

New species of *Arthoniales* from NE Brazil

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Abstract: The new species *Coniarthonia aurata* E. L. Lima, M. Cáceres & Aptroot, *Cresponea endosulphurea* A. A. Menezes, M. Cáceres & Aptroot, *Cryptothecia macrocephala* E. L. Lima, M. Cáceres & Aptroot, and *Synarthonia sarcographoides* Aptroot, A. A. Menezes, E. L. Lima & M. Cáceres are described from Caatinga vegetation in NE Brazil. They were found in the Chapada do Araripe in the state of Ceará and/or the Vale do Catimbau National Park in Pernambuco. *Coniarthonia aurata* has weakly organized, semiglobose apothecia with golden crystals, and on first impression looks like the anamorph of a *Tylophoron*. *Cresponea endosulphurea* has a pigment of the group of xantholepinones in the thallus. It is the first time that a substance from this group is reported from the *Arthoniales*. *Cryptothecia macrocephala* has strongly macrocephalic ascospores and contains psoromic acid in the thallus. *Synarthonia sarcographoides* is only the third species in this rarely found genus. It is characterized within the genus by muriform, brown ascospores, but it is assigned with hesitation to the genus. It is locally quite common.

Key words: Caatinga, Ceará, *Coniarthonia*, *Cresponea*, *Cryptothecia*, lichens, Pernambuco, *Synarthonia*, xantholepinone

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Introduction

The natural vegetation of the central part of NE Brazil consists mainly of the rather open Caatinga forest, which is interspersed with more closed forest enclaves at higher altitudes, such as islands of the coastal Atlantic rainforest (Thomas 2008). The lichen diversity of this biome is still largely unexplored (Cáceres 2007).

The epiphytic lichen flora in this whole area is dominated by crustose lichens, with

Graphis and *Polymeridium* as the most speciose genera. The *Arthoniales* are, together with *Ostropales* and *Trypetheliales*, among the main groups in terms of species number and abundance.

The order *Arthoniales* includes several families, with *c.* 60 genera and 1200 species in total (Ertz *et al.* 2009). Members of this group are an important component of the lichenized mycota in many types of forests, but mostly in tropical regions, where the diversity of corticolous and foliicolous species is high (Cáceres 2007; Ertz *et al.* 2009).

Species which were partly the same, and partly different, were found in the Vale do Catimbau National Park and the Chapada do Araripe, in NE Brazil. The Vale do Catimbau National Park is one of the most important reserves of the Caatinga biome in Brazil. It is a unique place, with an altitude ranging from 800 to 1100 m and with mostly dry and open vegetation, located *c.* 300 km west of the Atlantic coast. The Chapada do Araripe includes a National Forest reserve,

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and is an isolated table mountain in Ceará State, further west than Vale do Catimbau, in the middle of the Brazilian semi-arid region. The Araripe plateau, at an altitude of c. 900 m, comprises at least four different vegetation types, including rainforest patches but mostly areas of Caatinga, with Cerrado and Cerradão forests (Sampaio *et al.* 1981).

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, on which all measurements were taken. The specimens from this study are preserved in ISE. The chemistry of the type specimens was investigated by thin-layer chromatography (TLC) using solvent A (Orange *et al.* 2001).

The Species

Coniarthonia aurata E. L. Lima, M. Cáceres & Aptroot sp. nov.

Mycobank No.: MB 802589

Coniarthonia with mustard yellow soralium-like structures that contain clavate asci 60–70 × 23–28 µm and hyaline 1-septate ascospores 20–28 × 7–11 µm.

Type: Brazil, Pernambuco, Buíque, Vale do Catimbau National Park, on bark of tree, c. 900 m alt., 4 February 2012, E. L. Lima 684 (ISE—holotype).

(Fig. 1)

Thallus crustose, not corticate, dull, nearly white, very thin and closely following the bark surface, without prothallus. *Algae* trentepohlioid.

Ascigerous structures 0.2–0.4 mm diam., sessile, soralium-like, mustard yellow, hemispherical. *Asci* clavate, 60–70 × 23–28 µm, wall in upper half thickened. *Hamathecium* of anastomosing, curled hyphae, incrustated with golden crystals. *Ascospores* 8 per ascus, hyaline, 1-septate, clavate, 20–28 × 7–11 µm, upper cell much larger than the lower cell, slightly constricted around the septum, without perispore, upper cell rounded, lower cell pointed, wall very thin.

Pycnidia not observed.

Chemistry. Ascigerous structures UV–, C–, P–, K+ purple. TLC: anthraquinone.

Ecology and distribution. On smooth bark of trees in Caatinga forest. Known only from Brazil. It grows together with, for example, *Acanthothecis abaphoides* (Nyl.) Staiger & Kalb, *Chrysothrix xanthina* (Vain.) Kalb, *Dirinaria leopoldii* (Zahlbr.) D. D. Awasthi, *Glyphis scyphulifera* (Ach.) Staiger, *Graphis furcata* Fée, *Lecanora leprosa* Fée, *Phaeographis ventosa* Malme, and *Ramboldia haematites* (Fée) Kalb *et al.* It grows on moderately rain-exposed, not sheltered, bark.

Discussion. This species is assigned here rather schematically to the recently described small genus *Coniarthonia* (Grube 2001). It agrees in the hydrophobic ascomatal structures without much differentiation, the ascus shape and the ascospores. It also agrees in the presence of pigmented crystals in the ascoma, but differs by the mustard yellow rather than red colour of the crystals. The new species is remarkable because of the soralium-like structures that contain loose asci. It resembles a sterile *Tylophoron* in some respects, as it has the aspect of a whitish thallus with soralium-like spots, but differs by the presence of asci and the mustard yellow rather than nearly black colour of the soralium-like structures. It closely resembles the truly sorediate *Caloplaca lucifuga* G. Thor in colour and K-reaction, so it may contain the same anthraquinone. So far only six species are known in the genus *Coniarthonia* (Grube 2001). The new species is closest to *C. erythrocarpa* Grube, although this differs markedly in the red, elongated apothecia.

Cresponea endosulphurea A. A. Menezes, M. Cáceres & Aptroot sp. nov.

Mycobank No.: MB 801925

Cresponea with deep yellow medulla, reaction KOH+ orange due to the presence of a xantholepinone.

Type: Brazil, Ceará, Crato, Chapada do Araripe, on bark of tree, c. 800 m alt., May 2012, A. A. Menezes P8-A4-T-CE (ISE 15896—holotype).

(Fig. 2)

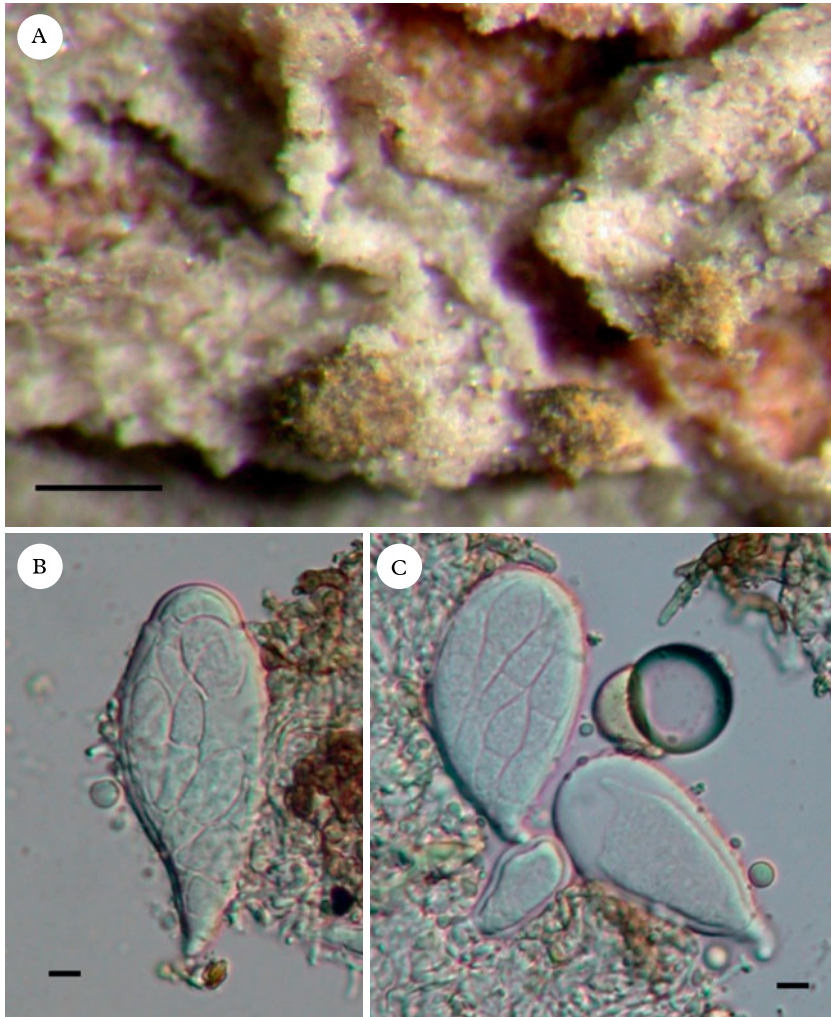


FIG. 1. *Coniarthonia aurata* (holotype). A, habitus; B & C, asci with ascospores. Scales: A = 0.5 mm; B & C = 5 μ m. In colour online.

Thallus crustose, corticate, a little shiny, green, thin and closely following the bark surface, with minute (c. 0.05 mm diam.) warts that occasionally break off revealing a deep yellow medulla, without prothallus. *Algae* trentepohlioid, 7–13 \times 10–15 μ m.

Apothecia 0.7–1.0 mm diam., rounded; *disc* bright orange pruinose; *margin* crenulated, c. 0.2 mm thick, glossy black, epruinose, raised above the disc. *Excipulum* black throughout, also below the hymenium. *Epihymenium* orange crystals. *Asci* cylindrico-

clavate. *Hamathecium* 60–80 μ m high, not interspersed. *Ascospores* 8 per ascus, hyaline, consistently 7-septate, narrowly fusiform, 37–43 \times 5–7 μ m, without perispore, lumina rounded.

Pycnidia not observed.

Chemistry. Medulla UV–, C–, P–, K+ orange; disc pruina K+ purple. TLC: a xantholepinone in the thallus.

Ecology and distribution. On smooth bark of trees in Caatinga forest. Known only from Brazil.

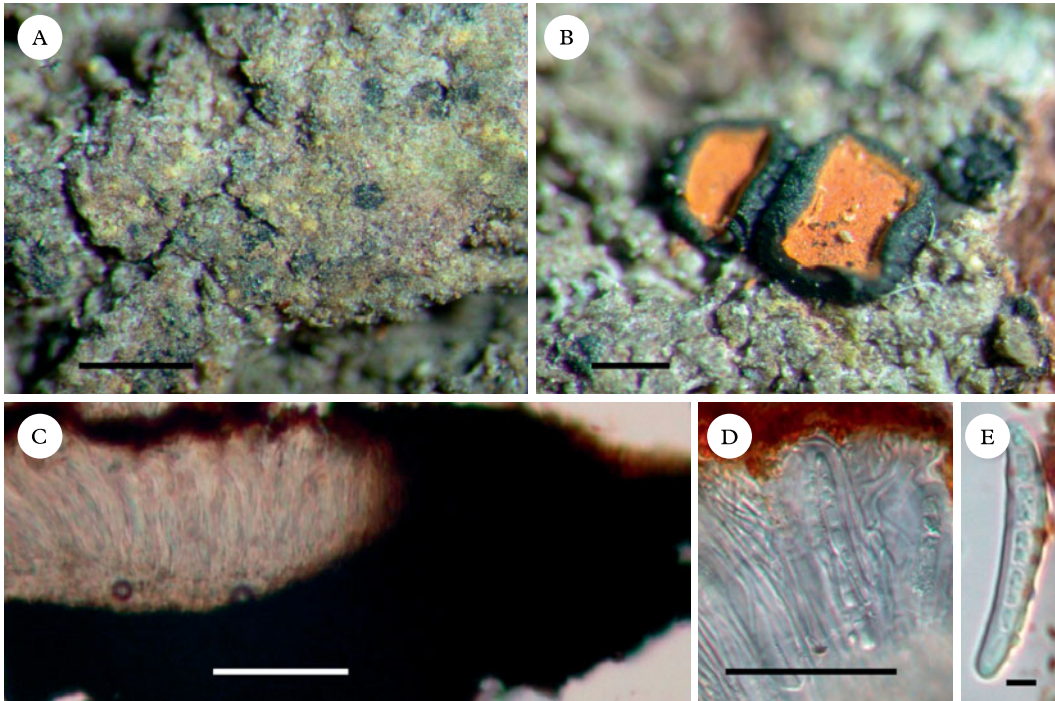


FIG. 2. *Cresponea sorediata* (holotype). A, thallus; B, apothecia; C, section through ascoma; D, hamathecium; E, ascospore. Scales: A & B = 0.5 mm; C & D = 50 μ m; E = 5 μ m. In colour online.

Discussion. This is the first *Cresponea* known with a pigmented thallus medulla (Egea & Torrente 1993). It is close to *Cresponea proximata* (Nyl.) Egea & Torrente, which differs by having a thallus without a coloured medulla, and by the smaller ascospores which are 25–38 μ m long (Egea & Torrente 1993). The medullary pigment is deep yellow and reacts orange with KOH, showing that it is a xantholepinone, a group of substances known only from a few lichen groups, viz. *Malmidea* and *Rinodina* [thiomelin, see Leuckert & Mayrhofer (1984), for description of the characteristics] and not yet from the *Arthoniales*. The orange pruina of the disc reacts K+ purple and is an anthraquinone.

***Cryptothecia macrocephala* E. L. Lima, M. Cáceres & Aptroot sp. nov.**

Mycobank No.: MB 802590

Cryptothecia with macrocephalic ascospores 45–50 \times 14–19 μ m and thallus with psoromic acid.

Type: Brazil, Pernambuco, Buíque, Vale do Catimbau National Park, on bark of tree, c. 900 m alt., 3 October 2011, E. L. Lima 139 (ISE—holotype).

(Fig. 3A & B)

Thallus crustose, cracked, not corticate, dull, pale ochraceous white, very thin and closely following the bark surface, surrounded by a brown prothallus line. *Alga* trentepohlioid.

Ascigerous structures rounded and flattened, 0.3–0.6 mm wide, partly IKI+ blue (around asci), mostly IKI+ reddish (hemiamyloid). **Asci** clavate, c. 90–120 \times 40–60 μ m. **Ascospores** 8 per ascus, hyaline, 7–9 \times 1–3-septate, ellipsoidal, 45–50 \times 14–19 μ m, with one deviating large upper end cell that occupies 1/3 to 1/4 of the ascospore (macrocephalic), without perispore, wall c. 1.5 μ m thick.

Pycnidia not observed.

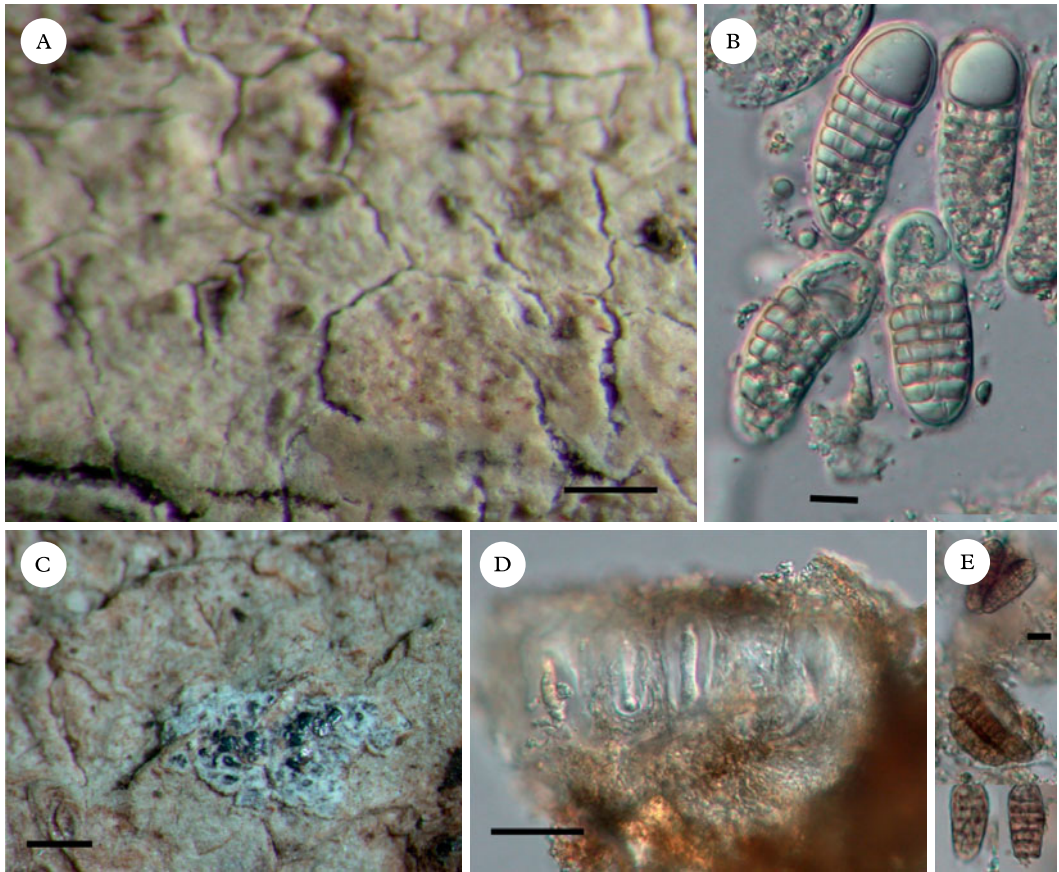


FIG. 3. A & B, *Cryptothecia macrocephala* (holotype). A, habitus; B, ascospores. C–E, *Synarthonia sarcographoides*, holotype. C, habitus; D, section through ascoma; E, ascospores. Scales: A & C = 0.5 mm; D = 50 μ m; B & E = 5 μ m. In colour online.

Chemistry. Thallus and ascigerous structures UV–, C–, P+ yellow, K–. TLC: psoromic acid.

Ecology and distribution. On smooth bark of trees in Caatinga forest. Known only from Brazil. It grows together with *Polymeridium pleiomerellum* (Müll. Arg.) R. C. Harris.

Discussion. This species differs from all other described *Cryptothecia* species (Makhija & Patwardhan 1986, 1987, 1994; Thor 1997; Sparrius & Saipunkaew 2005; Lücking *et al.* 2006; Wolseley & Aptroot 2009; Lima *et al.* 2013) by the markedly macrocephalic asco-

spore septation. Macrocephalic ascospores are known, however, from two species in the closely related genus *Stirtonia* (Aptroot 2009), *viz.* *S. alba* Makhija & Patw and *S. santessonii* Makhija & Patw. The occurrence of this character in *Cryptothecia* is therefore not unexpected. *Stirtonia* species differ by the only transversely septate instead of muriform ascospores.

Additional specimens examined. **Brazil:** Pernambuco: same as the type, E. L. Lima 146 (ISE). Ceará: Crato, Chapada do Araripe, on bark of tree, c. 800 m alt., 2012, A. A. Menezes 238 (ISE).

**Synarthonia sarcographoides Aptroot,
A. A. Menezes, E. L. Lima & M. Cáceres
sp. nov.**

Mycobank No.: MB 801924

Synarthonia with black ascomata in white pseudostromata, and brown, broadly ellipsoid, muriform ascospores $20\text{--}22 \times 11.0\text{--}12.5 \mu\text{m}$.

Type: Brazil, Pernambuco, Buíque, Vale do Catimbaru National Park, on bark of tree, c. 900 m alt., 3 February 2012, E. L. Lima 333 (ISE—holotype).

(Fig. 3C–E)

Thallus crustose, not corticate, usually dull, pale green, very thin and closely following the bark surface, surrounded by a black prothallus. *Algae* trentepohlioid.

Ascomata c. 0.1 mm diam., round, black, white pruinose, aggregated in groups of 5–50 in white pseudostromata which are rounded to usually elongated and branched, and up to 2 mm diam. *Hymenium* hyaline, not interspersed; *paraphyses* c. 1 μm wide, frequently anastomosing; *epihymenium* c. 10 μm thick, formed of clustered paraphyses tips with brown incrustation; *hypothecium* dark brown, black in thick section. *Asci* clavate, with 8 ascospores, $35\text{--}45 \times 15\text{--}20 \mu\text{m}$, wall in upper half thickened. *Ascospores* brown, broadly ellipsoid to slightly clavate, muriform, $7 \times 1\text{--}2$ -septate, $20\text{--}22 \times 11.0\text{--}12.5 \mu\text{m}$, wall and septa thin, ends rounded.

Pycnidia not observed.

Chemistry. Thallus and ascomata UV[−], C[−], P[−], K[−]. TLC: three unidentified xanthenes (pale yellow-brown, UV⁺ yellowish at Rf 7, pale yellow, UV⁺ bluish at Rf 6 and pale yellow, UV⁺ greenish at Rf 5).

Ecology and distribution. On smooth bark of trees in Caatinga forest. Known only from Brazil.

Discussion. This new species is here tentatively assigned to the small genus *Synarthonia*, which is characterized by clavate asci, transversely septate ascospores and tiny ascomata aggregated in pseudostromata (Sparrius 2009). The organization of several ascomata in a pseudostroma makes it difficult to ascertain whether or not the pale marginal areas of the ascomata should be seen as ascomal tissue

(apothecium margins). They are interpreted here as sterile tissue. There are only two species known in the genus, which both differ from the new species by their transversely septate instead of muriform ascospores. The new species superficially resembles a *Sclerophyton*, but differs by the broad, symmetrical ascospores. The species is very frequent on at least one of the sites, but the ascomata are rarely fertile. All ascospores observed are brown.

Additional specimens seen. **Brazil:** Ceará: Crato, Chapada do Araripe, on bark of tree, c. 800 m alt., 2012, A. A. Menezes 086, 238, 524 (all ISE); v 2012, A. A. Menezes (ISE 15950, 15951, 15952, 15953, 15954); xi 2011, A. A. Menezes (ISE 8279 ISE).

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