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Mystic Lichens

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LICHENS form part of a group collectively known as cryptogams (spore producing plants). Most of us would probably know what lichens are, but may not know much more about them other than seeing the familiar crusts on roofs or gravestones. Aspects of lichens such as how they reproduce, what they live on, where they grow, how many species we have in Western Australia, or what uses they have, are not common knowledge. But lichens are a biologically fascinating, ecologically important, surprisingly biodiverse and often very attractive part of our flora.

Lichen is a symbiotic partnership between a fungus and a green algal or a cyanobacterial (blue green algal) partner. Most of the structure is made up of the fungus, which plays the role of providing support and anchorage, absorbing water, and helping to obtain mineral nutrients by breaking down substrate material. The algal partner is photosynthetic and so produces food for both partners. This alliance has been so successful that 20,000 species of lichens are recognised in the world.

The diversity of Australian lichen taxa is estimated to be around 2,820 species and about 2,000 of them are endemic, which indicates that the lichen flora is mostly unique to this country. They are included in 363 genera. It is currently estimated that the lichen flora for WA would be around 900 species in 145 genera.

Historically lichens have played an important role as indicators of air pollution based on species presence or absence in industrial or mining areas of Europe. They can also take an environmental monitoring role in Australia, although here it is as a measure of land quality that lichens can be most valuable. Lichens can be found on most stable habitats, with species diversity and population sizes becoming smaller in the very arid areas of Australia. However, although fewer in arid areas, their value in soil stability is actually much greater, especially in WA, with our large expanses of arid and semi-arid landscapes. Monitoring of lichens in these and other landscapes is essential, considering the levels of modification resulting from agricultural and other practices.

A first requirement for using lichens in environmental monitoring is to know what species are present. Collection and recording of our lichen flora has until recently been a low priority which has led many people to consider that lichens were not an important feature of our landscape and that the species diversity was low. My work in preparing a Lichen Census has indicated that this State has a relatively large flora and as more collections are made it is expected that the number of known species will increase. Communities and Land Care groups in Australia have an increasing need for information regarding soil microflora, and their role and interactions in maintaining soil health.

Several lichen species form extensive soil crusts, while some exist as isolated groups associated with other cryptogam species in arid areas. An excellent example of soil crusting lichens is *Diploschistes*, which at first glance might appear to be a dried bird dropping. Lichen assemblages have several recognised desirable functions that can be used as a factor to measure soil health of a given area. Lichens are digesters of organic and inorganic materials releasing many nutrients including nitrogen into the soil, improving it for other plants. Dense crusts formed by soil lichens contribute to the protection of soil surfaces from wind and water erosion. Many of these crusts can withstand heavy rain by buffering the soil surface from splash erosion. Soil crusts have been recognised as moisture soaks by acting as a partial barrier, slowing the flowing water and retaining quantities of moisture longer in areas associated with crusting. Several of these arid area soil lichens appear to be able to withstand elevated levels of salt and mineral concentrations.

Although lichen crusts sound robust, hot fires and hard hoofed livestock cause damage, especially during periods of extreme dryness when lichens become brittle. Lichens are a good example of an interesting botanical phenomenon called resurrection plants, which concerns the very rapid softening and greening of highly desiccated, apparently dead, plants. Many arid area lichens respond to the presence of water vapour from dews and frosts by absorbing this moisture within a few seconds. An example of resurrection lichen is *Chondropsis semiviridis*; a common soil surface species that turns yellow and rolls up when dry and when re-hydrated unrolls and turns green. If this moisture can be retained for an extended period the lichens usually rapidly reactivate their tissues preparing for a quick spurt of food production while the moisture is available. Extended periods of moisture availability commonly associated with the winter months promote growth and fruiting body development but appear also to be linked with a temperature requirement.

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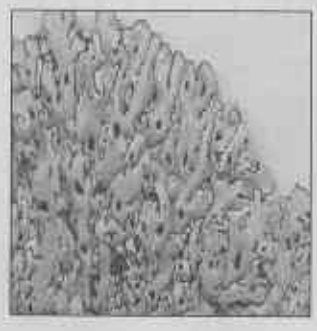
Three main lichen growth forms

Crustose: Diploschistes



Foliose: Menegazzia

Fruticose: Ramalina

Forest lichens can be found mainly in the tree and shrub layers, with a few species occurring on the ground. Old logs are an ideal habitat to observe lichens where they can form extensive populations that contribute to the break down of the wood, thus releasing nutrients to both micro and macro flora and many species of invertebrate fauna. The reduced number of lichens found on the forest floor may be the result of lowered light levels and the rapid build up of litter that smothers them. Regular fires may also contribute to the reduced numbers as most lichens are slow developers and some are sensitive to scorching. Woodland areas appear to have larger populations of lichens on all strata with areas of high densities especially around wetlands and water bodies.

Lichens can traditionally be divided into three main growth forms. These forms are crustose, fruticose and foliose, which form a convenient starting point for identification.

Many lichen species are determined by observing morphological characters and the testing for presence of chemical compounds. New techniques have enabled many of these compounds to be formally identified and this data can be used to identify specific species. Until a few years ago interested collectors were frustrated by the lack of available published identification texts. Although many publications have been written on lichens, the compiling of this scattering of data across the world has begun. Three lichen volumes of the Flora of Australia have been published, with more to follow.

The fungal component of the lichen partnership produces the reproductive structures (usually disc-like in shape) known as apothecia or perithecia. These structures contain fungal ascospores which vary in shape, size and structure and are important for the identification of certain taxa. Species that reproduce by means of ascospores can only develop into lichens by the random meeting with a suitable algal partner.

Although many lichens produce ascospores, others mostly reproduce by asexual or vegetative methods. Fragments of lichens are either shed or broken off and easily transported to where these fragments can develop into new populations if a suitable habitat is present. The inland species *Chondropsis semiviridis* spreads by vegetative fragmentation, and although fruiting bodies have been recorded none have been seen in WA. *Menegazzia* is a genus that can reproduce by both vegetative methods and the production of apothecia (seen in photo).

The varied structures and forms located in any given area are what fascinate and encourage the lichenologist. The variations observed range from tiny microscopic specks to large mats on rock outcrops, or to wispy pendulous strands festooning branches of trees. *Ramalina* is a genus which grows on the branches of shrubs and trees and can be located in areas of high humidity usually associated with wetland areas.

Because we know so little about them, I would be really delighted if you could collect lichens from your area and send them to me! The sampling of lichens is straight forward as most collections are whole plants with some of the growth substrate, eg bark pieces. Transporting of lichen material is the difficult part as dry lichens are brittle and easily damaged. If you are interested, contact me and I can explain.

(Note: Lichens are a protected flora and, similar to all native flora, their collection from Crown land requires a licence from the Department of Conservation and Land Management, or the permission of the owner of private land.)

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LFW Tasmania produced an article with a slightly different slant on lichens in their Dec 2002 edition. If you would like a copy of that article, email Claire on claireh@calm.wa.gov.au