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## A new combination in *Angiactis* (lichenised Ascomycetes: Roccellaceae)

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### Introduction

The genus *Angiactis* was introduced by Aptroot *et al.* (2008) to accommodate three crustose species of the lichen family Roccellaceae, recorded from southern Australia, Bermuda and the Galápagos Islands respectively. The type species, *A. littoralis*, was initially described by Kantvilas (2004) in the genus *Lecanographa*, but with considerable hesitation as that genus was perceived simply as the best fit at the time for what was clearly a novel and remarkable species.

*Angiactis* is characterised by an ecorticate, crustose thallus containing gyrophoric acid, a thick, cretaceous medulla, a *Trentepohlia* photobiont, ascomata with a thick, prominent, thalline margin, a dark-pigmented or carbonised, cupular proper excipulum in which the dark pigments are KOH–, hemiamyloid, eight-spored asci approximating the *grumulosa*-type (terminology after Egea & Torrente 1994), slender, branched and anastomosing paraphysoids, hyaline, transversely 3–7-septate ascospores with cylindrical locules and usually with a thin gelatinous sheath, and rod-shaped conidia. *Lecanographa* differs from *Angiactis* chiefly in that its ascomata lack a thalline margin (Kantvilas 2004; Aptroot *et al.* 2008) and that the dark ascomatal pigments react strongly olive in KOH.

### Abstract

The new combination *Angiactis banksiae* (Müll.Arg.) Kantvilas & Stajsic is proposed. The ecology of this remarkable species, known from coastal south-western Western Australia, Victoria, Flinders Island (Tasmania) and southern New South Wales, is discussed.

**Keywords:** *Lecanographa*, rare species, taxonomy

In the course of reviewing lichen type material held at the National Herbarium of Victoria (MEL), one of us (VS) located material of *Platygrapha banksiae* Müll.Arg., a name that has not been in use since its description (Müller 1893). Field work at the type locality failed to locate this species but searches of similar habitats at nearby Westernport Bay yielded collections which matched the protologue and type of *P. banksiae*. Detailed study proved that the material was also identical to *Angiactis littoralis*. The necessary new combination is introduced here, and *A. littoralis* is placed in synonymy.

## Material and methods

This study is based on specimens housed in the Australian National Herbarium (CANB), the National Herbarium of Victoria (MEL) and the Tasmanian Herbarium (HO), as well as on field observations by the authors. Morphological and anatomical investigations were undertaken on hand-cut sections of the thallus and apothecia, using standard methods, reagents and stains (water, 10% KOH, Lactophenol Cotton Blue, ammoniacal erythrosin and Lugol's Iodine). Measurements of ascospores are presented in the format 5<sup>th</sup> percentile–average–95<sup>th</sup> percentile, with outlying values in brackets and *n* being the number of observations. Routine chemical analysis was undertaken using standard methods (Orange *et al.* 2010; Elix 2014).

## Taxonomy

### *Angiactis banksiae* (Müll.Arg.) Kantvilas & Stajsic comb. nov.

Mycobank No.: MB 833564

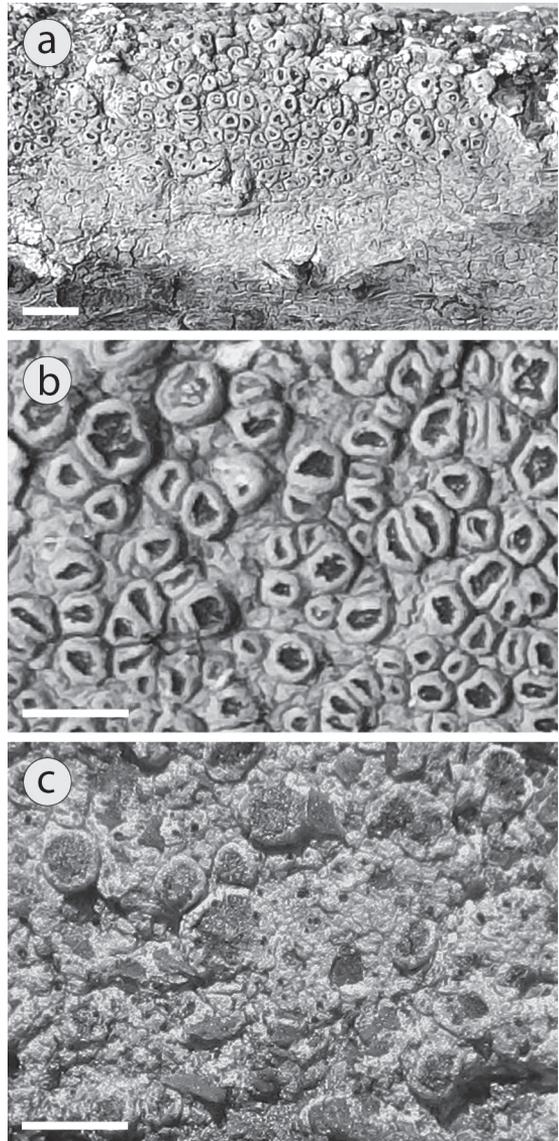
*Platygrapha banksiae* Müll.Arg., *Bull. Herb. Boissier* 1: 55 (1893); *Schismatomma banksiae* (Müll.Arg.) *Zahlbr., Cat. Lich. Univ.* 2: 554 (1923) [1924]. Type: [Australia] Victoria: Cheltenham, [37°58'S 145°03'E], on bark of *Banksia serrata* by [the] sea, 1892, *Rev. F.R.M. Wilson* 364 (lectotype-G, here designated; isolectotypes–MEL 26181!, NSW).

*Angiactis littoralis* (Kantvilas) Aptroot & Sparrius, *Bryologist* 111: 513 (2008); *Lecanographa littoralis* Kantvilas, *Symb. Bot. Upsal.* 34(1): 197 (2004).

**Type: Australia.** Western Australia, Cape Leeuwin, on dead *Melaleuca* twigs in coastal heathland, 34°22'S

115°07'E, 9 October 1992, G. Kantvilas 320/92 & J. Jarman (holotype–HO!; isotypes: BM!, GZU!, PERTH!, UPS!).

Thallus scurfy-crustose to ± byssoid, whitish to pale yellowish cream or greyish green, 0.1–1 mm thick, forming irregular, rather discontinuous, bullate-areolate patches to c. 10 cm wide; photobiont cells irregularly roundish, 12–20 × 12–14 µm. Ascomata apothecia, roundish, 0.3–1.2 mm wide, adnate to basally constricted, scattered and solitary, or in clusters of 2–4;



**Figure 1.** Morphology of *Angiactis banksiae*. a, b. Corticolous specimen, Victoria (V. Stajsic 7002 & J.G. Eichler). c. Saxicolous specimen, New South Wales (P.M. McCarthy 4476).

Scales: a = 2 mm; b, c = 1 mm.

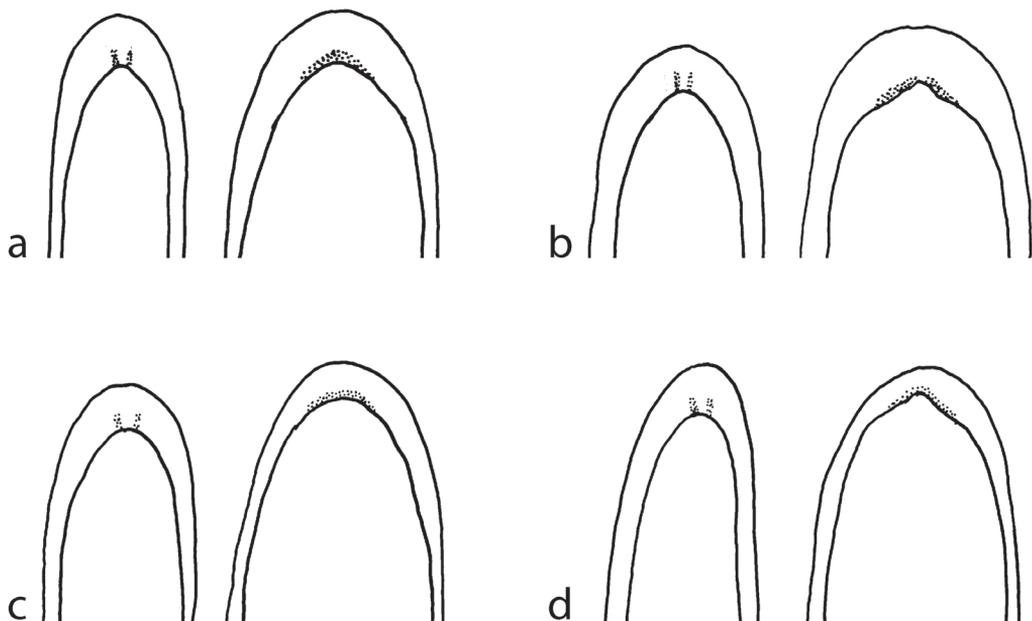
thalline margin entire, 60–100(–150)  $\mu\text{m}$  thick; disc plane, undulate to convex, black, usually coarsely and thickly white pruinose. Proper excipulum in section 6–20  $\mu\text{m}$  thick laterally, 25–40  $\mu\text{m}$  thick basally, but extending a ‘foot’ into the medulla. Hypothecium hyaline to pale brownish, 30–60  $\mu\text{m}$  thick. Hymenium 70–100  $\mu\text{m}$  thick; asci 60–90 x 10–18  $\mu\text{m}$ , approximating the *grumulosa* type, non-amyloid apart from a small, amyloid ring in the tholus when young; paraphysoids 1–1.5  $\mu\text{m}$  thick, strongly conglutinated. Ascospores ellipsoid-fusiform, 3–6(–7)-septate, (11–)18–20.3–23(–24) x (4–)5–5.5–6.5  $\mu\text{m}$  ( $n=110$ ); wall 0.5–1  $\mu\text{m}$  thick; gelatinous perispore seen mainly in immature spores. Pycnidia immersed; conidia rod-shaped, 5–8 x 1–1.5  $\mu\text{m}$ . Chemical composition: gyrophoric acid and lecanoric acid (trace); thallus K–, KC+ reddish, C+ reddish, P– (Figures 1 and 2).

**Remarks:** This species is easily recognised in the Australian biota by its cretaceous, pale thallus, pruinose apothecia with a thalline margin (Figure 1) and, anatomically, by the *grumulosa*-type asci and ellipsoid-fusiform, transversely septate ascospores. There are no known confusing species. Minor variations in thallus chemistry and morphological characters, pertaining mainly to apothecial shape and position, separate it

from the other species of the genus (see Aptroot *et al.* 2008).

The *grumulosa*-type ascus was defined and illustrated by Egea and Torrente (1994). It features an essentially non-amyloid ascus wall but with a minute amyloid ring in the tholus, visible at certain stages of development. When first describing *A. littoralis* (as a *Lecanographa*), Kantvilas (2004) observed that the asci of this species deviated slightly from the *grumulosa*-type in the strict sense in that rather than having a ring, the tholus featured a thin amyloid sheath adjacent to the ascoplasm. Further study suggests that *Angiactis* asci can vary somewhat through their development (Figure 2). The ring is best observed in young asci. As the ascospores develop and the tholus becomes compressed, the ring also becomes compressed into the thin amyloid sheath as described and illustrated by Kantvilas (2004) or is obliterated altogether.

**Distribution and ecology:** *Angiactis banksiae* is now known from south-western Western Australia, Victoria, southern New South Wales and Flinders Island (Bass Strait). In each area, it has been recorded from quite different habitats, although nowhere is it common, and it remains to be established as to what its core habitat



**Figure 2.** Semi-schematic depiction of the asci of *Angiactis*, with amyloid parts (after pretreatment with KOH) stippled; young asci on the left, mature asci on the right. a. *Angiactis banksiae* (isotype, MEL). b. *A. banksiae* (McCarthy 4476); c. *A. banksiae* (Stajsic 7002 & Eichler). d. *A. spinicola* (Galápagos, Bungartz 7948; HO).

and ecological requirements might be. The common feature of all the localities is that they are coastal, which is consistent with the distribution of the two other species of the genus, found on Galápagos and Bermuda. In Western Australia, *A. banksiae* grows on the twigs of shrubs in dense, low coastal heathland. On Flinders Island, it is confined exclusively to large outcrops of calcarenite, where it is restricted to shady underhangs, associated with *Enterographa cretacea* P.M. McCarthy & Elix. On the south coast of New South Wales, this species occurs on moderately to strongly sheltered siliceous rocks, principally quartzitic and other hard sandstones, as well as shale, in and above the supralittoral zone of rocky seashores. It forms part of a rich community dominated by crustose lichens, including *Amandinea* spp., *Buellia* spp., *Catillaria austrolittoralis* Kantvilas & van den Boom, *Diploicia canescens* subsp. *australasica* Elix & Lumbsch, *Enterographa cretacea*, *Halecania subsquamosa* (Müll.Arg.) van den Boom & H. Mayrhofer, *Opegrapha* spp., *Porina corrugata* Müll.Arg., *P. guentheri* (Flot.) Zahlbr. and *Solenopsis vulturiensis* A. Massal. In Victoria, *Angiactis banksiae* is known from a single site at Jam Jerrup, Westernport Bay, where it grows on the branches of *Avicennia marina* subsp. *australasica* (Grey Mangrove), and is associated with *Caloplaca subluteoalba* S.Y. Kondr. & Kärnefelt, *Enterographa divergens* (Müll.Arg.) Redinger, *Opegrapha varia* Pers. and several additional, as yet unidentified crustose lichens. Most of the historic collections were gathered from *Banksia integrifolia* subsp. *integrifolia*, but a search for the lichen on this tree species in Victoria was not successful. *Angiactis banksiae* has been searched for in coastal habitats across its range elsewhere, notably along the South Australian coast, on Kangaroo Island and the Tasmanian mainland, but again without success.

Lichens have a remarkable propensity for “finding” their niche. Thus it is not unusual to find typically alpine species in lowland, fire-protected refugia; examples include *Thamnolia vermicularis* (Sw.) Schaer. and *Parasiphula fragilis* (Hook.f. & Taylor) Kantvilas & Grube, two high elevation taxa that have been found in lowland dry sclerophyll woodland on fire-protected rock plates. Similarly, typical wet forest lichens, such as species of the Lobariaceae and Sphaerophoraceae, are sometimes found in marginally moister, highly protected microhabitats in a dry environment. Terricolous species

that might normally be found in a dry exposed site, e.g. *Trapelia* spp., can become established on the elevated soil mound of a toppled wet forest tree. Narrow ecological niches and highly disjunct distributions are also not uncommon in lichens. For example, a very similar ecological range is displayed by *Porina corrugata*, which occupies an almost identically broad suite of substrata (siliceous rock, limestone, and *Banksia* and *Melaleuca* stems) in coastal & seashore habitats across southern mainland Australia and Tasmania, as well as in South Africa and New Zealand. Further examples are shown by the Roccellaceae, notably *Ocellomma rediuntum* (Stizenb. ex Hasse) Kantvilas, Gueidan & Tehler, which occurs in starkly different habitats at several, widely separated localities in south-eastern Australia and western North America (Kantvilas *et al.*, in press). At the same time, the Roccellaceae is also noteworthy for containing a relatively high number of small genera, rare and highly localised species, and species of high conservation value (e.g. Ertz *et al.* 2015; Follman & Werner 2000; Grube 1998; Tehler & Irestedt 2008; Tehler *et al.* 2009). *Angiactis banksiae* fits this profile extremely well and the next discovery of this remarkable species is greatly anticipated.

**Other specimens examined: NEW SOUTH WALES:** South Coast, 5 km N of Bermagui, Camel Rock, 36°22'41" 150°04'37"E, 3 m alt., on sheltered quartzitic sandstone on the seashore, above the splash zone, 10 Feb. 2016, P.M. McCarthy 4476 (CANB, HO); South Coast, Pooles Beach, 3 km S of Mystery Bay, 36°18'46"S, 150°07'57"E, c. 1 m alt., on exposed shale outcrops along foreshore, 18 Nov. 2016, P.M. McCarthy 4532, 4557 (CANB); South Coast, Ben Boyd National Park, Green Cape Peninsula, Haycock Point, 36°57'03"S, 149°56'10"E, c. 1.5 m alt., on hard, sheltered sandstone on the seashore, 21 Mar. 2018, P.M. McCarthy 4754 (CANB). **VICTORIA:** Black Rock, 37°58'S 145°01'E, 26 Dec. 1899, R.A. Bastow s.n. (MEL 1071547); *ibid.* (MEL 515681); Sandringham, 37°57'S 145°00'E, 26 May 1900, R.A. Bastow 88 (MEL 515680); *ibid.* (MEL 26182); Jam Jerrup, Stockyard Point, c. 500 m S from the carpark, 38°19'52.35"S 145°30'57.04"E, corticolous on living stems and branches of *Avicennia marina*, 29 Mar. 2014, V. Stajsic 7002 & J.G. Eichler (BR, HO, MEL). **TASMANIA:** Flinders Island, Cave Beach, 40°01'S 147°53'E, 2 m alt., on soft, Tertiary limestone [calcarenite], 28 Dec. 1997, G. Kantvilas 311/97 (HO); *ibid.*, 23 Jan. 2006, G. Kantvilas 81/06 (HO); *ibid.*, 23 Mar. 2014, G. Kantvilas 226/14 (BR, HO).

## Notes on *Platygrapha* in Australia

The genus *Platygrapha* was introduced by Nylander (1855) and is now regarded as a synonym of *Schismatomma* (Tehler 1993), although the many species it formerly included are now combined in several genera, chiefly in the Roccellaceae and Graphidaceae. McCarthy (2018) lists two species of *Platygrapha* for Australia: *P. banksiae*, which is dealt with above, and *P. congerens* Nyl. The latter species is represented solely by the type specimen (in H), attributed to the 19<sup>th</sup> Century collector Augustus Oldfield, originating from the herbarium of William Mitten. Although labelled as being from Tasmania, this is by no means certain as intensive lichenological activity in Tasmania over the last four decades has not revealed any further collections.

Oldfield collected in Tasmania as well as on the Australian mainland (Henderson & Henderson 2018), whereas Mitten's herbarium (now held in the New York Botanic Gardens Herbarium) comprises specimens from all over the world. Therefore a confusion of provenance is possible. The type of *Platygrapha congerens* was studied by Tehler (1993) who ascribed it to the Lecanorales. The same specimen was also examined by the first author who observed the following salient characters: apothecia 0.2–0.5 mm wide, occurring singly or grouped in stroma to 1 mm wide; disc red-brown to black-brown, hypothecium reddish brown,  $\pm$  wedge-shaped in section; asci approximating the *Bacidia*-type, eight-spored; paraphyses sparsely branched; ascospores hyaline, narrowly cylindrical, 3–5-septate, 14–17  $\times$  3–3.5  $\mu$ m. Until further collections are made, this taxon remains unclassified, but its position in any genus of the Roccellaceae is untenable.

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## References

- Aptroot, A., Sparrius, L.B., LaGreca, S. and Bungartz, F. (2008). *Angiactis*, a new crustose lichen genus in the Roccellaceae, with species from Bermuda, the Galápagos Islands and Australia. *Bryologist* **111**, 510–516.
- Egea, J.M. and Torrente, P. (1994). El género de hongos liquenizados *Lecanactis* (Ascomycotina). *Bibliotheca Lichenologica* **54**, 1–205.
- Elix, J.A. (2014). *A Catalogue of Standardized Chromatographic Data and Biosynthetic Relationships for Lichen Substances*. Third Edition. Published by the author, Canberra.
- Ertz, D., Tehler, A., Irestedt, M., Frisch, A., Thor, G. and van den Boom, P. (2015). A large-scale phylogenetic revision of Roccellaceae (Arthoniales) reveals eight new genera. *Fungal Diversity* **70**, 31–53.
- Follman, G. and Werner, B. (2000). New saxicolous *Roccella* species from Galápagos and reflections on the evolution of the Roccellaceae (Arthoniales) on the “Enchanted Islands”. *Bibliotheca Lichenologica* **75**, 1–18.
- Grube, M. (1998). Classification and phylogeny in the Arthoniales (lichenized Ascomycetes). *Bryologist* **101**, 377–391.
- Henderson, H.M. and Henderson, W.G. (2018). *The greater prize than gold: Augustus Oldfield, nineteenth century botanical collector and ethnographer*. The Book Reality Experience: Perth, W.A.
- Kantvilas, G. (2004). A contribution to the Roccellaceae in Tasmania: new species and notes on *Lecanactis* and allied genera. *Symbolae Botanicae Upsalienses* **34(1)**, 183–203.
- Kantvilas, G., Gueidan, C. and Tehler, A. (in press). The strange case of *Ocellomma rediuntum* (Arthoniales: Roccellaceae) in Australia: a remarkably disjunct lichen. *Lichenologist*.
- McCarthy, P.M. (2018). *Checklist of the Lichens of Australia and its Island Territories*. Australian Biological Resources Study, Canberra. Version 17 May 2018. <http://www.anbg.gov.au/abrs/lichenlist/introduction.html>.
- Müller, J. (1893). Lichenes Wilsoniani a Lichenes a cl. Rev. F.R.M. Wilson in Australiae prov. Victoria. *Bulletin de l'Herbier Boissier* **1**, 3–65.
- Nylander, W. (1855). Essai d'une nouvelle classification des lichens (second mémoire). *Mémoires de la Société des Sciences Naturelles de Cherbourg* **3**, 161–202.
- Orange, A., James, P.W. and White, F.J. (2010). *Microchemical Methods for the Identification of Lichens*. 2<sup>nd</sup> edition. British Lichen Society: London.
- Tehler, A. (1993). The genus *Schismatomma* (Arthoniales, Euascomycetidae). *Opera Botanica* **118**, 1–38.
- Tehler, A. and Irestedt, M. (2008). Endemism in the lichen flora of California with examples from the Arthoniomycetidae. The 6<sup>th</sup> IAL Symposium and Annual ABLs Meeting. Asilomar, CA, USA, 13–19 July, 2008. *Biology of Lichens and Bryophytes*. Program. p. 70.
- Tehler, A., Irestedt, M., Wedin, M. and Ertz, D. (2009). Origin, evolution and taxonomy of American *Roccella* (Roccellaceae, Ascomycetes). *Systematics and Biodiversity* **7**, 307–317.