Pteridophyte Diversity:
Monilophyte

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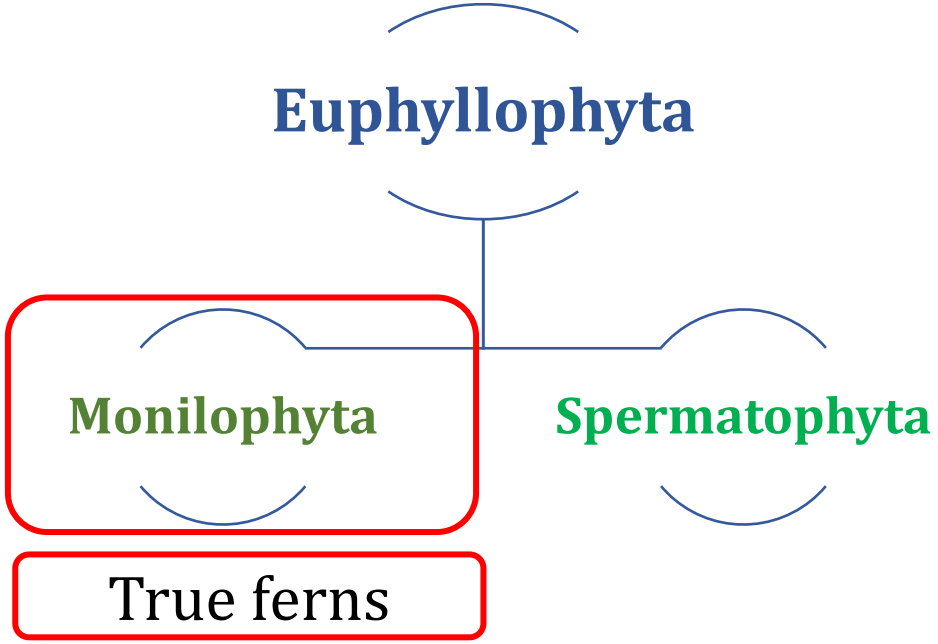
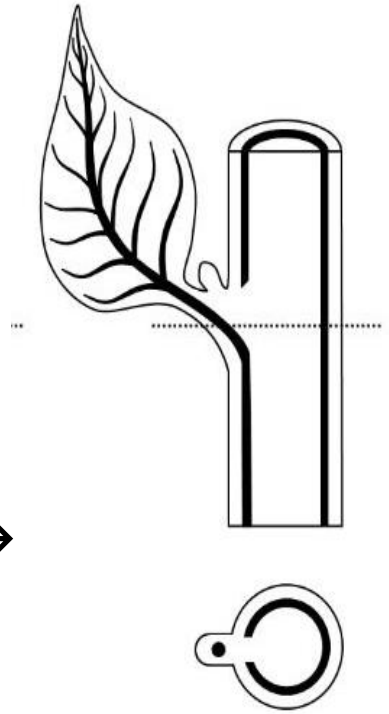
Euphyllophyta



Major apomorphies of euphyllophyta:

- Roots: exarch protoxylem
- Euphyllous leaf, called euphyll or megaphyll→ leaf gap

Leaf gap: a region of nonvasc., parenchyma tissue interupting the vasculature of the stem



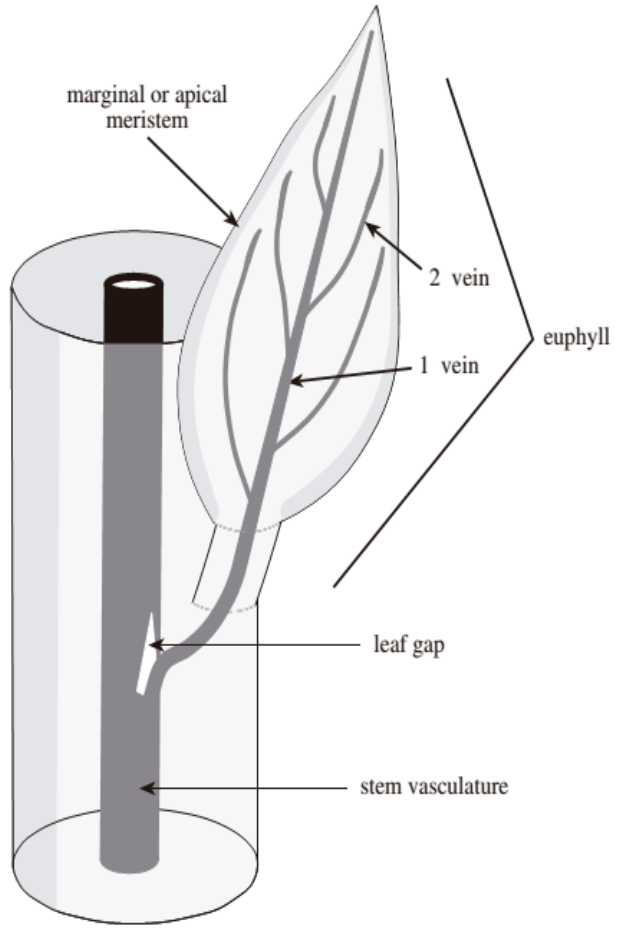


FIGURE 4.16 Euphyll structure.

ORDERS OF Monilophyta

Eusporangiate

Ophioglossales

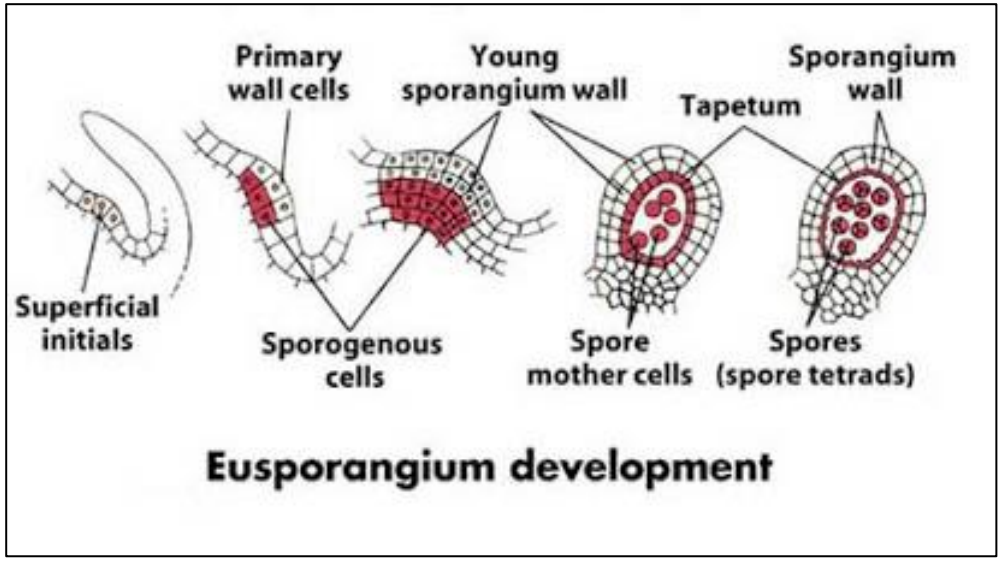
Psilotalles

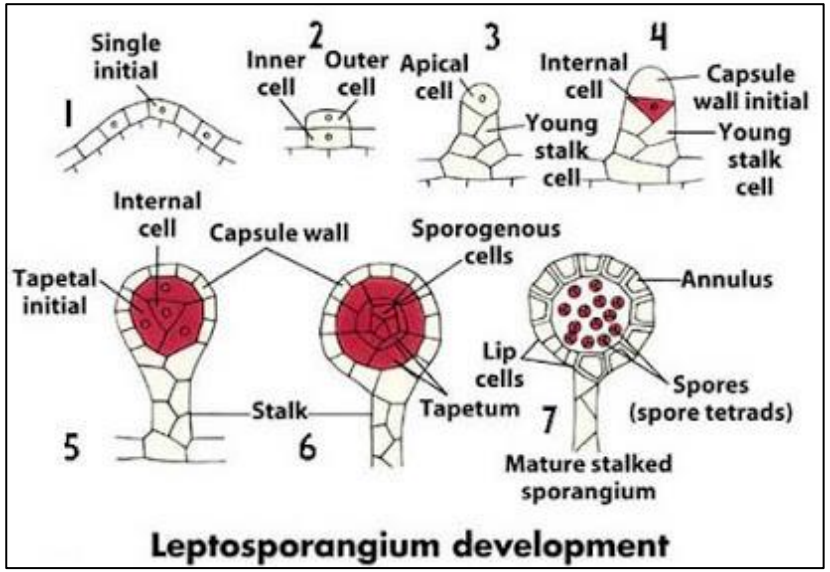
Equisetales

Maratiales

Pollypodiales

Leptosporangiate





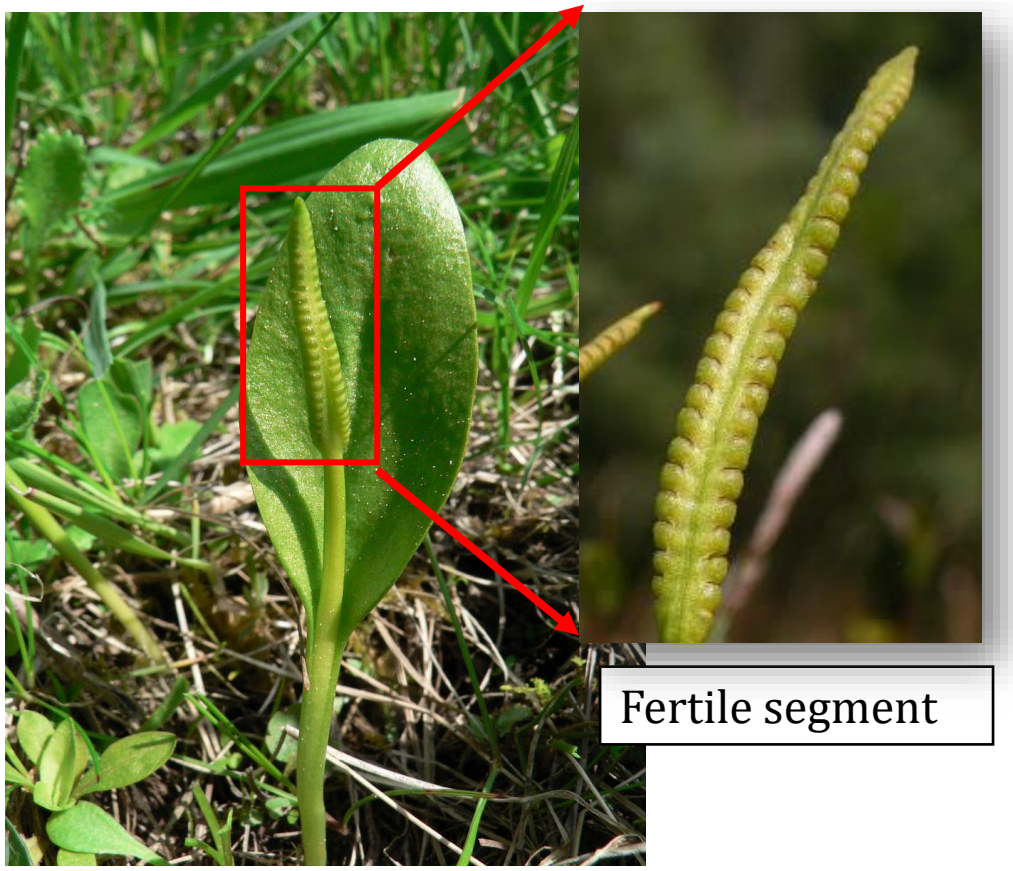
Eusporangia	Leptosporangia
Arise from several initial cells	Arise from a single initial cell
Sporangium wall more than one cell layer thick	Sporangium wall composed of only a single layer of cells
Produces many spores (generally 100+ spores per sporangia)	Produces fewer spores (generally 64 or fewer per sporangia)
Various dehiscence mechanisms, no annulus	Specialized dehiscence mechanism, typically with annulus

1. Ophioglossales (Ophio-glossoid ferns)

Each frond consist of:

- Sterile segment → which contains the photosynthetic blade or lamina
- Fertile segment → nonphotosynthetic and produces spores (eusporangium that relatively large)

- **Sporangia** aggregated in fertile portion (sporophore), thick walled (eusporangiate- more than one celled thick)



Fertile segment

1. Ophioglossales (Ophio-glossoid ferns)

Each frond consist of:
- Sterile segment → which contains the photosynthetic blade or lamina
- Fertile segment → nonphotosynthetic and produces spores (eusporangium that relatively large)

- **Blade** or lamina in the sterile segment is simple or bipinate up to 50 cm long,

Ophioglossum

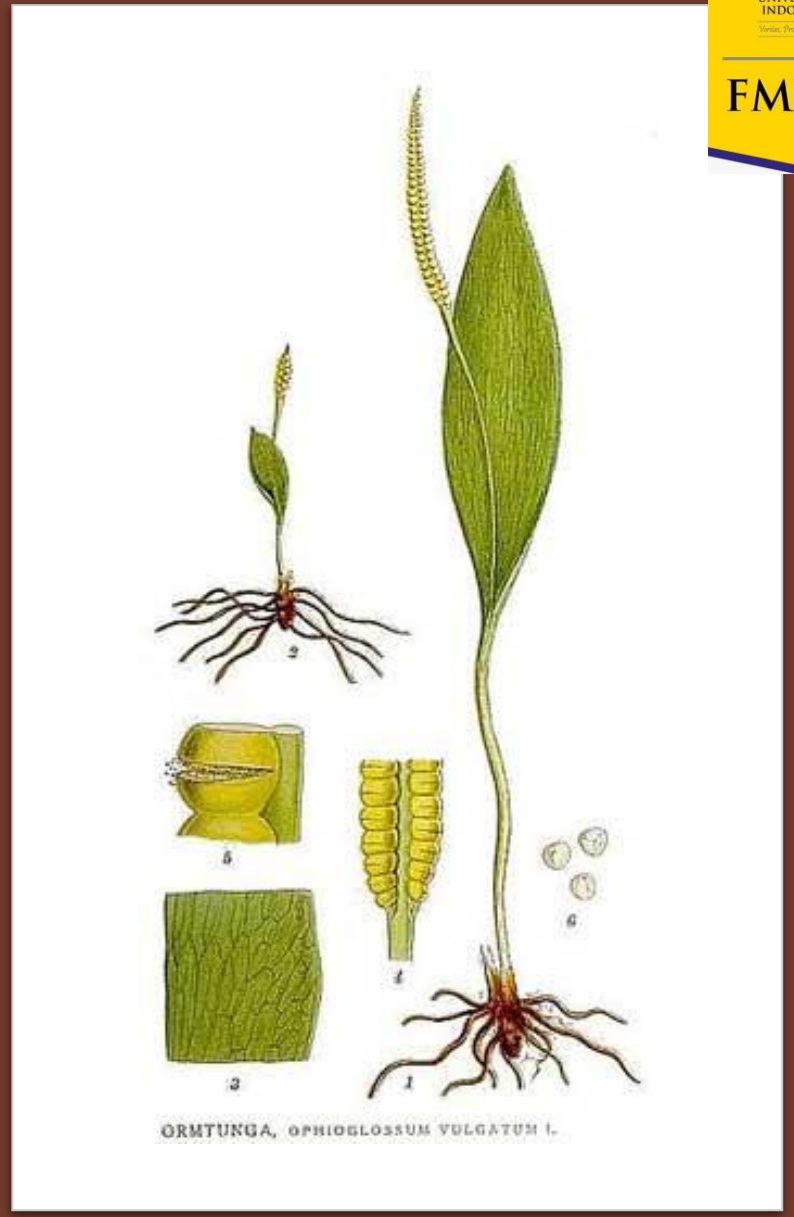
Simple lamina

Botrychium

Bipinate lamina

1. Ophioglossales (Ophio-glossoid ferns)

- Stem short, tuberous or rhizomatous.
- The underground rhizome gives rise to unbranched roots that lack root hairs.
- Petiole fleshy with expanded sheathing base
- Young leaves are not coiled as in other groups
- Common genera: *Botrychium, Ophioglossum.*



2. Psilotales (Whisks ferns)

- The sporophyte consists of a horizontal rhizome, gametophyte nonphotosynthetic
- Generally dichotomously branching stem
- very reduced and peglike leaf and may lack a vascular strand → **enations.**
- Sporangia: two- or three-lobed eusporangia, interpreted as a **synangium**, a fusion product of two or three sporangia
- The mature synangia are yellowish and subtended by forked appendage
- Lack a true root

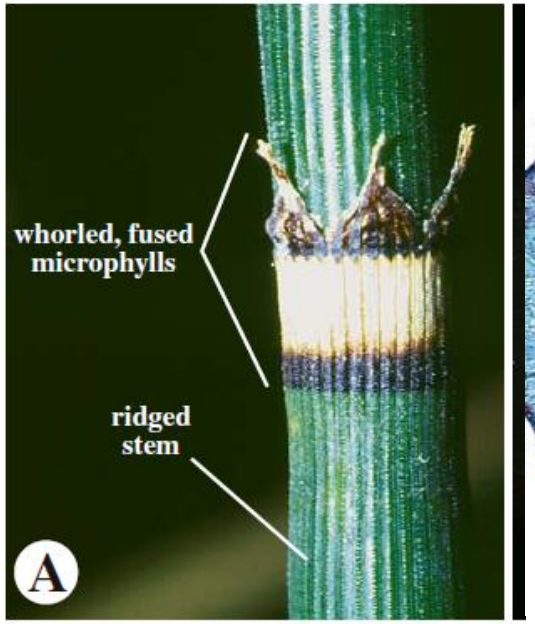
3. Equisetales (Horsetails)

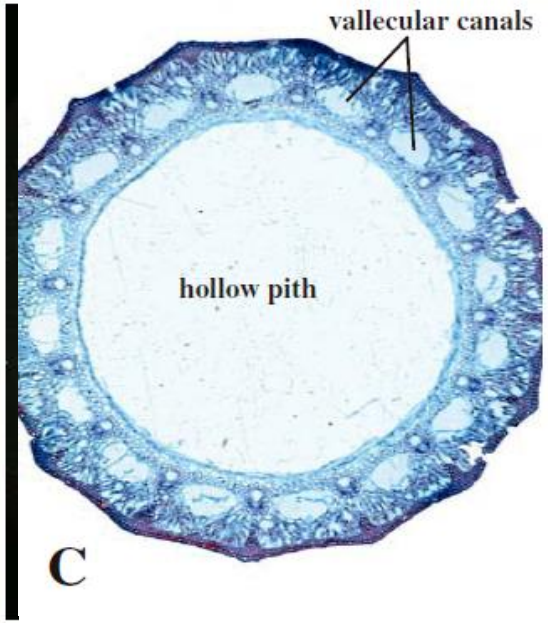
Horsetail: *Equisetum*

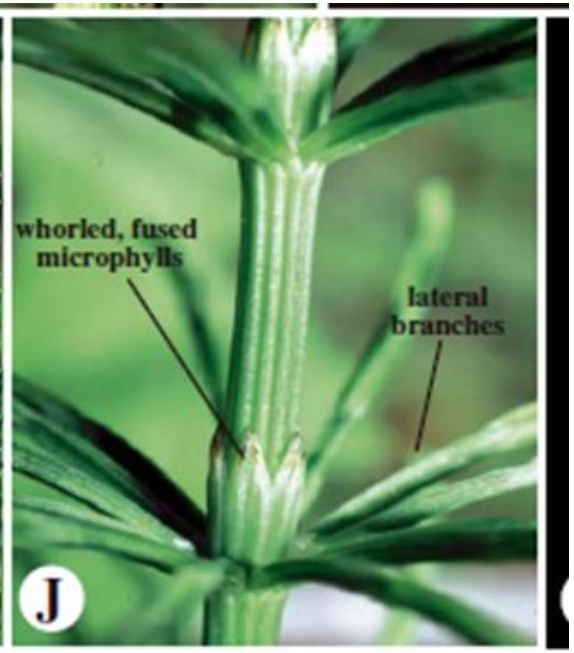
3. Equisetales (Horsetails)

Apomorphies:

1. **Ribbed stems**, often associated with internal **hollow canals.**
2. **Reduced, whorled** leaves, usually marginally fused



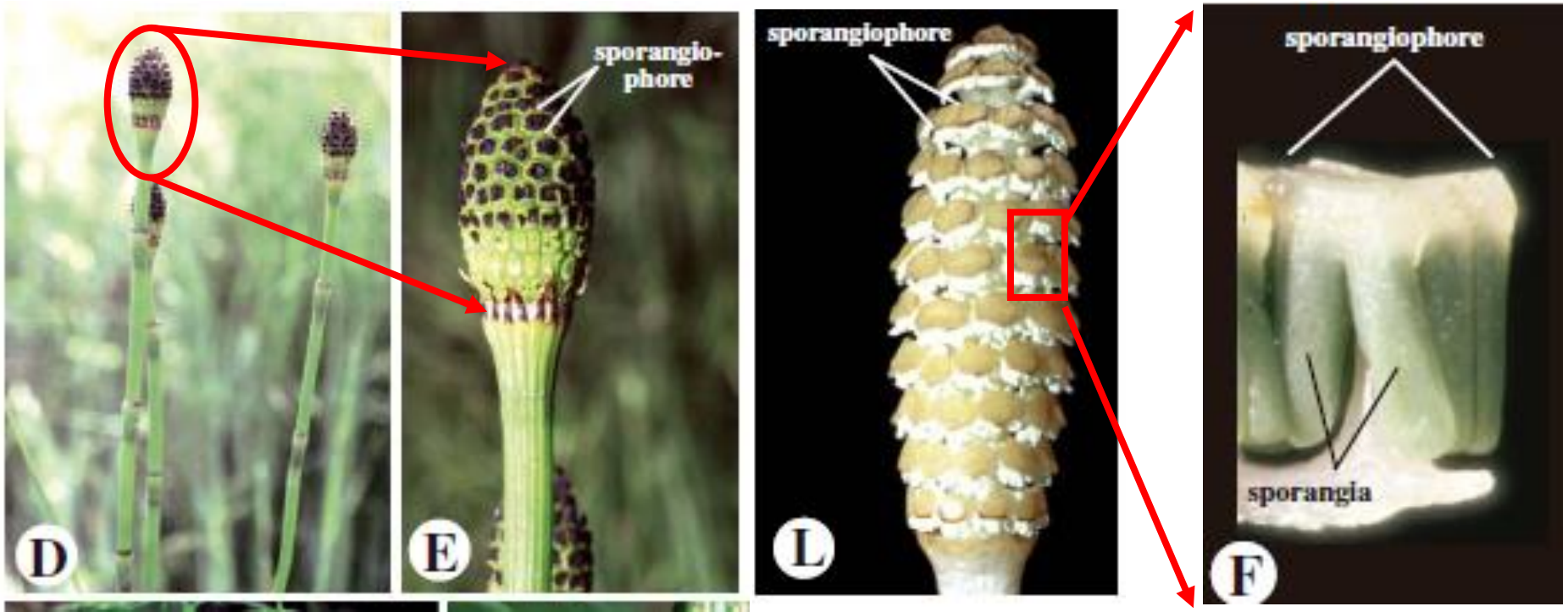




3. Equisetales (Horsetails)

Apomorphies:

1. Strobili or cones are at the tip of aerial stems. Each strobilus consists of sporangiophores
2. **Sporangiophores**: each of which consists of a peltate axis bearing pendant longitudinally dehiscent sporangia.
3. Photosynthetic spores with **elaters**.



4. Marattiales (Marattoid Ferns)

1. very similar to the Polypodiales or leptosporangiate ferns in general form.
2. large pinnate or bipinnate leaves with circinate vernation.
3. sporangia located on the abaxial surface of leaflet blades
4. photosynthetic gametophyte

Sporangia:

- of the Marattiales are eusporangiate
- In some taxa, the sporangia are fused into a common structure, a synangium

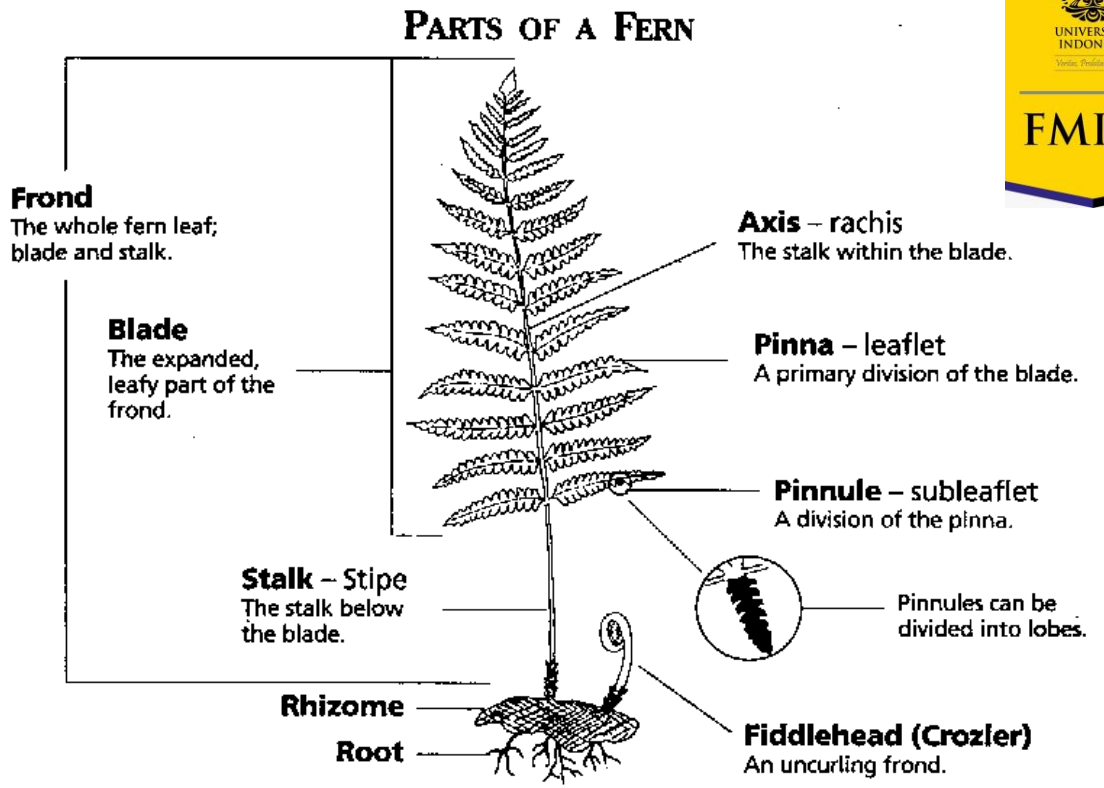
FIGURE 4.22 **A–D.** Marattiales. **A,B.** *Marattia* sp. **A.** Whole leaf, bipinnately compound. **B.** Close-up of synangium containing eusporangiate sporangia near margin on abaxial leaf surface. **C,D.** *Danaea* sp. **C.** Synangium containing several eusporangia. **D.** Pinnately compound leaf, with lower, fertile pinnae having numerous synangia on abaxial surface.

5. Polypodiales (Leptosporangiate Ferns)

a) contain by far the greatest diversity, with more than 11,000 species.
b) Immature leaves are coiled, known as **fiddleheads** or **croziers.** This type of developmental morphology is called **circinate vernation**.
c) Often have trichomes or scales on the rhizome or leaves → valuable taxonomic character

Croziers

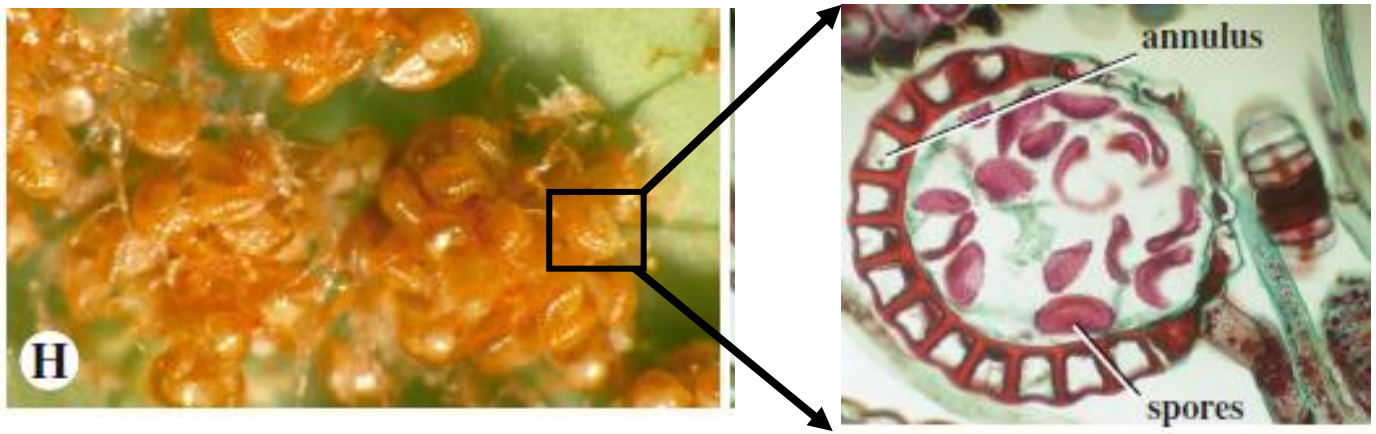
Trichomes on the stipe surface

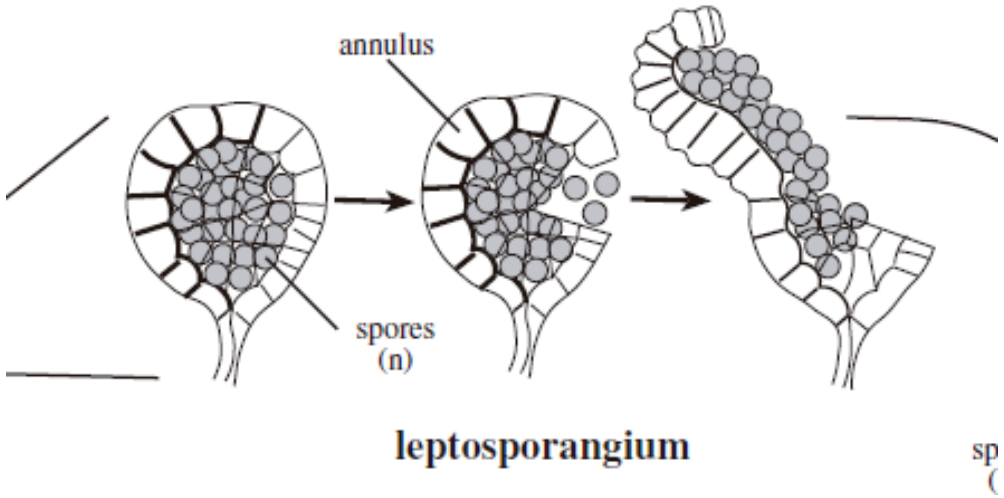


Most of Polypodiaceae have rhizomatous stem

Only Cyatheaceae has aerial stem

Leptosporangium in Polypodiales





- On the outer rim of the leptosporangium is a single row of specialized cells → an annulus
- Mature leptosporangium → water evaporate from annulus cells
- the cells to buckle on the outer faces
- This buckling provides a force resulting in splitting, or dehiscence, of the leptosporangium
- total evaporation of water within the cells causes the spores release

Leptosporangium in Polypodiales

- often aggregated into clusters → **sori** (singular **sorus**), which may or may not be covered by a flap of tissue, the **indusium**

- Some species have an extension of the pinnule margin called a **false indusium** that overlaps the sorus.

In addition to general frond morphology, the position and shape of the sorus and indusium are useful taxonomic characters in delimiting the ferns.

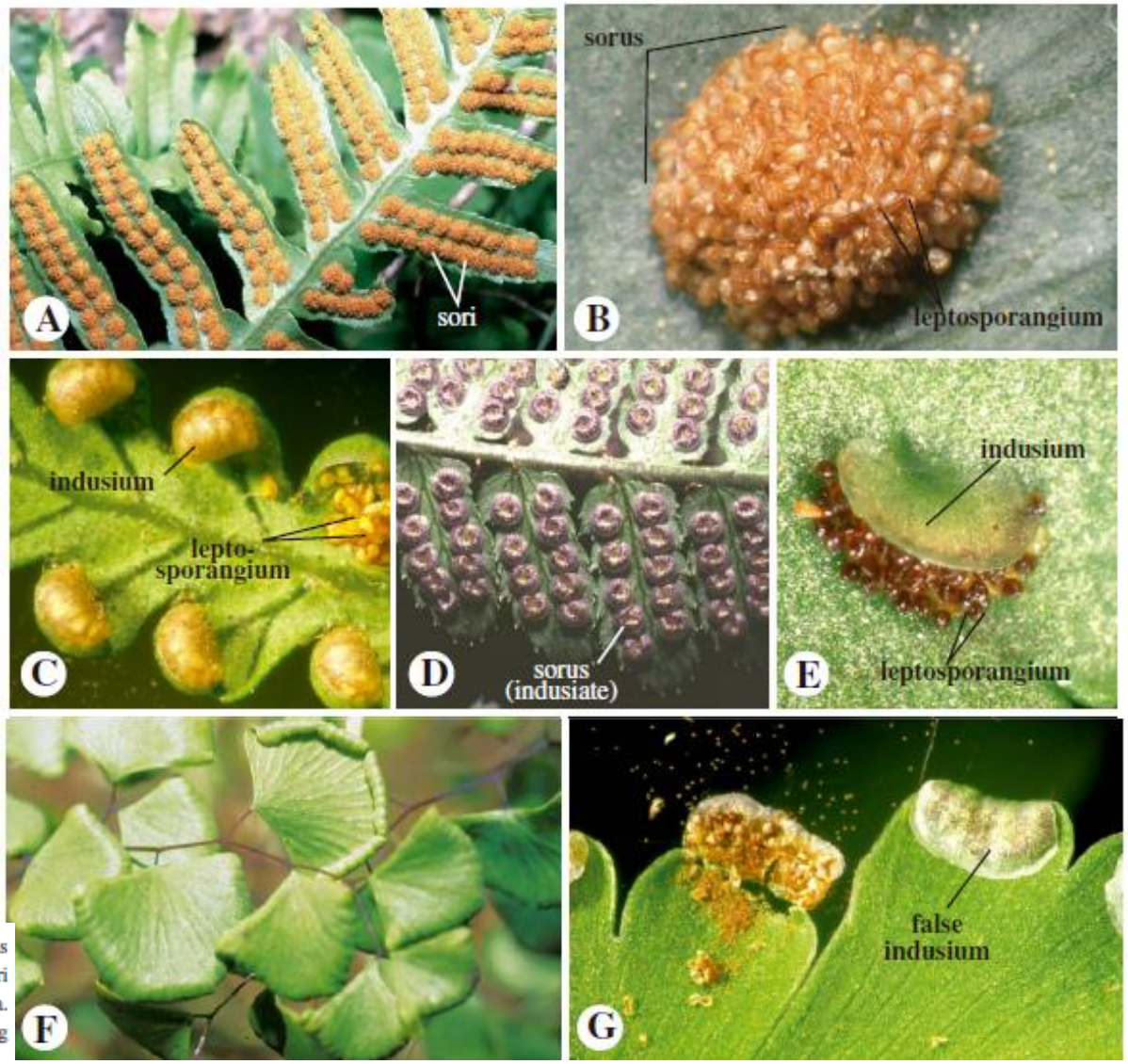


FIGURE 4.24 Polypodiales Leptosporangiate ferns. **A.** *Polypodium californicum*, an indusiate species. **B.** *Polypodium aureum*, sorus close-up. **C.** *Cibotium* sp., a tree fern, showing indusia at margin of pinnules. **D.** *Dryopteris arguta*, with orbicular-reniform indusiate sori on leaf surface. **E.** *Nephrolepis cordifolia*, close-up of indusium and sorus of leptosporangia. **F.** *Adiantum jordanii*, with false indusia. **G.** *Adiantum capillus-veneris*, close-up of false indusia. **H.** Close-up of leptosporangia. **I.** Leptosporangium in sagittal section, showing annulus and internal spores. Note single cell layer of wall.


Thank you