



Bhagalpur National College, Bhagalpur

(A Constituent unit of Tilka Manjhi Bhagalpur University, Bhagalpur)

PPT Presentation for B.Sc. I- Life Cycle of Lycopodium



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Classification:

- **Systematic Position:**
Pteridophyta
- **Division :** Lycophyta
- **Class .:** Eligulopsida
- **Order. :** Lycopodiales
- **Family:**
Lycopodiaceae
- **Genus :** Lycopodium


There are about 180 species in this genus.

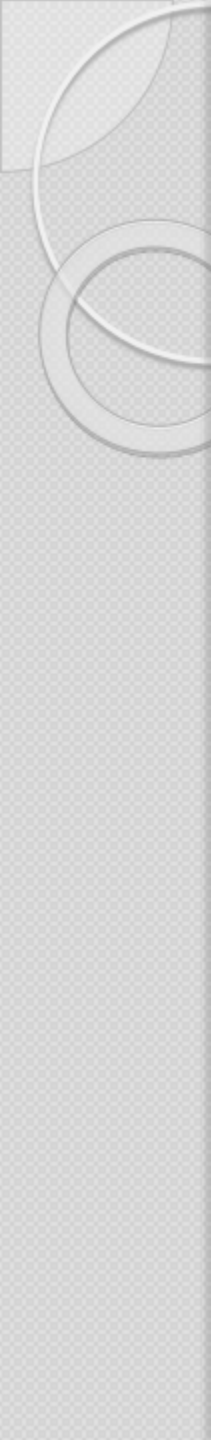


LYCOPODIUM

- The living Lycopodiales are the representatives of a group which, during **the Carboniferous** period, formed the chief vegetation. Many of the types then growing, e.g., **Lepidodendron**, were large trees.



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- The modern representatives are **small and herbaceous sporophytes**
 - The leaves are **small and simple**. Each leaf possesses an **unbranched midrib**.
 - The leaves have no ligules. There are no leaf gaps in the stele of the stem.
 - The sporophylls may or may not be restricted to the terminal

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- The sporophylls and simple vegetative leaves may be similar or dissimilar. They possess **homosporous** sporangia, i.e., all the spores of one kind only.
 - The gametophytes are **wholly or partly subterranean**. The antheridia remain embedded in the tissue of the prothallus. The antherozoids are biflagellate.

Distribution and habit

- The species of *Lycopodium* are world-wide in distribution.
- They are mainly found in **tropical and sub-tropical forests**. In India they are found in the hills of Eastern Himalayas.



- The plants are commonly known as 'ground pines', 'club mosses' and 'trailing evergreens' many species occur in the tropics as hanging epiphytes (e.g., *Lycopodium*. These species include:
 - *Lycopodium clavatum*
 - *L. cernuum*
 - *L. heamiltonii*
 - *L. setaceum*
 - *L. phlegmaria*
 - *L. wightianum*
 - *L. serratum*
 - *L. phyllanthum*
- The most common species is *L. clavatum*.



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Habit:

All species possess small, herbaceous or shrubby sporophytes. The stem in almost all the species is delicate and weak. Some species are epiphytic and with erect or pendant sporophytes while other species are terrestrial and have a trailing habit.(vines) The stem and its branches are densely covered with small leaves.

Lycoedium phlegmaria is an

Stems:

Species referred to the sub-genus **Urostachya** possess **branched or unbranched** stems that are **erect or pendant** but never creeping. This subgenus includes the species, e.g., *L. selago*, *L. lucidulum*, *L. phlegmaria* and others.

If the stem is branched, the **branching is always dichotomous**. Usually the successive dichotomies are found at right angles to one another. The species belonging to this subgenus do

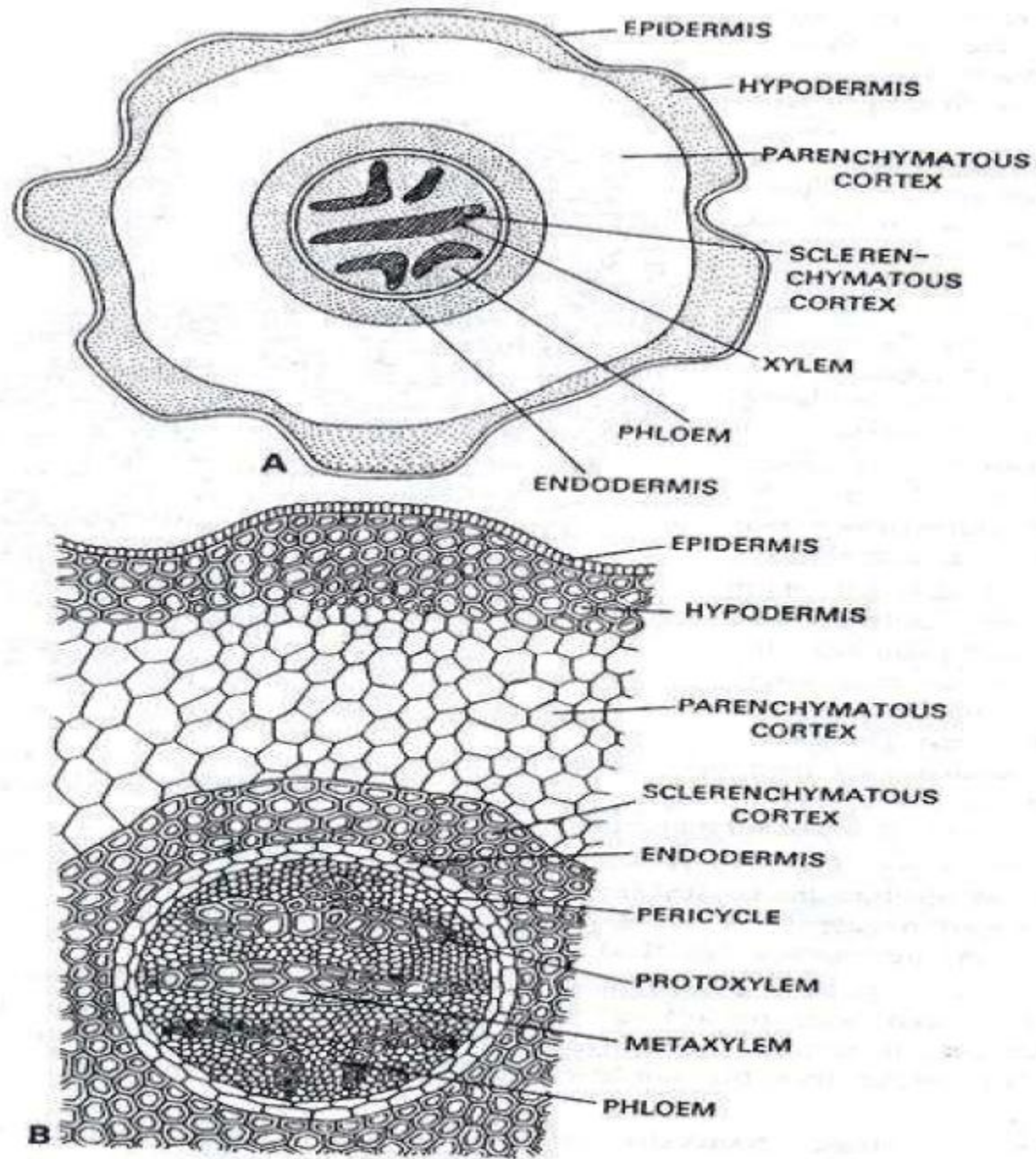


Fig. 27.3. *Lycopodium* sp. A, transverse section of stem (diagrammatic); B, transverse section of stem (detailed).

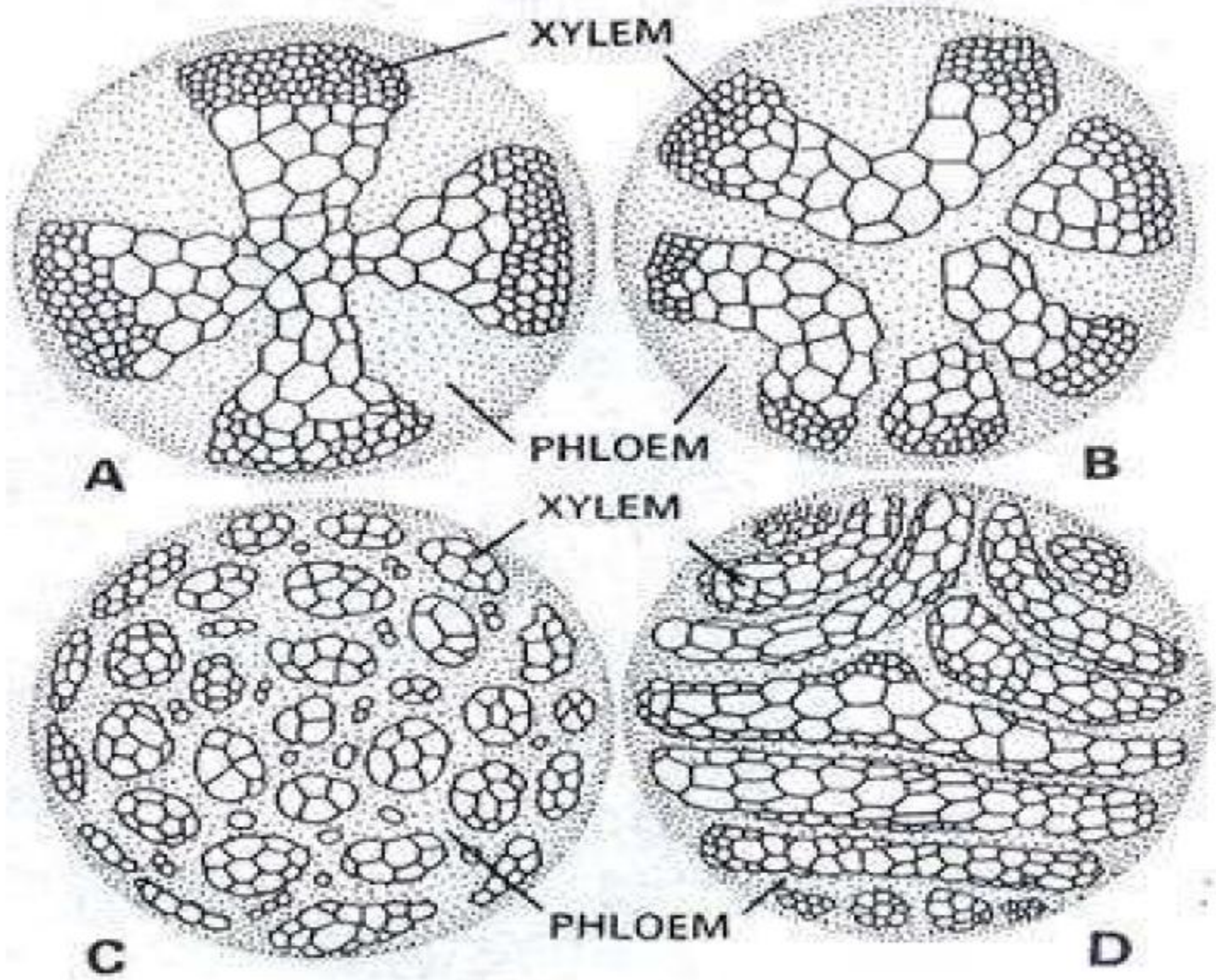


Fig. 27.4. *Lycopodium* sp. Transverse section of steles of various species of *Lycopodium*-A, *L. serratum*; B, *L. annotinum*; C, *L. cernuum*; D, *L. volubile*.

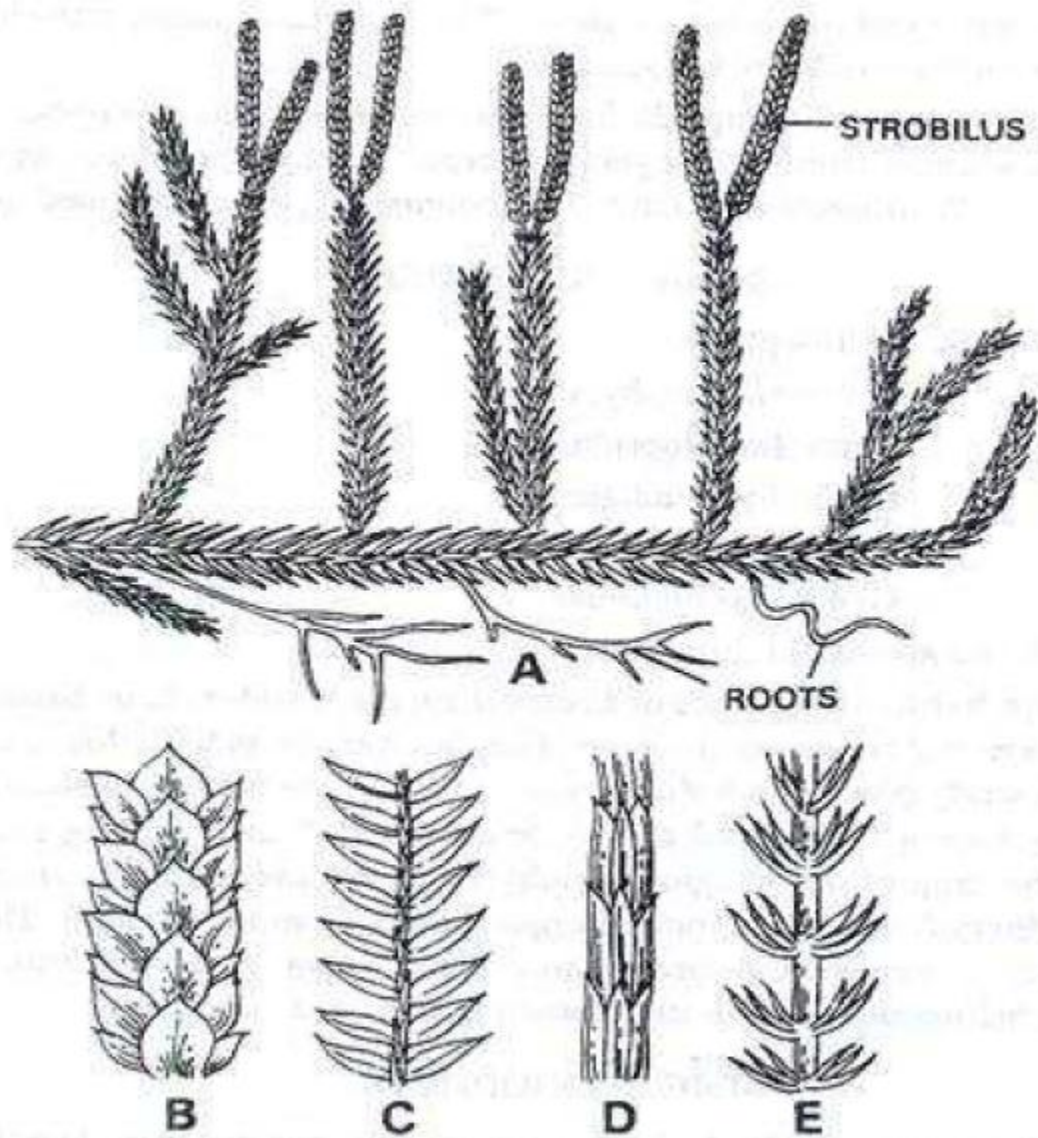


Fig. 27.1. *Lycopodium*. A, part of a plant of *L. clavatum* showing strobili; B-E, leaf form and arrangement in *Lycopodium*; B, *L. refescens*; C, *L. volubile*; D, *L. complanatum*; E, *L. cernuum*.

Leaves:

The leaves are **small, simple, sessile, numerous** and cover the axis closely.

Typically the leaves are **2 to 10 mm long**.

Usually the leaves are arranged in **closed spirals** (e.g., in *L. clavatum* and *L. annotinum*) while in other cases they are arranged **in whorls** (e.g., in *L. verticillatum* and *L. cernuum*).

In some species the leaves are found to be arranged in **opposite pairs** (e.g., *L. alpimum*); in others they are irregularly arranged. Usually the leaves are lanceolate (pointed)

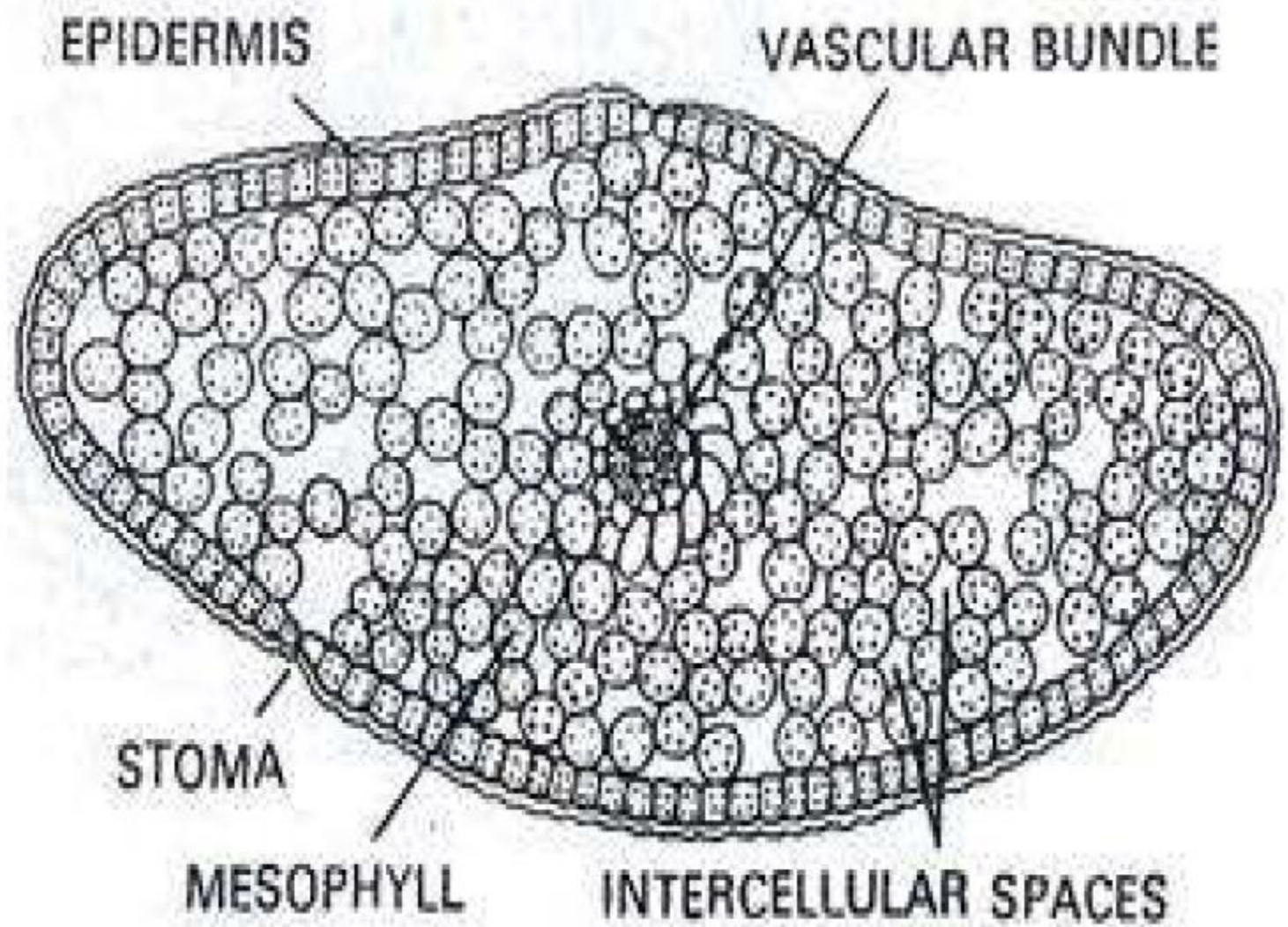


Fig. 27.5. *Lycopodium clavatum*. Transverse section of leaf.

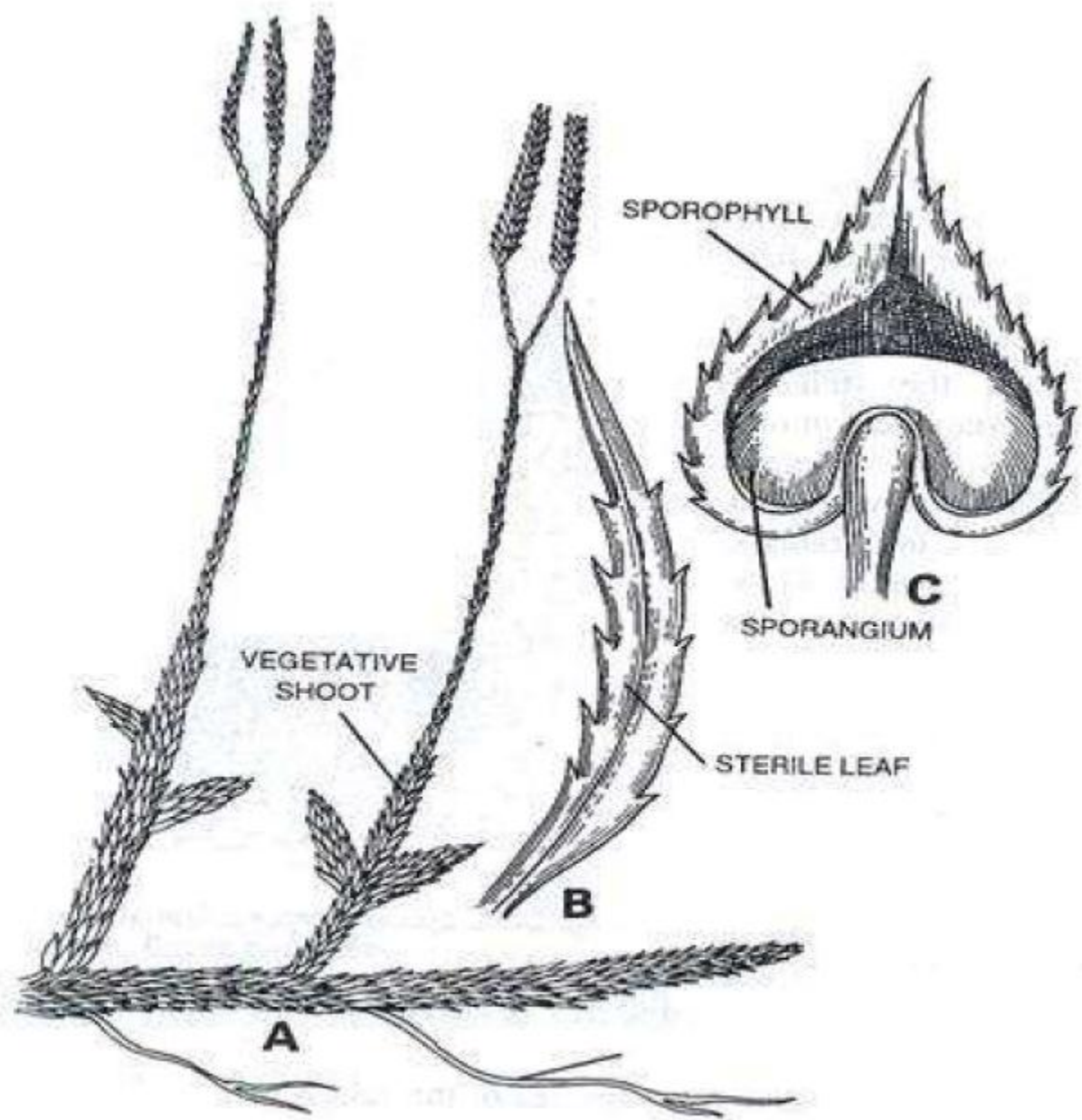
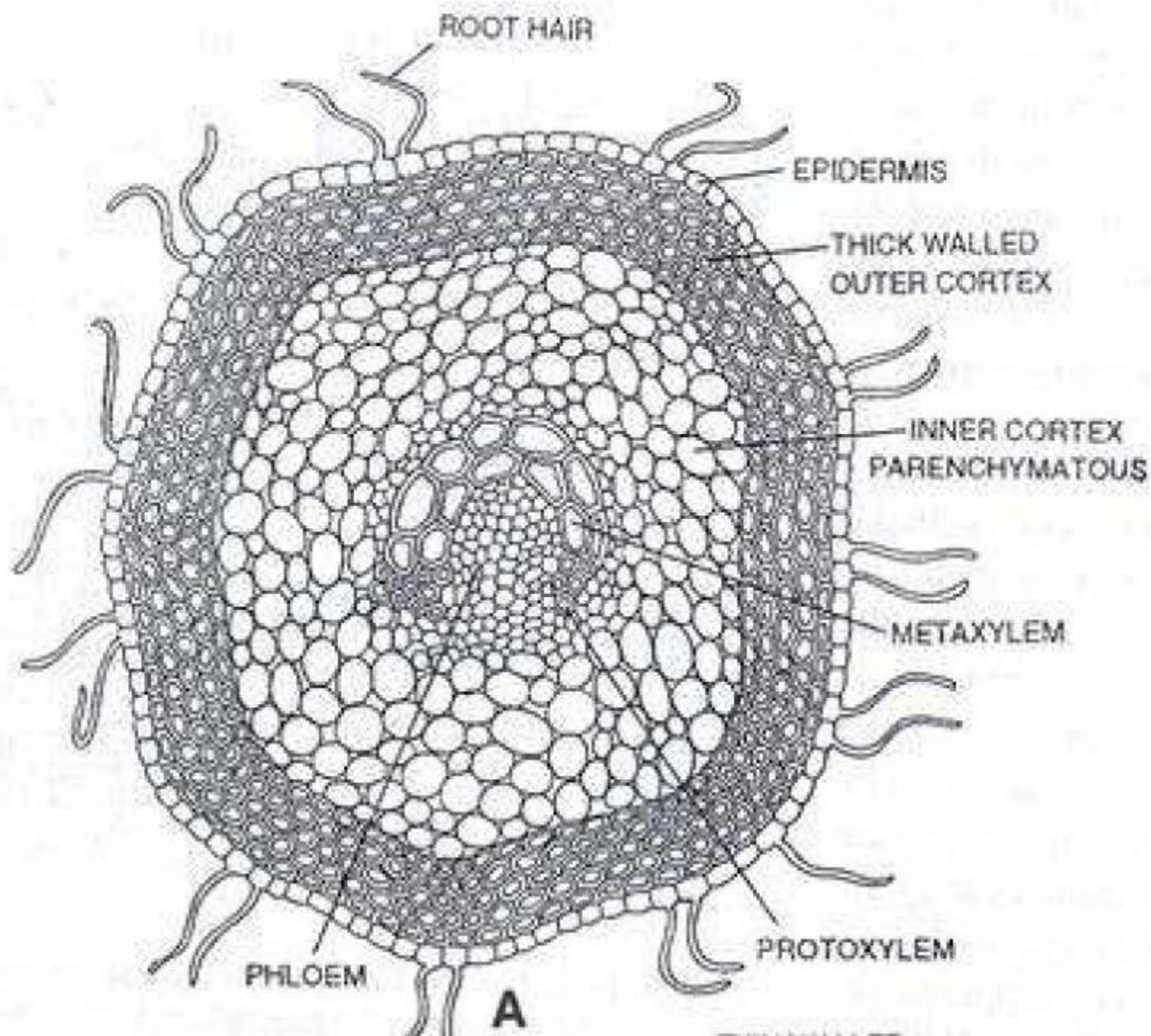


Fig. 27.8. *Lycopodium* spp. A, shoot bearing strobili; B, sterile leaf; C, sporophyll with sporangium.

ROOTS:

The roots that arise on the outside of the stele do not penetrate the cortical region of the stem at once. These roots turn downward and penetrate the soft middle cortex making canals through it, and ultimately they emerge only at the stem. Such roots are known as 'cortical roots'



Apical growth:

The apical growth of the shoot takes place by means of an apical meristem which consists of a group of apical cells.

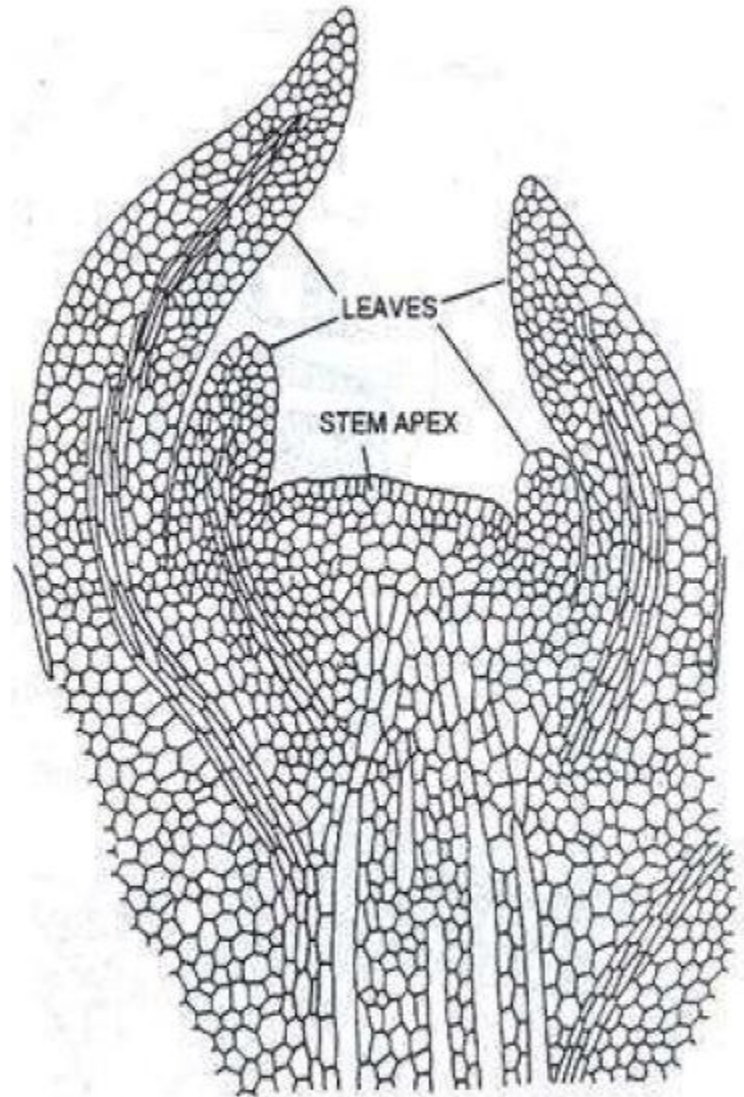


Fig 27.2. *Lycopodium* spp. L.S. of stem apex.

Vegetative propagation of the sporophyte:

The new plants may be developed from

- (a) vegetative propagation of the gametophyte,
- (b) vegetative propagation of the juvenile stage of the sporophyte,
- (c) gemmae produced from the cortical cells of the root,
- (d) tubers developed at the apices of roots and
- (e) bulbils

Development of sporangium:

- The sporangia begin to develop at a time when the sporophyll is composed of embryonic cells
- The inner daughter cells formed by this periclinal division give rise to the stalk and the basal portion of a sporangium. The outer daughter cells contribute to the formation to the bulk of the sporangium.
- The outer cells again divide periclinally forming an outer layer, the jacket initials; and an inner layer, the archesporial cells.

- The archesporial cells divide periclinally and anticlinally forming a massive sporogenous tissue.
- The cells of the last generation of the sporogenous tissue act as spore mother cells.
- They become rounded and are being separated from one another.
- Now these spore mother cells float about in a viscous liquid and divide meiotically into tetrads of spores

- The jacket initials, which are found external to the sporogenous tissue divide repeatedly forming a jacket layer of three or more cells, in thickness.
- Shortly before the development of the spore mother cells a nutritive tapetal layer is formed around the

- This layer is partly formed from the inner-most layer of jacket cells and partly from sporangial cells found just beneath the sporogenous tissue.
- As found in most other pteridophytes, in *Lycopodium* there is no disintegration of the Tapetum during spore formation.

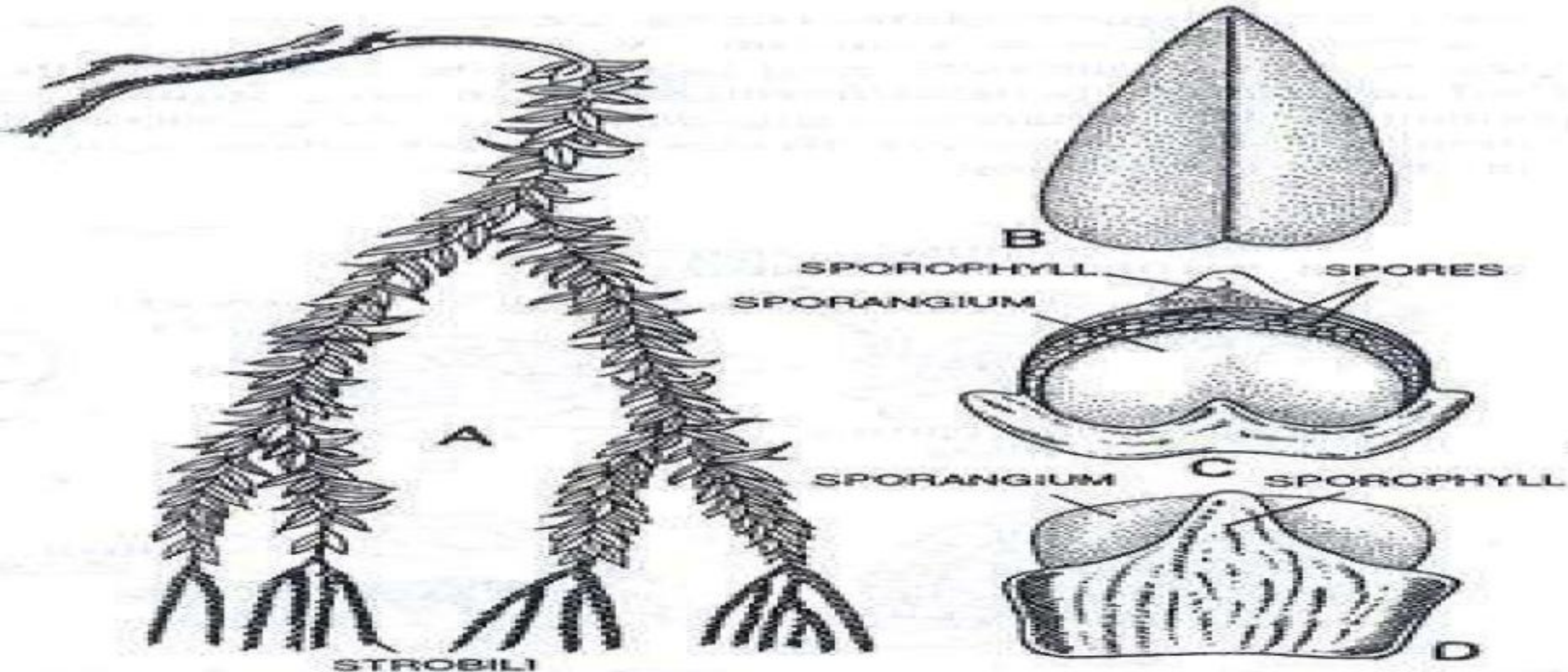


Fig. 27.9. *Lycopodium phlegmaria*. A, drooping plant with strobili

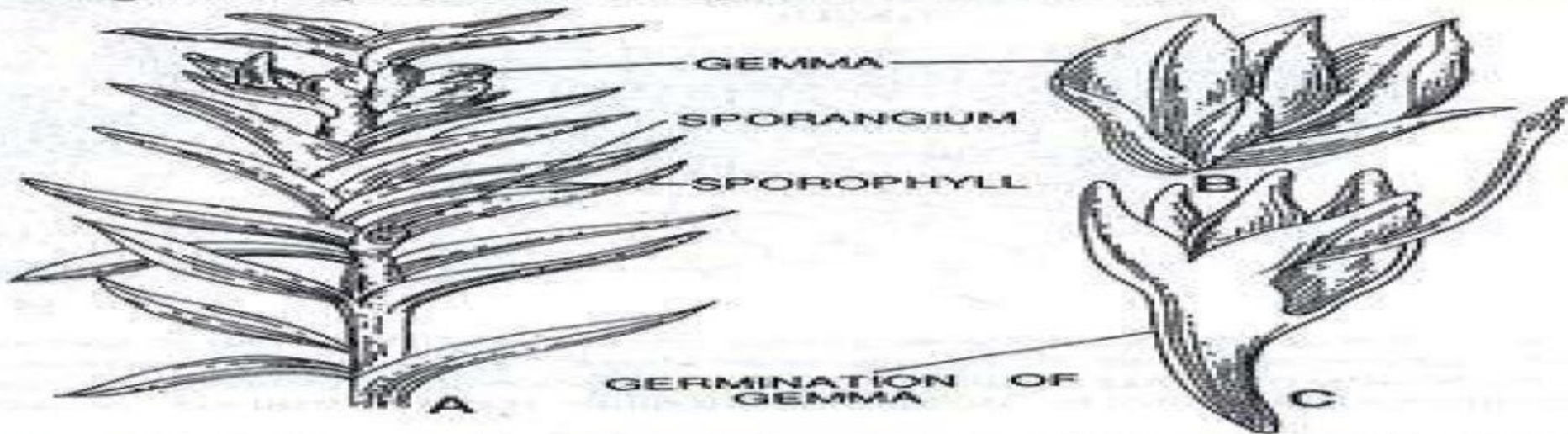


Fig. 27.10. *Lycopodium*. Vegetative reproduction. A, part of stem of *Lycopodium lucidulum* bearing gemmae; B, single gemma; C, germinating gemma of *L. selago*.

Dehiscence of sporangium:

The mature sporangium is about **2 mm across** and **kidney-shaped**. On the maturity of the sporangium narrow transverse strip of cells, the stomium is formed across the apical portion of the outermost jacket layer.

The cell walls of the stomial portion become thickened and may easily be differentiated from those of other cells present in the jacket layer of the sporangium. The mature sporangium ruptures by a transverse slit at its apex along the line of the stomium. The sporangium divides into two valves which remain united at the base and dehiscing the yellow spores

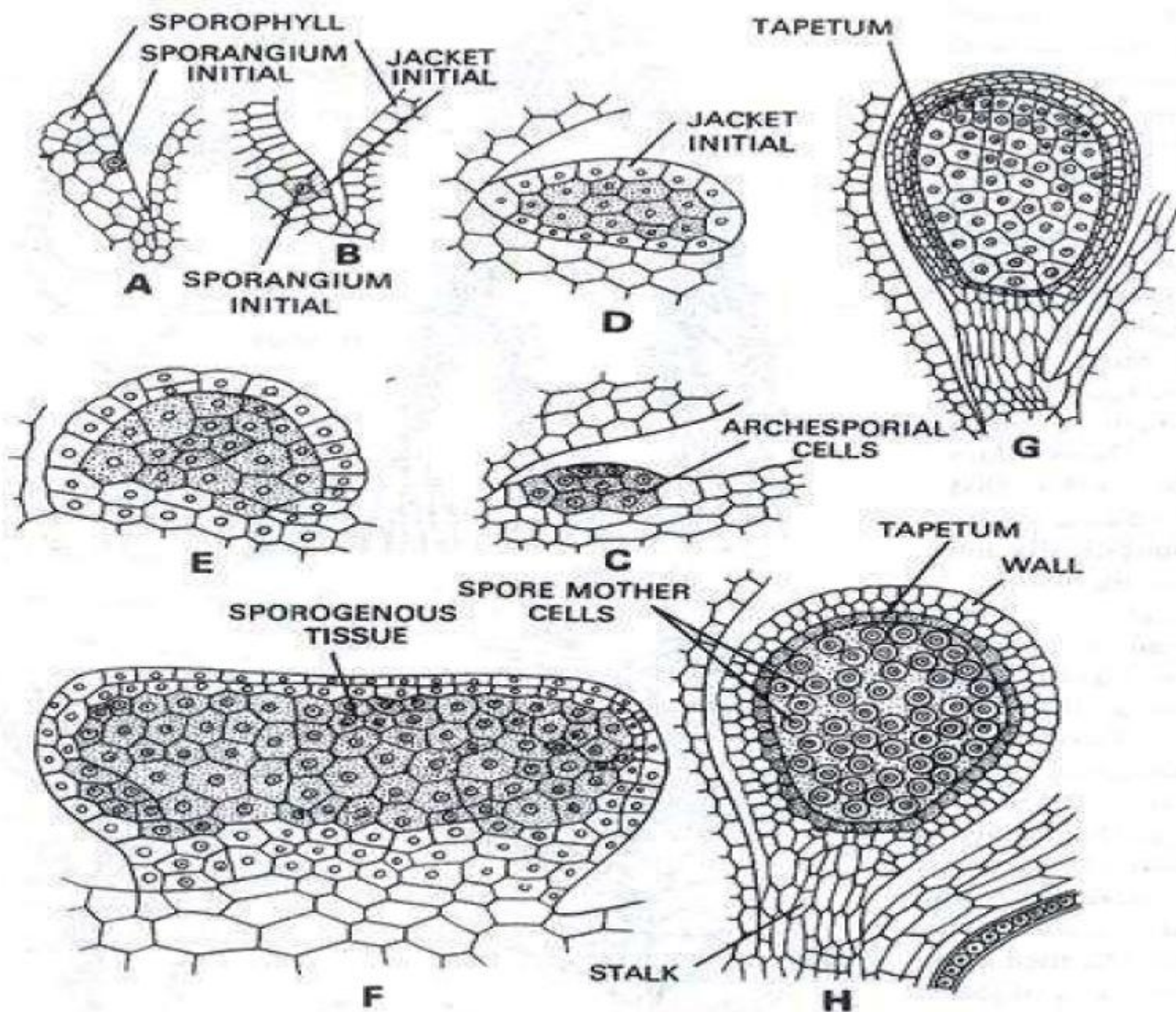


Fig. 27.11. *Lycopodium* sp. Development of sporangium-A, radial section through base of young sporophyll showing sporangial initial, B, slightly later stage; C-E, successive stages in the development of sporangium; F, sectional view of young sporangium showing sporogenous tissue; G, radial section of a later stage, showing development of tapetum; H, stalked sporangium about to mature containing spore mother cells.

The Gametophyte

The spore:

The small spores (*about .03 to .05 mm.* diameter) are uniform in size and shape, i.e., **homosporous**. This way Lycopodium is similar to most of the ferns and Equisetum. The spores are **round or tetrahedral** in shape.

Germination of spore and development of prothallus:

- The spores settle on the ground after their liberation from the sporangium and each germinates into a prothallus

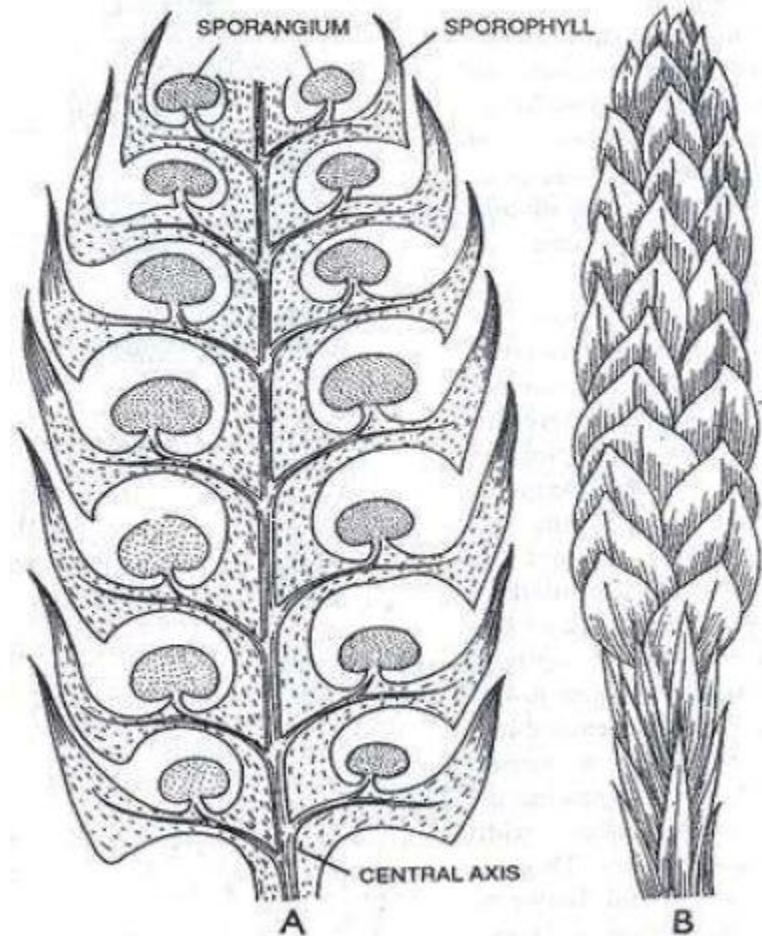


Fig. 27.12. *Lycopodium clavatum*. A, L.S. of strobilus bearing sporophylls and sporangia; B, a strobilus.

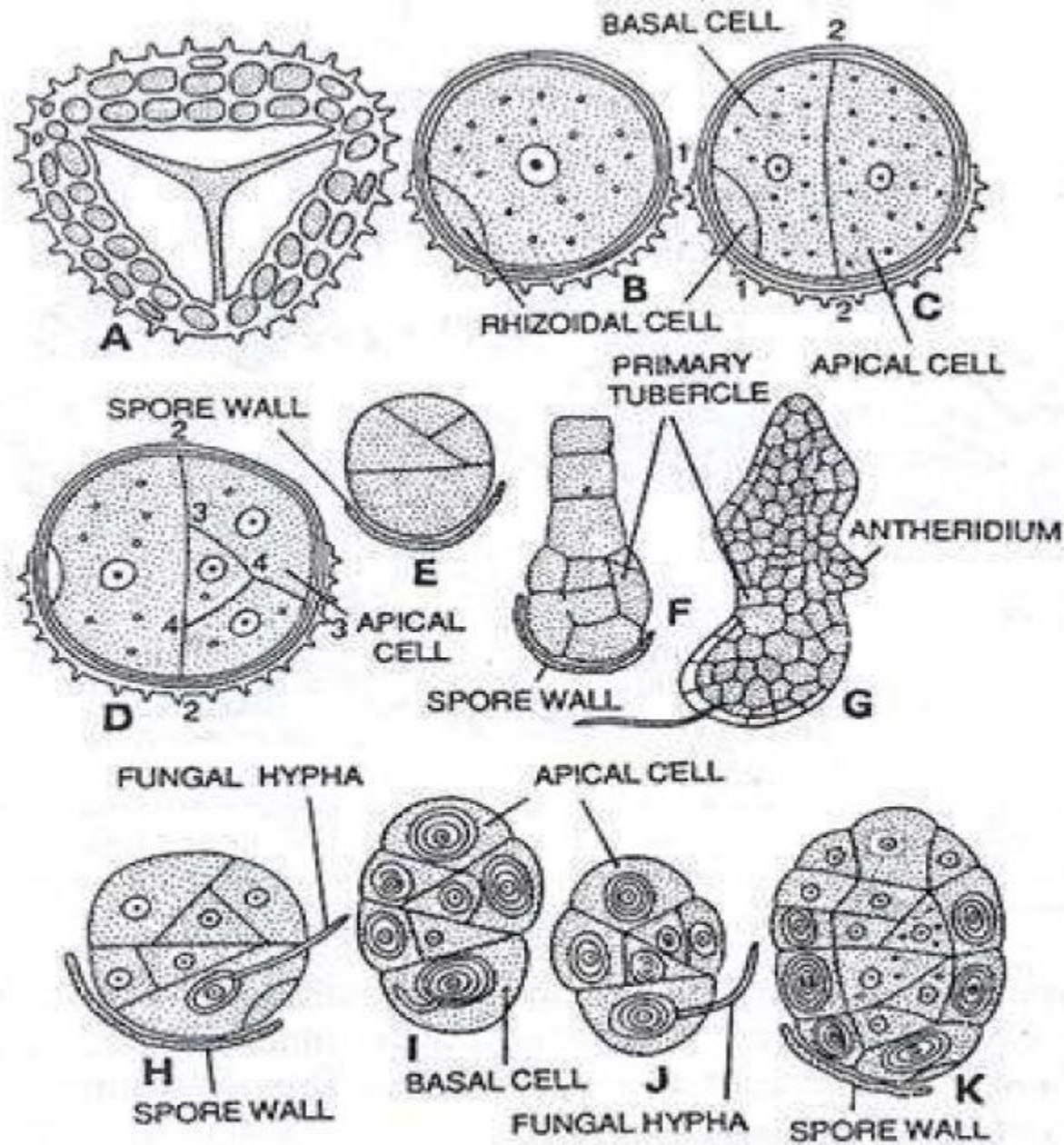


Fig. 27.15. *Lycopodium* spp. Spore germination and development of gametophyte. A, spore of *L. clavatum*; B-D, early stages in the development of gametophyte of *L. clavatum*; E-G, early stages in the development of gametophyte of *L. cernuum*; H-K, gametophytes of *Lycopodium* showing origin of mycorrhizal association.

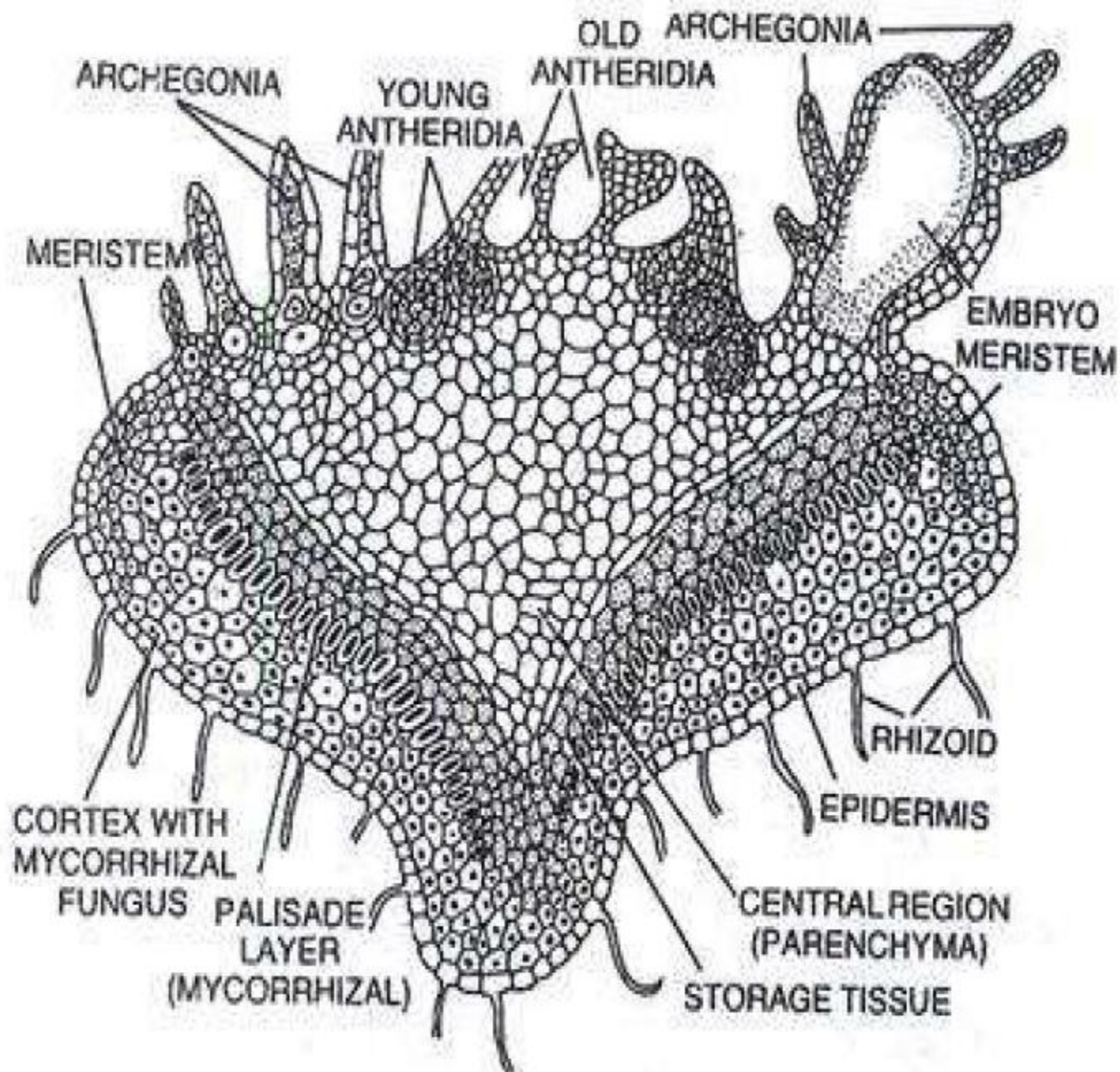
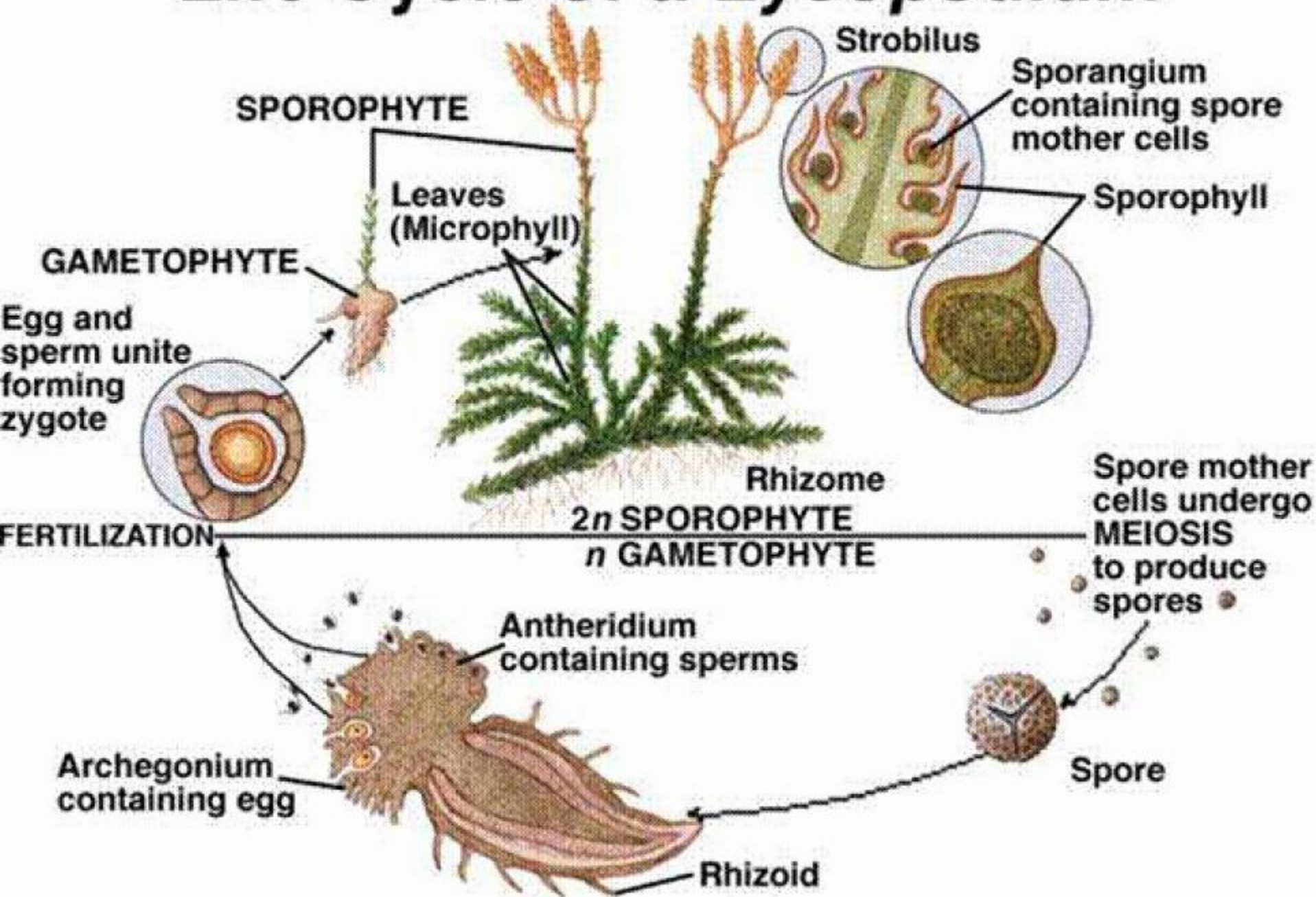


Fig. 27.16 (a). *Lycopodium clavatum*. Gametophyte; median vertical section through a mature prothallus* showing mycorrhizal zone, archegonia, antheridia, embryo, etc.

Life Cycle of a *Lycopodium*



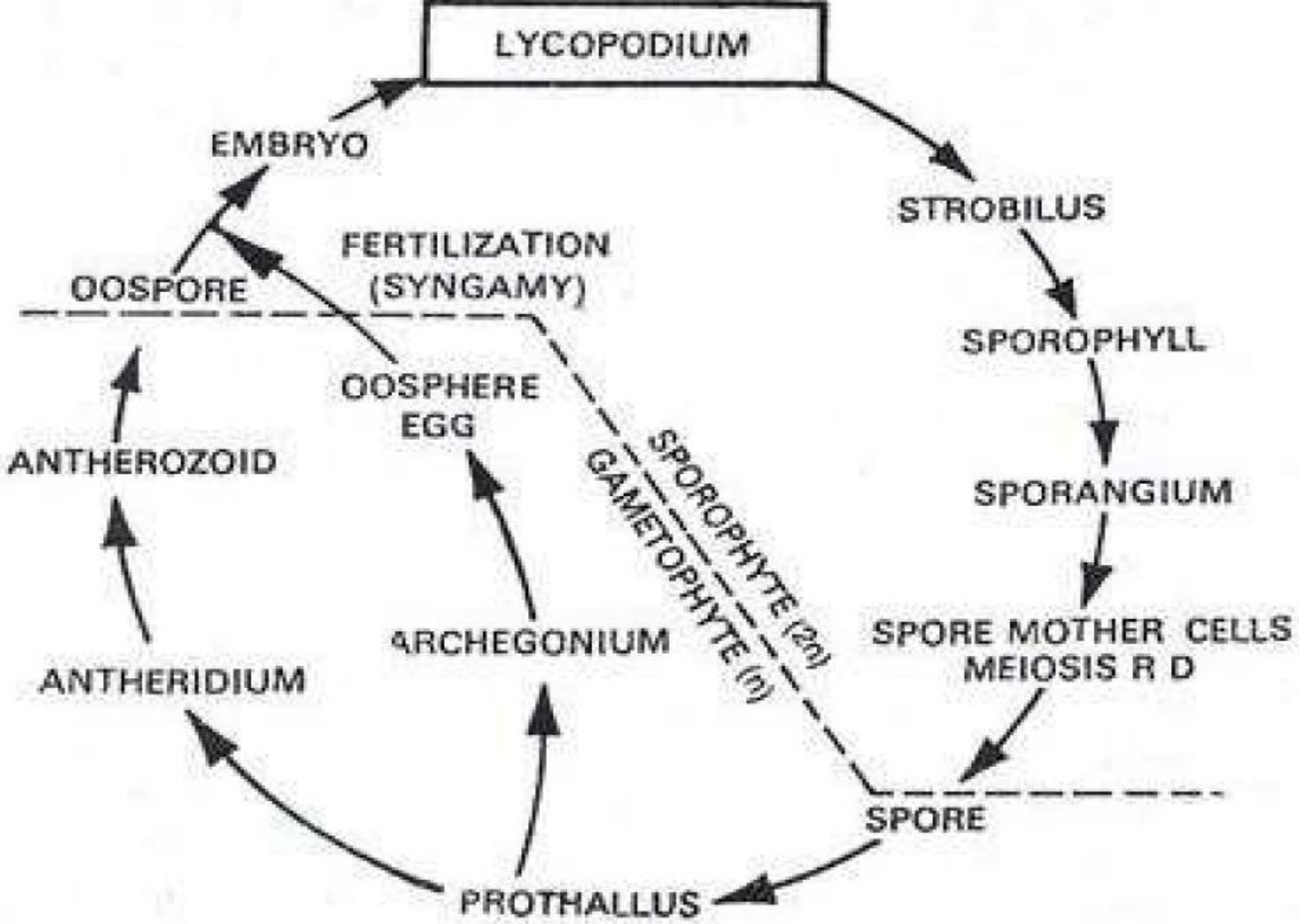


Fig. 27.27. *Lycopodium* sp. Graphic life-cycle.

Economic Importance.

- *Lycopodium* sp. herb has been used in the traditional Austrian medicine internally as tea or externally as compresses for treatment of disorders of the locomotor system, skin, liver and bile, kidneys and urinary tract, infections, and gout.
- *Lycopodium* powder is also used to determine the molecular size of oleic acid.



**Thank
You!!!**