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Brazilian Semi-Arid Ascomycetes III: New records of Dothideomycetes and Sordariomycetes

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With 5 figures

Abstract: This is the third paper in a series of articles reporting the diversity of Dothideomycetes and Sordariomycetes in the semi-arid region of Brazil. Two Dothideomycetes and three Sordariomycetes are reported in this study: *Annulatascus joannae* and *Kirschsteiniothelia lignicola* are new records for the New World, *Hilberina caudata* and *Saccardoella macrasca* are new records for South America and *Macrodiplodiopsis uniseptata* is a new record for Brazil. We provide illustrations, descriptions and discussions for all five species.

Key words: Caatinga, lignicolous Ascomycota, taxonomy.

Introduction

A survey of ascomycetes in three enclaves of Atlantic Forest in the Caatinga biome of Brazil was performed from 2011 to 2013, resulting in the collection of 460 specimens. The ongoing study of these specimens has already resulted in the descriptions of seven new species and a new genus (Almeida et al. 2014b), while new and interesting records were reported in Almeida et al. (2014a). In this paper we provide descriptions and illustrations for five additional records to add to the increasing knowledge of this group in Brazil.

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Materials and methods

Description of the study area and methods for the collection and morphological examination of specimens have been previously described (Almeida et al. 2014b). Specimens are deposited in the Herbarium of the State University of Feira de Santana (HUEFS).

Results

Taxonomy

Dothideomycetes

Kirschsteiniothelia lignicola Boonmee & K.D.Hyde, in Boonmee, Ko Ko, Chukeatirote, Hyde, Chen, Cai, McKenzie, Jones, Kodsueb & Bahkali, Mycologia 104(3): 706. 2012. Fig. 1A–J

Ascomata superficial, scattered or clustered in small groups, subglobose to globose, papillate, black, ostiole usually brown, ascomal wall smooth, sometimes laterally collabent, 230–380 µm high, 240–440 µm diam. Pseudoparaphyses filamentous, hyaline, simple, septate, embedded in a gelatinous matrix, 1–1.5 µm wide. Asci 8-spored, bitunicate, cylindrical-clavate, short stipitate, apically rounded, with an ocular chamber, 100–130 × 17–20 µm. Ascospores irregularly biseriate, ellipsoidal to short fusiform, slightly curved, 1-septate, septa median or in lower part, constricted at septa, brown, smooth, 25–35 × 7–12 µm.

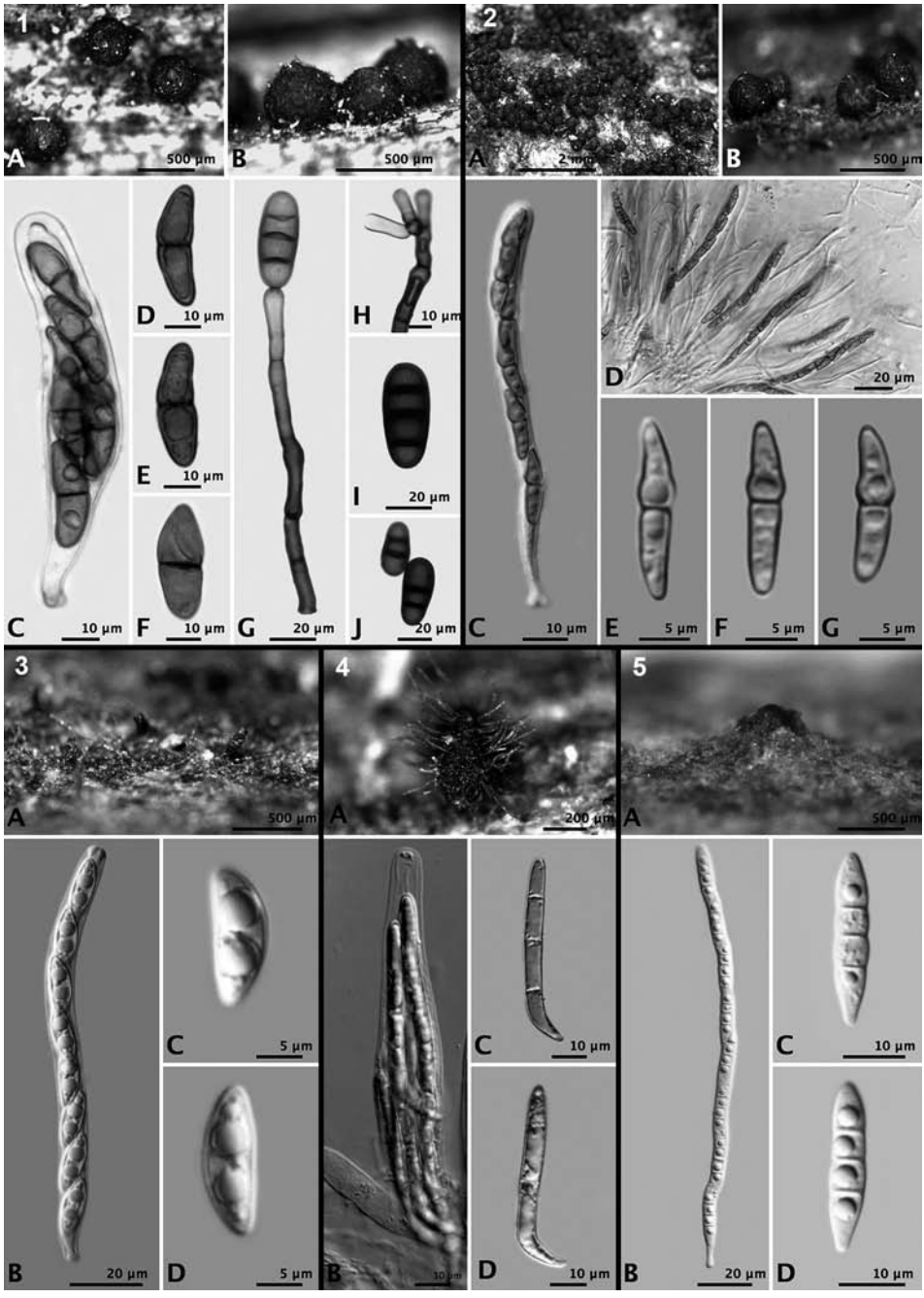
Conidiophores distinct, single, erect, branched, flexuous, septate, smooth, dark brown, 150–218 × 8–10 µm. Conidiogenous cells terminal, integrated, monotretic, brown, 11–32 µm long. Conidia broadly obovoid, smooth, with 1–3 transverse septa, dark brown, thick walled, 37–50 × 16–22 µm.

Geographical distribution: Brazil (this study), Thailand (Boonmee et al. 2012).

Material examined: Brazil, Paraíba, Areia, Mata do Pau Ferro Ecological Reserve, on decaying wood of an unidentified plant, 7 Nov 2011, D.A.C.Almeida (HUEFS 131065).

Notes: *Kirschsteiniothelia* is typified by *K. aethiops* (Sacc.) D.Hawksw. (Hawksworth 1985). The DNA-based phylogenetic placement of five species of *Kirschsteiniothelia*, including *K. aethiops*, performed by Boonmee et al. (2012), resulted in the introduction of a new family, Kirschsteiniotheliaceae, and two new species. *Kirschsteiniothelia lignicola* clustered with *K. aethiops*, *K. emarceis* Boonmee & K.D.Hyde and *Dendryphiopsis atra* (Corda) S.Hughes in a strongly supported clade, which represented

Fig. 1–5. 1. *Kirschsteiniothelia lignicola*. A–B. Superficial ascomata. C. Ascus with ascospores. D–F. Ascospores. G. Conidiophore with conidium. H. Branched conidiophore apex. I–J. Conidia. 2. *Macrodiplodiopsis uniseptata*. Superficial ascomata. C. Ascus with ascospores. D. Asci with ascospores and paraphyses. E–G. Ascospores. 3. *Annulatascus joannae*. A. Immersed ascomata showing the necks above the substrate. B. Ascus with ascospores. C–D. Ascospores. 4. *Hilberina caudata*. A. Superficial ascomata. B. Ascus with ascospores. C–D. Ascospores. 5. *Saccardoella macrasca*. A. Immersed ascoma. B. Ascus with ascospores. C–D. Ascospores.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the new family (Boonmee et al. 2012). Beyond the morphological similarities, all three species have *Dendryphiopsis*-like anamorphs. As *D. atra* is the type of *Dendryphiopsis*, the results of Boonmee et al. (2012) confirmed that *Dendryphiopsis* and *Kirschsteiniothelia* are synonyms, a link previously pointed out by Hughes (1978) based on culture of fragments of the ascomata. Although *Dendryphiopsis* is the older name, Wijayawardene et al. (2014b) choose to protect *Kirschsteiniothelia* because of the higher number of epithets (18 vs. 6), causing less nomenclatural changes.

The Brazilian specimen agrees well with the original description presented by Boonmee et al. (2012), including the characteristics of the *Dendryphiopsis*-like anamorph growing on natural substrate. This is the second world record of *K. lignicola* and the first report of this species in the New World.

Macrodiplodiopsis uniseptata (Mugambi, A.N.Mill. & Huhndorf) Wijayawardene, Camporesi, Bhat & K.D.Hyde, in Wijayawardene, et al., Phytotaxa 176(1): 199. 2014. Fig. 2A–G

Bas.: *Misturatosphaeria uniseptata* Mugambi, A.N.Mill. & Huhndorf, in Mugambi & Huhndorf, Stud. Mycol. 64: 114. 2009.

Ascomata superficial, scattered or clustered, obpyriform to globose, ostiolate, black, ascomal wall smooth, 220–400 µm high, 240–400 µm diam. Pseudoparaphyses numerous, hyaline, simple or branched, septate, 1–1.5 µm wide. Asci 8-spored, bitunicate, short pedicellate, cylindrical-clavate, 75–100 × 5.5–7 µm. Ascospores overlapping uniseriate, fusiform, upper cell often shorter and broader than the basal cell, straight or slightly curved, thick walled, guttulate, 1-septate, constricted at septa, brown, smooth, 13.5–18.5 × 3–5 µm.

Anamorph: Unknown.

Geographical distribution: Brazil (this study), Ecuador (Boonmee et al. 2012).

Material examined: Brazil, Paraíba, Areia, Mata do Pau Ferro Ecological Reserve, on decaying wood of an unidentified plant, 18 Mar 2013, D.A.C.Almeida (HUEFS 192193); 3 Jul 2012, D.A.C.Almeida (HUEFS 192033, HUEFS 192034); 4 Jul 2012, D.A.C.Almeida (HUEFS 192031).

Notes: Mugambi & Huhndorf (2009) described *Macrodiplodiopsis uniseptata* (as *Misturatosphaeria uniseptata*) along with eight other new species in the newly established genus *Misturatosphaeria* Mugambi & Huhndorf. Another species was added by Mugambi & Huhndorf (2009): *Macrodiplodiopsis mariae* (as *Misturatosphaeria mariae*). Recently, Zhang et al. (2013) used a multi-gene phylogeny of small subunit rDNA (SSU), large subunit (LSU) and elongation factor 1-alpha (EF1-α) to establish the link between the type species of *Misturatosphaeria* and the type species of the older asexual genus *Macrodiplodiopsis* Petr. Thus, they transferred all ten of the *Misturatosphaeria* spp. to *Macrodiplodiopsis*. *Macrodiplodiopsis uniseptata* is easily differentiated from all *Macrodiplodiopsis* species by having 1-septate ascospores. Our collection agrees well with the original description except for the longer conidia (13.5–18 µm vs. 12–14 µm). This specimen represents the second world record and the first record for Brazil.

Sordariomycetes

Annulatascus joannae K.M.Tsui, Hodgkiss & K.D.Hyde, in Tsui, Ranghoo, Hodgkiss & Hyde, Mycoscience 43(5): 384. 2002. Fig. 3A–D

Ascomata immersed, globose to subglobose, ostiolate, black, 150–200 µm diam. Neck cylindrical, erect, 200–400 µm long above the substrate. Paraphyses septate, simple, hyaline, tapering towards the apex, 6.5–8.5 µm wide at base. Asci 8-spored, unitunicate, short pedicellate, cylindrical, with a pronounced, inamyloid, refractive apical ring, 100–130 × 7.5–9 µm. Ascospores overlapping uniseriate, ellipsoidal to fusiform, thick-walled, guttulate, aseptate, hyaline, smooth, mucilaginous sheath not seen, 15–18 × 5–6 µm.

Anamorph: Unknown.

Geographical distribution: Brazil (this study), China (Wijayawardene et al. 2014a).

Material examined: Brazil, Ceará, Ubajara, Ubajara National Park, on decaiyng wood of an unidentified plant, 9 Nov 2011, D.A.C.Almeida (HUEFS 131040).

Notes: *Annulatascus* K.D.Hyde is a genus occurring predominantly in aquatic environments (Tsui et al. 2002), with only two out of the 17 accepted species collected from terrestrial habitat: *A. citrisporus* J.Fröhl. & K.D.Hyde and *A. licualae* J.Fröhl. & K.D.Hyde (Hyde 1992, Tsui et al. 2002, Barbosa et al. 2008, Abdel-Wahab et al. 2011, Boonyuen et al. 2012).

This is the second record of *A. joannae* for the world and the first on a terrestrial substrate. The Brazilian specimen agrees with the original description except for the terrestrial habitat and non-mucilaginous, smaller ascospores (15–18 × 5–6 µm versus 20–28 × 9–12 µm). These differences could reflect a new species, but we prefer to wait for DNA data before describing a new taxon. This is the first record of *A. joannae* for the New World.

Hilberina caudata (Fuckel) Huhndorf & A.N.Mill., in Miller & Huhndorf, Mycol. Res. 108(1): 31. 2004. Fig. 4A–D

Bas.: *Leptospora caudata* Fuckel, Jb. nassau. Ver. Naturk. 23–24: 144, tab. 3, fig. 6a, 6b. 1870.

For more synonyms see Index Fungorum (www.indexfungorum.org).

Ascomata superficial, scattered, ovoid to obpyriform, ostiolate, black, ascomal wall smooth, densely setose, 350–450 µm high, 260–390 µm diam. Setae brown, thick-walled, 14–27 µm wide at base, up to 400 µm long, attenuated toward the apex, apex rounded. Paraphyses numerous, hyaline, simple, septate, basal cell enlarged, attenuated toward the apex, 9–11 µm wide. Asci 8-spored, unitunicate, cylindrical, short stipitate, with a refractive apical ring, 100–130 × 13–25 µm. Ascospores bi- or triseriately arranged, cylindrical, geniculate, basal cell curved and distinctly tapering toward the end, guttulate, 1–3-septate, pale brown, smooth, 44–58 × 4–6 µm.

Anamorph: Phialophora-like (Fröhlich & Hyde 2000).

Geographical distribution: Brazil (this study), Canada, Costa Rica, Denmark, Ireland, Morocco, Norway, Sweden, United Kingdom Fuckel (1870), Germany (GBIF 2016), Puerto Rico, USA (Fuckel 1870).

Material examined: Brazil, Ceará, Ubajara, Ubajara National Park, on decaying wood of an unidentified plant, 19 May 2013, D.A.C.Almeida & A.N.Miller (HUEFS 192219).

Notes: Miller & Huhndorf (2004) established the genus *Hilberina*, with *H. caudata* as the type species, based on phylogenetic analyses of partial nuclear large subunit nrDNA (LSU) sequences. The two sequences used by Miller & Huhndorf (2004), however, were later determined to be contaminates by Miller et al. (2014). Currently, *Hilberina* includes 13 species and has been shown to be a polyphyletic genus in Helminthosphaeriaceae based on combined LSU and β-tubulin gene sequence data (Miller et al. 2014).

In addition to *H. caudata*, four other species in *Helminthosphaeria* were reported to have septate ascospores: *H. punctata* (Munk) A.N.Mill. & Huhndorf (0–3-septate), *H. meznaensis* (R.Hilber) Huhndorf & A.N.Mill. (5–9-septate), *H. moseri* (3–4-septate) and *H. robusta* (0–5-septate). *Hilberina caudata* can be distinguished from *H. punctata* by the smooth ascospores and from *H. meznaensis* by smaller and less septate ascospores. *Hilberina moseri* lacks ascospores with an attenuate basal tip, which is present in *H. caudata*, while *H. robusta* is distinct in having ascospores that are pointed at each end but not attenuate at the basal end. Miller et al. (2014) presented illustrations of most of the species and a key to the accepted species in the Helminthosphaeriaceae, including *Hilberina*.

The Brazilian specimen has longer ascospores than reported by Fuckel (1870) (44–58 µm vs. 32 µm). This study represents the first record of *H. caudata* for South America.

Saccardoella macrasca (Sacc.) M.E.Barr, Mycotaxon 51: 218. 1994. Fig. 5A–D

Bas.: *Zignoëlla macrasca* Sacc., Michelia 2(no. 6): 138. 1880.

For more synonyms see Index Fungorum (www.indexfungorum.org).

Ascomata immersed, apex erumpent, scattered, subglobose to obpyriform, papillate, ostiolate, black, ascomal wall smooth, 400–560 µm diam. Paraphyses numerous, filamentous, hyaline, simple, septate, attenuated toward the apex, 2–4 µm wide. Asci 8-spored, unitunicate, cylindrical, short stipitate, with a refractive apical ring, 130–190 × 5–7.5 µm. Ascospores uniseriate, fusiform, guttulate, 3-septate, slightly constricted at septa, hyaline, smooth, 20–29 × 5–6 µm.

Anamorph: Unknown.

Geographical distribution: Brazil (this study), Taiwan (Hsieh & Chen 2000), USA (Farr et al. 2017).

Material examined: Brazil, Paraíba, Areia, Mata do Pau Ferro Ecological Reserve, on decaying wood of an unidentified plant, 7 Nov 2011, D.A.C.Almeida (HUEFS 42868).

Notes: *Saccardoella macrasca* is quite similar to *S. aquatica* K.M.Tsui, K.D.Hyde, Hodgkiss & Goh in the shape of the asci and ascospores, but differs in that these

structures are larger in *S. aquatica* (asci 185–230 × 7–9 µm, ascospores 26–34 × 6–8 µm) (Barr 1994). *Saccardoella macrasca* also lacks a mucilaginous sheath surrounding the ascospores and has a terrestrial habitat. The Brazilian specimen agrees well with the description presented by Tsui et al. (1998). This is the first record of *S. macrasca* for South America.

Discussion

The five new records of Ascomycota in addition to our previous new genus, new species, and new records (Almeida et al. 2104a, b, c, Barbosa et al. 2008) confirm that the Caatinga biome in Brazil hosts a high diversity of mycologically unexplored fungi. Four of the five species are hitherto only known from two or three countries. It is, therefore, not possible to evaluate whether the ascospore sizes of the Brazilian specimens of three species (*Annulatascus joannae*, *Hilberina caudata*, and *Macrodiplodiopsis uniseptata*) deviating from those reported in the literature represent infraspecific variability or indicate undescribed species. The finding of *A. joannae* in a terrestrial habitat may indicate that other species described from aquatic habitats are not limited to this environment.

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