RESEARCH REVIEW JOURNALS
Volume-04
Issue-05
May-2019

ISSN: 2455-3085 (Online)
RESEARCH REVIEW International Journal of Multidisciplinary
www.rrjournals.com[UGC Listed Journal]

The Threat of Endangerment and Extinction to the Medicinal Ethanobotany of the Koshi Region and the Suggested Approach to Counter it

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ARTICLE DETAILS

Article History
Published Online: 25 May 2019

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

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.

1. Introduction

Medicinal plants are one of the precious blessings of nature for humans, especially for livelihood of poor communities and tribal races among all over the 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 use medicinal plants for their self medication (Zoopharmacognosy). It is found that people suffering from side effects caused by synthetic drugs. So they move towards natural herbal products during the search of other modes of treatment. An adverse drug reaction (ADRs) causes 3% death and 12% hospitalization in Sweden and 5% death in the US. However Fatal Adverse Drug Reactions (FADRs) in the plants medicine is very low thus provides a scientific explanation for utilization of medicinal plants. FADRs are regarded as the seventh most common death cause in Sweden (Nature: march 17, 2008). It is widely reported that there is presence of disease inhibitory substances in herbal medicines, 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 rise of global population, anthropogenic activities, excessive erosion of natural ecosystem and so many species 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 Nation 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 a sustainable ecosystem or agro ecosystem should help fulfill drug requirements of India's growing population. Growing demand of herbal products has lead to overexploitation in and outside the country. A very small proportion of medicinal plants are lower plants while a majority of medicinal plants are higher plants. Though, India has rich biodiversity but growing demand causes a heavy strain on existing resources and leads to a number of species in the category of either threatened or endangered. Over 70% of medicinal plants collection involves destructive harvesting due to use of plant parts like roots, barks, wood, stem or whole Plants in case of herbs.

This possess 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 transformation, impacts of modern cultural transformation and rapid land degradation. [4,5,6] At the same time there is depletion of resources due to over exploitation 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 degree 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 threatened category. Species with small population, at present not endangered or vulnerable but at risk; due to localized and restricted geographical area or are thinly scattered (Singhet al., 2006). A species may become threatened and vulnerable with extinction due to natural and manmade 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 population is especially affected by human activities (Nrggemannetal. 2009). Exploitation through legal and illegal means has resulted in decline in medicinal and aromatic plants (MAPs) of ecological and economic significance. A large number of medicinal plant 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 scientist can investigate them. Currently extinction rate expert estimated, the earth is losing at least one potential drug every two years (World Atlas of Biodiversity, 1995). Use of plants as medicines, 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% comes from plant.[13] According to National Cancer Institute, 70% of new drugs introduced in united states in the last 25 years are derived from plant sources.[14] Anti -viral drugs derived from plants such as star arise provide unprecedented hope for combating potential epidemic viral disease such as flu. [15] Drugs to fight life threatening diseases such as diabetes, HIV and diarrhea developed from plants. Recently discovered compounds in plants likely to provide novel antibiotics and cure the epidemic antibiotic- resistant disease.[16,17] Plant derived anti-cancer drug such as Taxol save at least 30,000 lives/year in the US(Daily, 1997). Remedy for leukemia increased by 85% in 1960-1997 is due to discovery of two alkaloids from Madagascar"s rosy periwinkle.[18, 19] Medicinal Plants are of great importance to the health of individuals and communities. The importance of the plant is due to some chemical substances that cause a physiological action on human beings. The most active bioactive constituents are alkaloid, tannins, flavnoids and phenolic compounds. Many medicinal plants are sometimes used as food for pregnant women and nursing women for medicinal purposes (Okwu, 1999, 2001; Hill 1952). In developing countries, a huge number of people live in extreme poverty so they depend on herbal medicine for primary health care (Grieve, 1931). It is estimated that 70-80 % of the world population fulfil 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).

2. Materials and Methods

A survey was conducted in 6 blocks (selected at random to represent the Koshi Region) from Saharsa and Supaul district from 2013 - 2014 at regular intervals. People of these blocks were consulted and the sample consisted of people from different age brackets and socio - economic classes. The sample was verbally interviewed and the questionnaire comprised of the following questions -

- Local name of the Wild Herbs being used by them for medicinal purposes.
- Part of a particular plant that is being used.
- Application method.
- Availability of the plant on a relative scale.

3. Observations

The ethnic communities of the Koshi Division depend on a variety of plants to meet their basic requirements and to cure various diseases. Koshi is prone to annual flooding which severely hampers crop yields, especially in the Marauna, Nirmali, Nawahatta, Salkhua, Mahishi and Simri Bakhtiyarpur, blocks of the Koshi Division. Further, the traditional knowledge about the medicinal traits of plants usually is limited to the older demography of the society who have failed to pass it to the younger generations. Therefore, there is an urgent need to document this knowledge before it is lost. Plant species whose root, rhizome and bark are of medicinal importance requires maximum attention for their protection. The indiscriminate exploitation of such species will adversely affect their natural population in the forest. On the basis of my survey, the following species at risk have been identified :

S. No	Name of Plant	Local Name	Family	Medicinal Use
1.	*Aconitum hetrophyllum*	Atis	Ranunculaceae	Anti-dysenteric, anti-diarrheal, Anti fertility
2.	*Aconitum napellus*	Dudhiyaa	Ranunculaceae	Toxic in large dose, remedy for fever, rheumatism
3.	*Timospora cordifilia*	Guruslatti	Menispermaceae	Jaundice, Diabetes, Piles, Skin diseases
4.	*Papaver somniferum*	Aphima	Nymphaeaceae	Piles, dyspepsia, Kapha and Pitta, Ring Worm
5.	*Argemone Mexicana*	Pilikantaya	Papavaraceae	Narcotic, Bronchitis, Relieve pain
6.	*Gynandropsis pautaphylla*	Hurhur	Capparidaceae	Muscular pain, rheumatism, intestinal wound
7.	*Sida cordifolia*	Chikana	Malvaceae	Urinary disease, biles, neurological disorder
8.	*Acalypha indica*	Kuppee	Euphorbiaceae	Bronchitis, liver tonic, blood purifier
9.	*Euphorbia hirta*	Dudhi	Euphorbiaceae	Worms, bowel, breast pain, asthma
10.	*Euphotbia tiricalli*	Vajraduhu	Euphorbiaceae	Leprosy, leucorrhoea, dropsy
11.	*Phyllanthus niruri*	Jaramla	Euphorbiaceae	Dropsy, Urino-genital system

12.	*Boerhavia diffusa*	Punarnawa	Nyctaginaceae	Diuretic, diaphoretic, Jaundice, diabetes
13.	*Moriga oleifera*	Shahajan	Moringaceae	Hysteria, epilepsy, rheumatism
14. `	*Ipomoea batatas*	Sakarkand	Cunvolvulaceae	Urinary discharges, skin disease
15.	*Evolvulvus alsinoides*	Shankhavali	Cunvolvulaceae	Powerful brain stimulant, anti- spasmodic, bronchitis and asthma
16.	*Solanum nigrum*	Lalbhutca	Solanaceae	Diaphoretic, diuretic, antispasmodic and narcotic and vomiting
17.	*Solsnum xanthocarpum*	Kaate ringannee	Solanaceae	Source of Vitamin C, analgesic, increases capillary of Blood vessels
18.	*Cannabis Sativa*	Bhang	Cannabaceae	Menorrhagia, cholera, diarrhea, hydrophobia, tetanus
19.	*Leucas aspera*	Dulpha	Labiatae	Remedy for worms fever, intestinal catarrh, Jaundice, respiratory trouble
20.	*Mentha arvensis*	Podina	Labiatae	Rheumatism, antiseptic, diuretic
21.	*Eclipta prostata*	Bhagrai	Compositae	Purgative, liver tonic, night blindness, headache
22.	*Ageratum conyzoides*	Osari	Compositae	Diarrhea, dysentery, leprosy
23.	*Echinops echiatus*	Gokru	Compositae	Diuretic, nerve tonic, hysteria, dyspepsia
24.	*Eclipta alba*	Bhangra	Compositae	Asthma, scorpion sting, Jaundice, elephantiasis
25.	*Elephantopus scaber*	Pathari	Compositae	Diarrhea, dysentery, rheumatism, vomiting
26.	*Vernonia cinerea*	Sadodi	Compositae	Leucorrhoea, bladder stones, piles
27.	*Hygrophila spinosa*	Surya Kanta	Acanthaceae	Gonorrhea, spermatorrhoea, Jaundice, dropsy
28.	*Rungia rupens*	Parpatha	Acanthaceae	Diuretic, vermifuge, snake bite
29.	*Achyranthes aspera*	Latjira	Amarantaceae	Dropsy, urinary diseases, skin eruption, scabies, pneumonia, kidney stone
30.	*Clarodendron infortunatum*	Bhant	Verbenaceae	Bronchitis, dyspepsia, remedy for respiratory disease
31.	*Rauwolfia serpentine*	Sarp gandha	Apocynaceae	Remedy for central nervous system disorders, reduces blood pressure
32.	*Calotropis procera*	Aak	Asclepiadaceae	Dyspepsia, constipation, loss of appetite
33.	*Oxalis corniculata*	Khatti Buti	Oxalidaceae	Fever, dysentery, in digestion, diarrhea, dyspepsia, piles
34.	*Centalla asiatica*	Brahmi buti	Umbelliferae	Diabetes, anemia, syphilis, skin disease
35.	*Vetiveria zizanioides*	Khas	Poaceae	Anti-spasmodic, diuretic, stomachic

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 Practioners	438721	17560	43578	217460
5.	Undergraduate college	219	06	37	178
6.	Post graduate college	57	03	08	31

Source : (Anonymous, 2005)

4. 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 the history of farming reflects. The cost profit ratio is different for different plant species. Farmers need permits from the government agencies for cultivation of particular plant Potential for development of medicinal plants in Bihar exclusively depends upon agriculture for economy. The state has been trying to improve products from the 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 the field will cater to new opportunities in processing, product development, marketing and export of raw and value added products.

5. 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 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 the 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. The Koshi Region falls in Zone - I and Zone - II of the above agro climatic divisions.

6. 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 the 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 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 use medicinal plants; like herbalists, plant collectors, health workers and local peoples. Already WHO collaborates with the ministry of health in the development of programmes on utilization of medicinal plants. IUCN helps many countries to prepare a national conservation strategy which includes 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 the database 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 the 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.
- Ethano - 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 practioners - To provide information on use and availability of medicinal plants.

Baseline Survey of Medicinal Plants

There is a need to conduct a fresh survey in the Koshi Region to find out frequency, density and species abundance of medicinal and aromatic plants. Identification of medicinal plants and outlines their distribution should be a major aspect during the course of the survey. To conserve medicinal plants effectively, it is vital to know precisely which species are conserved, what are their correct name and where they grow. 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 plant species used for medicinal purposes 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 plam.

The national herbarium should identify threatened medicinal plants in the wild, so they can be given priority in conservation programmes. Most developed countries have a list of threatened medicinal plants in the form of Red Data Books. However most developing countries, especially those having rich tropical flora have not been included in the list of threatened plants due to lack of basic field information on status of individual plant species. Threatened medicinal plants 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 the experimental stage; it should be applied at field level.

Capacity building of resources

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

Establishment of forest protection committee

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

Development of database

The Ministry of forestry and Environment department should develop the database. 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 textbook of every state of India.

7. Conclusion

There is an urgent need to document the complete biodiversity of Koshi region to 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 attract 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 the 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 concerns of the conservation organization. It should be seriously needed to study and documentation of medicinal plants. There is also a need to establish a 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 wildlife sanctuaries, national parks and biosphere reserves in the hot biodiversity area are required for the protection and conservation of valuable plants. There is a great role of local people in the conservation strategy, so government and nongovernment organizations

should create awareness to them regarding the future value as well as biodiversity importance of medicinal plants. 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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