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TRAINING WORKSHOP ON

QUALITY CONTROL

OF MEDICINAL & AROMATIC PLANTS AND THEIR PRODUCTS

15-20 JUNE 1998

Regional Research Laboratory,
Council of Scientific & Industrial Research, Canal Road, Jammu,
India

S.S.Handa

Director

The training workshop on "Quality Control of medicinal and aromatic plants and their products" was conducted in accordance with the terms and conditions of the contract No.98/168(Project No.TF/GLO/96/105). A bound volume (237 pages) of the Manual (copy enclosed Annexure I) containing the entire course material prepared by the resource persons (Faculty) was provided to all the participants a day before the start of the workshop. The workshop bags given to the participants contained in addition to the manual other material such as information leaflet on field visit to Patnitop for medicinal aromatic plant collection, details of the daily programme including lectures, demonstrations and practicals, newsletter and annual report of the Institute.

On 15th June after the invocation at 09.10 a.m. Professor S. S. Handa, Director of the Institute gave formal welcome address followed by introduction to the training workshop by Prof. T. de Silva. The Training Workshop was inaugurated (card Annex II) by Prof. N. K. Ganguly, Director general, Indian Council of Medical Research. The key-note address (Annex III) was delivered by Prof. B..Dhawan, National Resource Person. This was followed by the country presentations (copies of the country status papers enclosed, Annex IV). The post lunch session started with an hour's lecture on standardization and quality control of medicinal and aromatic plants and their products by Professor S. S. Handa (copy of the lecture Annex I p 1-14). This was followed by demonstration on authentication of MAPs and practical on plant drug identification (Manual p. 15-48 Annex I).

On 16th June visit to Chatha Farm i.e. Medicinal Plant garden and Medicinal and Aromatic Plant Farm station of the Institute (10 Km. from the Institute) was organised in the morning from 08.00 to 11.00 hrs followed by two lectures on Good Cultivation Practices and Post harvest Management (Annex I p.49-69) and on Organoleptic macroscopic, microscopic examination for authentication of Medicinal Aromatic Plants (Annex I p.70-77) followed by practical on crude drug identification, microscopic examination, staining of slides and microbial count in herbal drugs (Annex I p. 78-93).

In the morning session on 17th June, lectures on Processing technology and extraction procedures (Annex I p.101-110). Isolation of markers from medicinal plants (Annex I p.112-127) were delivered and thereafter demonstration on physicochemical parameters was given. This followed a visit to pilot plant for 'on the spot' demonstration on various extraction processes.

During the post lunch session lecture on Chromatographic finger print profile of medicinal plants and their products (Annex I p.128-138) was delivered and this followed by demonstration and practical Training on HPLC, HPTLC and densitometric techniques.

In the prelunch session of June 18, lectures on 'Qualitative/quantitative GLC techniques for MAPs (Annex I p.139-150) and 'Stability testing of plant drugs' (Annex I, p 151-161) as well as demonstration and practical training on GLC/GCMS and stability study of plant preparations (Annex I p. 162-170) were

organised.

During the post lunch session lectures on 'Bioevaluation by invitro techniques (Annex I, p.171-198) in mammalian cell cultures and 'Bioevaluation by in vivo techniques (Annex I p.218-227) were delivered and practical demonstrations were arranged on in vitro Antihepatotoxic and anticancer screening techniques as well as on various pharmacological models of bioactivity testing.

A field trip to Patnitop for medicinal aromatic plant collection in nature and on the spot taxonomical identification (Annex V) were undertaken on 19th June.

On the last day (June 20) of the training workshop, lecture on 'Safety evaluation (Annex I p.228-237) was followed by practical/demonstration on various pharmacological techniques on Bioevaluation of plant drugs in the prelunch session. During the post lunch session visit to the division of Natural Product Chemistry, Essential Oils, Biotechnology, Food Technology, Biopharmaceutics and Instrumentation of the Institute was arranged.

An open session on discussion relating to the technical assistance needs and cooperation among the countries resulted in certain recommendations which were placed in the concluding session of the programme. These recommendations are enclosed as Annex VI.

All the lectures were delivered by the Institutional faculty

and the resource persons (List attached Annx VII) in the Conference hall and the practical demonstrations were conducted in various laboratories (Annex VIII) of the Institute by the faculty and scientific/technical staff. The participants (list attached, Annx XI) interacted freely amongst themselves as well as with the faculty and the resource persons. The press media exhibited good coverage of the training workshop (Newspaper clippings, Annex X). The participation certificate to each participant was given (Annexure XI).

ANNEXURES

Annexure No.	
I	Manual
II	Inaugural card
III	Key note address
IV	Country status papers
V	Field trip to Patnitop brochure
VI	Recommendations
VII	List of faculty
VIII	Arrangement schedule of practicals and demonstration
IX	List of participants
X	Press clippings about the training workshop
XI	Participation certificate
XII	Lecture of International Resource Person

Director, Regional Research Laboratory (CSIR), Jammu
invites you on the inauguration of

ICS-UNIDO Training Workshop

on

Quality Control of Medicinal and Aromatic Plants and Their Products

by

Professor N. K. Ganguly

M. D., F. A. M. S., F. N. A., F. N. A. Sc., F. A. Sc., F. R. C. Path

Director General
Indian Council of Medical Research,
New Delhi

on 15th June, 1998 (Monday) at 9.00 A. M in the
RRL Conference Hall

Programme

9.00 a. m.	Invocation	
	Welcome Address	Prof. S. S. Handa Director, RRL
	Introduction to the Workshop	Dr. T. de Silva ICS/UNIDO International Resource Person
	Inaugural Address	Prof. N. K. Ganguly DG, ICMR
	Keynote Address	Prof. B. N. Dhawan Former Director, CDRI
	Vote of thanks	Dr. G. N. Qazi
10.30 a. m.	Tea	

KEY-NOTE ADDRESS

B.N. DHAWAN
EX-DIRECTOR, CENTRAL DRUG RESEARCH INSTITUTE, LUCKNOW, INDIA

I am happy to be associated with this important workshop. It is appropriate that it is being held in Laboratory which has been so intimately involved in multidisciplinary research on medicinal and aromatic plants, including Quality Control, for almost half a century. My familiarity with aromatic plants is limited to being an end user hence my remarks will be centred around the medicinal plants even though some of them may be equally applicable to aromatic plants.

Our planet is said to be inhabited by over 3 million species of plants and animals out of which only 1.75 million have been described and 90% have not been studied in any detail. About 21,000 plants have been ascribed medicinal properties in various countries , a large percentage coming from the countries represented in this workshop. Only about 10,000 of these have been so far investigated. In depth studies have been done on much fewer plants. The problem of standardizing such a large number of plants and their resulting products is not only enormous but also difficult. I will, therefore , limit myself to what WHO has defined as herbal medicine. It is a plant derived material or preparation with therapeutic or other human health benefits and it contains either raw or processed ingredients from one or more plants. In some traditional medicinal preparations materials of inorganic or animal origin may also be present. WHO has assigned the highest priority to botanical authentication, characterisation of active principles and standardisation of dosage form. In India , a similar strategy was proposed by the pioneer investigator of medicinal plants in India and also the founder of RRL, Jammu, Sir Ram Nath Chopra , in mid thirties. The concept is however, evident and stressed even in the earliest treatises of Ayurveda by Charak and others.

Historically, the earliest method of standardising plant products was the use of observational procedures. Simple laboratory procedures like amount of extractives etc. got added as science progressed . During the last century and the earlier part of the

present century many galenical preparations were standardised by bioassay. The bioassays gradually got reduced as galenicals were phased out and more sensitive chromatographic and other analytical techniques were developed. These are gradually getting incorporated in Pharmacoepias and Formularies. In India, ever the earliest Pharmacoepia (Pharmacoepia of India, 1868) contains details of crystalline principles in plant drugs. Such details are missing from British Pharmacoepias till the end of last century. The current Indian Pharmacoepia (I. P. 1996) and the Indian Herbal Pharmacoepia (1998) compiled by a team led by Prof. S.S. Handa provide more details of botanical characters, physicochemical and other identification tests and the active constituents than contemporary Pharmacoepias and herbal pharmacoepial monographs of many developed countries.

The standardisation of herbal drugs poses several special problems. The plant materials are complex and of variable composition . The analytical limits are, therefor, less precise. The processes of production of herbal drug formulations also are not well standardised even though the processes is crucial to constancy . Finally, many standardisation procedures are based on the content of a single active moiety. It is known that other constituents can significantly modify the actions of active constituents due to altered bioavailability and other interactions. I feel it is desirable to utilise chromatographic procedure to establish the limits of several group of chemical constituents while standardising herbal preparations.

I have referred above to variable composition of plant materials. The variability can be reduced if cultivated plants are used. There are several other equally compelling reasons for developing agricultural practices for medicinal plants being collected from the wild. Many plants have chemotypes. Regulatory and social pressures and high costs of collection and transportation limit utilisation of wild rersources. There are additional uncontrollable factors limiting availability of wild plants like rapid urbanisation, drought, forest fires etc. There is danger of exterminating an overexploited species and even the germ plasm may be destroyed. Cultivation is the only practical answer and does not really require large financial inputs, land requirement or time span . For example about 200

tonnes of plant material may be required to provide adequate quantity of active constituents for treatment of 10,000 cases (a modest number for economically viable marketed drugs) if treatment is needed for 4 weeks and content of the active constituent is 0.01%. It is feasible to increase the yield to about 3 fold while domesticating the plant. The required biomass can be harvested from 100 acres of agricultural land and developmental period should not be more than 3-5 years. In this context, I will also like to stress the use of standardised extracts instead of single pure compounds. We have shown in several cases the standard extract to exhibit greater activity than can be accounted for by the content of the active compound. The extract devoid of active constituent is inactive in each case. Similar observations are now being reported by other investigators also. This also makes manufacturing process simpler and less expensive and significantly reduces the requirement of the crude drug. In many cases the active constituent has not been identified. In such cases any distinctive marker compound (called characterizing compound by WHO) could be used as an interim measure to standardise the extract till an active constituent is isolated.

Before closing I will like to comment on the parameter generally utilised to assess the value of herbal medicines. The estimates based on value of raw drugs or even finished products are in my opinion, too narrow and unrealistic. A correct evaluation must include an assessment of the societal values accruing from the use of herbal drugs. Drugs reduce mortality. How do we apply value to life? In some developed countries parameters like employers willingness to pay(WTP) or employers willingness to accept(WTA) are used for this purpose. A recent US estimate was 8 million $ and U.K. estimate is about 2 million £. Drugs also reduce mortality thereby reducing loss of working time and minimise reduction in working capacity. Finally herbal drugs are supposed to improve quality of life in many cases. How can that be valued? Using reduction of mortality only as a criteria, an analysis has been made of the cost of lives of cancer patients saved in U.S.A. by chemotherapy a few year ago. Forty percent of the drugs used were plant derived and a 15% reduction in mortality is estimated to be produced by chemotherapy. Plant based drugs would be saving approximately 30,000 lives anually in cancer patients.

The WTA value of the economic gain will be about 240 billion $ annually against value of plant based prescription sales in U.S. being about 1.5 billion $ only. Such estimates are necessary about other diseases and in developing countries. This will help in mobilising greater funds for research on medicinal plants.

We have been largely considering herbal drugs for treatment of diseases. In old Ayurvedic system herbal drugs are also used for maintenance of health and prevention of recurrence of desease. The concept is also inherent in increasing use of health foods and nutraceuticals. Future work on medicinal plants must pay greater attention to their prophylactic ability. I may conclude with a comment by Mahatma Gandhi "I am hard headed enough to let them die if you can tell me how to prevent others from falling sick".

PHILIPPINE STATUS REPORT

by
Merle A. Villanueva

I. PLANT-BASED INDUSTRIES IN THE PHILIPPINES

A. Herbal Medicine Industry

- WHO Study: Majority of the world's population rely on medicinal plants for primary health care. WHO repeatedly called on member countries to develop and utilize Traditional Medicines especially medicinal plants
- 1,500 medicinal plants species actively being utilized by traditional healers
- Government Support
  - Traditional Medicine Unit and 4 herbal processing plants established by the Department of Health
  - Local and International Promotion by the Department of Trade and Industry (SEA Regional Conference and Exhibition on Natural and Herbal Products)
- RA 8423: Traditional and Alternative Medicine Act of 1997
- 78% Population
- 31% Doctors
- 2 Local Private Pharmaceutical Firms
  - Altermed
  - Gruppo Medica
- 2 Local plants licensed as medicine by the Bureau of Food and Drugs
  - Vitex negundo
  - Blumea balsamifera

B. Personal Care Product Industry

- Botanical Extracts
- Essential Oils

C. Distribution Channels

- Pharmacies and Drugstores
- Herb dealers
- Health food stores
- Grocery stores, supermarkets
- Multi-level or network marketing organizations

D. Issue/Concern: Non-existence of Philippine Herbal Pharmacopeia

II. RESEARCH PROGRAM ON MEDICINAL AND AROMATIC PLANTS IN THE PHILIPPINES

- National Integrated Research Program on Medicinal Plants financed by the Philippine Council on Health R&D, Department of Science and Technology
  - Vitex negundo - asthma, cough, fever
  - Mentha cordifolia - muscle pain
  - Blumea balsamifera - anti-urolithiasis, diuretic
  - Carmona retusa - stomach ache
  - Psiduim guajava - disinfectant
  - Cassia alata - trinea flava treatment
  - Peperomia pellucida - gout, rheumatism
  - Allium Sativum - cholesterol
  - Momordica charantia - diabetes (mild non-insulin dependent)

III. RESEARCH PROGRAM ON MAP AT THE INDUSTRIAL TECHNOLOGY DEVELOPMENT INSTITUTE

- Pharmaceutical applications of Manila elemi oil, monolaurium and medium chain triglycerides
- Development of soft and hard gel capsules using carrageenan
- Insect-repellant property of essential oils/botanical extracts

Herbal Drugs in Thailand

Juthamas Thiangtham
Research and Development Institute
Government Pharmaceutical Organization
Thailand.

Introduction

After modern medicine had taken root in Thailand,the use of herbal medicine began to dwindle, but a portion of the Thai population still adhered to the old ways of life, in which herbal medicine played a vital role. This is especially true in rural areas where traditional healers and herbalists are still held in reverence by the communities. This being the case, Somdej Phra Wanarat (Poon Poonasiri) the abbot of Wat Phra Chetuphon Wimonmang khalaram (Wat Po) at the time, ordered the establishment of a school of Thai traditional medicine within the temple in 1957. A number of temples in rural areas also established their own medicinal plant gardens which served as a source of herbs for the treatment of patients as well as an education venue.

Policy

The National Economic and Social Development Plan include three main aims :

1. Research and development of natural products
2. Development of herbal medicines from natural sources
3. Promotion of the use of traditional medicines in rural areas.

Medicinal use of herbal drugs

Three major medicinal uses of herbal drugs are as following.

1. Usage in primary health care
2. Usage in traditional medicines
3. Usage in modern medicines

1. *Usage in primary health care*

The first group of 44 plants for the treatment of common ailments were selected from herbs with the long experiences of practices and existing information on pharmacology, chemistry and toxicology. At present there are 61 types of herb that have already been promoted to use in primary health care.

2. *Usage in traditional medicines*

In Thailand herbal drugs are mainly utilized as traditional medicines. Traditional medicines are widely used in traditional medicine clinics, modern and traditional drug stores, as well as registered traditional healers. In 1995 there were 635 clinics, 12,268 drug stores and 30,287 traditional practitioners which still gave traditional remedies in service to the public.

At present ASEAN countries including Thailand had already developed GMP guidelines for the manufacture of traditional medicinal products.

Up to now there are 4,139 traditional medicines registered with drug control division, the Food and Drug Administration.

Six herbal drugs which are most commonly used in registered traditional drug preparations (3,079 preparations in 1992) are clove,

glycyrrhiza, long pepper, ginger, borneo camphor and camphor, respectively.

3. *Usage in modern medicines*

They can be described in 2 groups, as follows :

3.1 Medicinal plants which have been accepted as raw materials for modern medicines, with all the basic characteristics specified as those raw materials used in modern medicines. The Thai Pharmacopoeia has monographs of 14 botanicals which can be produced in Thailand.

3.2 Medicinal plants which have been researched for medicinal use in scientific manners, ready to be further developed for use as modern medicines.

The Government Pharmaceutical Organization (GPO) is a state enterprise under the Ministry of Public Health

The GPO's main functions are:

1. Production of drugs and medicinal products.

2. Surveying the indigenous raw materials and investigating the possibilities of developing bulk production utilizing local resources for the country's self-reliance.

3. Reserving stock to prevent shortage in case of emergencies and disasters.

4. Running a business of drugs and medicinal products.

5. Studying and research on manufacturing of drugs and medicinal products.

The work plans relating to research and development of medicinal plants are :

1. To find out precisely the indigenous raw materials available in the country and to investigate the possibility of developing bulk drug production utilizing local resources for the country's self-reliance

2. Selection of formulation from medicinal plants

3. Extraction of naturally occurring materials without isolation of the active material

4. Extraction and purification of naturally occurring substances of plant origins

5. Production and control of the above formulation including crude drugs; pharmacological, toxicological and clinical evaluation of the formulation.

Manufacture and quality assurance

The processing of our raw materials, semi-finished and finished products conforms fully with the methods and criteria laid down by GMP guidelines.

GPO manufactures drugs from plant origins to substitute modern medicines in order to fulfil the policy of Ministry of Public Health.

Medicinal plant products which have been completely researched in the field of botany, pharmacognosy, phytochemistry, pharmacology, toxicology, clinical study and manufactured by GPO are :

1. Senna Tea (*Cassia angustifolia*)
2. Senna Tablet (*Cassia angustifolia*)
3. Ma-Waeng Tablet (*Solanum trilobatum*)
4. Chofibrin Capsule (*Allium sativum*)
5. Plygesal (*Zingiber purpureum*)
6. Curmin Capsule (*Curcuma longa*)
7. Aloe Gel (*Aloe vera*)
8. Phaya Yo Cream (*Clinacanthus nutan*)
9. Fa-Thalai-Chon Capsule (*Andrographis paniculata*)
10. Citronella (*Cymbopogon nardus*)
11. Lingzhi Tablet (*Ganoderma lucidum*)

Limits for microbial contamination

Microbial limits are specified for 6 types of non-sterile pharmaceutical preparations. They are :

1. Preparations for burns and severe ulcerations

2. Topical preparations for broken skins, abscess, lesions, and mucous membranes (nose, throat, ear, vagina etc)

3. Topical preparations for intact skin eg. creams, lotions, ointments, solutions, powders etc

4. Preparations for oral, rectal and transdermal use

5. Preparations of crude drugs and mixtures of crude drugs for internal use, which will undergo a process for reduction of count before use (eg by pouring over with boiling water) and externally used preparations containing whole or ground crude drugs

6. Other internally used preparations which contain whole or ground crude drugs

Stability test

The stability of the medicinal product should be determined by appropriate fingerprint chromatograms.

It must be shown that interactions between the active ingredients and the excipients in the finished product are unlikely to occur.

Research & Development of Herbal Medicines

One of the national drug policy on herbal and traditional medicines is to support research and development activities for safe and effective treatment. These activities may involve:

1. Basic science research on phanmacognosy, Pharmaceutical chemistry, biochemistry, pharmacology, and toxicology of botanicals.

2. Clinical research.

3. Investigation and standardization of nomenclatures and quality of herbs medicinal plants.

4. Extraction and separation of known active substances

5. Quality development of drug formulations and dosage forms of herbal medicines

Problems and difficulties in research for the development of medicinal plant-derived drugs.

1. Lack of scientific data, e.g.,data concerning of medicinal plants, pharmacological and toxiclolgical actions are incomplets or fragmentary.

2. The profile of development is not clear and the primcipal direction of research and development of medicinal plants is also missing.

3. The quality of raw materials, namely medicinal plants,is not consistent and there is no quality standardization.

4. Lack of organized managemant. Theoretically, the research of medicinal plant-derived drugs is composed of many research activities in various disciplines.

5. Lack of organized and research equipment for isolation and purification of active ingredicnts from medicinal plants including technology in organic synthesis, standard production, stability of active substances.

6. Limited nymber of experts available in certain fields. Research facilities are also limited such as facilities for organic aynthesis and toxiclolgical study.

7. Accessibility of clinical trial. There is litile problem in finding doctors to use unnmodified, medicinal plant derived drugs in clinical study.

8. Protocol for clinical trial is not well established. Therefore, it is difficult to interpret experimental results and there will be no clearcut evidence to separate the effect of medicinal plants from the placebo effect.

COUNTRY REPORT

TRAINING WORKSHOP ON QUALITY CONTROL OF MEDICINAL AND AROMATIC PLANTS AND THEIR PRODUCTS

Jammu, India
15-20 June 1998

Jamsranjav Ganbaatar

Department of Plant Chemistry
Institute of Chemistry and Chemical Technology
of the Mongolian Academy of Sciences
Ulaanbaatar-51
Mongolia

COUNTRY REPORT

Ladies and Gentlemen, our colleagues!

I am really happy that I have opportunity to present a brief information about Mongolia, Mongolian sciences and especially the investigations in the field of chemistry of natural products.

As you know Mongolia is a large landlocked country, measuring 1.5 thousand square km in area - about three times the size of France. The capital and largest city of our country is Ulaanbaatar. The Southern third of Mongolia is dominated by the Gobi Desert. Much of Mongolia covered by grassland. Less than 10% of the land is forested, mostly in the north. Mongolia is also one of the highest countries in the world, with the average elevation of 1 580 meters. Mongolia is a land of extremes. So one day you are walking in T-shirt and sandals, the next day you need an overcoat and boots, then the followin g day it is back to T-shirts. Because of it the flora is pretty interesting and not ordinary.

There are over 2 500 species in Mongolian flora among them 700 species of medicinal plants that are used as the constituents of more than 10 thousand prescriptions of Mongolian traditional medicine. Natural products chemistry is one of the main research subjects in Institute of Chemistry and Chemical technology of the Mongolian Academy of Sciences. The investigation of natural products was founded in 1972 in the Laboratory of plant chemistry of our Institute. Our department now has 14 researchers, 3 of them Doctor of Sciences and 4 - has Ph.Degree. Now we are enganging in chemical studies of Mongolian traditional medicinal plants.

One of the more interesting field of our investigation is the study of Mongolian endemic plants. About 250 species of endemic plants grown in Mongolia. More than 300 biologically active compounds such as alkoloids, coumarins, flavonoids, xanthones and lignans were isolated, purified and structurally elucidated from different species of medicinal plants grown in Mongolia by our laboratory. About 60 new compounds were found and structurally characterized by means of chemical and spectral analysis.

National Agency for inspection of medicine and biopreparations responsible for quality controls of raw materials (MAP), processes and the final based products.

I'd like to give you a brief information of the results of investigations some medicinal plants carried out in our laboratory. Some of them used as a raw materials for manufacture medicines. For example:

Astragalus mongolicus Bunge.
[Mongolian Milkvetch]

Family: Leguminosae

A perennial herbaceous plant reaching 25-60 cm in height.

Distribution: Khubsugul, Khangai, Mongol Daurian, Mongolian Altai, Middle Khalkha, Depression of Great Lakes, Valley of Lakes, Gobi-Altai

Habitat: This plant grows on sands and sandy steppes, pebbly terraces along the sandy bottoms of channels (riverbeds), on stony screes and rocks, in brush-woods of bushes, by larch wood borders.

Parts used: Root

Ingredient: The plant contains flavonoids (quercetin, isorhamnetin, citrin and their derivatives, formononetin, calycosin, glucisides of di-methoxyflavone and methoxyflavone)

Taste and properties: Sweet, slightly warmness

Action: Roborant, antisudorific, diuretic, hemostatic, healing of wounds, draws out pus or stagnated poor yellow liquor, reinforces tissue regeneration

Conditions most used for: Weakness, perspiration, chronic diarrhoea, hemorrhoids, dropsy, incontinence, injuries of internal compact organ (liver, heart, lung, kidney, spleen), chronic wounds, fevers caused by blood and vessel tract diseases, poor yellow liquorstasis

Ephedra equisetina Bunge
[Mongolian ephedra]

Family: Ephedraceae

An ever-green shrub reaching 30-60cm in height.

Distribution: Khangai, Mongolian Altai, Middle Khalkha, East Mongolia, East Gobi, Gobi-Altai, Dzungarian Gobi, Transaltai Gobi, Alashan Gobi

Habitat: Rocky and stony slopes of mountains and knolls, stony sides of dry riverbed

Parts used: Green

Ingredient: The green contain 0.97-2.5% of alkaloids (consisting mainly of L-ephedrine, not much pseudoephedrine) and also 8-14% of curtiment substances (leucoanthacyanidine, catechins)

Taste and properties: Bitter, astringent, coldness, bluntness, dryness, lightness, roughness

Action: Clears (Eliminates) liver fever, hemostatic, dispels concretion, reduces swelling, repairs wounds, diaphoretic.

Conditions most used for: Liver and spleen fevers (fevers caused by liver and spleen diseases), shaked (trembled) fever, disorders caused by fever, traumatic wound bleeding, hematemesis, dysentery, hemoptysis, amenorrhoea, concretion, intestinal wounds, chronic and acute fevers.

Paeonia anomala L.
[Ural Peony]

Family: Ranunculaceae

A perennial herbaceous plant reaching 40-80cm in height.
Distribution: Khubsugul, Khentei, Khangai, Mongol Daurian
Habitat: Larch and mixed forests, forest skirts, birch groves and river head peashrups
Parts used: Rhizome and root
Ingredient: The rhizome contains 1.5% of essential oil (composition: phenol, methylsalicylate, etc.), benzoic and salycilic acids, sugars, tannins, amyloid (carbohydrate), salicin (glycosides), starch, amino acids (principal compounds are alanine, aspereganic acid, arginine and others).

Glycyrrhzia uralensis Fisch.
[Uralian Licorice]

Family: Leguminosae

A perennial herbaceous plant reaching 40-70 (100)cm height.
Distribution: Khentei, Khangai, Mongol Daurian, Great Khingan, Middle Khalkha, East Mongolia, Depression of Great Lakes, Valley of Lakes, East Gobi, Gobi-Altai, Dzungarian Gobi, Transaltai Gobi, Alashan Gobi
Habitat: Moist salted meadows, saline sandy grounds, in valleys of small steppe rivers, in depression near lakes
Parts used: Root and rhizome
Ingredient: The root and rhizome contain 4.9-8.9% of triterpenic saponin called glycyrrhizine, some flavonoids (liquiritozide), sitosterin, carbohydrates (starch, saccharose, glucose, mannit), bitter substances
Taste and properties: Sweet, coolnes, thinness, delicate, lightness, soft
Action: Antitusive, expectorant, acts against bronchial obstruction, antiemetic, nutrient, roborant (tonic), quenches thirst, antidote.
Conditions most used for: Excretion of sputum caused by lung fever, enlargement of chest, dyspnea, pneumonia, pregnancy toxicosis, vomiting in cases of disorders of stomach-intestinal tract, acute and chronic tracheitis (bronchitis), cole-influenza, pulmonary abscess, dryness in mouth, thirst, hoarseness, throat fever, throat rash, weakness, abnormal colour of skin, hypomnesia, unilateral paresis, nervous disorders, contraction, etc.

Achillea asiatica Serg.
[Asian Yarrow, Asiatic Yarrow]

Family: Compositae

A perennial herbaceous plant reaching 25-50cm in height.
Distribution: Khubsugul, Khentei, Khangai, Mongol Daurian, Great Khingan, Khobdo, Mongolian Altai, Depression of Great Lakes
Habitat: Larch forests and their skirts forest and riverside meadows, brakes etc.
Parts used: Herb
Ingredient: The herb contains flavonoids, sugars, curtiment substances, saponins, alkaloids, vitamin C, vitamin K, carotenes, organic acids, sesquiterpenic acids, 0.2-0.5% of essential oil, sabinene 35.7%, cineol 16.3%, carenes 10.2%, limonene 6.1%, α-pinene, terpinene 4.01-6.2%, n-cymol 4%, hamazulene 12.5%, camphor, terpineol.
Taste and properties: Bitter, acrid, neutral
Action: Antidote, antioedemic, antihydropic, styptic, decompose internal tumours.
Conditions most used for: Internal boils, oedema of limbs, hemorrhoidal bleeding, painful menstruation, snake bites, internal tumour

Bergenia crassifolia (L.) Fritisch.
[Thick-leaved Bergenia, Leater Bergenia]

Family: Saxifragaceae

A perennial herbaceous plant, the peduncle of which reaching 6-20cm in hight.
Distribution: Khubsugul, Khangai, Khentei, Mongolian Altai
Habitat: In high mountain belt and in upper part of forest belt among rock places of stones and boulders, on screes, rocky slopes, in light coniferous forests.
Parts used: Leaves and rhizome
Ingredient: The leaves contain 20-25% of curtiment substances (astrigent), to 21% of arbutin, hydroquinone, pyrogallic acid, vitamin C, dye stuffs, curtiment substances are found in rhizome 15-27%, in seeds 18%. The rhizome also includes starch, sugars, bergenin (isocoumarins), etc.

Delphinium grandiflorum L.
[Bouquet Larkspur, Large flower larkspur]

Family: Ranunculaceae

A perennial herbaceous plant reaching 15-70cm in height.
Distribution: Khubsugul, Khentei, Khangai, Mongol Daurian, Great Khingan, East Mongolia, Gobi-Altai
Habitat: Meadows and herbs steppe, steppe slopes, steppe and dry meadows in river valleys, forest meadows and skirts, pine forest and birch forest
Parts used: Herb
Ingredient: The herb contains alkaloids (methylliaconitine, magnoflorine, eldeline, condelpirine, anthranoillicoctonine), flavonoids, coumarins, curtiment substances. The alkaloids are obtained with a yield that varies from 0.1-0.7%. The root contains alkaloids, coumarins.
Taste and properties: Bitter, coolness, poisonous, bluntness, roughness, lightness
Action: Antipyretic in cases of infectious fever, binding (stops diarrhoea), anodyne, vermifuge, repairs wounds, eliminates poor yellow liquorstasis.
Conditions most used for: Cholera, dyspepsia, dysentery, poor yellow liquorstasis, toothache, caused by windy-feyer, enterodynia, diarrhoea, causes by hematic-bilious disorders.

Aconitum barbatum Pers.
[Slenderleaf Monkshood]

Family: Ranunculaceae

A perennial herbaceous plant reaching 50-100cm in height.
Distribution: Khubsugul, Khentei, Khangai, Mongol Daurian, Khobdo, Mongolian Altai, Gobi-Altai
Habitat: In forest belt, birch forest, larch forest, and their skirts, forest meadows, steppe and meadows slopes, rocks, screes.
Parts used: Root
Ingredient: Alkaloids
Taste and properties: Acrid, sweet, warmness, very poisonous
Action: Bactericidal, anodyne, antihydropic
Conditions most used for: Influenza, cold, enterodynia, erysepals, furuncle, lymphadenitis, bacterial colic, sudden pains, neck contraction, diphtheria, anthrax, gout, rheumatism, pains in back and legs, poor yellow liquorstasis, paresis

Country Paper

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Research Institute of Medicinal Plants
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Vientiane . Lao PDR

Mr. Chairman .
Distinguished ladies and gentlemen.

I bring greetings from the Institute of Medicinal Plants to all participants in this training and special greetings to our friends in Jammu , India . I am very happy that the ICS-UNESCO . has awarded me a fellowship for training in Jammu , India .
First of all . I would like to introduce my Institute to our friends from different countries .
The complete name of the Institute is : Research Institute of Medicinal Plants . This Institute belong to the Ministry of Public Health and was established in 1976 . It is only Institute of this kind in the whole country conducting adaptive research on tradicinal medicine and medicinal plants . There are 30 people in this Institute and consists of 5 units : namely . Administrative Bureau . Pharmacognosy Laboratory , Phytochymistry Laboratory . Production Unit and Pilot plant .

The main tasks of the Institute are :
1. Studies on the utilization of medicinal plants and tradicinal medicine in the whole country.
2 . Preservation of important tradicinal prescriptions of traditional healers by publishing the booklets .
3 . Surveying of medicinal plants in different provinces and then classifying them into suitable families .
4 . Transfering the achievements of our work to Pharmaceutical factory for industrial scale production .
5 . Offering technical assistance to provincial tradicinal medicine's stations in the form of seminar and short term training
6 . Contributing to the formation of students from the Faculty of Pharmacy in the field of medicinal plants in theory and practice .

Work achieved:
- Extraction of berberine from coscinium usitatum Pierr .
- Extraction of rotundine from stephania rotunda Lour
- Extraction of active substance from artocarpus lakoocha Roxb
- The Institute has successfully brought forth four new drugs for industrial production : dry extract of leonurus heterophullus Sweet . , dry extract of adenesma capitatum Benth . curcuma sp . , curcuma longa L . and eleutherine subaphulla Gagnep .
- The Institute has cooperation with University of Illinois at Chicago (UIC) to collect some anti-inflammatory plants . In this case we have send the extracts to UIC for testing and send herbarium to the Field Museum at Chicago .
Over the past decade , the Institute has carried out a survey in some provinces . Despite the limited coverage and means utilized , this survey has revealed that the forest in different provinces are rich in precious medicinal plants .

Ongoing work:
At present , the research efforts are aimed at producing antimalarial drugs . Malaria is one of the serious diseases occuring in our country and causes a high persentage of mortality . Therefore , from 1994 we cancentrated our research work on new antimalarial drug from domestic medicinal plant . Furthermore , in cooperation with Vietname we have extracted artemisinine at pilot scale from artemisia annua L .

Future work:
Lao PDR , a land-locked country has an area of 23,680,000 ha , of wich 47 % is covered by forests . Our people , particulary those who live at grass root level used to have plants as food and medicine . The covernment of the Lao PDR encourage and support the use of traditional medicine and medicinal plants in the health system of our country . According to this policy our traditional healers in different regions participate actively in the prevention and treatment of diseases . The knowledge has been handed down from generation to generation up to the present . Therefore , in order to preserve the treasure for next generation , for the benifit of the people living in remote areas and for scientific researchers we will set up an inventory of importan medicinal plants in some provinces .
As a part of national drug policy and in order to reach the goal of health for all by the year 2000 a number of traditional medicine should be advantageously used in organized health care . To obtain this objective in a short period of time is not easy because it requires scientific studied to evaluate the clinical efficacy and safety of traditional medicines whithout comprehensive scientific data relating to traditional medicines people will lose confidence in this kind of medicine . Consequently it is difficult to promote the rational use of natural drugs in the whole country .

To participate in this training I expected to have the opportunity to learn how to develop appropriate methodology and technology for strengthening our research work in medicinal and aromatic plants for the benefit of people's health . I also hope to obtain suitable knowledge concerning the inclusion of quality control of medicinal and aromatic plants and their products.

COUNTRY STATUS ON THE PLANT BASED INDUSTRIES AND THEIR RESEARCH AND DEVELOPMENT IN BANGLADESH AND AT THE DEPTARTMENT OF PHARMACY,J U.

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Plants have been serving the animal kingdom as its source of energy (food, fuel) as well as it means of shelter and sustenance since the very beginning of its existence on earth. In addition, plants have also been used for therapeutic purposes since the dawn of human civilisation. Although modern medicines are extensively used to manage almost all of the diseases, plants and plants products also play a vital role in curing various diseases along with modern medicines in Bangladesh and all over the world.

Bangladesh posseses a vast wealth of medicinally important plant species. Many of these are in common use even today throughout the country though much of the folk-medicine is steadily being replaced by advancing tide of synthetic drugs. A large number of these plants are common weeds generally found on the roadsides, village thickets, waste places, homesteads and as an undergrowth of the forest distributed throughout the country. Although we have no survey work about the total number of plant species occurring in the country, a general estimate show that there are about 5000 of phanarogams and pteridophytes. We assume from various medical literature that we have more than 1000 medicinal plants species, wild and cultivated. This number may increase up to 1500 when the survey of ethnomedical information of the country is completed. We are continuing our effort from the herbarium to prepare a complete checklist of medicinal plants, wild and cultivated available in the country.

Herbal medicines are officially recognised by the Government of the Peoples Republic of Bangladesh and a board of Unani and Ayurvedic systems of medicines was constituted under the Unani, Ayurvedic and Homeopathic Practitioners Act of 1965. After the introduction of National Drug Policy of Bangladesh in 1982 herbal products have been brought under the control of The Department of Drugs Administration of the Ministry of Health and Family Welfare by legislation to control and regulate the commercial manufacturing and marketing of herbal products. In 1983 the Unani, Ayurvedic and Homeopathic Practitioners Act of 1965 was replaced by enacting the Bangladesh Unani, Ayurvedic and Practitioners Ordinance 1983. Under this ordinance the Board of Unani and Ayurvedic systems of medicine was given some specific functions: registration of herbal medicine practitioners, recognition of the relevant teaching institution, holding of qualifying examinations, publication of text books, standardisation of plant products, preparation and publication of pharmacopoeias and undertaking research and development programmes.

At present there are about 6000 practitioners of herbal medicines in Bangladesh who are either registered or have been accepted for registration by the board under the above mentioned Ordinance. About 800 of these practitioners are institutionally trained and qualified, the others are privately trained under registered qualified practitioners. In addition to them , there are about 10,000 unregistered practitioners who are practising in many rural and peri-urban areas

of the country. Most of them have no professional training and many of them are illiterate, half trained or non-trade apprentices and quacks. Efforts are now being made by the Board to bring them under legal control and to give them minimum level of professional training.

In our country, a total of 15 government recognised and funded educational institutions are currently engaged in teaching of herbal medicine and training of practitioners. these institutions offer a four years Diploma course and six month internship training in the outpatient hospital of each Institutions. The curriculum of the courses offered includes Anatomy, Physiology, Hygiene, Community Medicine, Minor Surgery and other relevant subjects of the respective systems. Annual intake of these institutions currently stands at about 400 students. Since 1989-90 academic session a governmental Unani and Ayurvedic Degree College has been established in Dhaka. The college is affiliated to the University of Dhaka, Bangladesh.

Plant Based Industries:

A total of 479 big and small industries are now engaged in manufacturing plant medicines in various dosage forms using local and imported materials. Of these manufacturers, 74 are Homeopathic, 161 are Ayurvedic and 244 are Unanic. They are commercially manufacturing about 3000 herbal products in different brand names under the direct control of the Department of Drug Administration of the Ministry of Health and Family Welfare, Bangladesh. There are two Government Laboratory i.e., Institute of Public Health at Mohakhali and Drug Testing Laboratory at Chittagong, where all the allopathic and plant products are tested before getting licence of marketing. In case of plant products, pH, solid contents, specific gravity, color and heavy metal contents are analysed. Due to the complex nature of the preparations, it is very difficult to analyse the active ingredients separately with our limited facilities. About 75% of the rural people of our country are using these drugs. Many of the important raw materials of plant origin are derived from the rich tropical flora of Bangladesh or cultivated in their own garden. Some of them are imported from India and Pakistan.

Although many of these manufacturers are still using the traditional methods of producing the drugs, some of them have modernised their factories by installing modern equipments and mechanaries. They use modern methods and technologies for the production and quality control of their drugs. The presentation and quality of their products are as good as those of modern medicines. These herbal medicines are now dispensed and sold from many modern drug stores and some of them are even prescribed by the modern medicine practitioners. Modernisation and utilisation of modern technology and knowledge in manufacturing and quality control of herbal products are now rapidly increasing in Bangladesh.

Research in the Institutions of Bangladesh:

In the Department of Pharmacy, Jahangirnagar University, I am actively engaged along with some of my colleagues in investigating the plant and plant extracts. Phytopharmacological , microbiological and toxicological experiments are extensively continued on herbal products in our department to explore the noble compounds, to ensure the quality and to manufacture the herbal products in large scale. In addition, the departments of Pharmacy and Chemistry of Dhaka, Rajshahi, Chittagong, Sylhet and Khulna Universities are also engaged in pursuing the natural products. Although we have no such remarkable facilities, our goal is to set up, develop or strengthen national industries for the production of plant derived pharmaceutical materials and industrial products.

Some problems in our Country:

1.Manufacturing: As we have no such remarkable methodology and mechanaries, it is very difficult to manufacture the different dosage forms of herbal products as like as the modern medicines.

2. Standardisation: The problems of standardisation of plant products can be summarised as follows:

i) The complex nature of the preparations: almost all of the plant products are multicomponental and involve in a number of procedural methods in their preparation, including some unhygienic processes and cultural or religious retuals.

ii) Secrecy of the ingredients: in most cases the ingredients of plant products are not known as they are kept secret by their practitioner, who is often very uncooperative and guard recipe very closely.

iii) Vagueness in therâpeutic claims: in their eagerness to impress upon the users and general public, the practitioners often make sweeping claims about the effectiveness of their products.

iv) Instability of preparations: most of the herbal products are prepared on the requirement basis and are intended to be used within a short time. Thus, no preservative is normally used to improve their keeping quality, which makes their standardisation meaningless.

v) Absence of legal control over practice of plant products: there is no legal requirement for the practice of herbal medicine. This further complicates the issue of standardisation of the products of the innumerable practitioners.

COUNTRY PAPER OF NEPAL
ON
MEDICINAL & AROMATIC PLANTS & THEIR PRODUCTS

Jaishree Sijapati Pandey
Neesha Rana Basnyat

Country Background

Nepal is a landlocked country with India to the east, south and west and Republic of China to the north occupying the central third of himalayan range. Its area is 147,181 sq. km. It extends from east to west for an approximate length of 830 km & for nearly 200 km from north to south. Within this area there are remarkable latitudinal variations ranging from 50m above sea level in the south to well over 8000m including the world's highest mountain (Mount Everest 8845m)at the northern crest line.

The physiographic diversity associated with the latitudinal variations & (every 100m increase in elevation attributes to the decrease of temperature by 0.5^0 C) climatic zones contributes to the large numbers of indigenous sps of flora & fauna. At ecosystem level, Nepal has great diversity which ranges from dense tropical mansoon forests of the terai to subtropical deciduous forest, tropical evergreen forest to lower temperate mixed forest, upper temperate mixed forest & alpine conifer forest. Above 4900m to the snow line there is discontinuous perennial herbs. About 54% of Nepal's land surface is under some sort of vegetational cover (forested area 37% shrublands & degraded forest 5% & grassland 12%).

In the continental scale of richness of flora, Nepal stands 11th position & in the global context 25th position. Thus Nepal is being importantly recognizes for the value & diversity of its plant wealth which comprises of many economic plants (including plants of food, medicinal, aromatic & industrial value) Above all Nepal contributes about 5% of its flora which are native & 30% not found outside the himalayan range. This phenomenon calls for global concern.

Introduction

Nepal being rich in natural heritage, which has diverse topography, the range of altitudinal & climatic zones contributes to the large number of indigenous sps of flora & fauna. It contains over 5000 sps of flowering plants, over 1500 sps of fungi more than 600 sps of lichen & 687 sps of algae, of which 370 sps are for medicinal purposes.

Due to variation in altitude and climate, the vegetation is also changed & consequently it is possible to grow both the high altitude sps: such as *Swertia chirayita* as well as low altitude sps such as *Acacia consinna*. Around 100 sps of medicinal & aromatic plants are traded to India & third countries. The private sector handles over 95% of the total trade throughout the country .

More than 500 ha land are used for commercial cultivation of medicinal aromatic plants (MAPs) at different regions of varying altitudes & climatic zones .

Following are some legally conserved plants which are band for collection use and export by His Majesty Government forest act.

Collection & Use	Export
Cordyceps sinensis (yarsagumba) *Orchis incarnata (panchaule)*	*Nardostachys grandiflora (jatamansi)* *Rauwolfia serpentina (sarpagandha)* *Cinamomum glaucescens(sugandhakokila)* *Valeriana jatamansi (sugandha wala)* *Usnea barbata parmelia (jhyau),lichen* *Abies,Tsuga (talispatra)* *Rocksalt (silajit)* *Taxus wallichiana (lauthasalla)*

Research activities in medicinal and aromatic plants (MAPS)

Research activities in MAP products have been running by both public and private sectors .

Public Sectors

Royal Nepal Academy of Science and Technology (RONAST)

RONAST was established in 1982. The patron of this academy is His Majesty the King of Nepal . The main objectives of RONAST are as follows:

- Advancement of S&T for all round development of the nation .
- Improvement and promotion of indigenous technologies.
- Promotion of research in S&T .
- Identification and facilitation of appropriate technology transfer .

RONAST has been launching in-house research programs in its own initiation or in collaboration with other national and international agencies. RONAST has research development division which has been running research programs such as biodiversity conservation of medicinal and aromatic plants, natural product research program etc. Natural product research laboratory analyzes chemical compounds in selected medicinal and aromatic plants whereas in the biodiversity conservation project makes database characterizes and cultivates MAPS of endangered and rare species.

Department of Plant Resources

The Department of Plant Resources (DPR) is under Ministry of Forest and Soil Conservation of His Majesty Government of Nepal (HMG). DPR is mainly a research institution responsible for :

- Carrying out activities related to the conservation , promotion & utilization of plant resources & their scientific & practical studies
- To assist in scientific & technical research studies of plants with an emphasis on medicinal plants.

Divisions of DPR :

I. **Natural Product Development Division** – It has chemical laboratory for phytochemical screening of plants & their analysis, pharmacological laboratory, microbiology & biochemistry laboratories. Quality control approval is given by this division to aromatic & medicinal plant products (essential oil) of the government, semigovernment & private sectors. In pilot plant section of this division some of the essential oils have been extracted and exported.

II. **Plant Research Division**:- It has two wings :

- National Herbaruim & Plant Laboratories :- About 19,000 specimens have been collected & preserved in herbaruim.

- Royal Botanical Garden :– More than 17 books related to MAPs are published. It has launched a program on 'Nepal Flora Project' which aims to identify all the flora of the country. DPR has also conducted experiments on cultivation of some medicinal and aromatic plants in its various farms situated at different altitudes & climatic zones. DPR has succeeded in the development of the method for mass propagation of different plants of ornamental & economical values by tissue culture.

Herbs Production & Processing Company Limited (HPPCL)

HPPCL is a commercial company operating under the Ministry of Forest & Soil Conservation & is mandated to extract the constituents of aromatic & medicinal plants (MAPS) for medical use. The main activities of this company are:

a) Cultivation & processing of about 600 families of MAPS in its two farms they are Tamagadhi & Belbari.
b) Production of essential oil & medicinal extracts .
c) Quality control.

Some of the research institutes which come under Tribhuvan University such as Research Centre for Applied Science & Technology (RECAST), Institute of Science & Technology etc are also involved in the cultivation of plants & plant analysis for its active constituents.

Private Sector

Asian Network for Small Scale Agricultural Biotechnologies (ANSAB) an INGO, in close coordination with Humla Conservation & Development Association (HCDA) has established an essential oil distillation unit in Humla district to distill Jatamansi oil (Nardostachys grandiflora), Sunpati oil (Rhododendron anthopogan) & Dhupi oil (Juniperus indica)out of which jatamansi oil has been extracted & exported whereas others are in the initial phase.

Some of the organizations such as Singha Durbar Vaidhyakhana, Dabur Nepal, Gorkha Ayurved etc. are involved in ayurved, also utilized MAPS to manufacture ayurvedic drugs.

Research and Development (R &D) Problems & Constraints

- Limited amount of funds for S&T (0.13%)
- Lack of awareness of usefulness of MAPs
- Lack of trained manpower.
- Less market facility.
- No quality improvement in processing of MAPs.
- No standard value of essential oils.
- Less coordination between collectors, growers, middleman, traders & research scientists.

Conclusion

Ethnobotanical & ethnomedical practices as well as the scientific knowledge have focused attention on the utilization & commercialization of natural resources towards development of the various valuable industries e.g. pharmaceutical, cosmetics, flavour essence etc. However, one of the main constraint of the product which can be competitive in the world market is the lack of good quality and good manufacturing processes . Hence, the competent manpower has to be set up in this area and develop national industries for the production of plant derived pharmaceutical & other industrial products. This will not only increase the export of plant products but also leads to tremendous economic development of the country.

HMG/ N has not been able to make any standard value of MAPs and other essential plants products due to lack of trained manpower and essential sophisticated equipments like GCMS. DPR is the only authorized HMG/N department to approve the quality of MAPs for exporting or use within the country. Another HMG body Bureau of Standard is in the process (preliminary stage) for standardization of MAP products.

Destruction due to shrinkage of the natural vegetation which has accelerated the rate of extinction of rare and endangered plant species. Being aware of this, government has established conservation act on 1982, under this King Mahendra Trust for Nature Conservation (KMTNC) was formed . KMTNC has many national parks spreading every region of the country, which conserves flora and fauna. Despite having conserved area, rational use of the rare and endangered plant sps and lack of harvesting and cultivation knowledge, caused plant resources depletion. This is because to lack of awareness in community level. Recently, some of the organizations have started rotational harvesting methods & few of them have started cultivation of MAPS in community level.

Acknowledgement

I am highly obliged to ICS-UNIDO for the travel grant and Mr. Arjun Upadhaya for providing me an opportunity to participate in this training workshop. We would like to express our sincere thanks to Vice-Chancellor , Research & Development Division & Administration Division of RONAST. We would like to thank Dr. Chiranjivi Regmi , chief of our project whose proper guidance, suggestion & encouragement made us able to prepare this paper. At last but not least our deep appreciation go to our colleague for their kind & continued cooperation.

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Annex 1

Cultivated aromatic plants for essential oil

Species	Product
Matricaria chamomila	Camomile oil
Cymbopogon winterianus	Citronella oil
Ocimum basillicum	French basil oil
Cymbopogon flexuous	Lemon grass oil
Mentha arvensis	Mentha oil
Cymbopogon martini	Palmarosa oil
Tagetes grandulifera	Tagetes oil

Indegenous industrial aromatic plants product

Species	Product
Nardostachys grandiflora	Jatamansi oil
Gaultheria fragrantissima	Winter green oil
Cinnamomum glaucescens	Sugandhakokila oil
Acorus calamus	Calamus oil
Pinus roxburghii	Rosin Terpantine oil
Rhododendron anthopogon	Anthopogon oil
Valeriana jatamansi	Valerian oleoresin
Xanthoxylum armatum	Xanthoxylum oil

Important medicinal plants processed in Nepal

Species	Product
Aconitum spicatum	Aconite extract
Justicia adhatoda	Vasaka liquid extract
Atropa belladonna	Belladonna liquid extract
Taxus wallichiana	Taxol /resin

Banned plants for collection, use and export

Collection & Use	Export
Cordyceps sinensis (yarsagumba) *Orchis incarnata (panchaule)*	*Nardostachys grandiflora (jatamansi)* *Rauwolfia serpentina (sarpagandha)* *Cinamomum glaucescens(sugandhakokila)* *Valeriana jatamansi (sugandha wala)* *Usnea barbata parmelia (jhyau),lichen* *Abies,Tsuga (talispatra)* *Rocksalt (silajit)* *Taxus wallichiana (lauthasalla)*

PLANT BASED INDUSTRIES IN SRI LANKA

by

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The Country paper presented at the ICS-UNIDO Training Workshop on Quality Control of Medicinal and Aromatic plants and their products (CMAPP)
June 15-20, 1998.- Jammu, India.

The country paper of Sri Lanka on plant based industries presented by
T. M. S. G. Tennakoon, Research scientist, Link Natural Products (Pte) Ltd.

INTRODUCTION

Sri Lanka has greater bio-diversity per unit area than any other country in Asia. It is one of eleven areas in the tropics identified by the committee on research priorities in tropical biology as demanding special attention because of it high level of biological diversity endemism and its vulnerability to habitat destruction. Sri Lanka posses a remarkably rich flora of about 3000 angiosperms of which over 27% are endemic species. The Ayurvedic Pharmacopoeia lists some 400 plants which are used in preparing drugs. A number of these species have been over exploited. Some of these such as *Rauvolfia serpentina (L.) Benth. ex. Kurz.*, *Saraca asoca* L., *Strychons-nux - vomica* L., , *Munronia pinnate* Wight., *Cleisthanthus collinus* (Roxb.) Hook.f. have become rare in the wild.

Ayurveda, Unain, Siddha, and Deseyachikistha are the various traditional systems of medicine still prevalent in Sri Lanka which utilise plant based drugs. In the present context all these are called 'Ayurveda'.

The essential oil industry has been in existence in Sri Lanka for a long time. Presently about ten different oils are produced locally for export and for domestic consumption. Among these are cardamom oil, clove bud oil, cinnamon leaf and bark oil and ginger oil.

THE PLACE OF THE INDIGENOUS MEDICAL SYSTEM IN SRI LANKA

There are about 15000 registered Ayurvedic practitioners of Ayurveda in Sri Lanka . The ministry of indigenous was established in 1980. The government has established a factory for manufacturing Ayurvedic medicine. There are about 80 manufactures of Ayurvedic medicine in the country of which about 10 could be considered large scale manufacturers. All these manufacturers have to be registered in the department of Ayurveda and inspected annually for re-registration. The ministry of indigenous medicine has published an Ayurveda pharmacopoeia which provides a guide for the manufacturing Ayurvedic drugs.

MANUFACTURING TECHNOLOGY OF TRADITIONAL MEDICINE

This section will brief outline the major processing technologies involved in the preparation of Ayurvedic drugs used by the larger manufacturers.

1. Drying of plant materials

This is invariably carried out by direct or indirect (shade) exposure to solar radiation The materials is placed directly on a prepared ground surface or on a mat cloth placed on the ground.

2. Size reduction

The initial step (cutting, chopping) is carried out manually using a cutting tool. Thereafter, grinding, crushing and powdering is carried out using electrically operated machinery.

3. Preparation of water extracts

Water extracts from the basis for a number of different type of drugs. The directions include a boil down ratio, usually 8:1 or 4:1. Large scale manufacturers use steam heated steel vessels whereas firewood or gas is used directly by smaller scale manufacturers.

4. Fermentation

Fermentation is traditionally carried out for one month in sealed clay or wooden vessels. The Ayurvedic pharmacopoeia describes involved procedures for sterilisation and sealing of the vessel. The manufacturers do not follow the traditional procedures. Some of them the carried out the fermentation in stainless steel vessels which have been sterilised using modern sterilisation procedures. Some even flash sterilise their products before bottling. All manufacturers however observe the stipulated 30 days fermentation period.

5. Preparation of medicated oils

The preparation of medicated oils generally involves the heating of an oil to which has been added a water extract of plant material and powdered dry plant material. Heating is continued firstly until the water phase is evaporated. The Ayurvedic pharmacopoeia specifies to what extent heating should be continued beyond this point. The parameter evaluated is the physical state of the powdered plant material in the oil.

6. Purification of raw materials

The Ayurvedic system of medicine describes 'Shodana' or detoxcation procedures for certain plant as well as some minerals. These procedures have a rational basis. Thus the root of *Plumbago indica* L. containing toxic Phenolic compounds. By washing with lime solution, the Phenolic content of the root can be reduced.

QUALITY CONTROL AND STANDIZATION OF TRADITIONAL MEDICINE

There are no accepted methods for the quality assessment and quality control of Ayurvedic drugs. Further there are no accepted quality standards for the manufactured traditional medicine. The manufacturers would welcome the availability of such standard procedures and quality standards. But admittedly it will be no easy task to formulate them. The department of chemistry in the University of Sri Jayewardenapure and CISIR are conducting research in this area.

THE ESSENTIAL OIL INDUSTRY

Sri Lanka is fortunate that it is blessed with a varied climate profile that can supply a variety of essential oil bearing plants. Through out history, spices and essential oil bearing plants have been cultivated in Sri Lanka which supplies about 80% of the worlds requirement of cinnamon , which has a unique flavour that hard is to duplicate. Similarly Sri Lanka pepper is much sought after for fine flavour and 8-14 % piperine, 2 to 6 fold greater than that reported for the major Indian varieties.

Export Quantity of spices In Sri Lanka (Metric tons)*

Spices	1995	1996	1997
Cinnamon quills	10815	10891	11056
Cinnamon leaf oil	205	110	100
Clove bud	1500	1437	2333
Cardamom	75	75	75
Citronella	180	190	210
Nutmeg & Mace	988	1198	1067

* Central Bank Report 1997

According to the estimates of department of agriculture , the production of clove ,pepper, citronella, during 1997 has improved production levels over the previous years. The production of nutmeg, cinnamon leaf oil declined. Sri Lanka's share of world trade in spices excepted cinnamon, is less than 2%.

CULTIVATION - AROMATIC PLANTS

Major and minor scale cultivation aromatic plants are given below.

MAJOR

1. Cinnamon (*Cinnamon verum* Presl.)
2. Pepper (*Piper nigrum* L.)
3. Citronella (*Cymbipogen nardus*(L.) Rendle)
4. Nutmeg (*Syzigium aromaticum*(L.) Merr. & Perry)
5. Ginger (*Zingiber officinale* Roscoe.)

MINOR

1 .Lemon grass (*Cymbopogon citratus* (D C) Stapf.)
2. Eucalyptus (*Eucalaptus globulus* Labill. & Citriodora Hook)
3. Curry leaf (*Murraya koenigii* (L) Spreng.)
4. Pinus (*Pinus roxbuurghii* Sarg.)
5. Vetiver (*Vetiveria zizanoides* (L) Nash.
6. Vanilla (*Vanillia plarfoila* Andr.)
7. Lime (*Citrus sinensis*(L.) osb.)

Spices and other aromatic plants are grown under small holding in Sri Lanka, as mixed crop in home gardens except cinnamon, which is cultivated in a more organised manner on large scale estates in Southern province. Most of the plantations are confined to 2-10 hectares. Product of most of the spices could be increased by inter-cropping the coconut lands. Presently, only about 5% of coconut lands are inter-cropped with these crops, except cinnamon.

EXTRACTION OF ESSENTIAL OIL

Steam distillation of aromatic plant materials such as cinnamon, citronella, lemon grass are done in cottage level, using traditional steam distillation units. Several private enterprises have acquired modern technology, and are experienced in processing commercial quantities.

LINK NATURAL PRODUCTS (PTE) LTD

Link Natural Product (Pte) Ltd, is one of the leading manufacturing of Ayurvedic pharmaceuticals ,consumer herbal products and essential oils. It has an annual turn over of SL Rs.200 Million. The company produces a wide rang of high quality herbal products. The company's current rang of products numbering over 80 includes the following categories,

1. Ayurvedic preparations
2. Herbal health care products
3. Tinctures
4. Herbal teas
5. Essential oils

The company has well equipped manufacturing facility with state of the art machinery as well as in - house fabricated machinery. It is now in the process of developing a research and development laboratory which is equipped with sophisticated analytical equipment such as h.p.l.c, GC, and tlc - Densitometer.

The company conducts training programs from the factory floor workers upto the senior managers on various aspects of GMP , productivity techniques, quality system, quality assurance and quality control techniques etc.

R & D ACTIVITIES

A brief summary of R & D activities of the company is given below,

1. Raw material quality control
1. Finished product quality control
2. On- Line quality assessment
3. Quality assessment of the essential oils

1. Raw materials quality control

The plant materials are authenticated and approved by a detailed comparison with authentic samples. The volatile matter if present is determined by steam distillation of the plant drugs. TLC, HPLC and GLC are used for monitoring the identity and purity of the raw materials. Monographs are being compiled for all raw materials.

2. Finish product quality control

With absence of any specification of the quality parameters further the evaluation of the Ayurvedic pharmacopoeia , the company has established its own criteria to evaluate the final product. The criteria used for medicinal products and essential oils. comes under 4 categories.,

1. Sensory evaluation
    i. odour ii. Taste
2. Physicochemical tests
    i. Moisture content
    ii. pH value
    iii. Brix value
    iv. Refractive index.
3. Chromatographic finger printing
    i. TLC, HPLC and GLC finger prints.
4. Quantitative determination of active ingredients

The sensory evaluation is carried out by a trained officer for colour, odour and taste.

Finally Link Natural Product(Pte) Ltd, is grateful to the UNIDO and RRL Jammu for inviting us to participate in this programme which would be beneficial for the future development objective of an company as well as enhance the status of the Ayurvedic system and natural product industries in Sri Lanka.

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MEDIROMA NIRGALITS INTERNATIONAL

Manufacturers & Exporters of Natural Essential Oils, Herbal Extracts & Products.
#40, Industrial Area Shamshi, District Kullu (H.P.). 175126-INDIA.

STATUS OF ESSENTIAL OIL INDUSTRY IN INDIA

INTRODUCTION :

Perfumes & Flavours are very much a part of India's cultural tradition & rituals, thus, there is a great history behind the fruiting of the Essential Oil Industries in India. The art of perfumery and flavour dates back to Mughal times. The country has a special designation in the herbal sector because of its capability to cultivate most of the plants used in the modern & traditional medicines, perfumes, flavours etc. This has been possible due to its vast area with a wide variation in the climate, soil, altitude and latitude. The constant increasing demands of aroma chemicals, natural essential oils etc. in the International market pin points the bright prospects of Essential oil industries in India.

PRESENT STATUS :

Indian Essential Oil Industry dates back to the production of "Attars". Attars of Rose, Jasmine, Kewda (Pandanus odaratissimus), Khus (Vetiveria zizinoides), Kesar (Crocus sativus), Kuth (Sassurea lappa) are very famous. The commercial production of essential oils started during the initial years of present century. The Essential Oils Research Committee set up in 1941 by the Council of Scientific & Industrial Research has resulted into a resurgence of Indian Essential Oil industry during the last forty five years. The production of flower oils and absolutes from rose, jasmine, tuberose initiated about twenty years ago, has now been established commercially. A list of Essential oils, Spice oils, Oleoresins etc. which are produced and available in the country is given in Appendix 1. The CHEMEXCIL, Mumbai has compiled statistics on export of essential oils & aroma chemicals. As per their data, the export value for essential oils has risen to Rs 60.1 crores during 1995-96 as compared to Rs 51.3 crores during 1992-93. Producers of flavours & fragrances all over the world are looking towards India as the best source of mints and other essential oil based isolates/chemicals. As far as mints, spice-oils & oleoresins are concerned, India has already acquired firm position.

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OPPORTUNITIES & SUGGESTIONS :

The importance of minor constituents can not be ignored as India is going to become a major supplier of the natural isolates to the World. A constant increase in the demand of Natural essential oils and aroma chemicals in the International market indicates the possibilities of its shortage in the near future and India has bright prospects/chances to fulfill the increasing demands. But, to compete in the Global markets our R&D efforts supported by the emerging technologies should be demand and market oriented. To ensure the quality of International standards, dedicated & skilled manpower is essential & need of an hour.

Further, with an objective to meet the increasing demands, production of uniform quality raw material on a regular basis is of prime significance. For this, cultivation of aromatic & medicinal plants on a commercial scale in the country are required. Many areas in the northern India have not been exploited so far. The entire area of Himachal Pradesh has been blessed by the Nature with respect to wild growth of a large number of aromatic & medicinal plants & there is a great potential /scope to promote the cultivation of such herbs on a commercial scale. The State Environ--ment Report prepared by the State Council for Science, Technology & Environment highlights survey of fields (private & government), and such possibilities. The survey has shown the keen interest of persons to opt for the commercialization of their idle lying areas with such herbs. Our Research Institutes/Centres are already in the job of such promotions but a lot of efforts are still required for its implementation.

Economically viable production technologies along with the post harvest technologies to check the losses during processing, marketing & storage although being promoted & developed by our premier Research centres donot reach the maximum percentage of enterprenuerers. These are required to be passed regularily to the State Governments & Industries departments of all the districts in the state.

The State government is itself not clear about its policy with respect to the wild collection, cultivation of aromatic & medicinal plants and its movement from one place to another. This question marks the fruiting

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of the healthy herbal based projects in the country. Thus, the subject of Minor Forest Produces, its extraction, processing, survey regeneration aspects do require an immediate attention to revitalise, replenish & regulate the precious natural wealth so as to ~~increase~~ glorify the status of Essential Oil Industry & other allied industries in India magnificiently.

MANISH KAPOOR
M.Pharm. D.E.M.
(Managing Director).

List of Essential oils, Spice oils, Oleoresins produced in India

AGARWOOD OIL
AJOWAN OIL
AMBRETTE SEED OIL
ANGELICA ROOT OIL
ANISE SEED OIL
ARTEMESIA OIL
BASIL OIL
BETEL LEAF OIL
CALMUS ROOT OIL
CAMOMILE OIL
CAPSICUM OLEORESIN
CARAWAY OIL
CARDAMOM OIL
CARROT SEED OIL
CEDARWOOD OIL
CELERY SEED OIL
CELERY SEED OLEORESIN
CINNAMON BARK OLEORESIN
CINNAMON LEAF OIL
CITRONELLA OIL (JAVA TYPE)
CLOVE OILS
CLOVE OLEORESIN
CORIANDER OIL
CORIANDER OLEORESIN
COSTUS ROOT OIL
CUMIN OLEORESIN
CUMIN SEED OIL
CURRY LEAF OIL
CYPERUS ROTUNDUS ROOT OIL
CYPERUS SCARIOSUS ROOT OIL
DAVANA OIL
DILLSEED OIL
EUCALYPTUS CITRIODORA OIL
EUCALYPTUS GLOBULUS OIL
FENNEL OIL
FENNUGREEK OLEORESIN
GALANGA OIL
GARLIC OLEORESIN
GERANIUM OIL
GINGER GRASS OIL
GINGER OIL
GINGER OLEORESIN
GREEN CHILLI OLEORESIN
HEDYCHIUM OIL
HOPS
JAMROSA OIL
JATAMANSI ROOT OIL
JUNIPER BERRY OIL
KEORA OIL
KOKAM
LAVENDER OIL
LEMONGRASS OIL
LIME OIL COLD PRESSED & DISTILLED
MACE OIL
MACE OLEORESIN
MARJORAM OIL
MENTHA ARVENSIS OIL
MENTHA CITRATA OIL
MENTHA PIPERITA OIL
MENTHA SPICATA OIL
MYRRH
NUTMEG OIL
NUTMEG OLEORESIN
OLIBANUM
ONION OLEORESIN
PALMAROSA OIL
PAPRIKA OLEORESIN
PATCHOULI OIL
PEPPER (BLACK) OIL
PEPPER (BLACK) OLEORSIN
ROSE OIL
SANDALWOOD OIL
SCOTCH MINT OIL
SPEARMINT OIL
SUGANDH KOKILA OIL
SUGANDH MANTRI OIL
TAGETUS ERECTA OIL
TAGETUS MINUTA OIL
TURMERIC OIL
TURMERIC OLEORESIN
TURPENTINE OIL
VALERIAN ROOT OIL
VETIVER OIL (CULTIVATED)
VETIVER OIL (WILD)

List of Absolutes/Concretes produced in India

CHAMPA
FRANGIPANI
JASMINE
KEORA
MIMOSA
ROSE
TUBEROSE

List of Attars from flowers produced in India

CHAMPA
GULAB
GUL HINA
KEORA
MAULSHREE
MOTIA
ZAFARI

Director, Regional Research Laboratory (CSIR), Jammu
invites you on the inauguration of

ICS-UNIDO Training Workshop

on

Quality Control of Medicinal and Aromatic Plants and Their Products

by

Professor N. K. Ganguly

M.D., F.A.M.S., F.N.A., F.N.A.Sc., F.A.Sc., F.R.C.Path

Director General
Indian Council of Medical Research,
New Delhi

on 15th June, 1998 (Monday) at 9.00 A. M in the
RRL Conference Hall

ANNEXURE II

Programme

9.00 a. m.	Invocation	
	Welcome Address	Prof. S. S. Handa Director, RRL
	Introduction to the Workshop	Dr. T. de Silva ICS/UNIDO International Resource Person
	Inaugural Address	Prof. N. K. Ganguly DG, ICMR
	Keynote Address	Prof. B. N. Dhawan Former Director, CDRI
	Vote of thanks	Dr. G. N. Qazi
10.30 a. m.	Tea	

STATUS OF HERBAL DRUGS IN INDIA

[Paper presented at ICS-UNIDO workshop on Quality Control of Medicinal and Aromatic Plants and their Products (QCMAPP), 15th to 20th June, 1998]

Mr. Amit. A
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Crude drug scenario in India is very unorganized and unsystematic. Majority of the crude drugs, available to manufacturers of herbal products are through crude drug suppliers, who source the material from collectors who in turn collect the medicinal plants from the wild. The collectors are generally illiterate and ignorant about the identity of the medicinal plants. Thus the material supplied in many cases is unintentionally adulterated.

Multilingual identity of the plant, and its several vernacular synonyms further add to the confusion. Thus the availability of authentic crude drugs has been a major problem to the herbal drug manufacturers in India.

Pharmacognosy - the primary science of identification of crude drugs, is taught only to students of Pharmacy. The academic curriculum, for science graduates, post graduates and doctors of Ayurveda, Siddha, Unani System of Medicine, does not include this subject. Hence even practitioners of traditional systems of medicine are often unaware of the identification methodology for crude drugs and thus not sure about the botanical origin of herbs.

With the ever increasing demand for crude drugs and indiscriminate clearing of forests, medicinal plants are constantly being lost. This has led to extinction and endangering of several medicinal plant species. Thus, conservation and cultivation of medicinal plants has become an absolute necessity. Recently Indian Government has banned export of 29 threatened medicinal plants and their value added products in an effort towards conservation. But one should not confuse conservation with preservation. There are several herbal products available in the Indian market which contain ingredient from the banned list of plants. Instead of banning the exports, if concrete steps were to be taken in promoting propagation of these plants, it would have proved to be a long term solution without hampering the export potential of these herbal products which have ingredients from the banned list of species.

The need of the hour is to develop proper agronomical practices for those medicinal plants which are being exploited in large quantities and are rapidly diminishing in the nature. An important part of the information on cultivation practices should be that of economic viability. Many farmers who are regularly cultivating cash crops are reluctant to try cultivation of medicinal plants simply because they are not sure whether this cultivation will be economically viable, inspite of being provided with a buy-back guarantee, for their produce, by the manufacturers of herbal products.

Initially one may fear that cultivation is not economically viable since the collectors of herbs from the forests does not need to spend money and time for land preparation, sowing, irrigation, weeding etc, while a cultivator has to do all the above and wait till the plant part to be used comes of right age before harvest.

Many medicinal plants are biannual, need minimal of care, are not attacked easily by pest and other herbivorous animals. Often the whole plant is used as medicine thus chances are that in the long run cultivation of medicinal plants might actually become more lucrative to farmers when compared to the conventional cash crops where the part used is often the grains only.

Studies need to be taken up to try and increase the content of active principles in these plants either through plant breeding methods or by increasing the bio-mass ratio of the useful part of the plant.

Another major bottleneck for the herbal drug industry is the lack of proper information systems about medicinal plants. One would recognize and acknowledge that the precious wealth of information that is available to us as our heritage of traditional systems of medicine, can be further popularized throughout the world (especially in the western countries) if we could add to it a modern scientific outlook.

The western world is generally skeptical about the effectiveness, safety and consistency of traditional herbal medicines as a result India has a poor quantum of exports of such products. The answer to this problem lies in standardisation of herbal drugs. In most of the developed countries the word standardisation implies a clear knowledge about the active principles, structure-activity relationships, elaborate pharmacological and toxicological studies, pharmaco-kinetics and pharmacodynamics. Such information on Indian medicinal plants is almost absent. Many of the herbal formulations in India are polyherbal in nature(often having more than 25-30 different ingredients). Standardisation therefore becomes a much tougher task.

One of the recent approaches towards standardisation of medicinal plants is through **bio-activity guided fractionation**. For this the most important requirement is the availability of bio-assays. Any pharmacological method which is rapid, reproducible, economical, sample hungry (which has a high sample throughput) and most importantly requires small amounts of sample for evaluation, has been described as a bio-assay[1]. Activity guided fractionation is a multidisciplinary approach involving pharmacological evaluation of a given mixture (crude drug), followed by separation by means of extraction. Each of these successive extracts are then tested for biological activity and the extracts which are not active are discarded and the most active extracts are further separated into fractions. Each of these fractions are again tested for activity and the active fractions again separated to obtain sub-fractions. The process is repeated till the pure active compounds are obtained. For fractionation normally preparative chromatographic techniques like Column chromatography, flash chromatography, Vacuum liquid chromatography, CCTLC (Centrifugal circular thin layer chromatography), preparative TLC and sometimes preparative HPLC are used[2].

Once the chemist reaches upto the fraction level, he can generate only milligram quantities of samples. Most of the *in-vivo* pharmacological methods require at least gram quantities of sample in order to evaluate the desired biological activity. Thus bioassays which require only milligram quantities of samples can be utilized for directing the fractionation. Once the active compound(s) is identified several other aspects of standardisation become possible like detection of seasonal and geographical variation, bio-stability studies etc.

Some of the important non-specific, simple, bench top bio-assays used for activity guided fractionation of natural products are :

1. Brine-shrimp lethality[3]
2. Hippocratic screen[4,5,6,7]
3. Isolated Guinea pig ileum test[8]
4. Opiate receptor-binding studies[9]

Anti microbial tests[11]
Bio-autography[12]

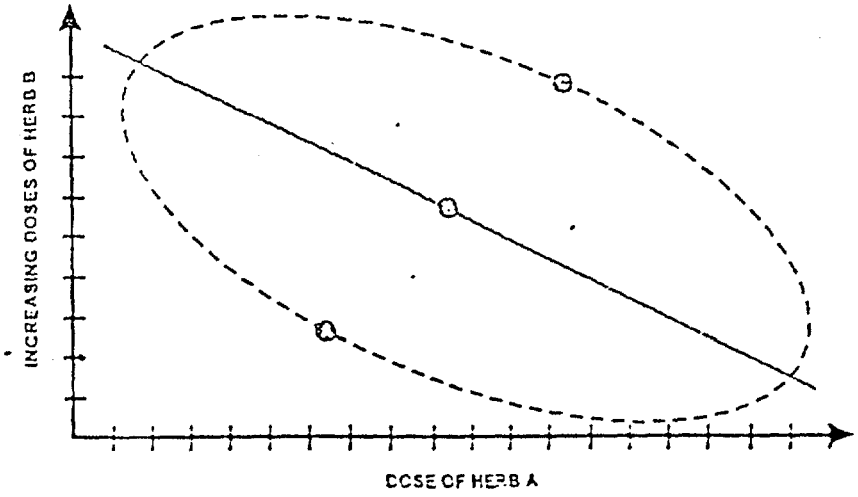
One of the major obstacles to this approach is the lack of sufficient number of pharmacological models and bio-assays. The non-specific bio-assays mentioned above are generalized and do not indicate the kind of activity that can be anticipated, thus they can be utilized as primary screens only.[13] The pharmacological models for evaluating specific bio-activity are cumbersome, complicated and expensive. They generally do not have a high sample throughput and often special expertise is required to interpret and derive meaningful inferences from the results obtained.

The trend these days is to develop mono or diherbal formulations. This trend is appreciable and should be encouraged, as the pharmacological evaluation of such products becomes easier and the activity guided fractionation becomes practical. An important factor in case of polyherbal formulations, that is often neglected is the interaction effects of its ingredients. Though this study is very important it is not always practical as there are no proper methodologies available for such studies. Whenever a herb A is mixed with a herb B, there are basically three kinds of possible interactions, namely :

1) Synergism
2) Antagonism
3) Additivity

Recently a novel methodology has been described for this purpose, which is called as isobologram technique[14]. An Isobologram is a graphical representation of extent of efficacy (covering interaction effects) increasing concentrations of a herb A in presence of increasing concentrations of a herb B. For this experiment a series of permutation and combinations are worked out as per the checker board technique and biological efficacy determined for each prototype and plotted as described below.

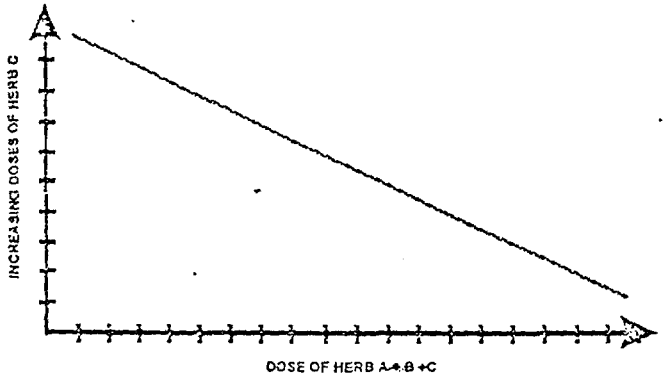
ISOBOLOGRAM [Compatibility studies]



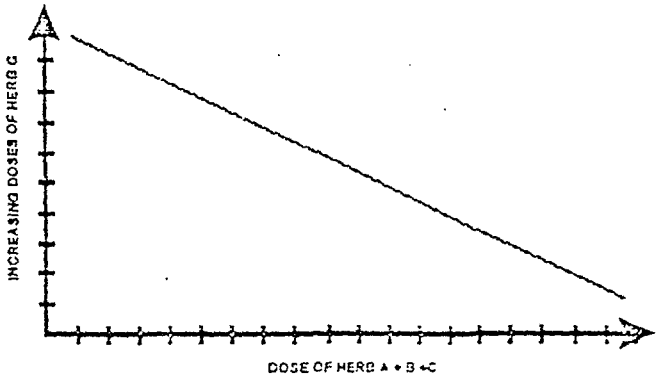
(A) SYNERGISM (POTENTIATION) i.e 2 + 2 > 4
(B) ADDITIVITY i.e 2 + 2 = 4
(C) ANTAGONISM i.e 2 + 2 < 4

Thus once having arrived at the most synergistic combination of the two herbs, one can continue similar experiments in presence of other ingredients in case of a polyherbal formulation. This approach helps in rationally arriving at the percentages of ingredients in a formulation. Thus far this technique has been used successfully for some anti microbial and anti protozoal formulations only, where the bioassays are *in-vitro* and simple. Isobologram technique can also be applied for developing hepatoprotective / anti hepatotoxic formulations using *in-vitro* primary cultured rat hepatocyte model[15].

ISOBOLOGRAM [Compatibility studies]



ISOBOLOGRAM [Compatibility studies]



The major limitations of approach of activity guided fractionation is that if a herb has a multiple properties and modes of action, one may misout on some of the actives which may not be detectable by the bioassay employed for fractionation. Unlike modern medicine, herbal medicines are said to have a 'holistic' mode of action. Their mode of action is multipronged, and hence it is all the more complicated to pinpoint their route(s) of action.

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A BRIEF NOTE ON THE AYURVEDIC DRUGS OF INDIA

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Dear colleagues,

At the outset, I would like to express my sense of gratitude to the Organisers of this Workshop, and particularly to Prof. Handa, the Director of this reputed Institution, for having given me this opportunity to speak to you a few words about Ayurvedic drug sector.

Ayurveda, as all of you might know, is the ancient Indian system of health care. But it is a health care system with a difference. It is evidently a system of healing; but more importantly it is a system for well-being. It is rather a philosophy of life. It perceives the human being as an integral part of nature and it proclaims that there is hardly any material in the nature which cannot act as a healing agent. It deals with every condition of human existence, whether of well-being or of disease, as a psycho-somatic manifestation.

Having made these introductory remarks, we shall take a cursory look at certain salient aspects of Ayurvedic drugs. The most important point to be noted is that Ayurvedic drugs use only naturally occurring

materials as ingredients. About 80% of such materials belong to the vegetable kingdom. The remaining ones are of either animal or mineral origin. The Ayurvedic drugs are not what is commonly and rather loosely termed as herbal medicines. Because, herbs can be employed, and they are indeed used, as ingredients for other popular systems of medicines, including Allopathy. It is the pharmacopoeia which decides whether a particular formulation is Ayurvedic or otherwise and not just the presence of herbs in it as ingredients. And, as mentioned above, non-herbal items form a very significant component of Ayurvedic drugs. Even in the case of herbs, as stipulated by the World Health Organisation(1), chemically isolated components cannot be used. It is the whole-plant or its various individual parts like the flower, the root, the bark, the seed etc which must be used through a process of cooking. And more over, as a practising system, Ayurveda makes extensive use of compound drugs rather than single drugs. On an average, an Ayurvedic formulation may comprise 20 to 30 ingredients; and there are instances where more than 75 ingredients go into the preparation of a medicine.

There are more than 20 categories(2) of ayurvedic dosage preparations as listed by the official formulary. The basic process involved in majority of these preparations is the aqueous extraction of the

various herbs, minerals or animal products, at boiling water temperature. There are numerous classical text books dating back to a couple of thousand years, which give details of hundreds and hundreds of formulations. Most of these texts are written in the ancient Indian classical language of Sanskrit and occasionally in other Indian regional languages. They form the documentary basis for the Ayurvedic Pharmacopoeia. About 60 of these texts are recognised as forming part of the Official formulary by the Drugs Law(3) of the Government of India. And a compendium official of these formulations is being brought out by the Government as a consolidated Formulary(2). It should also be mentioned here that new formulations are arriving at the present day Ayurvedic market in the form of patented and proprietary products.

The traditional practice of using Ayurvedic drugs was for the physician prescribe tailor-made formulations to each individual patient. And such formulations were expected to the prepared by the physician specifically for each patient or by the patient himself at home. The present century has brought in a major shift in this practice. The concepts of pharmacology and pharmacy have been accepted in the field of Ayurveda with the result that most of the standard Ayurvedic formulations are now made available as ready-made, packed commodities

in the market for the patient to purchase as per a physician's prescription. I may be permitted to state here modestly that the Institution which I represent here, the Arya Vaidya Sala of Kottakkal, which was established in 1902 by the late Vaidyaratnam P.S. Varier, played a pioneering role in introducing this modern trend in Ayurveda and thereby helping in its survival and growth.

The principles and practices of pharmacology and all its allied aspects were an important part of classical Ayurvedic scholarship. They are of lesser practical importance these days. This change has taken place as a necessary consequence of the changes that have occurred in the life style of people. This has led to the industrialisation and commercialisation of the Ayurvedic medicine sector. It has naturally resulted in consequential benefits as well as in some disadvantages to the system in general. The original formulations were all envisaged to be prepared in single dose quantities. But the industry can produce only in bulk. This might have resulted in reducing the fidelity and sensitivity of the system. But, that is, perhaps, inevitable, just as it has happened in every other sphere of human endeavour. And it goes without saying that for an ancient system to be able to adapt to the changing times and also to be able to remain a living system, it should necessarily take in its stride

the basic elements of change. And the greatest proof of Ayurveda having done this remarkably is the fact that it still remains as an important health care system for a vast majority of the population of the country.

The organised Ayurvedic drug manufacturing sector is basically of two types. The units belonging to the first group still follow traditional methods and practices to a very large extent with unavoidable and contemporary modifications in the infrastructure. Industries of this group are mostly medium in size and have dedicated regional customer loyalty. The case of the second group is a little different. Here the units have been able to extensively and advantageously implement modern pharmaceutical methodologies and appropriate technology in the fields of production, material handling, marketing etc. Such units are large in size and less in number and their operation has grown globally. There is a third type as well. They are the small scale operators, mostly involving individual efforts. They stick to conventional methods of production and marketing in a localised manner. There are large numbers of them dispersed across the country. Cumulatively they also form a significant part of the Ayurvedic medicine sector.

There are different interesting aspects to this organised drug sector. The basic aspect is that it is still in a state of transition. Its operations are

largely governed by traditional practices. At the same time it cannot escape from the compulsions of the modern society and its accompanying industrial methodologies. Added to these opposing forces is the diverse nature of the very industry as mentioned earlier. All these factors present a rather complex picture which makes it quite difficult to provide simple answers to all the woes that Ayurvedic drug industry in general faces. We shall consider here a few pertinent issues.

As mentioned at the beginning, the Ayurvedic drugs are precariously dependant on the sound support of a large variety of natural resources. The world over, natural resources are a threatened and endangered lot. The Indian Ayurvedic drugs consume about 45000 tones of herbal resources annually. In the next decade this is likely to go up considerably. There are many factors which make the uninterrupted availability of such a quantity quite improbable. Unabated deforestation, indiscreet use of resources, improper preserving techniques, unscientific herb collection methods etc are some of the major problems. An appreciation of the gravity of these problems on the part of the industry and a visionary planning on the part of the policy makers will only be able to surmount this grave situation. There are no easy solutions because Ayurvedic drugs need to have naturally occurring ingredients and not

their synthetic equivalents. This predicament is with respect to the quantity aspect. The case of quality aspect is not much different. Classical texts describe several parameters for the quality standard of the various herbs. They were quite valid at a time when life was much less complex and the nature was much more abundant in its resources. For example, one of the classical statements is that herbs available in the region lying between the Himalayas and the Vindhya ranges are the ideal ones and that uncontaminated rain water collected optimally should be used for processing. Such strictures are beyond the means of the present day drug industry. But, the industry can prudently make use of the vast scientific and technological know-how available now. And, of course, the Government itself is making efforts through its various research institutes to establish and implement physico-chemical procedures as well as identity and quality standards for the herbal ingredients. This is a herculian task considering the fact that the industry uses more than 700 various species for producing 500 or so standard products. This Laboratory, for example, has brought out a Manual giving various salient aspects of herbal standardisation(4). And I think that the present Workshop is a part of its on-going efforts in this direction. It may also be mentioned here that the Bureau of Indian Standards have published(5)

several monograms giving analytical procedures and quality standards for certain groups of ingredient materials and that TLC profiles of many herbs are also documented and published(6).

Setting standards for the finished products is also an important aspect. The traditional practice of relying exclusively on organoleptic characteristics needs to be supplemented by other objective procedures, in these days of globalisation. The Government has come out with an Official set of Pharmacopoeial Standards(7). It specifies several parametrical values for characteristics like saponification and iodine values, pH, alcohol content, loss of weight on drying, specific gravity, refractive index etc etc. They indeed serve a very useful purpose by providing a practical set of guidelines in an area where subjective factors were the only available yardsticks. But, in the case of Ayurvedic drugs, where multiple natural herbs are used instead of synthetic single components and where cooking in various media is a primary step of processing, the physico-chemical parameters have a limitation. Because, they do not say anything about the medicinal property of the product. Hypothetically at least, one can think of an artificial concoction satisfying a set of prescribed physical parameters and yet not being the intended

medicine. Setting Chromatographic finger prints may provide an answer to this problem.

The medicine manufacturing domain is also an important area where the transitional character becomes a decisive factor. This is one area where much updating has already taken place. Earthen pots and wooden vats have been replaced by large size food grade stainless steel vessels, earthen furnaces by electric muffle furnaces, sun drying by controlled electric or steam drying, fire wood by steam boiling etc. The efforts have been guided buy the objective to adapt modern technological innovations without compromising the philosophical spirit of the old strictures. This area also provides a challenge to serious innovators. The drastic fall in the availability of genuine raw herbs makes it imperative that ways should be sought to rationalise and optimise the use of them by employing more efficient and appropriate techniques of cooking. Similarly, energy is a critical factor. Presently the Ayurvedic medicine manufacture is highly energy intensive, time intensive and labour intensive. The industry owes it to the nation and to the world at large to make efforts to introduce innovative procedures with a view to frugalising the use of material, energy and time. Even though the Ayurvedic drugs were in vogue in an informal way for the past many

centuries and in an organised manner in the past one century, the required statutory provisions have been promulgated by the Government only in the last two decades. Now we have official Formulary, Drugs Act, Drug Controlling Authority, Pharmacopoeial Committees etc. There are also many National Institutes engaged in research activities in the various allied fields of Ayurveda. There is an increased awareness among the professionals about the need for multidisciplinary efforts to enhance the inherent strength of the Ayurvedic system. Knowledge of every kind like physics, chemistry and life sciences will have to play important roles in such efforts. Only then will the unique benefits of Ayurveda reach every ailing person in need of its special capabilities. It is my wish that this workshop and similar other efforts will ultimately achieve that objective.

I have not touched upon the important branch of clinical aspects of Ayurveda. That is a very critical area where efforts of updating can be thought of. But that aspect is beyond the scope of this brief note. An attempt has been made here to take a general look at certain aspects of Ayurvedic drug scene rather than to go into statistical details.

Thank you

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2. "The Ayurvedic Formulary of India", in 2 parts, Ministry of Health and Family Welfare, Government of India, Delhi, 1978.

3. "Drugs and Cosmetics Act-1940", Government of India, Delhi.

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7. "Parmacopoeial Standards for Ayurvedic Formulations", 2nd ed; Central Council for Research in Ayurveda and Siddha, Government of India, New Delhi, 1987.

STATUS OF PHYTOCHEMICAL INDUSTRY IN INDIA

Maninder Karan
University Institute of Pharmaceutical Sciences
Panjab University, Chandigarh (India)

ICS-UNIDO Training Workshop on Quality Control of Medicinal and Aromatic Plants and their Prcducts (QCMAPP), June 15-20, 1998, RRL (CSIR), Jammu (India).

DRUG RAW MATERIALS AND PHYTOCHEMICALS

- World trade in plant based drug raw materials and phytochemicals is around 12,000m US $ (33,000m $ by the end of century)

- At present, India's share in world trade is estimated at 0.04% which is quite insignificant considering the large geographical area diverse nature of crops and existence of a fast growing pharmaceutical industrial sector

- Tropane alkaloids market - 100 m $ (US)
  Hyoscyamine/scopolamine- 350 to 1400 $ per kg

- Digitoxin costs Rs. 45,000 per kg and digoxin is more expensive

  Can be produced in the country for export as India possesses both improved cultivars and cultural practices

- Vinca alkaloids - India is third largest producer in the world

- Prominent phytopharmaceuticals produced in India are: quinine, quinidine, morphine, codeine, papaverine, thebaine, emetine, caffeine, hyoscine, hyoscyamine, xanthotoxin, psoralen, colchicine, rutin, berberine, vinblastine, vincristine, nicotine, strychnine, brucine, ergot alkaloids, senna glycosides, pyrethroids and podophyllotoxin resin
- Improved technology for large scale production: L-dopa from *Mucuna* beans; ajmaline and ajmalicine from *Rauwolfia serpentina* and *Catharanthus roseus*; 18 β-acetyl glycyrrhetic acid from *Glycyrrhiza glabra*; etoposide, tenoposide, VLB, VCR

- Quinine: India's monopoly due to elimination of two other potential sources (Java and Indonesia) Good demand both with in the country and abroad
- Steroid industry- *Dioscorea composita, D.floribunda; Solanum khasianum* Diosgenin and solasodine —> 16DPA (first main intermediate)
- Opium alkaloids – morphine, codeine, thebaine, narcotine and papaverine

  Morphine– only 1% used as such in medicine and 90% is converted to codeine

  Manufacturing units– Government Opium and Alkaloid Works Undertaking at Ghazipur (U.P.) and Neemuch (M.P.)
- Tropane alkaloids– *Atropa belladonna, A. acuminata, Datura stramonium, D. innoxia* and *Physochlaina prealta*

- Xanthotoxin (a photosensitizing agent)- *Ammi majus, Heracleum*

  Mac Laboratories, Bombay and Himalaya Drugs Ltd. Delhi are pioneers in its production

- Rutin– *Eucalyptus youmanii* and *E. macrorhyncha*
- Podophyllotoxin– *Podophyllum emodi* (syn. *P. hexandrum,* Indian podophyllum*);* content up to 4% (free of peltatins); *P. peltatum* (American podophyllum)

  Tenoposide, etoposide (marketed by Cipla)

- Coleonol– CDRI, Lucknow; Hoechst India Ltd. 'FORSKOLIN'
- Berberine– Constant export to Japan for last three decades
- Emetine– Demand for natural emetine by the developed countries is met by India.
- *Plantago ovata* (psyllium, Isabgol)– India is the sole supplier

- Annato dye
- 'Neem' Products
- Agar- agar
- Katha and Cutch Industry
- Antihyperlipoproteinemic drug Gugulipid- CDRI; Cipla

INDUSTRY BASED ON AROMATIC PLANTS AND PERFUMERY COMPOUNDS

- India is second largest producer and exporter of Jasmine and Tube-rose concrete to the world market
- Garlic oil– needs immediate attention of the industry
- CHEMEXIL (Bombay) currently estimated India to have a total perfume market valued at Rs 318.5 crore which is less than 2% of the total world market in perfumery products.

Table-1: Annual consumption figures (kg) of some medicinal plants by herbal drug industry in India 1996-97 (after Handa,1998)

Saussurea lappa	*1,66,849*	*Aconitum ssp*	*11,670*
Acorus calamus	*1,09,760*	*Rauwolfia serpentina*	*11,082*
Hydnocarpus species	*72,645*	*Aristolochia species*	*6,460*
Commiphora wightii	*68,383*	*Costus speciosus*	*2,186*
Aquilaria malaccensis	*48,599*	*Colchicum luteum*	*1,637*
Taxus baccata	*23,635*	*Atropa belladonna*	*1,628*
Strychnos potatorum	*23,425*	*Didymoarpus pedicellata*	*1,527*
Swertia chirata	*23,185*	*Orchidacea spp*	*1,437*
Pterocarpus santalinus	*15,873*	*Hyoscyamus niger*	*1,055*
Nardostachys jatamansi	*14,228*	*Rheum emodi*	*235*

Table-2: Indian Herbal Drug Industry(after Handa, 1998)

		Rs. (Crores)
TOTAL TURNOVER OF HERBAL PRODUCTS		2,300
OTC products (including cosmetics)	1,200	
Ay. Ethical formulations	650	
Ay. Classical formulations	450	
RAW MATERIAL REQUIREMENTS (MED. PLANTS)		300
For OTC products	120	
For Ethical formulations	60	
For Classical formulations	60	
For Traditional vaidyas	40	
For Home remedies	20	
EXPORT TURN OVER		255
Herbal exts & essential oils	110	
Herbal drugs	145	

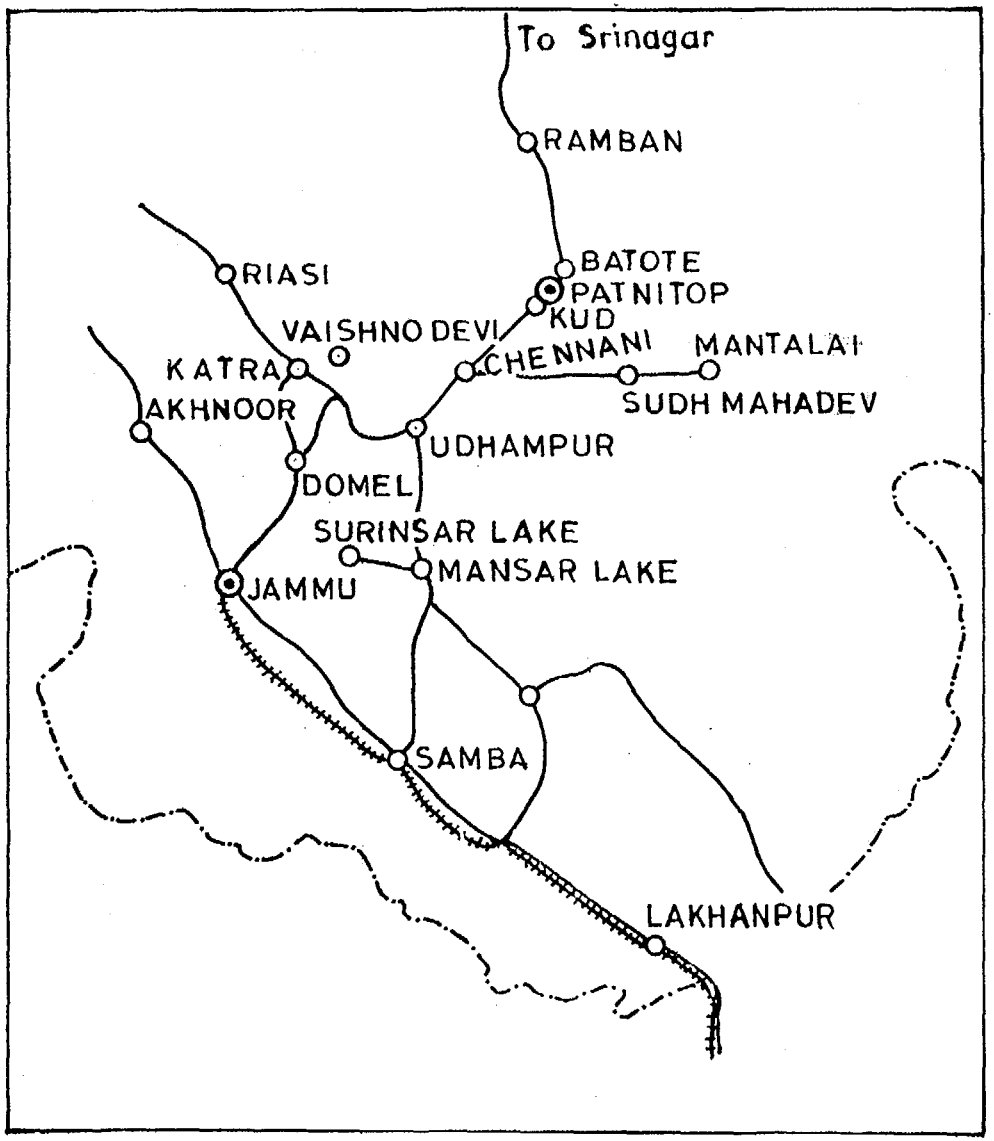
Table-3: Area and production of major essential oils in India (after Sharma et.al., 1996)

Aromatic plants/oils	Production India (tons)	Production World (tons)
1. Japanese mint *(Mentha arvensis)*	6,000	13,000
2. Pepper mint *(M. piperita)*	100	2,000
3. Bergamot mint *(M. citrata)*	90	200
4. Spearmint *(M. spicata)*	150	1,500
5. Basil *(Ocimum basilicum)*	200	250
6. Citronella Java *(Cymbopogon winterianus)*	500*	1600-1750 (600+)
7. Lemongrass *(C. flexuosus)*	600*	800-1300
8. Palmarosa *(C. martinii var. motia)*	60*	70
9. Vetiver *(Vetiveria zizanioides)*	30*	250
10. Geranium *(Pelargonium graveolens)*	20*	245-265
11. Dill seed *(Anethum graveolens)*	25*	300
12. Cedar wood *(Cedrus deodara)*	100*	700-1400
13. Eucalyptus *(E. citriodora* and *E. globulus)*	80*	1600-1750
14 Sandal wood *(Santalum album)*	60*	250-350
15. Damask rose *(Rosa damascena)*	0.001	15-20
16. Davana *(Artemisia pallens)*	2+	2
17. Ginger *(Zingiber officinalis)*	15	50
18. Patchouli *(Pogostemom cablin)*	N.A.	500-550
19. Lavender *(Lavandula angustifolia)*	0.25+	200
20. Lavandin *(L. intermedia)*	0.10+	750
21. Cardamom *(Eletiana cardomomum)*	300+	N.A.
22. Celery seed *(Apium graveolens)*	1+	N.A.
23. Cinnamon leaf *(Cinnamomum verum)*	5+	100
24. Clary sage *(Salvia sclarea)*	0.3+	100
25. Linaloe *(Bursera delpechiana)*	50+	NA
26. Ajowain *(Trachyspermum ammi)*	25+	NA
27. *Artemisia vestita*	0.1+	NA
28. Jasmine *(Jasminum grandiflorum)*	0.1+	12-15
29. Ylang-ylang *(Cananga odorata)*	N.A.	120-130
30. Chamomile *(Chamomilla recutita)*	N.A.	N.A.

+Largely estimated values;* Relate to 1988-89 and rest for 1992

Table-4: Export of major essential oils from India during the year 1994-95 (after Sharma et.al., 1996)

	Essential oil	Quantity	Value (tons)	Major importing countries (Rs. in lakhs)	Other exporting countries
1.	Lemongrass oil	65.1	174.1	Russia, U.K., USA, Australia, France, Germany	Guatemala (threatening our position)
2.	Palmarosa oil	5.4	35.0	France, Germany, Netherlands, Switzerland, USA, U.K.	Brazil (threatening our position) Australia, Singapore
3.	Japanese mint oil	695.4 (118.7) 586.5 (710.3)	1187.2 (3200.0) 1895.8 (2505.6)	USA, West Europe, Singapore, CIS, Germany, Japan, Australia,	China (threatening our position), Brazil UAE, U.K.
4.	Eucalyptus oil	15.3	22.60	West Europe, USA, Japan, Spain, UAE, France	China, Brazil, Australia, Spain
5.	Ginger oil	5.8	80.9	USA, EEC, Japan, Korea,	China Singapore, Turkey, Australia
6.	Sandalwood oil	27.4	1604.3	USA, West Europe, Australia,	Indonesia U.K.
7.	Others	-	563.0		



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ICS-UNIDO TRAINING WORKSHOP ON
QUALITY CONTROL OF MEDICINAL AND
AROMATIC PLANTS AND THEIR PRODUCTS

Regional Research Laboratory,
Jammu-Tawi.

PATNITOP

ANNEXURE—V

Colchicum luteum Baker

an introduction

ICS-UNIDO Training Workshop on quality Control of Medicinal and aromatic plants and their products (QCMAPP) June 15-20, 1998.

RECOMMENDATIONS

At the end of the workshop all the participants, consultants, faculty participated in the discussion and the following recommendations emerged.

1. Initiative taken by the ICS for holding this workshop on Quality Control of Medicinal and Aromatic Plants was greatly appreciated and it was felt that this is useful model for organising future workshops. Structure of such workshops should include sufficient time for practical training and discussion as was done in the present case.

2. As a follow up of the training activity it is proposed that ICS considers setting up network of associated centres which are centres of excellence in specialized areas of Industrial Utilization of medicinal and aromatic plants.

3. As a part of the TCDC programme, a scheme of short-term fellowships of 3-6 months should be initiated in order to train scientific personnel from developing countries at the associated centers and they be given some seed money to initiate activities after their return to their respective countries.

4. Exchange of consultants within the developing countries need to be encouraged by providing some financial support.

5. ICS may provide financial assistance for establishing Repository of reference marker compounds for promoting work on standardization and quality control of medicinal and aromatic plants and their products.

6. At present there is no consolidated document on the institutes/organisations/industries involved in the development of medicinal and aromatic plants in the region. Thus, steps may be initiated to procure information from developing countries on the institutes/Organisation/industries so that a compilation could be made.

7. Manual on Bioactivity Screening which is in the process of publication is a step in the right direction. There is a need to develop similar manuals on other aspects such as agrotechnology including post harvest techniques, authentication and standardization, process development, formulation techniques, safety and therapeutic evaluation and IPR issues on medicinal and aromatic plants.

ANNEXURE VII

WORKSHOP FACULTY

NAME	SPECIALIZATION
1. DR.K.L.BEDI	BIOPHARMACUTICS
2. DR.O.P.GUPTA	PHARMACOLOGY
3. MR.C.L.TIKOO	CHEMICAL ENGINEERING
4. DR.R.K.THAPPA	NATURAL PRODUCT CHEMISTRY
5. DR.T.N.SRIVASTAVA	PLANT TAXONOMY
6. DR.C. SINGH	PLANT AGRONOMY
7. DR.JASWANT SINGH	BIOCHEMISTRY
8. DR.B.K.KAPAHI	PLANT TAXONOMY & SURVEY
9. DR.R.K.MAURYA	NATURAL PRODUCT CHEMISTRY
10.DR.DEEPA SINGH	NATURAL PRODUCT CHEMISTRY

RESOURCE PERSONS

1. PROF. TULEY de SILVA International Resource Person	Pharmaceutical Chemistry
2. PROF. B. N. DHAWAN National Resource Person	Pharmacology
3. PROF. S. S. HANDA Course Director	Pharmacognosy & Phytochemistry

DATEWISE FACULTY

15.06.1998

1. Prof. S.S. Handa
2. Dr. T.N. Srivastava

16.06.1998

1. Dr. Charan Singh
2. Dr. B.K. Kapahi

17.06.1998

1. Dr. K.L. Bedi
2. Dr. C.L. Tikoo
3. Dr. R.K. Maurya
4. Dr. Deepa Singh

18.06.1998

1. Dr. R.K. Thappa
2. Dr. Jaswant Singh
3. Dr. B.N. Dhawan
4. Dr. O.P. Gupta

20.06.1998

1. Dr. B.N. Dhawan

June 15, 1998 (Monday)

Registration	9.00 - 9.10
Invocation	9.10 - 9.20
Welcome address (Prof. S. S. Handa)	9.20 - 9.30
Introduction to the Workshop (Prof. T. de Silva)	9.30 - 9.40
Inaugural address (Prof. N. K. Ganguli, DG ICMR)	9.40 - 10.00
Keynote address (Prof . B.N. Dhawan)	10.00 - 10.
Vote of Thanks	10.30 - 10.
Tea	10.35 - 11.
Country presentations :	11.15 - 12.
Ms. Juthamas Thiangtham, Thailand	
Ms. Merle Villanueva, Philippines	
Mr. Mudiyaselage Tennakoon, Srilanka	
Mrs. Jaishree Sijapati, Nepal	
Mr. Mustapha Nik Musa "Adah, Malaysia	
Mrs. Somsanith Bouamanivong. Lao PDR	
Mr. Mohd. Nazrul Islam, Bangladesh	
Mr. Ganbaatar Jansranjav, Mongolia	
Dr. P.M. Varier, India	
Mr. Amit Agarwal, India	
Mr. Munish Kapoor, India	
Mrs. Maninder Karan, India	
Lunch	12.30 - 1
Standardization and quality control of Medicinal Plants & their products. (Prof. S. S. Handa)	13.30 -
Tea	14.30 -
Visit to Herbarium- Demonstration and Practical on plant drug identification and authentication of MAPs.	15.00 -

June 16, 1998 (Tuesday)

Visit to Chatha Farm for 'on the spot' study on cultivation, drying and storage of MAPs.	8.30 - 10.30
Role of a Chemist in development of good quality plant based products (Prof. T. de Silva)	10.30 - 11.30
Good cultivation practices and post harvest management MAPs (Lecture: Dr. Charan Singh)	11.30 - 12.30
Lunch	12.30 - 13.30
Organoleptic,macroscopic and microscopic examination for authentication of MAPs (Lecture : Dr.B. K. Kapahi)	13.30 - 14.30
Practical and Demonstration on Crude drug identification (in Crude Drug Museum), microscopic examination and staining of slides and determination of microbial count in medicinal plants.	14.30 - 17.30

June 17, 1998 (Wendnesday)

Extraction procedures (Lecture : Dr. K. L. Bedi)	9.00-9.45
Processing technology (Lecture: Shri C. L. Tikoo)	9.45-10.30
Isolation of markers from medicinal plants (Lecture : Dr. R. K. Maurya)	10.30-11.00
Demonstration on Physicochemical parameters their determination ;visit to pilot plant for demonstration on extraction process.	11.00-13.00
Lunch	13.00-14.00
Chromatographic finger print profile of Medicinal plants and their products (Lecture : Dr. Deepa Singh)	14.00-14.45
Demonstration and practical training on HPLC and HPTLC densitometric techniques.	14.45-17.30

June 18 ,1998 (Thursday)	
Biocvalution by *in vitro* techniques(Lecture: Dr. Jaswant Singh)	9.00 - 9.45
Biocvalution by *in vivo* techniques (Lecture: Prof .B.N.Dhawan)	9.45 - 10.30
Biocvalution by *in vivo* techniqoes (Lecture : Dr. O. P. Gupta)	10.30 - 11.15
Practical demonstration on *in vitro*techniques(B ochemistry Lab)	11.15 - 13.30
Lunch	13.30 - 14.30
Qualitative / Quantitative GLC techniques for MAPs (Lecture : Dr. R. K. Thappa)	14.30 - 15.30
Stability testing of Plant Drugs (Lecture: Dr. K. L. Bedi)	15.30 - 16.00
Demonstration and Practical training on GLC/GCMS (essential oil) and stability studies of plant preparations	16.00 - 18.00
June 19 , 1998 (Friday)	
Field trip to Patnitop for medicinal and aromatic plant collection in nature and ' on the spot ' taxonomical identification.	8.00 - 20.00
June 20 , 1998 (Saturday)	
Safety evalation (Lecture : Prof . B. N. Dhawan)	9.00-10.00
Practicals/demonstration on various pharmacological techniques (*in vivo*) on bioevaluation of plant drug	10.00-13.00
Lunch	13.00-14.00
Visit to Natural Products Chemistry Division and Essential Oil Section	14.00-14.30
Visit to Biotechnology Division	14.30-15.00
Visit to Food Technology Division	15.00-15-30
Visit to Instrumentation Division	15.30-16.00
Technical Evaluation	16.00-16.30
Discussin on technical assistance-needs & Co-operation among Countries	16.30-17.00
Concluding Session	17.00-17.30

June 15, 1998

⇨	Practical demonstration : Pharmacopoeial procedures for determination of quantitative standards.	IDMA Lab.	A.N.
⇨	Practical demonstration : Botanical identification of plant drugs - Part I	Herbarium	A.N.
⇨	Practical Manual for plant anatomy - Part II	---------- do----------	

June 16, 1998

⇨	Practical demonstration : Crude drug identification, microscopic examination, staining of slides and determination of microbial count in herbal drugs	IDMA Lab.	F.N.

June 17, 1998

⇨	Demonstration on extraction process in pilot plant	Bay No. 2	F.N.
⇨	Demonstration on physicochemical parameters and their determination	Dr. Maurya's Lab.	F.N.
⇨	Demonstration and practical training on HPLC and HPTLC- densitometric techniques	ICMR Lab.	A.N.

June 18, 1998

⇨	Practical demonstration Part I : Procedure for screening of plant extracts/isolates for anti- hepatotoxicity activity in rat primary monolayer cultures. Part II : *In-vitro* screening of anticancer activity	Bio-chem. Lab.	F.N.
⇨	Demonstration and practical training on GLC/GCMS of essential oils.	Dr. Thapa's Lab.	A.N.
⇨	Practical demonstration on stability studies of plant preparations	Biopharm. Lab.	A.N.

June 20, 1998

⇨	Practical demonstration on various pharmacological techniques *in-vivo* on bioevalution of plant drugs.	Pharmacol. Lab.	F.N.

ICS-UNIDO Training Workshop on quality Control of Medicinal and aromatic plants and their products (QCMAPP) June 14-21, 1998.

14.6.1998 (Sunday)

11.00 AM	Mr. L.C.Sharma Dr.B.K.Kapahi	Reception of participants at the Airport lodging them in Asia Hotel, and RRL Guest House.
1.00 PM	Mr.L.C.Sharma Dr.B.K.Kapahi	Receiving the delegates at Asia Hotel and to bring to RRL,Jammu for guest house and dropping them back in Asia Hotel.
2.30 PM	Dr.B.K.Kapahi	Visit of participants to Mansar Lake.

15.6.1998 (Monday)

8.30 AM		Asia Hotel to RRL,Jammu
5.30 PM		RRL to Asia Hotel
6.30-7.45PM	Dr.Jaswant Singh	Visit to Hari Palace

16.6.1998 (Tuesday)

8.30 AM		RRL to Asia Hotel and back
3-6 PM	Dr.Gandhi Ram Dr.S.S.Balyan	Visit to Chatha Farm Saplings to be planted by the delegates
6.30-7.45 PM	Dr.Charan Singh	Visit to Baghe-Bahu

17.6.1998 (Wednesday)

8.30 AM		RRL to Asia Hotel and back
5.30 PM		RRL to Asia Hotel
6.30-7.45 PM	Dr.Y.S.Bedi	Raghunath Temple, Shiv Temple

18.6.1998 (Thursday)

8.30 AM		RRL to Asia Hotel and back
5.30-7.45 PM	Sh.N.K.Gupta	Visit to Akhnoor, Chinab River

19.6.1998 (Friday)

8.00AM to 8 PM		Visit to Patnitop

20.6.1998 (Saturday)

8.30 AM		RRL to Asia Hotel and back
5.30 PM		RRL to Asia Hotel
6.30-7.45 PM	Dr.S.Malhotra	Visit Raghunath Market for shopping

21.6.1998 (Sunday)

12.00 Noon	L.C.Sharma	RRL to Airport, RRL-Asia Hotel-Airport

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20.06.1998

1. Dr. B.N. Dhawan

June 16, 1998 (Tuesday)

Good Cultivation practices and post harvest Management MAPs (Lecture)	09.00-10.00
Organoleptic, macroscopic and microscopic examination for authentication of MAPs (Lecture)	10.00-11.00
Practical and Demonstration on Crude drug identification (in crude Drug Museum) and Microscopic examination and staining of slides	11.00-13.00
Lunch	13.00-15.00
Visit to Chatha Farm for 'on the spot' study on cultivation, drying and storage of MAPs	15.00-18.00

June 17, 1998 (Wednesday)

Processing technology & extraction procedures (Lecture)	09.00-09.45
Isolation of markers from Medicinal Plants (Lecture)	09.45-10.30
Demonstration on Physicochemical parameters and their determination; visit to pilot plant for demonstration on extraction processes	10.30-13.00
Lunch	13.00-14.00
Chromatographic finger print profile of Medicinal Plants & their products (lecture)	14.00-14.45
Demonstration and practical training on HPLC & HPTLC densitometric techniques	15.00-17.30

June 18, 1998 (Thursday)

Qualitative/Quantitative GLC techniques for MAPs (Lecture)	09.00-10.00
Stability Testing of Plant Drugs (Lecture)	10.00-10.30
Demonstration and Practical training on GLC/GCMS (essential oil) and stability studies of plant preparations	10.30-13.00
Lunch	13.00-14.00
Bioevaluation by *in vitro* techniques (Lecture)	14.00-15.00
Bioevaluation by *in vivo* techniques (Lecture)	15.00-16.00
Practical demonstration on *in vitro* techniques (biochemistry Lab)	16.00-17.50

June 19, 1998 (Friday)

Field Trip to Patnitop for medicinal aromatic plant collection in nature and 'on the spot' taxonomical identification	08.00-20.00

June 20, 1998 (Saturday)

Safety evaluation (Lecture)	09.00-10.00
Practicals/demonstration on various pharmacological techniques (*in vivo*)	10.00-13.00

Cover Photograph : ***Bergenia ligulata*** **(Wall.) Engl.**

PROGRAMME

June 15, 1998 (Monday)

Registration	9.00 - 9.10
Invocation	9.10 - 9.20
Welcome address (Prof. S. S. Handa)	9.20 - 9.30
Introduction to the Workshop (Prof. T. de Silva)	9.30 - 9.40
Inaugural address (Prof. N. K. Ganguli, DG ICMR)	9.40 - 10.00
Keynote address (Prof. B.N. Dhawan)	10.00 - 10.30
Vote of Thanks	10.30 - 10.35
Tea	10.35 - 11.15
Country presentations :	11.15 - 12.30
Ms. Juthamas Thiangtham, Thailand	
Ms. Merle Villanueva, Philippines	
Mr. Mudiyaselage Tennakoon, Srilanka	
Mrs. Jaishree Sijapati, Nepal	
Mr. Mustapha Nik Musa "Adah, Malaysia	
Mrs. Somsanith Bouamanivong, Lao PDR	
Mr. Mohd. Nazrul Islam, Bangladesh	
Mr. Ganbaatar Jansranjav, Mongolia	
Dr. P.M. Varier, India	
Mr. Amit Agarwal, India	
Mr. Munish Kapoor, India	
Mrs. Maninder Karan, India	
Lunch	12.30 - 13.30
Standardization and quality control of Medicinal Plants & their products. (Prof. S. S. Handa)	13.30 - 14.30
Tea	14.30 - 15.00
Visit to Herbarium- Demonstration and Practical on plant drug identification and authentication of MAPs.	15.00 - 17.30

June 16, 1998 (Tuesday)	
Visit to Chatha Farm for 'on the spot' study on cultivation, drying and storage of MAPs.	8.30 - 10.30
Role of a Chemist in development of good quality plant based products (Prof. T. de Silva)	10.30 - 11.30
Good cultivation practices and post harvest management MAPs (Lecture: Dr. Charan Singh)	11.30 - 12.30
Lunch	12.30 - 13.30
Organoleptic,macroscopic and microscopic examination for authentication of MAPs (Lecture : Dr.B. K. Kapahi)	13.30 - 14.30
Practical and Demonstration on Crude drug identification (in Crude Drug Museum), microscopic examination and staining of slides and determination of microbial count in medicinal plants.	14.30 - 17.30
June 17, 1998 (Wendnesday)	
Extraction procedures (Lecture : Dr. K. L. Bedi)	9.00-9.45
Processing technology (Lecture: Shri C. L. Tikoo)	9.45-10.30
Isolation of markers from medicinal plants (Lecture : Dr. R. K. Maurya)	10.30-11.00
Demonstration on Physicochemical parameters their determination ;visit to pilot plant for demonstration on extraction process.	11.00-13.00
Lunch	13.00-14.00
Chromatographic finger print profile of Medicinal plants and their products (Lecture : Dr. Deepa Singh)	14.00-14.45
Demonstration and practical training on HPLC and HPTLC densitometric techniques.	14.45-17.30

June 18 ,1998 (Thursday)

Bioevalution by *in vitro* techniques(Lecture: Dr. Jaswant Singh)	9.00 - 9.45
Bioevalution by *in vivo* techniques (Lecture: Prof.B.N.Dhawan)	9.45 - 10.30
Bioevalution by *in vivo* techniqoes (Lecture : Dr. O. P. Gupta)	10.30 - 11.15
Practical demonstration on *in vitro* techniques(Biochemistry Lab)	11.15 - 13.30
Lunch	13.30 - 14.30
Qualitative / Quantitative GLC techniques for MAPs (Lecture : Dr. R. K. Thappa)	14.30 - 15.30
Stability testing of Plant Drugs (Lecture: Dr. K. L. Bedi)	15.30 - 16.00
Demonstration and Practical training on GLC/GCMS (essential oil) and stability studies of plant preprations	16.00 - 18.00

June 19 , 1998 (Friday)

Field trip to Patnitop for medicinal and aromatic plant collection in nature and ' on the spot ' taxonomical identification.	8.00 - 20.00

June 20 , 1998 (Saturday)

Safety evalation (Lecture ; Prof . B. N. Dhawan)	9.00-10.00
Practicals/demonstration on various pharmacological techniques (*in vivo*) on bioevaluation of plant drug	10.00-13.00
Lunch	13.00-14.00
Visit to Natural Products Chemistry Division and Essential Oil Section	14.00-14.30
Visit to Biotechnology Division	14.30-15.00
Visit to Food Technology Division	15.00-15-30
Visit to Instrumentation Division	15.30-16.00
Technical Evaluation	16.00-16.30
Discussin on technical assistance-needs & Co-operation among Countries	16.30-17.00
Concluding Session	17.00-17.30

June 15, 1998

⇨ Practical demonstration : Pharmacopoeial procedures for determination of quantitative standards.	IDMA Lab.	A.N.
⇨ Practical demonstration : Botanical identification of plant drugs - Part I	Herbarium	A.N.
⇨ Practical Manual for plant anatomy - Part II	---------- do----------	

June 16, 1998

⇨ Practical demonstration : Crude drug identification, microscopic examination, staining of slides and determination of microbial count in herbal drugs	IDMA Lab.	F.N.

June 17, 1998

⇨ Demonstration on extraction process in pilot plant	Bay No. 2	F.N.
⇨ Demonstration on physicochemical parameters and their determination	Dr. Maurya's Lab.	F.N.
⇨ Demonstration and practical training on HPLC and HPTLC- densitometric techniques	ICMR Lab.	A.N.

June 18, 1998

⇨	Practical demonstration Part I : Procedure for screening of plant extracts/isolates for anti- hepatotoxicity activity in rat primary monolayer cultures. Part II : *In-vitro* screening of anticancer activity	Bio-chem. Lab. F.N.
⇨	Demonstration and practical training on GLC/GCMS of essential oils.	Dr. Thapa's Lab. A.N.
⇨	Practical demonstration on stability studies of plant preparations	Biopharm. Lab. A.N.

June 20, 1998

⇨	Practical demonstration on various pharmacological techniques *in-vivo* on bioevalution of plant drugs.	Pharmacol. Lab. F.N.

ICS-UNIDO Training Workshop on quality Control of Medicinal and aromatic plants and their products (QCMAPP) June 14-21, 1998.

14.6.1998 (Sunday)

11.00 AM	Mr. L.C.Sharma Dr.B.K.Kapahi	Reception of participants at the Airport lodging them in Asia Hotel, and RRL Guest House.
1.00 PM	Mr.L.C.Sharma Dr.B.K.Kapahi	Receiving the delegates at Asia Hotel and to bring to RRL,Jammu for guest house and dropping them back in Asia Hotel.
2.30 PM	Dr.B.K.Kapahi	Visit of participants to Mansar Lake.

15.6.1998 (Monday)

8.30 AM		Asia Hotel to RRL,Jammu
5.30 PM		RRL to Asia Hotel
6.30-7.45PM	Dr.Jaswant Singh	Visit to Hari Palace

16.6.1998 (Tuesday)

8.30 AM		RRL to Asia Hotel and back
3-6 PM	Dr.Gandhi Ram Dr.S.S.Balyan	Visit to Chatha Farm Saplings to be planted by the delegates
6.30-7.45 PM	Dr.Charan Singh	Visit to Baghe-Bahu

17.6.1998 (Wednesday)

8.30 AM		RRL to Asia Hotel and back
5.30 PM		RRL to Asia Hotel
6.30-7.45 PM	Dr.Y.S.Bedi	Raghunath Temple, Shiv Temple

18.6.1998 (Thursday)

8.30 AM		RRL to Asia Hotel and back
5.30-7.45 PM	Sh.N.K.Gupta	Visit to Akhnoor, Chinab River

19.6.1998 (Friday)

8.00AM to 8 PM		Visit to Patnitop

20.6.1998 (Saturday)

8.30 AM		RRL to Asia Hotel and back
5.30 PM		RRL to Asia Hotel
6.30-7.45 PM	Dr.S.Malhotra	Visit Raghunath Market for shopping

21.6.1998 (Sunday)

12.00 Noon	L.C.Sharma	RRL to Airport, RRL-Asia Hotel-Airport

TRAINING WORKSHOP ON QUALITY CONTROL OF MEDICINAL AND AROMATIC PLANTS AND THEIR PRODUCTS, JAMMU, INDIA JUNE 15-20, 1998

ANNEXURE IX

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ANNEXURE X

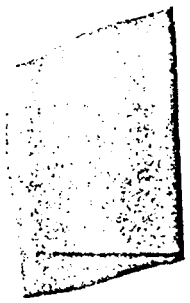
The Indian EXPRESS J&K Newsline
NEW DELHI (J&K) ■ WEDNESDAY ■ JUNE 17, 1998

Experts speak on aromatic, medicinal plants

EXPRESS NEWS SERVICE
JAMMU, JUNE 16

LECTURES and demonstrations marked the second day of the ICS-UNIDO training workshop on quality control of medicinal and aromatic plants and their products being held at the Regional Research Laboratory here.

The day began with a lecture on good cultivation practices and post-harvest management of medicinal and aromatic plants (MAPs) by Dr Charan Singh. It was followed by a lecture on Organoleptic, macroscopic and microscopic examination for authentication of MAPs.



Gupta.

'Formula must for preparation of herbal drugs'

SAMEER BHASIN
JAMMU, JUNE 18

HERBAL drugs can be considered free of toxicity if manufactured according to the standard formulae of Ayurvedic or Unani system of medicine. A slight alteration from the formula will put them in a new drug category, safety data of which is needed to be generated and thus required to be brought under regulatory control.

Dr B N Dhawan, retired director of Central Drug Research Institute told *J&K Newsline* that ayurvedic drugs are considered to be comparatively safer because of no reported side effects, unless some new observations prove otherwise. In the allopathic drugs, he added, there are certain molecules which are not always accepted by the human body, he said.

Dr Tuley De Silva, consultant with the ICS, Italy informed that ayurveda and herbal are two different concepts. While ayurveda has been known for its efficacy from times immemorial, herbal is the ultra-modern scientific concept.

A drug is termed to be ayurvedic, only if it is manufactured strictly according to the historic text of this science, he said, adding, any deviation in its composition may affect its fidelity. A fresh documentation after a thorough study of such herbal drug has to be established, he said.

"Sometimes it happens that the manufacturer in order to cut down the production cost may deliberately not use a particular constituent as mentioned in the ayurvedic text or there is some error while preparing a medicine," Tuley said while explaining the importantance of the adherence to the formula. "In that case the medicine cannot be called an ayurvedic one," he warned

Dr S S Handa, director of Regional [illegible]

while in olden times, fresh plants were used to prepare ayurvedic medicines, today, the plants are made available through the sellers. The plants acquired, thus lose their freshness and many of their benefits are lost.

Dhawan and Tuley are among the experts attending a five-day Training Workshop on 'Quality Control of Medicinal and Aromatic Plants and Their Products', organised by the International Centre for Science and High Technology (ICS), Trieste, Italy and United Nation Industrial Development Organisation (UNIDO). Vie[illegible]

Quality must for exploring India's huge herbal potential'

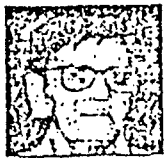
IANT SOOD
JUNE 17

E tall claims of herbal product anufacturers may soon be a thing past. The research now being n the country on aromatic and inal plants will ensure that the made by companies about their ased products are not only true e the promised result each and ime these are purchased by the ers.

essing the need for standardisa- this sector, experts gathered here training workshop on 'Quality l of medicinal and aromatic plants eir products' say that developing ies like India which were incredi- diverse had a great stake in de- ng fool-proof processes and high- products derived from medicinal omatic plants.


Dr B N Dhawan


Dr De Silva


Prof S S Handa

B N Dhawan, former director, CDRI, Lucknow and National Resource Person for the workshop, says that an Allopathic drug, even if manufactured by 50 companies, would always give the same result but this cannot be said about the Ayurveda and Unani drugs. Stressing on exploring and developing the inherent richness of these native systems, he says that the new methods of research can help bring out facts and processes not known before.

Dhawan says that with an eye on the $ 50 billion worth annual trade in medicinal plants, expected to touch $ 5 trillion by 2050 AD, the multi-nationals pharmaceutical giants are seeking to develop the high-quality processes and products using the knowledge and material of the developing countries. "Since there is no restriction on the export of germplasm under the International Bio-diversity Convention, we have to be particularly careful about not losing what we have been practicing for years. Instead of the crude we should be exporting the value-added product", he says.

Favouring South-South cooperation in the field of medicinal and aromatic plants, Dr De Silva, International Resource Person from UNIDO, says that the method adopted need not be sophisticated but should be reliable. Maintaining that India was leading the other developing countries, he said that the Regional Research Laboratory, Jammu, had established itself as an international centre of excellence in the field and its experts were sought after by a large number of developing countries.

Talking of the challenge before the developing countries, he said that not only have they to lay stress on quality and packaging but ensure that harnessing of plant resources does not lead to violation of the the new environment norms. He said that the native systems of medicine in Sri Lanka were also similar to those in India.

S S Handa, Director, RRL, Jammu, informed that the laboratory's work in the field of medicinal plants had reached the farms and industries all over the country. "The quality of the germplasm of hops with us is the best in the world and menthol (popular as peppermint) which the country imported not long ago is being now produced here in the largest quantity", he said.

Asserting that the drug control administration in the country was not adequately trained to test the quality of Ayurvedic drugs, he called for setting up a separate directorate for the purpose. Handa said that at present, many cosmetic manufacturers were exploiting the provisions of Drug and Cosmetic Act, 1940, by labelling their contraptions as herbal products.

The workshop being held at the RRL here has delegates from the eight developing Asian countries besides four from India and is being sponsored by the International Centre for Science and High Technology, Italy and United National Industrial Development Organisation, Vienna, Austria.

I request the Chief Minister and Fi rious view of the whole issue and provi who has deposited sales tax under the o interest free loan for the excess amour and also provide the benefit of the SC rowers who have cleared their loans scheme.

L

Not a wise decision

THE announcement of State Gover cation would be curtailed to one mon two months, should not be looked up a view the trouble, students from hilly a face. Since students of areas like Bu Doda have to cover lot of distance to becomes difficult for them to move in t water inundates the areas for days alto have to cross many *nullahs* and hence The government should reconside closure of the schools in Jammu provin far as teachers are considered, they sh but be engaged in some other works as of other departments.

T R

The Indian EXPRESS J&K Newsline
NEW DELHI (J&K) ■ TUESDAY ■ JUNE 16, 1998

Workshop on medicinal plants opened

EXPRESS NEWS SERVICE
JAMMU, JUNE 15

A TRAINING workshop on Quality Control of Medicinal and Aromatic Plants and their Products organised by the Regional Research Laboratory (RRL) was inaugurated here today. The workshop has been sponsored by the (International Centre for Science and High Technology, Italy, and the United National Industrial Development Organisation, Vienna, Austria. Besides delegates from our country, the workshop is being attended by delegates from the country, and from eight Aisan countries viz. Sri Lanka, Bangladesh, Vientiane (Lao PDR), Thailand, Malaysia, Mongolia, Nepal and Philippines.

The workshop was inaugurated by Prof N K Ganguly, Director General, Indian Council of Medical Research, by lighting the lamps. During his inaugural address, Prof Ganguly said that he was highly impressed by the work done by RRL in the fields of Botanical Sciences and on the development of Herbal Drugs. He said that the Advanced Centre of ICMR and RRL have done a tremendous job by short-listing 50 plants out of 500 plants of medicinal importance. Some of the drugs have reached clinical trial stage, Prof Ganguly said. The two manuals prepared by RRL for the training of the people in the herbal drug profession will go a long way to help focus on Rasayana, Ayurvedic Drugs and Pharmacological practices.

Prof Ganguly stressed the need for standardising the products from indigenous plants by resorting to chemical and DNA finger printing. He said that standardisation of the extracts was very important to keep intact the active principles and eliminate chances of undersirable components.

Keeping in view the depletion of natural resources, Prof Ganguly said that Tissue Culture programmes should be initiated on a large-scale for replenishing the depleting herbal drugs and also for the development of new varieties. He said that National Germplasms Bank of Medicinal and Aromatic Plants should be created.

Earlier, Prof S S Handa, Director, RRL, Jammu, while presenting the welcome address, said that the annual value of medicinal plants derived from developing countries is to the tune of US $ 50 billion. Resurgence of interest in the herbal drugs in the western and European countries has really enhanced the consumption of medicinal plants manifold. He further said that the estimates of the World Bank Report 1996 put the figure of World Trade in medicinal plants and related products at US $ 5 trillion by 2050 AD.

Dr T de Silva, International Resource Person from ICS, Trieste, Italy, while introducing the workshop, said that the thrust of ICS shall be on enhancing the quality of herbal products in Asian countries which are given to the customers without standardisation.

Prof B N Dhawan, former Director, Central Drug Research Institute, Lucknow, delivered the key-note address and said that the Late Col Sir R N Chopra had come out with a document in 1935 wherein he had stressed that medicinal plants should be subjected to botanical diagnosis, pharmacological evaluation, toxicology studies and bioassay procedures.

DAILY EXCELSIOR

TUESDAY, JUNE 16, 1998 (PAGE-3)

RRL organises workshop on medicinal, aromatic plants

Excelsior Correspondent

JAMMU, June 15: Regional Research Laboratory (RRL), Jammu inaugurated today, another training workshop on Quality Control of Medical and Aromatic Plants and their products.

This Training Workshop has been sponsored by ICS (International Centre for Science and High Technology, Italy) and UNIDO (United National Industrial Development Organisation), Vienna, Austria.

Besides delegates from our country, the Workshop is being attended by delegates from eight Asian Countries viz. Sri Lanka, Bangladesh, Vientiane (Lao PDR), Thailand, Malayasia, Mongolia, Nepal and Phillipines. The Workshop was inaugurated by Prof N K Ganguly, Director General, Indian Council of Medical Research by lighting the lamps.

During his inaugural address Prof Ganguly said that he was highly impressed by the work done by RRL in the fields of Botanical Sciences and on the development of Herbal Drugs. He said that Advanced Centre of ICMR and RRL have done a tremendous job by shortlisting 500 plants of medicinal importance to 50 plants. Some of the drugs have reached clinical trial stage, he said.

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Prof Handa said "many developing countries share the common asset of varied and abundant resources of spontaneous medicinal and aromatic plants. Ethnobotanical ethnomedical practices, and perhaps aromatic plants. Ethnobotanical ethnomedical practices, and perhaps even recently derived scientific knowledge have focussed attention on the possibilities of utilising this natural flora towards development of valuable pharmaceuticals and processed industrial products.

Dr T De Silva, International Resource Person from ICS, Trieste, Italy while introducing the Training Workshop said that the thrust of ICS shall be on enhancing the quality of herbal products in Asian countries which are given to the customers without standardisation.

Prof B N Dhawan, Former Director, Central Drug Research Institute, Lucknow delivered the key-note address. The vote of thanks was pre-

ICS-UNIDO TRAINING WORKSHOP ON

Quality Control of Medicinal and Aromatic Plants & Their Products

June 15-20, 1998

Regional Research Laboratory, Jammu-180 001

DAILY EXCELSIOR JUNE 22, 1998

ICS-UNIDO workshop on quality control of medicinal plants ends

Excelsior Correspondent

JAMMU, June 21: The six days training workshop on quality control of Medicinal & Aromatic Plants (M&Ps) and their products concluded yesterday after noon.

As per a release the valedictory function was chaired by Prof T De Silva, representative of International Centre for Science and High Technology, Italy. In his address to the delegates and resource persons he said that the pioneering work done at RRL, Jammu and the availability of the best expertise and equipment in the area of Medicinal and Aromatic Plants made ICS-UNIDO to select RRL, Jammu as the venue for this workshop.

Dr De Silva also praised RRL, Jammu for having successfully completed the workshop and the earlier UNIDO sponsored assignments under the leadership of Prof S S Handa. He said that in view of the scientific excellence available in this institute, the future cooperation of RRL Jammu with ICS-UNIDO will be strengthen. He thanked all the participants, Resource persons and behind the scene workers for making meaningful and successful.

In the concluding speech Prof S S Handa, Director, RRL, Jammu said, "It was a great recognition to my institute that ICS-UNIDO decided to conduct such training programmes at RRL Jammu" Dr Handa thanked Prof Dhawan, the National Resource persons for having agreed to be present during the whole workshop inspite of his busy schedule. He appreciated the keen interest taken by Prof Dhawan and Prof T De Silva in the conduct of training workshop.

The certificates and momentoes were distributed to all the participants at the end of the programme.

On behalf of the participants Mohd Islam a trainee from Bangladesh thanked the host institute, its faculty members, the International & National Resource Persons and ICS-UNIDO for organising the programme and making it successful.

Phone : 546368 EPABX 549051, 549084, 547493

Fax : 0191-546383 and 0191-548607

ICS-UNIDO Training Workshop on Quality Control of Medicinal and Aromatic Plants and Their Products

This is to certify that _____

_____

participated in the ICS-UNIDO Training Workshop on Quality Control of Medicinal and Aromatic Plants and Their Products held at Regional Research Laboratory (CSIR), Jammu, India during June 15-20, 1998

Prof. S.S. Handa
Director
Regional Research Laboratory
Jammu

ROLE OF A CHEMIST IN THE DEVELOPMENT/ PRODUCTION OF QUALITY PLANT BASED PRODUCTS

Most developing countries are endowed with vast resources of medicinal plants. These plants have been used over the millennia for human welfare in the promotion of health and as drugs and fragrance materials. This close relationship between man and his environment continues even today as a large proportion of people in developing countries still live in rural areas.

Traditional medicines which contain mainly plant constituents have not kept pace with scientific and technological advances. In effect, not much research and development work has been carried out on traditional medicine. In fact traditional practitioners have resisted any attempts as being detrimental to their practice. The traditional medicines do not easily lend themselves to quality control procedures mainly because these are mixtures of compounds of sometimes still unknown constituents and composition.

Over the years the art of preparing these medicines have undergone modification, mainly in a negative manner. The ability of practitioners to identify plant species properly has decreased. The practice of having the practitioner dispense prescriptions himself has been replaced by referring the patient to herbal drug stores or other profit making production outlets. This has resulted in rather ill-defined, badly prepared medicines which even lack some main ingredients. Hence there is need to intervene to improve the quality of the drugs and make readily available in a more effective, scientifically and technologically acceptable form, those traditional medicines which are the only source of medicare for vast numbers of people.

The demands of the majority of the people in developing countries for medicinal plants have been met by indiscriminate harvesting of spontaneous flora including those in forests. As a result many plant species have been lost and some are in danger of extinction. It has also caused biodiversity conservation problems. It is therefore necessary that systematic cultivation of medicinal plants be introduced in order to maintain a steady supply of quality raw materials.

This is the first stage at which a chemist has to work in close collaboration with botanists and agronomists to develop packages for the domestication of wild species. It is not enough to get a plant to grow well as a monoculture but the plant also should contain the constituents found in the wild state at least to the same extent. the increase in biomass is not sufficient without the content of constituents. Hence chemical and biological monitoring have to carried out during the stages of development of domesticated species. The chemist too has to get involved in the determination of maturity and time of harvesting as these are determined by the maximum yield in terms of active constituents.

The next stage in the process is postharvest treatment. the plants collected have to be dried or stored under conditions to minimize any degradation or deterioration of the constituents. The drying and storage conditions have to de developed whilst monitoring the chemical constitution so as to minimize any degradation.

The building up of quality of a plant extract has to be initiated at the point of selection of raw materials as quality of complex mixtures cannot be controlled at the final product stage. Hence specifications have to be developed for the control of the quality of raw materials by preparing monographs for each raw material. This is a task where chemist's inputs are also required in addition to the work of a pharmacognosist/botanist. A sample of a monograph is attached and you will notice the many requirements that have to be complied with.

Quality is defined as the properties of the product that the final user/customer expects and hence has to be present at the time of usage. This means that the quality of a product has not only to be controlled at the final product stage but during storage as well up to the time that it is to be used by the consumer. This will entail monitoring of the quality at the following stages:

Good planting material
Good agricultural practices
Correct harvesting times
Good post harvest treatment procedures
Selection of good quality raw materials
Optimal processing conditions
Optimal formulation procedures

Quality Final product
Good packaging
Optimal storage conditions
Expiration dating

Chemist plays a leading role during the processing of the plant material in terms of developing optimal conditions for extraction, separation/fractionation, isolation and drying. In-process control have to be developed once the process methodology has been finalised. At this stage the chemist works with the engineering counterparts in introducing in-process controls which require chemical parameters. Chemist too will be involved in the development of formulations where the active constituents and composition in terms of each dosage form has to be controlled. The analytical chemist plays a crucial role during this period by developing specifications for the final product in terms of the identity, purity, and assay of constituents which have to be included in the monograph for each product. A sample for a monograph is attached in figure 2.

Any product could deteriorate if the packaging is bad. packaging conditions have therefore to be tested so that the product maintains the specifications tested at the final product stage during storage. Sometimes the storage conditions to keep the quality up to the expiration date have to specified. Chemist has a role to play in all these activities. Once a product is developed its stability under climatic conditions of the country of use has to be studied. This has to be ideally done by storing the product under those conditions for a long time. But in order to determine an expiration date for the product a series of accelerated stability tests are carried out by the chemist under different conditions of temperature and humidity. You will notice the different stages at which the services of a chemist are required in the production of a plant based product.

Chemist has also to play an important part a member of the R&D team for the development of a drug. He has to extract and fractionate components for bioactivity screening and for detailed of pharmacological and toxicological studies. Once a lead is found isolation and chemical modification techniques have to developed.

Some of the terms used in quality determination are quality control, quality assurance and quality management(Total Quality Management). More and more companies are introducing TQM as an efficient way of controlling the quality of their products. Quality control is done by testing the raw materials, processes and the finished products for conformity with the specifications developed and involves mainly the chemists. The control could be carried out by examination of the following characteristics to comply with drawn up specifications.

Physical / Sensory
Chemical/Physico-chemical
Biological

Specifications could be individual company based, national(Pharmacopoeial), regional or international as given by the international standards organisation(ISO). ISO also has introduced other requirements in terms of certifications for Good Manufacturing including environmental conservation such as ISO 9000 and 14000.

Quality assurance involves a team where the supervisors are also involved in introducing a system by which the controlling could be carried out. It includes some managerial activities in terms of validation, maintenance and training whilst Total Quality management involves the entire management in terms of , personnel, machinery, methods etc. whereby if the system works well should ensure that the final product would be of the expected quality. The final test on the finished products would thus become more a formality as the quality management system introduced to get the desired quality product has to result in a product of expected quality. This will involve the whole management and the other staff.

It has to be emphasized that the tests to be applied for control will depend on three M's, methods, means and men. The methods selected or developed have to be accurate, precise, reliable, reproducible, specific, sensitive and simple. Even with these requirements, controls have to be done by using blanks and standards.

The means includes all instruments and chemicals used for testing. The chemicals have to be of the analytical quality in terms of purity. The instruments too have to be accurate, sensitive, reliable, reproducible, precise and simple. Besides the instruments have to be properly calibrated, validated and maintained. The accuracy of a series of measurements will depend on the least accurate instrument. eg. if a set of glass ware is used such as pipettes, volumetric flasks, burettes, the reading will only be accurate to the limits of the least accurate measurement.

Men include the operators. More and more automatic instruments are being developed to eliminate the variable personal error factor involved with different personnel. As many of these instruments are very expensive, many developing countries will continue to use instruments which are simple but prone to human judgement. hence the personnel involved in testing should be knowledgeable and well trained in the use of the equipment. they have to be observant. open minded, honest and dedicated and should follow good laboratory practices(GLP). Included in GLP are correct sampling, duplication, controls, documented procedures, timely record keeping specially writing down readings of instruments and measures and use of clean glassware and pans. Special attention has to be paid to analysis of results by discarding readings that are inaccurate and subjecting the values to statistical control. Safety requirements and avoidance of contamination are obligatory components of GLP.

CONCLUSIONS

Today the promotion and development of processing of medicinal plants have gained momentum due to certain ground realities:

- Green consumerism and the current resurgence on the use of "Naturals" in developed countries which has given a fresh impetus to the development of plant based products.
- Free market economy bringing in more openness and expanding markets and demand for new resources, materials and products.
- A growing acceptability of the social responsibility of minimizing socio-economic inequalities in favour of rural people resulting in opening up of additional job and income opportunities for the poor people.
- Poor economic conditions in developing countries restricting import thereby placing increasing reliance on substitutes using indigenous plant resources.
- Increasing awareness regarding biodiversity conservation and therefore sustainable and protective use of plant resources.
- Search for new phytopharmaceuticals for deadly and chronic diseases

The entry into world markets depends not only on the demand but on the competitive price of production, quality and the ability to provide the quantities required by the purchaser.

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 markets and human consumption. For most of the plant based products, quality has to be built into the product beginning from the use of good quality authentic raw materials followed by good post harvest treatment and process control to avoid contamination and loss of quality. Monographs have to be prepared for each product to include all specifications developed. Modern analytical techniques should be extensively used to develop identity and quality parameters. The machinery and processes used in industries have to be validated to comply with International Standards.

The quality requirements for medicinal plants preparations are still more stringent in terms of toxic materials and active principles. Here again it is easy to produce known phytopharmaceuticals complying to pharmacopoeial standards. In cases of compound traditional medicines, much R & D work has to be done, in order to develop specifications so that a standardized uniform product could be obtained.

Associated with quality management where all steps involved in the industrial utilization process are properly and strictly controlled to produce the desired quality products, is the compliance with current good manufacturing practices(cGMP). Without GMP products cannot be expected to be of required standards and quality. The concept of safety which is almost non-existent in many developing countries has to be introduced with respect to buildings, machinery and staff and, safety manuals should be published in order to focus the attention of the management and staff on these issues.

It is imperative that the processed products comply with national and international specifications. There are International Standard Specifications for some of the processed products. In addition, countries and buyers can have their own requirements. Hence the products could be tailor made to conform to the buyers requirements. Sometimes the requirements of the buyers are more stringent and specific, demanding the application of good manufacturing procedures. The legal requirements for registration and packaging have to be adhered to in the case of export products. Stringent requirements are being introduced presently to safeguard the environment and eco-audit procedures will be required for safeguarding environmental damage. In fact ISO 14000 requirements may have to be met in the future if the buyers insist on ecolabelling.

PLANT RAW MATERIALS
(Monograph specifications)

Botanical Name:

Local Name:

Description:	**macroscopy, fracture, sensory characteristics**
Identity:	**microscopy,chemical constituents**
Purity:	**adulterants, other contaminants**

Loss on drying / Moisture content

Extractives / Volatile components

Ash Content:

Limit tests:	**Heavy metals, pesticides, micro-organisms**

Chromatographic patterns:

Quantitative tests

Storage

Figure 1

STANDARDISATION OF EXTRACTS (MONOGRAPH)

Description:

Identification:

Moisture Content/Loss on drying:

Solubility:

Acidity of water extract:

Extractives: **Water soluble, Alcohol soluble, Solvent soluble**

Ash Content: **Total, Sulphated**

Limit Tests:

Heavy Metals Pesticide residues Microorganisms

Chromatography(TLC,GC,HPLC etc):

Finger prints, Marker compounds,

Spectroscopy: **IR, UV,**

Quantitative analysis:

Densitometry, HPLC, GC, Specific assays

Bioassays if possible:

Stability:

Storage:

Figure 2

Director, Regional Research Laboratory (CSIR), Jammu
invites you on the inauguration of

ICS-UNIDO Training Workshop

on

Quality Control of Medicinal and Aromatic Plants and Their Products

by

Professor N. K. Ganguly

M.D., F.A.M.S., F.N.A., F.N.A.Sc., F.A.Sc., F.R.C.Path

Director General
Indian Council of Medical Research,
New Delhi

on 15th June, 1998 (Monday) at 9.00 A. M in the
RRL Conference Hall

Programme

9.00 a. m.	Invocation	
	Welcome Address	Prof. S. S. Handa Director, RRL
	Introduction to the Workshop	Dr. T. de Silva ICS/UNIDO International Resource Person
	Inaugural Address	Prof. N. K. Ganguly DG, ICMR
	Keynote Address	Prof. B. N. Dhawan Former Director, CDRI
	Vote of thanks	Dr. G. N. Qazi
10.30 a. m.	Tea	