Chapter 1: Sexual Reproduction in Flowering Plants

Exercises — Chapter-end Exercises

Q1 Name the parts of an angiosperm flower in which development of male and female gametophyte take place.

SOLUTION

In angiosperms, the two reproductive structures where gametophytes develop are located within the flower.

Male gametophyte (pollen grain) develops inside the microsporangia (pollen sacs) of the anther. The anther is the terminal part of the stamen. Each anther is bilobed and dithecous, with four microsporangia in total. The sporogenous tissue within the microsporangia undergoes meiosis (microsporogenesis) to produce microspore tetrads, and individual microspores mature into pollen grains — the male gametophytes.

Female gametophyte (embryo sac) develops inside the megasporangium (ovule), which is present within the ovary of the pistil. The megaspore mother cell in the nucellus of the ovule undergoes meiosis (megasporogenesis) to produce four megaspores, of which one functional megaspore develops into the embryo sac — the female gametophyte.

Answer: Male gametophyte develops in the anther (microsporangia); female gametophyte develops in the ovule (megasporangium) inside the ovary.

Q2 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

Microsporogenesis vs. Megasporogenesis:

Microsporogenesis: The process of formation of microspores (pollen grains) from the pollen mother cell (PMC / microspore mother cell) through meiosis. It occurs inside the microsporangia of the anther. Each pollen mother cell undergoes meiotic division to produce a microspore tetrad — a cluster of four haploid microspores. The microspores then mature individually into pollen grains.

Megasporogenesis: The process of formation of megaspores from the megaspore mother cell (MMC) through meiosis. It occurs in the nucellus of the ovule (megasporangium). The MMC undergoes meiotic division to produce four megaspores, of which typically three degenerate and one (functional megaspore) develops further.

Type of cell division: Both microsporogenesis and megasporogenesis involve meiosis (reduction division), which reduces the chromosome number from diploid (2n) to haploid (n).

Structures formed:
— At the end of microsporogenesis: microspore tetrad (group of four haploid microspores), which mature into pollen grains.

— At the end of megasporogenesis: four haploid megaspores (a tetrad of megaspores), of which one functional megaspore remains.

Answer: Both involve meiosis. Microsporogenesis (in anther) produces microspore tetrads → pollen grains; megasporogenesis (in ovule) produces a tetrad of megaspores.

Q3 Arrange the following terms in the correct developmental sequence: Pollen grain, sporogenous tissue, microspore tetrad, pollen mother cell, male gametes.

SOLUTION

The correct developmental sequence in microsporogenesis and pollen development is:

Sporogenous tissue → Pollen mother cell (PMC) → Microspore tetrad → Pollen grain → Male gametes

Explanation:
1. Sporogenous tissue: A compact group of homogenous cells in the centre of each microsporangium in the young anther.
2. Pollen mother cell (PMC): Each cell of the sporogenous tissue is a potential pollen mother cell (microspore mother cell).
3. Microspore tetrad: The PMC undergoes meiosis to produce a cluster of four haploid microspores (microspore tetrad).
4. Pollen grain: Individual microspores dissociate and mature into pollen grains (male gametophytes), each containing a vegetative cell and a generative cell.
5. Male gametes: The generative cell divides mitotically to produce two male gametes (either within the pollen grain before shedding, in 3-celled pollen, or during pollen tube growth).

Answer: Sporogenous tissue → Pollen mother cell → Microspore tetrad → Pollen grain → Male gametes

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

SOLUTION

A typical angiosperm ovule (anatropous ovule) is a small structure attached to the placenta inside the ovary. Its parts are described below:

Funicle: The stalk that attaches the ovule to the placenta.

Hilum: The region where the body of the ovule fuses with the funicle; it is the junction between ovule and funicle.

Integuments: One or two protective envelopes that encircle the nucellus. They leave a small opening at the tip called the micropyle.

Micropyle: A small pore or opening at one end of the ovule, formed where the integuments do not meet. The pollen tube enters the ovule through the micropyle during fertilisation. It also facilitates entry of water and oxygen during seed germination.

Nucellus: A mass of parenchymatous cells enclosed within the integuments. It contains abundant food reserves. The megaspore mother cell (MMC) differentiates in the micropylar region of the nucellus.

Chalaza: The basal part of the ovule, opposite to the micropylar end, from which the integuments arise.

Embryo sac (Female gametophyte): Located inside the nucellus; formed from the functional megaspore. The mature embryo sac is 7-celled and 8-nucleate.

Diagram labels to include: Funicle, Hilum, Outer integument, Inner integument, Micropyle, Chalaza, Nucellus, Embryo sac (female gametophyte), Egg cell, Synergids, Antipodals, Central cell with polar nuclei.

Answer: Key parts: funicle (stalk), hilum (junction), integuments (protective coat), micropyle (opening), nucellus (nutritive tissue), chalaza (basal region), and embryo sac (female gametophyte) within the nucellus.

Q5 What is meant by monosporic development of female gametophyte?

SOLUTION

Monosporic development refers to the development of the female gametophyte (embryo sac) from a single (mono = one) megaspore.

In a majority of flowering plants, the megaspore mother cell (MMC) in the nucellus undergoes meiosis to produce four haploid megaspores (a megaspore tetrad). Of these four megaspores, only one — called the functional megaspore — survives and develops into the female gametophyte (embryo sac). The other three megaspores degenerate.

The nucleus of the functional megaspore divides mitotically three times (free nuclear divisions) to produce 8 nuclei. After the 8-nucleate stage, cell walls are laid down, organising the 7-celled, 8-nucleate mature embryo sac.

Because the entire female gametophyte originates from a single functional megaspore, this method is called monosporic development. This is the most common pattern of embryo sac development in angiosperms.

Answer: Monosporic development: the female gametophyte (embryo sac) develops from a single functional megaspore (one of the four produced by meiosis of the MMC), with the other three megaspores degenerating.

Q6 With a neat diagram explain the 7-celled, 8-nucleate nature of the female gametophyte.

SOLUTION

The mature female gametophyte (embryo sac) in a typical angiosperm is 7-celled and 8-nucleate. This is explained as follows:

Development: The functional megaspore undergoes three successive free nuclear mitotic

divisions to produce 8 nuclei arranged in the embryo sac. Cell wall formation then organises these nuclei into cells.

Organisation of the 7 cells and 8 nuclei:

At the micropylar end — Egg apparatus (3 cells):
• One egg cell (contains 1 nucleus) — the female gamete.
• Two synergids (each contains 1 nucleus) — flanking the egg cell; they have filiform apparatus at the micropylar tip that guides pollen tube entry.
Total: 3 cells, 3 nuclei.

At the chalazal end — Antipodals (3 cells):
• Three antipodal cells (each contains 1 nucleus) — their function is nutritive and they degenerate after fertilisation.
Total: 3 cells, 3 nuclei.

At the centre — Central cell (1 cell):
• One large central cell containing 2 polar nuclei (one from each pole of the embryo sac that migrate to the centre). This is the largest cell of the embryo sac.
Total: 1 cell, 2 nuclei.

Summary count: 3 (egg apparatus) + 3 (antipodals) + 1 (central cell) = 7 cells; 3 + 3 + 2 = 8 nuclei.

Diagram labels to include: Micropyle, Filiform apparatus, Synergid (×2), Egg cell, Polar nuclei (×2) in central cell, Antipodals (×3), Chalaza, Nucellus, Integuments.

Answer: The embryo sac is 7-celled (2 synergids + 1 egg cell at micropylar end; 3 antipodals at chalazal end; 1 central cell) and 8-nucleate (each of the 7 cells has 1 nucleus, plus the central cell has 2 polar nuclei).

Q7 What are chasmogamous flowers? Can cross-pollination occur in cleistogamous flowers? Give reasons for your answer.

SOLUTION

Chasmogamous flowers: These are flowers that open normally at maturity, exposing the anthers and stigma to the environment. In chasmogamous flowers, both cross-pollination and self-pollination are possible, depending on the flower's structure and timing. They are the typical open flowers seen in most plant species. Examples include the open flowers of Viola (pansy), Oxalis, and Commelina, in addition to most common flowering plants.

Cross-pollination in cleistogamous flowers:
No, cross-pollination cannot occur in cleistogamous flowers.

Reasons:
Cleistogamous flowers are flowers that never open at all. They remain permanently closed (cleisto = closed). Since the flowers do not open, there is no opportunity for external pollinators or wind to carry pollen from another plant to the stigma. When the anthers dehisce inside the

closed bud, pollen grains come in direct contact with the stigma of the same flower, resulting in invariable self-pollination (autogamy). Therefore, cleistogamous flowers are obligately autogamous and cross-pollination is impossible in them.

Despite the inability to cross-pollinate, cleistogamous flowers offer an advantage: they produce assured seed-set even in the absence of pollinators.

Answer: Chasmogamous flowers open normally, exposing anthers and stigma. Cross-pollination cannot occur in cleistogamous flowers because they never open — pollen always lands on the stigma of the same closed flower, making them obligately autogamous.

Q8 Mention two strategies evolved to prevent self-pollination in flowers.

SOLUTION

Flowering plants have evolved several outbreeding devices to prevent self-pollination and promote cross-pollination. Two important strategies are:

1. Dichogamy (temporal separation of pollen release and stigma receptivity): In some species, the anther and stigma of the same flower do not mature at the same time. Either pollen is released before the stigma becomes receptive (protandry — e.g., sunflower, Salvia) or the stigma becomes receptive before pollen is released (protogyny — e.g., Mirabilis). This prevents self-pollination as pollen and receptive stigma are never available simultaneously in the same flower.

2. Herkogamy (spatial separation of anthers and stigma): In some flowers, the anthers and stigma are placed at different positions or heights so that pollen from the same flower cannot reach its own stigma. This physical barrier prevents autogamy.

Other strategies (bonus context): Self-incompatibility — a genetic mechanism that inhibits pollen germination or pollen tube growth when self-pollen lands on the stigma. Production of unisexual flowers (monoecy or dioecy) also prevents autogamy.

Answer: Two strategies: (1) Dichogamy — anther dehiscence and stigma receptivity occur at different times; (2) Herkogamy — anthers and stigma are spatially separated so self-pollen cannot reach the stigma.

Q9 What is self-incompatibility? Why does self-pollination not lead to seed formation in self-incompatible species?

SOLUTION

Self-incompatibility: Self-incompatibility is a genetic mechanism in plants that prevents self-fertilisation. It operates by inhibiting pollen germination on the stigma or by inhibiting the growth of the pollen tube in the style when pollen from the same plant (or a genetically identical plant) lands on the stigma.

It is an outbreeding device that prevents inbreeding and promotes cross-pollination, thereby maintaining genetic diversity in the population.

Why self-pollination does not lead to seed formation in self-incompatible species:

When self-pollen lands on the stigma of the same plant, the pistil recognises it as incompatible through a chemical dialogue between the pollen grain and the pistil. This recognition is based on specific proteins/glycoproteins coded by the self-incompatibility (S) gene locus. If the pollen carries the same S-allele as the pistil, the pistil rejects the pollen by:

- Inhibiting pollen germination on the stigma surface, or
- Inhibiting the growth of the pollen tube in the style.

As a result, the pollen tube cannot reach the ovule, male gametes are not delivered to the embryo sac, and fertilisation does not occur. Without fertilisation, the zygote is not formed, and consequently no seed is produced.

Thus, self-incompatibility acts as a post-pollination but pre-fertilisation barrier to self-fertilisation.

Answer: Self-incompatibility is a genetic mechanism that inhibits pollen germination or pollen tube growth when self-pollen lands on the stigma; as fertilisation is prevented, no seed forms.

Q10 What is bagging technique? How is it useful in a plant breeding programme?

SOLUTION

Bagging technique: Bagging is the process of covering flowers or flower buds with a bag (usually made of butter paper) to protect the stigma from contamination by unwanted pollen from other sources.

Procedure in a plant breeding programme:

1. If the female parent plant bears bisexual flowers, the flower bud is first emasculated — the anthers are removed from the bud before they dehisce, using forceps. This prevents self-pollination.
2. The emasculated flower is then immediately covered with a butter paper bag to prevent any unwanted pollen from landing on the stigma. This is bagging.
3. When the stigma of the bagged flower attains receptivity (becomes ready to receive pollen), the bag is removed, and mature pollen grains collected from the desired male parent are dusted on the stigma.
4. The flower is then rebagged to prevent contamination until the fruit and seed develop.

If the female parent produces unisexual flowers, emasculation is not needed. The female flower bud is bagged before it opens, and pollination is done with the desired pollen when the stigma is receptive, followed by rebagging.

Usefulness in plant breeding:
Bagging ensures that only the desired pollen (from the chosen male parent) is used for pollination. It prevents contamination by foreign/unwanted pollen, making controlled cross-hybridisation possible. This is essential in artificial hybridisation programmes to produce new varieties with desired traits.

Answer: Bagging = covering flowers with butter paper bags to prevent stigma contamination. Useful in plant breeding to ensure only desired pollen is used in artificial hybridisation, enabling controlled crosses.

Q11 What is triple fusion? Where and how does it take place? Name the nuclei involved in triple fusion.

SOLUTION

Triple fusion: Triple fusion is the fusion of one male gamete with the two polar nuclei present in the central cell of the embryo sac. It is called 'triple' because three nuclei (one male gamete nucleus + two polar nuclei) fuse together in this event.

Where it takes place: Triple fusion occurs in the central cell of the embryo sac, within the ovule.

How it takes place:
After compatible pollination, the pollen grain germinates on the stigma and the pollen tube grows through the style into the ovule. The pollen tube enters the ovule through the micropyle and then penetrates one of the synergids through the filiform apparatus. The pollen tube then discharges two male gametes into the cytoplasm of the synergid.

One male gamete moves towards the egg cell and fuses with the egg nucleus — this is syngamy, forming the diploid zygote (2n).

The second male gamete moves towards the central cell and fuses with the two polar nuclei present there. This fusion of one male gamete (n) with two polar nuclei (n + n) produces the triploid primary endosperm nucleus (PEN) (3n). This event is triple fusion.

Nuclei involved in triple fusion:
- One male gamete nucleus (haploid, n)
- Two polar nuclei (each haploid, n) of the central cell

Together (syngamy + triple fusion) constitute double fertilisation, an event unique to flowering plants.

Answer: Triple fusion = fusion of one male gamete (n) with two polar nuclei (n + n) in the central cell of the embryo sac, forming the triploid primary endosperm nucleus (3n). Three nuclei are involved: one male gamete and two polar nuclei.

Q12 Why do you think the zygote is dormant for sometime in a fertilised ovule?

SOLUTION

After fertilisation, the zygote does not divide immediately. It remains dormant (metabolically quiescent) for a period of time before embryo development begins. The likely reasons are:

1. Endosperm must develop first: Most zygotes begin to divide only after a certain amount of endosperm tissue has been formed. The endosperm provides nutrition to the developing embryo. If the embryo were to start dividing before adequate food reserves are established, it

would lack the nutritional support needed for its growth and differentiation.

2. Assured nutrition: The dormancy of the zygote until sufficient endosperm is in place is an adaptation to ensure assured nutrition for the developing embryo. This increases the probability of successful embryo development.

3. Coordination of development: Endosperm development preceding embryo development ensures that the embryo's nutritional requirements are met at each stage of its growth — from proembryo to globular to heart-shaped to mature embryo.

Thus, the dormancy of the zygote is a biological adaptation that ensures the embryo starts developing only when its nutritional environment (endosperm) is ready.

Answer: The zygote remains dormant until sufficient endosperm is formed to nourish the developing embryo; this ensures assured nutrition and is an adaptation for successful embryo development.

Q13 Differentiate between:
(a) hypocotyl and epicotyl;
(b) coleoptile and coleorrhiza;
(c) integument and testa;
(d) perisperm and pericarp.

SOLUTION

(a) Hypocotyl vs. Epicotyl:
Hypocotyl: The cylindrical portion of the embryonal axis below the level of attachment of the cotyledons. It terminates at its lower end in the radicle (root tip), which is covered by the root cap. It gives rise to the root of the seedling.
Epicotyl: The portion of the embryonal axis above the level of attachment of the cotyledons. It terminates in the plumule (shoot tip / stem tip). In monocot (grass) embryos, the epicotyl has a shoot apex and leaf primordia enclosed in the coleoptile.

(b) Coleoptile vs. Coleorrhiza:
Coleoptile: A hollow, foliar (leaf-like) protective sheath that encloses the shoot apex (epicotyl with a few leaf primordia) in monocot (grass) embryos. It protects the plumule as it pushes through the soil during germination.
Coleorrhiza: An undifferentiated protective sheath that encloses the radicle and root cap in the embryo of grasses (monocots). It protects the radical as the seedling emerges from the soil.

(c) Integument vs. Testa:
Integument: The protective envelope(s) surrounding the nucellus in the ovule (before fertilisation). An ovule may have one or two integuments. They leave a small opening called the micropyle.
Testa: The seed coat formed from the integuments after fertilisation, when the ovule matures into a seed. The integuments harden and become the tough protective seed coat (testa). Thus, testa is the post-fertilisation, mature derivative of the integuments.

(d) Perisperm vs. Pericarp:

Perisperm: A residual, persistent nucellus that remains in some mature seeds (e.g., black pepper, beet). It represents the remnant of the nucellus tissue that is not completely consumed during seed development.

Pericarp: The wall of the fruit, derived from the wall of the ovary after fertilisation. It may be fleshy (as in mango, guava) or dry (as in groundnut, mustard). Pericarp thus surrounds and protects the seeds inside the fruit.

Answer: (a) Hypocotyl is below cotyledons (→ radicle); epicotyl is above cotyledons (→ plumule). (b) Coleoptile sheathes the shoot apex; coleorrhiza sheathes the radicle in grasses. (c) Integument surrounds the nucellus in the ovule; testa is the hardened seed coat derived from integuments after fertilisation. (d) Perisperm is persistent nucellus remnant in seeds; pericarp is the ovary wall that forms the fruit wall.

Q14 Why is apple called a false fruit? Which part(s) of the flower forms the fruit?

SOLUTION

Apple is called a false fruit (pseudocarp or accessory fruit) because the fleshy, edible part of the apple does not develop from the ovary alone. In a true fruit, only the ovary wall (pericarp) develops into the fruit after fertilisation.

In apple, the thalamus (the receptacle — the swollen end of the floral axis on which all floral parts are borne) also contributes significantly to the formation of the fruit. The thalamus becomes fleshy, enlarges, and forms the major edible portion of the apple, enclosing the actual fruit (derived from the ovary) at the centre (the core of the apple).

Parts of the flower that form the fruit in apple:

- Thalamus (receptacle): forms the major fleshy, edible part of the apple (the false fruit portion).
- Ovary: develops into the true fruit (the core region containing the seeds).

Thus, since the thalamus — a non-ovarian floral part — contributes to fruit formation, apple is called a false fruit. Other examples of false fruits include strawberry (thalamus forms the fleshy part) and cashew (peduncle / thalamus).

In contrast, true fruits develop exclusively from the ovary (e.g., mango, tomato, banana).

Answer: Apple is a false fruit because the fleshy edible part develops from the thalamus (receptacle), not from the ovary alone. Both the thalamus and the ovary contribute to fruit formation.

Q15 What is meant by emasculation? When and why does a plant breeder employ this technique?

SOLUTION

Emasculation: Emasculation is the process of removal of anthers from the flower bud of the female parent plant before the anthers dehisce (before they open and release pollen), using a pair of forceps. This is done to prevent self-pollination in bisexual (hermaphrodite) flowers.

When is it employed: Emasculation is carried out at the bud stage, before the flower opens and before the anthers mature and shed pollen. If done after anther dehiscence, the pollen would already have been shed and may have reached the stigma, causing self-pollination.

Why is it employed:
In artificial hybridisation, a plant breeder wants to cross two specific plants — a chosen male parent and a chosen female parent — to combine desirable characters. If the female parent bears bisexual flowers, there is a risk of self-pollination (the flower's own pollen fertilising its own ovules), which would prevent the desired cross from occurring.

By removing the anthers (emasculation), the breeder ensures that the female parent cannot pollinate itself. The emasculated flower is then bagged to prevent contamination from unwanted foreign pollen. When the stigma becomes receptive, pollen from the desired male parent is applied, resulting in controlled cross-pollination.

Note: Emasculation is not needed if the female parent naturally produces unisexual (pistillate) flowers, since there are no anthers to remove.

Answer: Emasculation = removal of anthers from bisexual flower buds of the female parent before dehiscence, to prevent self-pollination. Employed by plant breeders in artificial hybridisation to ensure only the desired male parent's pollen fertilises the female parent.

Q16 If one can induce parthenocarpy through the application of growth substances, which fruits would you select to induce parthenocarpy and why?

SOLUTION

Parthenocarpy is the development of fruit without fertilisation. When induced artificially through the application of growth substances (such as auxins or gibberellins), it produces seedless fruits.

Fruits that would be selected for inducing parthenocarpy:

Ideal candidates would be fruits where seeds are undesirable for consumers or where seedlessness significantly increases the commercial value and eating convenience. Examples:

1. Watermelon: Seeds are undesirable to many consumers. Seedless watermelons are commercially highly valued. Inducing parthenocarpy would eliminate seeds and make them more consumer-friendly.

2. Grapes: Seedless grapes (table grapes) are highly preferred commercially and for eating. Auxin-induced parthenocarpy would produce seedless grapes, which are more convenient to

eat.

3. Tomato: Seedless tomatoes would be preferred in food processing and for fresh consumption. Parthenocarpy can be induced with auxin sprays.

4. Cucumber: Consumers often prefer seedless or fewer-seed cucumbers for culinary purposes.

Reason for selection: Fruits with seeds that are hard, numerous, or that detract from the eating experience are the best candidates. Seedless fruits have higher market value, longer shelf life in some cases, and greater consumer acceptance. They are easier to process in the food industry.

Note: Banana is a natural example of a parthenocarpic fruit that is already seedless and commercially very important.

Answer: Fruits like watermelon, grapes, tomato, and cucumber would be selected — their seeds are undesirable to consumers, and seedless varieties have higher commercial value and eating convenience. Parthenocarpy induced by auxins/gibberellins would eliminate seeds in these fruits.

Q17 Explain the role of tapetum in the formation of pollen-grain wall.

SOLUTION

The tapetum is the innermost wall layer of the microsporangium, surrounding the sporogenous tissue. It plays a crucial nutritive and synthetic role in the development of pollen grains, particularly in the formation of the pollen grain wall.

Roles of tapetum in pollen wall formation:

1. Nutrition: Tapetal cells are metabolically very active. They have dense cytoplasm and generally more than one nucleus (binucleate or polyploid), which supports high metabolic activity. They provide nutrients to the developing microspores and pollen grains.

2. Sporopollenin synthesis: The tapetum is believed to synthesise and supply sporopollenin — the most resistant organic material known — which forms the hard outer wall (exine) of the pollen grain. Sporopollenin can withstand high temperatures, strong acids, and alkalis. No enzyme is known to degrade it, making pollen grains excellent fossils.

3. Pollen coat (pollenkitt): Tapetal cells secrete the pollenkitt — a lipid-rich coating deposited on the surface of the pollen grain exine. This sticky coating helps pollen grains adhere to the bodies of pollinators and to the stigma surface.

4. Recognition proteins: The tapetum contributes proteins to the pollen grain surface (the exine), which are involved in pollen-pistil recognition reactions (compatible/incompatible response).

5. Ubisch bodies / orbicules: Tapetal cells also produce small sporopollenin bodies called Ubisch bodies that are involved in patterning the exine.

In summary, the tapetum provides both the raw materials (sporopollenin, lipids, proteins) and

the nutrition required for the formation of the thick, resistant, and functionally specialised pollen grain wall, especially the exine.

Answer: Tapetum nourishes developing microspores and supplies sporopollenin (for the hard exine), pollenkitt (sticky surface coating), and recognition proteins for the pollen grain wall. It is indispensable for formation of the resistant pollen exine.

Q18 What is apomixis and what is its importance?

SOLUTION

Apomixis: Apomixis is a special mechanism found in some flowering plants (particularly some species of Asteraceae and grasses) to produce seeds without fertilisation. It is a form of asexual reproduction that mimics sexual reproduction in outward appearance (seeds and fruits are produced), but fertilisation does not actually occur.

Modes of apomixis:

• In some species, the diploid egg cell is formed without reduction division (without meiosis) and develops directly into the embryo without fertilisation.

• In others (e.g., many Citrus and Mango varieties), nucellar cells surrounding the embryo sac start dividing, protrude into the embryo sac, and develop into embryos. Each ovule thus contains many embryos — a phenomenon called polyembryony.

Importance of apomixis:

1. Maintenance of hybrid vigour: In agriculture, high-yielding hybrid varieties are cultivated extensively. However, hybrid seeds must be produced anew every year — if seeds from hybrids are sown, the progeny segregates and does not maintain the desired hybrid characters (due to meiosis and recombination). This makes hybrid seed production expensive.

2. Apomixis eliminates the need to buy seeds every year: If hybrid plants are made apomictic, seeds produced apomictically will have the same genotype as the parent (since no meiosis or fertilisation occurs). Farmers can use seeds harvested from one crop season to grow the next, without purchasing fresh hybrid seeds each year.

3. Prevents segregation: Because apomictic seeds are genetically identical to the parent, there is no segregation of characters in the progeny. The hybrid characters are maintained over generations.

4. Cost reduction: Reduces the cost of hybrid seed production, making improved crop varieties accessible to farmers.

5. Active area of research: Due to its agricultural importance, understanding the genetics of apomixis and transferring apomictic genes into hybrid varieties is an active area of research worldwide.

Apomixis is also significant in horticulture — it allows clonal propagation through seeds, maintaining the superior traits of fruit varieties.

Answer: Apomixis = seed formation without fertilisation (asexual reproduction mimicking sexual). Its importance: allows hybrid plants to maintain hybrid characters across generations without fresh hybrid seed purchase each year, reducing agricultural costs and preventing progeny segregation.