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12th CBSE Biology

1 Asexual and Sexual Reproduction in Plants

Book Back Solved Questions - 1 Mark

Choose the Correct Answer

1. Choose the correct statement from the following
a) Gametes are involved in asexual reproduction
b) Bacteria reproduce asexually by budding
c) Conidia formation is a method of sexual reproduction
d) Yeast reproduce by budding

2. An eminent Indian embryologist is
a) S.R.Kashyap b) P. Maheshwari
c) M. S. Swaminathan
d) K. C. Mehta

3. Identify the correctly matched pair
a) Tuber - Allium cepa
b) Sucker - Pistia
c) Rhizome - Musa
d) Stolon - Zingiber

4. Pollen tube was discovered by
a) J. G. Kolreuter b) G. B. Amici
c) E. Strasburger d) E. Hanning

5. Size of pollen grain in *Myosotis*
a) 10 micrometer
b) 20 micrometer
c) 200 micrometer
d) 2000 micrometer

6. First cell of male gametophyte in angiosperm is
a) Microspore b) Megaspore
c) Nucleus
d) Primary Endosperm Nucleus

7. Match the following

I) External fertilization	-	i) pollen grain
II) Androecium	-	ii) anther wall
III) Male gametophyte	-	iii) algae
IV) Primary parietal layer	-	iv) stamens

a) I-iv; II-i; III-ii; IV-iii
b) I-iii; II-iv; III-i; IV-ii
c) I-iii; II-iv; III-ii, IV-i
d) I-iii; II-i; III-iv; IV-ii

1. (d) Yeast reproduce by budding
2. (b) P. Maheshwari
3. (c) Rhizome - Musa
4. (b) G.B. Amici
5. (a) 10 micrometer
6. (a) Microspore
7. (b) I-iii; II-iv; III-i; IV-ii

8. Arrange the layers of anther wall from locus to periphery

a) Epidermis, middle layers, tapetum, endothecium

b) Tapetum, middle layers, epidermis, endothecium

c) Endothecium, epidermis, middle layers, tapetum

d) Tapetum, middle layers, endothecium, epidermis

9. Identify the incorrect pair

a) Sporopollenin - exine of pollen grain

b) Tapetum - nutritive tissue for developing microspores

c) Nucellus - nutritive tissue for developing embryo

d) Obturator - directs the pollen tube into micropyle

10. Assertion : Sporopollenin preserves pollen in fossil deposits

Reason : Sporopollenin is resistant to physical and biological decomposition

a) Assertion is true; reason is false

b) Assertion is false; reason is true

c) Both assertion and reason are not true

d) Both assertion and reason are true.

11. Choose the correct statement(s) about tenuinucellate ovule

a) Sporogenous cell is hypodermal

b) Ovules have fairly large nucellus

c) Sporogenous cell is epidermal

d) Ovules have single layer of nucellus tissue

12. Which of the following represent megagametophyte?

a) Ovule

b) Embryo sac

c) Nucellus

d) Endosperm

13. In *Haplopappus gracilis*, number of chromosomes in cells of nucellus is 4. What will be the chromosome number in Primary endosperm cell?

a) 8 *b) 12*

c) 6 *d) 2*

14. Transmitting tissue is found in

a) Micropylar region of ovule

b) Pollen tube wall

c) Stylar region of gynoecium

d) Integument

8. (d) Tapetum, middle layers, endothecium, epidermis

9. (c) Nucellus - nutritive tissue for developing embryo

10. (d) Both assertion and reason are true.

11. a) Sporogenous cell is hypodermal (and) d) Ovules have single layer of nucellus tissue

12. (b) Embryo sac

13. (b) 12

14. (c) Stylar region of gynoecium

15. The scar left by funiculus in the seed is

a) Tegmen *b) Radicle*
c) Epicotyl *d) Hilum*

16. A Plant called X possesses small flower with reduced perianth and versatile anther. The probable agent for pollination would be

a) Water *b) Air*
c) Butterflies *d) Beetles*

17. Consider the following statement(s)
i) In Protandrous flowers pistil matures earlier
ii) In Protogynous flowers pistil matures earlier
iii) Herkogamy is noticed in unisexual flowers
iv) Distyly is present in *Primula*

a) i and ii are correct
b) ii and iv are correct
c) ii and iii are correct
d) i and iv are correct

18. Coleorhiza is found in

a) Paddy *b) Bean*
c) Pea *d) Tridax*

19. Parthenocarpic fruits lack

a) Endocarp *b) Epicarp*
c) Mesocarp *d) Seed*

20. In majority of plants, pollen is liberated at

a) 1 celled stage
b) 2 celled stage
c) 3 celled stage
d) 4 celled stage

Book Back Solved Questions - 2 Marks

1. What is reproduction?

- The production of **offspring**.
- It causes **multiplication** of individuals.
- It consists of **sexual** or **asexual** processes.
- It is a **vital** process for the existence of a species.
- It brings **variation** in the offspring for survival.
- It plays an important role in **evolution.**

2. Mention the contribution of Hofmeister towards embryology.

Hofmeister described the **structure of pollen tetrad.**

3. List out two sub-aerial stem modifications with example.

1. Runner - *Centella asiatica*
2. Stolon - *Fragaria*
3. Offset - *Pistia stratiotes*
4. Sucker - *Chrysanthemum*

4. What is layering?

- In this method, the ***stem*** of a parent plant is allowed to ***develop roots*** while still intact.
- When the root develops, the ***rooted***

15. (d) Hilum
16. (b) Air
17. (b) ii and iv are correct
18. (a) Paddy
19. (d) Seed
20.(b) 2 celled stage

part is cut and planted to grow as a new plant.

- A method of plant **propagation.**
- It is a **conventional method.**
- It is of **two** types:
  1. *Mound layering*
  2. Air layering

Eg. • *Ixora*
• *Jasminum*

5. What are clones?

Morphologically and **genetically** *identical individuals.*

6. A detached leaf of *Bryophyllum* produces new plants. How?

Bryophyllum has **adventitious buds** at the leaf notches in the margin. These adventitious buds are called **epiphyllous buds.**

When the detached leaf gets decayed, the adventitious buds form a **root system.**

Then, they become **independent plants.**

7. What is cantharophily?

Pollination by **beetles** is called cantharophily.

8. What is endothelium?

1. The specialized **inner layer** of the **integument** of **ovule.**
2. It is also known as **integumentary tapetum.**
3. It is found in the species having **unitegmic tenuinucellate.**
4. It performs the **nutritive function** for **embryo sac.**

9. " The endosperm of angiosperm is different from gymnosperm"?. Do you agree? Justify your answer.

Yes

Justification

The endosperm of Angiosperm is **triploid** but the endosperm of gymnosperm is **haploid.**

10. Define the term diplospory.

1. In diplospory, a **diploid embryo sac** is formed from **megaspore mother cell without** a regular **meiotic division**.
2. It is also called **generative apospory.**
3. It is an **agamospermy**-A type of apomixis

Eg. ⬩ *Eupatorium*
⬩ *Aerva*

11. What is mellitophily?

Pollination by **bees** is called mellitophily.

12. List the conventional methods adopted in vegetative propagation of higher plants.

1. Cutting
2. Grafting
   i) Bud grafting
   ii) Approach grafting
   iii) Tongue grafting
   iv) Crown grafting
   v) Wedge grafting
3. Layering
   i) Mound layering
   ii) Air layering

Book Back Solved Questions - 3 Marks

1. Differentiate grafting and layering.

Grafting	Layering
1. *A method of plant propagation, in which, two **plants** join together to grow as one.*	1. *A method of plant propagation, in which, stem of a parent plant is allowed to develop* **roots** *while* **still intact.**
2. **Two** different plants are required.	2. Only **one** plant is required.
3. It includes **stock** and **scion.**	3. **Stock** and **scion** are absent.
4. It has the following **five** types: ☞ *Bud grafting* ☞ *Approach grafting* ☞ *Tongue grafting* ☞ *Crown grafting* ☞ *Wedge grafting*	4. It has the following **two** types: ☞ *Mound layering* ☞ *Air layering*
5. It produces **more varieties.** *Eg.:* ☞ *Citrus* ☞ *Mango* ☞ *Apple*	5. It produces **one** type of offspring. *Eg.:* ☞ *Ixora* ☞ *Jasminum*

2. "Tissue culture is the best method for propagating rare and endangered plant species" -Discuss.

1. Tissue culture helps in **regeneration** of a whole plant, using **single cell** or **small pieces** of vegetative structures. This occurs by **micropropagation**.

2. In nature, **rare** and **endangered** species have
   - Less population
   - Low seed production.
   - Lowered seed germination activity

3. Such plants can be **reproduced** using tissue culture in **large numbers** during a **short period.**

4. Plants endangered due to **disease** can be reproduced to produce **disease** free **plants.**

5. Plant with less **seed production** or **lowered seed germination** can be produced.

3. List any two strategies adapted by bisexual flowers to prevent self pollination.

1. Dichogamy
   a. Protandry
   b. Protogyny
2. Herkogamy
3. Heterostyly
   a. Distyly
   b. Tristyly
4. Self sterility or
   Self incompatibility

4. Distinguish mound layering and air layering.

Mound Layering	Air Layering
1. *A method of plant propagation in which the flexible branches are buried in the soil for rooting.*	1. *A method of plant propagation in which the aerial portion of stem is girdled and hormones are applied for rooting.*
2. Applied for the plants having **flexible branches.**	2. Applied for the plants having **woody branches.**
3. Part of the stem is **buried** in the soil.	3. The girdled portion is covered with **damp** or **moist soil** in the air.
4. Hormones are **not applied** to promote rooting.	4. **Hormones** are applied to promote rooting.
5. Root emerges from the **buried portion.**	4. Root emerges from the **aerial portion.**

5. What is polyembryony? How it can be commercially exploited?

Polyembryony

Occurrence of more than one embryo in a seed is called polyembryony.

Commercial Exploitation

1. Polyembryony was exploited by plant breeders to produce **multiple seedlings.**

2. It was used in **commercial production** of plants.

3. **Nucellar** embryo culture is used to produce.

- **Disease free** plants
- Root stocks

4. **Root stocks** produced reduce the cost of production of **hybrid seeds**.

5. It is used to **increase yield.**

6. It can be used to improve the **survival** of plants under varied conditions.

6. Why does the zygote divide only after the division of primary endosperm cell?

1. Zygote develops into an **embryo.**

2. The developing embryo needs **nourishment.**

3. The primary endosperm cell divides into an **endosperm.**

4. The endosperm is a **nutritive tissue.** It nourishes the embryo.

5. Hence, the zygote divides after the division of primary endosperm.

7. "Endothecium is associated with dehiscence of anther". Justify the statement.

1. The following cause the dehiscence of anther:

1. Stomium
2. Absence of thickenings in the endothecial cells of stomium
3. Hygroscopic nature of the endothecium

2. Endothecium is a layer of cells present below the epidermis of anther.

3. The inner tangential wall of the endothecial cells are provided with **thickenings** like;

- *Bands of cellulose*
- *Lignin*

4. These thickenings are absent in **stomium**-along the junction of two sporangia of an anther lobe.

5. The endothecial cells are **hygroscopic.**

8. Distinguish tenuinucellate and crassinucellate ovules.

Tenuinucellate Ovule	Crassinucellate Ovule
1. *Ovule with one layer of cell in nucellus.*	1. *Ovule with two or more layers of cells in nucellus.*
2. Sporogenous cell is **hypodermal** in origin.	2. Sporogenous cell is **subhypodermal** in origin.
3. Nucellar tissue is **single layered.**	3. Nucellar tissue is **multilayered.**
4. Nucellus is **very small** in size.	4. Nucellus is **large** in size.

9. List out the functions of tapetum.

1. Tapetum supplies **nutrition** to the developing microspores.

2. It contributes **sporopollenin** through **ubisch bodies.**

3. It plays an important role in **pollen wall formation.**

4. It contributes the **pollenkitt material.**

5. Exine proteins responsible for **'rejection reaction'** of the stigma are derived from tapetal cells.

10. Write short notes on pollenkitt.

1. *An oily layer forming a thick viscous coating over pollen surface.*

2. It is contributed by the **tapetum.**

3. It is **yellow** or **orange** in colour.

4. It contains **carotenoids** or **flavonoids.**

5. It attracts **insects.**

6. It **protects** against **damage** from UV radiation.

11. 'Pollination in gymnosperms is different from Angiosperms'-Give reasons.

1. In gymnosperms, the pollination is **direct.** The pollens are deposited directly on the **exposed ovule.**

2. In Angiosperms, the pollination is **indirect.** The pollens are deposited on the **stigma** of the flower.

12. Write short notes on heterostyly.

1. *The condition in which the flowers of same plant have styles of different lengths.*

2. It is a contrivance of **cross-pollination.**

3. Some plants produce two or three **different forms** of flowers.

4. They are different in their length of:

- *Stamens*
- *Style*

5. Pollination will take place only between organs of the **same length.**

6. Heterostyly is of the following **two** types:

i) *Distyly*-Two forms of flowers

ii) *Tristyly*- Three forms of flowers

13. Enumerate the characteristic features of entomophilous flowers.

Entomophilous flowers are pollinated by **insects.**

1. Flowers are **large.**

2. If the flowers are small, they aggregate to form dense **inflorescence.**

Eg.: *Asteraceae* flowers

3. Flowers are **brightly coloured.**

4. The adjacent parts are **brightly coloured.**

5. Flowers are **scented.**

6. They produce **nectar.**

7. If there is no secretion of nectar, the pollen is consumed by the honey-bees for;

- *Food*
- *Building up the hive*

8. Flowers pollinated by flies and beetles produce **foul odour** to attract them.

9. In some flowers **juicy cells** are present. Insects pierce the juicy cells and suck the content.

16. Differentiate the structure of dicot and monocot seed.

Dicot Seed	Monocot Seed
1. A seed with **two** cotyledons.	1. A seed with **single** cotyledon.
2. Coleoptile is absent.	2. **Coleoptile** is present.
3. Covered by **testa** and **tegmen.**	3. Covered by **husk** containing **glumes.**
4. **Coleorhiza** is absent.	4. **Coleorhiza** is present.

Book Back Solved Questions - 5 Marks

1. Describe cutting.

1. *A method of producing new plant by cutting and planting the plant parts from the parent plant.*

2. It is a conventional method of **vegetative plant propagation.**

3. The following plant parts are cut from the parent plant:

- *Root*
- *Stem*
- *Leaf*

4. **Stem cutting** is widely used.

5. The cut part is placed in **soil** for growth.

6. It produces root and grows into a **new plant.**

6. Depending upon the part used, it is called

Root cutting - ❖ *Malus*

Stem cutting - ❖ *Hibiscus*
❖ *Bougainvillea*
❖ *Moringa*
❖ *Bryophyllum*

Leaf cutting - ∗ *Begonia*
∗ *Bryophyllum*

2. What is grafting? List its types.

Grafting

1. *A method of* **vegetative plant propagation** *in which two plants are joined together to grow as one.*

2. The parts of **two different plants** are joined.

3. They continue to grow as **one plant.**

4. The plant which is in contact with the **soil** is called **stock.**

5. The plant used for **grafting** is called **scion.**

Eg. ❖ *Citrus*
❖ *Mango*
❖ *Apple*

Types

Based on the **method** of **uniting** scion and stock, grafting is of **five types,** namely:

1. *Bud grafting*
2. *Approach grafting*
3. *Tongue grafting*
4. *Crown grafting*
5. *Wedge grafting*

3. Write notes on bud grafting.

1. Grafting **bud** from a plant on to another plant.

It is a **conventional** method of **vegetative plant propagation**.

2. A **T-shaped incision** is made in the **stock.**

3. The bark is lifted.

4. A bud with **little wood** is removed from another plant, called **scion.**

5. The scion bud is placed in the **incision** beneath the bark.

6. They are properly **bandaged** with tape.

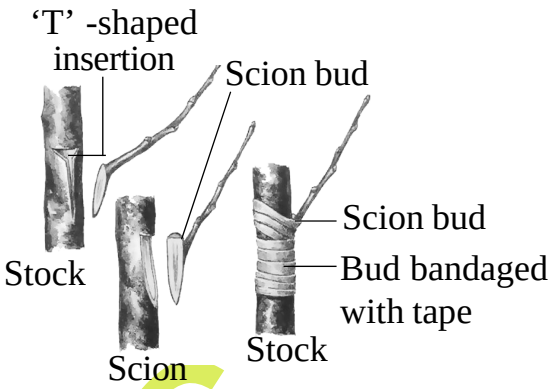

Fig. Bud grafting.

4. Describe approach grafting.

1. A graft made by joining a **rooted scion with a rooted stock.**

2. It is a conventional method of **vegetative plant propagation.**

3. The scion and stock **remain rooted.**

4. The stock is grown in a **pot.**

5. The scion is grown in **soil** or another pot.

6. Both of them should have the **same thickness.**

7. A **small slice** is cut from both.

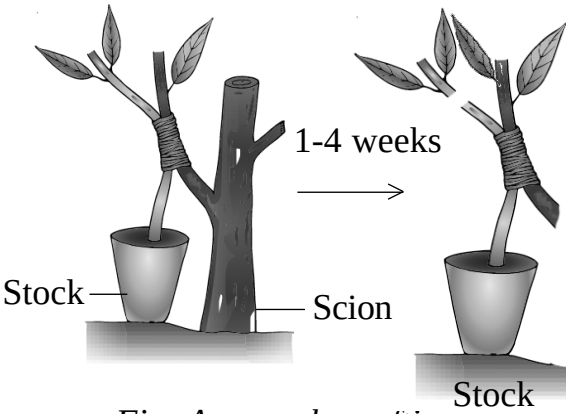

Fig. Approach grafting.

8. The cut surfaces are **brought nearer.**

9. They are **tied** together.

10. They are held by a **tape.**

11. After **1-4 weeks**, the **tip** of the stock and **base** of the **scion** are cut off and detached.

12. They are grown in a separate pot.

5. Write notes on tongue grafting.

1. A graft made by fitting a piece of **tongue shaped** scion with the stock.

2. It is a **conventional** method of **vegetative plant propagation.**

3. The scion and stock should have the **same thickness.**

4. They are cut **obliquely.**

5. The scion is fit into the stock and bound with a tape.

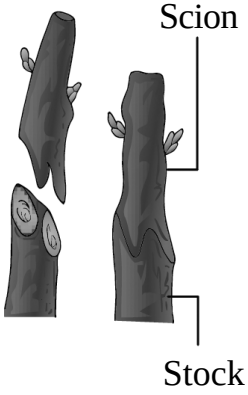

Fig. Tongue grafting.

6. Explain crown grafting.

1. A graft is made by **inserting** the scion at the **clefts** of the stock.

2. It is a conventional method of **vegetative plant propagation.**

3. This method is done in the stock that is **larger** in size.

4. **Slits** or **clefts** are made on the stock.

5. The scions are cut into **wedge** shaped structures.

6. The wedge shaped scions are **inserted** on the slits or clefts of the stock.

7. They are **fixed** in position using **graft wax.**

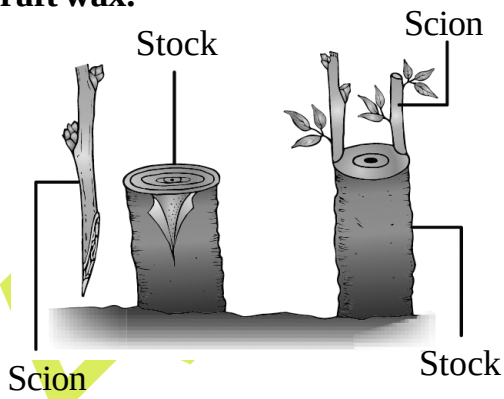

Fig.Crown grafting.

7. Describe the wedge grafting process.

1. *A graft made by inserting the wedge shaped scion at the slit of stock.*

2. It is a conventional method of **vegetative plant propagation.**

3. A **slit** is made in the stock (or) the bark is **cut.**

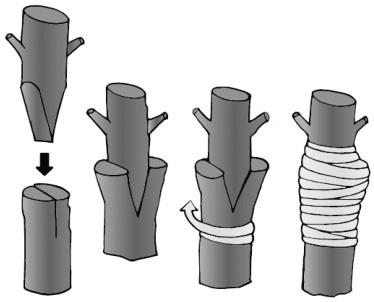

Fig. Wedge grafting.

4. A twig of scion is made into **wedge** shaped.

5. The wedge shaped scion is **inserted** into the **slit** of stock.

6. They are tightly bound.

7. The **cambium** of the two is joined.

8. What is layering? What are the types of layering?

Layering

1. *A method of vegetative plant propagation in which the stem of a parent plant is allowed to develop roots while still intact.*

2. It is a **conventional** method of **vegetative plant propagation.**

3. The stem of a parent plant is allowed to develop roots while still **intact.**

4. When the root develops, the **rooted part** is cut.

5. Then this portion is planted to grow as a **new plant.**

Eg. ☞ *Ixora*

☞ *Jasminum*

Types

1. Mound layering

2. Air layering

9. Write notes on mound layering.

1. *A method of vegetative plant propagation in which the flexible branches are buried in the soil for rooting.*

2. It is a **conventional** method of **vegetative plant propagation**.

3. The **lower branch** with leaves are **bent** to the ground.

4. The bent part of the stem is **buried** in the soil.

5. The tip of the branch is exposed **above the soil.**

6. When roots emerge, the branch is detached from the parent plant.

7. The buried part grows into a **new plant.**

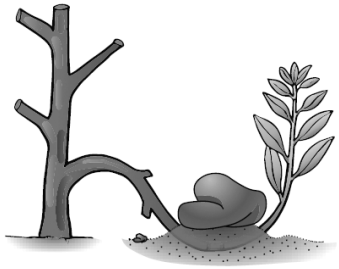

Fig. Mound layering.

10. Describe air layering.

1. *A method of vegetative propagation in which the stem is girdled at nodal region and hormones are applied for rooting.*

2. It is a conventional method of **vegetative plant propagation.**

3. The stem is **girdled** at nodal region.

4. The **hormones** are applied to this region.

5. Hormones promote **rooting.**

6. This portion is covered with **damp** or **moist soil** using a polythene sheet.

7. Roots emerge after **2-4 months.**

8. After rooting, these branches are **removed** from the parent plant.

9. They are **grown** in a separate pot or ground.

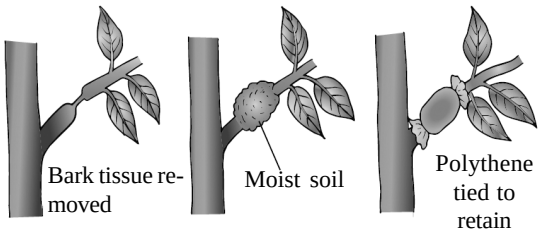

Fig. Air layering.

11. Highlight the milestones from the history of plant embryology.

1682	Nehemiah Grew	Stamens as the male organ of a flower
1694	R. J. Camerarius	Structure of the following: • *Flower* • *Anther* • *Pollen* • *Ovule*
1761	J. G. Kolreuter	Importance of insects in pollination
1824	G. B. Amici	Pollen tube
1848	Hofmeister	Structure of pollen tetrad
1870	Hanstein	The development of embryo in *Capsella* and *Alisma*
1878	E. Strasburger	Polyembryony
1884	E. Strasburger	The process of syngamy
1898	S. G. Nawaschin	Double fertilization
1899	L.Guignard	Double fertilization
1904	E. Hanning	Embryo culture
1950	D.A.Johansen	Classification for embryo development
1964	S.Guha and S.C. Maheshwari	Raised haploids from *Datura* pollen grains
1991	E.S.Coen and E.M.Meyerowitz	ABC model to describe the genetics of initiation and development of floral parts.
2015	K.V. Krishnamurthy	Molecular aspects of pre and post fertilization reproductive development in flowering plants.

12. Discuss the importance of modern methods for reproduction of plants.

Tissue culture is the modern method for reproduction of plants.

1. To multiply plants with **desired characteristics** in a **short duration.**
2. To produce **genetically identical plants.**
3. To propagate plants which **do not** produce **viable seeds** and seeds that are **difficult to germinate**.
4. To propagate rare and **endangered** plants.
5. To produce **disease free plants** by **meristem culture.**
6. To **genetically modify** and **transform cells.**

13. i) What is the cell which develops into pollen grain?

ii) Where it develops?

iii) What is the process by which pollen grain develops?

iv) Explain the process.

i) Cell which develops into pollen grain

Sporogenous cell

ii) **Location of Sporogenous cell**

Anther - Microsporangium

iii) **Name of pollen grain-developing process**

Microsporogenesis

iv) Steps in Microsporogenesis

It is the formation of **pollen grains.**

The process of formation of haploid microspores from diploid microspore mother cell through meiosis is called microsporogenesis.

5. The last generation - sporogenous cells develop into the ***microspore mother cells.***

6. Microspore mother cells are ***diploid.***

7. Each microspore mother cell divides ***meiotically*** to form four ***pollen tetrads (microspore tetrads).***

8. Pollen tetrads are ***haploid.*** This stage is called ***pollen tetrad stage.***

9. Microspore tetrads separate from one another. This stage is called ***microspore stage.***

10. Then the microspores remain ***free*** in the anther locule.

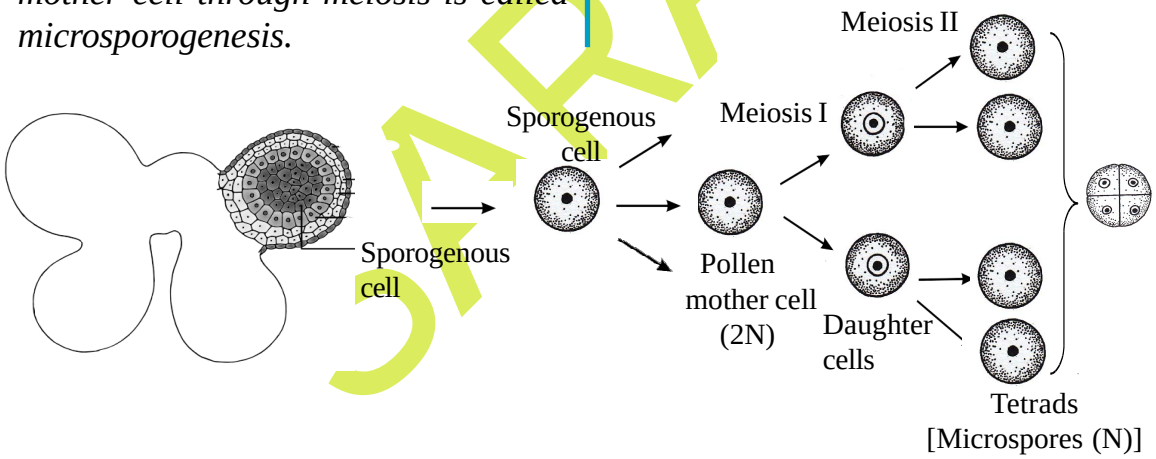

Fig. Stages in Microsporogenesis.

1. Microsporogenesis occurs inside the **anther** (Microsporangium).

2. It occurs during the ***development*** of anther.

3. The ***sporogenous cells*** are present inside the anther.

4. They develop into ***sporogenous tissue*** by ***repeated mitosis***.

11. They develop into ***pollen grains.*** This stage is called ***pollen grain stage.***

12. In some plants all the microspores are held together called ***pollinium***.

Eg. *Calotropis*

14. With a suitable diagram explain the structure of an ovule.

Ovule is the **megasporangium.**

A part of the ovary of seeded plants that contains the female reproductive cells.

Structure

A mature ovule consists of the following:

- *A stalk*
- *A body*

Stalk

1. Stalk is the **base** of an ovule.
2. It is also called **funicle.**
3. It attaches the ovule to the **placenta.**
4. The point of attachment of funicle to the **body of the ovule** is known as **hilum.**
5. Hilum represents the **junction** between **body** and **funicle.**
6. In an inverted ovule, the funicle is adnate to the body of the ovule. It forms a ridge called **raphe.**

Body

The body consists of the following parts:

1. *Integuments*
2. *Nucellus*
3. *Embryo sac*

1. The body is enclosed by one or two **integuments.**
2. The ovule with one integument is called **unitegmic ovule.**
3. The ovule with **two integuments** is called **bitegmic ovule.**
4. The integument encloses a central mass of parenchymatous tissue called **nucellus.**
5. It encloses the nucellus except at the top. It forms a pore called **micropyle.**
6. Nucellus has large **reserve food** materials.
7. The following joins at the base to form a **chalaza.**
   - *Nucellus*
   - *Integuments*
   - *Funicle*
8. An **oval, sac-like** structure is found in the nucellus. It is called **embryo sac.**
9. The embryo sac is also called **female gametophyte.**
10. Embryo sac develops from the functional **megaspore.**
11. Group of cells found at the base of the ovule between the chalaza and embryo sac is called **hypostase.**
12. The thick walled cells found above the micropylar end is called **epistase.**

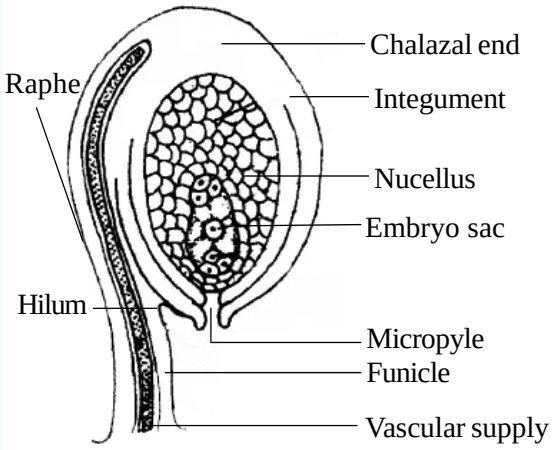

Fig. Structure of an ovule.

15. Give a concise account on steps involved in fertilization of an angiosperm plant.

1. *The fusion of male and female gametes is called fertilization.*

2. **Double fertilization** occurs in angiosperms.

3. It involves the following **stages**:

- *Germination of pollen to form **pollen tube** in the **stigma.***
- *Growth of pollen tube in the **style.***
- *Direction of pollen tube towards **micropyle.***
- *Entry of the pollen tube into ovule*
- *Discharge of male gametes*
- *Syngamy*
- *Triple fusion*

4. Pollens fall on the **stigma.**

5. The **receptive surface** of the stigma receives the pollen.

6. The pollen is **hydrated.**

7. Pollen wall proteins are **released** from the surface.

8. Pollen **germinates** to form a tube called **pollen tube.**

9. Pollen contents include the following **move** into the pollen tube.

- *Vegetative nucleus-Tube nucleus*
- *Male gametes*

10. The tip of the pollen tube **grows continuously.**

11. The pollen contents move to the **tip region.**

12. The remaining part of the pollen tube is occupied by a **vacuole.**

13. This portion is cut off from the tip by **callose plug.**

14. The tip region of the pollen tube is **hemispherical** and **transparent.** It has a **cap block.**

15. The pollen tube enters the **style.**

16. Then the pollen tube enters the **ovule.**

17. There are **three** types of **pollen tube entry** into the ovule. They are:

1. Porogamy
2. Chalazogamy
3. Mesogamy

18. In **porogamy**, the pollen tube enters through the **micropyle**-pore.

19. In **chalazogamy**, the pollen tube enters through the **chalaza.**

20. In **mesogamy**, the pollen tube enters through the **integument.**

21. Then the pollen tube enters the **embryo sac** at the **micropylar end.**

22. After reaching the embryo sac, the pollen tube enters directly into one of the **synergids.**

23. Pollen tube discharges the **cytoplasmic contents.**

24. The tube nucleus (vegetative nucleus) **disorganizes.**

25. Both the male gametes are involved in **fertilization.** Hence, it is called **double fertilization.**

26. One of the male gametes fuses with the **egg nucleus** to form **zygote.**

27. The second gamete fuses with the **two polar nuclei** or their fusion product to form **primary endosperm nucleus**-PEN.

28. This phenomenon is called **triple fusion.**

29. Endosperm forms the **nutritive tissue** for the embryo.

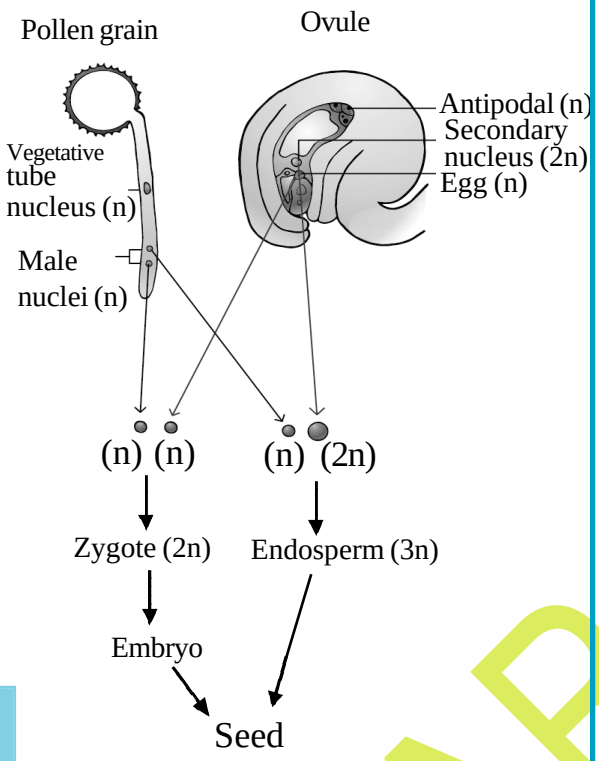

Fig. Fertilization in angiosperms.

6. What is endosperm? Explain its types.

Endosperm

1. *A tissue produced inside the ovule. It is a nutritive tissue and regulatory structure that nourishes the developing embryo.*

2. It is formed by division of **primary endosperm nucleus**, immediately after fertilization.

3. It is **triploid.** It is formed by **triple fusion.**

Types

1. Nuclear endosperm
2. Cellular endosperm
3. Helobial endosperm
4. Ruminate endosperm

1. Nuclear Endosperm

• Endosperm exists in the **free nuclear** condition.

• Primary endosperm nucleus undergoes several **mitotic** divisions.

• Cell wall formation is absent.

Eg. • *Coccinia*
• *Capsella*
• *Arachis*

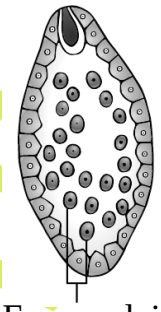

Fig. Nuclear endosperm.

2. Cellular Endosperm

1. Endosperm has **distinct cells.**

2. Primary endosperm nucleus divides into **two nuclei.**

3. It is followed by **wall formation.**

4. Subsequent divisions also follow cell wall formation.

Eg. *Adoxa*
Helianthus
Scoparia

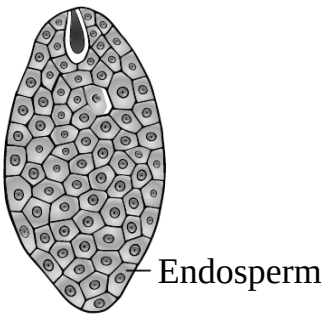

Fig. Cellular endosperm.

3. Helobial Endosperm

1. Endosperm with **cells** and **free nuclei.**

2. Primary endosperm nucleus moves towards base of **embryo sac.**

3. It divides into **two nuclei.**

4. It is followed by **cell wall formation.**

5. Cell wall formation leads to the formation of

- *Micropylar chamber-large*
- *Chalazal chamber-small*

6. The nucleus of the micropylar chamber undergoes several **free nuclear division.**

7. The nucleus of the chalazal chamber **may** or **may not divide.**

Eg. • *Hydrilla*

• *Vallisneria*

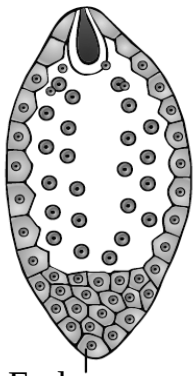

Fig. Helobial endosperm.

4. Ruminate Endosperm

The endosperm with **irregularity** and **unevenness** in its surface forms ruminate endosperm.

Eg. ✒ *Areca catechu*

✒ *Passiflora*

✒ *Myristica*

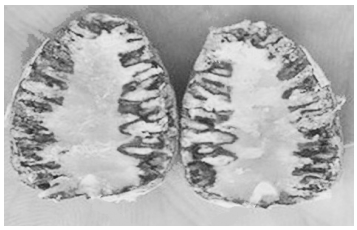

Fig. Ruminate endosperm.

17. Give a detailed account on parthenocarpy. Add a note on its significance.

Parthenocarpy

1. *The development of fruit without fertilization.*

2. The fruits produced by parthenocarpy are called **parthenocarpic fruits.**

3. Parthenocarpic fruits do not have **true seeds.**

4. Many commercial fruits are made **seedless.**

- ✒ *Banana*
- ✒ *Grapes*
- ✒ *Papaya*

5. Parthenocarpy is classified into the following types:

1. Genetic parthenocarpy

2. Environmental parthenocarpy

3. Chemically induced parthenocarpy

1. Genetic Parthenocarpy

Parthenocarpy arises due to **hybridization** or **mutation.**

Eg. *Citrus*

Cucurbita

2. Environmental Parthenocarpy

Parthenocarpy is induced by the **environmental conditions** like:

- ✒ *Frost*
- ✒ *Fog*

- *Low temperature*
- *High temperature*

Eg. **Low temperature** for 3-19 hours induce parthenocarpy in **Pear.**

3. Chemically Induced Parthenocarpy

Parthenocarpy is induced by **growth promoting substances** like:

- *Auxins*
- *Gibberellins*

Significance

1. The **seedless fruits** have great significance in **horticulture.**

2. The seedless fruits have great **commercial importance.**

3. Seedless fruits are useful for the preparation of:

- *Jams*
- *Jellies*
- *Sauces*
- *Fruit drinks, etc.*

4. **High proportion** of **edible** part is available due to the **absence of seeds.**

Additional Solved Questions - 1 Mark

1. Which of the following is modern method of vegetative plant reproduction?

a) Grafting *b) Layering*
c) Tissue culture *d) Cutting*

2. "An introduction to the embryology of Angiosperm" was published by

a) Maheshwari
b) K.V. Krishnamurthy
c) E. Strasburger
d) D.A. Johansen

3. Which of the following is called "Terror of Bengal"?

a) Bryophyllum *b) Eichhornia*
c) Pistia *d) Allium*

4. A highly condensed shoot is called

a) Node *b) Branch*
c) Flower *d) Fruit*

5. Embryo sac is located inside the

a) Stamen *b) Style*
c) Stigma *d) Ovule*

6. The stamens are collectively known as

a) Androecium *b) Gynoecium*
c) Calyx *d) Corolla*

7. Functional megaspore in a flowering plant develops into

a) Endosperm *b) Ovule*
c) Embryo sac *d) Embryo*

8. Which of the following statement is correct?

a) Sporogenous tissue is haploid
b) Outer layer of pollen is called intine
c) Tapetum nourishes the developing sporogenous tissues.

1. (c) *Tissue culture*
2. (a) *Maheshwari*
3. (b) *Eichhornia*
4. (c) *Flower*
5. (d) *Ovule*
6. (a) *Androecium*
7. (c) *Embryo sac*
8. (c) *Tapetum nourishes the developing sporogenous tissues.*