International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Conservation of Threatened Medicinal Plants – A Futuristic Approach

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Abstract:

Many of the important plant species are going to be threatened due to various natural as well as artificial reasons. The conservation of medicinal plants such as threatened species can be tackled by scientific techniques such as *in situ* conservation and *ex situ* conservation. Tissue culture technology gave us an opportunity to conserve them by achieving multiple numbers of plantlets in small space and less time. The present research paper gives us an opportunity to various methodologies for conservation of these valuable plants for future generations.

Keywords: Medicinal plants, conservation, tissue culture

Introduction:

Hippocrates, 460-380 BC, known as the "Father of Medicine," classified herbs into their essential qualities of hot and cold, moist and dry, and developed a system of diagnosis and prognosis using herbs. The earliest Ayurvedic texts on medicine from India date from about 2,500 BC. In Ayurvedic theory, illness is seen in terms of imbalance, with herbs and dietary controls used to restore equilibrium. In 1803, morphine became one of the first drugs to be isolated from a plant. It was identified by Frederich Serturner in Germany. Medicinal properties derived from plants can come from many different parts of a plant including leaves, roots, bark, fruit, seeds, flowers.

All cultures from ancient times to the present day have used plants as a source of medicines. According to the World Health Organization (WHO), as many as 80% of the world's people depend on traditional medicine needs for their primary health care. Plants are an important source of food and of valuable products for industry, agriculture and medicine. They are unique in many aspects of metabolic processes, development and reproduction. Addition to the crop plants that provide us food, many thousands of wild plants have great economic and cultural importance and potential for use in traditional medicines throughout the world. However, the world's biodiversity is declining at an unprecedented rate due to the alarming increase in the world population and many plants are in danger of extinction, threatened by habitat transformation, over-exploitation (Vinoth and Ravindhran 2013). Threatened fauna and flora may be listed in any one of the following categories as defined in Section 179 of the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act): Section 179 Categories of threatened species i.e., (i) A native species is eligible to be included in the extinct category at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died. (ii) A native species is eligible to be included in the endangered category at a particular time if, at that time: (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near

future, as determined in accordance with the prescribed criteria. (iii) A native species is eligible to be included in the vulnerable category at a particular time if, at that time: it is facing a high risk of extinction in the wild. There are many threats that impact on species and contribute to their risk of extinction. Threats can be human-induced such as clearing of habitat, pollution, overharvesting, introduced species, or random natural events such as cyclones, floods, droughts, fire.

Why conservation is needed?

Threatened species are any species (including animals, plants, fungi, etc.) which are vulnerable to endangered in the near future. The reasons may be declining in number due to threats such as habitat destruction, climate change, or pressure from invasive species. The World Health Organization (WHO) estimated that 80% of the population of developing countries relies on traditional medicines, mostly plant drugs, for their primary health care needs. Plants provide the predominant ingredients of medicines in most medical traditions while the demand for medicinal plants is growing; some of them are increasingly being threatened in their natural habitat. Plants are endangered by a combination of factors: over collecting, unsuitable agriculture and forestry practices, urbanization, pollution, habitat destruction, fragmentation and degradation, spread of invasive alien species.

Conservation strategy (IUCW, UNEP & WWF, 1980) defines conservation as "the management of human use of the biodiversity so that it may yield the greatest sustainable benefit to present generation while maintaining its potential to meet the needs and aspirations of future generations". The conservation of wild medicinal plants such as threatened species can be tackled by scientific techniques such as in situ conservation and ex situ conservation. In-situ conservation is a conservation of a given species in its natural habitat or in the area it grows naturally. It includes Gene banks, Biosphere reserves, National Parks, Sacred sites, sacred grooves, etc. Ex situ conservation means conservation of medicinal plants can be accomplished by the ex situ i.e., outside natural habitat by cultivating and maintaining plants in botanical gardens, parks and through long term preservation of plant propagules in gene banks and in plant tissue culture repositories and by cryopreservation.

Necessity of present work

Despite, the existence of various sets of recommendations for the conservation and sustainable use of medicinal plants, only a small portion of these have achieved adequate protection of medicinal plant resources through conventional conservation in natural reserves or botanic gardens. Tissue culture technology gave us an opportunity to conserve the threatened medicinal plants by achieving multiple numbers of plantlets in small space and less time.

The objective and methodology adopted for the presence work is as follows, (i) the plant specimens will be collected at the time of sprouting of seeds, tubers and during flowering of plants. (ii) Plants specimens shall be maintained in the garden and herbarium was prepared by using plant. (iii) After successful preparation of medium, the explants of threatened medicinal plants were cultured. (iv) The successful plant tissue culture setup is prepared for multiplication of plants. (v) The protocol was setup for multiplication of shoots and roots in culture environment. (vi) The rooted plantlets were transfer in green house and those stable transfers in wild environment.

Research and Development:

The importance of *ex situ* conservation has gained international recognition with its inclusion in Article 9 of the Convention on Biological Diversity (CBD) and in Target 8 of the Global strategy for Plant Conservation. Conventionally, *in situ* conservation allows evolution to continue within the area of natural occurrence, and *ex situ* conservation provides a better degree of protection to germplasm compared to *in situ* conservation. However, both *ex situ* and *in situ* conservation are complementary and should not be viewed as alternatives (Wang *et al*., 1993). *Ex situ* conservation includes germplasm banks, common garden archives, seed banks, DNA banks and techniques involving tissue culture, cryopreservation; incorporation of disease, pest and stress tolerance traits through genetic transformation and ecological restoration of rare plant species and their populations.

Cultivation may not be solution to save and at the same time utilize sustainably the endangered medicinal plant. The plant will conserved by tissue culture technique. By this technique not only we cultivate the good quality of plant but also enhance the valuable component of plant and reduce the over harvesting of plant (Singh *et al*., 2013). Tissue culture is the term used for 'the process of growing of cells artificially in the laboratory'. Plant tissue culture is an emerging tool for the propagation and conservation of some economically important plants that are listed as endangered, rare and threatened. There have many application of plant tissue culture like (i) a single explant can be multiplied into several thousand plants in less than a year - this allows fast commercial propagation of new cultivars. (ii) Taking an explant does not usually destroy the mother plant, so rare and endangered plants can be cloned safely. (iii) Once established, a plant tissue culture line can give a continuous supply of young plants throughout the year. (iv) Plants prone to virus diseases, virus free explants (meristem tissue) can be cultivated to provide virus free plants. (v) Tissue culture clones are 'true to type' as compared with seedlings, which show greater variability. During the past decade research in plant sciences has demonstrated the feasibility of plant cell and tissue culture techniques as major tools in biology and agriculture. These techniques are also essential in strategies for engineering of biological systems (Nukamp et al, 1990). Tissue culture produces clones, in which all product cells have the same genotype (unless affected by mutation during culture). Tissue culture had its origins at the beginning of the 20th century with the work of Gottlieb Haberlandt. The success of White's experiments opened the field of root cultures, which have been explored by many workers to solve morphological, physiological and pathological problems. In the 1950's and 60's there was a great deal of research, but it was only after the development of a reliable artificial medium (Murashige & Skoog, 1962) that plant tissue culture really 'took off' commercially. A more recent advance is the use of plant and animal tissue culture along with genetic modification using viral and bacterial vectors and gene guns to create genetically engineered organisms. Tissue culture can also be used when wild grown plants are difficult to propagate for *ex situ* preservation in botanical gardens. Such plants can be used as a source of seed for longterm storage and if seed is not produced, the tissue culture lines themselves can be cryopreserved. Propagated plants might also be used for *ex situ* studies on the biology of threatened plant species. Biotechnology offers avenues for maintenance, genetic improvement and efficient use of endangered plant resources and products (Bapat *et al*., 2008).

Future Need of Conservation

In vitro techniques have found increasing use in the conservation of threatened plants in recent years and this trend is likely to continue as more species face risk of extinction; while a large body of

knowledge is available on the *in vitro* culture of plants, there are limited research relating to threatened plant conservation. Thus, combined plant system using micropropagation and cryopreservation technologies hold great potential in justifying the impact of current ecological disaster while complementing global preservation strategies.

Conclusion

Usage of plants 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. Hence, there is an immense need for conservation of diversity of threatened medicinal and related plants for upcoming generations. Tissue culture plays a vital role in this process; because, by using this cannot destroy natural habitat but reintroduced thousands of plantlets in environments.

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