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Consequences and conservation of medicinal plants

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Abstract
The emerging field of herbal products industry holds a great potential to the economic development of the Indian region. Usage of herbs as a source of food, medicine, fragrance, flavour, dyes and other items in Indian systems of medicine is in increasing trend. It is estimated that, 95% of the medicinal plants used in Indian herbal industry today are collected from wild. Our herbal wealth constitutes more than 8,000 species and accounts for around 50% of all higher flowering plant species of India; around 70% of the medicinal plants in the country are spread across the tropical forests of Western Ghats. Although there are around 8,000 medicinal plant species used by different communities in India across different ecosystems, only around 10% of them (880species) are in active trade. Among these, around 48 species are exported in the form of raw drugs and extracts, while around 42species are imported. The wild populations of about 100 of the traded species are known to have declined, thereby making them to be considered threatened.
Plant parts like leaves, bark, roots, fruits, seeds or even whole plant is indiscriminately collected from wild sources without taking care of saving the plants. Many of the important useful species are on the verge of extinction due to over-exploitation and habitat destruction. More than 95% of the medicinal plants are collected from the wild; a number of them have become endangered in their natural habitats. There is need to encourage multiplication and cultivation of these plants. Collection of the following species from wild sources should be prohibited.

Keywords: Biodiversity, medicinal plants, aromatic plants, conservation, forest

Introduction
Forests cover approximately a third of the world's land area and are vital for terrestrial species and rural communities. The rapid loss and fragmentation of forests due to human activities threaten ecological stability and local economies, especially in developing regions. Plant genetic resources have made substantial contributions to the domestication, utilization and improvement of all kinds of crops including medicinal and aromatic plants. Collection, characterization and their efficient utilization are keys to efficient management of any kind of genetic resource including those of medicinal and aromatic plants. Modern techniques offer the opportunity for collecting, rapid propagation, medium and long-term storage and distribution of germplasm. Complementary strategies are significant for conservation, particularly of medicinal and aromatic plants as we come across a wide spectrum of species with orthodox or recalcitrant or intermediate seed storage behaviour or exclusively vegetatively propagated plants.
The conservation of Medicinal and Aromatic Plants (MAPs) is crucial, as their declining numbers threaten traditional medicine, biodiversity, and human welfare. The main consequences of failing to conserve MAPs include the loss of biodiversity, disruption of traditional medical systems, economic losses for communities reliant on these plants, and increased vulnerability to climate change. Conversely, effective conservation efforts, such as in-situ (in their natural habitat) and ex-situ (off-site collections) methods, alongside sustainable harvesting and cultivation, can ensure a continued supply of these vital resources for future generations.

Table 1: Bio-geographical distribution of traded medicinal plants

Bio-geographic Zones	No of Medicinal Plants Identified	Example Species
Trans – Himalayan	700	*Ephedra gerardiana, Hippophae rhamnoides, Physochlania praalta, Arnebia euchroma, Ferula jaeschkeana*
Himalayan	2900	*Aconitum heterophyllum, Arnebia benthamii, Dactylorhiza hatagirea, Podophyllum hexandrum, Picrohiza kurroa, Pistacia chinensis, Nardostachys grandiflora, Rubia sikkimensis, Coptis teeta, Polygonatum cirrhifolium, Swertia chirayata, Valeriana jatamansi, Rhododendron anthopogon, Taxus wallichiana.*
Desert areas	500	*Tecomella undulata, Tribulus rajasthanensis, Citrullus colocynthis, Commiphora wightii, Acacia nilotica*
Semi-arid areas	1000	*Balanites aegyptiaca, Withania coagulens, Tribulus alatus, Commiphora wightii, Boswellia serrata, Canscora, Acacia nilotica.*
Western ghats	2000	*Myristica malabarcia, Garcinia indica, Coscinium fenestratum, Hydnocarpus pentatandra, Garcinia gummigutta, Vateria indica, Nilgirianthus ciliatus.*
North East India	2000	*Aquilaria malacensis, Smilax glabra, Ambroma augusta, Hydnocarpus kurzii, Vetivaria zizaniodes.*
Deccan peninsula	3000	*Embelia tsjeriam-cottam, Caesalpinia digyna, Screbera sweitenoides, Decalepis hamiltonii, Pterocarpus santalinus.*
Gangetic plains	1000	*Holarrhenaq pubescens, Mallotus philippensis, Pluchea lanceolata, Peganum harmala.*
Andaman & Nicobar islands	1000	*Claophyllum inophyllum, Adnanthera pavonina, Barringtonia asiatica, Aisandra butyrace*
Coastal islands	Coastal islands	Coastal islands

Consequences of Decline

Overharvesting for commercial use, habitat destruction, and increasing demand are major threats leading to population decline and loss of biodiversity.

Loss of Biodiversity

Over-exploitation and habitat loss are leading to a concerning reduction in the population and genetic diversity of MAPs, with over 45% of species currently harvested directly from their natural habitats.

Impact on Human Health

The decline of MAPs jeopardizes the availability of traditional and modern medicines, which rely on their valuable chemical components for drug development and manufacturing.

Threat to Local Economies and Communities

These plants are crucial for local economies and cultural integrity, particularly for rural and vulnerable populations, and their loss threatens their livelihoods.

Escalating Demand

The growing global demand for MAPs, driven by their use in pharmaceuticals, cosmetics, and traditional medicine, exacerbates the pressure on these plant resources.

Consequences of Over-Exploitation

Habitat Destruction

The need to collect vast quantities of plants from the wild leads to the destruction of their natural habitats, such as forests and shrublands.

Unsustainable Harvesting: Direct collection from wild populations, without sustainable practices, leads to rapid declines in plant numbers and threatens species survival.

Climate Change

Climate change is altering the distribution and survival rates of MAPs, further threatening their long-term viability.

Strategies for conservation of medicinal plants

There are basically three scientific techniques of conservation of genetic diversity of these plants. (i.) Legislation (ii.) In-situ conservation (iii.) Ex-situ conservation

Legislation

Various laws *viz.* Forest Act 1927, Wildlife (Protection) Act 1972 and Wildlife (Protection) Amendment Act 1991, Forest (Conservation) Act 1980, Environment Protection Act 1986, National forest policy, 1988 vi. National biodiversity act, 2002 formulated by government of India for conservation of forests which directly or indirectly protects the wild herbal flora.

In-situ conservation

- Conservation of a given species in its natural habitat or in the area where it grows naturally is known as in-situ conservation.
- It includes Gene bank/Gene sanction, Biosphere reserves, national parks, sacred sites, Sacred grooves etc.
- It is only in nature that plant diversity at the genetic, species and eco-system level can be conserved on long-term basis
- It is necessary to conserve in distinct, representative biogeographic zones inter and intra-specific genetic variation.

Ex-situ conservation

Conservation of medicinal plants can be accomplished by the exsitu i.e. outside natural habitat by cultivating and maintaining plants in botanic gardens, parks, other suitable sites, and through long term preservation of plant propagules in gene banks (seed bank, pollen bank, DNA libraries, etc.) and in plant tissue culture repositories and by cryopreservation(in liquid nitrogen at-196°C).

Sustainable Resource Management

Implementing practices like sustainable harvesting, setting collection limits, and protecting natural habitats are crucial for ensuring continued availability.

Community Participation and Traditional Knowledge

Involving local communities in conservation efforts and incorporating their traditional knowledge can lead to more

effective and context-specific strategies.

Utilizing Plant Waste
The by-products from MAPs, like leaves and roots, contain valuable compounds and can be converted into value-added products such as compost, biofuels, and biochar, reducing waste and creating new revenue streams.

Research and Development
Further research into the distribution, ecology, and genetics of MAPs is essential to understand their needs and develop effective conservation plans.

Genetic Resources
It emphasize the need to collect, characterize, and preserve the genetic resources of MAPs for long-term conservation and improvement.

Modern Techniques
Advanced methods like plant tissue culture, cryopreservation of genetic material, and DNA banking are used for rapid propagation, storage, and distribution of germplasm.

Conclusion
Importance of Medicinal Plants in health care and livelihood is well known fact. However, due to various factors severe depletion of the medicinal plant resources has been reported all over. Therefore, conserving medicinal plants is vital not only for the country's ecosystem, but also for its thousands of ethnic communities. There is a need to take corrective measures to conserve and augment the medicinal plants resources in the State. So that a proper road map prepared for conservation of rich biodiversity available in medicinal plants. This will also help in protecting the endangered species. There should be a shift in focus from conserving primarily conspicuous plants to the need to conserve all kinds of plants as well as their ecosystems. Furthermore, international conservation agencies, in conjunction with governments and other NGOs, need to determine a mechanism whereby those benefiting from the conservation of biotic diversity also contribute towards the costs of conserving it. Therefore, an integrated approach towards conservation of the rich MAPs diversity should be followed globally which includes in situ and ex situ conservation strategies along with sustainable utilization of the biodiversity.

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