

Classification of Pteridophytes

Pteridophytes constitute a significant and important group in the plant kingdoms as the first true land plants. **Pteridophytes are the "spore bearing vascular plants" and also called as seedless vascular plants belong to the cryptogams.**

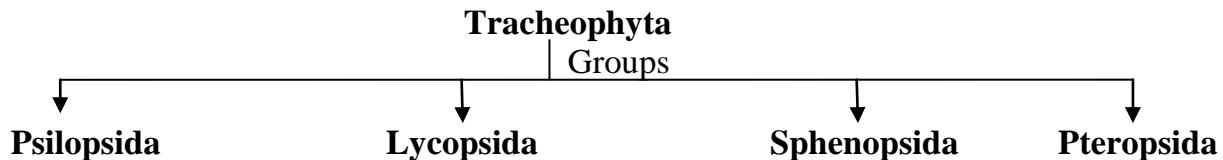
The term Pteridophytes is derived from two words "Pteron meaning feather" and "phyton meaning plant". Thus Pteridophytes are the plants with feather like leaves. Their first traces were recognised in the Silurian period of the late paleozoic age. Pteridophytes occupy a transitional position between bryophytes and spermatophytes.

Since a long time vascular plants are usually divided into pteridophyta and spermatophyta. This classification was based on the assumption that the former lack the seeds while for the latter produced them. But the discovery of pteridophytes (seed bearing ferns) broke down this artificial classification.

In 1935, Sinnott introduced term Tracheophyta to include all vascular plants. Tracheophyta are further divided into four main groups : Psilopsida, Lycopsida, Sphenopsida and Pteropsida. But it is not certain whether these are divisions or classes.

In 1953, Haupt considers them as classes in the division Tracheophyta. While many other like Zimmermann (1930), Arnold (1947), Wardlaw (1952), regard them as divisions.

Arthur J. Eames (1936) classified Tracheophyta into four groups on the basis of nature and relation of leaf and stem vascular anatomy and position of sporangia :-



Tracheophyta :-

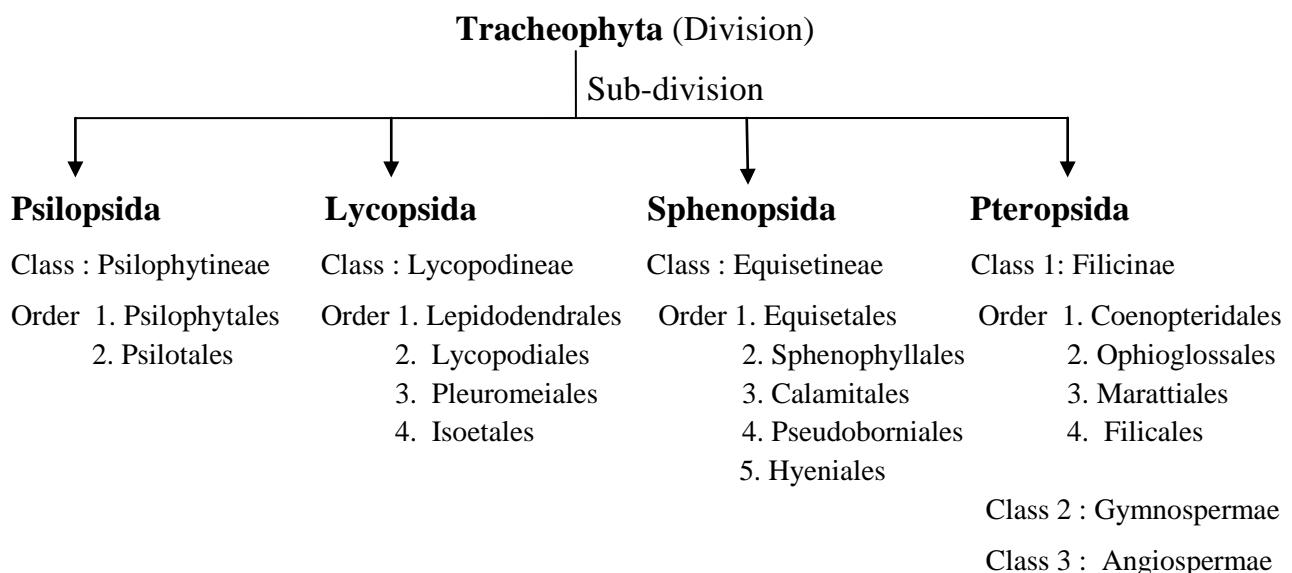
- Group I. Psilopsida (Psilophytales and Psilotales)
- Group II. Lycopsida (Lycopodiales, Selaginellales, Lepidodendrales, Pleuromeiales and Isoetales)
- Group III. Sphenopsida (Hyeniales, Sphenophyllales and Equisetales)
- Group IV. Pteropsida (Filicineae, Gymnospermae and Angiospermae)

Tippo (1942) called the 'groups' of Eames as sub-phylum. Wardlaw (1955) gave them the rank of sub-division.

A good number of botanists (Eames, 1936; Darrah, 1939; Campbell, 1940; Arnold, 1949) treat Pteridophyta as a single unit (a division of plant kingdom) with four major groups (subdivisions)

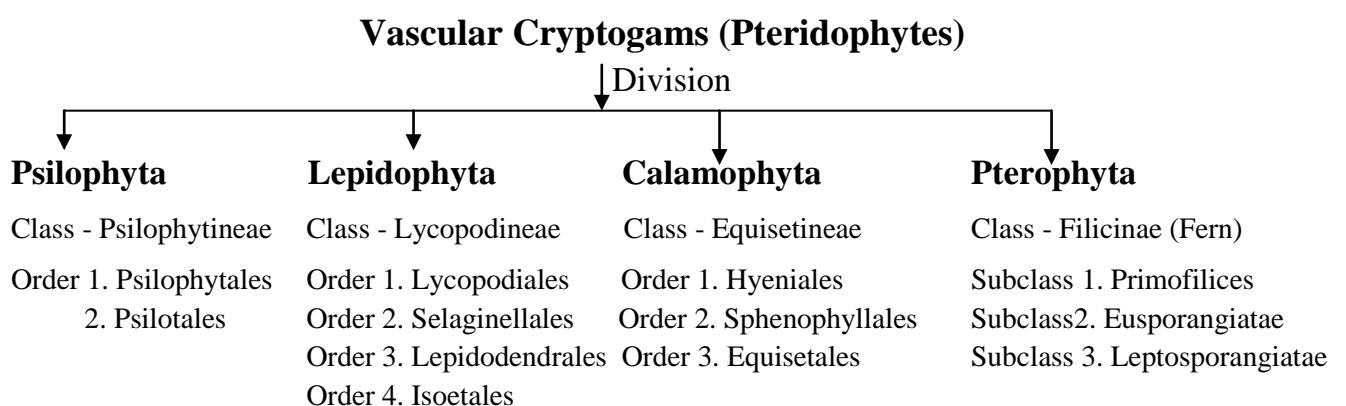
According to recommendation of I.C.B.N (1952), the name of the division should end in the suffix-phyta, and the subdivision should end in the -opsida.

On this basis, Wardlaw (1955) divided the Pteridophytes into four divisions :

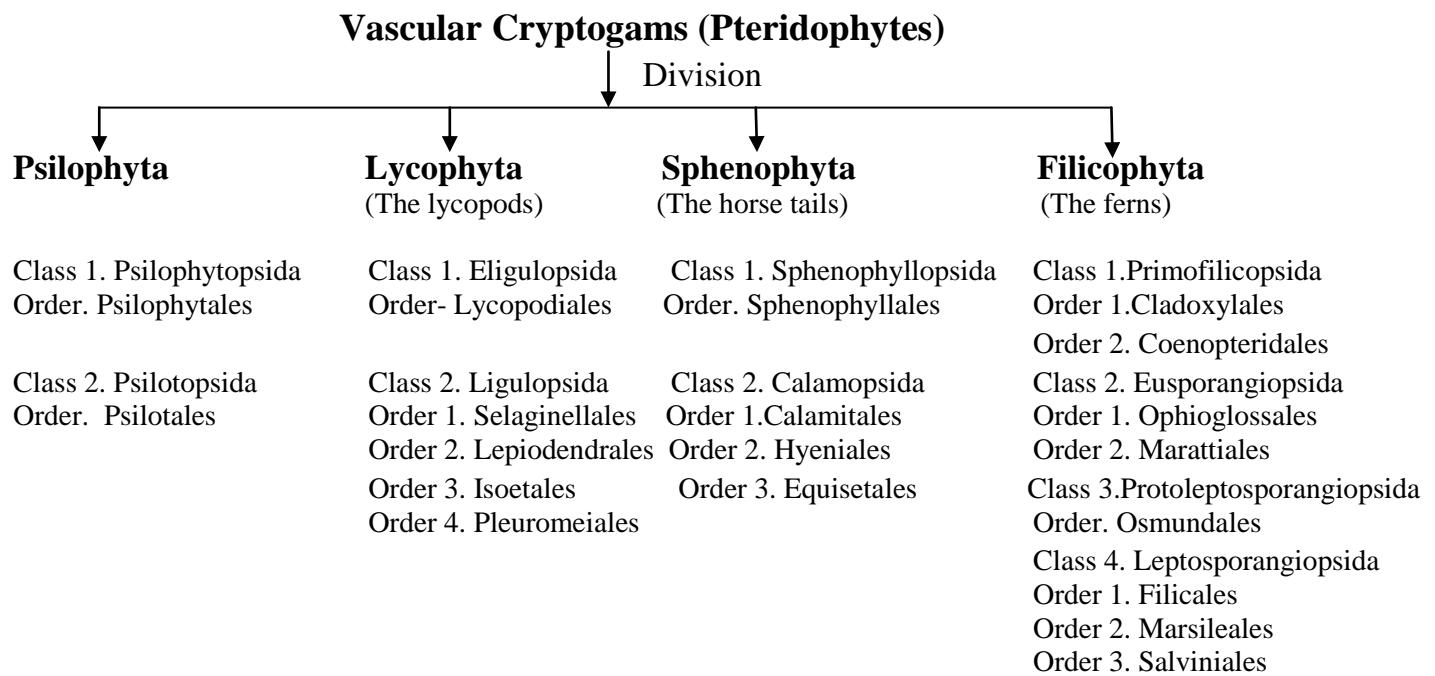


Modern botanists such as Smith (1955), Bold (1957), Benson (1957), Zimmermann (1959), Cronquist (1960) and Takhatajan (1964) have dropped the term Tracheophyta as taxon, raising the different groups of lower vascular plants themselves to division level.

Smith (1955) divided the vascular cryptogams into four divisions :-



A fairly complete, and the present most accepted system of classification of vascular that is based on Smith (1955), Bold (1957), Benson (1957), Zimmermann (1959) , Cronquist (1960), and Takhatajan (1964) may be referred to in outline form as follow-



The characteristic features of the divisions are as follows :-

I. Psilophyta (Psilopsida)

1. The plant body is a rootless sporophyte that differentiates into a subterranean rhizome and an aerial erect shoot.
2. Branching is dichotomous in both subterranean rhizome and aerial shoot.
3. Rhizoids borne on the rhizome absorb water and nutrients from the soil.
4. Leaves often absent or if present, they are spirally arranged scale like (e.g. *Psilotum*) or leaf-like appendages (e.g. *Tmesipteris*) are bone
5. The vascular tissue is of primitive type i.e., simple, cylindrical protostele with annular or spiral tracheids.
6. Secondary growth is absent.
7. Sporangia are borne at the apex of the aerial shoots. They are either solitary (e.g., *Rhynia*) or in groups and terminal in position. There was nothing like that of sporophyll.
8. Sporangia always bearing the same type of spores i.e., they are homosporous
9. The gametophyte is known only in *Psilotum* and *Tmesipteris* (living genera) while unknown in Psilophytales.

10. The gametophyte is cylindrical or branched, subterranean and colourless.
11. Sex organs are partially embedded in the prothallus.
12. Antherozoids are spirally coiled and multi-flagellated.

II. Lycophyta (Lycopsida, Lepidophyta, Lycopodophyta,)

It includes both fossil (e.g., *Lepidodendron*) and living Pteridophytes (five living genera e.g., *Lycopodium*, *Phylloglossum*, *Isoetes*, *Stylites* and *Selaginella*)

1. The plant body is sporophytic and can be differentiated into root, stem and leaves.
2. The leaves are small (microphyllous), simple with a single mid vein. They are usually spirally arranged, sometimes in opposite fashion and or even in whorls.
3. In some cases the leaves are ligulate (e.g., *Selaginella*, *Isoetes*). The ligule is present at the base of each leaf.
4. The vascular tissue may be either in the form of plectostele, siphonostele or sometimes even polystele. Leaf gaps are absent.
5. Sporophylls are loosely arranged or aggregated to form strobilus or cones.
6. Some members are homosporous (e.g. *Lycopodium*) while others are heterosporous (e.g. *Selaginella*).
7. Heterosporous forms have endoscopic gametophytes while in homosporous forms the gametophyte is exosporic.
8. Antherozoids are biflagellate or multi-flagellate.
9. Secondary growth does not take place except in *Isoetes*

III. Sphenophyta (Sphenopsida, Calamophyta, Arthrophyta)

It includes both fossil plants (e.g., *Calamophyton*, *Sphenophyllum*) as well as living plants (e.g., *Equisetum*). It is represented by one living genus *Equisetum* and about 18 extinct forms.

1. The plant body is sporophytic and can be differentiated into root, stem and leaves.
2. The stem in majority of the forms is long, jointed or articulated and is ribbed i.e., having ridges and grooves. Stem is divisible into nodes and internodes and is developed as upright aerial branches from the underground creeping rhizome.
3. Leaves are thin, small, scaly brown and are arranged in transverse whorls at the nodes of the aerial branches.
4. Branches also develop in whorls from the axil of the scaly leaves.
5. As the foliage leaves are reduced to scales, the process of photosynthesis is taken up by the stem and hence it becomes green.
6. The stem has a solid protostele (e.g., *Sphenophyllum*) or medullated protostele (e.g., *Equisetum*).
7. The sporangia are borne on specialized appendages called sporangiophores (the whole structure resembling but not homologous with a strobilus)

8. Sporangia are developed at the apex of the fertile branches in whorls forming compact cone.
9. Most of the members are homosporous but some fossil forms are heterosporous (e.g., *Catamites*).
10. Gametophytes (prothalli) may be monoecious or dioecious. Gametophytes are exosporic and green.
11. Antherozoids are large and multi-flagellate.
12. The embryo is without suspensor and is exoscopic in nature.

IV. Pterophyta (Pteropsida, Filicophyta,)

It includes the plants which are commonly known as 'ferns'. It is represented by about 300 genera and more than 10000 species.

1. They occur in all types of habitats. Majority of the ferns are terrestrial and prefer to grow in moist and shady places. Some are aquatic (e.g., *Azolla*, *Salvinia*, *Marsilea*), xerophytic (e.g., *Adiantum emarginatum*), epiphytic (e.g., *Asplenium nidus*), halophytic (e.g., *Acrostichum aureum*) or climbing (e.g., *Stenochlaena*).
2. Majority of the members (except some tree ferns (e.g., *Angiopteris*) have short and stout rhizome. The rhizome may be creeping, upright or growing above the soil.
3. Leaves are large, may be simple (e.g., *Ophioglossum*) or pinnately compound (majority of the ferns for example, *Pteridium*, *Marsilea*, *Adiantum* etc.) and described as fronds. Young fronds are circinately coiled.
4. Leaves are ex-stipulate (e.g., *Filicales*) while stipulate in some other groups.
5. The vascular cylinder varies from a protostele to a complicated type of siphonostele. Solenostele, dictyostele and polystele are also found.
6. Vegetative reproduction takes place by fragmentation (e.g., *Adiantum*, *Pteridium*), stem tubers e.g., *Marsilea*), adventitious buds (e.g., *Asplenium bulbiferum*) or by apogamy (e.g., *Marsilea*).
7. Sporangia arise from placenta (a swollen cushion of cells) in groups (sori).
8. Sori develop on the margins or abaxial surface of the leaves (sporophylls) or leaflets.
9. Sori are protected by true (e.g. *Marsilea*) or false indusium (e.g. *Adiantum*, *Pteris*)
10. The sporangial development may be leptosporangiate (e.g., *Osmunda*) or eusporangiate type (e.g., *Ophioglossum*).
11. The sporangia in most cases have a distinct annulus and stomium.
12. Members may be homosporous (e.g., *Pteris*, *Adiantum* etc.) or heterosporous (e.g., *Marsilea*, *Azolla*, *Salvinia* etc.).
13. The gametophyte may be exosporic or endosporic.
14. Antheridia and archegonia are partially or completely embedded in the gametophyte. Antherozoids are multi-flagellated.
15. Embryogeny largely endoscopic. Embryo may or may not have suspensor.