

# **EARLY LAND PLANTS**

## ***Cooksonia and Rhynia***

**CORE COURSE 4: ARCHEGONIATAE AND  
PALEOBOTANY  
(FOR BOTANY SEM II HONOURS)**

Dr. Rimi Roy

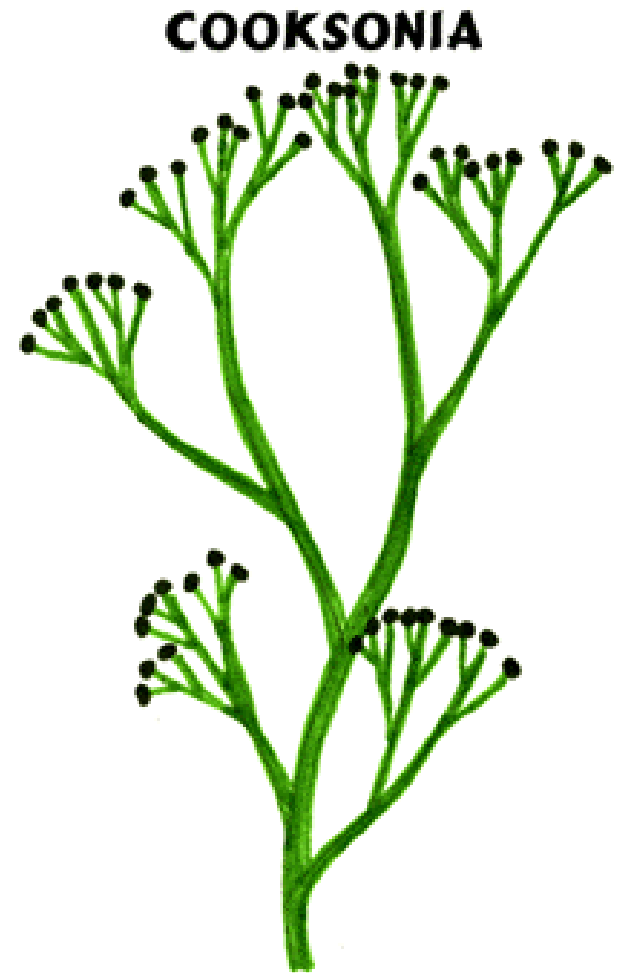
# SYSTEMATIC POSITION

DIV	PTERIDOPHYTA
CLASS	Rhyniopsida
ORDER	Rhyniales
FAMILY	Cooksoniaceae

- It is an extinct grouping of primitive land plants, ranging in age from middle-upper Silurian to lower Devonian.

- Cooksonia* fossils are distributed globally and described from places like Ireland, South Wales, Scotland, Germany, Czechoslovakia, Russia, N. Africa and N. America.

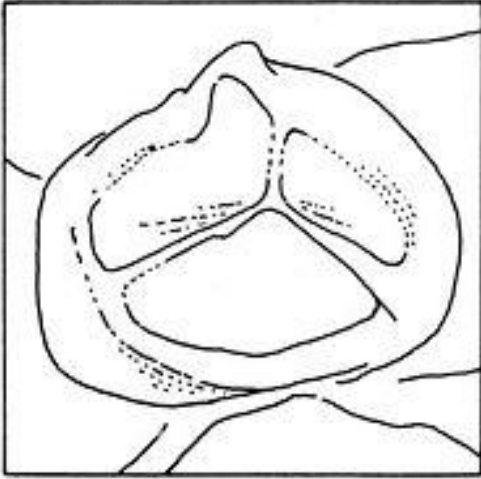
- Cooksonia* includes the oldest known plant to have a stem with vascular tissue.



The oldest known vascular plant is *Cooksonia*. Branches on this plant were about 6.5 cm long. Sporangia were terminal, that is, on the tips of the branches

# MORPHOLOGY

- Only the sporophyte phase of *Cooksonia* is currently known.
- Individuals were small, a few centimetres tall, and had a simple structure.
- They lacked leaves, flowers and roots — although it has been speculated that they grew from a rhizome that has not been preserved.
- They had a simple stalk that branched dichotomously a few times. Each branch ended in a sporangium.
- Sporangia were more-or-less trumpet-shaped with a 'lid' or operculum which disintegrates to release the spores.
- The existence of four different types of spores in *C. pertoni* has been proved from smooth to ornamented ones.



**SEM-photo of a spore of *C. pertoni* (diameter 30µms; drawing J. Hulst)**

Name of few species:

*Cooksonia pertoni*

*Cooksonia paranensis*

*Cooksonia acuminata*

*Cooksonia cambrensis*

# RHYNIA

- Systematic Position:

DIV PTERIDOPHYTA

CLASS Rhyniopsida

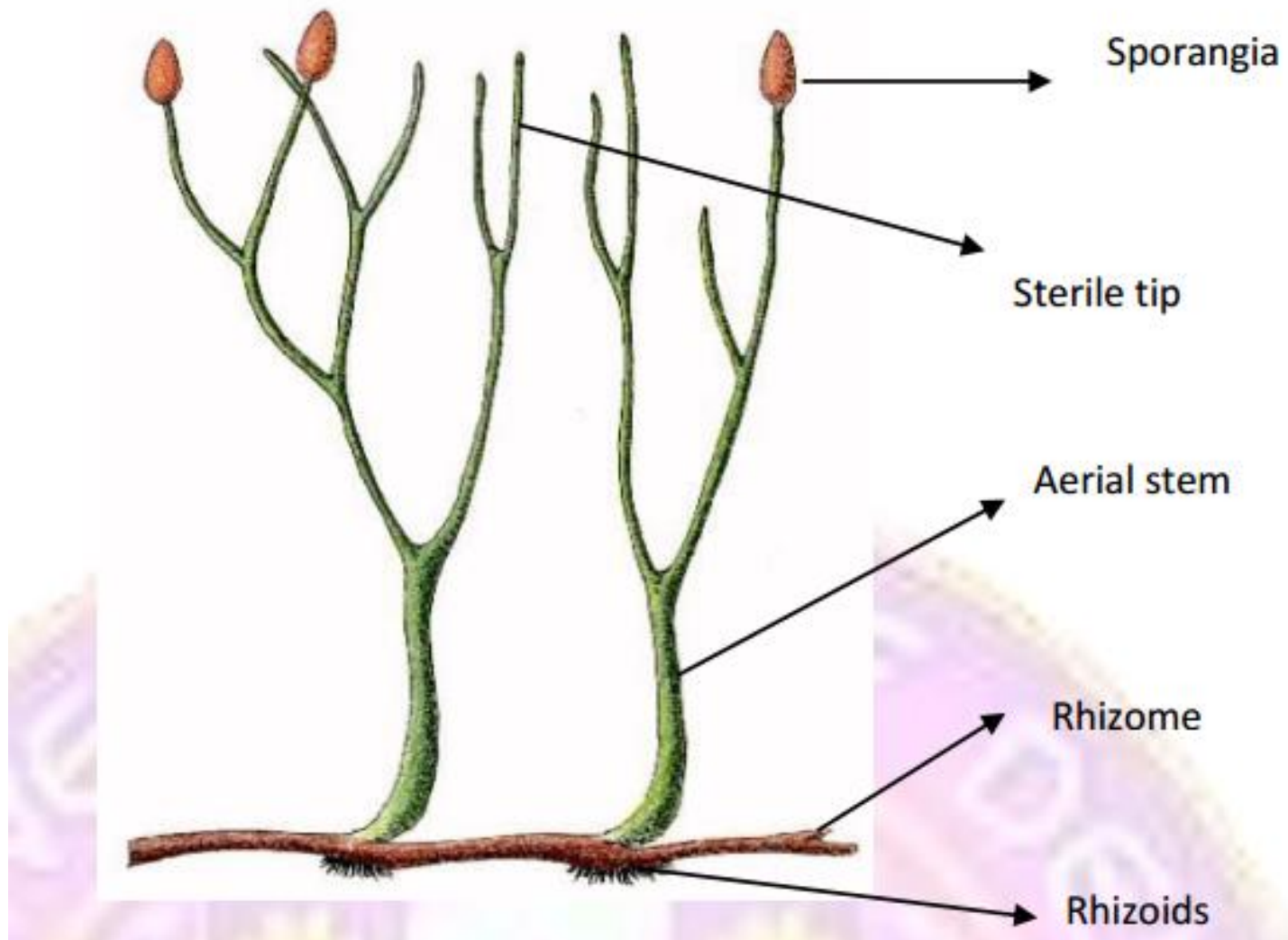
ORDER Rhyniales

FAMILY Rhyniaceae

- Geological occurrence: Lower Devonian
- Geographical distribution: species is known only from the Rhynie chert in Aberdeenshire, Scotland

# MORPHOLOGY

- Kidston and Lang (1917) discovered the fossils of Rhynia. Two species *R. major* and *R. gwynne-vaughani* were found preserved as whole plants in petrified condition. They grew in the vicinity of a silica-rich hot spring.
- Rhynia was herbaceous plant.
- The plant body consisted of a subterranean, prostrate, cylindrical and dichotomously branched rhizome which had dichotomously branched leafless aerial shoots.
- The aerial shoots of *R. major* were estimated to be 50 cm long and 6 mm in diameter and those of *R. gwynne-vaughani* were comparatively smaller.
- The plant lacked roots, but tufts of rhizoids present towards lower portion the rhizome.
- Many adventitious branches were found on the rhizome and aerial shoots and they were probably means of vegetative propagation.
- The aerial branches bore pear-shaped terminal sporangia.



**Morphology of *Rhynia***

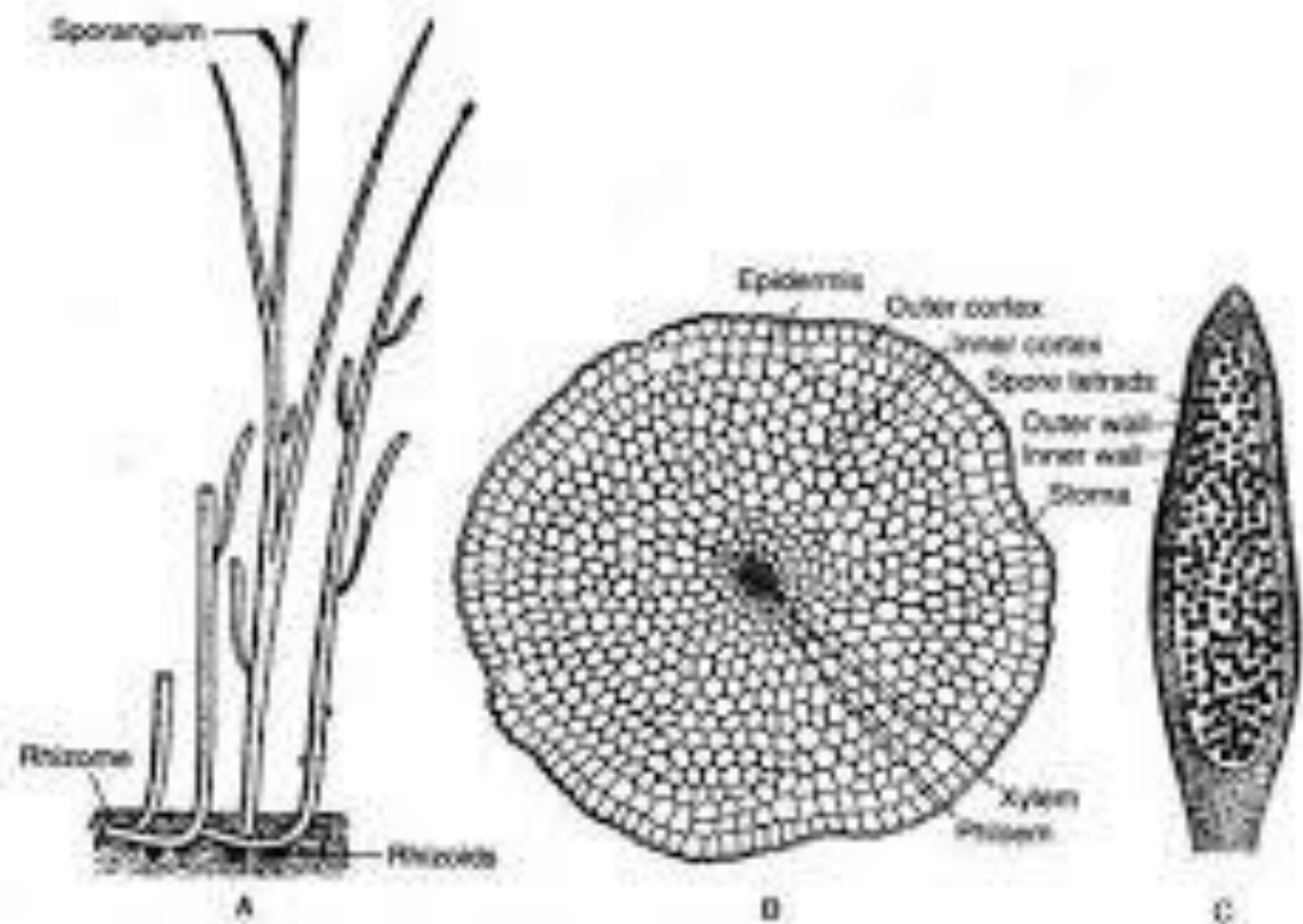
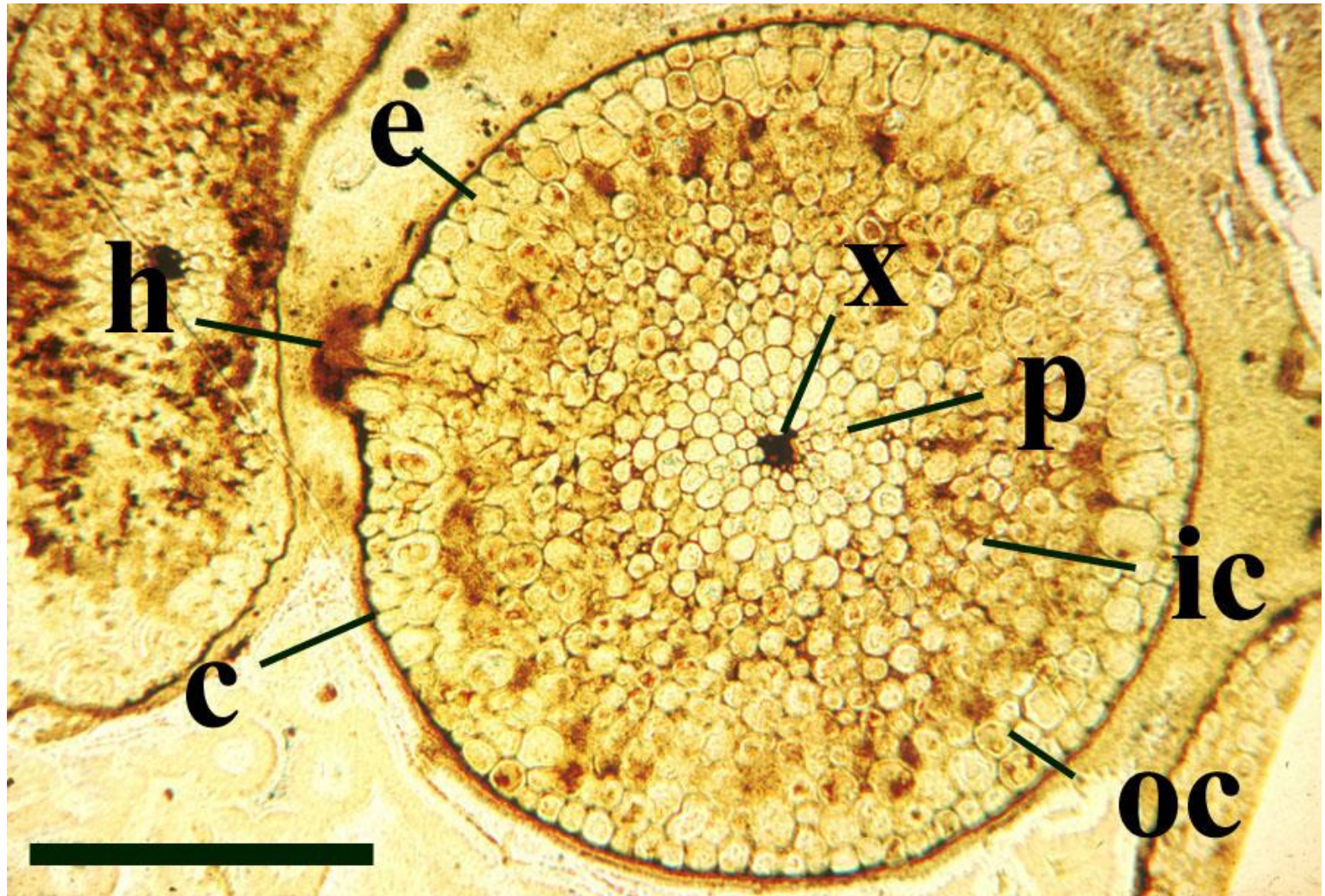


Fig. 7.6 : *Rhynia gwymra-laughani* : A. A sporophyte, B. T.S. of stem, C. L.S. of sporangium



# Anatomy of rhizome and aerial shoot

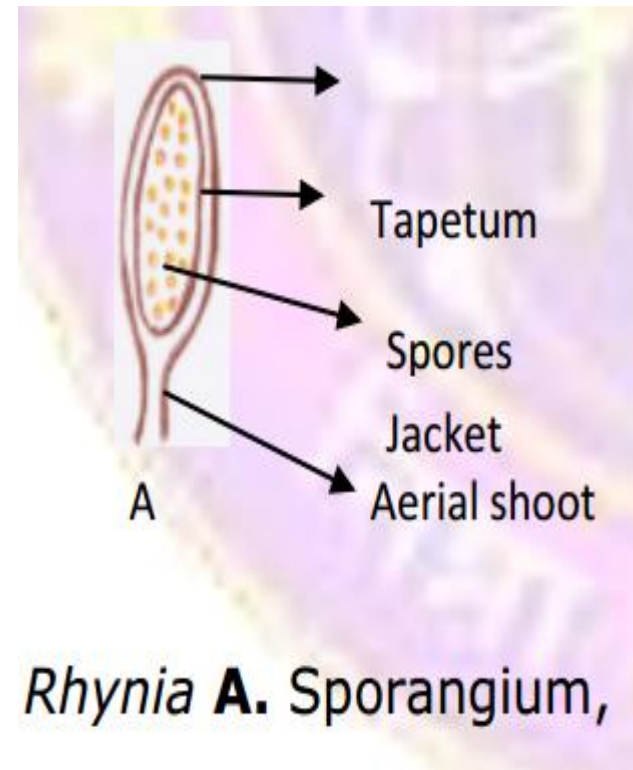
- Epidermis - The outermost layer forms the epidermis of thick walled cells which had a thick layer of cuticle. The aerial shoots had stomata with two guard cells, surrounded by many subsidiary cells.
- Cortex - Cortex is distinguished into an outer and an inner region. The outer zone consisted of 1-4 layers of compactly arranged angular parenchymatous cells. This region perhaps represents hypodermis. The inner cortex was consisted parenchymatous cells with intercellular spaces which are connected with the outer stomata. In the cortex, some fungal hyphae were present.
- Vascular system - A protostele was present in the central zone of the shoot and rhizome in which Phloem surrounded xylem. The xylem was made up of tracheids with annular or spiral thickenings. The phloem consisted 4-5 layers of thin walled elongated cells with oblique end walls. There were some minute sieve-like areas on the lateral walls of the phloem cells. Endodermis and pericycle were not distinct.



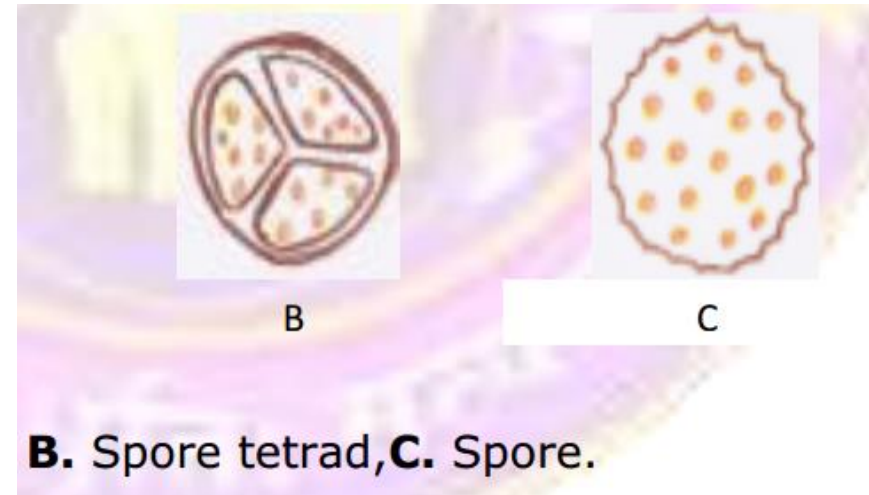
A transverse section of a stem of *Rhynia gwynne-vaughanii*

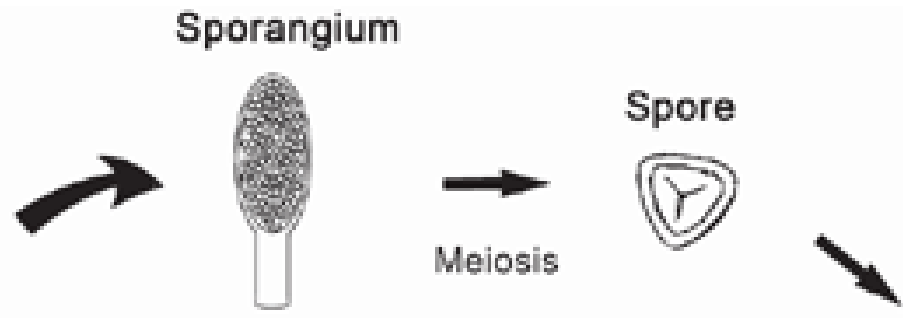
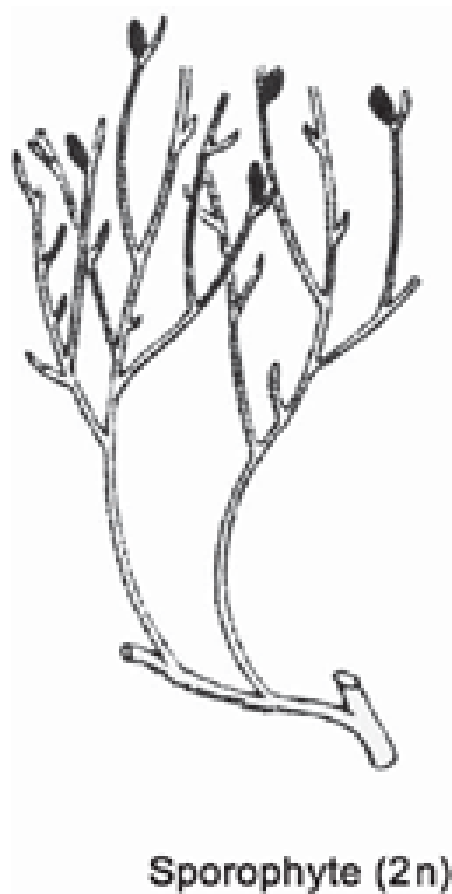
# Reproductive Structure: Sporangia

- Sporangia were present singly on the apices of aerial shoots. The sporangia were oval and nearly 12mm long and 4 mm wide. Sporangium had a multilayered jacket, in which the outer wall is made up of thick-walled cells, and then 2-3 layers of thin walled palisade-like cells. The innermost layer had small rounded cells, which seems to be tapetum. There were many spore tetrads were present in the sporangium.

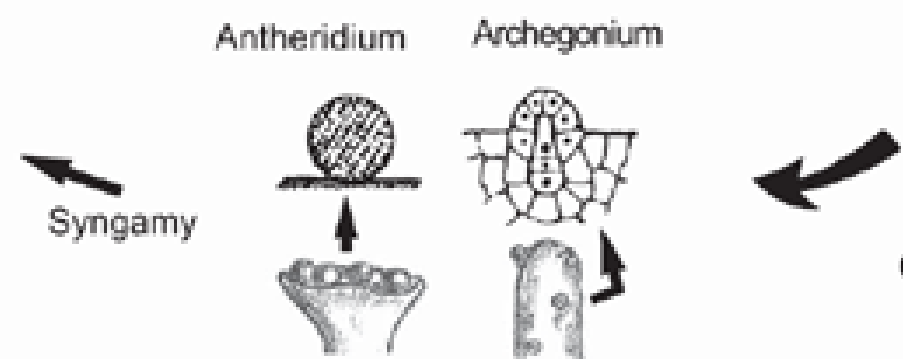
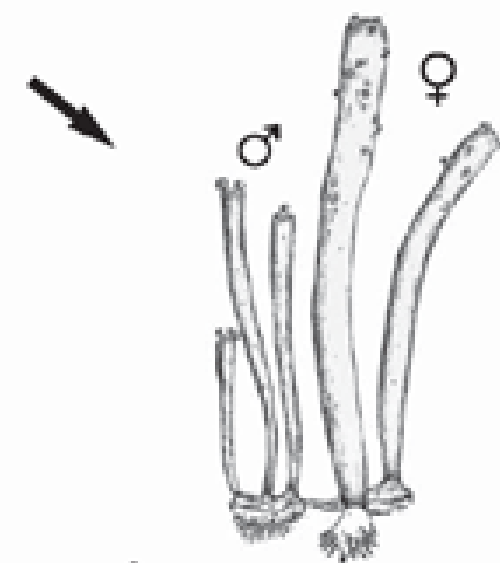


- The spore size was 65 microns and all spores were similar (homosporous). They had thick cutinized wall. Each spore showed a triradiate mark. The tetrahedral arrangement of spores suggest that they were produced by meiosis.
- The gametophyte in pteridophytes is generally very fragile and there is no information of the gametophyte of Rhynia.



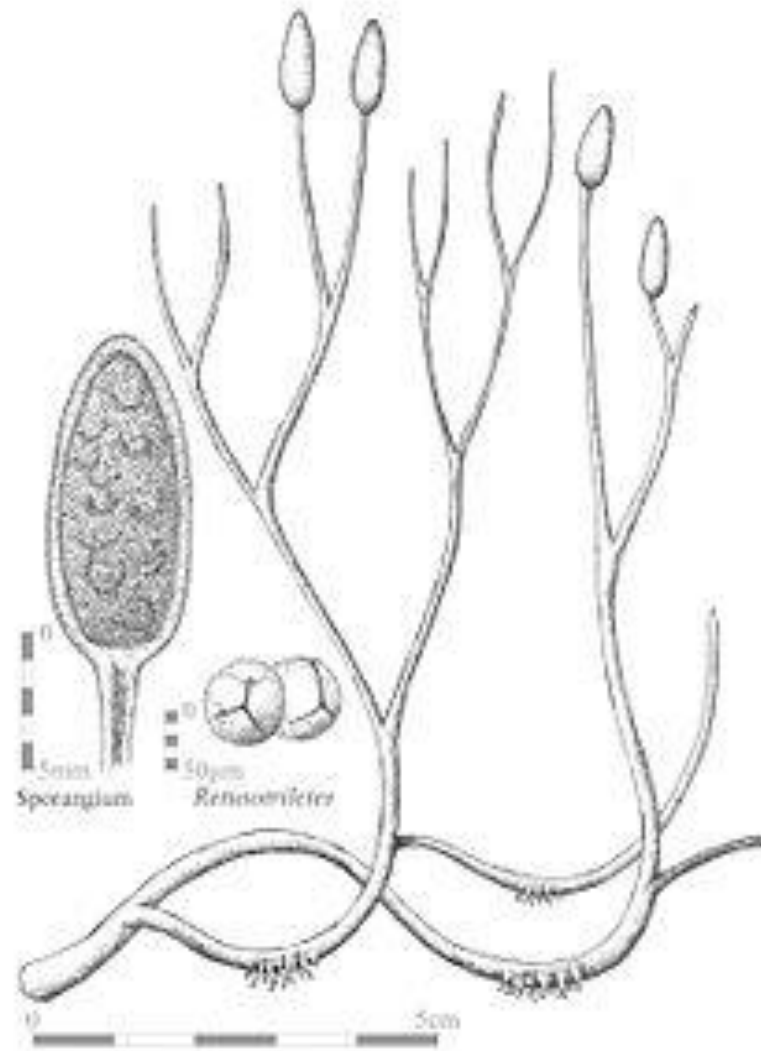


*Rhynia*



## *Rhynia major* ( now *Aglaophyton major*)

- The other species of *Rhynia* (*Rhynia major*) has been transferred to a new genus, *Aglaophyton major* by D.S. Edwards, 1986.
- He demonstrated that it was not a true vascular plant and its conducting element was structurally different from trachieds and was more like the water-conducting system (hydroids) of moss sporophytes.
- *A. major* is reconstructed as a plant approximately 10 cm tall.
- It consisted of a system of naked, stomatiferous, more or less cylindrical, prostrate axes that were loosely lying on substrate surface and functioned as rhizomes.
- It had aerial erect dichotomous axes, some of which were terminated by ellipsoidal sporangia filled with thick walled isospores.



Reconstruction of the sporophyte of *Aglaophyton*, illustrating bifurcating axes with terminal sporangia, and rhizoids