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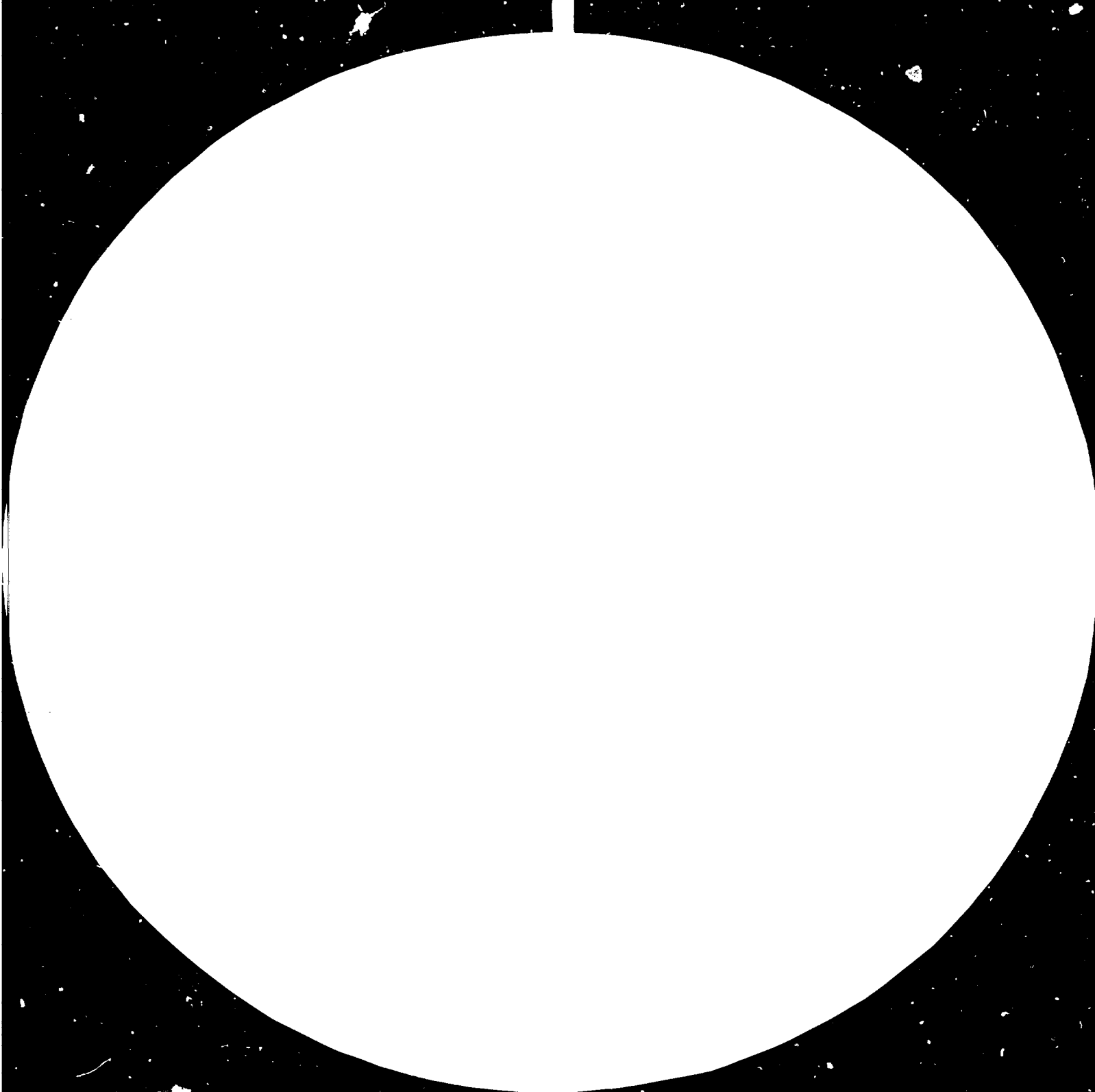
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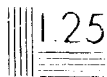
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English

ECONOMIC MAPPING OF SPONTANEOUS FLORA
(MEDICINAL AND ESSENTIAL OILS PLANTS)
OF A GEOGRAPHICAL AREA FROM NEPAL

N E P A L

SI/NEP/78/802

Terminal report*

Prepared for the H.M. Government of Nepal
by the United Nations Industrial Development Organization
executing agency for the United Nations Development Programme

Based on the work of Ovidiu Bojor, pharmaceutical scientist
(The State Institute for Drug Control and Pharmaceutical
Research - Bucharest)

United Nations Industrial Development Organization
Vienna

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S U M M A R Y

The basis of the present Report is represented by the aspects concerning the implementation and Follow-up in the Kingdom of NEPAL of a medicinal plants and essential oils extractive industry.

At present, there are favourable conditions to start a small-scale industry which could be extended by 1985, enough to become a branch of the national industry in order to meet both domestic and export needs.

Spontaneous and cultivated flora of medicinal plants can provide the raw-material for the future industry.

In order to reevaluate the spontaneous flora, the economic mapping has already begun and the methodology presented.

The last UNIDO Mission (1979/80) in Nepal estimated that the economic mapping might be completed within 4-5 years, covering the whole medicinal plants zones of the country (see Annex 3).

As for the medicinal and oleo-etheric plant cultures, the positive results obtained by cultivating some species of the seven herbal farms by the Royal Drug Research Laboratory (R.D.R.L.) permit to extend the following cultures (*Atropa belladonna*, *Claviceps purpurea*, *Datura stramonium*, *Chrysanthemum cinerariifolium*, *Cymbopogon citratus*, a.s.o.).

As for the quality of the raw-material of the future industry it is of importance to standardize the main medicinal and oleo-etheric plants belonging to the spontaneous or cultivated flora. In this report we give the basic principles of the quality requirements for medicinal plants (see Annex 9). Standardization of the raw material will also provide the basic rules of collecting, drying and processing the raw material subsequently used in industry.

We have selected and prepared so far approximately 50 pharmaceutical products using local raw materials (See Annex 8). The products were obtained by means of non-sophisticated methodology and procedures described in the international pharmacopoeias and simple apparatus, taking also into account the traditional Nepalese medicine.

New products can be easily added to the list of these

drugs for Nepal with minimum UNIDO technical assistance, so that about 40% of the imported pharmaceutical products should be replaced by indigenous drugs till 1985.

The extension of *Cymbopogon citratus* culture and of other essential-oil plants in Nepal could offer this country to export immediately essential oils more especially as Nepal has already been solicited for them.

In the field of analytical drug control it is primarily important to give technical assistance for physical-chemical analysis of raw materials, of intermediate and finished products. The Laboratory of Pharmacology of R.D.R.L. needs also urgently suitable apparatus and basic methodology (See Annex 15)

The positive results of the staff from R.D.R.L. in obtaining hiosgenin, the alkaloids from *Rauwolfia serpentina* and some extracts from *Rheum emodi*, *Valeriana walichii* and Ergot of rye afford to pass on from Laboratory stage to the Pilot stage of those products. For this project we take into consideration to equip urgently the R.D.R.L. with a crushing and grinding plant (See Annex 15, V/2). The products obtained from those raw-materials could be exported immediately.

With the aim of an indigenous reevaluation of the pharmaceutical products obtained from plants by R.D.R.L., we recommend to set up in Kathmandu a Governmental pharmacy endowed with furniture, equipment and suitable personnel (pharmacists, a traditional physician and technical staff). Such pharmacies could be also created in other important towns. The central pharmacy in Kathmandu and eventually the other pharmacies could have rural branch offices ("Pharmaceutical points").

As industry will develop at a Pilot scale or even small industry, the processed products could provide raw material for a large-scale production by the Royal Drug Ltd. after 1985.

Finally, Subregional co-operation in this field with Sri-Lanka, Thailand, Buthan and Bangladesh is also recommended.

INTRODUCTION

The Chemical Industries Section from IOD/UNIDO has during the past few years attached a special importance to the possibility of processing in some developing countries from Africa and Asia a new pharmaceutical and essential oils industry from indigenous herbs.

The development of a small-scale industry in this field is based on the natural resources of raw materials, the classical and traditional data of medicine.

In February 1977, a group of Romanian experts, under the project RP/RAS/76/009 visited NEPAL to collect information and data concerning the available medicinal and essential oils plants which could be processed in this country with UNIDO assistance.

In May 1978 was draft a preliminary Project document for His Majesty's Government of Nepal by UNDP Kathmandu with the title: Primary Health support services programme NEP/78/009/A/25/14. The estimated starting date was proposed 1 September 1978. One of the development aims of this project is to increase the efficacy and production of Ayurvedic medicine to make Ayurvedic establishments provide therapeutic treatments and family planning service also. The Royal Drugs Limited (R.D.Ltd.) belonging to the Ministry of Forests has been indicated in the Long-Term Health Plan (1975-1990) as the institution to be developed for the supply of the total need in essential drugs for Health Services. The same Plan envisages the transfer of R.D.Ltd. under the Ministry of Health. At present (1979), R.D.Ltd. manufactures about 70 preparations.

In September 1978, a UNIDO-Vienna and Joint UNIDO Romanian Centre mission of 2 experts and 2 drivers with two

all-ground cars equipped with quality control laboratory crossed Nepal for two months under the project RP/RAS/78/012. The report of this project has the following title : "Mobile unit of pharmaceutical and essential oils industry to the least developed countries in Asia". This was the second phase of the UNIDO assistance programme for Nepal.

The present report refers to the activity between 5 October 1979 - 4 January 1980 of one expert in the third UNIDO mission in Nepal under the project SI/NEP/78/802/11-01/32.1.D.

The contribution of the host government consisted of research workers, local laboratory facilities, solvents, reagents and a driver with an allground car as well as a part of the field equipment and some porters and workers whose work and food were partly paid by the expert and partly by the Government.

The main objectives of the last mission and the programme of activities in the field, Herbal Farms and in the Royal Drug Research Laboratory (R.D.R.L.) of the Department of Medicinal Plants from Ministry of Forests were established on the basis of Job description (see Annex 1) with Mr. John Melford the Resident Representative and Mr.Cadiravail Myl-Vaganam SIDFA from UNDP-Kathmandu and with Dr.S.B.Malla, Director General of R.D.R.L.

At present, the R.D.R.L. have quite all the facilities and specialists for research, drug control, laboratory and Pilot scale industry for processing the most important medicinal and essential oils plants from Nepal.

With UNIDO assistance in some technical and laboratory equipment and experts, the small-scale industry could be started by R.D.R.L. in the classic and traditional medicine using the medicinal herbs resources of Nepal.

After extension, one part of this activity can be transferred to R.D.Ltd. for industrialization.

The name and functions of project counterparts are listed in the Annex 2. The mission was supported also by the Staff of U.N.D.P.-Kathmandu.

In the present report are given the exemplifications of an economic mapping of medicinal and essential oil plants of Ganesh-dimal area, the problems concerning the standardization of raw-materials for industry, some methodological data in the laboratory control and processing of a lot of new medicines for Nepal.

The main short-term objectives are to stimulate the developing of R.D.R.L. activity in the Laboratory, Pilot and small-scale industry field.

For long-term objectives we consider necessary to develop the research programme of R.D.R.L. in practical field and to transfer the technology to the R.D.Ltd. for industrial processing. The new medicinal and essential oils plants industry could be extended for it to become a branch of the national industry of Nepal.

FINDINGS

1. Activities in the field

1.1. In the second part of Octobre and the first part of Novembre 1979 with the assistance of R.D.R.L. an expedition was organized in the Ganesh-Himal area in the Nord of the country.

In this trekking a more than 500 Km distance was covered, comprising 8 peak of mountains between 3000 - 3500 m alt. and 4 tops of more than 4000 m alt. from Tiru Danda and Ganesh-Himal zone.

During this trekking an area of approximately 800 sq.Km was investigated in which more 70 medicinal and essential oil plants were identified in large quantities between 250-20.000 Kg (expressed in dry raw material in each 25 sq.km. mapped concerning the protection of nature. In the same area, in each 25 sq.Km are available approximately 50 species till 250 Kg.

For this evaluation we used the methodology of economic mapping given in the Final Mission Report RP/RAS/78/012 (See Ref. 23).

The quantities available for industrialization from each medicinal plant are shown in the map from Annex 3 using the codification from the code index of the same annex.

A general survey of the Nepalese territory allows to see that approximately 50,000 sq.Km. are intended to be cultivated, that over 25,000 sq.Km. represent zones that cannot be mapped, with heights overtopping 5000 m,

and an area of approximately 70,000 sq.Km. covered by spontaneous medicinal or oleo-etheric plant cultures.

In the light of the experience we have had so far, we estimate that the mapping of that area with spontaneous medicinal plants of Nepal could take 4-5 years if 4 teams would work actually in the field for 6 (six) months every year simultaneously in different zones.

We think this activity to have priority in order to allow an industry on the vegetable raw material basis in Nepal to be created and developed.

At the same time we must point out that it is necessary that exportation of raw materials from Nepal should be regulated and concrete measures of protecting the nature and the genetic stock of some medicinal species of great importance should be adopted. In case such measures are not taken, some of the most important medicinal species of Nepal flora will completely disappear within the next 10 years.

Collecting and drying centres for medicinal plants organized under the control of the Department of Medicinal Plants from the Ministry of Forests and a central planning of collection of plants in different zones will promote rural development. Thus more manpower will be used and additional income will become available.

Thus the population of those zones will supply more manpower and will be able to make additional profits.

- 1.2. The second travel in the field was carried out in the Southern zone of the country i.e. the Makwampur and Chitwan Districts in Terai.

Although the trekking was not done in the optimum season, in that zone ecologically completely different from the high mountainous zones over 30 species of medicinal plants were identified (See List in Annex 4).

The number of the main medicinal and oleo-etheric plants in Terai, after a first estimating, is over 100 and the existent available amounts represent a strong supply basis for the future extracting industry. Exploitation of those natural resources in the respective zone is less difficult than in the high zones because of the existing or under construction roads.

On the whole, over 930 medicinal and oleo-etheric plants have been coded in view of future research.

- 1.3. Besides the economic mapping of the prospected zones in Himalaya and Terai, samples of medicinal plants for analysis and processing have been collected.

The samples are presented in Annex 5, each species having a species code and a therapeutical group code, following W.H.O. indications (See Annex 14).

- 1.4. During our investigations in the field, a special attention was given to the *Eupatorium adenophorum* species. Owing to its wide dissemination that species represents a real danger for the crops and the forests zone. For the time being, very large surfaces of productive soil or of forests zone are overgrown with *Eupatorium adenophorum*. After a first estimating, approximatively 10 tons of raw material could be collected from each square kilometer from the overgrown zones. In co-operation with R.D.R.L.-Hitaura Farm - a first batch of that species was distilled obtaining thus 1 Kg of essential oil. One sample of that essential

oil was tested in the Microbiological Laboratory of the State Institute for Drug Control and Pharmaceutical Research - Bucharest. The results of the preliminary microbiological screening are promising, the oil having a strong antifungal and antibacterial activity, as can be seen in Annex 10. At the same time, preliminary investigations carried out on vegetal cells and in mice with a flowers extract of that species resulted in a low toxicity and a mitodepressive effect.

A first practical application of the oil obtained from that species is its use - after a clinical trial - as a remedy in dermatological diseases caused by Trichophyton and Micosporium, both widely spread in man and animals. The investigations are still going on.

Thus, by collecting and valorizing in therapeutics E. adenophorum species, one could help the fight against that noxious plant in agricultural and forests zones.

1.5. Besides the collection of some information concerning the medicinal herbs used in the traditional medicine during the trip on the field in Ganesh-Himal zone in Kathmandu two Ayurvedic physicians were contacted.

The first, Dr. Kamdeo Jha - Ayurvedacharya of Tribhutan University, Institute of Medicine - Nardevi Ayurved Campus - Kathmandu - is a specialist in Practice of Herbal Medicine, Yoga, Meditation, Religious treatise and Physiotherapy. He has a consulting room in northern Side of Durbar Square. He uses for therapy medicines prepared by himself and imported from India. He agrees with the idea of one Governmental Ayurvedic Pharmacy establishment in Kathmandu on the national raw-materials and production basis.

Dr. Kamdeo Jha has prepared a list of medicinal plants used in the traditional medicine (completed with other data in Annex 6).

The second, Dr. Vaidya Nath Bhatt from Yetkha 14/73 Kathmandu - Ayurvedic medicine has presented the results obtained in the treatment of Breast and Uterus tumours, gravellish complaints (Kidney and Liver), cardio-vascular and hypertensive diseases, palsy, a.s.o. The basis of Ayurvedic medicine consists of plant extracts and microelements from rocks and some animals.

He has also presented pharmaceutical products prepared in his laboratory : "Nepal Medicine Research Centre Syano Pokhara, HETAUNDA-2 Narayani zone". Some of these medicines are : "Leucorex" (prepared from ^{Trichomonas lobata - etc.} Elettaria cardamomum, Crocus sativus, Shorea robusta etc.); "Parpatadi Caps" indicated in chronic fever, chronic headache, hyperacidity etc.; "Calcivit" (from Nymphaea, Rhododendron, Trachispermum ammi, etc. and oxide of coral in syrup base); "Menavip" (from Tinospora cordifolia, Terminalia chebula, Piper longum, Emblica sp., Cinnamomum tamala, Elettaria cardamomum, etc.) recommended in hyperacidity, peptic ulcer, kidney and urinary bladder stone, etc.

The "Vita-Tona" in whose formula there are more of 30 medicinal plants is recommended to increase strength and vision power, to stimulate the memory being also useful in post delivery conditions.

A part of the medicinal herbs used in this traditional medicine products was introduced in the Annex 6.

We recommend to use the experience of this and other Ayurvedic physicians and help the developing of the traditional medicine data of Nepal.

1.6. During our trekkings various plants were collected for a Herbarium in two copies. The plants herbarized are partly listed in Annex 7 and partly are going to be identified.

2. Methodological and Laboratory Activities in the Department of Medicinal Plants - R.D.R.L.

2.1. At the same time with the identification of availability of raw materials existing in the spontaneous flora of Nepal and the possibility of culture of some medicinal and essential oils plants we consider as opportune to elaborate quality requirements for the reception and delivery of medicinal and aromatic plants with the aim of their industrial processing or to the export.

The main aim in elaborating quality standards for medicinal plants is to delivery to the Industry first quality of raw material. The efficiency of this Industry depends on the quality of raw materials.

With this end in view on the basis of international Pharmacopoeas and in accordance with the existent realities in the field, in co-operation with the staff of R.D.R.L. a group of national quality standards was elaborated. These quality requirements for medicinal plants should be useful also for the future national Pharmacopoea. The basic criterion of standardization and some exemplifications are given in Annex 9.

2.2. Using the raw materials collected from Ganesh-Himal and Terai area and others existing in R.D.R.L. in co-operation with the counterparts almost 50 new pharmaceutical products were prepared at laboratory scale (tinctures, extracts, syrups, drops, tablets, ointments, etc.) and

others are in course of preparation.

In preparing these new pharmaceutical products for Nepal two fundamental aspects should be taken into account :

- a) The adaptation of the formulae and processing according to the pharmaceutical products existing in other national pharmacopoeas.
- b) The modification of the classic formulae on the basis of the data existing in the local traditional medicine after scientific investigation concerning the active principles of the concerning plants.

The name of syrups, tablets, capsules, ointments, drops - Nepalese name was adopted following the vernacular denomination of medicinal plants.

The majority of these pharmaceutical products can be safely used after analytical control without pharmacological investigations because they are already used in different countries. For all these new pharmaceutical products there is an analytical methodology which will be transferred to R.D.R.L. directly at the time of processing.

The new pharmaceutical products are presented in Annex 8. For each product are given the name of products, the name of plant, the processing, principal compounds, pharmacological activity and use in therapeutics, dosage, contraindications, availability of raw materials and the therapeutical group adapted following the W.H.O. indications. New products can be easily added to the list of these drugs for Nepal with UNIDO technical and material assistance, so that about 40% of the imported pharmaceutical products should be replaced by indigenous drugs till 1985.

2.3. As in the spontaneous flora of Nepal there are available some species of Solanum genera (Solanum xanthocarpum, S. aculeatissimum, S. glaucum a.s.o.) a new procedure was proposed and experimented for obtaining solasodine as a basis for steroid hormone synthesis. The procedure, a non-sophisticated one, is presented in Annex 11 and is applicable in small-scale industry.

2.4. In the field of analytical methodology, besides the data presented in Annex 9 concerning the general quality requirements for reception of raw materials, two new analytical procedures were added. The first, concerning the determination of the content of ergot alkaloids (Annex 12) is very useful for Claviceps purpurea project which was introduced with UNIDO assistance in Nepal.

The second analytical procedure is a new methodology for phytobiological preliminary screening of some extracts or active principles isolated from plants for testing the cytostatic or cytotoxic effects. The procedures are rapid, sensitive and economic. Details on these procedures are given in Annex 13.

We contemplate taking into account the development of a Pharmacological Laboratory belonging to R.D.R.L. for scientific research and for the future Pharmaceutical Industry. The most important laboratory equipment and assistance are listed in Annex 15.

2.5. In the extraction field, besides the obtaining of essential oil from Eupatorium adenophorum and a small amount of solasodine, was examined the possibility of a small-scale Industry for the Diosgenin project. The processing of Diosgenin and all the technical details for obtaining this

product from *Dioscorea deltoidea* are available in the R.D.R.L. The raw material for this project exists in large quantities. In order to start the processing of this very important intermediary product for the production of the steroid hormones it is necessary to provide as quickly as possible a mill and a grinding plant. The existence of such units and the small-scale industry equipment listed in Annex 15 could be used for obtaining other extracts and active principles from *Rhenu emodii*, *Rauwolfia serpentina*, *Claviceps purpurea*, *Valeriana walichii* a.s.o.

The positive results of the staff from R.D.R.L. in obtaining at laboratory level all these products give the possibility of starting a Pilot and small-scale Industry immediately with UNIDO assistance.

- 2.6. The training programme during the mission had an implementing nature. Thus in the economic mapping in the field practical demonstrations were carried out in the Tiru-Danda and Ganesh-Himal zones.

In order to standardize and elaborate the basic criteria for quality requirements of raw-materials, 11 models of medicinal plant standards were developed.

In the analytical field, for a group of scientific workers from R.D.R.L. the basic criteria for a new method of Phytobiological screening of some extracts or active principles were demonstrated. At the same time practical demonstrations on 5 vegetable extracts using the laboratory equipment existing in the R.D.R.L. were carried out.

During the processing of pharmaceutical products the theoretical and practical aspects concerning this processing

were examined as well as some aspects belonging to analytical problems of tinctures and extracts.

The results of analyses carried out in Nepalese and in Romanian laboratories and the processing methodology for the new pharmaceutical products are presented in the Annexes 9 and 10.

Completion of the training programme is shown in the Annexes 9, 11, 12 and 13 from the present Report. We think these annexes to be useful for the future activity of R.D.R.L.

At the same time we think that a group of R.D.R.L. should be sent abroad as soon as possible in order to prepare the training programme organized by UNIDO (in progress). Some specialists of R.D.R.L. should be also given the opportunity of participating in different International congresses, for example, those from Paris in March 1980 and Bangkok in Septembre 1980, which would improve the scientific level of the Institute workers.

In the scientific research field for developing a new Pharmaceutical Industry on the medicinal and essential oil plants basis, we take into account the possibility of developing the already existing research small group in R.D.R.L. With this end in view we consider useful to centre the short and long term projects of research on the Adaptation proceedings and Development research and later on the Applied and Basic research (in the advanced stage). The first necessity for Nepal is the quantitative and qualitative knowledge of raw material for industrialization. In a second stage investigations on medicinal and essential oil plants in different zones should be extended and adequate new medicinal herbs introduced. In addition it is important to develop the

analytical research in Pharmacology, Phytochemistry, Microbiological and Pharmaceutical technology field.

3. Others

3.1. Development of a distribution system of the new drugs obtained from plants and the medical information system.

In order to distribute the new drugs, we recommend to set up a specialized pharmacy in Kathmandu for products obtained from plants, more than 50% drugs manufactured in the country. The pharmacy should have a staff comprising an ayurvedic doctor at least, 1-2 pharmacists and adequate technicians.

There are at present in Nepal all the favourable conditions to develop Pharmaceutical Industry based on plants with UNIDO technical assistance and to provide the country with semi-industrial and laboratory equipment.

The length of time, from the moment the equipment is obtained until it is made use of, is estimated to be of 12 months in order that a range of at least 50 products should reach a normal output.

3.2. We consider that an important form of training the specialized personnel is to give the R.D.R.L. specialists the opportunity of becoming doctors, the Nepalese Government sending them abroad. Thus they could obtain Ph.D. diplomas in different fields: botany, agrotechnique fermentative analysis and technology.

We propose the subjects of their Ph.D. thesis should be centred on problems concerning closely the development of the extractive Nepalese industry.

3.3. During my mission I had a series of talks with the specialists from the Department of Medicinal Plants in Nepal with Dr. Cadiravali Myl-Vaganam, SIDFA from UNDP Kathmandu, and in Bangkok with : Mr.Christian A. Newman, SIDFA, UNDP, with Dr. Emilio Meneses, Pharmaceutical adviser (UN Asian and Pacific Development Institute) and with Mrs. Sasithorn Wasunat, from Applied Scientific Research Institute of Thailand.

Based on these talks we have come to the conclusion that a cooperation amongst specialists in medicinal and essential oil herbs from Nepal, Shri-Lanka, Thailand (in the future Bangladesh and Buthan as well) is of utter importance and use for the development of small scale pharmaceutical industry based on natural resources of the respective countries.

RECOMMENDATION

According to the present state of valorization of the medicinal and essential-oil plants in Nepal, the following recommendations are submitted for consideration :

1. To continue the economic mapping of natural resources of spontaneous medicinal plants in Nepal so that in the following 4-5 years the total surface of Kingdome be mapped.
2. To develop the culture of the following species:
Claviceps purpurea, Dioscorea deltoidea, Rauwolfia serpentina, Atropa belladonna, Centella asiatica, Chrysanthemum cinerariifolium, Cymbopogon citratus, Foeniculum vulgare, Valeriana Walichii, Datura innoxia, Mentha arvensis a.s.o. and scientific investigations for the improvement of these species.
3. To elaborate quality standards for the vegetal raw materials and for the pharmaceutical products produced at small-scale industry.
4. To start the production of about 50 new pharmaceutical products and the processing of diosgenin, total alkaloids from Rauwolfia, Claviceps purpurea, Atropa belladonna, Datura stramonium, and some total extracts from Rheum emodi, Valeriana walichii, Dryopteris filix-mas, Centella asiatica and others.
5. To follow-up the positive results obtained with the Eupatorium adenophorum project till a new group human and veterinary drugs for external used are developed.
6. To set up of a Pharmacological and a Phytochemical laboratories for research and production. To develop the

existing basis of R.D.R.L. for follow-up of small-scale industrial projects. With this and in view we recommend the endowment with supplementary laboratory and Pilot Plant equipment as well as with technical assistance which are listed in Annex 15.

7. To regulate the collecting and export of the medicinal plants from the spontaneous flora of Nepal.
8. To begin a training programme for the local scientific workers under UNIDO aegis in other countries having experience in research and processing of the medicinal and essential oil plants.
9. To assist the population with new drugs prepared by R.D.R.L. and set up new Pharmaceutical units in Kathmandu and in other 2-3 important towns in Nepal.

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

JOB DESCRIPTION

SI/NEP/78/802/11-01/32.1.D.

Post Title: Expert in the economic mapping of spontaneous flora (medicinal plants)

Duration: 3 months

Date required: 1 December 1978

Duty Station: Kathmandu and surroundings

Purpose of the Project: The establishment of this mapping will ensure more information and an overall view about the medicinal plants which are available in the country at different periods and for different uses. A programme of production for local use and for export purposes could be developed.

Duties: The expert, in co-operation with the local specialised institute, Royal Drugs Limited, will specifically be expected to:

1. Collect data and information about the different plants, their location, their availability and their traditional use.
2. Prepare an economic mapping for medicinal plants available in the country for local use or for export. Their possible use should also be indicated.

Qualification: Botanist with extensive experience in medicinal plants, their cultivation, utilization and production.

Language: English

Background Information: The development of traditional medicine based on available medicinal plants in developing countries is one of the very important programmes of UNIDO. Several programmes for different developing countries have been designed and some of them are already in the stage of implementation. The utilization of medicinal plants in developing countries has always been known and 50% of the population of these countries are using extract or dry herbs for curing many tropical and epidemic diseases.

Due to the increase of demand of drugs in the world and in developing countries, it merits attention to explore the possibility of the production of drugs on a more economical basis such as utilization of medicinal plants which many developing countries are rich in.

In February 1977 a group of Romanian experts, under the project RP/RAS/76/009, visited Afghanistan and Nepal to collect information and data on the available plants which could be utilized locally or for export purpose. A detailed report on this mission as well as some recommendations can be seen in the document UNIDO/IOD.104.

The above mission recommends the preparation of an economic mapping of available medicinal plants in Nepal in order that the Royal Drug Institute can plan and develop a medicinal plant project, based on this information, in the interest of the local needs or for export purposes. Therefore the Government has requested

Background Information (ctd): UNIDO to assist the Royal Drug Institute in the preparation of this mapping.

In completing the Job Description during my 3 months mission I also settled the following aspects described analytically in the present Final Report :

1. To settle potentialities of new oleo-etheric species excepting the Cymopogon species. For a profitable industrialization it is necessary to find new sources of plants containing volatile oils. It is necessary to cultivate some classic aromatic species too, so that the future distilling facilities should work to that full output all the year round.
2. To settle, technically assisted by UNIDO, the quality standard for receiving and delivering with priority medicinal plants of spontaneous or cultivated flora from the following species or raw materials : Centella asiatica, Catharantus roseus, Folium belladonnae, Radix belladonnae, Herba Absinthi, Rhizoma Calami, Tubera Dioscorea, Rhizoma Rhei, Radix Valerianae, Fructus Juniperi, Fructus Cynosbati, Strobili Lupuli, a.s.o.

Without settling quality standards for raw material one could not reckon the industrial output and serious difficulties may arise in supplier-beneficiary relationship.

3. Obtaining new pharmaceutical products with indigenous raw material.

NAME AND FUNCTION OF PROJECT COUNTERPARTS

UNDP - Kathmandu

Mr. John Melford - Resident Representative.

Mr. Cadivarail-Myl-Vaganam, SIDFA.

Mr. Vaidya - Programme Officer.

Mr. Hussain, Adm. Officer, Miss. Shanta Khadga, Secretary and Staff of U.N.D.P.

His Majesty's Government of NEPAL :

Mr. Mir Suoba Prakash M. Singh - Secretary of Ministry of Forests.

Mr. Dr. S.B. Malla - Director General of Department of Medicinal Plants - Royal Drug Research Laboratory.

Mr. Dr. Pharm. P.N. Suwal - General Manager of Royal Drugs Ltd

Mr. Amir Badur Shresta - Director of Drug Control Laboratory.

From Royal Botanical Garden :

Mr. Damodrr Prasad Joshi, Botanist, Botanical Survey and Herbarium Godawari;

From Royal Drug Research Laboratory the following scientists :

Dr. Asfaq Sheak, Dr.P.M.Adhikary, Dr.K.R.Amatya, Dr. Shresta, Dr.S.R.Adhikary, Dr.Aumitra Vaidya, Mr. Tirtha Ratna Sakya, Mr. Radha Raman Prasad and other counterparts from Royal Drug Research Laboratory.

Dr. Kamdeo Jha (Ayurvedacharya) from Tribhuvan University, Institute of Medicine, Narvedi Ayurved Campus, Kathmandu.

Dr. Vaidya Nath Bhatt, Yetkka 14/73, Kathmandu.

Code Index Used for Tiru-Danda End
Ganesh-Himal Zone Economic Map^{*)}.

Code No.	Botanical name	Evaluated part of the Plant
43	<i>Alnus nepalensis</i> D. Don	Bark
57	<i>Anaphalis nepalensis</i> Spreng and <i>A.triplinervis</i> (Sims) C.B. Clarke	Plant
61	<i>Anemone rivularis</i> Buch.-Ham.ex. DC.	Root
62	<i>Anemone vitifolia</i> Buch.-Ham.ex. DC.	Root
82	<i>Artemisia vulgaris</i> L.	Plant
104	<i>Berberis asiatica</i> Rox.ex. DC.	Bark
106	<i>Berberis</i> sp.	Bark
107	<i>Bergenia ligulata</i> (Wall.) Engl.	Root
132	<i>Butea minor</i> Buch.	Seed
133	<i>Bidens pilosa</i> L.	Flowers
153	<i>Cassia fistula</i> L. and <i>C. laevigata</i> Willd.	Pod
158	<i>Cassia tora</i> L.	Pod
194	<i>Clematis acuminata</i> DC.	Plant
195	<i>Clematis buchananiana</i> DC.	Plant
204	<i>Colebrookea oppositifolia</i> Sm.	Root
211	<i>Coriaria nepalensis</i> Wall.	Leaves
233	<i>Cymbopogon citratus</i> (DC.) Stap.	Plant
249	<i>Daphne bholua</i> Buch.-Ham.ex. D.Don	Bark
275	<i>Dioscorea deltoidea</i> Wall.	Tubers
284	<i>Dryopteris filix-mas</i> (L.) Schott.	Rhizome
303	<i>Ephedra gerardiana</i> Wall.	Plant
321	<i>Euphorbia royleana</i> Boiss.	Plant
322	<i>Euphorbia</i> sp.	Plant

*)

In the economic map only quantities exceeding 250 Kg which we recommend to be collected from each 25 sq.Km are shown.

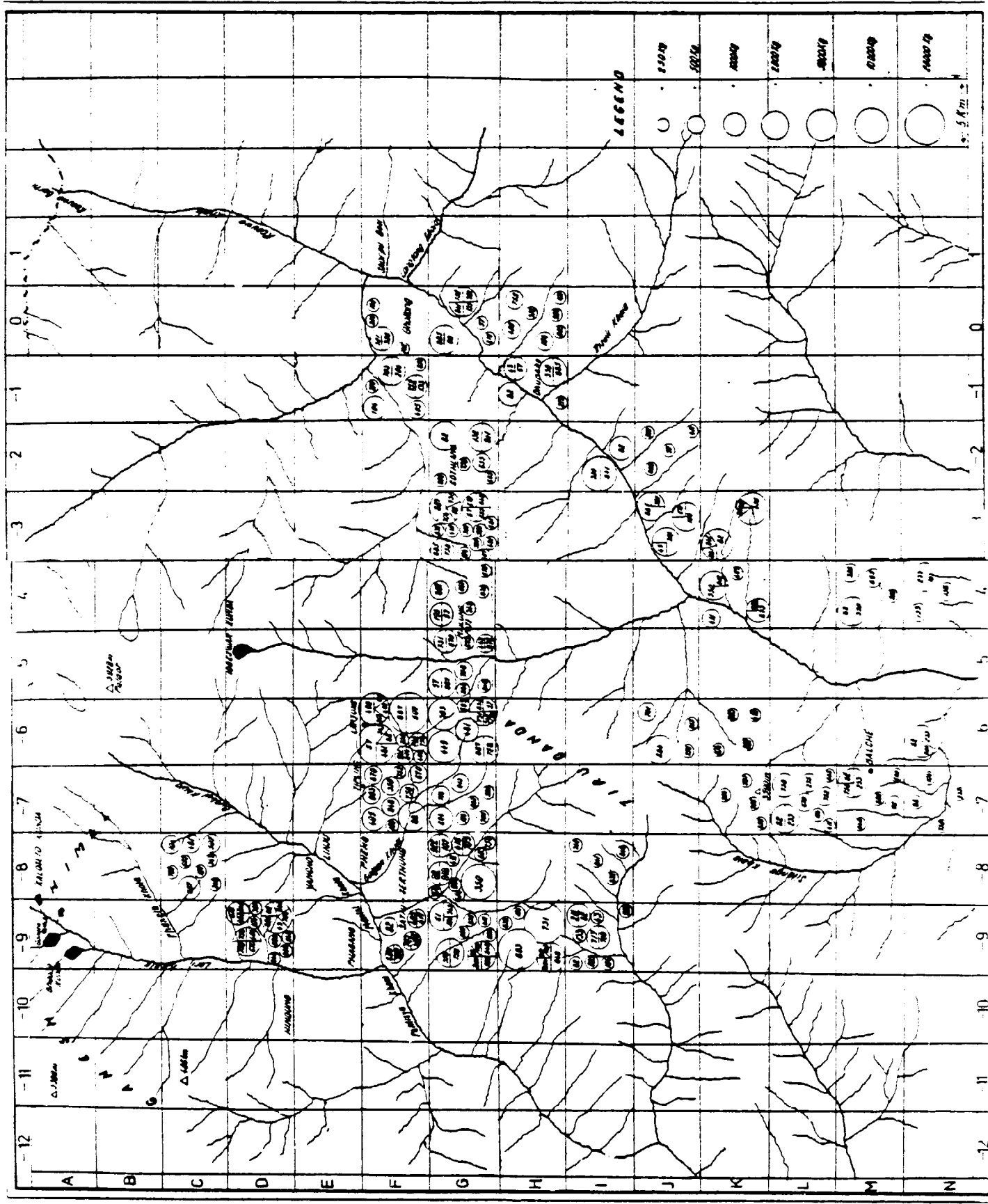
Code No.	Botanical name	Evaluated part of the Plant
326	<i>Eupatorium</i> sp.	Plant
343	<i>Fragaria nubicola</i> Lindl. ex Lacaita and <i>Fragaria</i> sp.	Leaves
350	<i>Gaultheria fragrantissima</i> Wall.	Leaves
366	<i>Gnaphalium luteo-album</i> L.	Flowers
376	<i>Gerbera maxima</i> (D. Don) Bauv.	Flowers
387	<i>Heracleum wallichii</i> DC.	Rhizome
405	<i>Hydrocotyle nepalensis</i> Hook	Plant
406	<i>Hydrocotyle podantha</i> Molk	Plant
411	<i>Hypericum uralum</i> Buch.-Ham.ex.D.Don	Flowering tops.
414	<i>Hedera nepalensis</i> K. Koch	Plant
416	<i>Ilex</i> sp.	Leaves
449	<i>Juniperus recurva</i> Buch.-Ham.ex.D.Don	Berries (cones)
481	Lichen sp. (<i>Parmelia furfuracea</i> Ach.)	Plant
499	<i>Lobelia pyramidalis</i> Wall.	Plant
500	<i>Lobelia</i> sp.	Plant
507	<i>Lycopodium clavatum</i> L.	Plant
520	<i>Mahonia nepaulensis</i> DC.	Berries
529	<i>Meconopsis nepaulensis</i> DC.	Root
653	<i>Physalis peruviana</i> L.	Plant
670	<i>Plantago major</i>	Leaves
676	<i>Pogostemon amaranthoides</i> Benth.	Plant
681	<i>Polygonum molle</i> D. Don	Plant
682	<i>Polygonum</i> sp.	Plant
693	<i>Potentilla fulgens</i> Wall	Rhizome
697	<i>Prinsepia utilis</i> Royle	Plant
703	<i>Pteridium aquilinum</i> (L.) Kuhn	Rhizome
704	<i>Pteris</i> sp.	Rhizome

Code No.	Botanical name	Evaluated part of the Plant
714	<i>Pteris quadriaurita</i> Retz.	Rhizome
715	<i>Primula</i> sp.	Rhizome, Plant
718	<i>Quercus lamellosa</i> Smith.	Acorn
731	<i>Rhododendron anthopogon</i> D. Don.	Leaves
732	<i>Rhododendron arboreum</i> Sm.	Leaves
750	<i>Rubia cordifolia</i> L.	Plant
752	<i>Rubus ellipticus</i> J.E.Smith	Leaves
756	<i>Rubus</i> sp.	Leaves
758	<i>Rumex nepalensis</i> Spreng.	Rhizome
782	<i>Saurauia nepaulensis</i> DC.	Bark
793	<i>Selinum tenuifolium</i> Wall.ex C.B.Clarke	Plant
832	<i>Swertia chirata</i> Hamilt.	Plant
840	<i>Senecio densiflorus</i> Wall. ex DC.	Flowering tops
841	<i>Senecio</i> sp.	Flowering tops
848	<i>Taraxacum officinale</i> (L.) Wigg.	Root and Leaves
856	<i>Thalictrum foliosum</i> DC.	Plant
885	<i>Urtica dioica</i> L.	Plant
886	<i>Urtica palmata</i>	Plant
887	<i>Usnea longissima</i> , <i>U. barbata</i> Mot.	Plant
893	<i>Valeriana hardwickii</i> Wall.	Root, Rhizome
894	<i>Valeriana wallichii</i> DC.	Root, Rhizome
912	<i>Viburnum coriaceum</i> Bl.	Bark
913	<i>Viburnum erubescens</i> Wall.ex DC.	Bark
922	<i>Zanthosylum alatum</i> Roxb.	Bark and Seeds
928	<i>Zingiber officinale</i> Rosc.	Rhizome

Remarks

On the mapped territory there are very important amounts of the following arborescent species:; *Abies spectabilis*, *Acer campbelli*, *Alnus nepalensis*, *Listea umbrosa*, *Lindera pulcherri-
ma*, *Michelia champaca*, *Pinus roxburghii*, *Pinus Wallichiana*, *Quercus lamelosa*, *Quercus semecarpifolia*, *Rhododendron arboreum*, *Rhododendron barbatum*, *Sorbus cuspidata*, *Tsuga dumosa*, *Tetra-
centron sinense*, *Viburnum sp.*, a.s.o.

Amounts up to 250 Kg. of dried raw material of the following species easy to collect exist also in the same area : *Aconitum sp.*, *Sectio Napellus*, *Cimicifuga foetida*, *Corydalis cashmeriana*, *Datura stramonium*, *Delphinium sp.*, *Gentiana depressa et G.sp.*, *Impatiens sp.*, *Inula cappa*, *Jasminum nepalense*, *Leontopodium alpinum*, *Paris polyphylla*, *Primula denticulata*, *Primula glomerata*, *Primula periolaris*, *Primula sp.*, *Prunella vulgaris*, *Rheum emodi*, *Sanicula elata*, *Smilax sp.*, *Strobilanthes atropur-
pureus*, *Viola pilosa*, *Verbascum thapsus*, a.s.o.

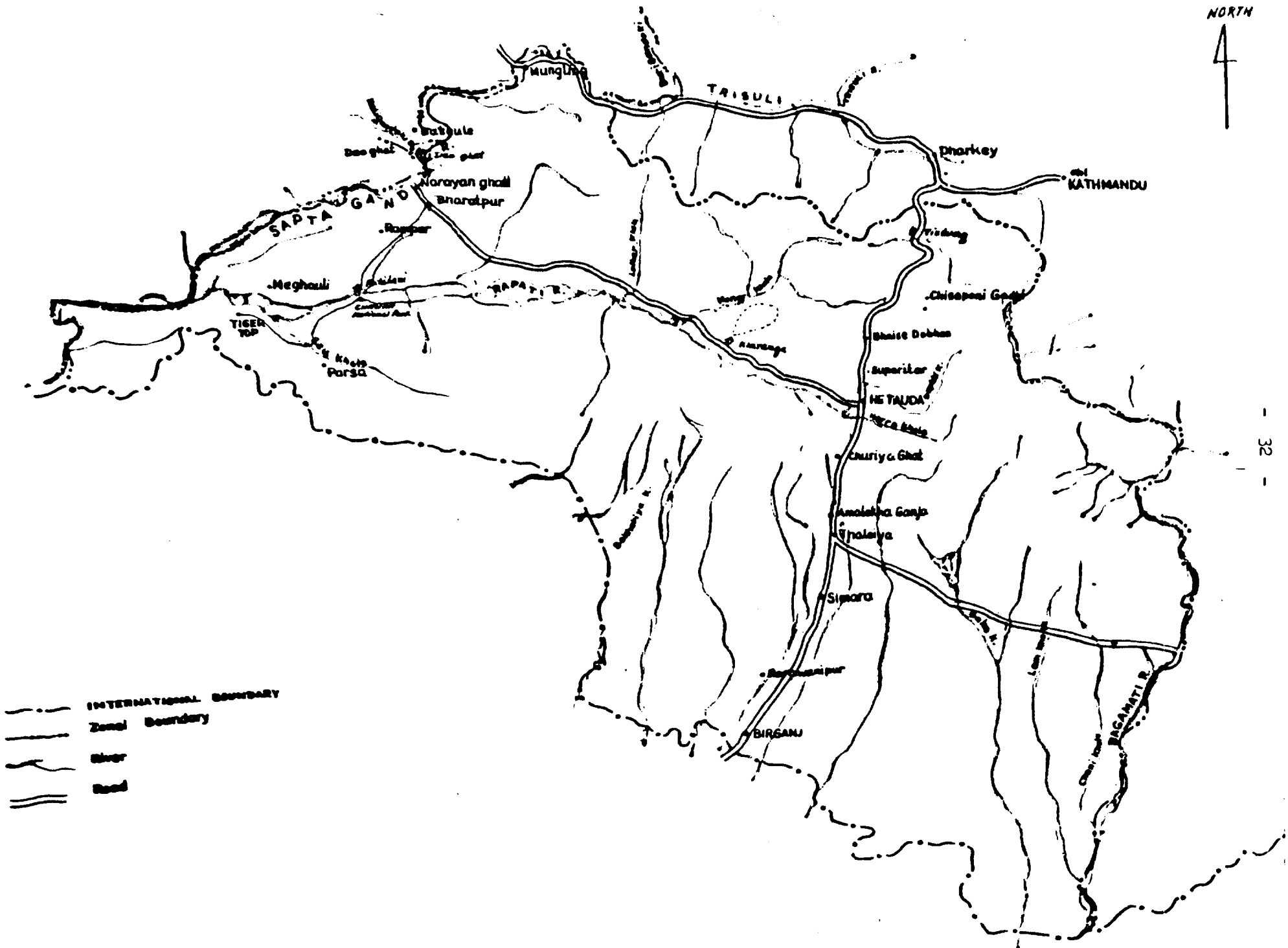






The map of Narayani zone
(Makawampur and Chitwan Districts)
and the list of plants identified
in that zone

Code No.	Botanical name	Code of Therapeutic Group
7	<i>Acacia catechu</i> (L.f.) Willd. (Leguminosae)	XXIV, XXXI, XL
-	<i>Artemisia dubia</i> Wall. ex DC. (Compositae)	XX
83	<i>Artemisia</i> Sp. (Compositae)	XX
-	<i>Bauhinia vahlii</i> Wight et Arn. (Caesalpinaceae)	XXIV
-	<i>Blumeopsis falcata</i> (D. Don) Merrill. (Compositae)	-
126	<i>Bryonopsis laciniosa</i> (L.) Naudin (Cucurbitaceae)	II, XX
153	<i>Cassia fistula</i> L. (Caesalpinaceae)	XXII
158	<i>Cassia tora</i> L. (Caesalpinoideae)	XXII
-	<i>Conyza stricta</i> Willd. (Compositae)	
-	<i>Debregeasia</i> Sp. (Urticaceae)	
277	<i>Dioscorea peltata</i> Sm. var. <i>lunata</i> (?) (Dioscoreaceae)	XXV
-	<i>Duabunga grandiflora</i> (Roxb) (Sonneratiaceae)	
319	<i>Eupatorium adenophorum</i> Spreng. (Compositae)	VII
340	<i>Floscopa scandens</i> Lour. (Cammeliaceae)	XXXIX
-	<i>Gonatanthus pumillus</i> (D. Don) Engler (Araceae)	-
370	<i>Grewia asiatica</i> L. (Tiliaceae)	-
429	<i>Ipomoea rederacea</i> Jacq. (Convolvulaceae)	XXII
521	<i>Mallotus philippinensis</i> Muell-Arg (Euphorbiaceae)	VIII, XXI, XXII
-	<i>Moghania bracteata</i> (Roxb.) (Papilionaceae)	-

Code No.	Botanical name	Code of Therapeutic Group
-	<i>Persicaria posumbus</i> (D. Don) H. Gross (Polygonaceae)	XXIV (?)
-	<i>Peristrophe speciosa</i> Nees. (Acanthaceae)	-
-	<i>Phoenix acaulis</i> (Palmae)	-
657	<i>Pimpinella archilleifolia</i> (DC.) C.B. Clarke (Umbelliferae)	XL
682	<i>Polygonum posumbu</i> Buch-Ham. ex D. Don (Polygonaceae)	XXIV
694	<i>Potentilla cryptotaeniae</i> Maxim (Rosaceae)	XXIV
726	<i>Reinwardtia indica</i> Dum. (Linaceae)	XL
777	<i>Sambucus hookeri</i> Rehder (Caprifoliaceae)	I
-	<i>Scurrula elata</i> (Edgew) Danser (Loranthaceae)	-
794	<i>Semecarpus anacardium</i> L. (Anacardiaceae)	X (?)
806	<i>Smilax ovalifolia</i> DC. (Smilacaceae)	I, XL
835	<i>Symplocos racemosa</i> Roxb. (Symplocaceae)	XXIV
851	<i>Terminalia bellirica</i> (Gaertn.) Roxb. (syn. <i>T. Bellerica</i> C.B. Clarke) (Combretaceae)	XXIV
932	<i>Zizyphus mauritiana</i> Lam (Rhamnaceae)	I, XXIV

NORTH



-  INTERNATIONAL BOUNDARY
-  Zonal Boundary
-  River
-  Road

ANNEX 5

List of medicinal plants samples
collected for analysis and processing

Code No.	Botanical name	Code of Therapeutic Group
7	Acacia catechu Willd.	XXIV, XXXI, XL
18	Aconitum sp.Sectio Napellus	I
19	Acorus calamus L.	XX, XXIII, XXX
54	Amonum subulatum Roxb.	XX
82	Artemisia vulgaris L.	XX
104	Berberis asiatica Rox ex DC.	V, XXIV
132	Butea minor Buch.	VIII
145	Capsicum annum L.	I, XXXIX
147	Cardiospermum helicacabum L.	I, XXXIX
167	Centella asiatica (L) Orban	XVII, XXXIX
183	Cinnamomum obtusifolium Ness	XX
191	Citrus limon (L) Burn	XX
190	Citrus aurantium L.	XX
233	Cymbopogon citratus (DC) Stapf.	XX, XXXIX
254	Datura stramonium L.	XX
275	Dioscorea deltoidea Wall.	XXX
284	Dryopteris filix-mas (L) Schott	VIII

Code No.	Botanical name	Code of Therapeutic Group
303	<i>Ephedra gerardiana</i> Wall.	XXXI
321	<i>Euphorbia royleana</i> Boiss.	VIII, X (?), XXI
319	<i>Eupatorium adenophorum</i> Spreng.	VII
350	<i>Gaultheria fragrantissima</i> Wall.	I, XXXIX
387	<i>Heracleum wallichii</i> DC.	XX
405	<i>Hydrocotyle nepalensis</i> Hook.	XVII, XXXIX (?)
406	<i>Hydrocotyle podantha</i> Molk.	XVII, XXXIX (?)
411	<i>Hypericum uralum</i> Buch-Ham. ex D. Don	XXIV, XXXIII, XXXIX
449	<i>Juniperus recurva</i> Buch-Ham. ex D. Don	XIX
-	<i>Meconopsis nepaulensis</i> DC.	XX (?)
681	<i>Polygonum molle</i> D. Don	XXIV
693	<i>Potentilla fulgens</i> Wall.	XXIV
729	<i>Rheum emodi</i> Wall.	XX, XXII
732	<i>Rhododendron arboreum</i> J.E. Smith	XXII
758	<i>Rumex nepalensis</i> Spreng.	-
794	<i>Semecarpus anacardium</i> L.	X (?)
813	<i>Solanum xanthocarpum</i> Schrad ex Wendl.	XXV
840	<i>Senecio densiflorus</i> Wall ex DC.	XX, XXIX
832	<i>Swertia chirata</i> Hamilt.	XX

ANNEX 5

Code No.	Botanical name	Code of Therapeutic Group
848	<i>Taraxacum officinale</i> (L.) Vigg.	V, XXXVII
851	<i>Terminalia bellerica</i> (Gaertn) Roxb.	XXIV
885	<i>Urtica dioica</i> L.	XXIV, XXXIII
894	<i>Valeriana wallichii</i> DC.	XV, XXX
928	<i>Zingiber officinale</i> Rosc.	XX

List of the medicinal herbs and trees
used in traditional medicine

Vernacular name, Botanical name.	Part used	Code of Therapeutic Group
Aduwa <i>Zingiber officinale</i>	Rhizome	XX
Agnimantha <i>Trachyspermum ammi</i>	Fruit, Root	XX, XXIV
Agasti <i>Sesbania grandiflora</i>	Bark	XXIV, VII
Ainselu <i>Rubus ellipticus</i>	Plant	XXIV
Ajeru <i>Dendrophthoe falcata</i>	Bark	XXIV, XXX XXXI
Akash beli <i>Cuscuta reflexa</i>	Seeds Plant	VIII XXII
Alaichi <i>Amonum subulatum</i>	Seeds	IV, XX, XXVIII
Amala, Amal <i>Emblica officinalis</i>	Fruit (dried)	XXIV XXVIII
Amala jhar <i>Cassia mimosoides</i>	Roots	XX
Amba <i>Psidium guajava</i>	Leaves	XXIV, XXXIX
Amp <i>Mangifera indica</i>	Leaves, Ripe fruit, Unripe fruit, Seed	IV, XIX, XXII XXVIII
Amantamul <i>Hemidesmus indicus</i>	Root	I, IV, VII, XII, XX
Anar <i>Punica granatum</i>	Root bark Rind of fruit	XX, XXIV
Ander <i>Ricinus communis</i>	Seeds Oil from seed	XXII
Angeri <i>Lyonia ovalifolia</i>	Leaves	XVII, XXXIX
Ankhataruwa <i>Heynea trijuga</i>	Leaves, bark	Toxic.
Aparijita <i>Clitoria ternatea</i>	Seeds, Root	XXII

Vernacular name, Botanical name.	Part used	Code of Therapeutic Group
Apamarga	Plant	XXII
<i>Achyranthes aspera</i>	Root	XXIV
Aphim	Opium	XXX
<i>Papaver somniferum</i>		
Arfu	Leaf juice	XX
<i>Acacia pennata</i>	Juice of bark	IV
Arka	Root bark	XIX
<i>Calotropis gigantea</i>	Latex	XXXIX, VIII
Ashoka	Bark	XXIV
<i>Saraca indica</i>		XII
Ashvatta, Pipal	Bark	XXIV
<i>Ficus religiosa</i>	Fruit; Leaves	XXII
Asuro	Leaves, Root	I, XX,
<i>Adhatoda vasica</i>		XXXI
Aswagandha	Root, Leaves, Fruit	XIX, XXX
<i>Withania somnifera</i>	Seeds	XXXIX
Atis	Root	XXIV,
<i>Aconitum heterophyllum</i>		XXXI
Atiwala	Root and rhizome	XXII
<i>Ipomoea sp.</i>		
Babul	Bark	XXIV
<i>Acacia arabica</i>	Bark, leaves, pod, gum	
Badahar	Seeds	XXII
<i>Artocarpus lakoocha</i>	Bark	VII, XXXIX
Badakatus	Bark and acorns	XXIV
<i>Quercus pachyphylla</i>		
Banlasun	Plant	VII
<i>Allium wallichii</i>		
Bar	Milky juice	XXXIX-I
<i>Ficus bengalensis</i>	Bark, Seeds	XXIV, XL
Barhamase, Barakmase	Root	Toxic
<i>Nerium indicum</i>		XXXIX-II
Barlikunda	Root	XXXIX-I
<i>Pueraria tuberosa</i>		
Barro	Fruit (half ripe)	XXII
<i>Terminalia belerica</i>	Fruit (fully ripe)	XXIV
Bayer	Fruit	XII, XXXI,
<i>Zizyphus jujuba</i>	Root	XXXIX

Vernacular name, Botanical name.	Plant used	Code of Therapeutic Group
Bethe <i>Chenopodium album</i>	Plant	VIII, XII
Bhalayo <i>Rhus wallichii</i>	Juice of leaves	XXXIX
Bhang <i>Canabis sativa</i>	Plant	XXX
Bhargi <i>Clerodendrum indicum</i>	Root Resin Juice of leaves	XXXI, I VII
Bhoj patra <i>Betula utilis</i>	Bark	VII, XX
Bhringraj <i>Eclipta prostrata</i>	Plant Plant juice Root	V, XXI, XXII
Bojho <i>Acorus calamus</i>	Rhizome	XX, XXIV IV, XXXI
Chakramandi <i>Cassia tora</i>	Leaves, seeds Root	VIII, X, IV
Chambo, Chaba, <i>Piper chaba</i>	Fruit	XX, XXXI XXXV
Chameli Phool <i>Jasminum arborescens</i>	Leaves	XXIV
Champ <i>Michelia champaca</i>	Bark Dried root and root bark	I, XXXI, XXIV
Chamsur <i>Lepidium sativum</i>	Plant Root Leaves	XXXI VII XIX
Chandan <i>Santalum album</i>	Wood	XXXIX-II XVII
Chandmaruwa <i>Rauwolfia serpentina</i>	Root Juice of leaves	XIII, XX XVIII
Chemeli phool <i>Jasminum arborescens</i>	Leaves Juice of leaves	XX, XXIV XXXI
Chhatiwan <i>Alstonia scholaris</i>	Bark Milky juice	I, IV, XXIV XXIII
Chichindo <i>Trichosanthes anguinia</i>	Fruit	VIII, XXII

Vernacular name, Botanical name.	Part used	Code of Therapeutic Group
Chiraita <i>Swertia chirata</i>	Plant	I, VIII, XXIV
Chiraito <i>Swertia angustifolia</i>	Plant	I, VIII, XXIV
Chitu <i>Plumbago zeylanica</i>	Root	XVII, XXIV
Chopechini <i>Smilax aspera</i>	Root	XII, XVII IV
Chutro <i>Berberis aristata</i>	Root bark and wood Plant	I, XVII, XXVIII
Chyuri <i>Madhuca butyracea</i>	Fat as ointment	I
<i>Convolvulus pluri- caulis</i>	Plant	XX, XXII
Daalchini <i>Cinnamomum zeylanicum</i>	Bark, Leaves	I, XX IV
Darba, Durbha <i>Poa cynosuroides</i>	Root Juice of Plant	XIX XXIV
Daruhaldi <i>Mahonia nepaulensis</i>	Leaves	XX, XXIV
Deodar <i>Cedrus deodara</i>	Wood	I, XIX, XXXI
Dhaiaro <i>Woodfordia fruticosa</i>	Flowers	XXIV, XXXV
Dhanjya <i>Coriandrum sativum</i>	Fruit	XIX, XX
Dhaturo <i>Datura stramonium</i>	Plant, Leaves, Fruit, Juice of flowers	XX, XXX XXVIII
Dhupi <i>Rhododendron anthopogon.</i>	Leaves	XX
Dronapuspi <i>Leucas cephalotes</i>	Flowers Plant and fresh juice	XXXI XXXIX
Eklebir <i>Lobelia pyramidalis</i>	Leaves	XX
Ganja <i>Cannabis sativa</i>	Plant	XXX

Vernacular name Botanical name	Part used	Code of Therapeutic Group
Ghiu kumari <i>Aloe barbadensis</i>	Plant, juice	XXII
Ghod tapre <i>Centella asiatica</i>	Plant	XII, XIX, XVII, XXX
Gokhur <i>Tribulus terrestris</i>	Fruit	XIX, XXXVIII
Gulab <i>Rosa alba</i>	Flower	XV, XVI
Guras, Gunnash <i>Rhododendron barbatum</i>	Leaves	Toxic
Gurip <i>Tinospora cordifolia</i>	Stem, root Juice of fresh plant	I, XX, XIX, XXXVIII
Hadachur <i>Viscum articulatum, V. album</i>	Plant, berry	XVI, XIX, XXII X, XXXVIII
Haledo <i>Curcuma longa</i>	Rhizome	XII, XX, XXVIII, XXXIX
Halonre <i>Lannea coromandelica</i>	Bark	XXXIX
Harro <i>Terminalia chebula</i>	Fruit	XXXIV-XXXIX
Hasta karni palas <i>Butea monosperma</i>	Seeds, Gum, Flowers, Bark	VIII, XXIV XIX
Hathikan <i>Opuntia sp.</i>	Fruit	XXII
Hathikane <i>Kalanchoe spathulata</i>	Plant	Toxic XXXIX
Hattipaila <i>Eulophia campestris</i>	Rhizomes	XV, XXI XXXIX
Himalcheri <i>Antidesma bunius</i>	Leaves	IV Toxic!
Imali <i>Tamarindus indica</i>	Fruit Infusion of Fruits	V, XXII I
Indrajow <i>Holarrhena antidysenterica</i>	Bark, Seeds	XXIV, I VIII

Vernacular name Botanical name	Part used	Code of Therapeutic Group
Isabgol <i>Plantago major</i>	Seeds, Leaves Root	XXIV I
Jamane mandro <i>Mahonia nepaulensis</i>	Berries	XIX, XXIV
Jangali bihin <i>Solanum nigrum</i>	Berries	XIX, XXII XXVIII, XXXVI
Jangali mewa <i>Physalis peruviana</i>	Juice of leaves Plant	VIII XIX
Japa puspi <i>Hibiscus rosa-sinensis</i>	Root, Flower	XXXI
Jatamansi <i>Nardostachis jatamansi</i>	Root	VI, XXX XV, XIX
Jeera <i>Cuminum cyminum</i>	Fruit	XXIV
Jethi madhu <i>Glycyrrhiza glabra</i>	Root	XXII, XXXI
Jiwanti <i>Desmotrichum fimbriatum</i>	Plant	IV, XXXVIII
Jwanu see Agnimantha	-	-
Jyamir <i>Citrus Limon</i>	Juice of ripe fruit	I, XXIV
Jyotismoti <i>Cardiospermum helicacabum</i>	Plant Root	I, IV, XXX XIX, XXII
Kachur <i>Curcuma zedoaria</i>	Rhizome	XIX, XX
Kafal <i>Myrica esculenta</i>	Bark	I, VII, XXXI
Kaka nasika <i>Leea aequata</i>	Tubers	XXIV
Kakad singhi Insect gall on <i>Pistacia</i> sp.	Gall	XXXI XXIV, IV
Kakoli <i>Fritillaria cirrhosa</i>	Bulb	XXXI

Vernacular name Botanical name	Part used	Code of Therapeutic Group
Kalo dhaturo <i>Datura metel</i>	Seeds, Leaves, Roots	I, XX, XXIV XXXI
Kalo haledo <i>Curcuma longa</i>	Rhizome	XII, XX, XXVIII, VIII
Kamal <i>Nelumbium nucifera</i>	Root	XXIV, XXXIX-XVII
Kankro <i>Cucumis sativus</i>	Seeds	XIX
Kantakari, Kantkari <i>Solanum xanthocarpum</i>	Root, Juice of berries Leaves, Plant	XXXI, XIX, XXXIX
Kapas <i>Gossypium arboreum</i>	Root Seeds	I, VII, XIX
Kapur <i>Cinnamomum camphora</i>	Plant	VIII, XX XXXIX
Karela <i>Momordica charantia</i>	Juice of leaves Fruit and leaves Root	V, XXII, VIII, XXXV
Kause phool <i>Cotoneaster affinis</i>	Stolens	XXIX
Kauso <i>Mucuna prurita, Mucuna nigricans</i>	Seeds Pod, Root	I, IV, VIII, XXII, XXXI
Kesar <i>Crocus sativus</i>	Flowers	XXXVIII
Khas <i>Andropogon muricatus</i>	Root	I, XX
Khayer <i>Acacia catechu</i>	Bark Plant	XXIV XXXIX
Khursani <i>Capsicum annum</i>	Fruit	IV, XXXIX
Khursani ajawan <i>Hyoscyamus niger</i>	Leaves	XXX XXXI
Koeralo <i>Bauhinia variegata</i>	Bark Buds, Root	XXIV, XXXIX IV, VIII
Krishna jeerach <i>Guizotia abyssynica</i>	Oil from seed	I

Vernacular name Botanical name	Part used	Code of Therapeutic Group
Kuchila, Dalchini Strychnos nux-vomica	Root-bark, Leaves, Seeds, Wood	Toxic I, XX, XXIV
Zukurdaino Smilax macrophylla	Root	I, VII, XXIV
Kumkun Didymocarpus leucocalyx	Herb	XX
Kurkure ghas Equisetum debile	Plant	VII, XIX
Kuth Saussurea lappa	Root	XX, XXXI XXXIX
Kutki Picrorhiza kurroa	Root	I, IV, XX XXII
Labsi Spondias axillaris	Fruits	XL
Lali gurash Rhododendron arboreum	Leaves	Toxic XIII
Lazzabati Mimosa pudica	Root Leaves	XL XXXV
Lodh, Lodhra Symplocos paniculata	Bark	XXIII, XXIV XXVIII-XXXIX
Madesi souf Foeniculum vulgare	Seeds Leaves, Root Oil	XX XIX, XXII VIII
Majitho Rubia cordifolia	Root Stem, Fruit	XXIV IV, XVII
Mamira Parnassia nubicla	Root and Rhizome	II
Mothe Cyperus rotundus	Tubers	VIII, XIX XX
Musali Curculigo orchoides	Rhizome	XIX, XXXI, XXXV, XXXIX
Musli, Siyah musali Aneilema scapiflorum	Root Root-bark	XXIV XXXVIII
Nagarmothe Cyperus scariosus	Tubers	XIX, XXIV
Nagebeli Lycopodium clavatum	Herb	I, XIX, XXXI

Vernacular name Botanical name	Part used	Code of Therapeutic Group
Nagesori <i>Mesua ferrea</i>	Flowers, Bark	XXIV, XXXI IV, XXXV
Narkat <i>Phragmites maxima</i>	Root	XIX
Nilokamal <i>Nymphaea</i>	Plant	XXIV
Nim <i>Azadirachta indica</i>	Bark, Root bark, Leaves, Gum, Oil	I, IV, VII, XX, XVIII
Nisotha, Niswanto <i>Operculina turpenthum</i>	Root	IV, XXII
Nutmegs - Ram patri, Jai patri <i>Myristica fragrans</i>	Seeds Oil	XX
Ole <i>Amorphophallus campanu- latus</i>	Tubers	I, XX, XXXI
Okhar <i>Juglans regia</i>	Bark, Leaves	VIII, XXIV
Paan <i>Piper betle</i>	Leaf, Fruits, Root, E. oil	IV, VII, XXXI
Padamchal <i>Rheum emodi</i>	Root and Rhizome	XXII
Paidram <i>Chrysanthemum cinerari- aefolium</i>	Flowers	Toxic XL
Paiyun <i>Prunus cerasoides</i>	Kernel	XIX
Palas <i>Butea monosperma</i>	Seeds, Leaves Gum, Flowers	VIII Toxic XXIV
Panch aunle <i>Orchis latifolia</i>	Tuber	XX
Parwal <i>Trichosanthes dioica</i>	Leaves, Root Fruit	I, XXI XL
Pashanved <i>Bengenia ligulata</i>	Root	I, XXIV, XXVIII, XXXI
Patha <i>Stephania hernandifolia</i>	Root	I, XXIV

Vernacular name Botanical name	Part used	Code of Therapeutic Group
Pipala Piper longum	Root, Fruit	IV, XX XXXI
Pitta papada Naregamia alata	Root, Leaves, Plant	I, V, XXIV, XXXI
Pudina Mentha arvensis	Plant	XX
Punarnava Boerhaavia diffusa	Root, Leaves	I, XII, XXXI
Purpure timur Zanthoxylum hamiltonianum	Fruit	XX
Raj briksha Cassia fistula	Root bark Fruit	
Rittha Sapindus mukorossi	Fruit	VI, XXXI
Rudilo Nyctanthes arbor-tristis	Leaves, Flowers	I, VIII, XX, XXII
Rudrakshya Eleocarpus sphaericus	Fruit	VI
Sajiwan, Sajiba Jatropha curcas	Nuts, Seeds Juice of plant	XXII XVII-XXXIX
Salla Pinus roxburghii	Resin Wood	IV, XX, XXXI
Salparni Desmodium gangeticum	Roots	I, XIX, XXIV
Sano pipala see Pipala		
Sariba Ichnocarpus frutescens	Roots	I, XII, IV, XIX
Sarpaganda see Chandmaruwa		
Satavari Asparagus racemosus	Root Plant	I, XII, XIX, XXIV
Sathi Curcuma zedoaria	Rhizome	XIX, XX XXXIX
Seto dubo Cynodon dactylon	Root	XIX, XXIV XXVIII, XXXV

Vernacular name Botanical name	Part used	Code of Therapeutic Group
Shobhanjan <i>Moringa oleifera</i>	Root, Root bark Fruits	VI, XVI, XXX, XXXIX-I
Shrikhand, Chandan <i>Santalum album</i>	Wood	XVII, XXXIX
Sihundi <i>Euphorbia royleana</i>	Milky-juice	VIII, XXI
Sikakai <i>Acacia concinna</i>	Pod Leaves	XXXI V, XXI
Simal <i>Salmalia malabarica</i>	Root, Gum	XXXVIII XXIV
Sipligan <i>Gataeva religiosa</i>	Bark	XIX, XXII
Sisnu <i>Urtica dioica</i>	Root Plant	XIX VIII, XII, XXIV
Sivalingi <i>Bryonopsis laciniosa</i>	Plant	V, I
Somalata <i>Ephedra gerardiana</i>	Plant	XXXI XVI
Soya <i>Anethum sowa</i>	Fruit	XX
Sugandhaval <i>Valeriana wallichii</i>	Root	XX, XXX
Sukumel <i>Elettaria cardamomum</i>	Seed	XIX, XX
Supari <i>Areca catechu</i>	Nut	VIII, XXIV XXXVIII
Surti <i>Nicotiana tabacum</i>	Leaves	XXX XX
Sutho see Aduwa		
Talis patra <i>Abies spectabilis</i>	Leaves	XXXI
Talmakhana <i>Astercantha longifolia</i>	Leaves, Root, Seeds	I, XIX
Tapre <i>Cassia sophera</i>	Leaves Plants	VIII XXXI

Vernacular name Botanical name	Part used	Code of Therapeutic Group
Tateberi <i>Dalbergia stipulacea</i>	Bark and Roots	Toxic
Tatelo <i>Croxyllum indicum</i>	Root bark, Fruits, seeds	XXIV XXII
Tej pat <i>Cinnamomum tamala</i>	Bark	XX
Thotne <i>Polygonum molle</i>	Plant	XXIV
Thulo bihin <i>Solanum torvum</i>	Fruits	XX
Thulo pipala <i>Piper cubeba</i>	Oil	VII
Timur <i>Zanthoxylum armatum</i>	Seeds Fruits	I, VII, XX XL
Tingir <i>Saurauja napaulensis</i>	Bark	XXXIX
Tissi <i>Salix babylonica</i>	Leaves Bark	I, VIII
Titepati <i>Artemisia vulgaris</i>	Herb Root	VIII, XX XXY, XXXI
Tori <i>Brassica campestris</i>	Roots	XXXIII
Tuki phul <i>Taraxacum officinale</i>	Root, Plant	V, XIX XXII
Tulsipatra <i>Ocimum sanctum</i>	Leaves, Seeds, Root, Plant	I, V, VII, XX, XXXI
Ukhu <i>Saccharum officinarum</i>	Stem Root	XIX, XXII
Utis <i>Alnus nepalensis</i>	Bark	XXIV
Yarsa gumba <i>Cordyceps sinerisis</i>	Plant	XX

List of Plants from Herbarium

Botanical name	Family	Code No.
I. Tiru Danda and Ganesh-Himal		
<i>Abies spectabilis</i> (D. Don) Spach.	PINACEAE	3
<i>Achyranthes aspera</i> L.	AMARANTHACEAE	12
<i>Aconitum</i> sp. Sectio Napellus	RANUNCULACEAE	18
<i>Ageratum conyzoides</i> L.	COMPOSITAE	31
<i>Anaphalis triplinervis</i> (Sims) C.B. Clarke	COMPOSITAE	57
<i>Andropogon citratus</i> D.C. syn. <i>Cymbopogon citratus</i> (DC) Stap.	GRAMINEAE	58/233
<i>Artemisia vulgaris</i>	COMPOSITAE	82
<i>Aster albescens</i> (D.C) Hand.-Mzt.	- " -	-
<i>Aster</i> sp.	- " -	-
<i>Aster tricephalus</i> C.B. Clarke	- " -	-
<i>Berberis concinna</i> Hock.f.	BERBERIDACEAE	106
<i>Berberis jaeschkeana</i> Schneid	- " -	106
<i>Bergenia ciliata</i> (Haw.) Sternb	SAXIFRAGACEAE	107
<i>Betula alnoides</i> Buch.-Ham.	BETULACEAE	110
<i>Boenninghausenia albiflora</i> (Hook) Meisn.	RUTACEAE	117
<i>Bryonopsis laciniosa</i> (L.) Naudin	CUCURBITACEAE	126
<i>Butea minor</i> Buch	LEGUMINOSAE	132
<i>Campanula colorata</i> Wall.	CAMPANULACEAE	-
<i>Cassia floribunda</i> Cav.	CAESALPINACEAE	-
<i>Cassiope seleginoides</i> Hook.f. et Thoms.	ERICACEAE	-
<i>Cimicifuga foetida</i> L.	RANUNCULACEAE	-
<i>Clinopodium umbrosum</i> (M.-Bieb) C.Koch (syn. <i>Calamintha umbrosa</i>)	LABIATAE	-

Botanical name	Family	Code No.
<i>Coleus forskohlii</i> (Willd.) Briq.	LABIATAE	205
<i>Colquhounia coccinea</i> Wall.	- " -	-
<i>Coriaria nepalensis</i> Wall.	CORIARIACEAE	211
<i>Corydalis cashmeriana</i> Royle	FUMARIACEAE	-
<i>Delphinium</i> sp.	RANUNCULACEAE	261
<i>Elsholtzia flava</i> Benth	LABIATAE	297
<i>Epilobium roseum</i> Schreb.	ONAGRACEAE	-
<i>Ephedra gerardiana</i> Wall	GNETACEAE	303
<i>Erigeron multicaulis</i> Wall.ex.DC.	COMPOSITAE	309
<i>Eugenia jambolana</i> Lam.	MYRTACEAE	-
<i>Euphorbia heterophylla</i> L.	EUPHORBIACEAE	322
<i>Gaultheria nummularoides</i> D.Don	ERICACEAE	-
<i>Gentiana depressa</i> D.Don	GENTIANACEAE	355
<i>Geranium grevilleanum</i> Wall.	GERANIACEAE	360
<i>Gerbera maxima</i> (D.Don) Beauv	COMPOSITAE	376
<i>Gynura nepalense</i> DC.	- " -	-
<i>Hemiphragma heterophyllum</i> Wall.	SCROPHULARIACEAE	-
<i>Holboellia latifolia</i> Wall.	BERBERIDACEAE	399
<i>Hydrocotyle podantha</i> Molk	UMBELLIFERAE	406
<i>Hydrocotyle nepalensis</i> Hook	- " -	405
<i>Hypericum cordifolium</i> Choisy	HYPERICACEAE	413
<i>Hypericum uralum</i> Buch.-Ham.ex. D.Don	HYPERICACEAE	411
<i>Hypericum tenuicaule</i> Hook.f. et Thom.	- " -	413
<i>Indigofera pulchella</i> Roxb.	PAPILIONACEAE	-
<i>Inula cappa</i> DC.	COMPOSITAE	-
<i>Jatropha curcas</i> L.	EUPHORBIACEAE	445

Botanical name	Family	Code No.
<i>Juniperus recurva</i> Buch.-Ham. ex.D.Don	CUPRESSACEAE	449
<i>Kalanchoe spathulata</i> DC.	CRASSULACEAE	454
<i>Leontopodium alpinum</i> Cass.	COMPOSITAE	472
<i>Lobelia pyramidalis</i> Wall	LOBELIACEAE	499
<i>Luculia gratissima</i> (Wall) Sweet	RUBIACEAE	504
<i>Lycopodium clavatum</i> L.	LYCOPODIACEAE	507
<i>Martynia annua</i> L.	MARTYNIACEAE	524
<i>Peperomia tetraphylla</i> (Forst.f.) Hook.f.et Arni (<i>P. reflexa</i>)	PIPERACEAE	-
<i>Phyllanthus parvifolius</i> Buch.-Ham.	ELLPHORBIACEAE	650
<i>Physalis minima</i> L.	SOLANACEAE	652
<i>Physalis peruviana</i> L.	- " -	653
<i>Pieris formosa</i> (Wall.) D. Don	ERICACEAE	656
<i>Plectranthus repens</i>	LABIATAE	-
<i>Plectranthus rugosus</i>	- " -	-
<i>Polygonum polystachyum</i> Wall ex. Meisn.	POLYGONACEAE	682
<i>Potentilla fulgens</i> Wall	ROSACEAE	693
<i>Primula glomerata</i> Pax.	PRIMULACEAE	715
<i>Prunella vulgaris</i> L.	LABIATAE	-
<i>Pyrus pashia</i> Buch.-Ham.ex.D.Don	ROSACEAE	713
<i>Reinwardtia indica</i> Dum.	LINACEAE	726
<i>Rhododendron anthopogon</i> D.Don	ERICACEAE	731
<i>Rhododendron barbatum</i> Wall.	- " -	733
<i>Rhododendron campanulatum</i> D.Don	- " -	-
<i>Rhododendron lepidotum</i> Wall.ex. D.Don	- " -	-
<i>Rhus javanica</i> L.	ANACARDIACEAE	740
<i>Rubus ellipticus</i> J.E.Smith	ROSACEAE	752
<i>Rubus fockeanus</i> Kurz	- " -	756

Botanical name	Family	Code No.
<i>Sambucus hookeri</i> Rehder	CAPRIFOLIACEAE	777
<i>Sanicula elata</i> Buch.-Ham. ex. D.Don (syn. <i>S.europaea</i> L.)	UMBELLIFERAE	-
<i>Scutellaria repens</i> Buch. Ham. ex. D.Don.	LABIATAE	-
<i>Senecio chrysanthemoides</i> DC.	COMPOSITAE	841
<i>Senecio densiflorus</i> Wall. ex. DC.	- " -	- "-
<i>Senecio scandens</i> Buch.-Ham. ex. D.Don	- " -	- "-
<i>Senecio wallichii</i> DC.	- " -	- "-
<i>Silene indica</i> Roxb.	CARYOPHYLLACEAE	-
<i>Smilax elegans</i> Wall. ex. Hook. f.	SMILACACEAE	806
<i>Solanum aculeatissimum</i> Jacq.	SOLANACEAE	-
<i>Solanum indicum</i> L.	- " -	807
<i>Spermaoctyon suaveolens</i> Roxb.	RUBIACEAE	816
<i>Strobilanthes capitatus</i> (Ness.) T. Andors	ACANTHACEAE	-
<i>Swertia chirata</i> Hamilt.	GENTIANACEAE	832.
<i>Thalictrum foliolosum</i> DC.	RANUNCULACEAE	856
<i>Tripterospermum volubile</i> (D.Don) Hara	GENTIANACEAE	-
<i>Valeriana hardwickii</i> Wall.	VALERIANACEAE	893
<i>Valeriana wallichii</i> DC. (syn. <i>jatamansi</i> Jones)	- " -	894
<i>Viburnum coriaceum</i> Blame	CAPRIFOLIACEAE	912
<i>Zizyphus mauritiana</i> Lam.	RHAMNACEAE	932

II. Narayani zone

Botanical name	Family	Code No.
<i>Acacia catechu</i> (L.f.) Willd.	LEGUMINOSAE	7
<i>Bauhinia wahlbi</i> Wight et Arn.	CAESALPINACEAE	-
<i>Blumeopsis falcata</i> (D.Don) Merrill	COMPOSITAE	-
<i>Bryonopsis laciniosa</i> (L.) Naudin	CUCURBITACEAE	126
<i>Calotropis gigantea</i> (L.) Dryand.	ASCLEPIADACEAE	137
<i>Cassia fistula</i> L.	CAESALPINACEAE	153
<i>Centella asiatica</i> L.	UMBELLIFERAE	167
<i>Conyza stricta</i> Willd.	COMPOSITAE	-
<i>Debregeasia</i> sp.	URTICACEAE	-
<i>Duabanga grandiflora</i> (Roxb.) Valp.	SONNERATIACEAE	-
<i>Floscopa scandens</i> Lour	CAMMELIACEAE	340
<i>Gonatanthus pumilus</i> (D.Don) Engl.	ARACEAE	-
<i>Grewia asiatica</i> L.	TILIACEAE	370
<i>Mallotus philippinensis</i> Muell-Arg.	CONVOLVULACEAE	521
<i>Moghania bracteata</i> (Roxb.)	PAPILIONACEAE	-
<i>Peristrophe speciosa</i> Nees.	ACANTHACEAE	-
<i>Potentilla cryptotaeniae</i> Maxim.	ROSACEAE	694
<i>Reinwardtia indica</i> Dum.	LINACEAE	726
<i>Semecarpus anacardium</i> L.	ANACARDIACEAE	794
<i>Symplocos racemosa</i> Roxb.	SYMPLOCACEAE	835
<i>Terminalia bellirica</i> (Gaert.) Roxb.	COMBRETACEAE	851
<i>Zizyphus mauritiana</i> Lam.	RHAMNACEAE	932

The List of Pharmaceutical Products

Prepared in Nepal

(October - December 1979)

Mode of Presentation :

Name of Pharmaceutical Product.

Name of Plant, Family.

Part used.

Processing.

Principal compounds.

Pharmacological Activity and Use in Therapeutics.

Technological form.

Dosage.

Contraindications.

A.R.M. = Availability of Raw Material.

Abbreviations

(Part of the plant used)

B.	= Bulbs	R.	= Root
Bc.	= Bark	Rb.	= Root bark
Be.	= Beans	Rh.	= Rhizome
Br.	= Berries	Rz.	= Resin
C.	= Capsules	S.	= Steam
Fl.	= Flowers	S.b.	= Steam bark
Fl.t.	= Flowering tops	Se.	= Seeds
Fr.	= Fruits	S.w.	= Stem wood
G.	= Gum	Tb.	= Tubers
J.	= Juice	W.p.	= Whole plants
L.	= Latex	A.R.M.	= availability of raw material (unlimited, satisfactory, limited, low)
Lf.	= Leaf		
L.J.	= Leaf juice		
L.p.	= Leaf and pods		
P.	= Pods		

I XL = The number in Latin feature represents the therapeutical group elaborated by WHO for the essential drugs.

(See Annex 14).-

Procedure of extraction

(M) = Maceration
(P) = Percolation
(T.B.) = Turboextraction
(Ph.C.Ph.T.) = Physico-Chemical and Pharmaceutical Technology.

R - OH % = The concentration (%) in ethyl alcohol.
(C - R - OH = Concentrated Alcohol)

Dp = Drops
(Fl.ex.) = Fluid extract
Pl. = Pils
P.c. = Pure compound
(D.ex.) = Dry extract
(S.ex.) = Selective extract
Tra. = Tincture
Tab. = Tablets
Ungv. = Ointment

Tinctura ArtemisiaeXXThe plant: *Artemisia vulgaris*

(Compositae)

Part used: Fl.t.

Processing: (M) R-OH 55-69%

(20 p plant 80 p.R-OH)

Principal compounds: essential oil, (α and β - tujon, esters with acetic, izovalerianic & palmitic acids pinene cadinen, proazulens, etc.).

artamarin, artamaridin, artamaridinin (bitter part); one flavonol: artemetin, vit.B₆, C.FP, sesquiterpens, etc.

Pharm. activ. & use : stimulation of gastro-intestinal secretions antibiotic, antihelminthic and antispastic.

Teh. form: Tra.

Dosage: 2-6 g daily for no more than 1 week.
(10-20 drops x 2-4 x daily).

Contraindications: Pregnancy.

A.R.M. : unlimited.

Tinctura Artemisiae compositaXX

("Tra.amara") Nr.1

Formula:

Herba Absinthii vulg. (Fl.t).	.....	80 g.
Herba Swertiae chir. (W.p.) = <i>Geothia</i>	.....	40 g.
Pericarpum Aurantii (Fr.Bc.)	.....	30 g.
Rhizoma calami (Rh.)	.....	20 g.
Cortex Cinnamomi (S.b.)	.....	10 g.
Rhizoma Zingiberis (Rh.)	.....	10 g.
R-OH 70% q.s.	.....	1000 ml.

Processing: (M) or (P)Principal compounds: complex.

Pharm. activ. & use : stimulation of gastro-intestinal secretions antibiotic, anthelmintic, antispasmodic.

Teh.form: Tra.

Dosage: 20-30 drops x 2-3 x/daily.

Contraindications: Pregnancy, hyperacidity.

A.R.M. : unlimited.

Extractum Artemisiae Spissum

XX

(Fl.ex.) Concentrated.

The plant: *Artemisia vulgaris* L.

(Compositae)

Part used: Fl.t.

Processing: Double (M) or (T.B.)

R-OH 17% 85 p.

Plant 15 p.

After maceration boil for 15' on a B.M. (water bath) - Filtra-
tion - Concentration to a soft extract.

Principal compounds: see Tra. *Artemisiae*.

Pharm.activ. & use : See Tra. *Absinthii*.

Teh.form: Pl., Tabl.

Dosage: 0.5 - 1.0 g/daily.

Contraindications: Pregnancy.

A.R.M. : unlimited.

Tinctura Amonum

XX

The Plant: *Amonum subulatum* Roxb.

Part used: Se.

Processing: (P) R-OH 70%

20 g seeds. + 80 ml. R-OH 70%.

Principal compounds: essential oil (cineol, terpineol, borneol,
sabinen, etc.).

Pharm.activ. & use : aromatic, stimulant-stomachic.

Tehn.form: Tra.

Dosage : 2-3 ml/daily.

Contraindications : hyperacidity.

A.R.M.: limited in Eastern Nepal.

Tinctura Aconiti

I

The Plant: Aconitum Sp. SECTION ^U ~~NAPELLUS~~ ^X)

Part used: Tb.

Processing: (P) R-OH 70%

10 g. Tubers (sieve V) ad.

190 ml R-OH 70% + 1 % HCl dil. (pH = 4,0-4,7).-

Principal compounds: aconitine, neopelin, napelin, mesaconitine, hipaconitine, picroaconitine, etc. (alkaloids).

Pharm. activ. & use: analgetic.

Tehn.form: Tra. containing 0,05 g % of total alkaloids.

Dosage: 0,30 g (30 drops) x 2 daily

In 1 Day max. 60 drops (1 g).

*) In medicinal spontaneous flora of Nepal are growing up:

A.R.M.: satisfactory.

Aconitum balfourii and A. Spicatum (poisonous species) and

A. palmatum & A. heterophyllum (no poisonous).

A preliminary phyto-chemical study is necessary!!

Extractum Aconiti Siccum

I

D. ex.

The plant: Aconitum Sp. Sectio Napellus.

Part used: Tb.

Processing: (P) R-OH 70%

33 p Tubers

66 p R-OH.

Filtrations, concentrations - Dry Extract (Contains 0.50 g % of alkaloids).

Principal compounds: See Tra. Aconiti.

Pharm. activ. & use : See Tra Aconiti.

Obs. From dry extract it is possible to prepare Tra.Aconiti:

10 g Dry extract

90 g R-OH 25% + 3.0 ml HC dil. (pH = 2.5-3.0).

Dosage : 0.03 g dry extract to 0.06 g dry extract (for 24 hrs.)

Technolog.forms: Pl. and Tab.

Aconitum Juice

I

The plant : Aconitum sp.,
Sectio Napellus

Part used : Tb.

Processing: Press juice obtained from fresh tubers and preserved with Na benzoate; 1 ml contains 0.5 mg of alkaloids.

Principal compounds: see Tra. Aconiti.

Pharm. activ. & use : See Aconitum Syrup.

Dosage: 3 x daily 5-10 drops.

Contraindications: See Aconitum Syrup.

A.R.M. : satisfactory.

Aconitum Syrup

I

Formula:

Tra. Aconiti 5 g.

Cane Sugar Syrup..... 95 g.

(Alkaloids content: 0.0025 g%).

Principal compounds: See Tra. Aconiti.

Pharm. activ. & use: analgetic, for neuralgias, rheumatism, sciatica and in acute form of cough, bronchitis.

Dosage: 3-6 tea spoon daily.

Contraindications: Cardio-vascular diseases.

A.R.M. = satisfactory.

Tinctura Aurantii DulcisXX

The plant: Citrus aurantium L.
var. dulcis Pers.

Part used: Fr. Bc.

Processing: (M) R-OH 60%
20 p Fr. Be (dry) + 80 p R-OH

Principal compounds: essential oil (80.90 % d-limonen, n-decyclic aldehyde, d-linalol, n-nonilic alcohol n-caprilic acid, d-terpineol, methyl antranilat, aurapten etc.); hesperidoside (- 7 rutinoside of hesperetine) neohesperidin, linolein, linolenin etc.

Pharm. activ. & use : correcting the taste of syrups with :
antibiotics, vitamins, sulphamides, antihistaminics, piperazine, Na-p-aminosalicylate, barbiturates etc.
In combination with other plants for stimulation of gastro-intestinal secretions.

Techn. Form : Tra.

Dosage: 1-6 g/daily.

Contraindications: Nil.

A.R.M. : unlimited.

Tinctura Citri RecensXX

(Rutaceae)

The plant: Citrus medica var. limonum.

Plant used: Fresh Bc. of fruits.

Processing: (M) 8 days 100 g. fresh raw material (Bc) + 200 g.
R-OH 95 %.

Principal compounds: essential oil 0.25-0.40%. (citral, nerol, geraniol) aldehyde, citronelal, terpenics alcohols (esterificated with acetic acid) methyl antranil of methyl, n-methyl antranilic acid etc. flavonoids, eriodictiol (glycoside).

Pharm. activ. & use: Stomachic, eupeptic, tonic and aromatic for pharmaceutical preparations with sulphamides, Vit. B₁, barbiturals, antihistaminics extr. valerianae etc.

Dosage: 1 dosis = 2.5 g.; 5-10 g/daily.

A.R.M.

Tinctura Catechu

XXIV, XXXI, XL

The plant: *Acacia catechu* Wild.

(Fam. Leguminosae)

Part used: Se.

Processing: Double (M) with R-OH 70%

(20 p.seeds + 80 p.R-OH)

Principal compounds: 30-50% cathechic tannin, 2-10% l-catechin,
1-epicatechin, 20-30% mucilaginous subst.,
2-3% mineral salts.

Pharm. activ. & use: astringent, cough, diarrhoea, mouth and
gums pain.

Tech. Form: Tra.

Dosage: 2-3 g./daily.

Contraindications: constipation.

A.R.M.: ?

Tinctura Ephedrae

XXXI

The plant: *Ephedra gerardiana* Wall. (Gnetaceae)

Part used: Fl.t., Lf.

Processing: 25 g raw material + 1% HCl dil. + R-OH 70% (P) -

Titration Analysis.

1 ml. Tra. contains 3 mg. of total alkaloids.

Principal compounds: till 2% of alkaloids (l-ephedrine, d-pseudo-
ephedrine, d-N-methylpseudoephedrine, etc.) tannin,
catechine, resine, sugars.

Pharm. activ. & use: stimulant action on the cerebrum and the
respiratory centre.

Techn. form: Tra associated with other medicaments.

Contraindications: in organic heart disease and hyperthyroidism.

A.R.M.: limited.

Tinctura Calami

XXIII, XXI

The plant: *Acorus calamus* L.

(Syn. *A. aromaticus* Gilib.)

(Araceae)

Part used: (Rh)

Processing: (M) or (P) 20 p.Rh + 80 p.R-OH 60%.

Principal compounds: essential oil (asarone till 82%, asarilic aldehyde, eugenol, calamol, calameon, celamen etc) acorine, tannin, choline etc.

Pharm. activ. & use: Antacid, sedative, psychotherapeutic, laxative.

Technological form: Tra, Tabl. of powder prep. from rhizome.

Dosage: Tra 1-3 g/daily.

Contraindications: Nil.

Tinctura Capsici

I, XXXIX

The plant: *Capsicum annuum* L.

(Solanaceae)

(Syn. *C. fastigiatum* Blume, *C. frutescens* L.)

Part used: (Fr.)

Processing: (M) or (P) with R-OH 70% or 95% (10% plant)

Principal compounds: capsaicin, capsantin, capsorubin, zeaxanthin, criptoxanthine, vit.: B₂, C, PP, E.

Pharm. activ. & use : external, revulsive, antirheumatic rubefacient.

Techn. form: Tra.

Dosage : external, local applications.

Contraindications: dermatitis, skin diseases.

A.R.M.: satisfactory from culture.

Extractum Capsici Fluidum Concentratum

I, XXXIX

(Oleorezina Capsici)

The plant: Capsicum annuum L
(Solanaceae)

Part used: (Fr.)

Processing: (P) with acetone 1 : 2 second (P) 1 : 2;
(water wash)

Principal compounds: See Tra Capsici.

Pharm. activ. and use: See Tra Capsici.

Techn. form : Extract.

Contraindications: See Tra Capsici.

A.R.M. : satisfactory from culture.

Extractum Cardiospermi

I, XXXIX

The plant: Cardiospermum helicacabum L.

(Sapindaceae)

Part used: (Lf)

Processing: (M) 20 p. of leaf + R-OH 95% (80 p.)
Evaporation - till concentrated extract (95%).

Principal compounds: complex revulsive compounds.

Pharm. activ. & use: rubefacient, external in rheumatism.

Techn. form : associated with other extract, external, ointment.

Contraindications: dermatitis.

A.R.M. : satisfactory.

Tinctura Cinnamomi

XX

The plant: *Cinnamomum Zeylanicum* Blume
(Lauraceae) or *C. obtusifolium* Ness.

Part used: S.b.

Processing: (M) or (P) 20 g Pulv. bark (Siebe V) with 80 g
R-OH 70%.

Principal compounds: 0.9-2.3 % essential oil (comp. of cinamic
aldehyde, eugenol, methyl-n-amyl-cetone,
-pinen. phelandren, benzyl aldehyde,
p-cimen, cariophilen, lindol etc. tannin

Pharm. activ. & use : digestion stimulant, carminative, oestrogen
effects, aromatic for Pharm. prep. from :
Aloe, Cascane, Catechu, China, Hydrastis,
Lobelia, Ergot of Rye, sulphonamides,
amino-acids, antinistamines, etc.

Dosage: 1-1.5 til 3 ml/daily.

A.R.M. : limited.

Extractum Rhizoma filicis

VIII

The plant: *Dryopteris filix mas* Schott.

Part used: Rh.

Processing: (P) with chlorophorm (1:12) Evaporation - Analysis -
(After evaporation of chlorophorm the soft extract
contains 1.5-1.7% of crude filicine, when it is
more diluted with vegetable oil)(For homogenization
heat at 50°C, before use).

Principal compounds: fluoroglucinic compounds : filixic acid
(mixture of 6 substances), flavaspidic
acid, albaspidine, aspidinol cetofluoro-
glucinic derivatives, etc.

Pharm. activ. & use : Anthelmintic against oxyuris and tapeworms.

Dosage: As directed by the physician.

A.R.M. : satisfactory.

Tinctura Hyperici

XXIV, XXXIII, XXXIX

The plant: *Hypericum uralum* Ham ex D. Don
(Hypericaceae)

Part used: Fl.t.

Processing: (M) 20 p. Fl.t. + 80 p. R-OH 40%.

Principal compounds: essential oil, catechic tannin, leucocianidine, rutoside, hyperoside, quercetin, etc. antibiotics substances.

Pharm. activ. & use: Vit. P type action used in vascular permeability diseases; antiseptic: heals the wounds (external); astringens, antidiarrhoeal and antispasmodic.

Techn. form: Tra & infusion from dry flowers tops (2%)

Dosage: 5-10 g x 3 /daily.

A.R.M. : satisfactory.

Tinctura Polygonii

XXIV

The plants: *Polygonum mole* D. Don^{*)}
Polygonum chinense L.^{*)}
(Syn. *Persicaria chinensis* (L) Gross).

Part used: Rh. & R.

Processing: (M) R-OH 70% or (T.B.) (20 p. plant, 80 P.R-OH)

Principal compounds: tannin, galic acid, sugars, flobaphen etc.

Pharm. activ. & use : adstringeous antidiarrhoea.

Techn. form: Tra., Potion.

Dosage: Tra. 2-3 g/daily.

Contraindications: in chronic constipation.

A.R.M. : unlimited.

^{*)} The Foreign Pharmacopea use *Polygonum bistortae* with 15-20% tannin in Rhizom and Roots; It is necessary to analyse the indigenous species.

Extractum Polygonii

XXIV

The plant : see Tra. Polygonii

Part used : Rh. & R.

Processing: (M) R-OH 70% - (see Tra Polygonii) Filtration,
Concentration to a soft or fluid extract.

Principal compounds: tannin, golic acid, sugars, flobaphen, etc.

Pharm. activ. & use : adstringecus, antidiarrhoea.

Techn. form: Fluid or soft extract.

Dosage: Fluid extract 0.20-0.30 g. x 2-3 times/daily.

For children : 0.05 g/pro
1 year-age.

Contraindications : Nil.

A.R.M. : satisfactory.

Extractum Taraxaci Spissum

V, XXXIII, XXXVII

The plant : Taraxacum officinale (L) Wigg
(Compositae)

Part used : (R).

Processing: (M) 20 g. R.Pulv. + 80 Aqua chlorophormii.

Concentration, precipitation of pectius with concentrated R-OH (96%). Concentration till a soft extract.

Principal compounds: triterpenics alcohols (-amirin, taraxerol
(A,B,C and D) inuline, taraxacin (bitter part).

Pharm. activ. & use : choleric and cholegogue, diuretic, diaphoretic and tonic.

Dosage : 0.70 - 2.00 g. per dosis.

Contraindications: Nil.

A.R.M. : unlimited.

Tinctura Rhei

XX, XXII

The plant: Rheum emodi Wall.

(Polygonaceae)

Part used: (Rh).

Processing: (M) 20 g Rh. + 80 ml R-OH 70%.

Principal compounds : anthracenic derivatives, (rheumemodine, isoemodine, rheocrisidine, rheocrisin, rhein, crisophanol etc.) galotannins, resins, calcium oxalate, cinamic acid, essential oil, enzymes.

Pharm. activ. & use : stomachic- tonic and purgative cathartic.

Techn. form : Tra.

Dosage: 0.25 - 1 g; stomachic- tonic, eupeptic;

1 - 2.5 g laxative;

5 - 15 g purgative.

Contraindications: pregnancy.

A.R.M. : satisfactory.

Extractum Rhei Fluidum

XX, XXII

Raw material : Extractum Rhei Siccum

Processing : dissolution : 35 p. dry extract + 65 p (water + R-OH 95% : 25:40).

Principal compounds : see Tra. Rhei

Pharm. activ. & use : see Tra. Rhei

Techn. form: fluid extract.

Dosage : 0.03 - 0.10 g stomachic

0.15 - 0.25 g laxative

0.50 - 2.50 g purgative

Obs. Stability : 3 months.

Contraindications: see Tra. Rhei.

A.R.M. : satisfactory.

Extractum Rhei Siccum

XX, XXII

The plant : Rheum Emodi Wall.

(Polygonaceae)

Part used : (Rh).

Processing: (P) 20 g Rh. + 80-100 ml R-OH 35-70% Evaporation.

Principal compounds : see Tra.Rhei.

Pharm. activ. & use : see Tra.Rhei.

Techn. form: Dry extract which contains about 5-10% of OMA corresponding to raw material 1 p. extract to 2.5 p. of raw material (with lactose).

Dosage : 0.01 - 0.05 g. stomachic;
 0.05 - 0.10 g. laxative;
 0.25 - 1 g. purgative.

Contraindications: see Tra Rhei.

A.R.M. : satisfactory.

Tinctura Rhei Composita

XX

Formula :

Rhizoma Rhei 8 g.
Herba Swertia chir. 3 g.
Rhizoma Calami 1 g.
Semen Amonum 2 g.
Fructus Coriandri 1 g.
Alcoholum (70%)100 g.

Processing: (M)

Principal compounds : complex.

Pharm. activ. & use : stomachic - bitter tonic.

Dosage : 2-4 m/daily.

Contraindications: see Tra.Rhei.

A.R.M. : satisfactory.

Tinctura Valerianae Stabilizata XV, XXX

The plant : Valeriana jatamansi Jones

Syn. V. Wallichii D.C. (Valerianaceae)

Part used : Rh and R

Processing: Transfer Fresh Rh & R 200 g (washed) in a 2 l flask with refrigerant, add 1000 ml R-OH-96%. Boil for 20 minutes on a water wash. Allow to cool and then grind Rh and R. The fine Rh and R, the alcohol which is used for the first extraction is completed till a total weight of 2.000 g. Boil for 20 minutes on a water wash. Decantation - Pressing - After 8 days : Filtration.

Principal compounds: essential oil (bornil isovalerianate, bornil-formiate, butiratean acetate, etc.)
- oxivalerianic acid, valepotriotes etc.

Pharm. activ. & use : sedative in hyperexcitability, neurosis (cardiac and digestive).

Dosage: 5-10 g/daily (0.5 - 2.5 g per dosis).

A.R.M. : satisfactory. ~ 2000 ~ 5 -

Tinctura Valerianae aetherea XV, XXX

The plant: Valeriana jatamansi Jones

Syn. V. Wallichii D.C.

Part used: Rh and R.

Processing: (M) 20 g plant to 80 ml C-R-OH + ethylic aether
(75 : 25)

Principal compounds: See Tra.Valerianae stabilisata.

Pharm. activ. & use : See Tra.Valerianae stabilisata.

Dosage: 1-4 g/daily (0.2-1 g per dosis).

A.R.M.: satisfactory.

Extractum Valerianae Sicum

XV, XXX

Processing: Concentration till evaporation of Tinctura
Valerianae Stabilisata.

Principal compounds : See Tra. Valerianae Stabilisata.

Pharm. activ. & use : See Tra. Valerianae Stabilisata.
Tablets in association with others
medicines.

Techn. form : Dry extract.

Solubility : 1 g dry extract to 4.5 g R-OH.

Extractum Valerianae Spissum

XV, XXX

The plant : Valeriana jatamansi Jones
(syn. V. Walichii D.C.)

Part used : Rh and R.

Processing: (M) 3 days 100 g of raw material + 300 ml R-OH 70%
pressed, filtrated and evaporated till a soft extract

Principal compounds: See Tra. Valerianae Stabilisata.

Pharm. activ. & use : See Tra. Valerianae stabilisata.

Dosage: 0.5 - 5 g daily for adults.
0.10 g/year age for children/day.

Techn. form : soft extract.

A.R.M. : satisfactory.

Tinctura Semen Stramonii

IX

The plant: *Datura stramonium* L.

(Solanaceae)

Part used: Se. (defated W. Petrol ether)

Processing: (P) - R-OH 70%.

10-15 g seeds + 85-90 g R-OH (cont.0.025-0.05 g.%).
(total alkaloids)

Principal compounds: alkaloids (l-hyoscyamine, atropine,
scopolamine, tannins, ~~tannins~~ flavonoids
etc.

Pharm. activ. & use : antispasmodic, depressive, hypnotic.

Techn. form : Tra. containing 0.025 g % of total alkaloids.

Dosage: 10-20 drops/dosis (1 g = 50 drops)

Maximal dosis: 1 g/dosis;
2 g/daily

A.R.M. : limited. Possibility for cultivation.

Extractum Stramonii Fluidum

XX

The plant : *Datura stramonium* L.

(Solanaceae)

Part used : Lf.

Processing: (P) R-OH 45%, concentration - Alkaloids dosage -
Dilution with R-OH 45% to 0.25 g. % of total alka-
loids.

Principal compounds: see Tra. Semen Stramonii.

Pharm. activ. & use : see Tra. Semen Stramonii.

Techn. form : Fluid extract.

Dosage: 1-2 drops per dosis (1 g = 50 drops) Maximal dosis:
0.1 g /dosis
0.4 g/daily

A.R.M. : limited. Possibilities of cultivation.

Tinctura Senecionis

XX, XXIX

The plant : Senecio densiflorus Wall ex.DC.

(Compositae)

Part used : Fl.t.

Processing: (M) - R-OH 60% 20 g Fl.t + 80 g R-OH 60%.

Principal compounds : pirolizidinic alkaloids (senecionin, retrorsin, senecifilin etc.) senecic acid.

Pharm.activ. & use : antispasmodic and emenagogue - oxytocics.

Dosage : 10-15 g/daily.

Contraindications: pregnancy.

A.R.M. : unlimited.

Extractum Urticae Fluidum

XXIV

The plant : Urtica dioica L

(Urticaceae)

Part used : Joung S with Lf.

Processing: (M) R-OH - 50%.

20 g plant + 80 p R-OH 50%.

Princ.compounds: the essential amino-acids (acetylcholine, histamine, 5-oxi-triptamine, etc.) glucids, chlorophyl, protoporphirine, carotenoids, folic acid, vitamins : B₂, C, K; etc.

Pharm.activ. & use : depurative, antidiarrhoeal, in acute and chronic diarrhoea of tuberculosis.

Dosage: 2-5 g/daily.

A.R.M. : unlimited.

Extractum Terminaliae

The plant : Terminalia belerica Roxb.

(Combretaceae)

Part used : ripe Fr.

Processing: fully ripe fruits and R-OH 60% (1:1) (M) pressed,
filtrated and evaporated till a dry extract.

Principal compounds: tannin, galic acid, sugar.

Pharm. activ. & use : astringent, in summer diarrhoea, enteric
disturbances.

Dosage: 0.20 g x 3 /daily

children 0.10 g x 3 /daily.

Contraindications: in chronic constipation.

A.R.M. : satisfactory.

Tinctura amaraXX

(Nr.2.)

Formula:

Pericarpum Aurantii (Fr.Bc.)	.....	50 g.
Herba Trifolii Fibrini (W.p.)	.....	25 g.
Herba Swertia Chir. (W.p.)	.....	45 g.
Herba Artemisiae vulg. (Fl.t.)	.....	25 g.
Rhizoma Calami (Rh.)	.....	25 g.
Cortex Cinamomi (s.b.)	.....	10 g.
Rhizoma Zedoriae (Rh.)	.....	15 g.
R-OH 70% q.s.	.....	1000 ml.

Processing: (M).

Principal compounds : complex.

Pharm. activ. & use : stimulation of gastro-intestinal secretions

Dosage : 0.25 ml/per age/children

For adults : 3-10 ml/daily.

Contraindications: pregnancy, hyperacidity.

A.R.M.: unlimited.

Tinctura Carminativa

XX

Formula:

Rhizoma Calami	30 g.
Flores Chamomillae	20 g.
Folium Menthae	20 g.
Semen Foeniculi	20 g.
Semen Carvi	10 g.
R-OH 70% ad	1000 g.

Processing: (M)

Principal compounds : complex.

Pharmac. activ. & use : see Tra Calami and the activity of other plants.

Dosage: 1-2 g/daily.

Contraindications: Nil.

A.R.M. : satisfactory.

Ungventum Capsici

I, XXXIX

(Ungventum Antirheumaticum)

Formula:

Extractum Aconiti Sicum.....	2 g.
Extr. Capsici Fluidum conc.....	5 g.
Extr. Cardiospermi	3 g.
Vaselinum	90 g.

Processing: ointment.

Principal compounds: rubefacient and revulsive comp. complex.

Pharm. activ. and use : antirheumatic ; external use.

Techn. form : ointment.

Dosage : local applications.

Contraindications: dermatitis, skin diseases.

A.R.M. : satisfactory.

Berberine (alkaloid)V, XXIV

The plant : Berberis asiatica Roxb. ex. DC.

Berberis aristata D.C. (+ 17 other species in Nepal) (Fam. Berberidaceae).

Part used : S.b. and the root (R.b.).

Processing: (Ph.C.Ph.T.)

Principal compounds: Berberine.

Pharm. activ. & use : The alkaloid berberine is used as a specific treatment of tropical diarrhoea (dysentery) and against Leishmania tropic. Hepato and cholecystopathies.

Techn. form : Tablets, capsules prepared from HCl Berberine.

Dosage: 0.01 g - 0.03 g x 3/daily.

Contraindications: heart, respiratory diseases and hyperthyroidism.

A.R.M. : satisfactory till unlimited.

BOJHOSECALIN - Antihypertensive and Sedative Tablets.

Formula : 1 tablet contains : Extr.Secalis Cornuti Siccum, exgotoxin type (which contains 0.50% total alkaloids) about 50 mg, Pulvis Radix Calami 100 mg, Extractum Belladonnae siccum (which contains 1% total alkaloids) 15 mg, Pulvis Radix Rauwolfiae Serpentinae about 100 mg (2.0 mg total alkaloids), Extractum Hyperici Uralum about 100 mg, Excipient q.s. ad 400 mg of total weight.

Pharma. activ. & use in therapeutics: hypotensive effects produced by Rauwolfia alkaloids, activation of cerebral vascularization produced by secalis cornuti alkaloids, antispasmodic and sedative effects produced by Belladonna alkaloids and Rad. Calami active principles and stimulation of the vascular permeability by Extr. Hyperici.

Dosage: 2-3 tablets/daily prophylactically and for long term therapy.

Contraindications: see SARPAGANDIN -
A.R.M. : satisfactory.

SOMALATIN - Anti-asthmatic syrup.

XXXI

Formula : Tra. Semen Stramonii 12 g., Tra. Aconiti 2g., Tinctura Ephedrae 30 g, Tra Auranti dulcis 10 g, Kalium bromatum 15 g, Cane sugar syrup 50 g.

Processing : solve the K.Br. in syrup, then add the tinctures.

Principal compounds: complex active principles from Datura stramonium, Aconitum and Ephedra gerardian

Pharm. activ. & use : general antispasmodic action, stimulant on the cerebrum and respiratory centre.

Antiasthmatic.

Dosage : 1-2 tea spoonfuls in an acute attack of asthm.

Contraindications: organic heart disease and hyperthyroidism.

A.R.M. : satisfactory.

SARPAGANDIN - Antihypertensive Coated tablets.

XII

Formula : 1 drag. contains: Pulv. Radix Rauwolfiae Serpentinae about 150 mg (2.3 mg whole alkaloids), Extractum Valerianae Sicum 100 mg, Excipient q.s. ad 350 mg of total weight.

Pharm. activ. & use : hypotensive effect is produced by the total alkaloids from Rauwolfia serpentina. The sedative effects is potentiated by the valepotriates from Valeriana jatamansi.

Dosage : 2-3 coated tablets /daily, or as directed by the physician.

Contraindications: bronchial asthma, ulcers, cholitis and gastroenteritis, epilepsia, depression, cardiac arrhythmia, myocardial infarction.

A.R.M. : satisfactory.

LALI-GURASHIN = Antihypertensive capsules.

XII

Formula : 1 capsule contains : Extractum Fol.Rhododendroni arboreae (containing maxim 0.15 mg Andromedotoxin) about 100 mg., Extr.Rauwolfiae (containing 0.25 mg whole alkaloids) about 50 mg, Extr.Hyperici Uralum (prepared by Tra.Hyperici) about 150 mg. excipient q.s. ad 350 mg of total weight.

Pharm.activ. & use : hypotensive effect produced by total alkaloids from Rauwolfia serpentine and Andromedotoxin. Stimulation of the vascular permeability by the active principles from Hypericum uralum.

Dosage : 1-2 capsules, daily for long-term therapy.

Contraindications: see SARPAGANDIN

GAULTERIN - Antirheumatic ointment.

I

Formula : Ol.Gaultheriae 12.5 g., Ol. Eucalypti 1.5 g.
Ol.Pini roxburgii 2.5 g., Ol. Menthal 3.5 g.
Ol. Thymi 2.0 g., Extr.Cardiospermi 3.0 g.
Ol. Aurantii dulcis 20 g.
Ungventum basis q.s. ad 100 g.

Pharmac.activ. & use : Rubefacient action, causing a certain amount of increased vascularity, sensation of warmth, local anesthesia. For the relief of rheumatic pains.

Dosage : Massage with about 2 g of ointment and then cover with warm chlothes.

Contraindications: Dermatitis, eczema. It should be used with caution in small children.

A.R.M. : satisfactory.

FILICARIN - Antihelmintic capsules.

VIII

Formula: Extractum Rhizoma Filicis 0.80 g., Extractum Artemisiae Spissum 0.20 g., Ol. Ricini 1 g. for one capsule (gelatine). Separate gelatine capsule contains 1 g ol.Richi.

Pharm.activ. & use : antihelmintic against oxyuris and tape worms.

Dosage : As directed by physician. The first day : 4 capsules in the morning. Second day 6 capsules and after 1 hour 4 capsules. After 1 hour, 10 Ol. Ricini capsules.

Contraindications: Liver diseases, gastro-intestinal tract. diseases, Cardiogene and nephrogene troubles pregnancy.

A.R.M. : unlimited.

EXPECTASURO - Antibronchitis drops.

XXXI

Formula: 100 ml = Extr.alcohol (70°) from Adhatoda vasica (1:5) 70 ml., Ol.Foeniculi 0.3 ml., Ol.Eucalypti 0.05 ml., Ol.Menthae 0.1 ml., Ol. Pini roxburghii 0.1 ml., Tra. Valerianae walichii stabilisata 5 ml., Tra Droserae (1:1) 1 ml., Saccharum 12 g Watter 24 ml.

Principal compounds: complex active principles from Adhatoda vasica, essential oils and from Valeriana Walichii.

Pharm.activ. & use : antiseptic and reflex expectorant. Mild sedative, analgesic.

Indications: in the treatment of bronchitis, pneumonia and tuberculosis.

Dosage : Adults : 3 x 20-30 drops/daily.
Children: 3 x 10-15 drops/daily.

Contraindications: Nil.

A.R.M. : satisfactory.

SUGANDHAWALI - Sedative Syrup.

XXY

Formula: Tra.Valerianae aetherea 8 g. Tra.Senecionis 42 g.,
Tra Semen Stramonii 15 g., Tra.Hyperici 10 g., Tra.
Citri recens 10 g., Cane Sugar syrop 25 g.

Principal compounds: complex active principles from medicinal
plants (see Tra. Valerianae, Tra Senecionis, Tra.Semer
Stramonii and Tra.Hyperici).

Pharm.activ. & use : Sedative in hyperexcitability cardiac
and digestive neurosis, antispasmodic.

Dosage : 2-4 spoons daily.

Contraindications: pregnancy, severe pulmonary insufficiency.

A.R.M. : satisfactory.

BARRO-STOP - Antidiarrheas tablets.

XXIV

Formula : 1 tablet contains : Dry extract from fully ripe fruit
of Terminalia belerica (1:1) 0.20 g., Radix and
Rhizoma Potentillae fulgens (pulvis) 0.15 g., Folium
Belladonna-pulvis (contains 0.30 - 0.40% whole alka-
loids) 0.05 g., Excipients q.s. ad 0.45 g. of total
weight.

Pharm.activ. & use : astringent, antidiarrhoeal, antispasmodic
in biliary intestinal and urinary colic.

Dosage: Adults : 4-6 tablets per day in case of acut diarrhoea
and dysentery.

Children: 2-4 tablets per day in acut or chronic
diarrhoea and dysentery.

Contraindications: in chronic constipation, in severe cardiac
disease and cerebral arterosclerosis.

A.R.M. : satisfactory.

PADAMCHALIN - Laxative and purgative tablets.

XXII

Formula: 1 tablet contains: Extractum Rhei siccum 0.10 g.,
Rhizoma Calami pulvis 0.20 g., Excipiens q.s. ad
0.40 g. of total weight.

Pharm. activ. & use : the anthracenic derivatives of Rh.Rhei
and the activ principles from Accrus
calamus to confer of this product laxative
sedative and purgative effects.

Dosage : laxative : 1 tablet, daily.
purgative: 2-4 tablets.

Contraindications: pregnancy.

A.R.M. : satisfactory.

KHAYERIN - Mouth-Wash

XXXIX

Formula: Tra.Artemisiae 10 ml., Tra. Catechu, Tra.Cinnamomi $\bar{a}\bar{a}$.
10 ml., Tra. Hyperici 10 ml., Tra. Polygonii 20 ml.,
Extr. Urticae fluidum 30 ml., Ol. Citronellae 0.10 g.,
Ol. Pini roxburghii 0.10 g., Ol. Menthae 0.10 g.

Pharm. activ. & use: astringeous, antibacterial, in mouth and
gums pain.

Dosage : 1 spoon to 1/2 glass of water.

A.R.M. : satisfactory.

GENERAL QUALITY REQUIREMENTS
FOR THE RECEPTION AND DELIVERY OF MEDICINAL AND AROMATIC
PLANTS COLLECTED FROM WILD OR CULTIVATED FLORA WITH THE
AIM OF THEIR INDUSTRIAL PROCESSING

by

Dr. Ovidiu Bojor

GENERALITIES

The present quality requirements refer to the specifications regulating the quality and purity control and the general method of analysis of medicinal and aromatic plants intended to be manufactured.

These requirements apply also to the export of the raw material when the beneficiary does not claim special conditions from the supplier.

The term of "vegetal raw material" must not be mistaken for "vegetal product" the latter being the result of a processed raw material.

By the term "raw material" or "drug" are meant the plants or parts of dry plants that must meet certain quality specifications concerning: external appearance, maximum percentage of impurities and foreign matter, moisture or other physico-chemical properties as well as the minimum amount of the active constituents or volatile oils. For industry, the crude (not dried) raw material may also be delivered on request but should comply with the quality specifications too.

Standardization of the raw material is very important for industry because on this factor ^{depends} the yield and efficiency of the product obtained, after its processing.

REQUIREMENTS FOR TESTING THE QUALITY

1. The quality of the vegetal raw material intended to become drugs or to be exported is tested on lots. By the term "lot" is meant an amount of the same raw material obtained in identical conditions and packed in one type of packaging.

2. The quality of a lot can be tested by examining its size, weight and external appearance, the organoleptic evaluation of raw material and laboratory tests. When the lot consists of several packing unities, a minimum of 10 per cent of the whole number of unities should be examined. When the lot consists of 10 or less number of unities, 2 unities at random are examined.

3. The organoleptic refers to evaluation by means of the organs sense and includes the macroscopic appearance of the drug, its odour and taste meeting the quality requirements for each raw material. The items characterizing the vegetal drugs are usually the following: aspect (shape and size), colour and external markings, fracture and internal colour (of rhizomes, tubers, bulbs and roots), odour, taste and the other items mentioned by the quality requirements for each drug.

The organoleptic evaluation consists of checking at random 3 packing unities of a lot, unities taken from the top, the center and the bottom of the lot without removing arbitrarily any foreign matter or impurities of the mouldy or browned plants. Those unities reunited, mixed and homogenized are considered representative sample of the lot.

4. When the raw material is packed in paper bags or sackcloth, approximately 20 g will be taken from the three levels of the packing by graduated emptying. Samples of seeds, small fruits or cut (minced) drugs may be taken by means of special sounds.

Amounts of about 50 g from ballots will be taken by opening or unstacking them in three different points.

5. The approximately necessary amounts for the organoleptic evaluation and for laboratory tests are the following:

- a) flowers, seeds, Rye ergot, hops and cut (minced)
raw material 160 g;
- b) leaves, herba, fruits, buds, tubers, bulbs,
roots, bark (peel) 200 g;
- c) fir cones, oak galls 300 g;
- d) big rhizomes (fern, rhubarb, etc.) 500 g;
- e) big seeds (chestnut) 1000 g;
- f) spores 10 g.

The laboratory samples are introduced into parchment or grease-proof paper bags or other suitable material for keeping the moisture. Each bag will have labelled the name and organ of the plant (in Latin or a national or international language), the number of the lot, the date of its sampling, the date of collecting, the team that has performed the sampling (names) and the unity or corporation (legal entity) the merchandise belongs to. The laboratory samples should be sealed.

6. During the organoleptic evaluation and sampling one can immediately ascertain the following:

- identity of the raw material;
- high moisture content, presence of mouldiness or a foreign odour;
- loss of the colour, of the characteristic odour;
- appreciable excess of the admitted percentage of foreign matter and impurities.

If these defects are visible during the sampling, the lot should be reassorted and checked again.

METHODS OF ANALYSING THE RAW MATERIAL

1. Checking of the dimensions

The measurements will be taken by means of a scale in mm or a calliper-square. For small seeds and fine fragments of plants, magnifying glasses provided with 1/10 mm scale should be used. The size of the fragments may be estimated by means of sieves whose mesh dimension is known. The result given per cent indicate the degree of the crumbling.

2. Checking of the colour

A sample of about 5 g, weighed, is spread on a mat, white paper. The colour will be examined following the quality requirements for each raw material. The fragments of different colour than that require should be removed and weighed. The result will be given in percentage.

3. Checking of the odour and taste

The same fragments of plants used for the colour checking will be rubbed with both hands and smelt. In case of doubt concerning the odour, transfer 10 g of raw material into a flask, add water at the boiling temperature and then cover the flask with a glassplate; after 2-3 minutes the cover is removed and the odour perceived.

The taste is characteristic for the majority of plants. In case the degree of bitterness is required, that is established by comparing it with a brucine standard of a determined strength.

4. Determination of impurities and foreign matter

By impurities are meant parts of the same plant which represent the aim of the analysis but others than those declared as the lot. Thus for "Herba" the roots represent impurities as well as for "Radix" the aerial parts. For "Folium" the remnants of branches and for seeds the remnants of fruits represent impurities.

Foreign organic matter refers to any other species of plant than the declared one or to any other organic matter.

Foreign inorganic matter refers to earth, dust, sand, gravels.

In order to determine the impurities and foreign matters the following amounts of samples will be used:

- for very small fruits and seeds (ϕ under 1.5 mm)... 2-5 g;
- for fruits and seeds (ϕ between 1.5 - 4 mm) 10 g;
- for galls, buds, flowers, leaves, herba 30 g;
- for rhizomes, roots, tubers, bulbs, fruits and seeds (ϕ over 4 mm) 50 g.

After separating the impurities and foreign matters (organic and inorganic separately) each will be weighed and the results given as percentages.

5. Determination of moisture

From the samples of raw material meeting the previous requirements about 10 g will be weighed. They will be divided into fragments (minced) manually or by means of a laboratory electric mill until fragments of 1.5 mm are obtained. When the samples are under that size the grinding is not necessary. From the ground sample 5-10 g are weighed - with an accuracy of 0.002-0.01 g - and transferred into a graduate/^{tare-}bottle previously tared. The height of the sample in the tare-bottle should not exceed 5 mm. The sample is dried by means of an electric dry-oven at 100-105°C for 4 hours, then cooled and weighed. Drying and weighing operations are repeated until obtention of a constant mass.

$$\text{Moisture } \% = \frac{m - m_1}{m} \cdot 100$$

where: m = mass of the sample intended to be determined, in grams;
 m_1 = mass of the sample after drying, in grams;

Determination of moisture in plants containing volatile oils is done taking into account the amount of volatile oil of the respective plant.

In that case, the formula will be:

$$\text{Moisture } \% = \frac{(m - m_1) - V \cdot D}{m} \cdot 100,$$

where: m = mass of the sample intended to be determined, in grams;
 m_1 = mass of the sample after drying, in grams;
 V = volume of the volatile oil, in cm^3 ;
 D = density of the volatile oil at 20°C, in g/cm^3 .

6. Determination of total ash

Necessary reagents:

- ethylic alcohol - 96% vol. ;
- concentrated nitric or sulphuric acids;
- 10% solution of ammonium nitrate;
- hydrogen peroxide.

Total ash is the residue obtained by burning some raw material or a vegetal or animal product.

To determine total ash, proceed as follows:

Weigh about 2g of the sample with an accuracy of 0.001 g in a porcelain crucible, previously tared. In case the fragments of the sample exceed 1.5 mm in diameter, proceed as at point 5. The sample is burnt cautiously with a flame so that nothing should be lost. Introduce the crucible in an electric oven and calcine at 600-700°C. After calcination weigh the crucible and after it cools, add a small amount of water or alcohol. Evaporate the liquid on a water-bath and calcine again.

In case the residue after cooling contains still some particles of coal, add a few drops of hydrogen peroxide, concentrated nitric acid or ammonium nitrate solution. Evaporate in a water-bath and calcine again until the residue becomes white or uniformly coloured.

After the last calcination introduce the crucible into an exsiccator. Weigh after completely cooling. Calcination and weighing will be repeated until obtention of a constant mass (the difference between two weighs should not exceed 0.5 mg).

Total ash is calculated as follows:

$$\text{Total ash \%} = \frac{m_1}{m} \cdot 100 \quad , \quad \text{where: } m = \text{mass of ash, in grams;} \\ m_1 = \text{mass of the sample introduced to be determined, in grams.}$$

7. Determination of insoluble ash in 10% HCl

Necessary reagents:

- 10% Chlorhydric acid;
- 1% solution of silver nitrate;
- 10% nitric acid.

Over the ash found in the crucible after determining point 6, add 3 cm³ of 10% Chlorhydric acid. Cover the crucible with a glass plate and keep for ten minutes in a water-bath. Pipet 5 cm³ of hot water washing at the same time the glass plate. Filter by filter paper and wash the remnants from the filter paper with hot water until the filtrate gives no more the reaction for chlorine ion.

The absence of chlorine ion is checked in the washing water (in the filtrate) by means of silver nitrate in the presence of nitric acid.

Dry the filter with the residue at 100-105°C. Transfer again into the crucible and calcine as at point 6.

The insoluble ash in diluted HCl is calculated as follows:

$$\text{Insoluble ash in HCl\%} = \frac{m_1 - m_2}{m} \cdot 100, \text{ where:}$$

m_1 = mass of ash in the crucible, in grams;

m_2 = mass of ash in the filter, in grams;

m = mass of the sample intended to be determined, in grams (as at point 6).

8. Quantitative determination of volatile oils in plants

Quantitative determination of volatile oils is effected by steam distillation by means of a special apparatus.

The apparatus (Fig. 1) consists of:

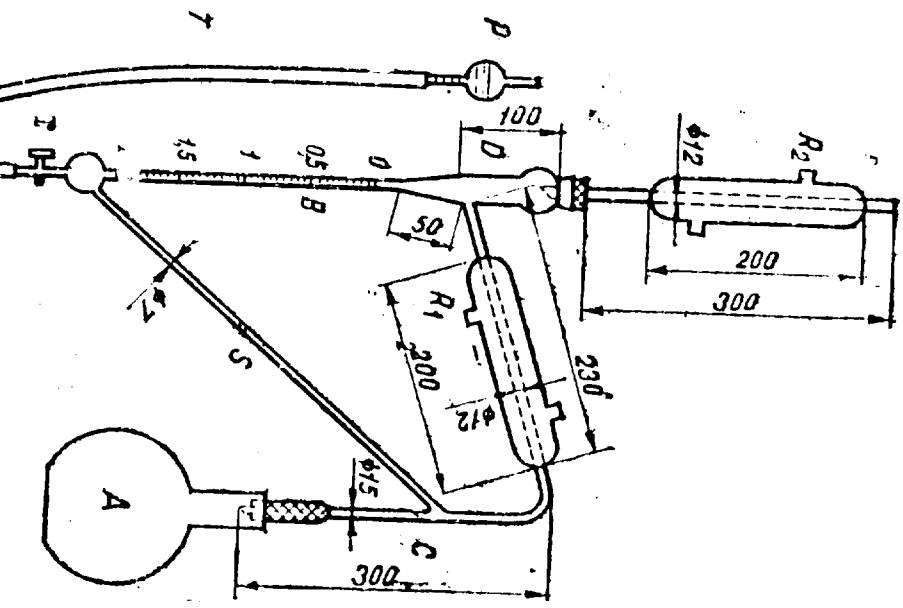
- a flat bottomed glass flask (A) of 500-2000 cm³, with ground-glass stopper;
- an apparatus provided with a tube (C) whose inferior part should be ground-glass stoppered and fit perfectly to the glass flask (A), a syphon (S), a tube of 1-2 cm³ in length (B) graduated in divisions of 0.01-0.02 cm³, a separator (D), a descending refrigerent (R₁);
- an ascending refrigerent (R₂);
- a funnel (P) attached to the apparatus by a rubber tube (T);
- rubber tubes for joining up the refrigerents to the water source;
- a heat source.

Quantitative determination is carried out on fresh or dried raw material, weighed with an accuracy of 0.1 g using suitable solvents.

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Figure 1





In Table 1 are given a few examples of raw materials containing volatile oils, the amount required for the determination and the solvent used. Before weighing, the big parts of plants, herba, big fruits, some flowers, rhizomes or roots are minced.

Table 1

Denomination of raw material	Amount used for determination (in grams)	Solvent used to determine the volatile oil (in c.cm.)
Folium Eucalypti	25	250, water
Folium Menthae	50	500, water
Herba Gaultheriae	75	750, water
Herba Citronellae	75	750, water
Herba Absinthii	75	750, water + 1 c.cm of xylol
Herba Thymi	50	500, water
Flores Chamomillae (or Flores Millefolii)	75	a mixture of 400 c.cm. of glycerine + 600 c.cm of water + 1 g of ascorbic acid + 1 c.cm. of xylol
Fructus Foeniculi (or Fructus Anisi)	25	250 c.cm. water + 0.5c.c xylol
Fructus Coriandri	100	1000, water
Fructus Juniperi	50	500, water
Sumitates Pini	75	750, water
Rhizoma Calami	50	500, water
Rhizoma Zingiberis	50	500, water
Radix Valerianae	100	1000 c.cm. water + 0.5 c.cm. xylol

After the raw material and solvents have been weighed, transfer them into flask A. For a uniform boiling add some pumice-stone. Generally, when water is used as a solvent for distillation, add an amount ten times higher than that of the raw material. Adjust then the flask to the distilling device.

By means of funnel P fill the graduated tube (B) with distilled water up to the upper level of syphon (S). Adjust the ascending refrigerent R_2 to the separator D, join the refrigerents R_1 and R_2 by rubber tubes, connect with water tap and let the cooling water running. Place the flask on an asbestos sieve heated by means of a gas burner or an electric heating mantle. Heat gently so that distillation be performed at a moderate rate.

After 4 hours of distillation stop the water to run within the refrigerents and let run the steam for 2-3 minutes, in order to wash the traces of volatile oil from the descending refrigerent R_1 . Stop heating.

When refrigerents R_1 and R_2 become warm let run the water again. After cooling the whole apparatus (1-2 hours), when the oil reached room temperature, let descend slowly the volatile oil from separator D into the graduated tube B, opening the lower tap r and read its volume.

The amount of volatile oil is calculated thus:

$$\text{Volatile oil } \% = \frac{V \cdot D}{m} \cdot 100, \quad \text{where:}$$

V = volume of oil read within the graduated tube B, in c.cm.;

D = density of volatile oil, in g/cm^3 ;

m = amount of the sample intended to be determined, in grams.

The amount of xylol added when oils are too viscous, of great density or in small amount is deduced from the total volume read in the graduated tube B.

ABSINTHII HERBA
(*Artemisia absinthium*)

Description:

Both terminal aerial parts and terminal base leaves and the stems of the plant. Velvety leaves, grey-green on the upper epidermis and grey-silver on the lower one. Yellow flowers. Slight, characteristic odour. Aromatic bitter, astringent taste.

Impurities:

- maximum percentage of browned or yellowed leaves 3
- maximum percentage of leaves thicker than 3 mm 3
- maximum percentage of leaveless stems and flowers 1
- maximum percentage of other plants 1

Foreign matter:

- maximum percentage of ash 15
- maximum percentage of insoluble ash in HCl 3
- maximum percentage of organic matter 0.5
- maximum percentage of inorganic matter 1.5

Moisture:

- maximum percentage 13
- minimum of essential oil containing azulene 0.20

FOLIA BELLADONNAE
(Atropa belladonna)

Description:

Leaves with petiole, green on the upper epidermis and light green on the lower one. The top of the stem with leaves 10 cm in length at most are admitted. Its taste is bitter and piquant.

Impurities:

- γ maximum per cent of darkened leaves 4
- maximum per cent of other parts of the plant 3
- maximum per cent of other plants 0.5
- maximum per cent of fragments passing through the 1 mm sieve 4

Foreign matter:

- maximum percentage of ash 16
- maximum percentage of insoluble ash in HCl 3
- maximum percentage of organic matter . . . 0.5
- maximum percentage of inorganic matter . . 0.5

Moisture: 12

Minimum percentage of total alkaloids calculated as hyoscyanine 0.30

RADIX BELLADONNAE
(Atropa belladonna)

Description:

Portions of no lignificated roots of 5-20 cm in length, whole or cut. The inner surface is longitudinally striate, easily splitting and spreading, when split, a white powder. The outer surface is grey-brown and the inner one white-yellowish. Characteristic odour. Bitter, pungent, unpleasant taste.

Impurities:

- maximum percentage of knotted, dry lignificated roots . . . 5
- maximum percentage of inner browned roots 4
- maximum percentage of other plants 0.5

Foreign matter:

- maximum percentage of organic matter 0.5
- maximum percentage of inorganic matter 1
- maximum percentage of total ash 7
- maximum percentage of insoluble ash in HCl 1

Moisture: maximum percentage 13

Minimum percentage of total alkaloids calculated as
hyoscyanine 0.40

HERBA CENTELLAE
(Centella asiatica (L)
Urban)

Description:

Greenish herb with leaves of 1.5-3.5 cm in diameter, cordate, crenate, lobed petiole often up to 2-4 cm long. Prostrate herb with stolons of 5-10 cm. in length. It has no specific odour, and the taste is astringent and bitter.

Impurities:

- maximum percentage of parts of the plant turning yellow or brown 2
- maximum percentage of roots 5

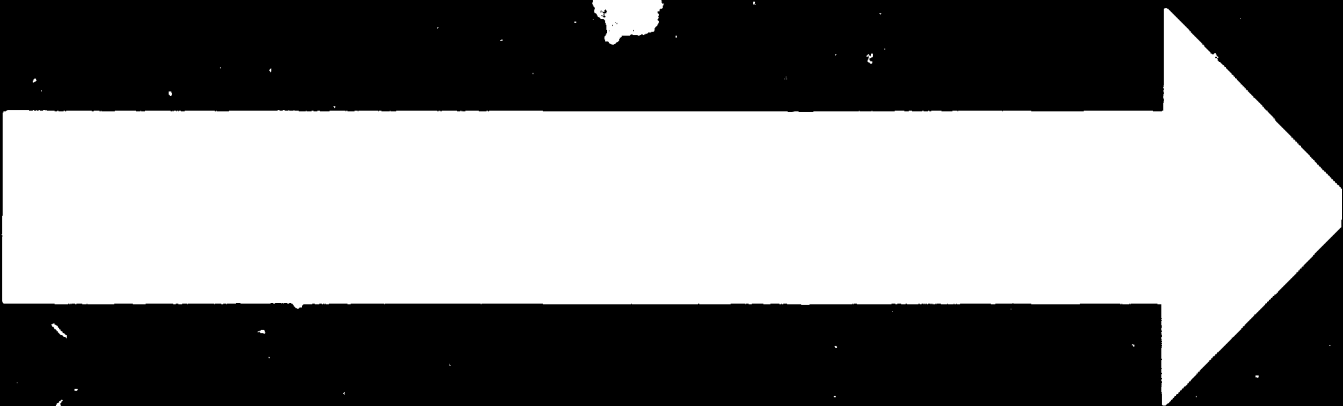
Foreign matter:

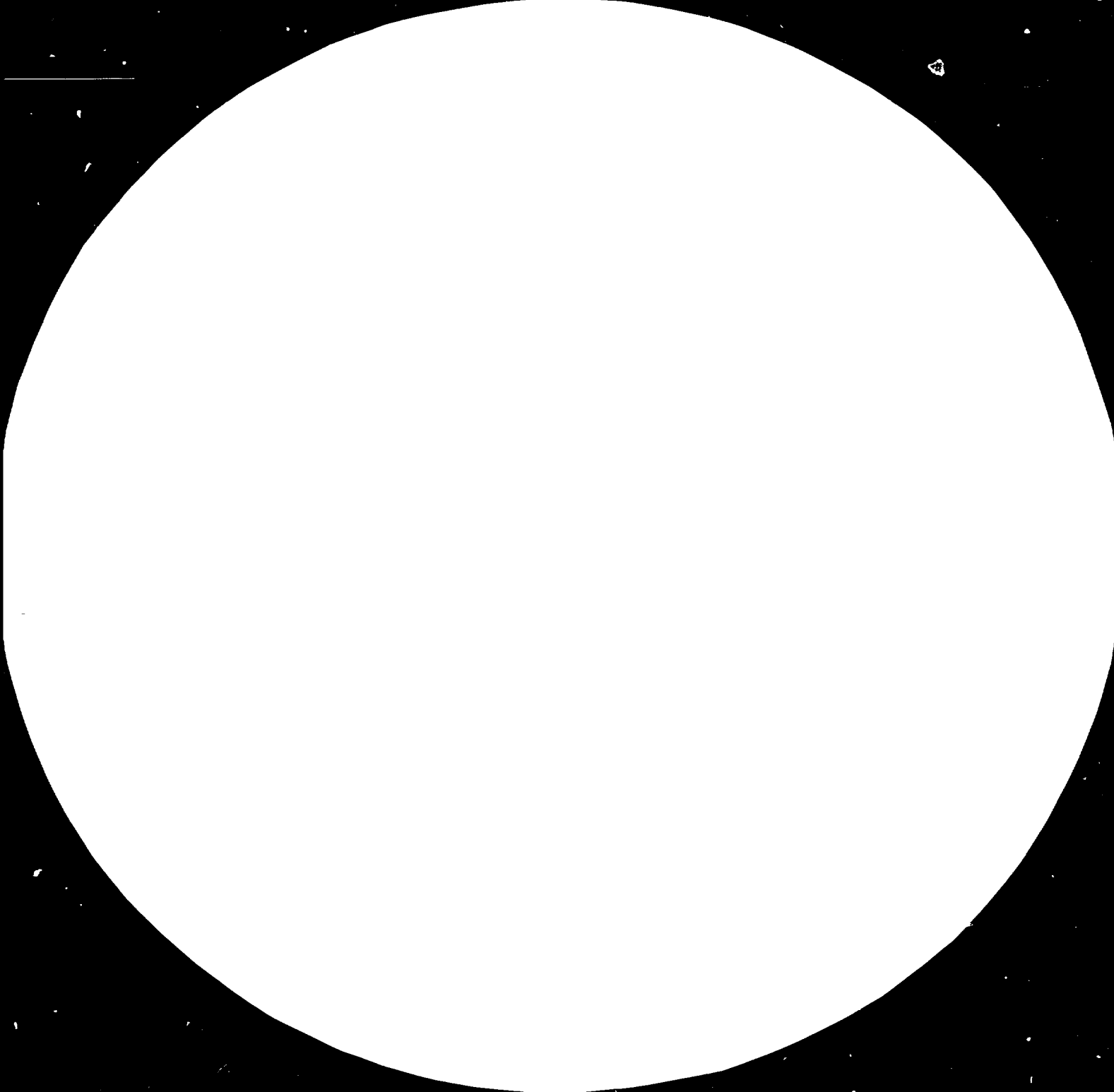
- maximum percentage of organic matter 1
- maximum percentage of inorganic matter 1
- maximum percentage of ash 11
- maximum percentage of insoluble ash in HCl... 4

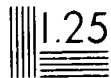
Moisture:

- maximum percentage 10

D-566







2.8 2.5



FRUCTUS CYNOSBATI
(Rosa Macrophylla)

Description:

Whole fruits, fusiform with smooth or (on request) wrinkled surface, longitudinally cut fruits without any seeds and hairless. Orange to red. Odourless, slightly acid, pleasant taste.

Impurities:

- Maximum percentage of red-brown or darkened fruits . . . 3
- Parts of the plant (leaves, branches, petioles):
 - maximum per cent of whole fruits 1
 - maximum per cent of cut fruits 0.25
- Maximum per cent of fragments of fruits (cut) with traces of seeds and hairs 5
- Maximum per cent of immature yellow-greenish or yellow-orange fruits 3

Foreign matter:

- Maximum percentage of organic matter 0.5
- Maximum percentage of inorganic matter 0.25

Moisture:

- Maximum percentage of the whole fruits14
- Maximum percentage of the cut fruits13

Minimum percentage of ascorbic acid:

- whole fruits 1
- cut and cleaned fruits 2

FRUCTUS JUNIPERI
(Juniperus communis)

Description:

Globe-like smooth fruits, dark blue or brown-violet, sometimes covered by a waxed layer. Aromatic resinous odour. Aromatic sweetish taste.

Impurities:

- Maximum percentage of branches and other portions of plant 0.5
- Maximum percentage of fruits having under 5 mm in diameter 5
- Green, brown, wrinkled fruits 5

Foreign matter:

- maximum percentage of organic matter 0.5
- maximum percentage of inorganic matter 0.5
- maximum percentage of insoluble ash in HCl 0.5

Moisture: . maximum percentage 20

FOLIUM MENTHAE
(Mentha piperita L)

Description:

Leaves or fragments of leaves dark green, sometimes with violet-reddish shade. Aromatic, characteristic odour, more pronounced when rubbing the leaves. Peppered, pungent taste, producing a cooling sensation when air is drawn into the mouth.

Impurities:

- Maximum per cent of darkened leaves 5
- Maximum per cent of parts of the plant 5
- Maximum per cent of other plants 0.5
- Maximum per cent of fragments passing through a 1 mm sieve 4

Foreign matter:

- Maximum percentage of ash 12
- Maximum percentage of insoluble ash in HCl 3
- Maximum percentage of inorganic matter (dust, earth, sand) 0.5
- Maximum percentage of organic matter 0.5

Moisture: maximum percentage 13

Volatile oil: minimum percentage 1

RADIX VALERIANAE

(Valeriana officinalis or V. Wallichii)

Description:

Whole or irregular sectioned rhizomes, with cylindrical thin roots. The outer surface is brown and the inner one whitish. Strong, characteristic odour. Sweetish-eromatic, then bitterish taste.

Impurities:

- maximum percentage of rhizomes with traces of stems depassing 3 cm in length 3
- maximum percentage of other plants 0.5

Foreign matter:

- maximum percentage of organic matter 0.5
- maximum percentage of inorganic matter 4
- maximum percentage of insoluble ash in HCl . . .10
- maximum percentage of ash 12

Moisture: maximum percentage 14

RHIZOMA CALAMI
(Acorus calamus)

Description:

rhizomes whose outer surface is light brown and the inner one white-pink; yellow-hued of no more than 20 cm in length. Aromatic pleasant odour. Aromatic, bitter taste.

Impurities:

- rhizomes under 1 cm in diameter no admitted;
- maximum percentage of stem and roots traces 5
- maximum percentage of browned inner surface
rhizomes 5

Foreign matter:

- maximum percentage of organic matter 1
- maximum percentage of inorganic matter 1

Moisture: maximum percentage 14

RHIZOMA RHEI

(Himalayan Rhubarb, Rheum emodi, Rheum webbianum)

Description:

Sub-cylindrical or irregular segments of the root and rhizome, from 2 to 20 cm in length and from 1.5 to 8 cm in diameter. Externally, dark brown to purplish brown, or from yellowish brown to reddish brown particularly where the cork is abraded. The fracture is uneven and granular, the fractured surface having a dull orange to yellowish brown colour. The odour is faintly aromatic, the taste bitter and astringent.

Impurities:

- maximum percentage of browned roots and rhizomes 2
- maximum percentage of empty roots and rhizomes 3
 attacked by insects or lignificated
- maximum percentage of roots or parts of other plants . 0.5

Foreign matter:

- maximum percentage of organic matter 0.5
- maximum percentage of inorganic matter 1
- maximum percentage of total ash 7
- maximum percentage of insoluble ash in HCl 2

Moisture: maximum percentage of 14

STROBULI LUPULI
(Humulus lupulus)

Description:

Oval- cone-shaped or globe-like flowers, whole or non-compressed, green-yellowish. Characteristic odour, bitter taste.

Impurities:

- maximum percentage of browned cones 15
- maximum percentage of plant traces 2

Foreign matter:

- maximum percentage of organic matter 1
- maximum percentage of inorganic matter 0.5

Moisture: maximum percentage 13

Results of the analysis of some raw-materials
and Pharmaceutical Products prepared in Nepal

Raw material or Product designation	Results	Observations
<u>Herba Artemisiae vulg.</u> (Sample 1 from high altitude)	1.12 ml.% E.o.	u = 6.60 %
<u>Herba Artemisiae vulg.</u> (Sample 2 from high altitude)	1.20 ml.% E.o.	u = 6.62 %
<u>Herba Artemisiae vulg.</u> (Sample 3 from low altitude)	1.35 ml.% E.o.	u = 7 %
<u>Tubera Aconiti</u> (Sample 1)	2.02 % total alkaloids	u = 9 %
<u>Tubera Aconiti</u> (Sample 2)	2.05 % total alkaloids	u = 9.50%
<u>Cortex Aurantii dulcis</u>	4 ml.% E.o.	u = 7.88%
<u>Cortex Berberidis</u> asiaticae (Sample 1 - Young Bark)	2.06 g.% total alkaloids	
<u>Cortex Berberidis</u> asiaticae (Sample 2 - Old Bark)	2.59 % total alkaloids	

Abbreviations :

A = ash; A.B. = antibiotic activity; A-HCl = insoluble ash
HCl; A.F. = antifungal activity; A.S. = alcohol strength;
B.I. = bitter index; C.S. = cytostatic action; C.T. = cyto-
toxic action; D = density; E.O = essential oil; FeCl₃ = Ferric
chloride test; L.d.t. = limit dilution for taste; b.d.o. =
limit dilution for odour; O.M.A. = oxymethylantraquinone;
R = residue on evaporation; u = moisture.

Raw material or Product designation	Results	Observations
<u>Fructus Juniperi recurvae</u>	0.96 ml.% E.o.	U = 7.11% A = 4.55%
<u>Folium Daturae</u> stram.	0.48 g.% total alkaloids	U = 9.33%
<u>Herba Ephedrae</u> gerand	0.95 g.% total alkaloids	
<u>Rhizoma Heracleii</u> wallichii	0.90% E.o.	
<u>Rhizoma Rhei</u> (Sample from Ganesh-Himal)	3.60% O.M.A.	A = 3.28% A-HCl = 0.20% U = 8.59%
<u>Rhizoma Rhei</u> (Sample from Trisuli Bazar market)	3.88% O.M.A.	A = 5.65% A-HCl = 0.36% U = 8.77%
<u>Rhizoma Potentillae</u> fulgens	5.9% ratanhia- tannius type 8.2% others tannins	A = 3.49% U = 7.43%
<u>Rhizoma Zingiberis</u>	2.56% E.o.	
<u>Tubera Aconiti</u> Extr. 2%	C.T. (Cytotoxic action)	Method from Annex 13
<u>Butea minor</u> (seeds) 10%	Strong cytotoxic	- " -
- " - " - 5%	Strong cytotoxic	- " -
- " - " - 2,5%	Strong cytotoxic	- " -
- " - " - 0.25%	Cytotoxic action C.T.	- " -
<u>Cortex Berberidis asia-</u> Extr. 2% <u>ticae</u>	C.S. (Cytostatic action)	- " -
<u>Epilobium adenophorum</u> Flowers Extr. 5-10%	antimitotic	- " -
<u>Semecarpus anacardium</u> Leaves Extr. 5-10%	antimitotic	- " -

Raw material or Product designation	Results	Observations
<u>Oleum Eupatorii</u> (Antibiotic and antifungal activity)	Aspergillus niger + 2 Bacillus subtilis + 2 Escherichia coli + 2 Staphylococcus aure- us + 2 Saccharomyces cerevi- siae + 2 Sarcina lutea + 4 Mycobaterium phley + 4 Trichophyton viola- cum + 2 Micosporium gypseum +2	A.B. A.F. Refrraction index = 1.501 D = 0.9017
Tra. Artemisiae compo- sita	D = 0.900 B.I. = 800	L.d.t. = 1:800 L.d.t. = 1:400
Extractum Artemisiae spiss.	B.I. = 4000	
Tra. Aconiti	0.08 g.% total alkaloids	
Extractum Aconiti	0.60 g.% total alkaloids	
Tra. Aurantii dulcis	A.S. = 59% FeCl ₃ = + (brown) R = 3.80%	L.d.o. = 1:750
Tra. Calami	D = 0.900 FeCl ₃ = + (green) R = 4.20 %	
Tra. Capsici	D = 0.880 R = 2 %	L.d.t. = 1:1000
Tra. Catechu	A.S. = 69% FeCl ₃ = + (green- brown) R = 13%	
Tra. Cinnamomi	D = 0.902 FeCl ₃ = +blue-green R = 1.5%	

Raw material or Product designation	Results	Observations
Tra. Hyperici	D = 0.950 FeCl ₃ = + green R = 2.80%	
Tra. Amara (No.2)	A.S. = 59% B.I. = 1000 D = 0.908 R = 3.9%	
Tra. Rhei emodi	R = 5 % O.M.A. = 0.4 g %	
Tra. Semen Stramonii	0.04 g % total alkaloids	
Tra. Valeriana stabiliz.	0.15% valerianic acid R = 2.4 %	
Extr. Polygoni	0.9% tannin D = 0.800 R = 11%	
SOMALATIN Anti-asthmatic syrup	0.0096 g. total alkaloids from Datura stramonium; 0.0016 g. total alkaloids from Tubera Aconiti; 0.28 g. total alkaloids from Herba Ephedrae %	
PADAMCHALIN	1 tablet contains 0.0036 g O.M.A.	
SUGANDHAWALI Sedative syrup	0.006 g total alkaloids from Datura stramonium	

Procedure for Obtaining Solasodine

Extract 1 kg. of dried, powdered leaves or fruits of *Solanum Xanthocarpum* by maceration for 24 hrs. with 20 l. of 2% acetic acid. After filtration, the extractive liquids are made alkaline with approximately 1 l. of concentrated ammonia water. A black-brown precipitate, containing glycoalkaloid in its free state as base and amount of worthless stuff is obtained. Wash the precipitate with water until a neutral reaction of the washings. After drying, the precipitate is powdered and extracted in a Soxhlet apparatus with methyl alcohol for 15 hrs. The methanol extracts are concentrated. Solasodine is settled as a very fine white-nacreous precipitate, m.p. 264°.

The yield obtained was of 0.8 - 1.2 g. solasodine for 100 g of dried leaves or fruits.

Solasodine is soluble in ethanol, methanol, dioxan, propylene-glycol ; $[\alpha]_D = -8.9^\circ$.

Paper chromatography using a system of solvents of Chloroform, dioxan, butanol (7:2:5) and paper formamite-soaked following Pitra's technique produce only one spot of tomatin reacting with Dragendorff's reagent modified by Meunier, with a $R_f = 0.293$.

The main regions occurring in IR absorption spectrum with a KBr tablet are due to the OH or CH₂ groups belonging to the glucidic part.

**SEMI-QUANTITATIVE MICROMETHOD OF DETERMINING
TOTAL ALKALOIDS**

Reagents:

- Solution of methanol tartaric acid
- 10% solution of Zn acetate
- Van Urke reagent
- Chloroform

Procedure

Weigh an amount of 0.0200-0.0600 g Ergot of Rye very finely and homogeneously distributed amongst quartz sand. Place the weighed quantity into a test tube and add 2 ml. of methanol tartaric acid. Heat the test tube 3 times for 1 minute each, on a water-bath at no more than 60°C, stirring continuously the content with a glass rod (stir for one minute on the water-bath and for 1 minute at room temperature and repeat this 3 times, homogenizing thoroughly with a glass rod).

Add to the warm solution from the test tube 2 ml. of 10% solution of Zinc acetate and stir thoroughly for still 1 minute. Allow to stand the solution until it becomes perfectly clear and a deposit is formed.

Take 1 ml. of the cleared solution and treat it with a double quantity of Van Urke reagent and read, after 20 minutes, the extinction of the coloured solution at Spekol against a blank containing 1 ml. of methanol tartaric acid and the double quantity of the same reagent. Extinction is read at $\lambda = 570 \text{ nm}$.

Calculate the percentage of alkaloids in ergotamine base using as reference standard a solution of 0.01% ergotamine tartrate. Readings will be made in 0.5 or 1 cm cells, depending on the intensity of colour.

For a chromatographic checking proceed as follows: add to the solution from the test tube a few ml. of methanol tartaric acid solution, stir, allow to precipitate and, after decanting, transfer the solution thus obtained into a separating funnel; alkalize with concentrated ammonium hydroxide until a pH of 8 and extract three times each, with 5 ml. of chloroform (freshly washed). The chloroform solutions become anhydrous with sodium sulphate; then evaporate them to dryness on a water bath at no more than 40°C. The residue is taken out with 1 ml. of chloroform and placed on a chromatographic plate in order to perform a thin-layer chromatography (Kellingsma, G. and water)

PHYTOBIOLOGICAL PRELIMINARY SCREENING
METHODOLOGY OF SOME EXTRACTS OR ACTIVE
PRINCIPLES ISOLATED FROM PLANTS FOR
TESTING THE CYTOSTATIC EFFECT

by Dr. Ovidiu BOJOR

GENERALITIES

Phytociological research carried out over the last three decades has shown that the vegetal cell may serve as a test to ascertain the cytostatic effect of some active principles isolated from plants or synthetic products.

The method is based on the action these substances have on vegetal cells during mitosis.

Being quick, economical (cheap) and sensitive, the method has been applied lately in several institutes of research as a means of preliminary screening natural or synthetical substances supposed to be cytostatic. Without being a general method in this trend of research, it can provide in several cases valuable information on the cytostatic effect of some substance groups. When positive results are obtained, research may be carried out on tissue cultures, in animals or using other laboratory tests.

With the help of this method a large number of plants can be tested from whom extracts have been already obtained following the "Research Methodology of Vegetal Products" as shown within the Final Mission Report, UNIDO, Mobile Unit of Pharmaceutical and Essential Oil Industry to the Least Developed Countries in Asia, Phase II - Afghanistan and Nepal (RP/RAS/78/012). Extracts or active principles isolated from vegetal and animal raw materials or obtained through synthesis may be also tested.

I. REAGENTS

1. As a biological reagent corn (*Triticum vulgare* Vill.) cariopse (grains) are currently used. Bulbs of *Allium cepa* L., seeds of *Lupinus albus* L. or other seeds of plants that germinate and grow quickly may be also used.

2. Carmin acetic method. In a flask of 200-250 ml. mix 45 ml. of concentrated nitric acid with 55 ml. of distilled water and 5 g of pure Carmin (Nacarat or Grüber). Connect an ascending refrigerent or cover the flask with a funnel having the stem towards the flask. Boil on an asbestos sieve with small-pointed flame for 30-40 minutes. After cooling, filter through a filter-paper and keep tightly closed the carmin acetic solution in a glass-stoppered flask.

3. Acetic orceine method. It uses orceine in an acid medium. Preparation of the colouring:

- orceine p.a. 2.2 g;
- glacial acetic acid p.a. 100 ml.

Orceine is dissolved in glacial acetic acid at boiling temperature after which boiling is continued for still 2-3 minute. Filter after cooling.

From this stock solution, prepare a diluted solution, at moment of use:

- Stock solution 45 p;
- Distilled water. 55 p.

To the standard solution of 1% acetic orceine thus obtained, add 10% of N/1 HCl solution.

PROCEDURE

1. Germination of corn caryopses

Soak caryopses in water for 4 hours, then let them germinate at a temperature of 23-25°C, in Petri dishes whose bottom is covered with two discs of filter-paper damped with tap water boiled and cooled. Caryopses are apt to be tested when their main root is as long as 1 cm.

An equivalent number of caryopses of *Triticum vulgare*, germinated in similar conditions represent the control.

2. Determination of minimum active concentration (CM_A)

A series of 11 Petri dishes (A series), high of 4-5 cm and with a diameter of 10 cm. will be pipeted each with the volumes of cytostatic solution, M/800 coffeine solution and tap water boiled and cooled in the amounts indicated in the following table :

Preparation of dilutions for A series

No. of the Petri dish	Cytostatic solution (ml.)	Coffeine solution M/800 ^x (ml.)	Water boiled and cooled (ml.)	Total volume (ml.)
I	1.00	7.50	6.5	15
II	2.00	7.50	5.5	15
III	3.00	7.50	4.5	15
IV	3.50	7.50	4.0	15
V	4.00	7.50	3.5	15
VI	4.50	7.50	3.0	15
VII	5.00	7.50	2.5	15
VIII	5.50	7.50	2.0	15
IX	6.00	7.50	1.5	15
X	6.50	7.50	1.0	15
XI	7.50	7.50	-	15

^{x)} M/800 solution of coffeine is prepared taking into account that 1 ml. of solution contains 265 grammes of coffeine.

Transfer in each Petri dish 10 caryopses of germinated *Triticum vulgare* and keep for 24 hours at 23-25°C. After this interval examine under microscope the modifications of the mitosis produced by the cytostatic in the main roots of caryopses.

At the same time prepare a series B of Petri dishes numbered as series A and pipet into each the same concentration of cytostatic. Complete up to a total volume of 15 ml. with tap water boiled and cooled.

Microscopic examination should start with the higher dilution of cytostatic (dish No. 1) and note which Petri dish contains the first disturbances of mitoses at 80% at least of the top of examined roots.

3. Microscopical preparations

Changes brought about by alkylating cytostatics through the phytobiological method can be seen by means of :

- a) rapid staining (Schnellmethode)
- o) classic fixation and staining methods.

In B series of preparations the microscopical examination may show if the product has any activity when coffeine is absent. (Substances displaying C type mitotic activity bring about alterations even when coffeine is absent).

- a) Microscopical preparations by rapid staining method (Schnellmethode)

Acetic carmin staining method

Take out at random from the Petri dish no. 1 five caryopses of *Triticum vulgare*, place them on some filter paper and cut each main root at about 3 mm from the respective tip. The cut tips are placed on a microscopical slide and 1-2 drops of acetic carmin solution are added. Heat gently the slide in a small flame until the liquid begins to boil; repeat this heating 2-3 times. Cover with a thin slide and press perpendicullary the finger on the thin slide until the root tips are crushed.

Examine with the microscope each root tip, immersed; results are

considered satisfactory when at least four tips from the five examined give a positive answer. Repeat the procedure on the five caryopses left. in Petri dish; if once again neither of the minimum four from the five root tips present alteration of all mitotic patterns but a mixture of normal and altered patterns, the tip of the following Petri dish will be examined until the anticipated result is obtained.

Acetic orceine method

Cut the tip of main roots from five caryopses, following the same technique as in the previous method, place them into a porcelain crucible with a \emptyset of 2 cm where 3 ml of diluted acetic orceine solution have been already transferred. Heat the crucible on a sieve at a very small flame and boil for 90 sec. from the moment vapours appear over the crucible. Put out the flame, cover the crucible and allow it to cool for 10 minutes. Examine with the microscope as previously shown. The minimum active concentration is conventionally noted as CM_A . To calculate CM_A use following formula :

$$CM_A = C \times 6.666, \quad \text{where}$$

C = amount of cytostatic in Petri dish corresponding to the highest dilution that yielded alterations of all mitotic patterns.

The alterations must be characterized by: prolongation of the mitoses, retorted chromosomes, ana- and telophasic bridges chromatin blocks of available sizes and micronucleia.

b) Classic fixation and staining method

In order to check the results obtained by rapid methods, use the classic fixation and staining of ADN from the specimen.

The usual fixing agents are: Nevaquin, Carnov I and Helly solutions.

These methods may be found in any textbook of cytology.

The microscopical pieces obtained from the fixed specimen may be used to study the structure of cellular components by means of Heidenheim's staining method with hematoxylin prepared following Regaud, and for reactions on nucleus and nucleolus, following Feulgen Rossenbek, Unna-Pappenheim, D.Gr. Constantinescu, etc.

Therapeutic Groups

- I. Anaesthetics, Analgesics, Antipyretics, Antirheumatics.
- II. Nonsteroidal, anti-inflammatory drugs and antigout drugs.
- III. Antiallergics (Antihistamines).
- IV. Antidotes, chelating agents.
- V. Cholagogue and cholaretics.
- VI. Anti-epileptics (convulsants).
- VII. Anti-infective, Antiprotozoa (Antibacterials, Antiseptics)
- VIII. Anthelmintics.
- IX. Anti-migraine preparations.
- X. Antineoplastics.
- XI. Antiparkinsonism drugs.
- XII. Blood and Haematopoetic System.
- XIII. Cardiovascular and antihypertensive.
- XIV. Cardiovascular - antihypotensive.
- XV. Antiarrhythmics.
- XVI. Cardiotonic.
- XVII. Dermatologicals.
- XVIII. Diagnostics.
- XIX. Diuretics.
- XX. Gastrointestinal drugs, Antispasmodics.
- XXI. Cathartics.
- XXII. Laxatives, Purgatives.
- XXIII. Antacids.
- XXIV. Antidiarrheals.
- XXV. Hormones.
- XXVI. Immunologicals (Immunosuppressive).
- XXVII. Muscle relaxants and Antagonists (Peripherally acting)
(Skeletal muscle relaxants).

- XXVIII. Ophthalmologicals.
- XXIX. Oxytocics.
- XXX. Psychotherapeutic and Hypnotics (Psychostimulants sedatives).
- XXXI. Drugs acting on the respiratory tract.
- XXXII. Solutions correcting water, electrolyte and acid-base disturbances.
- XXXIII. Vitamins and Minerals.
- XXXIV. E.N.T. (Ear, Nose, Throat) preparations.
- XXXV. Anti-hemorrhoidal preparations.
- XXXVI. Anorexics.
- XXXVII. Cholesterol reducers and antihyperlipidemics.
- XXXVIII. Geriatrics.
- XXXIX. External Treatment.
- XL. VARIAE.

LIST OF PHARMACOLOGICAL LABORATORY EQUIPMENT,
SMALL SCALE INDUSTRY EQUIPMENT AND TECHNICAL
ASSISTANCE (UNIDO EXPERTS) AS A FOLLOW-UP
ACTIVITY OF THE PRESENT REPORT IN NEPAL.-

<u>I.- Necessary equipment for pharmacodynamic screening.</u>	Approximate cost in U.S.\$
1. Physiopolygraph with transducers for experimental work:	
- Helighe-Schwarzer (F.R.Germany).....	30,000
- Nihon Kohden (Japan)	
2. Autoanalyser SMA-12, type S (for Na, K, Ca, glucose, enzymes in blood)	
- Technicom (France)	72,000
- Union Carbide	
3. Electrocardiograph	2,000
4. Electroencephalograph	5,000
5. Apparatus for studying the conditioned reflexe. Ugo - Basile (Italy).....	500
6. Animex activity meter.	
- Farad Electronics - Stockholm - Sweden (Apparatus for measuring the motor activity)	500
or Activity Cage for mice Ugo - Basile (Italy)	
7. Analgesy-meter for the rat paw Ugo-Basile-Milano (Italy).....	300
8. Ect Unit Electro-convulsive Treatment for small Mammals. Ugo-Basile-Milano.....	600
9. Apparatus for measuring volums and anti-inflammatory activity volum Differential-meter, Ugo-Basile - Milano (Italy).....	250

II. Necessary equipment for pharmacokinetic studies. Approximate cost in U.S.\$

- 1. Apparatus for studying resorption (artificial stomach and intestine)
Resorptions Modell Komplet SM 16750
Packungseinheit M.1 SM 15701
Packungseinheit D.1 SM 15702
Sartorius membranfilter (West Germany).... 1,000
- 2. Spectroskop U.V.-V.I.S.-Zeiss Jena..... 8,000
- 3. Microcomputer Quartz-Casio 150

III. Necessary equipment for studying biochemical pharmacodynamics (second necessity) amount about.... 15,000

- 1. Cooling Centrifuge (Kühlzentrifuge K 24 Janetzki D.R.G.).
- 2. Homogenizer
- 3. Refrigerator
- 4. Electric pH-meter
- 5. Warburg apparatus
- 6. Universal adjustable stand (Grösstes Universalstativ) E.Zimmermann - Leipzig (D.R.G.).
- 7. Kymograph penholder and inscripting pens or Electric-Kymograph (Trommeleregistergerat - Zimmermann - Leipzig).
- 8. Baths for isolated organs (with accessories)
- 9. Synchronograph (E.Zimmermann - Leipzig.)
- 10. Ultrathermostat. Metrimpex - Typ LP 225.
- 11. Operation table for laboratory animals.
- 12. Pump for artificial respiration with variable rythm and amplitude.
- 13. Electric steriliser for instruments.
- 14. Biological pH-meter Tip OP-212 Avec electrode micro-capillaire, Metrimpex, Budapest..... 3,000

IV. <u>Varia</u> : Syringes, Surgical Scissors,	Approximate
Anatomic Clips, Hemostatic	cost in U.S.\$
Clips type Kocher, Pean, Divenwasek,	
Lancets, Suture needles type	
Reverdin, Immobilization devices,	
Watching Cages (plexiglass, glass),	
Cages etc. Total:	200

V. Small scale industry equipment and technical assistance by UNIDO Experts

1. The UNIDO assistance cost previous in Appendix XVIII Final Mission Report RP/RAS/78/012..... 342,100
2. Hammer mills - Condux-Werk (D-6450 Hanau 11 - W - Germany) or : Special mills - Type W - 3 R or W - 45 R - Winicker & Lieber (Maschinenfabrik - 2930 Varel 1 - Hansastrasse 1 W - Germany) 50,000
3. Dryer, Tray Chamber Hareaus(WEST - Germany) 2,500
4. Filter Press 1/4 H.P. (West Germany).. 1,200
5. Mill, Cutter 1/2 H.P. or Mill Fitz Patrick 8,800
6. Blister packing machine (automatically) Bosch or Uhlmann - for capsules and tablets..... 40,000
7. Semi-automatic Ointment filling, cumping and coding machine (Engl.).... 10,000
8. One All-ground car with laboratory equipment 2,400

A. TECHNICAL ASSISTANCE :

Approximate
cost in U.S.\$

- 1. Pharmaceutical adviser or expert,
long experienced in medicinal plants
and Phytotherapeutical products for
24-48 m/m.
- 1 Agronomist (Agr.Eng.) 6 m/m.
- 1 Pharmacologist (Dr.Med.) 6 m/m.
- 1 Analyst for medicinal plant analyses
and drugs control, 6 m/m.
- 1 Technologist for vegetal extraction
and conditioning of pharmaceutical
products for 6 m/m.

Total approximate cost:... 250,000

B. TRAINING PROGRAMME :

- 3 Scientists (x 3 m/m) and one Manager
(1 m/m)(for management and Marketing)
from R.D.R.L., in Europe 45,000

GRAND TOTAL U.S.Dollars:..... 387,500.-

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