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Session118: Seed Production in Apomictic Grasses



Introduction

- In more than 33 families of angiosperms (Carman, 1997), including the grass family Poaceae, seeds also form asexually by apomixis (apo= without, mixis=union)
- Among the grasses it prevails in polyploid species of Paspalum, Panicum, Poa, Bothriochloa, Dichanthium, Eragrostis, Pennisetum and Cenchrus (Bashaw, 1975).
- **Apomixis** is a clonal reproductive mode that involves avoidance of the process of meiosis, fertilization-free embryo development (parthenogenesis), and endosperm formation with or without fertilization of the polar nuclei (Koltunow, 1993)
- Apomixis is synonymous with agamospermy i.e. seed formation without fertilization of the egg cell
- Burton (1948) first reported that **bahiagrass** reproduced by obligate apomixis after making controlled crosses and the F1 progeny were classified through visual progeny tests carried out on a few F2 plants, and chromosome counts
- ***Panicum maximum* (guinea grass)** is a model crop for apomixis and polyploidy studies. It is predominantly tetraploid ($2n = 32$) and is characterized by gametophytic apomixis, Panicum-type apospory and pseudogamous endosperm development

TYPES OF APOMIXIS AND DEFINITIONS

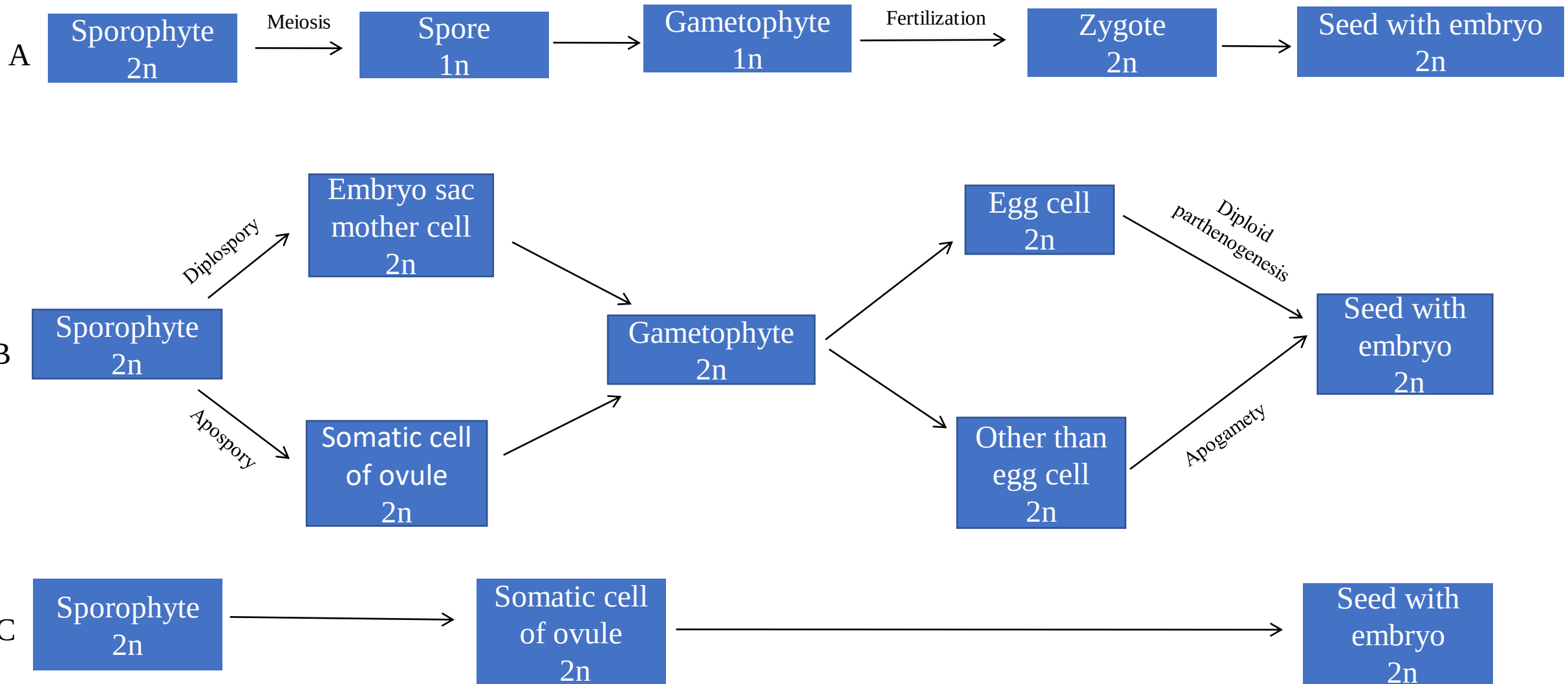
Diplospory: a non-reduced embryo-sac develops from an archespore cell (embryo-sac mother cell) through omission or restitution of meiosis

Apogamety: egg cell develops parthenogenetically into an embryo, or another cell of the embryo-sac divides and develops into an embryo

Apospory: the non-reduced embryo-sac develops from a somatic cell of the nucellus or the integument instead of the embryo-sac mother cell

Adventitious or nucellar embryony: the embryo develops directly from the sporophytic tissue, without formation of a gametophyte

Modes of agamosperous reproduction



A. Normal sexual life cycle; B. Gametophytic apomixis & C. Adventitious embryony

Development of Apomictic lines

Apomictic lines can be developed by following three different approaches:

1. Gene transfer from wild species
2. Induce mutation
3. Selection of Apomictic recombinants from interspecific crosses

Production and Maintenance of Apomictic Hybrid

➤ In case where apomixis is dominant, a sexually reproducing line is used as the female parent and an obligate apomictic line is used as male parent to produce the hybrid that is apomictic

➤ The hybrid will produce only apomictic seeds, which are used for maintenance, multiplication and cultivation of the hybrid variety

➤ Ex: Buffel grass and Bahia grass

➤ In case of facultative apomixis (Ex: Kentucky blue grass and Guinea grass), at least some of the hybrids may be highly apomictic and used for fixation of heterosis.

**Sexually reproducing line
(Female parent)**



**Apomictic line
(Male parent)**



Apomictic hybrid



**Maintained and
multiplied through seed**

Problems in utilization of apomixis

- Apomixis is very complicated
- Estimation of the level of apomixis in case of facultative apomixis is tedious and time consuming
- In case of facultative apomixis, the proportion of sexual reproduction is affected by environmental factors
- The genetic basis of apomixis is not clear in most cases



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*Thank
you*

