BENNETTITALES

- Fossil group of Gymnosperms
- 1825- ***Bucklandia***- cast from Britain
- Triassic to Cretaceous periods of Mesozoic era
- resembled Cycads
- Mesozoic era – AGE OF CYCADS
- Fossils – Compressions/ Petrefactions

SIMILARITIES

- Both stumpy appearance of stem
- Large pinnate compound leaves
- Naked seeded

MAIN DIFFERENCES

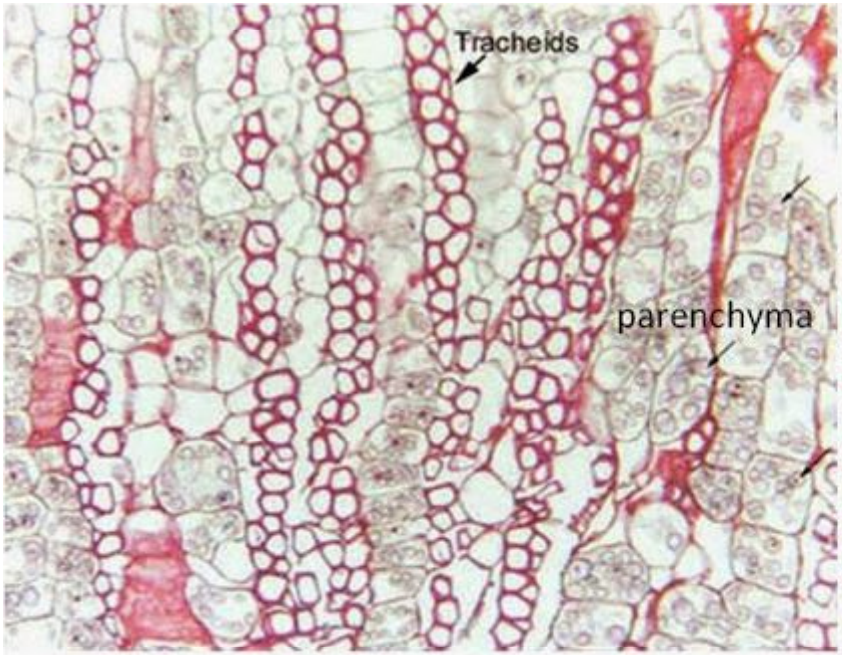
1. STOMATA

Syndetochelic in Benettitales
- 2 guard cells & subsidary cells – all derived from a single mother cell

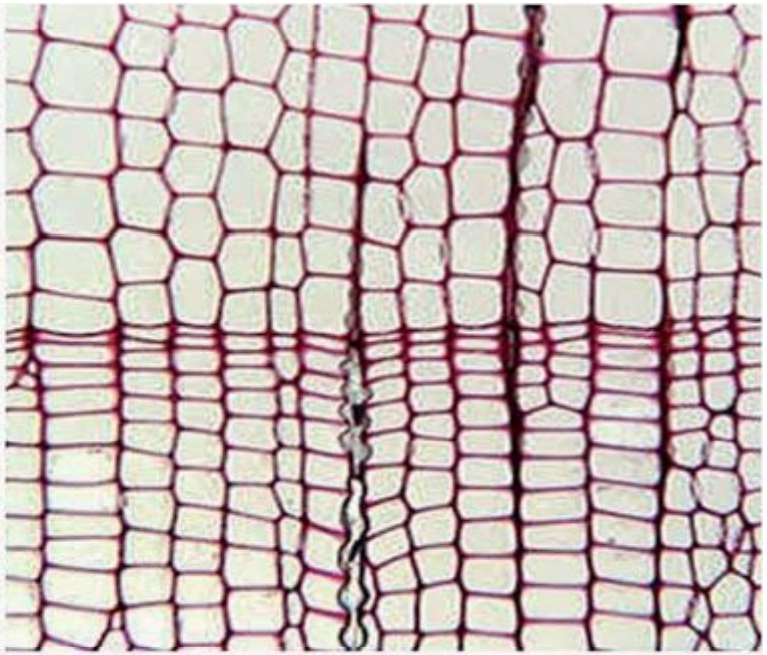
Haplochelic in Cycads
- **2 guard cells- derived from a single mother cell**
- **Subsidary cell – derived from different initial**

2. SECONDARY WOOD

- MANOXYLIC in Benettitales & PYCNOXYLIC in Cycads



Manoxylic wood



Pycnoxylic wood

Manoxylic wood	Pycnoxylic wood
It is porous, soft & has more broad prenchymatous medullary rays	Compact & has narrow medullary rays
Commercially useless	Great commercial use
It is found in Cycadophyta	It is found in Coniferophyta
Eg. Cycas	Eg. Pinus

- Wood formed may be in one ring due to **persistent** cambium
- short lived cambium
- Broad cortex, pith & parenchymatous rays.

- Wood formed may be in many rings due to **ephimeral** cambium
- long lived cambium
- Reduced cortex, pith & parenchymatous rays.

3. REPRODUCTIVE ORGANS

CYCADS:

- **Flower like organs with a whorl of stamens suurounding a central receptacle**

BENETTITALES:

- **Flower like with an elongated receptacle with a central ovuliferous region surrounded by microsporophylls which are surrounded by a whorl of perianth like bracts**

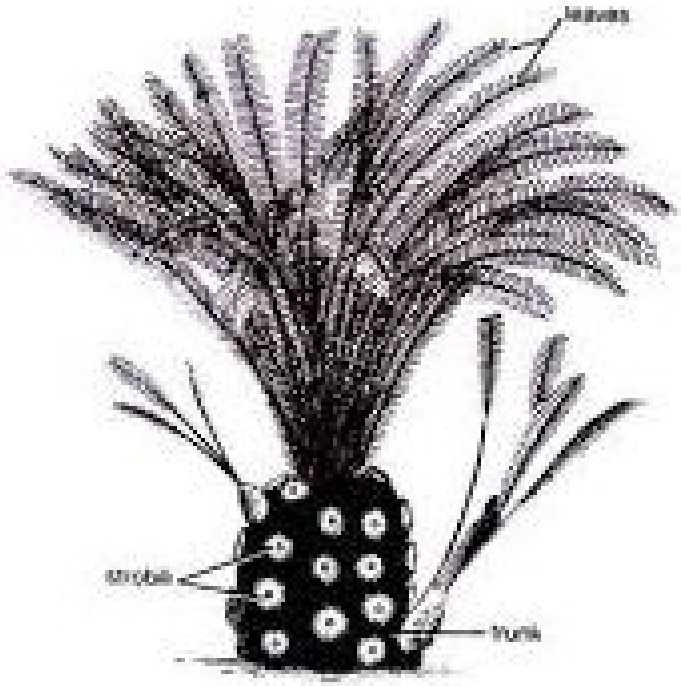
These major differences conclude that Cycadales and Benettitales represent parallel lines independently derived from paleozoic Pteridosperms.

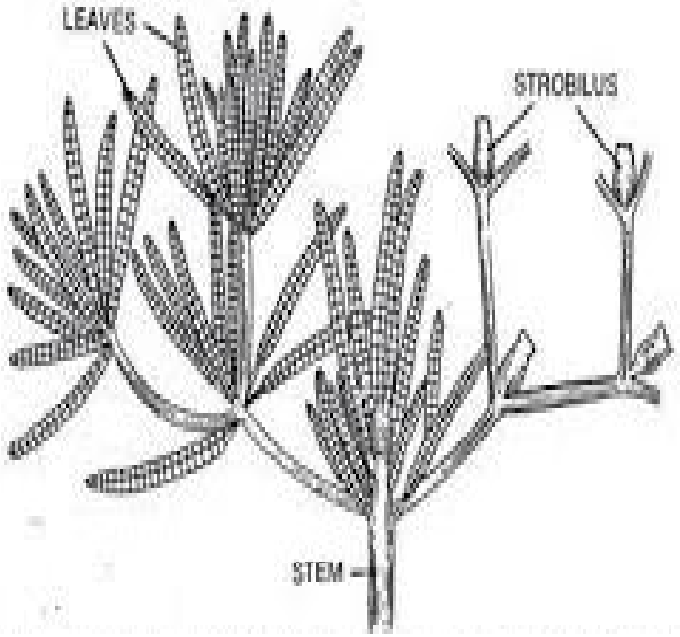
CLASSIFICATION

3 families by SPORNE

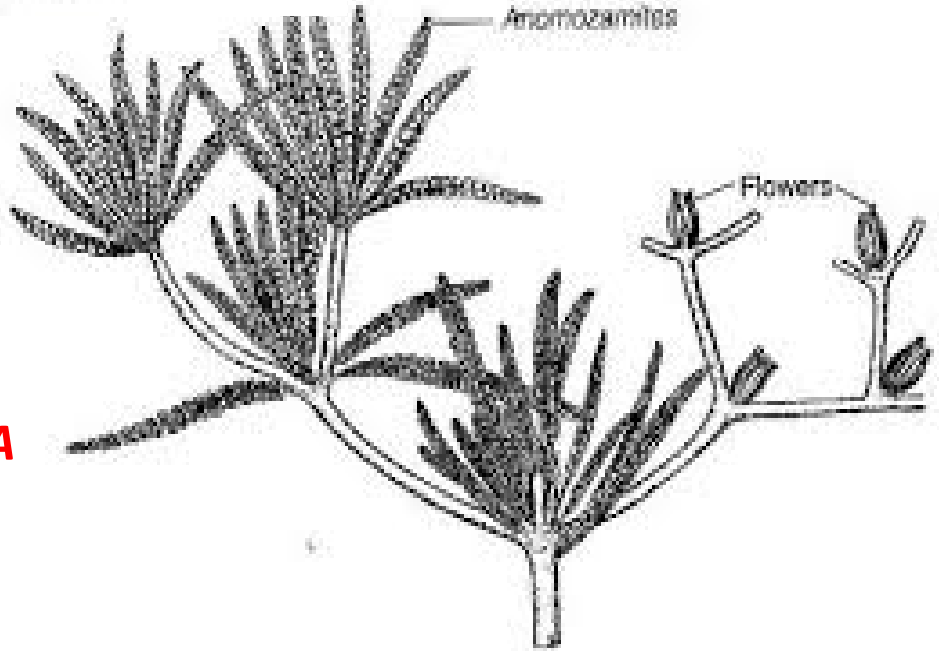
- CYCADEOIDEACEAE
- WILLIAMSONIACEAE
- WIELANDIELLACEAE

CYCADEOIDEA





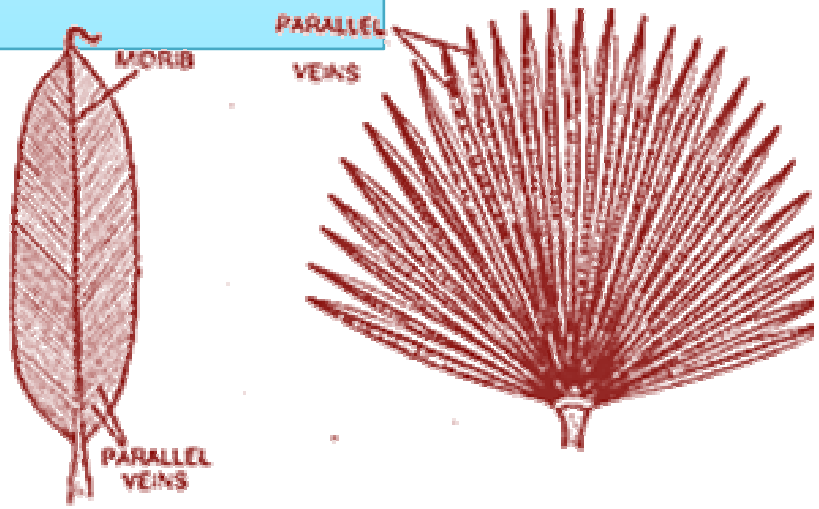
WILLAIMSONIELLA



WIELANDIELLA

CHARACTERISTIC FEATURES

1. Upright columnar forms/ conical shape under a metre height
2. Grow very slowly and branch profusely
3. Leaves – large, pinnately compound
    1. *Williamsoniella* – simple & linear
4. Venation – unicostate parallel
5. Stomata – Syndetochelic

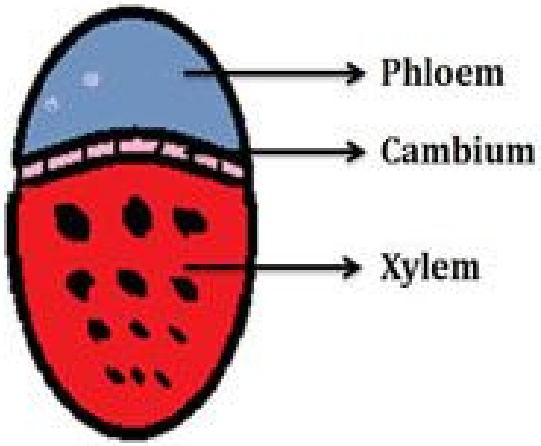


Parallel venation; unicostate and multicostate

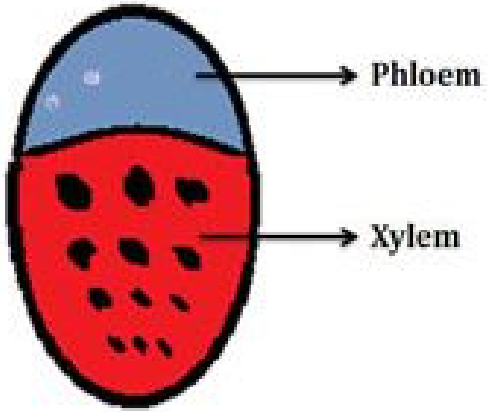
6. Stems have large pith surrounded by a ring of collateral, conjoint, endarch, open primary vascular bundles

7. CORTEX – parenchymatous with mucilage canals

8. Presence of RAMENTUM (scale like hairs) in between the leaf bases



Open Vascular Bundle



Closed Vascular Bundle

RADIAL – xylem and phloem are arranged separately in bundles
CONJOINT - xylem and phloem are arranged together in the same radius

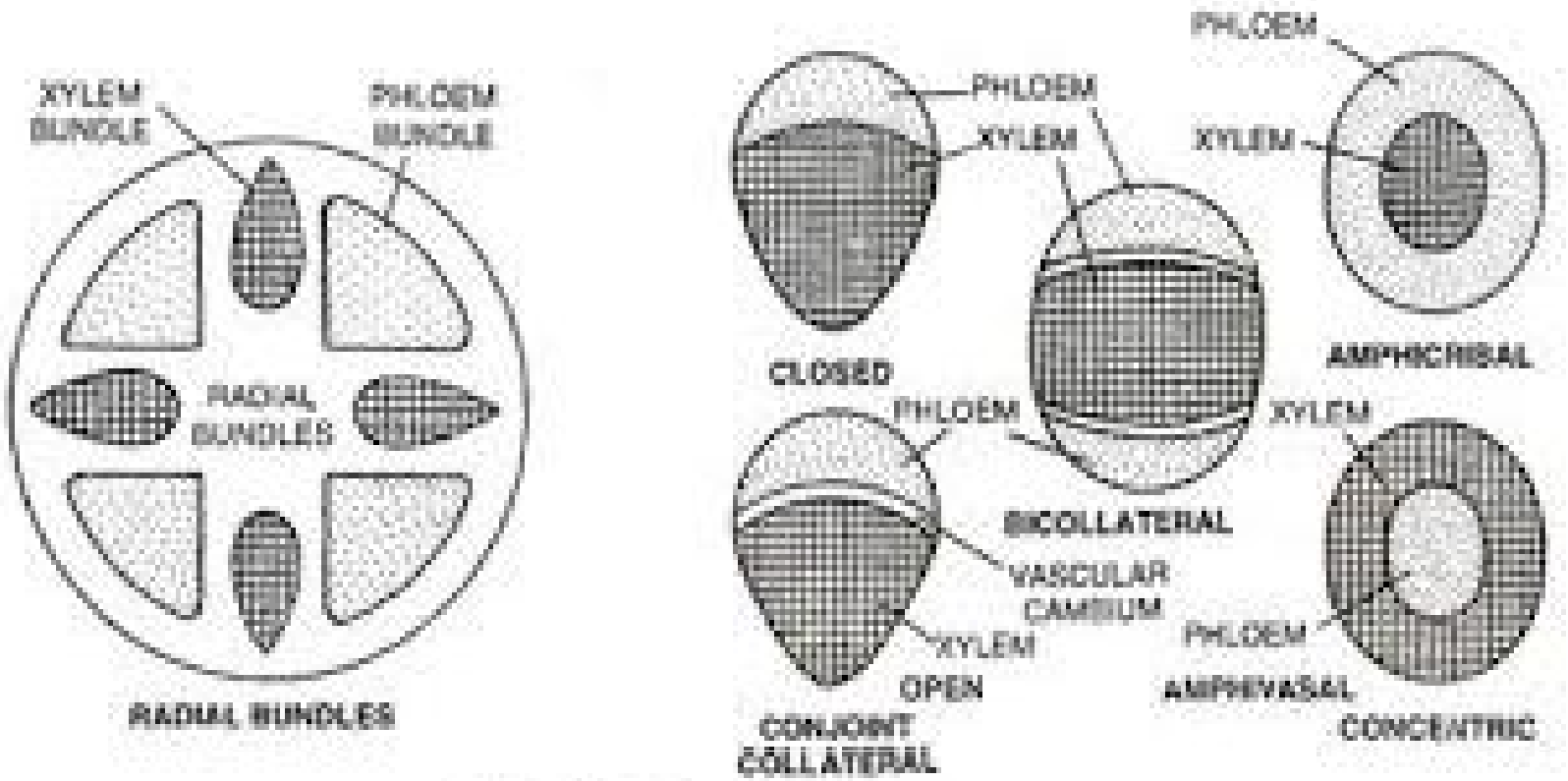


Fig. 6.19. Types of vascular bundles.

	Exarch xylem	**Endarch xylem**
(i)	Protoxylem is towards the outer side of the organ.	Protoxylem is towards the centre of the organ.
(ii)	Exarch condition of xylem is found in roots.	Endarch condition of xylem is found in stems.

9. Reproductive organs :

-bisexual in *Cycadeoidea* & *Williamsoniella*

-- monosexual in *Wielandiella*

- Flowers of Cycadeoidea are similar to the flowers of *Magnolia* genus
- Has a basal aggregation of microsporophylls surmounted by a flat receptacle
- Receptacle has interseminal scales on which seeds and ovules are distributed
- ovules & seeds – stalked in *Cycadeoidea*
- sessile – other two

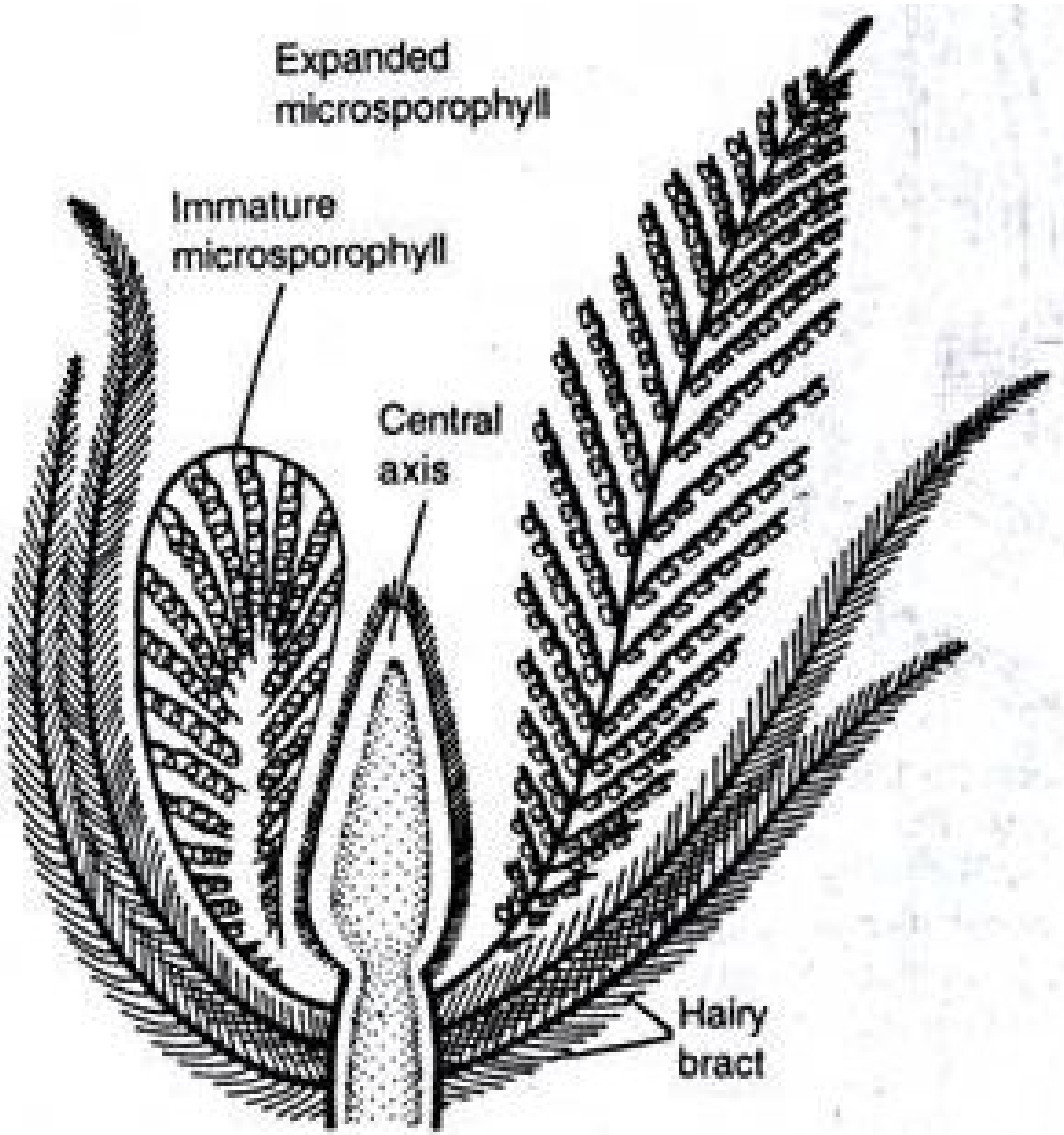
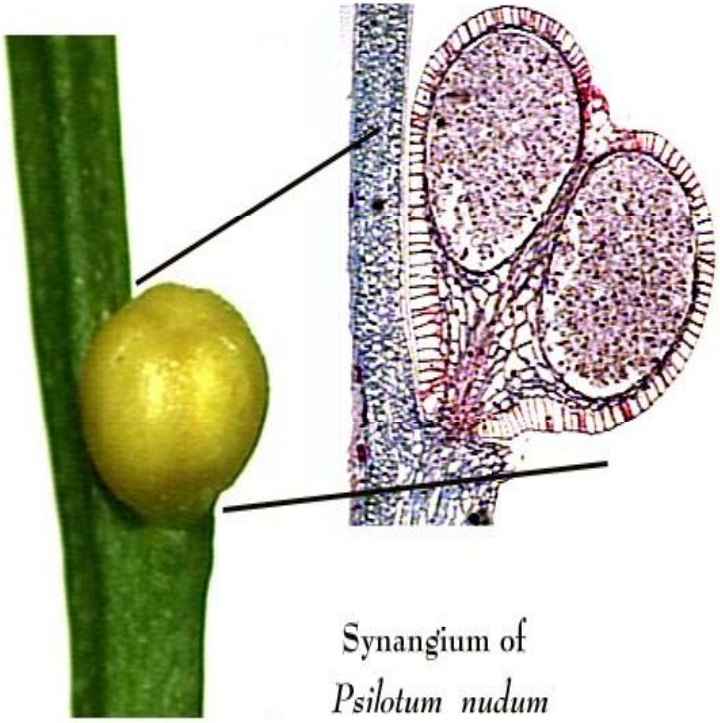


Fig. 2.16. *Cycadeoidea decotensis.* Apical portion with expanded and curved microsporophylls; the conical central axis possesses female reproductive structures.

- **Flowers – surrounded by numerous hairy bracts from the base of receptacle**
- **Ovules are enclosed in cupule**
- **Pollen grains are borne in bilocular synangia**
- **Two cotyledons in seeds**



Synangium of *Psilotum nudum*

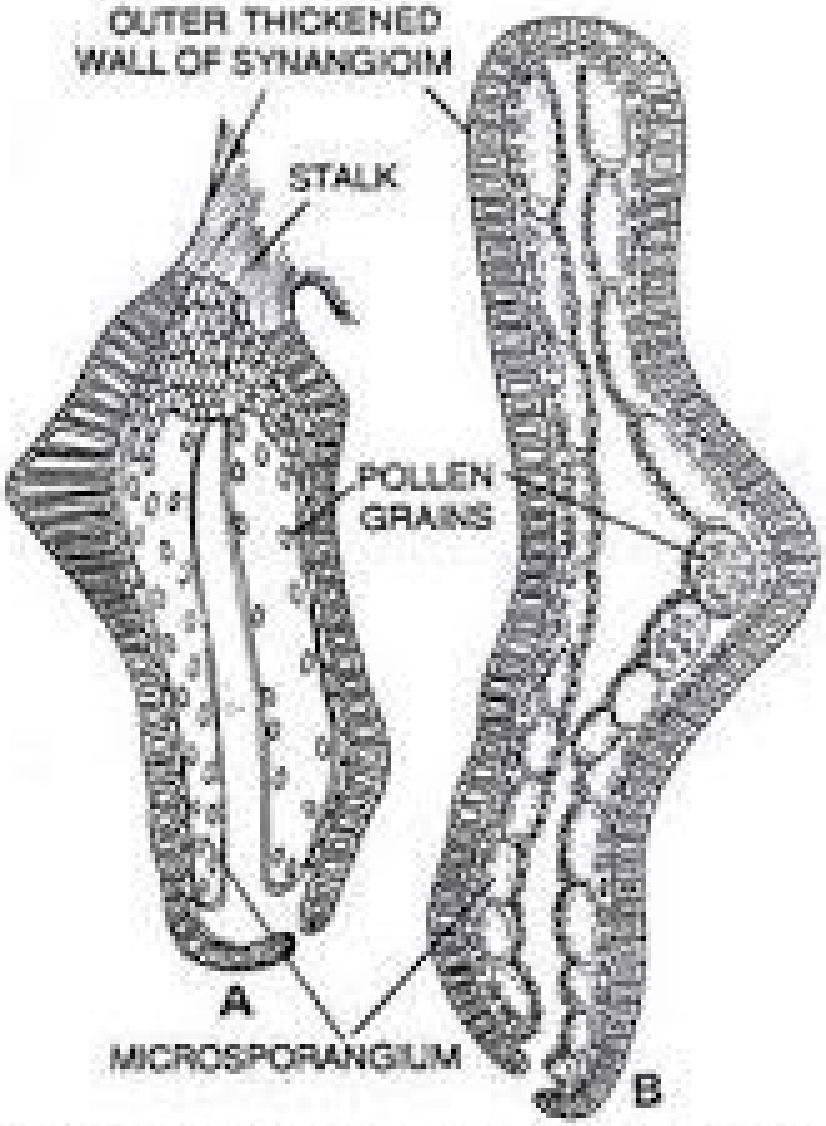


Fig. 2.18. *Cycadeoidea dacotensis*. A, central structure of a synangium showing stalk and two microsporangia in longitudinal section; B, T.S. of the synangium showing thickened outer wall and inner parenchymatous layer.

PENTOXYLALES

-By Prof. BIRBAL SAHNI IN 1948 – fossils in RAJMAHAL HILLS IN BIHAR

- Unique combination of Benettitales, Cycadales & Coniferales

- Petrified -1962 - Newzealand

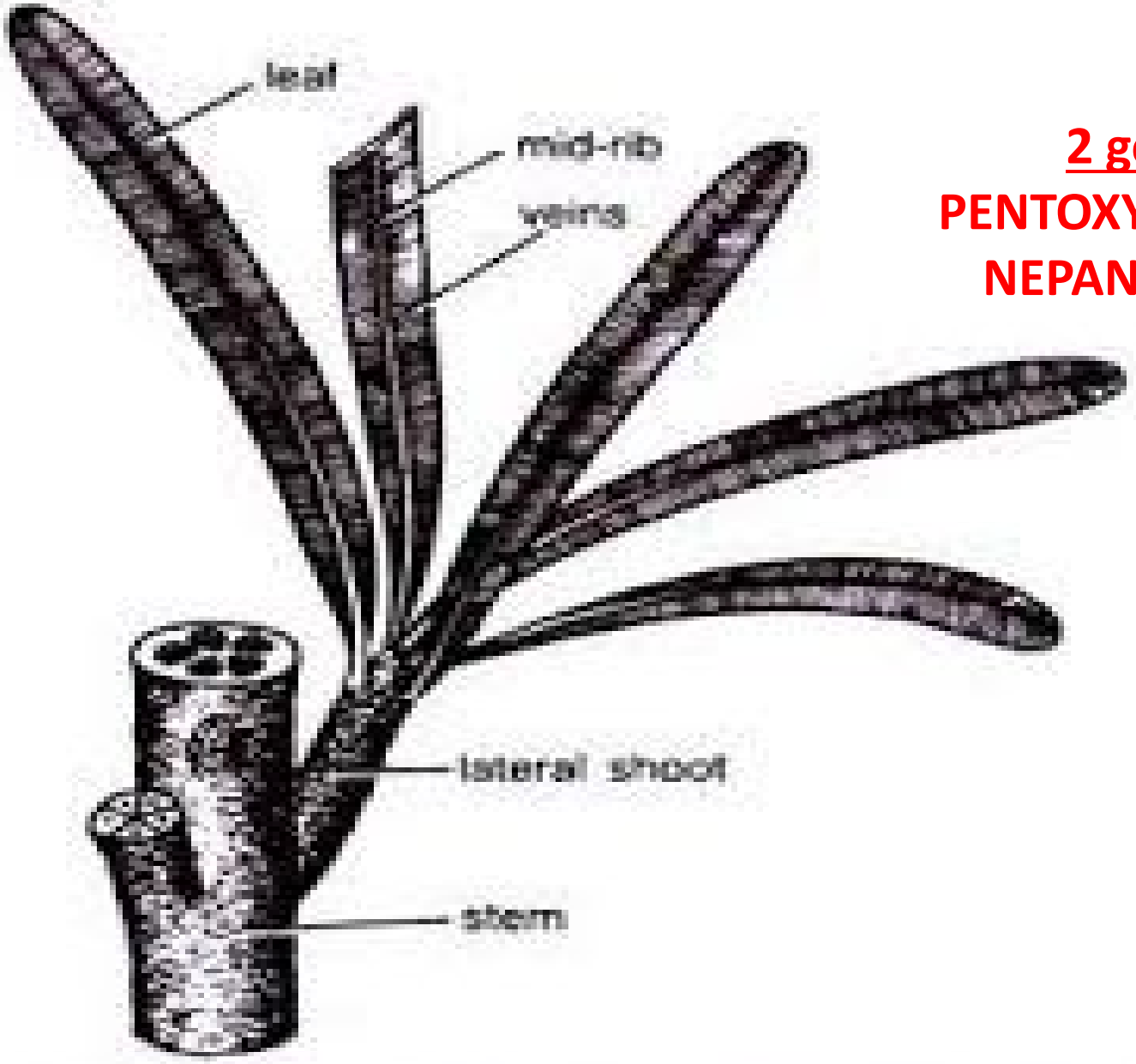


Fig. 7.2. *Pentoxylon sahni*. Reconstruction of stem and leaves (*Nipaniophyllum raoi*). (after Sahni).

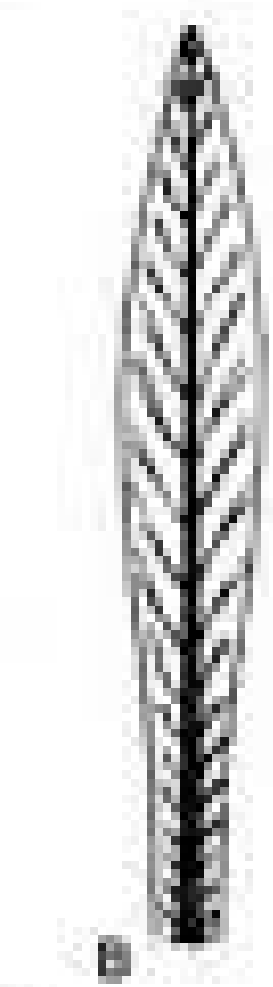
2 genera

PENTOXYLON SAHNI

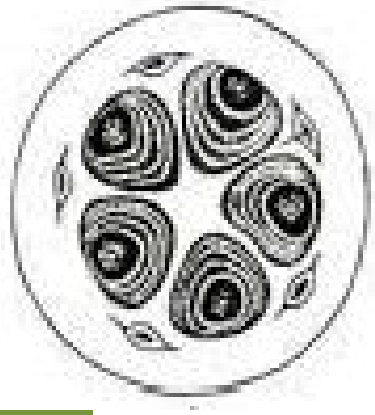
NEPANIOXYLON

MORPHOLOGY:

- Shrubs / small trees
- stem – 3mm to 2cm
- long & dwarf shoots
- leaves only on short shoots
- leaves – simple, petiolate, margin entire, obtuse apex, distinct midrib with lateral veins towards margin (parallel)
- leaf – 7cm long & 1 cm broad
- Rep organs – terminal on short branches



ANATOMY



- 5 primary steles – POLYSTELIC
- Concentric with cambium
- Secondary tissues in older stem towards the centre sec wood is EXOCENTRIC
- Primary xylem & phloem – external to cambium- as ring
- 5 smaller vascular strands alternating main strands
- smaller – strands of lateral shoots
- No. of strands varies at different levels
- 3 @ lower, 5# middle , 6 @ top
- secondary xylem – pcynoxylic, with growth rings
- Tracheids – bordered pits (uni/bi seriate)
- Both types of stomata
- Combination of Benettitales & Cycadales

Female Reproductive organ:

- Like mulberry fruits
- Peduncle – several branches – female strobilus – terminal position
- 2-3cm long
- Central receptacle to which 20 sessile ovules are attached
- No sterile structures – distinct feature
- Ovule – surr by 2 layers of integument – outer sarcotesta & inner sclerotesta
- Micropyle – directed outwards
-

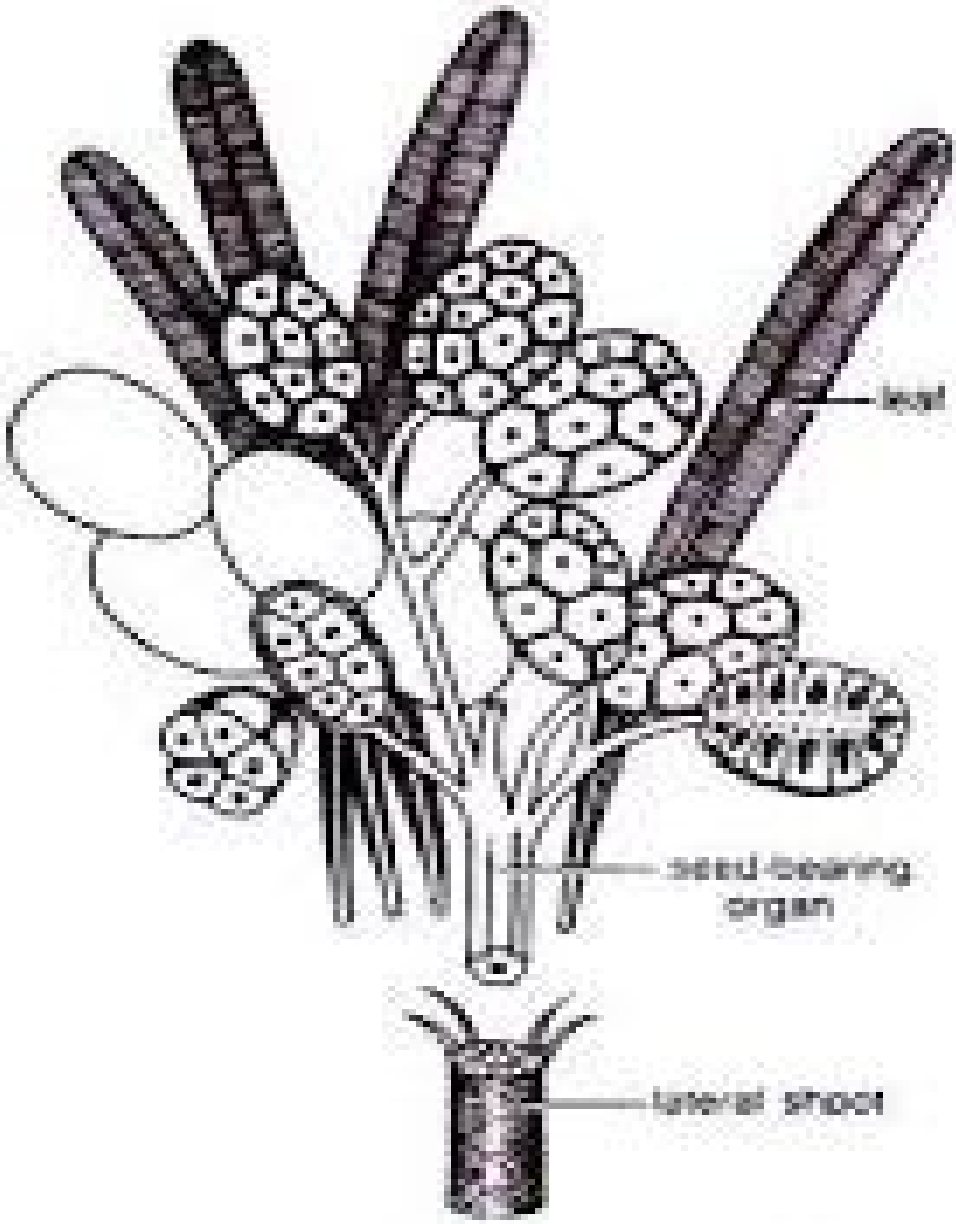


Fig. 7.3. *Carnoconites compactum*. Female cones. (after Sahni)

Male strobilus

- ✓ Terminal of lateral shoots ‘
- ✓ Dome shaped receptacle – 20 microsporangiophores – arranged in a whorl
- ✓ Pear shaped unilocular microsporangia terminally
- ✓ Several boat shaped microspores

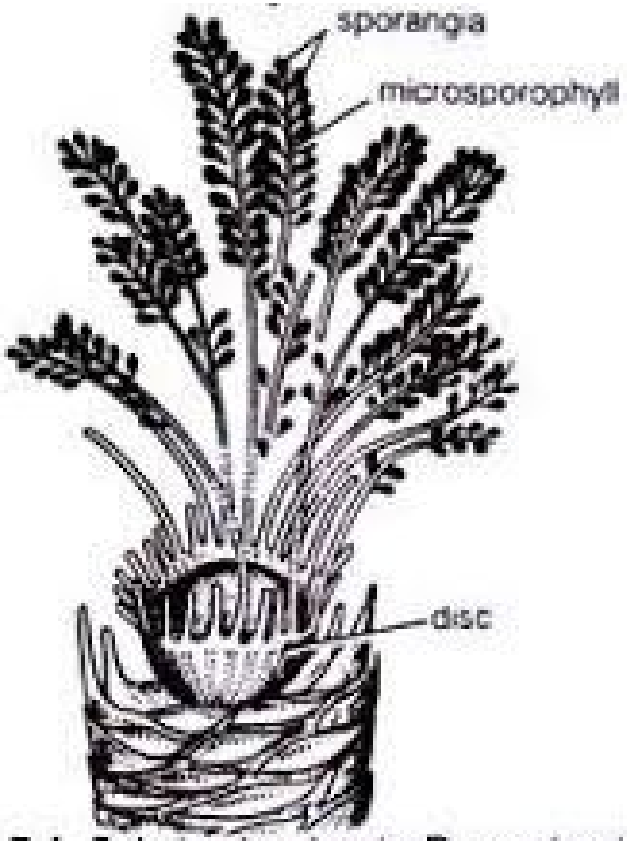


Fig. 7.4. *Sahnia nipaniensis*. Reconstruction of male "flower". (after Vishnu-Mittre).