S.Y.B.Sc. Botany CBCS Pattern

BO 241: Plant Anatomy and Embryology

Credit-II Plant Embryology

Chap –10. Pollination and Fertilization

Semester IV, Paper I- 2020-2021

By

Dr Shilpa Jagtap

Learning Object

- 10.1 Introduction and definition
- 10.2 Types of pollination
- 10.3 Germination of pollen grain
- 10.4 Entry of pollen tube- porogamy, mesogamy and chalazogamy
- 10.5 Double fertilization and its significance.

10.1 Introduction and definition

- After development of male and female gametophyte, the next biological phase is pollination, which is must for fertilization.
- The term pollination which means the transfer of the pollen from the anther to the receptive stigma whether of the same flower or of a different flower. In gymnosperms, pollination involves pollen transfer from the male cone to the female cone. Upon transfer, the pollen germinates to form the pollen tube and the sperm that fertilize the egg.
- **Types of Pollination:**
- Based on the destination of pollen grains, **two types of pollinations** are there:
- (1) Self-pollination: If the pollen is transferred from anther to the stigma of the same flower, it is called self pollination or **autogamy** as in pea, wheat and rice.
- When the pollen of one flower pollinates the stigma of different flower, but on the

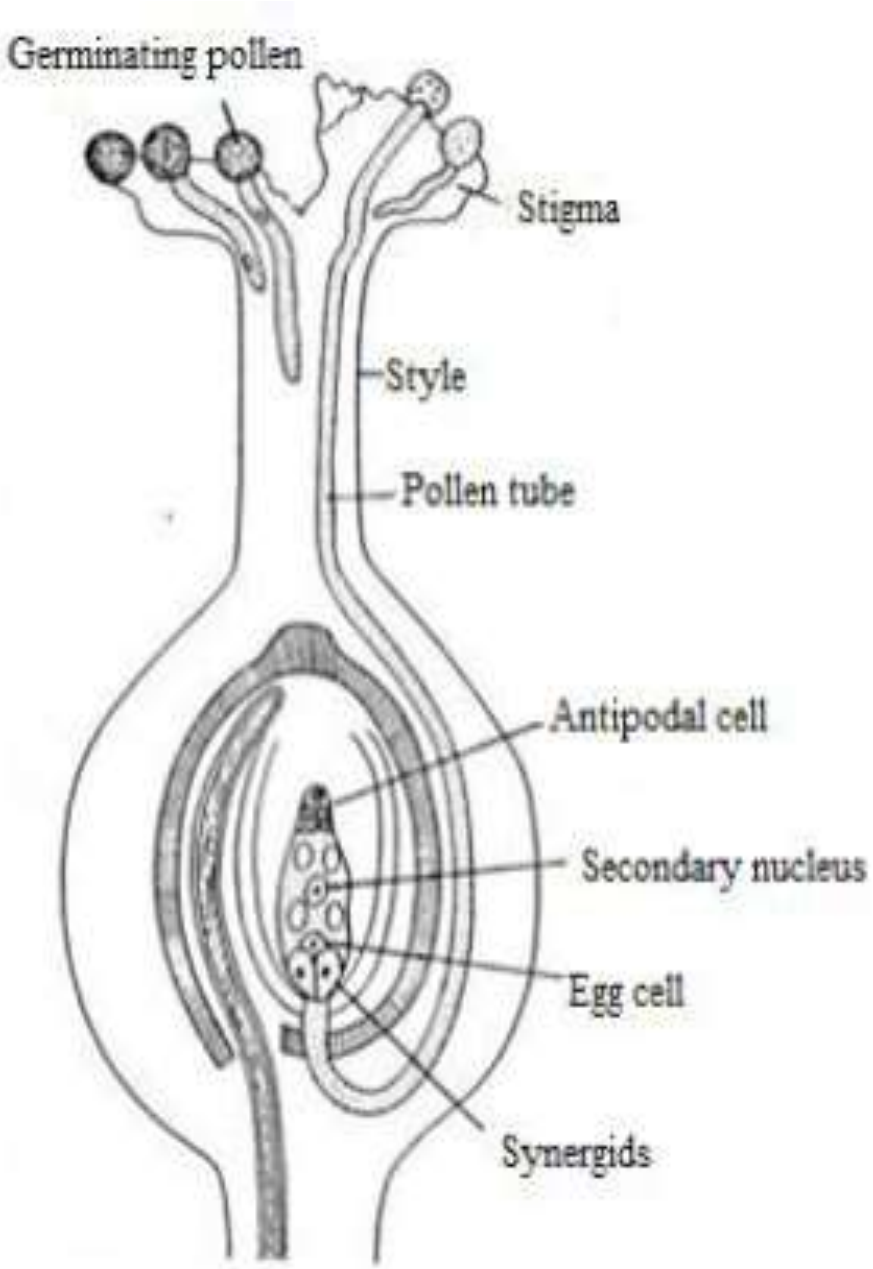
- (2) Cross-pollination: If the pollen is transferred from anther to the stigma of the another flower, it is called cross pollination or **allogamy** as in hemp and willow.
- Cross pollination within a species (may be inter-varietal) is termed as **xenogamy**.
- For self pollination flower must be bisexual (hermaphrodite) and only those bisexual flower which achieve anther dehiscence and receptivity of stigma simultaneously means when anther releases pollen grains then stigma should be ready to receive them. For cross pollination flowers are mostly unisexual.
- Pollination leads to fertilization and production of seeds and fruits which ensure continuity of plant life.

- Agents for pollination
- Pollination process can occur by different agencies which can be classified into two categories:
- 1. Abiotic such as wind (anemophily or anemophilous) and water (hydrophily or hydrophilous)and
- 2. Biotic such as insects (entomophily or entomophilous), birds (ornithophily or ornithophilous), and bats (cheiropterophily or cheiropterophilous)
- Anemophily or anemogamy: Here pollinating agent is wind e.g. in most cereals, poplar, willow, alder, elm, oak, beech, Urtica.
- Hydrophily or Hydrogamy: Here pollinating agent is water e.g. aquatic plants.
- Zoophily or Zoogamy: Again divided into entomophily, ornithophily, and chiropteriphily
- Entomophily: Pollinating agents are insects as in Salvia, Ficus, orchids etc.
- Ornithophily: Pollinating agents are birds as in Bignonia, silk cotton etc.
- Cheiropterophily: Pollinating agents are bats as in Bauhinia megalandra, Eperua falcata etc.
- Pollination ends in a copious dusting of the stigma surface with pollen grains.

10.3 Germination of pollen grain

- When the pollen is shed from anther it has usually two cells:
- 1. A generative cell
- 2. A vegetative cell (tube cell)
- The generative cell forms two male gametes. Once the pollen has landed on compatible receptive stigma as a result of pollination, its germination starts. On the surface of stigma the pollen hydrates. This means pollen absorbs water from the surrounding and swells.
- After that the vegetative cell forms a pollen tube. The stigmatic fluid secreted by the stigma contains sugars, lipids and resins, etc. which provides suitable medium for the germination of pollen grains.
- Pollen grains as well as pollen tube contain an enzyme cutinase which helps in the penetration of pollen tube into the stigmatic tissue. Cutinase as the name indicates degrades the cutin of the stigma at the point of contact with the pollen tube.

- The entire content of the pollen including two male gametes of generative cell move into the pollen tube .
- The growing pollen tube penetrates the stigmatic tissue and pushes its way through the style and then down the wall of the ovary. The style may be hollow or solid. If it is hollow, then the pollen tube grows along the epidermal surface but in case of solid style, the pollen tube travels through intercellular spaces between the cells which lie in its path.



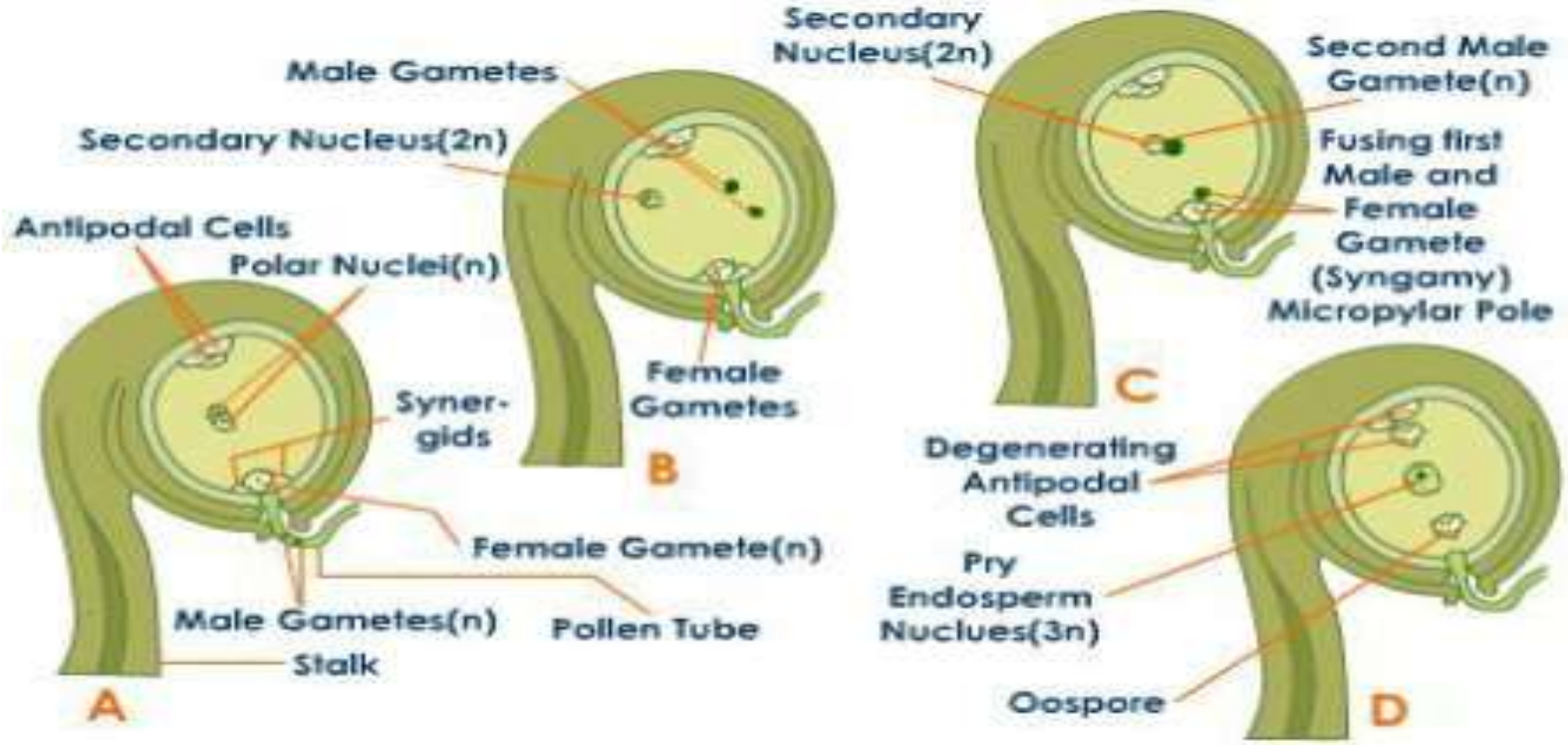
10.4 Entry of pollen tube- porogamy, mesogamy and chalazogamy

- After arriving in the ovary, the pollen tube finds its way into the ovule. The pollen tube may enter into the ovule via three routes.
- 1. through the micropyle
- 2. through the chalazal end
- 3. through the integument
- On that basis of modes of entry of pollen tube into the ovule, three terms are given as follows:
- **1. Porogamy:** When the pollen tube enters the ovule through the micropyle, the condition is known as porogamy. This is the most common mode of pollen tube entry into the ovule and so the most common type of fertilization.
- **2. Chalazogamy:** When the pollen tube enters the ovule through the chalazal end, the condition is known as chalazogamy. This type of pollen tube entry into the ovule and so the type of fertilization is observed in Casuarina, Betula and Juglans regia. The chalagogamy was first reported by Treub (1891) in Casuarina.

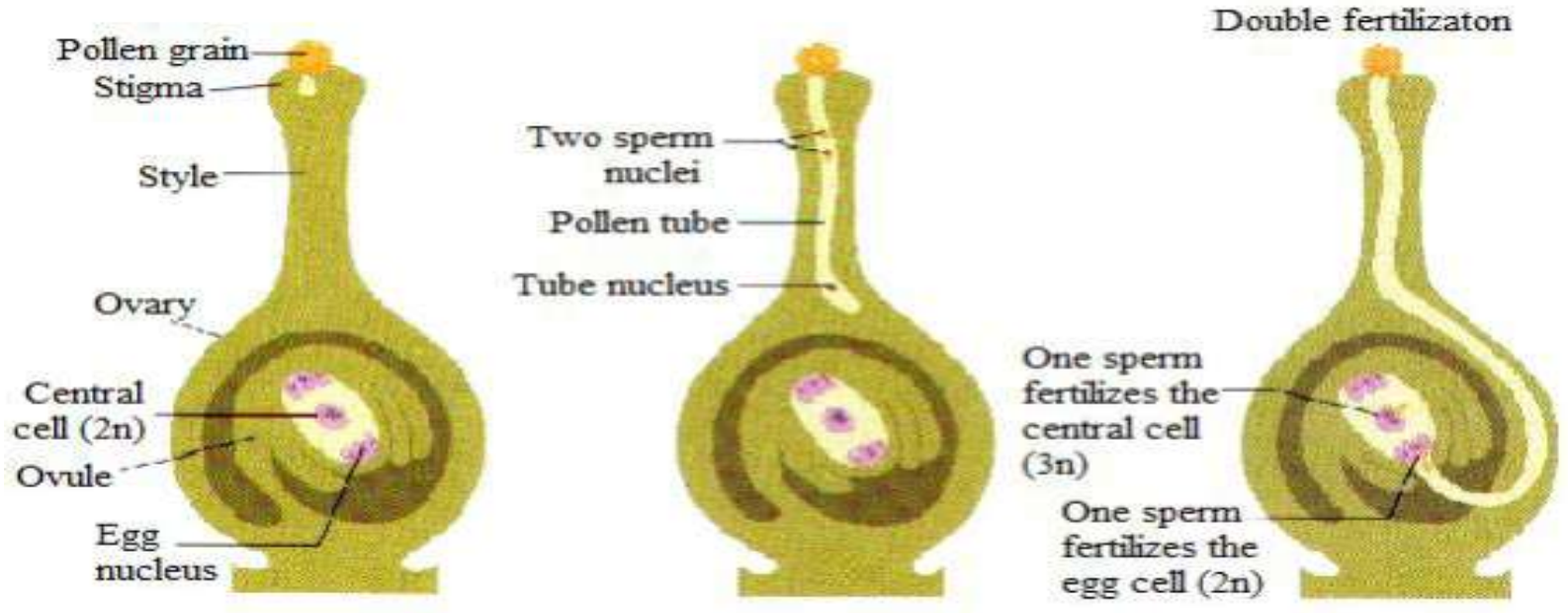
- **3. Mesogamy:** When the pollen tube enters the ovule through the integument or through the funiculus, the condition is known as mesogamy. This type of pollen tube entry into the ovule and so the type of fertilization is observed in Cucurbita (through the integument), and Pistacia (through the funiculus).
- Therefore depending on the place of pollen tube entry into the ovule, fertilization may also be called of three types: 1. Porogamous 2. Chalazogamous 3. Mesogamous
- Porogamy Chalazogamy Mesogamy

10.5 Double fertilization and its significance.

- As the one of the male gametes reached the egg, it fuses with it. As a result of this fusion diploid zygote/oospore (2n) forms . The fusion of male and female gametes is known as **fertilization**. This is also known as **syngamy.**
- Triple fusion The other male gamete fuses with the two polar nuclei (or secondary nucleus, if the two have already fused) and so forms triple fusion nucleus (3n), called primary endosperm nucleus
- **Showing syngamy and triple fusion**



- Double fertilization
- Thus in an embryo sac **two** sexual fusions occur; one is **syngamy** (i.e. fusion of one male gamete with the egg) and another is **triple fusion** (i.e. fusion of other male gamete with the polar nuclei or secondary nucleus), and therefore, the phenomenon is known as **double fertilization.**
- As a result of first fertilization the zygote or oospore cell is formed which is the mother cell of the embryo and is a diploid cell containing 2n complement of the chromosomes. The nucleus of the triple fusion product (primary endosperm nucleus) is triploid or 3n. This is the first nucleus of the endosperm



Significance of Double fertilization

- Two products are obtained as a result of double fertilization.
- There are chances of polyembryony and the plant has better chances of survival.
- Double fertilization gives rise to an endosperm that provides nourishment to the developing embryo.
- It increases the viability of the seeds of angiosperms.
- It utilizes both the male gametes produced by the pollen grains.

Reference

- BSCBO- 202 B. Sc. II YEAR Anatomy,Embryology and Elementary Morphogenesis DEPARTMENT OF BOTANY SCHOOL OF SCIENCES UTTARAKHAND OPEN UNIVERSITY
- http://lnmuacin.in/studentnotice/2020/Double%20fertilization.pdf