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Class - M.Sc.IV Sem.

Subject - Botany

Paper - paper-I

Unit - II

Topic - Male gametophyte

STRUCTURE OF POLLEN GRAIN

- Pollen grain is the first cell of male gametophyte.
- Pollen grain develop from pollen mother cell by meiosis division.
- It is unicellular, uninucleate , spherical or oval haploid structure.
- 10-250 μ in size.
- Smallest pollen grain – *Myosotis*(10 μ), largest pollen grain – *Mirabilis* (250 μ).
- Study of pollen grain called PALYNOLOGY.
- In some plants the surface of pollen grains is covered by pollenkit, colour and smell of pollen is present of the pollenkit. It has sticky nature and helps in insect pollination.

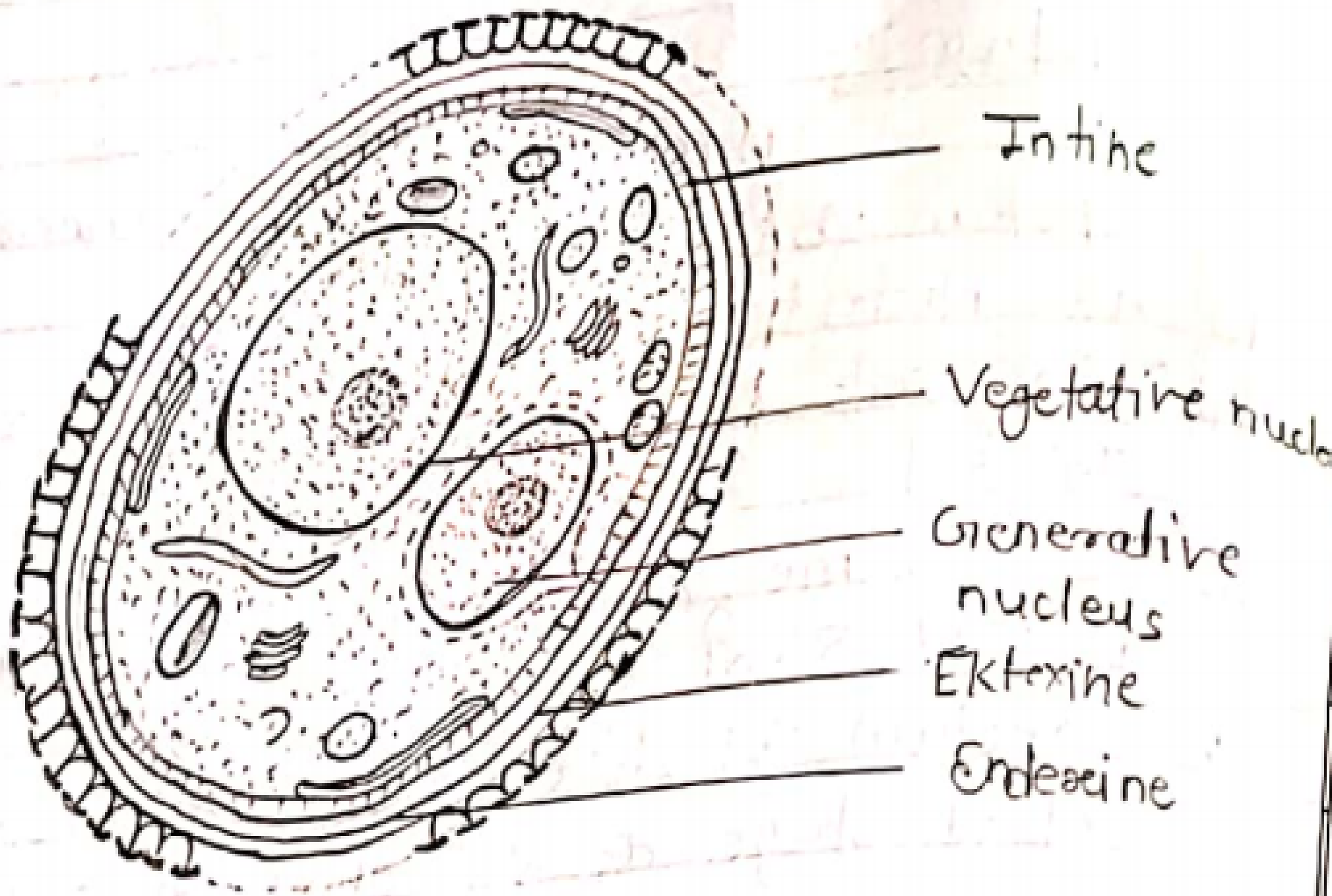
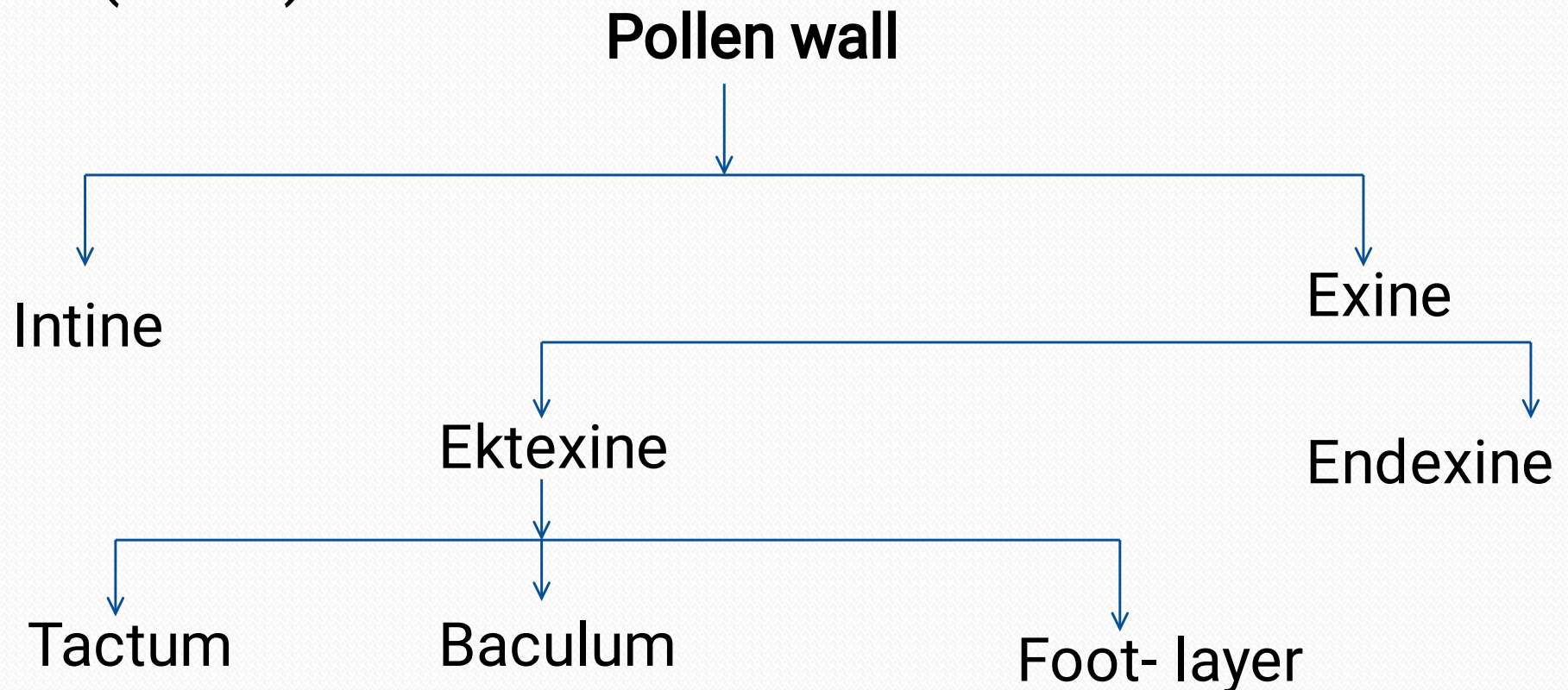


Fig. mature pollen grain

POLLEN WALL

- The wall of the mature pollen grain is stratified. It comprises two principal layers :- the inner layer is called intine and outer layer is called exine.
- The terms intine and exine were proposed by Fritzsche(1837).



Endexine:- The layer present in contact with intine is called endexine.

Intine:-

The intine is pecto-cellulose in nature , as is the primary wall of somatic cells . The cellulose component is microfibrillar , with the microfibrils oriented in a plane parallel to the surface. A special feature of the intine is the presence of beads , ribbons , or plates of enzymatic proteins, particularly in the vicinity of the germ-pore.



Exine:-

- The exine is composed chiefly of a class of material called sporopollenin. It is derived from carotenoids by oxidative polymerisation. Sporopollenin is resistant to physical and biological decomposition.
- They may be reticulate, striate, spinous etc.
- At certain places in exine small pore like structure are found which called germ pore.

Ektexine:- The layer on the side of exine is called ektexine. This sub-layer again divide into three layers:-

1. Tactum
2. Bacula
3. Foot-layers

DEVELOPMENT OF MALE GAMETOPHYTE

- Pollen grain is the first cell of male gametophyte.
- The microspore has dense cytoplasm with a prominent nucleus. Many vacuole appear in cytoplasm.
- The first division in pollen grain results into two unequal cells.
- The large one is the vegetative cell, which eventually forms the pollen tube.
- The smaller one is the generative cell, which produces the sperms by another mitosis .
- The generative cell is initially attached to the wall of the pollen grain but, later comes to lie freely in the cytoplasm of the vegetative.


FORMATION OF VEGETATIVE AND GENERATIVE CELLS

❖ Vegetative cell:-

➤ After pollen mitosis the vegetative cell increases in size . Vacuoles disappear and quantities RNA and protein increase. The nuclear envelope becomes highly convoluted.

❖ Generative cell :-

➤ Initially it is lens shaped. The generative cell loses contact with the wall of the microspore and come to lie freely in the vegetative cell. Immediately after detachment, the generative cell is spherical . However, variation in shapes, like elliptical, lenticular, spindle shaped and sometimes vermiform have also been observed in different species.



➤ Cytoplasm is highly reduced but it contains cell organelles- mitochondria, ribosomes, ER, microtubules, dictyosomes. The nucleus is smaller but contains higher amount of DNA. Two male gamete are formed by a mitotic division in the generative cell.

➤ The tube cell, which enclose the generative cell, will produce the pollen tube, a structure essential for sperm delivery to the egg.

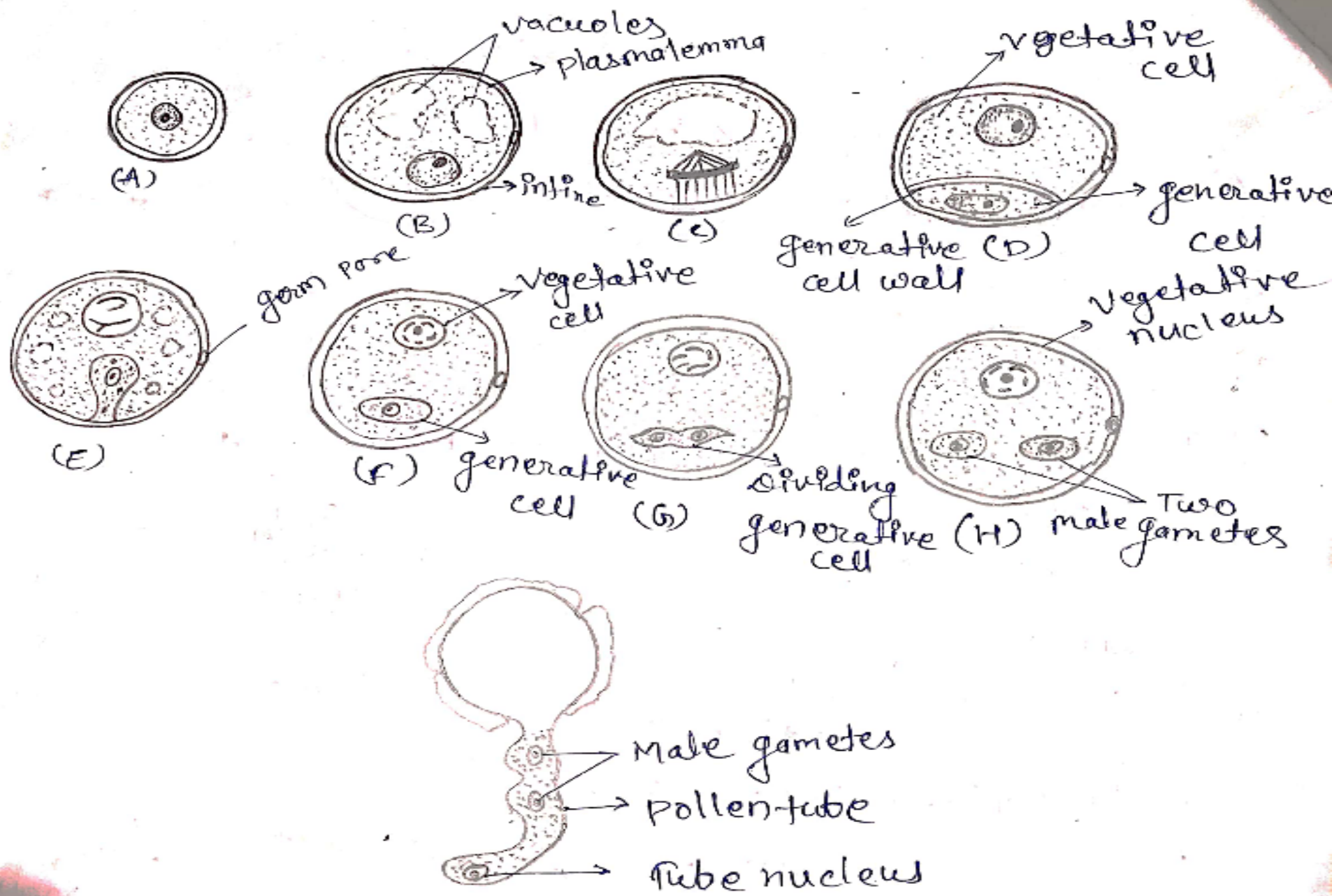


fig - Development of male gametophyte

ABNORMAL TYPE OF MALE GAMETOPHYTE OR POLLEN EMBRYO SAC

- Normally , the number of nuclei in a mature pollen grain is two or three. In some liliaceous members, however, the increase in the number of nuclei in the male gametophyte may lead to the formation of female gametophyte (embryo-sac) like structures.
- **Nemec (1898)** was the first note embryo sac-like pollen grains in the petaloid anthers of *Hyacinthus orientalis*.
- This phenomena is called **Nemac hypothesis**.

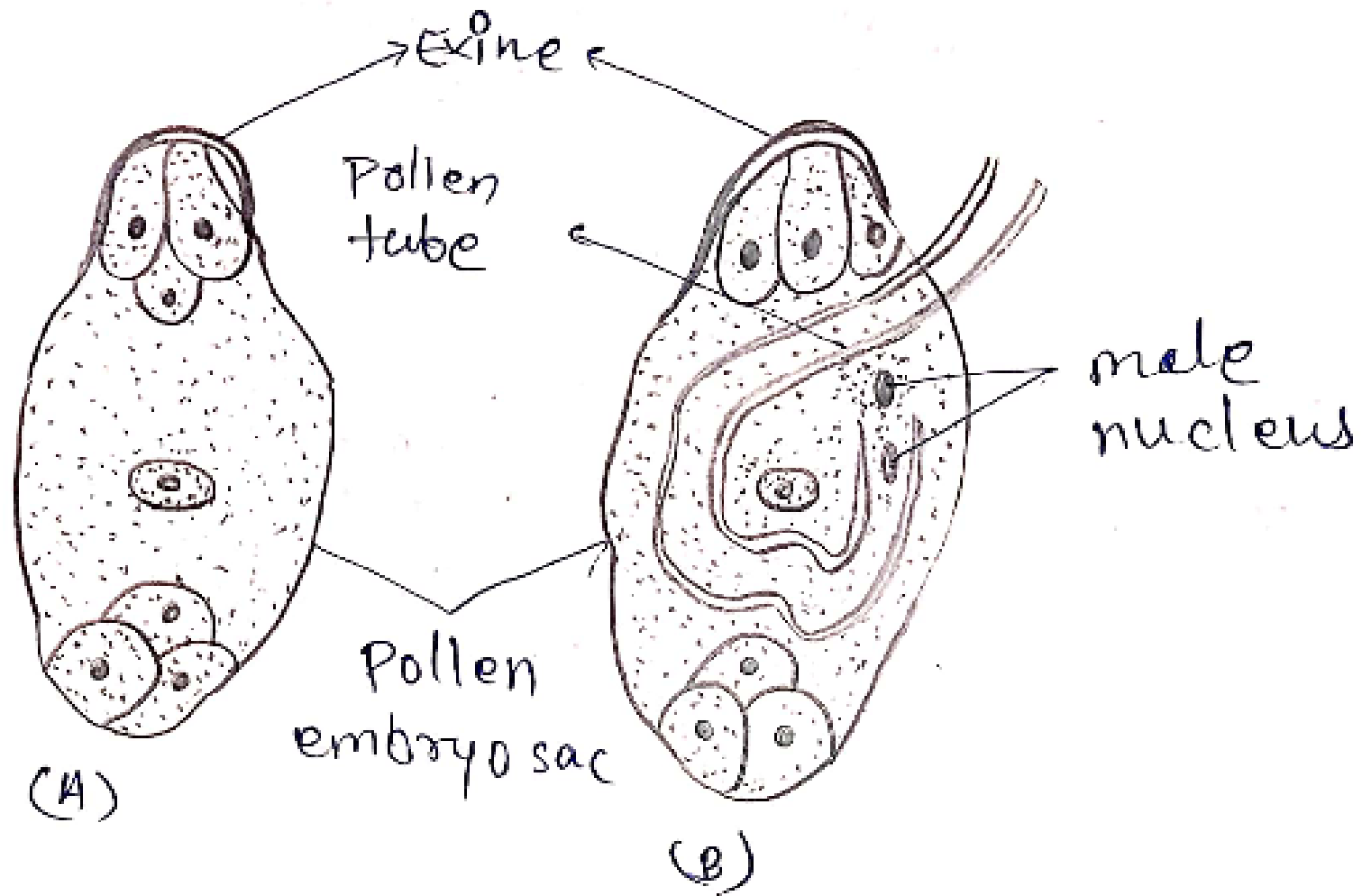


Fig - Pollen embryo sac— (A) Egg apparatus and antipodal cells in pollen embryo sac (B) Discharged male nuclei by pollen tube from the pollen embryo sac.

THANK YOU