
Amandinea lobarica, a new corticolous species from Guatemala, with notes on some additional *Amandinea* taxa

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Abstract: *Amandinea lobarica*, a new corticolous lichen species, is described from high elevations in Guatemala. It is characterized by a thin, granulose, brownish thallus containing lobaric acid, small, convex lecideine apothecia, filiform conidia and large, narrowly ellipsoid ascospores with roughly ornamented walls. The new species is compared with other *Buellia* s. lat. taxa that possess rather large and strongly ornamented ascospores, such as *Buellia hypothallina*, here placed in synonymy with *Gassicurtia vaccinii*, *Amandinea leucomela*, *A. mediospora*, *A. megaspora*, *A. subduplicata* and five very closely related taxa treated here as belonging to the *Amandinea incrustans* group. Two tables summarizing the main differences between these species and a key are provided. New data on the chemistry of *A. leucomela* and a new record of *A. montana* for Guatemala are also included.

Keywords: biodiversity, lichens, lichenized Ascomycota, Neotropics, *Physciaceae*, taxonomy

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Introduction

During studies of crustose *Physciaceae* from Guatemala (Giralt *et al.* 2014), we examined an interesting corticolous lichen with lobaric acid, filiform conidia and large, roughly ornamented ascospores. This lichen has proved to be a new species that we include in *Amandinea* M. Choisy *ex* Scheid. & H. Mayrhofer and a formal description is given in this paper. In the process of attempting to identify this new taxon, mainly using the monographs of tropical and subtropical species of *Buellia* s. lat. by Malme (1927) and Marbach (2000), we realized that quite a number of corticolous species shared the diagnostic characters of filiform conidia and large, strongly ornamented ascospores.

Thus, although the emphasis of this paper is to describe the new species, we also attempt to reappraise all those corticolous *Buellia* s. lat. species, mainly included in *Amandinea* and possessing large ascospores with markedly ornamented walls. These species include five taxa placed here within the *Amandinea incrustans* group: *A. crassiuscula* Giralt & Etayo (Giralt *et al.* 2000), *A. incrustans* (J. Steiner in A. Zahlbr.) Marbach (Zahlbruckner 1926; Marbach 2000), *A. langloisii* Imshaug *ex* Marbach (Imshaug 1951; Marbach 2000), *A. montana* (H. Magn.) Marbach (Magnusson 1954; Marbach 2000) and *A. submontana* Marbach (Marbach 2000); *A. leucomela* (Imshaug) P. May & Sheard (Imshaug 1955; Marbach 2000), *A. mediospora* Marbach, *A. megaspora* Marbach (Marbach 2000), *A. subduplicata* (Vain.) Marbach (Vainio 1890; Marbach 2000), and *Buellia hypothallina* Aptroot (Aptroot *et al.* 1997). Despite these taxa clearly being morphologically heterogeneous, a fact that strengthens our belief that the genus *Amandinea* does not constitute a monophyletic group, as already indicated by several phylogenetic studies (e.g. Grube & Arup 2001; Blaha 2002), we prefer to

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retain them in *Amandinea* (except for *Buellia hypothallina*) until additional genetic data are available, as all are characterized by filiform conidia (except for *A. montana* where conidia have not been observed) and ascospores with weak or no inner wall thickenings and clearly ornamented outer walls.

Material and Methods

This study is based on the type and additional material from institutional and private herbaria (B, BCN, CANB, FH, STU, W, WIS, hb. v.d. Boom and hb. Etayo). Spore measurements were made on material mounted in water at $\times 1000$ to a precision of $0.5 \mu\text{m}$. Only free ascospores lying outside the asci were measured for which mean length and width values (\bar{x}), standard deviation (SD) and the mean length/width ratio were calculated. In the text and in Tables 1 and 2 the results are given as (minimum value observed)– \bar{x} –SD– \bar{x} +SD (–maximum value observed); \bar{x} , SD, n (the total number of ascospores measured) and the mean l/w ratio are also given.

Chemical constituents were identified by standardized thin-layer chromatography (TLC) (Orange *et al.* 2001; Elix 2014).

Results and Discussion

The new species

Amandinea lobarica Giralt, van den Boom & Elix sp. nov.

MycoBank No.: MB 811038

Thallus corticolous, brownish, smooth to granulose, containing lobaric acid. Apothecia lecideine, small, $0.1\text{--}0.5 \text{ mm}$ diam., disc becoming strongly convex and emarginate, black. Proper exciple poorly developed, brown, N–. Hymenium without oil droplets. Epithymenium brown, N–. Ascospores *Buellia*-type, $(17.0\text{--})19.1\text{--}23.5(-26.0) \times (7.0\text{--})7.3\text{--}8.9(-10.0) \mu\text{m}$; walls strongly rugulate (ornamentation visible at $\times 400$). Conidia filiform, curved, $15\text{--}20 \times c. 1 \mu\text{m}$.

Type: Guatemala, Quezaltenango, S of Quezaltenango, S of Llano del Pinal, N slope of Volcano Santa María, path among small agricultural fields with small forests, shrubs, trees and outcrops along path, $14^{\circ}47.1'N$, $91^{\circ}32.9'W$, 2500 m, on lower part of trunk of a mature *Quercus*, 23 July 2004, P. & B. v. d. Boom 32943 (BR—holotype; hb. v. d. Boom—isotype).

(Fig. 1A & B)

Thallus corticolous, episubstratal, discontinuous, thin, smooth to granulose, greyish brown to dark brown; algal cells

chlorococcoid, $7\text{--}15 \mu\text{m}$ diam. *Prothallus* absent. *Medulla* not amyloid, I–.

Apothecia lecideine, adnate to sessile, $(0.1\text{--})0.2\text{--}0.3(-0.5) \text{ mm}$ diam. Proper margin thin, not persistent; disc black, flat, becoming strongly convex, epruinose. *Proper exciple* poorly developed, up to $30 \mu\text{m}$ thick, outer part brown, inner part colourless, N–. *Hymenium* colourless, not interspersed with oil droplets, $100\text{--}120 \mu\text{m}$ high. *Hypothecium* $90\text{--}120 \mu\text{m}$ deep, brown, in young apothecia upper part brown-olivaceous, N–. *Epithymenium* brown, N–. Apical cells of the paraphyses up to $6 \mu\text{m}$ wide, with brown caps. *Asci* *Bacidia*-type (Rambold *et al.* 1994), 8-spored. *Ascospores* *Buellia*-type, $(17.0\text{--})19.1\text{--}23.5(-26.0) \times (7.0\text{--})7.3\text{--}8.9(-10.0) \mu\text{m}$, ($\bar{x} = 21.3 \times 8.1 \mu\text{m}$; SD = $2.2 \times 0.8 \mu\text{m}$; $n = 80$; l/w ratio = 2.7), narrowly ellipsoid, straight or slightly curved, walls strongly rugulate (ornamentation visible at $\times 400$), constricted at septum when mature.

Conidia filiform, curved, $15\text{--}20 \times c. 1 \mu\text{m}$.

Secondary chemistry. Thallus K+ dirty yellow (deep yellow under the microscope): lobaric acid (major) and unknown (traces) detected by TLC.

Etymology. The epithet refers to the major chemical compound occurring in this species.

Ecology and distribution. *Amandinea lobarica* is known only from the type locality which is in a mountainous area at 2500 m, influenced by human activities. Many low rock outcrops are present in the area. The only tree in an open area was a mature *Quercus*, with a poorly developed lichen community. Accompanying species included *Japewiella tavaresiana* (H. Magn.) Printzen and two sorediate crusts, one with all negative spot tests and one which reacts C+ orange. This latter resembles *Lecanora jamesii*.

Notes. The new species is characterized by the thallus chemistry (lobaric acid), the small, strongly convex, epruinose and emarginate apothecia with a poorly developed proper exciple, the large, narrowly ellipsoid

TABLE 1. Comparison of the distribution, elevation, chemistry (mainly based on literature) and the main morphological characters (based on our own observations) of the new species *Amandinea lobarica* and the five species of the *A. incrustans* group which are all corticolous and with large and clearly ornamented ascospores.

	<i>Amandinea incrustans</i> -group					
	<i>A. lobarica</i>	<i>A. crassiuscula</i>	<i>A. incrustans</i>	<i>A. langloisii</i>	<i>A. montana</i>	<i>A. submontana</i>
Distribution	Guatemala	W Iberian Peninsula	Namib Desert	Florida	Tropics/Subtropics	Subtropics
Elevation	2500 m	100–500 m	Coastal	Coastal	(220–)1800–3000 m	150–2600 m
Thallus colour	Brown	Ochraceous	Ochraceous	Grey-green (damaged)	Ochraceous	Whitish to ochraceous
Chemistry	Lobaric	–	–	–	–	Atranorin
Caps of the paraphyses (diam. up to)	6.0 µm	6.0 µm	6.0 µm	6.0 µm	6.0 µm	6.0 µm
Ascospore-type	<i>Buellia</i>	<i>Buellia</i>	<i>Buellia</i>	<i>Buellia</i>	<i>Buellia</i>	<i>Buellia</i>
Ascospore size range	(17.0–)19.1–23.5 (–26.0) × (7.0–)	(14.5–)16.9–20.0 (–22.0) × (8.0–)	(12.0–)14.2–17.6 (–19.0) × (7.0–)	(13.0–)14.1–16.7 (–18.0) × (7.0–)	(17.0–)18.7–23.0 (–26.5) × (9.0–)	(13.0–)14.8–18.0 (–20.0) × (7.0–)
means	7.3–8.9(–10.0) µm	8.8–10.4(–11.0) µm	8.2–10.3(–11.5) µm	7.9–9.8(–12.0) µm	9.9–11.9(–14.0) µm	7.2–8.3(–9.0) µm
SDs	21.3 × 8.1 µm	18.5 × 9.7 µm	15.9 × 9.2 µm	15.4 × 8.8 µm	20.9 × 10.9 µm	16.4 × 7.8 µm
l/w ratio	2.2 × 0.8 µm	1.5 × 0.8 µm	1.7 × 1.1 µm	1.3 × 1.0	2.1 × 1.0 µm	1.6 × 0.6 µm
Number of spores measured	2.7	1.9	1.7	1.9	2.2	2.1
Ornamentation at magnification	80	75	92	79	90	58
Ornamentation at magnification	Rugulate ×400	Rugulate ×400	Rugulate ×400	Heavily rugulate < ×400	Rugulate ×400	Rugulate ×400
Conidium length	15–20 µm	12–20 µm	15–21 µm	15–35 µm	Unknown	10–17 µm

TABLE 2. Comparison of the distribution, elevation, chemistry (mainly based on literature) and main morphological characters (based on our own observations) of additional corticolous *Amandinea* species (and *Gassicurtia vaccinii*) with large and clearly ornamented ascospores.

	<i>A. mediospora</i>	<i>A. megaspora</i>	<i>A. leucomela</i>	<i>A. subduplicata</i>	<i>Gassicurtia vaccinii</i> (= <i>Buellia hypothallina</i>)
Distribution	Tropics	Tropics	Jamaica	Mainly Tropics/ Subtropics	Tropics
Elevation	2700–2850 m	3300–4500 m	Coastal	700–2600 m	900–3200 m
Thallus colour	Whitish	Whitish	Sulphureous	Whitish grey	Whitish grey to ochraceous
Chemistry	6- <i>O</i> -methylarthothelin	Atranorin	6- <i>O</i> -methylthiophanic lichexanthone	Atranorin	3- <i>O</i> -methylthiophanic, thiophanic, arthothelin, atranorin
Caps of the paraphyses (diam. up to)	6.0 µm	7.0 µm	2.0–3.0 µm	3.0–4.0 µm	3.0(–3.5) µm
Ascospore-type	± <i>Callispora</i>	± <i>Callispora</i>	<i>Physconia</i>	<i>Buellia</i>	<i>Buellia</i>
Ascospore size range	(24.0–)25.3–27.0 (–29.0) × (10.5–) 10.9–12.3(–13.0) µm	(24.0–)29.7–35.4 (–38.0) × (10.0–) 12.0–14.5(–16.0) µm	(13.0–)14.0–16.5 (–17.5) × (6.5–)6.7–7.6 (–8.0) µm	(15.0–)17.0–21.9 (–24.0) × (6.0–)7.0–8.6 (–9.0) µm	(12.0–)13.1–17.1 (–19.0) × (4.5–)5.0–6.0 (–6.5) µm
means	26.6 × 11.6 µm	32.6 × 13.2 µm	15.3 × 7.2 µm	19.4 × 7.8 µm	15.1 × 5.5 µm
SDs	1.3 × 0.7 µm	2.8 × 1.2 µm	1.3 × 0.4 µm	2.4 × 0.8 µm	2.0 × 0.5 µm
l/w ratio	2.3	2.5	2.1	2.5	2.7
Number of spores measured	20	30	20	25	25
Ornamentation at magnification	Microrugulate ×1000	Microrugulate ×1000	Rugulate ×400	Microrugulate to rugulate ×1000 (overmature at ×400)	Microrugulate ×1000
Conidium length	23–30 µm	Unknown	Unknown	24–27 µm	Unknown

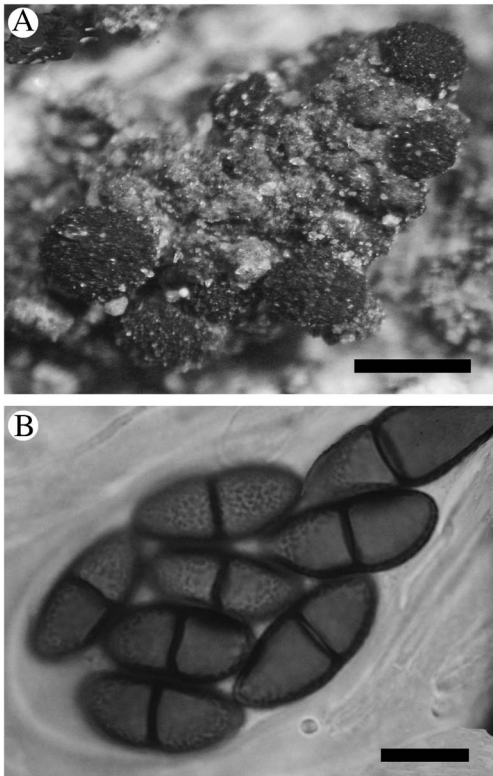


FIG. 1. *Amandinea lobarica* Giralt, van den Boom & Elix (holotype). A, thallus with apothecia; B, *Buellia*-type ascospores with strongly ornamented walls (rugulate) and slight constrictions at the septa. Scales: A = 0.5 mm; B = 10 μ m.

and strongly rugulate *Buellia*-type ascospores, 17–26 \times 7–10 μ m, and the filiform conidia. As a consequence of the latter character, we have included this species in *Amandinea*. Other crustose genera in the *Physciaceae* with filiform conidia include *Orcularia* (Malme) Kalb & Giralt, *Fluctua* Marbach and *Sculptolumina* Marbach. All possess ascospores with strong inner wall thickenings (see Kalb & Giralt 2011, Marbach 2000 and Giralt *et al.* 2009, respectively) so can be readily distinguished from *Amandinea*.

The external morphology and the large, narrowly ellipsoid ascospores of *A. lobarica* resemble those of the genus *Chrimofulvea* Marbach (Marbach 2000). However, this genus is mainly separated from other crustose

buellioid genera of *Physciaceae* by containing the fumarprotocetraric chemosyndrome. Unfortunately, the conidia of *Chrimofulvea* have not yet been described.

Among the known corticolous species of *Buellia* s. lat., only the sorediate *Amandinea efflorescens* (Müll. Arg.) Marbach var. *efflorescens*, the isidiate *Gassicurtia clathrisidiata* Aptroot, *G. bellardii* (Sipman) Marbach, *G. coccifera* Marbach & Kalb, *Sculptolumina serotina* (Malme) Marbach and *Tetramelas regionmontanus* Marbach contain lobaric acid. The first two taxa are distinguished by their vegetative propagules, *G. bellardii* and *G. coccifera* by much smaller ascospores, 9–12 \times 5–6 μ m and 8–11 \times 4.5–5.5 μ m, respectively, *S. serotina* by rinodinoid ascospores of the *Pachysporaria*-type and *T. regionmontanus* (Marbach 2000) by larger ascospores (25–31 \times 9–11 μ m) with subapical wall thickenings.

Other *Amandinea* species with ascospores as large as those of *A. lobarica* include *A. mediospora*, *A. megaspora* and *A. montana* (Fig. 2). However, the ascospores of the two former species are larger than those of *A. lobarica* (24–29 \times 10–13 μ m and 24–38 \times 10–16 μ m, respectively), possess weak inner subapical and septal wall thickenings (\pm *Callispora*-type) and are less strongly ornamented (ornamentation visible at \times 1000) while those of *A. montana* are much broader (17.0–26.5 \times 9.0–14.0 μ m). They also differ chemically since *A. mediospora* contains 6-*O*-methylarthothelin, *A. megaspora* contains atranorin and *A. montana* lacks lichen substances.

Additional differences between *A. lobarica* and the other species mentioned above are summarized in Tables 1 and 2.

Species of the *Amandinea* *incrustans* group

The species in the *Amandinea incrustans* group include *Amandinea crassiuscula*, *A. incrustans*, *A. langloisii*, *A. montana* and *A. submontana*. All are corticolous, characterized by robust, smooth, glossy, ochraceous to olivaceous thalli with well-developed epinecral and cortical layers, the latter

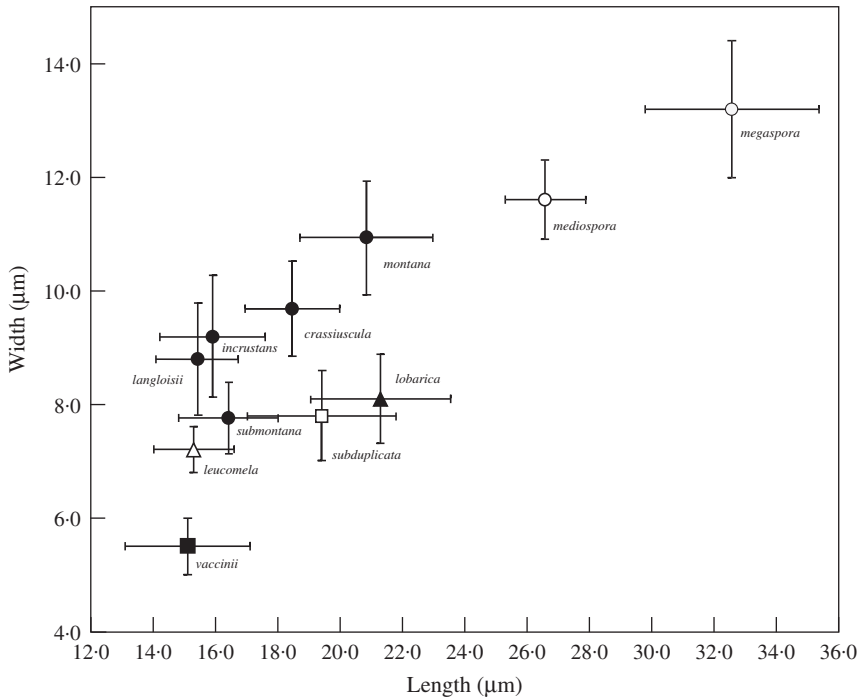


FIG. 2. Comparison of ascospore length and width of the five species of the *Amandinea incrustans*-group (●), the new species *A. lobarica* (▲), the two species *A. mediospora* and *A. megaspora* (○), *A. leucomela* (△), *A. subduplicata* (□) and *Gassicurtia vaccinii* (■). Points plotted are mean values \pm 1SD (see also Tables 1 & 2).

composed of \pm rounded-cells (see Giralt *et al.* 2000: Fig. 2A: 524); an absence of secondary metabolites (except *A. submontana* which contains atranorin); juvenile apothecia covered by a thin thalline veil and mature apothecia with plane discs and thick proper margins (see Giralt *et al. op. cit.*: Fig. 1: 523), which usually become convex and emarginate; a brown proper exciple (paler within) composed of \pm isodiametric cells; rather large, broadly ellipsoid (l/w ratio = c. 2), *Buellia*-type ascospores with a strongly rugulate ornamentation clearly visible at $\times 400$ magnification (see Giralt *et al. op. cit.*: Fig. 3: 525); paraphyses with large apical cells (up to 6.0 μ m diam.) with brown caps; and filiform conidia (not yet seen in *A. montana*). Leaving aside *A. submontana* which contains atranorin, the other four taxa of the *A. incrustans* group could be regarded as conspecific since they differ from one another mainly in the size of the ascospores (see Fig. 2 and

Table 1). Nevertheless, until more material is collected to confirm whether the divergences among species in ascospore size, ecological requirements and distribution patterns are constant or not, it seems most appropriate to conserve them as valid taxa.

***Amandinea crassiuscula* Giralt & Etayo**

Giralt *et al.*, *Lichenologist* 32: 522 (2000); type: Iberian Peninsula, Spain, Andalucía, Cádiz, Jerez de la Frontera, canuto del Caballo, carretera de Alcalá de los Gazules a Puerto Galiz km 16, 30STF6347, 420 m, on *Quercus suber*, 1994, Casares, Etayo, Gómez-Bolea & Hladun (BCN—holotype!; hb. Etayo—isotype!).

Notes. This species has ascospores of intermediate size within the *A. incrustans* group, smaller than *A. montana* and longer than those of the other three taxa (Fig. 2, Table 1). It lacks secondary metabolites.

Amandinea crassiuscula seems to be restricted to the western Iberian Peninsula

where it occurs in Mediterranean woods of the mesomediterranean belt, with a humid and hyperhumid ombroclimate (Giralt *et al.* 2000).

Additional specimens examined. These are listed in Giralt *et al.* (2000) and Paz-Bermúdez & Giralt (2010).

***Amandinea incrustans* (J. Steiner in Zahlbr.) Marbach**

Biblioth. Lichenol. 74: 75 (2000).—*Buellia incrustans* J. Steiner in Zahlbr., *Bot. Jahrb.* 60: 550 (1926); type: Namibia, “Deutsch-Südwestafrika, Haifischinsel an der Lüderitzbucht”, W. Finke; A. Zahlbruckner, *Lichenes rarioris exsiccati* N 260 [WU 41358—lectotype, designated by Marbach 2000: 75 (as ‘holotype’); W 1927–1063 & W 1920–718—isolectotypes!].

Taxonomic note. Şenkardeşler (2010: 443, sub *Buellia incrustans*) mentioned erroneously the specimen W 1927–1063 as the lectotype and the specimen WU 41358 as one of the isolectotypes.

Notes. *Amandinea incrustans* and *A. langloisii* have the shortest ascospores within the *A. incrustans* group. In addition, *A. langloisii* has longer conidia than *A. incrustans*. *Amandinea submontana*, with ascospores of similar length, differs from both of these species by possessing narrower ascospores and containing atranorin (Fig. 2, Table 1).

All material of *A. incrustans* examined (the type included) contained two *Amandinea* taxa growing together. One species has broadly ellipsoid ascospores, 12.0–19.0 × 7.0–11.5 µm (l/w ratio = 1.7); and the other narrowly ellipsoid ascospores, 11.0–16.5 × 5.5–7.5 µm (l/w ratio = 2.3). According to the protologue (J. Steiner in Zahlbruckner 1926), *A. incrustans* (sub *Buellia incrustans*) has ascospores 14.0–18.5 × 9.0–11.0 µm, so *A. incrustans* s. str. corresponds to the species with the broadly ellipsoid ascospores. The second taxon, with narrowly ellipsoid ascospores, corresponds to *A. extenuata* (Müll. Arg.) Marbach. Besides the smaller ascospores, *A. extenuata* differs from *A. incrustans* in having a thinner, warty to verrucose-areolate thallus, smaller apothecia, and *Physconia*-type ascospores with weak inner septal wall thickenings (when young)

and microrugulate outer spore walls (ornamentation visible at ×1000) rather than rugulate (ornamentation visible at ×400).

The description of *A. incrustans* given in Wirth (2010, sub *Buellia incrustans*) is likely to refer to *A. extenuata* and not to *A. incrustans*, since the size given for the ascospores is 11–15 × 6–7 µm.

Amandinea incrustans is endemic to the Namib Desert (Marbach 2000).

Additional specimens examined. **Namibia:** Omaruru, c. 2 km N of Cape Cross, Namib Desert, gravel plain c. 5 km E of the road, on branchlets of *Arthroa leubnitziae* shrubs, 25 m, 1986, Sipman 19722 (B); Swakopmund, gravel flats in central Namib Desert, c. 10 km E of Swakopmund, along road to Namib-Naukluft Park, near power station, on scattered low shrubs, c. 50 m, 1986, Sipman 19661 (B); Karas Region, 200 m, 2009, R. & V. Wirth 42030 (STU).

***Amandinea langloisii* Imshaug ex Marbach**

Biblioth. Lichenol. 74: 80 (2000).—*Buellia langloisii* Imshaug, The lichen-forming species of the genus *Buellia* occurring in the United States and Canada: 114 (1951), *nomen nudum*; type: Florida, Sanford, on old tree trunk, 1918, Rapp 619 (FH—holotype!).

Notes. *Amandinea langloisii* clearly differs from the other species of the *A. incrustans* group by the more strongly rugulate ornamentation of the ascospores and the longer conidia (Table 1). It lacks lichen substances (see also under *A. incrustans*).

The thallus of the holotype of *A. langloisii* was described as “smooth and ochraceous” by Imshaug (1951), like all species of the *A. incrustans* group, but as dark greyish green by Marbach (2000). Our study of the type material established that the thallus has been damaged over the years with a hyphomycete and black soil present on it. The thallus of *A. langloisii* is thinner than that of the other members of the *incrustans* group but it still possesses the typical epinecral layer and the cellular cortex.

Amandinea langloisii was considered conspecific with *A. leucomela* by Harris (1988) and Sheard & May (1997). However, a study of the respective type materials showed this to be incorrect, as pointed out by Marbach (2000). The thallus and

apothecia of *A. leucomela* contain xanthenes, it has smaller ascospores (of *Physconia*-type when young) and the apical cells of the paraphyses are weakly enlarged (2.0–3.0 µm diam.).

According to Marbach (2000), *A. langloisii* is known only from the type locality in Florida. However, additional records from Louisiana listed by Imshaug (1951) and from Florida and Louisiana by Harris (1988) and Sheard & May (1997) under *A. leucomela*, could actually refer to *A. langloisii*.

***Amandinea montana* (H. Magn.) Marbach**

Marbach, *Biblioth. Lichenol.* 7: 93 (2000).—*Buellia montana* H. Magn., *Bot. Not.* 1954(2): 199 (1954); type: India, United Provinces, Nainital, Chine Peak, 2100 m, on bark, 1949, Mehra 14 (UPS, not seen).

Notes. *Amandinea montana* has the largest ascospores of those species included in the *A. incrustans* group (Fig. 2, Table 1). According to Kalb & Elix (1998), *A. montana* contains myeloconone D1, but it actually lacks lichen substances. Myeloconone D1 is a synonym of unknown SV-1 (Culberson 1972), a chlorophyll or xanthophyll derivative originating from the photobiont.

Amandinea montana is known from the type locality in India (Magnusson 1954), Kenya (Marbach 2000), Australia (Elix & Kantvilas 2013) and from Guatemala (present record) where it typically occurs at high elevations in the mountains of subtropical to tropical regions. In the Guatemalan locality the species was growing on *Quercus*, with a rather well-developed lichen community, accompanied by macrolichens such as *Canoparmelia carneopruinata* (Zahlbr.) Elix & Hale, *Heterodermia albicans* (Pers.) Swinscow & Krog, *H. diademata* (Taylor) D. D. Awasthi, *H. magellanica* (Zahlbr.) Swinscow & Krog, *Leptogium cochleatum* (Dicks.) P. M. Jørg. & P. James, *Pannaria malmei* C. W. Dodge, and *Parmotrema chiapense* (Hale) Hale. Well-developed crustose specimens from that locality included *Glyphis cicatricosa* Ach., *Graphis barillae* van den Boom & Sipman, *Graphis furcata* Fée, *Haematomma collatum* (Stirt.) C. W. Dodge, *Jamesiella*

perlucida (Vězda & Hafellner) Lücking *et al.*, *Phaeographis dendritica* (Ach.) Müll. Arg., *Phlyctidia boliviensis* (Nyl.) Müll. Arg. and *Pyrenula pyrenuloides* (Mont.) R. C. Harris.

Additional specimens examined. **Guatemala:** NE of Antigua Guatemala, park Florencia, mature and small young *Quercus* trees, on a mature *Quercus*, 14°34.1' N, 90°42.1' W, 1800 m, 2004, P. & B. van den Boom 33622 (hb. v. d. Boom).—**Kenya:** *Central Province:* Nyeri district, Strasse zwischen den Aberdare-Region und Nyeri, 1985, Kalb & Schrögl 13746 (WIS).

***Amandinea submontana* Marbach**

Biblioth. Lichenol. 74: 105 (2000); type: Kenya, Central Province, Nanyuki District, zwischen Naro Moru und Nanyuki, Wälder zwischen dem Bantu und den Mao Mao Grotten, 2050 m, 1985, Kalb & Schrögl 28776 & 13355 (WIS—holotype! & isotype!, respectively).

Notes. This species differs from the other members of the *A. incrustans* group by possessing the narrowest ascospores (Fig. 2), the shortest and rarely curved conidia and the presence of atranorin in the thallus (Table 1). According to Marbach (2000), this species may sometimes contain norstictic acid or lack lichen substances.

It seems to be the most common species of the *A. incrustans* group, occurring in subtropical and warm-temperate regions from low to high elevations (Marbach 2000). It has recently been reported from the coastal plain of Virginia (USA) (Hodkinson & Case 2008).

Additional species

***Amandinea leucomela* (Imshaug) P. May & Sheard**

Sheard & May, *Bryologist* 100: 162 (1997).—*Buellia leucomela* Imshaug, *Farlowia* 4: 496 (1955); type: Jamaica, N slope of Portland Ridge, Parish of Clarendon, 200 ft., 1952, Imshaug 13269 (FH—holotype!; CANB—istotype).

Notes. The thin sulphurous to yellowish thallus well delimited by a black prothallus, the presence of lichexanthone and 6-*O*-methylthiophanic (not 6-*O*-methylarthothelin as stated in Marbach 2000), the small (up to 0.4 mm diam.), persistently plane apothecia

and the rather small, *Physcomia*-type ascospores with weak inner septal wall thickenings (13.0–17.5 × 6.5–8.0 μm), clearly distinguish *A. leucomela* from the other species treated. The conidia have not yet been observed (see also comments under *A. langloisii* and Table 2).

It is known with certainty only from the type locality in Jamaica (Marbach 2000). The record of *A. leucomela* (sub *Buellia leucomela*) from the Sonoran Region (Bungartz et al. 2007) is doubtful since the species is described as possessing larger apothecia (up to 1 mm diam.) and larger ascospores (16.0–21.5 × 8.0–10.0 μm), which furthermore are of *Buellia*-type.

Amandinea mediospora Marbach

Biblioth. Lichenol. 74: 81 (2000); type: Ecuador, Azuay, c. 35 km S von Cuenca, Waldestre in einem Grasparamo, 3200 m, 1987, *Kalb* 18365 & 18360 (WIS—holotype! & isotype! respectively).

Notes. This taxon is characterized by the whitish to beige, rimose to warty thallus containing 6-*O*-methylarthothelin; apothecia with persistently plane discs, prominent and persistent proper margins and hypothecia interspersed with oil droplets; large, often curved ascospores (24.0–29.0 × 10.5–13.0 μm) with weak subapical and very weak septal inner wall thickenings when young (\pm *Callispora*-type), with pointed and paler apices, some with an additional pseudo-septum per cell when mature and with walls showing microrugulate ornamentation (visible at ×1000).

Amandinea mediospora is very closely related to *A. megaspora* but the latter taxon contains atranorin and has larger ascospores of 24–38 × 10–16 μm (Table 2).

The species is known only from a few tropical localities in Ecuador and Venezuela where it occurs at high elevations (Marbach 2000).

Additional specimens examined. **Ecuador:** Tungurahua, Aufstieg zum Zumbahua, etwa 20 km westlich von Baños, 2750–2850 m, 1987, *K. & A. Kalb* 18499 & 18477 (WIS); Pichincha, zwischen Nono und Nanegal, nord-westlich von Quito, 2700 m, 1987, *K. & A. Kalb* 16641 (WIS).—**Venezuela:** Mérida: Distr. Rangel,

zwischen Santo Domingo und Apartaderos, an abgestorbenen Blättern und Ästen von *Espeletia*, 8°55'N, 70°45'W, 2500 m, 1989, *K. & A. Kalb* 25829 (WIS).

Amandinea megaspora Marbach

Biblioth. Lichenol. 74: 84 (2000); type: Ecuador, Napo, zwischen Quito und Baeza, etwa 50 km von Baeza, in Paramovegetation, 4000 m, 1987, *K. & A. Kalb* 18665 (WIS—holotype!).

Notes. The presence of atranorin rather than 6-*O*-methylarthothelin and the larger ascospores distinguish this species from *A. mediospora* (see previous species and Table 2).

Amandinea megaspora has been reported from the tropical mountains of South (Ecuador) and Central America (Costa Rica) where it occurs at high elevations in the paramo vegetation (Marbach 2000).

Additional specimen examined. **Costa Rica:** Cartago, Cordillera de Talamanca, Cerro de la Muerte, Cerro de la Asunción, subalpine Regen-Paramo-Stufe, 9°3'N, 83°46'W, 3300–3396 m, 1978, *Kalb & Plöbst* 28651 & 28652 (WIS).

Amandinea subduplicata (Vain.) Marbach

Biblioth. Lichenol. 74: 84 (2000).—*Buellia subduplicata* (Vain.) *Kalb, Lich. Neotrop. Fasc.* 8: 4 (1984).—*Buellia disciformis* var. *subduplicata* Vain., *Acta Soc. Fauna Fl. Fem.* 7: 166 (1890); type: Brazil, Rio de Janeiro, 1885, *E. A. Vainio* 96, *Lichenes Brasiliensis Exsiccati* (M— isotype, not seen).

Notes. *Amandinea subduplicata* is characterized by a whitish grey thallus containing atranorin; young apothecia being immersed, surrounded by a thalline veil and with concave discs and mature apothecia with a proper margin which is often paler than the disc; a colourless inner proper exciple; a pale brown hypothecium, which is hyaline in the upper part; a pale brown epihymenium with crystals (epipsamma); paraphyses with slightly enlarged apical cells (up to 3–4 μm diam.); and ascospores 15–24 × 6–9 μm with wall ornamentation visible at ×1000 (ornamentation on some overmature ascospores visible at ×400). It differs from the other taxa treated in this contribution by the external morphology of the juvenile apothecia and the

hyaline inner part of the proper exciple and upper hypothecium (see also Tables 1 and 2).

A species mainly occurring in subtropical and tropical regions of South America where it grows at mid to high elevations. It has also been reported from Asia, Australia and North America (Marbach 2000; Elix 2011).

Selected specimens examined. **Ecuador:** Tungurahua, zwischen Baños und Ulba, am Rand eines steilen Bergregenwaldes, 1850 m, 1987, K. & A. Kalb 18557 (WIS).—**Brazil:** Minas Gerais: Fazenda Bela Vista bei Camanducaia, an einem freistehenden Baum, 1100 m, 1980, K. Kalb 28643 (WIS); São Paulo, Serra Mantiqueira, Campos do Jordão, etwa 45 km nördlich von Taubaté, 1978, Kalb & Plöbst 28644 (WIS).

Gassicurtia vaccinii (Vain.)

Marbach et al.

Marbach, *Biblioth. Lichenol.* 74: 247 (2000).—*Buellia vaccinii* Vain., *Philipp. J. Sci. Sect. C* 8(2): 211 (1913); type: Philippines, Mindanao, Davao, summit of Mt. Apo, ±9500 ft, on stems of *Vaccinium villarii*, 1904, Copeland 1154 (TUR—holotype, not seen).

New Synonym. *Buellia hypothallina* Aptroot in Aptroot et al., *Biblioth. Lichenol.* 64: 31 (1997); type: Papua New Guinea, Morobe, Huon Peninsula, Honzeukngon village S of Derim in Timbe valley, Saruwaged Range, 6°14'S, 147°06'E, 1950 m, 1987, Aptroot 17938 (B—holotype!).

Notes. The type specimen of *Buellia hypothallina* is characterized by the whitish grey to ochraceous, granulose thallus which contains thiophanic and 3-*O*-methylthiophanic acids as major substances, together with traces of arthothelin (HPLC, J. Elix ined.); the lecideine apothecia up to 0.65 mm diam., with plane to subconvex discs and well-developed and persistent proper margins; the thick proper exciple (c. 70 µm) containing many crystals which dissolve in K⁺ to form a yellow solution; the red-brown epihymenium with epipsamma; the only slightly enlarged apical cells of the paraphyses [up to 3.0(–3.5) µm diam.] and the narrowly ellipsoid *Buellia*-type ascospores of 12.0–19.0 × 4.5–6.5 µm, with a microrugulate ornamentation visible at ×1000 (Table 2).

Precisely the same morphological and chemical characters are diagnostic for *Gassicurtia vaccinii* (cf. Vainio 1913, sub *Buellia vaccinii*; Kalb & Elix 1998; Marbach 2000). The conspecificity of these two taxa is established here.

Gassicurtia vaccinii occurs at mid to high elevations in tropical mountains (Aptroot et al. 1997; Marbach 2000).

Key to the *Amandinea* species and *Gassicurtia vaccinii*

- 1 Ascospores ±*Callispora*-type, mostly larger than 25 × 10 µm, microrugulate (ornamentation visible at ×1000) 2
Ascospores *Buellia*- or *Physconia*-type, smaller, microrugulate or rugulate (ornamentation visible at ×400) 3
- 2(1) Thallus with atranorin (K+ yellow, C–, KC–, UV–); ascospores 24–38 × 10–16 µm **A. megaspora**
Thallus with 6-*O*-methylarthothelin (K+ orange or KC+ orange or UV+ orange); ascospores smaller, 24.0–29.0 × 10.5–13.0 µm. **A. mediospora**
- 3(1) Thallus and apothecia with xanthenes (UV+ yellow-orange to orange); ascospores *Physconia*- or *Buellia*-type 4
Thallus and apothecia without xanthenes (UV–); ascospores always *Buellia*-type 5
- 4(3) Thallus smooth; ascospores *Physconia*-type, 13.0–17.5 × 6.5–8.0 µm, rugulate (ornamentation visible at ×400) **A. leucomela**
Thallus granulose-coralloid; ascospores *Buellia*-type, narrower, 12.0–19.0 × 4.5–6.5 µm, microrugulate (ornamentation visible at ×1000) **Gassicurtia vaccinii**
- 5(3) Thallus with atranorin (K+ yellow) 6
Thallus without atranorin (K–) 7

- 6(5) Hypothecium pale brown, hyaline in the upper part; epihymenium with crystals (epipsamma); caps of the paraphyses 3–4 µm diam **A. subduplicata**
Hypothecium uniformly dark brown; epihymenium without crystals; caps of the paraphyses larger, up to 6 µm **A. submontana**
- 7(5) Thallus discontinuous, thin, smooth to mostly granulose, greyish brown to dark brown, with lobaric acid; ascospores narrowly ellipsoid, 17–26 × 7–10 µm (l/w ratio 2.7) **A. lobarica**
Thallus different, continuous, thick, with well-developed epinecral and cortical layers, ochraceous, without secondary metabolites; ascospores widely ellipsoid (l/w ratio ±2.0) 8
- 8(7) Ascospores 17.0–26.5 × 9.0–14.0 µm **A. montana**
Ascospores smaller 9
- 9(8) Ascospores 14.5–22.0 × 8.0–11.0 µm; known only from Western Iberian Peninsula **A. crassiuscula**
Ascospores smaller 10
- 10(9) Conidia 15–21 µm; ascospores 12.0–19.0 × 7.0–11.5 µm; known only from the Namib Desert **A. incrustans**
Conidia 15–35 µm; ascospores 13–18 × 7–12 µm; known only with certainty from coastal Florida **A. langloisii**

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