

New species and new records of the lichen genus *Baculifera*  
(Physciaceae, Ascomycota) in Australia

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**Abstract**

*Baculifera epifuscescens* Elix & Kantvilas, *B. macromera* Elix & Kantvilas and *B. metaphragmioides* Elix & Kantvilas are described as new to science. *Buellia microsporella* Elix is found to be synonymous with *Baculifera xylophila* (Malme) Marbach, and that species is reported as new to Queensland. The new combination *Baculifera metaphragmia* (C.Knight) Elix & Kantvilas is made, and *B. intermedioides* Marbach, *B. micromera* (Vain.) Marbach, *B. orosa* Marbach & Kalb and *B. pseudomicromera* Marbach are reported as new to Australia.

We continue our investigation of buellioid lichens in Australia, which has included the first account of the family (Elix 2011) and additions and revisions to *Amandinea* (Elix & Kantvilas 2013a), *Buellia sens. lat.* (Elix & Kantvilas 2013b) and *Buellia sens. str.* (Elix & Kantvilas 2014). In this paper, we deal with the species of *Baculifera* which are characterized by bacilliform conidia (4–8–11(–14)  $\mu\text{m}$  long and a non-inspersed hymenium (Marbach 2000). The superficially similar *Buellia sens. str.* is distinguished from *Baculifera* by having short, bacilliform or weakly clavate conidia and a hymenium usually inspersed with oil droplets. In this paper, we describe three species new to science, report four new records of *Baculifera* for Australia, and provide a key to the Australian species.

**Material and methods**

The study is based on collections and observations of the authors, and on other herbarium specimens held in the Tasmanian Herbarium (HO) and the Australian National Herbarium (CANB). Observations of thallus and apothecial anatomy were made on hand-cut sections mounted in water, 15% KOH and 50% HNO<sub>3</sub>. Chemical constituents were identified by thin-layer chromatography (Elix & Ernst-Russell 1993), high-performance liquid chromatography (Elix *et al.* 2003) and comparison with authentic samples. Nomenclature of ascus types follows Hafellner (1984). Nomenclature of pigments follows Meyer & Printzen (2000), Marbach (2000) and Bungartz *et al.* (2007). The *micromera*-green pigment was described by Bungartz *et al.* (2007) as being greenish brown and reacting K+ greenish yellow, K followed by HCl + bluish green, N+ black, whereas Etayo *et al.* (2010) describe that pigment as dark brown to olivaceous black, reacting N+ blackish, K+ yellowish green and KC+ dark blue-green to blackish. In our experience, its detection can be problematical, especially when in low concentrations. In water mounts, it is seen as olive- or dark greenish brown, reacting N+ dark purplish grey or purplish black which fades on standing; reactions in K, KC and K/HCl can be ambiguous.

**The new species**

**1. *Baculifera epifuscescens* Elix & Kantvilas, sp. nov.**  
MB 809823

Fig. 1

*Baculiferae orosae* Marbach & Kalb similis sed atranorinum deficienti et epihymenio hypothecioque K+ atro-fusco reagentibus, ascosporis 15–23  $\mu\text{m}$  longis, 7–12  $\mu\text{m}$  latis, parietibus medialiter subapicaliterque non incrassatis differt.

*Type:* Australia, New South Wales, Red Rock, 36 km NNE of Coffs Harbour, 29°59'S, 153°14'E, 1 m alt., on *Casuarina* at margin of mangrove swamp, *J.A. Elix* 42707, 19.iv.1998 (holotype – CANB).

*Thallus* crustose, forming discontinuous patches to c. 4 cm wide, white, sordid white or pale yellow-grey, 100–200  $\mu\text{m}$  thick, esorediate; prothallus not apparent; cortex c. 10  $\mu\text{m}$  thick; medulla I–; photobiont cells 7–10  $\mu\text{m}$  wide. *Apothecia* 0.2–1.0 mm wide, lecideine, scattered or crowded, subimmersed then broadly adnate; disc black to black-brown, epruinose, weakly concave at first, then  $\pm$  plane to markedly convex; proper excipulum concolorous with the disc,  $\pm$  persistent, excluded in older, convex apothecia, black, in section 25–35  $\mu\text{m}$  thick, dark brown to black-brown, paler within, K+ forming red crystals, N–. *Epihymenium* 8–12  $\mu\text{m}$  thick, orange-brown to olive-brown, K+ dark brown to blackish brown, N– (*arnoldiana*-brown). *Hypothecium* 35–50  $\mu\text{m}$  thick, pale orange-brown to brown, K+ dark brown to blackish brown. *Hymenium* 50–75  $\mu\text{m}$  thick, colourless, not inspersed; paraphyses 1–1.5  $\mu\text{m}$  wide, simple to weakly branched, capitate, with apices brown, 3–4  $\mu\text{m}$  wide; asci approximating the *Bacidia*-type, 8-spored but often with fewer spores (6- or 4-spored). *Ascospores* of the *Buellia*-type, 1-septate, olive-green to brown, ellipsoid, 15–23  $\times$  7–12  $\mu\text{m}$ , larger when fewer per ascus,  $\pm$  constricted at central septum, curved or not, rounded at apices, lacking medial and subapical wall-thickenings; outer spore wall strongly ornamented. *Pycnidia* immersed; conidia bacilliform, straight or rarely slightly curved, 8–13  $\times$  1  $\mu\text{m}$ .

*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).

*Etymology:* The species name is derived from the Latin *fuscus* (dark, blackish brown) in reference to the reaction of the epihymenium with KOH.

**Remarks**

This new species is characterized by the crustose, white to sordid white or pale yellow-grey thallus that contains norstictic acid, the presence of *arnoldiana*-brown pigment in the epihymenium and hypothecium, the 1-septate, *Buellia*-type ascospores without medial or subapical wall-thickenings, and the relatively long, bacilliform conidia. As with several *Buellia*-like lichens studied by us (e.g. *Buellia nebulosa*, *B. testaceina*; Elix & Kantvilas 2013b), the ascus type of *Baculifera epifuscescens* is difficult to interpret. The well-developed, intensely amyloid tholus is penetrated almost entirely by a rather narrow masse axiale with relatively parallel (rather than convergent) flanks and a rounded (rather than acute) apex. *Baculifera orosa* from Central America, and reported here for the first time from Australia, has similar sized ascospores and conidia, but differs in having a K– epihymenium and hypothecium, ascospores with medial and subapical wall thickenings and predominantly 8-spored asci, and in containing additional atranorin. Furthermore, the apothecia of *B. orosa* often have whitish pruinose discs, whereas those of *B. epifuscescens* are epruinose.

*Buellia epifuscescens* is known from bark in lowland and coastal forests in Queensland and New South Wales. Associated species include *Buellia demutans* (Stirt.) Zahlbr., *Canoparmelia texana* (Tuck.) Elix & Hale, *Cratiria aggreddens* (Stirt.) Marbach, *C. melanochlora* (Kremp.) Marbach, *Punctelia subflava* (Taylor) Elix & J. Johnst. and *Usnea dasaea* Stirt.

**ADDITIONAL SPECIMEN EXAMINED**

*Queensland:* • Baralaba–Woorabinda road, State Forest 212, 50 km S of Duaringa, 24°10'S, 149°38'E, 190 m alt., on lower stem of *Callitris* in *Eucalyptus-Callitris*-dominated woodlands on flats, *H. Streimann* 52544, 29.viii.1990 (B, CANB).

## 2. *Baculifera macromera* Elix & Kantvilas, sp. nov.

Fig. 2

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*Baculifera micromerae* (Vain.) Marbach similis sed ascis 4–8-sporis et ascosporis grandioribus, (12–)16–30  $\mu\text{m}$  longis, (5–)7–12  $\mu\text{m}$  latis, pariete laevi differt.

*Type:* Australia, Tasmania, summit of Table Mountain, 42°14'S, 147°08'E, 1095 m alt., on twigs of dead eucalypts in low woodland, *G. Kantvilas* 938/01, 6.x.2001 (holotype – HO).

*Thallus* crustose, smooth, indistinctly areolate, uneven to occasionally verruculose, white to pale grey or greenish grey, esorediate, 0.5–6.5 cm wide, to 150  $\mu\text{m}$  thick; prothallus marginal and black or not apparent; cortex c. 10  $\mu\text{m}$  thick; medulla white, I–; photobiont cells 8–16  $\mu\text{m}$  wide. *Apothecia* 0.1–0.7 mm wide, lecideine, scattered or crowded, broadly adnate; disc black, epruinose, weakly concave at first, then  $\pm$  plane to weakly convex; proper excipulum concolorous with the disc, persistent, in section 35–50  $\mu\text{m}$  thick, dark red-brown to black-brown, N+ weak red-brown, paler within. *Epithymenium* 8–20  $\mu\text{m}$  thick, dark olive-brown to dark brown, K–, N–. *Hypothecium* 75–140  $\mu\text{m}$  thick, dark brown to dark red-brown. *Hymenium* 50–100  $\mu\text{m}$  thick, colourless, not interspersed; paraphyses 1.8–2.0  $\mu\text{m}$  wide, simple to weakly branched, capitate, with apices dark red-brown, 3–5  $\mu\text{m}$  wide; asci approximating the *Bacidia*- to *Lecanora*-types, 4–8-spored. *Ascospores* of the *Buellia*-type, olive-green to brown, ellipsoid to broadly fusiform, (12–)16–30  $\times$  (5–)7–12  $\mu\text{m}$ , usually 1-septate but with older spores rarely becoming 3-septate,  $\pm$  constricted at central septum and developing pointed apices and moderate subapical wall-thickenings; outer spore wall smooth. *Pycnidia* immersed; conidia bacilliform, straight, 5–6  $\times$  1  $\mu\text{m}$ .

*Chemistry:* Thallus K+ yellow or K–, P+ pale yellow or P–, C–, UV–; containing atranorin (minor or trace).

*Etymology:* The epithet reflects the similarity of this species to *B. micromera*, highlighting its larger ascospores.

### Remarks

This new species is characterized by the thin, white to pale grey or greenish grey thallus containing atranorin, the non-interspersed hymenium, the 4–8-spored asci, and the 1-septate, *Buellia*-type ascospores with moderate subapical wall-thickenings and a smooth outer wall. As with *B. epifuscescens*, the ascus type is rather equivocal: the masse axiale has a rounded apex and parallel flanks, and it penetrates the tholus  $\pm$  entirely. *Baculifera macromera* is most similar to *B. micromera*, which also contains atranorin, but differs in having an epithymenium containing *micromera*-green, 8-spored asci and smaller ascospores (12–17  $\times$  5–7  $\mu\text{m}$ ) with a strongly ornamented outer wall. *Baculifera macromera* could also be confused with *B. xylophila*, but *B. xylophila* lacks lichen substances, has 8-spored asci, smaller ascospores (12–22  $\times$  5–9  $\mu\text{m}$ ) and an epithymenium containing *micromera*-green pigment.

*Baculifera macromera* is known only from Tasmania, where it has a wide ecological amplitude, having been recorded from coastal sclerophyllous woodland, cool temperate rainforest, upland eucalypt forest and high-altitude scrubby woodland. It colonizes twigs and young branches. Associated species, gleaned from examination of herbarium specimens, reflect its variable habitat ecology and include *Austroparmelia pseudorelicina* (Jatta) A. Crespo, Divakar & Elix, *Caloplaca* spp., *Candelariella xanthostigmoides* (Müll. Arg.) R. W. Rogers, *Coccotrema cucurbitula* (Mont.) Müll. Arg., *Haematomma nothofagi* Kalb & Staiger, *Menegazzia subpertusa* P. James & D. J. Galloway, *M. subtetacea* Kantvilas, *Pertusaria pertractata* Stirt., *Ramboldia laeta* (Stirt.) Kalb, Lumbsch & Elix, *Rinodina asperata* (Shirley) Kantvilas, *Usnea inermis* Motyka and *U. oncodes* Stirt.

## ADDITIONAL SPECIMENS EXAMINED

*Tasmania:* • Five-Road, Florentine Valley, 42°43'S, 146°26'E, 450 m alt., on *Atherosperma moschatum* in rainforest, *G. Kantvilas* 239/81, 10.iv.1981 (HO); • Pelion Plains, 1 km W of Pelion Hut, 41°50'S, 146°02'E, 890 m alt., on twigs of *Cyathodes parvifolia* in open *Eucalyptus delagatensis* forest, *G. Kantvilas* 245/92, 11.iii.1992 (HO); • Cape Contrariety, 43°01'S, 147°31'E, 50 m alt., on dead *Allocasuarina verticillata* on cliff edge overlooking the sea, *G. Kantvilas* 184/98, 25.ix.1998 (HO); • Renard Point, 42°54'S, 147°40'E, 10 m alt., on *Allocasuarina verticillata* in littoral woodland, *G. Kantvilas* 272/06, 28.vi.2006 (HO); • Bisdee Tier, 42°26'S, 147°17'E, 640 m alt., on *Acacia dealbata* in rocky grassland, *G. Kantvilas* 275/09, 22.iv.2009 (HO).

## 3. *Baculifera metaphragmioides* Elix & Kantvilas, sp. nov.

Fig. 3

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*Baculifera metaphragmiae* similis sed acidum norsticticum continenti et ascosporis aliquantum magnioribus, 16–30  $\mu\text{m}$  longis, 7–14  $\mu\text{m}$  latis differt.

*Type:* Australia, Tasmania, Skullbone Plains, 42°02'S, 146°19'E, 1000 m alt., on twigs of *Richea acerosa* in open heathland, *G. Kantvilas* 176/12, 29.ii.2012 (holotype – HO).

*Thallus* crustose, endophloedal or forming a discontinuous, whitish or pale grey membranaceous film to 200  $\mu\text{m}$  thick, esorediate; prothallus absent or marginal and forming a very thin black line at the periphery of the thallus; cortex c. 10  $\mu\text{m}$  thick; medulla white, I–; photobiont cells 8–18  $\mu\text{m}$  wide. *Apothecia* 0.2–1.5 mm wide, lecideine, broadly adnate, scattered or crowded and distorted by mutual pressure; disc black, epruinose, weakly concave at first, then  $\pm$  plane to weakly convex; proper excipulum concolorous with the disc, persistent, in section 25–35  $\mu\text{m}$  thick, dark brown to black-brown, N+ red-brown, paler within. *Epithymenium* 8–25  $\mu\text{m}$  thick, dark brown to olive-brown, K–, N+ weak red-brown, sometimes with aeruginose flecks. *Hypothecium* 70–150  $\mu\text{m}$  thick, yellow brown to dark brown. *Hymenium* 70–100  $\mu\text{m}$  thick, colourless, not interspersed; paraphyses 2–2.5  $\mu\text{m}$  wide, simple to weakly branched, capitate, with apices dark brown, 4–5  $\mu\text{m}$  wide; asci approximating the *Bacidia*- to *Lecanora*-types, 3–8-spored. *Ascospores* of the *Callispora*-type, 1–3-septate, olive-green to brown, ellipsoid to broadly fusiform, highly variable in size, 16–30  $\times$  7–14  $\mu\text{m}$ , largest when fewer per ascus, constricted at central septum, rarely slightly curved, often pointed at apices, with strong subapical wall thickenings; outer spore wall smooth. *Pycnidia* immersed; conidia bacilliform, straight, 5–8  $\times$  1  $\mu\text{m}$ .

*Chemistry:* Thallus K+ yellow then red, P+ yellow, C–, UV–; medulla K+ yellow then red, P+ yellow, C–, UV–; containing norstictic acid (major), conorstictic acid (minor). Spot or squash tests can be unreliable when the thallus is thin and norstictic acid is in very low concentrations.

*Etymology:* The specific epithet derives from the Greek suffix '-oides' (having the form of), and refers to the close resemblance to *B. metaphragmia*.

### Remarks

This new species is characterized by the endophloedal or whitish grey thallus containing norstictic acid and the commonly 3-septate, *Callispora*-type ascospores with strong subapical wall-thickenings. So strong are the subapical thickenings that 1-septate ascospores often appear to have bone-shaped lumina in each locule. *Baculifera metaphragmioides* is superficially similar to *B. metaphragmia*, a corticolous species in mainland Australia, with predominantly 8-spored asci, somewhat smaller ascospores (12–23  $\times$  5–10  $\mu\text{m}$ , this study) and lacking lichen substances. *Baculifera metaphragmioides* could also be confused with *Buellia conspirans* (Nyl.) Vain. in that both are corticolous, contain norstictic acid and have ascospores that become 3-septate with age and have strong subapical wall thickenings. However, *B. conspirans* differs

in having invariably 8-spored asci, a hymenium strongly interspersed with oil droplets, and narrower ascospores (6–8 µm wide).

The asci of this species are very distinctive, with a conical to narrowly cylindrical masse axiale that often entirely penetrates the highly thickened tholus; the edge adjacent to the masse axiale can also be slightly more intensely amyloid. Similar asci were observed in two rather unusual species of *Buellia* [*B. nebulosa* Elix & Kantvilas and *B. testaceina* Elix & Kantvilas (see Elix & Kantvilas 2013b)] as well as in *Baculifera epifuscescens*, *B. macromera* and *B. metaphragmia*.

*Buellia metaphragmioides* is known from bark and dead wood in heathland and sclerophyll forests in Tasmania and Western Australia, ranging from lowland to alpine elevations. In Tasmania, it has been collected commonly on the cut stumps of old eucalypts in regenerating logging coupes about five years after burning. In that habitat, associated species include *Austroparmelina pseudorelicina* (Jatta) A.Crespo, Divakar & Elix, *Caloplaca* spp., *Candelariella xanthostigmoides* (Müll.Arg.) R.W.Rogers, *Lecanora subsecta* (Stirt.) Kantvilas & LaGreca, *Menegazzia subpirtusa* P.James & D.J.Galloway, *Micarea intersociella* (Stirt.) Coppins, *Placynthiella icmalea* (Ach.) Coppins & P.James, *Ramboldia soreliata* Kalb, *Rinodina asperata* (Shirley) Kantvilas and *Usnea inermis* Motyka. In alpine habitats it grows on the twigs of heathland shrubs together with *Cocotrema cucurbitula* (Mont.) Müll.Arg., *Fuscidea australis* Kantvilas, *Mycoblastus campbellianus* (Nyl.) Zahlbr. and *Tasmidella variabilis* Kantvilas, Hafellner & Elix.

#### SELECTED SPECIMENS EXAMINED

**Tasmania:** • southern shore of Lake Ada, 41°53'S 146°29'E, 1150 m alt., on twigs of *Orites acicularis* in alpine heathland, *G. Kantvilas* 419/99, 14.xii.1999 (HO); • West of Tahune Bridge in the Warra SST, Big Coupe, Plot 372, 43°06'S, 146°41'E, 130 m alt., on old cut stump in regenerating logging coupe, *G. Kantvilas* 218/04, 20.vii.2004 (HO); • West of Tahune Bridge in the Warra SST, Big Coupe – understorey island no. 13, 43°06'S, 146°41'E, 180 m alt., on bark of dead, fire-killed *Eucryphia lucida* in regenerating wet forest, *G. Kantvilas* 243/06, 23.v.2006 (CANB, HO); • Blue Peaks, northern summit, 41°43'S, 146°22'E, 1350 m alt., on dead, rotting wood in alpine heathland, *G. Kantvilas* 535/06, 20.xi.2006 (HO); • Turrana Bluff, 41°46'S, 146°21'E, 1450 m alt., on twigs of *Richea sprenglioides* in alpine heathland, *G. Kantvilas* 52/12, 16.ii.2012 (HO); • Circular Marsh, 41°59'S, 146°29'E, 870 m alt., on *Richea acerosa* in boggy shrubland, *G. Kantvilas* 91/14, 20.ii.2014 (HO).

**Western Australia:** • unnamed Nature Park, 20 km S of Moora along Gingin road, 3 km E on Bullbarnet Road, 30°41'38"S, 116°12'19"E, 225 m alt., on dead *Acacia* in remnant *Eucalyptus-Acacia* woodland along seasonal creek, *J.A. Elix* 37167b, 2.iv.2006 (CANB).

#### A new combination

***Baculifera metaphragmia*** (C.Knight) Elix & Kantvilas, comb. nov.

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**Basionym:** *Lecidea metaphragmia* C.Knight, *Trans. Linn. Soc. London Bot.* 2, (1882).

*Hafellia metaphragmia* (C.Knight) Puszwald, *Australas. Lichenol.* 63, 5 (2008).

*Buellia metaphragmia* (C.Knight) Elix, *Fl. Australia* 57, 660 (2009).

This species is characterized by a whitish to grey-white thallus, 8-spored asci approximating the *Bacidia*- to *Lecanora*-types, a non-interspersed hymenium, relatively small, 1–3-septate ascospores 15–23 × 7–10 µm with pronounced subapical wall thickenings, and the absence of lichen substances. A more recent study of the conidia has confirmed them to be bacilliform, 7–10 × 0.5–1 µm. Those relatively elongate, bacilliform conidia and the non-interspersed hymenium suggest that the species is better accommodated in the genus *Baculifera*.

The species is known from Western Australia, New South Wales and Victoria (Elix 2009, McCarthy 2014).

#### New records for Australia

##### 1. *Baculifera intermedioides* Marbach, *Biblioth. Lichenol.* 74, 130 (2000)

This species was known previously from North, Central and South America and Hawai'i, (Bungartz *et al.* 2007, Marbach 2000). It is characterized by a grey to yellow-brown, verrucose, crustose to subsquamulose thallus that reacts K+ red (indicating the presence of norstictic and connorstictic acids), densely pruinose discs with the pruina concolorous with the thallus, *Buellia*-type ascospores 14–25 × 5.5–9 µm without wall thickenings and with a smooth to weakly ornamented outer spore wall, a non-interspersed hymenium, a pale to dark brown hypothecium, and elongate, bacilliform conidia, 7–11 × 0.5–1 µm. *Baculifera intermedia* Marbach is rather similar, but differs in containing additional atranorin and in having ascospores with a strongly ornamented outer spore wall. A detailed description is given in Marbach (2000) and in Bungartz *et al.* (2007) [as *Buellia intermedioides*], together with a colour photograph.

#### SPECIMENS EXAMINED

**Queensland:** • Mt Farrenden, 26 km SSW of Charters Towers, 20°19'S, 146°13'E, 450 m alt., on dwarf tree in dry sclerophyll forest, *J.A. Elix* 20608A, 22.vi.1986 (CANB); • Callide Range, Dawson Highway, 19 km ENE of Biloela, 24°14'S, 150°34'E, 350 m alt., on *Alphitonia* trunk in disturbed dry sclerophyll forest, *J.A. Elix* 34835, 28.viii.1993 (CANB); • Mareeba–Cooktown road, 17 km SSE of Lakeland, 16°01'S, 144°49'E, 500 m alt., on shaded *Eucalyptus* stem among large rock outcrops above creek, surrounded by shrubs, *H. Streimann* 46437, 12.xii.1990 (CANB).

##### 2. *Baculifera micromera* (Vain.) Marbach, *Biblioth. Lichenol.* 74, 134 (2000)

This species was known previously from Central and South America as well as southern and eastern Africa (Marbach 2000). It is characterized by a white to pale grey, crustose thallus containing atranorin (K+ yellow), a green to greenish black epihymenium [containing *micromera*-green pigment: K+ greenish, N+ purple-black or grey-black (Bungartz *et al.* 2007)], *Buellia*-type ascospores, 12–17 × 5–7 µm, with weak subapical wall thickenings and a strongly ornamented outer wall, and bacilliform conidia 4–5 × 1 µm. A detailed description is given in Marbach (2000). *Baculifera pseudomicromera* Marbach is rather similar, but differs in containing additional norstictic acid and in having ascospores with a weakly ornamented outer wall, while *B. macromera* (above) has larger ascospores with a smooth wall and lacks the *micromera*-green pigment in the epihymenium.

#### SPECIMENS EXAMINED

**Queensland:** • Jondaryan–Mount Tyson road, opposite Oakey Golf Club, 27°23'05"S, 151°36'44"E, 390 m alt., on *Pittosporum* in remnant *Eucalyptus-Pittosporum* woodland, *J.A. Elix* 39772, 5.v.2005 (CANB); • Tully Falls National Park, Charmillin Creek, 10 km S of Ravenshoe, 17°41'09"S, 145°31'34"E, 960 m alt., on canopy branch in remnant montane rainforest, *J.A. Elix* 44760, 7.viii.2006 (CANB).

**New South Wales:** • Old Macleay River estuary, Stuarts Point, 30°49'S, 153°00'E, 1 m alt., on *Aegiceras corniculatum* in mangrove swamp and strand vegetation, *J.A. Elix* 21371 *pr.p.*, 21382, 19.i.1987 (CANB); • Bermagui Trig Station, 36°25'S, 150°05'E, 15 m alt., on dead treelet in coastal woodland with *Eucalyptus* and *Allocasuarina*, *J.A. Elix* 28843, 16.ix.2005 (CANB); • Tabourie Lake, 8 km SW of Ulladulla, 35°25'S, 150°25'E, 3 m alt., on *Banksia* trunk in *Banksia*-dominated shrubland on sand dune, *H. Streimann* 10694, 28.xii.1980 (CANB); • South Coast, along coastal scenic road, Pedro Swamp, 7 km ESE of Moruya, 35°56'S, 150°10'E, 3 m alt., on dead branches of *Casuarina* in *Casuarina*-dominated woodland, *D. Verdon* 2336A 22.vi.1976 (CANB).

##### 3. *Baculifera orosa* Marbach & Kalb, *Biblioth. Lichenol.* 74, 138 (2000)

This species was known previously from Central America (Marbach 2000). It is characterized by a white to grey or pale yellow-brown, crustose thallus containing

atranorin, norstictic and connorstictic acids (K+ red), epruinose or sparsely white pruinose apothecia, *Buellia*-type ascospores, 17–28 × 7–12 μm, with weak medial and subapical wall thickenings and a strongly ornamented outer wall, and bacilliform conidia 8–12 × 0.7–1 μm. A detailed description is given in Marbach (2000). *Baculifera macromera* (above) has similar sized ascospores but with a smooth wall, lacks norstictic acid and has much shorter conidia.

**SPECIMEN EXAMINED**

Queensland: • Nobby–Pittsworth road, 25 km NW of Nobby, 27°46'45"S, 151°41'53"E, 500 m alt., on dead wood in remnant *Eucalyptus* woodland, J.A. Elix 39656, 5.v.2005 (CANB).

**4. *Baculifera pseudomicromera* Marbach, *Biblioth. Lichenol.* 74, 141 (2000)**

This species was known previously from South America and East Africa (Marbach 2000). It is characterized by a white to grey, crustose thallus containing atranorin, norstictic and connorstictic acids (K+ red), epruinose apothecia, an olive-green to greenish black epihymenium (containing *micromera*-green pigment), *Buellia*-type ascospores 14–19 × 6–8 μm, with no or only weak subapical wall thickenings and a smooth or weakly ornamented outer spore wall, and bacilliform conidia 6–8 × 1 μm. A detailed description is given in Marbach (2000).

**SPECIMEN EXAMINED**

Queensland: • Kelvin Grove, Brisbane, 27°21'S, 153°00'E, 15 m alt., on branch of dead tree in cultivated garden, J.A. Elix 22616, 8.vii.1988 (CANB).

**A new state record**

**1. *Baculifera xylophila* (Malme) Marbach, *Biblioth. Lichenol.* 74, 148 (2000)**

*Hafellia microspora* Pusswald, In J.A.Elix, *Australas. Lichenol.* 60, 17 (2007).

*Buellia microsporella* Elix, *Fl. Australia* 57, 660 (2009).

This species was known previously from South America and Hawai'i (Marbach 2000), and in Australia from Western Australia, South Australia, New South Wales, Australian Capital Territory, Victoria and Tasmania (Elix 2009, McCarthy 2014). It is characterized by a white to grey, crustose thallus lacking lichen substances (K–), the epruinose apothecia, the dark brown, olive-brown to dark olive-green epihymenium (containing *micromera*-green pigment), a non-inspersed hymenium, *Buellia*-type ascospores 12–22 × 6–9 μm, with weak to moderate subapical wall-thickenings and a smooth or weakly ornamented outer spore wall, and bacilliform conidia 8–12 × 1 μm.

**SPECIMENS EXAMINED**

Queensland: • Leichhardt Highway, 12 km NNW of Taroom, 25°32'S, 149°46'E, 200 m alt., on twigs of *Myoporum* in *Acacia*, *Myoporum*, *Geigera*-dominated scrub, J.A.Elix 35061, 30.viii.1993 (CANB); • Tin Can Bay, E end of village, c. 55 km NE of Gympie, 25°56'S, 153°01'E, sea level, on mangrove, H.T. Lumbsch 10996b, 19.x.1994 (CANB).

**Key to *Baculifera* in Australia**

- 1 Ascospores 1–3-septate ..... 2
- 1: Ascospores 1-septate ..... 3
- 2 Thallus K+ red; norstictic acid present ..... **B. metaphragmioides**
- 2: Thallus K–; norstictic acid absent ..... **B. metaphragmia**
- 3 Thallus K+ red; norstictic acid present ..... 4
- 3: Thallus K–; norstictic acid absent ..... 7

- 4 Epihymenium olive-green to greenish black, N+ dark purplish grey or black; apothecia epruinose ..... **B. pseudomicromera**
- 4: Epihymenium yellow-grey to orange-brown or brown, N–; apothecia pruinose or not ..... 5
- 5 Atranorin present; apothecia epruinose or sparsely pruinose; ascospores 17–28 × 7–12 μm ..... **B. orosa**
- 5: Atranorin absent; apothecia pruinose or not; ascospores smaller ..... 6
- 6 Apothecia epruinose; epihymenium K+ dark brown to blackish brown; ascospores 15–23 × 7–12 μm ..... **B. epifuscenscens**
- 6 Apothecia pruinose; epihymenium K–; ascospores 14–25 × 5.5–9 μm ..... **B. intermedioides**
- 7 Epihymenium olive-brown to dark brown, N–; ascospores 16–30 × 7–12 μm ..... **B. macromera**
- 7: Epihymenium olive-brown to dark olive-green, N+ dark purplish grey or black; ascospores 12–22 × 5–9 μm ..... 8
- 8 Thallus K+ yellow, atranorin present; ascospores 12–17 μm long ..... **B. micromera**
- 8: Thallus K–, atranorin absent; ascospores 12–22 μm long ..... **B. xylophila**

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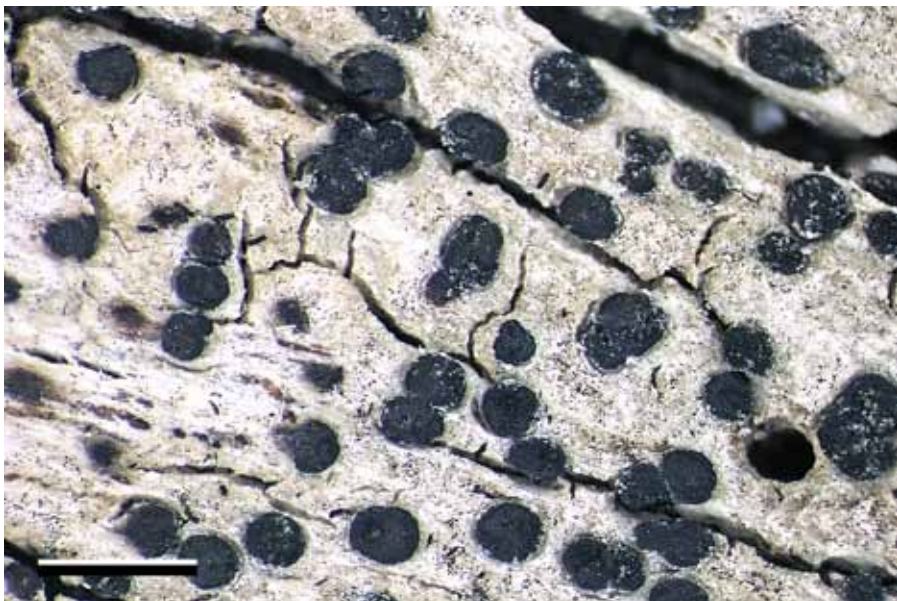


Fig. 1. *Baculifera epifuscescens* (holotype in CANB); scale = 1 mm.

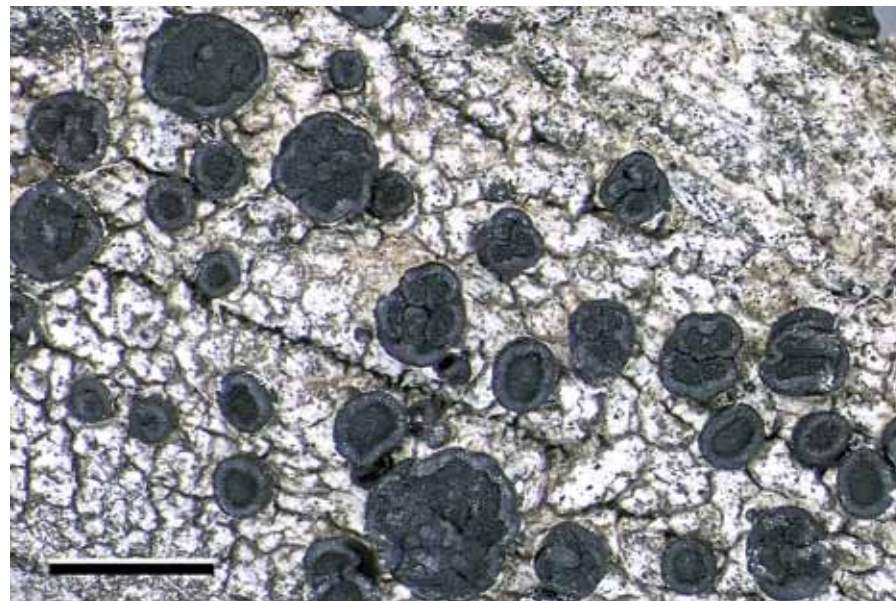


Fig. 3. *Baculifera metaphragmioides* (holotype in HO); scale = 1 mm.

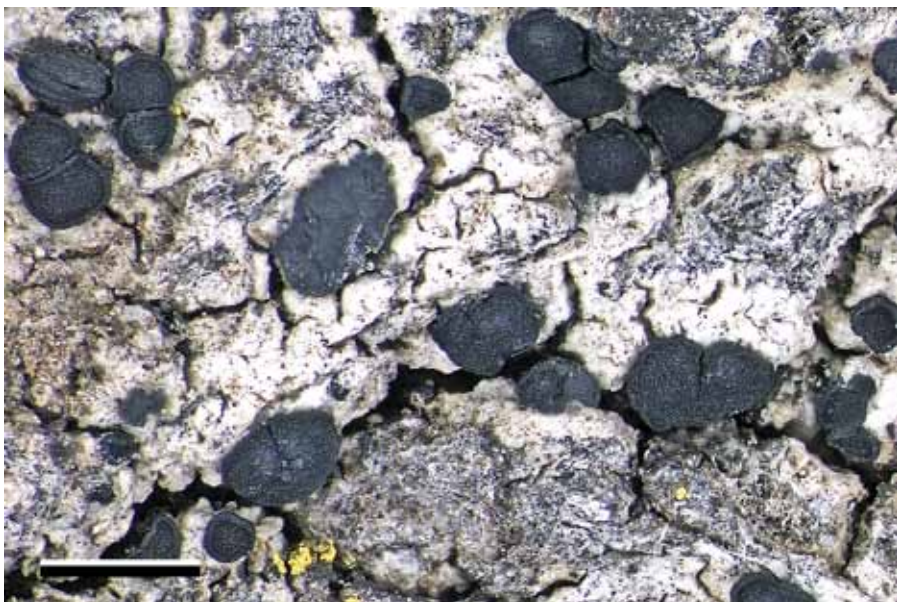


Fig. 2. *Baculifera macromera* (*Kantvilas* 272/06 in HO); scale = 1 mm.