Reproduction in Lower and Higher Plants

EXERCISES [PAGES 16 - 17]

Exercises | Q 1.1 | Page 16

Multiple choice question.

Insect pollinated flowers usually posses _____

1. **Sticky pollens with rough surface**
2. Large quantities of pollens
3. Dry pollens with smooth surface
4. Light coloured pollens

Solution:

Insect pollinated flowers usually posses **Sticky pollens with rough surface.**

Exercises | Q 1.2 | Page 16

Multiple choice question.

In ovule, meiosis occurs in _____

1. integument
2. nucellus
3. megaspore
4. **megaspore mother cell**

Solution:

In ovule, meiosis occurs in **megaspore mother cell.**

Exercises | Q 1.3 | Page 16

Multiple choice question.

The ploidy level is not the same in _____.

1. Integuments and nucellus
2. Root tip and shoot tip
3. **Secondary nucleus and endosperm**
4. Antipodals and synergids

Solution: The ploidy level is not the same in **secondary nucleus and endosperm**.

Exercises | Q 1.4 | Page 16

Multiple choice question.

Which of the following types require pollinator but the result is genetically similar to autogamy?

1. **Geitonogamy**
2. Xenogamy
3. Apogamy
4. Cleistogamy

Solution: Geitonogamy

Exercises | Q 1.5 | Page 16

Multiple choice question.

If diploid chromosome number in a flowering plant is 12, then which one of the following will have 6 chromosomes?

1. Endosperm
2. Leaf cells
3. Cotyledons
4. **Synergids**

Solution: Synergids

Exercises | Q 1.6 | Page 16

Multiple choice question.

In angiosperms, endosperm is formed by/ due to _____

1. free nuclear divisions of megaspore
2. polar nuclei
3. **polar nuclei and male gamete**
4. synergids and male gamete

Solution: In angiosperms, endosperm is formed by/ due to **polar nuclei and male gamete.**

Exercises | Q 1.7 | Page 16

Multiple choice question.

Point out the odd one.

1. Nucellus
2. Embryo sac
3. Micropyle
4. **Pollen grain**

Solution: Pollen grain.

Exercises | Q 2.01 | Page 16

Very short answer type question:

Name the part of gynoecium that determines the compatible nature of pollen grain.

Solution: Pistil determines the compatible nature of pollen grain.

Exercises | Q 2.02 | Page 16

Very short answer type question:

How many haploid cells are present in a mature embryo sac?

Solution: Total 6 haploid cells are present in a mature embryo sac. They are antipodal cells (3), synergids (2), and egg cell (1).

Exercises | Q 2.03 | Page 16

Very short answer type question:

Even though each pollen grain has 2 male gametes, why at least 20 pollen grains are required to fertilize 20 ovules in a particular carpel?

Solution: During double fertilization, one of the male gamete of pollen grain fuses with egg cell, while other male gamete fuses with secondary nucleus. Thus to fertilize 20 ovules in a particular carpel, 20 pollen grains are required.

Exercises | Q 2.04 | Page 16

Very short answer type question:

Define megasporogenesis.

Solution: It is the process of formation of haploid megaspores from diploid megaspore mother cell (MMC) by meiotic division

Exercises | Q 2.05 | Page 16

Very short answer type question:

What is hydrophily?

Solution: Pollination carried out by water is called hydrophily.

Exercises | Q 2.06 | Page 16

Very short answer type question:

Name the layer which supplies nourishment to the developing pollen grains.

Solution: Tapetum supplies nourishment to the developing pollen grains.

Exercises | Q 2.07 | Page 16

Very short answer type question:

Define Parthenocarpy.

Solution: It is the condition in which fruit is developed without the process of fertilization is called parthenocarpy.

Exercises | Q 2.08 | Page 16

Very short answer type question:

Are pollination and fertilization necessary in apomixis?

Solution: In apomixis, the embryo is formed without the formation of gametes and fertilization.

Thus, pollination and fertilization are not necessary for apomixis.

Exercises | Q 2.09 | Page 16

Very short answer type question:

Name the parts of pistil which develop into fruits and seeds.

Solution: After fertilization, the ovary of the pistil develops into fruit and ovules into seeds.

Exercises | Q 2.1 | Page 16

Very short answer type question:

What is the function of filiform apparatus?

Solution: Filiform apparatus guide the entry of pollen tube towards the egg.

Exercises | Q 3.1 | Page 16

Short Answer Question:

How polyembryony can be commercially exploited?

Solution:

1. Polyembryony increases the chances of survival of the new plants.
2. Genetically uniform parental type seedlings are obtained from nucellar embryos, thus nucellar adventive polyembryony is of great significance in horticulture.
3. Plantlets obtained from these embryos are disease-free.
4. These embryos can be isolated and grown on embryo culture to produce clones.

Exercises | Q 3.2 | Page 16

Short Answer Question:

Pollination and seeds formation is very crucial for fruit formation. Justify the statement.

Solution:

1. Pollination is a very important part of the life cycle of a flowering plant.
2. The flowers must be pollinated in order to bring about the process of fertilization.
3. Pollination brings male and female gametes of a flower together during fertilization.
4. As a result of fertilization, ovary develops into fruits and ovules into seeds.
5. Seeds on germination give rise to a new plant that further grows and develops fruits and seeds. Thus pollination and seed formation are required to create offsprings for the next generation.

Exercises | Q 3.3 | Page 16

Short Answer Question:

Incompatibility is a natural barrier in the fusion of gametes. How will you explain this statement?

Solution:

1. Incompatibility refers to inability of certain gametes even from genetically similar plant species to fuse with each other.
2. It is considered as the most prevalent and effective device to avoid inbreeding and outbreeding.
3. Pollen pistil interaction is a dynamic process that involves pollen recognition followed by promotion or inhibition of the pollen.
4. Chemical substances released by the style act as a barrier.
5. Typically the pollen belonging to the correct mating type germinates on stigma, develops a pollen tube, and brings about fertilization.
6. The pollens belonging to the other mating type are discarded.

Thus, incompatibility is a natural barrier in the fusion of gametes.

Exercises | Q 3.4 | Page 16

Short Answer Question:

Describe three devices by which cross-pollination is encouraged in angiosperms by avoiding self- pollination.

Solution:

Genetic diversity is an essential factor for evolution by natural selection. Continued self-pollination results in inbreeding depression. Thus, plants have developed many devices to encourage cross-pollination. Examples of outbreeding devices are as follows:

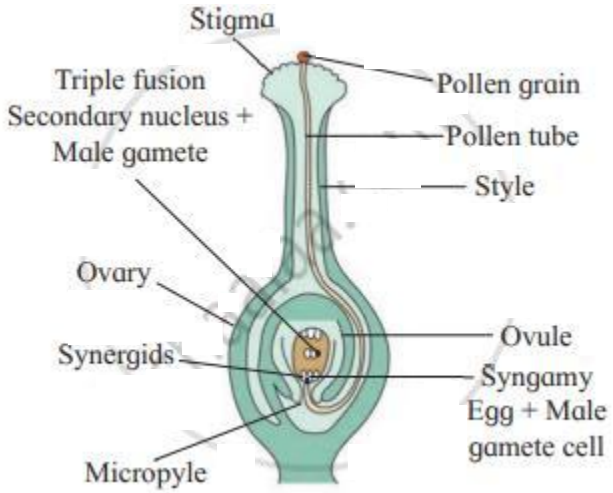
1. **Unisexuality:**
   In this, the plant bears either male or female flowers. It is also called as dioecism.
   As flowers are unisexual, self-pollination is not possible. Plants may be monoecious, e.g. Maize or dioecious, e.g. Mulberry, Papaya.
2. **Dichogamy:**
   In this, anthers and stigmas mature at different times in a bisexual flower due to which self-pollination is prevented. It can be further divided into two types:
   a. Protandry:
   In this type, anthers mature first, but the stigma of the same flower is not receptive at that time.
   e.g. in the disc florets of sunflower.
   b. Protogyny:
   In this type, stigma of carpel matures earlier than anthers of the same flower. e.g. Gloriosa.
3. **Prepotency:**
   In this, pollen grains of other flowers germinate rapidly over the stigma than the pollen grains from the same flower, e.g. Apple.
4. **Heterostyly (heteromorphy):**
   Plants like Primula (Primrose) produce two or three types of flowers in which stigmas and anthers are placed at different levels (heterostyly and heteroanthy).
   This prevents the pollens from reaching the stigma and pollinating it. In heteromorphic flowers, pollen grains produced from anther pollinate stigmas produced at the same level.
   Thus self-pollination is not possible in such cases.
5. **Herkogamy:**
   It is a mechanical device to prevent self-pollination in a bisexual flower. In plants, a natural physical barrier is present between two sex organs and avoid contact of pollen with the stigma of the same flower, in e.g. Calotropis, pentangular stigma is positioned above the level of anthers (pollinia).
6. **Self-incompatibility (self-sterility):**
   This is a genetic mechanism due to which the germination of pollen on the stigma of the same flower is inhibited, e.g. Tobacco, Thea.

Exercises | Q 4.1 | Page 16

Long Answer Question:

Describe the process of double fertilization.

Solution:



1. The fusion of one male gamete with an egg and that of another male gamete with a secondary nucleus is called as double fertilization.
   It is the characteristic feature of angiosperms.
   It was discovered by Nawaschin in the liliaceous plants like Lilium and Fritillaria.
2. When pollen grain reaches the surface of the stigma, it germinates and forms a pollen tube.
3. Pollen tube penetrates the stigma, style, ovary chamber and then enters ovule.
4. The growth of pollen tube is guided by the chemicals secreted by the synergids.
5. Usually when pollen tube enters ovule through the micropyle, it is termed as porogamy. But in some cases, it enters through chalaza which is known as chalazogamy. In some plants it enters by piercing the integuments which are called mesogamy.
6. A pollen tube penetrates the embryo sac of ovule through its micropylar end.
7. The pollen tube carrying male gametes penetrates in one of the synergids.
8. Watery contents of synergid are absorbed by the pollen tube, due to which it ruptures and release the contents, including the two non-motile male gametes.
9. As non-motile male gametes are carried through a hollow pollen tube, it is known as siphonogamy that ensures fertilization to take place.
10. Fertilization mainly involves two processes: Syngamy and Triple fusion.
    a. Syngamy:
    It is the fusion of haploid male gamete with a haploid female gamete (egg). It results in the formation of a diploid zygote which develops to form an embryo. Syngamy is a type of generative fertilization.
    b. Triple fusion:
    It is the fusion of second haploid male gamete with diploid secondary nucleus. It results in the formation of Primary Endosperm Nucleus (PEN) which develops into triploid endosperm. Triple fusion is a type of vegetative fertilization.

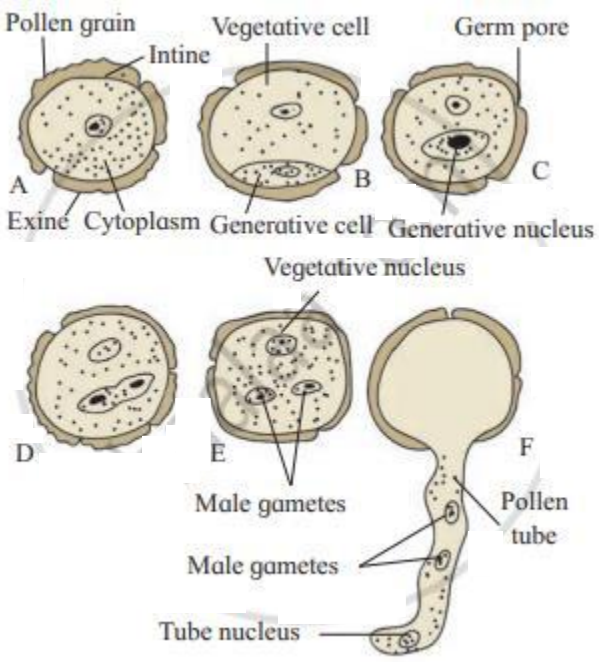
11. In this process, both the male gametes participate, due to which fertilization occurs twice in the same embryo sac, hence it is described as double fertilization.

Exercises | Q 4.2 | Page 16

Long Answer Question:

Explain the stages involved in the maturation of microspore into a male gametophyte.

Solution:



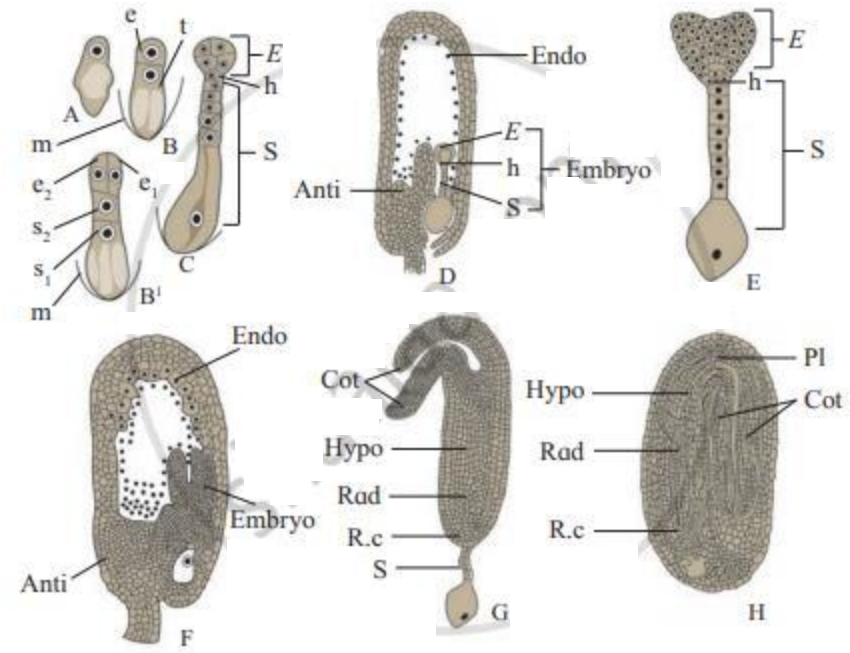
1. Pollen grain/microspore marks the beginning of male gametophyte, thus it is the first cell of the male gametophyte.
2. It undergoes the first mitotic division to produce bigger, naked vegetative cells and small, thin-walled generative cells.
3. The vegetative cell is rich in food and having an irregular shaped nucleus.
4. The generative cell floats in the cytoplasm of the vegetative cells.
5. The second mitotic division is concerned with generative cells only and gives rise to two non-motile male gametes.
6. The mitotic division of the generative cells takes place either in the pollen grain or in the pollen tube.
7. The pollen grains are shed from the anther, at this two-celled stage in most of the angiosperms.

Exercises | Q 4.3 | Page 17

Long Answer Question:

Explain the development of dicot embryo.

Solution:



A: Oospore.

B: Two celled proembryo.

e: embryonal initial;

t: suspensor initial;

m: Embryo sac membrane.

B^1 : 4-celled I-shaped proembryo;

e_1, e_2: embryonal initial; **s_1, s_2 :** suspensor initial.

C: Further development of embryo.

S: Suspensor, **h:** Hypophysis; **E:** Embryonal mass

D: L. S. of ovule

Endo: Endosperm in free nuclear stage.

Anti: Antipodal tissue.

Embryo: Developing embryo

E: Embryo showing further development of embryonic octants and hypophysis.

F: L. S. of ovule. Endosperm becoming cellular.

G: Embryo; **Cot:** Cotyledons; **Hypo:** Hypocotyl; **Rad:** Radicle; **R.c.:** Rootcap;

H: Mature seed; **Pl:** Plumule. Endosperm has been consumed almost completely

Development of dicot embryo:

1. The zygote divides to form two-celled proembryo.
2. The larger cell towards the micropyle is called basal or suspensor initial cell and smaller cell towards chalaza is called terminal or embryonal initial cell.
3. The suspensor cell divides transversely in one plane to produce filamentous suspensor of 6-10 cells.
4. The first cell of the suspensor towards the micropylar end becomes swollen and functions as a haustorium.
5. The lowermost cell of the suspensor is known as hypophysis.
6. The suspensor helps in pushing the embryo in the endosperm.
7. The embryonal initial undergoes three successive mitotic divisions to form octant.
8. The planes of divisions are at right angles to each other.
9. The lower tier of four cells of octant gives rise to hypocotyl and radicle whereas four cells of the upper-tier form the plumule and the one or two cotyledons.
10. The hypophysis by further division gives rise to the part of radicle and root cap.
11. Subsequently, the cells in the upper tier of the octant divide into several planes so as to become heart-shaped which then forms two lateral cotyledons and a terminal plumule.
12. Further enlargement of hypocotyl and cotyledons result in a curvature of the embryo and it appears horseshoe-shaped.

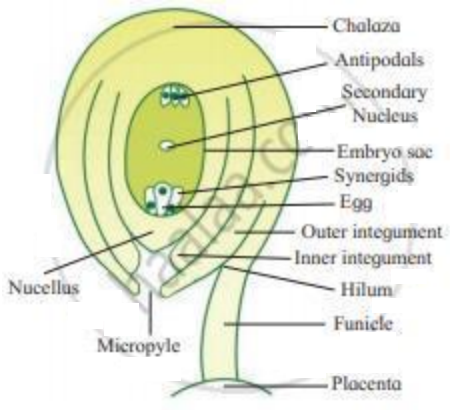
Exercises | Q 4.4 | Page 17

Long Answer Question:

Draw a labeled diagram of the L.S. of anatropous ovule and list the components of the embryo sac and mention their fate after fertilization.

Solution:

1. Structure of anatropous ovule:



2. List the components of embryo sac and mention their fate after fertilization:

Components of the embryo sac	Fate after fertilization
Ovule	Seed
Egg	Embryo
Nucellus	Perisperm
Secondary nucleus	Endosperm
Outer integument	Testa (outer seed coat)
Inner integument	Tegmen (inner seed coat)
Micropyle	An opening in the seed (i.e. micropyle)
Synergids	Degenerate
Antipodals	Degenerate

Exercises | Q 5.01 | Page 17

Fill in the blank:

The _____ collect the pollen grains.

Solution:

The **stigma** collect the pollen grains.

Exercises | Q 5.02 | Page 17

Fill in the blanks:

The male whorl, called the _____ produces _____.

Solution:

The male whorl, called the **androecium** produces **pollen grains**.

Exercises | Q 5.03 | Page 17

Fill in the blank:

The pollen grains represent the _____.

Solution:

The pollen grains represent the **male gametophyte.**

Exercises | Q 5.04 | Page 17

Fill in the blank:

The _____contains the egg or ovum.

Solution:

The **embryo** sac contains the egg or ovum.

Exercises | Q 5.05 | Page 17

Fill in the blank:

_____takes place when one male gamete and the egg fuse together. The fertilized egg grows into a seed from which the new plants can grow.

Solution:

Syngamy (fertilization) takes place when one male gamete and the egg fuse together. The fertilized egg grows into a seed from which the new plants can grow.

Exercises | Q 5.06 | Page 17

Fill in the blank:

The _____ is the base of the flower to which other floral parts are attached.

Solution:

The **thalamus** is the base of the flower to which other floral parts are attached.

Exercises | Q 5.07 | Page 17

Fill in the blank:

_____is the transfer of pollen grains from the anther of the flower to the stigma of the same or a different flower

Solution:

Pollination is the transfer of pollen grains from the anther of the flower to the stigma of the same or a different flower.

Exercises | Q 5.08 | Page 17

Fill in the blank:

Once the pollen reaches the stigma, the pollen tube traverses down the _____to the ovary where fertilization occurs.

Solution:

Once the pollen reaches the stigma, the pollen tube traverses down the **style** to the ovary where fertilization occurs.

Exercises | Q 5.09 | Page 17

Fill in the blanks:

The _____ are coloured to attract the insects that carry the pollen. Some flowers also produce _____ or _____ that attracts insects.

Solution:

The **petals** are coloured to attract the insects that carry the pollen. Some flowers also produce **sweet odour** or **nectar** that attracts insects.

Exercises | Q 5.1 | Page 17

Fill in the blank:

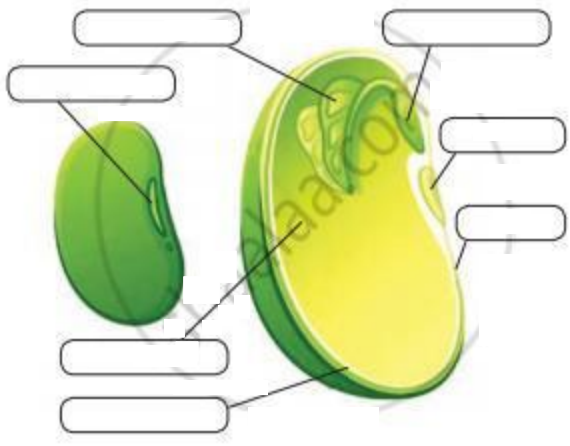
The whorl _____is green that protects the flower until it opens.

Solution:

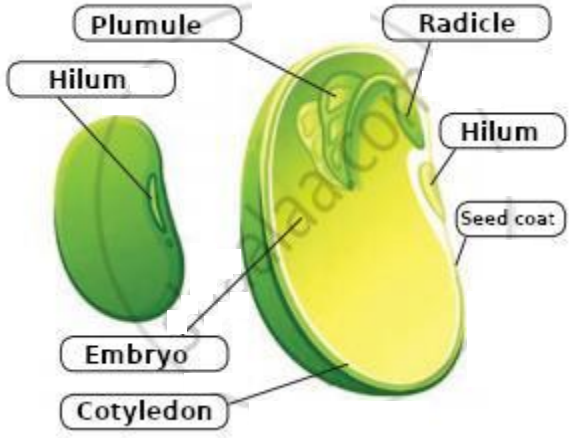
The whorl **calyx** is green that protects the flower until it opens.

Exercises | Q 6 | Page 17

Label the parts of seed.



Solution:



Exercises | Q 7 | Page 17

Match the column.

Column - I (Structure before seed formation.)		Column - II (Structure after seed formation.)	
A.	Funiculus	I.	Hilum
B.	Scar of ovule	II.	Tegmen
C.	Zygote	III.	Testa
D.	Inner integument	IV.	Stalk of seed
		V.	Embryo

1. A - V, B - I, C - II, D - IV
2. A - III, B - IV, C - I, D - V
3. **A - IV, B - I, C - V, D - II**

4. A - IV, B - V, C - III, D - II
   Solution:

   A - IV, B - I, C - V, D – II