

# BIOLOGY -

# POLLINATION



&

# Fertilization

CLASS -9



## Chapter Outline

- Pollen Grains and Male Gametes
- Ovary and Female Gamete
- Fertilisation
- Pollen Tubes—One or Many
- Post-fertilisation Changes

In the previous Chapter, you have studied that the first step in the process of plant reproduction is pollination during which the pollen grains reach the stigma of a flower.

The pollen grains contain the male gametes and the ovary contains the female gametes. Both these gametes have to come in contact and fuse with each other to give rise to an offspring.

How does the male gamete reach the female gamete for fertilisation? Let us try to understand.

### POLLEN GRAINS AND MALE GAMETES

Pollen grains are very minute dust-like particles present in the pollen sacs of the anther. These are very small in size varying from 10 to 200 microns. Each pollen grain is single-celled and covered by two layers, **exine** and **intine**.

#### Exine

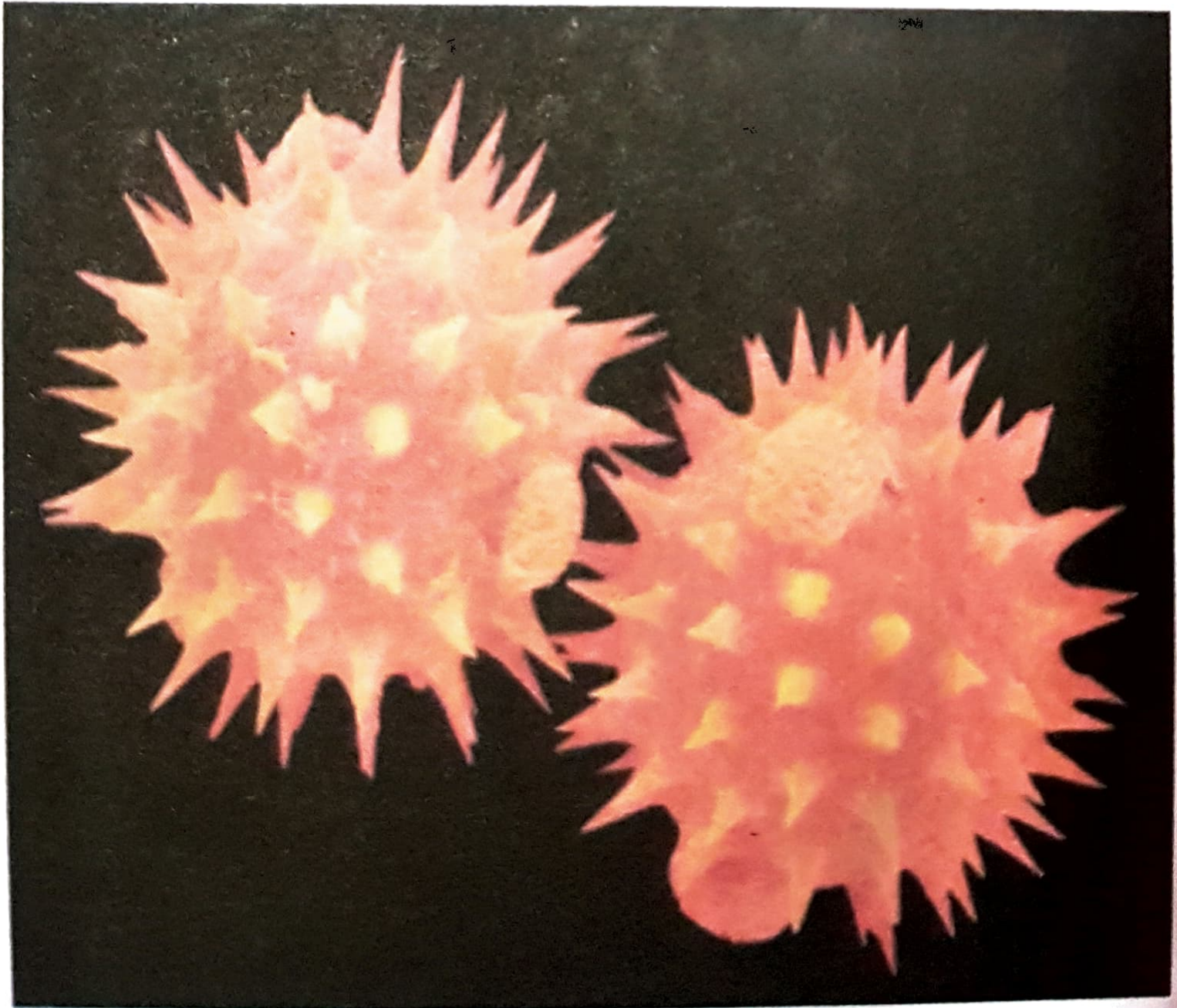
Exine is the outer, tough, cutinised layer often provided with spiny outgrowths. It has a few thin pores, called **germ pores** through which pollen grains give rise to pollen tubes.

#### Intine

It is the thin, delicate inner layer of pollen grains which is made up of cellulose.

Each mature pollen grain contains only one nucleus. It divides into two unequal nuclei after the pollen grain reaches the proper stigma.

Larger nucleus is called **vegetative** or **tube nucleus**. Smaller nucleus is known as **generative** or **male nucleus**.



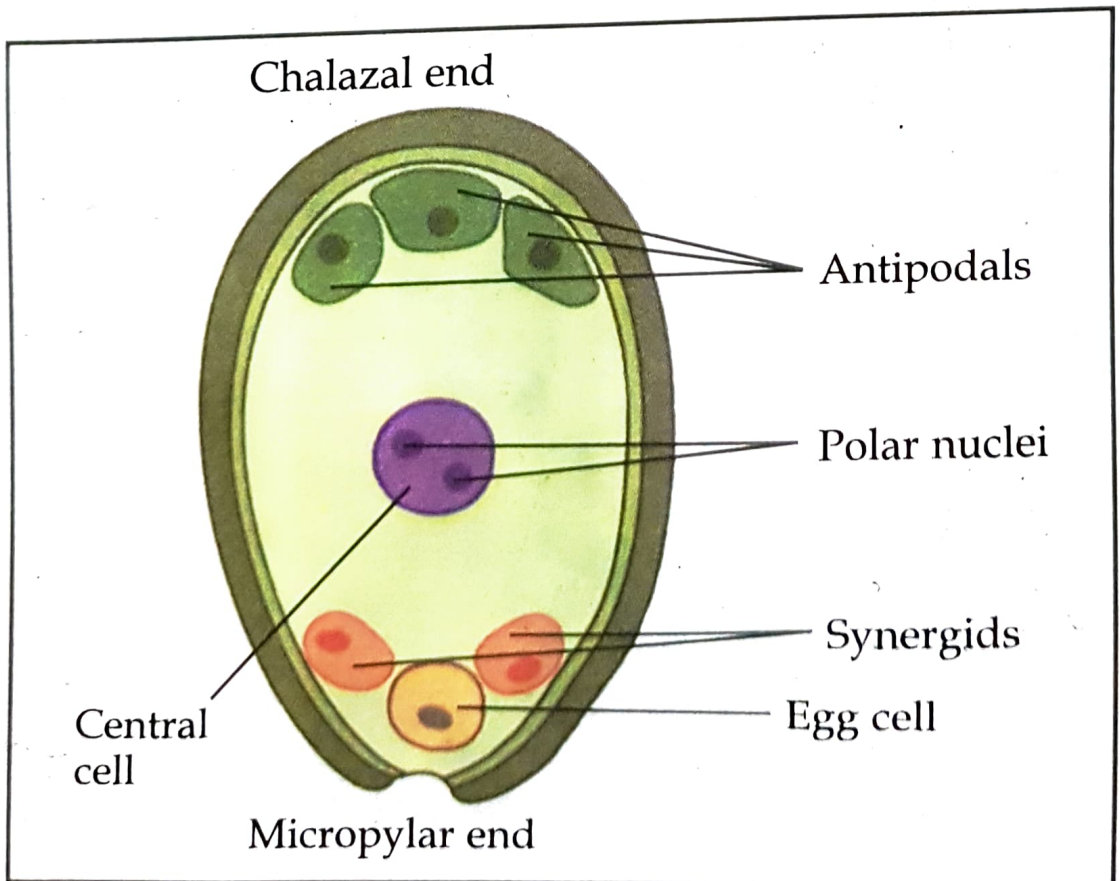
**Fig. 5.1:** Pollen grains

## OVARY AND FEMALE GAMETE

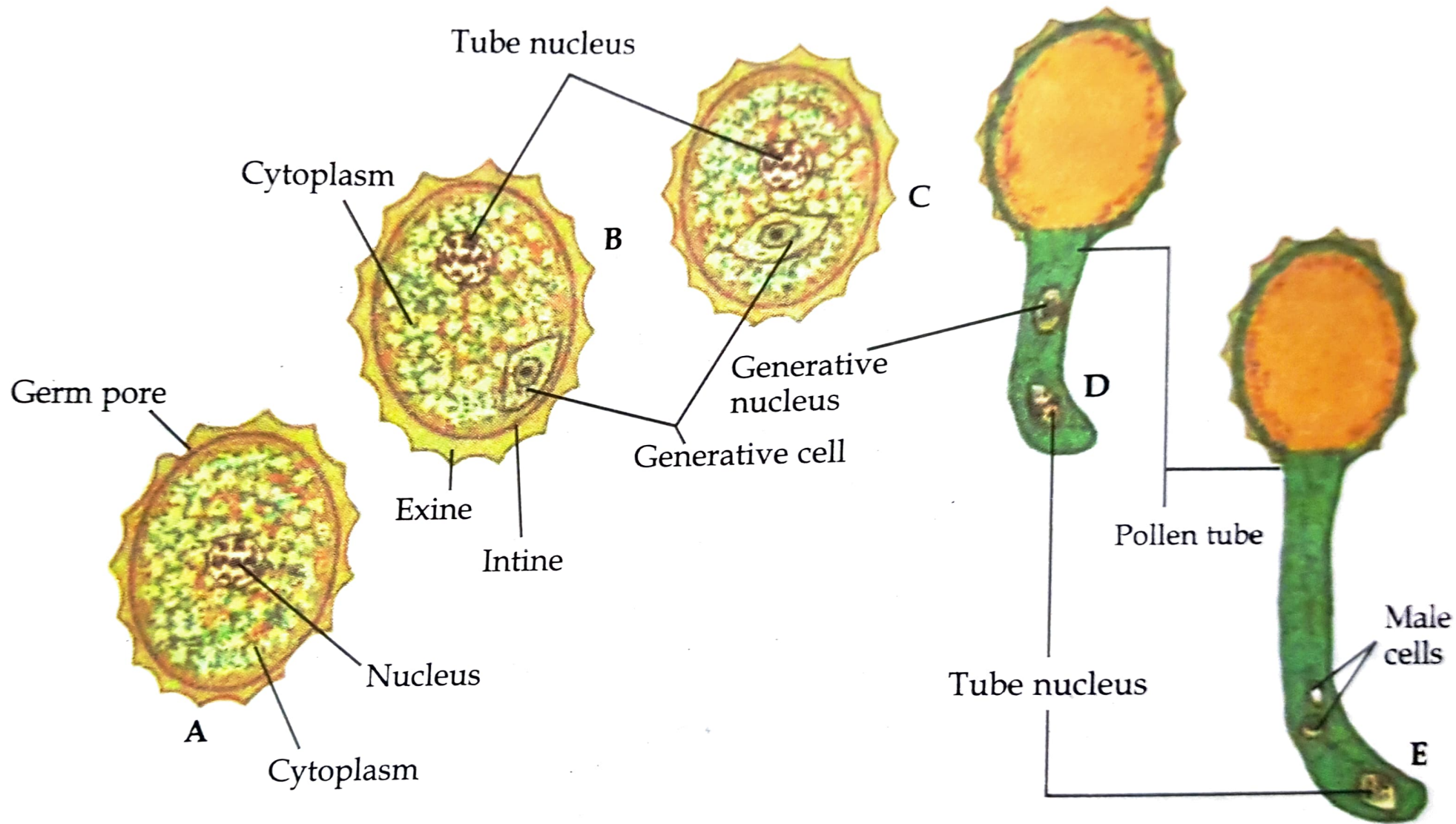
The ovary is the lower, swollen part of the gynoecium. It contains one or more spherical or oval-shaped structures called **ovules**.

Each ovule is attached to the placenta of the ovary through a slender stalk known as **funicle**. The point of attachment of the body of the ovule to funicle is termed as **hilum**. Ovule is surrounded by two coats known as **integuments** which have a small opening called **micropyle** on its one end.

The main body of the ovule is called the **nucellus**, a mass of food-laden cells. The nucellus contains an oval cell called the **embryo sac** which contains the embryo.



**Fig. 5.3:** Longitudinal section of an ovule



**Fig. 5.2:** Structure of pollen grain and its germination

The embryo sac contains seven cells:

1. Three cells are present at the end opposite to the micropyle – **antipodal cells**.
2. One cell, known as **central cell** is present in the middle which contain two **polar nuclei**.
3. Three cells are present at the micropyle end – one **egg cell** and two **synergids**. These constitute the egg apparatus (See Fig. 5.3).

## FERTILISATION

The process of fertilisation in plants was first discovered by Strasburger in 1886.

Fertilisation involves the fusion of male and female gametes. It comprises of the following steps:

## Germination of Pollen Grains

The pollen grains germinate only if they fall on the stigma of the same plant species or they disintegrate. Stigma of the flower provides sugar solution as a food for the pollen cells.

The intine of each pollen grain grows out through the germ pore of exine into a tube called the **pollen tube**.

The formation of pollen tube and its growth in the style was first observed in *Yucca* by **Amici** in 1830.

### POLLEN TUBES—ONE OR MANY

Generally, each pollen grain grows into a single pollen tube. But, sometimes, more than one pollen tube can grow out from a single pollen grain.

The pollen grains which develop one pollen tube are called **monosiphonous**, while those which develop more than one pollen tube are known as **polysiphonous**.

For example, in *Althea rosea*, 10 pollen tubes arise from one pollen grain, while in *Malva neglecta*, 14 pollen tubes are formed from each pollen grain.

### Entry of Pollen Tube into the Ovule

- ❑ The two nuclei present in the pollen grains enter the pollen tube.
- ❑ The tube nucleus is present at the apex of the pollen tube behind which is the generative nucleus.



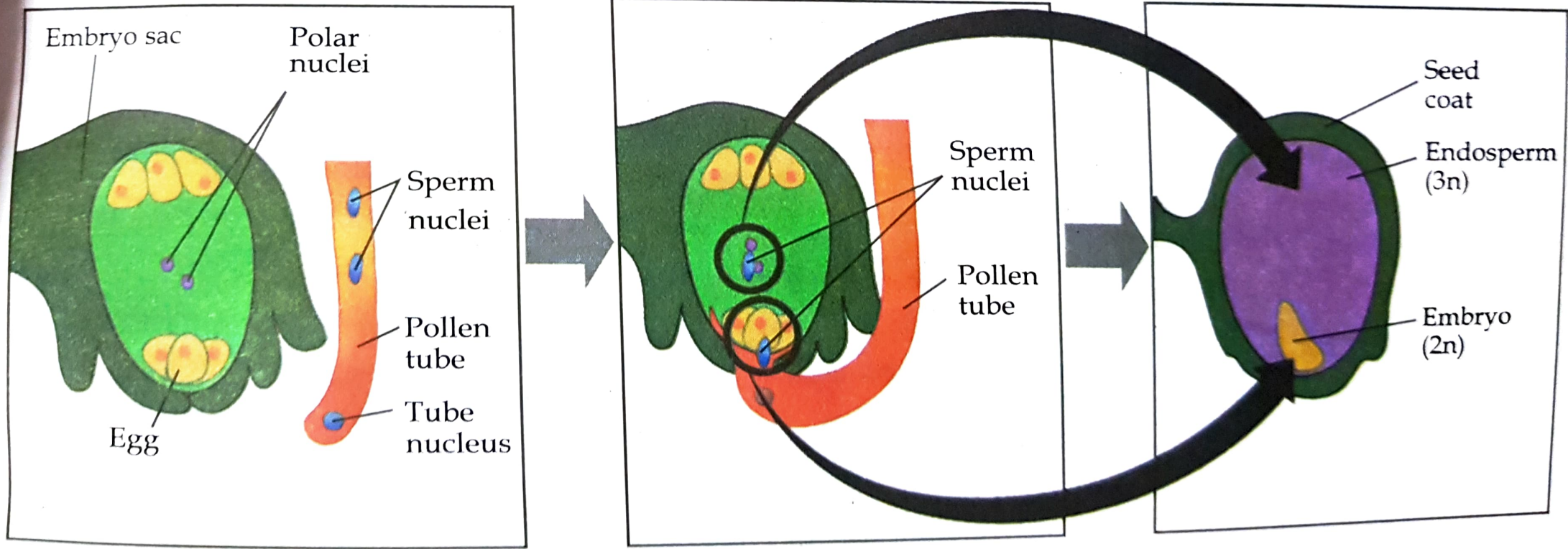
- ❑ The generative nucleus soon divides further and results in the formation of two nuclei, called **sperm nuclei** or **male gametes**.
- ❑ The pollen tube grows through the stigma, travels down the style and enters the ovule through the micropyle. This is known as **porogamy**.
- ❑ Now, the tube nucleus which has directed the growth of pollen tube degenerates and the pollen tube has only the two male gametes.
- ❑ The male gametes move towards the tip of the pollen tube and lie there in a mass of cytoplasm.

### Entry of Pollen Tube into the Embryo Sac

The pollen tube containing male gametes now passes through the nucellus and reaches the embryo sac. The tip of the pollen tube dissolves and the two male gametes are released.

### Fusion of Male and Female Gametes

- ❑ One of the male gametes fuses with the egg cell and forms the zygote. This is called **true fertilisation** or **syngamy**.
- ❑ Two polar nuclei fuse to form **definitive nucleus** with which the second male gamete fuses and forms the **endosperm mother nucleus**. This is called **triple fusion** as it involves the fusion of three nuclei.
- ❑ Other cells present in the ovule, antipodal cells and synergids, degenerate.
- ❑ This kind of fertilisation thus involves two fertilisations and is known as **double fertilisation**.



**Fig. 5.4:** Process of double fertilisation in plants

(a) Fusion of sperm nucleus and egg cell nucleus.

(b) Fusion of sperm nucleus and polar nuclei.

□ The diploid zygote forms the embryo of the plant and endosperm nucleus develops into

endosperm, which provides nutrition to the embryo.

□ If due to some reasons, fertilisation does not take place, the ovary withers and falls off.

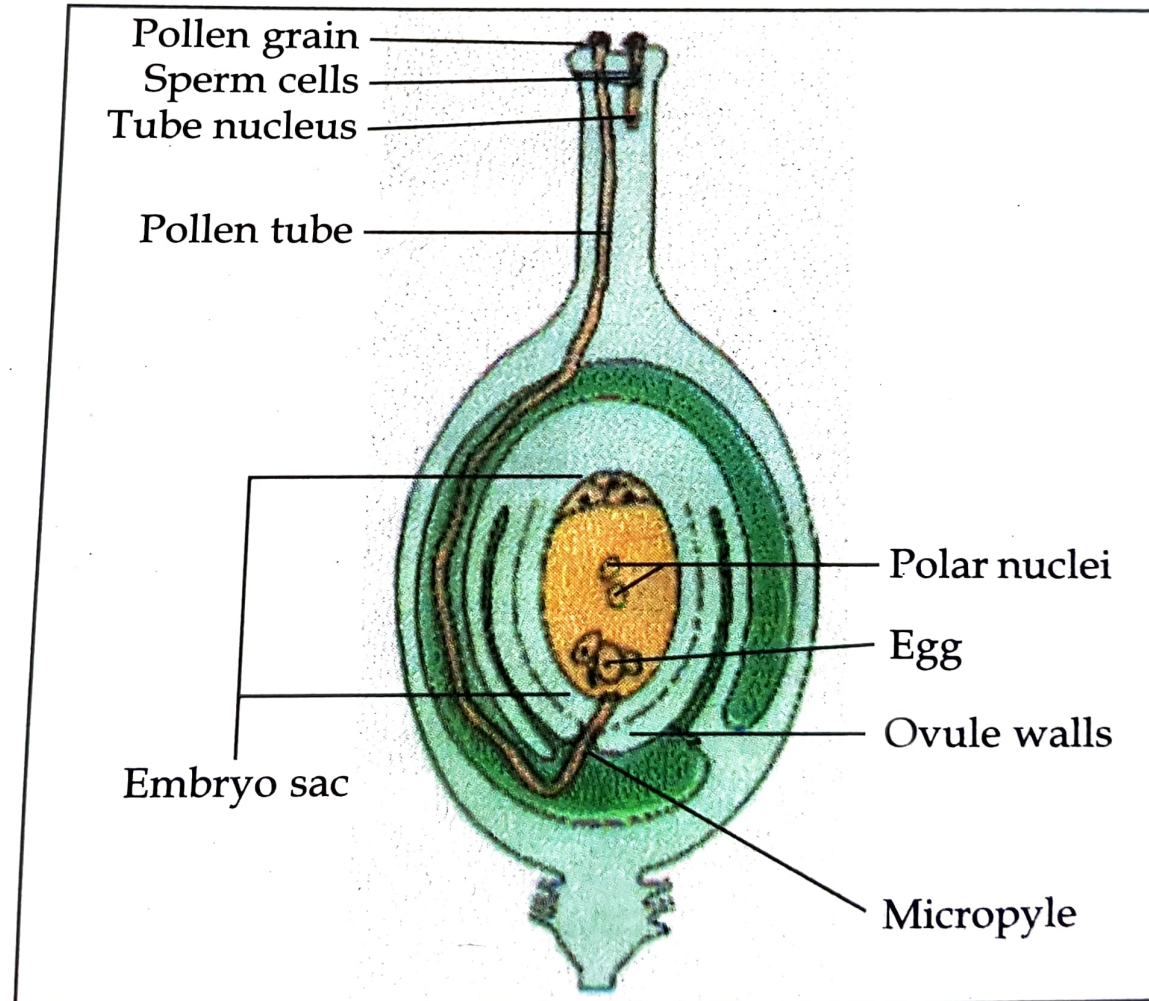
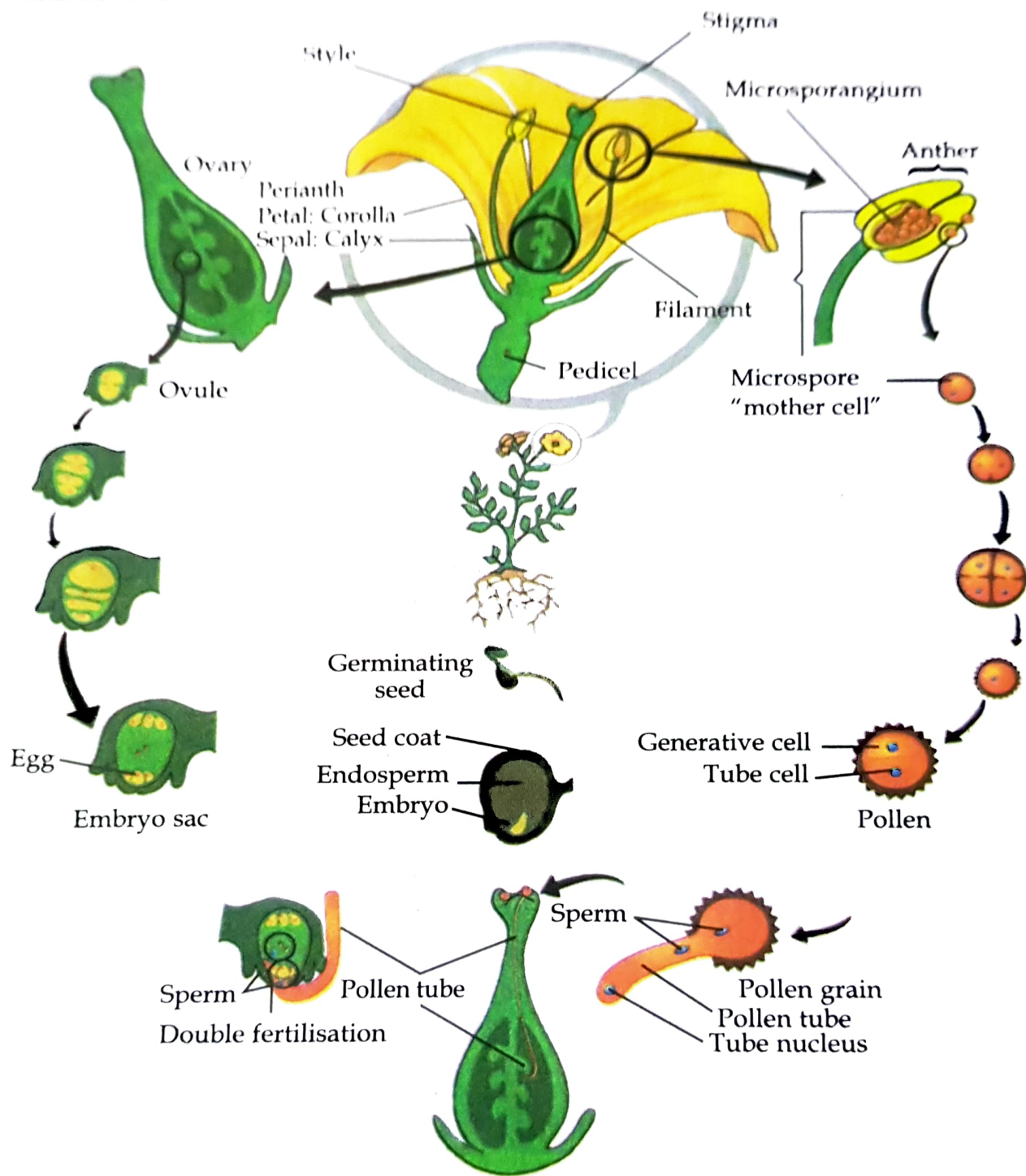


Fig. 5.5: Process of fertilisation



**Fig. 5.6:** Summary of the process of pollination and fertilisation in plants

## POST-FERTILISATION CHANGES

After fertilisation, several changes take place in the flower and its parts.

1. Petals, stamens, style and stigma wither and fall.
2. The calyx may remain intact in a dried form or it may also shed along with the other floral parts. Such dried sepals can be seen in tomato, guava and brinjal.
3. The ovule converts into a seed. The outer integument becomes hard and forms the seed coat called **testa**. The inner integument forms the thin and papery **tegmen**. The seed contains the embryo which later gives rise to a new plant.
4. The ovary enlarges to form the **fruit** and the ovarian wall forms the **fruit wall**.

A fruit is thus, a **ripened ovary**, while ovules present in the ovary form the **seeds**. Fruits may contain one or more seeds, depending on the number of ovules present in the ovary. When a fruit ripens, it liberates seeds which are dispersed to various places by different means such as wind, water and animals, or due to the explosion of fruits. These seeds, if provided with favourable conditions, germinate into seedlings and gradually grow into plants.

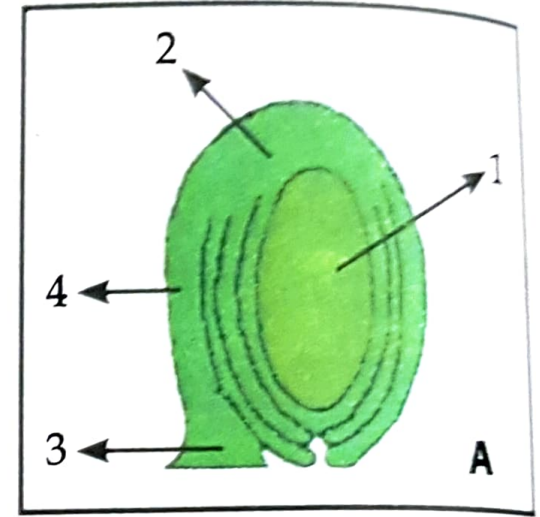
Thus, fruits not only form the edible part of the plant, but also predictable seeds and help in the dispersal of seeds; which then grow into plants.

1. Explain the structure of a pollen grain.
2. Draw a well-labelled diagram of an ovule. Explain each part of the ovule in brief.
3. Give the significance of different types of nuclei present in an embryo sac.
4. Name the types of fusions that male gametes undergo during the process of fertilisation.
5. Why is fertilisation in plants known as double fertilisation?
6. List the post-fertilisation changes that take place in the floral parts of a plant.

1. Explain the following terms and write their significance:
  - (a) Porogamy
  - (b) Syngamy
  - (c) Triple fusion.
2. Describe the process of fertilisation in a flowering plant in brief.
3. How does double fertilisation help in the growth of an embryo?
4. Describe the process of the formation of male gametes within the pollen tube.
5. What is the significance of the double fertilisation in plants?

1. Observe the figure **A** carefully and answer the following questions:

- (a) Identify the part of the plant.
- (b) Label the structural parts numbered 1 to 4.
- (c) Write the function and significance of each part.
- (d) Which parts of the seeds are formed by above parts?



2. Observe the figure **B** carefully and answer the following questions:

- (a) Identify the part of the plant.
- (b) Label the structural parts numbered 1 to 4.
- (c) Write the fate of each part.
- (d) Name the process described by the figure **B**.
- (e) Write the significance of the above process.

