A SUMMARY OF LICHEN ASSOCIATIONS IN DIFFERENT HABITATS FROM FOUR OFF-SHORE ISLANDS, NORTH-EAST NEW ZEALAND

by Glenys C. Hayward* and B.W. Hayward†

SUMMARY

The lichen associations of nine arbitrarily defined habitat types that occur on some or all of four off-shore islands (Great Barrier, Red Mercury, Ruamahua-iti, and Whale Island) are described, together with combined species lists for each habitat. Reasons for the presence or absence of various species on the different islands are briefly discussed.

INTRODUCTION

In this article, the lichens collected during the last three years’ AUFC scientific camps have been brought together in an attempt to summarise the species occurring in various habitats. The lichens are from four off-shore islands and are described individually in Puch (1971) — Whale Island; Puch (1972) — Red Mercury Island; Hayward (1973) — Ruamahua-iti, Aldermen Islands; and Hayward and Hayward (1973) — part of Great Barrier Island (Fig. 1).

The publication of Martin and Child (1972) since the first of these lichen studies in 1970, has facilitated and made more accurate the identification of lichen species. As a result, the collection from Whale Island has now been determined to specific level and several more species have been added to the Red Mercury list. In total, seventy-eight different lichen species from thirty genera are now recorded from these four islands.

All lichen specimens are held in the collection of the senior author (G.C.H.).

HABITATS

Distribution of various habitats on the four islands is shown in Figure 1. Abbreviations used in species lists are:

B = Great Barrier Island
M = Red Mercury Island
R = Ruamahua-iti
W = Whale Island

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Fig. 1. Locality map of Gt. Barrier, Red Mercury Is., Ruamahua-iti and Whale Is. Insets of the individual islands (not to scale) showing distribution of the lichen habitats sampled.
1. Saxicolous (rock-inhabiting) — beneath a dense forest canopy

Shade-tolerant lichens commonly found on rocks beneath a dense coastal forest canopy are species of the encrusting genera *Lecanora*, *Lecidea*, and *Pertusaria*, and also species of the foliose genera *Lobaria* and *Pseudocyphellaria*.

Species present:
- *Lecanora* sp.  M
- *Lecidea* sp.  B
- *Lobaria lacinata*  M

2. Epiphytic (bark-inhabiting) — beneath a dense forest canopy

Shade-tolerant epiphytic lichens, found on the bark of tree trunks and lower branches beneath a dense coastal forest canopy, are dominated by foliose genera. Species of *Sticta* and *Pseudocyphellaria* generally constitute over half the lichen flora of this habitat. Other foliose genera commonly found are *Leptogium* and *Psoroma*. The fruticose genus *Sphaerophorus* and crustose *Pertusaria* and *Lecidea* often occur in association with these foliose lichens in this habitat.

Species Present:
- *Cyphelium emergens*  M
- *Lecidea* sp.  B
- *Lepraria* sp.  M
- *Leptogium inflexum*  M, R
- *L. phyllocarpum*  R
- *L. cf. saturninum*  B
- *Pertusaria* spp.  B, M
- *Psoroma asperellum*  B
- *Sphaerophorus cuneatus*  B
- *S. melanocarpus*  B
- *P. carpoloma*  B
- *P. episticta*  B
- *P. muelleriana*  B
- *Sticta amplificata*  M
- *S. caperata*  B, M
- *S. latifrons*  B
- *S. limbata*  M
- *S. subcaperata*  B

3. Epiphytic — forest margin and open canopy.

There is no sharp dividing line between this habitat and that beneath a dense forest canopy, but instead there is a gradual change in the lichen flora. As the dense forest canopy opens up and light penetration increases, lichens of the family *Stictaceae* become fewer and lichens of the genera *Parmelia*, *Ramalina*,
and Usnea increase. Epiphytic Parmelia species are very numerous and diverse in this habitat. The species Parmelia caperata, P. cetrata, and P. laevigata occur on three of the islands. Ramalina menziesii and Usnea spp. are also abundant in this habitat, being found on all four islands. Other genera found in the lighter conditions of this habitat, and not beneath the darker forest, are the crustose Caloplaca and Graphis, foliose Physcia, and fruticose Teleoschistes.

Species present:

**Caloplaca spp.**  M  Parmelia borreri  B
**Graphis sp.**  M  P. caperata  B, R, W
**Lecanora sp.**  R  P. cetrata  B, M, R
**Lobaria lacinata**  R  P. laevigata  B, R, W
**Physcia sp.**  R  P. rutidota  W
**Ramalina ecklonii**  B  P. saxatilis  R
**R. menziesii**  B, M, R, W  P. sinuosa  M
**Pseudocyphellaria aurata**  R, W  P. subtiliacea  R
**P. mougeotiana**  W  P. tasmanica  B
**Sticta caperata**  W  P. tiliacea  R
**S. lacera**  R  P. trichotera  M
**Teleoschistes chrysophthalmus**  R  Usnea spp.  B, M, R, W

4. Saxicolous — forest margin, open canopy, and grasslands.

Here again there is a gradation within the lichen flora, from beneath a forest canopy into open areas, but this time it is within saxicolous lichen associations. The Stictaceae are confined to rocks occurring beneath at least some forest canopy, even though this may be only that of Metrosideros excelsa on cliff-tops, as on Ruamahua-iti. The remaining genera listed for this habitat have all been found on rocks in areas ranging from open canopy to grasslands (as on Whale Island). The colourful genera Caloplaca and Xanthoria are very common in this habitat, together with species of the crustose genus Lecidea, foliose Parmelia, and fruticose Ramalina, Stereocaulon, and Usnea.

Species present:

**Caloplaca sp.**  R  Ramalina menziesii  M, W
**Lecidea sp.**  R, W  Stereocaulon corticatulum  W
**Lobaria montagnei**  R  Sticta caperata  W
**Parmelia caperata**  W  S. lacera  R
**P. sinuosa**  M  S. variabilis  R
**P. tiliacea**  R  Usnea sp.  W
**P. trichotera**  M  Xanthoria parietina  R, W

5. Epiphytic — manuka scrub

The epiphytic lichen association found within manuka scrub with a semi-open canopy is composed of elements from both the dense and open canopy associations. Species of the foliose genera Anaptychia, Pseudocyphellaria, and Sticta, fruticose Ramalina and Usnea, and crustose Pertusaria thrive in this habitat.

Species present:

**Anaptychia speciosa**  M  Ramalina menziesii  W
**Pertusaria sp.**  M  Sticta limbata  M
**Pseudocyphellaria aurata**  M  Usnea sp.  M, W
6. Epigean (soil-inhabiting) — beneath manuka scrub.

A lichen flora poor in genera but rich in species occurs on soil and leaf litter beneath manuka scrub. Only three genera, *Cladia*, *Cladonia*, and *Stereocaulon* have been found in this habitat. Species commonly known as the coral lichen, pixie-cups and reindeer lichen, as well as the distinctively red-and brown-fruited *Cladonia* are abundant. *Cladonia borbonica* occurs on three of the off-shore islands and *C. leptoclada* on all four, though not beneath manuka on Ruamahua-iti, but on open-canopied cliff-tops.

Species present:

<table>
<thead>
<tr>
<th>Species</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Cladia aggregata</em></td>
<td>B,W</td>
</tr>
<tr>
<td><em>C. retipora</em></td>
<td>B</td>
</tr>
<tr>
<td><em>Cladonia borbonica</em></td>
<td>B,M,W</td>
</tr>
<tr>
<td><em>C. degenerans</em></td>
<td>B</td>
</tr>
<tr>
<td><em>C. floerkeana</em></td>
<td>B,M</td>
</tr>
<tr>
<td><em>C. gracilis</em></td>
<td>B,M</td>
</tr>
<tr>
<td><em>Cladonia leptoclada</em></td>
<td>B,M,R,W</td>
</tr>
<tr>
<td><em>C. pyxidata</em></td>
<td>M</td>
</tr>
<tr>
<td><em>C. squamosa</em></td>
<td>B</td>
</tr>
<tr>
<td><em>C. subdigita</em></td>
<td>W</td>
</tr>
<tr>
<td><em>C. subulata</em></td>
<td>B,W</td>
</tr>
<tr>
<td><em>Stereocaulon corticatum</em></td>
<td>W</td>
</tr>
</tbody>
</table>

7. Epigean — other than manuka scrub.

Five species have been collected from soil other than that beneath manuka scrub. Three, *Peltigera polydactyla*, *Stereocaulon colensoi*, and *S. corticatum* were growing on rotting logs or on a thin veneer of soil overlying rocks beneath an open canopy. Two other epigean lichens — the distinctively pink-fruited *Baeomyces fungoides* and the dog-lichen *Peltigera canina* — have been found on clay banks.

Species present:

<table>
<thead>
<tr>
<th>Species</th>
<th>Location</th>
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</thead>
<tbody>
<tr>
<td><em>Baeomyces fungoides</em></td>
<td>B</td>
</tr>
<tr>
<td><em>Stereocaulon colensoi</em></td>
<td>B</td>
</tr>
<tr>
<td><em>Peltigera canina</em></td>
<td>W</td>
</tr>
<tr>
<td><em>S. corticatum</em></td>
<td>B</td>
</tr>
<tr>
<td><em>P. polydactyla</em></td>
<td>B</td>
</tr>
</tbody>
</table>

8. Saxicolous — maritime zone.

Comprehensive collection from the maritime zone was only carried out on Ruamahua-iti and Red Mercury Island. It was found that the fruticose genera *Ramalina* and the occasional *Usnea* colonised only the boulders of the upper maritime zone. Species of the foliose genus *Parmelia* and crustose *Lecanora* and *Pertusaria* dominated a belt in the mid to upper maritime zone, while below these, in the lower maritime zone, the dominant lichens were the yellow foliose *Xanthoria parietina* and the white and grey crustose *Lecidea* spp. Other genera present in the maritime zone are the crustose *Rinodina*, *Opegrapha*, and orange *Caloplaaca*.

Species present:

<table>
<thead>
<tr>
<th>Species</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Caloplaaca acheila</em></td>
<td>R</td>
</tr>
<tr>
<td><em>Lecanora</em> sp.</td>
<td>M,R</td>
</tr>
<tr>
<td><em>Lecidea</em> spp.</td>
<td>M,R</td>
</tr>
<tr>
<td><em>Opegrapha</em> sp.</td>
<td>R</td>
</tr>
<tr>
<td><em>Parmelia otagensis</em></td>
<td>M</td>
</tr>
<tr>
<td><em>P. rudecta</em></td>
<td>M</td>
</tr>
<tr>
<td><em>Pertusaria</em> sp.</td>
<td>M</td>
</tr>
<tr>
<td><em>Ramalina</em> sp.</td>
<td>M,R</td>
</tr>
<tr>
<td><em>Rinodina</em> sp.</td>
<td>M</td>
</tr>
<tr>
<td><em>Xanthoria parietina</em></td>
<td>B,M,R</td>
</tr>
<tr>
<td><em>Usnea</em> sp.</td>
<td>M</td>
</tr>
</tbody>
</table>

Three black species have been collected from the mid to upper eulittoral zone. The genera *Verrucaria* and barnacle-encrusting *Arthopyrenia* occur mostly in the mid eulittoral, while the tufted *Lichina pygmaea* var. *intermedia* occurs in the upper-mid to upper eulittoral zone around high tide level.

Species present:

<table>
<thead>
<tr>
<th>Species</th>
<th>Habitats</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Arthopyrenia</em> sp.</td>
<td>R</td>
</tr>
<tr>
<td><em>Verrucaria</em> sp.</td>
<td>M,R</td>
</tr>
<tr>
<td><em>Lichina pygmaea</em> var. <em>intermedia</em></td>
<td>B,M,R</td>
</tr>
</tbody>
</table>

**DISCUSSION**

Distribution of the lichen genera is in many respects related to form. Foliose lichens abound in all epiphytic associations, especially that beneath a dense coastal forest canopy (*Stictaceae* dominant). Beneath an open canopy foliose species (especially of *Parmelia*) are abundant, but fruticose genera (*Ramalina* and *Usnea*) are also well represented. Foliose, fruticose, and crustose genera are equally abundant on rocks (saxicolous) in all habitats, from a dense forest canopy to open grasslands. Epigean lichens beneath manuka scrub are restricted to three fruticose genera, whilst fruticose and foliose genera occur on clay banks, moss, or soil veneer beneath open-canoped coastal forest. Saxicolous lichens of the maritime-eulittoral zones are dominated by crustose genera, with foliose and fruticose forms more common at the highest levels.

The presence or absence of lichen genera on the various islands appears in part to reflect the vegetation differences. For example the epigean genera *Cladia*, *Cladonia*, and *Stereocaulon* found flourishing beneath manuka scrub on Great Barrier, Red Mercury, and Whale Island, are virtually absent on Ruamahua-iti, thus reflecting the lack of manuka on this island. On Whale Island and Ruamahua-iti, where a dense canopy is rare, species of the shade-tolerant family *Stictaceae* and genera *Psoroma* and *Sphaerophorus* are sparse, yet they are abundant on Great Barrier and Red Mercury where dense coastal forest abounds.

The occurrence of various lichen species on some islands and not on others is difficult to explain. Certainly some species not recorded from an island may be present but have been overlooked during collection, but this incompleteness of the species list could only account for a few of the absences. More detailed studies on reproduction and dispersal patterns may bring some light to bear on the problem. Vegetative reproduction by wind dispersal of soredia and isidia may be an important factor; for example the common and widespread species *Parmelia caperata*, *P. laevigata* and *Pseudocyphellaria aurata* have abundant soredia. Other common species (*Ramalina menziesii*, *Cladonia leptoclada*, and *Xanthoria parietina*), however, lack soredia and isidia, yet their widespread distribution indicates that other factors must also be considered, such as how common in nature is the algal partner of the lichen, and consequently how great is the chance of union with a fungus spore produced sexually by the lichen.

Numerous other factors that may have contributed to determining the present lichen flora of these islands include recent changes in vegetation – such as those following burn-offs (patches of coastal forest probably remained on Great Barrier and Red Mercury, but possibly not on Ruamahua-iti and Whale...
Island) — or the Pleistocene glacio-eustatic sea-level changes, with consequent complete submergence of some islands during interglacials, and additional land-links during glacials.

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