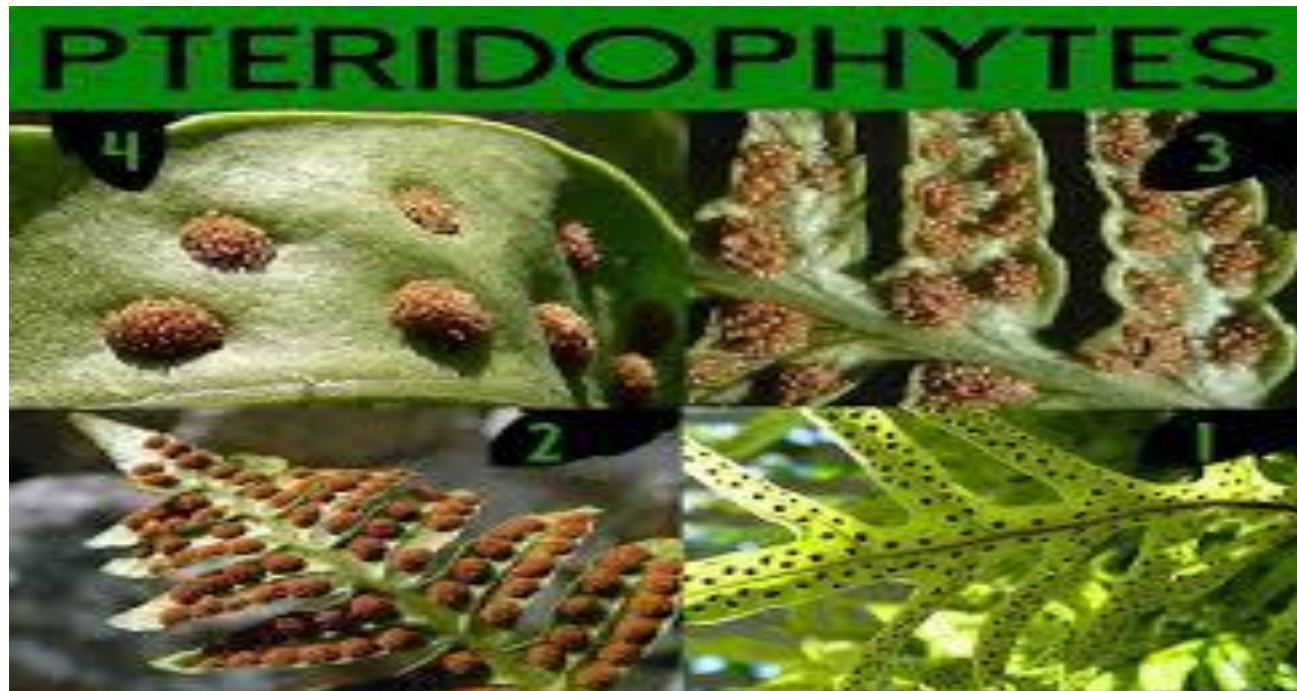




# Bhagalpur National College, Bhagalpur

(A Constituent unit of Tilka Manjhi Bhagalpur University, Bhagalpur)

PPT Presentation for B.Sc. I- Pteridophyta: General Characters & Classification



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# Pteridophytes



- **Seedless** vascular plants – **Vascular cryptogams**
- In **Gk Pteron** means. **Feather** , **phyton** means plants (Feather like fronds / leaves)
- Reproduce by means of **spores**
- **First land plants**



First ferns are estimated to be about 400 million year old

kingd

as per

# Status of Pteridophytes – India

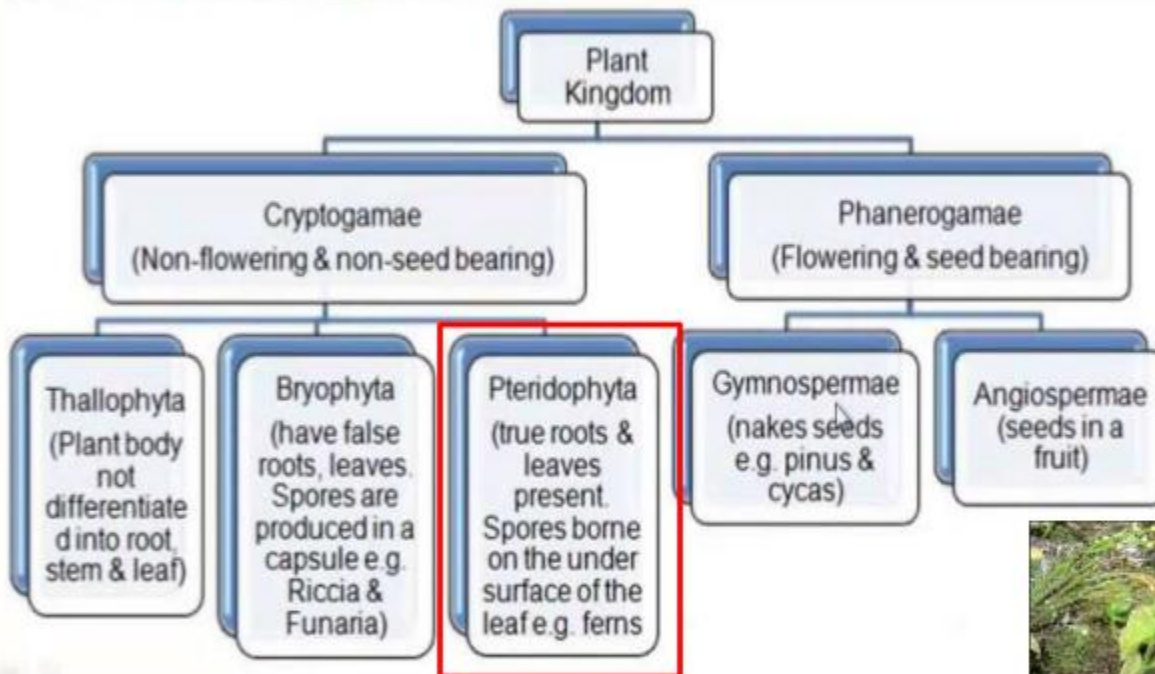


- 500 species of ferns and 100 species of fern allies (**other than the order of filicales**) are on record from India
- Pteridophytic flora of India comprises of **67 families, 191 genera and more than 1000 species** including **47 endemic Indian ferns**, and **414 species of pteridophytes (219 at risk, of which 160 critically EN, 82 NT, 113 rare)** constituting **41-43 %** of the total number of 950 -1000 pteridophytes of india. (**Vineet and Satyanarayana, 2015**)

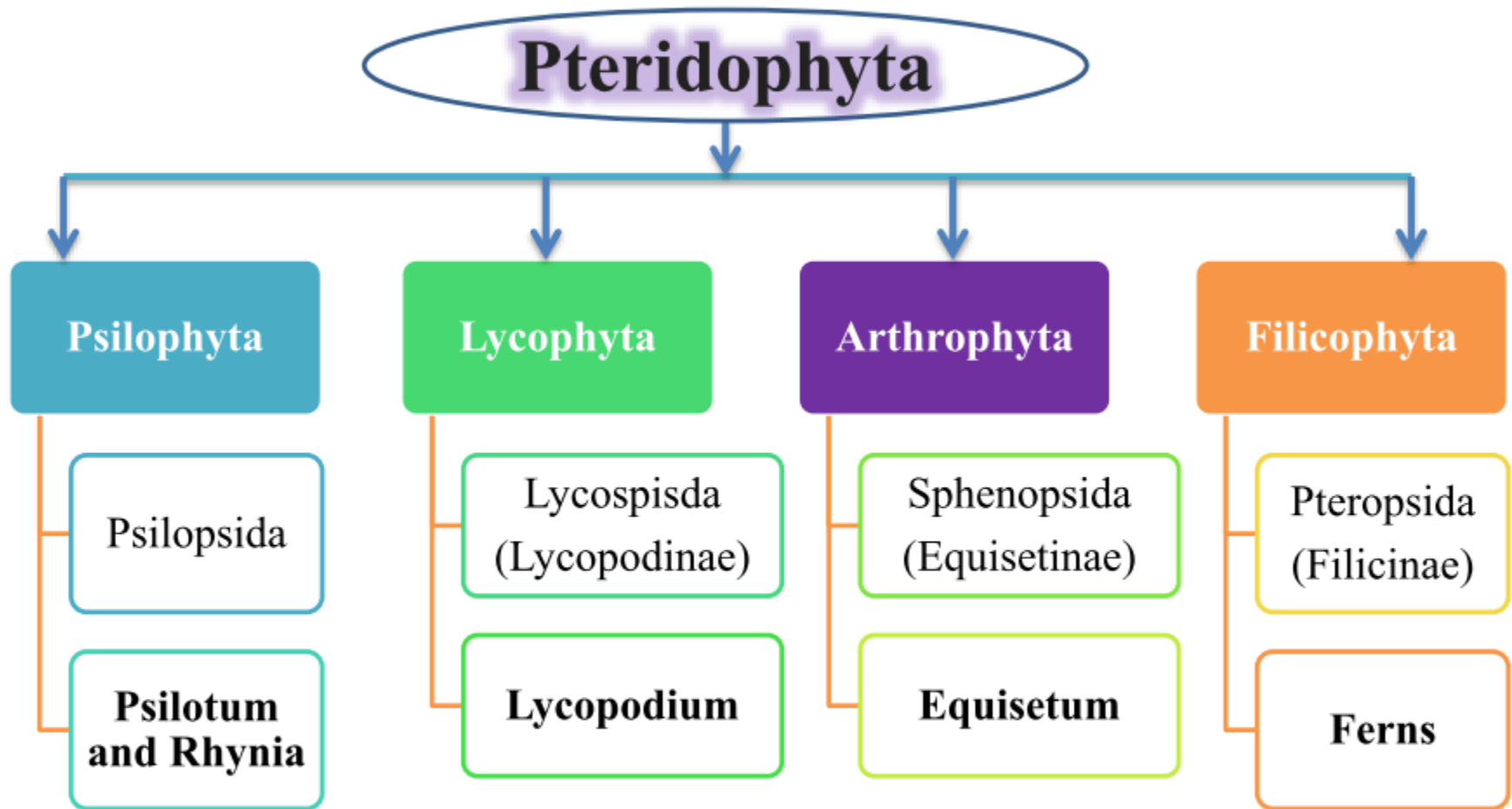
# Plant kingdom – Classification



- **A W Eichler**



# Further Pteridophytes Classified into 4 classes





1. **Psilotum**
2. **Rhynia**
3. **Lycopodium**
4. **Equisetum**
5. **Ferns**



# PTERIDOPHYTES: GENERAL CHARACTERS



## *Pteridophytes: the ferns*

- Plant with feather like leaves
- *Pteron* = feathers; *phyton* = plant
- **Vascular cryptogams:** cryptogams with vascular system
- Includes primitive living and fossil vascular plants
- Represented by 400 genera and 10500 species (living and fossil)
- Plant body is **sporophytic**, differentiated into **stem, root and leaves**
- Mature sporophyte is nutritionally **independent** of gametophyte



**Pteridophytes**  
*Plants with Feather-like Leaf*

# PTERIDOPHYTES: GENERAL CHARACTERS



- Show much variation in form, size, and habitat
- Small annuals (*Azolla*, *Salvinia*) to large perennial trees (*Angiopteris*)
- Most of the living Pteridophytes are terrestrial



*Psilotum*



*Selaginella*



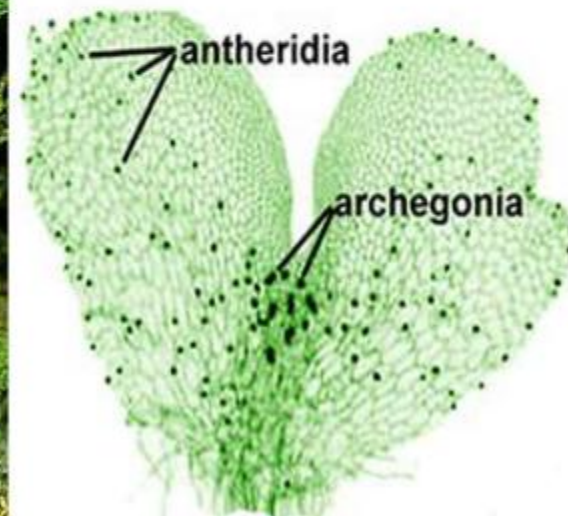
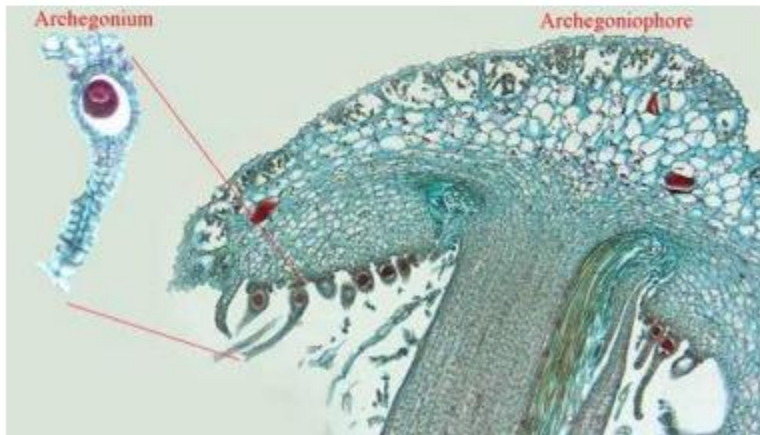
*Lycopodium*



**Contd.,**



- Young leaves of sporophyte show **circinate vernation**
- **Gametophyte** develops **small sessile antheridia** and partially embedded **archegonia with 4- rowed neck**
- Sex organs **multi-cellular and jacketed**
- **Embryonic** stage present



# PTERIDOPHYTES: GENERAL CHARACTERS



- Some members are aquatic (*Azolla*, *Marsilea*, *Isoetes*, *Salvinia*)
- Few are xerophytes (*Selaginella rupestris*)

## *Aquatic Pteridophytes*



*Azolla*



*Marsilea*



*Salvinia*



*Isoetes*

## *Selaginella lepidophylla* (Resurrection plant)



*In dry conditions*



*In wet conditions*

# PTERIDOPHYTES: GENERAL CHARACTERS



- Stem and roots have permanent growing apex
- Most of them having herbaceous stem
- Leaves:
  - Scaly in *Equisetum*
  - Small sessile in *Lycopodium*, *Selaginella*
  - Large, petiolate compound in Ferns

## *Leaves in Pteridophytes*



Scale Leaf



Sessile Leaf



Petiolate Leaf

# PTERIDOPHYTES: GENERAL CHARACTERS



- In ferns, leaves show **Circinate Vernation**
- Circinate vernation: Young leaves coiled inward

## *Circinate Vernation*



# PTERIDOPHYTES: GENERAL CHARACTERS



- Based on leaf structure pteridophytes are classified into
  - Microphyllous Pteridophytes
  - Macrophyllous Pteridophytes

## ***Microphyllous:***

- Simple leaves with single vein and no leaf gap formation  
(*Lycopodium*)

## ***Macrophyllous:***

- Large pinnatifid, leaves having complex series of veins and they form prominent leaf gap in the stem stele (*Pteris*)

# PTERIDOPHYTES: GENERAL CHARACTERS



- Stem usually branched
- Branching monopodial or dichotomous
- Branches do not arise from the axils of leaves
- Leaves and stem possess trichomes
- Stomata are present on both surface of leaf
- Root and stem have well developed vascular system
- Vascular system composed of xylem and phloem
- Cambium is absent, hence secondary thickening is absent
- Some Pteridophytes show secondary growth (*Isoetes*)

# PTERIDOPHYTES: GENERAL CHARACTERS



- Vascular elements are well developed in Pteridophytes
- Progressive advancement of vascular structure in different groups
- Vascular structures are commonly called as stele
- Stele may be:
  - **Protostele:** (*Lycopodium*)
  - **Siphonostele:** (*Equisetum*)
  - **Dictyostele :** (*Pteris*)
  - **Polystele :** (*Angiopteris*)

# PTERIDOPHYTES: GENERAL CHARACTERS



- Xylem made up of tracheids
- Phloem made up of sieve cells and phloem parenchyma
- Xylem vessels absent
- Xylem conduct water and minerals
- Phloem conduct food materials
- Photosynthetic tissue mostly restricted to leaves
- No tissue differentiation in microphyllous leaves
- In megapyllous leaves: palisade and spongy differentiation



# PTERIDOPHYTES: GENERAL CHARACTERS



## *Reproduction:*

- Pteridophytes reproduce by spores
- Spores are produced in sporangia
- Sporangia are borne on the ventral side of leaf
- ***Sporophyll***: Leaf on which sporangia are produced
- ***Opioglossum***: fertile spike bearing sporangia arise from axil of leaf

# PTERIDOPHYTES: GENERAL CHARACTERS



- In aquatic forms (*Salvinia* & *Marsilea*) sporangia are present within specialized structure called sporocarps

## *Sporocarp in Pteridophytes*



*Marsilea*



*Salvinia*

- Plants May be either:
  - **Homosporous** (*Lycopodium, Pteris*)
  - **Heterosporous** (*Selaginella*)

# PTERIDOPHYTES: GENERAL CHARACTERS

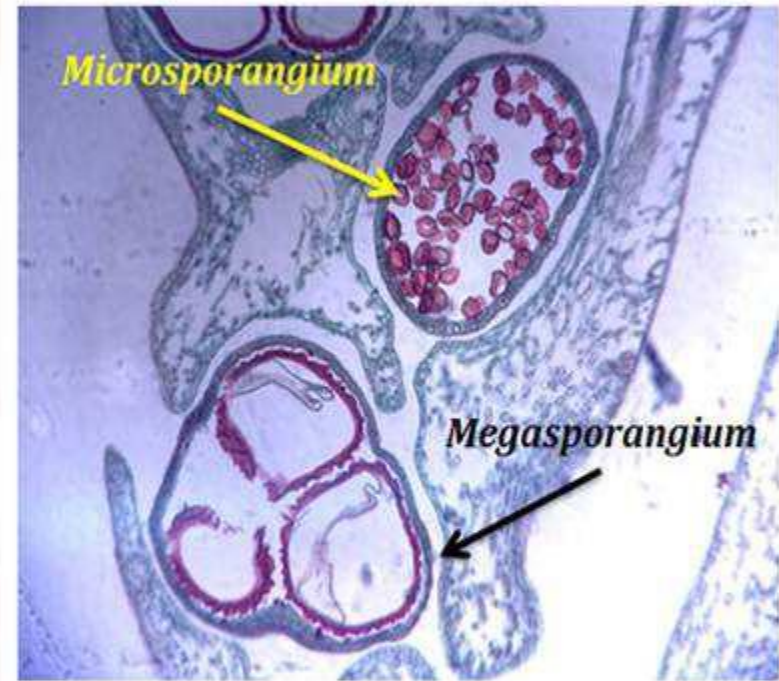


## *Homosporous:*

- Single type of spore and sporangia
- Spores small

## *Heterosporous:*

- Two types of spores and sporangia
- One large and other small
- Large sporangia - megasporangia produce female *megaspore*
- Small sporangia - microsporangia produce male *microspore*



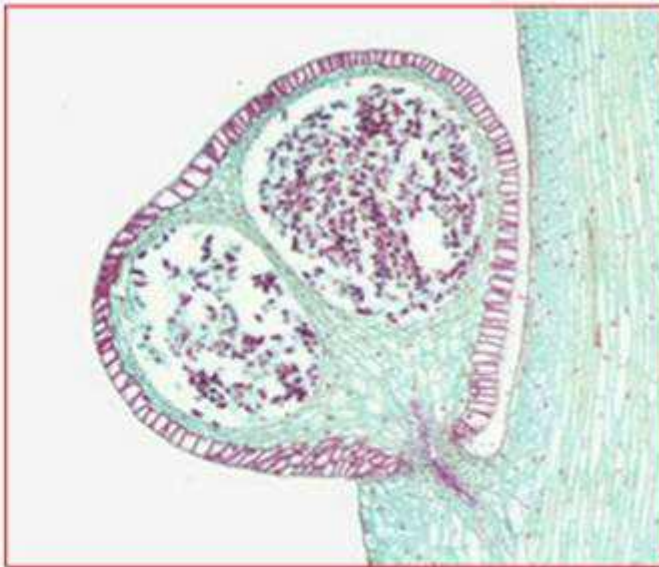
*Microsporangium and Megasporangium  
of Selaginella with Spores*

# PTERIDOPHYTES: GENERAL CHARACTERS



- Two types of sporangia based on development
  - **Eusporangiate**: developed from a group of initial cells
  - **Leptosporangiate**: developed from a single initial cell

## *Sporangia in Pteridophytes*



*Eusporangiate Sporangium  
(Psilotum)*



*Leptosporangiate Sporangium  
(True Fern)*

# PTERIDOPHYTES: GENERAL CHARACTERS



- Sporophylls may be either:
  - Aggregated into compact cone (strobili) at the end of stem (*Selaginella*, *Lycopodium*, *Equisetum*).
  - Uniformly distributed (*Pteris*, *Adiantum*)

## *Cone or Strobilus in Pteridophytes*



*Equisetum*



*Selaginella*



*Osmunda*



*Lycopodium phlegmaria*

# PTERIDOPHYTES: GENERAL CHARACTERS

- In true ferns sporangia located on lower surface of leaf in clusters called sori (sorus)

*Different Types of Sori in Pteridophytes*



# PTERIDOPHYTES: GENERAL CHARACTERS



- Spore wall thick, differentiated into outer **exine** and inner **intine**
- Spores germinate to form gametophytic generation
- **Homosporous species**, development of gametophyte is **exosporic** (Gametophyte develops outside the spore wall)
- **Heterosporous species**, development is **endosporic** (Gametophyte develops within the spore wall)
- Gametophyte and sporophyte are two separate independent plants
- No physical connection between two generation

# PTERIDOPHYTES: GENERAL CHARACTERS



- Much variation in gametophyte among different species
- Gametophyte is called as *prothallus* (thallus like morphology)
- In homosporous type prothallus is simple, green and heart shaped
- Homosporous species are monoecious – antheridia and archegonia are borne on the same prothallus



*Prothallus with a Young*



# PTERIDOPHYTES: GENERAL CHARACTERS



- Heterosporous type are always dioecious
- Microspore give rise to male prothallus
- Macrospore give rise to female prothallus
- Sex organs are embedded or projected in the prothallus
- Antheridium is surrounded by a sterile jacket
- Jacket is always single layered
- Antheridia are sessile or shortly stalked
- Antherozoids: unicellular, spirally coiled with two apical flagella

# PTERIDOPHYTES: GENERAL CHARACTERS



- Archegonia is differentiated into neck and venter
- Neck is projected and venter is embedded in the prothallus
- Neck canal cell degrade to produce mucilaginous substance
- Mucilage attract antherozoids towards the archegonium
- Water is essential for fertilization
- Egg and antherozoids fuse to form zygote
- Zygote is the first cell of sporophyte

# PTERIDOPHYTES: GENERAL CHARACTERS

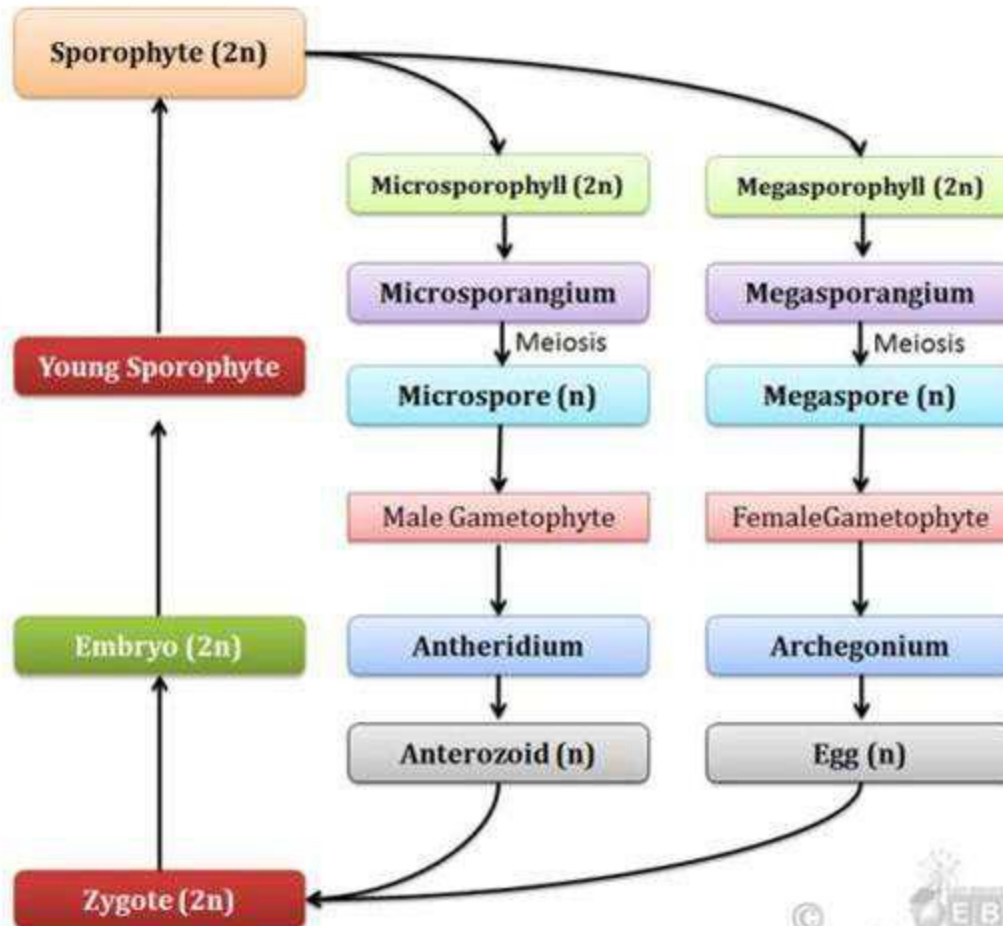


- Zygote divide to form embryo
- First division of zygote determine the polarity of embryo
- Basal pole form the foot and roots
- Apical pole give rise to shoot apex
- Pteridophytes show typical heteromorphic alternation of generation
- Morphologically distinct sporophytic and gametophytic generation
- Main plant body is sporophyte - dominant phase
- Separate and independent gametophytic and sporophytic generation

# PTERIDOPHYTES: GENERAL CHARACTERS



## LIFE CYCLE OF PTERIDOPHYTES



# THANX

