Course : B.Sc. Botany

Semester: II

Paper Code: BOT CC-204

Paper Name: Archegoniate

Topic: Psilotum

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Psilotum

Systematic Position

Division – Psilophyta

Class – Psilopsida

Order – Psilotales

Family- Psilotaceae

Genus- Psilotum

Occurrence

Psilotum is represented by two species P.nudum and P. flaccidium .P. nudum is mostly found throughout the tropic and subtropic region. In India , it commonly grows in Panchmari hills , Bengal , Assam and kullu . The epiphytic plant grows as pendant on branches of trees like P. flaccidium.

The plant body (The adult sporophyte)

External features

- The plant body is generally small , usually 20 cm high but sometimes they may reach upto 100 cm.
- The plant body is differentiated into- basal , subterranean rhizome and aerial shoot .
- It is dichotomously branched and bears no roots or leaves.
- It bears large number of filamentous , long thin rhizoids . The rhizoids are coated with cuticle . They perform the function of anchorage and absorption.
- The aerial branches arise as tubular elongation of rhizomatous branches which turn upwards.
- The basal portion of aerial shoot is ribbed and multiangular whereas the upper portion is radially symmetrical.
- The aerial portion bears minute scale like leaves . The process of photosynthesis is performed by aerial stem as the leaves are small , scale like and non – vasculated.

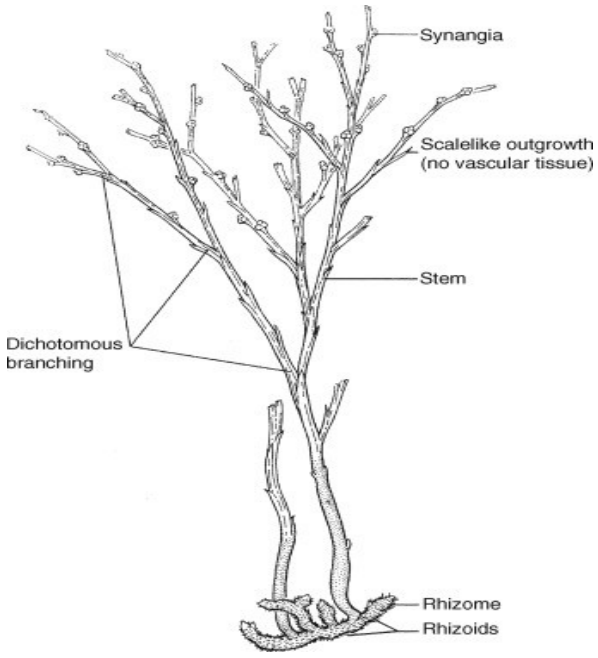

Fig: Habit of Psilotum

Internal features

Anatomy of rhizome

- The T.S is almost circular in outline. It shows 3 distinct regions – epidermis, cortex and stele.
- The cuticularisd epidermis consists of rectangular or square cells, not much different from the underlying cells.
- The cortex is divisible into 3 regions-
  1. Outer - The cells are thin walled and parenchymatous containing the hyphae of endophytic mycorrhiza.
  2. Middle – The cells are thin walled and parenchymatous with abundant starch grains.
  3. Inner – The cells are small , thin walled and parenchymatous.They are coloured brown due to the presence of tannin. Tannin undergors condensation and oxidation and imparts dark brown colour to the inner cortex due to the deposition of phlobaphene.
- Endodermis separates cortex from stele and bears casparian strips.
- The centrally located stele is protostele.

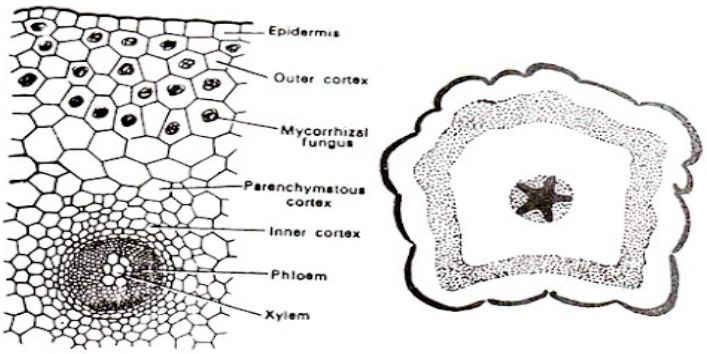

Fig. 20. *Psilotum* : T.S. of Rhizome.
A. Sector Enlarged, B. Ground Plan.

Anatomy of stem

- The T.S appears slightly triangular in outline.
- It shows 3 distinct region – epidermis , cortex and stele .
- The epidermis comsists of single layered rectangular cells . The outer tangential walls are highly cutinised and covered by a definite cuticle . Stomata are slightly sunken and are situated mainly in areas between the longitudinal ribbons.
- Cortex is divisible into 3 zones :
    1. Outer cortex -This is the photosynthetic region . These cells contain numerous small chloroplasts.
    2. Middle cortex – This zone is made of thick walled cells . The cells are sclerenchymatous and becomes progressively towards the inner zone.
    3. Inner cortex – It is many celled, broad , parenchymatous and contains numerous starch grains.
- The stele is actinostelic , generally with 6 lobes .
- Centre of the xylem is occupied by thick walled sclerenchymayous fibres with simple pits on their walls .

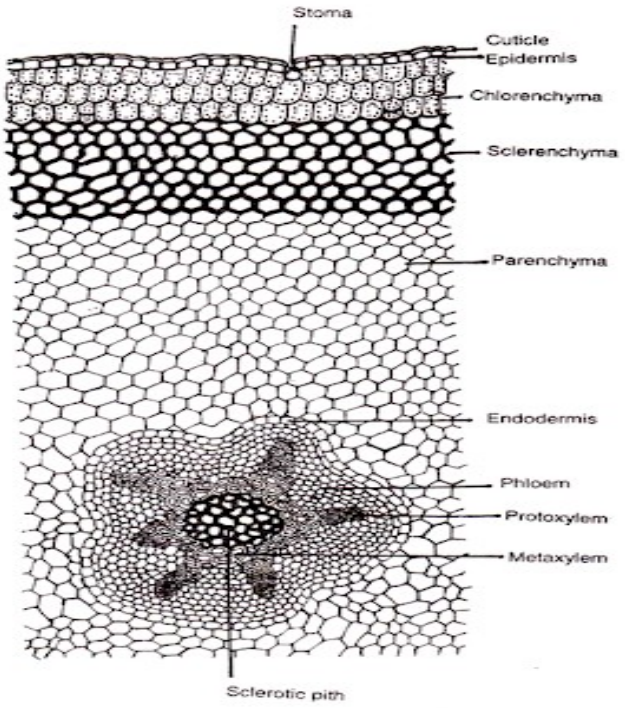

Fig. 21. *Psilotum* : T.S. of Aerial Shoot (a sector enlarged)

Anatomy of leaf

- The leaf is divisible into – epidermis , cortical tissue and a small leaf trace if present.
- The epidermis consists of thin walled cells while the rest of the foliar appendage is filled by photosynthetic tissue.
- A leaf trace ends into the base of foliar appendage (e.g. in P. flaccidium), however , in P. nudum there is no vascular bundle.

Vegetative Reproduction

- The plant propagates vegetatively by means of gemma.
- The gemma are multicellular but one celled thick body which are oval in shape.
- They arise on prothallus of sporophytic plant body as well as on pothallus of the gametophytic plant.

Spore producing organs

- The spores are produced inside special trilobed structure called synangium.
- Each synangium is considered as fusion of 3 sporangia.
- The synangia are borne on the axil of foliar leaves on the upper portion of aerial branch.

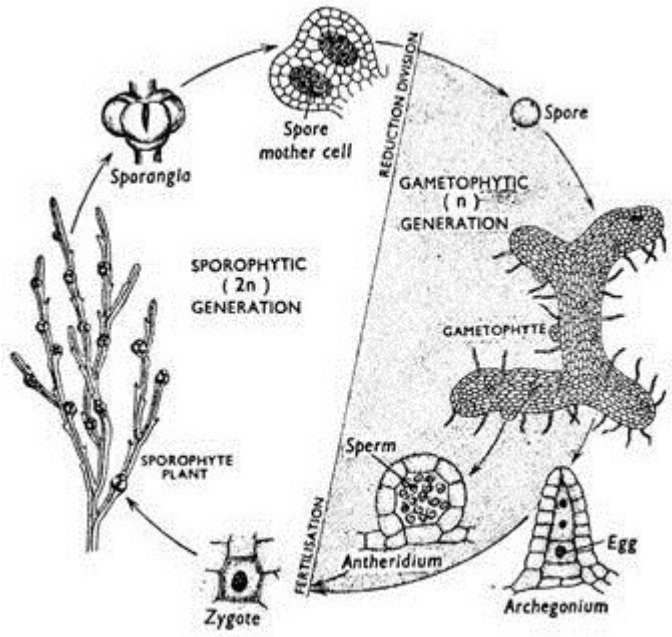

Fig. 7.22 : Life cycle of *Psilotum*

Development of synangium

- The development of synangium in Psilotum starts with distinct group of initials formed below the apex and each one of them develop into single sporangium .
- Each initial cell divides by periclinal division and forms outer primary jacket initial and inner primary archesporial cell .
- The primary jacket initial forms outer 3-4 layer thick wall of sporangium and primary archesporial cell forms the sporogenous tissue .
- Most of the cells of the sporogenous tissue become spore mother cell while the other degenerate to produce nourishing fluid for developing spores.
- Each spore mother cell divides by meiosis and forms 4 haploid spores.

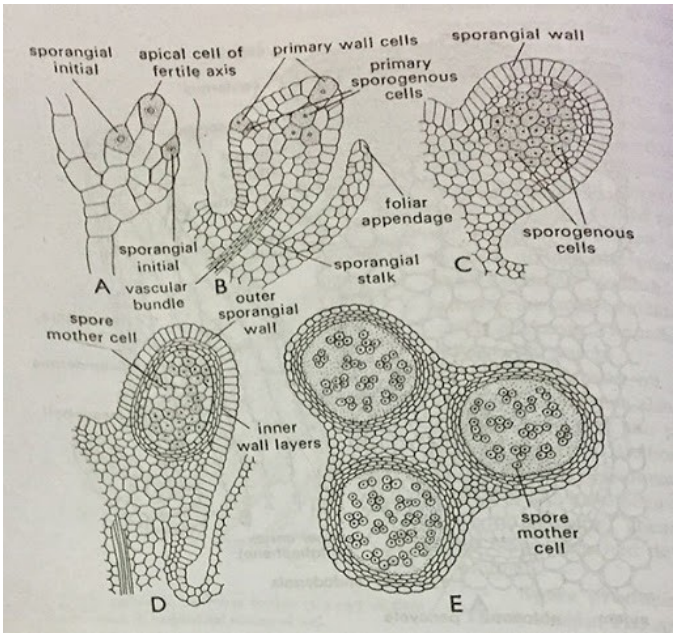

Fig :Psilotum : Development of synangium

Dehiscence

When the spore mother cells are undergoing reduction division , some of the wall cells thicken except in a small vertical row marking the future line of dehiscence. The synangium splits open along three longitudinal lines of dehiscence passing through the median line of each , liberating the spores.

Gametophyte :

Each spore germinates to produce a small thallose gametophyte or prothallus. The gametophyte is colourless and subterranean (underground). It has one two or more dichotomous branches . Gametophyte is infested with mycorrhizal fungi. There are no vascular strands in the gametophyte. It bears numerous unicellular rhizoids . The gametophyte does not have much internal differentiation of tissues. It is monoecious. The sex organs are produced near the growing apex. The male sex organ is antheridium and the female sex organ is archegonium.

Antheridia:

Antheridia are produced earliar than archegonia. The mature antheridium is globular in structure. It projects out on the surface of gametophyte.

Development of antheridium:

Each antheridium developes from a single superficial cell. It divides into an outer jacket initial and an inner primary androgonial cell . The jacket initial divides to produce a single layered wall. The primary androgonial cell divides to produce a mass of androcytes or antherozoid mother cells. Each androcyte gives rise to a single, coiled and multiflagellate antherozoid . The antheridial wall ruptures to release the antherozoid.

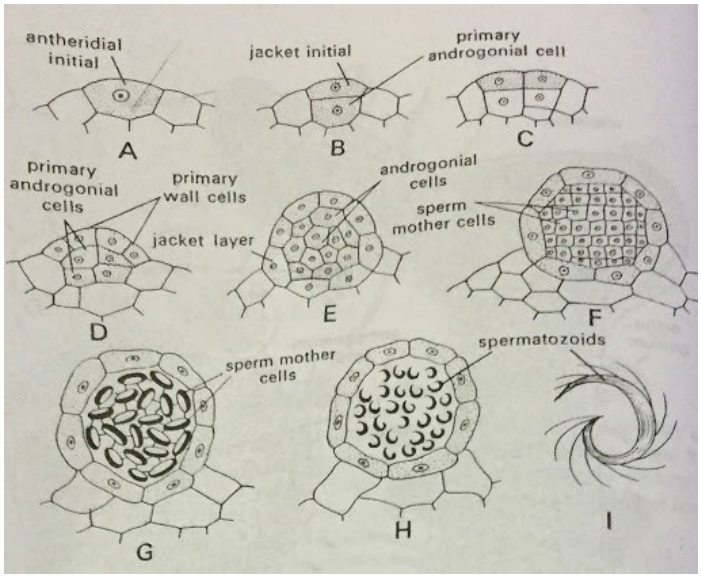

Fig: stages in the development of antheridium of Psilotum

Archegonium:

The mature archegonium consists of a neck and a basal part. The neck contains one or two neck canal cells. The basal part is embedded in the gametophytic tissue. It is without any well defined venter.It contains a single large oosphere.

Development of archegonium:

Each archegonium develops from a single superficial cell. It divides transversely into an upper primary cover cell and a lower cental cell. The primary cover cell divides to produce a group of four neck initials. These neck initial divides to produce neck. The central cell divides transversely

into a primary neck canal cell and a primary ventral cell. Primary ventral cell functions as an egg directly.

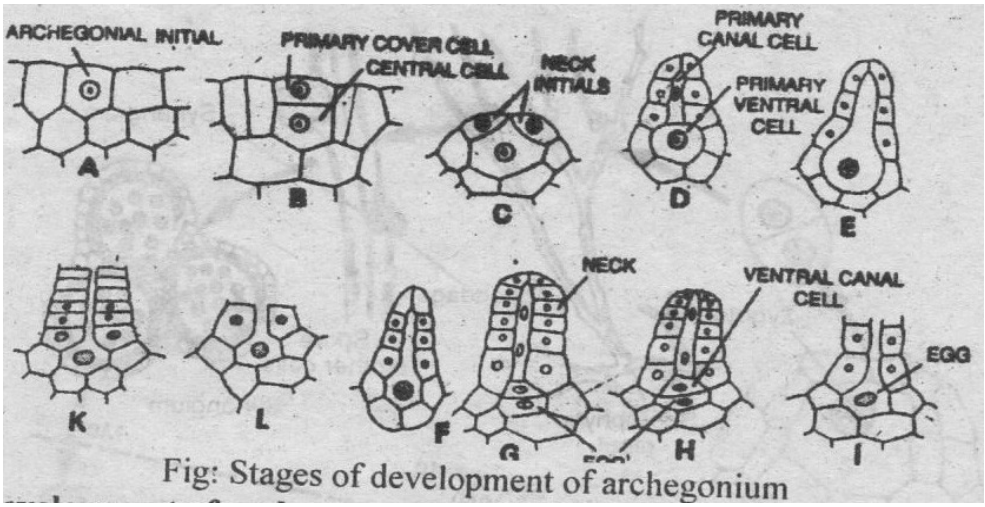

Fig: Stages of development of archegonium

Fertilization:

The neck canal cells of mature archegonium disintegrate. It produces a pore through which antherozoids enter the archegonium. Only one antherozoid fuses with the oosphere to produce oospore.