CLASS II

CLASS ANTHOCEROTAE – THE HORNWORTS

CLASS ANTHOCEROTAE – THE HORNWORTS

- The class contains a single order Anthocerotales
- Although formerly included with the Hepaticae
- the Anthocerotales are now placed in a separate class
- mainly on account of their unique sporophyte

THE HORNWORTS Cont'd

- Mature sporophytes of hornworts look like miniature, greenish cattle horns
- *Anthoceros* is representative of its class

STRUCTURE AND FORM

- The Anthocerotae have the simplest gametophyte of the Bryophytes
- but the sporophytes are more complicated than that of any other order
- They are small, green thalloid plants with little internal differentiation of vegetative tissues
- They are slightly lobed with numerous rhizoids growing from the lower surface

STRUCTURE AND FORM Cont'd

- They are usually less than 2cm in diameter
- and thrive in moist soil in shaded areas although some occur on trees
- Hornworts usually have one large chloroplast in each cell (a few have up to eight)
- Each chloroplast has pyrenoids similar to those of green algae
- a feature not found in other Bryophytes

STRUCTURE AND FORM Cont'd

- The pyrenoid consists of a mass of minute disc
- or spindle-shaped bodies which are the rudiments of starch grains
- The thalli have pores and cavities filled with mucilage
- in contrast to the air-filled pores and cavities of thalloid liverworts

STRUCTURE AND FORM Cont'd

- Nitrogen–fixing blue-green bacteria/algae (e.g. *Nostoc*) often grow in the mucilage
- The internal structure of the thallus is very simple
- consisting of a mass of thin-walled parenchyma
- without any differentiation of tissues

ASEXUAL REPRODUCTION

- Hornworts reproduce asexually primarily by fragmentation
- or as lobes separate from the main part of the thallus
- A few hornworts form tiny tubers on the margin
- which grow into new gametophytes

SEXUAL REPRODUCTION

- Like both mosses and hornworts
- some species of hornworts are monoecious (bisexual/homothallic)
- bearing both antheridia and archegonia
- while other species are dioecious (unisexual/heterothallic)
- bearing either of the two

SEXUAL REPRODUCTION Cont'd

- The antheridia are similar in structure to those encountered in the Hepaticae
- They grow in small groups usually 2-4
- and are located on roofed chambers in the upper portion of the thallus
- Each antheridium consists of
- a short multicellular stalk
- a sterile outer layer (one or more cells thick)

SEXUAL REPRODUCTION Cont'd

- and a compact mass of antherozoid mother cells
- Each mother cell gives rise to
- a single minute
- biciliate antherozoid (sperm cell)
- The archegonia develop singly and separately
- and are embedded within the thallus

SEXUAL REPRODUCTION Cont'd

- and in direct contact with the vegetative cells surrounding them
- When fully developed each archegonium consists of
- a venter and a neck
- The neck consists of a vertical row of 4-6 neck canal cells
- The venter consists of a ventral canal cell and an egg cell

SEXUAL REPRODUCTION Cont'd

- At maturity
- the neck canal cells and the ventral canal cells get disorganized
- and become converted into mucilage
- While the major part of the archegonium remains sunken in the thallus
- the upper end of the neck only projects out of it

SEXUAL REPRODUCTION Cont'd

- When young
- the neck of the archegonium is covered by four cells which separate out later
- Fertilization
- By the breakdown of the roof of the antheridial chamber
- an outlet is formed for the antherozoids to escape

SEXUAL REPRODUCTION Cont'd

- They swim to the archegonium
- and enter through the neck
- Finally one antherozoid fuses with the egg nucleus in the venter
- A zygote is formed after fertilization

SPOROPHYTE

- The sporophyte develops from the zygote
- and consists of a FOOT and CAPSULE
- For a time it is surrounded at the base by a sheath
- or INVOLUCRE formed by an upward growth of the archegonium
- Soon after fertilization
- the zygote grows of the archegonium

SPOROPHYTE Cont'd

- Soon after fertilization the zygote grows
- and completely fills up the venter
- By repeated divisions it gives rise to the FOOT
- embedded in the thallus below
- serving as an absorbing organ
- and the CAPSULE above
- There is no seta of the capsule in *Anthoceros*

SPOROPHYTE Cont'd

- The capsule (sporangium) is an upright
- slender, cylindrical
- deep green structure
- usually 1-3cm long
- but sometimes much longer in a few species
- The following regions can be seen in a longitudinal section through the capsule

SPOROPHYTE CONT'D

❖A MERISTEMATIC TISSUE

- at the base of the capsule
- just above the foot through the activity
- of which the sporophyte continues to elongate
- and the sporocytes (spore mother cells) continue to be formed

SPOROPHYTE CONT'D

❖Centrally there is a sterile tissue

- the COLUMELLA
- consisting of rows of elongated cells
- The sterile columella is an early indicator
- of the differentiation of the conducting system
- at a later stage in higher plants

SPOROPHYTE CONT'D

- ❖Surrounding the columella is a cylinder of SPOROGENOUS TISSUE
- ❖The sporogenous tissue is surrounded by the CAPSULE WALL
- which is a jacket of green sterile tissue
- 4-8 layers of cells in thickness
- each cell having 2 or sometimes more chloroplasts

SPOROPHYTE CONT'D

- The outermost layer of the capsule wall is the epidermis
- which is strongly thickened and cutinized
- and provided with stomata
- The sporogenous tissue may extend down to the base of the capsule
- or only half-way down
- and may be 1, 2, 3 or 4 layers of cells in thickness

SPOROPHYTE CONT'D

- The sporophyte matures from the apex downwards
- i.e. the base is younger than the apex
- The sporogenous cells develop into small groups of sterile cells called ELATERS
- and small groups of spores in an alternative manner
- The elaters are mostly smooth-walled

SPOROPHYTE CONT'D

- and rarely with spiral bands
- Each spore mother cell undergoes reduction division
- and four spores are formed in a tetrad
- Spores mature in progression from top to down
- The gametophyte generation begins with the formation of the spores

SPOROPHYTE CONT'D

- When the spores at the top of the capsule are ripe
- the tip of the sporophyte horn splits
- into two or three ribbon-like segments
- releasing the spores
- and the segments continue to peel back
- as long as the meristem is producing new tissue at the base

SPOROPHYTE CONT'D

- with the slender columella standing free in the center
- Because of the presence of chloroplasts
- the sporophyte can manufacture most of its food
- and is dependent on the gametophyte only for water and mineral salts
- The sporophyte is therefore a semi-independent body

SPOROPHYTE CONT'D

- Under exceptionally favourable growing conditions
- the sporophyte may lengthen greatly
- Some sporogenous tissue at the base of the capsule
- may be replaced by a conspicuous conducting strand
- The foot enlarges and through decay of gametophyte

SPOROPHYTE CONT'D

- comes into more or less direct contact with the soil
- Such sporophytes are capable of maintaining themselves independently for some time
- and they represent the most primitive sporophytic terrestrial plants

DEVELOPMENT OF ANTHOCEROTAE SPOROPHYTE TOWARDS INDEPENDENT LIFE

- ❖ The development of a considerable amount of green tissue and stomata
- ❖ Development of massive foot to facilitate greater absorption of water and mineral salts from the gametophyte
- With the decay of the gametophyte tissue
- the foot may even touch the ground
- and absorb water and mineral salts from the soil

DEVELOPMENT OF ANTHOCEROTAE SPOROPHYTE TOWARDS INDEPENDENT LIFE CONT'D

❖The complexity of the sporophyte

- with a considerable development of sterile tissue
- is an early indication of a more complex
- and quite independent sporophyte
- at a later stage in the evolution of higher plants

DEVELOPMENT OF ANTHOCEROTAE SPOROPHYTE TOWARDS INDEPENDENT LIFE CONT'D

❖The development of the sterile axis (columella)

- represents the beginning of a conducting system

❖The method of shedding spores

- can be compared to that of ferms and allied plants

CLASS III

MUSCI – THE MOSSES

ORDER I: ORDER SPHAGNALES – PEAT MOSSES/BOG MOSSES

- The *Sphagnales*, represented by a single genus, *Sphagnum* are confined to acid waterlogged habitats
- They are the principal components of peat bogs where they form a more or less continuous layer
- *Sphagnum* has a special capacity for retaining water in its body

ORDER I: ORDER SPHAGNALES Cont'd

- It is therefore extensively used as good stuffing material for pot herbs and hanging plants like orchids to keep them moist
- Being soft and antiseptic it makes a good surgical dressing
- It forms peat which may be used as fuel
- It is also added to alkaline soils to neutralize them

GAMETOPHYTE

- The gametophyte consists of

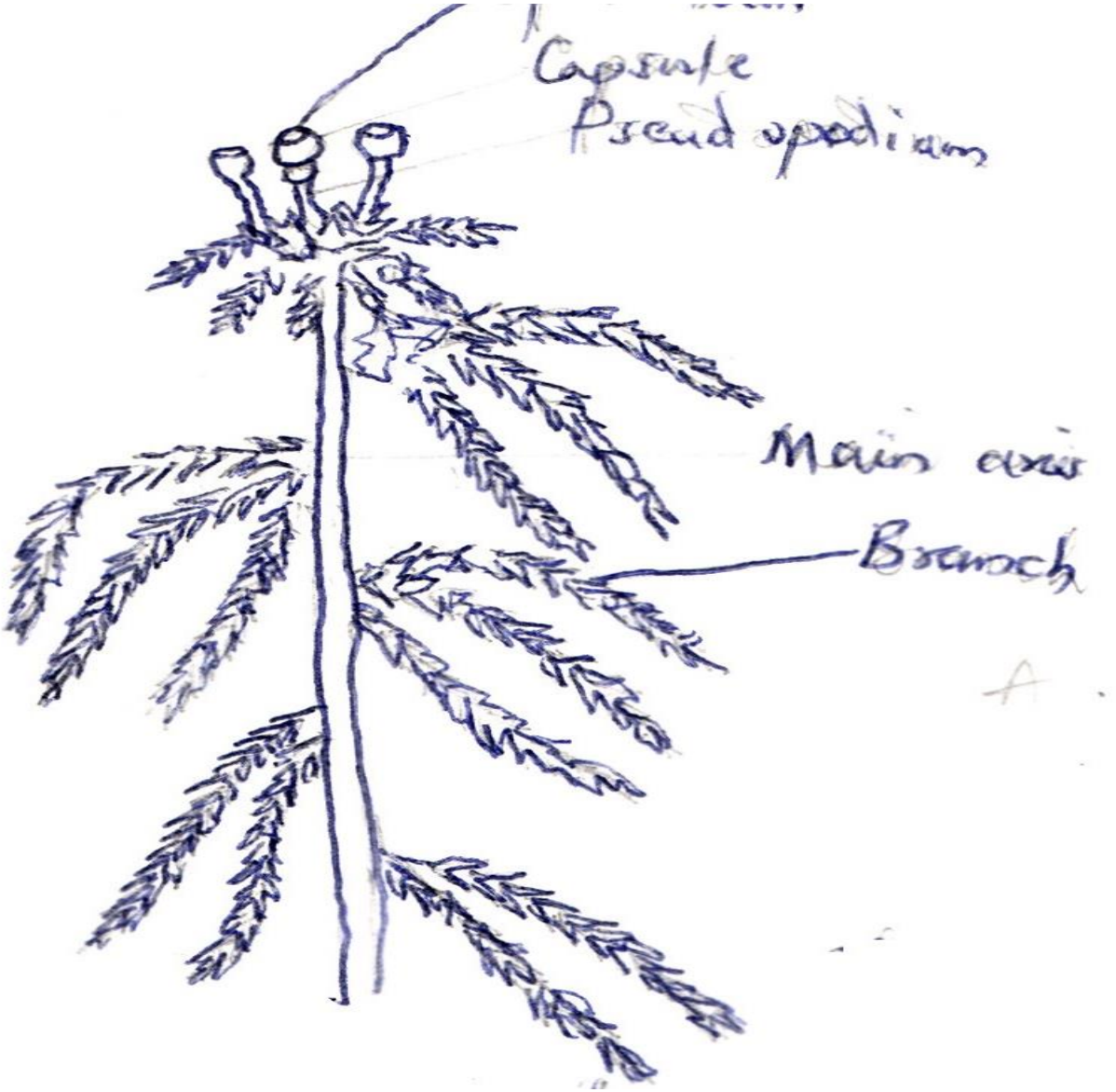
✓ a long or short slender erect axis usually a few centimeters on land and sometimes above two meters in water

✓ a profusion of slender branches

✓ a dense mass of minute greenish leaves

✓ and sex organs on special short branches near the apex

Operculum



***Sphagnum*: upper portion of shoot with sporophytes**

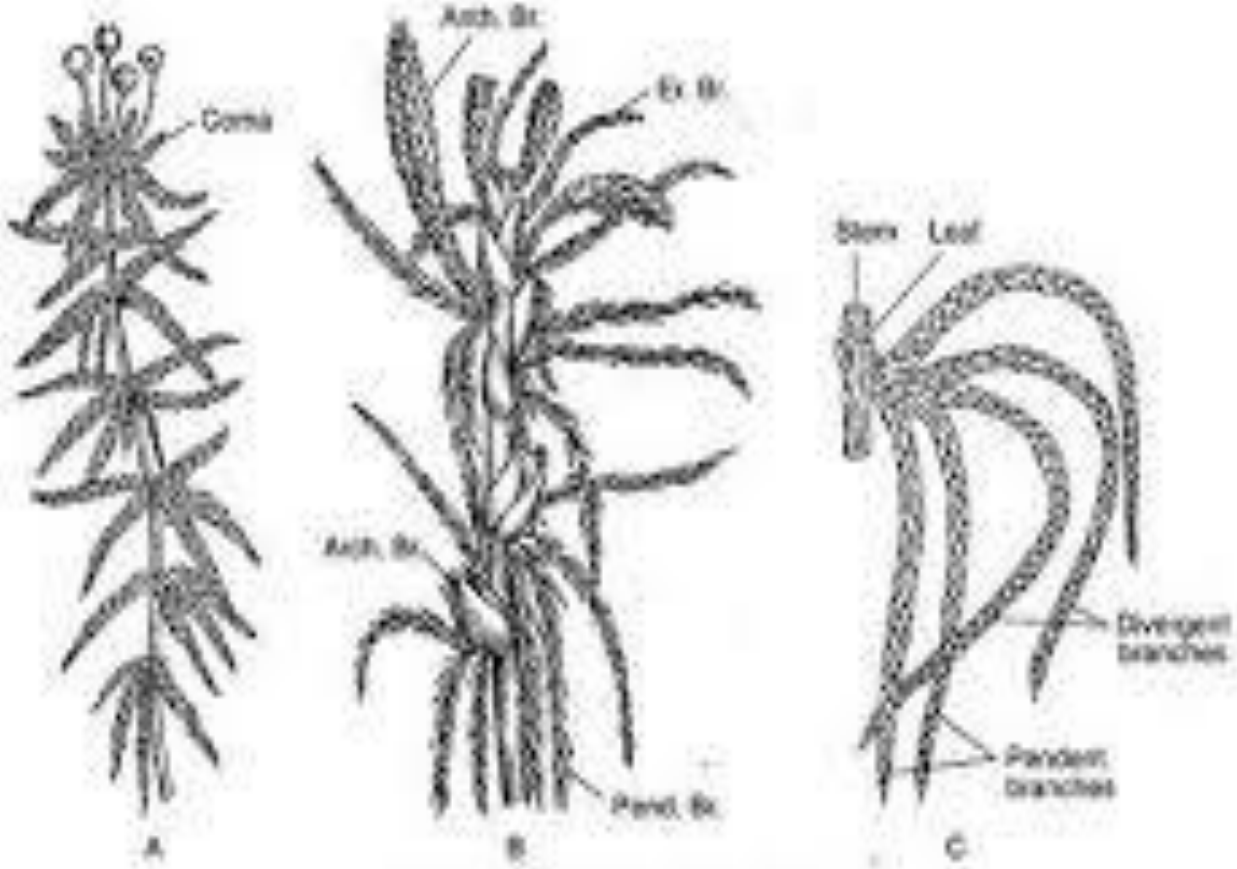
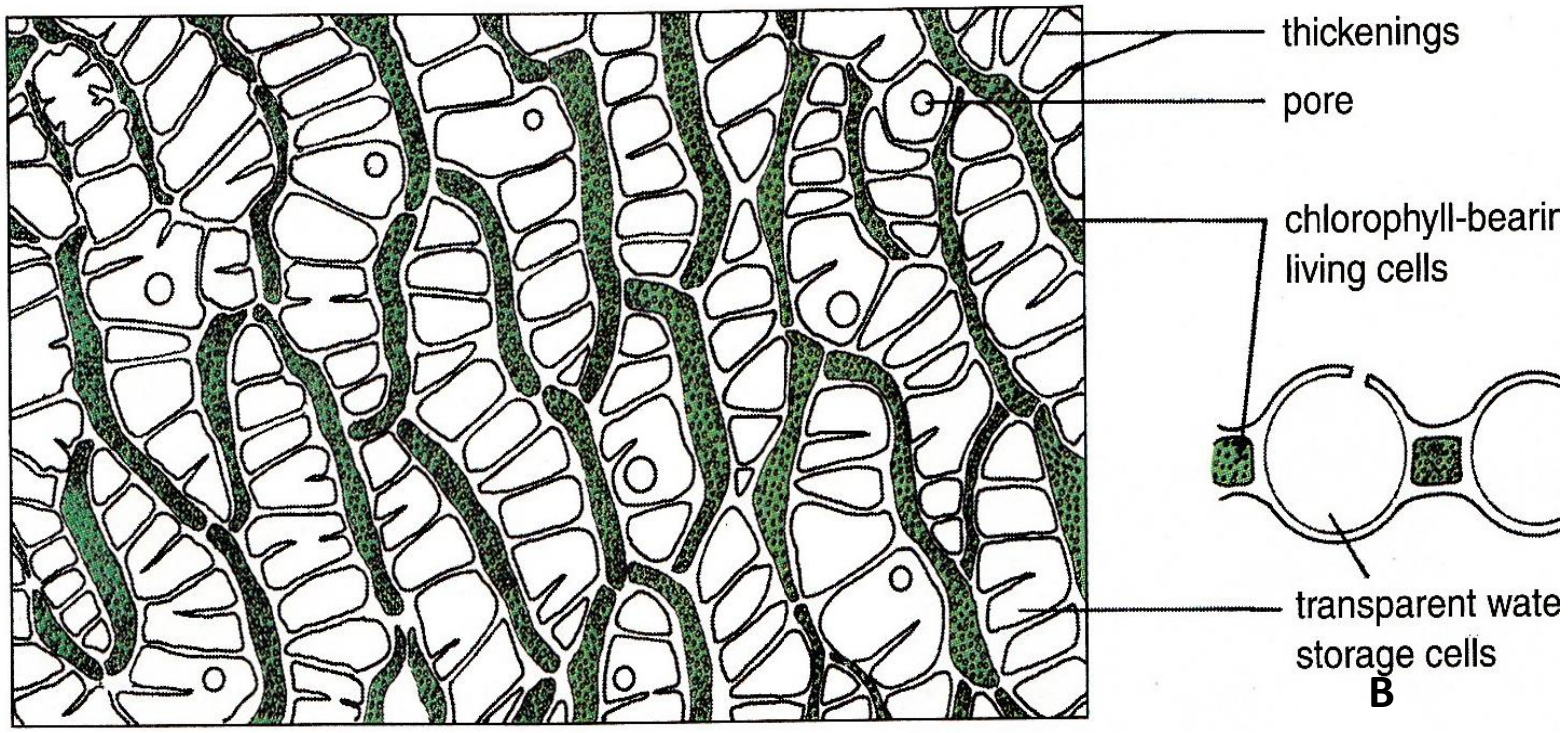


Fig. 6.38 : A. Gametophyte plant of *Sphagnum palustre*, bearing terminal cluster of sporogonia. B. Part of *Sphagnum rerrorsum* gametophyte showing antheridial branches (Anth. Br.), archegonial branches (Arch. Br.), erect branches (Er. Br.) and pendent branches (Pend. Br.) (after Schimper). C. Divergent and pendent branches on the main axis



A: Adaxial surface showing arrangement of cells of leaf

B: Transverse section of leaf

GAMETOPHYTE Cont'd

- The plant is perennial in habit
- ✓and continues to grow almost indefinitely by a tetrahedral apical cell
- The older parts always die off from below
- The leaf is ovate and linear, composed of a single layer of cells
- ✓and has no mid-rib

GAMETOPHYTE Cont'd

- Under the microscope the leaf is seen to be composed of

✓ a network of elongated narrow green cells containing chloroplasts

✓ interspersed with large broad hyaline dead cells filled with water

- Such cells are spongy, absorbing and retaining water in enormous quantities

GAMETOPHYTE Cont'd

- The big mass of dead parts accumulating year after year forms peat which in the course of time may cover up a bog or even a lake
- The acid water in which the plant grows discourages bacterial activity and retards the decay of dead parts

ANATOMY OF STEM

- Internally the stem is differentiated into three distinct regions:

✓ a central pith or medulla made of thin-walled colourless cells

✓ a narrow cylinder of thick-walled cells acting as a supporting tissues:

✓ the cell walls of this tissue may be of various colours - red, brown, yellow, blackish or greenish, and

- ✓externally a spongy cortex consisting of one layer (varying, however from 1 to 5 according to species) of dead hyaline cells with circular or oval pores on their walls and sometimes spiral thickening
- These features are not however constant
- The cortex absorbs and retains water

SEXUAL REPRODUCTION

- *Sphagnum* may be monoecious, bearing both the antheridia and archegonia on the same plant

✓or dioecious, bearing the sex organs on separate plants

SEXUAL REPRODUCTION Cont'd

- The antheridia are borne singly,

✓each in the axil of a coloured leaf (reddish, purplish or brownish on special short, stout, lateral branches (**antheridial branches**)

✓near the apex of the shoot

SEXUAL REPRODUCTION Cont'd

- Each antheridium is ovoid or spherical and has a slender long stalk
- It consists of a mass of antherozoid mother cells (androcytes), each giving rise to biciliate antherozoids
- The two cilia are of equal length

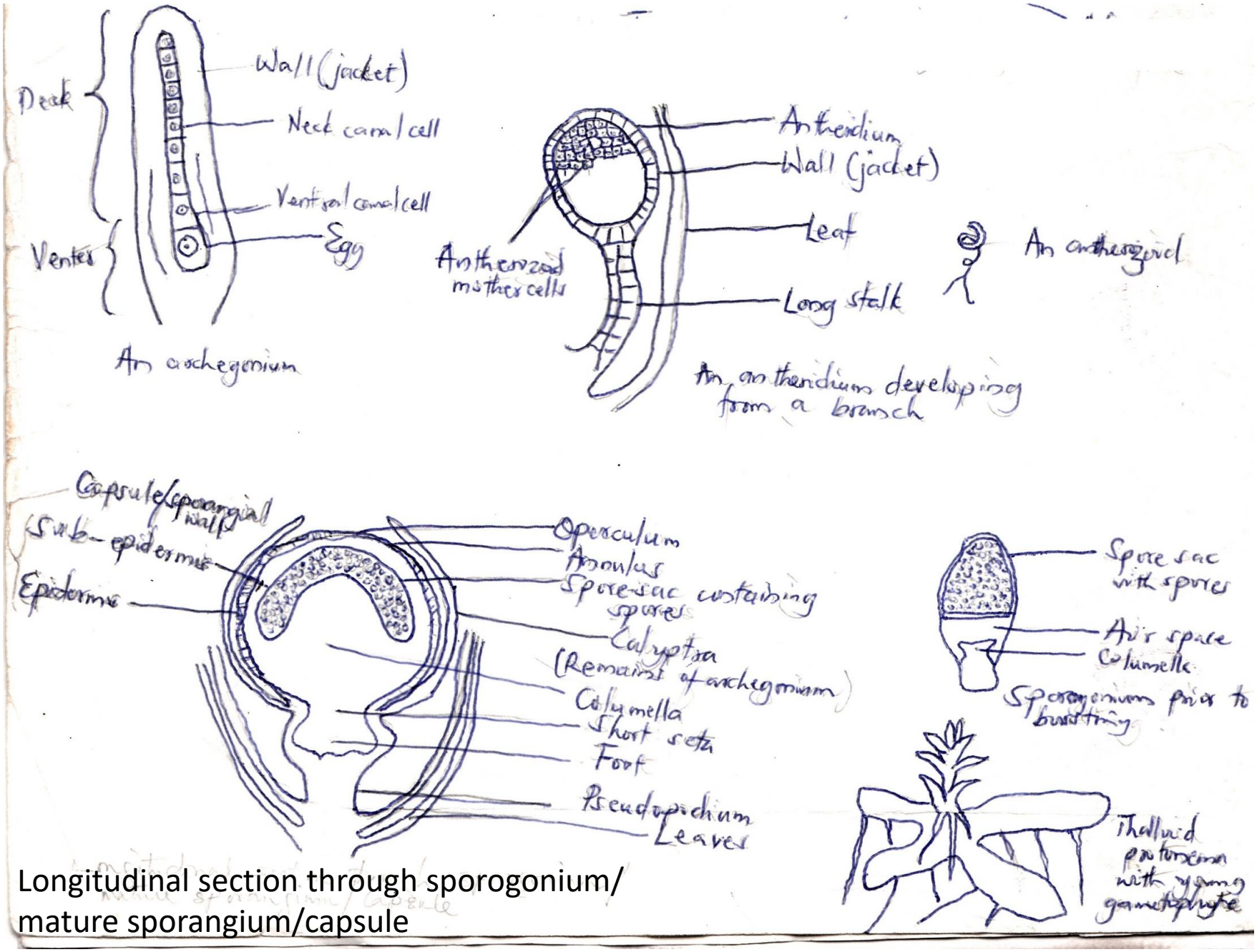
SEXUAL REPRODUCTION Cont'd

- The archegonia grow in a group of three (varying, however from 1 to 5) at the apex of very short branches (**archegonial branche**s) just below the apex of the axis
- Each archegonium consists of

✓a swollen venter with an egg

✓a long neck with canal cells surrounded by a wall

✓and has a long multicellular stalk



Longitudinal section through sporogonium/ mature sporangium/capsule

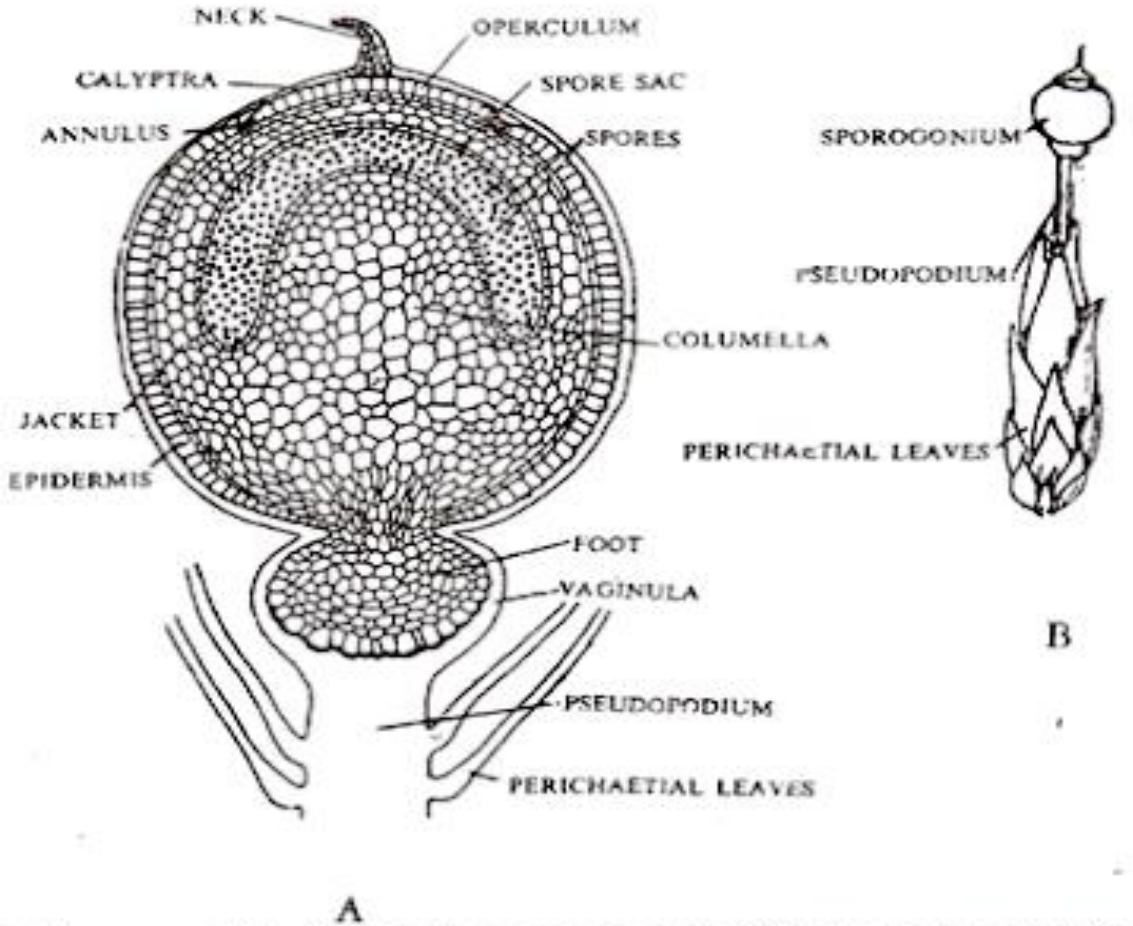


Fig. 12. (A, B). *Sphagnum*. (A) L. S. of mature sporogonium, (B) Female branch with sporogonium.

FERTILIZATION

- The antheridium bursts irregularly at the apex into valves and antherozoids are liberated
- They swim to the mature archegonium and enter it though the open neck (neck canal cells dissolve into mucilage)
- One of the antherozoids then fuses with the egg-nucleus

FERTILIZATION Cont'd

- The zygote formed divides repeatedly and finally a spherical or ovoid spore-bearing body, the SPOROGONIUM is formed on top of the branch
- Usually only one zygote of an archegonial branch develops into a sporogonium

SPOROPHYTE

- The sporogonium is the sporophyte reproducing asexually by means of spores
- It consists of

✓ a CAPSULE (SPORANGIUM) developing from the upper part of the filament

✓ a very short neck-like stalk called the SETA (often remaining undeveloped)

✓ a large bulbous FOOT developing from the lower part of the filament

✓ and a PSEUDOPODIUM

SPOROPHYTE Cont'd

- The sporogonium in longitudinal section shows the following regions:
- There is a compact mass of colourless sterile cells forming the COLUMELLA at the centre
- A dome-shaped SPORE SAC containing numerous spores formed in tetrads occurs on top of the columella

SPOROPHYTE Cont'd

- There is a lid or cover known as the OPERCULUM on top of the capsule; it has a ring-like layer of thickened cells known as ANNULUS
- The capsule wall is made of a layer of thick-walled, cutinized cells internal to it, the EPIDERMIS, and a few layers of thin-walled cells internal to it, the SUB-EPIDERMIS

SPOROPHYTE Cont'd

- Rudimentary (not yet fully developed) stomata (two guard cells only, without any chloroplasts or opening) are present in the epidermis

SPOROPHYTE Cont'd

- The capsule, however, is greenish in colour containing some chloroplasts
- The whole capsule is bound by a loose cap or CALYPTRA which is the enlarged and stretched archegonium wall
- Soon however it is torn off

SPOROPHYTE Cont'd

- The seta is very short (almost absent),
- ✓ and the function of elevating the capsule is taken over by a false stalk or PSEUDOPODIUM (base of the female inflorescence)
- ✓ which develops from the stem at the base of the capsule
- As the spores begin to mature the stalk elongates rapidly and pushes up the capsule

SPOROPHYTE Cont'd

- When the capsule is ripe the columella shrinks away from the spore-sac leaving an air-cavity in between
- The spore-sac now assumes a cylindrical form
- The compressed air contained in the air-space exerts a heavy pressure on the spore-sac with the result that the capsule explodes, blowing off the lid and scattering the spores

GERMINATION OF SPORE

- The spores germinate to form a filament but this is rapidly replaced by a small thalloid protonema
- This in turn gives rise to a bud which develops into the familiar leafy gametophyte, the protonema meanwhile becoming moribund (near to end of existence) and disappearing

VEGETATIVE PROPAGATION

- This is very common in *Sphagnum,* helping the plant to multiply rapidly and spread over large areas
- The methods are

✓Separation of some of the long and strong branches after the death of the older parts

✓Development of secondary protonema by some of the short apical branches

VEGETATIVE PROPAGATION Cont'd

- ✓Splitting of the protonema, and
- ✓Formation of secondary protonema from the primary protonema

ORDER II: ORDER ANDREAEALES

LANTERN MOSSES - the sporangium resembles a Chinese Lantern

ROCK MOSSES - grow on bare exposed rocks

ORDER ANDREAEALES

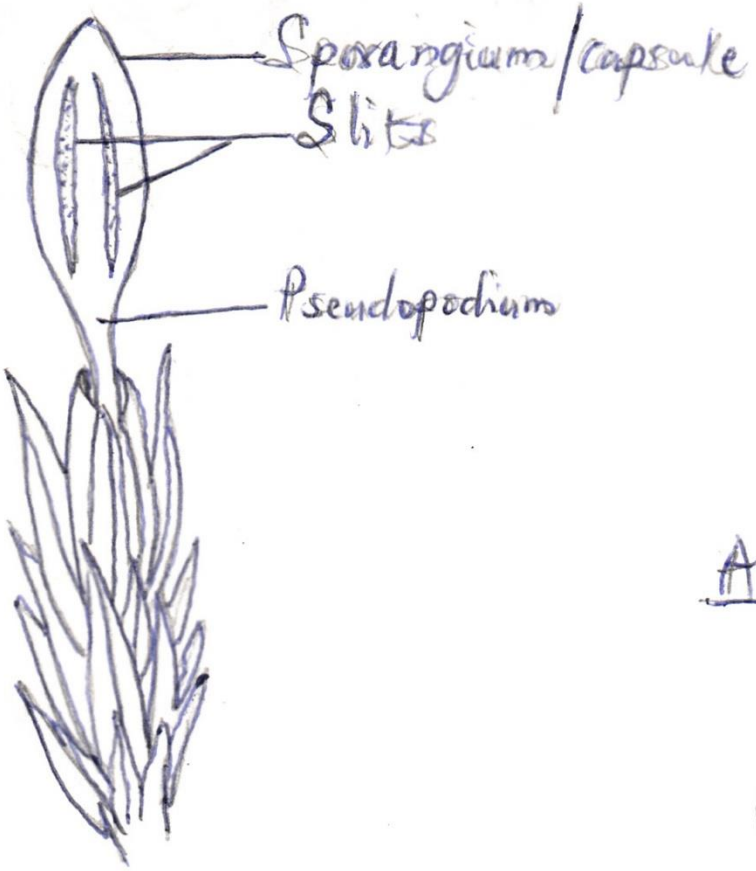
- The Andreaeales are another order containing only a single genus distinguished only by its peculiar capsule
- The leafy gametophyte of *Andreaea* rarely exceeds 1cm in height
- It is usually found growing on rock, chiefly in cold, exposed and relatively dry regions

ORDER ANDREAEALES Cont'd

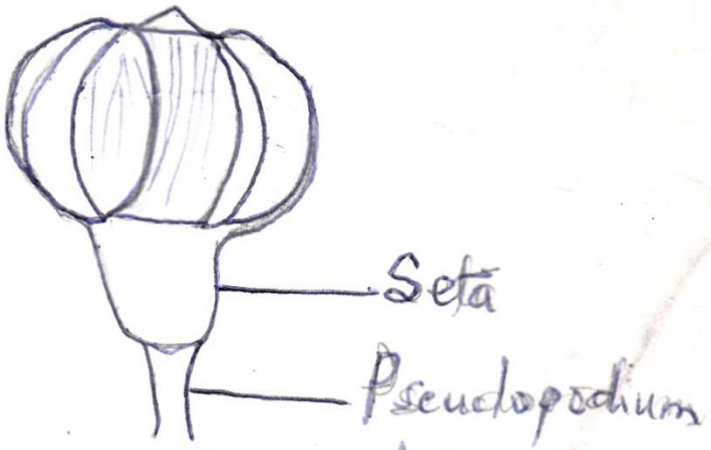
- The leaves are olive-brown in colour, composed of rounded cells, and in most species showing no distinct mid-rib
- Sex organs are formed apically
- The sporophyte resembles that of *Sphagnum* in having a domed sporogenous layer (archesporium) and being borne on a pseudopodium at maturity

ORDER ANDREAEALES Cont'd

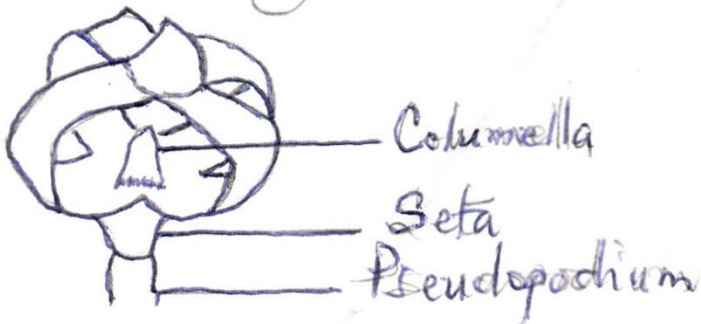
- Dehiscence of the capsule takes place by four longitudinal slits which do not meet at the tip
- The hygroscopic properties of the wall cause the slits to close in damp conditions and to open again in dry conditions
- The protonema of *Andreaea* is similar to that of *Sphagnum*



Andreaea rothii: fertile plant



A. mossiensis: dehisced capsule in dry condition.



A. rupestris: dehisced capsule in dry condition.

ORDER III: ORDER BRYALES – TRUE MOSSES

- Mosses occur most commonly on old damp walls, trunks of trees and damp soil, during the rainy season and dry up in the dry season
- They are gregarious in habit; wherever they grow they form a green patch or soft, velvet-like green carpet
- Common examples are *Mnium, Funaria* and *Polytrichum*

ORDER BRYALES – TRUE MOSSES Cont'd

- Some species e.g. *Tortula ruraliformis* are able to survive periods of drought in sand dunes and other arid habitats
- The cells of these species appear to have acquired the capacity to continue metabolism at a reduced rate while partially dehydrated

ORDER BRYALES – TRUE MOSSES Cont'd

- At the other extreme are a few sub-aquatic species such as *Fontinalis autipyretica*
- Some mosses are remarkably tolerant of heavy metals and in some areas serve as indicator plants

ORDER BRYALES – TRUE MOSSES Cont'd

- The worldwide genus *Mielichhoferia* for example, contains a number of species characteristic of acidic copper-bearing soils and rocks

GAMETOPHYTE

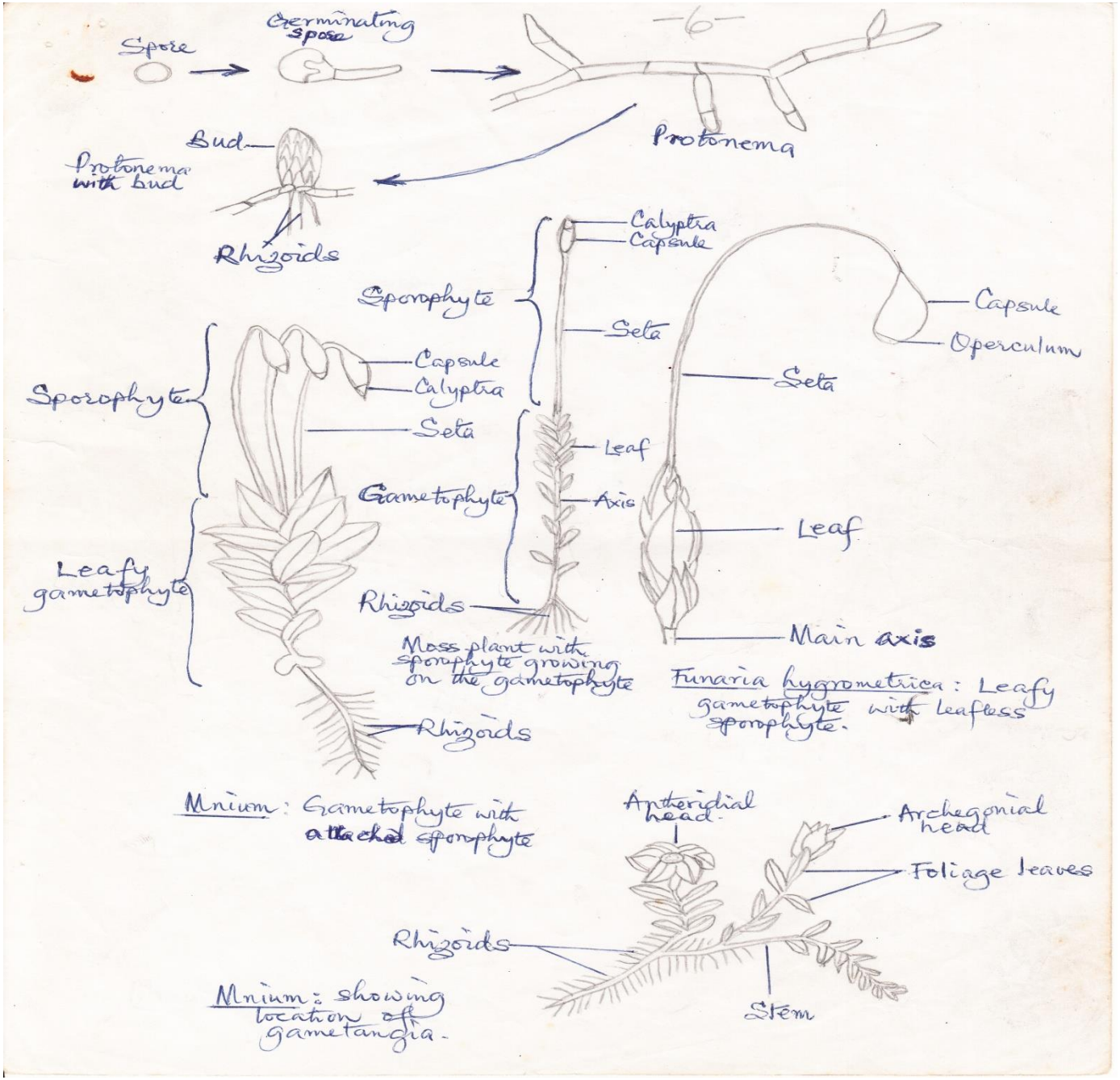
- The moss plant is small, usually a few centimeters in height and consists of a short axis with spirally arranged minute green leaves
- The axis may be branched or unbranched
- The mature stem of the leafy gametophyte shows a wide range of differentiation depending on the species, age and environment

GAMETOPHYTE Cont'd

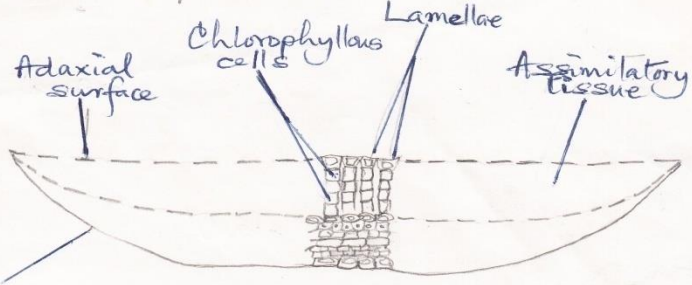
- Enlarged cells called **RHIZOIDS** anchor the gametophyte to the substrate
- These structures are not roots and apparently not involved in absorption
- The stems of simpler mosses like *Tetraphis* have an outer layer of thick-walled epidermal cells (**STEREIDS**) surrounding an undifferentiated cortex made up of parenchyma-like cells

GAMETOPHYTE Cont'd

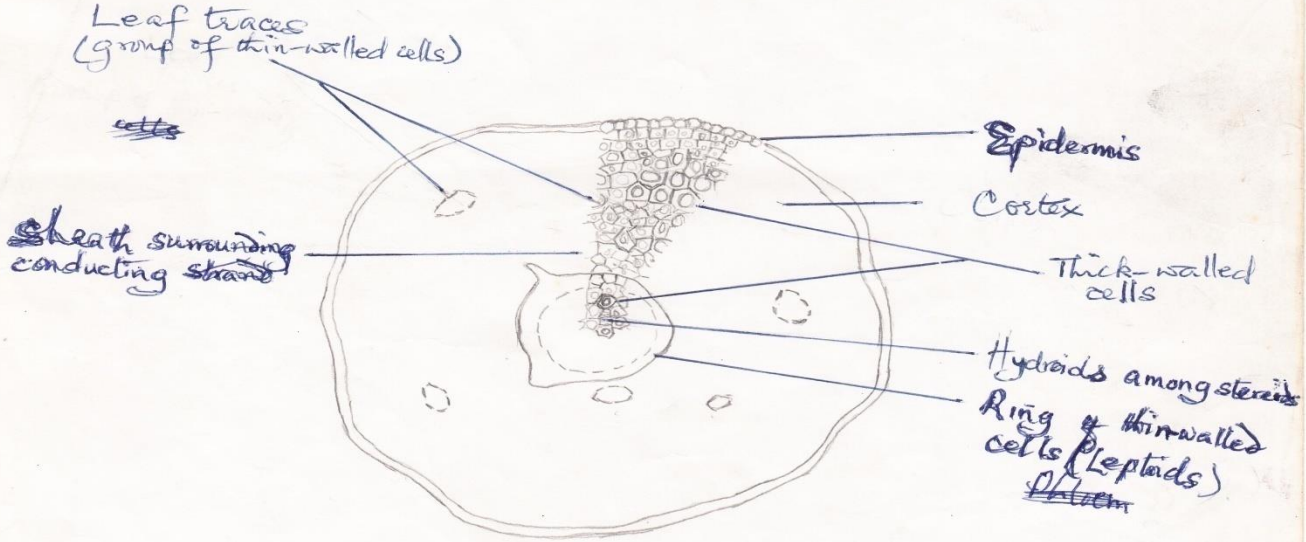
- Some mosses, such as *Mnium* have a central conducting strand in their stems
- The stem of *Mnium* is made up of elongated thin walled **HYDROIDS** which are dead empty cells that conduct water
- Their end walls are oblique and sometimes very thin, perforated with pores or partly dissolved


Spore
Germinating spore
Protonema
Bud
Protonema with bud
Rhizoids
Sporophyte
Capsule
Calyptra
Seta
Gametophyte
Leaf
Axis
Rhizoids
Moss plant with sporophyte growing on the gametophyte
Sporophyte
Capsule
Calyptra
Seta
Leafy gametophyte
Rhizoids
Mnium: Gametophyte with attached sporophyte
Capsule
Operculum
Seta
Leaf
Main axis
Funaria hygrometrica: Leafy gametophyte with leafless sporophyte.
Antheridial head
Archegonial head
Foliage leaves
Rhizoids
Stem
Mnium: showing location of gametangia.

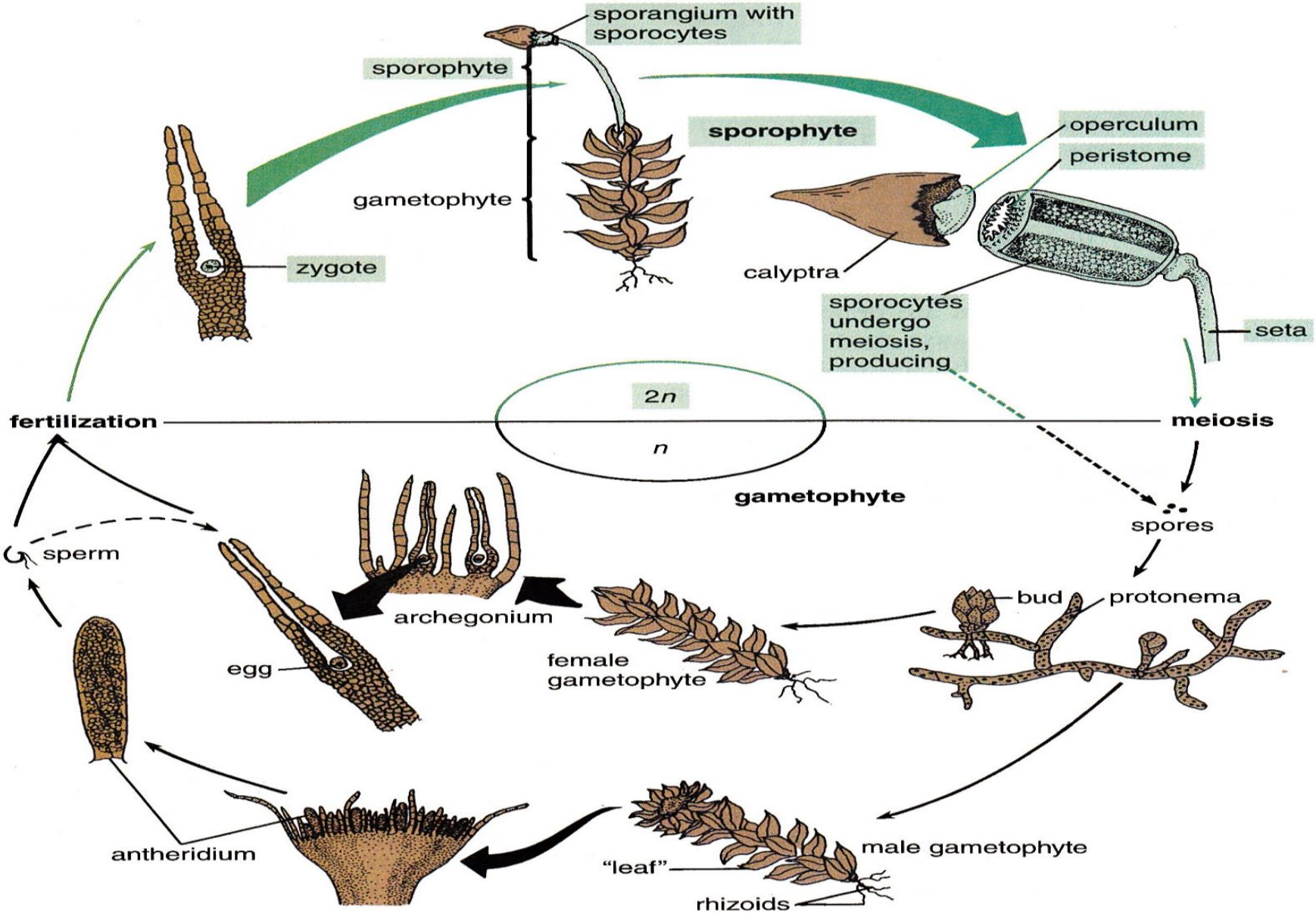
Section of mass leaf showing multiple layer of cells at the margin and in the mid-rib.



Polytrichum commune : transverse section of leaf showing assimilatory lamellae.



Polytrichum commune: Transverse section of stem.



Life cycle of a moss

GAMETOPHYTE Cont'd

- Experiments with dyes show that translocation of water can occur in these cells but most water used by the plant apparently travels up the outside of the plant by means of capillarity

GAMETOPHYTE Cont'd

- The closely packed habit of many mosses and the fact that they rarely extend more than a few centimeters into the air favours such outside movements of water which is absorbed directly through the plant surfaces

GAMETOPHYTE Cont'd

- The mid-rib of some mosses' leaves also contain hydroids but only in one genus is this known to connect with the hydroids of the stem
- Hydroids show some resemblance to tracheids but lack specialized pitting and lignified walls
- No lignin has been detected in Bryophytes

GAMETOPHYTE Cont'd

- A few of the most specialized mosses also contain cells resembling the sieve cells of the vascular plants
- Between the epidermis and the central strand elongated cells with oblique end walls (**LEPTOIDS**) may occur
- These cells are alive but their nuclei are degenerate and inactive

GAMETOPHYTE Cont'd

- They have many enlarged **plasmodesmata** in their end walls 35 - 40nm in diameter and callose may be present
- Studies with $^{14}CO_2$ show that sugars may be translocated through these cells at the rates of 0.3-50cm/hr
- Although leptoids are always associated with parenchyma cells it is not yet clear if parenchyma cells function as companion cells

GAMETOPHYTE Cont'd

- The leaves of moss gametophytes have no mesophyll tissue, stomata or veins like the leaves of more complex plants
- The blades are nearly always mainly one cell thick except at the **MIDRIB**, which runs lengthwise down the middle and they are never lobed nor divided, nor do they have a petiole

GAMETOPHYTE Cont'd

- The midrib (often referred to as a NERVE), which is absent in some genera sometimes projects beyond the tip in the form of hair or spine
- The leaf cells usually contain numerous lens- shaped chloroplasts, except at the midrib

GAMETOPHYTE Cont'd

- The most complex leaf is found in *Polytrichum* and its allies
- Here a number of parallel longitudinal lamellae grow up from the upper surface and chloroplasts occur principally in these cells

ASEXUAL REPRODUCTION

- Vegetative propagation plays a large part in the reproduction of the Bryales
- Almost any part of the gametophyte – leaf, stem or even rhizoid - is capable of regeneration, either directly or by the production of gemmae and giving rise to a new individual

SEXUAL REPRODUCTION

- Sexual reproduction begins with the formation of multicellular gametangia, usually at the apices of leafy shoots of gametophytes although they frequently form on special separate branches
- Both male and female gametangia are often produced on the same plant but in some species they occur on separate plants

SEXUAL REPRODUCTION Cont'd

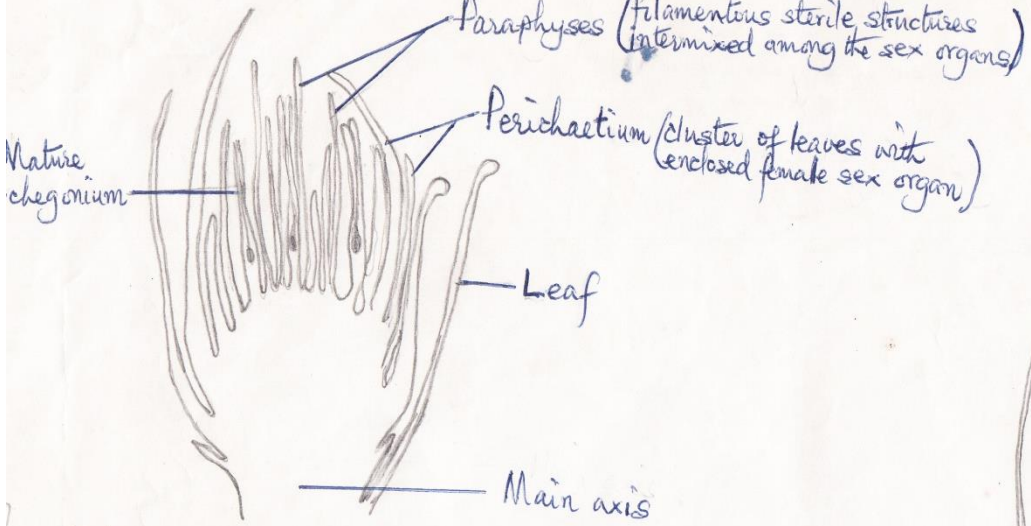
- In *Mnium,* shoots bearing antheridia are easily recognized by the surrounding leaves that spread around them somewhat like petals of a flower
- The group of antheridia appears as an orange spot in the centre of the terminal cluster of leaves

SEXUAL REPRODUCTION Cont'd

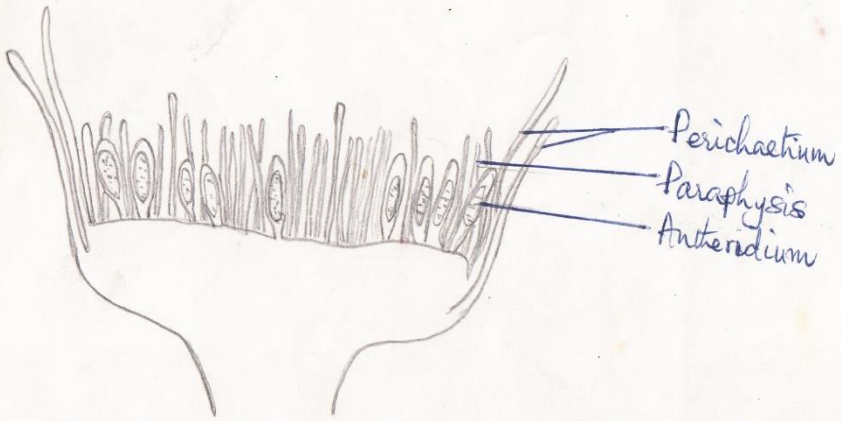
- The ARCHEGONIA are somewhat cylindrical and project upward from the base of the expanded gametophyte tip
- When certain cells breakdown in the VENTER a cavity develops in which a single egg cell is produced
- The part of the archegonium above the venter is called the NECK

SEXUAL REPRODUCTION Cont'd

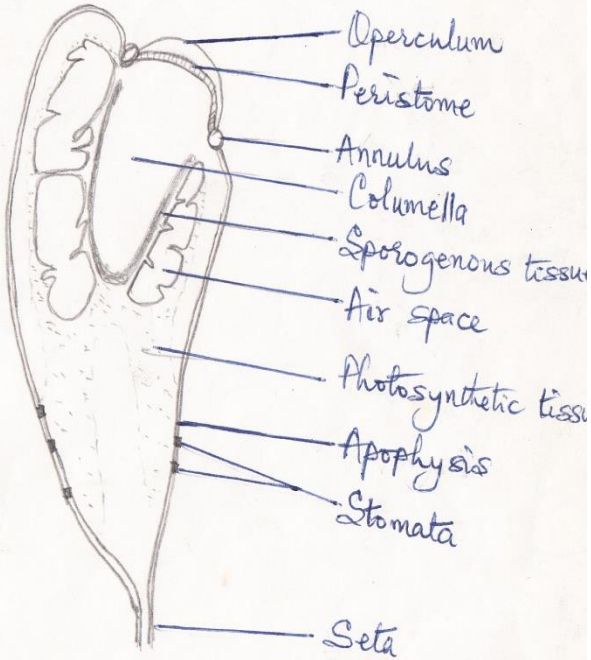
- The neck which may taper toward the tip contains a narrow canal
- The canal is at first plugged with cells but these break down as the archegonium matures leaving an opening at the top
- Several archegonia are usually produced at the same time, with sterile hair-like, multicellular filaments called PARAPHYSES (Sing: Paraphysis) scattered among them



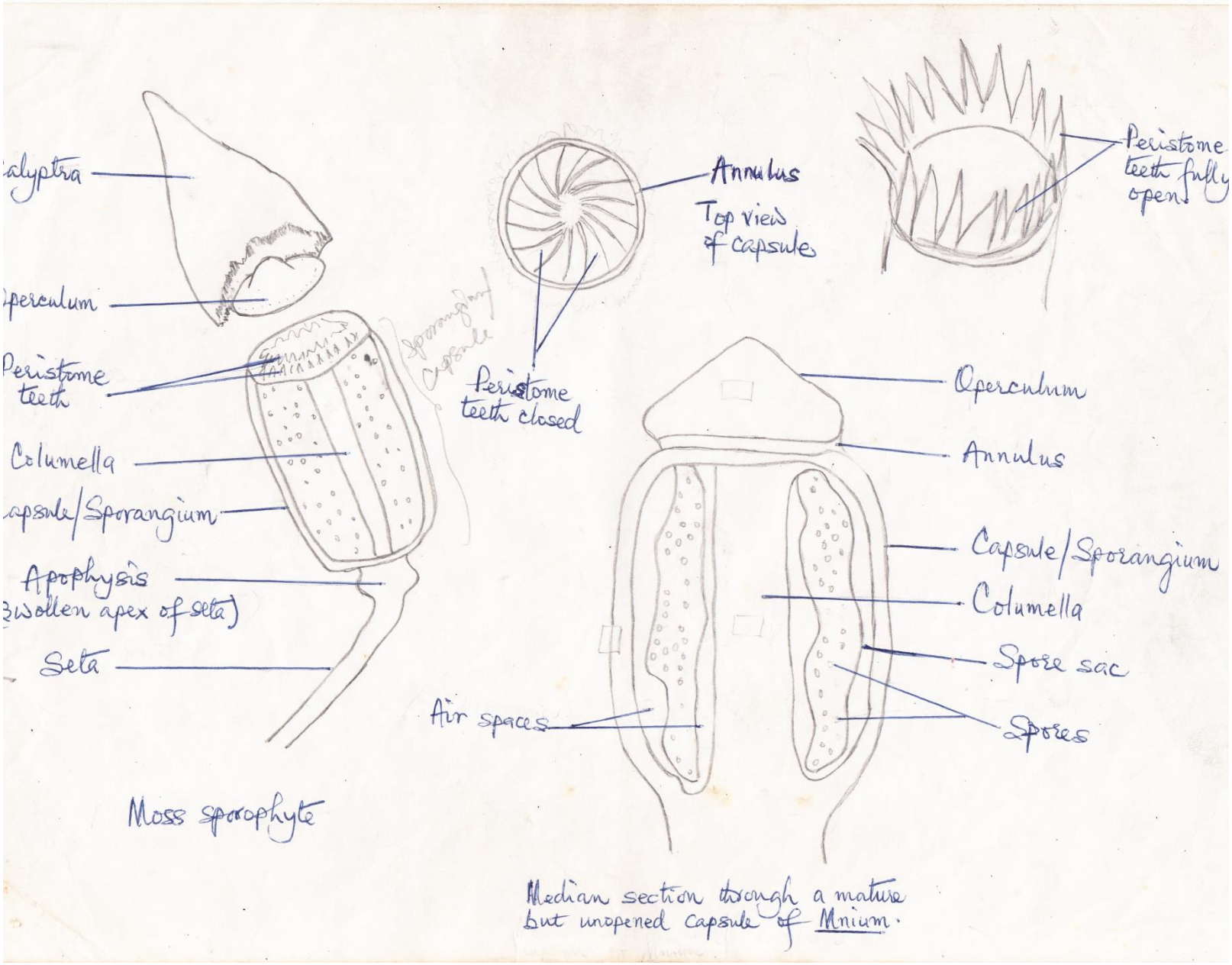
Mnium sp.: Longitudinal section of female head



Mnium hornum: Longitudinal section of male head.



Funaria hygrometrica: Longitudinal section of immature capsule.


Calyptra
Operculum
Peristome teeth
Columella
Capsule/Sporangium
Apophysis (swollen apex of seta)
Seta
Moss sporophyte
Sporangium/Capsule
Annulus
Top view of capsule
Peristome teeth closed
Peristome teeth fully open
Operculum
Annulus
Capsule/Sporangium
Columella
Spore sac
Air spaces
Spores
Median section through a mature but unopened capsule of Mnium.

SEXUAL REPRODUCTION Cont'd

- Male gametangia also have paraphyses among them and are sausage shaped to roundish with walls that are one cell thick
- The antheridia are borne on short stalks
- A mass of tissue inside the antheridium develops into numerous coiled or comma- shaped sperm cells

SEXUAL REPRODUCTION Cont'd

- This mass of sperms is forced out of the top of the antheridium when it absorbs water and swells
- After release the sperm mass breaks up into individual cells each with a pair of flagella
- It is believed the break up of the sperm mass is aided in some cases by fats produced by the moss while in other instances rain splash is responsible

SEXUAL REPRODUCTION Cont'd

- Archegonia release sugars, proteins, acids or other substances that attract the sperm
- And eventually a sperm after swimming down the neck of an archegonium unites with the egg forming a diploid zygote

SEXUAL REPRODUCTION Cont'd

- The zygote usually grows rapidly into a spindle-shaped embryo
- The embryo breaks down the cells at the base of the archegonium and becomes firmly established in the tissues of the stem by means of a swollen knob called a foot
- As the embryo grows cells around the venter divide thereby accommodating its increasing size

SEXUAL REPRODUCTION Cont'd

- The length of the embryo soon exceeds the length of the cavity in the venter
- The top the venter is split off and is left sitting like a **pixie cap** on top of the embryo
- By this time the embryo is a developing sporophyte
- The pixie cap, called the **calyptra**, remains until the sporophyte is mature

SEXUAL REPRODUCTION Cont'd

- The cells of the sporophyte become photosynthetic as it develops, remaining so until maturity
- The sporophyte however depends to varying degrees on the gametophyte for some of its carbohydrate needs as well as for at least a part of its water and minerals which are absorbed through the foot

SEXUAL REPRODUCTION Cont'd

- The mature sporophyte is at first green and photosynthetic
- It consists of a **capsule** located at the tip of a slender stalk called the **seta**
- Depending on the species the seta may be less than 1 millimeter (0.04 inch) long
- Or it may be up to 15 centimeters (6 inches) long

SEXUAL REPRODUCTION Cont'd

- Most however are less than 5 centimeters (2 inches) long
- Unless extremely dry conditions prevai
- The free end of the capsule is usually protected by a little rimmed lid the operculum which falls off at maturity
- As the capsule matures sporocytes inside it undergo meiosis producing haploid spores

SEXUAL REPRODUCTION Cont'd

- The spores often numbering in millions are released from the capsule usually through a structure called a **peristome** after the **operculum** falls off
- Most peristomes consist of a circular row or two of narrowly triangular and membranous teeth arranged around the rim of the capsule each row having 16 teeth

SEXUAL REPRODUCTION Cont'd

- They open or close in response to changes in humidity
- In a few species of mosses the peristome is a cone-shaped structure with pores through which the spores are released

SEXUAL REPRODUCTION Cont'd

- Some rock mosses have neither a peristome nor an operculum
- The spores in these mosses are released when the capsule splits lengthwise along four lines
- In the dung mosses a putrid odour is given off when the spores are ready for release

SEXUAL REPRODUCTION Cont'd

- Some of the spores adhere to the legs and bodies of flies which are attracted by the odour and are disseminated as the insects clean themselves
- Most moss spores are however simply blown away by the wind
- And if they fall in a suitable damp location they usually germinate relatively quickly