

DOUBLE FERTILIZATION

SAB

The term 'double fertilization' was coined by S. G. Nawaschin (1898). It is a phenomenon unique to angiosperm in which both the male gametes released by the pollen tube fertilize the different elements of embryo sac.

Double fertilization involves two

processes —

17. Syngamy → Union of male gamete with haploid egg which form zygote (2n)

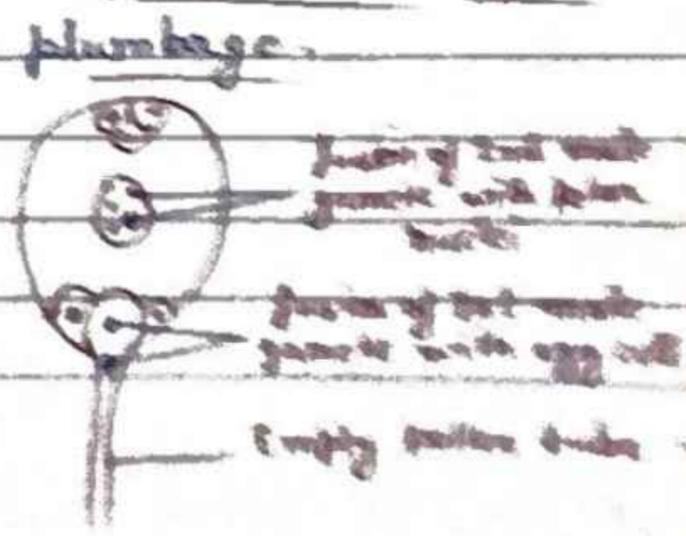
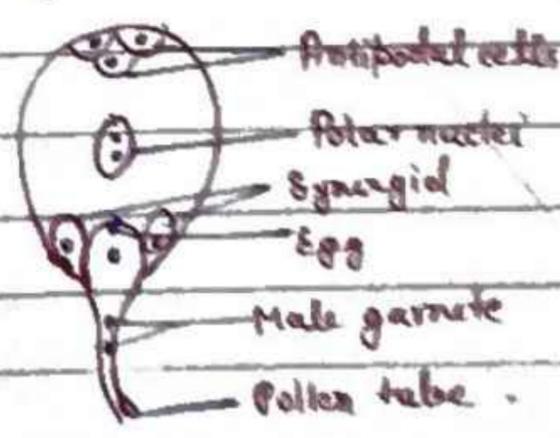
27. Triple fusion → Union of sec. male gamete with the nuclei (2n) and their fusion product (2n) endosperm nuclei) to form triploid endosperm nucleus (3n). Since it involves union of three nuclei, it is called "triple fusion".

Fusion products develop in endosperm except in orchidaceae or podostemaceae.

VARIATIONS:-

Three nuclei always don't unite simultaneously.

- (i) $(P_1 + P_2) + SP \rightarrow$ More common [P_1 = upper polar nuclei, P_2 = lower polar nuclei, SP = spermatogenous nucleus]
- (ii) $(P_1 + P_2 + SP) \rightarrow$ (Zea, Nicotiana, Tulipa, Jertillaria)
- (iii) $(P_1 + SP) + P_2 \rightarrow$ Monotrope
- (iv) $(P_2 + SP) + P_1 \rightarrow$ Adnoid
- (v) $(P_1 + SP) \rightarrow$ Helosis (Antipodal polar nuclei absent)
- (vi) Endosperm nucleus (diploid) → Centrosea
- (vii) Endosperm nucleus (Polyploid) → Peparemia, Lilium.



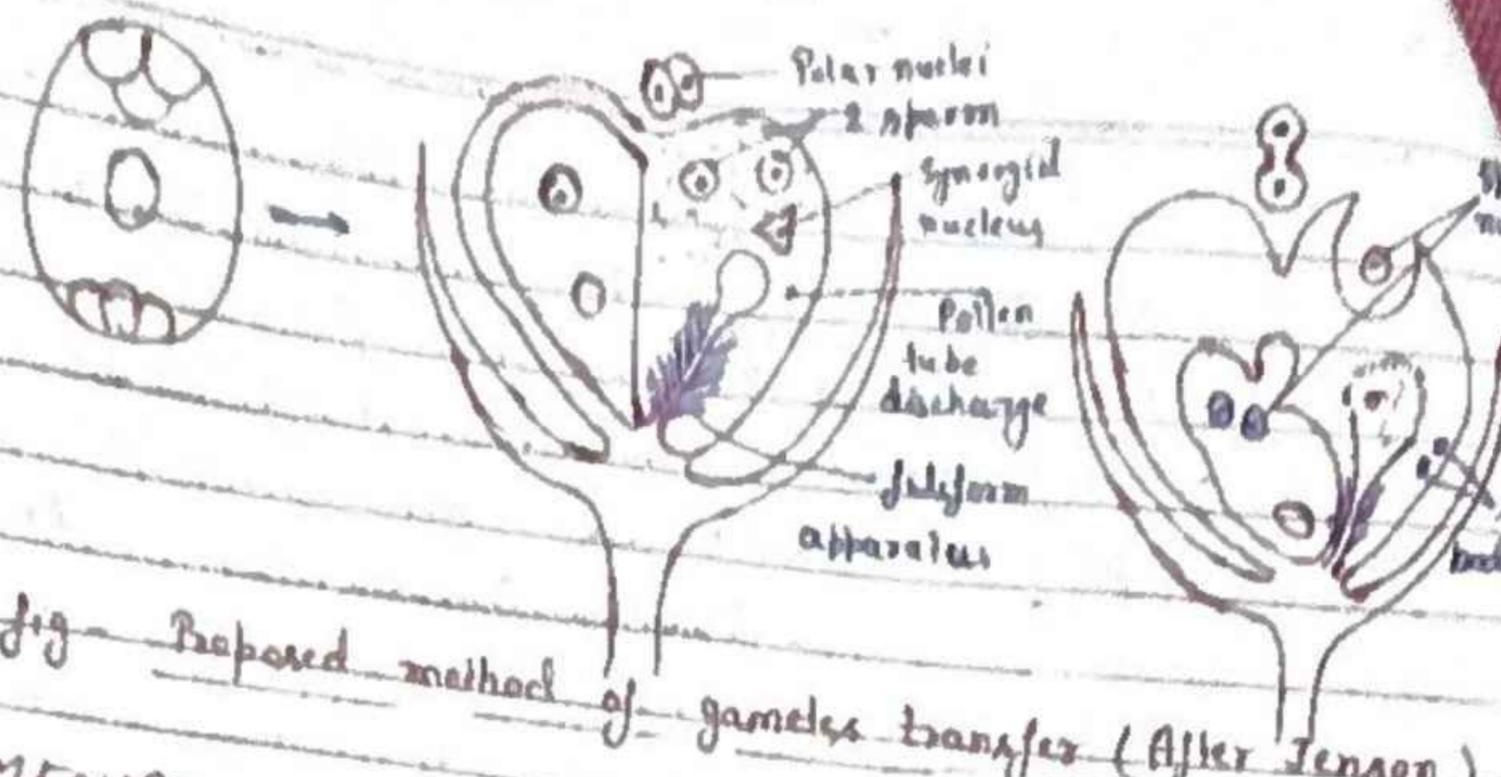


Fig - Proposed method of gametes transfer (After Jensen) 1973

MECHANISM

According to Jensen (1973) -

- (i) The sperm are released in syngonium as intact cells but only three nuclei migrate.
- (ii) One of the sperm, come in contact with plasma membrane of egg cell, while other contact with plasma membrane of polar nuclei.
- (iii) The membrane at the point of contact dissolves & sperm nuclei are released one in egg and other in polar cell.
- (iv) Male nuclei are passively carried along do the cytoplasm to the egg nuclei in case may be.
- (v) Male nucleus reaches the egg nucleus much quickly than others but triple fusion is accomplished more quickly than syngamy.

- Syngamy may be -
- a) Pri - mitotic → Gn Gramineae
 - b) Post - mitotic → Gn Liliaceae
 - c) Inter - mitotic → Gn Impatiens.

POLYEMBRYONY

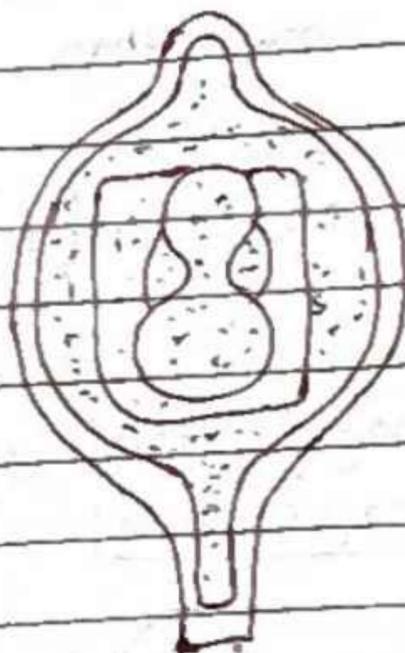
Polyembryony :- Occurrence of two or more embryos per seed is called 'polyembryony'.

This phenomenon is more common in gymnosperm (because more than one archegonia present in single ovule), than angiosperm.

Polyembryony has placed in one group 'true' & 'false' polyembryony.

'False' Polyembryony is that in which two or more embryos are present & that consequence of the development of apospary embryo sac.

"True polyembryony induced in vivide embryos in which embryos are divide from the tissue of nucleus & integument i.e. outside the embryo sac."



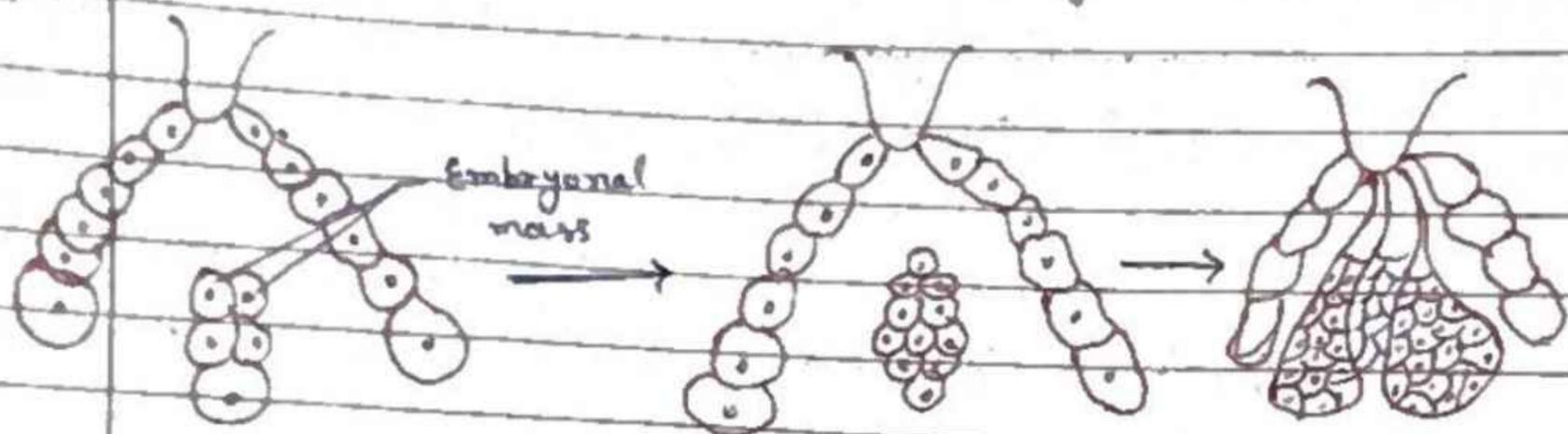
Several embryos in seed

Origin of polyembryony →

[A] Cleavage polyembryony :- Embryoes arising from cleavage or splitting of zygote, proembrya or form synergids, Antipodal & endosperm cell.

(i) According to Jeffery (1895) in case of Erythronium americanum, zygote undergoes

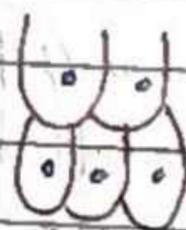
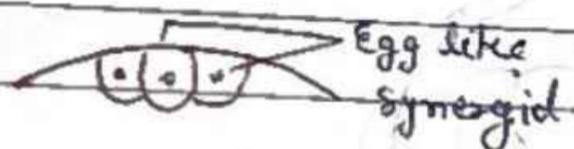
repeated division forming a small group of cell due to which outgrowth originates at the lower end of embryonal mass - each of out growth as a result of further multiplication fusion as independent embryos.



Eg:- Erythronium americanum

(ii)

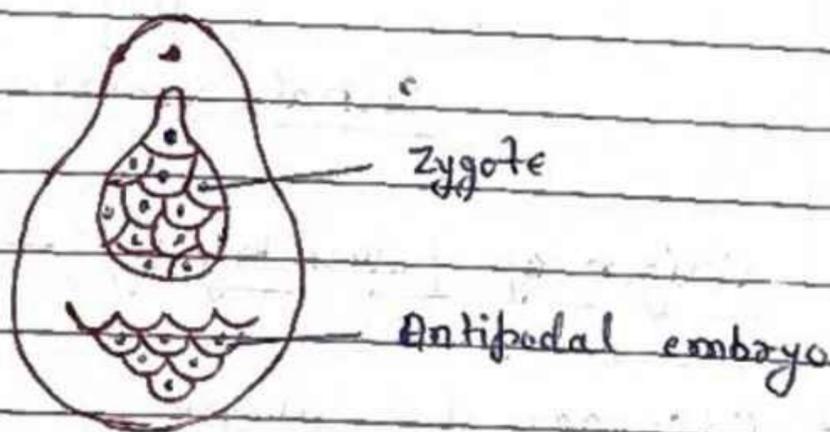
In the case of Sagittaria, graminaceae, Argemone maxicana, Lilium, species one or both synergid may become egg like & fertilized giving rise one or more embryos.



Three two cell proembryo in Sagittaria sps.

(iii)

Antipodal may form embryos in Ulmus sps eg (Ulmus americana).



U. glabra

(iv)

Ram (1989), reported the formation of embryo by the proliferation of suspensor cells in case of exocarpius.

(v) Cleavage proembryo is more common in Orchidaceae.

[B] Less frequently present of two or more embryos ~~in~~ per ovule.

[C] More than one cells of embryo sac may divide into embryo.

[D] Adventive polyembryony → Embryoes arising from cells outside the embryo sac i.e. by budding & proliferation of the cells of nucleus & integuments. eg - Citrus, Eugenia, Mangifera. The embryos, although initiated outside the embryo sac, subsequently come to live inside the embryo sac & are nourished by the endosperm.

The adventive embryos can be distinguished from the zygote embryo by their

- (i) lateral position &
- (ii) To lack of suspensor.

[E]. Origin of embryos from other embryo sac in the ovule →

The polyembryony condition is some time due to occurrence of multiple embryo sac within the ovule.

These may arise —

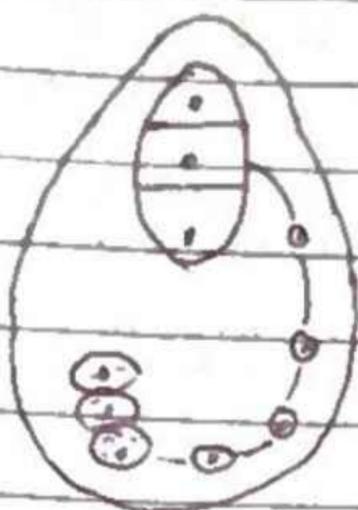
- (i) either from the derivatives of the same M.M.C.
- (ii) From two or more MMC.
- (iii) From nucellar cell (Apospory).

Significance of polyembryony →

- a) Polyembryony place & important role in plant breeding & horticulture.

b)

Adventive embryos great utility in providing
genetically uniform seedling.



Eg. Polyembryony in Elaeostema sp.

