Sexual Reproduction in Flowering Plants

1 Chapter

1. Name the parts of an angiosperm flower in which development of male and female gametophytes take place.

Ans: In pollen sacs of the anther, male gametophytes (microgametogenesis) develop up to the 2-celled stage. The nucellus of an ovule is where the gametophyte develops (megagametogenesis).

2. Differentiate between microsporogenesis and megasporogenesis. Which type of cell division occurs during these events? Name the structures formed at the end of these two events?

Ans: Microsporogenesis and megasporogenesis differ in the following ways:

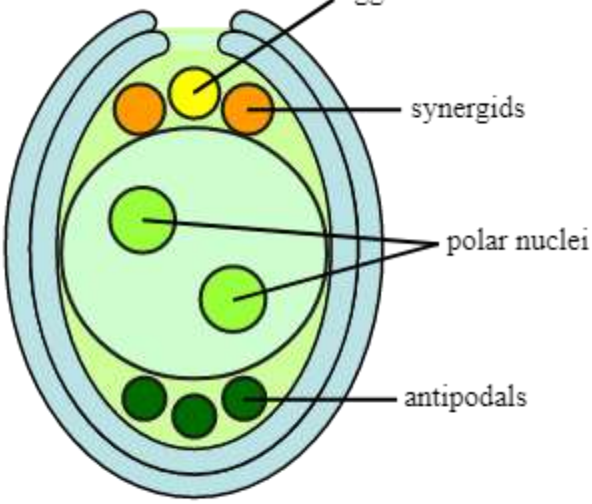
Microsporogenesis	Megasporogenesis
The process by which microspore mother cells divide and produce pollen grains is known as microsporogenesis.	Megasporogenesis is the process by which megaspore mother cells are formed and differentiate into megaspores by meiosis.
Located within the pollen sac of the anthers.	It is present in the nucellus of the ovule.
A pollen grain produced by a microspore mother cell functions properly.	The megaspores have only one functional megaspore.
Results in the formation of pollen grains (male gametophyte)	Resulting in the formation of embryo sacs (female gametophyte)
Microspore mother cells and megaspore mother cells are every diploid, as they have two sets of chromosomes.	The mother cells for megaspores and microspores enlarge and undergo meiosis in order to produce four haplotypical cells called megaspores and microspores, respectively.

3. Arrange the following terms in the correct developmental sequence: Pollen grain, sporogenous tissue, microspore tetrad, pollen mother cell, male gametes.

Ans: The sporogenous tissue is composed of a pollen mother cell, a microspore tetrad, pollen grains, and male gametes.

4. With a neat, labeled diagram, describe the parts of a typical angiosperm ovule.

Ans:

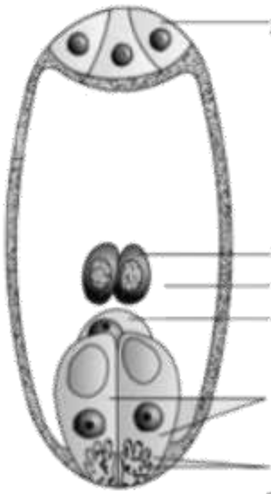


An angiosperm ovary is capable of forming a small structure called an ovule. Nucellus, a multi-layered cellular tissue, develops as the ovule first appears on the placenta. Placentas are attached to ovules via a stalk known as a funicle. A funicle attaches to a placenta at the hilum. The hypodermal cells of the nucellus enlarge and transform into megaspore mother cells. One haploid cell undergoes meiosis to form an embryo sac (female gametophyte). The others do not develop. A pollen tube enters an ovule through a small opening called a micropyle, surrounded by one or two protective layers. Ovules consist of the nucellus and integuments of a fully developed embryo.

5. What is meant by monosporic development of female gametophytes?

Ans: The female gametophyte or embryo sac develops only from one of the four megaspores in many flowering plants. Degeneration occurs in the three remaining megaspores. The monosporic type of embryo sac formation is referred to as the monosporic type of embryo development.

6. **A neat diagram explains the 7-celled, 8-nucleate nature of the female gametophyte.**



Ans: Three successive mitotic divisions form it in the megaspore nucleus (or female gametophyte). The nucleus itself divides into two nuclei which move to opposite poles to form two nuclei of the embryo sac. The 8-nucleate stage of the embryo sac is formed after two more sequential mitotic nuclear divisions. A typical female gametophyte or embryo sac is formed after the 8-nucleate stage. The antipodal and micropylar end of each of the eight nuclei comprises the six nuclei grouped. There are two synergids and an egg cell at the center of the egg apparatus. The polar nuclei are located within the large central cell of the embryo sac just below the egg apparatus. A typical female gametophyte comprises seven cells with eight nuclei as both polar nuclei are present within the same cell.

7. **What are chasmogamous flowers? Can cross-pollination occur in cleistogamous flowers? Give reasons for your answer.**

Ans: The anther and stigma of chasmogamous flowers are exposed for pollination. Cleistogamous flowers are incapable of cross-pollination. Therefore, only self-pollination is caused by these closed flowers. During the dehiscence process of cleistogamous flowers, anthers dehisce into closed flowers. As a result, pollen grains are exposed to stigma. Therefore, it is impossible for cross-pollination to occur, such as Oxalis and Viola.

8. **Mention two strategies evolved to prevent self-pollination in flowers**

Ans: An individual race's vigor and vitality are diminished by continuous self-pollination. In order to prevent self-pollination and to promote cross-pollination, flowering plants have developed many devices. Cross-pollination is most frequently ensured by dichogamy and self-sterility.

Dichogamy: Different maturation times for the anthers and stigmas prevent self-pollination.

Self-sterility (or self-incompatibility): pollen grains from some flowers do not germinate on their stigma due to the presence of self-sterility genes. Examples include tobacco and potatoes.

9. What is self -incompatibility? Why does self-pollination not lead to seed formation in self-incompatible species?

Ans: On its stigma, a flower that does not produce pollen grains is incompatible or self-sterile. This condition is called self-incompatibility or self-sterility. It is called pollination when pollen grains are transferred from the stigma to the anthers. As a result of this transference, seeds are formed. The process of self-pollination occurs when pollen grains are shed from the anther in the same flower to the stigma in the same flower. Some flowers, however, do not produce seeds when self-pollination occurs because they contain the same sterile gene on the pistil and pollen grain. Since pollen grains cannot germinate, male gametes cannot fertilize egg cells. This prevents the ovule from developing into a seed.

10. What is a bagging technique? How is it useful in a plant breeding programme?

Ans: A bag of polythene butter paper, when applied to emasculated flowers (which are in the bud stage), prevents pollen contamination of its stigmas. Emasculated flowers can be removed from their buds and stuffed into a bag of butter paper before anthesis. A pre-sterilized brush is used for dusting the stigmas of mature emasculated flowers with pollen grains of desired male plants. Flowers are then re-bagged until the fruits are formed. Artificial hybridization uses this technique primarily. Plant breeders use this technique to prevent unwanted pollen grains from contaminating the stigma of flowers.

11. What is triple fusion? Where and how does it take place? Name the nuclei involved in triple fusion.

Ans: Vegetative fertilization is the formation of a triploid primary endosperm nucleus (PEN) by fusing the second male gamete with the two polar nuclei present in the central cell of the central cell. The embryo sac is where this process occurs. The micropylar end of the pollen tube enters the embryo sac after reaching the ovary. Once the pollen tube has penetrated, its tip ruptures, releasing two male gametes. To form the diploid zygote, the one male gamete fuses with the egg. Trichotomy is the method of creating a triploid endosperm by combining the two male gametes and the two polar nuclei, and this method is called syngamy. It is a process of double fertilization in which both events of fertilization coincide.

12. Why do you think the zygote is dormant for some time in a fertilized ovule?

Ans: Zygotes become emb ryos after resting for a while. Until some amount of endosperm forms, most zygotes remain dormant. Developing embryos need this nutrition to grow and develop properly.

13. Differentiate between:

(a) hypocotyl and epicotyl;

Ans:

Epicotyl	Hypocotyl
This is the part of the embryonal axis between plumules and cotyledon nodes.	The area between the cotylendonary node and radicle forms part of the embryonal axis.
When epicotyl 2 elongates during hypogeal germination, the soil retains the cotyledons.	Hypocotyls extend so that cotyledons emerge from soil during epigeal germination.
Epicotyls have plumules at their terminal ends.	Hypocotyls have radicles at their terminal ends.

(b) coleoptile and coleorhiza;

Ans:

Coleoptile	Coleorhiza
A foliar structure called the coleoptile surrounds the epicotyl and a leaf primordium.	Roots and their caps are enclosed in a sheath called a coleorhiza.
It protects the plumule during emergence from soil.	For the first leaf to appear, there is an opening at the end of the coleoptile. The colorhizae are solid structures.
Plumules are protected from soil when they emerge from soil.	Radicles are not protected when they pass through the soil.
It grows much beyond the grain	After emergence from grain it stops growing
Coleoptile after emergence from soil	Coleorhiza does not come out of soil.

Germination occurs when the seed becomes green and begins to photosynthesise.	It remains nongreen

(c) Integument and testa;

Ans:

Integument	Testa
The ovule is covered by this membrane.	In other words, it is the outer covering of a seed.
There are two or three layers, and it is thin.	It is layered and quite thick.
Live cells make up its structure.	Cells in it are no longer alive.
There are no sclereids.	Sclereids are found in abundance in cells.
The ovule produces it at the chalazal end.	The ovule outer integument is the source of the ovule structure.
Integument is prefertilized.	Structures that develop postfertilization are called testa

(d) Perisperm and pericarp.

Ans:

Perisperm	Pericarp
It serves as the nucleus of the seed.	From the ovary wall develops a covering for the fruit.
Seeds contain it.	It is a component of fruit.
Usually, it is dry.	There is no moisture or flesh in it.
Many times, seeds do not function properly.	Protection and nutrition are also provided by this covering.
Seeds without perisperm are rare.	Every fruit contains this.

14. Why is an apple called a false fruit? Which part(s) of the flower forms the fruit?

Ans: True fruit is an ovary that has ripened botanically. Often called false fruits, these are fruits in which the thalamus, floral parts, and ovary are present—apples, strawberries, cashews, etc. Mainly the fleshy thalamus of apples can be eaten—the ovaries from a parthenocarpic fruit after or without fertilization.

15. What is meant by emasculation? When and why does a plant breeder employ this technique?

Ans: The stem of a flower bud is systematically excised to remove the anthers and stamens before they die. In order to minimize self-pollination, this is done. Hybridization by artificial means includes emasculation. This method is used by plant breeders to prevent the pollination of adjacent flowers and pollinate stigmas with pollens of the desired variety.

16. If one can induce parthenocarpy through the application of growth substances, which fruits would you select to induce parthenocarpy and why?

Ans: The fruit of the parthenocarpy is seedless. The ovary does not fertilize them before they develop. A few seedless fruits are of great economic importance, such as banana, grape, orange, pineapple, guava, watermelon, and lemon. In fruits with edible seeds or seeds (e.g., pomegranates), parthenocarpy is not selected.

17. Explain the role of tapetum in the formation of pollen-grain walls.

Ans: Microsporangia are surrounded by a thin layer called the tapetum. Multinucleated and polyploidy tapetal cells make up the tissue. Pollen grains develop as a result of them. Ubisch bodies are found in these cells and contribute to the ornamentation of the microspores and pollen grains. Sporopollenin is a substance produced by the Ubisch bodies of the tapetal cells. This substance is present on the exine layer of pollen grains. A spiny appearance is attributed to the exine of pollen grains due to the presence of this compound.

18. What is apomixis and what is its importance?

Ans: The asexual reproduction process of apomixis results in seeds without fertilization, such as in certain species of Asteraceae and Grasses. The hybrid seed industry relies on this method. Increasing productivity is the leading reason for cultivating hybrids. However, the main problem is the need to grow hybrid seeds annually since seeds from hybrid plants do not preserve hybrid characteristics for long periods because of the segregation of characters. By introducing apomixis into hybrid seeds, this can be avoided. As a result, scientists are seeking genes associated with apomixis.