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ROYAL BOTANIC GARDENS VICTORIA

A sorediate addition to the genus *Megaloblastenia*

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Abstract

The epiphytic species, *Megaloblastenia sorediata* Kantvilas sp. nov., is described from the wet forests of Tasmania and New South Wales; its preferred host is the understorey tree *Pomaderris apetala*. The newly described species is distinguished from the widespread *M. marginiflexa* (Hook.f. & Taylor) Sipman chiefly on the basis of having soredia, although its apothecia, asci and ascospores are also marginally smaller. A key to the three species of *Megaloblastenia* is presented, and the application of soredia as a taxonomic character is discussed briefly.

Keywords: Australia, lichens, species pairs, Tasmania, taxonomy

Introduction

Megaloblastenia Sipman is a small genus of three taxa, restricted to oceanic climates in temperate to tropical latitudes of Australasia and South America, and typically occurring as epiphytes in moist forests. It is characterised by a crustose, mostly ecorticate thallus containing *Dictyochloropsis* as the photobiont, biatorine to lecideine, relatively large apothecia, a non-inspersed hymenium, clavate, 8-spored asci with an intensely KI+ blue outer coat, a well-developed KI+ blue tholus lacking internal differentiation, and sometimes with a short, conical, ocular chamber (*Megalospora*-type: see Kantvilas & Lumbsch 2012, Fig. 1D), slender, branched and anastomosing paraphyses, and hyaline, bicellular ascospores with thickened polar and septal walls and the locules connected by a narrow channel (polaribilocular: Kantvilas & Lumbsch 2012, Figs 1E-F). It is classified in the family Megalosporaceae (Teloschistales) together with the genus *Megalospora* Meyen, which, although superficially similar, differs by having a hymenium densely inspersed with oil droplets, and transversely septate or muriform ascospores. Thallus chemistry in both genera is relatively simple and includes zeorin, together with either pannarin or usnic acid.

The family Megalosporaceae was comprehensively monographed by Sipman (1983) who established the framework of characters, chiefly based on ascospores, by which the species are defined. Since that time there have been further new taxa and new records of *Megalospora* for Australia (including Tasmania) by Allen *et al.* (2001), Elix (2009), Hafellner *et al.* (1989), Kantvilas

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(1994, 2008, 2018), Sipman (1986) and Vězda (1989), bringing the total to 19 (McCarthy 2020). *Megaloblastenia*, however, has continued to comprise only the three taxa recognised by Sipman (1983), two of which occur in Australia. However, its distinct and separate status has been confirmed by DNA-sequence data (Gaya *et al.* 2012; Kantvilas & Lumbsch 2012). Here, a further species from the wet forests of Tasmania and south-eastern mainland Australia is described and illustrated.

Methods

The study is based mainly on specimens housed in the Tasmanian Herbarium (HO) and on field observations made by the author. Morphological and anatomical investigations were undertaken on hand-cut sections of the thallus and apothecia using standard methods, reagents and stains: water, 10% KOH (K), Lactophenol Cotton Blue, ammoniacal erythrosin and Lugols Iodine (I). Amyloid reactions where sections were pre-treated in K, rinsed in water and then mounted in I are described in the text as KI. Calcium oxalate was detected by eluting thin sections with 20% H_2SO_4. Measurements of ascospores are presented in the format 5th percentile–*average*–95th percentile, with outlying values in parentheses and *n* indicating the number of observations. Routine chemical analysis was undertaken using standard methods (Orange *et al.* 2010); solvent A was the preferred medium.

Taxonomy

Megaloblastenia sorediata **Kantvilas, sp. nov.**

Mycobank No.: MB 846876

Similar to *M. marginiflexa* (Hook.f. & Taylor) Sipman, from which it differs by the convex to excavate soralia, 1–2 mm wide, the smaller asci, 80–110 x 12–26 µm, and smaller ascospores, 20–34 x 10–20 µm.

***Type*:** Australia, Tasmania: Stony Head MTA, Ryans Hill, SE of summit, 41°01′05″S 147°01′43″E, 210 m, on *Pomaderris apetala* in wet sclerophyll forest, 4 November 2020, *G. Kantvilas 212/20* (holo - HO; iso - CANB)

Thallus pale grey or greenish grey, ecorticate, smooth to rimose, rarely verruculose, sorediate, lacking calcium oxalate, forming patches to *c.* 10 cm wide; soralia discrete, at first punctiform, at length convex or excavate, 1–1.5(–2) mm wide, occasionally becoming confluent; soredia farinose to granular, whitish or ± concolourous with the thallus. *Photobiont Dictyochloropsis*, with ± globose cells 6–12 µm wide. *Apothecia* biatorine, sessile, basally constricted, 0.8–2.5(–3) mm diam.; disc plane, pale to dark reddish brown, mostly with a thin, sometimes patchy, bluish grey pruina; proper exciple prominent and persistent, entire, pale to deep red-brown to dark brown, usually darkest at the rim, in section cupulate, 90–200 µm thick, pale yellow-brown to dark brown, darkest along the inner edge and especially so beneath the hypothecium, composed of tightly packed, radiating, branched and anastomosing, conglutinated hyphae, inspersed with calcium oxalate crystals. *Hypothecium* 60–90 µm thick, hyaline to yellowish brown in the lower part, usually inspersed with oil droplets. *Hymenium* 90–140 µm thick, hyaline, not inspersed, I+ blue, KI+ blue, overlain by a yellow-brown to red-brown epithecial layer to *c.* 10–15 µm thick. *Asci* clavate, 80–110 x 12–26 µm, 6–8-spored, of the *Megalospora*-type. *Ascospores* hyaline, ellipsoid, non-halonate, polaribilocular, (20–)22–*26.0*–30(–34) x (10–)11–*14.3*–18(–20) µm (*n* = 60), with the locules connected by a narrow channel. *Pycnidia* uncommon, immersed in small verrucae *c.* 0.2 mm wide; conidia bacilliform, 3-5 x 0.5 µm. Chemistry: pannarin, zeorin; thallus K–, KC-, C– P+ orange, UV- or dull grey. Figs 1A-B.

***Etymology*:** The specific epithet refers to the thallus being sorediate, a character that distinguishes it from the other species of the genus.

***Distribution and ecology*:** The ecological observations presented here are based on fieldwork by the author in Tasmania, where the newly described species is common. There, *Megaloblastenia sorediata* is widespread, locally abundant and most commonly collected in lowland wet

Key to *Megaloblastenia* in Australasia

1 Thallus pale yellowish, P– (containing usnic acid and zeorin); apothecia entirely black and epruinose; Tas, NZ. .... ***M. flavidoatra***

1: Thallus grey, P+ orange (containing pannarin and zeorin); apothecia usually with a pale, reddish brown, thinly grey-pruinose disc and yellowish to dark brown margin 2

2 Thallus sorediate; Tas, NSW. .... ***M. sorediata***

2: Thallus lacking soredia; Tas, Vic, NSW, NZ. .... ***M. marginiflexa***

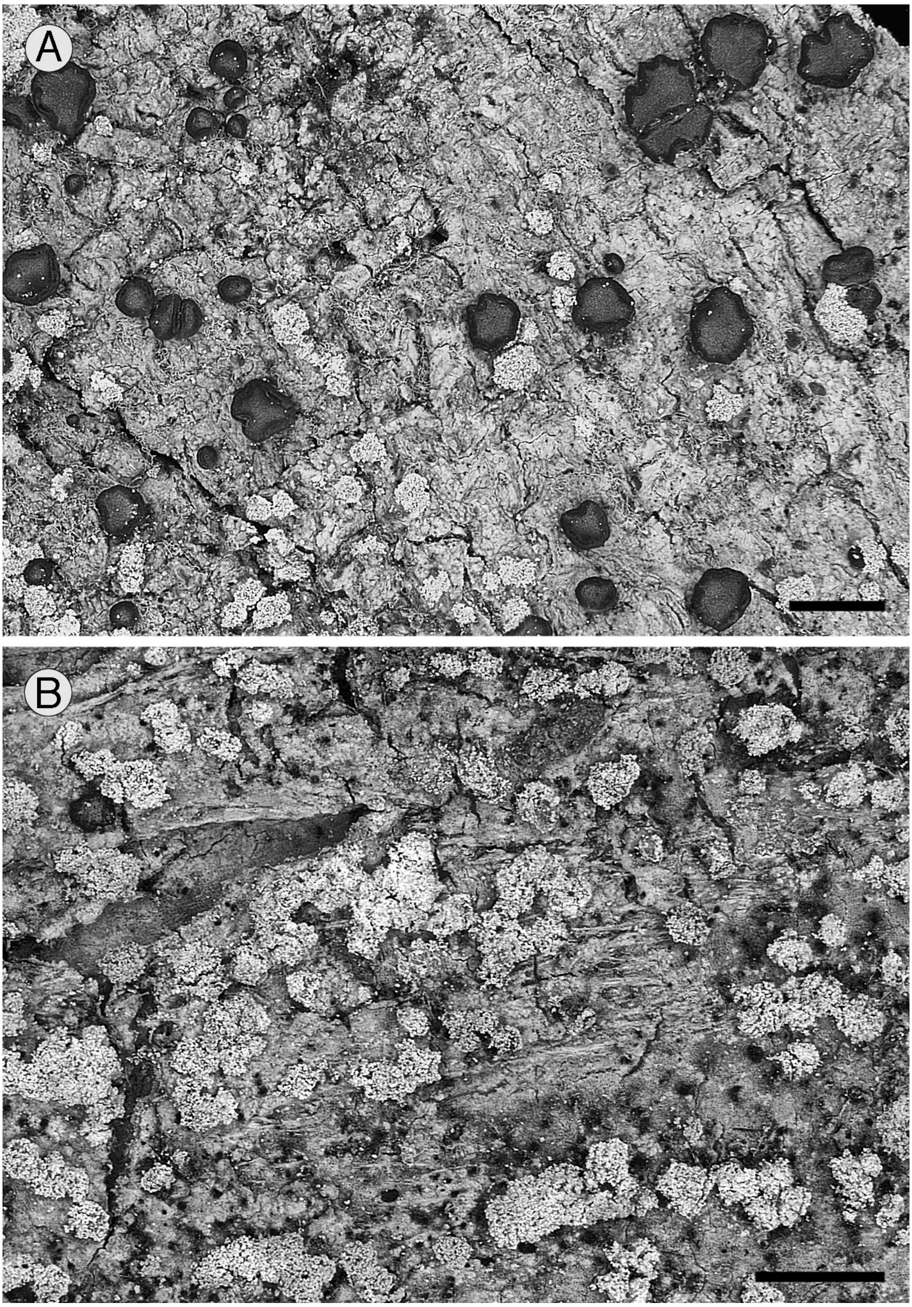

Figure 1. *Megaloblastenia sorediata* habit. **A.** Fertile thallus with discrete, roundish soralia and abundant apothecia (holotype). **B.** Sorediate, sterile thallus dominated by soralia with coarse, granular soredia (*Kantvilas 317/21*). Scale = 2 mm.

sclerophyll forest or tall, coastal scrub where it particularly favours the bark of *Pomaderris apetala*. However, it has also been found in such vegetation communities on other trees with a similar smooth bark, such as *Hakea lissosperma*, *Notelaea ligustrina* and *Banksia marginata*, or on the wood of *Bedfordia salicina*. In these habitats, it is part of a rich assemblage of chiefly-crustose lichens, with the dominant species being *Megalaria melaloma* (C.Knight) Kantvilas, *M. melanotropa* (Nyl.) D.J.Galloway, *Pyrenula ravenellii* (Tuck.) R.C.Harris, *Sarrameana albidoplumbea* (Hook.f. & Taylor) Farkas, *Strigula albicascens* (Nyl.) R.C.Harris and *Thelotrema lepadinum* (Ach.) Ach. Also invariably present in these epiphytic communities is the closely related *Megaloblastenia marginiflexa*, and it is because it grows so closely associated with *M. sorediata* that the latter was overlooked as distinct for so long (see discussion below). Although the two species co-occur in this habitat, *M. marginiflexa* is generally more widespread and, in Tasmania, extends across most of the island and is also found in *Nothofagus*-dominated cool temperate rainforest. *Megaloblastenia sorediata* also occurs in *Melaleuca ericifolia*-dominated swampy woodland, a vegetation type remarkable for its concentration of lichens of high conservation significance, such as *Bactrospora metabola* (Nyl.) Egea & Torrente, *B. paludicola* Kantvilas, *Coniocarpon cinnabarinum* DC., *Enterographa micrographa* (Nyl.) Redinger, *Haematomma sorediatum* R.W.Rogers and *Pseudocyphellaria aurata* (Ach.) Vain. (Baker *et al.* 2021; de Salas *et al.*, in press). Sipman (1983) clearly saw sorediate material, which he included under *M. marginiflexa*, but makes no specific mention of its provenance.

Although no specimens from Victoria have been seen, *M. sorediata* can confidently be expected to occur there due to the abundance of the appropriate wet forest habitat. The same applies to the coastal ranges of New South Wales, from where a single specimen has been collected. The author has not encountered any sorediate specimens of *Megaloblastenia* in New Zealand although the species could well occur there.

***Selected specimens examined*: TASMANIA:** Three Thumbs, 42°36′S 147°52′E, 350 m, 4.vii. 1987, *G. Kantvilas s.n.* (HO); Deadmans Bay, 43°32′S 146°30′E, 5 m, 17.i.1987, *A. Moscal 14096a* (HO); Denium Hill, Robbins Island Track, 40°45′S 144°53′E, 5 m, 10.xii.1993, *G. Kantvilas 140/93 & J. Elix* (HO); High Yellow Bluff, 42°56′S 147°59′E, 250 m, 27.xii.2000, *G. Kantvilas 551/00* (HO); Sandspit River, 42°43′S 147°51′E, 170 m, 16.vi.2010, *G. Kantvilas 102/10* (F, HO); Lichen Hill, 43°04′S 147°56′E, 570 m, 10.viii.2010, *G. Kantvilas 120/10* (HO); south-western slopes of Mt Fortescue, 43°10′S 147°58′E, 440 m, 6.iv.2012, *G. Kantvilas 269/12* (HO, MEL); Hellfire Bluff, 42°44′S 147°55′E, 150 m, 13.ix.2014, *G. Kantvilas 377/14* (HO, UPS); track to St Columba Falls, 41°19′S 147°55′E, 300 m, 27.vi.2020, *G. Kantvilas 107/20* (HO); Stony Head MTA, Quarry Road, 41°02′26″S 146°59′40″E, 50 m, 19.iii/2021, *G. Kantvilas 88/21* (HO); *c.* 7 km N of Branxholm, 41°06′S 147°44′E, 220 m, 10.ix.2022, *G. Kantvilas 470/22* (HO). **NEW SOUTH WALES:** Brown Mountain, Rutherfords Creek, 36°35′22″S 149°26′44″E, 815 m, 17.iv.2008, *G. Kantvilas 106/08, J. Elix & P. McCarthy* (HO, NSW).

Discussion

Lichens offer many examples where there are exclusively sexually reproducing entities and closely related asexually reproducing ones, with or without apothecia. However, how to deal with these taxonomically is somewhat controversial. Du Rietz (1924) noted that sorediate and esorediate morphs of a lichen often displayed different geographical distributions and ecological preferences. He elected to recognise them as species and coined the term “Artenpaar”, a concept developed further by Poelt (1970, 1972). Species pairs were generally adopted with enthusiasm for several lichen groups, such as in the Parmeliaceae and *Pseudocyphellaria*, and have stood the test of time and further investigations. At the same time, other lichenologists, for example Tehler (1982) in his studies of the Roccellaceae, readily accepted sorediate and esorediate morphs within a single species. The concept of species pairs is discussed extensively by Mattson & Lumbsch (1989) who offer guidelines for their taxonomic evaluation but essentially recommend that each case be treated on its merits. In the Australian biota, there are clear examples where the species pair idea has been applied and is generally accepted [e.g. *Menegazzia subbullata* P.James & Kantvilas (sorediate) versus *M. elongata* P.James (fertile only)]. At the same time, there are also cases, such as the widespread *Trapeliopsis colensoi* (C.Bab.) Gotth.Schneid., where exclusively sorediate forms, exclusively fertile forms, and sorediate forms with abundant apothecia all co-occur and are considered conspecific.

It is largely because of this controversy that the author has, for a considerable time, been reluctant to uncritically recognise the sorediate morphs of *M. marginiflexa* as distinct, even as field observations across several decades were suggesting otherwise. In the herbarium, it is easy to overlook the sorediate forms, especially as collectors inevitably strive to collect fertile material and apothecia on the sorediate morph tend to be fewer and smaller. However, in the field, the distinction becomes more apparent and, where both are present, it becomes obvious that there are two distinct entities in play: the exclusively fertile, esorediate one and an unequivocally sorediate one. An attempt to explore the relationship between the two morphs using molecular methods was made by Kantvilas & Lumbsch (2012). However, obtaining usable DNA proved difficult, despite the abundance of fresh material available, and the result, although placing sorediate and non-sorediate morphs in separate clades, was not conclusive.

Detailed anatomical study revealed further, albeit subtle differences between the two entities that support their recognition at species rank. *Megaloblastenia sorediata* is generally smaller in all its parts: the apothecia are rarely more than 2.5 mm wide, whereas in *M. marginiflexa* they are commonly as wide as 3.5 mm, and may even be as wide as 5 mm; the asci in *M. marginiflexa* are 110–140 x 20–35 µm, whereas in *M. sorediata* they are 80–110 x 12–26 µm. Critically there is also a difference in ascospore size with those of *M. marginiflexa* being (26–)29–*36.0*-42(–44) x (14–)15–*18.9*–24(–25) µm (*n* = 60), compared to (20–)22–*26.0*–30(–34) x (10–)11–*14.3*–18(–20) µm in *M. sorediata*.

A possible parallel example of a sorediate-esorediate species pair in the Megalosporaceae is seen in *M. subtuberculosa* (C.Knight) Sipman (sorediate, rarely fertile) and *M. melanodermia* (Müll.Arg.) Zahlbr. (exclusively fertile). In the former, the ascospores are 30–*40.4*-50(–56) x 19–*24.9*–31(–34) µm (this study), whereas in the latter, they are (32-)36-*42.0*-48(-54) x 20–*24.0*–30 µm (Kantvilas 1994). In this case, there is no significant difference in ascospore size, even though the notion that the two species are distinct has never been in dispute.

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