# SALIENT FEATURES OF THE MALE AND FEMALE GAMETOPHYTE OF PINUS & EMBRYOGENY OF THE NEW SPOROPHYTE

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TDC Part-II(H)

PAPER-III
Gr.-A

## MALE GAMETOPHYTE

(i) Microspores (Pollen) begin to germinate about a month before they are released from the microsporangium.

(ii) Microspore nucleus divides to form two daughter nuclei, one of which flattens out against the spore wall, and is cut off from the other daughter nucleus and most of the cytoplasm due to formation of a thick wall.

The cell thus cut off is the first vegetative cell (=Prothallial cell) whose nucleus rapidly degenerates.

(iii) The other nucleus of the larger sister cell divides again, and forms a second vegetative cell (Second prothallial cell), whose nucleus also behaves in the same manner, while the large persistent cell, with its prominent nucleus and cytoplasm, is called the antheridial cell.

(iv) A little before the microspores are liberated, the antheridial cell divides to form a smaller cell, the generative cell, cut off against the second vegetative cell, and a larger cell, the tube cell.

(v) It is at this stage that microsporangia burst longitudinally, and the microspores (Pollen grains) are liberated.

(vi) The amount of pollen grains liberated is enormously large, which fill the surrounding atmosphere, and are usually called flowers of Sulphur. They are disseminated by wind

- Most of the pollen grains are wasted during transport, but some of them reach the mature carpellate (Female) cones with their megasporophylls slightly separated at this time.

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(vii) Microspores glide between the megasporophylls and remain in close proximity of the micropyles of the ovules.

(viii) At this time a pollination drop consisting of a sticky fluid appears at the tip of the ovule, which catches some of the pollen grains.

(ix) As the pollination drop dries up, pollens are sucked inside the nucellus.

(x) After this process, carpellary leaves close up.

(xi) Following this, during the subsequent eleven months, male gametophytes do not develop further considerably, but a short pollen tube may be formed from each pollen grain.
— Pollen tube may branch somewhat, penetrate the nucellus, and grow very slowly till winter sets in.

(xii) During the second spring, pollen tube grows slowly downwards, penetrated the nucellus, and finally its tip reaches the surface of the female gametophyte.

(xiii) During subsequent development, tube nucleus first enters the pollen tube. Generative cell also divides into a stalk nucleus and a body nucleus, which also enter into the pollen tube, where the body nucleus again divides to form two male or sperm nuclei

(xiv) About the stalk nucleus cytoplasm is organized to form a definite stalk cell, around which there is a definite membrane.

(xv) Male gametes have clearly differentiated cytoplasm, and a large nucleus.

## FEMALE GAMETOPHYTE

(i) Following pollination during a year, development of the female gametophyte takes place.

(ii) Megaspore germinates within the megasporangium. It first enlarges at the expense of the nucellar tissue.

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- Its nucleus divides repeatedly without accompanying wall formation for a long period, forming a large number of free nuclei distributed in the cytoplasm of the megaspore.

(iii) Wall formations ultimately occur between the nuclei leading to the formation of a solid mass of gametophytic tissue called endosperm.

(iv) Nearly a year after pollination, a number of archegonia (2-3) develop at the micropylar end of the female gametophyte (endosperm)

- Each archegonium arises from a superficial cell of the gametophyte.

(v) A fully developed archegonium consists of a neck of 8 cells, in two tiers of four, the ventral canal cell, and a very big cavity containing an egg.

(vi) Ventral canal cell gets disorganized before fertilization

- Necal canal cells are completely lacking, and the large cavity containing the egg is surrounded by a jacket of cells which provide nutrition to the egg cell, and ultimately to the developing embryo.

(vii) Archegonia mature and are ready for fertilization about a year after pollination.

(viii) Tip of the pollen tube on reaching an archegonium destroys the neck cells and discharges its contents into the cytoplasm of the egg.

(ix) Nucleus of one male cell moves towards the egg nucleus, and fertilizes it.

- The other male nucleus, the tube nucleus as well as the stalk nucleus soon disintegrate.

(x) Fertilized egg surrounds itself with a wall and forms an oospore.

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## THE NEW SPOROPHYTE

(i) Fusion nucleus migrates to the base of the oospore, and forms four nuclei by two successive divisions, which become arranged at right angles to the long axis of the oospore.

(ii) Two further divisions occur, resulting in the formation of four tiers, each tier containing four nuclei.

(iii) Partition walls develop which separate all the nuclei, except those of the uppermost tier.

(iv) The three lower tiers from below upwards are known respectively as the embryo tier, suspensor tier, and rosette tier, and the whole structure is called the proembryo.

(v) Embryos develop from the lowermost embryo tier, the other tiers being only nutritive in function.

(vi) Suspensors elongate rapidly and diverge, so that the embryos are pushed deep within the tissue of the female gametophyte.

(vii) Each suspensor bears at its apex one of the four embryo cells.

- Four potential embryos are produced by rapid division of each of the embryo cells. This is polyembryony which is a characteristic feature of conifers.

- Only one embryo attains maturity while the others perish.

(viii) A fully developed embryo consists of a radicle, the hypocotyl, three to many cotyledons, and a small plumule.

(ix) Nucellus is usually crushed out, but sometimes it persits as a thin layer forming the so called perisperm.

(x) Integument is gradually converted into the seed coat, and the ovule develops into a seed.

(Figs. below)

—X—

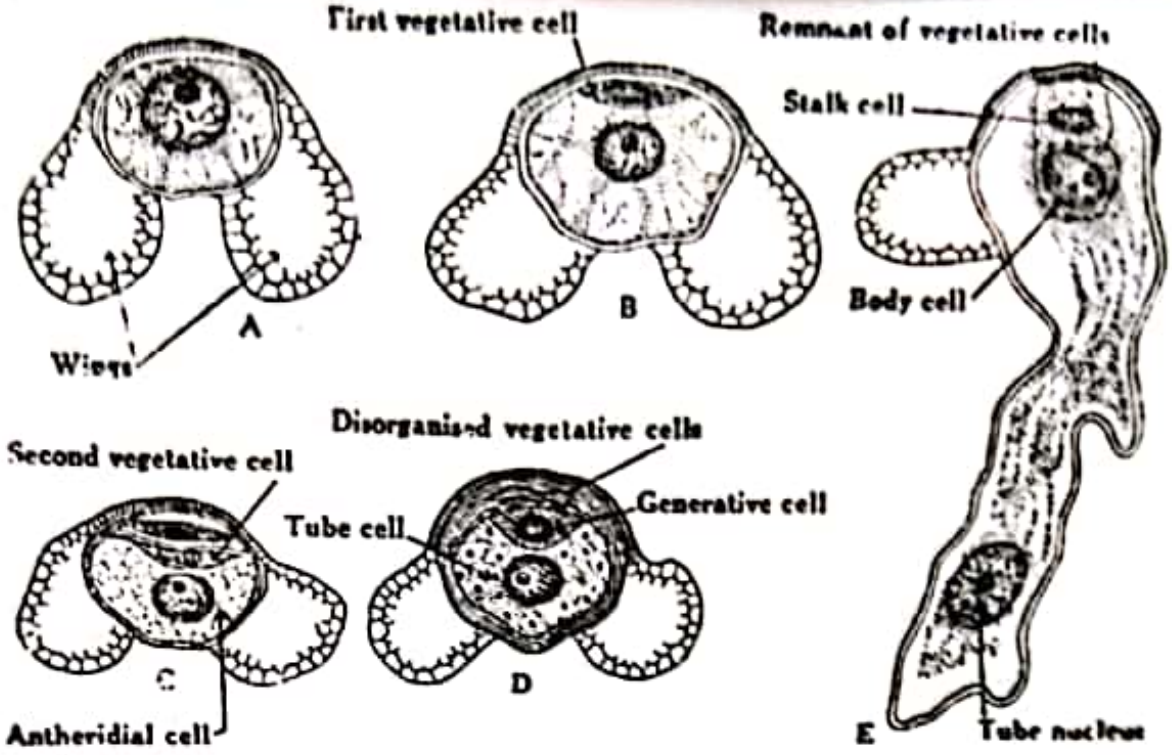


Fig. 464. *Pinus.*
A–E, Successive stages in the development of the male gametophyte.

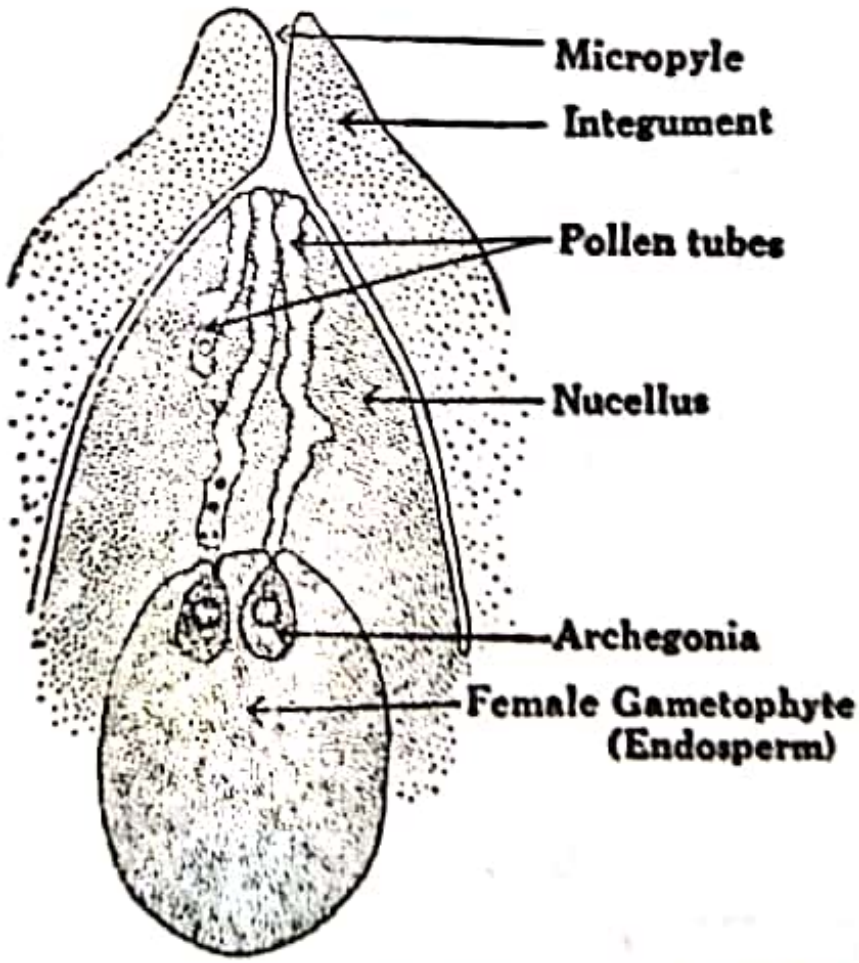


Fig. 465. *Pinus.*
Part of a longitudinal section through a megasporangium (ovule); three pollen tubes growing down into the nucellus and effecting fertilization.

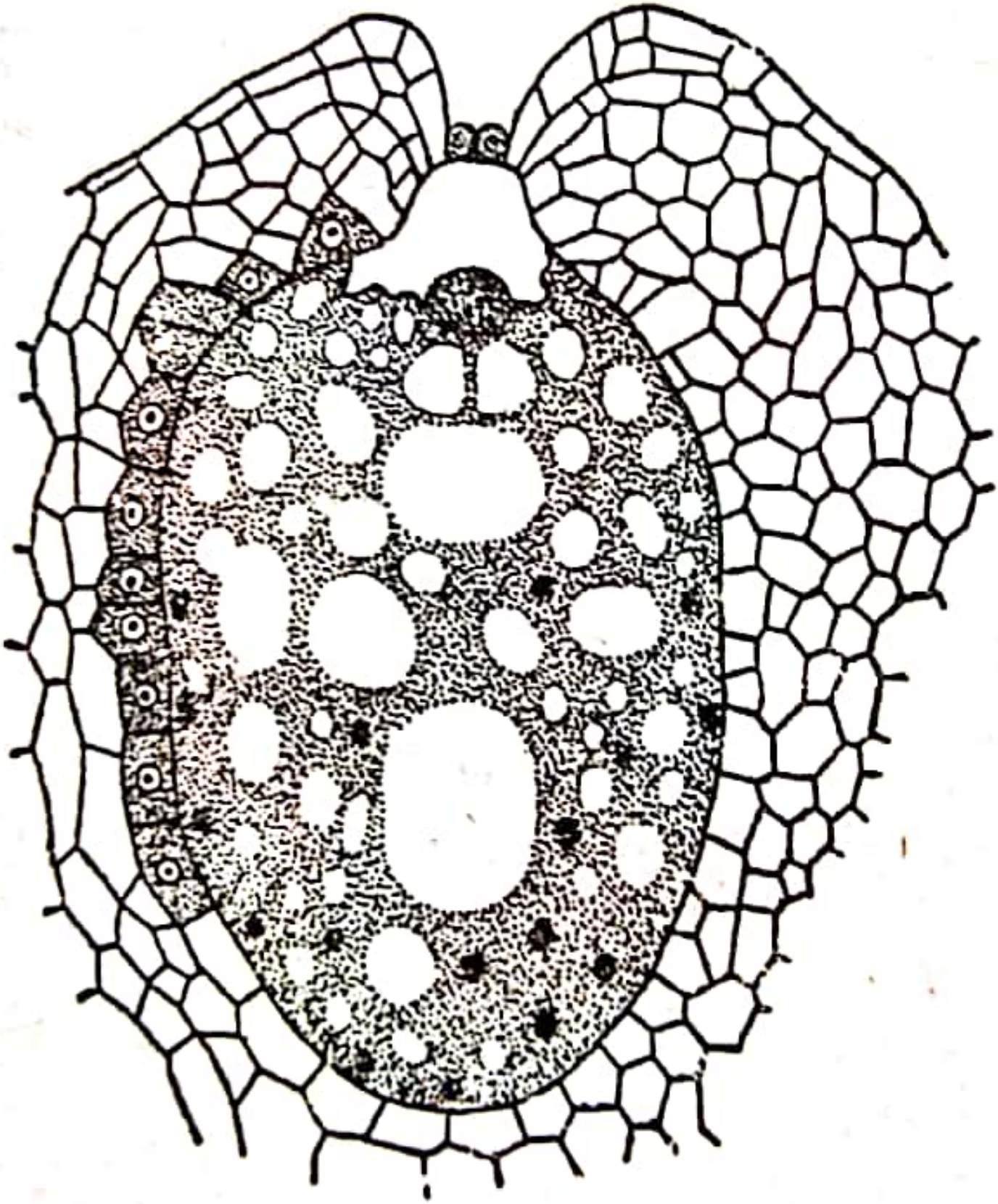

Fig. 466. *Pinus*.
Longitudinal section of an archegonium.

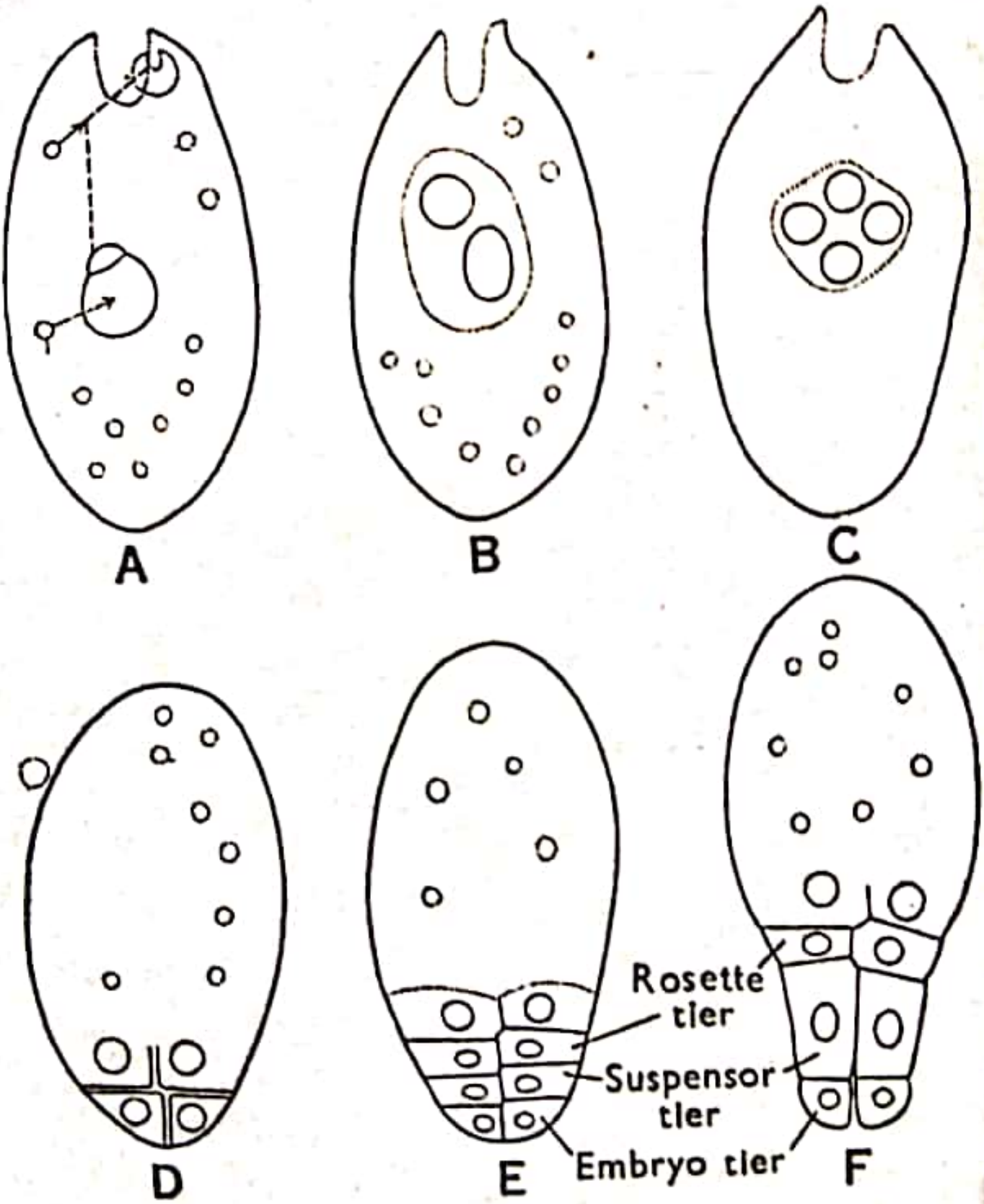


Fig. 467. *Pinus.*
A–F, Stages in the development of the embryo.

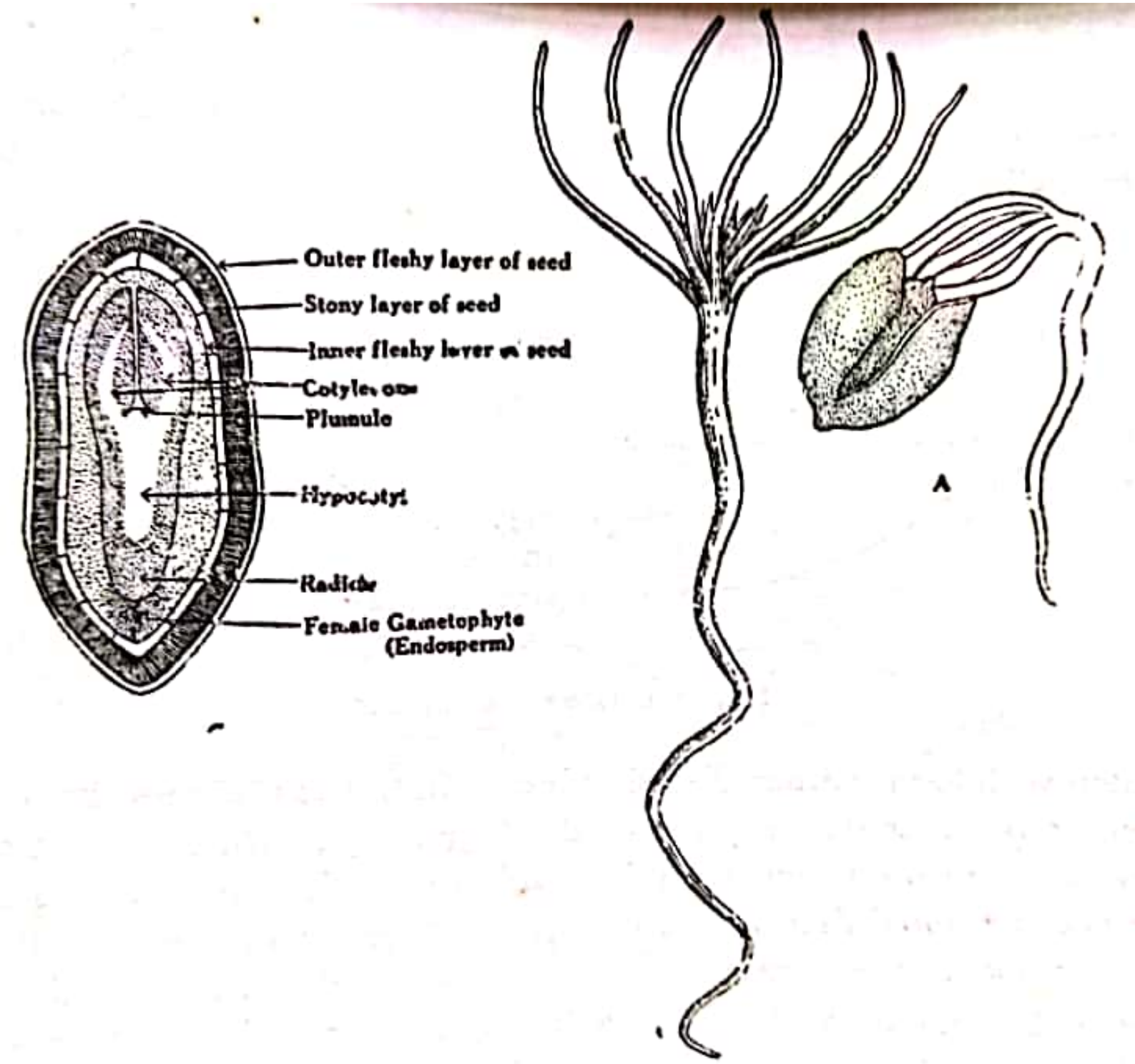


Fig. 468. *Pinus.*
A–B, Stages in the development of a seedling; C, Longitudinal section of a mature seed.

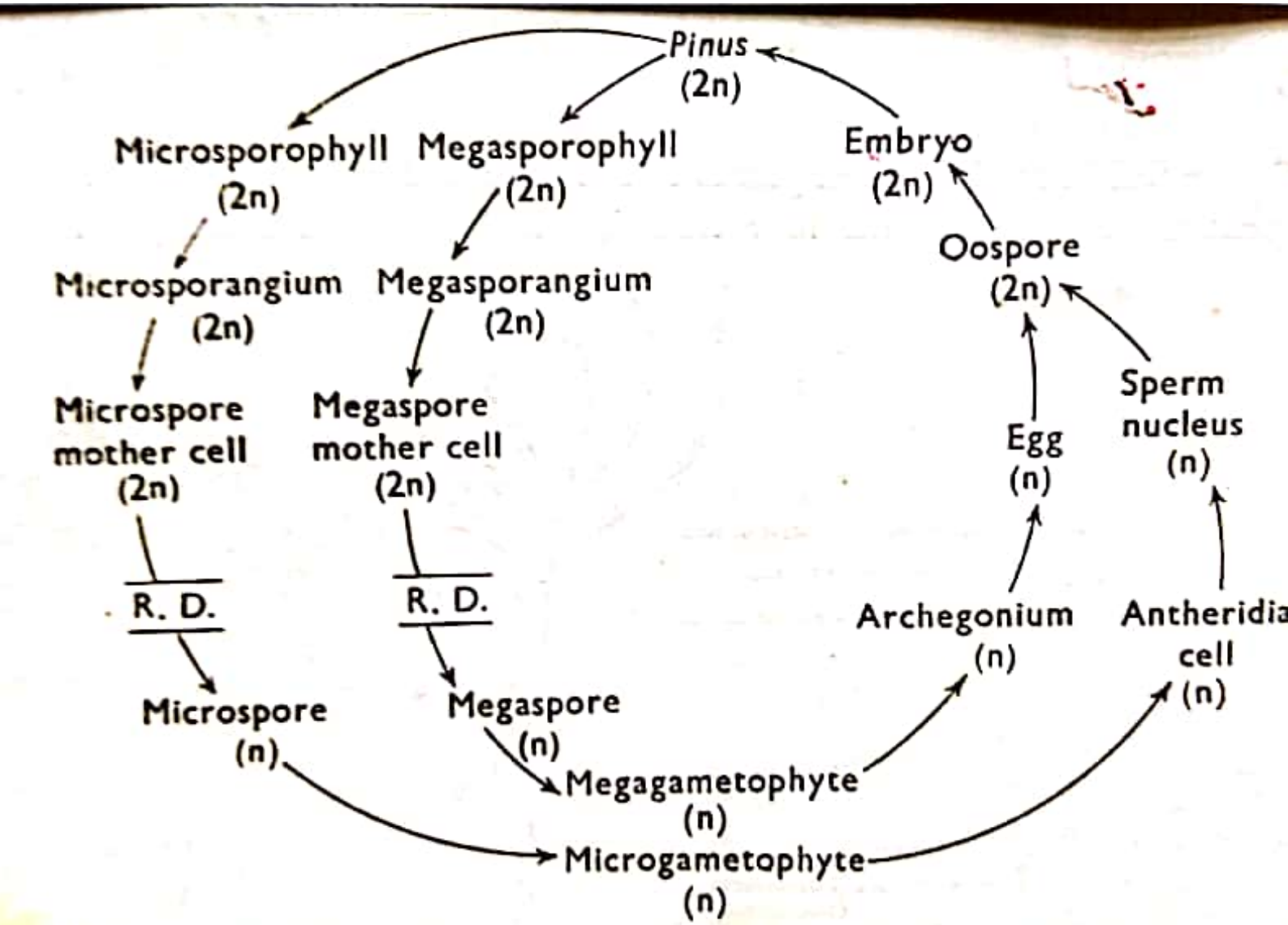


Fig. 469. Life cycle of *Pinus*.