

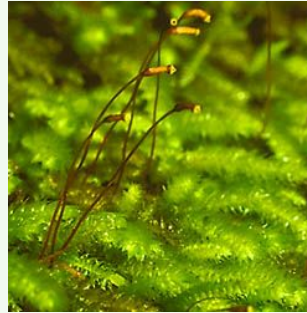
*Lab 12: Bryophytes :
Mosses and Liverworts
(and hornworts)*

Bryophytes

- Plants without well developed vascular systems.
- Sporophyte (diploid generation) is attached to and dependent on the gametophyte for the entire life cycle.
- The gametophyte is the leafy part. The sporophyte is the spore bearing part.
- Used to be one phylum (Bryophyta). Now three: Bryophyta (mosses), Hepatophyta (liverworts), and Anthocerotophyta (hornworts)

Comparison of Moss and Liverwort Characteristics

Prepared by : Barbara Crandall-Stotler, Department of Plant Biology, Southern Illinois University, Carbondale, IL 62901-6509



Mosses: Class Bryophyta

- Gametophytes are leafy.
- Sporophytes have capsules on the end of stalks (setae).



Leafy liverworts: Class Jungermanniidae

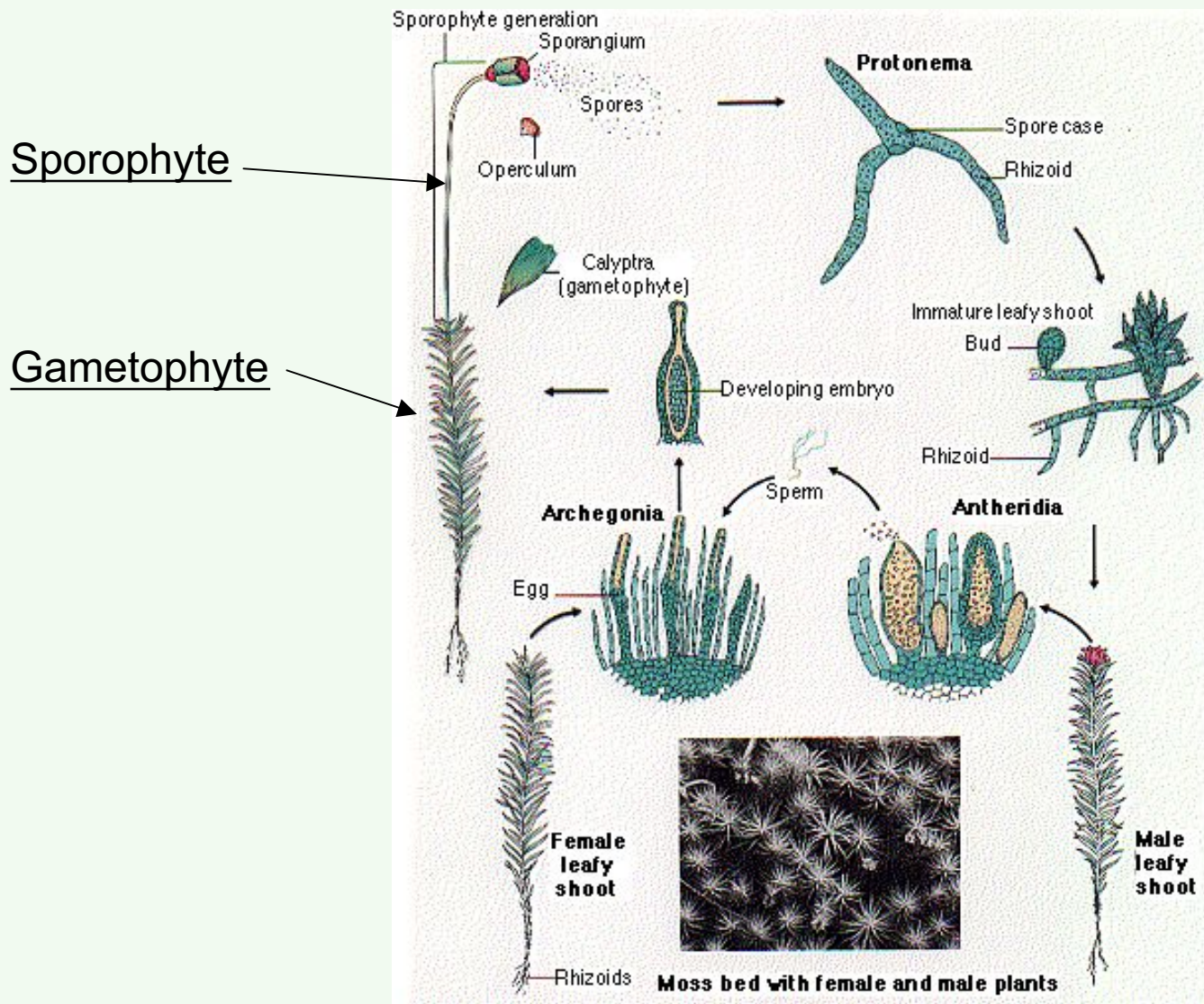
- Gametophytes have leaves without costa (midvein)
- Leaves inserted at angle to stem.
- Leaves in 2-3 rows.
- Sporophyte has a translucent stalk, capsule black and egg-shaped



Thalloid liverworts: Class Marchantiophyta

- Flat thallus
- Umbrella-shaped structure on gametophyte is a *carpocephalum*.
- Sporophyte is hidden under the carpocephallum.

Moss life cycle



Acrocarpous vs. pleurocarpous mosses



Polytrichum commune

Acrocarpus:

- erect growth form
- non branching
- terminal archegonia and fruiting bodies

Pleurocarpus:










- branched morphology
- fruiting bodies in axils of lateral branches



Hyocomium armoricum

What to Look For When Identifying Mosses





Leaf

- shape**—broad  narrow 
or thread-like 
- edges**—toothed or toothless, flat,
rolled upward  or
rolled backwards 
- midrib**—single , double  or none
- leaf bases**—stop abruptly at stem  or
continue down stem like wings 


Capsule covering (calyptra)

- surface**—hairy  or smooth

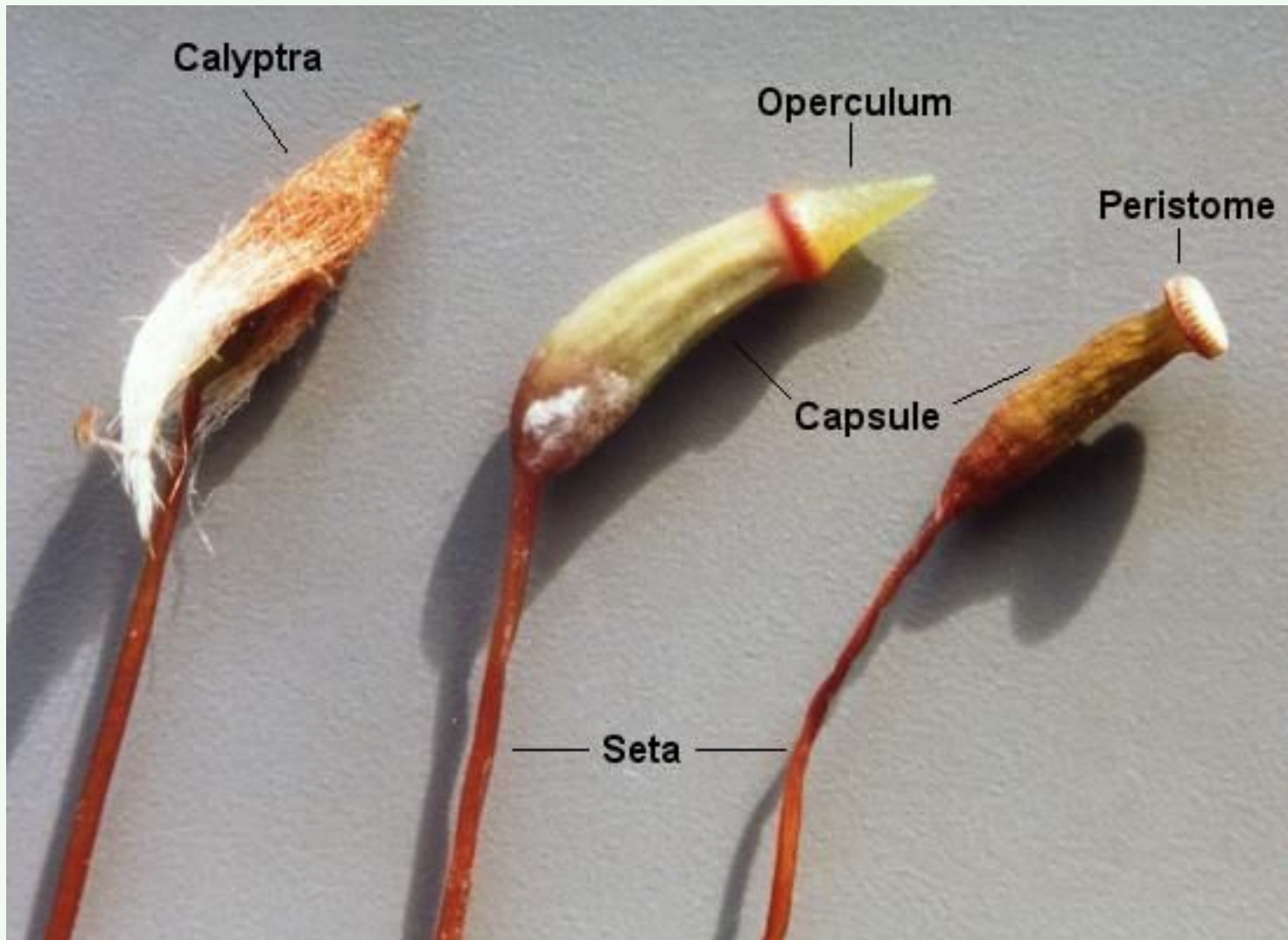
Capsule

- shape**—straight , curved 
- symmetrical, asymmetrical,
with small bump at base 
- contracted under mouth when dry
- orientation**—erect, inclined or hanging
- surface**—smooth or ribbed 

Capsule stalk

- shape**—long or short;
- surface**—smooth or rough 
- colour**—red, straw, green, etc.

Moss Capsules:



<http://www.hiddenforest.co.nz/bryophytes/mosses/photos/intro06.htm>

Campylium stellatum (Hedw.) Lindb.

Family: Amblystegiaceae

Common Name:
Star Campylium Moss

- Pleurocarpus.
- Has bristly appearance of bottle-brush.
- Single stem and squarrose (at right angles to the stem) somewhat contorted (when dry) leaves.
- Occurs in wet calcareous fens.



Plants of the Western Boreal Forest & Aspen Parkland,
by Johnson and Kershaw

Drepanocladus uncinatus (Hedw.) Warnst. (= *Sanonia uncinata*)

Family: Amblystegiaceae

Common Name:
Sanonia Moss or
Sickle Moss



<http://www.borealforest.org>



Plants of the Western Boreal Forest & Aspen Parkland,
by Johnson and Kershaw

- Falcate secund leaves (turned to one side and strongly curved).
- Pleurocarpus.
- Plicate (pleated lengthwise) leaves with drawn out fine point.
- Often in pure mats, having a shiny golden color (in dry situations).
- Often found in drier areas, calcareous soils.

Scorpidium scorpioides (Hedw.) Limpr.

Family: Amblystegiaceae

Common Name:
Scorpidium Moss



<http://home.clara.net/adhale/bryos/sscorpio.htm>



Baldellia ranunculoides, *Scorpidium scorpioides*,
Potamogeton gramineus, *Eleocharis multicaulis*,
Eleogiton fluitans, *Littorella uniflora*.

<http://users.bathspa.ac.uk/watd2/veglis.html>

- Grows in submerged aquatic calcareous habitats.
- Pleurocarpus.
- Flaccate secund leaves.
- Very dark colored, often black leaves.
- Plants can be very large.
- Distinguished from *Drepanocladus* by lack of costa (central midvein of leaves)

Tomentypnum nitens

Family: Brachytheciaceae

Common Name:

Tomentypnum Moss



Tomentypnum nitens-*Trichophorum caespitosum* community.



<http://www.floraislands.is/MOSAR/tomennit1m.jpg>

- Common most abundant moss in moist fens, nonacidic soils.
- Pleurocarpus
- Soft appearance with golden color.
- Leaf strongly plicate and acuminate (sharply pointed).
- Stems covered in reddish brown tomentum.

Photo from <http://www.geobotany.uaf.edu>

Aulacomnium palustre (Hedw.) Schwaegr.

Family: Aulacomniaceae

Common Name:
Aulacomnium Moss



Photo and Description from <http://www.borealforest.org>



- <http://www.geog.ubc.ca/richmond/city/bryophytesphotos.html>
- Often with bright yellow green leaves.
- Pleurocarpus, erect, upright branches
- Leaves sharp pointed, serrulate (minutely regularly toothed) at the tip.
- Leaves twist when dry.
- Reddish brown tomentum on stem.
- Occurs in neutral to acidic habitats, moist sites, often mixed with

Aulacomnium turgidum (Wahlenb.) Schwaegr

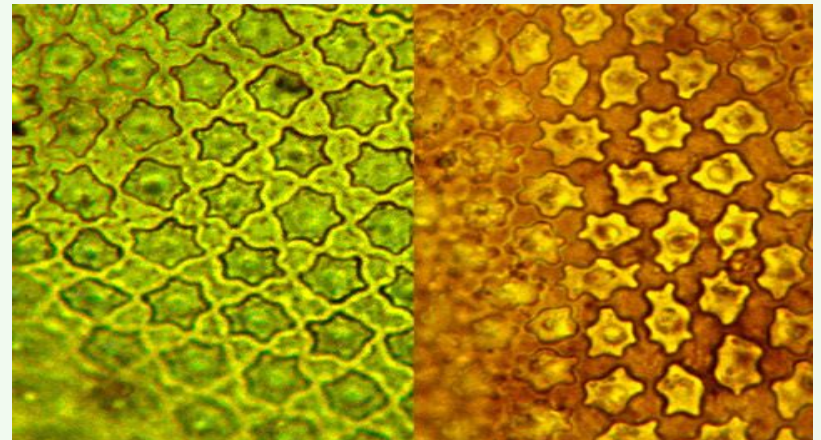
Family: Aulacomniaceae

Common Name:

Turgid Aulacomnium Moss



- Robust plants with yellow green dull color.
- Pleurocarpus, upright branches, but sometimes unbranched.
- Obtuse, concave, oblong-ovate leaves
- Leaves strongly imbricate (overlapping as in shingles).
- Very common in moist to drier calcareous habitats often mixed with *Rhytidium rugosum*, *Hylocomium splendens*.
- Leaf cells strongly sinuous, often star-shaped.



Photos from <http://www.nrm.se/kbo/krypt/aulatur/aulatur3.html.se>

Dicranum scoparium Hedw.

Family: Dicranaceae

Common Name:
Brook Moss



<http://www.borealforest.org>

- *Dicranums* arcrocarpus mosses.
- Grow in tufts or loose mats.
- Leaves erect, falcate secund
- Leaves lanceolate to ovate lanceolate, toothed on the upper margins.
- Grows in moist acidic habitats.



<http://www.geog.ubc.ca/richmond/city/bryophytesphotos.html>

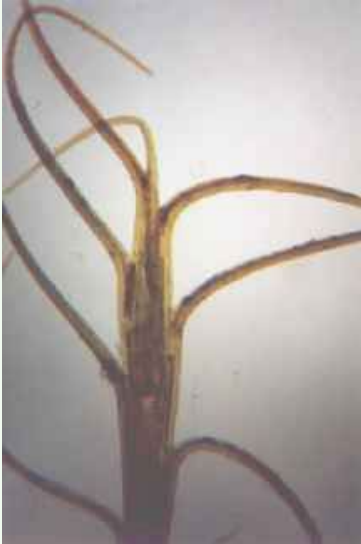


<http://sunsite.ee/taimed/sammal/hkaksh.htm>

Distichium capillaceum (Hedw.) B.S.G.

Family: Ditrichaceae

Common Name:
Distichium Moss



www.ijon.de/moose/geni/distichium.html

- Acrocarpus.
- Distichous leaves (arranged in two rows on opposite sides of the stem) that sheath the stem (like and Iris).
- Capsule is erect cylindrical.
- Common in moist to dry calcareous habitats



<http://www.floraislands.is/MOSAR/disticap1m.jpg>

Ditrichum flexicaule (Schwaegr.) Hampe

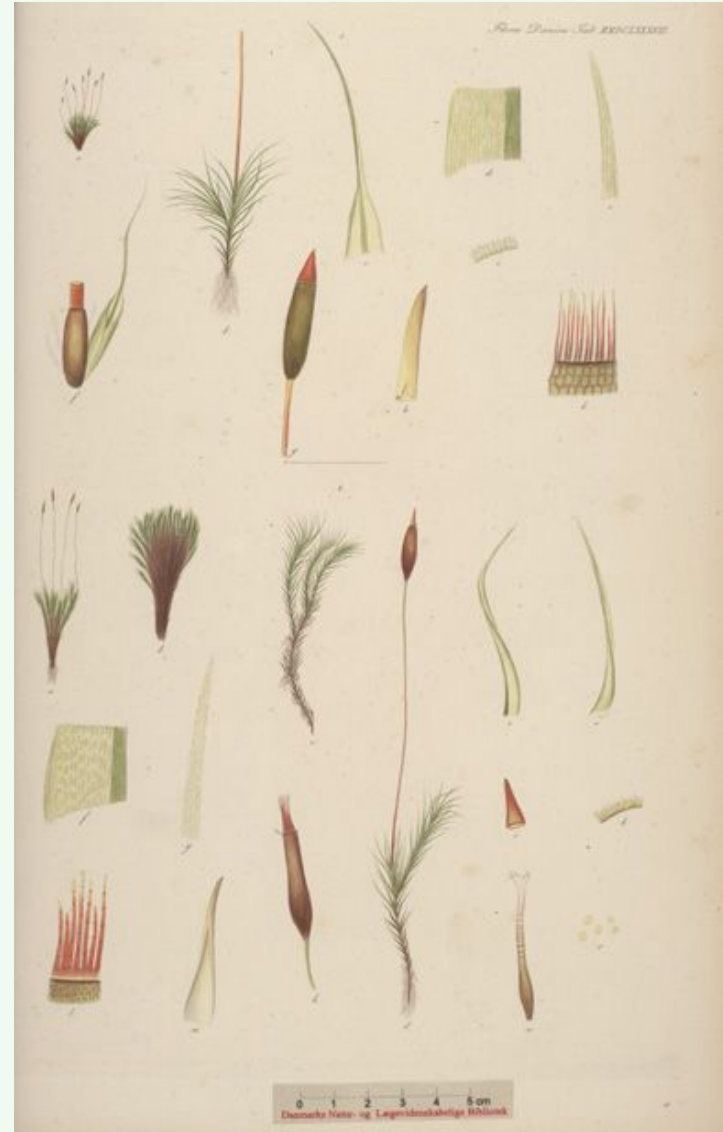
Family: Ditrichaceae

Common Name:
Ditrichum Moss



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by Johnson and Kershaw

- Common in moist to dry calcaeous habitats.
- Slender upright flexuous leaves from all sides of the stem.
- Often has a dark “Army-green” appearance. often blackish bases to stems.
- Often found with *Distichium*, but does not have distichous leaves.



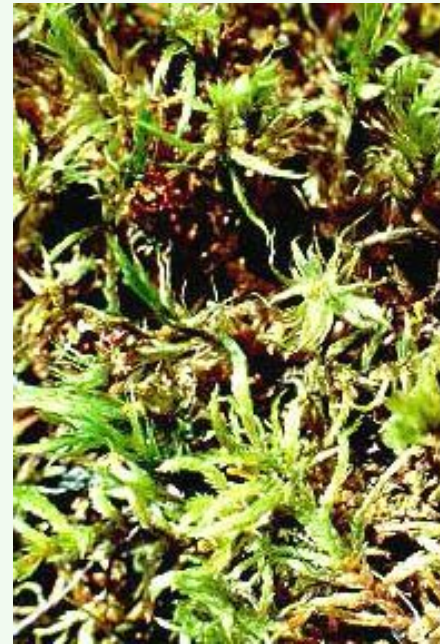
<http://www.pictures.dnlib.dk/FloraDanica>

Pleurozium schreberi (Brid.) Mitt.

Family: Entodontaceae

Common Name:

Big Red Stem Moss or
Schreber's Moss



<http://www.borealforest.org>

- Common pleurocarpus moss in forests.
- Bright red stem when wet.
- Irregularly pinnately branched.
- Leaves are shiny yellow-green, bluntish.
- Often occurs with and can be confused with *Hylocomium splendens* (next slide), which is more regularly pinnately branched, and has paraphyllia, and has stair-step branching.

<http://sunsite.ee/taimed/sammal/palus.htm>

Hylocomium splendens (Hedw.) B.S.G.

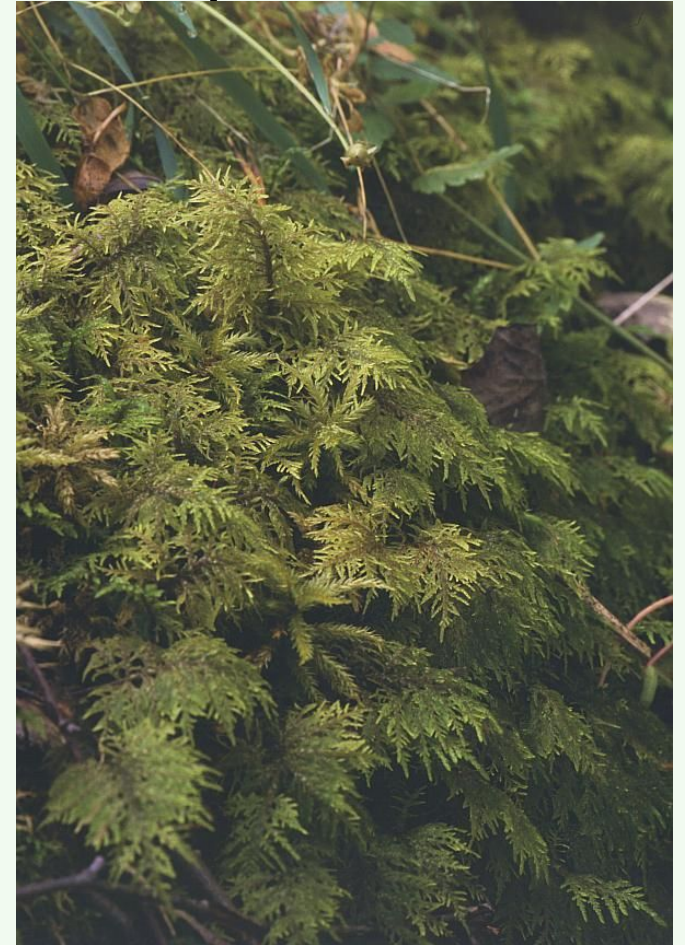
Family: Hylocomiaceae

Common Name:
Stair-step Moss



<http://www.borealforest.org>

- Feather moss.
- Stair-step branching formed from annual growth increments. (Stair-step branching generally does occur in the tundra).
- Regularly twice pinnately branched.
- Numerous paraphyllia (tiny scales or leaf-like structures) on the stems.
- Most common moss in the boreal forest.



<http://www.nic.funet.fi/pub/sci/bio/life/plants/bryophyta/bryopsida/bryales/hylocomiaceae/hylocomium/splendens-1x.jpg>

Rhytidiadelphus triquetrus (Hedw.) Warnst.

Family: Rhytidiaceae

Common Name: Electrified cat's tail moss

- Robust, coarse, irregularly branched plants.
- Upper tuft of leaves more “ruffled” than the lower leaves.
- Common boreal forest moss.



<http://www.borealforest.org>



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<http://www.floraislands.is/mosamynd.htm>

Polytrichum strictum Brid.

Family: Polytrichaceae

Common Name:
Polytrichum Moss

- Polytrichaceae have vascular bundles.
- *Polytrichum* leaves have lamellae (can be viewed with hand lens)
- *P. strictum* has reddish brown leaf points.
- Entire margins to the leaves.
- Whitish gray rhizoids on lower stem and “root” (separates this from *P. juniperinum*).

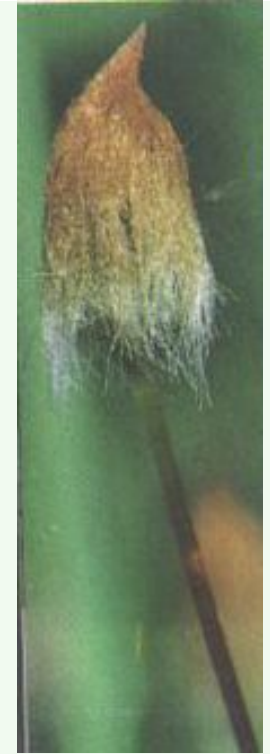


Photo by Ilkka Korpela

Cross section of *Polytrichum* leaf.

<http://www.botany.ubc.ca/bryophyte/3320.jpg>

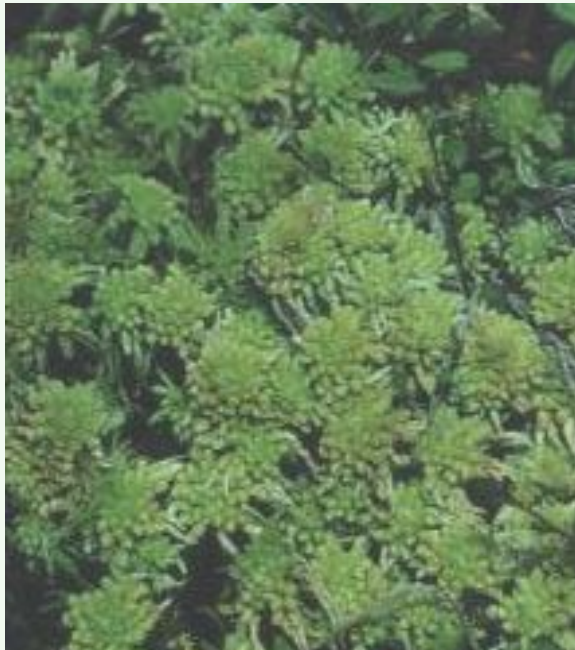


Above photos from *Plants of the Western Boreal Forest & Aspen Parkland*, by Johnson and Kershaw

Sphagnum angustifolium (Russ.) Tolf.

Family: Sphagnaceae

Common Name:
Sphagnum



Plants of the Western Boreal Forest & Aspen Parkland,
by Johnson and Kershaw

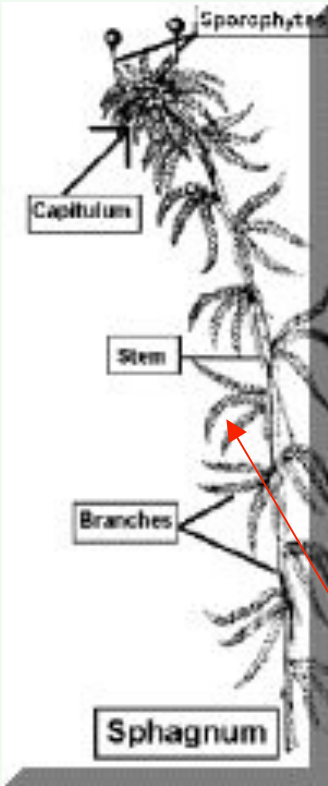


<http://www.botanik.univie.ac.at/pershome/temsche/morpho.html>



www.bioimages.org.uk

Sphagnum characteristics



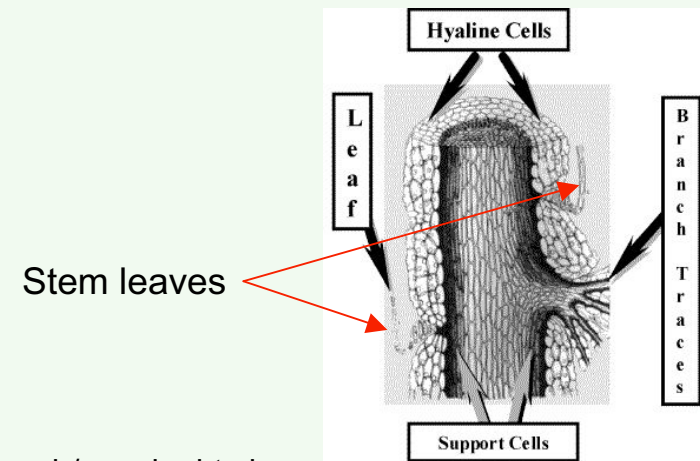
Capitulum (Sphagnum head)

Branches



Branch leaves

- Consist of a main stem, branches, and head (capitulum)
- Nature of stem leaves is a primary diagnostic character.
- Branch leaves are distinct from stem leaves.



Sphagnum warnstorffii Russ.

Family: Sphagnaceae

Common Name: Warnstorff's sphagnum

- Red, often wine color, mixed with green leaves.
- Branch leaves are five-ranked (aligned in rows).
- Grows in more calcareous habitats than other Sphagna.



<http://www.borealforest.org>



<http://www.floraislands.is/mosamynd.htm>

Splachnum luteum

Family: Splachnaceae

Common Name: Yellow Moosedung Moss

- Bright yellow skirts of capsule bases.
- Splachnaceae are mostly nitrogeous dung mosses that grow on scat and carcasses of small animals.



<http://www.personal.psu.edu/users/e/j/ejm220/Webpage/Features%20shared.htm>



<http://www.nrm.se/kbo/krypt/parasoll/parasoll3.html.se>

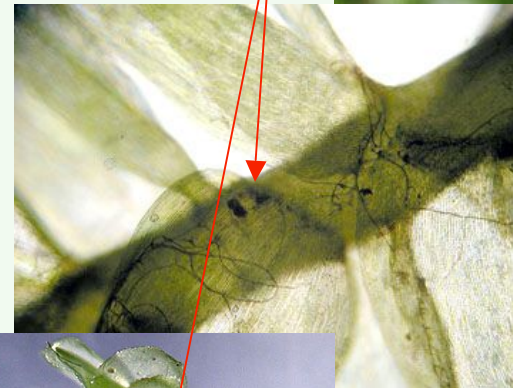
Characteristics of liverworts

Leaves inserted at angles to stem.

Two major groups:

Leafy liverworts

- Look a lot like mosses except for insertion of leaves and arrangement in two or three rows, inserted at angles to the stem.
- Leaf arrangement is critical to identification.



Thalloid liverworts:

- Look more like foliose lichens. “Flat green thallus” with no stems or leaves.



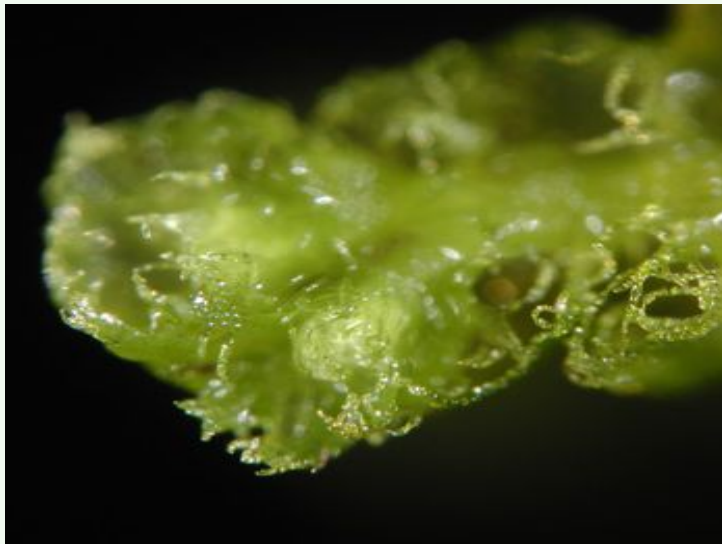
UBC Botany 321 website:
<http://www.botany.ubc.ca/bryophyte/liverwortintro.html>

Ptilidium ciliare

Family: Ptilidiaceae

Common Name: NA

- Example of a leafy liverwort.
- Leaves have ciliated margins.
- Concave leaves look inflated.
- Common in moist tundra.



<http://www.floraislands.is/MOSAR/ptilicil1m.jpg>

http://dommeldal.jnm.nl/illus/verslag05_1.jpg

<http://www.uni-koeln.de/math-nat-fak/botanik/lehre/nebenfach2001/moose/ptilidium/ptilidium.htm>

Marchantia polymorpha L. (slide 1 / 2)

Family: Marchantiaceae

Common Name: NA

- Large flat thalloid liverwort.
- Common on burned areas. Common weed.
- Unisexual. Male plants have lobed discs. Females are “deely boppers” (finger-like lobes extending out from the main stalk).



http://www.nps.gov/olymp/crypto/photo/V_MAPO_sex.jpg

Male gametophyte

Female gametophyte

http://www.hkflora.com/v2/projects/stud_proj03/img_medium/Marchantia_polymorpha.jpg

Marchantia polymorpha L. (slide 2 / 2)



Male gametophytes:

<http://www.boga.ruhr-uni-bochum.de/html/Marchantia.polymorpha.ja4.jpg>