

Role of tissue culture in conservation of endangered *Ayurvedic* plants

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Abstract- *Ayurveda* is oldest science of treatment. In ancient era, there are many plants which are easily available were used in treatment in different forms. As years passed, due to various reasons many plants didn't survived till date. Some useful important species already extinct and many having fear of extinct in near future. This can cause huge loss to authentic *Ayurvedic* treatment protocols. Tissue culture is modern technique to replicate the plant with the help of single cell. Different methods of tissue culture can actually assure us about rare plants conservation.

Keywords –plant tissue culture, endangered, *Ayurvedic*.

Introduction

Ayurveda has 4 main aspect of treatment i.e. *chikitsa chatuspad*. Those are *Vaidya* (doctor), *rugna* (patient), *paricharak* (nurse) and *Aushadh* (medicines). Amongst them medicines plays important role. *Ayurvedic*

medicines are of 2 types herbal and mineral. Herbal medicines are those who have plant origin. Most of plants which are found in nature are used in *Ayurvedic* treatment since ancient times. *Nighantu* (*Ayurvedic* texts having compilation of plant and its information) used as reference books for plants and its medicinal use. In *nighantus* many plants are mentioned which are not found today and this can cause limitation in treatment. Due to poor environmental conditions many *Ayurvedic* Medicinal plants are extinct from surrounding and declared as endangered. Also many of them are red listed. Tissue culture is technique producing whole plant from single viable cell of plant. This technique is essentially used for production on large scale as well as conservation of rare plants. When climatic conditions are not supporting or seeds have poor germination rate, tissue culture can be used.

Material and methods

Endangered plant species^{[1][5]}- this are the species of plants which are very likely to become extinct in near future either worldwide or in a particular jurisdiction.

Many medicinal plants which were available easily in past are today having fear of extinction. IUCN^[2] (International union for conservation of nature and natural resources) is an international organization working on the field of nature. IUCN updated its list in 2015 which included many Indian medicinal plants in red list that means these plants having fear of extinction in near future. Total of 560 plant species of india have been included in the IUCN red list of threatened species. Out of which 247 species are in threaten category. On a global basis, IUCN has estimated that about 12.5% of world's vascular plants, totaling about 34,000 species are under varying degrees of threat. this threat not only affects the biodiversity of atmosphere but also reduce the potential of effective *Ayurvedic* practice. Some plants are available in other species of same genus, but slight change in habitat can also differs the medicinal properties of drug.

The list includes following endangered plants^{[3][4]}-

1. *Aconitum chasmanthum* (meetha zahar)
2. *Chlorophytum borivilianum* (safed musali)
3. *Gentian kurro* (trayamaana)
4. *Gymnocladus assamicus* (menangmanba-shi)
5. *Lilium polypyllum* (kshirkakoli)
6. *Saussurea costus* (kuth)

7. *Commiphora wightii* (guggulu)
8. *Microstylis wallichii* (jeevaka)
9. *Malaxis muscifera* (vrushabhaka)

This are major concern species today. Many factors affecting the productivity of plants.^[4] some of them are listed below

- Adverse climatic condition- due to global warming, weather shock, heat, flood, drought plant productivity and reproduction rate can be decreases. Climatic changes can shift global production patterns. Species that used to be grown productively in one region under certain condition may not sustain to live in new agro-ecological conditions. This can cause species to fear of extinct.
- Deforestation- due to urbanization, more and more land is undergoing deforestation. Many species which meant to be in certain *desha* (region) are endangered because of this reason. Deforestation affects the certain habitat of plant which makes it having fear of extinction.
- Pollution – as developing era, pollution is the part and parcel of development. Soil pollution, noise pollution, water pollution, air pollution can also decreases the productivity of plants. this can leads to sterilization of seeds. Hence, line of propagation affected and species can be extinct.
- Negligence- huge negligence about ancient knowledge of *Ayurveda* is also the reason of many species to be extinct. Lack of awareness about plants, their extremely useful

preparations, importance in treatment, long term effects of shortage of specific species are plays key role in negligence. Many species face extinction due to negligence.

- Invention of other medicinal branches - due to repeated attacks of enemies, medicinal science in India always had threat of extinction. Rulers introduced their own line of treatment which is very much different than ours. For example- Mughals introduced Unani stream, Chinese medicines were introduced by continuous attacks by Chinese rulers, British introduced English medicines, intervention between eastern world and western countries introduced modern medicines cause huge loss and negligence to rare species.
- Chemical fertilizers – in recent decades, use of chemical fertilizers is reaching at its peak. Many plants can't survive to this new addition in soil. Their potency and germination rate affected by this. Hence many species vanished due to use of chemical fertilizers.
- Increase in demand- now a day more and more people are attracted towards *Ayurvedic* treatment due to its high success rate and authentic way. This increases the demand of *Ayurvedic* plant species worldwide. Some *Ayurvedic* plant species are already rare. Increase in demand can lead to its smuggling without making sure its preservation.

All this factors affects the plant growth and their natural propagation results into the reduction of number. This leads to species to be endangered.

Tissue culture-^{[6][7][8]}

Tissue culture is an alternative method of propagation and widely used for commercial propagation on large scale. Plant tissue culture is maintenance and propagation of plant parts, as small as single cell in axenic under controlled environment condition. The regeneration of whole plant depends upon 2 concepts: that all plant cells given the correct stimuli, can express the total genetic potential of the parent plant. This maintenance of genetic potential is called *totipotency*.

On the other hand, ability to initiate cell division from almost any tissue of the plant and to regenerate lost organs or undergo different development pathways in response to particular stimuli is plasticity. In vitro condition and stimuli required to manifest plant can be extremely difficult for woody plant species as compared to herbaceous plant species. It is largely empirical process hence, herbaceous plant tissue culture is much easier and simple to perform.

In this process, plant tissue and organs are grown in vitro on artificial media, under aseptic and controlled environment. The techniques depend mainly on the concept which states, ability of single cell to express full genome by cell division. Along with the totipotent potential of plant cell, the capacity of cell to alter their metabolism, growth and

development is equally important and crucial to regenerate entire plant.

Plant tissue culture medium contains all nutrients required for the normal growth and development of plants. It is mainly composed of macronutrients, micronutrients, vitamins, other organic components, plant growth regulators, carbon source and some gelling agent (in case of solid medium).

Types of Plant Tissue Culture:-

- ❖ Primary PTC – it is the process where cells are removed from plant and introduced in to artificial environment with favorable conditions for growth. It contains cells directly from host plant.
- ❖ Secondary PTC – it is the process where previously cultured cell from primary tissue culture medium.

Methods of PTC :-^{[9][10]}

- Single cell culture- it is a method of growing isolated single cell from host plant
- Embryo culture – it is used to grow embryo from seeds and ovules in nutrient medium
- Organ culture – the organs or plant parts culturing in an artificial media or a culture from isolated medium.
- Shoot culture- culture from terminal portion of shoot comprising meristem together with developing leaves and adjacent stem tissue
- Callus culture- culture of dedifferentiated plant cell induced on media usually containing relatively auxin concentration in vitro.

Scope of plant tissue culture in preservation of endangered species

- A plant breeder may use tissue culture to screen cells rather than plants for advantageous characters, e.g. herbicide resistance/tolerance.
- Large-scale growth of plant cells in liquid culture in bioreactors for production of valuable compounds, like plant-derived secondary metabolites and recombinant proteins used as biopharmaceuticals.
- To rapidly study the molecular basis for physiological, biochemical, and reproductive mechanisms in plants, for example in vitro selection for stress tolerant plants.
- As a tissue for transformation, followed by either short-term testing of genetic constructs or regeneration of plants.
- Production of identical sterile hybrid species can be obtained.
- Large scale production of artificial seeds through somatic embryogenesis.

Discussion

With the help of all or one of tissue culture techniques, it is easy to grow entire plant which is replica of parent plant. Many endangered and rare species can be preserved with the help of tissue culture method to ensure their long term used in *Ayurvedic* medicines. All the external as well as internal characteristics of plants can be expressed through single cell. Also, some genetic changes can be done to extend fertility and survival rate of plant. This can minimize the substitution and adulteration of

important plant which also conserves the quality and effectivity of medicinal preparations. Modern intervention can be used to preserve ancient knowledge of *Ayurveda*.

CONCLUSION

Tissue culture can be used for endangered species for preservation of species and maintenance of their valuable medicinal properties. It can be achieved by proper development of tissue culture technique for each plant separately.

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