

Introduction- Psilotum

- Also known as WHISK FERNS
- **Vascularized member of genus fern**
- A member of family Psilotaceae
- **Lack true root (but Rhizomes) and leaves but stems (branched spore bearing) are developed with conducting tissues**
- Only two pure species of Psilotum exist along with a hybrid between these two
- **Gametophytes are underground saprophytic, sometimes even mycorrhizal**
- Nutrition of gametophyte is Myco-heterotrophic assisted by endosymbiotic fungi

Salient Features of Psilotum

- The sporophytes are dichotomously branched with an underground rhizome and upright branches.
- **The upright branches are leafless.**
- Rhizoids present instead of roots.
- **Stem have a relatively simple vascular cylinder.**
- The sporangia are borne in groups (trilocular) and form synangia.
- **Spores produced are all alike (homosporous).**
- The development of gametophyte is exosporic and form monoecious subterranean gametophyte.
- **The development of embryo is exoscopic.**

Whisk Ferns

- Have rootlike stems structures called **Rhizomes** to anchor (can't absorb water)
- May **asexually** reproduce from rhizomes
- **Sexually** reproduce by spores made in **Sporangia** (spore cases on the stems)



Taxonomic position

Division : Psilophyta
Class: Psilotopsida
Order: Psilotales
Family: Psilotaceae
Genus: Psilotum



Occurrence

- It is commonly called as whisk fern (because it is without fern and stem perform all function)
- Found in humus rich soil , in tropical and sub tropical regions.
- Some species grows as epiphytes (tree trunk)

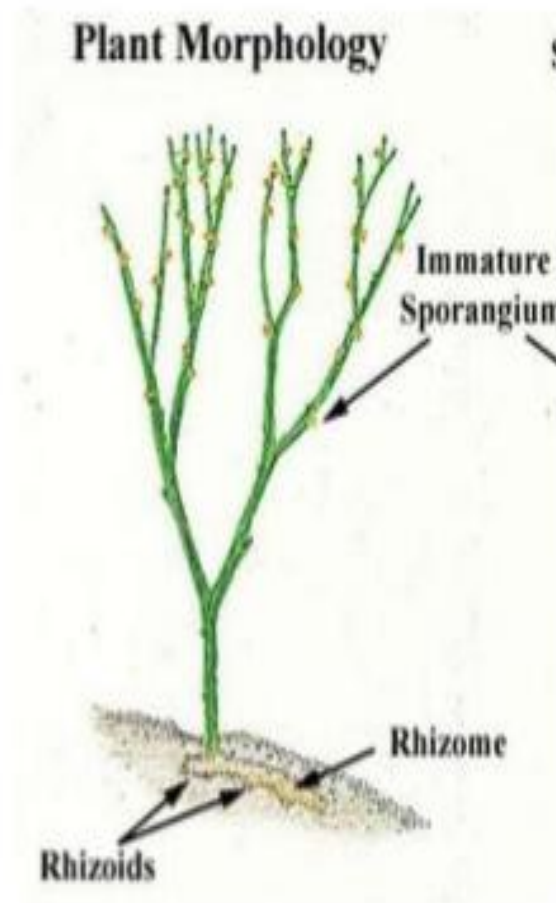


Vegetative morphology

Plant Body:

It is sporophyte and contains following parts

1. Rhizome
2. Aerial branch
3. Sporangia



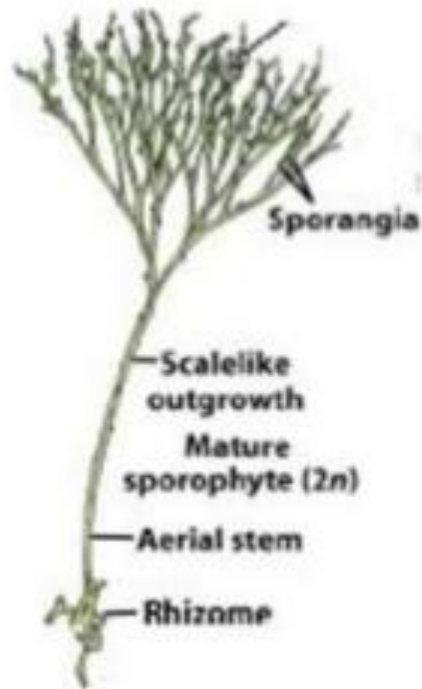
Rhizome

- The horizontal portion is rhizome
- Buried in soil or humus.
- Dichotomously branched
- 2 celled rhizoids are present near the apices of the younger branches
- These rhizoids absorb water and nutrients from soil for aerial branches



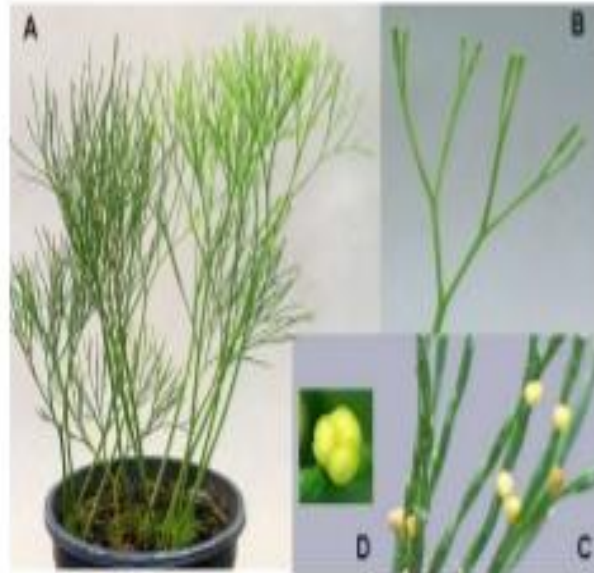
Aerial branch

- Rhizome bears aerial branches
- The branches are green, cylindrical and dichotomously branched
- The leaves are small, scale like and are scattered over these branches.



Sporangia

- The sporangia are borne in triads.
- They have very short stalks.
- They are borne in the axils of small bifid leaves on the aerial branches.
- This triad of sporangia is called a **synangium**.
- The two lobes of the leaf are closely united with the synangium.

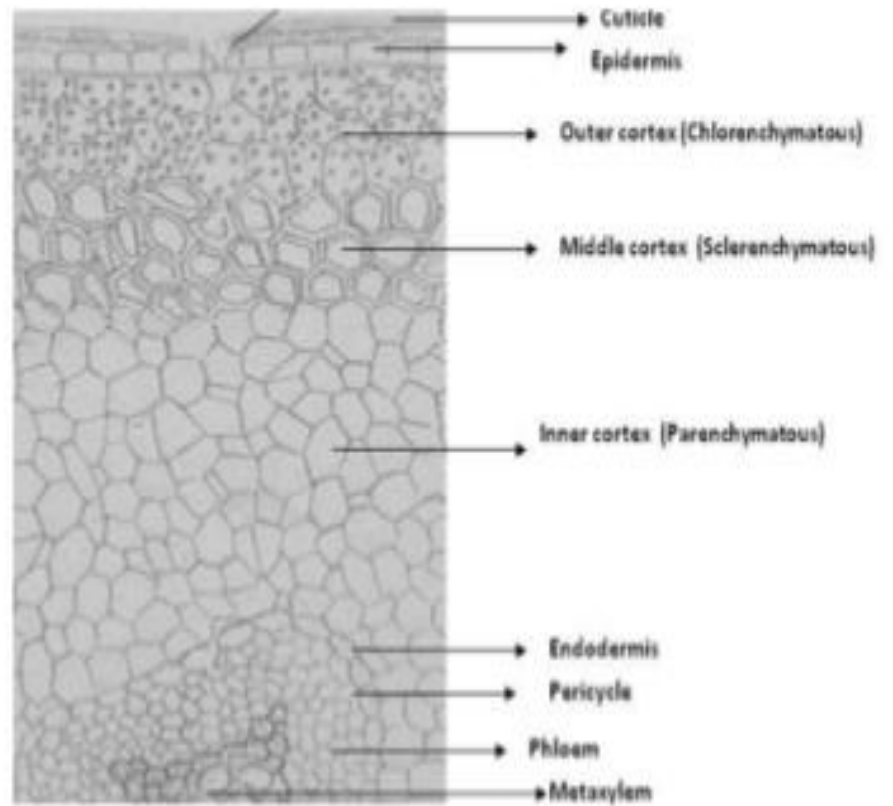


Stem Anatomy

It is circular in outline from base, pentagonal near the first dichotomy and triangular between successive dichotomies .

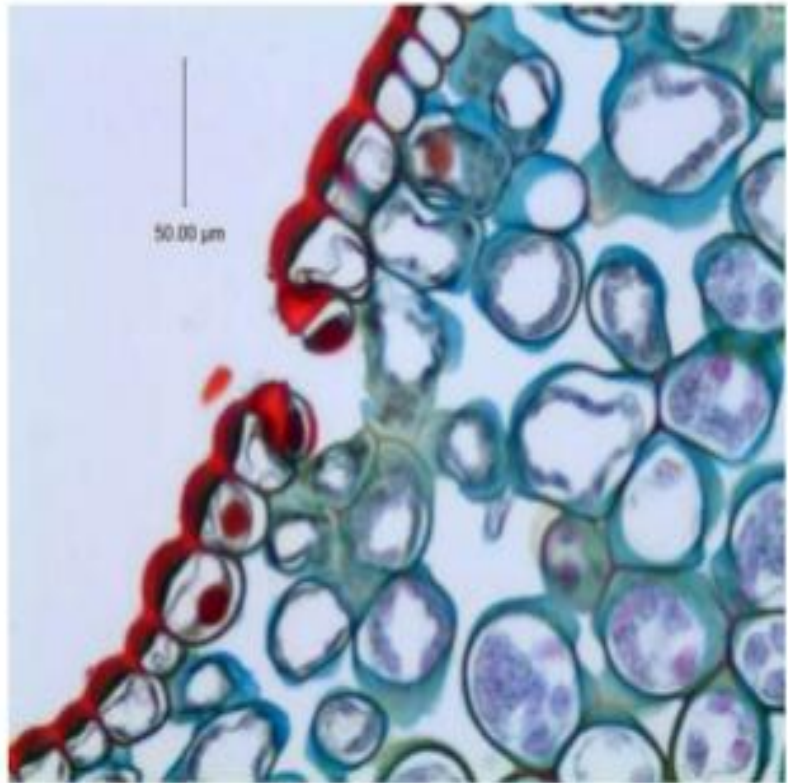
It has following parts.

1. Epidermis
2. Cortex
3. Stelar system



1: Epidermis

- There is a single layer of epidermis present outside
- It is heavily cutinized
- Stomata are also present on epidermis , situated at the grooves

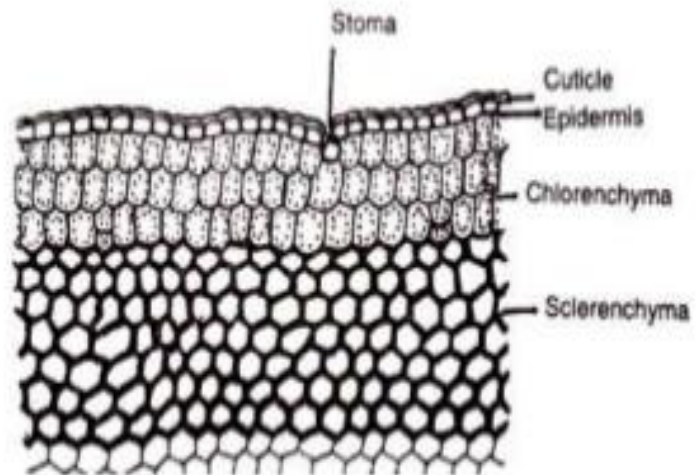


Cortex

b) Sclerenchymatous cortex

Below the parenchymatous cells there are 2-4 layers of sclerenchymatous cells .

The cells are thick walled and provide support

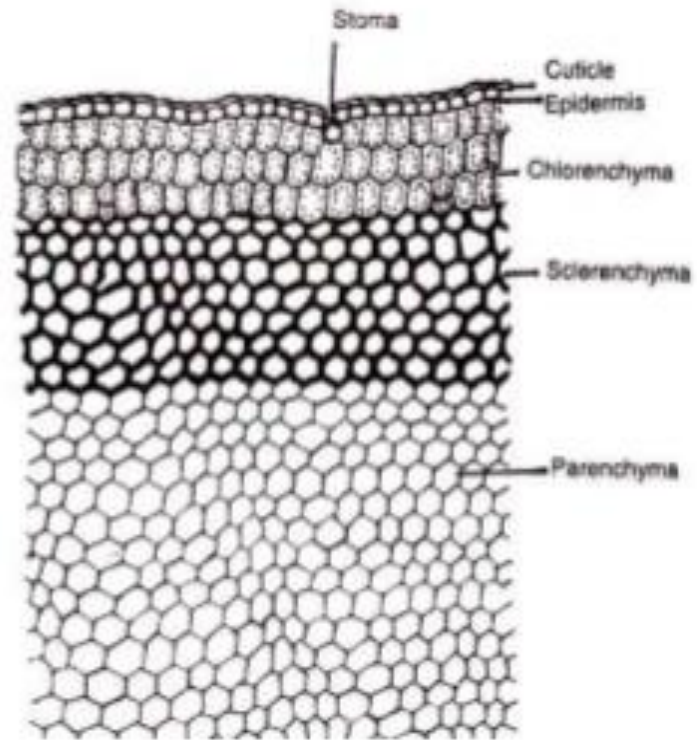


Cortex

c) Parenchymatous

They form the major portion of the stem.

The cells are thin walled and no inter cellular spaces in them



Stelar system

The stele of *Psilotum* consists of following parts a, while pericycle and pith are usually absent.

1. Endodermis

There is well developed endodermis between the stele and the cortex. These cells has casparian bands on their radial walls

2: Xylem :

The xylem is actinostelic and radial in outside in 6 rays, the protoxylem is located at the tip of the rays. In the center the metaxylem xore is present

The cells of xylem are thick walled and their main function is transport of nutrients

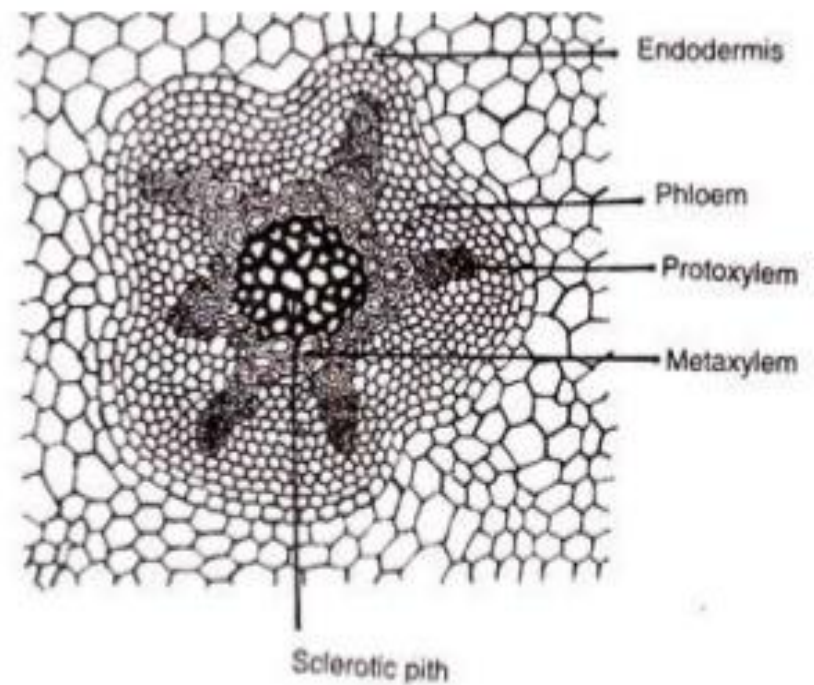


Fig. 21. *Psilotum* : T.S. of Aerial Shoot (a sector enlarged)

Stelar system

4: Phloem

Between the endodermis and the xylem there is phloem.

It is of thin walled cells

It consist of sieve cells and sieve areas in their oblique end walls. Nuclei disintegrate at maturity

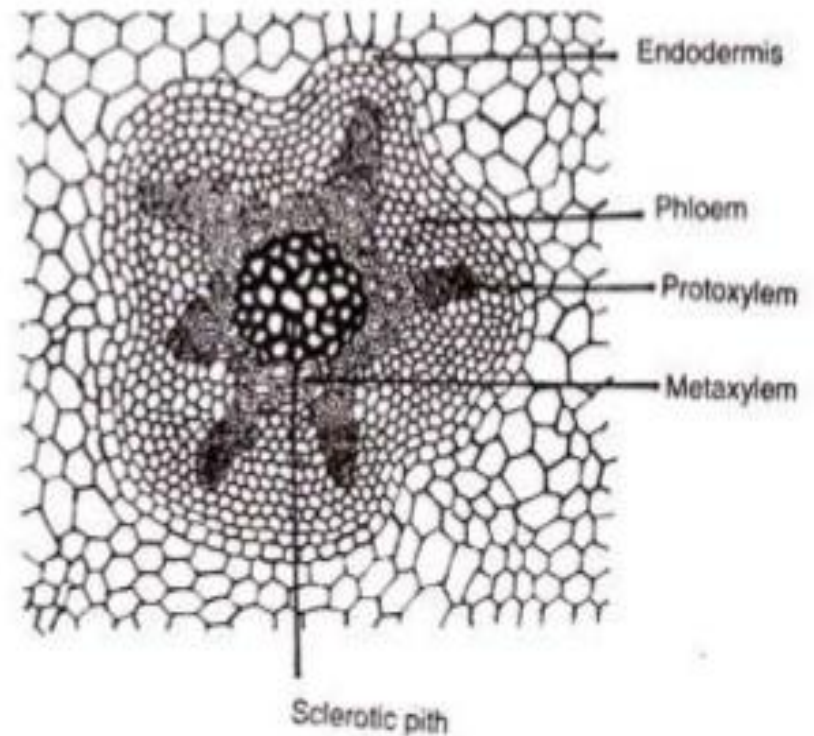


Fig. 21. *Psilotum* : T.S. of Aerial Shoot (a sector enlarged)

Anatomy of rhizome

In rhizome the epidermis is inconspicuous and all the cells of outermost layer of cortex extend into rhizoids.

The cortex is thin walled and cells contain fungus

The endodermis is conspicuous

The stele in rhizome is protosteles (xylem is surrounded by phloem)

The pith is absent

And xylem occupies center of the axis and surrounded by the phloem

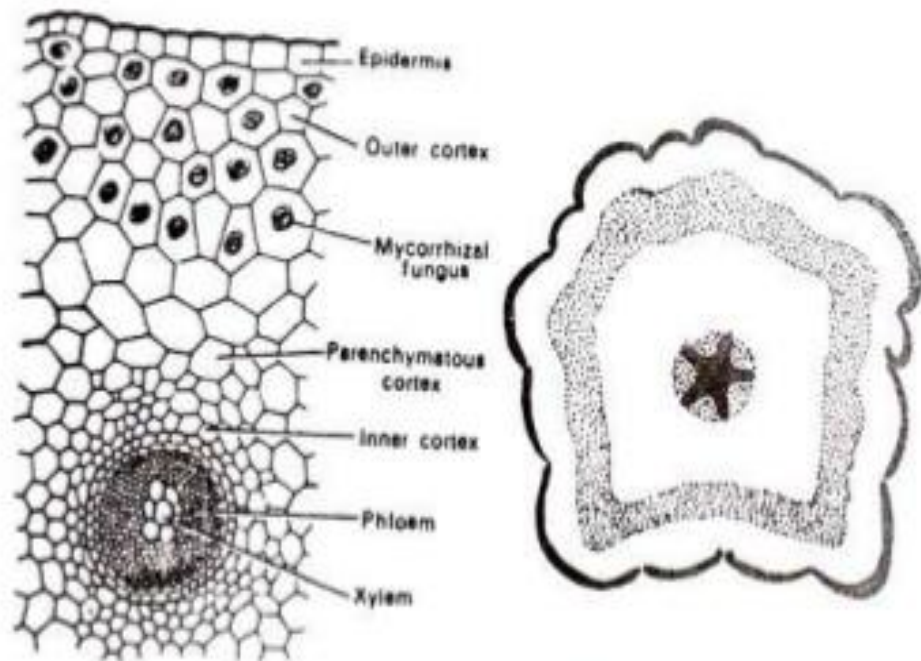


Fig. 20. *Psilotum* : T.S. of Rhizome.
A. Sector Enlarged, B. Ground Plan.

Reproduction

- It is characterized by alternation of generation
- Both spore producing and gamete producing regeneration are independent
- Sporophyte reproduces by asexual reproduction
- Gametophyte reproduces by sexual reproduction



Asexual reproduction (the sporophyte)

Sporophytes reproduces by formation of asexual reproductive units ,

Called as spores , produced in complex trilobed structure synangium



Structure of synangium

Each synangium is trilobed , stalked structure borne at the apex of short lateral branch .

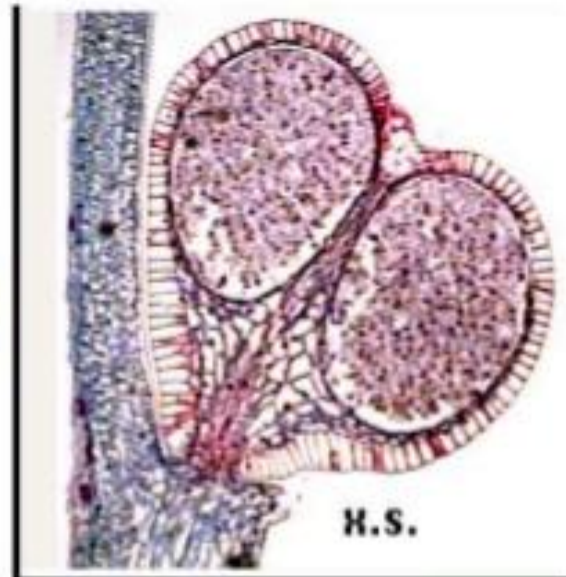
A bilobed appendage is present at the base of each synangium that curve and surround the stalk of synangium



Nature of synangium

There are different views

1. The trilobed synangium is formed by fusion of two or more sporangia
2. One sporangium with 3 chambers (trilocular sporangium)
3. Synanium is cauline (developed at the apex of stem) in nature and it is actually modified trilocular sporangium present on lateral branches
4. This concept was suggested by Bierhorst (1956) according to him each unit in synangium represents a condensed fertile axis. The synangium in *Psilotum* can be considered as homologous to fertile portion of (*Rhynia*) where one arm is fertile and other is sterile . The condensation of fertile arm is modified into synangium .the bract modified to surround the synangium



***Psilotum*
Sporangium**

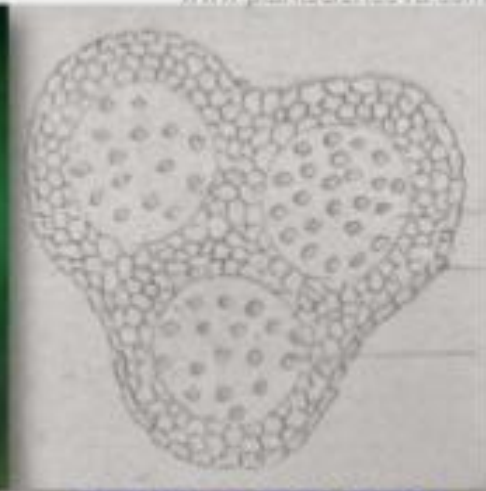
Structure of synangium

It consists of three chambers or locules.

1. Wall of synangium is 3 – 4 layers
2. Thick outer wall forms the epidermis
3. Inner wall separates the three locules
4. Each locule is filled up with large number of spore. And these are homosporous in nature
5. Synangium splits up from 3 lines along the epidermis and dehiscence occurs.



SYNANGIUM



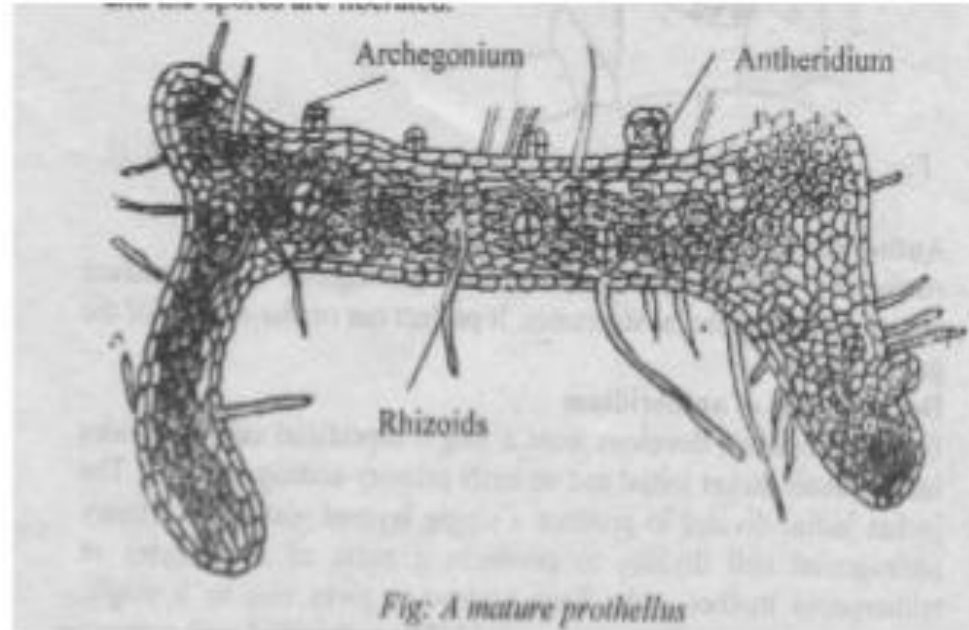
SYNANGIUM CROSS SECTION

Sexual reproduction (**gametophyte**)

The **gametophyte** lives underground as a saprophyte, sometimes in a mycorrhizal association. When the **gametophyte** is mature, it produces both egg and sperm cells. ... The **gametophyte of Psilotum** is unusual in that it branches dichotomously, lives underground and possesses vascular tissue.

The gametophyte of *Psilotum* is called as Prothallus .

It contains parenchyma cells and there is strand of tracheids extending back from the apex.



Life Cycle of *Psilotum*

