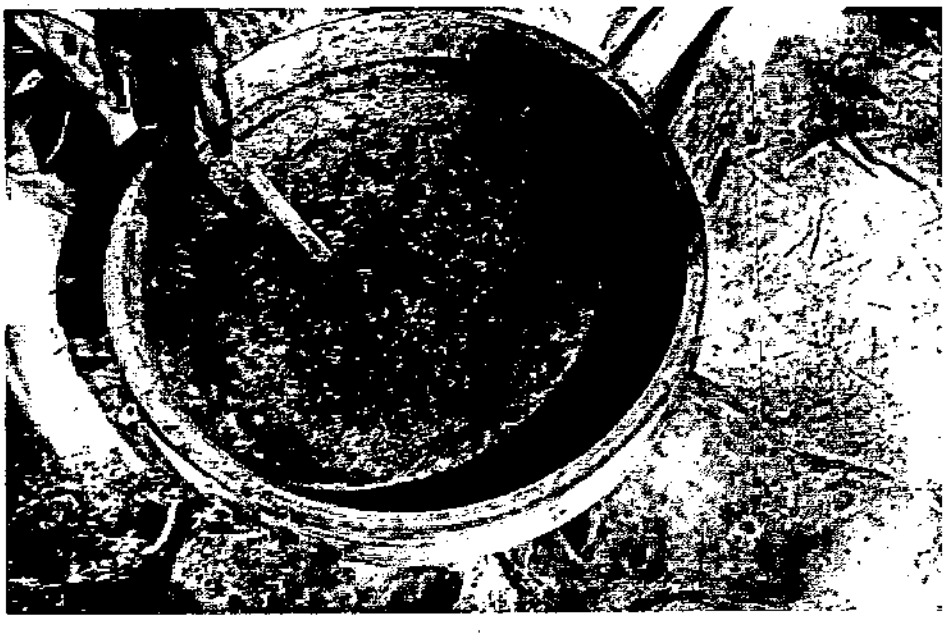
Kurukshetra

December 1997 Rs. 5

Rediscovering Herbal Treasure

Scanning the forest to identify medicinal plants

Preparation of herbal medicine through traditional means



The concoction in the making of traditional medicines

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CONTENTS

❑ I am a final year student of BS honours degree in 'Third World studies (developmental)'. I live in England. I was not aware of an Indian journal looking solely at rural development until I visited Simla in Feb., 1997, where I discovered "Kurukshetra" by accident. Having read it through, I was very much impressed by it. I found that it projected a more truthful and more positive picture of India than what is normally projected. I am writing to you for help in my research for the final year project. I have chosen to study the Scheduled Castes of India and Indian governmental policies relating to them to promote equality. I would be most grateful if you could send me any information regarding this. I will require information on all the aspects of untouchability, eg housing, education, employment, health, gender, political rights, policies, whether government policies have succeeded or failed, Scheduled Castes freedom fighters, etc including statistical findings of any kind. Please do not forget to intimate to me about the subscription rates of your excellent journal.

(Ms Kamlesh Badhan, 673, Stoney Station Road, Foleshill Coventry, CV6 5 Fy, West Midlands, England, UK)

❑ I would be very pleased if you send me information on how it is possible for me to obtain a copy of the special issue of *Kurukshetra*—May-June 1996 (on housing). Please send me also a form and information on the subscription fees. Thanking you in advance for your kind attention.

(Vinicius Nobre Lages, 25, rue Brea 75006, Paris, France)

❑ The special issue of *Kurukshetra* on forests and the environment (Back to Nature) has been well received by the Asian Development Bank experts. Kindly accept my congratulations. With a better layout, the journal should shine all the more.

(Mohan Sundara Rajan, North field Drive, Normal, USA)

❑ The *Kurukshetra* Annual 1995 (October) is an excellent document containing valuable and useful articles on land reform in all its aspects. The photographs of Mahatmaji and Vinobaji have also been very well brought together. I congratulate the *Kurukshetra* team on this imaginative and purposeful efforts in the cause of rural development and rural poor.

[*S.R. Sankaran, Former Secretary, Ministry of Rural Development, Govt. of India, (114, Saphire, Amrutha Hills, Rangagutta, Hyderabad-500 082, AP)*]

❑ I have read the Independence Day issue of *Kurukshetra* (August 1997). It is very interesting and informative.

(G. Thimmaiah, Member, Planning Commission, New Delhi)

❑ The subject (Rural-Urban divide) you have chosen for *Kurukshetra* Annual 1997 is a very good one which has interested me.

(Dr K.N. Raj, 'Nandavan', Trivandrum-695 011, Kerala)

❑ Nice to see your good work in the August 1997 issue.

(Dr Neela Mukherjee, Prof of Economics, LBS National Academy of Administration, Mussoorie-248 179, UP)

❑ I am returning the record copies of *Kurukshetra*. I am very grateful to you for lending me this magazine. This contains a wealth of information for a serious student. As a matter of fact, some of these magazines can be marketed abroad to research institutions. I commend you and your colleagues.

(S. Narendra, Principal Information Officer, Press Information Bureau, Govt. of India, Shastri Bhavan, New Delhi-110 001)

❑ I wish to begin with the quote on page No. 7 of *Kurukshetra's* August, 1996 edition that reads, "It's not too late to choose *Kurukshetra*". I am happy to choose it now. I happened to go through your August 1996 edition which was lying in our News Editorial section. I appreciate the standard of articles included in this magazine. It gives lots of insight into our rural development, problems of progress and above all these, it opens a pandora's box for an imaginative Television Producer to create unique visuals for the Electronic Media. The magazine would be of great use to improve the visual contents of our various bulletins.

[*(Mahendra Maharishi, Asstt Station Director (News), Doordarshan News, New Delhi)*]

❑ You deserve congratulations for the excellent special issue on housing (May-June 1996). Perhaps you will consider a similar treatment to problems of rural-urban interface like flight of labour from rural areas which creates pressures of employment and habitations in urban areas.

[*(Prof Amitabh Lahiry, Retd. Principal, Govt. Postgraduate College, Raipur (MP)*]

❑ I have read your Annual 1996 on Basic Minimum Services. I must say that there has been considerable improvement in the quality of the journal. My hearty congratulations to you and your colleagues for the untiring efforts made for improving quality.

(Dr Baidyanath Misra, Director, Nabakrushna Centre for Development Studies, Bhubaneswar, Orissa)

❑ The special number of *Kurukshetra* on Media and Rural India is a very useful issue. Kindly accept my warmest congratulations. This is one of the issues which I would like to treasure for a long time to come, for the valuable material that it contains.

(Prof V.S. Gupta, 10A/13, New Campus, Haryana Agricultural University, Hisar, Haryana)

❑ Congratulations for bringing out an excellent issue of *Kurukshetra* on Media and Rural India. The issue will serve as a resource material for academics and researchers.

(Dr Uma Tripathi Head, Dept. of Communication Studies and Research, R.D. University, Jabalpur, MP)

❑ I have read *Kurukshetra* Annual on Mahatma Gandhi. I must congratulate you on not only keeping up the high standard of *Kurukshetra* but enhancing it with such issues. At a time when Gandhi is not only being... neglected by his own countrymen but also reviled and abused by leading politicians and some mediamen... who should know better, your initiative and careful selection of writers to contribute thoughtful articles on Gandhiji was highly commendable.

(S.C. Bhatt, 21 Maitri Apartments, A-3, Paschim Vihar, New Delhi-110 093)

❑ The Annual number on Gandhi has come out very well. The articles... are excellent and are well edited.

(K. Velayudhan Nair, 'Varada', Nandavanam, Trivandrum-695 033)

❑ I am glad to find that *Kurukshetra* presents a new look. It is well edited and produced.

[*Prof Anjan Kumar Banerji, Chairman, Mass Communication Panel, UGC (New G/7, Jodhpur Colony, BHU, Varanasi-221 005)*]

❑ It was gratifying to hear from Dr R.K. Rath, Project Officer (Rural), UNICEF, New Delhi that the article "Power to the people: people's campaign for Ninth Plan in Kerala", published in the June 1997 issue of *Kurukshetra* was very interesting and informative, which we would like to share with you.

(Dr Jos Chathukulam, Director, Centre for Rural Management, Kottayam-686 028, Kerala)

❑ I have been a regular reader of your esteemed journal. The new look as well as the editorial content indeed is attractive and meaningful.

(Dr J.S. Murthy, Dept of Communication Studies and Research, R.D. University, Jabalpur, MP)

❑ *Kurukshetra* has proved its worth and merit. Please accept my heartiest congratulations for bringing out an excellent journal.

(Rosscote Krishna Pillai, Kottakkal, Trivandrum-695 010, Kerala)

❑ We have gone through the write-up on "elegantly designed houses for the poor" in your July 1995 issue. We are much fascinated by the details provided therein and we would like to get more information regarding these houses to see if we could implement this in our institution since we are engaged in the treatment and rehabilitation of leprosy patients.

(K. George William, Farm Manager, Schieffelin Leprosy Research and Training Centre, Karigiri-632 106, S. India)

❑ Thank you for publishing this informative journal. It gave me great pleasure to read the issues on Panchayati Raj and women's empowerment. I feel that the government should take note of these discussions. Your journal has highlighted the various issues involved in women's empowerment. We have to take several remedial measures to empower women. Can we prevent the dowry system? Are our laws strong enough to prevent atrocities on women? I feel sad that no opinion-makers have stressed the need for strict laws. We should emulate countries like Singapore, Thailand and Saudi Arabia in tightening our laws.

[*A graduate, Utkal University (Orissa)*]

❑ Sixty valuable pages of the journal have been allocated to Lakshadweep (September 1996), when there is no need to start a new series on States and Union Territories. Latest information is available from respective States and Union Territories. Please use the valuable space of *Kurukshetra* keeping latest developments in several sectors in view. There is no meaning in printing an abridged version of 1974 article in September 1996. We want latest data.

(R. Madhukar, 64, Montieth Road, Egmore, Madras-600008)

❑ The focus on Lakshadweep (September 1996) is very informative. It has thrown light on the various facets of development in the far off Union Territory, especially the efforts to introduce democratic decentralization. It is heartening to note that *Kurukshetra* has highlighted the development concerns of a remote area like Lakshadweep which usually remains neglected. An article from Mr Ramunni Menon who was associated with the development of Lakshadweep for a long time would have certainly added to the value of the edition. I am happy to say that the issue benefited me a lot.

(Jacob Abraham, LIG 128, Indira Nagar, Kaloor, Kochi-682017, Kerala)

❑ I have gone through the special issue of *Kurukshetra* on Panchayati Raj. I highly appreciate the great academic work you are undertaking through the publication of *Kurukshetra*.

(Dr A.K. Chirappanath, Dean, Faculty of Social Sciences, Mahatma Gandhi University, Priyadarshni Hills, Kottayam, Kerala)

❑ I am a postgraduate student of extension education. I am a regular and enthusiastic reader of your splendid journal. I find this journal very useful. I get a lot of material related to my studies from *Kurukshetra*.

[*Sumita Kumari, M.Sc (Home Science) Extension Education, Rajendra Agriculture University, Samastipur, Bihar*] ❑

Read *Kurukshetra* to know Rural India

Plant based health system: revitalization needs and conservation efforts in India

Sunil K. Agarwal

The conservation of ethno-botanical knowledge accumulated through trial and error over generations to treat most common diseases in rural areas is crucial for a country like India where over 75 per cent of the population live in villages. Such knowledge based system and resources need to be nurtured, revitalized and effectively tapped with proper scientific base and good delivery system to cater to the health care needs of the masses. A number of medicinal plant species have become vulnerable to extinction due to indiscriminate collection and deforestation. Also, indigenous population and their knowledge are threatened with destruction. Any erosion in the medplant diversity and any efforts aimed at preventing people's access to and control over biodiversity will be detrimental to the very process of sustainability.

Conservation of biodiversity and of the germ-plasm of important plant species has assumed global significance from the point of view of ecological security and for ensuring a secure livelihood as well as food security for the people. This is particularly true of the developing countries located in the tropical/sub-tropical belt and which have much of the biodiversity relevant to humankind. Much of the world's agricultural and pharmaceutical needs come from its prime forests. It is estimated that more than 25 per cent of all medicines available today are derived from tropical plants. According to a UNDP (1994) report, the annual value of medicinal plants derived from developing countries is about $ 32 billion.

The shift towards herbal drugs: It is estimated that 50-75 per cent of the population, particularly in the developing countries, still rely on traditional medicine than the modern synthetics. Easy availability at low cost and comparative safety of the traditional medicines increase people's faith in such remedies. The World Health Organization, while declaring Health for All by 2000 AD has also emphasized the need for revitalization and expansion of traditional systems of medicine, especially in meeting the health care needs of the rural and tribal population of the world. This growing demand of medicinal plants and herbal drugs is due to the ever-increasing evidences of the efficacy of many crude plant drugs used by the tribals or traditional societies in preventive and curative aspects of health care. The development of varieties of the so-called 'wonder drugs' wherein plant product was the initial lead for drug design, is another indicator of the rapid spurt of interest in plant based health system. For example: Diosgenin steroids derived from *Dioscorea spp.* (threatened species) are used as precursor for synthesis of cortisones, sex hormones and oral contraceptives. Perhaps, these may be the reasons for shifting consumer preferences away from chemicals to plant derived drugs not only in developing countries but also in the developed world. There are 47 major plant based drugs in the world market and there is a possibility of discovering 328 new modern drugs having an estimated value of $47 billion annually.

The Indian scenario

With its wide eco-geographic, climatic and biological diversity, the Indian subcontinent is enormously endowed with one of the most indigenous knowledge base of medicinal plants and herbs, which played a vital role in the traditional health care systems. The medicinal value of some such plants are mentioned in the oldest Hindu scriptures. The Rig-Veda, one of the oldest repositories of human knowledge written between 4500-1500 BC mentions the use of 67 plants for therapeutic purposes, the Yajur-Veda enlists 81 plants, whereas the Atharva-Veda written sometime in 1200 BC describes 290 plants. *According to an estimate, about 80 per cent of the raw material for the drugs used in Indian systems of medicine and homoeopathy are based on plant derived products that have helped to sustain the health of most rural people of India.*

It is reported that the North-Eastern States, which have an almost 47 per cent forest cover, contain rich medicinal flora. Assam alone is stated to contribute 3,000 species of plants, which are used in indigenous systems of medicine.

A dictionary of Indian Folk Medicine and Ethnobotany by noted ethnobotanist Dr S.K. Jain (1990) also enumerates some 2,500 Indian plant species and 15,000 folk uses. There are nearly three lakh registered practitioners of plant based traditional health systems of medicine (Classical system like Ayurveda etc and local or folk—an autonomous community-supported system of health delivery at village level). A survey revealed that nearly 540 plant species are being used in different formulations by various pharmaceutical concerns in India.

The estimated annual production of herbal drugs which was around Rs. 100 crore in 1991 is expected to increase to Rs. 4,000 crore by the turn of the century. Unquestionably, India is one of the foremost countries in the use of plant based products to cure diseases.

Deforestation and overexploitation of medplant flora

In recent times, continuous and often indiscriminate collection and deforestation activities from diverse ecosystems, coupled with destruction of natural habitats have resulted in irreplaceable loss of valuable genetic diversity. Satellite imagery revealed that the country was losing on an average 1.3 million hectares of forests per year. *As a result, a number of medicinal plant species have also become vulnerable to extinction. The problem is further aggravated because, the bulk of plant raw materials is still collected from the wild much before the onset of their seed setting, through untrained and unskilled labourers to earn their livelihood in response to the ever-increasing demand and export potential, thus posing a great challenge to the survival of this traditional health care system.* Over 95 per cent of the medicinal plants used by the Indian industry today are reported to be collected from the wild.

In the 'Red Data Book of India', out of 45,000 plants species, 1,000 species including many medicinal plants are reported to be threatened to extinction. Of these, 14 medplant species are endangered or are under immediate danger of loss while 35 are vulnerable mainly due to indiscriminate collection as well as excessive trade from natural population for commercial purpose.

High value species are naturally the most threatened of the lot. For instance, the Himalayan Yew (*Taxus wallichinna*) which grow mostly in the Eastern Himalayas is now in great demand globally due to its anti-cancerous properties. During the last 2-3 years, about 548 metric tonnes of yew derivates are reported to be exported. It is now considered as a rare tree. In Himachal Pradesh—the major producer of medicinal herbs in the country, more and more medplant species such as Dioscorea, Ephedra and Berberis, are reported to be reaching the extinction level.

The Foundation for Revitalization of Local Health Traditions, Bangalore currently engaged in medplant conservation in the three South Indian States of Kerala, Karnataka and Tamil Nadu has listed 74 South Indian medicinal plant species under the rare, endangered and threatened category and marked for priority conservation action in Southern Penisular India—South Western Ghats, which has been included in the IUCN's list of 18 global biodiversity "Hotspots".

Thus, the present scenario shows a great threat to continuing availability of the target species, particularly of those whose roots happen to contain the desired chemicals or which take long time to generate and are endemic to particular area as in the case of Himalayan Yew. We may now be losing species that we do not even know but, which could perhaps in the future may yield better medicines. *Furthermore, indigenous populations and their knowledge are threatened with destruction.*

Traditional practices: need for revitalization

There is a great challenge to the survival of traditional life support systems of medicine, particularly for meeting the primary health care needs of the rural/tribal people, who have no access to modern medicine. These rural people mostly rely on medplants, which are administered by traditional health workers (Vaidyas, Dais et al). It has been estimated that 90 per cent deliveries in India are performed by *Dais* and 80 per cent of the fracture cases are treated by traditional bone-setters. Identifying themselves as part of the ecosystem, these tribal/rural people and forest dwellers have acquired practical knowledge about the ecosystem functions; interdependence of floristic and faunistic species, reproductive growth and productivity and the ecological relationship between human society and their living and non-living environment. For example, tribals' faiths, taboos and practices have helped in conservation of many species, viz sacred plants like 'Tulsi', 'Bel', 'Pipal', 'Vat', etc all of ethno-botanical significance as well as valuable in indigenous system of medicine. These people are the repository of accumulated experiences and knowledge of indigenous flora and fauna. Thus, in the rural scenario, local or folk health traditions, which are self-reliant in nature, socially and environmentally closer to the masses, are rooted deep in the community's traditions and knowledge systems. *In these practices the material, knowledge, experts and the patient all are derived from the locality itself, while in the organized systems of medicine practitioners are becoming dependent on pharmaceutical preparations.* Yet, it is being felt that the scientific component must be strengthened for revival and revitalization of traditional/herbal remedies focusing on quality control of plant-derived products by using modern techniques. A recent status report on ethnobotanical investigations has revealed that out of 7,500 wild species used by tribals in India for medicinal purposes, about 950 are found to be new claims and worthy of attention for scientific validation. However, what worries today is the interference in their habitat due to rapid industrialization and urbanization. This, in turn, endangers the rich heritage of knowledge and expertise of age-old wisdom of the traditional communities, habitats where they lived, their economic basis and the environment in which the folklore evolved on the use of wild flora—which need to be revitalized and strengthened.

Medplant cultivation and production of drugs

To meet the required demands of raw material of specified standards—rich in active ingredients—efforts are being made to use modern biological approaches including biotechnological applications such as cell and tissue culture, and recombinant DNA technique, etc to standardize and improve agronomic practices and plant varieties for production of plant drugs of established economic value of new formulations based on traditional remedies. Specific efforts are being made to validate the claims of traditional drugs; modernise their production and develop appropriate formulations for large-scale commercialization; dosage forms and quality control standards; *ex-situ* and *in-situ* conservation approaches and broad spectrum biological screening of plants in search of new drugs, etc. In India, several ICAR institutions, CSIR institutions like the Central Institute of Medicinal and Aromatic Plants, Lucknow, and Regional Research Laboratories at Jammu, Jorhat and Bhubaneswar and several universities are engaged in the promotion of R&D in cultivation and plantation sector including chemistry, pharmacy and technology related to their components and compositions. Many of them have identified and

developed cultivation practices for important medplant species and are involved in developing propagation protocols for endangered species like *Nardostachys jatamansi, Picrorhiza kurroa, Podophyllum hexandrum, Saussaurea lappa, Valleriana wallichii,* etc. Some of them have been reintroduced into their native habitats after regeneration through *in vitro* methods. Besides, for the production of standardized herbal drugs, clinical trials have been initiated by the Indian Council of Medical Research to ensure therapeutic efficacy of traditional herbal remedies in the areas of anal fistula, bronchial asthma, diabetes, filariasis and viral hepatitis, etc. Such R & D efforts will pay dividends to the farmers and traditional healers in the field as well. They will often relearn local lore, reacquiring their own heritage, while gaining the benefit of scientific precision in establishing dosages etc. Besides, adequate research will not only recall which cures are beneficial, but also which are not, thus affording protection against harmful treatment.

Conservation and promotive efforts

In a country like India, where over 75 per cent of the population live in villages, there is a need for a well-focused approach to repopularize and restrengthen traditional health care practices at the grass-roots level with the emphasis on household herbal remedies for common ailments: common cold, bronchitis, tonsilitis, diarrhoea, constipation and oral hygiene, etc. Establishing support from local resources and local people for healing common and frequent ailments of the rural poor becomes crucial at this juncture. Providing practical guidance on modern nursery techniques for raising a primary health care package of medicinal plants at household and community level; self-help processing and preparation of educational material on local resources and practices would result in spreading awareness on the strengths and utility of local health practices. In this process, it becomes imperative to organise and involve practitioners of folk medicines, practising *dais* and *vaidyas* in mobilising and training village people especially womenfolk because of their age-old association with agricultural activities and responsibility for taking care of their families. The need is to provide them technical back-up support and scientific training in identification and use of plant and plant parts, proper collection time and season, diagnosis of common diseases, preparation for therapeutic application, storage and preservation and knowledge about the use of plants for various health disorders focusing on economic and ecological value. *The cultivation of medicinal plants can also be conveniently linked with the production of leafy vegetables and fruits with high nutritive value that should be of particular benefit to women and children in rural areas.*

Grass-roots endeavours: At the grass-roots level, various developmental field groups have been able to give the desired momentum to such an approach in different parts of the country.

In Tehri Garhwal region, Jan Vikas Sansthan, Chirbatia situated at the height of 7,200 feet above sea-level, is involved in organizing village people especially the womenfolk in upgrading their local skill and knowledge about the sustainable use and conservation of medplant flora of that region. These trained womenfolk are actively involved in developing nurseries of important medplant species and in preparing herbal products like dental powder and incense from abundantly available local herbs like Bajradanti, Timur, Samewa, etc leading to substantial source of income to women and most importantly the judicious use of local medplant flora. As in the case of Timur herb, which was traditionally used by the women in that area for fire due to ignorance is now being protected by this group by creating awareness about the medicinal use of this herb especially its seeds to cure toothache.

Jagaran Jan Vikas Samiti, another developmental field group based in Udaipur working amongst the tribals in Rajasthan has been able to reorganize and strengthen the traditional health workers locally called 'Gunies' by organising training camps and establishing herbal gardens through sharing of knowledge, upgradation of skills and documentation of folk/traditional knowledge and beliefs about the plant based health system at the village level. Growing medicinal plants *vis-a-vis* the diseases prevalent in the area has helped a lot in renurturing this system; conserving local medplant flora and meeting the demand of Gunies for plant material to cure diseases. *The group has also evolved a novel method of imparting training to rural people by composing songs which describe the causes, symptoms and cures for common diseases.*

As a national conservation strategy, *in situ* conservation of wild flora in the form of biosphere reserves, national parks, sanctuaries, genetic reserves, etc is through a protective area network. Today, India has a wide network of 67 national parks and over 400 sanctuaries and reserves. Several NGOs and government agencies are involved in establishing nurseries for supply of quality plant material for medicinal plants for primary health care and economic plants for industry. The Department of Biotechnology, Govt. of India recently set up a network of three national gene banks (located at the Central Institute of Medicinal and Aromatic Plants, Lucknow; National Bureau of Plant Genetic Resources, New Delhi; and Tropical Botanic Garden and Research Institute, Thiruvananthapuram) to strengthen medium and long-term storage and conservation of important medicinal plant species covering different biogeographic regions of the country.

Benefit sharing with indigenous people

With the involvement of traditional health workers and developmental field groups, village Panchayats can effectively work on conservation and propagation of local medplant flora and rapidly disappearing knowledge in this area, ensuring active participation of the people as beneficiaries as well as guards to avoid exploitation by middlemen and sustainable utilization of such precious germplasm—based on protection, production and participatory approach. *The need of the hour is to to ensure that forest-dwelling indigenous people whose knowledge was the basis on which the drug was discovered, should get maximum benefits.* According to FAO report (1993) on the current threats to the world's biodiversity, *"the world market value of medicines derived from plants used in traditional systems exceeds $43 billion; less than 0.01 per cent of the profits have gone to the indigenous people who led researchers to them". This underscores the need to protect the rural people's interest; regularising germplasm collection/*

export, and evolving appropriate measures for protecting the rights of the communities/tribal/farmers groups who have acted as custodians of the precious germ-plasm resources, conservation traditions and folk knowledge of local ecology for many centuries. Further, population stabilization becomes the most urgent necessity to achieve the health for all in view of linkages between poverty, population growth and the environment. In this context, the role of traditional plant based system needs to by evaluated. Neem (*Azadirachta indica*), native to the Indian subcontinent whose medicinal and agricultural applications have been known for ages, has recently been reported to have a high potential as a 'safe contraceptive'.

Conclusion

The increased demand for medicinal plant products coupled with dwindling natural resource base calls for systematic and sustained multiplication and use of medicinal plants resource base involving local communities, R & D institutions and developmental field groups with stronger linkages for collaborative work to meet future demand on a sustainable manner. In view of this, it is essential to have an interface between traditional trends and modern concepts of production, marketing and technology, besides, creating manpower and knowledge through documentation, training and proper networking. Above all, to make the conservation strategy successful, it is essential to create region-specific inventories of medplant biodiversity of use in traditional medicine and related knowledge system, and legal protection in the light of mushrooming of biopiracy patents in recent years. With the advent of modern biotechnological tools, it is being felt that in the near future users may develop their own skill of producing the raw material in the laboratory under artificially created environment, depriving the ecosystem people of their bargaining edge. Hence the need to develop institutional mechanisms for judicious benefit sharing after development of products from bio-resources and knowledge systems. *Any erosion in the medplant biodiversity and any efforts aimed at breaking down people's access to and control over biodiversity as a whole will be detrimental to the very process of sustainability.* Needless to say, it is high time to make attempt for more forest and open land for the natural growth of medicinal plants as well as to document the rapidly disappearing ethno-botanical knowledge in rural areas.

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● *The author is with the Science & Society Division, Department of Science & Technology, Technology Bhavan, New Mehrauli Road, New Delhi-110016. The article is based on his paper "Strengthening Medplant Resource Base & Traditional Health Practices: Present Status & Planning for a Conservation Project in India & UK", presented as part of the individual study activity during the training course attended by him on "Planning of Projects for Biodiversity Conservation" held at the University of Bradford, Bradford, UK from 3 February to 27 March, 1997.*

Plants, People and Medicine

When pain or injury or disease struck, early man had little choice but to turn to plants. Developed empirically, by trial and error, many herbal treatments were nevertheless remarkably effective. Then medicine became theoretical. The belief arose that the harsher the treatment, the better. Herbal medicine fell out of favour, branded as ignorant superstition. Change came when formal medicine opened its doors and let the light of modern science shine in. Now, the new medical science is reaffirming much of the old herbal lore and extending the horizon of botanical medicine. (*Magic and Medicine of Plants*, 1986)

Bioresources of medicinal and aromatic plants in India : their conservation and related issues

B.M. Singh and P.L. Gautam

With about 2500 plant species used by traditional healers and about 500 varieties utilized by pharmaceutical firms, India occupies an enviable position in medicinal plant wealth. In view of the increased threat to our priceless bioresources, their collection, conservation, documentation and scientific management have now emerged as a priority concern. The National Bureau of Plant Genetic Resources (NBPGR) under ICAR is poised to play a crucial role towards this direction. The bureau is fully geared up to assume the role of a centre for human resource development in plant genetic resources related activities involving the custodians of the bioresources like farmers, NGOs, community organizations et al. Discussing the various facets of the challenge, the authors call for a system approach towards a well programmed national action plan on management, conservation and use of the priceless gift of nature.

The heritage of medicinal plants use in India has an ancient history. The *epic of Ramayana* witnessed *Sanjivani Booti* as life saving drug. Two important compendia on medicinal plants, ie *Charaka Samhita* and *Sushruta Samhita* were published between 1000 BC and 600 BC. In these *Ayurvedic* literature, uses of more than 1,200 plant drugs along with their action and specific therapeutic applications are mentioned. *Charaka* made 50 *vargas* (groups) of drugs while *Sushruta* made 38 *ganas* (groups) of drugs.

India: home of medicinal plants

According to a reasonable estimate, around 70 per cent of Indian population still rely on herbal medicines for various ailments. Apart from classical systems practised, viz *Ayurveda, Siddha* and *Unani*, innumerable local folk medicinal traditions exist. In all, over 7,000 plants are known to be used for medicinal purposes (Holley and Williams, 1996). The World Health Organization (WHO) has listed over 21,000 plant species that have been reported for medical uses the world over. In India, about 2,500 plant species belonging to more than 1,000 genera, are used by traditional healers and about 500 plant species are utilized by 159 different pharmaceutical companies (Chandel *et al*, 1996).

India's diverse agro-climatic and regional topography, the preponderance of indigenous tribal populations and their ethnic groups have contributed immensely to the diversification of medicinal and aromatic plants over a period of time. Of the 18 hotspots of biodiversity identified in the world, two are located in India, viz Western Ghats and North-Eastern region, both rich in medicinal and aromatic flora.

Indian forests show a rich component of the medicinal plants. All the eight phytogeographic regions are rich home of medicinal plants. Table 1 presents the species diversity in the eight phytogeographic regions.

Saving the endangered species: The most disturbing fact in recent times is that several species of medicinal and aromatic plants have reached endangered/threatened status due to large-scale and unregulated collection of germ-plasm from forest areas. The *Red Data Book* of India which listed 10 species in 1980 has increased the number to 35 and all are of medicinal value (Table 2). These endangered species deserve special attention as we need to understand their reproductive biology, genetic architecture and evolutionary relationship to ensure their establishment and multiplication in botanical gardens, herbal gardens and biological reserves.

The factors contributing to this alarming situation are (i) high pressure of local communities, and lack of protection of these species; (ii) increase in pharmaceutical industries and their demand for naturally growing plant-based raw material, (iii) poor regeneration of the species in natural habitat.

TABLE 1
Diversity of Medicinal and Aromatic Plants in Indian Gene Centre

Region	*Species diversity*
Western Himalayas	*Atropa belladona, Aconitum spp., Alliums, Adhatoda zelanicum, Berberis spp., Bunium persicum, Centella asiatica, Colchicum luteum, Dioscorea spp., Ephedra gerardiana, Ferula spp., Gentiana kurroo, Holarrhena antidysentrica, Inula racemosa, Mentha spp., Nardostachys jatamansi, Ocimum spp., Orchis latifolia, Picrorhiza kurroa, Rheum spp., Swertia chirata, Sassurea lappa, Thymus serphyllum, Terminalia tomentosa, Valeriana grandiflora, Zingiber spp.*
Eastern Himalayas	*Aconitum spp., Berberis spp., Chlorophytum urundinaeum, Cinnamomum, Coptis teetha, Curcuma, Dioscorea spp., Gentiana, Kurroo, Mentha, Nardostachys jatamansi, Podophyllum*

	hexandrum, Piper spp., Rheum spp., Rauvolfia serpentina, Swertia chirata, Taxus baccata, Valeriana grandiflora.
North-Eastern Region	*Aristolochia bracteta, Alpinia galanga, Aquallaria Agallocha, Coptis teetha, Curcuma spp., Cymbopogon spp., Centella asiatica, Clerodendron spp., Dioscorea, Hydnocarpus kurzii, Mucuna pruriens, Mucuna nigricans, Piper spp., Rauvolfia serpentina, Smilax chinensis and Solanum spp.*
Gangetic Plains	*Aegle marmelos, Cassia fistula, Crataeva nurvala, Curcuma spp., Dioscorea, Pluchea lanceolata, Psoralea corylifolia, Phyllanthus fraternus, Sida spp., Tinospora cordifolia, Terminalia spp., Vetiveria zizanoides and Zizyphus spp.*
Semi Arid Region	*Aloe barbadensis, Balanites aegyptiaca, Boswellia Serrata, Calotropis procera, Citrullus colocynthis, Commiphora wrightii, Diospyros melanoxylon, Tribulus terrestris and Withania somnifera.*
Western Ghats	*Amomum aromaticus, Curcuma spp., Chlorophytum, Cinnamomum tamala, Elettaria cardamomum, Piper niger, P. longum, P. betel, Strychnos nuxvomica, Terminalia spp., Zingiber.*
Eastern Ghats	*Alstonia scholaris, Azadhiracta indica, Boswellia serrata, Curcuma spp., Cassia fistula, Curuligo orchioides, Celastrus paniculatus, Clerodendron serratum, Diospyros spp., Dioscorea, Grewia spp., Hemidesmus indicus, Luptadenia reticulata, Phyllanthus amara, Plumbago zeylanicum, Pterocarpus marsupium, Santalum album, Terminalia spp.*
Andaman & Nicobar Islands	*Terminalia bialata, Pandanus fasicularis, P. leatus, Aglaia argentea, Alstonia macrophylla, A. kurzii, Amomum fenzil, Ardisia solancaea and B. other Ardisia spp., Costus speciosus, Dischidiabenngalessi, Myristica elliptica, Phyllanthus gomphocarpus, Uncaria ferrea.*

Source : Veena Gupta et al, 1997.

TABLE 2
Endangered Medicinal and Aromatic Plants in India

Plant name	*Trade name*
Podophyllum hexandrum	Bankakri
Nardostachys grandiflora	Jatamansi
Ferula jaeskuena	Indian Hing
Chlorophytum spp.	Safed Musli
Picrorhiza kurroa	Kutki
Orchis latifolia	Salam panja
Eulopia campestris	Salib misri
Aconitum heterophyllum	Patees
Commiphora wrightii	Guggal
Panax pseudo-ginseng	Indian Ginseng
Dioscorea deltoidea	Steroidal Yam
Rheum astrata	Rwead chini
Saussurea lappa	Yogisapada
Coptis teeta	Mamira
Curculigo orchioides	Kali musli
Brunium persicum	Kala Zeera
Colchicum lutium	Suranjan-I-Talah
Inula racemosa	Pushkar mool
Onosoma bracteatum	Ratanjot
Ephedra gerardiana	Somlata
Piper cubeba	Kabab chini
Microstylis mucifera	Jeevika
M. wallichii	Rishvak
Taxus baccata	Talispatra
Atropa acuminata	Indian Belladona
Lavateria kashmiriana	Resha Katuri
Swertia chirata	Chirayata
Polygonatum cirrhifolium	Maha Meda
P. verticilatum	Meda
Roscorea procera	Kankoli
Lilium polyphyllum	Kshira kankoli
Anchusa strigosa	Gaozaban
Concinum fariestatum	Jeevani
Holostema annulure	Kasturi manzil
Aristolochia bracteata	Kiram

Source : Gupta and Chadha, 1995.

Conservation strategies

In 1972, the Indian Forest Act was enacted due to the rising demand for wild medicinal plants in the organised manufacturing sector. Under this Act, the export of wild growing *Sarpgandha (Rauvolfia serpentina)* and some other plants like *Nardostachys jatamansi, Aconitum* sp., *Podophyllum hexandrum, Dioscorea deltoidea*, etc was banned because of overexploitation. Today, the preservation of this medicinal diversity is of prime importance and needs to be addressed adequately on high priority basis.

Two basic approaches of conservation have been identified, viz *ex situ* and *in situ*.

Ex-situ conservation approach

It requires maintenance of germ-plasm outside their original habitats. The diversity is being conserved in *field gene banks, seed genebanks, in vitro genebanks and cryobanks.* The *ex situ* conservation, however, lacks the natural evolution process that is always operative in nature.

(i) *Field genebanks:* This involves maintenance of collections in fields, herbal gardens and botanical gardens. The clones are maintained *in vivo* in green houses or as field planting. Although field genebank assures ready supply of planting materials, it requires considerable space and high costs.

(ii) *Botanical gardens:* The conservation of living plants in botanical gardens involves substantial investments in terms of facilities and maintenance. Therefore, the scope has to be limited accordingly.

There are about 1,500 botanical gardens and *arboreta* in the world (Heywood and Heywood, 1991). Needless to say that such gardens can contribute immensely be generating information on seed physiology, reproductive biology and on the techniques of propagation, maintenance and protection.

The main limitation in conserving threatened species in such

gardens is that the species suffer from inadequate population/ genepool, as they have limited individuals to represent genetic diversity..

(iii) *Herbal gardens:* These are more specific and specialize mainly on cultivation and maintenance of medicinal plants.

A number of herbal gardens are being maintained at various universities, States and the private sector. Gupta (1993) has reported that the Ministry of Agriculture (Horticulture Division), Govt. of India has sanctioned funds to set up 16 medicinal plants gardens in State Agriculture Universities (SAUs) and research institutes all over the country. These gardens will collect and maintain diversity in 100 economically important plants and 35 endangered species in their respective regions. *Such herbal gardens not only help in conservation of important species but also create public awareness by holding short-term training programmes for students, farmers and growers.* The National Bureau of Plant Genetic Resources (NBPGR), New Delhi under the Indian Council of Agricultural Research (ICAR) and its regional stations at Bhowali, Shimla, Shillong and Thrissur are actively engaged in collection and conservation of medicinal plants.

(iv) *Seed genebanks:* A major global emphasis on conservation of germ-plasm diversity has been to conserve *ex situ* in long-term repositories called genebanks. India ranks fourth among the best maintained, voluminous genebanks and has been able to conserve over 1.63 lakhs of seed samples of different agri-horticultural crops through Indian Plant Genetic Resources System (In-PGRS). The recently added new genebank facilities at NBPGR, New Delhi, include 12 long-term modules maintained at –20°C and one medium-term storage module at 10°C. Further, medium-term storage facilities have also been provided in the network at some of its regional stations and at National Active Germ-plasm Sites (NAGS).

This enhanced capacity of the National Genebank can accommodate 10 lakh seed samples. The workshop on "national concern for management, conservation and use of agrobiodiversity" recently held at Shimla (October 15-16, 1997), recommended that the National Genebank be declared as national heritage. All the participants in the workshop were requested to deposit germ-plasm of different crops (including medicinal plants) in the National Genebank at NBPGR.

In order to further strengthen conservation activities of medicinal plants, a proposal on "Establishment of G-15 Genebank for Medicinal and Aromatic Plants (GEBMAP) was approved for implementation in the 'Summit at Caracas' by the group on South-South Consultation and Co-operation (G-15 countries) in November, 1991. As part of this programme, the Department of Biotechnology, Government of India, has identified NBPGR as one of the three centres recognized to carry out survey, collection and conservation of medicinal and aromatic plants in north and north-west Himalayas. Rajasthan and Gujarat and adjoining northern plains are also to be covered by its network system.

Two more genebanks set up under G-15 (GEBMAP) are located at the Tropical Botanic Garden and Research Institute (TBGRI), Thiruvananthapuram and the Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow.

The G-15 genebank at NBPGR, New Delhi, became operational in 1993. The programme has four major components, viz, field genebank, seed genebank, *in vitro* genebank and cryobank.

(v) ***'In vitro' conservation:*** The *in vitro* technology has witnessed tremendous advancement during the past four decades. Every plant part (root, stem, leaf, hypocotyl, axillary buds, embryo, single cell and naked protoplast) can be grown successfully in culture under completely asceptic conditions. With this technology, tropical or temperate plant species can be maintained on normal or modified culture media, in normal culture room (25 to 28°C) for a number of years.

At NBPGR, New Delhi, *in vitro* genebank conserves 'threatened species' of medicinal and aromatic plants in nutrient media. Concerted efforts have been made towards evolving simple, efficient and economical protocols that ensure rapid multiplication and genetic stability of germ-plasm.

The status of *in vitro* conservation of threatened species of medicinal plants at NBPGR is given in Table 3.

TABLE 3
In vitro Conservation of Threatened Medicinal and Aromatic plants at NBPGR

Plant species	*No. of collections*	*Storage temp. (°C)*
Allium tuberosum	1	10
Coleus forskohlii	8	25
Crocus stivus	1	25
Chlorohytum spp.	2	—
Digitalis lanata	3	25
Gentiana kurroo	1	10
Kaempferia galanga	4	25
Mentha sp.	22	—
Orchis latifolia	1	10
Podophyllum hexandrum	1	25
Picrorhiza kurroa	1	25
Pogostemon patchouli	2	25
Rauvolfia serpentina	6	25
R. canescens	1	25
Rheum emodi	1	10
R. moorcrofitianum	1	10
Saussrea lappa	1	—
Tylophora indica	2	25
Valeriana wallichi	3	10
V. officinalis	1	—
Total	64	

Source : Chandel et al, 1996.

(vi) *Cryo-banks and conservation of germ-plasm:* The long-term conservation of vegetatively propagated species, orthodox and recalcitrant seeds can be achieved by using cryopreservation. The reproductive material such as tissues, pollen, embryo, embryonic axis and seed material can be preserved in liquid nitrogen (-196°C) and vapour phase (-150°C). NBPGR has created

a facility of this kind where 2.5 lakhs of germ-plasm lines can be stored through this technique.

The 'cryopreservation' strategy for long-term conservation is still in its infancy, as far as threatened species are concerned. However, NBPGR conserves 220 accessions of different crops belonging to 85 genera and about 100 species.

(vii) *DNA conservation:* DNA can be used for conservation of threatened species. Preservation can be in the form of *extracted DNA* or as *genomic DNA libraries*. Additionally, DNA can be extracted from dead tissues, ie herbarium specimens, providing information that would be otherwise lost if living tissues are not available.

In-situ conservation approach

The *in-situ* conservation, in contrast to the *ex-situ* approach, allows for continued, dynamic adaptation of plants to the environment. The distribution pattern of the wild PGR in different phytogeographical regions and the areas of their concentration where rich diversity of wild species still continue to perpetuate is of special significance for undertaking programmes on their *in-situ* conservation.

In-situ conservation of wild flora through protected habitats and ecosystems is being implemented by the Ministry of Environment and Forests, Govt. of India. Fourteen biospheres have been identified on the basis of survey of data. Seven of them are already being made operational under UNESCO's Man and Biosphere (MAB) project. The NBPGR, New Delhi, has active collaboration with the Ministry of Environment and Forests in establishing the first Biosphere Reserves on *Citrus* genetic resources in Meghalaya.

In-situ approaches have to be different in the case of cultivated and non-cultivated genetic resources. Wild relatives of crop plants require an altogether different approach. Inventories are required to be prepared for each target area using public information/ literature, herbarium collections and satellite imageries.

To strengthen the *in-situ* conservation of the medicinal plants resources, Chandel *et al* (1996) cited three critical factors to be incorporated in all conservation oriented programmes : (i) prevention of the destruction of populations and their habitats; (ii) maintenance and/or enhancement of the population level and variability; (iii) prevention of collection and excessive commercial exploitation.

Future thrust

(i) Areas/habitats where genetic erosion is under severe threat should be identified.

(ii) *Ex-situ* conservation should be given top priority which may be supplemented in a big way by *in-situ* for rare and endangered species of medicinal and aromatic plants.

(iii) *There is need to chronicle ethnic/traditional knowledge and practices at the national level. Indigenous knowledge is closely related to the environment that the people live in.* The close interactions between plant genetic resources, the environment and local people/farmers will generate the basic sources of indigenous knowledge in the community in the arena of PGR conservation.

(iv) *PGR literacy campaign and human resource development:* The stress for the future is on mass education on plant genetic resources. It has been realized that there is need to look at the student group, the future leaders and citizens who will manage the PGR in the country. In fact, the PGR subjects should be introduced in the school curriculum. In order to take up such a work of national dimension, NBPGR, New Delhi, may set up a "PGR literacy campaign wing" to take up this work in an aggressive way. Community participation, involvement of tribal groups, NGOs, different government agencies, SAUs in this effort will go long way in achieving the goals on a sustainable basis.

Certain villages in critical areas, ie Centres of Agro-biodiversity in medicinal plants be identified and villagers in those areas be trained in conservation methods. Of course, they should be provided with incentives.

NBPGR has been deeply involved in HRD and PGR related activities since its inception in 1976. Several training programmes, workshops/consultations on various PGR aspects sponsored by FAO/IPGRI/UNDP have been organised successfully for the participants from South and South-East Asian countries. Around 350 scientific/technical staff from various ICAR institutes, SAUs, NGOs and other organizations have been trained through regular programmes conducted by NBPGR, New Delhi. Apart from that about 700-800 undergraduate students from different agricultural/ traditional Indian universities visit NBPGR every year as part of their education tours. They get full exposure as regards PGR activities in the Indian context. NBPGR is fully geared up to assume the role of a centre for human resource development in plant genetic resources related activities.

Of late, M.Sc. course on Plant Genetic Resources has been initiated at NBPGR in collaboration with Indian Agricultural Research Institute (IARI), New Delhi.

(v) *On-farm conservation of local and indigenous germ-plasm:* On-farm conservation of traditional, indigenous germ-plasm/ cultivars is finding increasing attention by several groups and stakeholders. The community organizations, NGOs and farmers have evinced keen interest through their involvement in the efforts towards sustaining the indigenous medicinal and aromatic plant resources in close co-operation with local farmers.

The agreed scientific principles and practices for 'on-farm conservation' of medicinal plants in particular and other agro-biodiversity in general is lacking. *The capacity building for on-farm conservation requires formulation of suitable policies, sectoral and cross-sectoral mechanisms.* It shall be more appropriate to encourage 'on-farm conservation' of the identified niche *in toto*, encompassing landraces (primitive cultivars), the cultivation practices and the farming systems (Paroda, 1997).

(vi) *World Information and Early Warning System (WIEWS)*

on plant genetic resources: The FAO has initiated the WIEWS on PGR as required under Article 7-1 (e) and (f) of the International Undertaking on PGR.

The World Information System's primary function is the information service regarding 'facts and figures' on plant genetic resources. The system is open to and responsive to queries from the wide community of genetic resources scientists and users, viz national programmes, international organizations, NGOs, private industry, individuals, etc. A large number of simple queries are being handled such as, where to find germ-plasm of a given species and/or origin, who is researching on a particular problem, etc.

The Early Warning System's main function is to continuously watch on key elements of genetic resources conservation in order to alert against any threat. The warnings will be directed to the decision-making bodies when needed. It is planned to develop components on *in-situ* conservation, on-farm conservation and use, evaluation and utilization of PGR, research, training, biodiversity assessment related to biotechnologies and safe movement of genetic resources, etc.

(vii) *Convention of Biological Diversity (CBD) and conservation of bioresources:* The Convention of Biological Diversity is an international treaty which has come into force on 29 December, 1991. One hundred and seventy-one countries adopted the Convention and Agenda 21. India is a party to the Convention. It, *inter-alia*, requires the 'contracting parties' to take measures to promote access to genetic resources with prior and informed consent and on mutually agreed terms with a commitment on the recipient country to share the benefits of utilizing the resources thus transferred. The convention also requires that 'contracting parties' co-operate in order to ensure patent and other Intellectual Property Rights (IPRs) are supportive of and do not run counter to the objectives of the convention. Gautam (1997) and Gautam and Kochhar (1997) have discussed in detail the "intellectual property protection and benefit sharing" and related issues. The issues evoked and triggered off by CBD are both wide-ranging and basic. The concern is not only with biodiversity of the living things as such, its origin, mechanisms, functions and dynamics, but also with utilization and conservation. It has, thus, become a major subject to pursue, keeping the total perspective in view.

Conclusion

The bioresources of medicinal and aromatic plants are increasingly being threatened due to continued degradation of their habitats and over-exploitation of the natural resources. The collection, conservation, documentation and scientific management of these invaluable resources has now emerged as a priority area. In achieving this gigantic task, training component for the custodians of these bioresources (farmers, NGOs, community organizations), PGR literacy campaign for students at school and college levels is a must. NBPGR, New Delhi, is poised to play a very dynamic role in this effort.

A well-programmed National Action Plan on management, conservation and use of agro-biodiversity of medicinal and aromatic plants needs a system approach encompassing such components as agro-biodiversity appraisal; key players; mission mode approach; national networks; information networking; documentation; use of biotechnology and DNA fingerprinting; community gene-funds, national community gene funds; equitable sharing; public awareness campaign, etc.

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"Dasa Koopa samo vapi	**(Ten wells are equal to one pond;**
Dasa vapi samo hridaha	**Ten ponds are equal to one lake;**
Dasa hrida samaha putro	**Ten lakes are equal to one son;**
Dasa putra samo drumaha."	**Ten sons are equal to one tree.)**
—Vrikshayurveda	

Conservation of wild medicinal plants : need for a comprehensive strategy

N.C. Shah

In recent years, the pressure on medicinal plants, especially those collected from the forests has become so acute that many species have become vulnerable. The time is not far off when we would not only be deprived of the unique system of health care with herbs but also witness a grave threat to our biodiversity affecting the environment. This calls for a comprehensive and effective conservation strategy involving the rural people and tribal communities, experts in the field, policy-makers, pharmaceutical firms, exporters and NGOs. The role of the media in spreading awareness about the need to protect the medicinal plant wealth is crucial, the author opines.

The term 'medicinal plants' generally denotes those non-aromatic and aromatic plants, which are used for medicinal, perfumery, dye and cosmetic purposes. Spices and condiments also fall under this category. Generally, the whole plant, flowers, leaves, fruits, stem, roots or their bark, gums and oleoresins, etc are used. In India, the medicinal plants or herbs (the parts of the plant mostly dried) are used in (i) indigenous systems of medicine, ie Ayurvedic, Unani and Sidha; Tibetan system of medicine (mostly in border regions, ie Ladakh, Himachal Pradesh, Sikkim, etc); (ii) modern system of medicine; and (iii) homoeopathic system to some extent.

Importance of medicinal plants

It is roughly estimated that about 350 medicinal plants are collected from the wild sources in the country and used for various purposes. Many are those which have been collected from time immemorial and in recent years the pressure is so high that many have become vulnerable.

Apart from the above stated uses, the plants are used in folk medicines by various tribal and ethnic groups in India. Recently, patenting of uses of neem and turmeric under the Intellectual Property Rights, has led us to think of conserving the scientific information on various uses of plants. We lost the battle for 'neem' but won the turmeric patent case with the Council of Scientific and Industrial Research (CSIR) presenting to the US Patent and Trademark Office sufficient claims of uses for Haldi.

According to Alok (1991), it was estimated that there were 46,000 licensed pharmacies (covering the modern, indigenous and homoeopathic systems) in the country using the medicinal plants and now the number may have increased to 50,000. Besides, it is estimated that there are about 4,000 indigenous and modern perfumeries that manufacture and blend the scents and 'attar' from natural oils derived from wild-growing or cultivated aromatic plants. To cater to the needs of the pharmacies and perfumeries the herbs are either collected from the wilds or cultivated or imported. As already stated, a majority of plants are collected from the wilds. A number of such plants have become vulnerable or threatened. The words 'vulnerable' and 'threatened' do not necessarily refer to the ones described in the IUCN Red List Categories [IUCN (1994)].

This paper attempts to discuss the present status of vulnerable 'medicinal plants' from different phytogeographical regions of the country and suggests ways and means to conserve and preserve them. It also seeks to discuss a few salient points regarding Intellectual Property Rights for patenting uses of the medicinal plants.

A number of workers have drawn attention towards the threatened medicinal plants of India from time to time—Jain & Shastry (1980); Shah (1975), (1978), (1981) and (1983) regarding Kumaon Himalaya; Tandon (1996) and BCPP CAMP (1966) in respect of South India; and Kumar *et al* (1996) for the entire country. A brief discussion on the threatened plants is given below.

Endangered species : regionwise analysis

It would be easier to understand the threatened plants under the phytogeographical regions for this purpose. The regions and subregions are:

1. The western Himalayas with subregions; the north-west Himalayas or the Kashmir & Ladakh Himalayas; the west Himalayas or the Himachal Pradesh (Punjab) Himalayas and the UP Himalayas or the Kumaon Himalayas.
2. The eastern Himalayas with subregions; Darjeeling Himalyas; Sikkim Himalayas and the north-east Arunachal Himalayas.
3. The Indus plains and desert with subregions, Rajasthan western part and Gujarat.
4. The Gangetic plains with Punjab, UP, Bihar, and West Bengal.
5. The Deccan or peninsualr region of India.
6. The Assam consisting of all eastern States.
7. Throughout India up to 1500 m.

The threatened plants have been dealt with botanical names, local or common trade names. The abbreviations used are: In. [Indigenous industries mainly Ayurveda (A) and Unani (U)]; Fo. (in folk-lore); Mo. (Modern medicine); Pe. (perfumery); Con. (condiment); Ex. (Exported either in crude drug form or extracts); Dy. (Dye colour) Liq. (Liquor industry); Cos. (cosmetics). The parts of the plants used are indicated in parenthesis at the end of the description.

1. The Western Himalayas

Aconitum heterophyllum (ativisa, atis) (In. and Fo.): The plant is so much depleted in nature that genuine 'atis' is not available in market. Even if available, the cost will be very high ie about Rs. 600 to Rs. 700 per kg. The tuberous roots are developed in three years. No systematic studies for growing these with seeds or tissue culture techniques have been conducted. The plants could be grown in north-west Himalayas at the height from 2000 to 3000 m.; in west Himalayas from 2500 to 3500 m. (Parts used: tuberous roots).

Angelica glauca (cora, gandrayan, chipi) (Fo., Mod., Perf.): The native people mostly of western Himalayan region use the roots of the plant as condiment and for seasoning purpose and also as medicine. Its oil, recently extracted through distillation, fetches good price. The plants would be easy to grow in localities 2500 to 3000 m in wet alpine regions. (Parts used: roots and rhizome).

Atropa acuminata (sagangur, angur-sefa, Indian belladonna): It is found in western Himalayas and not in Kumaon Himalayas. The Britishers started its exploitation as a substitute for European belladonna for preparing medicines and belladonna plaster. This plant has also been exploited indiscriminately as it is used in modern medicine and Unani system of medicine. It is very much feared that there is every possibility of erosion of its germ-plasm. It is regrettable that notwithstanding its good demand in modern medicine, no efforts have been made for its systematic cultivation in the areas where it grows wild in nature. (Parts used: roots and leaves).

Bunium persicum (siah zira) [Con., In. (U) and Fo.]: The fruits are highly priced in the market ranging from Rs. 600 to Rs. 800 per kg. Though it is mentioned to be used in Unani system of medicine, it is very rarely used due to its prohibitive cost. It is either exported to Arab countries or sold in cosmopolitan cities. like Bombay, Delhi, etc. The local people due to its high value collect the fruits before they get matured and ripened leaving very little chance for their natural growth. (Parts used: fruits often called seeds).

Cochicum luteum (suranjan siri) [In.(U) and Fo.]: The roots are a source of colchicine, which has good demand in the modern system of medicine but the alkaloids are not extracted from this source as it is uneconomical. The plants have been left in a few localities, where these grow in stands. (Parts used: roots).

Dactylorhiza hatazirea and *Orchis habernarioides* (Both plants are used as salam panja, salab, hathajari) (In. and Fo.): These plants have also been exploited indiscriminately from the entire western Himalayas due to their high price of the tuberous roots. The present market rates are Rs. 800 to Rs. 900 per kg. Its micro seeds like other orchids germinate with great difficulty in nature; possibly, they need certain microflora for their germination. To meet the demand of the country it is being imported from Afghanistan and Nepal. (Parts used: tuberous roots).

Fritillaria foylei and *Lilium polyphyllum* (kakoli, kshir-kakoli) [In.(A)]: These two plants were earlier available and were used as one of the genuine ingredients of 'ashtawarga', an item used in 'Chavanprash' and now it is not seen. This is a typical example of those plants the phytochemistry of which had never been conducted, and we would lose not only the plant but also its chemical constitutents. (Parts used: roots).

Gentiana kurrooa (karu) [In.(U) and Liq.]: The plant has been so much depleted that it is difficult to trace a single plant in the western Himalayas. Earlier, it was exported as Indian gentian to Europe to be used as bitter in the liquor industry as a substitute for European gentian. (Parts used: roots).

Hedychium spicatu (kapur kachri, kachur) [In.(A) Per.]: Day by day its roots and rhizomes are being collected, from the western Himalayas mostly in Himachal and UP. (Parts used: roots & rhizome).

Jurinea dolomiae or *J. macrocephala* (dhup, guggul) (Pe.): The roots are extensively used in 'havan samagri' and in 'attar' industries. This commodity has great demand in perfumery industries. The worst affected area is Himachal Pradesh. (Parts used: roots).

Nardostachys jatamansi or *N.grandiflora* (mansi, balchar, jatamansi, Indian spikenard) (In., Pe., Fo.): It is available in western Himalayas only in Kumaon Himalayas and reported to occur in eastern Himalayas, but no information for its collection from this region. Presently, it is imported from Nepal to meet the domestic demand. It is collected illegally from Kumaon Himalayas and sent to the market through Himachal Pradesh. It is day by day depleting and no efforts have been taken to grow the plant through seeds and rhizomes, systematically. (Parts used: roots and rhizome).

Onosma bracteatum and *Macrotomia benthamii* (gaujuban and ratanjot) (In. Food colour): The plant grows throughout the Himalayas but extracted mostly from the western Himalayas. Its main use is colouring the syrups, meat and curries. (Parts used: roots with red papery bark).

Podophyllum hexandrum or *P. emodi* (ban-kakri, Indian podophyllum) [In.(U), Mo., Amchi or Tibetan system]: The roots yield resin podophyllotoxin, which is converted into a semi-synthetic compound known as etoposide. It is an anticancer drug for lungs and testes. In the early sixties, the drug was in good demand and it was heavily collected from the western Himalayas. Though, it is a banned item but its extract is being prepared by some of the pharmacies based in Himachal Pradesh. Roots are used in modern system of medicine and plant parts in Tibetan and Unani systems. No systematic study has been conducted for its cultivation. (Parts used: roots and plant parts).

Picrorhiza kurroa (kutki, karu) (In., Mo., Fo., Liq.): The plant

is under pressure in Himachal Pradesh and UP Himalayas. Presently, the country is meeting its extra demand from Nepal. The plant is a runner and could easily be cultivated through small pieces of rhizome. Recently, the CDRI has developed a medicine 'Picroliv' which is to cure liver troubles and this would further increase the pressure on the plant natural resources. (Parts used: roots & rhizome).

Rheum australe and *R. spp.* (revanda chini, dolu, Indian rhubarb) (In., Fo.): The plant is very much used in the folk system of medicine throughout the Himalayas in cuts and wounds, fevers, stomach trouble, etc. (Parts used: roots & rhizome).

Saussurea costus or *S.lappa* (kuth, quest-e-sirin) (In., Pe.): Originally the plant is native to Jammu & Kashmir and Pakistan. In J&K, the plant is virtually on the verge of extinction. Whatever quantity we receive in the market is from Lahaul & Spiti (HP), where it was brought under cultivation by the missionaries in the 1864. The plant was also brought under cultivation in 1931 in Bhuna in Chamoli district to meet the demand from China by the UP Forest Dept; but during the Second World War, the nursery was abandoned. Still there are about 50,000 plants in the nursery, Shah (1992) (1996). The market of the drug very much fluctuates due to perfumery requirement. The oil is exported to Grasse (France) where it is used in high grade perfumery. (Parts used: roots & rhizomes).

Swertia chirayata (chirayata, nepali-chirayata) (In., Liq., Fo.): Though the plant is distributed in the entire Himalayas but for medicinal purposes it is usually collected from the eastern Himalayas, mainly Darjeeling, Sikkim, where the plant attains vigorous growth and is much bitter. These plants are dwindling day by day. India meets her extra demand for the herb from Nepal. The present market rates of the herb is Rs. 80 to Rs. 90 per kg. (Parts used: whole plant).

Valeriana wallichii or *V. jatamansi* (asarun, tagar, sugandhbala. Valerian) (In., Pe., Mo., Fo., tobacco industry): Nowadays, there is much pressure on this plant in the western Himalayas. If the plant is systematically cultivated, then it would be a profitable crop as there is good demand for the herb in European countries. (Parts used: roots & rhizome).

Viola odorata and *V. canesoens* and *serpens* (banafsha, gulbanafsha) (In.): The plant is extensively used in 'doshanda', a Unani cough & cold tea and other Unani and Ayurvedic preparations. *V. odorata* is only found in J&K and has been much depleted. The other species are actually the substitute but also in good demand. (Parts used: whole herb and flowers).

The Eastern Himalayas

Coptis teeta (mamira, mishmiteeta, golden thread) (Ex., Fo., In.): Earlier, the plant was an important commodity of export to Arabian countries, where it is used to prepare corylium *(surma)*. The plant is indigenous to Mishmi hills and was sold by the tribals in small baskets as it is used to prepare a high quality corylium. The plant has been conserved by the Arunachal government and efforts are being made to cultivate it. The roots fetch good export market. Possibly, the Arabian countries have started importing the herb from China & Japan, where another species of *Coptis japonica* is found. (Parts used: roots).

Gaultheria fragatissima (Indian winter green) (Pe., Mo.): It is distributed in places of heavy rainfall like Khasya hills, and also in the Western Ghats, Nilgiris and Pulneys and Travancore (now part of Kerala) above 1,300 m. The oil of the leaves are much used in perfumery and in modern medicine in preparation of balms used for headaches and body aches. To get the leafy twigs, the plant is mercilessly destroyed and it dies after some time. (Parts used: twigs with leaves).

Panax pseudoginseng (tapmari) (Fo., Mo.): The plant is used as a substitute of *P. ginseng* the original ginseng and due to its high price and good demand the local people collect its roots and sell these to outsiders who come to collect it. The plant is ruthlessly collected in this region. (Parts used: tuberous roots).

The Indus plains and desert

Commiphora wightii or *C. mukul* (guggul) (In., Mo., Fo.): The plant is distributed in Rajasthan, Gujarat and occaionally in other parts of the country's hot valleys. Earlier, the plant was used in Ayurvedic and Unani systems of medicine. Now it is also used in modern medicine since CDRI has patented 'guggul lipid', a medicine used for lowering blood cholesterol. Thanks to its unscientific collection, the trees in the wild are dwindling due to premature death. Morphologically it is difficult to distinguish 'guggul' from other gums in the market. There is extensive demand for the gum-guggul. Plantation on a large scale is required to be taken up in dry hot valleys like Bhind and Morena (MP), Chambal (UP). (Parts used: gum oleoresin.).

The Gangetic plains

Curcuma caesia (narak-chur, kalihaldi) [Fo., In.(A)]: The plant is very much used by the tribal people for various diseases and ailments in West Bengal, Madhya Pradesh, Orissa, Bihar and UP. It is recorded that it used to be cultivated in Bengal in some localities. In Madhya Pradesh, the plant is regarded very auspicious and it is stated that the person who possesses it never experiences shortage of cereals and food [Shah (1982)]. This plant also needs a detailed scientific investigation like common 'haldi' before it is lost for ever. (Parts used: roots and rhizome).

Gymnema sylvestre (gurmar) [In.(A), Fo.]: Though the plant is not used in a big way in Ayurvedic system of medicine recently, there was a big demand from Japan and the plant is being collected. The aerial part with leaves are being exported to Japan, where it is said to be used with some synthetic compound for medicinal purpose possibly in some form of diabetes. (Parts used: leaves & twigs).

The Deccan

Coscinium fenestratum (marmanjil) [In.(A)Fo.]: The plant is a stout climber and in South India it is used in place of Daruharidra (*Berberis* sp.) as it also contains a good amount of berberine alkaloid. During the past 30 years, the pressure on this plant was so extensive that it has become vulnerable. (Parts used: stem).

Pterocarpus santalinus (Raktachandan, lalchandan) (In., Dy.): The plant is restricted to Andhra Pradesh and Tamil Nadu. It is a tree and is confined to some localities only. The red chips of stem are used in Ayurvedic system of medicine and as food colour in European countries. It is exported from the country in good quantity. Now efforts are on to ban its export. (Parts used: Wood-chips).

The Assam

Aquilaria malacensis or *A. agallocha* (agru, eaglewood) (Pe., Ex.): Only the fungal infected wood yields the 'agru' of commerce. It has such a rampant demand in Arabian countries that the uninfected trees were also cut down by the wood poachers. The 'agru' wood is mostly used by the rich Arabian Sheikhs as an incense burnt in a golden bowl. The essential oil is used in very high grade costly perfumery. The present market rate of the infected wood is about 60 to 80 thousand rupees per kg. It is mostly an export item though its export has been banned. (Parts used: infected wood).

Throughout the country

There are many plants which grow throughout the country but the pressure on their collection is day by day increasing. The root and rhizome of the plants which are used and are mostly under threat are briefly enumerated below. Their commercial use and the parts used are also indicated in parenthesis. The plants are: *Acorus calamus* (vacha, ghur-vacha) (In., Pe., Fo.) (rhizome); *Adhatoda vasica* (vasa, adusa) (In., Fo., Mo.) (aerial part); *Aloe barbedensis* (kumari, gheekaul, aloe) (In., Mo., Cos.) (leave mucilage); *Aristolochia bractelata* & *A. indica* (ishwari, visanika) [In.(A), Fo.] (whole plant); *Asparagus racemosus* (satawari) (In., Fo.) (tuberous roots); *Bacopa monniera* (Brahmi) (In., Mo., Fo.) (whole plant); *Chlorophytum arundanaceum* (safed musli) (In., Fo.) (tuberous roots); *Curcilago orchioides* (kali musli) (In., Fo.) (tuberous roots); *Gloriosa superba* (kalihari) [In.(A) Fo., Mo.] (roots & seeds); *Hemidesmus indicus* (anantamul) (In., Fo.) (roots); *Plumbago zeylanica* and *P. indica* (cheeta lakri chitrak) (In., Fo.) (roots); *pueraria tuberosa* (vidari-kanda) [In.(A), Fo.] (tuberous roots); *Rauwolfia serpentina* (sarpagandha) (In., Fo., Mo.) (roots); *Rubia cordifolia* (manjistha), (In., Fo., Dy.) (roots); *Withania somnifera* (ashwagandha) (In., Fo.) (roots).

It is true that with the speed with which the medicinal plants are being denuded from the wild resources, a time would come, when we would not only be deprived of health care through herbal medicines but also witness a disaster to our biodiversity threatening the environment. Therefore, necessary steps for protecting the vulnerable medicinal plant species have to be taken before it is too late.

Methods of conservation

***In-situ* conservation:** Herbal sanctuaries be established in those areas where we want to maintain the wild population of vulnerable medicinal plant species.

***Ex-situ* conservation:** The areas for collection of medicinal plant species be opened in a planned manner, ie the area should be given a rotational period for 4-5 years and then the area should be opened for collection purpose. The areas should be divided into the open sector and the closed sector periodically. Thus we would be able to get sustainable supply from the natural resources.

The best way is to bring the plants under cultivation. But cultivation of every plant may not be economical and such plants may be put under planned rotational extraction as stated above. Agro-technologies for each vulnerable species have to be developed so that if suitable time for their cultivation comes up, then it is immediately taken up.

Tissue culture techniques for those plants should be immediately taken up which are difficult to grow. Such laboratories should strictly be set up in the fields and not in cities.

Herbal gardens and field gene banks should be set up to study the life cycle of the plants and to undertake morphological and genetical studies.

The conservation of medicinal plant species is not an easy task; it may take years before any results could be achieved. It requires specially trained staff and awareness among the general public, especially the rural people about its importance.

Conservation strategy could not become successful unless and until we do not involve the target groups, such as the rural or tribal communities; medicinal plant experts; government policy-makers such as administrators and forest officials; the indigenous and modern pharmaceutical and perfumery companies and the exporters of medicinal plants and last but not least the NGOs who are in touch with the rural communities and tribal people. The media should bring about the general awareness for effectively implementing the programmes and the utility of each programme.

Intellectual Property Rights (IPRs)

This issue emerged recently when two scientists of Indian origin, University of Mississipi had filed a patent for the use of turmeric at the site of injury by topical application and/or oral intake of turmeric to promote healing of wounds. The patent was granted in March 1995. At the direction of Dr R.A. Mashelkar, Director General, CSIR, the patent was challenged through a leading US patent attorney. To prove that it is the Indian heritage, a vast literature on the uses of *haldi* was collected from all parts of India and presented as documentary proof. Unlike the 'neem' case, this case was won. In the words of Dr Mashelkar, "This is a significant development of far-reaching consequences for the protection of traditional knowledge base not only for India but also with other Third World countries." (Shah, 1997).

India is a vast country with ample knowledge of uses of a number of plants and many of those have not yet been properly identified. The only way is to record and document such information systematically under the indigenous knowledge system as a national property, which could easily be presented,

(Continued on page 33)

Role of sacred groves in conservation of biodiversity and protection of the environment

Rajendraprasad M., Krishnan P.N., and P. Pushpangadan

Sacred groves or Kavus are tracts of virgin forests, the vestiges of an ancient practice in which people protected forest patches to avoid the perceived wrath of Gods. A repository of medicinal plants, they represent a unique example of the all-embracing concept and practice of Indian way of in-situ conservation and protection of the environment. The increase in population coupled with developmental activities and the reckless promotion of tourism have threatened the very survival of these virigin forest patches. In Kerala, financial assistance is now provided for protecting the sacred groves besides the launching of an action plan to revegetate and protect the Kavus associated with the temples.

Protection of environment and life supporting systems is intricately interwoven with the conservation of biological diversity. The spreading of eco-consciousness everywhere and the role played by various agencies to promote this have partially succeeded in creating a new culture which considers deforestation and destruction of ecosystems as almost a sin. Sacred groves (*Kavus*) are tracts of virgin forests, the vestiges of an ancient practice in which people protected forest patches to avoid the perceived wrath of their resident Gods. *These sanctum sanctorum of rare and endangered and endemic plants combined with other biotic and abiotic components represent a unique example of the all-embracing concept and practice of Indian way of in situ conservation and protection of the environment.* The usual saying is that the sacred groves were preserved on behalf of the deity/deities and for generations people have restrained themselves from denuding these forest patches. The abiding sacredness of the flora and fauna was deep-rooted in the faith and culture of the ancient people of India. It was an ancient Indian culture to attribute divinity to material and objects, both living and non-living. The abundant occurrence of sacred groves all over the country is the living examples of such practices. Restraints excercised due to the fear of deity/deities/spirits concerned residing in the sacred groves thus help preserve the virgin forest patches. The eroding faith and belief in such divinity is now threatening the survival of these virgin forest patches.

Sacred groves of Kerala

Sacred groves or *Kavus* constitute an integral part of the life, culture and folklore traditions of Kerala. The myths, legends and faith gave divinity to the trees, the abode of Gods/Godesses or spirits. In Kerala, most *Kavus* are associated with the temples and old Namboodiri, Nair, and Ezhava *tharavadus*. Their distribution is mostly in the low land or midland and rarely in high lands of Kerala. Every *kavu* has a presiding diety in the form of *Naga (Nagaraja, Nagayekshi, and Nagakannya), Kali (Bhagawathi, Vanadevada, Vanadurga)* and *Lord Sastha (Ayyappa)* or some ancestral spirits. The religious rites performed in these groves are varied like *Sarpamthullal, Theyyam, Vechunivedyam, Noorumpalum, Poopada*, etc which are eco-friendly in nature. These age-old cultural and religious practices supported by religious beliefs directly or indirectly promoted conservation and sustainable utilization of these natural ecosystems.

In the census report of Travancore published in 1891, Lt. Ward and Lt. Corner reported the presence of 15,000 *kavus*. The area of these groves ranged from a few cents to many acres. The biggest surviving one is Iringole *kavu* of Perumbavoor village in Ernakulam district. With the inclusion of Kochi and Malabar provinces in Kerala, the number of *kavus* is very large. *Kavus*, once a regular feature in every village of Kerala, are being shrunk considerably or getting degraded due to several reasons. Well-to-do families and temples maintained their *kavus* with all pride. But the recent increase in population necessitated the need for more land for construction of buildings and developmental activities which are exerting great pressure on the *kavus*. There are instances of selling the whole land to others who have no faith in religious practices. In due course, the new owner clears the *kavu*. There are other cases where religious beliefs are still intact, but the deity is shifted to the well-known shrines to clear the *kavu*. This is particularly the case of many sacred groves, where the main deity is *Nagaraja*. Developmental activities of temples like expansion to accommodate additional deities, Chithrakoodam for the residing deities and to provide better amenities to the increasing pilgrims, etc are also causing shrinkage and at times even total disappearance of many *kavus* in Kerala. The indiscriminate collection of firewood, medicinal plants, cutting grass and other minor forest produce are other reasons for denudation of many *kavus*. *Recent developments like the promotion of tourism without adequate measures for conservation/protection lead to degradation and destruction of many kavus. Such deterioration can be seen in Iringole kavu, the*

biggest surviving kavu in Kerala. Also many developmental activities inside as well as outside the groves like road construction, water supply, etc are also adversely affecting the ecosystem and normal functioning of the kavus. For example, a pipeline is laid through the middle of the 10-acre Cheemani *kavu* from the pond situated beside the *kavu*, resulting in the formation of a footpath inside the *kavu*.

Islands of biodiversity

Although limited in area, the *kavus* of Kerala are distinct and unique in their biological diversity and ecosystem functioning. The climax type of vegetation in these groves exhibits enormous flora and fauna and the varied life forms depend on one another for their existence. Presently, the biotically rich evergreen forests of Kerala in terms of genetic variability and species diversity are depleting due to large-scale conversion to agricultural land, settlements, developmental activities and the overexploitation of natural resources. The religious worship and sacredness attributed to these *kavus* by the local people helped it to become sanctum sanctorum of rare and endangered species many of which have disappeared from the regions outside the grove. For example, Nair and Mohanan (1981) located the presence of an endemic endangered tree *Syzygium travancoricum* in a *Kavu* of Pathanamthitta district and Andallor Kavu in Tellicherry. This species is otherwise totally eliminated from its type locality. Similarly, an endangered tree species, *Vateria macrocarpa* found only in Muthikullam area of Palghat district was located in some sacred groves of Kozhikode and Kasaragode districts (Krishnan 1996). Many such endemic plants, which are on the verge of extinction and could be located in the sacred groves, are *Pheanthus malabarica, Blepharistemma membranifolia, Myristica malabarica,* and the light golden yellow flowered orchid *Vanda spathulata.*

The luxuriant growth of the vegetation is a remarkable feature of the *Kavus* of Kerala. The dominant families found in the *Kavus* are Fabaceae, Rubiaceae, Lamiaceae, Orchidaceae, Poaceae and Asteraceae. Evergreen trees are the most developed and conspicuous elements of the *Kavus* and most of the species are endemic to the Western Ghats of Kerala. These tree species usually of about an average 30-50 m height, consists mainly of *Artocarpus hirsutus, Alstonia scholaris, Anacolosa densiflora, Hopea parviflora, Hopea ponga, Callophyllum calaba, Diospyros ebenum, Holigarna arnottiana, Ficus recemosa, Ficus religosa, Mesua nagassarium, Vateria indica, Antiaris toxicaria,* etc. The second storey about 20-30 m height is composed of all the members of the first storey as well as species like *Garcinia gummi-gutta, Carallia brachiata, Mimusops elengi, Polyalthia fragrans, Hydnocarpus alpina, Hydnocarpus pentandra, Mangifera indica, Myristica malabarica, Knema atenuata, etc.* The third storey between 10-20 m consists mainly of *Aglaia elaegnoidea, Ixora brachiata, Meiogyne ramarowii, Acronychia pedunculata, Listsea coriceae, Nothopegia recemosa, Morinda pubescens, Polyaltia korinti,* etc. The monocots are represented by *Calamus travancoricus, Calamus rotang, Borassus flabelifera, Caryotta urens, Pandamus tectorius, Ochlandra travancorica, Bambusa bambos, etc.*

The ground flora is always represented with seedlings of the emergent and dominant species. In addition, many perennials and annuals are seen according to their sunlight requirement. The ground flora is commonly represented by *Myxopyrum smilacifolium, Piper spp., Dioscoria spp., Amorphophalus sp., Costus speciosus, Sesamum indicum, Amaranthus spinosa, Solanum wightii, Oldenlandia spp., Ipomea sp., Liparis sp., Gloriosa superba, Bhoerhavia sp., Achyranthus sp., Leucas sp., Phyllanthus sp., Plumbago sp.*, etc. Woody lianas represented in the *Kavus* are *Gnetum ula, Anamirta coculus, Cissus palida, Ichnocarpus frutescense, Strychonos minor,* etc and the straggling types like *Tetracera akra, Hugonia mystax, Mussaenda belilla, Morinda umbellata, Jasmimum sp., Connarus spp., Smilax spp., Ipomoea spp., Myxopyrum sp., Piper sp.* are very common. Dominant epiphytes found in the *Kavus* include *Hoya wightii, Fragaria,* orchids like *Vanda spp., Bulbophyllum spp., Cymbidium spp., Taenophyllum spp.*, etc are common. Pteridophytes represented in the groves are *Leptochinus decurrens, Drynaria quercifolia, Lepisorus spp., Drymoglosum spp., etc.* Among parasites, *Loranthus spp., Ficus spp., Fragaria, Santalum, etc* are very common.

According to the report of Balasubrahmanian and Induchoodan (1996), the floristic study conducted in 761 *kavus* of Kerala recorded 722 species of plants belonging to 129 families and 474 genera. They were spread over 108 dictos, 19 monocots and 2 gymnosperm families. Among the 722 species, 153 are endemic to peninsular India. Studies by Rajendraprasad (1995) and Rajendraprasad et al (1997) on the ecology and vegetation structure in 167 *kavus* report 318 species of higher plants under 247 genera belonging to 86 families. The status of the distribution of the genera reported at 1.3 per cent are very common, 5.2 per cent are common occurrence, 9.3 per cent often present, 19.6 per cent are seldom present and 64 per cent are rare, indicate the presence of diversity in the *kavus* of Kerala.

Kavus: a repository of medicinal plants

Medicinal plants are a set of natural resources and the traditional knowledge on the identity and uses of these plants are part of this great heritage of Kerala. Over the centuries, *kavus* of Kerala nourished and sustained the glorious traditions of systems like Ayurveda, Sidha and other local health traditions. The *Kavus* acted as an emergency medicinal chest. The overexploitation of roots of some wildly growing species like *Holostema ada-kodien, Rauwolfia sarpentina, Aristolochia indica, Nervilia prioniana, Amorphalus whittiana,* etc has now resulted in the non-availability of these raw materials. Interestingly, all these species are found in the *Kavus* of Kerala. Additionally, other important medicinal plants are also located in the *Kavus* (see table). Many wild relatives of cultivated plants like ginger, pepper, turmeric, cinnamomum, myristica, etc found in many *kavus* and therefore the *kavus* constitute precious gene pools valuable in genetic enhancement of these cultivated species.

TABLE 1
Some Important Plants Found in the *Kavus* of Kerala

Botanical name	Family
Adhatoda zeylanica Medico*	Acanthaceae
Aglaia elaeagnoidea (Juss.) Benth.	Meliaceae
Ancistrocladus heyneanus Wall. ex. Grah.	Ancistrocladaceae
Andrographis paniculata (Bur.f.) Wall.ex. Nees*	Acanthaceae
Aristolochia indica L.*	Aristolochiaceae
Artocarpus hirsutus Lam.	Moraceae
Asparagus racemosus Willd.*	Liliaceae
Asystasia travancorica Bedd.	Acanthaceae
Bacopa monnieri (L.) Natts*	Scrophulariaceae
Begonia floccifera Bedd.	Begoniaceae
Blepharistemma membranifolia (Miq.) Hous.	Rhizophoraceae
Buchanania lanceolata Wt.	Anacardiaceae
Calophyllum apetalum Willd.	Clusiaceae
Caseria esculenta Roxb.	Samydaceae
Cassia fistula L.*	Caesalpiniaceae
Centella asiatica (L.) Urban*	Apiaceae
Cinnamomum malabatrum (Bur.f.) Bl. et Pr.*	Lauraceae
Cissampelos pareira L.*	Menispermaceae
Clausena heptaphylla (Roxb.) Wt. & Arn.*	Rutaceae
Coffea travancorensis Wt. & Arn.*	Rubiaceae
Curculigo orchioides Gaertn.*	Hypoxidaceae
Curcuma aromatica Salish*	Zingiberaceae
Curcuma pseudomontana Grah.*	Zingiberaceae
Cyclea peltata Hook.f. & Th.*	Menispermaceae
Desmodium gangeticum (L.) DC.*	Fabaceae
Dioscorea bulbifera.L.*	Dioscoreaceae
Diospyros bourdillonii Brunbis	Ebenaceae
Diospyros humilis Bourd	Ebenaceae
Diospyros paniculata Dalz.	Ebenceae
Elephantopus scaber L.*	Asteraceae
Embelia ribes Burm. f.*	Myrsinaceae
Emblica officinalis Gaertn.*	Euphorbiaceae
Ervatamia heyneana (Willd.) Cook	Apocynaceae
Ficus bengalensis L.*	Moraceae
Ficus racemosa L.*	Moraceae
Garcinia indica Chois.*	Clusiaceae
Geophila repens (L.)Johnston*	Rubiaceae
Gloriosa superba L.*	Liliaceae
Gymnema sylvestre (Retz.) R.Br.ex Schult*	Asclepiadaceae
Hemidesmus indicus (L.) R.Br.*	Periplocaceae
Holigarna arnottiana Hook. f.	Anacardiaceae
Holigarna grahamii Kurz.	Anacardiaceae
Holostemma annulare (Roxb.) K.Schum.*	Asclepiadacee
Hopea parviflora Bedd.	Dipterocarpaceae
Hopea racophloea Dyer.	Dipterocarpaceae
Hydnocarpus alpina W.&A.	Flacourtiaceae
Ixora brachiata Roxb.ex DC.	Rubiaceae
Ixora coccinea L.*	Rubiaceae
Ixora lanceolaria Colebr.*	Rubiaceae
Ixora nigricans R.Br.ex W.&A.	Rubiaceae
Jatropha gossypifolia L.	Euphorbiaceae
Knema attenuata Warb.	Myristicaceae
Kunstleria keralensis C.N. Moh.& Nair	Fabaceae
Litsea coriacea Hook.f.	Lauraceae
Litsea floribunda (Bl.) Gamble	Lauraceae
Madhuca neriifolia (Moon) Lam.	Sapotaceae
Memecylon depressum Benth.	Melastomataceae
Memecylon heyneanum Benth.	Melastomataceae
Murraya paniculata (L) Jack.*	Rutaceae
Mussaenda belilla Buch. Ham.	Rubiaceae
Myristica malabarica Lam.*	Myristicaceae
Myxopyrum smilacifolium Bl.	Oleaceae
Piper longum L.*	Piperaceae
Poeciloneuron indicum Bedd.	Bonnettiaceae
Polyalthia fragrans Bedd.	Annonaceae
Pouzolzia zeylanica (L.) Broon	Urticaceae
Premna wightiana Schauer	Verbenaceae
Psychotria dalzellii Hook.f.	Rubiaceae
Rauvolfia serpentina (L.) Benth.ex Kurz*	Apocynaceae
Santalum album (L.)*	Santalaceae
Sida cordifolia L.*	Malvaceae
Symplocos cochinchinensis Moore*	Symplocaceae
Syzygium travancoricum Gam.	Myrtaceae
Terminalia bellerica (Gaertn.) Roxb.*	Combretaceae
Terminalia paniculata Roth.	Combretaceae
Thottea idukkiana Pandurangan et V.J. Nair*	Aristolochiaceae
Tinospora cordifolia Hook.f.&Th.*	Menispermaceae
Vateria indica L.*	Dipterocarpaceae
Vateria macrocarpa B.L. Gupth	Dipterocarpaceae

**Medicinal plants having common use among the local people.*

Fauna present in the *Kavus*: Besides this floristic wealth, *kavus* are also abode for a rich faunistic wealth. Many rare animals like bonnet macaque, small Indian civet, toddy cat, mongoose, porcupine, jackal, wild rabbits, Malabar lizard and white bellied sea eagle are found in the *Kavus*. These animal species are completely protected by the Indian Wild Life Protection Act. Sasi Kumar (1995) recorded 100 birds of which at least 12 are migratory, and 24 belong to 13 wild species, breed in the *Kavus* of Kannur and Kasaragode districts. Palat Jafer (1995) recorded 84 species of butterflies in a grove near Kannur of which 12 are endemic. *Kavus* are also dwelling place for predators like eagles, owls, bats, lizards, frogs and snakes, which help in maintaining the biological balance by the reduction of agricultural loss due to pests.

Environment protection: role of *kavus*

Kavus are the mini-evergreen forested ecosystem in the midst of human settlements or in the middle of agricultural field in Kerala. The different life forms in a well associated and established manner in the *Kavus* situated in the urban or populated areas render great environmental services to the mankind.

The following are some of the positive ways in which *Kavus* protect or balance the local environment.

1. The luxuriant vegetation spread at different levels with the plants capturing maximum sunlight leads to optimum level of biomass accumulation and CO2=O2 balance locally.

2. Just like a forest, spread canopy of the *Kavus* release large quantities of water vapour resulting in a cool and breezy climate in the locality.

3. The thick vegetation, with different layers of canopy exist in the *kavus* reduce the rain drop impact, and the rain water reaches slowly to the soil system. This water gradually penetrates into the ground due to high infiltration rate because of the high humus and the root network. The infiltrated water is then stored as ground water in underground aquaducts, ponds or wells. The *kavus* thus facilitate the harvesting and distribution of water.

4. The organic matter accumulated in the *Kavus* are degraded by the soil-dwelling organisms permeating into nearby agricultural lands and enhancing their fertility.

5. The *kavus* are the nesting place of many birds. The bird droppings which are rich in phosphorus enrich phosphorus deficient soils of the locality.

6. *Kavus* are the abode of many pollinator insects and bees of many economically important plants of the region.

7. *Kavus* are helpful in checking the extension of desertification, degradation of soil and soil erosion due to the intensive agricultural practices.

8. *Kavus* are the centres of biological control in agriculture due to the existence of complicated food web regulated by a balanced predator-prey organisms residing in the *kavus*.

9. They are sanctum sanctorum of many rare, endangered and endemic plants.

10. *Kavus* are the source of many medicinal plants used by the local health practitioners.

11. They hold gene pool of wild relatives of cultivars offering genetic stocks for agricultural scientists in their crop improvement programme.

12. *Kavus* in the urban areas act as mitigating agents for air pollution by controlling widespread free movement of dust and other air pollutants.

Conclusion

With a high literacy rate close to 100 per cent in Kerala, even a child is aware of the relation between the protection of trees and healthy life. Due to pressures from the environmentalists and conservationists, the Government of Kerala has now started giving financial assistance for protecting sacred groves through the State Forest Department. Also, the Travancore Devaswom Board with the help of Tropical Botanic Garden and Research Institute (TBGRI) recently formulated a detailed action plan to revegetate and protect the sacred groves associated with the temples under its control. TBGRI scientists have carried out a detailed study of the *kavus* of Kerala, particularly on the composition, structure and functional dynamics of the ecosystem of *kavus* with the financial assistance of the Ministry of Environment and Forests, Govt. of India. The results of the study provide a sound scientific basis for reviving/revegetating and conserving these precious islands of biodiversity.

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Conservation of medicinal plants: a need of the times

Sr. Francina

People are now increasingly becoming inclined towards traditional medicines with their becoming conscious about the side-effects of synthetic drugs. But our medicinal plant wealth is under serious threat of extinction thanks to various factors. This calls for effective conservation efforts focusing on those varieties which face the most severe threat of extinction. Both in-situ and ex-situ conservation systems are to be resorted to. The household garden is the best method to conserve the medicinal plant wealth. People's participation and their awareness about the plant wealth play a crucial role in the conservation of nature's priceless gift.

Man's dependence on nature is perhaps as old as his history. It was not only for food and shelter that he depended on nature but also for health care and solace of mind. The innumerable varieties of medicinal plants provided him with the basic health care facilities. In fact, plant life is the single most important element in nature influencing the animal life on the planet. Rig-Veda says "plants originated on this earth some three *yugas* even before the incarnation of Gods".

Man knew from very early that plants could be used as medicine. The Rig-Veda, Yajur-Veda and Atharva-Veda together speak about some 430 varieties of medicinal plants. It is believed that our predecessors inherited the systematic herbal practices from the Aryan culture. We are fortunate to have volumes of ancient books written about these matters. This great system of health care which is known as Ayurveda mostly depends on plant medicines. Almost 80 per cent of medicines in this system are made out of medicinal plants. It is estimated that 7,000 varieties of flowering plants are used in the Indian systems of medicine—Ayurveda, Sidha, and Unani. Besides this, a lot more herbs are used in traditional medicine and Tribal medicine systems.

With the advancement of science and medical technology, a lot of synthetic drugs are used. However, people have become conscious about the after-effects of such systems. Therefore, people are increasingly becoming inclined towards the traditional medicines.

In the past, when we had rich virgin mixed forests, a lot of important medicinal plants were available to us. But now due to many problems, these natural resources are under serious threat of extinction.

Reasons for extinction

We can classify the whole medicinal plant wealth into two broad categories—those available in the virgin forests and those available in the agricultural fields. In both cases there are some common factors which destroy the medicinal plant wealth. They are, for example, the destruction of natural habitats like felling of trees, grazing of cattle, construction works, massive and exhaustive collection of raw drugs, etc.

Felling of trees: Removal of even one plant from a particular place causes an entire disruption of the biotic association of that area. For example, destruction of one tree affects all the underbushes, mosses, epiphytes, microbial and other dependent organisms.

Grazing: Many farmers in India set free their animals to the forest for grazing. None of them bothers to grow a little fodder for their cattle. Even though many people are practising monoculture methods, many medicinally important plants are growing in such fields. These are being destroyed as a result of grazing or fodder collection by the farmers.

Collection of raw drugs: Nowadays, a huge number of Ayurvedic production units are coming up. They all need quality raw drugs and this has resulted in the indiscriminate collection of raw drugs. This type of collection leads to the loss of a good chunk of our medicinal plant wealth. In addition to this, a good number of drugs are collected for use in the allopathy field also. Until and unless they are checked, the after-effect will be drastic.

Construction works: Multicrore hydroelectric and thermal power projects are a severe threat to the medicinal plant wealth of our country. Again, soil bunding practices like check dams and gully plugs are also posing danger to this. A hydel project destroys the lush vegetation along the river banks and the most valuable marshy places in the forests. The small gully plugs may collect the soil sediments, but prevent chances of disbursing the seeds of many plants.

There are many other reasons for the destruction, some of which are very specific to forest land while others are very specific to a farm land. Social forestry practices in a grassland or in a so-called wasteland may destroy the natural habitats and thus the medicinal plant wealth in that habitat may also disappear. Induced forest fire by farmers is also destroying the good wealth hiding in the grasslands.

Conservation practices

Conservation efforts should start by placing more emphasis on those medicinal plants which face the most severe threat of extinction. For that a complete study should be done on the availability of these plants.

Conventionally, there are two systems of conservation, classified as *in situ* and *ex situ* conservation. Out of these, *in situ* is more effective, because in this system a plant is being conserved in its natural habitat. For an *in situ* conservation practice, the thrust areas should be identified. A detailed forest survey can reveal the real plant wealth of a habitat. For example, a survey conducted by the Peermade Development Society's research wing shows that the dry deciduous forests are inhabitated by a majority of known medicinal plants. Places like Shola forests, marshy lands and other water-logged areas hold a good diversity of plants. Perhaps the medicinal properties of a good number of them have to be identified.

In rural areas, there are many places ideal for an *in-situ* conservation. In the past, the sacred groves and other religiously important places were kept as such, not only for its religious importance, but in view of preserving the plants, and natural inhabitants. Nowadays, everyone knows that these are the best places where the endangered plants can be preserved. The rituals and beliefs about the snakes, ghosts, etc spread out by the old generation were only intended to protect such sacred places. But most of such places are nowadays being turned into monoculture of crops.

Another area of importance in the *in-situ* conservation practice is, no-man's land such as roadsides, river banks, public ponds and other wastelands. But these areas are cleared and felled as part of maintenance or other developmental activities. This kind of clearance actually makes room to exotic weeds like *Lantana camera, Eupatorium* sps and *Parthenium*. If such places are left undisturbed, it could hold a good variety of medicinal as well as other plants. But this continues to be an impractical *in-situ* conservation practice due to various reasons.

Most conservationists are working in the field of *ex situ* conservation. This seems to be an acceptable form for demonstration purposes and for keeping germ-plasm at a selected area. This will, in turn, help create awareness among the people of that area.

Another idea proposed by the conservationists is the construction of a medicinal plant forest. Medicinal plant forest (MPF) is supposed to accommodate the whole plant species available in a particular area, say one district. The entire forest area of the selected place can be sampled in a reconnaissance survey and frequent visit can be made to this area for studying the medicinal plants available. A careful collection of these identified species may be transferred to the medicinal plant forest (MPF), so as to rebuild the natural association of plants. By adopting this method one can reproduce a cross-section of the medicinal plant wealth of one area. This collection and reproduction can be restricted either to plants important/relevant in Ayurveda, ethnobotanically important plants or to the entire plant wealth of one area.

A medicinal plant forest is different from a medicinal plant garden, where only those plants which have wide approval are being maintained. This may eliminate the chances of keeping the so-called unimportant or unattractive plants. And also in such a demonstration garden, the biotic association is a quite neglected factor. This biotic association is very important to highly threatened medicinal plants in preserving their medicinal properties and existence. All the same, medicinal plant forest has its own disadvantages, such as the neglect of small herbs, lack of individual attention, etc.

Household germ-plasm

A demonstration garden and MPF have their own limitations like climate, limited space and lack of individual care. In such cases, small homestead garden in various households can supplement the efforts of germ-plasm conservation.

The idea behind this is that many plants can be grown along with the common agricultural plants as well as in the kitchen garden. Some of these can even be grown as ornamental plants. If we take a quick look around one's household, one can see that at least 250 flowering plants have medicinal importance. A list of most common and easily available medicinal plants that can be grown in households, is given in annexure 1.

These plants grow without any special care. A proper listing and documentation of the existing species and the newly added ones will give a representative data about the germ-plasm existing in one's household. *A household garden is considered to be the best way to conserve the wealth of medicinal plants. This is not only a way of conservation but also a way of preserving our medicinal plants by our own people.*

Participation of the local people is invaluable as far as the conservation programme is concerned. The important thing is that they should be made aware of the importance of medicinal plant cultivation. The problems related to this should be identified and effectively overcome. Financial assistance may prove to be inevitable for the initiation of the programme as far as the local people are concerned. Further, marketing opportunities and other incentives should be provided to entice cultivators to this field.

Annexure 1

Plants commonly available in a household garden of Kerala

Trees: *(1) Aegle marmelos, (2) Alstonia venenata, (3) Alstonia scholaris, (4) Annona reticulata, (5) Annona squamosa, (6) Artocarpus hirsutus, (7) Artocarpus integrifolia, (8) Azadirachta indica, (9) Bauhinia purpurea, (10) Bauhinia recemosa, (11) Bauhinia variegata, (12) Bombax ceiba, (13) Cassia fistula, (14) Cinnamomum verum, (15) Crataeva nurvala, (16) Emblica officinalis, (17) Erythrine stricta, (18) Garcinia gummigutta, (19) Gmelina arborea, (20) Hydnocarpus wightiana, (21) Maesa indica, (22) Mangifera indica, (23) Moringa olefera, (24) Oroxylum*

indicum, (25) Pajenalia indica, (26) Pongamia pinnata, (27) Psidium guajava, (28) Pterocarpus marsupium, (29) Saraca asoca, (30) Semecarpus anacardium, (31) Symplocos cochinchinensis, (32) Syzigium cumini, (33) Tamirindus indica, (34) Termenalia paniculata, (35) Thespesia populnea.

Shrubs: *(1) Abrus precatorius, (2) Acalypha fruticosa, (3) Acalypha indica, (4) Acorus calamus, (5) Adhatoda beddomei, (6) Adhatoda vasika, (7) Ageratum conyzoides, (8) Amorphophallus companulatus, (9) Aristolochia indica, (10) Asparagus racemosus, (11) Calotropis gigantea, (12) Calycopteris floribunda, (13) Cassia tora, (14) Celastrus paniculata, (15) Clerodendrum serratum, (16) Costus speciosus, (17) Curcuma domestica, (18) Discorea oppositefolia, (19) Glycosmys pentaphylla, (20) Hemidesmus inducus, (21) Hibiscus rosa-sinensis, (22) Holostemma pubescence, (23) Ichnocarpus frutescens, (24) Ipomea mouritiana, (25) Ixora coccinea, (26) Jasminum auriculatum, (27) Jasminum officinale, (28) Jatropha curcas, (29) Justicia gendarussa, (30) Kaemferia galanga, (31) Kaemferia rotunda, (32) Lawsonia inermis, (33) Lobelia nicotianifolia, (34) Murrya koeniggi, (35) Mucuna puriens, (36) Myxopirum smilacifolium, (37) Naregamia alata, (38) Pandanus tectorius, (39) Pavetta indica, (40) Piper nigrum, (41) Piper bettle, (42) Plumbago rosea, (43) Plumbago zeylanica, (44) Punica granatum, (45) Randia dumeforum, (46) Ricinus communis, (47) Strobilanthus nilgirianthus, (48) Tabernemontana dicotoma, (49) Tinospora cordifolia, (50) Vitex negundo, (51) Zingiber officinale.*

Herbs: *(1) Achyranthes aspera, (2) Amaranthus spinosus, (3) Andrographis paniculata, (4) Anisomeles indica, (5) Artemesia nilagirica, (6) Bacopa monnieri, (7) Basella alba, (8) Biophytum sensitivum, (9) Boerhavia diffusa, (10) Cardiospermum helicacabum, (11) Catheranthus roseas, (12) Centella asiatica, (13) Clitoria ternatia, (14) Coccinia grandis, (15) Coleus ambonicus, (16) Cyclea peltata, (17) Datura metel, (18) Desmodium gangeticum, (19) Elephantopus scabar, (20) Emelia sonchifolia, (21) Euphorbia hirta, (22) Evolvulus alsinoides, (23) Leea indica, (24) Leucas aspera, (25) Maranta arundinacea, (26) Merremia tridentata, (27) Mimosa pudica, (28) Ocimum americanum, (29) Ocimum gratissimum, (30) Ocimum sanctum, (31) Ophiorhiza mungos, (32) Oxalis corniculata, (33) Phyllanthus amarus, (34) Physalis minima, (35) Piper longum, (36) Pseudarthria viscida, (37) Rauvolfia serpentina, (38) Rotula aqautica, (39) Sida acuta, (40) Sida cordifolia, (41) Sida rhombifolia, (42) Solanum indicum, (43) Solanum melongena, (44) Solanum nigrum, (45) Solanum xanthocarpum, (46) Tragia involcurata, (47) Tribulus terrestris, (48) Vernonia cinerea, (49) Vetiveria zizanoides, (50) Wedelia chinensis.* ❑

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"Attend Lord of the Forests; Soma, King of Herbs and Plants has approved thee, mayest thou and he cleanse my mouth with glory and good auspices that I may eat abundant food."

(Prayer for chanting while cleaning the teeth with fig twig—Atharva-Veda IV-3.1)

Domestication of medicinal plants

L.J. Srivastava and R. Raina

The Himalayan region especially Himachal Pradesh abounds in medicinal plants. But the natural wealth is fast depleting making it difficult to maintain sustained supply of raw materials to the plant-based drug industry. Uncontrolled and senseless collection of the forest-based medicinal wealth has threatened their very survival. The challenge of conservation has led to domestication and cultivation of these plants on a scientific basis. The venture has been a tremendous success. Motivation of the growers and an assured market are important factors in giving a boost to the cultivation of medicinal plants. Creation of a nodal agency at the Central level, buy-back guarantee from the user industries and support price will facilitate a congenial atmosphere for the development of medicinal plants, the authors feel.

Since the indiscriminate use of synthetics and antibiotics has resulted in serious symptoms and side-effects all over the world, the demand of plant-based raw materials for pharmaceuticals has increased enormously. This can further be known by the facts that world trade in crude drugs and intermediary chemicals, etc is estimated to exceed US $ 50 billion annually. India has been maintaining an important position in the production and trade of such materials. Recently, the World Health Organization (WHO) also emphasized the utilization of indigenous systems of medicine based on locally available raw material sources vis-a-vis medicinal plants in the developing countries and has compiled an inventory of about 20,000 plants being used throughout the world. Furthermore, approximately one-third of all drugs are plant based and if bacteria and fungi are also included, nearly 60 per cent of all pharmaceuticals are of plant origin. Hence our country that abounds in a large number of such plants which can either be used directly or as the source of active principles in formulation of drugs for curing dreaded ailments, assumes the prime position.

Maintaining regular supply

Among the various parts of our country, Himalayan region specially Himachal Pradesh is a big repository of medicinal plants and has a vast area covered under these plants. While much of it is gathered by herb collectors and small traders for use in Ayurvedic and Unani systems of medicine, there is yet shortage of these materials for maintaining the sustained supply to the plant-based drug industries. Secondly, it is also not proper under the present situation to rely on only natural resources to keep the wheel of industries running all the time in view of the fast depleting natural wealth. This calls for domestication and cultivation of these plants as well as producing the drug products of uniformly high potency. At the same time, the increasing demand of plant-based raw materials has led to overexploitation of the wild plants resulting in serious hazard to regeneration of these species in their natural habitats. This has increased their vulnerability to loss of population, and threatening in some cases, their extinction at least from their known habitat. Belladonna, *Rouvolfia, Dioscorea, Swertia chirata,* etc have already headed to such a situation rapidly whereas *Gentiana kurroo, Podophyllum emodi Urginea indica, Coptis teeta* are likely to face a similar situation. The Union Ministry of Commerce, has placed 56 important medicinal plants on the negative list of exports [Public Notice No. 47 (PN)/92-97].

In addition to this, with the screening of more and more new plants in the recent past as a source of drugs, a scenario of losing much of our heritage in medicinal wealth has been posed through the uncontrolled and often senseless collections. This necessitated the urgent need of their conservation on one hand and systematic cultivation for sustained supply to the user industries on the other. Efforts made in these directions will also help in eliminating other difficulties faced from our dependence on natural resources like those of access and transport of these materials; collection problem because of their sparse distribution and admixture of the genuine material with spurious material due to the ignorance of collectors (Chopra, et al, 1958). These difficulties are of high magnitude in the hilly areas like Himachal Pradesh. In this State, concerted efforts were made during the past few years towards domestication and cultivation of many such plants for internal as well as external use.

Possibilities of domestication and cultivation of medicinal plants in Himachal Pradesh

With the varied climate, geology and physiography, Himachal Pradesh represents an epitome of many types of vegetation spread over the vast tract of forest and alpine pastures. It is, therefore, possible that the drug plants which even do not naturally grow within its bound, could be easily made to do so and domestication has been possible to a great extent of a large number of drug plants. Under the co-ordinated scheme of the Indian Council of Agricultural Research (ICAR) on improvement of medicinal and aromatic plants, many exotics, viz *Glaucium flavum* (Srivastava et al, 1982), *Solanum laciniatum* (Bhardwaj et al, 1982), *Digitalis lanata* (Puri et al, 1982 and Bhardwaj et al, 1984), *Mentha piperita* (Bhardwaj et al, 1983), *Ocimum* (Srivastava and Bhardwaj, 1983) and many others have been successfully domesticated and their

cultivation practices have been developed in the university at Solan. Beside this, a large number of indigenous as well as other exotic plants collected from different places in the State and obtained from other ICAR centres along with those obtained through the National Bureau of Plant Genetic Research (NBPGR), New Delhi, under the seed exchange programme, have also been domesticated and maintained in the herbal garden. Likewise, the possibility of many more can be explored for which the condition in the State is more congenial and conducive. Since there are more than 100 medicinal plants used in the modern system of medicine and the number of those used in the traditional system exceeds 500 (Husain, 1984), there is a need for fixing up the priority in view of their importance from use and demand points of view.

Though there are a large number of plants found in this State but some of them which find regular use in Indian system of medicine are *Abies webbiana, Aconitum heterophyllum, Acorus calamus, Aesculus indica, Adhatoda vasica, Aloe indica, Alpinia galanea, Angelica glauca, Artemisia maritima, Berberis species, Butea monosperma, Cedrela toona, Carum carvi, Curcuma zedoaria, Datura* spp., *Eclipta alba, Ephedra gerardiana, Gentiana kurroo, Holarrhena antidysenterica, Hydrocotyle asiatica, Hyoscyamus niger, Orchis latifolia, Pistacia integerrima, Podophyllum emodi, Rauvolfia serpentina, Rheum emodi, Saussurea lappa, Skimmia laureola, Solanum spp., Swertia chirata, Terminalia* spp., *Thymus serpyllum, Valeriana jatamansi* and *Withania somnifera*, etc. These can be domesticated and brought into cultivation at suitable locations where conditions are favourable for their growth and development. *However, it is difficult to advocate cultivation of any particular plant in a region as a permanent feature due to the fluctuations in demand from year to year. It is, therefore, important to keep a watch on the demands and regulate the cultivation accordingly.* Depending upon the prevailing conditions, the State can be divided into three main regions where the following plants can easily be grown.

Shiwalik hills: In this region, *Adhatoda vasica, Acacia catechu, Adina, Butea monosperma, Berberis* spp., *Cedrela toona, Datura* spp., *Eclipta alba, Gloriosa superba, Hydrocotyle asiatica, Holarrhena antidysenterica, Rauvolfia serpentina* and *Withania somnifera* are found in plenty and can be domesticated. *Glycyrrhiza* glabra can also be tried in this zone.

Temperate hill zone: This zone is house of *Aesculus, Alnus, Ephedra, Dioscorea, Digitalis, Gentiana, Heracleum, Picrorhiza, Quercus, Rhododendron, Solanum, Swertia, Terminalia, Ulmus, Valeriana, Viola* and many others. These can easily be domesticated by selecting better varieties.

Alpine grassland zone: Herbs of many types are predominantly found in this zone of high altitude. Domestication of *Carum bulbocastanum, Orchis* spp., *Nardostachys, Saussurea lappa,* among indigenous and *Ferula asafoetida* along with other exotics can easily be done and introduced in this region. Trees are very few in this region. However, *Betula, Juniperus and Spiraea*, etc can also be domesticated for their use in medicine.

Work done on domestication and cultivation of medicinal plants in the university

Complete cultivation practices of nine medicinal plants of exotic and indigenous origins have been developed along with the introduction and domestication of a large number of such plants under the All-India Co-ordinated Project on Improvement of Medicinal and Aromatic Plants in the University at Solan. These are summarized below:

A. Cultivation

1. *Digitalis lanata:* Its leaves are a rich source of digoxin, an active cardial glycoside. With the adoption of proper agrotechniques, strain EC 115996 gives high glycoside content up to 1.20 per cent with 156 quintals per ha herb yield on fresh weight basis and 31 quitals per ha on dry weight basis in conditions pertaining at Solan.

2. *Dioscorea deltoidea:* This is a good source of diosgenin used in preparation of steroidal drugs. Although these drugs are used for treatment of more than 100 human disorders, they are most commonly used as sex hormones, cortico steroid, oral contraceptives and anabolic agents. Cultivation of this crop is now more essential in view of the fast depleting wealth from its natural source.

3. *Fagopyrum* species: Rutin is obtained from the leaves and tender shoots of this plant. This compound is used in treatment of capillary fragility and retinal haemorrhage.

4. *Glaucium flavum:* It is cultivated from the leaves and pods which contain glaucine, a potential substitute of codeine, used in formulation of cough and bronchitis syrup. In western countries, glaucine has formed a place in pharmaceutical industries due to the restricted availability and movement of codeine, a product of opium poppy. EC-114696 has been extensively used in experimentation at Solan and agro-technique for its cultivation has been developed. It can produce 40 quintals per ha of leaves and pods (on dry weight basis) with 26 to 30 kg of glaucine under optimum condition by adopting appropriate cultivation practices.

5. *Mentha* species: Peppermint oil (*Mentha piperita*) costs nearly Rs. 250-Rs. 300 per kg depending upon the market. It can be successfully cultivated in lower and mid hills.

6. *Solanum lacinaitum:* The leaves and berry are rich sources of solasodine. This chemical is nitrogen analogue of diosgenin. Through 16-dehydropregnenolone (16 DPA), it is converted into a group of drugs like testosterone and methyl testosterone and cortico steroids like predinisolone and hydrocortisone. This can substitute the decreasing sources of diosgenin.

7. *Matricaria chamomilla:* An essential oil bearing species, it is highly valued in both cosmetics and pharmaceutical industries. Apart from perfumes, its essential oil is also used in muscular liniments, oral sprays, etc. Being a crop of 4-5 months duration, its cultivation is highly profitable. Its essential oil is valued between Rs. 10,000 and Rs. 20,000 per litre. One hectare of harvest yields approximately 5-6 litres of essential oil.

8. *Salvia sclarea:* An aromatic species, its essential oil finds use in cosmetics, flavouring of liquors, beverages, ice-creams, candy and baked foods. About 13-15 litre per ha of oil can be obtained from its flowering stalks. The essential oil is valued at Rs. 3000 per litre.

9. *Valeriana jatamansi:* Its rhizomes yield up to two per cent essential oil used in perfumery. The rhizomes are also an important source of valepotriates (0.5-2%) which find use as CNS—depressant and anti-spasmodic effects. About 20-30 quintals of dry rhizomes can be obtained from one hectare of land. The rhizomes are valued at Rs. 25 per kg and essential oil Rs. 6000 per litre.

10. *Gloriosa superba:* Being a negatively listed species for export (Ministry of Commerce, GoI), its seed and tubers are used in treatment of gout, arthritis, etc. The active content colchicine present in its seed and tubers also finds use as a polypolidisation agent. This species is under limited cultivation in parts of Tamil Nadu and the seeds are exported to Italy, France for extraction of colchicine. The seeds are valued at Rs. 300 per kg. By adopting controlled self-pollination, approximately 500 kg seed can be produced per hectare per season.

Other important medicinal and aromatic plants, on which work relating to domestication, breeding, agro-techniques and chemical analysis is in progress are *Spilenthes acmella, Gentiana kurroo, Mucuna prurience, Podophyllum hexandrum, Pelargonium graveolens and Tagetus minuta.*

B. Introduction and domestication

Efforts have been made to introduce and domesticate a large number of medicinal plants at Solan and on improvement of these plants. Many of these are collected from various places in Himachal Pradesh while others are exotics and obtained through the co-ordinator of the project under seed exchange programme of NBPGR, New Delhi. Those which attained successful domestication are: *Aconitum heterophyllum, Acorus calamus, Adhatoda vasica, Berberis, Carum bulbocastanum, Datura species, Digitalis lanata, D. purpurea, D. grandiflora* and *D. lutea, Dioscorea deltoidea, Fagopyrum* species, Glaucium flavum, Glycyrrhiza *glabra, Matricaria chamomilla, Melissa officinalis, Mentha* species, *Ocimum* species, *Podophyllum emodi, Rauvolfia serpentina, Rosmarinus, Salvia officinalis, S. moorcroftiana, Saussurea lappa, Solanum laciniatum, Solanum* khasianum *Valeriana wallichii, Viola* species and *Withania somnifera,* etc. *Crocus sativus, Heracleum,* and *Swertia* spp., etc have also been received recently and placed in the herbal garden. Seeds of exotic material obtained from foreign countries are usually very small in quantity (some only a few in number) with very low germination and many of them usually failed to germinate. Work on domestication of these plants has led to the conclusion that efforts in this direction can lead to success for many medicinal plants that even do not occur in Himachal Pradesh.

However, these efforts are useful only if growers undertake large-scale cultivation of these plants. Although about 400 medicinal plant species are used by Indian industry but less than 20 species are under commercial cultivation.

For boosting their cultivation, the growers need to be motivated and market assured. This can be done by the creation of a nodal agency at the Central level, buy-back guarantees from the user industries, and giving support price by the government.

In the light of WTO, IPRs, etc effective steps are needed to protect our indigenous knowledge and material by adopting suitable measures. The recent success in the Turmeric patent issue has shown that our traditional knowledge base can be protected. Similar safeguards are needed for other indigenous traditional remedies, species and uses.

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"In nature, everybody can be his or her own doctor, not so in the various systems of medicine."

—Mahatma Gandhi

Kurukshetra February 1998

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Medicinal plants: our rich heritage

J.R. Mani, I. Deepthi Nair and J.R. Ani

The people of India, from time immemorial, have been using medicinal plants for curing various diseases and to ward off plant pests. With the increased population pressure and many other factors, our plant wealth is threatened with extinction. The threat from foreigners has added a new dimension to the task of protecting and preserving our herbal treasure trove. There are innumerable medicinal plants which we come across in our day-to-day life. Their conservation and documentation will go a long way in addressing the task of providing cheap and safe remedies for various ailments especially to the rural folk. The authors throw light on the medicinal importance and common use of ten such plants.

The wet evergreen forests of India with their rich biodiversity are, in fact, a treasure-house of valuable medicinal plants. Indians from time immemorial have been using them for curing ailments and also to ward off pests and diseases of their crops. There are reports of using dried neem leaves to safeguard granaries from storage pests.

Thanks to ignorance and the ever-increasing population pressure, large chunks of our tropical forests were decimated for agriculture and dwelling purposes. Many of our herbaceous plants have vanished or are facing extinction. At the same time, foreigners who are aware of the high therapeutic value of the tropical plants introduced them to their own soil and with their modern sophisticated technologies, identified and isolated ingredients which are medicinally important. The same idea has been emphasized by Dr Nadkarni in *Indian Materia Medica*. The sorry picture is that India and other tropical countries which are the home of these medicinal plants will have to recognize foreign patent rights on the products obtained from our indigenous drugs. This is particularly so in the light of the post-WTO scenario.

The USA is now having large monocultures of neem, native to Indian subcontinent and has also claimed patents for several products where neem is an integral component. Lately comes the hue and cry over turmeric and so on. Fortunately, the Council of Scientific and Industrial Research (CSIR) fought and won the turmeric patent case in the US Patent and Trademark Office.

Against this backdrop, identification and documentation of medicinal plants assume great importance. There are also plants which we come across in our day-to-day life, rich in medicinal value. Their role in the rural health care system is of crucial importance. This article seeks to elucidate the medicinal importance of a handful of plants like Tulsi, turmeric, etc which we encounter very often in our day-to-day life.

Tulsi (*Ocimum sanctum Linn*)

Tulsi is a household name among all and sundry throughout the Indian subcontinent. It occupies pride of place on the popular list of medicines of the grandma. Tulsi has been considered by Indians as a sacred plant, a remedy for all diseases and the mother of all medicines.

It is a common herb seen in India growing up to a height of one metre. The most common varieties are Krishna Tulsi and Rama Tulsi. The most differentiating character of Krishna Tulsi is the dark blue colour of stem and leaves whereas Rama Tulsi is a whitish herb. Due to the good quality of active ingredients in Krishna Tulsi it is commonly used for medicinal purposes.

The herb, leaves and seeds are used medicinally. In Ayurveda, it is included under 'Jwarakhna Gana' (Antipyretic). It is expectorant, stomachic, antiperiodic, diaphoretic and aromatic. An in-depth study carried out on Tulsi reveals that the leaves possess antistress property. It is also found that the extract of Tulsi leaves has a marked anti-ulcerogenic activity on the intestinal lining. Tulsi provides immunity against many viral and bacterial infections.

Common medicinal uses of Tulsi

1. The daily use of 20 Tulsi leaves as decoction helps to make immunity against viral diseases, high blood pressure, peptic ulcers and heart diseases.

2. In case of scorpion sting or spider bite, a few fresh leaves of Tulsi should be crushed and applied to the stung place and decoction made from 30 Tulsi leaves should be taken two to three times a day for ten days.

3. Tulsi is also a good medicine for common fever found among children. Five ml Tulsi juice mixed with 2.5 ml honey can be given orally three times daily for five days.

4. For cough and coryza among children, equal quantities of juice of Tulsi and ginger should be given together.

5. A common eye epidemic, conjunctivitis can be treated using Tulsi. Equal quantities of juice of Tulsi leaves and honey (5 ml each) are mixed. This mixture is poured into the affected eye within an interval of four hours for three days.

6. Tulsi juice with lemon is also found useful for abdominal pain caused by indigestion.

In short, Tulsi is a priceless gift of Nature and truly is a friend of mankind, especially the rural folk.

Turmeric *(Curcuma longa Linn)*

Turmeric has a very important place in our daily life. With the dawn of our civilization, we Indians were fully aware of its therapeutic uses. In fact, it is added with curries to reduce the toxicity of the food materials.

Turmeric is extensively cultivated all over India, especially in marshy places. Moderately warmer and humid atmosphere is essential for the healthy growth of the plant.

The active chemical ingredients are curcumin, turmerol, carproic acid, valeric acid, etc. According to the Ayurvedic system of medicine, it is included in "Vishaghna Gana" (Antitoxic). The underground stem or rhizome is used medicinally. It is used both internally and externally. It is aromatic, vermicide, antiseptic, a blood purifier and a tonic. It gives complexion to the skin. It has been recommended as a reliable antiseptic for external application to wounds, as a dressing for washing ulcers and inflammed conjunctiva as a weak lotion. It is reputed to be an antidote to poisons and specially used to purify the poisoned atmosphere.

Common medicinal uses of turmeric

1. Taking equal quantities of turmeric and goosberry powder in a dose of 5 to 10 gm with hot water early morning is beneficial to diabetic patients.

2. A favourite remedy for allergic rhintis is milk boiled with turmeric and sugar.

3. A dried cloth with raw paste of turmeric soaked with neem oil rolled like a cigarette is burned and the smoke is inhaled as an indegenous treatment for sinusitis.

4. The water boiled with turmeric powder and neem leaves is good for cleaning ulcers. A paste of turmeric made with lime acts as an excellent dressing.

5. Raw turmeric juice mixed with equal quantity of mustard oil is used to care otitis media of the ear. Dosage : Pour 4 to 6 drops in the affected ear twice daily for six days.

6. In piles, an ointment made of turmeric, hemp leaves, onions and warm mustard oil gives great relief. This is also effective in eczema, itches, etc.

7. The daily use of turmeric powder internally and topically improves flesh tone and colour of human skin.

Adosa *(Adhatoda vasica Nees)*

It is an evergreen shrub seen throughout the plains of India. It is commonly found near habitations. It is of two types. The small one is *Adhatoda bedonia* and the large one *Adhatoda vasica.*

This shrub has a height of 1 to 2 m. It is much branched with large lance-shaped leaves. The inflorescence contains sessile flowers. Corolla is white with a few purplish markings.

The leaves and roots are used medicinally. They contain an alkaloid vasicine. In Ayurvedic system of medicine, it comes under 'Kasaghna Gana' (Anti-tussive).

It is expectorant, antispasmodic, a blood purifier and a tonic. Adosa is chiefly used in diseases of the respiratory tract particularly in all kinds of coughs, chronic bronchitis, asthma, TB, etc. The juice of leaves is found useful in diarrhoea and dysentery espicially in haemoptysis and in bleeding of dysentery. In all 'fever decoctions' when *kapha* and *pitha* are involved, Adosa is given in combination with other drugs.

Common uses of Adosa

1. One tablespoon juice of leaves with equal quantity of honey three times daily is very beneficial in cough. This mixture is useful in bronchitis and asthma.

2. For bleeding piles, the decoction made from Adosa 60 ml taken with honey twice daily is found useful.

3. Externally a poultice of the leaves or a fomentation of a strong decoction is used on rheumatic joints, inflammatory swellings and neuralgia.

4. For excessive bleeding during menstruation, 15 ml of leaf juice with sugar candy twice daily should be given.

Sant *(Boerhavia diffusa Linn)*

In Ayurvedic treatment, Sant is one of the most useful herbs. The sanskrit name is *Punarnava* and the name itself denotes that its use rejuvenates the body. It is a stimulant to both heart and kidney. During rainy season this plant is particularly seen spreading on ground. So it is called *Varshabhu.* It is seen throughout the subcontinent.

This herb is seen branched profusely, generally spreading on the ground or partly ascending. Leaves are thick, in unequal pairs, ovate, oblong or roundish. Flowers are small, reddish pink in colour blooming in clusters. Fruits are oval, viscid, glandular on the ribs.

The whole plant particularly the leaves and roots are useful. The leaves are used as vegetable. This plant contains the alkaloid 'Punarnavine'. It also contains potassium nitrate in large quantities.

It is a valuable diuretic, laxative, diaphoretic and anti-helminthic. Due to this diuretic property, it can reduce oedema. So its is known as 'sobhaghni'. As a diuretic, it is particularly useful in diseases of heart and kidneys. Externally, it is used as a dressing for oedematous swelling. It is also found useful in poisoning due to insect bites. The juice of the leaves is given in liver complaints such as jaundice.

Common uses of Sant

1. The whole plant ground to paste, taken 3-6 gm twice daily is found useful for reducing swelling. This paste can also be used externally for the same.

2. In scorpion and rat poison, the root is applied externally. In addition, internal use of root is also done.

3. With Sunth (dried ginger) and chiretta *(Swertia chirata)* the

root is given in jaundice, ascitis, scanty urine and internal inflammations.

4. The juice of the leaf mixed with honey, is dropped into the eyes in chronic ophthalmia.

5. In mild cases of dropsy, a dish of the fresh herb boiled, salted and eaten with bread gives much relief.

Pippali *(Piper longum Linn)*

Long pepper, known as Pippali, that comes under the *trikadu* (the bitter three) (the other two being dried ginger and black pepper), is a household name from the ancient time. It is highly acclaimed for its spicy nature and medicinal value.

It is a small shrub with a large woody root and numerous creeping, jointed stems, thickened at the nodes. Leaves are smooth, alternative and ovate. Flowers are minute and unisexual. The inflorescence is a spike; berries small and red when ripe.

It is indigenous in North-eastern and Southern India, often cultivated.

The dired unripe fruit spike and roots are used medicinally. It contains the alkaloid 'Piperine'. Old Pippali is considered to be more efficacious in medicine than the fresh one. It is carminative, cardic stimulant, digestive, diuretic, emollient, an appetiser, a vermifuge, and a rejuvenator. It is useful in arthritis, lumbago, weakness, pain all over the body and dyspepsia. Externally, it is rubefacient.

The use of Pippali for a long period is not good.

A few common uses

1. Two gm of fine powder of Pippali taken with honey cures cough, cold, hoarseness and hiccup.

2. The powder of *trikadu* in equal quantities with hot water is useful in colic and flatulence.

3. One or two gm of powdered Pippali taken with a glass of milk twice daily for a period of 15-30 days will rejuvenate vitality, relieves anorexia and anaemia. This is also found useful in chronic cases of fever and piles.

4. Pippali with equal amount of black pepper (2 gm each) taken with hot water relieves diarrhoea.

5. The oil to which are added long pepper and ginger, is used as a rubefacient in sciatica and paraplegia.

Ginger *(Zingiber officinale Roseoe)*

It is a very important drug in Ayurveda. Both fresh and dried rhizomes are used medicinally. The fresh one is known as 'adrak' and the dried one as 'sunth'. The dried one is an ingredient of *trikadu*. It is a home remedy used in a variety of diseases like colic, flatulence, dyspepsia, cough; loss of appetite, nausea and fever. So much so, it enjoys the popular names of *Viswabheshaja* (universal medicine) and *Mahoushadhi* (the great drug).

It is a perennial herb, with solid, aromatic, horizontal rhizome. It can grow up to a height of one metre. Leaves are linear, without stalks. Flowers are rarely produced.

It is a native of tropical Asia. In India, it is cultivated mainly in Kerala, Punjab, Tamil Nadu and West Bengal.

The important ingredients of ginger are zingiberine and gingerol.

Internally, it is an active ingredient of various preparations used for dyspepsia and piles. If the powder of dried root is kept in mouth, it stimulates the flow of saliva, warms and tones the stomach. For ordinary ailments such as cold, influenza, etc giner tea is a pleasant and effective drink. A hot infusion is very useful for relieving flatulence. It is also useful in delaying the action of poison. For relieving pain and swelling, it is applied as a paste externally.

Some common uses of ginger

1. Taking dry ginger with salt before meals is an excellent carminative.

2. For chronic rheumatism, one dessert-spoon of ginger infused in six ounces of boiling water is taken warm at bed time.

3. The ginger made into a paste with water, applied topically is a local stimulant and rabefaciant.

4. Enclosed in Tulsi leaf, fresh ginger is used for relief of severe toothache.

5. Administration of five ml juice of ginger with one spoon of honey is a good remedy for cough and sore throat. Take this preperation in the morning and evening for seven days.

Brahmi *(Bacopa mooniera Linn)*

Brahmi is an annual herb found throughout India in wet and marshy areas. Hence the name *Seethakamini*.

It is a succulent, glabrous, creeping herb with ascending branches. The leaves are semicircular, pulpy, glossy and juicy. Flowers are solitary, stalked and generally light blue. Fruits are elongated and pointed at the tip. Seeds are numerous.

It is included under the 'Medhya Gana' (nervine tonic) in Ayurveda. The whole plant is used medicinally. The herb is administered as a nervine, cardiac tonic and as febrifuge. It is considered very useful in nervine disorders, mental diseases, constipation and as a diuretic. It is also considered as a blood purifier. Chemically active ingredients are *Brahminin*, erpestin and tanin.

Important uses of Brahmi

1. In children with weak intelligence, the extract of entire plant 5-10 ml with butter should be given regularly in the early morning. If fresh plant is not available, then the powder of dried Brahmi should be given (1-1.5 gm).

2. The intake of Brahmi boiled in milk regularly is good for insane persons and epilepsy patients.

3. Leaf juice mixed with petroleum jelly makes a good liniment for rheumatism.

4. A poultice prepared by boiling the plant is effective in acute bronchitis, cough and chest complaints in children.

5. Fried leaves are effective in hoarseness.

In some States like UP, Punjab, *mandorkaparni (hydrocotyl)* is known as *Brahmi.*

TIL *(Sesamum indicum Linn)*

The Sanskrit name is *tila* and this comes under *snehavarga* in Ayurveda. A *snehadravya* is one which makes the body *snigdha.* The oil extracted from Til—Tilatail is considered as the best *snehadravya.*

The plant is an annual herb growing up to a height of 1 1/2 metre. The stem is angular and hairy especially in the upper parts. Flowers are shortly stalked, pale pink, solitary and arise from the axils of the leaves. Fruit is a capsule, 1-2 inches long, seeds are numerous and varying in colour—white, red, black or brown. China and India are the leading Til-producing countries of the world.

The parts used in medicine are leaves, seed and oil. The seed contains 45-50 per cent oil and 22 per cent protein. The white seeds are said to yield the finest oil. Til oil is a mixture of oleine, stearine and other compounds of glycerine. It acts as nutrifine and lubricant both internally and externally.

It is a very useful drug in different types of menstrual disorders, *oligo menorrhoea, dysmenorrhoea,* etc. Daily intake in small quantities increases general health, hair growth, keeps the skin bright and teeth good. The seeds are laxative, lactogenic, digestive and nourishing. Externally, the leaves are used as an emollient poultice.

Important uses

1. For *dysmenorrhoea* and secondary *amenorrhoea,* take powdered Til one spoon twice daily (start taking before menstruation for dysmenorrhoea). This treatment is coupled with a hip bath to which a handful of crushed seeds has been added. Decoction of seeds is given as an emmenogogue.

2. Daily intake of 10 gm of *thriphala* and Til in the morning keeps the body healthy.

3. A poultice made of the seeds is used for ulcers, burns, etc.

4. Taking about 10 gm of black gingili seeds ground and mixed with goat's milk, is found effective in dysentery with blood and mucous secretion.

5. Five to ten gm of gingili powder mixed with water and butter is given for bleeding piles.

Giloe *(Tinospora cordifolia Miers)*

Tinospora, commonly known as Giloe is distributed throughout tropical India, Pakistan and extends up to Sri Lanka. This stem climber with perinnial stems reaching up to two inches in diameter with a thick, soft warted bark. Its leaves are smooth, heart-shaped, long and stalked.

The useful medicinal parts are mainly root and stems collected during the hot season when as per Ayurvedic system of medicine they are most abundant and concentrated.

Giloe is reputed to possess tonic, antiperiodic, antipyretic and diuretic properties. It is regarded as especially valuable in general debility after fevers and other exhausting diseases. It is also useful in secondary syphilitic affections and chronic rheumatism. Fresh plant is considered to be more effective than the dry plant. Its watery extract is known as "Indian quinine". It is highly effective in ordinary, simple fevers due to cold or indigestion in children.

Important medicinal uses

1. In acute phase of renal failure, the juice of Giloe is useful. Fifteen ml juice of Giloe is taken in the morning and evening daily for one month. It can be cured.

2. For excessive hotness and peripheral neuritis of the body, Giloe powder is useful—250 mg powder of Giloe taken with honey in the morning and evening daily for 20 days will cure this disease to a great extent.

3. Half ounce juice of green stem of Giloe and one spoon of honey is taken orally in the morning in empty stomach for seven days will cure common fever and coryza in children.

Salsa *(Hemidesmus indicus R.Br)*

This blood purifier shrub is common in West Bengal extending to Southern India, found in many parts of Northern India, Pakistan and upper Gangetic plain.

This twining shrub has numerous, very slender, woody, smooth stems and slightly branched tortuous root with branches much elongated, whip like, simple and smooth. Leaves are variable in shape and size; flowers are almost without stalks, green on the outside, purple within.

Dried root is used as medicine. Chemically a crystalline substance, hemidesmin is present in the root of Salsa plant. The roots are an excellent substitute for *sarsaparilla;* they are sweet, blood purifying, diaphoretic, diuretic and tonic. The root is very useful in loss of appetite, dyspepsia, fever, skin diseases and leucorrhoea. Nowadays, it is also tested for the treatment of psoriasis, an uncurable skin disease. Salsa has a good reputation in the beverage industry also.

Medicinal uses

1. For the yellow and red colouring of urine due to jaundice, 10 gm Salsa powder is boiled with one glass of cow's milk and taken in the morning and evening. Continue this therapy for a few days until the condition is cured.

2. For chronic cough and coryza, the pulverized root, mixed with cow's milk is beneficially given for seven days.

3. For curing skin diseases, Salsa is a reputed drug of choice. Three gm of Salsa powder is taken in the morning and evening daily for ten days. There is a significant improvement observed in the case of skin disease like eczema.

4. The decoction made from Salsa is used for blood

purification. According to the Indian system of medicine, blood purification is necessary in diseases like eczema, psoriasis, etc.

Conclusion

There are some plants which are, in fact, panacea for most of the human ailments. Their documentation is the need of the hour with a view to thwarting any foreign designs on our inherited medicinal treasure. Also, suitable propagation techniques are to be developed, like ideal tissue culture method and medium for their growth. Germ-plasm storage of these sacred and valuable plants are to be done for the posterity also. There are umpteen plants in our diversely rich flora which lie underexploited. Our scientific community is endeavouring to throw light on their immense potentialities.

Creating awareness on the medicinal properties of these indigenous plants, which we very often encounter in our daily life, through dissemination of research data coupled with extension activities will go a long way in conserving nature's priceless gift. In fact, conservation is to replace preservation ensuring the utilization of the plant wealth on a sustained basis without endangering their existence. And that would be the ideal method.

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(Continued from page 18)

when cases like 'haldi' come up. Speaking on what should be patented under IPRs whether the knowledge itself or the product of the knowledge, Dr M.S. Swaminathan stated, "Indigenous knowledge systems are similar to general scientific information in that they are part of public knowledge. Intellectual Property Rights have so far been applied to novel and discreet intellectual goods rather than to public goods such as knowledge systems. The usual criteria for recognising IPRs, novelty and non-obviousness, generally tend to ignore the knowledge systems of rural and tribal families, although they are often characterised by a high degree of inventiveness. While the knowledge itself may not be patentable, the product of the knowledge, namely "folk" varieties, land races and genetic diversity at the intraspecific level, provide the basic raw material for modern plant breeding and biotechnology (Swaminathan, 1994).

The issues which have been elucidated above are not so easy to tackle. In a country like India, it would be very difficult to convince the people and the government of the consequences which a scientist-planner envisages to be met after 50 years for the vulnerable plant species of medicinal and other importance. The government and other agencies, who are funding medicinal plant projects have to consider many other aspects on conservation, cultivation, etc, which have not been touched upon in this article.

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"He that planteth a tree is a servant of God. He provideth a kindness for many generations and faces, that he hath not seen, shall bless him."

—Henry Van Dyke

Stopping bio-piracy

Vandana Shiva

The recent withdrawal of the turmeric patent on the basis of a challenge filed by the Council of Scientific and Industrial Research is a small step in reversing bio-piracy. The US needs to cancel all patents based on indigenous knowledge. Examples of bio-piracy make it clear that it is not just Indian patent laws that need modification. The American laws also need to be changed to fit into a fair and honest global Intellectual Property Rights system. Submission to the World Trade Organisation in this regard will ensure adequate protection against bio-piracy, says the author.

Two major decisions have revived the intensity of the patent debates that occupied centre stage in the national political arena during the finalisation of the Dunkel draft text of the General Agreement on Tariffs and Trade and the subsequent coming into force of the World Trade Organisation.

The first is the WTO ruling against India in the Indo-United States dispute on Trade Related Aspects on Intellectual Property Rights (TRIPs).

The second is the decision of the US Patent Office to revoke the turmeric patent on the basis of a challenge filed by the Council of Scientific and Industrial Research.

The WTO dispute panel is putting pressure on India to adopt US style patent laws. However, as the turmeric patent makes evident, the US patent system has its own weaknesses—it allows bio-piracy to be practised as a rule. The withdrawal of the turmeric patent is only a first step in reversing bio-piracy.

Patents on *neem, Amla, Jar Amla, Anar, Salai, Dudhi, Gulmendhi, Baghherenda, Karola, Rangoon-ki-bel, Erand, Vijayetishisham and Chamkura* all need to be revoked.

The US needs to revoke all patents based on indigenous knowledge and "prior art". In addition, America also needs to change its patent laws which allow bio-piracy by non-recognition of foreign prior art.

Patents are supposed to satisfy the three criteria of novelty, being non-obvious and utility.

Novelty implies that the innovation must be new. It cannot be part of "prior art" or existing knowledge. Being non-obvious implies that someone familiar with the art should not be able to achieve the same step. Most patents based on indigenous knowledge appropriation violate the criteria of novelty combined with being non-obvious because they range from direct piracy to minor tinkering which involves obvious steps to anyone trained in the techniques and disciplines involved. In the US, many distortions in law exist, facilitating the patenting process for companies such as those in the pharmaceutical industry. One such distortion is the intepretation of "prior art". It permits patents to be filed on discoveries in the US despite the fact that identical ones may already exist and be in use in other parts of the world.

Section 102 of the US Patent Act does not state a general definition of "prior art", but a very narrow rule bound method to be used by low level patent examiners to determine which materials will defeat a patent application by violation of the novelty and being non-obvious criteria. Prior foreign activity anticipates a US patent only when the foreign activity is fixed in a tangible, accessible form such as a published document or patent. However, prior foreign knowledge, use and invention are all excluded from the prior art related to a US patent application.

Unless Section 102 of the US patent laws are changed, new forms of bio-piracy will continue to occur.

Examples of bio-piracy make it clear that it is not just Indian patent laws that need to be changed. The American laws also need to be changed to fit into a fair and honest global Intellectual Property Rights system. The WTO which has been established to set up a multilateral rule based system has a role in ensuring that the inequity and injustice that bio-piracy exhibits is removed from the IPR regimes of all member countries.

India needs to make a submission to the WTO to initiate proceedings to change US patent laws to ensure adequate protection against bio-piracy. This will serve India in two ways. If we get a ruling in our favour, the world will have solved the problem of piracy of indigenous knowledge of the South. If India's submission is not accepted and a panel not set up to investigate the inherent weaknesses and inadequacies of the US patent system, the bias of the WTO towards the powerful countries will have been rendered transparent.

The hurry with which the WTO has given a ruling on the Indo-US TRIPs dispute is an example of the built-in bias of the WTO.

The first submission of the US to the WTO against India's "patent protection for pharmaceutical and agricultural chemical products" was made on March 6, 1997. The submission addresses Article 5 of the Indian Patent Act which excludes pharmaceutical and agricultural chemical products from the scope of patentable subject matter. Article 5 of the Patent Act provides: "In the case of inventions—

(a) claiming substances intended for use, or capable of being used, as food or as medicine or drug, or

(b) relating to substances prepared or produced by chemical processes (including alloys, optical glass, semiconductors and intermetallic compounds), no patent shall be granted in respect of claims for the substances themselves, but claims for the methods or processes of manufacture shall be patentable."

In particular, the submission states: "India has not yet made available product patent protection for pharmaceuticals and agricultural chemicals, and thus has chosen to take advantage of at least part of the exclusive marketing rights. Thus, India has violated its obligations under Article 70, paragraphs 8 and 9, of the TRIPs Agreement to (1) establish a mailbox system in its law, and ensure that no applicants are denied eligibility for patent protection because of the delay in establishing the mailbox system, and (2) establish a system for the grant of exclusive marketing rights.

India has up to January 1, 2005 to make available product patent production for pharmaceuticals and agricultural chemicals. We need to utilise this transition period to the fullest to ensure that our patent laws do not violate the "order public" or have a negative impact on animal and human health or the environment.

Article 27.2 of TRIPs allows exclusions on grounds of public morality:

Members may exclude from patentability inventions, the prevention within their territory of commercial exploitation of what is necessary to protect "Order Public" or morality, including to protect human, animal or plant life or health or to avoid serious prejudice to the environment, provided that such exclusion is not made merely because the exploitation is prohibited by their law.

Quite clearly, exclusive marketing rights (EMRs) cannot be granted for products which would violate our public morality, our environment, our public health and nutrition and our socio-economic and technological development.

Clauses 70.8 and 70.9 of TRIPs which required an instant creation of a mailbox arrangement and granting of EMRs when the WTO agreement came into force thus, in effect, negate the transition period available to countries to evolve legislation appropriate to their contexts. This is further complicated by the fact that without changes in US patent laws, many patents are based on bio-piracy.

Should India give an EMR to a corporation which has a pharmaceutical patent or an agri-chemical patent based on indigenous knowledge systems of India? Should the system to prevent bio-piracy, be there at all?

Suppose a corporation like W.R. Grace applies for an EMR for neem-based pesticides in India—will India grant it? Suppose a corporation asked for EMRs for hepatitis drugs derived from *Phyllanthus Niruri*; is it in our interests to grant such EMRs?

Unless we have a system in place which prevents the granting of EMRs on the basis of patents obtained through bio-piracy, EMRs will basically become an instrument of destruction of our economy.

We have a legitimate method under our international legal obligations to stop bio-piracy and protect our indigenous innovations. We need to evolve legislation to first protect our own innovations. Foreign claims to innovation should be protected after our own systems have been put in place.

The Convention on Biological Diversity does allow us mechanisms to frame laws to prevent bio-piracy. In particular, Article 8 (j) recognises that:

"subject to its national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilisation of such knowledge, innovation and practices.

It is in India's interest to implement our national bio-diversity legislation before granting EMRs or changing the Indian Patent Act. The determination and will to defend our national and public interests and protect our innovation should be stronger than the determination and will to defend our national and public interests and protect our innovation should be stronger than the determination and will to defend US interests and protect US bio-piracy. This is a real test of our freedom and sovereignty. We need to take stock of the scale and extent of our bio-diversity based economy which, in my assessment, accounts for two-thirds of our productive economy, but is invisible because it is the economy of people our centralised planning has rendered invisible. We need to show that the potential loss to India in the form of global markets or domestic markets is due to bio-piracy by countries like the US. We need to go through this exercise to protect our sovereignty and make our rightful claims with trading partners. The exercise of the potential loss due to bio-piracy also needs to be done to avoid unnecessary and illegitimate trade action by the US due to the TRIPs dispute ruling.

When the US was introducing IPRs in the Uruguay Round as a new issue, the US had accused the Third World of piracy. The estimates provided for royalties lost in agricultural chemicals are $202 millions and $2,545 millions for pharmaceuticals. However, as the team at the Rural Advancement Foundation International (RAFI), in Canada has shown, if the contribution of Third World peasants and tribals is taken into account, the roles are dramatically reversed: the US owes $302 millions in royalties for agriculture and $5,097 millions for pharmaceuticals to Third World countries, according to these latter estimates. In other words, in these two biological industry sectors alone, the US owes $2.7 billions to the Third World. This debt will not be paid by the US unless we have our bio-diversity legislation in place. India needs to take stock of its bio-diversity based economy both for ecological, economic and political survival.

It is not the US submission, or the ruling of the WTO Dispute Panel, which will determine whether we will act as a sovereign country. It is Parliament and the people in whose hands the exercise of our sovereignty lies. *(By courtesy of The Hindu, Chennai-600002).*

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Keeping vigil against bio-piracy: lessons from the turmeric patent case

T.D. Nagpal

India's recent victory in the turmeric patent case has enhanced the confidence of our scientific community and has helped in removing apprehensions about preventing bio-piracy of inventions based on traditional Indian knowledge base by developed nations. The case has demonstrated that CSIR and other Indian institutions have now acquired capabilities to fight the complex techno-legal issues of Intellectual Property Rights both defensively and aggressively to meet the challenges under the WTO. The turmeric case underscores the vital importance of documentation of prior knowledge. The victory has activated CSIR to take initiative to cover 160 medicinal plants and to build a modern knowledge-based infrastructure in the country.

There is an old adage that India is a rich country where poor people live. India is rich because of its biodiversity—the vast variety of flora and fauna. It is on record that the First International workshop on medicinal plants and their characteristics was held in Himalayan region in India as early as 1500 BC, wherein medicine specialists from European countries, China and other South-East Asian countries gathered to exchange their expertise, experiences and to collect firsthand information on the medicinal plants growing in Himalayan region. Indians are poor because they could not convert their knowledge of biodiversity into wealth. The position has not changed much even today when the nation is knocking at the door of 21st century. A glaring example for this is the case of 'Turmeric Patent'. Turmeric powder is being used to heal wounds since centuries in India and in this region of the world but the inventors of this phenomenon did not bother to document this information. The Vaidyas who gathered or generated this knowledge kept it confined to their family members only and did not want to share it with any one outside the closed circle. The mode adopted to pass down the information to their near kin was simply by word of mouth and teaching them orally.

China is the native land for tea which has been growing there since centuries and people have been using it as a stimulant. They were conscious of the 'Intellectual Property Rights' and did not allow the seeds to go out of the country in any form. It was a daring Briton who smuggled the seeds of tea plants out of the country and tried to grow them in the suitable climate in India in the early 19th century. It is now a household name in India.

The Indian challenge

The turmeric tale is related to the Indian way of handling information. Taking advantage of this attitude of the Indians, two Americans of Indian origin Mr Suman K. Das and Mr Harihar P. Cohly of the University of Mississippi Medical Centre, Mississippi filed a patent on the use of turmeric powder for healing wounds with the US Patent and Trademark Office (USPTO) vide US patent No. 5401504. The patent was granted to these physicians on 28 March, 1995 though they had to part with US$ 15,000 for obtaining the same. Again, because of the lack of alertness on the part of Indians, it could not be taken note of till 2 July, 1996. It was Dr R. Saha, Director, Patent Facility Cell, Dept of Science & Technology who came across this information accidentally while scanning on Internet. The information was highlighted in one of the leading newspapers from New Delhi. The very next day the Director-General, Council of Scientific & Industrial Research (CSIR) decided to challange the patent by Mr Das and Mr Cohly. The petition was to be filed with the USPTO for re-examining the specific US patent on the use of turmeric powder in healing wounds on the basis of scientific principles that patent can be obtained if it satisfies the following important criteria of patentability:

1. It should be new and useful novelty;
2. It should involve an inventive step; and
3. It should have utility, capable of commercial application.

The criterion of novelty is particularly strong in the case of patents. No doubt, turmeric has utility as it heals wounds but it could not be claimed to be non-obvious. As the use of turmeric in the form of powder, paste and other forms is an age-old practice in India, its prior art was well-documented in social, religious and scientific literature in different languages in the country. This motivated CSIR to plunge into action.

CSIR had to collect the maximum number of documents to ask the USPTO to re-examine the decision. CSIR took about three months to collect this information available in English and other Indian languages and got these translated into English to present them in the required scientific form. The USPTO does not accept oral evidence in the case of information from countries other than US and accepts evidences in one go only, not in bits. CSIR could pick up 32 relevant documents published before the date of filing of the patent. Among the important documents was a paper by

Gujral *et al*, "The Effect of Indigenous Remedies on Wounds", *published in the Journal of Indian Medical Association* (1953). The other important references were *The Wealth of India* (1950), *Indian Materia Medica* (1976), *Economic and Medicinal Plant Research* (1990), *The Ayurvedic Pharmacopoeia of India* (1986), *The Selected Medicinal Plants of India* (1992), 'Haldi Can Heal', *Science Today* (1986), *Susruta Samhita* (1980) and several others. The condition of the USPTO that the information complete in all respects is to be submitted in one go was taken care of.

The USPTO re-examined the case and unequivocally rejected all the six claims of this patent on 13 August, 1997 ruling finally that the invention is not patentable. It has been observed clearly by the examiners that the earlier act of the USPTO in granting the patent was mainly because of lack of information that the turmeric was being used for wound healing since centuries in India and emphasised that the fact that it had now cancelled the patent, shows clearly that it acted in a fair and transparent manner. The monetary gain from this patent, of course, would have been restricted to US consumers only as US patent does not apply to India. *The real gain for India in the withdrawal of the patent by the USPTO is that it has demonstrated that CSIR and other institutions have acquired capabilities to fight the complex techno-legal issues of Intellectual Property, both defensively and aggressively to meet challenges under the World Trade Organization (WTO).*

This contest was not at all a battle between the two countries or the scientific communities of the two nations, but was based on the scientific principles and with academic interest only. *The patent was contested to enhance the confidence of the Indian scientific community and help in removing the unfounded fears in the minds of the people of helplessness in preventing bio-piracy and appropriation of inventions based on traditional Indian knowledge base by developed nations and other international organizations.* The rejection of this patent by the USPTO has not only proved that such cases could be successfully fought as these should be based on well-argued and well-supported techno-legal grounds and not just on emotional basis. The documentary evidence submitted by CSIR was acceptable to the USPTO even for the admission of its case for re-examination and this entailed painstaking research and careful selection of documents from the enormous amount of literature on the subject available in various Indian languages which had a bearing on all the claims in the patent.

All the six claims have been rejected by the USPTO under 35 USC 102(b) and 35 USC 103(a) of the USPatent Statute:

1. A method of promoting healing of wound in a patent, which consists essentially of administering a wound healing agent consisting of an effective amount of turmeric powder to said patent.
2. The method according to claim 1, wherein said turmeric is orally administered to said patent;
3. The method according to claim 1, wherein said turmeric is topically administered to said patent;
4. The method according to claim 1, wherein said turmeric is both orally and topically administered to said patent;
5. The method according to claim 1, wherein said wound is a surgical wound;
6. The method according to claim 1, wherein said wound is a body ulcer.

According to Dr R.A. Mashelkar, Director-General, CSIR, the victory is 'only a small step forward'. Still it is quite significant from the people's perspective. The kind of emotional response that CSIR received from school and college students from remote areas of Rajasthan to Assam, from Kashmir to Kanyakumari is indicative of the sense of pride that the verdict has evoked throughout the country.

Far-reaching consequences

This appears to be the first case where the use of traditional knowledge base of a Third World country, patented in US has been successfully challenged with the US Patent and Trade Mark Office, leading to complete cancellation of the patent.

It may be recalled that earlier efforts made by several interested groups to challenge the neem patent were not even entertained for admission by the USPTO. The neem story is altogether different. It needs to be made clear that neem has never been patented in US as complete tree including bark, leaf, extracts, etc. The patent on neem has been granted for the process developed to stabilize the active ingredient 'azadarichtin' involving innovation and novelty. The patent has gone to M/s. W G Grace & Co., Washington. Indian scientists are reported to be in possession of 140 patents involving the use of the same compound.

The success on the turmeric front strongly sends signals that if patent cases are fought on techno-legal grounds, then there is nothing to fear about our traditional knowledge base being stolen. For this, documentation has to be done properly and needs to be put on CD ROM as the days for printed hard copy are over.

This achievement has further activated CSIR to take initative to cover 160 medicinal plants which include traditional ingredients such as the terminalias and the myrobalams and gooseberries which go into making of the famous elixirs such as *Triphala Churan* and *Chavanaprasha*. In addition to the documentation and study of literature, the efforts in the laboratory will be to isolate the active principles and compounds and to carefully categorise their effects in modern clinical trials. *This is a crucial part of the effort to build a modern knowledge-based infrastructure in India.* There are about 7,500 plant species in India used in one or the other form for curing various types of ailments both in humans and animals. A very conservative estimate shows that medicinal plant trade in India is of around Rs. 5.5 billion per year, while the world trade in these items is of the value of Rs. 60 billion. *This calls for aggressive patenting by creating new products in order to survive the highly competitive international market.*

Revamping the patenting system

With the turmeric patent victory infusing a new spirit into the system, the Government of India has constituted a high powered

(Continued on page 47)

Cultivation of aromatic plants: a viable alternative for income generation

Ashok K. Pandey and A.K. Bisaria

Essential oils are used in the manufacture of perfumes, soaps, cosmetics, phamaceuticals, ice cream, non-alcoholic beverages, toothpastes, etc. They have therapeutic and antiseptic properties and are valuable from the medicinal point of view. The world trade in essential oils is more than one billion dollars with India producing a substantial quantity. Natural forests account for the lion's share of essential oils produced in the country and only a small quantity is produced from cultivated plants.

Man has for ever sought the use of flowers and fragrances for a variety of purposes. Higher plants have provided the basic raw materials for such fragrances and flowers. Essential oils are the volatile odoriferous substances widely found in plants. Their main constituents are organic substances. The oil content ranges from trace to two per cent or even more in some plants. Essential oils are used in various ways, depending upon their specific odour and high volatility. They are extensively used in manufacture of perfumes, soaps and other toilet preparations. Many find use as essences for ice creams, liquor and non-alcoholic beverages, toothpastes and tobacco, etc. These have therapeutic and antiseptic properties and are valuable from the medicinal point of view. Thus keeping in view its use, utility and importance, they find use in perfumes, soap and cosmetics, pharmaceuticals, confectionery and *agarbathi* industries, etc. A substantial quantity of essential oil is produced in India, much of it from natural forests and a small quantity from cultivated plants.

Today, essential oils from more than 100 different species of higher plants are used all over the world as raw material in perfumery, cosmetics and flavour industries. More than 50,000 tonnes of essential oils, in addition to oleoresins as well as turpentine oil are used as raw material for fragrances and flavours all over the world. The world trade in essential oil alone is more than one billion dollars. The important essential oil produced in India are lemon grass oil, palmarosa oil, citronella oil, Khus oil, sandalwood oil, lavender oil, etc. With increase in demand for essential oils, efforts are being made to cultivate important aromatic plants keeping in view their best utility as a source of essential oil.

Being cash crops, the cultivation of *Cymbopogon* and *Vetiver* species has played a vital role in the uplift of the socio-economic status of the growers. The cultivation and processing of these crops are quite different from the traditional crops. Hydrodistillation and steam distillation is the most common process for obtaining the essential oils from plants.

Citronella oil

Citronella oil is one of the most important essential oils used in perfumery and cosmetic industries. The oil is obtained from the steam distillation of the leaves of *Cymbopogon winterianus* Jowitt, designated in trade as Java citronella and *Cymbopogon nardus* Rendle, designated in trade as Ceylon citronella.

Java citronella is much superior to Ceylon citronella. Because of its superior perfumery value, most of the production of citronella oil in the world consists of Java type and only a limited amount of Ceylon citronella is produced in Sri Lanka. At present, the world production of Java citronella is approximately 5,000 tonnes. It is produced mainly in China, Indonesia, Taiwan, Guatemala and India.

At present, citronella grass is cultivated in Assam, West Bengal, Uttar Pradesh, Karnataka, Tamil Nadu, Madhya Pradesh, Kerala and Goa. Approximately 500-600 tonnes of oil is produced annually in the country.

Cultivation: Citronella is propagated vegetatively by splitting the clumps. The clump is divided into a number of slips containing 1-3 tillers. Before planting, fibrous roots and leaves should be trimmed and slips are planted at a distance of 60-30 cm at a depth of 10 cm in rows which are 60 cm apart. Before planting, the field should be ploughed thoroughly. The ideal time for planting in tropical areas is the onset of monsoon. The planting distance depends upon the fertility of soil and climate.

As citronella is generally planted during rainy season, it faces serious competition from weed growth in the initial stages. Weeds put more and faster growth and are more competitive under high fertility, which is necessary to obtain higher yields in this crop. Weeds can be controlled by application of 2, 4-D, diuron and simazine.

Harvesting and processing: First harvest of citronella is taken after 3-4 months to induce tillering. Subsequent harvests are taken every 3-4 months during the first year and after 4-5 months in subsequent years. It does not require repeated planting. However, it is advisable to pull up the crop after 3-4 years and plant the field with rotational crop. Harvesting is done by sickles and the leaves are harvested 15 cm above the ground level. After cutting, the

grass is exposed to sun for 12-24 hours to remove the excess moisture.

Citronella oil is obtained by steam distillation of the leaves. Distillation of oil usually carried out in directly fired stills or stills which are operated with steam boiler is generally completed within 4-5 hours. After distillation, the excess moisture is removed, oil is filtered and stored in aluminum or galvanized steel cans. The average recovery of the oil is 1.0 per cent. The yield is approximately 100 kg/ha during the first year and 150 kg/ha in the subsequent years. The oil is being sold for Rs. 300 per kg.

The main constituents of Java citronella oil are citronellol (13.4-15.7%), geraniol (14.3-24.3%) and citronellal (12.0-46.8%).

Palmarosa oil

Palmarosa oil is obtained from Rosha grass (*Cymbopogon martini*) which occurs in Madhya Pradesh, Bihar, Rajasthan, Uttar Pradesh, Maharashtra, Gujarat, Andhra Pradesh and some other parts of South India. Two important varieties of grass are found, a sporadic variety bearing the name 'Motia' which gives better quality of oil with higher geraniol content (75-95%) and a gregarious variety 'Sofia' with lower geraniol content (Less than 70%).

Rosha grass (*Cymbopogon martini*, Var. Motia) is a tall perennial aromatic grass about 3 m high occurring wild in drier tracts of Khandwa, Betul and Indore divisions of Madhya Pradesh. In Madhya Pradesh, this grass is also being cultivated in Bhopal, Khurrai (Sagar district), and Mandla. The oil is obtained from inflorescence while small quantities of oil can also be obtained from leaves and stem. The total annual world production of Palmarosa oil is approximately 60-70 tonnes. India is the main producer followed by Brazil, Guatemala and Indonesia.

Cultivation: Palmarosa grows well in well-drained medium loam and light sandy loam soils. Heavy clay and waterlogged soils are not suitable. It is a hardy plant and can be cultivated in degraded and poor soils, eroded land as well as marginal and submarginal soils.

Palmarosa is propagated through seeds. Seeds are mixed with sand and sown in rows at a distance of 15 cm in seed beds in April-May. Beds are covered with a thin layer of sand and farmyard manure. It is kept moist by frequent water sprinkling. Two and a half kg seeds are required for one hectare of land. Seedlings are ready for transplanting after four weeks. They are transplanted in field in the month of June-July, soon after the onset of monsoon. About 15 cm tall seedlings are planted at a distance of 60 cm in rows which are 60 cm apart. However, spacing depends upon the agro-climatic conditions and soil fertility.

Control of weeds during the initial period of 4-6 months is very important for getting good growth of seedlings. Two hand weedings are required during the period of 4-6 months after planting. Effective weed control is needed for the first year of growth and no weed control measures are required in subsequent years.

Harvesting and processing: Palmarosa is harvested in full bloom stage, ie 7-10 days after start of flowering. The first harvest is taken in October-November and subsequent harvests can be obtained at 4-5 months interval depending upon rainfall and fertility of the soil. In the first year, 2-3 harvests are obtained and 3-4 during subsequent years. The crop should be harvested 10-15 cm above the ground level.

Palmarosa oil is obtained by steam distillation of the flowering tops. Distillation is carried out in directly fired field stills or a still operated by boiler. The harvested material is spread out in shade for a day prior to distillation to reduce moisture. Chopping of grass into 3-4 pieces before charging in still will allow proper packing of plant material and saving of fuel. After distillation, oil should be made free of moisture. The moisture-free oil is filtered and stored in aluminum or galvanized steel containers.

The yield of oil is 0.5 per cent to 0.6 per cent depending upon the growth and climate. About 60 kg per hectare of oil is obtained during the first year and 80 kg per ha oil during subsequent years. However, under good management conditions, yield up to 200 kg per hectare can be obtained. Currently, this oil is being sold at Rs. 450 per kg.

Uses: Palmarosa oil is used as a base for perfumes and in cosmetics, particularly in soap industries where its great tenacity is highly valued. It is also used for flavouring tobacco. It forms an ingredient of mosquito-repellent ointments. It has several applications in medicine. It is the best natural source of high grade geraniol.

Palmarosa oil contains geraniol (65-85%), geranyl acetate (6-12%), citral (4-12%), citronellol (6.4%), linalool (2-4%) as major constituents.

Khus oil (Vetiver)

Vetiver (*Vetiveria zizanioides* Linn.) (Nash, Khus) is a densely tuffed perennial grass 0.9 to 1.8 m high. It is found in India throughout the plains and lower hills, up to an altitude of 1200 m. It is particularly abundant on the banks of rivers and in rich marshy soils. It is found wild in Uttar Pradesh, Punjab, Rajasthan (Bharatpur and Ajmer). It is also found in Assam, Bihar, Orissa, Andhra Pradesh and Madhya Pradesh in semi-wild state. It is cultivated in some parts of Kerala and Tamil Nadu.

Vetiver has been known as an article of commerce in India for thousands of years and it has been used in Ayurveda as an ingredient of medicine for more than 1000 years. The oil has been distilled in India at least for 500 years and roots have been used for scenting and cooling curtains during summer months at least for 1000 years. The roots of this perennial grass yield an essential oil on steam distillation which is very pleasant in odour and is referred to as vetiver oil or Khus oil. Khus oil is used in perfumes, cosmetics and soaps. It is also used for flavouring beverages. The present annual world production is approximately 250-280 tonnes. Indonesia and Haiti produce 75 per cent of the total world export. At present, vetiver is exploited both from wild and cultivated sources, but vetiver population under natural growth is dwindling

fast and forest areas are under constant pressure of change due to agricultural and industrial development.

Cultivation: Vetiver is a hardy plant that can grow under a wide range of soil, climatic and geographic conditions. It grows wild under fairly hot as well as damp environments and can be cultivated in sandy loam, swamp, waterlogged areas or even in alkaline soils. This is due to the plant's genetic architecture as it possesses fibrous, spongy and branching roots with long and narrow leaves.

Vetiver is propagated vegetatively by root division. Culms are dig out and larger roots are cut off. The culms are divided into slips with 2-3 tillers. Planting is done during rainy season when the establishment of the plant is easy. However, it may be planted at the time of harvesting during January and February if irrigation facilities are available. These are planted at a distance of 60 cm from plant to plant and in rows 60 cm apart. If the planting is done during the rain-free period of winter, the field should be irrigated immediately after planting. Vetiver is a weed-smothering crop. Once it is established, it does not need weeding as it smothers all the weeds.

Harvesting and processing: Mature roots are harvested 15-18 months after planting. The usual practice is to dig out the roots by hand forks. Soil is shaken off and the root is cut close to the stem. The roots are made free of soil and dried in shade. Although fresh roots can also be distilled but dry roots yield better quality of oil. Dry roots are chopped into pieces and mashed and immersed in water before packing in stills. Vetiver oil has two fractions: one fraction is lighter and it floats in water and the other is heavier and sinks to the bottom of the separator. The total period is about 12-13 hours for complete distillation of roots.

The yield of oil depends upon the variety, method of cultivation and maturity of the roots. It varies widely from 0.4-1 per cent. An average of 12-15 kg oil per ha may be obtained from cultivated roots. In Northern India, Bharatpur is the biggest centre for Khus oil and Cochin in South India. The current market rate of vetiver oil ranges from Rs. 3,300-7,250 per kg depending upon the variety and quality.

Uses: Vetiver oil is a thick viscous and scented liquid. It is used as a fixative for highly volatile odours and blending of various perfumes in perfumery. It is also used for isolation of vetiverol and vetiveryl acetate which are used in high grade perfumes and cosmetics. It is also used for flavouring tobacco, *pan masala* and cold drinks in India.

The main constituents of Khus oil are Khusimol (13.4-27.9%), Vetiselinenol (10.3-19.5%), beta-endesmol (4.5-5%), alfa vetivone (1.5-2.5%), beta-vetivone (1.5-1.8%) and vetiverol (6.1-7%).

Sources of information

Since the importance of and awareness about aromatic plants has been increasing over the past couple of years, it is essential to know the sources of seed/planting stock, technology packages, which could be utilized for cultivation, processing and marketing of these plants.

The Central Institute of Medicinal & Aromatic Plants (CIMAP), Lucknow is serving as a nodal agency for technical services for cultivation and distillation/extraction; transfer of process; know-how developed; analysis; marketing; survey of land for cultivation and preparation of feasibility reports. Details can be had from the Director, Central Institute of Medicinal & Aromatic Plants, P.O. CIMAP, Lucknow-226015, Uttar Pradesh (Phone: 387570, 387550, 387530, 387520, 387543; Fax: 0512-385554).

The other organizations associated with aromatic plants are: (1) Indian Council of Forestry Research & Education, P.O. New Forest, Dehradun-248006 (UP), (2) The Department of Forest Products, Dr Y.S. Parmar University of Horticulture & Forestry, Nauni-Solan-173230 (HP); (3) Regional Research Laboratory, Jammu-Tawi, 180001 (J&K); (4) Perfume and Flavour Association of India, 23, Court Chambers, 35, New Marine Lines, Mumbai-400020 (Maharashtra); (5) Essential Oil Association of India, 301, 3832/24, Ansari Road, Darya Ganj, New Delhi-110002. ❑

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Mythology and medicinal plants

Nageswar Sharma

A number of plants and plant products which are used by Indian households have great significance to the health and well-being of the society as a whole. Our forefathers had great therapeutic sense while prescribing time-tested remedies for a number of diseases. Notwithstanding our rich heritage and knowledge on the use of plant drugs since time immemorial, little attention had been paid to harnessing the simple and inexpensive remedies to modern requirements. It is heartening to note that during the last couple of decades, rapid strides have been made to rediscover the virtues of these ancient drugs as the most harmonious remedies for a host of ailments that are beyond the pale of understanding of modern medicine.

The small herb that is found invariably in a Hindu house both in the foreyard and the backyard, the Tulasi (Holy basil), botanically called *Ocimum sanctum* has a legend dating back to the advent of Lord Krishna. The present-day Vrindavan was once a thicket of this holy plant which even to this day plays a vital role in the life of an average devout Hindu. It is mandatory for every family to grow a 'tulasi van' within the precincts of the house and one or two plants especially to be available for daily worship.

The daily routine of a devout Hindu consists of watering the plant in the morning with devotion and to gulp Tulasi *theertham* (Water flowing over the leaves of Tulsi). A simple Hindu woman spends considerable time around this plant doing worship and lighting lamps. The tender twigs and leaves of this plant form the *puja* material on all occassions mostly substituting for flowers. Beads made from the stem of this plant often adorn the pious Bhaktas. Let us see why?

Tulsi: various uses

The *Materia Medica* lists the various uses of Tulasi as follows:

The holy basil is the most sacred plant of the Hindus, being dedicated to Lord Vishnu. It drives away mosquitoes. Medically, the plant is useful in a variety of diseases.

An infusion of the leaves is given in malaria and as a stomachic in gastric diseases of children and hepatic affections. The leaf juice is used as an adjunct to metallic preparations which are rubbed with it into a thin paste and then licked up.

Mixed with lime juice, the leaves are used for ringworm as a paste. The dried plant in decoction is a domestic remedy for cough, catarrh, bronchitis and diarrhoea. A compound decoction of its leaves, the roots of *Solamum jacquibi* and of *Clerodendron siphonanthus*, "gulancha" and ginger in equal parts is recommended by Chakradatta in cough and affections of chest.

A decoction of the leaves with a little cardamom powder and *salep* powder makes a nourishing and sphrodisiac drink. The dried leaves are used as snuff in miosis and ozaena. The leaf juice poured into the ear is laid to be a first rate remedy for earache. Ten grams of expressed leaf juice taken every morning is said to cure chronic fever, haemorrhage, dysentery and dyspepsia.

Mixed with a little ginger, leaf juice is given for colic in children. Fresh juice is said to check vomiting and destroy intestinal worms. With honey, ginger and onion juice, it forms a good expectorant remedy useful in cough and bronchitis.

Tulsi is said to be useful in anchlostoma as it contains thymol.

The juice of fresh leaves, and the flower tops and the slender roots are used as an antidote in snake-poisoning.

The root is decoction is used in febrile affections.

A powder made out of the seeds of *Ocimum*, poppy capsules, *Tribulus terristris*, cabbage seeds and *Curculigo orchioides* with sugar is used in seminal debility.

The seeds rubbed in cow's milk is given for vomiting and diarrhoea in children.

There are a number of species of this genus *Ocimum pilosum* (green basil) which is found throughout India. It is a remedy for gonorrhoea, spermatorrohoea and kidney diseases.

The leaves of *Ocimum longifolium* found only in Assam and some parts of South India are made into a tea and used in the treatment of diseases of the kidneys and bladder and other urinary organs.

Ocimum gratissimum called the shrubby basil, probably a native of Ceylon is useful in curing rheumatic disorders and skin diseases.

Ocimum canum, the rosary Tulasi and *Ocimum album* are effective in curing ringworm.

The sweet basil or *Ocimum basilicum*, a native of Persia has a cure for internal piles and nephritis. A 12 per cent decoction of the plant is used as irrigation in nasal miosis which acts as a parasiticide and antiseptic so that the larvae which cause the disease are rendered inactive and expelled. It cures asthma in combination

with lily, cinnamon, cardomom, *cyperus rotundus, phyllanthus niruri*, dried ginger and camphor.

The sacred lotus

Lotus, botanically, called *Nymphaea* found in fresh water ponds all over the country is a demulcent, diuretic and nutrient. The flowers are said to be alleviative of cough, bile, vomiting, giddiness and burning of skin, as well as head apoplexy and inflammation of brain. A decoction of the flowers is given as a cure for palpitation. The filaments of lotus and *Nelumbium speciosum*, another variety of lotus are a cure for bleeding piles and menorrhagia.

The gooseberry

Another species of plant closely associated with the spiritual and daily life of the people is the Indian gooseberry *(Emblica officinalis)*. This plant grows luxuriously in the Deccan and coastal regions and the tree is a sine qua non for any spiritual assembly. A chutney or pickle made of its berries is religiously eaten as an appetiser before a meal. What is the basis for this sanctified custom? Its medicinal properties vouchsafe for such a custom being honoured voluntarily through the ages:

The fresh fruit of Emblica is used for inflammations of lung and eyes, as a collyrium. The juice of fruits given with honey is a vermifuge. The fruits are made into pickle to stimulate appetite throughout India. A paste of the fruit along with *Nelumbium speciosum* (Lotus) and saffron plus rose water is useful as an application over the pubic regions in irritability of the bladder, in retention of urine and to the forehead in oephalgia.

An infusion of the seeds is given as a febrifuge and in diabetes. It is also used as a collyrium and applied to the eye for inflammations of the conjunctivitis and other eye complaints.

An extract of the fruit with honey and 'pipli' added is given to stop hiccups and in painful respiration.

The dried fruit immersed in water in a new earthen vessel a whole night yields a decoction which is used as a collyrium in opthalmia. The dried fruit with iron is a valuable remedy for anaemia, jaundice and dispepesia.

A *sherbet* prepared from the fresh fruit with honey is a favourite cooling drink which is said to have diuretic effect. The juice of the bark combined with turmeric is a remedy for gonorrhoea.

The root-bark rubbed with honey is used in aphtous stomatitis. A mixture of the fruit juice and sugar relieves burning in the vagina. The seed, burnt and mixed in oil is a useful application for scabies. The milky juice of the leaves is a good application for offensive sores. A fix obtained from the berries strengthens and promotes growth of hair. The essential oil distilled from the leaves is largely employed in perfumery. The berries made into a confection in sugar is a pleasant purgative and is useful in habitual constipation.

Likewise, a number of other plants and plant products which are used by Hindu households have particular significance to the health and well-being of the society as a whole. For example, turmeric, ginger and bel (*Aegle marmilos*) occupy a pivotal place in Hindu rituals. No wonder, our forefathers had valid medical/ therapeutic sense while prescribing such unquestionable adherence of these time-tested customs.

Development of ancient Indian Materia Medica

Despite our rich heritage and knowledge on the use of plant drugs, little attention has been paid to harnessing the simple inexpensive remedies to modern requirements. India is endowed with a wealth of medicinal plants which have been instrumental in the development of ancient Indian medicine. The *Charak Samhita* which dates back to 1000 BC recorded the use of over 340 drugs of phytochemical origin.

The curative properties of herbs are due to the presence of complex chemical substances of varied composition in one or more parts of these plants. Such substances of medical and curative value fall under the present-day chemical compounds such as alkaloids, glycosides, corticosteroids, essential oils, etc of which the alkaloids form the largest group: morphene and codein from the poppy plant, strychnine and brucine from *Nux vomica*, quinine from *Cinchona*, cocaine from coca, ephedrine from *Ephedra*, to name a few.

Science vs custom: While the Indian Pharmacopoeia (1966) recognises 85 drug plants, the ingredients of which are used in a variety of pharmaceutical preparations; the Indian *Materia Medica* mentions 1,053 species of plants as sources of drugs. *During the last couple of decades, great strides have been made to rediscover the virtues of these ancient drugs as the most harmonious remedies for a host of ailments that are beyond the pale of understanding of modern medicine and surgery. With numerous synthetic drugs invading the arena of medical treatment, the helpless patients get vexed with the after-effects and side-effects of these medicines, at times, bordering on lethality. The result is the slow but steady return to pure drug therapy practised by the Ayurvedic and other systems of Indian medicine.*

The core of Indian or rather the oriental psyche is the complex cultural and religious beliefs contributing as a whole to a sustainable and harmonious living, as against the so-called scientific attitude that balkanises social and spiritual life altogether, landing the modern man in an abyss of nothingness, thus reducing him to a state of slavery to chemicals and drugs which he formulated himself.

Ayurveda: It is a well-known fact that Indians since time immemorial have been depending on herbal medicine, which even to date is valued the world over as the panacea for a host of chronic ailments defying solution by the mighty medical men of the modern era. Now, let us see what the many westerners who had occasion to witness or experience the magic of the native cures of India have to say:

The Indian Medical Gazette of November 1924, in vogue, during the height of British power in India stated, "It's (Ayurveda) and not Western medicine is the medicine of the (Indian) people."

The British Medical Journal in its September 15 issue of 1924 wrote thus:

"The native practitioners perform a useful service in the villages more especially is the medical side of practice."

"I would rather trust ancient Hindu practice than the allopathic practice of what we want to learn in this enlightened age. If the physicians of the present day would drop from the Pharmacopoeia all the modern drugs and chemicals, and treat their patients according to the method of Charaka, there would be less work for the undertakers of a few chronic invalids in the world", said Dr. Gen. E. Clarke, M.D. of Philadelphia in another context.

Insofar as its popularity among the rich, Sir Patrick Hehir wrote once in the Times Educational Supplement that "Some of the leaders of pure Ayurvedic practice make considerable fortunes out of their calling and when consulted in up-country cases from the large towns, charge heavy fees." He was generous enough to say that leading Ayurvedic physicians in urban areas commanded princely fee in attending princes, noblemen and rich people in cases where allopathy failed.

Any number of such opinions eulogizing the Indian herbal medicine may be quoted from famous European and American doctors which should convince even the hardened skeptic about the efficacy of the indigenous form of treatment based on preparations made from Indian plants and drugs.

This can be summed up in the arguments put forth by the late Sir Charles Pardey Lukis while speaking in the Imperial Legislative Council in March 1916.

"I resent strongly the spirit of the trade unionism which leads many modern doctors to stigmatise all "Vaids" and "Hakims" as quacks and charlatans. I shall always be proud of the fact that I was privileged to have the friendship of two such trained men... and/Mahamahopadyaya Bijoya Ratna Sen of Calcutta."

Speaking on a different occasion what he said is more worthy in the present context.

"We, the allopaths are just emerging from the slough of empiricism. Personally I would frankly say that if I were ill, I would prefer to be treated by a good Vaid or a Hakim than by a bad doctor. I am not alone in my opinion as regards the value of the indigenous system of medicine. I do so in the good company amongst whom I may mention my friend and former colleague Sir Havelock Charles, Colonel king of Madras and Dr. Turner of Bombay."

He further elaborated on the virtue of this system by stating in *The British Medical Journal* of October 1918 that "the longer I live in India the more intimate my connection with Indians, the greater will be my appreciation of the wisdom of the ancients and the more I will learn that *the westerners have still to learn much from the East. Many of the empirical methods of treatment adopted by the Vaids and Hakims are of the greatest value and there is no doubt whatever their ancestors knew ages ago many things which are now-a-days being brought forward as new discoveries. Those trained in the Western system should learn to unravel the mysteries of the indigenous system of medicine and unearth its hidden treasures*".

People's medicine

It will be evident from the above that there is a close nexus between the ancient wisdom of India reflected in the time-tested customs and rituals involving the use of a variety of plants in the day-to-day life of the common people and the medical sciences. Thus the medicinal plants have been a part and parcel of the life of an average Indian, while these continue to be the concern of the specialist elsewhere in the world.

In fact, the cheapness as well as efficacy of Indian drugs has been repeatedly admitted by eminent British medical authorities. For instance, Col. G.T. Birdwood, writing on Indian drugs in his book *Practical Bazaar Medicines*, says "there is no question that *bazaar* medicines are much cheaper. District Board Dispensaries can give a vast amount of medical relief at very little cost, if *bazaar* medicines are intelligently and largely used. Even in such epidemics as Influenza, Plague, Cholera and relapsing Fever, *bazaar* drugs can give much relief. At the big Medical Schools attached to our hospitals, in the course of Materia Medica, Indian plants and drugs receive attention, but in the wards of the big hospitals, *bazaar* medicines are never prescribed, so that the men leave the medical schools with little practical knowledge of prescribing them. If a man has a good knowledge of these he can treat many minor maladies and relieve at a very little cost".

Conclusion

It must be remembered that a great many maladies of everyday life for which people come as out-patients to dispensaries are of minor nature, such as cough, cold, indigestion, ulcer, sore eyes, sore throat and worms. *Indian remedies based on herbal medicine have a sufficiently practical and wide enough range to cure most of these minor maladies.* Today, the Indian practitioners are too much inclined to run after the latest drug or the newest poison cleverly advertised by multinational companies!

It is imperative on the part of the medical men of India to use their discretion in employing simple and efficacious local remedies in place of costly foreign medicines to effect economies for the low-income groups in terms of time, trouble and anxiety. It is a well-known fact that pure and fresh herbal formulae are generally more powerful in their efficacy than those which have undergone various laboratory processes for their preparation and preservation. Moreover, the extraction of alkaloids by the use of alcohol etc is said to destroy the actual and intrinsic therapeutic properties of such drugs. ❑

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Industrial products from neem

Bijender Singh and Pawan Kumar

Neem, a versatile tree sacred to the people of India, is poised to break new ground in view of its exceptionally high medicinal properties. A priceless gift of nature, it may eventually benefit every person on earth. Probably, no other tree yields as many strange and varied products or has as many exploitable by-products. The wonder tree may usher in a new era in pest control, provide millions with inexpensive medicines, cut down the rate of population growth, and perhaps even reduce erosion, deforestation and the excessive temprature of an overheated globe.

The people of India have long revered the neem tree (*Azadirachta indica*). For centuries, millions have cleaned their teeth with neem twigs, smeared skin disorders with neem-leaf juice, taken neem tea as a tonic, and placed neem leaves in their beds, books, grain bins, cupboard and clothes to keep away troublesome bugs. The tree has relieved so many different pains, fevers, infections and other complaints that it has been called "the village pharmacy".

Neem seems to be one of the most promising of all plants and may eventually benefit every person on the planet. Probably, no other tree yields as many strange and varied products or has as many exploitable by-products. Indeed, as forseen by some scientists, this plant may usher in a new era in pest control, provide millions with inexpensive medicines, cut down the rate of human population growth, and perhaps even reduce erosion, deforestation and the excessive temperature of an overheated globe.

Beyond all the possible pesticides and pharmaceuticals, neem provides many useful and valuable commonplace materials. For instance, oil extracted from the seeds goes into soaps, waxes, and lubricants, as well as into fuels for lighting and heating. The solid residue left after the oil is removed from the kernels is employed as a fertilizer and soil amendment. In addition, wood from the tree is valued for construction, cabinetry and fuel. The bark is tapped for gum and extracted for tannin and dental care products. The leaves are sometimes used for emergency livestock feed. And the profuce flowers are a prized source of honey.

Neem oil

Of all these products, the oil is perhaps the most commercially important. In composition, it is much like other vegetable oils, composed primarily of triglycerides of oleic (41%), stearic (20%), linoleic (1%) and palmitic (18%) acids.

To obtain neem oil, the seeds are first broken open and the kernels separated. The kernels are then pressed in industrial expellers or in hand or bullock-operated wooden presses *(ghanis)*. The oil yield is sometimes as high as 50 per cent of the weight of the kernel.

This 'cold-pressed oil' is mainly used in lamps, soaps, and other non-edible products. It is generally dark, bitter, and smelly. Unlike most vegetable oils, it contains sulphur compounds, whose pungent odour is reminiscent of garlic.

A large industry in India extracts the oil remaining in the seed cake using hexane. This solvent-extracted oil is not as high quality as the cold-pressed oil., but it also goes into certain soaps and consumer products.

Purifying neem oil is an elaborate and costly process at present., In one method, the smelly sulphur compounds are distilled off, which frees the oil from both odour and susceptibility to rancidity (because it also removes the free fatty acids). This process has long been used industrially.

As an alternative to pressing out the oil, the kernels can be extracted first with alcohol and then with hexane. Alcohol removes the bitter and odoriferous compounds; hexane recovers the oil. This stepwise extraction upgrades both meal and oil. On the other hand, it requires costly solvents and complex facilities. So far, at least, little oil has been produced this way.

The Indian scenario

Neem trees occurring throughout India represent a large, although very scattered, resource. Already, neem oil is a common commodity traded freely in the markets, but much more could be produced. *It has been estimated that India's neems bear about 3.5 million tonnes of kernels a year and that, in principle, about 7,00,000 tonnes of oil might be recoverable.* The annual production in the late 1980s was only around 1,50,000 tonnes. (About 34 tonnes of neem oil valued at Rs. 3 lakh were exported in 1990).

To increase the amount of oil harvested, the Khadi and Village Industries Commission (KVIC) has pioneered various aspects of processing the fruit and seeds over the past two decades. This grass-roots organization located in Pune has been the leading advocate for neem oil as a resource for India's villagers. Already, it has created the making of a major village industry, development on a rational and organized basis.

One difficulty, as with most oil-seeds of the forest, is that neem must be harvested during the wet season, and without local drying

facilities the fruits and seeds rapidly deteriorate and become contaminated with aflatoxin ideally, the fruits should be depulped without delay and the seeds thoroughly dried. KVIC has devised and popularized simple methods for depulping, drying, and decorticating neem products, even in the remotest villages.

In India, neem ingredients are found in many popular consumer goods. Neem oil, for instance, has been a major ingredient in soaps for at least 50 years. Its antiseptic properties have been used to particular advantage in the manufacture of special medicated soaps and toothpastes. In addition, pharmaceutical preparations-emulsions, ointments, poultices, and liniments, as well as cosmetics such as creams, lotions, shampoos, hair tonics, and gargles have been prepared. The latest cosmetic preparations are entirely free of the odour that previously restricted neem oil's use.

Some of the everyday uses for neem oil in India are discussed below.

Soap: India's supply of neem oil is now used mostly by soap manufacturers. Although much of it goes to the small-scale sector, large-scale producers also use it, mainly because it is cheap. Generally, the crude oil is used to produce coarse laundry soaps. However, more expensive soaps are made by saponifying the crude oil and distilling the resulting fatty acids before adding the lye. The resulting almost colourless and odourless product is suitable for top-quality toilet and laundry soaps. Some are being exported. Neem soaps, toothpastes, oil, and leaves are widely available in Canada and Britain, for example.

Cosmetics: Neem is perceived in India as a beauty aid. Powdered leaves, for example, are a major component of at least one widely used facial cream. Purified neem oil is also used in nail polish and other cosmetics.

Lubricants: Neem oil is nondrying, and it resists degradation better than most vegetable oils. In rural India, it is commonly used to grease cart wheels. It could find many similar lubrication applications in other locations, especially in village settings in the warmer parts of the world, where neem can be grown.

Fertilizers

Neem has demonstrated considerable potential as a fertilizer. For this purpose, neem cake and neem leaves are especially promising.

Neem cake: The residue left after the oil has been removed varies widely in composition. However, the broad ranges in composition are: grude protein (13-35%), carbohydrate (26-50%), crude fiber (8-26%), fat (2-13%), ash (5-18%), acid-insoluble ash (1-17%).

This so-called 'neem cake' has considerable local potential. Although too bitter for animal feed, it seems to have unique promise as a fertilizer. It contains more nitrogen, phosphorus, potassium, calcium, and magnesium than farmyard manure or sewage sludge. It is widely used in India to fertilize cash crops, particularly sugar-cane and vegetables. Ploughed into the soil, it protects plant roots from nematodes and white ants, probably due to its content of the residual limonoids.

Surprisingly, neem cake sometimes seems to make soil more fertile than calculations predict. This is apparently due to an ingredient that blocks soil bacteria from converting nitrogenous compounds into (useless) nitrogen gas. When mixed with urea, for example, neem cake cuts down on the amount of urea converted to nitrogen gas in the soil. So far, this finding, which might prove to be a major breakthrough, has not been pursued beyond the laboratory. It if proves real in everyday practice, it might boost the effectiveness of fertilizers everywhere—restoring to the soil that part of their power now lost by bacterial action.

Neem leaves: The cake is not the only source of fertilizer. In some areas of Karnataka, people grow the tree mainly for its green leaves and twigs, which they 'puddle' into flooded rice fields before the rice seedlings are transplanted. Neem leaves have been used as mulch in tobacco fields in the Jaffna district of Sri Lanka. In Gambia, tomato plants matured several weeks earlier and had more numerous and longer branches when mulched with neem leaves.

Timber

Neem is a member of the mahogany family, and the properties of its wood resemble mahogany. It is relatively heavy, with a specific gravity varying from 0.56 to 0.85 (average, 0.68). When freshly cut, it has a strong smell. Although easily sawn, worked, polished, and glued, it must be dried carefully because it often splits and warps. It also splits easily when nailed, so that holes must be prebored. Nevertheless, it is a good construction timber and is widely used in carts, tool handles, and agricultural implements. In South India, it is a common furniture wood.

The heartwood is red when first exposed, but in sunlight it fades to reddish brown. It is aromatic, beautifully mottled, narrowly interlocked, and medium to coarse in texture. It is subject to only slight shrinkage and can be readily worked by hand or machine. Although it lends itself to carving, it does not take a high polish.

The timber is durable even in exposed situations. It is seldom attacked by termites, is resistant to woodworms, and it makes useful fence posts and poles for house construction. Polewood is especially important in developing countries; the tree's ability to resprout after cutting and to regrow its canopy after pollarding makes neem highly suited to pole production.

Fuel

Neem produces several useful fuels. As mentioned above, its oil is burned in lamps throughout India. In addition, its wood has long been used for firewood. Moreover, the husk from the seeds-containing no oil and representing the bulk of the wastage in pesticide manufacture, is mainly employed as fuel.

Because of the tree's good growth and valuable firewood, it has become the most important plantation species in northern Nigeria. It is also grown for fuel around large towns. Charcoal made from this neem wood is of excellent quality, with a calorific value only slightly below that of coal from Nigeria's Enugu mines.

Other products

Several products in addition to those mentioned above have been generated from neem. Among them are the following:

Resin: An exudate can be 'tapped' from the trunk by wounding the bark. This high-protein material is not a substitute for polysaccharide gums, such as gum arabic. It may, however, have a potential as a food additive, and it is widely used in South Asia as 'neem glue'.

Bark: Neem bark contains 14 per cent tannin, an amount similar to that in conventional tannin-yielding trees (*such as Acacia decurrens*). Moreover, it yields a strong, coarse fiber commonly woven into ropes in the villages of India.

Honey: In part of Asia, neem honey commands, premium prices, and people promote apiculture by planting neem trees.

Food: There are odd reports of people eating neem. Leaf teas may be harmful, especially if drunk in quantity over a long period, but it is said that Mahatma Gandhi, who had a hearty respect for the nutritive value of greens, commonly prepared a neem-leaf chutney and ate it with gusto despite its incredibly bitter taste. Recently, the discovery of a rare neem tree with 'sweet' leaves has been reported.

Fruit pulp: Pericarp represents about half the weight of neem fruits, and when they are processed to obtain the seeds, large quantites of pulp are also produced. This neem-fruit pulp is a promising substrate for generating methane gas, and it may also serve as a carbohydrate-rich base for other industrial fermentations. ❑

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(Continued from page 38)

Panel on Patent under the chairmanship of Prof C.N.R. Rao. The panel has come out with a proposal of revamping the patenting system in India at the cost of Rs. 65 crore. The project is to be implemented in three years with the objective of removing various deficiencies in the system which are causing inordinate delay in processing of patent applications. At present, it takes three years for processing a patent application and six to eight years for a final decision as against just two years in US. There is a backlog of 26,000 patent applications in the country and this will increase at a very fast pace particularly because of he rapid growth in the number of applications being filed after the awareness on the importance of patenting generated recently. As against the capacity to process 2-3 thousand applications a year, 7,000-8,000 applications are being filed every year. It is expected to go up to 10,000 by the year end and 30,000 by AD 2000. All the patent offices in Delhi, Chennai, Calcutta, Mumbai are now manually operated. There is discontentment among the patent examiners. All these aspects are to be taken into account and automation brought immediately.

Besides making the process of patenting easier and faster in India, the revamping envisages electronic storage of data and link up with patent offices the world over.

Institute for Innovation & Intellectual Property: The CSIR triumph has prompted the Government of India to set up an institute to catalogue the medicinal applications of plants described in the ancient Indian literature. The move is intended to counter any effort by other countries to patent the restorative characteristics of Indian plants. The Institute for Innovation and Intellectual Property will work under the aegis of the CSIR. This pioneering facility will have the support of other science departments and the industry. The turmeric case was an eye-opener. There is a strong need for this Institute to deal with the complex emerging scenario in intellectual property generation. The recently formed Panel on Patents has also mooted a Bill on plant variety protection to protect new plant species. It has also suggested patenting of microbial processes and genetically engineered micro-organisms.

Definitions

Industrial property and intellectual property: Patents for inventions, designs for industries and trade marks for marketing products are collectively known as industrial property. These forms of industrial property along with the copyright in literary, artistic and similar works are referred to as intellectual property.

Patent: A patent, therefore, is a property which like any other property, movable or immovable, may be bought, sold, assigned or licensed.

Trade mark: A trade mark is a visual symbol in the form of a word, a device or a label as applied to an article of manufacture or commerce with a view to indicating to the purchasing members of the public about the origin of the manufacture of the goods affixed with such a mark. It facilitates to distinguish such goods from the goods manufactured by others in the trade.

Design: A design is an idea or conception as to features of shape, configuration, pattern or ornament applied to an article. Such designs form a special branch of industrial property.

Copyright: Copyright is a proprietary right which accrues on the creator as soon as the work is created. ❑

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The man planting trees by the wayside will enjoy bliss in heaven for as many years as there are fruits and flowers and leaves in what he planted. (*Padma Purana*)

Traditional medicines and homestead technologies—need for scientific evaluation

Verma T., Varma S.K. and Jain V.

Indigenous knowledge of a society developed out of usage and current wisdom is a treasure trove that needs to be scientifically evaluated and documented. Developed out of centuries of trial and error and handed down the generations, the wisdom about herb-based remedies of common diseases as well as serious ones is too precious to be lost for want of documentation. The integration of scientific and indigenous wisdom would help develop need-based technologies which are intelligible and credible to the rural people, the authors say.

Traditional knowledge of any society presents a unique picture which is fabricated on the basis of the belief, norms and culture of the society to which they belong. Traditional wisdom cherished by rural society is built upon their day-to-day activities which strongly project their continuously tested experiences. Hence careful documentation and scientific analysis for further transmission to those who are not familiar with the practice is essentially required. It is now increasingly felt that the integration of scientific and indigenous knowledge would help develop technologies which are need-based, more intelligible, convincing and credible to the rural clientele. Also, being based on indigenous wisdom and hence appealing to the rural mind-set, it would bridge the technological gap. Further, this will provide scientific explanation to the experience-generated knowledge.

This paper seeks to explain the traditional wisdom of rural women on indigenous homestead technologies, viz grain storage, storage of woollen garments and health practices.

The data generated from Slimgarh of Hisar district of Haryana along with the cherished experiences on post-harvest technologies have been briefly described.

Time-honoured remedies

Grain storage: Studies on grain storage reveal that most farm women (80%) stored their wheat grains in locally prepared storage bins like *kothi, kuthla, bukhari*, etc. These storage bins are prepared with the help of waste-paper and *multani mitti*. The waste-paper was allowed to decay for a week, then beaten to make a fine dough with *multani mitti*. This dough is used for preparing storage bins as per requirement. They are then kept for drying in sun and used for storing grains. Before storing, the grains were dried up nicely and at night kept in storage bins with neem leaves at the bottom and also at the top of the grains.

Pulses: Most farm women (70%) stored their pulses after sun-drying with neem leaves. About 60 per cent of farm women used ash/sand for storing the pulses for their consumption. Only 35 per cent of farm women applied mustard oil on pulses to avoid infestation.

Rice: In the case of rice, 50 per cent of the respondents used turmeric and neem leaves for stored rice for home consumption. However, 20 per cent of them mixed boric powder with rice to avoid infestation from rice weevils, whereas more than 15 per cent used *mercury* balls for storing wheat, pulses and rice.

Wool: Almost all the respondents (90%) stored their woollen garments with dried neem leaves to protect from infestation. These neem leaves are generally dried up in shades.

Treatment of diseases

The study further revealed that farm women treat common child and infant diseases with locally available foodstuff.

Gastro-enteritis: About 40 per cent of the total respondents believed that *isabgol* husk and roasted cloves were good medicines for treating gastro-enteritis.

Pneumonia: Twenty-four per cent of the respondents used the local method of giving a mixture of turmeric and *Santhi ki jar* for treating pneumonia. There exist other treatments for pneumonia where nutmeg, cinnamon, cardamom, brandi, yellow myrobalen, coriandar seeds, ginger and garlic with water is given. However, this practice is not widely prevalent.

Malaria: In the case of malaria, farm women generally use *Ajjwain* aniseed and *tulsi* leaves tea for treatment.

Fever: Half of the respondents treat simple fever with a syrup of dry ginger, mace, clove, coriander, aniseed, cinnamon and black pepper. Only 10 per cent of the respondents took a syrup of lemon, onion and mint for treatment of simple fever.

Typhoid: For treatment of typhoid, 68 per cent believed in giving cinnamon, clove, mace, nutmeg, dry ginger and cardamom *ghutti* to the patients.

Whooping cough: For treating whooping cough, honey was the best method as reported by 40 per cent of the respondents. About 20 per cent of the total respondents gave *ghee* and an equal number of respondents used mace, clove, nutmeg, cardamom and dry ginger as a medicine to treat the disease.

Cold and cough: Cold and cough were not considered as serious diseases. However, its incidence was quite high and caused high morbidity among children. Almost 20 per cent of farm women gave *besan halwa*, wheat flour *halwa*, dry ginger tea, Tulsi leaves tea, roasted clove and a decoction of dry ginger, nutmeg, mace and clove to the patients suffering from cold and cough.

Measles: Most of the respondents (46%) gave a mixture of cinnamon, mace, nutmeg, clove and dry ginger. A sizeable group of 22 per cent of women did not favour any medicine to be given in measles cases. Only 20 per cent of the respondents gave raisins as a medicine to treat measles.

Ear discharge: In the case of ear discharge, brandy drops and boiled garlic oil were used by 50 per cent of the respondents. About 30 per cent respondents used cow's urine and 10 per cent respondents gave lactating mother's milk as medicine to cure ear discharge.

Eye infection: Incidence of eye infection in Haryana is quite high due to the dusty atmosphere during the summer months. Some of the methods followed by women however, were equally traditional like *methi* seeds, goat's milk, lemon leaves, mustard oil, boric powder. These methods were practised by 20 per cent of the respondents.

Several areas have been explored where traditional practices have surpassed modern technical know-how. This calls for deliberate attempt on the part of educational institutions to find out the scientific relevance of these traditional practices for continuous use. Otherwise, these might affect the extent of acceptability of scientific practices. ❑

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Health Care

Vegetarianism—towards a disease-free life

Rakesh Singh

In earlier days, it was a common belief that non-vegetarian diet was superior to vegetarian. It was due to this reason that people believe that non-vegetarian diet provides us more power and is full of energetic ingredients. This belief attracted more and more people and ultimately a large number adopted non-vegetarianism as their dietary style.

But, now this concept is changing. According to new developments in medical science, vegetarian diet is closer to and is more useful for human nature. It is more scientific for the human body. Therefore, nowadays, more and more people are taking to vegetarianism.

It is a fact that non-vegetarian diet contains cholesterol and saturated fatty acid. This is the root cause of the problems like coronary heart disease, cerebro-vascular accidents (strokes), eye-vessel diseases and high blood pressure. In a non-vegetarian diet, only 60 per cent of its content are useful for human body; the remaining 40 per cent contain harmful and toxic products. In addition to it, non-vegetarian diet is generally heavy for stomach and produces acidity, which, in turn, can cause many diseases of the gastrointestinal system.

Another significant difference between vegetarian and non-vegetarian diet is that the former contains dietary fibres, whereas non-vegetarion diet is lacking in that. These dietary fibres are very useful for human body, because it has been observed that people who take fibre-rich diet have low incidence of diseases like coronary heart disease, cancer of intestinal tract, piles, obesity, diabetes, constipation, hiatus, hernia, diverticulitis, irrigable bowel syndrome, dental caries and gallstones. The food stuffs rich in these dietary fibres are cereals and grains, legumes, fruits with seeds, citrus fruits, carrot, cabbage, celery, green leafy vegetables, apples, melons, peaches, pears, etc.

Many disease-causing organisms can travel in the human body by consumption of non-vegetarian diet and can produce serious diseases, whereas a vegetarian diet is free of these. For example, bovine spongi form encephalopathy and mad cow disease is caused by consumption of non-vegetarian diet. Similarly, the bacteria known as salmonella typhicurium can travel in the human body by consumption of eggs which can cause diseases like pneumonia and bronchitis. These bacteria belong to the group of typhoid disease producing organisms.

According to a study, it has been observed that the body of carnivorous animals contain 10 times more amount of hydrochloric acid than that of the herbivorous ones. The human body does not have that amount of hydrocholoric acid. It shows that human body is basically meant for a vegetarian diet.

Influenced by all these facts, Mr Robins, a well-known American writer has mentioned in his book *Diet for new America* that if Americans want to live, they should avoid non-vegetarian diet and eggs. Not only Americans but Britishers and Germans are also adopting vegetarianism as their dietary style.

In sum, we can say that if we want to lead a healthy and disease-free life, we must take to the vegetarian way of life. ❑

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Medicinal importance of leafy vegetables

M.K. Rana, Azad Singh and Y.S. Malik

In India, leafy vegetables are generally considered inferior to peas, cauliflower, tomato and okra but, in fact, from the nutritive point of view, they are equally good. Some dieticians have recognised their importance in human diet more than other vegetables. Leafy vegetables have a very high protective food value. They are the storehouse of many nutrients which are very essential for our body. They contain cellulose as fibrous matter and moisture in sufficient amount which supply necessary roughage in the diet and prevents constipation. They also contain proteins, carbohydrates, fats, vitamins specially vitamin A and minerals such as, calcium, iron, phosphorus and potassium in sufficient quantity. Green vegetables help the adults to keep good health and enable the children to grow big and strong. Thus, they are a boon to the vegetarians, poor children, lactating mothers and convalescents. The importance of a few vegetables is discussed below:

Spinach

It is a very good source of essential amino acids, iron, vitamin A, folic acid and protein. It also contains beta carotene which improves health and eyesight. In spinach, iron is present in such a form that can be easily assimilated by our body. Because of high iron content, spinach is essentially involved in the diet of anaemia patients. Being a rich source of calcium, it keeps the body tissues alkaline. Thus, it is equally useful for young, growing children and old ones. Its leaves are low in carbohydrate content, thus it is recommended for the patients suffering from diabetes and particularly for women who are conscious about their figures. Raw spinach leaves help in cleansing and regenerating the entire intestinal tract, thereby improving digestion and assisting in the assimilation of food. It is a good source of roughage; so it is an effective remedy for patients suffering from constipation. Spinach also cures respiratory tract ailments. It keeps the teeth and gums healthy and prevents gums from bleeding. The vitamin C present in spinach leaves is destroyed with heat but this can be saved by adding some lemon juice on cooked spinach dishes. This addition of vitamin C superficially helps in absorbing iron content better. Raw spinach and carrot juice may be taken together as a tonic. Its dried leaves can be preserved and used as dry mint by blending well with every food stuff particularly with curd without changing its taste.

Amaranthus

The leaves of amaranthus are highly nutritious, packed with proteins, iron, carbohydrates, calcium, phosphorus and vitamins A and C. This is a rare example wherein all these essential dietary components are combined in one vegetable. In spite of too much dietary components, it is low in calories. It contains all essential amino acids such a leucine, lysine, cysticine and methionine. It also serves as a natural protein tonic for the growing children. So by the regular use of amaranthus in the diet, one can overcome the deficiencies of vitamins and minerals in the body. It is said that amaranthus cures the infections in respiratory tract, recurrent colds and optical vision defects. The decoction prepared from its juice and honey is a useful cure against several diseases like asthma, bronchitis, emphysema and tuberculosis. Its juice mixed with a teaspoon of lemon juice is a useful remedy against the bleeding from nose, lungs, gums and even from piles. Amaranthus is considered to be very useful for pregnant and lactating mothers. A teaspoon of its fresh juice with equal honey makes the small babies healthy and strong. It profects the babies against constipation and also makes the teething process easy.

Fenugreek

Fenugreek commonly known as *methi* is grown throughout the world for its tender leaves and seeds which are very important due to their medicinal properties. Its leaves are rich in essential minerals, protein and vitamins A and C. Its inclusion in diet removes constipation and indigestion, stimulates spleen and liver, increases appetite and acts as diuretic. It is low in carbohydrates and calories and hence, it is a very useful food for diabetics and figure-conscious persons. It protects against cold, and provides warmth to the body. It is good for asthma patients.

Mint

Mainly, mint is used in medicines for stomach disorders, in ointments for headaches, rheumatism and other pains, in cough-drops, inhalants, mouthwash, toothpastes, shaving creams, etc and also for seasoning foods. The dried leaves are antiseptic, carminative, refrigerant, stimulant and diuretic. It is expectorant, emmenagogue, tonic to the kidney and useful in the diseases of spleen and liver, asthma, etc. It also has antispasmodic properties and is given in jaundice and vomitings. In China, the leaves are used to prepare an infusion which is used as carminative, sudorific and anti-spasmodic. It is also given in fever and indigestion to give relief. It can cure colds and stomach aches. Its gargles give relief to sore throat. It is believed to be good for the patients suffering from insomnia, hysteria and nervous breakdown. It improves appetite and digestion. Its oil extracted from green or dry leaves is believed to dilate the heart vessels and used as sedative and disinfecting agents.

Curry leaves

It contains plenty of minerals, vitamins and flavouring compound, and is used chiefly to impart aroma to vegetable dishes and *dals*. It can also be used as a dry powder because it retains flavours even after drying. Its leaves, bark and roots are storehouse of medicinal properties. Ayurveda doctors prescribe its roots as medicine to cure piles, inflammation and itching, the raw leaves to treat dysentery and diarrohoea and roasted leaves to check nausea and stomach aches. The ground curry leaves powder is a very useful remedy for worm and stimulates appetite by improving the digestive system. Externally, the leaves are used to cure eruptions and the bites of poisonous animals. The extract of the roots is taken to relieve kidney pain. The chutney of its leaves with mint is claimed to check vomitings. It is also used as an antiperiodic and dry leaves powder mixed with juice of betelnut and honey is prescribed in the Ayurvedic system of medicine.

Drumstic leaves

Drumstick leaves are rich in calcium, phosphorus, iron and vitamin C. They are also a storehouse of minerals and proteins. The leaves are comparatively more nutritious than its roots. It is known to have anti-bacterial properties. Thus it builds resistance in the body against any kind of infection. The leaves are fully packed with several medicinal properties. This is an excellent tonic to purify the blood and to make the bones strong when taken with warm milk. It cures peptic ulcer when the dried leaf powder is taken with curd. The juice of its leaves is diuretic when tkaen with carrot juice. A decoction prepared with its leaf juice, coconut water and honey is a well-known remedy to cotrol colitis and weak bowels. Its leaf extract is considered an excellent tonic for lactating mothers. ❑

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Peace be to Heaven, Peace be to the Cosmos;
Peace be to the Earth, Peace be to Waters;
Peace be to Herbs, Peace be to Vegetation;
Peace be to all Gods, Peace that is Brahman;
Peace be to All; Peace and peace alone
That peace bestow on me.

—Yajur-Veda

Computerisation of land records: a victim of undefined objectives

Sukumar Das

Even though the scheme of computerisation of land records was launched with the intention of eliminating the problems inherent in the manual system, the lack of clear-cut objectives led to development of deficient software with the States selecting diverse systems. No study has been conducted to estimate the cost-benefit ratio of the scheme to assess its impact on the delivery systems. Even the revised guide-lines failed to remove the vagueness. There is need to revamp the scheme to reach the benefit to the common man.

The Centrally sponsored scheme of computerisation of land records was introduced in 1988-89 as a pilot project in eight States on an experimental basis as a subscheme of the agrarian studies. The objectives of agrarian studies, which include mainly the impact assessment of various land reforms programmes, had no relevance with the programme for introduction of computerised management of land records in India. The designers of this Centrally sponsored scheme justified its introduction with the following words:

> "To eliminate the problems inherent in the manual system of maintenance and updation of land records, it was considered necessary to take the advantage of computers for maintenance and updation of land records."

At the time of initiation of the scheme, neither the advantages of computers were elaborated nor the inherent problems in the manual system were specified; and it was not explained as to how such inherent problems would be eliminated by computerisation. The documents and information which would constitute the so-called "Land Records" were also not spelt out resulting in the States selecting varied information for computerisation of land records. The absence of a clear idea about the documents to be generated or services to be rendered, led to development of defective and deficient software which required improvement and modifications time and again.

A scheme sans clear objectives

In 1993, an EFC Memo was prepared for giving the "programme of computerisation of land records" the shape of a separate Centrally sponsored scheme. At this stage, the objective of the scheme was slightly elaborated under six subheads as follows:

i) To facilitate easy maintenance and updating of the changes which occur in the land data base such as changes due to availability of irrigation, natural calamities, consolidation or on account of legal changes like transfer of ownership, partition, land acquisition, lease, etc.

ii) To provide for comprehensive scrutiny to make the land records tamper-proof which indirectly is expected to reduce the menace of litigation and social conflicts associated with land disputes.

iii) To provide the required support for implementation of development programmes for which data about distribution of land holding is vital.

iv) To facilitate detailed planning in the areas of infrastructural development as well as environment development.

v) To facilitate preparation of annual set of records in the mechanised process and thereby producing accurate documents for recording details such as collection of land revenue, cropping pattern, etc.

vi) To facilitate a variety of standards and ad hoc queries on land data.

From the aforesaid objectives mentioned in the EFC Memo one can understand the general objective of the programme but nowhere was it specified as to what services were to be exactly rendered to the common citizens through such computerised land data. The benefits to be accrued to the general administration, specially to the revenue administration were also not spelt out. No study was conducted to estimate the cost-benefit ratio of the scheme, to quantify the expected impact or contribution of the scheme towards improving the delivery system or generating useful records/data base for effective land revenue administration or supporting the land-based planning or reducing the cost of management of land resource, land acquisition, or for bringing transparency in the revenue administration, etc.

However, on the basis of the EFC Memo, the Planning Commission also accorded its approval for introduction of the scheme as a very specific Centrally sponsored scheme. The approval was received only on 16 February, 1994.

In 1993, the Ministry of Rural Development appointed a Committee on Standardisation and another Committee on Costs, both of which also failed to identify the core data, specific registers to be selected for preparation of computerised data base. The

former failed to suggest the average size per record, character per record, the number fields, the optimum break-up of the fields in various menus for easy retrieval of data or generation of reports/documents/certificates etc.

The land records of various States thus started generating differential quantum of data with wide variation in number of fields and volume of characters. The differential size of a land record led to differential cost in data capture in terms of both time and money. The National Level Steering Committee on Computerisation of Land Records also preferred to leave it to the States to develop their own data base, as per their felt need for future use.

Administrative problem: While efforts were taken to introduce the scheme as a separate Centrally sponsored scheme after bifurcating the scheme of agrarian studies, a very essential point was inadvertently lost sight of. It relates to the proper head of account in which the scheme can be properly financed. As the scheme is to be executed through State governments and funds are to be released to the States, the appropriate head should have been 3601; but inadvertently it remained in its original head of account, ie 2506. Because of this, funds amounting to Rs. 8 crore could not be released to the States directly and hence as a special measure the funds were placed with the National Institute of Rural Development (NIRD) for subsequent disbursement to the States. NIRD kept the funds for the major part of the year in fixed deposit accounts and after a great deal of efforts the amounts were disbursed to the States by the year end leading to delay in the execution of the scheme. The tasks assigned to NIRD for supporting implementation of the scheme was not taken up by NIRD and the States also showed reluctance to sign MoU as well as to implement the scheme with the desired speed and zeal. The most important reason attributed to such lack of interest on the part of the implementing agencies including the district authorities is the lack of clarity regarding the objectives and benefits, both short and long-term, of the scheme.

Vague guide-lines: The guide-lines on the scheme, including the revised guide-lines, failed to remove the vagueness regarding the objectives and benefits of the scheme. The guide-lines for the implementation of the scheme were issued only in 1994-95—after 6 years of initiation of the scheme. Even then, the objective of the programme was spelt out only in general terms by reproducing the six items mentioned in the EFC Memo in full and adding only the following two additional points:

i) To provide data base for agricultural census.

ii) To issue updated copy of Record of Rights (RoR) to land holders quickly and at a cheaper rate.

It may be mentioned here that agricultural census is being conducted through an altogether separate method and the Ministry concerned was never consulted to prepare a software or data-base through this programme to support the agricultural census operation. The Ministry of Agriculture also did not express any desire for using the settlement and cadastral data for generation of agricultural census report.

Even though the avowed objective of the scheme for "issuance of an updated copy of RoR to land holders quickly and at a cheaper rate", for the first time appeared in the guidelines, it does not address to so many other major services which can be generated through computerised land records.

Unjustified expenditure: Any person not having any documentary proof of ownership of any land may prefer to take a RoR from computerised land records units. Such categories of people come from the groups who are recipient of ceiling surplus land, *bhoodan* land, government wasteland or whose other land records are lost or where survey settlement operation was not conducted during the last two decades or where the revenue administration heavily defaults in setting mutation cases. But the "one-sheet" document called RoR does not replace the requirement of fundamental land documents like registered sale-deed, registered deed of gift, mutation certificate, rent receipt, etc. In fact, if a person has got a registered sale-deed as well as current rent receipt or a mutation certificate, he or she does not require any separate sheet of substitute land records or RoR. The problem of acceptance of the computer generated RoR in the court of law became also a point for serious deliberation. Revenue Secretaries of various States observed that there were specific requirements of amendment of land laws for making such RoR acceptable in the court of law. A certified copy of the relevant page of *Khatauni* or *Khasra* is accepted by the court as a more reliable document than the computer-generated RoR authenticated under signatures of any authorised person. Therefore, the only issuance of RoR cannot justify the huge expenditure in the land records computerisation programme as use of RoR is restricted only to a smaller percentage of the land owners and the value of the document is also not so basic or intrinsic which can supplement the documents like sale or purchase-deed, mutation certificate, settlement records, rent receipt, etc.

The problem of software: From the beginning of the scheme, ie since 1988-89, a debate also started about the suitable software needed for appropriate and efficient land resource management through a comprehensive Land Information System (LIS). The Ministry constituted two committees in 1992, ie Committee on Costs and Committee on Standardisation which submitted their reports in 1993. The detailed report submitted by the Committee on Costs included suggestions regarding configuration of the hardware, desirable software and also a rough estimate about project costs for different districts. The Committee on Standardisation could not submit any report suggesting suitable software or data-base on the basis of consensus among the members. All these resulted in a differential approach by various States in installation of hardware, adoption of software and designing the size of the computerised land records. The NIC persistently suggested UNIX as the best operating system for computerisation of land records, which has been contested by various representatives of the State governments at various fora. The State government officials were apprehensive about the security of land data and its tamper-proof updation.

From 1994-95 to 1996-97, nearly 300 more districts were

brought under the programme of computerisation of land records and a huge amount of money was released to the States/UTs for the purpose. During the very "high-velocity-expansion" regime of the programme, the problem of the existing software surfaced and issues relating to the "core data" and operational/auxiliary data came up for discussion in various meetings of the National Level Steering Committee and the conference of Revenue Secretaries. It was also noticed that in one or two districts, where the projects were operationalised, mainly RoR was being generated and issued out of the computerised data. Such computer printed RoR was of limited use for the majority of the land owners and its demand declined within a very short period. For example, in the district of Morena in Madhya Pradesh, of the more than 11 lakh land owners whose records were computerised, only a little over one lakh collected the computerised RoR till April 1997.

Rising expectations and falling demand: In March-April, 1997 when the Cabinet Secretariat and the Ministry of Personnel, Public Grievances and Pensions showed special interest in the programme particularly from the angle of providing a more responsive and transparent administration in the field of land revenue management, the question relating to wider applications of the computerised land data came up for intensive study and consideration. Senior officers of various ministries were sent to selected districts in different parts of the country and Collectors of the pilot project districts were called along with Survey Settlement Commissioners/Directors and Revenue Secretaries for deliberations with the Ministry of Rural Areas and Employment as well as with the representatives of the Ministry of Personnel, Public Grievances and Pensions. A meeting was convened in New Delhi on 28 April, 1997.

During the deliberations, it was revealed that representatives of the States or even Project District Collectors could not spell out more than 3-4 uses of the computerised land records. In fact, none of the project districts could claim that they have generated more than 3-4 services to the common citizens through such computerised land records. The services generated reportedly include issuance of RoR, mutation certificate, and other information relating to different parcels of land. The number of applications received for such type of records was very meagre—varying from 50 to 100 in a month. This situation was also corroborated by the report submitted by a senior officer of the Union government visiting the pilot project districts and also from the interim report of the Lal Bahadur Shastri National Academy of Administration (LBSNAA) on the district of Morena (MP).

Suggestions for broad-basing the objectives and targeted services

It is not too late as yet for attempting to set afresh the objectives and targeted services which can be generated out of the computerised land data under the ongoing scheme. If the core data is duly computerised from the *Khatauni/Khasra* and the mutation register, and if suitable software is used while such data is captured, then the computerised land data may effectively serve a large number of objectives/purposes. Of these, 30 may directly benefit the common citizens in providing services in the form and manner as prescribed below:

1. Issue Record of Rights (RoR).

2. Issue ownerwise details of all plots held, with plot nos., areas, rent, cess, land classification and land utilisation figures/information.

3. Issue Khasra (Plotwise details of land records including area, ownership, crop details, irrigation status, etc).

4. Issue mutation certificates.

5. Issue history sheet of mutation records for the last three transactions.

6. Prepare revenue demand slips (for each land owner) including arrears dues to give notice and make collection/payment easier.

7. Issue rent receipt.

8. Issue Barga certificate/tenancy certificate.

9. Issue cadastral map or relevant portion of the cadastral map.

10. Issue crop particulars of any plot.

11. Issue land valuation estimates (for registration of sale-deed), or base-price wherever notified for the purpose of the Stamp Act.

12. Issue irrigation details of any plot for fixation and payment of irrigation charges/rates.

13. Verify validity of proposed transfer/transaction.

14. Issue printed sale-deeds.

15. Issue printed gift deeds.

16. Issue printed Kisan passbook and make regular updation thereof.

17. Use most convenient and accurate system to convert all "land area-figure" from local measurement acre and hectare as required under Weights and Measures Act, 1975.

18. Issue government land allotment certificate (*Patta*).

19. Issue government land allotment certificate for homesteads.

20. Keep record of government land for distribution for public uses.

21. Ensure easy and instant updation of land records/maps and issuance of the same.

22. Prevent sale of government allotted land beyond the prescribed limit and irregular transfer of tribal land.

23. Maintain update records of tenancy rights.

24. Supply instant information to court/any authority or individual on any law to bring total transparency in land management.

25. Issue duplicate land records, in a standardised form, after due authentication.

26. Issue print-out of cadastral maps of any village, part of a village, or any specific parcel of land, in any desired scale.

27. Issue the copy of consolidation proceeding including print-out of alternative cadastral maps.

28. Issue computer printed certified copy of the registered sale-deeds.

29. Issue land acquisition notices containing computer printed details of ownership, co-shares, and other interest on land including classification, irrigation status, crop details of the land to be acquired.

30. Prevent unlawful transfer of tribal lands, by using computer generated land data for registration purposes. It may also prevent fictitious transfers/transactions particularly by impersonation.

Suggestions for wider fixation of administrative uses and benefits of the scheme

If we take a perspective and holistic view of the programme, we may very easily identify at least 25 other administrative benefits which can be generated from computerised land records. These can be in the form of generation of essential records and documents for improvement of the delivery system of the revenue administration and other land related planning and administration. Most of the benefits are imminent while some of them accrue gradually. The benefits are as follows:

1. Generate Khasra register after every five years (wherever law prescribes, without doing it manually as is being done now.)

2. Generate tax demand notice legal register.

3. Generate cess demand notice/legal register.

4. Generate irrigation rates demand notice/legal register.

5. Generate land transfer (mutation) register.

6. Generate villagewise register of wasteland/Bhoodan land/ceiling surplus land.

7. Generate crop register (area, production, rate of productivity).

8. Generate land valuation register, or create dynamic land valuation register.

9. Generate village/tehsil/district land use register.

10. Generate village/tehsil/district details of land data as per local classification and valuation of land.

11. Generate a list of allottees of government wasteland/ Bhoodan land/ceiling surplus land for agricultural purposes.

12. Generate a list of allottees of government land for homestead purposes.

13. Maintain register for common property resources.

14. Maintain correct records of government land (Central/ State).

15. Monitor encroachment of government land.

16. Monitor conversion of agricultural land for non-agricultural use.

17. Monitor extension of agriculture in new areas on account of wasteland development or reclamation of degraded/fallow land.

18. Publish State/national level annual report on land uses, crop statistics, revenue and tax collection, etc.

19. Regular updation of cadastral map.

20. Use of computerised land records for expeditious disposal of land acquisition proceedings.

21. Use computerised maps to reproduce alternative village maps to suit variable demands of lands—location-specific, quality specific, use-specific.

22. Use of land-related data to fix entitlement of each land-owner in a revenue village under consolidation operation.

23. It may help to monitor unauthorised transfer of SC/ST land, protection of tenants, detect concealed property, ceiling surplus land and to help automatic conversion of land area in metric system (sq m/ha).

24. Computerisation of registry offices and computer generation of land transfer deeds; computer print-out of old deeds for reference purposes.

25. To ultimately develop an Integrated Land Management System through which all land transactions should be an easy and automatic process and "title to the land" will be guaranteed by the government, to bring total transparency in land revenue administration.

Conclusion

The aim of this paper is to generate a debate leading to a rethinking on data capture, application of suitable software with specific preconceived intentions and also to get the feedback from all concerned leading to improvement in the existing programme, its due implementation and to maximise the benefits. Even if all the benefits cannot be generated immediately, with clear perspectives and predefined objectives the existing programme can be so restructured that in due course of time the above mentioned objectives or even more than that can be achieved. Such an overall review and the concurrent evaluation can enhance the good return of the money already invested and required to be invested in completing the ongoing schemes. The cadastral maps, an important component of the schme are to be immediately computerised as an essential part of the land records. Suitable software for using the computerised land records for acquisition, consolidation and improvement of land, watershed development, changing cropping pattern, computerisation of registration of transfer-deeds, etc and many other land-based administrative activities can be brought under an integrated land management system. If need be, both the data-base and the software programming may be slightly modified with a view to generating manifold economic returns and social benefits, much in excess of the cost incurred in the process. A serious rethinking on the whole issue with a wider perspective is essential for maximising the benefits of the ongoing computerisation programme. ❑

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Poverty alleviation programmes in India—new challenges

S. Mohanan

The poverty level in the country has not declined notwithstanding the spectacular increase in the budget estimates for poverty alleviation programmes over the years. The forces of competition unleashed by the liberalisation and reforms process have blunted the poverty alleviation programmes hard-hitting the poor and the underprivileged. Besides strengthening the programmes further, structural and functional changes should be effected in their design and implementation. Also, the very concept of poverty line should be redefined linking it with the general well-being rather than to a rigid level of calorific intake, the author opines.

Development of the weaker sections of the society has been an important concern of the Government of India, ever since Independence. The programmes implemented towards this direction include the general programmes like Integrated Rural Development Programme (IRDP), Training of Rural Youth for Self-employment (TRYSEM), Jawahar Rozgar Yojana (JRY), Nehru Rozgar Yojana (NRY), Prime Minister's Integrated Urban Poverty Eradication Programme (PMIUPEP), and Prime Minister's Rozgar Yojana (PMRY), and some special programmes for the development of the socially and economically weaker sections such as Scheduled Castes and Scheduled Tribes. Besides, there are also programmes for the development of women and children and the old. The basic idea of all these programmes was to initiate social justice to remove the glaring disparities that exist in the matter of development. The dictum of socialistic pattern of society accepted as the underlying goal of the planned development of the country on the eve of the Second Five Year Plan has accentuated the tempo of poverty alleviation programmes in India. The concept of self-reliance which gained momentum in the III and IV Plans have also provided further impetus to these programmes. The Janata government in their revised plan proposal has also strengthened the idea of community development. The Minimum Needs Programmes and the added attention given to rural development was providing much wider connotation to the poverty alleviation programmes in the country. The 20-Point Programme also has clearly identified the role and significance of rural development programmes. During the 1980s also a host of new programmes were implemented in this direction.

New economic policy and poverty alleviation programmes

In fact, the launching of the New Economic Policy in 1991 has raised doubts about the future of the poverty alleviation programmes in the country. But to the surprise of everybody, it is found that the tempo of rural development programmes has been maintained and even further accelerated by means of safety net and other new programmes.

At the same time, it is also important to observe that these programmes have to face new challenges in the wake of the new Economic Policy and the liberalisation. The impact of Dunkel and the opening up of the economy has just begun producing results. The spirit of competition thrust upon the economy cannot be thought of having no effect on the life of the poor and the underprivileged. It is evident that all the sections of the society may be hit by the forces of competition and liberalisation. The poor and the downtrodden cannot be an exception. The commercialisation of agriculture, the forays of the foreign companies into the industrial sector and the influx of the foreign consumables into the Indian market have created a situation calling for substantial changes in the structure and method of the poverty alleviation programmes existing and newer forms of programmes that suit the requirements of time.

In this context, it is worthwhile to look at the budget estimates for major schemes of poverty alleviation in India since the introduction of the New Economic Policy. It can be found that the budget estimates for rural development registered a considerable increase of 178.45 per cent in 1996-97 over the past four years. The budget estimate has been rising from Rs. 3,100 crore in 1992-93 to Rs. 8,632 crore in 1996-97. During the past four years, more thrust was given to Jawahar Rozgar Yojana (JRY) in which the estimated budget allocation has risen from Rs. 2,046 crore in 1992-93 to Rs. 3,862 crore in 1995-96. During all these years, there has been a considerable increase in the allocation to this programme. In JRY alone, there is 88.8 per cent increase in the Central plan outlays during the period. But in 1996-97, there was a decline in the budget estimates by 51.71 per cent over that of the previous year. The allocation to IRDP in 1995-96 slightly declined (by 2.8%) compared to that of the preceding year. But in 1996-97, the budget estimates remained constant, when compared to the previous year. The decline was incidental on the eve of the tremendous increase in the allocation for other programmes. On the whole, there was 75,66 per cent increase in the allocation over the last four years. The Employment Assurance Scheme launched in 1993-94 also has made a tremendous advancement showing 349.77 per cent

increase in the allocation in 1996-97 over 1993-94. The Nehru Rozgar Yojana (NRY) has not shown any major breakthrough during the period.

Budget Estimates for Major Schemes of Poverty Alleviation from 1992-93 to 1996-97

(Rs. in crores)

Scheme	*1992-93*	*1993-94*	*1994-95*	*1995-96*	*1996-97*
IRDP	480	654	675	656	656
JRY	2,046	3,306	3,855	3,862	1,865
NRY	71	75	70	71	71
EAS		438	1,200	1,570	1,970
Total	2,597	4,473	5,800	6,159	4,562

Source : Economic Survey, Government of India 1995-96 and 1996-97

The foregoing discussion points to the fact that there has been a spectacular increase in the budget estimates for poverty alleviation programmes. In terms of the number of new programmes also there has been a phenomenal increase. However, it is really a pity to see that the poverty level has not declined correspondingly. According to Alternate Economic Survey (1995-96), the percentage of population below the poverty line has increased from 35 per cent in 1990-91 to 37.52 per cent in 1993-94. The modified methodology adopted by the Government of India on the recommendations of the Lakdawala Committee on poverty estimate says that the proportion of people living below the poverty line is likely to be as high as 40 per cent in 1993-94. The UNDP Human Development Report has estimated that 61.5 per cent of India's population do not have access to three basic capabilities—capability to be healthy and nourished, capability for healthy reproduction and capability to be educated and knowledgeable. The Capability Poverty Measure (CPM) index—a new index introduced by UNDP in 1996 has ranked India 89th amongst 101 developing countries. All these call not only for further strengthening of the poverty alleviation programmes, but also for structural and functional changes in the design and implementation of these programmes.

Redefining poverty

To begin with, it is quite imperative to redefine the concept of poverty line. It has to be linked to the general well-being rather than to a rigid and stationary level of calorific intake. The spectacular hike in the cost of living following the opening up of the economy with the liberalisation programme calls for more income and expenditure in absolute terms even to maintain the standard of living the people have been used to. Besides, the advancement in science and technology and the consequent stream of innovations have forced the common man to be subject to a 'demonstration effect' to raise his consumption expenditure to a considerable extent. These factors have to be taken into consideration while thinking of redefining the poverty line. If such a redefined poverty line is considered, it could be seen that the percentage of people below the poverty line has been rising rather than falling.

Finance: It is also meaningful to observe the quantum of finance available for the programme with regard to each poverty alleviation programme. In many cases, the governmental allocation is insufficient to meet the requirements. This is particularly true in the case of assistance to dairy development, where due to the smallness of the fund, the programme could not be implemented successfully. The present estimates are based on the assessment made years ago, which are not compatible with the requirements of today. Accordingly, much of the money spent in this regard may not be used properly.

It is also important to observe whether the assistance is timely or not. In most cases, there will be long delay. Even if a programme is approved, it will take months for the amount to reach the ultimate beneficiaries. The governmental machinery, the financial institutions and all others involved in the process can be held responsible for the delay in the implementation.

Similarly, the cost of delivery is also very high. Moreover, each beneficiary will have to bear with the complicated rules and procedures.

Another useful observation to be made is the people's participation that the programmes offer. In planning, designing and implementing the programme, greater participation of the target groups is required so as to ensure that the felt needs of the people are addressed in the programmes, the available resources are mobilised and efficiency is secured in the implementation. *This sort of participation of the target groups is possible only through the grass-roots level organisations.*

Perspective: An interesting feature of the poverty alleviation programmes and other developmental programmes implemented hitherto is that they were mostly having macro perspective ignoring the micro level orientation they need to have. This void has to be filled. Each programme has to be viewed in a micro level perspective. The benefit it brings to each individual beneficiary has to be weighed more in relation to the aggregate benefits. Only this sort of micro level intervention can lead to the empowerment of the target group. The widely accepted strategy of development today, is the concept of empowerment. It does not mean charity or help to the poor as a special category; on the other hand, it implies a helping hand to improve their faculties so that they themselves can come up to the level of others, fighting the forces of poverty and underdevelopment. So the development programmes must have this sort of orientation to see that the poor do not remain as poor after the help; instead, they are elevated to the level of others. This is a new challenge to the development programmes.

Conclusion

It is also necessary that there is constant monitoring and evaluation of the programmes. But in terms of the outcome or long-term benefits, no one can be sure of any concrete judgement. How far the programmes have helped to raise the status of the poor? What goals could be achieved? What is the impact they have on the economic well-being of the people in a micro level perspective? These are questions that call for more coherent evaluation of all the existing programmes. It is also possible to find out the pitfalls and remedy them, by resorting to such an indepth evaluation. ❑

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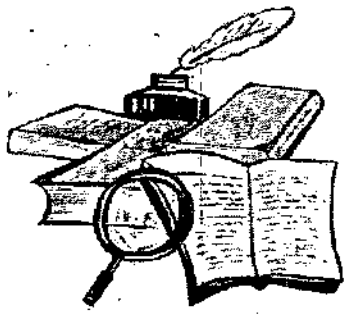

***SOCIAL ECOLOGY*: Edited by Ramachandra Guha; published by Oxford University Press, New Delhi; pages 387; price Rs. 425.**

With the growing awareness of the causes and consequences of environmental degradation in recent times, the once-neglected field of 'social ecology' which rests on the biophysical and socio-cultural domains has assumed enormous theroretical and practical importance.

In India, as elsewhere, sociological research has been closely linked to the rise and maturity of the environmental movement. One can as well distinguish between two waves of environmentalism: and earlier period of pioneering and prophecy and a more recent phase when intellectual concern has been associated with a popular social movement. After the attainment of Independence, began an age of ecological 'innocence' when the urge to 'industrialise' and 'catch up' with the developed world pushed ecological concern to the background. It was only from the early 1970s that this concern re-emerged in the form of a more vocal and articulate social movement (perhaps this new-found concern is best illustrated by now well-known but contrasting episodes: the 'Chipko' movement, that famous initiative of the Himalayan peasantry towards forest protection and the industrial tragedy of Bhopal). It is this second wave that has created the conditions for the elaboration of an ecologically informed social science.

It is against this background that this book, a collection of essays, assumes greater importance; instead of looking at the environmental issues in terms of structures, values and institutions, it proves a compact and analytical overview of various dimensions of the dynamic interface between man and nature in the contemporary Indian society.

The volume opens with an exhaustive and insightful introduction which, while analysing the neglect of ecological issues in the dominant traditions of social science, discusses the alternative ecologically sensitive traditions of 'cultural ecology' (ie the relationship between ecological context and social structure) besides providing the contours of 'social ecology'.

The selections in section I 'Nature and Culture', analyse in different ways, the relationship between ecological context and social structure. The relationship between nature and culture is both interactive and dynamic with human beings trying to mould the environment to their ends but always having to work within the limits set by nature. Sometimes human intervention is successful in establishing a new and stable balance between society and nature; on other occasions, it itself is the cause of ecological decline.

The selections in section II, 'Resource Use and Abuse', emphasize based on several case studies, the material uses of nature, the goods and services it provides for human society besides examining the relations between different social groups in conjunction with social relations regarding the use and abuse of natural resources.

The essays in section III, 'Conflicting Claims Over Nature', highlight the conflicts that may arise as a result of different interest groups staking claim over the same resources of different reasons such as the conflicts that arose between the Baiga Tribe in Central India and the colonial officials and the conflicts between large mammals and human populations living in and around national parks and sanctuaries besides the policy implications.

The selections in section IV, 'Towards environmental Renewal', deal with the intimate links between intensive resource use, environmental degradation and poverty besides providing the elements of an environmentally friendly and socially humane strategy of development.

Given the ecological and cultural diversity of India, there is a vast scope for studies of the reciprocal relations of the natural environment and human, economic, social and religious life. However, the interdisciplinary research barriers have hampered the progress of social ecology such as history and sociology in terms of method and the characteristic emphasis, with historians focusing more on the domains of economics and politics and sociologists and anthropologists on caste, community, religion and ritual; or demarcation between 'science' and 'arts' that takes effect from the time students are in high school—which at a later stage may adversely affect those interested in social-ecological research (ie without a proper scientific temperament). Perhaps a greater challenge to social ecology comes from the present ideology of global consumerism particularly since liberalisation. Futher, in the Indian context, liberalisation has been even more antipathetic to traditions of environmentalism than was development in its heyday. The way out as Radha Kamal Mukerjee puts it aptly, 'applied human ecology is the only guarantee of a permanent civilisation'.

An important feature of the volume is section introductions explaining the rationale behind each selection along with an annotated bibliography at the end of each section, of additional readings on issues discussed in the volume.

—R.H. Itagi

***THE PRESIDENTS OF INDIA AND THEIR CONSTITUTIONAL PORTRAYAL*; by M.L. Ahuja; published by Om Publications, 1643A, Sector 29, Housing Board Colony, Faridabad-121008, Haryana; first published: 1997, pages 168; price, Rs. 325.**

In India, as in other parliamentary democracies, the Prime Minister is the head of the government but the President is the Head of State. Under the Constitution, the executive authority is vested in the President, but it is to be exercised in accordance with the Constitution which provides for a Council of Ministers to aid and advise the President.

However, since 1952 when independent India's first President, Dr Rajendra Prasad took over, there have been certain instance when the need was felt to redefine President's role.

"New situations require new formulations and new interpretations to be made in the interest of the country", wrote Mr G.V.G. Krishnamurty, Election Commissioner of India in his foreword to the book under review. The author of this book has attempted a brief portrayal of the constitutional status of the President of India in his Introduction of the book. It is followed by short biographical essays on the succesive Presidents from Dr Rajendra Prasad to the present incumbent, Mr K.R. Narayanan. The book also throws light on the way these great Indian Presidents tackled difficult situations.

In his detailed foreword to the book, Mr G.V.G. Krishnamurty, says: "As on today at the fag end of 20th Century, when India, which emerged as one of the powerful nations and as the largest practising democracy, it is time to interpret our Constitution in the light of the spirit of a free India and no more depend on British conventions and practices." After analysing the various constitutional provisions, the Election Commissioner observes: "The nation also expects the President to play an active role, as and when the nation faces political, economic or anti-social crises (like an emergency lamps in times of darkness)."

In view of the fine portrayal of men and matters, the title should serve as a useful reference work. The publication is timely and an eminently readable work.

—S.P. Malik

It must always be remembered that what is new is not necessarily true and what is true is not necessarily new. Perhaps Pope's advice in *Essays in Criticism* (1711) is still applicable:

"Be not the first by whom the new is tried
Nor yet the last to lay the old aside."

The Indian palmyra

Rev. Fr. D'Souza

Here in a garden on the banks of the Moola-Mutha river in Poona where I sit and work, is a lonely palmyra, its great trunk crowned by a thick mass of dark green fronds. All through the summer I saw its heavy bunches of dark shining fruits grow and mature. I noted the time when a stalwart climber hopping up the rude surface of its trunk should have cut down the tender fruit and lowered it into the hands of awaiting youths. But no one thought of it because the tree and its riches are unknown here. Then the fruits ripened, and one by one fell on the ground, and filled the place with their strong scent. No straggling children to pick them up and warm them in the ashes of a dying fire, and chew the fibres and eat the sweet yellow substance that binds fibres and nuts into a shining compact mass.

My mind went back to the lovely village in the West Coast of India where I saw the light of day and where in boyhood I learnt all the uses to which this wonderful tree could be put. That village nestles, between the hills and the sea, in the land that used to be known as Tuluva, a land of rice fields, coconut groves and palmyras, of casuarinas and cashews, and mango *topes!* I shall not give the name of the enchanted village but shall call it Shantipur, for as in Rupert Brook's *Grantchester,* "there is peace and holy quiet there."

In Shantipur people know what to do with the palmyra. Eating the luscious kernel dripping with the nectar which each of its triple nuts holds within it, is the least of its uses, though to boyish appetites, it is the chief attraction....The trees are tapped and the juice prevented from fermenting by putting some lime in the pot that receives the flow from the pruned spadix. And even in the old days not all the trees were tapped for drink. A good proportion were tapped for jaggery or gur, one of the principal articles of food in the neighbourhood. By ten in the morning the tappers had gathered their days's quota, and round about their houses in the still heat of the noon hung the aroma of the boiling liquid as it slowly hardened into a brown paste. It solidified in the form of thin round slabs when poured out on plain cloth and kept in shape by rings made of slips of dried palmyra leaf. They would be packed into round rolls of twenty to thirty slabs also in palmyra leaves. The very firewood that went to boil the palm juice was made of palmyra leaves and droppings from the tree. So from first to last, that round bundle of country sugar which our people have eaten for centuries, was a product of the palmyra tree.

It is not often that palmyra fruits are allowed to ripen when there are cultivators or toddy tappers around the place. But when it does ripen the starchy substances in the covering fibre turns into a rich and appetising yellow pulp the food value of which has probably never been tested.

There is yet another utilization of the palmyra as food which is unknown in the West Coast but common on the East Coast, in the Tirunelveli and Madurai Districts. The seedling, after it sprouts and before it emerges from the ground, grows in the form of a longish tuber which the people call "palmyra potato", *pana kilangu.* Boiled and eaten with palm gur it is said to be tolerable food, cheap, and eaten by poor people who cannot afford rice. So you can see how rich in food-value this neglected tree is, giving palm juice or alcohol, tender kernel or ripened rind, gur or oil or tuber, thus rivalling the coconut in the variety of its edible products.

These great fan-like fronds have other uses besides. The leaves themselves, thick and unattractive, may yet be softened to many domestic uses. Cut down green and dried in the sun they turn to a creamy white, and torn into slender ribbons, they make mats and baskets for everyday use. The mats are rough and used by the poorer people while the better classes use mats made of the leaves of the *pandanus,* or the screw-pine. The leaf takes red and green colours easily and helps to give a decorative look to the baskets. When they dry by themselves on the trees these fronds make a crackling fuel which can be easily tied up into big torches used by the country people for lighting them in the dark. It is an unforgetable sight to see these flaming torches on the way side blazing furiously in the night. From time to time the pedestrain rubs off the cinders against the ground letting a hundred sparks flying about, and swings it in the air to make it blaze again. Or more thrilling still, you may see groups of fishers holding them high in the rivulets as the tide comes in, to attract the fish.

This precious palmyra hardly asks for any care from man for its cultivation beyond the initial step of sowing a nut.... And if man does not plant the seed, nature has means of doing so without man's intervention. I have seen in the Tirunelveli District many an example of three trees growing as it were from a single root.

Marvellous are the devices of Nature to propagate and perpetuate herself without the agency of man. And so let us conclude this tale of the virutes of this *kalpa vriksha* whose praises no one sings, with this note: that in its way, it brings home to the effective mind the wisdom and goodness of the Creator, Who in primeval ages, prepared the world of tree and fruit in wonderful ways for the advent of Man, and for his service to the end of time. ❑

Leucas aspera: an essential component of the backyards of Kerala households

Kunstleria keralensis: Species nova, endemic to Western Ghats, reported first from sacred groves of Kerala.

Pepper

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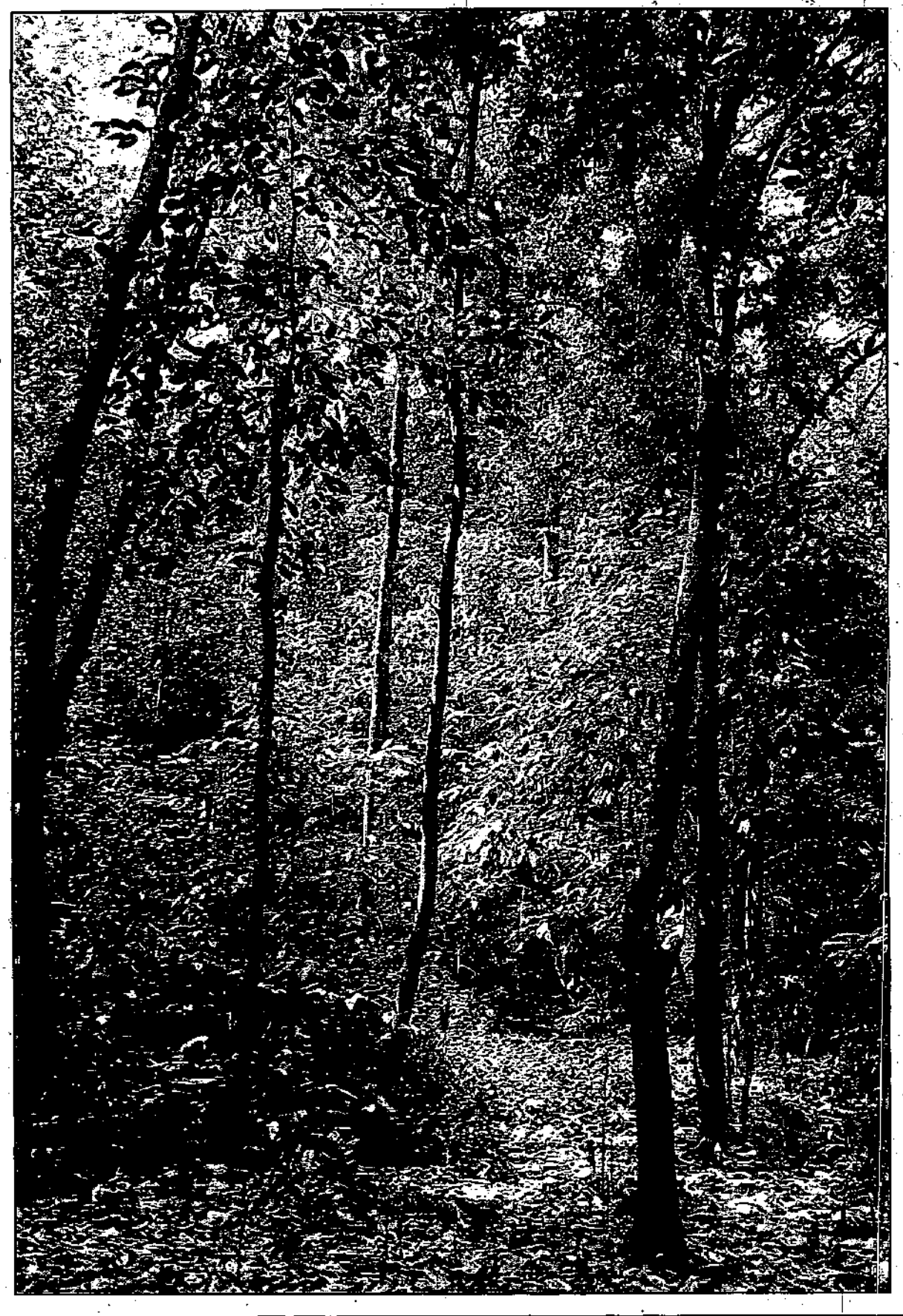

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