Pteridophytes

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Introduction

The term Pteridophyta was first coined by Haeckel. Pteridophyta (Greek, Pteron = feather, phyton = plant) are the groups of plants which have well developed pinnate or frond like leaves. Pteridophytes are cryptogams with well developed vascular tissue. Hence they are also known as "Vascular cryptogams". Palaeobotanical studies reveal that these plants were dominant on the earth during the Devonian period and they were originated about 400 million years ago in the Silurian period of the Palaeozoic era. According to recent literatures, Pteridophytes are represented by about 400 living and fossil genera and some 10,500 species.

General Characters of Pteridophytes:

1) Majority of the living Pteridophytes are terrestrial and prefer to grow in cool, moist and shady places (e.g., Ferns). Some members are aquatic (e.g., Marsilea, Azolla), xerophytic (e.g., Selaginella, Equisetum) or epiphytic (e.g., *Lycopodium squarrosum*).

2) Majority of the Pteridophytes are herbaceous but a few are perennial and tree like (e.g., Angiopteris). Smallest Pteridophyte is Azolla (an aquatic fern) and largest is Cyathea (tree fern).

3) Plant body is sporophytic and can be differentiated into root, stem and leaves.

4) Roots are adventitious in nature with monopodial or dichotomous branching. Internally usually they are diarch.

5) Stem is usually branched. Branching is monopodial or dichotomous. Branches do not arise in the axil of the leaves. In many Pteridophytes stem is represented by rhizome.

6) Leaves may be small, thin, scaly (microphyllous e.g., Equisetum), simple and sessile (e.g., Selaginella) or large and pinnately compound (megaphyllous e.g., Dryopteris, Adiantum).

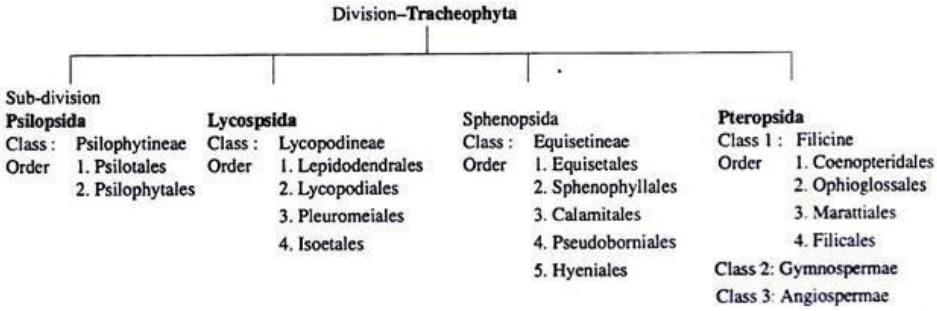
7) Vascular tissue is present in stem and root. It consists of xylem and phloem. Xylem consists of tracheids only and phloem has only sieve tubes.

8) The stele is protostele (e.g., Rhynia, Lycopodium), siphonostele (e.g., Equisetum), dictyostele (e.g., Adiantum) or polycyclic (e.g., Angiopteris).

Tridip Boruah

Classification of Pteridophytes:

One of the widely accepted classifications of Pteridophytes is put forwarded by Wardlaw (1955) who divided the Pteridophytes into four divisions:



1. Psilopsida:

Sub-division Psilopsida (according to Wardlaw, 1955) includes living (Order Psilotales e.g., Psilotum), as well as fossil plants (Order Psilophytales e.g., Rhynia). The members are sporophytic, roots are absent. The organization of the plant body of the members is very simple. It is differentiated into a subterranean (underground) rhizome and an erect aerial portion. Rhizome bears tufts of unicellular Rhizoids. Aerial axis may be leafless or sometimes may bear scaly appendages (e.g., Psilotum) or large foliage leaves (e.g., Tmesipteris).The vascular tissue is of primitive type i.e., simple, cylindrical protostele with annular or spiral tracheids. The reproductive organs are in the form of sac like sporangia. 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. Sporangia always bearing the same type of spores i.e., they are homosporous. The gametophyte is cylindrical or branched, subterranean and colourless.

2. Lycopsida:

It includes both fossil (e.g., Lepidodendron) and living Pteridophytes (five living genera e.g., lycopodium, Phylloglossum, Isoetes, Stylites and Selaginella). History indicates that these Pteridophytes developed during the Devonian period of the Palaeozoic era. The plant body is sporophytic and can be differentiated into root, stem and leaves. Lleaves are small (microphyllous), simple with a single mid vein which are usually spirally arranged, sometimes in opposite fashion and or even in whorls. In some cases the leaves are ligulate (e.g., Selaginella, Isoetes). The ligule is present at the base of each leaf. The vascular tissue may be either in the form of plectostele, siphonostele or sometimes even polystele. Leaf gaps are absent. Sporangia are quite large in size and develop on the adaxial surface of the leaves (sporophylls). Sporophylls are loosely arranged and form strobilus. Some members are homosporous (e.g., Lycopodium) while others are heterosporous (e.g., Selaginella). Antherozoids are biflagellate or

Tripti Boruah

multiflagellate. Gametophytes which are in the form of prothalli are formed by the germination of spores.

3. Sphenopsida

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 18 fossil forms. These Pteridophytes evolved during the Carboniferous period of the Palaeozoic era. The plant body is sporophytic and can be differentiated into root, stem and leaves. 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. Leaves are thin, small, scaly brown and are arranged in transverse whorls on the nodes of the aerial branches. Branches also develop in whorls from the axil of the scaly leaves. The stem has a solid protostele (e.g., Sphenophyllum) or medullated protostele (e.g., Equisetum). Secondary thickenings were observed in some extinct forms (e.g., Sphenophyllum). Sporangia are developed at the apex of the fertile branches in whorls forming compact cone. Living members are homosporous but some fossil forms are heterosporous (e.g., Catamites). Spores germinate to give rise to gametophytes (prothalli) which may be monoecious or dioecious. Antherozoids are large and multiflagellate. Embryo is without suspensor.

4. Pteropsida

This sub-division includes the plants which are commonly known as 'ferns'. It is represented by about 300 genera and more than 10000 species. These Pteridophytes were originated during the Devonian period. 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). 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. Leaves are large, may be simple (e.g., Ophioglossum) or compound (majority of the ferns for example, Pteridium, Marsilea, Adiantum etc.) and described as fronds. Young fronds are circinately coiled. Leaves are exstipulate (e.g., Filicales) while stipulate in some other groups. The vascular cylinder varies from a protosete to a complicated type of siphonostele. 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). Sporangia arise from placenta (a swollen cushion of cells) in groups (sori). Sori develop on the margins or abaxial surface of the leaves (sporophylls) or leaflets. Sori are protected by true (e.g., Marsilea) or false indusia (e.g., Adiantum, Pteris). The sporangial development may be leptosporangiate (e.g., Osmunda) or eusporangiate type e.g., Ophioglossum). The sporangia in most cases have a distinct annulus and stomium. Members may be homosporous (e.g., Pteris, Adiantum etc.) or heterosporous (e.g., Marsilea, Regnellidium, Azolla, Salvinia etc.) Spores on germination form autotrophic prothalli (gametophyte). Antheridia and archegonia are partially or completely embedded in the gametophyte. Embryo may or may not have suspensor.

Tulip Boruah