



Medicinal Plants of Rural India: A Review of Use by Indian Folks

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ABSTRACT: Historically plants have played an important role in medicine. Through observation and experimentation, human beings have learnt that plants promote health and well-being. The use of these herbal remedies is not only cost effective but also safe and almost free from serious side effects. The village elders, farmers and tribal have tremendous knowledge about for health reasons started thousands of years ago and is still part of medical practices by folks of various regions of Indian sub-continent as well as several other countries including China middle East, Africa Egypt, South America and other developing countries of world. This review article shade a small beam of light on conservational strategies of medicinal plants as well as their marketing price in past and near future scenario. © 2011 IGJPS. All rights reserved.

KEYWORDS: Herbal medicine; Folks, Tribal Communities; Herbal Gardens.

INTRODUCTION

The world 'Environment' has originated from French word "environ". It means surroundings. It includes each and everything outside the plant, which influences directly or indirectly the life of the plant. This is an integral part of the earth's ecosystem. Each component of the environment is called environmental factor. Plants grow best within certain ranges of various factors includes temperature, soil moisture, soil nutrients, light, air pollutants, humidity, soil structure and pH. Although these factors affect all plants are frequently grown or kept in cultural particles (fertilization, irrigation, spraying with pesticides) that may affect their growth considerably.

According to the WHO, over 80% of the world's population relies on traditional forms of medicine, largely plant based to meet primary health care needs. In India, the collection and processing of medicinal plants and plant products contributes a major part each year to the national economy, as a source of both full and part time employment¹. Micro-studies suggest that a large number of those employed are women. In recognition of the significance of the sub-sector and the fact it is largely undocumented, the World Bank and the IDRC Medicinal plants Network (IMPAN) agreed to produce this state of the art report on the medicinal plants sector in India. The report suggests that despite a wealth of resources (biological, human and financial being available, the lack of a coordinated approach which considers sustainable and equitable development to be short as well as long term goals for the sub sector) has resulted in the simultaneous under utilization and overexploitation of the valuable plant resource. It is hoped that this review will be a step towards achieving such a coordinated effort. In addition, to identifying information gaps and research priorities, it outlines a set of

possible interventions at various levels which could lead to the promotion of the sustainable and equitable development of the sub-sector for human and environmental benefits².

Plants are one of the most important sources of medicines. The application of plants as medicines date back to prehistoric period. In India the references to the curative properties of some herbs in the Rig-veda seems to be the earliest records of use of plants in medicines. The medicinal plants are extensively utilized throughout the world in two distinct areas of health management; traditional system of medicine and modern system of medicine. The traditional system of medicine mainly functions through two distinct streams (1) Local or folk or tribal stream and, (2) Codified and organized Indian system of medicines like Ayurveda Siddha and Unanni etc.

Over the centuries, the use of medicinal herbs has become an important part of daily life despite the progress in modern medical and pharmaceuticals research. Approximately 3000 plants species are known to have medicinal properties in India³. The Rigveda (3700 B.C.), mentions the use of medicinal plants. Our traditional systems of medicines, viz., Ayurveda, Yunani, Siddha and Homeopathy etc. use herbs for treatment. It is estimated that 40% of the world populations depends directly on plant based medicine for their health care⁴. In India, medicinal plants offer low cost and safe health care solutions. There are several attempts were made to explore indigenous knowledge on use of common medicinal plants for the treatment of diseases related to various systems of human beings (Table 1 and 2).

The medicinal attributes of many plants are found in leaves, used as alterative, tonic diuretic, blood purifier and antiphlogistic. They are used as remedy against chronic eczema, chronic ulcers, chronic rheumatism, chronic nervous diseases, madness, cholera amenorrhoea, piles and fistula. Usually, the power of dried leaves is given with milk in mental disability and for the improvement of the memory. The fresh juice of leaves is given as alterative in jaundice, fevers and gonorrhoea. The same is also useful for children's in cutaneous diseases and for the improvement of nervous system.

Medicinal plants are also varying in their effectiveness against any kind of cure. As an example; brain tonic Brahmi is more effective than Mandukparni. Brahmi is used to decrease fatigue and depression and to stimulate the sex drive. It energizes the CNS and aids the circulatory system, soothes and minimizes varicose veins and helps to minimize scarring. It is also useful in repairing skin and connective tissues and smoothing out cellulite. Besides this, it has been used by Ayurveda in India for almost 3000 years. The Ayurvedic treatise, the CharakaSamhita (100 A.D) recommends Brahmi in formulations for a range of mental conditions including anxiety, poor cognition and lack of concentration. In India, Brahmi is correctly recognized as being effective in the treatment of mental illness and epilepsy.

Ganga plains covering an area of about 3.75 lakh Km² in the states of Uttar Pradesh, Bihar and Bengal was formed by the deposition of sediments brought by the river Ganga and its tributaries in the quaternary period of Cenozoic era. Since ancient days the Ganga plains has been rich in floral diversity. The variety of medicinal plants growing in wild states due to favourable climatic and edaphic conditions in this region includes the Punarnava (*Boerhaaviadiffusa*), Gokhru (*Tribulusterrestris*), Ark (*Calotropisprocera*) and many more. To be on the Herbal medicine front, mere utilization of plants in medicine would sound low when the drug is already threatened for existence. So a path breaking step would be to protect such plants from becoming extinct in the near future, which would serve the generations to come. It becomes our sole responsibility to highlight such endangered species, which would help the herbal practioners, conservationists and environmentalists to narrow down their cynosures to such indigenous plant species, thereby ensuring safety to the country's flora from being swept off by threatening catastrophes.

Rapid industrialization has led to an uncontrolled increase in human interference to play a spoilsport, which has resulted in a considerably decline of the habitat. Also, several endemic plant species to peninsular India, highly appreciated for its medicinal value, is at threat in its own land. Delineated as one of the critically endangered species in the red list of the IUCN² needs an urgent attention

for conservation. They considered by different names in different systems of medicines like Ayurveda, Unani siddha and is highly preferred in local healing traditions for curing many diseases. There are needs to collate all the available information regarding medicinal plants development in the country in order to obtain a comprehensive overview which will provide the necessary insight for coordinated and effective action. Although, only micro-studies are currently available in which most of the indicate that current practices are both unsustainable as they rapidly deplete the natural supplies of the country's plant base and inequitable, perpetuating improvement for those charged with stewarding and harvesting the resource, while a few profit in dramatic disproportion to their inputs. Negative impacts on local primary health care, as plants become diverted to national and International markets, have also been cited in some cases. The global market would appear to be more receptive than ever to the mounting of a concentrated Indian effort at supplying it with medical materials and know how such an effort would also appear to be increasingly remunerative for the country.

Table 1. A list of practitioners and institutions involved in different kind of traditional and non-traditional systems of medicine in India.

System of medicine	Practitioners	Institution registered
Ayurveda	223,000,	117,774
Sidha	18,128	10,268
Unani	30,456	1,559
Unregistered	189,416	-----
Total	460,000	30,456

In terms of the number of the species individually targeted, the use of the plants as medicines represents by far the biggest human use of the natural world. Plants provide the predominant ingredients of medicines in most medical traditions. There are no reliable figure for the total number of medical plants on earth, and number and percentages of countries and regions vary greatly⁵. Estimates for the number of the species used medicinally include: 35000-70,000 or 53,000 worldwide⁵; 10,000-11250 in China⁶; 7500 in India⁷(**Table 3**).

The United Nations Conference on Environment and Development (UNCED), held at Rio de-Janeiro, Brazil helped to place the loss of biodiversity and its conservation on the global agenda resulting in biodiversity becoming a household word. Biodiversity is a new term for species-richness (Plant animals and organisms) occurring as an interacting biotic component of an ecosystem in a given area. Age old Astrological sources in India have considered medicinal plants to be sacred, which finds Niches for itself in Nakshatra Vana (group of plants specific to birth stars and accredited as the plant to be worshiped) and other parts. Down the ages people have been exploiting this plant for various purposes, which have led to a heavy loss of their habitat especially in the 19th century.

Table 2.A list representing some botanicals and /or their particular part used for treatment of various diseases in India.

Disease	Name of plant	Botanical name	Properties	Scientific base	Method of use
	Isabgol	<i>Plantagoovata</i>	Stomachic Constipation	Relive pain in stomach	Mix 2 seeds in half cup curd
Diarrhoea	Adrak	<i>Zinger officinale</i>	Carminative Appetizer Emollient	Destroys germs Stimulate appetite Provide soothing effects	Soak 2 or 3 seeds with one cup of butter milk
	Dhania	<i>Corinadum sativum</i>	Stomachic constipation Carminative	Improve digestion Cure flatulence Proving soothing effects	Take equal amounts of sonth and black pepper and make a fine powder
Dysentry	Tesu	<i>Butea monospera</i>	Antihelmintic	Kill worms in intestine	Grind stem bark of dhak and gum of drum stick to make powder
Stomach Pain	Aakol	<i>Alangium salvifolium</i>	Laxative Anti	Loosen the bowels Cures flatulence	Grind 50-60 gm bark of aakol to make powder,keep it for 30 min. and drink it.
Vomiting	Mint	<i>Menthaarvensis</i>	Anti emetic Antibacterial	Extricates worms from intestine Provides cooling effects	Extract juice from 50 gm leaves

	Amla	<i>Phyllanthus emblica</i>	Laxative Stomachic	Improve digestion Cure flatulence digestion	Take 40 gm dried fruit of amla to made into fine churan
	Guarpatha	<i>Aloe barbandeneris</i>	Antihelmitic Digestive Stomachic	Kill worms from intestine Loosen the bowels Improves	Take 2-3 leaves and cut into pieces and eaten with salt
Constipation	Date	<i>Phoenix dactylifera</i>	Laxative Digestive Tonic	Loosen the bowels Improves digestion	Soaks 100 gm dates in water for over night.
	Amla	<i>Phyllanthus emblica</i>	Anodyne Digestive Stomachic	Allays pain Relives pain in Stomach	Soak 130gm dreidamla in 1 glass of water for over night and drink it in morning.
Pachish	Bael	<i>Aegle marmelos</i>	Appetizer Restorative Laxative	Increase appetite Provides strength to body	Make paste of pulp of 1 friut and unripe seeds of mango in equal proportion.
Scabies	Bael	<i>Aegle marmelos</i>	Laxative	Increase moisturization capacity of skin	Paste of leaves applied externally
Bacterial skin infections	Semal	<i>Bombax cieba</i>	Appetizer	Destroy small colony of spores	Powered bark is mixed with honey and taken orally

Ring worm	Papita	<i>Carica papaya</i>	Anti-fungal	Destroy small colony of fungal spores	The latex from unripe fruits is applied on infected skin
Sore wounds and Eczema	Neem	<i>Azadirachita indica</i>	Bark, Seeds and leaves has healing properties	Prevents the developments of insects	Paste of powered bark is applied externally
Dry skin	Ghritkumari	<i>Aloe barbedensis</i>	Leaves has moisturizing properties	Prevents the dryness factor of mammalian skin	The gel obtained from the leaves is layered on the affected area
Abscess	Lahsun	<i>Allium sativum</i>	Helpful in wound healing	Unwounded leaves (inflorescence) in animals	Crushed pieces are applied on affected area.

Objectives of Review

It was with the intention of providing such a comprehensive overview that the International Development Research centre (IDRC) and the World Bank's Department of Agriculture and Natural Resources (WBDANR) commissioned the authors to conduct a state of art review of the medicinal plants. Medicinal plants, of course, do not presently constitute a sector as typically defined in international development discourse; generally they have been defined as a forestry sub-sector, or less often as a sub-sector in health care. However, this review takes up medicinal plants as an independent sector for two reasons: 1) medicinal plants have been assigned provide a sufficient base of experience for their sustainable and equitable development and 2); provide an organizational framework for the community of researchers and stakeholders.

Table 3. Number and types of ailments treated by traditional system of medicine in India.

Traditional	Carrier Subjects	Number
Mothers and house wife	Home remedies	Millions
Traditional birth Attendants	Normal deliveries	700,000
Herbal Healers	Common ailments	300,000
Bone Setters	orthopaedics	60,000
VishaVaidhyas	Natural Poisons	60,000

This review is a map exercise to identify what, how, where, why and when of medicinal plants development in India, in order to supply a comprehensive understanding and overall picture to researchers, NGOs, health care workers, private companies, conservation and developmental agencies, policy makers and other interested stakeholders. It is intended to provide a framework and knowledge base and an initial way forward, for those interested in India exploit her comparative advantage in the global market.

Medicinal plants: A global view

Recent estimates suggest that over 9,000 plants have known medicinal applications in various cultures and countries, and this is without having conducted comprehensive research amongst several indigenous and other communities⁸. Medicinal plants are used at the household level by women taking care of their families at the village level by medicine men or tribal shamans, and by the practitioners of classical traditional systems of medicine such as Ayurveda, Chinese medicine, or the Japanese kamposystem. According to the World Health Organization, over 80% of the world's population or 4.3 billion people rely upon such traditional plant-based systems of medicine to provide them with primary health care⁹. Allopathic medicine too owes a tremendous debt to medicinal plants; one in four prescriptions filled in a country like the U.S are either a synthesized form or derived from plant materials¹⁰. According to the International Trade Centre, as far back as 1967, the total value of imports of starting materials of plant origin for the pharmaceuticals and cosmetics industry was one of the order of USD 53.9 million⁹. India was the largest supplier by far, with 10,055 tons of plants and 14 tons of vegetable alkaloids and their derivatives¹¹. However, it is only during the last decade that the real significance of the medicinal plants sector has begun to be realized by mid 1980s, there was a renewed interest in natural materials and approaches to health care, coupled with a recognition that technology alone could not solve the pressing health care needs of the world's population¹². The participation of various companies in the market also attests to its new strength and importance. By 1990, some 223 major companies worldwide were reportedly screening plants for new leads; the figure had been zero in 1980¹³. In response to the overwhelming interest in alternative therapies, many of the prestigious allopathic medicinal institutions have also recognized their importance: an example is the National Institute of Health which created the Office of Alternative medicine in 1991 to provide the public with information on alternative treatments and to assess those therapies which have been proven successful¹⁴. According to one account, in 1992 significant amounts of at least 74 species of medicinal plants were being commercially traded in the global market¹⁵. During the last 3 years, approximately 40,000 tons of plant drug materials were imported into Germany, annually¹⁶.

Recourse base: Cultural and Historical context

There is an immediate need to consolidate and officially link the existing herbal gardens and gene banks, as well as references specimens in Herbaria, to ensure that the 540 species of highest importance in the major classical systems, as well as those supplied to the international market, are protected in ex-situ reserves. This requires strategic planning since the range of germplasm obtained for each species must be representative. Plant collections need to evolve from being species references collections to being genetic resources collections.

The low number of medicinal plants currently being cultivated should be increased, in order to meet the demands of industry for continuous and uniform material supplies, and to take some of the pressure off medicinal plants originating from natural ecosystems. At present, commercial varieties have been developed for about 16 species, most of which are cultivated for export. Much more needs to be done to select superior genotypes of many more species. To achieve this initiative, it will be necessary to make extensive use of the network of nurseries and gardens in the country, in order to establish high quality plant supply systems.

Wild-harvesting practices are presently highly sustainable and are likely to remain so. The lack of sufficient information and of relevant scientific procedures are important contributing factors to this situation, as is the absence of any land right regulations, which provide local communities with access to and some degree of control over their resources. Unfortunately, little work has been done in this area. It will be necessary, based on an understanding of where medicinal plants are currently distributed, to develop novel programs for their in-situ conservation and to design genetic reserves.

This intervention also applies to raw drug materials as well as wild relatives of crops and current government activities relating to protected areas may need to be modified in order to accommodate these species. The implementation of JFM schemes in these areas would be the logical approaches to use, given the viability of medicinal plants for generating income as well as rehabilitating degraded lands. Due to their position as the major stewards of the resource base, women and tribal groups, especially, should be given some control over these lands. It will be critically to understand the actual distribution of the resources and to research their genetic diversity for policy and strategies formulations. This is a long term process and a research initiative.

To cope up with alarming situation, the recent exciting development in biotechnology has come as a boon. One of them is the use of plant tissue culture technique. Most of the plant raised through seeds are highly heterozygous and show great variations in growth, habit and yield and may have to be discarded because of poor quality of products for their commercial release. Likewise, majority of the plants are not amenable to vegetative propagation through cutting and grafting, thus limiting multiplication of desired cultivars. Moreover, many plants propagated by vegetative means contain systemic bacteria, fungi and viruses which may affect the quality and appearance of cultivated items.

In recent years, tissue culture has emerged as a promising technique to obtain genetically pure elite populations under in vitro conditions rather than have in different populations. Tissue culture has now become a well-established technique for culturing and studying the physiological behaviour of isolated plant organs, tissues, cells, protoplasts and even cell organelles under precisely controlled physiological and chemical conditions.

Most of the medicinal plants either do not produce seeds/seeds are too small and do not germinate in soils. Thus mass multiplication of diseases free planting material is a general problem. In this regard, the micro propagation holds significant promise for true to type, rapid and mass multiplication under disease free conditions. Besides, the callus derived plants exhibit huge genetic variations that could be exploited for developing superior clones of varieties particularly in vegetatively propagated plant species.

Propagation of this plant is difficult due to production of large number of non-viable seeds¹⁷. Seed germination was reported by the few authors¹⁸. Cultivation of the important medicinal plants species in India was reported by many authors¹⁹. This plant has

been designated as threatened with extinction, endangered and threatened, critically endangered in India²⁰. Because of over-exploitation, need for conservation and low propagation rate there are several reports of in vitro propagation and manipulation of this plants²¹. Phytochemical analysis of this plant has been a popular research field for many decades and several works have been carried out in this area²².

Medicinal systems in India date back at least 5000 BC, coinciding with the emergence of the cities of the agricultural based Indus Valley civilization around 4500 BC. However, superimposed upon earlier Mesolithic hunter gatherers societies centred in Mehrgarh in the plains of Kacchi, which themselves bore traces of a similar society based in the Vindhya, and south of the River Ganga. Colonization of the alluvial plains only occurred after the formation of more complex societies, firstly in the Indus Basin and 2500 years later in the Ganges valley. While far more is known about the food habits as opposed to the use of medicines of these early peoples, several factors influenced the development of medicinal systems over a period of time. Firstly, ethnic changes between 2000 BC and 1500 BC, resulting from the arrival of Aryan immigrants, led to the domination of a new culture over the earlier pre-Caucasoid Dravidian settlers. A second major factor involved the trade links of the Indus Valley civilization overland to Gandhara and Bactria in Afghanistan, as well as by sea to Persia and the Persian Gulf. By the time of the post-Vedic period (after 600 BC), when medicines had been modified according to rational, scientific principles as opposed to magical principles, the materia medica was extensive and incorporated plants from neighbouring regions. India obtained by diffusion rather than by trade, some important medicinal species including *Cannabis sativa* and garlic from Central Asia; *Aloe vera*, *Cuminum cyminum*, opium poppy and *Glycyrrhiza* from the Mediterranean; nutmeg from Southeast Asia; *Trigonella*, *foenum-graecum*, *Crocus sativus*, *Carum carvi* and *Medicago sativa* from Southeast Asia; *Coriandrum sativum* from the Mediterranean and Southwest Asia. At one point in time, approximately around 1526 AD, the Vedic and Unani systems interacted and functioned in an integrated manner as documented by Bala²³⁻²⁵.

Traditional systems of medicine continued to be used in India even during the British era when western system was promoted due to outbreaks of epidemic diseases such as cholera, smallpox and Malaria. Over time many of the ancient as well as the more recent introductions have become vital components of traditional medicine systems, India has over the millions primarily relied on her own indigenous plant diversity in this regard. The Botanical Survey of India records over 15,000 plant species occurring in the country, of which at least 7,500 species have been used for medicinal purposes. Attempts to document the plant wealth of India have continued since the landmark publication by Watt²⁶. Around 1700 species have been documented for their biological properties and drug action²⁷ and data is available for approximately 1200 species, especially those most frequently used in traditional Indian Systems of medicine, resulting in a reasonable knowledge base. A plan by way of introducing the importance of medicinal plants in international trade which implies that accelerated attempts to harvest and trade materials, or to cultivate medicinal plants for profit, can well result in a focus on non-indigenous plants with consequent repercussions on the availability of the resource base to sustain national needs.

TRADITIONAL KNOWLEDGE & USE

In order to understand the extent to which medicinal plants are used at the local community level, a useful distinction can be employed related to the type of medicinal practice. Allopathic, generally understood as modern medicine and based predominantly on the principles of Western post-Enlightenment Science which has dominated the last three centuries. Classical traditional, referring to the documented and standardized great tradition systems of medicines including Ayurveda, Siddha, Unani, Amchi and Homeopathy with different epistemological bases to that of Western Science²⁸.

Folk traditional, referring to those medicinal practices which are usually transmitted orally from generation to generation and whose use is generally confined to a particular geographical region or group of people such as a tribe or caste community.

Most studies and common wisdom in India suggest that few people adhere solely to any one of these types of medicine, more often shifting from one to other, based on a combination of factors including preference, faith availability and cost. The organized Indian systems of medicine are said to have similar levels of penetration. Hence, it has been asserted by some that up to 500 million people continue to take resources to some of traditional folk medicine, including local innovative on classical systems²⁹. According to this assertion cannot be conclusively proven there is information to suggest that it may be correct. According to the Anthropological Survey of India, there are over 4,635 tribes spread throughout the country most of whom live near forests and depend their resources to fulfil basic needs. In addition, the majority of India's populations of nearly 1 billion continue to be rural and village-dwelling, frequently isolated from the usual means of medicinal knowledge transmission. In South Asia reveal the existence of a large number of practitioners, displaying various levels of specialization, millions of house-holds still practice self-medication using locally available remedies based on medicinal plants. A large number of species, many of which are indigenous to the south Asian region are used in these preparations, which are themselves unique to India in many cases. Information about tribal and folk practices assists these companies in identifying prospective plant for future drug manufacture. In recent times, such bio prospecting companies have attracted a great deal of attention, both positive and negative, at international level especially at the UN Conference and at subsequent discussion. A large number of pharmaceutical companies of national and International pride will continue to benefit from traditional knowledge since many pharmaceuticals products have been derived from plants some 75 percent of these were discovered by examining the use of these plants in traditional medicine¹².

Since the therapeutic practices based almost entirely on the use of traditional herbal remedies are prescribed by traditional medical practitioners, who are respected members of the community the government has responsibilities to formulate national policies that encourage the national use of herbal medicine and to promote their safety and quality^{30,31}. A WHO/IUCN/WWF International Consultation on Conservation of Medicinal Plants noted that the losses of indigenous cultures has direct consequences on the identification of new medicinal species to benefit the wider community. Growing urbanization and changing cultural preferences, the overexploitation of the plant resources base upon which traditional medicine depends, and the lack of organized support and activity with regard to folk and tribal medicine have led most experts working in this field to conclude that these traditions are slowly dying out³².

Traditional uses of medicinal plants may also decline due to increasing commercialization of the medicinal plant sector and diversion of raw materials for sale in markets. One study conducted in Arunachal Pradesh examined the use of *Mishitita*, a better root that is found at altitudes of between 2000 meters and 3000 meters in the districts of Dibang and Lohit. Over the last decade, local people have been selling the species for a very remunerative price of Rs.1000 per kilogram locally, after which it is exported via Calcutta to Japan and Switzerland. Though this plant was traditionally used by tribal for the treatment of fever, backache and dysentery, it is now being substituted by opium for local use due to the fact that all available supplies are for export¹³. The fact that other locally available species such as *Kutaya (Hollarrhenaantisysenterica)* and *Berberis* are not being substituted is an indication of the locally specific nature of traditional knowledge(**Table 4**).

Table 4.A list of price variations of botanicals obtained by selected species of Indian states.

Botanical name	Co-Price	Raw price	% variation
<i>Adathoda vasica</i>	1.40 13.75	882	
<i>Eclipta alba</i>	1.00 8.6	776	
<i>Terminalia chebula</i>	3.80 15.71	313	
<i>Syzygium cumini</i>	1.40 16.67	1054	
<i>Tragia involucrate</i>	4.75 16.68	1087	
<i>Helictersisora</i>	1.90 28.00	1374	
<i>Phyllanthus amarus</i>	1.00 18.57	175	
<i>Momordica dioica</i>	1.15 28.00	1374	
<i>Cyperus rotundus</i>	1.90 12.75	571	

However most studies relating to folk and tribal medicine have concentrated more on the practice themselves, in isolation from the social and economic context in which they occur. Manuals and publications of ethanobotanical studies tend to be primarily lists of plants with brief descriptions of their methods of use. In most cases, little information is included regarding the number of people knowledge about the practice, in the demographic make-up of both the practitioners and the use of the medicines. The logic of the practice as understood by the practitioners themselves, as well as important associated rituals apart from drug administration, for example methods of collecting and processing, are also rarely reported (Table 5).

Homeopathy: An ancient system of medicine in India

Unlike the folk and tribal system of traditional medicine systems, the traditional systems of Ayurveda, Sidha and Unani are well documented, highly formalized systems, which have evolved over centuries. Medicinal plants are the raw materials for indigenous drug manufactures within India. These manufactures can be divided into two types of enterprises: these which produce drugs used in the so-called Indian Systems of medicine and Homeopathy and those which produce allopathic drugs. Ayurveds developed with the Aryan invasion. The origins of the Sidha system, whose practice is mostly confined to the South of India, particularly the state of Tamil Nadu, are however more contested. While some hold that the system is a variation of Ayurveda, others argue that it has pre-Aryan, Dravidian roots. The unani system was a later introduction and continues to be widely practiced especially in North India and among the country's Muslim community. Homeopathic medicine is also often attached to the other three systems in describing India's medical diversity and the policy and planning measures adopted by the government, officially recognize all four forms of medicine for the purposes of national health services. Although not a traditional system, homeopathy like those other systems differs in its theoretical orientation from allopathy and is highly reliant on medicinal plants and nature-based cures. In addition, to these four systems, Yoga, Naturopathy and Amchi medicine are also practiced in India, although the available database and degrees of recognition accorded to these systems appear to be low at present.

Table 5.A list of some most priced medicinal plants of India and their respective states.

State	Species
Gujarat	<i>Rauwolfia serpentine</i> , Kadayam gum
Maharashtra	<i>Rauwolfia serpentina</i>
Karnataka	Sandalwood oil, <i>Phyllanthus emblica</i>
Tamil Nadu	<i>Terminalia chebula</i> , <i>Terminalia bellerica</i>
Kerala	Gum, fibres, roots of rose wood
Orissa	Sandal wood, rose wood
Uttar Pradesh	Gum, Chiranjiv

Allopathy in India common and the same degree of scope, organization and reach that is commonly associated with Western allopathic medicine in other countries. It has been estimated that there are approximately 460,000 practitioners of the traditional systems, or whom about 271,000 are registered under the state boards and about 145,000 practitioners of homoeopathy.

There are also over 100 undergraduate teaching Institutes specializing in traditional systems of medicine and awarding degrees in Ayurveda, Siddha, and Unani as well as over 20 post graduate departments awarding degrees and doctorates. Finally, traditional medicine hospitals account for 1,690 of the total number of hospitals in India, and there are at least 13,770 dispensaries of traditional medicines³³. Some of the most interesting statistics have been provided by the Arya Vaidasala Kerala which manufactures traditional ayurvedic drugs for domestic use as well as for limited export. The relatively large number of people, plants and products involved suggests that the domestic industry's consumption of medicinal plants must indeed dwarf that of the formal exports market. Growth has also occurred in this sector with one of the largest Ayurvedic companies, Dabur India Ltd. Reporting annual growth rate of 25% of in their sales since 1990 and a doubling of their turnover every year. The use of alternative medicines has become increasingly popular in the developed world. For example, 1 in 3 Americans have at some time used unconventional medical therapies according to a national telephone survey published in the New England Journal of Medicine in 1993. In another survey conducted in 1994, it was found that 60% of the doctors had at some time referred patients to practitioners of alternative medicine. Also in 1990, more than 2000 companies in Europe alone were marketing herbal medicinals, with 30% having a turnover in excess of 20 million-expenditure in the United States on Unconventional alternative, or unorthodox" therapies reached 13.7 billion dollars during the same year³⁴. The so called Nutraceuticals sector consisting of herbal medicines which are dubbed food or dietary supplements in order to pass FDA criteria more easily is now estimated to be valued at USD 27 billion³⁵ (Table 4 and 5).

Indian scenario

The global context sketched above suggest several tremendous opportunities for India, a country unrivalled terms of diversity of medicinal systems and practices, in addition to being a major storehouse of biological diversity, with 2 of the 4 mega diversity areas

of the world located within its borders. India is of course already an active participant in the global medicinal plants market having been for some time the world's largest supplier of raw materials. Of the 74 species accounted for in one of the studies mentioned above, India was known to be exporting 22 and importing 8¹⁵, while the German study quoted earlier, which is now underway has found India to be Germany's largest trading partner by far¹⁶. Moreover, medicinal plants are one of the most important components of the non-wood forest products sector which supplies over 80% of India's net forest annual export earnings³⁶. In addition, several concerns arise in relation to the current consequences of participation in the market, with regard to the sustainable and equitability of prevailing practices in the sector. To add to all of these aspects, the market in India has been shown to be highly inefficient and imperfect.

The need of the hour, then, is to replant India's participation in the expanding global market, in light of the interests of all the stakeholders who are affected and who play a role in this sector. Such an overview could form the basis of a renewed development of India's medicinal plants sector, and a strategic exploitation of other comparative advantage in the global market on a sustainable and equitable basis.

Reducing populations of medicinal plants in India

The reducing populations of medicinal plants are a matter of great concern in Ganga plains. Therefore, it is extremely essential to conserve important medicinal plants species by the restoration of its natural habitats like shrub lands and woodlands. In addition, also its alterations will not only help in the conservation but also be helpful in additional income of generations to the farmers. Thus conservation of medicinal herbs is inevitable to sustain our traditional system of disease treatment (Ayurveda) which is cheap, effective without any side effect unlike modern system of disease treatment based on clinical drugs¹.

In view of the tremendously growing world population, increasing anthropogenic activities, rapidly eroding natural ecosystems etc. the natural habitats for a great number of herbs and trees are dwindling. Many of them facing extinctions. The ballooning populations in plains of Ganga have led to clearance of shrub lands and woodlands in rural areas for agricultural purposes and also to meet the need of fuel and timber traditionally had been the main habitats of medicinal plants. This has resulted in substantial decline in population of medicinal plant species in this region. The rural communities of Ganga plains living below the poverty line (BPL) and use the soft and tandem leaves of medicinal plant as vegetables. Besides this, the schedule caste and schedule tribe communities extract the medicinal plants from its natural habitat, for sale to pharmaceuticals companies. Thus exploitation of plant as vegetables and for sale has significantly contributed in downfall of the population of medicinal plants.

Conservational strategies

Medicinal plant species are increasingly under threat. At present, it is feared that 15.20 percent of the total vascular flora of India (over 3,000 species) may fall under one of the IUCN categories of threatened, rare or endangered. While a comprehensive analysis of the status of medicinal plant species has never been carried out, it is estimated that approximately one third of the plant species listed in the Red Data Book of India, may have medicinal properties. The largest gap in knowledge relates to paucity of information on patterns of genetic diversity as well as which segments of the gene pool/distribution need attention for conservation and for further development through domestication and cultivation. It is often easier to uproot the entire plant rather to selectively gather the specific parts required, especially where commercial profits are available for the collectors. Together with increasing populations, increased demands for crude drugs and lack of a comprehensive knowledge base, the continued availability of plant material from the wild cannot be scientifically or practically assured. Nearly all experts consulted in the field agreed that the vast

majority of plants continue to be harvested from the wild, with estimate of up to 100% for wild harvesting in some of the predominantly rural and tribal regions^{14,37}.

The forests of Himachal Pradesh, said to have been the birthplace of Ayurveda, are known to supply a very large proportion of the medicinal plant requirements of India, with one estimates quoting figures as high as 80 percent of all Ayurvedic drugs, 46% of all Unani drugs and 33% of all allopathic drugs developed in India¹³. The western Ghats, one of the hotspots areas of mega diversity form a second major source, while the Himalays represent a third heterogeneous source. Unfortunately however, information regarding major supply zones is often protectively guarded as a result of increasing scarcity of supply, and is far from being well documented. Researchers at the Workshop estimated that over 120 million people in the Himalays region rely primarily on plant products, mostly extracted from the wild which medicinal plants were one of the major groups. Swertiachirayita (Chirayata) is one of the low-value altitude plants. Most chirayate in India commerce is collected from East Nepal. India also exports the extract chiretta containing the glycoside chiratin to Europe and Asia³⁸. *Nardostachysjatamansi* is a high altitude high value plant. Although non-processed exports are officially banned from Nepal, a major illegal trade continues to India for extraction of a pale yellow volatile oil of high value as a drug for numerous ailments.

Due to spread and prevalence of modern system of disease treatment based on the use of chemical drugs (Allepath), the people in rural areas have gradually lost their interest in medicinal attributes of medicinal herbs. Consequently, they do not get proper protection and often destroyed as weeds. The escalating problem of environmental pollution has also substantially contributed in shrinking of the population of the medicinally important plant species.

On the other hand, the government has in place a wide range of organizations with initiatives aimed at strengthening various aspects of the sector and co-ordinating parts of it. These are supplemented by many non-governmental initiatives, several supported by outside donors. New government coordination efforts would not however be feasible at present due to the currently apparent constraints. These all could pave the way for sharply focused strategic planning for the future. We hope that the this review will be useful to government agencies, developmental planners, researchers, NGOs, and donor agencies, who can work together to make the sector more sustainable and equitable.

Ex-Situ Conservation

Demands of the market for a continuous and uniform supply of raw materials and the increasing depletion of the forest resources base, expanding the number of medicinal plants in cultivation appears to be an important strategy for research and development. However, according to one estimate, of more than 400 plant species used for production of medicines by Indian Industry, less than 20 are currently under cultivation in the country²⁷.

The potential returns to the former form cultivation of medicinal plants are reported to be quite high. A study suggested that the cultivation of certain high altitude Himalayan herbs could yield products priced anywhere between Rs. 7,150 to 55,000 per hectare, although it is not clear at which point in the marketing chain these prices are paid³⁹. Tiwari³⁴ reported average annual (per hectare) incomes Rs. 120,000 through mixed cropping of high altitude medical herbs. Data for some low altitude crops from the Amarkantak region of M.P show economic returns for four profitable species. Number of the products of cultivated medicinal and aromatic plants is exported as crude drugs. Unfortunately, however, due to emphasis being placed on most cultivation efforts is not alleviating the pressure being exerted on the natural resource base. Nevertheless, a number of techniques have been developed to increase the quality and yield of many of the cultivated species. It is estimated that Indian public sector research institutes have developed standardized practices for the propagation and agronomy of a total of about 40 species⁴⁰.

Efforts have mainly focused on the development of agro-technology techniques, including propagation methods for medicinal and aromatic plants. Aromatic plants have, however, tended to receive more attention, perhaps because their market values are in general more widely known. ICAR research stations like National Research Centre for Medicinal and Aromatic Plants located in Gujarat, which specializes in domestication and has created structures links between the NBPGR and its plant Breeding. Division in order to develop improved varieties of some of the medicinal plant species used in allopathic preparations.

Another major nation public research organization is the CSIR has also played a significant role with regard to cultivation of medicinal plants through its creation of CIMAP, is now a prominent institute in India focusing on agro-technology as well as basic studies; improvement and enhancement of the resource base, and chemistry and related research regarding product development from plants. Beside this, two another research efforts described above the Central Government initiated a five year program (1992-1997) implemented by the Ministry of Agricultural to accelerate research and development of medicinal plants. With the support of 16 state agricultural universities, state horticulture and agriculture Departments, regional laboratories and the International Crop research Institute for the Semi-Arid tropics (ICRISAT), also engaged in this field.

Private companies have also begun to invest in the cultivation of medicinal plants, since they face difficulties with regard to increasing supply gaps as well as in some cases adulterated materials from the wild. One such company, the AryaVaidyaSala in Kerela, in addition to maintain two large herbal gardens, has also undertaken research on the propagation of various medicinal plant species, the demand for which currently outstrips supply, or may soon do so.

Other traditional drug manufactures in India have also begun to invest in cultivation experiments and developments. Some of the companies are undertaking research and development programmes through the creation of company foundation, such as the Zandu Foundation for health Care in Mumbai and The ShreeeDhootapapeshwarAyurveic Research Foundation in Bangalore and Panvel. These companies are actively involved in the development of cultivation method of medicinal plants of importance to them, with the direct participation and partnership of local farmers and tribal women's⁴¹.

India has joined the G-15 Gene Banks for Medicinal and Aromatic plants (GEBMAP) initiatives and currently acts as the coordinator for the Asian countries in the network. Three banks including CIMAP (Lucknow) NBPGR (New Delhi) and one coordinated by the TBGRI (Trivandrum). The Department of Biotechnology is the nodal agency to which this work has been assigned. The Tropical Forest Research Institute (TFRI Jabalpur) has established a herbal garden with a collection of 461 species, including rare and endangered species.

The Forest Research Institute at Dehra-Dun has collected significant medicinal and aromatic plants of the Himalayan region and is using the NWFP nursery at Chakrata and the Botanical garden at Dehradun to produce large numbers of plants. The Department of Indian System of Medicine and Health, Ministry of Health and Family Welfare have promoted the establishment of small herbal gardens in educational institutes as a number of endangered species. The Central Council of Research in Ayurveda and Siddha situated in Pune maintains a Medical Plant Garden, which houses 320 species of medical and aromatic plants, including a number of endangered species⁴².

In-Situ Conservation efforts

In-situ conservation has for some time been given priority by the GOI although it is still too early to assess the success of its initiatives in protecting biodiversity and their consequences for local means of income generation and land access. The government created forest preservation plots in 1905 and since then has established them throughout the diverse forest ecosystems of India. These include 65 National parks, 426 Sanctuaries and 13 Biosphere reserve, 316 Preservation plots and more than 7200 Sacred/Religious

groves. The networks cover more than 5% of the nation's geographical area, and are coordinated by the Ministry of Environment and Forest⁴³.

The wildlife Act of 1972 refers mostly to the protection of species within the protected areas network, with only a small number of plant species being covered regardless of location. The only medicinal species among these in Kuth, which is also a restricted species identified but the CITES (The convention on international trade in endangered species). However, a policy dialogue has been initiated regarding medicinal plants conservation, and statements of support for such a policy are forthcoming from many of the stake holders in the sector, including the private companies which depend upon a continuous source of raw materials supply⁴¹.

Several institutions, including ICFRE, TFRI, the forest Survey of India, the Botanical Survey of India, and CIMAP, has conducted vegetation surveys revealing continuing losses of the medicinal plants resource base³⁴. Additionally, several meetings of experts organized in the region have called for a judicious mix and balance of ex-situ and in-situ approaches to conservation; for example IDRC Canada has in the past 3 to 4 years repeatedly stressed this need³².

A key organization involved in mobilizing a movement for medicinal plants conservation policy is the recently formed Foundation for Revitalization of Local Health Traditions (FRLHT) with headquarters in Bangalore and founded by DANIDA. It established coordinated networks of 30 in-situ research areas in the states of Tamil Nadu, Karnataka and Kerala between 1993-1997. These medicinal plant conservation areas (MPCAS) average 200 hectares in size and are located within notified forest reserves or wildlife sanctuaries²⁹. To ensure that the MPCAs continue to exist in the long-term.FRLHT has obtained communities from the states forest departments involved to maintain them beyond the duration of the project.

An old Approach to conserve medicinal plants in India: Joint Forest Management

Achieving the empowerment and involvement of people is also the primary thrust of a growing movement in India known as JFM. It refers to cooperative agreements made between village communities and the local forest departments to protect a particular area of state owned forest land and then share the final harvest⁴⁴. It offers an approach which allows communities to have a greater degree of control and access of state-owned lands. Several medicinal plants are already threatened, rare or endangered. In addition, the precautionary principle applies to those status is currently unknown and to segments of genepols⁴⁵.

JFM has proved to be a novel and workable concept in achieving the combined objectives of development and conservation⁴⁶. In 1990, the Ministry of Environment and Forests wrote to the Forest Secretaries of all States and Union Territories, requesting them to actively encourage participation of communities in rehabilitation of degraded forest areas, and attempt to replicate successes. Although many areas have been slow to adopt⁴⁷, it is essential that 10,000 to 15,000 village forest protection and management groups are currently protecting over 1.5 million hectares of state forest lands.

More than any other aspect of the medicinal plants sector, the maintenance of the resource base itself has received the most attention with regarded to both government and non-governmental initiatives²⁰. A relatively complex group but uncoordinated scientists and a smaller group of policy makers and social activists involved in such initiatives, whether incidentally as an part of forestry or agricultural research or specifically with medicinal plants as the focus. Efforts have been concentrated primarily on cultivation and conservation. In addition, the movement for joint Forest Management (JFM) in India has likewise been relevant regarding access to and use of NTFs such as medicinal plants.

SUMMARY OF REVIEW

This review report the current status of the medicinal plant sector in India used by the folks usually which supports the primary health care needs of most of the country's population. Much of the health care sector is informal, especially since India has three major systems of traditional medicine. However, many plant products are used for tribal and folk medicine practices which have not been properly studied. India therefore is one of the world's most medico-culturally diverse countries. Added to this scenario is the practice of Western medicine and past efforts to change indigenous medicine: in fact both have benefited from each other since indigenous systems introduced drugs to the western pharmacopoeias while western medicine helped upgrade a few important raw plant products to some degree of standardization. Nonetheless, India exports significant quantities of raw materials to other Asian countries and some of these exports are associated with traditional medicine. However, India's comparative advantage in producing materials for export has not been exploited to the at all. With the exception of a limited number of plant species, the production bases rely mainly on materials harvested from the wild. Nonetheless, India known to be a storehouse of biological diversity, has to focus on sustain the resource base of medicinal plants. Efforts to relive pressure on wild plants through cultivation have made a good start but have a long way to go. This is a complex issue by virtue of the sheer number of plant species and the needs for sustainable propagation, suitable agronomic practice, the selection of superior genotypes and linking production to people. Medicinal plants fall into segments of these formal sectors and receive more or less attention depending on policy. For instance, they are one of the most valuable components of the non-timber forest products sector, being important generators of revenue. Most of the available data regarding the formal sectors are in aggregate form and such statistics supply little information about how the market actually works; they rely solely on market price as an indicator of value. Much more attention therefore needs to be given to the socio-intuitional context of the market. It is clear that a set of interventions at various levels could lead to the promotion of the sustainable and equitable development of the sector and help to avert a crisis.

Future guidelines

The present study revealed that most of the tribal and rural people of ancient India depend on crude preparations of these medicinal herbs for a number of treatments. The use of the herbal remedy is not only cost effective but also safe and almost free from serious side effects. In ancient time, village elders, farmers and tribal have tremendous knowledge about medicinal plants and the need of hour is sustainable exploration, development and use of their knowledge and plant wealth. Because the rural communities rely greatly on indigenous knowledge for health care. Since, ages herbs are being used as medicine as they are readily available, safe and cost effective. In spite of the overwhelming influence and our dependence on modern medicine and tremendous advances in synthetic drugs, many people still relies on herbal drugs. The reason is that, if the herbal medicines are used properly they don't have any side effects. Thus, efforts should be made to promote such traditions knowledge of healing for better health of the people throughout the country.

Though the forest Departments and conservationists are trying to make their best in their protection, physicians dedicated for medicinal and plant studies along with NGO's should take initiatives to plants the sapling of this plant in schools, colleges, parks temple premises, avenues etc., which are artificial reserves and would assure its safety growth, thereby serving the purpose and preventing it from extinction in the near future. Over exploitation, loss of habitats, poor seed germination rate etc., are the major factors of decline of the important medicinal plant species. Several attempts have been made to conserve the most threatened and

endangered plant species either by *in situ* and *ex-situ* or *in vitro* conservational strategies. It is to be noted that the tribal use of the plant species must be verified by further scientific experimentation and this rich folklore can be utilized in herbal thereby and drug discovery.

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