Topic: Microsporogenesis and Microgemetogenesis
B.Sc. Botany (Hons.) II
Paper: IV
Group: B
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Microsporogenesis and Microgametogenesis

Microsporogenesis

Microspores i.e., the pollen grains are developed inside microsporangia. The microsporangia are developed inside the corners of the 4-lobed anther.

Young anthers are more or less oblong in shape in section and made up of homogeneous mass of meristematic cells without intercellular space with further development, the anther becomes 4-lobed. The outer layer of anther is called epidermis. Below the epidermis, at each corner, some cells become differentiated from others by their dense protoplasm- archesporium or archesporial cells. Each archesporial cell then divides mitotically and forms an outer primary parietal cell and an inner primary sporogenous cell.

The outer primary parietal cells form primary parietal cell layer at each corner. Below the parietal cell layer, the primary sporogenous cells remain in groups i.e., the sporogenous tissue. The cells of primary parietal layer then divide both periclinally and anticlinally and form multilayered antheridial wall.

The innermost layer of antheridial wall, which remains in close contact with the sporogenous tissue, functions as nutritive layer, called tapetum.

The primary sporogenous cells either directly function as spore mother cells or divide mitotically into a number of cells which function as spore mother cells. The spore mother cell undergoes meiotic division and gives rise to 4 microspores arranged tetrahedrally.

Structure of Microspores

Microspore i.e., the pollen grain is the first cell of the male gametophyte, which contains only one haploid nucleus. These are of various shapes — polyhedral (milk thistle, Sonchus palustris of Asteraceae), cubical (Basella alba of Basellaceae), trigonal (common in Onagraceae), cylindrical (Rheo discolor of Commelinaceae) etc.

The size of the pollen grains generally varies from 10-80μm, but the size may be even 100μm in diameter. The pollen grains have two walls i.e., outer exine (the exine is further differentiated into two regions, outer sexine and inner nexine) and inner intine.

The exine is cutinised and tough with different ornamentations. It may be warty, spiny etc. It can protect the pollen from external injury. The intine is very thin, elastic and delicate. Usually the mature pollens are not attached in tetrad and they get separated from one another. In some plants like Typha angustata of Typhaceae etc., they do not get separated from one another (compound pollen grain). In orchids and members (Calotropis procera etc.) of Asclepiadaceae; all the pollen grains within each pollen sac remain united forming the structure called pollinium (pi. pollinia). The pollen grains of Pinus spp. of Pinaceae are provided with two wing-like expansions of exine (winged pollen), which help in wind dispersal of pollen.

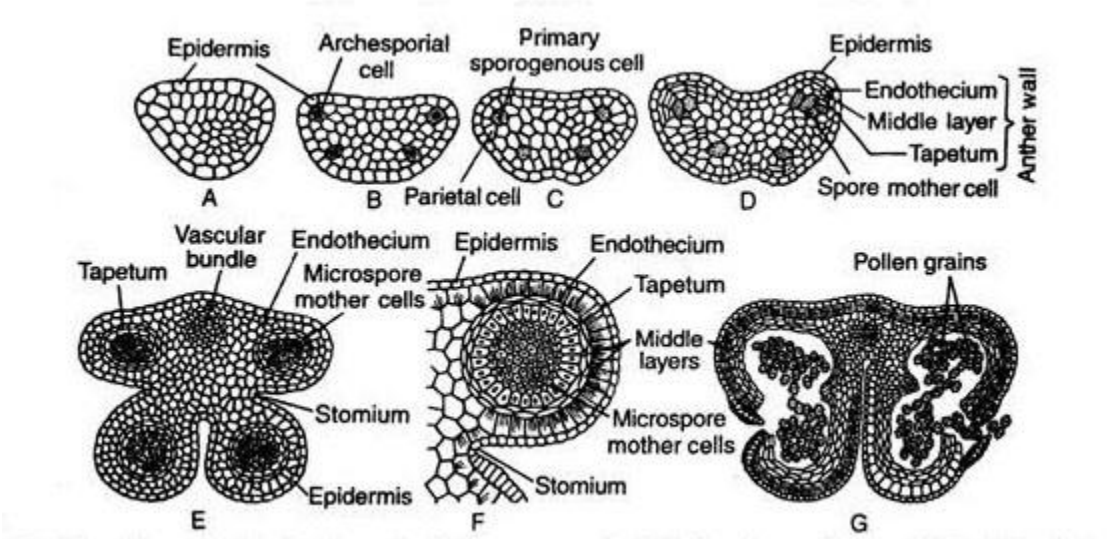

Fig. Stages of anther development and microsporogenesis : A–D. Developmental stages, E. T.S. of developing

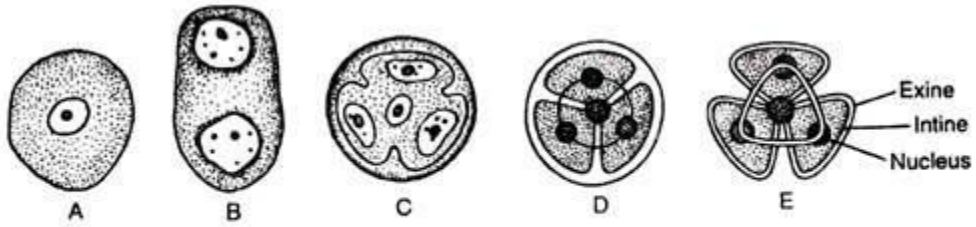

Fig. Different stages of development of microspore from microspore mother cell : A. Microspore mother cell, B. Diad stage, C. Tetrad stage, D. Clevage of protoplast and formation of pollen grains, and E. Four microspores i.e., pollen grains with exine and intine

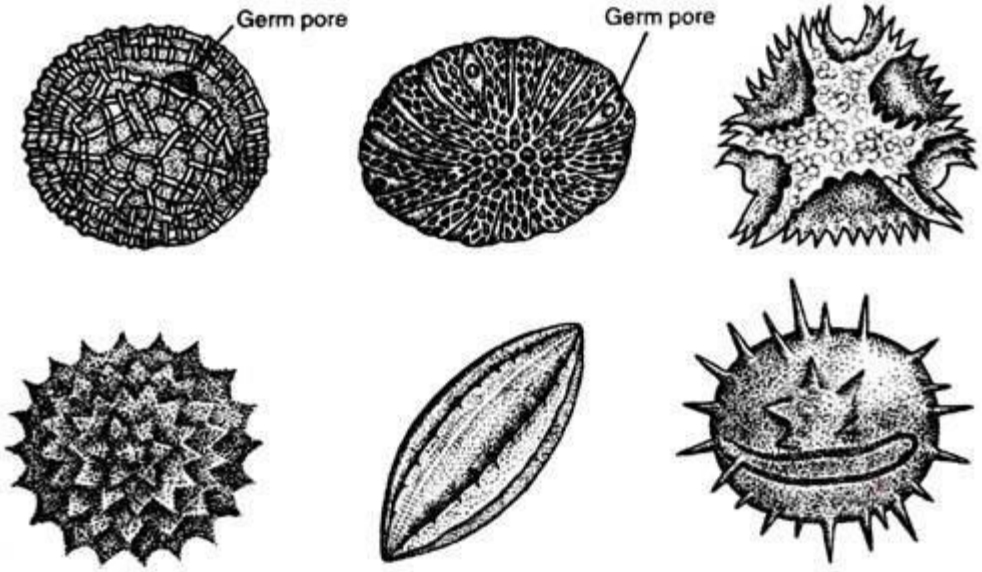

Fig. Different pollen grains showing various types of sculpturing

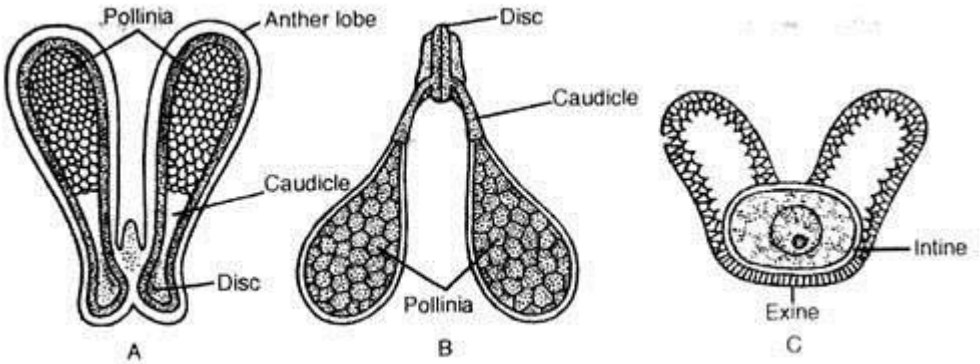

Fig. Pollen grains and Pollinia : A. Pollinia of *Orchis*, B. Pollinia of *Calotropis*, and C. Pollen of *Pinus*

Microgametogenesis (Development of Male Gametophyte)

Microspore i.e., the pollen grain is the first cell of the male gametophyte, which contains only one haploid nucleus. During early stage of development, it remains within the microsporangium. The cell undergoes unequal division and forms a small generative cell and a large vegetative or tube cell. Initially the generative cell remains lying at one corner of the spore wall.

Within short time, it gets detached and becomes ellipsoid or fusiform in shape and remains suspended in the cytoplasm of the vegetative cell (2-celled stage i.e., vegetative cell and generative cell). Later on, the generative cell divides and gives rise to two ellipsoidal or lenticular or spherical cells — the male gametes (3-celled stage i.e., vegetative cell and two male gametes.

The second division i.e., the division of generative cell may take place either in the pollen grain or in the pollen tube which develops through germ pore after pollination.

The nucleus of the vegetative cell is commonly known as tube nucleus. It usually shows sign of degeneration with the maturation of generative cell. Finally the tube nucleus remains within spore or may enter the pollen tube. Sooner or later it may be degenerated completely.

Significance of tube nucleus

Earlier workers thought that the tube nucleus had great significance in the direction of growth of the pollen tube, as it is usually present just behind the growing point within the pollen tube.

However, recent workers differ with the above opinion and consider it as a purely non-functional vestigial structure, based on the following facts-

1. In branched pollen tube, the tube nucleus remains in one tube, but all the tubes grow normally.

2. It does not always occupy the position behind the growing point within the pollen tube, but in many cases it lies behind the male gametes.

3. In some cases, the growing pollen tube does not have any tube nucleus as it degenerates prior to the development of pollen tube.

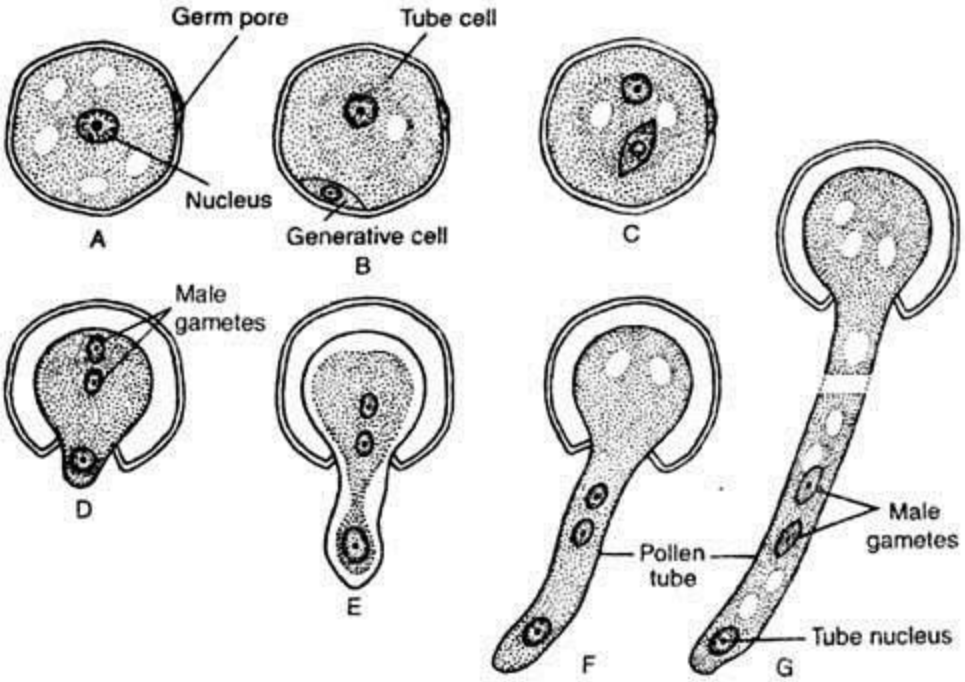

Fig. A-G. Germination of the pollen grain and development of the male gametes