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LIVING

Better together

A lichen is a dual organism made up of an alga and a fungus that enjoy a mutually beneficial relationship

Of all the conspicuous organisms in the natural landscape, lichens are probably the most overlooked. With far fewer plants to compete for the eye's attention, winter can

be a good time to get to know this interesting division of the fungi kingdom.

One reason why lichens are so interesting is that they often grow where no other organisms can survive or be a source of competition. Often resembling nothing more than a curious crusty patch, they are found in the most inhospitable places possible — on sun-scorched rocks, on the bare bark of trees, and even on bare soil.



OUR CHANGING SEASONS
Drew Monkman

Lichens are actually "dual organisms" consisting of an alga and a fungus living

together as a single unit for mutual benefit. Although they both can live on their own, they seem to do better together. This type of relationship in nature is known as mutualistic. The fungus, which is the visible portion of the lichen, provides the algae with protection and a "house" to live in. The alga makes food for the fungus. The alga uses sunlight to photosynthesize glucose both for itself and for the fungus. The fungus provides the alga with mineral nutrients and water, both of which it absorbs from the surrounding substrate and directly from the air. Although lichens have no roots, they do have fungal strands that attach the under surface of the lichen to the tree or rock.

If you look at a cross-section of a lichen, you will find a protective outer layer of fungal cells, usually coloured green, brown, yellow, orange or grey. This covers a layer of algal cells (usually single-celled green or blue-green algae) a short distance below the surface.

Lichens survive the cold by drying out to the point of becoming brittle. If temperatures climb above freezing, however, and if sufficient moisture becomes available, these algal cells can photosynthesize, and the lichen will grow even in winter.

Lichens have been divided into four subgroups, based on differences in growth form. Leaf lichens such as lungwort, *Parmelia* and rock tripe, look somewhat like leaves. Club or cup lichens such as false pixie cup, powder horn and British soldiers, stand upright and tend to have bright colours. Shrub lichens such as coral and reindeer lichen usually form extensive carpets on the ground. Hair lichens like old man's beard and spruce-moss are found hanging from tree branches. Many of the above varieties can be found during a winter hike or ski outing. Some good lichen habitats include rock ridges, conifer swamps, hardwood stands with large sugar maples and anywhere there are rotting logs and stumps.

Some of the most common lichens in Peterborough and the Kawarthas are those belonging to the genus *Parmelia*. They are usually pale grey or light green leaf lichens that typically grow on tree trunks, logs and rocks. Some species of *Parmelia* such as hammered shield lichen (*Parmelia sulcata*) are pollution-tolerant and can easily be found on the bark of city trees. This is probably the species most familiar to casual observers of urban lichens. *Parmelia* lichens are used by ruby-throated hummingbirds and eastern wood-peewees in the construction of their nests.

A second lichen that is extremely common in urban areas is candleflake lichen (*Candelaria concolor*). It is generally yellow in colour and forms colonies of small rosettes over large areas of tree bark.

Another well-known species is British sol-



British soldiers lichen. Note the red spore-bearing structures used in reproduction.

Drew Monkman, special to The Examiner

diers. This lichen gets its name from its resemblance to the uniforms worn by English soldiers during the Revolutionary War. Because it is easily recognized, British soldiers is one of the easiest lichen species to learn. The fungus in British soldiers is called *Cladonia cristatella*, while the alga is known as *Trebouxia erici*. Because lichens take the name of the fungus part of the relationship, British soldiers is also known as *Cladonia cristatella*.

The red tips on the clubs are actually fruiting structures called apothecia. They are the places where the fungal part of the lichen reproduces itself by releasing spores. The spores are produced in little sacs that are surrounded by a protective cup-like body. Spores are a lot like seeds from plants, in that they can travel by wind and start a new fungus. The new fungus will not become British soldiers, though, until the algae joins it. Pieces of lichens that get broken off can also start making a new lichen, if they are in the right environment. Like all lichens, this species grows very slowly, usually not more than one to two millimeters each year. The typical habitat of British soldiers includes areas dominated by pine as well as rocky, open areas.

Ecologically, lichens are important because they often occupy niches where

nothing else will grow. Taking advantage of their unique mutualistic association, lichens are able to make a living where neither the fungal partner nor the algal partner could survive on its own. Lichens such as rock tripe, for example, are the only organisms that will grow on bare rock. Over the course of many years, the lichen will slowly collect around and beneath itself tiny amounts of moisture and mineral and organic fragments. When freezing temperatures come, the lichen's collected water will expand as it forms ice. This expanding action may break off a few more particles from the rock below the lichen, thus making more soil. Acids in the organic material collected by the lichen will also eat away at the stone.

As the lichen grows, these processes speed up and occur over an ever-expanding area. Eventually, other more complex plants such as mosses or ferns, or even some form of flowering plant, may take root in the modest accumulation of soil and replace the lichen.

Because most lichens cannot survive in areas where atmospheric pollution occurs, scientists can use these organisms as "bioindicators" of the amounts of certain pollutants in the air. They are especially sensitive to sulfur dioxide. Part of the reason for this intolerance is their extreme effi-

ciency in accumulating nutrients (such as sulphur) from trace levels in the atmosphere. So, when lichens are exposed to high levels of sulphur, the rapid accumulation of this pollutant destroys the chlorophyll in the algal cells and thereby inhibits photosynthesis.

It is therefore possible to estimate the amount of sulfur dioxide in the air by observing the number and type of lichens growing at a particular site. Because they also absorb metals, lichens can also be analyzed to determine the types of metallic pollutants in an area. For these reasons, lichens are not common in urban areas.

An extreme example of a lichen's ability to absorb matter from the atmosphere was seen in northern Scandinavia after the Chernobyl nuclear disaster. Reindeer moss, a species which is also common in northern Ontario, accumulated so much radioactivity that reindeer feeding on it were considered dangerous for human consumption.

The Forest Plants of Central Ontario, published by Lone Pine, is a good general guide to the more common lichens.

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