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Buellia rhizocarpica, a new corticolous species from Mexico

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Abstract: *Buellia rhizocarpica* is described from Mexico. This corticolous species is characterized by a yellowish, granulose thallus, the presence of rhizocarpic acid and an unknown pulvinic acid derivative, apothecia containing large amounts of *micromera*-green together with yellow crystals which react K+ pinkish and by the presence of very small, *Buellia*-type ascospores. It grows in a well-preserved *Pinus hartwegii* forest at *c*. 4000 m altitude at the base of the volcano Popocatepetl.

Key words: Lecanoromycetes, lichenized fungi, new species, North America, *Physciaceae*, taxonomy

Introduction

In November 2008, a team of Spanish lichenologists and Mexican and Spanish glaciologists began to study the Transmexican Volcanic Belt (TVB). It lies between 19°–21° N latitude, forming a nearly continuous belt from the Gulf of Mexico to the Pacific coast along fault systems oriented mainly along a WNW–ESE direction. It has been recognized as having distinct geological and biological features which make it a unique natural region.

This first lichenological expedition was centred in the Izta-Popocatepetl National Park, also known as Izta-Popo or PNIP. It was founded in 1935, but in 1948 the boundaries were expanded to include those regions above 3600 m, with a total area of 25·7 ha. PNIP is the southern part of the Mexican Sierra Nevada, and it is located just 60 km south of Mexico D.F. where the states Méjico, Puebla and Morelos meet. The geomorphological variety, climate and vegetation are responsible for the high plant diversity (more than 1000 species). Today the park is considered an important water resource and the old forests are making a good recovery.

Our goals included the study of the lichens and lichenicolous fungi of this region as well as lichenometric studies in the higher glaciers (Iztaccíhuatl, at 5240 m and Popocatepetl, at 5480 m). The present study is a contribution to the knowledge of this interesting, lichenologically unknown region.

Material and Methods

This study was based on herbarium material from the private herbaria of the second author (J. Etayo). 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 in material mounted in water at ×1000 magnification. Mean value (M) and standard deviation (SD) were calculated and the results are given as (minimum value observed) M ± SD (maximum value observed). M, SD and *n* (the total number of ascospores measured) are given within parentheses. The terminology used for the proper excipulum- and ascospore-types follows Bungartz *et al.* (2007), for the asci Rambold *et al*. (1994) and for the ascospore ontogeny Giralt (2001).

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

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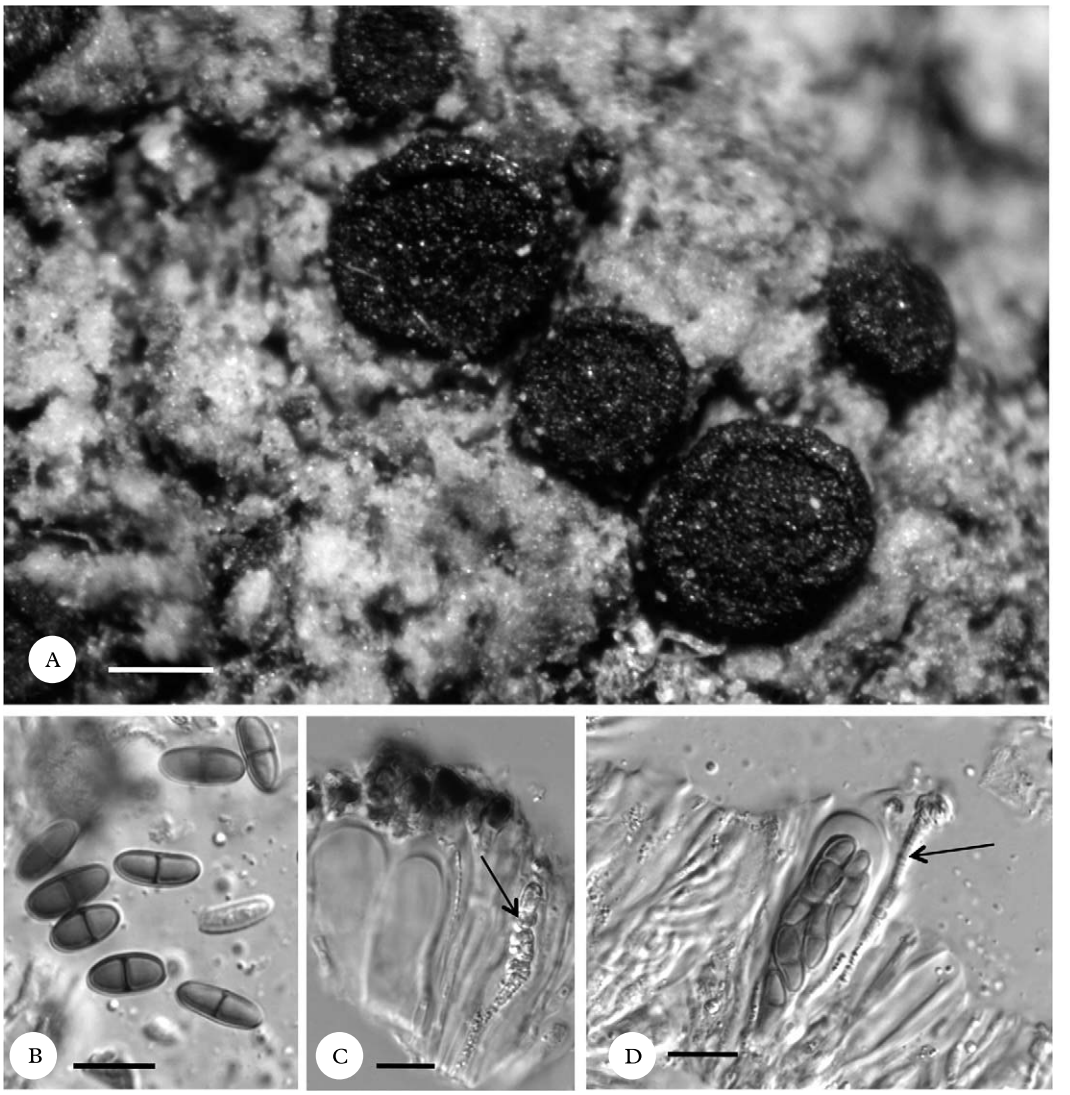

FIG. 1: *Buellia rhizocarpica* (holotype). A, habitus; B, ascospores; C & D, hymenium with asci, paraphyses and crystal clusters (arrows). Scales: A = 100 μm; B, C & D = 10 μm.

The Species

Buellia rhizocarpica Etayo, Giralt & Elix sp. nov.

MycoBank No.: 516788

Buellia schaereri De Not similis sed in thallo acidum rhizocarpicum et pulvinicum continens; hymenium flavum quia crystalles K+ rosei et ascosporae maiores (9–)10–12(–14) × (3–)3–4·5(–6) μm.

Typus: Mexico, from Refugio de Pocatépetl to repetidor, on old *Pinus hartwegii*, 3950 m, 19°03′39″N, 98°37′57″W, 2 November 2008, *J. Etayo* (MEXU—holotypus; BCN, hb. *Etayo* 24882—isotypi).

(Fig. 1)

Thallus epiphloeodic, ±continuous, covering wide areas, indeterminate, yellowish green, yellowish orange or yellowish grey; composed of granules 0·1–0·5 mm diam. (Fig. 1A) covered by a gelatinous, hyaline

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cortex intermixed with dead algal cells. Alga chlorococcoid, 10–15(–18) µm diam. with oil droplets, intermixed with hyphae and many small yellow crystals soluble in K. Medulla I−.

Apothecia lecideine, adnate or rarely sessile, black, (0·2–)0·3–0·4(–0·5) mm diam., abundant, confluent. *Proper margin* thin, usually persistent. *Disc* plane to subconvex or rarely convex, epruinose (Fig. 1A). *Proper excipulum aethalea*-type, blackish green (*micromera*-green), N+ blackish, K+ yellowish green, KC+ dark blue-green to blackish. *Hymenium* hyaline, 60–80 µm high, with many small yellow crystals forming clusters (Fig. 1C & D) which dissolve in K to give a pinkish solution; epihymenium dark brown to olivaceous black (*micromera*-green). *Hypothecium* 150 µm deep, dark brown, upper part aeruginose (*micromera*-green). *Paraphyses* very thin, up to 1 µm wide; apical cells capitate, 2–4 µm wide, olivaceous. *Asci* 8-spored, *Bacidia*-type. *Ascospores* pale brown, *Buellia*-type, (9–)10–12(–14) × (3–)3·5–4·5(–6) µm [M =11·1; 4·1 µm; SD 1·1; 0·5 µm; n = 70], walls very thin, smooth at ×1000, ontogeny of type A (Fig. 1B & D).

Conidia short bacilliform to almost globose, 2–4·5 × 1·5–2 µm.

Chemistry. Thallus K+ purple; C+ rose, KC+ pale purple, Pd−, UV+ dark orange. Atranorin [minor], rhizocarpic acid [major], epanorin [minor], conrhizocarpic acid [minor], gyrophoric acid [minor], alectorialic acid [minor], unknown pulvinic acid derivative [major].

Ecology and distribution. At present *B. rhizocarpica* is known only from the type locality, at the base of the volcano Popocatepetl in Central Mexico where it grows on the bark of *Pinus hartwegii* Lindl. in a well-preserved *P. hartwegii* forest with a rich epiphytic lichen flora. Accompanying species included several large foliose thalli of *Hypogymnia bitteri* (Lynge) Ahti, *Pseudevernia consocians* (Vain.) Hale & W. Culb, *P. intensa* (Nyl.) Hale & W. Culb., *Punctelia* aff. *subrudecta* (Nyl.) Krog and *Tuchermannopsis platiphylla* (Tuck.) Hale. Other crustose lichens associated with *B. rhizocarpica* included *Candelariella* aff. *efflorescens* R. C. Harris & Buck, *Cyphelium tigillare* (Ach.) Ach., *Ochrolechia* cf. *parella* (L.) A. Massal., *Pertusaria* sp., *Pycnora xanthococca* (Sommerf.) Hafellner, *Pyrrhospora* sp. and *Scoliciosporum chlorococcum* (Graewe ex Stenh.) Vězda.

Observations. *Buellia rhizocarpica* is characterized by its granulose, yellowish thallus containing rhizocarpic acid and an unknown pulvinic acid derivative as major secondary metabolites, apothecia containing the pigment *micromera*-green in the proper excipulum, epihymenium and hypothecium, a hymenium interspersed with abundant, small yellow crystals which react K+ pinkish and by small *Buellia*-type ascospores, with pale, thin, smooth walls.

Among all the *Buellia* s. lat. species hitherto described only *B. schaereri* De Not. has such small ascospores. However, *B. schaereri* has a thin, greyish to inconspicuous thallus without secondary metabolites or containing only atranorin (Marbach 2000, sub. *Amandinea endachroa* (Malme) Marbach; Bungartz *et al*. 2007), smaller apothecia (up to 0·2–0·3 mm diam.), significantly smaller ascospores (M: 8·4 × 3·9 µm), a hymenium without crystals, and a brown to brown-olivaceous proper excipulum, epihymenium and hypothecium containing low concentrations of the *micromera*-green pigment.

According to Obermayer *et al*. (2004), rhizocarpic acid is known in the *Physciaceae* only from *Dermatiscum thunbergii* (Ach.) Nyl. and *Buellia centralis* H. Magn. As rhizocarpic acid was only known from one species of *Buellia* s. lat., we considered the possibility that *B. rhizocarpica* could be parasitic on a yellow epiphytic lichen thallus. The thalline granules of *B. rhizocarpica* resemble those of some species of *Candelariella* Müll. Arg., a genus known to contain pulvinic acid and calycin, but which lacks rhizocarpic acid (Geyer 1985). Another chemically similar, yellow genus is *Chrysothrix* Mont. It normally contains pulvinic acid derivatives and some species produce rhizocarpic acid, including *C. chrysophthalma* (P. James) P. James & J. R. Laundon and *C. flavovirens* Tønsberg.

However, the thalli of these two species are clearly different, with the former being entirely immersed (endophloeodic) and the second uniformly sorediate, with soredia up to 0·02–0·025 mm diam. (Tønsberg 1994; Fletcher & Purvis 2009).

A further important reason for considering that the yellowish thallus actually belongs to *B. rhizocarpica* rather than to a host thallus, is the fact that the crystals which form clusters within the thallus are also present in large quantities in the hymenium, intermixed with the paraphyses.

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