

Seed of *Lyginopteris*:

The best known seed has been described under the name *Lagenostoma*. These seeds were small in size, only about 1/4 but they were highly organized. It was barrel shaped and whole seed enclosed in cupule. This cupule opened out when seed was mature.

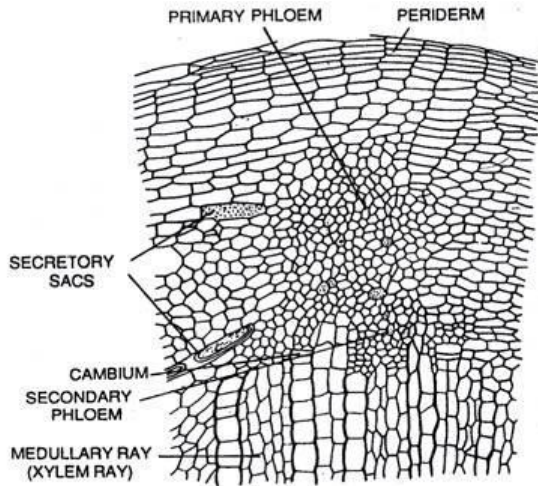


Fig. 2.6. *Lyginopteris oldhamia*. A part of T.S. stem showing the outer portion of the stele.

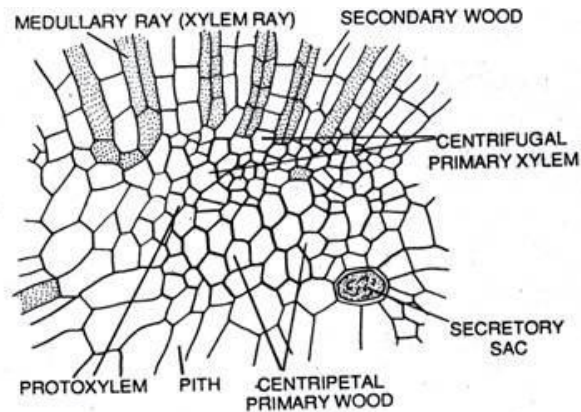


Fig. 2.7. *Lyginopteris oldhamia*. A part of T.S. of stem primary and secondary xylem, medullary rays and pith

Each seed was borne at the tip of stalk. The cupule rose from the base of the seed but not fused with it. The cupule was in three main lobes. These lobes were divided in the upper parts of the seeds. The seed or ovule was orthotropous and of cycadian type. It was radially symmetrical.

The cupule was separated from the seed along its entire length. The seed itself has an integument which surrounded the nucellus. The integument and nucellus were fused except at the top. The integument formed nine projections. In each of these projections there was a vascular bundle present. These projections surrounded the nucellar beak.

The pollen grains then came to lie in pollen chamber formed by disorganization of some of nucellar tissue round the base of nucellar beak.

In some of preparations the megaspore membrane is very well seen. In the centre of the seed there was a tissue but so far neither any archegonium nor any embryo has been found in these Palaeozoic seeds.

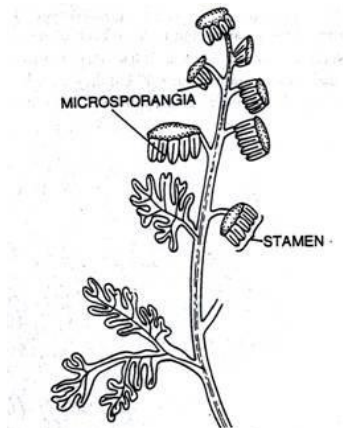


Fig. 2.8. *Crossotheca* sp. The male reproductive structures of *Lyginopteris oldhamia* with few stamens and pendent sporangia.

The seeds were borne at the tips of the stalks. They were not organized to form cover. In addition to this *Lagenostoma* there are many other Palaeozoic seeds which have been described some simpler other more complex than *Lagenostoma*.

A peculiar feature of all Palaeozoic seeds which so far has not been explained is the absence of any embryo in them. Pollen grains have been found in pollen chambers. Some of them had even showed their germ tube, but so far no seed is discovered in which embryo was developed. It is possible that all the seeds described might have not preserved or they preserved before embryo formation.

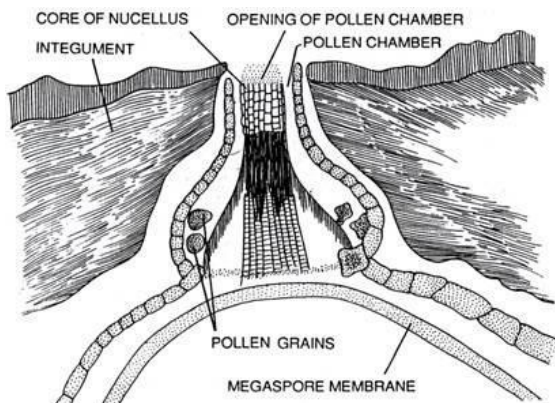


Fig. 2.9. *Lagenostoma lomaxi*. L.S. through the apex of the seed of *Lyginopteris oldhamia* showing pollen grains in the pollen chamber.

Phylogenetic Relationships of Lyginopteris:

We find that the xylem in the case of pteridophytes show only scalariform thickening on it. In Cycads we find the pitted type of thickening on it. It is seen that the xylem of some cycads passes through scalariform stage and one recent cycad *Stangeria*, here the xylem shows only scalariform thickening in tracheids.

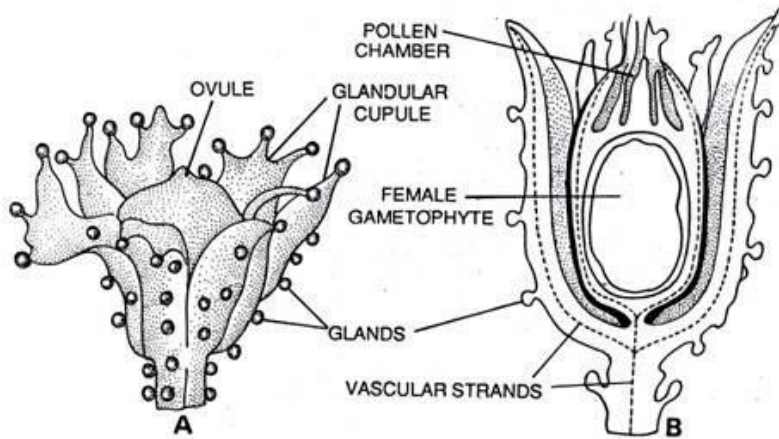


Fig. 2.10. *Lagenostoma lomaxi*. A, the seed of *Lyginopteris oldhamia* enclosed in a glandular cupule; B, L.S. of seed showing details of cupule.

There were no pits. On account of the absence of pitted thickening the genus *Stangeria* was for a long time included among ferns, and it was only later when a plant was found bearing seeds on it that it was shifted from ferns to Cycadales.

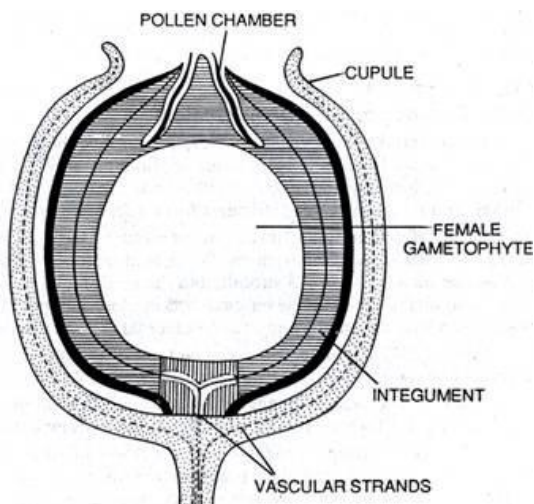


Fig. 2.11. *Lagenostoma lomaxi*. Longitudinal section of the ovule with the investing cupule.

The stem of Cycadofilicales has combined structure of both ferns and cycads. In Cycadofilicales arranged from protostelic to polystelic structure and there is found only in some of lower types like *Marattia*, *Angiopteris*, *Ophioglossum* and *Botrychium*. These Cycadofilicales in appearance were like the ferns. In Carboniferous times the vegetation was very much like most of present day ferns.

It was due to the strong resemblance in the external features that the group was described as Cycadofilicales. It was later on when seeds of *Lagenostoma* were found growing on leaves of *Lyginopteris* that fern connection of the group came to an end.

English workers (Oliver and Scott) call the group Pteridosperms. They are of opinion that they belong to an extinct group of pteridophytes which has developed seeds on them. American workers called the group as Cycadofilicales. They think that the group has distinct affinities with ferns on one hand and Cycadales on other hand also.

The fossil leaves found in Carboniferous strata cannot be suitably assigned either to the ferns or to Cycadofilicales. With more advancing knowledge more and more of these Carboniferous leaves are coming to be associated with Cycadofilicales, and some workers have even gone so far to say that during the Carboniferous the ferns were not at all common and they did not exist in those times.

Some of the more primitive type of ferns probably did exist in those times but so far known all those types were homosporous. Heterospory probably developed only in Cycadofilicales.

These Cycadofilicales are of course definitely related to ferns in the general appearance of plant, the form of leaves, the general anatomy of stem and particularly in the form of microsporangia which in the two groups are very much alike the features which separate the Cycadofilicales from the ferns in a more complex stem anatomy with secondary growth and the presence of seed structure.

The origin of this seed structure has not been explained so far. There is no direct evidence with regard to the evolution of structure. There is only guess work, this seed habit must have preceded heterospory. It must have come from some heterosporous plants that the Cycadofilicales had originated.

We know all bryophytes and primitive ferns are homosporous.

It is only a few types of present day pteridophytes like *Selaginella* and heterosporous ferns that heterospory is seen, it appears that the two groups pteridophytes and Cycadofilicales have originated from some common ancestral group in which heterospory had come into existence or it may be that homosporous ancestral ferns may have given rise to pteridophytes and the heterosporous one to the Cycadofilicales.

So clearly the Cycadofilicales must have come from some heterosporous ancestors, but so far no such fossil has been discovered. Chamberlain and other American workers are of opinion that Cycadofilicales form the most primitive group of gymnosperms. Though there were no cones yet we know that in *Cycas* itself in the female there are no cones. The seeds were like those of present day cycads, and like them the xylem had pitted thickenings on its wall. English workers, however, think that the group is an extinct one and it is co-ordinate with gymnosperms and angiosperms and they call it Pteridosperms. They think, commonly met within the stem of *Cycas* the primary structure was polystelic. Each stem has secondary growth round it.