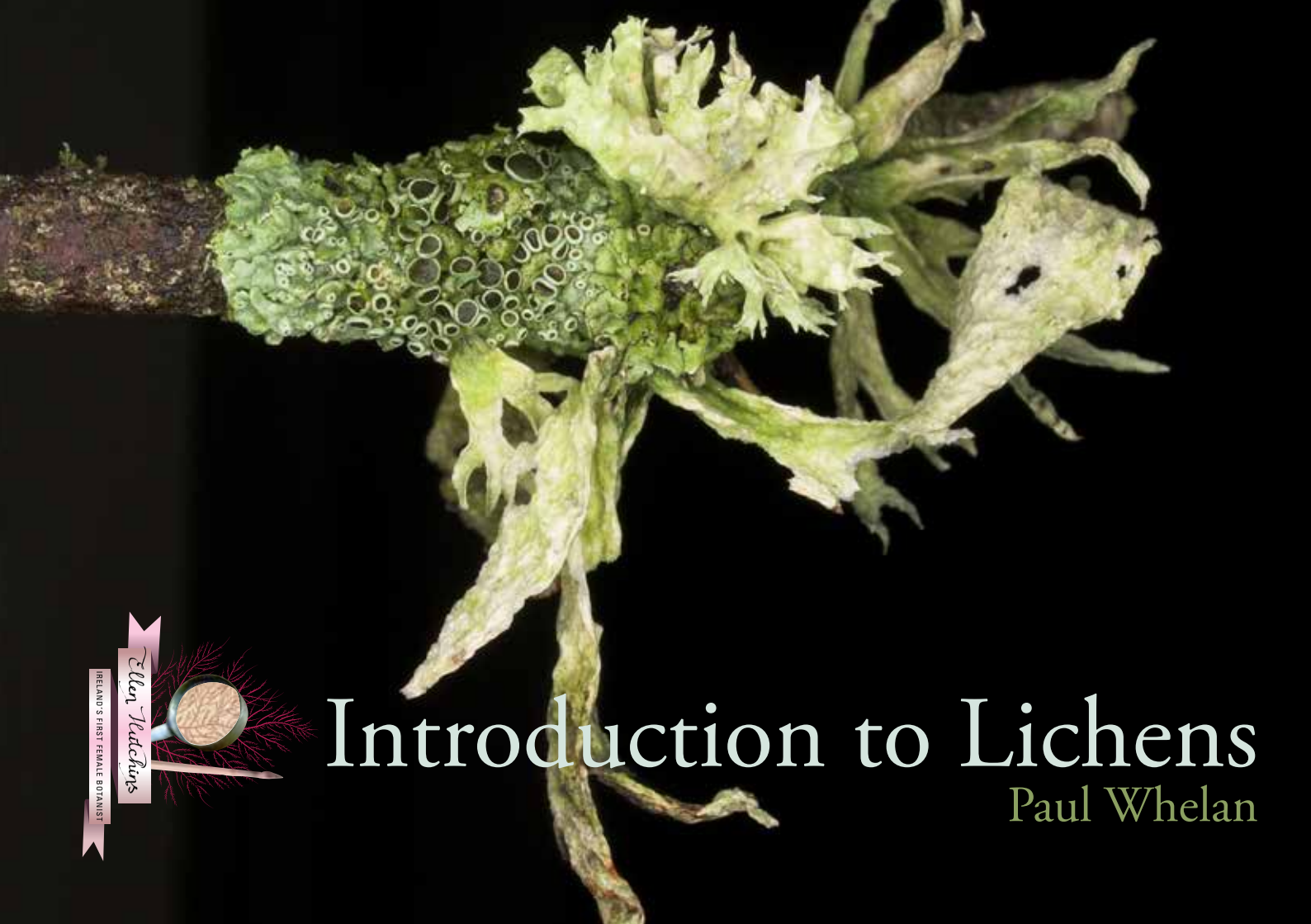


Introduction to Lichens

Paul Whelan

Introduction to Lichens

Lichens are living things and so form part of our planet's many forms of life. They play an important role keeping our planet in a healthy state, for example they help form soil and provide nitrogen to plants for growth. Many also provide shelter and food to tiny insects and soft bedding material for bird's nests. Often snails or slugs feed on them at night. In Tundra regions of the world where there is an abundance of lichens, reindeer and Caribou feed on them.

Humans can also directly benefit from lichens. People in Scandinavian countries sometimes mix lichens with bread giving substance and nutrients to it. Some perfumes contain lichens as it allows them to release the scent slowly. Without the lichens the perfume would disperse too quickly. In days before synthetic dyes lichens were used to colour clothes, especially wool garments.

They are found living on almost every surface of the planet, rocks, bark, soil and many Man-made materials such as glass, rubber, plastic and cement.

Lichens are known as pioneer species because they are often the first to grow on a new surface. The bark of a sapling tree is a new surface and immediately lichens will start growing on it. When fresh cement dries on the top of a wall, lichens are often the first new living things to grow on it. When rocks are exposed for one reason or another (by an avalanche or a retreating glacier or even by volcanic eruptions) lichens are usually the first living things to try the new surface for size.

image - *Fuscidea cyathoides* on Donegal granite © Paul Whelan

Being a pioneer species is an important role to play for life on Earth, as they make the new habitat suitable for other forms of life to follow. It also explains why lichens are found almost everywhere on the planet. Indeed, there is only one habitat on Earth where you will not find lichens and that is permanently submerged in water: so, lichens are not found in the oceans or rivers and lakes of the world. They are, however, found on rocky seashores and along the edges of mountain streams splashed by water, but never in permanently submerged zones.

So, what do lichens look like? Well they look like almost anything you can think of. Some look like splashes of white, cream, yellow, brown or black paint on rocks, walls and trees. It's often difficult for people new to looking at lichens to imagine that these splashes or crusts of colour are living, but yes, they are. They grow and reproduce like any living thing. If you look at them with a 10x hand lens you will see very tiny little cups that produce spores. It's the spores that grow to give rise to new lichens. But more on that later. Scientists like to put living things into groups and they group all lichens that look like splashes of paint or crusts into a group called CRUSTOSE.

What are lichens?

Before we look at other groups of lichens it is worth figuring out what lichens actually are. People who study lichens will tell you that they are a very special form of life. If this is so then what is so special about them?

Animal life **-** First let's look at how living things in general are put together. A cat or dog or human is made of millions of tiny, microscopic, soft, squishy bags called cells. Special groups of cells make up the various organs in animals. For example, similar types of cells make the heart, others make up the brain or the skin or liver or what ever. That is how animals are put together. If you study animals to become a zoologist or a vet or doctor you will study how these cells work. An interesting thing about all animals is that they must get food by hunting and eating other living things. Cats will hunt mice, rabbits or cows will eat grass.

Plant life **-** Plants are also made up of cells and these are like tiny microscopic bricks. Some plants, like green algae, are single cells and others, like trees, are multicellular. Plant organs like leaves and flowers are made from these brick-like cells. Plants don't go hunting for food because they can't move around. Instead they use chlorophyll molecules in their cells to take energy from sunlight and combine it with carbon dioxide to make their own food. This is a brilliant technique if you can't move around. The problem, of course, is that you can't run away if something else tries to eat you. There is always a downside to some neat way of living.

image - Mosaic of interacting crustose lichens © Paul Whelan

Plants and animals are pretty special forms of life on Earth but another form that is extra special are Fungi. Fungi are living things like mushrooms or bread mould. Their cells are not soft squishy bags like in animals, nor are they like miniature bricks as in plants, instead they are like long thin scaffolding tubes. They are very interesting to botanists

because they LOOK like plants but are definitely NOT plants. They don't make food from sunlight and they invade plants and animals with their tube-like cells (usually when they are dead) and eat them as a source of food. Factually, fungi are more like animals than plants!

So, what has all this to do with lichens?

Lichens are not just made from lichen cells. This is what is so unique about them. They are a combination of fungal scaffolding-like cells and microscopic plant-like green algal cells and some extra special lichens also have good bacteria living in them. The green algal cells and the good bacteria (called cyanobacteria) make food from sunlight and the fungal tube-like cells absorb nutrients from dead things. This explains why lichens are found almost everywhere on the planet and on nearly every surface. When the sun is out they can make their own food by photosynthesising (using the algae and cyanobacteria) and when the the sun is lacking, the fungal part can absorb nutrients from what they are growing on. This is an ingenious way of living! Never hungry!

image - Spores of *Micarea ligaria* © Paul Whelan

Symbiosis - So, a lichen is a special relationship between a fungus which absorbs food and an alga and/or cyanobacteria, which makes its own food. Each depends at some stage on the other. This type of dependent relationship is called a symbiosis. There are many types of symbiosis found in the natural world but the type of symbiosis in lichens is unique to them. Here is an example to illustrate the difference.

Sharks often have a symbiotic relationship with small pilot fish. The pilot fish benefit from hanging around with the shark by eating left-overs after the shark feeds. The shark benefits by allowing the pilot fish to eat parasites that attach themselves to the sharks' skin and gills. Now, if the pilot fish swim away and leave the shark, the shark is still a shark and the pilot fish are still pilot fish! The symbiosis in lichens is different. If the algae / cyanobacteria in the lichen leave the lichen fungus, then the lichen ceases to exist! Put another way, the lichen only exists as long as the green algae and or cyanobacteria and fungal cells are together. No other form of life exists on the Earth in this way.

Close up of the apothecia of Lecanora gangleoides, a seashore species © Paul Whelan

Habitats

Ireland is one of the best countries in the world for lichens. We have a rich biodiversity. To date, about 1200 species have been recorded here. That's a lot of different species for such a small island. Why do they seem to like Ireland so much?

There are several reasons:

- The air is generally moist, and they are good at absorbing moisture from the air.
- The sun is rarely too hot here ... they don't like too much heat
- Lichens like different types of rock and there are lots of different rock types in Ireland, especially west of the River Shannon.
- They like our native trees such as ash and oak.

If the place they are living in changes too much, such as drying out a lot, they can become dormant. Some lichens can be dormant for many years, say twenty or fifty years, and if conditions suit them again they start to live as though nothing much happened. In Ireland, lichens usually just go dormant during periods of dry weather.

Lichens don't like to be submerged in water very much. Usually they only last about ten days submerged and then die. Some lichens specialise in living at the edge of mountain streams where they are splashed continually by water. They like that, but don't like to be totally submerged.

image - *Cladonis gracilis* which grows on dead wood and in bogs © Paul Whelan

Two important Irish lichenologists were Matilda Knowles and Ellen Hutchins. Each working with lichens in a different way. Matilda worked mainly in Dublin in the early part of the 20th century. Ellen worked in Bantry Bay at the beginning of the 19th century. Ellen named many beautiful lichens found in west Cork where the damp weather suited them, especially the large leaf- like species. She also studied seaweeds and produced many beautiful drawings and paintings of them.

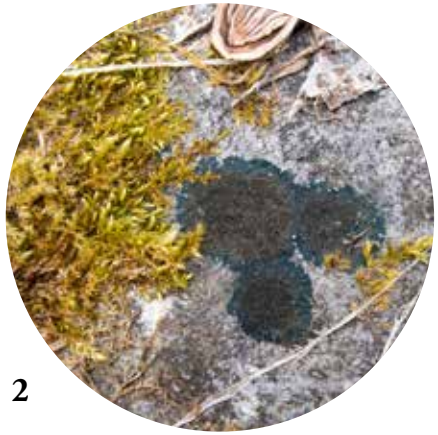
Lungwort (*Lobaria* sp) in Glengarriff Woods © Clare Heardman

Other groups of lichens

There are several types but the crustose, foliose and fruticose are the most common

Earlier we saw that biologists group crust-like lichens into a group called CRUSTOSE.

1



2

1 Mosaic of crustose species © Paul Whelan
2 *Placynthium nigrum* on limestone © Paul Whelan

Lichens that look like flattened out leaves are in a group called FOLIOSE. Foliose lichens are often seen on the main trunk of trees. Most are grey or yellow in colour. Insects and spiders like to hide under them.

3

4

3 *Caloplaca verruculifer*a on the seashore © Paul Whelan
4 *Xanthoria polycarpa* © Paul Whelan

FRUTICOSE lichens usually stick up or out from branches like tiny protruding fruits. They are found mainly in high rainfall areas of the country.

5

6

5 Three common *Ramalina* species © Paul Whelan
6 *Cladonia bellidiflora* on a blanket bog © Paul Whelan

Longevity

It's difficult to know how long lichens live for because if the place they are living is disturbed or changes too much they will die. They like a stable and secure habitat. If they are not disturbed, they can live three or four hundred years or more. Some are known to live several thousand years. A small yellow and black lichen called *Rhizocarpon geographium* was found in the Rocky Mountains and scientists think its about 4000 years old. They calculated this age by working out how much it grows in a single year, then measuring its size and making a simple calculation. *Rhizocarpon geographium* also grows in Ireland. It likes granite rock and is found in Wicklow, Kerry, Cork, Mayo, Down and Donegal in particular.

Some grow very quickly. In Bantry Bay and the Glengarriff area the temperature and humidity suit lichens perfectly and many foliose lichens in the area grown rapidly. Lichens never grown quickly enough to be farmed and harvested for human use. Parts of Ireland have many FRUTICOSE lichens hanging over the branches of trees, decorating them like Christmas decorations. Indeed, this is where the idea for Christmas decorations came from!

Some lichens are poisonous. One called the Wolf lichen was once used in Norway to protect villages from wolves. People wrapped it in meat and local wolves that ate it died.

People used to think that lichens indicated that the air was free of pollution. This is not true because only some lichens are indicators of clean air. You have to know those lichen to be able to judge the air quality in a place. Many lichens can tolerate polluted areas and some even love plenty of pollution. A yellow lichen called

Xanthoria is often seen in Ireland growing on trees around farms. It grows near farms because it loves the nitrate fertiliser that blows in the air after a farmer has put it on the fields.

So, we can see that lichens are a very special form of life. They are symbionts and if one partner leaves the relationship the lichen will cease to exist. They will never starve as they have two methods to obtain nutrition: the fungus absorbs nutrients and the other organisms makes nutrients by photosynthesis. When living conditions are not suitable they can become dormant and wait until conditions are good again.

image - *Usnea articulata* which only grows where the air is unpolluted © Paul Whelan

Front cover image - *Ramalina cararensis* and *Ramalina fraxinea* with *Physcia apiola* © Paul Whelan
Back cover image - *Golden-eye (Teloschistes chrysophthalmus)* thrives in nitrate pollution © Paul Whelan

Paul Whelan lives in Co Cork and is the author of Lichens of Ireland. A former teacher, he is passionate about lichens and continues to impart his knowledge of lichens and other branches of natural history through his writings, websites (www.lichens.ie and www.biology.ie), walks and workshops.