APOMIXIS AND IT'S TYPES

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Apomixis, derived from two Greek words "APO" (away from) and "mixed" (the act of mixing or mingling). It refers to the occurrence of an asexual reproductive process in the place of normal sexual processes involving reduction division and fertilization. Apomixis can be best described as the reference to the asexual process.

During sexual reproduction, developmental steps occurring inside the ovule produce the female gametophyte (embryo sac) and following a double fertilization event give rise to embryo and endosperm structures.

Apomixis is widely distributed among higher plants. More than 300 species belonging to 35 families are apomictic. It is most common in Gramineae, Compositae, Rosaceae, and Rutaceae. Among the major cereals maize, wheat, and pearl millet have apomictic relatives.

Types of Apomixis

Three types of apomixis are generally recognized – diplospory, apospory and adventitious embryony. These apomictic processes are depicted compared to sexual processes in the formation of a common Polygonum-type embryo sac.

Diplospory

In diplospory, the unreduced embryo sac is derived from the megaspore mother cell either directly by mitotic division or by aborted meiotic events.

Three major types of diplospory have been reported, named after the plants in which they occur, and they are the Taraxacum, Ixeris and Antennaria types.

In the Taraxacumtype, meiotic prophase is initiated but then the process is aborted resulting in two unreduced dyads one of which gives rise to the embryo sac by mitotic division.

In the Ixeris type, two further mitotic divisions of the nuclei to give rise to an eight-nucleate embryo sac follow equational division following meiotic prophase. The Taraxacum and Ixeris types are known as meiotic diplospory because they involve modifications of meiosis.

Apospory

In apospory, the nuclear cells that give rise to the apomictic embryo sac, termed aposporos initials, are distinct from the ameiotic megasporocyte.

They are similar in appearance to the ameiotic megasporocyte and may differentiate close to the ameiotic megasporocyte and develop into an apomictic embryo sac.

Once the aposporos initial cells differentiate they immediately enter mitosis to produce an embryo sac. Some ovules can contain multiple embryo sacs and, depending on the species, the structure of the embryo sac may be quite different from that seen in the sexual process.

The initiation of the apospory embryo sac can occur together with a sexual one or it can displace or inhibit sexual embryo sac formation.

Adventitious Embryony

In this process, embryos initiate parthenogenetically outside of an embryo sac structure.

Adventitious embryony is most commonly initiated later in ovule development from nucellar and integumentary tissues.

In general, fertilization in the adjoining sexual embryo sac and subsequent endosperm formation is necessary to form viable seeds. The developing embryos closest to the embryo sac grow towards it, presumably to obtain nutrient and other developmental signals from the embryo sac.

There are some few further types of apomixis which are discussed in brief below.

Recurrent and Non-recurrent Apomixis

In recurrent apomixis, both the egg-cell and embroyo are diploid and the embroyosac is developed from the megaspore mother cell.

In non-recurrent apomixis, both the egg-cell and embroyo are haploid and embroyo is

developed directly from an egg-cell without fertilization.

Vegetative Apomixis

In this apomixis type, vegetative bulbils or buds are produced in the inflorescence instead of flowers.

They are easily reproducable and are seen in certain plants like Fragaria, Agave, Poa bulbosa, etc.

Benefits of Apomixis

It helps in hybrid seed production.

It is one of the most cost-effective methods to produce seeds.

Apomixis prevents the loss of specific characters in the hybrid.