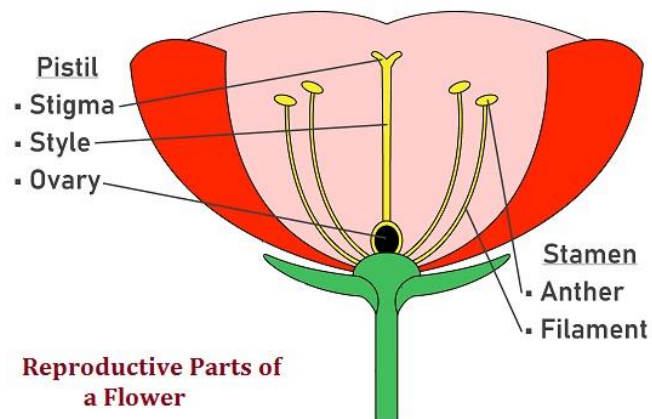


POLLINATION AND FERTILIZATION

Male Gametes - The anthers of the stamens produce powdery material called pollen which consists of particles called **pollen grains**.

Female Gametes - The female gamete formed in an ovule is also known as **the egg**.



POLLINATION

Transfer of pollen grains from Anther to Stigma is called **Pollination**.

It may happen in three principal ways:

- Autogamy** (auto: self, gamy: marriage): The pollen of the same flower may fall on its stigma by itself
- Geitonogamy** (geitono: neighbouring) : The pollen of another flower of the same plant may fall on the stigma
- Allogamy** (allo: other) : The pollen of a flower of another plant of the same species may fall on the stigma

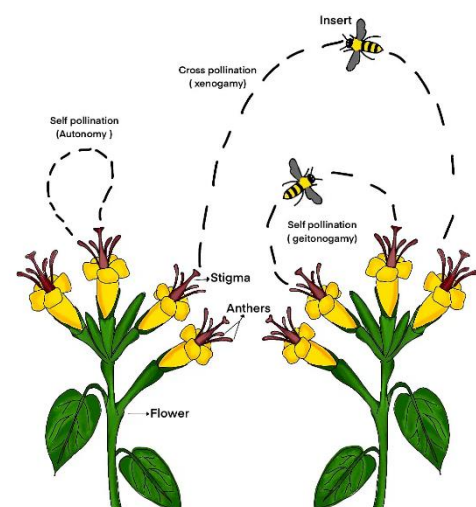
Kinds of pollination.

There are two kinds of pollination : self-pollination and cross-pollination.

Self-pollination

Self-pollination is the transfer of pollen from the anther to the stigma of the same flower (**autogamy**), or to the stigma of another flower of the same plant (**geitonogamy**)

Cleistogamy (cleisto: closed) : In pansy, some flowers growing close to the ground level, do not open at all, the anthers and stigma lie close to each other which mature at the same time and self-pollination is assured.



When can self-pollination occur ?

1. Bisexuality: Self-pollination can occur in bisexual flowers, i.e. in flowers having both male and female organs, or it can also occur in such unisexual flowers where both male and female flowers are borne on the same plant.

2. Homogamy: To ensure self-pollination, it is necessary that the anther and stigma of a flower must mature at the same time.

Advantages of self-pollination

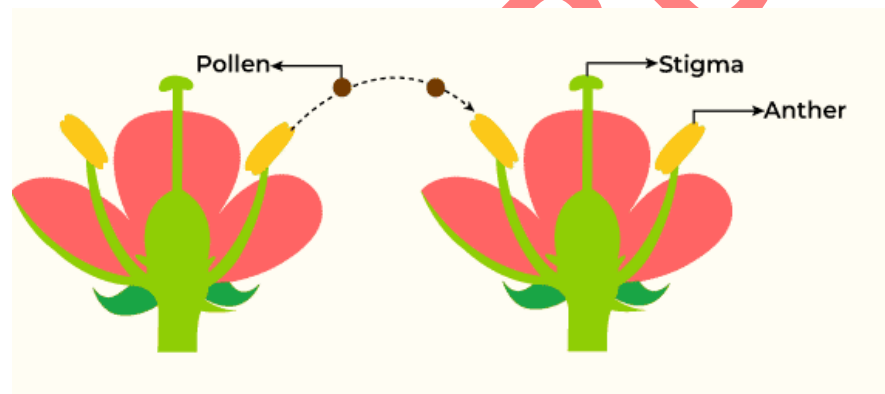
1. It is much surer in such bisexual flowers where stamens and carpels mature at the same time.
2. Parental characters are preserved indefinitely.
3. There is no wastage of pollen grains. Even a small quantity of pollen will suffice.
4. The flowers need not be large and showy.

Disadvantages of self-pollination

1. Continued self-pollination, generation after generation, may lead to weakening of the variety or the species.
2. The weaker or defective characters of the variety or breed cannot be eliminated.
3. It does not yield new varieties.

Cross-pollination

Cross-pollination is the transfer of pollen from the anthers of flowers of one plant to the stigma of a flower of another plant of the same species.



Advantages of cross-pollination

1. The offsprings are healthier.
2. The seeds produced are abundant and viable.
3. New varieties may be produced by cross- pollinating two different varieties of the same species or even two species.

Disadvantages of cross-pollination

1. The pollination is not always certain because some pollinating agent is always needed which may or may not be available at the proper time.
2. The pollen has to be produced in large quantity to ensure chances of pollination which means a lot of wastage of pollen.
3. The process is uneconomical for the plant because the flowers have to be large, coloured, scented and have to produce nectar-for attracting pollinating agents.

Nature favours cross-pollination.

The conditions which favour cross-pollination are as follows:

1. Unisexuality. The flowers may be either male or female and they may be borne on separate plants. In this way cross-pollination is the only possibility; e.g. palms and papaya. (Papaya usually has separate male and female trees).

2. Dichogamy : (Different timings of maturation of androecium and gynoecium). In many bisexual flowers, the anthers and stigma of the same flower mature at different times.

-- In some plants, anthers of the flower mature earlier than the stigma (**protandry**), e.g. bhindi, sweet pea, salvia, sunflower.

-- In some plants, the stigma of the flower matures earlier than the anthers (**protogyny**), (protos: first, gyne: female), e.g. custard apple, peepal.

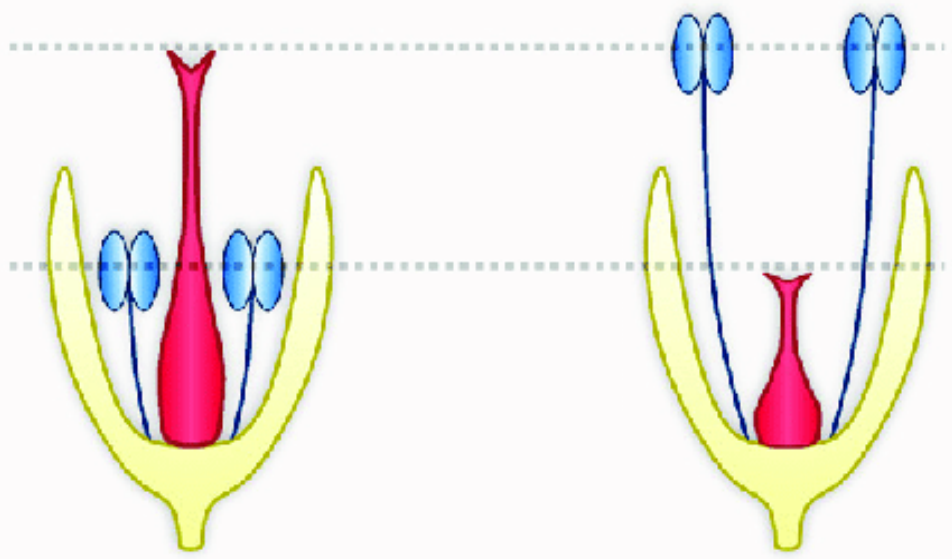
3. Self-sterility : This is a condition in which even if the stigma receives pollen from the anthers of the same flower, the pollen fails to undergo further growth. e.g.- ray florets of sunflower, orchids, etc.

4. Herkogamy (Mechanical or Structural barriers) (herkos: barrier) : In some flowers, the pollen of a flower cannot reach the stigma of the same flower. For example, a *hood* covering the stigma acts as a mechanical barrier in Pansy flowers, Iris, etc.

5. Heterostyly : In such flowers the stigma and anthers grow at different heights which does not favour self-pollination. e.g. prim rose, oxalis.



Heterostyly (Distyly)



Agents of cross-pollination

The two commonest agents of cross-pollination are *insects and wind*. Some flowers are also pollinated by birds (**Ornithophily**) Ex- Canna. Pollination by elephants is called **Elephophily** Ex- Rafflesia, etc.

Insect-pollinated (or entomophilous ; entomon: insect, phile: affinity) flowers usually have the following characteristics (Ex- Dahlia)

1. The flowers are large.
2. They are usually brightly coloured to attract insects.
3. They usually emit scent for attracting insects.
4. They produce nectar which is food for the insects.
5. The pollen grains are sticky or spiny to enable them to be carried by the insects easily.

Wind-pollinated (or anemophilous, anemo: wind; phile: affinity) flowers usually possess the following special features. (Example: Maize)

1. The flowers are small.
2. They are usually not brightly coloured and often dull green.
3. They do not produce scent or nectar.
4. The stamens are long and hang out of the flower to be exposed to wind.
5. The anthers are large and loosely attached to the filaments so that the slightest wind may move them (versatile).
6. Pollen is produced in very large quantities.

Water-pollinated (or hydrophilous, hydro: water, phile: affinity) flowers are found only in aquatic plants. They have the following characteristics :

1. Pollen grains are produced in large numbers.
2. In some plants the pollen grains have a specific gravity almost equal to that of water so that they remain floating below the surface of water.
3. In some special cases male flowers are such that they float on the surface of water till they meet female flowers e.g. Vallisneria.

Artificial pollination : When man himself transfers pollen to the stigma, it is called artificial pollination/ crossing.

Plant Breeders remove the anthers in young flowers (**emasculation**) and cover these flowers with plastic bags. Later, they pollinate such flowers with the pollen from the plants of the desired variety.

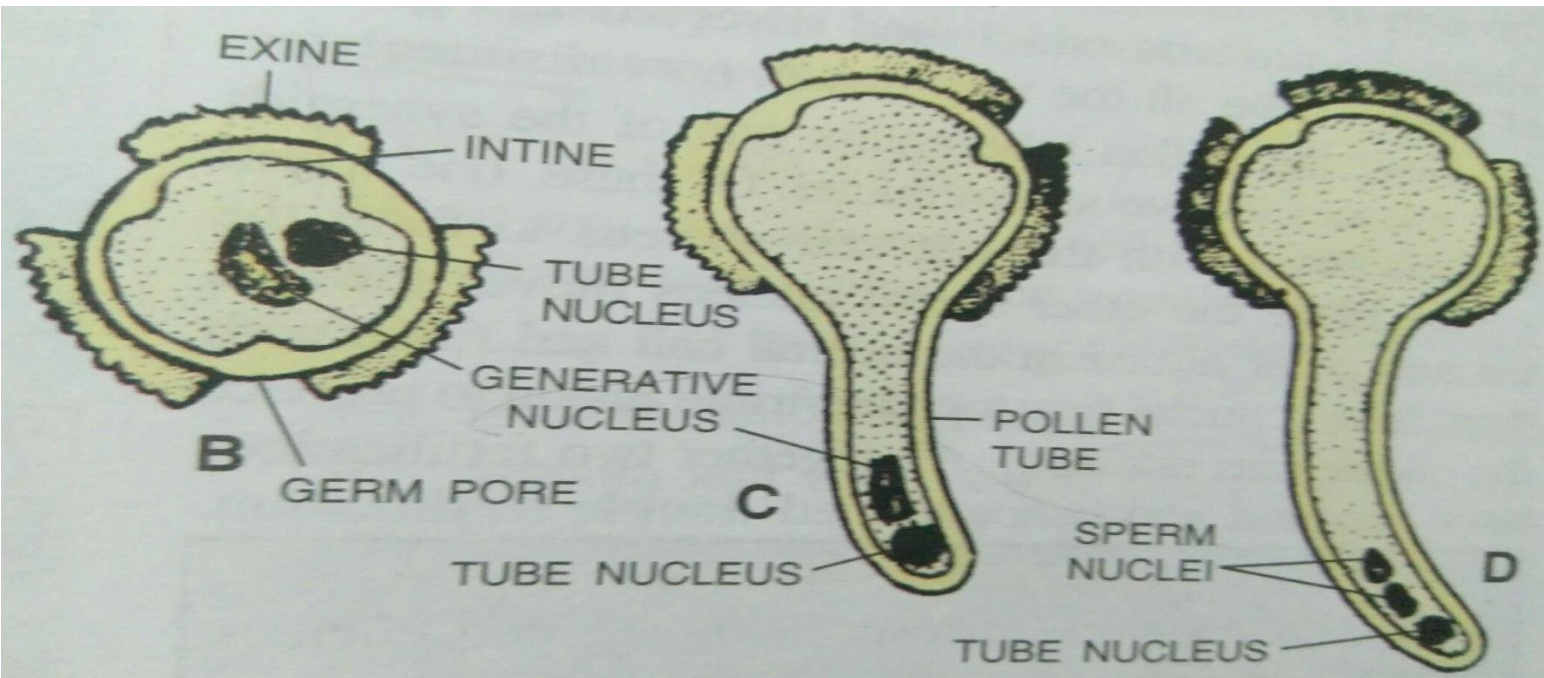
FERTILIZATION

Fertilisation is the union/fusion of the nuclei of male and female gametes.

- The pollen grain is the male gamete.
- The ovule inside the ovary is the female gamete.

The Pollen Grain

The mature pollen grain is a cell with a double wall the outer exine and the inner intine. Its nucleus has already divided into a tube nucleus and a generative (male) nucleus.



The Ovule

Ovule is the inner part of ovary. Ovule become the seed and the ovary become the fruit after fertilisation.

Each ovule has one or two protective coverings, the integuments.

Micropyle is a small opening in the integument for the entry of pollen tube.

Integument encloses nucellus (food containing cells) and embryo sac.

The Embryo sac contains seven cells (3+3+1)

At Micropylar side – 3 cells – 1 egg cell and 2 synergids

At opposite side – 3 antipodal cells

At centre – 1 central cell containing 2 polar nuclei.

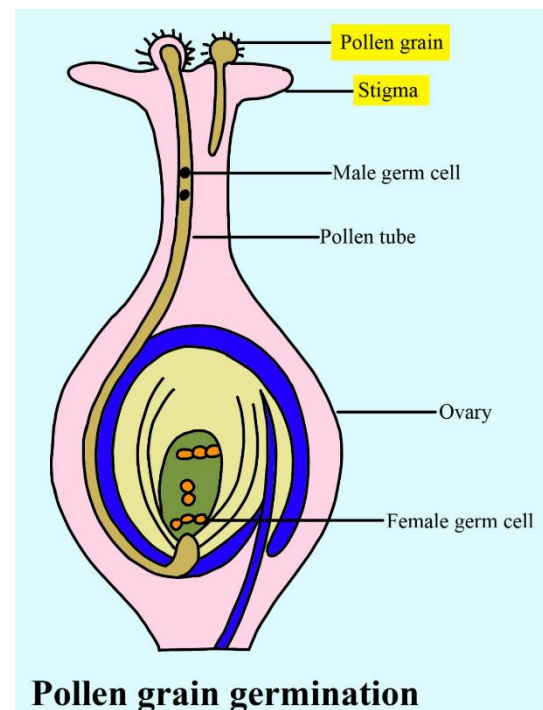
Germination of pollen grain

Pollen grain germinates only if it falls on the stigma of the same plant species, otherwise, it disintegrates.

The pollen grain on falling on the stigma is stimulated to germinate due to the secretion of sugars by the stigma.

Through a point in the exine a pollen tube grows out of the pollen grain, carrying at its tip the generative nucleus and the tube nucleus.

Generative nucleus divides into two sperm nuclei.



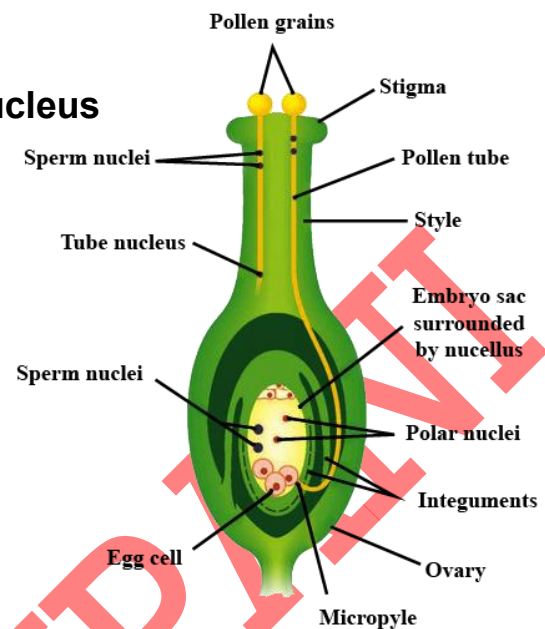
Pollen grain germination

Tube Nucleus directs the growth and later disintegrates.

Triple Fusion : 2 Polar Nuclei fuses to form Secondary Nucleus and the One sperm nucleus unites with secondary Nucleus.

Double fertilisation

1. One sperm nucleus fuses with egg cell nucleus.
2. The other sperm nucleus fuses with two polar nuclei together.



Fate of floral parts after fertilization. After fertilization the flower has served its purpose.

- The *petals, stamens, style and stigma* wither and generally fall off.
- The calyx may either fall off or may remain intact in a dried and shrivelled form. Apple and guava show such dried sepals very clearly, in brinjal it remains.
- The ovary enlarges to form fruit, the ovarian wall forming the fruit wall (pericarp).
- Ovules become the seeds.
- Placenta becomes stalk of seed and Integument becomes seed coat.