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Additions to the lichen genus *Pertusaria* in Tasmania

Ergänzungen zur Flechtengattung *Pertusaria* in Tasmanien

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Key words: Australia, chemistry, new species, *Pertusaria*, Tasmania.

Schlagwörter: Australien, Chemie, neue Spezien, *Pertusaria*, Tasmania.

Summary: The following new species are described: *Pertusaria dactylinella* KANTVILAS & ELIX, *P. flavoexpansa* KANTVILAS & ELIX, *P. flindersiana* KANTVILAS & ELIX and *P. parathalassica* KANTVILAS & ELIX; all are only known from Tasmania or its offshore islands. *Pertusaria xanthoplaca* MÜLL. ARG. is recorded from Tasmania for the first time, and new locality data are given for the rare species, *P. knightiana* MÜLL.ARG., *P. pseudodactylina* A.W. ARCHER and *P. subdactylina* NYL. The name *P. pertractata* STIRT. is reinstated for the widespread and common Australian species hitherto referred to as *P. gibberosa* MÜLL.ARG.

Zusammenfassung: Folgende neue Arten werden beschrieben: *Pertusaria dactylinella* KANTVILAS & ELIX, *P. flavoexpansa* KANTVILAS & ELIX, *P. flindersiana* KANTVILAS & ELIX und *P. parathalassica* KANTVILAS & ELIX. Alle sind nur von Tasmanien oder den vorgelagerten Inseln bekannt. *Pertusaria xanthoplaca* MÜLL. ARG. wird das erste Mal aus Tasmanien nachgewiesen und von Neufunden für die seltenen Arten *P. knightiana* MÜLL. ARG., *P. pseudodactylina* A.W. ARCHER und *P. subdactylina* NYL. wird berichtet. Der Name *P. petractata* STIRT. wird wieder eingeführt für die weitverbreitete und häufige australische Art, für die bisher der Name *P. gibberosa* MÜLL. ARG. verwendet wurde.

Introduction

Pertusaria DC. is a genus of more than 300 species (KIRK et al. 2001), well-represented on all the continents of the world including Antarctica. Species of *Pertusaria* colonise bark, wood, rock or soil, or may overgrow bryophytes and other small plants. The genus has a diverse chemical composition that underpins the delimitation of many taxa (e.g., see HANKO 1983, ARCHER 1993). Comprehensive accounts of the genus in the Northern Hemisphere, also providing discussion of generic and infra-generic characters, include DIBBEN (1980) and

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PURVIS & JAMES (1992). Generic delimitation has been explored by SCHMITZ et al. (1994) and SCHMITT & LUMBSCH (2004).

The Australasian species of *Pertusaria* have been studied extensively in recent years, mainly by A. W. ARCHER and colleagues (e.g., see ARCHER 1991, 1992; ARCHER & ELIX 1992, 1993), resulting in two major continent-wide accounts (ARCHER 1997, 2004). In the latter work, 119 species and four varieties are recognised. In Tasmania, species of *Pertusaria* are prominent components of the lichen floras of most habitats. They may dominate sea-shore rocks, in some case being responsible for the white coloration of entire sea cliffs, be conspicuous, brightly coloured epiphytes in a range of forest types, colonise rocks in open woodlands and heathlands, and, in alpine areas, overgrow soil, bolsters and low shrubs. The genus appears to attain its greatest species-richness in the eastern part of Tasmania, in relatively dry coastal areas and on offshore islands. The Tasmanian rainforest species were studied by KANTVILAS (1990). The Australia-wide account by ARCHER (2004) includes 15 species that occur in Tasmania, based mainly on herbarium material collected by the late Geoff Bratt and the present author (GK), as well as collections by John Whinray from the Bass Strait islands. However, extensive field work indicates that there are several additional overlooked species present within Tasmanian territory. These species, which include four that are new to science and one new record, are dealt with here. They bring the total number of *Pertusaria* species from Tasmania and it offshore islands to 20.

Material and methods

The study is based on material collected by the first author and housed in the Tasmanian Herbarium (HO), with some duplicates distributed to BM, CANB, herb. Vězda and MIL. Anatomical investigations were conducted on hand-cut sections of thalli and apothecia mounted in water, 10% KOH, Lugols iodine and ammoniacal erythrosin. Measurements of ascospores are based on at least 30 observations and are presented in the format: lowest value-*mean*-highest value. Chemical constituents were identified by thin-layer chromatography (CULBERSON 1972, ELIX & ERNST-RUSSELL 1993), high-performance liquid chromatography (ELIX et al. 2003) and comparison with authentic samples.

Taxonomy

Pertusaria dactylinella KANTVILAS & ELIX sp. nov. figs. 1A–B

Pertusariae dactylinae, P. pseudodactylinae P subdactylinaeque affinis et item isidiis cylindricis sed acidum norsticticum continenti et isidiis aliquantum dispersis, non caespitosis, usque ad 1.2 mm altis differt.

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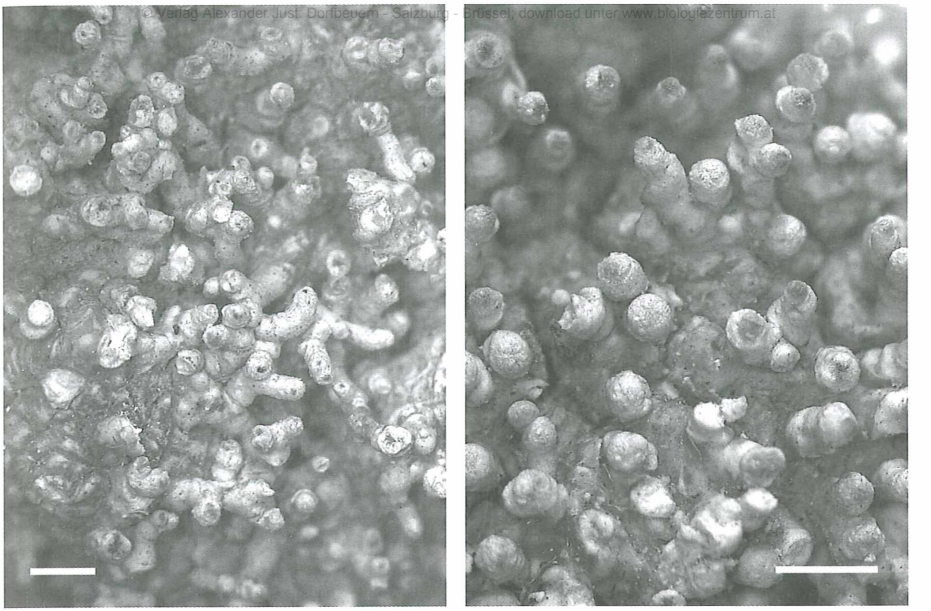

Fig. 1: *Pertusaria dactylinella.* Isidiate thallus with pycnidia (KANTVILAS 138/95) (left) and detail of isidia with apical, aborted and/or incipient apothecia (holotype) (right). Scale = 2 mm.

Typus: Australia: Tasmania, Freycinet Peninsula, Sleepy Bay Road, 1.6 km W of coast, 20 m altitude, on vertical granite rock face in dry forest, 2.II.1984, G. KANTVILAS 158/84 & P.W. JAMES (HO– holotype; BM, MIL– isotypes).

Thallus crustose, dull olive grey to whitish grey, deeply cracked, to *c.* 0.5 mm thick, ecorticate, isidiate; isidia cylidrical, to *c.* 1.2 mm tall, 0.3–0.4(–0.5) mm thick, perpendicular to the thallus or somewhat slanted, rather scattered and remaining discrete, not entangled or mat-forming, mostly simple but occasionally furcate, with apices rounded, often discoloured greyish, very brittle and easily abraded or fractured. Photobiont a unicellular green alga with cells globose, 8–16 µm diam. Apothecia not seen; incipient or aborted apothecia immersed in the apices of the isidia. Pycnidia occasional, immersed in the thallus and isidia; condia fusiform, 4–5 × 0.5 µm.

Chemistry: norstictic acid (major), connorstictic acid (minor) and salazinic acid (trace); thallus K+ yellow then red, KC-, C-, P+ orange, UV-; microscope squashes of the thallus form red, needle-like crystals with the addition of KOH.

Etymology: The specific epithet refers to the similarity of the new species to *P. dactylina* and its allies.

Remarks: This species belongs to the *P. dactylina* group, which is characterised by a crustose, whitish or off-white thallus, generally dominated by isidia that are either scattered or form dense cushions or turfs, and by the presence of

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depsidones or β-orcinol depsides (section *Digitatae* of ARCHER 1993). The species of the complex are readily separated from each other by chemical means: *P. dactylina* (ACH.) NYL. contains fumarprotocetraric acid, *P. pseudodactylina* A.W. ARCHER contains salazinic acid and *P. subdactylina* NYL. contains hypothamnolic acid. DIBBEN (1980) and ARCHER (2004) also discuss some minor morphological differences between some of the species. In the same way, *P. dactylinella* also has some minor morphological distinguishing features, with the isidia being rather scattered and not forming a thick mat or cushion that dominates the whole appearance of the thallus.

Distribution and ecology: *Pertusaria dactylinella* is localised on Freycinet Peninsula on Tasmania's east coast where it occurs occasionally on large granite boulders in dry sclerophyll forest. This species appears to favour sheltered, marginally drier microhabitats, often in slight overhangs.

Specimens examined: Australia: Tasmania, The Hazards, near Wineglass Bay Lookout, 42°09'S 148°17'E, 180 m alt., 19.VII.2005, G. KANTVILAS 176/05 (HO); Mt Dove, 42°09'S 148°18'E, 485 m alt., 28.X.1995, G. KANTVILAS 138/95 (HO).

Additional information for *P. pseudodactylina* and *P. subdactylina*

The *P. dactylina* complex in Tasmania is represented by three species, *P. dactylinella*, *P. pseudodactylina* and *P. subdactylina*. All are extremely localised within the Devonian granite provenence that extends along the eastern coast to the Bass Strait islands and beyond to Wilsons Promontory, Victoria. The latter two species are rare.

Pertusaria pseudodactylina is endemic to Tasmania and was previously known only from the type locality, Mt Cameron, in the State's far north-east. This species is characterised by rather robust, densely crowded or scattered isidia, and by the presence of salazinic acid (see ARCHER 1991 for a full description). It is here recorded from a second locality.

Specimen examined: Australia: Tasmania, Freycinet Peninsula, Sleepy Bay, 42°08'S 148°19'E, ± sea-level, 22.IV.1997, G. KANTVILAS 145/84 & P.W. JAMES (BM, HO, MIL).

Pertusaria subdactylina is a bipolar species, common in the Arctic and recorded by ARCHER (2004) from a single Australasian locality (Cape Barren Island, Bass Strait). It is here recorded for the first time from the Tasmanian mainland, again from an essentially lowland, sub-coastal locality. In Tasmanian material, the isidia are rather squashed and crowded, giving the thallus a rather papillate to verrucose appearance; both specimens occur directly on granite. It remains to be seen whether they are indeed conspecific with the humicolous/terricolous entity in Arctic North America (see DIBBEN 1980 and THOMSON 1997 for descriptions).

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Specimen examined: Australia: Tasmania, Mt Cameron, 40°59'S 147°56'E, 350 m alt., 22.IV.1997, G. KANTVILAS 138/97 & J.A. ELIX (HO).

Pertusaria flavoexpansa KANTVILAS & ELIX sp. nov. figs 2A–E

Species conspicua expansaque, praecipue plantas putridas humumque incolens, habitu *Pertusariae gymnosporae* aliquantum similis sed thallo flavescenti, acidum 5-*O*-methylhiascicum continenti et ascosporis grandissimis, 106–220 longis, 40–112 µm latis differt.

Typus: Australia: Tasmania, Crater Peak, 41°39'S 145°56'E, on soil, shrubs and stones in alpine heathland, 1200 m altitude, 16.II.1984, G. KANTVILAS 415/84 & P.W. JAMES (HO– holotype; BM– isotype).

Thallus crustose, pale lemon-yellow, sometimes ± maculate, typically thick (to 2 mm), widespreading and encrusting the substrate, continuous and smooth to verrucose, papillate or glomerulate, or rather granular, with the granules 0.1–1.5 mm wide, typically crowded and fused together or, more rarely, rather dispersed, discrete and scattered over a thick, glossy, effuse, pale yellow prothallus; in section ecorticate, inspersed with crystals that fluoresce in polarised light and dissolve in KOH. Photobiont a unicellular green alga with roundish to irregularly ellipsoid cells, 7–14 µm wide. Apothecia scattered, immersed in gall-like verrucae 0.4–1 mm wide, ± globose, superficial, basally constricted, pale brownish, pale greyish to pale yellowish, splitting by up to 5 ± radial fissures, becoming coarsely abraded and exposing the 'disc'; disc initially convex and brown, at length eroded and becoming ± plane and black, with a thin, rather ragged rim of thalline tissue resembling a lecanorine margin. Verrucae in section subtended by a band of dark brown tissue 20–40 µm thick, sometimes with flecks or streaks of a purple-black, K+ aeruginose-greenish pigment. Hymenium pale brown, intensifying orange-brown in KOH, 180–250 µm thick, sometimes inspersed with oil droplets 4-10 µm wide, rather poorly differentiated from the hypothecium below, comprising scattered, elongate-clavate, thick-walled asci embedded in a dense reticulum of highly branched and anastomosing paraphyses to 1.5 µm thick, overlain by a pale reddish brown 'plug' of sterile tissue 20–100 µm thick that is composed of rather thick, short-celled to pseudoparenchymatous hyphae inspersed with crystals and flecks of purple-black pigment as above. Ascospores occurring singly in the ascus, broadly ellipsoid to ovate to oblong, (106–)130–*167.7*–220 × 40–*84.3*–112 µm, colourless but sometimes becoming pale brown with age and internally sculptured with transverse strands, extruded at an early stage from the verrucae, typically with adhering fragments of the ascus wall and sterile tissue attached, sometimes observed lying loosely or partially overgrown by thalline tissue on the surface of the verrucae; wall 5–10 µm thick, generally swelling noticeably in KOH. Pycnidia not found.

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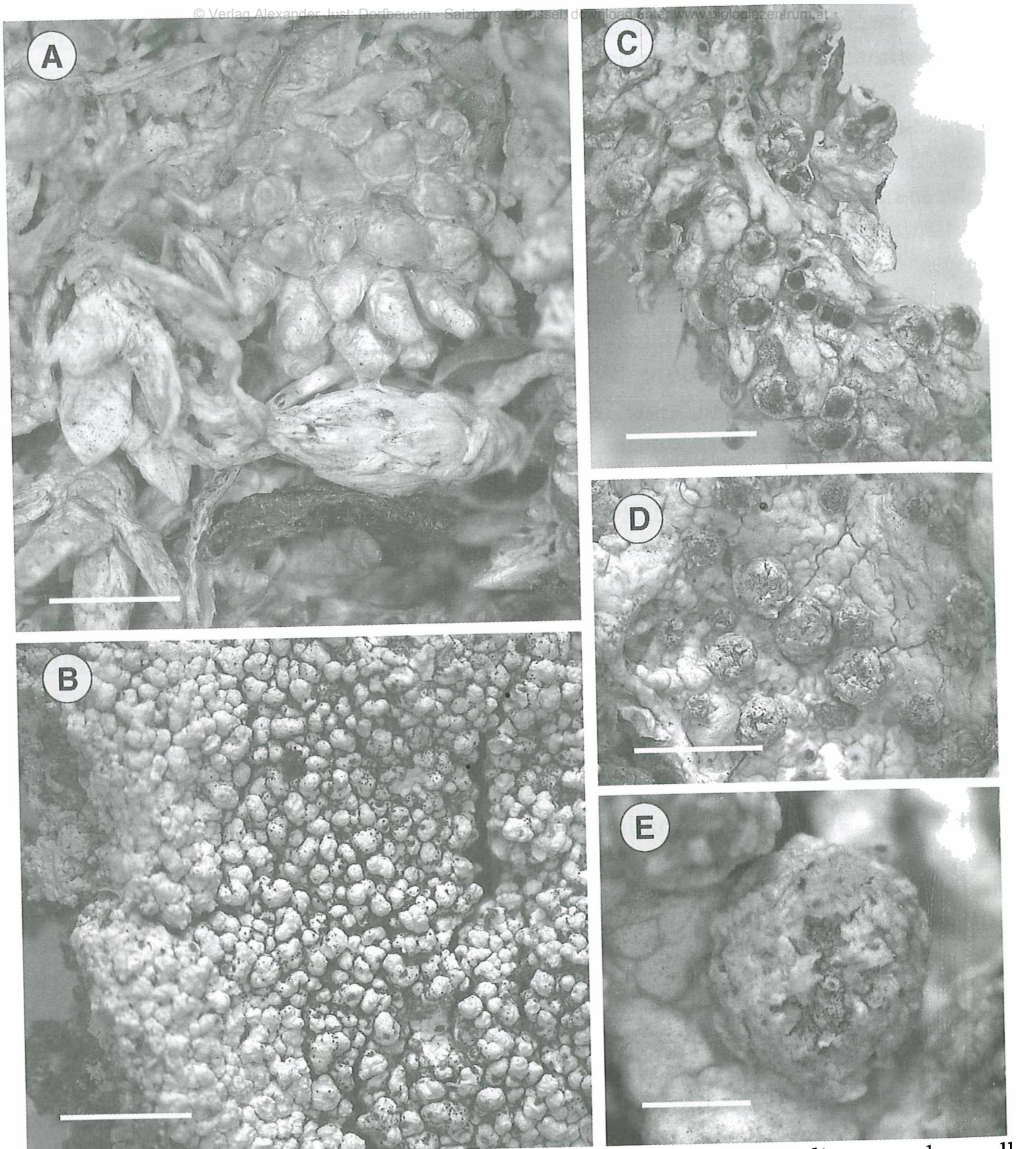

Fig. 2: *Pertusaria flavoexpansa*. A: typical thallus encrusting litter and small shrubs; note the leaves of the substrate, *Donatia novaezelandiae*, clearly visible beneath the lichen (MOSCAL 9238); B: granular thallus from a dry habitat on vertical rocks (KANTVILAS 121/97); C: fertile verrucae with some abraded and appearing *Lecanora*-like (KANTVILAS 106/86); D: fertile verrucae beginning to fissure and abrade; well-developed ascospores are best observed at this stage (KANTVILAS s.n.); E: detail of fertile verruca, with the tip of a protruding, ruptured ascus visible (KANTVILAS s.n.). Scales: A–D = 2 mm; E = 0.5 mm.

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Chemistry: usnic acid, 5-*O*-methylhiascic acid (major), two unknowns (minor - with UV spectra comparable with that of 5-*O*-acetyl-4-*O*-methylhiascic acid) and lecanoric acid (trace); thallus K-, KC+ orange-pink, C+ pink, P-, UV-.

Etymology: the specific epithet refers to the yellowish, wide-spreading thallus of the new lichen.

Remarks: This is a very distinctive and conspicuous species, easily recognised by its yellowish, wide-spreading thallus that can form patches of more than 50 cm in extent. It is clearly a rapid and aggressive coloniser, capable of overgrowing small, actively-growing living plants. In such cases, the impression of leaves and other substrate details remain clearly evident in the thallus surface (fig. 2A). The thallus is sometimes covered with black specks that appear to be either apothecial initials or the eroded impressions of old apothecia; the specks do not seem to be associated with pycnidia.

Fertile asci and ascospores are not easily observed. Most individuals are abundantly covered with globular, gall-like verrucae but these rarely contain asci; at most the remnants or initials of asci may be detected as amyloid tissue in squash preparations. The verrucae are globose at first but soon split and abrade, and at length resemble deformed, 'lecanorine' apothecia, with a thin thalline margin and a dark brown to black, convex 'disc' (fig. 2C). By this late stage of development, no fertile asci will be located either. Instead, the asci are to be found in relatively young verrucuae that are just beginning to abrade (fig. 2D). At low-power magnification, the surface of these is scabrid and pierced by tiny, flesh-coloured 'tubes' that are actually apically ruptured asci extruding through sterile surface tissue (fig. 2E). Sectioning of verrucae at this stage will reveal occasional asci, each with one huge ascospore, scattered through a matrix of interwoven, reticulate paraphyses. Mature ascospores may even be seen at this stage lying loose on the surface of the thallus or the verrucae. A similar situation is described and illustrated for *P. gymnospora* by KANTVILAS (1990). So rapid is the growth of the thallus that sometimes such loose spores are partially enveloped in thalline tissue.

The thallus of *P. flavoexpansa* varies from ± smooth and continuous to being composed of distinct granules (fig. 2B). The latter form appears to be a response to habitat dryness, because such thalli are found in lower rainfall sites (such as on the drier, lower, outlying peaks of eastern Tasmania), on steep rocks where water can be expected to drain away quickly, or as epiphytes on low trunks and branches well elevated above the ground. Despite the marked difference between the extremes of morphology, a continuum of form can be observed and the morphological differences are not correlated to any anatomical or chemical characters.

The apothecial verrucae vary from pinkish to yellowish to brownish or black. Frequently they strongly resemble the galls induced by lichenicolous fungi. However, despite offering a seemingly extensive and highly suitable

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habitat for parasites, a lichenicolous fungus was observed in only one specimen (HO 39477). This was a species with black apothecia and simple ascospores, displaying some affinities to *Micarea inquinans* (TUL.) COPPINS.

Distribution and ecology: *Pertusaria flavoexpansa* is widespread throughout the mountains of Tasmania, being the locally dominant lichen at many sites. It occurs in equal abundance in the Precambrian and Jurassic geological provenances (cf. KANTVILAS 1995). It is found mostly at alpine altitudes in exposed, windswept places, mostly on the ground where it encrusts soil, litter, pebbles, bryophytes and low shrubs including cushion plants (bolsters). Here it is usually associated with tufts of fruticose lichens such as *Cladia aggregata* (SW.) NYL., *C. fuliginosa* FILSON, *C. retipora* (LABILL.) NYL., *C. sullivanii* (MÜLL. ARG) W. MARTIN, *Cladonia confusa* R. SANT., *C. subsubulata* NYL. and *Leifidium tenerum* (LAURER) WEDIN, or with soil encrusting species such as *Laurera robusta* MCCARTHY & KANTVILAS, *Micarea isabellina* COPPINS & KANTVILAS, *M. magellanica* (MÜLL. ARG) FRYDAY, *M. melaena* (NYL.) HEDL. and *Pertusaria gymnospora* KANTVILAS. Less commonly it may occur as an epiphyte near the bases of trees and shrubs or on larger boulders and rock faces. In such habitats it may extend down to subalpine or even lower (to 500 m) elevations.

Selected specimens examined: Australia: Tasmania, Western Arthur Range, summit of Moraine A, 43°07'S 146°13'E, 959 m alt., 4.XII.2006, G. KANTVILAS 441/06 (HO); Clear Hill, 42°41'S 146°16'E, 1050 m alt., 22.II.1992, G. KANTVILAS 105/92 (HO); Reservoir Lakes, 43°29'S 146°43'E, 780 m alt., 21.III. 1984, A.M. BUCHANAN 2986A (HO); Jubilee Range, 42°53'S 146°33'E, 940 m alt., 13.I.1985, A.MOSCAL 9238 (HO); Elliot Range, 42°28'S 145°43'E, 900 m alt., 12.I.1985, G. KANTVILAS 23/85 (BM, HO); Mt Bobs, 43°18'S 146°36'E, 1080 m alt., 14.III.1998, G. KANTVILAS 59/98 (HO); summit of Snowy North, 42°52'S 146°39' E, 1240 m alt., 29.VIII.1993, G. KANTVILAS 98/93 (CANB, HO); Greystone Bluff, 43°05'S 146°04'E, 750 m alt., 9.IV.1986, G. KANTVILAS 106/86 (herb. Vězda, HO); Mt Mawson, 42°42'S 146°35'E, 1230 m alt., 13.X.1981, G. KANTVILAS 771/81 (BM, HO); 4 km N of Precipitous Bluff, 43°25'30"S 146°36'30"E, 730 m alt., 14.III1990, G. KANTVILAS 109/90 (CANB, HO); Weindorfers Forest, 41°38'S 145°56'E, 1000m alt., 17.II.1984, G. KANTVILAS s.n. (CANB, HO).

Pertusaria flindersiana KANTVILAS & ELIX sp. nov. fig. 3

A *Pertusaria knightiana* verrucis in glebis cerebriformibus, 3–5 mm latis coalescentibus et acidum divaricaticum continenti differt.

Typus: Australia: Tasmania, Flinders Island, Patriarch Inlet, Red Bluff, 39°57'S 148°12'E, on granite boulders along seashore, 3 m altitude, 1.IV.2007, G. KANTVILAS 139/07 (HO– holotype; CANB– isotype).

Thallus crustose, whitish grey, areolate and deeply cracked, to *c.* 350 µm thick, ecorticate. Photobiont a unicellular green alga with individual cells globose to irregularly rhomboid, 6–14(–20) µm diam. Apothecia verruciform, con-

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colorous with and dominating the thallus; individual verrucae 1.5–2 mm wide, ± globose, usually somewhat flattened at the apex, mostly fused in clumps of 3–10 and forming irregular, ± cerebriform, wrinkled, basally constricted clumps 3–5 mm wide. Ostioles black, rather sunken, mostly 2–4 per verruca. Paraphyses reticulately branched, to 1.5 µm wide, rather sparse and separating easily. Asci 2-spored, elongate-oblong, soon rupturing at maturity. Ascospores ellipsoid to oblong, hyaline, (80–)120–*138.1*–192 × 34–*52.9*–66 µm; inner wall internally rough and sculptured. Pycnidia not found.

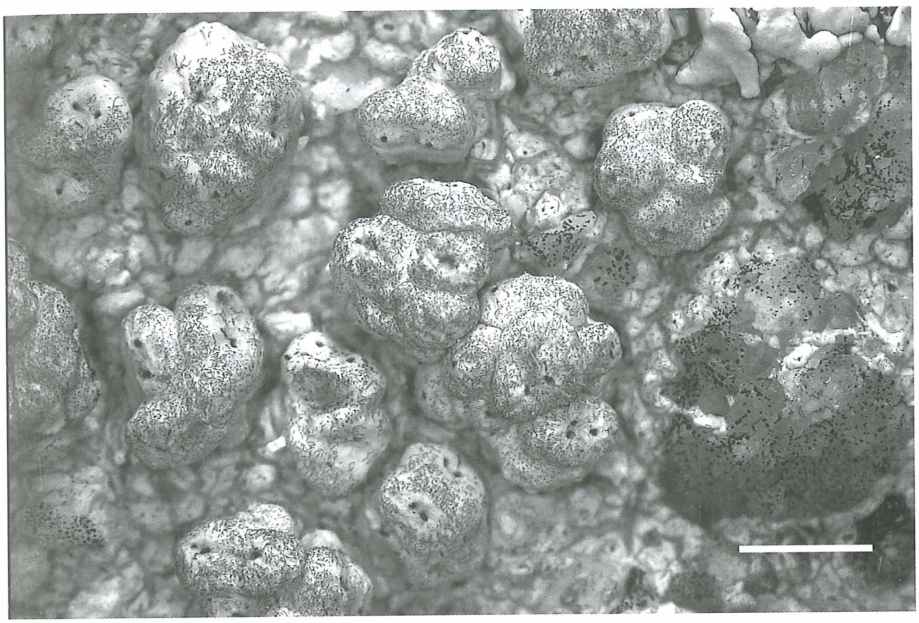

Fig. 3: *Pertusaria flindersiana.* Detail of prominent, wrinkled, gall-like verrucae with multiple black ostioles (holotype). Scale = 2 mm.

Chemistry: divaricatic acid (major), subdivaricatic acid (minor), 4,5-dichlorolichexanthone (minor), 4,5-dichloro-3-*O*-methylnorlichexanthone (trace); thallus K-, KC± faint pink, C-, P± faint orange, UV+ whitish.

Etymology: the specific epithet honours the achievements of the English navigator Matthew FLINDERS (1774–1814), who charted the coastlines of the Bass Strait islands (1798), Tasmania (1798–1799) and the Australian continent (1801–1803). It also recalls the type locality, Flinders Island, the largest of the Furneaux Group in eastern Bass Strait.

Remarks: With its grey thallus and verruciform apothecia, two-spored asci and large ascospores with an internally rough wall, *P. flindersiana* is superficially similar and very closely related to *P. knightiana* MÜLL. ARG. (= *P. whinrayi* ARCHER) (see ARCHER & ELIX 1992; ARCHER 1997, 2004 for full description). This

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latter species occurs in a very similar habitat and, since the work of ARCHER (2004), is now also known from Flinders Island (see below). The two species can be distinguished unequivocally only by their chemistry, with *P. knightiana* containing norstictic acid in addition to 4,5-dichlorolichexanthone. Although the individual verrucae in both species fuse together, in *P. flindersiana* this is particularly marked, and the fused verrucae form very prominent, wrinkled, gall-like lumps that are very brittle and easily dislodged. In the type specimen, the verrucae dominate the entire lichen and overgrow the grey thallus of an unidentified, sterile lichen (possibly another *Pertusaria* species) that contains norstictic acid and has very abundant, immersed, black pycnidia with filiform conidia 10–15 × 0.5 µm. Whether this is a fortuitous or obligate association will only become clear with further field study.

Distribution and ecology: This new species is known only from the type locality where it grew on large boulders of Devonian granite by the sea-shore. It is part of a rich saxicolous lichen association that characterizes the granitic coastline of the Bass Strait islands: *Caloplaca* spp., *Flavoparmelia haysomii* (C.W. DODGE) Hale, *Lecanora subcoarctata* (C. KNIGHT) HERTEL, *Neofuscelia subprolixa* (KREMP.) ELIX, *Ochrolechia* cf. *parella* (L.) A. MASSAL., *Paraparmelia conranensis* (ELIX) ELIX & J. JOHNSTON, *Tylothallia pahiensis* (ZAHLBR.) HERTEL & KILIAS, *Xanthoparmelia australasica* D.J. GALLOWAY, *Xanthoria ligulata* (KÖRB.) P. JAMES and many additional foliose and crustose species.

Additional Tasmanian records of *P. knightiana*:

This species was previously known only from Badger Island in eastern Bass Strait, and from New Zealand (ARCHER 2004). Its habitat ecology, on exposed granite boulders, suggests that it is likely to be common throughout the area.

Specimens examined: Australia: Tasmania, Flinders Island, North Patriarch, eastern summit, 39°58'S 148°12'E, 235 m alt., 31.III.2007, G. KANTVILAS 128/07 (HO); Flinders Island, summit of Mt Killiecrankie, 39°49'S 147°52'E, 310 m alt., 22.I 2006, G. KANTVILAS 33/06 (HO).

Pertusaria parathalassica KANTVILAS & ELIX sp. nov. fig. 4

Species littoralis, saxicola, thallo crasso, acidum protocetraricum continenti, ascis monosporis et ascopsoris oblongo-ellipsoideis, 164–281 µm longis et 51–109 µm latis recognita.

Typus: Australia: Tasmania, Bruny Island, Coal Point, 43°20'S 147°19'E, on sea-side sandstone rocks within spray zone, 1 m altitude, 14.VI.2005, G. KANTVILAS 145/05 (HO– holotype; CANB– isotype).

Thallus crustose, whitish to pale dull grey, deeply cracked and areolate, 0.4–1.5(–2) mm thick, very hard, brittle, lacking isidia or soredia, ecorticate, densely inspersed with crystals that fluoresce in polarised light but do not dis-

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solve in KOH. Photobiont a unicellular green alga with individual cells ± globose, 6–10 µm diam. Apothecia disciform, 0.8–1.5(–2.5) mm wide, single or 2–3 fused, usually rather deformed and squashed; hymenia at first deeply immersed within the verrucae and obscured by a thick, sterile "plug" of thalline tissue, at length exposed and revealing an orange-brown to greyish disc, soon becoming abraded, eroded and excavate. Asci one-spored, elongate-oblong, soon rupturing. Paraphyses very numerous, much branched, anastomosing and entangled, separating easily, 1–1.5 µm thick. Ascospores oblong-ellipsoid, hyaline, (164–) 195–*235.4*–281 × 51–*71.8*–109 µm; wall 3–4 µm thick, internally smooth. *Pycnidia* not found.

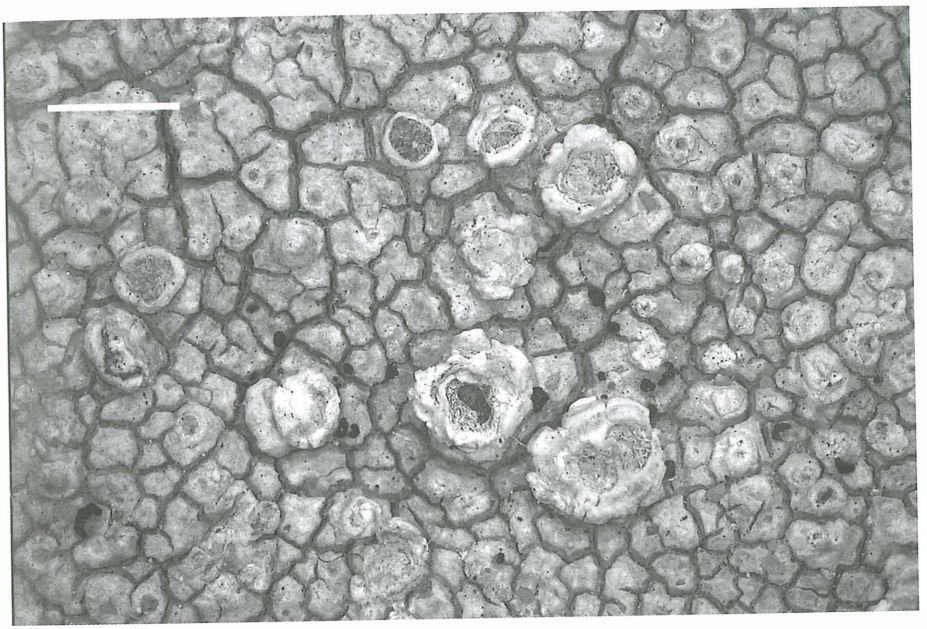

Fig. 4: *Pertusaria parathalassica*. Thick, deeply cracked thallus with prominent disciform apothecia (holotype). Scale = 2 mm.

Chemistry: protocetraric acid; thallus K-, KC-, C-, P+ red, UV-.

Etymology: the specific epithet derives from the Greek (παραθαλασσιος, meaning 'of the coast') and refers to the habitat of the species.

Remarks: The combination of large, disciform apothecia, single-spored asci, huge ascospores and the presence of protocetraric acid make this species very distinctive. The most closely related species appears to be the chiefly saxicolous *P. macloviana* MÜLL. ARG., recorded from southern South America and the Falkland Islands; the record of this species from Auckland Island by MESSUTI & ARCHER (1999) is erroneous and based on a labelling error (A.M. FRYDAY pers. comm). *Pertusaria macloviana* is chemically identical to *P. parathalassica* but

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its ascospores are smaller (147–187 × 49–74 µm and the disciform apothecia become coarsely sorediate (MESSUTI & ARCHER 1999). There are no species with this suite of characters, least of all in such a narrow yet clearly defined ecological niche, in the Tasmanian or Australian lichen floras. Protocetraric acid is a relatively uncommon metabolite in Australian *Pertusariae*. The only known species with disciform apothecia and this chemistry is *P. lacericans* A.W. ARCHER, a corticolous species of warm temperate rainforests (ARCHER 1991).

The thallus of the new species is extremely hard and crystalline and resistant to wetting, presumably as an adaptation to growth in a wet, salty environment.

Distribution and ecology: *Pertusaria parathalassica* is an infrequently collected and hitherto poorly studied species, despite being locally common. On the exposed southern coasts of Tasmania, this species extends almost continuously over hundreds of square metres in a band from approximately the high water mark upwards. On very steep cliffs, it may grow 100 m above the water, but nevertheless within the influence of sea spray and salt laden winds. So extensive can populations of this species be that it is observable at the 'landscape scale', forming a conspicuous white zone between the sea and shrubby vegetation. The habitat of this species has not been studied extensively, but amongst its asscociated species are *Caloplaca cribrosa* (HUE) ZAHLBR. and *Lecanora austrooceanica* HERTEL & LEUCKERT.

There are several common crustose lichens with a white thallus that occur within the littoral zone in Tasmania; the most frequently observed of which are *Tylothallia pahiensis* (ZAHLBR.) HERTEL & KILIAS and *Ochrolechia* cf. *parella* (L.) A. MASSAL. Interestingly, these widespread taxa have not been found where *P. parathalassica* occurs.

Selected specimens examined: Australia: Tasmania, Roaring Bay, 43°18'S 147°06'E, 6.VII.1968, G.C. BRATT 68/529 & J.A. CASHIN (HO); Bruny Island, channel between Penguin Island and Grass Point, 43°21'S 147°22'E, 28.II.2004, G. KANTVILAS 115/04 (HO); Cape Hauy, 43°08'S 148°00'E, 112 m altitude, 3.VI.2001, G. KANTVILAS 420/01 (HO).

Pertusaria pertractata STIRT.

Trans. Glasgow Soc. Field Naturalists **4**: 93 (1876); type: Australia, Tasmania, 'ad ligna decorticata', 1875, H. PATON (holotype – BM!).

= *Pertusaria gibberosa* MÜLL. ARG., Flora **65**: 486 (1882); type: corticola in Tasmania, ad truncos *Eucalypti cordati*' 1882, F. V. MÜLLER (holotype– G!, isotype– M).

The type specimen of this species is a small fragment of thallus containing 4,5-dichlorolichexanthone and 2'-*O*-methylperlatolic acid (thallus K-, C-, KC-, P-UV+ orange), with verruciform apothecia and eight-spored asci. These characters confirm that this species is identical to the widespread and common Aus-

tralian taxon that has been referred to extensively as *P. gibberosa* [see KANTVILAS (1990) and ARCHER (1997, 2004) for full descriptions]. The extensive synonymy of the species is detailed by ARCHER (2004).

Pertusaria xanthoplaca MÜLL. ARG.

Flora **65**: 485 (1882); type: Toowoomba, Queensland, 1881, C. HARTMANN 32 (holotype– G, isotype– MEL 7286!).

This species, also known from eastern mainland Australia, Papua New Guinea, Lord Howe Island, Norfolk Island and New Zealand, is here recorded for Tasmania for the first time. In the Tasmanian lichen flora, it is easily recognised by its bright, lemon-yellow crustose thallus with tiny, scattered, fleck-like soralia. Apothecia are verruciform, with the ascospores eight per ascus, 55–75 (–90) × 25–37 µm; no fertile material has been observed in Tasmania. It contains thiophaninic acid (major), arthothelin (± minor), stictic acid (± major or minor), constictic acid (± minor), lichexanthone (minor), 2-chloro-6-*O*-methylnorlichexanthone (minor), 2,4-dichlorolichexanthone (± trace) and 4,5-dichlorolichexanthone (± trace); thallus K-, KC+ orange, C+ orange, P-, UV+ orange (see ARCHER 2004 for full description). The presence of soralia distinguishes *P. xanthoplaca* from two similar, chemically identical species, neither of which occurs in Tasmania: *P. hypoxantha* MALME (fertile, non-sorediate) and *P. xanthodactylina* A.W. ARCHER & ELIX (isidiate).

Pertusaria xanthoplaca is locally common at Freycinet Peninsula on Tasmania's East Coast where it occurs on large granite boulders in coastal dry sclerophyll forest.

Specimens examined: Australia: Tasmania, c. 1 km NE of Coles Bay township, 42°07'S 148°17'E, 100-110 m alt., 23.IV.2007, G. KANTVILAS 164/07 (HO); western slopes of Mt Freycinet, 42°13'S 148°18'E, *c.* 250 m alt., 27.X.1995, G. KANTVILAS 149/95 (HO).

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