

Conservation of Plant Biodiversity

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ABSTRACT

Plants are a major resource base for the traditional medicine and herbal industry. In fact, vegetation provides livelihood and health security to a large segment of population across the globe. During last few decades, an exponential growth has been observed in the demand of herbal drugs in global herbal market. However, adulteration and substitution are major causes of deterioration of popularity of herbal remedies. Till date, forests are the main source for supply of crude herbs. Overexploitation of natural reservoirs has led to the extinction of various plant species, while some others have become endangered. Such unavailability of a particular drug led to the thought of using another alternative herb instead of scarce drug, which is usually not as potent as the original herb. Hence, in order to meet the growing demand of herbal drugs, it is important to conserve genetic diversity either by domestication and cultivation or by other ex-situ and in situ conservation measures for their sustainable use. The present paper aims to overview the issues regarding conservation and cultivation of medicinal plants in the country.

Key words: Conservation, Cultivation, Herbs, Medicinal plants

INTRODUCTION

Since time immemorial, people have utilized plant and animal resources to meet out their needs. Among these, use of plants as medicine has been an area of thrust, not only in traditional medicine but also in modern medicine. Demand for a wide variety of plant species is increasing with growth in human population, needs and commercial trade. Some wild species are being over-exploited after a realization that, numbers of agencies are working towards the conservation of endangered and high demand species by cultivation. India has 15 Agro-climatic zones and 17000-18000 species of flowering plants of which 6000-7000 are estimated to have medicinal usage in folk and documented systems of medicine like *Ayurveda*, *Siddha*, *Unani* and *Homoeopathy*.^[1] Medicinal plants are not only a major resource base for the traditional medicine & herbal industry but also provide livelihood and health security to a large segment of population across the globe. The domestic trade of the AYUSH industry is of the order of Rs. 80 to 90 billion. In India, crude herbs and their products account of exports in the range of Rs. 10 billion. There is global resurgence in traditional and alternative health care systems resulting in world herbal trade which stands at US\$ 120 billion and is expected to reach US\$ 7 trillion by 2050.

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Indian share in the world trade, at present, however, is quite low.^[1]

A proper approach to conservation and cultivation of medicinal plants is the needed to cope with the globally rising demand *Ayurvedic* drugs. This article serves to aims to overview the issues regarding conservation and cultivation of medicinal plants in the country and throw light on the ways to address these issues.

Considering such a great physiological importance of *Rakta*, Sushruta designated it as fourth *Dosha*, apart from the three *Doshas Vata, Pitta, Kapha*.^[5] The scholars of ancient Greek medicine have also considered that the regulators of all physiological processes in

REVIEW AND DISCUSSION

Need of cultivation of medicinal plants

Blood According to WHO reports, about 80% of population of developing countries depends on herbal drugs for their primary health care needs.^[2] Judicious use of herbs as a single drug as well as in polyherbal formulations in *Ayurveda* is the leading cause of global acceptance of *Ayurveda* as an alternative system of medicine. During last few decades, adulteration and substitution are the major causes of deterioration of popularity of herbal remedies in the global market. Unavailability of a particular drug compelled the thought of use of an abundant herb in place of scarce drug. Frequent use of adulterant and substitution leads to the fading identity of the original genuine drug. Increasing recognition of these facts in India has now led to focused cultivation of such herbs in various parts of the country.

Importance of cultivation of medicinal plants

Unplanned development and over exploitation of medicinal plants from non-managed, natural resources has not only resulted in shortage of various herbs, but extinction of several species in nature. In order to meet the growing demand for these plants, it has become important to conserve these plant species either by way of cultivation or by other ex situ and in situ conservation measures for their sustainable use. Emphasis on cultivation of the wild forms, rather than collecting from the wild would also ensure botanical identity, genetic improvement, quality and continuity in supply. Cultivation may have to be initiated under appropriate well defined conditions.

Cultivation of medicinal plants is required both to conserve the species and to ensure the supply of quality raw material to the industry. Cultivation of medicinal plants for production of crude materials for industries can be taken up as an alternative land use or mixed cropping system on existing farm and forestry lands. However the major constraints in cultivation are non-availability of quality planting material of genuine varieties, lack of extension support in the cultivation and processing and an organized market. [3]

Cultivation situation of wild conservation

Destructive harvesting has brought about depletion and scarcity of medicinal plants. The habitat loss due to deforestation finally leads to severe and irreplaceable loss of genetic diversity of many of these species. The ministry of environment and forests has therefore notified 29 species which are banned for export. [4] In International union for conservation of nature and natural resources (IUCN), red list criteria plants are categorized as vulnerable, critically endangered, extinct, endangered, low risk, extinct in wild, near threatened at regional and global levels. By using IUCN criteria, about 121 species have been recorded in the red data book of Indian plants from Himalayan Region; of these 17 are medicinal plants. Red listed important medicinal plants species of India are 195 which contain certain drugs used in folk or traditional systems other than *Ayurveda*. [5]

Wild vs Cultivated [Table 1]

Medicinal properties of plants are mainly due to the presence of secondary metabolites which the plants need in their natural environments under particular conditions of stress and competition and which perhaps would not be expressed under mono-culture conditions. Active ingredient levels can be much lower in fast growing cultivated stocks, whereas wild populations which can be older due to slow growth rates usually have higher levels of active ingredients. So, while it can be presumed that cultivated plants are likely to be somewhat different in their properties from those gathered from their natural habitats, it is also clear that certain values in plants can be deliberately enhanced under controlled conditions of cultivation [6].

Table.1: Advantages and disadvantages of wild resource versus cultivated medicinal plant [7]

Characteristics	Wild resources	Cultivated species
Advantages	1. Without investment resource. 2. Natural resources and free from chemical fertilizers and pesticides 3. More efficacious in therapeutic potency.	1. Useful for conservation of rare and threatened species. 2. Genotype can be standardized or improved. 3. Fulfill demand and supply requirement of market and maintained price stability.
Disadvantages	1. Scarce resources and threatened by over harvesting. 2. During harvesting risk of adulteration. 3. Over-harvesting leads to extinction of species. 4. Lack of proper wild resource management system.	1. Need investment till end of production. 2. Lowers the chances of Genetic diversity and environmental stress. 3. Cultivated species causes gradual loss of therapeutic potency in species. 4. Practice of even easily available species causes loss of gene pool of wild resources.

Governing body for Cultivation and Conservation of Medicinal Plants in India

National Medicinal Plants Board (NMPB) has drawn policies and strategies for conservation, proper harvesting, cost-effective, cultivation, research and development, processing, marketing of raw material to promote and develop this sector. Government of India has announced in the context of a merging of two existing schemes, the “Centrally Sponsored Scheme of National Mission on Medicinal Plants” (NMPB) and the “National AYUSH Mission (NAM)”. Medicinal and Aromatic Plants Association of India (MAPAI) has been also contributing a service for conservation of Medicinal and Aromatic Plants.

Suggestions for cultivation of medicinal plants

The following measures for conservation of medicinal plants resources suggested are worth considering: [6]

1. Government should encourage the traditional methods of conservation of forests.
2. In situ conservation by establishment of natural reserves or biosphere reserves.
3. Ex situ conservation through medicinal plant gardens, artificial regeneration of botanical gardens and arboreta.
4. Creation of medicinal plant gene bank.
5. Proper assessment of population size mapping and biology of threatened plants.
6. To popularize the potential avenue of medicinal plants among local farmers for their commercial cultivation.
7. To conduct regular training camps for the farmers for cultivation, harvesting and sustainable utilization.
8. Dissemination of all related knowledge (conservation task) through print and electronic media.

Conservation Strategies^[8]

They can be summarized as follows: [Fig.1]

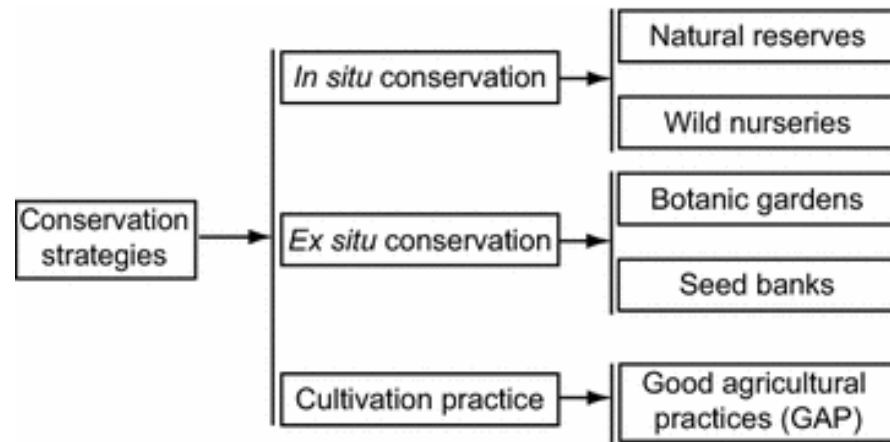


Fig.1: Conservation strategies of medicinal plants

In situ conservation

Most medicinal plants are endemic species, and their medicinal properties are mainly because of the presence of secondary metabolites produced in response to stimuli in natural environments, and that may not be expressed under culture conditions. In situ conservation of whole communities allows us to protect indigenous plants and maintain natural communities, along with their intricate network of relationships. Additionally, in situ conservation increases the amount of diversity that can be conserved, and strengthens the link between resource conservation and sustainable use. In situ conservation efforts worldwide have focused on establishing protected areas and taking an approach that is ecosystem-oriented, rather than species-oriented.^[9]

Natural reserves: The degradation and destruction of habitats is a major cause of the loss of medicinal plant resources. Natural reserves are protected areas of important wild resources created to preserve and restore biodiversity. Around the world, more than 12,700 protected areas have been established, accounting for 13.2 million km², or 8.81 % of the Earth's land surface. Conserving medicinal plants by protecting key natural habitats requires assessing the contributions and ecosystem functions of the individual habitats.^[10]

Wild nurseries: Owing to cost considerations and competing land use, it is impossible to designate every natural plant habitat as a protected area. A wild nursery is established for species-oriented cultivation and domestication of endangered medicinal plants in a protected area, natural habitat, or a place that is only a short distance from where the plants naturally grow. Although the populations of many wild species are under heavy pressure because of overexploitation, habitat degradation and invasive species, wild nurseries can provide an effective approach for in situ conservation of medicinal plants which are endemic, endangered and in-demand.^[11]

Ex situ conservation

Ex situ conservation is not always sharply separated from in situ

conservation, but it is an effective complement to it, especially for those overexploited and endangered medicinal plants with slow growth, low abundance and high susceptibility to replanting diseases. Ex situ conservation aims to cultivate and naturalize the threatened species to ensure their continued survival and sometimes to produce large quantities of planting material used in the creation of drugs, and it is often an immediate action taken to sustain medicinal plant resources. Many species of previously wild medicinal plants can not only retain high potency when grown in gardens far away from the habitats where they naturally occur, but can have their reproductive materials selected and stored in seed banks for future replanting.^[12]

Botanic gardens: Botanic gardens play an important role in ex situ conservation, and they can maintain the ecosystems to enhance the survival of rare and endangered plant species. Although living collections generally consist of only a few individuals of each species and so are of limited use in terms of genetic conservation, botanic gardens have multiple unique features. They involve a wide variety of plant species grown together under common conditions, and often contain taxonomically and ecologically diverse flora. Botanic gardens can play a further role in medicinal plant conservation through the development of propagation and cultivation protocols, as well as undertaking programs of domestication and variety breeding.^[13]

Seed banks: Seed banks offer a better way of storing the genetic diversity of many medicinal plants ex situ than through botanic gardens. They are recommended to help preserve the biological and genetic diversity of wild plant species. The most noteworthy seed bank is the 'Millennium Seed Bank Project' at the Royal Botanic Gardens in Britain. Seed banks allow relatively rapid access to plant samples for the evaluation of their properties, providing helpful information for conserving the remaining natural populations. The challenging tasks of seed banking are how to reintroduce the plant species back into the wild and how to actively assist in the restoration of wild populations.^[14]

Cultivation practice

Although wild-harvested resources of medicinal plants are widely considered more efficacious than those that are cultivated, it is domestic cultivation that is widely used and is the general accepted practice. Cultivation under controlled growth conditions can improve the yields of active compounds, which are almost invariably secondary metabolites, and ensures production stability. Cultivation practices are designed to provide optimal levels of water, nutrients, optional additives, and environmental factors including temperature, light and humidity to obtain improved yields of target products. Moreover, increased cultivation contributes to decrease in the harvest volume of medicinal plants, benefitting the recovery of their wild resources, and all this decreases their prices to a more reasonable range.^[15, 17]

Good agricultural practices (GAP): GAP for medicinal plants have been formulated to regulate production, ensure quality, and facilitate the standardization of herbal drugs. A GAP approach ensures high quality, safe and pollution-free herbal drugs (or crude drugs) by applying available knowledge to address various problems. GAP include comprehensive items, such as the ecological environment of production sites, germplasm, cultivation, collection, and quality aspects of pesticide detection, macroscopic or microscopic authentication, chemical identification of bioactive compounds and inspection of metal elements. ^[16, 17]

CONCLUSION

Conservation of genetic resources of medicinal plants is the most important task for present day intellectuals because gradual loss of biodiversity of medicinal plants has been seriously affecting the potency and therapeutic efficacy of herbal medicine. This can be achieved only by domestication and cultivation of rare and endangered species and species in high demand, so as to alleviate the pressure on natural resources and prevent such species from entering red data book. Moreover, since no systematic distribution and marketing network exists, the growers have to depend largely upon the middlemen, who deprive the farmers of their legitimate share of revenue. The cost of production for cultivated crops is usually high as compared to the cost of material collected from the wild, due to lack of proper crude drug market. As a result, cultivation of medicinal plants has not been an attractive proposition to the farmers. Therefore, it is the need of the hour that Governments must formulate national support price policy and regulate the trade of medicinal plants.

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