Liverworts of the Wellington Area

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LIVERWORT FEATURES

Liverworts are plants similar in many ways to mosses: they are usually small, and generally lack the hard supporting tissues of larger plants such as ferns. Like ferns, liverworts show alternation of generations, having separate gametophyte and sporophyte entities; unlike ferns the sporophyte is not a separate plant. As with mosses, the gametophyte generation is the dominant phase of the life cycle, and the sporophyte generation is permanently dependent on it. Liverworts show a greater range in general morphology and form than mosses, and as well as normal leafy plants, there are dozens of species of thalloid liverworts that lack organisation into stems and leaves. The most striking differences between mosses and liverworts are in the sporophytes where liverworts have a simple outer wall lacking the peristome of mosses, and in the capsule which usually splits into four valves to release the spores. Mixed amongst the spores are hair-like elaters, which flick and twist as they dry out, helping to throw the spores clear. The stalk that bears the capsule (the seta) remains short until the capsule is mature, then, by cell elongation, it expands rapidly to its full size. Thus, the expanded seta of a liverwort is a delicate translucent structure, not tough and wiry like a moss seta which elongates slowly by cell growth. The vegetative parts of leafy liverworts differ from mosses in details of cell shape, contents, leaf structure (liverwort leaves lack a central nerve or vein), shape (liverwort leaves are rarely markedly elongate but are often complexly lobed) and position. Liverworts have leaves in three (or more rarely two) rows on the stem, whereas moss leaves are rarely arranged in rows.

In New Zealand, liverworts are often abundant in cool shaded sites and many "moss"-covered logs, banks and trees are, in fact, liverwort-covered. Few liverworts, however, are fully aquatic and those that are, tend to occupy specialised habitats such as lakes or alpine streams. Many frequent rocks and banks around streams, often intermingled with mosses and hornworts. At the other extreme, specialist forms (as with mosses) can be encountered in quite dry sites and spend part of the year dried out and dormant. Many epiphytic liverworts have to cope with the even more extreme conditions of frequent cycles of wet and dry, especially when growing on the bark of trees in coastal forest.

While there are relatively few sites in the Wellington area that have constantly moist conditions, there are many more or less constant streams with gully sides that are nearly always damp. On these may be found a variety of species from the main groups of liverworts. The most exciting of the local liverworts

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is *Monoclea forsteri*, reputedly the largest thalloid liverwort in the world, and also worthy of mention in that it is an archaic form with a single close relative (the one other species of *Monoclea*) in the Andes. *Monoclea* is the only genus in the order Monocleales and is as different from other liverworts as the tuatara is from other reptiles. *Monoclea* has a massive dark green thallus that forms closely attached patches on clay or rock, by or in small streams, or even gutters. In dense bush it is also found on rotting logs. It is a plant of shaded places and is quite common in New Zealand.

Growing also in such sites are unusual dendroid (tree-like, or in this case more fan-like) thalloid liverworts such as *Symphyogyna podophylla* which looks much like a small filmy fern except that it bears typical liverwort sporophytes on its upper surface. The very similar *Hymenophyton flabellatum* (Fig. 1) may be found in the same sites but bears its sporophytes on the underside. There are other species of *Symphyogyna* in shaded areas but they are usually prostrate and attached to the soil by fine hair-like rhizoids.

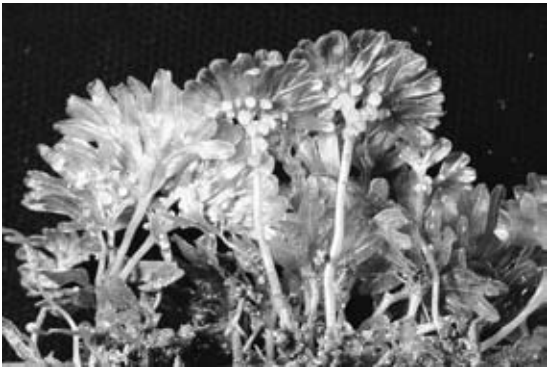

Fig. 1. *Hymenophyton flabellatum* with sporophytes developing on the ventral surface of the thallus.

A third type of thalloid liverwort is also found along clay banks but this group is more likely to be found near the margins of bush areas or even in the open. These are members of the Marchantiales which are characterised by having air chambers in the upper (dorsal) side of the thallus and, thus, have a more complex structure than other liverworts. *Lunularia cruciata*, one of the commonest and most distinctive of these, is probably an adventive species. It is the only species that has crescent-shaped gemma cups on its dorsal surface. The plants, however, do not always display the distinctive gemma cups, as these are not produced when sexual branches are forming.

Generally similar to *Lunularia*, the species of *Marchantia* are mostly native and can be identified by the cup-shaped gemma cups and the nine-lobed sporangiophores that bear the sporophytes. *Marchantia foliacea* is the commonest forest species and is often found on streamside and trackside banks.

Another genus in the same group is *Asterella*, with both native species being

found in Wellington. They lack gemma cups but have distinctive white scales around the sporophyte; those of *A. tenera* being smaller, fewer, and shorter than those of *A. australis*.

Despite the visual impact these distinctive thalloid plants have, most liverworts are leafy and, thus, are easily mistaken for mosses. The leaf arrangement of liverworts differs from mosses, in that the leaves are arranged in three rows, with two lateral rows and a third row along the ventral side (Fig. 2). The underleaves are usually smaller and of different shape from the lateral leaves. In some genera the third row is lost and only the two lateral rows are present.

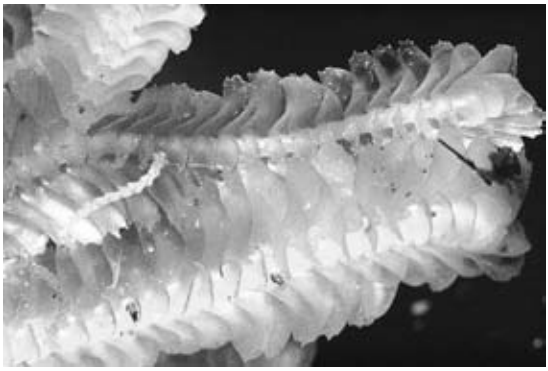

Fig. 2.
Bazzania novae-zelandiae showing the two lateral rows of leaves and the ventral row of smaller leaves.

The leafy liverworts make up for their simple leaf arrangement by the many and complex variations of leaf form. Here, variation is almost without limit compared to the simple leaf form of mosses: liverworts may have leaves with lobes, or lobules (normally on the underside at the base of the lateral leaves) of various shapes (often flask-shaped). Furthermore, the surface and/or margins of the leaves may be variously toothed or ciliate, even in leaves that already have lobes or lobules. This plethora of forms is best appreciated with a microscope, but many have detail large enough to be seen with a hand lens.

The leafy liverworts (Jungermanniales), as well as growing on the ground, roots, and rotting logs, are frequently epiphytes on the bark of trees. Fairly open sites can be rich sources of such taxa as *Frullania*, *Lejeunea*, *Microlejeunea*, or even *Acrolejeunea* and *Cololejeunea*. On the more sheltered bases of trunks *Chiloscyphus* (*Lophocolea*) *lentus* is common and other species of *Chiloscyphus* are found on the edges of clay banks in quite exposed sites. *Mastigolejeunea anguiformis* and *Cuspidatula monodon* are also plants of tree trunks but in somewhat more shaded, sheltered sites; as with most other epiphytes from drier sites they have simple, oval, or pointed leaves.

Epiphylls are plants found growing on the living leaves of other plants. In the case of liverworts some species seem to specialise in this habitat, whilst others appear to only occasionally and by chance grow on such sites. Epiphylls are

best developed in the most moist sites, and in areas that dry out occasionally they are not common. For example, the filmy fern *Hymenophyllum demissum* is a frequent host, but no epiphylls were observed on that species on a recent trip along the track to Smith's Creek in the southern Tararua Range. In contrast, some of the dark, damp stream valleys in the Akatarawa Range have many epiphylls. Genera commonly met as epiphylls are *Cololejeunea*, *Echinolejeunea* (Fig. 3) and other Lejeuneaceae, *Chiloscyphus* (*Lophocolea*) *muricatus*, and *Metzgeria* spp. Rarely, even species of *Schistochila* and *Lepidolaena* may be found as epiphylls.

Fig. 3.
Echinolejeunea papillata growing on *Hymenophyllum demissum*.

Sheltered shady sites may have *Trichocolea* species in which the art of leaf dissection is taken to its limit. Here the leaf lamina is dissected more and more finely until the segments consist of uniseriate rows of elongate cells and the basic leaf structure is almost impossible to determine. This results in plants that appear to have been made of green velvet.

The softly matted banks of shaded tracks are often clothed with liverworts – most often wefts of *Telaranea* and its relatives, especially *Lepidozia*; each comprising soft, much-branched stems with delicate, deeply dissected, four-lobed leaves. Occasionally there are patches of thalloid *Riccardia* with thalli dissected into fine lobes. In less shaded spots the liverworts may colour deeply, such as the striking wine red of *Balantiopsis* or red-brown of *Isotachis*. All of these add to the richness of texture and colour of the trackside banks whilst protecting them from erosion and soil loss.

Among the largest and most striking of all liverworts are the plagiochilas and schistochilas, each with about 30 species in New Zealand (in each case a group of related genera). In both cases the largest (and commonest) of the species are larger than all but the biggest filmy ferns. *Plagiochila* has the simplified leaf arrangement mentioned earlier with only two rows of lateral leaves, these usually having simple teeth or short cilia along their margins. *Plagiochila stephensoniana* is common as a trunk epiphyte in many areas, and individual

stems may be 20 cm or more long and bipinnate, so that they are much the same size as large filmy ferns.

In contrast, species of *Schistochila* have wonderfully complex leaves with extra dorsal lobes on the lateral leaves and extra ridges (lamellae) on the surfaces, the margins of which are beset with teeth or even complex cilia. The underleaves are a totally different shape – basically four-lobed, but again with teeth or cilia. The largest species, *Schistochila appendiculata*, is undoubtedly the largest leafy liverwort of all. It is widespread in New Zealand and Schuster and Engel (1985) report a specimen 110 cm long and 2.6 cm wide. Unlike the stems of the large plagiochilas, *S. appendiculata* stems are simple or infrequently branched.

Species of both complexes are common in the wettest areas around Wellington and some extend into less favoured sites. Most areas around Wellington are under-collected as far as liverworts are concerned, and this is true for much of New Zealand, except perhaps for the Dunedin area and the area where Mrs E.A. Hodgson lived near Wairoa. The small valleys off the Akatarawa Hill road and some areas of the southern Tararua Range are particularly rich in species, but at present it is still not possible to describe groups of species as being typical of particular sites or forests. It seems that distribution is more determined by local microhabitat than the overall forest type. With greater knowledge it is likely that some species will be found to be associated with particular forest types but such associations are not yet clear.

More collections are needed from all areas around Wellington – perhaps most importantly from the smaller patches of forest in the city itself. Unlike mosses, some effort should be made to examine liverworts whilst they are fresh, as useful features such as oil bodies in leaf cells are soon lost if the plants dry out. Even if only the number and shape of them is recorded from fresh material this is very useful extra information, in some cases allowing rapid identification of some generic pairs such as *Cheilolejeunea*/*Lejeunea* and *Mastigolejeunea*/*Archilejeunea* (Fig. 4), where the former in each case has few, large, complex oil

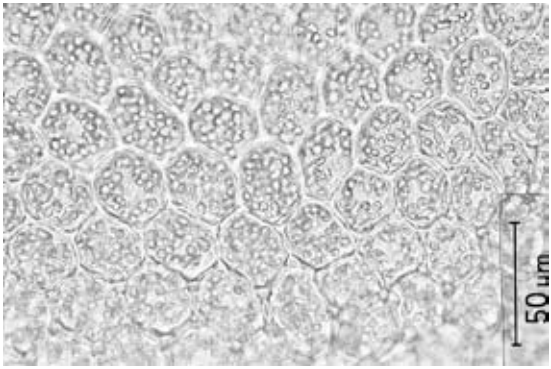

Fig. 4.
Oil bodies of *Archilejeunea olivacea*.

bodies and the latter numerous, small oil bodies. There are other morphological features that distinguish these genera, but the number and structure of oil bodies provide by far the easiest characters.

Further information and descriptions for the commoner species may be found in K W Allison and John Child's book "The liverworts of New Zealand" published in 1975. Some beautiful illustrations of liverworts can be found in Bill and Nancy Malcolm's book "The forest carpet", published in 1989.

REFERENCE

Schuster, R.M.; Engel, J.J. 1985: Austral Hepaticae vol (2), temperate and subantarctic Schistochilaceae of Australasia. *Journal of the Hattori Botanical Laboratory 58*: 255-539.