

## ***Herbotechnik***

A BAIF Program for the understanding, conservation, cultivation, and utilization of medicinal herbs.

### ***An Approach Note***

*Dr. Anil Saraf and Mr. Girish Sohani*

#### ***Background***

##### ***The Living Traditional Roots***

Traditional and folklore medicine bequeathed from generation to generation is rich in domestic recipes and communal practice. Encompassing concepts and methods for the protection and restoration of health, traditional medicine has served as a fount of alternative medicine, new pharmaceuticals, and healthcare products.

The best known examples of health systems based on traditional medicine, differing in concept and protocol, are well-developed systems such as acupuncture and ayurveda, that have been widely used to conserve human health in China and India. These ancient but formalized bodies of traditional health knowledge have drawn extensively from the folk medicine that was and has been in practice in different communities.

This folk knowledge has in turn been retained, nurtured and built upon by an extended line of unknown and unremembered traditional healers who have passed it on from generation to generation. This line exists even today, more commonly in relatively remote communities. The folk medicine thus represents a system that, on the one hand, functions as an extensive network for people-based incremental generation of knowledge about plant utilization, and on the other hand, functions as a low-cost community-based health care system. The future existence of this living knowledge system is however seriously threatened by the existing societal forces of change.

The practice of traditional medicine is widespread in China, India, Japan, Pakistan, Sri Lanka and Thailand. In China about 40% of the total medicinal consumption is attributed to traditional tribal medicines. In Thailand, herbal medicines make use of legumes encountered in the Caesalpiniaceae, the Fabaceae, and the Mimosaceae. In the mid-90s, it is estimated that receipts of more than US\$2.5 billion have resulted from the sales of herbal medicines. And, in Japan, herbal medicinal preparations are more in demand than mainstream pharmaceutical products.

##### ***The Present and the Future.***

Interest in medicinal plants as a re-emerging health aid has been fuelled by the rising costs of prescription drugs in the maintenance of personal health and well being, and the bio prospecting of new plant-derived drugs. Based on current research and financial investments, medicinal plants will, seemingly, continue to play an important role as a health aid.

The industrial uses of medicinal plants are many. These range from traditional medicines, herbal teas, and health foods such as nutraceuticals to galenicals, phytopharmaceuticals and

industrially produced pharmaceuticals. Furthermore, medicinal plants constitute a source of valuable foreign exchange for most developing countries, as they are a ready source of drugs such as quinine and reserpine; of galenicals like tinctures and of intermediates (e.g. diosgenin from *Discorea* sp.) in the production of semi-synthetic drugs.

Developed countries, in recent times, are turning to the use of traditional medicinal systems that involve the use of herbal drugs and remedies. About 1400 herbal preparations are used widely, according to a recent survey in Member States of the European Union. Herbal preparations are popular and are of significance in primary healthcare in Belgium, France, Germany and the Netherlands. Such popularity of healthcare plant-derived products has been traced to their increasing acceptance and use in the cosmetic industry as well as to increasing public costs in the daily maintenance of personal health and well being. Examples of such beauty-oriented therapeutics are skin tissue regenerators, anti-wrinkling agents and anti-age creams.

Over exploitation of several herbs has significantly reduced their quantities and have endangered their existence. This situation calls for the conservation and culturing of these herbs in laboratories, nurseries and gardens.

In 1978, the WHO drew up a list of 240 essential medications that can be obtained only from plants. Every year nearly two hundred varieties of Indian medicinal plants are being tested in the research departments of several prestigious drug companies all over the world.

Issues concerning intellectual property rights, compensation for loss of finance-rich biodiversity resources, and the acquisition and safeguarding of traditional healthcare knowledge are no longer neglected.

The development and commercialization of medicinal plant-based bioindustries in the developing countries is dependent upon the availability of facilities and information concerning upstream and downstream bioprocessing, extraction, purification, and marketing of the industrial potential of medicinal plants. Absence of such infrastructure compounded by lack of governmental interest and financial support restricts the evolution of traditional herbal extracts into authenticated market products. Furthermore the absence of modernized socio-economic and public healthcare systems reinforces reliance of rural and lower-income urban populations on the use of traditional medicinal herbs and plants as complementary aids to routine pharmaceutical market products.

It is thus necessary to dovetail the above opportunities into a coherent program for the conservation, cultivation, and utilization of medicinal herbs. Herbotechnik is planned to be such a program.

### ***Herbotechnik***

The program has the following four cornerstones:

- To help in the continuation of the traditional knowledge systems on medicinal herbs, in a living form.
- To promote availability of medicinal herbs in all their diversity.
- To integrate use of medicinal herbs in the Community Health Program.

- To enable processing and marketing of herbal medicines with a flow-back of benefits to communities who have contributed the knowledge.

Each of the cornerstones has important program implications:

"To retain the traditional systems in a living form" will imply support for the retention, recording, validating, prospecting and practice of traditional herbal knowledge systems by the traditional healers as well as other lay-persons.

"To promote availability of diverse herbs" implies programs for conservation, cultivation, and plantation.

"To integrate the use of herbs in Community Health Programs" implies making traditional and indigenous medicinal treatments a part of the community living through integration as home-remedies, diet additives, primary cures dispensed by traditional healers / village health guides and treatment centers for specific ailments.

"To process and market with benefit to communities" implies a state-of-the-art processing technology implements through a network of 'people'-owned collection, cultivation and processing units for production of herbal medicines / extracts.

***Objectives:***

Herbotechnik has been launched by BAIF in selected areas as a new program direction with the following objectives:

- 1) To create a people-based program for the conservation, cultivation, growth and utilization of medicinal plants in our operational area.
- 2) To develop and promote organic cultivation of medicinal plants on wastelands.
- 3) To establish quality assurance methods for medicinal plants, semi-processed / finished herbal products.
- 4) To develop suitable products for captive use in the program area.
- 5) To establish linkages with industry for further processing.

***Outcomes :***

The program is planned to generate the following outcomes:

1. The recording, cross-referencing, and validation of use of plants for medicinal purposes.
2. Establishment of farmer-nurseries of medicinal plant species in tribal and other areas; plantation of a range of perennial trees and shrubs; cultivation of seasonals.

3. Establishment and empowerment of co-operative societies / other organizations of traditional healers / health functionaries / larger community members for the collection, cultivation of medicinal plants and other activities related to Herbotechnik.
4. Strengthened Primary Health Care Programs through Herbal Medicine.
5. Standardized Quality Assurance Systems for Herbal Medicine and Medicinal Plants and their by-products with BAIF Quality Standards.
6. Certification of Medicinal plants / Quality of Manufacturing Activities as per Schedule T of Drugs and Cosmetics Act, and guidelines of GMP, WHO GMP,
7. Empowered People's Organizations participating in National / International markets of herbal medicines / products.

### **Medicinal plants : Global Market Potentials**

Medicinal plants, since times immemorial, have been used in virtually all cultures as a source of medicine. The widespread use of herbal remedies and healthcare preparations, as those described in ancient texts such as the Vedas and the Bible, and obtained from commonly used traditional herbs and medicinal plants, has been traced to the occurrence of natural products with medicinal properties.

The use of traditional medicine and medicinal plants in most developing countries, as a normative basis for the maintenance of good health, has been widely observed (UNESCO, 1996). Furthermore, an increasing reliance on the use of medicinal plants in the industrialised societies has been traced to the extraction and development of several drugs and chemotherapeutics from these plants as well as from traditionally used rural herbal remedies (UNESCO, 1998). Moreover, in these societies, herbal remedies have become more popular in the treatment of minor ailments, and also on account of the increasing costs of personal health maintenance. Indeed, the market and public demand has been so great that there is a great risk that many medicinal plants today, face either extinction or loss of genetic diversity.

#### ***Background***

Medicine, in several developing countries, using local traditions and beliefs, is still the mainstay of health care. As defined by WHO, health is a state of complete physical, mental, and social well being and not merely the absence of disease or infirmity.

The practise of traditional medicine is widespread in China, India, Japan, Pakistan, Sri Lanka and Thailand. In China about 40% of the total medicinal consumption is attributed to traditional tribal medicines. In Thailand, herbal medicines make use of legumes encountered in the Caesalpiniaceae, the Fabaceae, and the Mimosaceae. In the mid-90s, it is estimated that receipts of more than US\$2.5 billion have resulted from the sales of herbal medicines. And, in Japan, herbal medicinal preparations are more in demand than mainstream pharmaceutical products. Africa is a rich source of medicinal plants. Perhaps, the best known species is *Phytolacca dodecandra*.

Extracts of the plant, commonly known as endod, are used as an effective molluscicide to control schistosomiasis (Lemma, 1991). Other notable examples are *Catharanthus roseus*, which yields anti-tumour agents such as vinblastine and vincristine; and *Ricinus communis*, which yields the laxative--castor oil. In Botswana, Lesotho, Namibia and South Africa, *Harpagophytum procumbens* is produced as a crude drug for export. Similarly, *Hibiscus sabdariffa* is exported from Sudan and Egypt. Other exports are *Pausinystalia yohimbe* from Cameroon, Nigeria and Rwanda, which yields yohimbine; and *Rauwolfia vomitoria*, from Madagascar, Mozambique and Zaire, which is exploited to yield reserpine and ajmaline.

The use of medicinal plants like *Eupatorium perfoliatum* (bonest), *Podophyllum peltatum* (mayapple), and *Panax quinquefolium* (ginseng) in the USA has long been associated with the American Indians. These plants have also been appreciated and recognised for their aesthetic and ornamental value. In Central America medicinal plants have been widely used -

by the Maya Indians in Mexico, the Miskitos and Sumus in Honduras and Nicaragua, the Pech, Lencas, and Xicaques in Honduras, the Pipiles in El Salvador, the Talamancas in Costa Rica, and the Guaymis and Kunas in Panama.

In Europe, some 1500 species of medicinal and aromatic plants are widely used in Albania, Bulgaria, Croatia, France, Germany, Hungary, Poland, Spain, Turkey, and the United Kingdom. The Maltese islands constitute an apt example where medicinal plants are widely used in every day life as part of folk medicinal remedies (Lanfranco, 1992).

### *Issues*

Traditional and folklore medicine bequeathed from generation to generation is rich in domestic recipes and communal practice. Encompassing concepts and methods for the protection and restoration of health, traditional medicine has served as a fount of alternative medicine, new pharmaceuticals, and health care products. The best known examples of traditional medicine, differing in concept and protocol, are well-developed systems such as acupuncture and ayurvedic medicine that have been widely used to conserve human health in China and India.

Developed countries, in recent times, are turning to the use of traditional medicinal systems that involve the use of herbal drugs and remedies. About 1400 herbal preparations are used widely, according to a recent survey in Member States of the European Union. Herbal preparations are popular and are of significance in primary healthcare in Belgium, France, Germany and the Netherlands. Such popularity of healthcare plant-derived products has been traced to their increasing acceptance and use in the cosmetic industry as well as to increasing public costs in the daily maintenance of personal health and well being. Examples of such beauty-oriented therapeutics are skin tissue regenerators, anti-wrinkling agents and anti-age creams.

Most dermaceuticals are derived from algal extracts that are rich in minerals and the vitamin B group. Skincare products such as skin creams, skin tonics, etc. derived from medicinal plants are grouped together as dermaceuticals. Also, amongst the poor, cures and drugs, derived from plants, constitute the main source of health care products.

Gorman (1992) drew attention to the power of Chinese folk medicinal potions in treating maladies from eczema and malaria to respiratory disorders. In the quest for new medicines to treat old and emergent diseases such as malaria and AIDS, attention is now being given to discovering the active ingredients encountered in the treasury of over 5,000 Chinese herbs, plants and roots that have been used routinely and traditionally. Quinghaosu and Chaihu are two such examples. Whereas the former, called artemisinin and obtained from *Artemisia annua* is expected to yield, in the coming millennium, a potent new class of antimalarials, the latter, obtained from *Bupleurum chinense* and used as a popular remedy for hepatitis is the focus of intense research by the Japanese pharmaceutical industry. More recently, the biochemistry of tianhuafen or cucumber is being studied in the USA to decipher the identity of compound Q, an extract used in China and credited with remedial and relief properties in AIDS sufferers.

Medicinal plants are an integral component of ethnoveterinary medicine. Farmers and pastoralists in several countries use medicinal plants in the maintenance and conservation of the healthcare of livestock. Intestinal disorders in cows, in Mexico, are treated with herbal

extracts of *Polakowskia tacaco*. Dietary supplements such as vitamin A in poultry feeds in Uganda are supplied through enrichments of amaranth (*Amaranthus* sp.). It is estimated that medicinal plants, for several centuries, have been widely used as a primary source of prevention and control of livestock diseases. In fact, interest of such use in the veterinary sector has resulted primarily from the increasing cost of livestock maintenance and the introduction of new technology in the production of veterinary medicines and vaccines.

McGee (1998), surveying the use of spice and their medicinal properties around the world, concluded that spices serve the adaptive purpose of reducing food-borne disease. In reviewing relevant texts ranging from the preservative properties of spices against food spoilage to the presence of antimicrobial substances that lay claim to the elimination of pathogenic organisms in food preparations, the case is made for a more objective analysis and study of the medicinal properties of spices in *victu* rather than in *victo*. A whole range of plant-derived dietary supplements, phytochemicals and pro-vitamins that assist in maintaining good health and combating disease are now being described as functional foods, nutraceuticals and nutraceuticals. Table 1 provides some examples of national activities concerning medicinal plants in several developed and developing countries.

Despite the increasing use of medicinal plants, their future, seemingly, is being threatened by complacency concerning their conservation. Reserves of herbs and stocks of medicinal plants in developing countries are diminishing and in danger of extinction as a result of growing trade demands for cheaper healthcare products and new plant-based therapeutic markets in preference to more expensive target-specific drugs and biopharmaceuticals. Such concerns have stimulated positive legal and economic interest.

Issues concerning intellectual property rights, compensation for loss of finance-rich biodiversity resources, and the acquisition and safeguarding of traditional healthcare knowledge are no longer neglected.

Bio-prospecting of new drugs from medicinal plants and the exploitation of unprotected traditional knowledge in starting-up potentially new bio-industries are the focus of new monitoring measures. Such concerns that call for adherence to and observation of cultural and intellectual property rights have been addressed and enshrined in the Chiang-Mai and Kari-Oca Declarations (Table 2). The first countries to seriously tackle these issues are China and India. Indeed, programmes dealing with medicinal plant conservation, cultivation, community involvement and sustainable development being initiated elsewhere, could benefit immensely from the Chinese and Indian experiences (World Bank, 1997).

Genetic bio-diversity of traditional medicinal herbs and plants is continuously under the threat of extinction as a result of growth-exploitation, environment-unfriendly harvesting techniques, loss of growth habitats and unmonitored trade of medicinal plants.

Medicinal herbs, possessing penile potency properties and anti-cancer principles are the focus of smuggling to import markets in Germany, France, Switzerland, Japan, the U.K., and the U.S.A. The best known example, in recent times, is that of *tetu lakda* (*Nothadoytes foetida*). Commonly encountered in southern India and Sri Lanka, the herb is exploited as a source of anti-cancer drugs.

On the other hand, *Adonis vernalis*, extinct in Italy and the Netherlands, is an endangered species in Germany, Slovakia, Sweden and Switzerland. Fortunately, to safeguard against

such practices and losses, guidelines and licensing concerning the use of such plants are provided for in the Convention on International Trade Endangered Species of Wild Flora and Fauna (CITES).

The industrial uses of medicinal plants are many. These range from traditional medicines, herbal teas, and health foods such as nutraceuticals to galenicals, phytopharmaceuticals and industrially produced pharmaceuticals. Furthermore, medicinal plants constitute a source of valuable foreign exchange for most developing countries, as they are a ready source of drugs such as quinine and reserpine; of galenicals like tinctures and of intermediates (e.g. diosgenin from *Discorea* sp.) in the production of semi-synthetic drugs.

The world market for plant-derived chemicals - pharmaceuticals, fragrances, flavours, and colour ingredients, alone exceeds several billion dollars per year. Classic examples of phytochemicals in biology and medicine include taxol, vincristine, vinblastine, colchicine as well as the Chinese antimalarial - artemisinin, and the Indian ayurvedic drug-forkolin. Trade in medicinal plants is growing in volume and in exports. It is estimated that the global trade in medicinal plants is US\$800 million per year.

The botanical market, inclusive of herbs and medicinal plants, in the USA, is estimated, at retail, at approximately US\$1.6 billion p.a. China with exports of over 120,000 tons p.a., and India with some 32,000 tons p.a. dominate the international markets. It is estimated that Europe, annually, imports about 400,000 t of medicinal plants with an average market value of US\$ 1 billion from Africa and Asia. A growing awareness of this new contributor to the foreign-exchange reserves of several national treasuries is beginning to emerge. To satisfy growing market demands, surveys are being conducted to unearth new plant sources of herbal remedies and medicines.

In several industrialized societies, plant-derived prescription drugs constitute an element in the maintenance of health. Medicinal plants are an integral component of research developments in the pharmaceutical industry. Such research focuses on the isolation and direct use of active medicinal constituents, or on the development of semi-synthetic drugs, or still again on the active screening of natural products to yield synthetic pharmacologically-active compounds. In Germany, for example, over 1500 plant species encountered in some 200 families and 800 genera have been processed into medicinal products. In South Africa, likewise, some 500 species are commercialized trade products. Today, Bulgaria, Germany and Poland are recognized as major exporters of plant-based medicinal products.

The development and commercialization of medicinal plant-based bio-industries in the developing countries is dependent upon the availability of facilities and information concerning upstream and downstream bio-processing, extraction, purification, and marketing of the industrial potential of medicinal plants. Absence of such infrastructure compounded by lack of governmental interest and financial support restricts the evolution of traditional herbal extracts into authenticated market products. Furthermore the absence of modernized socio-economic and public healthcare systems reinforces reliance of rural and lower-income urban populations on the use of traditional medicinal herbs and plants as complementary aids to routine pharmaceutical market products.

The prophylactic and therapeutic effects of plant foods and extracts in reducing cardiovascular disease has been reviewed (Walker, 1996). Non-nutrient phytochemicals are



increasingly being recognised as potential health promoters in reducing the risks of cardiovascular disease and atherosclerosis. Prominent herbs identified were *Achillea millefolium* (yarrow), *Allium sativum* (garlic), *Convallaria majalis* (lily of the valley), (hawthorn), *Cynara scolymus* (globe artichoke), *Gingko biloba* (gingko) and *Viburnum opulus* (cramp bark).

Saint-John's work known as Johanniskrant in German for centuries has been used to treat people with mild and moderate depression without the side effects of Prozac. Widely sold in Germany and other European countries, and awaiting official approval by the US Food and Drug Administration, Saint-John's wort is being regarded as a serious rival to Prozac (Andrews, 1997).

Medicinal plants can make an important contribution to the WHO goal to ensure, by the year 2000, that all peoples, worldwide, will lead a sustainable socio-economic productive life. The Centre for Science and Technology of the Non-Aligned and other Developing Countries in India organised an international Workshop on Tissue Culture of Economic Plants in April, 1994, as a means of using modern biotechnological techniques to nurture and conserve medicinal plants.

In late 1997, the World Bank, within the framework of the Global Environmental Facility, provided a US\$ 4.5 million grant for the Sri Lanka Conservation of Medicinal Plants Project which focuses on the conservation of medicinal plant populations, their habitats, and their sustainable use in Medicinal Plant Conservation Areas (MPCAs). Inventories with emphasis on the management, research and conservation of rare and endangered species of medicinal plants are the main programmes at MPCAs at Ritigala, Naula, Rajawaka, Kanneliya, and Bibile.

Aspects of policy and research concerning the cultivation of non-tropical and tropical medicinal plants and their genetic improvement; their conservation in botanical gardens; their storage in liquid nitrogen; their economic potential in international pharmaceutical trade; and their vulnerability to over-exploitation and extinction have been dealt with authoritatively (Akerle et al, 1991; Chadwick and Marsh, 1994). Moreover, such concerns and issues are addressed through a variety of programme activities and projects conducted, and promoted by several International, regional, and non-governmental organisations (Table 3).

### ***Concluding remarks***

Recent and renewed interest in medicinal plants coupled to developments in information technology has fuelled an explosion in the range and content of electronic information concerning medicinal plants as a re-emergent health aid. Bhat (1997) recently reviewed diverse sources of such information in traditional abstracting services as well as in a variety of online electronic databases. As a result of such developments, access to indigenous peoples and cultures concerning medicinal plants are greatly facilitated. Furthermore, the active participation of such natural custodians and practitioners of valuable knowledge is guaranteed in the generation of research focussing on screening programmes dealing with the isolation of bio-active principles and the development of new drugs.

## **References**

Akerele, O., Heywood, V. and Syngé, H. (1991). eds., Conservation of Medicinal Plants, Cambridge University Press Ltd., Cambridge, UK, pgs. 362.

Andrews, E.L. (1997). A Humble Herb as Rival to Prozac, International Herald Tribune, Paris, 11 November.

Anjara, J. (1996) Ethnoveterinary Pharmacology in India: Past, Present and Future. In: Ethnoveterinary Research and Development. eds. McCorkle, C.M., Mathias, E. and Schillhorn van veen, T.W., Intermediate Technology Publications, London, UK, pgs. 137 - 147.

Bhat, K.K.S. (1997). Medicinal and plant information databases. In: Medicinal Plants for Forests Conservation and Health Care. eds. Bodeker, G. and Vantomne, P., FAO, Non-Wood Forest Products Series No. 11, FAO, Symposium 185, John Wiley and Sons, Chichester, UK, pgs. 280.

Gorman, C. (1992). The Power of Potions, Tim, April 20, pgs. 52 - 53.

Lanfranco, G. (1992). Popular Use of Medicinal Plants in the Maltese Islands, Insula, No. 1, pgs. 34 - 35.

Lemma, A. (1991). The Potentials and Challenges of Endod, the Ethiopian Soapberry Plant for Control of Schistosomiasis. In: Science in Africa: Achievements and Prospects, American Association for the Advancement of Sciences (AAAS), Washington, D.C., USA.

McGee, H. (1988). In victu veritas, Nature 392:649 - 650.