

# CC II-UNIT 3

## *Sphagnum*

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<https://i.pinimg.com/originals/b8/5d/10/b85d10337de93709338724c71f300fed.png>

# *Sphagnum* sp. (e.g., *S. palustre*)

- Division- Bryophyta
- Class – Bryopsida/Musci
- Order – Sphagnales
- Family – Sphagnaceae
- **Genus - *Sphagnum***
- **Species – *Sphagnum palustre***



<http://www.bio.brandeis.edu/fieldbio/Survival/Images/Sphagnum%20Moss/sphag%20moss,%20red,%20resize%20-%20ed.jpg>

- ***Sphagnum*** commonly known as "**peat moss**" or "bog moss"
- Decayed, dried sphagnum moss has the name of peat or peat moss. **Peat**, sometimes known as **turf**, is an accumulation of partially decayed vegetation or organic matter. Landscapes covered in peat are home to specific kinds of plants including *Sphagnum* moss and sedges.
- Sometimes grows in small patches, but generally found growing in a thick, dense clump.
- Moss grows so close that it forms a cushiony "bog mat" that floats on top of the water; the mat is so strong that it can support the weight of several large moose

# Sphagnum Moss/Peat Moss

# *Sphagnum spp.*

- **Location:** found in wet and boggy areas
- likes acidic (low pH) soil
- generally not found growing in the woods or in water that contains lime

## V. LIFE CYCLE

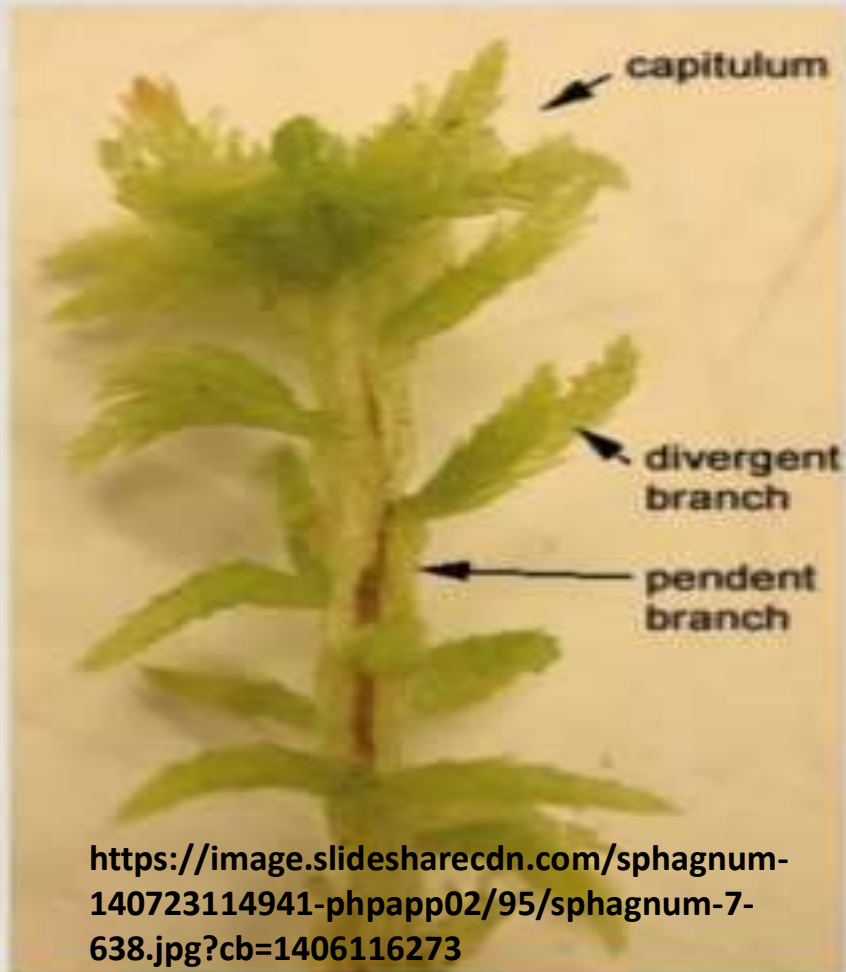


- Different kinds of sphagnum mosses grow at different rates.
- When they die, they do not rot away because the ground is both wet and acidic.
- Sphagnum mosses produce chemicals which potentially increases the acidity of water and further prevent the decay of dead plants.
- The dead remains of sphagnum mosses pile up and get pressed together to eventually form the soil we know as **peat**.

Adopted from Fortaleza M.A.

<https://image.slidesharecdn.com/sphagnum-140723114941-phpapp02/95/sphagnum-9-638.jpg?cb=1406116273>

# IV. MORPHOLOGY



<https://image.slidesharecdn.com/sphagnum-140723114941-phpapp02/95/sphagnum-7-638.jpg?cb=1406116273>

The plant exhibits two types of branches:

- pendant branches – aid in capillary movement
- divergent branches – provide the plant structure

## A. STEM

- has inner pith and cortical layer
- inner pith: site of food production and storage
- cortical layer: for water absorption and protection

The cortical layer have **retort cells** that are believed to help the moss retain water under intense sunlight and are home to a wide variety of invertebrates and microorganisms.

# Leaves

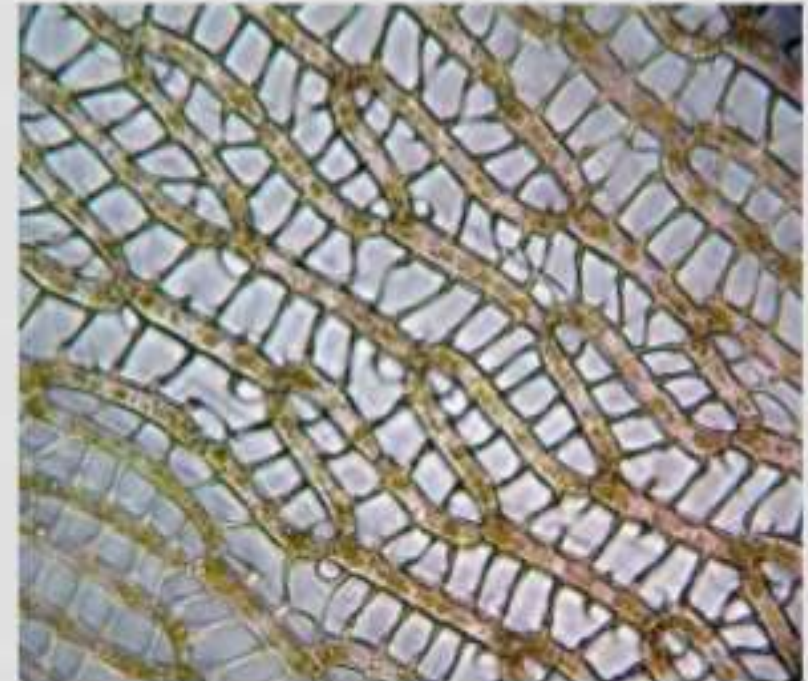
- **Leaves:**  
tiny and sometimes slightly toothed
- grow in hair-like tufts close to the stem (no higher than 4 inches)
- usually light green, but some species have yellow, pink, deep red, or brown leaves

## IV. MORPHOLOGY

### B. LEAVES

Sphagnum leaves have unique and unusual arrangement and they are of two types:

- **hyaline cells** – large and the most obvious cells; they have thickened bands strengthened by fibrils that serve as supporting material; they help retain water because they are perforated and dead at maturity
- **chlorophyllous cells** – small and slender cells having chlorophyll to manufacture food



# IV. MORPHOLOGY

Adopted from Fortaleza M.A.

<https://image.slidesharecdn.com/sphagnum-140723114941-phpapp02/95/sphagnum-9-638.jpg?cb=1406116273>

## C. RHIZOIDS

In the absence of roots, rhizoids occur for the *Sphagnum* moss and these would aid in anchorage or attachment to their preferred substrate. However, these rhizoids are not capable of absorbing nutrients.



*Sphagnum* sp. sporophyte and gametophyte



*Sphagnum compactum* (line drawing inset)

# Gametophytic plant with male and female branch and sporogonium

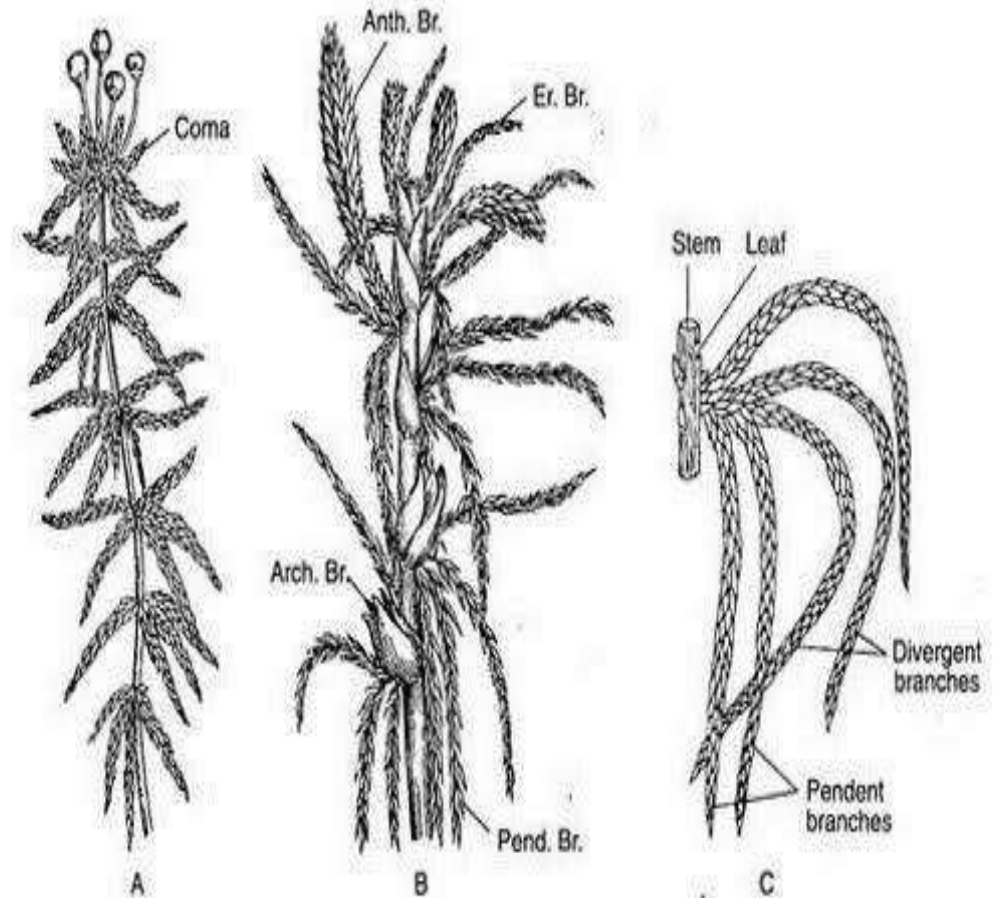
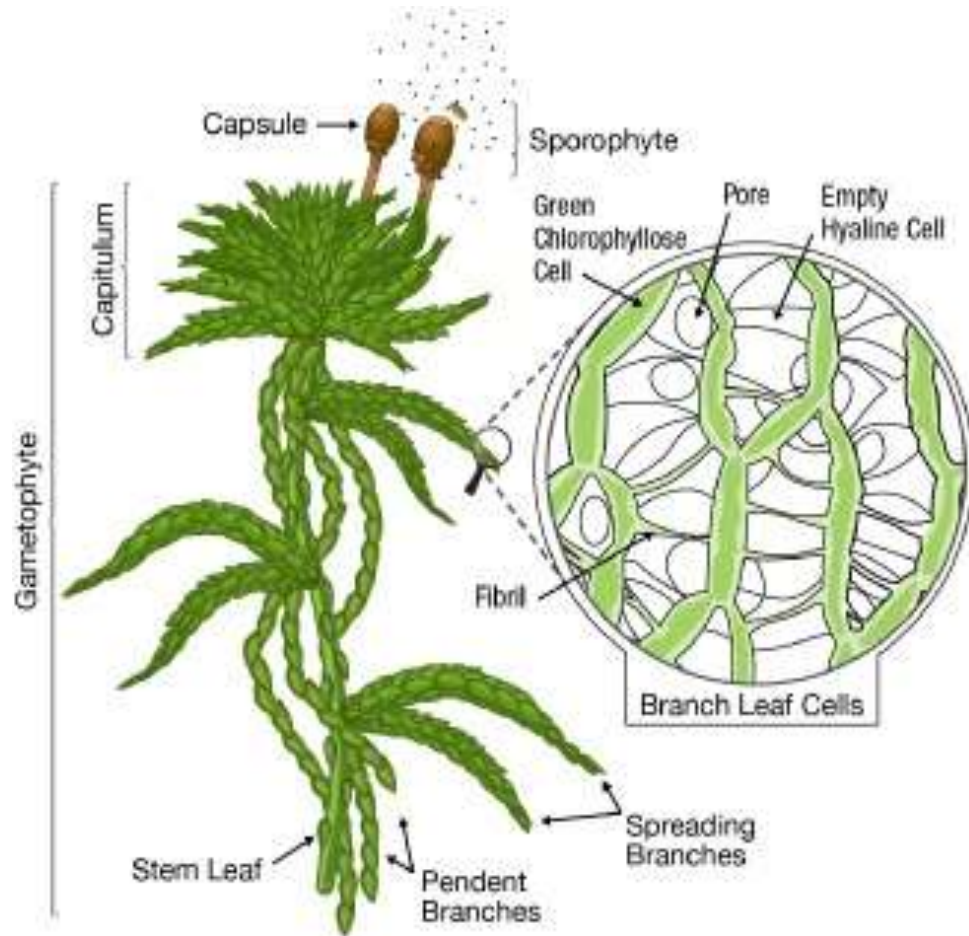


Fig. 6.38 : A. Gametophyte plant of *Sphagnum palustre*, bearing terminal cluster of sporogonia. B. Part of *Sphagnum nemoreum* gametophyte showing antheridial branches (Anth. Br.), archegonial branches (Arch. Br.), erect branches (Er. Br.) and pendent branches (Pend. Br.) (after Schimper). C. Divergent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

### Life cycle of Sphagnum (Peat Moss)

(Division: Bryophyta, Class: Bryopsida, Order: Sphagnales, Family: Sphagnaceae, Genus: Sphagnum)

**Occurrence:** Aquatic, in margins of small lakes, ponds on dripping rocky banks. They grow closely matted together forming a spongy cover on the water. The dead plants are slow to decay due to acidic water and they aggregate to form a brown spongy mass called peat.

**Vegetative morphology (Structure of Gametophyte):** Sphagnum is a **perennial plant**. Gametophyte is **erect and leafy** with stem, branches and leaves. Stem is weak and fragile. It is divided into nodes and internodes. A tuft of branches is found at each node.

Branches are of 2 types: short and stout branches are called **divergent branches**. Long, slender, descending branches called **drooping branches**. At the tip of the gametophyte, a dense crown of short branches called **coma** is present.

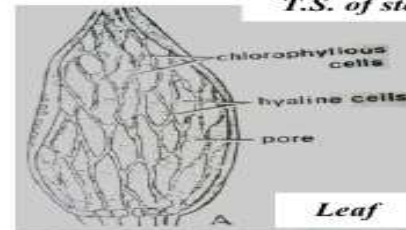
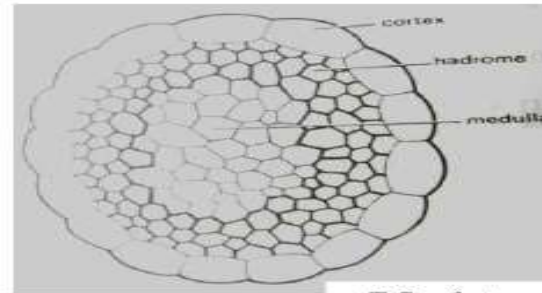
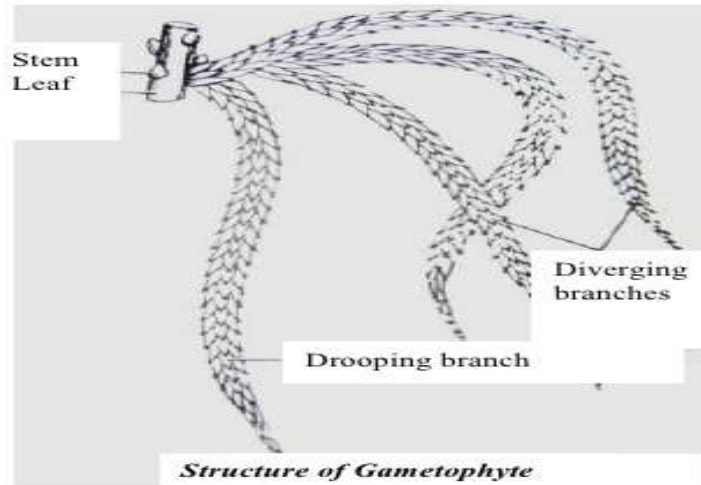
Stem and branches are covered with small leaves. Leaves are without midrib. Mature gametophytes do not have rhizoids.

**Anatomy of stem:** T.S. of stem shows 3 regions. The outer **cortex** or **hyalodermis** is about 3-6 layers of compactly arranged cells, in older stems. It stores water.

The middle region is **hadrome**. It comprises of prosenchymatous cells. It provides mechanical support.

The inner most region is **medulla**, made up of colourless parenchymatous cells.

**Anatomy of leaf:** Leaves of sphagnum are unique in structure. They have a single layer of cells in thickness. The cells are of two types: Narrow, chlorophyll containing cells are called **assimilatory cells**. Large, rhomboidal dead cells are called **hyaline cells**. These two types of cells are arranged alternately in the leaf, to form a net-like structure.



#### **Vegetative Reproduction:**

**By innovations:** one of the vegetative branch becomes upright, grows vigorously like the main stem. This branch is called innovation. It separates from the main stem and grows into an independent plant.

**By gemmae:** some species produce gemmae.

**By protonemal branches:** some protonemal branches become meristematic and develop into additional gametophytes.



**Sexual reproduction:** It is advanced oogamous type. **Antheridia** and **archegonia** are produced in special branches called **antheridial** or **male** and **archegonial** or **female branches**, in same (**monoecious**) or different (**dioecious**) plants. These branches occur at the tip of the stem (in the coma) or at the lower nodes.

**Structure of antheridial branch and antheridia:** Antheridial branches are shorter than the vegetative branches and appear like catkins. They are covered with red/brown coloured leaves.

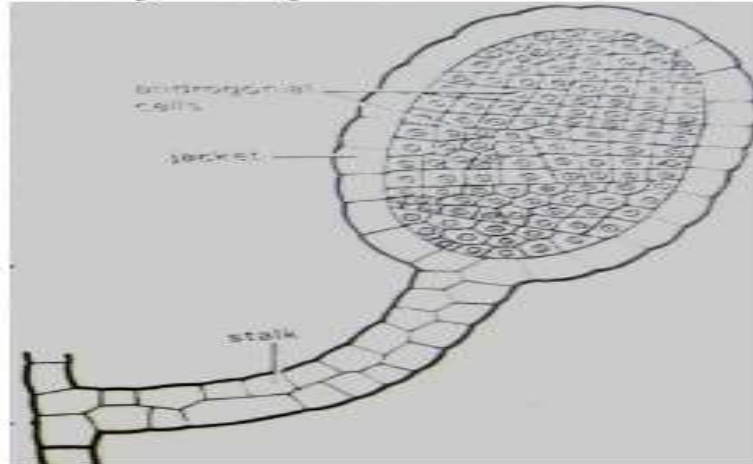
- Antheridia are arranged acropetally in the axils of the leaves of these branches.
- Antheridia are club shaped with a long, multicellular **stalk** and a globular **body**.
- The body is covered with a single layered **jacket** which surrounds numerous **androgonial cells**.
- The androgonial cells develop into **antherozoids** or **sperms**.
- Each sperm is spirally coiled, elongated structure with a pair of flagella.
- Mature sperms are released from the antheridium by the separation of the jacket cells.

**Structure of archegonial branch and archegonia:** The archegonial branches are very short and thick. They are purple in colour. They are covered with large leaves called **perichaetial leaves**. Groups of 3-5 archegonia are found at the tip of the each branch.

- The mature archegonium is flask shaped with a long twisted **neck** and a swollen **venter**.
- The neck is covered with 6 vertical rows of **neck cells** and **cover cells**. It encloses 8-9 **neck canal cells**.
- The venter is covered by 2-3 layers of cells. It encloses a **venter canal cell** and a basal **egg cell**.



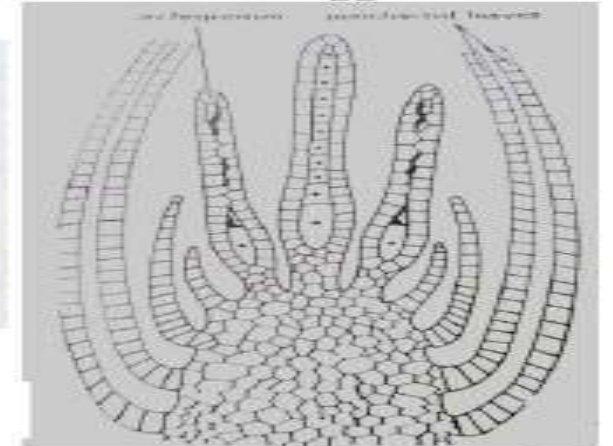
*Antheridial branch*



*L.S. of Antheridial branch*



*Archegonial branch*



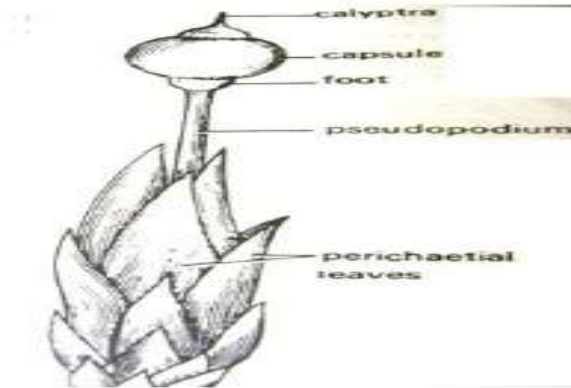
*L.S. of Archegonial branch*

**Structure of Sporophyte:**

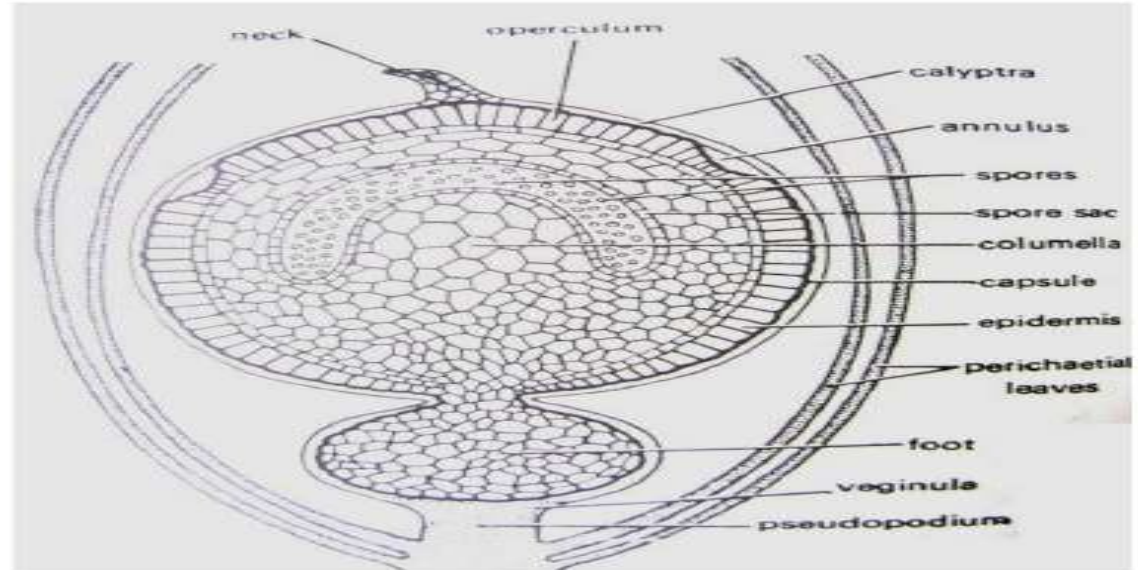
The ripe sporophyte is a dark brownish-black coloured spherical structure appearing at the tip of the female branch. It is found on a stalk called the **seta**. The mature sporophyte consists of a bulbous **foot** and a spherical **capsule**. The two are connected by a narrow neck-like region which represents the **seta**.

- The foot is embedded in the tissue of the pseudopodium of the gametophyte. It absorbs nutrition and water for the growing sporophyte. The capsule has the following parts:
- A massive central column of sterile cells called **columella**.
  - A thin dome shaped **spore sac** overarching the columella. It contains haploid **spores**. **Elaters** are **absent**.

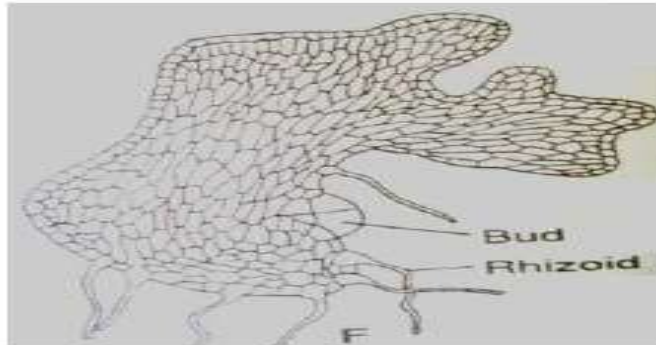
- The 4-6 layered **capsule wall** surrounds the columella and spore sac. Its outer layer is called **epidermis** and it consists of many **non-functional stomata**.
- A convex disc-shaped **operculum** or **lid** is found at the top of the capsule. It is separated from the rest of the capsule by a ring like groove of thin cells called **annulus**.
- The remains of archegonia form a **calyptra** which cover the tip of capsule.
- When the sporophyte is mature, the operculum is blown off forcefully, by the rupturing of the annulus cells. The spores are also released into the air like a cloud.



*A mature sporophyte*



*Internal structure of sporophyte*



*Structure of Protonema*

**Germination of the spores:** The spores germinate when the conditions are favorable to develop into a green, flat, irregularly lobed, thallus like structure called **primary protonema**. It is photosynthetic and bears rhizoids. From the marginal cells of this protonema, a bud like structure develops which further grow to form the young erect gametophyte.

# V. LIFE CYCLE

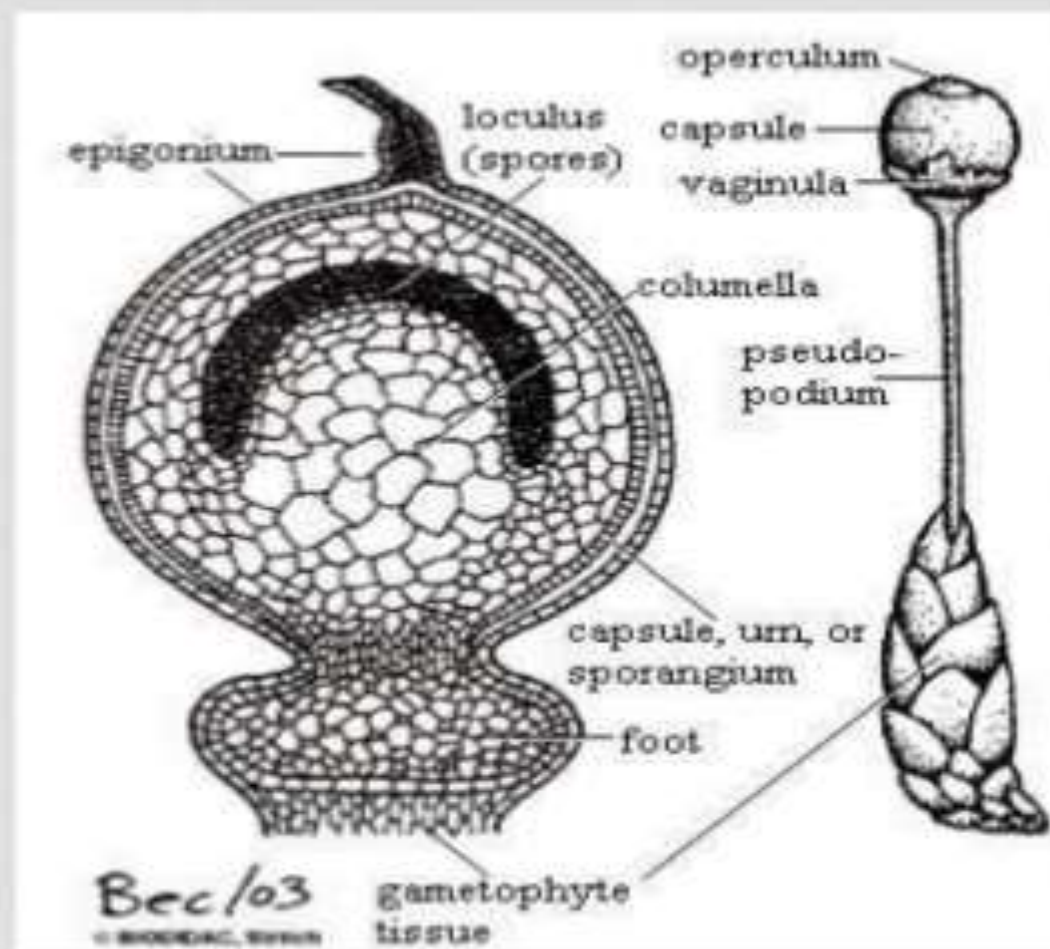
## Gametophyte

-have substantial asexual reproduction by fragmentation, producing much of the living material in sphagnum peat lands

## Sporophyte

-short lived and consists of shiny, black, spherical spore capsule

-raised on stalks to expose the spores in aerial setting to facilitate its dispersal



# Spore Dispersal

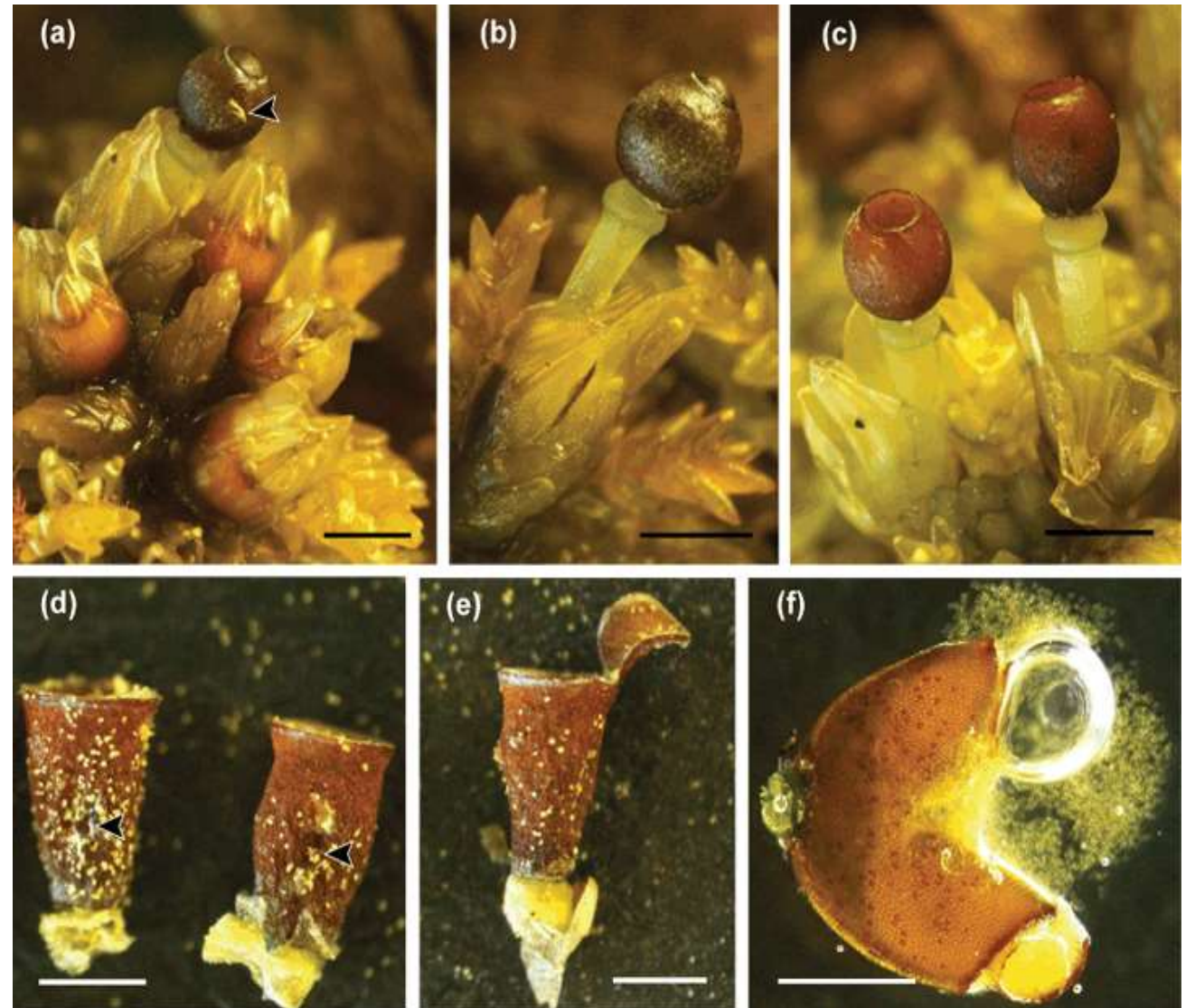
As with many other mosses, *Sphagnum* species disperse spores through the wind.

The tops of spore capsules are only about 1 cm above ground, and where wind is weak.

As the spherical spore capsule dries, the operculum is forced off, followed by a cloud of spores.

The exact mechanism has traditionally attributed to a "pop gun" method using air compressed in the capsule.

High-speed photography has shown vortex rings are created during the discharge



Adopted from Jeff Duckett; [Pressel, Silvia](#); P'ng, Ken M. Y.; Renzaglia, Karen S. (2009)

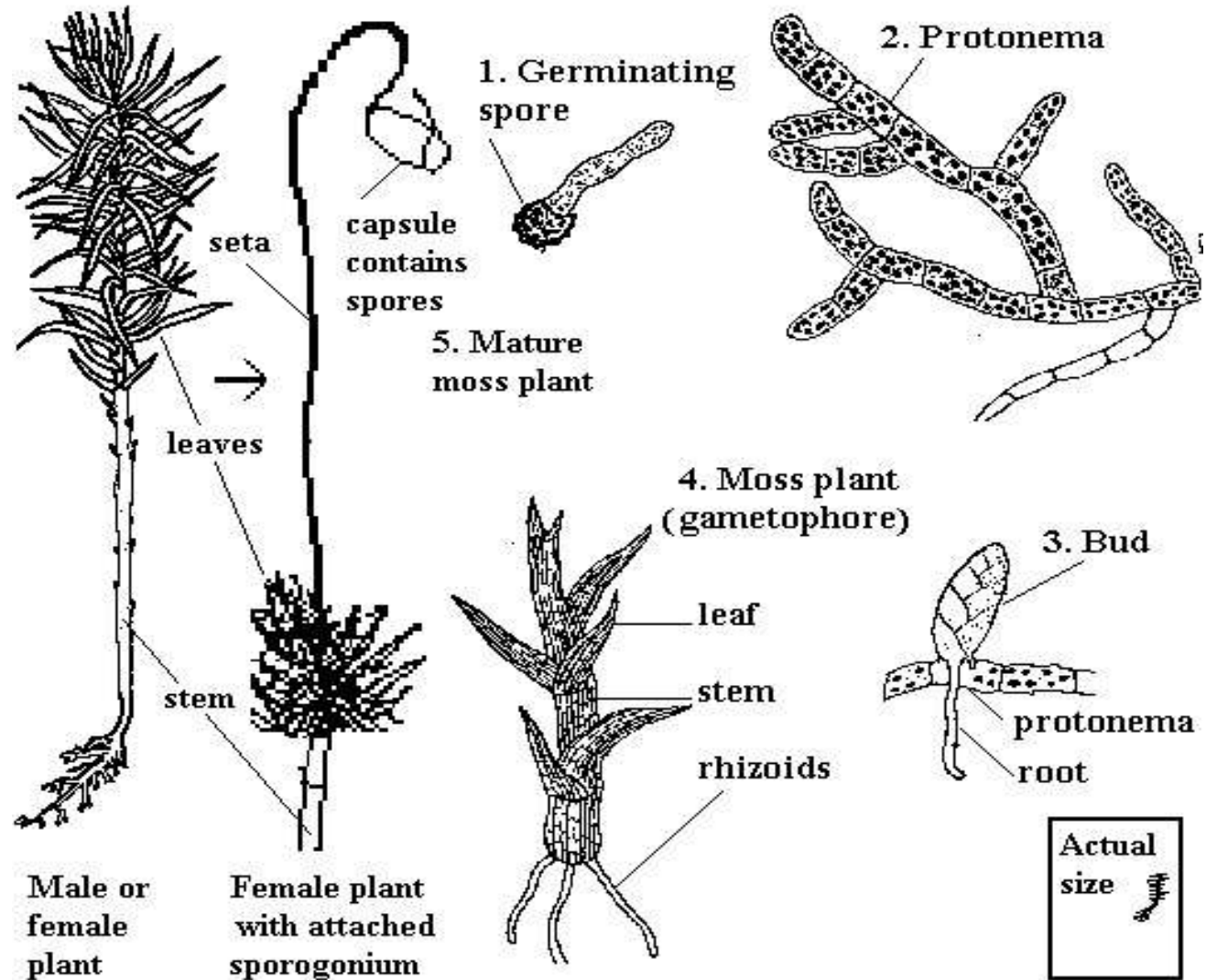
## Germination of spore & development of Protonema

A **protonema** (plural: protonemata) is a thread-like chain of cells that forms the earliest **stage** of development of the gametophyte (the haploid **phase**) in the life cycle of **mosses**. ... **Moss** spores germinate to form an alga-like filamentous structure called the **protonema**. It represents the juvenile gametophyte.

It is formed by germination of spores and is a branched filamentous structure. The protonema develops a lateral bud which further gives rise to the leafy stage in mosses.

Protonema are composed of two cell types- chloronemata and caulonemata.

9.47.2 Moss life cycle

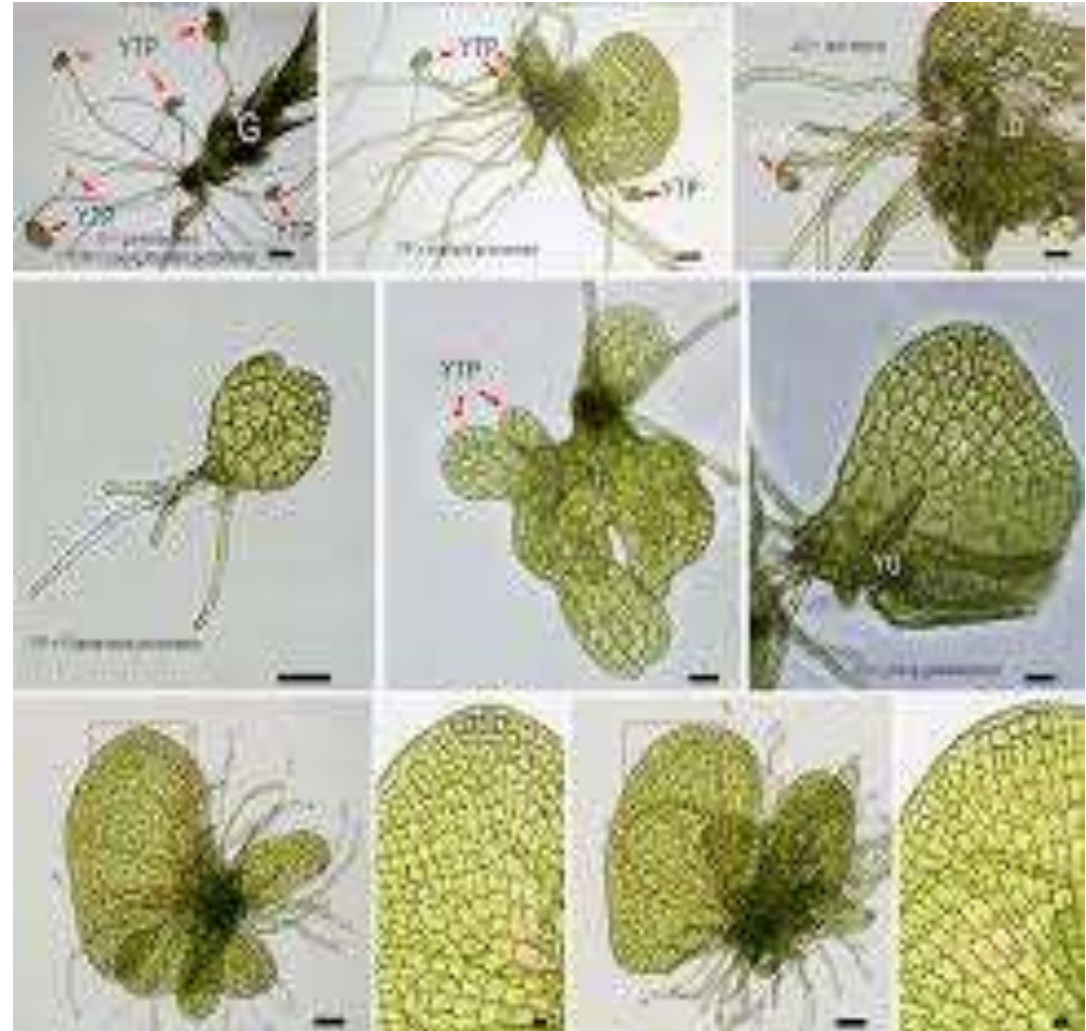


# Protonema proliferation

Protonema is defined as the primary filamentous thalloid stage of the gametophyte in mosses and liverworts. It is formed by germination of spores. The protonema develops a lateral bud which further gives rise to the leafy stage in mosses.

Protonema are composed of two cell types- chloronemata and caulonemata. **chloronemata**, which form upon germination, and **caulonemata**, which later differentiate from **chloronemata** and on which buds are formed, which then differentiate to gametophores.

in **mosses**, part of the gametophyte that develops from the spores (primary **protonema**) or from the rhizoids, stems, and leaves (**secondary protonema**). ... The rhizoids of a leafy gametophore when exposed to light in a moist atmosphere also form **secondary protonema**.



# USES

- A delicate system of capillary tubes allows the moss to absorb water like a sponge. It can then be squeezed out and used again.
- Dried moss catches fire easily and is therefore an excellent tinder material. However, because moss grows in wet, swampy areas, dried moss is hard to find in abundance, and it does not burn as long as some other more readily available tinder materials.
- The whole fresh plant is antiseptic. ... The **moss** is dried thoroughly before **use**. A tar extracted from the decaying **moss** is antiseptic and is seen as a valuable external **application** in the treatment of eczema, psoriasis, pruritus and many other forms of skin diseases.
- Compared to other bryophytes *Sphagnum* is certainly the moss of greatest importance to humans.
- In its natural **habitat**, sphagnum selectively absorbs certain ions and secretes others.
- The bogs in which it grows become acidic and **anaerobic** over **time**, and the **decomposition rate** by **bacteria** is particularly slow in these bogs. Organisms buried in sphagnum bogs remain well-preserved for a very long time.

Read more: [Moss - Importance To Humans - Sphagnum, Peat, Bogs, and Plant - JRank Articles https://science.jrank.org/pages/4460/Moss-Importance-humans.html#ixzz6jXZwrJZb](https://science.jrank.org/pages/4460/Moss-Importance-humans.html#ixzz6jXZwrJZb)

# Peat moss- uses

**Decayed, dried sphagnum moss has the name of peat or peat moss.** This is used as a **soil conditioner** which increases the soil's capacity to hold water and nutrients by increasing **capillary forces** and **cation exchange capacity** – uses that are particularly useful in gardening.

This is often necessary when dealing with very **sandy** soil, or plants that need increased or steady moisture content to flourish. A distinction is sometimes made between sphagnum moss, the live moss growing on top of a peat bog, and 'sphagnum peat moss' (North American usage) or 'sphagnum peat' (British usage), the latter being the slowly decaying matter underneath.

Dried sphagnum moss is used in northern **Arctic** regions as an **insulating** material.

Peat moss is used to dispose of the clarified liquid output (effluent) from **septic tanks** in areas that lack the proper conditions for ordinary disposal means. It is also used as an environmentally friendly alternative to **chlorine** in **swimming pool sanitation**. The moss inhibits the growth of **microbes** and reduces the need for chlorine in swimming pools.

- By Ragesoss - Own work, CC BY-SA 3.0, <https://commons.wikimedia.org/w/index.php?curid=4334841>
- **Peat moss soil amendment, made of partly decayed, dried sphagnum moss**





# Sphagnum moss vs. Peat moss

- **Peat moss** is harvested by collecting the dead moss debris from the bottom of the bogs and wetlands where the sphagnum moss grows. This means that this dead moss material is also mixed with other decayed plant and insect material, making it extremely rich in organic nutrients. In fact, the peat moss found at the bottom of bogs can be thousands of years old!
- Sphagnum moss is collected from still-living moss on the surface of bogs and wetlands.
- For general **soil amendment**, peat moss is the best choice. It can easily be found in larger bags and is less expensive. Besides being more cost-effective, the wide range of decayed matter in peat moss makes it a great soil amender for both potted plants and the garden.
- peat moss has a very acidic pH level while sphagnum moss has a neutral pH level.

# Uses.....

Anaerobic acidic sphagnum bogs have low rates of decay, and hence preserve plant fragments and pollen to allow reconstruction of past environments.

They even preserve human bodies for millennia; examples of these preserved specimens are [Tollund Man](#), [Haraldskær Woman](#), [Clonycavan Man](#) and [Lindow Man](#).

Such bogs can also preserve human hair and clothing, one of the most noteworthy examples being [Egtved Girl](#), [Denmark](#).

Because of the acidity of peat, however, bones are dissolved rather than preserved. These bogs have also been used to preserve food.

- By P199 - Own work, CC BY 2.5, <https://commons.wikimedia.org/w/index.php?curid=653184>
- **A large, protected *Sphagnum* bog near Ottawa, Ontario, Canada**



## Uses -

*Sphagnum* moss has also been used for centuries **as a dressing for wounds**, including through World War I.

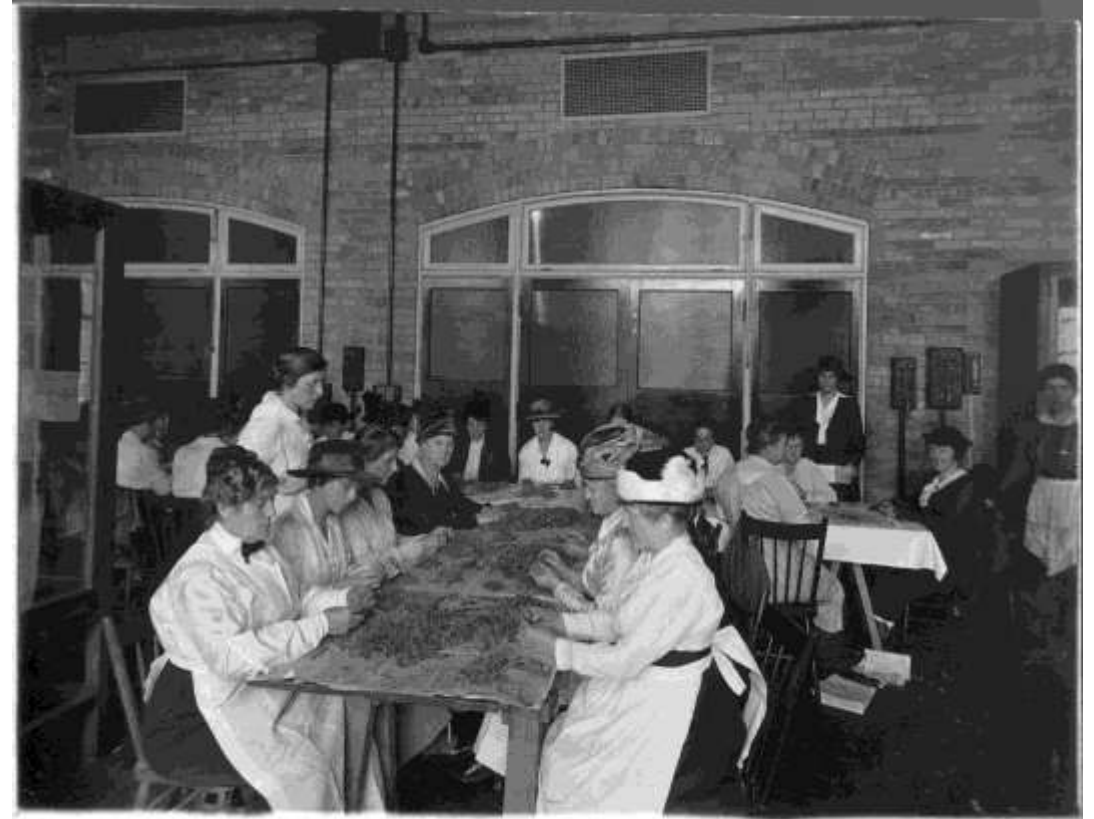
Since it is absorptive and extremely acidic, it inhibits growth of bacteria and fungi, so it is used for **shipping seeds and live plants**.

- **It is spongy in nature.** As a result of this they help in the packing of different types of material.

- **This type of plants are also used in the packing of some sensitive plants.** in addition to this it is also used in the growth of certain types of plants in in region where the soil is slightly higher in the pH value.

- They help in **retaining moisture** and helps the plant in the growth since adequate amount of moisture is required for the proper growth of plants

## Sphagnum moss wound dressings being made at the University of Toronto c. 1914



City of Toronto Archives, Fonds 1244, Item 873A

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