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Apomixis and Its Exploitation in Crop Improvement

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Apomixis is a unique mode of reproduction in plants that involves the formation of seeds without egg cell fertilization. Progenies from apomictic seeds are genetically identical to the parent plant, as they inherit the same genetic material without any genetic recombination. Winkler coined the term "apomixis". The first report of apomixis in citrus was reported in 1719, when Leeuwenhoek observed the development of two plantlets from the same seed.

Endosperm development in apomictic plants: Proper development of the endosperm relies on the balance between maternal and paternal chromosomal contribution called Endosperm Balance Number (EBN) which is commonly 2:1 maternal to paternal genome ratio.

Autogamous apomixis: evelopment of an endosperm independent of fertilization of the polar nuclei *e.g.* Asteraceae apomictic plants.

Pseudogamous apomixis : Endosperm formation depends on the fertilization of the polar nuclei by male nuclei *e.g.* ***Tripsacum.***

Detection of Apomixis

Phenotypic identification

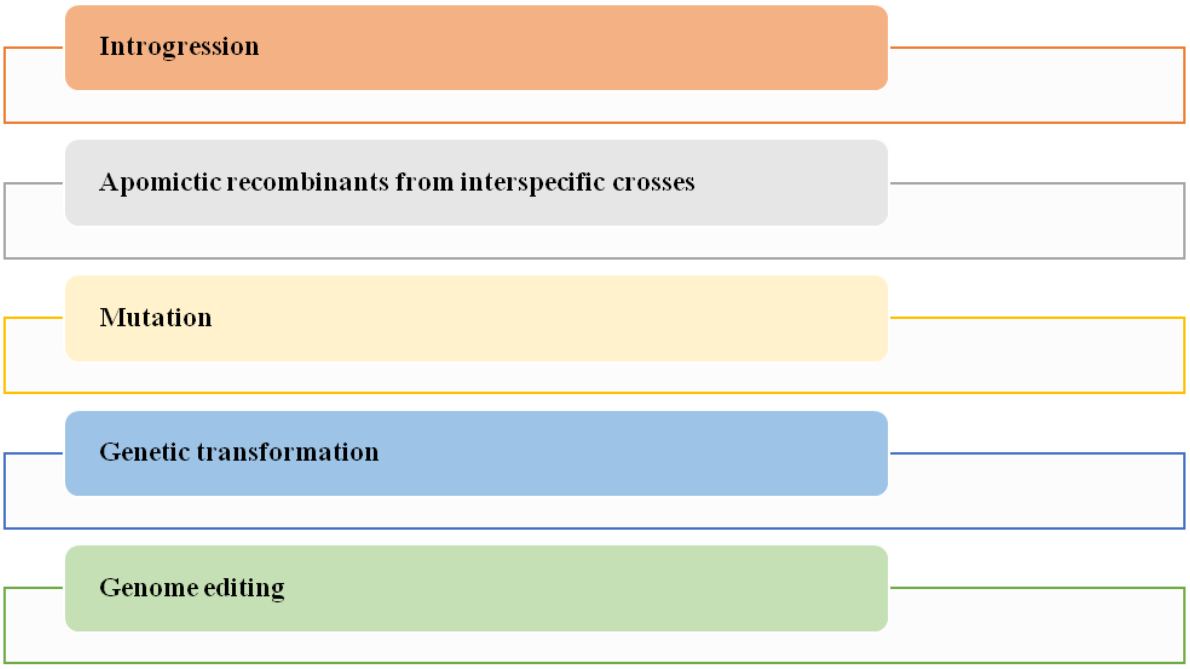
1. In the absence of pseudo gamy, careful **emasculation** and isolation of the maternal parent may also provide evidence of apomixis
2. Presence of **multiple seedlings** indicates apomixis
3. One way to determine if all of the offspring's genes come from the mother is by employing a test that checks for the preservation of the maternal genotype in the progeny
4. In obligate apomixis, all the progeny from a cross **resemble the female parent**
5. In facultative apomixis, the **percentage of progeny** that are **identical to female** parent gives the **degree of apomixis**
6. The production of a high percentage of irregular, sterile pollen grains is a traditional, reliable apomixis indicator, but for Autogamous plants only **(rare)**

Advantages of Apomixis

- Obligate apomixis permits fixation of heterosis.
- Reduced cost and price of hybrid seed production.
- Farmers can produce their own hybrid seeds which is not possible with conventional approach.
- No need to identify *cms* and restorer sources.
- Parental lines are not to be maintained.
- Minimum isolation distance (3m) is required to avoid mechanical mixture irrespective of mode of pollination.

- Flowering synchronization of parental lines is not required.
- Nucleus seed can be maintained conveniently.
- A major advantage of apomixis for plant breeding is that it will increase the survival of interspecific crosses.
- In vegetatively propagated crops, apomict seeds can reduce the cost of seed storage and transportation required in handling of bulky propagules.
- Virus free clonal propagation through seed.

Development of Apomictic Plant



Disadvantages of Apomixis

- The genetic and molecular base of apomixis is not clear.
- Complicated phenomenon.
- Estimation is difficult, tedious and time consuming.
- In facultative apomixis, the proportion of sexual progeny affected by environmental factors.
- Apomixis breeding in cereals is hindered by genomic imprinting.
- It is a nuisance when the breeder desires to obtain sexual progeny.
- Unfortunately, barring a few exceptions in some forage grasses and fruit trees, apomixis is not a common feature among crop species.

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