

## Morphology, anatomy and reproduction of *Selaginella*

### Morphology of Sporophyte

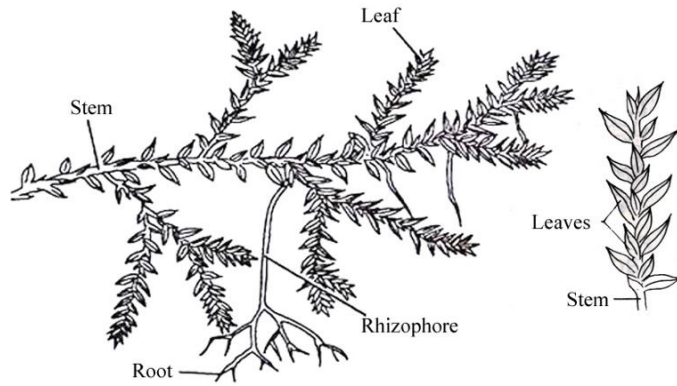


Fig: *Selaginella*. A habit

The plant body is the sporophyte, differentiated into root stem and leaves

1. Creeping or erect plant body
2. Stem: dichotomously branched later become monopodial
3. Leaves: small, simple, sessile, green, thin microphyllous leaves. Unbranched midrib.
4. Function: photosynthesis

5. Roots: Adventitious roots, dichotomously branched arising from the stem

### Leaves

The main stem and the branches are covered by green leaves. Each leaf has a ligule. The leaves are of two sizes, large and small. The leaves are arranged in four vertical rows. Leaves present in pairs. The larger leaf of each pair is attached toward, the ventral side of the stem and the smaller leaf towards the dorsal side. The leaves bearing sporangia in their axils are called sporophylls. Many sporophylls form cones or strobili.

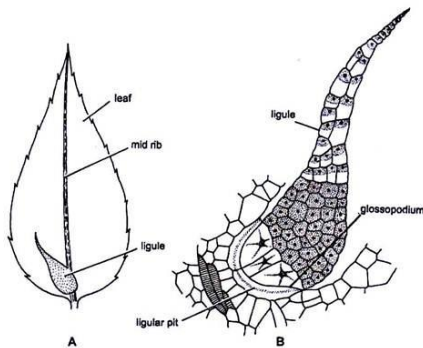


Fig. 2 (A, B). *Selaginella*. Structure of ligule : A. Leaf with ligule, B. Longitudinal section of ligule

### Ligule

Small tongue shaped outgrowth or appendage present at the base of each young leaf on its adaxial or upper side. At the base of ligule, a sheath of elongated secretory cells are present called as glossopodium.

### Function

Not well known. Protective organ. Secretory organ that keeps sporangium and young leaf wet

### Rhizophore and its morphological nature

#### Rhizophores:

(Greek rhiza = root; phora = bearer).



In many species of *Selaginella*, peculiar leafless, prop-like cylindrical, structures, originate from the stem at the point of branching. These grow downwards into the surface and form many adventitious roots at their free ends. They are known as rhizophores.

### **Morphological nature of rhizophore:**

The morphological nature of rhizophore is controversial because of its unusual position and structure. It has been interpreted by various plant scientists as root, stem or an organ sui generis (i.e., an organ, neither a stem nor a root).

#### **I. Similarities with Root**

- i. Rhizophores are positively geotropic in nature.
- ii. It does not bear leaves.
- iii. Monarch xylem like that of root.
- iv. Presence of root cap in some species, e.g., *S. densa*, *S. kraussiana*, *S. martansii*, *S. wallacei* (Webster and Steeves, 1967).
- v. Transport of auxin in rhizophore is acropetal which is similar to root (Wochok and Sensex, 1974).

#### **II. Similarities with Stem**

- i. Exogenous in origin like stem.
- ii. Absence of root caps and root hairs.
- iii. Originate due to the activities of meristems which are present between the two branches of the stem. This meristem has been termed as angle meristem which is basically an embryonic shoot (Curick, 1959).
- iv. Production of roots endogenously from the tip.

v. Under experimental conditions the rhizophore can be transformed into a leafy shoot (Foster and Cifford, 1959).

Hence Bower (1908, 1935) and Goebel (1905) suggested that rhizophore is neither a root nor a stem, but an organ sui generis. According to Schoute (1938) it is a specialised stem behaves like root.

However, recent biochemical studies of protein from stem, leaf, root and rhizophore revealed that the polypeptides of the rhizophore more closely resemble those of the stem rather than subterranean roots. The above-mentioned features are not for a typical root, moreover, they produce roots endogenously. Therefore, these outgrowths are called rhizophores (Gr. rhiza = root; phora = bearer).

### Internal Structure of the Stem

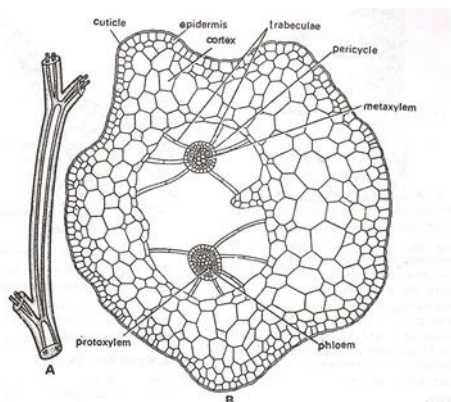


Fig. 213. *Selaginella kraussiana*. A, A part of cleared distile stem showing vascular cylinder; B, T.S. of a distile stem.

In cross section, the stem is composed of epidermis, cortex and central stele.

1. Epidermis: It is outermost layer. It is without stomata.

2. Cortex: Cortex is present inner to the epidermis. It has many layered. It composed of parenchymatous cells. The cortex surrounds central stele. Cell of peripheral region of cortex contain chloroplasts. In mature regions of stem, the cortex form

sclerenchymatous hypodermis.

3. Stele: Their stele is from monostelic to polystelic condition. Each stele is protostelic in nature. The metaxylem forms the solid central core. The protoxylem groups on the periphery. The xylem core is surrounded by the phloem. Outside the phloem is the pericycle. It is composed of single layer of parenchymatous cells. The stele is separated from the cortex by a wide, air space. These spaces have long radiating cells

## Strobilus: Spore producing structure

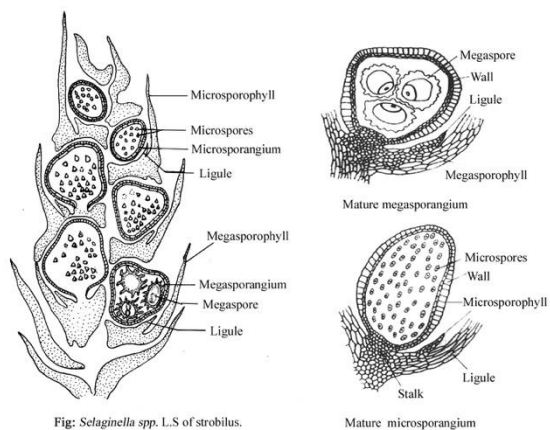
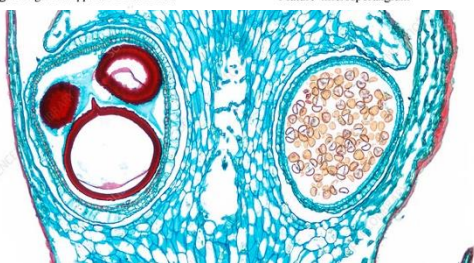


Fig: *Selaginella* spp. L.S of strobilus.



*Selaginella* is heterosporous. The larger spores are megaspores and the smaller spores are microspores. Megaspores are produced in megasporangia and microspores are produced in microsporangia. Both sporangia are borne in the axils of leaves called microsporophyll and megasporophylls. Megasporangia are present in the basal portion and the microsporangia are present in the upper part of the cone. Each microsporangium contains several microspores. But there are only four megaspores in each sporangium. The mature spores are pyramidal in shape. The sporangial wall consists of three layers. The inner most layer is tapetum. They

provide nourishment to the developing spores. A slit is produced in mature sporangia. The spores come out of this slit. The spores germinate to develop gametophytes. Microspore give rise to male gametophytes and the megaspores produce female gametophytes. Both male and female gametophytes remain within the walls of the spores. The young embryo develops in the megaspore. This is an approach towards the seed habit.

### Evolutionary advancement of *Selaginella*

#### Approach to seed habit

*Selaginella* shows an evolutionary advancement over the other Pteridophyta. It has an approach towards seed habit due to following advanced characteristics.

1. The production of gametes, fertilization and the development of the embryo, take place on the sporophyte. Megaspore is never released from the sporophyte.
2. *Selaginella* is heterosporous. The microspore produces the male gametophyte: It completes its development within the wall of the spore.
3. Megaspore contains a large amount of reserve food material. The female gametophyte completes its whole development within the megaspore wall. Fertilization and the development of



the embryo also take place within spore wall. The developing gametophyte and the embryo use the reserve food.

4. In many cases the megaspore is not released from the megasporangium. The development of the gametophyte, fertilization of the oosphere and the early development of the embryo take place while the spore is still in the sporangium.

### References

- A Textbook of Botany: Singh, Pande, Jain, Rastogi Publications.
- College Botany Vol-I: Gangulee , Das , Dutta, New Central Book Agency (P) Ltd.