

Three new species of *Sarcogyne* (Acarosporaceae) from the Australian Capital Territory

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Abstract

Sarcogyne molongloensis P.M. McCarthy & Elix sp. nov. (Acarosporaceae) is described from sandstone outcrops, while *S. porphyricola* P.M. McCarthy & Elix sp. nov. and *S. terrulenta* P.M. McCarthy & Elix sp. nov. are reported from consolidated, siliceous soil in the Australian Capital Territory. Some recent collections of *S. canberrensis* P.M. McCarthy & Elix, *S. iridana* P.M. McCarthy & Kantvilas and *S. tholifera* P.M. McCarthy & Elix are reported from the A.C.T. and the Northern Territory, and an updated key is provided to the 12 Australian species of *Sarcogyne*.

Introduction

Species of *Sarcogyne* Flot. (Acarosporaceae) have a crustose, often immersed and usually inconspicuous thallus, reddish brown to black apothecia with a lecideine exciple, a non-carbonized epihymenium, simple to sparingly branched paraphyses and asci that usually produce 50–200 or more, simple ascospores (Magnusson 1935a; Poelt 1969; Clauzade & Roux 1985; Knudsen & Standley 2008; Fletcher & Hawksworth 2009; Westberg *et al.* 2015; Knudsen & Kocourková 2018). Approximately 50 species inhabit calcareous and siliceous rocks and soil mainly in temperate and semi-arid areas, especially in Europe, North Africa and North America, less commonly in subtropical, wet-tropical and subpolar regions. Nine species have been reported from Australia, most of which are saxicolous and found only in southern latitudes (McCarthy & Kantvilas 2013; McCarthy & Elix 2014, 2017a, b). In this paper, three new species of *Sarcogyne* are described from sandstone and consolidated, siliceous soil in the Australian Capital Territory, new records are reported for the endemic *S. canberrensis* P.M. McCarthy & Elix, *S. iridana* P.M. McCarthy & Kantvilas and *S. tholifera* P.M. McCarthy & Elix, and a key is provided to the 12 species currently known from Australia.

Methods

Observations and measurements of thallus and apothecium anatomy, asci and ascospores 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.

New species

1. *Sarcogyne molongloensis* P.M. McCarthy & Elix, sp. nov. Figs 1, 2
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Distinguished from the endemic, coastal, silicolous *S. maritima* P.M. McCarthy & Elix by having larger apothecia [(0.28–)0.65(–1.1) diam. vs (0.23–)0.40(–0.55) mm diam.]; a thinner apothecial margin (c. 30–50 µm thick vs 50–70(–80) µm thick) that is concolorous with the disc, and a cupulate proper excipulum (apothecial margin markedly paler in *S. maritima* and the excipulum annular); and a thicker hymenium and longer asci (100–140 µm thick and 65–105 µm long vs 80–100 µm thick and 55–80 µm long).

Type: Australia. Australian Capital Territory. W bank of Molonglo River at Coppins Crossing, c. 8 km W of Canberra, 35°17'17"S, 149°02'04"E, c. 500 m alt., on flat, exposed sandstone outcrop, P.M. McCarthy 4846, 30.i.2019 (holotype – CANB).

Thallus crustose, endolithic to subepilithic or epilithic, effuse-granular to ± determinate, continuous to areolate, pale cream-grey to medium or rather dark greenish grey, 0.06–0.15(–0.2) mm thick, forming colonies to c. 30(–50) mm wide, heavily impregnated with rock fragments and crystals. *Areoles* contiguous or scattered, usually plane, occasionally somewhat convex or slightly concave and with faintly raised margins, 0.3–1(–1.5) mm wide, rounded, angular or irregular; surface smooth to minutely and irregular uneven, dull to slightly glossy. *Cortex* poorly delimited, c. 8–15 µm thick, hyaline, of rounded, thick-walled cells 4–6(–8) µm wide, or an indistinct and almost amorphous layer c. 5–10 µm thick, or the cortex not apparent. *Algal layer* ± continuous, 40–80(–110) µm thick, with an uneven lower edge; cells green, chlorococcoid, globose, 6–13(–15) µm wide; interstitial mycobiont cells in short hyphae, 2–4 µm wide. *Medulla* usually poorly defined and almost obscured by rock fragments and crystals, or distinct and 60–120 µm thick, non-amyloid (I–), not containing calcium oxalate (H₂SO₄–); hyphae short- to long-celled, 2–3 µm wide. *Prothallus* not apparent. *Apothecia* very numerous, lecideine, initially innate in areoles, many becoming adnate, solitary, paired or in proliferating clusters of 3–5, rounded or broadly ellipsoid or irregular in outline, the shape commonly distorted due to mutual pressure, (0.28–)0.65(–1.1) mm diam. [*n* = 120], subtended by a continuous layer of algae; disc slightly concave to plane or slightly convex, smooth, epruinose, dull greenish black to black, occasionally slightly glossy, the colour unchanged when wetted; margin c. 30–50 µm thick, entire, flush with the disc or slightly prominent, smooth, persistent at maturity or almost excluded, concolorous with the disc, epruinose. *Proper excipulum* cupular, non-carbonized, 30–55(–70) µm thick laterally in section, radiating-prosoplectenchymatous, the outer 10–15(–20) µm medium to dark orange-brown to reddish brown (K–, N+ deep red-brown), the hyphae tightly conglutinate, elongate, thick-walled, with cells 2–3(–4) µm wide, the outermost cells subglobose to globose, 3–5 µm; inner marginal zone hyaline to pale brown, 20–30 µm thick, with longer, thinner-walled, paler hyphae; excipulum base colourless, 10–15(–20) µm thick, composed of long-celled and moderately thick-walled periclinal hyphae with cells 7–15 × 2–3 µm, 15–20(–25) µm thick in the centre of the apothecial base, with variously orientated hyphae and cells 3–5 µm wide, these merging with the hypothecium above and the thallus below. *Hypothecium* hyaline to pale red-brown, 30–75(–90) µm thick, interspersed with minute crystals and oil droplets or not, I–, KI+ lilac blue, K–, N+ intensifying, of loose, short-celled, variously orientated hyphae 1.5–2 µm wide. *Hymenium* 100–140 µm thick, not interspersed with granules or oil droplets; hymenial gel I+ red-brown, KI+ deep blue, K–, N–. *Epihymenium* pale brown to medium orange-brown or dark reddish brown, 8–15 µm thick, K–, N+ intensifying. *Paraphyses* rather tightly conglutinate in water, loosening a little in K, unbranched throughout, long-celled, 1–2(–2.5) µm wide; apical cells thicker-walled, dark brown, broadening gradually to 3(–3.5) µm wide. *Asci* narrowly ellipsoid, narrowly to broadly clavate or clavate-cylindrical, containing c. 150–200 ascospores, 65–105 × 16–32 µm [*n* = 15], with a short abrupt stalk; apex rounded, with a thin, uniformly lightly amyloid tholus; ocular chamber not apparent. *Ascospores* colourless, simple, narrowly to broadly ellipsoid or subglobose, obovoid or fusiform to bacilliform, with rounded or, occasionally, somewhat pointed ends, lacking a perispore, usually uni- or biguttulate, the contents usually clear, (2.5–)4(–6) × (1.5–)2(–2.5) µm [*n* = 50]. *Pycnidia* not seen. *Chemistry*: Thallus K–, C–, KC–, PD–, UV–; no substances detected by TLC.

Etymology: The specific epithet refers to the type locality adjacent to the Molonglo River.

Remarks

Sarcogyne molongloensis is characterized by its preference for siliceous rock substrata, combined with an endolithic to epilithic, continuous to areolate thallus that lacks lichen substances, moderately large, innate to adnate apothecia with a thin, persistently dark margin and a cupulate excipulum, a thick hymenium and large asci with very numerous

ascospores. Thalline and apothecial attributes distinguish it from two endemic Australian silicoles, *S. maritima* and *S. iridana* (see key, below). The widespread *S. hypophaea* (Nyl.) Arnold occurs on siliceous and calcareous rocks, has a very thin and inconspicuous thallus, and its apothecia have carbonized and jointed margins (Knudsen & Standley 2008; Fletcher & Hawksworth 2009; Knudsen *et al.* 2013b), while the usually silicolous *S. similis* H.Magn. (North America, the Mediterranean and southern Africa) has a predominantly endolithic thallus and apothecia 0.5–1(–2.1) mm wide, each with a thick, black margin (Knudsen & Standley 2007).

Sarcogyne arenosa (Herre) K.Knudsen & Standley, known from California, Colorado, Texas and Kansas, U.S.A. (Knudsen & Standley 2008; Lendemmer *et al.* 2009), occurs on calcareous and siliceous rocks and is broadly similar to *S. molongloensis* in many thalline and apothecial characters. However, in the former species the hymenium is thinner, the asci are shorter and, most significantly, the ascospores are only 1–1.5 µm wide (Knudsen & Standley 2008).

The new species has been collected from siliceous rocks at two localities in the west and east of the Australian Capital Territory.

ADDITIONAL SPECIMENS EXAMINED

Australian Capital Territory: ● type locality, on flat sandstone rock outcrops, *P.M. McCarthy 4845, 4848*, 30.i.2019 (CANB); ● Kowen Road, Kowen Forest, 11.7 km E of Canberra, 35°19'02"S, 149°15'07"E, 700 m alt., on sandstone beside an old road bank bordering dry *Eucalyptus* woodland, *P.M. McCarthy 4868*, 31.vii.2019 (CANB).

2. *Sarcogyne porphyricola* P.M.McCarthy & Elix, sp. nov.
Mycobank No. **MB 832309**

Figs 3, 4

Characterized by the mainly off-white to pale greenish grey, granulose to quasi-areolate thallus lacking lichen substances and with a ± prosoplectenchymatous, but poorly defined, hyaline cortex, immersed apothecia, 0.13–0.46 mm diam., with a rather smooth, slightly concave to plane, blackish and lightly pruinose disc, with a thin and mainly colourless (thin section), cupulate, proper exciple (pale to medium brown distally), a deep, hyaline hymenium, 180–250 µm thick, a colourless and almost vestigial hypothecium, thin and largely unbranched paraphyses, and clavate-cylindrical asci 150–210 × 16–32 µm, each with *c.* 150–200(–250) ascospores measuring (3–)5(–7.5) × (1.5–)2.2(–2.5) µm.

Type: Australia. Australian Capital Territory. NE slope of Mt Mugga Mugga, Canberra Nature Park, Woden Valley, Canberra, 35°20'43"S, 149°07'10"E, 660 m alt., on consolidated, porphyritic soil in an area of dry land salinity in open *Eucalyptus-Allocasuarina* woodland, *P.M. McCarthy 4777*, 22.ix.2017 (holotype – CANB).

Thallus crustose, predominantly immersed in the substratum to partially superficial, effuse to ± determinate, continuous to granulose and quasi-areolate, off-white, greenish white or pale to medium greenish grey, (0.05–)0.1–0.25(–0.4) mm thick, visible as numerous, small, inconspicuous colonies to *c.* 5 mm wide, scattered on bare soil or among the thalli of other crustose lichen species, occasionally forming larger colonies to *c.* 20 mm wide; 'areoles' rounded to angular-irregular, 0.15–0.4(–0.5) mm wide, their size and shape largely determined by cracks in the soil substratum. *Cortex* poorly defined, hyaline, 15–27 µm thick, ± prosoplectenchymatous, of thick-walled, periclinal hyphae 2–3 µm wide, or indistinct. *Algal layer* dense, continuous, 40–70 µm thick; cells green, chlorococcoid, globose, 7–12(–15) µm wide; interstitial hyphae 2–3 µm wide. *Medulla* poorly delimited, dominated by soil material, non-amyloid (I–), not containing calcium oxalate (H₂SO₄–); hyphae loose, long-celled, (1.5–)2–2.5(–3) µm wide. *Prothallus* not apparent. *Apothecia* numerous, lecideine, immersed in the thallus and substratum, solitary, paired or in small clusters, rounded or broadly ellipsoid in outline, although commonly distorted due to mutual pressure, (0.13–)0.33(–0.46) mm diam. [*n* = 100], subtended by a continuous layer of algae *c.* 50 µm thick; disc dull black, slightly concave to

plane, mostly smooth or, sometimes, minutely uneven, with a sparse, whitish pruina or epruinose; margin concolorous with the thallus or dull black, entire, scarcely raised above the disc, 50–80 µm thick. Many immature and submature apothecia with a pale grey, pseudothal-line margin that is, anatomically, mostly amorphous, necral material with soil fragments and incorporating very few or no algal cells. *Proper excipulum* deeply cupulate, 50–70 µm thick distally and uniformly pale to medium brown (the colour intensifying a little in K and N), paraplectenchymatous in thin section; cells thick-walled, 2–3.5 µm diam.; occasionally the upper excipular edge with an outer, hyaline amorphous zone to 10(–15) µm thick; excipulum sides hyaline to pale brown, 22–30 µm thick; excipulum base hyaline to pale brown, 13–25 µm thick, the sides and base composed of long-celled, thin-walled, periclinal hyphae, with cells 4–8(–10) × 1–1.5(–2.5) µm. *Hypothecium* hyaline, (10–)12–18(–20) µm thick, not interspersed with granules or oil droplets, K–, N–, I– (with or without pretreatment in K). *Hymenium* 180–250 µm thick, hyaline, not interspersed, K–, N–, KI+ deep blue. *Epihymenium* uniformly greenish brown or pale purple-brown in water, granular, 5–10(–15) µm thick, colour intensifying a little in K, N+ pale olive-brown. *Paraphyses* strongly conglutinate in water and K, especially the apices, unbranched below and mainly unbranched above, with sparse anastomoses, long-celled, 1–1.5(–2.5) µm thick; cell contents clear or minutely granulose or with small oil globules; apices strongly conglutinate, not swollen. *Asci* narrowly to broadly clavate or clavate-cylindrical (immature asci often narrowly cylindrical), with *c.* 150–200(–250) ascospores, 150–210 × 16–32 µm [*n* = 20], with an abrupt or tapering stalk; apex rounded, with an amyloid tholus 3–5 µm deep, lacking a distinct ocular chamber. *Ascospores* colourless, simple, narrowly to broadly ellipsoid, oblong or short-bacilliform, occasionally subglobose, straight or slightly curved, with rounded or, occasionally, somewhat pointed ends, lacking a perispore, usually (1–)2-guttulate, the contents also commonly granular, (3–)5(–7.5) × (1.5–)2.2(–2.5) µm [*n* = 50]. *Pycnidia* not seen.

Chemistry: Thallus K–, C–, KC–, PD–, UV–; no substances detected by TLC.

Etymology: The specific epithet refers to the occurrence of the type specimen on porphyry-derived soil.

Remarks

The new species, while inconspicuous in the field, possesses a distinctive suite of thalline and apothecial characters. The thallus is comparatively pale and well-developed (cf. *S. terrulenta*, below), and the apothecia exhibit a discrete and largely unvarying morphology and anatomy, being almost completely immersed, with a rather smooth, usually concave and lightly pruinose disc, a deep hymenium on a rudimentary hypothecium and the thin, cupulate and basally hyaline proper excipulum subtended by a dense and unbroken layer of algal cells. In contrast, the thallus of *S. terrulenta* is thinner, rather nondescript and almost indistinguishable from the substratum, the apothecial discs are rougher and epruinose, the excipulum sides and base are usually medium to dark brown or brown-black, and the ascospores are shorter [(2–)3(–4) µm long vs (3–)5(–7.5) µm long].

Very few *Sarcogyne* species are known to occur exclusively on soil. Thus, for example, the thallus of *S. terrena* H.Magn., from sandy soil in coastal, southern Brazil, is completely immersed in the substratum, being anchored by anastomosing rhizohyphae, and the minute apothecia, to 0.3 mm wide, have a punctiform disc to 0.1 mm wide and an elevated margin (Magnusson 1935b; Knudsen *et al.* 2012). *Sarcogyne crustacea* K.Knudsen & Kocourk., from western North America, has sessile apothecia 0.4–1.5 mm wide with a margin that becomes crenulate to flexuose. The asci are only 60–80 × 20 µm, and they contain *c.* 100 ascospores (Knudsen & Kocourková 2010). *Sarcogyne mitziae* K.Knudsen, Kocourk. & McCune (Knudsen *et al.* 2013a), also from western North America, has a brown corticate thallus, ± sessile apothecia with an interspersed hymenium *c.* 80–100 µm tall and asci that are 50–65 × 15–20 µm, while *S. brunnea* K.Knudsen & Flakus, known from montane soil in Bolivia and Ecuador, has a pruinose, white to brown thallus and a dark reddish brown upper cortex (Knudsen *et al.* 2012). In Australia, the recently described *S. tholicola* P.M.McCarthy & Elix occurs on consolidated, acidic soil in southern Queensland and central-western New South Wales (McCarthy

& Elix 2017a). This highly distinctive species has a minutely squamulose, predominantly yellowish thallus and a secondary chemistry dominated by rhizocarpic acid. Moreover, the apothecia are semi-immersed to almost superficial and moderately to strongly convex or ± hemispherical, 0.32–0.62 mm diam., with a dull greenish black, bilayered, cupulate excipulum, and ascospores 2–3.5 µm long (McCarthy & Elix 2017a).

Sarcogyne porphyricola is known only from a low, porphyritic soil-bank, several metres in extent, in open *Eucalyptus-Allocasuarina* woodland in the Australian Capital Territory. It is part of a rich, terricolous cryptogam community that includes *Buellia suttonensis* Elix & A.Knight, *Caloplaca arandensis* Elix, S.Y.Kondr. & Kärnefelt, *Diploschistes thunbergianus* Lumbsch & Vězda, *Endocarpon pallidum* Ach., *E. pusillum* Hedw., *Heterodea muelleri* (Hampe) Nyl., *Lecanora pseudistera* Nyl., *Lecidea terrena* Nyl., *Micarea humilis* P.M. McCarthy & Elix, *Trapelia* sp., as well as sterile pottiaceous mosses and cyanobacterial crusts.

ADDITIONAL SPECIMEN EXAMINED

Australian Capital Territory: ● type locality, P.M. McCarthy 4806, 15.ix.2017 (CANB).

3. *Sarcogyne terrulenta* P.M. McCarthy & Elix, sp. nov.

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Fig. 5

Similar to *S. porphyricola* P.M. McCarthy & Elix, but differs in having an inconspicuous, pale greyish brown or pale to medium sandy brown thallus (not off-white to pale greenish grey), with a thinner necral layer, apothecia that are subtended by a broken algal layer (not continuous as in *S. porphyricola*) with an uneven, epruinose disc (not smooth and lightly pruinose), a pale brown or, more commonly, medium to dark brown or brown-black proper excipulum (in thin section, not hyaline to very pale brown), and smaller ascospores [(2–)3(–4) µm long vs (3–)5(–7.5) µm long].

Type: Australia. Australian Capital Territory. Kowen Road, Kowen Forest, 11.7 km E of Canberra, 35°19'02"S, 149°15'07"E, 700 m alt., on consolidated, siliceous soil on an old road bank bordering dry *Eucalyptus* woodland, P.M. McCarthy 4827, 9.i.2019 (holotype – CANB).

Thallus crustose, very inconspicuous, largely immersed in to partly superficial on the substratum, effuse to ± determinate, continuous to rimose or quasi-areolate, pale greyish brown or pale to medium sandy brown (and ± concolorous with the substratum), 0.08–0.2(–0.3) mm thick, forming poorly delimited colonies to c. 20(–30) mm wide dominated by soil material; 'areoles' rounded to angular-irregular, 0.2–0.5(–0.7) mm wide, slightly concave and with a somewhat raised margin, or immarginate and plane to moderately convex, areolar size and shape largely determined by the soil substratum, ecorticate, but often with an uppermost, hyaline, amorphous layer c. 10 µm thick. *Algal layer* dense, continuous, 40–60 µm thick; cells green, chlorococcoid, globose, 7–13(–15) µm wide; interstitial hyphae, 2–3 µm wide. *Medulla* poorly defined, dominated and largely obscured by soil material, non-amyloid (I–), not containing calcium oxalate (H₂SO₄–); hyphae loose, long-celled, 2.5–4 µm wide. *Prothallus* not apparent. *Apothecia* numerous, lecideine, 2/3-immersed to almost completely immersed in the substratum (sometimes more prominent following the erosion of the adjacent substratum by wind or rain), solitary, paired or in small clusters, mostly rounded or broadly ellipsoid in outline, occasionally the shape distorted due to mutual pressure, (0.27–)0.41(–0.58) mm diam. [*n* = 100], subtended by a discontinuous layer of algae, the cells in clusters c. 50 µm deep; disc dull black, slightly concave to plane, smooth or minutely to coarsely uneven, epruinose; margin often incorporating soil material, pseudolecanorine and dark grey to lecideine and dull black, entire, thin and inconspicuous to rather tumid, ± flush with the disc or raised and prominent, 60–100(–120) µm thick. *Proper excipulum* cupulate, 45–70(–90) µm thick distally, with a dark brown to brown-black outer zone (K+ deep red-brown or chestnut-brown and N+ red-brown), this often subtending an outermost, hyaline to pale brown, amorphous zone 5–10(–15) µm thick; internally the excipular apex is slightly to considerably paler (and almost hyaline), paraplectenchymatous in thin section, the dark brown cells thick-walled, 3–5 µm diam.;

excipulum sides and base pale brown or, more commonly, medium to dark brown to brown-black, 15–25(–30) µm thick, composed of long-celled, thin-walled, periclinal hyphae, the cells 5–10 × 1–2 µm. *Hypothecium* hyaline, 20–30(–40) µm thick, not interspersed with granules or oil droplets, K–, N– or N+ pale brown, I– (with or without pretreatment in K). *Hymenium* 150–250(–330) µm thick, hyaline to pale brown, not interspersed, K–, N–, I+ blue, fugitive to red-brown, KI+ pale blue. *Epithymenium* pale brown or pale red-brown in water, 15–25(–35) µm thick, the colour intensifying in K, intensifying or fading in N. *Paraphyses* strongly conglutinate in water and K, unbranched below and above, with very sparse branches and anastomoses (anastomoses most numerous adjacent to the excipulum, other branching mainly in and below the epithymenium), long-celled, not or scarcely constricted at the septa, (1–)1.5–2.5(–3.5) µm thick; cell contents clear or minutely granulose or with minute oil globules; apices strongly conglutinate, pale brown, not or only slightly swollen. *Asci* narrowly ellipsoid or narrowly to broadly clavate or clavate-cylindrical, containing c. 200–250 ascospores, 120–170 × 20–35(–40) µm [*n* = 20], with an abrupt or more tapering stalk; apex rounded, with an amyloid tholus 2–4 µm deep, lacking a distinct ocular chamber. *Ascospores* colourless, simple, narrowly to broadly ellipsoid or subglobose, occasionally ovoid or short-bacilliform, straight and with rounded ends, lacking a perispore, with or without 1 or 2 guttules, other cell contents clear or minutely granular, (2–)3(–4) × (1.5–)2.2(–2.5) µm [*n* = 60]. *Pycnidia* not seen; however, numerous conidia observed adjacent to an apothecial section, 1–2 × 0.5–0.7 µm. *Chemistry*: Thallus K–, C–, KC–, PD–, UV–; no substances detected by TLC.

Etymology: The specific epithet *terrulenta* (Latin, of the soil) refers to the preferred substratum of this species.

Remarks

The diagnostic attributes of *S. terrulenta* are outlined in the comparison with *S. porphyricola* and the species diagnosis above, and in the key to Australian taxa below.

Elsewhere in the Australian lichen flora, *S. terrulenta* exhibits a marked, superficial similarity to the terricolous Tasmanian endemic *Acarospora tasmaniensis* K.Knudsen & Kocourk. (syn: *Polysporina terricola* Kantvilas; Kantvilas 1998; Knudsen & Kocourková 2015) in its rather nondescript, greyish thallus, apothecial morphology and anatomy. However, the epithymenium of the Tasmanian lichen has melanized accretions, and the paraphyses develop abundant anastomoses, their hyphal cells containing oil-filled vacuoles that can give them a moniliform appearance (Kantvilas 1998).

Sarcogyne terrulenta is known from consolidated siliceous soils, mainly in *Eucalyptus*-dominated woodland, at several localities in the Australian Capital Territory. Associated lichens include *Caloplaca arandensis* Elix, S.Y.Kondr. & Kärnefelt, *Catapyrenium* spp., *Cladonia* spp., *Diploschistes* spp., *Endocarpon pusillum* Hedw., *Heterodea muelleri* (Hampe) Nyl., *Lecanora pseudistera* Nyl., *Lecidea terrena* Nyl., *Micarea humilis* P.M. McCarthy & Elix, *Trapelia* spp. and *Verrucaria kowenensis* P.M. McCarthy.

ADDITIONAL SPECIMENS EXAMINED

Australian Capital Territory: ● type locality, P.M. McCarthy 4864, 31.vii.2019 (CANB); ● Woodstock Nature Reserve, Shepherds Lookout Walk, 20 km WNW of Canberra, 35°14'34"S, 148°58'38"E, 555 m alt., on consolidated, siliceous soil bank in open *Eucalyptus-Callitris* woodland, P.M. McCarthy 4805, 17.vii.2018 (CANB); ● Canberra Nature Park, Aranda Bushland, Powerline Track, c. 4 km W of Canberra, 35°16'00"S, 149°04'54"E, 690 m alt., on siliceous soil bank in open *Eucalyptus* woodland, J.A. Elix 46806, 10.viii.2019 (CANB); ● *loc. id.*, J.A. Elix 46810, 14.viii.2019 (CANB); ● *loc. id.*, P.M. McCarthy 4881, 14.viii.2019 (CANB).

New records

1. *Sarcogyne canberrensis* P.M. McCarthy & Elix, *Australas. Lichenol.* **80**, 17 (2017)
Initially described and known only from Cotter Caves in the A.C.T. (McCarthy & Elix 2017a), this species was recently collected on calcareous substrata at two other localities in the Territory.

SPECIMENS EXAMINED

Australian Capital Territory: ● Woodstock Nature Reserve, Shepherds Lookout Walk, 20 km WNW of Canberra, 35°14'34"S, 148°58'38"E, 555 m alt., on concrete in remnants of paved track through *Eucalyptus-Callitris* woodland, P.M. McCarthy 4798, 4790, 4793, 4794, 5.xii.2018 (CANB); ● Namadgi National Park, former Honeysuckle Creek Tracking Station, 32 km SSW of Canberra, 35°35'03"S, 148°58'35"E, 1020 m alt., on vertical edge of concrete slab in open *Eucalyptus* woodland, P.M. McCarthy 4852, 27.ii.2019 (CANB).

2. *Sarcogyne iridana* P.M. McCarthy & Kantvilas, *J. Adelaide Bot. Gard.* **26**, 15 (2013)

This species was previously known only from sandstone outcrops in dry scrub at Rainbow Valley, c. 75 km south of Alice Springs, Northern Territory (McCarthy & Kantvilas 2013).

SPECIMEN EXAMINED

Northern Territory: ● near Rockhole Bore, Henbury Station, Chandler Range, 24°30'55"S, 133°27'12"E, 434 m alt., on sandstone boulder near base of a steep rocky slope, in open shrubland dominated by *Acacia*, V. Stajsic 6635, 22.v.2013 [MEL, NT (n.v.)].

3. *Sarcogyne tholifera* P.M. McCarthy & Elix, *Australas. Lichenol.* **80**, 18 (2017)

This lichen is known from consolidated, acidic soils at two woodland localities in southern Queensland and central-western New South Wales (McCarthy & Elix 2017a).

SPECIMEN EXAMINED

Australian Capital Territory: ● track to Aranda Bushland, 4 km W of Canberra, 35°15'32"S, 149°04'53"E, 655 m alt., on soil at base of *Eucalyptus* in dry *Eucalyptus* woodland, J.A. Elix 46828, 7.ix.2019 (CANB).

Key to the Australian species of *Sarcogyne*

- 1** Thallus growing on soil.....2
1: Thallus growing on rock.....4
- 2** Thallus squamulose-areolate, yellow-green, containing rhizocarpic acid.....*S. tholifera*
2: Thallus crustose, rimose to quasi-areolate, shades of grey, green or brown, not yellowish, lacking lichen substances.....3
- 3.** Thallus off-white to pale greenish grey; apothecia subtended by a continuous algal layer, and with a lightly pruinose disc; proper excipulum colourless at the sides and base; ascospores (3–)5(–7.5) μm long.....*S. porphyricola*
3: Thallus pale greyish brown or pale to medium sandy brown; apothecia subtended by a discontinuous algal layer, and with an epruinose disc; proper excipulum mostly medium to dark brown or brown-black at the sides and base; ascospores (2–)3(–4) μm long.....*S. terrulenta*
- 4** Excipulum carbonized.....5
4: Excipulum not carbonized.....6
- 5** Apothecia 0.4–1 mm diam.; margin entire; hypothecium colourless to pale brown.....*S. hypophaea*
5: Apothecia 1–3(–6) mm diam.; margin crenulate; hypothecium medium to dark brown.....*S. clavus*

- 6** Thallus on calcareous rocks.....7
6: Thallus on siliceous rocks.....9
- 7** Apothecia 0.4–1.2 mm diam.; disc usually white- to blue-grey-pruinose, plane to convex.....*S. regularis*
7: Apothecia 0.15–0.5 mm diam.; disc epruinose, deeply concave to plane.....8
- 8** Apothecia immersed, often leaving pits in the substratum; ascospores 3–6 \times 1.5–2.5 μm , c. 150–200 per ascus; hypothecium 30–80 μm thick.....*S. meridionalis*
8: Apothecia mostly adnate; ascospores 4–8.5 \times 2.5–5 μm , c. 80–150 per ascus; hypothecium 10–35 μm thick.....*S. canberrensis*
- 9** Ascospores 6–9.5 μm long, c. 40–60(–80) per ascus; thallus containing sekikaic acid; apothecia usually white-pruinose.....*S. sekikaica*
9: Ascospores 2.5–5.5(–7) μm long, c. (100–)150–180(–250) per ascus; thallus lacking secondary substances; apothecia epruinose.....10
- 10** Thallus whitish, diffuse, 15–25 μm thick; apothecia usually moderately to markedly convex or subglobose and then strongly constricted at the base.....*S. iridana*
10: Thallus pale greenish or pale brown to medium or dark greenish grey, forming substantial colonies that are rimose to areolate and 60–200(–250) μm thick; apothecia innate to adnate, slightly concave to plane or slightly convex, never constricted at the base.....11
- 11** Apothecia (0.23–)0.40(–0.55) mm diam.; margin 50–70(–80) μm thick, slightly or markedly paler than the disc; proper excipulum annular; hymenium 80–100 μm thick; asci with c. 100–150 ascospores, 55–80 μm long.....*S. maritima*
11: Apothecia (0.28–)0.65(–1.1) mm diam.; margin c. 30–50 μm thick, concolorous with the disc; proper excipulum cupulate; hymenium 100–140 μm thick; asci with c. 150–200 ascospores, 65–105 μm long.....*S. molongloensis*

References

- Clauzade, G; Roux, C (1985): Likenoj de Okcidenta Eŭropo. Ilustrita Determinlibro. *Bulletin de la Société Botanique du Centre-Ouest*, Nouvelle Série, Numéro Spécial 7, 1–893.
- Fletcher, A; Hawksworth, DL (2009): *Sarcogyne* Flot. (1851). In Smith, CW; Aptroot, A; Cop-pins, BJ; Fletcher, A; Gilbert, OL; James, PW; Wolseley, PA (eds), *The Lichens of Great Britain and Ireland*: 829–830. British Lichen Society, London.
- Kantvilas, G (1998): Notes on *Polysporina* Vězda, with a description of a new species from Tasmania. *Lichenologist* **30**, 551–562.
- Knudsen, K; Flakus, A; Kukwa, M (2012): A contribution to the study of Acarosporaceae in South America. *Lichenologist* **44**, 253–262.
- Knudsen, K; Kocourková, J (2010): Lichenological notes 1: Acarosporaceae. *Mycotaxon* **112**, 361–366.
- Knudsen, K; Kocourková, J; McCune, B (2013a): *Sarcogyne mitziae* (Acarosporaceae), a new species from biotic soil crusts in western North America. *Bryologist* **116**, 122–126.
- Knudsen, K; Kocourková, J; Westberg, M (2013b): The identity of *Sarcogyne hypophaea* (Nyl.) Arnold. *Opuscula Philolichenum* **12**, 23–26. Knudsen, K; Kocourková, J (2015): A new species of *Acarospora* (Acarosporaceae) from east-ern Canada with melanized ephymenial accretions, with additional notes on *A. anatolica* and *Polysporina terricola*. *Opuscula Philolichenum* **14**, 144–147.
- Knudsen, K; Kocourková, J (2018): *Sarcogyne praetermissa* (Acarosporaceae), a new calci-colous lichen species from Europe, with a key to the European *Sarcogyne* species. *Herzogia* **31**, 133–139.
- Knudsen, K; Standley, SM ('2007') [2008]: *Sarcogyne*. In Nash III, TH; Gries, C; Bungartz, F (eds), *Lichen Flora of the Greater Sonoran Desert Region* **3**, 289–296. Lichens Unlimited, Tempe.

- Lendemer JC; Kocourková, J; Knudsen, K (2009): Studies in lichens and lichenicolous fungi: more notes on taxa from North America. *Mycotaxon* **110**, 373–378.
- Magnusson, AH (1935a): Acarosporaceae, Thelocarpaceae. In Rabenhorst, GL, *Kryptogamen-Flora von Deutschland, Österreich, und der Schweiz. Die Flechten*, Abt. **5**(1), 1–318. Gebrüder Borntraeger, Leipzig.
- Magnusson, AH (1935b): On the species of *Biatorella* and *Sarcogyne* in America. *Annales de Cryptogamie Exotique* **7**, 115–145.
- Magnusson, AH (1937): Additional notes on Acarosporaceae. *Meddelelser fran Göteborgs Botaniska Trädgård* **12**, 87–103.
- McCarthy, PM; Elix, JA (2014): Two new lichens from Mount Canobolas, New South Wales. *Telopea* **16**, 119–125.
- McCarthy, PM; Elix, JA (2017a): Two new species and a new record of Acarosporaceae (lichenized Ascomycota) from eastern Australia. *Australasian Lichenology* **80**, 16–27.
- McCarthy, PM; Elix, JA (2017b): Five new lichen species (Ascomycota) and a new record from southern New South Wales, Australia. *Telopea* **20**, 335–353.
- McCarthy, PM; Kantvilas, G (2013): Two new species of *Sarcogyne* (lichenised Ascomycota, Acarosporaceae) from central and southern Australia. *Journal of the Adelaide Botanic Garden* **26**, 15–21.
- Poelt, J (1969): *Bestimmungsschlüssel Europäischer Flechten*. J. Cramer, Lehre.
- Westberg, M; Millanes, AM; Knudsen, K; Wedin, M (2015): Phylogeny of the Acarosporaceae (Lecanoromycetes, Ascomycota, Fungi) and the evolution of carbonized ascomata. *Fungal Diversity* **70**, 145–158.

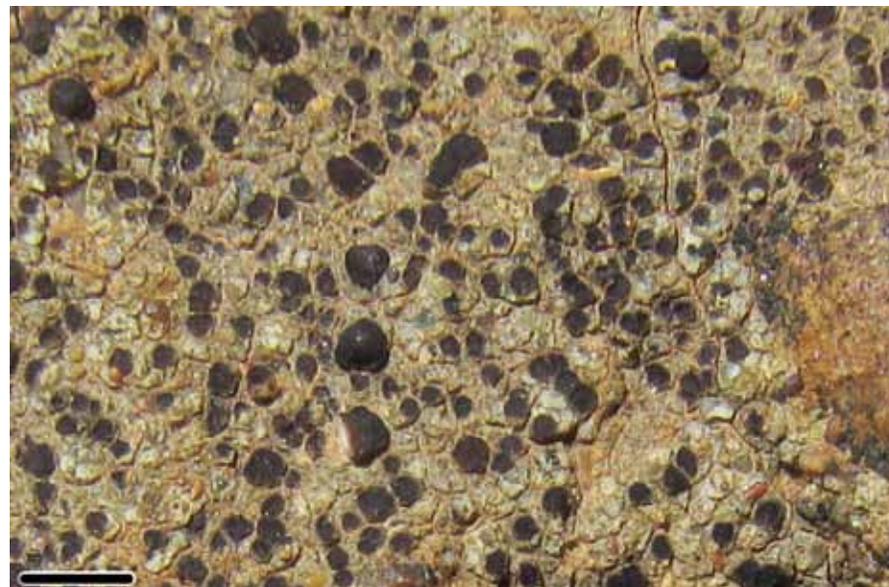


Figure 1. *Sarcogyne molongloensis* (holotype). Scale: 2 mm.

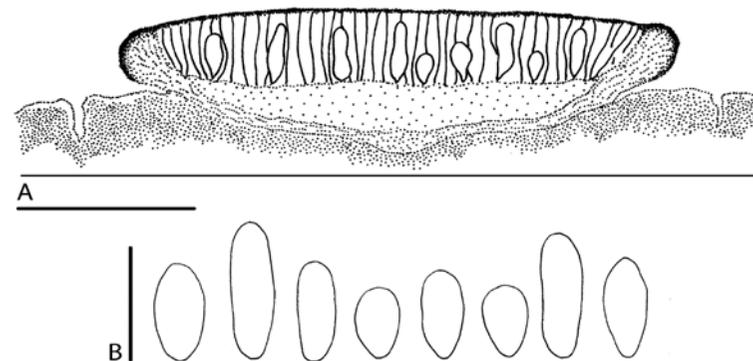


Figure 2. *Sarcogyne molongloensis* (holotype). A, Section of apothecium (semi-schematic); B, Ascospores. Scales: A = 0.2 mm; B = 5 µm.



Figure 3. *Sarcogyne porphyricola* (holotype). Scales: 1 mm.

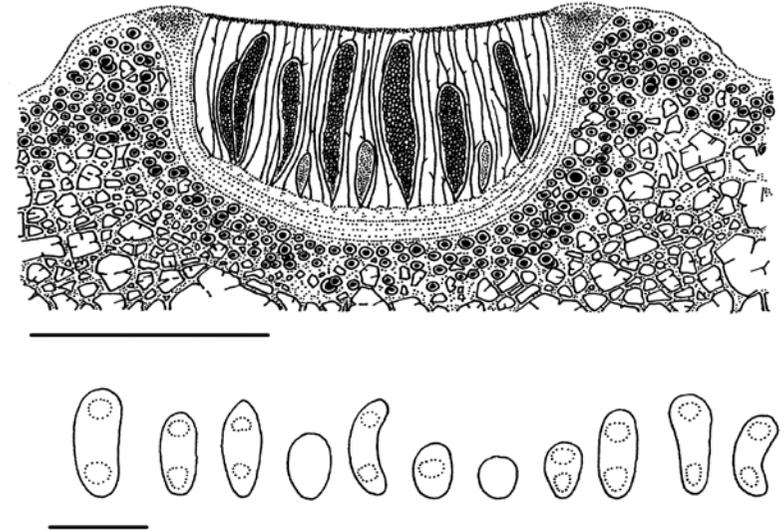


Figure 4. *Sarcogyne porphyricola* (holotype). A, Section of apothecium (semi-schematic); B, Ascospores. Scales: A = 0.2 mm; B = 5 μ m.

**A new species of *Cratiria* (Caliciaceae, Ascomycota)
from Ascension Island, South Atlantic Ocean**

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Abstract

Cratiria jamesiana Elix & H.Mayrhofer, a saxicolous species with *Physconia*- then *Buellia*-type ascospores and bacilliform conidia, and containing thuringione and arthothelin, is described as new to science.

Introduction

This paper is a continuation of our investigations into *Buellia*-like lichens in the Southern Hemisphere (Elix 2018; Elix & McCarthy 2018; Elix *et al.* 2018; Elix 2019a, b and references therein). The genus *Cratiria* Marbach includes species that are characterized by relatively large, submuriform or 1-septate ascospores, 15–28 × 7–13 µm, with apical wall-thickenings, short, bacilliform conidia 4–6 µm long, a hymenium that can be interspersed with oil droplets or not and an excipulum containing lichen substances (Marbach 2000; Elix 2014). In this paper we describe a new saxicolous species of *Cratiria* from Ascension Island in the South Atlantic Ocean. Methods are as described in previous papers cited above.

Cratiria jamesiana Elix & H.Mayrhofer, sp. nov.
Mycobank number: **MB 832570**

Figs 1, 2

Similar to *Cratiria chloraceus* Marbach, but differs in being saxicolous and in having a K-excipulum and hypothecium.

Type: Ascension Island, Green Mountain, Monkey Rock, [07.9500°S, 14.3500°W], 460 m alt., on volcanic rock, *P.W. James s.n.*, 3.xi.1976 (BM – holotype).

Thallus crustose, continuous, to 55 mm wide and up to 1 mm thick; upper surface pale grey to pale yellow-grey, verruculose, matt; warts 0.1–1 mm wide; prothallus black, marginal when abutting other lichens; medulla white, lacking calcium oxalate (H₂SO₄-), I-; photobiont cells 8–14 µm diam. *Apothecia* 0.4–1.5 mm wide, lecideine, scattered, sessile; disc black, pale grey-pruinose, concave to ± plane; proper exciple thick, concolorous with the disc, entire, persistent, cupuliform, in section 75–100 µm thick; outer zone opaque brown-black with crystals, K-, N-; inner zone brown. *Hypothecium* 190–240 µm thick, dark brown to brown-black, K-. *Epihymenium* 10–15 µm thick, pale brown to grey-brown, with crystals soluble in K, K-, N-. *Hymenium* 90–110 µm thick, colourless, interspersed with oil droplets; subhymenium 25–35 µm thick, pale brown; paraphyses 1.7–2.0 µm wide, simple to branched, capitate, with apices dark brown, 3–3.5 µm wide; asci approximating the *Bacidia*-type, with 8 or fewer spores. *Ascospores* at first of the *Physconia*-type, then of the *Buellia*-type, 1-septate, olive-brown to brown, ellipsoid, 15–[16.6]–20 × 8–[8.9]–10 µm, rarely constricted at the septum, with apical wall-thickenings; outer spore-wall rugulate. *Pycnidia* immersed; conidia bacilliform, straight, 4–5 × 0.7–1 µm.

Chemistry: Thallus K-, C-, P-, UV+ orange; containing thuringione (major), arthothelin (major), 3-*O*-methylthiophanic acid (minor).

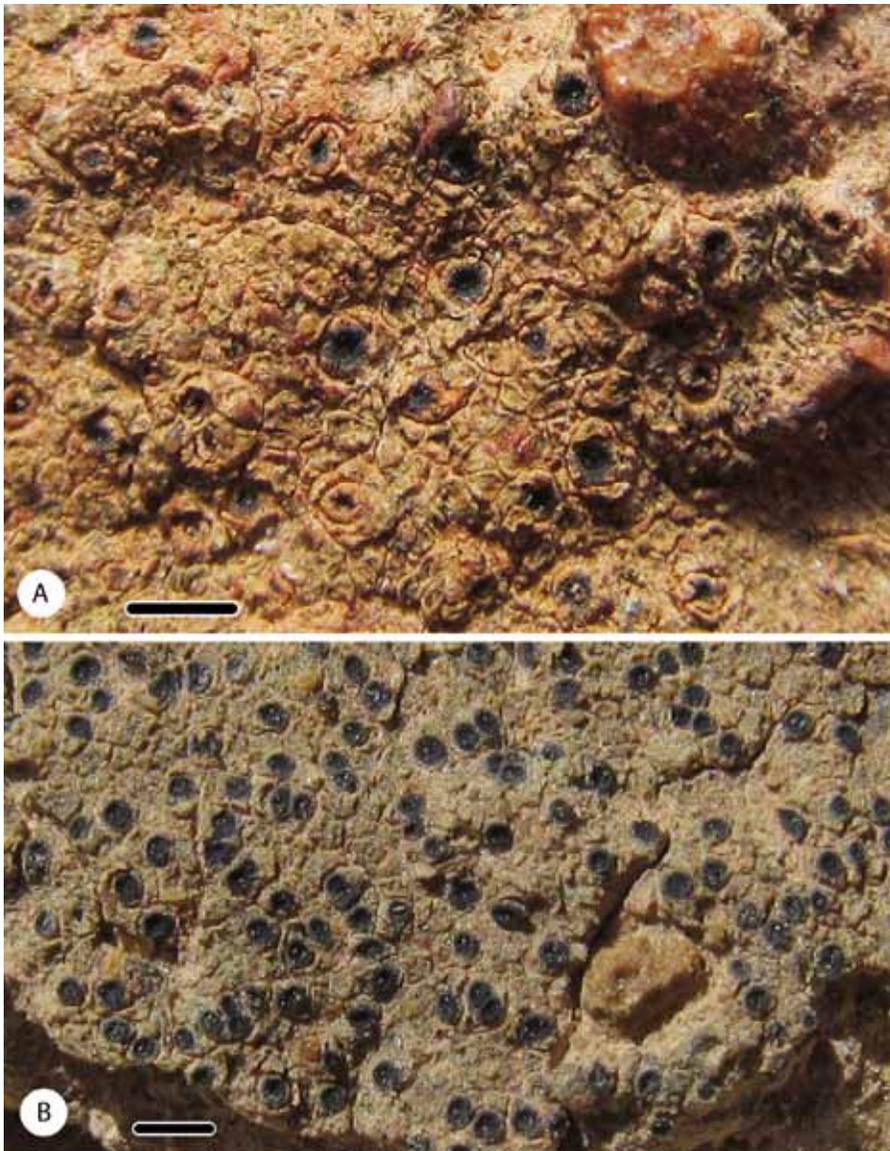


Figure 5. *Sarcogyne terrulenta*. A, holotype; B, J.A. Elix 46806. Scales: 1 mm.