

ETHANOBOTANICAL STUDY OF REMEDIAL PLANTS OF NORTHERN BIHAR AND TARAI REGION OF NEPAL

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ABSTRACT

The study shows that herbal medicine has great prospect in health care worldwide. It is reported that 25% of prescribed drug for conventional healthcare were derived from ethno medicine. But in present medicinal plants facing threats due to depletion of natural resources as an impact of growing population size, urbanization and climate change. The major challenges on traditional medicine and medicinal plant is lack of data on seriously threatened and endangered medicinal plant species. The other challenges include inadequate and conflicting guidelines on management and utilization of medicinal plant or natural resources. So effort for conservation of medicinal plants has been suggested. The *ex-situ* and *in-situ* conservation of medicinal plants in Bihar is a great step towards the conservation of medicinal plants as well as other species. The conservation in all the agro-climatic zones would be a long way for conservation of biodiversity. These include creation of awareness of medicinal plants in healthcare by training programmes at local community level. It is essential to conserve medicinal plant through sustainable harvesting of medicinal plant resources.

KEYWORDS:

Ethno medicine, Urbanization, Climate change, Threatened, Sustainable harvesting.

INTRODUCTION

Medicinal plants are one of the precious blessings of nature for the humans, especially for livelihood of poor communities and tribal races among all over world. Generally medicinal plants are phanerogames and more than 10 percent of higher plants are of medicinal value. ^[1] In spite of human beings, animals also uses medicinal plants for their self medication (Zoopharmacognosy). It is found that people suffering from side effects caused by synthetic drugs. So they moves towards natural herbal products during search of other modes of treatment. An adverse drug reaction (ADRs) causes 3% death and 12% hospitalization in Sweden and 5% death in United state. However Fatal Adverse Drug Reactions (FADR) in the plants medicine is very low thus provides a scientific explanation for utilization of medicinal plants. FADR are regarded as seventh most common death cause in Sweden (Nature: march 17, 2008). It is widely reported that there is presence of disease inhibitory substances in the herbal medicine, which supports the use of medicinal plants in traditional practices. ^[2] The country accounts for 8% of the total global biodiversity with an estimate of 49,000 species of plants, among which 4900 are endemic. The tremendous rising of global population, anthropogenic activities excessive eroding natural ecosystem so many of them facing extinction. There is no reliable figure for total number of medicinal plants on earth and number and percentage for country and

region vary greatly.^[3] The number of species used medicinally include 35000-70000 or 53000 worldwide (Schippmann et al., 2002); 10000-11250 in China (He and Gu, 1997; Pei, 2002; Xiao and Youg, 1998); 7500 in India (Shiva, 1996); 2237 in Mexico (Toledo, 1995); and 2572 traditionally by North American Indians (Moerman, 1998). The United Nations conference on environment and development (UNCED), held recently at Rio de Janeiro in 1992, Brazil helped to place the loss of biodiversity and its conservation on the Global level. Conservation of genetic diversity for sustainable ecosystem or agro ecosystem should be helpful to fulfill drug requirements of India's growing population. Growing demand for herbal products has led to overexploitation in and outside the country. A very small proportion of medicinal plants are lower plants while the majority of medicinal plants are higher plants. Though, India has rich biodiversity but growing demand causes heavy strain on existing resources, leading to a number of species in the category of either threatened or endangered. Over 70% of medicinal plants collection involves destructive harvesting due to the use of plant parts like roots, barks, wood, stem or whole plants in case of herbs.

This poses a definite threat to the genetic stock or to the diversity of medicinal plants. There is rapid loss of traditional medical knowledge and practices due to their dependency on verbal transmission, impacts of modern cultural transformation and rapid land degradation.^[4,5,6] At the same time there is depletion of resources due to overexploitation and lack of management system.^[7] Globally, the IUCN has estimated about 12.5% of total world vascular plants, totaling about 34,000 species are under varying degrees of threat (Phatyal et al., 2002).

IUCN recognizes the following categories: Extinct, Extinct in wild, critically endangered, endangered, vulnerable, near threatened, least concern, data deficient and not evaluated, while critically endangered, endangered, vulnerable together constitute the threatened category. Species with small populations, at present not endangered or vulnerable but at risk; due to localized and restricted geographical areas or are thinly scattered (Singhet et al., 2006). A species may become threatened and vulnerable with extinction due to natural and man-made causes.^[8] According to WHO 80% of the world population uses herbs for their treatment, resulting in increasing demand for medicinal plants.^[9]

The distribution pattern of plants is mainly governed and regulated by altitude, edaphic and climatic factors (Bongers et al. 1999; Nautiyal et al. 2001; Kala 2004; Kharkwal et al. 2005, 2007) and their populations are especially affected by human activities (Nrggemann et al. 2009). Exploitation through legal and illegal means has resulted in a decline in medicinal and aromatic plants (MAPs) of ecological and economic significance. A large number of medicinal plants become threatened due to their small population size, narrow distribution area, habitat specificity, destructive mode of harvesting, heavy livestock grazing, high nature of utilization, climate change, habitat loss and genetic drift.^[10] Habitats are being destroyed more quickly than scientists can investigate them. Currently, extinction rates are estimated, the earth is losing at least one potential drug every two years (World Atlas of Biodiversity, 1995). Use of plants as medicine, ranges from 4-20% in different countries and about 2500 species are traded internationally (Schippmann et al., 2002). Worldwide 50000-80000 flowering plants are used medicinally.^[11,12]

Drugs prescribed in the United States, at least 118 are based on natural sources and 74% come from plants.^[13] According to the National Cancer Institute, 70% of new drugs introduced in the United States in the last 25 years are derived from plant sources.^[14] Anti-viral drugs derived from plants such as star anise provide unprecedented hope for combating

potential epidemic viral disease such as flu. ^[15] Drugs to fight life threatening disease such as diabetes, HIV and diarrhea developed from plants. Recently discovered compound in plant likely to provide novel antibiotics and cures the epidemic antibiotic-resistant disease. ^[16,17] Plant derived anti-cancer drug such as Taxol save at least 30,000 lives/year in United state (Daily, 1997). Remedy for leukemia increased by 85% in 1960-1997 is due to discovery of two alkaloid from Madagascar's rosy periwinkle. ^[18,19] Medicinal Plant are of great importance to the health of individuals and communities. The importance of plant is due to some chemical substances that causes a physiological action on the human beings. The most active bioactive constituents are alkaloid, tannins, flavonoids and phenolic compound. Many medicinal plants sometimes used as food for pregnant women and nursing women for medicinal purposes (Okwu, 1999, 2001; Hill 1952). In developing country, a huge number of people lives in extreme poverty so they depends on herbal medicine for primary health care (Grieve, 1931). It is estimated that 70-80 % people of world population fulfils their primary healthcare needs from herbal medicine (Farnsworth and Soejarto 1991; Pei 2001). The requirement of such medicine is not only huge while it is expanding (Srivastava 2000).

Distribution of medicinal plant

Around 70% of India's medicinal plants are found in the tropical area. Mostly in forest of eastern and western Ghat, Vindhya, Chhotanagpur plateau, Tarai regions of Himalayas and north east India. Comparatively larger occurrence of medicinal plant in the dry and moist deciduous forest than evergreen temperate forest. Medicinal species may be found in the form of algae, lichens, bryophytes, pteridophytes, gymnosperm, and angiosperms. ^[20,21]

Wealth of medicinal plants resources in India

India is one of the 12 mega biodiversity centre having world's 10% biodiversity wealth. Among 17,000 species of higher plants in India about 6,500 are known for medicinal properties. This is maximum percentage of known medicinal plant in any country of world for existing flora. ^[22] Presently 25 % are herbal drug obtained from plants, while others are synthetic analogue of compound isolated from the plants in pharmacology. ^[23]

About seven lakhs practioners of Ayurveda, Siddha, Unani, Yoga, naturopathy and Ayush are registered in the Indian system of medicine (Anonymous, 2005) table-

1. A total of 960 species of medicinal plants are in active trade. About 90% of medicinal plants are collected from the wild. ^[24]

Table 1: The status of various medicinal systems in India.

Sr. No	Characteristics	Medicinal system			
		Ayurveda	Siddha	Unani	Homeopathy
1.	Medicinal plants known	2006	1121	751	482
2.	Licensed Pharmacy	8533	384	462	613
3.	Dispensaries	15193	444	1193	5634
4.	Registered Practitioners	438721	17560	43578	217460
5.	Undergraduate college	219	06	37	178
6.	Post graduate college	57	03	08	31

Source : (Anonymous, 2005).

Bio-prospecting of Medicinal Plant

Medicinal plants are highly profitable. It is estimated that world's medicinal plants business will cross 5 trillion US dollar by 2050 (Shinwari, 2010). Each new plant derived drug is worth an average of \$94 million to pharmacy companies and \$449 million to society.^[25] Other estimate has reported, sales ranging from \$1.5 to \$ 5.7 billion annually for non prescribed herbal medicine in the United State and \$24.4 billion in sales worldwide. The reported market values of prescription and plant based drugs in 1985 was \$ 19.8 billion in United state and \$ 84.3 billion worldwide (Pearce and Moran 1994; Tuxhill, 1999). In India herbal medicine market expanding at the rate of 20 % per year (Subrat 2002), while in the China it has grown by 10 times in last ten year (Pei 2002b). The herbal medicine industry grows rapidly in richer country; its market has grown approx 15-20% in Europe and North America in the recent years (Ten Kate and Laird 1999). A study of 25 best pharmaceutical company in 1997 reveals 42% were derived from plant sources with a total value of US dollar 17.5 billion (Laird and Ten Kate 2002). The drug derived from *Taxus baccata* of market value of US dollar 2.3 billion in 2002.^[26] The global market value of herbal medicine was estimated to be worth US dollar 19.4 billion with US dollar 6.7 billion in Europe, followed by Asia (US dollars 5.1 billion), North America (US dollar 4.0 billion), Japan US dollars 2.2 billion) and then rest of world (US dollar 1.4 billion) (Laird and Pierce 2002). Medicinal plant can provide significance sources of income for rural people in the developing country and only 15% of pharmaceutical drug is consumed in developing country.^[27] Between 50- 100% of the household in the northern part of central Nepal and about 25-50% of the in the middle part, collecting plant material and traded to wholesale market of Delhi (India) (Olsen 1997) and represented the 15- 30% of the total income of poorer household. Medicinal and aromatic plants have potential for contributing to the local economy, subsistence health needs and NRM (Natural Resource Management), which leads to conservation of ecosystem and biodiversity of an area.^[28]

Farming of medicinal plants

Knowledge for farming of medicinal plants is less than 10%. Agro- technology is available for only 1% of known medicinal plants worldwide. [29,30] The cultivation of medicinal plant is not an easy task as history of farming reflects. The cost profit ratio is different for different plant species. Farmers needs permit from government agency for cultivation of particular plant **Potential for development of medicinal plant in Bihar** exclusively depends upon agriculture for economy. The state has been trying to improve products from field. The systematic cultivation of high value medicinal and aromatic plants under prevailing agro-ecological condition is being emphasized to meet the growing importance of herbs as a source of therapeutic agents, essential oils and raw material for producing a variety of health promoting products. Availability of green produce in bulk from field will cater to new opportunities in processing, product development, marketing and export of raw and value added products.

Geography and Climate of Bihar state

Bihar is located on the eastern part of India. The river Ganga divides Bihar plane into two halves. The state lies between the humid West Bengal and sub-humid Uttar Pradesh in the west which gives it transitional climate. There are mainly six rivers flows in Bihar namely Gandhak, Burhi Ganghak, Bagmati, Ghaghra, Kosi, Kamla. Bihar plane is mainly composed of alluvial soil which is light or heavy textured soil. The Kaimur Plateu lies the extreme southwest, it is consists of horizontal sandstone strata that are underlain by limestone. Rainfall during the monsoon which is variable in different agro-climatic zones of Bihar and its surroundings. It is lowest agro-climate zone III (935.5 mm) and moderate rainfall in agro-climate zone I (1077.3 mm) and maximum in zone II (1105.9 mm) fig-1.



Figure-1. Bihar state showing different agro-climatic zones.
(Sources: Directorate of Horticulture, dept. of agriculture, Bihar).

The different agro-climatic zones of Bihar support different medicinal plant vegetation (table-2). So it suggested to analytical estimation of medicinal plant in accordance to agro-climatic zones of Bihar and surroundings.

Threatened medicinal plant species of Bihar

More than 150 species of medicinal plants occur in Bihar. Some of the plant species which were reported to occur abundantly in Bihar, half a century ago. In the present day they become rare or very rare due to overexploitation and fallen in the category of endangered species (table-3). Plant species whose root, rhizome and bark are of medicinal importance requires maximum attention for their protection. Due to indiscriminate exploitation of such species will adversely affect their natural population in the forest. On the basis of survey carried out in the Bihar and its neighboring regions, the following priorities have been identified.

- A. Species in immediate danger of extinction
- B. Species seriously threatened

Table 3: Overexploited plant species of Bihar and its surroundings regions.

S L · N o	Scientific name	Vernacular name	Family	Parts used	Distribution	Current status
1.	Rauvolfia serpentine Benth.	Sarpagandha	Apocynaceae	Roots and leaves	Damp and moist area of Singhbhum, Chhotanagpur District	Immediate danger of extinction
2.	Gloriosa superba L.	Karihari	Liliaceae	Whole tuber	Low forest of Chhotanagpur, Santhalpargana District	Immediate danger of extinction
3.	Asparagus racemosus Willd.	Satamuli	Asparagaceae	Leaves & roots	Motihari, Chhotanagpur, Palamu District	Seriously threatened
4.	Diocorea pentaphyllia Linn.	Kantaalu	Discoreaceae	Tubers	Balmikinagar, altitude of Ranchi, Singhbhum district forest	Seriously threatened
5.	Urginia indica	Jungali piaz	Liliaceae	Tubers	Rajgir, grassy plateau of Palamu, Ranchi and Singhbhum	Seriously threatened
6.	Zingiber cassummar Roxb.	Banda	Zingiberaceae	Rhizome	Betia, Netarhat as well as damp shady forest of Chhotanagpur district	Seriously threatened
7.	Costus speciosus	Keu	Zingiberaceae	Rhizome	Damp shady forest of Chhotanagpur district	Seriously threatened

8.	Curcuma angustifolia Roxb.	Tikhur	Zingiberaceae	Rhizome	Shady margins of Raxul and Chhotanagpur forest district	Seriously threatened
9.	Hemidesmus indicus	Anatmool	Asclepiadaceae	Root	Rajmahal, Balmikinagar, Santhalpargana, Chhotanagpur, Hazaribagh district	Seriously threatened
10.	Leea robusta	Haramda	ampelidaceae	Root	Cool aspect of Nawadah district.	Seriously threatened
11.	Pueraria tuberosa	Patal kohran	Leguminoceae	Root	Sides of rocky streams of Hazaribagh and Giridih district	Seriously threatened
12.	Oroxylum indicum Vent.	Sona	Bignoniaceae	Bark, root, fruit	Moist localities of santhalpargana and Chhotanagpur district	Seriously threatened
13.	Tinospora cordifolia	Guduch	Menispermaceae	Root, stem, leaves	Narrow distribution area of Santhalpargana district	Seriously threatened
14.	Muccuna prurita	Kawanch	Leguminoceae	Seed, root	Dry areas streams of Bihar and Jharkhand state	Seriously threatened
15.	Withania somnifera Dunal.	Ashwagandha	Solanaceae	Whole plant	Waste places of Betia and Motihari district	Seriously threatened
16.	Berberis asiatica Roxb.	Sumlu	Berberidaceae	Root	Parasnath area of Bihar	Rare occurrence
17.	Ranunculus pensylvanicus Linn.	Manira	Ranaunculeae	Whole plant	Found along the hills of Palamu & Netarhat hills	Rare occurrence
18.	Rubia cordifolia Linn.	Manjit	Rubiaceae	Root	Area of Parasnath & Netarhat	Rare occurrence

(Sources: Report of Bihar Survey, Forest Ministry.).

APPROACH TO CONSERVATION OF MEDICINAL PLANTS

No single sector either private or public can undertake the conservation of medicinal plant alone. The job requires a team effort, involves broad spectrum of discipline and institutions.

Development of strategy

The best approach for each state of India to prepare a national strategy for conservation and sustainable use of medicinal plants. This strategy would be helping in development of consensus on medicinal plants for assigning tasks to different institutions. One way of starting the programme would be hold a regional or national workshop. Bringing together experts of different subjects to assess the situations, define objectives, set priorities and draw up a plan of action. In developing and implementing the strategy, it is essential to work in partnership with those who uses medicinal plants; like herbalist, plant collectors, health workers and local peoples. Already WHO collaborates with ministry of health in the development of programmes on utilization of medicinal plants. IUCN helps many countries to prepare national conservation strategy which include the conservation of plants and WWF funds to many projects to conserve medicinal plants. One task that should be done at the international level is the development of a common design for data base on the conservation and sustainable use of medicinal plants. This should involve leading agencies such as WHO, FAO, UNIDO, UNESCO and IUCN etc. Experts needed for programme of conservation and sustainable utilization of medicinal plants.

- Agronomist- To improve techniques for cultivating medicinal plants.
- Ecologist- To understand the ecosystem in which medicinal plants can grow.
- Ethno botanist- To identify the use of plants as medicines in traditional society.
- Health policy makers- To include conservation and utilization of medicinal plants in their policy and planning.

- Horticulturist- To cultivate medicinal plant.
- Park managers- To conserve medicinal plants with in their parks and reserves.
- Pharmacologist- To study application of medicinal plants.
- Plant breeders- To breed improved strains of medicinal plants for cultivation.
- Plant pathologist- To protect cultivated medicinal plant from the pest and disease without use of hazardous chemicals.
- Religious leaders- To promote a respect for nature.
- Resource economist- To evaluate the pattern of use and economic value of medicinal plants.

- Taxonomists- To identify medicinal plants accurately.
- Traditional health Practitioners - To provide information on use and availability of medicinal plants.

Baseline survey of medicinal plant

There is need to conduct a fresh survey in Bihar state forest as well as surrounding state to find out frequency, density and species abundance of medicinal and aromatic plants. Identification of medicinal plants and outlines their distribution should be major aspect during the course of survey. To conserve medicinal plants effectively, it is vital to know precisely which species are conserved, what are their correct name and where they grows. In many cases medicinal plants have been misidentified. So for conservation of medicinal plants any country should prepare stock for identification. In spite of these, outline of distributions should be done to assess their scarcity or abundance. Botanical institute should make a catalogue of all the plants species used for medicinal purpose in the country. The following data should be included on each species.

- Its scientific name and its vernacular names.
- Its geographical distributions.
- Its population size, abundance and conservation status.
- Description of plant parts used
- Habitat.
- Its occurrence in the protected area.
- Availability and location of *ex-situ* germ plasm.

The national herbarium should identify threatened medicinal plant in wild, so they can be given priority in conservation programmes. Most developed country has list of threatened medicinal plants in the form of Red Data Books. However most developing countries, especially those having rich tropical flora have not list of threatened plant due to lack of basic field information on status of individual plant species. Threatened medicinal plant can be easily determined because these plants will be better known in the field and better commercial than others. In determining the plants as threatened, the criteria of IUCN threat category should be followed.

Development of planting stock

State forest department should establish nursery stock for planting in the field to support the depleting species growing in the wild. The development of nursery is essential for propagation and storage of germplasm.

Development of seed bank

Germplasm can be preserved for several years by process of cryopreservation. In these techniques seed can be preserved till viability last. Presently such kind of facility is available at experimental stage; it should must be applied at field level.

Establishment of forest protection committee

Members of such committee should interact with local community for awareness creation and focus on our rich health tradition. The emphasis on conservation should be enhanced by management members through educate local people in local or vernacular language.

Capacity building of resources

Capacity building for management of medicinal plant ia an essential steps for conservation. Training programme should be provided to promote the setting up of herbal gardens and nursery at grass root level.

Development of database

Ministry of forestry and environment department should develop databank. After collection of data it should be analyzed up to its logical conclusion.

Other suggestions

Identification of species diversity and study of dynamics of resources and population of the species with limited distributions. Cost effective and rapid assessment to priorities the medicinal plants and assign threat status based on IUCN guidelines. Study concern to the management of plant resources should be included in the text book of every state of India.

CONCLUSION

There is urgent need to document the complete biodiversity of Bihar and its neighboring regions for prioritize threatened medicinal plants. So medicinal plants can be conserved *in-situ* and *ex-situ* for sustainable utilization in healthcare and human welfare. Green medicines attracts us presently due to many reasons, the number of diseases and disorders are increasing day by day. Some diseases like asthma, cancer, diabetes, epilepsy, filaria, jaundice, gout and arthritis are still incurable in allopathic system of medicines. Thus loss of medicinal plants affects global health. With this point of view medicinal plants have become one of the major concern of the conservation organization. It should be seriously needed to study and documentation of medicinal plants. There is also need to establish herbal drug centre for collecting, processing, preparation of ethno medicine. For improvement of life and economy of tribal and local people, social forestry operation of ethno medicinal plants is essential to develop cultivation, farming and documentation of potential medicinal plants. The establishment of more wild life sanctuaries, national parks and biosphere reserve in the hot biodiversity area are required for the protection and conservation of valuable plants. There is great role of local people in the conservation strategy, so government and nongovernment organization should create awareness to them regarding the future value as well as biodiversity importance of medicinal plant. Training programmes should be provided to local communities to estimate the depleting species in their surrounding forest. Therefore it is not enough to protect only these plants but also revive and reinvent practices of nature conservation and environmental management

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