

***Amandinea coniops* (Physciaceae, Ascomycota)
and its mimics in Tasmania and New Zealand**

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Abstract: The status of the widespread species *Amandinea coniops* (Wahlenb.) M.Choisy ex Scheid. & H.Mayrhofer in Australasia is discussed and found to include an additional three taxa. *Amandinea austroconiops* Elix & Kantvilas and *A. destituta* Elix & Kantvilas are described as new to science, and the new combination *Amandinea subbadioatra* (C.Knight) Elix & Kantvilas is proposed.

Amandinea coniops (Wahlenb.) M.Choisy ex Scheid. & H.Mayrhofer is a widespread species that has been reported from coastal rocks in Europe, Iceland, North America (Scheidegger 2009), Antarctica and subantarctic islands (Lamb 1968, Øvstedal & Lewis Smith 2001), Tasmania (Elix 2011, Elix & Kantvilas 2013), New Zealand (Elix *et al.* 2015) and Norfolk Island (Elix 2015). It is characterized by the pale grey-brown to brown, areolate to bullate or sublobate thallus, the broadly adnate to sessile apothecia up to 1 mm wide with epruinose discs, ascospores that are at first *Physconia*-type and then *Buellia*-type, 13–18 × 7–10 µm, which become constricted at the septum, filiform conidia, 15–30 × 0.8–1.0 µm, and by the absence of any lichen substances. A detailed re-examination of the Australasian material and comparisons with authentic *A. coniops* from the Northern Hemisphere has revealed that three additional species are involved; their circumscription is the subject of this paper.

Material and methods

The study is based on herbarium holdings, chiefly in the Tasmanian Herbarium (HO), the Australian National Herbarium (CANB) and the Herbarium GZU, Karl-Franzens-Universität Graz, Austria, and on recent collections and field observations by the authors. Hymenial and subhymenial inspersion and conidia were observed by mounting the apothecial or pycnidial tissue in a 0.5% solution of erythrosin B in dilute (10%) aqueous ammonium hydroxide and leaving for 2 minutes before placing the cover slip and examining under a compound microscope. Medullary amyloid reactions were observed in section by treatment with Lugol's Iodine (I) without pre-treatment with K. Dimensions of ascospores are based on 50 observations. The latter are presented in the format: 5th percentile–[average]–95th percentile. Chemical constituents were identified by thin-layer chromatography (Elix 2014) and comparison with authentic samples.

Key to *Amandinea coniops* and similar species in Australasia

- 1 Medulla I+ purple **A. austroconiops**
- 1: Medulla I- 2
- 2 Atranorin present **A. subbadioatra**
- 2: Atranorin absent 3
- 3 Subhymenium inspersion with oil droplets; ascospores 18–25 × 10–16 µm, coarsely rugulate **A. destituta**
- 3: Subhymenium not inspersion with oil droplets; ascospores 12–20 × 7–11 µm, minutely rugulate **A. coniops**

1. *Amandinea austroconiops* Elix & Kantvilas, sp. nov.
Mycobank number MB 815352

Figs 1, 2

Similar to *Amandinea coniops*, but differing in having an amyloid medulla, a subhymenium inspersion with oil droplets, and larger ascospores, 15–25 × 8–14 µm.

Type: Australia, Tasmania, Lagoon Bay, Forestier Peninsula, 42°53'S, 147°58'E, 1 m alt., on littoral boulders and shingles, *G. Kantvilas* 318/09, 11.viii.2009 (holotype – HO; isotype – CANB).

Thallus crustose, to c. 50 mm wide and 0.1 mm thick, rimose-areolate; individual areoles irregular, angular, 0.1–0.5 mm wide; upper surface white to grey-white, matt, smooth; prothallus not apparent; medulla white, H₂SO₄ –, I+ purple; photobiont cells 8–16 µm wide. *Apothecia* 0.3–1 mm wide, lecideine, initially immersed but soon broadly adnate, rarely sessile and constricted at the base, dispersed or crowded, rounded or irregular through mutual pressure; disc black, epruinose, weakly concave to plane or weakly convex; proper exciple distinct, persistent, often slightly higher than the disc when young, thinner and level with the disc in older apothecia, in section 30–60 µm thick, with the outer zone dark brown to black-brown, K–, N+ red-brown, paler brown within. *Epithymenium* 12–18 µm thick, dark brown, K–, N–. *Hypothecium* brown to brown-black, 110–190 µm thick, K–, N+ red-brown. *Hymenium* 75–100 µm thick, colourless, not inspersion; subhymenium 30–50 µm thick, colourless to pale brown, inspersion with oil droplets; paraphyses 1.5–2 µm wide, simple to sparsely branched, with dark brown apices, 5–6.5 µm wide; asci of the *Bacidia*-type, with 8 or fewer ascospores. *Ascospores* of the *Physconia*-type initially, of the *Buellia*-type when mature, 1-septate, medium to dark brown, ellipsoid, 15–[19.6]–25 × 8–[11.2]–14 µm, sometimes curved, becoming constricted at the septum; outer spore wall strongly ornamented (rugulate). *Pycnidia* common, pyriform, immersed, black; conidia filiform, curved, (15–)20–27 × 0.7–1 µm.

Chemistry: Thallus K–, C–, P–, UV–; no lichen substances detected.

Etymology: The epithet refers to the austral distribution of the new species, and its similarity to *Amandinea coniops*.

Remarks

Both *Amandinea austroconiops* and *A. coniops* are characterized by their relatively large, 1-septate ascospores that become constricted at the septum and have ornamented outer walls, and by their curved, filiform conidia. However, *A. coniops* differs in having somewhat smaller ascospores, 12–[16.5]–20 × 7–[8.5]–11 µm, a hymenium and hypothecium without oil droplets, a non-amyloid medulla and usually a much better-developed thallus that often becomes shortly lobed at the margins or where the areoles become aggregated and imbricate to form a bullate, warted, secondary subscamulose crust. In addition, the outer spore wall in *A. coniops* is more finely ornamented. Thus *A. austroconiops* more closely resembles *A. subbadioatra*, from which it differs chiefly by lacking atranorin and having smaller ascospores (see below).

Amandinea austroconiops has been recorded in Tasmania and the South Island of New Zealand. It occurs on siliceous rock, and ranges from coastal to montane elevations. Although unusual, such a wide ecological amplitude is displayed by other buellioid lichens we have studied, including *Buellia halonia* (Ach.) Tuck., *B. stellulata* (Taylor) Mudd var. *stellulata*, *Endohyalina arachniformis* Elix & Kantvilas and *Baculifera metaphragmioides* Elix & Kantvilas. Coastal collections from Tasmania are associated with typical littoral species such as *Buellia halonia* (Ach.) Tuck., *Caloplaca cribrata* (Hue) Zahlbr., *C. gallowayi* S.Y.Kondr., Kärnefelt & Filson, *Halecania subsquamosa* (Müll.Arg.) van den Boom & H.Mayrhofer, *Lecanora subcoarctata* (C.Knight) Hertel, *Pertusaria xanthoplaca* Müll.Arg., *Rinodina blastidiata* Matzer & H.Mayrhofer and *Xanthoria ligulata*

(Körb.) P.James. In montane areas, associated species include *Buellia aethalea* (Ach.) Th.Fr., *B. ocellata* (Flot.) Körb., *Lecanora farinacea* Fée, *Lecidella stigmatea* (Ach.) Hertel & Leuckert, *L. sublaticida* (C.Knight) Hertel, *Notoparmelia signifera* (Nyl.) A.Crespo, Ferencova & Divakar, *Rhizocarpon geographicum* (L.) DC., *Umbilicaria cylindrica* (L.) Delise ex Duby and *U. umbilicarioides* (B.Stein.) Krog & Swinscow.

SPECIMENS EXAMINED

TASMANIA: • Type locality, 3 m alt., on vertical dolerite rocks facing the sea, *G. Kantvilas* 310/09, 11.viii.2009 (CANB, HO); • Alum Cliffs, 42°58'S, 147°20'E, on mudstone rocks above the water-line, *G. Kantvilas* 165/97, 6.v.1997 (HO); • c. 3 km east of McDowall Hill, 41°54'S, 146°38'E, 1120 m alt., on dolerite boulder in alpine woodland, *G. Kantvilas* 105/00, 8.iii.2000 (HO); • Blowhole Point, Marion Bay, 42°45'S, 147°45'E, 2 m alt., on littoral dolerite outcrops, *G. Kantvilas* 342/12, 343/12, 5.viii.2012 (HO); Skullbone Plains, ridge SW of Kenneth lagoon, 42°03'S, 146°20'E, 980 m alt., on dolerite boulder in alpine heathland, *G. Kantvilas* 695/12, 12.xii.2012 (HO); • Cockle Bay Lagoon, 42°42'S, 147°56'E, 1 m alt., on dolerite cobbles on sea-shore, well beyond the splash zone, *G. Kantvilas* 737/12, 16.xii.2012 (HO).

NEW ZEALAND: *South Island*: • Canterbury, Mount Somers hut, NZMS 262 13:375733, 43°35'36"S, 171°19'E, c. 900 m, on rock, *W. Malcolm* 0379, 30.xii.1992 (CANB); • Nelson, Cable Bay, N face of Sentinel Hill, NZMS 260 O27:444054, 41°09'36"S, 173°24'36"E, 3 m alt., on rock, *W. Malcolm* 1918, 27.iv.1994 (CANB); • Canterbury, Banks Peninsula, Te Oka S of Little River, 43°48'18"S, 172°47'18"E, on basalt, *J. Blaha* 089, 090, 11.iii.2001 (GZU).

2. *Amandinea destituta* Elix & Kantvilas, sp. nov.
MycoBank number MB 815353

Figs 3, 4

Similar to *Amandinea coniops*, but differing in having larger ascospores, 18–25 × 10–16 μm, and a subhymenium interspersed with oil droplets; also similar to *Amandinea subbadioatra*, but with shorter ascospores and lacking atranorin.

Type: Australia, Tasmania, Raspins Beach near Sheas Creek, 42°33'S, 147°53'E, 2 m alt., on littoral sandstone boulders, *G. Kantvilas* 232/11, 11.viii.2011 (holotype – HO; isotype – CANB).

Thallus crustose, continuous, cracked and areolate, to 35 mm wide and 0.5 mm thick; individual areoles irregular, angular, 0.3–1.5 mm wide, becoming verrucose and bulate near the thallus margins; upper surface whitish grey to grey, matt, becoming eroded and granular with age; prothallus not apparent; medulla white, lacking calcium oxalate (H₂SO₄-), I-; photobiont cells 8–16 μm diam. *Apothecia* 0.4–1 mm wide, lecidine, broadly adnate to sessile and constricted at the base, dispersed or crowded, ±rounded; disc black, epruinose, weakly concave then plane; proper exciple thick, raised above the disc, persistent, in section 50–90 μm thick, outer zone brown-black, K-, N+ red-brown, inner zone brown. *Epithymenium* 10–12 μm thick, dark brown to brown-black, K-, N+ red-brown. *Hypothecium* dark brown to brown-black, 150–300 μm thick, K-, N+ deep red-brown. *Hymenium* 75–110 μm thick, colourless, not interspersed; subhymenium 60–70 μm thick, colourless to pale brown, interspersed with oil droplets; paraphyses 1–1.5 μm wide, sparsely branched, with apices dark brown, 4.5–6 μm wide; asci of the *Bacidia*-type, with 8 or fewer spores. *Ascospores* of the *Physconia*-type at first, of the *Buellia*-type when mature, brown, ellipsoid, 18–[21.8]–25 × 10–[12.8]–16 μm, sometimes curved, older spores constricted at the septum; outer spore wall strongly ornamented (rugulate). *Pycnidia* superficial, black, marginal; conidia filiform, curved, 15–23 × 0.7 μm.

Chemistry: Thallus K-, P-, C-, UV-; no lichen substances detected.

Etymology: The species name refers to the absence of lichen substances, in contrast to the morphologically similar *A. subbadioatra*, which contains atranorin.

Remarks

This species is characterized by the crustose, rimose-areolate, whitish grey to grey thallus, the broadly adnate to sessile apothecia, the non-amyloid medulla, the 1-septate, *Buellia*-type ascospores, 18–25 × 10–16 μm, the curved, filiform conidia, 15–23 μm long, and the absence of lichen substances. *Amandinea subbadioatra* from New Zealand is morphologically very similar, but is distinguished by having longer ascospores and in containing copious amounts of atranorin (see below). Furthermore, *A. subbadioatra* occurs on montane rather than coastal rocks. *Amandinea destituta* is also very similar to *A. austroconiops* described above, but the latter has somewhat smaller ascospores, 15–[19.6]–25 × 8–[11.2]–14 μm and a strongly amyloid medulla. *Amandinea coniops* is also superficially similar to *A. destituta*, but differs in having a non-interspersed subhymenium and smaller ascospores.

Amandinea destituta is known from siliceous coastal rocks in Tasmania. Associated species include *A. austroconiops*, *Buellia halonia* (Ach.) Tuck., *Caloplaca cribrosa* (Hue) Zahlbr., *C. gallowayi* S.Y.Kondr., Kärnefelt & Filson, *Halecania subsquamosa* (Müll.Arg.) van den Boom & H.Mayrhofer, *Lecanora subcoarctata* (C.Knight) Hertel, *Pertusaria xanthoplaca* Müll.Arg., *Rinodina blastidiata* Matzer & H.Mayrhofer and *Xanthoria ligulata* (Körb.) P.James.

SPECIMEN EXAMINED

TASMANIA: • Hibbs Pyramid, 42°36'S, 145°16'E, on littoral rocks, *A. Moscal* 6128a, 4.ii.1984 (HO).

3. *Amandinea subbadioatra* (C.Knight) Elix & Kantvilas, comb. nov. Figs 5, 6
MycoBank number MB 815355

Basionym: *Lecidea subbadioatra* C.Knight, *Trans. N.Z. Inst.* **8**, 317 (1876)
Buellia subbadioatra (C.Knight) Müll.Arg., *Bull. Soc. Roy. Bot. Belg.* **31**(2), 33 (1892).

Type: New Zealand: *sine loco*, Charles Knight (lectotype – BM *vide* D.J. Galloway, *Flora of New Zealand Lichens*, 53 [1985]; isolectotype – WELT!).

Thallus crustose, to 35 mm wide and 0.7 mm thick, continuous, rimose-areolate, becoming verrucose and lumpy with age and near the margins; individual verrucae irregular, 0.5–3.5 mm wide and thick; upper surface matt, esorediate, white to whitish grey, epruinose; prothallus black, marginal, apparent only when bordering other lichens; photobiont cells 8–14 μm wide; medulla white, lacking calcium oxalate (H₂SO₄-), I-. *Apothecia* 0.5–1.5 mm wide, lecidine, broadly adnate to sessile, separate or crowded and distorted by mutual pressure; disc black, epruinose, weakly concave at first, then ±plane to weakly convex or undulate, rarely tuberculate; proper exciple distinct, persistent, black, rarely excluded, in section 65–80 μm thick, dark brown, K-, N+ red-brown, brown within. *Epithymenium* 15–25 μm thick, dark brown, K-, N+ red-brown. *Hypothecium* 150–350 μm thick, dark brown to brown-black, K-, N+ deep red-brown (slow). *Hymenium* 115–130 μm thick, colourless; subhymenium 50–75 μm thick, colourless to brown, finely interspersed with oil droplets; paraphyses 1.5–2.5 μm wide, simple to weakly branched, with dark brown apices, 4–6 μm wide; asci of the *Bacidia*-type, with 8 or fewer spores. *Ascospores* of the *Callispora*- or *Physconia*-type in early ontogeny, then of the *Buellia*-type, 1-septate, olive-green to brown, ellipsoid then broadly fusiform with age, 20–[25]–32 × 10–[13]–16 μm, commonly curved, often pointed at the apices, constricted at the septum when older; outer spore wall finely to strongly ornamented. *Pycnidia* immersed; conidia filiform, curved, 18–31 × 0.7–1 μm.
Chemistry: Thallus K+ yellow, P+ pale yellow, C-, UV-; atranorin (major).

Remarks

The discovery of curved, filiform conidia, 18–31 × 0.7–1 µm, in both specimens examined confirms that this species should be accommodated in *Amandinea*.

SPECIMEN EXAMINED

NEW ZEALAND: *South Island*: • Otago, Mt. Maungatua, SW of Dunedin, c. 500 m W of summit, 45°54'S, 170°08'E, c. 850 m alt., on rock, *H. Mayrhofer 10468*, *H. Hertel & A.F. Mark*, 31.i.1985 (GZU).

4. *Amandinea conioops* (Wahlenb.) M.Choisy ex Scheid. & H.Mayrhofer, *Lichenologist* 25, 342 (1993) Figs 7, 8

Thallus crustose, to c. 45 mm wide and 2 mm thick, bullate-areolate to sublobate; individual areoles irregular, angular, 0.5–2 mm wide, becoming aggregated and imbricate to form a secondary, bullate, warted or subsquamulose crust; lobes very short, highly imbricate and compacted, placodioid at the margins, 0.1–0.5 mm wide; upper surface grey-white to grey-brown or dark grey, matt, smooth; prothallus black but usually not apparent; medulla white, H₂SO₄–, I–; photobiont cells 10–16 µm wide. *Apothecia* 0.3–1 mm wide, lecideine, broadly adnate, dispersed or rarely crowded; disc black, epruinose, weakly plane to strongly convex; proper exciple distinct, initially slightly higher than the disc, excluded in older convex apothecia, in section 30–60 µm thick, with the outer zone dark brown, K–, paler brown within. *Ephymenium* 10–14 µm thick, dark brown, K–, N–. *Hypothecium* 30–50 µm thick, pale brown to brown, K–, N–. *Hymenium* 75–90 µm thick, colourless; subhymenium pale brown, not interspersed with oil droplets; paraphyses 1.5–1.7 µm wide, simple to sparsely branched, with the apices brown, 3.5–5 µm wide; asci of the *Bacidia*-type, 8-spored. *Ascospores* of the *Physconia*-type initially, of the *Buellia*-type when mature, 1-septate, brown, ellipsoid, 12–[16.5]–20 × 7–[8.5]–11 µm, straight, constricted at the septum; outer spore wall finely ornamented (microrugulate). *Pycnidia* common, pyriform, immersed, black; conidia filiform, curved, 20–30 × 0.7–1 µm.

Chemistry: Thallus K–, C–, P–, UV–; no lichen substances detected.

Remarks

In Australasia, authentic *A. conioops* has been found in New Zealand, Norfolk Island and Tasmania. It is also common elsewhere in the Southern Hemisphere, including Antarctica and South Georgia and other subantarctic islands (Øvstedal & Lewis Smith 2001). This morphologically variable species (Lamb 1948) grows on siliceous coastal rocks.

SELECTED SPECIMENS EXAMINED

AUSTRALIA: *Tasmania*: • Hope Beach, Cape Direction end, 43°03'S, 147°25'E, on unstable mudstone rocks along the shore, *G. Kantvilas 174/01*, 12.ii.2001 (HO); *Norfolk Island*: • Rocky Point, Rocky Point Reserve, 29°03'S, 167°55'E, 40 m alt., on volcanic rocks along the cliff tops, *J.A. Elix 18533, 18534, 18536 pr.p., 18538 & H. Streimann*, 5.xii.1984 (CANB).

CANADA: • British Columbia, Queen Charlotte Islands, Graham Island, Tow Hill, 54°04'N, 131°47'W, 357 ft. alt., exposed face of cliff on slopes at summit, *I.M. Brodo 9926 & M.J. Shchepanek*, 16.vi.1967 (CANB).

NEW ZEALAND: *North Island*: • Coromandel Peninsula, NW of Colville, between Waiaro and Port Jackson, 36°30'55"S, 175°19'40"E, on coastal rocks, *J. Blaha 0193*, 16.iv.2001 (GZU). *South Island*: • Nelson, Golden Bay, Patons Rock NW of Takaka, 40°47'S, 172°43'E, on coastal rocks, *H. Mayrhofer 13144 & N. & B. Malcolm*, 25.viii.1992 (GZU); • Marlborough, NE of Kaikoura, Ohau Strea N of Ohau Point, 42°14'30"S, 173°50'E, on coastal rocks, *H. Mayrhofer 12191 & C.D. Meurk*, 31.viii.1992 (GZU); • Canterbury, Banks peninsula, Otanerito Bay, 43°50'14"S, 172°03'28"E, 0–3 m alt.,

on coastal basalt rocks, *J. Blaha 0107*, 14.iii.2001 (GZU); • Otago, S of Dunedin, St. Clair Beach, Second Beach Road, 45°54'47"S, 172°29'20"E, 15 m alt., on coastal basalt rocks, *J. Blaha 0117*, 22.iii.2001 (GZU); • Southland, E of Invercargill, Wai-kawa, Curio Bay, 46°39'41"S, 169°06'18"E, 1–3 m alt., on coastal sandstone rocks, *J. Blaha 0141*, 23.iii.2001 (GZU);

NORWAY: • Finnmark, Varager-Halbinsel: Insel Vadsöya vor Vadsö, an meeres-nahen Küstenfelsen oberhalb der Spritzwasserzone, 8 m, *K. Kalb & A. Schrögl*, 22.viii.1984 (Plantae Graecenses, Lich. 520 – CANB).

SWEDEN: • Bohuslän Prov., Stenkyrka par., Bäcekilen (Bäcke kile), 57°58'N, 11°40'E, on stones in the storm belt, among grass, *A.H. Magnusson 7500*, 24.vii.1923 (Lichenes Selecti Exsiccati Upsalienses no. 101 – CANB). Det. C. Scheidegger, 1991.

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References

- Elix, JA (2011): *Australian Physciaceae (Lichenised Ascomycota)*. Australian Biological Resources Study, Canberra. Version 18 October 2011. <http://www.anbg.gov.au/abrs/lichenlist/PHYSCIACEAE.html>
- Elix, JA; Kantvilas, G (2013): New taxa and new records of *Amandinea* (Physciaceae, Ascomycota) in Australia. *Australasian Lichenology* 72, 3–19.
- Elix, JA (2014): *A Catalogue of Standardized Chromatographic Data and Biosynthetic Relationships for Lichen Substances*, 3rd edn. (Published by the author, Canberra).
- Elix, JA (2015): Additional lichen records from Australia. 80. *Australasian Lichenology* 76, 2–7.
- Elix, JA; Malcolm, WM; Knight, A (2015): New records and new combinations of buellioid lichens (Physciaceae, Ascomycota) from New Zealand. *Australasian Lichenology* 77, 36–41.
- Lamb, IM (1968): Antarctic lichens II. The genera *Buellia* and *Rinodina*. *British Antarctic Survey Reports* 61, 1–129.
- Øvstedal, DO; Lewis Smith, RI (2001): *Lichens of Antarctica and South Georgia. A guide to their identification and ecology*. Cambridge University Press, Cambridge.
- Scheidegger, C (2009): *Amandinea* Choisy ex Scheid. & H.Mayrhofer (1993) in Smith, CW; Aptroot, A; Coppins, BJ; Fletcher, A; Gilbert, OL; James, PW; Wolseley, PA (eds), *The Lichen Flora of Great Britain and Ireland*, second edn, pp. 142–144. The British Lichen Society, London.

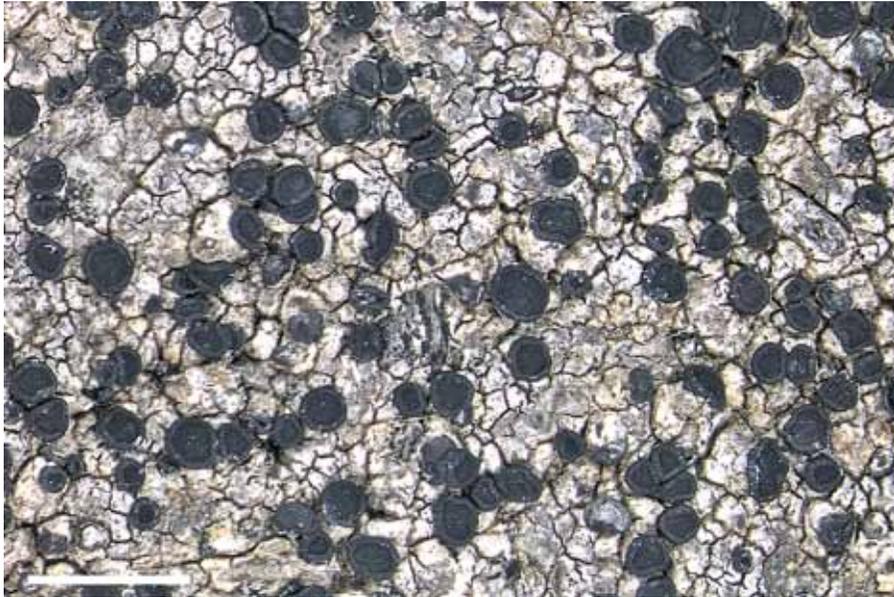


Figure 1. *Amandinea austroconiops* (holotype in HO). Scale = 2 mm.



Figure 3. *Amandinea destituta* (holotype in HO). Scale = 2 mm.



Figure 2. Ascospore ontogeny of *A. austroconiops*. Scale = 10 μ m.

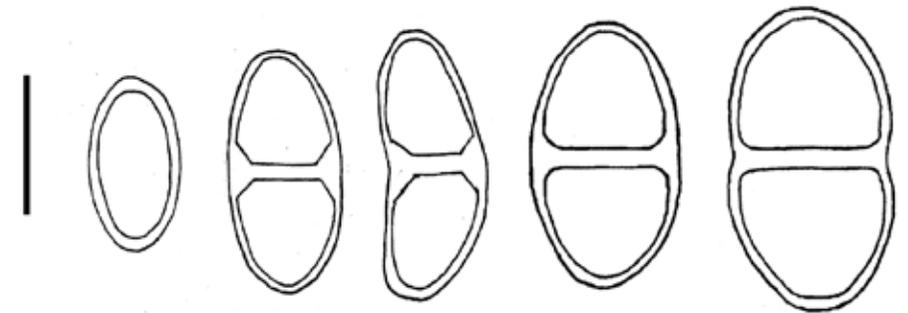


Figure 4. Ascospore ontogeny of *A. destituta*. Scale = 10 μ m.



Figure 5. *Amandinea subbadioatra* (Mayrhofer 10468 in GZU). Scale = 1 mm.



Figure 7. *Amandinea coniops* (Elix 18538 in CANB). Scale = 1 mm.

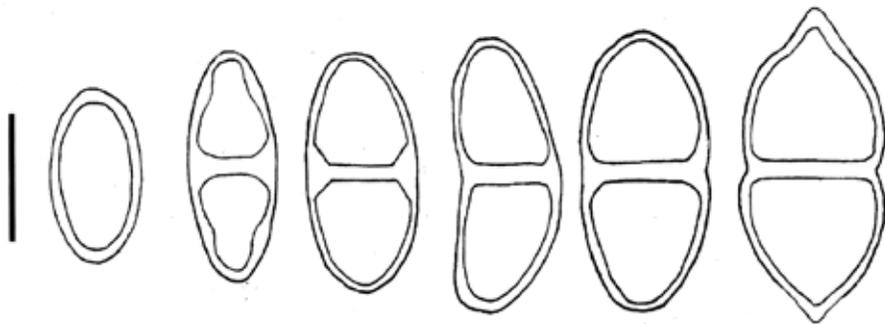


Figure 6. Ascospore ontogeny of *A. subbadioatra*. Scale = 10 μ m.

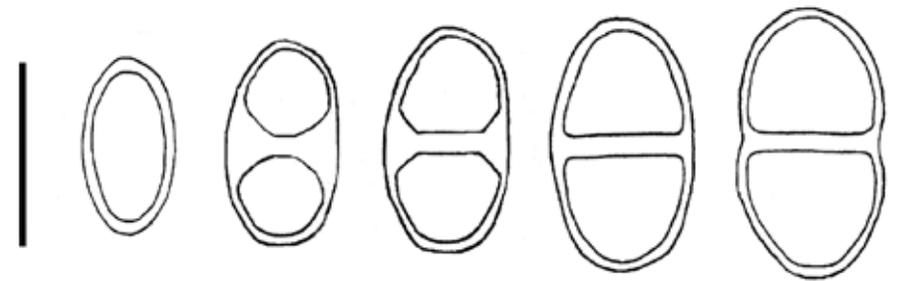


Figure 8. Ascospore ontogeny of *A. coniops*. Scale = 10 μ m.