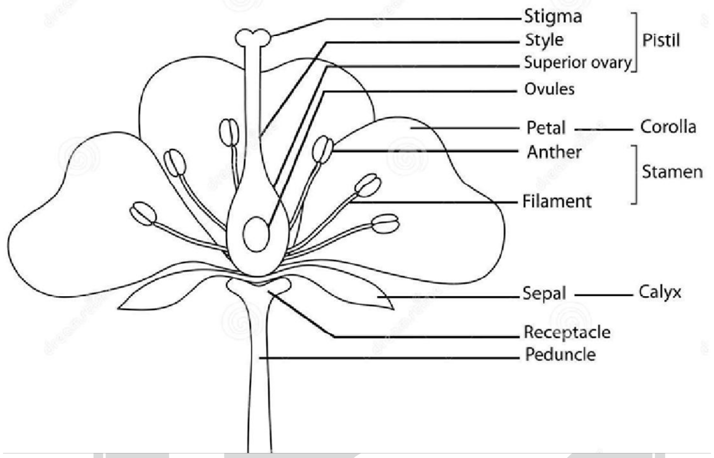
1 EMBRYOLOGY

Flower is a modified shoot which is highly condensed.

A complete flower has 4 whorls – (i) calyx (ii) Corolla (iii) Androecium (iv) Gynoecium

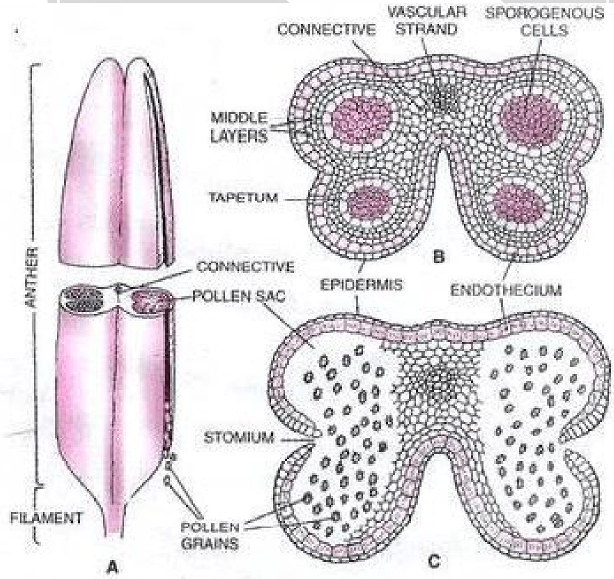
Calyx and corolla are non-essential or **accessory whorls** while Androecium and Gynoecium are **essential whorls**.



Flowers can be **monoecious** (having both male and female reproductive structures on the same flower, eg Pea, Hibiscus) or **dioecious** (having male and female reproductive structures on different flowers, eg Papaya).

Androecium

It consists of **stamen** which is made up of anthers and filaments. Anthers are borne on filaments and contain pollen grains. Anthers can be monothecous (one lobe), dithecous (two lobes) depending on the number of lobes present in them.



The anther in the figure has 2 lobes joined through a **connective** which is a sterile tissue and may contain a vascular strand between the lobes. (dithecous). Each lobe has 2 pollen sacs. (**tetrasporangiate**).

The outermost wall layer is the **epidermis**. Below the epidermis is the **endothecium or fibrous layer**. This wall (two radial and inner) develop fibrous thickenings on them except at the junctions of two pollen sacs. This point of no thickenings is known as the **stomium** and is the **point of dehiscence**. Below the endothecium, there are 1-3 **middle layers** of parenchyma cells. The cells of innermost wall layer are radially elongated and rich in protoplasmic contents. This layer is called **tapetum** which is the nutritive tissue nourishing the developing microspores. The cells of tapetum may be multinucleate or may have large polyploid nucleus. The tapetal cells provide nourishment to young microspore mother cells either by forming a **plasmodium (amoeboid or invasive type)** or through **diffusion (parietal or secretory type).**

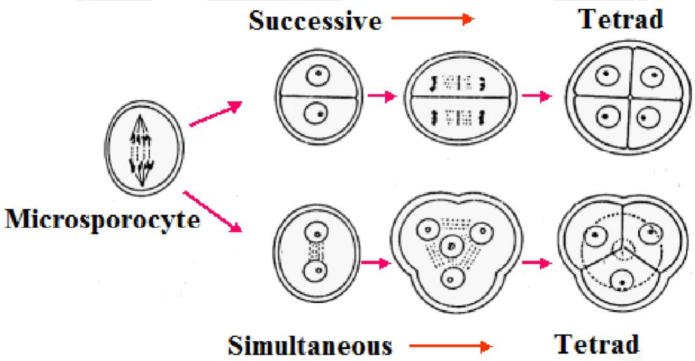
Amoeboid or invasive type– The cells flow into the pollen sac after the callose dissolves and engulf the separated microspores. This may happen during the prophase or may get delayed until the tetrad stage. Eg. Alisma, Butomus, Tradeschantia.

Parietal or secretory type– The cells remain in their original position and later break down and get absorbed by pollen mother cells. Eg. Sorghum

The pollen sac wall encloses a number of **archesporial cells** which form**microspore mother cells** (microsporocytes). A few microspore mother cells become non- functional and are absorbed by developing microspores.

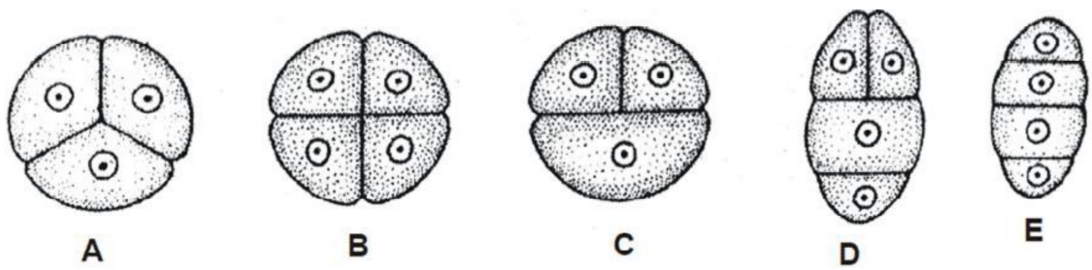
Microsporogenesis

Successive cytokinesis	Simultaneous cytokinesis
Wall formation after each cytokinesis	Wall formation only after meiosis II
2 nuclei undergo 2nd meiotic division simultaneously	Non synchronous 2nd meiotic division
Centripetal wall formation	Centrifugal wall formation
Eg- common in monocots	Common/ seen in dicots.



Formation of microspores from the microspore mother cell is known as microsporogenesis.

During microsporogenesis the nucleus of each microspore mother cell undergoes meiosis and gives riseto four haploid nuclei (**microspore tetrad**). These four nuclei are arranged in a tetrahedral manner forming tetrahedral tetrad. The four microspores separate from each other, and each develops a characteristic shape or form which differs in different species of plants. The different types are as follows: (i) Tetrahedral (ii) Isobilateral (iii) Decussate (iv) T-shaped (v) Linear



Different types of microspores
A. Tetrahedral, B. Isobilateral, C. Decussate, D. T-shaped, E. Linear

Pollen grains develop from the diploid microspore mother cells in pollen sacs of anthers. They are haploid, unicellular with a single nucleus. Their cytoplasm is surrounded by a two layered wall. The outer layer **exine** is thick and sculptured or smooth. It is cuticularised and the cutin is of special type called **sporopollenin** which is resistant to chemical and biological decomposition. In insect pollinated pollen grains, the exine is covered by a yellowish, viscous and sticky substance called **pollen kit**. The inner layer is known as **intine** and it forms the pollen tube. Pollen grains are well preserved as fossils because of the presence of sporopollenin. At certain places the exine is thin. The thin areas are known as **germ pores**, when they are circular in outline and **germ furrows or colpi** when they are elongated. The cytoplasm is rich in starch and unsaturated oils. Uninucleate protoplast becomes 2-3 celled at the later stages of development. The branch of study of pollen grains is called **palynology**.

Ques. Callose deposition in meiocytes during microsporogenesis mainly ensures: **[DU- 2015]**

(a) prevention of water loss from the meiocytes. (b) gametophytic control of development.

(c) firmness to the microspores. (d) sporophytic control of development.

Soln callose wall insolates meiocytes form other sporophytic tissues and presents then form dehydration in water stress conditons.

Correct option is (a)

Ques. One of the following plant species exhibits all possible types of configurations of microspore tetrads during microsporogenesis. **[DU- 2018]**

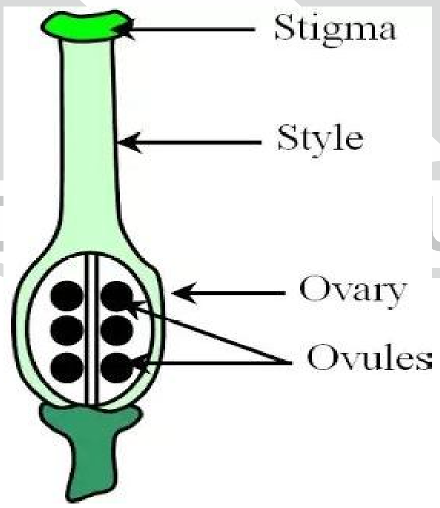
(a) Aeschynomene indica. (b) Amorphophallus titanium.

(c) Amborella trichopoda. (d) Aristolochia elegans.

Soln. *Aristolochia elegans* contains all possible types of configuration of microspore tetrads such as T-shaped ,linear, decussate and isobilateral.

Correct option is (d)

Gynoecium



It is composed of one or more **carpels** or megasporophylls.

When there is a single carpel, the pistil is called **simple or monocarpellary**. It is not commonly found. It is a characteristic of the large families of Leguminosae and Gramineae .

Compound or polycarpellary gynoeciums are much more common. In such a gynoecium, the different carpels may remain completely free from one another and is called **apocarpous** or the carpels may unite with each other, wholly or partially, forming **syncarpous** gynoecium.

A typical carpel has three parts—ovary, style and stigma. The lowermost swollen part is the ovary contain-ing one or more swollen bodies called **ovules** which later form seeds. Above the ovary is a long or short style which ends in a somewhat rounded and usually sticky stigma on which the pollens are depo-sited during pollination. A sterile pistil devoid of fertile ovules is called a **pistillode**.

The style usually drops off after fertilization (deciduous). But in some plants, eg. Naravelia zeylanica, Clematis, Digitalis, it may be persistent . The style of Carina , Iris, etc., is petaloid. The base of the style in the family Umbelliferae is swollen forming the **stylopodium**.

Ovary

It contains the ovules which form the seeds. The ovules are attached to the placenta which is present at the margins of the ovary. It may also be present at the base. Owing to the location of the placenta, different types of placentation can be seen as follows:

Placentation:

(i) **Marginal :** The ovules develop in rows near the margin on the placenta. It occurs in monocarpellary and unilocular ovary, eg, Leguminosae.

(ii) **Parietal :** It occurs in bicarpellary or multicarpellary but unilocular ovary. It occurs when two or more carpels unite. The ovary is usually unilocular but **false septum** forms in Cruciferae. The false septum is called **replum** and it makes the ovary bilocular, trilocular or even hexalocular.

(iii) **Axile :** the placentae develop from the central axis. The ovary is divided into as many chambers as there are carpels. This is found in Solanaceae, Malvaceae, Rutaceae, Liliaceae

(iv) **Free central :** the placenta develop in the centre of the ovary as a prolongation of floral axis and the ovules are attached on this axis. Ovary is multicarpellary but unilocular e.g., Primulaceae.

(v) **Basal :** The placenta develops directly on the thalamus and bears a single ovule at the base of the unilocular ovary, e.g., Compositae.

Types of ovule

There are six types of ovules:

1. Orthotropous or atropous ovule

The body of the ovule is erect or straight. The hilum, chalaza and the micropyle lie in a straight line e.g. **Polygonum.**

2. Anatropous ovule

The body of the ovule becomes completely inverted during the development so that the micropyle lies very close to the hilum (eg) Gamopetalae members.

3. Hemi-anatropous or hemitropous ovule

The body of the ovule is placed transversely at right angles to the funicle. The micropyle and chalaza lie in one straight line e.g. ***Ranunculus.***

4. Campylotropous ovule

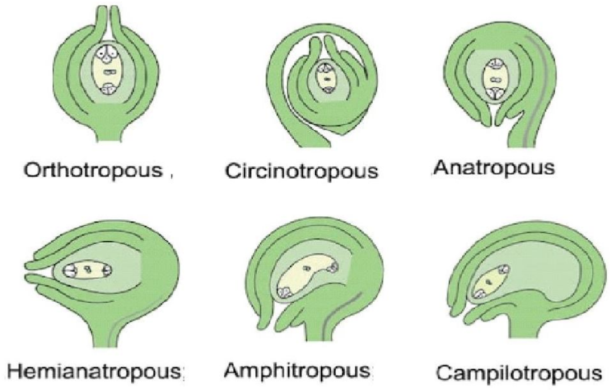
The body of the ovule is curved or bent round so that the micropyle and chalaza do not lie in the same straight line. e.g. ***Leguminosae.***

5. Amphitropous ovule

The curvature of the ovule is very much pronounced and the embryosac also becomes curved e.g.***Allismaceae,*** and ***Butomaceae.***

6. Circinotropous ovule

The nucellus and the axis are in the same line in the beginning but due to rapid growth on one side, the ovule becomes anatropous. The curvature continues further and the micropyle again points upwards (e.g.) ***Opuntia.***



Ques. When micropyle, chalaza and funiculus are in a straight line, the ovule is called : **[BHU-17]**

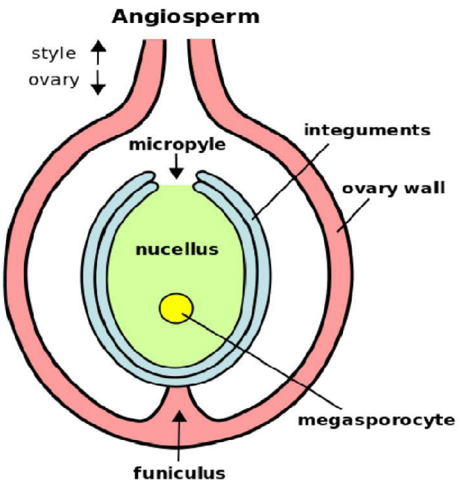
(a) Hemitropous (b) Amphitropous

(c) Orthotropous (d) Anatropous

Soln. An orthotropus ovule is the one in which the body of the ovule is straight such that the micropyle, the chalaza and the funiculus, all lie in a straight line.

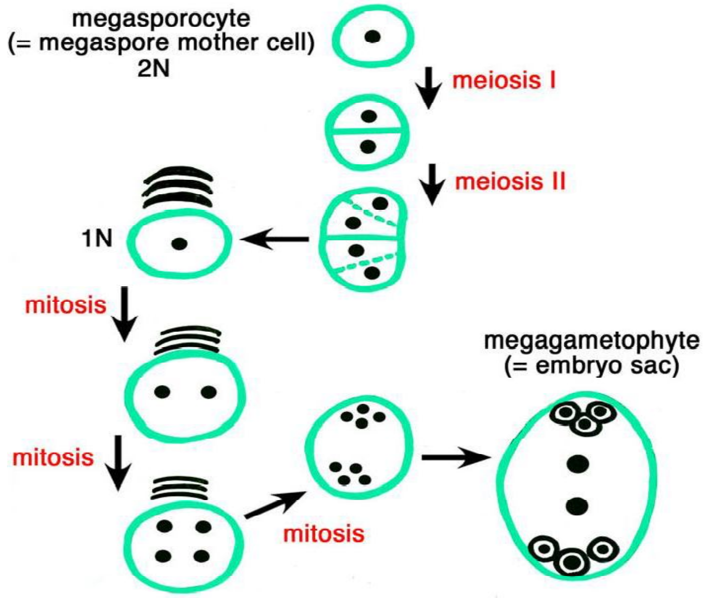
Correct option is (c)

Megasporogenesis



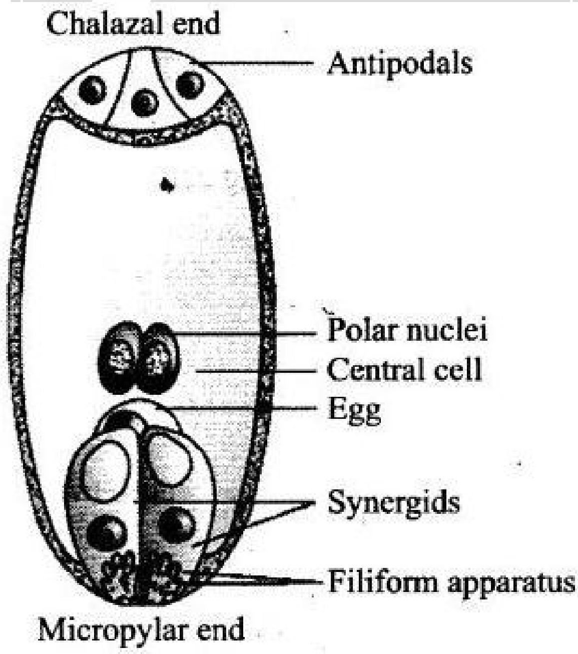
The formation of megaspores inside the ovules of seed plants is known as **megasporogenesis**. The nucellus is a tissue in which the archesporial cell is embedded. The **integuments** are the outer protective layers which surround the nucellus. Gymnosperms are usually **unitegmic** and angiosperms are **bitegmic.** The integuments leave an opening towards the apex called the **micropyle.** A diploid cell in the ovule, called a megasporocyte or a **megaspore mother cell**, undergoes meiosis and gives rise to four haploid megaspores. In most plants, only one of the megaspores then goes on to develop into a megagametophyte within the ovule, while the other three disintegrate. In the ovules of angiosperms, megasporogenesis takes place within the nucellus. it is the megaspore farthest from the micropyle of the ovary that survives.

E.g. Elytraia aeaulis & in others micropylar megaspore is functional. E.g. Epilobium palustre.



Embryo sac

It is the megagametophyte. It has the following: (i) three antipodals towards the chalazal end. (ii) two polar nuclei in the central cell. (iii) one egg cell towards the micropylar end. (iv) two synergids towards the micropylar end.



Depending on the number of megaspore nuclei taking part in development, female gametophytes are classified into (i) monosporic (ii) bisporic (iii) tetrasporic

Ques. Which type of embryosac is found in *Allium* ? **[BHU-2016]**

(a) Monosporic type (b) Bisporic type

(c) Tetrasporic type (d) Polygonum type

Soln. The embryo sac of *Allium* is bisporic type with 8-nucleate embryo sac.

Correct option is (b)

Ques. In angiosperms, embryosac represents : **[BHU-2016]**

(a) Megagametophyte (b) Megasporophyte

(c) Megagamete (d) Megaspore

Soln. Megagametophyte is the female gametophyte that arises from a megaspore of a heterosporous plant. In angiosperms, the megagametophyte is the embryo sac.

Correct option is (a)

Ques. Tetrasporic embryo sac develops from the following : **[BHU-2017]**

(a) Tetranucleate megaspore (b) Megaspore tetrad

(c) Tetraploid megaspore (d) Tetranucleate megaspore mother cell

Soln. In tetrasporic embryo sacs, cell plates fail to form after both meiotic divisions of the megaspore mother cell resulting in a single four-nucleate megaspore or tetranucleate megaspore.

Correct option is (a)

Ques. In an embryo sac: **[DU-2015]**

(a) nucleus of the egg cell is usually located towards the micropylar end and those of the synergids towards the chalazal end.

(b) cell wall of the egg cell is not attenuated towards the chalazal end.

(c) of plant species where the egg apparatus is without the synergids, the egg cell possesses the filiform apparatus.

(d) central cell invariably harbours two nuclei.

Soln. The embryo sac consists of 7cells and 8 nuclei the micropylar end has 3 cells egg cell and 2 synergids. The chalazal end has 3 chalazal cells. The large single central cell has 2 nuclei known as polar nuclei.

Correct option is (d)

Ques. Female gametophyte in Peperomia is: **[DU-2015]**

(a) Bisporic, 16-nucleate and bipolar (b) Tetrasporic, 4-nucleate and bipolar

(c) Tetrasporic, 16-nucleate and polypolar (d) Monosporic, 8-nucleate and bipolar

Soln. In peperomia, the female gemetophyte is tetrasporic, 16-nucleate and polypolar.

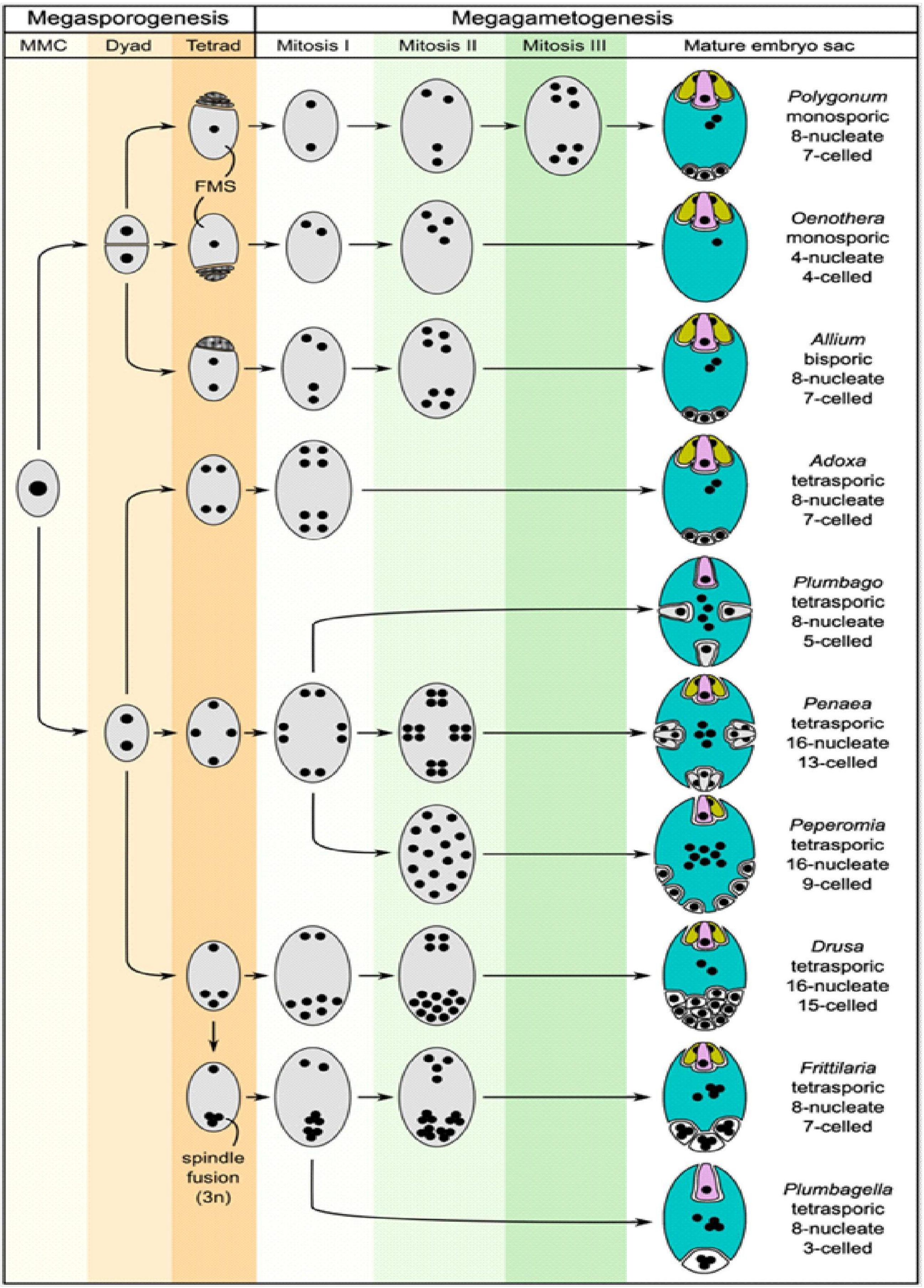
Correct option is (c)

Ques. In Polygonum type of embryo sac, which of the following is attached to the wall of the embryo sac, only at the micropylar end. **[DU-2018]**

(a) Central cell (b) Antipodal cells (c) Egg cell (d) Egg apparatus

Soln. The egg apparatus is present at the micropylar end always, in the embryo sac.

Correct option is (d)


Megasporogenesis
Megagametogenesis
MMC
Dyad
Tetrad
Mitosis I
Mitosis II
Mitosis III
Mature embryo sac
FMS
spindle fusion (3n)
Polygonum monosporic 8-nucleate 7-celled
Oenothera monosporic 4-nucleate 4-celled
Allium bisporic 8-nucleate 7-celled
Adoxa tetrasporic 8-nucleate 7-celled
Plumbago tetrasporic 8-nucleate 5-celled
Penaea tetrasporic 16-nucleate 13-celled
Peperomia tetrasporic 16-nucleate 9-celled
Drusa tetrasporic 16-nucleate 15-celled
Frittilaria tetrasporic 8-nucleate 7-celled
Plumbagella tetrasporic 8-nucleate 3-celled

Components of Mature Embryo Sac & their main Functions:

Synergids : Present near micropylar end

- Comprise of filiform apparatus which is thought to show direction to pollen tube for fertilization
- Form seat for pollen tube discharge in embryo sac

Egg Apparatus:

- Female gamete
- Highly polarized
- In Plumbago capensis finger like projection resembling filiform apparatus is present since it lacks synergids.

Antipodals:

- Present at chalazal end of female gametophyte
- Highly variable in ploidy & number
- Thought to store nutrients & important amino acids & other molecules.

Central cell:

- Largest cell of embryo sac
- Comprise of a large vacuole
- Nutrition absorption is probable function

Pollination

Pollination is the act of transferring pollen grains from the male anther of a flower to the female stigma of the same or different flower. In insect pollinated flowers, pollination is usually the unintended consequence of an animal's activity on a flower. The pollinator is often eating or collecting pollen for its protein and other nutritional characteristics or it is sipping nectar from the flower when pollen grains attach themselves to the animal's body. When the animal visits another flower for the same reason, pollen can fall off onto the flower's stigma and may result in successful reproduction of the flower. It is of different types:

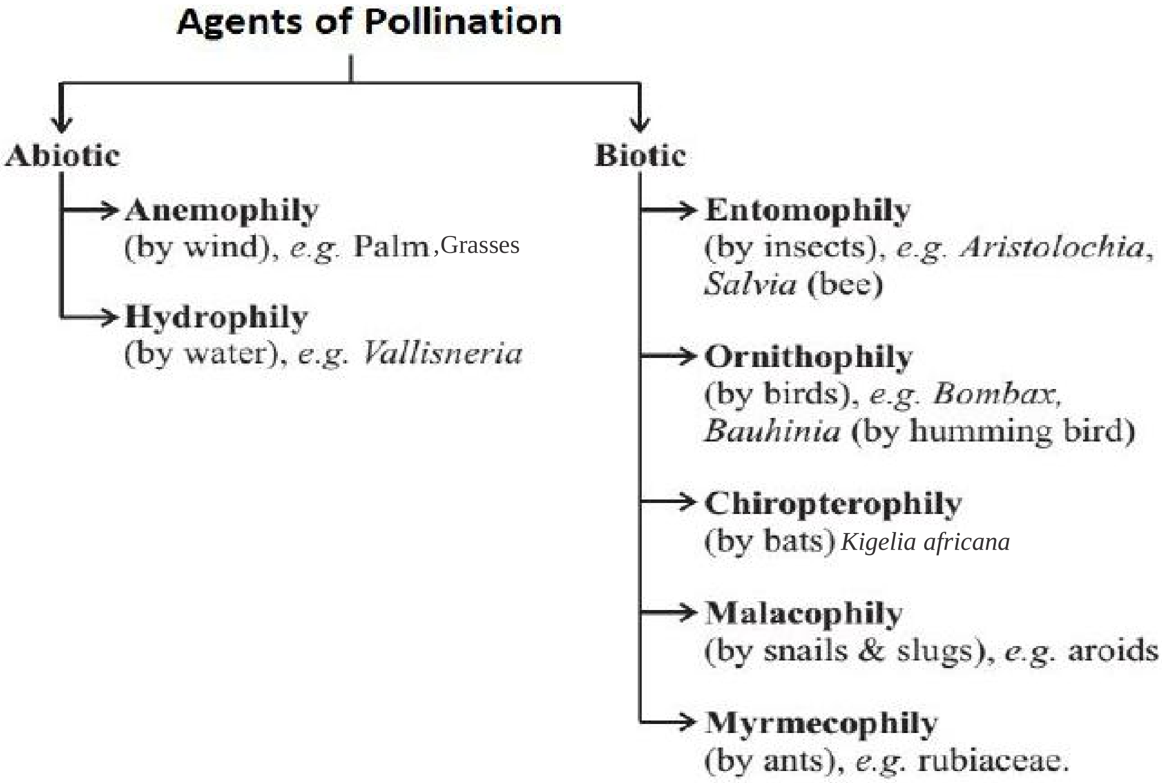
A. Self-pollination- when the transfer occurs in the same flower or two plants on the same plant. The stamen and carpel mature at the same time. This method does not require investment of nectar/pollen as food/showy flowers.These plants have less genetic diversity. e.g. Commeline forskalei

(i) autogamy –pollination in the same flower (always occurs in permanently closed cleistogamous flower)

(ii) geitonogamy – pollination in different flower of the same plant.(occurs in chasmogamous flowers – which are open but undergo self pollination)

B. Cross-pollination (Xenogamy/allogamy) – pollination in different flower of different plant of the same species.

Different plants have different pollinating agents. Some of them are mentioned below:



Ques. The phenomenon where transfer of pollen grains from the anthers to the stigma of another flower of the same plant is referred as **[BHU-2014]**

(a) Xenogamy (b) Cleistogamy (c) Geitonogamy (d) Autogamy

Soln. Geitonogamy is the fertilisatin of flower by pollen from another flower on the same or genetically identical plant.

Correct option is (c)

Ques. Vallisneria is a **[BHU-2015]**

(a) haolophyte (b) hydrophyte (c) xerophyte (d) mesophytic fern

Soln. Vallisneria is a submerged aquatic plant whose flower comes out to the water surface for pollination.

Correct option is (b)

Ques. Malacophily refers to pollination by **[DU-2014]**

(a) Snails and slugs (b) Sphinx moths (c) Honeybees (d) Spiders

Soln. Malacophily is pollination by snails or slugs. It is a type of zoophily.

Correct option is (a)

Pollination by bats

Bats pollinate nocturnal flowers in the tropics and arid regions. Eg. agave, guava, and morning glory. The flowers are usually large and white or pale-colored so that they can be contrasted and are easily visible at night. The flowers have a strong fruity fragrance and produce large amounts of nectar. They are large and wide-mouthed to accommodate the head of the bat. As the bats suck on the nectar, their faces and heads become covered with pollen, which are then transferred to the next flower.

Pollination by birds

Small birds, such as hummingbirds and sun birds, pollinate orchids and other wildflowers. The curved, tubular shape of the flower allows access to the bird's beak. Flowers are brightly colored and odorless. As a bird seeks energy-rich nectar, pollen is deposited on the bird's head and neck and is then transferred to the next flower it visits. Botanists determine the range of extinct plants by collecting and identifying pollen from 200-year-old bird specimens from the same site.

Pollination by wind

Plants such as grasses, maples, and oaks, and conifers are pollinated by wind. Pine cones are brown and unscented, while the flowers of wind-pollinated angiosperm species are usually green, small, reduced or no petals, produce large amounts of pollen. These flowers do not produce nectar or scent. In wind-pollinated species, the microsporangia hang out of the flower, and, as the wind blows, the lightweight pollen is carried with it. The flowers usually emerge early in the spring before the leaves so that the leaves do not block the movement of the wind. The pollen is deposited on the exposed feathery stigma of the flower.

Pollination by deception

Flowers often attract pollinators with food rewards, in the form of nectar. However, some species of orchid are an exception. They use a method known as **food deception**, in which bright colors and perfumes are offered, but no food. *Anacamptis morio*, commonly known as the green-winged orchid, has bright purple flowers and emits a strong scent. The bumblebee, its main pollinator, is attracted to the flower because of the strong scent, which usually indicates food for a bee. In the process, the bee picks up the pollen to be transported to another flower.

Other orchids use **sexual deception**. *Chiloglottis trapeziformis* emits a compound that smells the same as the pheromone emitted by a female wasp to attract male wasps. The male wasp is attracted to the scent, lands on the orchid flower, and, in the process, transfers pollen. Some orchids, like the Australian hammer orchid, use scent as well as **visual trickery** to attract wasps. The flower of this orchid mimics the appearance of a female wasp and emits a pheromone. The male wasp tries to mate with what appears to be a female wasp, but instead picks up pollen, which it then transfers to the next counterfeit mate.

Pollination by insects

Bees are most important pollinators. The most common species of bees are bumblebees and honeybees. Since bees cannot see the color red, bee-pollinated flowers usually have shades of blue, yellow, or other colors. Bees collect energy-rich pollen or nectar for their survival and energy needs. They visit flowers that are open during the day, are brightly colored, have a strong aroma or scent, and have a tubular shape, typically with the presence of a **nectar guide**. A nectar guide includes regions on the flower petals that are visible only to bees, which help guide bees to the center of the flower, thus making the pollination process more efficient. The pollen sticks to the bees' fuzzy hair; when the bee visits another flower, some of the pollen is transferred to the second flower. Recently, there have been many reports about the declining population of honeybees. Many flowers will remain unpollinated, failing to bear seeds if honeybees disappear. The impact on commercial fruit growers could be devastating.

Flies are attracted to flowers that have a decaying smell or an odor of rotting flesh. These flowers produce nectar but have a dull color such as blue or brown. They are found on the corpse flower or voodoo lily (*Amorphophallus*), dragon arum (*Dracunculus*), and carrion flower (*Stapleia*, *Rafflesia*). The nectar provides energy while the pollen provides protein. Wasps are also important insect pollinators, pollinating many species of figs.

Butterflies, such as the monarch, pollinate many garden flowers and wildflowers, which are usually found in clusters. These flowers are brightly colored, have a strong fragrance, are open during the day, and have nectar guides. The pollen is picked up and carried on the butterfly's limbs. Moths, on the other hand, pollinate flowers during the late afternoon and night. The flowers pollinated by moths are pale or white and are flat, enabling the moths to land. One well-studied example of a moth-pollinated plant is the yucca plant, which is pollinated by the yucca moth. The shape of the flower and moth have adapted in a way to allow successful pollination. The moth deposits pollen on the sticky stigma for fertilization to occur later. The female moth also deposits eggs into the ovary. As the eggs develop into larvae, they obtain food from the flower and developing seeds. Thus, both the insect and flower benefit from each other in this **symbiotic relationship**. The corn earworm moth and *Gaura* plant have a similar relationship.

Advantages of self pollination

1. maintain parental characters
2. maintain pure lines for hybridization experiments.
3. large number of pollen grains not needed.
4. accessory flower parts not needed.
5. ensure seed production.

Disadvantages

1. New characters not introduced.
2. no hybrid vigour.
3. decreased immunity/resistance to diseases.

Outbreeding devices

Since self-pollination causes inbreeding depression, cross-pollination in plants is promoted by outbreeding devices.

1. **Unisexuality** – it is also known as dioecism. Plants are unisexual so that cross-pollination becomes a rule for fertilization.
2. **Dichogamy** – Here, stigma and anther mature at different times so that the pollen do not fertilize the ovary of the same flower.
   (a) **Protandry** – When androecium matures first.
   (b) **Protogyny** – When gynoecium matures first.
3. **Herkogamy** – It is the natural physical barrier such as position (spatial separation) of the style and stamen.
4. **Self sterility** – gene that recognizes similar gene is not allowed to germinate.
5. **Pollen prepotency** – pollen from different flower germinates faster than that of the same flower. Eg. *Oxalis.*

Ques. In species where pollen matures and is released prior to the maturation and receptivity of the gynoecium, the condition is called **[DU-2014]**

(a) protogyny (b) protandry (c) dichogamy (d) androdioecy

Soln. The condition in which the male reproductive organs (stamens) of a flower mature before the female ones (carpels), thereby ensuring that self- fertilisation does not occur.

Correct option is (b)

Ques. Occurrence of anthers and the stigma at different levels in a flower is referred as **[DU-2014]**

(a) Herkogamy (b) Dichogamy (c) Flower constancy (d) Protandry

Soln. Herkogamy is a strategy employed for preventing self pollination. It gives spatial separation of anthers and stigma such as different sizes of filaments or styles due to which pollination cannot take place.

Correct option is (a)

Self incompatibility

Self-incompatibility mechanisms are all those genetic mechanisms in flowering plants, which prevent selfing. Here, self-pollinated flowers fail to set seed. It is incompatibility between the pollen and the pistil of the same plant.

General features of self-incompatibility

- Prevents selfing and promotes outbreeding so increases the probability of new gene combinations
- Causes may be morphological, physiological, genetical or biochemical
- Normal seed set on cross pollination
- May operate at any stage between pollination and fertilization
- Reduces homozygosity
- In plants, self-incompatibility is often inherited by a single gene (S) with different alleles (e.g. S_1, S_2, S_3 etc.) in the species population

Heteromorphic self – incompatibility	Distyly
	Tristyly
Homomorphic self – incompatibility	Gametophytic self – incompatibility
	Sporophytic self – incompatibility

Heteromorphic self-incompatibility

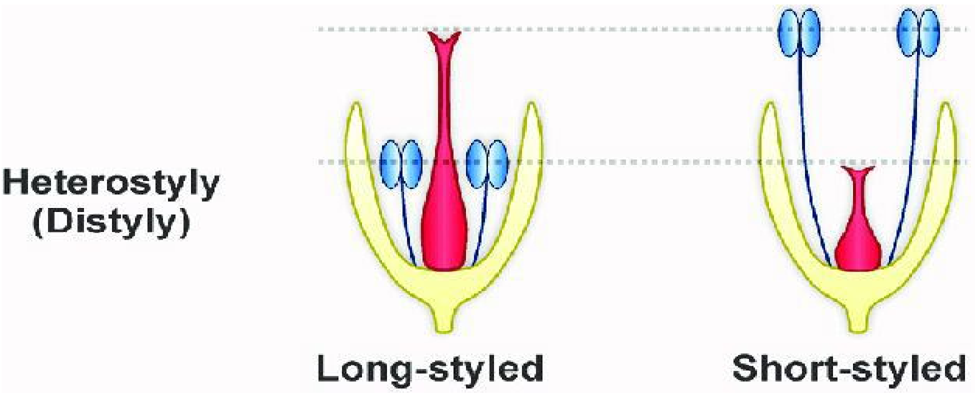
Heteromorphic self-incompatibility is associated with flower morphology, exists in heterostylous flowers. Do not have much importance in crop plants. Flowers have different morphology. It is of two types – (i) distyly (ii) tristyly

Distyly

Here, both stamens and styles are of two types.

Stamens may be low and high; styles short and long. It is determined by a single gene, with two alleles.

The flower with short style and high stamen is called as **thrum type** and flower with long style and low stamen is called as **pin type.** Both thrum and pin flowers differ for six characters in addition to stamen and style length.



Genotype of thrum flowers – Ss , genotype of pin flowers – ss , S allele is dominant over s allele.

The incompatibility reaction of pollen is determined by the genotype of the plant producing them.

Ss x ss = incompatible (pin x pin)

Ss x Ss = incompatible (thrum x thrum)

Ss x ss = compatible (thrum x pin)

Tristyly

In tristyly, styles and stamens have three different positions.

It is determined by two genes S and M, each with two alleles. S gives rise to short style, S and M to medium style and s and m to long style. The number of possible genotypes is greater, but a 1:1 ratio exists between individuals of each SI type.

Homomorphic self-incompatibility

In homomorphic self-incompatibility, all the flowers have exactly the same structure. Self-fertilization inhibition depends on genetic or biochemical or physiological mechanisms. It has importance in crop plants.

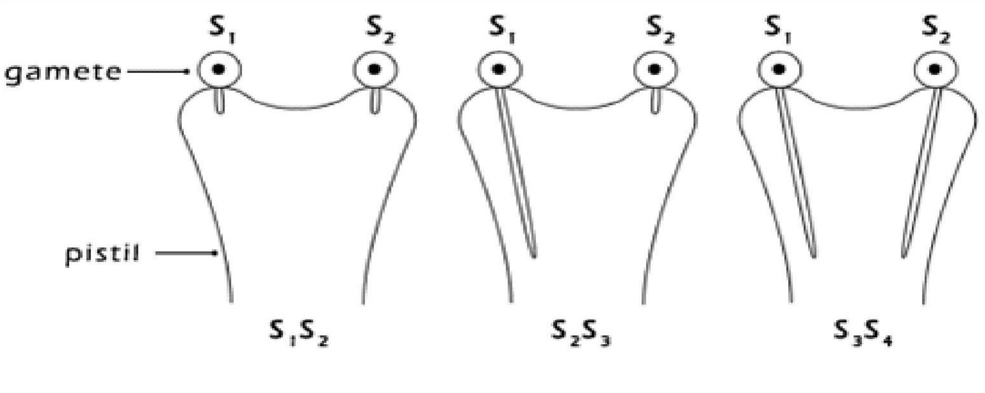
It can operate in various ways like

- Pollen grain does not germinate on the stigma of same flower.
- Even if germination occurs, germinated pollen cannot penetrate the stigma
- If penetrates, pollen tube growth retardation or very slow rate of pollen tube growth
- No release of male gametes from the pollen tube having normal growth.

It is of two types. Generally, each plant possesses only one of these two.

- Sporophytic self-incompatibility (SSI)
- Gametophytic self-incompatibility (GSI)

Gametophytic self-incompatibility



Gametophytic Self Incompatibility

S loci have multiple alleles.

SI is controlled by a single S allele in haploid pollen grain. Thus, pollen grain grows in any pistil that does not contain the same genes. Growth of incompatible tube stops within the style. This block is created by S-locus encoded ribonuclease (S-RNase). It destroys RNA molecules of pollen tube and stops its growth. The RNase molecules contain a hypervariable region, encoded by different alleles. (S1, S2, S3). Pollen tube expresses a protein designated SLF (S-locus F-box Protein). It bind S-RNase.

SLF exists in different specificities.

(i) In compatible (non-self) pollen tubes, SLF triggers degradation of S-RNase and allows the pollen tube to grow.

(ii) In incompatible (self) pollen tubes (eg S1-SLF and S1 S-Rnase) S1-SRNase blocks its degradation and it acts on RNA of pollen tubes. The tube is destroyed and growth is stopped.

The genotype of the pollen grains and not the whole plant is responsible for this type of self-incompatibility.

S_1S_2 X S_3S_4	Fully compatible
S_1S_2 X S_1S_3	Partially compatible
S_1S_2 X S_1S_2	Fully incompatible

Examples: Members of Solanaceae, Scrophulariaceae, Poaceae, Fabaceae, Campanulaceae, Onagraceae, Papaveraceae and Rosaceae

Sporophytic self-incompatibility

In this case, self-incompatibility is governed by genotype of pollen producing plant i.e. diploid genotype of the sporophyte generation.

This system inhibits pollen germination or pollen tube growth on the stigma of same flower. Progeny from cross between two genotypes is either fully fertile or complete sterile. It permits recovery of parent genotypes in some crosses.

Pollen does not germinate on the stigma of a flower that contains either of the two alleles that are present in the sporophyte parent on which the pollen is produced. The same condition is applicable even though each pollen grain (haploid) contains only one of the alleles. So, pollen grains (S_1 or S_2) produced by S_1S_2 plant will germinate only on S_3S_4 plant not on S_1S_2 or S_1S_3. Order of dominance followed is $S_1 > S_2 > S_3 > S_4$