

# An introduction to Plant Tissue Culture

PREPARED BY

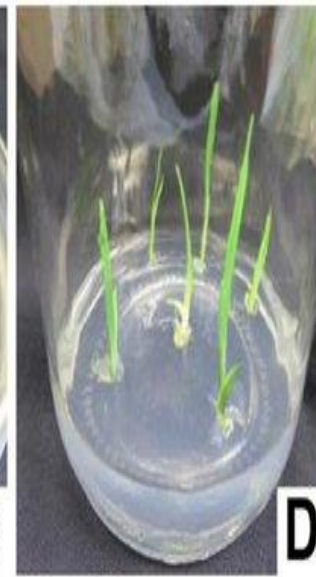
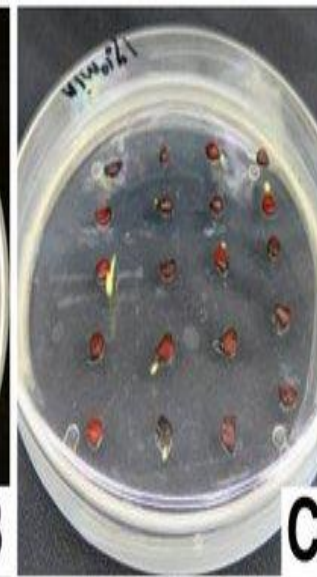
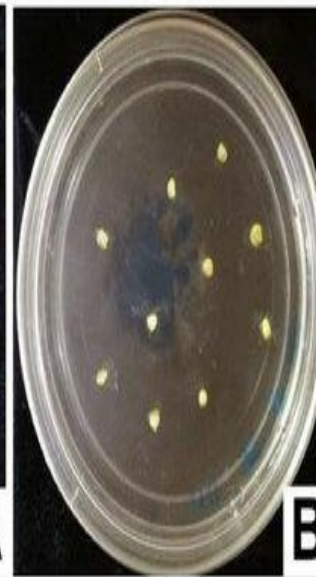
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# PLANT TISSUE CULTURE



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- ▶ Plant tissue culture is a collection of techniques used to maintain or grow plant cells, tissue or organs under sterile conditions on a nutrient culture medium (E.g., **Murashige and Skoog medium (MS)**, **Linsmaier and Skoog medium (LS)**) of known composition. Plant tissue culture is widely used to produce clones of a plant in a method known as Micropropagation

# History of plant tissue culture

Years	Scientists	Work
1838	Schleiden & Schwann	Cell Theory
1902	Haberlandt	Totipotency (first attempt to in vitro culture)
1904	Hanning	Nearly mature zygotic embryo developed into a plant in vitro
1925	Laibach	Development of inter-specific embryo in vitro
1948	Skoog	Kinetin could induce organogenesis in tobacco callus
1957	Skoog & Miller	Effect of hormone interaction in vitro
1962	Murashige & Skoog	MS medium formulation
1966	Guha & Maheswary	Haploid plants from anthers

# Application of plant tissue culture

## ▶ **Disease elimination from unhealthy plants**

- Meristem culture to establish healthy stock after viral, fungal or bacterial infection

## ▶ **Transport and quarantine inspection**

- Low volume & ease observation

## ▶ **Germplasm Storage**

- Ease of manipulation & miniaturized plant organs convenient for preservation of live genetic resources

## ▶ **Genetic improvement**

- Biotech approaches to genetic modification and the creation of novel variation

## ▶ **Micropropagation**

- Rapid multiplication of clean, clonal stock

# Advantages of plant tissue culture

- ▶ The production of exact copies of plants that produce particularly good flowers, fruits.
- ▶ To quickly produce mature plants.
- ▶ The production of multiples of plants in the absence of seeds
- ▶ The regeneration of whole plants from plant cells that have been genetically modified
- ▶ The production of plants from seeds that otherwise have very low chance of germinating and growing eg. orchids and *Nepenthes*

# Disadvantages of plant tissue culture

- ▶ Tissue Culture can require more labor and cost more money.
- ▶ There is a chance that the propagated plants will be less resilient to disease due to the type of environment they are grown in.
- ▶ While the success rate is high if the correct procedures are followed, success with the tissue culture is not a guarantee. There is still a chance that the process triggers a secondary metabolic chemical reaction, and the new explants or cells' growth gets stunted, or even die off.

# Explant

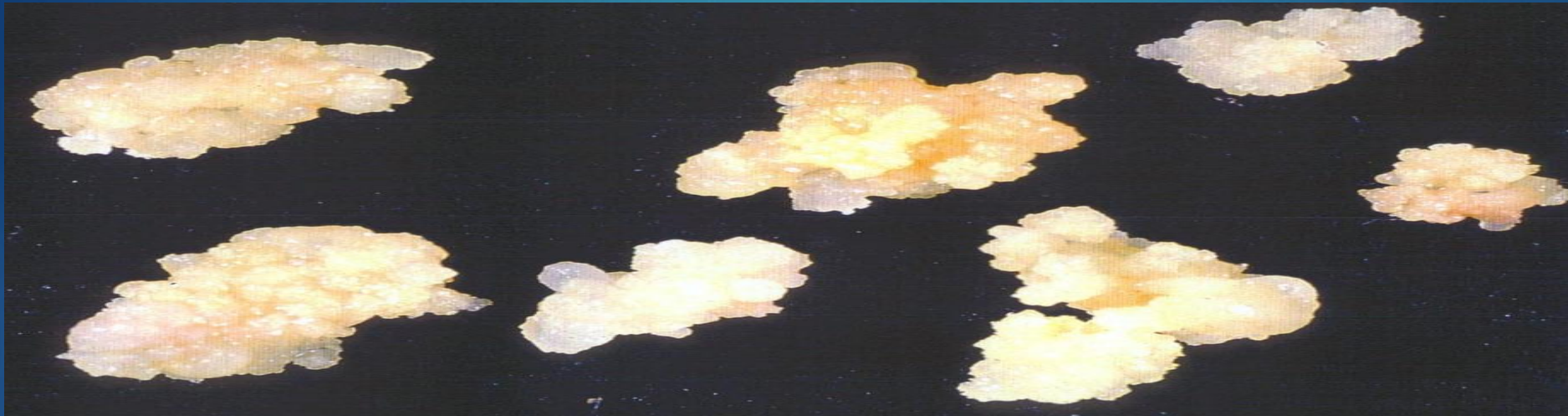
- ▶ An explant is a piece of tissue used to initiate a tissue culture.
- ▶ There are examples of almost every part of the plant being used as explants. The most commonly used explants for Micropropagation include stem and leaf sections.
- ▶ However, flower parts, roots and seed tissue have all been used.





# Methods of Plant Tissue Culture

- ▶ **Based on invitro method**
  - Callus culture & Suspension Culture



- ▶ Type of Explant
  - Single cell Culture, Shoot and Root Culture, Somatic embryo culture, Meristem culture Anther culture and Haploid culture, Protoplast culture and Somatic hybridization, Embryo culture ,Ovule culture Ovary culture etc.

# Environmental conditions

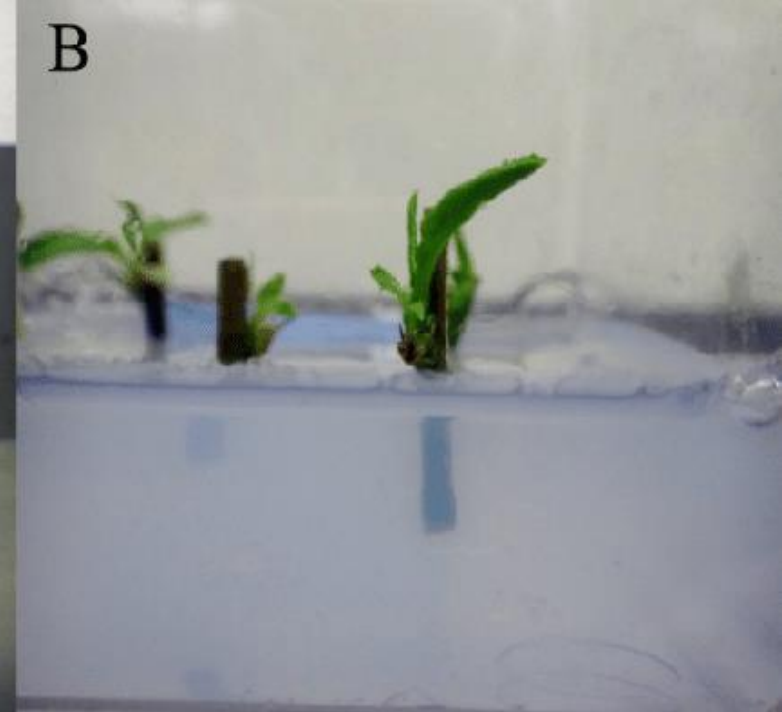
- ▶ There are 3 important aspects of invitro culture
  - Nutrient Medium
  - Aseptic Condition
  - Aeration of the tissue

# Nutrient Medium

- ▶ Medium depends upon the type of plant tissue or cell used for culture
- ▶ Generally nutrient consist of
  - A carbon source (usually sucrose)
  - A nitrogen source (**Nitrate and ammonium** are usually employed in plant tissue culture.)
  - Inorganic salts ( both micro & macro elements)
  - Vitamins (eg. Nicotinic acids( niacin), Thiamine, Pyridoxine(Vit. B6) and myo-inositol )
  - Amino acids( **casein hydrolysate, L-glutamine, L-asparagine and adenine** )
  - Growth Regulators (eg. Auxins)
- ▶ An optimum pH(**5.2 to 5.8**) are required for optimum growth of explant.

# Aseptic condition

- ▶ Asepsis or aseptic means **the absence of germs**, such as bacteria, viruses, and other microorganisms that can cause disease.
- Tissue culture should be done in completely aseptic condition.
- Care should be taken so that the tissues, equipment, culture media and the room should be completely free from microorganisms.
- For sterilization of plant materials, glass equipment, other instruments, culture media etc. several methods are used. These are dry heat, wet heat, ultrafiltration
- Wet heat sterilization is done in an autoclave at 120°C at 15 lb pressure for 15 minutes.



# Aeration of the Tissue

- ▶ Proper aeration of the cultured tissue is also an important aspect of culture technique
- ▶ It is achieved by occasionally stirring the medium by stirring or by automatic shaker





THANK YOU

