

PTERIDOPHYTES

LYCOPODIUM-

Morphology of the plant-The plant body consists of creeping rhizomes with elongated aerial branches. The branches are densely covered with numerous small narrow pointed leaves arranged in whorls. The strobilus is present at the tip of the branch.

Leaf- The leaves called microphylls are simple, small, sessile lens-shaped with broad bases. The leaf has single mid-rib.

T.S. of stem- The transverse section of the stem reveals the following structures:

(i) Epidermis- a single outermost layer of small cells provided with numerous stomata covered by a layer of cuticle.

(ii) Cortex- the cortex is differentiated into (a) outer cortex made up of a few layers of parenchyma cells, (b) middle cortex made up of thick-walled sclerenchyma cells and (c) inner cortex made up of thin walled parenchyma cells.

(iii) Endodermis- a single layer of small thin-walled cells followed by a single celled layer of pericycle. Both layers are not clearly distinct.

(iv) Stele- the stele is of mixed protostele type. The xylem is broken up into isolated strands which lie embedded in the ground mass of phloem.

L.S. of strobilus- The strobilus bears a central axis where the sporophylls are arranged in whorls. The sporangia are found singly on the adaxial surface of the sporophyll i.e. it is foliar. The sporangium bears some tiny spores, which are homosporous.

Morphology of sporophyll- The sporophylls are smaller, scale-like and paler in colour with serrated margins having mid veins. The sporophyll bear oval shaped sporangium without having a distinct stalk on the adaxial surface. The sporangium is protected by flange-like outgrowth from the sporophyll above.

Identifying characters-

The sporophytic plant body is differentiated into roots, stems and leaves- division-Lycophyta.

The plant is homosporous and the leaves are without ligules-class-Eligulopsida.

The plant is small and herbaceous without showing secondary thickness of stem and roots-order-Lycopodiales.

The leaves are small and simple having single unbranched midvein-family-Lycopodiaceae.

The plant body consists of slender and branched stem and dichotomously branched roots-genus-Lycopodium.

SELAGINELLA-

Morphology of the plant- The plant body is differentiated into root, stem and leaves. It is sub-erect, creeping along the surface of the ground and much branched. The stem bears four rows of leaves- two rows of small leaves on the upper surface and two rows of larger leaves at two sides. A ligule is present on each leaf. The rhizophore is present at the point of branching. The rhizophore bears small fibrous roots at the tip.

Leaf- The leaves are small, thin and delicate, simple and ovate in form. The leaves are of two types- larger leaves and small leaves. On the adaxial surface of each leaf close to its base, a small flap like appendage called ligule is present.

T.S. of stem- The transverse section of the stem reveals the following structures:

- (i) Epidermis- a single layer cells with a cuticle.
- (ii) Sclerenchyma- a few layers of thick-walled sclerenchyma cells occur below the epidermis.
- (iii) Ground tissue- a continuous mass of thin-walled, polygonal cells without having intercellular space.
- (iv) Stele- the number of steles may vary from 2 to 3. Each stele is a typical protostele is surrounded by an air space and remains suspended in the air space by some delicate strands of cells called trabeculae. Each concentric stele consists of pericycle, phloem and xylem. Pericycle is made up of single layered thin walled cells. Phloem surrounds the central spindle-shaped xylem. Protoxylem lies at the two ends and metaxylem in the middle.

T.S. of rhizophore- The transverse section of the rhizophore reveals the following structures:

- (i) Epidermis- a single layer made up of thick-walled cells.
- (ii) Hypodermis- it is made up of several layers of thick-walled cells.
- (iii) Cortex- it is composed of simple parenchymatous cells.
- (iv) Endodermis- is a single layered cell followed by single layered pericycle.
- (v) Stele- it is protostele, where xylem is present with one protoxylem at the center surrounded by phloem.

L.S. of strobilus- The strobilus has a central axis. The megasporophyll and microsporophyll having ligule, are crowded and spirally arranged around the axis in four rows forming a distinct four angled cone or strobilus. The megasporophylls are present at the base of the strobilus and the rest are the microsporophylls. Each megasporophyll bears in its axil a single megasporangium with one spore tetrad. The microsporophyll bears in axil a microsporangium with numerous microspores. The sporangia consist of a short stout stalk and a capsule.

Morphology of sporophyll- The sporophylls are slightly smaller than the vegetative leaves. Each sporophyll bears the sporangium in the axil. The sporophyll that bears microsporangium is called microsporophyll and that bears megasporangium is called megasporophyll. Each sporophyll on its adaxial surface bears a ligule and a single stalked sporangium, either micro or megasporangium.

Identifying characters-

The sporophytic plant body is differentiated into roots, stems and leaves- division-Lycophyta.

The plant is heterosporous and the leaves possess ligules-class- Ligulopsida.

The sporophytic plants are herbaceous, small and delicate-order- Selaginellales.

The stems and roots of the plant are without any secondary thickness-family-Selaginellaceae.

The only living plant in the family- genus-Selaginella.

EQUISETUM-

Morphology of the plant- The plant body composed of much branched rhizome and erect, aerial stem with leaves. It has distinct nodes and internodes. At each node, there is a whorl of small scale-like leaves, which are united at the base forming a sheath surrounding the stem. The aerial stems may be branched which are sterile or unbranched which are fertile. Many branches arise at the nodes. The internodes are long with ridges and furrows. The growth of the unbranched fertile branches is stopped after the formation of the strobili or cones.

T.S. of internode- The internal structure of the internode is as follows-

- (i) Epidermis- a single outer layer of cells in wavy outline and has stomata in two rows in the furrow.
- (ii) Sclerenchyma- it develops in the ridges below the epidermis, interrupted in the furrows by the cortex.
- (iii) Cortex- it is of many layered- outer cortex is chlorenchymatous and in the middle large air canals corresponding to the groove present in the general cortex.
- (iv) Endodermis- this is the innermost layer of the cortex, with distinct casparian strip in it.
- (v) Pericycle- single layered cell present bellow the endodermis.
- (vi) Vascular bundles- these are closed, collateral and arranged in a ring each opposite to a ridge. Water containing carinal cavity present within the bundle. The protoxylems lie in isolated strands against the carinal cavity and the metaxylems lie in two strands laterally outwards. Phloem lies between the metaxylem strands.
- (vii) Pith- it lies on the inner side of the bundles.

L.S. and T.S. of strobilus- The strobilus composed of an axis with whorls of many stalked, peltate structures called sporangiospores, projecting outwards from the axis. Immediately below the whorls of sporangiophores, the axis bears a ring like outgrowth called annulus.

The shape of each sporangiophore is umbrella like and has a slender stalk bearing a peltate and hexagonal disc on the under surface of which there are many elongate, cylindrical hanging sporangia.

Sporangiophore and spore- The sporangiophores are umbrella like in shape. It has a slender stalk bearing a peltate and hexagonal disc on the under surface of which a group of elongate, cylindrical hanging sporangia are present. The sporangia contain many small green spores.

The spore contains numerous minute chloroplasts and a large central nucleus. Each spore has three layers- intine, exine and perinium. The spore is covered by two spirally wound bands called elaters attached at the center. The elaters appear as four distinct appendages.

Identifying charactres-

The sporophytic plant body is true roots, stems and whorled leaves- division-Sphenophyta.

The stems are jointed with distinct nodes and internodes-class- Calamopsida.

The leaves are scale like and borne in wholes at the nodes and are united to form a sheath around each node-order- Equisetales.

The sporophytic plant is homosporous-family-Equisetaceae.

The only living plant in the family- genus-Equisetum.

MARSILEA-

Morphology of plant- The plant body consists of a slender prostrate dichotomously branched rhizome with distinct nodes and internodes, rooting at the nodes and giving off leaves along the upper side. The leaves consist of a long petiole and four obovate leaflets arranged in a peltate manner. The spore bearing structure called sporocarps are present in 2-5 numbers on the base of the petiole. The short stalked sporocarp is bean-shaped with very hard outer covering.

T.S. of rhizome- The transverse section of the rhizome reveals the following structures:

- (i) Epidermis- it lies externally as a single layer.
- (ii) Cortex- it consists of two layers of thin walled parenchyma internal to the epidermis, a ring of fairly big air-cavities traversed by trabeculae, usually 1-3 layers of thick-walled lignified cells, and internally several layers of thin walled parenchyma containing starch grains.
- (iii) Stele- it is an amphiphloic siphonostele. It is bounded both externally and internally by phloem, pericycle and endodermis which occur twice. In the middle xylem occurs as a ring with protoxylem and metaxylem and externally by outer phloem, outer pericycle and outer endodermis. Internal to xylem again occur inner phloem, inner pericycle and inner endodermis in the reverse order.
- (iv) Pith- it occupies the central portion and may be parenchymatous and sclerenchymatous.

T.S. of petiole- The internal structure of the petiole is as follows-

- (i) Epidermis- it lies externally as a single layer and it is rectangular in shape.
- (ii) Cortex- it consists of three layers- the outer cortex is sclerenchymatous internal to the epidermis with large air chambers being separated by one cell thick trabeculae. The middle cortex is also sclerenchymatous and the inner cortex consists of compact parenchyma cells.
- (iii) Stele- a triangular stele occupies the central region surrounded by endodermis and pericycle. Xylem is arranged in V-shaped two arms which come close in the middle region. Protoxylem present on both end of the arms with metaxylem at the center. The xylem remains surrounded by phloem.

V.T. section of sporocarp- The vertical transverse section of sporocarp shows outermost thick wall of single layered of epidermis followed by two layered cells of hypodermis. The gelatinous ring appears as the two masses on the dorsal and ventral sides. In this section two sori are visible, each of which remains covered by a two layered indusium. Each sorus shows only one kind of sporangia. In this section, the visible parts are dorsal bundles, lateral bundles and placental bundles.

V.L. section of sporocarp- The vertical longitudinal section of the sporocarp shows the outermost wall is very thick and consists of an outer layer of epidermis and two layers cells constituting the hypodermis. Below these layers there present a gelatinous ring which surrounds the sori. Each sorus shows only one kind of sporangia. In this section the stalk bundle and the cut lateral bundles are visible.

Identifying characters-

The sporophytic plant body consists of true roots, stems and whorled leaves- division-Filicophyta.

The sporangium is small, and the spore content is low-class- Leptosporangiopsida.

The plant is sub-aquatic with creeping branched rhizome bearing leaves with long petioles- Marsileales.

The sporophytic plant is heterosporous-family-Marsileaceae.

The sporangia are produced within sporocarp, leaves show circinate venation- genus-Marsilea.