Chapter 4
Parthenogenesis

Haploid plant production via parthenogenesis involves culturing egg cell in the embryo sac without any involvement of sperm nuclei. Palmer and Keller (2005) differentiated parthenogenesis from gynogenesis whereby the former involves "the normal development of endosperm and embryo formation occurs in vivo," whereas in the case of gynogenesis, endosperm degenerates with the passage of time and there is a need to rescue the embryo in the laboratory conditions. Chase (1949) produced doubled haploids in maize via parthenogenesis and exploited these haploids in his breeding program. He used a color genetic marker (dominant purple) in the pollinator to distinguish haploids (colorless) from diploids that followed chromosome doubling using a colchicine injection in the scutellar node of maize haploid plants. Since parthenogenesis occurs rarely in nature, it is, therefore, difficult to distinguish between diploids and haploids. Thus, genetic markers are usually used in the pollinators for selection purposes as described by Bordes et al. (1997) in apple. The induction of parthenogenesis is usually brought out by using irradiated pollen, heat treatment, and gametocidal chemicals. The pollen was successfully treated with heat to produce haploids in maize by Mathur et al. (1980). The use of chemicals to treat pollen is also common and it has also been applied in maize (Deanon 1957) and brassica (Kitani 1994). As described earlier, one of the best example of parthenogenesis is the production of haploid plants in cultivated tetraploid potato (*Solanum tuberosum*) species by crossing it with diploid *S. phureja* (pollen donor). The genetic control of parthenogenesis has been identified in maize and barley where indeterminate gametophyte (*ig*) and *hap* initiator genes are capable to induce parthenogenesis in maize (Kermicle 1969) and barley (Hagberg and Hagberg 1980), respectively. The frequency of haploids occurrence in nature is very low. An auxin test has been identified to estimate the frequency of parthenogenic haploids (Mazzucato et al. 1996). However, the use of inducer and marker genes will definitely improve the recovery of haploids to be used or exploit this method to breed genotypes on a larger and commercial scale.

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