NORTH POINT SR. SEC. BOARDING SCHOOL,
ARJUNPUR
Class –XII Subject: Biology

CHAPTER

SEXUAL REPRODUCTION IN FLOWERING PLANT

TODAYS TOPICS

- POLLEN PISTIL INTERACTION
- ARTIFICIAL HYBRIDIZATION

1. EMASCULATION
2. BAGGING
3. TAGGING

- DOUBLE FERTILIZATION

1. SYNGAMY
2. TRIPLE FUSION

OUTBREEDING DEVICES TO DISCOURAGE SELF POLLINATION:

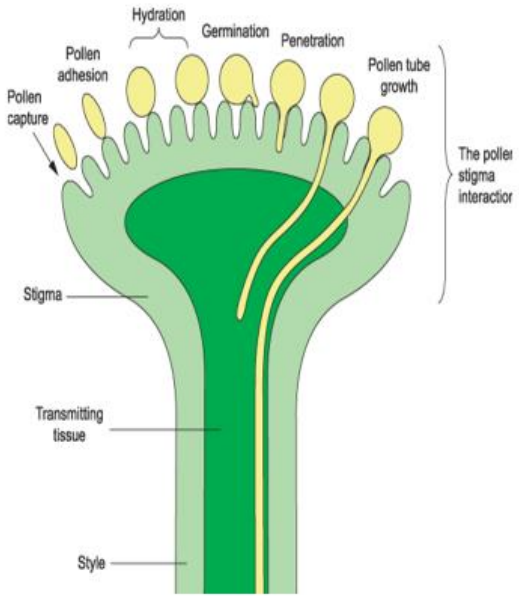
1. **POLLEN RELEASED AND STIGMA RECEPTIVITY ARE NOT SYNCHRONISED.**
2. **ANTHER AND STIGMA ARE PLACED AT DIFFERENT POSITION SO THE POLLEN CAN NOT COME IN CONTACT WITH STIGMA OF THE SAME FLOWER.**
3. **SELF INCOMPATIBILITY : POLLEN GERMINATION OE GROWTH OF POLLEN GRAN WILL BE INHIBITED BY THE SAME FLOWER OR DIFFERENT FLOWER ON THE SAME PLANT.**
4. **A.)UNISEXUAL FLOWER : THIS CAN STOP AUTOGAMY AND GEITONOGAMY WHEN MALE AND FEMALE PLANTS ARE SEPARATE EXAMPLE PAPAYA A.**

4. B.) BUT IF BOTH MALE AND FEMALE FLOWERS ARE PRESENT ON SAME PLANT (CASTOR/ MAIZE) , IT PREVENTS AUTOGAMY BUT NOT GEITONOGAMY.

Outbreeding Devices : Majority of flowering plants produce hermaphrodite flowers and pollen grains are likely to come in contact with the stigma of the same flower. Continued self-pollination result in inbreeding depression. Flowering plants have developed many devices to discourage self-pollination and to encourage cross-pollination. In some species, pollen release and stigma receptivity are not synchronised. Either the pollen is released before the stigma becomes receptive or stigma becomes receptive much before the release of pollen. In some other species, the anther and stigma are placed at different positions so that the pollen cannot come in contact with the stigma of the same flower. Both these devices prevent autogamy. The third device to prevent inbreeding is self-incompatibility. This is a genetic mechanism and prevents self-pollen (from the same flower or other flowers of the same plant) from fertilising the ovules by inhibiting pollen germination or pollen tube growth in the pistil. Another device to prevent self-pollination is the production of unisexual flowers. If both male and female flowers are present on the same plant such as castor and maize (monoecious), it prevents autogamy but not geitonogamy. In several species such as papaya, male and female flowers are present on different plants, that is each plant is either male or female (dioecy). This condition prevents both autogamy and geitonogamy.

Pollen-pistil Interaction : Pollination does not guarantee the transfer of the right type of pollen (compatible pollen of the same species as the stigma). Often, pollen of the wrong type, either from other species or from the same plant (if it is self-incompatible), also land on the stigma. The pistil has the ability to recognise the pollen, whether it is of the right type (compatible) or of the wrong type (incompatible). If it is of the right type, the pistil accepts the pollen and promotes post-pollination events that leads to fertilisation. If the pollen is of the wrong type, the pistil rejects the pollen by preventing pollen germination on the stigma or the pollen tube growth in the style. The ability of the pistil to recognise the pollen followed by its acceptance or rejection is the result of a continuous dialogue between pollen grain and the pistil. This dialogue is mediated by chemical components of the pollen interacting with those of the pistil. It is only in recent years that botanists have been able to identify some of the pollen and pistil components and the interactions leading to the recognition, followed by acceptance or rejection.

As mentioned earlier, following compatible pollination, the pollen grain germinates on the stigma to produce a pollen tube through one of the germ pores (Figure 2.12a). The contents of the pollen grain move into the



POLLEN PISTIL INTERACTION

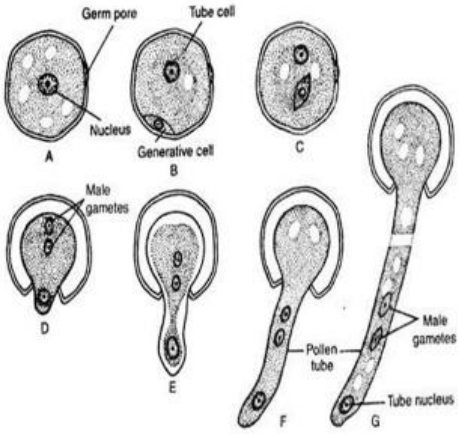
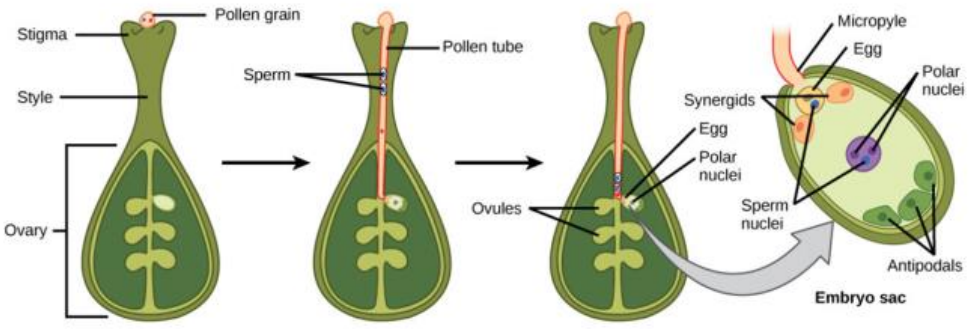


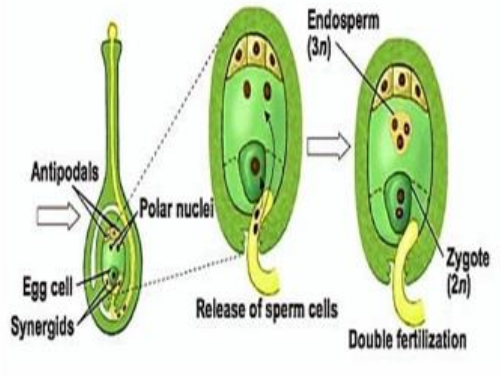
Fig. 3.5 : A-G. Germination of the pollen grain and development of the male gametes

pollen tube. Pollen tube grows through the tissues of the stigma and style and reaches the ovary (Figure 2.12b, c). You would recall that in some plants, pollen grains are shed at two-celled condition (a vegetative cell and a generative cell). In such plants, the generative cell divides and forms the two male gametes during the growth of pollen tube in the stigma. In plants which shed pollen in the three-celled condition, pollen tubes carry the two male gametes from the beginning. Pollen tube, after reaching the ovary, enters the ovule through the micropyle and then enters one of the synergids through the filiform apparatus (Figure 2.12d, e). Many recent studies have shown that filiform apparatus present at the micropylar part of the synergids guides the entry of pollen tube. All these events–from pollen deposition on the stigma until pollen tubes enter the ovule–are together referred to as pollen-pistil interaction. As pointed out earlier, pollen-pistil interaction is a dynamic process involving pollen recognition followed by promotion or inhibition of the pollen. The knowledge gained in this area would help the plant breeder in manipulating pollen-pistil interaction, even in incompatible pollinations, to get desired hybrids.

You can easily study pollen germination by dusting some pollen from flowers such as pea, chickpea, *Crotalaria*, balsam and *Vinca* on a glass slide containing a drop of sugar solution (about 10 per cent). After about 15–30 minutes, observe the slide under the low power lens of the microscope. You are likely to see pollen tubes coming out of the pollen grains.

As you shall learn in the chapter on plant breeding (Chapter 9), a breeder is interested in crossing different species and often genera to combine desirable characters to produce commercially 'superior' varieties.





2.3 Double Fertilisation

After entering one of the synergids, the pollen tube releases the two male gametes into the cytoplasm of the synergid. One of the male gametes moves towards the egg cell and fuses with its nucleus thus completing the **syngamy**. This results in the formation of a diploid cell, the **zygote.** The other male gamete moves towards the two polar nuclei located in the central cell and fuses with them to produce a triploid **primary endosperm nucleus** (PEN) (Figure 2.13a). As this involves the fusion of three haploid nuclei it is termed **triple fusion.** Since two types of fusions, syngamy and triple fusion take place in an embryo sac the phenomenon is termed **double fertilisation**, an event unique to flowering plants. The central cell after triple fusion becomes the **primary endosperm cell** (PEC) and develops into the **endosperm** while the zygote develops into an **embryo.**

ASSIGNMENT NO. 5

1. What do you mean by pollen pistil interaction?
2. What is bagging technique? How is it useful in plant breeding programme?
3. Write the importance of emasculation technique in plant breeding.
4. State the function of filiform apparatus. Where is it found?
5. What is triple fusion ? Where and how does it take place? Name the nuclei involved in triple fusion.
6. Explain double fertilization in flowering plant.