



CANDELARIELLA ¹

Gintaras Kantvilas ²

Candelariella Müll.Arg., *Bull. Herb. Boissier* 2, app. 1: 11 (1894).

Type: *C. vitellina* (Hoffm.) Müll.Arg.

Thallus crustose to granular, sometimes entirely sorediate, typically bright yellow to greenish yellow or yellow-orange, with or without a prothallus. Photobiont a green alga with cells ± globose, 8–20 µm diam. Ascomata apothecia, lecanorine with a persistent thalline margin, rarely biatorine, sessile. Hypothecium hyaline. Hymenium mostly hyaline, yellowish in the upper part, I+ blue, not interspersed, separating readily in K, overlain by a yellow-brown, granular epithecium insoluble in K. Paraphyses simple or sparsely branched towards the tips; apices usually a little expanded. Asci 8- or multispored, of the *Candelaria*-type: clavate, with a well-developed tholus, in the lower part intensely amyloid and penetrated entirely by a non-amyloid, cylindrical *masse axiale* with parallel flanks; ocular chamber not developed. Ascospores simple, hyaline, ellipsoid to rather oblong. Conidiomata pycnidia, immersed. Conidia ellipsoid, c. 2.5–4 × 1–2 µm. Chemistry: calycin, pulvinic acid and their derivatives; these compounds convey the characteristic yellow colour of the genus.

A cosmopolitan genus of about 50 species, found on wood, bark, rocks or, more rarely, on other lichens, frequently in eutrophicated habitats. It is usually easily recognised by the bright mustard- or egg yolk-yellow colour of the thallus and apothecia. Superficially similar genera include *Caloplaca*, which differs by reacting K+ purple and having polarilocular ascospores, and *Chrysothrix*, which has a byssoid thallus with a trentepohlioid photobiont. It is closely related to *Candelaria*, which differs chiefly by its squamulose growth form, although the distinction between the two requires further study (Westberg & Arup 2011).

Key references: Filson (1992); Westberg (2007a, b); Cannon *et al.* (2021).

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| 1 | Thallus ± entirely sorediate, usually growing on bark or wood | 2 |
| | Thallus granular or areolate, never sorediate, sometimes ± absent, mostly growing on rocks or man-made substrata, or occasionally on wood | 3 |
| 2(1) | Asci 8-spored; widespread and common | 5 <i>C. xanthostigmoides</i> |
| | Asci at least 16-spored; rare | 3 <i>C. efflorescens</i> |
| 3(1) | Asci 8-spored; thallus growing on calcareous substrata | 1 <i>C. aurella</i> |
| | Asci at least 16-spored; thallus growing on siliceous rocks, treated timber or wood | 4 |
| 4(3) | Thallus egg-yolk yellow, composed of convex or flattened granules or areoles 0.1–0.3 mm wide; common and widespread | 4 <i>C. vitellina</i> |
| | Thallus lemon-yellow, composed of aggregated, coralloid granules 30–80 µm wide; rare | 2 <i>C. coralliza</i> |

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2 Tasmanian Herbarium, Tasmanian Museum & Art Gallery, PO Box 5058, UTAS LPO, Sandy Bay, TAS 7005, Australia.

1 *Candelariella aurella* (Hoffm.) Zahlbr.

Cat. Lich. Univ. 5: 790 (1928); —*Verrucaria aurella* Hoffm., *Deutschl. Fl.*: 197 (1796).

Thallus bright yellow to orange-yellow, rarely continuous and scurfy, more typically composed of dispersed, plane to convex areoles or granules 0.1–0.4 mm wide, or disappearing altogether and the lichen dominated by apothecia, forming dispersed, irregular, diffuse patches; prothallus rarely developed, effuse dark grey and visible between the apothecia and thallus granules. Apothecia lecanorine, 0.2–1 mm wide, sessile, roundish or a little deformed-angular, scattered or crowded together in clumps; disc ± concolorous with the thallus or slightly yellow-orange, epruinose, plane to convex; thalline margin yellow, entire, in section 20–60 µm thick. Hypothecium 50–90(–130) µm thick. Hymenium 40–70 µm thick; paraphyses 2–3 µm thick, with the apices expanded to 3.5–6 µm and sometimes moniliform; asci 8-spored, 35–50 × 12–17 µm. Ascospores 10–13.5–17.5(–18) × (4–)4.5–5.2–6 µm. Conidia 3–4 × 1–2 µm.

A cosmopolitan, calcicolous species, known in Tasmania almost exclusively from alkaline, man-made substrata such as concrete, mortar and asbestos. The 8-spored asci are diagnostic. The scattered yellow apothecia frequently occur together with those of *Caloplaca* species, which differ by their K⁺ purple reaction and polarilocular ascospores.

Mt Wellington summit, 42°54'S 147°35'E, 1971, G.C. Bratt 71/1485 (HO); Cascades, Hobart, 42°54'S 147°17'E, 130 m, 1998, G. Kantvilas 162/98 (HO); Lemont, Miena property, 42°19'S 147°37'E, 370 m, 2016, G. Kantvilas 119/16 (HO).

2 *Candelariella coralliza* (Nyl.) H. Magn.

Svensk. Bot. Tidskr. 29: 122 (1935); —*Lecanora coralliza* Nyl., *Flora* 58: 15 (1875).

Thallus lemon-yellow, sometimes with a faint greenish tinge, composed of coralloid granules 30–80 µm wide, aggregated in loosely attached, dispersed or contiguous, pulvinate clumps 0.5–1 mm wide; prothallus not developed. Apothecia lecanorine, 0.2–0.5 mm wide, roundish, ± nestled amongst the thallus granules; disc ± concolorous with the thallus, sometimes a little pruinose, plane to convex; thalline margin concolorous with the disc and thallus, smooth to granular, in section 30–60 µm thick. Hypothecium 80–100 µm thick. Hymenium 45–60 µm thick; paraphyses 2–3 µm thick, with the apices mostly capitate, occasionally moniliform, to 5 µm wide; asci 16–32-spored, 40–55 × 20–25 µm. Ascospores 9–9.8–11 × 4–4.8–5.5 µm, sometimes appearing spuriously 1-septate. Conidia not found.

Widespread in the temperate Northern Hemisphere but seemingly rare in Tasmania, where it has been collected once from exposed rocks at high elevation. Identification of this Tasmanian specimen is tentative but, when growing in close proximity to the similar *C. vitellina*, the distinction between the two appears clear: although anatomically ± identical, the lemon-yellow, coralloid-granular thallus of *C. coralliza* contrasts sharply with the egg-yolk thallus of *C. vitellina* where the thallus granules and areoles are larger, scattered and never coralloid. Reported here for the first time from Australia.

Platform Peak, 42°41'S 147°03'E, 975 m, 2015, G. Kantvilas 242/15 (HO).

3 *Candelariella efflorescens* R.C. Harris & W.R. Buck

Michigan Bot. 17: 155 (1978).

A sorediate species, morphologically very similar to *C. xanthostigmoides* but with the soralia dispersed and not forming a continuous crust, the individual soredia generally a little coarser and (20–)30–40 µm diam., 16-spored asci, 35–50 × 15–20 µm, and somewhat smaller ascospores 8–10.2–12 × 4–4.5–5 µm.

Widespread in the Northern Hemisphere but rarely observed (or collected) in Tasmania, possibly due to the thallus being very diffuse and relatively inconspicuous, and the apothecia very uncommon. The 16-spored asci distinguish it unequivocally from the common *C. xanthostigmoides*. It is found on rocks or the bark of small trees in exposed situations in areas of low rainfall. The name *C. xanthostigma* (Ach.) Lettau, a multisporous species with a granular, esorediate thallus, has been misapplied to this species in the past. Reported here for the first time from Australia.

Pontville Small Arms Range Complex, 42°40'S 147°18'E, 90 m, 2003, G. Kantvilas 205/03 (HO); Wind Song Property, Ronnies Spur, 42°21'14"S 147°55'01"E, 30 m, 2017, G. Kantvilas 274/17 (HO).

4 *Candelariella vitellina* (Hoffm.) Müll.Arg.

Bull. Herb. Boissier 2, app. 1: 47 (1894); —*Patellaria vitellina* Hoffm., *Descr. Pl. Cl. Crypt:* 2: 5 (1794).

Thallus bright egg yolk-yellow, sometimes with a tint of orange, composed of dispersed or contiguous, convex or flattened granules or areoles 0.1–0.3 mm wide, when well developed becoming aggregated together with apothecia in gnarled and contorted, loosely attached, pulvinate clumps to c. 2 mm wide and 1 mm thick, separated by deep cracks, occasionally absent or almost so; prothallus rarely developed, effuse and patchy, dark grey and visible between the apothecia and thallus granules. Apothecia lecanorine, 0.2–1(–1.5) mm wide, sessile, roundish or a little deformed-angular when crowded together; disc ± concolorous with the thallus, sometimes a little pruinose, plane to convex; thalline margin concolorous with the disc and thallus, smooth and entire or a little crenulate, in section 40–100 µm thick. Hypothecium 80–110 µm thick. Hymenium 60–80 µm thick; paraphyses 2–3 µm thick, with the apices not expanded or slightly capitate and 3–4 µm wide; asci 16(–32)-spored, 45–65 × 18–25 µm. Ascospores (8–)9–11.5–13.5(–15) × 4–4.9–6 µm, sometimes appearing spuriously 1-septate. Conidia 3–4 × 1.5–2 µm.

Cosmopolitan. This is a highly variable species with a wide ecological amplitude, widespread in Tasmania from coastal to alpine elevations, and in areas of low to high rainfall. It occurs on a wide range of siliceous rock types, over mosses on rocks, occasionally on treated timber and, more rarely, on wood. It tends to be particularly abundant in nutrient-enriched habitats such as in rough pasture or on the tops of large boulders or fenceposts where birds perch. In the Northern Hemisphere, *C. vitellina* is sometimes infected by the lichenicolous *Carbonea vitellinaria* (Nyl.) Hertel, but this species has not been recorded for Tasmania.

The Hunting Ground, 42°32'S 147°05'E, 1969, G.C. Bratt 69/158 (HO); Lake Augusta, 41°51'S 146°35'E, 1160 m, 1993, G. Kantvilas 177/93 & J. Elix (HO); Ben Lomond, Meadow Vale, 41°32'S 147°40'E, 1430 m, 2021, J. Jarman s.n. (HO).

5 *Candelariella xanthostigmoides* (Müll.Arg.) R.W.Rogers

Muelleria 5: 32 (1982); —*Lecanora xanthostigmoides* Müll.Arg., *Flora* 65: 484 (1882); *Candelaria xanthostigmoides* (Müll.Arg.) Müll.Arg, *Bull. Herb. Boissier* 1: 33 (1892).

Thallus vivid egg yolk-yellow, occasionally greenish yellow to greenish grey in extreme shade or in moribund parts, initially composed of minute, scattered, stellate to irregularly lobate squamules 0.15–0.3 mm wide that soon burst and become sorediate, or, more typically, with the thallus sorediate ± from the outset; soredia granular, 16–30(–40) µm diam., at first scattered in specks or small clusters 0.1–0.8 mm wide, usually forming a diffuse, irregular, extensive sorediate crust; prothallus effuse, dull grey, mostly not developed. Apothecia lecanorine, generally uncommon, 0.2–0.5 mm wide, roundish, sessile; disc ± concolorous with the thallus or faintly orange, epruinose, plane to convex; thalline margin concolorous with the disc and thallus, smooth to crenulate, sometimes sorediate, in section 20–70 µm thick. Hypothecium 50–120 µm thick. Hymenium 45–60 µm thick; paraphyses 2–3 µm thick, widening somewhat but not capitate at the apices; asci 8-spored, 35–50 × 12–18 µm. Ascospores 10–12.6–15(–16) × 4–4.7–5(–6) µm, sometimes appearing spuriously 1-septate. Conidia rare, 3–4 × 2 µm, found in pycnidia immersed beneath the apothecia.

Common and widespread in Tasmania in areas of low rainfall where it occurs mostly on the rough bark of *Exocarpos*, *Allocasuarina*, *Callitris* and *Acacia*, as well as on wood; rarely also found on rocks. This species is based on a type specimen from New South Wales and is widespread throughout temperate Australia, but it is now also recognised as occurring in the Northern Hemisphere. The morphologically similar *C. efflorescens* differs mainly by having 16-spored asci. Sterile sorediate specimens of *Candelariella* cannot, therefore, be identified to species, although *C. xanthostigmoides* is much more common. In earlier accounts of Tasmanian lichens, specimens referred to here as *C. xanthostigmoides* were identified as *C. reflexa* (Nyl.) Lettau, a Northern Hemisphere species which differs chiefly by having a more rosette-forming, squamulose thallus.

Brown Mtn Road, 42°35'S 147°29'E, 220 m, 1981, G. Kantvilas 742/81 & P. James (BM, HO); Carr Villa Cemetery, Launceston, 41°28'S 147°10'E, 80 m, 1992, A.V. Ratkowsky s.n. (HO); Wind Song Property, Ronnies Spur, 42°21'14"S 147°55'01"W, 30 m, 2017, G. Kantvilas 200/17 (HO).

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