PTERIDOPHYTES (PTERIS = FEATHER, PHYTON = PLANT):

Introduction

- The term pteridophytes coined by Haeckel (1866).
- The study of pteridophytes is called pteridology.
- These are seedless, spore producing land plants which are popularly known as botanical snakes or vascular cryptogams (vascular tissues xylem and phloem present).

General characters:

In pteridophytes main plant body is sporophytic.

- The plant body is completely differentiated in to true root, stem and leaves
- The primary root remains alive for short period. After some time it is replaced by adventitious roots.
- Stem is erect or prostrate. In some pteridophytes stem is underground, which is known as rhizome.

On the basis of leaves, pteridophytes are of two types -

- First, in which stem is larger and leaves are smaller. They are called as microphyllous Pteridophytes. Eg. Equisetum, Lycopodium, Selaginella
- Second, in which stem is smaller while leaves are larger. They are known as macrophyllous Pteridophytes.
- Eg. Pteridium, Pteris, Marsilea (most of ferns)
  Note: Differentiation in plant body starts from bryophytes.

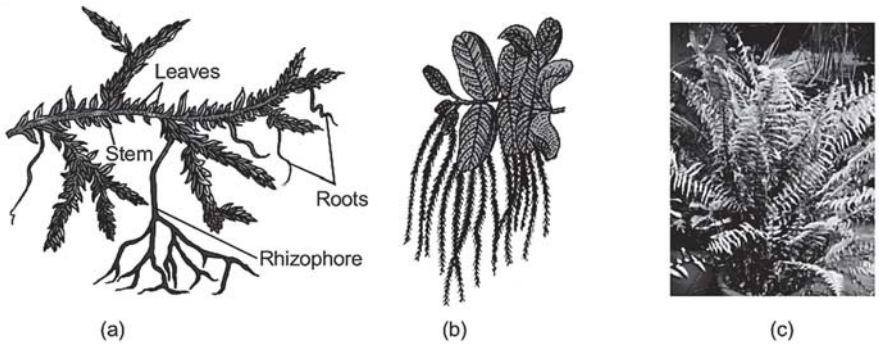


Fig.: (a) Selaginella, (b) Salvinia (aquatic fern), (c) Terrestrial fern

Habitat of some important pteridophytes –

Most of the pteridophytes are found in moist soil and shady places.

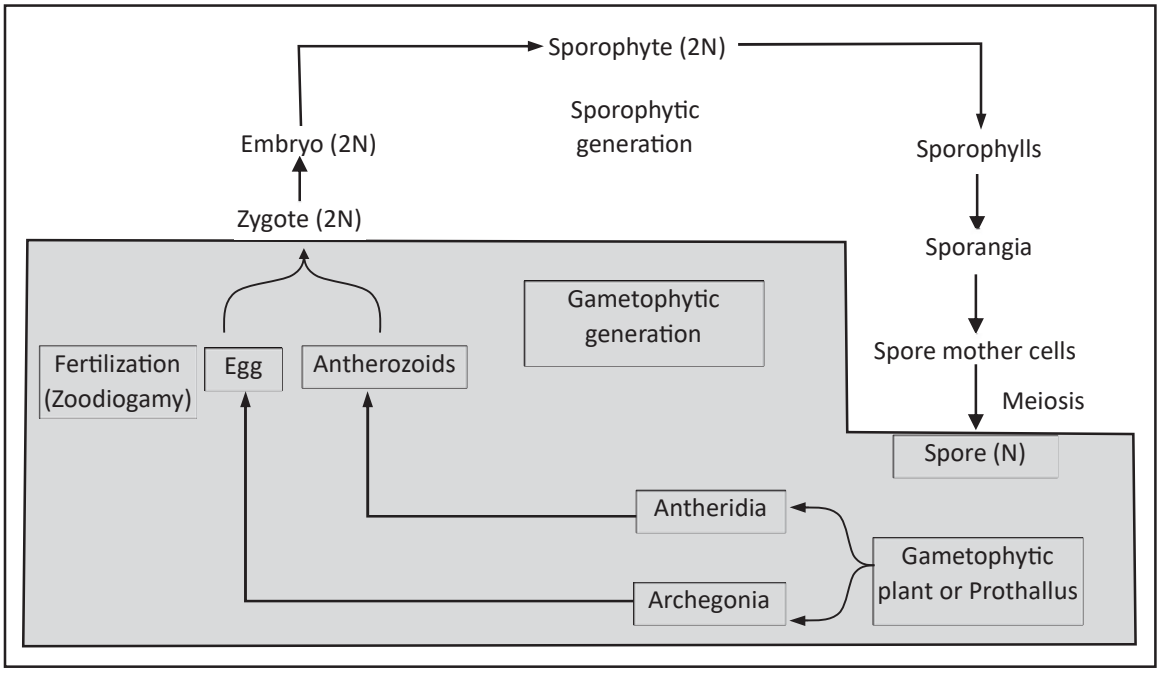
- Aquatic - Some pteridophytes are found in water.
  Eg. Marsilea, Salvinia, Azolla, Isoetes
- Epiphytes – Some pteridophytes grow on other plants.
  Eg. Lycopodium phlegmeria, Ophioglossum pendulum, Pleopeltis

Life cycle of Pteridophytes:

Homosporus pteridophytes

- Main plant body is sporophyte (2N).
- Sporophyll possess spore forming structure (Sporangia) on abaxial surface (Ventral / lower surface) of leaf. The leaves in pteridophyta are small (microphylls) as in Selaginella or large (macrophylls) as in ferns. The sporophytes bear sporangia that are subtended by leaf-like appendages called Sporophyll.
- In some cases Sporophyll may form distinct compact structures called strobili or cones (Selaginella, Equisetum)
- Spores (N) released from sporangia and reach the soil and germinate to develop into gametophyte (Prothallus).
- Prothallus is small, inconspicuous, multicellular, independent, free living, monoceious, mostly photosynthetic (sometimes saprophytic), non-vascular and thalloid gametophyte.

- Prothallus require cool, damp, shady place to grow.
- In most of homosporous pteridophytes (e.g. Pteris, Equisetum, Adiantum, Dryopteris and Lycopodium) prothallus is monoecious (male and female sex organ present on same prothallus).
- Male sex organ (antheridia) and female sex organ (archegonia) develop on protoallus.
- Antheridia form Bi-flagellated (Selaginella) or multiflagellated (Most of pteridophytes like Dryopteris) male gamete / Antherozoids by mitosis.
- Archegonia form egg in venter and have neck of 4 rows.
- Male gametes swim in water (Zoodiogamy) and reach up to mouth of archegonia where fertilization take place to form zygote (2N).
- Zygote develops into embryo and form main sporophytic plant.



- Fertilization takes place by Zoodiogamy and zygote is formed as a result of fertilization.
- Zygote develops mitotically and forms an embryo.
- Now this embryo develops and forms a sporophytic plant with root, stem, and leaf.

Heterosporus Pteridophytes

- Some of the pteridophytes are heteroporus (e.g. Azolla, Isoetes, Marsilia, Selaginella and Salvinia) in which two type of spores are formed, microspore (in microsporangia) and megaspore (in mega sporangia).
- Microspore produce male gametophyte and megaspore form female gametophyte (Dioecious prothallus).
- The female gametophyte in these plants are retained on parent sporophyte for variable periods (Precocious development).
- Male gametophyte form male gametes (antherozoids) which move through water to reach the neck of archegonia (female gametophyte).
- Fertilization and embryonic development take place within the female gametophyte. This event is precursor to seed habit and considered important step in evolution.

Economic importance:

Pteridophytes are used for medicinal purposes and as soil-binders.

E.g.

- An anthelminthic drug is obtained from rhizomes of Dryopteris.

- Homeopathic medicine is obtained from Lycopodium.
- Selaginella is helpful in soil conservation.

They are also frequently grown as ornamentals. E.g. Ferns.

Points to be remember

- Type of sexual reproduction in pteridophyta is oogamous.
- Their life cycle is diplo-haplontic type.
- The unique character of life cycle of Pteridophyte is - Independent alternation of generation i.e. sporophyte and gametophyte are separate to each other and morphologically different.
- In some Heterosporus species female gametophyte retained on parent sporophyte and develop embryo after fertilisation on same sporophyte eg. Selaginella.
- This event is precursor to seed habit in evolution.

Pteridophyta is divided in to 4 classes

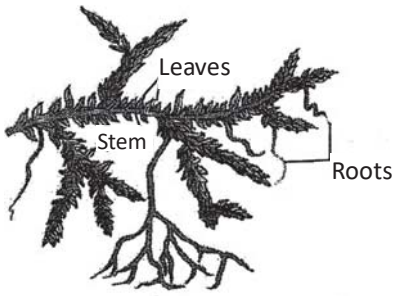
- Psilopsida
- Lycopsida
- Sphenopsida
- Fillicinae/Pteropsida

Psilopsida

- The most ancient vascular plants are placed in this class.
- The plants in this class have many primitive characters –
- Their plant body is differentiated in to stem, scaly leaves and rhizoids.
- Rhizoids are present instead of roots. In Psilopsida stem is underground i.e. rhizome.
- This rhizome bears some aerial branches. Sporangia are formed on these branches.
  Note: Vascular tissue is present only in stem.
- Trophophyll are absent, scaly leaves are known as cataphylls.
- Scaly leaves - dry, brown coloured and non-photosynthetic. They are only for protection of sporangia
- Their leaves do not have the capacity of photosynthesis, therefore photosynthesis is done by stem.
- Sporangia are formed on stem. Sporophyll are absent
- Most of the plants in this class are extinct.
  Only one living genus is present in this class - Psilotum → A living fossil Rhynia and Horneophyton - Fossil plants

Lycopsida:

- Club mosses are placed in this class.
- The plant body of club mosses is differentiated into root, stem and leaves. Leaves are green and photosynthetic and known as trophophyll.
- Sporophyll are present in group. At the tip of plant. This groups is called as strobilus or cone.
  Lycopodium - Common club moss
- It is a medicinal plant. It is used as tonic in Homeopathic medicines.
  Selaginella - Spike moss or Resurrection plant. It is known as "Sanjeevani"



Selaginella

Phenopsida or Arthrophyte or Calamophyta

- In this class Horse tails are included.
- The plant body of horse tails are differentiated into root, stem & leaves.
- Their stem is modulated i.e. stem distinctly differentiated into node and internode.
- Scaly leaves are present on these nodes (Microphyllous).
- Silica is present in the epidermis of stem and leaves.
- Due to silicated surface, leaves become rough. If two horse tail plants collide, then there is a dangerous chance of fire in the forest.
- The formation of sporangia takes place on Sporophyll.
- Sporophyll are arranged in a group and form a tall and condensed cone or strobilus.
- This cone is formed at the apical part of aerial stem. The stem on which cone is formed is called as sporangiophore.
  Eg. Equisetum (Pipe), Sphenophyllales, Hyenia

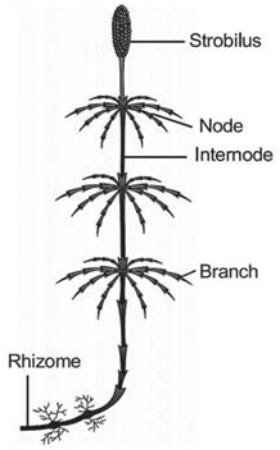


Fig. : *Equisetum*

Filicinae or Pteropsida or Ferns

This is the largest group of pteridophytes.

- Ferns are included in this class. Most of the pteridophytes are ferns.
- Ferns are megaphyllous (macrophyllus) i.e. stem is small and leaves are comparatively larger these leaves are known as 'Fronds'
- Leaves are multinerve.
- Young leaves show circinate ptyxis, as they are coiled in the form of a watch spring.
- This coiling protects the growing point which comes to lie in the centre.
- Multicellular hair are present on the young leaf and young stem of ferns which are called as rementa. They are for protection.

- There is no difference between trophophyll in fern i.e. every leaf of fern bear sporangia at the time of reproduction. Therefore cones are not produced in ferns.
- Sporangia occurs on the ventral surface of leaves in clusters called sori (singular-sorus).
- The fertile leaves are known as Sporophyll.
- A sorus is covered by a flap-like outgrowth from its surface called Indusium (true indusium e.g., Dryopteris) or turned margin of the Sporophyll (false indusium, e.g., Adiantum).
- Development of sporangium in true ferns is leptosporangiate.

E.g.
Pteridium

Pteris	-	They are called 'Braken fern' or 'Sun fern'
Dryopteris	-	Also called as 'Brook shield fern'
Adiantum	-	Walking fern or Maiden hair fern This name is given to them due to rapid vegetative reproduction. Vegetative reproduction in Adiantum takes place means of leaf tip. It spreads very fast.
Osmunda	-	Royal fern or flowering fern
Ophioglossum	-	Adler's tongue fern
Salvinia	-	Heterosporus Aquatic fern
Marsilea	-	Pepper wort fern (Aquatic fern)
Azolla	-	Aquatic fern (smallest pteridophyte and bio fertilizer)
Onychium	-	Golden fern
Cyathea	-	Lofty tree fern
Alsophila	-	Tree fern (Largest pteridophyte)
Chielanthus	-	Silver fern
Botrychium	-	Moon wort fern

Points to Be Remembered

- Selaginella - Vivipary is present in it i.e., partial endosporic germination.
  Seed habit originated in Selaginella like pteridophytes.
  - Ligulate leaves (tongue shaped) are present in it
  Function - Ligule is secretory structure, which secretes water and keeps the sporangium and the yound leaf moist.
- In some pteridophytes sporangia are formed at the axil of leaf.
  Eg. Selaginella
- In some pteridophytes sporangia are formed in spike.
  Eg. Ophioglossum
- In some pteridophytes sporangia are formed in sporocarp.
  Eg. Marsilea, Azolla