viewpoints of traders and co-operatives are briefly described.

Studying the medicinal plant market in India, Guptha (1996) reported about the unorganised nature of market. There is a complete lack of market surveillance, demand projection, price structure, foreign trade and management of major producing forests to allow planned development of the resources. The future growth in manufacturing sector on Indian System of Medicine (ISM) will make higher demand on availability of raw materials, requiring more and more items of bulk demand. Some of them are to be introduced in to agriculture and remaining others in forestry sector. These naturally demand systematic management to sustain and enhance their production.

The report of Agricultural and Industry Survey (1998) assessed the total market potential for crude drugs as well as extracts in India as worth Rs. 3 billion during 1997-98. Of this ethical and classical formulation accounted for Rs. 600 million each, traditional vaidyas Rs. 400 million and home remedial measures Rs. 200 million. The largest share is held by the Over the Counter Products (OTC) worth Rs. 1.2 billion. However, Indian herbal markets still remain unorganised.

Thomas et al (1999) also made similar observation on the trade of medicinal plants and related sector in India. The fluctuation in the national and international prices on account of variable supply and demand causes many problems in the industry. India can achieve comparative advantage in this sector

by producing low volume high cost materials or medicines through value addition to the raw and unfinished products.

Some specific studies on medicinal plants sector in Kerala projects the market situation in the state. Kerala Forest Research Institute (1993) conducted an extensive study and identified 300 plant species found in Kerala forest, which had commercial use as medicinal plants (FRLHT). Forest department had given permission to collect only 120 items from forest, to tribes and tribal communities. Out of these 120 items, 73 are listed as medicinal herbs for ayurvedic industries, which consist of 22 roots, 19 tubers, 16 creepers and the rest under spikes, bark etc. The value of minor forest produce collected by the tribal communities increased from Rs. 15 lakhs during 1982-83 to Rs. 96 lakhs during 1991-92.

Thomas and Sankaranarayan (1993) studied marketing arrangement for Non Timber Forest Produces (NTFP) in Kerala, which includes a good number of medicinal plants. Private traders have been enjoying monopoly status in collection and marketing of NTFP from the forest areas up to 1977-78. Since 1978, the government has entrusted the right of collection of NTFP to the tribals and forest dependent people from reserve forests and marketing to the Girijan Service Co-operative Society (GSCS) on concessional lease rent. The NTFP collected by the GSCS will be sold to the SC/ST Federations at prices fixed by

the NTFP committee. The committee has to fix collection charges, procurement value and the sale value of the collected materials. Nearly 75 per cent of sale value is given as collection charges to Girijans, 15 per cent as commission charge to GSCS and 10 per cent to SC/ST Federation.

Surveying 147 pharmaceuticals of Kerala in a one-year period, Sankaranarayan (1995) has identified the major plant/ plant parts required by the industry. The leaves of *Adhatoda vasica* are required to the tune of 1238 tones, followed by *Tinospora cordifolia* (1106.62 tones) and *Cynadon dactylon* (537.73 tones). In the case of roots, *Sida rhombifolia* is required to the tune of 1917.47 tonnes followed by *Ricinus communis* (883.73 tones), *Ichinocarpus fruitiscens* (564.12 tones,) *Hemidesmus indicus* (529.11 tones) and *Aegle marmelos (*524.01 tones). The whole plant of *Eclipta alba* is required to the tune of 261.35 tones and the shoots of *Azadirachta indica* were in demand to the tune of 660.34 tones.

Devi (1996) studied the economics of production and marketing of selected medicinal plants in Thrissur district. Her study aimed at estimating the cost of cultivation, cost of production, cost- benefit ratio and the market structure. The various uses to which these medicinal plants are put and the problems encountered in medicinal plant cultivation were looked in to. The major marketing channels identified in Thrissur market for marketing of

medicinal plants were 1.) producer-dealer- ayurvedic medicine manufacturer. 2) producers- Amrutha- ayurvedic medicine manufacturer. 3) producers- ayurvedic medicine manufacturer. Among the channel identified the producer-dealer-ayurvedic medicine manufacturer is the channel through which bulk of the produce was marketed. Nearly 57 per cent of the respondent farmers of kacholam sold their produce to medicinal plant dealers, 33.3 per cent sold through amrutha and the rest 10 per cent sold their produce directly to ayurvedic medicine manufactures. In the case of koduveli 58.33 per cent sold their produce to medicinal plant dealers, 25 per cent sold through Amrutha and the rest 16.67 per cent sold their produce directly to ayurvedic drug manufacturer.The producers share on dealer price was Rs.69 per kilogram (92 per cent) for kacholam and Rs. 20 per kilogram (83.3 per cent) for koduveli. The index of marketing efficiency was 11.5 for kacholam and 7 for koduveli indicating the economic efficiency of marketing of kacholam was more compared to koduveli.

Sankar (1996) studied the medicinal plants trade in Thrissur district and identified that *Sida Spp* has the largest pharmaceutical demand followed by *Asparagus, Gmelina, Oroxylum, Stereospermum, Desmodium, Pseudarthia, Piper longum* and *Vigna radiata*. The major source of supply of Sida is from marginal lands collected by the local people, while the other plants are collected from the forests and tribals play an important role in gathering.

Suneeta (1998) has identified ten major medicinal plants based on the descending order of the magnitude of the quantity procured by six sample ayurvedic pharmacies in Kerala. The major ten plants identified are *1) Sida spp. 2) Tinospora cordifolia. 3) Asparagus racemosus. 4) Aegle marmelos. 5) Phyllanthus emblica. 6) Terminalia chebula. 7)Withania somnifera.8)Strobilanthes ciliatus.9)Cuminum cyminum.10) Adhatoda sp.* In her study the pharmaceutical demand for ten medicinal plants, marketing channels, price spread in the major marketing channel and percentage composition of medicinal plants in major medicines were analysed. The major marketing channels identified are 1) collector- ayurvedic medicine manufacturer.
2) Collector- Traders- ayurvedic medicine manufacturer.3) collector- commission agent- trader- ayurvedic medicine manufacturer.4) trader in North India- Trader in Kerala- ayurvedic medicine manufacturer. 5) Collector-tribal society-TRIFED- end-user. Among the marketing channels, collector-trader-Ayurvedic medicine manufacturer is the channel through which major portion of the medicinal plants are marketed in the state.

The study undertaken by Thomas (2000) in Thiruvananthapuram district identified the marketing channel for the supply of raw materials for pharmaceutical industry. The different marketing channels identified in the marketing of medicinal plants were 1) Producer - Dealer - Ayurvedic medicine

manufacturers.2) Producer - Voluntary agencies - Ayurvedic medicine manufacturer.3) Producer - Retail shop dealer - Ayurvedic medicine manufacturer.4) Producers - Ayurvedic medicine manufacturer. Among the channels identified producer - dealer - ayurvedic medicine manufacturer is the channel through which bulk of the produce is marketed. Out of the total sample farmers of medicinal plant cultivation 58 per cent sold their produce to medicinal plant dealers, 20 per cent sold to voluntary agencies like Amrutha, 16 per cent sold their produce directly to Ayurvedic medicine manufacturers and the rest six per cent sold their produce directly to small scale retail shop dealers (Angadikkadakal).

Sasidharan and Muraleedharan (2000) studied the ayurvedic drug manufacturing units in Northern Kerala and assessed the consumption of raw drugs by the manufacturing units , their source of supply and dependency on forests. The annual consumption of 140 raw drugs is estimated to be 11,350 tonnes of which 83 per cent is consumed by large units, 6 per cent by medium units and 11 per cent by small units. Of this, 16 items are used over 200 tonnes, 21 items between 200 and 100 tonnes, 23 between 100 and 50 tonnes, 20 between 50 and 25 tonnes and 60 items between 25 and 10 tonnes. The medicine manufacturing units get raw drugs collected from forests, non-forests and through imports. Among the 140 raw drugs items, 117 are naturally seen in Kerala and in neighbouring states of Tamil nadu and Karnataka. The

consumption of raw drugs collected from forests is 44.94 per cent, non-forest areas 14.31 per cent, cultivation 13.58 per cent and imports 7.39 per cent.

Some of these reports are not based on systematic research studies. However a scientific assessment of market behaviour of medicinal plants is of paramount importance in view of its rising importance and changing trade climate.

Methodology

3. METHODOLOGY

The objective of the study as reported in the introductory chapter was met by following a scientifically charted methodology, which is detailed in this section.

3.1. Sampling frame and selection of sample

3.1.1. Production

Kerala the 'God's own country' is well known for practices of using herbal medicine (Ayurveda) and have retained this tradition though the allopathic system of medicine had the capacity to invade this tradition. The state has more than 900 ayurvedic pharmacies with 4000 registered and 6000 unregistered out lets for Ayurvedic medicines with a turnover of about 200 crores. The details of important manufactures and their relative share in the total turnover are furnished (in descending order of contribution) in table 3.1. The business share of ayurvedic drug manufacturing sector is highly skewed in favour of a few large manufactures. Two percent of ayurvedic pharmacies account for 81 percent of total turnover. The first seven pharmacies, accounting for 68 percent of the total turnover of the industry are purposively selected for in-depth study. From the selected units the following informations were gathered.

Table. 3.1. Ayurvedic drug manufacturing units in Kerala. (2000)

	Name of the pharmacy	Turnover Rs. in crores	% to the total turnover
1	**Kottakkal Arya Vaidyasala, Malappuram.**	**65**	**32.5**
2	**Arya Vaidya Pharmacy (Coimbatore) Ltd.Palakkad.**	**17**	**8.5**
3	**Nagarjuna herbal concentrates, Thodupuzha.**	**15**	**7.5**
4	**Vaidyaratnam Oushada Sala, Thrissur.**	**13**	**6.5**
5	**Oushadihi, Thrissur.**	**13**	**6.5**
6	**Kerala Ayurvedic Pharmacy, Athani.**	**7**	**3.5**
7	**Sitaram Ayurveda Pharmacy, Thrissur**	**6**	**3.0**
8	S.D. pharmacy, Alappuzha.	5.5	2.75
9	Vaidyamadam	1.5	0.75
10	Deseya Pharmacy	3	1.5
11	Santhegiri Ayurveda and Sidha, Thiruvananthapuram	3	1.5
12	Santhosh Pharmacy	2	1.0
13	Ashik herbal	2	1.0
14	Jayabharatham	2	1.0
15	Kandamkulathi, Mala, Thrissur	2	1.0
16	Sidha Vaidyasramam – Kanhangad	2	1.0
17	Kerala Ayurvedic Samajam	1	0.5
18	C.K.K.M,	0.5	0.25
19	Vasudeva vilasam	0.5	0.25
20	Dhanwanthari madam	0.5	0.25
21	Exports	5	2.5
22	Others	33.5	16.75
23	**Total**	**200**	**100**

(source, Kerala Ayurvedic Medicine Manufacturing Association,2000)

1. Identification of ten important medicinal plants in terms of quantity and value.
2. The plant/plant parts used.
3. Quantity/ value of these ten plants.
4. Unit purchase prices of important medicinal plants.
5. Marketing channel of important medicinal plants.
6. Problems in medicinal plant procurement and challenges faced by the industry.

A personal interview method with important persons in the industry was resorted for data collection. This primarily included the Managing Directors of the firm, Marketing managers, other persons in the marketing department, purchase managers, workers in the manufacturing unit, and accounts department. Moreover the practicing ayurvedic doctors were also often consulted.

The researcher has to visit each unit, on an average 10-15 times to obtain the desired information. While some of the firms enthusiastically cooperated with the study while some others were reluctant to provide all required information.

3.1.2. Marketing

Enquiries with the pharmacies and Kerala Ayurvedic Medicine Manufactures Association has revealed that there are around 30 major wholesale traders of medicinal plants in the state and bulk of the business is handled by eight traders and all of them are in Thrissur district. Thrissur markets for medicinal plants is one of the most dynamic markets in Kerala. Over years this market has been a constant supplier of raw materials to 94 registered Ayurvedic drug manufactures including three big units and 176 registered ayurvedic practitioners in Thrissur district and many other units in the state (Sankar 1996). From them the information of price of important species, sources, plant part traded and other relevant details were gathered. Data collection from traders were extremely cumbersome as they were very reluctant to provide the information.

3.2 Location

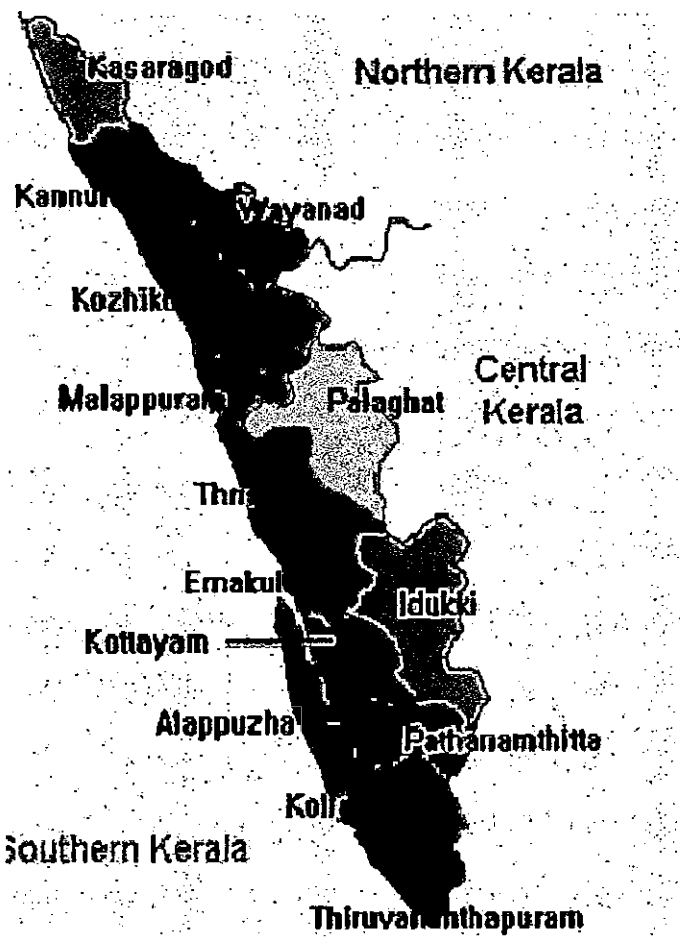
The district wise details of ayurvedic drug manufacture units in the state are furnished in table 3.2. It can be seen that there is a concentration of these units in the districts of Ernakulam, Thrissur and Palakkad. They together house 50 percent of total manufacturing units. Fig.1. shows the location of the selected units.

Table 3.2. District wise distribution of ayurvedic drug manufacturing units in Kerala.(2000)

No.	Name of Districts	Companies	Co-op sector	Ownership Doctors	Non-ownership Doctors – others	Members in KAMMA	Non-members of KAMMA	Total no. of Ayurvedic pharmacies	Percentage to Total
1	Trivandrum	2	2	11	23	38	32	70	8
2	Kollam	1	2	12	36	51	23	74	8
3	Pathanamthitta	1	0	6	7	14	4	18	2
4	Idukki	1	2	4	9	16	5	21	2
5	Kottayam	1	0	4	19	24	11	35	4
6	Alappuzha	1	0	7	16	24	26	50	6
7	Eranakulam	6	0	30	41	77	88	165	19
8	Trichur	15	2	42	112	170	15	185	21
9	Palakkad	5	0	14	36	55	27	82	9
10	Malappuram	3	1	16	34	54	4	58	6
11	Kozhikode	0	1	8	34	43	27	70	8
12	Wynad	0	0	2	3	5	6	11	1
13	Kannur	1	1	14	24	40	13	53	6
14	Kasargode	0	0	2	5	7	3	10	1
		37	**11**	**172**	**399**	**618**	**284**	**902**	**100**

(Source: Kerala Ayurvedic Medicine Manufactures Association.) (KAMMA)

Figure 1. Map of Kerala showing sample units



1.Ernakulam
2.Malppuram
3.Thrissur
4.Palakkad
5.Idukki

3.3. Analytical tools

The study mainly uses simple arithmetic tools like percentage analysis and weighted averages. The import and export data on medicinal plants were analysed by using these tools only.

The growth in consumption of medicinal plant was estimated by computing the annual compound growth rate, based on the exponential function. The results were derived with the help of computer programme EXCEL.

3.3.1. Weighted average price

Considering the quantum of requirement of medicinal plants by the sample pharmacies, the top ten medicinal plants species, which are the most required by the pharmacies were selected and the weighted average price for each of the medicinal plants are calculated as:

Weighted average price $Pw = \frac{\sum q_i p_i}{\sum Q}$

ΣQ = Total quantity of i^{th} medicinal plant procured by the sample pharmacies.

Piqi = Product of the quantity procured and the price paid for the i^{th} medicinal plant by the sample pharmacies.

3.3.2.Price index

Price index of major ten medicinal plants are calculated as:

$$\text{Price index} = Pa \times \frac{100}{Pw}$$

Pa = Price paid by the individual pharmacy for each medicinal plant.

Pw = Weighted average price of the medicinal plant.

3.3.3. Coefficient of variation

Though the major portion of the medicinal plants procured by the pharmacies in Kerala are from the traders of this field, the price paid by the sample pharmacies for a particular plant shows variation among the pharmacies. To estimate the extent of variation in the price of major medicinal plants, coefficient of variation for the major ten medicinal plants were calculated as ;

$$\text{Coefficient of variation} = \text{S.D.} \times \frac{100}{Pa}$$

ie S.D = Standard deviation of the price of ith medicinal plant

Pa = Average price of the ith medicinal plant.

3.3.4.Price elasticity of demand

Price elasticity of demand for major ten medicinal plants are worked out to understand the relationship between the price and quantity demanded.

$$\text{Price elasticity of demand} = \frac{\frac{(Q2 - Q1)}{(Q2 + Q1)}}{\frac{(P2 - P1)}{(P2 + P1)}}$$

Q1= Quantity purchased at price P1 during 1999-2000

Q2= Quantity purchased at price P2 during 2000-2001

3.3.5.Estimation of pharmaceutical demand

Ratio estimation (Cochran, 1953) is the technique used in projection for the population using data from sample. The total demand of each of the medicinal plants for the year 2000-2001 was estimated using the total sale value of ayurvedic industries in Kerala as an auxiliary variant.

$$\text{Estimated quantity of pharmaceutical demand of ith medicinal plant} = \frac{\text{Quantity of ith medicinal plnt procured byseven sample pharmacies}}{\text{annual sale value of seven sample pharmacies}} \times \text{TSV}$$

$$\text{Estimated value of pharmaceutical demand} = \frac{\text{Value of ith medicinal plant procured by 7 sample pharmacies}}{\text{Annual sale value of products of 7 sample pharmacies}} \times \text{TSV}$$

3.3.6.Scarcity ratio for medicinal plants

The increases in the real price of a resource over a period of time, indicate the economic scarcity of the resource (Barnett and Morse, 1969). Considering this rule, the scarcity ratio of medicinal plants is estimated using the formula:

$$\text{Scarcity ratio} = \frac{\frac{SP_t}{CPI} - SP_0}{SP_0} \times 100$$

SP_0 = Selling price of the medicinal plant in 1996

SP_t = Selling price of the medicinal plants in 2001

CPI= Consumer price Index for 2001 with base 1996

If the scarcity ratio is positive, it can be inferred that there is economic scarcity of medicinal plant.

Results

4. RESULTS

The results of the analysis as detailed in the methodology are presented in this chapter. In the first section, an overview of medicinal plant trade in India is attempted, which emphasis on the international market. Followed by it, the market analysis of domestic trade is attempted based on the data collected from the major pharmacies in Kerala and market intermediaries.

4.1. International trade.

The information on international trade on medicinal plants is available under 27 items (Table 4.1.1). Among them the trade of one group i.e. "the ayurvedic and unani herbs", which constitute the major item of trade, is only discussed here, as it is the relevant group in this study.

4.1.2 Export of ayurvedic and unanai herbs in India

Exports of ayurvedic and unani herbs have registered a steady increase, especially after 1996 and are reported to the tune of 9585.70 tonnes in 1999-2000. However this is not fully reflected in export earnings, where 1999-00 exhibits a negative growth compared to the previous year (Table 4.1.2) (Fig.2.)

Table 4.1.1. Plant/ parts of plant used for perfumery/ pharmaceutical or insecticidal or similar properties exported from India.

1. Liquorice roots	15. Chirata
2. Ginseng roots	16. Poppy flowers
3. Galangal rhizome and roots	17. Psyllium husk
4. Zedovary roots	18. Psyllium seed
5. Kuth roots	19. Sandal wood chip
6. Other ginseng roots	20. Sarasaparilla
7. Agar wood	21. Senna leaves
8. Ambrette seeds	22. Tamarind seed and seed powder
9. Belladona leaves	23. Tukmaria
10. Betel leaves	24. Indian jujubi
11. Betel nuts (ground)	**25. Ayurvedic and unani herbs**
12. Betel nuts split	26. Catharanthus roseus
13. Betel nuts whole	27. Others
14.Cascara sagrada bark	

4.1.2.Export of ayurvedic and unani herbs in India

(1990-91 to 1999-2000)

	Year	Quantity(T)	Value(Rs.lakhs)
1	1990-91	2401.60	351.60
2	1991-92	3783.56	554.01
3	1992-93	4145.27	999.10
4	1993-94	2892.64	1143.59
5	1994-95	4172.96	1002.83
6	1995-96	3716.29	1158.31
7	1996-97	5660.02	1675.97
8	1997-98	7631.67	2266.50
9	1998-99	9578.77	3875.56
10	1999-00	9585.70	1850.66

(Source: Directorate General of Commercial Intelligence and Statistics, Government of India, Calcutta.)

4.1.3.The major countries to which ayurvedic and unani herbs are exported from India.

The major destinations of export of these goods are Chinese Taipei (28.10 per cent) Japan (26.38 per cent), and Pakistan (19.04 per cent) (Table 4.1.3). It may be noted that Bangladesh which was the major importer from India in 1991(28.81 per cent) is having a very low share of 3.21per cent in 1999-2000. Same is the case with Saudi Arabia and Sri Lanka. On the contrary Chinese Taipei who was only a small consumer ten years back has increased their imports and is now one of the major importing country. Similar is the case with Pakistan. Though US imports from India shows wide inter year variation, USA can be identified as a potential consumer. Apart from these, countries like Yemen Republic, UK, UAE, Thailand, Switzerland, Sri Lanka, Spain, Qatar, Singapore, Saudi Arabia, New Zealand, Nepal, Maldives, Malaysia, Kuwait, Korea, Italy, France, Australia and Bahrain were regular consumers though their relative share in total exports are negligible. Recently some of the African countries and Bhutan have started importing from India. Of the foreign exchange earnings from export of ayurvedic and unani plants, the major share is contributed by Pakistan (20.15 per cent) followed by Japan (16.8 per cent) and Chinese Taipei (13.6 per cent). i.e. though China imports highest quantity of materials, in value terms it comes only to the third position, the major share being that of Pakistan. But Pakistan occupies only third position in terms of

Table 4.1 3. Export markets for ayurvedic and unani herbs from india(1990-91 to 1999-2000)
Percentage to total quantity/ value of export earnings

Year	Bangladesh		German		Japan		Saudi Arabia		Sri Lanka		Chinese Taipei		UAE		USA		Pakistan		Others	
	Qty	Value	Qty	Value	Qty	Value	Qty	Value	Qty	Value	Qty	Value	Qty	Value	Qty	Value	Qty	Value	Qty	Value
90-91	28.8	11.1	7.1	7.53	18.2	9.24	7.47	10.4	7.71	8.54	1.08	3.07	2.01	1.38	1.95	5.34	0.49	0.51	25.2	36.8
91-92	34.2	22.5	12.7	2.72	12.5	8.86	2.82	4.77	4.65	7.4	6.14	2.4	3.25	4	4.12	11.9	2.87	1.16	16.7	31.5
92-93	22	10.7	3.57	3.29	21.6	10.3	4.94	7.01	1.27	1.05	1.69	0.69	4.3	6.52	13.9	30.7	8.51	2.78	18.2	20.2
93-94	15.1	3.39	5.81	3.85	17.3		3.74	3.54	0.53	0.55	0.74	0.94	4.47	3.36	16.2	27.2	8.23	2.07	27.9	48.9
94-95	22.2	9.3	6.91	6.26	19.1	12.1	2.45	4.19	4.31	4.39	6.45	0	2.96	3.76	4.86	16.6	12.1	4.73	19.6	35.4
95-96	14.8	6.82	2.52	5.23	15.7	18.5	2.55	2.41	10.3	6.8	5.16	1.2	2.99	0.29	6.94	19	22.7	7.26	17.4	27.8
96-97	16.4	7.27	3.69	6.19	8.87	5.55	0.83	1.4	6.38	7.14	0	0	2.33	2.41	9.85	28.5	21.5	6.5	30.1	33.1
97-98	5.52	2.74	4.14	6.24	15.3	6.68	1.31	2.65	1.38	1.86	24.77	7.66	2.52	2.23	9.91	24.7	10.3	5.43	24.8	34.5
98-99	3.62	1.44	4.39	2.54	19.2	5.11	1.1	2.2	1.38	1.78	24.54	5.75	1.15	1.48	16	28.9	4.67	2.21	23.9	47.2
99-200	3.21	1.95	1.98	3.56	26.4	16.8	0.18	0.64	1.12	2.02	28.1	13.6	0.78	1.98	2.44	6.74	19	20.2	16.8	29.7

quantity imported from India. In this context Pakistan markets are to be further explored.

4.1.4. Import of ayurvedic and unani herbs in India.

Import of ayurvedic and unani herbs to India shows wide inter year variations during 1990-91to 2000-01 period. But the variation in foreign exchange payments is not that pronounced (Table 4.1.4.) (Fig.3.)

Traditionally, lion's share of ayurvedic and unani herb imports to India has been from Nepal. Lately, Pakistan has entered the market and emerged as major supplier to India, reducing the share of Nepal to 30.76 per cent from 86.86 per cent in 1990-1991. These countries together account for 72.83 per cent of total imports of the country. The rest is from countries like Afganistan, China, Indonesia etc.(Fig.4).

4.1.5.Net balance of trade

The net balance of trade on account of this transaction however is positive always but shows a decline on two occasions, during the ten-year period under study. From Rs. 3247.27 lakhs in 1998-'99 the earnings declined to Rs.1201.24 lakhs in 1999-'00 and from 926.26 lakhs in 1993-94 to 671.82

Table 4.1.4. Import of ayurvedic and unani herbs in India. (1990-91to 1999-2000)

Year	Quantity(T)	Value(Rs.lakhs)
1990-91	1117.41	76.24
1991-92	1732.5	128.99
1992-93	914.95	105.61
1993-94	1990.89	217.33
1994-95	1810.13	330.21
1995-96	1350.09	168.85
1996-97	1826.41	412.57
1997-98	1512.16	286.56
1998-99	3567.07	628.29
1999-00	3390.39	649.42

(Source: Directorate General of Commercial Intelligence and Statistics, Government of India, Calcutta.)

Fig.2. Quantity of export and import of ayurvedic and unani herbs in India(1990-91 to 1999-2000)

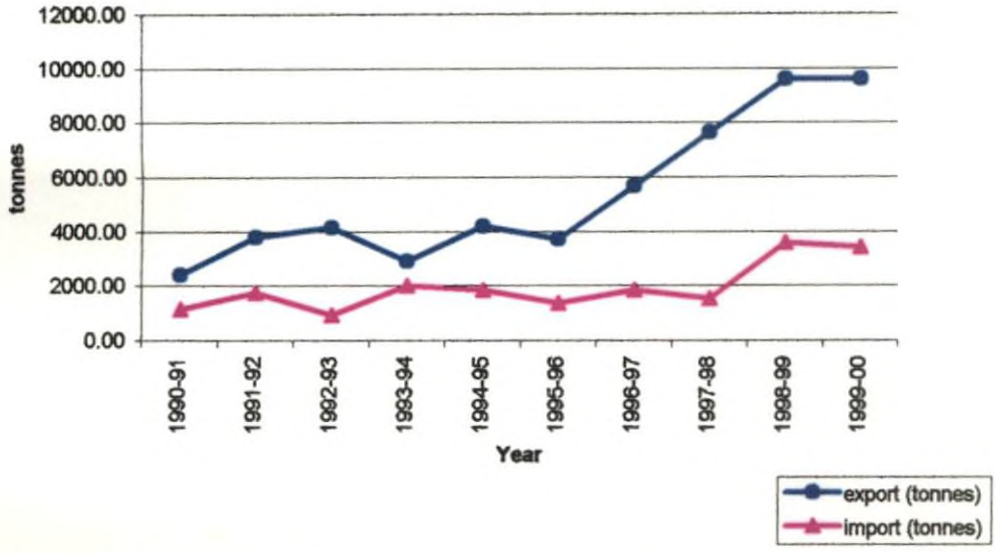
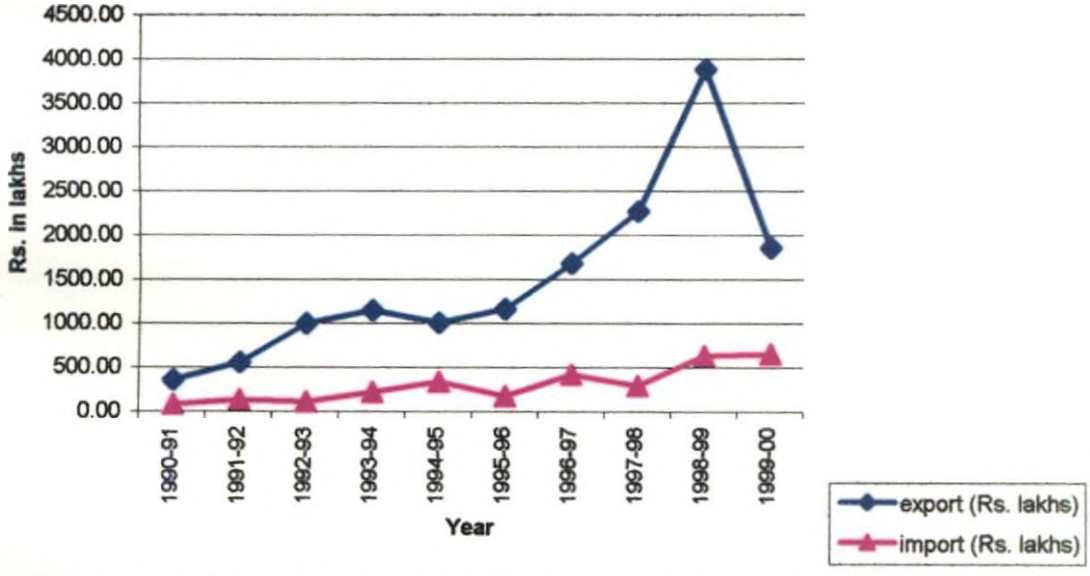


Fig.3. Value of export and import of ayurvedic and unani herbs from India(1990-91to 1999-2000)



lakhs in 1994-95. This is caused by a steep fall in export earnings despite an increase in quantity exported. On the contrary, even with a decline in quantity imported the import bill has risen to Rs.694.3 lakhs. (Table 4.1.5.)(Fig.5.)

4.2.1 The domestic scene.

Ayurvedic drug manufacturing sector in Kerala is constituted by the registered pharmacies, non-registered pharmacies, local vaidyas (traditional practitioners of ayurveda with no formal training) and household level preparations. In this study the organised manufacturing sector is given attention. According to the statistics provided by Kerala Ayurvedic Medicine Manufactures Association, nearly 68 per cent of total market share of ayurvedic industry is captured by seven pharmacies and the remaining pharmacies account for the rest. The results of the investigation as to the important medicinal herbs purchased by these pharmacies (in quantity terms) and its level of consumption over years is presented in table 4. 2.1.1 and Fig.6.

The major 10 species of medicinal plants selected based on the magnitude of quantity procured per annum by the seven sample pharmacies are arranged in the descending order. 1) *Sida Spp.* 2)*Tinospora cordifolia.* 3) *Terminalia chebula.* 4)*Withania somnifera.* 5) *Adhatoda sp.* 6) *Cedrus deodera.* 7) *Cyperus rotundus.* 8) *Woodfordia fruiticosa.* 9) *Boerhaavia ditffusa.* 10)

Table. 4.1.5. Net balance of trade in Ayurvedic and Unani herbs in India.

YEAR	EXPORT		IMPORT		NET EXPORT EARNINGS
	Qty (tonnes)	Value(Rs lakhs)	Qty(tonnes)	Value(Rs.lakhs)	Rs.lakhs
1990-1991	2401.6	351.60	1117.41	76.24	275.36
1991-1992	3783.56	554.01	1732.50	128.99	424.02
1992-1993	4145.27	999.10	914.95	105.61	893.50
1993-1994	2892.64	1143.59	1990.89	217.33	926.26
1994-1995	4172.96	1002.03	1810.13	330.21	671.82
1995-1996	3716.29	1158.31	1350.09	168.85	989.46
1996-1997	5660.02	1675.97	1826.41	412.57	1263.40
1997-1998	7631.67	2266.50	1512.16	286.56	1979.94
1998-1999	9578.77	3875.56	3567.07	628.29	3247.27
1999-2000	9585.7	1850.66	3390.39	649.42	1201.24

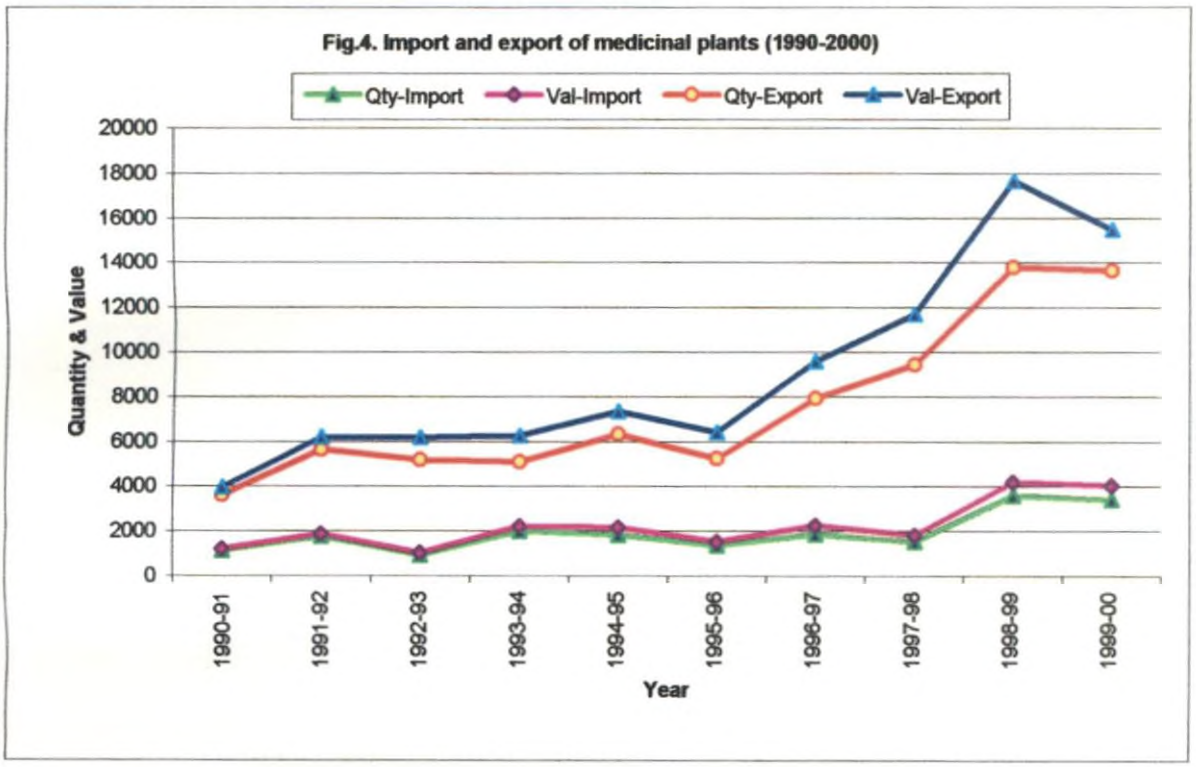


Fig.4. Import and export of medicinal plants (1990-2000)
Qty-Import
Val-Import
Qty-Export
Val-Export
Quantity & Value
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
1990-91
1991-92
1992-93
1993-94
1994-95
1995-96
1996-97
1997-98
1998-99
1999-00
Year

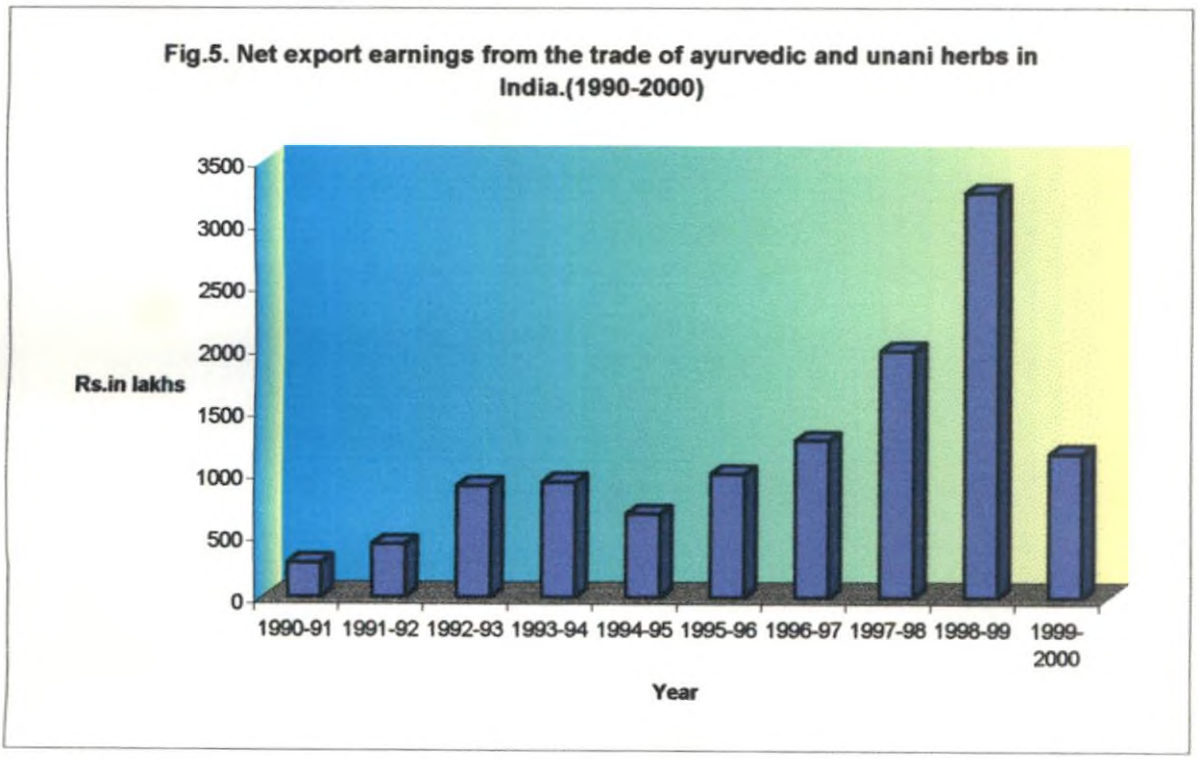


Fig.5. Net export earnings from the trade of ayurvedic and unani herbs in India.(1990-2000)
Rs.in lakhs
3500
3000
2500
2000
1500
1000
500
0
1990-91
1991-92
1992-93
1993-94
1994-95
1995-96
1996-97
1997-98
1998-99
1999-2000
Year

Table 4.2.1.1. Total quantity of the major medicinal plants procured by sample pharmacies during 1996-2001.

Name of the plant	Quantity in tonnes				
	1996-97	**1997-98**	**1998-99**	**1999-2000**	**2000-2001**
Sida Spp	284.47 (27.72)	319.63 (30.45)	355.51 (32.00)	379.44 (31.63)	413.48 (31.60)
Tinospora cordifolia	155.31 (16.22)	155.68 (14.83)	170.81 (15.38)	180.84 (15.08)	191.64 (14.65)
Terminalia chibula	83.94 (8.77)	92.74 (8.84)	97.06 (8.74)	104.19 (8.69)	111.48 (8.52)
Withania somnifera	77.73 (8.12)	84.34 (8.04)	86.16 (7.76)	93.84 (7.82)	101.11 (7.73)
Adhatoda sp	65.74 (6.86)	74.45 (7.09)	74.73 (6.73)	84.65 (7.06)	95.74 (7.32)
Cedrus deodera	63.43 (6.62)	71.75 (6.84)	75.16 (6.77)	81.94 (6.83)	93.64 (7.16)
Cyperus rotundus	72.97 (7.62)	79.54 (7.58)	79.50 (7.16)	83.56 (6.97)	92.88 (7.10)
Woodfordia fruiticosa	55.86 (5.84)	73.66 (7.02)	65.35 (5.88)	77.18 (6.43)	83.39 (6.37)
Boerhaavia difusa	57.55 (6.01)	54.76 (5.21)	56.03 (5.04)	63.20 (5.27)	66.02 (5.05)
Aegle marmelos	40.07 (4.19)	43.05 (4.10)	50.49 (4.55)	50.65 (4.22)	58.83 (4.50)
Total	**957.07**	**1049.54**	**1110.81**	**1199.49**	**1308.21**

* Figures in parenthesis indicate percentage of each medicinal plant to the total quantity procured.

Fig.6. Quantity of the medicinal plants consumed by the sample pharmacies

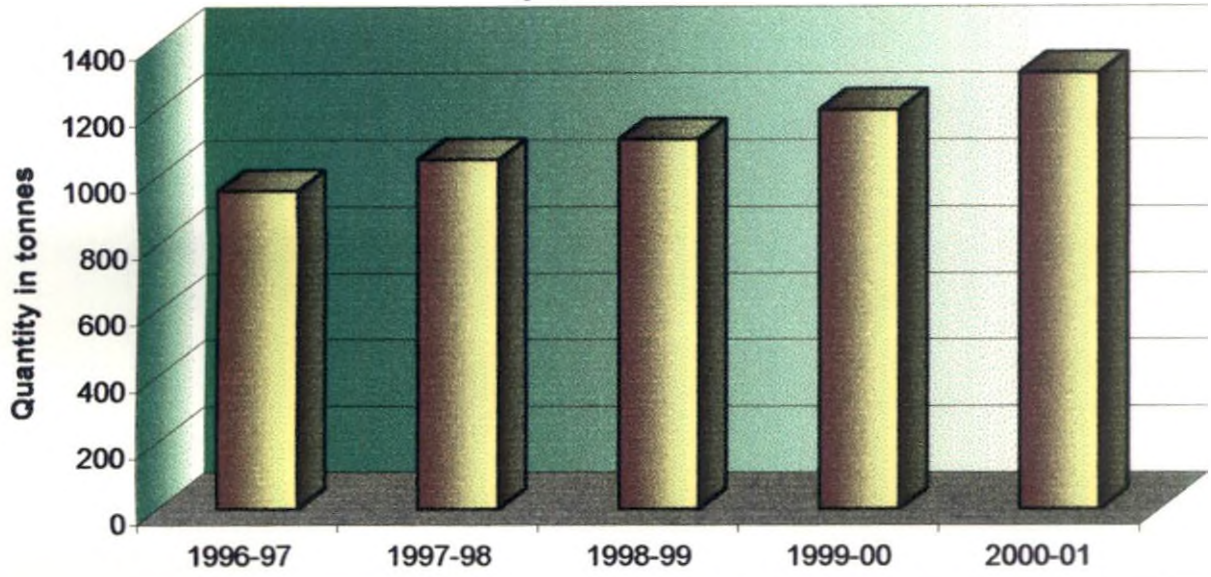
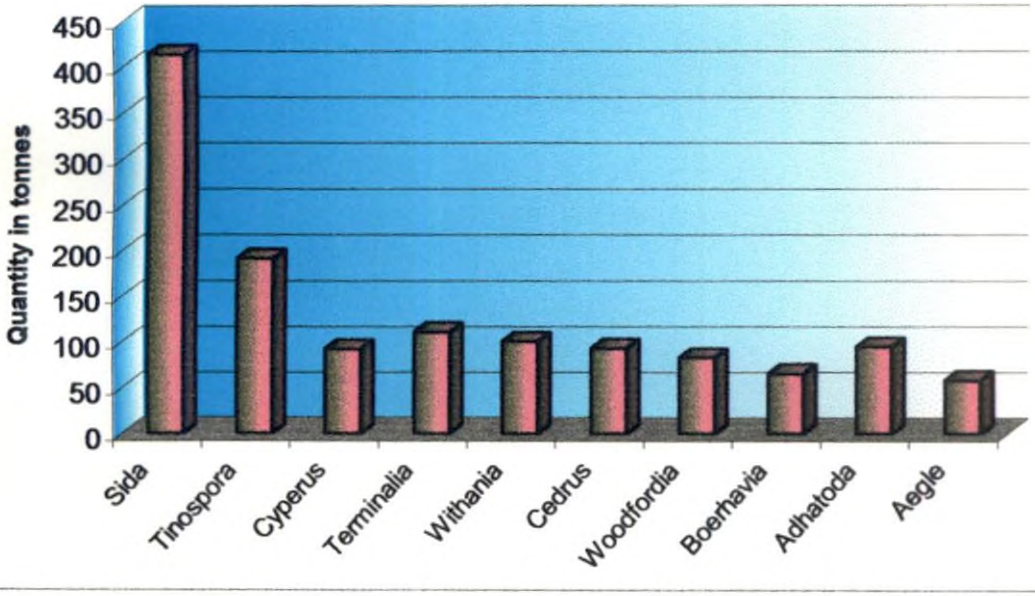


Fig.7. Quantity of the major medicinal plants consumed by the sample pharmacies during 2000-01



Aegle marmelos.(Table 4.2.1.2.) Among the major medicinal plants procured by the sample pharmacies, S*ida Spp* has the largest share of 31.6 per cent and *Aegle marmelos,* the lowest share of 4.5 per cent. There is a slight variation in the percentage procurement of other plants *Withania somnifera* (7.73 per cent), *Adhatoda sp* (7.32 per cent), *Cedrus deodera* (7.16 per cent) and *Cyperus rotundus*(7.1 per cent).(Fig.7).

4.2.2.The growth in medicinal plants consumption

The Ayurvedic medicine industry exhibits a promising market and the quantity of raw materials procured by each of the sample pharmacies show an increasing trend year after year. The annual compound growth in the consumption of medicinal plants varies from 4.19 per cent in *Boerhaavia diffusa* to 9.31 per cent in *Aegle marmelos*. (Table4.2.2.). The annual compound growth in the total quantity of medicinal plants procured by sample pharmacies is estimated to be 7.3 per cent during 96-97 to 2000-01periods. (Fig.8.and Fig .9).

4.2.3. Price structure of major medicinal plants.

Weighted average price for the major ten medicinal plants were calculated and was compared with the percentage quantity required by the

Table 4.2.1.2. Major medicinal plants (in quantity terms) procured by the sample pharmacies.

Sl. No.	Scientific Name	Common Name in English	Common Name in Malayalam	Parts used	Major Preparations
1.	*Sida Spp.*	Country Mallow	Kurunthotty	Roots, Leaves	*Balaristam, Dhanwantharam Kuzhambu.*
2.	*Tinospora cordifolia*	Amruth Balli	Chittamruth	Stem	*Amrutharistam*
3.	*Terminalia chibula*	Alalekaayil	Kadukka	Fruits, Fruit rind	*Abhayaristam*
4.	*Withania somnifera*	Ashwaganda	Amukkuram	Roots	*Ashwagandaristam*
5.	*Adhatoda sp.*	Malabar Nut	Adalodakam	Roots, Leaves	*Vasharistam*
6.	*Cedrus deodera*	Deoder	Devatharam	Bark	*Varunadhi kashayam*
7.	*Cyperus rotundus*	Nut grass	Muthanga	Roots	*Mustharistam*
8.	*Wodfordia fruiticosa*	Dhatki	Thathiri	Dried flowers	*Abhayaristam, kutajaristam*
9.	*Boerhavia diffusa*	Punarnava	Thazuthama	Leaves,whole plant	*Panarnavasam*
10.	*Aegle marmelos*	Bael fruit	Koovalam	Roots	*Dasamoolaristam*

Table 4.2.2.Annual compound growth rate of major medicinal plants consumed by the pharmacies (1996-97 to 2000-01)

Name of plant	Compound growth rate (%)
Sida Spp	9.20
Tinospora cordifolia	5.70
Terminalia chibula	6.80
Withania somnifera	6.30
Adhatoda sp	5.30
Cedrus deodera	8.80
Cyperus rotundus	9.12
Woodfordia fruiticosa	8.47
Boerhaavia difusa	4.19
Aegle marmelos	9.31

Fig.8. Trend in consumption of major medicinal plants by the sample ayurvedic pharmacies

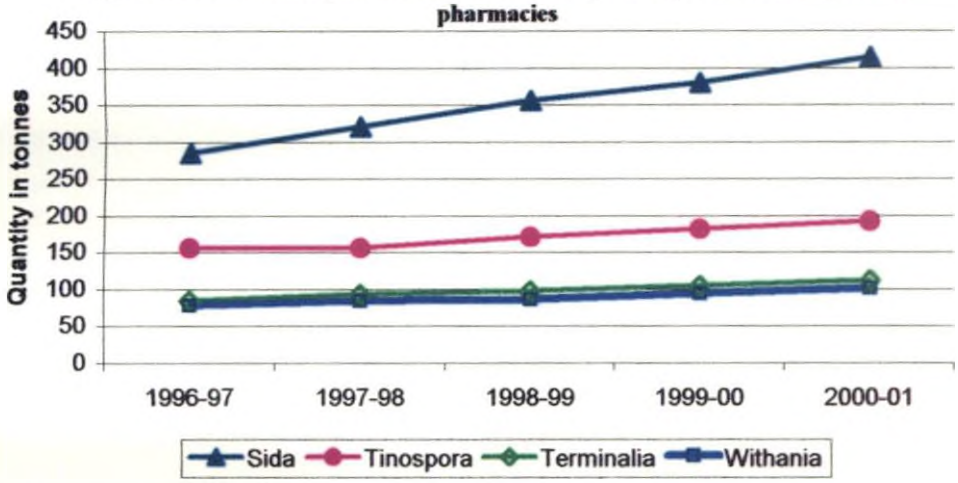
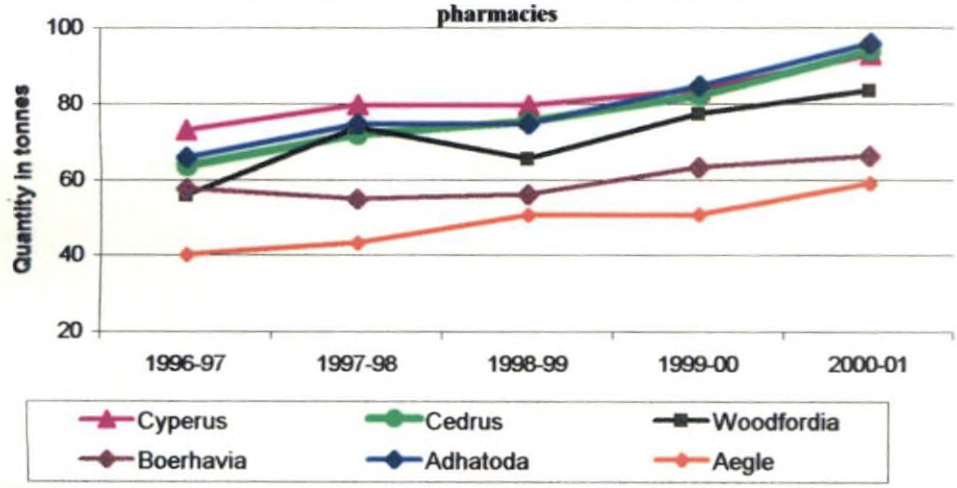


Fig.9. Trend in consumption of major medicinal plants by the sample ayurvedic pharmacies



sample ayurvedic pharmacies to establish the normal price demand relationship. Contrary to the normal market behaviour, the relationship between the price and quantity demanded didn't establish the normal demand curve in this case. The pharmacy, which demanded the highest quantity of medicinal plants, offered the highest price. For instance, in the case of the plant Withania, two pharmacies had the same price index of 94.76 while their percentage of quantity purchased to total purchase varied between 3.56 per cent to 50.44 per cent. Similar results were obtained for most of the medicinal plants studied.(Table 4.2.3.) (Fig.10).

On further analysis to examine the extent of price variation among the sample pharmacies with respect to a particular plant, the coefficient of variation of the price was estimated. . The coefficient of variation in the price of major medicinal plants ranges from 8.62 per cent in *Boerhaavia diffusa* to 29.89 per cent in the case of *Terminalia chibula* (Table 4.2.4.)

4.2.4. Price elasticity of demand.

Though a normal demand-price behavior was not shown by the medicinal plant market due to various reasons, an effort was made to study the responsiveness or elasticity of quantity demanded to price change. As expected, the elasticities were positive for the ten medicinal plants, ie: the quantity demanded increased with price of the medicinal plants varying from 0.33 per

Table 4.2.3. Price indices and percentage procurement of major medicinal plants by the sample ayurvedic pharmacies.

	Sida	Tinospora	Terminalia	Withania	Adhatoda	Cedrus	Cyperus	Woodfordia	Boerhaavia	Aegle
Weighted Average Price (Rs./kg)	18.87	5.21	22.63	60.15	13.28	17.64	22.63.	23.77	14.06	8.96
Pharmacy.1	121.85 (48.37)	115.18 (41.75)	110.46 (49.34)	94.76 (50.44)	120.50 (31.34)	113.36 (44.85)	107.96 (39.84)	105.16 (72.00)	99.54 54.53)	
Pharmacy. 2	63.58 (2.63)	95.98 (4.3)	110.46 (5.34)	103.08 (3.29)	97.90 (5.89)	113.36 (3.8)	80.97 (5.65)	96.74 (11.29)	85.32 (4.91)	145.14 (9.82)
Pharmacy. 3	112.05 (8.6)	105.58 (3.56)	106.04 (8.88)	91.44 (3.76)	64.01 (7.10)					
Pharmacy.4.	55.63 (13.31)	77.94 (27.54)	49.71 (5.94)	96.43 (19.17)	109.20 (24.96)	97.72 (19.95)	85.47 (27.27)	67.30 (9.51)	104.88 (19.35)	80.39 (25.42)
Pharmacy.5.	84.77 (12.09)	67.19 (7.83)	97.21 (12.56)	113.05 (9.89)	52.72 (10.45)	102.03 (12.81)	107.96 (10.77)			89.32 (22.10)
Pharmacy.6.	84.77 (12.09)	115.18 (12.52)	61.86 (9.87)	124.69 (9.89)	90.37 (14.62)	51.01 (14.10)	107.96 (16.47)		99.54 (21.21)	133.98 (23.80)
Pharmacy.7.	63.58 (2.90)	115.18 (2.50)	110.46 (8.07)	94.76 (3.56)	105.43 (5.64)	113.36 (4.49)		96.74 (7.20)		

- Figures in parenthesis indicate the percentage of the medicinal plants to the total sample quantity procured by each pharmacy. Base = Weighted average price.
- Blank space - Indicates, those plants did not come as major plants procured by some of the sample pharmacies.

Table 4.2.4 Coefficient of variation in the price and price elasticity of demand for major medicinal plants procured by sample pharmacies (2000-01).

Name of plant	Coefficient of variation (%)	Price elasticity of demand (%)
Sida Spp	29.87	0.54
Tinospora cordifolia	20.76	0.35
Terminalia chibula	29.89	3.31
Withania somnifera	12.93	0.60
Adhatoda sp	29.33	1.46
Cedrus deodera	27.00	1.98
Cyperus rotundus	13.48	2.23
Woodfordia fruiticosa	22.15	0.42
Boerhaavia diffusa	8.62	0.33
Aegle marmelos	28.15	0.98

Fig.10 Weighted average price of major medicinal plants consumed by the sample pharmacies during 2000-2001

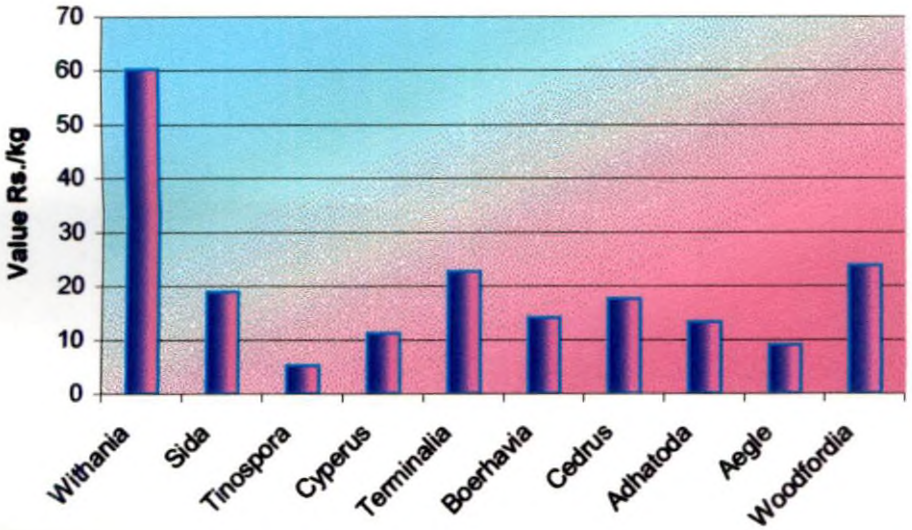
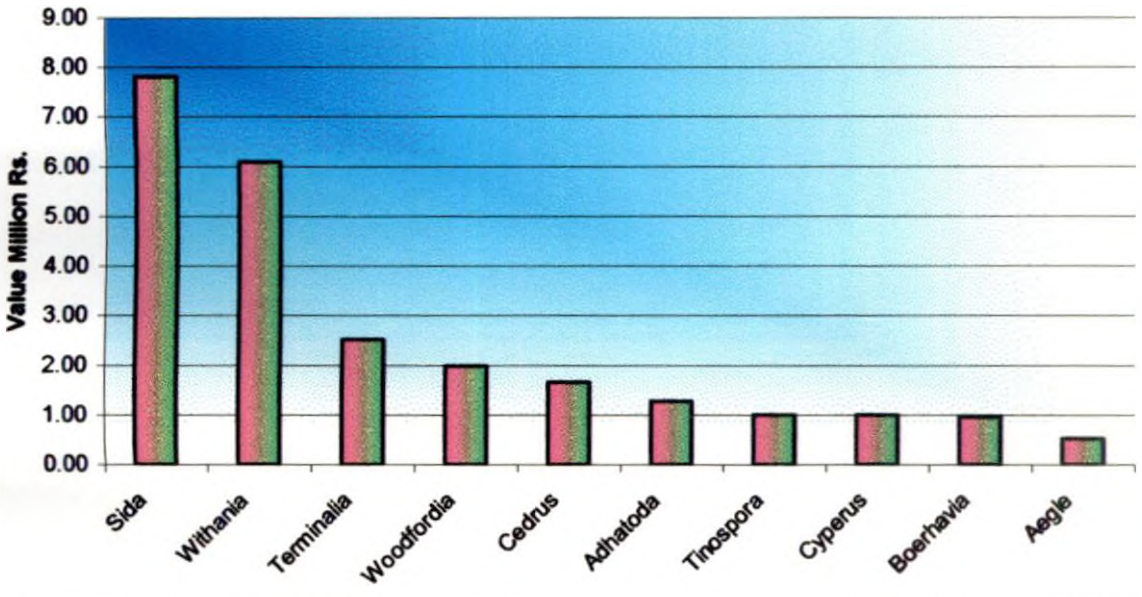


Fig.11. Total value of the major medicinal plants consumed by the sample pharmacies during 2000-2001



cent in the case of *Boerhaavia diffusa* to 3.31 in the case of *Terminalia chibula.*(Table 4.2.4.)

4.2.5. Ratio estimates of quantity and value of medicinal plants.

Considering the demand for the medicinal plants by the seven sample Ayurvedic Pharmacies during 2000-01, Sida has the largest demand followed by Tinospora, Terminalia, Withania, Adhatoda, Cedrus and Cyperus. The ratio estimates of value of the medicinal plants traded indicate that Sida is the medicinal plant procured with largest value followed by Withania. Tinospora and Terminalia rank higher in quantity wise than Withania but have lower value due to lower unit prices. Aegle was the medicinal plant, which was procured with lowest position in both quantity and value. (Table 4.2.5.)(Fig.11).

4.2.6. Scarcity of medicinal plants.

The economic scarcity of medicinal plants is estimated by comparing the change in the real price of the medicinal plants between 1996 and 2001,the period for which the price data is available. The medicinal plant, which shows a positive ratio, can be considered as scarce. The scarcity ratio for Sida (2.79), Aegle (0.49) and Boerhaavia (6.82) are positive, which indicate that these plants are scarce. (Table 4.2.6.)

Table 4.2.5.Ratio estimates of quantity demanded and the value for major ten medicinal plants in Kerala (2000-01).

Name of plant	Sample		Estimate	
	Quantity (tonnes)	Value (Rs. In million)	Quantity (tonnes)	Value (Rs. in million)
Sida Spp	413.45	7.80	608.05	11.48
Tinospora cordifolia	191.64	1.00	281.82	1.47
Terminalia chibula	111.48	2.52	163.94	3.71
Withania somnifera	101.11	6.08	148.69	8.94
Adhatoda sp	95.74	1.27	140.79	1.87
Cedrus deodera	93.64	1.65	137.70	2.43
Cyperus rotundus	89.37	0.99	131.42	1.46
Woodfordia fruiticosa	83.34	1.98	122.55	2.91
Boerhaavia diffusa	67.68	0.95	99.53	1.40
Aegle marmelos	58.83	0.53	86.52	0.78

Sample - Quantity procured by the sample pharmacies.
Estimate - Estimated quantity for the ayurvedic industries in Kerala.

Table 4.2.6. Change in the real price of major medicinal plants from 1996-97 to 2000-01.

Name	Price.(Rs./kg) (1996-97) (a)	Price.(Rs./kg) (2000-2001) (b)	Deflated price.(Rs./kg) (c)	Difference between deflated price and 1996-97 price. (c-a)	Expressed as % of 96-97 price
Sida	11.73	18.87	14.52	2.79	23.79
Tinospora	4.01	5.21	4.01	0.00	0.00
Terminalia	20.61	22.63	17.41	-3.20	-15.53
Withania	50.29	60.15	46.27	-4.02	-7.9
Adhatoda	11.81	13.28	10.21	-1.60	-13.55
Cedrus	17.37	17.64	13.57	-3.80	-21.88
Cyperus	9.14	11.12	8.55	-0.59	-6.46
Woodfordia	15.98	23.77	10.82	-5.16	-32.29
Boerhavia	11.47	14.06	18.29	6.82	59.45
Aegle	6.39	8.96	6.89	0.49	7.67

Consumer price index deflator was obtained as consumer price index for 2001/consumer price index for 1996 = 1.30
Deflated price =2001 price /price index deflator.

4.2.7. Major medicinal plants (in value terms) procured by the sample pharmacies. (Based on Rs./kg)

The major medicinal plants selected based on the value terms by sample pharmacies are arranged in the descending order, (Table. 4.2.7.). 1. Aconitum *heterophylum*. 2.*Lodolcea seychellarum* 3. *Crocus sativus.4. Anacyclus pyrethrum. 5. Holostemma ada-kodien. 6. Kaempferia galanga. 7. Piper longum.8. Commiphora mukul. 9.Cinnamomum camphora. 10. Trichosanthes cucumerina.* Most of the plants identified are not seen in Kerala conditions, except *Holostemma ada-kodien, Piper longum* and *Trichosanthus cucumerina* and *Kaempferia rotunda.*

4.3. Marketing of medicinal plants:

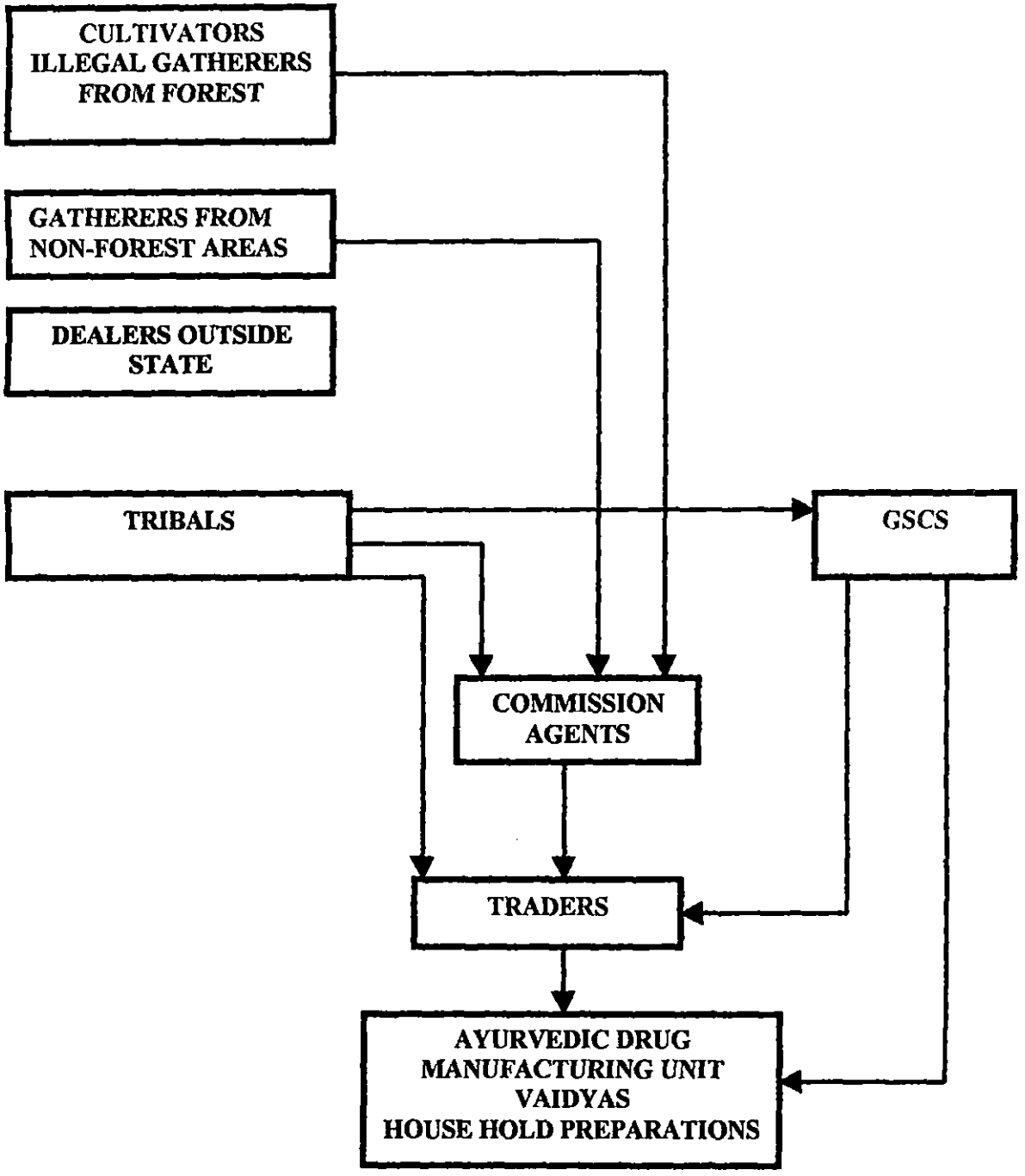
Tracing back the source/channel of the medicinal plants/plant parts for the drug manufacturing units, the marketing channels for raw materials were identified (Fig.12.). Bulk of the requirement of the pharmacies was supplied by the big traders/dealers. Mainly five traders/dealers in Thrissur handled bulk of the volume of the organised medicinal plant trade in the state.

Gathering information from these traders was very difficult as they most often refused to provide the information requested and declined to co-operate

Table.4.2.7. Major medicinal plants (in value terms) procured by sample pharmacies in 2000-2001. (Rs./kg)

Sl. No.	Scientific Name	Common Name in Malayalam	Quantity purchased (kg)	Price/kg	Parts used	Value in million Rs.
1.	*Aconytum heterophylum*	Athividayam	2000	3800	Roots	0.76
2.	*Lodolcea seychellarum*	Aklari thenga	60	3500	Fruits	0.021
3.	*Crocus sativus*	Kunkumappov	105	30000	Flowers	0.31
4.	*Anacyclus pyretheum*	Akki karuka	100	1200	Leaves, Roots	0.012
5.	*Holostemma ada-kodien*	Adapathiyan	17000	280	Roots	0.48
6.	*Kaempfera galanga*	Kachoory	16000	235	Rhizome	0.38
7.	*Piper longum*	Thippali	18000	200	Fruits	0.36
8.	*Cinnamomum kamphora*	Pacha karpooram	17500	200	Camphor	0.35
9.	*Commiphora mukul*	Gulgulu	22000	180	Resin	0.40
10.	*Trichosanthus cucumerina*	Kattupadavalam	26000	115	Stem	0.30

Fig.12. Marketing channels for medicinal plants in Kerala



with the study. So the study could not highlight some of the aspects, but could have been done, if the respondent co-operated.

4.3.1. Tribals :

They are involved in the collection of medicinal plants from the forest belts since time immemorial. They are the most downtrodden community of the state and account for 1.1 percent of the total population in the state. Their main source of income is from the collection of NTFP, which include medicinal plants and other minor forest products like fuel wood, edible tubers, fruits, honey, resins etc. In 1970 the government granted the right of NWFP collection to the tribal people in the state and in 1978 a number of Tribal Service Co-operative Societies were started with membership reserved only for the tribal people to ensure a fair deal and to free them from the clutches of the middlemen and thereby aiming at their increased welfare. In 1981 the government established an apex body of tribal societies viz. The Kerala Scheduled Caste Scheduled Tribe Development Co-operative Federation Limited, called as Federation and it was entrusted with the right of monopoly procurement and sale of all NWFP collected by societies.

Collection process : NWFP collection by the tribal is based on an agreement on large allotment, which is signed in the presence of the concerned Divisional Forest Officers. Collection permits are then issued to the member of the

societies. Once the collection depot exhaust their storage capacity, the goods are transported to the societies and then to the federation godown, for marketing.

4.3.2. Illegal gatherers of medicinal plants from the forest.

They may be either local people (non tribal people) living in the forest fringes or may be the agents of private traders. The collected materials from the forest are sold to the private traders, which often leads to competition between tribal and non tribal people for collecting the products, resulting in the over extraction and depletion of biodiversity of NWFPs.

4.3.3. Gatherers from non-forest areas.

The plants like Sida, Cyperus, Adhatoda etc. are naturally seen in most parts of the sate (homesteads, paddy fields, garden lands). There are people who collect it from these areas either with the permission of owners or with out it, for small or no payments. The collected materials are sold to the commission agents or traders directly.

4.3.4. Traders/Dealers.

They are the middlemen involved in the business transaction. There are about 30 major traders or dealers of medicinal plants in the state, who can be termed as price setters or price leaders. They procure the raw materials from the tribals and locals, stored in the their godowns and sell it in the off season periods. Since there are no fixed floor price, during the off season price boosts with demand. Lacks of infrastructure for storage, weight loss during storage, fungal attacks and decay of materials are the major problems reported by them. According to them the benefit is more through retail sales. ie. Selling low quantities with high profit margin.

4.3.5. Cultivators:

Cultivators of medicinal plants were there in some areas of Thrissur, Palakkad and Idukky districts. The statistics regarding the number of cultivators, total area under medicinal plants and the types of crops cultivated are not available. Enquiries with Department of Agriculture proved futile in this regard. Ayurvedic pharmacies are cultivating medicinal plants in their own herbal gardens.

4.3.6. The Tribal Societies:

Girijan Service Co-operative Society: In 1979, State government granted the right of collection of NWFPs to the tribals and many girjan co-operative societies were established.. But the functioning of these societies was not satisfactory for the last two decades. The societies were giving only 15-20 per cent of prevailing market price to the gatherers (tribals), moreover the payment is not immediate. So they generally preferred to sell to the commission agents illegally.

Since 1990-91, the federation has permitted the societies to procure the materials at the existing market prices.

The contribution of Non Timber Forest Produce as an income source varied from 12 to 88 per cent with an average of 58 percent in the state. (Thomas, 1996) Fifty per cent of the potential supplies of NWFP or even the full collection made by its own member were not collected by the GSCS. At present there are 33 GSCS are in the state and only 70 per cent of GSCS are functioning properly. Federation (Kerala State Scheduled Caste, Scheduled Tribe Development Co- operative Federation Limited.) is the apex body of the tribal societies, and was established in 1981. The federation was mainly engaged in the collection of NWFP and the societies engaged in collection were permitted to buy the materials from the tribal people at the price fixed by the federation.

4.3.7. Commission agents:

They are also intermediary in the business transaction, who collect supply order from the manufactures and dealers/traders to deliver the goods. They select specific areas for the collection of raw materials. The collected goods of the agents are transported to the town immediately. Immediate transfer also reduces the considerable reduction in weight due to moisture loss. Some times they also procure materials from GSCS by participating in the auction. (closed tender system)

4.3.8. Dealers out side state:

Dealers of out side state plays an important role in the transaction of certain medicinal plants which are not seen in Kerala conditions. They sells the medicinal plants either to the dealers inside the state or to the ayurvedic drug manufacturing units direct. The major plants procured from the dealers out side the state are Withania, Terminalia, Aconitum, Cedrus, Phyllanthus and Alpinia.

4.3.9 Ayrvedic drug manufacturing units:

There are about 900-ayurvedic drug manufacturing units/pharmacies practicing this system of medicine. They are the ultimate or end users of major

portion of medicinal plants transacted in the state, but pricing of ultimate products for the user industry generally depends on the season, availability of materials and demand raised. In addition to the ayurvedic drug manufacturing units there are local vaidyas, herbal healers, monks, and tribal doctors who posses knowledge and practice of ayurveda. Many of them are depending on retail outlets run by the traders for supply of raw materials.

Discussion

5. DISCUSSION.

5.1. International trade of medicinal plants in India

The results of the analysis on international trade in India shows that India has a good chance of exploiting the international markets for ayurvedic and unani herbs. However, it may be pointed out that the efforts to identify the items included in this section turned out to be futile as the Directorate of Commerce and Intelligence did not provide that information. As such it was impossible to identify the plant/plant parts which are grown in Kerala which found a place in the Export/import basket

The efforts to identify the reasons for decline in export earnings despite a positive trend in quantity exported in 99-00 period, turned futile as the information on the unit price /quantity of each herb exported was not available. The reasons to identify the loss of important markets like Bangladesh, Saudi Arabia, and Srilanka is to be analysed in depth and then only efforts to capture back these markets can be evolved. Considering the high share of Pakistan markets with respect to exchange earnings, trade relations with Pakistan is very important. Pakistan is the major contributor to Indian imports as well.

Contrary to the export markets the import payments of ayurveidc and unani herbs remain steady despite a high inter year variation in quantity

imported. This is to be viewed with concern, in view of declining foreign exchange earnings.

5.2.1. The domestic market in Kerala

Though the quantity demanded of each plant shows an increasing trend in absolute terms their relative importance remains constant over the years. In the list of major plants demanded by the industry, *Sida Spp* tops while *Aegle marmelos* is ranked last, when arranged in the descending order of preference. But according to the estimates of Sankaranarayanan, (1995) *Sida spp* is the plant consumed in highest quantity, while there is difference in the consumption of other plants. Sida is followed by Adhatoda,Tinospora, Ricinus, Ichinocarpus, Cyanadon, Hemidesmus, Aegle, Eclipta, and Azadirachta in the descending order of consumption, in his study.

Suneeta,(1998) also made similar observations in the case of Sida and Tinospora, which occupied in the first and second positions in the list of major medicinal plants demanded by the Ayurvedic industries. While Terminalia was positioned sixth, Withania was in seventh position, Aegle in fourth postion and Adhatoda the last, in the list of major medicinal plants consumed.

Sankar (1996) in a study in Thrissur district identified that Sida to be the plant with highest demand, followed by Asparagus, Gmelina, Oroxylem, Stereospermum, Desmodium, Pseudaritha, Piper longum and Vigna radiata.

Among the ten major medicinal plant, identified based on the quantity procured by the seven sample pharmacies *Sida Spp* came in the top position with an absolute quantity of 413.48 tonnes in 2000-2001. *Sida Spp* is a bushy perennial weed found throughout the tropical and subtropical regions of India, chiefly in Bengal, Bombay, Coromandel, Carnatic and Kerala (Plate 1.). Economic part is root, which is used for the treatment of rheumatism, and it forms a chief ingredient of several important preparations, like *Dhanwantharam kuzhambu, Balaristam, Rasnadi kashayam* etc.

The annual compound growth rate of consumption of Sida is 9.20 per cent which is the second highest among the top ten medicinal plants identified. The price elasticity of demand was 0.54 per cent which shows a comparatively less elastic nature of quantity demanded for a price change. This ensures a steady market for Sida.

In this context, it may be pointed out that price elasticity of demand was positive for all the crops studied. Suneeta (1998) reported the same. The demand for medicinal plants was the derived demand based on the demand for

finished products. The market for ayurvedic drugs exhibits a steady growth rate and hence demand for the medicinal plants shows a steady increase despite an increasing price. The price rise may be attributed to the scarcity factor as evidenced by the analysis. Further it may be highlighted that the pharmacies that purchase more quantity of a medicinal plant in a given year offer a higher price than those who purchase lesser quantities.

The ratio estimates show that Sida has an estimated demand of 608.01 tonnes with an estimated value of Rs. 11.48 million. Similarly the ratio estimates of the value of the medicinal plant traded in the state, indicate that Sida is the medicinal plant procured, with highest value by the sample pharmacies. The scarcity analysis reveals that the plant is scarce with a positive scarcity ratio of 2.74. The weighted average price was estimated to be Rs. 18.87 per kg with a very high inter pharmacy variation of 29.87 per cent.

The plant is considered to be a weed in the garden lands, homesteads and wet lands in the state and local traders or commission agents collect it from these places by nominal payments or by free of cost. Despite this very high and steadily increasing demand, cultivation of this as a commercial crop is not seen taken up by the farmers in the State. Enquiries as to this, with the Department of Agriculture, traders as well as pharmacies couldn't provide any indication to this

effect. Further, it is reported that root yield from cultivated crop is less when compared to naturally occurring plants (Asha, 1998).

Observations reveal the possibility of growing Sida as a commercial crop in the homesteads / coconut gardens in Kerala, as an effective inter crop. Scientific studies are also to be taken up to evolve agronomic practices and management methods. No studies are seen undertaken in Kerala Agricultural University on this regard.

Tinospora cordifolia is a perennial climber, which climb on highest trees and produces aerial roots up to the length of 30 feet (Plate 2.). The mature stem and roots are the commercially important parts used for preparing *Amrtaristam, Dhanvantharam tailam Cheriya rasnadi kasayam* etc. It is used as an effective medicine in the treatment of fever, jaundice-, diabetics, respiratory disorders, neurological disorder, rheumatism etc. The plant is collected during the summer season, when the bitter principle is most abundant.

Tinospora comes after Sida with an annual demand of 191.64 tonnes which exhibits a steady growth of 5.70 per cent. The average price for the herb is 5.21 per kg and shows a variation of 20.76 per cent between the users. The elasticity of production was 0.35 per cent, i.e. less elastic to price change, which ensure a steady market. The pharmaceutical demand for the plant was estimated

Plate1. S*ida Spp*

Plate 2.*Tinospora cordifolia*

to the tune of 281.82 tonnes with an estimated value of Rs. 1.47 million. This climber has been extensively seen in the home gardens of the state and can be efficiently reintroduced as a component in homestead and coconut gardens.

Terminalia chibula and *Withania somnifera* are the two species, which accounts around 7 to 9 per cent of total quantity demanded with an annual compound growth rate of 6.80 per cent and 6.30 per cent respectively.

Terminalia is a perennial tree growing up to a height of 15-20 meter height and the plant is found throughout India chiefly in deciduous forests, on dry slope up to 3,000 feet (Plate 3.). Fruit rind is used in many preparations like *Abhayarishtam, Thriphaladi churnam, Agastyarasayanam* etc. It has astringent, digestive, antiseptic, laxative, diuretic and carminative properties. It is one of the most coveted laxatives used by traditional practitioners. According to the descending order of quantity of medicinal plants consumed by seven sample pharmacies, Terminalia has third position after Sida and Tinospora. The annual consumption of terminalia was 111.48 tonnes in 2000-2001 with an annual compound growth rate of 6.80 per cent in consumption. The average price paid by the pharmacy was Rs. 22.63 per kg with a coefficient of variation of 29.89 per cent, which is the highest among the plants studied. Ratio estimates reveals that Terminalia has a pharmaceutical demand of 163.94 tonne with an estimated

pharmaceutical value of Rs. 3.71 million. Scarcity ratio of the plant is negative (-3.2).

Withania is bushy and erect in nature and it is found in high altitudes of Kashmir and Himalayas forests (Plate 4.). The plant is not common in Kerala. The commercially important part is roots, which is bitter in taste and is a main constituent of *Ashwagandharistam, Valiya Narayana tailam* etc. The plant is used for curing, rheumatism, impotence, leucoderma ulcer, fever, cough etc. The average price paid by the sample pharmacies was Rs 60.15 per kg, which is the highest among the plants studied. It occupies the fourth position among the major ten medicinal plants identified with an absolute consumption of 101.11 tonnes 2000-2001. The annual compound growth rate in consumption was estimated to be 6.30 per cent with a low variation in the price.(12.93 per cent). The price elasticity of demand of the plant was 0.60 per cent, i.e. less elastic to price changes. The pharmaceutical demand of the plant is 148.69 tonnes with an estimated value of Rs. 8.94 million. The scarcity analysis shows that the plant is not scarce, but its higher price may be due to its high export potential.

Adhathoda sp is a perennial shrub which was one of the essential component of traditional Kerala home gardens, as it was a major component in home remedies. (Plate 5.) With the transformation of home garden structure in favour of cash crops, these plants disappeared from the system. Roots, leaves

Plate 3. *Terminalia chebula*

Plate 4. *Withania somnifera*

and flowers are the commercially important parts, which are used for making many preparations like *vasaristam, Valiya rasnadi kashayam* etc. The leaf juice is especially used in anemia and hemorrhage, in traditional medicine. Of the ten major medicinal plants, identified based on quantity of medicinal plants consumed by the sample pharmacies, Adhatoda comes after Withania.

The annual consumption of plant in 2000-01 was 95.74 tonnes, with an annual compound growth of 5.3 per cent. The average price paid by the sample pharmacies was Rs 13.28 per kg with a price variation of 29.33 per cent between the pharmacies. The price elasticity of demand was 1.46 per cent and it is price elastic. The pharmaceutical demand for Adhatoda was 140.79 tonnes with an estimated value of Rs.1.87 million in 2000-01. The plant has a negative scarcity ratio of –1.6.

To capture the potential market Adhatoda can be reintroduced in the coconut garden or home gardens as a live fence. The study conducted by Kerala Agricultural University (1999) on the feasibility of growing this crop as inter crop in coconut garden reveal that the root, stem and whole plant weight showed progressive increase with advance in age and the highest value were observed at the harvesting stage of two year.

Cedrus deodera is a woody perennial tree found in moist parts of India growing on rocky places (Plate 6.). The commercially important part is bark, which is main ingredient of *Sahajarady kashayam and Sahajarady Thailam.* The consumption of cedrus increases at a faster rate at 8.80 per cent per annum and was 93.64 tonnes in 2000-01. The average purchase price was found to be Rs. 17.64 per kg with a variation level at 27 per cent. The price elasticity of demand was 1.98 per cent, found to be price elastic, higher quantity demanded at higher prices. The quantity of cedrus demanded by the Ayurvedic industry was 137.71 tonnes with an estimated value of Rs. 2.43 million. The scarcity ratio of –3.80, indicate that the plant is not scarce.

Cyperus rotundus is a perennial herb often considered as a weed in the front and back yard of houses in Kerala (Plate 7.). Root tuber is the part commercially used for preparing *Mustaristam, Cheria rasnadi kashayam* etc. Root tubers are used as carminative, diuretic, anthelmentic and nervine tonic. An annual demand of 92.88 kg is estimated for this plant with an annual compound growth rate of 9.12 per cent, which is the highest value among the plants studied. Ratio estimates indicate that the plant has a pharmaceutical demand of 131.43 tonnes with a value of Rs.1.46 million. The average price paid by the sample pharmacies was Rs. 11.12 per kg with a variability level of 13.48 per cent. The plant is highly elastic with a price elasticity of demand of 2.23 per cent, which is next to Terminalia.

Plate 5. *Adhatoda sp.*

Plate 6. *Cedrus deodera*

The prospect of utilising this herb as a promising medicinal plant is yet to be realised. The plant has not figured in any of the research works and the farmer's mindset also has to be geared to this effort. The extensive spread of the plant and difficulty in harvest may be two major problems in cultivating this on a commercial scale.

Woodfordia fruiticosa is a woody shrub found in most parts of India growing in rocky places. The dried flower of Woodfordia are used in the preparation of aristas and asavas (Plate 8.) The dried flowers are the major ingredients of *Abhayaristam* and *Kutajaristam.* In the list of major medicinal plants identified, Woodfordia ranks the seventh position with an annual consumption of 83.39 tonnes in 2000-01 with a compound growth rate of 8.47 per cent in consumption. The average price paid by the pharmacies is Rs. 23.77 per kg with a coefficient of variation of 22.15 per cent among the pharmacies. Price elasticity of demand shows less elasticity to price changes. The pharmaceutical demand for the plant is estimated to the tune of 122.55 tonnes with an estimated value of Rs. 2.914 million. Scarcity analysis shows that the plant has a scarcity ratio of –5.16.

Boerhaavia diffusa is a very common weed of sandy tracts, wastelands and road sides of the plain districts found all over India, (Plate 9.) especially

Plate 7. *Cyperus rotundus*

Plate 8. *Woodfordia fruiticosa*

during rainy season. The commercially important part is the root and it forms a chief ingredient of several formulations like *Punarnavasavam, Dhanvantaram kuzhambu, Chyavanaprasam* etc. It stimulates the function of heart and kidney and is specific for jaundice and diabetes. The annual consumption of the plant was 66.02 tonnes with an annual compound growth of 4.19 per cent, which is the least growth rate among the plants studied. The average price was Rs. 14.06 per kg with lesser variation of 8.62 per cent among the pharmacies. The price elasticity of demand was 0.33 per cent, which indicate that the plant has less elastic nature, i.e. the quantity demanded would not change with a small change in price. The annual pharmaceutical demand for the plant was estimated to the tune of 99.51 tonnes with a value of Rs. 1.4 million. The scarcity analysis reveals that the plant has a high scarcity ratio of 6.82, which indicate that the plant is scarce. This plant is also not cultivated as an inter crop by the farmers, while there is every chance to do so. The research work on these lines is also lacking.

Aegle marmelos is a sacred of religious significance tree found through out India and also reported from Burma, Indochina, Baluchistan etc. It is considered as an auspicious (mangalya, atimanglya) tree by Hindus (plate 10.). All parts of the plant, roots, bark and fruits are highly medicinal. The root is one of the ingredients of the group *Dashamoolam*, the ten plants used in ayurveda. The plant is astringent, carminative, laxative, restorative and cooling. The plant

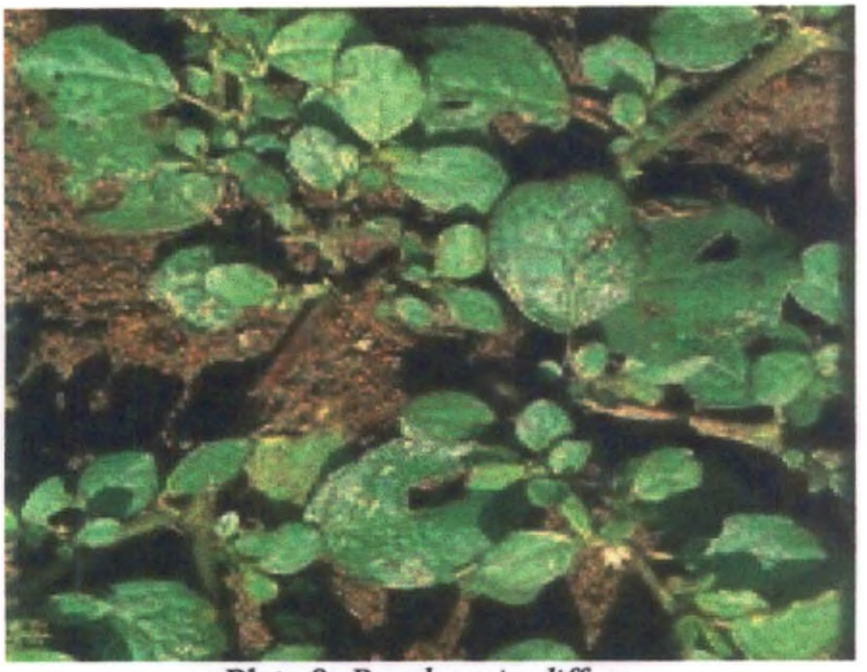


Plate.9. *Boerhaavia diffusa*

Plate 10. *Aegle marmelos*

is major ingredient of *Amrutharishtam, Dasamoola, Katutrayadi Kashayam, Vilvadi lehyam* etc. The annual consumption of the plant is 58.83 tonnes in 2000-01 with annual compound growth rate of 9.31 per cent, which is the highest among the plants studied. The plant fetches an average price of Rs. 8.96 per kg with a variation of 28.15 per cent within the pharmacies. The price elasticity of demand of Aegle is 0.98 per cent, which is quite inelastic to price changes. The demand for the whole Ayurvedic industries was estimated to 86.52 tonnes with an estimated value of Rs. 0.79 million. The plant has a positive scarcity ratio of 0.49, which indicate that the plant is scarce as well.

To conclude, the analysis proves a high growth rate and low elasticity for plants like *Sida Spp, Aegle marmelos, Woodfordia fruiticosa,* which assures a steady market for them. The plants *Sida Spp, Boerhaavia diffusa, Aegle marmelos* etc. are to be given priority in commercial cultivation in view of its scarcity value.

Of the ten medicinal plants studied *Withania somnifera, Aegle marmelos* and *Woodfordia fruiticosa* are recommended for cultivation in Kerala by Sashidharan and Muraleedharan (2000). Reviewing the studies conducted by Kerala Agricultural University and All India Co-ordinated Research project on medicinal and aromatic plants it was noticed that some studies are initiated in plants like Adhatoda, Terminalia and Tinospora. Major parts of the works were

concentrated in plants like Holostemma, Alpinia, Plumbago, Gymnema, Asparagus etc, which did not find a place in the top ten medicinal plants identified based on the quantity procured by the sample pharmacies.

A market drawn management policy is warranted for the popularisation of medicinal plants in Kerala.

5.2.2. Major medicinal plants (value terms) procured by the sample pharmacies. (Based on Rs./kg)

Though the quantity procured is low, the expenditure incurred by the pharmacies on certain plants is very high due to the high unit price. In commercial angle these plants are also very important.

Crocus sativus is found on the forests of Jammu and Kashmir State and it can not be grown in Kerala conditions (Plate11). The commercially important part is flowers, which is a major constituent of *Amularasayanam.* Dried flowers are available in the market and the unit price paid by the pharmacies for saffron was Rs.30000 per kg and the requirement of the plant is about 105 Kg per year by sample pharmacies.

Plate11. *Crocus sativus*

Plate12 Aconitum heterophyllum

Aconitum heterophylum is not seen in Kerala conditions and it is considered as critically endangered plant species (Plate12). It is commonly found in the dry cool areas of Himalaya forests. The major source of this plant is the dealers of North India.The plant is a major ingredient of *Rasnadikashayam* and *Dhasamoolarishtam* . The plant has a unit price of Rs. 3800 per kg with an annual requirement of 7000 kg by the sample pharmacies.

Lodolcea scychellarum is found in the forests of Andaman and Nicobar islands(Plate 13). The commercially important part is the fruit, which is a major constituent of *Manasamithravadakam*. Average unit price of the fruit is Rs.3500 per kg with an annual consumption of 70 kg by the sample pharmacies.

Anacyclus pyrethrum is an imported plant from China, though it can be grown in North Indian hilly regions (Plate14.). The commercially important parts are roots and leaves. The plant has a unit price of Rs. 1200 per kg with an annual consumption of 100kg by the sample pharmacies. The plant is used for preparation of *karpooradhichoornam*.

Holostemma ada-kodien is a perennial climber found throughout India, mainly in tropical himalayas, Dehradhun, Konkan, Bombay,Karnataka, Kerala etc (Plate15). It grows over hedges and in open forests especially on the lower slopes of the hills. The commercially important part is root, which is a major

Plate13. *Lodolcea scychellarum*

Plate14. *Anacyclus pyrethrum*

constituent of *Balarishtam.* Annual consumption of the plant is about 17,000 kg by the sample pharmacies with a unit price of Rs.280 per kg.

Piper longum is a root climber, which is considered to be indigenous to the hotter parts of India. It is found growing in the West Coast as undergrowth in the evergreen forests of Western Ghats (Plate16.). Dried ripe fruits and roots are commercially important parts used for preparing *Abhayarishtam, Draksarishtam, Chyavanaprasam* etc. The plant has a unit price of Rs. 200 per kg with an annual consumption of 18,000 kg by the sample pharmacies.

Cinnamomum camphora is a profusely branched evergreen tree growing up to 30 meters in height commonly found in Gujrat, Rajastan and Karnataka (Plate17). Camphor is formed in the oil cells distributed in all parts of the tree mainly obtained from the leaves and stems. It is aromatic and bitter. Camphor is in the form of an amorphous powder, which is molded in to different shapes. The unit price of the plant is Rs. 200 per kg with an annual consumption of 17,500 kg by the sample pharmacies. Camphor is used as a major ingredient of oils, ayurvedic tablets and lehiam.

Commiphora mukul is a small tree found in arid rocky tracts of Rajputana, Bellari, Mysore and Baluchistan. The gulgulu of commerce is a pale yellow or brown aromatic gum resin, consisting of irregular roundish masers of

Plate. 16. Piper longum

Plate. 15. Holostemma - ada - kodien

varying sizes (Plate18.). It is opaque, reddish brown in colour and has a dusty surface. It is astringent, thermogenic, aromatic, digestive, anti-inflammatory, general tonic and rejuvenate. The unit price of resin is Rs. 180 per kg with an annual consumption of 22,000 kg by the sample pharmacies. It is used for making *gulgulu thiktha kashayam.*

Kaempfera galanga is a small stem less plant with fleshy leaves and listed as a endangered plant species (Plate19.). The annual consumption of the plant is about 16,000 kg with a unit price of Rs.235 per kg in 2000-2001.

Trichosanthus cucumerina is an extensive dioecious annual climber found throughout India (Plate20). Both the roots and the fruits are considered to be cathartic. The root is used as a cure for bronchitis, headache and boils. The plant has a unit price of Rs. 115 per kg and the annual consumption of the plant by sample pharmacies is 26,000 kg in 2000-2001.

The plant with highest unit price is *Crocus sativus* while *Trichosanthus cucumerina* is demanded in bulk. As a whole the highest value is attached to *Aconitum heterophylum* by the sample pharmacies, as they have to spend the highest amount on that.

Plate17. *Cinnamomum camphora*

Plate18. *Commiphora mukul*

Plate19. *Kaemphera galanga*

Plate 20. *Trichosanthes cucumerina*

Of the ten medicinal plants identified based on the unit price, *Holostemma ada-kodien* and *Trichosanthus cucumerina* are recommended for cultivation in Kerala by Sashidharan and Muraleedharan (2000).

5.3. Marketing of medicinal plants.

Collecting information on the marketing aspects of medicinal plants was the most difficult part of the study, as most of the intermediaries involved refused to co-operate. Though major channels were identified, the quantum of flow through each channel could not be attempted. However that was not a stated objective.

The channels are discussed one by one:

5.3.1. Marketing channels for medicinal plants in Kerala.

1. Tribals – Traders/dealer – Ayurvedic drug manufacture units.

Tribals (forest dependent population), who collect the NTFP, which include medicinal plants from the forests and sell these materials to GSCS (tribal societies) or to the traders/dealers. Rather than selling to the society, they preferred to sell to the traders/dealers on account of ready payments. The price paid to the tribals depended mainly up on the demand for the raw materials, i.e. whenever there is a large demand, and the price will be higher. However, the

price paid for the medicinal plants can only be considered as collection charges (labour) and do not truly represent the value of the plant.

2. Tribal – Commission Agent – Trader/Dealer – Ayurvedic manufacturing units

This is the main marketing channel through which major portion of the medicinal plants marketed in the state (60-65%). Commission agents take supply order from the Ayurvedic manufacturing units and traders/dealers for different plant or plant parts. They contact the tribals who are engaged in the collection and often make advance payments or canvass often them with illicit liquor. The commission agents often manage to procure the items with meager payment. Due to the illegal transaction involved, neither the tribals nor the commission agents provided the information to the price paid or quantity collected..

3. Dealers/trader outside state – Dealers/Traders in Kerala – Ayurvedic drug manufacturing units

Certain medicinal plans, which are not seen in Kerala condition are supplied by the traders/dealers outside state (North India). The traders in Kerala procure plant parts (dried) from the traders in North India, who in turn sells the

produce to the manufacturing units. Some times the manufacturing units purchase the raw drugs directly from the dealers outside state. The major plants supplied by them are *Withania somnifera*, *Terminalia chebula*, *Cedrus deodera* (Madhya Pradesh) and *Heidesmus indicus* from Bombay.

4.Cultivators/ illegal gatherers from forest – commission agents – Traders/Dealers – Ayurvedic drug manufacturing units

Cultivation of medicinal plants is seen near to forest belts by local people living near to the forest belts and they also illegally collect the medicinal plants from the forest. Commission agents or trader/dealer purchase medicinal plants from them based on the supply order of large manufactures. Large-scale cultivation of medicinal plants is not seen in the state and the statistics regarding the number of cultivators, crops and area are not available. This however doesn't include the cultivation by the pharmacies themselves. Some times the agents of private traders also illegally collect the raw materials from the forests, which often leads to competition between tribal and non-tribal people for collecting the products.

5. Tribals – GSCS – Ayurvedic manufacturing units

The tribal co-operative societies are regulated by the co-operative societies Acts. They offer minimum prices for Minor Forest Produces, which

include medicinal plants. The Federation (Kerala State SC/ST Development Co-operative Federation Limited) an apex body of the tribal societies take over all the collected products from the societies for marketing. They usually auction the perishable medicinal plants to the manufactures, traders/dealers or any other end users. The procurement price and sale prices of medicinal plants are fixed by NTFP committee. The functioning of the tribal societies is not satisfactory for the last two decades. Out of 33 GSCS, only 70% are functioning properly.(Thomas,1996). The presence of alternate roots for the sale of medicinal plants gathered by tribals itself shows the failure of GSCS.

6. Gatherers from non forest areas - Commission agents - Traders - Ayurvedic medicine manufacturing units

Certain plant species like, Sida, Cyperus, Adhatoda etc. are naturally seen in most part of the state. Local people (gatherers from non forest areas) who collect ti from these areas with or with out the permission of owner for small or no payments. Commission agents or traders purchase these collected materials from them, who in turn sell it to the ayurvedic medicine manufacturing units or to the local vaidyas.

The marketing structure and practices of medicinal plants in Kerala needs a thorough study focussed on the issue. This study is only a modest attempt to that effect.

Problems faced by the medicinal plant industries in Kerala.

1. Proper identification of plants/plant parts

Proper identification of medicinal plants with active principle has been a serious issue not only for the drug industry but also for botanist Crude drugs are known differently in various regional names across the country and they are marketed in these names only i.e. the same name of a crude drug may be attributed to more than one plant and several plants may be sold under a single name. A very small percentage of people in this field of collection are aware of the actual botanical identity of the plants used. Moreover farm level minimal processing like drying makes the problem more complex.

2. Many of the medicinal plants are available only in particular season and the price of such seasonal plants fluctuate drastically in the market. To overcome the price fluctuations, many large manufacturing units procure their annual requirements for such plants in specific season and store it through out the year for their use. Storing the plant parts for a

long period can result in the deterioration of their medicinal potential. Studies on these aspects are to be properly undertaken.

3. Ayurvedic medicine manufacturing units purchase the medicinal plants from different parts of the country and most of them are collected from wild. As a result there are intense phytochemical variation within a single supply because of several inherent factors like variations due to different climatic/edaphic factors and age of the plant. Hence reproducible drug quality is often not achieved.

4. In a number of cases the produce has to be used fresh for which instant transportation is a must and in many case it can't be stored for long periods as this would entail fumigation of storage area (to ward off storage pests). Improper fumigation at times results in chemical contamination of the raw materials. If the plant material is not dried up thoroughly (moisture not less than 10% w/w), the plant material gets contaminated and eventually the quality of final products (medicine) is also adversely affected.

5. Ayurvedic medicine manufacturing units always insists for the preferred source of medicine, but when supply is in large quantities, checking each sample is very difficult, particularly in the case of dried roots and barks.

In the case of *dasamoola,* the root is the preferred part used, but due to its scarcity, wood is widely used.

6. Adulteration and substitution are the major problems faced by the manufacturing units. In certain plants more than one species are used as raw drug. In the case of moovila, *Pseudaritha visida* is the preferred source, but it was found that roots of *Demodious palchellum, Rhynchosia rufescens, Desmodium heterocarpon* and *Uraria hamosa* were also used as Moovila. Higher cost of raw drug is another reason for substitution. Recent trend in the raw drug trade involves the sale of different qualities of the same drug, consisting of cheaper substitute. Bombay Naruneende is a substitute of the preferred Naruneende, which is cheaply available in the market. However the relative merits or demerits on the quality of the final products needs further investigation.
7. In many cases, the important plant parts used are roots or the entire plant. This result in plant collectors engaging in destructive collection/extractive methods resulting in many becoming extinct or being listed as threatened.

8. Sustainable management of wild sources of medicinal plant is a problem in view of the conflicting interest of conservation and livelihoods of tribal population.

9. Government of India in 1970 grants the right for collection of NTFP from forest to the tribes and they are the only talented people to collect these herbs from forests. Lack of imparting proper training to them has resulted either to deterioration of its quality or non-collection of these items from the forests.

10. Absence of quality standards in Ayurvedic drug industry. In the phytochemical industry presently no quality standards have been fixed both for the raw materials are also for the final products and such one finds wide variation in the quality specification.

11. Many medicinal plants require proper postharvest technology for cleaning, cutting and drying the economic parts. Some mechanical chopping and drying facilities are essential to impart efficiency while handling large harvest and to undertake drying when weather conditions are unfavourable. These are often lacking at the base level.

12. An unstable market condition has also kept farmer away from taking up cultivation of the crop and the prices of certain crops are highly volatile.

Recommendations.

- Current data on export and import basket of ayurvedic and unani herbs or drugs does not provide any information on the list of plants which is grown or can be grown in Kerala. Data generation on this aspect is very important for Kerala.

- The production planning of the medicinal plants in Kerala is to be geared in line with the market demand for plants.

- Research priorities should there for be in favour of those plants which are identified as of highest demand in quantity or value. Presently it is not so.

- Some of the plants identified are recommended for cultivation in Kerala (Sasidharan *et al*,2000). There should be concentrated efforts to popularise those plants in the state. This can generate additional income to the farmers. The prospects of introducing them as intercrop is to be explore in detail. This is more important in view of the present problems in coconut farming.

- Farm level value addition (cleaning, drying, minimal processing) of medicinal herbs is to be popularised through proper training and awareness.

- Anatomical or bio-chemical methods for scientific identification of medicinal plants are to be taken up to ensure quality and genuineness.

- Currently the marketing of medicinal plants are monopolized by a few traders who were very reluctant to co-operate with the study. A detailed study on marketing is recommended in view of the complexity of the situation.

- Organised cultivation of the medicinal plants is warranted on account of the increasing pressure on existing forest and resultant scarcity.

- Popularising indigenous species, which are genuine substitutes of certain high drugs, most of them being imported. Eg. *Andrographis paniculata* which is a genuine equivalent of the high value hepatoprotectant, *Swertia chirayeta.*

- In the context of popularising cultivation of selected medicinal species, regular supply of quality planting materials is to be insured and improved accessions/ecotypes are to be introduced.

- Viable protocols for large-scale rapid multiplication of medicinal species based on demand by user industry.

- Exploring the buy-back arrangement of the cultivator's produce by reputed membership forms based on demand.

Summary

6. SUMMARY

The present study on analysis of market economy of medicinal plants in Kerala was under taken during the year 1999-2001. The objectives of the study are to identify the most important medicinal plants (in value and quantity terms) of pharmaceutical use in Kerala, the major forms in which it is demanded and the source and the extent of supply.

The state has more than 900 ayurvedic pharmacies with 4000 registered and 6000 unregistered outlets for Ayurvedic medicines with a turnover of about Rs. 200 crores. The study is based on a sample of seven pharmacies, accounting for 68 percent of the total turnover of the industry. From the selected units the following information were gathered.

1. Identification of ten important medicinal plants in terms of quantity and value.
2. The plant/plant parts used.
3. Quantity/ value of these ten plants.
4. Unit purchase prices of important medicinal plants.
5. Marketing channel of important medicinal plants.
6. Problems in medicinal plant procurement and challenges faced by the industry.

There are around 30 major wholesale traders of medicinal plants in the state and bulk of the business is handled by five traders and all of them in Thrissur district. They have been a constant supplier of raw materials to 94 registered Ayurvedic drug manufactures including three big units and 176 registered ayurvedic practitioners in Thrissur district and many other units in the state (Sankar, 1996). As such these five traders are contacted for further investigation. From them, the information of price of important species, sources, plant part traded and other relevant details were gathered. A personal interview method with important persons in the industry was resorted for data collection. The study mainly uses simple arithmetic tools like percentage analysis and weighted averages. The import and export data on medicinal plants were analysed by using these tools only. The growth in consumption of medicinal plant was estimated by annual compound growth rate.

Exports of ayurvedic and unani herbs have registered a steady increase, especially after 1996 and are reported to the tune of 9585.70 tonnes in 1999-2000. However this is not fully reflected in export earnings, where 1999-00 exhibits a negative growth compared to the previous year. The major destinations of export of ayurvedic and unani herbs are Chinese Taipei (28.10%) Japan (26.38%), and Pakistan (19.04%) . Of the foreign exchange earnings from export of ayurvedic and unani plants, the major share is

contributed by Pakistan (20.15%) followed by Japan (16.8%) and Chinese Taipei(13.6%).

Traditionally, lion's share of ayurvedic and unani herb imports to India has been from Nepal. Lately, Pakistan has entered the market and emerged as major supplier to India, reducing the share of Nepal to 30.76 per cent from 86.86 per cent in 1990-1991. These countries together account for 72.83 per cent of total imports of the country. The net balance of trade on account of this transaction however is positive always but shows a decline on two occasions. In 1999-2000 it declined to Rs. 1201.2 lakhs from Rs. 3247.27 lakhs in 1998-1999 and Rs. 671.82 lakhs in 1994-1995 from Rs. 926.26 lakhs in 1993-1994.

The major 10 species of medicinal plants selected based on the magnitude of quantity procured per annum by the seven sample pharmacies are arranged in the descending order. 1) *Sida Spp.* 2)*Tinospora cordifolia.* 3) *Terminalia chebula.* 4)*Withania somnifera.* 5) *Adhatoda sp.* 6) *Cedrus deodera.* 7) *Cyperus rotundus.* 8) *Woodfordia fruiticosa.* 9) *Boerhaavia ditffusa.* 10) *Aegle marmelos*. The annual compound growth in the consumption of medicinal plants varies from a low 4.19 per cent in *Boerhaavia diffusa* to high 9.31 per cent in *Aegle marmelos*. The annual compound growth in the total quantity of medicinal plants procured by sample pharmacies is estimated to be 7.3 per cent during 96-97 to 2000-01 periods.

Weighted average price for the major ten medicinal plants were calculated and was compared with the percentage quantity procured by the sample ayurvedic pharmacies to study the price demand relationship. The pharmacy, which demanded the highest quantity of medicinal plants, offered the highest price. For instance, in the case of the plant Withania, two pharmacies had the same price index of 94.76 while percentage of quantity purchased to total purchase varied between 3.56 per cent to 50.44 per cent. Similar results were obtained for most of the medicinal plants studied. On further analysis to examine the extent of price variation among the sample pharmacies with respect to a particular plant, the coefficient of variation in the price of major medicinal plants ranges from 8.62 per cent in *Boerhaavia diffusa* to 29.89 per cent in the case of *Terminalia chibula.* The price elasticity of demand of the medicinal plants varying from 0.33 per cent in the case of *Boerhaavia diffusa* to 3.31 in the case of *Terminalia chibula.*

The ratio estimates of value of the medicinal plants traded indicate that Sida is the medicinal plant procured with largest total value followed by Withania. Tinospora and Terminalia rank higher in quantity wise than Withania but have lower value due to lower unit prices. Aegle was occupying the lowest position in the list in both quantity and value terms. The scarcity ratio for major ten medicinal plants were calculated and it was found that the scarcity ratio for

Sida (2.79), Aegle (0.49) and Boerhaavia (6.82) were positive, which indicate that these plants were scarce.

The major medicinal plants selected based in value terms (based on the unit prices) by sample pharmacies are arranged in the descending order, 1. Aconitum *heterophylum*. 2.*Lodolcea seychellarum* 3. *Crocus sativus.4. Anacyclus pyrethrum. 5. Holstemma ada-kodien. 6. Kaempferia rotunda. 7. Piper longum.8. Commiphora mukul. 9.Cinnamomum camphora. 10. Trichosanthes cucumerina.*

The major marketing channels for medicinal plants in Kerala are 1. Tribals – Trader/dealer – Ayurvedic drug manufacture units.2. Tribals – Commission Agent – Trader/dealer – Ayurvedic drug manufacturing units. 3. Dealers/trader outside state – Dealer/Trader in Kerala – Ayurvedic drug manufacturing units.4. Cultivators/ illegal gatherers from forest – commission agents – Trader/Dealer – Ayurvedic drug manufacturing units. 5. Tribals – GSCS – Ayurvedic manufacturing units.6. Gatherers from non-forest areas-Commission agents-Trader/dealer-Ayurvedic medicine manufacturing units. Among the major channels identified, Tribals – Commission Agent – Trader/dealer – Ayurvedic manufacturing units is the main marketing channel through which major portion of the medicinal plants marketed in the state (60-65%).

Medicinal plant trade in the state is controlled mainly by a few traders, which gives an oligopoly nature to the market. Absence of scientific method to test the genuineness of the plant /plant parts lead to large-scale adulteration. Moreover there is also no mechanism to assure the quality of raw materials and pricing based on that and hence the concern for quality maintenance is rather nil. The study has identified the major bottlenecks in the market scene of medicinal plants in the state.

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APENDIX- I

List of medical plants of endangered species

Sl. No.	Plant Name	Common name
1	*Comniphora wightii*	Guggal
2	*Swertia chirayita*	Chiryata
3	*Coptis teeta*	Mamiri
4	*Ferula jaeschkeana*	Jangli hing
5	*Saussurea sacra*	Jogi badshah
6	*Atropa acuminata*	Indian belladona
7	*Gentiana kurroo*	Karu
8	*Picrorhiza kurrooa*	Kutki
9	*Nardostachys gradiflora*	Jatamansi
10	*Aconitum chasmanthum*	Aconites
	A. violaceum	Mitha patis
	A. heterophyllum	Patis
11	*Rheum australe*	Tukshu
	R. officianalis	Revandchini
12	*Dioscorea deltoidea*	Singli-mingli Kins
	D. prazeri	Kins
13	*Aristolochia bracteata*	Kiramar
14	*Podphyllum hexandrum*	Bankakri
15	*Rauvolfia serpentina*	Sarpagandha
16	*Panax pseudo – ginseng*	Indian Jenseng
17	*Chlorophytum arundinaceum*	Safed musli
18	*Ephedra gerardiana*	Somlata
19	*Deactylorhiza hatagirea (Orchis latifolia)*	Salampanja
20	*Eulophia campestris*	Salam misri
21	*Inula racemosa*	Puskarmool
22	*Nepenthes khasiana*	
23	*Onosma bracteatum*	Shankhahuli
24	*Bunium persicum*	Kalajira
25	*Colchicum luteum*	Suranja-talka
26	*Piper cubeba*	Kabab chini
27	*Thymus serphyllum*	Banajwain
28	*Malaxis muscifera M. wallichii*	Jeevak Rishbhak
29	*Polygonathum cirrhifolium*	Maha meda
30	*P. verticillatum*	Meda
31	*Roscoea – procera Ralphina*	Kakoli
32	*Lilium polyphyllum*	Shera kankoli
33	*Lavateria kashmiriana*	Shera kankoli
34	*Anchusa strigosa*	Gaozaban
35	*Coscinium fenestatrum*	Jhari-haldi
36	*Holostemma annularis*	Kasturi manzil

ANALYSIS OF MARKET ECONOMY OF MEDICINAL PLANTS IN KERALA

By

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ABSTRACT OF THE THESIS

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ABSTRACT

The present investigation on analysis of market economy of medicinal plants in Kerala was undertaken during the year 1999-2001. The study aimed at identifying the major medicinal plants (in quantity and value terms) of pharmaceutical use in Kerala, the form in which it is demanded and the source and the extent of supply.

The study is based on a sample of seven pharmacies, accounting for 68 percent of the total turnover of the industry. There are around 30 major wholesale traders of medicinal plants in the state and bulk of the business is handled by five traders and all of them in Thrissur district. From them, the information on price of important species, sources, plant part traded and other relevant details were gathered.

Exports of ayurvedic and unani herbs have registered a steady increase, especially after 1996 and are reported to the tune of 9585.70 tonnes in 1999-2000. The major destinations of export of ayurvedic and unani herbs are Chinese Taipei (28.10%) Japan (26.38%), and Pakistan (19.04%) . The major share of foreign exchange earnings from export of ayurvedic and unani plants is

contributed by Pakistan (20.15%) followed by Japan (16.8%) and Chinese Taipei (13.6%).

Nepal and Pakistan are the major countries from where ayurvedic and unani herbs are imported to India. They together account for 72.83 per cent of total imports of the country. The net balance of trade shows a fluctuating trend. It was declined from Rs. 3247.27 lakhs in 1998-'99 to Rs.1201.24 lakhs in 1999-'00 and from 926.26 lakhs in 1993-94 to 671.82 lakhs in 1994-95.

The major ten species of medicinal plants selected based on the magnitude of quantity procured per annum by the seven sample pharmacies are arranged in the descending order of importance. 1) *Sida Spp.* 2)*Tinospora cordifolia.* 3) *Terminalia chebula.* 4)*Withania somnifera.* 5) *Adhatoda sp.* 6) *Cedrus deodera.* 7) *Cyperus rotundus.* 8) *Woodfordia fruiticosa.* 9) *Boerhaavia ditffusa.* 10) *Aegle marmelos.* The annual compound growth in the consumption of medicinal plants varies from 4.19 per cent in *Boerhaavia diffusa* to 9.31 per cent in *Aegle marmelos.*

The coefficient of variation in the price of major medicinal plants ranges from 8.62 per cent in *Boerhaavia diffusa* to 29.89 percent in the case of *Terminalia chibula.* The price elasticity of demand of all the medicinal plants

studied were positve,varying from 0.33 per cent in the case of *Boerhaavia diffusa* to 3.31 in the case of *Terminalia chibula.*

The ratio estimates of value of the medicinal plants traded indicate that Sida is the medicinal plant procured with highest total value followed by Withania. Aegle occupied the lowest both in respect of quantity and value.

Estimates of scarcity ratio for Sida (2.79), Aegle (0.49) and Boerhaavia (6.82) were positive, which highlighted the relative scarcity of these plants.

The major medicinal plants selected based on the unit prices procured by sample pharmacies are arranged in the descending order, 1. Aconitum *heterophylum.* 2.*Lodolcea seychellarum* 3. *Crocus sativus.4. Anacyclus pyrethrum. 5. Holstemma ada-kodien. 6. Kaempferia rotunda. 7. Piper longum. 8. Commiphora mukul. 9.Cinnamomum camphora. 10. Trichosanthes cucumerina.*

In the marketing scene, among the major channels identified, Tribals – Commission Agent – Trader/Dealer – Ayurvedic manufacturing units is found to be the main marketing channel through which major portion of the medicinal plants are marketed in the state (60-65%).

The market for medicinal plant in the state is controlled by a few traders and pharmacies. The inadequate quality control mechanism both at product level and input level of ayurvedic industry is one of the major problems. This study has listed out the important constraints by the industry. However more concerted study is recommended to further elaborate the issues, among other recommendations.