

A new species of *Sarcogyne* (Acarosporaceae) on soil in South Australia

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Abstract

Sarcogyne humicola P.M.McCarthy & Elix sp. nov. (Acarosporaceae) is described from siliceous soil in south-eastern South Australia. It has a brown, areolate to subsquamulose thallus with a 3-layered cortex and a thick, continuous algal layer; also dark, adnate, thin-margined apothecia anchored by a thick, colourless stipe growing down from the basal excipulum, and asci containing 50–100(–150) ascospores measuring $3\text{--}7 \times 2.5\text{--}4 \mu\text{m}$. An updated key is provided to the 14 species of *Sarcogyne* known from Australia.

Introduction

This paper is a result of our continuing investigation of the lichen genus *Sarcogyne* Flot. (Acarosporaceae) in Australia (McCarthy & Kantvilas 2013; McCarthy & Elix 2014, 2017a, b, 2020, 2021). The description of *S. humicola* sp. nov. brings to 14 the number of Australian taxa, with six of these occurring on soil. Methods follow those reported in previous contributions.

Sarcogyne humicola P.M.McCarthy & Elix, sp. nov.
Mycobank No.: **MB 840453**

Figs 1, 2

Thallus superficial on siliceous soil, areolate to subsquamulose, 100–200 μm thick, with a 3-layered cortex subtended by a thick, continuous algal layer; attached to the substratum by rhizohyphae. Apothecia very numerous, adnate, 0.34–0.84 mm diam., with a dull dark wine-red disc, a thin, persistent margin that is often paler; the proper excipulum is cupular, predominantly hyaline, its base growing into a thick stipe that anchors the apothecium; epihymenium medium to dark orange-brown; hymenium 80–110 μm thick, not interspersed; paraphyses simple; hypothecium hyaline, 35–60(–75) μm thick; asci with 50–100(–150) ascospores, these $3\text{--}7 \times 2.5\text{--}4 \mu\text{m}$.

Type: Australia, South Australia, Mount Lofty Ranges, Guthries Steep Gully, 7 km E of Springton, 34°43'S, 139°09'E, 320 m alt., on consolidated, siliceous soil in pasture with scattered trees and shrubs, *J.A. Elix 26389*, 25.ix.1991 (holotype – CANB).

Thallus areolate to subsquamulose, terricolous, superficial, forming continuous colonies to c. 40 mm wide, pale to medium yellowish brown or ochre, to 100–150(–200) μm thick. *Areoles/squamules* contiguous, concave and with raised margins or plane to slightly convex, 0.3–1 (–1.5) mm wide, mostly angular or irregular, separated by deep, narrow cracks, non-amyloid (I–), not containing calcium oxalate (H_2SO_4 –), often almost completely obscured by massed apothecia; surface smooth to minutely and irregular uneven, dull to slightly glossy. *Cortex* clearly delimited in thin section, comprising 3 layers: uppermost *syncortex* hyaline, 12–20 (–25) μm thick, distally necral and amorphous, grading to paraplectenchymatous below, with the cells thick-walled and lumina rounded to ellipsoid and (1–)2.5–4 μm wide; *eu cortex* with an upper layer 8–15 μm thick, of rounded to vertically elongate, greyish brown to dark brown, moderately thick-walled cells 4–7 μm in maximum extent; this subtended by a layer, 10–15 μm thick, of hyaline, rounded to angular, thin-walled cells 4–6 μm wide; *lateral cortex*, thinner than the upper but similarly tri-layered; lower cortex absent. *Algal layer* occupying most of the thallus, dense, continuous, with an even upper edge, (35–)60–100(–130) μm thick; cells green,

chlorococcoid, globose, 6–12(–14) μm wide. *Medulla* usually poorly defined and dominated by soil material, otherwise 20–40 μm thick; hyphae 2–3 μm wide. *Rhizohyphae* long-celled, thin-walled, (2–)3–4(–5) μm wide, penetrating 0.25 mm or more into the substratum. *Prothallus* and a distinct hypothallus not apparent. *Apothecia* very numerous, lecideine, adnate, solitary or in proliferating clusters, rounded or broadly ellipsoid in outline, (0.34–)0.57(–0.84) mm diam. [$n = 100$], or distorted due to mutual pressure; disc plane to slightly convex at maturity, dull dark wine-red, the colour not changing when wetted, smooth, epruinose; margin c. 50–80 μm thick, entire, slightly to markedly prominent, usually persistent at maturity, concolorous with the disc or somewhat paler and almost similar in colour to the thallus. *Proper excipulum* cupular, 35–50 μm thick laterally, 10–15 μm thick at the base, predominantly hyaline and prosoplectenchymatous except for the outermost zone of the lateral excipulum which is dark brown (K+ intensifying reddish brown, N+ paler brown), 12–15 μm thick, with radiating, thick-walled cells $5\text{--}8 \times 3\text{--}5 \mu\text{m}$, these subtended by roundish or moniliform, radiating, hyaline cells $4\text{--}6 \times 3\text{--}4 \mu\text{m}$, and in turn by the narrow, periclinal cells of the tightly packed excipulum base, $6\text{--}10 \times 1\text{--}2 \mu\text{m}$. *Apothecial stipe* wedge-like, growing down from the centre of the basal excipulum and penetrating almost to the substratum, 120–200 μm wide, hyaline, of thick-walled, long-celled hyphae 2.5–4 μm wide. *Hypothecium* hyaline, 35–60(–75) μm thick, hyaline to very pale yellowish brown, not interspersed with granules or oil droplets, KI–, K– (but a minutely granular substance becoming visible), N–, of variously orientated and comparatively thick-walled hyphae 1–2 μm wide. *Hymenium* 80–110 μm thick, not interspersed; hymenial gel KI+ pale to deep blue, K–, N–. *Epihymenium* medium to dark orange-brown, 12–20 μm thick, K+ paler orange-brown and diffuse, N–. *Paraphyses* simple, tightly conglutinate in water and K, long-celled, 1–1.5(–2) μm wide, not constricted at the septa; contents clear to minutely guttulate; apices slightly swollen (c. 2.5 μm wide). *Asci* narrowly to broadly clavate or clavate-cylindrical, containing 50–100(–150) ascospores, $58\text{--}88(100) \times 12\text{--}18 \mu\text{m}$ [$n = 12$], with a tapering stalk; apex rounded, with a uniformly lightly amyloid tholus to 5 μm thick; ocular chamber low-convex or not apparent. *Ascospores* colourless, simple, narrowly to broadly ellipsoid or subglobose, lacking a perispore, $(3\text{--})4\text{--}6(7) \times 2.5\text{--}3.5(4) \mu\text{m}$ [$n = 50$]; spore contents usually clear. *Pycnidia* not seen. *Chemistry:* No substances detected by TLC (Elix 2020).

Etymology: The epithet *humicola* (L., ground-loving) refers to the occurrence of the new species on soil.

Remarks

The new species is characterized by the superficial, areolate to subsquamulose thallus on siliceous soil, a distinct, 3-layered cortex that is subtended by a thick, continuous algal layer, very numerous, adnate apothecia with a dull dark wine-red disc, an often paler, thin and persistent margin, the hyaline hypothecium and predominantly hyaline proper excipulum and stipe, along with asci containing 50–100(–150) ascospores that are $3\text{--}7 \times 2.5\text{--}4 \mu\text{m}$. This suite of characters sets it apart from the five other terricolous Australian species of *Sarcogyne* (see key below), as well as the five extra-Australian taxa known from soil, as follows.

Sarcogyne crustacea K.Knudsen & Kocourk., from soil in south-western U.S.A., has a pale, pseudoareolate thallus that is also truly corticate, sessile apothecia 0.4–1.5 mm wide, with a flexuose margin at maturity, branching paraphyses and ascospores c. 1.5–2 μm wide. (Knudsen & Kocourková 2010).

Sarcogyne brunnea K.Knudsen & Flakus, a corticate species from the Andes in Bolivia and Ecuador, has pruinose brownish areoles, an algal layer interrupted by hyphal bundles, immersed apothecia less than 0.6 mm diam. and a hymenium 100–200 μm tall (Knudsen *et al.* 2012).

Sarcogyne terrena H.Magn., from Brazil, has apothecia to 0.3 mm wide with a punctiform disc, a hymenium 100–150 μm tall, a very thin hypothecium, branching paraphyses and ascospores c. 1.5 μm wide (Knudsen *et al.* 2012).

Sarcogyne mitziae K.Knudsen, Kocourk. & McCune occurs on soil in western North

America. It has a complex corticate thallus as in *S. humicola* (not just an alga-free uppermost layer); however, the apothecia are only 0.2–0.5 mm diam., with discs that turn orange when wetted, and an inspersed hymenium (Knudsen *et al.* 2013).

Sarcogyne arenosa (Herre) K.Knudsen & Standley, an occasional colonizer of soil in south-western U.S.A., has a thin, pale areolate thallus ± lacking a cortex, large sessile apothecia and ascospores 1–1.5 µm wide (Knudsen & Standley 2008).

Sarcogyne humicola is known only from consolidated, siliceous soil at the type locality in south-eastern South Australia. Associated terricolous species include *Diploschistes hensseniae* Lumbsch & Elix, *Heterodea muelleri* (Hampe) Nyl., *Psora crystallifera* (Taylor) Müll.Arg., *P. decipiens* (Hedw.) Hoffm., *Xanthoparmelia amphixantha* (Müll.Arg.) Hale and *X. pseudoamphixantha* (Elix) Elix & J.Johnst.

Key to the Australian species of *Sarcogyne*

- 1 Thallus growing on soil..... 2
- 1: Thallus growing on rock..... 7
- 2 Thallus yellow-green, containing rhizocarpic acid..... *S. tholifera*
- 2: Thallus shades of grey, green or brown, not yellowish, lacking lichen substances..... 3
- 3 Apothecia 0.15–0.45(–0.58) mm diam.; hymenium 150–330 µm thick..... 4
- 3: Apothecia 0.28–0.8(–1.1) mm diam.; hymenium 80–140 µm thick 5
- 4 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*
- 4: 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*
- 5 Thallus areolate to subsquamulose, with a well-defined, 3-layered cortex; ascospores 50–100(–150) per ascus and 3–7 × 2.5–4 µm..... *S. humicola*
- 5: Thallus crustose and inconspicuous to pseudoareolate, ecorticate or with a thin, poorly defined cortex; ascospores *c.* 150–200 per ascus and 2–5(–6) × 1.5–2.5(–3) µm..... 6
- 6 Epithymenium dark olive-brown to green-black, coarsely uneven in section, 18–50 µm thick; excipulum base brown-black, to 80(–100) µm thick in the centre..... *S. regalis*
- 6: Epithymenium pale brown to medium orange-brown or dark reddish brown, 8–15 µm thick; excipulum base colourless, 10–15(–20) µm thick..... *S. molongloensis*
- 7 Excipulum carbonized 8
- 7: Excipulum not carbonized 9
- 8 Apothecia 0.4–1 mm diam.; margin entire; hypothecium colourless to pale brown..... *S. hypophaea*
- 8: Apothecia 1–3(–6) mm diam.; margin crenulate; hypothecium medium to dark brown..... *S. clavus*
- 9 Thallus on calcareous rocks 10
- 9: Thallus on siliceous rocks..... 12
- 10 Apothecia 0.4–1.2 mm diam.; disc usually white- to blue-grey-pruinose, plane to convex..... *S. regularis*
- 10: Apothecia 0.15–0.5 mm diam.; disc epruinose, deeply concave to plane..... 11

- 11 Apothecia immersed, often leaving pits in the substratum; ascospores 3–6 × 1.5–2.5 µm, *c.* 150–200 per ascus; hypothecium 30–80 µm thick..... *S. meridionalis*
- 11: Apothecia mostly adnate, not leaving pits; ascospores 4–8.5 × 2.5–5 µm, *c.* 80–150 per ascus; hypothecium 10–35 µm thick..... *S. canberrensis*
- 12 Ascospores 6–9.5 µm long, *c.* 40–60(–80) per ascus; thallus containing sekikaic acid; apothecia usually white-pruinose..... *S. sekikaica*
- 12: Ascospores 2.5–5.5(–7) µm long, *c.* (100–)150–180(–250) per ascus; thallus lacking secondary substances; apothecia epruinose..... 13
- 13 Thallus whitish, diffuse, 15–25 µm thick; apothecia usually moderately to markedly convex or subglobose and then strongly constricted at the base..... *S. iridana*
- 13: 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..... 14
- 14 Apothecia (0.23–)0.4(–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*
- 14: 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*

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Fig. 1. *Sarcogyne humicola* (holotype). Scale: 1 mm.

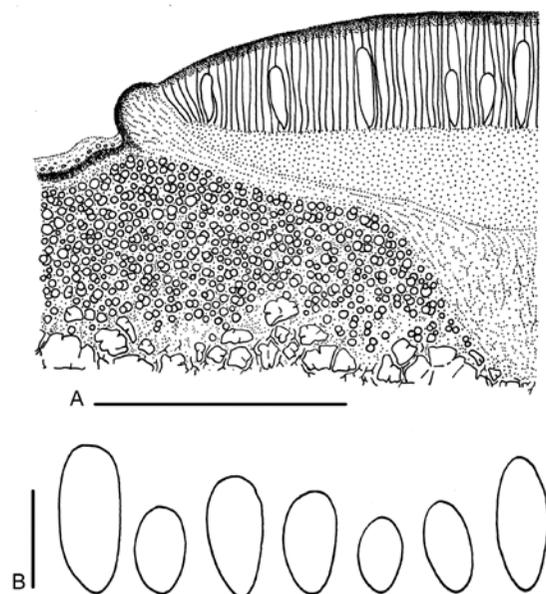


Fig. 2. *Sarcogyne humicola* (holotype). A, Vertical section of part of an apothecium and the adjacent thallus (semi-schematic); B, Ascospores. Scales: A = 0.2 mm; B = 5 µm.

A new species of buellioid lichen (Caliciaceae, Ascomycota) from Otago, South Island, New Zealand

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Abstract

Buellia springvalensis Elix & A.Knight is described as new to science. It occurs on quartz pebbles in the saline Springvale Scientific Reserve in Central Otago, South Island, New Zealand, and is characterized by small, *Buellia*-type ascospores, an aeruginose epihymenium and the presence of psoromic acid.

Introduction

This paper continues our investigation of *Buellia*-like lichens in New Zealand. For the more recent additions, see Blaha *et al.* (2016), Elix & Mayrhofer (2016, 2017, 2018, 2021), Elix *et al.* (2017), Elix & Knight (2017) and references cited therein. In this paper, we describe a new species of *Buellia* in the broad sense. Methods are as described in the papers cited above.

The new species

Buellia springvalensis Elix & A.Knight, sp. nov.
MycoBank No.: **MB 840261**

Fig. 1

Similar to *Buellia macularis* Zahlbr., but differs in having smaller ascospores, 10–[11.8]–16 × 5–[6.5]–9 µm, and in containing psoromic acid rather than norstictic acid.

Type: New Zealand, South Island, Otago, Springvale Scientific Reserve, 45°12'18"S, 169°12'08"E, 180 m alt., on quartz pebbles on Miocene mudstone, *A. Knight s.n.*, 9.xii.2020 (holotype – OTA 071080; isotype – CANB).

Thallus crustose, to 20 mm wide and 0.2 mm thick, rimose to rimose-areolate; areoles 0.2–0.5 mm wide, rounded, flat or weakly convex, contiguous; upper surface grey-white to pale yellow-grey, dull, often roughened; prothallus usually conspicuous, black, surrounding the thallus, sometimes stellate-fimbriate, to 0.5 mm wide; medulla white, lacking calcium oxalate (H₂SO₄⁻), I–; photobiont cells 7–14 µm wide. *Apothecia* 0.1–0.5 mm wide, lecidine, immersed, then adnate to sessile; disc black, flat to weakly convex, epruinose. *Excipulum* distinct, persistent, cupuliform, in section 25–70 µm thick, the outer zone greenish black to brown-black, K–, N+ red-violet or red-brown, the inner zone pale brown. *Epihymenium* 8–12 µm thick, dark brown to aeruginose, K–, N+ red-violet. *Hypothecium* 60–80 µm thick, pale brown to chestnut-brown. *Hymenium* 50–65 µm thick, colourless, not interspersed. *Paraphyses* 1.5–2 µm wide, simple to moderately branched, with apices 5–6 µm wide and aeruginose-brown caps. *Asci* *Bacidia*-type, 8-spored. *Ascospores* *Buellia*-type, 1-septate, olive-brown to brown, broadly ellipsoid, 10–[11.8]–15 × 5–[6.5]–9 µm, rarely constricted at the septum, with obtuse ends, uniformly thin-walled; outer spore-wall microrugulate. *Pycnidia* rare, immersed, urceolate to globose. *Conidia* bacilliform, 3–5 × 0.7–1 µm.

Chemistry: Thallus K+ yellow, P+ yellow, C–, UV–; containing psoromic acid [major].

Etymology: The species is named after the type locality.