Concept of Plant Tissue Culture in Ancient Science W.S.R Vriksha- Ayurveda

Mridula Chaturvedi¹ & Abhishek Kumar Chaturvedi²

¹Master of Science, Department of Biotechnology, V.B.S. Purvanchal University, Jaunpur, Uttar Pradesh-222002., ²Medical Officer (Ay.), CGHS Wellness Centre, North Avenue, Ministry of Health & Family Welfare, New Delhi-110001.

Abstract

Background: Plant tissue culture is a compilation of method used to maintain or grow plant cells, tissues or organs under sterile conditions on a nutrient culture medium of known composition. Plant tissue culture is widely used to produce clones of a plant in a method known as propagation. It comes under Plant biotechnology which is derived from a fusion of biology of plant and technology. Aim of study: Due to over abuse of traditional medicinal plants, environment unfriendly yielding and loss of growth habitat, the genetic biodiversity of traditional medicinal plants is under a continuous threat of extinction. So tissue culture is a best way to conserve the medicinal plant and also the mass production of the medicinal plants. Material & methods: The study material of present article is collected from various text books, thesis, research papers and Wikipedia of the internet. Conclusion: In the most authentic form of traditional medicine in AYUSH system, Vriksha Ayurveda is one of the best forms and have huge concept in every field for the plants. New technologies developed for the conservation of medicinal plants in the form of tissue culture is now necessary to prevent their extinction from the earth.

Key words: Vriksha Ayurveda, Tissue culture, Plant, Biotechnology etc.

Introduction:

In India, the medicinal plants used in AYUSH system of medicine since long years ago which includes mainly Ayurveda and Unani system. One of the authentic books of medicine i.e. Ayurveda consist of single plants, formulary of plants and their medicinal and spiritual uses. It is a system of medicinal uses about 700 species, Unani 700 and, modern medicine around 30 species¹ (Jawla et al., 2009). Plants have always been a universal source of medicament either in the form of established preparations or pure active principles. The history of herbal medicine is as old as human civilization (Devgun et al., 2009). According to an all India ethno biological survey carried out by the Ministry of Environment & Forest, Government of India, there are over 8000 species of plants being used by the people of India. While the demand for medicinal plants is growing, some of them are increasing being threatened in their natural habitat. (Sharma et al., 2010).

Now a day’s, The Foreign countries also showing curiosity in taking treatment by AYUSH system of medicine, due to this it has become necessary to concentrate on our traditional Ayurvedic and Unani system of therapy (Harilal, 2009). The medicinal value of natural and allopathic drug is due to the presence of certain active substance such as alkaloids, steroids, flavonoids, glycosides, resins, volatile oils, gums, tannins and saponin etc. The active principles of the plants drugs are commonly more concentrated in storage organs of the plant such as bark, root, seeds and leaves etc. due to higher demand of this natural form of drugs, excessive exploitation of the medicinal plants is now done. Thus to overcome the ruthless exploitation of plants, there is a great need for use of modern advanced technologies.

Advanced biotechnological methods of culturing plant cells and tissue should provide new means of conserving and rapidly propagating valuable, rare and endangered medicinal plants (Nalawade et al., 2003). Plant cell suspension and immobilized cells are being utilized for large scale production of valuable medicinal compound in vitro. Plant tissue culture is an alternative method of propagation (George and Sherrington, 1984) and is being used widely for the commercial propagation of a large number of plant species (Rout et al. 2000).

Plant tissue culture
The term tissue culture is commonly used in a very wide sense to include in-vitro culture of plant cells, tissues as well as organs. But in a strict sense, tissue culture denotes the in-vitro cultivation of the plant cells in an unorganized mass e.g., Callus culture. Another term, cell culture is used for in-vitro culture of single or relatively small groups of
plants cells, e.g., suspension culture. But in general, the word tissue culture is applied to both callus and suspension culture and cell culture is often used for callus culture as well. When organized structures like root tips, shoot tips, embryos etc, are cultured in-vitro to obtain development as organized structures. This is called organ culture.

**Historical background**

The science of plant tissue culture takes its roots from the discovery of cell followed by propounding of cell theory. In 1838, Schleiden and Schwann proposed that cell is the basic structural unit of all living organisms. They visualized that cell is capable of autonomy and therefore it should be possible for each cell if given an environment to regenerate into whole plant. Based on this premise, in 1902, a German physiologist, Gottlieb Haberlandt for the first time attempted to culture isolated single palisade cells from leaves in knop’s salt solution enriched with sucrose. The cells remained alive for up to one month, increased in size, accumulated starch but failed to divide. Though he was unsuccessful but laid down the foundation of tissue culture technology for which he is regarded as the father of plant tissue culture. White in 1934 cultured asexetically the excised roots of tomato. For the first time Gautheret (1934) reported extensive work on the tree species (woody trees). He cultured cambial tissue of *Ulmus campestris* and obtained adventitious buds. Further studies led to independent demonstration by Gautheret (1939), Nobecourt (1939) and White (1939) that the cells in culture, can be made to proliferate continuously which can undergo differentiation. Mathes (1964) was probably the first researcher to achieve growth of both shoots and roots in callus culture of *Populus tremuloides*. During 1960s a new era began and new approaches were tried such as the eradication of virus through meristem culture (Morel and Martin, 1952), culture of single cells and establishment of cell suspension culture (Muir _et al_., 1954), the auxin cytokinin basis of organogenesis (Skog and Miller, 1957), somatic embryogenesis (Reinert,1958), production of protoplast (Cocking, 1960), another culture (Guha & Maheshwari, 1964), regeneration of plants from single cell and DNA uptake by plant cells.

**Concept of plant tissue culture in Ayurveda:**

According to the World Health Organization (WHO), approximately 80% of the world’s population currently uses herbal medicines directly as teas, decocts or extracts with easily accessible liquids such as water, milk, or alcohol (Farnsworth, 1990). India has probably the oldest, richest and most diverse culture traditions in the use of medicinal plants (Veda _et al_., 2001). Ayurveda, the oldest medicinal system in the Indian subcontinent, has alone reported approximately 2000 medicinal plant species, followed by the Siddha and Unani medicinal systems. The Charak Samhita, an age-old written document on herbal therapy, reports on the production of 340 herbal drugs for curing various diseases (Prajapati _et al_., 2003). A glimpse on the concept of plant tissue culture in the ancient system of medicine is described as...

1. Various types of medicinal plants and their religious uses were first described in Veda’s especially in Atharvaveda in 2000 BC.
2. The Book Krishiparashram in 1300 BC was written by Acharya Parashara which based on the seeds, weeds and agriculture, in which various methods of Krishi were described.
3. Acharya Parasara wrote another book and mentioned 14 types of forest, characteristics of plants and their medicinal uses.
4. In 10th century, Acharya Surupala written a very authentic book on the plant and named as Vriksha Ayurveda.

**Vriksha Ayurveda:**

Once upon a time, from the Vedic time up to the medieval period, along with Ayurveda, its sister branches were also on flourish. For example: Mrga/Asha Chikitsa by Shalihotra (4th BC), Ashwa Chikitsa by Nakula, Gajayurveda by Ramapada etc. in the same time, Vriksha Ayurveda was also in main stream.

The references of Vrikshayurveda, the life science of plants are available in different classics. Among them, Vrikshayurveda by Sarangdhara, Brhat samhita, Mahabharata (Shanti Parva), Agni Purana, Arthashastra, Amara Kosh (Vannoushadhi varga), Upavana Vinoda, Brhat Jataka, Iyotishbyarnava, Grahavasteu darpana etc are main references books for Vrikshayurveda, along with the books of Ayurveda.

Vrikshayurveda mainly deals with various species of trees, their healthy growth & productivity. The text mentions about 170 species of plants, including herbs shrubs & trees. There are 325 systematically arranged verses, beginning with the salutation of lord Ganesha, followed by glorification of trees, composition on tree planting & production. Special references are made to Procuring, preserving treatment of seeds & plant materials. Seed treatment, prior to sowing, to ensure successful & vigorous germination were given lot of importance.
The test Vrikshayurveda written by Sharangadhara contains 12 chapters.

2. Beejotpathi Vidhi – About classification and preservation of the seeds.
3. Paada Vivaksha – About morphology and physiology of plants.
4. Ropana Vidhi – Location of different types of plants like Vriksha, Gulma, Late etc.
5. Nishechana Vidhi – About irrigations and preparation of special organic manure 
   ‘Kunapa Jala’

**Kunapa Jala:** The flesh of deer, insects, fish, sheep, goats etc. with portions which have plenty of marrow, fat and lard; mix up the whole mass, put it in a pot and boil well with water and mix the powder of Tila seeds and black gram. Then add milk and honey and some hot water. Place the whole thing in the sun or in hot places for a fort night. The liquid manure thus prepared is called as ‘Kunapa Jala’ which makes the plants grows plumpy.

**Examples for preparing special manures:**

1. Mixture of Vidanga, Rice, Fish to be ground with cow dung and cow’s urine. This is to be applied to the roots of plants accompanied by free watering for 7 days. This will yield fruits and flowers in abundance.
3. Boiling water with Barley, Green gram Tila Seeds, Black gram and Horse gram.
4. Mixture of common salt, bone meal, paddy husk and sand to be buried around the coconut trees.
5. Night soil (Human faecal matter) is to be applied for Arecanut trees in rainy season.

### Concept of Plant protection in Ayurveda

1. Poshana Vidhi – Protecting the plants
2. Druma Raksha – About harvesting and protecting the plants.

5. Nivasasanna Taru Shubhashubha Lakshana – Direction for planting near the houses.
6. Taru Mahima – About importance of plants.

**Chitree Karana** – Explains about magical feets to change the habit, colour, smell of flowers and to change the flowering seasons

a. The seeds of Utpala are soakes in Ankola oil and then put into water. They will spontaneously and surprisingly grow into creepers.

b. Kumuda root soaked in buffalo dung and urine 7 times and then planted. It quickly turns into a creeper.

The chapter on horticulture wonders for obtaining dwarf varieties of trees, it is necessary to slit open & burn the portion of the trunk slightly.

The most noteworthy fact in Vrikshayurveda is that it applies the Tridhatu theory of Ayurveda (the science of life) to plants. Kapha, Pitta and Vata are considered as the basic components of the plants, too, as of humans and the theory that a balance of the three indicates health and imbalance caused due to variation of anyone or more of them indicate disease is extended to plants too, justifying its title Vrikshayurveda. Even the treatment material prescribed in many cases is the same or similar to that of humans. Surupala, generally considered plants as equal and in some respect even superior to humans as stated above. But in this he treats them specifically equal to humans.

### Techniques of plant tissue culture in modern science^5:

1. **Micro propagation:** Micro propagation is the practice of rapidly multiplying stock plant material to produce a large number of progeny plants, using modern plant tissue culture method. The main advantage of micro propagation is that this technique is alternative method of vegetative propagation and is applied with the objectives of enhancing the rate of multiplication. The objective of plant propagation via tissue culture, termed micro propagation, is to propagate plants in large number acquiring less space and that too rapidly.

2. **Somatic cell genetics** - Contribution of in vitro methods to plant breeding i.e. somatic cell genetics is most significant,
most in terms of haploid production and somatic hybridization.

3. **Transgenic plants** - The plants, in which a functional foreign gene has been incorporated by any biotechnological methods that generally not present in plant, are called transgenic plants. The methods used in gene transfer are electrorotation, particle bombardment, microinjection, and Agrobacterium-mediated gene transfer, virus-mediated transformation, pollen-mediated transformation, leaf-disc transformation method. One of the successful approaches has been to engineer resistance, against insects, virus and other pathogens as well as herbicides.

4. **Morphogenesis in cell and tissue culture** - Plant cell and tissue culture system has been recognized as a powerful tool for the study of the process and control of developmental pathways, including cell differentiation and morphogenesis. The process of morphogenesis is regulated by many factors like culture media, culture conditions, type of explants; hormones have been recognized as modulators of plant growth and development. Propagation of plant cell requires both cytokinin and auxin. The importance of these two hormones, auxin and cytokinin in promoting the development of shoots and roots from undifferentiated cells was first demonstrated with cultured tobacco callus cells.

**Conclusion:** In Vrikshayurveda, there are explanations about the presence of sense organs in plants, selection and location of plants, special preparation of seed and seed bed, cross grafting, methods of Sericulture etc. There are some interesting explanations like tap letting treatment like bloodletting treatment in humans.

Some of the olden day beliefs are now being confirmed by scientists. For example, the Ashwatha tree releases more oxygen. This may be the reason for worshipping and doing Pradakshina around this tree by our ancestors. Some of the beliefs may be proved in the future.

Now, need of the day is to have a thorough literary and experimental researches about these sciences and the useful information’s are to be filtered from the junk. This information is to be utilized and incorporated by the departments of Dravyaguna, Botany, Forest, Agriculture and Environment in a joint venture for the benefit of the mankind. This work is to be completed in hurry before any multinational company or foreign countries patent them.

**References:**

2. [https://en.wikipedia.org/wiki/Plant_tissue_culture](https://en.wikipedia.org/wiki/Plant_tissue_culture)