Swainsona 38: 161–170 (2024)

Tasmanian additions to the genus *Inoderma* (Arthoniaceae)

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Abstract: The genus *Inoderma* (Ach.) Gray, a segregate of *Arthonia* Ach., is recorded for the first time from Australasia (mainland Australia, Tasmania, New Zealand). It is represented by two species: *I. applanatum* Kantvilas (*sp. nov.*), characterized principally by a thallus containing 2'-*O*-methylperlatolic acid, 2 (–3)-septate ascospores, 9–13 × 3.5–5.5 µm, and emergent, subglobose to cylindrical pycnidia, and *I. platygraphellum* (Nyl.) Kantvilas (*comb. nov.*), characterized by a thallus containing 2'-*O*-methylperlatolic acid, (2–) 3–4-septate ascospores, 12–19 × 5–7 µm, and immersed to semi-immersed, globose pycnidia. These species are comprehensively described, illustrated and discussed in the context of the genus as whole. Salient features of all seven species of *Inoderma* are summarized. The lichenicolous fungus *Chaenothecopsis brevipes* Tibell (Mycocaliciaceae) is recorded for Tasmania for the first time.

Keywords: *Arthonia*, Australia, *Chaenothecopsis*, *Inoderma*, lichens, New Zealand, *Reichlingia*, taxonomy

Introduction

Tasmania supports a remarkable lichen flora, rich in novelties and reflective of the island's geographic location in the Southern Ocean as one of several fragments of the former supercontinent of Gondwana, as well as being the southernmost extremity of a more or less continuous land mass (at least in geological time) extending north-south from the tropics to cool temperate latitudes (Jarman & Kantvilas 1995; Kantvilas 1995, 1996, 2009; Kantvilas & Jarman 1998, 2012). For the last several decades, the author's focus has been to document the lichens of Tasmania and bring them to the attention of the wider scientific communtity (see Kantvilas 2023a). Some more recent contributions where significant additions have been made include Kantvilas (2024: *Cliostomum* Fr.), Kantvilas (2023b: *Schaereria* Körb.) and Kantvilas & Coppins (2019: *Micarea* Fr.).

With in excess of 700 species and around 20 genera (Jaklitsch *et al.* 2016; Lücking *et al.* 2017), Arthoniaceae is one of the largest families of lichen-forming fungi in the world. Having served traditionally as something of a 'dustbin', *Arthonia* Ach. itself has been the subject of considerable recent study, especially (but not exclusively) using molecular methods, leading to the reinstatement or description of many, usually small, segregate genera (e.g. Ertz *et al.* 2020; Frisch & Thor 2010; Frisch *et al.* 2014a, b, 2015; van den Broeck *et al.* 2018). However, it can be difficult, if not impossible, to place individual species into genera purely on morphological, anatomical or chemical data. The extent of the challenge posed by Arthoniaceae is particularly well illustrated by Aptroot *et al.* (2024) who, by using molecular methods, attempted to classify and describe many sterile, otherwise unidentifiable taxa.

The study of *Arthonia sens. lat.* in Tasmania is in its infancy, and preliminary studies indicate that its diversity will far exceed the modest 20 species currently listed in the Australian lichen checklist (McCarthy 2023). The most recent investigations have been directed to *Arthothelium* A.Massal., where 10 species were treated (Kantvilas 2021), and to the lichenicolous species of *Arthonia*, with eight species (Kantvilas & Motiejūnaitė 2023). Also present in Tasmania is the genus *Coniocarpon* DC. with one species, the widespread *C. cinnabarinum* DC. However, much work remains to be done, especially on *Arthonia* itself. The task is made more difficult by the fact that many of the taxa described from the broader Australasian region, and therefore relevant to a Tasmanian-based study, are based on often fragmentary type material and the scantiest of published descriptions. Thus, a major focus of any study is to attach old, existing names to comprehensive, contemporary descriptions, supported by specimens that allow for proper morphological, anatomical and chemical evaluation, not to mention molecular analyses. Notwithstanding these limitations, the study of Tasmanian Arthoniaceae continues, with one optimistic aim being to inspire further studies. In this paper, two further species are treated and ascribed to the genus *Inoderma* (Ach.) Gray, based on morphological and anatomical characters, bringing the total number of species worldwide for the genus to seven. These two species are comprehensively described, illustrated and discussed in the context of the genus worldwide.

Published online: 30 Sep. 2024 • flora.sa.gov.au/swainsona

ISSN 2206-1649 (Print) • ISSN 2206-1657 (Online)

Material & methods

The study is based chiefly on specimens housed in the Tasmanian Herbarium (HO), collected by the author, with reference to the holdings of other herbaria as cited in the text. Comparative data for non-Tasmanian species were drawn mostly from the literature. Anatomical observations and measurements are based on thin, hand-cut sections of the thallus, apothecia and pycnidia, mounted in water, 10% KOH (K), Lugol's Iodine, ammoniacal erythrosin and/or Lactophenol Cotton Blue. Standard spot tests of the thallus with K, C (commercial bleach solution) and P (paraphenylenediamine in ethanol), and fluorescense under long-wave UV light are indicated in the text. Where apothecial sections were pre-treated in K, then washed with water before mounting in Lugol's Iodine, the observations are designated in text as KI. The presence of calcium oxalate was determined by eluting thin sections of the thallus and apothecia with 25% H_2SO_4, which yields needle-like crystals. Ascospore measurements are presented in the format 5th percentile–*average*–95th percentile, with outlying values in brackets and *n* signifying the number of observations. Chemical analyses were undertaken by thin-layer chromatography (TLC) using standard methods (Orange *et al.* 2010) and reliably analyzed reference specimens. Solvent A was the preferred routine medium and specimens of *Buellia stellulata* (Taylor) Mudd var. *stellulata* and *Paraporpidia leptocarpa* (C. Bab. & Mitten) Rambold & Hertel, both previously analyzed by Prof. J.A. Elix, Canberra, were used as references for 2'-*O*-methylperlatolic acid.

Generic considerations

Inoderma was erected by Gray (1821), based on a crustose lichen that for much of the time since has been known by the name *Arthonia byssacea* (Weigel) Almq. The genus was brought back into use by Frisch *et al.* (2014a) and subsequently delimited and expanded to include four species by Frisch *et al.* (2015). A fifth species, *I. sorediatum* Ertz, Łubek & Kukwa was added by Ertz *et al.* (2018). A further species, *I. epigaeum* (Pers.) Gray, is today accommodated in *Thrombium* Wallr. (Purvis & Orange 2009).

The genus is characterized by an ecorticate, often ± byssoid thallus with a trentepohlioid photobiont, immersed to adnate, white-pruinose ascomata with a well developed hypothecium, a KI+ blue hymenium, inspersed in the upper part or overlain by granular crystals, branched and anastomosed paraphysoids imbedded in a gelatinous matrix and at most only slightly widened at the apices, asci approximating the *Arthonia*-type and lacking any KI+ blue structures in the tholus, and transversely septate, commonly macrocephalic, hyaline ascospores; critically, the conidiomata are elevated, white-pruinose pycnidia developing bacilliform conidia (Cannon *et al.* 2020; Frisch *et al.* 2015). Unlike most species of *Arthonia sens. lat.*, species of *Inoderma* also have a secondary chemistry which can include confluentic acid, 2'-*O*-methylperlatolic acid and/or lepraric acid (Frisch *et al.* 2015).

Generic placement of the two Australasian species treated below involved consideration of several possibilities, and it is conceded that future work (on them as well as on other relevant taxa in *Arthonia sens. lat.*) may well initiate further nomenclatural changes. The presence of secondary metabolites in the taxa studied, notably 2'-*O*-methylperlatolic acid, is significant, but this substance also occurs elsewhere in the family, including *Crypthonia* Frisch & G.Thor (Aptroot *et al.* 2024), *Cryptothecia* Sirt. (Jagadeesh Ram & Sinha 2016), *Glomerulophoron* Frisch, Ertz & G.Thor (Aptroot *et al.* 2024; Frisch *et al.* 2015), *Herpothallon* Tobler (Aptroot *et al.* 2009), *Myriostigma* Kremp. (Aptroot *et al.* 2015; Jagadeesh Ram & Sinha 2016), *Pachnolepia* A.Massal. (Aptroot *et al.* 2024), *Reichlingia* Diederich & Scheid. (Frisch *et al.* 2014b; Cannon *et al.* 2020; Morse & Ladd 2021), *Sporodophoron* Frisch, Y.Omura, Ertz & G.Thor (Frisch *et al.* 2015) and *Tylophoron* Nyl. (Cannon *et al.* 2020). Of these, *Crypthonia*, *Cryptothecia*, *Herpothallon* and *Myriostigma* were discounted on account of their having cryptothecioid fructifications, where instead of ascomata, the asci are dispersed or only loosely aggegated in ascigerous areas of the thallus (Thor 1997).

Pruinose ascomata are not uncommon in *Arthonia* and occur in *Reichlingia* and *Sporodophoron*, as well as in *Synarthonia* Müll.Arg. (Joseph & Sinha 2015), although this last genus was also discounted as an option for the Australasian taxa due to its tendency to form multi-locular hymenia, its black pycnidia and complex thallus chemistry that can comprise parietin, psoromic or evernic acids, or other compounds. *Sporodophoron* and *Glomerulophoron* both produce sporodochia, a type of conidioma where the condiophores are formed in pulvinate clusters on the thallus surface, but which is unknown in the Australasian species studied (Frisch *et al.* 2015). *Tylophoron* also produces sporodochia and differs further by having mazaediate ascomata (Cannon *et al.* 2020). The type species of *Pachnolepia*, *P. pruinata* (Pers.) Frisch & G.Thor, has pruinose ascomata, but it contains arthoniaic acid and has thread-like, short conidia (Cannon *et al.* 2020). It too was discounted, especially given that Aptroot *et al.* (2024) considered that their 2'-*O*-methylperlatolic acid-containing taxon, *P. longipseudisidiata* Aptroot *et al.*, to be only tentatively ascribed to this genus. *Reichlingia*, as outlined, for example, by Frisch *et al.* (2014b) and Morse & Ladd (2021), shares several features with the Australasian taxa, in particular the relatively broad, flat and adnate apothecia. It differs, however, by having ± stellate-branched apothecia with the hymenium often cracked with deep fissures, and ascospores with a tendency to become rough-walled and brownish with age (e.g. Cannon *et al.* 2020), whereas in the Australasian species studied, the apothecia remain entire and the ascospores are hyaline and smooth-walled throughout development. Furthermore, the type species of *Reichlingia*, *R. leopoldii*

Diederich & Scheid., has sporodochia (Diederich & Scheidegger 1996), whereas *R. anombrophila* (Coppins & P. James) Frisch has immersed pycnidia (Coppins 1989). In sharp contrast, both Australasian taxa have emergent, elevated, pruinose pycnidia that are ± identical to those illustrated for *Inoderma afromontanum* Frisch & G.Thor by Frisch *et al.* (2015). It is an evaluation of these generic possibilities that led to *Inoderma* being considered the best fitting taxonomic placement for the species studied here.

Delimitation of the species of *Inoderma* is based on the combination of often rather subtle differences in apothecial and pycnidial morphology, ascospore size and septation, and thallus secondary chemistry. Salient features of the seven known species are summarized in Table 1, which offers a synoptic aid to their identification.

Taxonomy

Inoderma applanatum Kantvilas, ***sp. nov.***

Holotypus: Australia, Tasmania, end of Bolduans Road, 40°47'S 145°02'E, 1 m, on *Melaleuca ericifolia* in *M. ericifolia*-dominated swampy, coastal woodland, 30 Nov. 2011, *G. Kantvilas 476/11* (HO563787).

Mycobank number: MB855603.

Thallus white to whitish grey, ecorticate, effuse, smooth, 30–100 (–150) µm thick, forming diffuse, widespreading patches to 30 cm or more wide; medulla KI+ pale blue, lacking calcium oxalate; prothallus absent. *Photobiont* in clumps or chains, with cells subglobose to ellipsoid, 8–16 × 7–10 µm.

Apothecia roundish to irregularly ellipsoid, sometimes a little lobate, 0.5–1.5 (–2) mm wide, 80–160 µm thick, scattered and abundant, rarely fusing, adnate, ± flush with the thallus surface, plane to slightly convex, typically immarginate but sometimes surrounded by a thin, byssoid rim of white hyphae when very young; disc reddish brown to grey-brown, when young with a thin whitish pruina, frequently epruinose or almost so when older; exciple ± excluded, in section reduced to a ± opaque reddish brown, K+ olive-green to greyish green layer 10–70 µm thick beneath and poorly differentiated from the hypothecium. *Hypothecium* 30–80 µm thick, hyaline to patchily pale reddish brown, K+ olive-green. *Hymenium* 30–40 µm thick, mostly hyaline, KI+ blue, overlain by a granular-crystalline epithecium c. 10 µm thick, mostly dissolving in K. *Paraphysoids* c. 1.5 µm thick in the lower part, expanded to 2–3 µm at the apices and mostly pigmented greyish. *Asci* broadly clavate to obovoid, of the *Arthonia*-type, with an extended, basal "foot" especially when young, 25–38 × 12–18 (–26) µm; ascoplasm in young asci truncate, with a short, beak-like

Table 1. Comparison of salient features of the species of *Inoderma*.

Species	Distribution and habitat	Thallus chemistry	Apothecia	Ascospores	Pycnidia and conidia
I. afromontanum Frisch & G.Thor	East Africa; dry bark of large, old trees	2'-*O*-methyl-perlatolic acid	0.5–0.8 mm wide; slightly convex; thinly pruinose	8–10 × 3.5–4 µm; 3-septate; slightly macrocephalic	emergent, subglobose, 0.3–0.45 mm wide; conidia 3–6 × 1–2 µm
I. applanatum Kantvilas	Tasmania and Victoria; papery bark in coastal woodland and swamp	2'-*O*-methyl-perlatolic acid	0.5–1.5 (–2) mm wide; plane to slightly convex; thinly pruinose or epruinose	9–13 × 3.5–5.5 µm; 2 (–3)-septate; macrocephalic	emergent, subglobose to cylindrical, basally ± constricted, 0.1–0.2 mm wide; conidia 3.5–6 × 1.5–2 µm
I. byssaceum (Weigel) Gray	temperate Northern Hemisphere; dry bark of old trees or in old-growth forest	2'-*O*-methyl-perlatolic acid and unknown substances	0.4–1 mm wide; slightly to strongly convex; thickly pruinose	11–19 × 4–6 µm; (2–) 3–4 (–5)-septate; slightly macrocephalic	emergent, subglobose, 0.15–0.4 mm wide; conidia 4–6 × 1–1.5 µm
I. nipponicum Frisch, Y.Ohmura & G.Thor	Japan; bark of old trees	lepraric acid	0.4–0.6 mm wide; slightly convex; thickly pruinose	13–16 × 3–4 µm; (2–) 3–4-septate; not macrocephalic,	emergent, basally constricted, 0.25–0.5 mm wide; conidia 3–8 × 1–1.7 µm
I. platygraphellum (Nyl.) Kantvilas	Tasmania, south-eastern Australia, New Zealand; dry bark of old trees in old-growth forest	2'-*O*-methyl-perlatolic acid	0.5–2.5 mm wide; plane to convex; thickly pruinose	12–19 × 5–7 µm; (2–) 3–4-septate; macrocephalic	immersed to semi-immersed, ± globose, 0.15–0.2 mm wide; conidia 4.5–7 × 1–1.5 µm
I. sorediatum Ertz, Łubek & Kukwa	north-eastern Poland; old trees in old-growth forest	confluentic and 2'-*O*-methyl-perlatolic acids	unknown	unknown	emergent, subglobose, 0.17–0.28 mm wide; conidia 3.5–5 × 1.1–1.3 µm
I. subabietinum (Coppins & P. James) Ertz & Frisch	western Europe; dry bark of old trees	confluentic and lepraric acids	unknown	unknown	emergent, 0.2–0.45 mm wide; conidia 3–7 × 1–1.7 µm

ocular chamber or, more commonly concave and with the ocular chamber not developed. *Ascospores* clavate-ellipsoid, 2 (–3)-septate, macrocephalic, with an enlarged proximal cell, albeit sometimes only slightly, 9–*10.7*–13 × (3.5–) 4–*4.5*–5 (–5.5) µm (*n* = 80), remaining smooth-walled and hyaline throughout development.

Conidiomata pycnidia, at first immersed, then emergent, subglobose to cylindrical when well developed, superficial or basally constricted, 0.18–0.2 mm tall, 0.1–0.2 mm wide, whitish due to a thin veil of thalline tissue; wall in section dark brown, K+ olive greenish; ostiole central, black, 50–80 µm wide, becoming gaping with age; conidia bacilliform to ellipsoid, 3.5–5 (–6) × 1.5–2 µm. **Figs 1A–B, 2A–C.**

Chemistry. 2'-*O*-methylperlatolic acid; thallus K–, KC–, C–, P–, UV+ pale bluish white.

Diagnosis. Containing 2'-*O*-methylperlatolic acid, and most similar to *Inoderma platygraphellum* (Nyl.) Kantvilas, from which it differs by its smooth, effuse thallus, thinly pruinose or epruinose ascomata, and smaller, 2–3 (–4)-septate ascospores, 9–13 × 3.5–5.5 µm, and its subglobose to cylindrical pycnidia.

Etymology. The specific epithet alludes to the highly flattened, adnate apothecia of the new species.

Remarks. Within the Tasmanian and temperate Australian lichen biota, *Inoderma applanatum* is easily

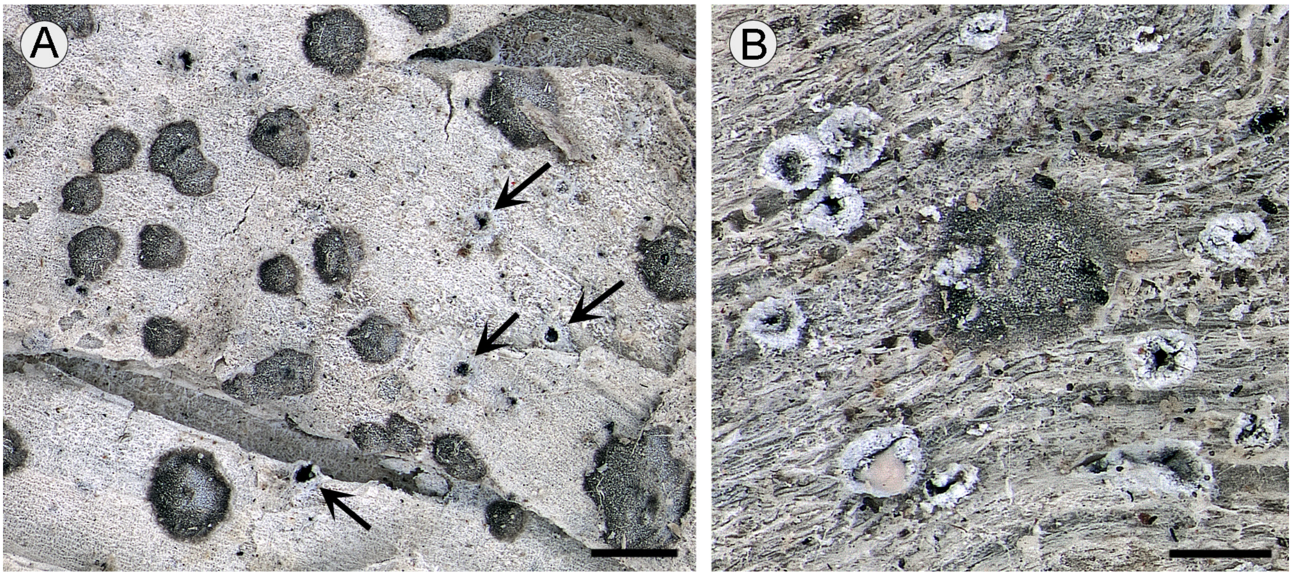

Fig. 1. *Inoderma applanatum* morphology. **A** Plane, adnate, thinly pruinose apothecia and emergent pycnidia (arrows). **B** Detail of pycnidia. Scale bars: A = 1 mm, B = 500 µm. Photos: J. Jarman.

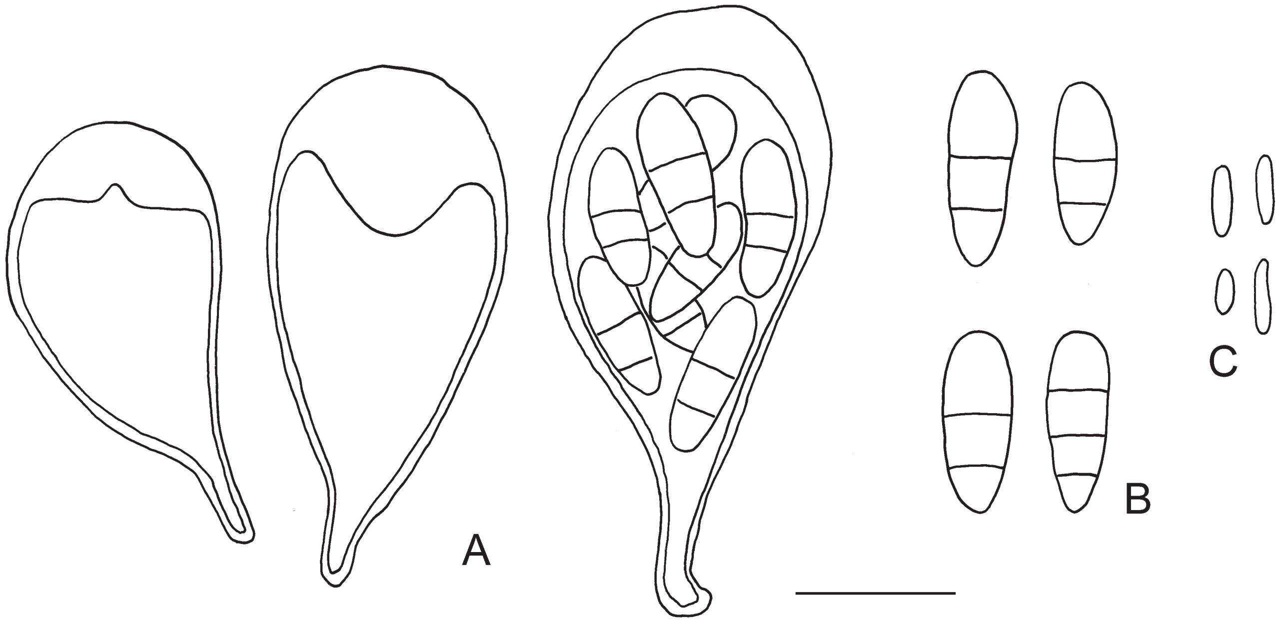

Fig. 2. *Inoderma applanatum* anatomy. **A** Non-amyloid asci, with young asci on left and mature, 8-spored ascus on right. **B** Ascospores. **C** Conidia. Scale bars = 10 µm.

recognised by the extensive, widely spreading, grey, diffuse thallus containing 2'-*O*-methylperlatolic acid, the broad, adnate, lightly grey-pruinose ascomata, the relatively small, 2 (–3)-septate ascospores, 9–13 × 3.5–5.5 µm, and the conspicuous, emergent pycnidia. Whereas some of these features are shared with *I. platygraphellum* (see below), that species differs by having larger ascospores, as well as a scurfy thallus, more convex and more heavily pruinose apothecia, and persistently globose to subglobose pycnidia. Critically, the two taxa have starkly different habitat ecologies and are never sympatric (see discussion below). The non-Australasian species differ from *I. applanatum* principally by having ascospores with at least three or more septa; in the case of *I. byssaceum* and *I. nipponicum* Frisch, Y.Ohmura & G.Thor, these are also longer, whereas those of *I. afromontanum* are shorter (Table 1). Some of these dimensions differ only subtly, but the pycnidia of *I. applanatum* help to further distinguish it from all others: in no other member of the genus do these become so markedly cylindrical and up to 0.2 mm tall.

All specimens seen of *I. applanatum* are remarkably uniform in morphology and anatomy. The diagnostic pycnidia are frequent and are usually scattered across the thallus amongst the ascomata. In section, the brownish K+ olive-green ascomatal pigment appears to be the same as that seen in other Arthoniacaeae and was described by Kantvilas (2021) as *Interveniens*-brown. The epithecial crystals are of unknown composition but are not calcium oxalate.

The two specimens cited from Victoria (MEL26223, MEL26224; both collected by F.R.M. Wilson) are unequivocally the new species, containing 2'-*O*-methylperlatolic acid and having the characteristic, small, mostly 2-septate ascospores, even though they are labelled as isotypes of a different (and unrelated) taxon, *Arthonia nigrorufa* Müll.Arg. Müller (1893) described *A. nigrorufa* as having 3-septate ascospores, 13–16 × 5–6 µm, and these are also illustrated on his type specimen in G (Victoria, Lakes Entrance, 1892, *F.R.M. Wilson 1579*, G00290268). Significantly, this specimen also has stellate, epruinose apothecia. A possible duplicate of this collection is housed in NSW (Victoria, Metung, *s.dat.*, *F.R.M. Wilson 1579*, NSW2028302, annotated "1579 Dup."). This collection also has stellate, epruinose apothecia and 3-septate ascospores larger than the new species (13–20 × 5–7 µm). It also lacks any secondary substances detectable by TLC and, critically, the ascospores become grey and rough-walled at maturity, characters that distinguish it from *I. applanatum* and from the genus *Inoderma* in general.

Distribution and ecology. This species is locally abundant in Tasmania, albeit with a highly specialised, restricted ecology. It is found commonly in coastal, swampy *Melaleuca ericifolia*-dominated low woodlands, or in eucalypt-dominated woodland in similar, lowland coastal locations, usually where *Meleleuca ericifolia* is also present. Although seen most commonly on this host, where it forms extensive, conspicuous whitish colonies extending over many 10s of centimetres of the loose, papery bark of mature trunks, it can also be found on other substrata, such as the rough bark of *Acacia melanoxylon* or on the dead, decorticated wood of eucalypts. The Victorian collections are from coastal vegetation, but with no further ecological details.

The Tasmanian habitat of this remarkable lichen has been noted previously for its diverse and unusual lichen flora by Baker *et al.* (2021), de Salas *et al.* (2023) and Kantvilas (2024). These *Melaleuca ericifolia* woodlands, described briefly by Harris & Kitchener (2005), essentially represent the climax, old growth vegetation community for extensive areas along the northern Tasmanian coast and King Island. Yet, due to their occurrence on prime agricultural land, they have been extensively cleared for farming (chiefly dairying) or degraded by serving as shelter for stock. It is estimated that as much as 70% of this vegetation has been lost since European settlement (Department of Natural Resources and Environment Tasmania 2022).

In the last two decades or so, the author has explored these swamps for lichens, both in an *ad hoc* casual manner and as part of more detailed surveys (under the banner of the Tasmanian Museum and Art Gallery Expeditions of Discovery). This vegetation type has proved to be remarkable for its lichens, in so far as these are frequently species not found anywhere else in Tasmania, or ones that attain their best development in this vegetation. The most significant species, all potentially rare or highly localised, and associated with *I. applanatum* are *Bacidia septosior* (Nyl.) Zahlbr., *Bactrospora metabola* (Nyl.) Egea & Torrente, *Bact. paludicola* Kantvilas, *Caloplaca pulcherrima* (Müll.Arg.) S.Y.Kondr. & Kärnefelt, *Enterographa micrographa* (Nyl.) Redinger, *Haematomma sorediatum* R.W.Rogers, *Leptogium coralloideum* (Meyen & Flot.) Vain. and *Pseudocyphellaria aurata* (Ach.) Vain., as well as two undescribed taxa in *Arthothelium* and *Enterographa* respectively. More widespread species also associated with *I. applanatum* are *Arthothelium ampliatum* (C.Knight & Mitt.) Müll. Arg., *Cliostomum griffithi* (Sm.) Coppins, *Ochrolechia africana* Vain., *Pannaria elixii* P.M.Jørg. & D.J.Galloway and several unidentified species of *Opegrapha*.

Additional specimens examined.

TASMANIA. **North West:** Denium Hill at end of Robbins Island Track, 40°55'S 144°53'E, 5 m, 10 Dec. 1993, *G. Kantvilas 133/93, 153/93 & J. Elix* (HO); 1 km SE of Wiltshire along Bass Hwy, 40°50'S 145°17'E, 5 m, 28 June 1999, *G. Kantvilas 274/99* (HO); near Stanley Cemetery, 40°49'S 145°14'E, sea-level, 1 Dec. 2011, *G. Kantvilas 493/11* (HO); Tatlows Beach, 40°47'S 145°17'E, 1 m, 15 May 2019, *G. Kantvilas 156/19* (HO); beyond end of Bolduans Rd, 40°47'S 145°02'E, 1 m, 22 Oct. 2021, *G. Kantvilas 424/21* (HO, UPS); Woolnorth, 'Paperbark Corner', 40°44'S 144°43'E, 15 m, 6 Feb. 2023, *G. Kantvilas 41/23* (HO); Woolnorth, Prospect Hills, 40°42'S 144°42'E, 70 m, 8 Feb. 2023, *G. Kantvilas 116/23* (E, H, HO); Woolnorth, Three Sticks Run, 40°43'S 144°43'E, 30 m, 9 Feb. 2023, *G. Kantvilas 140/23*, *167/23*, *194/23* (HO). **North East:** Stony Head Military Training Area, Ryans Hill, 41°01'S 147°02'E, 16 Mar. 2021, *G. Kantvilas 315/21* (HO); Waterhouse Rd near Old Port Rd intersection, 40°55'S 147°55'E, 20 m, 12 Sep. 2021, *G. Kantvilas 382/21* (HO). **King Island:** Pegarah Forest Reserve, 39°56'37"S 143°59'28"E, 36 m, 23 Oct. 2023, *G. Kantvilas 326/23*, *331/23* (H, HO, UPS); Pennys Lagoon, 39°39'28"S 144°04'16"E, 14 m, 24 Oct. 2003, *G. Kantvilas 355/23* (HO); Collier Swamp Conservation Area, 40°05'47"S 143°58'41"E, 25 m, 26 Oct. 2023, *G. Kantvilas 414/23* (HO); Kentford Forest Conservation Area, 40°01'49"S 143°58'31"E, 110 m, 28 Oct. 2003, *G. Kantvilas 443/23* (HO); Kentford Forest Nature Reserve, 40°00'39"S 143°58'19"E, 105 m, 28 Oct. 2023, *G. Kantvilas 450/23* (HO).

VICTORIA. Lakes Entrance, 1901, *F.R.M. Wilson s.n.* (MEL 26223); Lakes Entrance, *s.dat.*, *F.R.M. Wilson s.n.* (MEL 26224).

Inoderma platygraphellum (Nyl.) Kantvilas, ***comb. nov.***

Arthonia platygraphella Nyl., *J. Linn. Soc., Bot.* 9: 258 (1866); *Schismatomma paltygraphellum* (Nyl.) Zahlbr., *Cat. Lich. Univ.* 2: 563 (1923). — **Type citation:** "Ad corticem eundem ac *Opegrapha subeffigurans*"; "Ad corticem ("on bark of the Totara Pine"), Dunedin" [under *O. subeffigurans*]. **Lectotype:** New Zealand, Otago, Green Island Bush, on Totara bark, 4 Nov. 1861, *W.L. Lindsay s.n.* (E00456523!), *fide* Galloway, *Fl. New Zealand Lichens* 13 (1985). **Isotype:** H-NYL4786!

Mycobank number: MB855604.

Thallus white to whitish grey, sometimes with a faint bluish tinge, ecorticate, effuse, scurfy crustose to patchily ± byssoid, 60–300 µm thick, densely inspersed with crystals (including calcium oxalate), forming diffuse, widespreading patches to 30 cm or more wide; medulla KI+ pale blue; prothallus absent. *Photobiont* in chains, with cells subglobose to ellipsoid, 12–22 × 8–16 µm.

Apothecia roundish, irregularly ellipsoid or lobate, 0.5–2.5 mm wide, 100–200 µm thick, abundant, often fusing into irregular, lobate clusters to 3.5 mm wide, adnate and ± flush with the thallus surface or a little elevated, plane to undulate to convex, immarginate or, more commonly, surrounded by a thin, byssoid rim to c. 0.1 mm wide of white hyphae at least when young; disc grey-brown to grey, persistently thickly covered by a whitish pruina; exciple ± excluded, in section reduced laterally to c. 35 µm wide or ± absent, basally opaque reddish brown, K+ olive-green, 40–100 µm thick, poorly differentiated from the hypothecium. *Hypothecium* 20–60 µm thick, hyaline to patchily pale reddish brown, K+ olive-green. *Hymenium* 40–50 µm thick, mostly hyaline, KI+ blue, overlain by a dense, granular-crystalline epithecium c. 10 µm thick that partly dissolves in K, sometimes also containing calcium oxalate crystals. *Paraphysoids* c. 1.5 µm thick in the lower part, neither expanded nor pigmented at the apices. *Asci* broadly clavate, approximating the *Arthonia*-type, 33–50 × 15–23 µm, usually with an extended, basal 'foot'; ocular chamber absent or at most forming a short, conical beak in the youngest asci. *Ascospores* clavate-ellipsoid, (2–) 3–4-septate, macrocephalic, with an enlarged proximal cell, (12–) 13–*15.1*–18 (–19) × 5–*5.8*–7 µm (*n* = 100), remaining smooth-walled and hyaline throughout development.

Coniodiomata pycnidia, immersed to semi-immersed, ± globose, 0.15–0.2 mm wide, with a white-pruinose, intially incurved but later ± erect collar; wall dark brown, K+ olive greenish; ostiole black, ultimately gaping to c. 0.1 mm wide; conidia bacilliform 4.5–7 × 1–1.5 µm. **Figs 3A–B, 4A–B.**

Chemistry. 2'-*O*-methylperlatolic acid; thallus K–, KC–, C–, P–, UV+ pale creamish white.

Remarks. This distinctive species is easily recognised in the temperate Australasian biota by its broad, arthonioid, adnate, pruinose apothecia. Despite superficial similarities, it is easily distinguished from the other Australasian species, *I. applanatum*, by several critical features, including a scurfy-byssoid rather than smooth thallus, the more convex apothecia, larger ascospores with more transverse septa, the at most semi-immersed, ± globose pycnidia, and the marginally longer conidia; by the time the ostiole is gaping, the pycnidia are usually empty.

It is difficult to evaluate the significance of calcium oxalate on the basis of available specimens. In Tasmanian material, *I. platygraphellum* always contains calcium oxalate (detected by the needle-like crystals formed following elution with 25% H_2SO_4), whereas *I. applanatum* does not. However, calcium oxalate was not observed in any specimens of *I. platygraphellum* from mainland Australia, nor in the type specimen from New Zealand.

Within the broader context of the genus as a whole, *I. platygraphellum* appears to be most similar to the temperate Northern Hemisphere's *I. byssaceum* (Weigel) Gray, and indeed the possibility of these taxa being conspecific was considered in the early stages of this study, especially given that there is a significant number of species that are shared between the climax, cool temperate, *Nothofagus*-dominated rainforests of Tasmania and the old-growth, *Quercus*-dominated old woodlands of the Northern Hemisphere (author's observations). However, these two species are clearly distinct, not only chemically but also in that *I. platygraphellum* has almost invariably wider apothecia (Table 1). The young asci of *I. byssaceum* also have a better developed and more persistent, acute ocular chamber, a character that may be indicative of even more fundamental differences between the two taxa. The Japanese species *I. nipponicum* likewise differs chemically and has non-macrocephalic ascospores, whereas *I. afromontanum* contains

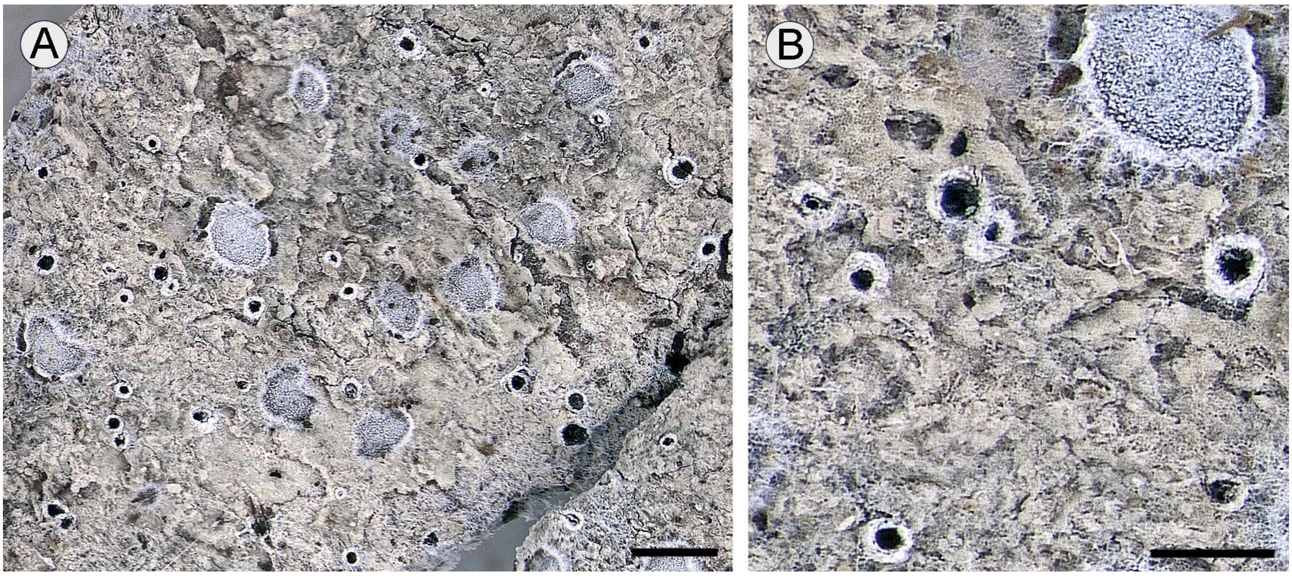

Fig. 3. *Inoderma platygraphellum* morphology. **A** Plane, adnate, thickly pruinose apothecia with a whitish rim, and semi-immersed pycnidia with black ostioles. **B** Detail of pycnidia. Scale bars: A = 1 mm, B = 500 µm. Photos: J. Jarman.

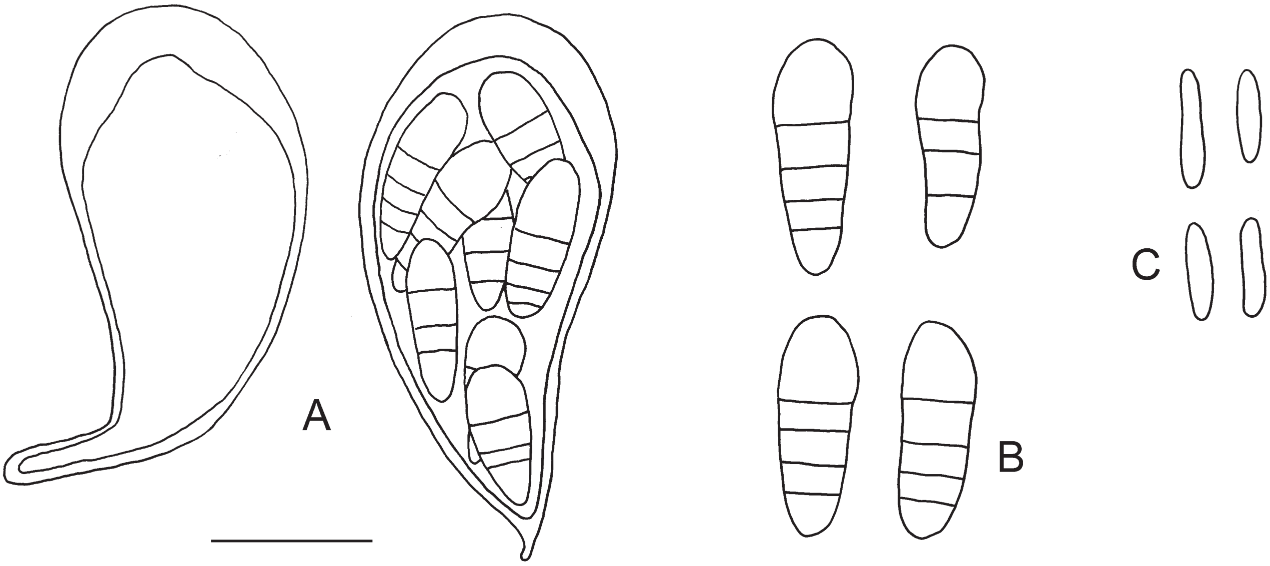

Fig. 4. *Inoderma platygraphellum* anatomy. **A** Non-amyloid asci, with young ascus on left and mature, 8-spored ascus on right. **B** Ascospores. **C** Conidia. Scale bars = 10 µm.

2'-*O*-methylperlatolic acid but has significantly smaller ascospores (Table 1).

In earlier, chiefly ecological accounts of the Tasmanian lichen flora (Kantvilas 1988; Kantvilas & Jarman 2012), this species was tentatively referred to as *Arthonia cinereopruinosa* Schaer., an unrelated species containing psoromic acid (Coppins & James 1978; Coppins 1989) and not present in Tasmania.

Distribution and ecology. This species was first described from New Zealand, where Galloway (2007) states that it is "widely distributed". It is here also recorded for Tasmania, Victoria and New South Wales, where it is occasionally seen on the dry, fissured, usually shaded and sheltered bark of the oldest trees in cool temperate rainforest and old-growth wet eucalypt forest, a habitat consistent with the ecology of other species of the genus (Frisch *et al.* 2015). One unusual collection is from dolerite in a deeply shaded cleft in eucalypt forest, a microhabitat interpreted as being relict from a time when old-growth forests were more extensive.

The typical, epiphytic habitat of this species is usually rich in lichens with a similar predilection for the oldest trees. These include *Arthonia apteropteridis* Kantvilas & Vězda, species of *Chaenotheca* and *Chaenothecopsis* (see below), *Cliostomum griffithii* (Sm.) Coppins, *Lecanactis abietina* (Ach.) Körb., *L. mollis* (Stirt.) Frisch & Ertz and *Micarea prasinastra* Coppins & Kantvilas.

Additional specimens examined

TASMANIA. **Central Highlands:** Little Fisher River, 9 June 1982, *G. Kantvilas 179/82* (HO, PRA-V); *ibid.*, 20 Oct. 1984, *G. Kantvilas 710/94* (HO, PRA-V); *ibid.*, 15 Feb. 1984, *G. Kantvilas 432/84 & P. James* (BM, HO). **East Coast:** Sandspit River, Wielangta Forest Walk, 42°42'S 147°50'E, 200 m, 12 Dec. 2017, *G. Kantvilas 327/17 & J. Jarman* (HO); track to Mt Hobbs, 42°31'S 147°35'E, 610 m, 18 Aug. 2019, *G. Kantvilas 193/19* (HO). **South West:** Adamsons Falls Track, 26 Sep. 1981, *G. Kantvilas 978/81* (HO); Riveaux Creek, 43°11'S 146°41'E, 120 m, 31 Oct. 1991, *G. Kantvilas 313/91, B. Fuhrer & J. Jarman* (HO); W of Tahune Bridge, site K688, 43°06'S 147°41'E, 14 May 2002, *G. Kantvilas 244/02* (HO); start of Mt Wedge Track, 42°50'S 146°16'E, 360 m, 31 Aug. 2010, *G. Kantvilas 165/10* (CANB, H, HO, S); North East Ridge Track to Mt Anne, 42°54'S 146°24'E, 340 m, 16 Apr. 2022, *G. Kantvilas 318/22* (HO).

VICTORIA. Bellel Creek, 5 Oct. 1983, *G. Kantvilas s.n.* (HO); Toolangi/Black Range State Forest, Sylvia Creek Road,Wirrawilla Rainforest Walk, 37°31'39"S 145°31'09"E, 650 m, 8 Apr. 2012, *V. Stajsic 6274* (HO, MEL).

NEW SOUTH WALES. Mt William, Barrington Tops National Park, 32°04'S 151°28'E, 1400 m, 30 June 1988, *G. Kantvilas 302/88* (HO, NSW).

Lichenicolous fungus

Tibell (1987) described *Chaenothecopsis brevipes* Tibell (Mycocaliciaceae) from the thallus of *I. platygraphellum*, and this species is now regarded as cosmopolitan, having been recorded widely from the Northern Hemisphere (Selva 1988; Titov & Tibell 1993), as well as from New Zealand (Galloway 2007), growing on species of *Arthonia* and *Schismatomma* (Titov 2000). It is here recorded for Tasmania for the first time, growing on both *I. applanatum* and *I. platygraphellum*. It is characterized by its short-stalked, relatively stout mazaedia, c. 0.1–0.2 mm tall, and its 1-septate, brown, smooth-walled ascospores, 6.5–7.6 × 2.8–3.2 µm (Tibell 1987). **Fig. 5.**

Fig. 5. *Chaenothecopsis brevipes*, on the thallus of *Inoderma platygraphellum*. Scale bar = 200 µm. Photo: J. Jarman.

Specimens examined.

TASMANIA. Start of Mt Wedge Track, 42°50'S 146°16'E, 360 m, 31 Aug. 2010, *G. Kantvilas 165/10A* (HO) (on *I. platygraphellum*); Woolnorth, Three Sticks Run, 40°43'S 144°43'E, 70 m, 9 Feb. 2023, *G. Kantvilas 141/23* (HO) (on *I. applanatum*).

Acknowledgements

For their prompt loans of specimens and, in some cases, hospitality during my visits to their institutions, I thank the curators of CANB, H, MEL and NSW. Some of the fieldwork underpinning this study was undertaken during TMAG Expeditions of Discovery and ABRS Bush Blitz surveys: I thank the supporters of these initiatives, including the Friends of TMAG and Woolnorth Wind Farm Holding. Bringing the study to conclusion was aided by an ABRS Bush Blitz Taxonomy Research Projects contract. For photography and preparing the line drawings for publication, I thank Jean Jarman. I am also grateful to Ernest Lacey for confirming my chemical analyses using his considerable technical wizardry. Comments on nomenclature on an earlier version of this paper by Jürgen Kellermann (AD) greatly improved this paper.

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References

Aptroot, A., Thor, G., Lücking, R., Elix, J.A. & Chaves, J.L. (2009). The lichen genus *Herpothallon* reinstated. *Bibliotheca Lichenologica* 99: 19–66.

Aptroot, A., Ertz, D., Silva, J.R., Grube, M. & Cáceres, M.E.S. (2015). The phylogenetic position of *Coniarthonia* and the transfer of *Cryptothecia miniata* to *Myriostigma* (Arthoniaceae, lichenized Ascomycetes). *Phytotaxa* 218: 12–136.

Aptroot, A., Cáceres, M.E.S. & dos Santos, L.A. (2024). The taxonomy of sterile Arthoniaceae from Brazil: White crusts on overhanging tropical trees can be named. *The Lichenologist* 56: 1–13.

Baker, M.L., Grove, S., de Salas, M.F., Byrne, C., Cave, L., Bonham, K., Moore, K., Cooke, L. & Kantvilas, G. (2021). Tasmanian Museum & Art Gallery's Expedition of Discovery. II. The flora and fauna of Musselroe Wind Farm, Cape Portland, Northeast Tasmania. *Papers and Proceedings of the Royal Society of Tasmania* 155: 69–96.

Cannon, P., Ertz, D., Frisch, A., Aptroot, A., Chambers, S., Coppins, B., Sanderson, N., Simkin, J. & Wolseley, P. (2020). Arthoniales: Arthoniaceae. *Revisions of British and Irish Lichens* 1: 1–48. https://britishlichensociety.org.uk/identification/lgbi3 [accessed: 1 Sep. 2024].

Coppins, B.J. (1989). Notes on the Arthoniaceae in the British Isles. *The Lichenologist* 21: 195–216.

Coppins, B.J. & James, P.W. (1978). New or interesting British Lichens II. *The Lichenologist* 10: 179–207.

Department of Natural Resources and Environment Tasmania (2022). *Melaleuca ericifolia* swamp forest. *Tasmanian threatened native vegetation communities. Version 2. 11 April 2022*. https://nre.tas.gov.au/Documents/30.%20Melaleuca%20ericifolia%20swamp%20forest.pdf [accessed: Jan. 2024].

de Salas, M.F., Baker, M.L., Cave, L. & Kantvilas, G. (2023). The botany of the Stony Head Training Area: New records from a biodiverse remnant in northern Tasmania, Australia. *Proceedings of the Royal Society of Victoria* 134: 85–107.

Diederich, P. & Scheidegger, C. (1996). *Reichlingia leopoldii gen. et sp. nov.*, a new lichenicolous hyphomycete from Central Europe. *Bulletin de la Société des Naturalistes Luxembourgeois* 97: 3–8.

Ertz, D., Sanderson, N., Łubek, A. & Kukwa, M. (2018). Two new species of Arthoniaceae from old-growth European forests, *Arthonia thoriana* and *Inoderma sorediatum*, and a new genus for *Schismatomma niveum*. *The Lichenologist* 59: 161–172.

Ertz, D., Aptroot, A., Sanderson, N., Coppins, B., van den Broeck, D. & Diederich, P. (2020). A new species of *Synarthonia* from Luxembourg, and a new combination in the genus *Reichlingia* (Arthoniaceae). *The Lichenologist* 52: 261–266.

Frisch, A. & Thor, G. (2010). *Crypthonia*, a new genus of byssoid Arthoniaceae (lichenised Ascomycota). *Mycological Progress* 9: 281–303.

Frisch, A., Thor, G., Ertz, D. & Grube, M. (2014a). The Arthonialean challenge: restructuring Arthoniaceae. *Taxon* 63: 727–744.

Frisch, A., Thor, G. & Sheil, D. (2014b). Four new Arthoniomycetes from Bwindi Impenetrable National Park, Uganda – supported by molecular data. *Nova Hedwigia* 98: 295–312.

Frisch, A., Ohmura, Y., Ertz, D. & Thor, G. (2015). *Inoderma* and related genera in Arthoniaceae with elevated white pruinose pycnidia or sporodochia. *The Lichenologist* 47: 233–256.

Galloway, D.J. (1985). *Flora of New Zealand lichens*. (Government Printer: Wellington).

Galloway, D.J. (2007). *Flora of New Zealand lichens: Revised second edition*, Vol. 1. (Manaaki Whenua Press: Lincoln).

Gray, S.F. (1821). *Natural Arrangement of British Plants*. (Baldwin, Cradock & Joy: London).

Harris, S. & Kitchener, A. (2005). *From forest to fjaeldmark: Descriptions of Tasmania's vegetation*. (Department of Primary Industries, Water and Environment, Tasmania: Hobart).

Jagadeesh Ram, T.A.M. & Sinha, G.P. (2016). A world key to *Cryptothecia* and *Myriostigma* (Arthoniaceae), with new species and new records from the Andaman and Nicobar Islands, India. *Phytotaxa* 266: 103–114.

Jaklitsch, W., Baral, H-O., Lücking, R. & Lumbsch, H.T. (2016). Ascomycota. In: Frey, W. (ed.), *Syllabus of plant families: Adolf Engler's Syllabus der Pflanzenfamilien* (13th edn), Part 1/2. (Borntraeger Science Publishers: Stuttgart).

Jarman, S.J. & Kantvilas, G. (1995). *A floristic study of rainforest bryophytes and lichens in Tasmania's myrtle-beech alliance.* (Forestry Tasmania and Department of Environment, Sport & Territories: Canberra). [*Tasmanian National Rainforest Conservation Program Report* 14].

Joseph, S. & Sinha, G.P. (2015). Contributions to the genus *Synarthonia* (lichenized Ascomycota, Arthoniaceae). *The Lichenologist* 47: 123–130.

Kantvilas, G. (1988). Tasmanian rainforest lichen communities: a preliminary classification. *Phytocoenologia* 16: 391–428.

Kantvilas, G. (1995). Alpine lichens of Tasmania's south-west wilderness. *The Lichenologist* 27: 433–449.

Kantvilas, G. (1996). Tasmania: Its vegetation and lichens. *British Lichen Society Bulletin* 78: 1–10.

Kantvilas, G. (2009). The Swinscow Lecture 2009: An antipodean odyssey – The lichens of Tasmania. *British Lichen Society Bulletin* 104: 86–96.

Kantvilas, G. (2021). A synopsis of the genus *Arthothelium* (Arthoniales) in Tasmania. *The Lichenologist* 53: 415–431.

Kantvilas, G. (2023a). *The lichen flora of Tasmania. Version 2023:1*. In: de Salas, M.F. (ed.), *Flora of Tasmania Online*. (Tasmanian Herbarium, Tasmanian Museum and Art Gallery: Hobart). https://flora.tmag.tas.gov.au/about/lichens/ [accessed: 15 Aug. 2024].

Kantvilas, G. (2023b). The genus *Schaereria* Körb. in Australia. *The Lichenologist* 55: 297–303.

Kantvilas, G. (2024). Additions to the genus *Cliostomum* (Ramalinaceae) from Australia. *The Lichenologist* 56: 27–37.

Kantvilas, G. & Coppins, B.J. (2019). Studies on *Micarea* in Australasia II. A synopsis of the genus in Tasmania, with the description of ten new species. *The Lichenologist* 51: 431–481.

Kantvilas, G. & Jarman, S.J. (1998). Lichens of buttongrass (*Gymnoschoenus*) moorland in Tasmania. *Papers and Proceedings of the Royal Society of Tasmania* 122: 1–17.

Kantvilas, G.& Jarman, S.J. (2012). Lichens and bryophytes in Tasmanian wet eucalypt forest: Floristics, conservation and ecology. *Phytotaxa* 59: 1–31.

Kantvilas, G. & Motiejūnaitė, J. (2023). Two new lichenicolous species of *Arthonia* (Ascomycota: Arthoniomycetes) from Tasmania. *Folia Crypotogamica Estonica* 60: 13–19.

Lücking, R., Hodkinson, B.P. & Leavitt, S.D. (2017). The 2016 classification of lichenized fungi in the Ascomycota and Basidiomycota – approaching one thousand genera. *Bryologist* 119: 361–416.

McCarthy, P.M. (2023). *Checklist of the lichens of Australia and its island Territories. Version 7 March 2023*. (Australian Biological Resources Study: Canberra). http://www.anbg.gov.au/abrs/lichenlist/introduction.html [accessed: 7 Mar. 2023].

Morse, C.A. & Ladd, D. (2021). A new species of *Reichlingia* (Arthoniaceae) from the grasslands of central North America. *Bryologist* 124: 33–38.

Müller, J. (1893). Lichenes Wilsoniani. *Bulletin De L'Hebier Boissier* 1: 3–65.

Orange, A., James, P.W. & White, F.J. (2010). *Microchemical methods for the identification of lichens* (2nd edn). (British Lichen Society: London).

Purvis, O.W. & Orange, A. (2009). *Thrombium* Wallr. (1831). In: Smith, C.W., Aptroot, A., Coppins, B.J., Fletcher, A., Gilbert, O.L., James, P.W. & Wolseley, P.A. (eds), *The lichens of Great Britain and Ireland*, p. 894. (British Lichen Society: London).

Selva, S.B. (1988). The Caliciales of Northern Maine. *The Bryologist* 91: 2–17.

Thor, G. (1997). The genus *Cryptothecia* in Australia and New Zealand and the circumscription of the genus. *Symbolae Botanicae Upsalienses* 32: 267–289.

Tibell, L. (1987). Australasian Caliciales. *Symbolae Botanicae Upsalienses* 27: 1–279.

Titov, A. (2000). Notes on calicioid lichens and fungi from the Gongga Mountains (Sichuan, China). *The Lichenologist* 32: 553–569.

Titov, A. & Tibell, L. (1993). *Chaenothecopsis* in the Russian Far East. *Nordic Journal of Botany* 13: 313–329.

van den Broeck, D., Frisch, A., Razafindrahaja, T., van de Vijver, B. & Ertz, D. (2018). Phylogenetic position of *Synarthonia* (lichenized Ascomycota, Arthoniaceae), with the description of six new species. *Plant Ecology and Evolution* 151: 327–351.

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