Thallus crustose, squamulose or effregitate-lobate, continuous to dispersed, rimose to areolate, 1–10 cm wide, corticate or not, rarely immersed in the substratum and inconspicuous. Prothallus absent or present as a thin brown or black marginal line, rarely spreading, but often extending between the areolae. Isidia present; soredia or blastidia (not in Australia) present or absent. Upper surface white, grey-white to grey, yellow-grey, yellow-orange, yellow-green or brown. Photobiont not forming a continuous layer. Medulla present or absent; medulla usually white, rarely with yellow, orange or red pigments, often containing calcium oxalate (forming clusters of needle-shaped crystals in 10% H₂SO₄).

Ascomata apothecial, immersed to sessile; disc dark brown to black, pruinose or not, plane to convex or rarely weakly concave; proper margin concolorous with the disc, with necrotic material remaining attached when emerging from the thallus (thalline veil), rarely with a collar of poorly differentiated thalline material ( pseudolecanorine); thalline exciple very rarely present. Proper exciple thin and poorly differentiated (aethalea-type) to conspicuously thickened and differentiated into an inner and outer exciple. Epihymenium 5–20 μm thick, olive, brown to dark greenish blue or black; hypothecium 40–220 μm thick, usually deep reddish brown, more rarely pale brown, yellowish or colourless; hymenium 35–140 μm thick, colourless, rarely inspersed with oil droplets, amyloid. Paraphyses septate, simple or sparingly branched, apically swollen and with a distinct pigmented cap. Asci of Bacidia- or Biatora-type, clavate; apex wall layers thickened; apex amyloid, with a distinct axial mass, 2–16-spored. Ascospores olive to dark brown, 1-septate to submuriform, Physconia- or Buellia-type, uniformly thin-walled or with septal wall thickenings, oblong to ellipsoidal, rarely globose, 7–28 × 3.5–14.0 μm; outer wall smooth to strongly ornamented; spore ontogeny usually type-A, rarely type-B (see Rinodina); torus present or absent. Conidiomata laminal, immersed, globose or flask-shaped; conidiophores usually of type V (Vobis, 1980), very rarely type III or type VI, acrogenous. Conidia short-oblong to ellipsoidal, bacilliform or filiform, 1.5–30.0 × 0.7–1.5 μm.

Buellia s. str. (formerly Hafellia Kalb, H.Mayrhofer & Scheid.) is one of the few well-delimited groups within Buellia s. lat. (Bungartz et al., 2007; Elix, 2009). It is characterised by the Callispora-type ascospores, bacilliform conidia, often by a strongly oil-inspersed hymenium and the presence of norstictic acid, diploicin and atranorin or 4,5-dichlorolichexanthone (Elix, 2009). For nomenclatural reasons, the generic name Hafellia must be regarded as a synonym of Buellia s. str. because B. disciformis, the conserved type of Buellia, shares all the typical characters of ‘Hafellia’. Thus, Moberg et al. (1999) suggested changing the listed type of Buellia to B. aethalea (Ach.) Th.Fr. However, B. disciformis had already been chosen as the type of Buellia when the name was conserved against Gassicurtia Fée. The suggested replacement of a conserved type would have been the first case in the history of the Botanical Code. The proposal was not recommended by the Committee for Fungi (Gams, 2004), and the decision to reject the proposal of Moberg et al. (1999) was accepted by general vote at the International Botanical Congress in Vienna in 2005. Therefore, the species formerly included in Hafellia must now be regarded as Buellia sens. str.

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Cite as: J.A.Elix, Buellia auct. non De Not., Australian Physciaceae (Lichenised Ascomycota).
The residual species of *Buellia*, which are not closely related, must be excluded from *Buellia s. str.*, but a precise generic circumscription must await the results of molecular investigations.

The cosmopolitan *Buellia s. lat.* is currently thought to contain c. 370 species, 33 of which occur in Australia. These lichens grow on rock, soil, bark and wood.

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1. Buellia aeruginosa A. Nordin, Owe-Larsson & Elix, Mycotaxon 71: 400 (1999)

Thallus crustose, continuous to rimose or areolate, 2–5 cm wide, up to 0.7 mm thick; areolae 0.5–2.0 mm wide, angular, ± plane to makedly convex; prothallus black or absent. Upper surface whitish to yellow-white, dull, pruinose; cortex 25–30 μm thick, with calcium oxalate crystals (H₂SO₄⁺): medulla 95–600 μm thick, with calcium oxalate (H₂SO₄⁺), I+ purple. Apothecia 0.2–0.6 mm wide, numerous, lecideine, immersed then sessile; disc black, concave to convex, white-pruinose, the pruina C+ orange; proper margin distinct, but excluded in strongly convex apothecia. Proper exciple 40–80 μm thick, dark brown; outer zone greenish black, N+ red-violet. Epiphyllium 7–10 μm thick, greenish black, K– or weak blue-green, N+ red-violet; hymenium 80–90 μm thick, colourless in the central part, blue-green above and below, not inspersed; hypothecium 50–75 μm thick, dark brown; upper part with a greenish tinge, N+ orange-brown. Paraphyses 1.7–2.0 μm wide, simple to branched subapically; apices 3–4 μm wide, with dark green caps. Asci Bacidia-type, 8-spored. Ascospores submiform, 4–6-celled, with 3 transverse septa and (usually) 1 longitudinal septum on either side of the median septum, olive-brown to brown, ellipsoidal, 14–17 × 7–10 μm; outer wall slim. Pycnidia immersed or slightly protruding, c. 80 μm wide; conidia fusiform to bacilliform, 4–5 × 1 μm.

Chemistry: Thallus K–, C+ orange, P–, UV+ orange; containing isoarthothelin (major), 2,5-dichloronorlichexanthone (minor), 2,7-dichloronorlichexanthone (trace), arthothelin (trace), thiophanic acid (trace), aseome (trace).

A scattered endemic species on siliceous rocks in coastal areas of southern S.A. and southern N.S.W.


Buellia aeruginosa is characterised by the whitish to yellow-white thallus, the submiform ascospores, the greenish black epiphyllium and outer excipulum (N+ red-violet) and the presence of isoarthothelin and 2,5-dichloronorlichexanthone.
2. Buellia aethalea (Ach.) Th.Fr., Lichenogr. Scand. 2: 604 (1874)


For further synonymy, see Foucard et al. (2002).


Thallus crustose, ±continuous to rimose-areolate, 1–3 cm wide; areolae 0.2–1.1 mm wide, ±angular, plane or rarely weakly convex; prothallus usually conspicuous, black, surrounding the thallus, c. 0.2 mm wide, also ±growing between the areolae, the thalli forming a mosaic. Upper surface grey-white, grey to dark grey or pale brown, dull, epruinose, corticate; cortex 10–15 µm thick; medulla white, lacking calcium oxalate (H₂SO₄−), I+ purple or I−. Apothecia 0.1–0.7 mm wide, cryptolecanorine or lecideine, immersed, not becoming sessile, angular to comma-shaped, predominantly in the centre of areolae; disc black, plane, epruinose; proper margin: lecideine, inconspicuous, occasionally surrounded by a thalline veil. Proper exciple 45–55 µm thick; outer zone greenish black to brown-black or carbonaceous, K−, N+ red-violet or red-brown; inner zone colourless to pale brown. Ephydemium 8–13 µm thick, dark greenish to olive-brown, K−, N+ red-violet to red-brown; hymenium 60–80 µm thick, colourless, not inspersed; hypothecium 40–55 µm thick, pale to dark brown. Paraphyses 2.0–3.5 µm wide, simple to moderately branched; apices 4–5 µm wide, with olive-brown caps. Asci Bacillia-type, 8-spored. Ascospores Buellia-type, 1-septate, olive-brown to brown, broadly ellipsoidal, 11–18 × 6–10 µm, ±constricted at the septum, with obtuse ends, uniformly thin-walled; outer wall weakly ornamented. Pycnidia rare, urceolate to globose; conidia bacilliform, 5.0–7.5 × 1 µm.

**Chemistry:** Thallus K+ yellow then red, P+ yellow-orange, C−, UV−; containing norstictic acid (major), connorstictic acid (minor).

Scattered on siliceous rocks in southern and eastern Australia (W.A., S.A. and N.S.W.); also in Europe, Macaronesia, North and South America, Africa, Asia, New Zealand and Antarctica.


This species is characterised by the grey-white, grey to dark grey or pale brown, crustose thallus, by the immersed, angular to comma-shaped apothecia, the prominent black prothallus, asci with 8 Buellia-type ascospores, the N+ red-violet to red-brown ephydemium and the presence of norstictic acid in the thallus.


Thallus crustose, ±continuous to rimose or areolate, usually forming circular, effigurate or sublobate patches, 4–10 cm wide, thin or up to 0.5 mm thick; areolae 0.3–1.2 mm wide, angular, ±plane to weakly convex; prothallus delimiting the thallus margin, distinctly blackened to pale gray or white and indistinct. Upper surface usually white, rarely grey, chalky, dull, heavily pruinose; cortex 50–80 µm thick, with calcium oxalate crystals (H₂SO₄+); medulla 200–500 µm thick, white, filled with calcium oxalate crystals (H₂SO₄+), L–. Apothecia 0.3–1.3 mm wide, lecideine, immersed, then adnate to sessile; disc black, usually with a dense fine grey-white pruina, plane, scarcely becoming convex with age; proper margin pale to dark grey, thick, persistent, not becoming excluded, weakly carbonised and typically whitish-pruinose, thus resembling a thalline margin. Proper exciple 50–100 µm thick; outermost layer dark reddish brown; inner layer medium to pale red-brown, K–. Epiphymenia 9–13 µm thick, yellow-brown to dark brown, K–, N–; hymenium 40–50 µm thick, colourless, not inspersed; hypothecium 75–100 µm thick, deep reddish brown. Paraphyses 2–3 µm wide, simple to moderately branched; apices 4–6 µm wide, with brown to yellow-brown caps. Asci Bacidia-type, 8-spored. Ascospores Buellia-type, 1-septate, olive-brown to brown, oblong to ellipsoidal, with obtuse ends, 10–15 × 4.5–9.0 µm, uniformly thin-walled; torus indistinct; outer wall smooth. Pycnidia rare, urceolate to globose; conidia bacilliform, 3–5 × 1.0–1.5 µm.

**Chemistry:** Thallus K+ yellow then red, P+ yellow or yellow-orange, C–, UV–; containing norstictic acid (major), connorstictic acid (minor), zarthothelin (minor or trace).

Very common on calcareous rocks in W.A., S.A., N.T., N.S.W., A.C.T., Vic. and Tas.; also in South America and New Zealand.


*T*: Lorne, [Vic.], on sandstone, 1892, F.R.M Wilson 1044; *holo*: G n.v.; *iso*: NSW.

Thallus crustose, ±continuous to rimose-areolate, 2–5 cm wide; areolae 0.2–0.5 mm wide, continuous to dispersed, angular or rounded, plane to slightly convex; prothallus absent. Upper surface sordid white, cream or yellowish brown, ecorticate; medulla white, lacking calcium oxalate (H₂SO₄–), IKI+ blue. Apothecia 0.3–0.7 mm wide, lecideine, scattered, sessile on or between areolae, constricted at the base; disc black, flat, dull, pruinose; proper margin moderate, entire. Proper exciple 35–75 µm thick, dark brown to brown-black, K–, N+ reddish. Epiphymenia 5–10 µm thick, brown, N+ reddish; hymenium 60–75 µm thick, colourless; lower part inspersed with oil droplets; hypothecium 200–300 µm thick, dark brown to brown-black, K–, N+ reddish. Paraphyses 1–2 µm wide, simple or sparingly branched; apices 4.0–5.5 µm wide, with brown caps. Asci Bacidia-type, 8-spored, but often with only 5 or 6. Ascospores Physconia-type, 1-septate, brown to dark brown, ellipsoidal to oblong-ellipsoidal, 16–22 × 8–11 µm; torus absent, with septal wall thickenings; outer wall smooth or finely ornamented. Pycnidia not seen.

**Chemistry:** Thallus K+ yellow, C+ yellow or orange, P+ pale yellow or P–, UV+ orange; containing 2,5,7-trichloro-3-O-methylnorlichexanthone (major), atranorin (minor). This very rare endemic species is only known from the type locality in southern Vic.
This lichen is very similar to *Buellia subarenaria* (q.v.), but it differs in having epruinose discs, often only 5 or 6 larger ascospores per ascus (16–22 × 8–11 µm vs. 11–17 × 6.5–9.0 µm), the inspersed lower hymenium, a thicker hypothecium (200–300 µm vs. 100–150 µm thick) and a thinner hymenium (60–75 µm vs. 80–100 µm thick).


T: Mt McKay, Bogong High Plains, Alpine Natl Park, 16 km SSE of Mt Beauty, Vic., 36°52'S, 147°14'E, alt. 1840 m, on exposed gneiss boulders in exposed subalpine grassland, 18 Feb. 1994, J.A.Elix 40609 & H.Streimann; holo: CANB.

Illustration: J.A.Elix, *op. cit.* 18, fig. 1.

Thallus crustose, continuous to rimose or areolate, 2–4 cm wide, up to 0.8 mm thick; areolae 0.2–2.0 mm wide, angular, ±plane; prothallus conspicuous, black, surrounding the thallus, c. 0.2 mm wide, also growing between areolae. Upper surface whitish to grey-white or grey, dull or glossy, epruinose; cortex 25–30 µm thick, lacking calcium oxalate crystals (H₂SO₄−); medulla 95–400 µm thick, lacking calcium oxalate (H₂SO₄−), IKI+ intense blue-purple. Apothecia 0.3–0.6 mm wide, lecideine, numerous, crowded and aggregated, round to angular-distorted, immersed in the thallus or between areolae, level with the thallus or slightly protruding; disc black, epruinose, plane; proper margin thin, black, almost completely reduced when immersed in the thallus. Proper exciple 50–75 µm thick; outer zone broad, greenish black. N+ red-violet; central part dark brown, grading into the hypothecium. Epiphytumium 7–10 µm thick, dark greenish blue to greenish black, K− or K+ weak blue-green, N+ red-violet; hymenium 75–100 µm thick, colourless in the central part, blue-green above, brown below, not inspersed; hypothecium 50–75 µm thick, dark brown, N+ orange-brown. Paraphyses 1.7–2.0 µm wide, simple to moderately branched; apices 2.5–4.0 µm wide, with dark green caps. Asci *Bacidia*-type, 8-spored. Ascospores submuriform, 4–6-celled, with 3 transverse septa and (usually) 1 longitudinal septum on either side of the median septum, olive-brown to brown, elongate-ellipsoidal, 15–23 × 7–10 µm; outer wall ornamented. Pycnidia not seen.

Chemistry: Cortex K+ yellow, P+ yellow, C−, UV−; medulla K+ yellow then red, P+ orange-red, C−, UV−; containing atranorin (minor), chloroatranorin (minor), norstictic acid (major), connorstictic acid (minor).

This very rare endemic species is only known from the type locality in eastern Vic.

Characterised by the whitish to grey-white or grey, areolate thallus, the immersed, often angular apothecia, the submuriform ascospores, the greenish black ephymenium and outer excipulum (N+ red-violet) and the presence of atranorin, norstictic and connorstictic acids in the thallus.


Thallus crustose, continuous to rimose or areolate, 2–6 cm wide; areolae 0.4–0.8 mm wide, angular, ±plane to weakly convex; prothallus absent. Upper surface white to creamy white, with a powdery to coarsely pruinose surface; cortex 70–80 µm thick, with calcium oxalate crystals (H₂SO₄+); medulla 90–110 µm thick, white, filled with calcium oxalate crystals (H₂SO₄+). Apothecia 0.50–1.25 mm wide, lecideine, immersed, becoming adnate to sessile; disc black, slightly white-pruinose, rarely epruinose, initially plane, becoming convex; proper margin thin, persistent. Proper exciple 70–100 µm thick; outermost layer dark brown, thin, K−; inner layer pale brown to bright red, K+ yellow solution. Epiphytumium 10–12 µm thick, dark brown, K−, N−; hymenium 75–90 µm thick, colourless, not inspersed; hypothecium c. 90 µm thick, pale brown; subhypothecium 80–100 µm thick, bright red, K+ yellow solution. Paraphyses 2–3 µm wide, irregularly branched; apices 5–6 µm wide, with brown or dark brown caps. Asci Bacidia-type, 8-spored. Ascospores Buellia-type, 1-septate,
brown, ellipsoidal, 13–19 × 6.5–8.0 µm, uniformly thin-walled; torus usually distinct; outer wall weakly ornamented. Pycnidia globose; conidiophores of type VI (Vobis, 1980); conidia bacilliform, 4–7 × 1 µm.

**Chemistry:** Cortex K+ yellow, P-, C-, UV--; medulla K-, P-, C-, UV--; containing atranorin (major), eumitrin U (major), secalonic acid A (minor), unknown secalonic acid derivative (minor), pannarin (minor or trace).

Endemic on limestone rocks in southern W.A., S.A., N.S.W. and Vic.


*Buellia cinnabarina* is distinguished by its white to creamy white, crustose thallus with a powdery to coarsely pruinose surface, the bright red pigment below the hypothecium extending into the excipulum, *Buellia*-type ascospores and the presence of atranorin, eumitrin U and pannarin.


Illustration: *J.A.Elix, op. cit.* fig. 2.

Thallus crustose, zcontinuous to areolate, 4–10 cm wide; areolae 0.4–0.8 mm wide, angular, zplane to weakly convex; prothallus conspicuous or not, black, delimiting the thallus and c. 0.2 mm wide, also growing between areolae. Upper surface whitish to grey-white, grey or dark grey, dull, epruinose, phencocorticite; cortex 20–25 µm thick; medulla white, lacking calcium oxalate (H₂SO₄–), 100–200 µm thick, occasionally filled with algal cells, IKI–. Apothecia 0.1–0.5 mm wide, lecideine, scattered, round or distorted by mutual pressure, immersed then adnate; disc very dark brown to black, epruinose, plane, rarely becoming slightly convex with age; proper margin thin, persistent, rarely becoming excluded, black or masked by a necrotic thalline veil. Proper exciple 25–55 µm thick, poorly differentiated; outer zone greenish black or carbonaceous, K–, N+, red-violet. Ephydemium 7–18 µm thick, aeruginose, K–, N+, red-violet; hymenium 40–50 µm thick, colourless, not inspersed; hypothecium 30–50 µm thick, pale brown to brown. Paraphyses 2.0–2.5 µm wide, simple to weakly branched; apices 3.0–3.5 µm wide, with brown or dark brown caps. Asci *Bacidita*-type, 8-spored. Ascospores *Buellia*-type, 1-septate, olive-brown to brown, ellipsoidal, 10–14 × 8–8 µm, uniformly thin-walled; outer wall smooth. Pycnidia not seen.

**Chemistry:** Thallus K+ yellow, P+ yellow, C–, UV--; containing atranorin (major), chloroatranorin (minor).

A scattered endemic lichen on siliceous rocks in south-western W.A.

W.A.: Murchison River Gorge, Hawkshead Lookout, Kalbarri Natl Park, 42.5 km ENE of Kalbarri township, *J.A.Elix 55736* (CANB); Dryandra Woodland, Caernarvon Hills, 17 km NW of Narrogin, *J.A.Elix 39856* (CANB).

*Buellia cranfieldii* has a whitish to grey-white, grey or dark grey crustose thallus, asci with 8 *Buellia*-type ascospores and an aeruginose outer excipulum and ephydemium that react N+ red-violet. The thallus contains atranorin and chloroatranorin.


T: Victoria Desert, W.A., on rock, *R.Helms 51*; holo: G n.v.; iso: MEL.

Thallus crustose, thick, zcontinuous to rimose or areolate, up to 3 cm wide; areolae 0.1–0.4 mm wide, angular, subcontiguous, zplane or concave towards the centre; prothallus inconspicuous or absent. Upper surface yellow to dull yellow-brown, matt to smooth and glossy; cortex 15–20 µm thick; medulla white, up to 100 µm thick, lacking calcium oxalate (H₂SO₄–), I–. Apothecia 0.2–0.4 mm wide, lecideine, sessile, initially with a pale accessory thalline margin that is soon excluded, solitary or grouped; disc black, epruinose, initially...
plane, convex with age, and with a distinct proper margin and the margin excluded. Proper exciple 35–50 µm thick; outer part dark brown; inner part pale brown, K–. Epiphytrenium 5–10 µm thick, dark brown to brown-black, N–; hymenium 35–50 µm thick, colourless, not inspersed; hypothecium 50–100 µm thick, dark brown, K–. Paraphyses 1.5–2.5 µm wide, sparingly branched; apices 4–5 µm wide, with brown caps. Asci Bacidia-type, usually 8-spored. Ascospores Physcionia-type, 1-septate, brown, globose to subglobose, 7–9 × 6–7 µm, with median thickenings; torus indistinct; outer spore smooth to finely ornamented. Pycnidia not seen.

Chemistry: Thallus K+ yellow, P+ pale yellow, C+ orange, UV+ yellow or orange; containing atranorin (major), thuringione (major), chloroatranorin (minor).

A very rare endemic on siliceous rocks in inland W.A. and northern N.T.


This species is characterised by the crustose, yellow to dull yellow-brown thallus, black apothecia with an initially pale, accessory thalline margin, very small, subglobose to globose ascospores, and by the presence of atranorin and thuringione.


Illustrations: U.Trinlaus, H.Mayrhofer & J.A.Elix, op. cit. 53, fig. 1: 54, fig. 2B; 55, fig. 3C (2001).

Thallus crustose to granulose-subsquamulose, if coherent then forming single granules or squamules in the outer part of the thallus, non-effigurate to rarely subeffigurate, 4–10 cm wide; prothallus absent. Upper surface chalky to dirty white, dull, epruinose; cortex 60–90 µm thick; medulla white, with calcium oxalate (H₂SO₄+), indistinct or up to 0.4 mm thick, merging with the substratum, occasionally with rhizinoid strands. Apothecia 0.9–1.7 mm wide, lecideine, slightly immersed when immature, soon sessile; disc black, usually finely yellowish white-pruinose, plane but becoming convex; proper margin initially distinct, becoming excluded. Proper exciple 30–70 µm thick, brown in the outer part, colourless within. Epiphytrenium 7–12 µm thick, brown, K–, N–; hymenium 75–110 µm thick, colourless, not inspersed; hypothecium 60–125 µm thick, brown. Paraphyses 2–3 µm wide, simple to weakly branched; apices 4–7 µm wide, with brown or dark brown caps. Ascii Bacidia-type, 8-spored, occasionally fewer. Ascospores Buellia-type, 1-septate, olive-green to brown, ellipsoidal, 14–21 × 5.5–10.0 µm, uniformly thin-walled; outer wall ornamented. Pycnidia immersed; wall brown in the upper part, paler below; conidia filiform, 13–25 × 1 µm.

Chemistry: Thallus K–, P–, C+ orange around the algal layer (in section), UV–; containing arthothelin (major), 4,5-dichloronorlichexanthone (minor), thiophanic acid (minor).

A common endemic lichen on soil in drier areas of southern W.A., S.A. and N.S.W.

W.A.: 80 km E of Balladonia, Eucla Division, N.N.Donner 3104 (AD); 5 km N of Fowlers Bay township, Eyre Penin., N.N.Donner 7136 (AD); 4 km E of Chinamans Well, Yorke Penin., J.A.Elix 3773 (CANB). N.S.W.: London Bridge, Googong Dam Foreshore Reserve, 18 km S of Queanbeyan, J.A.Elix 33113 & H.Mayrhofer (CANB).

Characterised by the crustose to subsquamulose, usually non-effigurate thallus, the pruinose apothecia and the presence of arthothelin.


Thallus crustose, bullate-areolate to subsquamulose or squamulose, moderately thick, ±continuous, to 10 mm wide; areolae and/or squamules dispersed, aggregated in irregular patches or forming rosettes with marginal lobes; areolae 0.2–1.0 mm wide; squamules 1.0–1.5 mm wide, ±rounded to angular; prothallus absent. Upper surface ivory, grey to pale or dark brown, paler to whitish at the margins, often pruinose, usually dull, rarely glossy, smooth to deeply fissured; cortex 40–50 µm thick; medulla white, with calcium oxalate (H₂SO₄⁺), I–. Apothecia 0.3–1.0 mm wide, lecideine, sessile; disc black, usually epruinose, rarely with sparse white pruina, plane or becoming markedly convex with age; proper margin distinct, thin to thick, black, rarely becoming excluded. Proper exciple 40–60 µm thick; outer zone dark brown; inner zone deep reddish brown, K–. Epihymenium 5–10 µm thick, brown, K–, N–; hymenium 50–70 µm thick, colourless, not inspersed; hypothecium 35–65 µm thick, dark brown. Paraphyses 2–3 µm wide, simple to moderately branched; apices 4–6 µm wide, with brown caps. Ascii Bacidia-type, 8-spored. Ascospores Buellia-type, 1-septate, brown, oblong to ellipsoidal, 9–19 × 4.5–9.0 µm; sepal walls briefly thickened during spore ontogeny (Physconia-type); outer wall finely ornamented. Pycnidia immersed, urceolate to globose; conidia bacilliform, ±6 × 1 µm.

Chemistry: Thallus K+ yellow, P+ pale yellow or P–, C–, UV–; containing atranorin (minor), chloroatranorin (minor), 2'-O-methylperlatolic acid (major), ±exfolincent acid (minor).

Scattered on siliceous rocks in arid inland W.A., N.T., S.A. and Qld; also in Europe, Africa, Asia and North America.

This species is distinguished by the bullate to squamulose thallus with an ivory, grey to pale or dark brown upper surface, Buellia-type ascospores and the presence of atranorin and 2'-O-methylperlatolic acid.


Illustrations: U.Trinhaus, H.Mayrhofer & J.A.Elix, op. cit 54, fig. 2A; 55, fig. 3A; 57, fig. 5.

Thallus subcrustose to effigurate, with short marginal lobes, often forming rosettes, 3–7 cm wide, up to 1.25 mm thick; prothallus absent. Upper surface chalky white, occasionally partly greyish due to an infection by the fungus Lichenostigma; cortex 30–100 µm thick; medulla white, distinct, with calcium oxalate (H₂SO₄⁺); lower surface with rhizinose strands not attached to the substratum. Apothecia 0.5–1.7 mm wide, lecideine or pseudelecancorine, slightly immersed when young, soon sessile; disc black, usually white-pruinose, plane to weakly convex; proper margin distinct, ±excluded with age. Proper exciple 45–90 µm thick, dark brown in the outer part, yellow within. Epihymenium 7–12 µm thick, yellowish or brown, with distinct yellow crystals, K–; hymenium 100–140 µm thick, colourless, not inspersed; hypothecium 90–150 µm thick, dark brown. Paraphyses 1–2 µm wide, simple to moderately branched; apices 3–5 µm wide, with brown or dark brown caps. Ascii Bacidia-type, 8-spored. Ascospores Buellia-type, 1-septate, olive-green to dark brown, ellipsoidal, 16–24 × 9.5–14.0 µm, slightly constricted at the septum, uniformly thin-walled; outer wall coarsely ornamented. Pycnidia immersed; wall brown above, paler below; conidia filiform, 15–25 × 1 µm.
Chemistry: Thallus K–, P–, C+ orange around algal layer (in section), UV–; containing arthrothelin (major), 4,5-dichloronorlitchexanthone (minor or trace), thiophanic acid (minor or trace).

A common endemic species on limestone in southern W.A., S.A., N.S.W., A.C.T., Vic. and Tas.; rare on calcareous soil.


This lichen is characterised by the subcrustose to effigurate thallus, rather large, coarsely ornamented ascospores and the presence of arthrothelin.


Thallus crustose, bullate-areolate to subsquamulose or squamulose, ±continuous, up to 5 cm wide and 0.4 mm thick; areolae and/or squamules dispersed, aggregated in irregular patches or forming rosettes with marginal lobes; areolae 0.2–1.0 mm wide; squamules 0.5–1.0 mm wide, ±rounded, broader at the margins of the thallus; prothallus not seen. Upper surface olive-brown to olive-black, dull or glossy; cortex 20–25 µm thick; medulla white, to 250 µm thick, lacking calcium oxalate (H₂SO₄). 1–.; Apothecia 0.5–6 mm wide, lecideine, scattered or crowded, rounded, sessile; disc black, epruinose, plane or rarely becoming weakly convex; proper margin thin, black, persistant, rarely becoming excluded. Proper exciple 35–45 µm thick, poorly differentiated; inner part colourless or pale brown; outer part dark red-brown to black-brown, K+ red-violet, N–. Ephyhymenium 4–10 µm thick, olive-brown to brown-black, N–; hymenium 50–90 µm thick, colourless, not inspersed; hypothecium 60–80 µm thick, dark reddish brown or brown-black. Paraphyses 1.5–2.5 µm wide, simple to moderately branched; apices 3–5 µm wide, with dark brown caps. Ascii Bacidia-type, 8-spored. Ascospores Buellia-type, 1-septate, olive-brown to dark brown, oblong to ellipsoidal, 12–14 × 5–6 µm; torus indistinct; outer wall ornamented. Pycnidia sparse; conidia bacilliform, 3–5 × 1 µm.

Chemistry: Thallus and medulla K–, P–, C–, UV–; excipulum K+ red-violet; containing cinnamomeic acid D (major).

This very rare endemic species is known only from the type locality in W.A. Buellia glomerulans has an olive-brown to olive-black, bullate to squamulose thallus, black, lecideine apothecia, Buellia-type ascospores, a K+ red-violet excipulum and the pigment cinnamomeic acid D.


Thallus crustose, thin and ±sunmersed to thicker, superficial and rimose-areolate, 2–5 cm wide; prothallus pale brown to grey-black or absent. Upper surface pale grey, often with a greenish or brownish tinge, smooth to wrinkled, sorediate; soralia mostly discrete, 0.15–0.40 mm diam., often crowded and occasionally confluent, pale grey-green to ash grey, often with a blue tinge, pale yellow when abraded; soredia 15–25 µm diam.; medulla white, lacking calcium oxalate (H₂SO₄). K–, N–, IKI–. Apothecia very rare, 0.4–1.5 mm wide, lecideine, adnate to sessile; disc black, concave, plane or weakly convex, epruinose; proper margin black, thick, persistent, enclosing the disc in young apothecia. Proper exciple 80–120 µm thick; outer zone thin, dark brown; median part pale brown; inner zone dark brown to
carbonaceous, K+ yellow, N-. Epihymenium 7–12 µm thick, brown, K–, N–; hymenium 80–120 µm thick, colourless, not inspersed; hypothecium 140–220 µm thick, dark brown, K+ yellow, N–. Paraphyses 2–3 µm wide, simple to weakly branched; apices 4–6 µm wide, with brown to dark brown caps. Ascii Bacidio-type, 8-spored. Ascospores subconiciform, with 8–12 cells and 3 or 4 transverse septa, grey to brown, ellipsoidal, 13–28 × 7–13 µm, uniformly thin-walled; outer wall weakly ornamented. Pycnidia rare, immersed; conidia bacilliform, 4–6 × 1 µm.

**Chemistry:** Thallus K+ yellow or K+ yellow then red, P+ yellow or yellow-orange, C– or C+ yellow, UV–; containing atranorin (major), norstictic acid (minor or trace), ±connorstictic acid (trace).

Rare on bark in Tas.; also in Europe, North America, Asia, Africa and New Zealand.

Tas.: W of New Norfolk along Glenora road, G.Kantvilas 54/97 (HO); South Sister, G.Kantvilas 287/04 & J.A.Elix (HO); 2 km N of Stonehurst Sugarloaf, G.Kantvilas 348/03 (HO).

This lichen has a comparatively thin, pale grey thallus and prominent grey-green soralia with farinose soredia; the thallus contains atranorin and norstictic acid.


For further synonymy, see Bungartz et al. (2004).


Thallus crustose, ±continuous to rimose-areolate, 1–5 cm wide; areolae 0.5–1.1 mm wide, angular, ±plane to weakly convex; prothallus usually conspicuous, black, surrounding the thallus and visible between areolae. Upper surface yellow-green to pale yellow or yellow-brown, dull or glossy, epruinose, smooth; cortex 50–60 µm thick; medulla white in the upper part, the lower part occasionally with a rust-red, K+ purple pigment, lacking calcium oxalate (H₂SO₄)}, 1–. Apothecia 0.2–0.7 mm wide, lecideine, immersed, then adnate to sessile; disc black, plane or rarely convex, epruinose or yellow-pruinose; proper margin thin, persistent, rarely becoming excluded, black or covered by coarse thalline fragments when young. Proper exciple 55–75 µm thick, greenish black to brown-black or carbonaceous throughout, K–, N+ red-violet or red-brown. Epihymenium 10–15 µm thick, brown, K–, N–; hymenium 60–100 µm thick, colourless, not inspersed; hypothecium 100–150 µm thick, dark reddish brown. Paraphyses 1.7–2.1 µm wide, simple to moderately branched; apices 4–5 µm wide, with dark brown caps. Ascii Bacidio-type, 8-spored. Ascospores Physconia-type, 1-septate, olive-brown to brown, oblong to ellipsoidal, 11.5–19.0 × 6–9 µm, usually not constricted at the septum, with median wall thickenings; outer wall weakly ornamented. Pycnidia globose, c. 0.2 mm wide; conidia bacilliform, 5–7 × 1.0–1.5 µm.

**Chemistry:** Thallus K–, C+ yellow-orange; P–, UV+ dull orange; medulla K–, C–, P–, UV–; chemical race 1 containing isarthothelin (major), 2,5-dichloronorlitchexanthone (trace), 2,7-dichloronorlitchexanthone (trace), 5,7-dichloronorlitchexanthone (trace), thiophanic acid (trace), ±secalonic acid A (minor), eumitrins X,Y (minor), ±atranorin (trace); chemical race 2 arthothelin (major), 2,4-dichloronorlitchexanthone (trace), 2,5-dichloronorlitchexanthone (trace), 4,5-dichloronorlitchexanthone (trace), thiophanic acid (trace), ±secalonic acid A (minor), eumitrins X,Y (minor), ±atranorin (trace).

Scattered on coastal rocks in S.A., N.S.W. and Tas.; also in North and South America, South Africa and New Zealand.

Characterised by the yellow-green to pale yellow or yellow-brown, crustose thallus, the Physconia-type ascospores, the aeuriginose excipulum that reacts N+ red-violet or red-brown, and the presence of isoarthothelin or arthothelin.

15. Buellia homophylia (C.Knight) Zahlbr., Cat. Lich. Univ. 7: 366 (1931)


Illustration: J.A.Elix, op. cit. 49, fig. 1.

Thallus crustose, zcontinuous to rimose-areolate, 2–5 cm wide; areolae 0.3–1.1 mm wide, angular, zplane to weakly convex; prothallus usually conspicuous, black, surrounding the thallus, c. 0.2 mm wide, also growing between the areolae. Upper surface whitish to grey-white or grey, dull or glossy, epruinose; cortex 20–25 µm thick; medulla white, lacking calcium oxalate (H₂SO₄), I+ purple or I–. Apothecia 0.2–0.6 mm wide, lecideine, immersed to adnate or rarely becoming sessile with age, often crowded and angular due to mutual pressure; disc black, plane or rarely convex, epruinose; proper margin thin, persistent, rarely becoming excluded, black or rarely masked by a necrotic thalline veil. Proper exciple 45–55 µm thick, poorly differentiated; outer zone greenish black to brown-black or carbonaceous, K–, N+ red-violet or red-brown. Epihymenium 7–10 µm thick, dark greenish to olive-brown, K–, N+ red-violet to red-brown; hymenium 35–45 µm thick, colourless, not inspersed; hypothecium 40–55 µm thick, reddish brown. Paraphyses 1.7–2.5 µm wide, simple to weakly branched; apices 4–5 µm wide, with dark green to olive-brown caps. Asci Bacidia-type, 8–spored. Ascospores Buellia-type, 1-septate, olive-brown to brown, ellipsoidal, 10–22 x 6–10 µm, ±constricted at the septum, uniformly thin-walled when mature but with apical wall thickenings when young; outer wall smooth or finely ornamented. Pycnidia not seen.

Chemistry: Thallus K+ yellow then red, P+ yellow-orange, C–, UV–; containing atranorin (major), norstictic acid (major), connorstictic acid (minor).

This very common and variable endemic species occurs on siliceous rocks in all States and Territories.


Buellia homophylia is characterised by the whitish to grey-white or grey, crustose thallus, the immersed then adnate and commonly crowded, angular apothecia, the prominent black prothallus, Buellia-type ascospores, the N+ red-violet to red-brown epiphyemenum and the presence of atranorin and norstictic acid.

T: “graniticolae in desertis Australiae occid., ad expeditionis Camp 14”, [Pingegurrina Hill, S.A.], *R.Helms 81*; holo: G.

Thallus crustose, thick, ±continuous to rimose-areolate, to 2 cm wide and 0.3 mm thick; areolae 0.3–1.0 mm wide, angular, initially subcontiguous, then separated and becoming convex; prothallus not apparent. Upper surface off-white to pale yellow brown or yellowish grey, dull or glossy; cortex 15–25 µm thick; medulla white, 100–280 µm thick, lacking calcium oxalate (H₂SO₄–), I–. Apothecia 0.5–0.8 mm wide, lecideine, scattered, ±round, adnate; disc black, epruinose, plane, becoming convex with age; proper margin thin, becoming excluded. Proper exciple 50–80 µm thick, poorly differentiated; inner zone colourless; outer zone dark red-brown to black-brown, K–. Epihymenium 7–15 µm thick, olive-brown to greenish black, K–, N+ red-brown; hymenium 60–70 µm thick, colourless, not inspersed; hypothecium 45–65 µm thick, pale to deep reddish brown K–. Paraphyses 1.8–2.2 µm wide, simple to sparingly branched; apices 3.5–5.0 µm wide with brown caps. Asci *Bacidia*-type, 8-spored. Ascospores *Buellia*-type, 1-septate, brown, subglobe to broadly ellipsoidal, 9–15 × 6–8 µm; torus indistinct; outer wall ornamented. Pycnidia not seen.

**Chemistry:** Thallus K+ yellow then pale red, P+ pale yellow or P–, C–, UV–; containing atranorin (minor), chloroatranorin (minor), hypostictic acid (major), hyposalazinic acid (minor).

A rare endemic on siliceous rocks in arid, inland Australia (N.T. and S.A.).

N.T.: Native Gap, Hann Ra., 114 km N of Alice Springs, *J.A.Elix 11194 & L.A.Craven (CANB).*

Characterised by the off-white to pale yellow brown or yellowish grey, areolate thallus, small, *Buellia*-type, subglobe to broadly ellipsoidal ascospores and the presence of atranorin, hypostictic and hyposalazinic acids.


T: Lake Argyle Rd, 31 km SE of Kununurra, W.A., 15°59'S, 128°56'E, alt. 160 m, on sandstone rocks along escarpment with *Eucalyptus*, *Xanthostemon* and *Buchanania*, 8 July 1991, *J.A.Elix 27791, H.T.Lumbsch & H.Streimann; holo: PERTH.*

Illustration: *J.A.Elix, op. cit. 18, fig. 2.*

Thallus crustose, acontinuous to areolate, up to 3 cm wide and 0.3 mm thick; areolae 0.3–0.8 mm wide, angular, ±plane to weakly convex; prothallus conspicuous or not, black, delimiting the thallus, c. 0.2 mm wide, rarely growing between the areolae. Upper surface yellowish grey to ochre or dark brown, matt; cortex 20–25 µm thick; medulla white, 95–170 µm thick, lacking calcium oxalate (H₂SO₄–), IK1–. Apothecia 0.1–0.5 mm wide, lecideine, scattered, rounded, initially immersed, then adnate, rarely becoming asexisile; disc brown-black to black, epruinose, plane, rarely becoming slightly convex; proper margin thin, persistent, rarely becoming excluded, black or masked by a necrotic thalline veil. Proper exciple 35–65 µm thick, poorly differentiated; inner part colourless; outer part dark brown, K–. Epihymenium 7–20 µm thick, olive-brown, K–, N+ weak red-brown; hymenium 50–55 µm thick, colourless, not inspersed; hypothecium c. 40 µm high, pale brown to reddish brown, K–. Paraphyses 1.7–2.5 µm wide, simple to sparingly branched; apices to 3.5 µm wide, with brown caps. Asci *Bacidia*-type, 8-spored. Ascospores *Buellia*-type, 1-septate, brown, ellipsoidal, 10–16 × 4.5–5.5 µm; torus indistinct; outer wall smooth. Pycnidia not seen.

**Chemistry:** Thallus K+ yellow then red, P+ yellow, C–, UV–; medulla K+ yellow then red, P+ yellow, C–, UV–; containing norstictic acid (major), connorstictic acid (minor).

A common endemic lichen on siliceous rocks in the Kimberley region of W.A. and in N.T.

W.A.: along road to Mount Joseph Yard, 25 km E of Lennard River Crossing on the Gibb River Rd, *J.A.Elix 22286, H.Streimann & D.J.Galloway (CANB, PERTH); Gibb River Rd, 54 km NNE of Karunjie Stn, *J.A.Elix 27864, H.T.Lumbsch & H.Streimann (CANB).*

N.T.: *Native Gap, Hann Ra., 114 km N of Alice Springs, J.A.Elix 11196 & L.Craven (CANB); Bullo River Rd, Pinkerton Ra., 16 km NW of West Baines River Crossing on Victoria Hwy, J.A.Elix 22069 & H.Streimann (CANB).*
This species is characterised by the yellow-brown to dark brown thallus, the non-amyloid medulla, Buellia-type ascospores and the presence of norstictic acid. Buellia spuria var. amblyogona is morphologically and chemically similar, but the upper surface is white to grey-white, the medulla is amyloid, and the cortex contains atranorin.


Illustrations: U.Trinkaus, H.Mayrhofer & J.A.Elix., op. cit. 54, fig. 2C-F; 55, fig. 3B; 59, fig. 7.

Thallus 3–6 cm wide, up to 0.4 mm thick, subcrustose to effigurate-lobate, the marginal lobes with dark tips, with distinct plane lobes in the inner parts, often forming rosettes; prothallus absent. Upper surface white, dirty white to greyish due to effigurate thallus Lichenostigma; cortex 20–50 µm thick; medulla white or indistinct, with calcium oxalate (H₂SO₄+); lower surface with rhizinose strands not attached to the substratum. Apothecia 0.5–1.6 mm wide, lecideine, slightly immersed when young, soon sessile; disc black, usually epruinose or weakly white-pruinose, plane; proper margin distinct, becoming excluded. Proper exciple 40–80 µm thick, dark brown in the outer part, colourless within. Epithelium 7–10 µm thick, brown, K–, N–; hypothecium 70–110 µm thick, colourless, not inspersed; hypothecium 70–140 µm thick, dark brown. Paraphyses 2–3 µm wide, simple to moderately branched; apices 4–7 µm wide, with brown or dark brown caps. Asci Bacidia-type, with 8 or fewer ascospores (often 2–6). Ascospores Buellia-type, 1-septate, grey-green to dark brown, ellipsoidal, 15–23 × 6.5–10.5 µm, uniformly thin-walled; outer wall ornamented. Pycnidia immersed; conidia filiform, 15–30 × 1 µm.

Chemistry: Thallus K–, P–, C+ orange, UV–; containing arthothelin (major), thuringione (major), 4,5-dichloronorlichexanthone (minor), thiophanic acid (minor or trace).

A common endemic on calcareous soils in southern W.A. and S.A.

W.A.: Eyre Hwy, Nullarbor Plain, 147 km W of Eucla, H.T.Lumbsch 10745c, E.Lumbsch & J.Carnow (CANB); Caiguna, G.C.Brait 67/248 (HO). S.A.: along the Maitland road, 7 km W of Ardrossan, Yorke Penin., J.A.Elix 3724 (CANB); 8 km S of Black Hill township, J.A.Elix 9355 (CANB).

This lichen is characterised by the subcrustose to effigurate thallus with distinct plane lobes in the inner part of the thallus, by the presence of arthothelin and thuringione and commonly fewer than 8 ascospores in the ascus.


Thallus crustose, continuous at first, then rimose, rarely becoming areolate, to 5 cm wide and to 0.4 mm thick; prothallus conspicuous or not, black, delimiting the thallus. Upper surface white to whitish grey, dull, smooth and even; cortex 20–25 µm thick; medulla white, 150–350 µm thick, lacking calcium oxalate (H₂SO₄–), I+ violet. Apothecia 0.2–0.5 mm wide, lecideine, scattered or up to 3 confluent, rounded, immersed, then adnate; disc black, epruinose, plane or rarely weakly convex with age; proper margin thin, persistent, rarely becoming excluded, black or masked by a necrotic thalline veil. Proper exciple 20–65 µm thick, poorly differentiated; inner part colourless; outer part dark brown to black-brown, K–, N–. Hypothecium 10–15 µm thick, pale brown to olive-brown, N–; hypothecium 70–80 µm thick, colourless, not inspersed; hypothecium 40–85 µm thick, deep red-brown to dark brown, K–. Paraphyses 1.7–2.5 µm wide, simple to moderately branched; apices 3–4 µm wide, with pale brown caps, Asci Bacidia-type, 8-spored. Ascospores Buellia-type, 1-septate, brown, oblong to ellipsoidal, 11–15 × 5–6 µm; torus indistinct; outer wall smooth to finely ornamented. Pycnidia not seen.
Chemistry: Thallus K+ yellow then red, P+ yellow, C–, UV–; medulla K+ yellow then red, P+ yellow-orange, C–, UV–; containing atranorin (major), norstictic acid (major), connorstictic acid (minor).

Rare on siliceous rocks in eastern Qld and N.S.W.; also in North America.


Buellia maculata is characterised by the white to whitish grey thallus, the amyloid medulla, black apothecia that become adnate, a proper exciple and epihymenium lacking aeruginose pigment (N–), Buellia-type ascospores and the presence of atranorin and norstictic acid.


For further synonymy, see Bungartz et al. (2007).

Thallus crustose, ±continuous to rimose, rarely becoming areolate, to 5 cm wide, thin to moderately thick; prothallus distinct, black, delimiting the thallus. Upper surface pale greenish yellow or rarely grey, smooth and matt, rarely glossy, epruinose; cortex 20–25 µm thick; medulla white, 125–150 µm thick, lacking calcium oxalate (H2SO4–), I+ blue-purple.

Apothecia 0.3–1.2 mm wide, mammillana-type (Bungartz et al., 2007), initially lecanorine and immersed, becoming lecideine and adnate to sessile, crowded to scattered; proper margin initially inconspicuous, soon becoming distinct, brown, blackening at maturity; disc dark brown to black, epruinose, plane, becoming convex. Proper exciple 50–80 µm thick, dark brown to dark reddish brown in the outer part, colourless at first then brownish internally. Epihymenium 10–12 µm thick, brown, K–, N–; hymenium 70–90 µm thick, colourless, not inspersed; hypothecium c. 50 µm thick, dark reddish brown. Paraphyses 2–3 µm wide, simple to moderately branched; apices to 5 µm wide, with brown caps. Ascii 8-spored, Bacidia type. Ascospores Buellia-type, brown, oblong to ellipsoidal, not curved, with obtuse ends, 10.5–18.5 × 5.5–10.0 µm; sepal walls briefly thickened during spore ontogeny (Physconia-type); outer wall ornamented. Pycnidia rare, urceolate to globose; conidia fusiform, 6–14 × 1.0–1.5 µm.

Chemistry: Thallus and medulla K+ yellow, P+ yellow or P–, C–, UV+ yellow to orange; chemical race 1 containing atranorin (minor), 4,5-dichlorolichenanthe (minor), 4-chlorolichenanthe (trace), 4,5-dichloro-3-O-methylorlicexanthone (trace), stictic acid (major), cryptostictic acid (minor), norstictic acid (trace), hypostictic acid (trace); chemical race 2 containing atranorin (minor), 4,5-dichlorolichenanthe (minor), 4-chlorolichenanthe (trace), 4,5-dichloro-3-O-methylorlicexanthone (trace), norstictic acid (trace), connorstictic acid (minor).

Scattered on siliceous rocks in northern N.T., Qld and N.S.W.; also in North, Central and South America, southern Africa, India and Norfolk Island.


This lichen is characterised by the apothecia having a thalline exciple that is replaced by a well-developed proper exciple at maturity.

T: Molonglo Gorge Reserve, 16 km SE of Canberra, A.C.T., 35°20’S, 149°15’E, rocks along river bank, 650 m, 24 Nov. 1999, U.Trinkaus 993 & J.A.Elix; holotype: CANB.

Illustrations: U.Grube, H.Mayrhofer & J.A.Elix, op. cit. 166, figs 1, 2; 167, fig. 3 (2004).

Thallus crustose, acontinuous to rimose or areolate, 2–6 cm wide; areolae 0.3–1.1 mm wide, angular, ±plane to weakly convex; prothallus usually present, black, delimiting the thallus. Upper surface greenish to yellowish or yellow-grey, smooth to waxy, epruinose; cortex 50–60 µm thick; medulla white, the lower part usually containing a bright red pigment. K+ dark yellow, lacking calcium oxalate (H₂SO₄−). Apothecia 0.4–1.3 mm wide, lecideine, immersed, then adnate or sessile; disc black, plane or rarely convex, epruinose to sparsely yellowish grey-pruinose; proper margin prominent, persistent, rarely becoming excluded, black, in early stages often with coarse thallus fragments. Proper exciple 55–75 µm thick; outer zone greenish black to brown-black, N+ red-violet or red-brown; inner zone dark brown. Epiphyllum 7–10 µm thick, greenish black to brown, K−, N+ red-violet to red-brown; hymenium 60–100 µm thick, colourless, not inspersed; hypothecium 100–150 µm thick, brown or lower part red. Paraphyses 1.7–2.1 µm wide, simple to weakly branched; apices 4–5 µm wide, with dark green to olive-brown caps. Asci Bacidiatype, 8-spored. Ascospores Physconia-type, 1-septate, olive-brown to brown, ellipsoidal, 14–19 × 7–8 µm, with weak apical and distinct median wall thickenings; ontogeny of type-B; outer wall weakly ornamented. Pycnidia globose, c. 0.2 mm wide; conidia bacilliform, 4.5–6.5× 1 µm.

Chemistry: Thallus K−, C+ yellow-orange, P−, UV+ dull orange, medulla K−, C−, P−, UV−; containing isoarthothelin (major), 2,5-dichloronorlichexanthone (trace), 2,7-dichloronorlichexanthone (trace), 5,7-dichloronorlichexanthone (trace), thiophanic acid (trace), eumitrin U (minor), unknown secalonic acid derivative (minor), ±atranorin (trace).

A rare endemic on siliceous rocks in the A.C.T.


Buellia molongo is characterised by the greenish to yellowish or yellow-grey, crustose thallus, the Physconia-type ascospores, the aeruginose outer excipulum and epiphyllum reacting N+ red-violet, the red pigmented lower medulla and hypothecium and the presence of isoarthothelin.


T: Umbrarwara Gorge, 22 km SW of Pine Creek, N.T., 13°57’56”S, 131°41’52”E, alt. 210 m, on sheltered sandstone rock in steep-sided rocky gorge with Melaleuca, Hex and Ficus, 8 Aug. 2005, J.A Elix 38860; holotype: CANB.

Illustration: J.A Elix, op. cit. 36, fig. 2.

Thallus crustose, thin, ±continuous to areolate, to 7 cm wide; areolae 0.1–0.4 mm wide, angular, ±plane; prothallus conspicuous, black, delimiting the thallus, ±growing between the areolae. Upper surface yellow to dull or yellow-green, matt to smooth and glossy; cortex 20–40 µm thick; medulla white, to 250 µm thick, with intermittent patches of a deep red pigment, especially in lower parts, the pigment dissolving in K to give a pale purple solution. Apothecia 0.1–0.5 mm wide, lecideine, numerous, round, sessile, solitary or grouped; disc black, epruinose, ±plane and with a distinct proper margin, becoming convex and with an excluded margin. Proper exciple 35–50 µm thick, outer part dark brown; inner part pale brown K−. Epiphyllum 5–10 µm thick, dark brown, K+ forming a deep yellow solution, N−; hymenium 35–50 µm thick, colourless, not inspersed; hypothecium 50–100 µm thick, dark brown, K−. Paraphyses 1.5–2.5 µm wide, sparingly branched; apical cells 4–5 µm wide, with brown caps, N−. Asci Bacidia-type, usually 8-spored. Ascospores Physconia-type, 1-septate, brown, ellipsoidal, 12–20 × 6–8 µm, with median thickenings; torus indistinct; outer wall finely ornamented. Pycnidia not seen.

Chemistry: Thallus K−, P−, C+ orange, UV+ yellow or orange; medulla K−, P−, C−, UV−; containing di-O-methylthiophanic acid (major), ±thuringione (major or minor), ±thiophanic...
acid (major or minor), ±3-O-methylthiophanic acid (major), ±arthothelin (trace), ±isoarthothelin (trace), ±asemone (trace), ±2,7-dichlorolichexanthone (trace), ±3-O-methyleasmine (trace), ±6-O-methylarthothelin (minor or trace), unknown red pigment (minor or trace).

A common endemic lichen on siliceous rocks in the Kimberley region of W.A. and in northern N.T.


Characterised by the yellow to yellow-green thallus, the presence of numerous xanthones and a red-pigmented lower medulla. *Buellia molongo* differs in having a more continuous thallus, larger apothecia, a different red medullary pigment and a different array of xanthones.


*T:* Beverley–Mawson road, 26 km NE of Beverley, W.A., 32°00'29"S, 117°08'38"E, alt. 270 m, on laterite rocks in remnant Eucalyptus woodland, 22 Apr. 2004, *J. A. Elix* 31780; holo: PERTH.

Illustration: *J.A.Elix*, op. cit. 19, fig. 3

Thallus crustose, ±continuous to rimose or areolate, 2–5 cm wide; areolae 0.3–1.1 mm wide, angular, ±plane to weakly convex; prothallus conspicuous, black, surrounding the thallus, c. 0.2 mm wide, also growing between the areolae. Upper surface whitish to grey-white or grey, matt or glossy, epruinose; cortex 20–25 µm thick; medulla 95–110 µm thick, white, lacking calcium oxalate (H₂SO₄⁻), IKI+ intense purple. Apothecia 0.2–0.6 mm wide, lecideine, numerous, round, immersed to adnate or rarely becoming ±sessile; disc black, epruinose, plane, rarely becoming slightly convex; proper margin thin, persistent, rarely excluded with age, black or masked by a necrotic thalline veil. Proper exciple 45–55 µm thick; outer zone greenish black to brown-black, K–, N+ red-violet or red-brown; inner zone dark brown. Epiphytichenium 7–10 µm thick, dark greenish brown, K–, N+ red-violet; hymenium 35–45 µm thick, colourless, not inspersed; hypothecium c. 50 µm thick, reddish brown. Paraphyses 1.7–2.5 µm wide, simple to weakly branched; apices 4–5 µm wide, with dark green caps. Asc *Bacidia*-type, 8-spored. Ascospores *Buellia*-type, 1-septate, brown, ellipsoidal, 11–16 × 6–9 µm, with apical wall thickenings when immature, ±constricted at the septum; outer wall faintly ornamented. Pycnidia not seen.

Chemistry: Thallus and medulla K+ yellow, P+ yellow, C–, UV–; containing psoromic acid (major), atranorin (major or minor), chloroatranorin (minor), 2′-O-demethylpsoromic acid (minor), subpsoromic acid (trace).

A scattered endemic on siliceous rocks in W.A., N.T. and the A.C.T.


This lichen has a whitish to grey-white thallus, a conspicuous black prothallus, an amyloid medulla, a dark green epiphytichenium (N+ red-violet), a reddish brown hypothecium, and the thallus contains atranorin and psoromic acid.


Thallus crustose, discontinuous and irregular or continuous, weakly rimose-areolate, verruculose or granulose, 2–4 cm wide, lacking a prothallus, with or without a distinct cortex. Upper surface white to grey or olive-brown. Apothecia 0.1–0.4 mm wide, lecideine or biaurine, immersed or soon becoming sessile; disc very dark reddish brown to black, plane to convex, epruinose; thalline exciple initially prominent and concolorous with the thallus, soon reduced or excluded; proper margin narrow to excluded. Proper exciple 20–25 μm thick, K−; outer zone brown. Epiphymenium 5–10 μm thick, olive-brown to brown, K−, N−; hymenium 35–70 μm thick, colourless, not inspersed; hypothecium 50–70 μm thick, dark reddish brown to almost colourless. Paraphyses 1.7–1.8 μm wide, simple to branched; apices 4–5 μm wide, with brown or dark brown caps. Ascii clavate, Bacidia-type, 8-spored, rarely 16-spored. Ascospores Buellia-type, 1-septate, olive-brown to brown, ellipsoidal, 6.5–12.0 × 3.5–5.5 μm, uniformly thin-walled; outer wall smooth. Pycnidia immersed, globose, black, 50–70 μm diam.; conidia short-oblong to ellipsoidal, 1.5–3.0 × 0.5–1.0 μm.

Chemistry: Thallus K− or K+ pale yellow, C−, P−, UV−; no lichen substances detected, or traces of atranorin present.

Rare on bark or wood in eastern N.S.W.: also in North, Central and South America, Asia, Africa, Europe and Macaronesia.

N.S.W.: Lowdown Forest Park, 14 km from Majors Creek, L.Tibell 11966 (UPS).

Characterised by the indistinct thallus, asci with 8 or 16 very small, Buellia-type ascospores, short-oblong to ellipsoidal conidia, and either no lichen substances or with only traces of atranorin.

25. Buellia spuria (Schaer.) Anzi, Cat. Lich. Sondr. 87 (1860)


For further synonymy, see Scheidegger (1993), Bungartz et al. (2007).

Thallus crustose, acontinuous to rimose and areolate, to 7 cm wide, to 1 mm thick; areolae 0.1–0.3 mm wide, angular, eplane; prothallus conspicuous or not, black, delimiting the thallus and growing between the areolae. Upper surface white to whitish grey, dull or glossy; cortex 20–25 μm thick; medulla white, 55–150 μm thick, lacking calcium oxalate (H₂SO₄−), I+ violet. Apothecia 0.2–1.0 mm wide, lecideine, scattered or up to 3 confluent, rounded, immersed to adnate, rarely sessile; disc black, epruinose, plane or rarely becoming weakly convex; proper margin thin, persistent, rarely becoming excluded, black or masked by a necrotic thalline veil. Proper exciple 20–65 μm thick, poorly differentiated; inner zone colourless; outer zone dark brown to greenish brown, K−, N+ pale violet. Epiphymenium 14–18 μm thick, green to olive-brown, N+ pale violet; hymenium 50–90 μm thick, colourless, not inspersed; hypothecium to 40 μm thick, dark brown, K−. Paraphyses 2.0–3.5 μm wide, simple to moderately branched; apices 4–6 μm wide, with brown caps. Ascii Bacidia-type, 8-spored. Ascospores Buellia-type, 1-septate, brown, oblong to ellipsoidal, 9–18 × 4.5–7.5 μm; torus indistinct; outer wall finely ornamented. Pycnidia usually sparse; conidia bacilliform, 4.5–6.0 × 1.0–1.5 μm.

Two varieties are separated by thallus chemistry.

Thallus and medulla K+ yellow > red; norstictic (crystals) and connorstictic acids present .............................................. 25a. var. amblyogona

Thallus and medulla K+ yellow or dark yellow; stictic, constictic and acids present (no crystals) ........................................ 25b. var. spuria


Chemistry: Thallus K+ yellow then red, P+ yellow, C-, UV-; medulla K+ yellow then red, P+ yellow-orange, C-, UV-; containing atranorin (major), norstictic acid (major), connorstictic acid (minor).

Scattered on siliceous rocks in the Kimberley region of W.A. and in the N.T., Qld and N.S.W.; also in North America.


N.T.: Surprise Creek Falls, Litchfield Natl Park, 17 km N of Daly River road, J.A.Elix 39223 (CANB); Bullo River Rd, Pinkerton Ra., 16 km NW of West Baines River Crossing on Victoria Hwy, J.A.Elix 22069 & H.Streimann (CANB). Qld: Salvator Rosa Section, Nooga R. campground, Carnarvon Natl Park, B.Barnsley 1671 (CANB).

25b. Buellia spuria (Schaer.) Anzi var. spuria


Chemistry: Thallus K+ yellow, P+ yellow, C-, UV-; medulla K+ dark yellow, P+ yellow-orange, C-, UV-; containing atranorin (major), stictic acid (major), constictic acid (minor), cryptocystic acid (minor), menegazziaic acid (minor).

Scattered on siliceous rocks in northern and eastern Australia (W.A., N.T., S.A. and Qld); also in Europe, Macaronesia, Asia, North and Central America, Africa and New Zealand.

W.A.: Mt Cockburn South, Cockburn Ra., 45 km S of Wyndham, J.A.Elix 22418 & H.Streimann (B, CANB, PERTH).


[Buellia protothallina auct. non (Kremp.) Vain.: R.B.Filson, Checklist Austral. Lichens 11, 1983]

For further synonymy, see Scheidegger (1993) and Bungartz et al. (2007).


Thallus crustose, thin to moderately thick, ±continuous to rimose and areolate, to 8 cm wide; areolae 0.2–0.5 mm wide, angular, ±plane; prothallus conspicuous, black, surrounding the thallus and growing between the areolae, the thalli ±forming mosaics. Upper surface white to pale grey, dull or glossy; cortex 10–15 µm thick; medulla white, 75–90 µm thick, lacking calcium oxalate (H₂SO₄–). 1–. Apothecia 0.2–0.5 mm wide, lecideine, scattered to confluent, rounded, immersed; rarely adnate or sessile; disc black, epruinose, concave, plane or rarely becoming weakly convex; proper margin thin, persistent, rarely excluded with age, black or masked by a necrotic thalline veil that is often raised above the level of the thallus. Proper exciple 15–25 µm thick, poorly differentiated; inner zone colourless; outer zone dark brown to greenish brown, K–, Na+ pale violet. Epiphymenium c. 10 µm thick, greenish brown to dark brown, Na+ violet; hymenium 45–70 µm thick, colourless, not inpersed; hypothecium 35–50 µm thick, dark brown, K–. Paraphyses 1.7–2.5 µm wide, simple to moderately branched; apices 3.5–4.0 µm wide, with brown caps. Asci Bacillia-type, 8-spored. Ascospores Buellia-type, 1-septate, brown, oblong to ellipsoidal, 8–15 × 4.5–8.5 μm; torus indistinct; outer wall finely ornamented. Pycnidia globose, globose to urceolate; conidia bacilliform, 3.5–5.0 × 0.5–1.0 µm.

Chemistry: Thallus and medulla K+ yellow, P+ pale yellow or P–, C–, UV–; containing atranorin (major), confluent acid (major) and/or 2’-O-methylperlatolic acid (minor).
Common on coastal rocks in southern S.A., eastern N.S.W. and in Vic.; also also known from Europe, Macaronesia, Africa, Asia, North and South America, Lord Howe Island and New Zealand.


**Buellia stellulata** is characterised by the white to whitish grey thallus, the non-amyloid medulla, black, immersed apothecia, **Buellia**-type ascospores, a dark brown to greenish brown ephymnium and outer excipulum (N+ violet) and by the presence of atranorin, ±confluent acid and ±2′-O-methylperlafotatic acid.

### 27. Buellia subalbula


Thallus crustose, thin to thick, acontinuous, rimose to ±areolate, usually forming distinct circular, subefigurate to sublobate patches, 4–10 cm wide, to 0.5 mm thick; areolae 0.4–0.8 mm wide, angular, ±plane to weakly convex; prothallus delimiting the thallus, pale grey to black, or whitish and indistinct. Upper surface white or, rarely, grey, chalky, dull, heavily pruinose; cortex 50–80 µm thick, with calcium oxalate crystals (H₂SO₄+); medulla white, 200–500 µm thick, filled with calcium oxalate crystals (H₂SO₄+), 1–. Apothecia 0.3–0.9 mm wide, lecideine, immersed, then adnate to sessile; disc black, epruinose or whitish-pruinose, plane, soon becoming convex; proper margin black, thin, rarely persistent, usually excluded with age. Proper exciple 50–100 µm thick; outer zone strongly carbonised, distinctly bluish green to greenish black, N+ red-violet; inner zone colourless to pale red-brown, K–. Ephyrmnium 9–15 µm thick, bluish green to greenish black, K–, N+ red-violet; hymenium 40–50 µm thick, colourless, not inspersed; hypothecium 75–100 µm thick, deep reddish brown. Paraphyses 2–3 µm wide, simple to moderately branched; apical cells 4–6 µm wide; caps brown, with a diffuse aeruginose pigment (N+ violet). Asci *Bacidia*-type, 8-spored. Ascospores *Buellia*-type, 1-septate, olive-brown to brown, oblong to ellipsoidal, with obtuse ends, 9–15 × 4–8 µm, uniformly thin-walled; torus indistinct; outer wall initially faintly ornamented, later smooth. Pyecidia rare, globose; conidia bacilliform, 2–4 × 1.0–1.5 µm.

**Chemistry:** Thallus K+ yellow then red, P+ yellow or yellow-orange, C–, UV– or UV+ orange in part; containing norstictic acid (major), connorstictic acid (minor).

Rare on calcareous rocks in the A.C.T. and Tas.; also in South America and southern Africa.


This lichen is characterised by the thick, chalky white thallus with subefigurate margins, immersed then sessile to adnate apothecia with black, epruinose to greyish white-pruinose discs, the bluish green to greenish black, N+ red-violet outer exciple and ephyrmnium and the presence of norstictic acid.

### 28. Buellia subarenaria


Illustrations: H. Mayrhofer, *op. cit.* 513, fig. 8; 519, fig. 12, as *Rinodina brattii*; M. Kaschik, *Biblioth. Lichenol.* 93: 123, fig. 80 (2006), as 'Rinodina' brattii.
Thallus crustose, ±continuous to rimose-areolate, 2–5 cm wide; areolae 0.3–1.1 mm wide, angular, ±plane to weakly convex; prothallus black-brown or absent. Upper surface yellowish, pale green brown to yellow-brown; cortex 20–25 µm thick; medulla white, 20–25 µm thick, lacking calcium oxalate (H₂SO₄⁻), I⁺ purple or 1–. Apothecia 0.3–1.0 mm wide, lecideine, immersed at first, then adnate to sessile, scattered to contiguous; disc black, plane to strongly convex, often pale grey-pruinose; proper margin thin, entire to subcrenate, becoming excluded. Proper exciple 45–55 µm thick, brown-black. K⁺, N⁺ reddish. Hymenium 5–10 µm thick, brown, N⁺ reddish; hymenium 80–100 µm thick, colourless, not inspersed; hypothecium 100–150 µm thick, brown-black. Paraphyses 1.4–1.6 µm wide, contiguous; apices 3–5 µm wide, with brown caps. Ascii Bacidiata-type, 8-spored. Ascospores Physconia-type tending towards Buellia-type, 1-septate, olive-brown to brown, ellipsoidal, 11–17 × 6.5–9.0 µm; torus absent, with septal wall thickenings; outer wall smooth. Pycnidia immersed, pustuliform; conidia bacilliform, 5–6 × 0.7–1.0 µm.

Chemistry: Thallus K⁺ yellow, C⁺ yellow or orange, P⁺ pale yellow or P⁻, UV⁺ orange; containing 2,5,7-trichloro-3-O-methylnorlichexanthone (major), atranorin (minor), ±pannarin (minor).

This scattered species occurs on siliceous rocks in southern W.A., eastern Qld, Vic. and Tas.; also in New Zealand.


Characterised by the yellowish, pale green-brown to yellow-brown thallus with frequent lecideine apothecia, usually with pruinose discs, Physconia- to Buellia-type ascospores and the presence of atranorin and 2,5,7-trichloro-3-O-methylnorlichexanthone.


Thallus squamulose, 2–4 cm wide, up to 1 mm thick; squamules adnate, orbicular to somewhat irregular, often crowded, plane to irregularly undulate or bullate, ultimately reticulately grooved; prothallus absent. Upper surface white, dirty white, olive-green to olive-brown or yellow-brown; cortex 25–50 µm thick; medulla white, 250–900 µm thick, lacking calcium oxalate (H₂SO₄⁻); lower side with rhizinose strands not directly attached to the substratum. Apothecia 0.8–1.0 mm wide, lecideine, erumpent, with an accessory thalline margin that becomes markedly denticate-corneate but excluded with age; disc black, epruinose, plane to markedly convex; proper margin distinct, thin to moderately thick, becoming excluded. Proper exciple 50–100 µm thick, dark brown in the outer part, colourless within. Epiphysium 8–13 µm thick, dark brown to brown-black, K⁺, N⁻; hymenium 50–60 µm thick, colourless, not inspersed; hypothecium 25–75 µm thick, dark brown to brown-black. Paraphyses 2–3 µm wide, simple to moderately branched; apices 4–6 µm wide, with brown or dark brown caps. Ascii Bacidía-type, 8-spored. Ascospores Buellia-type, 1-septate, brown, oblong to ellipsoidal, 12–20 × 5–10 µm, uniformly thin-walled; outer wall ornamented. Pycnidia immersed; conidia filiform, 12–20 × 1 µm.

Chemistry: Thallus K⁺ yellow or yellow then red, C⁻, P⁺ yellow or yellow-orange, UV⁻; three chemical races have been observed: 1, containing atranorin (minor), chloroatranorin (minor), norstictic acid (major), connorstictic acid (minor); 2, containing norstictic acid (major), connorstictic acid (minor); and 3, containing atranorin (major), chloroatranorin (minor).

A common endemic on soils in southern and central Australia (W.A., N.T., S.A. and N.S.W.).
N.S.W.: Brennans Rd, Lincoln S.F., 15 km ENE of Bellodoran, 21 km SE of Gilgandra, J.A.Elix 38455 (CANB).

This species has a white, dirty white to olive-brown or yellow-brown squamulose thallus and erumpent apothecia with an accessory, markedly dentate-corneate thalline margin. The thallus contains atranorin and/or norstictic and connorstictic acids.


*T*: Mt Macedon, [Vic.], Nov. 1882, Moffat; holotype: G n.v.

Thallus crustose, weakly verrucose, scontinuous to rimose-areolate, 1–3 cm wide; prothallus absent. Upper surface dirty white to yellow-white; cortex 10–15 µm thick; medulla white, 20–25 µm thick, lacking calcium oxalate (H₂SO₄−), I−. Apothecia 0.2–0.4 mm wide, lecideine, sessile to adnate; disc black, plane to concave, epruinose; proper margin moderately to very broad, persistent. Proper exciple 50–70 µm thick, dark brown to brown-black, paler internally, K−. Epihymenium 5–10 µm thick, olive-green to olive-brown, K−; hymenium 100–120 µm thick, colourless, densely inspersed with oil droplets; hypothecium 80–100 µm thick, carbonaceous. Paraphyses 1.6–1.8 µm wide, simple to branched; apices 3.0–3.5 µm wide, with brown or dark brown caps. Asci Bacidia-type, 8-spored. Ascospores Buellia-type, 1-septate, olive-green to olive-brown, broadly ellipsoidal to subglobose, 12–14 × 10–11 µm, uniformly thin-walled; outer wall smooth. Pycnidia not seen.

**Chemistry:** Thallus K+ yellow then red, C−, P+ yellow-orange. UV−: containing norstictic acid (major), connorstictic acid (minor), 4,5-dichlorolichexanthone (minor).

A rare endemic species on bark in southern and eastern Vic.

Vic.: Goonmirk Rocks Rd, Errinundra Natl Park, 20 km SE of Bonang, J.A.Elix 39865A (CANB).

Characterised by the dirty white to yellow-white crustose thallus, the broadly ellipsoidal to subglobose, Buellia-type ascospores, the densely inspersed hymenium and the presence of norstictic acid and 4,5-dichlorolichexanthone.


*T*: near summit of Mt Leswell, 32 km S of Cooktown, Qld, 15°46’S, 145°15’E, alt. 440 m, on granite in Eucalyptus-dominated woodland, 5 July 1984, J.A.Elix 17356 & H.Streimann; holotype: BRI.

Illustration: J.A.Elix, *op. cit.* 37, fig. 3.

Thallus crustose, scontinuous to areolate, up to 5 cm wide and 0.4 mm thick; areolae 0.1–0.5 mm wide, angular, ±plane to convex; prothallus conspicuous, black, delimiting the thallus, c. 0.2 mm wide, also growing between the areolae. Upper surface whitish to grey-white or grey to yellowish or greenish grey, matt to glossy, rarely becoming eroded and somewhat granular; cortex 20–25 µm thick; upper medulla colourless to pale yellow, 100–150 µm thick; lower medulla dark yellow-green to orange or dark red-brown, 125–150 µm thick, K−. Apothecia 0.3–1.0 mm wide, lecideine, numerous, rounded, adnate, solitary or rarely in groups of 2–4; disc black, epruinose or rarely slightly white-pruinose, plane, rarely becoming slightly convex. Proper exciple 50–80 µm thick; outermost layer dark brown, thin, due to the pigmented caps of the outermost hyphal cells; inner zone paler brown, K−. Epihymenium 10–12 µm thick, dark brown, K−, N−; hymenium 70–90 µm thick, colourless, not inspersed; hypothecium c. 50 µm thick, greenish yellow to pale reddish brown; subhypothecium dark red-brown, 80–100 µm thick. Paraphyses 2–3 µm wide, sparingly branched from the base; apices 4–5 µm wide, with brown caps (N−). Asci Bacidia-type, usually 8-spored. Ascospores Buellia-type, 1-septate, brown, oblong to broadly ellipsoidal, 12–16 × 5–8 µm, with apical and septal wall thickenings when young; torus usually distinct; outer wall finely ornamented to smooth. Pycnidia not seen.

**Chemistry:** Thallus K+ yellow, P+ yellow, C−, UV−; medulla K+ yellow then red, P+ orange-red, C−, UV−: containing norstictic acid (major), atranorin (major or minor), chloroatranorin (minor), connorstictic acid (minor), vioxanthin (minor), norvioxanthin (minor).
A scattered endemic on siliceous rocks in northern W.A., N.T. and Qld.


**Buellia vioxanthina** is characterised by the usually whitish to grey-white thallus, adnate apothecia with black discs, a yellow-green to orange or red-pigmented lower medulla and/or subhypothecium and the presence of atranorin, norstictic acid and vioxanthin.

### 32. Buellia xantholeuca


**T:** Wannan, Lincoln Natl Park, 18 km S of Port Lincoln, S.A., 34°54'S, 135°52'E, alt. 25 m, on limestone rocks among scattered low shrubs, 22 Sept. 1994, J.A.Elix 41788; holo: CANB; iso: B.

Illustrations: F.Bungartz, J.A.Elix, U.Grube, C.Heininger & H.Mayrhofer, *op. cit.* 432, fig. 6E–H; 434, fig. 8A, B.

Thallus crustose, continuous to rimose but not areolate, usually forming circular sublobate patches, 4–8 cm wide; prothallus delimiting the thallus, distinctly blackened to pale gray, or white and indistinct. Upper surface white or often with a yellowish tinge, chalky, dull, heavily pruinose; cortex 70–80 µm thick, with calcium oxalate crystals (H₂SO₄+); medulla white, filled with calcium oxalate crystals (H₂SO₄+), 1–90–110 µm thick. Apothecia 0.3–1.2 mm wide, lecideine, immersed then adnate to sessile; disc black, usually with a dense fine white pruina, plane or weakly convex with age; proper margin white to pale grey, thick, persistent, hyaline to very weakly pigmented, but typically not carbonised and whitish-pruinose, thus resembling a thalline margin. Proper exciple 70–100 µm thick; outer layer hyaline to very weakly carbonised with low concentrations of a brown pigment (N–); inner layer pale to deep red-brown, K–. Epihymenium 9–13 µm thick, pale brown to brown, K–, N–; hymenium 40–50 µm thick, colourless, not inspersed; hypothecium c. 90 µm thick, deep reddish brown. Paraphyses 2–3 µm wide, simple to moderately branched; apices 4–6 µm wide, with brown caps (N–). Asci *Bacidia*-type, 8-spored. Ascospores *Buellia*-type, 1-septate, olive-brown to brown, oblong to broadly ellipsoidal, with obtuse ends, 11–20 × 6–10 µm; septum narrow, slight thickening of the septum during spore ontogeny; torus indistinct; outer wall smooth. Pycnidia rare, urceolate to globose; conidia bacilliform, 4–5 × 1.0–1.5 µm.

**Chemistry:** Thallus K–, C– or C+ bright yellow, KC–, P–; medulla K–, C+ orange, KC+ dull orange to red, P–, UV+ bright orange; containing 2,5,7-trichloro-3-O-methylnorlichexanthone (major), thiophanic acid (major or absent), isoarthothelin (minor).

A scattered endemic species on calcareous rocks in southern W.A. and S.A.


**Buellia xantholeuca** is characterised by the thick, chalky white to yellowish white thallus with sublobate margins, immersed then adnate to sessile apothecia with black, white-pruinose discs, the hyaline to weakly carbonised outer part of the excipulum and the presence of xanthones.

### Doubtful and Excluded Names


Baculifera remensa is restricted to Central and South America and the Hawaiian Islands (Marbach, 2000: 144).


Reported from Victoria by J.Müller (Bull. Herb. Boissier 1: 53, 1893), this exclusively Northern Hemisphere species has an immersed thallus, very narrow ascospores, and it contains norstictic acid (M.Giralt, F.Bungartz & J.A.Elix, Mycol. Progr. 10: 115–119, 2011). No authentic material has been seen from Australia.

Buellia aeruginascens (Nyl.) Zahlbr., Cat. Lich. Univ. 7: 331 (1931)


Buellia cretacea Müll.Arg., Flora 72: 512 (1889)

This species was reported from Western Australia by F.R.M.Wilson (Victorian Naturalist 6: 180, 1890). However, no material has been seen, and the report of this South American species is probably a misidentification of Buellia albula.

Buellia diplotommoides Müll.Arg., Flora 64: 524 (1881)

Reported from Victoria by J.Müller (Bull. Herb. Boissier 1: 53, 1893), the type of this saxicolous species is from Brazil, and no authentic Australian collections have been located.

Buellia disciformis var. cinereoferruginea (C.Knight) Zahlbr., Cat. Lich. Univ. 7: 352 (1931)


According to the protologue, this lichen occurred on bark in Indooroopilly and Kelvin Grove (now suburbs of Brisbane, Queensland). However, the only specimen in the Knight herbarium (WELT) is labelled J.Shirley 71, Moreton Bay. Filson (Index to Type Specimens of Australian Lichens: 1800–1984 115, 1986) claimed it to be the holotype, but this is incorrect, as it is growing on rock and has much larger ascospores than those described for the type (8 × 3 µm).

Buellia epigaea (Hoffm.) Tuck., Gen. Lich. 185 (1872)

Reported from Western Australia (N.Sammy, Mycotaxon 35: 417–428, 1989) and South Australia (R.B.Filson & R.W.Rogers, Lichens of South Australia 61, 1979), a revision of this species group in Australia by Trinkaus et al. (Lichenologist 33: 47–62, 2001) confirmed that B. epigaea s. str. is confined to the Northern Hemisphere, and that Australian reports has been misidentifications of B. dijiana, B. georgei or B. lobata.


Reported from Queensland by F.M.Bailey (Bot. Bull. Dept Agric. Queensland 3: 20–32, 1891) and from an unspecified Australian locality (B.J.Coppins, C.Scheidegger & A.Aptroot, Lichens of Great Britain and Ireland, 2nd edn 233, 2009), no authentic material has been seen from Australia. This species occurs in Europe, North and Central America, Macaronesia, Asia and Africa.


This lichen does not belong to *Buellia* as the apothecia form a mazedium. Thus, it is possibly a species of *Calicium*.


Reported from Victoria by J. Müller (*Bull. Herb. Boissier* 1: 53, 1893). The type of this saxicolous species is from Brazil, and no authentic Australian collections have been located.


This saxicolous lichen was reported from Queensland by F.M.Bailey (*Bot. Bull. Dept Agric., Queensland* 3: 29, 1891). The type is from Socotra (Yemen), and no authentic Australian collections have been located.

**Buellia ocellata** (Flot.) Körb., *Syst. Lich. German.* 224 (1855)

Reported from Victoria (P.M.McCarthy, *Checklist Austral. Lichens*, 4th edn 15, 1991), this lichen is known from Europe, North America, Macaronesia, Asia and Africa. However, no authentic material has been confirmed from Australia, and the previous record was probably based on a misidentification of the common and closely related *B. halonia*.

**Buellia parasema** var. *rugulosa* (Schaer.) Körb., *Syst. Lich. German.* 228 (1855)

This lichen was reported from Mount Gravatt, now a suburb of Brisbane, Queensland, by F.M.Bailey (*Bot. Bull. Dept Agric. Queensland* 3: 28, 1891). However, the type material has not been located, and the identity of this European taxon is uncertain. Indeed, supposedly authentic European collections [L. Mudd, *Exsicc.* nos 188, 191, 192 (1860), *fide* A.L. Smith, *Monogr. Brit. Lichens* 2: 204, 1926] included *Diplotomma alboatra* as well as *Buellia disciformis*.


The type specimen is referable to the lichenicolous fungal genus *Dactylospora* (Ascomycota, Dactylosporaceae).

**Buellia rimulosa** Müll.Arg., *Flora* 71: 543 (1888)

Originally described from Brazil, and subsequently reported from Queensland (F.M.Bailey, *Bot. Bull. Dept Agric. Queensland* 8: 100, 1893), no authentic Australian collections have been located.


This species was reported from Victoria by Filson (*Checklist Austral. Lichens* 12, 1983), but it is now considered to be an Antarctic endemic (D. Øvstedal & R.I. Lewis-Smith, *Lichens of Antarctica and South Georgia* 126, 2001).


This saxicolous lichen, first described from Paraguay, was reported from Mt Mistake, Queensland by F.M.Bailey (*Bot. Bull. Dept Agric. Queensland* 8: 100, 1893). However, no authentic Australian collections have been located.
**Buellia subdisciformis** (Leight.) Vain., *Étud. Class. Lich. Brésil* 1: 167 (1890) var. subdisciformis

Although this lichen has been reported from New South Wales (W.Nylander, *Flora* 69: 325, 1886), Queensland (J.Shirley, *Proc. Roy. Soc. Queensland* 6: 189, 1889), Victoria (R.B.Filson, *Checklist Austral. Lichens* 12, 1983), Western Australia (R.N.Richardson & D.H.S.Richardson, *W. Australian Herb. Res. Notes* 7: 27, 1982), and from unspecified Australian localities (e.g. B.J.Coppins, C.Scheidegger & A.Aptroot, *Lichens of Great Britain and Ireland*, 2nd edn 238, 2009), no authentic material has been seen from Australia. Earlier reports were misidentifications of *B. homophylia* which differs from *B. subdisciformis* having an aeruginose, N+ red-violet or red-brown epihymenium and an I+ purple medulla, whereas *B. subdisciformis* has a N– epihymenium and a non-amyloid medulla.

**Buellia talcophila** (Ach.) Körb., *Syst. Lich. German*. 230 (1855)


T: Bellenden-Ker, Qld, on bark.

The type material could not be located, but according to the description this lichen differs from var. *tetrapla* in having a black prothallus (normally not apparent in this species). However, its identity cannot be confirmed until the type is examined.


Reported from Queensland by R.B. Filson (*Checklist Austral. Lichens* 10, 1983, as *Buellia dialyta*), this record was almost certainly a misidentification, this lichen being restricted to North America and Japan (Marbach, 2000).


This lichen was reported from Queensland by R.B.Filson (*Checklist Austral. Lichens* 10, 1983, as *Buellia elizae*). According to Marbach (2000), this species is known only from North America, Japan and Kenya. The Australian report was possibly a misdetermination of *G. catasema*, since both species are isidiate and contain barbatic acid (*G. elizae* lacks the lichexanthone that is present in *G. catasema*).


This lichen is known from South America, SE Asia, Papua New Guinea and New Caledonia (Marbach, 2000: 152). Although it has been reported from Queensland (Filson, 1983: 12, as *Buellia rosellotincta*), no Australian collections can be confirmed.