Importance of Anther and Embryo Culture

Anther Culture

Anther Culture is an ‘in vitro’ technique to produce haploid (half of the chromosome number) from normal diploid plant through culturing anthers on artificial nutrient medium.

Haploids are defined as sporophytes with gametophytic chromosome number and have been produced in a variety of plant species using a variety of methods. The important parameters recognized for successful anther culture are –

(i) Condition of growth of donor plant
(ii) Genotype of donor plant
(iii) The pretreatment
(iv) The developmental stage of anther (or microspore)
(v) The culture medium and the conditions during culture growth.

In anther culture technique, the developing anthers at a precise and critical stage are excised aseptically from unopened flower bud and are cultured on a nutrient medium where the microspores within the cultured anther develop into callus tissue or embryoids that give rise to haploid plantlets either through organogenesis or embryogenesis.

Importance of anther culture

Anther culture is practiced for producing small haploid embryos called embryoids. The production of such haploid embryoids or plantlets provides an important tool for geneticists and physiologists to carry out researchers in their respective fields. The importance of anther culture is as follows –

1. Among the different importance of haploids, their use in crop improvement is considered to be the most significant and stands out as the most important reason for emphasis on haploid research.
2. Haploids have also been successfully utilized for barley, maize, sugarcane, oilseed etc.
3. In sugarcane selection among anther culture, derived haploids led to the development of superior lines with tall stem and higher sugar content.
4. Due to presence of only one set of chromosomes, even the recessive mutations are immediately expressed in haploids.
5. Anther can be plated on solid medium like single cells.
6. Gametoclonal variation can be developed from culture derived from anthers. The gametoclonal variation is actually utilized in hybrid sorting during the use of haploids for plant breeding purposes.

7. In several crops, desirable mutants have been isolated among haploids derived in culture.

8. Haploids have been found to be useful in various areas of cytogenetics research, including the following:
   (i) Production of aneuploids
   (ii) determination of basic chromosome number, and
   (iii) determination of the nature of polyploidy.

**Embryo Culture**

Growth of embryo on an artificial nutrient medium is known as embryo culture. In many cases, development of embryo has been found to fail even after gametic fusion. Seeds formed in them were non-viable. When embryo is taken
out of such ovule and grown on artificial nutrient medium, it grows normally. Recent research has shown that in such cases it is frequently possible to excise the young embryos from the ovules and culture them in artificial media. Embryo culture was first done successfully by Hanning (1902) in certain crucifers e.g. *Raphanus* etc. He used sugars, mineral salts, plant decoctions, certain amino acids and gelatin as different media. The cultured embryos tended to skip the stages of development and grew directly into seedling.

The excised embryos are transferred into culture bottles containing a nutrient medium. All the steps are made in sterilized condition. Laminar flow chamber and various chemicals are available for sterilization purposes. Some embryologists observed that increased Osmotic value of the culture medium is essential for favoring the growth of the embryo. Some suggested that growth factors like IAA control the growth and differentiation of excised embryo on culture medium.

**Importance of Embryo Culture**

Embryo culture technique has obtained several practical applications—

1. Embryo culture experiments has also helped in finding out the nature of factors which are involved in dormancy of seeds after ripening and also vernalization of seeds to some extent.
2. Embryo culture experiments has also made it clear that the physiological differences between different species are due to genetic differences.
3. Embryo culture technique has given very clear understanding about the environment inside the seed.
4. Crosses between plants of different ploidy within the same species have been found to be possible. e.g. *Iris* and *Zea*.
5. Inter specific hybrids have been obtained in many cases, e.g. *Gossypium, Datura, Lycopersicum*.
6. Some inter-generic hybrids have been obtained e.g. *Hordeum* and *Secale*, between *Datura* and *Brugmansia*, between *Triticum* and *Elymus* etc.
7. The culture of embryos from normal seeds has been used to shorten breeding cycles. In roses also, which requires a whole year to come into flowering, embryo culture has made it possible to shorten the breeding cycle and produce two generations in a year.
8. Embryo culture has served as a tool in studies of the influence of specific substance on the morphology of embryos.

.........