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Normandina pulchella is readily identified by its distinctive blue-green colour and its ear-like squamules, which have raised and strongly inrolled margins. It colonizes a range of substrata, including rock, tree bark, moist humus, leaves, and even other lichens, and it's moderately tolerant of air pollution. It often produces dense patches of moss-green soredia on the surface and margins of its squamules, but ascomata and conidiomata are unknown. Occasional reports of perithecia have mostly been dismissed as fruiting bodies produced by *Lauderlindsaya borneri* or other lichenicolous Ascomycetes. Often overlooked because of its small size, it's nearly cosmopolitan in its distribution.

1 mm 

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Two new species of buellioid lichens (Caliciaceae, Ascomycota) from South Africa

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Abstract

Buellia subarnoldii Elix & H.Mayrhofer and *Tetramelas africanus* Elix & H.Mayrhofer, from South Africa, are described as new to science.

Introduction

Although the biodiversity of microlichens in southern Africa is not particularly well documented, in recent times the region has proved to be a rich source of crustose Caliciaceae (Bungartz & Wirth 2007; Wirth & Bungartz 2009; Wirth 2010; Fryday *et al.* 2020; Elix *et al.* 2021a, b). In this paper, we describe a new saxicolous species of *Buellia sens. str.* and a new saxicolous species of *Tetramelas* from South Africa.

Methods

Observations and measurements of photobiont cells, thallus and apothecium anatomy, asci, ascospores and pycnidia were made on hand-cut sections mounted in water and 10% KOH (K). Asci were also observed in Lugol's Iodine (I), with and without pretreatment in K. Medullary sections were treated with 10% sulfuric acid (H₂SO₄) and apothecial sections with 50% nitric acid (N). Chemical constituents were identified by thin-layer chromatography (Elix 2022) and comparison with authentic samples.

New species

1. *Buellia subarnoldii* Elix & H.Mayrhofer, sp. nov.
Mycobank No.: **MB 842952**

Fig. 1

Similar to *Buellia arnoldii* Servit, but differs in having a saxicolous thallus, larger ascospores and usually fewer spores per ascus.

Type: Republic of South Africa, *Natal*, Royal National Park, W of Plowman's Kop, below gorge "The Crack", 28°41'S, 28°55'E, c. 1850 m alt., on large S-exposed boulders, *D. Triebel* & *G. Rambold 6814*, 10.iii.1990 (holotype – M).

Thallus crustose, to 40 mm wide and 0.5 mm thick, immersed to rimose-areolate; areoles rounded to irregular, 0.5–1.5 mm wide, crowded and contiguous; upper surface off-white to pale grey-brown, dull, smooth, epruinose; prothallus black, marginal and between areoles or not apparent; photobiont cells 6–11 µm wide; medulla white, lacking calcium oxalate (H₂SO₄-), I-. *Apothecia* 0.5–1.5 mm wide, lecideine, separate and ± round or becoming distorted, adnate to sessile; disc black, epruinose, plane to convex with age. *Excipulum* distinct, thin, excluded in older, convex apothecia, in section 25–50 µm thick; outer part dark brown, K-, N-, brown within. *Hypothecium* 125–150 µm thick, dark brown merging with the brown-black central stipe. *Epithemium* 10–15 µm thick, brown, K-, N-. *Hymenium* 120–150 µm thick, colourless, densely interspersed with oil droplets. *Paraphyses* 1.5–2.5 µm wide, simple to sparsely branched, the apices 3–3.5 µm wide and with brown caps. *Asci* *Bacidia*-type, usually with 2–4 spores, rarely with 8 spores. *Ascospores* *Callispora*-type, 1-septate, brown, ellipsoid,

22–[32.3]–45 × 13–[16.0]–21 µm, becoming constricted at the septum, often curved; outer spore-wall smooth to finely ornamented. *Pycnidia* common, black, immersed, punctiform. *Conidia* bacilliform, 4–5 × 1 µm.

Chemistry: Thallus K+ yellow, P+ pale yellow, C-, UV-; containing atranorin.

Etymology: The species is named after its superficial similarity to *Buellia arnoldii*.

Remarks

Buellia subarnoldii is characterized by the crustose, off-white to pale grey-brown, immersed to rimose-areolate thallus with lecideine apothecia 0.5–1.5 mm wide, the non-amyloid medulla, the densely interspersed hymenium, usually with 2–4-spored asci, the ellipsoid, 1-septate, *Callispora*-type ascospores, 22–45 × 13–21 µm, and the presence of atranorin. *Buellia arnoldii*, a corticolous European species, is similar in having a densely interspersed hymenium, *Callispora*-type ascospores and in containing atranorin, but it differs in having 8-spored asci with smaller ascospores, 23–30 × 11–14 µm (Foucard *et al.* 2002; Coppins *et al.* 2009). *Buellia procellarum* A.Massal., a common, saxicolous South African species, is also very similar, but differs in having a thinner hymenium, 80–110 µm, slightly smaller ascospores, 22–40 × 10–18 µm, with a rugulate outer spore-wall and in containing additional diploicin and isofulgidin (Elix 2009).

Buellia subarnoldii is known from three collections, where it co-occurs with several *Lecidella* and *Lecidea* species and *Tetramelas africanus* (described below).

ADDITIONAL SPECIMENS EXAMINED

Republic of South Africa. *Cape Province*. • Massenberg, 40 km S of Velddrif, E of R27, 28 km N of crossing with road to Darling/Yzerfontein, 33°07'S, 18°08'E, 120–140 m alt., on rocks and boulders at W slope of hill, *D. Triebel* & *G. Rambold 8449* 6.iv.1990 (M). *Orange Free State*. • Golden Gate Highlands National Park, summit of Wodenhouse Kop, 28°33'S, 28°38'E, 2434 m alt., on W-exposed rocks, *D. Triebel* & *G. Rambold 6619*, 7.iii.1990 (M).

2. *Tetramelas africanus* Elix & H.Mayrhofer, sp. nov.
Mycobank No.: **MB 842953**

Fig. 2

Similar to *Tetramelas allisoniae* Elix, H.Mayrhofer & Glenn, but differs in having a thinner hymenium, 75–100 µm thick, and significantly longer conidia, 8–11 µm long.

Type: Republic of South Africa. *Natal*. Royal National Park, W of Plowman's Kop, below gorge "The Crack", 28°41'S, 28°55'E, c. 1850 m alt., on large S-exposed boulders, *D. Triebel* & *G. Rambold 6829*, 10.iii.1990 (holotype – M).

Thallus crustose, areolate to verrucose-areolate, to 40 mm wide and 0.5 mm thick; areoles irregular, angular, 0.1–0.6 mm wide, contiguous to separate; upper surface pale yellow-grey to grey-white, dull, epruinose; prothallus black and marginal or not apparent; photobiont cells 7–13 µm wide; medulla white, lacking calcium oxalate (H₂SO₄-), I+ purple. *Apothecia* 0.2–0.8 mm wide, lecideine, separate and ± round, adnate to sessile; disc black, epruinose, plane, soon becoming convex. *Excipulum* prominent, elevated above disc but excluded in older, convex apothecia, in section 40–70 µm thick, the outer part dark brown, K-, N-, paler brown within. *Hypothecium* 60–80 µm thick, brown to dark brown merging into a brown-black stipe, 120–150 µm thick. *Epithemium* 10–13 µm thick, brown to dark brown, K-, N-. *Hymenium* 75–100 µm thick, colourless, not interspersed but ± with scattered oil droplets; subhymenium 15–30 µm thick, pale brown to brown. *Paraphyses* 1.5–2 µm wide, simple to sparsely branched, the apices 3–3.5 µm wide with brown caps. *Asci* *Bacidia*-type, 8-spored or with fewer spores (4 or 5). *Ascospores* initially of the *Callispora*-type, then of the *Buellia*-type, 1-septate, brown, ellipsoid to broadly fusiform, 18–[21.8]–27 × 10–[11.1]–13 µm, becoming constricted at the septum, sometimes with 1 or 2 endosepta when mature; outer spore-wall finely ornamented (microrugulate). *Pycnidia* immersed, punctiform. *Conidia*

elongate-bacilliform, $8\text{--}11 \times 1\text{--}1.5 \mu\text{m}$.

Chemistry: thallus K⁺ yellow, C⁺ orange, KC⁺ deep orange, P⁻, UV⁺ orange; containing arthothelin (major), 4,5-dichloronorlichexanthone (trace).

Etymology: The species is named after its occurrence in Africa.

Remarks

Tetramelas africanus is characterized by the crustose, pale yellow-grey to grey-white, areolate to verrucose-areolate thallus with lecideine apothecia 0.2–0.8 mm wide, the amyloid medulla, the non-inspersed hymenium, asci with 8 or fewer, ellipsoid to broadly fusiform, 1-septate, *Callispora*- then *Buellia*-type ascospores, $18\text{--}27 \times 10\text{--}13 \mu\text{m}$, and the presence of arthothelin. In many respects it resembles *T. allisoniae*, a saxicolous species known from New Zealand (Elix & Mayrhofer 2017). Both lichens are characterized by the presence of arthothelin, an amyloid medulla and similar ascospores (sometimes with 1 or 2 endosepta) and apothecial anatomy including similar reactions of the hypothecium and epihymenium. However, *T. allisoniae* has a thicker hymenium, 110–130 μm thick, and shorter conidia, 3–5.5 μm long. Interestingly, *T. africanus* has much longer conidia than reported for any other species of this genus.

At present, *T. africanus* is known from two collections where it co-occurs with a *Lecidea* species, *Buellia spuria* (Schaer.) Anzi and *B. subarnoldii* (described above).

ADDITIONAL SPECIMEN EXAMINED

Republic of South Africa. *Orange Free State*. • Golden Gate Highlands National Park, trail to Glen Reenen-Brandwag below Wodenhouse Kop, shortly before Brandwag, below chain ladder, $28^{\circ}32'S$, $28^{\circ}38'E$, c. 2030 m alt., on boulders below overhanging rock wall, *D. Treibel* & *G. Rambold* 6742, 8.iii.1990 (M).

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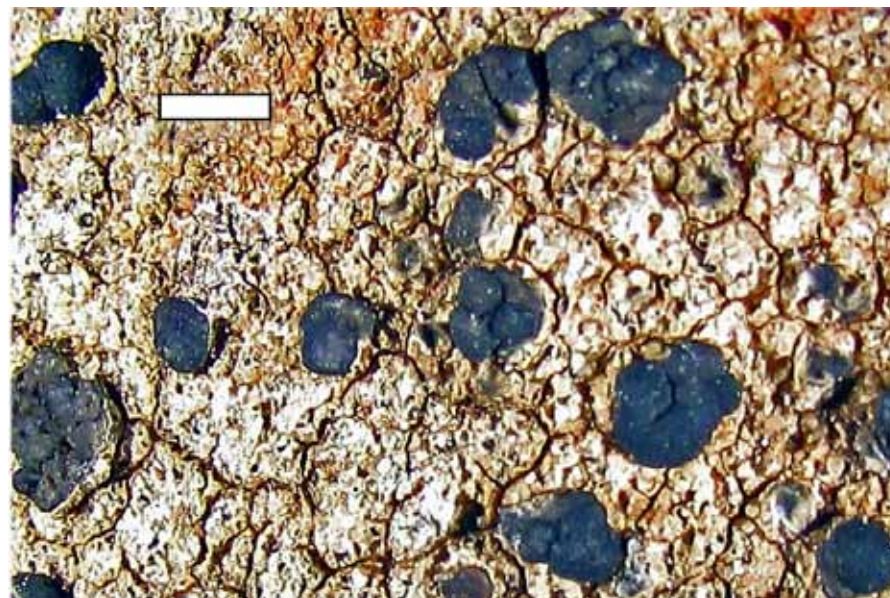


Figure 1. *Buellia subarnoldii* (holotype in M). Scale = 2 mm.

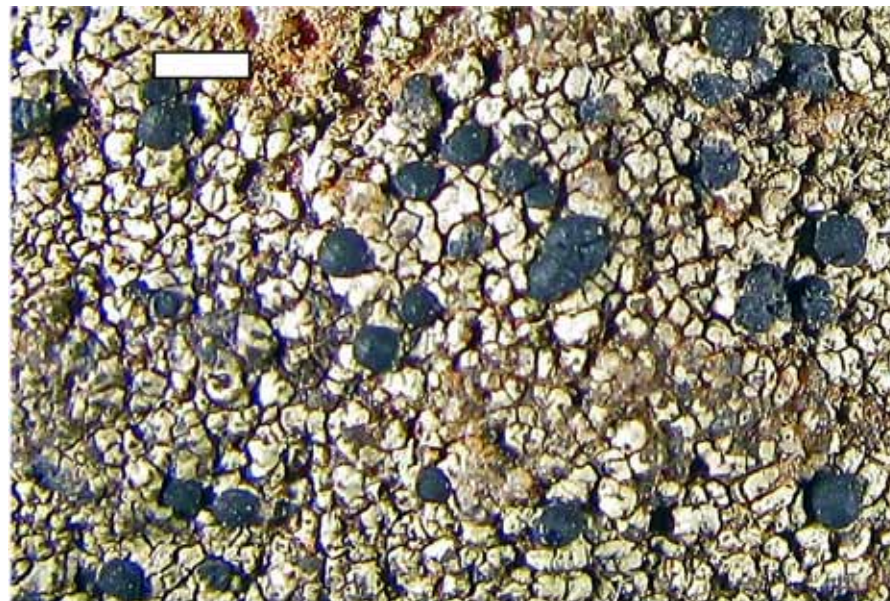


Figure 2. *Tetramelas africanus* (holotype in M). Scale = 1 mm.