# SEXUAL REPRODUCTION IN FLOWERING PLANTS

# DOUBLE FERTILISATION

## POLLINATION:

The transfer of pollen grains shed from the anther to the stigma of pistil is called pollination. Pollination is of two types.

**Kinds of Pollination :**

Depending on the source of pollen, pollination can be divided into three types.

(A) **Autogamy:** In this type, pollination is achieved within the same flower. Transfer of pollen grains from the anther to the stigma of the same flower.

**Contrivances for Autogamy:**

(i) **Bisexuality or hermaphrodite:** When male and female both reproductive part present within flower.

(ii) **Homogamy:** Male and female reproductive parts in bisexual flowers mature at the same time

Flowers are open (chasmogamous). **Eg:** ***Convolvulus, Gardenia, Catharanthus, Mirabilis,*** **sunflower (Fail-safe device).**

(iii) **Cleistogamy:** Sometimes bisexual flowers remain closed and never open, such flowers are known as cleistogamous **Eg:** ***Commelina benghalensis*****, Groundnut,** ***Viola and Oxalis*****.**

- **In cleistogamous flower, the anthers and stigma lie close to each other. When anthers dehisce in the flower buds, pollen grains come in contact with the stigma to effect pollination.**
- **Thus, cleistogamous flowers are invariably autogamous as there is no chance of cross-pollen landing on the stigma.**
- **Cleistogamous flowers produce assured seed-set even in the absence of pollinators.**

**Note: Commelina benghalensis** bears two types of flowers.

(a) **Chasmogamous -** These are open aerial flowers.

(b) **Cleistogamous -** These are subterranean closed flowers.

Such flowers are called chasmocleistogamous flowers. This phenomenon is called Amphicarpy**.**

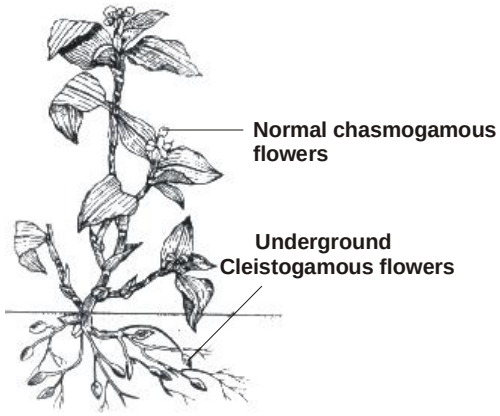



Fig. Chasmocleistogamy in *Commelina*

**Merits:**

**(i)** Flowers do not possess showy petals, presence of scent and nectar to attract pollinators.

**(ii)** The purity of the generation is maintained.

**(iii)**Pollen grains are not wasted.

**Demerits:**

**(i)** New and healthier varieties are not formed.

**(ii)** It results in weaker progeny producing weaker seeds and plants.

**(B) Geitonogamy :** Transfer of pollen grains from the anther to the stigma of another flower of the same plant. Although geitonogamy is functionally cross-pollination involving a pollinating agent, genetically it is similar to autogamy since the pollen grains come from the same plant.

**(C) Xenogamy or Cross pollination :** Transfer of pollen grains from anther to the stigma of a different plant. This is the only type of pollination which during pollination brings genetically different types of pollen grains to the stigma.

## AGENTS OF POLLINATION

There are different types of pollinating agents which are as follows-:

1. **Zoophily**

The zoophilous type of cross-pollination occurs when pollination is carried out with the assistance of animals. Flowers with hairy pollen grains stick to the body of animals, so zoophilous pollination plants have flowers with hairy pollen grains. When these creatures come into contact with another plant's blossoms, they transfer pollen to the stigma.

2. **Entomophily**

Cross-pollination is accomplished through the use of a variety of agents. This type of cross-pollination is known as entomophilous cross-pollination because it is pollinated by insects.

Insects pollinate the flowers when they are huge, vividly coloured, emanate a perfume, and generate nectar.

3. **Anemophily**

Wind pollination, also known as anemophily, is pollination carried out with the assistance of the wind. Anemophilous pollination is the term for this type of pollination. Wind pollinating flowers are those that carry out this form of pollination. They are little and light-coloured, with no scent or nectar. The stamens of these flowers are lengthy and protrude from the flower to aid pollination by the wind. The pollens are very light and dry, and the anthers are loosely linked to the filament. The stigmas of the flower are feathery and protrude from the blossom. Take maize, for example.

4. **Hydrophily**

Pollination is known as hydrophilous cross-pollination since it is done with the help of water. It's most common in aquatic plants, where pollen is generated in vast quantities and with a certain weight, causing them to float below the water's surface.

The male flower in Vallisneria floats on the water's surface until it comes into contact with the female blooms. Pollinating agents are substances that help plants reproduce.

## EXAMPLES OF POLLINATING AGENTS

- Many grass plants are pollinated by the wind.
- Pollination is also aided by bats. They're only found in a few bananas (Musa spp.).
- Evening primrose and tobacco plants are both pollinated by moths.

## OUTBREEDING DEVICES

Self-pollination is common and more likely to happen in the case of hermaphrodite flowers but a successive series of self-pollination affects negatively and causes inbreeding depression. This also results in homozygous genes. Thus plants are adapted to promote cross-pollination. This is known as outbreeding. Factors which encourage cross-pollination are as follows:

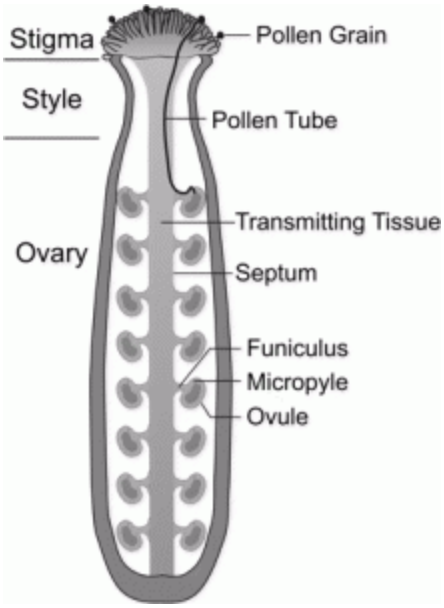
- **Unisexual flower:** If a flower is unisexual i.e., containing only one sex either female or male, cross-pollination is the only choice.
- **Non-Synchronization:** Timing is important for successful self-pollination. Pollen release and receptivity of stigma should happen for successful self-pollination. Sometimes, pollen matures and releases before the stigma is open which leads to loss of pollen vitality or vice-versa. This prevents self-pollination; even though the flower is hermaphrodite.
- **Self-incompatibility:** Incompatibility within a flower (or plant) includes self-sterility; structural barriers. Self-sterility means even though pollination takes place it can't proceed to fertilization due to further pollen growth failure. Structural barriers include height difference between gynoecium and androecium and some structures which hinder the stigma from receiving pollen. These are the more or less genetic mechanism.

## POLLEN-PISTIL INTERATION

The process of transfer of pollen grains from the anther of a male flower to the stigma of the female flower is known as Pollination. Pollination can be of two types which are cross-pollination and self-pollination. Most of the plants are bisexual or hermaphrodite which promotes self-pollination. Is this self-pollination desirable? What are the factors promoting cross-pollination?

### What is pollen-pistil interaction?

The sequence of events, which is carried out from the time of pollen deposition over the stigma and till the entry of the pollen tube inside the ovule is called pollen pistil interaction. The process of pollination during which the transferring of pollen grains takes place from the anther to the pistil is the first step of the pollen-pistil interaction.




## ARTIFICIAL HYBRIDIZATION

Pollen-stigma compatibility is essential for successful pollination and fertilization. Once compatible pollen is accepted by pistil, events of fertilization proceed, whereas incompatible pollen will be rejected. This interaction where a pistil is capable of recognizing its pollen is the result of long-term pollen-pistil interaction and chemicals released by pollen.

It is very important to understand pollen-pistil interaction in hybridization. It is one of the innovative methods of the crop production improvement program. During artificial hybridization, only the desired pollen grains are introduced to the stigma through pollination. This helps to avoid unwanted pollen rejection and saves time. Also, the plants with the desired characteristics can be grown.

## Steps in Artificial Hybridization

Hybridization proceeds in two steps:

- Emasculation
- Bagging

Emasculation

We know hybridization is the method of selective breeding. Thus, anthers have to be removed from a bisexual flower before they release pollen grains. This step of removal of anther using forceps is termed as emasculation. In the case of unisexual flowers, this step is not necessary.

Bagging

Bagging is the protection of emasculated flower from contamination by undesirable pollen grains. Here the flower is masked by a bag, still, the flower attains receptivity. In unisexual flowers, bagging is done before the flowers are open.

Emasculation and bagging ensure that the female flower is completely protected from contamination.

Once the flower attains stigma receptivity, the desired pollens are dusted on the stigma. This is resealed for further developments.

Hence, artificial hybridization ensures that the right type of pollen has been transferred to the stigma of the flower. In addition, the chance of fertilization is high. Through this approach, a variety of strains of crops can be developed and it improves the quality of crop with desirable characters.