IN VITRO FERTILIZATION (IVF) IN FLOWERING PLANTS

Summary

This review deals with the recent progress in studies on double fertilization in angiosperms. It briefly presents the IVF-methods and their impact on solving some questions asked by plant embryologists. In the past decade, electrofusion, Ca^{2+}-mediated or PEG-mediated fusion of plant gametes, as well as molecular and immunocytological studies on isolated sperm cells, egg cells, central cells and zygotes, yielded very important new results concerning fertilization in higher plants using maize as a model plant. The first of cellular events that occurs after gamete fusion is an increase of cytosolic Ca^{2+} concentration, known already in animals but found only recently in flowering plants. Egg cytoplasm activation appears to follow also the fusion of plant gametes but still needs to be demonstrated that the rise of cytosolic calcium is necessary and/or sufficient for the egg activation. Another similarity between the course of fertilization in plants and animals is the block to polyspermy. This was shown to occur in maize by Ca^{2+}-mediated gamete fusion *in vitro* and possibly depends on resynthesis of the egg cell wall. If an early block at the membrane level also exists, as in animals, needs to be elucidated. Maize sperm and egg electrofusion gave precise data on the karyogamy kinetics in plants, and studies on DNA content in isolated eggs and zygotes proved that the DNA synthesis occurs after gamete fusion, i.e. during zygote maturation. Unlike in animals, molecules responsible for sperm–egg interactions have not yet been identified. However, several sperm-, egg- and zygote-specific DNA sequences were found in maize and the very recent data suggest that the glycoproteins of tobacco gamete membranes might be involved in fertilization. Despite of this tremendous work done on isolated gametes, the question remains open if double fertilization is determined or random.