

A new species of *Micarea* (lichenized Ascomycota, Pilocarpaceae) from alpine Australia

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Abstract

Micarea argopsinosa sp. nov. (lichenized Ascomycota, Pilocarpaceae) is described from sheltered granite below the summit of Mt Ginini in the Australian Capital Territory. It has a thin, diffuse, greyish green thallus containing only argopsin, solitary or clustered, jet-black, convex apothecia with a K– and C– hymenium and a hyaline hypothecium, comparatively small 3-septate ascospores, and narrowly oblong to filiform, straight, curved or arcuate macroconidia with (1–)3-septa. A key is provided to distinguish the new species from broadly similar taxa known from Australia and elsewhere.

Introduction

The cosmopolitan but predominantly temperate lichen genus *Micarea* Fr. (Pilocarpaceae) includes approximately 100 species, occurring mainly on acidic bark, rock and soil. Thalli are crustose and effuse, granular or areolate, with or without soredia, and they contain diagnostic photobiont cells that are comparatively small and thin-walled (micareoid). The ascomata are usually adnate to sessile and immarginate, lack a thalline exciple, have a hyphal proper exciple, an amyloid hymenium, simple or branched paraphyses with scarcely swollen apices, a distinctive ascus apex structure (see below) and colourless, simple to transversely septate ascospores. Other informative characters include a small array of thalline chemical substances, as well as apothecial pigments and up to three types of conidia (Coppins 1983, 2009; Coppins and Kantvilas 1990; Czarnota 2007; Galloway 2007; Brand *et al.* 2014).

Twenty-one species of *Micarea* have been reported from Australia (Coppins and Kantvilas 1990; Coppins 2009; McCarthy 2015), and while the genus is known to be particularly diverse in Tasmania, the Tasmanian lichen flora includes many undescribed or unrecorded species (Kantvilas *et al.* 2008).

Among several discrete but informal species groups recognised by Coppins (1983) and expanded subsequently, the *M. lignaria*-*M. ternaria* group has solitary or clustered, jet-black, convex apothecia with a K– and C– hymenium and a usually hyaline hypothecium, as well as 3(–7)-septate ascospores. Thalli can contain alectorialic acid, gyrophoric acid, argopsin or they can lack lichen substances. In this contribution, a new and very distinctive species is described from alpine granite in the southern Australian Capital Territory (A.C.T.), and while it is compared with other known species of the *M. lignaria*-*M. ternaria* group, there are indications that the Australian lichen flora includes other similar, but as yet undescribed taxa.

Methods

Observations and measurements of photobiont cells, thallus and apothecium anatomy, asci, ascospores and conidia were made on hand-cut sections mounted in water and treated with 10% potassium hydroxide (K) and 50% nitric acid (N). Asci were also observed in Lugol's Iodine (I), with and without pre-treatment in K. Chemical constituents were identified by thin-layer chromatography (Elix 2014) and comparison with authentic samples.

New Species

Micarea argopsinosa P.M.McCarthy & Elix, **sp. nov.**

MycoBank No.: MB 815597

Characterised by a thin, diffuse, greyish green saxicolous thallus containing only argopsin, solitary or clustered, jet-black, convex apothecia with a K- and C- hymenium and a hyaline hypothecium, comparatively small 3-septate ascospores of $10\text{--}14.5 \times 3\text{--}5 \mu\text{m}$, and narrowly oblong to filiform, straight, curved or arcuate macroconidia that are (1-)3-septate and $10\text{--}19 \times 1\text{--}1.5 \mu\text{m}$.

Type: AUSTRALIA. Australian Capital Territory: Namadgi Natl Park, Mt Ginini, $35^{\circ}31'47''\text{S}$, $148^{\circ}46'41''\text{E}$, alt. 1665 m, on sheltered granite on scree slope, *P.M. McCarthy 4181*, 10 Dec 2013; holotype: CANB.

Thallus crustose, epilithic, diffuse, continuous or of scattered or contiguous areoles, pale greenish grey to medium or dark greyish green, c. $0.05\text{--}0.1\text{--}(0.14)$ mm thick, forming colonies 2–8 mm wide interspersed among the thalli of other, more robust crustose lichens. Areoles angular or irregular, occasionally somewhat rounded, plane to slightly but unevenly convex, $0.4\text{--}1.4$ mm wide; surface dull, scurfy-granular to verruculose or minutely subpapillose, ecorticate, but with a discontinuous, $8\text{--}20 \mu\text{m}$ thick hyaline necral layer. *Algal layer* continuous or not, $40\text{--}80 \mu\text{m}$ deep; cells micareoid, yellowish green to bright green, globose to subangular (when tightly clustered), $5\text{--}7\text{--}(8) \mu\text{m}$ wide. *Medulla* poorly delimited, dominated by rock fragments and crystals; hyphae $2\text{--}3 \mu\text{m}$ wide, thin-walled, more loosely arranged below. *Prothallus* absent. *Apothecia* numerous, dull jet-black, adnate or basally constricted, solitary and rounded or shallowly lobate, paired or in rounded or elongate clusters or short rows of 3–8 (–10), the apothecial shape distorted by mutual pressure, at first slightly convex, becoming strongly convex to subglobose; proper margin initially $20\text{--}30 \mu\text{m}$ thick in surface view, entire and concolorous with the disc, soon becoming excluded; solitary apothecia $(0.24\text{--})0.38\text{--}(0.51)$ mm diam. [$n = 60$]; clustered apothecia $(0.44\text{--})0.79\text{--}(1.18)$ mm in maximum extent [$n = 40$], some clearly formed by merged and fused apothecia, others likely to be derived from lobed and later subdivided apothecia; disc smooth, epruinose; in section the proper exciple is non-carbonized, $25\text{--}40 \mu\text{m}$ thick, partially subtending the hypothecium, consisting of grey-black to violet-black, radiating, conglutinate, thick-walled hyphae $2.5\text{--}3.5\text{--}(4) \mu\text{m}$ diam., with thin lumina, the outermost cells of the excluded margin tightly packed, similar or more rounded, thick-walled and $2.5\text{--}3.5 \mu\text{m}$ diam. *Epihymenium* greenish black, $10\text{--}25 \mu\text{m}$ thick, K-, N+ red-violet (*cinereorufa* green). *Hypothecium* hyaline, $60\text{--}180 \mu\text{m}$ thick, not interspersed with granules or oil droplets, K-, I+ yellowish brown. *Hymenium* $45\text{--}60 \mu\text{m}$ thick, not interspersed, I+ dark blue, K-, C-; the upper parts violet-black to dark-aeruginose, continuous with the epihymenium; *paraphyses* tightly conglutinate, sparingly branched and anastomosed, long-celled, $1.5\text{--}2.5\text{--}(3) \mu\text{m}$ thick; apical cells not swollen. *Asci* narrowly clavate or cylindroclavate, $36\text{--}56 \times 10\text{--}12 \mu\text{m}$, 8-spored, in Lugol's iodine with an amyloid outer coat; tholus well-developed, predominantly amyloid, with a short conical ocular chamber subtending a non-amyloid apical cushion that broadens distally. *Ascospores* colourless, irregularly biserial in the ascus, 3-septate at maturity, narrowly ellipsoid to oblong or short-fusiform, usually straight, occasionally a little bent, not constricted at the septa, $(10\text{--})12\text{--}(14.5) \times (3\text{--})4\text{--}(5) \mu\text{m}$ [$n = 50$], thin-walled, lacking a perispore; apices rounded to subacute. *Pycnidia* numerous, immersed in the areolae; apex plane to subconvex, dark greenish grey to black, $40\text{--}50\text{--}(70) \mu\text{m}$ diam., internally obpyriform, hyaline and $80\text{--}110 \mu\text{m}$ wide; conidiogenous layer not convoluted, $10\text{--}20 \mu\text{m}$ thick; macroconidia narrowly oblong to filiform, straight, curved or arcuate, (1-)3-septate, $10\text{--}19 \times 1\text{--}1.5 \mu\text{m}$; microconidia and mesoconidia not seen. **Fig. 1**

Chemistry: Thallus K-, C-, PD+ orange, UV-; argopsin (major) by TLC.

Relationships: The new species is characterised by a thin, diffuse, greyish green saxicolous thallus containing only argopsin, solitary or clustered, jet-black, convex apothecia with a K- and C- hymenium and a hyaline hypothecium, and comparatively small 3-septate ascospores of $10\text{--}14.5 \times 3\text{--}5 \mu\text{m}$. Its novelty is confirmed by comparison with the other species of the *Micarea lignaria*-*M. ternaria* group (see key below).

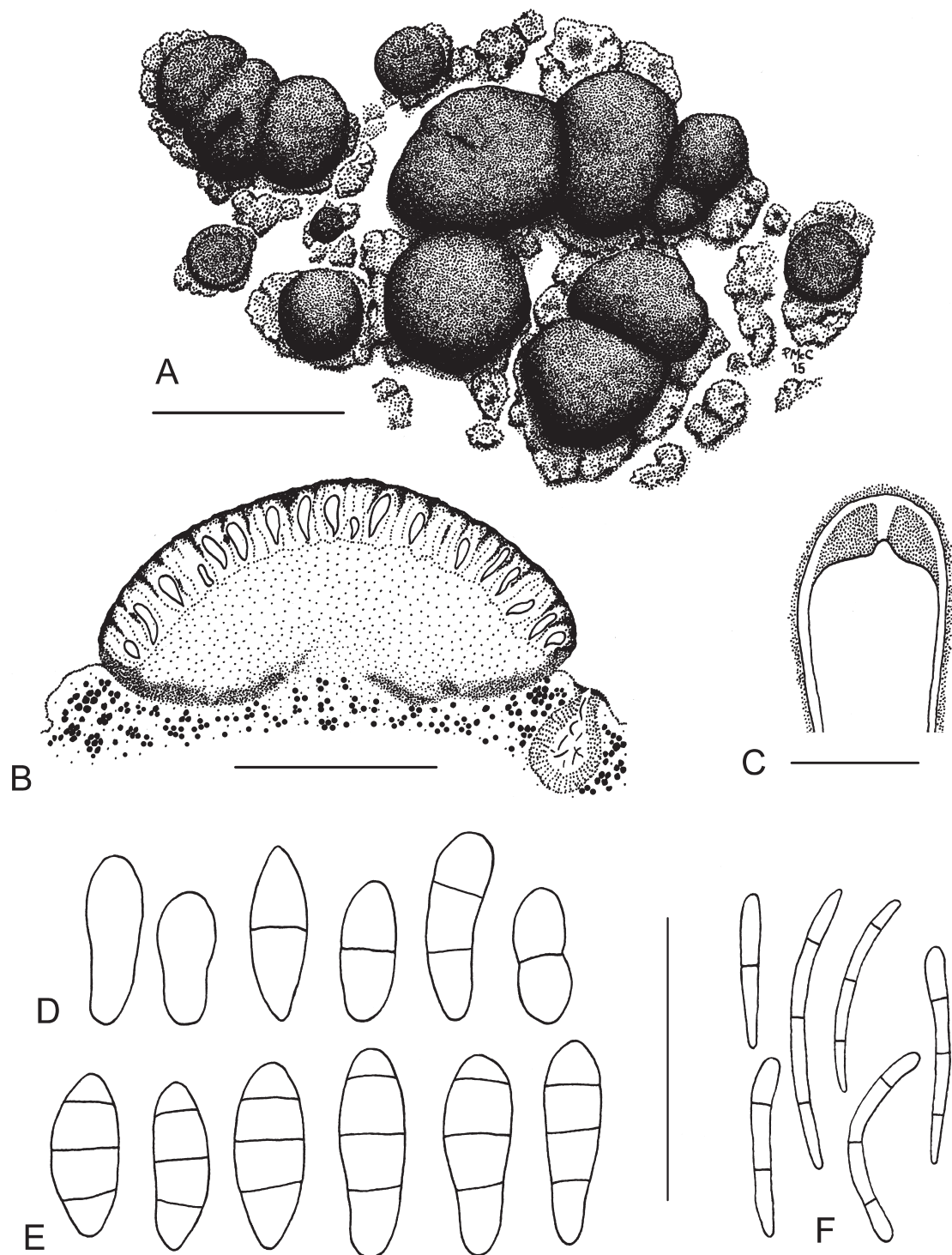


Fig. 1. *Micarea argopsinosa* (holotype). A, habit of thallus, apothecia and pycnidia; B, sectioned apothecium and adjacent pycnidium (semi-schematic); C, apex of a mature ascus; D, immature, 0–2-septate ascospores; E, mature, 3-septate ascospores; F, macroconidia. Scale bars: A = 0.5 mm; B = 0.2 mm; C = 10 µm; D–F = 20 µm.

Our incomplete understanding of the *Micarea lignaria*-*M. ternaria* group in Australia can be appreciated by a brief assessment of several other un-named taxa. Thus, specimens broadly similar to *M. argopsinosa* are known from Tasmania [The Nut, 40°46'S, 145°18'E, on moist, sheltered soil, *G. Kantvilas* 284/99 (HO 445388); South Sister, 41°32'S, 148°10'E, on exposed dolerite boulders, *G. Kantvilas* 361/07 (HO 456291)], and while they are close to the new species in their thalline and apothecial morphology, and in possessing small 3-septate ascospores, both specimens lack lichen substances.

Two saxicolous collections from South Gippsland, Victoria [Strezelecki State Forest, 38°28'S, 146°31'E, J.A. Elix 29897, 29898 (CANB)] share similar morphology and anatomy with *M. argopsinosa*, but their chemistry is anomalous, viz. gyrophoric acid (major) in the thallus, but not in the apothecia, with or without argopsin (minor). Finally, a diminutive specimen on twigs of *Eucalyptus pauciflora* in the southern A.C.T. [Namadgi National Park, Mt Scabby summit, 35°45'08"S, 148°56'35"E, P.M. McCarthy 4200 (CANB)] is reminiscent of *M. lignaria* var. *lignaria* (see below), but its spores are persistently 3-septate and significantly smaller (20–28 × 2.5–3.5 µm), and the thallus lacks lichen substances.

Etymology: The epithet *argopsinosa* refers the occurrence of the β-orcinol depsidone argopsin in the thallus of the new species.

Distribution and habitat: *Micarea argopsinosa* is known only from the sheltered surface of a granite outcrop, approximately 100 metres below the summit of Mount Ginini in the southern A.C.T. Associated saxicolous lichens included *Amandinea punctata* (Hoffm.) Coppins & Scheid., *Buellia ocellata* (Flot.) Körb., *Circinaria caesiocinerea* (Nyl. ex Malbr.) A.Nordin, S.Savic & Tibell, *Fuscidea australis* Kantvilas, *Lecanora polytropa* (Ehrh.) Rabenh., *L. rupicola* (L.) Zahlbr., *Lecidea diducens* Nyl., *Pertusaria erubescens* (Taylor) Nyl., *Ramboldia petraeoides* (Nyl. ex C.Bab. & Mitt.) Kantvilas & Elix, *Rhizocarpon badioatrum* (Flörke) Th.Fr., *R. distinctum* Th. Fr., *R. geographicum* (L.) DC., *R. intersitum* Arnold, *R. lecanorinum* Anders, *R. polycarpum* (Hepp) Th.Fr., *R. reductum* Th.Fr., *Xanthoparmelia mougeotina* (Nyl.) D.J.Galloway, *X. stygiodes* (Nyl. ex Cromb.) O.Blanc, A.Crespo, Elix, D.Hawks. & Lumbsch and *X. xanthomelaena* (Müll.Arg.) Hale.

Key to the species of the *Micarea lignaria-ternaria* group

Based on Coppins (1983, 2009), Coppins and Kantvilas (1990) and Fryday (2004).

- 1 Thallus with a cream-coloured to yellowish tinge, containing xanthonenes..... 2
- 1: Thallus without a cream-coloured or yellowish tinge, not containing xanthonenes..... 3
- 2 Ascospores 19–26 × 3.5–4 µm, (1–)3-septate, often curved [Tasmania, New Zealand, southern S America] **M. isabellina**
- 2: Ascospores 16–38 × 4–7 µm, 3–7-septate, straight or slightly curved [Europe] **M. lignaria** var. **endoleuca**
- 3 Ascospores 10–14.5 µm long, 3-septate **M. argopsinosa**
- 3: Ascospores 14–38 µm long, 3-septate or 3–7-septate..... 4
- 4 Ascospores 3–7-septate, 16–38 × 4–7 µm; thallus containing argopsin [Europe, Macaronesia, N and S America, Réunion, Siberia, Taiwan, New Guinea] **M. lignaria** var. **lignaria**
- 4: Ascospores 3-septate, mostly 14–22 µm long; thallus not containing argopsin 5
- 5 Thallus containing aleotorialic acid [Tasmania, New Zealand, southern S America] **M. magellanica**
- 5: Thallus without lichen substances [British Isles, Arctic Europe, Alaska]..... **M. ternaria**

Acknowledgements

The specimen was collected during a 2013 Bush Blitz survey of the southern A.C.T. and nearby alpine N.S.W., co-funded by the Australian Government and BHP Billiton.

References

- Brand AM, van den Boom PPG, Sérusiaux E (2014) Unveiling a surprising diversity in the lichen genus *Micarea* in Réunion (Mascarenes archipelago, Indian Ocean). *Lichenologist* 46: 413–439 <http://dx.doi.org/10.1017/S0024282913000911>
- Coppins BJ (1983) A taxonomic study of the lichen genus *Micarea* in Europe. *Bulletin of the British Museum (Natural History), Botany Series* 11: 17–214
- Coppins BJ (2009) *Micarea* Fr. (1825). Pp. 583–606 in Smith CW, Aptroot A, Coppins BJ, Fletcher A, Gilbert OL, James PW and Wolseley PA (eds), *The Lichens of Great Britain and Ireland*. (British Lichen Society, London)
- Coppins BJ, Kantvilas G (1990) Studies on *Micarea* in Australasia I. Four new species from Tasmania. *Lichenologist* 22: 277–288 <http://dx.doi.org/10.1017/S0024282990000317>

- Czarnota P (2007) The lichen genus *Micarea* (Lecanorales, Ascomycota) in Poland. *Polish Botanical Studies* 23: 1–199
- Elix JA (2014) *A Catalogue of Standardized Thin-Layer Chromatographic Data and Biosynthetic Relationships for Lichen Substances*, 3rd edn. (Published by the author, Canberra)
- Fryday AM (2004) New species and records of lichenized fungi from Campbell Island and the Auckland Islands, New Zealand. *Bibliotheca Lichenologica* 88: 127–146
- Galloway DJ (2007) *Flora of New Zealand Lichens*. Revised 2nd edn, Vol. 2. (Manaaki Whenua Press, Lincoln)
- Kantvilas G, Elix JA, Jarman SJ (2008) A contribution to an inventory of lichens from South Sister, northeastern Tasmania. *Papers & Proceedings of the Royal Society of Tasmania* 142: 49–60
- McCarthy PM (2015) *Checklist of the Lichens of Australia and its Island Territories*. (Australian Biological Resources Study, Canberra; <http://www.anbg.gov.au/abrs/lichenlist/introduction.html>; Version 10 December 2015)

Manuscript received 18 January 2016, accepted 8 March 2016