

BRANCHES OF UNLIMITED GROWTH

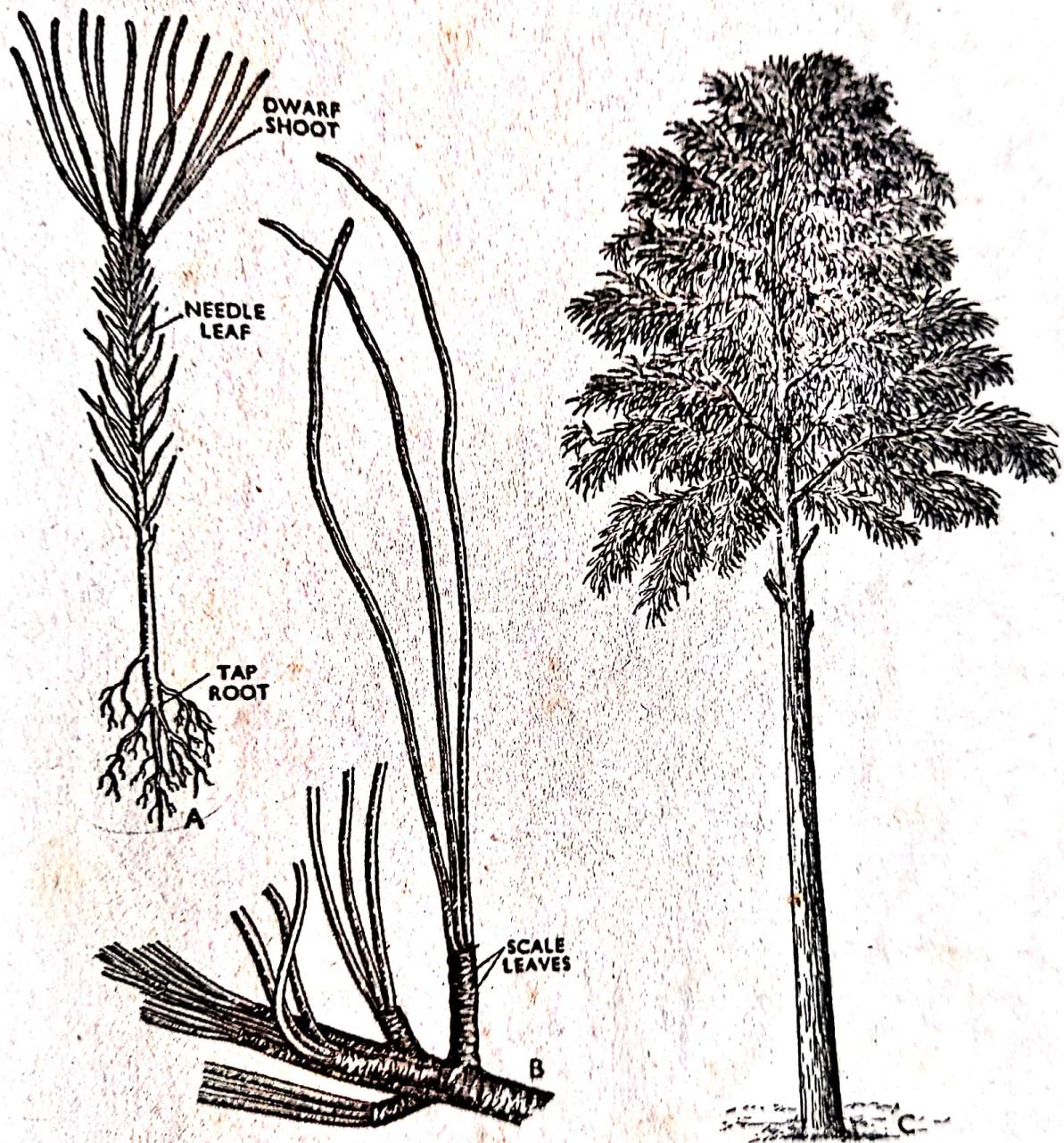


Fig. 697. A. Young seedling of *Pinus*. B. Dwarf shoots of *Pinus insularis* (one shown entire, others are dissected). C. A *Pinus* tree.

— roots show leaf scars and scale leaves only. —

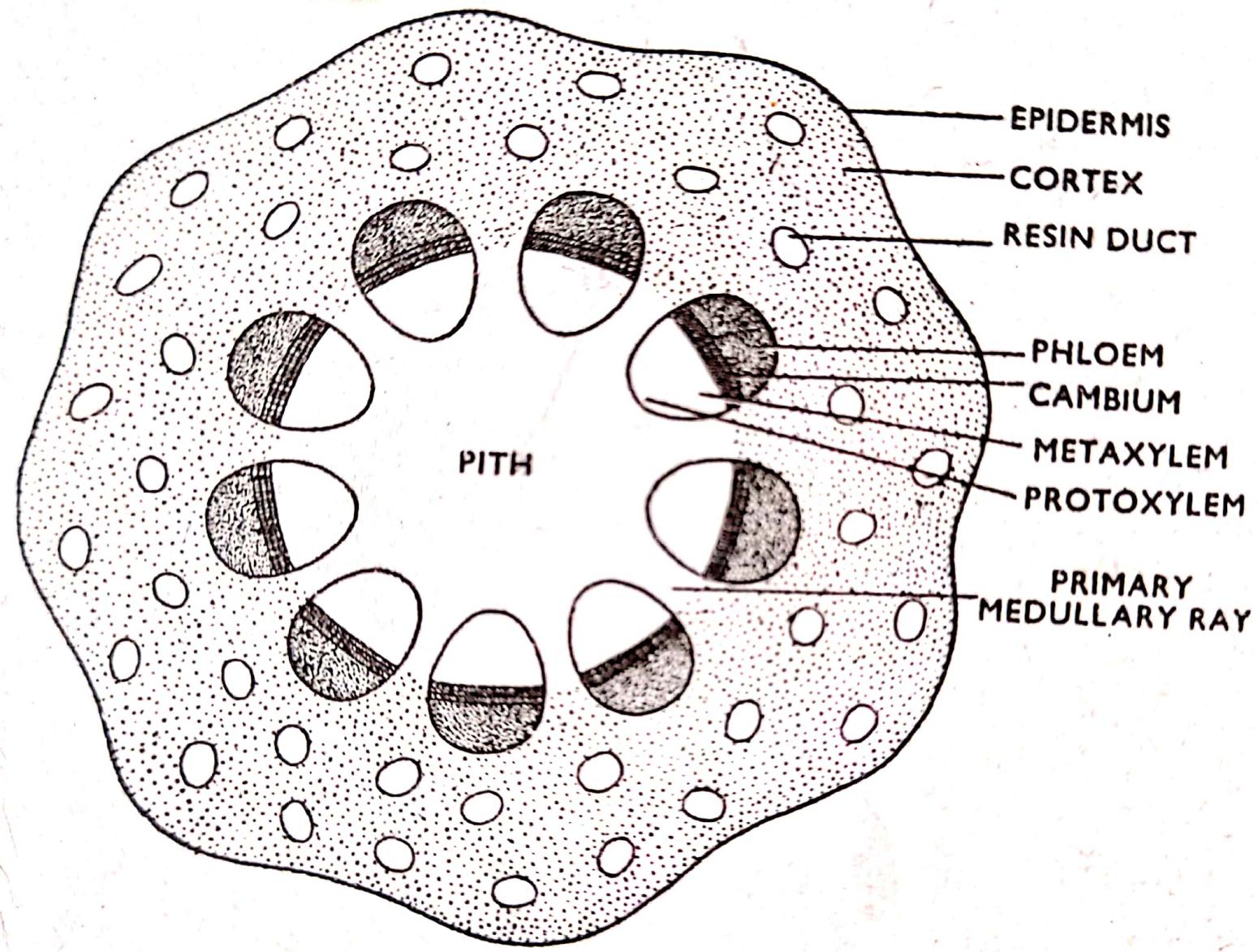


Fig. 698. T.s. of young *Pinus* stem (diagrammatic).

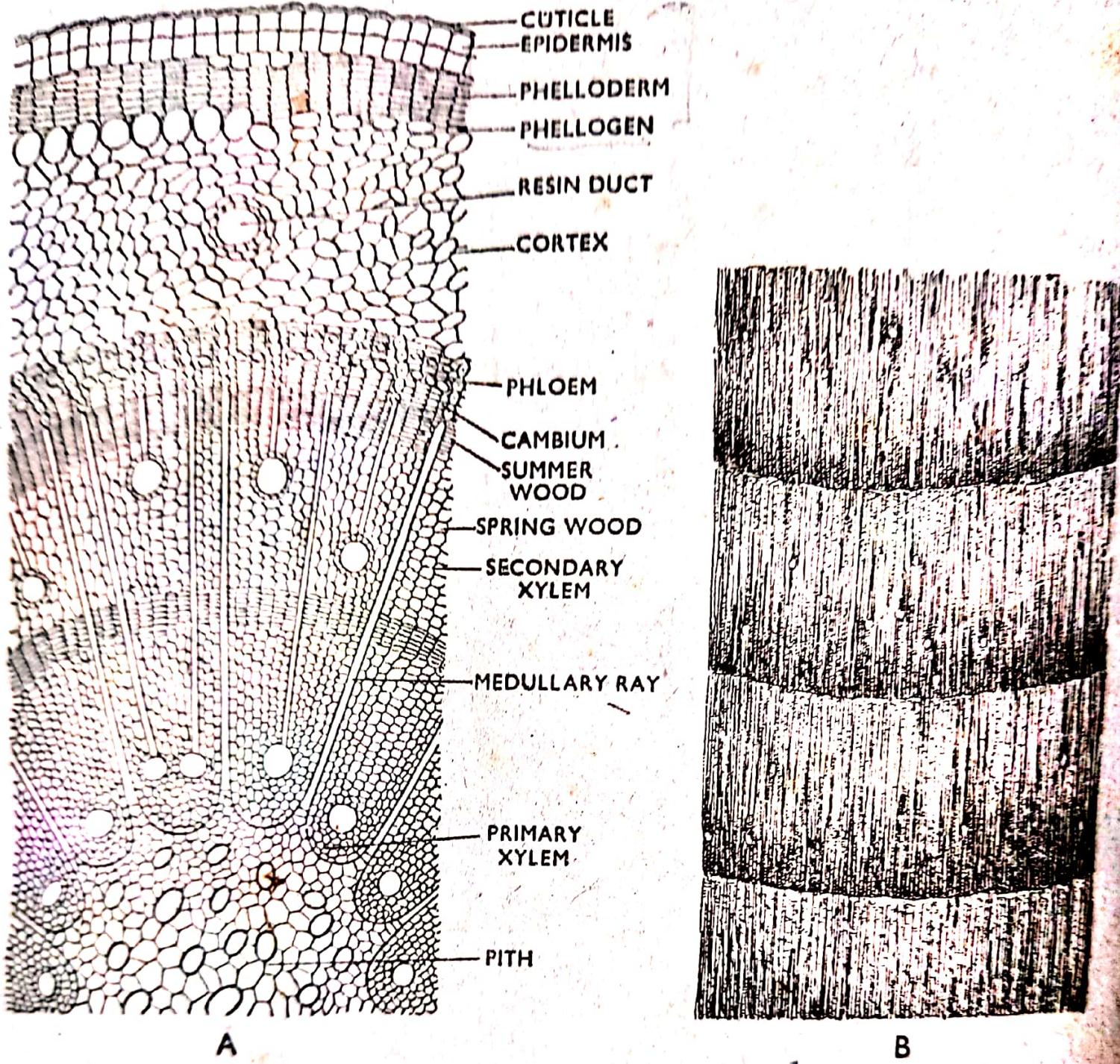
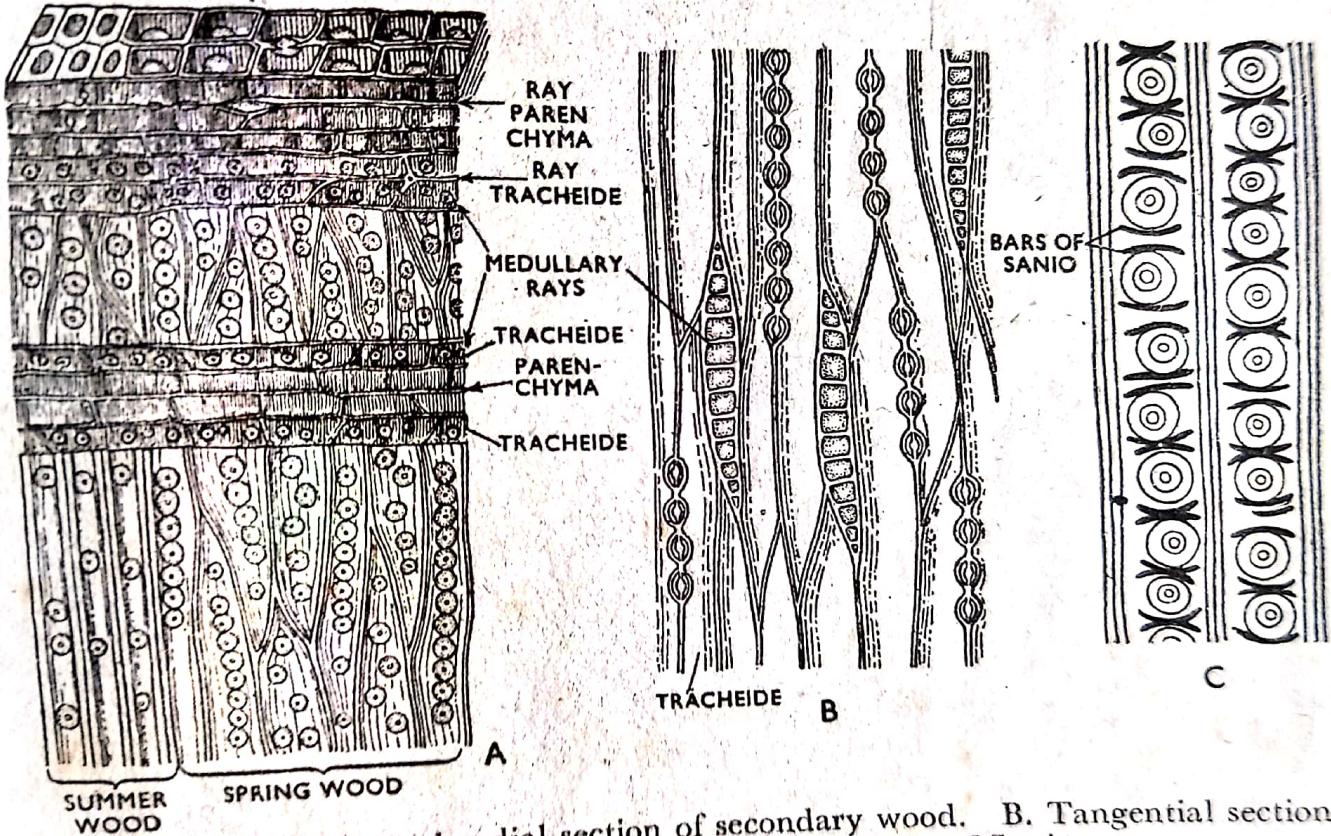


Fig. 699. *Pinus*. A. T.s. of two-year old stem. B. T.s. of wood.



700. *Pinus*. A. Longitudinal radial section of secondary wood. B. Tangential section of secondary wood. C. Tracheides showing bars of Sano.

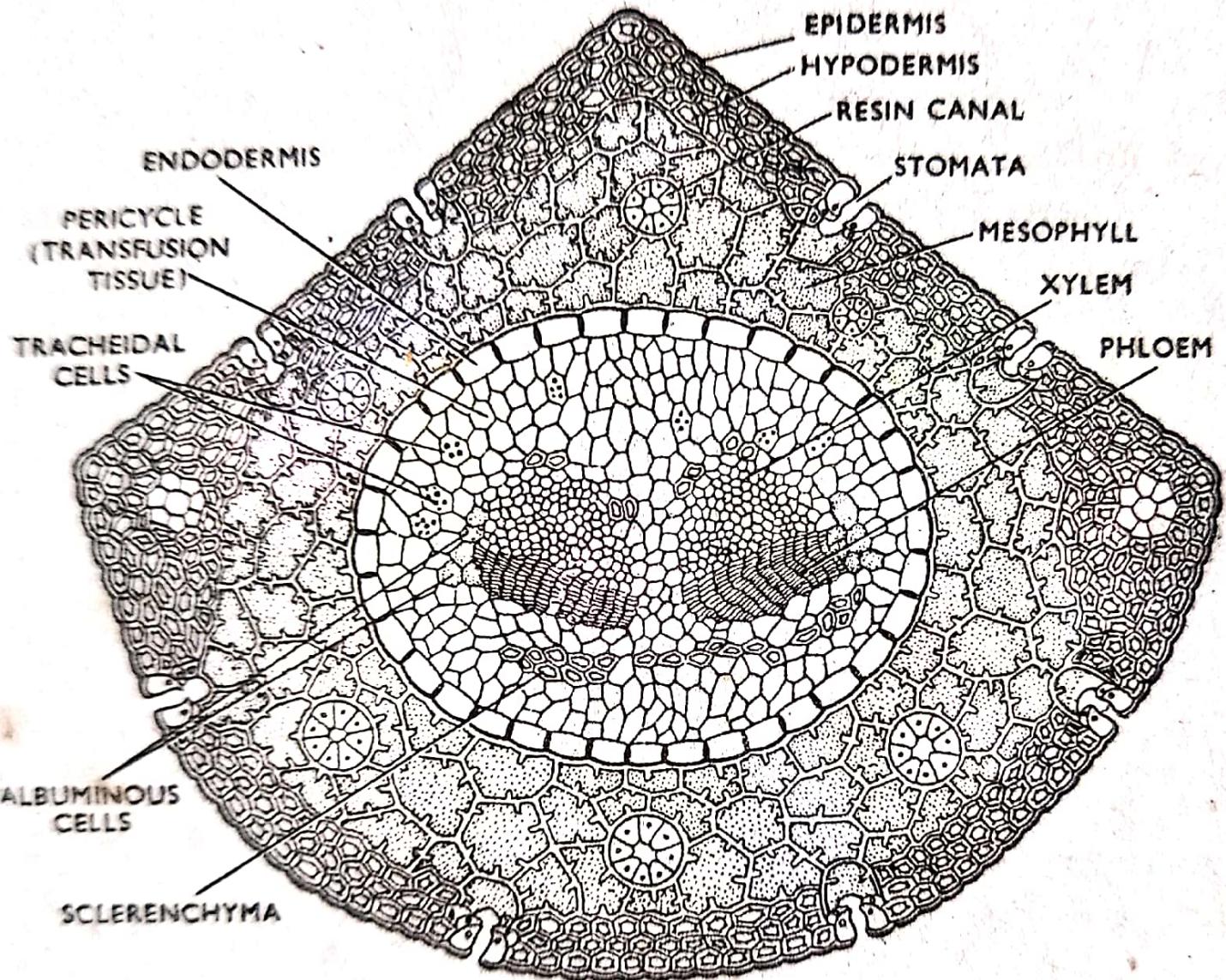


Fig. 701. T.s. of *Pinus roxburghii* leaf.

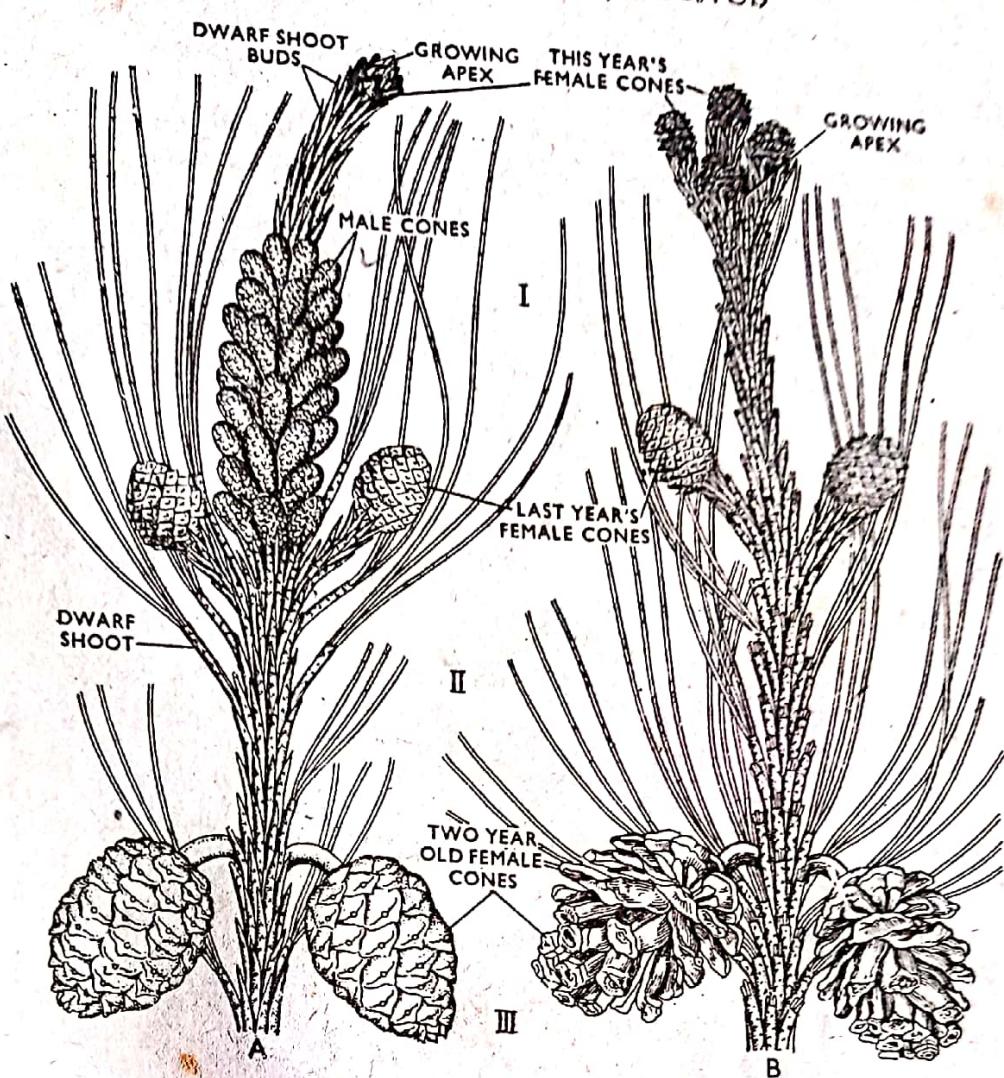


Fig. 702. Male and female cones of *Pinus insularis*. I. Long shoot development during current year. II. The same during last year. III. Part of long shoot which developed during year before the last.

thalamus (Fig. 703A). The male cone, therefore, is a 'flower' and not an inflorescence. On the under surface of each stalked, scale-like microsporophyll (Fig. 703B)

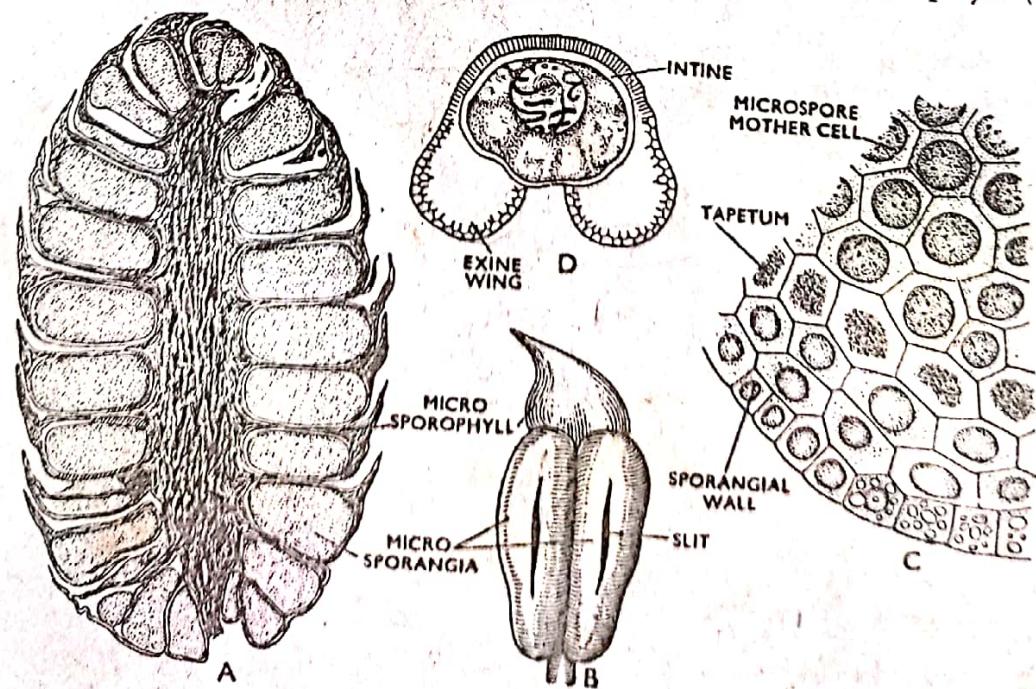


Fig. 703. *Pinus*. A. Median l.s. of male cone. B. A microsporophyll (lower surface). C. T.s. of a semimature microsporangium. D. A microspore or pollen.

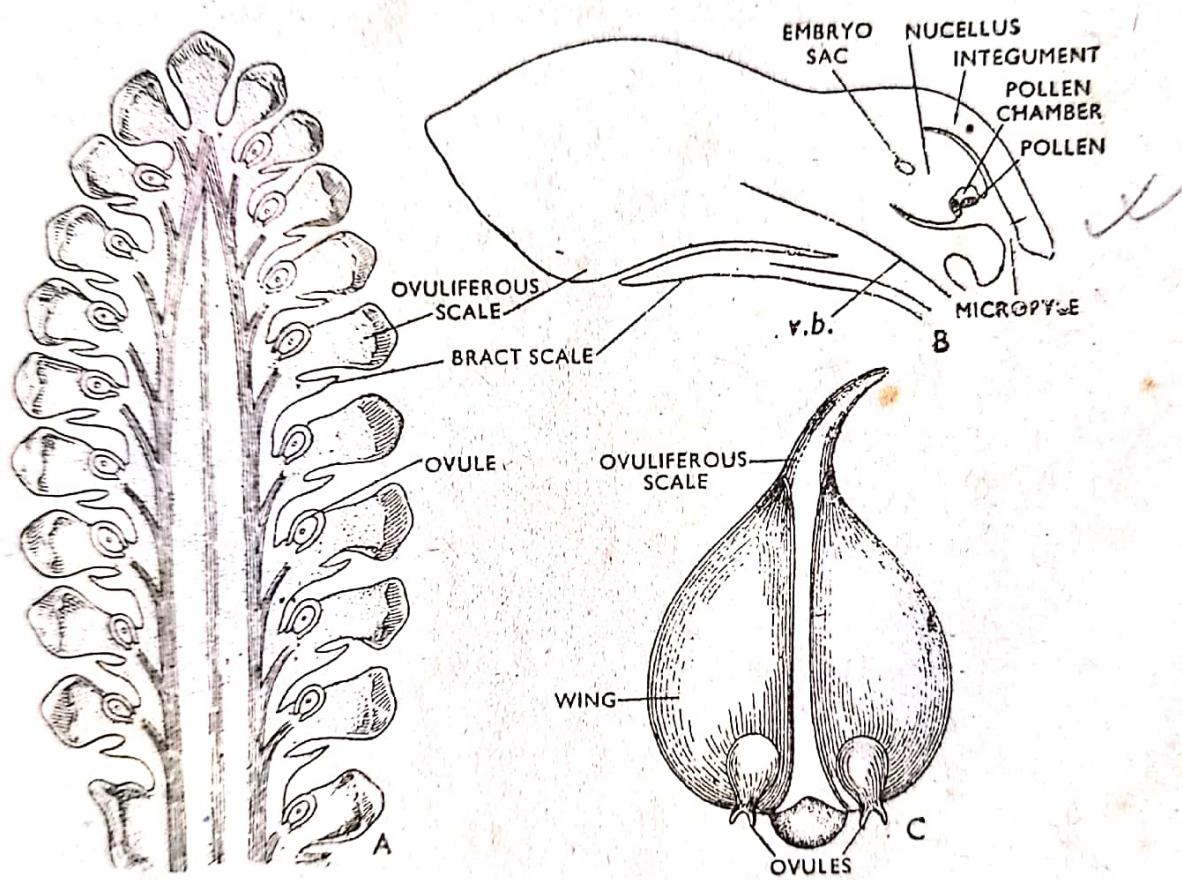


Fig. 704. *Pinus*. A. Median l.s. of female strobilus. B. Vertical l.s. of an ovule with scales. C. An ovuliferous scale with its two ovules.

DISORGANISED PROTHALLIAL CELLS

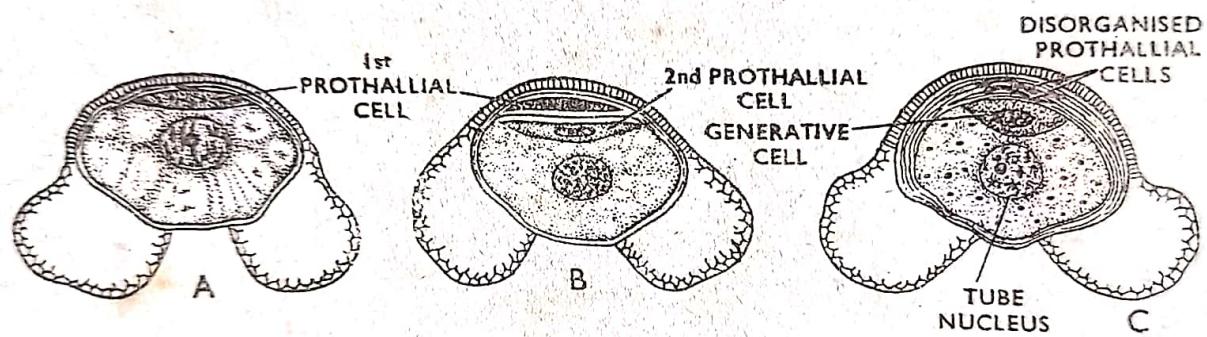


Fig. 705. A-C. Stages of development of the male gametophyte of *Pinus* before pollination.

TISSUE WHICH IS NUTRITIVE IN FUNCTION (A-G)

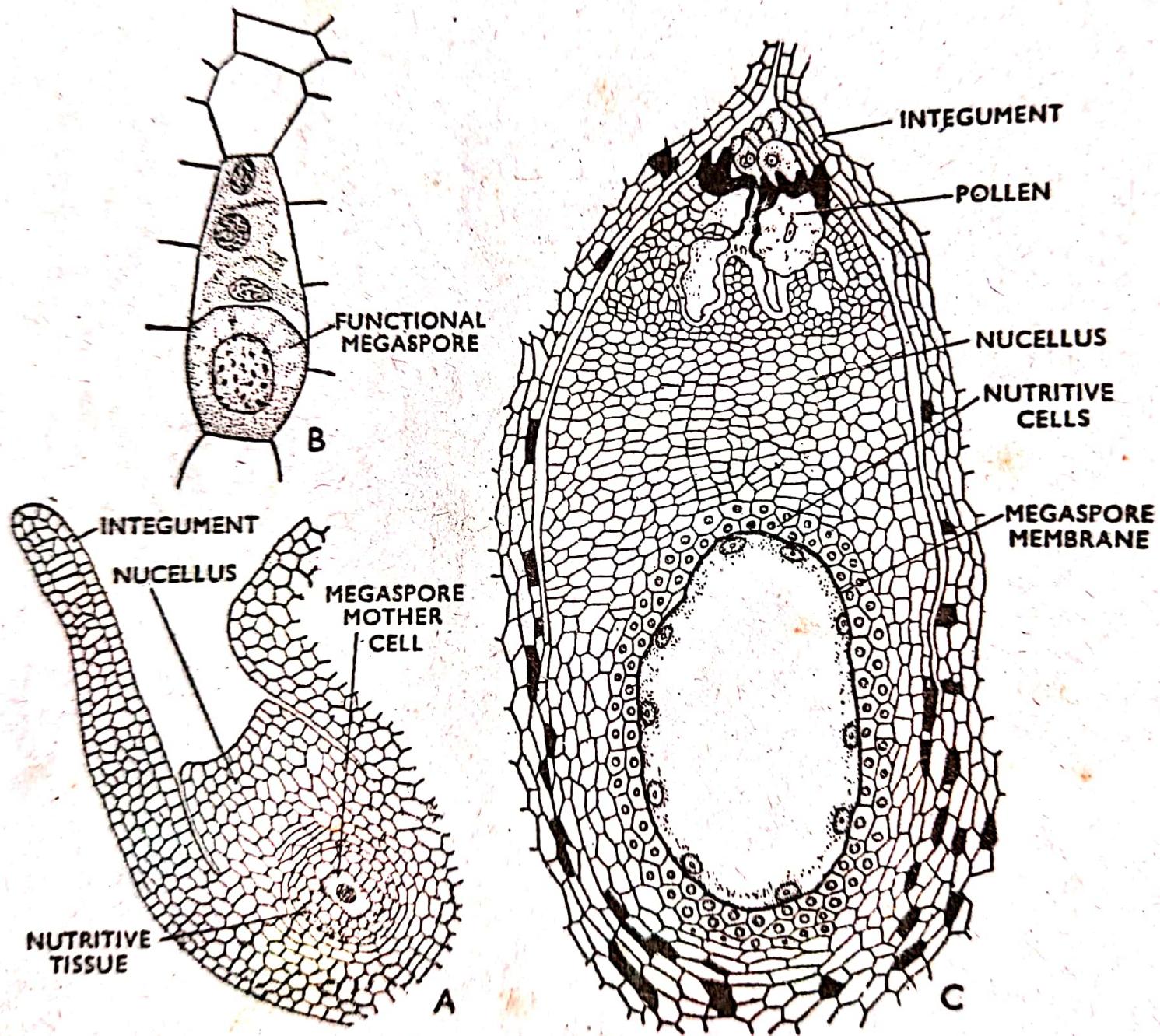


Fig. 706. *Pinus* ovule. A. Megaspore mother cell stage. B. Megaspore linear tetrad—the lowest one is functional. C. Free nuclear stage of female gametophyte.

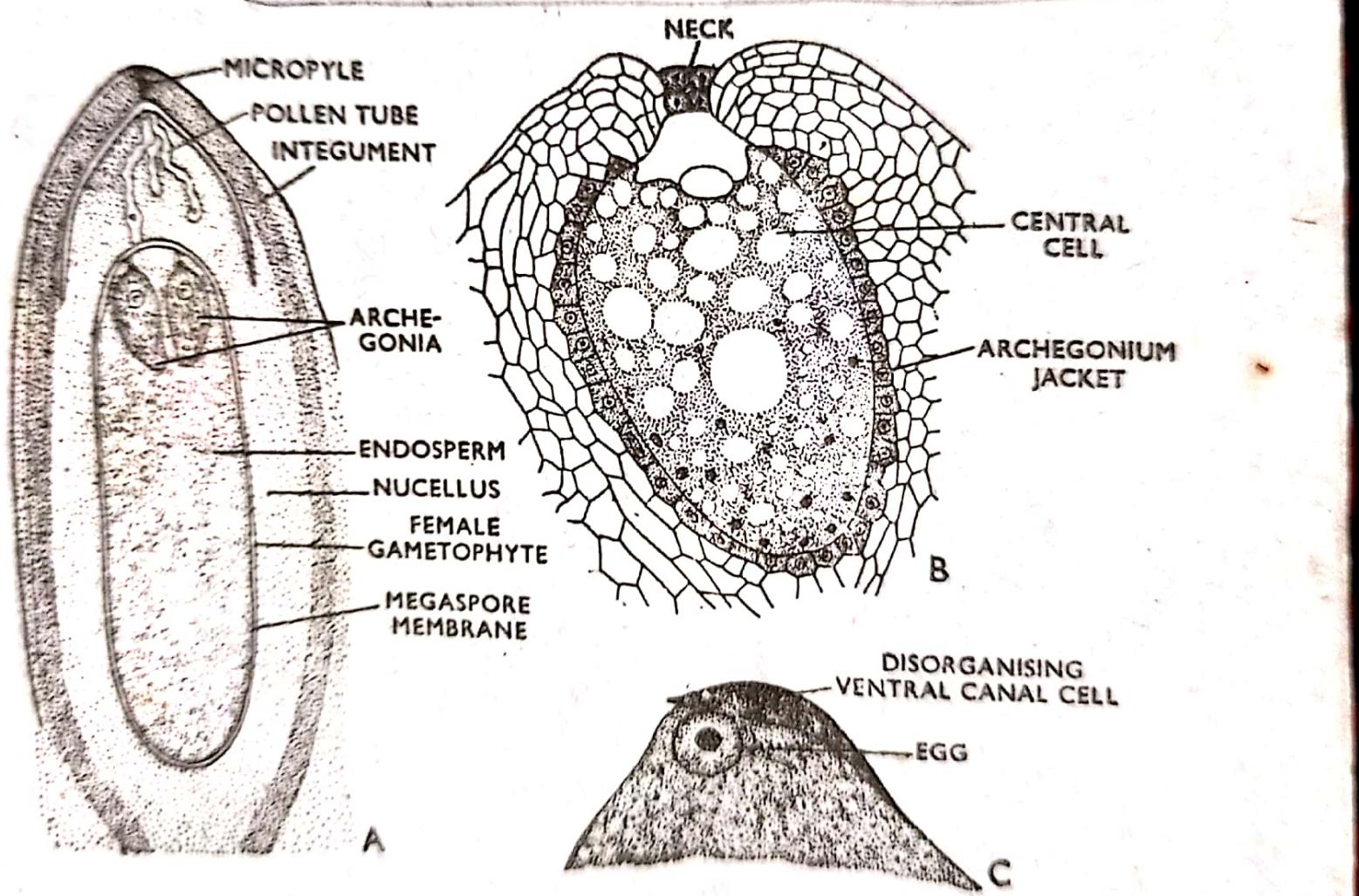


Fig. 707. *Pinus*. A. A mature ovule (the integument shows three layers). B. An archegonium. C. The division of the central cell into a transitory ventral canal cell and the egg cell,

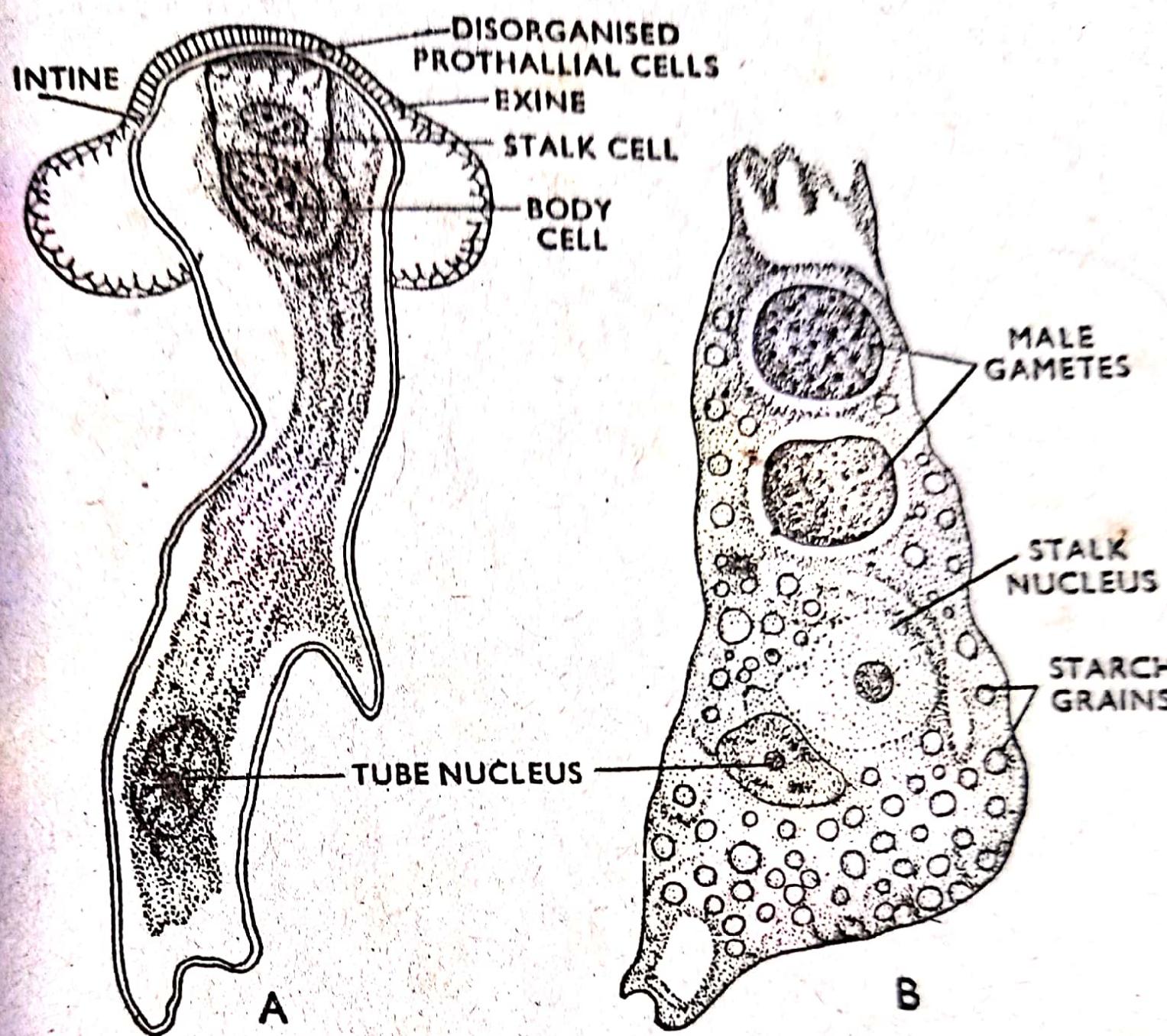


Fig. 708. *Pinus*. A. Pollen tube before development of gametes. B. Tip of pollen tube after development of male gametes.

generation begins. The fused nucleus resultant on fertilisation is the ~~zygote~~ ~~zygote~~

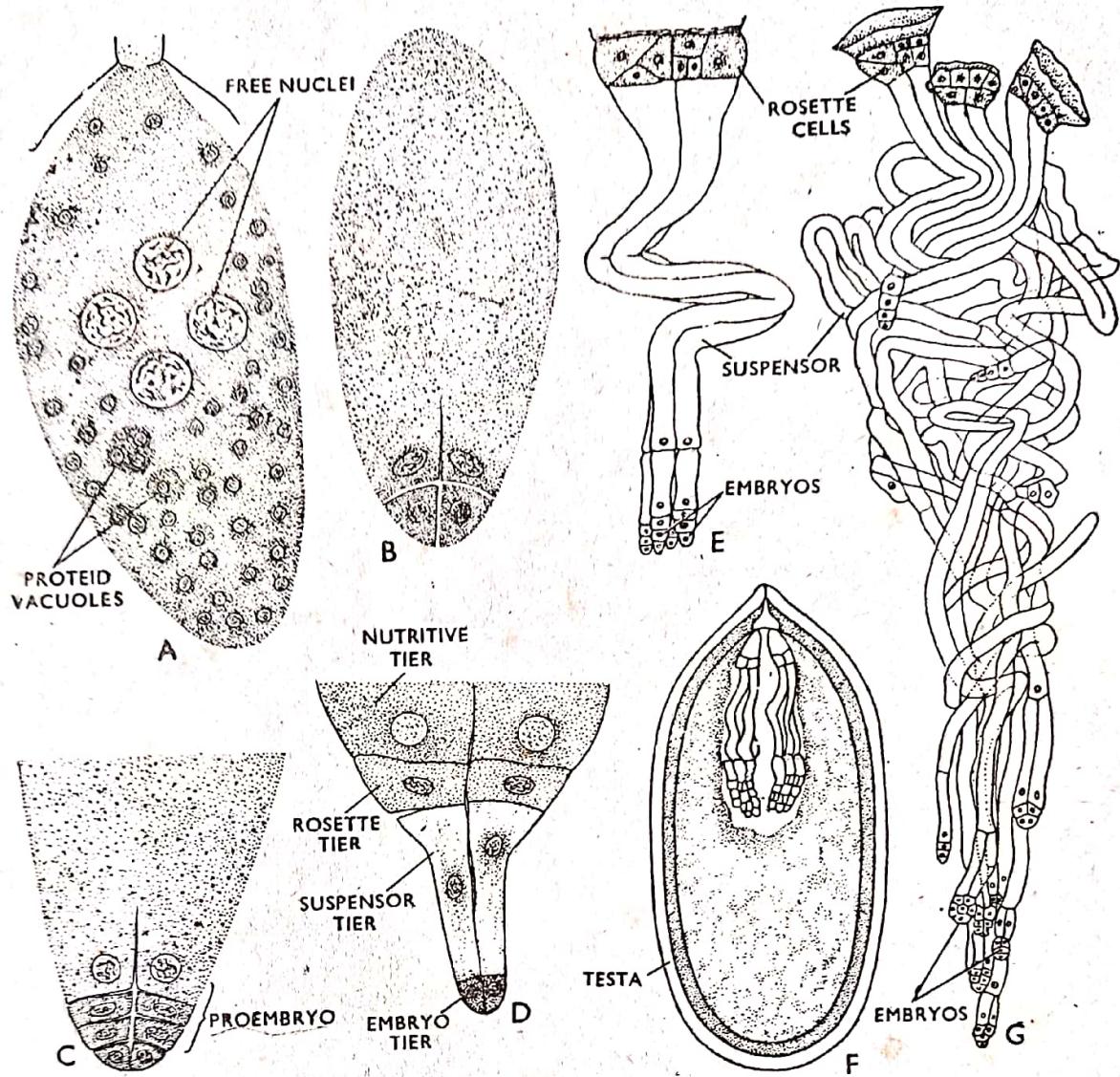


Fig. 709. *Pinus*. A-D. Stages of development of proembryo. A. Four free nuclei. B. 8-celled stage. C. Proembryo stage. D. Growth of the proembryo. E-G. Embryo development stages. E-F. A number of embryos developing in a young *Pinus* seed. G. About ten embryos with their suspensors resulting from three fertilised eggs in three archegonia. (After Buchholtz and Coulter).

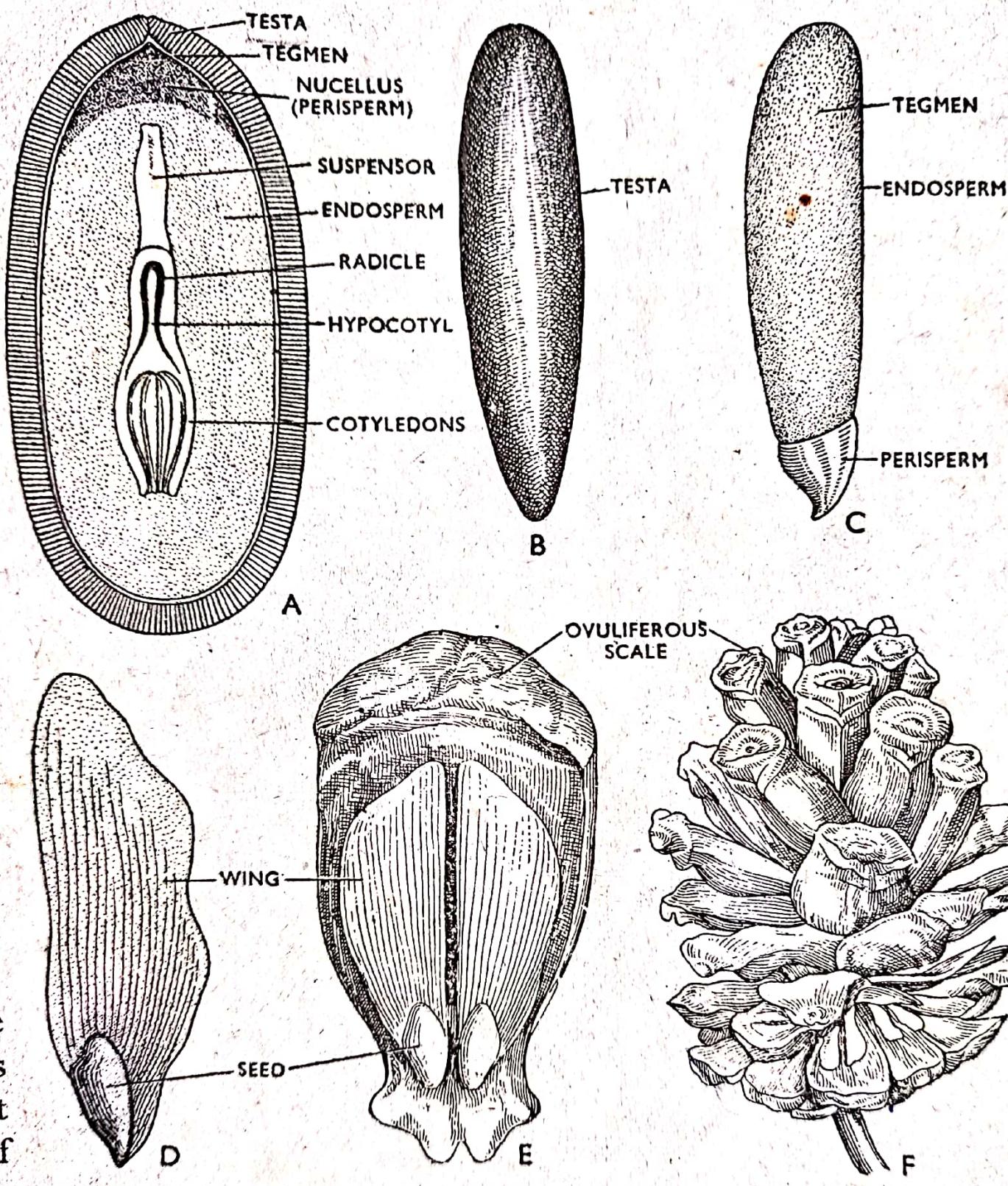


Fig. 710. A. L.s. of seed of *Pinus*. B-C. Seed of *Pinus gerardiana* (*chilgoza*) with the testa and after its removal. D. Seed of *Pinus* with the wing. E. The seeds on the ripe ovuliferous scale. F. A ripe pine cone with seeds ready for dispersal.

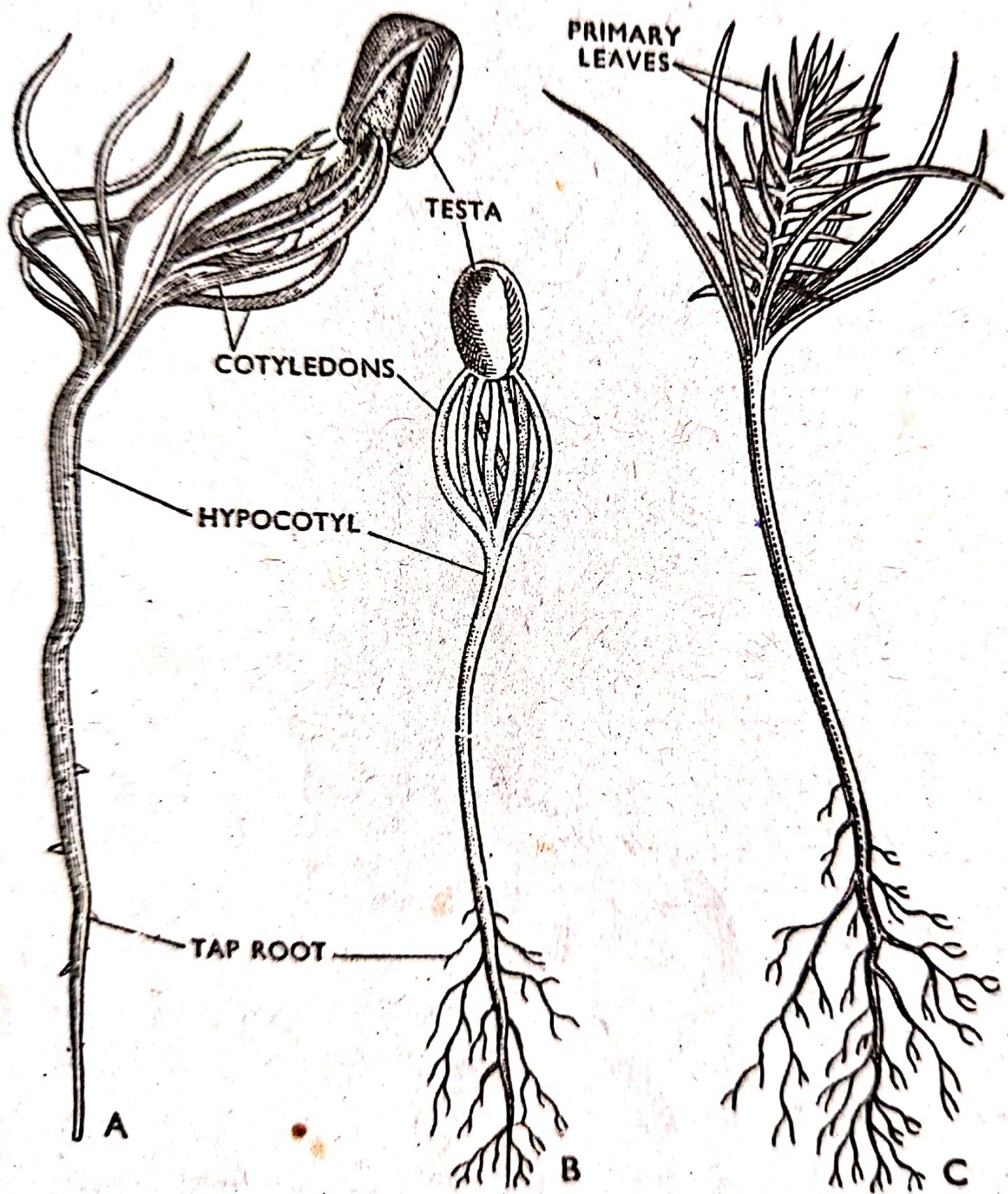


Fig. 711. A-C. Stages of germination of *Pinus* seed.

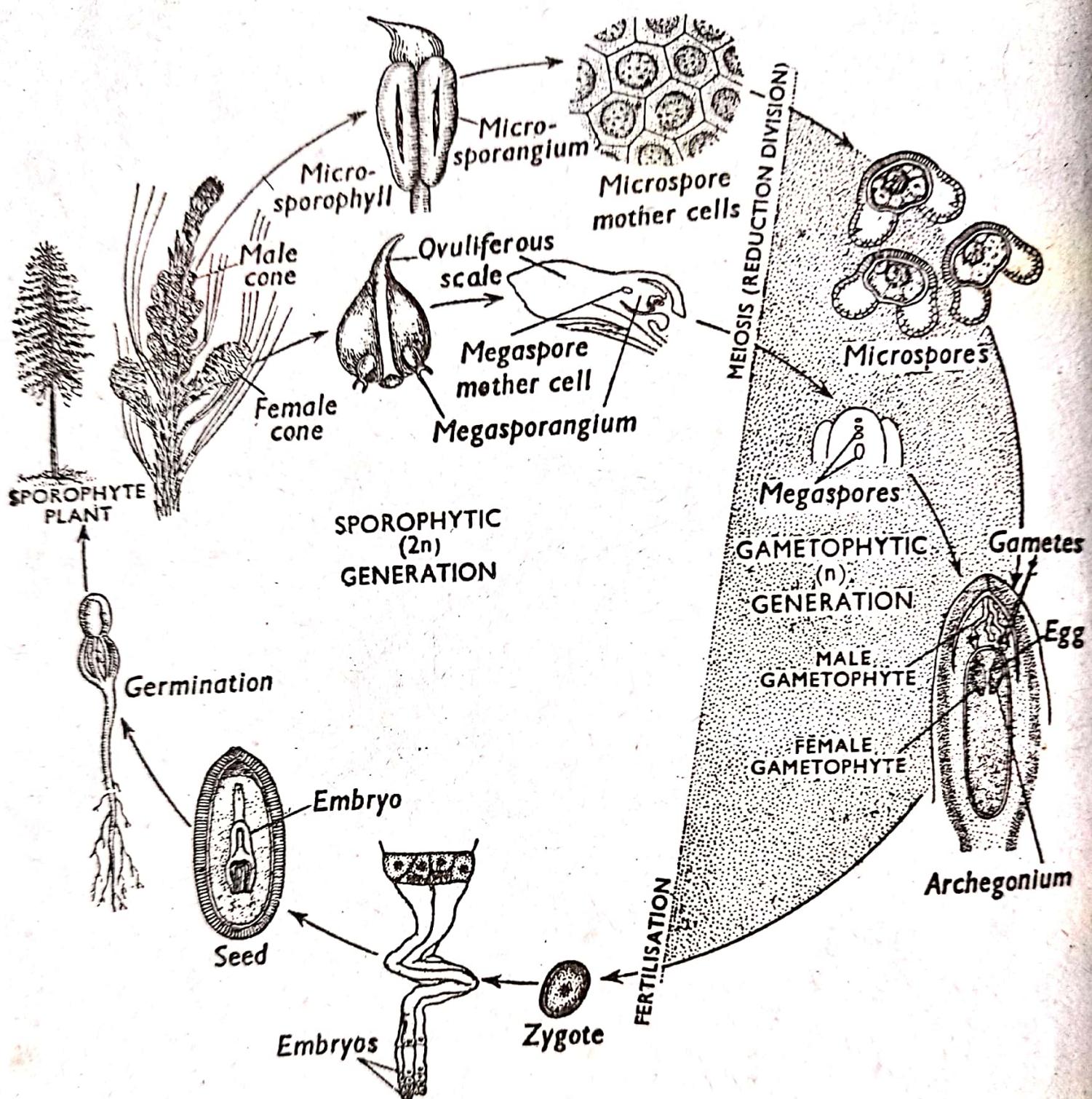


Fig. 712. Life cycle of *Pinus*.