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18405

Distr.
LIMITED

ID/WG.502/4(SPEC.)
10 May 1990

ORIGINAL: ENGLISH

United Nations Industrial Development Organization

Interregional Meeting on Co-operation among Developing Countries for the Development of the Pharmaceutical Industry

New Delhi, India, 19-22 March 1990

FACTORY-PRODUCED HERBAL MEDICINE

The Indian Experience*

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17

* The views expressed in this paper are the author's and do not necessarily reflect the views of the Secretariat of UNIDO. Mention of firm names and commercial products does not imply the endorsement of UNIDO. This document has not been edited.

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V.90-84363

Table of contents

Charts and annexes

PREFACE :

This study advocates the use of whole Herbs or its Extracts as medicine and health products. It also suggests the detailed Scientific investigation of Chemistry, efficacy, safety and kinetics for standardisation and quality control, but not to s bstitute active ingredients as medicines instead of whole plant.

There are many unknown active constituents in the plant that afford opportunity to the digestive system to accept as per needs, as well as regulate absorption and action. This will reduce severe side effects and reduce the incidence of iatrogenic hazards. Human body is acustomed to natural products.

It enumerates plant products that can be offered by India to world market and gives idea about the status of technology in India.

INTRODUCTION:

"There is no substance in the world which has no medicinal value.

"Medicines are of two kinds : One is promotive of vigour in the healthy, the other destructive of disease in the ailing".

The above two fundamentals written in Ayurveda 2000 years befoe Christ are the basis of this study on herbs and herbal products.

Ayurveda is a scientific system of medicine practiced and developed since more than 3000 years and had studied all available natural resources for health and healing.

India is a developing country with rich natural resources having all climatic conditions. It has its own vast resources of medicinal plants. It has its own system of medicine being practiced successfully for centuries.

The conventional system of medicine is also well practiced and preferred. It has a well established pharmaceutical Industry and several research institutions.

India has offered since hundreds of years many crude drugs to developed countries yet very little is known about its resources and its current status. This study reviews the aspects of Herbs and Herbal products as it is today.

This study reviews the current interest in herbal drugs and its practice and availabilit/ from India.

BACKGROUND :

Third Consultation on the pharmaceutical industry held by UNIDO in Madrid, Spain, and its recommendations are the basis of this study.- Annex I.

The Alma Ata declaration of "HEALTH FOR ALL BY THE YEAR 2000" and recognising the importance of traditional systems of medicine for achieving this by WHO, are the other factors which promotes the use and attention on Herbs, Herbal products and Traditional Systems.

The need of the Indian Pharmaceutical Industry to develop and search for wider global markets to offset their imports is the third factor for this study.

OBJECTIVES :

The objective of this report is to provide information on available Herbs and Herbal products from India.

This will assist the decision making authorities for the development of India's medicinal plant based pharmaceutical industry and the marketing of herbal drugs and health products.

To foster co-operation between the plant based Indian Pharmaceutical Industry and its counter part and consumers, in developed countries.

To make available and promote the use of Herbal drugs for primary health care requirements.

To support and accelerate research and development in this field in India.

In general to support and assist phytopharmaceutical industry in the country considering the availability of large varieties of medicinal plants, naturally found in the country owing to its continental size and multifaceted environment.

To search for new plant products for global Market.

GLOBAL REVIEW OF HERBS AND HERBAL PHARMACEUTICALS

In almost all countries of the world, useful medicinal herbs are availabe. Many of them are locally processed and used.

WHO has estimated that perhaps 80% of more than 4000 million inhabitants in the world rely on Traditional medicines for their primary health care needs and major part of this is plant based.

In U.S.A., for example, 25% of all prescriptions dispensed from community pharmacies from 1959 to 1980 contained plant extracts or active principles prepared from higher plants. In 1980 consumers in U.S.A. paid more than $8000 million for prescriptions containing active principles obtained from plants.

A consulting company in England recently sruveyed the demand for plant based medicines and has estimated it in the region of £4900 million.

All the countries having an old heritage are culturally using plants as medicines for primary health care and also as household remedies. Whole of Europe, Africa, South America and Asia has deep seated practice of using herbal remedies in various forms.

To provide these Herbal products, in developed countries, industrial units have taken up manufacturing and in developing countries this was done by small scale industries or by physicians themselves. Many of them are processed in the kitchens by the housewives. Thus the use of herbs and herbal products and its processing is not new to man. Diet itself is a part of health care and huge food industries also in a way countribute to health care aspects, by developing newer techniques of food processing and preservation.

Vegetable resources are the first ever known substances for health care and healing. Every herb is a complex potpourri of compounds, some beneficial and some harmful. The homeostatic human body can partially select from this potpourri using this herbal menu approach and physically grab some of the compounds needed, excluding those it does not need.

Through evolution, our genes have already experienced many of the natural compounds including toxic, nutritional and medicinal often equipping us with mechanisms to deal with reasonable doses of these toxins. On the other hand, our genes have no experience with synthetic chemicals.

Through maternal or cytoplasmic inheritance, our immune system has also aquired experiences of processing many of the nautral compounds. Herbs contain hundreds of pharmaceuticals, active compounds, some synergestic, some antagonistic and few if any, pharmacologically inactive.

The pattern of ailments encountered has been drastically changing in the second half of the 20th century, the most important of which is the occurance observed in types of disease. Statistical data on diseases including those on mortality show that the incidence of many infections which was once commonly growing has declined and that chronic disorders caused endogenously have increased instead. Public health services have undoubtedly contributed greatly to the control of infectious diseases. Unexpectedly, it is under these circumstances that traditional medicines have begun to attract attention world-wide.

Until 19th century, even conventional medicine depended largely on crude drugs. During 20th Century, the progress in chemical techniques and with the growth of pharmaceutical industry, crude drugs have been replaced gradually by pure chemical drugs.

The usual process of isolation of an active drug from a plant and their derrivatives was followed. Thereafter chemical derivatives have been developed independently of natural resources.

The change from crude drugs to synthetic, appears to have arisen from the scientific interest in investigating the pharmacological mechanism of action of crude drugs.

Ephedra herb is used for more than 2000 years. In 1885, ephedrine was isolated from the herb. In 1888 mydriatic action was reported. In 1924, its bronchodilator activity was shown and in 1927, Ephedrine was synthesised and is still being used widely. Ephedrine has been the first successful product of modern pharmaceutical industry.

If Ephedrine had produced all the effects associated with Ephedra herbs, then the use of the herb would have fallen out of repute, however, this has not happened. The Herb is used not only as a bronchodilator but is also widely used to counter pain or inflammatory diseases. Modern research has tried to elucidate the varied actions of the Ephedra herbs but a complete profile is still unidentified. This herb is used for bronchial Asthma and it is never given alone but always in combination with other crude drugs.

Crude drugs, in general, are a complex of a number of biologically active substances, integrated under a certain rule to make the drug function in the same way as a single chemical agent.

The ultimate objective is to cure patients and any method beneficial to the treatment should be employed.

Therapies in traditional systems are based on the unit of formula, which consists of crude drugs. They are seldom administered alone and are usually in combination as a formulation. Meticulous care is taken in the composition of formulae, which are prepared according to specific directions.

A large number of formulations in SHANG HAN LUN : JIN KUI YAU LUE written by ZHANG ZHONG JING at the beginning of third century are still clinically useful and effective. The fact that these two books have been regarded as a most reliable guide for such a long period of

time, both in China and Japan, indicates that these formulae were established on the basis of a meticulous preparation and wide clinical observations. A similar tradition exists in the practice of Ayurveda and Unani systems of medicine in this country.

Traditional medicines have gradually attracted the attention of the people since World War II and underwent resurgence of interest which now seems to have plateaued.

Sevral pharmaceutical Companies have developed formulations based on Kampo and Chinese preparations. Their listing in National Health Insurance Reimbursement list, has played a great part in the growth of these systems.

Similarly, Ayurvedic and Unani prescriptions are recognised by Health Authorities in India and many Pharmaceutical manufacturers market them.

The researches that have been designed to validate the mode of action of traditional medicines illustrate the challange in meeting some of the limitations inherent in using standard methodological procedures.

The list of drugs in conventional systems that have been or are being currently, obtained from plants are annexed as II. Annexure III gives the list of plants used in traditional medicine and the drugs derived from them.

Source : Bulletin of the World Health Organisation 63(6) : (1985).

Current estimates of the number of species of flowering plants are about 2,50,000. A very small percentage of the total species have been examined chemically or clinically. Inspite of a rapidly expanding literature on phytochemistry, there exists a large field for future research. The marine flora is another large source of medicines.

HERBS FROM INDIA

India, with its varied climatic conditions and topography has been considered a Botanical Garden of the World.

Plants continue to be a major source of drugs and pharmaceuticals since ancient times. Large number of these plants and their derivatives are listed in Pharmacopeas and national formularies of many countries world over. The trade in crude drugs is growing at an estimated growth rate of 7% per annum.

In addition, a large number of herbs find use in production of home remedies, adjuncts, branded drugs in form of syrups, tablets, pills, Capsules, Confections, tonics, teas, etc. The crude drugs are also used in large proportions in traditional formulations, Homoeopathic and also medicines in nature cure products all over the world.

There is not much information known or published on world trade in raw materials. However, the figures reported for west European Countries under OECD (Organisation for Economic and Commercial Development) showed that it improved, in 1976, crude drugs and herbal materials of a value of 217 million US $ and their derivatives and chemicals valued for 1147 million US $. Similarly, large number of aromatic plants, their essential oils and aromatic chemicals are in regular demand world over. Other plants and their products are also used as pharmaceutical aids, flavours, fragrance and colouring agents. Large number of plants are used as health foods.

There are about 800 species used as medicine in India. Many of these are available in India. The list of few important Herbs used is listed as annex IV. Some plants and their derivatives are listed in annex II & III.

Important crude drugs exported are mainly, Isabgol seeds and Husk, Senna leaves and pods, Catharanthus, poppy seeds/Husks, Zedovary roots, Tukmaria, Henna leaves, Nux Vomica, etc. The exports for the financial year 85-86, 86-87 & 87-88 are given in annex V and for essential oils as annex VI (Source : Chemexcil reports).

Exporting of crude drugs faces some problems of fumigation. No ideal fumigant is available for medicinal products. Gama radiation is not preferred by some consumers. Also, higher freight due to bulk, etc. can be avoided by exporting their extracts or isolates and intermidiates.

India offers a good opportunity and technology for processing of crude drugs. This will facilitate export in bulk in a good condition and shall be economical.

HERBAL PRODUCTS IN CONVENTIONAL MEDICINE

Three forms of products are covered under this :

a. Extracts
Isolated active ingredients/Intermediates

b. Formulations.

a. EXTRACTS AND ISOLATED ACTIVE INGREDIENTS/ INTERMIDIATES

These are manufactured by using modern methods of technology. Various types of extraction equipments are used. All Pharmacopeal extracts are prepared. There are many manufacturers who produce such extracts for parties as per their specifications. However, the technology and knowledge of extracting procedures so as to standardise on the basis of specific active ingredients is still needed. This is the field where co-operation from developed countries will be sought.

Opium and its alkaloids are extracted from poppy which is widely cultivated in India under regulatory control. This is being done by a Government factory. About 4000 hectares is under its cultivation in Rajasthan, U.P. and M.P. states in India. Morphine, Codeine and other alkaloids are manufactured from this.

Senna leaves and pods are exported but also sennosides are extracted and used in India as well as exported to other countries. More stress is needed to be placed on sennosides and extract than leaves and pods.

Cinchona is grown on about 10,000 hectares in West Bengal and Tamilnadu. Quinine, Quindine and other alkaloids are extracted by two Government factories.

Many species of Dioscoria are available. It is now cultivated in India. Diosgenin the most versetile precursor for steroid drugs is produced and many other stages are also produced in India. Main producers are Cipla, Wyeth, Ciba, Searle, etc.

Catharanthus roseus : It is cultivated in India. About 5000 hectares is under cultivation. Alkaloids vincristine and vinblastine are isolated. Manufactured in India by Cipla and few others.

Nux Vomica is available widely. Strychnine and brucine alkaloids are isolated and sold.

Ipecacuanha and its alkaloids : Cultivated in West Bengal. Alkaloids, Emetin cephaeline, etc are isolated. Two firms were licenced to manufacture the alkaloids.

Papain : Prepared from dry latex of Carica papaya fruits. There are many manufacturers.

Many other extracts from medicinal plants are manufactured and supplied. Names of manufacturers is given in Annex VII. The list of plants is given in Annex VIII.

Many other plant products are manufactured such as Podophyllum resin and etoposide, Berberine, Curcumin, Oleo resins, Glycyrrhizin, Glycyrrhizic acid and DGL, essential oils, Menthol, Camphor, βionen, Ergot Alkaloids, Cocoa alkaloids, fixed oils, fatty acids, proteins, Rutin, Carotene, Aloe juice, Gums and mucilages such as Tragacanth, Guar, etc. Mono & Polysaccharides, starches, Tannins, Catechu, etc.

Pharmacopieal formulations and other propreitory formulations containing plant products are also manufactured.

HERBAL PRODUCTS IN TRADITIONAL SYSTEMS

In India, traditional systems of medicine are widely used since centuries. These are Ayurvedic, Unani-Tibb, Homeopathy and Naturopathy.

AYURVEDIC : This is a well documented Science. The science of healing is covieal with human creation. Its first gleamings gather from Vedas, the earliest recorded knowledge on the earth, the period shows us the society more or less on our model. By the time of epics, this society had grown into a complicated form, needed all sorts of artificial human aids, Ayurveda of course was one of them. The Science of medicine is considered a Upaveda. Reference to illness and even surgery are found in Rigveda. The Atharva Veda gives many remedies. This is the oldest literary monument of Indian Systems and probably the first document of regular medical knowledge of any civilisation.

Despite the basic unity, a practical science would diversify/develop, in different places according to their requirements and their means to meet them.

As observed earlier two kinds of medicines are suggested i.e. promotive and curative. Definition of Health i.e. 'Swasthya' in Ayurveda is very comparable to that of WHO. 'Caraka' and Sushruta have compiled the knowledge of Ayurveda in 600 BC.

In Charaka Samhita, 1500 plant species are mentioned and thousands of their formulations. About 200 to 300 of these formulations are used frequently. Large population in villages are dependent on this.

Ayurveda is mentioned in eight specialities. They are : Internal medicine, Pedriatrics, psychological medicine, otorhinolaryngology and ophthalmology, Surgery, Toxicology, Geriatrics, Eugenics and Aphrodisiacs.

Ayurvedic educational institutions affiliated to various Universities are conducting courses. The courses are of 5-1/2 year duration after matriculation. There are more than 100 such institutions imparting education in Ayurveda. There are 2,50,000 practitioners in Ayurveda and about 5000 Licenced premises for the manufacturer of Ayurvedic drugs. There are about 13,000 Hospitals and dispensaries, with more than 16,000 b d strength.

In Ayurveda, mostly crude drugs, Minerals and animal products are used in formulations. Annex IX gives the list of plants used in primary health care and Annex IV gives list of important medicinal plants used in Ayurveda. Mostly, the Ayurvedic formulations contain more than one crude drug.

These formulations have been used in clinical practice since ages and have a good record of safety and efficacy. Hundreds of clinical trials, pharmacological studies and chemical investigations have been published on these plants. Some of these products can contribute immensely to the treatment of human ailments and promotion of health world over.

Unani-Tibb is the Greek medicine developed during Arab civilisation. It is also influenced by Iranian and Indian concepts. Thus, it has much in common with Ayurveda. It has a long and impressive record in India. Today, India is the only leading country in so far as its practice is concerned.

There are about 28,000 practitioners, 100 Hospitals, with 860 bed strength 18 colleges and few manufacturers.

These systems are covered under the Drugs Act (1940). Since 1964 by amendment of Act. The Pharmacoppeal Laboratory is set up for standardisation of these products. Central Council of Indian Medicine was set up in 1970 to regulate education and practice of these branches.

Also, a Central Council of Research was established in 1969 and in 1978 the same was bifurcated in to four Research Councils for each of the branch namely Ayurveda, Unani, Homoeopathy and Yoga and Naturapathy.

In the Health Ministry, the Director of ISM is responsible for all functioning.

With this preliminary background, utilisation of these plant extracts and formulations needs indepth considerations.

Many Western scholars from developed countries are of the opinion of using the whole drug or its extracts as they are potent and safe.

These are used since ages in clinical practice and their efficacy as well as safety is well studied

In earlier days this concept of safety and efficacy was amply practiced in Ayurveda. One example here will prove beyond doubt about Ayurvedic understanding of these aspects.

The concept of therapeutic safety of drugs has received an appropriate attention in the ancient texts of the Ayurvedic system of medicine. The safe therapeutic use of Aconite roots is a vivid example that will illustrate this fact. Aconite is known all over the world for its anti-pyretic, analgesic and cardiotoxic effects. On account of a lower therapeutic index, Aconite was discarded by modern medicine at the advent of aspirin. However, Ayurvedic practitioners have been using Aconite root safely for centuries and are still using it without encountering any serious toxicity. This system uses Aconite roots after subjecting them to an elaborate detoxification process called "shodhana" which involves a prescribed treatment with cow's milk or urine. By employing modern analytical and biological methods it is observed that the detoxification process renders the drug much safer as compared with the crude material. The Aconitine alkaloids are hydrolysed to Aconine which is much less toxic, as reflected in the LD 50 data. As regards the therapeutic effect, the processed roots

still retain the anti-pyretic efficacy almost to the same intensity, thus raising its therapeutic index. These observations highlight the fact that the ancient Ayurvedic System of medicine had successfully evolved methods to process potentially toxic drugs for their safe therapeutic use.

The Herbs and vegetable sources are used as food material. Difference between the food and medicine as per Ayurveda is in Dose/proposition. All over the world, we take food of different varieties, not only that, as human nature, one desires to eat and taste local countries' food which is unknown to him. Thus the potatoes were introduced in India from Europe or spices and curries from east to west.

The Herbs are consumed as medicines in very small proportions. In view of this, it is necessary to recommend entirely different protocols for study of herbal products' safety and should not be in line with current protocols for study of synthetic chemicals as required by FDA authorities.

Medicinal plants with literary reference in the country of use and with wide use, should be subjected to a formal prescribed safety tests and be permitted for clinical trials with consent. This will provide much needed safer drugs for primary health care of day to day problems.

Number of plants have been screened for various diseases where conventional system of medicine has very little to offer. Many groups investigated drugs for Hepatoprotective, Anti-inflammatory Cardiotonics, sedatives and tranquilisers, gastro intestinal disorders, Adaptogens, etc.

The recent advances in dynamic biochemistry, molecular biology and immunology have shown a dramatic impact on conventional understanding. It is also shown that many plants have immuno modulating properties and hence the positive action on immune related diseases. Conventional science has not advanced sufficiently to be able to give a complete answer.

The use of Herbal products in traditional systems of medicine for health purposes should be further relaxed. These are Health foods and they promote vigour in healthy persons. Products, such as herbal teas in Europe and in traditional systems need to be encouraged as they reduce the burden on the medical system as such in all countries.

PRODUCTION : STANDARDISATION - RESEARCH & DEVELOPMENT

In India, ample production capacity for Pharmaceuticals is established. Technology is also well developed. Standardisation and quality control is also farily good. Research and Development needs to be strengthened.

In factory - produced herbal medicines, including traditional formulations, more standardisation and Research and Development work is needed. The assistance from UNIDO and other authorities as well as from developed nations will go a long way in bringing out the best from these plant materials for human health and primary health care.

Presently, the R. & D. work in natural products has been basically aimed at isolating pure compounds and using them either as a Drugs or as an intermidiary Raw material for further processing of a semisynthetic Drug or as a model for producing synthetic drug with improved activity (Chart I).

The above approach needs to be corrected particularly in case of traditional Drugs which are known and used in clinical practice.

The approach should be to undertake an extensive clinical trial following a well thought-of protocol in a modern Hospital. This study will lead us to its proper indications and other effects as these drugs are believed to possess more than one therapeutic activity and act as a whole. Following this lead, classical plant research work should be started to evaluate its activity (Chart II).

The earlier discussed work on Aconite is an example of such a study. This will help establish standardisation, safety and efficacy of the Drug. There are many such formulations such as LIV 52, Herbinol, Guggulip Rhumayog etc.

This will lead to better utilisation of existing facilities and more assured positive results with Comparatively low inputs.

There are enough leads in this direction. A good survey work and establishment of a Data station is the primary need to accelerate such studies.

Prof. Handa et al (2) have listed 160 phytoconstituents representing a variety of chemical structures isolated from 101 plants belonging to 52 families that are used as hepatoprotective agents in the formulations, based on traditional systems of medicine. 33 proprietory multi ingredient plant formulations claimed to provide liver protection are sold in Indian Market. Annex (X). Same authors with others (3) have reviewed the anti-inflammatory activity from various medicinal plants giving an account of active constituents with diverse chemical structures from about 60 plants.

Many other plants like Commiphora mukul, Centella asiatica, Tinospora cordifolia, etc. have been worked out and useful informaiton is available.

It will not be out of place here to mention the trend in the highly developed country like Japan. In 1976, in Japan, total expenditure on all types of Pharmaceutical products was about two trillion yen which rose to 3.4 trillion yen in 1983 i.e. in 7 years increase of about 70%, out of which share of Japanese traditional medicine 'Kempo' was three billion yen in 1976, which rose to 36 billion yen in 1983 i.e. about 12 times (1200%).

In the field of agriculture, research work is required to be done for cultivation practices of selected medicinal plants and study of tissue culture, and Bio engineering technology for the production of required quality drugs.

CHART NO. 1

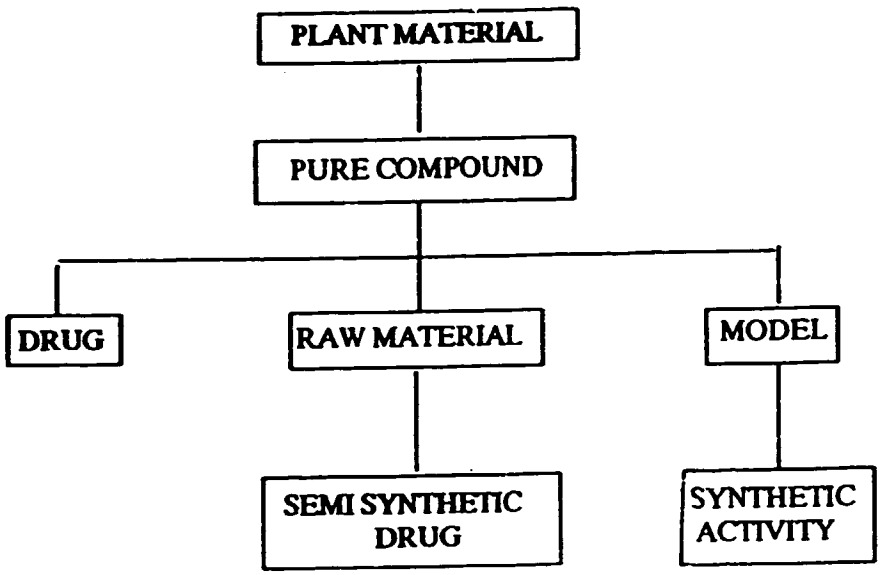
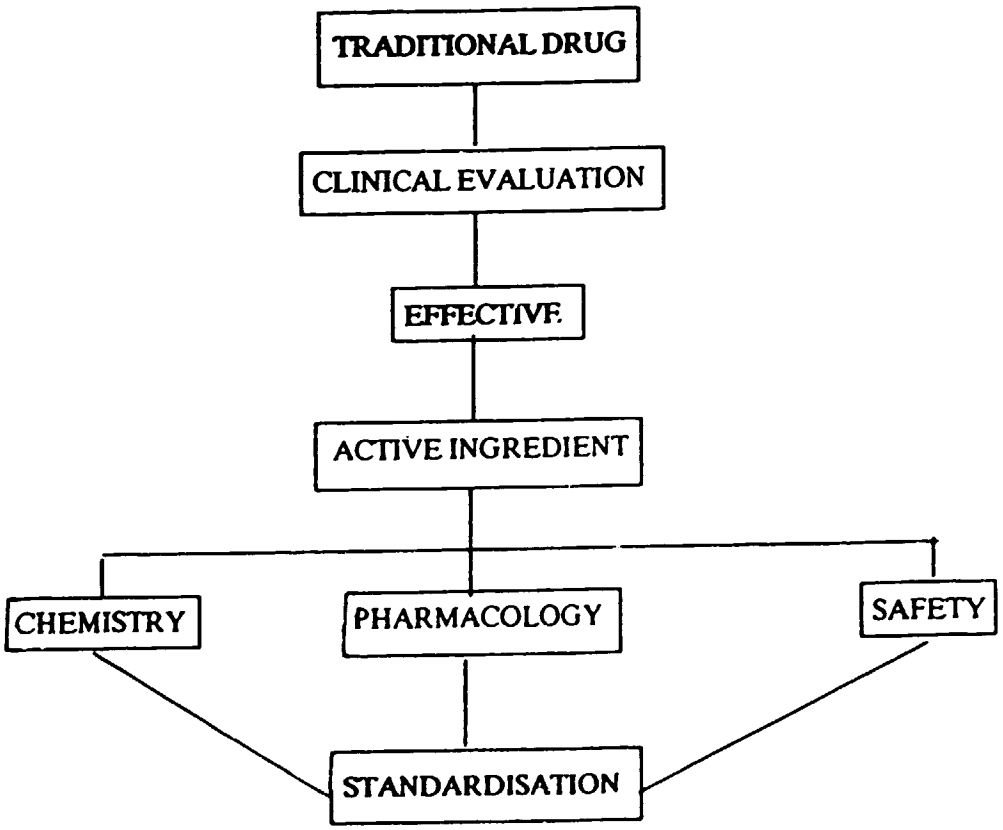


CHART NO. 2



CONCLUSION

Development of isolation technology with regards to known plant based pharmaceutical chemicals needs to be further strengthened by appropriate collaborative efforts and its market development.

The traditional crude drug formulations are the life line of a large section of rural population. They serve the needs of primary health care to some extent of more than 70% of population. They need to be scientifically investigated in details.

Extensive clinical trials for selected plant Drugs be conducted forestablishing their specific indications. On the basis of these indications, standardisation of products and plants should be undertaken by employing classical method

Evaluation of usefulness may require a modified testing methodology.

This may offer a relief and answer to health efforts providing :

1. Effective treatment of ailments where no effective conventional treatment is available.

2. Effective treatment of chronic and refractory diseases.

3. A possibility of reducing Drug related side effects of conventional treatment.

4. Easily available, economic and safe remedies for primary health care of family.

5. Exchange of knowledge, experience availability and use of traditional drugs amongst developing countries.

SUMMARY

The factory produced herbal products of India are classified into two major categories as follows :

a) Plant products in conventional/modern system of medicine.
b) Plant products used in traditional system of medicine.

a) Many pharmacopeal plants, their extracts and isolates are manufactured, for example : opium and its alkaloids, Cinchona and its alkaloids, diosgenins, Podophyllum resins, etoposide, Catharanthus, vincristine and vinblastine, Sennosides, berberine, extracts of Curcuma, Valeriana, red sandle wood, nux-vomica, Ipeacac, papain and Rauwolfia alkaloids etc.

There are possibilities of adding many more plants, plant extracts and isolates for medicinal and other use. There is a need to aquire know-how and state-of-the-art technology in this field. Substantial research and development activities are required to be undertaken in this important area. It may also be fruitful to invite collaboration from developed countries. A large number of Pharmacopeal formulations and proprietary products are manufactured in India. The possibilities of their export needs to be investigated and appropriate encouragement should be provided.

It is necessary to improve the quality of the plant materials by undertaking their scientific cultivation. Little is being done in this area. The application of Bio-technology and genetic engineering and tissue culture techniques will go a long way in developing this field. More acreage of land should be reserved for this purpose and public as well as private sectors should be given all the facilities and suitable incentives with a view to develop the cultivation aspect on an industrial scale. The cultivation of medicinal plants should be treated as an industry and all the industrial as well as agricultural benefits should be offered.

b) Indian Systems Of Medicine are well established in this country and are practiced since ages. Ayurveda is an ancient and scientifically developed system of medicine. It has its own diagnostic and clinical parameters. The system offers well thought-of and scientifically evaluated medicines and it has also developed a scientific pharmacy. Plants and Plant Products are extensively used in these systems of medicine.

These drugs and formulations are approved by Health Authorities. The Government and its agencies appreciate the effective role of these systems of medicine and actively support them. A Central Council is established to govern the practice and education in these systems in line with the conventional system of medicine. Seperate Central Councils for research are established for Ayurveda and Siddha, Unani-Tibb, Homoepathy as well as Naturopathy and Yoga. Seperate Pharmacopeal Laboratories have been established for developing standards of drugs used in these systems of medicine.

About 1500 plant species are described in these systems as drugs. Out of these about 800 are routinely used in practice. A list of 150 important plant species that have been extensively investigated for their medicinal properties and used most frequently is provided in the Annexure.

A large section of the population of this country depend on these systems of medicine. Some of the medicines are even used as common household remedies and play a major role in primary health care.

A few large and several small scale manufacturers are engaged in the manufacture of these medicines in various factories. These products are sold as over the counter preparations and also as prescription medicines to be prescribed by physicians. Several physicians of the Conventional System of Medicine extensively prescribe these products.

Some of the manufacturing units are employing modern pharmaceutical techniques of production. It is necessary to impress upon the manufacturers of these drugs the necessity to employ modern technology without affecting the traditional properties and efficacy of the drug. The modern technology is helpful in improving the quality of the drug and also reducing the cost of production.

The plants and plant products possess a remarkable property of promoting and maintaining good health. Their judicious use may provide a lasting solution to various human ailments. Many of the plant and plant products also form ingredients of our diet. The human body systems are highly sophisticated laboratories with capacities to convert natural substances as per the need and requirement of the body. These systems are more accustomed to the natural substances than the synthetic chemicals.

The modern knowledge of bio-chemistry, immunology, molecular biology and genetics have changed many of our understanding and have made great impacts on our approach to human health and disease. On the basis of this knowledge and recent discoveries of the immuno-modulating activities of some plants and their constituents should make us look for something else than the mere isolation of active principles that may act directly on isolated human organs. For understanding the effects of plants and their formulation it is necessary to develop entirely new methologies and approaches and study of new mechanisms of drug action. It is therefore suggested that a detailed clinical evaluation by following a properly designed protocol should be carried out for some important herbal remedies to establish their efficacy. These drugs should then be subjected to classical investigations for the purpose of their standardisation.

This kind of research will need a substantial assistance from all possible sources. The standardisation work should be assisted by international agencies, local governments and private enterpreuners with a view to achieve this stupendous task.

The collaborative efforts with developed countries for employing modern technology as well as opening an export market is also essential to industrialise the production of these medicines.

The cultivation of medicinal plants is an immediate necessity. The Government agencies as well as the private sector should be encouraged to employ the knowledge gathered by developed nations with the support of International agencies.

The knowledge and expertise of the Indian enterpreneurs dealing in herbal drugs and herbal products and their availability in India can be undoubtedly of immense use to other developing nations. Such a co-operation and collaboration should be explored directly as well as through the support of international agencies.

Several other important objectives can be achieved by development and propogation of herbal remedies and herbal health products on a global basis. These are :

* The target of "Health for all be the year 2000".
* Effective treatment of ailments where no conventional therapy is available.
* Effective and safe management of chronic and refractory diseases.
* Reduction of iatrogenic hazards.
* Provision of economic and safe remedies for primary health care programmes.
* Standardisation and creation of conventional scientific data on traditionally used herbal remedies.

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Annex I

Introduction

1. The third Consultation on the Pharmaceutical Industry was held at Madrid, Spain, from 5 to 9 October 1987. The Third Consultation was attended by 286 participants from 61 countries and 14 international and other organizations (See Annex 1) and was held at the invitation of the Government of Spain.

Background to the Third Consultation on the Pharmaceutical Industry

2. UNIDO organised two Consultations on the pharmaceutical industry, in 1980 and 1983, at which participants emphasized the importance of developing domestic pharmaceutical production in developing countries, covering all the major subsectors related to both preventive and curative medicine, including the production of pharmaceutical chemicals and their intermediates. they took into account factors involving policy and production measures and identified a number of issues involved in the promotion and development of the industry in developing countries.

3. In response to the recommendations of the First Consultation, UNIDO convened a a round-table meeting of experts in December 1981, a committed of experts on pharmaceuticals in October 1982 and an ad hoc panel of experts on contractual arrangements in December 1982 and April 1983, as well as a meeting on co-operation among developing countries in September 1983. UNIDO simultaneously undertook a study of technical, economic and environmental aspects related to the transfer of technology and the development of the pharmaceutical industry.

4. As a follow-up to the recommendations of the Second Consultation, UNIDO convened a third meeting of the ad hoc panel on contractual arrangements, and the panel gave their final views regarding three documents on contractual arrangements for the production of drugs (pharmaceutical chemicals, their intermediates and pharmaceutical formulations). With regard to the availability, pricing and transfer to technology for pharmaceutical chemicals and their intermediates, UNIDO prepared a number of studies and carried out surveys on sources of supply for pharmaceutical chemicals and intermediates and on the availability of technology. It also endeavoured to put technology recipients in contact with the technology holders, provided technical assistance and conducted feasibility studies leading to the integrated development of the pharmaceutical industry and transfer of technology for the production of pharmaceutical chemicals.

5. In February 1985, UNIDO convened an informal meeting of experts on medicinal plants, as a result of which UNIDO : (a) collected information on five medicinal plants of known therapeutic importance, including botanical, ethnomedical, chemical, pharmacological, agro-technological, technology and market aspects; (b) prepared guidelines to improve the supply of medicinal plants as raw materials or processed

products, in addition to documents on the transfer of technology for the genetical improvement of medicinal plants; and (c) intensified its technical assistance programme.

6. UNIDO established an Advisory Panel on Preventive Medicine to implement a programme on the industrial production of biologicals, which met four times since the Second Consultation. On the recommendation of the Panel, a sub-account of the United Nations Industrial Development Fund was established to finance the implementation of the programme. UNIDO also prepared a document on techno-economic aspects of the industrial production of biologicals, assisted in the establishment of a pilot demonstration unit for vaccine production responded to requests for the rehabilitation or expansion of existing production and control facilities in Africa and held discussions with United Nations agencies and bilateral aid organizations on the need for assured utilization of domestically manufactured biologicals. UNIDO also convened meetings at the regional level in 1984 (Latin America) and 1986 (Asia).

7. In addition to the activities carried out as a result of recommendations of the First and Second Consultations, UNIDO pioneered in setting up the International Centre for Genetic Engineering and Biotechnology and carried out studies on : strategies and policies for the development of a domestic pharmaceutical industry; industrial and marketing aspects of factory-produced herbal medicine (case study of the Chinese experience); and women and industrialization (employment and training practices in the pharmaceutical industry in Puerto Rico).

Identification of new issues

8. UNIDO convened a meeting of experts in December 1986 on medicinal plants and other issues related to the development of the pharmaceutical industry in developing countries. The meeting reviewed the action taken to implement the recommendations of the First and Second Consultations and identified the following issues for discussion at the Third Consultation :

Issue 1 : Industrial utilization of medicinal plants :
Factory-made herbal medicine
Technology for genetic improvement
Process technology development and product standardization.

Issue 2 : International co-operation for the development of the pharmaceutical industry :
Exchange of information and experience
Master plan for the development of the pharmaceutical industry.
Development of pharmaceutical-related ancillary industries, with special reference to packaging materials.

Agreed conclusions and recommendations of the Third Consultation

Issue 1 : Industrial utilization of medicinal plants

CONCLUSIONS

9. Herbal medicines play a vital role in the health care programmes for large segments of the world's population, especially in the developing countries; in many cases, they bridge the gap between the availability of and demand for medicines. Hence, research, development and the propagation of such medicines should be widely encouraged and in fact should be incorporated in health delivery systems.

10. Safety should be the overriding criterion in the selection of herbal medicines for human use, especially in the health service system. Different procedures for screening, chemical analyses, clinical trials and regulatory measures should be applied to the different groups of products, namdley : total plants or parts thereof; crude extracts; or pure phytochemicals. Whereas a less stringent procedure could be applied to the first two groups of products, the same procedure applicable for synthetic drugs should be applied to the last group.

11. The application of modern scientific methods in the cultivation, selection, manufacturing and clinical trials of herbal medicine is the most appropriate way to transform traditional trade into modern industrial practice. In this connection, the Chinese model, along with other models that may be identified by UNIDO, could be considered by other countries when developing their own systems. Industrial production would require the adoption of appropriate agro-technology in order to obtain adequate quantities of medicinal plants of standard physical and chemical quality. There is thus a need for the large-scale cultivation of such plants and to devote attention to their genetic improvement.

12. The evolution of pilot plants for the processing of various herbal plants according to the availability and demand in various countries should be further considered, and UNIDO, in co-operation with the industry, should develop suitable designs in this respect. Research and development activities in both developed and developing countries are needed to support the development of the industrial utilization of herbal medicine.

13. There should be wider compilation and dissemination of information on the availability, properties and products generated from herbal plants. In this connection, participants from a number of countries made offers to provide assistance for research, development and training facilities.

RECOMMENDATIONS

Developing Countries

14. It is recommended that developing countries should :

(a) Undertake, at the national level, the economic mapping of medicinal flora with a view to their use for industrial application;

(b) Establish data centres on medicinal plants and plant-derived products at the national, regional and sub-regional levels to facilitate the exchange of information;

(c) Establish national centres to carry out research and development activities in connection with the industrial utilizatcn of medicinal plants;

(d) Include the use of herbal medicines in national health delivery systems, as well as national health education and training;

(e) Establish regulatory bodies and registration authorities for herbal products;

(f) Strengthen co-operation among the developing countries in the above-mentioned fields.

Enterprises

15. It is recommended that industries in devloped and developing countries should undertake joint activities on the genetic improvement of medicinal plants and modern methods of plant propagation, including tissue culture and the standardization of plant-derived pharmaceutical products.

16. It is recommended that industries in developed countries should consider undertaking joint endeavours with developing countries for the pooling of technology relating to the production of plant-derived pharmaceuticals and their marketing.

International organizations

17. It is recommended that international bodies, including UNIDO and the World Health Organization (WHO), should:

(a) Assist developing countries in conducting pharmacological and clinical trials on plant-derived products to ensure regulatory requirements for safety and quality standards;

(b) Conduct special educational programmes to publicize the proper use of plant-derived herbal medicine;

(c) Organize consultations at regional levels on various facets of the medicinal plant industry, with special emphasis on quality standards and safety, with a view to promoting the wider use and acceptability of herbal medicines.

18. It is recommended that UNIDO should, in collaboration with other United Nations agencies, as appropriate:

(a) Develop suitable designs of pilot plants for process technology according to requests from developing countries;

(b) Provide a list of existing data bases with information on medicinal plants and assist national Governments, upon request, in the establishment of data bases on all aspects of medicinal plants and in the exchange of information between countries, directed towards the establishment of regional and interregional networks, using as far as possible existing data bases at the Food and Agricultural Organization of the United Nations (FAO), the United Nations Educational, Scientific and Cultural Organization (UNESCO), WHO, UNIDO etc;

(c) In collaboration with other appropriate organizations, initiate and expand programmes for the conservation of endangered medicinal plants;

(d) Actively promote manpower development in all facets of the industry related to medicinal plants, in industry as well as in research and development institutions.

Drug	Action or clinical use	Plant Source
Acetyldigoxin	Cardiotonic	Digitalis lanata Ehrh.
Adoniside	Cardiotonic	Adonis vernalis L.
Aescin	Anti-inflammatory	Aesculus hippocastanum L.
Aesculetin	Antidysentery	Fraxinus rhynchophylla Hance
Agrimophol	Anthelmintic	Agrimonia eupatoria L.
Ajmalicine	Circulatory Disorders	Rauvolfia serpentina (L) Benth. ex Kurz
Allantoin *	Vulnerary	Several plants
Anabasine	Skeletal muscle relaxant	Anabasis aphylla L.
Andrographolide	Bacillary dysentery	Andrographis paniculata Nees
Anisodamine	Anticholinergic	Anisodus tanguticus (Maxim.) Pascher
Anisodine	Anticholinergic	Anisodus tanguticus (Maxim.) Pascher
Arecoline	Anthelmintic	Areca catechu L.
Asiaticoside	Vulnerary	Centella asiatica (L) Urban
Bromelain	Anti-inflammatory; proteoiytic agent	Ananas comosus (L) Merrill
Cissampeline	Skeletal muscle relaxant	Cissampelos pareira L.
Colchicine	Antitumour agent; anti-gout	Colchicum autumnale L.

* Now also produced commercially by synthesis.

Cont..d on next page

Drug	Action or clinical use	Plant Source
Convallatoxin	Cardiotonic	Convallaria majalis L.
Deslanoside	Cardiotonic	Degitalis lanata Ehrh.
Digitalin	Cardiotonic	Digitalis purpurea L.
Digitoxin	Cardiotonic	Digitalis lanata Ehrh.
Etoposide **	Antitumour agent	Podophyllum peltatum L.
Hyoscyamine	Anticholinergic	Hyoscyamus niger L.
Kawain *	Tranquillizer	Piper methysticum Forst. f.
Lanatosides A,B,C	Cardiotonic	Digitalis lanata Ehrh.
a-Lobeline	Smoking deterrant; respiratory stimulant	Lobelia inflata L.
Monocrotaline	Antitumour agent (topical)	Crotalaria sessiliflora L.
Neoandrographolide	Bacillary dysentery	Andrographis paniculata Nees
Noscapine (narcotine)	Antitussive	Papaver somniferum L.
Ouabain	Cardiotonic	Strophanthus gratus Baill.
Picrotoxin	Analeptic	Anamirta cocculus (L) W & A.
Pilocarpine	Parasympathomimetic	Pilocarpus jaborandi Holmes
Protoveratrines A & B	Antihypertensives	Veratrum album L.
Quinidine	Antiarrhythmic	Cinchona ledgeriana Moens ex. Trimen
Rhomitoxin	Antihypertensive; tranquillizer	Rhododendron molle G. Don
Salicin	Analgesic	Salix alba L.
Scillarin A	Cardiotonic	Urginea maritima (L) Baker

* Now also produced commercially by synthesis.

** Synthetic modification of a natural product.

Drugs	Action or clinical use	Plant source
Silymarin	Antihepatotoxic	Silybum marianum (L) Gaertn.
Stevioside	Sweetener	Stevia rebaudiana Bertoni
Valepotriates	Sedative	Valeriana officinalis L.
Vasicine (peganine)	Oxytocic	Adhatoda vasica Nees
Vincamine	Cerebral stimulant	Vinca minor L.
Vinblastine (Vincaleukoblastine)	Antitumour agent	Catharanthus roseus (L) G. Don
Vincristine (leurocristine)	Antitumour agent	Catharanthus roseus (L) G. Don

Annex III

PLANTS USED IN TRADITIONAL MEDICINE AND THE DRUGS DERIVED FROM THEM

Plant	Drug	Plant	Drug
Adhatoda vasica	Vasicine	Cassia angustifolia	Sennosides A & B
Adonis vernalis	Adoniside	Cassia species	Danthron
Aesculus hippocastanum	Aescin	Catharanthus roseus	Vinblastine Vincristine
Agrimonia eupatoria	Agrimophol	Centella asiatica	Asiaticoside
Ammi majus	Xanthotoxin	Cephaelis ipecacuanha	Emetine
Ammi visnaga	Kheilin		
Anabasis aphylla	Anabasine	Chondodendron tomentosum	Tubocurarine
Ananas comosus	Bromelain	Cinchona ledgeriana	Quinidine Quinine
Anamirta cocculus	Picrotoxin	Cinnamomum camphora	Camphor
Andrographis paniculata	Andrographolide Neoandrographolide	Cissampelos pareira	Cissampeline
Anisodus tanguticus	Anisodamine Anisodine	Citrus species	Hesperidin Rutin
Areca catechu	Arecoline	Colchicum autumnale	Colchiceine amide Colchicine Demecolcine
Ardisia japonica	Bergenin		
Artemisia maritima	Santonin	Convallaria majalis	Convallatoxin
Atropa belladonna	Atropine	Coptis japonica	Palmatine
Berberis vulgaris	Bergenin	Corydalis ambigua	(±)-Tetrahydro-palmatine
Brassica nigra	Allyl isothiocyanate	Crotalaria sessiliflora	Monocrotaline
Camellia sinensis	Caffeine Theophylline	Curcuma longa	Curcumin
Cannabis sativa	Tetrahydro - cannabinol	Cynara scolymus	Cynarin
Carica papaya	Chymopapain Papain	Cytisus scolymus	Sparteine
		Daphne genkwa	Yuanhuacine Yuanhuadine
Cassia acutifolia	Sennosides A & B		

Continued on next page

Plant	Drug
Datura metel	Scopolamine
Digenia simplex	Kainic acid
Digitalis lanata	Acetyldigoxin Deslannoside Digoxin Lanatosides A,B,C
Digitalis purpurea	Digitalin Digitoxin Gitalin
Ephedra sinica	Ephedrine Pseudoephedrine Pseudoephedrine, nor
Erythroxylum coca	Cocaine
Fraxinus rhynchophylla	Aesculetin
Gaultheria procumbens	Methyl salicylate
Glaucium flavum	Glaucine
Glycyrrhiza glabra	Glycyrrhizin
Hemsleya amabilis	Hemsleyadin
Hydrangea macrophylla var. thunbergii	Phyllodulcin
Hydrastis canadensis	Hydrastine
Hyoscyamus niger	Hyoscyamine
Larrea divaricata	Nordihydroguaiaretic-acid
Lobelia inflata	∝- Lobeline
Lonchocarpus nicou	Rotenone
Lycoris squamigera	Galanthamine
Mentha species	Menthol
Mucuna deeringiana	L-Dopa
Nicotiana tabacum	Nicotine
Ocotea glaziovii	Glaziovine
Papaver somniferum	Codeine Morphine Noscapine Papaverine
Pausinystalia yohimba	Yohimbine
Physostigma venenosum	Physostigmine
pilocarpus jaborandi	Pilocarpine
Piper methysticum	Kawain
Podophyllum peltatum	Etoposide * Podophyllotoxin Teniposide *
Potentilla fragarioides	(+) Catechin
Quisqualis indica	Quisqualic acid
Rauvolfia canescens	Deserpidine
Rauvolfia serpentina	Ajmalicine Rescinnamine Reserpine
Rhododendron molle	Rhomitoxin
Rorippa indica	Rorifone
Salix alba	Salicin
Sanguinaria canadensis	Sanguinarine
Silybum marianum	Silymarin
Simarouba glauca	Glaucarubin
Simarouba glauca	Glaucarubin
Sophora pachycarpa	Pachycarpine
Stephania sinica	Rotundine
Stephania tetrandra	Tetrandrine
Stevia rebaudiana	Tetrandrine
Setvia rebaudiana	Stevioside
Strophanthus gratus	Oubain
Strychnos nux-vomica	Strychnine
Theobroma cacao	Theobromine
Thymus vulgaris	thymol
Trichosanthes kirilowii	Trichosanthin
Urginea maritima	Scillarin A
Valeriana officinalis	Valepotriates
Veratrum album	Protoveratrines A & B
Vinca minor	Vincamine Benzyl benzoate Borneol Pinitol

Annex IV

INDIAN MEDICINAL PLANTS

A Guide for Scientific use in Therapeutics

1. Abroma augusta Linn.. f.
2. Acacia arabica Willd.
3. acacia farnesiana Willd.
4. Acacia catechu Willd.
5. Achyranthes aspera Linn.
6. Aconitum ferox Wall.
7. Aconitum heterphyllum Wall
8. Aconitum napellus Linn.
9. Acorus calamus Linn.
10. Adhatoda vasica Nees
11. Aegle marmelos Corr.
12. Allium sativum Linn.
13. Aloe indica Royle
14. Alpinia galanga Willd.
15. Alstonia scholaris R. Br.
16. Andrographis paniculata Nees.
17. Anthocephalus cadamba Miq.
18. Asparagus adscendens Roxb.
19. Asparagus racemosus Willd.
20. Asteracantha longifolia Nees.
21. Atropa belladonna Linn.
22. Berberis aristata DC.
23. Bergenia ligulata (Wall) Engl.
24. Boerhaavia diffusa Linn.
25. Bombax malabaricum DC.
26. Boswellia serrata Roxb.
27. Butea frondosa Koen. ex. Roxb.
28. Calotropis gigantea (Linn) R. Br. ex. Ait.
29. Calotropis procera (Ait) R. Br.
30. Carica papaya Linn.
31. Carum copticum Benth. & Hook.f.
32. Cassia angustifolia vahl
33. Cassia fistula Linn.
34. Celastrus paniculatus Willd.
35. Centella asiatica (Linn) Urban
36. Cichorum endivia Linn.
37. Cinnamomum camphora Nees & Eberm.
38. Cinnamomum tamala Nees & Eberm.
39. Cissus quadrangularis Linn.
40. Citrus medica Linn.
41. Clerodendrum erratum (Linn) Moon.
42. Coleus forskohli
43. Commiphora mukul (Hook ex. Stocks) Engl.
44. Crataeva nurvala Buch.-Ham.
45. Crocus sativus Linn.
46. Cuminum cyminum Linn.
47. Curculigo orchioides Gaertn.
48. Curcuma aromatica Salisb.
49. Curcuma longa Linn.
50. Curcuma zedoaria Rosc.
51. Cyamopsis tetragonoloba Taub.
52. Cymbopogon flexuosus (Steud). Wats.
53. Cymbopogon winterianus Jowitt.
54. Cynodon dactylon (Linn) Pers.
55. Cyperus rotundus Linn.
56. Datura stramonium Linn.
57. Dolichos biflorus Linn.

58. Eclipta alba Hassk.
59. Elettaria cardamommum Maton.
60. Embelia ribes Burm. f.
61. Enicostemma littorale Blume.
62. Eugenia aromatica Kuntze
63. Evolvulus alsinoidies Linn.
64. Ferula foetida Regel
65. Ficus bengalensis Linn.
66. Ficus recemosa Linn.
67. Ficus religiosa Linn.
68. Fumaria officinalis Linn.
69. Gloriosa superba Linn.
70. Glycyrrhiza glabra Linn.
71. Gossypium herbaccum
72. Hedychium spicatum Ham. ex. Smith
73. Helianthus annuus Linn.
74. Hemidesmus indicus R. Br.
75. Hibiscus rosa - sinensis Linn.
76. Holarrhena antidysenterica Wall.
77. Hydrocotyle rotundifolia Roxb.
78. Hyoscyamus muticus Linn.
79. Hyoscamus niger Linn.
80. Inula racemosa Hook f.
81. Ipomoea digitata Linn.
82. Juglans regia Linn.
83. Lawsonia inermis Linn.
84. Leptadenia reticulata W & A.
85. Mallotus philippinensis Muell - Arg.
86. Melia azadirachta Linn.
87. Mentha arvensis Linn.
88. Mesua ferrea Linn.
89. Mimosa pudica Linn.
90. Momordica charantia Linn.
91. Mucuna pruriens Bak.
92. Musa sapientum Linn.
93. Myristica fragrans Houtt.
94. Myrrh.
95. Nardostachys jatamansi DC.
96. Nelumbo nucifera Gaertn.
97. Nyctanthes arbortristis Linn.
98. Ocimum sanctum Linn.
99. Operculina turpethum (Linn) Silva Manso
100. Phaseolus mungo Linn.
101. Phyllanthus emblica Linn.
102. Phyllanthus niruri Linn.
103. Picrorhiza kurroa Royle ex. Benth.
104. Piper longum Linn.
105. Piper nigrum Linn.
106. Plantago ovata Forsk.
107. Plumbago zeylanica Linn.
108. Psoralea corylifolia Linn.
109. Pterocarpus marsupium Roxb.
110. Ptercarpus santalinus Linn .f.
111. Punica granatum Linn.
112. Raphanus sativus Linn.
113. Rauwolfia serpentina Benth ex. Kurz.
114. Ricinus commiunis Linn.
115. Rubia cordifolia Linn.

116. Santalum album Linn.
117. Saraca indica Linn.
118. Saussurea lappa C.B. Clarke.
119. Semecarpus anacardium Linn .f.
120. Shilajeet.
121. Sida cordifolia Linn.
122. Smilax china Linn.
123. Solanum indicum Linn.
124. Solanum nigrum Linn.
125. Solanum xanthocarpum Schrad & Wendl.
126. Sphaeranthus indicus Linn.
127. Strychnos nux vomica Linn.
128. Swertia chirata Buch. - Ham.
129. Symplocos racemosa Roxb.
130. Syzygium cumini (Linn.) Skeels.
131. Tephrosia purpurea (Linn.) Pers.
132. Terminalia arjuna W. & A.
133. Terminalia belerica Roxb.
134. Terminalia chebula Retz.
135. Tinospora cordifolia (Willd.) Miers.
136. Tribulus terrestris Linn.
137. Trichosanthes dioica Roxb.
138. Trigonella foenum-graecum Linn.
139. Tylophora indica (Burm .f.) Merr.
140. Valeriana officianalis Linn.
141. Valeriana wallichii DC.
142. Vanda roxburghii R. Br.
143. Vanslalochanam.
144. Vinca rosea Linn.
145. Viola odorata Linn.
146. Vitex negundo Linn.
147. Wedelia calendulaceae Less.
148. Withania somnifera Dunal.
149. Woodfordia fruticosa Kurz.
150. Zanonia indica Linn.
151. Zingiber officinale Rosc.

Annex V

Export of plants and products (itemwise) for the years 1985 to 1988

(Est. in '000 Rs.)

	Exports During		
	April-85 to March-86	April-86 to March-87	April-87 to March-88
Crude Drugs:-			
Chirata	--	--	31.9
Galangal Rhizomes	79.0	144.3	362.3
Nux Vomica	--	--	813.4
Psyllium Husk	308773.4	220400.2	414065.1
Psyllium Seeds	39081.0	19100.0	10506.9
Senna Leaves & Pods	26553.8	26900.0	15462.6
Tukmaria	181.2	114.0	89.3
Zedovery Roots	262.5	85.6	243.7
Opium Crude	237500.0	249000.0	192833.1
Poppy Seeds/Husks	1394.9	5051.1	914.2
Vinca Rosea Roots	4551.5	2990.5	5558.5
Sarasaparilla	22.6	53.8	31.1
Crude Drugs n.e.s.	44559.1	55721.6	132717.9
Total	**662958.0**	**579562.0**	**773630.0**
Plant Products:-			
Rose Water	1173.8	518.4	1477.3
Henna Leaves & Powder	31096.7	40500.0	27534.4
Yeast n.e.s.	138.2	72.2	91.3
Fatty Acids	7307.9	16970.9	3334.6
*Keora Water	163.6	266.2	276.4

(Est. in '000 Rs.)

Items	Exports During		
	April-85 to March-86	April-86 to March-87	April-87 to March-88
Berberine Hydrochloride	4153.2	1382.9	2422.6
Ephedrine Hydrochloride	--	458.1	668.3
Emetine Salts/Hydrochloride	1978.4	390.7	2852.7
Quinine Hydrochloride	1345.0	--	735.6
Quinine Sulphate	233.1	2363.1	8163.5
Strychnine Alkaloids/Salt	3555.6	2131.7	3284.5
Salts & Other Devts of Nux Vomica Alkaloids/Brucine	11196.9	9762.7	20472.8
Ayurvedic & Unani Medicines	38047.2	43656.6	26830.3
Homeopathic Medicines	6.7	4.8	73.7
Cold, Cough, Bronchial Prepns except salves, ointments & Vaccines	666.9	2115.2	494.5
Gripe Water	7642.6	1988.6	2465.6
Headache, Neuralgia & PainRemedies	4743.8	388.8	890.6
Medicinal Castor Oil	544144.6	336710.0	617300.1
Menthol	603.8	631.6	4957.8
Beta Lonone	55952.6	69999.3	65485.0
Papain pure	11604.2	27650.9	10966.4
Harmless Medicines	169674.4	197769.2	143562.4
Calcium Sennoside	1009.4	3247.6	9628.1
*Solanesol	2974.8	1935.5	5295.7
*Venbalstine, Vineisterine	--	10500.0	213.8
*Methyl Dopa	27774.0	28590.2	

Annex VI

Export of essential oils (itemwise) for the years 1985 to 1988

(Est. in '000 Rs.)

Items	Exports During		
	April-85 to March-86	April-86 to March-87	April-87 to March-88
Essential Oils:-			
Cardamom Oil	2497.9	1664.9	717.5
Clove Oil	7.2	19.2	782.7
Eucalyptus Oil	3.8	--	89.0
Ginger Oil	56035.3	18360.0	5734.9
Lemongrass Oil	9136.4	29160.6	18279.5
Palmarosa Oil	2665.5	1210.1	746.5
Sandalwood Oil	54239.8	145060.0	73066.0
Vetiver Oil	--	0.8	--
Peppermint Oil	837.1	490.4	1161.3
Blended Rosa Oil	--	231.4	346.3
Essential Oil n.e.s.	8992.4	30623.0	39907.0
*Cidarwood Oil	--	--	105.8
*Davana Oil	2972.8	1164.5	3124.0
*Jasmine/Tuberose concrete	19235.0	8980.0	15491.8
Total	156623.2	236964.9	159552.3

Annex VII (A)

LIST OF MANUFACTURERS OF

FORMULATIONS

Alarsin,
12, K. Dubhash Road, Fort,
Bombay - 400 023.

Allen Pharmaceuticals,
2-3-105, Amberpet,
Hyderabad - 500 013

Anuja Pharmaceutical Works
5, Rajmahal Shopping Centre,
55-E, Sir M.V. Road,
Andheri (E), Bombay - 400 059.

Arya Aushadhi Pharmaceutical Works,
35/A/5, Fort Industrial Estate,
Indore - 452 006.

Atreya Ayurvedic Pharmacy,
P.B. No. 20, Delhi Road,
Badot - 250 611.

Ayurlab Pharmaceuticals,
K-392, GIDC, Makarpura Ind. Est.
Vadodara - 390 010.

Baidyanath Ayurved Bhavan Ltd.,
Great Nag Road,
Nagpur
412 009.

Bio-Ethicals Pharma Pvt. Ltd.,
Ashish Industrial Estate,
Gokhale Road, (South),
Dadar, Bombay - 400 025.

Bharatiya Aushadhi Nirman Shala (BAN)
Dr. Vikram Sarabhai Marg,
Gondal Road, Rajkot - 360 004.

Brinto Remedies,
Industrial Area, Maxi Road,
Ujjain (M.P.)

Chadda Traders (Reg),
H.O. Unit No. 2, 3416/17,
Harimandir Marg, Paharganj.
New Delhi - 110 055.

Cadila Laboratories,
244, Ghodasar, Maninagar
Ahmedabad - 380 050, Gujarat.

Dabur Dr. S.K. Burman Pvt. Ltd.
22, Site 4 Sahibabad,
Ghaziabad, U.P.

Deccan Ayurveda Pharmacy
Saidabad, Hyderabad - 560 659.

Deshrakshak Aushadhalaya,
Haridwar, U.P.

Eisin Pharma Co. Pvt. Ltd.,
34/7, Erandwana, Pune - 411 004.

Franco-Indian Pharma Ltd
20, Dr. E. Moses Road,
Bombay - 400 011.

GAMP-G.A. Mishra Ayu. Pharmacy
Jhansi - 284 002 (U.P.)

Ganga Ayurved Niketan,
Chandansar Road, Virar,
Bombay.

Gufic Ltd.
Subhash Road-A,
Vile Parle (E)
Bombay - 400 057.

Hamdard Dawakhana
Hamdard Marg, Delhi - 110 006.

Herbolab
Jay Bhuvan,
23, Kazi Sayed Street,
Mandvi, Bombay - 400 009.

Himalaya Drugs Co.
Shivsagar Estate - E,
Worli, Bombay.

Lupin Lab. Ltd.
159, CST Road,
Bombay - 400 098.

Maans Products (India)
244, Gheekanta,
Ahmedabad - 380 001.

Moderna Remedies Corporation
10, Soudagar Terrace, Deorukhkar Road,
Dadar, Bombay - 400 014.

National Homeo Laboratories,
110, Acharya Jagannath Bose
Road, Calcutta - 700 014.

Navshakti Ayurvedalaya Pvt.Ltd.
Bhusaval, Maharashtra.

Omkar Ayurved Mandir,
At & Post Mangaon, Dist. Raigad,
(Kulata) - 402 104.

Pharma Products Pvt. Ltd.
Vijai Medical College Road,
Tanjavur - 613 007.

Sandu Brothers
V.N. Purav Marg,
Chembur, Bombay - 400 071.

Sanros Pharma
Jivandi Road, Virar - 401 303.

Sarda Homeo Laboratories,
30, Creek Lane,
Calcutta - 700 014.

Sharma Unani Pharmacy,
New Delhi.

Siddha Medical Research Institute,
654, Vyalikaval, 11th Cross Road,
Malleswaram, Bangalore - 560 003.

Siddhi Pharmacy Pvt. Ltd.
8, Civil Lines, Lalitpur, U.P.

Simila, RK Bhandari Homeo-
pathic Pvt. Ltd.
B-217, Greater Kailash Part-I,
New Delhi - 110 048.

Tibbia College Dawakhana
Aligarh Muslim University,
Aligarh - 202 001.

Steadcure Homeo Laboratories,
Dhadda Market, Johari Bazar,
Jaipur - 302 003.

Triguna Ayurvedic Research Lab.,
47, Friends Colony,
Mathura Road,
New Delhi - 110 065.

TTK Pharma Pvt. Ltd.
Old Truck Road
Madras - 600 043.

Universal Ayurved,
545/C, Shanti Nagar,
Nagpur - 2.

Vikas Pharma
Loni Road,
Shahdara,
Delhi - 110 032.

V.N. Pharma,
1st Floor, Sukh Sadan,
Anand Bawa Chakala,
Jamnagar - 361 001.

Yogi Pharmacy
Lashkar Road,
P.O. Gurukul
Kangari,
Haridwar, U.P.

Zandu Pharmaceuticals Works Ltd.,
Gokhale Road, South,
Dadar
Bombay
400 025.

Annex VII (B)

LIST OF MANUFACTURERS

Extract/Isolates

1. Alembic Chemical Works Co. Ltd.
Vadodara 390 993
Gujarat.

2. Amser Pvt. Ltd.,
47, Laxmi Nagar,
Industrial Estate,
Fort, Indore 452 006. (M.P.)

3. Anand Pharmaceutical
Krishna Road
Anand 388 001. (Gujarat)

4. Biological E. Ltd.
18/1 & 3 Azamabad,
Hyderabad 500 020 (A.P)

5. Bombay Alkaloids Pvt. Ltd,
194 Samuel Street
Bombay 400 009.

6. Bharat Vinca Producers,
Dhavalganga,
9E 1 Carter Road,
Bandra West, BOMBAY 400 050.

7. Chemiloids,
Brindavan Colony,
Vijayawada 520 010 (A.P.)

8. Cipla Ltd,
289, Belasis Road,
Bombay 400 008.

9. Enzochem Labs Pvt. Ltd,
Aurangabad Road,
Yeola, Dist. Nashik
Maharashtra State

10. Director
Govt. Quinine factory,
Mungpoo, Darjeeling,
W. Bengal.

11. Govt. Quinine Factory,
Annamalais Cinchona,
P.O. 642 106
Pollachi Taluk
Dist. Coimbatore (T.N.)

12. Govt. Factory
Opium & Alkaloid Works
Ghazipur (U.P.)

13. Indo-German Alkaloids
P.O. Box 7376,
Bombay 400 093.

14. Metha Pharmaceuticals,
Cherharta
Amristar (Punjab)

15. Nutri Thera Laboratory Pvt. Ltd.,
P. 19 Darga Road,
Calcutta 700 017.

16. Sandoz (India) Ltd,
P.O. Box 6596
Bombay 400 018.

17. Saiba Industries Pvt. Ltd,
129, 131 Kazi Sayed Street,
Bombay 400 003.

18. Unichem Laboratories Ltd,
S.V. Road,
Jogeshwari, Bombay 400 102.

19. Zandu Pharmaceutical Works Ltd,
Gokhale Road South,
Bombay 400 025.

1. Quality Chemicals
91-A, 2nd Floor,
Deputy Ganj,
Moradabad 244 001.

2. Industrial Chemical Enterprise
P.B. No. 3597,
New Delhi 110 024.

3. Kosan Metal Product Pvt. Ltd,
64, 65, Laxmi Insurance Building,
Sir P.M. Road, Fort,
Bombay 400 001.

4. Hindustan Chemical & Allied Industries,
(Mr. Girishkumar)
Barehseni Street,
Chandausi 202 412

5. Bhagat Fine Chemical
164, Sitaram Podar Marg,
Bombay 400 002.

6. Ronak Fine Industries
35/B, Shilpa,
58 Besant Road,
Santacruz (West),
Bombay 400 054.

7. Menthol & Allied Chemicals (India)
Opp. Central Bank of India,
Rajdwara Road,
Rampur 244 901.

Annex VIII

List of a few important plants whose extracts are manufactured

1. Abroma augusta Linn. f
2. Acacia catechu Willd
3. Achyranthes aspera Linn.
4. Acorus calamus Linn.
5. Adhatoda vasica Nees
6. Allium sativum Linn.
7. Andrographis paniculata Nees
8. Asparagus racemosus Willd
9. Atropa belladonna Linn.
10. Berberis aristata DC
11. Boerhaavia diffusa Linn
12. Cassia angustifolia vahl.
13. Centella asiatica (Linn.) Urban.
14. Coleus forskohli
15. Commiphora mukul (Hook ex. Stocks) Engl.
16. Curcuma longa Linn.
17. Datura stramonium Linn
18. Eclipta alba Hassk.
19. Gloriosa superba Linn.
20. Glycyrrhiza glabra Linn
21. Gymnema sylvestre
22. Holarrhena antidysenterica Wall
23. Hyoscyamus muticus Linn
24. Melia azadirachta Linn
25. Mentha arvensis Linn
26. Nardostachys jatamansi DC
27. Ocimum sanctum Linn.
28. Picrohiza kurroa Royle ex. Benth.
29. Rauwolfia serpentina Benth ex. Kurz
30. Rubia cardifolia Linn.

31. Saraca indica Linn.
32. Sida cordifolia Linn.
33. Solanum xanthocarpum
34. Swertia chirata Buch - Ham.
35. Tinospora cordifolia (Willd.) Miers.
36. Valeriana wallichii DC
37. Vinca rosea Linn.
38. Withania somnifera Dunal.

Annex IX

USE OF MEDICINAL PLANTS IN PRIMARY HEALTH CARE

I. Plants for Promoting Health (Immunity)

1.	Tulsi	-	Ocimum sanctum
2.	Bala	-	Sida cordifolia
3.	Atibala	-	Abutilon Indicum
4.	Ashwagandha	-	Withania somnifera
5.	Arjuna	-	Terminalia arjuna
6.	Amalaki	-	Emblica officinalis

II. Plants for Care of the Mother

1.	Shatawari	-	Asparagus racemosus
2.	Ashok	-	Saraca indica
3.	Durva	-	Cynodon dactylon
4.	Haridra	-	Curcuma longa

III. Plants for the Care of Infants & Children

1.	Vacha	-	Acorus calamus
2.	Mandukaparni	-	Centella asiatica
3.	Jalneem	-	Bacopa monniera
4.	Shankhapuspi	-	Convolvulus pluricaulis
5.	Pippali	-	Piper longum
6.	Bhumyamalaki	-	Phyllanthus niruri
7.	Bibhitaki	-	Terminalia bellirica
8.	Shunthi	-	Zingiber officinalis
9.	Palasha	-	Butea monosperma
10.	Vidanga	-	Embelia ribes

IV. Plants for Promotion of Nutrition

1.	Gajar	-	Daucus carota
2.	Shigra	-	Moringa oleifera
3.	Nibu	-	Citrus medica
4.	Chana	-	Cicer arietinum
5.	Munga	-	Phaseolus aurcus
6.	Gehu	-	Triticum sativum (Sprouted wheat)
7.	Kanchanar	-	Bauhinia variegata
8.	Anawain	-	Trachyspermum ammi

V. Plants for Family Planning

1.	Japapushpam	-	Hibiscus rosa-sinensis
2.	Nirgundi	-	Vitex nigundo
3.	Vidanga	-	Embelia ribes

VI. Plants for Common Diseases

1.	Bilwa	-	Aegle marmelos
2.	Haritaki	-	Terminalia chebula
3.	Nimba	-	Azadirachta indica
4.	Lata Karanja	-	Caesalpinia crista
5.	Shirisha	-	Albizzia lebbeck
6.	Guduchi	-	Tinospora cordifolia
7.	Bhringaraj	-	Eclipta alba
8.	Vasa	-	Adhatoda vasica
9.	Ghrita kumari	-	Aloe vera
10.	Kalmegha	-	Andrographis paniculata
11.	Bakuchi	-	Psoralea corylifolia
12.	Kutaja	-	Holarrhena antidysenterica

VII. Plants for Infectious Diseases

A) Malaria :

1.	Lata Karanja	-	Caesalpinia crista
2.	Saptaparna	-	Alstonia scholaris
3.	Chireyata	-	Swertia chirata

B) Filariasis :

1.	Shakhotaka	-	Streblus asper

C) Tuberculosis :

1.	Vidarikanda	-	Pueraria tuberosa

D) Leprosy :

1.	Apamarga	-	Achyranthes aspera
2.	Mandukparni	-	Centella asiatica

VIII. Plants for Systemic Disorders

(A) Diabetes Mellitus

1.	Vijaisar	-	Pterocarpus marsupium
2.	Jambu	-	Eugenia jambolana
3.	Karela	-	Momordica charantia
4.	Gudmar	-	Gymnema sylvestre

(B) Hypertension :

1.	Sarpagandha	-	Rouwolfia sarpentina

(C) **Ischaemic Heart Disease**

1.	Arjuna	-	Terminalia arjuna
2.	Guggulu	-	Commiphora mukul
3.	Pushakarmula	-	Inula racemosa
4.	Kustha	-	Saussurea lappa

(D) **Bronchial Asthama**

1.	Shirisha	-	Albizzia lebbeck
2.	Kantakari	-	Solanum xanthocarpum
3.	Mulhathi	-	Glycyrrhiza glabra
4.	Vasa	-	Adhatoda vasica

(E) **Peptic ulcer**

1.	Amalaki	-	Emblica officinalis
2.	Bhringaraj	-	Eclipta alba
3.	Mulnathi	-	Glycyrrhiza glabra
4.	Shatawari	-	Asparagus racemosus

(F) **Infective Hepatitis**

1.	Kalmegha	-	Andrographis paniculata
2.	Bhumjamalaaki	-	Phyllanthus niruri

(G) **Impotency**

1.	Kapikachu	-	Mucuna pruriens

(H) Cancer

1.	Bhallataka	-	Semecarpus anacardium

(I) Injury (fractures)

1.	Ashti Shrinkhela	-	Cissus quadrangularis

(J) Stones & Urinary Tract Infection

1.	Varuna	-	Crataeva nurvala
2.	Gokhshura	-	Tribulus terrestris
3.	Punarnava	-	Boerhavia diffusa

Annex X

Patent Indian herbal preparations (with their plants and families) sold for liver ailments

Name of the preparation	Manufacturer	Plants used in the preparation	Part of the plant	Vern. name	Family
ACILVAN	Acis Laboratories, Kanpur	Achillea millefolium	Wp	Gandana	Compositae
		Borerhaavia diffusa	Wp	Punarnava	Nyetaginaceae
		Capparis spinosa	Rt. Bk	Kabra	Capparidaceae
		Casearia esulenta	Rt, Bk	Chilla	Samydaceae
		Cassia occidentalis	Lf	Kasondi	Leguminosae
		Cichorium intybus	Wp	Bhringaraja	Compositae
		Eclipta alba	Wp	Bhringraja	Compositae
		Ocimum sanctum	Lf	Tulsi	Labiatae
		Picrorrhiza kurroa	Rt	Kuru	Scrophulariaceae
		Solanum nigurum	Ft	Mako	Solanaceae
		Tamaaarix gallica	Bk	Jhau	Tamaricaceae
		Terminalia arjuna	Bk	Arjuna	Combretaceae
		Tinospora cordifolia	St	Giloe	Menispermaceae
ADL-75	Abala Drug House, Calcutta	Andrographis paniculata	Wp	Kalmegh	Acanthaceae
		Andropogon muricatus	Rt	Khas	Graminae
		Carum copicum	Ft	Ajowain	Umbelliferae
		Cassia angustifolia	Lf	Hindi sana	Leguminosae
		Centella asiatica	Wp	Kula kudi	Umbelliferae
		Holarrhena antidysenterica	Bk	Karchi	Apocynaceae
		Hygrophila spinosa	Lf	Gokshura	Acanthaceae
		Solanum xanthocarpum	Rt	Kandiali	Solanaceae

Name of the Preparation	Manufacturer	Plants used in the preparation	Part of the plant	Vern. name.	Family
BILIGEN	Standard Pharma Remedies Calcutta	Andographis paniculata	Wp	Kalmegh	Acanthaceae
		Apium graveolens	Ft	Ajmod	Umbelliferae
		Asteracantha longifolia	Lf	Talmakhana	Acanthaceae
		Ipomoea turpethum	Rt	Nishoth	Convolvulaceae
		Swertia chirata	Wp	Chirata	Gentianaceae
		Trachyspermum ammi	Ft	Ajowain	Umbelliferae
		Trigonella foenum-graecum	Wp	Methi	Leguminosae
HEPA-10	Jupiter Pharma-ceuticals Pvt. Ltd, Calcutta	Aloe indica	Lf	Ghikanvar	Liliaceae
		andrographis baniculata	Wp	Kalmegh	Acanthaceae
		Aphnamixis polystachya	Bk	Raktarohitak	Meliaceae
		Coculus cordifolius	Wp	Gulancha	Menispermaceae
		Eclipta alba	Wp	Bhringraja	Compositae
		Fumaria officinalis	Wp	Pitpapara	Fumariaceae
		Luffa echinata	Ft	Bindaal	Cucurbitaceae
		Podaphyllum	Rh	Papra	Berberidaceae
		Ptychotis ajowan	Ft	Ajowain	Umbelliferae
		Solanum nigrum	Ft	Mako	Solanaceae
HEPEX	The Anglo-French Drug Co. (Eastern) Ltd., Bombay	Achillea millefolim	Wp	Gandana	Compositae
		Boerhaavia diffusa Wp	Punarnava	Nyctaginaceae	
		Phyllanthus emblica	Ft	Amla	Euphorbiaceae
		Phyllanthus niruri	Wp	Jaramla	Euphorbiaceae
		Picrorrhiza kurroa	Rt	Kuru	Scrophulariaceae
		Solanum nigurm	Ft	Mako	Solanaceae
HIPEX	H.V. Pharma, Rajkot, Gujarat	Boerhaavia diffusa	Wp	Punarnava	Nyctaginaceae
		Cassia occidentalis	Sd	Kasondi	Leguminosae
		Cichorium intybus	Wp	Kashni	Compositae
		Embelia ribes	Sd	Vidang	Myrsinaceae
		Solanum bigrum	Ft	Mako	Solanaceae
		Terminalia chebula	Ft	Harar	Combretaceae

Name of the preparation	Manufacturer	Plants used in the preparation	Part of the plant	Vern. name	Family
KAMLESH COMPOUND	Bengal Chemicals Pharmaceuticals Pvt. Ltd, Calcutta	Andrographis paniculata	Wp	Kalmegh	Acanthaceae
		Apium gravelens	Ft	Ajmod	Umbelliferae
		Carum copticum	Ft	Ajowain	Umbelliferae
LIV-52	Himalaya Drug Co., Bombay	Achillea millefolium	Wp	Gandana	Compositate
		Capparis spinosa	Rt. Bk	Kebra	Cappariidaceae
		Cassia ocidentalis	Lf	Kasondi	Leguminosae
		Cichorium intybus	Wp	Kashni	Compositae
		Solanum nigrum	Ft	Mako	Solanaceae
		Tamarix gallica	Bk	Jhau	Tamaricaceae
		Terminalia arjuna	Bk	Arjuna	Combretaceae
LIV-77	Globe Pharmaceuticals, Jalandhar City (Punjab)	Boerhaavia diffusa	Wp	Punarnava	Nyctaginaceae
		Berberis aristata	Rt. Bk	Daruharidra	Berberidaceae
		Cichorium intybus	Wp	Kashni	Compositae
		Eclipa alba	Wp	Bhringraja	Compositae
		Heliotropium strigosum	Wp	Hathi sundi	Boraginaceae
		Prunus demostica	Ft	Alu Bukhara	Rosaceae
		Tinospora cordifolia	St	Giloe	Menispermacceae
		Trigonella foenum-graecum	Wp	Methi	Leguminosae
LIVA	Herbid (India) Pvt. Ltd., Calcutta	Andrographis paniculata	Wp	Kalmegh	Acanthaceae
		Apium graveolens	Ft	Ajmol	Umbelliferae
		Asteracantha longifolia	Lt	Tamakhana	Acanthaceae
		Berberis aristata	St. Bk	Daruharidra	Berberidaccae
		Boerhavia diffusa	Wp	Punarnava	Nyctaginaceae
		Carica papaya	Sd	Papita	Caricaceae
		Cassia angustifolia	Lf	Hindi sana	Leguminosae
		Plumbago zeylanica	Rt	Chitrak	Plumbaginaceae
		Solanum migrum	Ft	Mako	Solanaceae
		Tephrosia hirta	Wp	Sarponkha	Leguminosae
		Terminalia arjuna	Bk	Arjuna	Combretaceae
		Trachyspermum ammi	Ft	Ajowain	Umbelliferae

Name of the preparation	Manufacturer	Plants used in the preparation	Part of the plant	Vern. name	Family
LIVA-16	Madona Pharm. Research, Callcutta	Alstonia	Bk	Saptaparna	Apocynaceae
		Andrographis paniculata	Wp	Kalmegh	Acanthaceae
		Boerhaavia diffusa	Wp	Punarnava	Nyctaginaceae
		Carum copticum	Ft	Ajowain	Umbelliferae
		Cassia angustifolia	Lf	Hindi Sana	Leguminosae
		Eclipta alba	Wp	Bhringraja	Compositae
		Hygrophila spinosa	Lf	Gokshura	Acanthaceae
		Oldenlandia corymbasa	Lf	Khetpapra	Rubiaceae
		Piper nigrum	Sd	Golmirch	Piperaceae
		Sokanum nigrum	Ft	Mako	Solanaceae
		Solanum xanthocarpum	Rt	Kandiali	Solanaceae
		Tinopora cordifolia	St	Giloe	Menispermaceae
		Vernonia anthelmintica	Sd	Kalijeeri	Compositae
LIVARIN	Patiala Ayurvedic Pharm. Sirhind	Aloe	Lf	Ghikanvar	Liliaeae
		Andrographis paniculata	Wp	Kalmegh	Acanthaceae
		Boerhaavia diffusa	Wp	Punarnava	Nycraginaceae
		Cassia fistula	Ft	Amaltas	Leguminosae
		Picroorrhiza kurroa	Rt	Kuru	Scrophulariaceae
		Solanum nigrum	Ft	Mako	Solanaceae
		Tecoma undulata	Bk	Rohira	Bignoniaceae
LIVATONA	Scientific Research Industries, Pvt., Ltd., Lucknow	Andrographis paniculata	Wp	Kammegh	Acanthaceae
		Asteracantha longifolia	Lf	Talmakhana	Acanthaceae
		Cassia angutifolia	Lf	Hindi sana	Leguminosae
		Glycryrrhiza glabra	Rt	Mulathi	Leguminosae
		Oldenlandia corymbosa	Lf	Khetpapra	Rubiaceae
		Trachyspermum ammi	Ft	Ajowain	Umbelliferae
		Trigoncella foenum graccum	Wp	Methi	Leguminosae

Name of the preparation	Manufacturer	Plants used in the preparation	Part of the plant	Vern. name	Family
LIVERGEN	Standard Pharmaceuticals, Calcutta	Andrographis paniculata	Wp	Kalmegh	Acanthaceae
		Apium graveolens	Ft	Ajmod	Umbelliferae
		Asteracantha longifolia	Lf	Talmakhana	Acanthaceae
		Cassia angustifolia	Lf	Hindi sena	Leguminosae
		Trachyspermum ammi	Ft	Ajowain	Umbelliferae
		Trionella foenum-graecum	Wp	Methi	Leguminosae
LIERIN	Herbs ERa Pharm. Udayrajpur, West Bengal.	Andrographis paniculata	Wp	Kalmegh	Acanthaceae
		Cassia angustifolia	Lf	Hindi sena	Leguminosae
		Melia azadirachta	Lf	Neem	Meliaceae
		Oldenlandia corymbosa	Lf	Khetpapra	Rubiaceae
		Picrorhiza kurroa	Rt	Kuru	Scrophulariaceae
		Rubia cordifolia	Wp	Manjit	Rubiaceae
LIVERTONE	Gambers Laboratories, Bombay	Emblica officinalis	Ft	Amla	Euphorbiaceae
		Picrorrhiza kurroa	Rt	Kuru	Scrophulariaceae
		Rheum palmatum	St	Rewand chini	Polygonaceae
		Terminalia belerica	Ft	Bahera	Combretaceae
		Terminalia chebula	Ft	Harar	Combretaceae
LIVEX	Bhartiya Aushadh Nirmanshala, Rajkot, Gujarat	Achillea millefolium	Wp	Gandana	Compositae
		Aconitum heterophyllum	Rt	Atis	Ranunculaceae
		Cassia occidentalis	Lf	Kasondi	Leguminosae
		Embelia ribes	Sd	Vidang	Myrsinaceae
		Piper longum	Ft	Piplamul	Piperaceae
		Solanum nigram	Ft	Mako	Solanaceae
		Swertia chirata	Wp	Chirata	Gentianaceae
		Tamarix gallica	Bk	Jhau	Tamaricaceae

Name of the preparation	Manufacturer	Plants used in the preparation	Part of the plant	Vern. name	Family
LIVIN	Arya Aushadhi Pharmaceutical Works, Indore	Acorus calamus	Rh	Bach	Arojdeae
		Andrographis paniculata	Wp	Kalmegh	Acanthaceae
		Aphnamixis polystachya	Bk	Raktarohitak	Meliaceae
		Baliopermum montanum	Rt	Dantimul	Euphorbiaceae
		Boehaavia diffusa	Wp	Punarnava	Nyctaginaceae
		Cassia sophera	Rt,Bk,Lf	Bask-ki Kasundo	Leguminosae
		Citrullus cotocynthis	Sd	Indrayan	Cucurbitaceae
		Eclipta alba	Wp	Bhringraja	Compositae
		Embelia ribes	Sd	Vidang	Myrsinaceae
		Ficus religiosa	Lf	Pipal	Moraceae
		Ipomoea turpethum	Rt	Nishoth	Convolvulaceae
		Jatrorhiza turpethum	Rt	Kalambha	Menispermaceae
		Lawsonia inermis	Lf	Mehndi	Lythraceae
		Ocimum sabctum	Lf	Tulsi	Labiatae
		Piper chaba	Ft	Chavika	Piperaceae
		Plumbago zeylanica	Rt	Chitrak	Plumbaginaceae
		Salvandora persica	Bk	Chhotoa-pilu	Salvadoraceae
		Tephrosia purpurea	Wp	Sarponkha	Leguminosae
		Terminalia chebula	Ft	Harar	Combretaceae
		Tinospora cordifolio	St	Giloe	Menispermaceae
		Trachyspermum ammi	Ft	Ajowain	Umbelliferae
		Zingiber officinalis	Rh	Adrak	Zingirberaceae
LIVODIN	Madona Pharmaceutical Research, Calcutta	Aloe indica	Lf	Ghikanvar	Liliaceae
		Andrographis paniculata	Wp	Kalmegh	Acanthaceae
		Aphnamixis polystachya	Bk	Raktarohitak	Meliaceae
		Boerhaavia diffusa	Wp	Punarnava	Nyctaginaceae
		Carum copticum	Ft	Ajowain	Umbelliferae
		Cassia angustifolia	Lf	Hindi sena	Leguminosae

Name of the preparation	Manufacturer	Plants used in the preparation	Part of the plant	Vern. name	Family
LIVODIN		Eclipta alba	Wp	Bhringraja	Compositae
		Embelia ribes	Sd	Vidang	Myrsinaceae
Cont..d		Holarrhena antidysenterica	Bk	Karchi	Apocynaceae
		Hygrophila spinosa	Lf	Gokshura	Acanthaceae
		Oldenlandia corymbosa	Lf	Khetpapra	Rubiaceae
		Piper nigrum	Ft	golmirch	Piperaceae
		Solanum xanthocarpum	Rt	Kandiali	Solanaceae
		Tinospora cordifolia	St	Giloe	Menispermaceae
LIVOKIN	Herbo Med, Calcutta	Andrographis paniculata	Wp	Kalmegh	Acanthaceae
		Apium graveolens	Ft	Ajmod	Umbelliferae
		Berberis3/4	Rt	Daruharidra	Berberidaceae
		Cerum copticum	Ft	Ajowain	Umbelliferae
		Cichorium intybus	Wp	Kashni	Compositae
		Cyperus rotundus	Tu	Motha	Cyperaceae
		Eclipta erecta	Wp	Bhringraja	Compositae
		Hygrophila spinosa	Lf	Gokshura	Acanthaceae
		Ipomoea turpethum	Rt	Nishoth	Convolvulaceae
		Oldenlandia corymbosa	Lf	Khetpapra	Rubiaceae
		Picrorhiza kurroa	Rt	Kuru	Scrfophulariaceae
		Plumbago zeylanica	Rt	Chirak	Plumbaginaceae
		Solanum nigrum	Ft	Mako	Solaceae
		Tephrosia purpurea	Wp	Sarponkha	Leguminosae
		Terminalia arjuna	Bk	Arjuna	Combretaceae
		Terminalia chebula	Ft	Harar	Combretaceae
		Trigonrlla foenum-graecum	Wp	Methi	Leguminosae
LIVOL	Vedic Pharma. Calcutta	Adhatoda Vasica	Lf	Vasaka	Acanthaceae
		Andrographis paniculata	Wp	Kalmegh	Acanthaceae
		Asteracantha longifolia	Lf	Talmakhana	Acanthaceae

Name of the preparation	Manufacturer	Plants used in the preparation	Part of the plant	Vern. name	Family
LIVOL		Berberis aristata	St.Bk	Daruharidra	Berberidaceae
(Cont..d)		Eclipta alba	Wp	Bhringraja	Compositae
		Phyllanthus emblica	Ft	Amla	Euphorbiaceae
		Picrorrhiza kurroa	Rt	Kuru	Scrophulariaceae
		Terminalia belerica	Ft	Bahera	Combretaceae
		Terminalia chebula	Ft	Harar	Combretaceae
		Tinospora cordifolia	St	Giloe	Menispermaceae
LIVOMYN	Charak Pharma-ceuticals (India) Pvt., Ltd., Umbargaon Gujarat	Andrographis paniulata	Wp	Kalmegh	Acanthaceae
		Aphnamixis polystachya	Bk	Raktarohitak	Meliaceae
		Boerhaavia diffusa	Wp	Punarnava	Nyctaginaceae
		Caesalpinia bonduc	Rt,Bk,Lf	Kakachia	Leguminosae
		Capparis spinosa	Rt,Kb	Kabra	Capparidaceae
		Cassia occudentalis	Lf	Kasondi	Leguminosae
		Coriandrum sativum	Ft	Dhania	Umbrelliferae
		Eclipta alba	Wp	Bhringraja	Compositae
		Embelia ribes	Sd	Vidang	Myrsinaceae
		Fumaria officinalis	Wp	Pitpappra	Fumariaceae
		Hordeum vulgare	Sd	Jav	Graminae
		Ipomoea turpethum	Rt	Nishoth	Convolvulaceae
		Ocimum sanctum	Lf	Tulsi	Labiatae
		Piper longum	Ft	Pipli	Piperaceae
		Plumbago zeylanica	Rt	Chitrak	Plumbaginaceae
		Rosa chinensis	Fl	Gulab	Rosaceae
		Solanum nigrum	Ft	Mako	Solanaceae
		Swertia decussata	Wp	Kadu	Gentianaceae
		Tephrosia purpurrea	Rt	Sarponkha	Leguminosae
		Tinospora cordifolia	St	Giloe	Menispermaceae
		Zingiber officinalis	Rh	Adrak	Zingiberaceae

Name of the preparation	Manufacturer	Plants used in the preparation	Part of the plant	Vern. name	Family
LIVOPED	Anakem Labor. Pvt. Ltd, Calcutta	Andrographis paniculata	Wp	Kalmegh	Acanthaceae
		Apium gravelens	Ft	Ajmod	Umbelliferae
		Asteracantha longifolia	Lf	Talmakhana	Acanthaceae
		Oldenlandia corymbosa	Lf	Khetpapra	Rubiaceae
		Trachyspermum ammi	Ft	Ajowain	Umbelliferae
		Trigondella foenum-gracecum	Wp	Methi	Leguminosae
LIVOSIN	Jupiter Pharma-ceuticals Pvt. Ltd., Calcutta	Andrographis paniculata	Wp	Kalmegh	Acanthaceae
		Avena sativa	Sd	Jav	Graminae
		Carica papaya	Ft,Sd	Papita	Caricaceae
		Cassia angustifolia	Lf	Hindi sena	Leguminosae
		Eclipta alba	Wp	Bhringraja	Compositae
		Embedia ribes	Sd	Vidang	Myrsinaceae
		Ferula foetida	Gum resin from Rt	Hing	Umbelliferae
		Hemidesmus indicus	Rt	Anantamul	Asclepiadaceae
		Holarrhena antidysenterica	Bk	Karchi	Apocynaceae
		Mentha viidis	Lf	Pudina	Labiatae
		Phylanthus emblica	Ft	Amla	Euphorbiaceae
		Podophyllum	Rh	Papra	Berberidaceae
		Terminalia arjuna	Bk	Arjuna	Combretaceae
		Terminalia belerica	Ft	Bahera	Combretaceae
		Terminalia chebula	Ft	Harar	Combretaceae
		Withania somnifera	Rt	Asgandh	Apocynaceae
		Zinger officinalis	Rh	Adrak	Zingiberaceae
LIVOSPIN	Herbals (APS) Pvt. Ltd. Patna	Andrographis paniculata	Wp	Kalmegh	Acanthaceae
		Aphnamixis polystachya	Bk	Raktarohitak	Meliaceae
		Embelia ribes	Sd	Vidnag	Myrsinaceae
		Ipomoea turpethum	Rt	Nishoth	Convolvulanceae
		Moringa oleifera	Ft	Soanjna	Moringaceae

Name of the preparation	Manufacturer	Plants used in the preparation	Part of the plant	Vern. name	Family
LIVOSPIN		Oldenlandia corymbosa	Lf	Khetpapra	Rubiaceae
		Plumbago zeylanica	Rt	Chitrak	Plumbaginaceae
(Cont...d)		Salvia plibeia	Sd	Kamarkas	Labiatae
		Swerlia angulifolia	Wp	Pahari chirata	Gentianaceae
		Tephrosia purpurea	Rt	Sarponkha	Leguminosae
LIVOTONE	East India Pharmaceutical Works Ltd., Calcutta	Andrographis paniculata	Wp	Kalmegh	Acanthaceae
		Apium graveolens	Ft	Ajmod	Umbelliferae
		Asteracantha longifolia	Lf	Talmakhana	Acanthaceae
		Holarrhena antidysenterica	Bk	Karchi	Apocynaceae
		Rhamnus purshiana	Bk	Raktarohida	Rhamnaceae
		Trigonella foenum-graecum	Wp	Methi	Leguminosae
LIVOTRIT	Zandu Pharmaceutical Works Ltd., Bombay	Andrographis paniculata	Wp	Kalmegh	Acanthaceae
		Berberis aristata3/4	Rt,Bk	Daruharidra	Berberidaceae
		Eclipta alba	Wp	Bhringraja	Compositae
		Embelia ribes	Sd	Vidang	Myrsinaceae
		Holarrhena antidysenterica	Bk	Karchi	Apocynaceae
		Ipomoea turpethum	Rt	Nishoth	Convovulaceae
		Picrorhiza kurroa	Rt	Kuru	Scrophulariaceae
		Plumbago zeylanica	Rt	Chitrak	Plumbaginaceae
		Rhamnus purshiana	Bk	Raktarhida	Rhamnaceae
		Tinospora cordifolia	St	Giloe	Menispermaceae
NEOLIV-100	Bharat Pharmaceuticals, Delhi.	Achillea millefolium	Wp	Gandana	Compositae
		Boerhaavia diffusa	Wp	Punarnava	Nyctaginaceae
		Cassia occidentalis	Lf	Kasondi	Leguminosae
		Cichorium intybus	Wp	Kashni	Compositae

Name of the preparation	Manufacturer	Plants used in the preparation	Part of the plant	Vern. name	Family
		Phyllanthus emblica	Ft	Amla	Euphorbiaceae
NEOLIV-100		Solanum nigrum	Ft	Mako	Solanaceae
		Tamarix gallica	Bk	Jhau	Tamaricaceae
(Cont..d)		Tecoma undulata	Bk	Rohira	Bignoniaceae
		Tephrosia purpurea	Wp	Sarponkha	Leguminosae
		Terminalia arjuna	Bk	Arjuna	Combretaceae
STIMULIV	Franco-Indian Pharmaceuticals Pv. Ltd., Bombay	Andrographis paniculata	Wp	Kahnegh	Acanthaceae
		Eclipta alba	Wp	Bhringraja	Compositae
		Fumaria officinalis	Wp	Pitpapra	Fumariaceae
SYLIV	Systemic Pharmaceuticals Allahabad	Achillea millefolium	Wp	Gandana	Compositae
		Capparis-spinosa	Rt,Bk	Kabra	Capparidaceae
		Carum copticum	Ft	Ajowain	Umbelliferae
		Cassia occidentalis	Lf	Kasondi	Leguminosae
		Cichorium intybus	Wp	Kashni	Compositae
		Hygrophila spinosa	Lf	Gokshura	Acanthaceae
		Oldenlandia corymbosa	Lf	Khetpapra	Rubiaceae
		Solanum nigrum	Ft	Mako	Solanaceae
		Tamarix gallica	Bk	Jhau	Tamaricaceae
		Terminalia arjuna	Bk	Arjuna	Combretacea
TEFROLI	TTK Pharma Pvt. Ltd. Madras	Andrographis paniculata	Wp	Kalmegh	Acanthaceae
		Eclipta alba	Wp	Bhringraja	Compositae
		Ocimum sanctum	Lf	Tulsi	Labiatae
		Tephrosia purpurea	Wp	Sarponkha	Leguminosae
		Terminalia chebula	Ft	Harar	Combretaceae

Name of the preparations	Manufacturer	Plants used in the preparation	Part of the plant	Vern. name	Family
TRISOLIV	Medley Pharm. Pvt. Ltd. Bombay	Andrographis paniculata	Wp	Kalnegh	Acanthaceae
VIMLIV	Solumiks, Bombay	Boerhaavia diffusa	Wp	Punarnava	Nyctaginaceae
		Cochorium intybus	Wp	Kashni	Compositae
		Eclipta alba	Wp	Bhringraja	Compositae
		Phyllanthus emblica	Ft	Amal	Euphorbiaceae
		Picrorrhiza kurroa	Rt	Kuru	Scrophulariaceae

Abbreviations to Appendix : Bk = Bark; Fl = Flower, Ft = Fruit; Lf = Leaf; Rh = Rhizome; Rt = Root; Rt Bk = Root bark; Sd = Seed; St = Stem; Tu = Tuber; Wp = Whole plant; St Bk = Stem bark.