

***Verrucaria kowenensis* (lichenized Ascomycota, Verrucariaceae),  
a new species on soil in the Australian Capital Territory**

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**Abstract**

*Verrucaria kowenensis* P.M.McCarthy (lichenized Ascomycota, Verrucariaceae) is described from consolidated, siliceous soil in the Australian Capital Territory. It has a pale greyish green or pale to medium greenish grey, areolate to pseudosquamulose thallus that is corticate, comparatively thick and dominated by algae. Perithecia are numerous, exceptionally minute, non-involucellate and largely immersed in the thallus, with a black apex, the excipulum being colourless at the sides and base. The ascospores are  $11\text{--}20 \times 5\text{--}7.5 \mu\text{m}$ .

**Introduction**

Soil-inhabiting taxa form a very small minority among species of *Verrucaria sens. lat.*, most of which occupy terrestrial, freshwater and coastal rocks in temperate and cooler regions of the world. Among the Australian members of the genus, the usually saxicolous *V. nigrescens* Pers. and *V. compacta* (A.Massal.) Jatta can sometimes be found on compacted soil, while the endemic *V. solicola* P.M.McCarthy occurs on moist boggy soil in Mount Kosciuszko National Park, New South Wales and in southern and central Tasmania (McCarthy 1996, 2012). In this paper, a new and exceptionally diminutive species of *Verrucaria* is documented from consolidated, siliceous soil at two localities in the Australian Capital Territory.

**Methods**

Observations and measurements of photobiont cells, thalline and ascotal anatomy, asci and ascospores were made on hand-cut sections mounted in water. Asci were also observed in Lugol's Iodine (I), with and without pretreatment with potassium hydroxide (K).

***Verrucaria kowenensis*** P.M.McCarthy, sp. nov.

Figs 1 & 2

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Broadly similar to the terricolous Australian endemic *V. solicola*, but differs in having a thicker, areolate or  $\pm$  minutely pseudosquamulose thallus with a bilayered cortex, much smaller perithecia with a thinner, paler exciple laterally and at the base, and shorter asci.

*Type:* Australia, Australian Capital Territory, Kowen Road, Kowen Forest, 11.7 km E of Canberra,  $35^{\circ}19'02''\text{S}$ ,  $149^{\circ}15'07''\text{E}$ , 700 m alt., on consolidated, siliceous soil on an old road bank bordering dry *Eucalyptus* woodland, *P.M. McCarthy 4865*, 31.vii.2019; holotype – CANB.

*Thallus* terricolous, very inconspicuous, superficial, areolate or minutely pseudosquamulose (pseudosquamules distinguished by being slightly attenuated at the base), forming small, scattered colonies to 5 mm wide, pale greyish green or pale to medium greenish grey. *Areoles/pseudosquamules* rounded,  $\pm$  ellipsoid or rounded-irregular, not angular, contiguous or scattered, 0.2–0.6(–0.9) mm wide, to 0.3 mm thick, corticate; surface smooth to minutely and irregularly uneven. *Cortex* usually distinctly bilayered in thin section; outer layer prosopectenchymatous,  $\pm$  hyaline to pale greenish grey, (8–)10–15  $\mu\text{m}$  thick, the individual hyphae periclinal, long-celled, 1–1.5  $\mu\text{m}$  thick; inner layer paraplectenchymatous, dark grey-brown, 6–12  $\mu\text{m}$  thick, the individual cells rounded, thick-walled, 4–6  $\mu\text{m}$  wide. *Photobiont cells* dominating the thallus, forming a layer 80–150(–200)  $\mu\text{m}$  deep; cells pale green, unicellular,  $\pm$  globose, thin- to thick-walled, 5–13(–15)  $\mu\text{m}$  diam.; interstitial mycobiont cells (2–)2.5–3(–3.5)  $\mu\text{m}$  wide. *Medulla* nondescript, dominated by soil material; hyphae loose, 1.5–2  $\mu\text{m}$  wide. *Lower cortex* and rhizohyphae absent. *Prothallus* not apparent; hypothallus absent. *Ascomata* perithecia, numerous, usually solitary, occasionally semi-immersed, mostly 2/3–3/4-immersed in the thallus, 1–5(–12) per areole/pseudosquamule, c. 80–130(–150)  $\mu\text{m}$  wide (immersed part);

perithecial apex dull black, smooth, convex to subconical, (70–)100(–120)  $\mu\text{m}$  wide [ $n = 50$ ]; ostiole inconspicuous, usually in a minute, shallow depression 10–20  $\mu\text{m}$  wide. *Involucrellum* absent. *Excipulum* 25–35  $\mu\text{m}$  thick at and near the perithecial apex and mostly dark brown to blackish, with the cells ellipsoid to globose, thick-walled, 4–6  $\mu\text{m}$  wide; lateral excipulum colourless, 20–25  $\mu\text{m}$  thick; excipulum base colourless, 12–15  $\mu\text{m}$  thick; sides and base consisting of elongate, moderately thick-walled, periclinal cells 7–10  $\times$  1.5–2  $\mu\text{m}$ . *Subhymenium* hyaline, 5–8(–10)  $\mu\text{m}$  thick. *Paraphyses* absent. *Periphyses* unbranched, 12–20(–25)  $\times$  (1.5–) 2–3  $\mu\text{m}$ , thick-walled and rather long-celled, with narrow lumina, the end-cells often narrowly clavate. *Hymenial gel* I+ red-brown, KI+ red-brown. *Asci* 8-spored, narrowly ellipsoid or narrowly to broadly clavate, 35–48  $\times$  14–18  $\mu\text{m}$  [ $n = 10$ ], the apex lacking an ocular chamber; ascoplasm I+ orange-brown, KI–. *Ascospores* irregularly biseriate in the ascus, simple, colourless, narrowly to broadly ellipsoid or oblong-ellipsoid, occasionally the distal end slightly broader,  $\pm$  straight, with rounded ends, (11–)16(–20)  $\times$  (5–)6(–7.5)  $\mu\text{m}$  [ $n = 78$ ]; wall c. 0.5  $\mu\text{m}$  thick, lacking an epispore; contents clear or minutely granulose, often with 1 or 2 large vacuoles. *Pycnidia* not seen.

*Etymology*: The species epithet is derived from the type locality.

### Remarks

*Verrucaria kowenensis* is characterized by the soil substratum, the comparatively thick, areolate or minutely pseudosquamulose thallus with a bilayered cortex, as well as minute, simple perithecia, each with a brown-black excipulum apex, but with colourless sides and base. By contrast, *V. solicola* has a rather thin, ecorticate thallus, 30–70(–120)  $\mu\text{m}$  thick, small areoles, 0.1–0.25(–0.4) mm wide, larger perithecia, 0.11–0.25 mm diam., having a thicker and much darker excipulum and longer asci (48–60  $\mu\text{m}$  long).

Comparing this lichen with the few terricolous species known from the Northern Hemisphere, the perithecia of *V. kowenensis* are very much smaller than those of the boreal *V. geophila* Zahlbr. and *V. sibirica* Zahlbr. (Clauzade & Roux 1985). Furthermore, the ascospores are larger than the subglobose propagules of *V. bernaicensis* Malbr. and *V. terrigena* Zschacke, but are smaller than in *V. bryoctona* (Th.Fr.) Orange (Clauzade & Roux 1985; Orange 1991, 2013). The northern European species *V. xyloxena* Norman has somewhat similar perithecial morphology and dimensions, but the thallus of that species is granular-verrucose and composed of brown-pigmented gonocysts (Orange 1991, 2013).

The type specimen of *V. kowenensis* inhabited a dry, consolidated, siliceous soil bank beside *Eucalyptus*-dominated woodland in the Australian Capital Territory. It formed part of a species-poor lichen community along with extensive colonies of *Trapelia concentrica* Elix & P.M. McCarthy and an undescribed species of *Sarcogyne* Flot., and small thalli of a doubtfully lichenized *Arthonia* species. The second collection, a small fragment, was collected fortuitously.

### ADDITIONAL SPECIMEN EXAMINED

*Australian Capital Territory*: ● 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 in open *Eucalyptus* woodland, P.M. McCarthy 4869, 14.viii.2019 (CANB).

### References

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Figure 1. *Verrucaria kowenensis* (holotype). Scale: 1 mm.

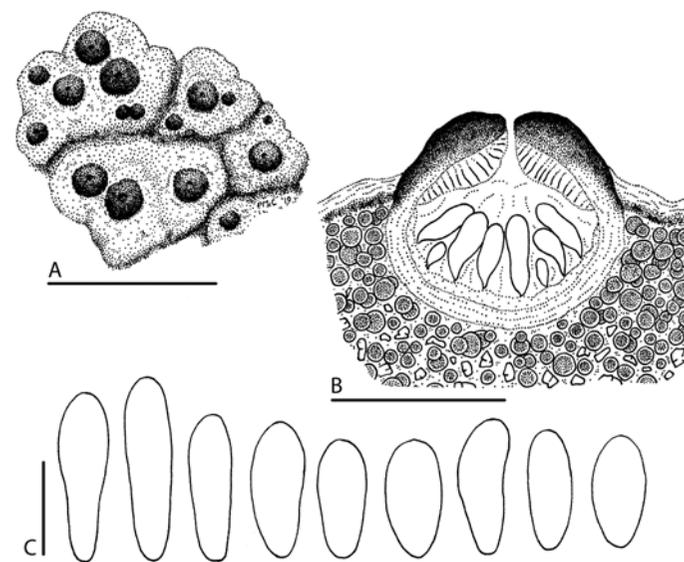


Figure 2. *Verrucaria kowenensis* (holotype). A, Habit of thallus and perithecial apices; B, Sectioned perithecium, with adjacent thallus (semi-schematic); C, Ascospores. Scales: A = 0.5 mm; B = 0.1 mm; C = 10  $\mu\text{m}$ .