

PTERIDOPHYTES

1.1 General Characters of Pteridophytes:

1. These are the first true land plants in the evolution of the plant kingdom.
2. Pteridophytes exhibit a well-defined heteromorphic alternation of generations. Diploid sporophyte is the dominant phase in life cycle.
3. Sporophyte is an independent plant and is free from gametophyte at maturity.
4. Gametophyte is either fully or partially dependent on sporophyte for its nutrition.
5. Sporophyte is differentiated into stem, root and leaves.
6. Pteridophytes have an internal conducting system consisting of xylem and phloem. They are the only vascular cryptogams.
7. The roots of Pteridophytes are adventitious type.
8. The stem of Pteridophytes is usually a rhizome. But in Lycopodials and horse tails the stem is aerial.
9. The leaves are small (microphyllous) in several groups of plants and in higher forms they are large (macrophyllous) and simple with well developed petiole.
10. Asexual reproduction is by spores. Sporophyte produces meiospores inside a little capsule called sporangia. The sporangia are borne on the lower surface or in the axils of fertile leaves called sporophylls. It may be homosporous (spores produced are of only one type) or heterosporous (spores produced are of two types).
11. The spores germinate to produce a haploid gametophyte called prothallus. Homosporous species usually produces bisexual (monoecious) gametophytes whereas heterosporous species produce unisexual (dioecious) gametophytes.
12. The microspore germinates to produce male gametophyte and the megaspore germinates to produce female gametophyte. Gametophyte performs sexual reproduction by zooidogamous type of oogamy.
13. Sex organs (both antheridia and archegonia) are multicellular with a sterile jacket but without stalks.
14. Fertilization takes place in the venter of archegonium. Water is necessary for it.
15. The diploid zygote develops into embryo in the archegonial venter. The embryo grows into sporophyte.

16. The life cycle of Pteridophytes is diplohaplontic with heteromorphic alternation of sporophyte and gametophyte. Sporophyte and gametophyte are independent of each other.

1.1.1. Classification: This classification is proposed by K.R. Sporne (1975) He divided the Division Pteridophyta into 6 classes.

1. Psilopsida (extinct)
2. Psilotopsida
3. Lycopsida
4. Sphenopsida
5. Pteropsida
6. Progymnospermopsida

1. Psilopsida

A subdivision comprising vascular plants with no roots, leaves only partially differentiated or lacking, no leaf traces, a usually protostelic vascular cylinder, and the sporangia merely terminal enlargements of the stem.

- These are the oldest known vascular plants. Most of them have become extinct (e.g., *Rhynia*, *Horneophyton*). Only two living species, *Psilotum* and *Tmesipteris*, are now available.
- Plant body is very simple and does not show much differentiation.
- Dichotomously branched rhizome takes the place of roots.
- Stem or "axis" is aerial, but either naked or have small spirally arranged leaves.
- Sporangia are directly borne on the stem (i.e., cauline). Either terminal or lateral.

2. Psilotopsida

The members of the class Psilotopsida show close resemblance in fundamental characteristics to the Silurian and Devonian members of Rhyniopsida (e.g., *Rhynia*, *Cooksonia*), Zosterophyllopsida (e.g., *Zosterophyllum*) and Trimerophytoids (e.g., *Trimerophyton*, *Psilophyton*). *Psilotopsida* includes only two living genera viz., *Psilotum* and *Tmesipteris*.

Characteristic features

- The plant body is a rootless sporophyte that differentiates into a subterranean rhizome and an aerial erect shoot.
- Branching is dichotomous in both subterranean rhizome and aerial shoot.
- The large rhizoids borne on the rhizome absorb water and nutrients from the soil.
- On the aerial shoots, spirally arranged scale-like (e.g., *Psilotum*) or leaf-like appendages (e.g., *Tmesipteris*) are borne.
- Stele is protostelic or siphonostelic with sclerenchymatous pith.
- Secondary growth is absent.
- Bi- or trilocular sporangia are borne in the axils of leaf-like appendages.
- Mode of sporangial development is of eusporangiate type.
- Spores are of equal sizes and shapes i.e., homosporous.
- The gametophytes are non-green, cylindrical, branched and subterranean. They grow as saprophytes with an associated endophytic fungus.
- Antherozoids are spirally coiled and multi- flagellated.

3. Lycopsidea

This class has a long evolutionary history and is represented both by extant and extinct genera. This group first originated during the Lower Devonian period of Palaeozoic Era (ca 390 my).

This class is represented by five living genera

— *Lycopodium*, *Selaginella*, *Phylloglossum*, *Styhtes*, and *Isoetes*, and fourteen extinct genera

— *Asteroxylon*, *Baragwanathia*, *Protolepido- dendron*, *Lepidodendron*, *Sigillaria* etc.

Salient Features of the Class Lycopsidea:

- The sporophyte plant body is differentiated into definite root, stem and leaves.
- The sporophytes are dichotomously branched.
- The leaves are usually small and microphyllous.
- The xylem in stem exarch.
- Sporangia are borne singly on the adaxial (upper) surface of the sporophylls.

- The spores may be of either one type i.e., homosporous (e.g., *Lycopodium*) or two types i.e., heterosporous (e.g., *Selaginella*).
- The spores develop into independent gametophyte.

4. Sphenopsida

This class is represented by only one living genus (*Equisetum*) and about 18 extinct forms (e.g., *Calamites*, *Annularia* etc.). This group originated during the Devonian period of Palaeozoic Era, attained their maximum development in the Carboniferous period. Subsequently, the group became less prevalent and at present is represented by only a single genus (*Equisetum*).

Salient Features of the Class Sphenopsida:

- The stems and branches are jointed with nodes and internodes. The internodes are with longitudinal-oriented ridges and furrows.
- The leaves are extremely reduced and borne in whorls at the nodes of, aerial branches and stems.
- Branches arise in whorls.
- The sporangia develop on a peltate appendage called sporangiophore. Sporangial walls are thick.
- Most of the members are homosporous including *Equisetum*. However, some extinct forms were heterosporous (e.g., *Calamites casheana*).
- The gametophytes are exosporic and green.
- Antherozoids are multiflagellated.
- The embryo is without suspensor and is exoscopic in nature.

5. Pteropsida

This group of pteridophytes is commonly known as 'ferns'. The Pteropsida differs from other classes in possessing raised leaves (mega-phylls). This is the largest and highly evolved group of pteridophytes and is represented by about 9,000 species which show a wide range of distribution. The Pteropsida are known from as far back as the Devonian period of Paleozoic Era.

Salient Features of the Class Pteropsida:

- The sporophytes are usually perennial in nature and differentiated into roots, stem and spirally arranged leaves.
- Most of the members grow in moist and shaded habitats, either epiphytic or terrestrial. A few are aquatics.
- Mostly, the rhizomes are short and stout.
- The leaves are large (megaphylls), pinnately compound and described as frond, except *Ophioglossum* (simple leaf).
- The rachis is covered with brown hairs (*ramenta*). Leaf trace is usually C-shaped with adaxial curvature.
- Young fronds show circinate vernation (coiling of leaves), except *Ophioglossum*.
- The stele in Pteropsida shows a wide variety of types, e.g., protostele, siphonostele, solenostele, dictyostele and polycyclic stele.
- Most ferns are homosporous, but a few aquatic members are heterosporous.
- Sporangia are borne at the tips or at the margin of the pinnule or to the abaxial surface of the fronds.