

Selaginella

Pteridophyta

Div: Lycophyta

Class: Lignulopsida

Order: Selaginellales

Family: Selaginellaceae

Genus: Selaginella

- Selaginella is a worldwide distribution & comprises about 700 species.
- Tropical habitat & grows in rain forests.
- 58 species of Selaginella have been reported from India.
eg S. Kraussiana; S. trachyphylla;
S. willdenovii; S. erythropus.
- S. alligans have & climb with the help of rhizophores.
- Selaginella are of 2 types: —
(Homoeophyllum) & (Heterophyllum)
 - erect stems & spirally arranged leaves.
eg S. spinulosa,
S. rupestris
 - Prostrate stem,
short erect branches
Dimorphic leaves
eg S. Kraussiana.
- Prostrate stem is dorsiventral.
 - Leaves are arranged in pairs.
 - Each pair consists of 2 different sized leaves.
 - Larger leaf of each pair is inserted on ventral side of the axis.
 - Small leaves alternates the small leaf & large leaf alternates the large leaf.

7. In *S. kraussiana* — leaves are quite small in size — triangular or lanceolate.

Each bears a thin, membranous small ligule at its base.

8. Structure of ligule —

- Tongue like to fan shaped.
- There is a cup-shaped sheath at its base.
- Just adjacent to the sheath, there is a hemispherical mass of thin walled cells, known as Glossopodium.
- Ligules are water absorbing (or) water secreting organs.

9. Rhizophores & Roots —

• The prostrate axis bears an elongate, colourless, leafless, cylindrical, downwardly growing structure called Rhizophore.

• Rhizophores arise from axis of of ramification (branching).

• At terminal end of rhizophore develop adventitious roots which are thin & dichotomously branched.

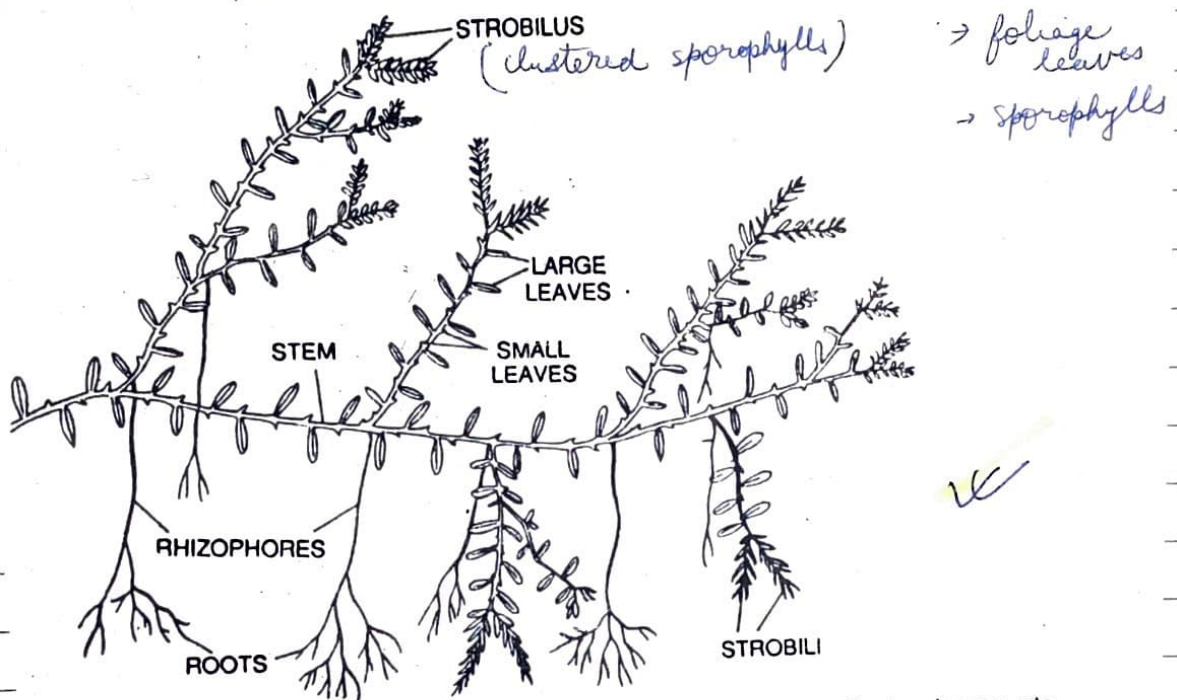
• Rhizophore is portion of stem as it is exogenous in origin. Root cap is absent.

10.) STROBILUS or Spike

• Reproductive structures develops at apices of branches & are called Strobili.

• Strobili is a compact str. of Sporophylls.

- Each sporophyll bears a ligule at its base & a single stalked Sporangium.
- Sporangia are of 2 types: Microsporangia & Megasporangia.
 - Microsporophyll bear microsporangia &
 - Megasporophyll bear megasporangia.
- In *S. spinosa* & *S. rupestris* megasporophyll are found in lower portion & microsporophyll are found in upper portion of strobilus axis.



28.1. *Selaginella kraussiana*. A, sporophyte with strobili, rhizophores roots, ligules, leaves, etc.

Anatomy of Stem

- 1) Epidermis consists of prosenchymatous cutinized cells.
- 2) Just beneath the epidermis is the cortical region. The cortex consists of thin walled

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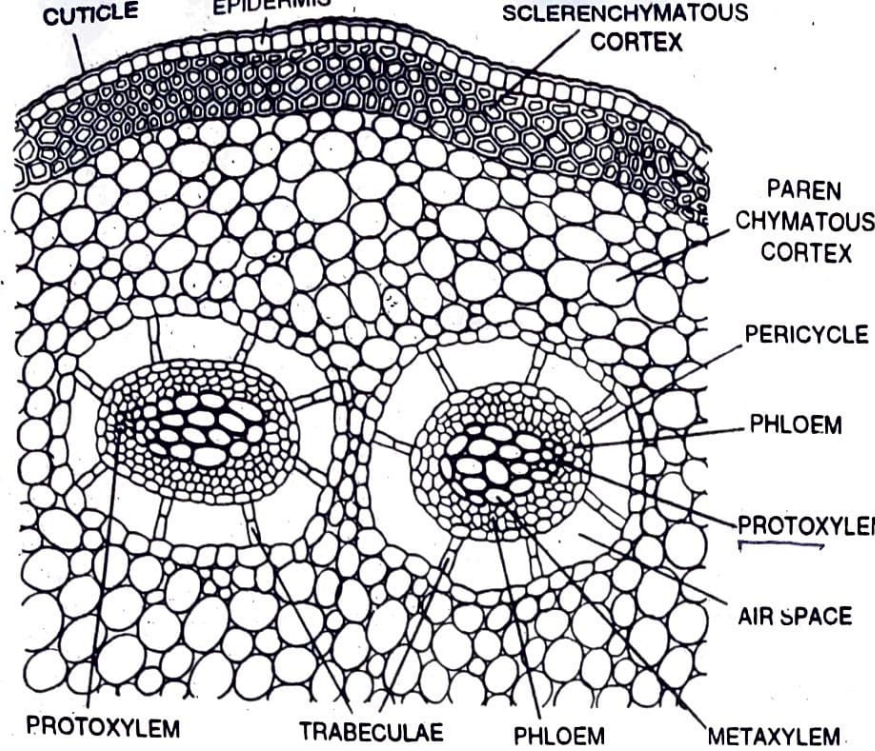
parenchymatous cells with no intercellular spaces.

In xerophytic species like *S. rupestris* a compact layer of sclerenchyma in hypodermis region is present just beneath the epidermis.

- 3.) Stems of most species have stretched endodermal cells called trabeculae having large intercellular spaces between them.
- 4.) Number of Stele⁽²⁻¹⁶⁾ may vary from species to species.
They may be Simple Protostele to complex Polycyclic Siphonostele.
- 5.) Each stele is surrounded by its trabecular endodermis.
- 6.) Stele has a single mass of exarch protoxylem. Metaxylem is centrally placed.
Phloem surrounds the xylem.
Phloem is composed of sieve tubes.
Companion cells are absent.

Apical growth →

occurs from a group of initials or from a single 3 or 4 sided Apical cell.



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✓ towards the periphery

Selaginella spp. T.S. of stem of *S. kraussiana* showing distelic condition. Note the trabeculae (endodermis).

Anatomy of Root :-

- 1.) Outermost layer of the root is single layered & bears many unicellular root hairs. (parenchymatous cells).
- 2.) Inner to the piliferous layer, is a wide cortical region. In some there is a 3-5 layered hypodermis layer consisting of parenchymatous cells. Last layer of cortex is the endodermis.
- 3.) Beneath the endodermis is 1-3 layered Pericycle (parenchymatous cells)
- 4.) Single stele which is a protostele. Protoxylem is exarch. Xylem is surrounded by Phloem. Metaxylem is made up of Scleriform tracheids.

T.S of Root

From
the Book/
Practical book.

T.S of Rhizophora

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Sporangia - are of 2 types (heterosporous) & borne in axil of the Sporophylls

- 1.) Both mega & microsporangia are stalked.
- 2.) The wall of mature sporangia are two-layered.
- 3.) Outer layer has thick walled columnar cells having chloroplasts in them.
- 4.) Inner layer has thin walled cells.
- 5.) Just beneath the 2 layer is a nutritional layer, the Tapetum. It nourishes the developing spores & then degenerates.
- 6.) Ripe microsporangia are red yellow or brown in colour.
In *S. kraussiana*, each microsporangium contains about 600 microspores in it.
- 7.) Megasporangia are pale or whitish in colour.
Ripe megasporangium is four lobed. Each lobe bears a single megaspore so in total 4 megaspores in each megasporangium.
- 8.) Megaspores are large in size & possess a triradiate ridge at its apex. It has thick sculpted exine & thin uniform intine.
- 9.) Microspores are pyramidal in shape & have thick ornamented exine & thin intine.
- 10.) Both spores have nucleus suspended in rich cytoplasm.

Spores are dispersed from splitted Sporangium (split of the jacket) by wind currents.

MICROPOROPHYLL

MICRO-SPORANGIA

MEGASPOR-ANGIA

MEGASPOROPHYLL

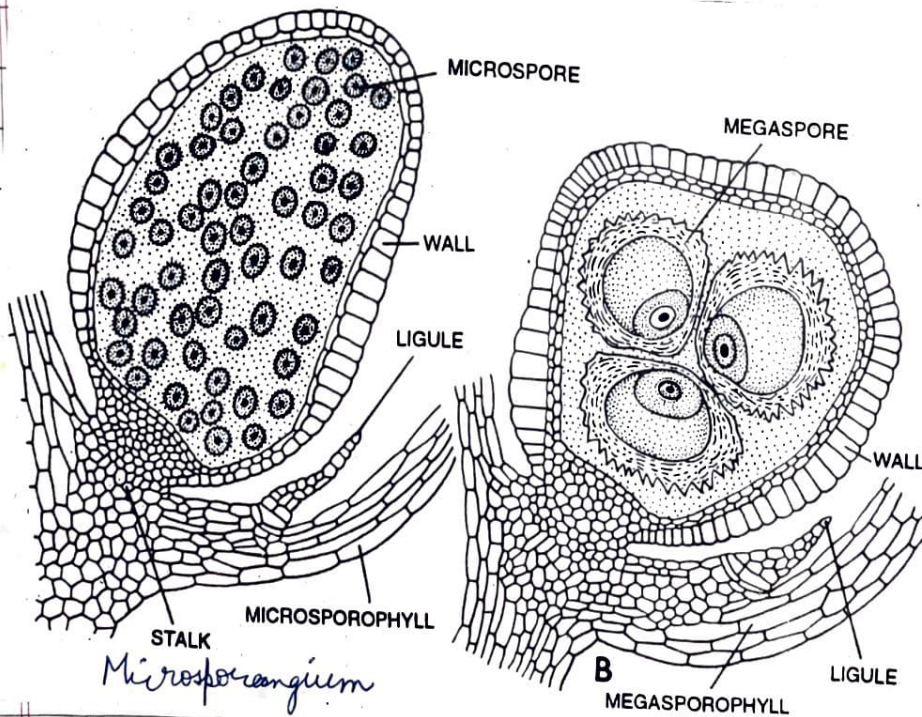
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STROBILUS



Germination of Spores

Microspore germinates in situ & the microgametophyte is developed within it.
 After a series of cell divisions, a 13-celled microgametophyte is developed.

9. Microgametophyte 13 celled

classmate

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It consists of 1 prothallial cell,
4 primary androgenial cells &
8 jacket cells.

At this stage, the microgametophyte is shed from the microsporangium.

Division go on & each 4 androgenial cells divide producing 256 androcytes

Each androcyte metamorphose into spindle shaped biflagellate antherozoid.
Microgametophyte of Selaginella is much reduced in size.

Then Microspore bursts along its triradiate ridge & antherozoids are liberated in film of water.

Germination of Megaspore -

Megaspore also germinates in situ. Megaspore enlarges in size & a two-layered wall is secreted around it. Further there is no cell division but nucleus divides several times to form multinuclear protoplast.

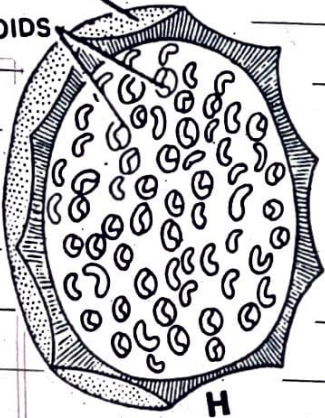
As soon as an apical tissue is formed wall of the megaspore cracks. A portion of tissues gets exposed & from this later on rhizoids develop.

Str. of Archegonia -

- 1) Archegonia are small & embedded in the apical cellular tissue of mega-gametophyte.

2. Outer tier of neck of archegonium is composed of 4 cells which project out of gametophyte.
3. Archegonium consists of neck composed of 2 tiers of 4 cells each, a neck canal cell, a venter canal cell & an Egg.
4. On maturity the egg & venter canal cells disintegrate. Projecting cells make a free passage for antherozoids to swim to the eggs.

MALE
GAMETOPHYTE
ANTHEROZOIDS



FERTILIZATION -

1. Fertilization may take place while megagametophytes are still in megaspores situated in megasporangium.
2. Water is essential for fertilization.
3. Antherozoids swim & come in contact with the egg. Only one antherozoid penetrates the egg.
4. After fertilization, an Oospore is formed.

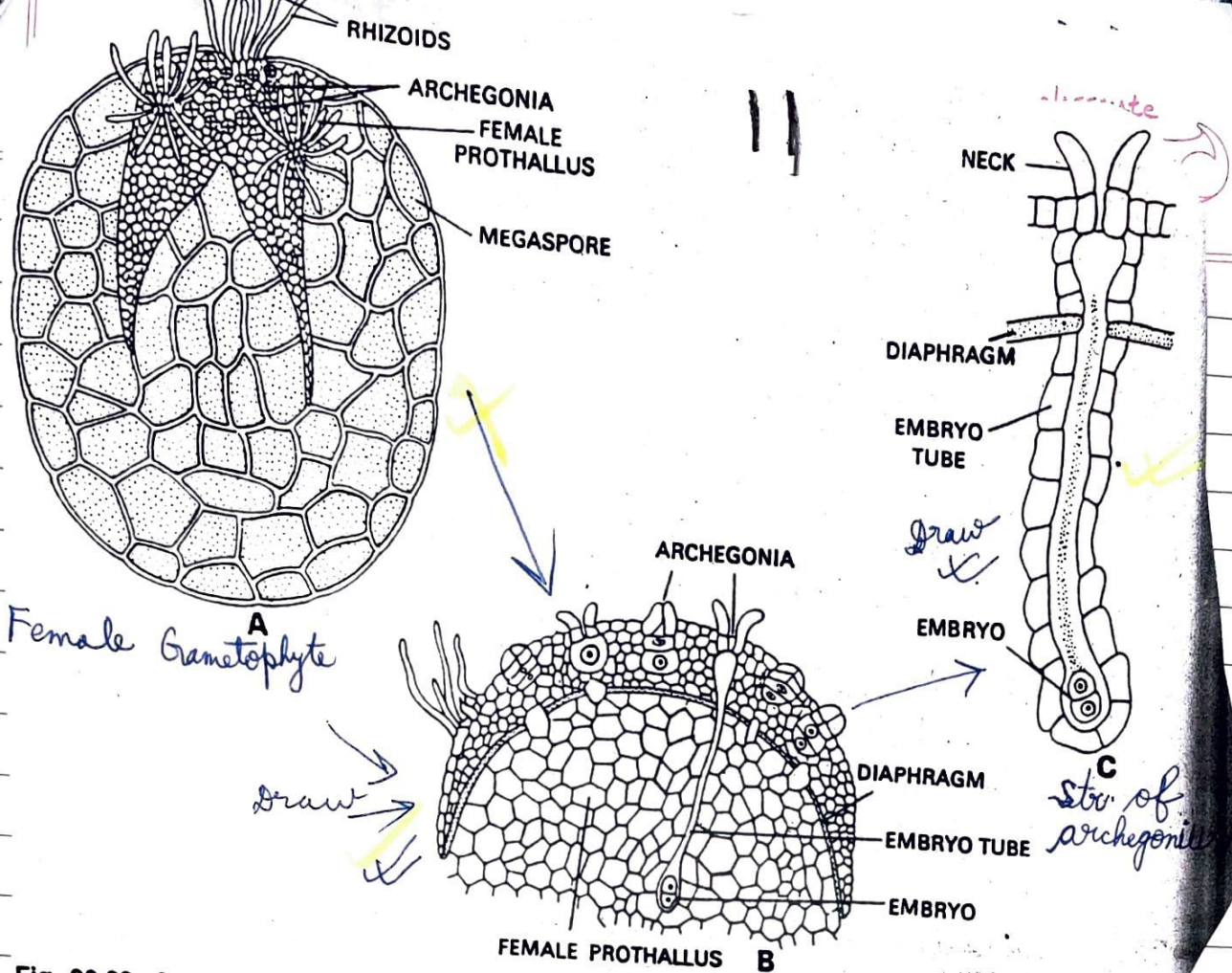


Fig. 28.22. Selaginella sp. Female gametophyte. A, splitted megaspore showing rhizoids, prothallus and archegonia; B, a part of the female gametophyte with diaphragm, rhizoid and young embryo; C, detailed structure of archegonium with young embryo.

EMBRYO

- 1.) After fertilization zygote secretes a wall around itself & develops into an embryo.
- 2.) Suspensor is apical in position & develops from epibasal cell.
- 3.) Other parts of embryo develop from hypobasal cell.
- 4.) Foot of embryo is at the base. It acts as a haustorium & absorbs food for the embryo from the gametophyte.
5. Two identical cotyledons are found in the apical portion of the embryo. These cotyledons possess ligules.
- 6.) Portion of embryo behind cotyledons develop into stem.

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7. Rhizophore develops apical to the foot but on one flank of the foot. From this primary rhizophore, primary root comes out.
8. Young sporophyte grows further by sending its stem & cotyledons upwards & rhizophore & roots downwards in the soil.

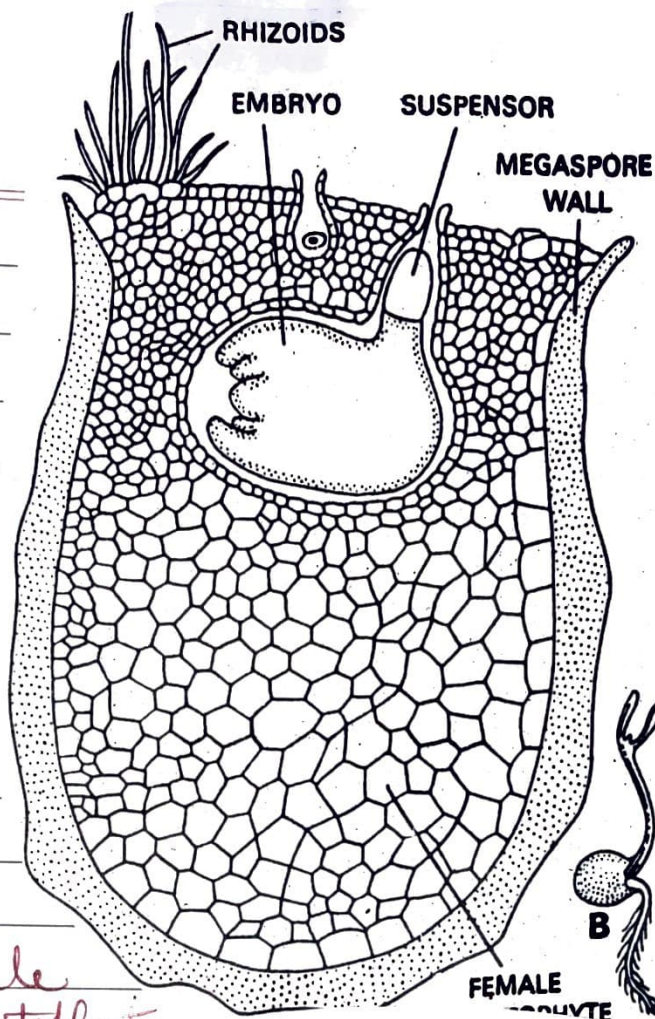
Main Characteristics of Selaginella :-

- a.) Cotyledons are directly borne upon the stem.
- b.) Just posterior to the cotyledons a hypocotyledonary part of stem develops.
- * c.) Later gametophyte is finished & young sporophyte becomes independent.

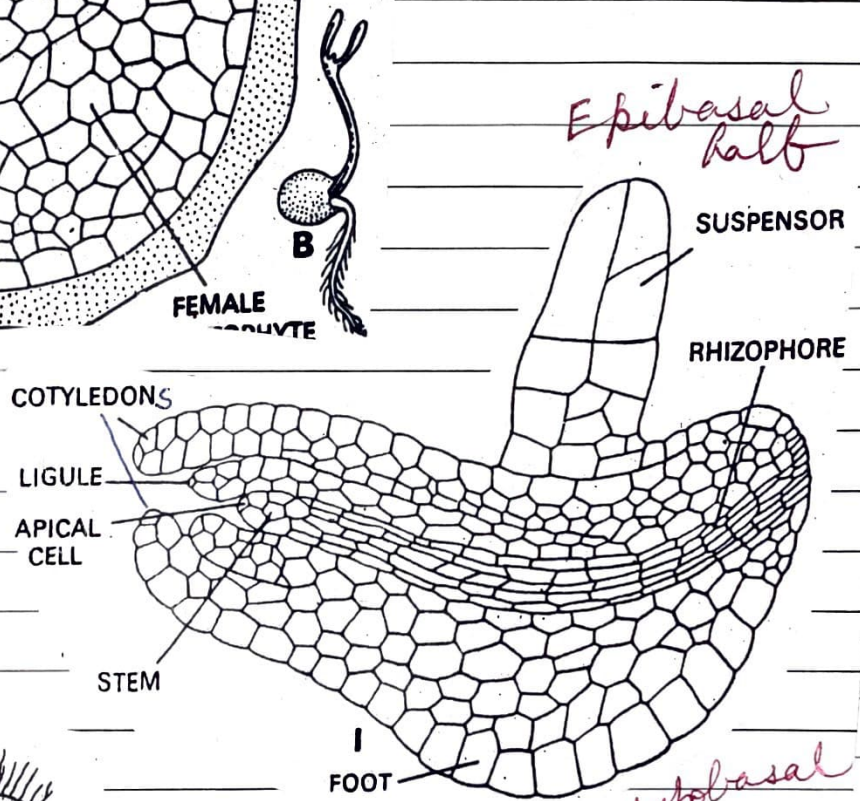
* Heterospory is found in :-

Selaginella, Isoetes, Marsilea, Salvinia, Azolla, Regnellidium & Pilularia.

Heterospory established seed habit in plants in course of evolution of plants.

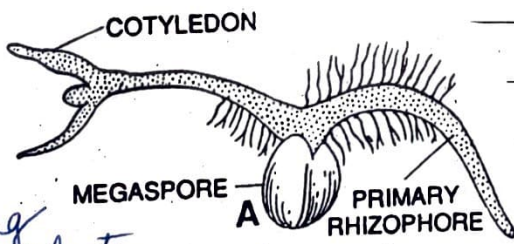


Female Gametophyte

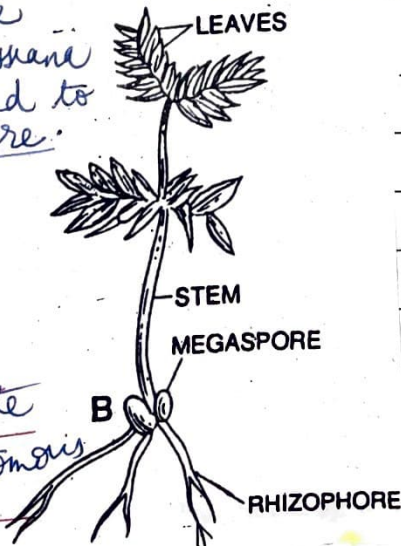


Epibasal half

hypobasal half



Young Sporophyte of *S. kraussiana* still attached to the megaspore.



Older Sporophyte with dichotomous stem

Alternation of Generation

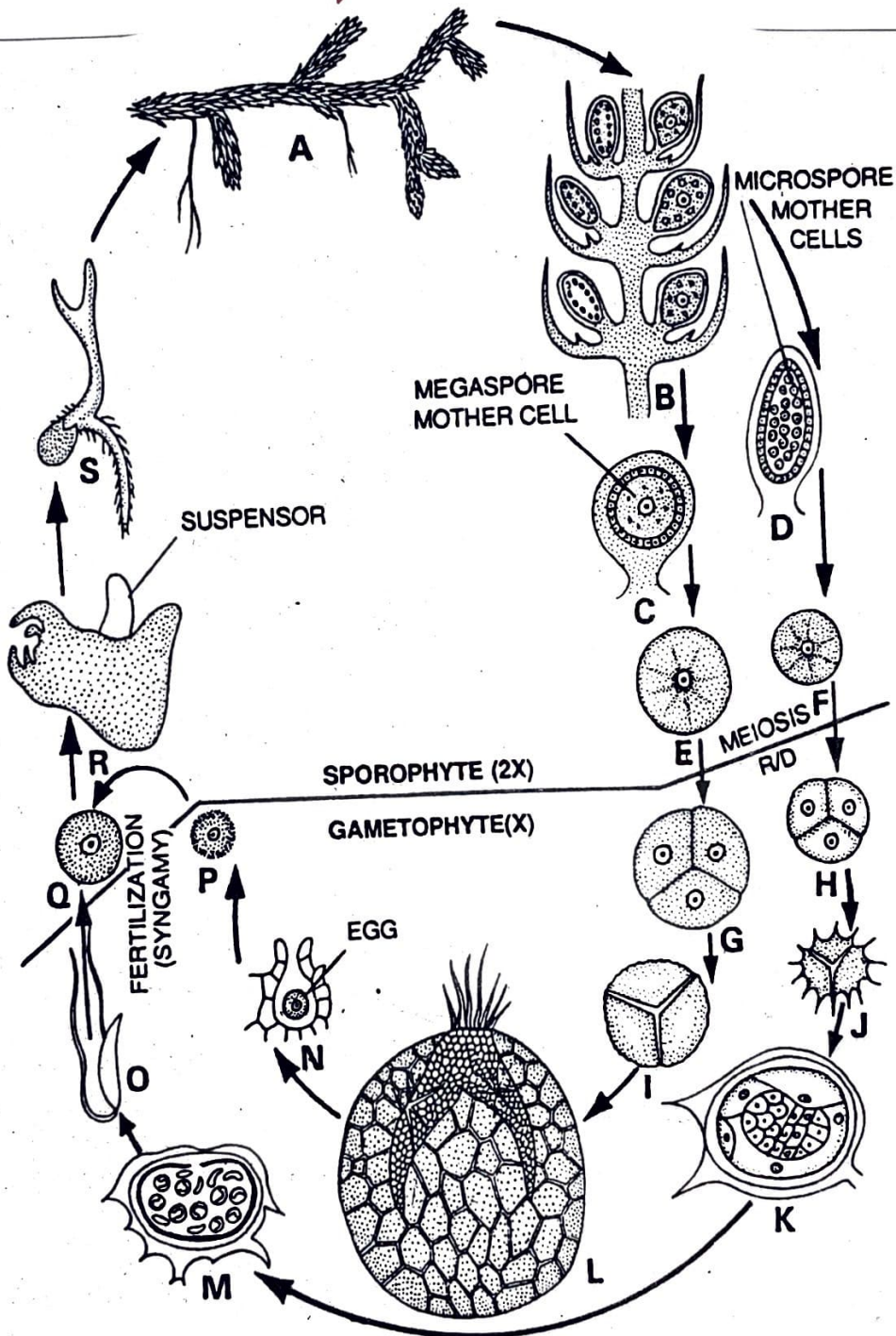


Fig. 28.27. *Selaginella* sp. Diagrammatic life-cycle. A, sporophyte with spikes and rhizophore; B, L.S. of spike; C, megasporangium with megaspore mother cell; D, microsporangium with microspore mother cells; E, megaspore mother cell; F, microspore mother cell; G, megaspore tetrad; H, microspore tetrad; I, megaspore; J, microspore; K, developing microgametophyte; L, megagametophyte; M, microgametophyte; N, archegonium with egg; O, antherozoid; P, egg; Q, oospore; R, embryo; S, young sporophyte.