

Ecological communities of tree species threatened by myrtle rust (*Austropuccinia psidii* (G. Winter) Beenken): The lichenised mycobiota of pōhutukawa (*Metrosideros excelsa* Sol. ex Gaertn., Myrtaceae)

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Abstract

Myrtle rust (*Austropuccinia psidii*) poses a serious threat to the New Zealand Myrtaceae. While the threat to the host tree is reasonably well-known, the threat myrtle rust poses to the associated biota is poorly understood. As a contribution to our knowledge of this, a preliminary list of the lichenised mycobiota that utilise pōhutukawa (*Metrosideros excelsa*) as a phorophyte is presented, based on a survey of the specimens in two herbaria with extensive collections from the natural range of this endemic tree species. We report 187 lichen species (and lower ranks) from 76 genera and 32 families.

Introduction

New Zealand has 28 indigenous Myrtaceae (de Lange & Rolfe 2010; de Lange 2014; Schönberger et al. 2020); all are endemic, with the exception of *Leptospermum scoparium* J.R.Forst. et G.Forst. as currently circumscribed. Probably the best known of the indigenous Myrtaceae is pōhutukawa (*Metrosideros excelsa* Sol. ex Gaertn.), the so-called New Zealand Christmas tree, a widely acknowledged iconic species, which is popular throughout New Zealand, and indeed worldwide, as an ornamental (Simpson 2005; Bylsma et al. 2014) (Figure 1). While the tree is culturally important, it and the leaf litter it produces are also a critical food source and habitat for a diverse array of life (Anderson 2003; Bylsma et al. 2014; Cummings et al. 2014; Galbraith & Large 2017; Hosking & Hutcheson 1993; Pattemore & Wilcove 2012; Schmidt-Adam et al. 2000; Taylor et al. 2007).

Pōhutukawa is part of a Pacific radiation centred on *Metrosideros collina* (J.R.Forst. et G.Forst.) A.Gray (Wright et al. 2000; Gardner et al. 2004). The biological flora of the species was reviewed by Bylsma et al.



Figure 1. Pōhutukawa (*Metrosideros excelsa*). (A) Mature trees, Tāwharanui, Omaha Bay, North Auckland. Photograph: A. J. Marshall. (B) Flowers, Tawhitokino Beach, east of Papanui Point, Kawakawa Bay, South Auckland. Photograph: P. J. de Lange.

(2014), who considered it indigenous to the northern portion of the North Island of New Zealand, ranging from Manawatāwhi Three Kings Islands south to Urenui (38° 59' 28.76" S) in the west and to Poverty Bay (38° 45' 29.715" S) in the east (Bylsma et al., 2014) (Figure 2), though exact southern limits are unclear due to possible plantings by iwi and more recently European settlers.

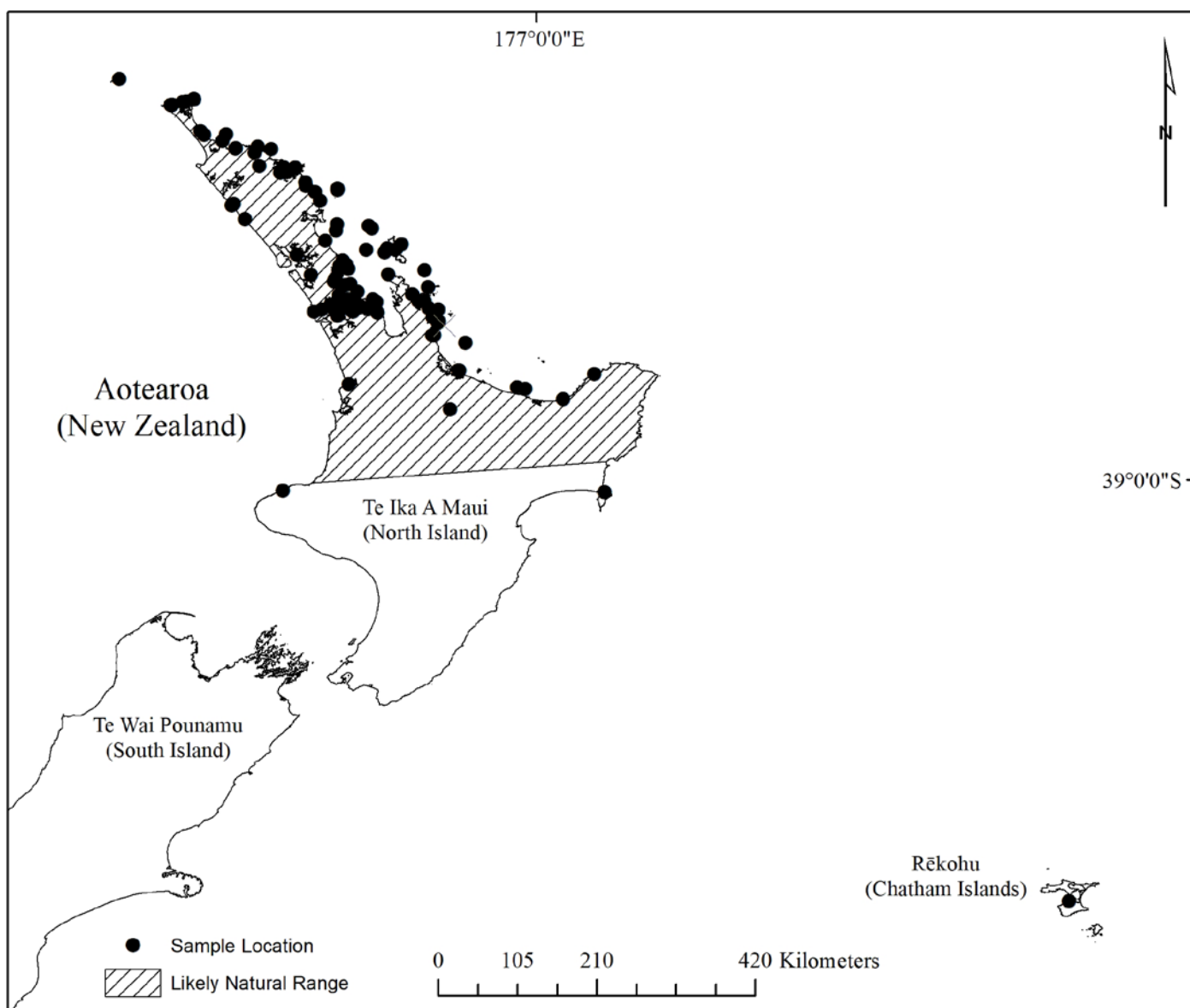


Figure 2. Locations from where lichen collections in AK and UNITEC have been made from pōhutukawa (including cultivated and natural occurrences of this phorophyte). The approximate natural southern limit of pōhutukawa as judged by Bylsma et al. (2014) is also shown. Image: Andrew Marshall.

Myrtle rust (*Austropuccinia psidii* (G. Winter) Beenken) was first reported from New Zealand in May 2017, after which it has spread rapidly throughout the North Island and northern South Island (Galbraith & Large 2017; Beresford et al. 2018). Although the full impact of myrtle rust on New Zealand Myrtaceae is still unknown, based on the Australian experience it may take a decade or more before this becomes evident (Carnegie et al. 2015; Carnegie & Pegg 2018; Fensham et al. 2020). Nevertheless, during the early stages of the establishment of that rust in New Zealand pōhutukawa (Figure 3) was one of the indigenous Myrtaceae that was found to be attacked (Toome-Heller et al. 2020). Due to concerns over the spread of myrtle rust and

its projected impacts on New Zealand Myrtaceae, as a precautionary measure, pōhutukawa was listed as 'Threatened – Nationally Vulnerable' by de Lange et al. (2018a).

The arrival of myrtle rust has prompted the need to better understand the ecological communities of our indigenous Myrtaceae. Currently there is some information available. Bylsma et al. (2014), for example, note that 16 fern and flowering plant taxa have been reported epiphytic on pōhutukawa. McKenzie et al. (1999) also published an annotated list of all of the fungi known from pōhutukawa that was part of a wider study of *Metrosideros*, although this excluded lichenised fungi. Two hundred and nine species were recorded, mainly



Figure 3. *Austropuccinia psidii* infection on epicormic growth of pōhutukawa (*Metrosideros excelsa*), Āwhitu Peninsula, vicinity of Manukau Lighthouse Station. Photograph: P. J. de Lange.

saprobies, but some endomycorrhizal fungi and primary or secondary pathogens were also included (McKenzie et al. 1999; Bylsma et al. 2014). Recently, Johnston and Park (2019) described a new species of leaf spot fungus *Blastocervulus metrosideri*, which is endemic, or nearly so, to pōhutukawa. The lichen mycobiota of pōhutukawa is less well-known. Pōhutukawa forest is thought to be important habitat for lichens (Blanchon 2013), particularly large foliose species such as *Pseudocyphellaria coriacea* and *Crocodia aurata* (Galloway 1988), and fruticose species such as *Ramalina australiensis* and *R. pacifica* (Blanchon et al. 1996), *Usnea nidifica* and *U. rubicunda* (Galloway 1985; Galloway 2007b). Useful but very local accounts are available of the lichens associated with pōhutukawa for Aotea Great Barrier Island (Hayward et al. 1986), Rangitoto Island (Blanchon et al. 2007), Motu Kaikoura (Blanchon et al. 2011) and Tuhua Mayor Island (de Lange et al. 2012), but there is a need for an in-depth survey of the lichens associated with pōhutukawa over

its full natural range.

To help rectify that apparent knowledge gap we provide a preliminary contribution to that need by listing the lichenised mycobiota that utilise pōhutukawa as a phorophyte. This contribution is not intended to be comprehensive, we have only examined herbarium holdings in two herbaria, AK and UNITEC (Thiers 2020–onwards) but nevertheless this list constitutes the first freely available compendium of lichenised mycobiota yet published for pōhutukawa.

Methods

The databases of AK and UNITEC were queried for lichen collections that specifically stated that pōhutukawa was the substrate. From that data we compiled a master list of lichenised and lichenicolous mycobiota. Any problematic taxa were then physically examined to resolve the names used for them in either herbarium.

Results and Discussion

From our sampling we report 187 lichen species (and lower ranks) from 76 genera and 32 families (Appendix 1), which include 25 of the lichen species currently believed to be endemic to New Zealand (Galloway 2007a, 2007b; authors' unpublished data). This represents 9% of the 2026 lichenised mycobiota and associated lichenicolous taxa reported for New Zealand by de Lange et al. (2018b). These figures, considering that our assessment is based on lichen holdings in just two of New Zealand's 14 herbaria (New Zealand National Herbarium Network n.d.) is almost certainly an underestimate of the full diversity associated with pōhutukawa. Galloway (2007a, 2007b) also recorded 44 of these species as being common or occasional associates of pōhutukawa forest.

The lichens associated with pōhutukawa held in AK and UNITEC came from c.109 locations, 12 of which were from cultivated trees. The locations mainly occur within the natural range of pōhutukawa with a bias toward the eastern extent of the species (Figure 2). Westerly locations with the exception of the Auckland isthmus are under-represented (Figure 2). Notably, offshore islands are well represented in the collections. These are patterns that reflect the field bias of the main lichen collectors, many of whom undertook field work on offshore islands or visited remote locations. The dominance of Auckland localities also reflects collector bias as the majority of collectors, J. Bartlett, D. Blanchon, E. Cameron, P. de Lange, G. Hayward, B. Hayward, A. Marshall and A. Wright, either reside

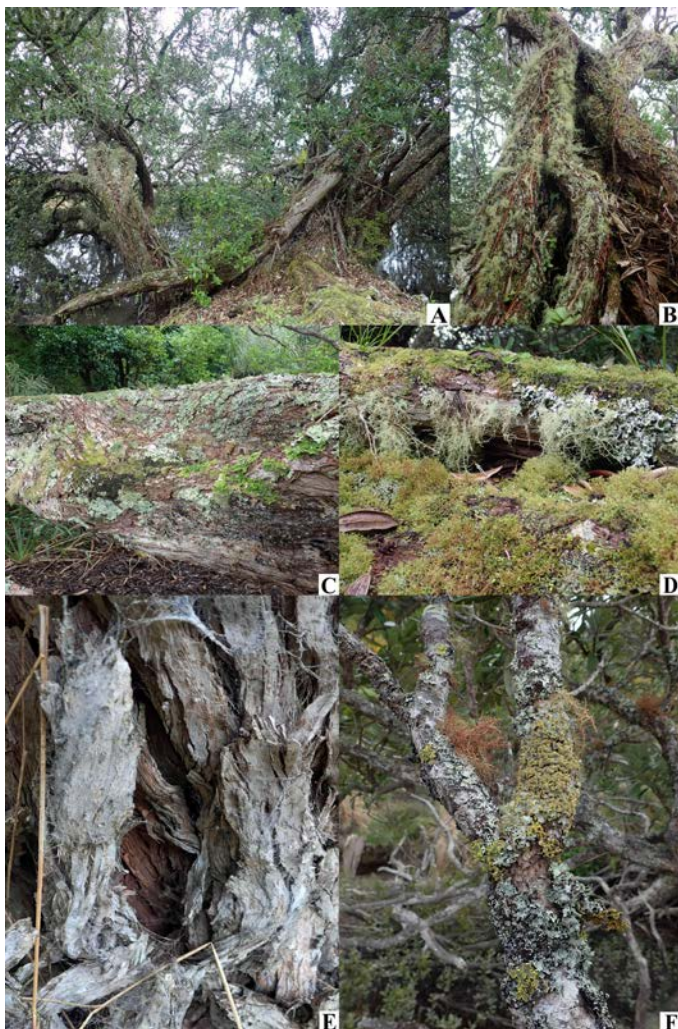


Figure 4. Examples of some pōhutukawa microhabitats. (A) Mature tree. (B) Trunk and aerial roots. (C) Horizontal branch. (D) Root mound and exposed roots. (E) Tree cavity. (F) Canopy branchlets. Photographs: Peter de Lange.

or once resided there. These general patterns are identical to those noted by de Lange et al. (2012) in the first nationwide assessment of the threat status of New Zealand lichenised and lichenicolous mycobiota. Further, despite the wide range of locations represented in AK and UNITEC herbaria, we could find no evidence of systematic lichen collection from pōhutukawa. Based on these herbarium records and field observations, a characteristic lichen assemblage can be identified as being associated with pōhutukawa, and some taxa may favour it as a substrate. Indeed, well-established pōhutukawa provide a diversity of habitats and micro-niches for lichens. These include root mounds, exposed roots (ground and aerial), trunks, tree cavities, vertical and horizontal branches, branchlets, and dead or dying branches and branchlets (Figure 4).

At humid, less-modified sites, photophilous

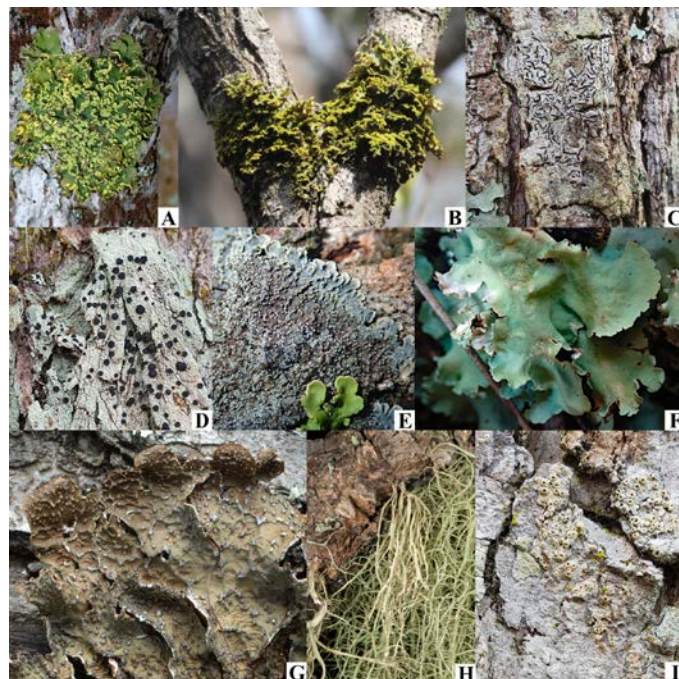


Figure 5. Examples of the diversity of lichens found on pōhutukawa. (A) *Crocodia aurata*. Photograph: M. Hutchison. (B) *Crocodia poculifera*. Photograph: K. A. Raharaha. (C) *Halegrapha mucronata*. Photograph: A. J. Marshall. (D) *Megalaria grossa*. Photograph: A. J. Marshall. (E) *Pannaria elixii*. Photograph: P. J. de Lange. (F) *Parmotrema robustum*. Photograph: P. J. de Lange. (G) *Pseudocyphellaria haywardiorum*. Photograph: R. Lücking. (H) *Ramalina pacifica*. Photograph: A. J. Townsend. (I) *Thelotrema lepadinum*. Photograph: A. J. Marshall.

foliose species of Parmeliaceae such as *Hypogymnia subphysodes*, *Menegazzia neozelandica*, *Parmotrema austrocetratum*, *Parmotrema crinitum*, *Parmotrema perlatum*, *Parmotrema reticulatum*, *Parmotrema subtinctorium*, *Parmotrema tinctorum*, and similarly members of the Peltigeraceae such as *Crocodia aurata* (Figure 5), *Crocodia poculifera* (Figure 5), *Podostictina pickeringii*, *Pseudocyphellaria carpoloma*, *Pseudocyphellaria coriacea*, *Pseudocyphellaria crocata*, *Pseudocyphellaria montagnei* and *Sticta squamata* are commonly encountered. Other foliose lichen species such as *Coccocarpia erythroxyli*, *Dirinaria applanata*, *Heterodermia speciosa*, *Pannaria allorhiza*, *Pannaria elixii* (Figure 5) and *Pannaria fulvescens* are also often present. The exposed trunks and canopy branches of pōhutukawa trees usually support a diverse range of fruticose lichens, including *Ramalina australiensis*, *Ramalina celastri*, *Ramalina pacifica* (Figure 5), *Ramalina peruviana*, *Teloschistes chrysophthalmus*, *Teloschistes flavicans*, *Usnea inermis* and *Usnea rubicunda*. Where

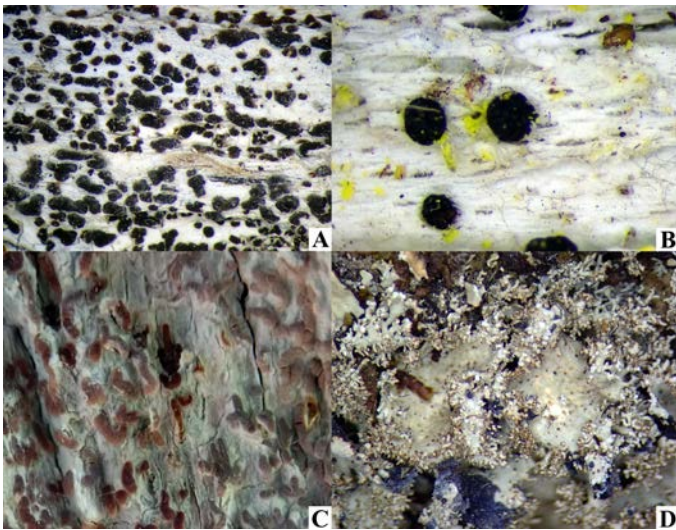


Figure 6. Examples of the diversity of lichens found on pōhutukawa. (A) *Arthonia nigrocincta* Photograph: P. J. de Lange. (B) *Bactrospora metabola* admixed with yellow granules of *Chrysothrix xanthina*. Photograph: P. J. de Lange. (C) *Enterographa pallidella* Photograph: P. J. de Lange. (D) *Hypotrachyna horrescens*. Photograph: P. J. de Lange.

more comprehensive field surveys have been carried out, crustose species such as *Calicium hyperelloides*, *Calicium lenticulare*, *Chaenotheca brunneola*, *Chrysothrix xanthina*, *Enterographa pallidella* (Figure 6) and *Opegrapha intertexta* have been collected, often in dry tree cavities, or on sheltered portions of necrotic wood. Several uncommon species, such as *Ramalina leiodea* (Blanchon et al. 2015) and *Sticta caperata* are so far known only from pōhutukawa in New Zealand.

Of the lichens recorded here on pōhutukawa, 57 have also been recorded on manawa (*Avicennia marina* subsp. *australasica*) (Reynolds et al. 2017), which is often found in association with pōhutukawa along an ecotone of northern New Zealand estuaries and coastal forest. This suggests that a common coastal forest lichen community exists in the northern North Island. Notably though, despite the lack of dedicated survey of lichen communities of pōhutukawa, our preliminary investigation shows that this phorophyte supports more species and lower ranks of lichens (187 taxa) than does manawa (106 taxa). Some of the differences between the mycobiotas of manawa and pōhutukawa could be explained by collecting biases and different reasons for specimen collection (e.g., the manawa study represents a targeted and detailed survey of all the lichens present on that phorophyte, sampling ten trees at each of 20 sites (Reynolds et al. 2017), while the pōhutukawa collections represent both opportunistic collecting

and, less commonly, detailed surveys of pōhutukawa forest for lichens. However, it is likely that many of the differences are indications of there being distinct lichen assemblages supported by pōhutukawa and manawa forests, reflecting their different bark characteristics, plant community composition, light levels and proximity to salt water (Reynolds et al. 2017).

Pōhutukawa trees are important substrates for a number of threatened lichens, with one species, *Ramalina pacifica* (Figure 5) currently assessed 'Threatened – Nationally Vulnerable,' and a further 31 collectively assessed as 'At Risk' (2 taxa listed as 'At Risk – Declining' and 29 as 'At Risk – Naturally Uncommon') (de Lange et al. 2018b). *Ramalina pacifica* was noted by Blanchon et al. (1996) and Galloway (2007b) as occurring mainly on manawa and pōhutukawa. While seemingly never common, this species does seem to be in decline (de Lange et al. 2012; Blanchon 2013). Of the two 'At Risk – Declining' species, there is little evidence that pōhutukawa is or was an important phorophyte for *Ramalina geniculata* (Blanchon et al. 1996). However, Galloway (2007b) noted that *Teloschistes flavicans* "is often a visually striking canopy epiphyte of coastal *Metrosideros excelsa*" (p. 1734), but this no longer seems to be the case for mainland sites, with an apparent decline in populations around Auckland and Northland (de Lange et al. 2012). Furthermore, although not confined to pōhutukawa other 'At Risk – Naturally Uncommon' species, including *Parmotrema robustum* and *Pseudocyphellaria haywardiorum*, particularly on Rangitoto Island, are commonly seen on this phorophyte (Figure 5). A further 21 taxa collected from pōhutukawa are listed as 'Data Deficient' by de Lange et al. (2018). Resolution of the conservation status of Data Deficient lichens is considered one of the Department of Conservation's highest priorities (J. R. Rolfe, personal communication). Targeted nationwide collecting of lichens from pōhutukawa has, as observed already, not been undertaken. The discovery of such species as the 'Data Deficient' *Soltaria chrysophthalma*, hitherto only known from New Zealand from a single collection made near Lake Lyndon, Canterbury, serves to illustrate the importance of phorophyte-based lichen surveys.

Conclusion

This contribution to our knowledge of the lichenised mycobiota of pōhutukawa, despite the limitations of the data and sampling, highlights the need for a more comprehensive study of pōhutukawa throughout its natural range. Although myrtle rust has yet to have

a serious impact on pōhutukawa, our ignorance of the microbiome of this iconic tree is yet another risk factor in its long-term management in the face of an increasing presence and potential impact of myrtle rust in New Zealand. Too often people value a tree species rather than the ecosystem it creates. Pōhutukawa not only forms an important vegetation association, and is a species that has immeasurable cultural value and significance to Māori and other New Zealand people and cultures (Simpson 2005), but each tree is also an ecosystem of interconnected associates that we so poorly understand. Our ignorance of that association is potentially an Achilles heel for the survival not only of pōhutukawa as a species but the many as yet unrecognised co-inhabitants. We recommend that more comprehensive sampling is done urgently before myrtle rust becomes more fully established on pōhutukawa in New Zealand.

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Appendix 1: List of lichens collected from pōhutukawa (*Metrosideros excelsa*) with specimens held in AK and UNITEC.

Species	Family	Threat status	Voucher	Endemic
<i>Amandinea punctata</i> (Hoffm.) Coppins et Scheid.	Caliciaceae	Not Threatened	AK 186260	
<i>Arthonia atra</i> (Pers.) A. Schneid.	Arthoniaceae	At Risk – Naturally Uncommon	UNITEC 9371	
<i>Arthonia nigrocincta</i> C.Knight et Mitt.	Arthoniaceae	Data Deficient	AK 359918	Yes
<i>Austroparmelina conlabrosa</i> (Hale) A.Crespo, Divakar et Elix	Parmeliaceae	Not Threatened	AK 177176	
<i>Austroparmelina labrosa</i> (Zahlbr.) A.Crespo, Divakar et Elix	Parmeliaceae	Not Threatened	AK 132940	
<i>Bacidia laurocerasi</i> (Delise ex Duby) Vain.	Bacidiaceae	Not Threatened	UNITEC 9357	
<i>Bacidia wellingtonii</i> (Stirt.) D.J.Galloway	Bacidiaceae	Not Threatened	UNITEC 9370	Yes
<i>Bactrospora arthonioides</i> Egea et Torrente	Roccellaceae	Data Deficient	UNITEC 12291	
<i>Bactrospora metabola</i> (Nyl.) Egea et Torrente	Roccellaceae	At Risk – Naturally Uncommon	UNITEC 3122	
<i>Biatora albopraetexta</i> (C.Knight) Hellb.	Ramalinaceae	Data Deficient	AK 18981	Yes
<i>Bunodophoron patagonicum</i> (C.W.Dodge) Wedin	Sphaerophoraceae	Not Threatened	AK 309317	
<i>Calicium hyperelloides</i> Nyl.	Caliciaceae	Not Threatened	AK 184962	
<i>Calicium lenticulare</i> Ach.	Caliciaceae	Not Threatened	AK 332731	
<i>Calicium tricolor</i> F.Wilson	Caliciaceae	Not Threatened	AK 203333	
<i>Chaenotheca brunneola</i> (Ach.) Müll.Arg.	Coniocybaceae	Not Threatened	AK 185242	

Species	Family	Threat status	Voucher	Endemic
<i>Chaenotheca citriocephala</i> (F.Wilson) Tibell	Coniocybaceae	Not Threatened	AK 194063	
<i>Chaenotheca stemonea</i> (Ach.) Müll.Arg.	Coniocybaceae	Not Threatened	AK 194100	
<i>Chaenothecopsis brevipes</i> Tibell	Mycocaliciaceae	Not Threatened	AK 194130	
<i>Chrysothrix xanthina</i> (Vain.) Kalb	Chrysotrichaceae	Data Deficient	AK 204257	
<i>Cladia inflata</i> (F.Wilson) D.J.Galloway	Cladoniaceae	Not Threatened	UNITEC 12294	
<i>Cladia schizopora</i> (Nyl.) Nyl.	Cladoniaceae	At Risk – Naturally Uncommon	AK 194808	
<i>Cladonia confusa</i> R.Sant.	Cladoniaceae	Not Threatened	AK 309266	
<i>Cladonia darwinii</i> S.Hammer	Cladoniaceae	Not Threatened	UNITEC 12288	
<i>Cladonia floerkeana</i> (Fr.) Flörke	Cladoniaceae	Not Threatened	AK 203852	
<i>Cladonia incerta</i> S.Hammer	Cladoniaceae	Not Threatened	AK 203854	Yes
<i>Cladonia scabriuscula</i> (Delise) Nyl.	Cladoniaceae	Not Threatened	AK 195050	
<i>Coccocarpia erythroxyli</i> (Spreng.) Swinscow et Krog	Coccocarpiaceae	Not Threatened	AK 161829	
<i>Coccotrema cucurbitula</i> (Mont.) Müll.Arg.	Coccotremataceae	Not Threatened	AK 332745	
<i>Coenogonium implexum</i> Nyl.	Coenogoniaceae	Not Threatened	AK 203885	
<i>Coenogonium luteum</i> (Dicks.) Kalb et Lücking	Coenogoniaceae	Not Threatened	UNITEC 9354	
<i>Collema laeve</i> Hook.f. et Taylor	Collemataceae	Not Threatened	AK 162373	
<i>Collema subflaccidum</i> Degel.	Collemataceae	At Risk – Naturally Uncommon	AK 209217	
<i>Crocodia aurata</i> (Ach.) Link	Peltigeraceae	Not Threatened	UNITEC 5516	

Species	Family	Threat status	Voucher	Endemic
<i>Crocodia poculifera</i> (Müll. Arg.) D.J.Galloway et Elix	Peltigeraceae	At Risk – Naturally Uncommon	UNITEC 7740	
<i>Dictyographa cinerea</i> (C.Knight et Mitt.) Müll.Arg.	Opegraphaceae	Not Threatened	AK 284437	
<i>Dictyonema cf sericeum</i>	Hygrophoraceae	Not Assessed	UNITEC 7734	Yes
<i>Dirinaria applanata</i> (Fée) Awasthi	Caliciaceae	Not Threatened	UNITEC 1425	
<i>Dirinaria picta</i> (Sw.) Clem. et Shear	Caliciaceae	At Risk – Naturally Uncommon	AK 169763	
<i>Enterographa pallidella</i> (Nyl.) Redinger	Roccellaceae	Not Threatened	UNITEC 7677	
<i>Erioderma solediatum</i> D.J.Galloway et P.M.Jørg.	Pannariaceae	At Risk – Naturally Uncommon	UNITEC 5237	
<i>Fissurina incrustans</i> Fée	Graphidaceae	At Risk – Naturally Uncommon	UNITEC 12290	
<i>Fissurina inquinata</i> C.Knight et Mitt.	Graphidaceae	At Risk – Naturally Uncommon	AK 169683	
<i>Flavoparmelia haywardiana</i> Elix et J.Johnst.	Parmeliaceae	Not Threatened	UNITEC 9361	
<i>Flavoparmelia soledians</i> (Nyl.) Hale	Parmeliaceae	Not Threatened	UNITEC 7060	
<i>Gabura fascicularis</i> (L.) P.M.Jørg.	Collemaaceae	Data Deficient	UNITEC 5518	
<i>Graphis elegans</i> (Sm.) Arch.	Graphidaceae	At Risk – Naturally Uncommon	UNITEC 9352	
<i>Graphis librata</i> C.Knight	Graphidaceae	Not Threatened	AK 169608	
<i>Halegrapha mucronata</i> (Stirt.) Lücking	Graphidaceae	Not Threatened	UNITEC 1432	

Species	Family	Threat status	Voucher	Endemic
<i>Heterodermia obscurata</i> (Nyl.) Trevis.	Physciaceae	Not Threatened	AK 175160	
<i>Heterodermia pseudospeciosa</i> (kurok.) W.L.Culb.	Physciaceae	Data Deficient	UNITEC 7583	
<i>Heterodermia speciosa</i> (Wulfen) Trevis.	Physciaceae	Not Threatened	UNITEC 1434	
<i>Hypogymnia lugubris</i> var. <i>compactior</i> (Zahlbr.) Elix	Parmeliaceae	Not Threatened	AK 193762	
<i>Hypogymnia subphysodes</i> (Kremp.) Filson	Parmeliaceae	Not Threatened	UNITEC 4403	
<i>Hypotrachyna horrescens</i> (Taylor) Krog et Swinscow	Parmeliaceae	At Risk – Naturally Uncommon	AK 155101	
<i>Hypotrachyna imbricatula</i> (Zahlbr.) Hale	Parmeliaceae	Data Deficient	AK 332631	
<i>Hypotrachyna immaculata</i> (Kurok.) Hale	Parmeliaceae	Data Deficient	AK 177160	
<i>Hypotrachyna jamesii</i> (Hale) Divakar, A.Crespo, Sipman, Elix et Lumbsch	Parmeliaceae	Data Deficient	AK 193450	
<i>Hypotrachyna osseoalba</i> (Vain.) Y.S.Park	Parmeliaceae	At Risk – Naturally Uncommon	AK 175180	
<i>Hypotrachyna sinuosa</i> (Sm.) Hale	Parmeliaceae	Not Threatened	UNITEC 12292	
<i>Hypotrachyna spumosa</i> (Asahina) Krog et Swinscow	Parmeliaceae	Not Threatened	AK 193493	
<i>Hypotrachyna subfatiscens</i> ((Kurok.) Swinscow et Krog	Parmeliaceae	Not Threatened	AK 177154	
<i>Lecanactis neozelandica</i> Egea et Torrente	Roccellaceae	Not Threatened	UNITEC 12286	
<i>Lecanactis subfarinosa</i> (C.Knight) Hellb.	Roccellaceae	Not Threatened	AK 193088	Yes
<i>Lecania cyrtella</i> (Ach.) Th.Fr.	Ramalinaceae	Not Threatened	UNITEC 9369	

Species	Family	Threat status	Voucher	Endemic
<i>Lecanora elatinooides</i> Räsänen	Lecanoraceae	Data Deficient	UNITEC 9379	
<i>Lecanora flavopallida</i> Stirt.	Lecanoraceae	Not Threatened	AK 206681	
<i>Lecanora novaehollandiae</i> Lumbsch	Lecanoraceae	Data Deficient	AK 191278	
<i>Lecanora queenslandica</i> C.Knight	Lecanoraceae	At Risk – Naturally Uncommon	AK 191279	
<i>Lecanora subumbrina</i> Müll. Arg.	Lecanoraceae	Data Deficient	UNITEC 9378	
<i>Lecanora symmicta</i> (Ach.) Ach.	Lecanoraceae	Not Threatened	AK 206782	
<i>Lecanora xylophila</i> Hue	Lecanoraceae	Not Threatened	UNITEC 9420	
<i>Lecidea conisalea</i> C.Knight	Lecideaceae	Data Deficient	AK 194396	Yes
<i>Leioderma pycnophorum</i> Nyl.	Pannariaceae	Not Threatened	AK 201647	
<i>Lepra psoromica</i> (A.W.Archer et Elix) A.W.Archer et Elix	Ochrolechiaceae	Not Threatened	AK 161407	
<i>Lepraria finkii</i> (B. de Lesd.) R.C.Harris	Stereocaulaceae	Not Threatened	UNITEC 3410	
<i>Leptogium aucklandicum</i> Zahlbr.	Collemataceae	Not Threatened	UNITEC 1972	Yes
<i>Leptogium crispatellum</i> Nyl.	Collemataceae	Not Threatened	UNITEC 1975	
<i>Leptogium cyanescens</i> (Rabenh.) Körb.	Collemataceae	Not Threatened	UNITEC 2680	
<i>Leptogium denticulatum</i> Nyl.	Collemataceae	Not Threatened	AK 209313	
<i>Leptogium limbatum</i> F.Wilson	Collemataceae	Not Threatened	AK 176571	
<i>Leucodermia leucomela</i> (L.) Kalb.	Physciaceae	Not Threatened	UNITEC 5347	
<i>Megalaria grossa</i> (Pers. ex Nyl.) Hafellner	Ramalinaceae	Not Threatened	AK 172641	
<i>Megalaria melanotropa</i> (Nyl.) D.J.Galloway	Ramalinaceae	Not Threatened	AK 185178	Yes
<i>Megaloblastenia flavidoatra</i> (Nyl.) Sipman	Megalosporaceae	Data Deficient	AK 332807	

Species	Family	Threat status	Voucher	Endemic
<i>Megaloblastenia marginiflexa</i> (Hook.f. et Taylor) Sipman	Megalosporaceae	Not Threatened	AK 203169	
<i>Megalospora campylospora</i> (Stirt.) Sipman	Megalosporaceae	Not Threatened	AK 294182	
<i>Megalospora knightii</i> Sipman	Megalosporaceae	At Risk – Naturally Uncommon	UNITEC 5355	Yes
<i>Menegazzia neozelandica</i> (Zahlbr.) P.James	Parmeliaceae	Not Threatened	UNITEC 8231	
<i>Neophyllis melacarpa</i> (F.Wilson) F.Wilson	Cladoniaceae	Not Threatened	AK 193654	
<i>Notoparmelia cunninghamii</i> (Cromb.) A.Crespo, Ferencova et Divakar	Parmeliaceae	Not Threatened	AK 168582	
<i>Notoparmelia erumpens</i> (Kurok.) A.Crespo, Ferencova et Divakar	Parmeliaceae	Not Threatened	UNITEC 7618	
<i>Notoparmelia testacea</i> (Stirt.) A.Crespo, Ferencova et Divakar	Parmeliaceae	Not Threatened	AK 18988	
<i>Normandina pulchella</i> (Borrer) Nyl.	Verrucariaceae	Not Threatened	UNITEC 1973	
<i>Opegrapha agelaeoides</i> Nyl.	Opegraphaceae	Not Threatened	UNITEC 4466	
<i>Opegrapha intertexta</i> C.Knight	Opegraphaceae	Not Threatened	UNITEC 10918	Yes
<i>Pannaria allorhiza</i> (Nyl.) Elvebakk et D.J.Galloway	Opegraphaceae	Not Threatened	AK 154803	Yes
<i>Pannaria araneosa</i> (C.Bab.) Hue	Pannariaceae	Not Threatened	AK 203850	Yes
<i>Pannaria athroophylla</i> (Stirt.) Elvebakk et D.J.Galloway	Pannariaceae	Not Threatened	AK 201713	Yes
<i>Pannaria crenulata</i> P.M.Jørg.	Pannariaceae	Not Threatened	UNITEC 6860	
<i>Pannaria elatior</i> Stirt.	Pannariaceae	Data Deficient	AK 309878	
<i>Pannaria elixii</i> P.M.Jørg. et D.J.Galloway	Pannariaceae	Not Threatened	UNITEC 7619	

Species	Family	Threat status	Voucher	Endemic
<i>Pannaria fulvescens</i> (Mont.) Nyl.	Pannariaceae	Not Threatened	UNITEC 6862	
<i>Pannaria immixta</i> Nyl.	Pannariaceae	Not Threatened	AK 332816	
<i>Pannaria leproloma</i> (Nyl.) P.M.Jørg.	Pannariaceae	Not Threatened	AK 328032	
<i>Pannaria minutiphylla</i> Elvebakk	Pannariaceae	Not Threatened	AK 332648	
<i>Pannaria sphinctrina</i> (Mont.) Hue	Pannariaceae	Not Threatened	AK 253988	
<i>Pannaria</i> aff. <i>patagonica</i> (Malme) Elvebakk et D.J.Galloway	Pannariaceae	Not Threatened	AK 230391	
<i>Parmeliella nigrocincta</i> (Mont.) Müll.Arg.	Pannariaceae	Not Threatened	UNITEC 12293	
<i>Parmotrema austrocetratum</i> Elix et J.Johnst.	Parmeliaceae	Not Threatened	UNITEC 2686	
<i>Parmotrema cetratum</i> (Ach.) Hale	Parmeliaceae	Not Threatened	UNITEC 5448	
<i>Parmotrema crinitum</i> (Ach.) M.Choisy	Parmeliaceae	Not Threatened	UNITEC 6199	
<i>Parmotrema cristiferum</i> (Taylor) Hale	Parmeliaceae	Data Deficient	AK 196031	
<i>Parmotrema mellissii</i> (C.W.Dodge) Hale	Parmeliaceae	At Risk – Naturally Uncommon	AK 312438	
<i>Parmotrema perlatum</i> (Huds.) M.Choisy	Parmeliaceae	Not Threatened	UNITEC 7610	
<i>Parmotrema reticulatum</i> (Taylor) M.Choisy	Parmeliaceae	Not Threatened	UNITEC 9018	
<i>Parmotrema robustum</i> (Degel.) Hale	Parmeliaceae	At Risk – Naturally Uncommon	UNITEC 8049	
<i>Parmotrema subtinctorium</i> (Zahlbr.) Hale	Parmeliaceae	At Risk – Naturally Uncommon	UNITEC 3722	

Species	Family	Threat status	Voucher	Endemic
<i>Parmotrema tinctorum</i> (Despr. ex Nyl.) Hale	Parmeliaceae	Not Threatened	AK 196003	
<i>Pertusaria muricata</i> J.C.David	Pertusariaceae	Data Deficient	UNITEC 12289	
<i>Pertusaria puffina</i> A.W.Archer et Elix	Pertusariaceae	At Risk – Naturally Uncommon	UNITEC 6816	
<i>Pertusaria sorodes</i> Stirt.	Pertusariaceae	Not Threatened	AK 193492	Yes
<i>Pertusaria theochroa</i> Kremp	Pertusariaceae	Data Deficient	AK 206946	Yes
<i>Pertusaria thiospoda</i> C.Knight	Pertusariaceae	Not Threatened	UNITEC 9364	
<i>Physcia poncinsii</i> Hue	Physciaceae	Not Threatened	AK 181603	
<i>Podostictina pickeringii</i> (Tuck.) Moncada et Lücking	Peltigeraceae	Not Threatened	UNITEC 4514	Yes
<i>Polyblastidium casarettianum</i> (A.Massal.) Kalb	Physciaceae	At Risk – Naturally Uncommon	UNITEC 12274	
<i>Polyblastidium japonicum</i> (M.Sâto) Kalb	Physciaceae	Not Threatened	AK 157383	
<i>Pseudocyphellaria billardierei</i> (Delise) Räsänen	Peltigeraceae	Not Threatened	AK 190090	
<i>Pseudocyphellaria carpoloma</i> (Delise) Vain.	Peltigeraceae	Not Threatened	AK 311099	
<i>Pseudocyphellaria chloroleuca</i> (Hook.f. et Taylor) D.J.Galloway et P.James	Peltigeraceae	Not Threatened	AK 331932	
<i>Pseudocyphellaria coriacea</i> (Hook.f. et Taylor) D.J.Galloway et P.James	Peltigeraceae	Not Threatened	AK 331942	Yes
<i>Pseudocyphellaria crocata</i> (L.) Vain. agg.	Peltigeraceae	Not Threatened	AK 200714	
<i>Pseudocyphellaria episticta</i> (Nyl.) Vain.	Peltigeraceae	Not Threatened	AK 190315	Yes
<i>Pseudocyphellaria haywardiorum</i> D.J.Galloway	Peltigeraceae	At Risk – Naturally Uncommon	UNITEC 9628	

Species	Family	Threat status	Voucher	Endemic
<i>Pseudocyphellaria intricata</i> (Delise) Vain.	Peltigeraceae	At Risk – Naturally Uncommon	AK 308826	
<i>Pseudocyphellaria lividofusca</i> (Kremp.) D.J.Galloway et P.James	Peltigeraceae	At Risk – Naturally Uncommon	AK 310330	Yes
<i>Pseudocyphellaria montagnei</i> (C.Bab.) D.J.Galloway	Peltigeraceae	Not Threatened	AK 169072	Yes
<i>Pseudocyphellaria multifida</i> (Nyl.) D.J.Galloway et P.James	Peltigeraceae	Not Threatened	AK 331920	
<i>Pseudocyphellaria punctillaris</i> (Müll.Arg.) D.J.Galloway	Peltigeraceae	At Risk – Naturally Uncommon	AK 331930	
<i>Punctelia borrieri</i> (Sm.) Krog	Parmeliaceae	Not Threatened	AK 176088	
<i>Punctelia subrudecta</i> (Nyl.) Krog	Parmeliaceae	Not Threatened	UNITEC 9358	
<i>Pyxine subcinerea</i> Stirt.	Caliciaceae	Not Threatened	UNITEC 9367	
<i>Ramalina australiensis</i> Nyl.	Ramalinaceae	Not Threatened	UNITEC 554	
<i>Ramalina celastri</i> (Spreng.) Krog et Swinscow	Ramalinaceae	Not Threatened	UNITEC 4475	
<i>Ramalina exiguella</i> Stirt.	Ramalinaceae	At Risk – Naturally Uncommon	UNITEC 5403	
<i>Ramalina geniculata</i> Hook.f. et Taylor	Ramalinaceae	At Risk – Declining	UNITEC 1358	Yes
<i>Ramalina leiodea</i> (Nyl.) Nyl.	Ramalinaceae	At Risk – Naturally Uncommon	UNITEC 6919	
<i>Ramalina meridionalis</i> Blanchon et Bannister	Ramalinaceae	At Risk – Naturally Uncommon	AK 161637	
<i>Ramalina pacifica</i> Asahina	Ramalinaceae	Threatened – Nationally Vulnerable	UNITEC 6822	

Species	Family	Threat status	Voucher	Endemic
<i>Ramalina peruviana</i> Ach.	Ramalinaceae	Not Threatened	UNITEC 9629	
<i>Ramboldia laeta</i> (Stirt.) Kalb, Lumbsch et Elix	Lecanoraceae	Not Threatened	AK 193388	
<i>Remototrachyna costaricensis</i> Divakar et A.Crespo	Parmeliaceae	At Risk – Naturally Uncommon	AK 332629	
<i>Sarrameana albidoplumbea</i> (Hook.f. et Taylor) Farkas	Sarrameanaceae	Not Threatened	AK 328028	
<i>Scytinium subfragrans</i> (Degel.) Otálora, P.M.Jørg. et Wedin	Collemtaceae	Data Deficient	UNITEC 5262	
<i>Scytinium kauaiense</i> (H.Magn.) Otálora, P.M.Jørg. et Wedin	Collemtaceae	Not Threatened	AK 327675	
<i>Solitaria chrysophthalma</i> (Degel.) Arup, Søchting et Frödén	Teloschistaceae	Data Deficient	UNITEC 10704	
<i>Sphinctrina tubaeformis</i> A.Massal	Spintrinaceae	At Risk – Naturally Uncommon	AK 192496	
<i>Sticta caperata</i> (Nyl.) Nyl.	Peltigeraceae	Data Deficient	UNITEC 7431	
<i>Sticta cinereoglauca</i> Hook.f. et Taylor	Peltigeraceae	Not Threatened	AK 200710	Yes
<i>Sticta fuliginosa</i> (Hoffm.) Ach.	Peltigeraceae	Not Threatened	UNITEC 8050	
<i>Sticta latifrons</i> A.Rich.	Peltigeraceae	Not Threatened	AK 203847	
<i>Sticta martini</i> D.J.Galloway	Peltigeraceae	Not Threatened	UNITEC 12086	
<i>Sticta squamata</i> D.J.Galloway	Peltigeraceae	Not Threatened	UNITEC 7739	Yes
<i>Sticta subcaperata</i> (Nyl.) Nyl.	Peltigeraceae	Not Threatened	AK 224888	Yes
<i>Teloschistes chrysophthalmus</i> (L.) Th.Fr.	Teloschistaceae	Not Threatened	UNITEC 7845	
<i>Teloschistes flavicans</i> (Sw.) Norman	Teloschistaceae	At Risk – Declining	AK 201272	

Species	Family	Threat status	Voucher	Endemic
<i>Teloschistes sieberianus</i> (Laurer) Hillmann	Teloschistaceae	At Risk – Naturally Uncommon	AK 331967	
<i>Tephromela atra</i> (Huds.) Hafellner	Tephromelataceae	Not Threatened	AK 248722	
<i>Thallolooma subvelata</i> (Stirt.) D.J.Galloway	Graphidaceae	Not Threatened	AK 169617	
<i>Thelotrema lepadinum</i> (Ach.) Ach.	Graphidaceae	Not Threatened	AK 168994	
<i>Thysanothecium scutellatum</i> (Fr.) D.J.Galloway	Cladoniaceae	Not Threatened	AK 193453	
<i>Topeliopsis decorticans</i> (Müll. Arg.) A.Frisch et Kalb	Graphidaceae	Data Deficient	AK 155084	
<i>Topeliopsis novae-zelandiae</i> (Szatala) Lumbsch & Mangold	Graphidaceae	Data Deficient	UNITEC 12287	
<i>Usnea angulata</i> Ach.	Parmeliaceae	Not Threatened	AK 206914	
<i>Usnea cornuta</i> Körb.	Parmeliaceae	Not Threatened	UNITEC 6718	
<i>Usnea dasaea</i> Stirt.	Parmeliaceae	Not Assessed	UNITEC 5423	
<i>Usnea inermis</i> Motyka	Parmeliaceae	Not Threatened	AK 294254	
<i>Usnea molliuscula</i> Stirt.	Parmeliaceae	Not Threatened	AK 203853	
<i>Usnea nidifica</i> Taylor	Parmeliaceae	At Risk – Naturally Uncommon	UNITEC 3114	
<i>Usnea oncodes</i> Stirt.	Parmeliaceae	Not Threatened	AK 178291	
<i>Usnea rubicunda</i> Stirt.	Parmeliaceae	Not Threatened	UNITEC 1002	
<i>Usnea subeciliata</i> (Motyka) Swinscow et Krog	Parmeliaceae	Data Deficient	AK 206926	
<i>Usnea xanthopoga</i> Nyl.	Parmeliaceae	Not Threatened	AK 247005	
<i>Xanthoparmelia mexicana</i> (Gyeln.)	Parmeliaceae	Not Threatened	AK 191017	
<i>Xanthoparmelia scabrosa</i> (Taylor) Hale	Parmeliaceae	Not Threatened	AK 191075	

Species	Family	Threat status	Voucher	Endemic
<i>Xanthoria parietina</i> (L.) Th.Fr.	Teloschistaceae	Not Threatened	UNITEC 9356	
<i>Yarrumia coronata</i> (Müll.Arg.) D.J.Galloway	Peltigeraceae	Not Threatened	AK 190196	

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