Popular Article

Popular Kheti
Volume -7, Issue-3 (July-September), 2019
Available online at www.popularkheti.com

eISSN: 2321-0001

Embryo Rescue Technique: A Tool for Crop Improvement

Rima Kumari*[1], Pankaj Kumar[1], Dan Singh Jakhar[2] and Arun Kumar[3]
[1]Department of Agricultural Biotechnology and Molecular Biology
Dr. Rajendra Prasad Central Agricultural University, Pusa (Samastipur)-848125, Bihar, India
[2]Department of Genetics & Plant Breeding, Institute of Agricultural Sciences,
Banaras Hindu University, Varanasi, India
[3]Department of Agronomy, Bihar Agricultural University, Sabour, India
***Email of corresponding author: rimakumari1989@gmail.com**

Embryo rescue is referred to as embryo, ovule, or ovary culture. It is most often used to rescue embryos from interspecific and intergeneric crosses and from embryos that do not fully develop naturally. It can also be used to rescue seedless triploid embryos, produce haploids, overcome seed dormancy, or determine seed viability. A brief description of its procedure and application is given in this article.

Introduction

The term "embryo rescue" refers to *in vitro* techniques whose purpose is to promote the development of an inherently weak, immature or hybrid embryos into a viable plant. Depending on the organ cultured, embryo rescue is referred to as embryo, ovule, or ovary culture. It is most often used to rescue embryos from interspecific and intergeneric crosses and from embryos that do not fully develop naturally. Wide hybridization involving crossing of two different species of plants from the same genus or different genera often results in failure, due to failure of zygote formation, zygote development and hybrid seedling development. Failure of zygote formation occurs due to the inability of the pollen tube to reach the embryo sac (pre-fertilization barrier) and failure of zygote development (post-fertilization barrier) may take place due to lethal genes, genotypic disharmony between genomes of the two parental species, chromosome elimination, incompatible cytoplasm and endosperm abortion. Endosperm abortion occurs due to inability of the young endosperm to continue development and provide nutrition to developing young embryo. The endosperm may abort during early embryo development preventing further development of the embryo or it may abort at a later stage allowing an almost complete development of the embryo. For example, in the cross between *Triticum* and *Secale*, endosperm aborts at such a late stage that a small frequency of viable seeds is also obtained. But in the cross *H. bulbosum x H. vulgare*, the endosperm aborts at an early stage so that viable seeds are not produced. Endosperm abortion can be overcome by embryo rescue technique by culturing young hybrid embryo on a suitable culture medium.

Embryo Culture

Embryo culture deals with the sterile isolation and *in vitro* growth of a mature or an immature embryo with an ultimate objective of obtaining a viable plant. There are two types of embryo culture:

1. **Mature embryo culture**: It is *in vitro* culturing of mature embryos from ripe seeds. This type of culture is done when embryos don't survive *in vivo* or become dormant for long periods of time or it is done to eliminate the inhibition of seed germination.

2. **Immature embryo culture/embryo rescue**: When embryo fails to develop due to endosperm degeneration, embryo culture is used to recover hybrid plants; this is called embryo rescue.

Procedure for Embryo Rescue

In the embryo rescue technique, hybridized and enlarged ovules are removed from the pistil after pollination. However, the time between hybridization and ovary excision has varied. Generally, ovaries are removed 3-5 days post pollination. After excision, ovaries are surface-sterilized first with 70% ethanol for 30 seconds then with 2% sodium hypo chloride for ten minutes following several rinses of distilled water, ovaries are placed in test tubes. The embryo culture is maintained at 22 ± 2 °C in 16 hours of light and 8 hours dark period. Fully developed plantlets are removed from the test tubes, washed with distilled water and transferred to sterile vermiculite. After two weeks, plantlets were transplanted into pots and grown in a greenhouse.

Applications

- Breeding of incompatible interspecific and intergeneric species.
- Embryo culture is also used in crosses between diploids and tetraploids.
- To overcome seed dormancy and for shortening the breeding cycle of deciduous trees
- To determine seed viability.
- Recovery of maternal haploids that develop as a result of chromosome elimination following interspecific hybridization.
- Used in studies on the physiology of seed germination and development.
- Embryos are excellent materials for *in vitro* clonal propagation. This is especially true for conifers and members of Gramineae family of rare plants.
- Germination of seeds of obligatory parasites without the host is impossible *in vivo*, but is achievable with embryo culture.
- To study morphogenesis and nutritional requirements.

Conclusion

Embryo culture is a valuable *in vitro* tool for breeding. It is most often used to rescue embryos from interspecific and intergeneric crosses and from embryos that do not fully develop naturally (as in early ripening and seedless fruit where the embryo aborts). The method can also be used to rescue seedless triploid embryos, produce haploids, overcome seed dormancy, or determine seed viability. It is useful in understanding embryo morphogenesis and precocious germination. As research continues with this technique, new and valuable uses will be developed to assist the biotechnological breeding of plants.