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Short Communication
Apiosordaria nigeriensis (Ascomycota): a new record for the Americas

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Abstract

Apiosordaria is a genus of fungus with species commonly reported inhabiting soil or herbivore feces. However, studies related to the association of representatives of this genus to plants, especially in semi-arid ecosystems, are still non-existent. In this work we documented a new occurrence for Brazil of a species of *Apiosordaria*, associated with the palm *Syagrus coronata*. The collections were carried out at the Raso da Catarina Ecological Station and the analyzes were carried out at the Laboratory of Sciences of the Bahia State University, Campus VIII, Paulo Afonso. From the topographic analysis of the plant substrate in stereomicroscope and the evaluation of fungal structures under optical light microscope, the species was identified as *Apiosordaria nigeriensis*. This fungus was reported for the first time in Enugu, Nigeria, after being isolated from soil samples. In this work, we report the second occurrence of *A. nigeriensis* to the world, being the first to Brazil, representing the first record for the Americas, and highlighting the palm *S. coronata* as the first botanical host colonized by the species. These data broaden the knowledge about the geographic distribution of the genus, especially on the microdiversity for the caatinga biome.

Key words: Caatinga, fungus, *Syagrus coronata*, taxonomy.

Resumo

Apiosordaria é um gênero de fungo com espécies geralmente reportadas habitando o solo ou fezes de herbívoros. No entanto, estudos referentes à associação de representantes deste gênero às plantas, especialmente em ecossistemas semiáridos, ainda são inexistentes. Neste trabalho documentamos uma nova ocorrência para o Brasil de uma espécie de *Apiosordaria,* associada a palmeira *Syagrus coronata*. As coletas foram realizadas na Estação Ecológica Raso da Catarina e as análises ocorreram no Laboratório de Ciências, da Universidade do Estado Bahia, Campus VIII, Paulo Afonso. A partir da análise topográfica do substrato vegetal em estereomicroscópio e da avaliação das estruturas fúngicas em microscópio óptico de luz, a espécie foi identificada como *Apiosordaria nigeriensis*. Este fungo foi relatado pela primeira vez em Enugu, na Nigéria, após de ter sido isolado de amostras de solo. Neste trabalho, reportamos a segunda ocorrência de *A. nigeriensis* para o mundo, sendo a primeira para o Brasil, representando o primeiro registro para as Américas, e dando destaque a palmeira *S. coronata* como o primeiro hospedeiro botânico colonizado pela espécie. Estes dados ampliam o conhecimento sobre da distribuição geográfica do gênero, em especial sobre a micodiversidade para o bioma caatinga.

Palavras-chave: Caatinga, fungos, *Syagrus coronata*, taxonomia.

The genus *Apiosordaria* is a member of the family Lasiosphaeriaceae (Ascomycota) and was first described by Arx & W. Gams in 1967 (Arx & Gams 1967). The species of the hat genus are characterized by having asci dark-brown to black, globose to piriform, ostiolate or not, sometimes having trichomes. The peridio is generally pseudoparenchymatous, membranaceous, or slightly coriaceous, with two or various layers. The asci are unitunicate, with 4 or 8-spores, cylindrical

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or clavate, stipitate, with ring indistinct or absent, non-amyloid. Paraphyses frequently present, filiform and hyaline when present. Ascospores with 2 cells or occasionally 3, with upper cell blackish, ellipsoidal to subglobose, dark-brown to black, with ornamentation and germinative pore; lower cell triangular to cylindrical, hyaline and smooth (Stchigel *et al*. 2000).

According to the Index Fungorum online database (2018), there are currently 23 accepted species. Generally encountered in the soil or in the feces of herbivores (Krug *et al*. 1983; Guarro *et al*. 1984; Udagawa 1990; Mukerji *et al*. 1995; Stchigel *et al*. 2000, 2003). However, studies related to the association of representatives of this group with plant species, especially in semi-arid climate ecosystems, are still non-existent.

Among the vegetables, palm trees have been showing interesting results regarding interactions with fungal species. According to the work carried out by Hyde (1996) in Queensland, the palm/fungus ratio of 1:26 species was proposed to provide estimates of diversity, which is higher than the generally accepted ratio of 1:6 for other plants (Hawksworth 1995). Subsequently, the ratio of 1:26 was revised to 1:33, based on the more detailed palm tree study in Australia and Brunei, suggesting that the global estimate of palm-associated fungi may become even larger (Fröhlich & Hyde 1999).

The Brazil is very rich in species of the family Arecaceae Juss., Being the third largest flora of the world in diversity of native palms, with about 38 genera and 511 species (BFG 2018). Among the species of the caatinga biome, the palm tree *Syagrus coronata* (Martius) Beccari, popularly known as licuri or ouricuri (Kiill 2011) stands out. It is an endemic plant of the northeastern semi-arid region, occurring in the states of Bahia, North of Minas Gerais, Sergipe, Alagoas and Pernambuco (Noblick 1986).

Because of its extreme socioeconomic and ecological importance, licuri has been considered the "life-saving tree" in natural occurrence areas, as it is a palm tree that withstands prolonged droughts and blooms and fruit for a long period of the year, providing resources for the subsistence of the population and animals of these regions (Lorenzi 1992; Drumond 2007). In addition, it is of particular importance for Lear's Macaw (*Anodorhynchus leari*), endemic to the Raso Ecoregion of Catarina, since its fruits constitute the main food item for this bird, extremely endangered due to the traffic and the absence of specific native diet (Ramalho 2008; Rocha 2009).

Although it is not among the palm trees included among endangered species, licuri has been exploited indiscriminately by agricultural practices that include fires for the formation of new pastures and sanitary landfills, victimizing several licurizeiros (Siqueira-Filho 2012). Therefore, the adoption of management techniques and sustainable use, together with biodiversity conservation policies, are fundamental to protect plants such as licuri, which is so significant for the caatinga biome and has a practically unknown associated mycobiota.

Given the information above and the relevance of this question, the objective of this study was to document the first occurrence of *A. nigeriensis* Stchigel Guarro to the American continent, colonizing the *Syagrus coronata* palm and increasing the distribution data on the representatives of this genus, providing new information for Brazilian mycological biodiversity.

Study Site

Collections were undertaken on a monthly basis between May/2014 and January/2015 in the Raso da Catarina Ecological Station in Bahia state, Brazil, located between the parallels 09º33'–9º54'S and meridians 38º27'–38º44'W. Samples of entire leaves, bracts, inflorescences, fruits, and sections of the trunk from the aerial portion of *Syagrus coronata* (locally "licurizeiro"), as well as the leaf litter around it, were harvested to survey their mycota.

Collection, morphological characterization and identification

The botanical material was fragmented using a pruning shears and machete into pieces 10 to 20 cm long to facilitate their handling and transport. The samples were sterilized with 70% alcohol and 2% sodium hypochlorite and then placed in plastic trays whose sides and bottoms were covered with moist paper towels to be held inside humid chambers. The trays were opened every two days and sprayed with distilled water to maintain their humidity. The botanical material was held for seven days at room temperature under a natural light regime to evaluate fungal growth.

The materials were examined under a stereomicroscope and fragments of any fungal structures were removed using a thin needle (the type used for insulin injections) and mounted on slides and stained with lactophenol cotton blue. The fungal structures were observed under a Zeiss Primo Star microscope, photographed using an attached Samsung 8.0 megapixel digital camera, and measured using a 40x micrometric objective lens (using a 2.5x µm correction).

Identifications were made based on fungal morphology and the reproductive structures, consulting the specialized literature (Krug *et al*. 1983; Stchigel *et al*. 2000). The identified specimens were deposited in the Padre Camille Torrend (URM) at the Mycology Department of the Federal University of Pernambuco (UFPE).

Taxonomy

Apiosordaria nigeriensis Stchigel & Guarro, in Stchigel, Cano, Guarro & Gugnani, Mycologia 92(6): 1206 (2000). Fig. 1a-g

Asci superficial, solitary or aggregated, translucent, not ostiolate, globose, 250–337.5 × 250–330 µm. Peridio membranaceous, fragile, pseudoparenchymatous, covered by hyphae 2.5–3 µm thick. Asci 92.5–100 × 25–32.5(–40) µm, 8-spores, unitunicate, clavate, pedicelate, with a non-amyloid ring. Paraphyses not observed. Ascospores 35–37.5 × 17.5–18.5 µm, llipsoidal, with germinative pore, 1 transversal septum; upper cell 25–27.5 × 17.5–18.5 µm, hyaline when young, becoming dark brown when mature, spiny, with apex acuminate and base truncate; lower cell 6–7.5 × 6–7 µm, triangular, hyaline, smooth or subtly spiny.

Material examined: BRAZIL. BAHIA: Paulo Afonso, Raso da Catarina Ecological Station (ESEC), on the fruit of *S. coronata* in the leaf litter, 10.VI.2014, *N.G.S. Fortes* (URM 91151).

Registered in soil samples (Stchigel *et al*. 2000) and in *Syagrus coronata*.

It is distributed in Nigeria and Brazil.

The material examined was morphologically identical to *A. nigeriensis*, although with slightly smaller asci 250–337.5 µm (*vs.* 300–600 µm) and asci 92.5–100 × 25–32.5(–40) µm (*vs.* 160–180 × 29–36 µm). The different sizes of the above-mentioned structures are probably related to the nutritional conditions for isolation used by Stchigel *et al*. (2000). The combined characteristics that allowed the identification of that species included: ascomata globose, translucent, not ostiolate; asci clavate; ascospores with germinative pore, spiny, 35–37.5 µm long and 17.5–18.5 µm wide. Additionally, Stchigel *et al*. (2000) reported that some species of *Apiosordaria* appear similar in terms of the characteristics of the upper cell of the ascospores of *A. nigeriensis,* including: *Apiosordaria effusa* (Morinaga *et al*.) J.C. Krug, Udagawa & Jeng, *Apiosordaria microcarpa* Udagawa & T. Muroi, *Apiosordaria terrestris* (S.C. Jong & E.E. Davis) J.C. Krug, Udagawa & Jeng, *Apiosordaria tuberculata* J.C. Krug, Udagawa & Jeng, *Apiosordaria vermicularis* (Morinaga *et al*.) J.C. Krug, Udagawa & Jeng, and *Apiosordaria verruculosa* (C.N. Jensen) Arx & W. Gams. Those species differ, however, in terms of the characteristics of their ascomata and asci. Although Brazil presents a great biodiversity in species of the family Arecaceae, research on the micota that colonize the palms in the cerrado biomes, atlantic forest and caatinga are still very scarce, compared to the studies carried out in the Asian countries. new occurrences and several new species. In the caatinga, studies carried out by Santos *et al*. (2016) and Vitória *et al*. (2016) registered 28 taxa, distributed in 25 genera, colonizing only the *S. coronata* palm. Of these records, 7 comprise new occurrences for the state of Bahia and 5 new ones for Brazil. The present work, in addition to reporting the first record of *A. nigeriensis* to Brazil and the second one of this species to the world, suggests the need for new investigations to increase knowledge about fungi recorded in areas of caatinga, exclusively Brazilian biome. In addition, it reinforces understanding of the relationships between these organisms and plants, which are still poorly understood, and the encouragement of strategies for biodiversity conservation.

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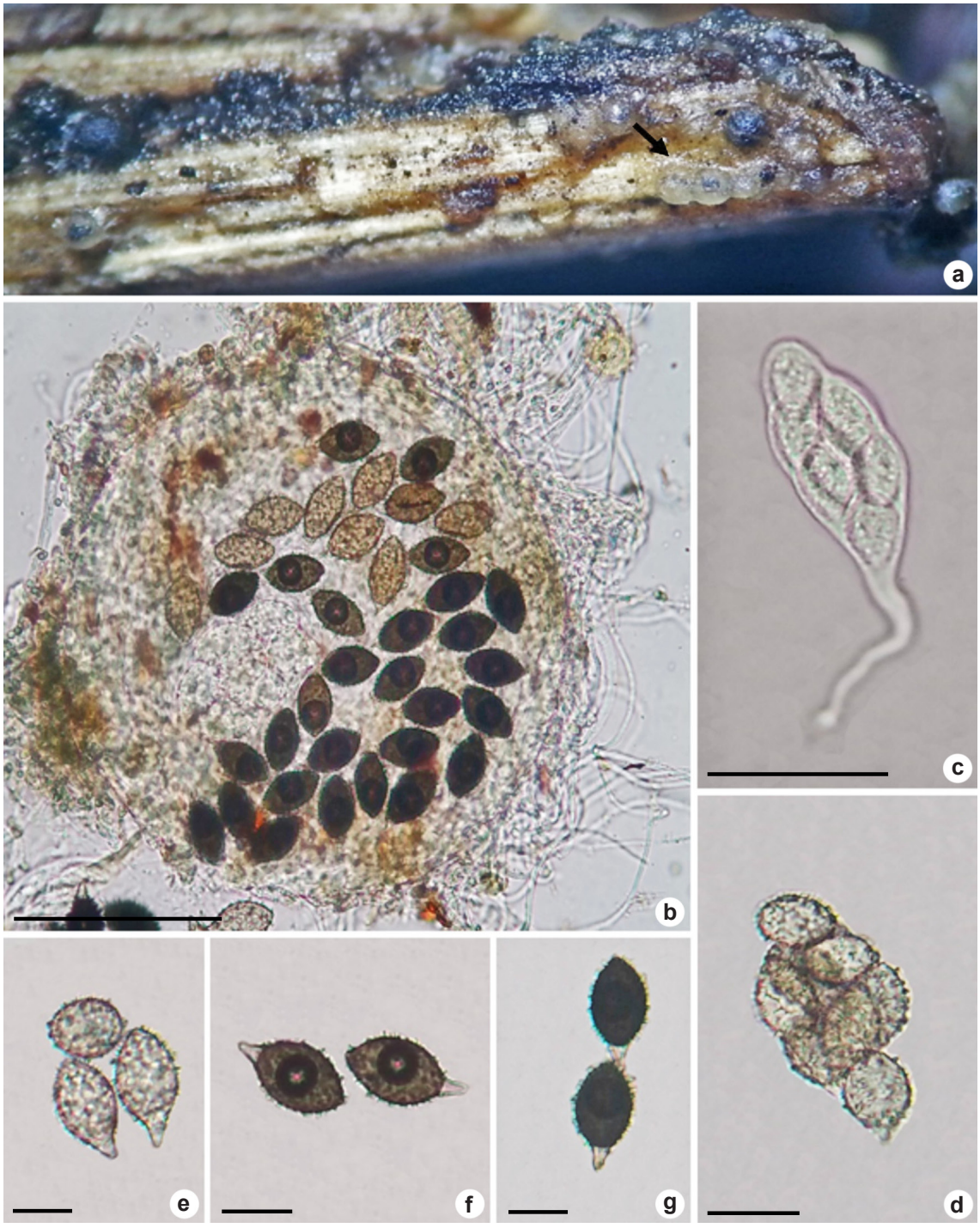

Figure 1 – a-g. *Apiosordaria nigeriensis* – a. habit; b. ascomata; c-d. asci; e-g. ascospores. Barras de escala: b. 100 µm; c. 50 µm; d-g. 25 µm.

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