Report of the Task Force on Conservation & Sustainable use of Medicinal Plants

Government of India
Planning Commission
March - 2000

PREFACE

Human life and knowledge of preserving it as a going concern, must have come into being almost simultaneously. All known cultures of the past - Egyptian, Babylonian, Jewiah, Chinese, Indus-valley etc. had their own glorious and useful systems of medicine and health care.

According to the ancient books of knowledge, health is considered as a prerequisite for achieving the supreme ends of Me consisting of righteousness, wealth, artistic values and spiritual freedom Preventive and curative aspects of disease are considered as important components of the concept of positive health

The Indian System of Medians, viz Ayurveda, Siddha, Unani and Homeopathic system predominantly use plant baaed raw materials m moat of their preparations and formulations Modem pharmacopoeia also contain at least 25% drugs derived from plants and many other which are synthetic analogues bum on prototype compounds isolated from plants.

The World Health Organisation (WHO) estimated that 80% of the population of developing countries rely on traditional medicine mostly plant drugs, for their primary health care needs Medicinal plants being natural, non-narcotic, having no side elect of ay a range of safe, cost effective, preventive and curative therapies which could be useful in achieving the goal of "Health for all" in a coat effective manner. Demand for medicinal plants is increasing m both developing and developed countries but 90% malarial la harvested from wild sources without applying scientific management hence many species are under threat to become extinct.

Medicinal plants occupied an important position in the socio-cultural, spiritual and medicinal arena of rural people of India. Their sustainable management and harvesting can conserve biodiversity, sustain human and environmental health, generate employment and enhance export earnings Therefore, a Task Force was set up, by the Planning Commission for Conservation and Sustainable use of Medicinal Plants (Annexure-I). Four Meetings of the Task Force were held (Details as per Annexure-ll).

The present report is based on contribution made by members of the task force and many other experts on medicinal plants. We hope the report on implementation will promote sustainable and equitable development of medicinal plants sector provide "Health for All", boost exports, and will improve livelihood of the people and green the country for the present and the generation to come

We would like to place on record our deep appreciation and thanks to Shri K C Pant. Deputy Chairman of the Planning Commission for his keen interest in developing Indian Systems of Medicine. Medicinal Plants sector and for guiding the task force to preparation of this report.

(D.N.TEWARI)

Place: New Delhi
Date : 29 02 2000

CHAIRMAN OF THE TASK FORCE ON CONSERVATION AND SUSTAINABLE USE OF MEDICINAL PLANTS

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TASK FORCE ON CONSERVATION AND SUSTAINABLE USE OF MEDICINAL PLANTS

EXECUTIVE SUMMARY

i) "Heath for AT continues to be a distant dream for India. With the increase in life expectancy and the problems of over crowding, air and water pollution, degenerative strata, allergies, diabetes, rheumatic and arthritic conditions, neurological conditions, memory disorders are likely to grow. Currently about 85 percent of woman are anaemic on account of iron deficiency and 22 million children are afflicted with cretinism while another 6.5 million are mildly retarded. About 1.1 lakh woman die every year of causes related to pregnancy and childbirth. This can affect the quality of life, productivity and the wet-being of future generates. The health of woman to especially important because if children are born to sick mothers, there will be problems in their later life.

ii) Our per capita annual consumption of drugs of Rs.125 is the lowest in the world mainly because medicinal plants constitute the principal health care resources for the majority of population. The World Health Organisation (WHO) estimated that 80% of the population of developing countries rely on traditional medicines, mostly plant drugs, for their primary health care needs. Also, modern pharmacopoeia still contains at least 25% drugs derived from plants and many other, which are synthetic analogues built on prototype compounds, isolated from plants. Transition from synthetic drugs and microbially produced antibiotics to plant based drugs is rapidly gaining acceptance. Global resurgence in the use of plant-based drugs is an opportunity for India to attain self-reliance and boost the export of herbal drugs.

iii) The demand on plant based therapeutics to Increasing in both developing and developed counties due to the growing recognition that they are natural products, being non-narcotic, having no side-effects, easily available at affordable prices and sometimes the only source of health care available to the poor. Medicinal plants sector has traditionally occupied an important position in the socio-cultural, spiritual and medicinal arena of rural and tribal lives of India. The global thrust areas for drugs from medicinal plants include disease conditions, whose incidence is increasing and where the modern drugs are either unavailable or unsatisfactory.

iv) In a wider context, there to a growing demand for plant based medicines, heath products, phar4maceuticals, food supplements, cosmetics, etc,. in the national and international markets. Conservation and sustainable use of medicinal plants are issues on which immediate focus is required in the context of conserving biodiversity and promoting and maintaining the health of local communities, besides generating productive employment for the poor with the objective of poverty alleviation in tribal and rural areas.

v) International market of medicinal plants is over US$60 billion per year, which is growing at the rate of 7%. India at present exports herbal material and medicines to the tune of Rs.6446.3 crores only which can be raised to Rs3000 crores by 2005. China and India are two great producers of medicinal plants having more than 40% of global biodiversity. China, besides meeting its domestic requirement is earning US $ 5 billion per year from herbal trade. There is thus an enormous scope for India also to emerge as a major player in the global herbal product based medicines. However, this requires a grand strategic plan, which takes a holistic view of the entire situation to boost the export of Rs.10,000 crores by 2010 and minimising the import.

vi) Medicinal plants are used at the household level in a self-help mode. One and a half million practitioners of ISM&H use medicinal plants in preventive/promotive and curative applications. There are about 4,60,000 registered practitioners of ISM&H using medicinal plants in the codified streams. Further, there are 7843 registered pharmacies of ISM and 851 of homeopathy and a number of unlicensed small-scale units. Besides meeting national demands, they cater 12% of global herbal trade. Pharmacies are mostly owned by family companies and most of them are secretive in trade and largely unregulated.

vii) At present, 90% collection of medicinal plants is from the wild, generating about 40 million mandays employment (part and full) and since 70% of plants collections involve destructive harvesting many plants are endangered or vulnerable or threatened. Currently medicinal plants are collected without paying attention to the stage of maturity. They are stored haphazardly for long period of time under unsuitable conditions. This results in deterioration in quality. Such materials are not acceptable to importers and standard manufacturing drug units.

viii) Marketing of medicinal plants is inefficient, informal, secretive and opportunistic. As a result, the raw material supply situation is shaky, unsustainable and exploitative. This results in depletion of resource base, exploitation of rural people (who are the real stewards of the resource), adulteration and non-availability of quality herbal drugs for domestic consumption as well as for exports.

ix) As the price paid to the gatherers tends to be very low, they often "mine" the plants, as their main objective is to generate income. A critical factor in wild harvesting is the availability of cheap labour to undertake the very labour intensive work of herbal gathering. Women are the main gatherers and also the users. With the rampant deforestation, women have to cover greater distances for the collection of herbs that once grew almost outside their habitation. As forest habitat disappear and over harvesting for commercial use reduces the stocks of wild medicinal plant material, there is a corresponding drop in the availability of the plants normally used as the first and last resort for all health care by rural population.

x) Despite the wealth of resources (biological, human and financial) available, the sector has not developed in the absence of suitable standardisation, quality control and efficacy of drugs. It has yet to formalize and organise marketing and trade and integrate the development of medicinal plants from production to consumption to boost export of herbal formulations.

xi) Medicinal plants sector has a number of stakeholders having divergent interests. Each stakeholder is interested in strengthening specific aspects of his sector only and ignoring the overall development. Unless, coordinated efforts are made the sector cannot develop.

xii) Several constraints exist due to inadequate awareness; inadequate investments in research and development; manufacturer - exporter dissonance; lack of quality and standardization norms; and lack of adequate marketing and trade information.

xiii) The emergence of the new intellectual property regime in the light of India's joining WTO will pose important challenges in this sector. The task force recommended several actions that were needed on the part of the government, institutions, etc. to strengthen India's capacity in the protection of its intellectual property rights. In particular, creating digital databases of India's traditional knowledge was recommended as a priority activity to provide the evidence of this knowledge in the public domain as well as India's ownership of the knowledge. Modernisation of the Patent office and the Trade Mark Register is long overdue. R & D institutions have to maximise their patenting efforts.

xiv) The Task Force recognizes that apart from the software industry, the pharmaceutical sector is the only one showing a constant growth of 15% and more. Medicinal plants can be viewed as a possible bridge between sustainable economic development, affordable health care and conservation of vital biodiversity. For sustainable and equitable development of the sector, the task force recommends the following programmes:

- Establishment of 200 Medicinal Plant Conservation Areas (MPCA), covering all ecosystems, forest types and subtypes preferably inside the protected areas already notified under the Wildlife Act.
- Medicinal plant species which are rare or endangered or threatened should be identified and their ex-situ conservation, may be attempted in the established gardens, plantations and other areas.
- Three gene banks created with the financial assistance of Department of Biotechnology should properly store the germless of all medicinal plants.
- Two hundred "Vanaspati Van" may be established in degraded forest areas (with an area of about 3500 - 5000 hectares each). Intensive production of medicinal plants from these "Vanaspati Vans" will produce quality herbal products and generate productive employment to 50 lakh people, specially women, who are skilled in herbal production, collection and utilization. "Vanaspati Van" should be managed under JFM for benefit sharing to atercate poverty of tribals.
- One million hectares of forest area rich in medicinal plants {about 5000 hectares each at 200 places) should be identified, their management plans formulated and sustainable harvesting encouraged preferably under the JFM system. Such areas, besides producing herbal products will generate employment for 50 lakh tribals on sustained basis and greatly help to alleviate poverty.
- Apart from CSIR, ICAR and ICFRE institution's engaged in medicinal plants about 50 NGOs, technically qualified, should be entrusted the job of improving awareness and availability of planting stock and agro-techniques for cultivation of medicinal plants. As recommended Twentyfive species having the maximum demand should be cultivated under captive and organic farming.
- All attempts should be made for medicinal plants screening/testing/clinical evaluation/safety regulation as well as research and development. Safety, efficacy, quality control, pharmacopoeia development should be expedited and completed by 2003.
- Policy, legal and institutional supports should be extended to the sector for adopting standards, quality control, efficacy and effectiveness of herbal drugs.
- Drug Testing Laboratories for ISM&H products should be established with qualified staff to test the plant/mineral based products. Training should be imparted to the laboratory staff, drug inspectors and to the quality control managers/in-charges of the manufacturing units so that they are able to identify the raw-materials for the presence of essential properties of medicinal plants.
- To prevent patenting of our traditional knowledge by outsiders, all the available information should be properly formatted in a digital form by using international standards for wider use both at the national and international level. Efforts should be intensified to create an Indian Traditional Knowledge Base Digital Library.

- The Task Force strongly recommends establishment of "Medicinal Plant Board" for an integrated development of the medicinal plants sector. It is expected to formalize and organize medicinal plants marketing and trade, coordinate efforts of all the stakeholders of the sector and ensure health for all by improving the awakening and availability of herbal products, besides generating productive employment to 10 million tribals and women on a regular basis. The "Medicinal Plant Board" will need a financial assistance of Rs.50 crores over a period of three years.
- Ten major medicinal plants identified for export should be extensively studied and appropriate literature on every aspect of such plants may be made available in the world market.
- Medicinal plants sector for its integrated development will need a financial assistance of Rs.1000 crores over a period of 5 years. Besides the national efforts external funding may be explored to ensure "Health For AH" by 2005 itself.

Chapter I
INTRODUCTION

General

The World Health Organisation (WHO) estimated that 80% of the population of developing countries rely on traditional medicines, mostly plant drugs, for their primary health care needs. Also, modern pharmacopoeia still contain at least 25% drugs derived from plants and many others which are synthetic analogues built on prototype compounds isolated from plants. Demand for medicinal plant is increasing in both developing and developed countries due to growing recognition of natural products, being non-narcotic, having no side-effects, easily available at affordable prices and sometime the only source of health care available to the poor. Medicinal plant sector has traditionally occupied an important position in the socio cultural, spiritual and medicinal arena of rural and tribal lives of India.

Medicinal plants as a group comprise approximately 8000 species and account for around 50% of all the higher flowering plant species of India. Millions of rural households use medicinal plants in a self-help mode. Over one and a half million practitioners of the Indian System of Medicine in the oral and codified streams use medicinal plants in preventive, promotive and curative applications. There are estimated to be over 7800 manufacturing units in India. In recent years, the growing demand for herbal product has led to a quantum jump in volume of plant materials traded within and across the countries. An estimate of the EXIM Bank puts the international market of medicinal plants related trade at US$ 60 billion per year growing at the rate of 7% only. Though India has a rich biodiversity, the growing demand is putting a heavy strain on the existing resources.

While the demand for medicinal plants is growing, some of them are increasingly being threatened in their natural habitat. For meeting the future needs cultivation of medicinal plant has to be encouraged.

According to an all India ethnobiological survey carried out by the Ministry of Environment & Forests, Government of India, there are over 8000 species of plants being used by the people of India. Figure 1 and 2 represents the plant in various Indian systems of medicine and the overlap of plant used across the medical systems.

Figure 1- Plants being used by various system of medicines

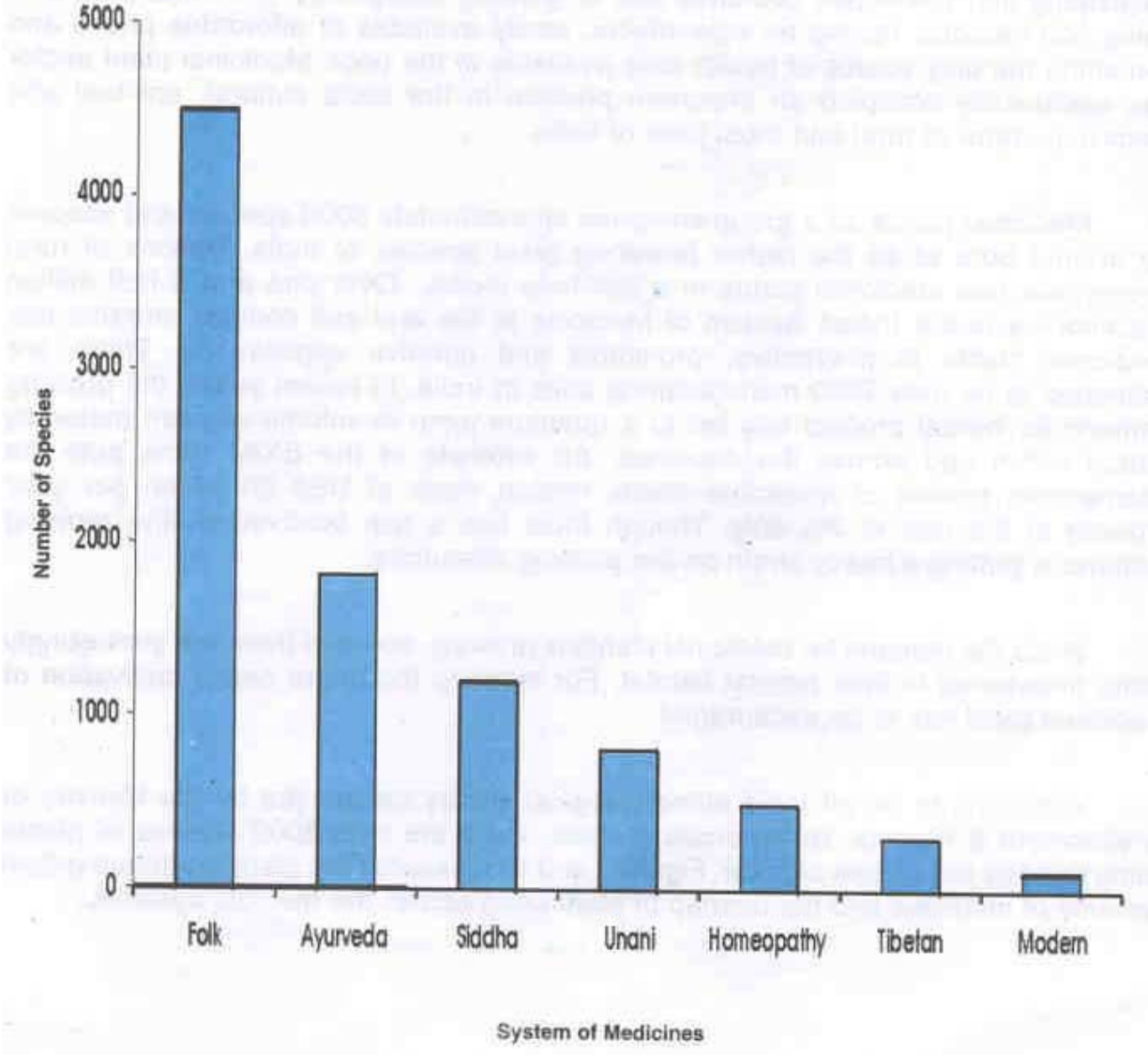
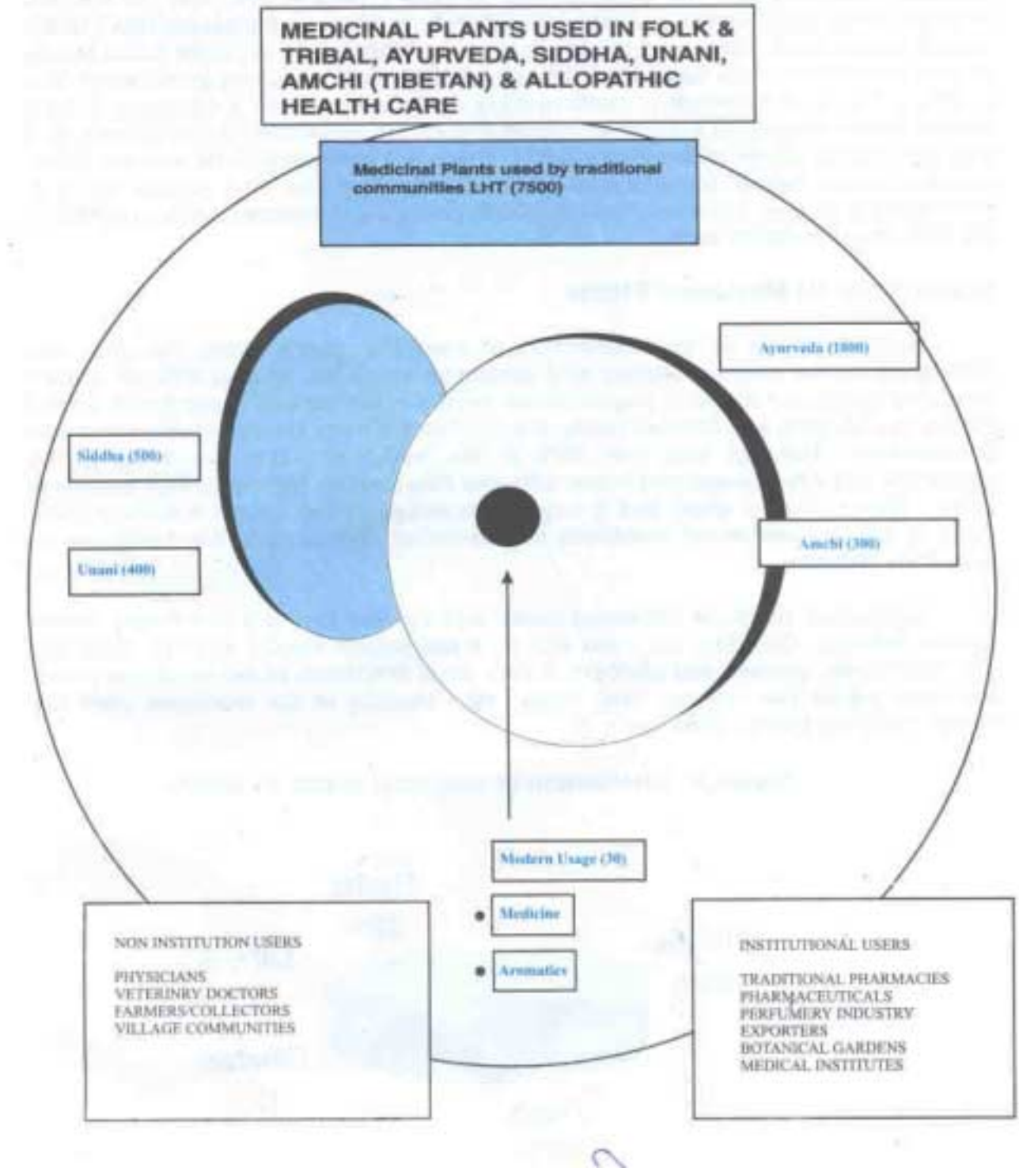


Figure 2 - Resource base of traditional medicine



Medical Plants As Part of Culture

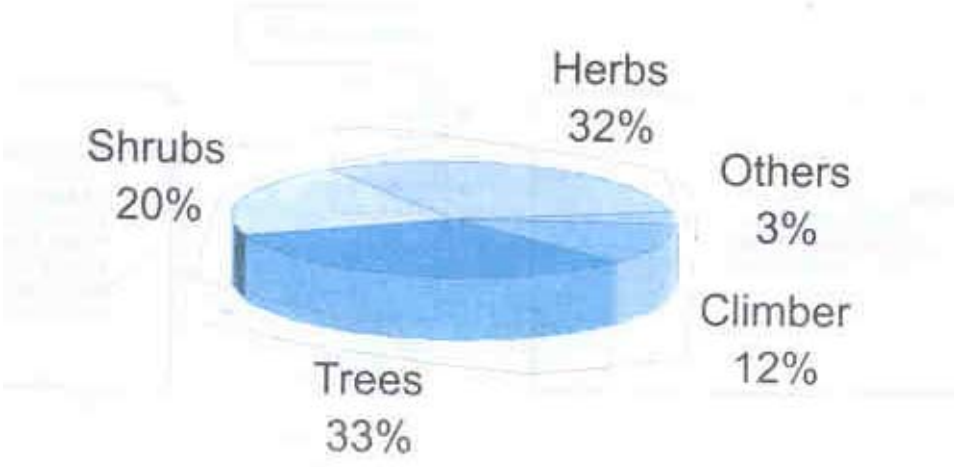
It is evident that the Indian people have tremendous passion for medicinal plants ans us them for wide range of health related applications from a common cold to memory improvement and treatment of poisonous snake bites to a cure for muscular distrophy and the enhancement of body's general immunity. In the oral tradtions local communities in every ecosystem from the trans himalayas down to the coastal plains have discovered the medical uses of thousands of plants found locally in their ecosystem. India has one of the richest plant medical culture in the world. It is a culture that is of tremendous contemporary relevance because it can on one hand ensure health security to millions of people and on the other hand it can provide new and sadfe herbal drugs to the entire world. There are estimated to be around 25000 effective plant based formulations used in folk medicine and known to rural communities all over India and around 10000 designed fromulations are available in the indigenous medical texts.

Distribution of Medicinal Plants

Macro analysis of the distribution of medicinal plants show that they are distributed across diverse habitats and landscape elements. Around 70% of India's medicinal plants are found in tropical areas mostly in the various forest types spread across the Western and Eastern ghats, the Vindhyas, Chotta Nagpur plateau, Aravalis & Himalayas. Although less the 30% of the medicinal plants are found in the temperate and alpine areas and higher altitudes they include species of high medicinal value. Macro studies show that a larger percentage of the known medicinal plant occur in the dry and most deciduous vegetation as comparted to the vergreen or temperate habitats.

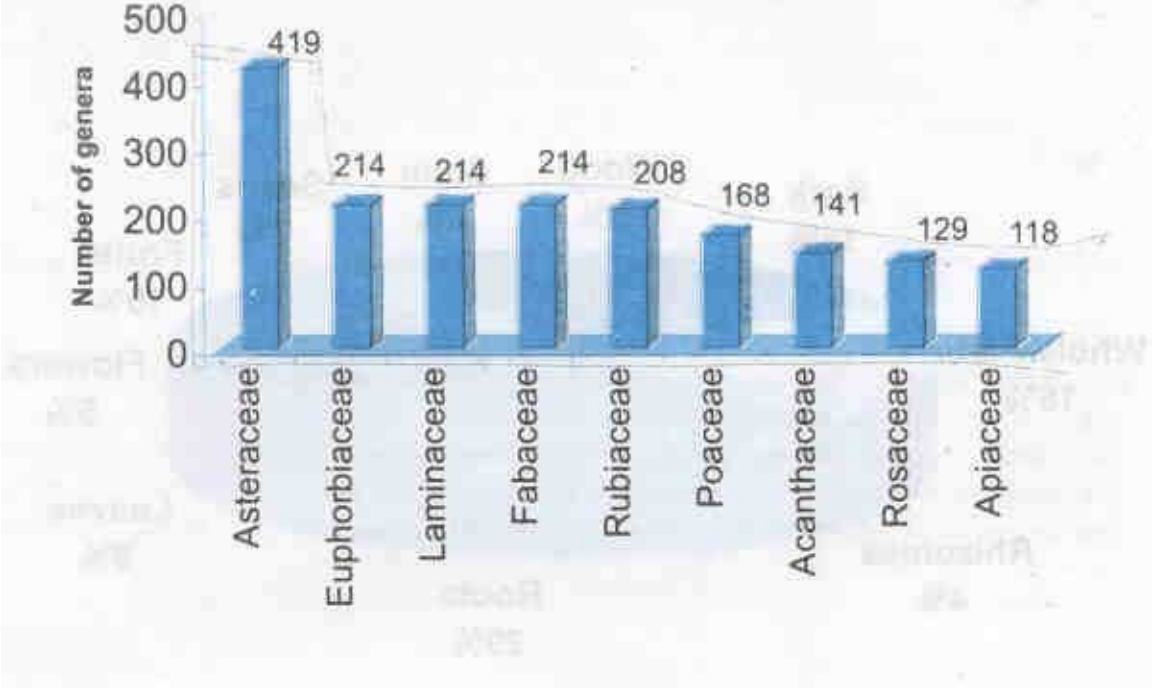
Analysis of habits of medicinal plants indicate that they are distributed across various habitats. One third are trees and an equal portion shrubs and the remaining one third herbs, grasses and climbers. A very small proportion of the meidicinal plants are lower plants like lichens, fern algae, etc. Majority of the medicinal plants are higher flowering plants. (See figure 3)

Figure 3 - Distribution of medicinal plants by habits



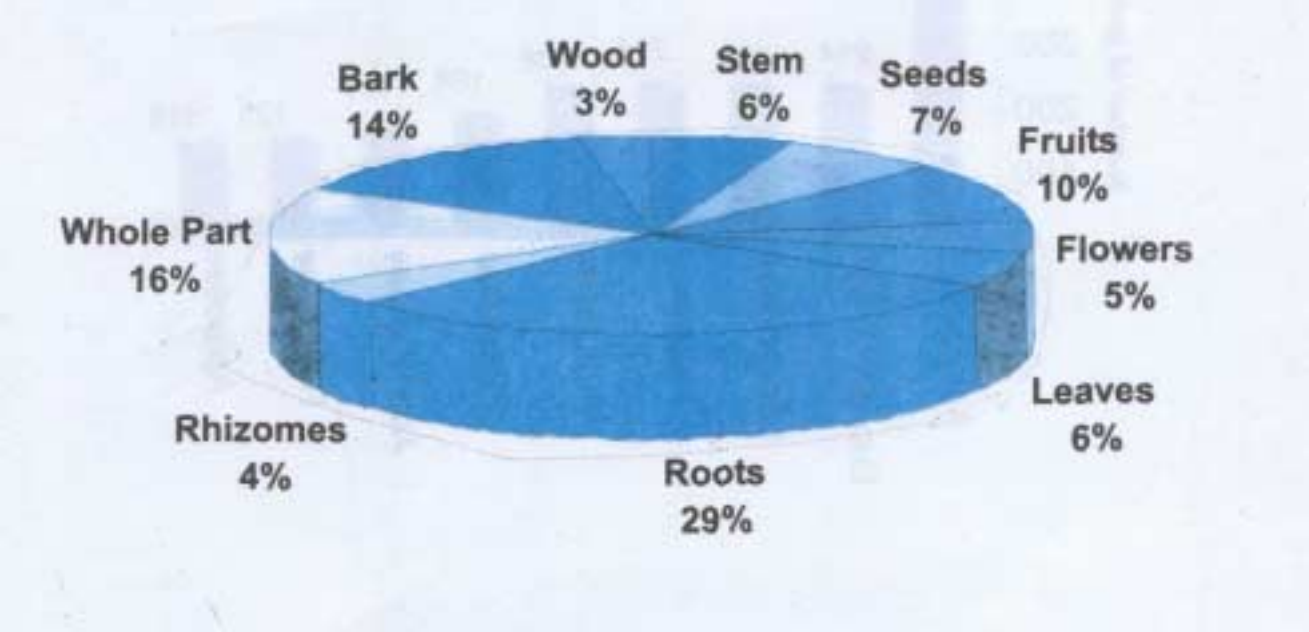
Of the 386 families and 2200 genera in which medicinal plants are recorded, the families Asteraceae, Euphorbiacae, Laminaceae, Fabaceae, Rubiaceae, Poaceae, Acanthaceae, Rosaceae and Apiaceae shore the larger proportion of medicinal plant species with the highest number of species (419) falling under Asteraceae (see fig.4)

Figure 4 - Distribution of medicinal plant by families



About 90% of medicinal plant used by the industries are collected from the wild. While over 800 species are used in production by industry, less than 20 species of plants are under commercial cultivation. Over 70% of the plant collections involve destructive harvesting because of the use of parts like roots, bark, wood, stem and the whole plant in case of herbs (See figure 5). This poses a definite threat to the genetic stocks and to the diversity of medicinal plants if biodiversity is not sustainably used.

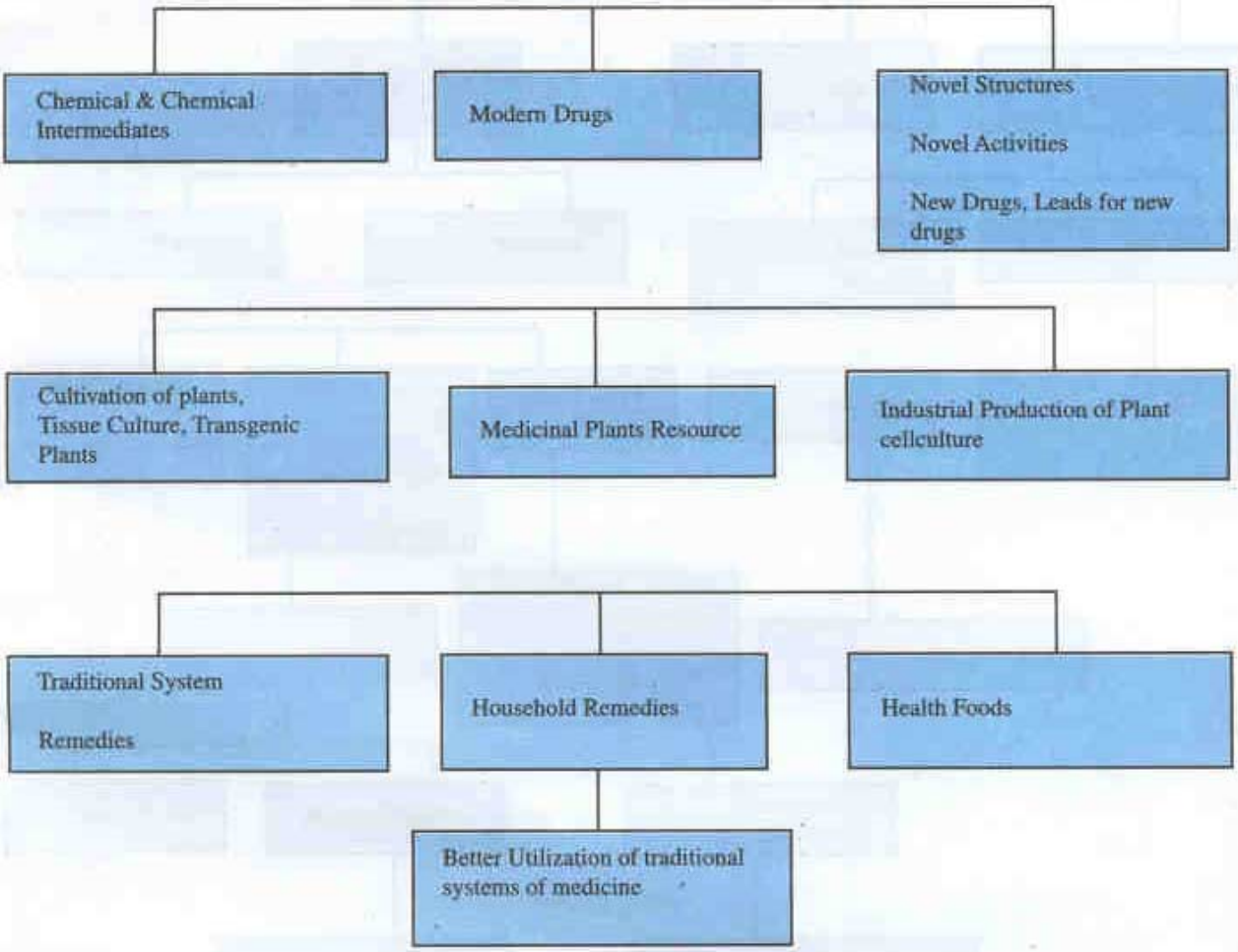
Figure 5 - Break up of medicinal plant by their parts utilised



Crude Drugs & Phytochemicals

Crude drugs are usually the dried parts of medicinal plants (roots, stem wood, bark, leaves, flowers seeds, fruits, and whole plants etc.) that form the essential raw materials for the production of traditional remedies of Ayurveda, Siddha, Unani, Homeopathy, Tibetan and other systems of medicine including the folk, ethno or tribal medicines. The crude drugs are also used to obtain therapeutically active chemical constituents by specialised methods of extraction, isolation, fractionation and purification and are used as phytochemicals for the production of modern allopathic medicines or herbal/phytomedicines. Various uses of medicinal plants are shown in figures 6 & 7.

Figure 6 - Drugs from plants



→ Quality Control Standards

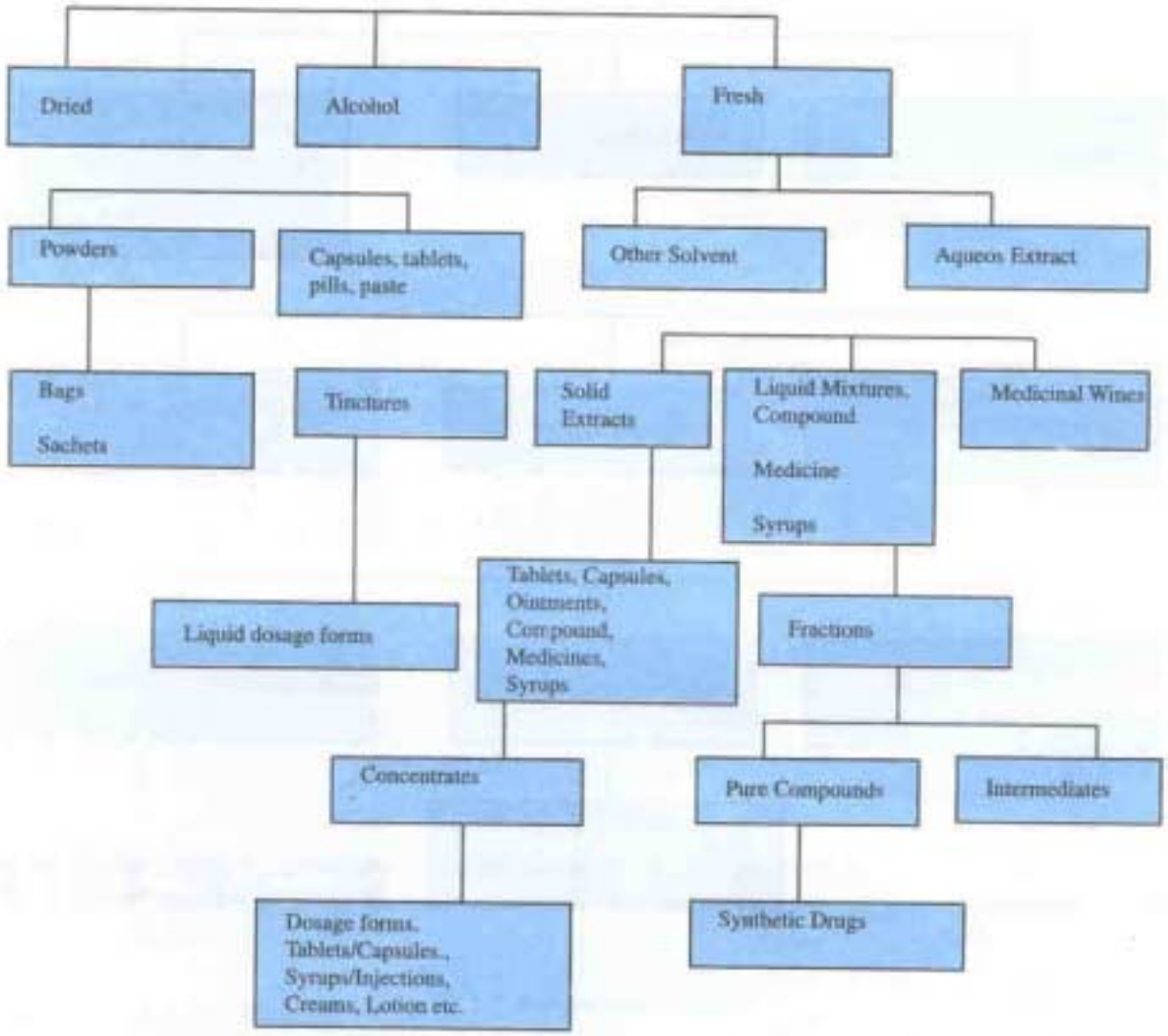
→ Modernization of Methods of Production

→ New Dosage forms & Pharmacokinetics

→ Safety of Drugs used in Chronic Diseases

→ Integration with Modern Medicine

Figure 7 - Medicinal plants parts/whole



C Commination
Ch Chemical Modifications
E Evaporation
Ex Extraction
F Formulation
Fe Fermentation
P Purifications
S Separation

Medicinal Plant Resource Base

Medicinal plants are living resource, exhaustible if overused and sustainable if used with care and wisdom. At present 95% collection of medicinal plant is from wild. Current practices of harvesting are unsustainable and many studies have highlighted depletion of resource base. Medicinal plants based industries although old and vast are still being managed on traditional ethos and practices and lack a proactive and socially responsible image. Many studies have confirmed that pharmaceutical companies are also responsible for inefficient, imperfect, informal and opportunistic marketing of medicinal plants. As a result, the raw-material supply situation is shaky, unsustainable and exploitative. There is a vast, secretive and largely unregulated trade in medicinal plants, mainly from the wild which continues to grow dramatically in the absence of serious policy attention with environmental planning. Confusion also exists in the identification of plant materials where the origin of a particular drug is assigned to more than one plant, sometimes having vastly different morphological and taxonomical characters. There are few others, where the identity of plant sources is doubtful or still unknown, therefore, adulteration is common in such cases.

The true source of the crude drug in such cases can be located only after detailed chemical and pharmacological studies. Detailed chemical investigation on Bacopa monnieri and Centella asiatica, the two plants variously described the name "Brahmi" has revealed entirely different phytochemical composition. The former contains alkaloids brahrnine, herpestine, gama amino butyric acid and bacoside A & B which have been found to have important action on brain function, while Centella asiatica contains asiaticoside, brahmoside, hydrocotyline etc. which have hardly common relationship with the properties ascribed to the drug "Brahmi" in the text.

The quality of medicinal plants depends on the geographical origin, time and stage of growth when collection has been done and post harvest handling. The collections in most cases are done by villagers tribals residing in the vicinity of forest in their spare time. The plant part is collected without paying attention to the stage of maturity, dried haphazardly and stored for long periods under unsuitable conditions. The quality of collected material, as such is often degraded.

Trade in medicinal plants at all levels in India is marked by secrecy and opacity in working. The trader views common survey with suspicion. There has been little attempt at external regulation by Government and self-regulation by traders and herbal medicine company. However it is in the best interest of the industry to develop a long term "social contract" with the collectors or growers & buyers.

Collection of Non Timber Forest Product (NTFP), which includes most of the medicine plants, is a way of life with tribal and rural communities in an around the forest. As the prices paid to the gatherers tend to be very low they often "mine" the natural resources as their main objective is to generate an income. A critical factor in the wild harvesting is the availability of cheap labour to undertake the very labour intensive work of gathering. As in many cases income from such sources represents the only form of paid employment for rural and tribal people, there is an eagerness to undertake such work.

Several medicinal plants have been assessed as endangered, vulnerable and threatened due to over harvesting or unskillful harvesting in the wild. Habitat destruction in the form of deforestation is an added danger. The Government of India has put 29 species in the negative list of export which are believed to be threatened in the wild. (See annexure - III)

The other main source of medicinal plant is from cultivation. Cultivated material is infinitely more appropriate for use in the production of drugs. Indeed, standardisation whether for pure products, extracts or crude drugs are critical and while become increasingly so, as quality requirements continue to become more stringent.

Given the higher cost of cultivated material, cultivation is often done under contract. In the majority of cases, companies would cultivate only those plant species which they use in large quantity or in the production of derivatives and isolates, for which standardisation is essential and quality is critical. More recently growers have set up cooperatives or collaborative ventures in an attempt to improve their negotiating power and achieve higher price.

Some of the constraints associated with the processing of medicinal plants which may result in reducing their competitiveness in global markets and which have to be remedied are:-

- Poor agricultural practices
- Poor harvesting (indiscriminate) and post-harvest treatment practices
- Lack of research on development of high-yielding varieties, domestication etc.
- Poor propagation methods
- Inefficient processing techniques leading to low yields and poor quality products
- Poor quality control procedures
- High energy losses due to processing
- Lack of current good manufacturing practices
- Lack of R&D on product and process development
- Difficulties in marketing
- Lack of local market for primary processed products
- Lack of trained personnel and equipments
- Lack of facilities to fabricate equipment locally
- Lack of access to latest technologies and market information

Systematic cultivation of many medicinal plants needs specific cultural practices and agronomical requirements. These are species-specific and are dependent on soil, water and climatic conditions. Hence research and development work has to be done to formulate good agricultural practices which will include appropriate selection and identification, propagation methods, cultivation techniques, harvesting, stepwise quality control of raw material upto processing stage, post-harvest treatment, storage and safety. These aspects have to be incorporated into protocols for the cultivation of medicinal plants;

Organic farming is another practice that is gaining wide acceptance as world demand particularly in developed countries for organically grown crops is rapidly on the increase. Farmers have to be trained in all aspects of organic farming of medicinal plants including obtaining certification from associations that do the monitoring starting from cultivation to final harvesting. Organic farming which is labour-intensive gives the developing countries the comparative advantage to be competitive.

Conservation of Medicinal Plant Resources In-situ conservation

It will be necessary, based on an understanding that where medicinal plants are currently distributed, to develop novel programmes for their in-situ conservation and to designate specific genetic reserves. This intervention also applies to timber species as well as wild relative of crops, and current government activities relating to protected areas may need to be modified in order to accommodate these species. The implementation of Joint Forest Management Scheme in these areas could be a logical approach to use, given the viability of medicinal plants for generating income as well as rehabilitating degraded lands. Due to their position as the major stewards of the resource base women and tribal groups, especially, should be given some control over these lands.

The project adopted should encompass existing initiatives introduced by organisations such as FRLHT, Bangalore and UTTHAN, Allahabad etc. In addition, these in-situ conservation areas should be made to serve several functions such as the provision of education and awareness building, as well as training for sustainable harvesting methods.

Ex-situ Conservation

Several medicinal plants are already threatened, rare, or endangered. In addition, the "precautionary principle" applies to those where status is currently unknown and to segments of germpools. There is an immediate need to consolidate and finally link the existing herbal gardens and gene banks as well as reference specimens in herbaria to ensure that the 540 species of importance in the major classical systems, as well as those supplied to the international market, are protected in ex-situ reserves. This requires strategic planning since the range of germplasm obtained for each species must be representative. Plant collections need to evolve from being species reference collections to being genetic resources collections.

Promotion & Development Of Processing Of Plant Base Products

The promotion and development of processing of plant-based products have been given a fresh impetus due to certain ground realities:-

- Green consumerism and the current resurgence of interest in the use of 'Naturals' in developed countries.
- Free market economy bringing in more openness and expanding market and demand for new resources, materials and products
- A growing acceptability of the social responsibility of minimising socio-economic inequalities in favour of rural people resulting in creating additional job and income opportunities for poor people.
- Poor economic conditions in the developing countries restricting import, thereby placing increase reliance on medicines using local plant resources.

- Increasing awareness regarding biodiversity conservation and the sustainable and protective use of plant resources.

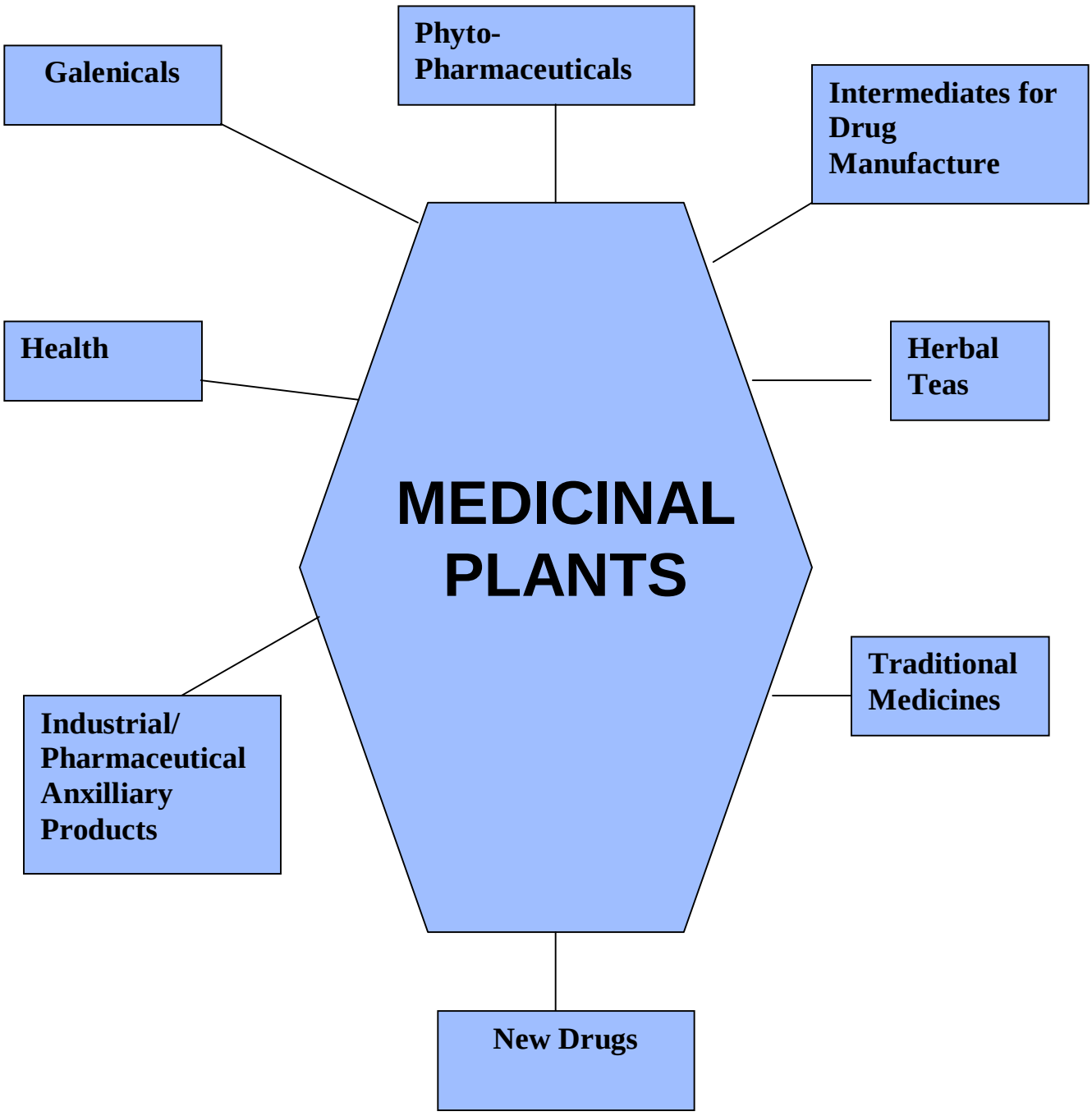
- Search for new phytopharmaceuticals for the prevention and cure of the deadly diseases such as cancer and AIDS.

Value Added Products From Medicinal Plants

Tradtional Medicines - Modern Technology

The medicines for internal use prepared in the traditional manner involve simple methods such as hot- or cold-water extraction, expression of juice after crushing, powdering of dried material, formulation of power into pastes via such a vehicle as water, oil or honey, and even fermentation after adding a sugar source. The range of products that could be obtained from medicinal plants is given in Figure-8.

Figure 8 - Industrial uses of medicinal plants



Traditional herbal medicines were produced using age old methods by the practitioner him/herself who was able to identify the correct plant species. This practice of the traditional practitioner dispensing his own medicines is being gradually shifted to herbal drug stores which are profit-oriented. As a result, there is no guarantee of the authenticity and quantity of plant material used in the preparations. The quality of traditional medicines so produced vary widely and may not even be effective. Therefore, there is a need to select proper and appropriate technologies for the industrial production of traditional medicines such that the effectiveness of the preparation is maintained. Traditional methods used have many disadvantages which could be corrected by selecting the suitable technologies. It has to be stated that the traditional methods were dependent on the status of technology that was available at that time. It therefore follows that these can be modified and improved using the technologies available today to make them more effective, stable, reproducible, controlled and in dosage forms that can easily be transported or taken to office.

Hence the introduction of appropriate, simple and low-cost technologies should be encouraged maintaining as much as possible the labour-intensive nature of such activities, conservation of biodiversity through small-scale production and preservation of cultural knowledge. Use of sophisticated modern technology will alienate the traditional practitioners as he has no control over such production methods. Even in the use of appropriate technologies, the practitioner who produces these drugs has to be educated about the advantages of using such production and quality control methods.

One major concern in introducing modern technology for the production of traditional medicines is whether the final preparation will be acceptable to the practitioner who has sole faith in extemporaneous preparations. This problem has to be overcome by a process of education, whereby the disadvantage of the old methods and the advantage of the new methods can be imparted.

The value of medicinal plant as a source of foreign exchange for developing countries depends on the use of those plant as raw materials in the pharmaceutical industry. These raw materials are used to:

- Isolate pure active compounds for formulation into drugs (guinini, reserpine, digoxin etc.)
- Isolate intermediates for the production of semi-synthetic drugs
- Prepare standardised galenicals (abstracts, powders, tinctures etc.) If one is to produce known pure phytopharmaceutical used in modern medicine more processing stages and more sophisticated machinery are required. Furthermore safety and pollution aspects have to be considered.

Certain plants are rich sources of intermediates used in the production of drugs. The primary processing of parts of plants containing the intermediate could be carried out in the country of origin thus retaining some value of the resource material.

Processed products (galenicals) from plants could be standardised fluid/ solid extracts or powders or tinctures. Standardised extracts of many plants are widely used in health care. Some of these have to be formulated for incorporation in modern dosage forms. New formulations require some development work, particularly on account of the nature of the processed products. Plant extracts are difficult to granulate, sensitive to moisture and prone to

microbial contamination. Hence the types of excipients to be used and the processing parameters have to be determined.

Quality Assurance & Standard Preparation

The control of the quality of the raw materials, finished products and of processes is an absolute necessity if one is to produce goods for world market and human consumption.

International Standard Specifications exist for some processed products and some countries and buyers have their own requirements. The quality requirements for medicinal plant preparations are stringent in terms of content of active principles and toxic materials. Whereas the production of traditional medicines for local use does not require such stringent standard, what is produced will be a much more improved version of the already produced medicines using traditional methods.

Quality has to be built into the whole process beginning from the selection of propagation material to the final product reaching the consumer. It is, therefore, a management system where all steps involved in the industrial utilisation process have to be properly and strictly controlled to produce the desired quality products. All elements of Total Quality Management (TQM) have to be introduced in any industrial project. The requirements for ISO 9000 certification and Good Manufacturing Practices (GMP) have to be introduced and the personnel trained so that enterprises could introduce the proper systems needed for certification. Furthermore eco-audit procedures (ISO 14000) leading to eco-labelling will be required for safeguarding environmental damage.

Registration & Property Rights

WHO has published guidelines for the assessment of herbal medicines taking into account long and extensive usage of them (WHO, 1999). These guidelines should encourage developing countries to relax some of the current regulations to be realistic in recognising the role of traditional medicines in the health care delivery of their countries.

Attempt should be made to identify traditional health practices and knowledge relating to process and products of medicinal plants and the information should be digitised and put on computer. Wherever possible patents may be obtained for the process and products of medicinal plants.

The vital question of property right to developing countries for the use of know-how and genetic resources in the development of modern drugs has to be discussed and a final solution to be derived.

Marketing

Marketing is an unsurmountable problem besetting the development of the plant-based industry in developing countries and marketability will be a crucial factor in determining the failure or success of these industries. The market outlets can be for local use and for export. As

for local use some products could reach the consumer directly while others have to be either further processed or used as secondary components in other industrial products. Hence user industries have to be promoted so that locally produce extracts can be used to save foreign exchange needed for importation of such additives.

Further processing to yield value added products will be limited by the local demand situation unless they could be produced at prices to be competitive in the world market. Even if the cost of production is low and quality of the products is good, substantial market promotion has to be undertaken in order to penetrate the world market.

A clear understanding of both the supply-side issues and the factors driving the demand and size of the medicinal plant market is a vital step towards planning for both the conservation and sustainable use of the habitats of these plants as well as for ensuring continued availability of the basic ingredients used to address the health needs of the majority of the world's population.

Conclusion

Medicinal plants constitute a vast, undocumented and overexploited economic resource and they are the principal health care resource for the majority of the people. Communities and herbalists use medicinal plants in promoting and maintaining health of majority of population of most countries in the South. Demand for herbal medicines in the North has led to significant changes in traditional patterns of medicinal plants trade.

Thus demand for medicinal plant is increasing in both developing and developed countries, and the bulk of the material trade is still from wild harvested sources on forest land and only a very small number of species are cultivated. The expanding trade in medicinal plants has serious implications on the survival of several plant species, with many under serious threats to become extinct. A holistic management action plan is necessary to formulate for assessment and management of resource base; best harvesting and processing practices; trade issues and aspects dealing with the intellectual property rights on the traditional medicines by the tribal people.

Investments are needed for the development of appropriate conversation, cultivation harvesting strategies, which will simultaneously meet the demand for low-cost and locally available medicines. At the same time, there must be immediate effort to ensure the conservation of diverse biological resources and the preservation and application of local cultural knowledge on the use of these resources. The subsequent chapters will deal various issues connected with integrated development of medicinal plants sector.

Chapter - II

MEDICINAL PLANTS
CONSERVATION AND DEVELOPMENT

Medicinal plants continue to be an important therapeutic aid for alleviating ailments of humankind. Search for eternal health and longevity and to seek remedy to relieve pain and discomfort prompted the early man to explore his immediate natural surrounding and tried many plants, animal products and minerals and developed a variety of therapeutic agents. Over millenia that followed the effective agents amongst them were selected by the process of trial, error, empirical reasoning and even by experimentation. These efforts have gone in history by the name discovery of 'medicine'.

In many eastern cultures such as those of India, China and the Arab/Persian world this experience was systematically recorded and incorporated into regular system of medicine that refined and developed and became a part of the Materia Medica of these countries. The ancient civilization of India, China, Greece, Arab and other countries of the world developed their systems of medicine independent of each other but all of them were predominantly plant based. But the theoretical foundation and the insights and indepth understanding on the practice of medicine that we find in Ayurveda is much superior among organized ancient systems of medicine. From history we learn that in the ancient times India was known as a place of rich natural resources, knowledge, wisdom and scholarship. People from other countries of the world as China, Cambodia, Indonesia and Baghdad used to come to the ancient universities of India like Takshila (700 BC) and Nalanda (500 BC) to learn health sciences of India, particularly 'Ayurveda'. It is perhaps the oldest (6000 BC) among the organized traditional medicine. It has gone through several stages of development in its long history. It spread with Vedic, Hindu and the Buddhist cultures and reached as far as Indonesia in the east and to the west it influenced the ancient Greek who developed a similar form of medicine.

All Systems of Medicine in India functions through two social streams:

Folk Stream: Comprising mostly the oral traditions practiced by the rural villages. The carriers of these traditions are millions of housewives, thousands of traditional birth attendants, bone setters, village practitioners skilled in accupressure, eye treatments, treatment of snake bites and the traditional village physicians/herbal healers, the vaidyas' or the tribal physicians. This stream of inherited traditions are together known as Local Health Traditions (LHT). LHT represent an autonomous community supported health management system which efficiently and effectively manage the primary health care of the Indian rural mass. LHT is still alive and runs parallel to the state supported modern health care system; but its full potential is still not fully utilized and also that the great service it is rendering to the rural people go largely unnoticed because of the dominant western medicine.

Classical stream: At the second level of traditional health care system is the scientific or classical systems of medicine. This comprises of the codified and organized medicinal wisdom with sophisticated theoretical foundations and philosophical explanations expressed in classical texts like [x]Charka Samhita', 'Sushruta samhita', 'Bhela samhita', and hundreds of other treatises including some in the regional languages covering treaties of all branches of medicine and surgery. Systems like Ayurveda, Siddha, Unani, Amchi and Tibetan, etc. are expressions of the same. Ayurveda was taught in the ancient universities in India and evolved, developed and flourished mostly among the urban centres and thus used to be a refined system of medicine.

Revival Of Traditional Medicine

Today we find a renewed interest in traditional medicine. During the past decade there have been an ever increasing demand especially from developed countries for more and more drugs from plant sources. This revival of interest in plant derived drugs is mainly due to the current widespread belief that green medicine' is safe and more dependable than the costly synthetic drug many of which have adverse side effects. This resurgence of interest in the plant based drugs have necessitated an increased demand of medicinal plants leading to over-exploitation, unsustainable harvesting and finally to the virtual decimation of several valuable plant species in the wild. Moreover, the habitat degradation due to increased human activities (human settlements, agriculture and other developmental programmes), illegal trade in rare and endangered medicinal plants, and loss of regeneration potential of the degraded forests have further accelerated the current rate of extinction of plants particularly the medicinal plants.

Medicinal Plants Wealth of India

India is rich in medicinal plant diversity. All known types of agroclimatic, ecologic and edaphis conditions are met within India. The biogeographic position of India is so unique that all known types of ecosystems ranging from coldest place like the Nubra Valley with - 57° C, dry cold deserts of Ladakh, temperate and Alpine and subtropical regions of the North-West and trans-Himalayas, rain forests with the world's highest rainfall in Cheerapunji in Meghalaya, wet evergreen humid tropics of Western Ghats, arid and semi-arid conditions of Peninsular India, dry desert conditions of Rajasthan and Gujarat to the tidal mangroves of the Sunderban. India is rich in all the three levels of biodiversity-such as species diversity, genetic diversity and habitat diversity. There are about 426 biomes representing different habitat diversity that gave rise to one of the richest centres in the world for plant genetic resources. The total number of flowering plant species although only 17,000, the intraspecific variability found in them make it one of the highest in the world. Out of 17,000 plants, the classic systems of medicines like Ayurveda, Siddha and Unani make use of only about 2000 plants in various formulations. The classical traditions were prevalent in the past particularly in the urban elite society. The rural people who constitute 70 to 75% of the Indian populations live in about 5,76,000 villages located in different agroclimatic conditions. The village people have their own diverse systems of health management. While most of the common ailments were managed in the house by home remedies which included many species and condiments like pepper, ginger, turmeric, coriander, cumins, tamarind, fenagree, tulsi, etc., more complicated cases were attended by the traditional physicians who use a large number of plants from the ambient vegetations and some products of animal or mineral origin to deal with the local diseases and ailments. These are indeed community managed systems independent of official or government system and are generally known as Local health Tradition (LHT). The traditional village physicians of India are using about 4500 to 5000 species of plants for medicinal purpose. There is however no systematic, inventory and documentation about the folk remedies of India. There is urgent need to document this fast disappearing precious knowledge system. The oral traditions of the villagers use about 5000 plant for medicinal purposes. India is also inhabited by a large number of tribal communities who also posses a precious and unique knowledge about the use of wild plants for treating human ailments. A survey conducted by the All India Coordinated Research Project on Ethnobiology (AICRPE) during the last decade recorded over 8000 species of wild plants used by the tribals and other traditional communities in India for treating various health problems. Some interesting observations made in the study is the use of the same species found in different regions for the same ailments while some other species are used differentially.

Conservation of Medicinal Plants: Strategies & Priorities

The world conservation strategy (IUCN, UNEP & WWF, 1980) defines conservations as "the management of human use of the biodiversity so that it may yield the greatest sustainable benefit to present generation while maintaining its potential to meet the needs and aspirations of future generations". The above definition invokes two complementary components "conservation" and "sustainability". The primary goals of biodiversity conservation as envisaged in the World Conservation Strategy can be summarised as follows:

1. Maintenance of essential ecological processes and life support systems on which human survival and economic activities depend,

2. Preservation of species and genetic diversity and

3. Sustainable use of species and ecosystems which support millions of rural communities as well as major industries.

Medicinal plants are potential renewable natural resources. Therefore, the conservation and sustainable utilisation of medicinal plants must necessarily involve a long term, integrated, scientifically oriented action programme. This should involve the pertinent aspects of protection, preservation, maintenance, exploitation, conservation and sustainable utilization. A holistic and systematic approach envisaging interaction between social, economic and ecological systems will be a more desirable one. The most widely accepted scientific technologies of biodiversity conservation are the in-situ and ex-situ methods.

In-Situ Conservation

In has been well established that the best and cost-effective way of protecting the existing biological and genetic diversity is the 'in-situ' or on the site conservation wherein a wild species or stock of a biological community is protected and preserved in its natural habitat. The prospect of such a 'ecocentric', rather than a species centred approach is that it should prevent species from becoming endangered by human activities and reduce the need for human intervention to prevent premature extinctions. Establishment of biosphere reserves, national parks, wild life sanctuaries, sacred groves and other protected areas forms examples of 'in-situ' methods of conservation. The idea of establishing protected area network has taken a central place in all policy decision process related to biodiversity conservation at national, international and global level.

In India 4.5% of its total geographical area constitute protected area network, comprising 8 designated biospheres, 87, national parks, 447 wild life sanctuaries. This network encompasses various biogeographic zones and biomes rich in biotic diversity, including medicinal and aromatic plants. In addition to these there area number of sacred groves in different parts of the country particularly in South, West and Eastern parts which are also active centres on in-situ conservation of medicinal plants. Such conservation area network can attribute significantly towards the conservation and sustainable management of biological resources of our country.

However, experiences have amply demonstrated that in a densely populated developing country like India, where a sizeable population are living in close proximity to forests, declaring protected areas will not entirely be sufficient to ensure conservation on the fast eroding biological diversity. The success of any conservation programme vests solely on the efficient management of protected areas. The involvement of local communities in conservation activities

has now been increasingly realised. A people nature-oriented approach thus become highly imperative. This will help to generate a sense of responsibility among the local people about the values of biodiversity and the need to use it sustainably for their own prosperity and the maintenance of ecosystem resilience.

In-situ conservation of medicinal plants in India can be accomplished through the active support and participation of people who dwell in or near and around the protected forest areas. Involving the local mass in all phases of conservation programmes, such as planning, policy^decision process, implementation etc. will be a significant component in achieving efficient management and utilization of medicinal plant resources. A few such in-situ conservation areas have been marked anci declared as medicinal plant in-situ conservation areas on the forests of three Southern States of Kerala, Tamilnadu and Karnataka by the joint efforts of the forest departments of these States and FRLHT, Bangalore.

Ex-Situ Conservation

Conservation of medicinal plants can be accomplished by the ex-situ i.e. outside natural habitat by cultivating and maintaining plants in botanic gardens parks, other suitable sites, and through long term preservation of plant propagules in gene banks (seed bank, pollen bank, DNA libraries, etc.) and in plant tissue culture repositories and by cryopreservation).

Botanical gardens can play a key role in ex-situ conservation of plants, especially those facing imminent threat of extinction. Several gardens in the world are specialised in cultivation and study of medicinal plants, while some contain a special medicinal plant garden or harbour special collection of medicinal plants.

India has a network of about 140 botanical gardens which include 33 botanical gardens attached to 33 universities botany departments. But hardly 30 botanical gardens have any active programme on conservation. Tropical Botanical Gardens & Research Institute (TGBRI), located in a degraded forest region of Western Ghat mountains in Kerala has an excellent example in ex-situ conservation of plant diversity in India. The field gene bank programme launched by TBGRI from 1992-1999 is now well acclaimed as a very effective method of conservation of medicinal and aromatic plant genetic resources. This field gene bank of medicinal and aromatic plants at TBGRI, Thiruvananthapuram is essentially a blend of the ex-situ and in-situ situations.

Field gene bank of medicinal plants: The concept of establishing field gene banks of plants provide ample options for long term preservation of the genetic variability (inter-specific) of species. Field gene banks are better established in a degraded forests where efforts could be made to reforest/restock the missing species complexes, trees, shrubs, herbs, climber etc. It is indeed a recreation of a forest or rather simulation of a typical forest. Before attempting to establish such a field gene bank it is essential to have a clear understanding of the natural ecosystem such as the spatial distribution, pattern of association i.e., structure and functional dynamics of the species in question. After undertaking an indepth study on the natural distribution pattern of the medicinal plants and the associated floristic elements - including their micro-ecological niche, a well planned action programme of recreating the same in a degraded forest area or place close to the species found in nature can be attempted. TBGRI has accomplished this task of simulating the nature while establishing the field gene bank of medicinal and aromatic plants under the G-15-GBMAP sponsored by DBT, Government of India, TBGRI experience now provide ample opportunity to repeat the same elsewhere in the country.

Identification of the keystone species and umbrella species are very important in this methods. After planting the keystone and umbrella species, other species complex which include the medicinal aromatic plants in question have to be introduced. The sampling and selection of samples for introduction have to be highly knowledge and science intensive. To capture the maximum possible genetic diversity of the target species it is extremely important to collect all valuable information such as morphological variants, chemical variants or genetic variants or chemical screening of the population of the targeted species by using the latest methods and tools.

The field gene bank of TBGRI has covered 30,000 accessions of 250 medicinal and aromatic plant species which include 100 endemic, rare and endangered medicinal and aromatic plants of the tropical region of India. A broad spectrum of the genetic diversity of these species were captured and introduced in this gene bank which covered morphotypes, cytotypes and chemotype and the number of samples from each species varied from 50-1000 plants.

Schemes of Ministry of Environment & Forests under Implementation-On-Going Schemes

National Parks and Sanctuaries

The National Parks and Wildlife Sanctuaries are protected areas encompassing the Biological Diversity in its pristine condition. At present there are 87 National Parks and 447 Wildlife Sanctuaries extending over an area of about 1.5 lakh sq. Km, which is more than 4.5% of the genographical area of the country. The National Parks stretch over 34,819 Sq. Km while the Sanctuaries cover an area of 1,15,903 Sq. Km.

A centrally sponsored scheme for the development of National Parks and Sanctuaries is in operation since VI Plan period. The main objective of the scheme is to support protection and conservation measures in these areas with a view to mitigate any adverse impact of biotic pressure and allowing the areas to rejuvenate through habitat manipulation and infrastructure development. During the VIII Plan Rs. 49.5 crores have been spent under this scheme and for IX Plan the outlay is Rs. 110 crores. Assistance is also provided for eco-development programmes around National Parks and Sanctuaries in order to achieve a ecologically sustainable economic development.

These protected areas harbour large varieties of medicinal plants. In-situ conservation programmes for medicinal plants in the National Parks and Sanctuaries could be taken up through Chief Wild Life Wardens. The programme needs to be in consonance with the objectives of the national parks and Sanctuaries.

Ethnobiological Studies

An All India Coordinated Research Project of Ethnobiology (AICRPE) under the Man and Biosphere was funded by the Ministry of Environment and Forests. The programme was executed by Tropical Botanical Garden Research Institute, Thiruvananthapuram and in association with other institutions such as Central Drug Research Institute (CDRI), Lucknow, Ethnobiology and Plant Systematic Laboratory, Garhwal, Botanical Survey of India, International Institute of Ayurveda, Coimbatore, etc. The first phase of the programme was completed in 6 years and was extended into the second phase. The study has covered about 80% of the tribal areas.

The data recorded on Indian ethnobiology is invaluable giving a status on the tribal communities along with the information on the ethnobiological inventorisation and their documentation. The study provides information on the wild plants used by the tribal communities as food, fodder etc., which also includes a large number of medicinal plants. The study reveals the sustained usage of the local resources and the natural system of conservation. However, this natural balance is being disturbed due to the intervention by other communities exploiting the medicinal plant resources. Data obtained from this study needs to be used in the process of planning and programme to conserve the rich biodiversity in our country. The focus on the medicinal plants resources and further investigation in these areas may lead to concrete programme for the conservation of medicinal plants.

Sacred Groves

There is no separate scheme for the Conservation or restoration of sacred groves under National Afforestation and Eco-development Board (NAEB). Documentation of the Sacred Groves have been carried out by the Regional Centres of the NAEB under the scheme to "Support to Regional Centres". There are seven regional centres and their activities include helping the State/UT Forest Departments and Forest Development Corporation in formulation of projects, conduct study research and educational programmes for the protection, development and improvement of forest area and the degraded forest areas.

Some Regional Centres have taken up the studies on the Sacred Groves under the forest protection and documentation. Such studies are proposed in the Annual Work Programme to the NAEB. The cost of the documents prepared are fixed on a case by case basis. The Work done so far included.

S.No.	Sacred Grove	Regional Centre	Year
1	Study of sacred grove in Kurukshetra	AFC, Delhi	1996
2	Sacred Groves of Rajasthan-relevance to afforestation and eco-development	AFC, Delhi	1997
3	Study of sacred groves in Varanasi and Mathura districts of U.P.	AFC, Delhi	n.a.
4	Study of sacred groves of Karnataka, Kerala and Tamilnadu	U.A.S, Bangalore	1997
5	Sacred groves in Bihar	Jadavpur University, Calcutta	1996
6	Sacred groves in Himachal Pradesh	UHF, Solan	n.a
7	Sacred groves of Eastern M.P.	IIFM, Bhopal	1997
8	Sacred groves of Meghalaya	NEHU, Shilong	1995
9	Study on the status and regeneration of forest trees in the sacred groves of Khasi Hills	NEHU, Shilong	1996

Studies have also been conducted by NGOs and research organisations to evaluate the status of sacred groves. The C.P.R Environmental Education Centre, Chennai is one of such an autonomous Centre of excellence of the Ministry of Environment & Forests. They have published books on the Sacred Trees of Tamilnadu and Ecological Traditions of Tamilnadu. A UNESCO study on the sacred groves of India provides a comprehensive picture of these groves along with their status. Some of the large groves and community associated

with them have been presented as case studies. However, a systematic nationwide survey of sacred groves have not been undertaken to account for the status of these groves in terms of the conservation of biological diversity and the traditional particular of the community. The most important of all is the legal status and ownership of the grove. The changing pattern of life styles and religious beliefs are also responsible for the deteriorating conditions of some of the groves.

NAEB's Scheme on Non-Timber Forest Produce including Medicinal Plants

Forest areas are the main source of medicinal plants, particularly the undisturbed natural forests. The medicinal plants from forests form an important component of the Minor Forest Produce, otherwise known as Non-Timber Forest Produce. Extraction of such produce including the medicinal plants from these areas is a traditional right of the local communities/tribals.

The National Afforestation and Eco-development Board (NAEB) has a mandate of promoting afforestation, tree planting, ecological restoration and eco-development activities in the country. Special attention is given to the regeneration of degraded forest areas and lands adjoining forest areas, national parks, sanctuaries and other protected areas as well the ecologically fragile areas like the Western Himalayas, Aravallis, Western Ghats etc.

A Centrally Sponsored Scheme of Minor Forest Produce was started in 1988-89 (Seventh Plan). The scheme provides 100% central assistance to the States and included following activities:-

a. Mixed plantation of bamboo with fruit bearing species (harra, imli, mahua, char, aam etc. and oilseed bearing trees;

b. Plantation of tendu bushes under light canopy of trees;

c. Plantation of cane;

d. Cultivation of medicinal plants like Rauwolfia spp, Dioscorea spp to augment the rising demand for plant-based drugs and to offfest the scarcity because of unscientific exploitation;

e. Cultivation of rosha grass/lemon grass.

During the Ninth Five Year Plan, the scheme is being operated in 25 States. The financial allocation is Rs. 80.50 crores. The grant released during 1997-98 and 1998-99 was Rs. 7.50 crores and Rs. 10.00 crores respectively. The outlay for 1999-2000 is Rs. 12 crores.

The main objectives of the scheme are:-

i. Conservation and improvement of the non-timber forest produce, including medicinal plants;

ii. Increasing the production of and replenishing the stock of non-timber forest produce and medicinal plants; and

iii. Providing additional income to the tribals and the rural poor living in and around forests.

Forest Departments and Forest Development Corporation in States and Union Territories are the nodal agencies for implementation of the scheme. Project areas are confined mainly to recorded forest land.

JFM is a central and integral part of all plantation projects. The project authorities are being given adequate leverage by way of "entry-point activites" and requisite funds for building awareness amongst communities. In the selection of the project sites, gram panchayats or other village bodies are to be associated in project preparation, implementation and usufruct sharing in consonance with provisions of the Forest (Conservation) Act, 1980 and the guidelines issued in June, 1990.

UNDP-CCP I assisted Sub-Programme on "Medicinal Plants Conservation and Sustainable Utilisation"

A UNDP Country Cooperation Programme assisted Sub-programme on "Medicinal Plants Conservation and Sustainable Utilisation" has been approved and initiated in December, 1999. Foundation for Revitalization of Local Health Health Traditions (FRLHT), Bangalore has been designated as the co-ordinating agency. This is a demonstration project to replicate the activities being carried out in the three Southern States of Karnataka, Kerala and Tamil Nadu and in the States of Andhra Pradesh and Mahrashtra, The executing agencies in Andhra Pradesh is Environmental Protection Training Research^ Institute (EPTRJ), Hyderabad and Rural Communes (RC), Mumbai in Maharashtra. The State Forest Department are the key players in the activities and would be responsible for providing the forest land for the in-situ conservation activities envisaged in the programme.

The activities include survey and inventorisation of medicinal plants in the selected areas in the State of Andhra Pradesh and Maharashtra. Identification of the sites for In-situ conservation. It would also include setting up of 8 Medicinal Plants Conservation Areas (MPCAs) in each of these states. The MPCAs thus set up would be repositories of the genetic material and the area would be demarcated as "no harvest zones". One of the important features is the threat assessment of the medicinal plant species by conducting "Rapid Threat Assessment" using IUCN methodology. The programme comprises of extensive field visits and preparing herbarium sheets. The community programmes envisaged under this project would provide an opportunity for interaction and exchange of views among the different communities. Extensive training programme is also envisaged to train different section of the community, the forest officers and other field staff.

GEF Small Grants Programme

The United Nations Development Programme (UNDP) operates the Small Grants Programme on behalf of Global Environmental Facility (GEF). This provides support for small-scale community based activities which contribute to the four GEF thematic areas namely Bio-Diversity, Climate Change, Ozone layer depletion and International Waters. The SGP in India took off towards 1995 and the theme areas include Biodiversity and CHmate Change. The GEF-SGP in India has been structured to operate in a decentralised manner with a National Co-ordinator based within the National Host Institution (NHI), which is Development Alternatives. A National Selection Committee (NSC) with members representing GOI, UNDP, research and voluntary organisations is responsible for overall coordination and approval of the projects.

The first phase of the GEF-SGP was set up with an initial outlay of US$ 300,000 to provide assistance to each individual project. Twenty Four projects were approved in 1995 and 1997 (20 on Biodiversity and 4 on Climate Change covering 12 States). The objectives of the programme include promoting innovative local response, capacity building, community based initiatives especially rural and tribal, create public awareness and strengthen NGOs.

The Phase-ll of GEF-SGP was initiated in 1998 and the project were approved in the first meeting of the NSC held in March 1999. A sum of US$ 700,000 are made available and a number of projects on medicinal plants were considered in the meetings of NSC held. There are 11 projects on medicinal plants sanctioned under this scheme in the States of Assam, Gujarat, Himachal Pradesh, Kerala, Meghalaya, Nagaland, Rajasthan and Uttar Pradesh. These are being executed by grass root NGOs.

Future Strategies to be Adopted:

For sustainable and equitable development of medicinal plant the various organisations of Ministry of Environment and Forests may adopt following strategies:-

Botanical Survey of India (BSI)

The Botanical Survey of India is responsible for inventorisation of plant resources and compilation of the flora of India. The BSI may address the need for inventorisation of remaining areas. It should also update the Red Data Book of Indian Plants. It may actively focus on the ex-situ conservation of rare or threatened or endangered species of medicinal plants in various Botanical Gardens.

Indian Council of Forest Research (ICFRE)

The Institutes of ICFRE should concentrate on collection of germplasm of the 25 plant species identified by the Task Force for cultivation. With well developed infrastructure the Institutes should try to develop agrotechnique and protocols for mass multiplication to provide quality planting material to the cultivators and foresters. It should also collect information on inter cropping rotational-cropping use of biofertilizers and organic farming for prividing know-how to the farmers and Forest Department for developing 'Vanaspati Van' and cultivation of medicinal plants. The Council should attempt to make available high quality planting material by developing a network on nursery of medicinal plants. Attempt should also be made for human resource development by organising training programmes on agropractices, post-harvest technology and quality control techniques.

Wild Life Wing of Forest Department

For conservation of medicinal plant the wild life wing of Forest Departments may consider establishment of 200 Medicinal Plant Conservation Area (MPCA) covering all ecosystems, forest types and sub types in the country.

State Forest Departments

The main problems which the forest departments are facing is continuing degradation of India's forest cover, which is a source of most of medicinal plants; and it is in this extremely difficult situation that the country has to implement its commitment to the conservation of biodiversity and its sustainable use. Considering that at present 90% collection of medicinal plants is from wild, generating about 40 million mandays employment current practices of harvesting are unsustainable and responsible for depletion of resource base. To reverse this process Forest Departments have to initiate following actions:-

i) Identify forest areas rich in medicinal plants (about 200 in number having an area of about 5000 ha) formulate a management plan for intensive management and sustainable harvesting of herbal products;

ii) Establishment of 200 "Vanaspati Van" in degraded forest areas where medicinal plants exist or existed. Each "Vanaspati Van" should have an area of 3000-5000 hectares, with irrigation facility and managed by a registered society headed by Divisional Forest Officer.

iii) It should effectively regulate extraction and transport of medicinal plants from wild. Department should maintain a list of petty traders, private agents, wholesale dealers and final consumers of medicinal plants. It should organise training and awareness campus on various aspects of medicinal plant development.

Chapter III
CULTIVATION OF MEDICINAL PLANTS

Given the demands of the market for a continuous and uniform supply of raw materials, and the increasing depletion of the forest resource base, expanding the number of medicinal plants in cultivation appears to be an important strategy for research and development. However, according to one estimate, of more than 400 plant species used for production of medicines by Indian Industry, less than 20 are currently under the cultivation in the country.[1]

The potential returns to the farmer from cultivation of medicinal plants is reported to be quite high. A 1995 study suggested that the cultivation of certain high altitude Himalayan herbs could yield products priced anywhere between Rs. 7,150 to 55,000 per hectare although it is not clear at which point in the marketing chain these prices are paid (Nautiyal 1995).[2] What is clear however is that although estimates of returns vary widely, medicinal plants can be valuable crops. Rao and Saxena (1994)[3] reported average annual (per hectare) income of Rs. 120,000 through mixed cropping of high altitude medicinal herbs. High altitude medicinal tend to command higher prices but those of lower altitudes are still significant. Data for some low-altitude crops from the Amarkantak region of Madhya Pradesh show economic returns for four profitable species. Cultivation is clearly a sustainable alternative to collection of medicinal plants from the wild.[4]

Economic Returns of Cultivated Species in Amarkantak Region, Madhya Pradesh

Species	Yield (kg/ha)	Market Rate (Rs./kg)	Makret Value (Rs.)	Total Expenses (Rs.)	Net Return (Rs.)
Curcuma angustifoiia	9800	6.00	58,800	10,760	48,040
Rauwolfia serpentina	850	75.00	63,750	9,480	54,270
Acprus Calamus	3500	10.00	35,000	7,950	27,040
Chlorophytum tuberosum	150	150.00	25,500	9,480	13,020

1. Report of the committee on Medicinal Plants submitted to GOI in May 1997
2. Nautiyal M.c-1995 - cultivation of medicinal plants and Biosphere Reserve Management in Alpine zones.
3. Rao, K.S., and K.G. Saxena 1994. Sustainable Develpment and Rehabilitation of Degraded Village Lands in Himalaya.
4. Tewari D.N. Cultivation of Medicinal Plants - unpublished manuscript

Most of the produce of cultivated medicinal and aromatic plants is exported as crude drugs e.g. Psyllium, senna leaves, opium poppy and Asgand. Unfortunately, however, due to emphasis being placed on important cash crops, as well as the fact that the majority of the cultivated species are not indigenous to India, most cultivation efforts are not alleviating the pressure being exerted on the natural resource base.

Nevertheless, a number of techniques have been developed to increase the quality and yield of many of the cultivated species. It is estimated that Indian public sector research institutions have developed standardized practices for the propagation and agronomy of a total of about 40 species.

Much of the research progress to date has resulted from the decision of the Indian Council for Agricultural Research (ICAR) to establish an All-India Coordinated Research Project on Medicinal and Aromatic Plants(AICRPMAP), in 1972, under the auspices of the National Bureau of Plant Genetic Resources (NBPGR). Efforts have mainly focused on the development of agro-technology techniques, including propagation methods for medicinal and aromatic plants. Aromatic plants have however tended to receive more attention, perhaps because their market values are in general more widely known.

ICAR works through a network of research stations, including the National Research Centre for Medicinal and Aromatic Plants located in Anand, Gujarat, which specializes in domestication, and has created structural links between the NBPGR and its Plant Breeding Division in order to develop improved varieties of some of the medicinal plant species used in allopathic preparations.

Another major national public research organisation, the Council for Scientific and Industrial Research (CSIR), has also played a significant role with regard to cultivation of medicinal plants, through its creation of (CIMAP), the Central Institute of Medicinal and Aromatic Plants, in Lucknow. CIMAP is now an eminent institution in India focusing on agro-technology as well as basic studies; improvement and enhancement of the resource base, and chemistry and related research regarding product development from plants.

In connection with the two major research efforts described above, the Central Government initiated a five year program (1992-1997) implemented by the Ministry of Agriculture to accelerate research and development of medicinal plants. With the support of 16 state agricultural universities, state horticulture and agriculture departments, regional research laboratories and the International Crop Research Institute for the Semi-Arid Tropics (ICRISAT), the GOI is establishing herbal gardens, nursery centres and demonstration seed production centres nation-wide.

Ministry of Health & Family Welfare (Department of ISM&H) started a "central scheme for development and cultivation of medicinal plants" in the year 1990-91 to encourage development of agrotechnique for important species through Govt/semi-government organisations having expertise and infrastructure for this work. The scheme is expected to initiate studies on harvesting, drying, and storage of medicinal plants.

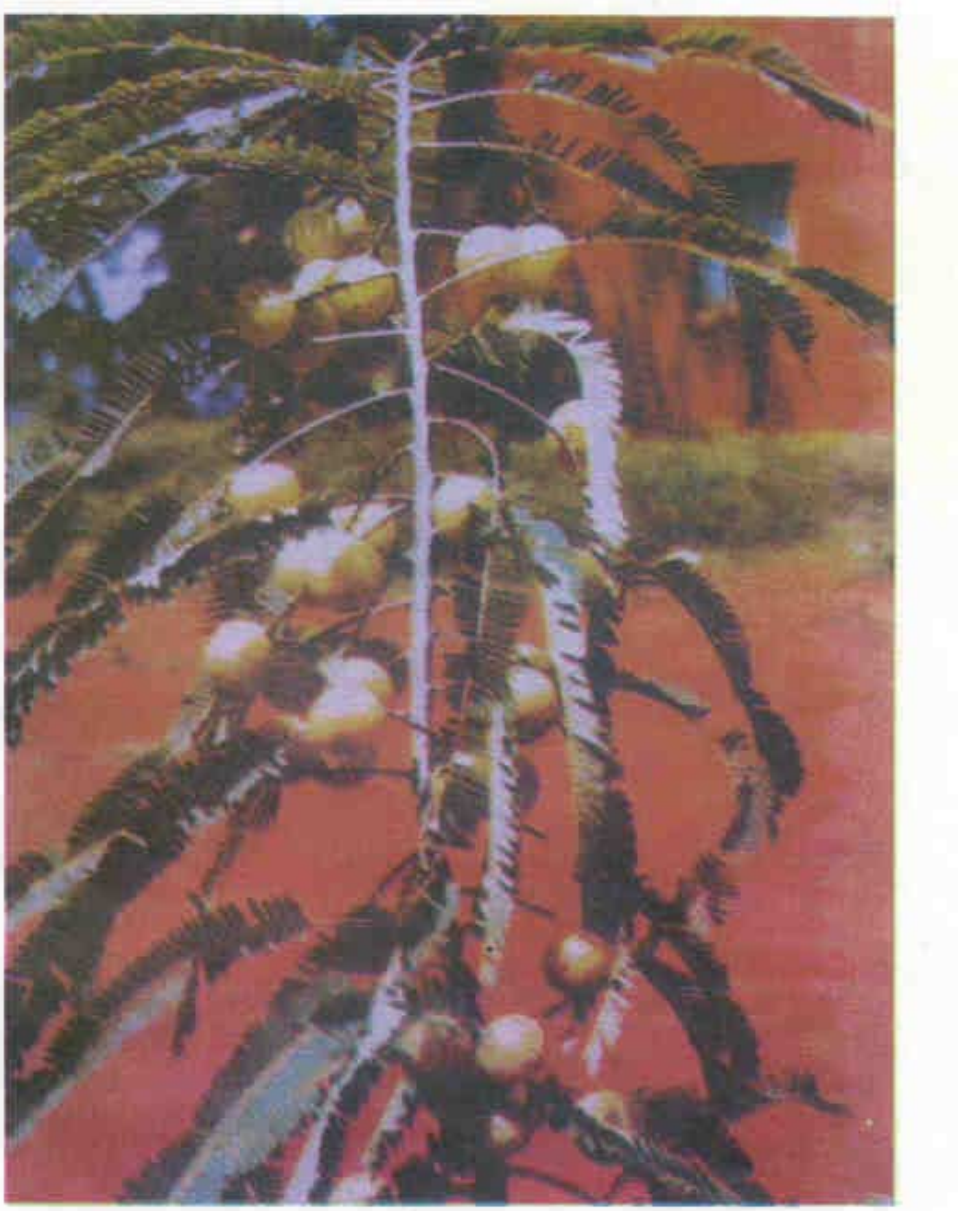
Private companies have also started to invest in the cultivation of medicinal plants, since they face difficulties with regard to increasing supply gaps as well as in some cases adulterated materials from the wild. One such company, the Arya Vaidya Sala, in Kottakal, Kerala, in addition to maintaining two large herbal gardens, has also undertaken research on the propagation of 10 species, the demand for which currently outstrips supply, or may soon do so.

Ministry of Health & Family Welfare

Under Reproductive Child Health (RCH) programme it was decided to include Ayurvedic $ Unani medicines, and, to ensure the availability of raw material of good quality and quantity, "Vanaspati Van Yojna" was incorporated. Each Vanaspati Van was to be identified over waste lands and denuded forest of 3000 to 5000 hectare of contiguous areas. Since the forestland cannot be transferred and sold, the interested State Governments were advised to register a society under the Society Registration Act in the name of Vanaspati Van Society for a particular State. The Society was to be headed by the Forest Officer with the members from the Department of Family Welfare and from the Department of Indian Systems of Medicine in its Executive Committee. The experts of forest, agriculture, botany, Ayurveda and Unani were also incorporated in the Executive Committee. Keeping in view the geo-climatic conditions suitable for medicinal plants the conservation and propagation of about 100 plants species in the

"Vanaspati Van" are encouraged in in-situ/ex-situ conditions. The site of the Vanaspati Van and suitability of the plants are identified by the Expert group of Government of India, Ministry of Health & Family Welfare, and the State Government. There is a provision of providing assistance of Rs.1.00 crore per year for a period of 5 years. Subsequently the Vanaspati Van Society will be self-sustained by scientific harvesting the produce for the benefit of the community as we!! as the society.W

The State Governments of Himachal Pradesh, Haryana, Madhya Pradesh and Andhra Pradesh have started implementing this scheme and the State Governments of Rajasthan, Karnataka, Kerala, Gujarat, U.P. and Tamilnadu are also approaching with the proposals. The ultimate objectives of the Scheme is to have at least one Vanaspati Van in each State so as to have full range of medicinal plants used in ISM.



Emblica officinalis Gaertn.
Syn. Phyllanthus emblica Linn

Scheme for improving awareness and availability of medicinal plants and remedies of Indian Systems of Medicine for RCH.

Because of pressure of population the cultivation of food grains and commercial crops has progressively practically eliminated locally growing medicinal plants and because of the vast changes in the social system, the family traditions have also become weak.

Worldwide there has been a huge growth in the popularity of alternative medicine and herbal products mainly due to their being no harmful side effects when genuine medicinal plants are used.

To address both these problems and to resurrect a highly cost effective preventive health and medical care system the NGOs will be assisted for raising nurseries of medicinal plants which are known to grow in that particular area. They will distribute the medicinal plants free of charge to desirous families and village level ISM practitioners.

These practitioners will be encouraged to grow these plants over a somewhat larger piece of land about 1-2 acres (if that can be managed). This will enable the products of these medicines to be not only readily available but to be available in a pure form.

The NGOs will also be simultaneously assisted to do extension work and educate local population about the uses of locally available medicinal plants for preventive health and for curative purposes.

In order to ensure impact, NGOs will be asked to take up this work on a project basis for a district and only a few of the NGOs with proven large capability will be assigned more than one district.

The applicant NGO having experience and expertise of medicinal plants in ISM will identify one district to propagate the ISM remedies. There is a provision of up to Rs.15.00 lakh per year for the scheme and the scheme can continue three to four years. Uthhan-Centre for Sustainable Development & Poverty Alleviation has improved awakening and availability of medicinal plants in Allahabad-Koshambi districts of Uttar Pradesh.

For improving awareness and availability of medicinal plants the task force recommends cultivation of 25 species which are in great demand. Information on these species are listed as under:

1.AONLA

1. Name of Medicinal Plant	Emblica officinalis Gaertn	
2. Family	Euphorbiaceae A deciduous tree, found in deciduous forests of the country upto 1350 m. on hills. Often cultivated.	
3. Area	1300 ha	
4. Production	88200 t	
5. Important States	UP, Gujarat, Rajasthan, Maharashtra	
6. Cultural Practices i. Varieties/Types/Clones released/ identified	Banarasi, Chakaiya, Francis, Kanchan, Krishna, Balwant, NA-6, NA-7, NA-9, Anand-2 and BS-1.	
ii. Propagation methods and planting time	Modified ring, patch and shield budding as well as soft wood grafting. June to August	
iii. Fertilizer dozes	1000 gm N, 500 gm P_2O_2 and 750 gm K 2O per plant/year. The fertilizer should be given in two split doses viz. Sep - Oct and April -May.	
iv.Irrigation schedule	Irrigation to young plantation at 10 days interval during the summer. To fruit bearing plantations, first irrigation should be given just after manuring and fertilization and then at 15 days intervals after fruit set (April) till onset of monsoon. Avoid irrigation during flowering period.	
v. Diseases, pests and their control:	Diseases/causitive Organism/agent	Control measures
	Aonla rust (Ravenellia ernblica) Fruit rot (Pencillum islandlium)	Spray (twice) Dithane Z 78(0.2%) during July-September. Treating the fruits
	Necrosis (Boron Deficiency)	with Nacl solutions. Spray of 0.5% - 0.6% borax in Sept-October Months.
	Bark eating caterpillar (Inderbela tetraonis)	Injecting kerosene oil/Dichlorovols or Endo-Sulfan (0.05%) in holes and plugging with mud
	Shoot gall maker (Betousa stylophora)	Galled twigs should be pruned. Spray of 0.05%monocrotophos during rainy season
	Aphid (Cerciaphis emblica)	Spraying of dimethoate @ 0.03%

	Scale insect	Application of mono-Crotophos @ 0.05%
	Anar butterfly (Virachola isocrates)	Remove and destroy all the affected fruits.
7. Planting time i) Rainy season ii) Spring season	July to September Mid of January to March	
8. Biochemical analysis (Active ingredients)	The fruit is rich source of vitamins and minerals. High vitamin C content (750-850 mg/100 gram pulp)	
9. Post Harvest Management	Different varieties mature at different period e.g Chakaiya (January), Banarasi (October end), Krishna (December) and Francis (mid November - December). Large size fruits (4 cm. & above) free from blemishes are used for preserve, candy and pickle. Small sized fruits are used for chavanprash making and defective fruits are used for Trifala making. Generally, basket for pigeon pea stem and gunny bag of 40-50 kg capacity with newspaper as liners are used for packing of aonla fruits. However, wooden crate with polythene lines is most suitable for packing and long distance transportation. Aonla fruits can be stored upto 15-20 days at low temperature (10-15°C). However Chakaiya can be stored upto 45 and 75 days in 10% and 15% salt solution respectively without any decay.	
10. Cost of Cultivation	Cost benefit ratio is 1 :4. Pay back period is six years.	
11. Internal consumption and export potential	Export potential yet to be exploited. Huge internal demand in ISM.	
12. Action and uses	Aperient, aphrodisiac, astringent, digestive, diuretic, laxative, refrigerant and tonic. Useful in anaemia, jaundice, dyspepcia, haemorrhagic disorders, bilionsness, diabetes, asthma, bronchitis. An Ayurvedic preparation Chyavanprasha is very much valued for its restorative action	
13. Compound Preparations alkaloid can be easily obtained	Chyavanprasha, Dhatri Lauha, Amalki Rasayana. from the roots in the form of its salts.	

Withania somnifera Dunal.

2. ASWAHAGANDHA

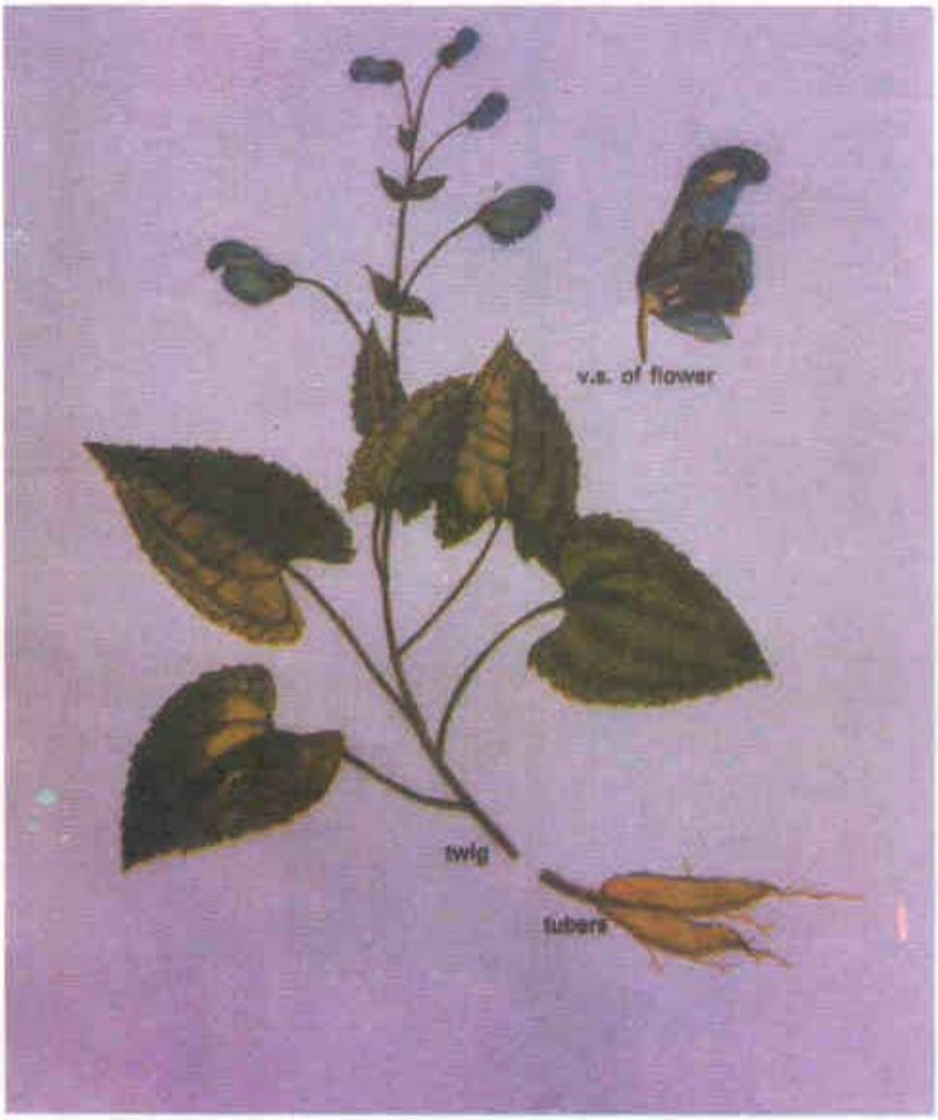
1.	Name of Medicinal Plant	Withania somnifera Dunal
2.	Family	Solanaceae
3.	Yield Plant Part	300-400 kg roots/ha + 50-75 kg seeds/ha
4.	Actual Ingredients	Withaferin, Anaferin, Tropine and many other Alkaloides and Steriodes
5.	Important States	Madhya Pradesh and Rajasthan
6.	Cultural Practices i) Varieties/Types/Clones released/identified	Jawahar Asgandh - 20, Jawahar Asgandh 134 and Rakshita
	ii)Propagation methods and planting time	Direct sowing of seeds (Broadcasting) Planting time in 3rd week of August to September.
	iii) Fertilizer doges	The crop is mainly grown on residual fertility. Hence, no fertilizers applied
	iv) Irrigation schedule	Rainfed
	iv) Diseases, pests and their control	Major disease is damping off, seedling rotting , seedling blight. Seed treatment with Captan 3 g/kg seed is recommended.
7.	Biochemical analysis (Active ingredients)	Alkaloids and Steroids
8.	Post Harvest Management	The crop is ready in six month, harvesting starts from January and continues upto March. Average yield 400-500 kg of root and 50 kg seed/ha. Cleaning, drying and grading of roots.
9.	Cost of cultivation (Cost : benefit ratio)	About Rs.1000/ha and gross return about Rs.2800 (CB ratio 1:2:8)
10.	Internal consumption export potential	Huge internal consumption also being and exported.
11.	Any other remarks	Immunomodulator/Rasayan drug, general tonic in arthritis.
12	Action and uses	Alterative, aphrodisiac, tonic, deobstruent, diuretic, narcotic, abortifacient. Used in rheumatism, consumption, debility from old age.
13.	Parts used	Root
14.	Compound preparation	Ashwagandhadi churna, Ashwagandha rasayana, Ashwagandha Ghrit, Ashwagandharishta

3. ASHOKA

1.	Name of Medicinal Plant	Saraca asoca (roxb.) DC Wild.
2.	Family	Leguminosae
3.	Local Name	Ashoka
4.	Habit and Habitat	A small evergreen tree 6-9 m. high, found wild along steams or in the shade of evergreen forests. It occurs almost throughout India up to an altitude of 720 m in the Centre and Eastern Himalayas & khasi, Garo & Lushai hills. It is also found in the Andaman islands. Leaves pari-pinnate, 15-20 cm long, leaflets 6-12, oblong, lanceolate, flowers organe or orange-yellow, very fragrant, pods flat, leathery, seeds 4-8, ellipsoid-oblong.
5.	Important Habitat	Himalayas, Bengal and Western Peninsula.
6.	Cultural Practices i. Propagation methods and planting time ii. Irrigation Schedule	Seeds. Seedlings are raised and planted in rainy season Rainfed
7.	Biochemical analysis (Active Ingredients)	Haematoxylin, tannins and glycoside, leucopelargonidin and leucoeyanidin have been extracted from the barks
8.	Post Harvest Management	Bark is removed and sun dried fur use in preparation of various herbal medicines.
9.	Utilisation	The bark is reported to stimulate the uterus, making the contractions more frequent and prolonged without producing tonic contraction as in the case of pituitary ergot. It is also reported to cure biliousness dyspepsia, dysentery, colic, piles and pimples. Leaves possess blood purifying properties. Flowers used in dysentery and diabetes.
10.	Plant used	Bark
11.	Actual Ingredients	Tannin and Catechol
12.	Internal consumption and export potential	Internal consumption is quite high in pharmaceutical industries. Good export potential
13.	Action and uses	Astringent, used in menorrhagia and uterine affections, internal bleeding, bleeding haemorrhoids and haemorrhagic dysentry.
14.	Compound Preparations	Ashokarishta, Ashokaghrita

Saraca asoca (Roxb) De Wild

Saraca indica Linn.



Aconitum heterophyllum Wall.

4. ATIS

1. Name of Medicinal Plant	Aconitum heterophyllum Wall
2. Family	Ranunculaceae
3. Use of Plant Part Actual Ingredients	Root Alkaloids (atisine 0.4%)
4. Important Habitats	Common in Alpine and subalpine zone of the Himalayas from Indus to Kumaon from 6000 to 15000 ft. from the sea level.
5. Cultural Practices	Local clones Propagation through seeds in rainy season
6. Biochemical analysis (Active ingredients)	Root alkaloids: hetrophylsive, hetrophylline and hetrophyllidine, heteratisine, artisine, altidine, F - dihydroatisine, Isatisine, Hetisine, Hetidines and Hetisinone.
7. Post Harvest Management	Roots are dried and powdered
8. Cost of cultivation	Not exploited commercially.
9. Internal consumption and exports	Roots are exported
10. Action and Uses	Antipyretic, antiperiodic, aphrodisiac, astringent tonic. Used in diarrhoea, indigestion, cough troubles during dentition in children.
11. Compound Preparations	Balachaturbhadra, Ativishadi Churna

5. BAIBERANG

1.	Name of Medicinal Plant	Embelia ribes Burm. F
2.	Family	Myrsinaceae
3.	Habit and Habitat	A scandanl shrub, reported to be distributed in the hilly parts of India, Assam and Tamil Nadu upto to 1700 m.
4.	Plant Part used	Fruits
5.	Actual Ingredients	Embelin (2.5-3.1%)
6.	Cultural Practices i) Varieties/Types/Clones released/identified	Local types
	ii) Propagation methods and planting time	Seeds are sown in rainy season
7.	Biochemical analysis (Active ingredients)	Embelin, raponone, homoembelin and homorapanone, quercitol, christembine.
8.	Post Harvest Management	Fully mature fruits are harvested and dried in sun.
9.	Action and uses	Anthelmintic, alterative, astringent, carminative, stimulant and tonic. Used in colic, constipation, flatulence and worms.
10.	Compound Preparations	Vidangadi churna, Vidanga lauha, Vidanga taila.

Embelia ribes Burm.f.

Aegle marmelos corr.

6. BAEL

1.	Narne of Medicinal Plant	Aegle marmelos L.Corr.	
2.	Family	Rutaceae	
3.	Habit and Habitat	A small or medium sized tree, distributed throughout the country.	
4.	Yield	7500 t	
	Plant Part used	Fruits and leaves (200-400 fruits/tree)	
	Actual Ingredients	Non reducing sugars, essential oil, abscisic acid and marmelosin.	
5.	Cultural Practices i. Varieties/Types/Clones Released/identified	Some well known types have been named according to fruit shape and locality e.g Mirzapuri, Darogaji, Ojha, Rampuri etc. Some improved selections are: NB-4, NB-5, NB*9.	
	ii. Propagation methods and and planting time	Vegetative propagation by Patch budding in June-July.	
	iii. Fertilizer dose	For 8 years old and onwards trees, 80 kg FYM, 480 g N, 320 g P and 480 g K/ tree/year is recommended.	
	iv. Irrigation	In the initial years, plants require frequent irrigation. Once established, light irrigation should be given after manuring and fertilization and proper soil moisture may be maintained after fruit set.	
	v. Diseases, pests and their control	Name	Control Measures
		Bacterial shot Hole (Xanthomonas	Spray of streptomycin sulphate @ 500 ppm. controls this disease. Bilvae)
		Fruit canker	Precaution should be taken so that fruit is Not hurt during plucking Also during transportation, the fruit should be packed tightly.
6.	Biochemical analysis (Active ingredients)	Protein (1.8%), Fat (0.39%), minerals (1.7%), Carbohydrate (31.8%), Carotena (55 mg/100 fruit), thiamine (0.13 mg/100g), riboflavin (1.190 mg/100).	

7. Post Harvest Management	At the time of harvest, tree become leafless and fruits get completely exposed. The fruits are picked individually from the tree keeping a portion of fruit stalk. Fruits are usually packed in gunny bags, baskets or wooden crates using newspaper as cushioning material. Fruits are quite hardy and they can be stored well at ambient temperature. However, fruits can be stored for 12 weeks at 9°C.
8. Internal consumption and export potential	Fruits are mostly consumed in our country. Export potential to be explored.
9. Cost of cultivation	Cost-benefit ratio is 1:3 and pay back period is six years.
10. Action and uses	Aromatic, astringent, carminative, cooling, laxative, febrifuge, stomachic; used in colitis, diarrhoea, dysentery and flatulence. Root is also an ingredient of Dashmoola.
11. Parts used	Fruits, root bark, leaves, rind of the ripe frurt, flowers.
12. Compound Preparations	Bilwapanchaka Kwath, Bilwandi Churna, Dashmoola rishta, Dashmools Kwath.
13. Any other remarks	Presence of marmelosin in fruits has anthelminitic activity.

Bacopa monnieri (Linn.) Pennell.

7. BRAHMI

1.	Name of Medicinal Plant	Bacopa monnieri L
2.	Family	Scrophulariaceae
3.	Yield Plant part Actual Ingredients	Whole plant especially leaves (100 kg dry herb/ha) Alkaloid, brahmine
4.	Habit & Habitat	A small herb found throughout India upto 4000 feet. Plant an annual, creeper is mostly found near water-logged place.
5.	Cultural Practices i. Varieties/Types/Clones Released/identified	Subodhak and Pragyashakti
	ii. Propagation methods and planting time	By runners and by seeds, In rainy season
	iii. Fertilizer doses	100 kg N/ha in three splits; 60 kg P_2O_5 60 kg K_2O/ha at the time of planting
	iv. Irrigation	After sowing/transplanting
6.	Biochemical analysis (Active ingredients)	Plant contains bacosides A & B, bacogenins, stigmasterol, stigmaotanol B-sitosterol. Leaves give herpestine. Monnierin is also isolated from the plant.
7.	Post Harvest Management	Harvesting in October-November
8.	Cost of cultivation Gross return Net return	Rs.35,000 / ha Rs.2,00,000 / ha Rs. 1,65,000 /ha
9.	Internal consumption and export potential	Having internal and external demand.
10.	Uses	Used as nervine tonic/memory enhancer
11.	Compound Preparations	Brahmighrit, Sarasvatarisht, Brahmivati.

8. CHANDAN

1.	Name of Medicinal Plant	Santalum album Linn
2.	Family	Santalaceae
3.	Actual Ingredients	Essential oil (1.5-6%)
4.	Distribution	A small evergreen tree, distributed in dry scrub forests of Salem, Mysore, Coorg, Coimbatore, Nilgiris upto 900 m. altitude. Also reported to be found in Andhra Pradesh, Bihar, Gujarat, Karnataka, Madhya Pradesh, Maharashtra and Tamilnadu.
5.	Cultural Practices i. Varieties/Types/Clones released/identified	Local type
	ii. Propagation methods and planting time	By seed and grafting. Seedlings are raised in polythene bags and plants during rainy season.
	iii. Fertilizer dozes	20t FYM/ha. Fertilizer requirement not yet worked out.
	iv. Irrigation schedule	Rainfed
	v. Diseases, pests and their control	Spike disease is common which is caused by mycoplasma. Under severe infection, the whole plant dies. Jassids (Pentacephala nigrilines), Fulgoroides and sandal wood beetle are important insects reported to cause considerable loss.
6.	Biochemical analysis (Active ingredients)	Alphasantalal, beta santalol and alphs and beta santalene are the main constituents in the oil.
7.	Post Harvest Management	Sandal wood trees are harvested at the age of 30-60 years. The soft wood is first removed, the hard wood is chipped and then converted into powder in a mill. The powder is soaked in water for 48 hours and then distilled. Distillation takes place in 48 hours. The oil is rectified by redistillation and filtration.
8.	Internal consumption and export potential	Export of sandal wood chips and oil and dust was 552.2 and 29.5 t respectively during 1995-96. Besides our internal consumption in cosmetics and perfumery industries is also high.

Santalum album Linn.

9. Action and use	Antiphlogistic, antiseptic, cooling and styptic. The wood round up with water into a fine parts is commonly applied to local infammations, to the temples in fever and to skin diseases to allay heat and pruritus. It is internally administered in cystitis, gonorrhoea, haemorrhagia, urinary disorders and gleet.
10. Compound Preparations	Chandanasava.

9. CHIRATA

1.	Name of Medicinal Plant	Swertia chirata syn. S.Chirata Buch - Ham.
2.	Family	Gentianaceae
3.	Use Plant part Actual Ingredients	Whole plant used Alkaloids
4.	Habit and Habitat	An erect herb, found in temperate Himalayas between 1300-3000 m. from Kashmir to Bhutan and Khasia hills. It is scarcely available in the market and generally substituted by Andrographis paniculata Nees or other species of Swertia.
5.	Cultural Practices i. Propagation methods and planting time	Propagated by seeds. The seeds are sown in the nursery and then seedlings are transplanted in the field.
	ii. Fertilizer doses	FYM is ideal for these plants
	iii. Disease	Some species of this genus are reported to serve as alternate host of blister rust of Pinus.
6.	Biochemical analysis (Active ingradients)	Plant contains alkaloids - gentianine, gentiocrucine, enicoflaving, swer - chirin. Plant is antiinflammatory, swerchirin - antimalarial, hypoglycaemic.
7.	Post Harvest Management	Drying of plants
8.	Internal consumption and export potential	Huge demand in ISM and was imported at a tune of 58.22 t valued at Rs.14.61 lakhs in 1995-96.
9.	Action and uses	Bitter, tonic, stomachic, laxative, febrifuge. Used in anorexia, biliary disorders, cough, constipation, fevers, skin diseases, worms.
10.	Compound Preparation	Kiratadi Kwath, Sudarshan Churna.

Swertia chirata Buch.

Tinospora cordifolia

10. GILOE

1. Name of Medicinal Plant	Tinospora cordifolia wild miers, ex hook
2. Family	Meninspermaceae
3. Local Name	Giloe
4. Habit & Habitat	A large, glabrous, deciduous climbing shrub found throughout tropical India. Ascending to an altitude of 300 m. Stem rather succulent with long filiform flesh aerial roots from the branches. Bark gray-brown or creamy white. Leaves membranous, cordate with a broad sinus. Flowers small, yellow or greenish yellow, appearing when the plant is leafless. Drupes ovoid, glossy, succulent, red. Seed curved.
5. Propagation	The Plant is sometimes cultivated as ornamental & propagated by cuttings.
6. Utilisation	The plant is used in general debilities, dyspepsia, fever & urinary disease. The leaves are good as fodder for cattle and rich in proteins and fairly in calcium and phosphorous. A decoction of the leaves is used for the treatment of gout. The young leaves bruised in milk, are used as a liniment in erysipeals. The leaves are beaten with honey and applied to ulcers. Dried & powdered fruit mixed with ghee or honey is used as a tonic and also in the treatment of Jaundice and rheumatism. The root is a powerful emetic and used for visceral obstructions. Its watery extract is used in leprosy.
7. Plant part used	Stem and Leaves
8. Active Ingredients	Alkaloid
9. Cultural Practices i. Varieties/Types/Clones Released/identified	Locally grown
ii. Propagation methods and planting time	Stem cuttings. Planting time is rainy season.
iii. Crop duration	Perennial
10. Biochemical analysis (Active ingredients)	Tinosporon, Tinosporic acid, Tinosporol, Giloin,

	gilonin, berberine, cordifol, Tinosporidine.
11. Post Harvest Management	The stem and leaves are harvested and dried in sun.
12. Internal consumption & export potential	Mostly consumed by Ayurvedic pharmaceuticals
13. Action	Rejuvinator, astringent, antipyretic, blood purifier and curative of dermatosis.
14. Uses	General debility, pyrexia, skin diseases, gout, rheumatic arthrites and spure.

Commiphora wightii (Arnott) Bhandari

11. GUGGAL

1.	Name of Medicinal Plant	Commiphora wightii (Arn) Bhandari
2.	Family	Burseraceae
3.	Yield Plant Part Actual Ingredients	700-900 g gum per plant Tree yield an oliogum-resin-guggulipid
4.	Habit and Habitat	A shrub or small tree, reported to be found in Karnataka, Rajasthan, Deccan and Gujarat.
5.	Cultural Practices i. Varieties/Types/Clones released/identified	Local types
	ii. Propagation methods iii. Fertilizer doses iv. Irrigation Schedule v. Diseases, pests and their controlq	Plants raised (about 80% success) by cutting. Application of 5 kg FYM and 25-50 gm urea per bush per year. Require moderate irrigation Plants are affected by white ants, Cercospora leaf spot and bacterial leaf blight. Control: Pits are filled with FYM and treated with BHC or aldrin to protect the new plants from white ants.
6.	Harvesting and yield	Plants attain normal height and girth after 8-10 years of growth when they are ready for tapping of the gum by shallow incision on the bark between December and March.
7.	Biochemical analysis (Active ingredients)	Gum resin contains guggulsteraes Z and E guggulsterois, two diterpenoids - a terpene, hydrocarbon named cembrne A and B, a cfiterpene - alcohol - mukulol 3 camphorone and cambrene
8.	Action and uses	Carminative, antispasmodic, disphoretic, ecbolic, antisuppurative, aphrodisiac, emmenagogue. Gum resin is commonly used for the treatment of rheumatoid arthritis.
9.	Compound Preparations	Yogarajaguggulu, Kaishoreguggulu, Chandraprabha vati.
10.	Marketing	Gum - resin is in great demand.

12. INDIAN BARBERY

1. Name of Medicinal Plant	Berberis aristata DC
2. Family	Berberidaceae
3. Local Name	Chitra, Rasaut
4. Habit & Habitat	An erect spinous shrub, 2 - 6 m. high, often forming gregarious patches, pale yellowish-brown bark, closely and rather deeply furrowed. Flowers are golden-yellow. It occurs in the Himalayas between 2000 - 3000 m & also in Nilgiri Hills.
5. Plant part used	Root bark, stem, wood fruit.
6. Actual Ingradients	Barberine
7. Important States	Assam, Bihar and Himalayan Region
8. Cultural Practices i. Varieties/Types/Clones Released/identified	Local clones
9. Propagotion	Propogation is from seeds, self sown in nature. Seedlings or cuttings can be taken during spring season after the berries are over. Layering is also recommended since the cuttings present some difficulties.
10. Biochemical analysis (Active ingredients)	Barberine (alkaloid)
11. Post Harvest Management	Drying of barks
12. Utilisation	The use of the roots as a source of Rasaut has been referred to. The dried berries are edible. The root bark is rich in alkaloidal content. Berberine, the principal alkaloid can be easily obtained from the roots in the form of its salts. Rasaut, mixed witii butter and alum, or with opium & lime-juice & painted over the eyelids as a useful louse-hold remedy in acute conjuctivities and in chronic ophthalkmia. A yellow dye is obtained from root and the stem. The berberry dye has been largely used in tanning & colouring of leather.

Daruharidra (*Berberis aristata* DC)

Berberis aristata D.C.

13. Action and uses	Stomachic, astringent, tonic, antiperiodic, diaphoretic, antiphyretic, alerative, purgative. Used in menorrhagia, diarrhoea, jaundice, skin diseases, malarial fever.
14. Compound Preparations	Darvyadi Kwath, Darvyadi leha, Darvyadi taila.

13. ISABGOL

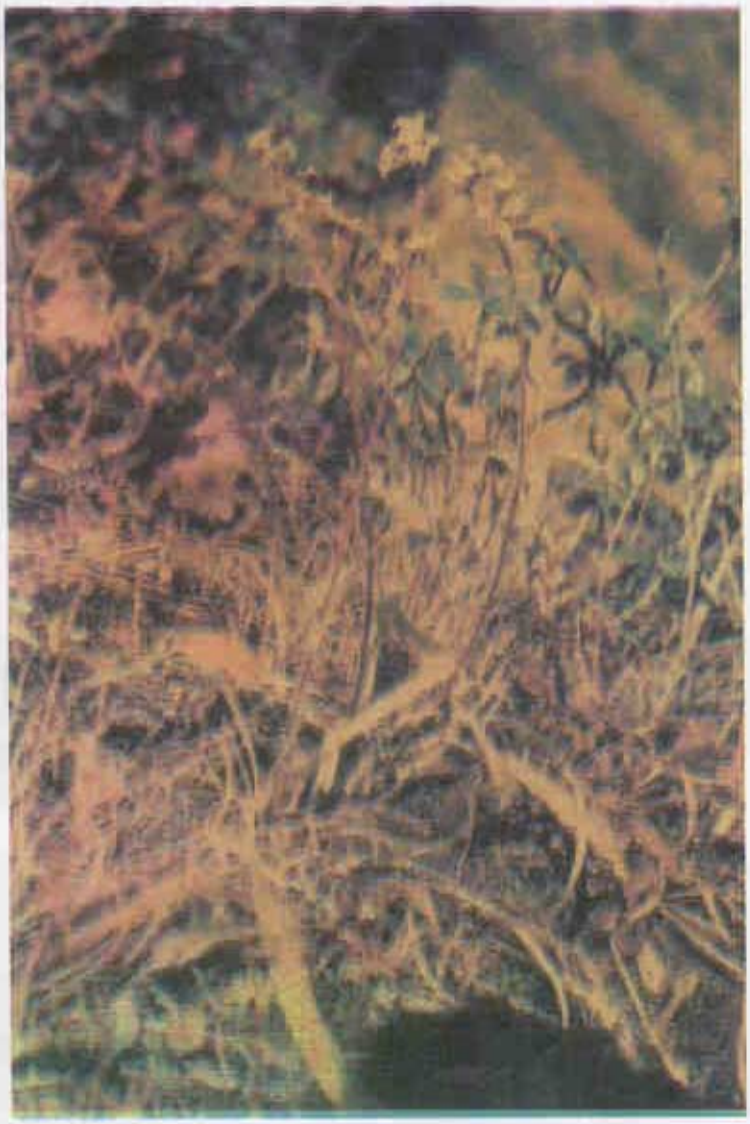
1.	Name of Medicinal Plant	Plantago Ovata Forsk
2.	Family	Plantaginaceae
3.	Habit and Habitat	A herb found in Punjab plains and low hills from Sutlej westwards, Sindh and Baluchistan.
4.	Area under cultivation	50000 ha
5.	Production in tonnes	48000 t of seeds
6.	Yield Plant part	Seeds 900-1500 kg/ha, Husk-225-375 kg/ha
7.	Cultural Practices	
	i. Varieties/Types/Clones released/identified	RI-87, RI-89, AMB-2, GI-1, GI-2, MI-4, MIB-121, HI-34, HI-2, HI-1, HI-5, NIHARIKA
	ii. Propagation methods and planting time	By seeds Mid October to Mid December
	iii. Fertilizers doses	N:P 50:25 kg/ha (25 kg of N + full P as basal dose 25 Kg N as top dressing 35 DAS)
	iv. Irrigation schedule	3 to 6 irrigations, Presowing, after sowing, Seedling stage, Spike formation stage, Flowering stage, Seed development stage depending upon the soil type and agro climatic condition.
	v. Diseases, pests and their control	Downy mildew and Powdery mildew: Dithane M-45 or Dithane Z-78 @ 2.0 to 2,5 g/lit or Bordeaux mixture 6:3:100 for downy mildew and Karathane W.D. (0.2%) for Powdery mildew 6:3:100 for downy mildew, Karathane W.D (0.2%) for Powdery mildew. Wilt : Wilt disease is also observed which can be controlled by seed treatment with Bavistin or Benlate 2.5g/kg of seed. Sucking type of pests (Aphid) attach the crop. Spraying with Endosulfan @ 0.5% or Dimethodafe @ 0.2% at fortnighty interval can control the aphids.
8.	Biochemical analysis (Active ingredients)	Protein, polysaccharides, cellulose, pectin, oil, muscilage.

Plantago ovata Forsk.

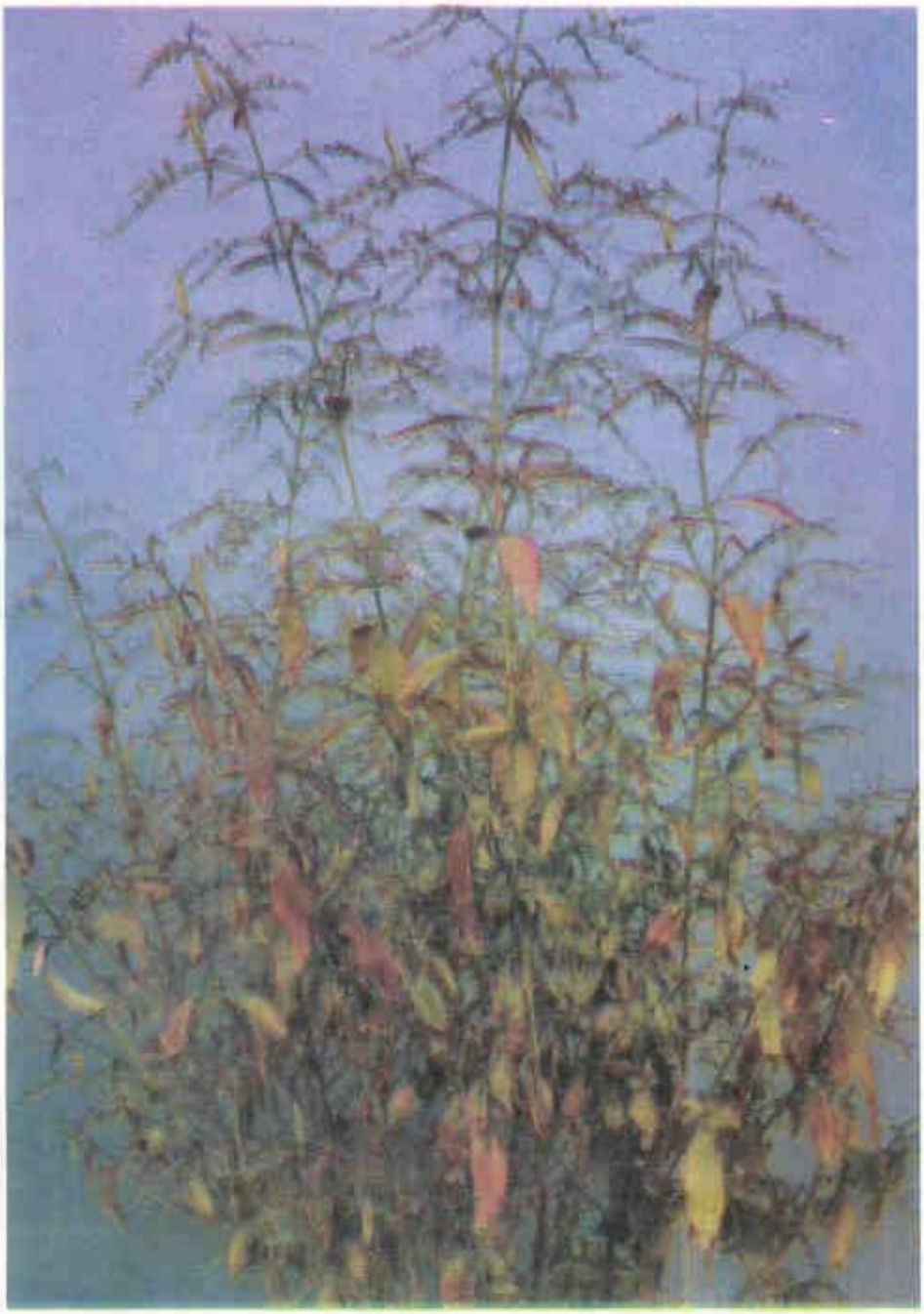
9. Post Harvest Management	Crop matures during March-April (110-130 days). It should be harvested when atmosphere is dry. Harvested plants spread over and after 2 days they are threshed with tractor/bullocks. Pinkish type husk are removed from the seed coat by processing through a series of grinding in mills to separate husk.
10. Cost of cultivation	Cost of Cultivation = Rs.19320/ha
11. Internal consumption and export potential	Isabgol seed 17,680.63 tonnes valued at Rs.4,069.78 lakhs and husk 2580.29 tonnes valued at Rs.1663.73 lakhs exported during the period from April - October, 1997-98. Besides our internal consumption is also quite high.
12. Action and uses	Demulcent, cooling, diuretic; used in inflammatory conditions of the mucous membrane of gastro intestinal and genitourinary tracts, in chronic dysentery, diarrhoea and constipation.
13. Parts used	Seeds and seek husk. Used as single drug for cure of constipation and Dysentery.
14. Any other remarks	This crop has good export potential and can be exploited commercially

14. JATAMANSI

1.	Name of Medicinal Plant	Nardostachys jatamansi De
2. 3.	Family Habit and Habitat	Valerianaceae An erect perennial herb with long, stout, woody rootstock; found in alpine Himalayas at 3500-5000 m. extending eastwards to Sikkim and Bhutan. The species is vulnerable.
4.	Yield Plant part Actual Ingredients	Rhizome (1290 kg/ha) Valeopotriate and Essential Oil
5.	Cultural Practices i. Varieties/Types/Clones released/identified	Dalhouse clones
	ii. Propagation methods and planting time	Seeds and Roots. Seed nursery preparation in July/Aug. Transplanting after 6-8 weeks (April/May)
	iii. Fertilizer doses	60:20:40 NPK
	iv. Irrigation schedule	One irrigation soon after sowing and 2-3 irrigations during rain free condition.
	v. Diseases, pests and their control	No serious pests and diseases.
5.	Biochemical analysis (Active ingredients)	Volatile essential oil 0.5% (Valeopotriates and Valerian oil)
6.	Post Harvest Management	Harvested roots washed and dried in shade condition.
7.	Cost of cultivation (Cost: benefit ratio)	Not commercially cultivated
8.	Action and uses	Aromatic, bitter, tonic, antispasmodic, deobstruent, stimulant, antiseptic, diuretic, emmenagogue. Used in epilepsy, hysteria, chorea, convulsions, palpitation of heart, mental disorders, insomnia.
9.	Parts used	Root-stock
10.	Compound Preparations	Mansyadi Kwath
11.	Any other remarks	Crop is not under regular cultivation, so there is a rapid depletion of the plant from its natural sources. Quality degradation under storage is reported.



Nardostachys jatamansi D.C.



Andrographis paniculata Nees

15. KALMEGH

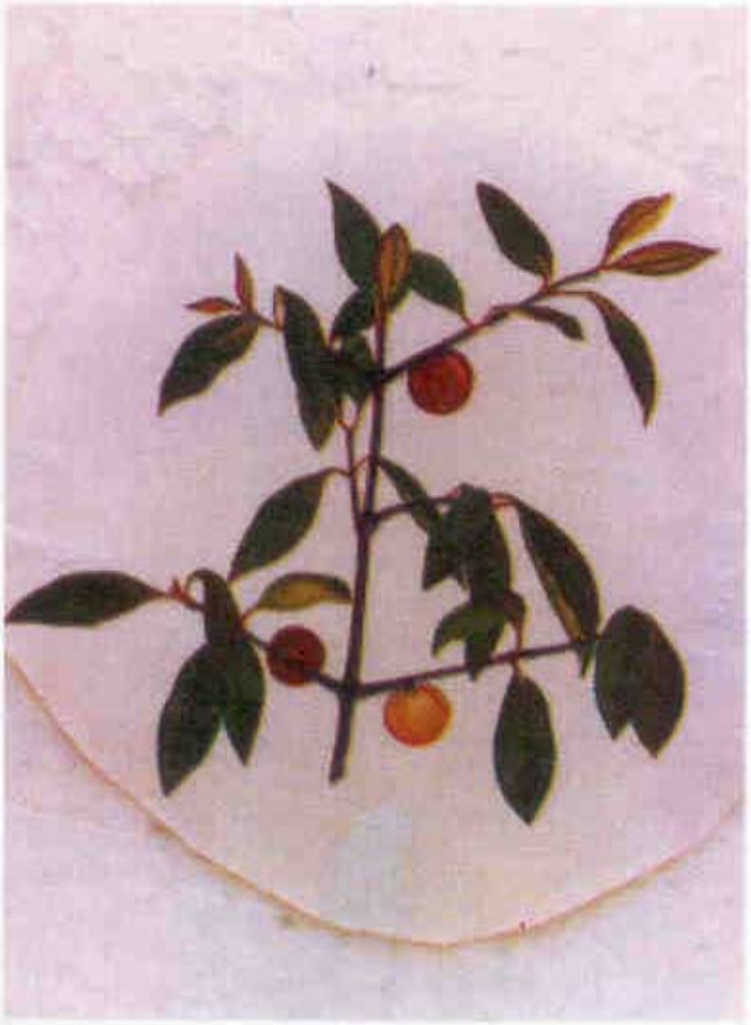
1.	Name of Medicinal Plant	Andrographis paniculata
2.	Family	Acanthaceae
3.	Yield Plant part Actual Ingredients	Panchang (Stem, leaf, flower, seed and root) Kalmeghin Andrographolide (0.8-2.%%). Leaves contains maximum while stem contains minimum amount.
4.	Habit and Habitat	A small herb found throughout India in plains of Himachal Pradesh to Assam, Mizoram, Gujrat, Bihar and South India.
5.	Cultural Practices i. Varieties/Types/Clones released/identified	Local clones. There is no named variety.
	ii. Propagation methods and Planting time	Propagated by seed and cuttings. Seedlings/plantlets raised in nursery in last week of July.
	iii. Fertilizer doses	Poultry manure or FYM 10 t/ha, Castor cake 2 t/ha, 75 Kg N, 75 Kg P_2Q_5.
	iv. lrrigation schedule	Kharif season crop. If rain is inadequate then 2-9 irrigations are given.
6.	Post Harvest Management	Crop duration 90-100 days. Harvesting is done in end of October and 1st week of November. Harvest should be spread over on the floor and it should be covered at night to protect from dew. One week drying under shade is required. Average yield 2-2.5 t/ha dry herb.
7.	Cost of cultivation Gross return Net return	Rs.10,000/ha Rs.43,000/ha Rs.33,000/ha
8.	Internal consumption and export potential	Ayurvedic formulations for debility, chronic malaria, jaundice, anemia and loss of apetite. Andrographis preparations in different potencies for Homeopathic medicines.

16.KATKI

1.	Name of Medicinal Plant	Picrohiza Kurroa Royle ex Benth
2.	Family	Scrophulariacae
3.	Habit and Habitat	A perennial herb, found in Alpine Himalayas from Kashmir to Sikkim at altitudes of 2700 -4500 m.
4.	Cultural Practices Propagation method	Through seeds and rhizome
5.	Biochemical analysis (Active ingredients)	Bitter glucoside Kutkin (3.4%), Kurrin, (0.5%), Vanillicacid (0.1%).
6.	Post Harvest Management	Drying
7.	Action and uses	Bitter tonic, antiperiodic, cholagogue, stomachic. Used in dyspepsia, fever, diseases of liver & spleen including jaundice, anaemia, scorpion stings and in purgative preparations.
8.	Parts used	Root and rhizome
9.	Compound Preparations	Arogyavardhani, Katukadya lauha, Tikkadi Kwath, Tiktadighrita
10.	Internal consumption and export potential	Limited internal consumption
11.	Any other remarks	Threatened perennial herb but can be domesticated and cultivated.

Katuki-Picrorhiza kurroa Royale ex. Benth.

Picrorhiza kurroa Royle ex Benth.



Garcinia indica

17. KOKUM

1.	Name of Medicinal Plant	Garcinia indica Linnacus
2.	Family	Clusiaceae
3.	Habit and Habitat	Frequent in evergreen and deciduous forests along the coasts on win-ward side of Western Ghats to 400 m.
4.	Area under cultivation Production	1200/ha 10200 t
5.	Yield Plant part Actual Ingredients	 Ripe Fruit, 8.5 t/ha Hydroxy Citric Acid (HCA) Cambogin & Camboginol
6.	Distribution	A tree found in Maharashtra, Goa, Karnataka, Kerala, South Gujarat, Assam and West Bengal.
7.	Cultural Practices i. Varieties/Types/Clones released/identified	Konkan Amrita and local types
	ii. Propagation methods and planting time	By soft wood grafting, July - August
	iii. Fertilizer doses	20 Kg FYM + 500 gm N + 250 gm P_2Os .
	iv. Irrigation schedule	Normally grown as rainfed crop. Hence regular irrigation is not in vogue for grown up orchards.
	v. Disease and Pests	Hardy crop. No major disease and pests. Leaf minor and pink disease sometime occurs which can be easily controlled.
8.	Biochemical analysis (Active ingredients)	Arabin, essential oil, resin, tartaric, citric and phosporic acids, Hydroxy citric Acid.
9.	Post Harvest Management	Harvesting in March to April. Drying of fruits and bark
10.	Cost of cultivation Net return	Rs.13000/ha Rs.34300/ha 1:1:37

11.	Internal consumption and export potential	Fruit mainly used for preparation of value added products like Kokum syrup, dried kokum rind etc. which are consumed within the country. However, kokum seed fat is exported to Netherlands, Italy, Japan, Singapore, U.K and Malaysia. Good export potential.
12.	Any other remarks	Hardy rainfed crop in coastal tropical region in the country. Crop has outs- standing medicinal properties (acidulent, dyscentry, pains, heart problems etc.) and also spice quality.

Saussurea lappa C.B. Clarke

18.KERTH

1.	Name of Medicinal Plant	Saussurea lappa
2.	Family	Compositae
3.	Area under Cultivation	About 100 ha
4.	Production	About 200 t
5.	Yield Plant part Actual ingredients	 Tuberous Roots (25000-30000 Kg/ha) Essential oil (1.5%) Saussunine (0.05%)
6.	Important States	Kashmir valley (J&K) Lahaul spiti (HP) Garhwal (UP)
7.	Cultural Practices i. Varieties/Types/Clones released/identified	Kashmir & Punjab types
	ii. Propagation methods and planting time	Seeds are sown in May
	iii. Irrigation schedule	5-6 irrigations between May-September.
	iv. Diseases, pests and their control	No major pests and diseases
	v. Crop duration	3 years.
8.	Biochemical analysis (Active ingredients)	Essential oil (1.5%). Essential oil constituents (Aplotaxena 20%, Sesquiterpenes (60%), Saussuine alkaloid, Kushtin, Lactones, Costunolide, Palmitic Acid, Dihydrodehydrocostus, lactone, propyl acetate, lauric acid.
9.	Post Harvest Management	Economical yield is obtained from 3 year old crop. Root is harvested in early spring. The roots are cleaned with water and dried for processing.
10	Cost of cultivation (Cost : benefit ratio)	1:3.2 (in 3 years) Cost of cultivation : Rs. 14, 0007- Gross income : Rs. 45,0007-
11.	Internal consumption and export potential	Exported to China, Japan, Italy and France. Internal consumption is limited.

19. LIQORICE

1.	Name of Medicinal Plant	Glycyrrhiza glabra Linn
2.	Family	Papilionaceae
3.	Habit and Habitat	A herb, reported to be found in sub-Himalayan tracts. Most of the requirement of Pharmaceutical industries is met by import only. Recently introduced in Gujarat, Himachal Pradesh and Haryana.
4.	Cultural Practices i. Varieties/Types/Clones released/identified	Haryana Mulhati No.1 (HM No.1) EC-111236, EC-124587, EC-21950
	ii. Propagation methods and planting time	By root cuttings February-March or July-August
	iii. Fertilizer doses	10 t FYM/ha applied at the time of planting Chemical fertilizers: N 80 kg (40 kg basal dose + 20 kg each at 2nd + 3rd year), PaOs - 40 kg/ha and KaO 20 kg/ha.
	iv. Irrigation schedule	At 30-45 days intervals in summer or in dry season, 7-8 irrigations are needed.
	v. Diseases, pests and their control Disease name / Causal Organism	Control
	Leaf spot / Cercospora	i) Dithane M-45 or Dithane Z - 78 @ 0.2%. ii) Bavistine (0.1%) followed by Daltan 0.3%.
	Root rot Collor rot / Rhizoctonia batalicola Selerotium sps	Bavistin or benlate before planting Aerial portion should be cut and destroyed.
	Wilting / Fusarium sps Leaf spot / Alternaria tenius	Carbonxazin 0.5% Bilitox 0.2%, 3-4 times at an interval of 6 days after appearance of disease symptoms.
	Pests: Attack of terminate has Observed in light soils	
	vi. Crop duration	2.5 to 3 year
5.	Biochemical analysis (Active ingredients)	Glycyrrhizin (12-15%), Flavonoids (Apioliquiretin, liquiritin, Apiossliquiritin, Isoliquiritin, monin, liquisitigenin, Glycycocernarin, Glycysol and Glycyrin).

Yasti-Glycyrrhiza glabra L.

6.	Post Harvest Management	After digging the roots in September, left in the field for sun drying, later the roots are sorted out and cleaned. Dry roots stored in polythene lined bags.
7.	Action and uses	Laxative, demulcent, emllkient, tonics, aphrodisiac. Used in sore throat, cough, genitourinary diseases, anorexia, asthma, persistent low fever.
8.	Compound Preparations	Yashtyadi churna, Yashtyadi Kwath, Yashtimadhwadya tails.
9.	Internal consumption and export potential	It is imported (about 5,000 to 10,000 of dry roots annually) from Afghanistan, Iran and Iraq.
10.	Any other remarks	Cultivation not yet popularised.

20. LONG PEPPER

1.	Name of Medicinal Plant	Long Pepper (Piper longum Linn)
2.	Family	Piperaceae
3.	Habit and Habitat	A slender climber with perennial woody roots, found in hotter parts of India with humid damp climate, viz., Western ghats, central Himalayas to Assam, Khasi and Mikir hills and lower hills of Bengal
4.	Yield Plant part Actual Ingredients	 Dry spike 650-700 kg/year/ha Root yield 500 kg/ha Piperine (4.5%) Essential oil 0.7%)
5.	Cultural Practices i. Varieties/Types/Clones released/identified	Cheemathipali, Viswam
	ii. Propagation methods and planting time	Rooted vine cuttings and suckers. Soon after the onset of monsoon
	iii. Fertilizer doses	Mostly grown as an under crop on residual fertility. 20 t FYM/ha. Application of inorganic fertilizers are not yet reported.
	iv .Irrigation schedule	During summer, one irrigation/week. Sprinkler irrigation is also beneficial.
	v. Diseases, pests and their control	Leaf and vine rot & necrotic spots and blights on leaves (1% spray of Bordeaux mixture). Mealy bug attack (any systemic insecticides). Adults and nymphs of Helopeltis theivora attack (neems seed kernel extract @ 0.25%).
6.	Biochemical analysis (Active ingredients)	Piperine and Piplartin
7.	Post Harvest Management	The first harvest from vines is available after six months of planting. Spike are ready for harvest after two months of formation. Harvested spikes and roots are sundried and stored in moisture proof bags. The produce fetches price according to the grade.

Pippali-Piper longum Linn.

Piper longum

8.	Action and uses	Alterative, tonic, sedative, vermifuge, cholagogue, emmenagogue. Used in cough, cold, chronic bronchitis, palsy, gout, rheumatism, lumbago, insomnia, epilepsy, asthma, amorexia, piles, dyspepsia, leucoderma.
9.	Compound Preparations	Gudapippali, Pippalikhanda, Pipalyasva.
10.	Internal consumption and export potential	Huge internal consumption. 558.31t imported in 1995-96 valued at Rs.76.92 lakhs and 38.523t exported in 1995-96 valued at Rs.17.02

21.MADHUNASHINI

1.	Name of the Medicinal Plant	Gymnema sylvestre R. Br
2.	Family	Asclepiadaceae
3.	Plant parts used	Leave and roots
4.	Habit and Habitat	A perennial climber found in Western Ghats, Konkan, Tamilnadu, Karnataka and Uttar Pradesh.
5.	Cultural Practices i. Varieties/Types/Clones released/identified	Local clones
	ii. Propagation methods and planting time	By cutting in rainy season
	iii. Fertilizer doses	10 g Nitrogen 6.5 g Phosphorous/vine
6.	Biochemical Analysis (Active ingredients)	Gymnemic acid, Quercitol, Lupeol, B-amyrin, Stigmasterol
7.	Harvesting	After one year leaves are ready for harvesting
8.	Harvesting period	September to February
9.	Post Harvest Management	Drying of leaves and roots
10.	Action and uses	Astringent, stomachic, tonic, refrigerant, antidiabetic. Leaves have a peculiar property neutralising temporarily the taste sensation for sugar and used in diabetis.
11.	Uses	Diabetes, Liver disorders, cardiac Amenorrhoea, Sec. Amenorrhoea, Cough and Asthma
12.	Compound Preparations	Sarivadyasava, Sarivadyavaleha, Sarivadi Kwath, Sarivadi vati.

Gymnema Sylvestres Withania somnifera Dunal.
Withania somnifera Dunal.

Asperagus racemosus

22.SATAVARI

1.	Name of Medicinal Plant	Asparagus racemosus Willd
2.	Family	Liliaceae
3.	Habit and Habitat	A climber found almost all over India
4.	Yield Plant Actual Ingredients	Tuberous roots (100-150 q/ha 3rd year). Saponin
5.	Cultural Practices i. Varieties/Types/Clones ii. Propagation methods and planting time	 Local clones By seeds/adventitious roots March-April (Sowing) July-August (Transplanting)
6.	Biochemical analysis (Active ingredients)	Shatavarin I, II, III and IV (Roots) Quercetin, rutin and Hyperoside (Flowers and fruits) Diosgenin and Quercetin - 3 Glucuronide (Leaves)
7.	Post Harvest Management	Tuberious roots are ready for harvesting in 3rd year. After harvesting, roots (tuberous) are washed and dried in sun for making of powder.
8.	Action and uses	Antidiarrhoetic, refrigerant, antidysenteric, diuretic, demulcent, nutritive tonic, galactagogue, aphrodisiac, antispasmodic. Used in consumption, epilepsy, diarrhoea, blood dysentery, haemophilic disorders, swellings.
9,	Parts used	Root
10.	Compound Preparations	Shatavari ghrita, Naraina taila, Vishnu Tails, Shatmulyadi lauha, Shatavari panaka.

23. SHANKAPUSHPI

1.	Name of Medicinal Plant	Convolvulus pluricaulis
2.	Family	Convolvulaceae
3.	Distribution	A prostrate perennial herb found all over India, in Lalitpur district found in Talbehat, Meharauni and Lalitpur forest ranges. Present day availability is very low, approximately 50 - 60 quintal per year.
-4.	Part used	Whole plant
5.	Soil type	Sandy loams, Block cotton soils Red sandy soils; PH 5.5 to 7. It is also grown in marginal lands with good drainage and some organic matter applied to the soil.
6.	Rainfall	800 mm - 1200 mm
7.	Field preparation	Deep ploughing in the month of May and is allowed to weather. 15 tons per hectare farm yard manure is spread out in the field during June before rains. After FYM applied and after on set of monsoons second ploughing is done followed by two cross harrowing. The land is finally divided in to small blocks.
8.	Sowing	The seeds are broadcast mixing with sand or Line sowing 30 cm x 30 cm also done. After sowing light top dressing of FYM is given. Very light watering is done. Seedlings appear within 30 days.
9.	Weeding & Hoeing	Generally two weedings & hoeing are given within 40 - 50 days.
10.	Harvesting	Plants get flowers in October and seeds developed in December. Crop harvesting period is January to May. Whole plant is dried in shade and is stored for marketing.
11.	Biochemical analysis (active ingredients	Alkaloids, Sankhpuspine
12.	Action	Intellect promoting, nervine tonic, Expectrorant, Anti-leprotic, Refrigerant
13.	Uses	Insomnia, Insanity and Epilepsy, Cough, Skin disorders, Hyperpyrexia, General debility

Chlorophytum borivillianum
Safed musli

Dry tubers

Covolvulus Puricolis

Convolvulus pluricaulis Choisy.

24. SAFED MUSLI

1.	Name of Medicinal Plant	Chlorophytum borivillanum
2.	Family	Liliaceae
3.	Yield Plant part Actual Ingredients	 Tuberous roots (1000 kg/ha) Saponin 2-4%
4.	Distribution	Southern Rajasthan, Western M.P and North Gujarat
5.	Cultural Practices i. Varieties/Types/Clones released/identified	 Selections viz. RC-2, RC-16, RC-36, RC-20, RC-23. RC-37 have been collected and maintained at RAU, Udaipur
	ii. Propagation methods and planting time	By seed and by tuberous roots, second week of June
	iii. Fertilizer doses	No chemical fertilizer tested on this crop. 10-15t FYM/ha provides good nutrient status for heatlhy growth.
	iv. Irrigation schedule	First irrigation immediately after planting. If there is no rainfall, then irrigation may be done after 10-15 days interval.
	v. Diseases, pests and their control a) Rotting of root during storage	 Infection of Aspergillus sps and Fusarium sps. Control : Treatment with thiram and captan at 4.0 g/kg of roots reduced rotting during storage.
	b) Chlorosis in foilage	This may be due to Iron defiency.
	vi. Crop duration	90-110 days
6.	Biochemical analysis (Active ingredients)	Carbohydrates 39.10% - 42% Protein 0.5% Saponin 2% - 4% Root fiber 3% - 5%
7.	Post Harvest Management	Harvested roots are spread in the shade for about 4-7 days. Later, fleshy roots separated from the bunches. Slight pressure exerted by thumb and finger on the skin of root so that they get separated and milky white root come out. It should be cleaned and dried for 7-10 days.

8.	Cost of cultivation (Cost : benefit ratio)	Cost of cultivation = Rs.22,000/- Gross return = Rs.65,000/- Cost benefit ratio = 1:2:95
9.	Internal consumption and export potential	Mainly consumed in herbal based pharmaceutical industries. It has large and consistent market demand in the country and current projection of the annual demand is estimated between 300-500 t.
10,	Any other remarks	Safed musli is a well known tonic and a aphrodiasic drug given to cure general debility and extensively used in Ayurvedic medicines. Still major requirements of the parmaceuticaf industries is fulfilled through collection from the forest, thus it has become threatened species in India. Effort should be made for its regular cultivation to fulfil the growing demand.

Cassia angustifolia Vahl.

25. SENNA

1.	Name of Medicinal Plant	Cassia angustifolia vahi
2.	Family	Caesalpinaceae
3.	Area under cultivation	25000 ha.
4.	Production	Leaves 22500 t and Pods 7500 t.
5.	Yield Plant part Actual Ingredients	 Leaves 1500-2000 kg/ha and pods 700-1000 kg/ha (Immature) Sennosides (2.5% in leaf; 3.5-4% in poda)
6.	Important States	Tamilnadu, Maharashtra, Gujarat, Rajasthan and Delhi
7.	Cultural Practices i. Varieties/Types/Clones released/identified	ALFT-2, Tinneyvalley senna and Sona.
	ii. Propagation methods and planting time 1	By seed, September-October in Tamilnadu. June - July in Western India.
	iii. Fertilizer doses	80 kg of N: 40 kg of P_2O_5: 20 Kg K_2Q/ ha. Nitrogen in 4 equal splits (sowing, 30 days thinning stage, after first and second harvest).
	iv. Irrigation schedule	At sowing and thinning stage.
	v. Diseases, pests and their control	Diseases a).N.W India - Damping off at seedling stage caused by Rhizoctonia bataticola. Control - Thiram or Captan 2.5g/kg b) Dry rot caused by Macrophomina phaseoli c) Leaf spot caused by Phyllosticta spp. And Cercospora sp. Control - 0.5% Diathene M-45. Pests a) Green leaf eating caterpillar b) Pod borer (0.05% Endosulfan or 0.25% Carbaryl).
	vi. Crop duration	130-150 days
8.	Biochemical analysis (Active Ingredients)	Sennosides, A, B, C, D rhein, aloe-amine, Kaempferein and Iso-rhein in free and

		compound/glycoside forms.
9.	Post harvest Management	Shade drying for 3-5 days to bring down to 8% moisture level and light green to greeish yellow colour is preferred.
10.	Action and uses	Laxative, purgative. Used in constipation.
11.	Compound Preparations	Yashtyadi churna, Shataskar churna.

Chapter IV

RESEARCH AND DEVELOPMENT (R & D)

In order to fully convert the potential of our medicinal plants into economic wealth, a very active R&D programme is essential. The R & D has to cover all aspects relating to the species from collection to utilisation. For convenience we may categorise medicinal species into : (a) those which are of proven medicinal value as per scientific parameters, (b) those on which sufficient leads are available, and (c) those on which much work is required to be done.

Research investigations need to concentrate on the first two categories on the following aspects:-

- Evolving and optimising the most appropriate technologies for conservation, especially for endangered or endemic specie and molecular methods for characterisation.
- Detailed studies on life cycle and breeding behaviour, taxonomy, seed biology
- Population and habitat viability studies
- Optimising appropriate methods for post-harvest handling, processing and storage.
- Investigation on quality control standardization and shelf life of raw materials and finished products.

The search for new drugs of plant origin has yielded fruitful result in the past. Today it is possible to use molecular techniques for detection of genetic variability and tagging desired traits as well as culling out duplicates in accessions. The availability of high throughout screen has made the possibility of converting 'hits' into lead compounds in comparatively short time. Drug development from plant sources using gene/molecular techniques is becoming increasingly important.

Drug development from new molecules/genes

In terms of a modern research endeavour, drug development from plants must necessarily imply a multi-displinary approach. Recent computerised studies of ethnomedical information, albeit in specialised areas of biological activity, have nevertheless confirmed that plants are a reservoir of chemical agents with therapeutic potential. What has been hitherto missed is the collation of data gathered in the trial-and-error is a prolonged clinical trial.

This information includes:

a. Ethnomedical particulars on cultivation, gathering and preparation of plant material for dosage.
b. The role of accompanying plants frequently used in multicomponent traditional preparations.
c. Recommended dosage regiments and contra-indications of certain foods.

In addition, it would be wise, in any research effort, to investigate the theories and concepts of the major systems of traditional medicine, as these cannot always be exactly interpreted in terms of modern concepts.

In general, natural products that have come into modern medicine are the result of an approach to drug development adopted over the past fifty years or more. The goal has been to find new chemical structures that have a novel biological activity. The alternative approach of finding plant derived therapeutic agents as extracts that could be standardised and formulated, has not received attention. The emphasis of R&D should be on the following:

- Development of technology for bulk production of medicinal products;
- Development of quality control standards for the starting materials as well as for the finished prodcuts;
- Development of new formulations and dosage forms specially suited to the prevailing climatic conditions and adapted to locally available raw materials;
- Assimilation of acquired technology and its continuous improvement to make the products competitive;
- Bioequivalence, bioavailability and pharmacokinetic studies on the dosage forms developed;
- Search of new plant sources for known drug and for new drugs from locally available plants.

Given the situation, production of standardized plant fraction should have priority over that of pure active substance, because of the simple technology needed and hence lower cost of the product, provided, of course, the technological testing indicates that the product is safe. It would be advisable to find out the chemical composition of the composite fraction and pharmacological action of each constitutent to ensure that they are safe and compatible with each other.

In view of the high capital and recurring costs of R & D, collaboration among developing countries and between developed and developing countries is advisable.

Keeping in view the national priority the target disease is selected and the plants on the formulation is evaluated clinically using current protocols/criteria. Studies on analytical methods, details chemistry, pharmacology along with toxicity and safety aspects are required.

A multidisciplinary approach to drug development from medicinal plants used in traditional medicine was tried out in several technical assistance programmes by UNIDO beginning in the mid-1970s.

- Economic mapping of the spontaneous flora.
- Selection and authentication of plant species.
- Collation of ethnomedical and ethnobotanical data.
- Trial popagation to develop high yielding varieties.
- Medium scale plant propagation.
- Chemical studies on plant constituents
- Analytical studies on quantitative assessment of major constituents.
- Pharmacological and toxicological studies
- Pilot plant scale processing of plant extracts.
- Standardisation of extracts.

- Formulation studies on extracts into dosage forms.
- Toxicity studies on formulations
- Analytical studies on formulated products

UNIDO's technical Assistance Programme envisaged that if a successful candidate plant was identified, then the large-scale plant cultivation was to be implemented with FAO and the clinical assessment of the drug be conducted with WHO participation. Success was recorded in a number of instances and the programme introduced the concept of goal-oriented research.

Ethnobotanical Approach to Drug Discovery

For pharmaceuticals ranging from digitalis to vincristine the ethnobotanical approach to drug discovery has proved successful. The advent of high-throughput, mechanism-based in vitro bioassays coupled with candidate plants derived from painstaking enthnopharmacological research has resulted in the discovery of new pharmaceuticals such as prostratin, a drug candidate for treatment of human immunodeficiency virus, as well as a variety of novel antiinflammatory compounds. Gastrointestinal maladies, inflammation, skin infections and certain viral diseases are likely to be of high saliency to indigenous healers, whereas diseases such as cancer and cardiovascular illness are unlikely to be easily diagnosed by indigenous peoples. Yet indigenous remedies may indicate pharmacological activity for maladies such as schizophrenia, for which the biochemical mechanisms have yet to be discovered. Ethnopharmacological information can be used to provide three levels of resolution in the search for new drugs: (1) as a general indicator of non-specific bioactivity suitable for a panel of broad screens: (2) as an indicator of specific bioactivity suitable for particular high-resolution bioassays: (3) as an indicator of pharmacological activity for which mechanism-based bioassays have yet to be developed.

Historically, ethnobotanical leads have resulted in three different types of drug discovery: (1) unmodified natural plant products where ethnomedical use suggested clinical efficacy (e.g digitalis); (2) unmodified natural products of which the therapeutic efficacy was only remotely suggested by indigenous plant use (e.g vincristine); and (3) modified natural or synthetic substances based on a natural product used in folk medicine (e.g aspirin).

The NAPRALERT database developed by Farnsworth is especially through, with systematic searches dating back to 1900, on natural products in the areas of cancer (chemotherapy, chemoprevention, carcinogenesis), fertility regulation (both male and female), diabetes, malaria and other parasitic diseases, viral diseases, sugar substitutes, molluscicides and anti-HIV agents. As an exercise to demonstrate the power of computer analysis, selected 10 diseases searched NAPRALERT for species that had both ethnomedical information and in vitro and/or in vivo experimental data supporting the ethnomedical claims.

Bioengineering of Medicinal Plants

Pharmaceutical importance/therapeutic value of medicinal plants is due to specific constituents/comibination of secondary metabolites present in them. Changes in the proportion of secondary metabolites are often required for the improvement of therapeutic values of medicinal plants. For example, increase in the artemisinin content of Artemisia annua in proportion to its immediate precursors and other terpenes is required to make the production of antimalarials from this plant more economically. The biosynthetic pathways for the biologically active chemical compounds in medicinal plants are usually complex and high branches. Genetic manipulations can help increase/decrease the contents of specific compounds in medicinal

plants. Detailed understanding of these pathways will be a prerequisite for the identification, cloning and genetic engineering of the qoncerned structural and regulatory genes. These genetic techniques will also help develop designer medicinal plants. For example it will be possible to produce medicinal plants that will help raise the immunity towards infectious diseases in the use of such plants.

In Vitro Propagation Techniques

The biotechnological tools are important to select, multiply and conserve the critical genotypes of medicinal plants by adopting techniques such as micropropagation, creation of somacional varations and genetic transformations. Biotechnological tools can also be harnessed for production of secondary metabolites using plants as bioreactors.

In vitro propagation involves cell culture systems of a range of ex-plant tissues and mostly micropropagation is achieved from organised tissues by multiplication of meristems and auxiliary buds. In many cases it provides an opportunity to maintain type-to type plant species and the propagation system can produce a large number of plants from a single clone. Plant regeneration from shoot and stem meristems has Yielded encouraging results in medicinal plants like Catharanthus roseus, Cinchona ledgeriana and Digitalis spp. The production of tropane alkaloids by hairy root culture has been resorted in several medicinal plants like Atropa, Datura and Hyoscyamus. Plant cell suspension culture is the selection of variant cell lines for the genetic improvement of plants. High secondary product yields in plant cell cultures of medicinal plants like Catharanthus roseus, Coleus blumei, Coptis japonica and Panax ginseng have been reported. Cryopreservation has been used successfully to store a range of tissue types, including meristems, anthers/pollens, embryos, calli and even protoplasts. Cryopreservation is already reported for many medicinal plants like Rauvolfia serpentina, Datura spp., Atropa, Hyoscyamus spp. etc. Protoplast fusion or somatic hybridization has been used to bypass the sexual process. The objective is to transfer important ge.nes which can not be transferred through sexual means due to the operation of incompatibility systems. Somatic hybrids between Atropa belladona and Datura innoxia were reported which showed higher amounts of tropane alkaloids. Biotransformation of psychotrine cephaeline to emetine production from cell cultures of Ipecac needs to be shown economically viable when compared with synthetic process of production of emetine.

Plant cell culture is of importance of improvement of medicinal plants. Complete plants have been regenerated from callus cultures, excised anthers and isolated protoplasts of many medicinal and aromatic plants. Many of the regenerated plants showed somaclonal variation and selections were made for high active principle yielding cell lines. Protoplast fusion has been plant is regenerated, micropropragation techniques can be used to multiply and clone the desired species. Gene transfer is possible from wild and related species to desired cultivars through wide hybridization including embryo rescue systems.

Thus, to sum up, various components of the application of tissue culture technology would be:

- Micropropagation
- Conservation through Cryopreservation
- Bioproduction of value added secondary metabolites
- Biotransformation of bioactive molecules
- Genetic upgradation for improvement

- Somatic hybridization
- Somaclonal variations
- Transgenic plants

The only limiting factor in commercialization of large number of medicinal plants has been the cost of cultivation. As for other annual/biennial crops per acre requirment of planting material is very large, cost of propagule is of major concern. Tissue culture can thus be adopted for species which are:

- difficult to regenerate by conventional methods and the only way to save them from extinction is to propagate them by tissue culture;
- species where population has decreased due to over exploitation and thus initial bulking of the stock can be taken up by tissue culture
- species which show lot of variability in terms of the active principles with medicinal properties. Tissue culture of selected clones will help in sustainable harvest and fetching better prices both in the domestic and international market.
- Trees with medicinal properties or elites can be identified based on their potential of yielding higher amount of active principle.

Tissue culture protocols have been developed for several plants but there are many more species which are over exploited and need conservation through in vitro techniques. Also there are large number of species for which limiting factor in expanding the area under the cultivation is the scarcity of planting material.

Choosing the Priorities

It is necessary to priotise the thrust areas to obtain the output of research efforts and other resources. Several factors help in determining the priorities. These include the distribution of flora, national or regional disease pattern, availability of modern health care etc. In addition we have to keep in mind the global priorities in developing new drugs so as to get a good financial return.

The disease pattern and the priorities have national characteristics but there are several diseases which are common to tropical areas and in fact to most developing countries. These include protozoal and helminthic infections like malaria, filaria, onchocerciasis etc. Many of these diseases do not exist in developed countries and large pharmaceutical houses;, therefore, do not give high priority to develop new drugs for such conditions. There is a gross mismatch between the health needs of the developing countries and the interests of the pharmaceutical industry. These should, therefore, receive priority in national/ regional plans. The above examples are only illustrative but we have to evolve our own list of priority for communicable diseases.

Primary health care usually requires comparatively milder medication and the acceptability of herbal medicines for such conditions is also much more. The main considerations should be adequate availability or possible cultivation on required scale, lack of toxicity and ease of formulation.

The global thrust areas for drugs from natural sources include disease conditions whose incidence is increasing and where the modern drugs are either unavailable or unsatisfactory. Some examples of such maladies may be summarised as follows:

- Tropical diseases; antimaiarial, antifilarials and antileishmaniasis
- Chronic conditions: anti-arthritic agents, anti-rheumatic agents
- Immunomodulators, immunostimulants, adaptogens
- Hepatoprotectors
- Rapid wounds and ulcer healing agents
- Central stimulating or sedating agents
- Alzheimers disease: prospective agents

- Memory enhancers
- Analgesics
- Sedatives

In considering the validation of the claims of ethnomedical therapies and derived preparations for introduction into the health-care systems, following deserve consideration:

(a) The inadequacy of animal models to serve as adequate systems to assess biological activities that can be extrapolated to the human situation. This is particularly so in some of the disease conditions for which no satisfactory modern therapy exists.

(b) The minimizing of toxicity tests needed to introduce the drug into a health care system. This is particularly necessary when the drug has been in long human use, toxic manifestations could be assessed by studying its long term effect on patients already undergoing treatment in the traditional milieu and the mode of industrial processing does not significantly vary from the ethnomedical methods. Product comparisons by modern instrumental parameters can also be made as between processed product and ethnomedical preparation.

(c) Clinical trials conducted under the supervision of competent authorities (e.g WHO) must be a necessary prerequisite.

(d) Stimulation of traditional processing methods, as well as adherence to ethnomedical regiments will be most helpful in not missing the activitiy present in an ethnomedical preparation. This will also stimulate examination of ethnomedical theories of disease with a view to interpretation of these, if at all possible, within modern concepts. (The idea particularly refers to long standing and well documented systems such as Ayurveda, Unani and the Chinese systems).

(e) The Selection of the appropriate dosage form and mode of administration should be recently based on economic parameters as well as shelf-life potential in the situations prevailing in the developing world.

(f) There is some concrete evidence that pure compound need not necessarily be the best drugs. But on economic ground as well as on the therapeutic grounds it will serve all interests well if the most appropriate processing methodology of a plant or combination of plants is examined in this light (This would also give rise to interesting researches on the synergistic and/or detoxificant effects of other constituents in the medicinal plants or non medicinal plants that are found often added to polyprescriptions used in traditional systems).

Conclusion

It is desirable to have a "need based" approach to research on medicinal plants including screening of plants for biological activity. Research efforts could thus be directed for a number of above mentioned diseases for which suitable drugs are not available in the modern system of medicine and where herbal drugs have a possibility of offering new drugs. Focussed R & D, inter-disciplinary approach research is the crux of accelerated development of this sector.

Chapter V
STANDARDS AND QUALITY

In India, the single most important factor which is standing in the way of wider acceptance of drugs based on medicinal plants is non-availability or inadequacy of standards to check or test the quality by modern instrumentation methods. A serious thought needs to be given to this aspect. Even with the best of intentions, no system of medicine can achieve any degree of credibility and mass acceptance unless some degree of quality control or quality assurance is maintained. In fact, this lack of regulation governing the identity and quality of herbs in the international trade has enabled substitutes, adulterated as well as fake plants to penetrate the international market, thus giving a bad name to the particular system of medicine.

Bottlenecks in quality control of ISM&H drugs.

Quality control in the case of synthetic drugs is much simpler and easier than in the case of drugs prepared from medicinal plants where multiplicity of active ingredients can create a difficulty in quality assurance. The main difficulty in preparing the standards is that most of these products use whole herbs or parts of plants or their extracts and in some cases even a mixture of number of plants. It is also difficult to identify these plants, as, medicinal plants collected in different seasons from the same place can exhibit marked difference in the content of active constituents. It is challenging to develop suitable standards because the preparation of drug based on medicinal plants is regarded as one active entity in its entirity. It is difficult to measure in quantity and quality the various constituents and their therapeutic activity. Again, the standardization of such drugs does not end with the identification or assay of active ingredient, rather it embodies total information and controls which are necessary to guarantee constituents of composition. Their standards are influenced by many factors such as age of the plant, the area of origin, harvesting time, method of drying, storage condition, manufacturing process, packing etc. Thus, there are number of bottlenecks in establishing standards for medicinal plants.

Pharmacopoeial Standards of ISM&H Drugs

Government of India have set up pharmacopoeial committees for Ayurveda, Siddha, Unani and Homeopathy systems. The Pharmacopoeial Laboratory for Indian Medicines (PLIM) and the Homeopathy Pharmacopoeial Laboratory (HPL) at Ghaziabad are providing the technical back up to these committees. At present 178 monographs are ready for publication. The pharmacopoeia committee has also published two volumes of Ayurvedic Formularies of India consisting of 635 formulations. The siddha pharmacopoeia committee has brought out seven volumes containing standards of 910 drugs.

The Unani pharmacopoeia committee has published one national formulary of 441 formulations of Unani medicines. Now 45 monographs on single Unani drugs have been published. The Homeopathy pharmacopoeia committee has brought out 7 volumes containing standards of 910 drugs.

A large part of the work relating to about 1000 drugs used in ISM remains to be done. The standardization of compound formulations is yet to take off. Realising the growing urgency of standards, the Department of ISM&H has implemented a scheme for evolving of standards through government, semi-government research laboratories. Financial assistance is provided to these laboratories. Each laboratory is allocated 10 drugs per year. So far 32 organisations have been assigned with the job and roughly 300 drugs have been covered. Work on 100 drugs is mature for preparation of monographs. However, this is going to be a time consuming process. As yet, even the established standards have not been tried out. In the meantime, countries like China have gone ahead and have captured a major share of the global export market. India cannot wait. There is necessity to expedite standardisation way by ensuring quality at every stage.

Good Operational Practices for Raw Materials

The quality control must start with raw materials. At present, the big markets of medicinal plans are in Khari Baoli in Delhi, Amritsar and Mumbai. Here, the raw or crude drugs are sold in the traditional manner. There is no cleaning, grading or selection of the medicinal plants. The buyer has no yardstick to judge the genuineness of the plants and their quality. There are no indications about the shelf life. There is no proper packing or labeling. The following steps are, therefore, recommended:-

Official Certification Centres (OCC)

First of all, the crude drugs of standard quality need to be identified and preserved as the reference standard. Therefore, a National Repository of Crude Drugs of ISM&H with an excellent herbarium having authentic reference samples needs to be established. This centre should have the crude drug samples (processed medicinal plants), herbarium specimen, chemical finger print profiles, anatomical slides, supporting literatures-and a collection of living plants. It should provide easy access to wide range of groups including traders, medical practitioners, plant chemists, TM students, academics, regulators as well as the pharmaceutical industry. User services will also have to be made available. This repository should then become the official certification centre for raw materials. The drug industry can get the raw materials certified from the centre. Perhaps, some regional branches of this centre could also be started. The centre could generate some income by way of charging fee for the authentication work of the crude samples. Perhaps some of the existing institutes working on medicinal plants could be developed into official certification centre. In addition to the crude drug samples, it is also necessary to have reference samples of standard marker compounds.

A repository of such marker compounds can be developed at the OCC.

Quality Control During Processing

The next stage is the quality control during processing and manufacturing. The Government of India in the Department of ISM&H have notified elaborate good manufacturing practices only recently. This is a very important step which will ensure quality during the manufacturing process. It is also felt that in order to ensure availability of genuine, authentic medicinal plants, it would be better to have a centralized agency for marketing of the medicinal plants and it may be made mandatory for all to purchase, the certified material only from authorised agencies like Forest Development Corporation or the proposed National Board for Medicinal Plants.

The packing also needs to be made more attractive and in suitable containers and sizes. There is also the question of labeling of products. The labels should give all the details and specifications.

Urgent need to set up State Drug Testing Laboratories for Indian Systems of Medicine

There are about 7483 drug manufacturing units of Ayurveda, Siddha & Unani (ASU) Systems of Medicine in the country. Keeping in view the growing demand of plant based drugs and cosmetics in domestic and international market, there is felt need to have good quality plant based medicines and cosmetics. To ensure the quality there is a need of public test houses as well as statutory State Drug Testing Laboratories for ASU drugs. Presently there are only a couple of laboratories in the country, which can perform few basic tests. In order to assure that quality medicines reach the consumer it is necessary to set up renovate or upgrade State Drug Testing Laboratories capable of testing ISM&H drugs in 20 State where there is good infrastructure for manufacture of ISM drugs. In the absence of such a mechanism being available the licensing of ISM drugs has no safety standard and this can lead to a situation where adulterated/spurious items are sold to the public which could be toxic and hazardous. It is equally essential to check that no synthetic/chemical substitutes are added into the ISM&H products and this responsibility has to be fulfilled while checking that the vital plant based ingredients are actually contained in the preparation. One time assistance to support the State Government to establish or strengthen such laboratories is essential. This is a very useful investment which will improve the credibility of the system as well as increase the export of plant based products.

Encouraging/Recognizing Public Test Houses

For modern system of medicine facilities are being extended by the public test houses to the pharmaceutical industry on commercial basis. On the same pattern public test houses need to be encouraged for ISM&H drug testing and recognised for testing plant based drugs. Necessary legislation needs to be introduced in the Drug and Cosmetic Act 1940.

Strengthening of Indian Medicine Pharmaceutical Corporation Limited (IMPCL) and State Government Pharmacies of ISM&H

There are about 25 pharmacies run by the State Governments themselves. At Govt. of India level also there is a public sector undertaking, Indian Medicine Pharmaceutical Corporation Limited, located at Mohan, Almora District of U.P. It is a joint venture with U.P. Government and is manufacturing classical Ayurvedic and Unani drugs. Its authorised and paid up share capital is Rs. 1.00 crore. The Govt. of India's share is 51%. This corporation is functioning in old barrack type accommodation. Lot of repairs, renovation and modernisation are required to enable this corporation to produce the drugs on a larger scale and ensure quality at every stage. It also needs to enter the open market. It is necessary to provide additional share capital of the order of Rs. 5.00 crore to this corporation. Similarly some funding could be provided to the State Government pharmacies to strengthen their existing pharmacies.

In-Process Quality Control Management.

The processes, which are used for the production of plant, based drugs vary widely and there is variation in quality of the same product produced by the process used by different manufacturers. Therefore, it is necessary to standardize the in-process quality control which is reproducible and some of the processes which are very traditional need to be modernised without changing the concept of ISM drug preparations. Any change in the process would need validation of establishing the equivalence of quality produced by the traditional methods as compared to the modern methods. It may be appropriate to have two centres for in process quality control standards development, which may cost about Rs. 5.00 crore. Some good existing centre could be developed accordingly.

Safety Evaluation Centres

Although the plant based drugs are considered to be comparatively safer, but some of the drugs are toxic especially when these are not properly processed and used judiciously. It has become mandatory to ensure the safety of all drugs put into the market for human consumption. At present we do not have any centre for safety evaluation of the plant based drugs. It is necessary to designate a safety evaluation centres with Good Laboratory Practices (GLP) norms. This will facilitate the acceptance of the drugs at a global level. Safety evaluation of herbometalic - mineral formulation of Ayruveda, Unani and Siddha is necessary.

Clinical Evaluation Centres

Although majority of the plant based drugs are time tested but still the clinical validation is necessary for confirming the efficacy. Some of the hospitals utilising plant based drugs could be identified for undertaking clinical trials following the double blind protocols to validate and reestablish the clinical efficacy following standard protocols as prescribed by WHO. For this certain additional financial inputs should be provided to such recognised hospital for promoting clinical evaluation status and recurring expenditure.

Standardisation of Drug Related Fundamental Concepts of ISM

The drug related fundamental concepts are unique in Ayurveda and the standardization of these concepts has not been attempted so far. The traditional system of medicine can be strengthenged further if these concepts of "Rasa, guna, virya-vipaka, Karma and prabhava are standardized in terms of modern scientific parameters also. These will go a long way in better acceptance of Ayurvedic and plant based drugs. It has been felt that this is an area which needs serious exploration and it will be advantageous to have an independent institute of developing standards for drug related concept of Ayurveda and validating these in terms of modern molecular pharmacology. This will need a multi-disciplinary approach involving Clinical Bio-Chemist, Clinical Pharmacologist, Modern Clinicians, Ayurvedic Clinicians, Phyto chemists etc. This will open new vistas for finding rare potentials of our traditional drugs. In the modern system of medicine there are many diseases for which there is no treatment available but exploring the fundamental concept of Ayurveda, Siddha and Unani may unfold treatment for dreaded diseases.

R&D Centre For Developing New Quality Control Methods

No Pharmacopoeia is considered perfect because each pharmacopoeia needs up-dating from time to time and development of newer methods for maintaining quality control for plant based drugs. Therefore, constant R&D inputs are needed for developing newer methods of standardization and quality control.

Human Resource Development

Human resource development in the drug related area of plant based products is very essential. There is need to appoint Drug inspectors qualified in the area of ISM medicines to inspect the plant based drug industry. Also there is a need to impart focused training to the existing Drug Inspectors on plant based drugs. Good Manufacturing Practices (GMP) and pharmacopoeial standards of Ayurveda, Siddha and Unani medicines are in the process of being notified. Therefore, the training of both the aspects viz. GMP and pharmacopoeial standards should be an essential part of the training for which specific modules need to be urgently prepared. Expert Institutions should be identified for training purposes and a systematic programme drawn to impart training to the Drug Inspectors as well as the persons working in plant based drug industry responsible for quality control.

At least one officer/expert working in the factory/industry should undertake this training which is also required as per the rules of the Drugs & Cosmetics Act.

Awareness and Publicity of Plant Based Products.

Plant based products whether in the name of Ayurveda, Siddha & Unani medicines or marketed as food items have been regularly used in the country. The knowledge about the medicinal value of the plants has been systematically documented and the therapies are regularly practiced in the South-Asia region. With the recent trends towards the use of herbal and natural products there is a need to popularise these products at an international level especially in Europe and USA. The ingredients and the efficacy of the plants need to be projected through the print and electronic media, particularly their strength in treating specific problems like Diabetes, hypertension, liver, disorders, Allergic disorders, Arthritis, Neurological disorders, Obesity and Ulcerative-colitis. Their immunomodulatory properties and their efficacy in treating autoimmune disorders like rheumatic conditions must be made known more widely.
Various Mission, High Commissions, Embassies of India in various countries also need to be provided with the literature on Indian Medicinal plants, their uses as well as the literature on systems of health care like Ayurveda, Siddha and Unani for various countries.

CHAPTER VI
MEDICINAL PLANTS DEMAND AND SUPPLY POSITION

Introduction

There are 7843 licensed pharmacies of Indian System of Medicine in addition to 857 of Homeopathy and a number of unlicensed small scale processing units engaged in the manufacture of the medicines to meet the requirement of 4.6 lakh 'registered practitioners of ISM & H and other users in the country. These pharmacies range from large Indian drug houses like Baidyanath, Dabur, Zandu, Himalaya Drugs etc., employing modern/sophisticated equipments and methods for production of drugs on mass scale to small ones which manufacture drugs generally following the traditional prescriptions of ancient medical texts in the form of Nighantus (Lexicons) and texts on Bhaisaj Kalpana (Pharmacy) that specifically deal with plants and plant products. Many pharmacies attached to Ayurvedic institutes and hospitals and Vaidyas of villages produce drugs for their own consumption. The largest numbers of these pharmacies are located in the states of Uttar Pradesh, Kerala, Maharashtra and Gujarat and the lowest numbers in the States of North East (N.E.) region.

Apart from pharmacies of ISM&H there are herbal industries like Alchem International, Delhi; Hitashi Chemicals, Calcutta; Kanga Aromatics, Madurai; Herbochem, Hyderabad; Chemiloids, Vijayawada; Natural Remedies, Bangalore, etc., which specialise in production and marketing of plant extracts for the use in the products of allopathy and Homeopathy.

Although about 8000 species of plants[1] are estimated to be used in human and animal health care and over 10,000 herbal drug formulations have been recorded in codified medical texts of ayurveda, the pharmaceutical industries are largely based on about 400 plant species.[2] Though accurate and updated data on the requirement of total quantity and quality of crude drug is not available, conservative estimates put the economic value of medicinal plant related trade in India to the order of Rs.1000 crore/year[3] and the world trade over U.S. $ 60 billion[4]. Unfortunately, data regarding the participation of both licensed and unlicensed firms in the medicinal plants raw material trade, and the extent of their demand for the raw materials are not readily available.

The structural break-up of licensed pharmacies in terms of large and small companies is unknown, making it difficult to assess the level of concentration in the market. Extensive and systematic surveys are required to generate data and information on this crucial aspect for useful resource planning. However, the task force has made an attempt to assess the demand and supply position with the help of simple questionnaire (Annexure-IV) sent to about 25 pharmacies (Annexure-V) but only about half of them have responded and that too partially.

[1] All India ethno-biology survey. MOEF, Govt. of India. 1995
[2] FRLHT Research manuscript on medicinal plants used in Ayurveda
[3] ADMA Mumbai, 1996
[4] Medicinal Plants by John Lambert, World Bank Report 1996

Demand

Requirement of individual pharmacies varies depending upon the total number and quantity of high and low value medicinal herbs used by them. For example, Gufic, Mumbai, engaged in production of herbal formulations and extracts requires annually 49.5 tons of raw material derived from 49 species worth Rs.18,70,000/-, while an ayurvedic pharmacy Shree Dhootapapeshwar Ltd., Mumbai, requires 204 tons of raw material of 30 species worth Rs.32,46,960/-. M/s.Sandu Brothers Ltd., need 1760 tons of 156 species worth Rs.1,26,0000/-. Raw material requirement of some of the Indian pharmacies is indicated in the following Table:

Medicinal Plant Material Requirement of Some Indian Herbal Pharmacies

Sr. No.	Name of the Pharmacy	Nature of Product	Number of Plant Species used	* Total demand (Tons/ annum)	Procurement Cost (Rs./ annum)
1.	Shree Dhhotpapeshwar Ltd., Mumbai	Ayurvedic formulations	38	204.0	32,46,960
2.	Gufic Healthcare Ltd., Mumbai	Formu-lations and extracts	49	43.5	18,70,613
3.	Sanmar Speciality Chemicals Ltd., Chennai	Colchicine, Thiocolchicosides	1	100.0	70,000
4.	Kanga Aromatics Ltd., Madurai	Single formulation	3	4.5	1,00,000
5.	Aryavaidyashala Kottakal, Kerala	Ayurvedic formulations	700	3,000.0	30,00,00,000
6.	Natural Remedies Pvt Ltd., Bangalore	Veterinary formulations and herbal extracts	84	6,771.0	67,71,000
7.	Ajanta Pharma Ltd., Mumbai	Herbal extracts	10	36.0	13,54,440
8.	Sandu Brothers Pvt. Ltd., Mumbai	Ayurvedic formulations	156	176.0	12,60,9499
	Averages		130.1	1291.8	40,75,2814

Source: Survey by the Task Force Group on Pharmacy Linkages.

In a survey conducted in 1991 by Vaidya Khadiwale of Pune for 120 species, a total demand of 509.4 tons of raw drugs was estimated for pharmacies located in Maharashtra (Annexure VI). With a modest annual growth rate of 18% suggested for the industry the figure for 1999 works out to 7335.36 tons for the state. However, Natural Remedies Pvt. Ltd., Bangalore, engaged in the sale of veterinary formulations and herbal extracts puts its annual demand of raw material to 6771 tons (Annexure VII). Arya Vaidya Sala, Kottakal, the most popular one of the 1000 odd pharmacies of Kerala has an annual demand of 3000 tons of raw material comprising of 700 species of medicinal plants worth Rs.30 crores (approx.).

Medicinal Plants Business Farm Project, a feasibility done by AFC in 1995, has estimated the annual requirement of raw herbal drugs for ayurvedic pharmacies to 92,994 tons for the Kerala State (Annexure - VIII) which is expected to double by 2000 A.D. An assessment

made by the traders of Guwahati suggests that the annual turnover of pharmaceutical concerns in Assam, where only 18 licensed companies are known to be in operation, could be in the range of Rs.350 to 450 crores requiring supplies of more than 700 tons of high value medicinal plants in the region every year. The total crude drug demand of Government run pharmacies of some states in 1998-99 varied from 60 tons for Madhya Pradesh to 2300 tons for Kerala. The demand averages to 386 tons per state worth Rs.1.48 crores (Annexure IX).

In statewise assessment of demand for 10 major states it works out to 33000 tons per State per year totaling to approximately 3.5 lakh tons for the country as a whole. However, individual pharmacy requirement works out to 1292 tons (approx.) annually. Assuming that there are 100 major pharmacies, the country's demand for crude drugs on this basis comes to 1.29 lakh tons per year. Combining the averages of the two sources, the demand estimate is worked out to 2.4 lakh tons of crude drugs per annum. With doubling of the rate of demand every five years the figure is expected to cross 10 lakh tons by 2010 A.D. The information received through CHEMIXCIL (Annexure X) indicates the total annual demand of major raw herbal material of 55 species to be 31,680 tons. ADMA puts the figure to 29,413 tons of 110 species (Annexure XI). Large variation in the figures received makes the estimation of demand and availability of medicinal plants at the national level a difficult task which re-affirms the need for a systematic survey in this regard.

The estimated annual demand of some of the important herbal crude drugs used in preparation of Indian system of medicines is - Guduchi (Tinospora cordifolia) (10,000 T), Rasna (Pulchea racemosa) (3000 T), Amla (Emblica officinalis) (2750 T), Aswagandha (Withania somnifera) (2500 T), Shatawari (Asparagus racemosus) (2500 T), Mandukparni (Centella asiatica) (1500 T), and Gugul (Commiphora wightii), Sonamukhi (Cassia ungustifolia), Harda (Terminalia chebula), Kalmegh (Andrographis paniculata) and Kumari (Aloe vera) 1000 tons each. The comparative annual demand of major crude drugs used by some Indian pharmacies is given in Annexure XII, which shows considerable variation in species and their quantity used by each pharmacy.

Progressive increase in demand of raw material can be inferred from the fact that Dabur India Ltd., one of the largest ayurvedic companies has recorded annual growth rates of 25% in their sales since 1990 and a doubling of their turnover, every three years[5]. A study of the ayurvedic products in both the organised and unorganised marketing channels from 1987-1990 has revealed an increase of nearly 30% in the trade[6]. AFC's study of 1995 estimates the Kerala State's demand .to double by 2000 A.D.[7]

The Supply Chain and Prices

Around 90% of the medicinal plants used by the Indian Pharmacies today are collected from the wild/natural sources. Less than 20 species of plants are under commercial cultivation and many of these have their uses for other purposes like perfumary/condiments/spices. The crude drug trade is based on local names. The bigger supply of the raw material is procured by pharmacies from the drug dealers in the markets of cities like Mumbai, Delhi, Calcutta, Chennai, Hyderabad, Amritsar, Patna and many small cities of the country. These drug dealers of the cities in-turn procure them from the so called unknown sources (as it forms a part of their

[5] Aryal. 1993. Himal. 6(1)
[6] *IDR The Medicinal Plant Sector in India 1995.*

[7] *AFC Study "Medicinal Plants Business Farm Project. 1995"*

trade secret) though 90% of them ultimately come from natural sources of various parts of the country collected by unskilled forest dwelling communities and purchased by the contractors at a nominal price. This supply chain often extends to 3 - 4 tiers without much value addition but with increase in sale price at each level. There is, on an average, 70 to 100% increase in sale price of crude drugs from primary collectors level to pharmacy level. Many times the same crude drug is available in various grades with major traders having considerable difference in price. For instance various grades of "safed musli" are available at varying prices of Rs.800/- to 1200/-per kg. The gradation is generally dependent on physical features of the crude drug as well as the geographical source of origin. Current market price of certain expensive crude drugs are given as follows:

S.No.	Crude drugs	Botanical name	Price (Rs./kg)
1.	Akkalkada	Anacyclus pyrethrum	1200/-
2.	Ativisha	Aconitum heterophyllurn	1300/-
3.	Safed Musli	Chlorophytum arundinaceum	880/- to 1200/-
4.	Kallawi	Gloriosa superba	700/-
5.	Triman	Gentiana kurroo	504/-
6.	Kankol	Piper cubeba	440/-
7.	Kakad Singi	Pistacia chiensis	385/-
8.	Jaiphal	Myristlca fragrance	348/-
9.	Phansombe (Fleshy fungus)	Arotocarpus heterophyllus	200/-
10.	Vavding	Embelia ribes	195.50
11.	Chopchini	Smilax china	192/-
12.	Dhotra bee (Blue)	Datura innoxia	176/-
13.	Nakeshar	Mesua ferrea	175/-
14.	Maiphal (galls)	Quercus infactoria	165/-
	Piplamool	Piper longum	
15:	Pipal lendi (Inflorescence)	Piper longum	120/-
16.	Kutki	Picrorhiza kurrooa	150.50
17.	Kapur Kachari	Curcuma zedoria	160/-
18.	Chirata	Swertia Chirata	135/-
19.	Gugul	Commiphora wightii	143/-
20.	Jatamanshi	Nadrostachys jatamansi	120/-

21. Kapila Meliotus philippiensis 100/-

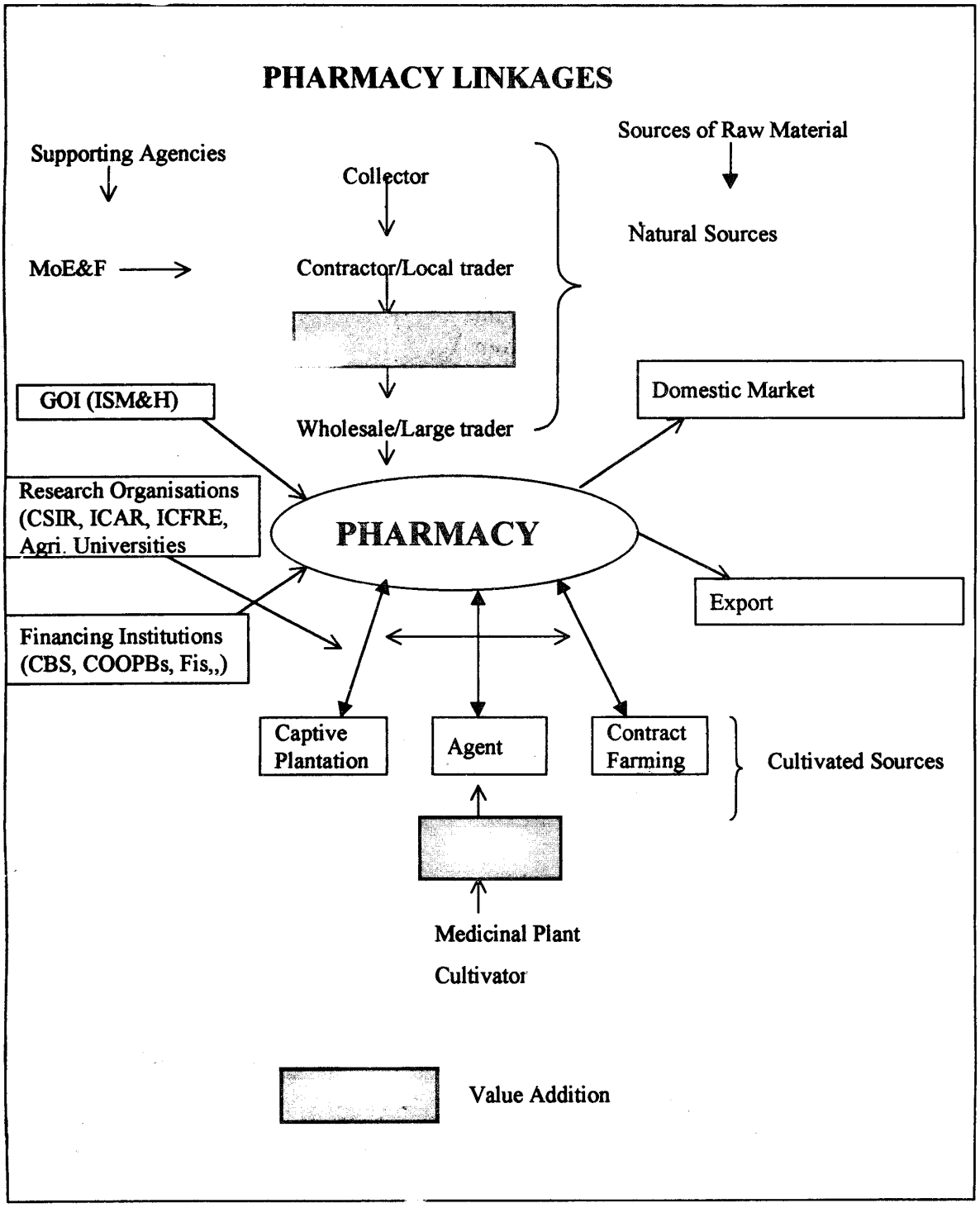
Comparative Prices of Some Medicinal Plant Crude Drugs at Collector and End-user Levels:

(Rs./kg)

Sr.	Local Name No.	Botanical Name	Collector level	End-user level	Mark-up %
1.	Amla fruits	Emblica officinalis	10	20	100
2.	Safed musli	Chlorophytum tubersosum	450	850	90
3.	Harda fruits	Terminalia chebula	15	25	70
4.	Satawari roots	Asparagus racemosus	10	20	100

Source: Multi State Study of NTFP - Medicinal Plants of Western Region, RC: NAEB, AFC, Mumbai, 1999.

FIGURE 1 - SCHEMATIC PRESENTATION OF PHARMACY LINKAGES



Crude drugs trade in certain states like Kerala, Andhra Pradesh and Maharashtra operates through Tribal Co-operative Societies established to ensure fair price for tribals who collect the crude drugs. However, the operation of many of these organisations is unsatisfactory and the tribals prefer to sell their produce to middle men who ensure quick payment in cash.

Most of the pharmacies of ISM have long standing relationship with large traders, through generation and at personal level and users satisfaction level is quite high. They often have preference for crude drugs originating from specific geographical region e.g., Tamalpatra' of N E and 'Kadechirayata' of arid tracts of Gujarat and Rajasthan are preferred over supplies from other regions. Most of the ayurvedic pharmacies rely on purity of their raw material supplied through their traditional source of suppliers and are generally sceptical about quality of crude drugs from cultivated source.

It appears that these informal trade routes are able to supply various types of raw materials in the quantity required by the pharmacies, though at varying prices depending upon the availability of the raw source in the market. Information supplied by ADMA indicates that of the total 3,15,826 tons of raw herbal drug material produced in the country annually only 29,413 tons are utilised by the ayurvedic pharmacies indicating that only 9.31% of total production is consumed by pharmacies.

Emerging Scenario

Unsustainable ways of harvesting and unrestricted marketing have led to the reduction in population of some of the high demand medicinal plants leading to sudden escalation in prices of these crude drugs in the market. AVS, Kottakal, informs that it is unable to get sufficient raw drugs of Saussurea lappa (Kustha), Aconitun heterophyllum (Ativish), Trichosanthes cucumerina (Jangli Padwal), and Coscinium fenestratum (Maramanjal) for use in their pharmacies. Bharat Ayurvedic Stores, Lucknow, informed that Safed musli (Asparagus adscendens), Salumpunja (Orchis latifolia), Akkalkadha (Anacyclus pyrethrum) are in short supply. In addition to Safed musli and Salum punja (Orchis latifolia), Karpur Kachori (Hedychium spicaturn), Ativish (Aconitum heterophyllum) and Raktachandan (Pterocarpus santalinus) are also reported to be in short supply by Gufic Healthcare, Mumbai. A list of species in short supply as communicated by Sandu Brothers, Mumbai, is given in Annexure XIII. Similar is the case with Coptis teesta, Podophyllum hexandrum, Rheum emodi, Rauwolfia serpentina, Embellia ribes, Gloriosa superba, etc.

Recognising the trend many larger pharmacies like Dabur, Zandu, Himalaya drugs, AVS, Kottakal, Shree Dhootpapeshwar etc., have started promoting contract farming of medicinal plants to meet their demand. The modern pharmaceutical industries like Cipla, Natural remedies, Core Health Care, Cadila Health Care, Bio-Ved Pharma etc., who specialise in production of a few speciality drugs/chemicals from plant sources are also involved in contractual cultivation to supplement their requirements. They enter into buy-back arrangements with the growers and employ modern product standardisation techniques. Established traders of crude drugs also feel that promotion of cultivation of medicinal plants is a step in right direction.

Growing popularity of herbal medicines in health care systems and the trend of increase in their export demand are quite apparent. Estimated figures indicate 15 -20% growth of Indian pharmaceutical concerns per year. Figures projecting global trade in medicinal plant species indicate a steep upward trend in near future. According to the World Bank report 1998 world

trade in medicinal plants and related products is expected to be of the order of US $ 5 trillion by A D 2050[8].

Unrestricted exploitation of crude drugs from natural sources without proper measures of conservation have brought the natural medicinal plant wealth of the country to a situation where twenty six species have become endangered, seven species on the verge of extinction and ten to threatened status. This calls for urgent measures for in-situ and ex-situ conservation of such species coupled with cultivation for sustained development of growing herbal drug industry. Policy intervention and support is, therefore, urgently needed for conservation and to encourage and facilitate investments into commercial cultivation of medicinal plants

Conclusion

Based on the data available through published sources and quick assessment survey conducted by the Group on Pharmacy Linkages, it is estimated that the current demand of medicinal plants is about 2.4 lakh tons annually and it is growing at the rate of about 20% per year. This demand pertains to the internal consumption only. It is also estimated that about 10 medicinal plants required in bulk (1000 to 10000 tons) are mainly obtained through natural sources which are depleting fast. Therefore, urgent steps will have to be taken to organise their cultivation to meet the growing demand. About 15 medicinal plants are currently imported to meet the internal demand and therefore for the purpose of import substitution also their cultivation may be necessary.

[8] Pharmaceuticals & Herbal medicines: A Sector Study Occasional Paper No. 53 EXIM Bank 1997.

MARKETING & TRADE OF MEDICINAL PLANTS & IMPORT AND EXPORT

Introduction

According to the Convenor (Ayurvedic Products Sub-Panel) of CHEMEXCIL National pharmaceutical market is of the order of Rs. 12500 Crores inclusive of Ayurvedic market, which is of Rs.2500 crores. Out of this, Rs.2000 Crores is of OTC range and Rs. 500 Crores is of Ethical range. The rate of growth of the market is approximately 20% per year. However, in absence of any systematic survey no authentic data of the Ayurvedic market is available.

Import

All the raw materials used by the Pharmacies are not of indigenous origin. Considerable supplies are received from Nepal, Bhutan, Bangladesh, Pakistan, Afganistan, Singapore, etc., often through informal routes. For instance most of the 'Chirata' and other Himalayan medicinal plant crude drugs come from Nepal and Bhutan, 'Oleoresin gugul' of best quality from Pakistan, 'Liquorice' from Afganistan and good quality of 'Banshalochan' from Singapore. According to the data received from CHEMEXCIL, of the total estimated annual demand of 31,780 tons of raw herbal material of pharmaceutical industries 7180 tons is met with through import. The requirements of Akkalkada - Anacuclus pyrethrum, Jestimadh - Glycrrhiza glabra (Pakistan, Iran, Afganistan), Dalchini -Cinnamomum zeylanica (China), Gajpimpli -Scindapus officinalis, and Kankol - Piper cubeba (Indonesia), Chopchini - Smilax china, Maiphal - Quercus infectoria and Revchini - Garania pictoria are mostly met through imports. About 90% requirement of Gugul (Commiphora wightii) is received from Pakistan. Clove (Syzygium aromaticum), Nutmeg mace (Myristica fragrence aril), Ginger (Zingiber officinale), Kapurkachri (Hedychium spicatum) and Patang (Caesalpinia sappan) are the other raw materials partially imported to fulfill the requirement. Data on import of medicinal plants for 1997-98 as supplied by CHEMEXCIL is given at Annexure XIV. The said data however, doesn't include any information in respect of import of medicinal plants of foreign origin and finished products thereof, such as Ginko biloba, Ginseng, St. John's Wort, Selimarine and such other items.

Export

Apart from requirement of medicinal plants for internal consumption, India is one of the major exporters of crude drugs mainly to the six developed countries, viz. USA, Germany, France, Switzerland, UK and Japan (Annexure XV) who share between them 75 to 80% of the total export of crude drugs from India. The principal herbal drugs that have been finding a good market in foreign countries are Aconite, Aloe, Ammi majus, Belladona, Bach, Cinchona, Cassia tora, Dioscorea, Digitalis, Ephedra, Ergot, Hyoscymus, Ipecac, Isabgol, Liquorice, Opium, Papain, Podophyllum, Pyrethrum, Rauwolfia, Rhubarb, Senna, Stramonium, Valerian, Vinca etc. of which Senna leaves, Isabgol seeds/husk and cassia tora seeds are in maximum demand[99]. The total value of export of crude drugs, Ayurvedic not put-up for retail and Ayurvedic put-up for retail has increased from Rs.394 crores in 1996-97 to Rs.446 crores in 1998-99. Itemwise data for a 3 years period is given in the following table:

(Value in Rs.)

[9] Extension strategies on NWFP with special emphasis on medicinal plants. Bisen and Lal. TFRI. Jabbalpore 1998.

Item	1996-97	1997-98	1998-99
Crude drugs	2559501617	2831380625	2824862157
Ayurvedic not put for retail	395000210	422417579	406265096
Ayurvedic put-up for retail	985250139	1187745520	1232053813
Total	3939751966	4441543724	4463181066

Source: 'CHEMEXCIL, Mumbai.

Emerging Scenario

Export opportunities of natural products are tremendous, as the world market is looking towards natural sources for the purposes of therapeutic use as well as nutritional dietary supplements.

The global herbal remedies market can be classified into five strategic areas as follows:

i) Phyto-Pharmaceuticals - the plant derived drugs containing isolated pure active compounds used to treat diseases,

ii) Medicinal Botanicals / Botanical Extracts / Herbal or Dietary Supplements-the whole plant or plant-part extracts, (either whole extracts or standardised extracts, which have been standardised for particular 'market compound') used for maintenance of health by affecting a body structure and its function,

iii) Nutraceuticals - the foods containing supplements from natural (botanical) sources, that deliver a specific health benefit, including prevention and treatment of disease,

iv) Cosmeceuticals - the cosmetic products which contain biologically active ingredients (of botanical origin) having an effect on the user

v) Herbal raw material

Details of the strategic areas are as under:-

i. Phyto-Pharmaceuticals

The Global market for sale of Phyto-Pharmaceuticals (single entry plant, derived drugs) in 1997 stood at US$ 10 billion. It is estimated that this market will increase at an average annual growth rate of 6.3% through 2002. India has tremendous potential to contribute to this market segment.

ii) Medicinal Botanicals / Botanical Extracts / Herbal or Dietary Supplements

In 1997 the global market for Medicinal Botanicals was at US$ 16.5 billion, which is analysed as follows:

(in US $ billion)

Global Mkt	Europe							North	Asia America	Rest of the world
	Germany	France	Italy	UK	Spain	Nether-land	Other			
16.5	3.6	1.8	0.8	0.5	0.3	0.1	0.4	4	4	1.0

Source: Heritage Healing, Vol.1 No.7, Sept.99.

The Projected Annual Growth by 2000 and beyond was estimated at 15-20% for European and 10 to 100% for the North American markets.

iii) Nutraceuticals

The nutraceuticals market in Europe is expected to increase from 1.05 to 1.6 billion US $ and in U.S. from 3 to 4.6 billion US $. Cosmeceuticals

Annual Market for cosmeceuticals have been estimated at 2.5 US $ billion in U.S. and 5.0 US $ billion in Europe.

iv) Herbal raw material

Herbal raw material market is very large but no definite estimates are available till date to quantify its size in dollar terms. The principal suppliers however to this market are the developing countries who collect the raw material mainly through wild sources.

Immense opportunities for Indian herbals industry exists in the global market in view of its vast herbal resources. With one quarter of all prescribed medicines in addition to OTC products now being herbals in the western countries, there is a vast market potential for India to exploit by catering to the international market on a much larger and organised scale than what it is doing presently.

Most of the medicinal plants required globally for processing of top-selling value added products and formulations in the Phyto-Pnarmaceuticals, Botanicals, Nutraceuticals and Cosmeceuticals category are the followings:

Sr.No.	***Common Name***	***Botanical Name***
1	*PERIWINKLE*	*Catharanthus roseus*
2	*SENNA*	*Cassia senna*
3	*VALERIAN*	*Valeriana wallichii*
4	*CAYENNE*	*Capsicum annuum*
5	*GUAR*	*Cyamopsis tetrogonolobus*
6	*HIMALAYAN MAYAPPLE*	*Podophyllum emodi or P. hexandrum*
7	*GARLIC*	*Allium sativum*
8	*NETTLE*	*Urtica dioica*
9	*HORSE CHESTNUT*	*Asculus hippocastanus*
10	*PHYLLANTHUS*	*Phyllanthus amarus*

11	*PUNCTURE VINE*	*Tribulus terrestris*
12	*WINTER CHERRY*	*Withania somnifera*
13	*GREEN TEA*	*Camellia sinensis*
14	*TURMERIC*	*Curcuma longa*
15	*GINGER*	*Zingiber officinale*
16	*ALOE VERA*	*Aloe barbadensis*
17	*HENNA*	*Lawsonia inermis*
18	*CHAMOMILE*	*Metricaria chamonilla*
19	*ROSEMARY*	*Rosmarinus officinalis*
20	*MARIGOLD*	*Tagtus erecta*
21	*HIBISCUS*	*Hibiscus rosa-sinensis*

The above medicinal plants either grow wild in the country or are grown commercially on a small scale. They need to be cultivated on a bigger scale and as an organised activity.

The cHmatic conditions prevailing in various parts of India are conducive for the cultivation of many exotic and "hot sellers" of the west. The examples of such species are:

Sr.	Name of the Medicinal Plant/Herbs	Botanical Name
1	ST. JOHN'S WORT	Hypericum perforatum
2	CONEFLOWERS	Echinacea angustifolia and E.purprarea
3	FEVERFEW	Tanacetum parbenium
4	MILK THISTLE	Silybum marianum
5	ANISEED	Pimpinella anisum

The processed and value added products from the aforementioned herbals can be a big source of foreign exchange for India, if their expanding markets could be better catered. For instance the Phyto-chemical of Valerian i.e. V'alepatriate sells at the rate of US $ 6000/kg as against the crude drug selling at the rate of US $ 2.3/kg. Average bulk (100 kg) wholesale prices in the US and leading European markets for certain medicinal plants (dried-whole/parts) are as follows:

Sr.	**Dried Roots**	**Price (US $/kg)**
1	Echinacea root	40
2	Echinacea leaf	18
3	Valerian root	15
4	Himalayan May-apple root	5.5

Source: "Opportunities for Indian Natural Products," Heritage Healing, Vol.1No.7 September '99.

Nutraceuticals are gaining popularity in USA and W. Europe in recent years comprise of many botanicals, which are available in India. Considering the markets of over US $ 14 billion, capturing the market share of even 10% will lead to export values equivalent to 50% of the Indian pharmaceutical turnover in the domestic market and equal to the projected total exports

of drugs and pharmaceuticals by 2000 AD. US demand for bulk nutraceuticals for the year 1997 has been estimated at about US $ 4 billion[10].

Apart from the opportunities for 'Herbais ana Ayurvedic', there is considerable scope for medicinal plants based phytochemical products development also. Examples of such components and their plant sources are given as follows:

Examples of important plant derived drugs

Compound	**Plant Species**
Ajmmaline	Rauwolfia serpentina
Ajmalicine	Catharanthus roseus, Rauwolfia Spp
Artemissine	Artemisia annua
Berberine	Berberis Spp
Caffeine	Camellia sinensis
Codeine	Papaver Spp
Colchicine	Colchicum autumnale, Glorios superba
Digitoxin.Digoxin, Digitoxigenin	Digitalis Spp
L-Dopa	Mucuna pruriens
Emetine	Caphaelis Ipecacuanha
Ergometrine, Ergotamine	Claviceps purpurea on Rye Plants
Glycyrrhizin, Glycyrrhizinic Acid	Glycyrrhiza glabra
Hyoscyamine	Datura Spp, Hyscyamus Spp
Hyoscine	Duboisia Spp
Hesperidin	Citrus Spp, Mentha Spp
Menthol	Mentha Spp
Morphine	Pappaver Spp
Papain	Carica papaya
Podophyliotoxin	Podophyllum emodi
Quinine, Quinidine	Cinchona Spp
Reserpine & Deserpidine	Rauwolfia serpentina
Rutin	Eucalyptus Spp, Fagopyrum Spp,
Santonin	Sophora japonica
Sennosides A&B	Cassia angustifolia, C acutifolia
Toxol	Taxus baccata
Vinblastine	Catharanthus roseus
Vincristine	C. roseus
Xanthotoxin	Ammi majus, Heracleum candicans

Chemical Intermediates

Citral	Lemon Grass
Diosgenin	Dioscorea Spp, Costus Spp
Phytosterols (Stigmasterol & Sitosterol)	Soya & Calabar Beans

[10] Source: Nutraceuticals: Emerging Markets, Heritage Healing, Vol. 1 No. 6. August 1999

Solasodine	Solanum Spp

Source : Exim Bank Report 1997.

Standardization of production technology of active constituents of these Species by India would result in remunerative returns.

Market Opportunity for Herbal Products

According to a survey conducted by MacAlpine Thorpe Warrier, Commonwealth Consultants, 1997, the global market for herbal products is estimated of US $ 9 billion (Rs.36000 Crores) which is expected to grow to US $ 40 billion (Rs.160000 Crores) by 2010. Of this European market is of the size of US $ 2.7 billion i.e., Rs.10800 crores. India's share of this market is less than one per cent revealing the fact that there is substantial scope for the country to exploit the opportunity.

Conclusion

It is obvious that we need to develop our export from Rs.446 crores of crude drugs and Ayurvedic products in 98-99 to Rs.10,000 crores plus by 2010 through scientific harnessing our unique biodiversity and the time tested scientific knowledge of natural remedies. Simultaneously, the areas of weaknesses, and threats need to be appropriately managed to avoid their adverse impact.

An analysis of the opportunities in the world market in terms of the following is necessary for developing a focus for a coordinated effort in the right direction.

a) Market survey in terms of classifications of herbal and natural products, vis-t-vis therapeutic segments.

b) Analysis of applicable regulations of the importing countries and defining do's and don'ts thereof, for Exporters

c) Selection of niche opportunities and development of products with appropriate dosage form and packaging.

d) Identification of specific products required by overseas Importer.

e) Systematic organic cultivation of appropriate species of medicinal plants in proper eco-system for sustained availability along with suitable regulation on extraction of wild flora.

f) Development of processing technology for all the year round, harnessing of the crops in appropriate harvesting season and preservation thereof without loss of quality for the year round consumption

g) Preparation of validation dossiers with respect to safety, stability and efficacy of (c) above.

h) Technical upgradation of processing with quality assurance at different stages.

i) Identification of permissible sales-promotion avenues in respective export markets.

j) Identification of exporters and importers,

k) Market tie-ups.

In view of the foregoing, comprehensive package of assistance and incentives may be needed **to promote medicinal plant sector as a thrust industry, on the lines of gems, jewellery and info-tech.**

Chapter VII

IPR & RELATED ISSUES

Background

Medicinal plants represent not only a valuable part of India's biodiversity but also a source of great traditional knowledge. Knowledge-rich companies and researchers from the developed world have been attracted to the wealth the poorer countries have in their biodiversity and the traditional knowledge systems. Some argue that the access to such biodiversity and community knowledge by the industrially developed nations is necessary for the larger welfare of mankind as this advances knowledge and leads to new products which contribute to the well being of global consumers. However, this is not the point. The point is that this access to the resources of the poor does not benefit in any way, while their natural resource and intellectual property continues to be appropriated and exploited.

There is also a deep philosophical divide on the issue of IPR that we have to deal with. The existing IPR systems are oriented around the concept of private ownership and individual invention. They are at odds with indigenous cultures, which emphasise collective creation and ownership of knowledge. There is a concern that IPR systems encourage the appropriation of traditional knowledge for commercial use without the fair sharing of benefits, or that they violate indigenous cultural percepts by encouraging the commodification of such knowledge.

Benefit Sharing

The local communities or individuals do not have the knowledge or the means to safeguard their property in a system which has its origin in very different cultural values and attitudes. The communities have a storehouse of knowledge about their flora and fauna - their habits, their habitats, their seasonal behaviour and the like - and it is only logical and in consonance with natural justice that they are given a greater say as a matter of right in all matters regarding the study, extraction and commercialisation of the biodiversity. A policy that does not obstruct the advancement of knowledge, and provides for valid and sustainable uses and intellectual property protection with just benefit sharing is what we need.

While it is true that many indigenous cultures appear to develop and transmit knowledge from generation to generation within a system, individuals in local or indigenous communities can distinguish themselves as informal creators or inventors, separate from the community. Furthermore, some indigenous or traditional societies are reported to recognise various types of intellectual property rights over knowledge, which may be held by individuals, families, lineage or communities. Discussion of IPRs and traditional knowledge should draw more on the diversity and creativity of indigenous approaches to IPR issues. In addition, there are power divisions as well as knowledge divisions among people in many communities, and sharing of benefits with community as a whole is no guarantee that the people who are really conserving traditional knowledge and associated biodiversity will gain the rewards they deserve for their efforts.

While recognising the market-based nature of IPRs, other non-market-based rights could be useful in developing models for a right to protect traditional knowledge, innovations and practices. Geographical indications and trademarks, or sui generis analogies, could be alternative tools for indigenous and local communities seeking to gain economic benefits from

their traditional knowledge. To date, debate on IPRs and biodiversity has focussed on patents and plant breeders' rights. The potential value of geographical indications and trademarks needs to be examined too. They protect and reward traditions while allowing evolution. They emphasise the relationships between human cultures and their local land and environment. They are not freely transferable from one owner to another. They can be maintained as long as the collective tradition is maintained.

It is generally difficult to attribute an objective economic value to the knowledge of local and indigenous communities, and associated resources for a number of reasons. One could be the absence of a market for genetic resources, and the complexity of inputs into creation, new crop varieties. It will be more pragmatic to focus on the costs of conservation to indigenous and local communities as a guide to designing economic incentives that will help them gain adequate rewards. Different interest groups such as industry intellectual property experts and indigenous and local peoples' organisations need to cooperate in order to define mechanisms for more effective sharing benefits with the providers of traditional knowledge and genetic sources.

Models of benefit sharing are beginning to emerge in India. There is the case of a medicine that is based on the active ingredient in a plant. Trichopus zeylanicus, found in the tropical forests of south-western India and collected by the Kani tribal people. Scientists at the Tropical Botanic Garden and Research (TBGRI) in Kerala learned of the tonic, which is claimed to bolster the immune system and provide additional energy, while on a jungle expedition with the Kani in 1987. A few years later, they, returned to collect the samples of the plant, known locally as arogyapacha, and began laboratory studies of its potency. These scientists then isolated and tested the ingredient and incorporated it into a compound, which they christened "Jeevani" - giver of life. The tonic is now being manufactured by a major Ayurvedic drug company in Kerala. In November 1995, an agreement was struck for the institute and the tribal community to share a license fee and 2% of net profits. The process marks perhaps the first time that cash benefits have gone directly to the source of the knowledge of traditional medicines and the original innovators. We need to formalise such models.

Protecting India's traditional knowledge on Medicinal Plants

Many times, wrong patents are given in the area of medicinal plants : the recent case of Jamun/Karela linked patent on diabetes is a point. First, it must be understood that patent offices do make mistakes in checking the novelty of an invention because these usually look at their own databases. So the chances of issuing wrong patents are quite finite especially when an application based on the indigenous knowledge is being examined in a foreign country. The knowledge which may be in public domain in one country may be a new knowledge in another country. Therefore, it is expected that foreign patent offices would make mistakes in granting patents for the inventions based on the traditional knowledge in India and such numbers are to increase with time. The question whether all such patents be opposed or not should be addressed on the following three basis:

(a) Would the Indian trade, both domestic and foreign, be affected by not opposing the patent?

(b) What would be the time and cost involved in opposing a patent? The time and cost would depend on how quickly all the necessary information could be collected, collated and presented?

(c) Have necessary ground and factual information been established to oppose the patents

successfully?

The following two paragraphs from the letter by Robert Saifer, Director, US Patent Office (dated 27 August, 1999) is revealing, since it shows the difficulties that such patent offices face as well as a way out.

" Patent examiners are particularly careful in searching patent literature when considering the patentability of claimed subject matter, and do the best job they can seeing available resources for searching the appropriate non-patent literature sources as well. Patent literature, however, is usually wholly contained in several distinctive databases and can be more easily searched and retrieved then can non-patent literature prior art that may be buried somewhere in the many and diverse sources of non-patent literature. The examiner who issued US Patent 5,401,504 was not aware, nor was he able to ascertain at the time he decided to grant the patent, that there existed non-patent literature which taught the use of turmeric in wound healing in India.

We should, however, address the need of creating more easily accessible non-patent literature databases that deal with traditional knowledge. Perhaps an office amongst the developing countries should suggest this as a project for the SCIT. Working Group on Standards and Documentation, working in close cooperation with the International Patent Classification (IPC) Committee of Experts. With the help of the developing countries, traditional knowledge can be documented, captured electronically, and placed in the appropriate classification within the I PC'so that it can be more easily searched and retrieved. This would help prevent the patenting of turmeric, as well as karela, jamun, brinjal and other traditionally used remedies."

National Traditional Knowledge Digital Library

Arising out of this suggestion, the concept of a National Traditional Knowledge Digital Library (TKDL) has emerged. The need for setting up of National Traditional Knowledge Digital Library (TKDL), so that this library could be utilised as a proof of prior art by the examiners of Patent Offices, nationally and internationally has been circulated recently at the initiative of Shri V.K.Gupta of NIC and motivated by ISM department. Efforts have been made to analyse international developments including inter-governmental processes and the national initiative made in the direction of conserving and/or promoting traditional knowledge of the country.

As traditional knowledge digital library aims at avoidance of grant of patent by developed countries, it is necessary that the systems and procedures related to grant of patents at national and international level are well understood. Also an innovative strategy will have to be formulated for addressing complex issues such as nonavailability of documentation, languages, classification, integration among different organisations on their knowledge base, so that it becomes possible to create TKDL within a defined time frame.

The primary objective of TKDL is that of avoidance of grant of patent on the traditional knowledge of the country. Therefore, it is imperative to understand in detail the process relating to grant of patent in an IP office and the requirements of a patent examiner. A patent application filed at an IP office is to minimally contain information on the following aspects:

- Date of filing
- Applicant

- Inventor
- International Patent Classifications
- Title
- Abstract
- Keywords

The application number and IPC classification is done by the IP receiving office, in the case of WIPO administered Patent Co-operation Treaty (PCT) countries and priority date is determined as per well laid down criteria. An application filed in an IP office is taken on first come first served basis for examination by a patent examiner by following well established search and examination procedures. An examiner may object to the grant of patent by formally communicating to the applicant the grounds for the decision. A mechanism of appeal and/or hearipg is available to the applicant and during appeal/hearing proceedings, if the applicant Js able to satisfy the examiner/appellate board, IP office may consider revocation of its objections and may agree to publish the basic details of invention in its patent gazette or grant the patent (based on national practice). During a definite time period, for the countries where pre-grant opposition is practiced, member of public Tribunal/board of opposition proceeding has to take a final view on grant of patent based on the claim of inventor and evidence filed by the part(s) opposing the grant of patent. It may be seen that TKDL has a dual role to contribute in avoidance of grant of patents, i.e,, readily making available the information to examiners during the examination process (best option). In case due to some reasons TKDL does not become available to the examiner at the examination stage, TKDL can also be utilised by the country concerned at the time of opposition proceedings. However, the first option is pro-active in nature, therefore, is superior whereas the second option is reactive in nature. Also some countries such as United States do not invite objections before the grant of patents. Therefore TKDL is the only viable route on patent avoidance, where pre-grant opposition facilities are not available, as post grant opposition is complex and extremely expensive.

It is apparent for the target segment of TKDL is a patent examiner, so that he is in a position to utilise TKDL for search and examination. Therefore, it is necessary to understand various kinds of search and examination, which are normally carried out in a national IP office viz. (I) search for novelty (ii) state of art search (non-obviousness) and (iii) bibliographic search. Successful novelty and non-obviousness search is normally the basis for grant of patents. Search requests to an IP office in a developed country are also received from the companies as input to R & D efforts. Search is based on some of the key attributes of the first page of the patent application. Following are the key attributes which are utilised for carrying out search:

• Inventor
• Title
• Classification
• Country
• Priority No.
• Filing date
• Abstract
• Key words

Following are the key considerations which must be addressed before taking up the project on TKDL:

i. Resource/knowledge classification

ii. Document Classification

iii. Enhancing subject based IPC classification to serve the national needs

iv. Deciding on key attributes of TKDL similar to the first page of patent application.

v. Finalising essential features for search and examination vi. Identifying primary attributes of TKDL

TKDL is to be created as a Web enabled product utilising the free search features, and at the same time permitting search on one or more of the attributes defined in the attribute list of TKDL at annex 3.4. Data dictionary on modern and traditional names equivalence need be integral to TKDL so that it is possible to search TKDL on traditional as well as modern names.

Next Steps on the creation of TKDL

TKDL is likely to be created from varied sources, i.e documents in multiple languages like Hindi, Urdu, Persian, Sanskrit, English etc. Some of the documents and publications may follow structured approach, however, majority of documents are lively to be available in a unstructured format. Significant efforts will have to be made in transcription of document and as well as on translation or transliteration. This may create obvious difficulties in realising the objectives therefore solutions in the area of document imaging and information system management must be explored for achieving the desired simplifications. Issues which need be addressed are cross referencing, conversion between different formats, including multilingual aspects, access control links between textual and image data (Bibliographic references), search techniques and methodologies etc. Once these issues are addressed implementable technical options are required for creating TKDL from (i) structured documents (ii) unstructured documents and (iii) combination of structured and unstructured documents.

- Finalisation and adaptation by International IP community of TKDL key attributes.
- Evolving the structure on classification of traditional resources, development and adaptation of traditional knowledge resources classification (TKRC).
- Validation and verification of our approach on creation of TKDL.
- Evolving and adopting standards such as document classification etc. in the context of TKDL by international IP community.
- Hosting of TKDL on WIPONET so that it is accessible to patent examiners of all the IP offices.

Involvement of WIPO on above mentioned aspects will ensure utilisation of TDKL by all the IP offices and will ensure establishment of prior-art to the content of TKDL.

Other measures for protection of traditional knowledge

While TKDL gets formulated, the need of the hour is to document the indigenous knowledge related to Indian herbs and plants and their medicinal and other uses and convert it into easily navigable computerized databases for easy access. For instance, CSIR has

converted the entire Wealth of India into a CD-ROM which has also hypertext linkages. Health Heritage is an archival, interactive multimedia compact disc incorporating both traditional knowledge from Sanskrit Classics referred to by practitioners of Indian systems of medicine and the modern information made available through systematic scientific research during the past forty years on 50 medicinal plants most widely used in Ayurveda.

The traditional Sanskrit shlokas have been reproduced alongwith English translations. The CD summarises the chemical studies of plants and biological evaluation of total extracts and fractions thereof. It also lists all the pharmacological, biological and clinical work done on pure constituents obtained from plants and gives the complete structure of new substances isolated.

The CD is an attempt by CSIR to put our traditional knowledge in the public domain, in English, in modern electronic formats such as CD-ROM and online databases, and on the internet which will be accessible to everyone in the world, including all Patent offices. The objective of this exercise is to show to the world that all such knowledge is a prior art and any patent application on our traditional medicinal plants does not fulfil the criteria of novelty for patenting purposes.

Once such databases are available, these can be put on the proposed WIPONET for the benefit of I PR offices of many member countries. Urgent steps are required to be taken in this direction.

Next Steps

India is behind the rest of the world in patents both quantitatively and qualitatively, even when comparison is made with our neighbour China. The continued illiteracy and confusion about patents is a serious matter. Our pool of knowledge that is protected by patents, even in areas where we have a competitive advantage is rather poor. Take the area of herbal products, where so much emotion has been raised. Have we protected our innovations by strong patenting ? No. But our neighbour China is doing it. The number of herbal patents (1995-98) were 1889, out of which China had a share of 889, and the Indian share was next to nothing. Incorporating strong systems of generation of IPR, documentation valuation, protection and its gainful use will need a massive thrust. A weak physical infrastructure, inadequate documentation, poor public awareness and delay in framing and implementing Government policies will hurt India. We need to act on this speedily. Some of the key actions are summarised below:-

Government would need to:

- Modernise the patent offices by
    - o modernising the premises, information processing and assessing systems and office management,
    - o creatk-ig conditions which will attract talented, qualified, trained and motivated personnel to work in these office.
    - o Empowering the employees in the patent offices and raising their level and stature; and
    - o Ensuring early and timely grant of IPR.
- Introduce attractive fiscal incentives and mechanism to enhance and encourage patenting of inventions overseas.

- Launch a massive programme on creating digital data bases on traditional knowledge, so that 'prior art' could be easily established.
- Create/amend IPR laws to protect national interests while meeting the international obligations.

Judiciary and legal system would need to:

- devise and provide mechanisms for quick and effective disposal of legal cases.
- Provide for registration of Patent Attorneys and form a Council for maintaining high professional standards.

Industry would need to:

- enhance skills to understand, analyse and manage IPR as a means for corporate strategy
- scout and seek alliances with sources of IPR for market positioning
- transact and treat IPR as any other tangible property
- spearhead formation of a National Assosication of inventors to foster inventiveness and to provide a forum for inventors to meet together.

S&T System would need to:

- stimulate and encourage creativity and inventiveness of their employees.
- promote awareness of IPR and the importance for its protection.
- develop skills to understand, interpret and use the techno-legal business information contained in patents.
- facilitate access to international IPR and information databases
- capture and assess the intellectual property generated at an early stage
- recognise and reward inve/itiveness
- develop skills to manage and exploit IPR

Educational systems would need to:

- devise appropriate curricula on IPR and introduce these as formal courses at school, graduate and post graduate levels.
- develop qualified manpower to draft and interpret patents and other IPRs
- provide referesher training to practising IPR professionals
- carry out research on IPR to further its knowledge and use.

Chapter VIII

POLICY AND INSTITUTIONAL ARRANGEMENT

Policy Issues

While addressing the policy issues, there is need to highlight various factors like constraints, importance, traditional knowledge and indigenous uses, marketing and trade, patent & I PR, quality control/standards etc.

Constraints

Medicinal Plants sector is facing following constraints:-

i) Depletion of the resource-base, which is the foundation of entire sector.

ii) Decline of folk traditional medicines, a source of primary health care for an estimated 800 million people in the country.

iii) Impoverishment of rural people, who are stewards of the resource base and the holders of traditional ecological and medical knowledge, through inequitable marketing channels.

iv) Medicinal plant trade is inefficient, imperfect, informal and opportunistic.

v) Crude drugs supply situation is shaky, unsustainable, exploitative and adulteration taking place.

vi) Deficient toxicology studies and standard preparations to improve the quality, efficacy and effectiveness of the traditional drugs.

vii) Unsustainable wild-harvesting.

viii) Lack of coordination amongst various stakeholders such as Govt. of India (Ministry of Agriculture, Environment & Forests, ISM&H, Science & Technology etc.) State Governments, Private traditional medicine sector, research institutes, NGOs, International Networks etc.

Importance of Medicinal Plants

In terms of policy, medicinal plants have generally been lumped into the broad category of Minor Forest Produce (MFP). Even the relatively progressive 1988 Forest Policy Resolution continues to use this terminology. However, as the markets and sizes of the user communities suggest, a more accurate designation for these products they have been termed as Non Timber Forest Products (NTFPs).

Nonetheless, NTFPs, including medicinal plants, have rarely been considered as warranting the enormous amount of consideration and research given to timber policies. However, some provision for regulation was made as early as 1927 under the Indian Forest Act.

Most medicinal plants are covered under sub-section 2 (4) (b), and are not subject to regulations unless extracted from the forests. However, some items such as bark and wood-oil from certain trees were covered under sub-section 2 (4) (a); and subsequent state amendments to the act have added several medicinal species to this sub-section, as shown in

table, the following subject to signficant regulation regardless of origin.

Medicinal plants included by State Amendments in section 2 (4) (a) of 1927 Indian Forest Act

State	Species
Gujrat	Rauwolfia serpentina, Kadaya gum
Maharashtra	Rosha grass including oil, Rauwolfia serpentiana
Karnataka	Sandalwood oil, rosha grass and oil, Phyllanthus emblica, Terminalia chebula, Terminalia belerica, Capparis mooni
Tamil Nadu	Sandalwood
Kerala	Gum, fibres and roots of sandalwood and rosewood
Orissa	Gums, roots of Patal garuda, sandalwood, tamarind
Uttar Pradesh	Gum, Chiraunji

Considering the importance of medicinal plants they should be taken out from NTFPs and given due importance for their development. A policy dialogue has already been initiated regarding medicinal plant conservation and statements of support for such a policy are forthcoming from many of the stakeholders in the sector, including the private companies which depend upon a continuous source of raw material supply. More recently governmental, non-governmental and private sectors have started the process of developing and enacting a national policy on medicinal plant. Some of the salient points are:-

i) Documentation relating to properties, natural distribution, ecological tolerances and uses of valuable medicinal plants.

ii) Identification of forest areas rich in medicinal plants and formulation of their management plan.

iii) At present 90% collection of medicinal plants is from the wild. The plant part is collected without paying attention to the state of maturity dried haphazardly and stored for long periods under unsuitable conditions. The unsustainable collection is rapidly depleting the resource base and, therefore, many species are under threat. The policy for sustainable development of medicinal plants resource may aim:-

a. In-situ conservation of medicinal plants in protected areas, herbal gardens, sacred groves, preservation plots and forest areas rich in medicinal plants.

b. Ex-situ conservation through cultivation, Joint Forest Management, gene banks etc.

c. Developing medicinal plant conservation areas (MPCAs) inside as well as outside protected areas.

d. Research and development efforts for developing agrotechniques, extension & dissemination of information on cultivation of super genotypes.

e. Establishing linkages between farmers and pharmaceutical industries for promotion of organic and contract farming.

f. Formalising and organising marketing by providing information and possible interventions at various level.s.

g. As prices paid to the gatherers tend to be very low, they often 'mine' the natural resources, as their main objective is to generate an income. Formalisation of market may resolve the problems of exploitation and impoverishment of gatherers.

Traditional Knowledge & Indigenous Uses

Policy implications relating to the traditional knowledge base of tribals peoples on medicinal plants and health care are complex due to the fact that they are coloured by debates on biodiversity conservation imperatives, knowledge systems for drug discovery, intellectual property rights/patents and equitable sharing of benefits derived from tribal knowledge. Although India is committed to the Convention of Biological Diversity, question of equity are yet to be fully addressed. The proposed UN declaration on the Rights of Indigenous Peoples; as well as the activities of the International Labour Organisation (ILO) and the General Agreement on Trade and Tariffs (GATT) all impinge on national policy development in this area. It will therefore be sometime before policy is formulated and practical applications developed. The latter are likely to devote attention to encouraging collaboration between all concerned parties in order to foster respect for the contribution of traditional knowledge, as well as to ensuring that regulations take local laws and customs into account in the utilisation of biodiversity.

Although they may constitute the largest part of health care provision among India's population, especially among the poor, tribal and folk practices are still not recognized" by GOI policies. However, the policies do recognize the value of the classical traditional systems. Furthermore, tribal practices have begun to assume greater importance in recent years due to the current debate on intellectual property rights and the potential implications of bioprospecting.

There is however a danger, as articulated by several NGOs, that new possibilities for the exploitation of the poor, will be created by the Trade Related Intellectual Property (TRIPS) stipulation attached to GATT. India is a signatory to GATT and has agreed to comply with the stipulation in principle, although a good deal of internal debate continues with regard to who should obtain universally valid patents as well as the benefits which should accrue to the communities providing the input knowledge.

The current policy have neglected the folk traditional sector which should be included in legislation and policy development especially in relation to health care centres and folk practitioners.

Policies regulating safety and efficacy need to be evolved based on recognition of the uniqueness of tribal and folk medicines, and this should be linked to intellectural property rights which is sure that community benefit from the use made of their technology.

Marketing & Trade

In the medicinal plant industry, the various actions needed include: setting up of a national level authority, responsive marketing cooperatives, organisation of formal market, dissemination of market information, creation of international market opportunity etc.

Patents & Intellectual Property Rights

Indian's present system, based on the Patent Act of 1970, especially defines process patents. However, the implications of developing product patents could involve higher investments in research and development by the traditional industry, given the likely returns through patent protection. There is little relevant policy which affects the marketing channels. The regulations on licensing and registration for certain products appear to be easily bypassed and are generally not enforced. Beyond these policies, little has been done to address the domestic market. The focus of most regulatory and related policy has been on export.

Measure for achieving an equitable marketing system and a thriving of new drugs for primary health care; as well as improvements in quality and production standards for existing drugs. Furthermore, it might have a relaxing effect on the secretive and defensive nature of the trade.

The major dilemma confronting India is how to apply patent law to formulations and products, which have been developed over 1000 years. In essence, no one can claim "innovations" of the medicines of ISM&H. And, it is also argued that upgrading a simple production technology to a more sophisticated one or adding or subtracting a single ingredient does constitute an innovation. The government is facing pressure to go for patents since foreign companies have already access to patents on Neem., Turmeric, Brinjal, Jamun seed etc.

India's wealth of traditional knowledge will be damaged by such patents if the government does not act quickly to protect the knowledge. Therefore we have to standardise our pharmacopoeia modify our laws and take patents of important plants medicine and para-medicine.

Quality Control/Standards

Quality control and standards constitute an area where policy making is still 'work in progress'. Pharmacopoeia are now available for the major species. Nevertheless, a universally recognised set of quality control standard have still not been developed for the preparation of ISM drugs, which pose serious challenges as they often contain a number of constituent plants, unlike the single principle allopathic medicines. Some of the unique aspects of traditional medicinal preparation that would need to be considered include specific means of identifying and collecting constituent plants, including seasons for collections and appropriate age of plants; ecological origins; cleanliness in processing and adherence to documented procedures in the ancient texts of relevance.

It is important to ensure that the plants used as medicines by the people are not toxic in any way. This is therefore, one area in which modern technology can be of great service. In addition, standard preparations need to be developed to make quality efficacy and effectiveness of the traditional drugs.

Focussed Strategies to Popularise Ten Major Indian Plants For Various Ailments In The World Market

As a policy issue there is a need to draw the proper strategy to increase our export of value added plant based products as was done in the matter of Gingseng or Gingko biloba (by China and Korea). There is lot of literature available on every aspect of such plants in the world market. Right from the improved variety of^hese plants, cultivation techniques, assured availability of the quality plants material, its chemistry, pharmacology, toxicology to their clinical efficacy indicating various ailments are available supported with data about the use of these

drugs. Products using medicinal plants are available over the counter in every nook and corner of the world market. That is why these drugs are fetching remunerative returns to China and Korea.

In order to increase export of plant based products a similar strategy is required to be followed in respect of the following Indian plants;

1.	Ashwagandha (Withania somnifera)	for Geriatrics problem.
2.	Bala (Sida Cordfolia)	for neurological disorders.
3.	Brahmi (Bacopa monnieri)	for memory disorders.
4.	Geloy-Gaduchi (Tinospora cordifolia)	As immuno-modular
5.	Chiraita (Swertia Chirata)	for liver disorder
6.	Kutki (Picrorrhiza kurroa)	for liver disorder
7.	Gudmar (Gymnema sylvestre)	for Diabetes
8.	Ashoka (Saraca asoca)	Uterine Tonic
9.	Satavari (Asparagus racemosus)	Anti-Ulcer, Aprodisiacs
10.	Amala (Amalaki) (Emblica officinalis)	For Rasayana, Geriatics
11.	Arjuna (Terminalia arjuna)	For Cardiac disorders
12.	Gugglu (Commiphora wightii)	For cholesterol related disorders, Arthritis

There is a need to conduct extensive R & D on these plants not only to improve their varieties, enhance availability but also to establish their efficacy in various clinical conditions mentioned above. While undertaking this research there has to be active interface with the industry so that the research leads to patents being obtained and new drugs being marketed for public benefit and for exports.

Conclusions

i) There is need for a comprehensive government policy for recognition of medicinal plants in health care system covering all the types of medicines-allopathic, classical traditional and folk practices.

ii) ISM & H, department of GOI should be the nodal agency for medicinal plants. For coordinating the efforts of various stakenolders circumstances warrant setting up of medicinal plant board.

iii) Making cooperatives more responsive and representatives : Although the scope of cooperatives has usually been limited to simply being a group of producers working together to create their own market linkages, which would be useful to build these up into more comprehensive organisations, with skills in collecting, cultivation and semi-processing were appropriate.

iv) Formalising and organising the market: The transformation of the market should be accomplished through a number of coordinated small steps taken by different actors, who together agree upon and change specifying their roles through a coalition body proposed above.

v) Dissemination of market information and adding value at the local level : Both of these need long term planning and action since the major Indian market currently require virtually no processing before the plants reach wholesalers. Goals would include new devoluation of resource management authority and the establishment of reliable markets with local returns for inputs.

vi) Making sense of domestic market : Currently little is known about the market, specially of the informal sector. This information will be essential to the coordinated planning required for the sector in order to deal with effectively with all stakeholders.

vii) Finding opportunities in the international market : Indian company have advantages in terms of its medico-cultural expertise and biological diversity. Research is needed which will identify opportunities in the global market in which Indian ventures would be uniquely suited to participate and perform strongly.

viii) With regard to the patent and IPR there is need to standardise our pharmacopoeia, modify our laws and take patents registration of important plants medicine and para-medicine.

ix) There is need to develop modern technology to ensure that the plants used medicines by the people are not toxic. Further, standard preparations are required to be developed to make quality, efficacy and effectiveness of the traditional drugs.

Institutional Issues

In order to have a focussed approach for developing the whole sector of medicinal plants both in terms of conservation, cultivation, sustainable use and legal protection, an institutional mechanism need to be evolved. For addressing the institutional mechanisms relating to the medicinal plants, the activities of various organisations/agencies and also the existing institutional mechanism need to be brought out.

The Task Force recommends following action plans for various stakeholders:

Ministry of Environment & Forest

i) Inventorisation and economic mapping of medicinal plants areas.

ii) Establishment of 200 Medicinal Plant Conservation Areas (MPCA) covering all eco-systems, forest types and sub-types in the country, (inside protected areas viz national park, wild life sanctuary, biosphere reserves, preservation plots etc.) for in-situ conservation of important species.

iii) All endangered or rare or threatened species should be grown in well established gardens managed by Agriculture, Horticulture, Forest Departments, Botanical Survey of India etc.

iv) Forest Department should identify forest areas rich in medicinal plant (MPDA), their management plan should be formulated for intensive management and sustainable harvesting of herbal drugs from 200 places.

v) Forest Department should effectively regulate extraction and transport of medicinal plant from wild. The department should maintain a list of petty traders, private agents, wholesale dealers and final consumer of medicinal plants.

vi) Forest Department should establish 200 "Vanaspati Van" in open forest areas (each having an area of about 5000 hectare) for commercial supply of crude drugs to pharmacies and for exports. The "Vanaspati Van" should be managed by a registered society headed by Divisional Forest Officer under JFM system.

vii) Organsing training and awareness camps on various aspects of medicinal plants.

Ministry of Agriculture & ICAR

i) Development of agro-technological packages under different ecological conditions and information on intercropping, rotation cropping and use of bio-fertilisers, organic farming etc.

ii) Large scale availability of high quality planting material by developing a protocol for bulk production of super genotypes and seedlings through a network of nursery of medicinal plants.

iii) Human Resource Development of farmers by organising training and awareness programme on various aspects of medicinal plants sector development including seminars and conferences.

Department of ISM&H (GOI)

i) Nodal agency for integrated development of medicinal plants.

ii) Establishment of National Medicinal Plant Board for coordinating various activities.

iii) Developing pharmacopoeial standards.

iv) Quality control and efficacy for medicinal plant and their products.

v) Legal, policy and other supports for overall development of the sector.

Department of Family Welfare (GOI)

i) Promoting use of medicinal plant product in RCH programme

ii) The scheme of establishing "Vanaspati Van" should continue and atleast one "vanaspati van" in each state should be established during 9th plan period.

iii) The scheme of improving awakening and availability of medicinal plants planting material should continue. Atleast 50 NGOs technically qualified may be identified for making available extension material such as literature, planting material etc.

Department of Biotechnology

i) Ex-situ conservation through establishment of genebanks

ii) R&D relating to biotechnological efforts involving Invitro culture, biotransformation, bioprospecting and bioengineering

Department of Scientific and Industrial Research

i) Chemical studies on medicinal plant constituents and quantitative assessment of major constituents.

ii) Pharmacological and lexicological studies

iii) Pilot plant scale processing of plant extracts

iv) Standardisation of extracts

v) Formulation studies on extracts into dosage form,

vi) Development of new drugs

Department of Science & Technology

i) Establishment of a cell for motivating the scientists and technologists to patent products and processes of their research findings.

ii) S&T interventions to help the rural people to process medicinal plant at local level for their economic development.

Pharmacies & Medicinal Industries

i) Supporting and conducting high quality biomedical research for developing new drugs.

ii) Encouraging contract farming of medicinal plants, iii)
Reducing secretive and exploitative trade

NON Governmental Organisation (NGO)

i) Create awakening amongst the people about importance of medicinal plant.

ii) Ensure supply of planting material and technology to motivate people for sustainable cultivation, harvesting, drying, processing and marketing.

iii) Preparation of posters and other information on medicinal plants,

iv) Establishing linkages between growers and Pharmacies,

v) Organising marketing of medicinal plants.

Chapter IX

CONCLUSION AND RECOMMENDATIONS

Conclusion

Earlier chapters of this report have highlighted following facts about medicinal plants sector in India:

i) The sector has traditionally occupied an important position in the socio-cultural, spiritual and medicinal arena of rural and tribal lives of India. In recent years, due to growing recognition of natural products and processes in sustaining human, cattle and environmental health, the economic as well as environmental importance of the medicinal plant resources have increased tremendously.

ii) The World Health Organisation (WHO) estimated that 80% of the population of developing countries rely on traditional medicines, mostly plant drugs, for their primary health care needs. Also modern pharmacopoeia contained at least 25% drugs derived from plants and many others which are synthetic analogous built on prototype compounds isolated from plants.

iii) The growing importance of herbal remedies in the developed countries has attracted the attention of all. Psychiatric disorders and neurodegenerative diseases require collaborative research. For brain related disorders synthetic drugs have only partial answers. Many medical practitioners see ISM&H systems happily co-existing with allopathy in the new millennium. The medicinal plants being natural, non-narcotic, having no side-effects and effective in treatments for ailments like cerebral malaria, cardiac diseases, hepatitis, arthritis, jaundice, mental disorder, premature aging, general immunity, stress related diseases, diarrhoea, etc.

iv) Ethnobiological survey indicated that about 8000 species of medicinal plants are used as food, medicine, phytochemicals, biocides and other products. Medicinal plants are used at the household level in a self-help mode. Over one and half million practitioners of ISM&H use medicinal plants in preventive, promotive and curative applications. There are 7843 licensed pharmacies of ISM in addition to 857 in Homeopathy and a number of unlicensed small scale processing units manufacturing drugs. International market of medicinal plants related trade is over US $ 60 billion per year and growing at the rate of 7%. India's export is around Rs. 447 crores per year only.

v) At present 90% collection of medicinal plants is from wild, generating about 40 million mandays employment. Current practices of harvesting are unsustainable and responsible for depletion of resource base. Marketing of medicinal plants is inefficient, imperfect, informal, secretive, and opportunistic. As a result, the raw-material supply situation is shaky, unsustainable and exploitative.

vi) Medicinal plants are collected without paying attention to the stage of maturity, dried haphazardly and stored long period under unsuitable conditions hence deteriorate in quality. As the price paid to the gatherers tend to be very low they often "mine" the plants as their main objective is to generate income. A critical factor in the wild harvesting is the availability of cheap labour to undertake the very labour intensive work of gathering.

vii) Several medicinal plants have been assessed as endangered, vulnerable and threatened due to overharvesting or unskillful harvesting in the wild. Habitat destruction in the form of deforestation is an added danger. Since rural communities still depend on herbal medicines, **sometime it is the only source of health care available to them.**

viii) There is a growing demand for natural product based medicines, health products, pharmaceuticals, food supplements, cosmetics etc. in the national and international markets. For meeting demand cultivated material is infinitely more appropriate for various uses. Systematic cultivation of medicinal plants needs following research and development support:-

a. Good agricultural practices which will include appropriate selection, identification, propagation methods, cultivation techniques, harvesting, stepwise quality control of raw-material upto processing stage, post harvest treatment, storage and safety.

b. Development of protocols for producing planting materials with desirable agronomic and therapeutic chemical derivatives.

c. Genetic transformation techniques to be developed and standardised.

d. Organic farming of medicinal plants as per world demand.

ix) World over about 100 plant species are yielding 120 chemical compounds for modern pharmaceuticals. These chemicals are isolated in following ways:-

a) Isolation of active compounds for formulation into drugs (quinine, reserpine, digoxin etc.)

b) Isolation of intermediate compounds for production of semi synthetic drugs.

c) Preparation of standardised galenicals (extracts, powders, tinctures etc.)

x) Medicinal plants sector spans a number of stakeholders having divergent interests. They include:-

a) The Government of India and State Governments, including the Ministries of Agriculture, Environment and Forests, and Health.

b) Traders and manufacturers.

c) Scientist, researchers and research institutions (including quality control labs).

d) Relevant Non Governmental Organisations which improve awakening and availability of medicinal plants and which serve as representatives of communities of collectors and users of plants and plant derived drugs.

e) Consumers

f) Collectors and cultivators of medicinal plants.

g) International networks in which India is represented and international organisations concerned with the broader aspects of biodiversity.

xi) The control of quality of the raw materials, finished products and of processes is an absolute necessity if one has to produce goods for world market and human consumption. Thl quality requirements for medicinal plant preparations are stringent in terms of active principles and toxic materials. Quality has to be built into the whole process beginning from the collection/cultivation of herbs to the final product reaching the consumer. Standard preparations need to be developed to improve quality, efficacy and effectiveness of the traditional drugs.

xii) The developed countries are exerting tremendous pressure on developing countries by patenting medicinal plant products and processes. In USA patents have been obtained on active ingredients of Neem, Turmeric, Basmati Karela, Gurmar, Brinjal etc. All attempts should be made to identify traditional formulations and knowledge relating to process and products and patents may obtained to the extent possible. The vital question of property right to developing countries for the use of know-how and genetic resources in the development of modern drugs has to be discussed and final solution to be derived.

xiii) Medicinal plants sector in India operates in policy vacuum. Immediate action is needed to produce clearly defined policies to regulate medicinal plants conservation, cultivation, marketing and trade, exports, domestic drug production and coordination efforts and information. Although the sector is largely informal but it works in practice. However the constraints are likely to have an increasing impact, resulting perhaps in a crisis situation in near future.

xiv) Despite a wealth of resources (biological, human and financial) being available the lack of coordinated approach has resulted in the simultaneous under-utilisation and overexploitation of medicinal plants. **For sustainable and equitable development of the sector and to avert a crisis, creation of "Medicinal Plants Board" should be expedited.** Similar boards were set up for tea, coffee, cardamom and spices trades. This board will certainly pave the way for development of medicinal plants sector for health care, generation of employment and ecological upgradation.

Strategy

In terms of sustainable development of medicinal plants sector, there are five obvious targets, most of which are recognised by the government and people.

A. **Focus on Environment and Biodiversity** conservation especially forests, wastelands, gardens, sacred groves etc. as these continue to be the primary habitat for medicinal plants, and linkages with incentives related to their conservation, sustainable harvesting and rehabilitation of degraded areas.

B. **Systematic cultivation of medicinal plants** by adopting following techniques:-

a) Selection of plants (best pheno, geno and chemotypes) for cultivation being demand and market driven

b) Development of high yielding varieties

c) In vitro propagation

d) Organic farming

C. **Quality control and standard preparations.** Genuineness of the plants to be ensured for maintaining quality and standard of Pharmaceutical preparations of crude extracts, decoctions and compound formulations. Assessment of safety and efficacy of herbal drugs for health improvement of poor as well as rich.

D. **Formalising and organising the market and trade.** India has comparative advantages in the market and can generate a stronger presence globally.

E. **Policy and institutional arrangement** for conserving, enhancing and sustainable utilising the medicinal plants resources.

Action Programmes

i) Establishment of 200 Medicinal Plants Conservation Areas (MPCA) covering all ecosystems, forest types and sub-types in the country. Details as per annexure XVIII.

ii) About 100 medicinal plants classified as endangered or rare or threatened should be grown in well established gardens of the country. Such gardens are mainly managed by Agriculture, Horticulture, Forest Departments & Botanical Survey of India.

iii) Three gene banks created through Central Institute for Medicinal and Aromatic Plants in Lucknow, National Bureau of Plant Genetic Resources in New Delhi and Tropical Botanical Garden and Research Institute in Trivendrum should properly store germplasm of all medicinal plants.

iv) Attempt should be made to establish 200 "Vanaspati Van" in forest areas (each having an area of about 5000 hectares) for commercial supply of crude drugs to pharmacies and for exports. The vanaspati van should be managed by a registered society headed by Divisional Forest Officer (details as per annexure XIX).

v) Forest Departments should identify and stockmap areas rich in medicinal plants. A "Management Plan" should be formulated for such areas (MPDA). Intensive management should aim sustainable harvesting and quality production of herbal drugs (details as per annexure XX).

vi) Forest Departments should effectively regulate extraction and transport of medicinal plants from wild. It should maintain a list of petty traders, private agents, wholesale dealers and final consumer of medicinal plants.

vii) About 50 NGOs (including agricultural universities) technically qualified may be identified for improving awareness and availability of seeds and planting material of medicinal plants to people interested in their cultivation.

viii) Twenty five species which are in great demand (listed in chapter III of the report) may be encouraged for cultivation. Contract and organic farming should be encouraged.

ix) Quality and pharmaceutical standards of herbal drugs should be finalised early to establish faith of the users in the domestic and international markets.

x) For formalising and organising the marketing and trade of medicinal plants "A National Medicinal Plants Board" should be established. The board should include representatives from the various stakeholders.

xi) Herbal gardens may be established in each "Development Block" under Rural Development schemes.

xii) Active principles of important medicinal plants to be determined and their quality improved by combination of biotechnology and genetic engineering.

xiii) Search for new molecules, development of new drugs their standardisation and patenting have to be given priority.

xiv) Appropriate policy, legislation & financial supports should be extended to the sector for greening the country, generating productive employment and supporting health care.

xv) All efforts to be coordinated to ensure export of herbal products to earn Rs. 3000 crores by 2005 and Rs. 10000 crores by 2010 A.D besides meeting domestic needs.

Financial Assistance Required

i) National Afforestation & Ecodevelopment Board's (NAEB) scheme on "Non-Timber Forest Produce including Medicinal Plant" should be bifurcated carving out a separate scheme on Medicinal Plants development. The scheme should aim to establish 200 Medicinal Plants Conservation Areas in Protected Areas with the help of Wild Life Wings of the states. The scheme may need an expenditure of Rs. 50 crores.

ii) Scheme of establishing "Vanaspati Van" of Department of Family Welfare should continue during the 9th Five Year Plan. An additional amount of Rs. 750 crores will be needed to complete establishment of 200 "Vanaspati Van" in the country.

iii) Forest areas rich in medicinal plants should be identified and management plan to be formulated for their intensive and sustainable harvesting. For formulating such 200 management plans an amount of Rs.50 crore will be required.

iv) "Scheme of improving awakening and availability of Medicinal Plants" through NGOs should continue. About 50 technically qualified NGOs should motivate the farmers to carry out contract and organic farming of medicinal plants. Additional amount of Rs. 40 crores will be needed for providing know-how on growing medicinal plants and quality planting material to the farmers.

v) For formalising and organising the marketing and trade of medicinal plants and to boost export establishment of "Medicinal Plant Board" is essential. It will need financial assistance of Rs. 50 crores.

vi) For developing pharmacopoeial standards and quality control of herbal drugs Department of ISM&H will need additional support of Rs. 50 crores.

vii) For developing invitro culture, biotransformation transgenic propagation of super chemotypes Department of Biotechnology will need additional support of Rs. 10 crores.

Thus an amount of Rs.1000 crores will be needed over a period of 5 years for comprehensive development of Medicinal Plants sector. The sector is expected to generate additional employment to 100 million people in the process of cultivation/regeneration, collection, drying, grading and processing of medicinal prants.

ANNEXURE-I

N0.30015/9/99-S&T
Government of India
Planning Commission

Yojana Bhavan, Sansad Marg
New Delhi - 110001

Dated : 14.6.1999

Subject: Constitution of Task Force on Conservation and Sustainable Use of Medicinal Plants.

It has been decided to set up a Task Force to provide policy directives, measures for sustaining the resource base, achieving an equitable marketing system and thriving pharmaceutical industry (ISM & H), regulation of domestic and international trade, besides facilitating protection of patent rights and IPR of medicinal plants. The composition and terms of reference of the Task Foce are as under:

S.N.	COMPOSITION	
1.	Dr. D.N.Tewari, Member, Planning Commission Government of India, New Delhi	Chairman
2.	Smt. Shanta Shastri, Secretary, Deptt. of ISM&H *	Member
3.	Dr. (Mrs.) Manju Sharma, Secretary, Deptt. of Biotechnology Government of India, New Delhi	Member
4.	Dr. R.A. Mashelkar, Director General, CSIR, Government of India, New Delhi	Member
5.	Director General, ICAR, Govt. of India, New Delhi	Member
6.	Secretary, Environment & Forests, Govt. of India, New Delhi**	Member
7.	Dr. K.N. Sinha, C-954-955, Mahanagar, Lucknow	Member
8.	Dr. Rajeev Tyagi, 91 E Sanik Farm, New Delhi	Member
9.	Shri A.E. Ahmed, Joint Secretary, Ministry of Industry*** Deptt. of Industrial Development, Govt. of India, New Delhi	Member
10.	Shri Anand Puranik, Chairman, Ayurvedic Products Panel of CHEMEXCIL, Ministry of Commerce, Govt. of India, New Delhi	Member
11.	Shri S. Narendra, Principal Adviser, Planning Commission Govt. of India, New Delhi	Member Secretary
12.	Shri A. P. Dikshit was copied as Member of the Task Force	
13.	Shri R.S. Shukla was copted as Member of the Task Force	

* *She attended only one first meeting and was replaced by Smt. Shailja Chandra.*
** *Secretary, Environment and Forest was represented by Shri R.H. Khwaja, Joint Secretary.*
*** *Shri A.E. Ahmed Jt. Secy was represented by Shri Sohan Lal, Director.*
**** *Shri S. Narendra, Pr. Adviser (S&T) was replaced by Dr. Rajan Katoch, Adviser (S&T) & JS(SP) on his retirement.*

II TERMS OF REFERENCE

1. Inventorisation, project formulation, conservation, sustainable harvesting of medicinal plants.
2. Measures for cultivation of medicinal plants, development of agro-technology commercial cultivation and ensuring remunerative to the growers.
3. Measures of achieving an equitable marketing system and a thriving medicinal plant industry.
4. Scientific, technological and economic researches for improvement of quality control, products safety and efficacy data on medicinal plants.
5. Facilitating protection of patent Rights IPR etc.
6. Suggesting policy, legislative and institutional changes necessary for promotion of coordination amongst various stakeholders.
7. Promotion of domestic and international trade of medicinal plants sector.

III. The Task Force may invite inputs suggestions from other experts and agencies.

IV. The non-officials members will draw their TA and DA from the Planning Commission as per the rules and regulations of TA/DA as applicable to Grade I Officers of Government of India.

V. The Task Force may submit its report within 10 weeks from the date of constitution.

Sd/-
(Arvind Kumar)
Director Administration

Copy forwarded to:

1. Chairman and all members of the Task Force
2. PS to Deputy Chairman, Planning Commission
3. PS to Minister of State (P&PI)
4. PS to all Members, Planning Commission
5. PS to Secretary, Planning Commission
6. All Principal Advisers/Advisers, Planning Commission
7. Administration (General), Planning Commission
8. Accounts-l Branch, Planning Commission
9. Information Officer, Planning Commission
10. Library, Planning Commission
11. PS to Director (Administration)

Sd/-
(Arvind Kumar)
Director (Administration)

ANNEXURE - II

MEETINGS OF THE TASK FORCE

Four meetings of the Task Force on Conservation and Sustainable Use of Medicinal Plants were held. The participants and the major decisions taken in these meetings are given below :

FIRST MEETING

Date : 5th July, 1999

Participants :

1.	Shri K.C. Pant, Deputy Chairman, Planning Commission	
2.	Dr. D.N. Tiwari, Member, Planning Commission	Chairman
3.	Smt. Shanta Shastry, Secretary, Deptt of ISM&H	Member
4.	Dr. (Mrs.) Manju Sharma, Secretary, Deptt. Of Biotechnology	Member
5.	Dr. R.A. Mashelkar, Secretary, DSIR & DG, CSIR	Member *9*
6.	Dr. K.N. Sinha	Member
7.	Dr. Rajeev Tyagi	Member
8.	Shri Anand Puranik, Chairman, Ayurvedic Product Panel of CHEMEXIL, M/o. Commerce	Member
9.	Shri R.H. Khwaja Joint Secretary, M/o Environment & Forests	Rep. of Secretary, E&F
10.	Dr. S.P. Ghosh DDG(Hort), ICAR	Rep. of DG, ICAR
11.	Shri Sohan Lal, Director Deptt. of Industrial Development	Rep. of Shri A.E. Ahmed JS, M/o Industry
12.	Shri S. Narendra Principal Adviser	Member-Secretary
13.	Dr. Lakshmi Raghupathy, M/o Environment & Forests	
14.	Dr. Mohd. Aslam, Deptt. of Biotechnology	
15.	Dr. S.K. Sharma, Adviser (Ayurveda) D/o ISM&H	
16.	Dr. Anupam Joshi, Consultant, Planning Commission	

Major Decisions :

i) Setting up of the following groups under the convenorship of concerned Members to work out the draft chapter on each of the areas:

	Groups	Chairman
a)	Cultivation	Dr. (Mrs.) Manju Sharma, Secretary, Department of Biotechnology.
b)	Quality Control & Standardisation	Smt. Shanta Shastry, Secretary, ISM&H
c)	Patent & IPR related issues	Dr. R.A. Mashelkar, Secretary, DSIR&DG.CSIR
d)	Identification, inventorisation JS) Conservation, and Formulationof Management Plan	Secretary, E&F (Shri R.S. Khawaja,
e)	Marketing (Import & Export)	Shri Anand Puranik, CHEMEXIL
f)	Policy issues	Dr. Rajeev Tyagi
9)	Institutional issues	Shri S. Narendra, Pr. Adviser, PC
h)	Pharmacy linkages	Dr. A. P. Dikshit

ii. The draft report should be submitted to the Chairman of the Task Force on or before 5th August, 1999. These draft reports would be circulated to all the Members of the Task Force for their comments/suggestions. It was decided that concerned departments would provide necessary administrative and financial support to the groups for completion of their report. Policy and Institutional groups will be supported by Planning Commission.

iii. The second meeting of the Task Force is scheduled to be held on 10th August, 1999 to finalise the report of the Task Force so that the report could be submitted within the tenure of the Task Force.

SECOND MEETING

Date : 10th August, 1909

Participants :

1.	Dr. D.N. Tiwari, Member, Planning Commission	— Chairman
2.	Smt. Shanta Shastry, Secretray, D/o ISM&H	— Member
3.	Dr. (Mrs.) Manju Sharma, Secretary, D/o Biotechnology	— Member
4.	Dr. R.A. Mashelkar, Secretary, DSIR & DG, CSIR	— Member
5.	Dr. K.N. Sinha	— Member
6.	Dr. Rajiv Tyagi	— Member
7.	Shri R.H.Khwaja, JS, M/o E&F E&F	Rep. of Secretary,
8.	Dr. S.K. Pareek, NBPGR, New Delhi	Rep. of DG, ICAR
9,	Shri Sohan Lal, Director, D/o I D JS, M/o Ind.	Rep. of Shri A.E. Ahmed,
10.	Shri S. Narendra, Principal Adviser, PC	— Member

Secretary
11. Dr. PL. Sanjeeva Reddy, Principal Adviser, Planning Commission
12. Dr. A.P. Dikshit, GM, AFC, Mumbai
13. Shri R.S. Shukla, CCF (Social Forestry), UP, Lucknow
14. Dr. S.K. Sharma, Adviser (Ayurveda), D/o ISM&H
15. Dr. Lakshmi Raghupathy, M/o Environment & Forests
16. Dr. Ambujam Nair Kapoor, Dy. Adv. (H&FW)

Major Decisions :

Excellent efforts have been made by the various groups in finalising their report. However, these reports need to be updated and each group was requested to incorporate various information/data etc. as well taking into consideration the suggestions/comments made thereof in this meeting so that each report could be used as an action plan for their implementation. These updated reports could also be used for finalising the composite/ comprehensive report of the Task Force which may highlights the importance, constraints, present status, existing mechanism and various suggestions/ recommendations related to the areas where the specific groups have been constituted. The recommendations should also indicate the agencies responsible for implementation and follow up action. It was decided to constitute a drafting Committee under the Chairmanship of Secretary, Department of Biotechnology to formulate a draft report of the Task Force taking into consideration the inputs of the updated reports of the various groups and submit the same by 10th September, 1999. The third meeting of the Task Force is scheduled to be held on 17.9.99 at 10.30 A.M. in the Planning Commission to finalise its draft report. It was also decided to extend the tenure of the Task Force beyond 23rd August, 1999.

THIRD MEETING

Date : 17th September, 1999

Participants :

1. Dr. D.N. Tiwari, Member, Planning Commission — Chairman
2. Smt. Shailja Chandra, Secretray, D/o ISM&H
3. Dr. (Mrs.) Mahju Sharma, Secretary, D/o Biotechnology
4. Dr. R.S. Paroda, Secretary, DARE & DG, iCAR
5. Shri S. Narendra, Principal Adviser, PC
6. Shri Vinod Vaish, Special Secretary, M/o Environment & Forests
7. Shri Arvind Puranik, CHEMXIL
8. Shri R.H.Khwaja, JS, M/o E&F
9. Dr. S.P. Ghosh, DDG (Hort.), ICAR
10. Shri Sohan Lal, Director, D/o I D Rep. of Shri A.E. Ahmed, JS, M/o Industry
11. Dr. N.N. Mehrotra, CDRI, Lucknow
12. Dr. A.P. Dikshit, GM, AFC, Mumbai
13. Shri R.S. Shukla, CCF (Social Forestry), UP, Lucknow
14. Dr. S.K. Sharma, Adviser (Ayurveda), D/o ISM&H

15. Dr. Lakshmi Raghupathy, M/o Environment & Forests

16. Dr. Anupam Joshi, Consultant (E&F), PC

Major Decisions :

i) Departments/institutions/agencies identified for preparation of document on various aspects of cultivation covering availability of planting material, agro-practices, protocol, status of technology of 25 plant species may be prepared and included in the chapter on cultivation.

ii) A core group was constituted for integration and consolidation of data base on medicinal plants under the Chairmanship of Secretary, ISM&H with the representatives from Ministry of Commerce, E&F, Industrial Development, ICAR, CSIR., IFM, Bhopal (Dr. Rama Prasad).

iii) Members of the Task Force were requested to closely interact and collaborate with various concerned departments/agencies individuals while preparing and finalising their chapters

iv) Regarding the finalisation of the report, following members of the Task Force were identified for preparation of the main chapters :

	Chapters	Members of the Task Force
(i)	Introduction, present scenario, constraints	Dr. D.N. Tiwari
(«)	Inventorisation, documentation, conservation,	Secretary, Env. & Forests
(iii)	Cultivation	DG, ICAR
(iii)	Research & development	Secretary, DBT
(iv)	Pharmacopia, standards and quality control	Secretary, ISM&H
(v)	Demand and supply	
	- Pharmacy linkages (internal consumption)	Dr. A. P. Dikshit
	- Export & Import	Shri Anand Puranik
(vi)	IPR and related issues	Shri A.E. Ahmad
(vii)	Policy issues and institutional framework	Shri S. Narendra
(viii)	Recommendation	Dr. D.N. Tiwari

All the concerned Members responsible for preparation of various chapters were requested to submit their respective chapter by 20th October, 1999.

FOURTH MEETING

Date : 12th January, 2000

Participants :

1. Dr. D.N. Tiwari, Member, Planning Commission - Chairman
2. Smt. Shailja Chandra, Secretray, D/o ISM&H

3. Dr. R.A. Mashelkar, Secretary, DSIR & DG, CSIR
4. Dr. R. Tyagi
5. Shri S. Narendra, Principal Adviser, PC
6. Ms J. Khanna, Principal Adviser, PC
7. Shri R.H.Khwaja, JS, M/o E&F
8. Dr. R.N. Pal, ADG (PC), ICAR
9. Shri Sohan Lal, Director, D/o I D
10. Dr. V.K. Bahuguna, DIG (Forest), M/o E&F
11. Dr. A. P. Dikshit, GM, AFC, Mumbai
12. Dr. (Mrs.) Prema Ramachandran, Adviser (Health), PC
13. Dr. S.K. Sharma, Adviser (Ayurveda), D/o ISM&H
14. Dr. R.M. Singhal, DDG (R), ICFRE
15. Dr. S. Natesh, Director, DBT
16. Shri R.C. Jhamtani, Joint Adviser (E&F), PC
17. Shri N.K. Singh, Deputy Adviser (Forest), PC

Major Decisions

Some of the aspects relating to efficacy study, extension, publicity, R&D, clinical trials as well as information and development of WIPO network would be included in the respective chapters. Concerned Members of the Task Force were requested to revise some of the chapters like standardization and quality control, R&D, Patent and demand supply and forward the same to the Planning Commission urgently. It was decided that the report would be finalized based on these inputs. The final report would be forwarded to the Members of the Task Force for their comments.

ANNEXURE - III

LIST OF MEDICINAL PLANTS PROHIBITED

Government of India
Ministry of Commerce

Notification No.24 (RE-98)/1997-2002
New Delhi, Dated the 14.10.98

S.O (E) Attention is invited to para 4 of Notification no.2 (RE - 98)/1997-2002 dated the 13th April, 1998 relating to export of plants, plant portion and their derivatives and extracts obtained from the wild.

2. In exercise of the powers conferred under Section 5 of the Foreign Trade Development & Regulation Act, 1992 (No.22 of 1992) read with Paragraph 4.1 of the Export and Import Policy 1997-2002, the Central Government hereby makes the following amendment in the Schedule 2 Appendix 2 of the book titled "ITO (HS) Classification of Export and import Items 1997-2002" relating to export of plants, plant portion sand their derivatives and extractsw obtained from the wild.

i) The export of under mentioned 29 plants, Plant portions and their derivatives and extracts as such obtained from the wild except the formulations* made therefrom, is prohibited:

1. Beddomes'' cycad (Cycas beddomei)
2. Blue Vanda (Vanda coerulea)
3. Saussurea costus
4. Ladies slipper orchids (Paphiopedilium species)
5. Pitcher plant (Nepenthes khasiana)
6. Red Vanda (Renathera imschootiana)
7. Rauvolfia serpentina (Sarpagandha)
8. Ceropegia species
9. Frerea indica (Shindal Mankundi)
10. Podophyllum hexandrum (emodi) (Indian Podophyllum)
11. Cyatheaceae species (Tree Ferns)
12. Cycadaceae species
13. Dioscorea deltoidea (Elephant's foot)
14. Euphorbia species (Euphorbias)
15. Orchidaceae species (Orchids)
16. Pterocarpus santalinus (Red Sanders)
17. Taxus wallichiana (Common Yew or Birmi leaves)
18. Aquilaria malaccensis (Agarwood)
19. Aconitum species

20. Coptis teeta
21. Coscinium fenestratum (Calumba wood)
22. Dactylorhiza hatagirea
23. Gentiana kurroo (Kuru, Kutki)
24. Gnetum species
25. Kamphergia galenga
26. Panax pseudoginseng
27. Picrorhiza kurrooa
28. Swertia chirata (Charayatah)

* The term "Formulation" used here shall include products which may contain portions/extracts of plants on the prohibited list but only in unrecognizable and physically inseparable from.

ii) Plants and Plant portions, derivatives and extracts of the cultivated varieties on the above plant species (excluding SI. No. 16) will be allowed for export subject to production of a Certificate of Cultivation from the Regional Deputy Director (Wildlife), or Chief Conservator of Forests or Divisional Forest Officers of the State concerned from where these plants and plant portions have been procure. However, in respect of the cultivated varieties of the species as covered by Appendix 1 (SI. No.1 tp 6 Of Paragraph 2 (1) above and Appendix 2 (SI. No.7 to 18 and SI. No. 26 & 28) of Para 2 (1) above, of CITES Permit for export will also be required.

iii) The value added formulations, as defined under sub-para (1) of paragraph 2 above, made out of imported species of plants and plant portions as specified in Sub-para (1) Paragraph 2 now will be allowed to be exported freely without any restriction subject to furnishing of an affidavit to the Customs authorities at the time of export that only the imported plant species as above have been used for the manufacture of value added formulations being exported. In the event of affidavit proving to be false, on the basis of random sample tests, actions would be initiated against the firm under the Foreign Trade (Development & Regulation) Act, 1992.

iv) All formulations - herbal/Ayurvedic medicines, where the label does not mention any ingredients extracted from these prohibited plants shall be freely, exportable without the requirement of any certification from any authorities whatsoever.

v) Export allowed only through the ports of Mumbai, Calcutta, Cochin, Delhi, Chennai, Tuticorin and Amritsar.

3. This issues in public interest.

Sd/-
(N.L.Lakhanpal)
Director General of Foreign Trade

ANNEXURE - IV-1

QUICK SURVEY FOR ASSESSING THE DEMAND AND SUPPLY OF MEDICINAL PLANTS AND FINANCIAL REQUIREMENTS OF PHARMACIES

A. DEMAND-SUPPLY POSITION OF MEDICINAL PLANTS

1. Name of the Pharmacy and Address:
2. Year of Establishment:
3. Types and qualities of drugs produced annually:
4. Total requirement of medicinal plants Types and quantity (per annum):
5. Species-wise annual requirement:

Sl. No.	Common name	Botanical Name	Average Price/Kg. (Rs.)	Total Quantity required/ Tonne	Place and Agency of procurement

6. Plants in short supply:

Sl. No.	Common Name	Botanica Name	Quantity required Tonnes/ annum	From when the supply got reduced

7. Plant Drugs obtained through cultivated source

Sl. No.	Common name	Botanical Name	Price (Rs/tonne)	Quantity/ Tonnes/	Place Annum

8. Crude drugs of plant origin imported:

SI. No.	Common Name	Botanical Name	Country of procurement	Quantity/ annum	Price (Rs./ (Tonnes)	Total Cost (Rs.) tonne)

B. FINANCIAL REQUIREMENTS

1. Total annual financial requirements (Rs.) _____

2. Itemwise details of purpose and finances required (Rs./Annum):

	Items	Financial Requirement Per Annum (Rs.)
(a)	Cultivation: - Captive cultivation - Contract cultivation	
(b)	Procurement from Natural Sources	
(c)	Storage	
(d)	Value addition i.e., processing and manufacturing	

ANNEXURE -V-1

NAME OF PHARMACIES TO WHOM QUESTIONNAIRE ON DEMAND AND SUPPLY POSITION OF MEDICINAL PLANTS WAS SENT

Fax: 887 0856/886 8349
Dr.G G Nair
President
Indian Drugs Manufacturers
Association, and
Chairman ofBDH Industries Ltd.,
Nair Baug, Akurli Road, Kandivli (E)
Mumbai 400 101

Fax: 8369008/8218103
Dr. Vijay Singh Chauhan
Vice President (Herbal Development)
GUFIC Health Care Ltd.,
Subhash Road A
Vile Parle (E)
Mumbai 400 057

Fax: 4375491
DrJ M Pathak
Research Director
(Pharmacognosy)
The Zandu Pharmaceutical Works Ltd
70, Gokhale Road South, Dadar
Mumbai 400 025

Fax: 0522-237469
Vaidya Omprakash Aggarwal
(Ayurvedacharya)
Bharat Ayurvedic Stores
Charnag,
Lucknow

Fax: 4938215
Shri Kishor Shroff
President
Ayurvedic Drug Manufacturers'
Association
Director
Charak Pharmaceuticals Ltd.,
Mumbai

Fax: 020-5657944
Dr.Narendra Bhatt
President
BIO-VED Pharmaceuticals Pvt Ltd
6 Pradeep Chambers
Bhandarkar Institute Road
Pune411 005.

Fax: (0493) 742572/742210
Prof.S Sitaraman
General Manager
Arya Vaidya Sala
Kottakkal 676 503
Kerala

Fax: (0268) 65424
Dr.S N Gupta
Head
Kayachikitsa Department
Superintendent
P D PatelAyurved Hospital
J S Ayurveda College
Nadiad387001

Managing Director
Herba Indica
351, Industrial Area
Phase II
Chandigarh 160 002.
Fax: 0172-548856

Managing Director
Jairamdas Khusiram Pvt Ltd.,
B-62, APMC Complex
Phase II, Market 1
Sector 19, Vashi
Navi Mumbai 400 705.
Fax: 7665618

Managing Director
Dabur India Ltd.,
3, Factory Road, Ring Road
Adjacent Safdarjung Hospital
New Delhi 110 029.
Fax: 011-6968433

Managing Director
Sanjivani Herbal Phama
VIP View, 105, 1st floor
VIP Road, Karelibaug
Baroda 390 018
Fax: 0265-434806

Managing Director
Sanmar Speciality Chemicals Ltd.,
8, Cathedral Road
Chennai 600 086
Fax: 044-8269359

Managing Director
Welex Laboratories Pvt
5/46, Tardeo Air Conditioned Market
Tardeo
Mumbai 400 034
Fax: 4951155

Managing Director
Indian Herbs Rsearch & Supply Co.,
P B No.5, Sharda Nagar
Saharanpur 247 009
Fax: 0132-726288

Fax: 5282403
Dr.Nagesh Sandu,
Director
Sandu Brothers (P) Ltd.,
D/124, TTC, MIDC
Shirvane, Nerul
Navi Mumbai 400 614

Managing Director
Herbs India
192, Mundaga Nagar Street
Sivakasi 626 123
(Tamil Nadu)
Fax: 04560-23105

Managing Director
Himalaya Drug Co.,
Makali
Sanaa/ore *562123.*
Fax: 080-8396057

Managing Director
Indian Herbs Concentrates Pvt Ltd.,
164/3, Vasavi Temple Road
V V Puram
Bangalore 560 004

Fax: 080-6612050/6656652

Managing Director
Warrier Herbal Products Ltd.,
PBNo.826
Visitors Building Complex
M G Road,
Thrissur 680 004
(Kerala)
Fax:0487- 427143

Managing Director
Natural Remedies
P B No.456, Vasani Temple Road
V V Puram
Bangalore 560 004
Fax: 080-6612526

Managing Director
Shree Baidyanath
Ayurved Bhawan Ltd
Gread Nag Road
Nagpur 440 009
Fax: 0712-743455

Managing Director
Alchem International
201, Empire Plaza,
Maharauli Gurgaon Road
Sultanpur
New Delhi 110030
Fax: 011-6802102/6802423

Managing Director
Hitashi Chemicals
11 Ezra Street,
Calcutta 700 001.
Fax: 033-2479738/2407173

Managing Director
Dr.Roopas Herbal System Pvt Ltd.,
T-5, Usha Chamber,
Central Market
Ashok Vihar
Delhi 11 0052
Fax: 011-7219969/7218836

Managing Director
Kanga Aromatics Pvt Ltd.,
S.N0.66/5A, 66/1 & 66/3A
Y Pudupatti Arumbanur Post
Madurai North 625 107
Fax: 0452-822824/531707

Managing Director
Alrasin Marketing Pvt Ltd.,
MIDC.PBNo.941 6
Opp. ESIS Hospital
Andheri (East)
Mumbai 400 093

Managing Director
Herbal (APS) Pvt Ltd.,
B M Das Road
Patna 800 004

Managing Director
Aimil Pharmaceuticals (India) Pvt Ltd.,
2699, Main Patel Road Patel Nagar (West)
New Delhi 110 008.

Managing Director
Kruzer Herbals
B-20/2. Okhla Phase 2
New Delhi 110 020

Managing Director
Hamdard (Wakf) Laboratories
Hamdard Marg Delhi 110 006.

Managing Director
Alien Laboratories Pvt Ltd.,
224/H, Maniktala Main Road
Calcutta 700 054

Managing Director
Bharati Rasyanagar
27, Nakukeshwar Bhattacharjee Lane
Calcutta 700 026

Managing Director
Jand J Dechane Laboratories Pvt Ltd.,
4-1-324, Residency Road
Hyderabad 500 001.

Managing Director
Shilpachem
47-D, Industrial Estate
Indore 452 006

Managing Director
Herbo-Med (P) Ltd.,
68 Hemachandra Naskar Road
Calcutta 700 010.

Managing Director
Madona Pharmaceuticals Research Pvt Ltd.,
208/7, Rishi Bankimchandra Road
Calcutta 700 028

ANNEXURE - VI-1

AN ESTIMATE OF DEMAND OF MEDICINAL PLANTS BY HERBAL INDUSTRIES AND AYURVEDIC DRUG PRODUCERS OF MAHARASHTRA,

1991 SURVEY

(Source: Vaidya Khadiwale, Demand of Medicinal Plants and Planning for Cultivation. 1998)

	Common Name	Botanical Name	Quantity in Kg.
1.	Ashok sal	Saraca asoca	15,000
2.	Arjun sal	Terminalia arjuna	12,000
3.	Upalsari mul	Hemidesmus indicus	7,500
4.	Askand	Withania semnifera (Nagori)	10,000
5.	Gulvel kadya	Tinoopora cordifalia	10,000
6.	Ova	Carum caraway	2,000
7.	Awal kathi	Emblica officinalis (dried fruit pulp)	25,000
8.	Adulsa leaves (dried)	Adathoda vasica	7,000
9.	Indrajav seeds	Wrightia tinctoria	1,000
10.	Isabgol (powder)	Plantago ovata	2,500
11.	Khairsal	Acacia catechu	1,800
12.	Kalabol	Alaevera jell	2,000
13.	Korphad (fresh)	Aloe vera	30,000
14.	Kapila churn	Mallotus philippiensis	400
15.	Ambehalad	Curcuma ungustifolia	2,000
16.	Kachora	C. zedorea	2,500
17.	Kapur Kachari	Heydichium spicatum	5,200
18.	Kama! phul	Nelumbo nucifera	400
19.	Kavach seed	Mucuna pipirita	800
20.	Sagargota	Caesalpinia bonducella	2,000
21.	Ringni panchang	Salanum zanthocarpum	4,000
22.	Dorli mul	Solanum indicum	400
23.	Kankol	Piper cubeba	500
24.	Kalmegh (Vasai)	Andrographis paniculatta	100

	Common Name	Botanical Name	Quantity in Kg.
25.	Kanchan sal	Bouhinia purpurea	150
26.	Kutki	Picrorhiza currou	3,000
27.	Kuchala seeds	Strychnos nux-vomica	300
28.	Kuda sal	Holerrhoena antidysentrica	9,000
29.	Kosht Uplet	Saussurea lappa	500
30.	Kokum tel	Garcinia indica	500
31.	Kadu jire	Vernonia anthelmintica	100
32.	Tulas seeds	Ocimum sanctum	3,000
33.	Karanj sal	Pongammia pinnata	150
34.	Wala	Veteveria zizanioides	3,000
35.	Gulab kali (Desi)	Roja demmcusiana	,1 ,000
36.	Gugul	Commiphora wightiana	25,000
37.	Bedkipala	Gumnema sylvestris	250
38.	Gokhru	Tribulus terrestris	8,000\
39.	Chavak	Piper chaba	900
40.	Chandan chilka	Santalum album	1,000
41.	Kadechirayat	Andrographis paniculata	1,600
42.	Chitrakmul	Plumbago zeylanica	4,500
43.	Jatamanshi	Nadrostachys Jatamanshi	1,000
44.	Jeshtamadh	Glycerrhiza glabra	30,000
45.	Jeetsaya	Hamiltonia sauveolens	100
46.	Jambul seeds	Syzygium cumini	500
47.	Dikemali	Gardenia gummifera	5,000
48.	Talispatra	Abies webbiana	250
49.	Tetu mul/sal	Oroxylum indicum	500
50.	Dantimul	Baliogpermum montanum	600
51.	Dashmuls (combined)	_	6,000
52.	Daruhalad	Berberis aristata	3,000
53.	Dhayati phul	Woodfordia fruiticosa	10,000
54.	Damasa	Fagonia oretica	1,000
55.	Nagar motha	Cyperus rotundus	5,000

	Common Name	Botanical Name	Quantity in Kg.
56.	Nakesar (Assal)	Mesua ferrea	5,500
57.	Nakesar (Surangi buds)	Ochrocarpus longifolius	2,000
58.	Nakasar (Undibuds)	Calophyllum oenophyllum	2,000
59.	Nishottar white	Ipomoea terpenthum	500
60.	Nishottar black	Ipomoea terpenthum	500
61.	Kadulim antarsal	Azadirechta indica	5,000
62.	Dried leaves, Kadulim	Azadirechta indica	500
63.	Kadu padwal	Trichosanthus dioeca	600
64.	Pashan bhed	Bergenia ligulata	500
65.	Punarnava mul	Boerrhaavia diffiusa	6,000
66.	Pahadmul	Cissampelos parieri	600
67.	Pithpapada	Glossocordia tinctoria	500
68.	Vekhand	Acorus calamus	8,000
69.	Behada Da! (pericarp)	Terminalia bellirica	15,000
70.	Brahmi (Manduk parni)	Centella asiatica	3,000
71.	Bala mul	Sida cordata	200
72.	Bala panchang	Sida cordata	500
73.	Bela mul	Aegle marmelos	800
74.	Belphal (young)	Aegle marmelos	2,000
75.	Chikna mul	Sida rhomboidea	2,500
76.	Belkachari		2,000
77.	Bavachi seeds	Psarelia corylifolia	1,000
78.	Bibba	Semicarpus anacardium	2,000
79.	Maka fresh	Eclipta erecta	5,000
80.	Maka dried	Eclipta erecta	1,000
81.	Bharang mul	Clerodendrum serratum	500
82.	Manjusta (Desi)	Rubia cordifolia	3,000
83.	Morvel	Schrebera swietenoides	500
84.	Rakta chandan	Pterocarpus santalinus	800
85.	Pantang sal	Caesalpinia sappan	200

	Common Name	Botanical Name	Quantity in Kg.
86.	Asana/Bibla sal	Holigarhna grahami	500
87.	Rasna Khadki	Pulchea lanceolata	1,000
88.	Pimpal lakh	Lac of Ficus religios	1,000
89.	Lodhra	Symplocos racemosa	1,000
90.	Dhup (oloresin)	Baswellia serrata	-
91.	Ran Ud	Teramnus labialis	-
92.	Limbonya (seeds)	Azadirechtra indica	5,000
93.	Warun sal	Crateava roligiosa	300
94.	Dukkar kand	Dioscorea bulbifera	300
95.	Bhui kohala	Pueraria tuberosa	5,000
96.	Vidari kand	Pureria stricta	2,000
97.	Murud seng	Helictris isora	200
98.	Vardhara	Rourea santalindes Ipomoea petaloidea	200
99.	Vavding Black and Red	Embellia ribes	5,000
100.	Shankhapushpi	Convolvalus pluricaulis	500
101.	Sonamukhi leaves	Cassia ungustifolia	6,000
102.	Sonamukhi seeds	Cassia ungustifolia	300
103.	Shatawari roots	Asparagus racemosus	18,000
104.	Salvan	Desmodium gangeticum	500
105.	Pithvan	Ureria picta	500
106.	Ranmug	Phareolus trilobus	200
107.	Ranudid	P. mungo	20
108.	Sharpunkha	Tephrosia purpurea	200
109.	Somlata	Ephedra sp	200
110.	Shivansal	Gmelina arborea	500
111.	Airan sal		500
112.	Pahadmul	Cissampelos parieri	500
113.	Hirdadal (Pericarp)	Terminalia chebula	25,000
114.	Bal hirda (young)	Terminalia chebula	10,000

	Common Name	Botanical Name	Quantity in Kg.
115.	Surwari hirda	Terminalia chebula	500
116.	Ativisha	Aconitum heterophyllum	400
117.	Agaru (Infected wood)	Aquilleria agallocha	100
118.	Dhotra seeds (black)	Datura stramonium	200
119.	Gavla		200
120.	Pimpli lendi (Navasari)	Piper longum (inflorescence)	20,000
121.	Pimpla mul	Piper longum (Stem, Rhizome)	400
122.	Jepal seeds	Croton tiglium	150
123.	Mayaphal	Quercus infectoria	200
124.	Kakadshingi (Round)	Pistachia chinesis	500
125.	Kakadshingi (Long)		300
126.	Bachnag white	Aconitum napellus	2,000
127.	Bachnag black		2,000
128.	Welchi small	Eletaria cardamomum	5,000
129.	Sunth	Zingiber officinale (Processed dried rhizomes)	25,000
130.	Miri	Piper nigrum (fruits)	25,000
131.	Palash phul	Butea frondosa (FIs)	100
132.	Palash seeds	Butea frondosa	100
133.	Parijatak leaves	Nyctanthes arbortristis	1,000
134.	Gajar seeds	Daucus carota	100
135.	Satap panchang	Ruta graveolens	100
136.	Lajalu Panchang	Mimusa pudica	100
137.	Padma Kashta	Nymphaea Sp (stems)	100
138.	Ghansale muli		50
	Grand Total		509400

5094 quintals

509.4 tons

Industry growth rate 18% per annum
Growth in 8 years upto 1999 = 509.4 x 144 = 7335.36 tons.

ANNEXURE-VII/1

NATURAL REMEDIES PVT. LTD. BANGALORE

List of Raw Materials required from April 1999 to March 2000 (Approx.)

S.No.	Botanical Name	Quantity(Kgs)
1	Calatropis procera	5,000
2	Terminalia arjuna	50,000
3	Phyllanthus emblica	65,000
4	Withania somnifera	20,000
5	Terminalia bellirica	40,000
6	Embelia ribes	12,000
7	Sida cordifolia	21 ,000
8	Adhatoda vasica	20,000
9	Dioscorea floribunda	1,000
10	Aegle marmelos	25,000
11	Eclipta alba	70,000
12	Semecarpus anacardium	1,000
13	Bacopa monneri	60,000
14	Pureria tuberosa	20,000
15	Luffa echinata	1,000
16	Acorus calamus	13,000
17	Achyranthes aspera	45,000
18	Swertia chirata	10,000
19	Plumbago zeylanica	3,000
20	Coleus forskohli	50,000
21	Berberis aristata	10,000
22	Woodfordia floribunda	9,000
23	Butea monosperma	6,000
24	Gardenia gummifera	7,000
25	Leptadenia reticulata	23,000
26	Tinospora cordifolia	13,000
27	Garcenia cambogia, Indica	50,00,000
28	Commiphora mukul	1,500
29	Tribulus terrestris	50,000
30	Terminalia chebula	1 ,00,000

ANNEXURE - VII/2

S.No.	Botanical Name	Quantity(Kgs)
31	Cissus officinarum	12,000
32	Balanites roxburghii	5,000
33	Aristolochia indica	4,500
34	Ichnocarpus fruitescenes	5,000
35	Gloriosa superba	2,500
36	Vernonia anthelminticum	10,000
37	Andrographis paniculata	1,15,000
38	Gossypium herbaceum	8,500
39	Gossypium herbaceum	8,500
40	Kamojini pan	8,000
41	Hedychium spicatum	6,000
42	Solanum xanthocarpum	20,000
43	Caesalpinia bonducella	10,000
44	Butea monosperma	12,000
45	Phyllanthus niruri	1,15,000
46	Saussurea lappa	6,500
47	Hollarrhena antydysenterica	10,000
48	Picrorhiza kurroa	5,000
49	Cedraus deodara	50,000
50	Pungamia pinnata	30,000
51	Eucalyptus citriodara	8,300
52	Symplocos racemosa	7,000
53	Rubia cordifolia	8,500
54	Solanum nigrum	1,15,000
55	Celastrus paniculata	1,000
56	Mangifera indica	18,000
57	Helicteres isora	1,000
58	Salmalia malabarica	2,200
59	Cyperus scariosus	10,500
60	Azadirachta indica	65,000

ANNEXURE - VII/3

S.No.	Botanical Name	Quantity(Kgs)
61	Punica granatum	20,000
62	Vitex negudo	5,000
63	Aesculus indica	1,000
64	Cassia tora	5,500
65	Aphnamixis rohituka	4,000
66	Fumaria parviflora	29,000
67	Cassia angustifolia	2,500
68	Boerhaavia diffusa roots	70,000
69	Boerhaavia diffusa whole plant	10,000
70	Asparagus racemosa	10,000
71	Tephrosia purpurea	17,000
72	Ephedra vulgaris	6,000
73	Cinnamomum tamala	1,000
74	Taxus baccata	6,000
75	Ocimum sanctum	10,000
76	Bacopa monneri	30,000
77	Aloe vera	15,000
78	Alpinia galanga	6,000
79	Glycyrrhiza herbaceum	6,000
80	Acacia arabica	5,000
81	Boswellia serrata	10,000
82	Tribulus terrestris	20,000
83	Bees Wax	8,000
84	Coleus roots	50,000
		67,71 ,000
	GRAND TOTAL	67,71 ,000

ANNEXURE - VIII

REQUIREMENT OF RAW MATERIAL FOR KERALA

(Source AFC study on Medicinal Plants Farm Project, 1995)

Sl. No.	**Malayalam Name**	**Botanical Name**	**Parts Used**	**Annual Requirement (M. Tonnes)**
1.	Neela Amari	Indigofera fincteria	Leaf+Root	900
2.	Avannak	Ricinus communis	Root+Seed	470
3.	Adalodakam	Adathada Beedomi	Root	800
4.	Kadaladi	Achyrhanthes apera	All Parts	18
5.	Karinochi	Vitex nigunde	Root+Leaf	47
6.	Karim Kurinji	Erobilanthes neilgherrense	Root	125
7.	Kattupadavalum	Momordica fioica	All parts	135
8.	Kattuthulasi	Ocimum tenniflorum	Leaf+Seed & Root	52
9.	Keezharnelli	Phyllanthus amarus	Root +AII parts	162
10.	Thippali	Piper longurn	Seed +AII parts	1,000
11.	Kiriyathe	Swartia chirata	All parts	500
12.	Kumizh (Tree)	Gmelina asiatica	Root +Fruit	152
13.	Kurunthotti	Sida Cordifolia	Root	1,500
14.	Koovalam	Aegle marmelos	Root	1,150
15.	Kottathuva Veru	Tragia involucrata	Root	480
16.	Garudakodi (Ex-danger plant)	Aristolocha indica	Root	1,500
17.	Cheru Vazhithina	Solamum nigrum	Root	1,250
18.	Thamizhayma	Boerhaavia diffusa	Root	1,150
19.	Thulasi	Ocimum sanctum	Leaf+Root	1,500
20.	Punnarichunda	Solonum torvum	Root	1,250

Sl. No.	Malayalam Name	Botanical Name	Parts Used	Annual Requirement (M. Tonnes)
21.	Munja	(a) Premna antegrifolia (b) Premnamucronata	Root Root	1,170
22.	Ramacham	Vertivera zizaniodes	Root	1,600
23.	Velvazhuthina	Solanum zizaniodes	Root	1,170
24.	Sangupushpam	Clitoria Ternatea (White +Blue)	Root	50
25.	Pathiri	Stereospermum chelenoider	Root	170
26.	Adapathiyan	Holostemma	Rizhomia	850
27.	Koduveli	Plumbago zylanica	Root	800
28.	Kattarvazha	Aloe vera	All parts	5,120
29.	Naruneendi Kizhangu	Hemidesmus indicus	Root	560
30.	Miithanga	Cyperus rotundus	Rzhone	62
31.	Sathavari Kizhangu	Asparagus racemosus	Root	250
32.	Amrithe	Tinospora cordifolia	Stem	200
33.	Parpadaka Pulle	Oldenlandia corymbosa	All parts	500
34.	Kayyunniam (Kythoni)	Eclipta alba	All parts	250
35.	Karrivepila	Murraya koenigi	Leaf+Root	110
36.	Neermaruthu (Tree)	Terminali arjuna	Leaf+Root & Bark	2
37.	Pachotti (small tree)	Symplocos coclinchinsis (Lodh Tree)	BarkV.	200
38.	Nella Ummam	Datura stramonium	All parts	2.5
39.	Kumbalanga	Benincasa cerifera	Fruits	2
40.	Nellikka	Phyllanthus emblica	Fruits	730
41.	Mathala Naranga	Punica grabatum	Fruit	11
42.	Muringha	Moringa olefera	Seed	1.5
43.	Ellu	Sesamum indicum	Seed	11

Sl. No.	Malayalam Name	Botanical Name	Parts Used	Annual Requirement (M. Tonnes)
44.	Asokam (Tree)	Saraca indica	Bark	850
45.	Avilmarum (Tree)	Holopetelia Integrifolia	Bark	650
46.	Oonghu (Tree)	Pongamia pinnata	Bark+Seed	650
47.	Kanikonna (Tree)	Cassia fistula	Bark	210
48.	Kudakappala (Tree)	Holarrhena pubescens	Bark	110
49.	Nenmenivaka (Trees	Albizia lebbeck	Bark	110
50.	Veppu (Tree)	Azadirachta indica (Neem Tree)	Bark	750
51.	Amalpori (Sarpagandhi)	Rauwolfia serpentina	Root	21
52.	Amukkooram	Withania sommifera	Root	620
53.	Vayampu	Acorus calamus	Rizhome	45
54.	Kacholam	Kempheria galanga	Rizhome	215
55.	Thathirippoovu (small tree)	Fruticosa	Flower	800
Total				32994

ANNEXURE- IX

DEMAND OF CRUDE DRUGS FOR STATE GOVERNMENT RUN ISM&H PHARMACIES/CORPORATIONS OF SOME STATES FOR 1998-99

Sr.No.	State	No. of Pharmacies	Quantity (Tons)	Procurement Cost (Rs. In Crores)
1.	Gujarat	4	86.4	1.74
2.	Kerala	2	2300.0	3.64
3.	Karnataka	1	78.0	0.72
4.	Himachal Pradesh	3	53.0	0.37
5.	Orissa	3	40.0	0.22
6.	Andhra Pradesh	2	111.4	0.55
7.	Madhya Pradesh	3	59.9	0.68
8.	Tamil Nadu	e	360.0+	3.98++
	Average	3	385.6	1.48

(+ One Pharmacy demand; ++ Cost for two Pharmacies.)

Source: ISM&H, New Delhi.

ANNEXURE - X/1

MAJOR HERBAL RAW MATERIAL REQUIRED BY INDIAN PHARMACEUTICAL INDUSTRIES, THEIR ANNUAL CONSUMPTION AND SOURCE(S) OF SUPPLY

(as of August 1999)

(Source: Shri Anand Puranik, CHEMEXCIL, Mumbai)

Sl. No.	**Ingredient**	**Sources of Supply**			**Consumption**
		Cultivation	**Wild**	**Import**	
1.	Ajwain	100% cultivation			200 T
2.	Akkalkadha			100% Import	501
3.	Cardamo mum green	40 T		20 T (Guatemala)	60 T
	Cardamomum big		Asam		
4.	Aloes		Maharashtra/ Tamil Nadu		200 T Ext.
5.	Amala green	50% South	50% MP/UP/ Maharashtra		10000T
	Amala dry				
6.	Anant mool		T.N./A.P.		200 T
7.	Adulsa		UP./Mah.		SOOT
8.	Ashok		Bengal South		1200T
9.	Ativish		Kulu/Nepal		20 T
10.	Amber		Sea/Gujarat South		200 Kg.
11.	Behada		Mah./M.P.		500 T
12.	Bhulawali		M.P./U.P./T.N.		250 T
13.	Bhringraj		M.P./U.P/T.N./ Mah. /Bengal		SOOT
14.	Bhulkohla		Mah./T.N.		200 T
15.	Brahmi		T.N. /Bengal		700 T
16.	Cubeb (Kankol)			150 T (Indonesia)	

ANNEXURE - X/2

Sl. No.	Ingredient	Sources of Supply			Consumption
		Cultivation	**Wild**	**Import**	
18.	Chitrak		Maharashtra 250 T/ Tamil Nadu 250 T		500 T
19.	Dalchini			100% China	200 T/300 T
20.	Daruhalad		Nainital/Kulu		500 T
21.	Dashmool		Nainital/Kulu		100 T
22.	Deodar		Nainital/Kulu		200 T
23.	Gaj pimpli		Indonesia 100		400 T
24.	Small Pepper	Halgaon 90%, Assam 10%			400 T
25.	Gulvel (Vel)		Maharashtra/ Gujarat/MP/UP		1000T
26.	Guggul		10% Gujarat/ Rajasthan	90% Import (Pakistan)	500 T
27.	Harda		Maharashtra/MP		500 T
28.	Nutmen/mace	20% Kerala		80% Indonesia/ Sri Lanka	500 T
29.	Jambhul bee]		Mah.Gujarat/UP/ MP/TN		500 T
30.	Jatamansi		Nepal/Assam/Kulu		200 T
31.	Jeshtimadha			100% Pak/Iran/ Afgan	5000 T
32.	Jeera				

ANNEXURE - X/3

Sl. No.	Ingredient	Sources of Supply			Consumption
		Cultivation	Wild	Import	
33.	Kadu Kutuki		Kulu/Naini/ Assam/ Nepal		200 T
34.	Kuda		Gujarat/Maharashtra		150 T
35.	Kirahit		Assam/Nepal		SOOT
36.	Kavach beej		Gujarat/Maharashtra		200 T
37.	Kesar				5T
38.	Clove	Kerala 20 T		Zanjibar/ Madgaskar/ Sri Lanka/ Indonesia	150T
39.	Neem Oil/feaves				
40.	Black Pepper (Miri)	Kerala			150 T
41.	Ginger (Sunthi)	50% Kerala Asam		50% China /Myanmar	500 T
42.	Aswagandha	50% MP	50% MP		SOOT
43.	Nagkeshar				200 T
44.	Nagrmotha		Maharashtra/Tamil Nadu	150 T	
45.	Coral/Praval			Maldive/Italy	20 T
46.	Pipramool	A.P./Maharashtra			200 T
47.	Musli white	40% Maharashtra/M.P.	40% Mah./M.P.	20% Pakistan	25 T
48.	Shatavari	50% MP/UP	50% MP/UP		500 T
49.	Shilajeet		20% TN/20% Nepal	60% Pakistan	200 T
50.	Tagar		Assam/Nepal		150 T
51.	Tulsi	TN/Mah./MP			
52.	Vavding		Mah./MP		200
53.	Kuchala		Assam/Bihar/AP		1000T
54.	Kalmegh		MP/UP/Bihar		250 T
55.	Vekhand	Tumkur			150 T
56.	Senna Irsbrd/ ood	60% TN/40% Kutch			1000T

Annexure -XI/1

ANNUAL PRODUCTION OF CRUDE HERBAL DRUGS VIS-A-VIS THEIR PERCENTAGE CONSUMPTION BY INDIAN AYURVEDIC PHARMACIES (1999)

(Source ADMA, Mumbai)

Item	Avail. MTS	Cons. %	Item	Avail. MTS	Cons%
Anantmul	3000	10-20%	Gulvel	5000	10%
Amla	10,000	25-30%	Hing	Imported	100%
Akkalkara	Its Imp.	100%	Harda	10,000	10%
Agheda	200	5-10%	Indrajav	250	50%
Ashoksal	50	40%	K.lndrayan	150	10%
Andimul	250	10%	Jambulbeej	5000	2%
Ashwangha	10,000	25%	Jambulsal	50	50%
Ambenhalad	200	5%	Jeetsaya	100	50%
Ativish Nep.	150	5%	Jatamansi	200	25%
Atibhala	300	15%	Jivanti	50	100%
Akadaphul	50	10%	K. Shingi	100	10%
Arjunsal	500	10%	Kalonji	200	30%
Bhuiawala	2000	30%	Kakdani	150	50%
Bael	1500	5%	Kachura	180	50%
Babul Sal	2000	5%	Kachnar	150	40%
Bavchi	2000	2%	Kasni	500	20%
Bahava	150	20%	Kallavi root	50	10%
Behada	5000	20%	Kalmegh	5000	20%
Bharangmul	200	10%	Kasundi	300	20%
Bhuikohala	200	5%	Kavachbeej	5000	10%
Maka	2000	30%	Kapurkachri	1000	10%
Kantakari	500	10%	Karanjbeej	10000	2%
Balharda	2000	15%	Kutki Nepal	2500	20%
Brahmi	3000	30%	Kudasal	5000	10%
Chitrak	150	5%	Kumari	100000	1%
Chopchini	100	10%	K Kulingan	2000	2%
Chirayit Nepal		100%	K Ajowan	50	5%
Chavak	1000	5%	Kali musli	120	15%
Daruhalad	5000	1%	Lodhra	1000	5%
Devdar	10000	1%	Lindi Pimpli	500	60%

Annexure -XI/2

Item	Avail. MTS	Cons. %	Item	Avail. MTS	Cons%
Dukkarkand	50	20%	Makoi	200	40%
Badi Elaichi	3000	1%	Deshi Manjistna	250	60%
Erandmul	10000	1%	Mamejav	250	to%
Guggul Imported	1000	100%	Mendi leaves	10000	1%
Gokharu	50	50%	Malkangoni	5000	2%
Nirgudi Ivs	250	10%	Mandukparni	3000	50%
Nirbishi Nepal	60	2%	Mochras	50	10%
Nagarmotha	500	5%	Nagkeshar	500	5%
Neemleaves	10000	5%	Nishotar	60/70	100%
Pashanbed	150	10%	Punarnava	1000	50%
Pithevan	200	5%	Parijatak Ivs	50	1%
Patha	100	10%	Pittapapda	600	50%
Pittapapda Beej	2500	10%	Paripath	500	40%
Pusrvkarmool	2500	10%	R. Rohida	200	10%
Raktachandan	3000	5%	Revanchini Nepal	100	100%
Ringnimool	150	15%	Rohitak	200	25%
Rojmari Imp	50	100%	Rasna	5000	60%
Shimalmool	500	10%	Sugandbala	1000	1%
Sonamukhi	10000	10%	Shatavari	10000	15%
Sarpankhi	500	20%	Shankhapushpi	1000	40%
Sarpagandha	800	20%	Salai	300	5%
Vayvarna	150	10%	Shevga	1000	5%
Vavding	1500	50%	Vadsal	200	20%
Vala	1000	10%	Vekhand	1500	5%
Vidarikand	2QO	50%	Vajradanti	150	100%

ANNEXURE -XII/1

REQUIREMENT OF MAJOR CRUDE DRUGS (TONS/ANNUM) BY SOME INDIAN PHARMACIES

Sr. No.	Common Name	Botanical Name	PHARMACIES®			Total		Average		@
			1	2	3	4	5			
1.	Guduchi cordifolia	Tinospora	6.400	13.000	6.600	2.000	2.885	30.885	6.117 Mumbai.	1 . SanduBorthers,
2.	Amalkai	Emblica offic inalis	6.200	65.000	0.360	30.500	0.457	115.617	23.124	2. Natural Remedies, Bangalore.
3.	Kutaki	Picrorhiza kurroa	1.550	5.000	1.080	1.000	0.775	8.405	1 .681 Mumbai.	3. Ajanta Pharma,
4.	*$* Jesthamadh	Glycyrrhiza glabra	6.500	6.000	0.485	1.000	2.589	16.574	3.314	4. Shree Dhhotpapeswar.Mumbai.
5.	Aswagan-dha	Withania somnifera	6.025	20.000	7.170	3.510	4.947	41.712	8.343	5. Gufic Health-care, Mumbai
6.	Hirda	Terminalia chebula	9.650	100.00	0.360	3.595	3.708	17.303	23.462	
7.	Behada	Terminalia bellirica	1.100	40.000	0.360	0.500	-	41.950	10.490	
8.	Chikna Bala	Sida cordifolia	1.100	21.000	6.000	0.500	-	28.600	7.150	
9.	Maka Bhringraj	Eclipta alba	2.150	70.000	3.600	-	0.524	76.275	19.674	
10.	Gugul	Commiph-ora wightii	2.300	1.500	-	7.000	0.668	11.468	8.867	
11.	Bhumama-laka	Phyllanthus amarus	0.525	115.000	-	27.675	1.257	114.457	36.114	

ANNEXURE -XII/2

Sr. No.	Common Name	Botanical Name	PHARM ACIES®				Total	Average	
			1	2	3	4	5		
12.	Darvis Daru halad	Berberis aristata	2.700	10.000	_	7.900	0.011	20.611	5.153
13.	Nirgudi	Vitex negundo	0.250	5.000	_	12.000	0.348	17.518	4.400
14.	Chitrak	Plumbago zeyianica	3.500	3.000	_	0.500	_	7.0	2.333
15.	Shatawari	Asparagus racemosus	2.650	10.000	_	_	0.534	13.184	503.296
16.	Chirata	Swertia chirata	2.500	10.000	_	0.500	_	13.00	503.250
17.	Adutea *W	Adathoda vasica	8.400	20.000	_	0.100	_	28.500	9.500
18.	Arjunsal	Terminalia arjuna	5.700	50.000	_	1.000	_	56.700	18.900
19.	Vavding	Embeiia ribes	3.400	12.000	0.150	-	_	15.550	5.184
20.	Brahmi	Bacopa monieri	3.300	60.000	_	0.500	_	63.800	21.267
21.	Ashoka	Saraca asoka	6.800	_	_	7.700	1.684	14.500	4.733
22.	Bel	Aegle marmelos	1.350	25.000	_	0.500	_	26.850	8.750
23.	Kate Gokhru	Tribulus terrestris	3.330	50.000	_	6.430	_	59.760	19.920
24.	Punar nava	Beerhaavia diffusa	0.575	80.000	_	_	1.583	82.158	27.386
25.	Vidarikand Bhuikohala	Pureria tuberosa	1.250	10.000	_	_	1.C58	12.318	4.106

Source: Survey by the Group on Pharmacy Linkages,

ANNEXURE - XIII/1

MEDICINAL PLANTS IN SHORT SUPPLY@

SI. No.	Common Name	Botanical Name	Quantity required Tonnes/ Annum	From when the supply got reduced
1.	Ashtavarga	-	0.095	Last 23 year
2.	Ativisha	Aconitum heterophyllum	0.550	"15"
3.	Ashok sal	Saraca asoca	6.800	" 4 "
4.	Indrajava	Wrighatia tinctoria	0.418	" 5"
5.	Kamalphool	Nelumbo nucifera	0.310	" 8 "
6.	Kapila	Mallotus philippiensis	0.155	"12"
7.	Kankol	Piper cubeba	0.335	" 5 "
8.	Kapurkachari	Curcuma zedoaria	0.225	" 5 "
9.	Kakadshingi	Pistacia chinesis	0.450	" 10 "
10.	Kaiphal	Myrica esculenta	0.225	" 5 "
11.	Kalimusali	Curculigo orchioides	2.250	" 4 "
12.	Krishnageru	Aquilaria agallocha	0.170	"12"
13.	Kirata	Swertia chirata	2.500	" 7 "
14.	Kirmani ova	Artemisia maritima	0.330	"5 "
15.	Kutaki	Picrorhiza kurrooa	1.550	"5"
16.	Koshtha	Saussurea lappa	0.430	"5"
17.	Kosthakolinjan	Alpinia galanga	0.220	" 4 "
18.	Khair sal	Acacia catechu	2.400+	"5 "
19.	Guggul	Commiphora wightii	2.300	" 5"
20.	Chavak	Hemidesmus indicus	1.200	"3 "
21.	Chopchini	Smilex china	0.550	" 5 "
22.	Jatamansi	Nardostachys jatamansi	0.660	" 5 "
23.	Jaiphal	Myristica fragrans	0.330	"3"
24.	Tagar	Valeriana wallichii	0.275	"5"

ANNEXURE- XIII/2

Sl. No.	Common Name	Botanical Name	Quantity required Tonnes/ Annum	From when the supply got reduced
25.	Triman	Gentiana kurroo	0.220	" 4 "
26.	Dantimool	Baliospermum montanum	0.320	"3 "
27.	Daruhalad	Berberis aristata	2.700	"6"
28.	Devdar	Cedrus deodara	2.200	"10"
29.	Nagkesar kala	Mesua ferrea	0.650	"6"
30.	Dukkarkand	Dioscorea bulbifera	0.175	"7"
31.	Pippali	Piper longum	1.250	" 5 "
32.	Pippalmool	Piper longum	0.850	"5"
33.	Pokharmool	Inula racemosa	0.650	" 6 "
34.	Phanas ambe	Artocarpus heterophyllus (fleshy fungus)	0.055	"5"
35.	Manjistha	Rubia cordifolia	1.150	« 4 «
36.	Motiringani	Solanum indicum	1.150	"5"
37.	Raktaroda	Tecoma undulata	0.300	"6"
38.	Raktachandan	Pterocarpus santalsnum	1.025	"18"
39.	Chitrak lal	Plumbago zeylanica	3.500	"5"
40.	Vakeri bhate	Wagatia spicata	0.120	« 4 »
41.	Vavading	Embelia ribes	3.400	"3"
42.	Vala	Vetiveria zinzanioides	1.150	« 4 «
43.	Shvet miri	Piper nigrum	0.090	"13"
44.	Harenvel	Convolvulus arvensis	0.156	"6 "

@ SANDU BROTHERS, Mumbai

(indicated in response to survey of the Group on Pharmacy Linkages)

ANNEXURE XIV/1

RAW DRUG MATERIAL IMPORTED TO INDIA

Sr. No.	Trade Name	Scientific Name	Quantity (in Tons)	Value in Rs.	Country
1.	Akkalkadha	Ariacyclus pyrethrum	200	-	-
2.	Cardamomum Green	Elettaria cardemomum	20	-	Gautemala
3.	Cubeb (Kankol)	Piper cubeba	150	-	Indonesia
4.	Kapurkachri	Heydichium splcatum	200	-	China
5.	Dalchini	Cinamonom zeylanica	200 - 300	-	China
6.	Gaj pimpli	Piper pepper!	400	-	Indonesia
7.	Guggul	Commiphora wightii	450	-	Pakistan
8.	Nutmeg/mace	Myristica fragrance	400	-	Indonesia/ Sri Lanka
9.	Jeshtimadha	Glycyrrhiza glabra	5000	-	Pakistan/ Iran/ Afganistan
10.	Musli white	Asparagus adscendens	5	-	Pakistan
11.	Liquorice	Glycyrrhiza glabra	363	4436586	Afganistan
	"	"	126	190542	Iran
	"	"	92	887929	UAE
				7073060	
12.	Belladona	Atropa belladona	-	230235	German F.Rep.
				230235	

ANNEXURE XIV/2

Sr. No.	Trade Name	Scientific Name	Quantity (in Tons)	Value in Rs.	Country
13.	Cubeb (Kankol)	Piper cubeba	184	5504054	Indonesia
	"	″	35	1054406	Singapore
				6558460	
14.	Sarpagandha	Rauwoifia serpentina	28	514139	Mayanmar
				514139	
15.	Kusth	Sassuria lappa	40	163527	Bhutan
	"	"	65	910236	Mayanmar
	"	"	89	1586499	Nepal
				2660262	
16.		Other Ginseng		81027	Bulgaria
		"	5	506866	Morocco
		"	4	91552	Pakistan
		"	11	119488	Singapore
		"	4	208953	UAE
				1007886	
17.	Chirata	Swertia chirata	272	2282212	Nepal
				2282212	
18.	Isabgol	Psyliium husk		572351	Indonesia
				572351	
19.	Sariva	Hemidesmus indicus	7	146591	Mayanmar
	"	"		27054	Mexico
	"	"		6942	Morocco
				180587	
20.	Ayurved & Unani Herbs	-	-	3452	Afganistan
			-	199816	China
			21	265156	Indonesia
			121	946283	Iran
			714	17303260	Nepal

ANNEXURE XIV/3

Sr. No.	Trade Name	Scientific Name	Quantity (in Tons)	Value in Rs.	Country
			543	6704313	Pakistan
				748756	Poland
			16	513101	Saudi Arab
			23	149085	Singapore
			8	3731	Somalia
			13	66650	Sri Lanka
			20	98622	UAE
				1563741	USA
				28597066	
21.	Kokum	Garcinia indica	192	12625666	Sri Lanka
				12625666	
22.	Saps & Extracts of Opium		1	533123	France
			-	2532474	USA
				3065597	
23.	Extracts of Neem		-	16988	France
				16988	

Source: CHEMEXCIL, 1997-98

ANNEXURE XV

MAJOR CRUDE DRUGS IMPORTED BY WESTERN EUROPE, USA AND JAPAN

Drugs	Italy	France	FRG	UK	Japan	USA	Switzerland
Pyrethrum	Yes	Yes	-	Yes	-	Yes	-
Liquorice Roots	Yes	Yes	Yes	Yes	Yes	Yes	-
Tonka Bean	Yes	-	-	Yes	Yes	-	-
Cichona Bark	Yes	Yes	Yes	Yes	-	Yes	Yes
Chiratta	Yes	Yes	Yes	-	-	Yes	Yes
Galangal Rhozones	Yes	Yes	Yes		-	Yes	Yes
Zedovery Roots	Yes	Yes	Yes	Yes	-	Yes	-
Psylium Seeds	Yes	-	Yes	Yes	Yes	Yes	Yes
Psyllium Husk	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Senna Leaves & Pods	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sarsaparila	Yes	-	-	-	-	Yes	-
Vincea Rosea Roots	Yes	Yes	Yes	-	-	Yes	Yes

Source : Pharmaceuticals and Herbal Medicines : A Sector Study -Exim Bank 1997.

ANNEXURE - XVI

INDIA'S EXPORTS OF PLANTS OR PARTS OF PLANTS OF MEDICAL USE (APRIL 1993 - MARCH 1994)

Sl. No.	Item	Rs. in Lakhs
01	Ginseng Roots	802.45
02	Galargal Rhizomes	
	Netherlands	10.17
	Saudi Arabia	5.72
03	Other Ginseng Root	10.17
	Australia	11.33
	Canada	10.40
	Denmark	18.04
	France	21.01
	German F Rep	113.08
	Italy	71.60
	Japan	49.52
	Netherlands	126.19
	Spain	7.91
	Sri Lanka	11.74
	UK	174.21
	USA	115.77
	Other Plants	
04	Agarwood	
	Japan	8.50
	UAE	5.06
	Nux Vomica	
	USA	10.00
05	Poppy Flowers & heads	
	German F. Rep	13.53
	USA	9.52
06	Psylium Husk	
	Australia	12.48
	Bangladesh	36.12
	Belgium	13.92

No.	Item	Rs. in Lakhs
	Libya	23.14
	Mexico	49.21
	Netherlands	19.29
	Pakistan	115.76
	Saudi Arabia	18.27
	Spain	12.37
	Sweden	71.96
	UAE	11.14
	UK	383.63
	USA	520.92
07	Psylium Seeds Isabgol	
	Canada	12.49
	German F Rep	258.51
	Nigeria	5.16
	Pakistan	97.89
	Saudi Arabia	9.30
	UK	38.32
	USA	189.68
08	Sandaiwood Chips & Dust	
	Chinese Taipei	977.56
	Hong Kong	458.52
	Saudi Arabia	16.22
	Singapore	34.34
	UAE	61.60
09	Senna Leaves & Pods	
	Argentina	8.29
	Australia	5.11
	Chinese Taipei	16.98
	China P Republic	28.95
	France	58.12

Sl. No.	Item	Rs. in Lakhs
	Canada	121.36
	Denmark	148.17
	France	337.50
	German F	162.00
	Republic	
	Italy	43.57
	Japan	115.34
	Spain	28.03
	Switzerland	13.03
	Thailand	19.83
	USA	159.88
10	Tukmaria	
	UAE	8.28
11	Ayurvedic & Unani Herbs	
	Australia	6.63
	Bangladesh	38.66
	Chinese Taipei	10.67
	Egypt A Rep	11.41
	France	70.92
	German F Rep	43.93
	Indonesia	14.70
	Italy	32.78

Sl. No.	Item	Rs. in Lakhs
	German F. Republic	272.53
	Hong Kong	23.84
	Italy	18.55
	Japan	112.52
	Portugal	7.51
	Singapore	9.56
	Japan	69.25
	Korean Rep	8.34
	Malaysia	9.15
	Pakistan	23.44
	Saudi Arabia	40.40
	Sri Lanka	6.31
	Thailand	7.56
	UAE	38.30
	UK	59.48
	USA	310.00
	Yemen Republic	10.88
12.	Vinca Rosea	
	France	67.73
	German F Rep	60.94
	Others	1018.6-

Source : Exim Bank Report, 1999169

ANNEXUREXVII

VALUE OF EXPORTS OF MEDICINAL PLANTS/PLANT PARTS TO VARIOUS COUNTRIES (APRIL 1993 - MARCH 1994)

Countries	Sales Value (Rsl Lakhs)
Argentina	18.24
Australia	94.46
Belgium	87.55
Brazil	9.56
Canada	50.38
Chinese Taipei	7.77
Denmark	12.02
Djibouti	12.06
Egypt A Rep	25.11
France	13.83
Germany F Rep	12.83
Italy	66.43
Japan	166.88
Kenya	6.36
Korea Rep	12.11
Kuwait	4.71
Lithuania	15.44
Malaise	75.63
Mauritius	33.09
Mexico	14.33

Countries	Sales Value (Rs. Lakhs)
Nepal	206.07
Netherland	65.59
New Zealand	21.92
Nigeria	39.53
Oman	13.90
Russia	128.59
Ruanda	4.96
Saudi Arabia	8.15
Singapore	26.19
South Africa	25.33
Sri Lanka	149.90
Switzerland	53.16
Tanzania	8.22
UAE	90.54
UK	57.02
USA	373.36
Vietnam SOC Rep	8.02
Yemen Rep	9.30
Zeire Rep	27.20

Source : Exim Bank Report, 1999

CONSERVATION OF MEDICINAL PLANTS

India is unique in richness of biodiversity due to diverse physiography and climatic conditions. Out of 18 unique "biodiversity hot-spots in the world two are located in India. Out of 17000 flowering plants there are about 8000 species of ethnobotanical importance. There are 5150 endemic species located primarily in 26 endemic centres.

For wild-life conservation there are 87 National Parks (3481900 million ha forest area) and 441 wildlife sanctuaries (11590.300-million ha forest area) covering a total forest area of 15 million ha which constitute 4.5 per cent of the country's land area and about 14 per cent of its forest area.

Legal procedures of establishment have not yet been completed for 60 per cent of National Parks and 90 per cent of the sanctuaries. Further, 57 per cent of national parks and 27 per cent of sanctuaries have no management plans.

The protected areas cover all the major 4 forest types and 16 detailed forest types of the country. For conservation of biodiversity it is proposed to lay out medicinal plant conservation areas (MPCA) at 200 sites in side covering relatively undisturbed forests of different vegetation types. The key activity of medicinal plants conservation area model will include the following:-

i) Selection of sites that cover the range of forest types, altitudes, areas of known species richness and medicinal plants presence. Sites having red listed species population should also be considered. Attempt should be made to capture the wild populations of entire medicinal plants of the country.

ii) Forest areas (within Protected areas) with high biodiversity or sites traditionally valued for medicinal plants diversity or sites with the presence of known red-listed medicinal species, are specially identified.

iii) Detailed botanical study of each site should be completed aiming documentation of all plant taxa occuring in MPCA with herbarium records, systematic estimation of plant population and regeneration, distribution patterns, association, micro habitat and cultural information related to the plants collected.

iv) Each site should be about 500 ha in area for which "Management Plan should" be formulated.

v) Taking efficient measures to protect sites from fire and other biotic pressure.

vi) Locating breeding populations of red listed species and economically viable species and at a subsequent stage developed a suitable species recovery programme for critically endangered species and enrichment planting programme for economically valuable species.

vii) Building and strengthening community institutions for long term management of the sites.

viii) Training of wildlife staff and others for in-situ conservation of medicinal plants.

ANNEXURE - XIX

ESTABLISHMENT OF 200 "VANASPATI VAN"

India is one of 12 mega biodiversity country having vast variety of flora and fauna, commanding 7% of world biodiversity and supports 16 major forest types, varying from Alpine Pasture in Himalayas to temperate, sub-tropical forest and Mangroves in the coastal areas. The recorded forest area has 76.5 million hectare or 23.3% of the total geographical area of the country. However, the actual forest cover is 66.34 million hectare of which 26.13 million hectares are degraded. There is another 5.72 million hectare shrub forest in addtion to the reported forest area of 63.34 million hectares. Thus in total 31.85 million hectare forests in the country are degraded or open.

Considering the growing demand for plant based medicine, health products, pharmaceuticals, food supplements, cosmetics, etc. in the national and international markets it is obligatory to grow medicinal plants in the degraded forest areas. It is proposed to identify 200 Medicinal Plant Development Areas (MPDA) which will be known as Vanaspati Van extending over one million hectare of open forests. While selecting the site the following points may be kept in view:

i) The degraded forest areas should be about 5000 hectares in area in a contiguous patch inside the reserve or protected forests.

ii) Such selected site should have productive soil irrigation facility and minimum biotic pressures.

iii) The largest number of medicinal plants are known to occur in dry deciduous forest as compared to the evergreen or temperate forests. Hence more "Vanaspati Van" should be located in dry deciduous forest areas. A management plan should be formulated for cultivation/ afforestation of by appropriate species in *a* mix of trees/shrubs and herbs that are native, relatively easily grown and are marketable.

iv) Selection of suitable species (best, pheno, geno and chemo types) of medicinal plants and adoption of appropriate models for their plantation/cultivation.

v) Establishing a network of nursery around Vanaspati Van for supply of quality planting material of the selected plants for raising plantation or cultivation.

vi) Building and strenthening community institutions for long term management of these sites. A society may be registered under the Chairmanship of Divisional Forest Officer in which various stakeholders may receive proper representation. Proceeds of the harvest of the medicinal plants to be shared under the JFM framework.

vii) Adopting a system of sustainable harvesting, drying, grading and semi processing of products.

viii) Creation of market links for sale of produce at the outset of programme.

ix) Involvement of a competent local NGO for organising the community and helping in implementation of programme.

x) Establishing a linkage with Ministries, Departments and envisaged Medicinal Plant Board for financial assistance to implement the programme.

ANNEXURE- XX

IDENTIFICATION OF 200 MEDICINAL PLANT DEVELOPMENT AREAS

India has recorded forest area of 76.5 million hectares out of which 37.21 million hectare is reported to be in good condition. It is proposed to identify 1 million hectares from such areas to be brought under Medicinal Plant Development Area (MPDA). The various activities involved in identifying such Medicinal Plant Development Areas will include the following:-

i) Forest areas with biodiversity sites traditionally valued for medicinal plant diversity having a contiguous area of about 5000 hectares should be identified for creating Medicinal Plant Development Area (MPDA). The boundaries of MPDA may correspond to the boundary of reserve and protected forests.

ii) Detailed botanical studies to be carried out and stock map to be prepared for this area.

iii) A management plan to be formulated for sustainable harvesting and development of medicinal plants.

iv) Establishing a system of scientific and sustainable harvesting, drying and grading of species.

v) Creation of market links for sale of produce at the outset of the programme

vi) Building and strengthening forestry institutions for sustainable management of MPDA sites.

vii) Registering a society under the Chairmanship of Divisional Forest Officers including various stakeholders.

viii) Availing financial assistance from Government of India and other agencies/donors.