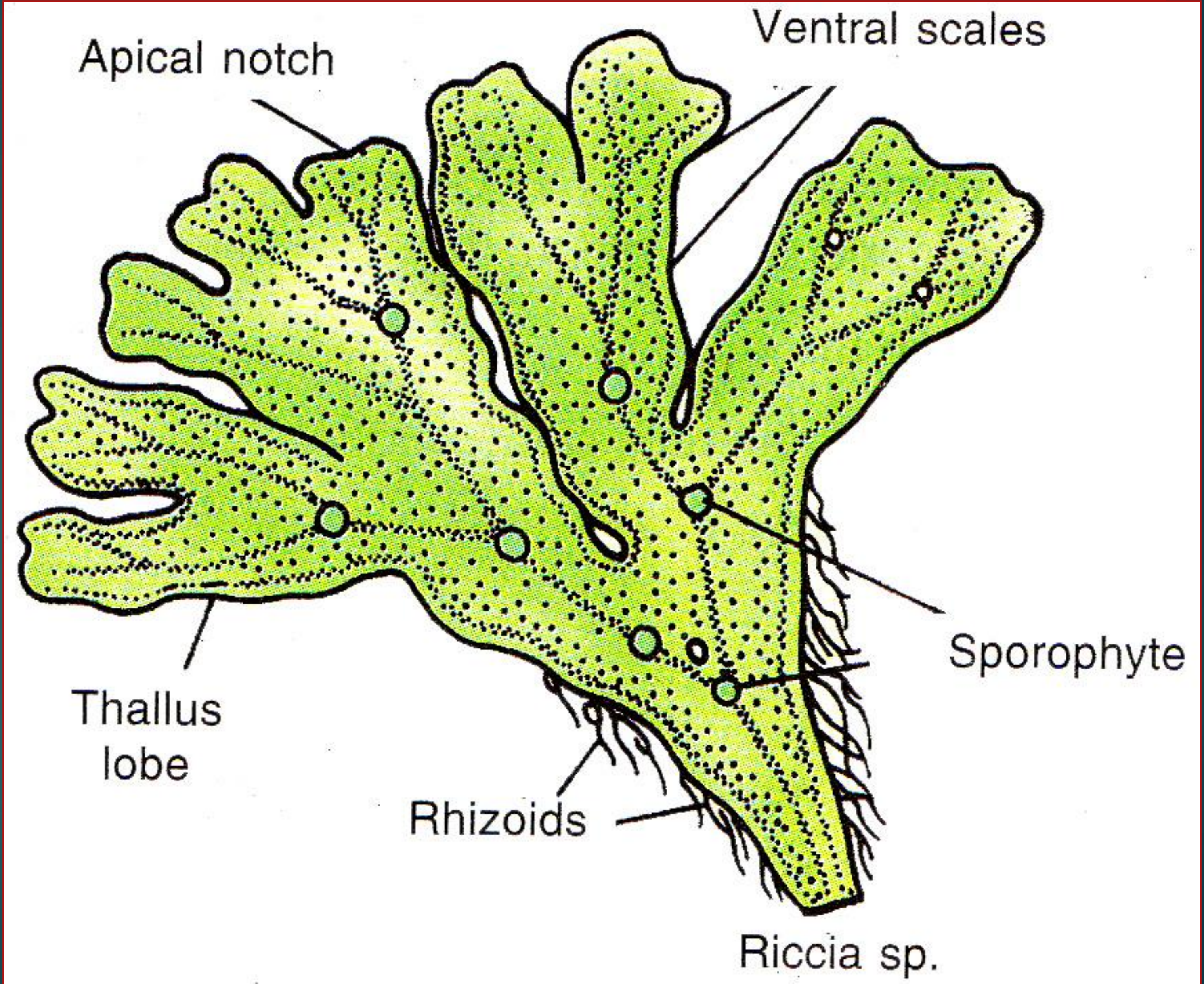
GURU NANAK COLLEGE (AUTONOMOUS) VELACHERY- CHENNAI – 42.

- DEPARTMENT OF PLANT BIOLOGY AND PLANT BIOTECHNOLOGY
- SEMESTER V
- COURSE: PLANT BIOTECHNOLOGY
- COURESE CODE:16UPBTC09

BY Dr.E.GAYATHIRI

RICCIA


Apical notch
Ventral scales
Sporophyte
Thallus lobe
Rhizoids
Riccia sp.

External Morphology of thallus –

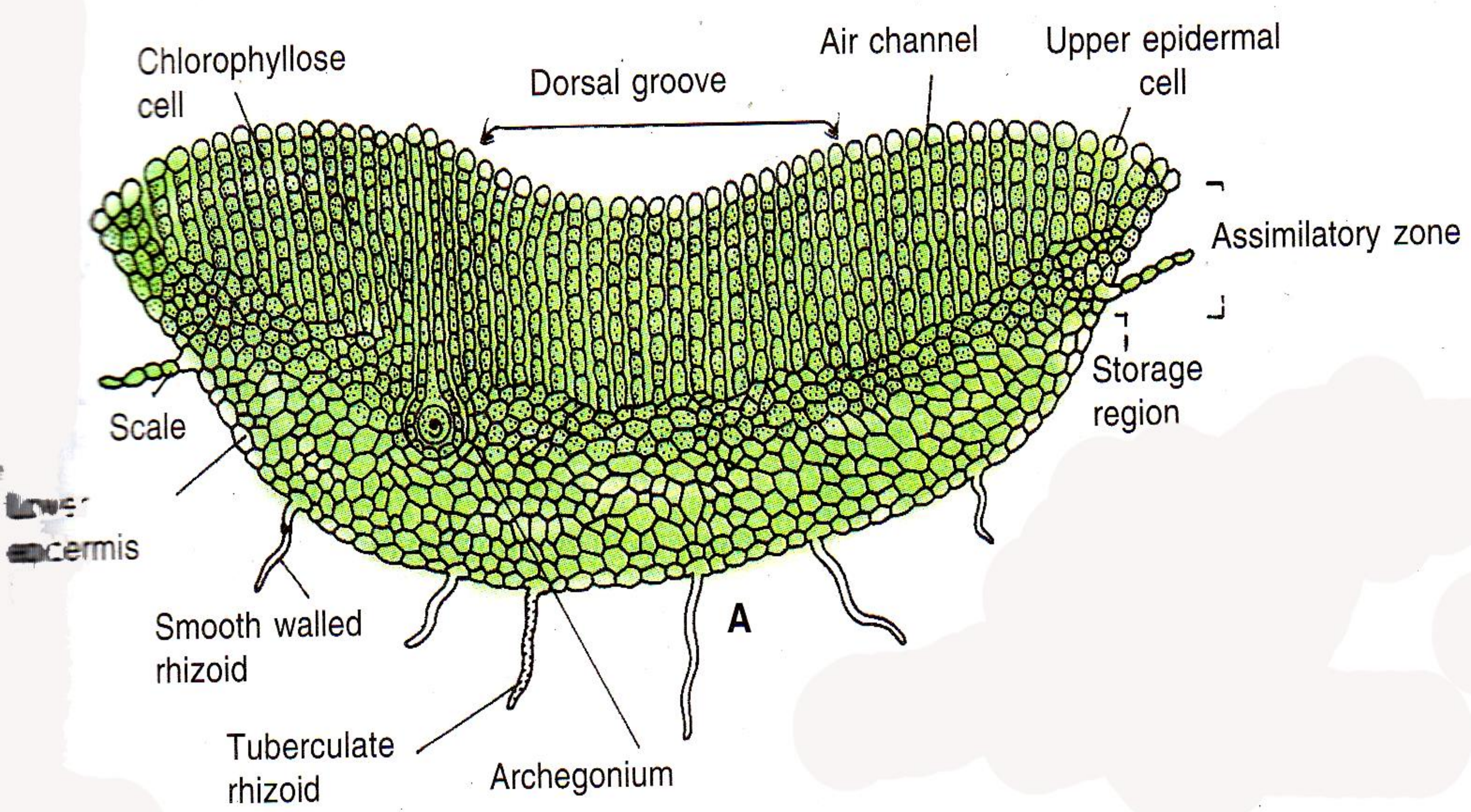
1. gametophyte - flat, fleshy, green thalloidal body - growing prostrate on moist ground.
2. Dichotomously branched, and branches are known as lobes.
3. Thallus - thick in the middle and it gradually thins or tapers towards the margin.
4. Thick region - midrib and extends throughout the length of the thallus.
5. Each thallus lobe terminates into an apical notch or depression in which less the growing point of the thallus.
6. The thallus is attached to the substratum by means of rhizoids on the lower surface.

External Morphology of thallus:

7. Rhizoids are unicellular and unbranched.
8. Two types of rhizoids, - smooth walled and tuberculated.
9. rhizoids - fixation and absorption.
10. The scales in young plants are arranged in one transverse row near the apex.
11. When the thallus matures, they form two rows near the margin of the thallus.

Internal structure of thallus –

1. A vertical section of thallus shows an outline with a depression in the centre termed as the dorsal groove.
2. The externally simple thallus shows a slight internal differentiation.
3. The thallus is formed of two distinct regions, viz.
   a. the lower or ventral storage region and
   b. an upper or dorsal photosynthetic or assimilatory region


Chlorophyllose cell
Dorsal groove
Air channel
Upper epidermal cell
Assimilatory zone
Storage region
Scale
Smooth walled rhizoid
Tuberculate rhizoid
Archegonium
A

Storage region–

1. present on the ventral surface – formed of closely packed parenchymatous tissue (no intercellular spaces)
2. The chloroplasts are absent in this region.
3. The region acts as storage tissue, storing water and reserved food material (starch).
4. From the lower epidermal cells, develop rhizoids and amphigastria.
5. The rhizoids help in absorption while the amphigastria give protection to the plant and retain water.

Photosynthetic region–

1. It is present on the dorsal surface of the thallus.
2. It consists of chlorenchymatous cells arranged in vertical rows of one cell thickness.
3. The rows of chlorenchymatous cells are called photosynthetic filaments.
4. Between the chlorenchymatous rows - air chambers, air-canals are air-clefts.
5. The air chamber lacks photosynthetic filaments.
6. The air cleft is surrounded by six to eight vertical rows of chlorenchymatous cells.
7. The outermost or the terminating cell of each row is slightly bigger and colourless.

Photosynthetic region–

8. These terminal cells together form an interrupted upper epidermis.
9. The air-cleft communicate with the outer environment through the gaps in the upper epidermis called air-pores.
10. In the case of the aquatic species, the epidermis is continuous and air-pores are absent.
11. The thallus shows large air-cavities which store air and give buoyancy to the plant.
12. The epidermal cells also show presence of chloroplasts.

Reproduction–

A. Vegetative

1. Fragmentation – Due to death and decay the older dichotomy separate – favourable conditions, – new thallus.
2. Adventitious branches – arise from the mid-ventral surface of the thallus – detached – new plants.
3. Tubers – The tips of branches store food material and become swollen – tubers. In favourable – new plants.
4. Persistent apices – prolonged dry conditions, the plant dies except the apical part. This apical part however grows deep into soil and becomes thick. It resumes active growth in next season and develops into a new thallus.

Reproduction– B. Sexual:

1. Sexual reproduction in *Riccia* is oogamous.
2. The sex organs are well developed, multicellular and separate.
3. The male reproductive organ is called the antheridium and the gametes, the antherozoid.
4. The female reproductive organ is called the archegonium and the gamete the ovum.
5. Both the sex organs - on the same plant- monoecious.
6. on different plants- dioecious or unisexual.
7. The sex organs are formed on the dorsal surface and are deeply sunk in the mid-furrow of the thallus.

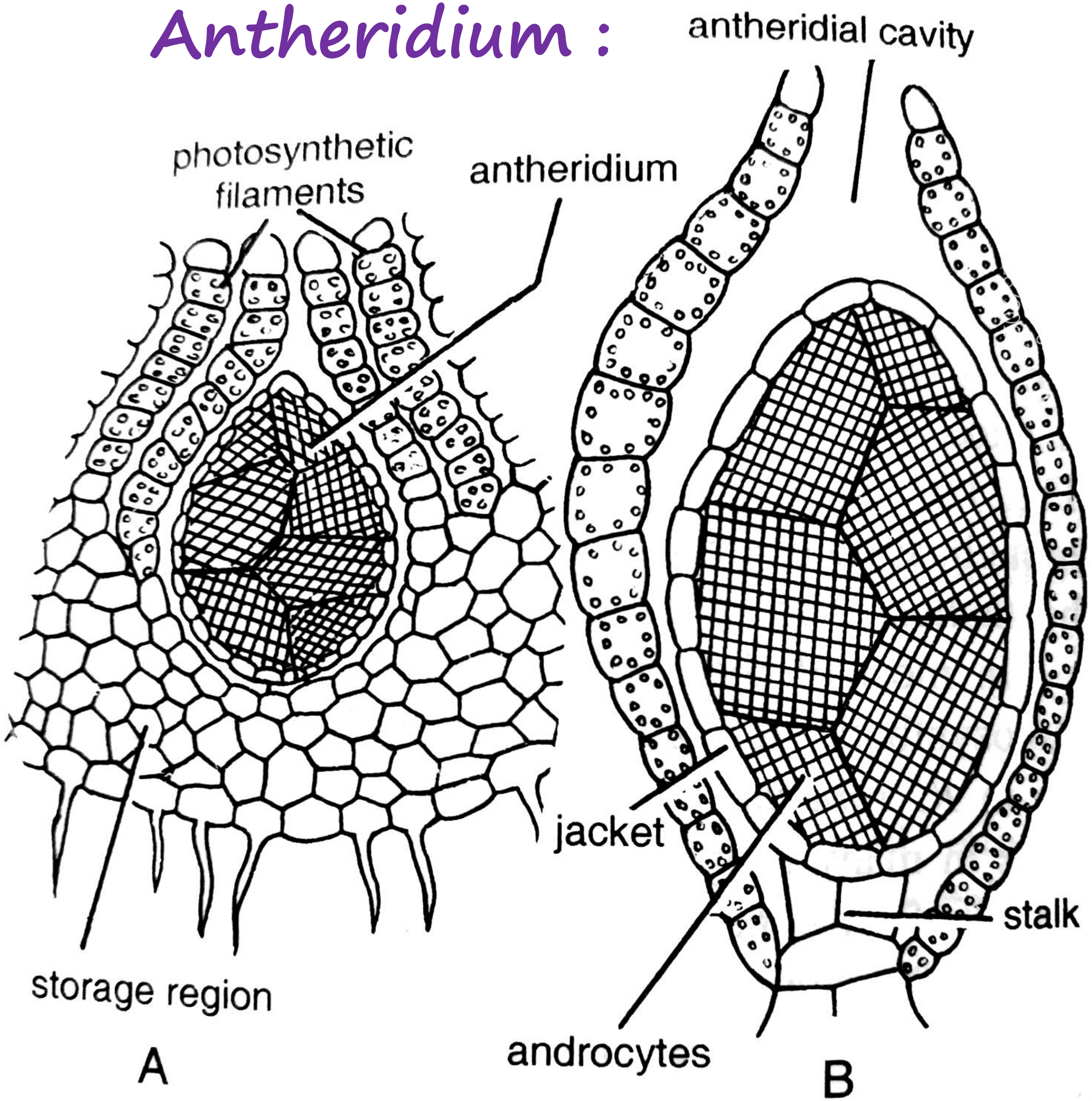
Reproduction–

B. Sexual:

8. Though formed on the dorsal surface, they are enclosed in cavities because of the vigorous growth of the neighboring vegetative cells.
9. The sex organs are formed in acropetal succession.
10. A self-fertilization is avoided in monoecious species due to the different maturation periods of the sex organs (prodandrous).

Antheridium :

▪

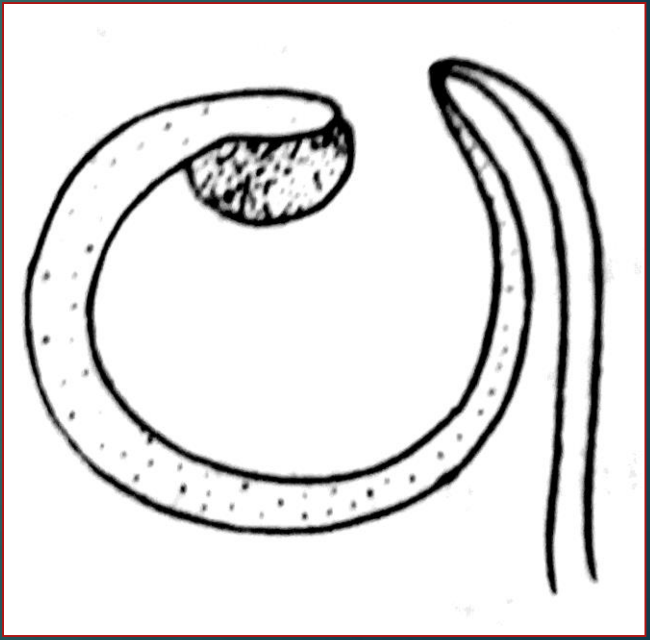


Antheridium :

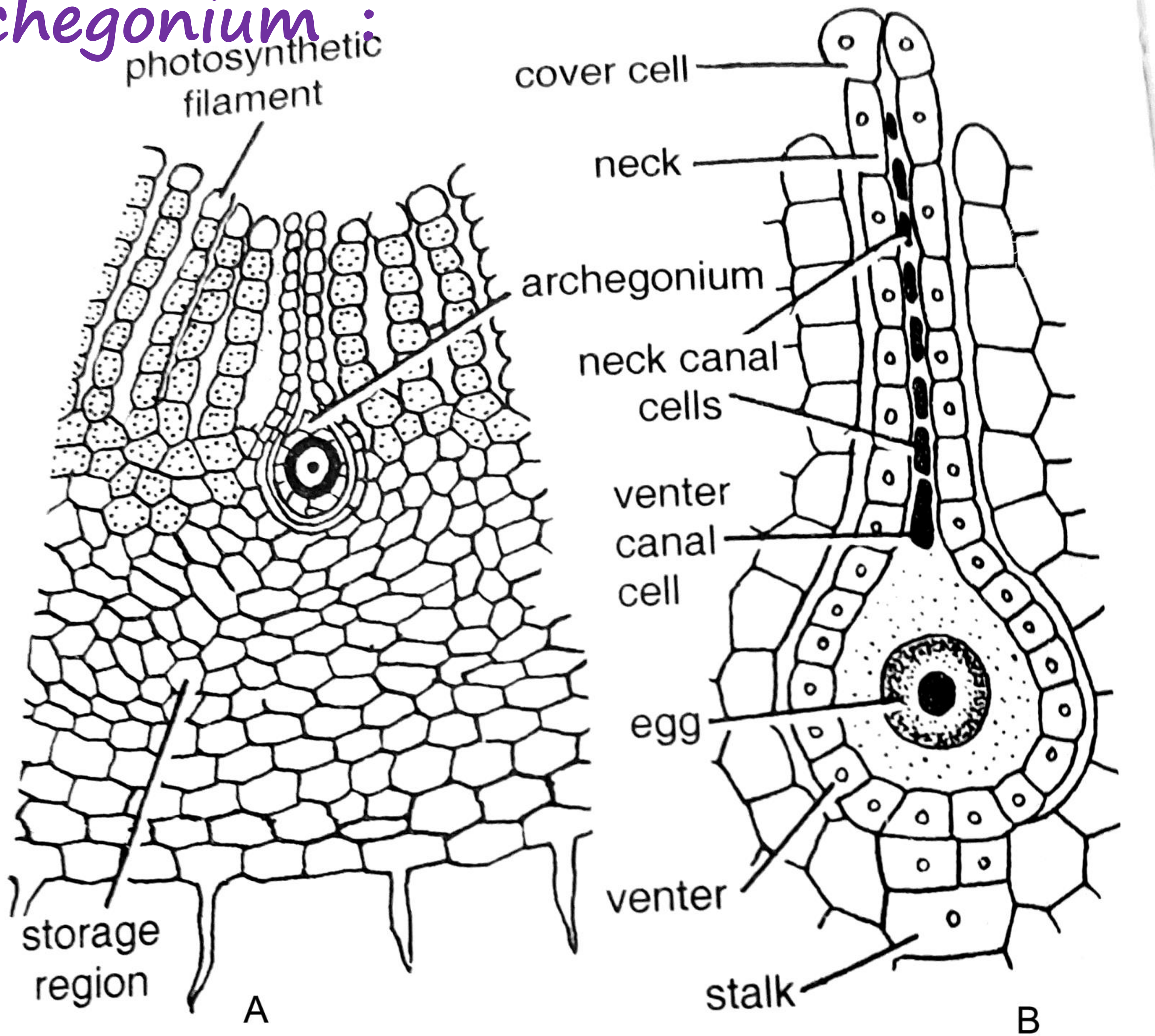
- multicellular and elongated structure enclosed in an antheridial cavity
- consists of a stalk and a body
- body is ovoid or pear-shaped
- outermost sterile layer called the jacket layer or the antheridial wall – protective
- encloses a mass of fertile, cubical cells called androcyte mother cells
- Each mother cell divides diagonally to form two androcytes or spermatids
- numerous antherozoids or spermatozoids are formed in an antheridium.

Antherozoid :

- spermatozoid is a minute, slender, curved and flagellate structure. Flagella are two in number and are inserted at the anterior end. The body possesses elongated blepharoplast, a nucleus and a little cytoplasm. The unused cytoplasm remains attached to the posterior end forming a vesicle.



Archegonium :



Antheridium :

- Present in a cavity (Archegonial cavity).
- Archegonium is flask shaped.
- Archegonium formed of three parts - stalk, ventre and neck
- Stalk is small and few celled
- Venter is broad & venter wall is one cell in thickness
  - Venter encloses a cavity - venter cavity
  - two unequal cells
  - smaller - ventral canal cell
  - larger, posterior cell - ovum or the egg cell
- Neck consists of six vertical rows of cells
- At the tip - four specialized cells - lid cells or cover cells.

Dehiscence of Sex organs:

- water or even moisture is necessary
- spermatozoids lie in the antheridial cavity because the walls of spermatids are already dissolved
- water finds its way to the antherdial cavity through the ostiole of the cavity
- antheridium bursts liberating antherozoids due to pressure created
- archegonium reaches maturity, the ventral canal cell and the neck canal cells disintegrate or degenerate to form mucilage
- mucilage absorbs more water and pressure is created separating the lid cells
- Sperms reach to the egg cell.

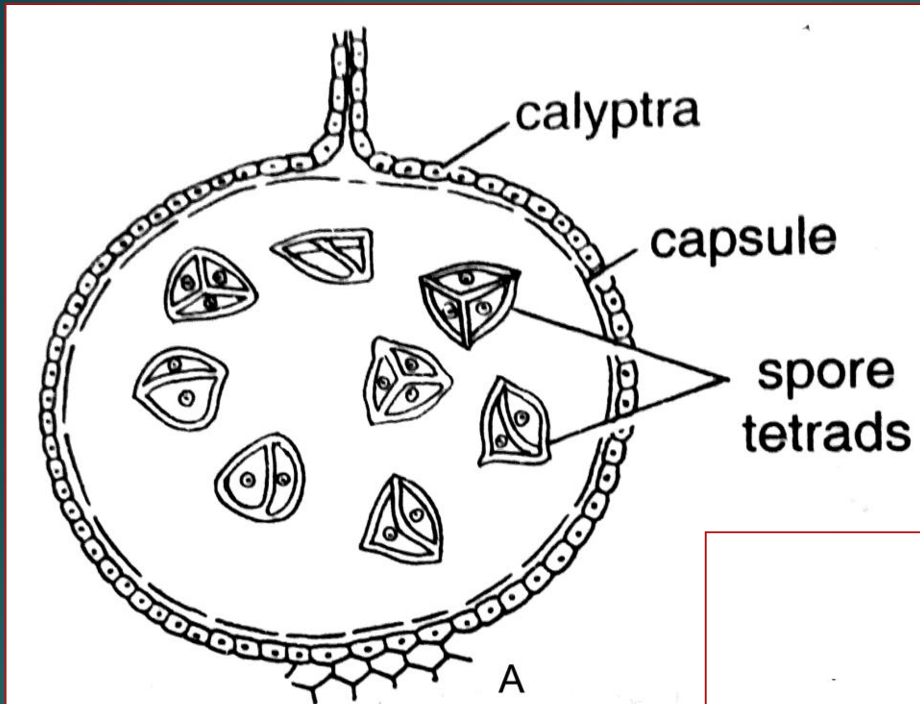
Fertilization:

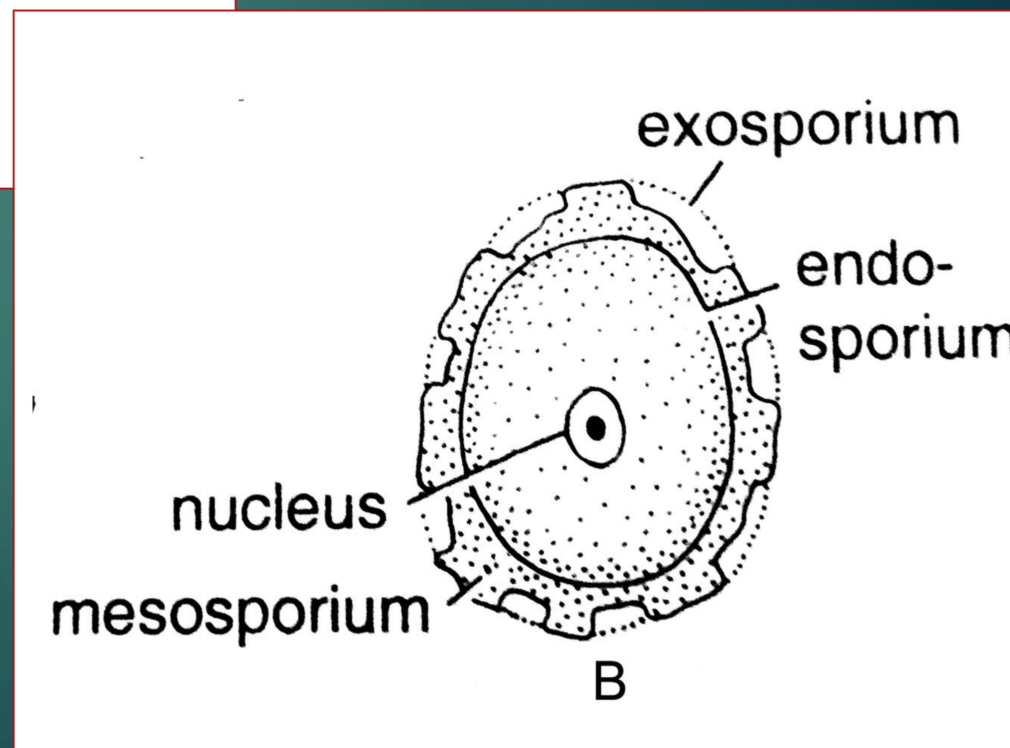
- Certain chemical substances are exuded along with the mucilage
- These chemicals probably attract the spermatozoids.
- Only one of the antherozoids surrounding the egg succeeds in uniting with the egg
- gamatophytic stage ends with the process of fertilization.
- The zygote, the first cell of the sporophytic generation is embedded in venter

Sporophyte:

- Zygote is the first cell of diploid or sporophytic generation
- The mature sporophyte of Riccia is the simplest among the sporophytes
- It consists of only capsule or the spore sac, while foot and seta are absent
- The sporophyte is embedded in the storage tissue of the gametophyte and enclosed in the venter cavity of the archegonium.
- zygote divides mitotically to form sporogonium having a single sterile layer, the capsule or jacket wall, enclosing spore mother cells or sporophytes
- The sporophytes are last cells of diploid generation
- The sporophytes divide meiotically to produce haploid cells

Spores :


calyptra
capsule
spore
tetrads
A


exosporium
endo-
sporium
nucleus
mesosporium
B

Sporophyte :

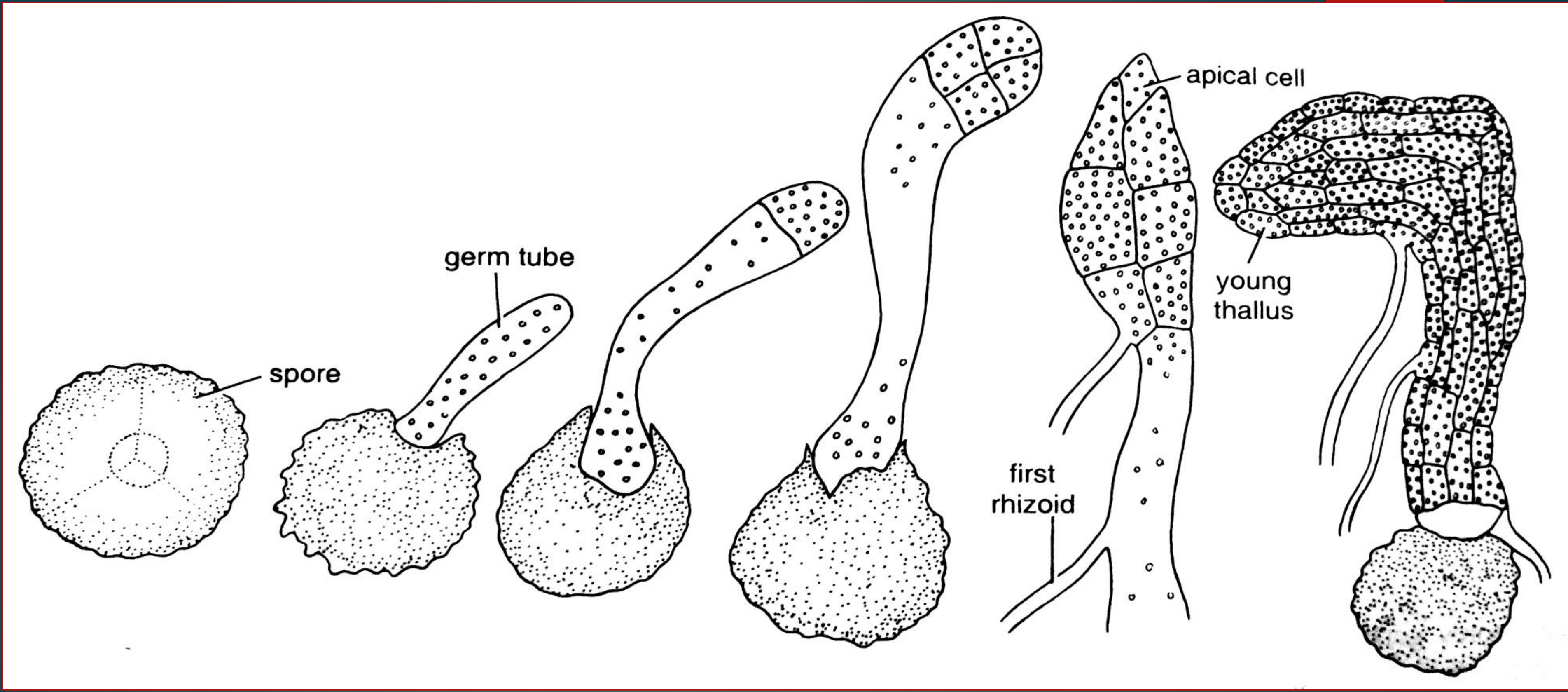
- sporophyte is completely dependent for nutrition on the gametophyte - complete
- sporogonium of Riccia never dehisces
- surrounding calyptra decay or disintegrate, the spores remain behind on the soil.
- favourable conditions, they germinate to from new plants

Spores:

- spore is tetrahedral
- spore wall or sporoderm is formed of two layers, the outer exine (exosporium), and the inner intine (endosporium)
- exine is variously ornamented
- exine is cuticularised, while the intine is thin walled

Spore germination:

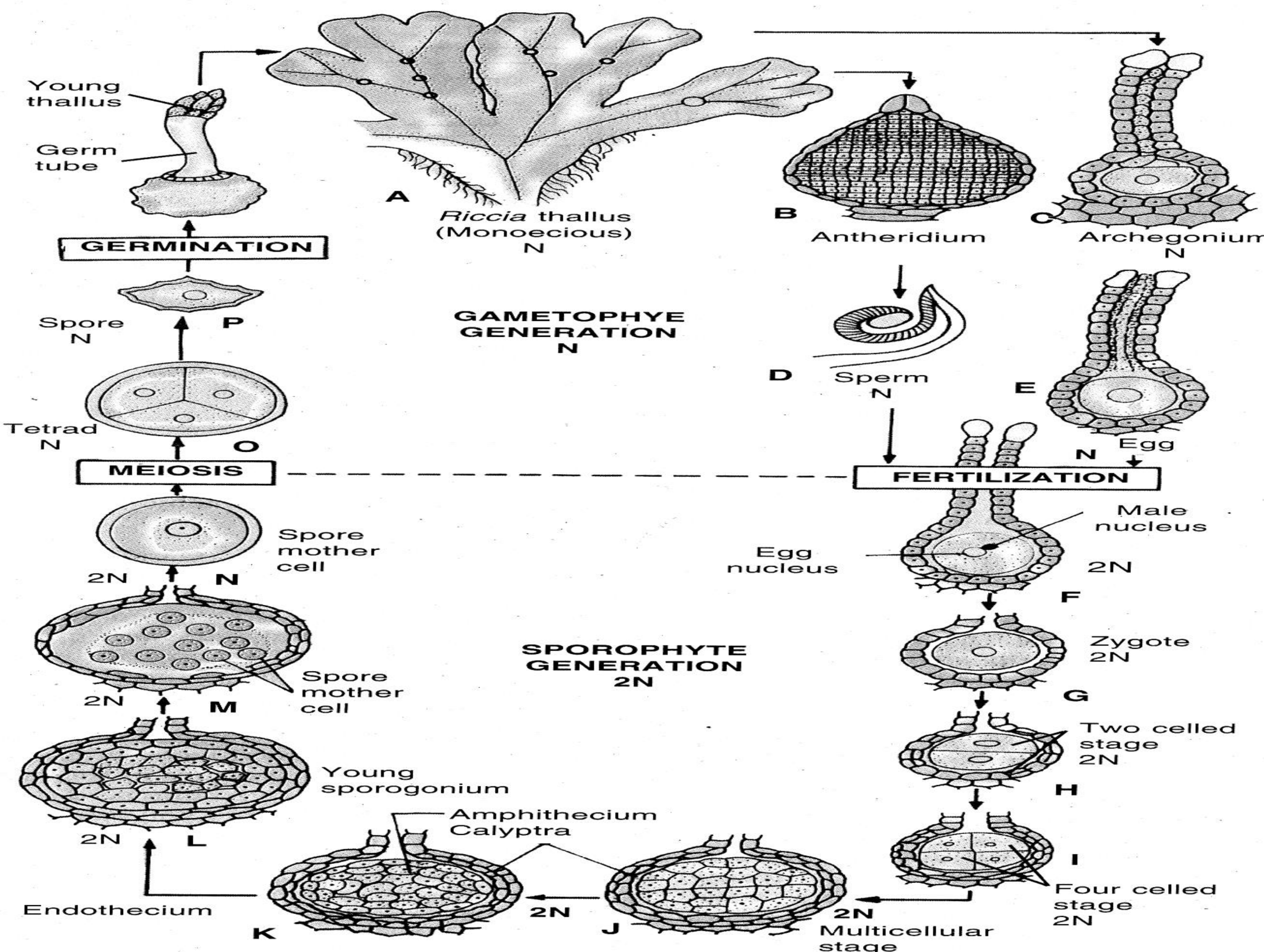
- presence of light and the presence of moisture
- spore absorbs water and the pressure created ruptures the exine.
- intine comes out forming a short germ tube
- contents of the spore migrate to the tip of the germ-tube and a partition is formed
- division and redivision of the apical region results into a new gametophyte



SPORE GERMINATION

Alternation of generation:

- two distinct generations in the life cycle of Riccia
- They are haploid and diploid generations or gametophytic and sporophytic generations.
- gametophyte –antheridia and archegonia develop antherozoids and ova respectively
- antherozoids unites with the egg resulting in the formation of a zygote (diploid)
- sporophyte, a diploid phase is a complete parasite depending for nutrition on the gametophyte
- Sporophyte – capsule, within it after reduction division, gives rise to a number of haploid spores.
- spore germinates and develops into a gametopyte
- gametophyte gives rise - sporophyte and sporophyte gives rise - gametophyte or gametophyte and sporophyte alternate with each other



Young thallus
Germ tube
A
Riccia thallus (Monoecious) N
B
Antheridium
C
Archegonium N
GERMINATION
Spore N
P
GAMETOPHYE GENERATION N
D
Sperm N
E
Egg N
Tetrad N
O
MEIOSIS
FERTILIZATION
Spore mother cell
2N
N
Male nucleus
Egg nucleus
2N
F
Zygote 2N
G
SPOROPHYTE GENERATION 2N
Spore mother cell
2N
M
Two celled stage 2N
H
Young sporogonium
2N
L
Amphithecium
Calyptra
I
Four celled stage 2N
Endothecium
K
2N
J
2N
Multicellular stage

Economic Importance:

- rock builders, in soil conservation and in development of vegetation.

A. **Medicinal uses:**

- treating liver disorders – so known as Hepatics or liverworts
- Marchantia polymorpha has been used to cure disorders of liver and for pulmonary tuberculosis
- Decoction of Sphagnum is used in the treatment of acute hemorrhage and diseases of eye
- Tea made from leaves of Polytrichum commune helps to dissolve stones of kidney and gall bladder
- some antiseptic property and therefore, it is used for filling absorbent bandages in surgical dressings
- antibiotics can be obtained from extract mosses like, Sphagnum, Mnium, Polytrichum

Economic Importance:

B. Horticultural Uses:

- Sphagnum and peat is used as a packing material for grafting sections.
- Sphagnum is also used as packing material for shipment of live plants, cut flowers, vegetables, perishable fruits and tubers.
- Peat is added to heavy soils like clayey soils to improve their textures as peat keeps such soil porous and prevents caking it.
- Peat is added to dry sandy soils and other humus poor soils to improve water-holding capacity of soil.
- Moss sticks are prepared from epiphytic mosses to give support and moisture for weak stem plants like, Pothos, Philodendron.