

CHAPTER 2

SEXUAL REPRODUCTION IN FLOWERING PLANTS

POINTS TO REMEMBER

Autogamy : When pollen grains of a flower are transferred from anther to stigma of the same flower.

Coleorhiza : A protective sheath of radicle in monocot seed.

Coleoptile : A protective sheath of plumule in monocot seed.

Endothecium : A fibrous layer in the anther next to epidermis.

Geitonogamy : Self pollination between flowers of the same plant.

Micropyle : A small pore in the ovule through which the pollen tube enters.

Nucellus : Multicellular tissue in the centre of ovule where embryo sac is present.

Tapetum : Inner most layer of cells in pollen sac which provide nutrition to developing pollen grains

Viability of Seed : Ability of seed to retain the power of germination.

1. **Microsporangium (Pollen sac)** :

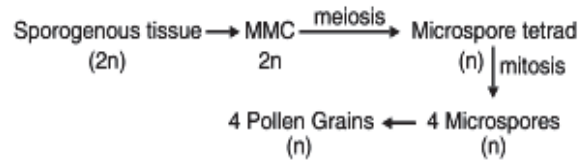
Outermost layer = Epidermis

Second layer = Endothecium

Middle layer = 2 – 4 layers of cells

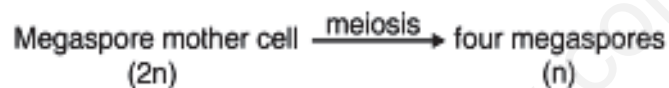
Innermost layer = Tapetum [Nourishes the developing Pollen grains (Microspores)]

2. **Microsporogenesis** : Process of formation of microspores from a pollen mother cell



3. **Pollen grain** →
- outerwall (Exine) – Thick, hard, made of sporopollenin
 - innerwall (Intine) – Thin, made of cellulose and Pectin
 - cell – a vegetative cell (large in size) and a generative cell (small in size)

4. **Megasporogenesis** – Process of formation of megaspore from the megaspore mother cell.



5. **Megasporangium (Ovule) :**

- The ovule is a small structure attached to the placenta by means of a stalk called funicle.
- The point of attachment of the body of the ovule to the funicle is known as hilum. The main body of the ovule is composed of paranchymatous cells known as nucellus.
- Each ovule has one or two protective integument, which encircle the ovule except at the tip having small opening called micropyle.
- Opposite to micropylar end, is chalaza.
- Generally a single embryo sac or female gametophyte located in nucellus.
- Cells of nucellus have abundant reserve food material and provide nourishment to the developing embryo.

6. **Female gametophyte (Embryo sac) :** In a majority of flowering plant one of the megaspore is functional while other three degenerate.

- The functional megaspore develops in embryo sac.
- The nucleus of the functional megaspore (n) undergoes three successive mitotic cell division which results the formation of eight nucleate stage of embryo sac (free nuclear division)
- The cell wall formation starts at eight nuclear stages. Three cells are grouped together at micropylar end to form the egg apparatus (2

synergids + 1 egg cell).

- ❑ Three cells are grouped at chalazal end, called antipodal cells.
- ❑ The remaining 2 nuclei are called polar nuclei move to the centre of embryo sac, called central cell.

Thus typical angiospermic embryo sac at maturity is 8 nucleated and 7 celled.

7. Pollen – pistil interaction

- ❑ The pistil has the ability to recognize the pollen, whether it is or right type (Compatible) or of the wrong type (incompatible).
- ❑ If it is compatible, the pistil accepts the pollen.
- ❑ The pollen grains germinate on stigma to produce tubes. The contents of the generative cell (or the two male gametes in those species whose pollen is liberated in the three celled stage).
- ❑ Pollen tube grows through the tissue of stigma and style by secreting enzyme and enters the ovule.

8. **Double Fertilisation** : The pollen tube releases two male gamete into the cytoplasm of synergid

Syngamy : One male gamete + Egg cell „_ Zygote (2n)

Triple Fusion : Second male gamete + 2 polar nuclei „_ PEN (3n)

9. **Post Fertilisation events** : (i) Endosperm and embryo development (ii) Maturation of ovule and ovary

Ovary	Fruit	(2n)
Ovary wall	Pericarp	(2n)
Ovule	Seed	(2n)
Outer Integument	Testa	(2n)
Inner Integument	Tegmen	(2n)
Zygote	Embryo	(2n)
Primary Endosperm cell	Endosperm	(3n)

Embryo formation starts after certain amount of endosperm is formed

Zygote → Pro-embryo → Globular embryo → Heart shaped embryo → Mature embryo

10. **Dicot Embryo** : A typical dicot embryo consist of an embryonal axis and two cotyledons. The portion of embryonal axis above the level of cotyledons is the epicotyle which terminates with the plumule or stem tip.

The portion below the level of cotyledons is hypocotyl that terminates at its lower end in the radicle or root tip.

Monocot Embryo : Monocot (Rice, Maize etc.) has one cotyledon called Scutellum. The embryonal axis has the radicle and root cap enclosed by a sheath called Coleorrhiza.

The upper end (epicotyle) has plumule which is covered by hollow folder sturcture, the coleoptile.

Apomixis : Apomixis is a form of asexual reproduction that mimics sexual reproduction where seed are formed without fertilisation.

Polyembryony : Occurance of more than one embryo in a seed. e.g. Orange, lemon, onion, mango, ground nut.

Reasons : More than one egg may be formed in the embryo sac. More than one embryo sac may be formed in an ovule.

QUESTIONS

VSA (1 MARK)

1. In a young anther, a group of compactly arranged homogenous cells were observed in the centre of each microsporangium. What is the name given to these cells?
2. Give the scientific name of a plant which came to India as a contaminant with imported wheat and causes pollen allergy.
3. Pollen grains of water pollinated species have a special characteristics for protection from water. What is that?
4. Why are pollen grains produced in enormous quantity in Maize?
5. In same species of Asteraceae and grasses, seed are formed without fusion of gametes. Mention the scientific term for such form of reproduction.
6. Arrange the following in correct developmental sequence :
Male gamete, Potential pollen mother cell, sporogenous tissue, Pollen grains, Microspore tetrad.
7. If the diploid number of chromosomes in an angiospermic plant is 16. Mention number of chromosomes in the endosperm and antipodal cell.

SA-II (2 MARKS)

8. In angiospermic plant before formation of microspore sporogenous tissue undergo cell division
 - (a) Name the type of cell division.
 - (b) What would be the ploidy of the cells of tetrad?
9. Outer envelop of pollen grain made of a highly resistant substance. What is that substance? At which particular point the substance is not present?
10. Fruits generally develops from ovary, but in few species thalamus contributes to fruit formation.
 - (a) Name the two categories of fruits.
 - (b) Give one example of each.
11. Among the animal, insects particularly bees are the dominant pollinating agents. List any four characteristic features of the insect pollinated flower.
12. Differentiate between geitonogamy and xenogamy.
13. In the given figure of a dicot embryo, label the parts (A) and (B) and give their function.

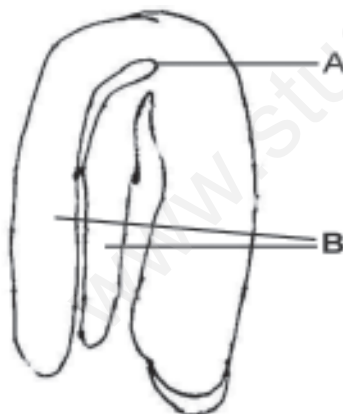


Figure 1

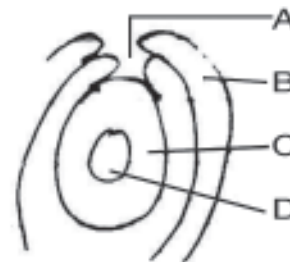
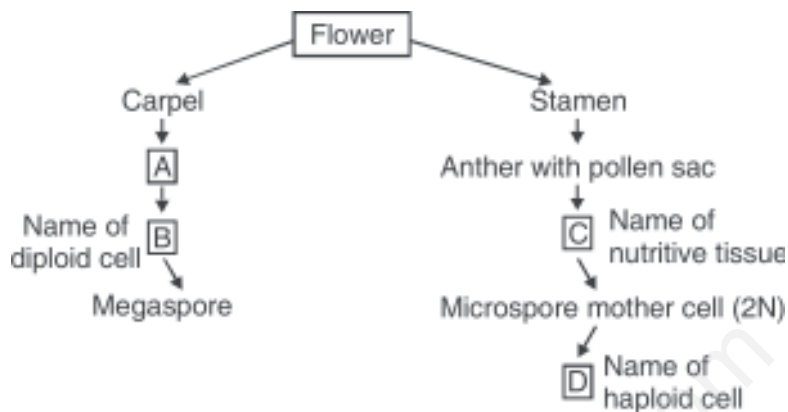


Figure 2

14. Name the parts A, B, C and D of the anatropous ovule (Figure 2) given above.
15. Given below is an incomplete flow chart showing formation of gamete in angiospermic plant. Observe the flow chart carefully and fill in the blank A, B, C and D.



16. Name the blank spaces a, b, c and d in the table given below :

<i>Item</i>	<i>What it represents in the plant</i>
(i) Pericarp	a
(ii) b	Cotyledon in seeds of grass family
(iii) Embryonal axis	c
(iv) d	Remains of nucellus in a seed.

17. Even though each pollen grain has two male gametes. Why are at least 10 pollen grains and not 5 pollen grains required to fertilise 10 ovules present in a particular carpel?

SA-I (3 MARKS)

- Continued self pollination lead to inbreeding depression. List three devices, which flowering plant have developed to discourage self pollination?
- What will be the fate of following structures in the angiospermic plant? Ovary wall, Ovule, zygote, outer integument Inner integument and primary endosperm nucleus.
- Differentiate between microsporogenesis and megasporogenesis. What type of cell division occurs during these events. Name the structure formed at the end of these two events.

LA (5 MARKS)

21. Draw the embryo sac of a flowering plants and label :
- (a) (i) Central Cell (ii) Chalazal end (iii) Synergids
 - (b) Name the cell that develops into embryo sac and explain how this cell leads to formation of embryo sac.
 - (c) Mention the role played by various cells of embryo sac.
 - (d) Give the role of filiform apparatus.

ANSWERS

- 1. Sporogenous tissue
- 2. *Parthenium*
- 3. Presence of mucilagenous covering
- 4. To ensure pollination because Maize is pollinated by wind.
- 5. Apomixis
- 6. Sporogenous tissue – Potential pollen mother cell – microspore tetrad – Pollen grain – male gamete.
- 7. 24 Chromosomes in endosperm and 16 chromosomes in antipodal cell.

SA - II (2 MARKS)

- 8. (a) meiosis division (b) haploid
- 9. Sporopollenin; at germ pore sporopollenin is absent.
- 10. Two categories of fruits are :
 - (i) True fruits e.g., Mango
 - (ii) False fruit e.g., Apple
- 11.
 - 1. Flowers are large.
 - 2. Colorful petals of flower.
 - 3. Presence of fragrance.
 - 4. Rich in nectar.

12.

<i>Geitonogamy</i>	<i>Xenogamy</i>
1. Transfer of pollen grains from the another to stigma of another flower of the same plant	Transfer of Pollen grains from another to stigma of defferent plant.
2. Does not provide opportunity for gametic recombination.	Provide opportunity for gametic recombination.

13. A = Plumule – To form shoot system

B = Cotyledons – Storage of food

14. A = Micropyle, B = Outer integument, C = Nucellus, D = Embryo sac

15. A = Ovule/megasporangium, C = Tapetum

B = Megaspore mother cell, D = Pollen grains

16. a = wall of fruit, b = scutellum, c = shoot and root tip, d = perisperm

17. Because only one male gamete is involved in syngamy. ie fusion of male gamete with egg cell.

SA - I (3 MARKS)

18. (a) Release of pollen and stigma receptivity is not synchronised in some species

(b) Anther and stigma are at different position/heights in some plants

(c) Self-incompatibility a genetic mechanism.

19. Ovary wall = Pericarp ; Ovule = Seed,

Zygote - Embryo; Outer integument = Testa;

Inner integument = Tegmen; Primary endosperm nucleus = Endosperm.

20. Microsporogenesis – Process of formation of microspore from a Pollen mother cell.

Megsporogenesis – Process of formation of megaspore from megaspore mother cell.

Meiotic division in both

Microsporogenesis results in the formation of pollen grain while megasporogenesis results in the formation of megaspore.

LA (5 MARKS)

21. A. Refer to figure 2.8(c) page 26 NCERT book.
- B. Functional Megaspore, Refer text on page 27 NCERT book.
- C. Egg : Fuses with male gamete to form zygote or future embryo
Synergid : Absorption of nutrient, attract and guides pollen tube.
Central Cell : After fusion with second male gamete forms Primary endosperm cell which gives rise to Endosperm
- D. Guides the entry of pollen tube.