



**Notable Nature
Along the Pasadena Ski
and Nature Park Trails**

XV: Lichens

Prepared for the Pasadena Ski and Nature Park

By

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Hundreds of lichens inhabit the forests, barrens and peatlands of Newfoundland and Labrador growing on trees, rocks and soil. In nature they are important in soil building, soil stabilization, addition of soil nitrogen, food and shelter for invertebrates eaten by birds, nesting materials for birds, and food for small mammals and caribou. Humans have also utilized lichens as decorations, as a food source, as a source of dyes for cloth and wool, for monitoring air pollution, and for medical purposes. A number of lichens produce chemical substances which have antibiotic properties.

A good time to observe lichens is in the late fall season after some heavy rains, but they can be seen in all seasons. This brief program will feature only some of the more common or noticeable lichens seen along the PSNP trails, and a few others, to introduce this fascinating group. A hand lens (magnifying glass/loupe) is useful, but not essential for viewing lichens.

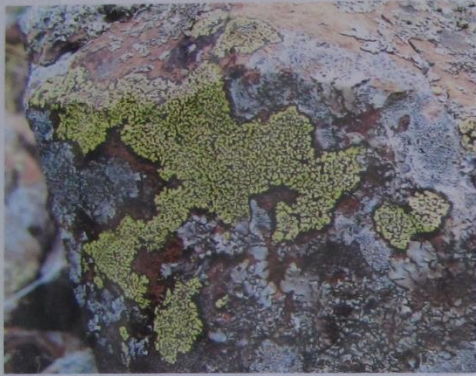


Lichens are small compound organisms that are composed of two distinctly separate groups, the algae and the fungi. Their bodies are composed of a tough outer fungal layer inside of which green or blue-green algae grow. The fungal layer is able to dry and quickly reabsorb water when it becomes available and prevents the internal more delicate algae from drying. In this way the algae provide nourishment for the fungus, and the fungus provides protection for the algae. Neither could alone successfully survive the habitats in which lichens grow, soil surfaces, rock surfaces and on the bark of trees and shrubs. Together they are an amazingly robust combination.

Lichens Survive in Space: Results from the 2005 LICHENS Experiment

Sancho, Leopoldo G.; de la Torre, Rosa; Horneck, Gerda; Ascaso, Carmen; de los Rios, Asunción; Pintado, Ana; Wierzos, J.; Schuster, M.
Astrobiology, Volume 7, Issue 3, pp. 443-454.

This experiment was aimed at establishing, for the first time, the survival capability of lichens exposed to space conditions. In particular, the damaging effect of various wavelengths of extraterrestrial solar UV radiation was studied. The lichens used were the bipolar species *Rhizocarpon geographicum* and *Xanthoria elegans*, which were collected above 2000 m in the mountains of central Spain and as endolithic communities inhabiting granites in the Antarctic Dry Valleys. Lichens were exposed to space in the BIOPAN-5 facility of the European Space Agency; BIOPAN-5 is located on the outer shell of the Earth-orbiting FOTON-M2 Russian satellite. The lichen samples were launched from Baikonur by a Soyuz rocket on May 31, 2005, and were returned to Earth after 16 days in space, at which time they were tested for survival. Chlorophyll fluorescence was used for the measurement of photosynthetic parameters. Scanning electron microscopy in back-scattered mode, low temperature scanning electron microscopy, and transmission electron microscopy were used to study the organization and composition of both symbionts. Confocal laser scanning microscopy, in combination with the use of specific fluorescent probes, allowed for the assessment of the physiological state of the cells. All exposed lichens, regardless of the optical filters used, showed nearly the same photosynthetic activity after the flight as measured before the flight. Likewise, the multimicroscopy approach revealed no detectable ultrastructural changes in most of the algal and fungal cells of the lichen thalli, though a greater proportion of cells in the flight samples had compromised membranes, as revealed by the LIVE/DEAD BacLight Bacterial Viability Kit. These findings indicate that most lichenized fungal and algal cells can survive in space after full exposure to massive UV and cosmic radiation, conditions proven to be lethal to bacteria and other microorganisms. The lichen upper cortex seems to provide adequate protection against solar radiation. Moreover, after extreme dehydration induced by high vacuum, the lichens proved to be able to recover, in full, their metabolic activity within 24 hours.



Rhizocarpon geographicum



Xanthoria elegans

Most of the technical terms used by lichen specialists are avoided for this introductory nature appreciation program. However, lichens can be organized into **three groups**: the **leafy** lichens, the **shrubby** lichens and the **crusty** lichens. Also grouped on what they normally grow, **trees, soil and rock**.

Leafy Lichens (foliose) – the lichen body (thallus) is flattened, with an upper and a lower surface. Those closely attached to soil or bark can be readily removed so that both surfaces can be observed.

Shrubby Lichens (fruticose) – the lichen body (thallus) is composed of upright single or branching stem-like structures or thin strands hanging from trees.

Crusty Lichens (crustose) – the lichen body (thallus) is composed of a thin crust that is tightly attached to soil, bark or rocks and cannot be easily removed to observe an underside.

A lichen fungus will sometimes produce spore producing structures on the thallus surface or on stalks in the form of tiny cups or knobs. These may not always be present.

Lichen Colours

Many lichens appear drab in shades of grey or green-gray, but some are brightly coloured, or have brightly coloured structures in shades of brown, yellow, orange or red.

One important feature is that lichens often change colour from dry to being wet. When wet, the outer fungus layer becomes more transparent allowing the green colour of the inner algae to shine through producing a more vibrant greenish colour. Immediately after a rainy spell is a good time to lichen hunt for brightest colours.



Lungwort
Lichen
dry



Lungwort Lichen wet



Camouflage Lichen, wet (L), and dry (R)

Tree Lichens

Two common shrubby lichens hang from tree branches. The pale yellow ones are **Old Man's Beard** (*Usnea* sp.) and the darker one is a **Horsehair Lichen** (*Bryoria* sp.)



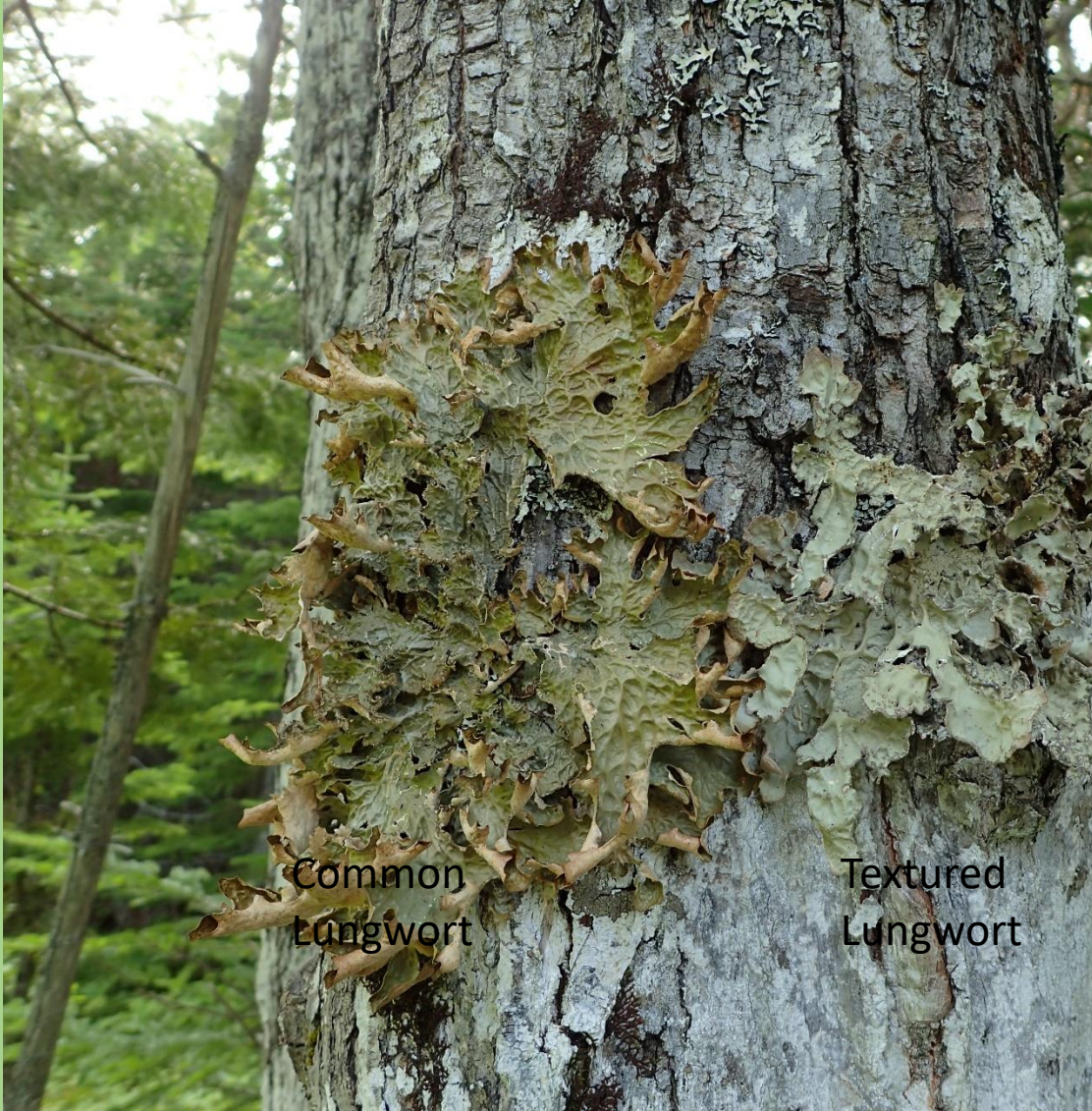
Lungwort (*Lobaria pulmonaria*) is one of our largest and more conspicuous leafy lichens often seen on the stems of old Red Maple trees and sometimes others. Its surface resembles lung tissue, hence the name *pulmonaria*.



Close-up view of leafy **Lungwort** to show “lung tissue” features on upper surface and distinctive lower side features. The brown structures on the green upper surface are fungal cups for spore production.



Another closely related *Lobaria* is sometimes found on old Red Maple trunks with common Lungwort. This is **Textured Lungwort** (*Lobaria scrobiculata*). It is less wrinkled and a more grayish in colour.



This gray leafy lichen is one of the **Shield Lichens** (*Parmelia* sp.) commonly seen on trees. Note the fine pale ridges on the upper surface.



Monk's Hood Lichen/Hooded Tube Lichen (*Hypogymnia physodes*) is one of the most common leafy species on shaded conifer stems and branches. The narrow lobes tend to have inflated tips that turn upward somewhat. The underside is smooth black, brown at tips.



Inflated tips sometimes break open to expose inner granular material.



Varied Rag Lichen (*Platismatia glauca*) is one of the most common lichens on shaded conifer branches. Its loose leafy lobes are quite distinctive and have brown to black undersides. Along with the Hooded Tube Lichen, it is one of the most common lichens in our woods.



Varied Rag Lichens and **Hooded Tube Lichens** are often found growing together on tree branches and trunks.

Most trees have **crusty lichens** on their bark. Although difficult to identify for the non-specialist, species can be recognized as different just by visual appearance. **A:** common whitish crusty lichen patches on White Spruce trunks, **B:** pale gray crusts on Balsam Fir, **C:** lichen patches on Speckled Alder.



Soil Lichens

One of the most common and interesting group of shrubby ground lichens are in the genus *Cladonia*. The variety of shapes and forms is indicated by some of the terms used in their common names, including reindeer, lipstick, soldier, cup, funnel, trumpet, antler, horn, peg and ladder. *Cladonias* are quite common along the trails. How many different kinds can you find?



Several species of shrubby **Lipstick Lichens** (*Cladonia* spp.) occur on open mossy soils. They are readily noticed by their red-knobbed branching stalks.



One of the best known Lipstick Lichens is **British Soldiers** (*Cladonia cristatella*) on bare and mossy soils. Common at the junction of the Marten and Caribou Trails (e.g. near the “Toilet Bowl”) on mossy trail edges.



One *Cladonia* subgroup, the **Pixie Cup** and **Trumpet Lichens** form cup-like structures at the top of upright stalks.



This Pixie Cup Cladonia Lichen produces stalk-like structures on the margins of some cups. The fungus produces spores in the brown tips.



The surface of the cups and stalks is covered with fine granular structures visible with the naked eye, but best seen with a hand lens.

The cups in this Cladonia lichen have frilly margins. It is common on decaying wood and stumps. It appears to be **Smooth Cladonia** (*Cladonia gracilis*).





This Cladonia (*C. verticillata*) is called the **Ladder Lichen**. Can you guess why?



This club-like *Cladonia* has only a tiny cup at its tip.



This Cladonia lichen barely produces cups, but has a more branching, almost antler-like pattern at the tips of the stalks.



The **Mealy Forked Cladonia** (*Cladonia scabriuscula*) is a shrubby ground lichen with branching antler-like tips. In the left photo a gray Reindeer Lichen can be seen in the background.



Another shrubby ground sub-group of *Cladonias* has upright branching or unbranching club or horn-like stalks. This species is quite common and appears to be **Smooth-footed Powderhorn** (*Cladonia ochrochlora*).



Reindeer Lichens are a common shrubby much-branched sub-group of *Cladonia* species (sometimes called *Cladinas*) common in open areas throughout the Boreal Forest. Their fine branching structure is characteristic and they range in colour from grey to pale yellow or yellow-green. They are an important food for caribou. One of the most common is the **Gray Reindeer Lichen** (*Cladonia rangiferina*) below.



Another common Reindeer Lichen is the **Star-tipped Reindeer Lichen** (*Cladonia stellaris*) which tends to grow in more compact mounds. It has a more pale yellow-green colour than the Gray Reindeer Lichen in the previous slide. The tiny branching tips radiate outward to form star patterns.



Pink Earth (*Dibaeis baeomyces*) forms a whitish-gray crust on bare soil. In autumn tiny mushroom-like structures are produced with pinkish knobs which produce the fungal spores. These are only 2 to 5 mm high. Common on open bare soils along the trails.



Evidence that some individuals will even brave the cold autumn rains to study **Pink Earth**.



Individual's anonymity
guaranteed!

Foam Lichens/Easter Lichens (*Stereocaulon* spp.) are pale gray shrubby ground lichens, much branched and covered with tiny warty lobes. Best seen on Lookout Hill of Looper Run.



This is one of the **Pelt Lichens**, sometimes known as **Dog-Lichens** (*Peltigera* sp.) growing on ground moss in a woodland clearing. It is composed of large thin flat lobes.



When dry (left and center above) it has a pale gray upper surface. When wet it turns almost black (upper left). The undersurface has white to brown veins and small projections known as rhizines which help to attach the lichen to the moss substrate (upper right).

Rock Lichens

Rock lichens are important for the initial breakdown of solid rock into soil particles upon which other soil lichens, mosses and higher plants can grow.

Mosses and lichens are very slow growing, but eventually cover rock surfaces with sufficient soil to allow growth of forest herbs.



* public online source

Rock Lichens

Several species/varieties of crust lichens inhabit the surface of this rock forming a mosaic with black margins where they meet. Most common is the **Orange Boulder Lichen** (*Porpidia flavocaerulescens*). The black dots are fungal spore producing cups.



A crusty species somewhat similar to the Pink Earth Lichen is the **Brown-beret Lichen** (*Baeomyces rufus*) which forms a greenish-gray crust with tiny brown-knobbed mushroom-like stalks in fall (also see next slide).



The **Brown-beret Lichen** (*Baeomyces rufus*) is often seen on rocks, sometimes soil, as a greenish pebbly crust. The tiny mushroom-like structures are only 1 – 2 mm tall.



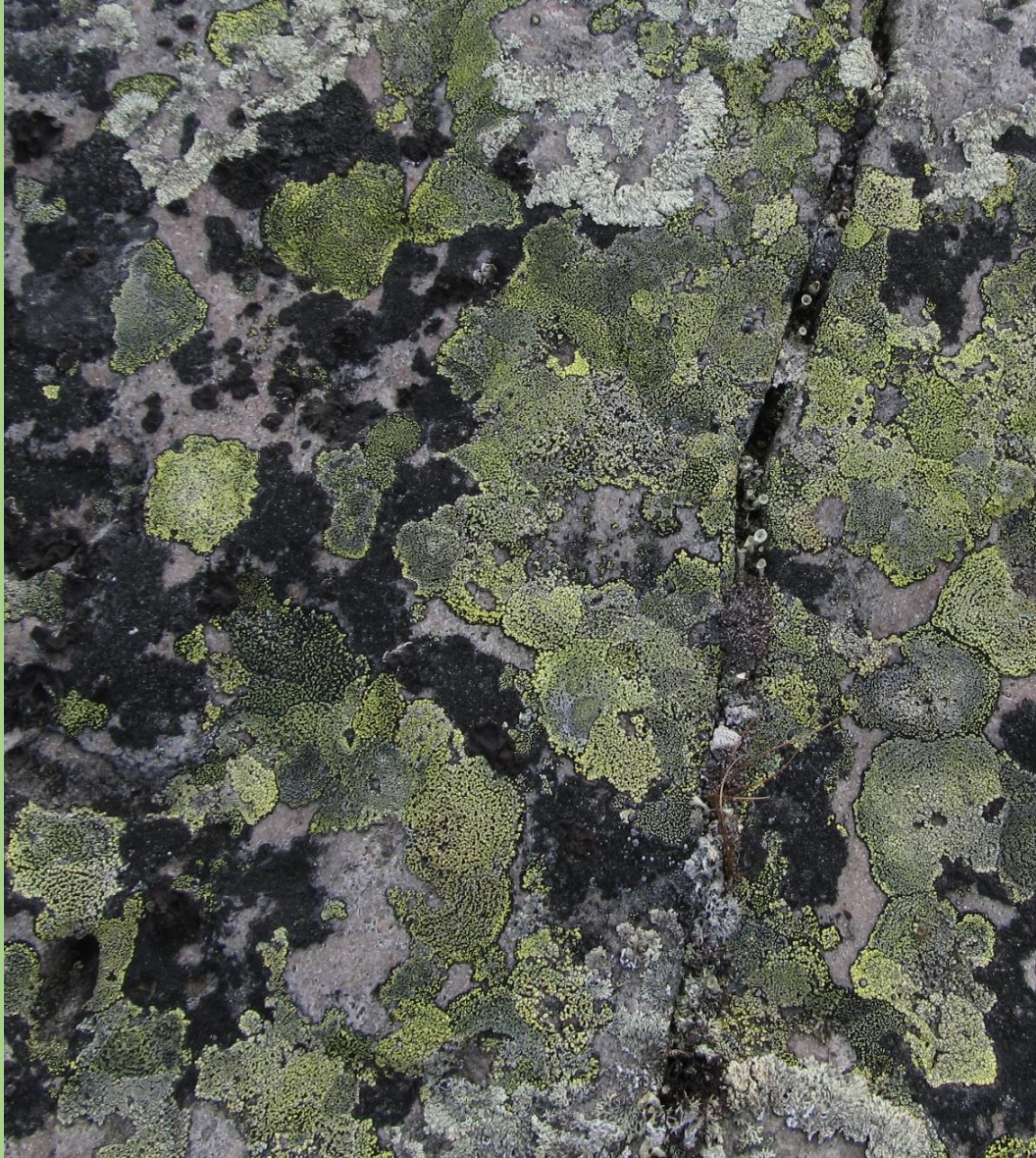
A rock lichen seen along the PSNP trails with many prominent black spore producing structures. Rock lichens are often difficult to identify for the non-specialist, but readily recognizable as lichens.



Following are a few other distinctive rock lichens common in Newfoundland on rock hills, outcrops, cliffs, and exposed boulders around coastal or aquatic habitats. Look for them in your travels.



The **Yellow Map Lichen** (*Rhizocarpon geographicum*) is very common on exposed rocky outcrops and easy to recognize because of the small yellow-green bodies arranged into map-like configurations.



Concentric Ring Lichen/Target Lichen (*Arctoparmelia centrifuga*) is commonly seen on exposed rocky outcrops. This circular patch about 20 cm across is surrounded by the yellow-green patches of the **Yellow Map Lichen** (*Rhizocarpon geographicum*)




The **Elegant Sunburst Lichen**

(*Xanthoria elegans*) is often common on rocks in coastal areas where birds tend to congregate, perch, or nest. It flourishes in sites that are high in nutrients derived from bird or animal droppings.





Rock lichens and Rock Ptarmigan chick on Gros Morne Mountain



Photos are from the archival files of HM unless otherwise indicated.

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