

KAWERUA LICHENS - A REVISION

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SUMMARY

One hundred and seventy-four lichen species from 65 genera are recorded from the Kawerua area, western Northland, New Zealand. The flora is dominated by lichens from mixed podocarp - broadleaf forest with less diverse associations recorded from pine forest, manuka heath, grassland, sand dune, maritime and intertidal habitats. The lichens recorded show the following affinities: cosmopolitan (28%), New Zealand endemics (28%), australasian (21%), austral (10%), pantropical (6%), paleotropical (4%) and Western Pacific (3%). The list includes the second records of three endemic crustose species and the second New Zealand records of two cosmopolitan species. The list also contains the northernmost records in New Zealand of 33 lichens.

INTRODUCTION

In 1974 we recorded 126 species of lichens from the area around the Auckland University Field Club scientific hut at Kawerua, North Auckland (Fig. 1) and presented details of their ecological distribution, especially in maritime, sand dune and kauri forest habitats (Hayward & Hayward 1974). At the time we noted "that a number of species remain unidentified ... an indication of our lack of knowledge of the New Zealand lichen flora". Since then there has been major progress in reviewing and documenting the taxonomy of our lichens, especially with the publication of the "Flora of New Zealand Lichens" by Galloway (1985), but also with a number of other family and generic reviews (eg Hayward 1977 - Graphidaceae, Opegraphaceae; Elix *et al.* 1986 - Xanthoparmelia; Degelius 1974 - Collema; Sipman 1983 - Megalosporaceae; Archer & Bartlett 1986 - Cladonia; Galloway 1988 - Pseudocyphellaria).

It is timely therefore to revise and update our earlier identifications and we have taken the opportunity to add further specimens collected during an Offshore Islands Research Group trip to Kawerua over the New Year period 1986-1987. For the purposes of this paper, the Kawerua area is taken to extend between the mouths of the Wairau and Waipoua Rivers and for 6km inland from the coast (Fig. 1).

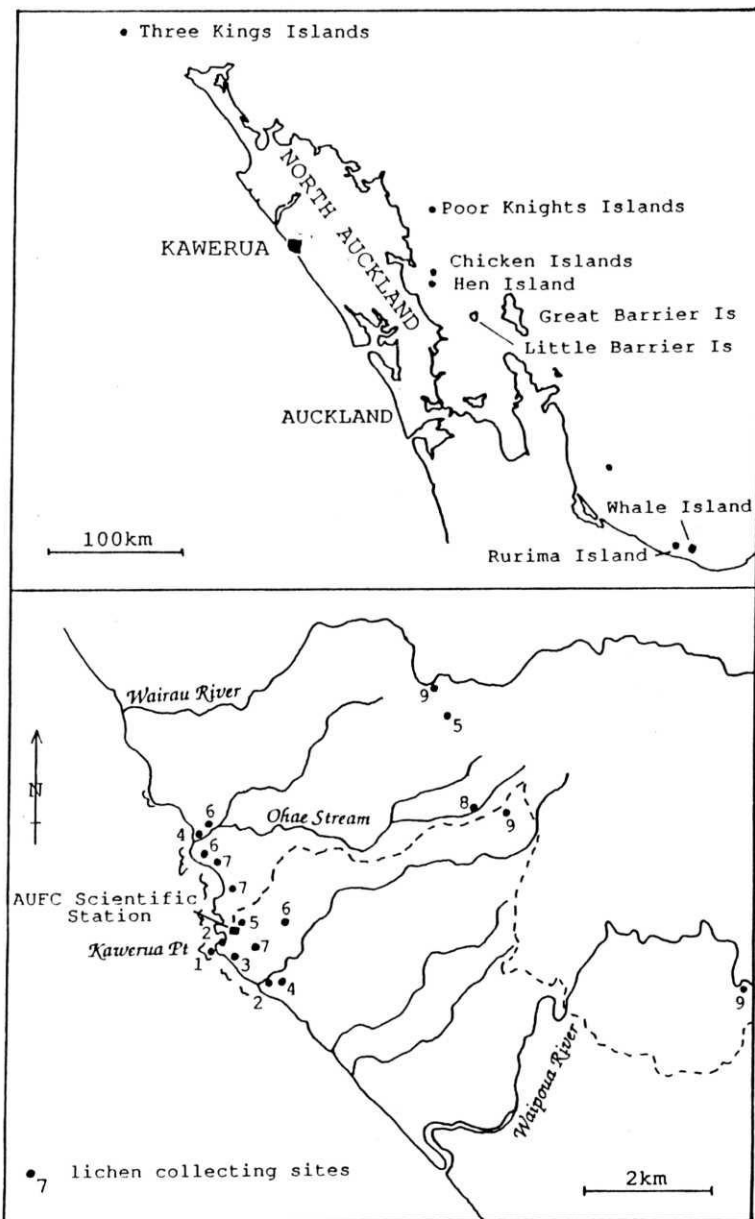


Fig. 1. Map of the Kawerua area, Northland, showing the main lichen study and collection localities. Collection numbers refer to habitat type codes in species list.

SPECIES LIST

Representative lichen collections and observations have been made in the main habitats. Specimens are housed in the herbarium of the Auckland Institute and Museum (AK). Classification follows Eriksson and Hawksworth (1987) and nomenclature for listed taxa follows Galloway (1985), except where otherwise stated.

Key to distribution symbols:

Habitat:

- 1 intertidal
- 2 maritime
- 3 sand dune
- 4 hard pan
- 5 grassland
- 6 manuka heath
- 7 pine forest
- 8 kauri forest
- 9 mixed forest

Substrate:

- b = bark
- ch = brick and mortar chimney
- cl = clay bank
- d = decaying log
- f = fence
- l = leaf
- r = rock
- rstm = rock in stream
- s = soil or sand

* recorded from Kawerua area by Hayward & Hayward (1974)

CLASS ASCOMYCOTINA

Order Arthoniales

Arthoniaceae

Arthothelium fusconigrum [as **Chiodecton* sp.] 8d,9b

Chrysothricaceae

Chrysothrix candelaris 5b

Order Caliciales

Sphaerophoraceae

Sphaerophorus insignis 9b

*Sphaerophorus melanocarpus** 8b

Order Dothideales

Arthopyreniaceae

Pyrenocollema sublitoralis (Leighton) Harris 1r

[as **Arthopyrenia* sp.]

Order Graphidales

Graphidaceae

Graphis inquinata 9b

Graphis insidiosa 5b,9b

Graphis librata 5b

Phaeographis australiensis [as **Graphis scripta*] 7b

Phaeographis inusta 7b

Thelotremaaceae

Diploschistes sticticus (Koerber) Mull Arg 2r

Ocellularia monosporoides [as **Lopadium monosporum*] 8b

<i>Thelotrma lepadinum</i>	5b,9b
Order Gyalectales	
Gyalectaceae	
<i>Coenogonium implexum*</i>	8b,9b
<i>Dimerella lutea</i>	9b
Order Helotiales	
Baeomycetaceae	
<i>Baeomyces arcuatus</i> Stirton*	6clrstms
<i>Baeomyces heteromorphus*</i> [also as <i>*B. cinnabarinus</i>]	6cl,7b
Order Lecanorales	
Bacidiaceae	
<i>Bacidia</i> cf. <i>plesia</i>	8rstm
<i>Bacidia wellingtonii</i>	7b
Brigantiaceae	
<i>Brigantiaea chrysostricta</i>	9b
<i>Brigantiaea tabacodes</i>	9b
Catillariaceae	
<i>Catillaria kelica*</i>	8b,9b
<i>Catillaria melanotropa</i> [as <i>*C. melaelina melastegia</i>]	8bd
Cladoniaceae	
<i>Cladia aggregata*</i>	4s,6bs,7s,9s
<i>Cladia retipora*</i>	6s
<i>Cladina confusa</i> (R. Sant) Follmann & Ahti [as <i>*Cladonia leptoclada</i>]	3s,4s,6bs 7s,8s,9s
<i>Cladonia capitellata*</i>	6s
<i>Cladonia cervicornis cervicornis*</i>	4s
<i>Cladonia cervicornis verticillata*</i>	6bs,7s
<i>Cladonia chlorophaea*</i>	7s
<i>Cladonia corniculata</i>	6s
<i>Cladonia didyma*</i>	6s
<i>Cladonia enantia</i>	3s
<i>Cladonia fimbriata*</i> [also as <i>*C. cf. pyxidata</i>]	3s,6bs,7s
<i>Cladonia floerkeana*</i>	6s
<i>Cladonia furcata</i>	6s
<i>Cladonia gracilis tenerrima</i> [as <i>*C. gracilis chordata</i>]	6b,7s
<i>Cladonia neozelandica</i> [as <i>*C. subcariosa</i>]	4s,7s
<i>Cladonia ochrochlora</i> [also as <i>*C. coniocraea</i>]	2r,3s,6s,7s
<i>Cladonia praetermissa</i> [as <i>*C. ochrochlora</i> , <i>C. pityrea subacuta</i>]	3s,6s,7s
<i>Cladonia ramulosa</i>	6s,7s
<i>Cladonia rei</i> [as <i>*C. cornutoradiata</i>]	3s,6s,7s
<i>Cladonia rigida</i> [as <i>*C. pityrea phyllophora</i>]	4s,7d
<i>Cladonia scabriuscula*</i>	7s
<i>Cladonia squamosa</i>	3s
<i>Cladonia</i> cf. <i>subsubulata</i>	6s,7s
<i>Cladonia sulcata</i>	8s
<i>Cladonia sulcata wilsonii</i>	6s,7s
Coccocarpiaceae	
<i>Coccocarpia palmicola</i>	9b

Collemataceae	
<i>Collema</i> cf. <i>subconveniens</i>	9b
<i>Collema subflaccidum</i>	9b
<i>Leptogium azureum</i> [as * <i>Collema</i> sp.]	8b,9b
<i>Leptogium crispatellum</i>	9b
<i>Leptogium cyanescens</i> [as * <i>Collema</i> sp.]	8b,9b
Lecanoraceae	
<i>Lecanora campestris</i>	2r
<i>Lecanora pallida</i>	5f,7b
<i>Lecanora symmicta</i>	3b
<i>Megalaria grossa</i> (pers. ex Nyl.) Hafellner	5b,9b
Lecideaceae	
<i>Lecidea aucklandica</i>	5f
<i>Lecidea</i> cf. <i>fuscoatrula</i>	9rstm
<i>Lecidea</i> cf. <i>fuscocincta</i> [as * <i>Lecidea albipraetexta</i>]	5f
<i>Lecidea subcoarctata</i>	2r
Megalosporaceae	
<i>Megalospora campylospora</i> *	8b
<i>Megalospora gompholoma</i> [as * <i>M. sulphurata</i>]	8b,9b
<i>Megalospora knightii</i>	9b
<i>Megalospora subtuberculosa</i>	9b
Micareaceae	
<i>Roccellinastrum neglectum</i>	9b
Miltideaceae	
<i>Miltidea ceroplasta</i>	9b
Pannariaceae	
<i>Leioderma duplicatum</i>	8b,9b
<i>Leioderma sorediatum</i>	5b
<i>Pannaria crenulata</i> [as * <i>Parmeliella</i> sp.]	8b,9b
<i>Pannaria elatior</i> [as * <i>Parmeliella</i> sp.]	6b,9b
<i>Pannaria fulvescens</i>	8b,9b
<i>Pannaria immixta</i>	9b
<i>Parmeliella nigrocincta</i> [as * <i>Pannaria nigrocincta</i>]	8b,9b
<i>Psoroma allorhizum</i>	8b,9b
<i>Psoroma araneosum</i> [as * <i>Pannaria</i> cf. <i>pholidota</i>]	9b
<i>Psoroma asperellum</i>	9b
<i>Psoroma athroophyllum</i>	9b
<i>Psoroma caliginosa</i>	9b
<i>Psoromo implexum</i>	9b
<i>Psoroma leprolosum</i>	9b
<i>Psoroma microphyllum</i>	9b
<i>Psoroma sphinctrinum</i> * [also as * <i>Parmeliella</i> sp.]	9b
<i>Psoroma sphinctrinum pyxinoides</i> Nyl.	9b
<i>Psoroma xanthomelanum</i>	9b
<i>Psoromidium aleuroides</i>	9b
Parmeliaceae	
<i>Flavoparmelia soredians</i>	5b,7b
<i>Menegazzia aucklandica</i>	8b,9b

<i>Menegazzia circumsorediata*</i>	8b
<i>Menegazzia nothofagi*</i>	8b,9b
<i>Parmelia cunninghamii</i>	9b
<i>Parmelia testacea</i>	5b,9b
<i>Parmotrema arnoldii</i> [as <i>*Parmelia</i> cf. <i>arnoldii</i>]	7b,9b
<i>Parmotrema chinense</i> (Osbeck) Hale & Ahti [as <i>*Parmelia reticulata</i>]	5bf
<i>Parmotrema cetratum</i> [as <i>*Parmelia cetrata</i>]	8b,9b
<i>Parmotrema crinitum</i>	2r
<i>Parmotrema reticulatum</i> [as <i>*Parmelia reticulata</i>]	2r,5bf,6b,7b,9b
<i>Usnea arida</i>	5f,7b
<i>Usnea inermis</i>	5f,7b
<i>Usnea pusilla</i> [as <i>*U. florida</i>]	6b
<i>Usnea rubicunda</i> [as <i>*U. rubescens</i>]	5bf,7b
<i>Usnea xanthophana</i> [as <i>*U. florida</i>]	5fr,7b,8b
<i>Xanthoparmelia australasica</i> [as <i>*Parmelia isidiigera</i>]	2r,3r
<i>Xanthoparmelia scabrosa</i>	9rstm
<i>Xanthoparmelia thamnoides</i>	9rstm
Physciaceae	
<i>Buellia alutacea</i>	2r
<i>Buellia</i> cf. <i>hypolepidna</i>	9b
<i>Buellia punctata*</i>	5b
<i>Buellia spuria</i> [as <i>*B. alboatrum</i>]	2r
<i>Buellia stellulata*</i>	2r
<i>Buellia</i> sp.	9b
<i>Dirinaria applanata</i>	5f
<i>Heterodermia japonica</i>	5b,9b
<i>Heterodermia microphylla</i>	9b
<i>Heterodermia obscurata</i> [as <i>*Anaptychia obscurata</i>]	2r,3b,6brstm
<i>Heterodermia speciosa</i> [as <i>*Anaptychia pseudospeciosa</i>]	2r,6b,8d
<i>Physcia caesia</i>	2r,5b
<i>Physcia tribacioides</i>	2r,5b
<i>Rinodina tubulata</i>	2r
Porpidiaceae	
<i>Porpidia macrocarpa</i> (D.C.) Hertel & Schwab	9rstm
Ramalinaceae	
<i>Ramalina celastri</i> [as <i>*R. cf. menziesii</i>]	2r,5f,7b
Rhizocarpaceae	
<i>Rhizocarpon geographicum</i>	2r
Stereocaulaceae	
<i>Stereocaulon corticaulm</i>	9rstm
<i>Stereocaulon ramulosum*</i>	4s,6srstm,7s,8rstm,9b
Trapeliaceae	
<i>Placopsis parellina*</i>	8rstm
<i>Placopsis perrugosa</i>	9rstm
<i>Placopsis rhodophthalma</i> [as <i>*Placopsis brevilobata</i>]	2r
Order Lichinales	
Lichinaceae	
<i>Lichina confinis*</i>	1r

Order Opegraphales	
Opegraphaceae	
<i>Enterographa gelatinosa</i>	5b
<i>Opegrapha agelaeoides</i>	5b,6b
<i>Opegrapha intertexta</i> [as * <i>Graphis</i> sp.]	5b
Peltigerales	
Lobariaceae	
<i>Pseudocyphellaria aurata</i> *	6b
<i>Pseudocyphellaria carpoloma</i> [as * <i>P. impressa</i>]	6b,8b,9b
<i>Pseudocyphellaria chloroleuca</i> (J.D. Hook & Taylor)	8b
Du Rietz [as * <i>Sticta variabilis</i>]	
<i>Pseudocyphellaria cinnamomea</i> *	9b
<i>Pseudocyphellaria coriacea</i>	8b,9b
<i>Pseudocyphellaria coronata</i>	6b,9b
<i>Pseudocyphellaria dissimilis</i> [as * <i>P. lacerata</i>]	8r,9b
<i>Pseudocyphellaria episticta</i> [as * <i>P. amphisticta</i>]	6b
<i>Pseudocyphellaria glabra</i> * (J.D. Hook & Taylor)	8b,9b
<i>Pseudocyphellaria haywardiorum</i> Galloway	9b
<i>Pseudocyphellaria lividofusca</i> [as * <i>P. amphisticta</i> ,	6b,8b
<i>Sticta internectens</i> , <i>Sticta sinuosa</i>]	
<i>Pseudocyphellaria montagnei</i> [as * <i>P. cinnamomea</i> , <i>Lobaria</i> cf. <i>montagnei</i>]	8bd,9b
<i>Pseudocyphellaria multifida</i> (Nyl.) Galloway	9b
<i>Pseudocyphellaria rufovirescens</i>	9b
<i>Pseudocyphellaria pickeringii</i> * (Tuck) Galloway	6b,9b
<i>Sticta babingtonii</i> [as * <i>S. variabilis</i> , <i>Lobaria</i> cf. <i>montagnei</i>]	8b
<i>Sticta fuliginosa</i>	9b
<i>Sticta lacera</i> *	8b
<i>Sticta latifrons</i> *	8b,9b
<i>Sticta squamata</i> [as * <i>S. filix</i>]	8b
<i>Sticta subcaperata</i> [as * <i>S. caperata</i>]	8b
Peltigeraceae	
<i>Peltigera dolichorhiza</i> * [also as * <i>P. virescens</i>]	9s
Pertusariales	
Coccotremataceae	
<i>Coccotrema cucurbitula</i>	9b
Pertusariaceae	
<i>Pertusaria graphica</i> *	2r
<i>Pertusaria leucodes</i> [as * <i>P. laevis</i>]	8b
<i>Pertusaria leucodeoides</i> [as * <i>P. cupularis</i>]	8b
<i>Pertusaria truncata</i>	5b
<i>Pertusaria</i> sp.*	2r
<i>Thelenella luridella</i> (Nyl.) H. Mayrhofer	2r
Order Pyrenulales	
Pyrenulaceae	
<i>Pyrenula dealbata</i>	8b,9b
<i>Pyrenula deliquescens</i> [as * <i>P. knuthii</i>]	8b
Trichotheliaceae	
<i>Clathroporina exocha</i> [as * <i>C. endochrysea</i>]	8b,9b

Order Teloschistales	
Teloschistaceae	
<i>Caloplaca acheila</i> [as * <i>C. holocarpa</i>]	2r
<i>Caloplaca circumlutosa</i>	2r
<i>Caloplaca cribrosa</i>	2r
<i>Teloschistes chrysophthalmus</i> *	5fr
<i>Xanthoria ligulata</i> [as * <i>Caloplaca</i> sp.]	2r,5f
<i>Xanthoria parietina</i> *	2r,3r,5ch
Order Verrucariales	
Verrucariaceae	
<i>Verrucaria maura</i> *	1r
Phylctillaceae	
<i>Phlyctis subuncinata</i> Stirton	5b
<i>Phlyctis</i> sp.	5b
Strigulaceae	
<i>Strigula elegans</i>	9l

HABITAT ASSOCIATIONS

The list of lichens identified from the Kawerua area is largely controlled by the types and abundance of habitat present. For example, over 50% of the recorded lichens live in the native kauri or mixed broadleaf forest that covers much of the inland parts of the area.

Marine and Maritime

Only a small area of the coastline has intertidal reefs or supratidal cliffs or boulders of solid rock suitable for lichen colonisation. This area, around Kawerua Point, is exposed to the full forces of wind, sun and often waves and has virtually no sheltered or slightly damp microhabitats in the maritime zone. Thus only the hardiest lichens, mostly crustose, flourish here and the maritime lichen flora of Kawerua is of much lower diversity (26 species), especially in foliose and fruticose species, than many other areas studied on the east coast of Northland (eg Great Barrier Island - 80 species, Hayward *et al.* 1986; Whale Island - 36 species, Hayward & Hayward 1990; Chickens Islands - 46 species, Hayward & Hayward 1984).

Sand Dune and Hard Pan

Few New Zealand lichens have been studied or recorded from these habitats. At Kawerua, eleven species of fruticose lichens in the genera *Cladia* and *Cladonia* grow on the ground in the damper hollows in these hot, dry habitats. This compares with seven species recorded from similar habitats on Whale Island (Hayward & Hayward 1990), but only two species (*Cladia aggregata*,

Cladonia rei) are recorded from both places.

Grassland

In the long grass of the ungrazed paddocks around Kawerua there are only a few substrates suitable for lichen colonisation. The rough bark of several mature trees of *Cupressus macrocarpa* and *Metrosideros excelsa* supports a meagre lichen flora dominated by crustose species (12 species) with only 6 foliose and 1 fruticose species recorded. The most common crusts are 5 species of script lichens (Opegraphaceae and Graphidaceae). On old wooden fence posts however, fruticose (6) and foliose (4) species are more common than crustose (3). Here the most obvious lichens are the fruticose *Ramalina celastri* and 4 species of *Usnea*.

Manuka heath

Vigorous youthful remnants of a once more extensive area of manuka heath in the area around Kawerua support only a sparse lichen flora. Lichens are rare on the branches with foliose *Pseudocyphellaria* species and *Parmotrema reticulatum* most frequent. Two species of *Baeomyces* colonise clay banks in the heath area and a diverse flora of 15 *Cladonia* species together with *Stereocaulon ramulosum* has been recorded growing on the sandy soil in parts of the heath. Depauperate lichen floras are characteristic of vigorous, young manuka and kanuka heath in northern New Zealand (e.g. Hayward & Hayward 1980); only the taller, more mature heath has been found to support rich lichen floras (e.g. Hayward & Hayward 1984, Galloway & Hayward 1987).

Pine Forest

Lichens are virtually absent from within the dense-canopied 30 to 40 year old plantations of exotic pines that occur near the coast around Kawerua. Twelve species have been recorded growing on pine branches and cones, but only in lighter areas on the edges of the plantations or in significant canopy gaps. Here the most common lichens seen are four species of old man's beard lichen, *Usnea*. Lichens are also absent from the needle-covered ground beneath most of the pine forest, but 15 species of Cladoniaceae have been recorded from sandy soil in several large canopy gaps in the plantation between Kawerua and the mouth of the Ohae Stream.

Kauri Forest

Lichens within and on the fringes of a stand of mature kauri (*Agathis*

australis) forest were studied by Hayward & Hayward (1974). Reidentification of those collections reveals a diverse lichen flora growing on the bark of kauris and associated broadleaf trees. Foliose lichens (25 species) are dominant, especially Lobariaceae, Pannariaceae, *Menegazzia* and *Leptogium*. Ten species of crustose lichens are recorded, in particular *Pertusaria*, *Pyrenula*, *Megalospora* and *Catillaria* (2 species each).

Mixed Forest

Mixed podocarp - broadleaf forest is the most abundant habitat in Waipoua Forest, inland from Kawerua. Lichens were studied and collected from localities in the upper Ohae, middle Wairau and middle Waipoua Valleys, all close to the access road to Kawerua. The wide variety of substrate types and microhabitats available in this mixed forest results in a diverse lichen flora with 75 species recorded (51 foliose, 20 crustose, 4 fruticose). The rich foliose flora on bark is dominated by species of *Pseudocyphellaria* and *Psoroma*, many of which only occur in this habitat in the Kawerua area. Other common foliose forest lichens are *Pannaria*, *Collema*, *Leptogium*, *Parmelia*, *Parmotrema*, *Menegazzia* and *Sticta*. Of the rich, epiphytic, crustose flora recorded the most abundant lichens are species of *Graphis*, *Brigantiaea*, *Megalospora*, *Buellia* and *Megalaria*.

FLORISTIC DIVERSITY

This paper lists 174 species of lichens in 65 genera from the Kawerua area. This floristic diversity is of a similar order to that of well-studied northern offshore islands, such as the Three Kings Islands (170 species, 81 genera, Galloway & Hayward 1987), Whale and Rurima Island (157 species, 63 genera, Hayward & Hayward 1990) and the Hen and Chicken Islands (156 species, 58 genera, Hayward & Hayward 1984).

The Kawerua area's 174 species represents approximately 15% of New Zealand's recorded lichen flora and about 40% of the lichen species so far recorded from Northland. Further detailed searching and collecting in the Kawerua area is likely to add another 50 or so taxa to the present list, especially small microlichens and crustose taxa.

BIOGEOGRAPHY AND SIGNIFICANT RECORDS

The lichens recorded here from the Kawerua area have the following biogeographic affinities (from Galloway 1985): cosmopolitan species 28%, nominally endemic 28%, australasian 21%, pantropical 6%, paleotropical 4%, austral 10%, and Western Pacific 3%. This floristic composition is very similar to that recorded for the lichens of Great Barrier Island (Hayward *et al.* 1986)

where there is a similar range of habitats with a predominance of mixed native forest cover. The composition differs considerably from the Three Kings and Poor Knights Islands lichen floras (Galloway & Hayward 1987, Hayward & Wright 1991) where mixed podocarp - broadleaf forest is absent and varieties of coastal forest, coastal scrub and maritime habitats predominate. These subtropical island floras have a greater percentage of cosmopolitan (35%, 44%) and pan- and paleotropical species (18%, 14%), with fewer endemic (20%, 17%) and austral species (7%, 5%).

This list of lichens from the Kawerua area contains the second records of three endemic crustose species previously known only from their type collections (*Lecidea aucklandica*, *Ocellularia monosporoides*, *Pertusaria leucodes*) and the second New Zealand records of a subtropical species (*Thelenella luridella*) and a cosmopolitan species (*Lecanora pallida*).

These Kawerua records extend the known northern limits within New Zealand of 33 species (*Arthothelium fusconigrum*, *Bacidia wellingtonii*, *Buellia alutacea*, *B. punctata*, *B. spuria*, *Cladonia didyma*, *C. rei*, *C. rigida*, *Collema subflaccidum*, *Diploschistes sticticus*, *Graphis insidiosa*, *Lecanora palida*, *Lecidea aucklandica*, *L. subcoarctata*, *Megalospora subtuberculosa*, *Menegazzia nothofagi*, *Ocellularia monosporoides*, *Parmelia cunninghamii*, *P. testacea*, *Parmotrema arnoldii*, *Pertusaria leucodes*, *P. leucodeoides*, *Placopsis perrugosa*, *P. rhodophthalma*, *Psoroma asperellum*, *P. implexum*, *P. xanthomelanum*, *Psoromidium aleuroides*, *Pyrenula deliquescens*, *Rinodina tubulata*, *Roccellinastrum negelectum*, *Thelenella luridella*, *Xanthoparmelia thamnoides*). All recorded species are known from further south.

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