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Study material for Sem-I (Hons) class
Paper: CC-2 (Archegoniate)
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Pteridophytes

- Origin: **Silurian period**(444-415MYA) of Paleozoic Era (***Cooksonia***)
- Dominance: **Devonian period**(416-358MYA) of Paleozoic Era

Features

- Cryptogams: No flowering
- Trachaeophyta: Presence of vascular bundle
- Archegoniate: Presence of Archegonium as female sex organ
- **Embryophytes:** Origin of sporophyte is from embryo but still seed is not produced (whereas Spermatophytes=Seed bearing plants).

Characteristic features

- **Vascular cryptogams** reproduced by means of spores
- Both gametophyte and sporophyte are **independent** of each other (at maturity).
- Main plant body sporophyte(2n).

General features

- Sporophyte is differentiated into root, stem & leaves.
- **Microphyllous leaf** (Small leaf with a single mid-vein) or **Megaphyllous leaf** (Large leaf with many veins apart from the mid-vein.
- **Homosporous** (identical spores production= Microspores=50um) species such as *Lycopodium*, *Equisetum*, *Pteris* etc. **Heterosporous** (Two different spores production= Microspores & Megaspores,250um) species such as *Selaginella*, *Marsilea* etc.

- **Homosporous** species produce **monoecious gametophytes** that have both antheridia & archegonia; such as *Lycopodium*, *Equisetum*, *Pteris* etc.
- **Heterosporous** species produce **dioecious gametophytes** that have either antheridia or archegonia; such as *Selaginella*, *Marsilea* etc.

- **Homosporous** species produce **exosporic gametophytes** that formed outside the spore; such as *Lycopodium*, *Equisetum*, *Pteris* etc.
- **Heterosporous** species produce **endosporic gametophytes** that formed within the spore; such as *Selaginella*, *Marsilea* etc.

- Xylem & Phloem are there in pteridophytes but still cambium is absent. So there is **no secondary growth**.
- Sporangium is formed at the axil or apex of the sporophyll. Many sporophylls aggregated to form **Strobilus**. In ferns many sporangia aggregated on lower side of leaf to formed **sorus**.
- Ferns leaves show **circinate vernation**.

Distinguish Pteridophytes from Bryophytes	
Bryophytes	Pteridophytes
Main plant body is gametophyte	Main plant body is sporophyte
Main plant body is not differentiated into root, stem & leaves	Main plant body is differentiated into root, stem & leaves
Absence of vascular bundle	Presence of vascular bundle
Production of homo-spores always	Production of homo or hetero spores
Gametophyte is always monoecious in nature	Gametophyte is either monoecious or dioecious
Strobilus is not formed	A bunch of sporophylls formed strobilus

Classification of Pteridophytes

Classification by Pitchi-Sermolii (1977):

- Pitchi-Sermolii (1977) proposed a classification of Pteridophytes.
- The phylogeny of the family and genera are described in his classification.

- Pitchi-Sermolii (1977) recognized Pteridophytes as the rank of division and divided into 4 sub-divisions:
- **Lycophytina**
- **Psilophytina**
- **Sphenophytina**
- **Filicophytina**

- Filicophytina is divided into 3 classes:
- **Ophioglossopsida**
- **Marattiopsida**
- **Filicopsida**

Outline of Classification by Pitchi Sermolii (1977)

Division	Sub-division	Class	Sub-class	Order
Pterido-phytes	Lycophytina	Lycopsida	1.Lycopodiidae	i)Lycopodiales
			2.Selaginellidae	ii)Selaginellales
			3.Isoidae	iii)Isoetales
	Psilophytina	Psilophytopsida	Psilotidae	Psilotales
	Sphenophytina	Equisetopsida	Equisetopsida	Equisetales
	Filicophytina	Ophioglossopsida	Ophioglossoidae	Ophioglossales
		Marattiopsida	Marattiidae	Marattales
		Filicopsida	1.Osmundidae	Osmundales
			2.Plagiogyriidae	Plagiogyrales
			3.Gleicheniidae	i)Stromatopteridales
				ii)Gleicheniales
				iii)Polypodiales
				iv)Matoniales
			4.Schizaeidae	i)Schizaeales
				ii)Negripteridalea
				iii)Pteridales
				iv)Platyzomatales
			5.Marsileidae	Marsileales
			6.Hymenophyllidae	i)Hymenophyllales
				ii)Hymenophylopsidales
				iii)Laxsomales
				iv)Dicksoniales
				v)Denstaedtiales
				vi)Aspidiales
				vii)Blechnales
			7.Salviniidae	Salviniales

Early vascular plants:**Rhyniaceae**
(Psilos= naked, phyton= plant)

Rhynia

Horneophyton

Cooksonia

❖Oigin of Pteridophytes: **Silurian** Period(444 - 415 my)

❖Dominance of Pteridophytes: **Devonian** Period (416- 358 my)

Early vascular plants:**Psilophyta=**
1.Psilophytales 2.Psilotales
(Psilos= naked, phyton= plant)

Characteristics features:
1.The plant body was simple and consisted of a **subterranean rhizome** and aerial branches.
2.The aerial branches were branched by simple forkings (**dichotomously**).
3.The **true roots were absent** but rhizomes bore rhizoids.
4.Stems were naked (had no true leaves) or had scale like leaves.
5.Vascular cylinder was generally a **protostele**, central xylem surrounded by phloem.
6.The sporangia were borne **singly at the tips** of the branches.
7.Sporangia were **homosporous**, i.e. spores were apparently all alike.

- ❖ The members of the Psilophyta are the **oldest known vascular plants**. They appeared in the late **Silurian** and flourished during the early and middle **Devonian**.
- ❖ Most members of the Psilophyta are known only as fossils except two living members in the order Psilotales; ***Psilotum*** & ***Tmesipteris***.

Rhynia is significant for its simple nature.

The significant features are---

- ❖ Lack of differentiation into roots, stem & leaves.
- ❖Presence of prostrate rhizomatous stem with aerial axes.
- ❖ The rhizomatous stem bears rhizoids.
- ❖Presence of leafless(naked) aerial axes.
- ❖Aerial axes with **terminal ellipsoidal sporangia.**
- ❖ Aerial axes with **uniform dicotomous branching.**
- ❖ The stem with simple stele(Protostele), a slender strand of trachids.
- ❖Homosporous with trilete spores(40Um).
- ❖Eusporangiate sporangia.

- ❖ Both the rhizomatous and aerial stem showed protostelic configuration with a central xylem strand surrounded by a narrow phloem tissue.
- ❖ The aerial axes were photosynthetic having **simple stomata** in their epidermal layer.
- ❖ The cortex differentiated into two zones. The **outer cortex** with tightly packed cells which provided mechanical strength to the stem; and the **inner cortex** with loosely packed cells.

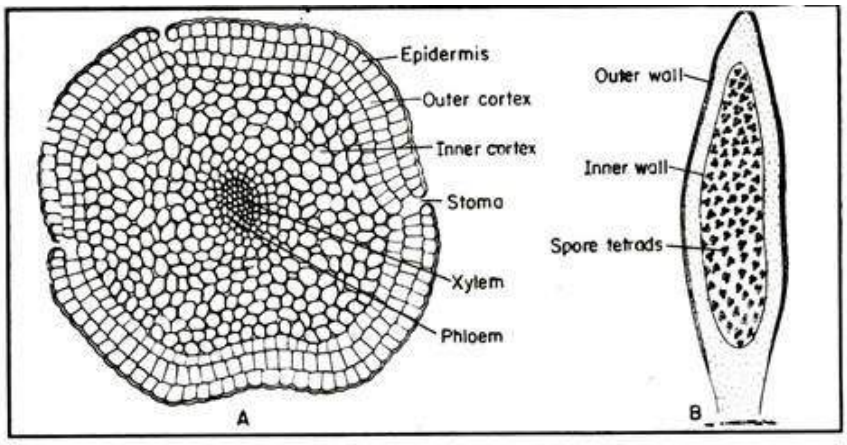


Fig 8.2 A – T. S. of stem of ***Rhynia*** *Sp., B – L.S. through sporangium.*

- Geological occurrence: **Lower Devonian** of Paleozoic era.
- Geographical occurrence: **Rhynie chert bed of Scotland**

In 1917,Robert Kidston &William H. Lang discovered two species of Rhynia.
1.Rhynia gwynne-vaughanii
2. Rhynia major: The height is three times than that of R. gwynne- vaughanii.

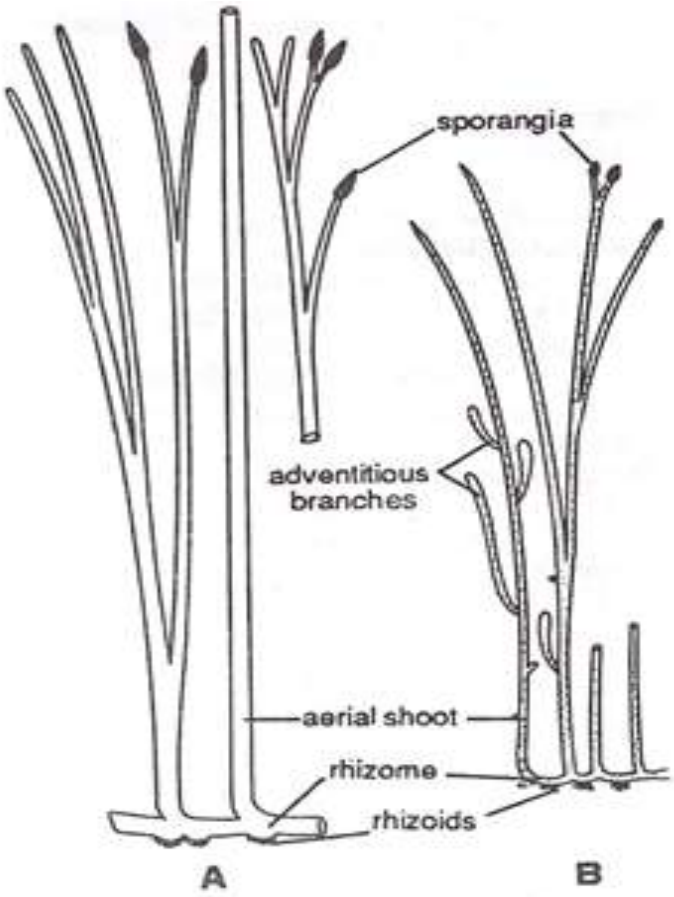
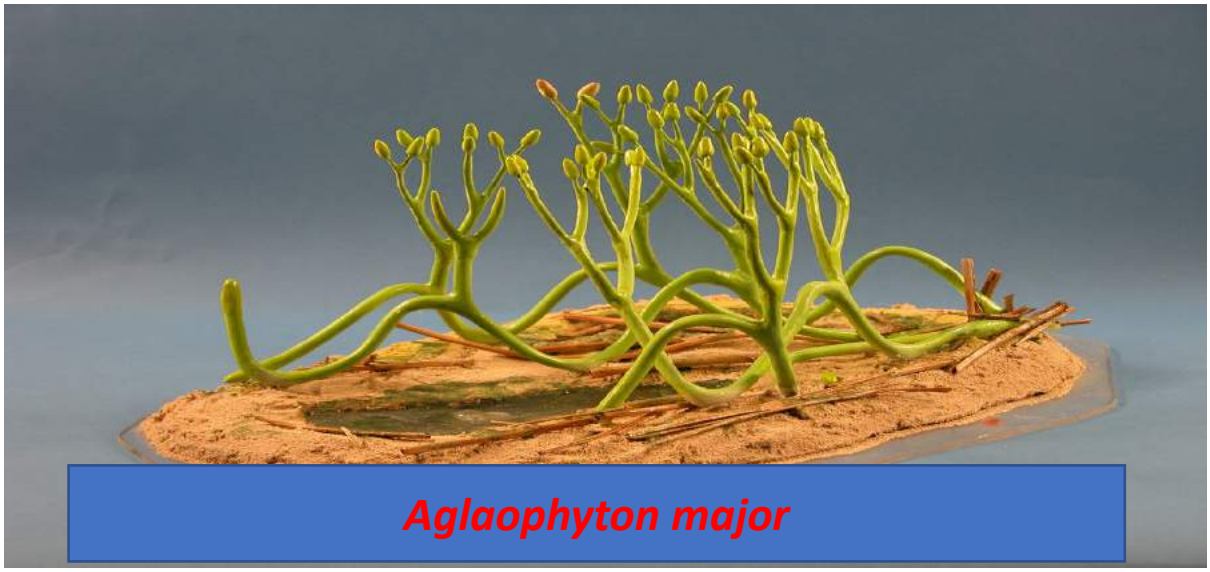


Fig. 206. Rhynia, external features. A, R. major; B, R. gwynne-vaughani.

Rhynia major has been transferred to a new genus- ***Aglaophyton major*** by D.S. Edwards in 1986.
He concludes that it was **a non- vascular plant**(no central xylem strand) with a pteridophytic life cycle.

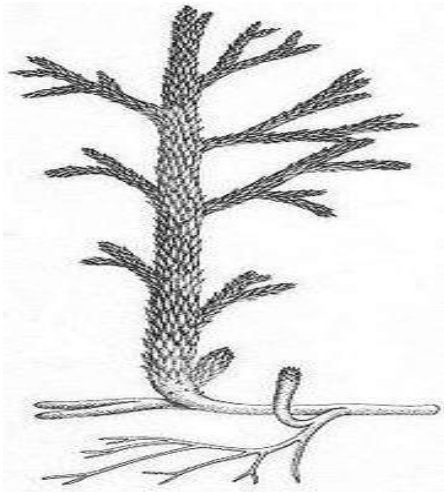


Aglaophyton major

Rhynie Flora

The Chief component of Rhynie flora: **Rhynia**, **Horneophyton** & **Asteroxylon** (Early fossil Lycopsid)

Horneophyton



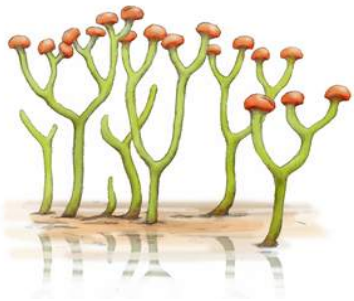
Asteroxylon

Horneophyton:

- The genus Horneophyton (Family: Rhyniaceae) possesses only one species- ***H. lignieri*** and is found in the **Rhynie chert**, either independently or in association of ***Rhynia***.

- The plant is very similar to *Rhynia*, but is rather smaller and more delicate. The rhizome is a lobed, tuberous structure bearing rhizoids. The subaerial shoot is also dichotomously branched like *Rhynia* and is without any appendage.
- The sporangia are also borne at the tips of some of the branches as in *Rhynia*, but differs mainly in having a prominent sterile columella, which projects into the cavity of the sporangium from its base and extends very near to the apex. The spores occur in tetrad.

Silurian Vascular Plants



Cooksonia was the smallest & simplest of vascular plants and at present it is accepted as the **oldest known vascular plant** discovered from Silurian of Australia by Cookson & Lang in 1935.

Cooksonia had the terminal **spherical sporangia**.

There were originally two species is ***Cooksonia pertoni*** and ***Cooksonia hamisphaerica*** .

Evolutionary Line

- *Rhynia*, *Horneophyton* & *Cooksonia* represent the first evolutionary line with terminal sporangia that dehisced longitudinally.
- Because of the more complex form (*Asteroxylon*) coexisted with *Rhynia* in Devonian period, the primitive status of *Rhynia* is questionable. It is very likely that *Rhynia* attained its present form and without evolving further had existed in this form for millions of years, in that case it is truly primitive.
- Alternately, if *Rhynia* is a reduced form from a more complex land plant, then it is not a primitive plant.
- All these fossil pteridophytes are described from Petrifications. The preservation was so perfect that not only cellular details but sub-cellular details could be seen.

.....Thank YOU.....