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Additional taxa and new reports in the genus *Pertusaria* (Pertusariales, lichenised Ascomycota) from Queensland and Norfolk Island (Australia)

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Abstract

Five new species, *Pertusaria dayi*, *P. glabra*, *P. heinarii*, *P. montoensis*, *P. stenospora* and a new combination, *Pertusaria aphelospora*, are reported from Australia. In addition, *Pertusaria phulhuangensis* described from Thailand, *P. karkarensis*, described from Papua New Guinea, and *P. virensica,* described from Florida, are reported from Australia for the first time.

Introduction

The lichen genus *Pertusaria* in Australia has been studied for over 150 years, since G.W. Körber, Professor of Botany, Breslau [now Wrocław, Poland] described *Pertusaria lophocarpa* from Victoria (Körber 1862). From that time additional species have been reported from Australia by, for example, Stirton (1876), Müller (1882), Knight (1882), Kantvilas (1990) and Archer (1991). A recent account of the genus in Australia (Archer & Elix 2016) listed 170 taxa, including 12 varieties. Worldwide the number of taxa in the genus is not known with any certainty but an estimate of 1,550 has been suggested (Messuti & Archer 2009) based on various combinations of the characters used for the systematic separation of the taxa, such as chemistry, morphology and ascospore number and structure. The lichen compounds, such as xanthones, depsides and depsidones that may be present in a specimen, are important characteristics for identification. Accounts of the genus in Japan (Oshio 1968) and North America (Dibben 1980) used chemistry extensively for identification.

The genus has been divided into 3 subgenera; *Monomurata*, *Pionospora* and *Pertusaria* (Archer 1997) but recent molecular work on the phylogeny of *Pertusaria* and allied taxa indicate that *Pertusaria* is polyphyletic, comprising three well-supported clades viz: (1) *Pertusaria* sens. str. group (including the subgenera *Pertusaria* and *Pionospora*); (2) *Monomurata* group; and (3) *Varicellaria* group (Schmitt 2002; Schmitt & Lumbsch 2004). The two subgenera, *Pertusaria* and *Monomurata*, are distinguished by the morphology of the apothecia (verruciform in *Pertusaria* and disciform in *Monomurata*) and chemistry (chloroxanthones sometimes present in *Pertusaria* and absent in *Monomurata* and β-orcinol depsides absent from *Pertusaria* and present in *Monomurata*). The morphology and chemistry [except *P. heinarii*] of the new species indicate that they belong in subgenus *Pertusaria* sens. str.

Materials and Methods

The specimens studied were collected in northern Queensland by J.A. Elix, H. Streimann and H.T. Lumbsch in the 1990's and on Norfolk Island by H. Streimann in 1984. The specimens are held in CANB. In the present work chemical constituents were identified by thin-layer chromatography (Elix 2014), and by comparison with authentic samples. Specimens were photographed at a magnification of ×4 with a Canon EOS 450D camera fitted with a Canon MP-E65 mm, F2.8 1–5× lens.

New Taxa

1. *Pertusaria aphelospora* (A.W. Archer) A.W. Archer & Elix, **comb. nov**. MycoBank no. 817381

Basionym: *Pertusaria wilsonii* var. *aphelospora* A.W. Archer, *Mycotaxon* **41**: 251 (1991).

Type: Australia, Queensland, Black Mountain, 25 km NW of Kuranda, 16°40'S, 145°29'E, alt. 500m, on *Acacia*, *J.A. Elix 17507*, 7 Jul 1984 (holotype: CANB).

Thallus corticolous, pale olive-green; surface smooth and cracked, corticolous, lacking isidia and soredia. Apothecia verruciform, numerous, crowded, flattened-hemispherical, rarely confluent, concolorous with the thallus, 0.4–0.8 mm diam. Ostioles inconspicuous, black-punctiform, *c.* 0.1 mm diam., 1–2 per verruca. Asci 2-spored. Ascospores elongate-ellipsoid, hyaline, with smooth inner walls, 100–112 µm long and 30–35 µm wide. **Figs 1 & 2**.

Chemistry: protocetraric acid (major) ± 4,5-dichlorolichexanthone (minor).

Additional specimens examined: Queensland, Leichardt Highway, 8 km NNW of Taroom, 25°35'S, 149°46'E, alt. 200 m, on tree trunk in poor monsoon forest, *J.A. Elix 35076*, 30 Aug 1993 (CANB); Isla Gorge National Park, 27 km NNE of Taroom, 25°10'S, 149°59'E, alt. 220 m, on fallen branch in dry monsoon scrub with *Brachychiton* on gently sloping terrace above stream, *J.A. Elix 35114*, 31 Aug 1993 (CANB). Further specimens were listed in Archer (1991).

Fig. 1. *Pertusaria aphelospora* (A.W. Archer) A.W. Archer & Elix; *Elix 35076* (CANB); bar = 1 mm.

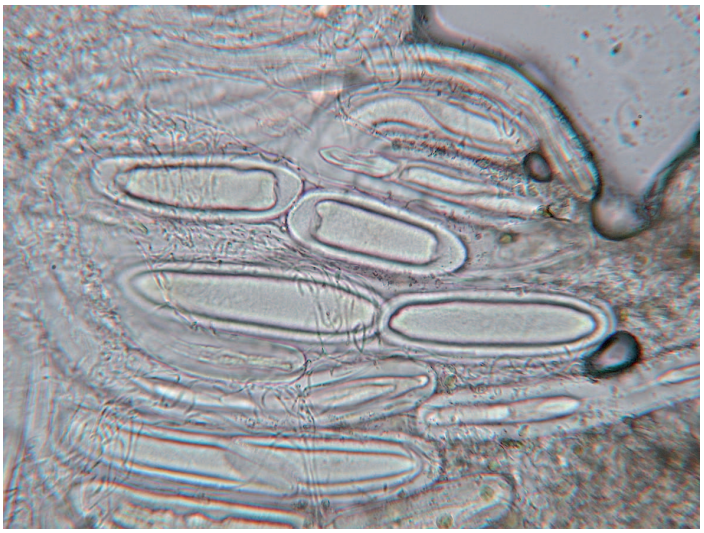

Fig. 2. *Pertusaria aphelospora* (A.W. Archer) A.W. Archer & Elix; *Elix 35076*; ascospores (CANB).

Relationships: *Pertusaria wilsonii* var. *wilsonii* and *P. wilsonii* var. *aphelospora* were published in the same paper (Archer 1991). Subsequently *P. wilsonii* var. *wilsonii* was found to be a later name for *P. thwaitesii* Müll. Arg., a species characterised by the presence of protocetraric acid and bisporous asci, the ascospores having rough inner walls. Although *P. wilsonii* var. *aphelospora* also has 2-spored asci, the ascospores differs in having smooth inner walls, and this taxon lacks the multi-ostiolate, flattened apothecia present in *P. thwaitesii* (Fig. 3).

Protocetraric acid is widely distributed in the genus *Pertusaria*; it is found as the sole lichen compound present in the following fertile species: *P. thwaitesii* Müll. Arg., *P. huanicola* Messuti & A.W. Archer, from Argentina, in *P. errinundrensis* A.W. Archer and *P. lacericans* A.W. Archer from Australia, *P. leeuwenii* Zahlbr. from Indonesia, *P. composita* Zahlbr. from Japan, *P. macloviana* Müll. Arg., from South America and *P. pseudoparotica* Sipman from Greece, and in the sterile species, *P. acroscyphoides* Sipman, *P. corallophora* Vain., *P. leucosora* Nyl. and *P. umbricola* A.W. Archer & Elix.

Fig. 3. *Pertusaria thwaitesii* Müll. Arg.; *A.W. Archer P177* (NSW); bar = 1 mm.

Distribution: *Pertusaria aphelospora* has been found in eastern New South Wales and eastern Queensland.

Etymology: The epithet *aphelospora*, is derived from the Greek *apheles* (smooth), and Greek *spora* (a seed), a reference to the smooth-walled ascospores present in this species.

2. *Pertusaria dayi* A.W. Archer & Elix, **sp. nov**. MycoBank no. 817382

Similar to *Pertusaria dussii* Vain. but differs in having smaller ascospores with smooth walls.

Type: Australia, Queensland, Finch Hatton Gorge, 21°07'S, 148°38'E, alt. 750 m, on dead wood in tropical rainforest, *M.F. Day 87.21*, Jul 1987 (holotype: CANB).

Thallus corticolous, pale greyish green; surface glossy and somewhat cracked, lacking isidia and soralia. Apothecia verruciform, conspicuous, scattered, concolorous with the thallus, flattened-hemispherical, conspicuously concave, 0.9–1.5 mm diam. Ostioles inconspicuous, black, punctiform, 2–4 per verruca. Asci 4-spored. Ascospores ellipsoid, hyaline, with smooth inner walls, 75–82 µm long and 30–32 µm wide. **Figs 4 & 5**.

Fig. 4. *Pertusaria dayi* A.W. Archer & Elix; *M.F. Day 87.21* (holotype: CANB); bar = 1 mm.

Fig. 5. *Pertusaria dayi* A.W. Archer & Elix, showing ostioles; *M.F. Day 87.21* (holotype: CANB); bar = 1 mm.

Chemistry: stictic acid (major) and menegazziaic acid (minor).

Relationships: *Pertusaria dayi* is characterised by large, concave, verruciform apothecia, asci with four ascospores and the presence of stictic acid. The new species is somewhat similar to *P. dussii* (Fig. 6) in that both have large verruciform apothecia and contain stictic acid. However, the asci in *P. dussii* can contain 2–8 ascospores and the spores differ from those of *P. dayi* in having rough inner walls and being up to 125 µm long (Vainio 1899). *Pertusaria aspera* Müll. Arg. from East Africa (Müller 1885) is also somewhat similar to *P. dayi*; this species has asci with 2–4 ascospores per ascus, *c*. 80 µ long and 30 µm wide, but differs in the smaller apothecia (Fig.7), and it contains constictic acid as the major lichen acid.

Fig. 6. *Pertusaria dussii* Vainio; *P. Dussi 561*, (holotype: TUR-V 6873); bar = 1 mm.

Fig.7. *Pertusaria aspera* Müll. Arg.; *Hildebrandt 2350* (holotype: G); bar = 1 mm.

Distribution: At present this new species is known only from the type collection at Finch Hatton Gorge, Queensland.

Etymology: The species is named after the collector, Dr M.F. Day.

3. *Pertusaria glabra* A.W. Archer & Elix, **sp. nov**. MycoBank no. 817383

Similar to *Pertusaria subisidiosa* A.W. Archer but differs in having smaller ascospores and in lacking isidia.

Type: Australia, Queensland, Mount Archer Environmental Park, 8 km NE of Rockhampton, 23°20'S, 152°34'E, alt. 780 m, on dead wood in dry sclerophyll forest on moderately steep slope, *J.A. Elix 34490*, 24 Aug 1993 (holotype: CANB; isotype: B)

Thallus corticolous, off-white to pale grey; surface smooth and dull; isidia and soredia absent. Apothecia verruciform, conspicuous, scattered, not confluent, sessile, flattened-hemispherical, concolorous with the thallus, 0.6–1 mm diam. Ostioles conspicuous, black, 1 per verruca, 0.2–0.5 mm diam. Asci (2–)3–4-spored.

Ascospores ellipsoid, hyaline, with rough inner walls, 55–75 µm long and 20–35 mm wide, or when 2 per ascus [in the same apothecium], 95–100 µm long and 25–30 µm wide. **Figs 8 & 9**.

Fig. 8. *Pertusaria glabra* A.W. Archer & Elix; *Elix 34490* (holotype: CANB).

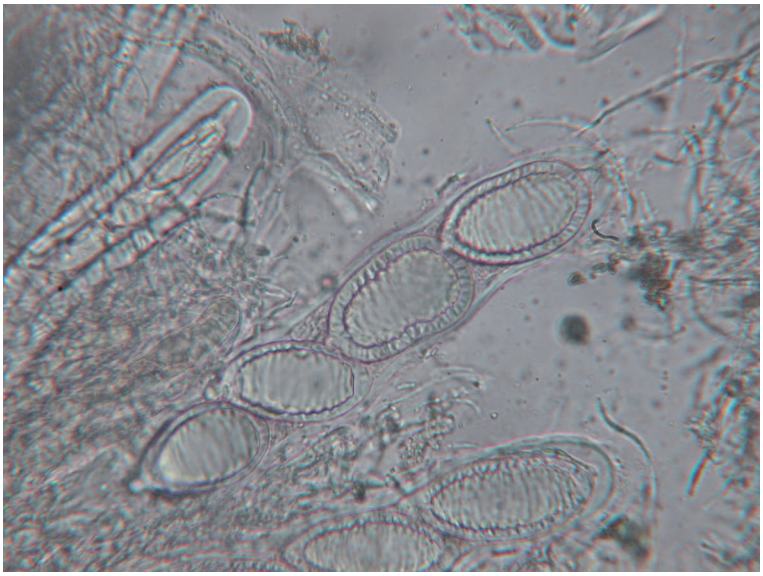

Fig. 9. *Pertusaria glabra* A.W. Archer & Elix; ascospores, *Elix 34490* (holotype: CANB).

Chemistry: 2,4-dichlorolichexanthone (minor), 2,5-dichlorolichexanthone (minor), 2,4,5-trichlorolichexanthone (minor) and stictic acid (major).

Relationships: The new species is characterised by the conspicuous black ostioles, asci with (2–)3–4 rough-walled ascospores and by its chemistry. The lichen substances are identical to those present in *P. subisidiosa*

(Archer 1991) (Fig. 10) and the ascospores are similar, in having rough inner walls. However, the ascospores are shorter than in *P. subisidiosa* (80-95 µm long) and thallus lacks isidia. Superficially the new species resembles *P. nebulosa* A.W. Archer (Archer in Elix *et. al.* 1992) (Fig. 11) but the latter can be distinguished by the smooth-walled ascospores and the absence of lichen compounds.

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

Etymology: The epithet *glabra*, is derived from the Latin *glaber*, (smooth), in reference to the smooth upper surface that lacks isidia.

Fig. 10. *Pertusaria subisidiosa* A.W. Archer; *Archer P382* (NSW); bar = 1 mm.

Fig. 11. *Pertusaria nebulosa* A.W. Archer; *Elix 18389* (holotype: CANB); bar = 1 mm.

4. *Pertusaria heinarii* A.W. Archer & Elix, **sp. nov**. MycoBank no. 817384

Similar to *Pertusaria salebrosa* A.W. Archer & Elix but differs by having larger soralia, by lacking lichen substances and by growing on bark.

Type: Norfolk Island, King Fern Valley, Mount Pitt Reserve, 29°01'S, 167°52'20"E, alt. 260 m, on treelet stem in poor lowland forest with palm regrowth, *H. Streimann 34519*, 7 Dec 1984 (holotype: CANB)

Thallus corticolous, pale olive-green; surface smooth, slightly cracked, isidia absent. Soralia white, numerous, scattered, rarely confluent, sessile, subglobose, 0.6–1 mm diam. Apothecia and ascospores not seen. **Fig. 12**.

Fig. 12. *Pertusaria heinari* A.W. Archer & Elix; *Streimann 34519* (holotype: CANB); bar = 1 mm.

Chemistry: no lichen substances detected.

Relationships: *Pertusaria heinarii* is characterised by the numerous, subglobose, white soralia and the absence of lichen compounds. It resembles the sterile, sorediate, corticolous species *P. salebrosa* A.W. Archer & Elix (Archer 1997) (Fig. 13) from Queensland but the latter differs chemically in containing higher homologues of perlatolic acid and in growing on rocks. In addition, the soralia of *P. heinarii* are larger than those of *P. salebrosa* (0.3-0.5 mm diam.).

Fig. 13. *Pertusaria salebrosa* A.W. Archer & Elix; *Elix 34510* (holotype: CANB); bar = 1 mm.

Distribution: At present, *Pertusaria heinarii* is known only from the type specimen.

Etymology: The species is named after the collector, Heinar Streimann (1938–2001) who made important contributions to the study of Australian mosses and lichens.

5. *Pertusaria montoensis* A.W. Archer & Elix, **sp. nov**. MycoBank no. 817385

Similar to *Pertusaria platycarpa* Jariangprasert but differs in having smaller, uniseriate ascospores, 56–62 µm long and 20–26 µm wide.

Type: Australia, Queensland, Hurdle Gully, Coominglah State Forest, 14 km WSW of Monto, 24°54'S, 157°01'E, alt. 310 m, on canopy branches in monsoon forest with dense shrubby understory, *J.A. Elix 35465*, 3 Aug 1993 (holotype: CANB) **Fig. 14**.

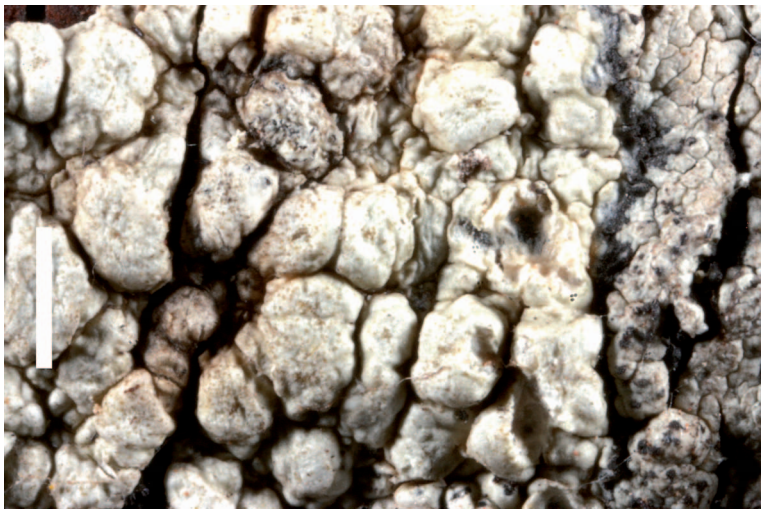

Fig. 14. *Pertusaria montoensis* A.W. Archer & Elix; *Elix 34565* (holotype: CANB); bar = 1 mm.

Thallus corticolous, pale olive-green; surface subtuberculate and slightly cracked, lacking isidia and soralia. Apothecia numerous, concolorous with the thallus, flattened-hemispherical, sometimes becoming distorted, 0.5–0.9 mm diam. Ostioles inconspicuous, pale brown, punctiform, 1 per verruca. Asci 8-spored. Ascospores 1-seriate, hyaline, ellipsoid, with smooth inner walls, 56–62 µm long and 20–26 µm wide.

Chemistry: lichexanthone (minor), 2'-*O*-methylstenosporic acid (major), stictic acid (major), cryptostoctic acid (trace), mengazziaic acid (trace) and skyrin (trace).

Relationships: *Pertusaria montoensis* is characterised by apothecia with pale punctiform ostioles, asci with eight ascospores per ascus and in containing lichexanthone, 2'-*O*-methylstenosporic and stictic acids. The chemically similar *P. platycarpa* Jariangprasert from north-eastern Thailand (Jariangprasert 2006) has larger, 2-seriate ascospores, 70-100 µm long and 36-46 µm wide, in contrast to the smaller, 1-seriate ascospores present in *P. montoensis*.

Distribution: At present this new species is known only from the holotype.

Etymology: The epithet is derived from Monto, the Queensland town nearest to the type locality and *ensis*, Latin for place of origin.

6. *Pertusaria stenospora* A.W. Archer & Elix, **sp. nov**. MycoBank no. 817386

Similar to *Pertusaria pycnothelia* Nyl. but differs by having conspicuous black ostioles and by containing 2'-*O*-methylstenosporic acid rather than 2'-*O*-methylperlatolic acid.

Type: Australia, Queensland, 3 km S of Forrest Beach, 16 km SE of Ingham, 18°43'S, 146°18'E, alt. 1 m, on a tree at the edge of mangrove and strand vegetation, *J.A. Elix 15899*, 22 Jun 1984 (holotype: CANB).

Thallus corticolous, pale fawn; surface smooth, lacking soralia and isidia. Apothecia verruciform, numerous, crowded, sometimes confluent, flattened-hemispherical, 0.4–0.7 mm diam. Ostioles black, conspicuous, 1 per verruca, *c.* 0.15 mm diam. Asci 2-spored. Ascospores elongate-ellipsoid, hyaline, with smooth inner walls, 100–110 µm long and 22–30 µm wide. **Figs 15 & 16**.

Fig. 15. *Pertusaria stenospora* A.W. Archer & Elix; *Elix 15899* (holotype: CANB); bar = 1 mm.

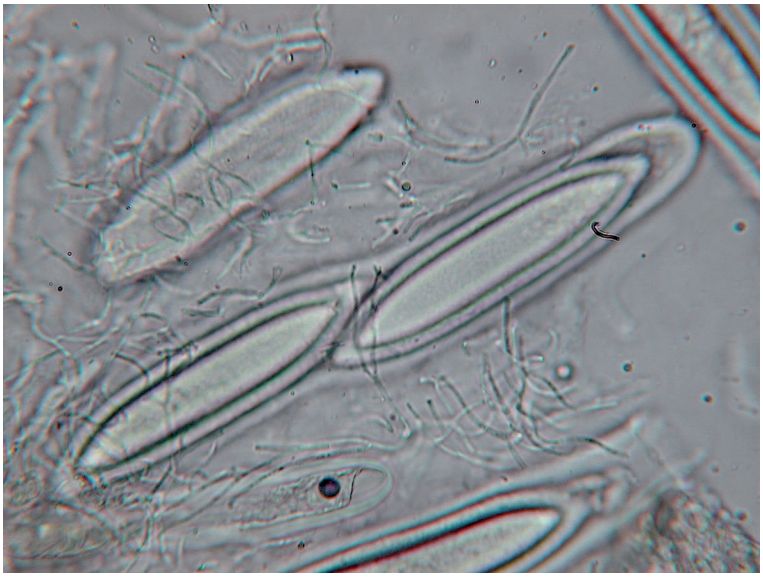

Fig. 16. *Pertusaria stenospora* A.W. Archer & Elix; ascospores, *Elix 15899* (holotype: CANB).

Chemistry: 4,5-dichlorolichexanthone (minor) and 2'-*O*-methylstenosporic acid (major)

Pertusaria stenospora is characterised by numerous small, verruciform apothecia with conspicuous black ostioles, asci containing two smooth-walled ascospores and the presence of 4,5-dichlorolichexanthone and 2'-*O*-methylstenosporic acid.

Relationships: It closely resembles *P. pycnothelia* described from New Caledonia (Nylander 1868), but differs in having conspicuous black ostioles and in containing 2'-*O*-methylstenosporic acid rather than 2'-*O*-methylperlatolic acid. The combination of 4,5-dichlorolichexanthone and 2'-*O*-methylstenosporic acid is rather uncommon in *Pertusaria* but is also present in *P. praetermissa* A.W. Archer & Elix from Australia (Archer & Elix in Archer 1997),

and *P. kansriae* Jariangprasert from Thailand (Jariangprasert & Anusarnsunthorn 2005). However in contrast to *P. stenospora,* these species have four- and eight-spored asci respectively.

Etymology: The epithet *stenospora* is derived from the Greek *stenos*, (narrow) and *spora*, (a seed), a reference to the elongate-ellipsoid ascospores.

New Reports

Pertusaria karkarensis A.W. Archer & Elix, *Mycotaxon* **67**:162 (1998).

Type: Papua New Guinea, Madang Province, Karkar Island, NW side, S of airfield at Kinim Station, 4°35'S, 145°55'E, alt. 300m, on trunks of *Cocos* in plantation, *H.J.M. Sipman 24217*, 28 Feb 1987 (holotype: B).

Pertusaria karkarensis was reported as a corticolous, isidiate species with fertile verruciform apothecia with asci containing eight, biseriate ascospores, 80–95 µm long and 30–35 µm wide and containing thiophanic acid, arthothelin and asemone in the thallus (Archer and Elix 1998). The specimen from Queensland lacked apothecia but it has an isidiate thallus and contains thiophanic acid and arthothelin.

Additional specimen examined: Queensland, Pepina Falls, Middlebrook Creek, 8 km S of Millaa Millaa, 17°34'11"S, 145°36'32"E, alt. 760 m, on canopy branch in remnant montane forest, *J.A. Elix 44463*, 6 Aug 2006 (CANB).

Pertusaria phulhuangensis Jariangprasert, *Mycotaxon* 96: 116 (2006).

Type: Thailand, Loei Province, Phu Lhuang Wildlife Sanctuary, behind the Queen's palace, Pha Yueang Cliff, alt. 1470 m, on tree trunk in oak/chestnut forest, *S. Jariangprasert 2193*, 3 Feb 2002 (holotype: QSBG).

This taxon was originally reported as an un-named species from north-eastern Thailand, "*Pertusaria* sp. 10" (Jariangprasert 2005) and was formally published as *Pertusaria phuluangensis* in 2006. The species is characterised by large, verruciform apothecia, translucent ostioles, asci with (5-)6-8 uniseriate subfusiform-ellipsoid ascospores and the presence of 2'-*O*-methylperlatolic and stictic acids. This combination of lichen acids is also found in *P. minor* Müll. Arg. from Indonesia (Müller 1882) but that species has smaller biseriate ascospores (58–80 × 22–26 µm compared to 74–110 × 30–44 µm in *P. phuluangensis*) and by the presence of additional constictic acid as a major lichen acid. *Pertusaria novaeguineae* A.W. Archer & Elix (Archer & Elix 1998) also contains 2'-*O*-methylperlatolic and stictic acids but has asci with four larger ellipsoid ascospores, (115–)125–150 × 35–45 µm.

A number of *Pertusaria* taxa, originally described from Australia, have also been found in Thailand including: *P. alboaspera* A.W. Archer & Elix, *P. howeana* A.W. Archer & Elix, *P. lordhowensis* A.W. Archer & Elix, *P. pilosula* A.W. Archer & Elix, *P. umbricola* A.W. Archer & Elix and *P. xylophyes* A.W. Archer. **Fig. 17**.

Additional specimens examined: Queensland: Ninney Point, Bingil Bay, 20 km N of Tully, 17°50'S, 146°06'E, alt. 1 m, on coconut trunk; *H. Streimann 45487*, 1 Dec 1990 (CANB); Cow Bay, Cape Tribulation National Park, 26 km NNE of Mossman, 16°14'S, 145°29'E, alt. 2 m, on treelet stem; *H. Streimann 45989*, 6 Dec 1990; *ibid*. on *Calophyllum* stem, *H. Streimann 46011*, 6 Dec 1990 (CANB).

Pertusaria virensica R.C. Harris, *Some Florida Lichens*: 62 (1990).

Type: United States of America, Florida, Okaloosa County, 1.2 miles [1.9 km] W of Florida Highway 85 on Antioch Road (County Road 4) ca. 4 miles [6.4 km] S of Crestview, *R.C. Harris 25182*, 5 May 1990 (holotype: NY – not seen).

Pertusaria virensica is characterised by having verruciform apothecia, asci with eight, uniseriate ascospores (60–70 µm long and 28–35 µm wide) and in containing thiophaninic and virensic acids (Harris 1990). This combination of lichen compounds is, so far, unique for the genus. The Australian material has asci with eight, uniseriate ascospores, 60–80 µm long and 24–34 µm wide. A recent photograph of this species (Lücking *et al*. 2011, Fig. 45G) is very similar to the Australian specimen. The apparently disjunct distribution of *P. virensica* is unusual but *Graphis supracola* A.W. Archer (Archer 2001), described from Australia, also occurs in Florida (Seavey & Seavey 2011). **Fig. 18**.

Additional specimen examined: Queensland, Cook District, ca. 5 km W of Mount Molloy, near road from Cairns to Cooktown, 16°40'S, 145°18'E, in dry sclerophyll forest, on *Eucalyptus*, *H.T. Lumbsch 11168b*, 5 Aug 1996 (CANB).

Fig. 17. *Pertusaria phuluangensis* Jariangprasert, *Streimann 46011* (CANB); bar = 1 mm.

Fig.18. *Pertusaria virensica* R.C. Harris, *H.T. Lumbsch 11168b* (CANB); bar = 1 mm.

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References

Archer AW (1991) New species and new reports of *Pertusaria* (lichenised Ascomycotina) from Australia and New Zealand with a key to the species in Australia. *Mycotaxon* 41: 223–269

Archer AW (1997) The lichen genus *Pertusaria* in Australia. *Bibliotheca Lichenologica* 69: 5–249

Archer AW (2001) The lichen genus *Graphis* (Graphidaceae) in Australia. *Australian Systematic Botany* 14: 245–271 http://dx.doi.org/10.1071/SB00023

Archer AW, Elix JA (1998) Additional new species and two new reports in the lichen genus *Pertusaria* (lichenised Ascomycotina) from Papua New Guinea. *Mycotaxon* 67: 155–179

Archer AW, Elix JA (2016) *Australian Pertusaria*: 1–177 (Published by the authors, Sydney)

Dibben MJ (1980) *The Chemosystematics of the Lichen Genus* Pertusaria *in North America North of Mexico*. Milwaukee Publications in Biology and Geology 5: 1–162

Elix JA (2014) *A Catalogue of Standardized Thin-Layer Chromatographic Data and Biosynthetic Relationships for Lichen Substances*, 3rd edn. (Published by the author, Canberra)

Elix JA, Streimann H, Archer AW (1992) The Lichens of Norfolk Island 2: The genera *Cladonia*, *Pertusaria*, *Pseudocyphellaria* and *Ramalina*. *Proceedings of the Linnean Society of New South Wales* 113: 57–76

Harris RC (1990) *Some Florida Lichens*. 1–107 (Published by the author, New York)

Jariangprasert S (2005) *Taxonomy and Ecology of the Lichen Family Pertusariaceae in Thailand*. Ph.D. Thesis, Chiang Mai University ISBN 974-9886-90-9

Jariangprasert S (2006) New taxa of the lichen genus *Pertusaria* (Ascomycota) from Thailand. *Mycotaxon* 96: 109–121

Jarinagprasert S, Anusarnsunthorn V (2005) Additional new taxa in the lichen genus *Pertusaria* (Lichenised Ascomycota) from Thailand. *Mycotaxon* 91: 279–292

Kantvilas G (1990) The genus *Pertusaria* in Tasmanian rainforests. *Lichenologist* 22: 289–300 http://dx.doi.org/10.1017/S0024282990000329

Knight C (1882) Contributions to the Lichenographia of New South Wales. *Transactions of the Linnean Society London, Botany* 2: 37–51 http://dx.doi.org/10.1111/j.1095-8339.1882.tb00003.x

Körber GW (1862) Reliquae Hochstetterianae. *Abhandlung der Schlesische Gesellschaft für vaterländische Kultur. Abhandlung für Naturwissenschaften und Medicin* 2: 30–34

Lücking R, Seavey F, Common RS, Beeching SQ, Breuss O, Buck WR, Crane L, Hodges M, Hodkinson BP, Lay E, Lendemer JC, McMullin RT, Mercado-Diaz JA, Nelsen MP, Rivas Plata E, Safranek W, Sanders WB, Schaefer HP, Seavey J (2011) The lichens of Fakahatchee Strand Preserve State Park, Florida: Proceedings from the 18th Tuckerman Workshop. *Florida Museum of Natural History Bulletin* 49: 127–186

Messuti MI, Archer AW (2009) ¿Cuanto taxones pueden incluirse teóreticamente en el género *Pertusaria*? *Glalia* 2: 1–9

Müller J (1882) Lichenologische Beiträgae XV. *Flora* 65: 326–337

Müller J (1882) Lichenologische Beiträge XVI. *Flora* 65: 483–490

Müller J (1885) Lichenologische Beiträge XXII. *Flora* 68: 503–518

Nylander W (1868) *Synopsis Lichenum Novae Caledoniae*: 1–101. (F. Le Blanc-Hardel, Caen)

Schmitt, I (2002) Molecular Phylogeny of the Pertusariales (Lichenised Ascomycota). Dr. rer. Nat. Dissertation. Essen, Fachbereichs Bio- und Geowissenschaften Landschaftarchitektur an der Universität Essen.

Schmitt I, Lumbsch H T (2004) Molecular phylogeny of the Pertusariaceae supports secondary chemistry as an important secondary character set in lichen-forming ascomycetes. *Molecular Phylogenetics and Evolution* **33**: 4355 http://dx.doi.org/10.1016/j.ympev.2004.04.014

Seavey F, Seavey J (2011) The lichen genus *Graphis* (Graphidaceae) in Everglades National Park (Florida). *Bryologist* 114: 764–784 http://dx.doi.org/10.1639/0007-2745-114.4.764

Stirton J (1876) Lichens, British and foreign. *Report and Transactions of the Glasgow Society of Field Naturalists* 4: 85–95

Vainio EA (1899) Lichenes novi rarioresque. Ser. III. *Hedwigia* 38: 253–259

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