

The genus *Pertusaria* (*Pertusariales*: *Pertusariaceae*) in the Juan Fernández Archipelago (Chile)

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Abstract: Eight species of the lichen genus *Pertusaria* (*Pertusariaceae*) are reported from the Juan Fernández Archipelago (Chile). *Pertusaria fernandeziana* is described as a new species and two species, *Pertusaria phlyctaenula* Nyl. and *Pertusaria dehiscens* Müll. Arg., are recorded for the first time from the archipelago. Range extensions of the known distribution within the archipelago are reported for *Pertusaria hadrocarpa* Zahlbr., *Pertusaria melanospora* Nyl., *Pertusaria pachythallina* (Räsänen) Messuti, *Pertusaria papillulata* Nyl., and *Pertusaria velata* (Turner) Nyl. *Pertusaria polycarpa* Kremp. var. *monospora* Zahlbr. is reduced to synonymy with *Pertusaria papillulata* and *Pertusaria chilena* Zahlbr. is synonymized with *Pertusaria velata*. A diagnostic key, descriptions, and illustrations of the species are presented with data on their habitat ecology and distribution.

Key words: Chile, Juan Fernández Archipelago, new species, new records, synonyms, *Pertusaria*

Introduction

The Juan Fernández Archipelago is a Chilean territory located approximately 667 km off the coast of continental Chile in the south-eastern part of the Pacific Ocean, at latitude 33° 36'–33° 47' S and longitude 78° 47'–80° 47' W. The archipelago, also known as Robinson Crusoe Islands, is made up of three principal islands of volcanic origin: Robinson Crusoe (Más a Tierra Island or Masatierra Island), Marinero Alejandro Selkirk (Más Afuera Island or Masafuera Island) and Santa Clara. These islands have an extraordinary biota with unique assemblages of species and high levels of endemism and each island has its own somewhat distinct vegetation types (Sanders *et al.* 1982; Stuessy 1992; Takhtajan 1998). The Juan Fernández Islands' temperate forests contain a high percentage of endemism among vascular plants at the specific, generic, and familial levels (Stuessy 1995; Marticorena *et al.* 1998; Greimler *et al.*

2002). The lichen flora of Juan Fernández is of great interest biogeographically as it has affinities with both South America and also with Australasia (Zahlbruckner 1924; Redón & Quilhot 1977; Galloway 1991, 1994).

The genus *Pertusaria* has received considerable attention during the last two decades (e.g. Dibben 1980; Archer 1997; Lumbsch *et al.* 1999; Messuti & Archer 1999; Messuti & Vobis 2002). It is characterized by a crustose thallus, hemiangiocarpous apothecia, a cupulate true exciple, verruciform or disciform apothecia, presence of paraphysoids, thick-walled asci, and one-celled, often thick-walled, hyaline to brownish ascospores together with different classes of lichen substances, such as xanthones, orcinol depsides or depsones. At present *c.* 25 species of the genus *Pertusaria* are known from Chile (Messuti & Archer 1995, 1998; Galloway & Quilhot 1998; Messuti & Vobis 2002) but only five of these taxa have previously been reported from the Juan Fernández Archipelago (Elix & McCarthy 1998).

The aim of this investigation was to reappraise all those *Pertusaria* species reported to occur in the Juan Fernández Archipelago,

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thus extending the knowledge of the *Pertusariales* in the Chilean insular region. The present study, based principally on specimens collected by C. & I. Skottsberg who visited Juan Fernández Archipelago in 1916–1917 and 1954–1955, and by H.A. Imshaug and his students during the 1965 Expedition, has resulted in the recognition of one undescribed taxon, two additional species not previously recorded from Juan Fernández Archipelago and, for several species, records of new localities within the archipelago. A diagnostic key is provided, in addition to taxonomic descriptions as well as notes on ecology and distribution.

Materials and Methods

Specimens were studied from the following herbaria: B, CANB, FH, GZU, H, H-NYL, MSC, SGO, UPS.

All material was examined using standard light microscope techniques and a range of mounting media (water, KOH and Lugol's iodine). Spore measurements were made in water at $\times 1000$ magnification and only well-developed ascospores lying outside the asci were measured. Colour reactions (spot test) were made using standard methods (White & James 1985). Routine chemical analyses were carried out using standard methods of thin layer chromatography (TLC) (Culbertson 1972) and gradient-elution high performance liquid chromatography (HPLC) (Lumbsch 2002).

The Species

Pertusaria fernandeziana Messuti sp. nov.

Thallus crustaceus, albus, albidus usque ad eburneus, continuus vel rimosus, tenuis, superficie laevi et hebetato, corticola. Soredia et isidia destituta. Apothecia verruciformia, numerosa, complanato-hemispherica, dispersa, solitaria ad conferta 2-na, sessilia, thallo concoloria, 0.35–1.50 mm diam.; ostiola rufa usque ad nigra, in verrucas 1 (–2)nae. Asci cylindrici vel subclaviformes. Sporae 8nae, hyalinae, uniseriatae, saepe biseriatae, ellipsoideae, (40–)48–65 μm longae, 24–36 μm latae, parietibus bipartitus, laevibus, 4 μm crassis. Pycnidia ignota. Thallus K– vel ?K+ luteus, C–, KC–, Pd–, materia chemica in thallo non detecta.

Typus: Chile, Juan Fernández Archipelago, Más Afuera, Quebrada de las Vacas, grove of *Myrceugenia* on north side of canyon above waterfalls, alt. 150 m., 29 November 1965, *Imshaug* 36877A' (MSC—holotype).

Thallus crustose, white or whitish to cream-white, continuous to rimose, thin,

surface smooth and dull, corticolous; isidia and soredia absent.

Apothecia verruciform, flattened hemispherical to hemispherical, numerous, sparse and scattered to crowded in groups of 2, sessile, not constricted at the base, concolorous with the thallus, the area around the ostioles reddish to black, 0.35–1.50 mm diam.; ostioles 1(–2) per verruca, brown-red to black, conspicuous. *Asci* cylindrical to subclaviform. *Ascospores* 8 per ascus, hyaline, irregularly biseriata, ellipsoid, sometimes slightly asymmetric, (40–) 48–65 \times 24–36 μm , spore walls double, smooth, 4 μm wide.

Conidiomata not observed.

(Fig. 1A)

Chemistry. No lichen substances detected by TLC or HPLC.

Etymology. The specific epithet *fernandeziana* refers to the archipelago's name 'Fernández', on which the new species occurs and was originally proposed by Imshaug (*in sched.*)

Notes. *Pertusaria fernandeziana* is characterized by flattened hemispherical verrucae with black ostioles, asci with eight ascospores, and the absence of lichen substances. It resembles *P. albissima* Müll. Arg., but is readily differentiated from that taxon by the morphology of the apothecia, the number and colour of the ostioles, and the spore arrangement (Müller 1884; Archer & Elix 1994). It is distinguished from *P. cretacea* Müll. Arg. by the thallus, the flattened hemispherical to hemispherical fertile verrucae, and the darker ostioles (Müller 1884; Archer & Elix 1994). The new species also resembles *P. subrigida* Müll. Arg. from Australia and Brazil, but is distinguished from that species by the conspicuous, brown-red to black ostioles, and the smaller size of the ascospores (Archer 1997). *Pertusaria hakkodensis* Räsänen is another chemically similar corticolous species, described from Japan (Räsänen 1940), which differs in having eight smaller ascospores.

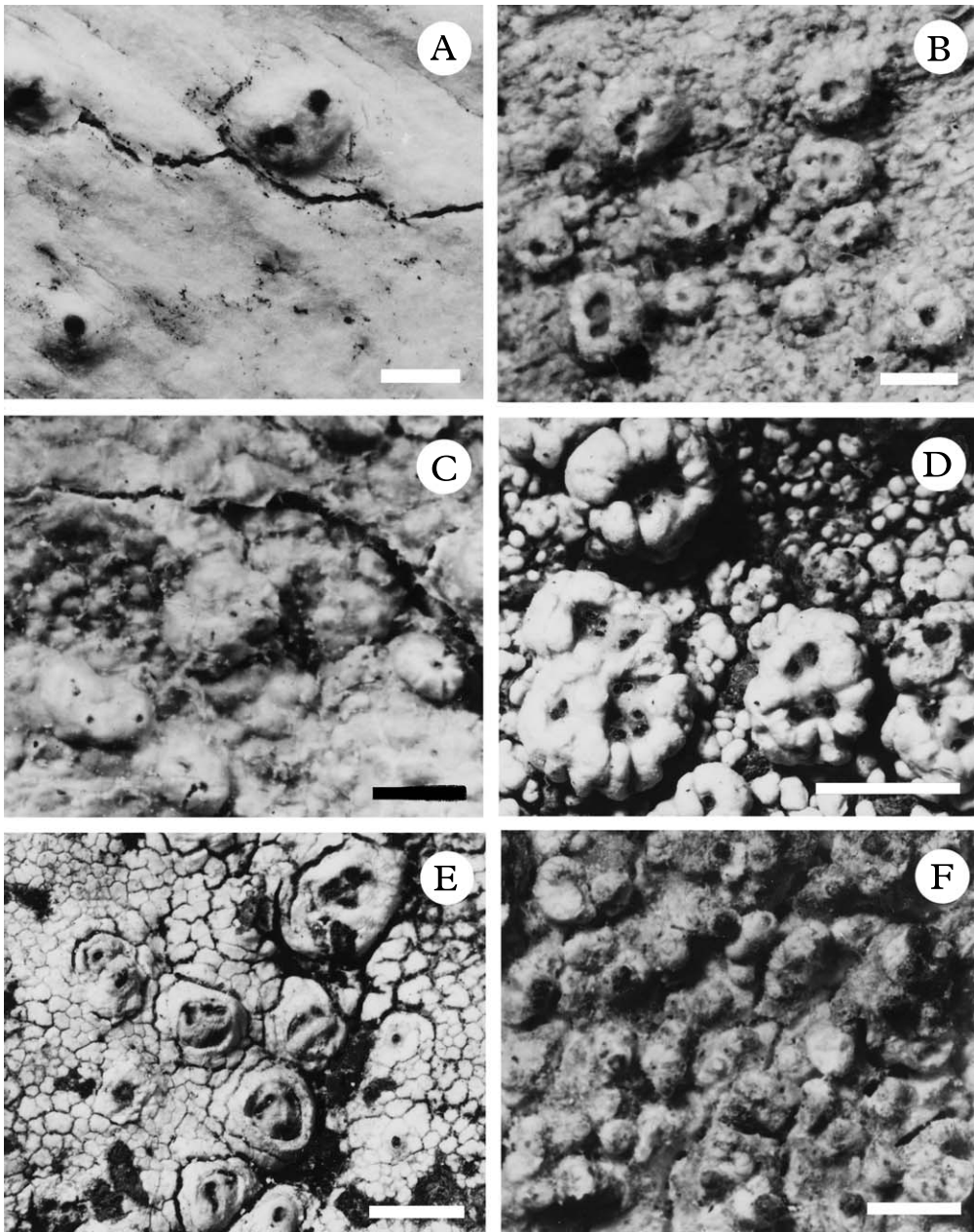


FIG. 1. Morphology of *Pertusaria* species from Juan Fernández Archipelago. A, *P. fernandeziana* (holotype, MSC); B, *P. dehiscens* (Imshaug 37074, MSC); C, *P. dehiscens* (Imshaug 37341, MSC); D, *P. hadrocarpa* (C. Skottsberg L36, UPS); E, *P. melanospora* (C. & I. Skottsberg, SGO 093973); F, *P. pachythallina* (C. Skottsberg L25, UPS). Scales: A–C, E & F=1 mm; D=1.5 mm.

Habitat and distribution. *Pertusaria fernandeziana* is a corticolous species endemic to the Juan Fernández Archipelago and is found only on Alejandro Selkirk Island (Más Afuera Island or Masafuera Island). The only reported substratum is *Myrceugenia* sp.

Specimen examined. **Chile:** Juan Fernández Archipelago: Más Afuera, Quebrada de las Vacas, grove of *Myrceugenia* on north side of canyon above waterfalls, 1965, *Imshaug* 36877 (MSC).

***Pertusaria dehiscens* Müll. Arg.**

In *Flora* 67: 349 (1884); type: Brazil, Apiaty (Apiaty, c. 250 km SW of Sao Paulo), July 1882, *J.I. Puiggari* 499 p.p. (G—lectotype); *ibid.*, *J.I. Puiggari* 2197 p.p. (G—isolectotype).

For synonyms see Archer (1997).

Thallus crustose, whitish grey or whitish olive-green to brownish olive-green, verrucose-rimose, thin, surface dull to slightly shiny, corticolous; isidia and soredia absent.

Apothecia verruciform, flattened hemispherical to somewhat irregular, numerous, sparse and scattered to crowded in groups of 2–4 to confluent, sessile, not constricted at base, concolorous with the thallus, 0.30–1.50 mm diam.; ostioles 1–6 per verruca, brown-red to black, punctiform or conspicuous to pseudolecanorine. *Asci* cylindrical to subclaviform. *Ascospores* (3–6)–8 per ascus, hyaline, biseriata, fusiform or ellipsoid to ovoid, sometimes having one side concave and the other straight, 90–140 × 30–50 µm, spore walls double, smooth, 0.5–1.5 µm wide.

Conidiomata not observed.

(Fig. 1B & C)

Chemistry. K–, C–, KC–, Pd–; lichexanthone (major), ± stictic acid (major or minor), ± constictic acid (major or traces), ± cryptostictic acid (traces), ± menegazziaic acid (traces). No lichen substances were detected by TLC or HPLC in *Imshaug* 36886 (MSC).

Notes. *Pertusaria dehiscens* is recognized by the verruciform apothecia, ostioles that may

or may not dilate to form a pseudolecanorine disc, biseriata 8-spored asci, and presence of lichexanthone, and sometimes also stictic and constictic acids as major lichen compounds. The chemistry of this species is variable. It is distinguished from the chemically similar saxicolous *P. hadrocarpa* by the morphology of the apothecia, the number of ascospores, and the almost constant presence of stictic and constictic acids. The corticolous species, *P. gracilis* Müll. Arg., from Brazil is chemically identical to *P. dehiscens*, but is distinguished by the morphology of the apothecia and by the 4-spored asci (Archer 1997). The 'new' species *Pertusaria masafuerensis*, originally proposed by *Imshaug in sched.*, appears to be indistinguishable from *P. dehiscens*.

Habitat and distribution. *Pertusaria dehiscens* is a corticolous species occurring on the bark of *Myrceugenia* sp. and was found only on Alejandro Selkirk Island (Más Afuera Island or Masafuera Island). The species was known from Australia, Norfolk Island, India and Brazil (Archer 1997), and is here recorded from the Juan Fernández Archipelago, Alejandro Selkirk Island (Más Afuera Island or Masafuera Island) for the first time.

Specimens examined. **Chile:** Juan Fernández Archipelago: Más Afuera, Quebrada de Blindado, 1917, C. & I. Skottsberg 70 (SGO 090388); *ibid.*, C. & I. Skottsberg 79 (UPS); Quebrada de la Mata Maqui (between Quebrada del Mono y Quebrada de las Casas), well developed grove of *Myrceugenia* with some *Aristotelia*, 1965, *Imshaug* 37074A (MSC); Quebrada de las Casas, 1965, *Imshaug* 36709B (MSC); Quebrada de las Vacas, grove of *Myrceugenia* on north side of canyon, above waterfalls, 1965, *Imshaug* 36886 (MSC); *ibid.*, *Imshaug* 36877 (MSC); *ibid.*, *Imshaug* 36892 (MSC), near summit of ridge on north side of canyon (just beneath Cordon Barril), well developed *Myrceugenia* grove with large *Dicksonia* and one large *Drimys*, 1965, *Imshaug* 37341 (MSC).

***Pertusaria hadrocarpa* Zahlbr.**

In Skottsberg, C. (ed.), *The Natural History of Juan Fernández and Easter Island* 2: 376 (1924); type: Chile, Juan Fernández Archipelago, Más a Tierra, Pico Central, Cordon Salsipuedes, 1916, C. & I. Skottsberg s.n. (GB—lectotype, GB—isolectotype).

For synonyms see Archer (1997).

Thallus crustose, off-white or pale greyish white to yellowish white, areolate to verrucose, cracked, thin, surface tuberculate, dull, saxicolous; isidia and soredia absent.

Apothecia verruciform, globose to hemispherical, conspicuous, numerous, scattered to confluent, constricted at the base, concolorous with the thallus, the area around the ostioles flattened to slightly depressed, 0.5–1.5(–2.5) mm diam.; ostioles 1–3(–5) per verruca, brown to black, conspicuous, sunken, 0.07–0.75 mm diam. *Asci* claviform. *Ascospores* 6–8 per ascus, hyaline, irregularly biseriolate, ellipsoid, 114–145 × 35–53 µm, spore walls double, smooth, 5–7 µm wide.

Conidiomata not observed.

(Fig. 1D)

Chemistry. K – or K+ yellow, C –, KC –, Pd – or Pd+ orange; lichexanthone (major), stictic acid (major), ± constictic acid (major or traces), ± connorstictic (traces), ± menegazziaic acid (traces).

Notes. *Pertusaria hadrocarpa* is characterized by verruciform apothecia, 6–8-spored asci, and the presence of lichexanthone and stictic acid, sometimes also with constictic acid as a major compound. It superficially resembles *P. petrophytes* C. Knight described from Australia, but differs in its chemistry and spore size (Archer 1997; Archer & Elix 1998).

Habitat and distribution. In Juan Fernández this species grows on volcanic rocks whereas in Australia it was reported on siliceous rocks, such as sandstone, as well as basalt (Archer & Elix 1994). It is an uncommon species found in the Juan Fernández Archipelago and Australia (Zahlbruckner 1924; Redón & Quilhot 1977; Archer 1997). The species is here reported from Santa Clara Island for the first time and is now known from Robinson Crusoe Island (Más a Tierra Island or Masatierra Island), Santa Clara Island and Alejandro Selkirk Island (Más Afuera Island or Masafuera Island).

Specimens examined. Chile: Juan Fernández Archipelago: Más a Tierra, Cordón El Pico, 17 xii 1916, C. & I. Skottsberg (SGO 093967, UPS); near Colonia, 6 xii 1916, C. & I. Skottsberg (SGO 093983); Paso Portezuelo, 25 xii 1916, C. & I. Skottsberg (UPS); Tres Puntas, 5 i 1917, C. & I. Skottsberg (UPS), *ibid.*, 7 i 1917, C. & I. Skottsberg (UPS); “Felswand beim Selkirk-Denkmal”, 22 i 1917, C. & I. Skottsberg (UPS); Portezuelo de Villagra, 30 iv 1917, C. & I. Skottsberg (UPS), *ibid.*, 1965, *Imshaug* 37594 (MSC); Puerto Francés, 1955, C. Skottsberg L154 (UPS); Valle Anson, 16 iii 1955, col.? (B); Plazoleta del Yunque, 17 iii 1955, col.? (B); Cerro Alto, 1955, *Sparre* L348 (UPS); Valle Colonial, slope of Cordón Salsipuedes, 1955, C. & I. Skottsberg L350 (UPS). Santa Clara, 1954, C. Skottsberg L36 (UPS). Más Afuera, Quebrada de las Casas, side north of the canyon, 1965, *Imshaug* 36735 (GZU), *ibid.*, 10 ii 1917, C. & I. Skottsberg (UPS); Quebrada del Ovalo, North Fork, 1965, *Imshaug* 36830 (B); Quebrada del Mono, at base of the end of the canyon, 1965, *Imshaug* 37128 (CANB, UPS); Lobería?, 17 ii 1917, C. & I. Skottsberg (UPS); “Hochplateau u. Masafuera”, 1917, C. & I. Skottsberg (UPS); *ibid.*, 7 iii 1917, C. & I. Skottsberg (SGO 093862).

Pertusaria melanospora Nyl.

In *Ann. Sci. Nat. Bot., Sér. 4*, 3: 159 (1855); type: Chile, Quilmenco, date?, *Gay s.n.* (H-NYL 23603—lectotype, H-NYL 23604—isolectotype).

For synonyms see Archer & Elix (1993) and Messuti & Archer (2003).

Thallus crustose, pale yellow to yellow-brown, areolate, rimose-areolate to verrucose, cracked, thin, surface smooth, dull, saxicolous; isidia and soredia absent.

Apothecia verruciform, immersed or hemispherical to flattened, with the central part depressed, conspicuous, numerous, scattered to confluent, becoming slightly constricted at base, 0.25–1.50 mm diam.; ostioles 1 per verruca, sometimes 2–6 per verruca, black, conspicuous, becoming pseudolecanorine, 0.05–0.50 mm diam. *Asci* claviform. *Ascospores* 6–8 per ascus, hyaline to bluish black, irregularly biseriolate, ellipsoid, 55–81 × 30–39 µm, spore walls multilaminar, smooth, 10–12 µm wide.

Conidiomata not observed.

(Fig. 1E)

Chemistry. K –, C – or C+ orange, KC – or KC+ orange-yellow, Pd –; arthothelin (major), ± 6-*O*-methylartho-

thelin (major or minor), \pm norstictic acid (major), \pm 4,5-dichloronorlichexanthone (minor) and \pm unknown depside with RI=16 (major).

Notes. *Pertusaria melanospora* is characterized by 6–8-spored asci, hyaline or dark coloured ascospores, black ostioles, and the presence of arthothelin (2, 4, 5-trichloronorlichexanthone), sometimes with 6-O-methylarthothelin as a major lichen substance. According to Archer (1997) this taxon is morphologically similar to the saxicolous *P. thula* A. W. Archer from Australia but that species contains thiophanic acid (2,4,5,7-tetrachloronorlichexanthone).

Habitat and distribution. *Pertusaria melanospora* is a common saxicolous crustose lichen on Juan Fernández (Zahlbruckner 1924). The species also occurs on the south-east coast of Australia, and in New Zealand, South Africa, Peru and Chile (Archer 1997; Dodge 1966; Follmann & Redón 1972; Messuti & Archer 2003). In the Juan Fernández Archipelago it is known from Robinson Crusoe Island (Más a Tierra Island or Masatierra Island), Santa Clara Island and Alejandro Selkirk Island (Más Afuera Island or Masafuera Island).

Specimens examined. **Chile:** Juan Fernández Archipelago: Más a Tierra, Tres Puntas, 5 i 1917, C. & I. Skottsberg (SGO 093973). Más Afuera, Quebrada del Ovalo, entrance of the canyon, 1965, Imshaug 36843 (GZU); Quebrada de las Vacas, 9 iii 1917, C. & I. Skottsberg (SGO 093969).

***Pertusaria pachyhallina* (Räsänen) Messuti**

In Guarrera, S.A., Gamundi de Amos I.J. & Matteri, C. M. (eds.) *Flora Criptogámica de Tierra del Fuego*. Lichenes Pertusariales: Coccotremataceae, Megasporeaceae y Pertusariaceae. Tomo 13. Fasc. 13: 53–55 Buenos Aires: CONIET (2002); *Pertusaria grisea* var. *pachyhallina* Räsänen, *Ann. Bot. Soc. Zool.-Bot. Fenn. "Vanamo"* 2: 28 (1932); type: Chile, "Fuegia occ., Mte. Buckland, 23 February 1929, Roivainen" (H!—lectotype), "Fuegia occ., Fj. Martínez, Bahía Plüschow, 21 February 1929, Roivainen" (H!—isolectotype).

Thallus crustose, greyish white to pale brown to brown, rimose-areolate to verru-

cose, cracked, thick, surface smooth, dull; soredia absent. *Isidia* simple, concolorous with the thallus, rarely branched at the apices, cylindrical, flattened hemispherical, pyriform, claviform, straight or slightly curved, profuse, distributed over the whole thallus, apices brown-red to black, pruinose, (0.07–) 0.10–1.80 mm tall, 0.1–0.4(–0.5) mm diam.

Apothecia not observed.

Conidiomata not observed.

(Fig. 1F)

Chemistry. K– or K+ yellow to red-brown, C–, KC–, Pd+ orange to red-brown; hypothamnolic acid (major) and protocetraric acid (major).

Notes. *Pertusaria pachyhallina* is recognized by the isidiate thallus and the presence of hypothamnolic and protocetraric acids. A discussion on the affinities of this species with other isidiate taxa can be found in Messuti & Vobis (2002).

Habitat and distribution. *Pertusaria pachyhallina* is usually saxicolous, terricolous or muscicolous and sometimes occurs on plant debris. It is an uncommon species in the Juan Fernández Archipelago and is known only from Robinson Crusoe Island (Más a Tierra Island or Masatierra Island). It is more common in southern Chile (Magallanes Province) and Argentina (Tierra del Fuego Province) (Räsänen 1932; Messuti & Vobis 2002).

Specimen examined. **Chile:** Juan Fernández Archipelago: Más a Tierra, Cerro Central, above Valle Anson, near "El Camote", 1954, C. Skottsberg L25 (UPS).

***Pertusaria papillulata* Nyl.**

In *Ann. Sci. Nat. Bot., Bot. sér. 4*, 3: 60 (1855); type: Chile, s.loc., date?, Gay (H-NYL 23664!—lectotype, H-NYL 23663!—isolectotype).

Pertusaria polycarpa Kremp. var. *monospora* Zahlbr., in Skottsberg (ed.), *The Natural History of Juan Fernández and Easter Island* 2: 375 (1924); type: Chile, Juan Fernández Archipelago, Más Afuera, 25 February 1917, C. & I. Skottsberg (UPS-L76595/135559!—holotype).

Pertusaria pustulata var. *erythrina* Räsänen, *Rev. Sudam. Bot.* 5: 65 (1938); type: Chile, Concepción, "ad

cort. *Cryptocarpa Peumus*”, 6 April 1937, Barros (H!—holotype); Concepción, “Quebrada de Yunque, auf *Cryptocarpa Peumus*”, 6 April 1937, Barros 168 (H!—isotype).

Thallus crustose, yellowish white, pale yellow, greenish yellow to brownish yellow, continuous or in patches, slightly adpressed on the substratum, thin, surface rugose, scrobiculate, faveolate to verrucose, rimose, shiny; *prothallus* yellow; isidia and soredia absent.

Apothecia verruciform, immersed or hemispherical to flattened, numerous, scattered to confluent, sessile, rarely constricted at the base, 0.2–1.8(–3.0) mm diam; ostioles 1–8 per verruca, rarely more, black or rarely hyaline, inconspicuous, rounded or ellipsoid, with a grey to dark grey area around the pore and a yellow area external to the former, both parts with radial striae. *Asci* claviform. *Ascospores* 6–8 per ascus, hyaline, biseriate to obliquely disposed, ellipsoid, straight or slightly curved, (70–)80–125 × (20–)25–45(–50) μm, spore walls double, the external smooth, the internal rugose, 4–5 μm wide.

Conidiomata not observed.

(Fig. 2A)

Chemistry. K–, C+ orange, KC+ orange, Pd– or Pd+ faint yellow; arthothelin (major), 6-O-methyl-arthothelin (major) and 4,5-dichloronorlichexanthone (major, minor or traces).

Notes. *Pertusaria papillulata* is characterized by verruciform apothecia, with a black, striate area around the ostioles, 6–8-spored asci and the presence of chlorinated norlichexanthones. The species resembles *P. howeana* A. W. Archer chemically, but differs in the morphology of the apothecia, the number of ostioles, and the size of ascospores (Archer & Elix 1994; Archer 1997). The species is also chemically similar to *P. idukkiensis* Awasthi & Srivastava, described from India, but the ascospores in that species are larger, being 112–212 μm long (Awasthi & Srivastava 1993; Archer 1995). *Pertusaria inconspicua* A.W. Archer &

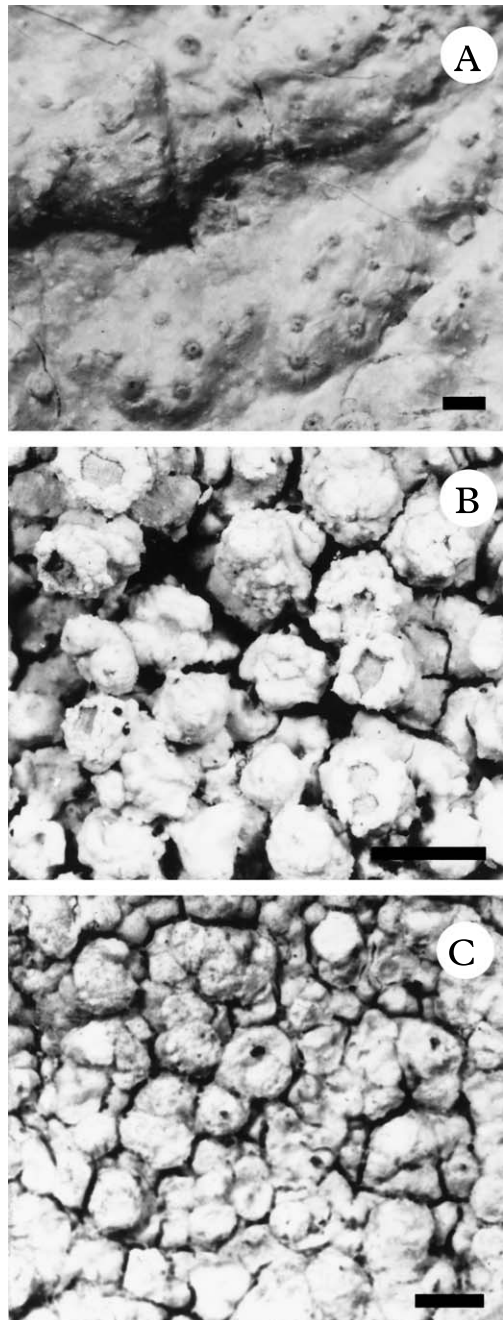


FIG. 2. Morphology of *Pertusaria* species from Juan Fernández Archipelago. A, *P. papillulata* (Imshaug 37720, MSC); B, *P. phlyctaenula* (holotype, H-NYL); C, *P. velata* (UPS). Scales: A=1.5mm; C-B=0.5 mm.

Elix, described from Papua New Guinea, is chemically similar to *P. papillulata*, but this species differs in having only four ascospores per ascus (Archer & Elix 1998).

Pertusaria polycarpa var. *monospora* was described as a new variety from Juan Fernández by Zahlbruckner (1924). According to this author the main feature of this taxon is the monosporous asci. Nevertheless, when the type material was examined (UPS L-76595!-holotype, mislabelled as *P. polycarpa* var. *monosperma* by Zahlbruckner), it was found to have the same morphological and chemical characters as *P. papillulata* including 6-8-spored asci. Therefore *P. polycarpa* var. *monospora* is reduced to synonymy with *P. papillulata*.

Habitat and distribution. *Pertusaria papillulata* is a corticolous or muscicolous species which may also be found on plant debris or similar substrata. In the study area it grows on the bark of *Drimys confertifolia* Phil. in forest dominated by *Myrceugenia* and *Dicksonia*, with a moist and shaded forest floor. Previously it was known from the type locality in Chile, (exact locality unknown), and, as *P. pustulata* var. *erythrina*, from Concepción (Archer & Elix 1998), and as *P. polycarpa* var. *monospora* from Más Afuera Island (Zahlbruckner 1924). The species is now reported for the first time from Robinson Crusoe Island (Más a Tierra Island or Masatierra Island) and is also known from Santa Clara Island and Alejandro Selkirk Island (Más Afuera Island or Masatierra Island).

Specimens examined. **Chile:** Juan Fernández Archipelago: Más a Tierra, El Yunque, Valle Anson, above of Plazoleta del Yunque, 1965, *Imshaug* 37720 (MSC), *ibid.*, *Imshaug* 37722A (MSC); Valle Anson, Cerro Damajuana, east side of the valley, 1965, *Imshaug* 38259 (MSC); Cerro Alto, 20 March 1955, *Sparre* (UPS L315). Más Afuera, Quebrada de las Vacas, north side of the canyon, below Cañón Barril, 1965, *Imshaug* 37371 (UPS).

***Pertusaria phlyctaenula* Nyl.**

In *Ann. Sci. Nat. Bot., Bot. sér.* 4, 3: 60 (1855); type: Chile, Coquimbo, s. loc., date?, *Gay* (H-NYL 23260!—holotype).

Thallus crustose, yellowish white to pale yellow, rimose or rimose-areolate to verrucose-areolate, thin to thick, surface dull, areoles plane, irregular, corticolous; isidia and soredia absent.

Apothecia when young, hemispherical, concolorous with the thallus, slightly constricted at base, the centre hyaline to whitish, the area around the ostioles hyaline to black, 0.15–0.50 mm diam., opening with age, becoming disciform, immersed or erumpent, round to irregular, numerous, sparse and scattered to crowded, 1 per verruca to 2–3 per verruca, sessile to somewhat stipitate, slightly constricted at base, 0.15–0.20 mm diam.; disc pinkish, brownish yellow or brown to black, flattened to concave, white pruinose, irregular, margin thick and erose, concolorous with disc and the internal margin white. *Asci* cylindrical to claviform. *Ascospores* 8 per ascus, hyaline, uniseriate to biseriate, ellipsoid to ovoid, 16–22 × 8.5–12 µm, spore walls simple, smooth, 1–2 µm wide.

Conidiomata not observed.

(Fig. 2B)

Chemistry. Holotype: K+ orange, C–, KC–, Pd+ orange; lichexanthone (major or traces) and norstictic acid (traces). L297 and L365 (UPS): K+ yellow to red, C–, KC–, Pd+ orange (medulla) and Pd– (apothecia); norstictic acid (major), stictic acid (major).

Notes. *Pertusaria phlyctaenula* is characterized by disciform apothecia, asci with eight spores, and the presence of lichexanthone and sometimes norstictic and stictic acids although the chemistry of this species is somewhat variable. The species resembles the corticolous *P. truncata* Kremp., distributed in rainforest in Australia and New Zealand, but is distinguished from that species by the number of ascospores per ascus and the chemistry. *Pertusaria truncata* has asci with 4–6(–8) ascospores and contains picrolichenic and isohyperpicrolichenic acids (Kantvilas 1990; Archer 1997). *Pertusaria phlyctaenula* is distinguished from

from *P. thamnolica* A. W. Archer, described from Australia and New Zealand, by the smaller ascospores and the absence of thamnolic acid (Archer 1992). The two additional specimens examined from Chile (L297 and L365, UPS) have shown differences in the chemistry from the holotype (H-NYL 23260!), although the general appearance of the thallus, the structure and size of the apothecia and the ascospores can all be accommodated with ease within *P. phlyctaenula*.

Habitat and distribution. *Pertusaria phlyctaenula* is an uncommon species on the bark of *Nothomyrcia* in forest areas of Más a Tierra Island. Previously it was known only from the type locality in continental Chile, Coquimbo (H-NYL 23260!-holotype), and is here recorded from the Juan Fernández Archipelago, Robinson Crusoe Island (Más a Tierra Island or Masatierra Island) for the first time.

Specimens examined. **Chile:** Juan Fernández Archipelago: Más a Tierra, Valle Anson, “bosque sobre Plazoleta”, 18 iii 1955, C. & I. Skottsberg L297 (UPS), *ibid.*, C. & I. Skottsberg L365 (UPS).

***Pertusaria velata* (Turner) Nyl.**

In *Lich. Scand.*: 179 (1861); *Parmelia velata* Turner, *Trans. Linn. Soc. London* 9: 143 (1808); type: England, Sussex, s. loc., on ash trees, 1805, *Borrer* s.n. (BM—holotype).

Pertusaria skottsbergii Zahlbr., in Skottsberg, C. (ed.), *The Natural History of Juan Fernández and Easter Island* 2: 376 (1924); type: Chile, Juan Fernández Archipelago, Más a Tierra, s. loc., on smooth bark, date?, C. & I. Skottsberg s.n. (GB!—holotype).

Pertusaria chilena Zahlbr., *Ann. Mycol.* 29: 83 (1931); type: Chile, s. loc., date?, col.? (SGO 090392!—holotype).

For further synonyms see Archer & Messuti (1997).

Thallus crustose, whitish olive-green or off-white to grey, rimose, rimose-areolate or verrucose, thin, surface smooth to wrinkled, dull; *prothallus* absent or present, white; *isidia* and *soredia* absent.

Apothecia disciform, numerous, crowded, immature apothecia somewhat irregularly hemispherical, constricted at base, mature apothecia flattened to convex or slightly con-

cave, sessile, 0.5–1.0 mm diam., sometimes sterile, discs reddish to red-orange, densely white pruinose, margin thick, concolorous with disc or white. *Asci* claviform. *Ascospores* 1 per ascus, hyaline, ellipsoid, 150–213 × 28–50(–57) µm, spore walls simple, smooth, 3(–5–7) µm wide.

Conidiomata not observed.

(Fig. 2C)

Chemistry. K – , C+ red, KC+ red, Pd – ; lecanoric acid (major) and lichexanthone (major, traces or absent).

Notes. *Pertusaria velata* is recognized by the disciform apothecia, the single spored asci, and the presence of lecanoric acid, sometimes with lichexanthone present as a major compound. A discussion of the taxonomy of this species was given by Archer & Messuti (1997). Other morphologically similar species have been recorded from the same areas *viz.*: *P. skottsbergii* Zahlbr. (Zahlbruckner 1924; Elix & McCarthy 1998), which is considered to be a synonym of *P. velata* (Archer & Messuti 1997), and the saxicolous *Pertusaria chilena* Zahlbr. (SGO 090392!—holotype) described from Chile by Zahlbruckner (1931). This latter species has slightly larger ascospores (194–225 × 51–74 µm) than those of *P. velata* but this is a very variable character and both species otherwise have identical chemistry and morphology. On this basis, the name *P. chilena* is reduced to synonymy with *P. velata*.

Habitat and distribution. *Pertusaria velata* is a widely distributed species, found mainly on bark, but occasionally on rock found in the archipelago. The species often grows on the bark of *Myrceugenia* or on volcanic rocks. It is a tropical to temperate species that is known in all continents except Antarctica (Archer & Messuti 1997). It was reported from Robinson Crusoe Island and Santa Clara Island by Zahlbruckner (1924) as *P. skottsbergii* Zahlbr. It is here reported for the first time from Alejandro Selkirk Island (Más Afuera) and is also known from

Robinson Crusoe Island (Más a Tierra Island or Masatierra Island) and Santa Clara Island.

Specimens examined. Chile: Juan Fernández Archipelago: Más a Tierra, Valle Colonial, date?, col.? (UPS); Valle Colonial, Quebrada Gutiérrez, 1916, *C. & I. Skottsberg* 382 (SGO 090390). Santa Clara, 26 i 1917, *C. & I. Skottsberg* (SGO 093986, UPS), Valle Anson, 1955, Kunkel 302/2 (B), Plazoleta del Yunque (?), 1954, *Kunkel* 332-b/10.2 (B). Más Afuera, Quebrada del Ovalo, South Fork, 1965, *Imshaug* 36801 (CANB); Quebrada de las Vacas, entrance to the canyon, 1965, *Imshaug* 36969 (MSC); Lobería Ventana, entrance to Quebrada Tongo, 1965, *Imshaug* 37206 (CANB); Quebrada de la Mata Maqui, between Quebrada Mono y Quebrada Casas, 1965, *Imshaug* 37071 (MSC).

Excluded species

***Pertusaria leioplaca* (Ach.) Schaer.
var. *turgida* Müll. Arg.**

In *Flora* 67: 305 (1884); type?: ‘Colombia, Nova Granata, date?, Lindig, 2700 (herb.?) et (*parcissime inter alias*), *prope Rio de Janeiro, Glaziou* s.n.’ (herb.?).

The type of this lichen could not be located in G (Clerc, *in litt.*), PC or UPS. *Pertusaria leioplaca* var. *turgida* was reported from Masafuera Island (Alejandro Selkirk Island), Quebrada del Blindado, by Zahl-

bruckner (1924) but the specimens on which this report was based (UPS, *C. & I. Skottsberg* 79) are now identified as *P. dehiscens*. A specimen of this variety from SGO (090388, Masafuera, Quebrada del Blindado, *C. & I. Skottsberg* 70) is also identified as *P. dehiscens*. No further localities in addition to those cited by Zahlbruckner (1924) could be found in the present study.

***Pertusaria polycarpa* Kremp.**

In *Flora* 67: 464 (1884); type?: Brazil, corticola *prope Rio de Janeiro* s. loc., date?, *Glaziou* 6265 (ex *Krempel.*) et 5540, (herb.?M).

The type of *P. polycarpa* could not be located in M. The three herbarium specimens in MSC (*Imshaug* 37720, 37722A and 38259) and one herbarium specimen in UPS (*Imshaug* 37371) from the Juan Fernández Archipelago under the name *P. polycarpa* are possibly a misidentification of a variety of this species (*P. polycarpa* var. *monospora*) which is a synonym of *P. papillulata* (Müller 1884; Zahlbruckner 1924). No specimens corresponding to the tropical *P. polycarpa* were found among material examined from the Juan Fernández Archipelago.

Key to the species of *Pertusaria* in the Juan Fernández Archipelago

- 1 Thallus isidiate or with sterile discs 2
 Thallus with fertile discs or verrucae, without isidia 3
- 2(1) Thallus isidiate, K – or K+ yellow to red-brown, KC – , hypothamnolic and
 protocetraric acids present **P. pachythallina**
 Thallus with sterile discs, K – , KC+ red, lecanoric acid present . . . **P. velata**
- 3(1) Apothecia disciform 4
 Apothecia verruciform 5
- 4(3) Thallus K – , KC+ red, lecanoric acid present; ascospores 1 per ascus **P. velata**
 Thallus K+ orange, KC – , lichexanthone present; ascospores 8 per ascus . . .
 **P. phlyctaenula**
- 5(3) Thallus lacking lichen compounds **P. fernandeziana**
 Thallus with lichen compounds 6
- 6(5) Thallus with chloronorlichexanthenes, lichexanthone absent 7
 Thallus lacking chloronorlichexanthenes, lichexanthone present 8

- 7(6) Ascospores often bluish black, 55–81 × 30–39 µm, spore walls multilaminar, smooth **P. melanospora**
 Ascospores hyaline, (70–)80–125 × (20–)25–45 µm, spore walls double, the external smooth, the internal rugose **P. papillulata**
- 8(6) Ostioles brown-red to black, punctiform to deeply concave and almost disciform (pseudolecanorine), 1–6 per verruca **P. dehiscens**
 Ostioles dark brown to black, conspicuous, sunken, 1–3(–5) per verruca **P. hadrocarpa**

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