

# Sexual Reproduction

1. Draw a longitudinal section of a pistil showing pollen germination. Explain the events on the embryo sac during the process of fertilization. (4 marks) (2080)

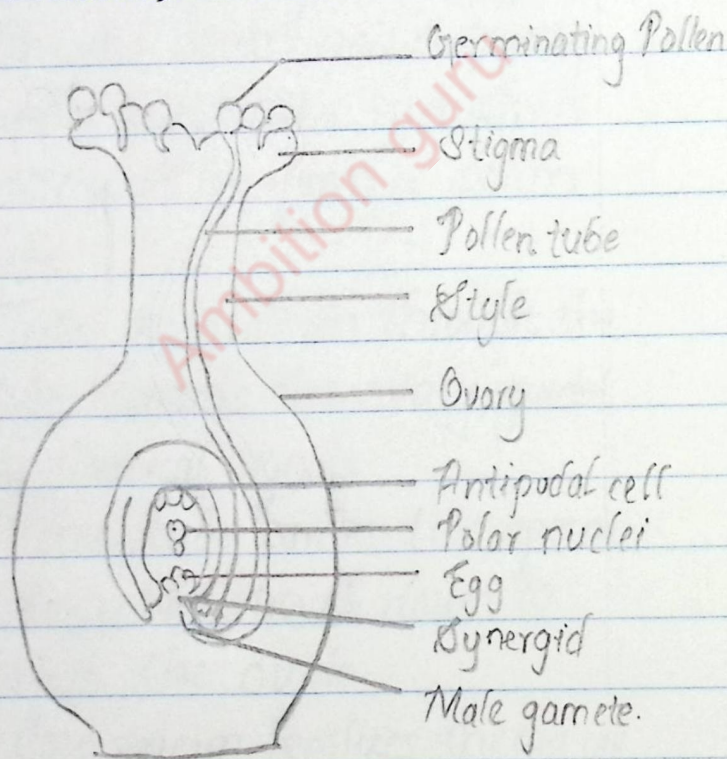


Fig: L.S. of pistil showing pollen germination.

Events occur in the embryo sac during fertilization are:

i) Germination of pollen grains and growth of pollen tube:

- Begins when a pollen grain lands on a compatible stigma.
- Absorbs water and nutrients, swells and breaks through its outer wall to form a pollen tube.
- Tube grows down through the style towards the ovary, guided by chemical signals.
- Pollen tube carries two sperm cells, which travel down to reach the ovule.
- One sperm fertilizes the egg cell,

- forming a zygote - syngamy
- Other fuses with two polar nuclei to form the <sup>triploid</sup> endosperm, which provides nourishment to the developing embryo - triple fusion.
  - This process ensures successful fertilization in flowering plants.

ii. Entry of pollen tube into ovule:

- Pollen tube enters to the ovule either through micropyle, chalazal or integuments.

iii. Entry of pollen tube into the embryo sac:

- 3 ways of entry of pollen tube into the embryo sac.

i.e. through one of the synergids, in between egg cell and synergid or in between the wall of embryo sac and one of the synergid.

iv) Discharge of male gametes from pollen tube:

- Male gametes discharge either directly to one of the synergid or directly inside the embryo sac.

v) Syngamy and triple fusion:

- One of the male gamete fuses with egg cell and form diploid zygote which later develops into embryo: syngamy

- Process of fusion of male gamete with two haploid polar nuclei or diploid secondary nucleus : triple fusion.

2. With a neat diagram, explain the development of 7-celled and 8-nucleated female gametophyte of angiosperms.

OR

Development of female gametophyte. (4 marks) (2019, 2016)

- Megaspore represents first stage of female gametophyte.
- Develops to form the female gametophyte.
- Female gametophyte is also

called embryo sac.

- Megaspore enlarges and its nucleus divides mitotically to form two nuclei.
- A vacuole appears between these two nuclei and pushes the nuclei towards the opposite poles of the cell.
- Both nuclei divide by two mitotic division to form 8 nuclei, 4 at micropylar end and 4 at the chalazal end.
- Followed by cellular organization of the embryo sac.
- One nucleus from each pole moves towards the centre of the embryo sac and fuse to form a polar nucleus or secondary nucleus.

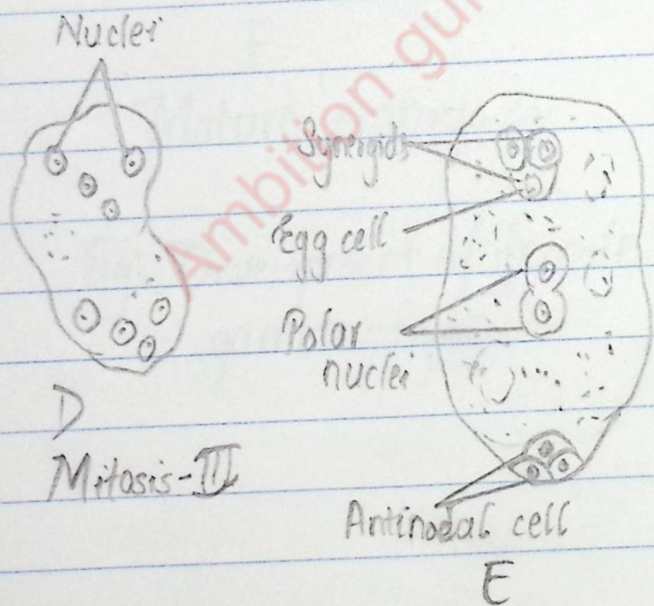
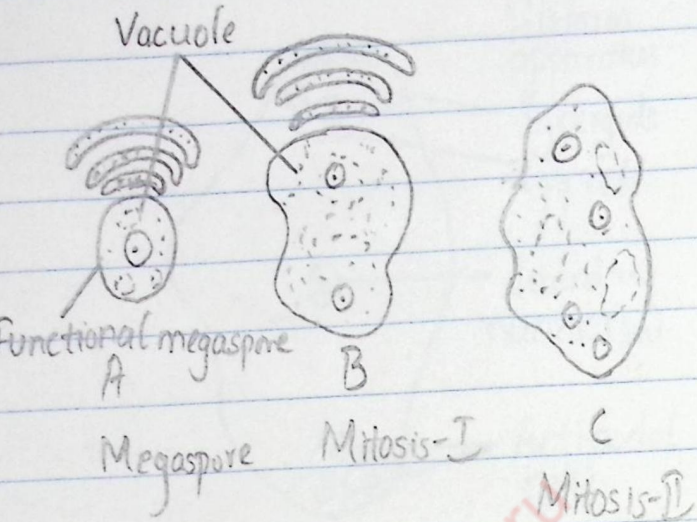
- Remaining 3 nuclei at the micropylar end organise into egg apparatus.

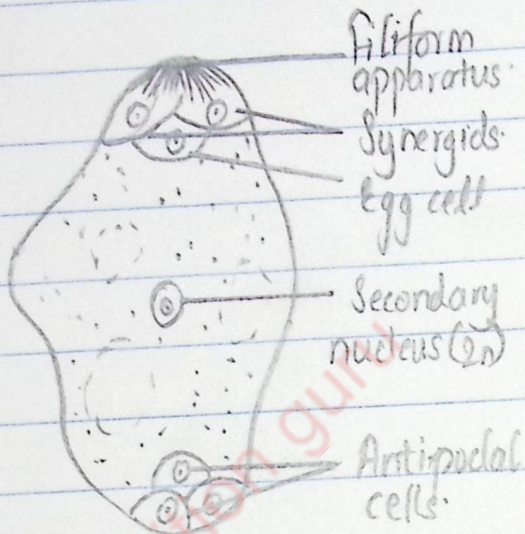
- 3 nuclei of the chalazal end form the antipodal cells.

- Those cells help to provide nutrition for embryo sac.

- A mature female gametophyte before fertilization has 8 nucleated, 7 celled nuclei.

i.e. 3-antipodal cells, 3-egg apparatus (2 synergids + egg), central cell - 2 nuclei.





F.  
Mature embryo sac.

Fig: Development of female gametophyte.

3. Describe the development of male gametophyte of an angiosperm with necessary labelled diagrams.

OR.

Process of male gametogenesis.  
(4 marks) (2079, 2076)

- Process of male formation of male gametes in the microspores or pollen grain possesses a very dense cytoplasm with a central nucleus.

- As the cell increases in size, the vacuole develops and the nucleus is shifted at the adjacent to the wall.

- Nucleus divides into 2.

i.e. smaller generative nucleus towards the wall and larger vegetative nucleus towards centre.

- At this, two-celled stage pollination occurs.

- Through pollination, pollen grains land on stigma.

- Pollen grains absorb stigmatic fluid and swell up.

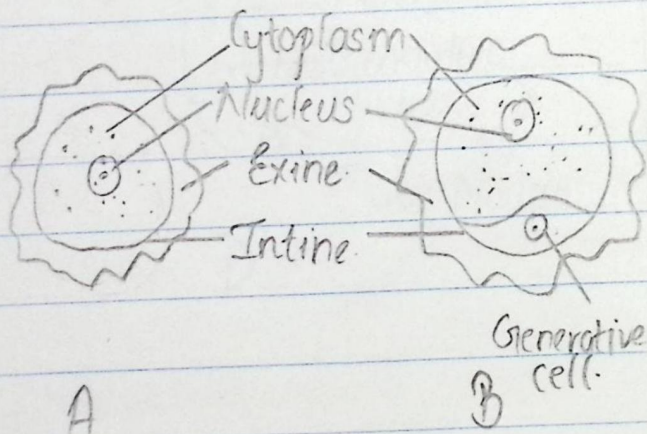
- Due to swelling, exine ruptures while intine bulges out in the form of pollen tube.

- Vegetative nucleus centre into the pollen tube followed by the generative nucleus.

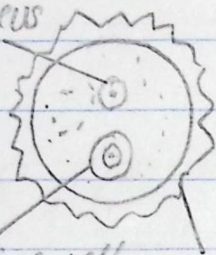
- As the pollen tube elongates, the generative nucleus

divides forming two male gametes while the vegetative nucleus is then referred as - tube nucleus. Pollen with - Pollen tube, containing the tube nucleus and two male gametes is called mature male gametophyte.

- Male gametophyte is 3-nucleated and with pollen tube.



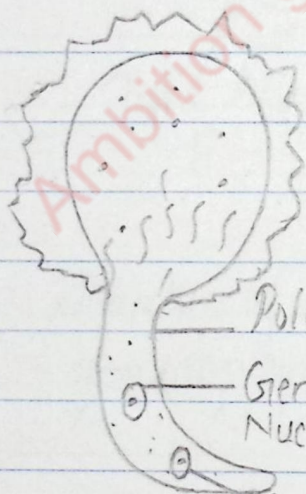
Tube nucleus



Generative cell.

Germ Pore.

C



Pollen tube.

Generative Nucleus.

Tube Nucleus

D.

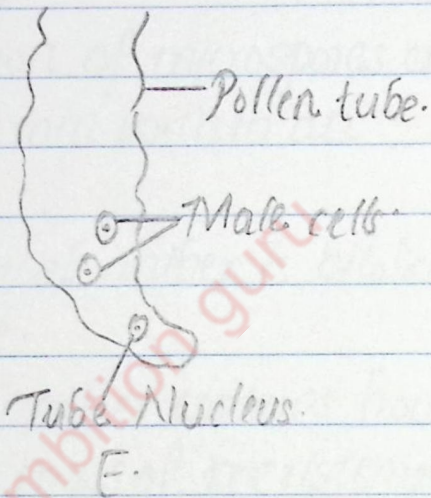


Fig: Structure of male gametophyte.

4. Describe the process of microsporogenesis. (2074)  
(4 marks)

- Formation of microspores or pollen grain within an anther.
- A typical anther is bilobed structure.
- Young anther contains homogenous mass of meristematic cells.
- During development it assumes 4-lobed structures.
- Few cells of hypodermis at each lobe become more distinct than others due to larger size, distinct nucleus and dense cytoplasm.

- Such cells are called archesporial cells.

- Cells divide periclinally into 2 layers.

i.e. Outer primary parietal layer and

Inner primary sporogenous layer.

- Primary parietal layer divides periclinally as well as anticlinally to form 2-5 concentric layers of anther wall which includes epidermis, endothecium, middle layers and tapetum.

- Primary sporogenous layer either directly function as microspore mother cell or

undergo one or more mitotic divisions to form microspore mother cells.

- Microspore mother cell divides meiotically into 4 haploid microspores.

- Aggregation of 4 microspores is called microspore tetrad.

- Microspores are aggregated by callose.

- Separated microspores are called pollen grains.

- Each pollen grain has two walls.

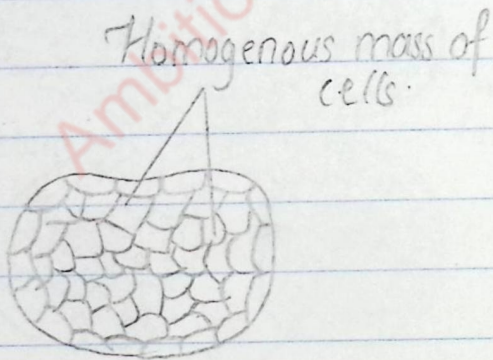
i.e. Outer  $\rightarrow$  thick exine

made up of hard polymer of carotenoids (sporopollenin)

Inner  $\rightarrow$  thin intine made up of cellulose and pectin.

- Contains haploid nucleus with some cytoplasm.

- Pollen grains are of various shapes but commonly they are globular.



A.

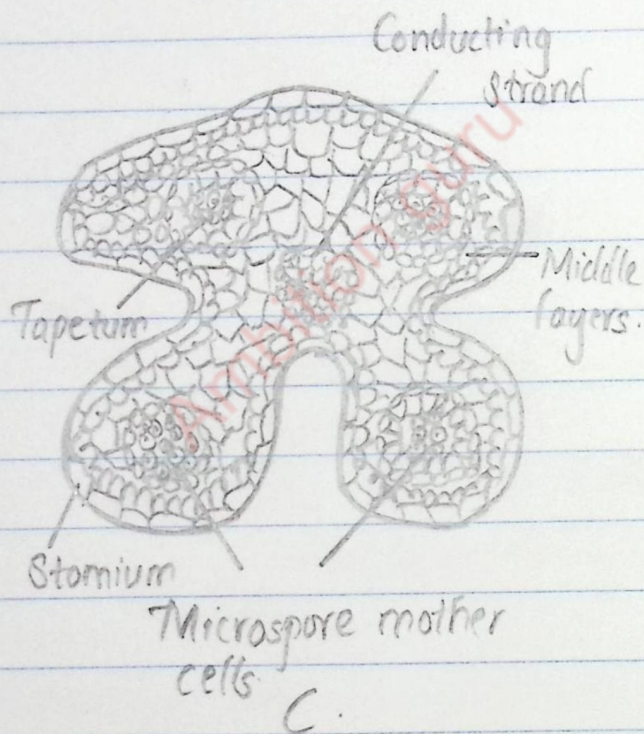
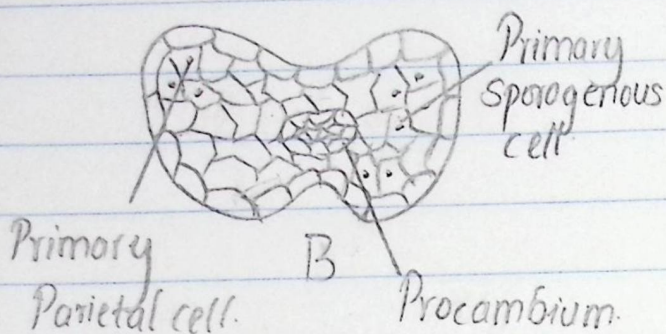


Fig. Different stages of development of anther.