CHRISTIAN EMINENT COLLEGE, INDORE

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E-Content

On

Somatic Embryogenesis

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Prepared By Dr Pramod Kr Singh

Department of Bioscience

Topic –Somatic Embryogenesis

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Introduction-Somatic embryogenesis is an artificial process in which a plant or embryo is derived from a single somatic cell Somatic embryos are formed from plant cells that are not normally involved in the development of embryos, i.e. ordinary plant tissue. No endosperm or seed coat is formed around a somatic embryo.

Cells derived from competent source tissue are cultured to form an undifferentiated mass of cells called a callus. Plant growth regulators in the tissue culture medium can be manipulated to induce callus formation and subsequently changed to induce embryos to form the callus. The ratio of different plant growth regulators required to induce callus or embryo formation varies with the type of plant. Somatic embryos are mainly produced *in vitro* and for laboratory purposes, using either solid or liquid nutrient media which contain plant growth regulators (PGR's). The main PGRs used are auxin but can contain cytokinin in a smaller amount. Shoots and roots are monopolar while somatic embryos are bipolar, allowing them to form a whole plant without culturing on multiple media types. Somatic embryogenesis has served as a model to understand the physiological and biochemical events that occur during plant developmental processes as well as a component to biotechnological advancement. The first documentation of somatic embryogenesis was by Steward et al. in 1958 and Reinert in 1959 with carrot cell suspension culture

Somatic Embroyogenisis-Somatic embryogenesis is the process in which a single cell or a small group of cells follow a developmental pathway that leads to reproducible regeneration of non-zygotic embryos which are capable of producing a complete plant. These non-zygotic embryos may originate directly from other organs or parthenogenetic embryos (without fertilization) or androgenetic embryos (from the male gametophyte).

In general somatic embryos are those which are formed from the somatic tissue in cultural i.e., in vitro condition. Embryos formed in cultures have been variously designated as accessory embryos, adventive embryos, embryoids and supernumerary embryos.

Types

1. Direct Embryogenesis:

The embryos initiate directly from the explant without callus formation and here some cells which are called as 'Pre-embryonic determined cells' (PEDC) initiates embryonic development, only those cells need to be released. Such cells are found mostly in embryonic tissues, certain tissues of young in vitro grown plants, hypocotyl, nucellus, embryo-sac, etc.

2. Indirect Embryogenesis:

Here, the embryos are developed through cell proliferation i.e., callus formation. The cells from which embryos arise are called as 'Induced embryogenic determined cells' (IEDC). Here growth regulators with specific cultural conditions are required for initiation of callus and then redetermination of those cells into the embryo development Somatic embryos arise from single cells located within clusters of meristematic cells either in callus mass or in suspension. Such cells develop into pro-embryos with polarity following a pattern that tends to mimic the general pattern associated with the development of in vivo embryos in the ovule. Pro-embryo initials may be single cells or multicellular groups. When the conditions are suitable these embryos germinate to produce plantlets.

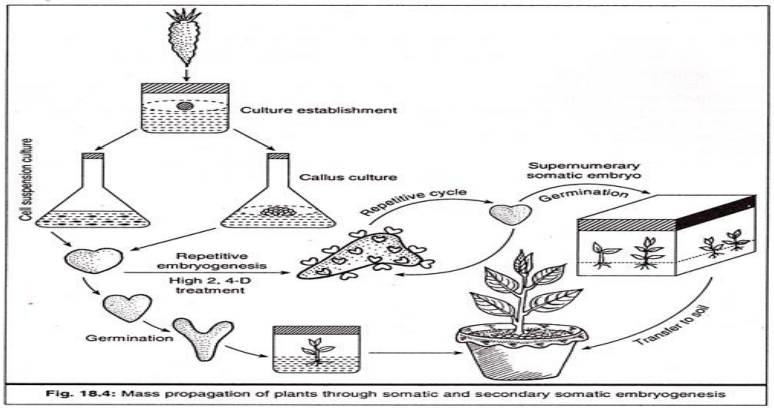

Fig. 18.4: Mass propagation of plants through somatic and secondary somatic embryogenesis

Stages of Somatic Embroyogenesis

Plant regeneration via somatic embryogenesis occurs in Five Stages:

1 Initiation of embryogenic cultures

2 Proliferation of embryogenic cultures,

3 Prematuration of somatic embryos,

4 Maturation of somatic embryos

5 Plant Develpoment

plant development on nonspecific media. Initiation and proliferation occur on a medium rich in auxin, which induces differentiation of localized merismetic cell The auxin typically used is 2,4-D. Once transferred to a medium with low or no auxin, these cells can then develop into mature embryos. Germination of the somatic embryo can only occur when it is mature enough to have functional root and shoot apices

Factor Affecting

Factors and mechanisms controlling cell differentiation in somatic embryos are relatively ambiguous. Certain compounds excreted by plant tissue cultures and found in culture media have been shown necessary to coordinate cell division and morphological changes. These compounds have been identified by Chung et al as various polysaccharides, amino acids, growth regulators, vitamins, low molecular weight compounds and polypeptides. Several signaling molecules known to influence or control the formation of somatic embryos have been found and include extracellular proteins, arabinogalactan proteins and lipochitooligosaccharides. Temperature and lighting can also affect the maturation of the somatic embryo.

Advantages

1.High Propagation rate

2.Somaclonal Variation

3.Germplasm conservation

Disadvantages

1 Confined to few species

2.Somatic embroyos show very poor germination