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Genetic diversity and conservation of medicinal plants in Deccan plateau region in India

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Abstract
Deccan plateau region in India is unique because of its varied geography and great diversity in its natural ecosystem that is immensely rich in agricultural diversity including wild plant biodiversity and various farms of faunal diversity. This region in particular is highly overexploited by several anthropogenic activities resulting in loss of life supporting resources, biodiversity gene pool and nature's self-sustaining and ameliorating capabilities. The Western Ghats (3500 species) and Easter (>1500 species) Ghats are rich repositories of medicinal plants. The regions globally know for it *Andrographis paniculata*, *Withania somnifera, Aloe vera*, *Ocimum sanctum*, *Ocimum basilicum*, *Eucalyptus*, *Piper longum*, *Bacopa monnieri, Centella asiatica*, *Tinospora cordifolia*, *Adathoda vasica*, *Eclipta prostrata*, *Chlorophytum borivilianum*, *Cassia senna*, *Curcuma longa*, *Mucuna pruriens* and *Abelmoschus moschatus* etc. are cultivated by the farmers of the region. *Ex situ* conservation and cultivation of selected Relisted plants of the region was initiated in 1200 at the CSIR-Central Institute of Medicinal and Aromatic Plants Research Centre, Hyderabad and are being maintained in a field gene bank and seed bank.

Keywords: Diversity, Medicinal plants, agriculture and flora.

Introduction
Plant diversity also playing a significant role in the presence of rest of the species diversity in certain habitats which are remarkable segment for formation of the rich biodiversity. On the basis of utility of the plants these are categorized as food, fodder, fuel plants etc. Out of the rich plant diversity many plant species showing capability for treatment of many disorders known as MPs. Variations can be also seen in terms of useful plant parts as well as their preparation methods for certain disorders. A complete life cycle of the plants is affected by various biotic, abiotic factors and also by the genetics of the plants. Plants are important source for global biodiversity. Adaptation capacity and utilization of the MPs are changeable among varied MPs in nature. Plants are showing variation in their diversity, presence, mode of utilization and propagation methods etc. These are leads by the variable climatic conditions, available facilities needed for their successful growth and development. On the basis of various habits plants are classified in herbs, shrubs and trees.

Conservation of Genetic diversity
Genetic diversity is the assemblage of all genes, species, and ecosystems present in a specific area or on the planet, where diversity is the result of evolutionary processes. Studies devoted to characterizing the components of biodiversity are justified by the importance and ecological interest of their potential and immediate use by humans, especially when certain specimens are known biological resources (or more specifically, genetic resource).
Because the number and genetic variability of many species are rapidly declining as a direct or indirect consequence of human actions and the demand for food products and other derivatives (e.g., biofuels and new drugs) is growing rapidly (Lee *et al.* 2014) [12], a notable need exists for research that helps establish conservation strategies as well a manage and make use of the variation in available genetic material.
The aims of conservation are preservation of genetic diversity and promotion of evaluation processes. Conservation program should be ecology-friendly and indigenous people - friendly. It is possible to preserve pollen, embryos, embryonic axes, shoot apexes, cell suspension, adventitious buds, DNA, etc. in cryopreservation at – 196 ^{0}C. Artificial seeds or alginate encapsulated microshoots produced in the laboratory are being used for reintroduction of wild-extinct or endangered species (Srivastava *et al.* 2009). Botanical survey of India, CIMAP

(Central Institute of medicinal and Aromatic Plants; 2762 accessions and 418 MPs in seed gene bank, 1774 accessions of 244 MPs in field gene bank, 264 accessions of 44 MPs in vitro gene bank, and 1389 accession of 53 MPs in DNA bank), and National Bureau of Plant genetic Resources (NBPGR) are maintaining herbal gardens, seed bank, and in vitro bank dedicated to MPs.

To seek public support and cooperation through sensitizing and educating them on the importance of conserving MPs with the help o1'medicinal plant gardens in hospitals, parks, colleges; guided tours to such gardens: organizing lectures and campaigns: introducing courses in student curricula, etc. Sensitizing communities that reside inside forests and forest fringe areas is especially important in conserving MPs diversity as traditional knowledge on their ethno medical uses is fast disappearing. This is also important since forests are exploited for food, fruit, flower, foliage, fodder, fuel. Fiber, wood/timber, and other economic purposes and MPs form a negligible part, hence ignored. WHO, IUCN, WWR and TRAFFIC revised these guidelines taking into account information and research, policy and legislation conservation strategie. Sustainable production, healthcare, responsible business practices, equity and awareness, training and capacity building (Kathe 2006) [4]. Biodiversity informatics that links taxonomy and distribution with environmental variables to assist MAPs conservation is an evolving new science.

Roles for medicinal plants in conservation

The special significance of medicinal plants in conservation stems from the major cultural, livelihood or economic roles that they play in many people's lives. Various sets of recommendations have been compiled relating to the conservation of medicinal plants, such as those associated with international conferences at Chiang Mai, Thailand, in 1988 and Bangalore, India, in 1998 (www.frlht-india.org) (Akerele *et al.* 1991) [9]. They include: the need for co-ordinated conservation action, based on both in situ and *ex situ* strategies; inclusion of community and gender perspectives in the development of policies and programmes; the need for more information on the medicinal plant trade; the establishment of systems for inventorying and monitoring the status of medicinal plants; the development of sustainable harvesting practices; encouragement for microenterprise development by indigenous and rural communities; and the protection of traditional resource and intellectual property rights.

There can be aspects of medicinal plant conservation which plant conservationists can pursue, working largely outside the normal dynamics of people/plant relationships. Work of this type can sometimes be found, for instance, associated with seed-banks, information systems or 'totally protected' nature reserves. The fact that efforts are made in favour of medicinal plants, rather than plants of any other type, is incidental, except as regards the criteria used for the initial selection of species for attention.

Probably, the single most important 'role' for medicinal plants in biological and ecological conservation stems from the foundations that they can provide for the involvement of people in conservation of natural habitats. In other words, the significance of medicinal plants to people can be sufficiently great that arrangements made for the conservation and sustainable use of medicinal plants can lay important foundations for the conservation of natural habitats and ecological services more generally. Therefore the 'biological beneficiaries' of 'medicinal plant conservation' are not necessarily only the medicinal plants themselves. This is nowhere more so than in those remoter parts of the world where cultural and biological diversity tend to be most concentrated, and where medicinal plants can assume high importance in cultures and for livelihoods.

Working effectively with communities requires conservationists to have an appreciation of the cultures, economies, social structures and dynamics of local societies, in addition to the knowledge that they need about the biology and ecology of the plants themselves. Similar 'lateral engagement' is also necessary for work with other classes of people involved with medicinal plants. For example, the main concerns of conservationists about manufacturers are likely to revolve around questions of the effects of their patterns of obtaining raw materials on the environment. However, manufacturers will often be more interested in other aspects of product quality than biological and ecological sustainability, especially those relating to quality control that involve species authentication, presence of active constituents, limitations to heavy metal content, and residues of pesticides and fertilisers. Conservationists working with manufacturers need to understand these facts of the business, just as they need to understand those of village life when working with communities.

Table 1: *In situ* and *ex situ* strategies to conserve and protect MPs

***In situ* conservation**	***Ex situ* conservation**
Medicinal plant conservation areas Biosphere reserves National parks Sacred groves Cultivation in forests: Joint Forest Management Legislation: Banning exports, converting forests for agricultural or commercial purposes such as mining	Herbal gardens, theme parks Social/urban forestry, avenue Plantation Cultivation of specific species Gene banks: Seed, pollen, DNA Tissue culture repositories Cryopreservation

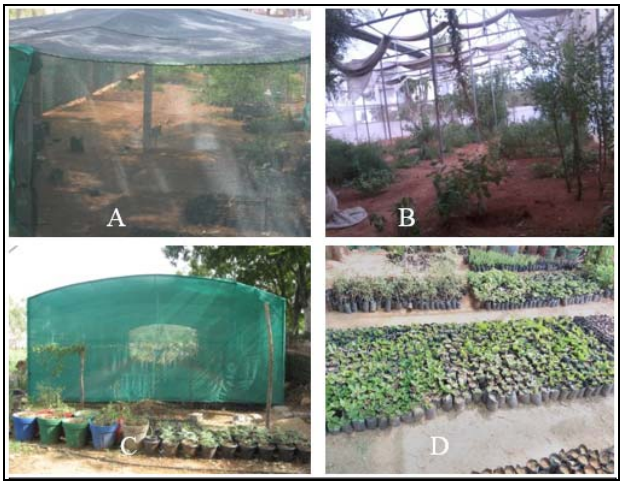

Fig 1: Field experimental site for cultivation and conservation of MAPs (A) Green-house (B) Poly-house (C) Different accessions (seed and propagules) (D) Cultivated Different accessions of MPs

Fig 2: (A-C) Field gene bank of the CIMAP Research Centre, Hyderabad Conservatory (D) Seed bank of the CIMAP Research Centre, Hyderabad.

Fig 3: Field experimental site for cultivation and conservation of MPs. (A) *Tinospora cordifolia* (B) *Spilanthes acmella* (C) *Caralluma fimbriata* (D) *Caralluma umbellata*

Fig 4: Field experimental site for cultivation and conservation of MPs. (A) *Aristolochia bracteata* (B) *Centratherum punctatum* (C) *Commiphora caudata* (D) *Leonotis nepetifolia*

Cultivation for Protecting Genetic Diversity

The dilemma on the choice of wild or cultivated MPs for use in medicines has been raging for a long time. Scientists opine that preference for wild species is based on local perceptions which are based on the presumption that the percentages of pharmacologically active secondary metabolites are higher in wild-gathered MPs, e.g. Some researchers feel that traditional perceptions are not completely unfounded as wild plants grow under specific ecological conditions (that influence accumulation of phytochemicals) s) which is difficult to replicate in cultivated regions. Scientist's investigations however, confirmed that phytochemical concentration can be regulated in cultivated MPs (Palevitch l99l) [9].

Cultivation requires varieties bred by traditional or modern biotechnological methods (marker assisted selection, transgenic plants) or carefully selected from wild populations to yield more biomass containing greater percentages of secondary metabolites and modern cultivation practices for these varieties under different agro climatic conditions. Knowledge about the existing genetic diversity greatly helps in selecting plants having maximum gene pools either for cultivation or for improvement. Table1 List some of the varieties developed in India for the cultivation in Deccan plateau. Systematic cultivation of MPs is becoming a profitable farming enterprise. Small-scale cultivation of many more MPs is practiced in home gardens and by herbalists.

In addition to simple cultivation (including organic agricultural) practices under rain fed and irrigated conditions in Deccan Plateau for enhancing quality and biomass yield per unit area per unit time; micro propagation protocols for rapid multiplication, for disease-free plantlets, for selecting somaclonal variants in vegetatively propagated species, for enhancing secondary metabolic in shoot or root ((hairy root) cultures (shake flask and bioreactor technologies e.g. C. roseus); biotechnological methods to identify genes and engineer biosynthetic pathways either for better accumulation of phytochemicals or elimination of undesirable phytochemicals; plants with different ploidy levels through induced mutations' soil less culture techniques, e.g., hydroponics and cultivation under controlled conditions (polyhouses and greenhouses), etc. have yielded fruitful results (Rajeswara Rao l999; Rajeswara Rao and Rajput 2005 [10]; CIMAP Resesrch Center *et al*. (Reddy and Rajeswara Rao 2006 [14]; (Rajeswara Rao *et al*. 2007; Lubbe and Verpoorte 2011) [11].

Conclusion

Present research deals with the Genetic Diversity and conservation of the medicinal plants including important and endangered in Deccan plateau region. It is an effort for their rapid propagation as well as for their *ex–situ* conservation in Herbal Garden. Among the introduced Medicinal some are endangered need for urgent protection and conservation. Not only in this region also all over in the India. Medicinal Plants (MPs) are useful for treatment of various disorders and are prime sources of traditional medicine. Demands of Medicinal Plants (MPs) are increasing day by day due to rich capacity for treatment of certain disorders and also their less or no side effect.

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