The Lichenologist **47**(2): 131–136 © British Lichen Society, 2015
doi:10.1017/S0024282914000607

A world key to species of the genus *Bactrospora* (*Roccellaceae*) with a new species from Brazil

Priscylla Nayara Bezerra SOBREIRA, André APTROOT and Marcela Eugenia da Silva CÁCERES

Abstract: The new corticolous lichen species *Bactrospora angularis* is described from Brazil. It has apothecia that are usually irregular in outline and transversely (19–)28–35-septate, filiform ascospores (85–)120–150 × 5–7 μm with some constrictions. A revised world key is given to all currently known species of *Bactrospora*.

Key words: *Arthoniales*, Brejo de Altitude, corticolous, lichens, Pernambuco

Accepted for publication 10 *October* 2014

Introduction

Bactrospora is a widespread but seldom abundant genus of the *Roccellaceae*, occurring usually corticolous, equally in tropical and temperate regions, in the latter often on the sheltered or overhanging side of trees. Species of this genus have black, sessile, round apothecia with filiform ascospores, usually without gel binding the paraphysoids. The thallus is usually inapparent or poorly developed, and the genus is often overlooked or not collected by lichenologists who mistake it for non-lichenized fungi.

So far 30 species of *Bactrospora* are known, 20 of which were treated in the revision of the genus by Egea & Torrente (1993), the others described in subsequent papers (Egea & Torrente 1995; Egea *et al.* 1997; Kantvilas 2004; Lendemer 2004; Ponzetti & McCune 2006; Sparrius *et al.* 2006; Aptroot *et al.* 2007; Berger & Aptroot 2008). Many species are known from one country only, but the known ranges of some species have expanded recently when additional reports were published (e.g. notably from Brazil by Cáceres 2007). Interestingly, endemics occur in very different biomes ranging from temperate rainforest in Tasmania to dry coasts in Chile and tropical rainforest in Malaysia or Brazil.

During studies on lichen ecology and diversity by the first author in mountain forest in Pernambuco State in the north of Brazil, an undescribed species was encountered which is described below. Because many new species have been recently described in the genus, making the key in Egea & Torrente (1993) increasingly incomplete, an artificial world key to all currently known species of *Bactrospora* is given here together with their known distribution ranges. We studied material of the majority of the known species.

The new species was found in Caruaru, one of the few places with mountain forest in the rather lowland state of Pernambuco. The lichens of these mountain forests, called Brejo de Altitude and part of the former more extensive Atlantic Rainforest biome (Thomas & Barbosa 2008), are not yet well studied. The only lichen records from Brejo de Altitude are those made by Cáceres (2007).

P. N. B. Sobreira: Departamento de Micologia, Universidade Federal de Pernambuco, CEP: 50670-901, Recife, Pernambuco, Brazil.
A. Aptroot (corresponding author): ABL Herbarium, G. v. d. Veenstraat 107, NL-3762 XK Soest, The Netherlands. Email: andreaptroot@gmail.com
M. E. S. Cáceres: Departamento de Biociências, Universidade Federal de Sergipe, CEP: 49500-000, Itabaiana, Sergipe, Brazil.

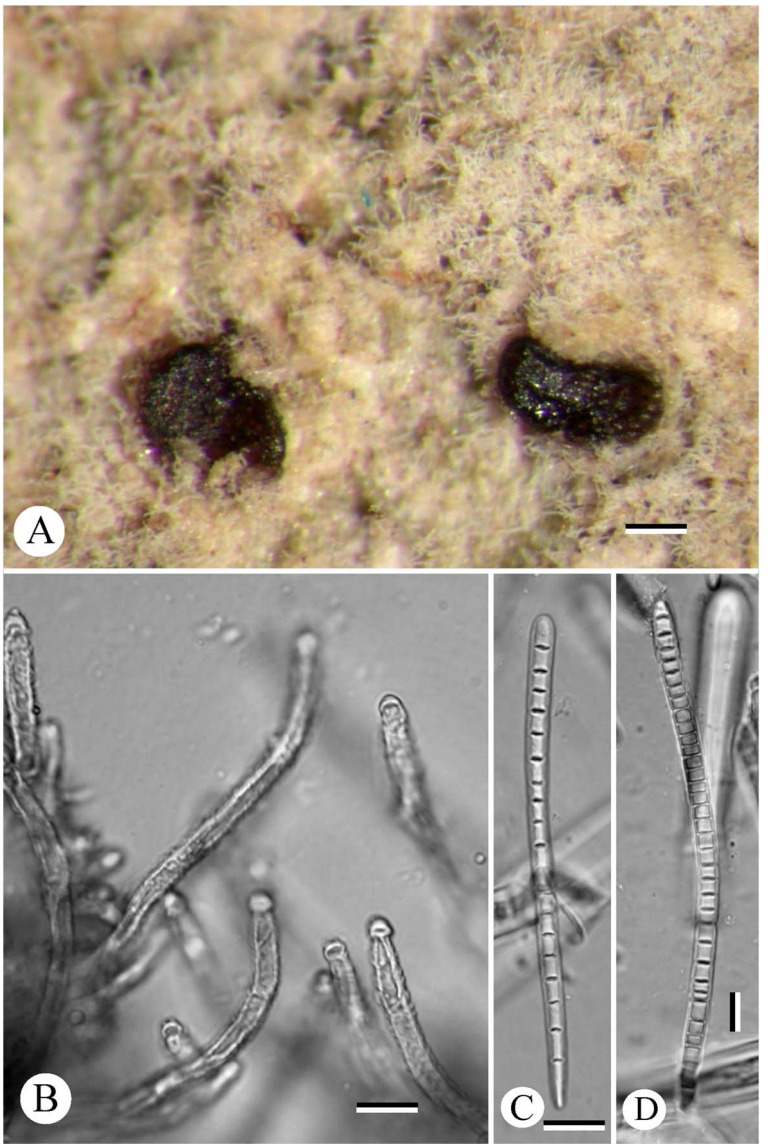

FIG. 1. *Bactrospora angularis*, holotype. A, habitus; B, superficial filaments of a trentepohlioid alga; C, young ascospore; D, mature ascospore. Scales: A=0·1 mm; B-D=10 μm. In colour online.

Material and Methods

Identification and descriptive work was carried out in Itabaiana, Universidade Federal de Sergipe, using a Leica EZ4 stereomicroscope and a Leica DM500 compound microscope, and also in Soest using an Olympus SZX7 stereomicroscope and an Olympus BX50 compound microscope with interference contrast, connected to a Nikon Coolpix digital camera. Sections were mounted in tap water, in which all measurements were also taken. The specimens from this study are preserved in URM. The chemistry of the type specimen was investigated by thin-layer chromatography (TLC) using solvent C (Orange *et al.* 2001). Iodine reactions (IKI/KOH) were observed by applying IKI (undiluted Lugol's) after pretreatment with 10% KOH.

https://doi.org/10.1017/S0024282914000607 Published online by Cambridge University Press

The New Species

Bactrospora angularis Sobreira, Aptroot & M. Cáceres sp. nov.

MycoBank No.: MB 811036

Corticolous *Bactrospora* with apothecia that usually have an irregular outline and transversely (19–)28–35-septate, filiform ascospores of (85–)120–150 × 5–7 μm, with some constrictions.

Type: Brazil, Pernambuco, Caruaru, Brejo dos Cavalos, Velha Joana trail, 8°22'S, 36°02'W, on bark of tree, 877 m alt., 14 November 2013, *P. N. B. Sobreira* 345 (URM—holotype).

(Fig. 1)

Thallus crustose, not corticate, slightly shiny, greyish green, closely following the bark surface, covered by superficial trentepohlioid algal filaments which may be symbiotic or epiphytic, surrounded by a black prothallus line. Superficial trentepohlioid filaments hyaline, septate, unbranched, 55–120 × 4·5–5·5 μm, wall very rough; tip with thickened wall; trentepohlioid cells inside the thallus ellipsoid.

Apothecia numerous, dispersed, sessile, round to usually irregular in outline, occasionally elongate, 0·2–0·5 mm diam.; *disc* flat, chocolate brown, dull, margin chocolate brown, *c.* 0·1 mm wide, not or only slightly raised above the disc. *Excipulum* carbonaceous, IKI/KOH–, at the sides up to *c.* 100 μm thick. *Hymenium* not inspersed, 200–250 μm high; *subhymenium* IKI/KOH–; *paraphyses* little branched, apices not swollen. *Asci* 180–200 × 18–26 μm. *Ascospores* 8 per ascus, hyaline, filiform, (19–)28–35-septate, (85–)120–150 × 5–7 μm, cells generally wider than long (except when young), each ascospore with a few constrictions, lower end rather pointed, upper end rounded.

Pycnidia not observed.

Chemistry. No spot reactions. TLC: no substances.

Ecology and distribution. On smooth bark of trees in Brejo de Altitude forest. Known only from Brazil.

Discussion. It is difficult to ascertain whether the omnipresent superficial trentepohlioid filaments are symbiotic or epiphytic. A similar case is *Bactrospora incana* Egea & Torrente, the type of which (we studied a large isotype in M) is also covered by trentepohlioid filaments. Symbiotic superficial filamentous trentepohlioid algae are rare, but known in *e.g. Microtheliopsis uleana* Müll. Arg.. In internal characters the new species is closest to *B. pleistophragmia* (Nyl.) Egea & Torrente, which differs by the positive reaction in IKI after pretreatment with KOH.

World key to the species of *Bactrospora*

This key records key characters, as well as ascus and ascospore measurements (except when ascospores soon break into part spores), world distribution and substratum if not bark. Synonymous names in *Bactrospora* are also mentioned for cross reference.

1 Ascospores muriform, 60–95 × 8–12 μm; asci 100–120 × 35–45 μm. Africa (e.g. Seychelles), Asia (e.g. Thailand, New Guinea) and Australasia (New Caledonia, New Zealand & Tasmania) **B. metabola** (Nyl.) Egea & Torrente
Ascospores transversely septate only 2

2(1) Ascospores breaking into part spores inside the asci 3
Ascospores not breaking into part spores or breaking only outside the asci . . . 7

3(2) Excipulum and subhymenium IKI/KOH–; asci 180–240 × 8–10 μm. On wood in Namibia . . . . . **B. namibiensis** Egea, *et al.*
At least subhymenium IKI/KOH+ blue; asci shorter 4

https://doi.org/10.1017/S0024282914000607 Published online by Cambridge University Press

4(3) Excipulum and subhymenium IKI/KOH+ deep blue; ascospores ± straight in asci; cells of ascospores 3–8 × (1–)2–3 μm, cylindrical 5
Excipulum IKI/KOH–; subhymenium IKI/KOH+ pale blue; ascospores usually spirally arranged in asci; cells of ascospores 2–4(–5) × 2–3 μm, roundish to cylindrical 6

5(4) Ascomata 0·2–0·7 mm diam. Europe . . . . . **B. dryina** (Ach.) A. Massal.
Ascomata 0·1–0·2 mm diam. Thailand . . . . . **B. subdryina** Sparrius, *et al.*

6(4) Asci 70–90 × 9–11 μm; cells of ascospores roundish to cylindrical. Europe . . . . . **B. corticola** (Fr.) Almq.
Asci 90–135 × 10–12 μm; cells of ascospores roundish. California. . . . . **B. spiralis** Egea & Torrente

7(2) Ascospores without constrictions 8
Ascospores with one or more constrictions at some septa 20

8(7) Hymenium with gel, inspersed; asci 80–100 × 12–15 μm; ascospores (55–)65–80 × 4–5 μm. Thailand . . . . . **B. inspersa** Aptroot
Hymenium not inspersed 9

9(8) Excipulum IKI/KOH+ deep blue; subhymenium IKI/KOH+ pale blue, soon becoming brown-yellow; asci 60–110 × 11–15 μm; ascospores 67–80 × 2·5–3·5 μm. Alaska & Washington . . . **B. cascadensis** Ponzetti & McCune
Either excipulum and subhymenium IKI/KOH+ deep blue or excipulum IKI/KOH– and subhymenium IKI/KOH+ pale blue. 10

10(9) Excipulum IKI/KOH–; subhymenium IKI/KOH+ pale blue 11
Excipulum and subhymenium IKI/KOH+ deep blue 15

11(10) Excipulum thin, up to 25 μm wide, open below the subhymenium; asci 65–80 × 11–13(–14) μm; ascospores 40–60 × 2–4 μm, 10–16-septate. Tasmania . . . . . **B. arthonioides** Egea & Torrente
Excipulum thick, more than 25 μm wide, closed or open below the subhymenium; asci longer; ascospores 12–26-septate 12

12(11) Pycnidia present; conidia filiform, often curved, 8–12 × 0·8–1·0 μm; asci 70–90 × 12–20 μm; ascospores (50–)55–73(–86) × 2·0–3·0(–3·5) μm. Tasmania . . . . . **B. paludicola** Kantvilas
Pycnidia absent 13

13(12) Excipulum and/or pseudoepithecium without granules; asci 90–l30 × 10–12 μm; ascospores 65–95 × 2·0–2·5(–3·0) μm, 14–23–septate. Chile, Galapagos, also on rock. . . . . **B. acicularis** (C. W. Dodge) Egea & Torrente
Excipulum and/or pseudoepithecium with yellowish to reddish granules, best seen in microscopic section, but sometimes visible macroscopically as yellow pruina. 14

14(13) Margin of ascomata smooth; asci 70–95(–110) × 9–12 μm; ascospores 47–85(–90) × 2·0–3·0(–3·5) μm, 12–20–septate. Pantropical (e.g. Central America, Caribbean Islands, Brazil, India, Seychelles, Thailand, Hong Kong, Taiwan) . . . . . **B. myriadea** (Fée) Egea & Torrente
(synonym: *B. nematospora* R. C. Harris)
Some ascomata with margin denticulate-stellate; asci 105–140(–150) × 10–12 μm; ascospores 70–130 × 2·0–2·5(–3·0) μm, 18–26–septate. Caribbean Islands, Florida, Galapagos. . . . . **B. denticulata** (Vain.) Egea & Torrente

https://doi.org/10.1017/S0024282914000607 Published online by Cambridge University Press

15(10) Apothecia yellow pruinose; asci 60–75 × 6–8 μm; ascospores 45–55 × 1·5–2·5 μm. Bermuda . . . . . **B. flavopruinosa** F. Berger & Aptroot
Apothecia not pruinose; ascospores wider 16

16(15) Asci 150–200 × 15–20 μm; ascospores spirally arranged 80–100 × 2–3 μm. Thailand. . . . . **B. perspiralis** Sparrius *et al.*
Asci shorter; ascospores straight 17

17(16) Asci (80–)90–135 × 11–13(–14) μm; ascospores 60–95 × 3–4 μm, up to 17-septate. Europe, northern Africa, California, Canada. . . . . **B. patellarioides** (Nyl.) Almq.
Asci less than 90(–110) μm; ascospores less than 60(–75) μm. 18

18(17) Asci 55–65 × 12·5–15·0 μm; ascospores 45–65 × (3·0–)3·5–4·0 μm, (10–)14–24-septate. Canada, Norway, Sweden . . . . . **B. brodoi** Egea & Torrente
Asci up to 13 μm wide; ascospores up to 13-septate 19

19(18) Ascomata 0·2–0·9 mm, sessile with a constricted base; excipulum 80–120 μm at the base; asci 70–90(–110) × 10–12 μm; ascospores (30–)35–60(–66) × 3·0–4·0(–4·5) μm, 3–9(–13)-septate. Macaronesia, northern Africa, Spain. . . . . **B. thyrsodes** (Stirt.) Llop & van den Boom
(synonym *B. carneopallida* Egea & Torrente)
Ascomata 0·2–0·5 mm, immersed to adnate; excipulum up to 75 μm; asci 55–75(–80) × 11–13 μm; ascospores 33–56(–65) × (2·5–)3·0–3·5 μm, 5–9(–12)-septate. Florida. . . . . **B. carolinensis** (Ellis & Everh.) R. C. Harris
(synonym *B. mesospora* R. C. Harris)

20(7) Ascospore cells mostly longer than wide 21
Ascospore cells mostly wider than long 24

21(20) Ascospores 3–7-septate 22
Ascospores 7–13-septate 23

22(21) Excipulum open below or a thin brown hypothecium; asci 60–75 × 18–21 μm; ascospores 28–42 × 4.5–6.5 μm, 3-7-septate. Venezuela. . . . . **B. incana** Egea & Torrente
Excipulum a thick brown stipe; asci (45−)50−70 × 10–12 μm; ascospores 20–32(−35) × 3.0–3.5(−4.0) μm, 3–6(−7)-septate. Florida, Jamaica . . . . . **B. brevispora** R. C. Harris

23(21) Asci 65–92 × 12–15 μm; ascospores 33–54 × 3·0–3·5(–4·0) μm, 7–12-septate. Malaysia. . . . . **B. leptoloma** (Müll. Arg.) Egea & Torrente
Asci 60–90 × 16–23 μm; ascospores 40–65 × (3·5–)4·0–5·0 μm, 8–13-septate. Ghana, Caribbean Islands, Brazil . . . . . **B. jenikii** (Vězda) Egea & Torrente

24(20) Apothecia usually with an irregular outline; excipulum and subhymenium IKI/KOH–; asci 180–220 × 18–22 μm; ascospores 85–120 × 5–7 μm, 20–30-septate. Brazil . . . . . **B. angularis** Sobreira *et al.*
Apothecia round; at least subhymenium IKI/KOH+ reddish, pale or deep blue 25

25(24) Excipulum IKI/KOH–; subhymenium IKI/KOH+ reddish or pale blue 26
Excipulum and subhymenium IKI/KOH+ deep blue 27

26(25) Asci (100–)110–140 × 13–18 μm; ascospores 70–100(–110) × 3·0–4·5(–5·0) μm, 19–30-septate. Chile. . . . . **B. intermedia** Egea & Torrente
Asci 150–200 × 20–25 μm; ascospores 110–150 × 4·5–6·0(–7·0) μm, 35–40-septate. New Caledonia, Hawaii. . . . . **B. pleistophragmia** (Nyl.) Räsänen

27(25) Thallus C+ red, with gyrophoric acid; asci 140–200 × 28–36 μm; ascospores 90–130 × 6–10 μm, 21–36-septate. Tasmania . . . . . **B. granularis** Kantvilas
Thallus C– 28

28(27) Hymenium with gel in the upper part; apothecia subglobose to tuberculate; asci 110–145 × 15–20 μm; ascospores 70–96 × 3–6 μm, 22–30-septate. Tasmania . . . . . **B. micareoides** Kantvilas
Hymenium without gel; apothecia flat. 29

29(28) Asci 110–150 × 23–33 μm; ascospores (60–)70–98 × (6–)7–10 μm, (18–)20–28-septate. Florida, Puerto Rico, Brazil.. . . . **B. lamprospora** (Nyl.) Lendemer (synonym *B. macrospora* R. C. Harris)
Asci and ascospores narrower 30

30(29) Asci 125–160 × 15–17 μm; ascospores (80–)110–130 × 4–5 μm, up to 45-septate. Norway, British Isles, Macaronesia, Tasmania. . . . . .**B. homalotropa** (Nyl.) Egea & Torrente
Asci 160–200 × 15–22 μm; ascospores 115–175 × 4·0–6·0(–6·5) μm, 40–45-septate. New Zealand . . . . **B. pleistophragmoides** (Nyl.) Egea & Torrente

PNBS thanks the Fundação de Amparo à Ciência e Tecnologia do Estado de Pernambuco (FACEPE) for a Masters scholarship. AA thanks the Stichting Hugo de Vries-Fonds for travel support. Damien Ertz is thanked for discussions on species characters in the genus and for making the collections in BR avaliable for study by AA. MESC is grateful to CNPq (Conselho Nacional de Desenvolvimento Científico e Tecnológico) for a research grant (Processo 311706/2012-6).

References

Aptroot, A., Saipunkaew, W., Sipman, H. J. M., Sparrius, L. B. & Wolseley, P. A. (2007) New lichens from Thailand, mainly microlichens from Chiang Mai. *Fungal Diversity* **24:** 75–134.

Berger, F. & Aptroot, A. (2008) *Bactrospora flavopruinosa*, a new lichen species from Bermuda. *Lichenologist* **40:** 543–547.

Cáceres, M. E. S. (2007) Corticolous crustose and microfoliose lichens of northeastern Brazil. *Libri Botanici* **22:** 1–168.

Egea, J. M. & Torrente, P. (1993) The lichen genus *Bactrospora*. *Lichenologist* **25:** 211–255.

Egea, J. M. & Torrente, P. (1995) *Melampilidium metabolum* belongs in *Bactrospora*. *Mycotaxon* **53:** 57–61.

Egea, J. M., Sérusiaux, E., Torrente, P. & Wessels, D. (1997) Three new species of *Opegraphaceae* (lichens) from the Namib Desert. *Mycotaxon* **61:** 455–466.

Kantvilas, G. (2004) A contribution to the *Roccellaceae* in Tasmania: new species and notes on *Lecanactis* and allied genera. *Symbolae Botanicae Upsalienses* **34**(1): 183–203.

Lendemer, J. C. (2004) Changes and additions to the checklist of North American lichens. - I. *Mycotaxon* **89:** 255–257.

Orange, A., James, P. W. & White, F. J. (2001) *Microchemical Methods for the Identification of Lichens*. London: British Lichen Society.

Ponzetti, J. & McCune, B. (2006) A new species of *Bactrospora* from northwestern North America. *Bryologist* **109:** 85–88.

Sparrius, L. B., Saipunkaew, W., Wolseley, P. A. & Aptroot, A. (2006) New species of *Bactrospora, Enterographa, Graphidastra* and *Lecanographa* from northern Thailand and Vietnam. *Lichenologist* **38:** 27–36.

Thomas, W. W. & Barbosa, M. R. de V. (2008) Natural vegetation types in the Atlantic coastal forest of northeastern Brazil. *Memoirs of the New York Botanical Garden* **100:** 6–20.