Two new corticolous species of *Rinodina* (Physciaceae, Ascomycota) from New Zealand

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**Abstract**
The corticolous *Rinodina fineranii* Elix, Ch.Edler & H.Mayrhofer and *R. malcolmii* Elix, Ch.Edler & H.Mayrhofer, both characterized by the presence of Mischoblastia-type ascospores, are described as new to science. In addition, *Rinodina australiensis* Müll.Arg. is reported for the first time from New Zealand.

**Introduction**
The corticolous and lignicolous species of *Rinodina* (Ach.) S.F.Gray in New Zealand are not well known. In the revised second edition of the *Flora of New Zealand Lichens, Lichen-forming and Lichenicolous Fungi*, eight species were recorded from bark or wood (Mayrhofer et al. 2007). These included the widespread *R. capensis* Hampe, *R. conradii* Körb., *R. ficta* (Stizenb.) Zahlbr. (as *R. boleana* Giralt & H.Mayrhofer), *R. inflata* Kalb, *R. oleae* Bagl., *R. pyrina* (Ach.) Arnold and *R. septentrionalis* Malme, as well as *R. exigua* (Ach.) S.F.Gray, but the latter record remains doubtful because the specimens cited were unavailable (Mayrhofer et al. 2007). Corticolous or lignicolous species of *Rinodina* with Mischoblastia-type ascospores are rare worldwide. The North American endemic, *R. wetmorei* Sheard, is one such species where the Mischoblastia-type spores become inflated at maturity and more *Pachysoraria*-type (Sheard 2010). *Rinodina australiensis* Müll.Arg. from the Southern Hemisphere exhibits a similar transition of the spore lumina with age (Mayrhofer et al. 1999, 2014), whereas the European *R. euskadiensis* A.Crespo & M.B.Aguirre has persistently Mischoblastia-type spores (Giralt 2001). *Rinodina colobina* (Ach.) Th.Fr., widespread in the Northern Hemisphere and characterized by its blue-grey K+ purplish red ephymenum, also has Mischoblastia-type spores at maturity after transitioning from a Physcia-type stage during development (Ropin & Mayrhofer 1995). In this paper, we describe two new corticolous species of *Rinodina* from New Zealand with Mischoblastia-type spores, and report the occurrence of *Rinodina australiensis* from the South Island.

**Methods**
Observations and measurements of photobiont cells, thallus and apothecium anatomy, asci and ascospores were made on hand-cut sections mounted in water and 10% KOH (K). Asci were also observed in Lugol’s Iodine (I), with and without pretreatment in K. Medullary sections were treated with 10% sulfuric acid (H2SO4) and apothecial sections with 50% nitric acid (N). Chemical constituents were investigated by thin-layer chromatography (Elix 2014).

**The new species**
*Rinodina fineranii* Elix, Ch.Edler & H.Mayrhofer, sp. nov. Figs 1, 2
MycoBank number: MB 832607

Similar to *Rinodina australiensis*, but differs in having smaller Physcia- to Mischoblastia-type ascospores, 17–25 × 7–10 µm.

**Type**: New Zealand, Bird Island, Foveaux Strait, [41°45’52"S, 168°25’06"E], on twig of...

Thallus to 15 mm wide, crustose, membranaceous to verruculose, areolate or coarsely granular; individual areoles 0.05–0.2 mm wide, to 0.05 mm thick; upper surface matt, smooth or granular, esorediate, off-white to pale grey; prothallus not apparent; medulla white, lacking calcium oxalate (H₂SO₄–), I–; photobiont cells 8–14 µm diam. Apothecia 0.1–0.7 mm wide, scattered or crowded, lecanorine, broadly adnate to sessile and basally constricted; disc pale brown to black, epruinose, weakly concave to plane; thalline exciple thick and raised above the disc at first, becoming thinner and excluded in older apothecia, concolorous with the thallus; proper excipulum brown to pale yellow-brown, persistent, thick, in section 35–50 µm thick; outer zone brown, K–, N–; inner zone colourless. Epiphragma 10–15 µm thick, pale brown, K–, N–. Hypotheicum 20–30 µm thick, colourless, K–, N–. Hymenium 90–110 µm thick, colourless, not inspersed; paraphyses 1.5–2.5 µm wide, simple to branched, capitate, with apices 3.5–4.5 µm wide and brown caps, with scattered oil paraphyses 5–7 µm wide; asci of the Lecanora-type, 8-spored. Ascospores with internal wall thickenings transitioning from Physcia- to Mischoblastia-types at different stages of development, 1-septate, brown, broadly ellipsoid, 17–20.5 × 7–8.5 µm, neither constricted nor dilated at the septum; ontogeny of type-A; outer spore-wall finely ornamented. Pycnidia not seen.

**Chemistry:** Thallus K–, C–, P–, UV–; no lichen substances detected by TLC.

**Etymology:** The species is named after the collector of the type material, the New Zealand botanist Dr Brian A. Fineran.

**Remarks**

In many respects this new species closely resembles the well-known *R. australiensis*, which is widespread in Australia and South Africa (Mayrhofer et al. 1999, 2014; Mayrhofer & Wirth 2011). Both have broadly adnate to sessile, lecanorine apothecia and Mischoblastia-type ascospores at different stages of development. However, the spore lumina of *R. australiensis* and *R. fineranii* differ subtly, those of *R. fineranii* transitioning from Physcia- to mainly Mischoblastia-type, whereas those of *R. australiensis* transition from Mischoblastia- to mainly Pachyvaroria-types. In addition, the ascospores of *R. australiensis* are consistently larger, 19–26 × 10–13 µm, and do not become inflated at the septum. It also differs in containing atranorin (Giralt 2001).

At present, the new species is known from twigs of trees in both North and South Islands of New Zealand. Associated lichens include *Bactrospora metabola* (Nyl.) Egea & Torrende, *Bacidiophyllum*, *Lecanora*, *Megalaria* (Pers. ex Nyl.) Hafellner and *Podotatra piliophoriformis* Malcolm & Vězda.

**ADDITIONAL SPECIMENS EXAMINED**

**New Zealand.** Type locality, on dead twig of *Myrsine chatamica*, B.A. Fineran 1276, ii-iii.1965 (CANU).

*Rinodina malcolmii* Elix, Ch.Edler & H.Mayrhofer, sp. nov. Figs 3, 4 MycoBank number: MB 832608

Similar to *Rinodina euskadiensis*, but differs in having lecanorine apothecia, smaller ascospores and in lacking lichen substances.

**Type:** New Zealand, South Island, Nelson, Wairoa Gorge Road, 6 km from Lee Valley junction, 41°29’54”S, 173°05’24”E, 135 m alt., on twigs of *Podocarpus totara*, W. Malcolm 2024, 25.i.x.1994 (GZU – holotype).

**Thallus** to 12 mm wide, crustose, membranaceous to verruculose, areolate or granular; individual areoles 0.05–0.1 mm wide, to 0.05 mm thick; upper surface matt, smooth to granular, esorediate, off-white to pale grey; prothallus not apparent; medulla white, lacking calcium oxalate (H₂SO₄–), I–; photobiont cells 8–16 µm diam. Apothecia 0.1–0.8 mm wide, scattered or crowded, lecanorine, broadly adnate, disc brown to dark brown, epruinose, plane to convex; thalline exciple thick and raised above the disc at first, becoming thinner and excluded in older apothecia, concolorous with the thallus; proper excipulum brown, persistent, in section 20–25 µm thick; outer zone brown, K–, N–; inner zone colourless. *Epiphragma* 10–12 µm thick, pale brown to pale red-brown, K–, N–. *Hypotheicum* 30–50 µm thick, colourless, K–, N–. *Hymenium* 60–90 µm thick, colourless, not inspersed; paraphyses 1.5–2.5 µm wide, simple to branched, capitate, with apices 3.5–4.5 µm wide and brown caps, with scattered oil paraphyses 5–7 µm wide; asci of the Lecanora-type, 8-spored. Ascospores with internal wall thickenings transitioning from *Pachyvaroria*-type when young to *Mischoblastia*-type at maturity, 1-septate, brown, broadly ellipsoid, 14–21 × 7–8.6 µm, not constricted but often dilated at the septum; ontogeny of type-A; outer spore-wall finely ornamented. Pycnidia not seen. Chemistry: Thallus K–, C–, P–, UV–; no lichen substances detected by TLC.

**Etymology:** The species is named after the New Zealand cryptogamist, botanical photographer and collector of the type specimen, Dr W.M. (Bill) Malcolm.

**Remarks**

This new species is characterized by the thin, off-white to pale grey membranaceous to areolate or granular thallus, the lecanorine apothecia, the relatively small, Mischoblastia-type ascospores, 14–21 × 7–10 µm and the absence of lichen substances. The European *R. euskadiensis* has pseudolecanorine apothecia with persistently Mischoblastia-type ascospores, but its spores are larger, 19–26 × 10–13 µm, and do not become inflated at the septum. It also differs in containing atranorin (Giralt 2001).

At present, the new species is known from twigs of trees in both North and South Islands of New Zealand. Associated lichens include *Bactrospora metabola* (Nyl.) Egea & Torrende, *Bacidiophyllum*, *Lecanora*, *Megalaria* (Pers. ex Nyl.) Hafellner and *Podotatra piliophoriformis* Malcolm & Vězda.

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**New record**


**Type:** Australia, Victoria, by seaside on Banksia serrata, F.R.M. Wilson 368, 1892 (lectotype - G! fide H.Mayrhofer, G.Kantvilas & K.Ropin, Muelleria 12, 177 (1999)).

This species was previously known from Australia (Mayrhofer et al. 1999) and southern Africa (Mayrhofer & Wirth 2011; Mayrhofer et al. 2014). It is characterized by a thick, well-developed areolate-crustose to subsquamulose thallus and comparatively large ascospores, 18–21.5 × 9–12.3 µm, where the spore lumina transition from Mischoblastia- to mainly Pachyvaroria-types. A detailed description is provided in Mayrhofer et al. (1999).

**SPECIMEN EXAMINED**

**New Zealand.** South Island, Southland, Cosy Nook Bay, E of Riverton, 46°19’54”S, 172°36’18”E, on twig and leaves of *Baccharis salicifolia*, 1892 (lectotype - B!).
Key to the corticicolous and lignonicolous species of *Rinodina* in New Zealand

<table>
<thead>
<tr>
<th>Key</th>
<th>Description</th>
<th>Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ascospores 3-septate at maturity; lignonicolous or rarely corticicolous</td>
<td>R. conradii</td>
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<tr>
<td>2</td>
<td>Thallus K+ yellow; atranorin present</td>
<td>R. pyrina</td>
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<tr>
<td>3</td>
<td>Thallus sorediate</td>
<td>R. inflata</td>
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<tr>
<td>4</td>
<td>Apothecial cortex distinct; I + pale-blue</td>
<td>R. capensis</td>
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<tr>
<td>5</td>
<td>Ascospores Physcienia-type; lacking apical thickenings when mature</td>
<td>R. exigua</td>
</tr>
<tr>
<td>6</td>
<td>Ascospores Physcia-type</td>
<td>R. freyi</td>
</tr>
<tr>
<td>7</td>
<td>Ascospores Dirinaria-type, Mischoblastia- or Pachysporaria-type; with apical thickenings when mature</td>
<td>R. oleae</td>
</tr>
<tr>
<td>8</td>
<td>Mature ascospores Pachysporaria-type</td>
<td>R. ficta</td>
</tr>
<tr>
<td>9</td>
<td>Ascospores 12–18 µm long</td>
<td>R. malcolmii</td>
</tr>
<tr>
<td>10</td>
<td>Ascospores 17–25 µm long, transitioning from Physcia- to Mischoblastia-type, not dilated at the septum</td>
<td>R. fineranii</td>
</tr>
<tr>
<td>11</td>
<td>Ascospores 14–16 µm long, transitioning from Pachysporaria-type to Mischoblastia-type, often dilated at septum</td>
<td>R. australiensis</td>
</tr>
</tbody>
</table>

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References


Ropin, K; Mayrhofer, H (1993): Zur Kenntnis corticoler Arten der Gattung *Rinodina* (lichenized Ascomycetes, Physciaceae) in der borealen Zone in North America, but it has often been confused with *R. freyi* in central and southern Europe. A detailed description of it is given in Mayrhofer et al. (2007, as *R. septentrionalis*) and Sheard (2010).


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A nomenclatural change


Mayrhofer et al. (2007) recorded *R. septentrionalis* Malme from twigs of *Malus domestica* in the South Island of New Zealand. The specimen was originally identified as *R. glauca* Ropin (Ropin & Mayrhofer 1993), but that species was subsequently synonymized with *R. septentrionalis*, as was *R. freyi* (Giralt & Mayrhofer 1995). In 2010 Sheard resurrected *Rinodina freyi* with *Rinodina glauca* as a new synonym. He distinguished two morphotypes, one with more distinctly grey thalli corresponding to the type of *R. glauca*. The species is a characteristic pioneer of the twigs of a wide range of shrubs and trees in Europe and North America (Ropin & Mayrhofer 1993; Sheard 2010), Japan and north-eastern Asia (Sheard et al. 2017). It has been confused with *R. septentrionalis*, which has very similar ascospores, but the apothecia of the latter are more scattered and narrowly attached. According to Sheard (2010), *R. septentrionalis* is widespread in the Arctic and northern Scandinavia, and more rarely in the boreal zone in North America, but it has often been confused with *R. freyi* in central and southern Europe. A detailed description of it is given in Mayrhofer et al. (2007, as *R. septentrionalis*) and Sheard (2010).
Figure 1. *Rinodina fineranii* (holotype in CANU). Scale = 1 mm.

Figure 2. Ascospore ontogeny of *R. fineranii*. Scale = 10 µm.

Figure 3. *Rinodina malcolmii* (holotype in GZU). Scale = 2 mm.

Figure 4. Ascospore ontogeny of *R. malcolmii*. Scale = 10 µm.