# NCERT Solutions for Class 12 Biology Chapter 1 – Sexual Reproduction In Flowering Plants

**1.1**

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

**Ans:** Flowering plants are collectively known as angiosperms. The reproduction cycle is the major purpose of the flower, which is also referred to as altered stalk. This flower consists of four distinct whorls which are described as follows:

- **Calyx:** This part is made of sepals.
- **Corolla:** This is made of petals.
- **Androecium:** The stamens are mainly responsible for the production of Androecium. It's also known as the flower's masculine reproductive stage.
- **Gynoecium:** The carpels are mainly responsible for the creation of Gynoecium and are commonly referred to as the flower's female reproductive stage.

Pollen grains are generated using pollen's mother cells, which is also an anther of stamen via meiotic proliferation. Male gametophytes are also called pollen particles. The carpel consists of 3 distinct divisions such as ovary, style & stigma. The ovule is developed inside the ovary. Meanwhile, the female gametophyte or embryo sac is created from the haploid megaspore using meiotic separation from the mother cell of the megaspore.

Male gametophytes (microgametogenesis) grow to the two-celled development within the anther's sacs of pollen. The gametophyte matures into (megagametogenesis) in the nucellus inside an ovule. The gametophytes (male & female) are essential to angiosperm reproductive functions. Male reproductive cells can pass through the female gametes (embryo sac) inside the ovule by creating a pollen tube after the male gamete (pollen grain) is transferred to the tip of the stigma of a suitable flower.

Once the female gametophyte (egg cells) & male gametophyte (sperm cells) merge inside the embryo sac, pollination occurs, eventually producing seedlings that grow into new vegetation. A vital aspect of blooming plants' life cycles is this mechanism.

**1.2**

**Differentiate between microsporogenesis and megasporogenesis. Which type of cell division occurs during these events? Name the structures formed at the end of these two events.**

**Ans**: The following table constitutes a few methods by which microsporogenesis & megasporogenesis are distinctive:

| **Microsporogenesis** | **Megasporogenesis** |
|---|---|
| Microsporogenesis is the mechanism that occurs when mother units of microspores proliferate & generate pollen grains. | Megasporogenesis is the procedure that occurs whenever meiosis changes megaspore parent cells into megaspores. |
| Located inside the anthers' pollen chamber. | This can be observed in the ovule's nuclei. |
| A microspore parent cell produces a pollen particle that works as intended. | There is only a single operational megaspore over the collection of numerous megaspores. |
| It causes pollen grains (male gametophytes) to build. | It facilitates the development of female gametes embryo sacs. |
| Since each cell contains 2 distinct collections of chromosomes, microspore mother cells along with megaspore mother cells, are collectively known as diploid. | To create 4 haplotypic units known as megaspores & microspores, the parental cells comprising megaspores & microspores grow by engaging in the meiosis process. |

During the process of microsporogenesis & megasporogenesis, meiotic cell division occurs. Meanwhile, this interaction will further move into the creation of haploid gametes called reductional division that takes place throughout these events.

After the microsporogenesis procedure, the shapes that are created at the culmination of each of these events are either pollen grains or microspores. At the final stage of the megasporogenesis method, the megaspore forms across the female gamete or embryonic pouch.

**1.3**

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

**Ans**: In angiosperm blooms, the formation of male reproductive cells, or sperm, starts with a specific tissue and moves throughout many phases of division of cells and transformation. We must comprehend the method of male gamete creation in blooming plants in order to group the information in the proper chronological order. The detailed approach will be as follows:

**1. Sporogenous Tissues:** Found inside the microsporangium (pollen sac), the sporogenous membrane is where the entire procedure starts. This diploid epithelium serves as the forefront of pollen production.

**2. PMC (Pollen Mother Cells):** The pollen mother cells (PMCs) are formed by the division of cells from sporogenous tissues. These embryonic cells will ultimately go through the meiosis process & are diploid as well.

**3. Microspore Tetrad:** A quartet of haploid microspores are produced when the pollen mother cells undergo the process of meiosis. The microspore tetrad is the grouping that contains these 4 microspores.

**4. Pollen Grains:** A pollen grain is subsequently formed by every microspore. The male gametes are found in the pollen grains of male gametophytes.

**5. Male Gametes:** Lastly, the male gametes develop inside the pollen grains. The earlier described gametes that are haploid will involve themselves in this fertilization process.

One of the most vital phases of the reproductive cycle in angiosperms is the production of male gametes. Additionally, pollinators like flies or prevailing winds help to assist this migration. The pollen grain develops when it touches the tip of the stigma, releasing male & female gametes that eventually combine to create seeds leading to the subsequent generations of vegetation.

**1.4**

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

**Ans:**

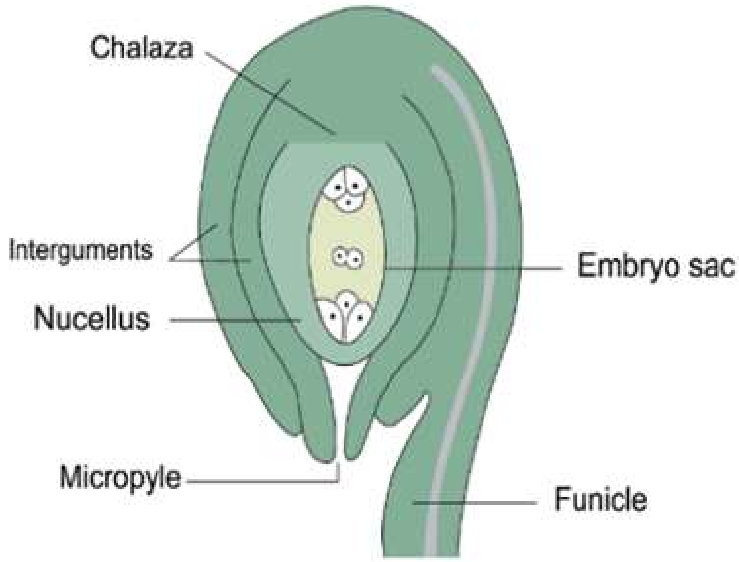


*Image: Structure of Angiosperm Ovule*

An ovule comprises a tiny object that can be formed by an angiosperm ovary. When the ovule initially emerges on the membrane of the placenta, a multilayered cellular structure called the nucellus is formed. A funicle is a stem that connects placentas with ovules. At the base of the hilum, a funicle affixes itself to an attached placenta. The nucellus's hypodermal units proliferate & develop inside megaspore mother cells. To create a developing embryo sac (female gametophyte), a single haploid cell proceeds with the meiosis process. Using a tiny aperture known as a micropyle, which is encased in a handful of protective layers, a pollination tube penetrates an ovule. The nucellus & attachments of a completely mature embryo make up ovules.

That specific end is referred to as a Chalazal end. Meanwhile, the intersection of the changes along with the nucellus is also referred to as a Chalaza. Following their fusing into one another performs well, the male gametes create a zygote. Whereas, their union with the outermost polar nuclei creates the endosperm, which serves as nutrition for the developing progeny. The fusing of the sperm in combination with polar nuclei results in the production of triploid endosperm. The raphe comprises a ridge-like feature produced by the ovule when it becomes attached to either the funiculus or the stock of eggs until a certain point.

**1.5**

**What is meant by monosporic development of female gametophyte?**

**Ans:** Monosporic formation is the process by which a single functioning megaspore gives rise to an embryonic female gametophyte. The method through which the female gametophyte grows from an individual viable megaspore is known as monosporic growth. An individual megaspore mother cell is found near the micropylar tip of the nuclear zone of an ovule in nearly every species of flowering plants. It produces 4 haploid megaspores during the meiosis process.

Following mitosis, the nucleus of a functional megaspore breaks into 2 nuclei, which will travel into opposite poles. This leads to the creation of a two-nucleate embryonic sac & 2 more successive mitotic nuclear divisions are needed to build the four phases of nucleate & eight levels of an embryo sac. The three distinct megaspores that are left undergo degeneration. The female gametophytes create the molecular & physical foundation underlying the initiation of fertilization & seed development using the female gametes. Cytokinesis doesn’t immediately follow karyokinesis when dealing with free nuclear form divisions in mitosis. The 8 nucleate section is the one responsible for the formation of the typical female gametophyte & upon completion, the outermost layers are constructed. The 2 polar nuclei that came before it are located in the massive core cell beneath the reproductive system. The membranes of cells consist of 6 of the 8 nuclei, which are grouped into cellular structures.

**1.6**

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

**A neat diagram explains the 7-celled, 8-nucleate nature of the female gametophyte.**

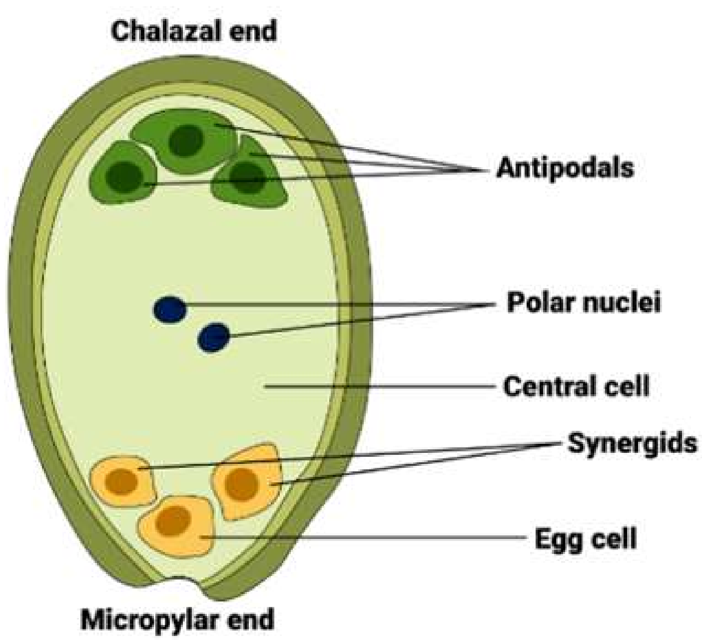


Image: Structure of Female Gametophyte

**Ans:** Following the initial split during mitosis, two different nuclei develop & migrate away from the chalazal & micropylar ends. The 8-nucleate phase is formed via division & re-division, resulting in 4 nuclei on both ends.

The 8-nucleate phase is followed by the formation of a usual female gamete or embryonic sac. The 6 nuclei clustered together make up the antipodal & micropylar ends of every one of the 8 nuclei. The center of the egg's apparatus consists of one egg layer & 2 synergids.

The massive center nucleus of the embryonic sac, directly under the fertilized egg region, contains polarized nuclei. Since 2 polar nuclei can be observed in a single cell, a usual female gametophyte has 7 lymphocytes & 8 nuclei.

**1.7**

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

**Ans:** The plants use chasmogamy as an alternative reproductive technique to aid in floral cross-pollination. Chasmogamous flowers belong to those that exhibit chasmogamy. The term "chasmogamous," which implies "open marriage," was borrowed straight from a Greek lexicon. In order to facilitate pollination, these blooms emerge at maturity, prior to fertilization. Chasmogamous flowers have open petals that reveal the reproductive systems (stigma & anthers), which draws pollinators & promotes cross-pollination. It also leverages the process of sexual modification & genetic diversity in the seeds that are generated.

Chasmogamous flowers have their stigma & anther open for pollination. Cross-pollination is not possible for cleistogamous flowers. Hence, those shut blooms solely produce self-pollination. The anthers within cleistogamous flowers form closed blooms as part of the dehiscence process. Consequently, stigma becomes susceptible to pollen grains. Cross-pollination, comparable to viola and oxalis, thus becomes impossible.

**1.8**

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

**Ans:** Persistent self-pollination reduces the strength & longevity of a single ethnic group. Flowering plants have evolved a variety of mechanisms to encourage cross-pollination & inhibit self-pollination. Most often, self-sterility & dichogamy guarantee cross-pollinating methods. Cleistogamy represents the term for pure self-pollination that takes place whenever pollination takes place prior to floral blooming.

The 2 strategies employed here to restrict self-pollination in flowers would be,

- **Dichogamy:** Self-pollination is prevented by the anthers & stigmas maturing at various points in time. Several angiosperms exhibit dichogamy, which implies a temporal distinction between stigma sensitivity and pollen distribution. This dichogamy will work to prevent self-fertilization or contact between pollen & pistils. In certain flowers, for instance, the end of the stigma could develop early (protogyny), whereas in others, the anthers themselves can grow initially (protandry).

- **Self-sterility (self-incompatibility):** An inability of pollen grains to fertilize a particular flower or adjacent blooms on a single plant, generally because the pollen tube's development in the area of the stigma & style is inhibited, making it impossible for male gametes to reach the ovule region. By preventing the sprouting of pollen via pollen tube development within the pistil, this genetic process stops self-pollination. At the same time, certain blossoms have self-sterility traits that prevent pollen particles from germinating underneath the stigma. Potatoes & tobacco are two such instances.

**1.9**

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

**Ans:** A flowering plant without pollen particles on the outer stigma is irreconcilable or self-sterile. This kind of disorder is known as self-sterility or self-incompatibility. The movement of pollen particles between the stigma towards the anthers is known as pollination. This process of transfer results in the formation of seedlings. Whenever pollen grains are transferred across the anther of one bloom onto the stigma of that particular flower, the method of self-pollination takes place. Nevertheless, certain blossoms have a distinct sterile genetic material located on their pistil & pollen grain, which prevents them from producing seeds once self-pollination takes place. Male gametes are unable to fertilize egg cells because pollen grains are unable to develop into seeds. As a result, the egg ovule cannot mature into a mature seed.

**1.10**

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

Bagging is an approach employed in plant breeding & fruit production to shield flowers & fruit against contaminants & undesired pollen particles.

- A package of polythene made from butter paper can be employed to safeguard the stigmas of weakened flowers (which remain in the budding phase) from pollen infection. Before anthesis, emasculated flowers might be taken out of their buds and placed inside a buttered paper pouch.
- The stigmas from ripe emasculated flowers are dusted by pollen grains from preferred male species using a pre-sterilized swab. Then, until the fruit begins to develop, the blossoms get

re-bagged.
- This method is mostly used in artificial hybridization. This method is used by plant cultivators to stop undesired pollen grains without infecting blooming stigmas.

**1.11**

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

**Ans:** Inside the sac containing the embryo of blossoming plants, a male gamete bonds with a pair of polar nuclei in an event known as triple fusion. In triple fusion, the following things have begun to occur:

- A pollen tube that penetrates the ovule's membrane is created when the pollen grain gets deposited on the edge of the stigma & sprouts.
- Two male gametes are released when the pollen tube enters either of the synergids; one of them unites into the nucleus of the eggs to produce a zygote.
- A triploid endosperm nuclear component is created when the second gamete joins the 2 distinct polar nuclei present within the heart of the cell membrane.

**1.12**

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

**Ans:** During double fertilization, the main endosperm nuclei & zygote are formed at the same time. In order to give the endosperm, which supplies vital nutrition for the growing embryo, time for growth, the zygote stays inactive within the fertilized ovule.

Zygote latency is an essential part of a plant's developmental process & reproductive mechanism. It has several functions, prominent among them being the protection and prosperity of the following generation of plants under a variety of often unpredictably changing environmental circumstances. This tactic is a reflection of the genetic modifications that plants have evolved in order to survive & function successfully in different kinds of environments.

**1.13**

**Differentiate between:**

**(a) hypocotyl and epicotyl;**

**(b) coleoptile and coleorrhiza;**

**(c) integument and testa;**

**(d) perisperm and pericarp.**

**Ans:**

| **Epicotyl** | **Hypocotyl** |
|---|---|
| Somewhere in between the plumule & cotyledon terminals resides this segment that constitutes the embryonal axis. | The embryonal axis includes the region within the radicle & the cotyledonary junction. |
| The surrounding soil keeps the cotyledons intact while epicotyl 2 lengthens over the hypogeal germination process. | Whenever epigeal germination occurs, hypocotyls spread out to allow cotyledons to come out from the earth's soil. |
| Plumules are found at the outermost layer of epicotyls. | The radicals are found in the outermost part of hypocotyls. |

| **Coleoptile** | **Coleorhiza** |
|---|---|
| The tip of the epicotyl along with leafy primordium is encircled by a foliar component known as the coleoptile. | A coleorhiza is a covering that encloses plant roots & the crowns they produce. |
| It shields the plumule as it emerges through the ground beneath it. | Additionally, there is a hole at the very tip of the coleoptile for the initial leaf to emerge. The internal framework of the coleorhiza tends to be robust. |
| Whenever plumules emerge from the ground's surface, they are shielded from the soil that surrounds them. | Once they start to travel under the earth's surface, there is no shield for radicles. |
| It spreads far above & beyond the surface of the grain. | It ceases to develop upon emerging from grain. |

| | |
|---|---|
| Upon emerging from ground level, it starts Coleoptile. | Coleorhiza won't tend to emerge from the surface of the soil. |
| The germination process will start once the plant's seed turns green in color & starts its photosynthesis process. | It doesn't turn into a green color. |

| **Integument** | **Testa** |
|---|---|
| The protective membrane covers the ovule. | In other terms, it can be regarded as a seed's exterior layer. |
| It's extremely delicate & has either two or three layers. | The membrane is rather dense & packed. |
| The framework of it is made up of living cells. | The cells within them are dead. |
| Sclereids tend to be absent. | The cellular structure contains a large number of sclerids. |
| It is produced near the chalazal terminal of the ovule. | The ovule formation originates from the exterior integument. |
| The integument region is already fertilized. | Testa comprises tissues that emerge after fertilization is done. |

| **Perisperm** | **Pericarp** |
|---|---|
| It functions just like the seed's nuclei. | The fruit's coating develops from the ovary's internal membrane. |
| It is commonly found in seedlings. | It comprises an actual fruit element. |
| The seeds often become drier. | It's devoid of flesh and wetness. |
| Plant seeds frequently fail to germinate effectively. | The exterior layer also provides nourishment & additional safety. |
| Perisperm-free seeds have been uncommon. | This can be found in all fruits. |

**1.14**

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

**Ans:** False fruits (also known as pseudo-carp) can be cultivated via the ovarian region along with various accessory floral elements. Botanically ripened ovaries are the vital source of true fruit (Eucarp). Since an apple is generated from its thalamus region rather than the ovaries of a flower, it can be named as a false fruit. The thalamus comprises a sizable element located near the flower's root. Apples are mostly edible in their fleshy thalamus. Tissues located outside the carpel can produce false fruit and it doesn't require fertilization. This can also be referred to as an accessory or parthenocarpic fruit.

**1.15**

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

**Ans:** Being used in several kinds of plant hybridization processes, Emasculation is the process of extracting anthers within bisexual flowers without additionally harming the female reproductive system (pistil). To get rid of the anthers & stamens shortly before they pass away the terminal part of the flower buds is methodically cut off. The following is carried out to reduce self-pollination. Emasculation is a form of artificial hybridization process. Plant cultivators employ this technique to fertilize stigmas using pollen particles that come from the preferred variety & prohibit neighboring flowers from being pollinated.

**1.16**

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

**Ans:** Auxins, gibberellins & cytokinins are prominent instances of regulatory substances for plant growth that can cause parthenocarpy among plants. We refer to this procedure as artificial parthenocarpy. The parthenocarpy's fruit has no seeds. They aren't fertilized by the ovaries before development. Some fruits without seeds like bananas, grapes, oranges, pineapples, guavas, watermelons & lemons are highly efficient economically. Fruits that have edible plant seeds, like pomegranates, would lack the parthenocarpy features.

**1.17**

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

**Ans:** The anther's lowest section which contains the sporogenous cellular tissue is called as tapetum. Microspores, which provide nutrients & enzymes during pollen formation, are produced through the formation of sporogenous tissues. The tapetum is a delicate covering that envelops microsporangia. The cell membrane is composed of polyploidy & multinucleated tapetal units leading to the development of pollen grains. These cellular structures include ubisch structures, which add to the microspores' & pollen grains' decoration. The tapetal cells' Ubisch cells generate a material called sporopollenin. The exine part of pollen grains contains this material. Because of this structural existence, pollen grains are said to have a jagged look.

**1.18**

**What is apomixis and what is its importance?**

**Ans:** The asexual creation of a fertilized seed or embryo that doesn't need a fertilization process is known as apomixis. It also involves the substitution of bulbils for the bloom or a plantlet for the seed itself. With the exception of nonrecurrent apomixis plants, apomictically generated offspring have the same genetic structure as the parental crop.

Some varieties of Asteraceae & Grasses produce seeds that don't require any fertilization process as a consequence of the asexual reproductive technique referred to as apomixis. This way of processing is indeed essential for the hybrid seedling business. The main goal for growing hybrids is to increase output. The primary issue is the demand to produce hybrid seeds yearly since the division of traits in hybrid seed varieties prevents them from retaining hybrid traits over an extended length of time. This phenomenon may be prevented by adding apomixis to the hybrid seeds. Hence, researchers are looking for gene sequences linked to apomixis.