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A further addition to the genus *Arthothelium* (Arthoniales) from Tasmania

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Abstract: *Arthothelium palustre* Kantvilas *sp. nov.* is described from lowland coastal swamp forests in Tasmania. It is characterised by having an opaque maroon-red to red-brown epithecial pigment that reacts magenta-pink in K and C, and ellipsoid, non-macrocephalic, richly muriform ascospores, (25–) 28–*33.5*–40 (–45) × (11–) 12–*14.6*–18 (–19) µm, with 6–8 transverse and 1–3 (–4) longitudinal septa. Reddish-reacting pigments in the genus are discussed, and a revised key to the 11 species of *Arthothelium* known from Tasmania is presented.

Keywords: Arthoniaceae, biodiversity, lichenised Ascomycetes, lichens, new species, pigments

Introduction

Arthothelium A.Massal. is a group of chiefly tropical or subtropical, mostly corticolous lichens, characterised by an ecorticate crustose thallus with a trentepohlioid photobiont, peculiar apothecioid ascomata with a highly reduced or excluded exciple that frequently yields a "rubbed down" appearance, branched and anastomosed paraphyses, and broadly clavate to subglobose, hemiamyloid asci. The genus is distinguished from *Arthonia* Ach. by its muriform (rather than transversely septate) ascospores. It was revised for Tasmania by Kantvilas (2021) who recognised ten species, of which five are known only from the island, the remainder being more widespread in temperate regions of Australasia and beyond. The history of systematic study of the genus, especially in the Australasian region, is outlined therein and is not repeated here. Its phylogenetic placement remains unresolved (Ertz & Tehler 2010; Frisch *et al.* 2014) and whereas some recent 'flora' accounts now treat *Arthothelium* species under *Arthonia* (e.g. Grube 2007; McCune 2017), others (e.g. Coppins 2009; Gupta & Sinha 2018; Cannon *et al.* 2020) continue to retain *Arthothelium* in its traditional, spore-defined circumscription.

Kantvilas (2021) discussed the salient features of *Arthothelium*, illustrating and noting the importance of the *Arthothelium*-type ascus: subglobose to broadly obovoid, hemiamyloid, with a thick, non-amyloid wall and a well-developed KI+ blue tholus with a small, darker-staining ring and beak-like ocular chamber (see also Grube & Giralt 1996; Grube 1998; Sparrius 2009). These features are best observed in younger asci, and as the ascospores mature, the tholus and ring structure become compressed between the ascus wall and the ascoplasm to eventually become imperceptible.

At the species level, a character of critical importance in *Arthothelium* is apothecial pigmentation, where Kantvilas (2021) recognised three main pigments, named *Endoauranticaum*-gold, *Magenteum*-red and *Interveniens*-brown. Since that study, a further new species has been discovered, characterised by an additional pigment. This new species is described here and the relevant pigments are characterised and compared.

Materials and methods

The study is based chiefly on the author's collections, derived from several decades of lichenological exploration in Tasmania and housed in the Tasmanian Herbarium (HO). Investigations were undertaken on hand-cut sections of the thallus and apothecia, using standard methods, reagents and stains: water, 10% KOH (K), 50% HNO_3 (N), commercial bleach solution (C), Lactophenol Cotton Blue, Lugols Iodine (I) and concentrated HCl (H). The presence or absence of calcium oxalate was investigated by eluting hand-cut sections in 20% H_2SO_4.

Measurements of ascospores are presented in the format 5th percentile–*average*–95th percentile, with outlying values in brackets and *n* the number of observations. Routine thin-layer chromatographic analysis (TLC) was undertaken using standard methods, with solvent A as the preferred medium (Orange *et al.* 2010).

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Key to the Tasmanian species of *Arthothelium*

1. Ascospores macrocephalic, with a conspicuously enlarged, undivided proximal cell and a muriform "tail"
- **2.** Apothecia internally with a brownish, K+ olive pigment . . . . . ***A. ampliatum***
- **2:** Apothecia internally golden-yellow, K+ crimson
  - **3.** Ascospores with 4–5 transverse and 0–3 longitudinal septa; on sheltered rocks in inland areas of moderate elevation . . . . . ***A. subtectum***
  - **3:** Ascospores with 6–8 transverse and 2–4 longitudinal septa; corticolous in wet forest . . . . ***A. macounioides***

1: Ascospores not macrocephalic, muriform ± throughout
- **4.** Apothecia internally with brownish, K+ olive pigment only
  - **5.** Ascospores longer than 50 µm; apothecia strongly convex to subglobose; thallus lichenicolous . . . . . ***A. insolitum***
  - **5:** Ascospores mostly shorter than 40 µm; apothecia usually applanate or flattened, and only rarely strongly convex; thallus corticolous or saxicolous
    - **6.** Apothecia markedly convex and basally constricted, coarsely white-pruinose with calcium oxalate crystals at least when young; usually on rough, dry bark . . . . . ***A. suffusum***
    - **6:** Apothecia applanate or plane, adnate, always epruinose; on smooth bark
      - **7.** Apothecia to 2 mm wide; ascospores sparingly muriform, with 4–8 transverse and 0–1 (–2) longitudinal septa, the central, widest cells typically undivided . . . . . ***A. interveniens***
      - **7:** Apothecia rarely > 0.6 mm wide; ascospores densely muriform throughout, with 6–10 transverse and 2–3 longitudinal septa . . . . . ***A. velatius***
- **4:** Apothecia with golden-yellow or reddish pigments yielding crimson or vivid pink reactions in K
  - **8.** Apothecial pigment golden-yellow, K+ crimson
    - **9.** Apothecia emergent, frequently with some attached fragments of thalline tissue, plane and adnate, occasionally white-pruinose with calcium oxalate crystals; corticolous in coastal scrub and woodland . . . . . ***A. endoaurantiacum***
    - **9:** Apothecia superficial, subglobose and basally constricted, never pruinose; on littoral rocks . . . . . ***A. bacidinum***
  - **8:** Apothecial pigment dark maroon-red or brownish red, K+ vivid magenta-pink
    - **10.** Apothecial pigment C+ magenta-pink, K+ magenta-pink with a blue halo that soon fades; ascospores 25–45 × 11–19 µm, with 6–8 transverse and 1–3 (–4) longitudinal septa . . . . . ***A. palustre***
    - **10:** Apothecial pigment C+ orange-brown, K+ magenta-pink without a short-lived blue halo; ascospores 25–55 × 11–22 µm, with 7–15 transverse and 1–5 longitudinal septa . . . . . ***A. magenteum***

Taxonomy

Arthothelium palustre Kantvilas, ***sp. nov.***

Holotypus: Australia, Tasmania, Woolnorth, "Paperbark Corner", 40°44'S 144°43'E, 15 m elevation, on *Melaleuca ericifolia* in low forest with dominant scattered eucalypts, 6 Feb. 2023, *G. Kantvilas 46/23* (HO613005).

Mycobank number: MB860919.

Thallus effuse, continuous or rather patchy, 60–180 µm thick, usually whitish grey to dull pale grey, forming extensive, undelimited, irregular patches to c. 20 cm wide or more, frequently interrupted by other lichens, in section ecorticate, I+ brownish red, KI+ patchily very pale blue, lacking calcium oxalate. *Photobiont* trentepohlioid, with cells subglobose to broadly ellipsoid, 12–18 × 10–12 µm, in short chains or clusters.

Apothecia abundant, scattered or rarely with adjacent ones fused, roundish to irregularly ellipsoid, 0.5–1.2 mm diam., 180–80 µm thick, brown-black, sometimes with a reddish brown tint when moist, epruinose, convex, broadly adnate, a little lobate when confluent. *Proper exciple* diffusely reddish brown, K+ olive-green, laterally extremely reduced or lacking, basally poorly differentiated from the hypothecium and 20–80 µm thick. *Hypothecium* barely differentiated from the hymenium and exciple, c. 25–100 (–160) µm thick, hyaline and K+ pale yellowish, or infused with brownish excipular pigment. *Hymenium* 80–130 (–180) µm thick, mostly hyaline and weakly K+ pale yellowish, I+ yellow-brown, KI+ blue, with the amyloid reaction strongest in the asci, overlain by a thick, uneven layer 20–70 µm thick of opaque, brownish maroon-red pigment, K+ magenta-pink with a diffuse blue halo that soon fades, C+ magenta-pink, soon fading to colourless. *Paraphyses* branched and anastomosed, embedded in a gel matrix, unevenly 1–1.5 µm thick, with the apices

not expanded. *Asci* 60–80 × 35–60 µm, 8-spored, of the *Arthothelium*-type: subglobose to broadly obovoid, hemiamyloid, with a thick, non-amyloid wall; tholus well-developed, KI+ blue, with a small, darker-staining ring and beak-like ocular chamber, best observed in younger asci and becoming compressed and imperceptible at maturity. *Ascospores* broadly ellipsoid, rarely a little curved, hyaline at first, becoming brown with age, persistently smooth-walled, (25–) 28–*33.5*–40 (–45) × (11–) 12–*14.6*–18 (–19) µm (*n* = 70), with 6–8 transverse and 1–3 (–4) longitudinal septa.

Coniodiomata rare, semi-immersed, black, speck-like, c. 0.08 mm wide; wall brown, K+ dull olive-green; conidia bacilliform, 5–8 × 0.5 µm. **Figs 1, 2A–F, 3.**

Chemistry. No substances detected by TLC.

Diagnosis. Similar to *A. magenteum* Kantvilas, but with a different, opaque maroon-red to red-brown epithecial pigment that reacts K+ magenta-pink with a blue halo, C+ magenta-pink, and with the richly muriform ascospores somewhat smaller, 25–45 × 11–19 µm, and with only 6–8 transverse and 1–3 (–4) longitudinal septa.

Etymology. The specific epithet refers to the swampy habitat of the new species.

Distribution & habitat. *Arthothelium palustre* is known only from Tasmania, where it is a common constituent of epiphytic communities on the papery bark of the small tree *Melaleuca ericifolia* (Myrtaceae) in coastal swampy forest and woodland. *Melaleuca* is either the dominant canopy species in such vegetation, or forms a significant part of the understorey. This forest type had long been overlooked in floristic and ecological studies, but in more recent years, targeted investigations have revealed a diverse and fascinating lichen flora, rich in species that are either entirely restricted to this vegetation or attain their greatest extent there (Baker *et al.* 2021; de Salas *et al.* 2023; Kantvilas 2024). The most significant species, all potentially rare or highly localised, include *Arthothelium endoaurantiacum* Makhija & Patw., *Bacidia septosior* (Nyl.) Zahlbr., *Bactrospora metabola* (Nyl.) Egea & Torrente, *B. paludicola* Kantvilas, *Caloplaca pulcherrima* (Müll.Arg.) S.Y.Kondr. & Kärnefelt, *Coenogonium flavoinspersum* Kantvilas, *Enterographa micrographa* (Nyl.) Redinger, *Haematomma sorediatum* R.W.Rogers, *Inoderma applanatum* Kantvilas, *Leptogium coralloideum* (Meyen & Flot.) Vain. and *Pseudocyphellaria aurata* (Ach.) Vain., as well as an undescribed species of *Enterographa*. The forests have been very significantly impacted by agricultural activities, particularly by clearing for grazing (mainly dairy) or serving as shelter for livestock, to the extent that as much as 70% of this vegetation is estimated to have been lost since European settlement (NRE TAS 2022). In many locations, the forests as a viable ecosystem complete with their epiphytes have essentially collapsed, even though individual *Melaleuca* trees may survive. The forests continue to be overlooked in conservation efforts and thus the long-term persistence of many of the lichens is tenuous.

The new species has been encountered only occasionally, and mostly in the far north-west of Tasmania (including King Island), even though *Melaleuca*-dominated woodlands range across the northern part of the island and down its eastern coast. Two outlying populations are known from the south-east, where it occurs on the papery bark of the low tree *Bedfordia salicina* (Asteraceae), also in coastal woodland.

Fig. 1. *Arthothelium palustre* (holotype) habit, with "rubbed down", black apothecia on a whitsh grey thallus. Scale = 2 mm. Photo: J. Jarman.

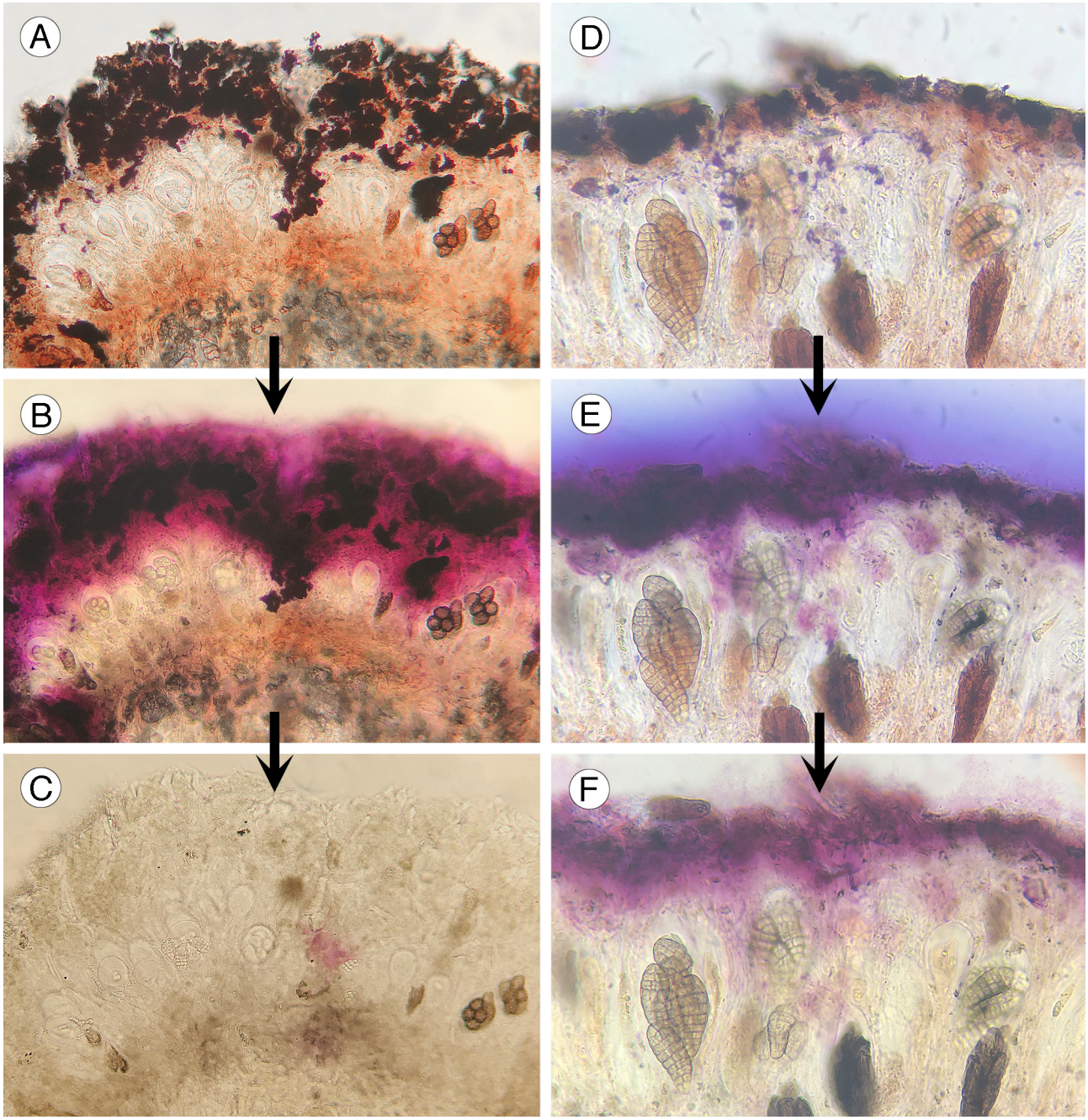

Fig. 2. Apothecial pigments in *Arthothelium palustre*. **A, D** In water. **B** Immediate reaction in calcium hypochlorite (C). **C** Reaction in C after 5 minutes. **E** Immediate reaction in potassium hydroxide (K). **F** Reaction in K after 5 minutes.

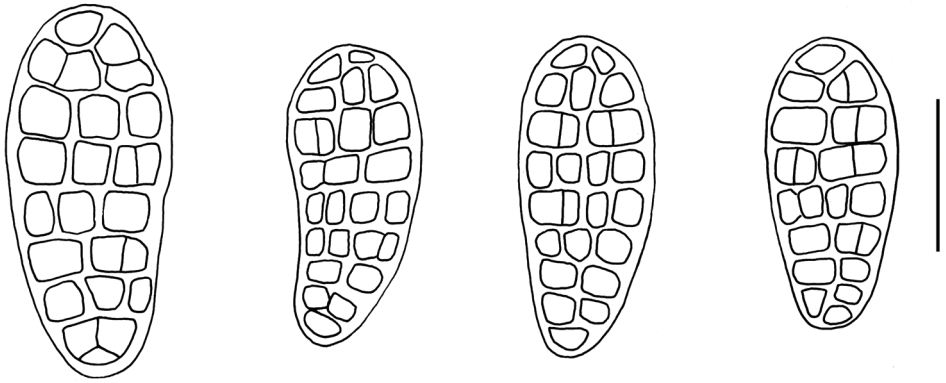

Fig. 3. Ascospores of *Arthothelium palustre*. Scale = 20 µm.

Table 1. Profiles of reddish-reacting pigments in Tasmanian species of *Arthothelium*.

	***Endoaurantiacum*-gold**	***Magenteum*-red**	***Cinnabarinum*-red**
Colour in water	golden-yellow to orange- or reddish brown when highly concentrated	dark maroon-red	maroon-red to red-brown
Colour in polarised light	brownish orange	orange-pink	orange-pink
Reaction in K	deep crimson-red	vivid magenta-pink	vivid magenta-pink with a diffuse blue halo which gradually dissipates
Reaction in C	pink (fading)	orange-brown	vivid magenta-pink, at length fading to colourless
Reaction in N	nil	orange-brown	slowly purple-black
Reaction in H	nil	nil	slowly dark purple
Species where present	*A. endoaurantiacum, A. bacidinum, A macounioides, A. subtectum*	*A. magenteum*	*A. palustre*; also present in *Coniocarpon cinnabarinum*

Remarks. The distinctive apothecial pigment, termed here *Cinnabarinum*-red, characterises this species. It appears to be the same as one of the pigments found in the apothecia of *Coniocarpon cinnabarinum* DC. (hence the name). There are several different pigments in *Arthothelium* that produce a shade of pink or red with K, and these are compared and contrasted in Table 1, where the distinctiveness of *Cinnabarinum*-red is clearly evident.

The most similar species to *A. palustre* is *A. magenteum* Kantvilas, but as well as having a different apothecial pigment, that species also has larger ascospores, (25–) 33.5–*41.4*–53.5 (–55) × (11–) 12.5–*17.7*–22 µm, with 7–15 transverse and 1–5 longitudinal septa (Kantvilas 2021). The two species also have starkly different ecologies, with *A. magenteum* occurring in cool temperate rainforest and associated wet sclerophyll forest or scrub, and ranging from lowland to subalpine elevations. In his description of *A. magenteum*, Kantvilas (2021) noted two unusual lowland collections with a subtly different pigment profile; these are now classified as *A. palustre*. In addition to *Cinnabarinum*-red, the new species also contains a brownish, K+ greenish pigment in the reduced exciple as well as sometimes in the hypothecium; this is *Interveniens*-brown of Kantvilas (2021).

Additional specimens examined.

TASMANIA. Tasman Track, W of O'Hara Bluff, 43°05'S 147°57'E, 380 m, 21 Nov. 2020, *G. Kantvilas 273/20* (HO); Bivouac Bay, 43°07'S 147°58'E, 5 m, 27 Dec. 2020, *G. Kantvilas 344/20*, *345/20* (HO); Woolnorth, "Paperbark Corner", 40°44'S 144°43'E, 15 m, 6 Feb. 2023, *G. Kantvilas 59/23* (HO); Woolnorth, Three Sticks Run, 40°43'S 144°43'E, 30 m, 9 Feb. 2023, *G. Kantvilas 144/23* (HO); King Island, Collier Swamp Conservation Area, 40°05'47"S 143°58'41"E, 25 m, 26 Oct. 2023, *G. Kantvilas 407/23* (HO); ibid., 40°05'37"S 143°59'08"E, 40 m, 26 Oct. 2023, *G. Kantvilas 421/23* (HO).

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References

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(2): 69–96.

Cannon, P., Ertz, D., Frisch, A., Aptroot, A., Chambers, S., Coppins, B., Sanderson, N., Simkin, J. & Wolseley, P. (2020). Arthonialeas: Arthoniaceae. *Revisions of British and Irish Lichens* 1. https://britishlichensociety.org.uk/identification/lgbi3 [accessed: 25 Sep. 2025].

Coppins, B.J. (2009). *Arthothelium* A. Massal (1852). 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*, pp. 176–179. (British Lichen Society: London).

Department of Natural Resources and Environment Tasmania [NRE TAS] (2022). *Tasmanian Threatened Native Vegetation Communities*. Version 2. 11 April 2022. https://nre.tas.gov.au/Documents/30.%20Melaleuca%20ericifolia%20swamp%20forest.pdf [accessed: 25 Sep. 2025].

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.

Ertz, D. & Tehler, A. (2010). The phylogeny of Arthonialaes (Pezizomycotina) inferred from nucLSU and RPB2 sequences. *Fungal Diversity* 49: 47–71.

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

Grube, M. (1998). Classification and phylogeny in the Arthoniales (lichenized Ascomycetes). *Bryologist* 101: 377–391.

Grube, M. (2007). *Arthonia*. In: Nash III, T.H., Gries, C. & Bungartz, F. (eds), *Lichen Flora of the Greater Sonoran Desert Region* 3: 39–61. (Lichens Unlimited: Tempe).

Grube, M. & Giralt, M. (1996). Studies on some species of *Arthothelium* occurring in the western Mediterranean. *Lichenologist* 28: 15–36.

Gupta, P. & Sinha, G.P. (2018). *Lichen Flora of Assam*. (Bishen Singh Mahendra Pal Singh: Dehra Dun).

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

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

McCune, B. (2017). *Microlichens of the Pacific Northwest*, Vol. 2: *Keys to the Species*. (Wild Blueberry Media: Corvallis).

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

Sparrius, L.B. (2009). *Synarthothelium*, a new genus in the Arthoniaceae with a thalline exciple, similar to *Synarthonia*. *Bibliotheca Lichenologica* 99: 373–382.