

The lichens of Lord Howe Island. 1. Introduction and the genus *Pertusaria* (Pertusariaceae)

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Abstract

Archer, Alan W.¹ & Elix, John A.² (¹National Herbarium of New South Wales, Royal Botanic Gardens, Sydney, NSW, Australia 2000; ²Department of Chemistry, The Faculties, Australian National University, Canberra, ACT, Australia 0200) 1994. The lichens of Lord Howe Island. 1. Introduction and the genus *Pertusaria* (Pertusariaceae). *Telopea* 6(1): 9–30. The historical records of lichens of Lord Howe Island are discussed and an account is given of the lichen genus *Pertusaria* on Lord Howe Island. Twenty species are found there, six of which are new: *Pertusaria howeana* Archer & Elix, *P. lordhowensis* Archer & Elix, *P. malabara* Archer & Elix, *P. maritima* Archer & Elix, *P. miniatescens* Archer & Elix and *P. puffina* Archer & Elix. *Pertusaria subventosa* Malme is also reported from New Zealand. A key to the species on Lord Howe Island is presented. *Pertusaria dehiscens* Müll.Arg. var. *alba* Müll.Arg., *P. dehiscens* Müll.Arg. var. *depressior* Müll.Arg. and *P. sulphurescens* Müll.Arg. are reported as synonyms of *P. dehiscens* Müll.Arg.

Introduction

Lord Howe Island and satellite islets (the Admiralty Islands, Rabbit Island, Mutton Bird Island, Balls Pyramid, etc.) are isolated volcanic outcrops in the South Pacific Ocean between longitudes 159° 02' 12" and 159° 06' 18" E and latitudes 31° 30' 42" and 31° 36' 00" S. The islands are the emergent portions of a large, nearly truncated seamount. This seamount sits on the western edge of the Lord Howe Rise — an undersea volcanic plateau some 300 km wide and 2,000 km long, extending from New Zealand to the Chesterfield Reefs, midway between New Caledonia and the Queensland coast. Lord Howe Island lies approximately 700 km north-east of Sydney and 1250 km north-west from the northern tip of New Zealand.

Lord Howe Island (Figure 1) is an Australian territory, under the administrative control of New South Wales. The island is roughly crescent-shaped, approximately 12 km long and 2.8 km wide, totalling 1,455 ha in area and almost completely volcanic in origin, with basalts and breccias the major rock types. Geologically Lord Howe Island is now considered to be the eroded remnant of a large shield volcano active during the Pleiocene epoch, some 7 million years ago. Several volcanic periods are believed responsible for different parts of the Island, but the two present mountains, Mt Gower and Mt Lidgbird, represent the most recent volcanic phase (6.4 million years ago). The low-lying central part of Lord Howe Island is covered by a coarse, marine calcarenite of late Pleistocene origin (McDougall, Embleton & Stone 1981).

Much of Lord Howe Island is mountainous or hilly country. The southern half of the island is dominated by the twin peaks of Mt Gower, 875 m, and Mt Lidgbird, 777 m. The volcanic hills in the northern and central parts of the island are lower — Mt Eliza is only 148 m and Intermediate Hill 250 m above sea level. Between the northern and southern hills there are low-lying sand and sedimentary deposits. The coastline

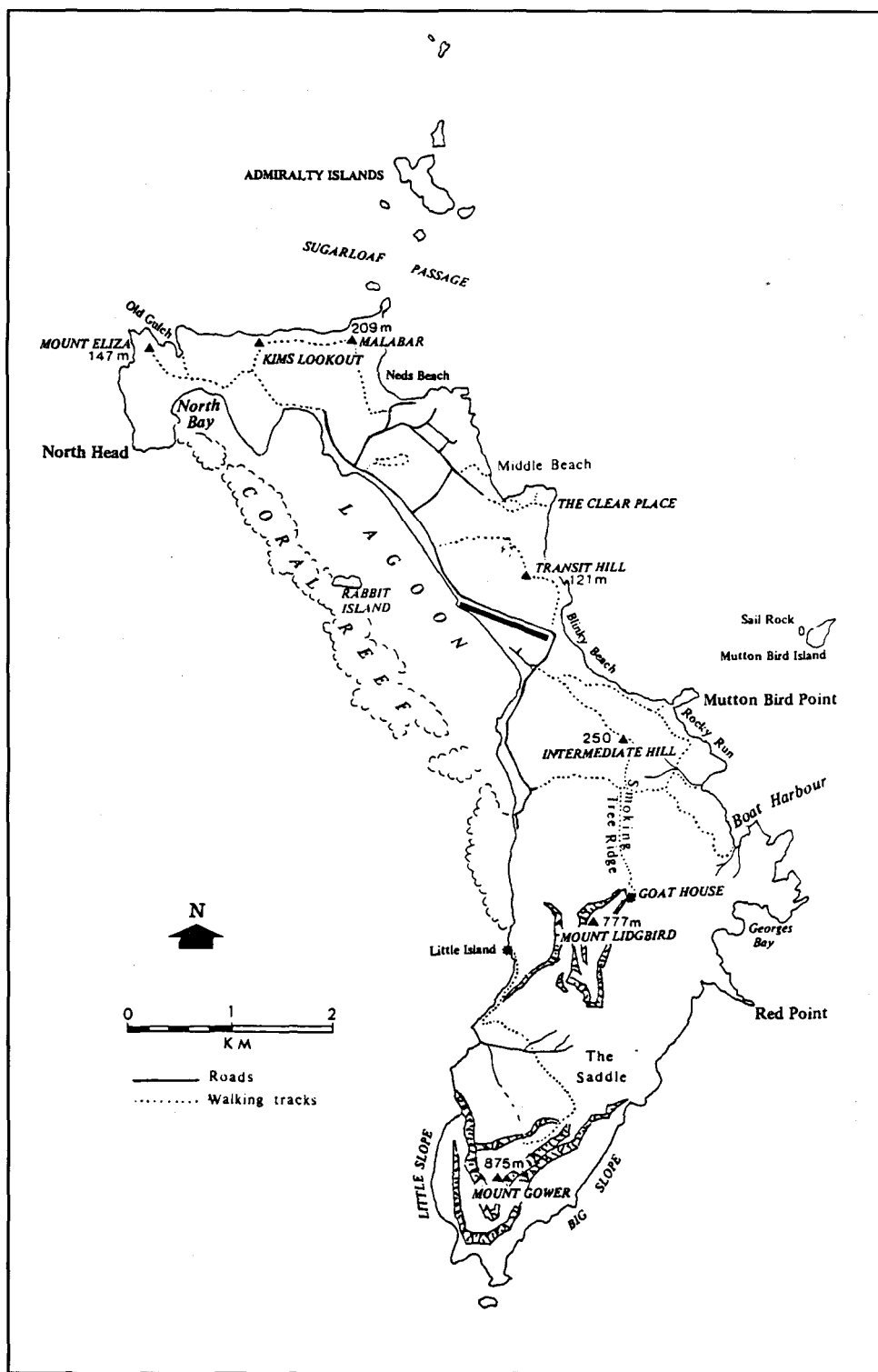


Figure 1. Lord Howe Island.

varies from the large shallow reef-fringed lagoon with white sandy beaches on the western side of the island to small sandy bays (e.g. Neds Beach) or sheer black cliffs of basalt up to 200 m high (Malabar) (Hutton 1985).

The climate of Lord Howe Island is subtropical with no extremes of temperature, no real seasonal pattern and moderate relative humidity (70–78%). Mean monthly temperature fluctuates from minima near 13° C (in winter) to maxima near 25° C (in summer) and the daily range is rarely more than 8° C. Rainfall (mean annual precipitation 1675 mm) occurs throughout the year with a winter maximum (June average of 187 mm) and summer minimum (February average of 113 mm). The summers are actually drier than the figures indicate, but erratic summer rain depressions (up to 300 mm in a month) boost the average monthly figures.

History of lichenological investigations

Lord Howe Island was discovered in 1788 by Lieutenant H. Lidgbird Ball, of H.M.S. *Supply*, while on his way from Port Jackson to establish a penal colony on Norfolk Island. The island had remained undiscovered by the Polynesians on their migrations throughout the Pacific and was uninhabited. The first settlers arrived in 1834 and grew fruit and vegetables which they traded with whalers.

The island has been visited by a number of scientific expeditions in the course of its short history, but few of the early expeditions contributed greatly to the knowledge of the lichen flora. The most important collections were made by Charles Moore, the then director of the Botanic Gardens in Sydney, who, with his assistant Mr Carron, visited the Island in 1869. They formed part of an observation party sent to report on the Island by the government of New South Wales, together with the water police magistrate, P. L. Cloete, sent to investigate a murder. The first lichens from Lord Howe Island to be determined were reported by Krempelhuber (1881), who recorded five species from collections made in the main by Fullagar and forwarded to him by Baron Ferdinand von Mueller (Royal Botanic Gardens, Melbourne). The first new lichen species reported from Lord Howe Island was *Pseudocyphellaria poculifera* (Müll. Arg.) D. Gall. & P. James [as *Sticta poculifera* Müll. Arg.], described by J. Müller of Argau (Müller 1882) from a collection made by de Camara, again forwarded to Europe by F. Mueller. Subsequently Moore's lichen collections were examined by A. Zahlbruckner in Vienna, who recorded a total of 12 taxa from the Island (Zahlbruckner 1896).

A combined list is presented here using currently accepted names for taxa followed, where appropriate, by the synonyms used by Krempelhuber, J. Müller and Zahlbruckner in brackets. These recorded taxa have not yet been verified. The species list included:

Cladonia furcata (Huds.) Schrad. [*Cladonia furcata* var. *tenuicaulis* Müll. Arg.]

Heterodea muelleri Nyl.

Lobaria querzicans Michx. [*Sticta querzicans* Ach.]

Pseudocyphellaria aurata (Sm.) Vain. [*Sticta aurata* Sm.]

Pseudocyphellaria carpoloma (Del.) Vain. [*Stictina carpoloma* Nyl.]

Pseudocyphellaria freycinetii (Del.) Malme [*Sticta freycinetii* Del.]

Pseudocyphellaria mooreana (Zahlbr.) Imshaug [*Sticta mooreana* Zahlbr.]

Pseudocyphellaria psilophylla Müll. Arg.) D. Gall. & P. James [*Sticta psilophylla* Müll. Arg.]

Ramalina peruviana Ach. [*Ramalina javanica* Nyl.]

Ramalina subfraxinea Nyl. [*Ramalina complanata* Ach.]

Sphaerophorus melanocarpus (Sw.) DC. in Lamy & DC. [*Sphaerophoron compressum* Ach. var. *candidum* Müll. Arg.]

Sticta latifrons A. Rich., [*Sticta sinuosa* var. *macrophylla* Bab.]

Usnea dasypoga (Ach.) Nyl. [*Usnea barbata* var. *dasypoga* Fr.]

Usnea vriesseana Mont. & v. d. Bosch.

Xanthoparmelia tasmanica (Taylor) Hale [*Parmelia stramineonitens* Zahlbr.]

Subsequently Edwin Cheel (Botanic Gardens, Sydney) referred to several lichens from Lord Howe Island (Cheel 1906, 1913) but no new records were included. More recently Pickard (1973) published an annotated bibliography of all the botanical literature on Lord Howe Island including 9 references to lichens and these have been summarised above. From the collections housed in NSW and CBG it is apparent that lichens have been collected on Lord Howe Island by C. Hedley and W. S. Dunn [1908], W. W. Watts [1911 — who also made an important collection of bryophytes], J. Stovold [1924], J. Pickman [1978], D.H. Vitt [1981]. Only one species of *Pertusaria* has been described from Lord Howe Island, *Pertusaria sublacerans* Archer (Archer 1991), the specimens of which were collected by W.W. Watts in 1911.

Principal vegetation formations

The vegetation of Lord Howe Island (Pickard 1981) can be divided into four major formations namely: pastures and foreshores, and three broad types of sub-tropical rainforest: lowland 'dry' forests, lowland sheltered forests and the mountain rainforest. Brief notes are given below for these, together with the dominant lichen genera occurring in each formation.

Pastures and foreshores: Here old fence posts are colonised by a few corticolous lichens (*Dirinaria*, *Lecanora*, *Pertusaria* sp.). Remnant *Cryptocarya triplinervis* (blackbutt) trees, which occur in scattered stands, are much better substrates, with more species present and larger populations of lichens. Basaltic rock surfaces in pasture and exposed ridges (e.g. ridge to Malabar Hill) are very interesting substrates and lichen communities here include representatives of *Parmotrema*, *Xanthoparmelia* and *Xanthoria* plus a variety of microlichen genera including *Lecanora* and *Pertusaria*. Interestingly the outcrops of calcarenite near Neds Beach appear to be almost devoid of lichens.

Lowland dry forests: Such forests occur in exposed low altitude areas and are dominated by *Cryptocarya triplinervis*, *Ficus macrophylla* subsp. *columnaris* (banyan) and dense thickets of the endemic palms *Howea fosteriana* and *H. belmoreana*. These forests are quite good lichen habitats: the richest substrates are the upper trunks and canopy branches of *Cryptocarya* and base of the trunks and dead wood on *Howea* palms. The macrolichen genera *Dirinaria*, *Physcia*, *Pyxine* and *Parmotrema* are prominent along with the crustose taxa *Caloplaca*, Graphidaceae, *Pertusaria* and *Buellia*.

Lowland sheltered forests: Lowland sheltered forests occur in protected sites with well watered basalt soils, and dominant phanerogam species include *Bubbia howeana*, *Cleistocalyx fullageri*, *Atractocarpus stipularis* and *Chionanthus quadristamineus*. Such forests are characteristic of the slopes of Mt Gower and Mt Lidgbird, the western slope of Intermediate Hill and Malabar Ridge near Kims Lookout. The tree branches in the canopy are rich lichen habitats, with *Pannaria*, *Pseudocyphellaria*, *Heterodermia* and *Bulbothrix* species being prominent. The endemic pandanus, *Pandanus forsteri*, is common along creek beds in such habitats and its prodigious prop roots (sometimes to 18 m high) are commonly covered with lichens, particularly Graphidaceae. Basalt rocks in such areas are also interesting lichen substrates often supporting large colonies of *Letrouitia*, *Lecanora*, *Buellia* and *Pertusaria* species.

Mountain rainforest: As a consequence of the higher humidity and rainfall on Mt Lidgbird and Mt Gower, the summit areas (particularly on the latter) are covered with a unique miniature rainforest. The forest consists of a dense growth of small trees, bushes, palms and tree ferns rarely more than 4 m in height, the trunks and branches of which are densely encrusted with epiphytic ferns, mosses, lichens and orchids. Many of the Island's unique plants grow in this forest, including the palms *Heyscepe canterburyana*, *Lepidorrhachis mooreana*, *Dracophyllum fitzgeraldii* and *Negria rhabdothermoides*. Moisture tolerant lichen genera abound, including large colonies of *Pseudocyphellaria*, *Leptogium*, Pannariaceae and *Sticta* in the wetter areas, while the canopy branches provide a rich substrate for crustose lichens, including many species of Graphidaceae, *Pyrenula*, *Clathroporina* and *Megalospora*. One of the most striking lichens of the forest is *Pseudocyphellaria poculifera*, with its brilliantly yellow and emerald green (when wet) thallus. This species commonly inhabits the trunks and branches of many trees and shrubs.

Materials and methods

This account is based mainly on specimens collected by one of us (J.A.E.) on Lord Howe Island in June 1992 and an examination of type specimens from H-NYL, G, NSW, TUR-V, S and WELT. The techniques used for the examination of the specimens have been described previously (Archer 1991); in addition, the chemistry was determined by liquid chromatography (Elix & Venables 1993). Sections of verrucae were mounted in water for measurement of spore size; the spore dimensions quoted are those of mature spores, although smaller, immature spores may also be present. The figures illustrate holotypes.

Results

Pertusaria asperata Archer

(Archer & Elix 1992: 417)

Type: New South Wales: Myall River State Forest, on sandstone rock, by side of track, near Crawford River, c. 10 km W of Bulahdelah, 32° 25' S, 152° 06' E, alt. c. 50 m, A.Archer P188, 20 June 1991 (holo NSW).

Thallus off-white to pale greyish white, thin, areolate and cracked, surface sub-tuberculate and dull, lacking isidia and soredia, saxicolous; apothecia verruciform, concolorous with the thallus, numerous, scattered, rarely confluent, flattened hemispherical, concave above, constricted at the base, 0.8–1.5 mm diam.; ostioles conspicuous, dark brown, 1 per verruca; spores 8 per ascus, ellipsoid to sub-fusiform, smooth, irregularly biseriate, 112–125 µm long, 37–50 µm wide.

Chemistry: K-, KC-, C-, Pd-; lichexanthone, stictic and constictic acids.

Pertusaria asperata is characterised by the eight biseriate subfusiform spores and the presence of lichexanthone and stictic acid. It somewhat resembles *Pertusaria petrophyes* Knight but is distinguished from that species by the spore size and chemistry. *Pertusaria asperata* is an uncommon species found in New South Wales and Lord Howe Island, where it occurs on basalt rocks.

Also examined: Lord Howe Island: Max Nicholls Track, 31° 31' 08" S, 159° 03' 03" E, alt. 50 m, in dry lowland forest, *Elix* 32720, June 1992 (ANUC); along ridge to Malabar Hill, 31° 31' 16" S, 159° 03' 50" E, alt. 80 m, in dense shrubby vegetation, *Elix* 32973, June 1992 (ANUC).

***Pertusaria dehiscens* Müll. Arg.** (Müller 1884: 349)

Type: Brazil: Apiahy [Apiai], *Puiggari* 499 p.p., vii.1882 (G-lectotype, fide M. Oshio 1978)[previously reported as *Puiggari s.n.* (Archer 1991)]; *Puiggari* 2197 p.p. (G-syntype).

Pertusaria dehiscens var. *alba* Müll. Arg. (Müller 1884: 349)

Type: Brazil: Apiahy, *Puiggari* 2197 p.p. (G-syntype).

Pertusaria dehiscens var. *depressior* Müll. Arg. (Müller 1884: 349)

Type: Brazil: Apiahy, *Puiggari* 499 p.p. (G-syntype); India, Neilgherries [Nilgiri Hills, ca. 250 km SSW of Bangalore], *Ziegler s.n.* (G-syntype).

Pertusaria sulphurescens Müll. Arg. (Müller 1884: 349)

Type: Brazil: Apiahy, *Puiggari* 2197 p.p., July 1881(G-holotype).

Thallus pale to dark olive green, wrinkled and cracked, lacking isidia and soredia, surface dull, corticolous; apothecia verruciform, conspicuous, numerous, concolorous with the thallus, flattened hemispherical, 0.8–1.5 mm diam.; ostioles black, punctiform, 2–5 per verruca, in a hyaline zone, the zone becoming conspicuous, deeply concave and almost disciform, to 0.8 mm diam.; spores 8 per ascus, biseriate, smooth, fusiform, 100–140(–150) µm long, 35–50 µm wide.

Chemistry: K-, KC-, C-, Pd-; lichexanthone and stictic and constictic acids.

Pertusaria dehiscens is characterised by the conspicuously depressed ostioles, the eight biseriate spores and the chemistry. The multiple black ostioles in a concave hyaline zone and the fusiform spores distinguish *Pertusaria dehiscens* from the chemically similar, saxicolous *Pertusaria asperata* which has single dark brown ostioles, not in a hyaline zone, and ellipsoid to subfusiform spores. The three additional synonymous taxa listed above are chemically and morphologically identical to *Pertusaria dehiscens*. The species also occurs in Queensland, New South Wales, Norfolk Island and India and Brazil.

Also examined: Lord Howe Island: along track to Mutton Bird Point, 31° 32' 45" S, 159° 05' 00" E, alt. 60 m, on dead canopy branches in dry lowland forest with basalt outcrops, *Elix* 32786, June 1992 (ANUC).

***Pertusaria elliptica* Müll. Arg.**

(Müller 1895: 635)

Type: Queensland: Goodna, *Shirley* 1754 p.p., 1893 (holo G).

Thallus off-white or pale grey to pale olive green, thin, surface smooth or slightly rough and dull, corticolous; apothecia verruciform, conspicuous, scattered, slightly

flattened hemispherical, rounded or elongated or irregular in outline, becoming constricted at the base and concave above, 0.5–1.5 mm diam.; ostioles conspicuous, black, sometimes in a grey translucent zone, 1–2 per verruca; spores 3–4 per ascus, uniseriate, elongate ellipsoid to subfusiform, rough, 80–110 µm long, 30–45 µm wide.

Chemistry: K-, KC-, C-, Pd-; 2,5-dichlorolichexanthone (major), 2,4,5-trichlorolichexanthone (major), 2,4-dichlorolichexanthone (trace), 2-chlorolichexanthone (minor), 4,5-dichlorolichexanthone (trace), 2'-O-methylperlatolic acid (minor), 2-O-methylperlatolic acid (minor).

Pertusaria elliptica is characterised by the three to four rough spores per ascus, the conspicuous black ostioles and the chemistry. The species was previously reported to contain 4,5-dichlorolichexanthone (Archer 1991a) but liquid chromatography has shown the presence of the complex xanthone mixture listed above. *Pertusaria elliptica* occurs in northern Western Australia, the Northern Territory, Queensland and New South Wales, and also in New Caledonia.

Also examined: Lord Howe Island: near junction of tracks to Mutton Bird Point and Intermediate Hill, 31° 32' 43" S, 159° 04' 48" E, alt. 60 m, on dead palm in dry lowland forest with basalt outcrops, *Elix* 32744, June 1992 (ANUC).

***Pertusaria howeana* Archer & Elix, sp. nov.**

Thallus flavo-olivaceus vel virido-flavus, areolatus et rimosus, superficies laevis et hebetata, isidiis et sorediis destitutis, corticola; apothecia verruciformia, conspicua, numerosa, dispersa, plano-hemisphaerica, basi constrictescentia et distortescentia, interdum plus flavida quam thallus, 0.8–1.5(–2.0) mm diam.; ostiola inconspicua, nigra vel translucida, in verruca 1–2na; sporae 8nae, irregulariter biseriatae, ellipsoideae vel subfusiformes, 75–87 µm longae, 30–35 µm latae. Thallus arthothelin et 6-O-methylarthothelin continens.

Type: Lord Howe Island: Neds Beach Road at Malabar Hill Track, 31° 31' 16" S, 159° 03' 50" E, alt. 10 m, on crown of *Cryptocarya* in disturbed lowland forest, *J.A. Elix* 32889, 22 June 1992 (holo ANUC).

Thallus dull yellowish green to dull greenish yellow, areolate and cracked, surface smooth and dull, lacking soredia and isidia; corticolous; apothecia verruciform, conspicuous, numerous, scattered, flattened hemispherical, becoming constricted at the base and distorted, sometimes yellower than the thallus, 0.8–1.5(–2.0) mm diam.; ostioles inconspicuous, black or translucent, 1(–2) per verruca; spores 8 per ascus, irregularly 2-seriate, ellipsoid to subfusiform, 75–87 µm long, 30–35 µm wide. Fig. 2.

Chemistry: K-, KC+ yellow orange, C+ yellow orange, Pd-; arthothelin (major), 6-O-methylarthothelin (major), 2,5-dichloronorlichexanthone (minor), 2,7-dichloronorlichexanthone (minor), 4,5-dichloronorlichexanthone (trace).

Pertusaria howeana is characterised by the 8 biseriate spores, the yellowish verrucae and the presence of polychlorinated norlichexanthone derivatives. It resembles *Pertusaria bartlettii* Archer & Elix, described from New Zealand (Archer & Elix 1994) but differs from that species in the absence of thiophanic acid and the presence of 6-O-methylarthothelin. *Pertusaria howeana* is known only from Lord Howe Island.

Also examined: Lord Howe Island: track to Little Island, near Salmon Beach, 31° 33' 30" S, 159° 04' 30" E, alt. 5 m, on dead tree in scrubby, partly disturbed forest, *Elix* 32668, June 1992 (ANUC); near junction of tracks to Mutton Bird Point and Intermediate Hill, 32° 32' 43" S, 159° 04' 48" E, alt. 60 m, on dead palm in dry lowland forest with basalt outcrops, *Elix* 32746, June 1992 (ANUC); along track to Mutton Bird Point, 31° 32' 45" S, 159° 05' 00" E, alt. 60 m, on base of palm in dry lowland forest with basalt outcrops, *Elix* 32795, June 1992 (ANUC).

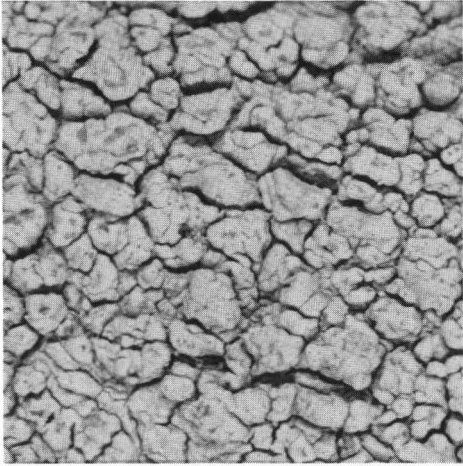


Figure 2. *Pertusaria howeana*, holotype, X 4.

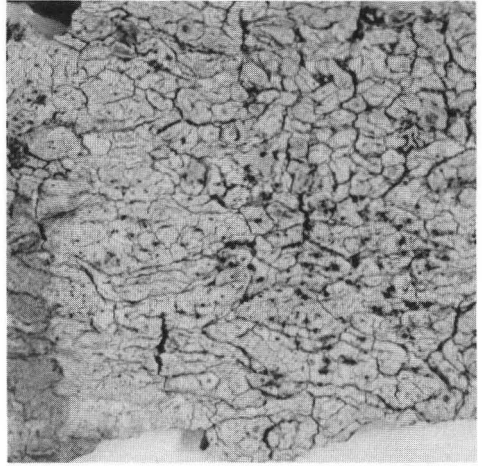


Figure 3. *Pertusaria lordhowensis*, holotype, X 4.

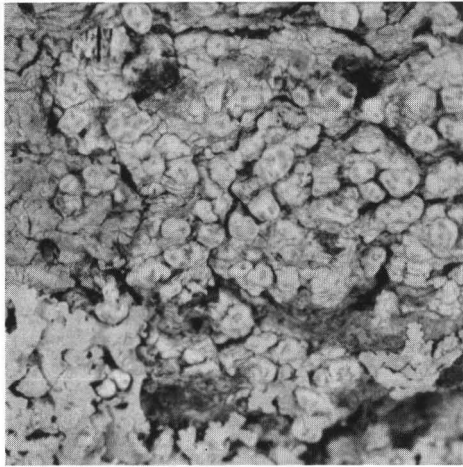


Figure 4. *Pertusaria malabara*, holotype, X 4.5.

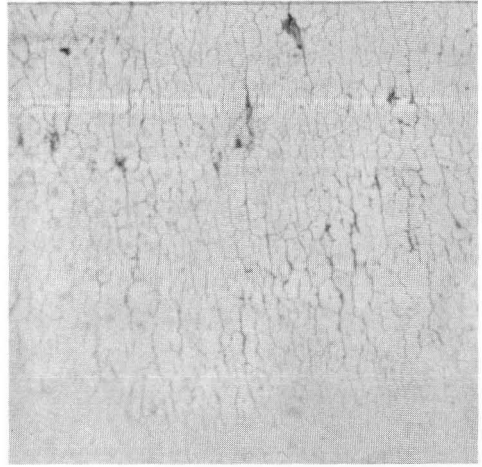


Figure 5. *Pertusaria maritima*, holotype, X 4.

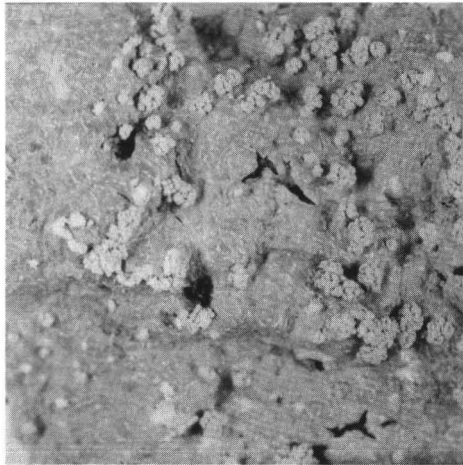


Figure 6. *Pertusaria miniatescens*, holotype, X 3.

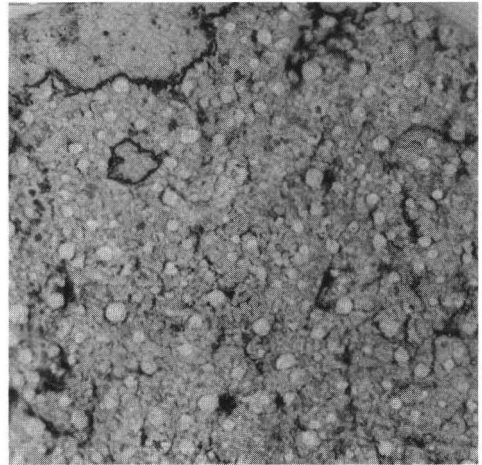


Figure 7. *Pertusaria puffina*, holotype, X 3.

***Pertusaria lavata* Müll. Arg.**

(Müller 1884: 462)

Type: New Zealand: s. loc., *Knight s.n.*, 1883 (holo G).

Thallus pale greyish-white to pale fawn, thick, coarsely areolate and cracked, lacking isidia and soredia, surface smooth and dull, saxicolous; apothecia verruciform, numerous, crowded, often confluent, concolorous with the thallus, flattened hemispherical, 0.7–1.0 mm diam.; ostioles conspicuous, black, punctiform, surrounded by a pale translucent zone, 1 per verruca; spores 8 per ascus, usually 6–8, ellipsoid to subfusiform, smooth, predominantly biserial, 85–105 µm long, 30–40 µm wide.

Chemistry: K-, KC-, C-, Pd-; 4,5-dichlorolichexanthone and 2'-O-methylperlatolic acid.

Pertusaria lavata is characterised by the flattened verrucae (which are often confluent), the eight biserial spores, flat ostioles and the chemistry. These morphological features distinguish *P. lavata* from the chemically similar, eight-spored saxicolous *Pertusaria lophocarpa* Körber (which also occurs in eastern Australia and New Zealand) and which has well-defined, rarely confluent verrucae, eight smaller uniserial spores and conspicuously sunken ostioles. *P. lavata* occurs in eastern Australia and also in New Zealand.

Also examined: Lord Howe Island: along track to Mutton Bird Point, 32° 32' 45" S, 159° 05' 00" E, alt. 60 m, on basalt rocks in dry lowland forest, *Elix* 32822, 32825, June 1992 (ANUC); between Little Island and The Cross, 31° 34' 20" S, 159° 04' 30" E, alt. 30 m, on basalt rocks in *Ficus* dominated steep slope, *Elix* 33008, 33011, 33013, June 1992 (ANUC).

***Pertusaria leioplacella* Nyl.**

(Nylander 1867: 71)

Type: New Caledonia: Lifu, *E. Marie s.n.*, 1863 (lecto H-NYL 23640, fide Awasthi & Srivastava, isolecto H-NYL 23643).

Pertusaria amblyogona Müll. Arg. (Müller 1895: 638)

Type: Queensland: Toowoomba, *Hartmann s.n.*, 1894 (holo G).

Pertusaria confluens Müll. Arg. (Müller 1895: 638)

Type: Queensland: Toowoomba, *Hartmann s.n.*, 1894 (holo G).

Thallus off-white to pale yellowish-white, areolate and cracked, surface smooth and dull, lacking isidia and soredia, corticolous; apothecia verruciform, numerous, scattered, sometimes confluent, flattened hemispherical, concolorous with the thallus, 0.5–1 (–1.5) mm diam.; ostioles inconspicuous, translucent, pale yellow, 1 per verruca; spores 8 per ascus, usually 6–8, irregularly uni- or biserial, ellipsoid, smooth, 52–72 µm long, 28–32 µm wide.

Chemistry: K-, KC+ orange, C+ orange, Pd-; thiophaninic and stictic acids with traces of hypostictic and constictic acids.

Pertusaria leioplacella is characterised by the pale yellow thallus giving a KC+ and C+ orange colour, the pale yellow ostioles and the eight spored asci. The species is distinguished from the somewhat similar *Pertusaria gibberosa* Müll. Arg. by the chemical reactions. The specimen from Lord Howe Island contained a relatively low concentration of thiophaninic acid compared to those found in specimens from eastern Australia.

Pertusaria leioplacella occurs in the Northern Territory, eastern Queensland, New South Wales and Tasmania. It is widely distributed in the Southern Hemisphere in Brazil, Paraguay, South Africa, New Caledonia and Vanuatu, and also occurs in the West Indies, Mexico and Hawaii.

Also examined: Lord Howe Island: Neds Beach Road at Malabar Hill Track, 31° 31' 16" S, 159° 03' 50" E, alt. 10 m, on crown of *Cryptocarya* in disturbed lowland forest, *Elix* 32876, June 1992 (ANUC).

***Pertusaria limbata* Vainio**

(Vainio 1890: 110)

Type: Brazil: Rio de Janeiro, *E. Vainio*, *Lich. Bras. Exsicc.* 208, 1885 (holo TUR-V 6719, iso UPS).

Pertusaria spaniostoma Vainio (Vainio 1926: 5)

Type: South Africa: Elsenburg, *P.A. van der Byl* 242 (holo TUR-V 34431).

Pertusaria simplex Vainio (Vainio 1929: 5)

Type: Mozambique: Palma, *A. Pires de Lima* 873, 1916 (holo TUR-V 34430).

Thallus pale olive green, areolate and cracked, surface smooth and dull, lacking isidia and soredia, corticolous; apothecia verruciform, flattened hemispherical, concolorous with the thallus, conspicuous, scattered, sometimes confluent, becoming constricted at the base, 0.7–1.2 mm diam.; ostioles inconspicuous, pale, translucent, 1–2 per verruca, sometimes fusing to form a sunken translucent disc; spores 8 per ascus, irregularly biseriata, ellipsoid to subfusiform, smooth, 65–75 µm long, 25–30 µm wide.

Chemistry: K-, KC-, C-, Pd-; 2-chlorolichexanthone, stictic and constictic acids.

Pertusaria limbata is characterised by biseriata eight-spored asci and the presence of 2-chlorolichexanthone and stictic acid. It occurs in Queensland and New South Wales, and also in Brazil, Angola, Mozambique and South Africa.

Also examined: Lord Howe Island: Neds Beach Road at Malabar Hill Track, 32° 31' 16" S, 159° 03' 50" E, alt. 10 m, on crown of *Cryptocarya* in disturbed lowland forest, *Elix* 32881, June 1992 (ANUC).

Queensland: Moreton, Andrew Drynan Park, 4 km WNW of Richmond Gap, on *Eucalyptus* bark, *Archer* P 418, Sep 1992 (NSW).

New South Wales: North Coast, Border Ranges National Park, Antarctic Beech Look-out, on *Solanum*, *Archer* P 428, Sep 1992 (NSW).

***Pertusaria lordhowensis* Archer & Elix, sp. nov.**

Thallus albido-olivaceus, areolatus et rimosus, superficies laevis et hebetata, isidiis et sorediis destitutis, corticola; apothecia verruciformia, inconspicua, numerosa, dispersa, plano-hemisphaerica, thallo concoloria, 0.5–0.8 mm diam.; ostiola conspicua, atrobrunnea, singula in verruca; sporae 8nae, biseriatae, ellipsoideae, laeves, (50–) 60–75 µm longae, 25–30 µm latae. Thallus 2,4-dichloro-lichexanthone, 2,5-dichloro-lichexanthone, 2,4,5-trichlorolichexanthone continens.

Type: Lord Howe Island: Neds Beach Road at Malabar Hill Track, 32° 31' 16" S, 159° 03' 50" E, alt. 10 m, on crown of *Cryptocarya* in disturbed lowland forest, *J.A. Elix* 32878, 22 June 1992 (holo ANUC).

Thallus pale olive green, areolate and cracked, surface smooth and dull, lacking isidia and soredia; corticolous; apothecia verruciform, inconspicuous, numerous, scattered, flattened hemispherical, concolorous with the thallus, 0.5–0.8 mm diam.; ostioles conspicuous, dark brown, 1 per verruca; spores 8 per ascus, biseriate, ellipsoid, smooth, (50–)60–75 μm long, 25–30 μm wide. Fig. 3.

Chemistry: K-, KC-, C-, Pd-; 2-chlorolichexanthone (minor), 2,4-dichlorolichexanthone (major), 2,5-dichlorolichexanthone (major), 2,4,5-trichlorolichexanthone (major), with or without stictic acid (minor).

Pertusaria lordhowensis is characterised by the presence of chlorinated lichexanthones and asci with eight biseriate spores. The species is similar to the South American taxon, *Pertusaria paraguayensis* Müll. Arg. (Müller 1889) but differs in the hemispherical verrucae, very flattened in *Pertusaria paraguayensis*, and in chemistry; *Pertusaria paraguayensis* has 4,5-dichlorolichexanthone as a major compound in place of the 2-chlorolichexanthone present in *Pertusaria lordhowensis*. The new species is known only from the two specimens cited.

Also examined: Lord Howe Island: type locality, J.A. Elix 32873, June 1992 (ANUC).

***Pertusaria malabara* Archer & Elix, sp. nov.**

Thallus albido-olivaceus, subrimosus, superficies subtuberculata et hebetata, isidiis et sorediis destitutis, corticola; apothecia verruciformia, conspicua, numerosa, plano-hemisphaerica, basi constricta, thallo concoloria, 0.5–1 mm diam.; ostiola conspicua, flavida, translucida, concavescentia, 0.2–0.3 mm diam., in verruca 1–4na; sporae 2nae, ellipsoideae, laeves, 90–100 μm longae, 30–37 μm latae. Thallus 6-O-methylarthothelin et acida thiophanicum et sticticum continens.

Type: Lord Howe Island: Neds Beach Road at Malabar Hill Track, 31° 31' 16" S, 159° 03' 50" E, alt. 10 m, on crown of *Cryptocarya* in disturbed lowland forest, J.A. Elix 32875, 22 June 1992 (holo ANUC).

Thallus pale olive green, somewhat cracked, surface subtuberculate and dull, lacking isidia and soredia; corticolous; apothecia verruciform, conspicuous, numerous, flattened hemispherical, becoming constricted at the base, concolorous with the thallus, 0.5–1.0 mm diam.; ostioles conspicuous, pale yellow, translucent, becoming concave, 0.2–0.3 mm diam., 1–4 per verruca; spores 2 per ascus, ellipsoid, smooth, 90–100 μm long, 30–37 μm wide. Fig. 4.

Chemistry: K-, KC+ weak orange, C+ weak orange, Pd-; stictic acid (minor), constictic acid (trace), thiophanic acid (minor), arthothelin (trace), thiophanic acid (major), 6-O-methylarthothelin (major), 2,4-dichlorolichexanthone (trace) and 4,5-dichlorolichexanthone (trace).

Pertusaria malabara is characterised by the two-spored asci and the chemistry. It resembles the two-spored *Pertusaria saltuensis* Archer & Elix from Queensland (Archer & Elix 1992) but is distinguished from that species by the presence of 6-O-methylarthothelin as a major lichen compound and the translucent ostioles. The new species is known only from the type specimen.

The epithet '*malabara*' refers to Malabar Hill, the type locality.

***Pertusaria maritima* Archer & Elix, sp. nov.**

Thallus albo-flavidus vel griseo-flavidus, tenuis, nonnihil areolatus et rimosus, superficies laevis et hebetata, isidiis destitutis, sorediatis, corticola; soralia flava, dispersa, subimmersa, 0.2–0.5 mm dia.; apothecia non visa. Thallus acida thiophanicum et sticticum continens.

Type: Lord Howe Island: near junction of tracks to Mutton Bird Point and Intermediate Hill, 31° 32' 43" S, 159° 04' 48" E, alt. 60 m, on dead palm in dry lowland forest with basalt outcrops, J.A. Elix 32765, 21 June 1992 (holo ANUC).

Thallus pale yellowish grey to pale yellow, thin, somewhat areolate and cracked, surface smooth and dull; sorediate, lacking isidia; corticolous; soralia yellow, scattered, slightly immersed, 0.2–0.5 mm diam.; apothecia and spores not seen. Fig. 5.

Chemistry: K-, KC+ weak orange, C+ weak orange, Pd-; stictic acid (minor), thiophaninic acid (major), 2-chloro-6-O-methylnorlichexanthone (minor), 4-chloro-6-O-methylnorlichexanthone (trace).

Pertusaria maritima is characterised by the pale yellow to yellow thallus with scattered yellow soralia and in this respect it somewhat resembles the saxicolous *Pertusaria persulphurata* Müll. Arg. The slightly immersed soralia, the paler yellow thallus and the absence of lichexanthone distinguish the new species from *Pertusaria persulphurata* which lacks immersed soralia and contains lichexanthone. The new species also occurs in coastal New South Wales.

Also examined: New South Wales: North Coast: Hat Head National Park, c. 25 km ENE of Kempsey, 31° 04' S, 153° 03' E, alt. 100 m, on *Banksia*, Archer P 385, Sep 1992 (NSW); Myall Lakes National Park, Mungo Brush Camping area, near Bombah Broadwater, Myall River, on *Erythrina*, Archer P387, Sep 1992 (ANUC, NSW); Kattang Nature Reserve, Fishermans Bluff, 31° 39' E, 152° 51' E, alt. 80 m, on *Banksia*, Archer P607, Oct 1993 (NSW); S side of Queens Lake near Laurieton, 31° 38' S, 152° 45' E, alt. 2 m, on *Casuarina*, Archer P614, Oct 1993 (NSW); Crowdy Bay National Park, Indian Head, 31° 45' S, 152° 50' E, alt. 90 m, on dead *Banksia*, Archer P632, Oct 1993 (NSW).

***Pertusaria miniatescens* Archer & Elix, sp. nov.**

Thallus olivaceus, perrimosus, superficies laevis et nitida, isidiis destitutis, sorediata; saxicola; soralia conspicua, numerosa, thallo concoloria, subsphaerica, 0.5–2.0 mm diam.; apothecia non visa. Thallus acidum norsticticum continens.

Type: Lord Howe Island: Max Nicholls Track, 31° 31' 08" S, 159° 03' 03" E, alt. 50 m, on basalt rocks in dry lowland forest, J.A. Elix 32728, 20 June 1992 (holo ANUC).

Thallus olive green, conspicuously cracked, surface smooth and shiny, lacking isidia, sorediate; saxicolous; soralia conspicuous, numerous, concolorous with the thallus, subspherical, 0.5–2.0 mm diam.; apothecia and spores not seen. Fig. 6.

Chemistry: K+ red, KC-, C-, Pd+ yellow; norstictic acid.

Pertusaria miniatescens is characterised by the olive green sorediate thallus containing norstictic acid. The presence of norstictic acid distinguishes the taxon from other sorediate species of *Pertusaria* on Lord Howe Island. The new species is the sterile, sorediate analogue of the fertile, esorediate *Pertusaria patagonica* Müll. Arg. (J. Müller 1889: 144), described from Argentina, and the two species form a species pair, *sensu* Poelt (1970, 1972). The olive green thallus distinguishes the new taxon from the white, sorediate, sterile saxicolous taxa *Pertusaria excludens* Nyl. [with norstictic acid] and *Pertusaria teneriffensis* Vainio [with norstictic and picrolichenic acids]. The new species is known only from the two specimens cited.

The epithet '*miniatescens*' refers to the red colour produced with alkali, due to the presence of norstictic acid.

Also examined: Lord Howe Island: type locality, J.A. Elix 32733, June 1992 (ANUC).

***Pertusaria montpittensis* Archer**

(Archer in Elix et al. 1992: 65)

Type: Norfolk Island: Mt Pitt Reserve, Mt Bates summit trail, on *Elaeodendron*, in mixed subtropical rainforest, 29° 00' S, 167° 56' 30" E, alt. 300 m, J.A. Elix 18641, Dec 1984 (holo ANUC).

Thallus pale olive-green to pale yellow-grey, thin, continuous, surface smooth and shiny, copiously isidiate away from the margin; corticolous and saxicolous; isidia concolorous with the thallus, simple, branched or becoming coralloid, narrow at the base and swelling somewhat at the tip, 0.4–1.0 mm tall, 0.2–0.5 mm diam.; apothecia and spores not seen. Fig. 7.

Chemistry: K-, KC-, C-, Pd-; 4,5-dichlorolichexanthone, stictic and constictic acids and skyrin.

Pertusaria montpittensis is characterised by the isidiate thallus, the absence of verrucae and the chemistry. The holotype from Norfolk Island is corticolous but in Lord Howe Island it is both corticolous and saxicolous, occurring on basalt rocks. The species also occurs in eastern Queensland, Papua New Guinea and Tonga as the corticolous form.

Also examined: Lord Howe Island: track to Little Island, near Salmon Beach, 31° 33' 30" S, 159° 04' 30" E, alt. 5 m, in scrubby, partly disturbed lowland forest, Elix 32692, 32702, 32706, June 1992 (ANUC); along ridge to Malabar Hill, 31° 31' 16" S, 159° 03' 50" E, alt. 80 m, in dense shrubby vegetation, Elix 32902, 32920, 32987, June 1992 (ANUC); ibid. on buttress roots of *Ficus* in dense shrubby vegetation, Elix 32955, June 1992 (ANUC).

Papua New Guinea: West New Britain: Willaumez Peninsula 20 km NNE of Talasea, 5° 07' S, 150° 07' E, sea-level, on *Barringtonia*, Kolema 38, Dec 1984 (CBG 9311284).

Tonga: Eua: Ana Afu, alt. 350 m, on *Ngatata*, Child 1746, 1748, Jan 1971 (CHR 448487, 448483).

***Pertusaria persulphurata* Müll. Arg.**

(Müller 1891: 391)

Type: Queensland: Brisbane, F.M. Bailey s.n. (holo G).

Pertusaria sulphurata Müll. Arg. (Müller 1893: 125)

Type: Queensland: Brisbane, F.M. Bailey s.n., 1891 (holo G).

Thallus thick or thin, pale to bright yellow, areolate and cracked, surface smooth and dull, lacking isidia, with sparse to numerous scattered yellow soralia; apothecia absent.

Chemistry: K-, KC+ orange-red, C+ orange, Pd- or Pd+ weak yellow; thiophaninic and stictic acids with or without lichexanthone. The chemistry of *Pertusaria persulphurata* was reported in detail by Elix et al. (1978).

Pertusaria persulphurata is characterised by the yellow, sorediate thallus, lacking verrucae and spores. It is the sterile counterpart of *Pertusaria xanthoplaca* Müll. Arg. and somewhat resembles *Pertusaria maritima*. *Pertusaria persulphurata* occurs in eastern Australia as a common and conspicuous species on exposed rock, often found with the white, sorediate *Pertusaria subventosa* Malme. *Pertusaria persulphurata* also occurs in New Zealand (Archer & Elix 1993).

Also examined: Lord Howe Island: s. loc., J. Stovold, s.n., May 1924 (NSW); along ridge to Malabar Hill, 31° 31' 16" S, 159° 03' 50" E, alt. 80 m, on basalt rocks in dense shrubby vegetation, *Elix* 32965, June 1992 (ANUC).

***Pertusaria petrophyes* Knight**

(Knight 1882: 47).

Type: New South Wales: near Sydney, C. Knight s.n. (holo WELT, iso H-NYL 23608).

Pertusaria leucoxantha Müll. Arg. (Müller 1895: 637).

Type: Queensland: Thursday Island, C. Knight 280, 1887 (holo G).

Thallus pale fawn or pale dull yellowish green, thin to effuse, surface smooth and dull, lacking isidia and soredia; apothecia verruciform, sparse to numerous, sometimes confluent, flattened hemispherical or irregular in outline, 0.5–1.5 mm wide; ostioles black, 1–2 per verruca, sometimes raised; spores 8 per ascus, hyaline, irregularly uniseriate, ellipsoid, smooth, 60–85 µm long, 25–45 µm wide.

Chemistry: K-, KC+ weak orange, C+ weak orange, Pd-; thiophaninic and 2-O-methylperlatolic acids with traces of 2-chloro-6-O-methylnorlichexanthone.

Pertusaria petrophyes is characterised by the eight-spored asci and the presence of thiophaninic and 2-O-methylperlatolic acids. Although both *Pertusaria petrophyes* and *Pertusaria persulphurata* contain thiophaninic acid, the latter species is bright yellow when compared with the dull yellowish green thallus of *Pertusaria petrophyes*. *Pertusaria petrophyes* occurs in eastern New South Wales and Queensland and also on the North Island of New Zealand.

The reported type locality of *Pertusaria leucoxantha*, which is morphologically and chemically identical to *Pertusaria petrophyes*, is probably an error (Archer & Elix 1993) as no subsequent specimens of *Pertusaria petrophyes* have been collected north of latitude 26° S.

Also examined: Lord Howe Island: along ridge to Malabar Hill, 31° 31' 16" S, 159° 03' 50" E, alt. 80 m, on basalt rocks in dense shrubby vegetation, *Elix* 32966, 32972, 32983, June 1992 (ANUC).

***Pertusaria puffina* Archer & Elix, sp. nov.**

Thallus subflavidus, tenuis, rimosus, superficies laevis et nitida, isidiis destitutis, sorediatus, saxicola; soralia alba, numerosa, dispersa, disciformia, 0.4–0.8 mm diam.; apothecia non visa. Thallus 2,4-dichlorolichexanthone, 2,4,5-trichlorolichexanthone et acidum sticticum continens.

Type: Lord Howe Island: along track to Mutton Bird Point, 31° 32' 45" S, 159° 05' 00" E, alt. 60 m, on basalt rocks in dry lowland forest, J.A. *Elix* 32823, June 1992 (holo ANUC).

Thallus dull yellow, thin, cracked, surface smooth and shiny; saxicolous; lacking isidia, sorediate; soralia white, numerous, scattered, disciform, 0.4–0.8 mm diam.; apothecia and spores not seen. Fig. 7.

Chemistry: K-, KC-, C-, Pd-; stictic acid (major), constictic acid (minor), 2,5-dichlorolichexanthone (major), 2-chlorolichexanthone (minor), 2,4,5-trichlorolichexanthone (major), 2,4-dichlorolichexanthone (major).

Pertusaria puffina is characterised by the dull yellow thallus with scattered white soralia and the chemistry. The colour and chemistry distinguish the new species

from *Pertusaria persulphurata*. A similar, un-named soresdiate, corticolous species (with stictic acid replaced by 2-O-methylperlatolic acid) occurs on Norfolk Island (CBG 9201720).

The epithet '*puffina*' is derived from *Puffinus*, the genus to which the mutton birds belong, a reference to Mutton Bird Point, the type locality.

Also examined: Lord Howe Island: Max Nicholls Track, 31° 31' 08" S, 159° 03' 03" E, alt. 50 m, on basalt rocks in dry lowland forest, *Elix* 32723, June 1992 (ANUC); type locality, *Elix* 32828, June 1992 (ANUC).

***Pertusaria schizostomella* Müll. Arg.**

(Müller 1895: 637).

Type: New South Wales: s. loc., *C. Knight* 31, 1887 (holo G).

Thallus pale yellowish green to pale greyish green, slightly or coarsely areolate and cracked, surface smooth or very slightly rough, dull, lacking isidia and soredia, corticolous; apothecia verruciform, conspicuous, scattered or crowded and becoming confluent, concolorous with the thallus, slightly flattened hemispherical, not constricted at the base, 0.5–1 mm diam.; ostioles conspicuous, pale, translucent, dull yellow, usually one per verruca; spores 2 per ascus, ellipsoid, smooth, or very slightly rough, 80–125 µm long, 30–45 µm wide.

Chemistry: K-, KC+ orange, C+ orange, Pd-; thiophaninic acid (major), stictic acid (major) with constictic acid (minor-trace).

Pertusaria schizostomella is characterised by the yellowish thallus, the two-spored asci and the presence of thiophaninic and stictic acids. It is distinguished from the very similar *Pertusaria thiospoda* by the translucent ostioles and the usually slightly rough spore walls. The species is common in eastern coastal Australia and also occurs on Norfolk Island and the North Island of New Zealand.

Also examined: Lord Howe Island: track to Little Island, near Salmon Beach, 31° 33' 30" S, 159° 04' 30" E, alt. 5 m, on *Pandanus* in scrubby, partly disturbed lowland forest, *Elix* 32678, June 1992 (ANUC); near junction of tracks to Mutton Bird Point and Intermediate Hill, 31° 32' 43" S, 159° 04' 48" E, alt. 60 m, on dead palm in dry lowland forest with basalt outcrops, *Elix* 32767, June 1992 (ANUC); along track to Mutton Bird Point, 31° 32' 45" S, 159° 05' 00" E, alt. 60 m, on dead canopy branches in dry lowland forest with basalt outcrops, *Elix* 32788, June 1992 (ANUC); Valley of Shadows, 31° 31' 45" S, 159° 04' 45" E, alt. 40 m, on fallen canopy branches of *Cryptocarya* in dry lowland forest on gentle slope, *Elix* 32840, 32841, June 1992 (ANUC); NNW of Middle Beach, 31° 31' 33" S, 159° 04' 22" E, alt. 25 m, on old fence posts in exposed, grazed grassland, *Elix* 32853, June 1992 (ANUC); Middle Beach, 31° 31' 42" S, 159° 04' 30" E, alt. 3 m, on shrubs along cliff face behind beach, *Elix* 32756b, June 1992 (ANUC).

***Pertusaria sublacerans* Archer**

(Archer 1991: 242).

Type: Lord Howe Island: top of Intermediate Hill, 31° 33' S, 159° 06' E, on old banyan tree, *W.W. Watts s.n.*, July 1911 (holo NSW L5219).

Thallus dull olive green, thin, somewhat areolate and cracked, surface smooth and shiny, isidia and soredia absent, becoming pustulate, the pustules conspicuous, numerous, at first subsidoid, becoming hemispherical to subspherical, 0.5–1.5 mm diam., the upper part opening to reveal the white medulla; corticolous; apothecia

disciform, somewhat sunken, the disc white pruinose 0.5–1 mm diam.; asci elongate-clavate, *ca.* 50 x 200 µm, spores rare, one per ascus, ellipsoid, smooth 150–175 µm long, 60–70 µm wide, spore wall c. 1 µm thick.

Chemistry: K+ red, KC-, C-, Pd+ yellow; norstictic acid.

Pertusaria sublacerans is characterised by the pustulate, dull olive green thallus and the presence of norstictic acid. It is distinguished from *Pertusaria miniatescens* by the esorediate thallus and the occasional disciform apothecia. The species also occurs on Norfolk Island.

Also examined: Lord Howe Island: Intermediate Hill, *Watts s.n.*, July 1911 (NSW L4557); Erskine Valley, *Watts s.n.*, Aug 1911 (NSW L4556).

Norfolk Island: Mt. Pitt, Mt. Pitt Reserve, 29° 01' S, 167° 56' E, alt. 300 m, on treelet stem, *Streimann 34841 p.p.*, Dec 1984 (CBG9201721)

***Pertusaria subrigida* Müll. Arg.**

(Müller 1895: 636).

Type: Queensland: Brisbane, *F.M. Bailey 1570*, 1891(holo G).

Pertusaria depressa (Fée) Mont. & v.d. Bosch var. *octomera* Müll. Arg. (Müller 1884: 289)

Type: Brazil, *Apiahy, Puiggiari 1470*, 1882 (holo G).

Thallus pale olive green to pale greyish green, areolate and cracked, surface smooth to subtuberculate, dull, lacking isidia and soredia; corticolous; apothecia verruciform, conspicuous, scattered, flattened hemispherical, becoming constricted at the base, concolorous with the thallus, 1–2 mm diam.; ostioles inconspicuous, black, often sunken, 1–3 per verruca; spores 5–8 per ascus, irregularly uniseriate or biseriate, ellipsoid to fusiform, smooth, 70–110 µm long, 30–37 µm wide.

Chemistry: K-, KC-, C-, Pd-; no lichen compounds detected by thin-layer chromatography.

Pertusaria subrigida is characterised by the eight spored asci and the absence of lichen compounds. It occurs in eastern Queensland and New South Wales (Archer 1991a) and also Brazil. *Pertusaria depressa* var. *octomera* was reported from 'Main Range, Toowoomba' by Shirley (1893).

The species is uncommon in Australia and is known from only one specimen on Lord Howe Island.

Also examined: Lord Howe Island: along ridge to Malabar Hill, 31° 31' 16" S, 159° 03' 50" E, alt. 80 m, on shrub in dense shrubby vegetation with basalt outcrops, *Elix 32944*, June 1992 (ANUC).

Pertusaria subventosa* Malme var. *subventosa

(Malme 1936: 7).

Type: Brazil: Matto Grosso: Serra da Chapada, Buriti, *G. Malme 3936*, 24 June 1894 (holo S).

Pertusaria paeminosa Archer (Archer 1990: 395).

Type: New South Wales: Bairne track, c. 30 km N of Sydney, on exposed sandstone, *A.Archer P 38*, 14.i.1989 (holo NSW, iso CBG).

Pertusaria soorediata Knight in Shirley [nom. illeg. non *Pertusaria soorediata* (Fr.) Fr. 1846] (Knight in Shirley 1889: 141).

Type: Queensland: Moreton Bay, *J. Shirley* 67 (holo WELT).

Thallus off-white to greyish white, thick, areolate and cracked, surface smooth, lacking isidia, sorediate, saxicolous; soralia white, conspicuous, becoming numerous and often confluent away from the margin, subspherical, sometimes slightly stipitate, 0.5–1.5 mm wide; apothecia very rare, disciform, discs dark brown, white pruinose, 0.2–0.5 mm diam., becoming exposed in stipitate soralia in groups of 1–3; spores solitary, elongate ellipsoid, rarely lachrymoid, sometimes slightly curved, 120–160 µm long, 35–50 µm wide, spore wall 1 µm thick.

Chemistry: K+ yellow, KC+ violet, C-, Pd+ yellow; lichexanthone and picrolichenic and thamnolic acids.

Pertusaria subventosa is a common, conspicuous saxicolous species in eastern Australia, often found with *Pertusaria persulphurata* Müll. Arg., from sea-level to c. 1000 m; it also occurs in Brazil and New Zealand. It resembles the northern hemisphere *Pertusaria amara* (Ach.) Nyl. but this species is predominantly corticolous and lacks lichexanthone and β-orcinol depsides such as thamnolic or hypothamnolic acids.

Also examined: Lord Howe Island: along ridge to Malabar Hill, 31° 31' 16" S, 159° 03' 50" E, alt. 80 m, on basalt rocks in dense shrubby vegetation, *Elix* 32952, June 1992 (ANUC).

New Zealand: North Island: Three Kings Islands, Great Island, Bald Hill, *Galloway s.n.*, Nov 1970 (CHR 451398).

Pertusaria subventosa Malme var. *deficiens* Archer & Elix

(Archer & Elix 1993a: 146).

Type: Queensland: Great Dividing Range, Hughenden–Townsville Highway, 28 km SW of Pentland, 20° 43' S, 145° 14' E, alt. 460 m, on sandstone, *J.A. Elix* 20753, June 1986 (holo ANUC).

Pertusaria subventosa var. *deficiens* is morphologically identical to var. *subventosa* but lacks thamnolic acid.

Chemistry: K-, KC+ violet. C-, Pd-; lichexanthone and picrolichenic acid.

Pertusaria subventosa var. *deficiens* is less common than var. *subventosa* and occurs predominantly in Queensland (Archer & Elix 1993a).

Also examined: Lord Howe Island: along ridge to Malabar Hill, 31° 31' 16" S, 159° 03' 50" E, alt. 80 m, on basalt rocks in dense shrubby vegetation, *Elix* 32993, June 1992 (ANUC).

Pertusaria thiospoda Knight

(Knight 1882:47).

Type: New South Wales: near Sydney, *Knight* 20 (holo WELT).

Thallus pale yellowish white to pale yellow, thin, slightly cracked, surface smooth and dull, isidia and soredia absent; corticolous; apothecia verruciform, inconspicuous, scattered, sometimes confluent, flattened hemispherical, not constricted at the base, 0.5–1 mm diam.; ostioles pale brown to black, one per verruca; spores 2 per ascus, ellipsoid, smooth, 80–110(–120) µm long, 30–40 µm wide.

Chemistry: K-, KC+ yellow orange, C+ yellow orange, Pd-; thiophaninic acid (major), stictic acid (major) and constictic acid (minor).

Pertusaria thiospoda is characterised by the two-spored asci and the presence of thiophaninic and stictic acids. It is distinguished from the similar *Pertusaria schizostomella* Müll. Arg. by the dark ostioles and spores with smooth walls. The species is common in eastern coastal New South Wales and also occurs on Norfolk Island (Elix et al. 1992).

Also examined: Lord Howe Island: track to Little Island, near Salmon Beach, 31° 33' 30" E, 159° 04' 30" E, alt. 5 m, on dead tree in scrubby, partly disturbed lowland forest, *Elix* 32666, June 1992 (ANUC); end of Anderson Road, 31° 31' 46" S, 159° 04' 20" E, alt. 25 m, on fallen canopy branches of *Cryptocarya* in disturbed lowland forest, *Elix* 32835, June 1992 (ANUC).

Summary

The lichen flora of Lord Howe Island contains 20 species in the genus *Pertusaria*; five of these appear to be endemic and 14 species also occur in Australia. Six of these also occur in New Zealand (Table 1).

Table 1. Distribution of Lord Howe Island *Pertusaria*

Species	Distribution			
	Lord Howe Island	Australia	Norfolk Island	New Zealand
<i>P. asperata</i>	+	+		
<i>P. dehiscens</i>	+	+	+	
<i>P. elliptica</i>	+	+		+
<i>P. howeana</i>	+			
<i>P. lavata</i>	+	+		+
<i>P. leioplacella</i>	+	+		
<i>P. limbata</i>	+	+		
<i>P. lordhowensis</i>	+			
<i>P. malabara</i>	+			
<i>P. maritima</i>	+	+		
<i>P. miniatescens</i>	+			
<i>P. montpittensis</i>	+	+	+	
<i>P. persulphurata</i>	+	+	+	+
<i>P. petrophyes</i>	+	+		+
<i>P. puffina</i>	+			
<i>P. schizostomella</i>	+	+		+
<i>P. sublacerans</i>	+		+	
<i>P. subrigida</i>	+	+		
<i>P. subventosa</i>	+	+		+
<i>P. thiospoda</i>	+	+	+	

Some recent studies have reported the lichen flora of a number of islands in the same region as Lord Howe Island (Galloway & Hayward 1987; Hayward et al. 1991; Elix et al. 1992; Hayward & Lumbsch 1992) and these findings, for the genus *Pertusaria*, are summarised in Table 2. Lord Howe Island has a relatively large number of *Pertusaria* species when compared with other islands in the same region; the number of endemic taxa is also noteworthy (Table 2).

Table 2. Number of *Pertusaria* species on islands in the same region as Lord Howe Island

Locality	Lat. Long.	Number of <i>Pertusaria</i> species	
		Total	Endemic
Lord Howe Island	31° 32' S 159° 05' E	20	5
Norfolk Island	29° 04' S 167° 55' E	10#	3
Three Kings Islands	34° 06' S 172° 20' E	6*	0
Little Barrier Island	36° 12' S 175° 07' E	5	0
Stewart Island	47° 10' S 167° 40' E	6	0

Seven species were originally reported (Elix et al. 1992) and *Pertusaria sublacerans* Archer, *Pertusaria globospora* Archer and *Pertusaria velata* (Turn.) Nyl. have been identified in more recent collections from Norfolk Island.

* Five species were originally reported (Galloway & Hayward 1987) and *Pertusaria subventosa* Malmé has been identified in earlier collections from Three Kings Islands.

Artificial key to *Pertusaria* in Lord Howe Island

- 1 Thallus saxicolous 2
- 1* Thallus corticolous 9
- 2 Thallus sterile, isidiate or sorediate 3
- 2* Thallus fertile, spores 8 per ascus, lacking isidia and soredia 7
- 3 Thallus isidiate; 4,5-dichlorolichexanthone and stictic acid
..... **P. montpittensis**
- 3* Thallus sorediate 4
- 4 Thallus white, UV bright yellow, KC+ violet, **P. subventosa**
- 4* Thallus yellow, dull yellow or olive green, UV bright or dull orange, KC+ orange
or -ve 5
- 5 Thallus olive green, soredia K+ red, Pd+ yellow **P. miniatescens**
- 5* Thallus yellow or dull yellow, soredia K-ve 6
- 6 Thallus yellow, KC+ orange **P. persulphurata**

- 6* Thallus dull yellow, KC-ve **P. puffina**
- 7 Thallus off-white, UV bright yellow, spores 100–125 μm long **P. asperata**
- 7* Thallus greyish-white or dull yellow green, UV dull orange 8
- 8 Verrucae KC+ orange, spores 60–85 μm long, thiophaninic acid **P. petrophyes**
- 8* Verrucae KC-, spores 85–105 μm long, 4,5-dichlororlichexanthone
..... **P. lavata**
- 9 Thallus sorediate, yellow, sterile, KC+ orange **P. maritima**
- 9* Thallus esorediate, fertile, apothecia disciform or verruciform 10
- 10 Apothecia disciform, K+ red, Pd+ yellow, spores uncommon, 1 per ascus, 150–
175 μm long **P. sublacerans**
- 10* Apothecia verruciform 11
- 11 Spores 2 per ascus, ca. 100 μm long, stictic acid 12
- 11* Spores 4 or 8 per ascus 14
- 12 Spore wall rough, ostioles usually translucent **P. schizostomella**
- 12* Spore wall smooth, ostioles black or translucent yellow 13
- 13 Ostioles black, thiophaninic acid **P. thiospoda**
- 13* Ostioles translucent yellow, thiophanic acid and 6-O-methylarthothelin
..... **P. malabara**
- 14 Spores 4 per ascus, spore wall rough, spores 95–110 μm long **P. elliptica**
- 14* Spores 8 per ascus, predominantly biserial 15
- 15 Spores 100–140 μm long, lichexanthone present **P. dehiscens**
- 15* Spores <100 μm long, lichexanthone absent 16
- 16 Verrucae KC+ orange 17
- 16* Verrucae KC- 18
- 17 Spores 75–85 μm long, arthothelin and 6-O-methylarthothelin **P. howeana**
- 17* Spores 52–72 μm long, thiophaninic acid **P. leioplacella**
- 18 Lichen compounds absent, spores 80–95 μm long **P. subrigida**
- 18* Lichen compounds present, spores <80 μm long 19

- 19 Spores 65–75 µm long, 2-chlorolichexanthone and stictic acid ***P. limbata***
 19* Spores 60–75 µm long, 2,4,5-trichlorolichexanthone ***P. lordhowensis***

Acknowledgements

The authors are grateful to the Herbaria referred to above for the loan of specimens, to Mr D. Verdon for checking the Latin descriptions and to Mrs C. Barclay (nee Crook) for technical assistance with liquid chromatography; one of us (AWA) is grateful to the National Herbarium of New South Wales for arranging the loan of type and other specimens and for permission to use the facilities of the Herbarium; the other (JAE) gratefully acknowledges the Australian Research Council for generous financial support. We also wish to thank Mr Ian Hutton and the Australian Council of National Trusts for permitting us to use the map of Lord Howe Island (Figure 1) which appeared in Hutton (1985).

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Manuscript received 12 January 1994

Manuscript accepted 20 June 1994