IMMUNITY BULLETIN

SYMPOSIUM
ON
INDIAN MEDICINAL PLANTS

1951

BENGAL IMMUNITY RESEARCH INSTITUTE
39, Lower Circular Road, Calcutta-16.
IMMUNITY SCIENTIFIC ASSOCIATION

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INDIAN AGRICULTURAL RESEARCH INSTITUTE, NEW DELHI.
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Published by Dr. T. N. Ghosh, D.Sc. and Dr. A. N. Bose, M.B., Joint Secretaries, Immunity Scientific Association, Bengal Immunity Research Institute, 39, Lower Circular Road, Calcutta—16.
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INAUGURAL MESSAGE

By Hon'ble Dr. B. C. ROY, M.D., M.R.C.P., F.R.C.S.
Chief Minister, Government of West Bengal.

It is a well-known maxim that 'wherever there is a disease prevalent, remedy is also available for the disease in the same area if only we search for it.' There is a deeper significance of this adage, more than one realises on a casual observation of the problem of medicinal plants. Medicinal plants found in any country have properties which are markedly affected by humidity, temperature, atmospheric conditions, and sunlight operating in the country. It is therefore essential that we in India should devote our whole attention to the investigation of properties of Indian medicinal plants and their uses.

I wish your Symposium all success.
PREFACE

In the history of medicinal plants one would find that the oldest records stem from the ancient civilization of the Hindus, the Chinese and the Mayas. A map of India on the distribution of the pharmacopoeial crude drugs would reveal the wonderful variety and number of drugs that naturally grow in this country. A scrutiny of the statistics on the sea-borne trade would show that over 32 lacs of rupees worth of crude drugs are annually exported out of India (pre-world war II figure). Is it not a paradox that people of the same country suffer or even die for want of proper medicinal treatment? Over and above, drugs worth several crores of rupees come to India for consumption and that again at a price much above the purchasing power of the average man.

In spite of the increasing flow of modern remedies it may be noted that there are products from natural sources which are maintaining their specialities, or, are being used for newer therapy. This naturally points to an intensive research on the remedies that had came down to us from generations. A complete survey of raw materials necessary for preparing the type of medicaments that are being used by Vaidas and Hakims and a thorough standardisation of the crude drugs would go far away in the advancement of the knowledge of medicinal chemistry. But pre-requisites for an ethical evaluation of a drug would be the coordinated efforts amongst the divergent scientists. When considered from all these angles a discussion on Indian Medicinal Plants seems to be of more than an academic interest.

In connection with this symposium on Indian Medicinal Plants, organised by the Immunity Scientific Association, various speakers have communicated summaries of their observations covering different aspects of the subject. In order to focus the attention of workers in the field, these observations are now being published in a special issue of the IMMUNITY BULLETIN.

U. P. BASU.
FOREWORD

By Sir R. N. CHOPRA, M. A., M. D., Sc. D.
Drug Research Laboratory, Jammu-Tawi.

It is indeed a great pleasure that Bengal Immunity Research Institute is holding discussion on various aspects of crude drugs in India. The subject is very important and I feel sure a discussion is indicated and will be very useful.

The Drug Enquiry Committee suggested means for ensuring supply of authentic and pure drugs by means of Drug Legislature which happily is now being implemented in many States. Unfortunately the Committee could not suggest preventive measures against adulteration of crude drugs used in the indigenous medicine practised in India for want of adequate standard which must be established.

The present position with regard to crude drugs which are used in the manufacture of pharmacopoeial and other preparations, is far from satisfactory. Very often the drug dealers intentionally adulterate crude drugs with spurious substitutes particularly where leaf and root are used. For instance leaf of Belladonna, Hyoscyamus, Datura, etc. are mixed with leafy materials of other plants such as Phytolacca sp., Morus sp. etc. Similarly roots and rhizomes are adulterated with materials having a similar appearance. The unscrupulous drug dealers unfortunately export these adulterated crude drugs to foreign countries and bring a name to the trade.

The petty drug dealers (pansari) who retail the sale of the crude drugs throughout the extensive length and breadth of this sub-continent excel in the art of adulteration. They produce worthless imitation of crude drugs, which are very difficult even for an expert to distinguish, from the genuine articles. In a detailed study of crude drugs sold in the market by these pansaries we have found that almost every genuine raw drug has a cheap and spurious substitute available in the market.

In the absence of any tests, standards or any legislation, this nefarious trade which is flourishing and highly injurious to the health of the people can not be possibly checked. Proper standards should therefore be worked out and laid down to determine quality and active principles of crude drugs. This needs not only research on chemical side, but intensive research on the Pharmacognostic aspects of these drugs.
In European countries and the U. S. A., Pharmacognosy is a well-advanced Science and almost the entire flora has been subjected to Pharmacognostical investigation. In India however only a beginning has been made. It will take many years before the Pharmacognostical aspects of the vast Indian flora could be worked out but there is no doubt that this should advance side by side with chemical investigations on plants. The physical, botanical, and chemical characteristics of medicinal plants, their identification, cultivation and supply to the market should go hand in hand. There is a very wide field for pharmacognosy to cover before it comes abreast of other research activities in our country.

India can produce most of the pharmacopoeial and extra-pharmacopoeial drugs of vegetable origin which if developed on scientific lines will amply meet the demand of the pharmaceutical industry in this country and even leave margin for export. The development of pharmacognostical research therefore needs considerable attention. The crude drugs form the basis for the manufacture of finished standard preparations which are urgently needed by the people. Cultivation on scientific lines, working out proper time of collection, suitable method of curing of drugs, affect in the active principle of the crude drugs, and should be worked out with due regard to climatic and weather conditions.

Another important factor is that crude drugs are often met with in highly adulterated condition in the market. The detection of adulteration in their normal and powdered condition is therefore very important. This is essential for detecting adulteration, stopping it and ensuring supply of pure drugs.

A beginning has been made in this direction for the drugs recognised in the Indian Pharmacopoeial List. Much, however, remains to be done. Numerous drugs of vegetable origin are imported annually from foreign countries on which large amount of country's wealth is spent. If a systematic search is made either in finding local substances much could be attained. Examples of those already found, are *Colchicum luteum* which grows in the Himalayas in a state of nature and which can replace the official drug *C. autumnale*, *Picrorhiza kurroo* has replaced *Gentiana utea*, *Atropa acuminata* which till recently was not recognised in British Pharmacopoeia, had been recognised during the second World War and large quantities were exported from Kashmir to the foreign market.

*Cultivation of drugs*: Except for a few drugs, little systematic effort has been made towards the cultivation of drugs in India. Our sources of crude drugs have been extensive forests, meadows and neighbouring areas.
Due to ruthless and excessive extraction during the Second World War, a marked decrease in the yield of crude drugs and a fall in their active principle content was observed. Owing to loss of certain areas which were rich in vegetable drugs to Pakistan, supply has been further decreased in case of many drugs. The demand of the growing pharmaceutical industry in this country can not now be met from the supplies obtained from natural resources. It is, therefore, essential that cultivation of drugs be taken up earnestly. A number of important exotic plants have taken root on the Indian soil. Amongst these which are of great practical utility are Cinchona, Ipecacuanha, Digitalis, Pyrethrum and others.

Many more drugs can be cultivated for instance Artemisia, Ephedra, Hyoscyamus, Ergot, Glycerrhiza etc. for which demand has enormously increased. Drug farming therefore deserves the attention of the Government and private individuals. It is gratifying to note that the Indian Medicinal Plants Committee of Council of Indian Agricultural Research has decided to set up model farms at six Regional Centres representing plain and hilly areas in different States of the Indian Union where experimental cultivation of medicinal plants would be conducted. It must however be realised that this is no Novice's job but needs specialized knowledge. It is only then that cultivation will bring about high percentage of active principles and regular supply to the Pharmaceutical industry. This can only be accomplished if Botanists, Chemists and Pharmacologists can collaborate whole heartedly.

Of the private organisations for research in connection with all aspects of drugs, the Bengal Immunity Company's Research Institute takes one of the foremost places. Under the able Directorship of Dr. U. P. Basu, I have no doubt that its activities will greatly benefit the people of this country generally and drug industry particularly. I wish this Institute success which it rightly deserves.
ON INDIAN MEDICINAL PLANTS
(GENERAL ASPECTS)

By S. N. BAL, Ph. C., B. S. (Phar.), M. S. (Mich.)
Bengal Immunity Research Institute, Calcutta.

Sydler introduced the term Pharmacognosy in 1815 and it was derived from two Greek words—'Pharmakon' meaning drug, and 'Gnosis' meaning knowledge. It literally means the knowledge of drugs. It is a study of drug having its origin in plants or animals. It implies not only the drugs, but it also includes a knowledge of the sources from which the drugs are prepared and the methods of their preparation. The history, distribution, cultivation, collection and selection of plants of economic importance are therefore the subjects of study to students of Pharmacognosy.

But in modern times the leading Pharmacognosist, Prof. Youngken of Massachusetts College of Pharmacy, is of opinion that Pharmacognosy is an applied science in the pursuit of which, a number of scientific disciplines enter. He extends the scope and the problems beyond the vegetable and animal drugs of the pharmacopoeia and formularies. He includes the vegetable dyes, resins, gums, starches, rubber and latexes, waxes and oils, spices, aromatic herbs, non-medicinal condiments, vegetable insecticides, rodenticides, plant and animal fibres used in textile, paper and other industries, cereals, tea, coffee, cocoa and other beverage foods which are now being submitted to pharmacognosist for determination and evaluation.

Therefore it can safely be said that the scope and problems have been greatly widened and it now can be termed as a true branch of Applied Botany.

I

Now coming to the main points to be discussed we first take up the problem—'Necessity of pharmacognostic researches of Indian Medicinal plants'. I hope there can not be a second opinion regarding the necessity of researches on the subject. It is high time that such researches should be taken up by every institution interested even in identification and evaluation of the crude drugs they are dealing with. It is regretted that inspite of the efforts of a very few people, the subject has not taken its proper place among the sister sciences. In 1944 a nucleus of organised
research was formed under a grant from Messrs. Bengal Immunity Co., Ltd. of Calcutta through the energetic efforts of Dr. U. P. Basu, the present Director of Bengal Immunity Research Institute which now has a separate section attached to it. At about the same time some work on Pharmacognosy had to be done in connection with the work of Indian pharmacopoeial List Committee. Later the Govt. of India established a 'Pharmacognosy Laboratory' in 1946 which now has been made as a permanent Section under Central Drugs Laboratory. Also there was establishment of some new schools and colleges of pharmacy in different parts of India where it is expected researches on the subject will be carried on. We have to take into consideration researches on Indian Medicinal plants—the researches on proper pharmacognostic lines have seldom been carried out resulting in many pitfalls in many of our publications on medicinal plants which require revision. There are many doubtful results in our sister sciences and so before going into any revisional work in the line of plant chemistry, pharmacology and other allied sciences, the first and foremost work should be pharmacognostic identification and standardisation of the drug. If pharmacognostic data are wanting in the plants to be experimented with, the results will necessarily be indifferent. Comparatively fair work has been done in the line of chemistry and other sciences on the medicinal plants of Indian origin, but if we review the work done on pharmacognosy and then compare it with the list of medicinally active plants as compiled by Watt in his Dictionary of Economic Products of India or Dymock's Pharmacographia Indica, it will be clear, how deplorable state of affair exists in the realm of Pharmacognosy of Indian Medicinal Plants. There are so many therapeutically active and recognised drugs whose researches in the line of cultivation, harvesting, curing, storing, identification from spuriousness are yet to be done.

II

The second subject of our symposia is adulteration and spuriousness of crude drugs as sold in Indian market and detection of the same. It is a very old problem which has done much harm in our crude drug industry, and indirectly to the Indian manufacturers of drugs. The problem is well known to every body and needs no clarification. The types of adulteration are—(1) Sophistication, (2) admixture, (3) substitution, (4) deterioration, (5) spoil-age and (6) inferiority.

Sophistication is the addition of the spurious articles to any material with intent to defraud, like the addition of wheat flour to powdered ginger.
Admixture is the addition of one article to another through ignorance or carelessness, as different kinds of Aconites which grow together in the wild state and are collected indiscriminately and so a heterogenous article is offered as a particular type. But the substitution is when an entirely different article is sold in the place of genuine one as is found when herbs of Verbascum thapsus are often substituted for those of the Lobelia nicotianaeefolia as both go by the common vernacular name “Ban-tamaku”. Deterioration is the degeneration of the quality or value of an article during storage. It is caused by contamination with moisture, fungi, or insect—as crude drugs are often found mouldy or insect bored. It is one of the most common drawback of crude drugs of Indian origin. Spoilage is the extreme state of deterioration, where the article is rendered totally unfit for further use. The common examples are found in the case of cheap ergot as offered in Indian market and also some canned products are found totally spoiled. The inferiority is the state of an article which is below the required standard. Most of the digitalis of Indian produce are inferior and also if ipecac roots are gathered within second year of planting they will be found inferior, as the required strength is only developed during 3rd and 4th year.

It is really regrettable that there is a dearth of organisation in India where adulteration and spuriousness can be tested. Although there exists one Pharmacognosy Laboratory under the Ministry of Health, Govt. of India, the laboratory is not empowered to check the adulterations of crude drugs sold in the market. Only a few manufacturing concerns have a pharmacognosy section where they can test the efficiency of crude drugs which form the basis of their finished products, but in the majority of cases the firms entirely depend on the mercy of crude drug dealers. Inspite of Drug Act these firms take a great risk of using spurious and adulterated drugs and consequently may use such articles which are injurious to the health of the patient.

Pharmacognostic methods, for identification and finding out the adulteration, mainly consist of:

1. Organopeptic—i.e. shape, size, colour, markings, smell, taste, touch etc.
2. Microscopic—Identification from microscopic characters and micro-chemical tests.
3. Physical—Determination of solubility, specific gravity, optical rotation, melting point, water content, degree of elasticity of fibres, fluorescence, effect with polarised light, etc.
4. Chemical—Evaluation for determining the percentage of active principle.
5. Biological—Study of the effects of preparations of the drug in animals as is done with Digitalis, Stropanthus, Apocynine, Aconite, Ergot, etc.

III

The third subject of our symposia is the standardisation of crude drugs. For the standardisation of crude drugs one standard method of evaluation cannot be employed. Each drug must have its specific method of evaluation. Some require microscopic, some biological, some chemical and some require physical methods. The pharmacognosist must have a wide knowledge of the related science, to apply these methods. In the case of many indigenous drugs, standard methods of evaluation have still to be worked out and until this is done the control of drugs will only be partially effective. I invite the attention of research workers to this problem.

The prime importance in the standardisation of drug is its identity. The identity of a drug is ascertained by systematic study and comparative anatomy. The next important point in standardisation is determining its quality and purity. The quality refers to the intrinsic value of the drug, that is, the amount of medicinal principle or active principles in the form of starches, sugar, mucilages, acids, bases, gums, fixed oils, fats, waxes, volatile oils, resins, tannins, glucosides, alkaloids, hormones, vitamins, toxins and antitoxins, etc. Pharmacognosist applies some methods which are characteristic of its own and which are acquired from the practical knowledge of drugs in pure form. The purity of a drug depends upon the absence of foreign matter, which may be organic or inorganic, which again can be determined by microscope or calculating the ash and then noting the insolubility of the same in acids. It is our firm opinion that when any galenicals or finished products are made from the indigenous drugs whose assays are not yet made, they must be thoroughly standardised. In this respect standardisation from a pharmacognosist’s point of view is of great value.

IV

The fourth subject of our symposia is the searching for substitute drugs for those therapeutically recognised but exotic to the country, and such other related matters. Though more than 50% of the B. P. and the B. P. C. drugs are found in India, the rest of the drugs are imported and we are entirely dependent on foreign sources. This dependability showed the helplessness in procurement of those drugs during the last two world wars when our manufacturers of B. P. and B. P. C. products were in a dismal condition and consequently the prices of the finished goods
rose to an alarming height. Even today the condition of the drug market is equally bad due to the political situation of the world. A single instance of this type can be cited here which will explain the condition. It is the case of Ergot. The main source of supply of Ergot is Europe. But now this drug is scarce even in London market. In India now Ergot is practically unavailable. A few months back Ergot was selling at Rs. 6/- a lb, and latest price offered was Rs. 100/- a lb. Though ergot is not commonly met with in Indian cultivated cereals yet in South India it is found to occur in several species of grasses. The point is whether these sclerotia of Ergot can be utilised as a source of Ergotoxin for our medicinal use. It can be mentioned here that a very limited quantity of ergot of high potency is now being produced in cultivated Rye in South India.

India has got a varied climate and soil and almost all the exotic drugs can be produced here and if some of them are found not suitable we have to find some other near related member of the genus which may be found quite good. We have already adopted some substitute drugs in our I. P. L. and in future we may be able to produce all the drugs that are necessary for our pharmacopoeia. Here it can be said that not only the nearly related members of a drug plant may give similar drugs but plant of remote relation may also give active principles of similar nature. Seeds of Sida cordifolia of Angiosperms do contain Ephedrine which is now obtained from Ephedra spp. of Gymnosperms. So a potential research is necessary for the search of substitutes.

The recent trend in Medical world is to produce some specifics against the particular type of organisms which give rise to the development of antibiotics. For the search of antibiotics many sources had been tapped and most of the sources of such drugs are from bacteria and lower division of plants. But we should not ignore searching antibiotic properties in parts of flowering plants. From the researches of this laboratory it was found that there are possibilities of producing antibiotics of high potency from the higher plants.

Apart from antibiotics, the specific diseases caused by deficiency are highly important. Vitamins and Hormones which are now extensively used are obtained from drugs of vegetable and animal origin. There is a wide search for these highly complex organic compounds from many crude drugs. In most cases it was found most convenient to synthesise these things from vegetable and animal products. I can mention here some facts about cortisone for which a world-wide search for starting materials is going on. The sarmentogenin from Strophanthus spp. the saponins from Dioscorea spp. stigmasterol from Soybeans and jervine a steriodal alkaloid
of Veratrum viride is being tried to produce cortisone. If these plants can be utilised as a source of starting materials, then not only the cost of the drug will be reduced but also a guarantee of unlimited supply can be given to the world. The cost to convert bile acid to cortisone will be halved if plant products are used in place of Ox-bile. There is also a search for total synthesis, and if that can be done many intricate problems will be solved more easily. But in the meantime, the search for other plant materials which might be utilized for this purpose should go on.

V

The last point of our symposia is the cultivation and the utilization of medicinal plants. The Barley and Date have been known to be cultivated since 5000 B.C. There is enough proof to show that medicinal plants were cultivated by the Ayurvedist in India. Linseed and poppy seeds have been known during stone age in Egypt. The cultivation of medicinal plants had been encouraged by Babylonian Kings even 2000 years before Christ. It appears that Anglo-Saxons in 10th century used about 500 plants as medicine. The medicinal plant culture were mainly confined to the monasteries during the early middle ages. The more important herb gardens were later started such as:

- Padua Herb Garden... 1533 A.D.
- Florence Herb Garden... 1544 A.D.
- Bologna Herb Garden... 1547 A.D.
- Oxford Herb Garden... 1632 A.D.
- Chelsea Herb Garden... 1673 A.D.
- Edinburgh Herb Garden... 1675 A.D.

Commonly medicinal plants are harvested from wild state. But through cultivation many difficulties in obtaining good drugs can be removed. But there are some difficulties in cultivation too. The main difficulty is economic. By cultivation increase in cost of production does occur in case of many crude drugs and also they become more susceptible to the attack of disease and insect. Also the adverse condition of the climate is a great risk which has to be faced by the cultivators of crude drugs. But on the other hand there are so many advantages in cultivation that all those above mentioned factors can be profitably eliminated in many drugs of interest. In short the advantages are (i) collection of large number of plants in a comparatively small area facilitating collection and eliminating accidental collection of spurious drugs, (ii) the drugs are essentially of uniform standard (iii) can be cultivated in easily accessible parts and
thereby facilitating transport and, lastly (iv) improvement can be done by selection of better strains, hybridisation, creating polyploids and grafting. Also improvement can be done by proper way of harvesting in proper season and time, which are important factors as regards the quality of the drug, curing and drying by artificial means.

There are many methods which should be followed in the way of harvesting in the different kinds of plant parts, and there are many physiological ways by which the improvement in crude drugs can be effected. There is a vast field for researches even in the best-known drugs in introducing the methods like grafting, hybridisation, and some special cultural methods like pruning, exploration, hydroponics, etc. The effects of different kinds of fertilisers are of great value for drug cultivation. I am giving you a list of medicinal plants, which are found to be cultivated in India and its account can be had from my paper published in Indian Journal of Pharmacy of 1941 in July—September issue, and some of the plants were dealt with in details elsewhere. The plants are:

(1) Aconite (2) Artemisia (3) Belladonna (4) Colchicum (5) Castor (6) Carica papaya (7) Chaulmoogra (8) Coptis teeta (9) Cinchona (10) Derris Root (11) Digitalis (12) Ephedra (13) Eucalyptus (14) Hyoscyamus (15) Ipecac (16) Nux vomica (17) Picrorhiza (18) Podophyllum (19) Pyrethrum (20) Polygala (21) Rhubarb (22) Senna leaves and pods (23) Sandal wood (24) Taraxacum (25) Valerian. I also published a list of plants in the same year where I mentioned exotic plants which are worthwhile to try on the Indian soil. It is gratifying to note that sporadic efforts have been made in cultivating the medicinal plants in different parts of the country very recently. Our state government is going to start the cultivation of some new drugs in the suitable sites in the state, and it is eagerly hoped that the work will be started as early as possible. By this cultivation of medicinal plants a considerable amount of money of our country will be saved by reducing imports and increasing exports, and also a guarantee of steady supply of standard drugs can be given to our manufacturers of medicine.
ON INDIAN MEDICINAL PLANTS

By K. BISWAS, M. A., D. Sc. (Edin.), F. R. S. E., F. N. I., F. B. S.,
Indian Botanic Garden, Howrah, Calcutta.

The points for discussion in the 'Symposium' seem to be interrelated if not interdependent. Correct determination of authentic drugs as well as those which are used for adulteration is the first and the most important item in the chain of Pharmacognostical researches. Detection of adulteration and spuriousness of crude drugs sold in the market and fixation of the standard of crude drugs presupposes accurate identification no doubt and naming the plant correctly. This means not only knowledge of systematic botany and taxonomy but prolonged pharmacognostical investigation. The necessity for pharmacognostical researches cannot be overemphasised. This fact was duly stressed by me in my Presidential address on 'Pharmacognosy in India' published in the Indian Pharmacist, Vol. VI, No. 4, pp. 107-114, 1951. — "Pharmacognosy is the science whose task is to scientifically investigate, correctly describe and to systematise according to general points of view, the drugs of vegetable and animal origin, with the exception of physiological effect. The final task of pharmacognosy will be to group the drugs according to their contents and to come gradually to a pharmacochromatic system of drugs that serves as a lead to pharmacology."

Nevertheless correct determination alone either for ascertaining systematic position or finding out authentic names of medicinal plants or detection of adulterations pharmacognostically is likely to solve the problems before us satisfactorily. It is admitted on all hands that those aspects of researches are of fundamental importance and, in fact, the first step towards the study and investigation of crude drugs or any plant of medicinal value. But physiological and ecological investigation in the field of original habitat of the medicinal plants as well as in experimental farms and large plantation are essential for testing the optimum efficacy of a drug. This has been proved in the case of Cinchona, Ipecac and Digitalis and other drugs grown in our country either on a commercial scale or experimental farms. The high percentage of quinine in Java Cinchona in comparison with the low percentage of the same in the Darjeeling and Nilgiri Cinchona, is mainly due to physiological, ecological and horticultural manipulation of the plants based on the results of intensive investi-
Indian Medicinal Plants

gations in the field and laboratory at the Java plantations unlike our plantations.

As regards standardisation of our crude drugs it is not an easy job if we are to keep up to the international standard. All the stages involved in handling the drugs from cultivation, harvesting, drying, storage, packing, transit and marketing and up to its final stage before manufacturing finished products for consumption will have to be very carefully worked out and taken into consideration in preserving the standard of the active principle of the drugs. It will therefore be quite clear that at every stage study and research are needed with a view to placing our drugs in the world market and also testing genuineness and efficiency of foreign drugs which are unavoidably imported for our use.

Another very important point is that certain form of control for preserving rare indigenous drugs is imperative with a view to preventing extinction of the rare species from India. Control not only over ruthless and sporadic collection of our own collectors but also outside collectors is necessary. Other biotic and climatic factors too will have to be controlled such as wind, rain, cattle, birds, monkeys and so on. It would therefore be advisable for our herbalists, for their own future and ultimate advantage, to form an association of their own and hold a license for selling genuine raw drugs with a view to holding their reputation in India and markets in countries overseas. In this matter state help may be forthcoming.

The Medicinal Plant Committee formed with Dr. B. C. Roy as the Chairman and other specialists as announced in the 'Calcutta Gazette' dated 7/12/50, page 2453—Resolution No. 2876 Cin. dated 30/11/50 of the Commerce & Industries Department (Cinchona Branch), may co-ordinate the various aspects of this most important question concerning cultivation, determination and testing of drugs, standardisation of drugs, collection of drugs, drying and storing, clinical experiment and finally marketing of drugs with the help and collaboration of the National Drug Research Institute, Lucknow and Botanical Survey of India and various other Government and private institutions like the Bengal Immunity Research Institute. There must not be any rivalry anywhere nor miserliness in response from any quarters as there exist vast vegetable resources in our country and enormous scope for several hundreds of firms and organisations to meet our own consumption and possibly supplementing world demand and thus advance the cause of pharmacognostical science for the welfare of herbalists and all those interested in drugs and alleviate the sufferings of the vast humanity at large.
MEDICINAL PLANTS AND THE TASK OF THE BOTANISTS

By J. C. SEN GUPTA, Dr. Phil. Nat.
Presidency College, Calcutta.

Introduction.

Improvement of the condition of the cultivation of medicinal plants with a view to the supply of drugs depends to a large extent on the various aspects of Botanical investigations.

It is well known that cultivation of medicinal plants in India has enormous possibilities specially in view of the country having areas which have subtropical, temperate and alpine conditions on the one hand and large areas with tropical (dry and moist) and even arid zones on the other.

I. Preliminary Survey

One of the first steps required to be taken is a survey of medicinal plants which commonly grow in India including those known to Ayurveda, their geographical distribution with reference to the different climatic zones. Considerable data are already available from the works of Watt's "Dictionary of Economic Products of India", Kirtikar and Basu's "Medicinal Plants of India", and publications of Ayurveda. In more recent time the question has been studied by various workers and the publications of Sir R. N. Chopra can be specially mentioned in this connection. Most of the medicinal plants of commerce of India are collected from their natural habitat where they grow wildly. The survey should include a study of the ecological factors and the range of their seasonal and annual variation, under which the plants grow.

The yield of the alkaloids, Glycosides or other active principles of the plants growing under natural conditions, by thorough biochemical studies where necessary, should complete the preliminary survey. These chemical studies should include not only species which have been found to yield the required chemicals in the well known species of the world included in the different Pharmacopoeas, but also of species which are allied to them.
After preliminary survey is completed, more intensive investigation will have to be restricted to only a limited number of selected species.

II. Taxonomic and Cyto-taxonomic studies.

With the species on which intensive studies become of importance, one of the first problems to be solved will be to study the taxonomy of the species and to establish pure line strains under each species, and to establish the genetical constitution of the plants by the present day methods of Cyto-taxonomic and Cytogenetic studies. Extension of cultivation and all experiments under controlled conditions should be done only with seeds and other propagules of pure line strains. These pure line strains will then form the starting points of experiments on breeding with a view to produce improved strains. Attempts to produce suitable mutants by the modern methods of X-ray or chemicals and of artificial production of polyphoids should naturally form an important part of these investigations.

III. Plant Physiological studies.

The chief problem will however be to find out the conditions under which the plant will yield the maximum quantity of the required chemicals and this is where studies on the physiology of the plants will come in. One of the simple set of experiment should be to find out from the growth habits of the plants with reference to the climatic conditions, the new areas where they have a possibility of flourishing well. For example in the case of annual plants growing naturally in the subtropical or even temperate regions in the summer season can very well be tried in the winter season in tropical plains. Quite a large number of useful medicinal plants can be tried under this category, and it is not unlikely that many of them will not only grow very well in the plains, but the yield may improve under the tropical conditions. Mention may be made here of the production of Ergot which is usually produced in subtropical and temperate climates. But an experiment conducted at the Presidency College experimental garden showed that Ergot sclerotia were not only very well developed in the tropical plains but the yield was more favourable than in the subtropical and temperate areas.

(1) Effect of time of sowing.

Even in regions where the plants grow normally, very useful information will be obtained by sowing the plants in different months or fortnights to find out the optimum conditions of their growth and quantitative production of drugs. It has now been well established that the
drug contents of the plants vary not only with the variation of soil or climatic conditions but also with the time of harvesting, the age of the plant, the stage of development of the plant with special reference to the flowering and fruiting stages. It will be possible to get a clear picture of this important aspect of the question by the time of sowing experiments. By these experiments it will be possible to understand the nature of the general reaction of the plants of the natural variation of the environmental factors, as all the factors vary at the same. For a study of the influence of individual factors like temperature and its variations, the humidity, the solar radiation, hours of bright sunshine, intensity of light, it is necessary to devise chambers for producing artificial climates in which the individual factors or combination of factors can be varied at will. Although plant houses in which some of the factors like temperature and light can be varied have now been devised in many countries, but complex technical device for the changing of all the factors at will is available only at the well known Kirchhoff Institute of Technology & Plant Physiology at California, the development of which through different stages of trial and error cost several millions of dollars.

But the results of time of sowing experiments which will require no special device are expected to show which of the factors are more prominent and to throw very useful light on the possibility of growing plants in new areas after a study of the climatic factors of the areas concerned. This would also be very useful for experiments on the acclimatisation of plants to new areas, and also for the introduction of well known medicinal plants into our country.

(2) Vernalization and Photoperiodism.

Another set of experiments worth trying will be to find out the influence of presowing cold and heat treatment of seeds on the growth and development of plants—well known as Vernalization, and also the effect of controlling the daily light period—known as Photoperiodism, as these factors have been found in the case of various plants to be of very great influence, not only on the time of onset of the flowering and fruiting phases of plants, but also on the vegetative growth and vigour.

(3) Mineral nutrition.

For a study of the effect of the nature of soil on the growth of the plant and to understand the mineral requirement of plants, culture of plants in artificial media in Sand culture will be necessary to investigate the levels of different ions required and their combinations as also the effect of different
trace elements. These investigations will give a clear direction about the judicious application of the required type of manure.

(4) Hormones.

In recent years the influence of large number of Hormones and growth regulating substances on the various growth and developmental processes of plants have been established and applied in Horticulture. It will be worth while to study the influence of these substances in the growth and yield of medicinal plants.

(5) Changes during drying, storage and curing.

It is well known that drugs undergo various changes after they are collected, during the stages of drying and storage. The respiration of the storage organs as also various enzymes undoubtedly are responsible for these changes. These changes however play a very prominent part in the ultimate yield of the drug and its quality. These changes should therefore be very thoroughly investigated. Various such studies on the biochemical changes have been made in other countries and as these changes are greatly influenced by temperature and other factors, studies in the changes of drugs grown in India will be necessary.

IV. Plant Pathological studies.

The question of dealing with diseases and pests of medicinal plants should also be tackled by the usual methods of plant pathological studies which are also closely connected with the general physiology of the plants.

V. Pharmacognosy.

A very useful now well developed aspect of scientific studies on the proper identification of genuine drugs against spurious and adulterated drugs has been Pharmacognosy which employs anatomical, taxonomical, micro-chemical and other specially developed techniques for the purpose. This is now a very well developed science and we have a band of young, enthusiastic and trained workers who are doing useful work as a part of the Central Drugs Laboratory. A further development and extension of facilities are required.

VI. Conclusion and practical steps.

The importance of the different aspects of study mentioned above is now well recognised and these have been and are being applied to the cases of various Agricultural crops like the Cereals, Pulses, Oil seeds, Fibre plants, Sugarcane, Tobacco and others. Research is being carried out in different
countries on various aspects of the crops in various institutions, Agricultural Farms and Stations with a view to improve the production.

But studies so detailed as above have not yet been applied to the cases of medicinal plants, although intensive studies on various aspects of medicinal plants have been done in U. S. A., Germany and other countries.

For our practical steps we can distinguish between short term and long term projects and start investigation with a restricted number of plants according to the facilities that it will be possible to create and provide.

In India a systematic cultivation of medicinal plants is restricted to Cinchona and perhaps a few others.

After a preliminary survey of the medicinal plants is completed it will be possible to make out a list of plants on which further investigation will be useful and these can be divided into different groups being suitable for investigation in the different States according to the climatic conditions.

An experimental station at Mungpoo at the Cinchona Cultivation Centre.

For West Bengal, it should not be difficult to make the Cinchona cultivation centre of Mungpoo of Darjeeling District into a centre of investigation of medicinal plants of the subtropical and temperate regions.

A second experimental station in Calcutta.

Calcutta which has a large number of trained personnel in different branches of Botany, should have a centre of investigation. A large number of enthusiastic investigators will be willing to take part in a co-ordinated scheme of work. The chief requirement will be an area near Calcutta easily accessible to scientific workers, where it will be possible to grow the plants and the provision of a few rooms to carry out the simple experiments and to provide for the sitting accommodation of the investigators will also be necessary.

These investigations will naturally have to be carried out in close collaboration with the existing centres of research on medicinal plants like the Bengal Immunity Research Institute, Central Drugs Laboratory, the Pharmacognosy section and their co-operation should be readily available.
NEED FOR PHARMACOGNOSTIC
STUDY OF INDIAN PLANTS OF
MEDICINAL VALUE

R. G. Kar Medical College, Calcutta.

The last war made both the profession and the public to realise how
India was dependent on foreign countries for her drug supply. I am sure
all of us will agree that India must be made self-supporting so far as her
drug requirements are concerned. In order, therefore, to attain this objec-
tive, it is necessary to review the present position of drug supply and drug
industry, what are the impediments which prevent their growth and how
best they can be rectified. Without going into detail regarding the future of
drug industry which is outside the scope of this symposium, I shall confine
myself to the question of drug supply in India. There is a vast field for
development of planned cultivation and research on a wide scale either to
establish their claims or to assess their proper value in therapeutics. In
these days of antibiotics and synthetic drugs, one is apt to overlook the
possibilities which India offers of her natural resources. However much
we may have benefitted from the introduction of newer remedies which no
doubt have revolutionised modern treatment of many incurable diseases, one
cannot overlook the fact that we have not yet been able to replace drugs
like Opium, Ergot, Digitalis, Quinine, Aloe, Rhubarb, to name only a few.
It must be admitted that India possesses quite a large number of vegetable
drugs of reputed value, but these have not yet been sufficiently investigated
to place them on modern scientific basis. Most of the vegetable drugs
which are included in the British or U. S. A. Pharmacopoeia either grow
in India or can be made to grow by proper cultivation. A list of drugs
which have a reputation in India and are of sufficient medicinal value, which
eventually may be included in the Indian Pharmacopoeia should be prepared.
The standards of identity of the crude drugs and the tests for purity and assay
of the different preparations should be undertaken to secure uniformity of
their strength and action. Many drugs which grow in this country can
easily replace foreign imported drugs provided their proper standards are fixed. A few examples will suffice, namely, the whole range of vegetable purgatives and bitters, Indian Valerian, Indian Podophylum, Acacia, Lobelia etc. while others, though not indigenous to this country, may be made to grow by proper cultivation as has been done with some, e.g. Belladonna, Digitalis, Ergot, etc. The field is so vast that a careful survey regarding the actual requirements, possibility for development and research etc. should be made and for this purpose co-operation between Pharmacognosists, Pharmacists, Pharmacologists, Chemists and drug manufacturers is necessary. I am sure, the newly formed Expert Committee, of which Hon'ble Dr. B. C. Roy is the Chairman, will be able to give guidance and will help to simplify the present confusing state of affairs.

There is also another aspect to which little attention has been given and that is identification of the proper type of crude vegetable drugs. It has been the experience of many when making investigation on Indian drugs from the specimens obtained from the market or preparations made by some drug manufacturers that some of the samples were found to be of little value; whereas they were found to possess some therapeutic value when work was done with genuine specimens. It is therefore necessary that there should be an organisation for the collection of pure and reliable vegetable drugs with arrangements for drying, curing and storing so that the research workers and manufacturers may be assured of the genuineness of the drugs they use.
NECESSITY OF PHARMACOGNOSTIC RESEARCHES ON INDIAN MEDICINAL PLANTS

By M. L. SCHROFF, A. B. (Cornell), M. S. (Mass.)
Birla College, Pilani.

India is a store house of medicinal plants capable of being grown in all types of climates and soils. The Ayurvedic books mention a very large number of them but no standards from the modern standpoint have been laid down for any of these drugs. For instance Ashtavarga, an important constituent of chyavanprash, consists of eight drugs but different drugs are used in different parts of India under the name of Ashtavarga. Further, while the merits of the constituents of the Ashtavarga are recognised by indigenous practitioners, no pharmacological or clinical data are available to inspire confidence in the scientifically minded people. The same is true of the constituents of Dashmool. Hence, unless we undertake systematic scientific investigation of the various indigenous drugs the prejudice against the use of indigenous drugs unsupported by scientific facts will undermine the Ayurvedic system of medicine and also will deprive the western system of medicine of the use of many useful drugs.

The pharmacognostical study does not simply mean the morphological and histological study of crude drugs, but it also includes the laying down of chemical standards, differentiation from allied drugs and adulterants, the study of changes likely to occur when subjected to various pharmaceutical processes, and the estimation of the activity of the drug and its products. A complete pharmacognostical study of drugs will stimulate (1) export trade in crude drugs of definite specifications; (2) encourage local manufacture of therapeutically active preparations; (3) enrich the Indian Pharmacopoeia; (4) add to our scientific knowledge of the effects of variation of climate, soil, and altitude on the quality of drugs grown in various states of India.
From time immemorial vegetable drugs are being used for combating human diseases. Of all places in the world, I don’t think it would be wrong if I say that, India is a country which is using the maximum number of vegetable drugs for medicinal uses with very good results. To-day, in this country though we use so many vegetable drugs, unfortunately there is no perfect arrangement for the scientific study of these drugs. I shall deal with one particular aspect i.e. the Pharmacognosy— which is the scientific study of structural, physical, chemical and sensory characters of crude drugs of animal and vegetable origin and includes also their history, cultivation and collection, evaluation and other particulars relating to the treatment they receive during their passage from the producer to the distributor or Pharmacist.

According to the modern trend of scientific researches in medicine, it is essential that we should also establish the true scientific value of a certain medicinal plant for particular type of disease. For this we need certainly a research unit; the researches would be more or less a team work, which would comprise, right from cultivation, collection, preservation and evaluation of a crude drug to a proper way of administration with definite knowledge of Physiological action. It is also necessary that the unit should be quite a big one and shall be able to tackle the large number of vegetable drugs available in this country. Unfortunately till now only two or three laboratories have cropped up in this country to tackle such gigantic problem, and I am very happy to mention that the Bengal Immunity Research Institute, through the great foresight of Capt. N. N. Dutta, has developed such a unit, which is taking up such problems.

I shall now enumerate briefly the necessity of Pharmacognostic research and what would be our achievements. It has often happened in some Laboratories that a drug on first analysis was found to be inactive but on subsequent analysis has been found quite active in some other Laboratory, which is most probably due to the defective pharmacognostic knowledge of
the drugs. Development of pharmacognostic research can help the country in several ways—the export trade of the drugs will be increased because of sending the purer samples. The long-standing Ayurvedic treatment will be helped tremendously—because without the authentic drugs their system might come into disrepute within a short time. There are many drugs of this Ayurvedic system which once gave marvellous therapeutic effect but now seem to be of little value. Why this loss of potency? They are due mainly to the following facts:—

(1) Lack of proper pharmacognostic knowledge in collecting the drugs;
(2) instead of the right type of drugs, a substitute has been collected;
(3) some drugs which are always collected from forests might have changed their constituents or the active principles have become less due to hybridisation. The pure strains have not been maintained for many drugs.

In pharmacognostic research it would always be necessary to have cultivation, without which real researches in medicinal plants cannot be done. By this research we shall be able to make some sort of standardisation of the Ayurvedic drugs. Along with this we need ways and means to find out the finer mechanism of physiological action of the vegetable drugs in the human system, which could not be standardized by chemical means or pharmacological tests in animals. I shall give a simple instance: it has been observed that the same drug with the change of “Anupan”, which is mainly different vegetable juice or decoction of some drugs, gives different physiological action in human beings.

So we can infer that a complete pharmacognostic research unit would help our medical profession in acquiring scientific knowledge on medicinal herbs. India is the only place where such Laboratories should grow, as in other European or American countries such hosts of useful medicinal plants (mainly due to our much developed Ayurvedic science) do not grow.
ADULTERATION AND SPURIOUSNESS OF CRUDE DRUGS SOLD IN INDIAN MARKET AND DETECTION OF THE SAME

By S. PRASAD, Ph. D., D. Sc.
Banaras Hindu University, Banaras.

Adulteration, one of the mean profit-making evils of the day, has been in existence for a long time, but never before did it assume such serious proportions as it has now during this post war period. The difficulties in securing good supplies of commodities during the Second World War gave a fillip to this malpractice, and now it has become rampant in this country. In the field of food and crude drugs, this nefarious practice is playing havoc with the life and the health of the poor and semi-starved millions of our countrymen. The admixture of ammonium sulphate with sugar, flours of maize and sorghum with wheat flour, seeds of *Argemone mexicana* with mustard seeds, and vegetable hydrogenated oils with ghee (clarified butter) are some of the examples on the food front, while adulteration of crude vegetable drugs with spurious plant parts in more than 75 % of the cases is a common experience of those of us dealing with crude drugs. Recently the Dept. of Pharmaceutics, Banaras Hindu University, obtained a number of crude drugs from a reputed Calcutta firm dealing in crude drugs, and hardly was there a sample free from adulterants. Lobelia was adulterated with four or five different plant species belonging to Compositae and other families. Glycyrrhiza, Belladonna and others were likewise profusely adulterated with spurious drugs.

Unfortunately in this country, we do not have any Governmental control over the crude drugs meant for home consumption or for export or import purposes. The manufacturers of pharmaceutical products are thus faced with the difficult problem of securing genuine samples of crude drugs, which is very essential if we have to have requisite standard of the finished products. Also due to the lack of such state legislation or organization as we find in other progressive countries like the Federal food and
drug laws of the U. S. A., our crude drug industry has adversely been
affected, particularly from the export point of view.

Looking to the great number of vegetable drugs employed in the indi-
genous system of medicine, both the Ayurvedic and the Unani (Grasco-Arab),
and considering the vast numbers of people who take recourse to these
systems of treatment, it is all the more imperative that the quality of
drugs should be controlled. And the best way to control adulteration
would be to establish units the task of which should be, as in the case of
Food and Drug Administration of the U. S. A., to certify the quality of
drugs meant for home consumption or for export purposes. The cost of
establishments of these certifying units might be met by levying a small duty
on the exporters and persons who would submit their samples of crude
drugs for attesting the quality.

As regards the detection of adulteration of crude drugs the pharma-
cognosists have laid down standards and methods of examination of crude
drugs and their powders. Adulteration includes the addition of a spurious
material to the genuine sample or its substitution for an entirely different
material, and also the admixture of a deteriorated, exhausted, or inferior
quality of drug to the standard quality of drug. And the methods employed
for their detection are also many and varied—organoleptic, microscopic,
physical, chemical and biological. Often more than one method are em-
ployed to detect adulterations. For example, adulterations due to faulty col-
lection, particularly without any regard to time factor which thus leads to
deteriorated or inferior quality of drugs, and also those due to the ad-
mixture of exhausted drugs, are usually ascertained by chemical methods,
namely by determining the percentage of active constituents, aided partly
by organoleptic and partly by microscopic methods. But adulterations
caused by the addition of different plant parts or by substitution are detec-
ted mainly by microscopic and organoleptic procedures.

The identification of drugs and their adulterants by microscopical
characters and micro-chemical tests has been of long-standing usage and
given rise to the special field of microscopy, known as "Quantitative Phar-
macognosy" with the help of which even the quantity of such adulterants
and foreign matter could be determined.

During recent years, however, ultra-violet rays have also been employed
as means of identifying crude drugs, their powders and adulterants. Although
the use of fluorescence analysis has been suggested as early as 1912 by
Heinstadt and later Wasicky drew attention to its application to the detec-
tion of adulterations in a number of powdered drugs and fibres, yet its
successful use has only recently been stressed.
COMMON ADULTERANTS AND SUBSTITUTES OF CRUDE DRUGS
OF THE INDIAN MARKET

Central Drugs Laboratory, Govt. of India, Calcutta.

The term crude drug is used to denote vegetable or animal drugs which consists of plant or animal parts that have undergone no other processes than collection and drying and these are the raw materials which are used by the manufacturers for getting finished preparations. India, in the past, had been reckoned as a treasure island of the East in respect of spices and crude drugs and for the search of spices alone, the Portugese, the Dutch, the Spaniards and the English came first to India. There still exists a great demand for these crude drugs in foreign countries but their export trade has recently deteriorated a great deal due to non-availability of genuine and pure drugs in commercial quantities. The most important bottleneck which has so far prevented India from securing a world market in crude drugs is the adulteration of crude drugs which is rampant in the Indian market. Such adulterations are due to ignorance or wilful negligence of the dealer and for this the crude drugs of Indian origin are generally regarded with suspicion in the foreign market. The faking and substitution of one drug for another is so prevalent here that the Indian manufacturers often fail to get a supply of genuine raw materials for their finished products with the result that many people of our country have lost faith in Indian preparations. This laboratory has been on a look out for such adulterated drugs of the Indian market and has come across a number of cases of such adulterations. A list of such instances is given below:

<table>
<thead>
<tr>
<th>Name of Drug</th>
<th>Official source</th>
<th>Substitute or adulterant</th>
</tr>
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|              |                 | 2. A. clematitis Linn.  
<p>|              |                 | 3. A. longa Linn.      |</p>
<table>
<thead>
<tr>
<th>Name of Drug</th>
<th>Official source</th>
<th>Substitute or adulterant</th>
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</table>

Substitute or adulterant:

4. A. rotundata Linn.
5. Spigelia marilandica L.
1. B. petiolaris Wall.
2. B. lycium Royle
3. B. asiatica Roxb.
4. B. nepalensis Linn.
1. Polygala crotalarioroides Ham.
2. P. rosmarinifolia W. & A.
3. P. telephoides Willd.
4. P. sibirica L.
1. S. angustifolia Buch-Ham.
2. S. alata Royle.
3. S. trichotoma Wall.
4. S. corymbosa Wight.
5. S. decussata Ham.
6. Andrographis paniculata Nees.
7. Rubia cordifolia Linn.
1. C. obtusifolium Nees.
2. C. iners. Reinw.
3. C. javanicum Bl.
1. D. chinensis Benth.
2. D. uliginosa Benth.
4. D. robusta Benth.
5. D. scandens Benth.
7. Milletia sp.
8. Tephrosia sp.
<table>
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<tr>
<th>Name of Drug</th>
<th>Official source</th>
<th>Substitute or adulterant</th>
</tr>
</thead>
<tbody>
<tr>
<td>9, Ephedra</td>
<td>Ephedra sinica Stapf (B.P.)</td>
<td>1. E. intermedia Schr.</td>
</tr>
<tr>
<td></td>
<td>E. equisetina Bunge (B.P.)</td>
<td>2. E. distachya L.</td>
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<td></td>
<td>E. gerardiana Wall. (B.P.C.) (I. P. L.)</td>
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<tr>
<td></td>
<td>E. nebrodensis Tineo. (B.P.C. &amp; I. P. L.)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>H. muticus L. (I. P. L.)</td>
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<tr>
<td></td>
<td></td>
<td>2. P. amplexicaulis Cav.</td>
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<tr>
<td></td>
<td></td>
<td>3. P. psyllium Linn.</td>
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<tr>
<td></td>
<td></td>
<td>4. P. ciliata Desf.</td>
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<tr>
<td></td>
<td></td>
<td>(I. P. L.)</td>
</tr>
<tr>
<td></td>
<td>Rheum webbianum Royle (I.P.L.)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A. strobiliferous Royle (I. P. L.)</td>
<td>2. Cochlospermum gossypium DC</td>
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<td></td>
<td></td>
<td>2. I. uniflora R. &amp; S.</td>
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<td></td>
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<td>3. I. pes-tigrides L.</td>
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<td></td>
<td></td>
<td>4. I. reniformis Chois.</td>
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<tr>
<td></td>
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<td>5. I. pes-caprae Sw.</td>
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<td></td>
<td></td>
<td>6. I. tuberosa L.</td>
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**Indian Medicinal Plants**

<table>
<thead>
<tr>
<th>Name of Drug</th>
<th>Official source</th>
<th>Substitute or adulterant</th>
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</thead>
<tbody>
<tr>
<td>25. Valerian</td>
<td>Valeriana officianalis Linn.</td>
<td>1. Abrus precatorius L.</td>
</tr>
<tr>
<td>27. Tylophora</td>
<td>Tylophora asthmatica W. &amp; A.</td>
<td>2. Cryptocoryne spiralis Fis.</td>
</tr>
<tr>
<td>28. Indian Gentian</td>
<td>Gentiana kurroo Royle.</td>
<td>3. Tylophora indica Burm.</td>
</tr>
<tr>
<td>29. Kantikari</td>
<td>Solanum xanthocarpum Schrad</td>
<td>4. Asclepias curassavica L.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Richardia scabra L.</td>
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<tr>
<td></td>
<td></td>
<td>6. Psychotria sp.</td>
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<tr>
<td></td>
<td></td>
<td>7. Anodendron paniculatum A. Dc.</td>
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<td></td>
<td></td>
<td>8. Euphorbia ipecacuanha L.</td>
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<tr>
<td></td>
<td></td>
<td>1. V. hardwickii Wall.</td>
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<tr>
<td></td>
<td></td>
<td>2. V. wallichii DC.</td>
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<tr>
<td></td>
<td></td>
<td>3. Nardostachys jatamansi DC.</td>
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<tr>
<td></td>
<td></td>
<td>1. Calotropis procera R. Br.</td>
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<tr>
<td></td>
<td></td>
<td>1. T. fasciculata Ham.</td>
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<td></td>
<td></td>
<td>1. Picrorhiza kurroa Linn.</td>
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<tr>
<td></td>
<td></td>
<td>2. Gentiana decumbents Linn and other sp.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. S. dulcamara Linn.</td>
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<tr>
<td></td>
<td></td>
<td>2. S. nigrum Linn.</td>
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<td></td>
<td></td>
<td>3. S. tuberosum Linn.</td>
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<td></td>
<td></td>
<td>4. S. spirale Roxb.</td>
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<tr>
<td></td>
<td></td>
<td>5. S. verbascifolium Linn and other sp.</td>
</tr>
<tr>
<td>Name of Drug</td>
<td>Official source</td>
<td>Substitute or adulterant</td>
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<td>---------------</td>
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<td>-------------------------------------------</td>
</tr>
</tbody>
</table>
2. Phytolacca Americana L.  
4. Althaea officinalis L. |
| 32. Senna     | Cassia angustifolia Vahl,        | 1. Cassia acutifolia Del.                 |
|               |                                  | 2. C ovata Linn.                         |
| 33. Ayapana   | Eupatorium Ayapana Vent          | 3. Coriaria myrtifolia L.                 |
| 35. Tejpata   | Cinnamomum tamala Fr. Nees.      | 5. Solenostemma argel Hayne.              |
| 36. Ashok Bark | Saraca indica L.                 |                                           |
| 37. Boch      | Acorus calamus L.                |                                           |
| 38. Randhuni  | Carum roxburghianum Benth.       |                                           |
| 39. Sarsaparilla | Smilax ornata Lam. S. medica Sch. & Ch. |                                           |
| 40. Chaulmoogra | Taraktogenos Kurzii King.        |                                           |
Drugs of vegetable origin are included to a greater or lesser extent in almost all pharmacopoeas of the world and the Ayurveda prescribes medicines which are mostly prepared from plants possessing therapeutic values. Up-till-now the use of plants as medicines has not been completely replaced by synthetic preparations of modern allopathic treatment. Efforts of scientists are engaged in this direction and we are hoping to see the synthesis of alkaloids, glucoside, tannins, saponins, gums, oils etc., which are exclusively of plant origin and possess definite physiological properties. Still the trade in crude drugs in all civilized countries is in vogue and a good amount of money is spent in research for improvement, and for new ones of better types by breeding for competition in the world market and for bringing more money.

A vital part in the trade of crude drugs is a constant resource and supply of genuine drugs in the market. A man, whether a dealer, a physician or a patient, almost always meets with difficulties to find genuine drugs in the market which are almost always adulterated or substituted. It is a fact that unless the drugs are genuine, the results of their application on patients and their use in pharmaceutical preparations will be misleading. I would say misleading for we take it for granted without examining their identities which are based on some scientific principles that they are genuine and hence the negative results interpret not only their uselessness, but also the medical system. I especially mean the Ayurvedic system, which prescribes them as unscientific. It is a serious setback for it is creating a public attitude which goes against the Ayurvedic system of treatment. Still more serious it is that it affects the national health. So, one can see where the defect lies. A census of crude drugs is
necessary for their identification by scientific personnel before their deal in the market.

The identification of crude drugs is based on exomorphic and endomorphic characters. It is easy to find out plant parts of different plants with similar exomorphic characters, but it is very difficult to find out the same with similar endomorphic characters. Almost all drugs are parts of plants, viz. either root or stem or leaf or fruit or flower or seed or bark, etc. When there is a possibility of obtaining two alike plant parts of different plants for substitution, more emphasis and importance are to be given to endomorphic characters of a drug. Endomorphic characters mean anatomical character of a drug. Again, the anatomical character of a root drug is quite different from anatomical character of a stem drug, and so on for leaf drug, bark drug, etc. Thus different plant parts will present different sets of anatomical values by which we distinguish between root, stem, leaf, bark, fruit, seeds etc. This needs a good knowledge and research in Plant Anatomy; otherwise, one cannot interpret the anatomical characters, their variations in different species of the same genus, in different genera of the same family and in different families and orders.

In the study of stem and root drugs it has been laid down as a schedule that the following characters are to be noted, viz., (1) position of the cork cambium and nature of cork, (2) amount, nature and distribution of sclarenchyma, (3) nature of the vascular structure in sections, (4) presence or absence of vessels, (5) diameter and distribution of the vessels, (6) vessel index, (7) length of vessel elements, (8) nature of pitting of the lateral walls and nature of perforations of the end-walls of vessel elements, (9) width and height of the medullary rays, (10) shape and arrangement of the ray cells, (11) fibre index, (12) starch index, etc.

In the study of leaf drugs it has been laid down as a schedule that the following characters are of significant value, viz., (1) epidermal hairs, (2) types of stomata, (3) stomatal number and stomatal index, (4) palisade ratio, (5) vein-islet number, (6) size, shape and number of epidermal cells, (7) presence or absence hypodermis, (8) vascular structure of the peltule, etc.

In the study of bark drugs it has been laid down as a schedule that the following characters are to be observed, viz., (1) nature of the composing tissues, (2) amount, nature and distribution of sclarenchyma, (3) amount, nature and distribution of starch grains, (4) starch index (5) amount, nature and distribution of cells, canals or ducts of resins or mucilage, (6) position of the cork cambium, (7) nature of the cork
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and cork cells per unit area, (8) nature and distribution of fibre cells, (9) fibre index, etc.

In the study of fruit and seed drugs it has been laid down as a schedule that the following characters are to be observed, viz., (1) nature of the tissue of the pedicel or peduncle, (2) nature of the tissue of the pericarp, (3) nature and distribution of sclerenchyma, (4) epidermal hairs, (5) structure of the testa and tegumen, (6) nature of the endosperm, (7) nature and cell-contents of the cotyledons, (8) structure of the embryo, (9) nature and amount of the oil of the seed, etc.

Schneider drew attention to the errors resulting from lack of records of the quantitative tissue variations and Wallis pointed out that the number, length, area, volume and mass of a particular element which forms the diagnostic character is to be studied in addition to its form and location.

Similarly, the identification of crude drugs in the form of powder is based on anatomical characters and on the quantitative estimation of a particular diagnostic anatomical element. The latter has led to the development of special methods and technique for quantitative estimation.

Thus, in this short review it is impressed that the importance of the fundamental study and research in Plant Anatomy in the identification of crude drugs is of great interest in the preservation of public health and in the development of Ayurvedic system on modern lines.
ADULTERATION AND SPURIOUSNESS OF CRUDE DRUGS SOLD IN INDIAN MARKET AND DETECTION OF THE SAME

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Before saying anything regarding adulteration it is my duty to say what I mean by adulteration in drugs. By adulteration we mean the deterioration or deficiency in quality of a commercial product, no matter what this may be due to. It may be due to variety of causes such as aging, lack of care in preparation, substitution, extraction of important constituents, or the addition of other substances which might be either harmless or harmful.

More or less throughout the world there is some sort of adulteration in crude drugs. As my experience goes by visiting different parts of Europe, the adulteration of crude drugs of European origin is very rare. Drugs mainly sent from outside Europe have more adulterations. But in India, we find the adulteration is very common. The reasons are many. It is not always the intentional adulteration; many times it is due to faulty collection. Intentional adulteration is mostly found in very costly drugs like musk, etc. Behind such deliberate adulteration there are many causes. The first cause of spuriousness, which strikes my mind most, is due to the encouragement which the drug dealers receive from our manufacturers in Pharmaceuticals. The purchasers, if careful and strict, can always avoid buying spurious drugs. They cannot shirk their responsibilities by saying that it is the duty of the Government to stop this practice. It is the duty of the manufacturers to supply the people with genuine medicine; but if they purchase the defective raw materials, how one would expect from them good medicine? It is often reported that drugs exported from India have come back to this land unaccepted because of the adulteration. If the manufacturers employ good pharmacognosists and have their drugs thoroughly examined before the purchase and do not take any inferior drug, the drug dealer due to his financial losses would not venture to take up such business of spurious drugs.
My second point would be that the Ayurvedic practitioners should exert little more to get authentic drugs for their use. It is they who use a large number of vegetable drugs; I would therefore request them to give better training regarding the modern methods of detection of crude drugs and the ways to find out their adulteration, to their college students.

The third suggestion of mine would be that the Government authorities must form some standards under the Drugs Act, and the Government laboratories must check the drugs which are sold in the market.

If we cannot stop this drug adulteration the immediate result would be:

(i) loss of export of crude drugs,
(ii) loss of faith in Ayurvedic Medicine and
(iii) loss of faith in Indian manufactured goods.
CULTIVATION OF INDIAN MEDICINAL PLANTS

By KAVIRAJ BIMALANANDA TARKATIRTHA AYURVEDA
BRIHASPATI SARASWATI.
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There is sufficient proof to indicate that there was regular study and culture of Botanical Science (Forestry and Agricultural Science) in ancient India. There was a definite branch of Science called "Brikshayurveda" which dealt mainly with the health of plants, the prevention of diseases to plant life and their treatment. We can safely come to this conclusion from books like "Kedar-Kalpa", "Parasar-Samhita", "Kshetra-Tatwa", "Goraksha-Samhita", "Brihat-Samhita", "Subhasita-Sarangadhara" etc. Along with the destruction that time entails in an ancient country, the efforts of some of the Muslim invaders in destroying Hindu culture caused the loss of these manuscripts and with that the basic principles of their sciences and the continuity of their knowledge in society were also lost. Thus many of the ancient sciences of this country are somehow maintaining their existence only to remind us of their past glory like dilapidated palaces and are still serving our society on a very small scale.

To-day it is necessary for us to discuss and study anew the wild and agricultural vegetation. In independent India its necessity has been felt and is proved by the ceremonies observed for tree plantation. But the plantation of medicinal herbs is of greater necessity and that is our subject of discussion.

There is no dearth of medicinal herbs in India. In this vast country of varied seasons and with its vast wealth of medicinal herbs and plants, and hand labour at a comparatively cheaper rate, there is no reason why success should not be achieved in producing all vegetable drugs in this country, if only a sincere collaborative effort is directed towards the solution of the problems by agriculturists, botanists, pharmacists, pharmacognocists and Ayurvedic practitioners.

In order to get the best drugs from herbs and plants grown in this country, it is first and foremost necessary to make a fresh and complete
survey of medicinal herbs and plants of the country. Much of our present knowledge about medicinal plants probably needs revision. Many pharmaceutical firms have been established and are being established which meet the demand of indigenous herbal medicines. But who supplies their needs? Hereditary profession was the characteristic feature of Indian society and in different Provinces, different classes of people follow this profession and earn their living; in U. P. they are known as "Mushera" and are called 'Bedias' in Bengal.

But like all other classes following a profession, 'Bedias' also had the opportunity of learning their profession and gaining experience and special knowledge in hereditary manner, and there are proofs of that. But after the last global war it is found that the system is gradually fading out. Many of them have left the profession. The present Bedias do not possess the knowledge which their forefathers had. In our early age, we found 'Bedias' supplying us with all herbs and plants on order being placed, but most of the modern 'Bedias' have not either seen those plants and herbs or have not even heard their names.

It appears to me now that knowledge about some special plants which were thought to be effective in particular diseases is gradually being lost and it may ultimately be lost for good. I think that such plants should be procured, preserved and their intensive cultivation made. These 'Bedias' are the only source of supply of herbs and plants of all the Pharmaceutical concerns.

The plants and herbs that they procure are from places where they naturally grow. It is sometimes found that the same kind of plant grown in different places and in different altitudes are of different efficacy. Like human beings, plants also draw their sustenance and strength from different elements. When plants get these elements in proper quantity, their efficacy also increases. In "Brikshayurveda", the nursing of plant is specially dealt with and in this connection special mention is made of 'Koonapa-jala' rich with chemical properties, which is of particular interest to note. Like preservation and development of animal life, it is necessary for us to deal with and arrange for the preservation and development of plant life. For this a special Research Institute is necessary, where research will be carried on about different soils and atmosphere, congenial to growth of plants. Without a research of high order it is not possible to ascertain how the efficacy of plants increases in different soils, climes and with different elements. The old science relating to plant diseases is also not to be neglected.

According to Ayurvedic Science the medicinal plants develop their
efficacy in different portions in different seasons. There are definite instructions as regards planting and uprooting of them. It is also mentioned that according to the position of astral bodies, the plants develop or lose their medicinal efficacy. I myself have found that the root of 'Clerodendron Siphonanthus R. Br.'—in Sanskrit known as 'Bhargi' and in Bengali known as ‘Bamunhati’—taken out under the influence of 'Pushya' Star gives great effect in Sciatica.

The ancient sages of our country with their deep Yogic insight found many truths and wrote about them. If a countrywide search or enquiries in different countries like U. S. S. R., Germany etc. are made, many of these manuscripts may still be found which should be collected and printed. If these Shastric truths are utilised with the aid of modern science, the real good will be done to the country.

Apart from special kinds of plants of economic value, it is necessary to have intensive cultivation of ordinary medicinal plants for reasons of economy as also for the supply of authentic plants of good strength. Previously it was our idea that plants which grow uncared for can be had at cheap cost. But now we know that if an extract of Tulsi leaves is to be used as a home-remedy, it is extremely costly. So if these common herbal plants are not cultivated then indigenous medicines will be more costly than foreign drugs. I feel, therefore, that the representatives of all Pharmaceutical concerns should meet together and chalk out a programme of action.

(i) It is necessary to compile a list of names, quantity required and prices of all plants and herbs that are used by Pharmaceutical concerns.

(ii) The steps should be taken for cultivation of these plants which are of special medicinal efficacy.

(iii) If all the Pharmaceutical concerns jointly raise a capital sum, fixing a quota for each, and with that start a farm for extensive cultivation of medicinal plants, then a very good result will be achieved in a short time. At first effort should be made to make such a farm economic and profitable and the larger amount of capital should be invested so that research institutes may be established along with the farm.

(iv) If the Governmental agricultural farms in different states start cultivation of medicinal plants, then the attention of common agriculturists will also be drawn to this profitable business. In that case the Governmental farms will cease to be a burden upon the Governments while people also can safely depend upon these farms for the supply of authentic plants and herbs. If the Pharmaceutical Congress can persuade the Government in this direction then work can be started early.
In Bengal many plants can be cultivated with profit and I mention a few of their names below:

- *Piper Longum (Peepul)*
- *Rawalftia Canescins (Barachandar)*
- *Rawalftia Serpentina (Chotachandar)*
- *Citrus Fruits*
- *Jinjiber Officinale (Ada)*
- *Wittania Somnifera (Aswagandha)*
- *Recinus Communis (Eranda)*
- *Holarrhena Antidysenterica (Kurchi)*
CULTIVATION OF MEDICINAL PLANTS

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In order to ensure a good supply of crude drugs of the requisite standard, cultivation of medicinal plants should be undertaken. This is all the more essential now when due to partition of India, some of the drugs coming from Pakistan may not be easily available now. Ephedra is one such drug which may be tried in the drier parts of East Punjab and Rajputana. Unfortunately we do not have in this country any such organization, like the Bureau of Plant Industry of the U. S. A., which could provide to the prospective growers all the pertinent information, such as the possible internal and external market, statistics of export and import, the advisability of growing a particular species in a particular locality, and factors determining the quality and yield of the drug concerned.

It is well known that the quality and potency of a drug plant depend upon the conditions of its growth and habitat. The same plant under one set of climatic conditions and soil produces appreciable amount of the active principle, but if grown in a different environment and soil, it may yield a markedly lower or different proportions of constituents. Varying ester content in the oil of lavender grown in England and in South of France, the development of narcotic principle in Cannabis indica in the tropical countries, and the varying amounts of resin content in Podophyllum emodi obtained from different places in the Punjab and the N. W. F. P. are some of the instances to illustrate the point. For the successful growing of drug plants, therefore, a consideration of all those factors which influence the fate and formation of active principles in them, is an essential requisite.

Of the various factors which influence the production of active principles in plants, the climatic complex such as light, temperature, altitude and rainfall, and the physical and chemical characteristics of the soil, play a dominant role in this regard. Which one happens to be of the greatest
significance at the moment will depend upon a number of circumstances. To take for instance, altitude: Cinchona grows very well at low altitudes, but the yield of alkaloids is greatly reduced; at higher altitudes again the yield is diminished (Bulletin of the Imperial Institute, 1929, 27, p. 61-63; 1939, 37, p. 18-31; Taylor, 1945). In Digitalis, however, which also grows at high altitudes, the case is quite different. The leaves from Ootacamund showed little glycosidal activity, while those from Mungpoo gave good results—even better than the imported ones (Bal, 1939). Although these two plantations are more or less at the same elevations and have proved equally good for drug like Cinchona, yet the cause of failure to show glycosidal activity in Ootacamund Digitalis, has not yet been known. Obviously not altitude alone, but some other factor or factors also appear to be concerned with the elaboration of glycosides in this plant. It has, for instance, been observed that temperature and light, particularly ultra-violet, markedly influence the glycosidal content of digitalis leaves (Braun, 1939).

As regards soil characteristics, the most desirable physical properties and texture of the soil and the most suitable chemical components essential for optimum growth and production of active constituents in the plant, should be ascertained. Digitalis, for instance, shows a poor and stunted growth with marked diminution in its glycosidal content in a soil containing even small proportions of chalk; Atropa belladonna, on the other hand, prefers a light, permeable soil with a chalky sub-soil and produces greater alkaloids with nitrogenous manures (Chevalier, 1910). In case of Datura metel and Hyoscyamus niger it was found that a suitable combination of potassium and nitrogen leads to a marked increase in the alkaloid formation (Prasad, 1943, 1944, 1946, 1947). Even some of the cultural operations, like exfloration, brought about sufficient increases in this direction (Prasad, 1948).

The amount of active constituents formed in a drug plant depends upon two factors—the yield of the material containing the active principle, and the concentration of the latter per unit weight of material. Conditions favouring increases in these two directions will, therefore, result in increased production of the active substance in the drug. Emde (1929) considered that the formation of alkaloids in a plant is dependent upon its photosynthetic activity; Boshart (1931), on the other hand, concluded that the formation of glycosides is directly proportional to assimilatory activity of the leaves, while formation of alkaloids, as in the case of Datura stramonium, is not directly related to assimilation but to later transportation in the plant. In oil-bearing plants, Charabot (1908, 1912) opined that the oils are actually formed in the chlorophyllous parts of the plant, possibly as a result of pathological
processes or as by-products of plant metabolism. As the plant matures, the oils are transported to other tissues, in particular to the flowering shoots where secondary changes such as oxidation and esterification in the constitution of oils may occur. It would thus be evident that the formation of active principles in plants is either directly related to photosynthetic activity of the assimilatory organs, or to later elaborations from materials brought within the plant during its nutrition. In any case, the production of active substance must depend upon the absorption of nutrients and all those factors which enhance or retard the latter process will affect the former also. Barring genetical limitations therefore, it is possible to bring about considerable increases in both the directions, viz., yield of material and concentration of the active constituents, provided of course, the optimum environmental conditions, the most suitable manurial combinations and other judicious treatments are made available to the plant.

The Bureau of the Plant Industry of the U. S. A., besides supplying detailed information to cultivators, has small experimental stations in different parts of U. S. A., conducts field experiments according to the requirement of that locality, finds out the best manurial combination and optimum conditions for the growth and production of chemical substances in plants and publishes the results so obtained in the form of bulletins for the benefit of cultivators at large. In this country, the Departments of Agriculture, in some of the States, took some initiative by way of cultivating a few medicinal plants, though mostly on an experimental scale, but the results are not known to the general public. The Indian Council of Agricultural Research also made some efforts in this direction, but all that has been done so far is very meagre and haphazard, not well-coordinated. The Agriculture Departments of the different States must now devote some more attention and make it a point to publish their results for the benefit of the common agriculturist.

Not much effort has been made even by private individuals, or crude drug dealers, or pharmaceutical concerns to cultivate medicinal plants for their requirement. Now it is high time that they should also extend their activities in this field also, so that in a short time we might have in this country a number of Penicks of the U. S. A. whose reputation to supply crude drugs of the standard quality might bring good name and money to this country.
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CULTIVATION AND UTILISATION OF MEDICINAL PLANTS

By M. SEN, D. Sc., A. R. I. C.

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The immense necessity and the vast possibility of cultivation of Medicinal Plants in India are too apparent to need emphasis. India's annual Imports of Drugs run into crores of rupees and this dependance on outside is not only economically unsound, but also highly risky, specially during emergencies. Whereas, India, being an epitome of the World, possesses a flora intensely rich and most varied, holding out promise of successful cultivation of all types of known medicinal plants, the goal should aim beyond self-sufficiency to exporting, which will help India's Trade balance.

What is needed is action—straight away—both individual and concerted as there is sufficient data to start off with. The Indian Council of Agriculture Research have given a welcome practical lead by selecting provisionally 50 plants to be tried out in six different promising areas.

Government of West Bengal also have recently constituted a Medicinal Plants Committee to go into the entire question. While Committees should be there to advise and guide, co-ordinate action and explore fresh possibilities, the drive should be immediate and simultaneous as follows:

1. All Botanical Gardens should be so many research laboratories, where experiments are to be carried out on a wide variety of medicinal plants on all scales, to find out the optimum conditions of their growth and maximum yields of the active principles under Indian conditions of soil and climate, the results being published for practical utilisation by others. To mention one, the Drug Research Laboratory, Kashmir, is doing a lot of valuable work in this line.

2. Plantations—State owned or private—, with technical staff, should try out the cultivation, at first on semi-large scale, of such medicinal plants, the conditions of growth of which are more or less known. Private Plantations should have State help to this end. The Cinchona Departments of West Bengal and Madras, started in 1860, have made a success of Cinchona Culti-
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...vation in India. The Bengal Cinchona Plantations have also cultivated with success, Ipecacuanha, Digitalis, Belladonna and are now experimenting with Oscimum and economic plants like Pyrethrum and Tung oil trees. Some of the Ipecacuanha roots grown have been found to be superior to Brazilian root containing 1.5% of Emetine and 3% of total Alkaloids.

(3) Government Laboratories, with facilities for assaying Crude Drugs, should help in the assaying of samples free for State Departments and at concession rates for bonafide private growers.

(4) State-owned Factories, like the Quinine and Opium Factories, should be converted into full-fledged Pharmaceutical Manufacturing concerns. The methods of isolation and purification of the active principles of the dry plants worked out there should be published for general benefit.

(5) Finally, the States should publish from time to time useful informations and statistical data about medicinal plants, crude drugs and finished products.
CULTIVATION OF MEDICINAL PLANTS IN THE PLAINS OF BENGAL AND BIHAR

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The need for production of crude drugs has long been felt in India but as yet, nothing definite has materialised in this direction except the cultivation of Cinchona and Ipecacuanha in the Darjeeling District, and Nilgiri Hills. A few other medicinal plants have also been tried on a small scale in Jammu and Kashmir, but the produce is very meagre and insufficient to meet the internal demands of the country. India has been drawing a major part of her requirements of crude drugs from regions which are now confined under the domain of Pakistan. In recent times, private enterprises towards the production of crude drugs appear to be forthcoming but none has met with success as the subject is a specialised one involving special methods and practices somewhat different from those applicable to agricultural crops. The cultivation of medicinal plants in Bengal has so far lagged behind except the Government plantation of Cinchona in the Darjeeling District. A number of medicinal plants can be grown in the plains and their cultivation can meet with success if directed on scientific lines.

The question of cultivation of medicinal plants in Bengal has recently been taken up by the Government of Bengal with the intention of producing these drugs in the Darjeeling District. There are a number of medicinal plants which grow in the plains of Bengal and Bihar; these can be raised by farmers easily, and they can form an extra source of income to the farmers if cultivated along with other crops which they produce. The following is the list of plants which, in our opinion, are likely to be successful, if cultivated in the plains of Bengal and Bihar upto an altitude of 3000 feet.

(1) Cassia angustifolia Vahl.—Dried leaves and dried fruits are used in medicine as a purgative. It is cultivated in India in Tinnevelly and Madura in the South and in Poona in the Bombay Presidency. There is
a good demand for this drug in the foreign market and it is likely to be successful here. The plant prefers light rainfall, about 35 inches per year and temperature between 50° to 100° F. The soil preferred is a mixture of sand and clay, of a grey alluvial type.

(2) *Citrus* †††ocynthiae Schrad.—Dried pulp of the fruit is used in medicine as a purgative. The drug is in good demand and the plant grows wild in waste tracts of North West, Central, and South India. The plants prefer a moist hot atmosphere and a rich loamy soil and are propagated by seeds.

(3) *Mentha arvensis* Linn and *Mentha piperita* Linn.—The plants yield volatile oil and are used for manufacture of Menthol. It can be easily grown as a garden plant on any calcareous soil, friable sandy loam or gravel. The plant prefers somewhat temperate climate but can be grown in plains of Bengal and Bihar.

(4) *Piper cubeba* Linn.—The dried full-grown unripe fruits are used in medicine. It has also a good demand as a spice. The plant grows upto an altitude 1500 feet and prefers a moderately moist and warm climate. It can be grown easily in the plains of Bengal and Bihar.

(5) *Plantago ovata* Forsk. (Isabgul)—The plants can be grown in plains and hills upto an altitude of 6,000 feet. The seeds have a good demand in India and foreign market due to their use as a remedy for dysentery and diarrhoea and for functional derangement of digestive organs. The plant prefers not too high rainfall and prefers light, friable soils. Seeds are sown in spring and an application of a fertiliser high in phosphorus content results in a better yield. The crop is cultivated twice during the early growing season.

(6) *Polygala chinensis* Linn.—The plant is found growing in the hills as well as in the plains in Santal Parganas. The plant prefers not too high rainfall and can be grown in peat and lime free loam. It can be grown easily.

(7) *Cephaelis ipecacuanha* (Bor.) A. Rich.—The plant grows at Mungpoo in the Darjeeling District in lower altitudes near about 3,000 feet. It prefers hill side for purpose of constant drainage, and a humid climate. It requires shade throughout its life and sunlight proves injurious. It is cultivated in nurseries at such places.

(8) *Strophanthus kombe* Ol.—The plant can be grown in drier regions in Bihar preferably, as well as in Bengal. It also grows well in moist tropical regions of South India. The drug is used to increase the tone as well as excitability and contractility of the cardiac muscles.
(9) *Urginea indica* Kunth.—The plants can be tried in sandy soils near the sea or in drier regions up to an altitude of 3,000 feet. The drug has a good demand and the plant prefers an annual rainfall of 20 to 25 inches and an annual mean temperature of 60°F.

(10) *Aloe vera* Linn.—The plants are capable of being grown on poor, well drained lime stone soils in dry situations having a mean annual temperature of 70° to 80° F. The soil is thoroughly forked and mixed with barnyard manure and trenches are dug between the base for proper drainage. Transplanting is done on moist soil and with proper care. Commercial crop is produced in one year. The yield of Aloe juice varies from year to year, and a one year old plantation yields about 100 lbs. per acre while a 4 year old plantation yields 500 to 1000 lbs. per acre.

(11) *Ferula fetida* Regel.—It grows in the plains in somewhat higher regions from 2000 feet to 4000 feet, and the average annual rainfall is 15 inches and the temperature 60°F. The plants are cut in June, the soil scraped away from around the root to a depth of 6 inches and several incisions are made around the head of the root. Fresh cuts are made every three or four days until the sap ceases to flow. Immediately after cutting, the root stump is covered with some twigs to protect it from sun so that it will not wither. The gum after exudation hardens into tears and are collected and further hardened in the sun. Each root yields from a few ounces to several pounds of asafoetida.

(12) *Barosma betulina* Bartl.—The drug is imported into this country but can be grown here from seeds. The plant is a shrub and can be grown on free lime soils or on sands or clays. It prefers a sandy loam with high organic matter content. The average rainfall required is about 30 inches and the mean temperature just over 50°F.

(13) *Claviceps purpurea* Tul.—Individual rye plants are infected with the ascospores of the fungus for producing sclerotia. The infected flowers do not produce the seed but the sclerotium of ergot which is used in medicine. This may be produced in the plains.

(14) *Lawsonia inermis* Linn. (Henna).—The plant grows well on irrigated lands and in places having a mean annual temperature of 60° to 70°F. The most desirable soil is well-drained sandy silt loam. Two harvests are made annually and the yield of dried leaves ranges from 1000 to 2000 lbs. per acre.

(15) *Strychnos nux-vomica* Linn (Nux-vomica).—The trees grow from seeds and can be easily cultivated in the plains.
Datura stramonium and other species of Datura.—These plants

\(\text{16}\) can be cultivated in the plains as well as in the hills and thrive best in

rich and rather heavy loams. It prefers an annual rainfall of about 25 to

30 inches and a mean annual temperature of 50°F. The plant yields 1000
to 1500 lbs. of dry leaf per acre and 500 to 2000 lbs. of seeds.

A number of other medicinal plants can also be cultivated in the plains

of Bengal and Bihar and some of these are mentioned below:—

Abroma augusta Linn. (Olatkambal); Acorus calamus Linn. (Boch);

Adhatoda vasica Nees (Basak); Allium sativum Linn. (Garlic); Andro-

graphis paniculata Nees (Kalmegh); Aristolochia indica Linn. (Isher

mool); Asparagus racemosus Willd. (Satamuli); Boerhavia repens L.

(Punarnava); Carum copticum Benth. (Jowan); Chenopodium ambrosioides

Linn. (Bethua shag); Eupatorium ayapana Vent. (Ayapana); Hemidesmus

indicus Br. (Ananta mool); Herpestis monniera H. B. K. (Brahmi);

Holarrhena antidysenterica Wall. (Kurchi); Hydnocarpus kurzii Warb.

(Chalmoogra); Hydrocotyle asiatica Linn. (Thankuni); Ipomoea hederacea

Jacq. (Kaldana); Mallotus philippinensis Muell. (Kamala); Pachyderia

foetida Linn. (Gandal); Rauwolfia serpentina Benth. (Sharpganda); Saraca

indica Linn. (Asoka); Scindapsus officinalis Schott. (Gajapeepul); Termin-

alia arjuna W & A. (Arjun); Terminalia bellerica Roxb. (Bahera); Ter-

minalia chebula Retz. (Haratak); Tinospora cordifolia Miers. (Gulancha);

Withania somnifera Dun. (Aswagandha).
CULTIVATION OF MEDICINAL PLANTS IN INDIA

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India is a country of all sorts of climates and altitudes. From the coldest tableland to the regions of extreme heat, everything is there in India. Whatever can, therefore, grow elsewhere can easily be grown in our country with agricultural research and by proper control.

Cultivation of medicinal plants in India is being carried out only at a very few places. It has often been found that they can hardly cope with the demand. By proper arrangement and organisation not only the existing reputed drugs can be cultivated in India but also the drugs of foreign origin can be cultured in the Indian soil. This is being done in other countries as well. Soviet Russia has grown many essential oil-bearing plants which were so long known indigenous only to Africa. It is well-known that Ergot of Rye was indigenous to Spain alone but Russia, Hungary and Portugal have worked the problem successfully and there is no doubt that the quality of their stuff will gradually improve. Ergot also was grown in Madras and the quality was very satisfactory. But in spite of their claim that the Ergot grown there was to be very cheap, the cost of Ergot in 1949-50 was Rs. 20/- per pound as against 5 sh. per pound from abroad. I do not know if the report is true that the matter is not being properly handled now, with the result that no Ergot of Indian origin is being available to-day to the industry. Ipecacuanha, if to be efficacious, must be of Mattograsso. Central American stuff has quite come up to the standard and now-a-days Brazil has almost stopped export of Ipecacuanha from their country and Emetine out of it is only being supplied to other countries. Ipecacuanha was grown in Mungpoo and the result was highly satisfactory. It is not known if the cultivation has been stopped and why, the stuff at least is not available to the consumers to-day. Possibilities of growing commercially and economically these drugs which have become scarce in these days need be thoroughly explored.
There is another important aspect also about the standard of the active principles of these medicinal plants. There should be some organisations to lay down (a) the standard of these drugs and (b) to control the quality so that only the standardised drugs are allowed to come into the home market as well as for export abroad.

Today trade in these drugs is more or less in the hands of people not scientifically trained. This cannot be allowed for any further length of time. The growing and trafficking in these medicinal plants must be taken up by scientific organisation and their collection, storing and distribution must be according to scientific requirements.

Bureau of plants industry established in America is an example which may be followed by others. They are not only maintaining and improving their present plants but are introducing new medicinal plants into their country and are finding markets for the growers of these plants.
PACKING AND STORING OF CRUDE DRUGS

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There are many sides to consider in the production, cultivation, and enriching the quality of crude drugs. In India though research work on Pharmacognosy was started not many years back and some advances have been made in the line of different pharmacognostic methods of identification and in the line of cultivation, harvesting and cultural methods, no work has yet been done in the preservation of the quality of the drugs produced, with special reference to packing and storing. Whatever stress we may give on the improvement in the production of crude drugs, it becomes of insignificant value in the actual field of commerce, if the improvement is not maintained at the time of storage, thus preventing deterioration and loss of standard before use.

By intimate association with the drug trade of India and examining the quality of various articles of commerce, it will be found that seldom we find an Indian drug in a good state of preservation. We know that Indian Belladonna and Digitalis are of good quality and possess high percentage of active principles, but the Indian manufacturers scarcely find these drugs to conform to the B. P. or U. S. P. standards. Why this thing happens?

From the actual field knowledge it can be safely said that most of the loss of potency and quality of drugs is due to the unhygienic and unscientific storage and packing. If a visit be ever made to the storage godowns of crude drugs, it will be found most unsatisfactory in many respects. The godowns are situated in the basements—dingy and damp—and in rainy season (in some godowns in all the the seasons), a stagnant filthy water is found on the floors. If drugs are kept a bit longer in these godowns, it is inevitable that these drugs get infested with germs, fungus and insects. In a place like Calcutta, where naturally the climate is moist and not very suitable for perfect storing for a long period, the present condition of storage needs utmost attention of the industrialists, government and scientific workers in the field. Industrialists and traders must try hard to improve the condition of storage, government must give the needful
facilities and the scientific workers should determine the ideal conditions necessary for long storage of individual drugs.

The case with Indian spices is equally regrettable, if not more. The spices contain volatile oils and must therefore be kept in dry, cool and dark place and must be filled up fully in a closed container. But we find in India, all these points of precautions are disregarded, with the result that India which was once the queen of all spice producing countries has been lowered to an insignificant position. A considerable improvement in spices can easily be made if the conditions necessary for storing and packing are observed rigidly. Attention can be drawn to the condition of storage of spices in the spice-markets of Calcutta situated in the Burrabazar area where the spices will be found lying in the open yard, in sun and rain, packed in burlap or fibre baskets. Piling with all grades of spices is done quite freely there, without giving any consideration to the future of the trade.

Storing of spices in perfectly dry, cool and closed godown and their packing, after thorough drying, in water and air-tight paper bags will ensure the improvement of Indian spices. The same principle is necessary in the trade of crude drugs. The drugs, containing volatile oils like Valarian, can suitably be stored in tarred-paper packets. Also a considerable attention is needed in packing the drugs like Digitalis, where vacuum packing can only make it last longer. There are other types of drugs like Aconitum, Taraxacum etc., which get infested with insects very easily. They can suitably be stored in large metal drums with cover, with an addition of volatile insecticide like carbon tetrachloride, and only in time of commercial transactions, they should be packed in gunny bags.

These suggestions can suitably be complied with if government sets up some bonded godowns, where dealers can keep these vitally important drugs and condiments properly guarded against any infection that might come from improper storage. Deterioration of drugs is injurious both to industry and to the health of the consumers. Proper care and precaution are therefore urgently needed in this matter.
UTILISATION OF THE MEDICINAL PLANTS OF INDIA IN THE PRODUCTION OF DRUGS

By (Mrs.) ASIMA CHATTERJEE (Nee Mookerjee), D.Sc.
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India is quite rich in medicinal plant resources. The present condition of India emphasises the utilisation of these resources in the production of drugs. The need of extensively growing in India medicinal plants indigenous to India as also those growing in other countries with a view to stopping import of foreign drugs cannot be questioned.

In order to illuminate the field of native therapeutics it is necessary to focus attention on the following aspects:

(1) Studies on the Pharmacognosy of the plants to check adulteration of the drugs.

(2) The isolation of the active principles: Instead of using crude preparations (from plants) which differ in constitution and vary in strength of their active principles and physiological characteristics from time to time, the active principles should be isolated as these will help in quick standardisation of the drugs.

(3) Studies on the variation of the nature and amounts of the active principles of the plants with the changes in climate, season and the soil: Soil requirements and the seasonal variations in the contents of the active principles constitute important field of research.

(4) Standardisation and

(5) Clinical experiments of the drugs before medicinal applications.

A list of the plants (investigated by the author) having therapeutic possibilities is submitted herewith:

1. *Rauwolfia canescens*, Linn. It contains an alkaloid (yield, 1.2%) which lowers blood pressure.
2. *Vinca rosea.*


4. *Eupatorium ayapana.*

5. *Aegle marmelos.*


7. *Tinospora corydifolia.*

8. *Lavandula vera.*

9. *Ferula glauca.*

10. *Luvanga scandens.*

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It contains an alkaloid (yield, 0.2%) which lowers blood pressure. Crude alkaloid content—8%. Cures fever.

Haemostatic.

Cures sprue.

Cures cough, cold and hoarseness of the voice.

It contains bitter glycosides which cure malarial fever.

Produces oil of lavender.

Stomachic and carminative.
ROLE OF ORGANIC CHEMISTRY IN PROPER UTILISATION OF INDIAN MEDICINAL PLANTS

By R. N. CHAKRAVARTI D.Sc., F.R.I.C.
School of Tropical Medicine, Calcutta.

We should consider ourselves fortunate in having in this country a vast resource of medicinal plants. The therapeutic values of some of these have already been established, although the major fraction still remains unexplored. It all depends on how best we can utilise them to alleviate the sufferings of our countrymen and for the general development of the country. In this respect a substantial contribution should be expected from the Organic Chemists of India.

The problems for the Organic Chemists are as follows:

1. Preparation of concentrates.
2. Isolation of the active ingredient and its characterisation.
3. Chemical assay and evaluation of the crude drug.
4. Standardisation of the strength of liquid extracts.
5. Determination of the distribution of the active ingredient in various parts of the plants.
7. Determination of the fine structure of the ingredient.

The preparation of concentrates forms the first step from the viewpoint of an Organic Chemist. For instance, the case of Kalmegh or *Andrographis paniculata* may be cited. Previously pastes of the leaves were administered direct but now-a-days alcoholic extracts of the drug are available in the market. The supremacy of the alcoholic extract over the old-fashioned paste of the leaves is unquestionable. But I think there is enough room for further improvement. The active ingredient of Kalmegh is a colourless crystalline product known as Andrographolide. Sugar-coated pills of this product should come out in the market to replace the liquid extract. On
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account of its extremely bitter taste the administration of Kalmegh to children is often a problem. Introduction of sugar-coated pills obviates the difficulty to a great extent.

I like to point out another important fact in this connection. Suitable method is not available for the standardisation of the liquid extract of Kalmegh. The method described in I. P. L. gives misleading results. In the chemical laboratories of School of Tropical Medicine and Bethune College we have assayed liquid extracts of a number of other plants (e. g. Alangium lamarkii, Glycosmis arborea etc.) by the method of assay for liquid extract of Kalmegh as described in I. P. L. and have obtained positive results. In other words, a liquid extract of another plant appears to be liquid extract of Kalmegh, which is absurd. Owing to these difficulties the liquid extract of Kalmegh as available in the market have no real standard and any bitter liquid extract may be safely passed as the liquid extract of Kalmegh. Work is in progress in our laboratories for finding out a more specific method of assay, but for the present we like to suggest a simple modification of the I. P. L. method, viz., washing of the chloroform extract with dilute hydrochloric acid to remove alkaloidal matter. This modification gives less fictitious results. There is other side also; even if the manufacturer is honest in using a pure specimen of the plant, the difficulties in maintaining a standard concentration of andrographolide in the liquid extract are not inconsiderable owing to the variations in the andrographolide content of the plant itself which varies from 0.25 to 2.5%.

In the matter of large scale cultivation of medicinal plants a detailed knowledge of the seasonal variation of the active ingredient and its distribution in various parts of the plants is of vital importance. In the case of Kalmegh we have found that the andrographolide content of the plant reaches a maximum in the month of October. In March the plant contains less than half as much andrographolide as in October. Just the reverse is true in the case of Glycosmis arborea. As regards distribution, in the case of Kalmegh, we have noticed that the leaves are the best source although most manufacturers buy the stems from the market whose andrographolide content is much lower. We failed to isolate any andrographolide from the root, flower and seed. In this connection I like also to mention an interesting case, that of A'langium lamarkii. Chemical investigation of the bark of this plant was undertaken by Parihar and Dutt, and the pharmacological examination by Chopra and Chowhan. I have recently noticed that the total alkaloid content of the leaves of this plant is greater than that of the bark, a fact which appears to have been overlooked. This is specially significant in view of the fact that it is easier to collect the leaves than the bark.
The most important part of the chemical investigation of plants, however, lies in the determination of fine structure of the active ingredient. Structural research is not much popular in this country and its value is not properly appreciated. It is my sad experience that we are too keen to count the chickens and consequently research in Pure Sciences is not being properly encouraged in this country. It is easier for workers in Applied Sciences to drum-beat the importance of their investigations and secure financial assistance, although they may be just repeating the works of foreign workers under Indian conditions. Partly for this reason and partly due to the fact that structural research is the job of an expert Organic Chemist, the volume of work done in this country on the structure of active ingredients of medicinal plants is extremely small. Most workers in this country stop as soon as they have isolated the active ingredient or utmost after the preparation of a few simple derivatives.

Detailed knowledge about the fine structure of the active ingredient is indispensable

(i) for modifying some of its properties to make it more useful, e.g. a product having disagreeable taste may be rendered tasteless or an insoluble product may be made soluble,

(ii) for the preparation of derivatives which may be useful in other ways, e.g. preparation of homatropine from atropine,

(iii) for a direct synthesis of the product, and

(iv) for the preparation of other drugs using these as starting materials.

In this connection I like to mention the case of Thiodiamin, a new drug prepared from the bark of Crataeva roxburghii (Bengali Barun) by some decomposition process. Clinical efficacy of this drug in case of cholera appears to have been established by Lahiri. Critical study of its degradation products was undertaken by me and ultimately it was possible to establish its fine structure as N, N'-dibenzylthiocarbamide, a product which can be prepared readily by the synthetic method from benzylamine and carbon bisulphide.

With regard to andrographolide, the active ingredient of Kalmegh, structural work was started by Gorter in 1910 and is being continued in our laboratories. As it now appears it is a diterpene-lactone having the molecular formula C_{20}H_{20}O_2. It has got a reduced naphthalene ring system with two double bonds, one of which is attached to a methylene group and three hydroxyl groups of which one is tertiary. One of the double bonds forms parts of an $\alpha: \beta$-unsaturated lactone system and in
In this respect it appears to be similar to the various physiologically active \( \alpha: \beta \)-unsaturated lactones occurring in nature. Our results have recently been confirmed by Prof. Paul Karrer and his collaborators. The structure of ajmaline, the chief alkaloid of *Rauwolfia serpentina*, has been established by Mukherji (now Mrs. Chakravarti), Robinson and Schillitler. It appears to have a structure in a sense intermediate between those of strychnine and yohimbine. The structure of the other important alkaloid of *R. Serpentina*, Serpentine, however, remains to be settled.

Lastly but not the least may be mentioned the importance of plant products in the preparation of semi-synthetic drugs. A number of costly drugs are prepared using plant products instead of synthetic products as starting materials, e.g. it may be pointed out that a number of drugs (progesterone, desoxycorticosterone etc.) are prepared using stigmasterol as starting material. Manufacture of these drugs may be easily started in India if a suitable source of stigmasterol is available. Stigmasterol is a common constituent of plants but it is almost always associated with much larger amounts of \( \alpha-, \beta-, \gamma \)-sitosterols and other phytosterols and this renders the problem of isolation of stigmasterol extremely difficult. While carrying out the chemical investigation of various plants I have come across a case, that of *Enhydra fluitans*, where stigmasterol forms the chief constituent of the sterol fraction and may be easily isolated in a state of purity.

Very recently we have started an interesting investigation for finding a suitable source for the preparation of a starting material for Kendall’s compound E or Cortisone. Cortisone is at present being prepared from cholic acid by an extremely laborious method. Sarmentogenin, the steroidal sapogenin of the seeds of *Strophanthus sarmentosus*, appears to be a far better starting material. Unfortunately, however, sarmentogenin as described in the literature, could not be traced in any of the Strophanthus plants collected from South Africa during an expedition which was organised for the purpose. The other prospective starting material for cortisone is Botogenin which was isolated by Marker from the yams of two Mexican plants of the Natural Order Dioscoreaceae. We are at present conducting a systematic investigation of Indian plants of this Natural Order to find out if a suitable steroidal sapogenin be obtainable with an oxygenated function at the 11 or 12 carbon atom.
NEED FOR INVESTIGATION OF INDIGENOUS PLANTS TO FIND SUBSTITUTES FOR OFFICINAL DRUGS

By R. CHATTERJEE, D. Sc.
Presidency College, Calcutta.

We export from India plants and other natural products and we reimport in most cases their purified active principles for medical use. This is an economic waste and we should make an effort to replace many of the imported drugs by producing them here, from indigenous sources. Many of the plants and plant products which have long been used in Indian medicine have been subjected to scientific tests, and certainly more intensive research is still needed to make a good chemical survey of the plant principles. Search for drugs from plants is pursued in different parts of the world even at this age of synthetic medicines. In 1934, an alkaloidal survey was made in Russia to discover 67 new alkaloid bearing plants; 12 of the species yielded 24 new alkaloids and of these only 2 were found to be of practical interest: anabasine which is an effective agent in the eradication of the plant pests and convolvine which has marked local anaesthetic properties and is useful in eye therapy. In 1939, another survey was made on 200 plants collected from Central Asia, and a new source of aconite alkaloids was found. In 1946, further investigation of 113 plants from Central Asia led to the discovery of promising materials among lichens, mosses, and liverworts.

As a result of such a study in Japan, an alkaloid cepharanthine has been isolated from Stephania cepharantha and it has been found to be of good use in tuberculosis. The National Research Council of Canada has been examining the alkaloid bearing plants for the last twenty years and to encourage such study the Council awarded even overseas scholarships last year and also this year. During the last war, in the United States of America, a team of workers made anti-malarial tests on 600 plants belonging to 123 families of phanerogams and 3 families of cryptogams. Plants from Africa have been investigated in France. In Australia such a study
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has led to a useful observation in *Duboisia myoporoides* which is distributed throughout Australia; in it the relative proportion of two main alkaloids is extremely variable, hyoscine being predominant in plants of the northern area, and hyoscyamine in those of the southern region. A more intensive research has revealed that leaves of some specimens of *Duboisia myoporoides* in Queensland, contained in October as much as 3 per cent of almost pure hyoscyamine and in April about the same amount of almost pure hyoscine. This plant proves to be the best source of hyoscyamine, for the usual sources, e.g., seeds of *Atropa belladonna* contain about 0.8 per cent, seeds of *Datura stramonium* contain 0.5 per cent, and leaves of *Hyoscyamus niger* contain about 1.4 per cent of hyoscyamine.

We have neglected some of our good sources of drugs. To cite one or two examples: we need the alkaloid berberine for curing oriental sore. We have the best source of berberine in *Coptis teeta* which contains 9 per cent of the alkaloid, and we have not fully exploited it. We depend upon the foreign made drug orisol, which is a preparation of berberine bisulphate. In Germany two patents were taken on the method of preparation of hydrastinine, a styptic, from berberine on a large scale. We can make use of German methods for preparing this styptic if we need it.

We depend more on the resin of American *Podophyllum* (4% resin) than the better source of resin of Indian *P. emodi* (12% resin) which is a B. P. drug. Because the collection of Podophyllum rhizomes is never carried out scientifically in our country, so no standard of uniformity of the drug is maintained. The components of the American Podophyllum resin have recently been shown to have tumour necrotising property; we do not know yet if our Podophyllum possesses that property.

In order to carry out researches bearing on the Chemistry of medicinal plants, proper laboratory facilities, besides suitably qualified scientists, are essential pre-requisites. Scientific talents are not lacking in this country and provided suitable laboratory facilities are available. India can make very valuable contribution towards the isolation, standardisation and determination of the fine structures of the active principles of many useful medicinal plants.
This special meeting of the Immunity Scientific Association, held on 2nd June, 1931 at 4-15 P. M. at the Bengal Immunity Research Institute, was arranged to hold a discussion on "Indian Medicinal Plants". In his introductory speech Dr. U. P. Basu, the Vice-President of the Association, narrated the background on which the symposium was organised. The solution of the problems in the production and discovery of useful drugs from Indian medicinal plants requires the co-operation and co-ordination of scientists of different branches. In this connection he referred to the foresight of the founder of this Institute, who always used to encourage researches on Indian medicinal plants.

He then read some messages and letters received, wishing success to this symposium.

The inaugural message of Hon'ble Dr. B. C. Roy was then read and finally Dr. U. P. Basu invited Mr. S. N. Bal to preside over this symposium and Mr. B. Gupta to be the Recorder.

In his presidential speech Mr. S. N. Bal dealt in details with the following aspects: (1) Necessity of Pharmacognostic researches on Indian medicinal plants; (2) Adulteration and spuriousness of crude drugs as sold in Indian market and detection of the same; (3) Standardisation of crude drugs; (4) Searching for substitute drugs for those therapeutically recognised, but exotic to the country; and (5) the cultivation and utilisation of medicinal plants.

Mr. Bal then read the foreword communicated by Sir R. N. Chopra, in which the adulteration practices of Indian crude drug dealers and some aspects regarding the cultivation of Indian medicinal plants have been dealt with. Various aspects of the subject were then taken up by different speakers present. Among those who read papers are: Dr. B. Mukerji, Dr. B. N. Ghosh, Dr. K. Biswas, Prof. P. C. Sarbadhikari, Prof. M. L. Schroff, Dr. P. K. Sanyal, Dr. (Mrs) Asima Chatterjee, Mr. S. P. Sen and Dr. S. C. Dutta. Their observations have been incorporated in the preceding pages. Dr. (Mrs.) D. Chakravarti read the paper contributed by Dr. R. N. Chakravarti on the role of Organic Chemistry in proper utilisation of Indian medicinal plants.
In the absence of Dr. M. Sen, Dr. S. Prasad, Kaviraj Bimalananda Tarkatirtha and Prof. J. C. Sen Gupta, Mr. Bal read the abstracts of their observations.

During discussion Dr. S. C. Dutta spoke about the recent development of Pharmacognostic researches in India and Dr. G. C. Mitra referred to the necessity of a drug museum and herbarium for proper identification and evaluation of crude drugs. Mr. M. L. Dutta urged scientists to help and collaborate with the traders in crude drugs for proper guidance in the field. Mr. V. Narayanswami spoke on the efficacy of some crude drugs and referred to their cultivation. Dr. J. K. Chowdhury raised the point why Indian industrialists should not arrange to cultivate the medicinal plants they need for their industries. In reply, Mr. S. P. Sen referred to the past achievements and the associated difficulties in the cultivation of drug plants in India.

Towards the latter part of the discussion, Mr. A. Ghosh moved a resolution, seconded by Mr. N. Adhikary, to the effect that this meeting recommends to the Inter-University Board to include the study of Indian Medicinal plants in the curriculum of Indian Universities. The resolution was carried unanimously.

Dr. T. N. Ghosh, the Joint Secretary, proposed a hearty vote of thanks to all assembled on this occasion.

Besides the members of the Association, more than fifty visitors were present in the meeting. The meeting terminated late at 8-15 P. M.