In continuation with last lecture...

It is interesting, however, to note that Taylor and Hickey (1996) no longer include *Pentoxylon* as a member of **Anthophytes** (a clade comprising plants bearing flower-like structures. The group contained the angiosperms - the extant flowering plants, such as roses and grasses - as well as the Gnetales and the extinct Bennettitales), which include angiosperm lineage and its sister groups Bennettitales and gnetopsids (see diagram below).

![Anthophytes diagram](image)

According to them, *Pentoxylon* lacks key anthophyte characteristics such as distal, medial and proximal positioning of female, male and sterile organs on the reproductive axis, as well as the enclosure of ovules by bract-derived organs.

Meeuse listed a number of common features between Pandanus and Pentoxylon, which include:

a. Both the members are erect or sub-erect dioecious plants with slender cylindrical stems.

b. Both bear terminal tufts of strap-shaped leaves in spiral arrangement.

c. The inflorescences of both members are borne among the leaves or on short lateral branches in the axils of the scaly bracts.

d. In both cases, the peduncles of inflorescences contain tracheids with spiral thickenings and bordered pitting.

e. The seeds are enclosed in a fleshy layer called sarcotesta, and a seed coat consisting of two layers.
f. Both bear seeds with copious endosperm and with minute embryo.

Based on these similarities, Meeuse considered Pentoxylales as ancestors of angiosperms. He proposed that Pandanus "is a direct descendent of a group of plants practically identical" with Pentoxylales. However, in spite of these resemblances, authors like Pant and Kidwai hold that they could equally be the result of parallel evolution.

**Gonophyll Theory –**

The *Gonophyll theory* was developed by Melville, (1962, 1963, 1983) largely on the basis of a study of the venation pattern. He believed that the angiosperms were derived from Glossopteridae, which formed important elements in the flora of Gondwanaland. He further stated that angiosperm flower was derived from *gonophyll*, a fertile branching axis adnate to a leaf. In simple Glossopterids like *Scutum* and *Ottokaria*, the fertile branch consisted of a bivalved scale (having two wings) called the *scutella* with terminal ovules on dichotomous groups of branches. Folding of the scutella along the cluster of its ovules forms the angiosperm condition, an indication of this closure being found in the Permian fossil *Breytenia*. In *Lidgettonia*, the fertile branch consists of four to eight disc-like bearing several seeds. In *Denkania*, described from Raniganj, India, about six seed-bearing *cupules* are attached to long stalks borne from the midrib of fertile scale. As shown in diagram below – Glossopteridae - B: Fertile branch (Gonophyll) of *Lidgettonia mucronata* C: Fertile branch of *Denkania indica* with cupules. (from Surange and Chandra, 1975)

The leaves of *Glossopteris* (as shown below - A: *Dictypteridium feistmantelii* (*Glossopteris tenuinervis*) vegetative branch) are lanceolate, with distinct reticulate venation. In *Glossopteris*, the fertile region is cone-like with a transition from leaves to fertile scales, spirally arranged and conforming to the *anthostrobiulus*. In *Mudgea*, there is a suggestion of *anthofasciculi*, i.e. leafy
structures with two fertile branches, one male and the other female, forming the angiosperm flowers as found in *Ranunculus* and *Acacia*.

Melville believed that angiosperms arose 240 mya ago in the Permian and took around 140 mya before they spread widely in the Cretaceous. It is pertinent to point out, as explained earlier, that although he considered angiosperms to be monophyletic, his justification puts him among the proponents of the polyphyletic origin of angiosperms.

However, there is one objection to the theory of pteridospermi ancestry of angiosperms, which includes the absence of scalariform xylem elements in pteridosperms, which occur in angiosperms. In spite of this objection, the similarities found between the pteridosperms and angiosperms suggest that angiosperms have some very close connection with pteridosperms. Due to the absence of any direct evidence, there is a growing tendency among phylogenists to accept the pteridospermic ancestry of angiosperms, at least tentatively.