

Seven new species of Australian *Pertusaria* (Pertusariales, lichenised Ascomycota) from New South Wales

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Abstract

Seven new species, *Pertusaria albula*, *P. dharugensis*, *P. ochrodigitula*, *P. pinnaculata*, *P. placocarpa*, *P. puttyensis* and *P. scabrida* from New South Wales are reported as new to science.

Introduction

This paper reports a continuation of our investigation of the lichen genus *Pertusaria* in Australia. We recently summarized our publications (Archer and Elix 2017) and reported an additional seven new species, bringing the total number of species reported for Australia to 177. Since then a number of these species have been transferred from *Pertusaria* subgenus *Monomurata* A.W. Archer (Archer 1993) to the genus *Lepra* (Hafellner and Türk 2016). The seven new species described in this paper belong to *Pertusaria sens. str.* Methods are as described in the previous paper cited above.

New species

1. *Pertusaria albula* A.W.Archer & Elix, *sp. nov.*

Mycobank no. 821241

Diagnosis: Similar to *Pertusaria valdiviana* Messuti & A.W.Archer but differs in having pale, inconspicuous ostioles and uniseriate ascospores.

Type: New South Wales, Macquarie Pass National Park, 7 km NE of Robertson, 34°33'26"S, 150°39'02"E, alt. 525 m, on base of *Acacia* in mixed *Eucalyptus* and rainforest, J.A. Elix 45027, 15 Sep 2008; holotype: CANB.

Thallus corticolous, greyish white, fluorescing bright yellow under long wave-length ultraviolet light, surface smooth and shiny, slightly cracked, lacking soredia and isidia. *Apothecia* verruciform, conspicuous, scattered, rarely confluent, flattened hemispherical, not constricted at the base, concolorous with the thallus, 1–1.5 mm diam. Ostioles inconspicuous, pale brown, translucent, 1–2 per verruca, 0.1–0.15 mm diam. Ascospores 8 per ascus, colourless, ellipsoid, with smooth inner walls, uniseriate, 84–100 μm long and 40–48 μm wide. **Fig. 1.**



Fig.1 *Pertusaria albula*; holotype; bar = 1 mm

Chemistry: lichexanthone.

Etymology: the epithet *albula* is from the Latin *albus*, whitish, a reference to the colour of the thallus.

Substrate and ecology: the specimen grew on the base of *Acacia* in mixed *Eucalyptus* and rainforest.

Discussion: *Pertusaria albula* is characterised by the conspicuous verruciform apothecia, asci with eight, uniseriate ascospores and the presence of lichexanthone as the sole lichen substance present. It resembles the South American species, *P. valdiviana* (Messuti and Archer 1998) as both species have eight-spored asci and contain only lichexanthone. However, the ascospores in *P. valdiviana* are 2-seriate, 96–140 μm long and the 1–5(–7) ostioles per verruca, are black, conspicuous, to 0.3 mm diam. with an irregular but prominent margin (Messuti and Archer, *loc. cit.* Figure 2, page 459). *Pertusaria albula* is also chemically identical to *P. phaeostoma* Müll.Arg. (Müller 1884a), but the ascospores in that species are 2-seriate and 120–135 μm long and the ostioles are conspicuous, black, 1 per verruca and are somewhat sunken and disc-like. Two other species also contain lichexanthone as the sole lichen compound, *P. subcerussata* A.W. Archer from Australia (Archer 1992) and *P. valliculata* Dibben from North America (Dibben 1980), but both differ in having four, rough-walled ascospores per ascus. At present this new species is known only from the type specimen.

2. *Pertusaria dharugensis* A.W.Archer & Elix, *sp. nov.*

Mycobank no. 821242

Diagnosis: Similar to *Pertusaria alboaspera* A.W.Archer & Elix but differs in containing thiophanic acid rather than lichexanthone and in possessing uniseriate ascospores.

Type: New South Wales, Dharug National Park, track by side of Mill Creek, 33°23'S, 151°02'E, alt. c. 100 m, ca. 55 km NW of Sydney, on dead tree, A. W. Archer P 216, 16 Nov 1991; holotype: NSW.

Thallus corticolous, pale fawn, surface smooth and subnitid, lacking soredia and isidia. Apothecia verruciform, conspicuous, scattered, rarely confluent, hemispherical or flattened hemispherical, often constricted at the base, concolourous with the thallus, 1–1.5 mm diam. Ostioles inconspicuous, pale brown, translucent, 1 per verruca, 0.2–0.4 mm diam. Ascospores hyaline, ellipsoid, 8 per ascus, imbricate uniseriate, with smooth inner walls, 80–105 µm long and 32–37 µm wide. **Fig. 2.**



Fig. 2 *Pertusaria dharugensis*; holotype; bar = 1 mm

Chemistry: thiophanic acid (minor), 2,2'-di-*O*-methylstenosporic acid (major), 2-*O*-methylperlatolic acid (minor), stictic acid (minor), 2-chloro-6-*O*-methylnorlichexanthon (trace).

Etymology: The epithet is derived from *Dharug* National Park and *ensis*, Latin, place of origin.

Substrate and ecology: the specimen grew on a dead tree by the side of a creek,

Discussion: *Pertusaria dharugensis* is characterised by the large verruciform apothecia, asci with eight smooth-walled ascospores and the, so far, unique chemistry. A similar combination of xanthon, depside and depsidone viz: lichexanthon, 2,2'-di-*O*-methylstenosporic acid and stictic acid, is present in *P. alboaspera* A.W.Archer & Elix but in *P. dharugensis* the lichexanthon is replaced by thiophanic acid. *Pertusaria alboaspera* also differs in having biseriata ascospores. At present this new species is known only from the type specimen.

3. *Pertusaria ochrodigitula* A.W.Archer & Elix, *sp. nov.*

MycoBank no. 821243

Diagnosis: Similar to *Pertusaria georgeana* A.W. Archer & Elix but differs in containing atranorin rather than 4,5-dichlorolichexanthon and 2-*O*-methylperlatolic acid.

Type: New South Wales: Crosslands, east bank of Berowra Creek, on *Casuarina*, 33°38'S, 151°06'E, alt. ca. 3m, ca. 28 km NNW of Sydney, A. W. Archer P 839, 1 Aug 1996; holotype: NSW; isotype: CANB.

Thallus corticolous, pale fawn, minutely subtuberculate, copiously isidiate, soredia absent; isidia numerous, crowded, simple, 0.1 mm diam. 0.3–0.5 mm tall, concolourous with the thallus. Apothecia and ascospores not seen. **Fig. 3.**



Fig. 3 *Pertusaria ochrodigitula*; holotype; bar = 1 mm

Chemistry: atranorin (major), bourgeanic acid (major).

Etymology: from the Latin *ochro*, pale yellow, and *digitula*, diminutive of *digitus*, finger a reference to the isidia present in this species.

Substrate and ecology: the specimen grew on *Casuarina*.

Discussion: Atranorin is a β -orcinol *p*-depside related to barbatic and squamatic acids, and occurs in many lichen genera. The compound is uncommon in *Pertusaria* but is found, as the sole lichen compound, in the fertile species *P. melaleuca* var. *octospora* Müll.Arg., from Brazil (Müller 1884), and in the sterile, sorediate species *P. selligii* H.Magn., from Hawaii (Magnusson and Zahlbruckner 1944). Bourgeanic acid is known from many other lichen genera including *Buellia*, *Cladonia*, *Ramalina* and *Rhizocarpon* but this is the first report of this compound in *Pertusaria*.

At present this new species is known only from the type specimen.

4. *Pertusaria pinnaculata* A.W.Archer & Elix, *sp. nov.*

Mycobank no. 821244

Diagnosis: Similar to *Pertusaria subareolata* Müll. Arg. but with larger ascospores.

Type: Australia, New South Wales, Border Ranges National Park, Pinnacle Track, 28°24'30"S, 153°08'E, alt. 1050 m, on fallen branch, A. W. Archer P460, 4 Sep 1992; holotype: NSW; isotype: CANB.

Thallus pale fawn, areolate and cracked, surface nitid, corticolous. Apothecia concolourous with the thallus, numerous, scattered, sometimes confluent, flattened hemispherical, constricted at the base, 0.75–1.0 mm diam. Ostioles inconspicuous, visible as a depression on the verruca. Ascospores 8 per ascus, 2-seriate, hyaline, elongate ellipsoid, with smooth inner walls, 100–125 μ m long and 40–45 μ m wide. **Fig. 4.**



Fig.4 *Pertusaria pinnaculata*; holotype; bar = 1 mm

Chemistry: lichexanthone (major) and 2,2'-di-*O*-methylstenosporic acid (major).

Etymology: from the Latin *pinnaculum*, top, pinnacle, a reference to the type locality, the Pinnacle Track.

Substrate and ecology: the specimen grew on a fallen branch.

Discussion: *Pertusaria pinnaculata* is characterised by apothecia with inconspicuous ostioles, eight biseriolate ascospores per ascus and the presence of lichexanthone and 2,2'-di-*O*-methylstenosporic acid. The chemically identical species, *P. subareolata* Müll. Arg., described from eastern Africa, has smaller ascospores, ca. 52 µm long and 27 µm wide (Müller 1890). In contrast, the ascospores of *P. pinnaculata* are 100–125 µm long. The holotype of the chemically similar *P. alboaspera* A.W. Archer & Elix was collected in the same area but at a lower altitude (Archer and Elix 1993). *Pertusaria alboaspera* differs in containing additional stictic acid and in having somewhat smaller ascospores, 90–100 µm long and 30–37 µm wide. *Pertusaria pinnaculata* can be distinguished from the chemically similar *P. alboaspera* var. *deficiens* Jariangprasert & A.W. Archer by the larger ascospores (100–125 µm long compared to (48-)64–78(-92) µm long) (Jariangprasert et al. 2003). At present the new species is known only from the type specimen.

5. *Pertusaria placocarpa* A.W.Archer & Elix, *sp. nov.*

Mycobank no. 821245

Diagnosis: Superficially similar to *Pertusaria hartmanii* Müll.Arg. but differs in having very flattened, multi-ostiolate apothecia with 8 ascospores per ascus and in containing 4,5-dichlorolichexanthone, planaic acid and 2-*O*-methylperlatolic acid

Type: Australia: New South Wales, Toonumbar State Forest, Murray Scrub Look-out, 28°30'S, 152°45'E, alt. 500 m, ca. 28 km WNW of Kyogle; on fallen tree, A. W. Archer P490, 2 Sep 1992; holotype: NSW.

Thallus corticolous, pale fawn, surface smooth, shiny and somewhat rimose, lacking soredia and isidia. Apothecia inconspicuous, concolourous with the thallus, scattered, rarely confluent, very flattened hemispherical, almost discoid, 1–2 mm diam. Ostioles inconspicuous, pale brown, becoming translucent, ca. 0.1 mm diam., 3–5 per verruca. Ascospores 8 per ascus, elongate-ellipsoid, colourless with smooth inner walls, uniseriate, 45–55 µm long and 22–25 µm wide. **Fig. 5.**



Fig.5 *Pertusaria placocarpa*; holotype; bar = 1 mm

Chemistry: 4,5-dichlorolichexanthone (major-minor), planaic acid (major), 2-*O*-methylperlatolic acid (major to minor) and \pm 2'-*O*-methylperlatolic acid (trace).

Etymology: from the Greek *placo*, flat, and *carpos*, fruit, a reference to the flattened apothecia.

Substrate and ecology: the specimen grew on a fallen branch.

Discussion: *Pertusaria placocarpa* is characterised by the inconspicuous, flattened apothecia, eight small, uniseriate ascospores and the presence of 4,5-dichlorolichexanthone, planaic acid and 2-*O*-methylperlatolic acid. The species is distinguished from the chemically identical species, *P. doradorensis* Elix & A.W. Archer also from New South Wales (Elix et al. 1997), by the size and number of ascospores per ascus. *P. doradorensis* has 4-spored asci and ascospores, 95–125 μm long. Planaic acid is an uncommon depside in *Pertusaria* but is found in four Australian species: *P. leucothelia* Müll.Arg., *P. planaica* A.W.Archer & Elix, *P. subarida* A.W.Archer & Elix, and *P. georgeana* var. *victoriana* A.W.Archer & Elix. These species are distinguished from *P. placocarpa* by the absence of 2-*O*-methylperlatolic acid. In addition, *P. leucothelia* has 4-spored asci, *P. planaica* has larger ascospores (80–100 μm long), *P. subarida* occurs only in Western Australia, and *P. georgeana* var. *victoriana* is a sterile, isidiate species. *Pertusaria siamensis* Jariangprasert, from Thailand (Jariangprasert and Anusarnsunthorn 2005) also contains planaic acid but the species has 2-3 spored asci and the ascospores are 90–174 μm long. The new species is known from two specimens from northern New South Wales.

Additional specimen examined: NEW SOUTH WALES: Border Ranges National Park, Pinnacle Track, 28°34'30"S, 153°08'E, alt. 1050 m, on fallen branch; A.W. Archer P461, 4 Apr 1992 (NSW).

6. *Pertusaria puttyensis* A.W.Archer & Elix, *sp. nov.*

Mycobank no. 821246

Diagnosis: Similar to *Pertusaria scaberula* A.W. Archer but differs in containing 4,5-dichlorolichexanthone and planaic acid.

Type: Australia, New South Wales, Putty Road, 64 km N of Windsor, 33°11'19"S, 150°41'28"S, alt. 340 m, on old wood in open *Eucalyptus* woodland, J.A. Elix 45014, 12 Aug. 2008; holotype: CANB.

Thallus corticolous, pale olive-green, thin, surface smooth, sorediate, lacking isidia. Soredia occurring in well-defined soralia, the soralia inconspicuous, scattered, circular, oval or irregular in outline, 0.2–0.5 mm wide; apothecia and ascospores not seen. **Fig. 6.**



Fig. 6 *Pertusaria puttyensis*; holotype; bar = 1 mm

Chemistry: 4,5-dichlorolichexanthone (major) and planaic acid (minor).

Etymology: from the Latin *ensis*, place of origin and the type location, *Putty Road*.

Substrate and ecology: it grows on *Eucalyptus* in open *Eucalyptus* woodland.

Discussion: *Pertusaria puttyensis* is characterised by the sorediate thallus, the absence of apothecia and the presence of 4,5-dichlorolichexanthone and planaic acid. Planaic acid is an uncommon depside in *Pertusaria* [see discussion above under *P. placocarpa*] and *P. puttyensis* is the first sterile, sorediate species found to contain planaic acid in the genus.

Additional specimen examined: NEW SOUTH WALES: type locality, on base of *Eucalyptus* in open *Eucalyptus* woodland, *J.A. Elix 45018*, 12 Aug 2008 (CANB).

7. *Pertusaria scabrida* A.W.Archer & Elix, *sp. nov.*

Mycobank no. 821247

Diagnosis: similar to *Pertusaria erythrella* Müll. Arg. but with soredia covering the complete thallus surface.

Type: Australia, New South Wales, Macquarie Pass National Park, 7 km NE of Robertson, 34°33'26"S, 150°39'02"E, alt. 525 m, on base of *Acacia* in mixed *Eucalyptus* and rainforest, *J.A. Elix 45029*, 15 Sep 2008; holotype: CANB.

Thallus pale olive green, completely covered with soredia, concolourous with the thallus; soralia, isidia, apothecia and ascospores not seen. **Fig. 7.**



Fig. 7 *Pertusaria scabrida*; holotype; bar = 1 mm

Chemistry: norstictic acid (major), connorstictic acid (minor-trace) \pm sekikaic acid (major).

Etymology: from the Latin *scabridus*, rough, a reference to the sorediate surface of the thallus.

Substrate and ecology: it grows on *Acacia*, vines and dead wood in *Eucalyptus* woodland and warm temperate rainforest.

Discussion: *Pertusaria scabrida* is characterised by a continuous sorediate covering of the thallus surface but the absence of well-defined soralia. In addition, isidia, apothecia and ascospores were not seen. A number of sterile, sorediate species containing norstictic acid as the sole major lichen acid are known but all have well-defined soralia. The saxicolous *P. excludens* Nyl. has soralia 0.6–1.2 mm diam. (Nylander 1885) and *P. miniatescens* A.W. Archer & Elix has soralia 0.5–2.0 mm diam. (Archer and Elix 1994). The corticolous *P. erythrella* Müll.Arg. (Müller 1893), *P. torulosa* Vain. (Wainio [sic] 1915) and *P. colorata* Awasthi & Srivastava (Awasthi and Srivastava 1993) also have well-defined soralia with diameters 0.5–1 mm, 0.4–2 mm and 0.5–1(-2) mm respectively. One specimen (*Elix* 45036) contained additional sekikaic acid.

Additional specimens examined: NEW SOUTH WALES: Saltwater, E of Taree, 30°00'S, 152°34'E, alt. 0 m, in coastal forest, J.A. *Elix* 4011, 7 Oct 1977 (CAMB); Bulee Gap, 8 km NE of Nerriga, just S of Morton National park, 35°05'18"S, 150°08'22"E, alt. 690 m, on dead shrub in open *Eucalyptus* woodland, with *Acacia* and *Kunzea* understory, J.A. *Elix* 39717, 31 Oct 2007 (CANB); Cooperook State Forest, Bangalow Road, ca 30 km N of Taree, 31°47'54"S, 152°37'27"E, alt. 20 m, on tree trunk in regrowth *Eucalyptus* forest with numerous vines, J.A. *Elix* 44983, 11 Aug 2008 (CANB); *ibid.* J.A. *Elix* 44987 (CANB); Macquarie Pass National Park, 7 km NE of Robertson, 34°33'26"S, 150°39'02"E, alt. 525 m, on vine in mixed *Eucalyptus* and rainforest, J.A. *Elix* 45024, 15 Sep 2008 (CANB); *ibid.*, on old wood, J.A. *Elix* 45034, 15 Sep 2008 (CANB); *ibid.*, on old wood, J.A. *Elix* 45036, 15 Sep 2008 (CANB, NSW); Minamurra Falls, Budderoo National Park, 5 km W of Jamberoo, 34°38'03"S, 150°43'46"E, alt. 210 m, on fallen branch in warm temperate rainforest, J.A. *Elix* 45051, 15 Sep 2008 (CANB); Jamberoo Mountain, 17 km E of Robertson, 34°40'06"S, 150°42'43"E, alt. 550 m, on dead *Acacia* in remnant warm temperate rain forest, J.A. *Elix* 45059, 15 Sep 2008 (CANB).

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