

VIVEKANANDA COLLEGE  
THAKURPUKUR  
KOLKATA-700063

NAAC ACCREDITED 'A' GRADE



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Name of the Teacher: Mrs. Rinku Halder Sahu  
Name of the Department: Botany (Morning)

## Reproduction in Selaginella

*Selaginella* reproduces by two methods:

- Vegetatively and
- by formation of spores.

### **1. Vegetative reproduction:**

**It takes place by following methods:**

#### *(i) Fragmentation:*

- Under humid conditions in *S. rupestris*, trailing branches of the stem develop adventitious branches.
- These branches later disjoin from the parent plant and develop into separate individual plants.

#### *(ii) Tubers:*

These appear towards the end of the growing season. The tubers may be aerial, developing at the apical end of aerial branches (e.g., *S. chrysocaulos*) or subterranean (e.g., *S. chrysorrhizos*). Under favourable conditions tubers germinate into a new plant (Fig. 7A).

### (iii) Resting buds:

These are the compact structures which develop at the apical end of some aerial branches. The leaves in this region are closely arranged and overlap the growing points. These resting buds are capable of passing on the unfavourable conditions. Under favourable conditions these buds give off rhizophore that bear roots at their tips (Fig. 7B).

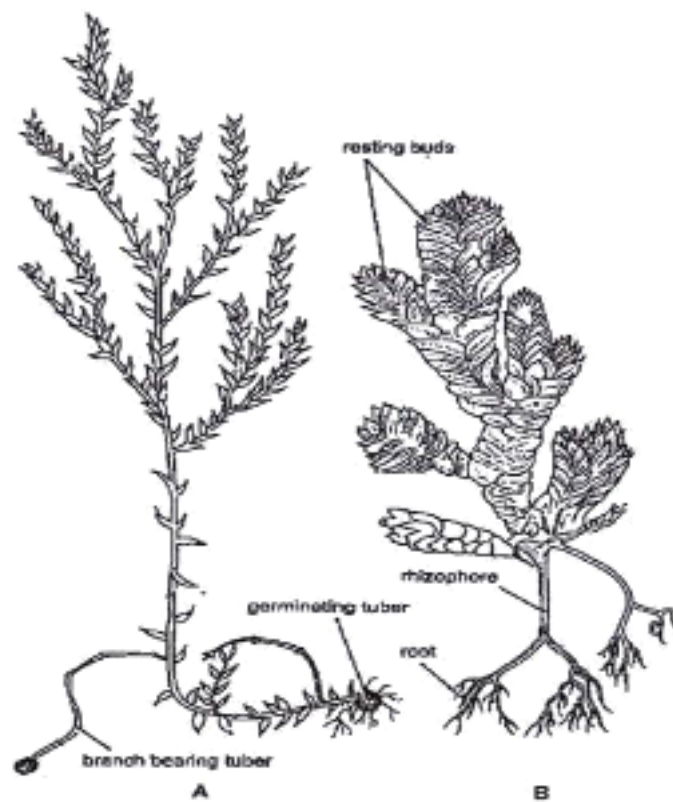


Fig. 7 (A-B). *Selaginella*. Vegetative reproduction, A. Tubers, B. Resting buds

## 2. Sexual Reproduction:

- *Spore producing organs:*

- *Selaginella* is a sporophytic plant (2x) and reproduces sexually. The plants are **heterosporous** i.e., produce two different types of spores—**megaspores and microspores**.

- These spores are **produced in megasporangia and microsporangia**, respectively which, in turn, are produced on fertile leaves known as **megasporophylls and microsporophylls** respectively.

- Usually both these structures are grouped together to form a **compact structure known as strobilus** which is usually a terminal structure (Fig. 8 A).

- *Strobilus:*

It is a reproductive structure **formed by the aggregation of ligulate sporophylls** at the apex of the branches of stem. In some species as for e.g., *S. cuspidata*, *S. patula* etc. the growth of the stem continues beyond the strobilus and such condition is called **selago condition** (fertile part is alternated by vegetative parts, Fig. 8 B).

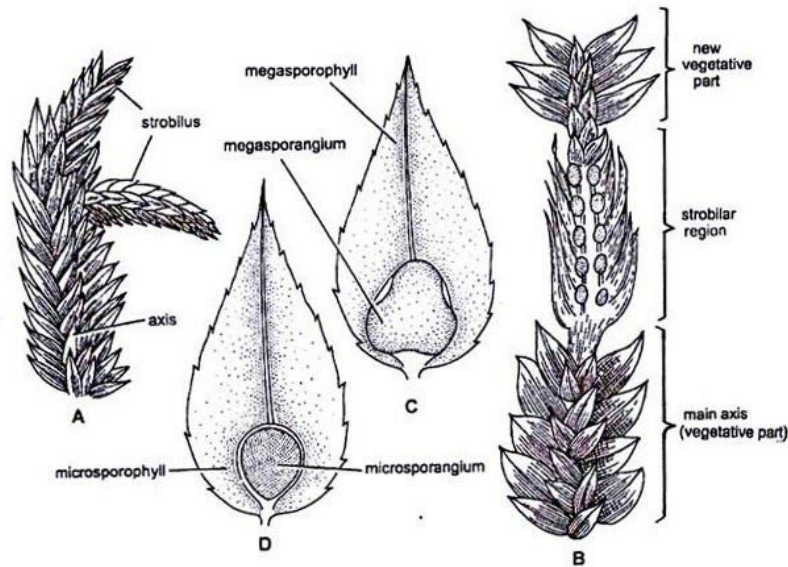


Fig. 8 (A–D). *Selaginella* : Structure of strobilus. A. A branch bearing strobilus, B. A branch after formation of strobilus region again changing into vegetative region, C. A megasporophyll, D. A microsporophyll

**The Longitudinal section (L.S.) of strobilus shows that**

- It consists of a central axis,
- The central axis is covered with spirally and densely arranged ligulate sporophylls. Each sporophyll abaxially bears a single stalked sporangium in its axis (Fig. 8C, D; 9A).
- The positions of the sporangia differ in different species. It may be in axil (axillary) or little upward on in position (cauline).
- *Selaginella* produces two types of spores—megaspores and microspores. The dimorphic condition of the spores is known as heterospory.

- In between the sporophyll and sporangium is present a small membranous structure known as ligule i.e., the sporophyll is similar to a vegetative leaf.
- The microsporangium produces a large number of microspores whereas megasporangium produces usually 4 megaspores.

*Strobili are usually bisporangiate but the arrangement of microsporophylls and megasporophylls differ in different species.*

- In *S. inaequalifolia* (Fig. 9 A) the microsporophylls are present on one side and megasporophylls on the other side.
- In *S. rupestris* megasporophylls are present on the lower side and microsporophylls on the upper side of the strobilus (Fig 9 B).
- In the case of *S. martensii* the microsporophylls are mixed irregularly with megasporophylls (Fig. 9 C).
- In *S. kraussiana* only one megasporophyll is present while all the rest are microsporophylls (Fig. 9 D).
- In the case of *S. gracilis* the strobilus is monosporangiate i.e., either it bears microsporophylls or megasporophylls alone.

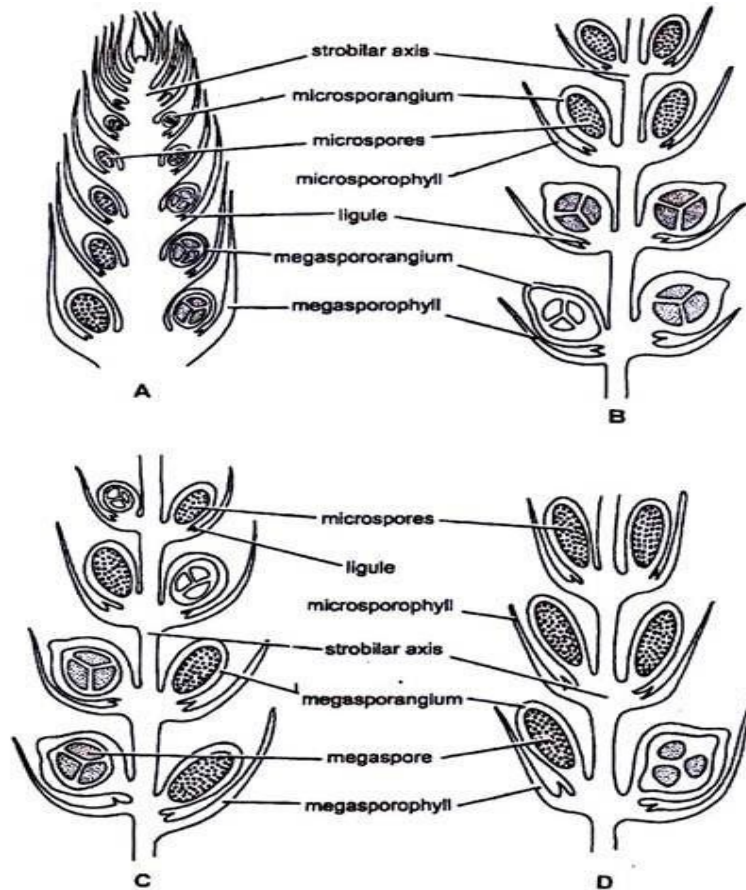


Fig. 9. (A–D). *Selaginella*. Longitudinal sections of strobili of different species showing position of microsporangia and megasporangia A. *S. inaequalifolia*, B. *S. rupestris*, C. *S. martensii*, D. *S. kraussiana*

- **Microsporangium:**

- Each microsporangium is a stalked, globular or elongated structure (Fig. 8 D).
- Its colour varies from red, yellow to brown in different species.
- The wall is 2 layered thick which is followed by a conspicuous tapetum (Fig. 10 F).
- In the young sporangium inside the wall is present a mass of sporogenous cells which in due course of development separate

into microspore mother cells and later on by meiotic divisions produce numerous haploid tetrads of microspores.

→ The microspores at maturity separate from each other. At maturity the tapetal cells as well as the inner wall of the microsporangium disorganizes i.e., the wall of the sporangium is usually one layered at maturity.

→ Microspores are smaller in size.

- *Megasporangium:*

→ Each megasporangium is also a stalked but lobed structure and somewhat bigger than the microsporangium.

→ Its colour varies from whitish yellow to red.

→ Its wall is also 2 layered thick and followed by a single layered tapetum (Fig. 10G).

→ In the young sporangium inside the wall is a mass of sporogenous cells which in due course of development separate into megaspore mother cells.

→ All the megaspore mother cells except one degenerate.

→ The remaining one later on by meiotic division produces only 4 haploid megaspores.

→ Sometimes less than 4 megaspores are produced inside each megasporangium. As for example, *S. rupestris* produces only one megaspore per megasporangium. At maturity the tapetal cells usually along with the inner wall of the sporangium disorganise. Megaspores are larger in size than microspores (Fig. 10 G).

→ The sporangia usually dehisce by a vertical slit formed in apical region of the sporangia and the spores are disseminated in the air.

### Development of sporangium and formation of spores:

As the position of sporangium is either cauline or foliar, the initials are either situated on the axis or on the leaf respectively. **The development of sporangium and formation of spores (micro-and mega) is similar upto the formation of spore mother cells** and is as follows:

- The development is of **eusporangiate type** i.e., it takes place with the help of a row of initials which are known as sporangial initials e.g., *S. kraussiana* (in some cases from a single sporangial initial cell e.g., *S. spinulosa*). These cells are superficial in position (Fig. 10 A).
- These cells divide periclinally forming outer jacket initials and inner archesporial initials (Fig. 10 B).
- The jacket initials by further periclinal and anticlinal divisions form the jacket which is 2 celled thick (Fig 10 E).
- The archesporial initials divide in all directions forming a group of cells known as sporogenous tissue.

- The cells of the outermost layer of sporogenous tissue divides periclinally forming a single layered tapetum just inner to wall of sporangium. It is a nourishing layer (Fig 10 C-E).
- Tissue at the base of sporangium divides to form the sporangial stalk. The cell of sporogenous tissue in case of microsporangium finally gives rise to microspore mother cells and in case of megasporangium gives rise to megaspore mother cells.

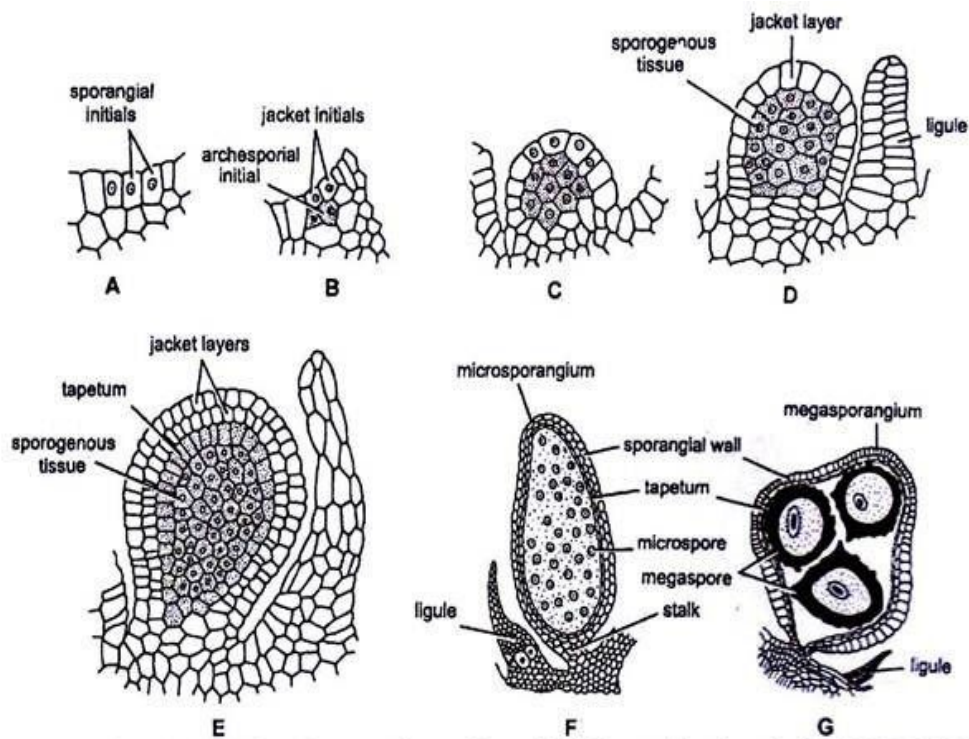


Fig. 10. (A–G). *Selaginella*. Development of sporangium. (A–E). Successive stages in the development of microsporangium in *S. kraussiana*, F. Mature microsporangium, G. Mature megasporangium

## **In microsporangium,**

- all the microspore mother cells are functional and each one divides reductionally forming a tetrad of 4 haploid microspores, as a result of which a large number of tetrads of microspores are formed inside microsporangium.
- Later on these microspores separate from each other.
- The mature microsporangium dehisces by a vertical slit in the apical region. By the drying of unsplit portions, the spores are forced out and then they are dispersed away by wind.
- In megasporangium all the megaspore mother cells degenerate except one which divides reductionally forming a tetrad (Fig. 11 D) of 4 haploid megaspores.
- The dehiscence of megasporangium is similar to that of microsporangium.
- *Spore:*

## The **microspores** are

- small, 0.015 to 0.05 millimeter in diameter,
- spherical or round in shape and double layered structures.
- The outer wall is thick and known as exospore (exine). The inner wall is thin and is called endospore (intine, Fig 11 A-C).
- The microspores on germination give rise to male prothalli.

The **megaspores** are

- much larger than microspores, 1.5 to 5 millimeter in diameter. Tetrahedral in shape and show triradiate ridge.
- The megaspore has three wall layers namely exospore, mesospore and endospore (Fig. 11 D, E).
- The megaspores on germination give rise to the female prothalli.

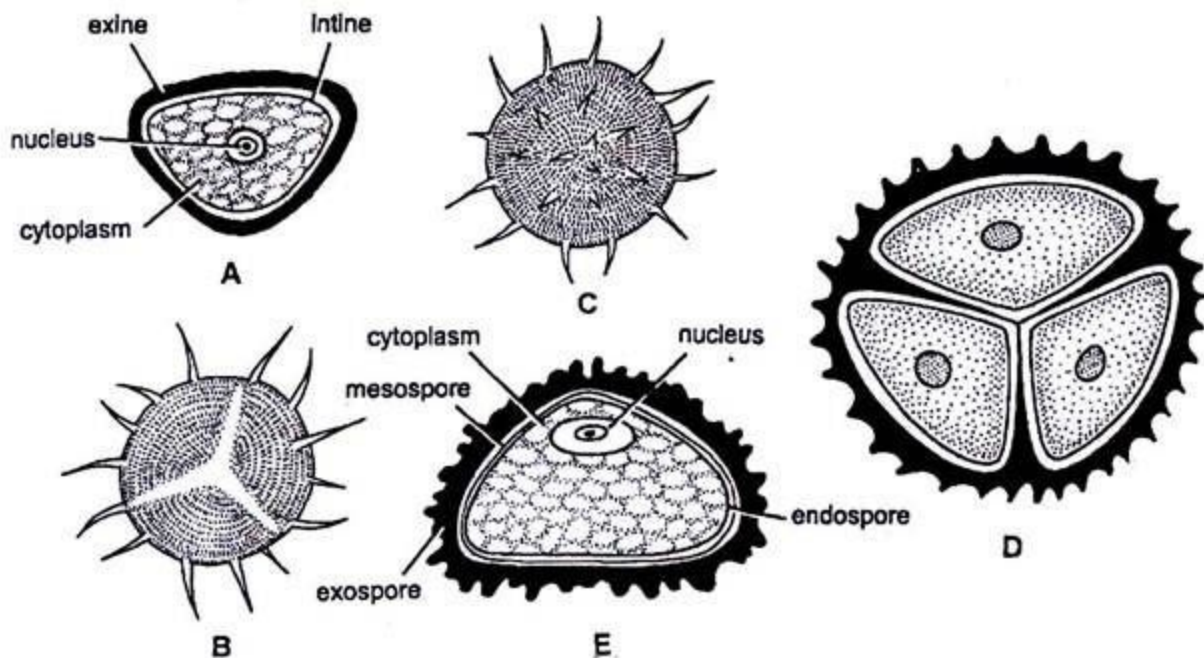


Fig. 11 (A–E). *Selaginella*. Structure of spores : A. A single microspore showing detailed structure, B. Apical view of spore, C. Basal view, D. Megaspore in tetraed, E. A single megaspore.

