

Internal Structure of Selaginella:

1. Stem:

A Transverse section (T.S.) of the stem of *Selaginella* is somewhat circular in outline and shows the following structures:

(i) Epidermis:

It is the outer most covering layer comprising of a single cell in thickness. The cells of the epidermis are without hairs and stomata. The epidermis is surrounded on all sides by a thick coating of cuticle.

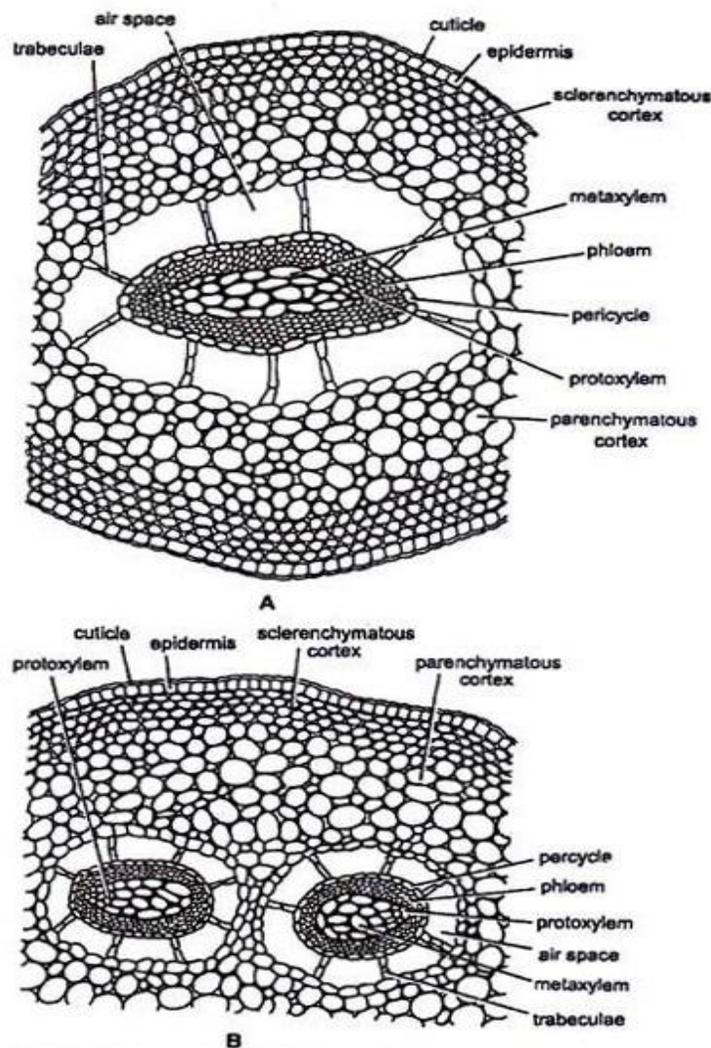


Fig. 3 (A-B). *Selaginella*. T. S. Stem. (A) T. S. monostelic stem, (B) T. S. distelic stem (a part cellular),

(ii) Cortex:

Inner to the epidermis is present a well-defined zone of cortex. The cortex may or may not be differentiated into inner and outer cortex. In case of *S. selaginoides*, the whole of the cortex is made up of parenchymatous cells while in *S. kraussiana*, it is differentiated into sclerenchymatous outer cortex and parenchymatous inner cortex.

The parenchymatous cortex is usually made up of angular cells i.e., without intercellular spaces but in some cases the cells are rounded and provided with a few inter-cellular spaces.

(iii) Stele:

The central portion of the stem is occupied by a well-developed stele. The stele is of protostelic type i.e., xylem is present in the centre and surrounded by phloem on all sides. Phloem, in turn, is surrounded by a single layered pericycle. Pith is absent.

The stele remains suspended in the centre by radially elongated tubular, unicellular structures known as trabeculae. These are formed by the radial elongation of the endodermal cells. Trabeculae are provided with conspicuous casparian strips. In between the trabeculae are present large spaces known as air spaces.

The number of stele is variable in different species of *Selaginella*. It is 1 (monostelic e.g., *S. spinulosa*), 2 (distelic e.g., *S. kraussiana*) or 12-16 (polystelic e.g., *S. laevigata*). The organization of the stele is also variable in different species. It may be protostele (e.g., *S. spinulosa*) to siphonostele (e.g., *S. laevigata*, var. *lyalli*).

The stele is surrounded by a single layered pericycle made of parenchymatous cells. The xylem is usually monarch (e.g., *S. kraussiana*), or diarch (e.g., *S. oregana*) or multiarch (e.g., *S. spinulosa*).

It is usually exarch but sometimes it may be mesarch (e.g., *S. selaginoides*). Xylem is usually made of tracheids. Vessels are completely absent. Xylem is surrounded on all sides by phloem which

consists of sieve cells and phloem parenchyma. Companion cells are absent in phloem.

2. Root:

A T.S. of the root is somewhat circular in outline (Fig. 4) and shows the following internal structures:

(i) Epidermis:

It is the outermost covering layer and is only one cell in thickness. The cells are large and the unicellular root hairs arise from them.

(ii) Cortex:

Just below the epidermis is present a wide zone of cortex. The cortex may be either wholly made up of thin walled parenchymatous cells or there may be sclerenchymatous outer cortex (hypodermis), 3 to 5 celled in thickness and parenchymatous inner cortex. In mature roots of *S. densa* the entire cortex may consist of thick walled sclerotic cells. Air spaces have also been reported in the inner cortex (e.g., *S. willdenovii*). It is traversed by trabeculae.

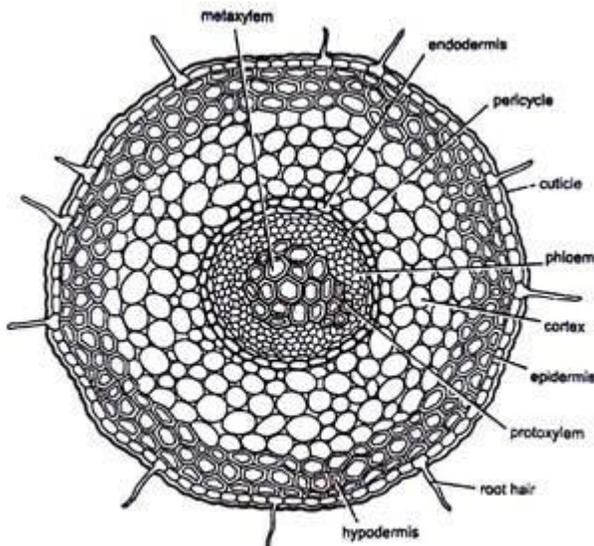


Fig. 4. *Selaginella*. T. S. of root

(iii) Endodermis:

It is usually not well defined but in some species as for example, *S. densa*, it is a distinct structure and only one cell in thickness.

(iv) Pericycle:

Endodermis is followed by one to three layered pericycle. It is made up of parenchymatous cells.

(v) Stele:

It is a typical protostele. The xylem is exarch and monarch i.e., there is only one protoxylem group situated at the periphery. Xylem is surrounded by phloem on all sides. The structure of xylem and phloem elements is similar to that of stem.

3. Rhizophore:

The internal structure of rhizophore is almost similar to that of root. It is also circular in outline.

It shows the following structures (Fig. 5):

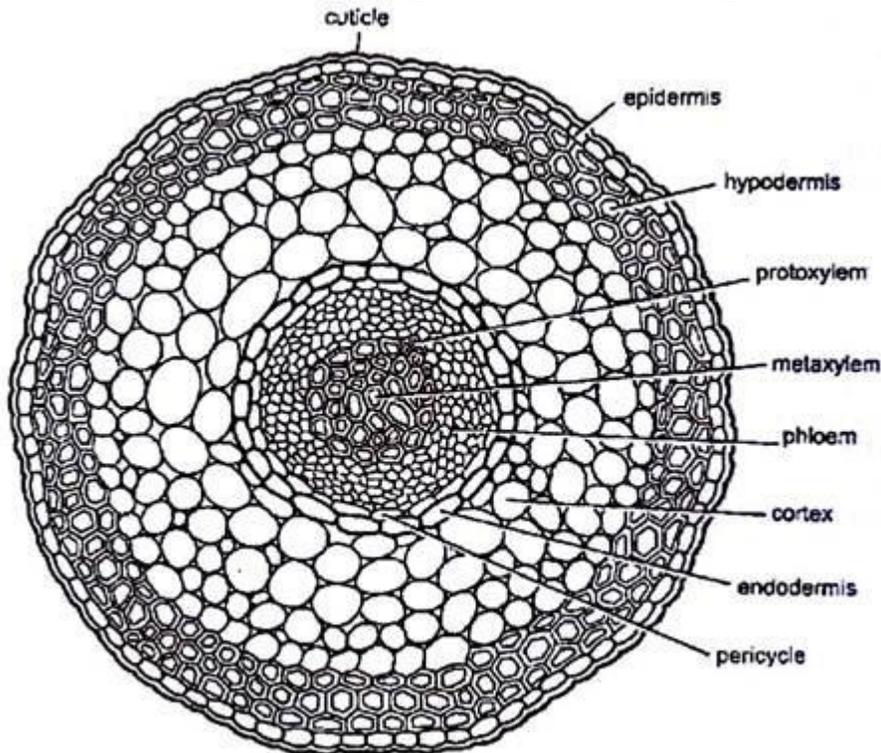


Fig. 5. *Selaginella* . T. S. rhizophore

(i) Epidermis:

It is single layered and the outer wall of epidermal cells is covered with a thick cuticle. Root hairs and stomata are absent.

(ii) Cortex:

Inner to the epidermis is present a wide zone of cortex differentiated into outer sclerenchymatous and inner parenchymatous zones.

(iii) Endodermis:

It is inner-most layer of the cortex. It is ill defined single layered structure.

(iv) Pericycle:

Inside the endodermis is present a single layered parenchymatous pericycle.

(v) Stele:

It is typically a protostele. The xylem is surrounded by phloem. Xylem shows distinct protoxylem and metaxylem elements. The position of protoxylem is different in different species. In *S. martensii* xylem is exarch and monarch. In *S. atroviridis* the metaxylem is crescentric with a number of protoxylem strands situated on the concave adaxial side. In *S. kraussiana*, *S. poulterii* etc. protoxylem is mesarch (centroxyletic).

4. Leaf:

A T.S. of the leaf shows epidermis, mesophyll and a single median vascular bundle which has been discussed below in detail:

(i) Epidermis:

It is the outermost surrounding layer and is only one cell in thickness. In most of the species the stomata are present only on the lower epidermis near the midrib. The stomata may be present on both the outer and inner epidermis. The cells of the epidermis are provided with chloroplasts.

(ii) Mesophyll:

It occupies a wide zone between upper and lower epidermis. The mesophyll is usually made up of parenchymatous cells which have conspicuous intercellular spaces. Each mesophyll cell has one (e.g., *S. martensii*), two (e.g., *S. kraussiana*), or eight (e.g., *willedenovii*) chloroplasts.

Each chloroplast has several pyrenoid like bodies similar to order Anthocerotales (Bryophyta). In some species (e.g., *S. concinna*) the mesophyll is distinguished into upper palisade and lower spongy parenchyma.

(iii) Vascular bundle:

Only one vascular bundle is present in the centre. It is concentric and amphicribal (ectophloic). It is made up of a few xylem tracheids (annular or spiral) surrounded by phloem elements (a few sieve elements). A single layered bundle sheath encircles the phloem on all sides.

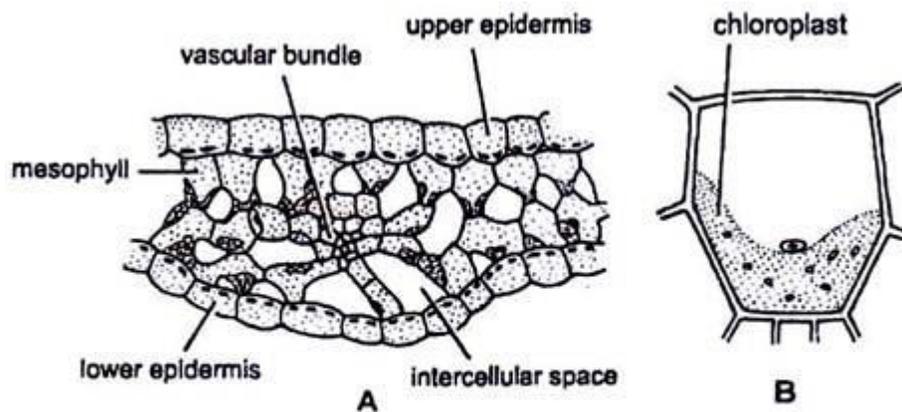


Fig. 6. (A–B). *Selaginella* : Internal Structure of leaf. A. T. S. of a part leaf of *S. kraussiana*, B. A mesophyll cell