

PLANT TISSUE CULTURE IN HERBAL MEDICINAL PLANTS– REVIEW***Dr. Vitthal B. Washimkar (PG Scholar.) and Dr. M. B. Shende(Guide & Asso. Prof.)**

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ABSTRACT

Medicinal plants are the most important source of life saving drugs for the majority of the world's population. In India, herbal medicine has been the basis of treatment for various diseases and physiological condition in traditional system such as Ayurveda, Unani and Siddha. The goal of "Health For All" by WHO can't be achieved without herbal medicine. Approximately 90% of the ingredient used in Ayurveda, Unani, Siddha and Homeopathy medicine are plant based over in Modern Allopathic medical system has 25% of its formulation from herbal medicine. Due to record of safety and efficacy the demand of herbal medicine is increasing abundantly in society. Because of this there is excess use of common as well as endangered medicinal plants and also the substitute of herbal medicinal plants. Hence, there is need to provide alternate methods to propagate, cultivate and conserve the important medicinal plant and also to maintain the balance of eco-system. To cope up with alarming situation the development in bio-technology has come as a boon. One of them is plant tissue culture technique. In recent years tissue culture has emerged as a promising technique to obtained genetically pure elite population under in-vitro condition rather than have different population. So, attempts should be made to apply the techniques of plant tissue culture in herbal medicinal plants.

KEYWORDS: Endangered, Medicinal Plants, Herbal, Plant Tissue culture.**INTRODUCTION**

Plants have been an important source of food. Fiber and medicine for thousands of years and still continue to be so.^[1] Even today the world health organization estimates that upto 50% of people still rely mainly on traditional remedies such as herbs for their medicine and in India 65% of the population in the rural area used traditional form of medicine to meet their primary health needs.^[2]

In view of tremendously growing world population increasing anthropogenic activities rapidly eroding natural eco-system etc. the natural habitat for a great number of herbs and trees are dwelling. Many of them are facing of extension. According to the need list of threatened species 44 plant species are critically endangered, 113 endangered and 87 vulnerable (IUCN 2000).^[3]

The massive demand of medicinal plants is depicting quite fast due to use of forest land in other purpose and over exploitation and unscientific collection of flora of medicinal and aromatic plants.^[2]

To cope up this situation, among all plant tissue culture is the promising technique. PTC is a practice used to propagate plants under sterile condition often to produce clones of plants.^[4]

Most of medicinal plants either do not produce seeds or seeds are too small and do not germinate in soil. Thus

mass multiplication of disease free planting material is a general problem. In this regard the micro propagation holds significant promises for true to type, rapid and mass multiplication under disease free condition.^[1,3]

AIMS AND OBJECTIVES

The study is carried out with an aim to review the recent study carried out on plant tissue culture In Herbal Medicinal Plants.

MATERIAL AND METHODS

This study is carried out by critical reviews. Searching various medical database like PubMed, Google scholar, Dhara, Google Search, etc. related to plant tissue culture in Herbal medicinal plant, endangered medicinal plants.

Plant Tissue Culture

It is a practice used to propagate plants under sterile condition often to produce clones of plants. It is the in-vitro aseptic culture of cells, tissue, organs or whole plants under controlled nutritional and environmental condition Often to produce clones of plants.^[4]

This is being widely used for large scale of plants multiplication. Apart from their use as a tool of research, PTC technique have in recent years because of major industrial importance in the area of plant propagation, disease elimination, plant improvement and production of secondary metabolite.^[4]

History of PTC^[4]

- 1838 - Schleiden and Schwann proposed that 'cell' basic structural unit of all living organism.
- 1902 - Haberlandt proposed concept of in-vitro cell culture.
- 1922 - Kalte and Robbins successfully cultured root and stem tips respectively.
- 1926 - Went discovered 1st plant growth hormone Indole acetic acid.
- 1941 - Overbeck was 1st to add coconut milk for cell division in Dhatura.
- 1955 - Skoog and Miller – Keratin – as a cell division hormone.
- 1960 - Kanta and Maheshwari developed test tube fertilization technique.

Basic Concept of PTC

In plant cell culture, plant tissue organs are grown in-vitro and artificial media under aseptic and controlled environment. The technique depends mainly on the concepts of totipotentiality of plant cells which refers to the ability of a single cell to express the full genome by cell division.

Along with the totipotent potential of plant cell. The capacity of plant cells to alter their metabolism, growth and development is also equally important and crucial to regenerate the entire plant. Plant tissue culture medium contains all the entire nutrient required for the normal growth and development of plants. Murashige and Skoog(MS) medium is most extensively used for the vegetative propagation. The pH media is also important that affects both the growth of plants and activity of plant growth regulators. It is adjusted between 5.4 - 5.8. Both solid and liquid media are used for cultures. Plant growth regulator (PGR's) plays an essential role in determining the development pathway of plant cell and tissue culture medium. The Auxins, Cytokinin and Gibberlins are the most commonly used plant growth regulators.

Amount of auxins and cytokinin determines the type of culture established or regenerated. The high concentration of auxins generally favours root formation whereas the high concentration of cytokinin promotes shoot regeneration. A balance of both auxin and cytokinin leads to the development of mass of undifferentiated cells known as Callus. (5)

Technique of Plant Tissue Culture^[4]**1) Micro-propagation**

In start with selection of plant tissue (explant) from a healthy, vigorous mother plant. Any part of the plant (leaf, root etc.) can be used as explants. The stages involves are:

a) Stage 0 – Preparation of donor plant

Any plant tissue can be introduced in-vitro. To enhance the probability of success, the mother plant should be ex-vitro cultivated under optimal condition to minimize contamination in the in-vitro culture.

b) Stage I – Initiation Stage

In this an explants is surface sterilized and transferred into nutrient medium generally. The conserved application and bactericide and fungicide products is suggested. The selection of products depends on type of explants to be introduced. Surface sterilization is used to remove contaminants with minimal damage to plant cells.

c) Stage II – Multiplication Stage

The aim of this phase is to increase the number of propagules. The number of propagules is multiplied by repeated sub cultures until the desired (or planned) number of plant is attained.

d) Stage III – Rooting Stage

The rooting stage may occur simultaneously in the same culture media used for multiplication of the explants. However, in some cases it is necessary to change media, including nutritional modification and growth regulator composition to induce rooting and the development of stage root growth.

e) Stage IV – Acclimatization Stage

In this stage, the in-vitro plants are weaned and hardened. Hardening is done gradually from high to low humidity and from low light intensity to high light intensity. The plants are then transferred to an appropriate substrate (Sand, peat, etc.) and gradually hardened under green house.

2) Somatic Embryogenesis and Organogenesis^[4]**• Somatic embryogenesis**

It is an in-vitro method of plant regeneration widely used as an important biotechnological tool for sustained clonal propagation. It is a process by which somatic cells / tissue develop into differentiated embryos. These somatic embryos can develop into whole plants without undergoing the process of sexual fertilization as done by zygotic embryos. The somatic embryogenesis can be initiated directly from the explants or indirectly by the establishment of mass of organized cells named callus.

• Organogenesis

It refers to the production of plant organs i.e. roots, shoot and leaves that may arise directly from the meristem or indirectly from the undifferentiated cell masses (callus).

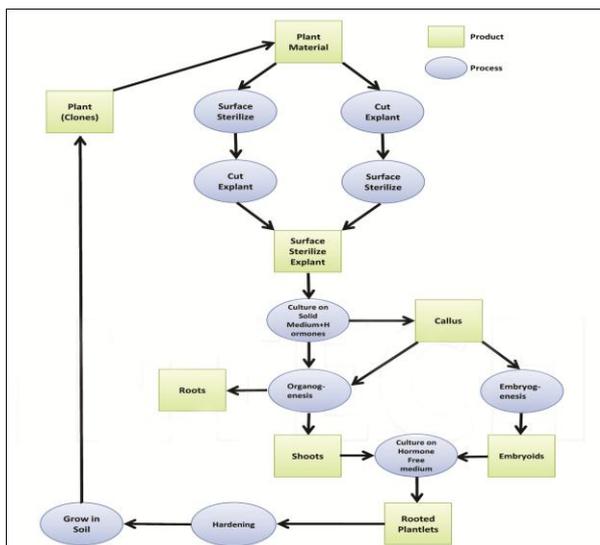


Fig. Flow chart summarizing tissue culture experiments.

Importance of Medicinal Plants^[5]

India has 2.4% world's area with 8% of global biodiversity and it is one of the 12th mega-diversity hot spot countries of the world's with rich diversity of biotic resources. Out of 34 hot spot India has two major hotspots the Eastern Himalayas and Western Ghats.

India is also rich in medicinal plant diversity with all the three levels of biodiversity such as species diversity, genetic diversity and habitat diversity. Across the country, the forest is estimated to harbor 90% of India's total medicinal plants diversity. Only about 10% of the known medicinal plants of India are restricted to non-forest habitat. It is estimated that in India 75,000 species of medicinal plants are present as compared to other countries.

Uses of Important medicinal plants of India^[5]

Name	Family	Common Name	Uses
Aegle marmelos	Rutaceae	Bel tree	Diarrhea, dysentery, malaria, fever, jaundice.
Acorus calamus	Araceae	Sweet flag, Bach	Anti-spasmodic, anti-helminthic properties also used for treatment of epilepsy, mental ailment, diarrhea, dysentery.
Celestrus paniculatus	Celestraceae	Malkangani	Memory booster, depression, paralysis.
Chomifora mukul	Burseraceae	Guggulu	Astriagent, expectorant, strong purifying and rejuvenating property and uterine stimulant.
Bacopa moneria	Scrophulariaceae	Brahmi	Mental function logativity, disease fatigue and depression, energise the CNS.
Glycerrhiza glabra	Fabaceae	Lycorus	Ulcer, anti-spasmodic, asthma, cough.

List of Medicinal Plants in-vitro culture^[3,5]

Sr.	Species Name	Explants	Ref.
1	Aegle marmelos	Nodal segment, shoot tip	Yadav & Singh, 2011
2	Acorus calamus	Rhizome tip & Rhizome segment	Yadav et.al., 2011
3	Celestrus paniculatus	Nodal segment	Sood & Choulin, 2009
4	Gymneme Sylvestre	Seed	Konalavalli & Rao, 2000.
5	Glycerrhiza glabra	Nodal segment	Vadodaria et.al., 2007
6	Tinospora cardifolia	Nodal segment	Gururaj et.al., 2007

WHO has estimated that the present demand for medicinal plant is approximately US \$14 billion/year. The demand for medicinal plants based raw material is growing at the rate 15 – 25% annually, and according to an estimate of WHO, the demand of 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 \$ 4 billion/year.

A total of 560 plants 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.

IUCN has recognized the following categories: Extinct, Extinct in wild, critically endangered, endangered, vulnerable, near threatened, least concern, data deficient and not evaluated.

In India many of species has facing extinction. In the past few decades, there has been an ever increasing global inclination towards herbal medicine, followed by belated growth in international awareness about the dwindling supply of the world's medicinal plants.

The genetic diversity of medicinal plants in the world is getting endangered at an alarming rate because of ruinous harvesting practices and over harvesting for production of medicine with little or no regard of future. Some of these endangered medicinal plants are Saussurea lappa, Aegle marmelos, Acorus calamus, Celestrus paniculatus, Chomifora mukul, Bacopa moneria, Glycerrhiza glabra, Picrorrhiza kurro, Rawalfia serpentina.

CONCLUSION

- The safety and affordable remedies in traditional health system has attracted the interest of people worldwide.
- The over exploration or use of forest land for the purpose of wealth of medicinal flora from the wild causing long term negative impact an environment and availability of certain important or commonly used medicinal plants.
- PTC is considered to be the best efficient technology for production of somaclonal and gametoclinal variants.
- This technology has a vast potential to produce plants of superior quality, high yielding with better disc resistance and enriched with active ingredients of plants.
- Because of this technique we are able to stop estimation of important medicinal plant and also we can maintain the eco-balance of endangered, substituent and commonly used important medicinal plants.

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