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**U.R. COLLEGE ROSERA
(SAMASTIPUR)**

**B.Sc. PART- I
PAPER-II**

(i) CALAMITES

Paper - I

Calamites

Systematic Position

- Division → Cryptogam
- sub division → Pteridophyta
- class → Sphenopsida
- order → Sphenophyllales
- family → Calamitaceae
- Genus → Calamites

Forms of Calamites

- i) Stylocalamites
- ii) Calamitino
- iii) Eucalamites

Occurrence

Calamites appear in the Upper Devonian, attained its zenith in the Carboniferous and disappeared in the Lower Triassic. Parts of these plants are known from the Carboniferous all over the world.

Calamites is considered as the only genus by many Pteridologists although numerous form genera of stem, leaves and strobilli are recognised. The name Calamites is due to SYKOW (1784) who used it for "pith casts."

The Plant body of Calamites (9)

[Sperophyte]

The sperophytic plants were mainly trees attaining height of 20-30 metres. Few of them might have been smaller shrubs. Although so large, it had a strong horizontally growing rhizome from which the aerial shoots arise. The rhizome is differentiated into root nodes and internodes with a whorl of adventitious roots at each node. The rhizome also had secondary growth. According to the habit three sub-genera are recognized.

(1) Stylocalamites → A single main stem branched at the base just above the rhizome giving rise to a clump of parallel, erect branches on the surface which did not branch any more.



Figure - Sub-genus of Calamites
[Stylocalamites]

(2) Calamitina → There was a single (3) strong stem which showed many smaller branches in whorl at every node. Leaf verticils were on the secondary branches. Here and there, very irregularly, there might be a node bearing comparatively stronger side branches.

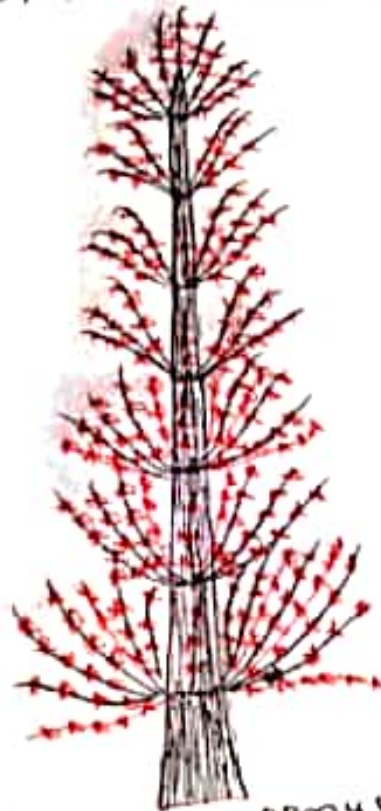


Figure. Subgenus of Calamites
[Calamitina]

(3) Eu Calamites → There was a main trunk unbranched for a short height then bearing verticils of two or more strong branches which again branched repeatedly giving rise to a bushy tree. The leaf verticils were on the basal branches. The manner of origin of the branches was peculiar. Each branch suddenly narrowed down at the base meeting the rhizome. The stronger

branch below or on articulated
 narrow point. Thus erect branches which
 grew from the upper side of the
 rhizome had a very constricted base.
 This certainly caused some weakness
 in the tall trees. The stem surface
 was ribbed and the ribs of alterna-
 te nodes were alternating. (a)



Figure. Sub genus of Calamites
 [Eucalamites]
Internal structure of stem

The stem anatomy shows following structures -

(A) Cortex → It had an outer thick-walled and an inner-thin-walled zones. A periderm was formed in the cortex during secondary growth. Calamites stem are known which are about 50cm

in diameter with the secondary wood about 6 cm thick and the pith also a few centimetres.

(B) Stele → Stele is endarch siphonostele. The protoxylem strands disintegrated forming "Carinal canals". Protoxylem strands have annular and spiral tracheids. Carinal canal was surrounded by metaxylem having scalariform and pitted tracheids. A cambium and the consequent secondary wood are the present. It was disintegrated into tracheids and rays but there were no annual rings, thus signifying uniformity of climate. A young stem shows about a dozen or more collateral bundles.

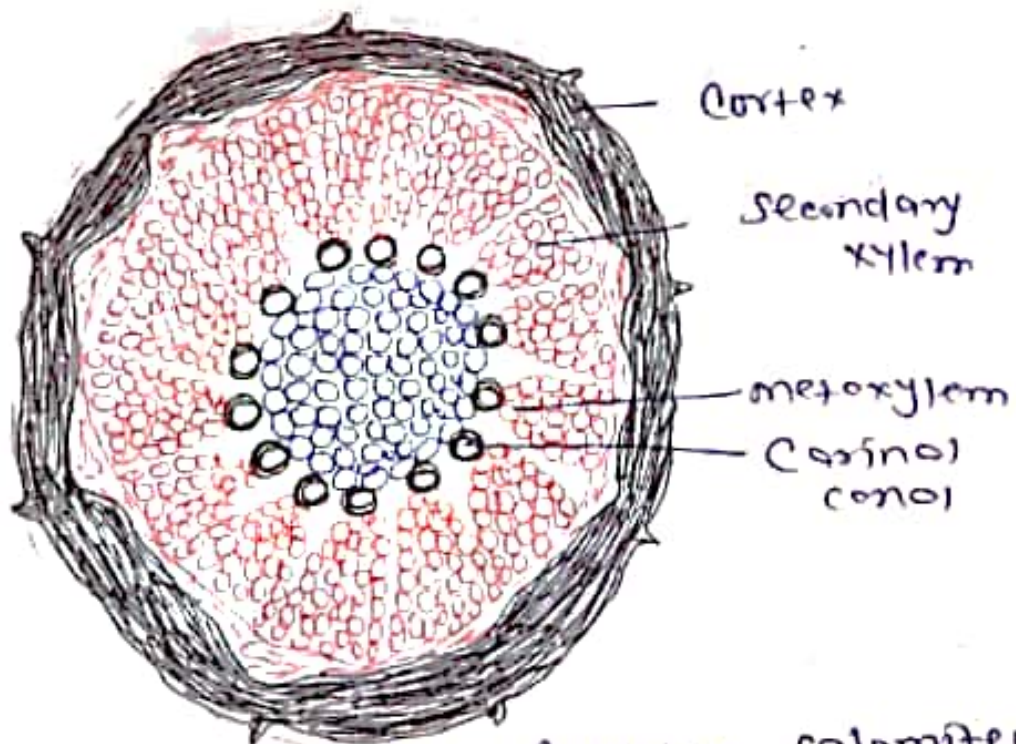


Figure - P.S. of mature Calamites stem.

(C) Pith or medulla → It has prominent ⁶ delicate pith which broke down in mature shoots leaving central cavities extending from node to node.

Internal structure of root of Colomites

Roots of colomites are usually placed in the fern genus 'Asteromyelon'. These adventitious roots do not show nodes and internodes. It has following parts -

(A) Cortex → The cortex usually had large air spaces as in aquatic plant.

(B) Stele → The primary xylem is exarch. Corinal canals are absent. It is di- to polyarch, phloem masses alternating with protoxylem patches.

Cambium growth was limited. Stele is surrounded by two layered endodermis.

(C) Pith → It is small and not hollow.

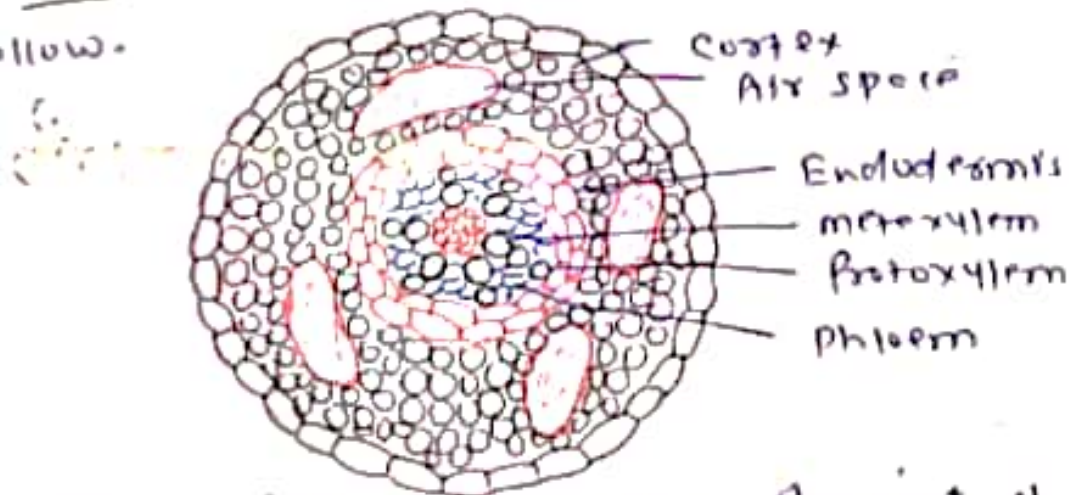


Fig. Internal structure of root of Colomites.

Internal structure of leaf of Colanites ⑦

The transverse section of leaf is triangular or semicircular. It shows following parts

① Epidermis [Epi: outer, derma: layer] →

It is the outermost and uniseriate layer. Cells are rounded. There are numerous stomata present in epidermis and responsible for gaseous exchange.

② Mesophyll [meso: middle, phyllon: leaf] →

This tissue is found in the middle of leaf. It has long, radiating pillar like cells known as palisade cells.

③ Bundle sheath → Vascular strand is surrounded by bundle sheath. It is starch bearing.

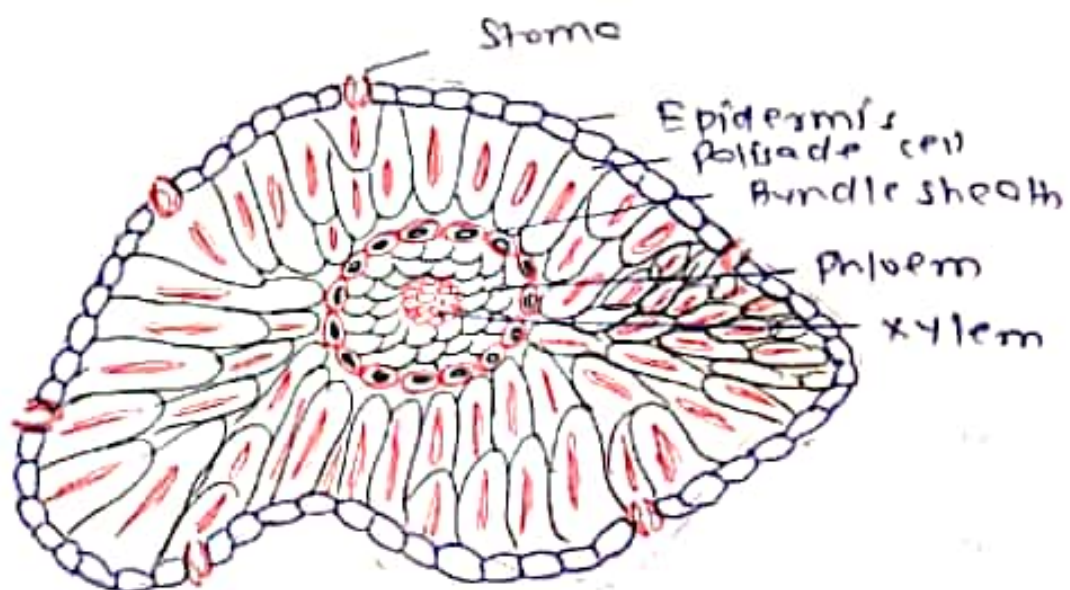


Figure. T.S. of leaf of Colanites

⑧ Vascular Strand → It is made up of vesicles bundle. It is the central part of leaf. Vascular bundle is hydrocentric, it means xylem is surrounded by phloem. Cambium is absent.

Reproductive Parts [Strobilli]

Several types of strobilli of *Colletes* are known and these have been placed in different form genera. The strobilli were born on special leafy shoots at the nodes in verticils of two or more in the axils of bracts. Each strobilus shows an articulated axis as in all sphenopsids and the sporophores are born in whorls at each node. The best known forms are -

i) Palaeostachya → In *palaeostachya* a sporangiophore whorl alternates with a sterile bract whorl. But the sporangiophores



Figure - Reconstruction of *Palaeostachya decanema* strobilli

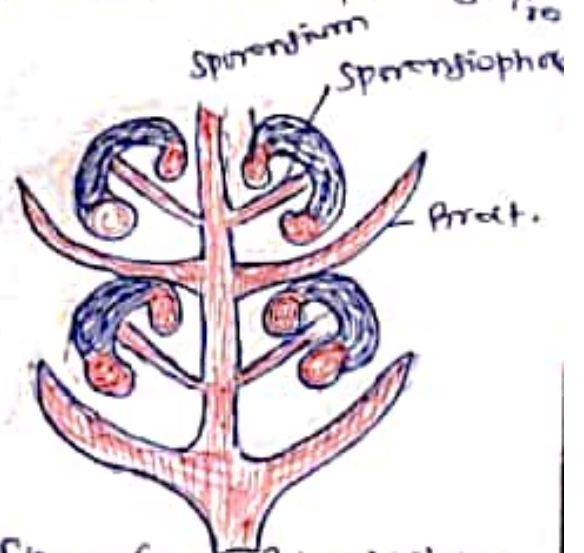


Figure - D.S. of *Palaeostachya strobillus*

were not appendages to the bracts (9)
 as they had independent vascular
 supplies coming from the axis.

ii) Calamostachys → In calamostachys
 there is limited alternation of sporon-
 giophore whorls with sterile bract whorls
 but the whorls arise directly from the
 stem at right angles to it so that they
 look quite independent. The sterile
 bracts are usually laterally based at
 the base and the numbers of sporon-
 giophores and bracts vary. The number
 of sporangia peltately borne by each
 sporangiophore also varies but the usual
 no. is four. In some forms several
 whorls of sporangiophores occur between
 two whorls of sterile bracts.



Figure - Part of calamostachys ludwigii fertile shoot.

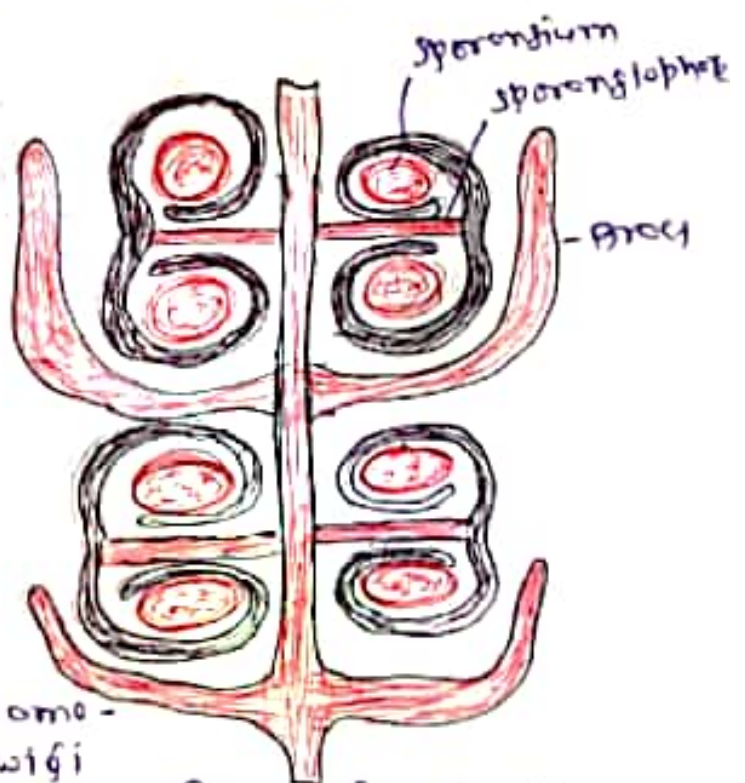


Figure - d.s. of Calamostachys strabilys

iii) Cingularia → It is a very peculiar fern in which it seems a horizontally developed fused whorl of bracts has got fused with a similarly fused whorl of sporangiophores divided into forked arms with two rows of sporangia hanging below each fork.

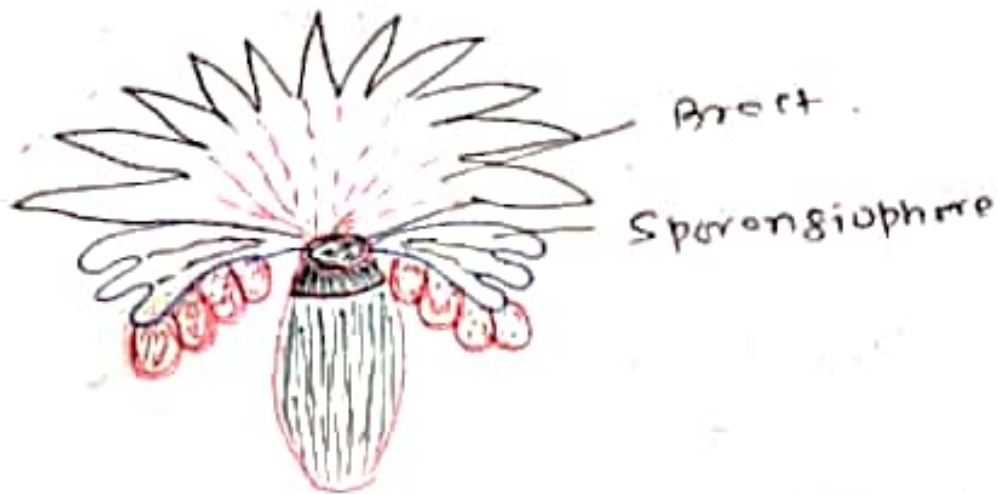


Figure - Part of strobilus node of Cingularia typica (after Hirmer)

as well as Calamiter shows homosporous as well as heterosporous strobilli. In Calamostachys binneyana the spores are of irregular size but that does not necessarily signify heterospory. But in Calamostachys castanea some of the sporangia bear fewer spores which are four times as large as in others. This seems to be definite heterospory. Macrostachya shows very large spores (up to 0.4 mm in diam etc) and one species, M. infundibuliformis, seems to be heterosporous. Palaeostachya andrewsii also shows very large spores (upto 0.9 mm)

Which may be megasporae. Recently (11)
Dr. Boxer has found separate male and
female strobilli resembling *Calamostachys*
in *Ranunculus carboniferus* in which each
megasporangium contains only one func-
tional megaspore which seems to be
retained within the megasporangium.

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