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Diversity and conservation of medicinal and endangered plants

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Abstract : The diversity refers to the numbers, variety and variability of medicinal plants and endangered plants, coupled with the ecosystem this is termed as biodiversity. The climatic conditions, altitudinal variations, types of soil and varied ecological conditions propagate the diversity in the medicinal plants. The medicinal plants are the main raw material for traditional medicine as well as for modern medicines around the world.As per WHO even today as many as 80% of the population depend on the traditional medicine for their primary health care needs. Around 90% of the herbal raw drugs used in the Ayurveda, Sidha, Unani and Homeopathy come from medicinal plants. Also the pharmaceutical industry around the globe greatly depends for their raw material upon the medicinal plants. The over exploitation of the resources with rapid increase in populations for addressing their health care needs and due to climatic changes too some medicinal plants becomes endangered species today. Therefore management of medicinal plant becomes a matter of urgency. The management of human use of the biodiversity so that it may yield the greatest sustainable benefit to the present generation, while maintaining the its potential to meet the needs and aspiration of future generations is the conservation. The dedicated medicinal plants are used by various tribal's and local people to cure different ailments ranging from simple injuries , common cold, fever, diarrhoea, skin care products etc, and therefore a major resource. Hence there is immense need for conservation of diversity of medicinal plant wealth for the present as well as for future generations by adapting the suitable techonologies. Tissue culture technology is potent and opened extensive areas of research for biodiversity conservation. Plant in vitro regeneration is a biotechnological tool that offers a tremendous potential solution for propagation of endangered and superior genotypes of medicinal; plants. There are two methods of conservation, conventionally in situ and ex situ conservation. In situ methods allow conservation to occur with ongoing natural evolutionary process while ex situ conservation via vitro propogation. In vitro cell and tissue methodology is envisaged as a mean for germplasm conservation to ensure the survival of endangered species rapid mass propagation for large scale revegitation and for genetic manipulation studies.

Keywords : Diversity, Medicinal Plants and Conservation

INTRODUCTION

An enormous diversity in the ecology and ecosystem is found in India, ranging from the sea level to the highest mountainaous ranges in the world,hot and arid conditions in the northwest i.e., dry and desert conditions in the Rajasthan and Gujrat to the coldest and arid conditions in the trans Himalayan region, the coldest place nubra valley in the ladakh, tropical wet evergreen rainforest in the northeast with highest rainfall in the cherapunji in Meghalaya and the wet evergreen humid tropics of Western Ghats arid and semi arid conditions of Penisular India, the tidal mangroves of the Sunderban which harbours about 4700 species of plants. India constitutes 2.4% of world areawith 8% of global bio diversity. India has 12 biogeographical provinces, 5 biomes and 3 bio regions domain. The country supports a diverse array of habitats or ecosystem such as forest, wetlands, grassland,

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costal, marine and deserts and each with reach and floristic diversity. These biological attributes are further enhanced by the geographic location of the country at the confluence of three major biogeographic realms, viz, Inodonesian, Eurasian and Afro tropical,and makes its one of the 17 megadiversitycountries in the world.The floral diversity in India is majorly concentrated in 4 bio diversity hot spots, namely Eastern Himalayas, Western Ghats, North east India and Andaman and Nicobar Island. Ecosystem Diversity: The major ecosystem in India are Forest, Grasslands, wetlands, costal, marine and deserts. The forest cover of the country is around 21% of the total geographical area.India has about 4.1 million hectares of wetlands. There is 6700 square km area of mangroves in India. The desert ecosystem covers around 2% of the total landmass. The cold deserts in Ladakh, lahulspiti and Himachal Pradesh covers around an area of 109,990 square km. The table below shows the bio geographical zones of India:

Sl.No.	Biogeographical zone	No. of known Medicinal Plants
1.	Trans Himalayan	700
2.	Himalayan	2900
3.	Desert	500
4.	Semi Arid	1000
5.	Western Ghats	2000
6.	Deccan Peninsula	3000
7.	Gangetic Planes	1000
8.	North east India	2000
9.	Andaman and Nicobars	1000
10.	Coastal	500

Species Diversity: India harbors a total of 47,513 plant species, out of about 0.4 million hitherto known in the world, representing as much as 11.4% of the flora. About 28% of the plants that occur in India are endemic.The table below represents a comparative study of plants in India: Total number of plant species (including virus, bacteria, algae, fungi and lichens) and their status in World and India.

SI. No.	Type	Number of known Species		Percentage of Occurrence in India	Number of Endemic Species	Number of Threatened Species
		World	India			
I	**Flowering Plants**					
1.	Gymnosperms	1021	74	7.35%	8	7
2.	Angiosperms	268600	18043	6.72%	ca. 4036	1700
II	**Non-flowering Plants**					
1.	Bryophytes	16236	2523	15.54%	629	ca. 80
2.	Pteridophytes	12000	1267	10.57%	47	414
III	**Others**					
1.	Virus and Bacteria	11813	986	8.77%	Not	Not known
2.	Algae	40000	7284	18.21%	Known	Not known
3.	Fungi	98998	14883	15.09%	1924	ca. 580
4.	Lichens	17000	2401	14.12%	ca. 4100	Not known
					ca. 520	
Total		465668	47513	–	11273	2781

Medicinal Plant Diversity: India is rich in medicinal plant diversity with all three levels of bio diversity such as habitat diversity, species diversity and genetic diversity. The forest cover of India is havingthe 90% of total medicinal plant diversity. Although, there is no reliable figure for the total number of medicinal plants on Earth, and numbers and percentages for countries and regions vary greatly but estimates for the numbers of species used medicinally include: 35,000-70,000 or 53,000 worldwide (Schippmann et al., 2002); 10,000- 11,250 in China (He and Gu, 1997; Pei, 2002; Xiao and Yong, 1998); 7500 in India (Shiva, 1996); 2237 in Mexico (Toledo, 1995); and 2572 traditionally by North American Indians (Moerman, 1998).The demand for medicinal plantbased raw materials is growing at the rate of 15 to 25% annually, and according to an estimate of WHO, the demand for medicinal plants is likely to increase more than US $5 trillion in 2050. In India, the medicinal plant-related trade is estimated to be approximately US $1 billion per year (Kala et al., 2006). According to Schippmann et al. (1990), one fifth of all the plants found in India are used for medicinal purpose. The world average stands at 12.5% while India has 20% plant species of medicinal value and which are in use.A total of 560 plant species of India have been included in the International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened species, out of which 247 species are in the threatened category. On a global basis, the IUCN has estimated that about 12.5% of the world's vascular plants, totaling about 34 000 species are under varying degrees of threat. IUCN recognizes the following categories: extinct, extinct in the wild, critically endangered, endangered, vulnerable, near threatened, least concern, data deficient and not evaluated. Species with small populations that are not at present endangered or vulnerable but are at risk are called rare. Many of them are facing extinction. In the past few decades, there has been an ever-increasing global inclination towards herbal medicine, followed by a belated growth in international awareness about the dwindling supply of the world's medicinal plants. The plants used in the phytopharmaceutical preparations are obtained mainly from the naturally growing areas. The genetic diversity of medicinal plants in the world is getting endangered at alarming rate because of ruinous harvesting practices and over-harvesting for production of medicines, with little or no regard to the future. Also, extensive destruction of the plant-rich habitat as a result of forest degradation, agricultural encroachment, urbanization etc. is other factors, thus challenging their existence. In view of the tremendously growing world population, increasing anthropogenic activities, rapidly eroding natural ecosystem, etc the natural habitat for a great number of herbs and trees are dwindling and of per capita consumption has resulted in unsustainable exploitation of Earth's biological diversity, exacerbated by climate change, ocean acidification, and other anthropogenic environmental impacts.

Needs for Conservation: The goal of conservation is to support sustainable development by protecting and using biological resources in ways that do not diminish the world's variety of genes and species or destroy important habitats and ecosystems. In general, it involves activities such as collection, propagation, characterization, evaluation, disease indexing and elimination, storage and distribution. The conservation of plant genetic resources has long been realized as an integral part of biodiversity conservation. There are two methods for the conservation of plant genetic resources, namely In-Situ & Ex-Situ conservation. On the other hand, ex situ conservation involves conservation outside the native habitat and is generally used to safeguard populations in danger of destruction, replacement or deterioration. Approaches to ex situ conservation include methods like seed storage, DNA storage, pollenstorage, in vitro conservation, field gene banks and botanical gardens.

Field gene banks provide easy access to conserved material for use, they run the risk of destruction by strategies using the tools of biotechnology are increasingly being applied towards conservation of plant genetic resources. These include **(a)** in vitro conservation **(b)** in vitro propagation and re- introduction of plants to their natural habitats, and **(c)** molecular marker technology. Several in vitro techniques have been developed for storage of vegetatively propagated and recalcitrant seed producing species. In general, they fall under two categories: (i)

slow growth procedures, where germplasm accessions are kept as sterile plant tissues or plantlets on nutrient gels; and (ii) cryopreservation, where plant material is stored in liquid nitrogen. Slow growth procedures provide short- and medium-term storage options, while cryopreservation enables long- term storage of the plant material.

Traditional Methods of Conserving Medicinal Plants: The rural people who constitute the bulk of population are heavily dependent on the vegetation around them for fuel wood and for medicine. They are mainly subsistence farmers, and cannot afford alternative fuels, let alone the high prices of modern medicine. As a result vegetation is lost and environmental degradation takes place. Major steps have been taken towards conserving the medicinal plants. They include: discouraging cutting down indigenous trees and encouraging the local people to plant fast-growing exotic and indigenous trees for domestic use, the inauguration of a national tree planting day and the creation of nature reserves. However, despite this intensified drive towards conservation, it is still difficult to prevent local people from destroying the plants around them. The planting of fast-growing exotics is not a complete solution to the problem of environmental degradation, mainly because the locals still need indigenous plants as a source of medicine and for crafts such as carving. Local people do not approve of the planting of medicinalplants because of their belief that indigenous plants lose their curative properties when cultivated.

Germplasm Technique for conservation: Germplasm conservation of vegetatively propagated crops, forest species especially those with recalcitrant seeds in live gene banks in fields poses tremendous problems in terms of required land space and labour input during annual or perennial replanting, testing and documentation. The advantage of in vitro or reduced growth storage include little space necessary in growth rooms for maintaining thousands of genotypes and the absence of diseases and pest attack in culture vessels. Furthermore, in vitro storage eliminates the need for long and frustrating quarantine procedures during move ment and exchange of germplasm.

CRYOPRESERVATION TECHNIQUE FOR CONSERVATION OF PLANTS: "Cryopreservation" is defined as the viable freezing of biological material and their subsequent storage at ultra low temperatures (196C)"using liquid nitrogen. The use of liquid nitrogen, either by itself or as a source of nitrogen gas, is based on the following unique combination of features: • Chemically inert • Relatively low cost • Non-toxic • Non-flammable • Readily available

TISSUE CULTURE TECHNIQUES USED FOR CONSERVATION: Cell suspensions: **a.** Pre-treatment: The cell suspension is inoculated at high density into standard medium containing 6% mannitol and cultured under standard conditions. **b.** The suspension is harvested when the cell will be dividing rapidly and chilled on ice. **c.** Cryopreservation: A double strength cryoprotectants solution (1M dimethylsulfoxide (DMSO) + 1M glycerol + 2M sucrose) was prepared and one volume cryoprotectants solution is added to one volume of cell suspension and the mixture is incubated on ice for 1hr. **d.** The mixture is dispensed as 1 ml aliquots and the ampoules are cooled at 1oC min-1 until they reach -35oC. **e.** Storage: The ampoules are stored in or over liquid nitrogen. The ampoules are dropped into sterile water at about 40oC with a ratio of 4 ampoules to 150 ml water. **g.** Regrowth: The cells in suspension are transferred to several layers of 5 cm filter paper on the surface of a 9 cm agar plate containing a growth medium and are incubated under standard conditions. The cells and upper layers of filter paper are then transferred to fresh medium, until after 5-6 days, the cells alone are transferred to agar medium.

Ex situ conservation of plants: It involves three methods namely, field gene banks, seed banks and in vitro storage. Of these, seed banks are the most efficient and effective method of conservation for orthodox seed. It is an effective and compact method of storage. The seeds are placed in packets and stored in medium term storage facilities (maintained at 00C to 50C temp. and 15% to 20% relative humidity) as active collections. Most of the material is also kept in long-term storage facilities (held at colder temperatures, -20 to -180C).Most seed samples are expected to remain viable for 20 to 30 years in medium

term storage and for up to 100 years in long term storage depending upon the species, the initial seed quality and specificity of storage environment and general state of infrastructure.

Botanical gardens can play a key role in ex-situ conservation of plants, especially those facing imminent threat of extinction. Several gardens in the world are specialized in cultivation and study of medicinal plants, while some contain a special medicinal plant garden or harbor special collection of medicinal plants.

India has a network of about 140 botanical gardens which include 33 botanical gardens attached to 33 universities botany departments. But hardly 30 botanical gardens have any active programme on conservation. Tropical Botanical Gardens & Research Institute (TGBRI), located in a degraded forest region of Western Ghats Mountains in Kerala has an excellent example in ex-situ conservation of plant diversity in India. The field gene bank programme launched by TBGRI from 1992-1999 is now well acclaimed as a very effective method of conservation of medicinal and aromatic plant genetic resources. This field gene bank of medicinal and aromatic plants at TBGRI, Thiruvananthapuram is essentially a blend of the ex-situ and in-situ situations.

For plants where seed banking is not possible, if they are long-lived species like trees and shrubs, the best means of ex situ conservation is the Field Gene bank. This is simply a plot of land in which the plants are grown in rows and carefully labeled. The disadvantages are that Field Gene banks take up a lot of space, cannot conserve as much variation as in seed banks, and are vulnerable to disease epidemics.A Gene bank conserves plant genetic wealth. The rich heritage of plants, which feeds and sustains humankind, is conserved through seeds, vegetative propagules, tissue culture, embryos, gametes or cells, DNA etc. Besides orthodox seeds, vegetatively propagated clonal material and recalcitrant species are maintained under in-vitro, Cryo and field conditions.

The importance of gene banks has been recognized since long and they have been in existence in various parts of the world for a long time. In India the largest, most modern gene bank was opened in New Delhi only a few years ago. This bank is primarily intended for the storage of crop species and their wild relatives. Despite the subject having been flagged at recent discussions, no concrete action has yet started with respect to the setting up of a gene bank for forest germ plasm. Given the rapid rate of destruction of forests around the world, including the Indian sub-continent, there is certain urgency about conserving the genetic material of the Indian forests.

GENETIC CONSERVATION: To expand the current tissue culture, propagation, and storage of all endangered species of plants is possible. Emphasis will be placed on the "Genetic Safety Net" (GSN) species in efforts to achieve complete genetic safety net coverage for these living critically endangered plants, includingcapture of the maximum genetic diversity remaining in wild populations.

TO CONSERVE POPULATIONS OF MEDICINAL PLANT SPECIESEX- SITU: The primary purpose of this is as an insurance policy. But it also has the advantage that it is usually easier to supply plant material for propagation, for re-introduction, for agronomic improvement, for research and for education purposes from ex situ collections than from in situ reserves. The disadvantages of ex situ conservation are that the sample of the species conserved ex situ may represent a narrower range of genetic variation than that which occurs in the wild. Species conserved ex situ can also suffer genetic erosion and depend on continued human care. For this reason, ex situ conservation must not replace, but should complement, in situ conservation.

CONCLUSION

The Medicinal plants play a vital role in the health care system in India and represent a major national resource. Approximately 80% of the people in the world's developing countries rely on traditional medicine for their primary health care, and about 85% of traditional medicine involves the use of plant extracts.The dedicated medicinal plants are used by various tribal's and local people to cure different ailments ranging from simple injuries, wounds, cuts, fever, diarrhea, ulcers, swelling, bone fractures, potency, antidote, skin care, night

blindness, toothache, asthma, cough & cold. Hence, there is an immense need for conservation of diversity of medicinal plant wealth for the present and fore coming generations, by adapting the suitable strategy with most appropriate method of conservation.

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