

***Buellia nordinii*, a new triseptate species from Venezuela**

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Abstract: *Buellia nordinii*, a new muscicolous or lignicolous species characterized by a blastidiate thallus containing atranorin, apothecia with a fine granular surface, markedly enlarged paraphyses tips and large triseptate ascospores is described from Venezuela. The species grows in very humid situations near the ground in open paramo vegetation at high elevations. It is compared with other known asexually reproducing and triseptate *Buellia* taxa.

Key words: Lecanoromycetes, lichenized fungi, *Physciaceae*, South America, taxonomy

Introduction

A very characteristic specimen of *Buellia* was found growing with *Rinodina fuscoisidiata* Giralt *et al.* (2010: 3, sub *Buellia* aff. *proximata*), an isidiate, muscicolous taxon recently described from high altitudes in the Paramo vegetation of Venezuela (Giralt *et al.* 2010). The presence of additional specimens in the herbarium of the second author (hb. K. Kalb) allowed detailed morphological and chemical studies which have shown that they can be clearly distinguished from all other known triseptate *Buellia* taxa by the larger triseptate ascospores and the markedly enlarged apical cells of the paraphyses which give to the surface of the apothecia a particular granular appearance. These specimens are described as a new species below.

Materials and Methods

The specimens were examined by standard techniques using stereoscopic and compound microscopes. Only free ascospores lying outside the asci have been measured. Measurements were made on material

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mounted in water at $\times 1000$ magnification. Mean value (M) and standard deviation (SD) were calculated and the results are recorded as (minimum value observed) $M \pm SD$ (maximum value observed). M, SD and n (the total number of ascospores measured) are given within parentheses. The terminology used for the asci follows Rambold *et al.* (1994), for the ascospore-types and ascospore ontogeny, Giralt (2001) and for the proper exciple-type, Bungartz *et al.* (2007).

Chemical constituents were identified by standardized thin layer chromatography and high performance liquid chromatography (HPLC) (Elix *et al.* 2003).

The Species

***Buellia nordinii* Giralt, Kalb & Elix sp. nov.**

Thallus muscicola vel lignicola, et in et supra substrato crescens, fuscus, atranorinum in vestigiis continens. Specimina in ligno crescentia normaliter blastidios formantia. Apothecia lecideina, nigra. Excipulum proprium typo *aethalea*. Cellulae apicales paraphysum usque ad 9–10 μm diametro auctae, parte superne fuscae. Ascosporae (1–2)–3-septatae, (25–)28.4–35.8 (–42) \times (10–)11.8–15.5 (–18) μm ; paries interioris apicaliter et ad basim septorum incrassatus, ontogenia typo A. Conidia bacilliformia, (2–)3–4 \times c. 1 μm .

Typus: Venezuela, Mérida, distr. Libertador, Pico Espejo, SE von Mérida, Loma Redonda, 4200 m, 8°35'N; 71°00'W, on very soft and decomposed wood, 8 & 10 August 1989, K. & A. Kalb (hb. Kalb 23952—holotypus; GZU, hb. Kalb 34813—isotypi).

(Figs 1 & 2)

Thallus lignicolous or muscicolous, developing beneath the uppermost layers of the substratum (endosubstratal) or episubstratal, brown, thin; in both cases formed of

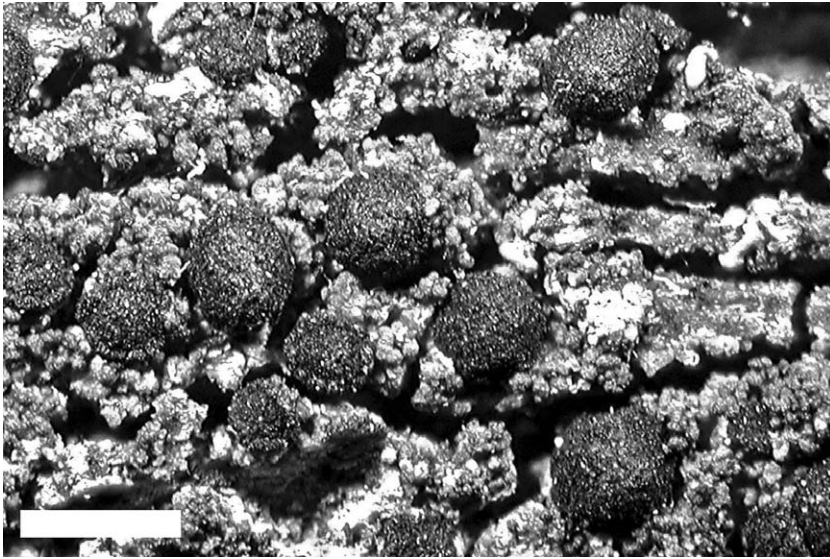


FIG. 1. *Buellia nordimii*, blastidiate thallus with apothecia (note the granular surface) growing on lignum (holotype). Scale = 1 mm.

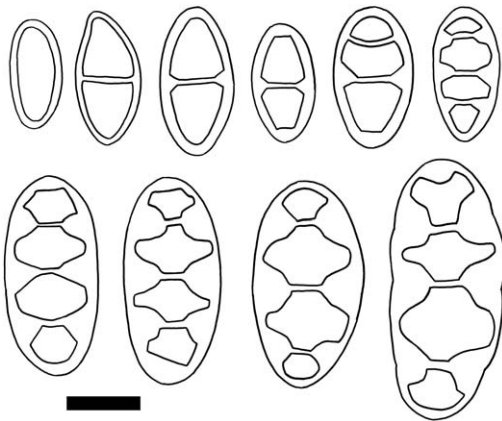


FIG. 2. *Buellia nordimii*, ascospore ontogeny of type A and ascospore variability (holotype). Scale = 10 μm .

\pm globose units of 70–120 μm diam. composed of a paraplectenchymatous tissue with cells of 3–5(–7) μm diam. intermixed with chlorococcoid algal cells, 8–15 μm diam. Outermost (cortical) cells surrounding the globose units brown pigmented, up to 9 μm diam.. When episubstratal the globose units develop into blastidia; *blastidia* scattered to usually contiguous, forming a continuous reddish to dark brown, shiny, granulose

crust. The anatomy of the blastidia is identical to that of the \pm globose units of the non-blastidiate, muscicolous thalli and of the endosubstratal part of the lignicolous thalli. All thallus structures are non-amyloid.

Apothecia lecideine, black, with a fine granular surface (a somewhat soft and spongy appearance, Fig. 1), (0.2–)0.3–0.6 (–0.8) mm diam., discrete to rarely crowded and coalescing, sessile and constricted at the base from the beginning when belonging to endosubstratal or muscicolous thalli or adnate when the thallus is an entirely blastidiate crust. Proper margin thick, prominent in young apothecia, becoming thinner, finally excluded. *Disc* concave at first, then flat and finally convex, epruinose. *Proper exciple aethalea*-type (Bungartz *et al.* 2007), laterally 10–30(–50) μm thick, expanded to 40–60 (–75) μm below, inner part hyaline to brownish, outermost part brown with cells with dark brown caps and markedly enlarged, like the apical cells of the paraphyses. *Hymenium* colourless, 100–120 μm high, not interspersed with oil droplets. *Epihymenium* brown. *Hypothecium* 100–150 μm deep, dark brown, upper part with an olivaceous tinge. *Paraphyses* slender, 1–1.2 μm wide, the apical cells

markedly enlarged, up to 9–10 µm wide, with dark brown cap. *Asci* *Bacidia*-type (Rambold *et al.* 1994), 8-spored but very often with only (2–)3–4 ascospores fully developed. *Ascospores* (1–2)–3-septate, (25–)28.4–35.8(–42) × (10–)11.8–15.5(–18) µm ($M = 32 \times 13.5$ µm; $SD = 3.7 / 1.8$ µm; $n = 73$), with inner walls slightly thickened at the apices and very pronounced at septa, when mature slightly constricted at septa; outer wall faintly microrugulate (visible at ×1000). Longitudinal septa never present. Ontogeny of type A (Giralt 2001) (Fig. 2).

Pycnidia rare, subimmersed, globose, unilocular, < 0.1 mm diam., ostiole dark brown with cells like the apical cells of the paraphyses; conidiogenous cells mainly apical but also intercalary (cf. conidiophore-type V, Vobis 1980). *Conidia* bacilliform, 2–3(–4) × c. 1 µm.

Chemistry. K–, C–, KC–, Pd–, UV–. The two specimens analysed (GZU, hb. Kalb 34813—isotype, hb. Kalb 34831) contain traces of atranorin.

Etymology. The species is named in honour of Dr Anders Nordin, Uppsala, Sweden, for his excellent revision of the pluriseptate species of *Buellia*.

Ecology and distribution. The new species is known only from two localities in Merida province in Venezuela growing on very decomposed lignum and on mosses. At the type locality a sterile, sorediate taxon containing xanthonenes grows intermixed with the new species. Other accompanying species included *Tetramelas regiomontanus* Marbach, *Rinodina stictica* Sheard & Tønsberg and *R. fuscoisidiata* Giralt, Kalb & Elix. These species grow in very humid situations near the ground in open paramo vegetation at elevations of 3500 and 4200 m.

Observations. *Buellia nordinii* is characterized by the endosubstratal to episubstratal thin, brown thallus which usually becomes entirely blastidiate (when growing on lignum), the presence of traces of atranorin, the markedly enlarged apical cells of the paraphyses which give to the apothecia their soft and porous appearance, and the large, tri-

septate ascospores ($M = 32 \times 13.5$ µm), with inner apical and septal wall thickenings and an ontogeny of type A.

Among all the other known triseptate *Buellia* s. lat. species (Nordin 1996, 2000), *Buellia nordinii* together with the terricolous *Tetramelas graminicola* (Øvstedal) Kalb and *T. geophilus* (Sommerf.) Norman have the largest ascospores. The two *Tetramelas* Norman species are clearly distinguished by the presence of xanthonenes (6-*O*-methylarthothelin) and ascospores which lack internal wall thickenings. Similarly, *T. triphragmioides* (Anzi) A. Nordin & Tibell has much smaller triseptate ascospores while *T. insignis* (Nägeli ex Hepp) Kalb has large ascospores, but they very rarely become triseptate (Marbach 2000; Kalb 2004; Nordin 2004; Nordin & Tibell 2005). The species of *Hafellia* Kalb, H. Mayrhofer & Scheid. species belong to *Buellia* s. str. since the type species of *Buellia* is *Buellia* (= *Hafellia*) *disciformis* (Fr.) Mudd. (cf. Gams 2004). *Hafellia bispora* Sheard, *H. disciformis* (Fr.) Marbach & H. Mayrhofer and *H. sanguinolenta* (T. Schauer) Hafellner & Türk are distinguished from *B. nordinii* by the *Callispora*-type ascospores and the hymenia interspersed with oil droplets (Sheard 1992; Giralt *et al.* 2002a; Etayo & Marbach 2003).

The tropical, montane *Buellia proximata* H. Magn. and *B. lauricassiaeoides* Aptroot, and the Macaronesian, submontane, *B. laurocanariensis* Giralt, Etayo & van den Boom, are probably more closely related to *B. nordinii*. All three taxa have ascospores with internal wall thickenings, but in contrast to *B. nordinii*, the ascospores are significantly smaller [$M = 24.3 \times 8.8$ µm; $n = 80$; 23.2×8.9 µm; $n = 10$; and 22.9×8.9 µm; $n = 61$, respectively] and those of the first two species show type-B ontogeny (cf. Imshaug 1955; Aptroot *et al.* 1997; Nordin 2000; Giralt *et al.* 2002b). Further, they are corticolous, lack vegetative propagules and have less enlarged paraphyses tips. Additional distinguishing features are the presence of diploicin as well as atranorin in *B. proximata* (Nordin 2000) and *B. lauricassiaeoides* (J. A. Elix unpublished data), the sporadic presence of longitudinal septa in the ascospores

of *B. proximata*, the often 4–5-septate ascospores of *B. lauricassiaeoides* and the strongly ornamented ascospore walls (rugulate) of *B. laurocanariensis*.

According to the literature, relatively few *Buellia* s. lat. species are known to develop vegetative propagules, namely, *Amandinea efflorescens* (Müll. Arg.) Marbach, *Buellia arborea* Coppins & Tonsberg, *B. dissimilis* (Nyl.) Müll. Arg., *B. elizae* (Tuck.) Tuck., *B. exalbida* (Kremp.) Zahlbr., *B. griseovirens* (Turner & Borrer ex Sm.) Almb., *B. manamiana* Diederich, *B. subfrigida* M. Inoue, *B. soreliata* (Tuck.) Magn., *B. violaceofusca* Thor & Muhr and *Tetramelas graminicola* (Imshaug 1955; Harris 1988; Thor & Muhr 1991; Tonsberg 1992; Inoue 1993; Aptroot *et al.* 1997; Marbach 2000; Nordin 2000; Øvstedal & Lewis Smith 2001; Kalb 2004; Bungartz *et al.* 2007). None of these species have features that are diagnostic of *Buellia nordinii*.

Additional specimens examined. **Venezuela:** Mérida: distr. Rangel, zwischen Laguna Mucubaji und Pico Mucuñuque, etwa 15 km SE von Apartaderos, in Paramo-Vegetation, 3500 m, 8°45'N; 70°45'W, on lignum, 1989, K. & A. Kalb & López-Figueiras (hb. Kalb 27015); distr. Libertador, Pico Espejo, SE von Mérida, Loma Redonda, 4200 m, 8°35'N; 71°00'W, on mosses, 1989, K. & A. Kalb (hb. Kalb 34821, 34831–topotypes).

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REFERENCES

- Aptroot, A., Diederich, P., Sérusiaux, E. & Sipman, H. J. M. (1997) Lichens and lichenicolous fungi from New Guinea. *Bibliotheca Lichenologica* **64**: 1–220.
- Bungartz, F., A. Nordin & U. Grube (2007). *Buellia* De Not. In *Lichen Flora of the Greater Sonoran Desert Region*, Volume 3 (T. H. Nash III, B. D. Ryan, P. Diederich, C. Gries & F. Bungartz, eds): 113–179. Tempe, AZ: Lichens Unlimited.
- Elix, J. A., Giralt, M. & Wardlaw, J. H. (2003) New chloro-depsides from the lichen *Dimelaena radiata*. *Bibliotheca Lichenologica* **86**: 1–7.
- Etayo, J. & Marbach, B. (2003) *Hafellia alisioae* and *H. gomerana* (lichenized Ascomycetes, Physciaceae), two new species from the Canary Islands, with a key to all known corticolous species. *Lichenologist* **35**: 369–375.
- Gams, W. (2004) Report of the Committee for Fungi: 11. *Taxon* **53**: 1067–1069.
- Giralt, M. (2001) The lichen genera *Rinodina* and *Rinodinella* (lichenized Ascomycetes, Physciaceae) in the Iberian Peninsula. *Bibliotheca Lichenologica* **79**: 1–160.
- Giralt, M., Barbero, M. & Elix, J. A. (2002a) Notes on some corticolous and lignicolous *Buellia* species from the Iberian Peninsula. *Lichenologist* **32**: 105–128.
- Giralt, M., Etayo, J. & van den Boom, P. P. G. (2002b) *Buellia laurocanariensis*, a new species from the Canary Islands. *Lichenologist* **34**: 203–206.
- Giralt, M., Kalb, K. & Elix, J. A. (2010) *Rinodina fuscosidiata*, a new muscicolous, isidiate species from Venezuela. *Lichenologist* **42**: 1–4.
- Harris, R. C. (1988) *Buellia* in North America and central Florida or the virtues and rewards of collections. *Evansia* **5**: 37–45.
- Imshaug, H. A. (1955) The lichen genus *Buellia* in the West Indies. *Farlowia* **4**: 473–512.
- Inoue, M. (1993) *Buellia subfrigida* sp. nov. (Lichens, Buelliaceae) from Lützow-Holm Bay Area and Prince Olav Coast, East Antarctica. The asexual sorediate species forming a species pair with *B. frigida* Darb. *Nankyoku Shiryô (Antarctic Record)* **37**: 19–23.
- Kalb, K. (2004) New or otherwise interesting lichens II. *Bibliotheca Lichenologica* **88**: 301–329.
- Marbach, B. (2000) Corticole und lignicole Arten der Flechtengattung *Buellia* sensu lato in den Subtropen und Tropen. *Bibliotheca Lichenologica* **74**: 1–384.
- Nordin, A. (1996) *Buellia* species (Physciaceae) with pluriseptate spores in Norden. *Symbolae Botanicae Upsalienses* **32**: 195–208.
- Nordin, A. (2000) Taxonomy and phylogeny of *Buellia* species with pluriseptate spores (Lecanorales, Ascomycotina). *Acta Universitatis Upsalienses* **33**: 1–117.
- Nordin, A. (2004) New species in *Tetramelas*. *Lichenologist* **36**: 355–359.
- Nordin, A. & Tibell, L. (2005) Additional species in *Tetramelas*. *Lichenologist* **37**: 491–498.
- Øvstedal, D. O. & Lewis Smith, R. I. (2001) *The lichens of Antarctica and South Georgia. A Guide to Their Identification and Ecology*. Cambridge: Cambridge University Press.
- Rambold, G., Mayrhofer, H. & Matzer, M. (1994) On the ascus types in the Physciaceae (Lecanorales). *Plant Systematics and Evolution* **192**: 31–40.
- Sheard, J. W. (1992) The lichenized ascomycete genus *Hafellia* in North America. *Bryologist* **95**: 79–87.
- Thor, G. & Muhr, L.E. (1991) *Buellia violaceofusca*, a new lichen from Sweden. *Lichenologist* **23**: 11–13.
- Tønsgberg, T. (1992) The sorediate and isidiate, corticolous, crustose lichens in Norway. *Sommerfeltia* **14**: 1–331.
- Vobis, B. (1980) Bau und Entwicklung der Flechtenpseudonidien und ihrer Conidien. *Bibliotheca Lichenologica* **14**: 1–141.

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