CHAPTER-1
Sexual Reproduction in Flowering Plants

EXERCISE-1.1

1 Marks

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

Solution: In an angiosperm, the male gametes are developed within the anther. On the contrary, the female gametes are developed inside the ovules.

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.

Solution: The important differences between microsporogenesis and megasporogenesis are mentioned below:

Microsporogenesis	**Megasporogenesis**
It is the process in which a diploid microspore mother cell undergoes meiosis to form haploid microspores.	It is the process of formation of haploid megaspores from the diploid mother cell.
Occurs inside pollen sacs.	Occurs inside ovules.
Pollens are produced by microsporogenesis.	Embryo sacs are produced by megasporogenesis.

The arrangement of microspores is tetrahedral.	The arrangement of megaspores is linear.
All four microspores formed are functional.	Only one out of the four megaspores formed is functional.

Meiotic cell division occurs during megasporogenesis and microsporogenesis**.** It is also known as reductional division that leads to the production of haploid gametes.

The structures formed at the end of these events are:

Microsporogenesis – Pollen grain

Megasporogenesis – Embryo sac

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

Solution: The following is the correct developmental sequence: Sporogenous tissue → pollen mother cell → microspore tetrad → pollen grain → male gamete. When the microsporangium is developing, every cell of the sporogenous tissue serves as a pollen mother cell, giving rise to a microspore tetrad possessing four haploid microspores through the meiosis process (microsporogenesis). When the anthers mature, these microspores dissociate and develop into pollen grains. The pollen grains mature and give rise to male gametes.

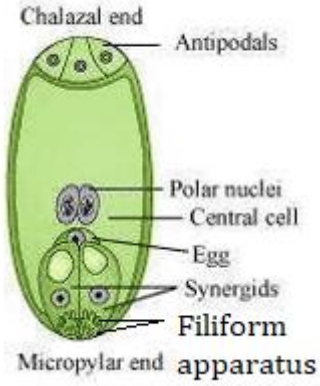
EXERCISE -1.2

2 Marks

1.What is meant by monosporic development of female gametophyte?

Solution: Monosporic development is the development of a female gametophyte from one functional megaspore. In angiosperms, a single diploid mother megaspore undergoes meiotic division to form four megaspores (haploid). Only one out of the four megaspores is functional, which forms a female gametophyte, while the rest of the three degenerate.

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



Solution:

The female gametophyte is formed by the mitotic division of the mother megaspore. The megaspore divides mitotically thrice to form 8 nucleate embryo sacs. The process of formation of the 7-celled, 8-nucleate nature of female gametophyte is mentioned below:

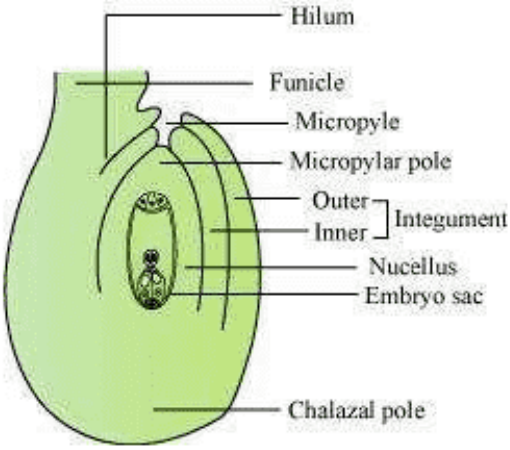
- Two nuclei are formed after the cell undergoes the first mitotic division.
- These two nuclei move towards the micropylar end and the chalazal end, respectively.
- They divide and redivide to form an 8-nucleate stage.
- Consequently, there are four nuclei each on either end.
- At the micropylar end, three out of the four nuclei differentiate into an egg cell and synergids.

- At the chalazal end, three out of the four nuclei differentiate as antipodal cells.
- The remaining cells, each from either end move towards the centre and is known as polar nuclei.
- Therefore, on maturation, the female gametophyte looks like a 7-celled structure.

3.What are chasmogamous flowers? Can cross-pollination occur in cleistogamous flowers? Give reasons for your answer.
Solution: Chasmogamous flowers are flowers that have open petals such that the reproductive organs are exposed to allow cross-pollination. Cleistogamous flowers are small, closed flowers with unexposed reproductive organs. Therefore, they cannot undergo cross-pollination. However, they undergo self-pollination since the stigma and anther are present near each other.

Q4: With a neat, labelled diagram, describe the parts of a typical angiosperm ovule.

Answer: An ovule is a female megasporangium where the formation of megaspores takes place.



The various parts of an ovule are -

1) Funicle - It is a stalk-like structure which represents the point of attachment of the ovule to the placenta of the ovary.

2) Hilum - It is the point where the body of the ovule is attached to the funicle.

3) Integuments -They are the outer layers surrounding the ovule that provide protection to the developing embryo.

4) Micropyle - It is a narrow pore formed by the projection of integuments. It marks the point where the pollen tube enters the ovule at the time of fertilization.

5) Nucellus - It is a mass of the parenchymatous tissue surrounded by the integuments from the outside.
The nucellus provides nutrition to the developing embryo. The embryo sac is located inside the nucellus

6) Chalazal - It is the based swollen part of the nucellus from where the integuments originate.

EXERCISE-1.3
4 Marks

1.Mention two strategies evolved to prevent self-pollination in flowers.
Solution: There are two strategies involved in preventing self-pollination in flowers:

Dichogamy – It refers to the production of male and female reproductive organs at different times in order to prevent self-fertilization.

Self-incompatibility – It is a genetically controlled mechanism in which pollen grains of a flower are unable to grow completely on the stigma of the same flower.

2.What is self-incompatibility? Why does self-pollination not lead to seed formation in self-incompatible species?
Solution: Self-incompatibility refers to a genetically controlled mechanism that prevents self-pollination and promotes cross-pollination in flowers. Self-pollination cannot lead to the formation of seeds in a self-incompatible species. This happens because the pollens are unable to fertilize the ovules that would develop into an embryo and hence form seeds.

3.What is bagging technique? How is it helpful in a plant breeding programme?
Solution: The bagging technique helps prevent fertilization of the stigma by any undesired pollen by covering the emasculated flower (flower whose anther is removed) with a polybag or butter paper. The bagging technique is beneficial in the plant breeding programme. In this, only desired pollens are made to fertilize the stigma in order to produce plants with desired characteristics.

4.What is triple fusion? Where and how does it take place? Name the nuclei involved in triple fusion.
Solution: Triple fusion occurs when a male gamete fuses with two polar nuclei within the embryo sac of flowering plants. The following events take place in triple fusion:

- The pollen grains get dusted on the stigma and germinate, giving rise to a pollen tube that enters the ovule.
- The pollen tube passes into one of the synergids and releases two male gametes.
- One out of the two gametes fuses with the egg nucleus and forms a zygote.
- The other gamete fuses with the two polar nuclei located in the central cell and forms a triploid endosperm nucleus.

The nuclei involved in triple fusion are:

- A male gamete nucleus
- Two polar nuclei

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

Solution: The zygote remains inactive until the endosperm is formed as a result of triple fusion. The endosperm provides nutrition to the developing embryo and is formed from the primary endosperm cell that results from triple fusion.

6.Differentiate between:

Epicotyl and hypocotyl Coleoptile and coleorrhiza

Integument and testa

Perisperm and pericarp

Solution:

Epicotyl and hypocotyl

Epicotyl	**Hypocotyl**
Region of embryo above the cotyledon.	Region of the embryo below the cotyledon.
Terminates at the plumule.	Terminates at the cotyledonary node.
Starts from the cotyledonary node.	Starts from the radicle.
Develops into the upper part of the stem.	Develops into that part of the stem that develops into roots.
Elongates in epigeal germination.	Elongates in hypogeal germination.

- **Coleoptile and coleorrhiza**

Coleoptile	**Coleorrhiza**
It is a protective sheath.	It is an undifferentiated sheath.
Protects young shoot tip in cereals and grass.	Protects the roots of a germinating grass or cereal.

Comes out of the soil.	Remains inside the soil.
Covers the plumule.	Covers the root cap and radical.
Breaks the seed coat and grows.	Breaks the seed coat and stops growth.

3. **Integument and testa**

Integument	**Testa**
Covers the ovule.	Outer covering of seed.
The cells are living.	The cells are dead.
Pre-fertilized structure.	Post-fertilized structure.
Sclereids are absent.	Sclereids are present.
One or two layered.	One layered.

4. **Perisperm and pericarp**

Perisperm	**Pericarp**
Part of a seed.	Part of a fruit.
Usually dry.	Dry or fleshy.
Present in only a few seeds.	Found in all fruits.
Non-functional in seed.	Protects the fruit and helps in nutrition and dispersal.

7.Why is apple called a false fruit? Which part of the flower forms the fruit?
Solution: A false fruit is derived from some secondary parts and not from the ovary. Apple is derived from the thalamus and is hence called a false fruit.

8.What is meant by emasculation? When and why does a plant breeder employ this technique?
Solution: Emasculation refers to the removal of stamens from bisexual flowers before the maturation of the anther in order to avoid self-pollination in the flowers. This technique is employed when the breeder wants plants of desired characteristics. The flowers are bagged even before the anther matures. When the anther matures, the pollen grains are shed on the covered stigma and are allowed to pollinate with the flowers of the desired characteristics.

9.If one can induce parthenocarpy through the application of growth substances, which fruits would you select to induce parthenocarpy and why?
Solution: Parthenocarpy refers to the development of fruits without fertilization. Fruits devoid of seeds, such as watermelon and muskmelon, are in great demand. Therefore, these varieties will be developed by parthenocarpy.

10.Explain the role of tapetum in the formation of pollen grain walls.
Solution: Tapetum is the internal layer of microsporangium and plays an important role in the formation of pollen grain walls. It provides nutrition to the maturing pollen grains. Various amino acids, enzymes, and hormones are produced by tapetum cells that are essential for the maturation of pollen grains. Tapetum also forms the exine layer of pollen grains.