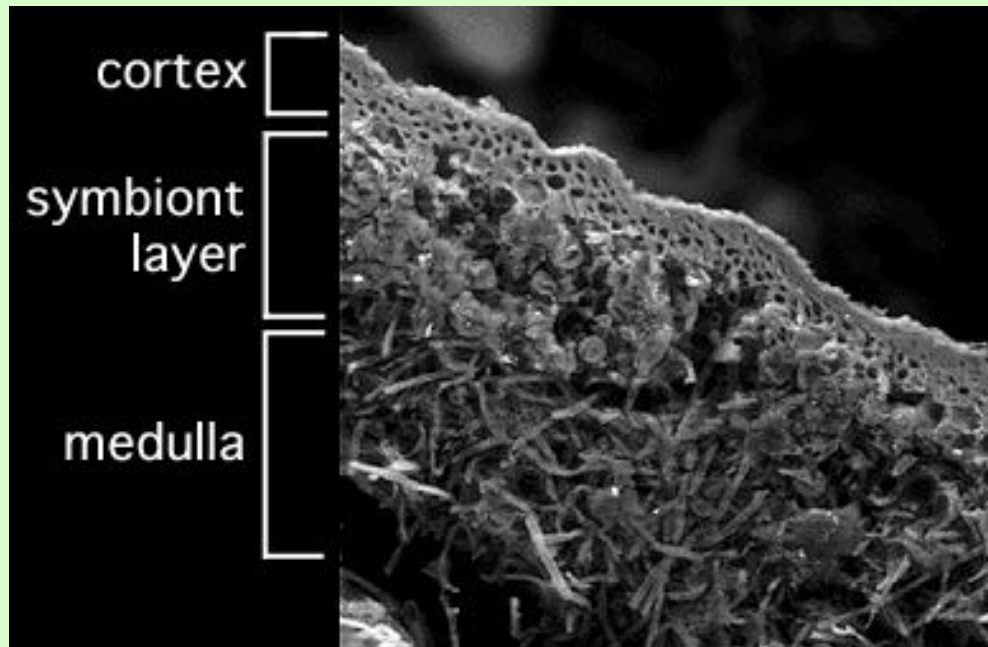


# *Lab 13: Lichens*

All lichens have similar internal morphology. Most of the lichen, the cortex and the filaments of the medulla, are composed of the fungal partner in the symbiosis.

The symbiont layer has algal partners. Lichens are named after the fungal component.

Foliose lichens have a second cortex below the medulla.



Courtesy of UC Berkeley: Ben Waggoner, [www.ucmp.berkeley.edu/fungi/lichens/lichenmm.html](http://www.ucmp.berkeley.edu/fungi/lichens/lichenmm.html)

## *Lichen growth forms:*

**CRUSTOSE** lichens form crusts that are so tightly attached to the rocks, trees, sidewalks, or soils they grow on that they can't be removed without damaging the substrate.



**FOLIOSE** lichens are somewhat leaf-like, composed of **lobes**. They are relatively loosely attached to their substrates, usually by means of **rhizines**). Their lobes have upper and lower sides and usually grow more-or-less parallel to the substrate. **Umbilicate** lichens are attached to their substrate only at a central point.



**FRUTICOSE** lichens are the most three-dimensional. They're usually round in cross section (**terete**), and most are branched. They can be like little shrubs growing upward, or they can hang down in long strands.



**SQUAMULOSE** lichens have scale-like lobes called **squamules** that are usually small and overlapping. The squamules of are edged in white. These are sometimes grouped with the foliose lichens.



Photos:  
<http://www.lichen.com/bigpix/Aevolutum.html>

# Two orders of lichens

- **Ascomycotina** (Ascomycetes): By far the most common. Fruiting bodies of most in this group are called *apothecia*.



- **Basidiomycotina** (Basidiomycetes): Have fruiting bodies like mushrooms.



Photos from *Lichens of North America*. I.M.Brodo et al. 2001. Yale Univ. Press.  
<http://www.lichen.com/book.html>

*Multiclavula corynoides*

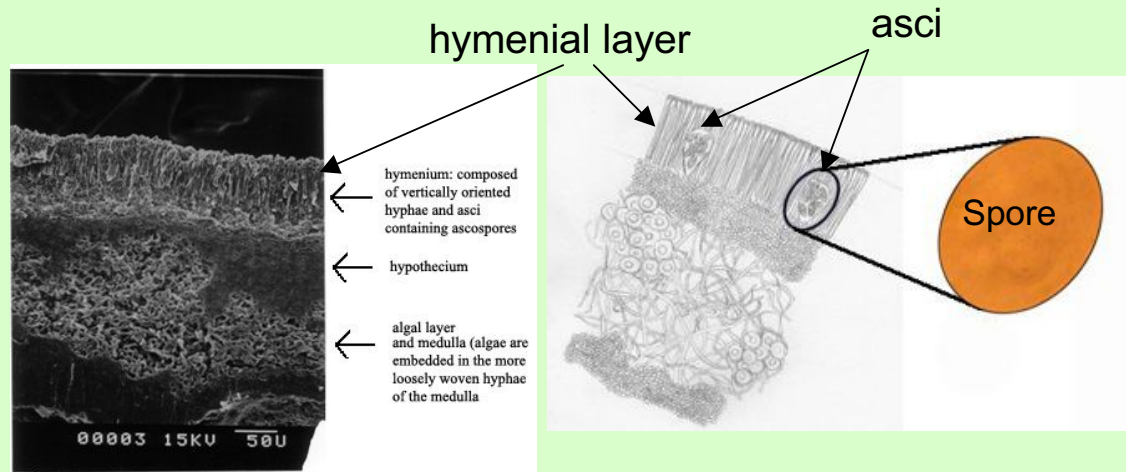


# Morphology of the apothecium



Apothecia of *Caloplaca coralloides*

<http://www.mbari.org/staff/conn/botany/lichens/morphology.htm>



- Lichens reproduce sexually. The fruiting bodies containing the spores are called *apothecia*.
- A cross section of an apothecium is shown above.
- The spores are contained in small sacs called *asci* that are located in the hymenial layer of the apothecia.
- Apothecia are usually 0.4-2 mm in diameter.
- The wall of the apothecium is the *exiple*.
- Once the spores are released from the apothecium, they need to encounter an appropriate algal cell.
- Identifying some lichens to species requires examination of the size and character of the spores.

# *Haematomma lapponicum* Raes.

**Family:** Lecanoraceae

**Common Name:** Bloodspot lichen

- Yellow crustose lichen
- Blood-red apothecia
- Grows on rocks (saxicolous)



<http://waynesword.palomar.edu>

# *Lecanora epibryon* (Ach.) Ach.

**Family:** Lecanoraceae

**Common Name:** Rim Lichen

- White crustose lichen
- Lecanorine (rimmed) apothecia
- Centers of apothecia black, gray, or brown
- Grows on soil (terricolous) or humus



<http://www.alm-neu.de>



<http://www.alm-neu.de>



# *Rhizocarpon geographicum* L. DC.

**Family:** Lecideaceae

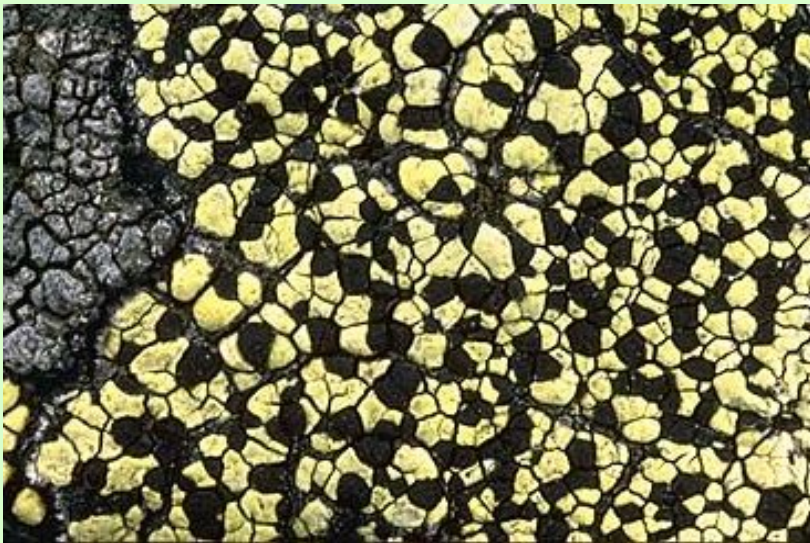
**Common Name:** Map Lichen



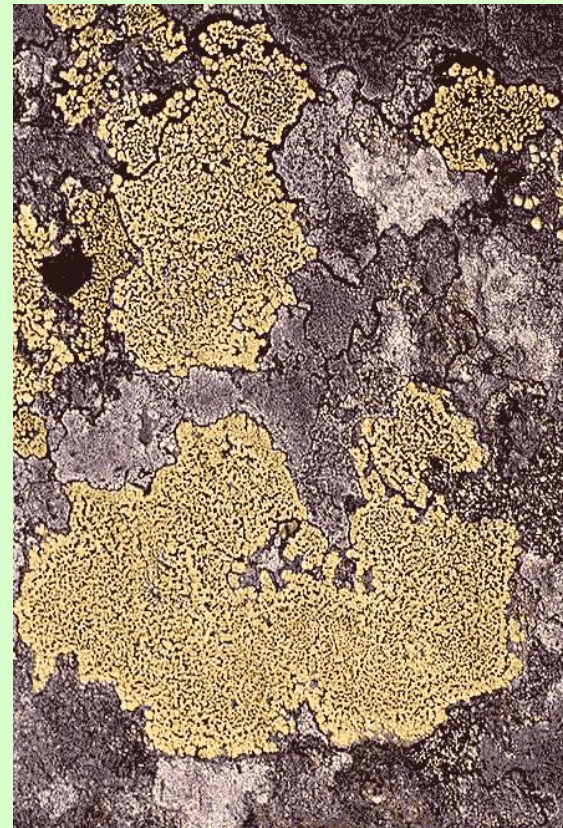
Courtesy Internet Scuola

<http://www.enn.com/news/>

- Thallus bright yellow to greenish yellow
- Black hypothallus (margin around thallus)
- Black apothecia
- Grows on rocks (saxicolous)
- Used in dating glacial moraines



<http://www.lichen.com>



[http://www.saxifraga.de/foto\\_div/](http://www.saxifraga.de/foto_div/)



# *Nephroma arctica* (L.) Torss.

**Family:** Nephromataceae

**Common Name:**

Arctic Kidney Lichen

- Large foliose lichen.
- Thallus bright yellow-green (chartreuse) *when wet*.
- Underside of thallus smooth.
- Large brown apothecia.
- Grows in acidic tundra and forests on humus and in mosses.
- Has cephalodia toward center of thallus (dark greenish colored spots with blue green algae).



Photo from *Lichens of North America* by Brodo, Sharnoff and Sharnoff



# *Peltigera aphthosa* (L.) Willd.

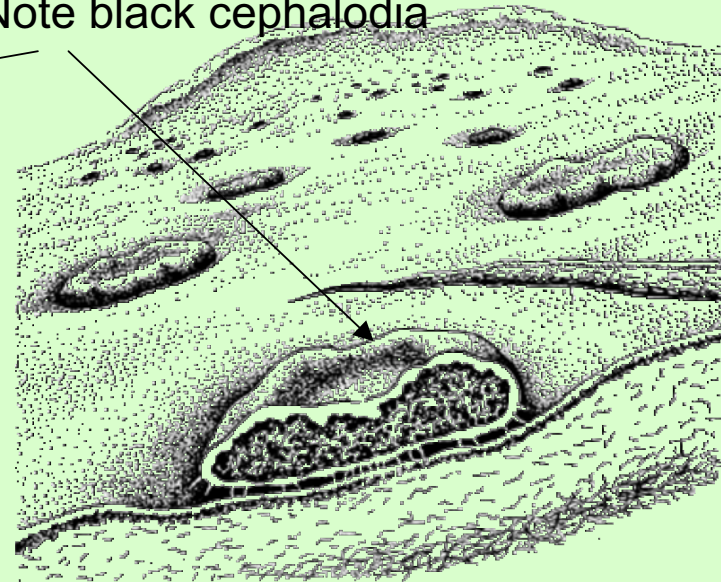
**Family:** Peltigeraceae

**Common Name:** Felt Lichen

- Foliose lichen growing on humus and moss.
- Pale to apple green when moist, gray when dry.
- Black cephalodia over entire upper thallus.
- Underside with white tomentum.



Note black cephalodia



<http://www.fs.fed.us/r6/aq/lichen>

[http://www.toyen.uio.no/botanisk/lav/Photo\\_Gallery](http://www.toyen.uio.no/botanisk/lav/Photo_Gallery)

# *Peltigera canina* (L.) Willd.

**Family:** Peltigeraceae

**Common Name:** Dog lichen

- Gray foliose lichen growing on humus and moss. Does not turn green when moistened.
- Underside with hair-like *rhizinae* and veins.
- Upper side of thallus smooth or with appressed tomentum.



<http://helios.bto.ed.ac.uk/bto/microbes>



Underside of thallus showing rhizinae and veins.

<http://www.fs.fed.us/r6/aq/lichen>



# *Umbilicaria hyperborea* (Ach.) Hoffm.

**Family:** Umbilicariaceae

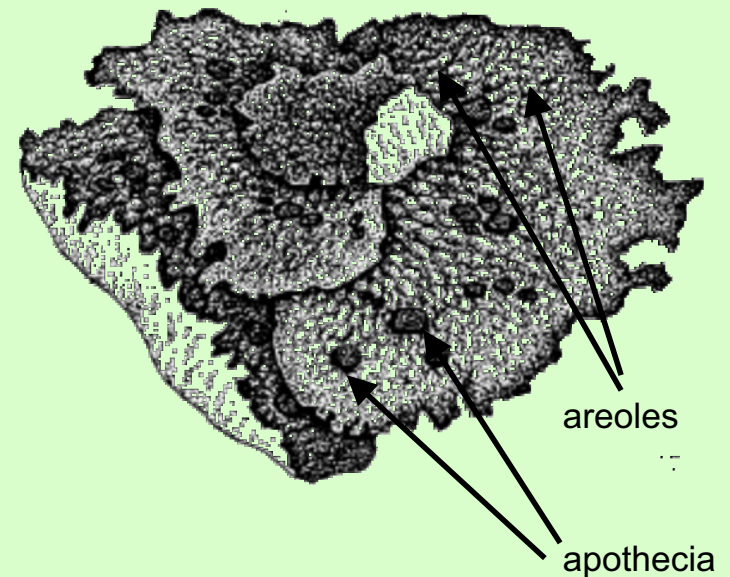
**Common Name:** Navel Lichen



Copyright: Hörður Kristinsson 2000

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

- All *Umbilicaria* are umbilicate (attached to substrate at one point (the umbilicus)).
- Black thallus.
- Thallus covered in black warts (*areoles*, which are much smaller than the black apothecia).



<http://www.fs.fed.us/r6/aq/lichen>

# *Hypogymnia subobscura* (Nyl.) Raes.

**Family:** Parmeliaceae

**Common Name:** Heath tube  
Lichen

- Brown and gray thallus.
- Inflated lobes of thallus.
- Grows on soil.



*Hypogymnia austerodes*

Photo from *Lichens of North America* by Brodo, Sharnoff and Sharnoff



# *Cladina mitis* (Sandst.) Hustich

**Family:** Cladoniaceae

**Common Name:** Reindeer Lichen

Shrubby, highly branched.

Ultimate branches of **podetia** (vertical branching stalks) are not turned in one direction as in *C. arbuscula*.

Light yellow color.

PD- chemical test.

Difficult to distinguish from *C. arbuscula* without chemical test.



Photo from *Lichens of North America* by Brodo, Sharnoff and Sharnoff



# *Cladina rangiferina* (L.) Nyl.

**Family:** Cladoniaceae

**Common Name:** Greygreen Reindeer Lichen

- Gray color.
- Looks much like *C. mitis* otherwise.
- Podetia tips “combed” to one side (sometimes).



<http://www.ars.usda.gov>



Photo from *Lichens of North America* by Brodo, Sharnoff and Sharnoff



# *Cladina stellaris* (Opiz) Brodo

**Family:** Cladoniaceae

**Common Name:** Star-tipped Reindeer Lichen

Pale yellow.

Rounded dense heads.

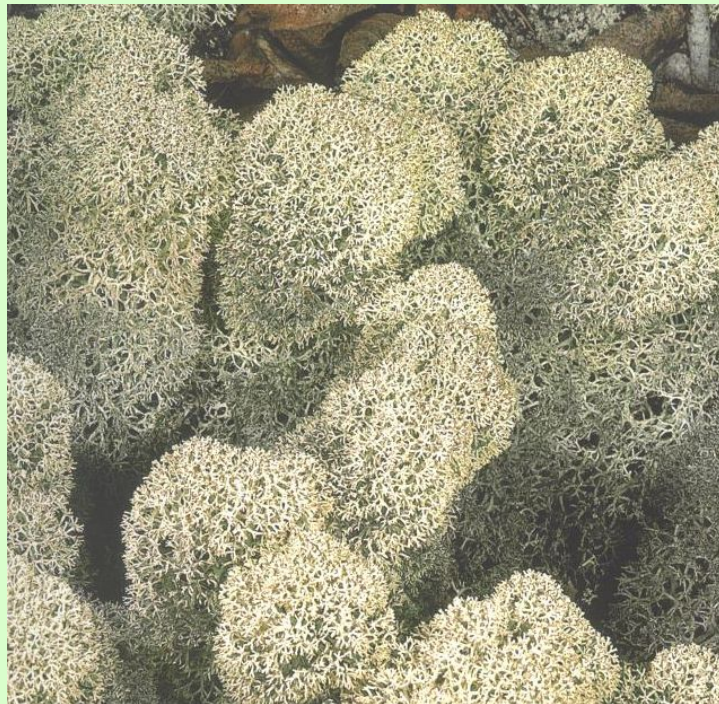


Photo from *Lichens of North America* by Brodo, Sharnoff and Sharnoff



<http://www.uku.fi/~holopain>

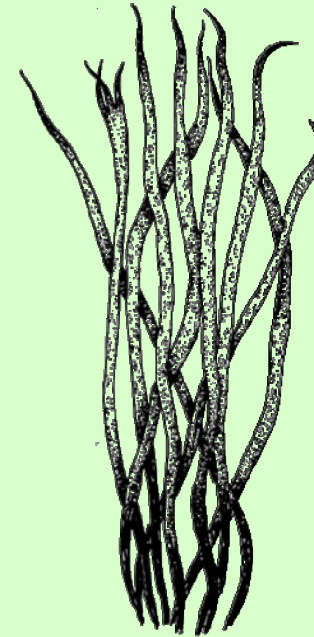
# *Cladonia gracilis* (L.) Willd.

**Family:** Cladoniaceae      **Common Name:** Smooth cladonia

- Highly variable.
- Common form has long green (becoming brown in the sun) podetia (vertical stalks)
- Smooth cortex (no soredia)
- Some podetia have cups that are entirely closed (no hole in the base of the cup)



[http://www.toyen.uio.no/botanisk/lav/Photo\\_Gallery](http://www.toyen.uio.no/botanisk/lav/Photo_Gallery)



<http://www.fs.fed.us/r6/aq/lichen>

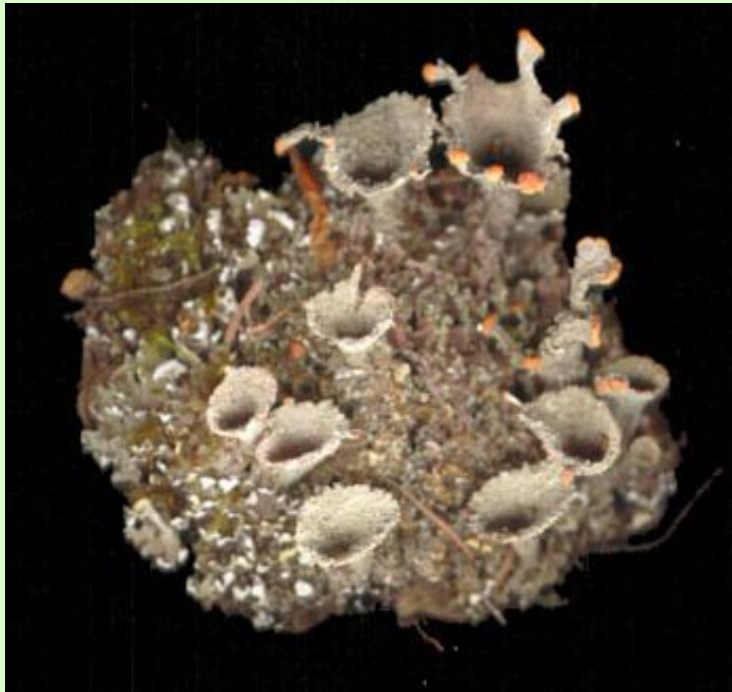


# *Cladonia pyxidata* (L.) Hoffm.

**Family:** Cladoniaceae

**Common Name:** Cup Lichen

- Gray to greenish thallus.
- Goblet-shaped podetia, less than 3 cm tall.
- Flattened areoles or squamules inside the cups and on the outside of the podetia.



<http://www.lichens.biz>



<http://www.fs.fed.us/r6/aq/lichen>

# *Bryocaulon divergens* (Ach). Karnef.

**Family:** Parmeliaceae

**Common Name:**  
Heather foxhair lichen

- Shiny thallus.
- Orange brown thallus.
- Some depressions in the thallus.
- Bushy, highly branched.





# *Cetraria cucullata* (Bell.) Ach. (=*Flavocetraria cucullata*)

**Family:** Parmeliaceae

**Common Name:** NA

- Cucullate (rolled inward) thallus, ruffled at the margin, often curving back at the tips.
- Light yellow, often with orange-red base.



Photo from *Lichens of North America* by Brodo, Sharnoff and Sharnoff



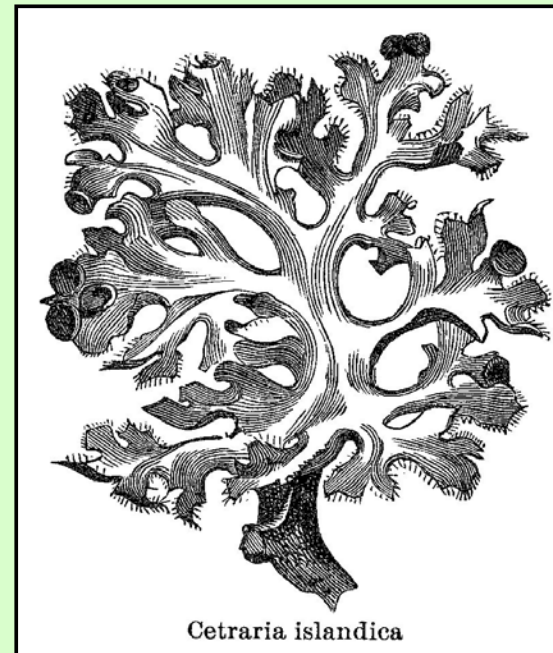
<http://www.lichens.biz>

# *Cetraria islandica* (L.) Ach.

**Family:** Parmeliaceae

**Common Name:** NA

- Brown thallus, flat to rolled.
- Spines at the tips of the thalli (The projections have dark pycnidia (globular or flask shaped body containing conidia) at the tip).
- White pseudocyphyllae dot the lower surface of the lobes, often forming white lines along the margins.



<http://www.lichens.biz>

[www.toyen.uio.no/.../  
Photo\\_Gallery/PG\\_index.html](http://www.toyen.uio.no/.../Photo_Gallery/PG_index.html)

<http://www.swsbm.com/illustrations>



# *Cetraria nivalis* (L.) Ach. (= *Flavocetraria nivalis*)

**Family:** Parmeliaceae

**Common Name:** NA

Superficially resembles *C. cucullata* except the thallus is flatter with indentations, not curled inward.



<http://www.bioimages.org.uk/>

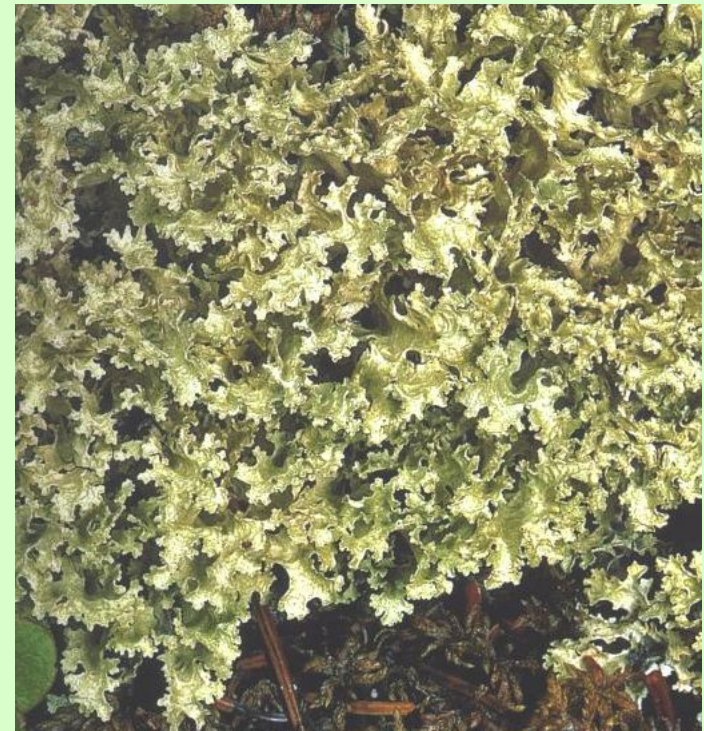


Photo from *Lichens of North America* by Brodo, Sharnoff and Sharnoff

# *Thamnolia subuliformis* (Ehrh.) W. Culb.

**Family:** Pertusariaceae

**Common Name:** Whiteworm Lichen



<http://home.hiroshima-u.ac.jp/lichen/jiman/thamnolia.htm>



<http://www.lichen.com/animals.html>



<http://www.fs.fed.us/r6/aq/lichen>



# *Sphaerophorus globosus* (Muell. Arg.) Zahlbr.

**Family:** Sphaerophoraceae

**Common Name:** Globe Ball Lichen

- Thallus orange brown, shiny.
- Stout main branch with many fragile dichotomously divided branches.
- Often the tips of the branches break to expose white medulla.



[www.floraislands.is/fletmynd.htm](http://www.floraislands.is/fletmynd.htm)



[http://www.toyen.uio.no/botanisk/lav/Photo\\_Gallery](http://www.toyen.uio.no/botanisk/lav/Photo_Gallery)



# *Alectoria ochroleuca* (Hoffm.) Mass.

**Family:** Usneaceae

- Hair-like, finely divided shrubby thallus.
- Light yellow-green with the tips darkened bluish-green to black.

**Common Name:** Witch's Hair



[http://www.toyen.uio.no/botanisk/lav/Photo\\_Gallery](http://www.toyen.uio.no/botanisk/lav/Photo_Gallery)



# *Dactylina arctica* (Hook.) Nyl.

**Family:** Usneaceae

**Common Name:** Arctic Finger lichen

- Finger-like thallus.
- Hollow, thin walled.
- Pale yellow, brownish.



<http://home.hiroshima-u.ac.jp>



<http://www.lichen.com>

# *Alectoria nigricans* (Ach.) Nyl.

**Family:** Usneaceae

**Common Name:** Gray Witch's Hair

Shrubby thallus.

Light colored main thallus with black tips.

Dull (not shiny) thallus



[http://www.toyen.uio.no/botanisk/lav/Photo\\_Gallery](http://www.toyen.uio.no/botanisk/lav/Photo_Gallery)



[www.floraislands.is/lichens.htm](http://www.floraislands.is/lichens.htm)