Chapter: Sexual Reproduction in flowering plants

Exercise

Question 1. Name the parts of an angiosperm flower in which the development of male and female gametophyte takes place.

Answer: The male gametophyte, also known as the pollen grain, grows within the pollen chamber of the anther, whereas the female gametophyte (also known as the embryo sac) develops within the nucellus of the functional megaspore.

Question 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.

Answer:

Microsporogenesis	Megasporogenesis
1. It is the process by which microspore tetrads are formed from a microspore mother cell via meiosis.	1. It is the process of forming four megaspores from a megaspore mother cell in the nucellus region via meiosis.
2. It takes place within the anther's pollen sac.	2. It takes place within the ovule.

Both events (microsporogenesis and megasporogenesis) involve the process of meiosis or reduction division, which results in the formation of haploid gametes from the mother cells of the microspore and megaspore.

Microsporogenesis is the process by which haploid microspores are formed from a diploid microspore mother cell. Megasporogenesis, on the other hand, results in the formation of haploid megaspores from a diploid megaspore mother cell.

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

Answer: The correct sequence of development is as follows:

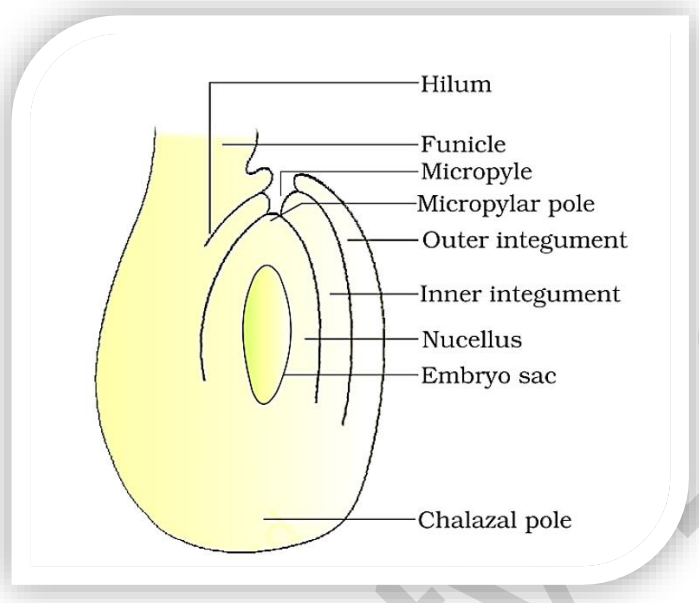
sporogenous tissue –Pollen mother cell – microspore tetrad – pollen grain – male gamete

During the development of microsporangium, each cell of the sporogenous tissue acts as a pollen mother cell, producing a microspore tetrad with four haploid microspores via meiosis

(microsporogenesis). These microspores dissociate and develop into pollen grains as the anther matures. Male gametes are produced when pollen grains mature.

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

Answer: An ovule is a female megasporangium in which megaspores are formed.



The important parts involved in ovule are –

Funiculus: The funiculus is a stalk-like structure that is used to represent the attachment point of the ovule to the ovary's placenta.

Hilum: The hilum is the place where the ovule's body can connect to the funiculus.

Integuments: Integuments can be considered as the outer layers which surround the ovule and are also used to protect the developing embryo.

Micropyle: A narrow pore is generated by integument projection. During fertilization, it is the point where the pollen tube enters the ovule.

Nucellus: A mass of parenchymatous tissue surrounded on all sides by integuments. The nucellus is responsible for feeding the developing embryo. The embryo sac is found within the nucellus.

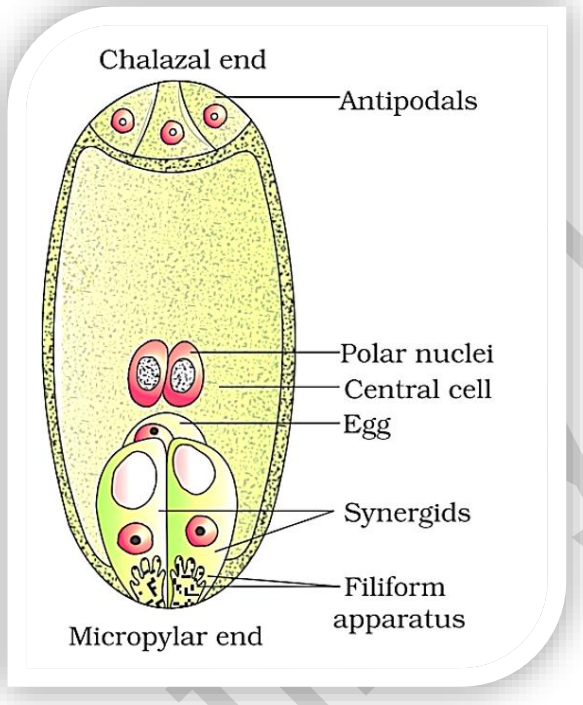
Chalazal: This is the swollen base of the nucellus from which the integuments emerge.

Question 5. What is meant by the monosporic development of a female gametophyte?

Answer: The female gametophyte or embryo sac is produced by a single functional megaspore. Female gametophyte monosporic development is the term for this. Most flowering plants go through meiosis to produce four haploid megaspores from a single megaspore mother cell present at the nucellus region of the ovule's micropylar pole. Only one of these four functional megaspores develops into a female gametophyte later on, while the other three degenerate.

Question 6. With a neat diagram explain the 7-celled, 8-nucleate nature of the female gametophyte.

Answer:



A single functional megaspore produces a female gametophyte (embryo sac). This megaspore divides three times in a row to form eight nucleate embryo sacs.

The megaspore's first mitotic division produces two nuclei. One nucleus advances to the micropylar end, while the other advances to the chalazal end. Then, at their respective ends, these nuclei divide and re-divide to form eight nucleate stages. As a result, there are four nuclei at each end of the embryo sac, namely the micropylar and chalazal ends.

Only three of the four nuclei at the micropylar end differentiate into two synergids and one egg cell. They are collectively referred to as the egg apparatus. Similarly, three out of four nuclei at the chalazal end differentiate as antipodal cells. The remaining two cells (from the micropylar and chalazal ends) migrate to the center and are known as the polar nuclei, which are housed in a large

central cell. As a result, the female gametophyte appears to be a 7-celled structure at maturity, despite having 8 nucleates.

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

Answer: Oxalis and Viola have two types of flowers: chasmogamous and cleistogamous flowers.

Chasmogamous flowers, like other species' flowers, have exposed anthers and stigmata.

Cross-pollination is impossible in cleistogamous flowers. This is due to the fact that cleistogamous flowers never open at all. In addition, the anther and stigma are close together in these flowers. As a result, in these flowers, only self-pollination is possible.

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

Answer: During the self-pollination of a single flower, pollen is transferred from the stamen to the pistil. The following are two strategies for preventing self-pollination in flowers:

The stigma of the flower in some plants has the ability to prevent pollen grain germination and thus the growth of the pollen tube. A genetic mechanism that prevents self-pollination is self-incompatibility. Incompatibility can occur between members of the same or different species. Incompatibility prevents breeding as a result.

In some plants, the gynoecium matures before the androecium, and vice versa. Depending on the gender, this is referred to as protogyny or protandry. This keeps pollen from coming into contact with the stigma of the same flower.

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

Answer: In angiosperms, self-incompatibility is a biological mechanism to prevent self-pollination. As a result, members of the same or different species are genetically incompatible.

Plants that show this phenomenon can inhibit pollen grain germination and, as a result, pollen tube growth on the stigma of the flower. This prevents gametes from fusing and the embryo from developing. As a result, no seeds develop.

Question 10. What is the bagging technique? How is it useful in a plant breeding program?

Answer: Various artificial hybridization techniques (under various crop improvement programs) involve the removal of the anther from bisexual flowers without affecting the female reproductive part

through the process of emasculation (pistil). After that, the emasculated flowers are wrapped in bags to keep unwanted pollen grains from pollinating them. This is referred to as bagging.

This technique is essential in plant breeding because it ensures that only desirable plant pollen grains are used for stigma fertilization in order to develop the desired plant variety.

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

Answer: The fusion of the male gamete with two polar nuclei within the angiosperm embryo sac is known as triple fusion.

This fusion takes place within the embryo sac.

When pollen grains land on the stigma, they germinate and give rise to the pollen tube, which travels through the style and into the ovule. Following this, the pollen tube enters one of the synergids and releases two male gametes.

One of the two male gametes fuses with the nucleus of the egg cell, forming the zygote (syngamy). The other male gamete fuses with the central cell's two polar nuclei to form a triploid primary endosperm nucleus. This process is known as triple fusion because it involves the fusion of three haploid nuclei. It leads to the formation of an endosperm.

This process involves one male gamete nucleus and two polar nuclei.

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

Answer: When the male gamete fuses with the nucleus of the egg cell, a zygote is formed. The zygote remains dormant for some time while the endosperm develops from the primary endosperm cell formed by triple fusion. The endosperm feeds the developing embryo, and the embryo develops further from the zygote after the endosperm forms.

Question 13. Differentiate between:

(a) Hypocotyl and epicotyl;

(b) Coleoptile and coleorhiza;

(c) Integument and testa;

(d) Perisperm and pericarp.

Answer:

(a) Hypocotyl and epicotyl

Hypocotyl	Epicotyl
1. The hypocotyl is the portion of the embryonal axis that lies beneath the cotyledon in a dicot embryo.	1. The epicotyl is the portion of the embryonal axis that lies above the cotyledon in a dicot embryo.
2. It comes to an end with the radicle.	2. It comes to an end with the plumule.

(b) Coleoptile and coleorhiza

Coleoptile	Coleorhiza
In a monocot seed, coleoptile is a conical protective sheath that encloses the plumule.	In a monocot seed, coleorhiza is an undifferentiated sheath that encloses the radicle and root cap.

(c) Integument and testa

Integument	Testa
It is the ovule's outermost covering. It shields it from harm.	It is the seed's outermost covering.

(d) Perisperm and pericarp

Perisperm	Pericarp
The residual nucellus is what remains. It can be found in seeds such as beet and black pepper.	It is the ripened wall of a fruit that develops from the ovary's wall.

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

Answer: False fruits are fruits derived from the ovary and other accessory floral parts. True fruits, on the other hand, are those that develop from the ovary but do not include the thalamus or any other floral part. The fleshy receptacle of an apple is the main edible part. As a result, it is a false fruit.

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

Answer: Emasculation is a plant hybridization method in which the anthers of bisexual flowers are removed without influencing the female reproductive part (pistil).

Emasculation in bisexual flowers is used by plant breeders to achieve the desired plant variety by crossing a specific plant with the desired pollen grain. Before opening the flowers to remove the

anthers, they are wrapped in a bag. This helps to ensure that only pollen grains from desirable varieties pollinate the flower. Later, breeders dust mature, viable, and stored pollen grains on bagged stigma to allow artificial pollination and obtain the desired plant variety.

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

Answer: Parthenocarpy is the development of fruits without the use of fertilization or seed formation. As a result, this technique is used to produce seedless varieties of economically important fruits such as orange, lemon, watermelon, and so on. This method involves the use of plant growth hormones such as auxins to stimulate fruit formation.

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

Answer: Tapetum is the microsporangium's innermost layer. It feeds the pollen grains that are developing. During microsporogenesis, tapetum cells produce a variety of enzymes, hormones, amino acids, and other nutrients required for pollen grain development. It also creates the exine layer of pollen grains, which is made up of sporopollenin.

Question 18. What is apomixis and what is its importance?

Answer: Apomixis is a mechanism for seed production that does not involve meiosis or syngamy. It is crucial in the production of hybrid seeds. Farmers face high costs when producing hybrid seeds through cultivation. Furthermore, because hybrid characters segregate during meiosis, it is difficult to maintain hybrid characters by sowing hybrid seeds.

Apomixis prevents the loss of specific hybrid characteristics. It is also a low-cost method of seed production.