



BIOLOGICAL SCIENCES

Revisiting *Diplococcium peruamazonicum* Matsush. (Ascomycota) 31 years after its description

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Abstract: *Diplococcium peruamazonicum* Matsush. (Helotiales, Ascomycota) is being reported for the first time from Brazil and for the second time worldwide, 31 years after its original description in Peru. This rare ascomycete was found on Marajó Island (Brazilian Amazon) as a saprobic fungus on leaf litter of *Astrocaryum vulgare* Mart. A detailed morphological description, illustrations and taxonomic comments are provided here, as well as a key to the *Diplococcium* species recorded in Brazil. This report expands the geographic distribution of *D. peruamazonicum* in the Amazon.

Key words: Amazon, *Astrocaryum*, new record, palm tree, taxonomy.

INTRODUCTION

Diplococcium was proposed by Grove (1885) to accommodate the type species *D. spicatum* Grove, found on decaying wood in Britain. This genus is characterized by macronematous, simple or branched conidiophores with polytretic, terminal or intercalary conidiogenous cells, forming 0–12-euseptate, smooth or verrucose, brown to dark brown conidia in acropetal chains, with schizolytic secession (Hernández-Restrepo et al. 2012).

Twenty-nine species are currently accepted in *Diplococcium* (Goh & Hyde 1998, Hernández-Restrepo et al. 2012, Ma et al. 2012, Silva et al. 2014, Almeida et al. 2015), being delimited mainly by the shape, size, septation, pigmentation and ornamentation of the conidia and the presence or absence of branched conidiophores (Hernández-Restrepo et al. 2012). *Diplococcium* species are primarily saprobes, occurring in decaying bark, leaves, or branches of various

plants, but may also act as mycoparasites (Holubová-Jechová 1982).

Diplococcium peruamazonicum was collected during an investigation of asexual morph of saprobic ascomycetes on leaf litter of *Astrocaryum vulgare* Mart. (common name: tucumã-do-Pará) in the Eastern Amazon (Pará). This is the first register of this species in Brazil. In this work, we provide the description, illustrations and taxonomic comments of the specimens found, and a key to the *Diplococcium* species recorded in the country.

MATERIALS AND METHODS

Collections of fungal specimens were carried out in July 2023 in the municipality of Cachoeira do Arari (Figure 1) (1°0'16"S, 48°57'27"W), belonging to the mesoregion of Marajó and microregion of Arari, located east of Marajó Island (Cidade-Brasil 2023). Decomposing leaflet samples of *A. vulgare* were collected and processed following the procedures outlined by Castañeda-Ruiz et

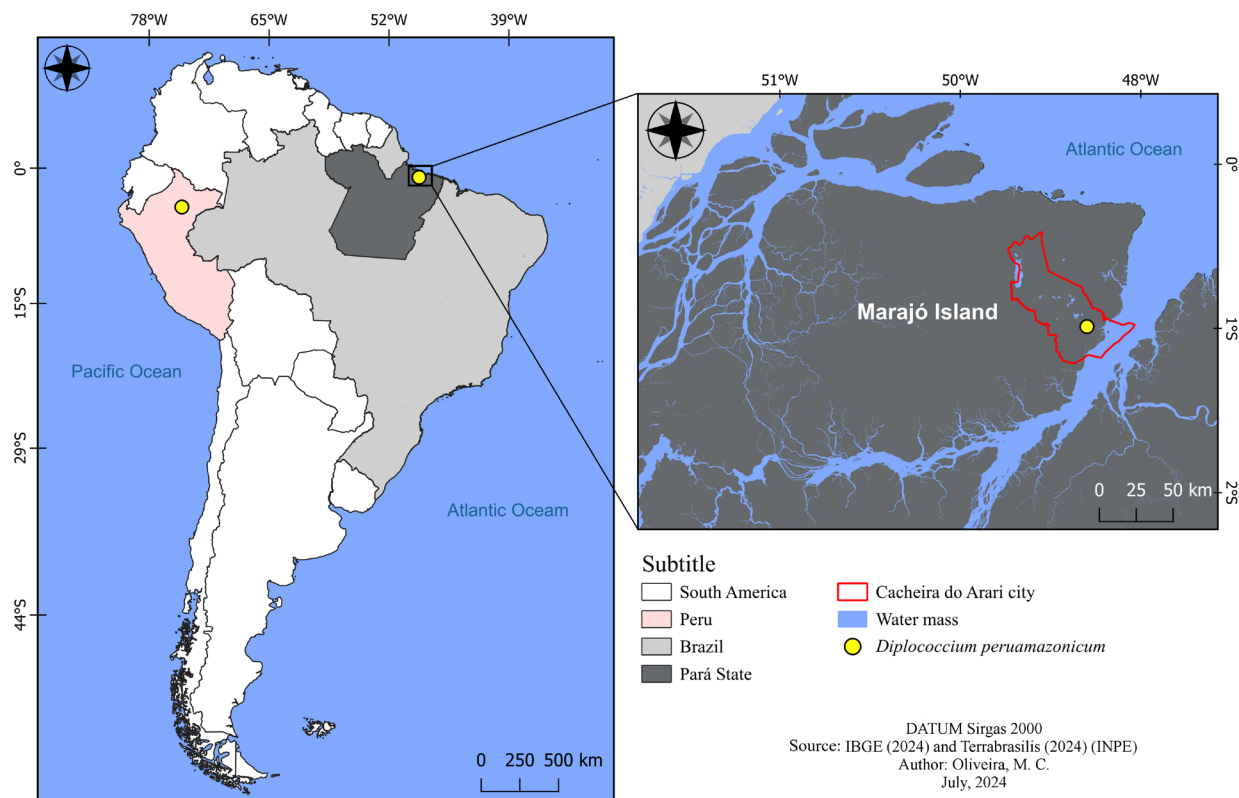


Figure 1. Location of specimen collection of *Diplococcium perumazonicum* in the municipality of Cachoeira do Arari, Pará, Brazil (study area) and the location of the holotype in Peru.

al. (2016). The substrates, kept under incubation, were examined periodically for 30 days with the aid of a stereomicroscope. Semi-permanent microscope slides of the fungal specimens were prepared using lactoglycerol. Reproductive structures were observed, measured and photographed under an optical microscope (Leica DM6B) equipped with a digital camera (Leica DFC7000 T). For identification, keys and descriptions available in the literature were used. Semi-permanent slides and samples of *D. perumazonicum* on dry substrate were deposited at the João Murça Pires Herbarium (MG) of the Emílio Goeldi Museum of Pará, Belém (Pará).

RESULTS

Diplococcium perumazonicum Matsush., Matsush. Mycol. Mem. 7: 49 (1993).

Conidiophores macronematous, mononematous, single, simple, erect, straight or slightly flexuous, cylindrical, septate, smooth, brown, $62.5\text{--}175 \times 5\text{--}5.5 \mu\text{m}$. Conidiogenous cells enteroblastic, polytretic, 1–3 pores, integrated, terminal, determinate, cylindrical, rounded apex, smooth, brown, $12.5\text{--}22.5 \times 5\text{--}5.5 \mu\text{m}$. Conidial secession schizolytic. Conidia catenate, acropleurogenous, broadly fusiform, ovoid to ellipsoid, acute at the ends, 1-septate, thick and darkly pigmented septum, smooth, dark brown, $12.5\text{--}25 \times 10\text{--}11 \mu\text{m}$.

Examined material: BRAZIL. Pará: Marajó Island, Cachoeira do Arari, Vila da Sé,

0°59'21.599"S, 48°43'40.22"W, on decaying leaflet of *Astrocaryum vulgare* Mart. (Arecaceae), 14 July 2023, E.G. Nascimento 01 (MG 249960).

Habitat: saprobes occurring on petioles of unidentified palms (Matsushima 1993) and leaflets of *A. vulgare* (Arecaceae).

Known distribution: Brazil (this study), Peru (Matsushima 1993).

Comments: *Diplococcium peruamazonicum* is morphologically comparable to *D. dendrocalami* Goh, K.D. Hyde & Umali (Goh et al. 1998), and *D. clavariarum* (Desm.) Hol.-Jech. (Holubová-Jechová 1982), due to the shape and septation of the conidia. However, in *D. dendrocalami*, the conidia are oblong to ellipsoidal, 1(–2)-septate, rarely 3-septate, measuring $12\text{--}22 \times 6\text{--}9 \mu\text{m}$, with conidiophores that sometimes regenerate percurrently. *Diplococcium clavariarum* presents ellipsoidal

to obclavate conidia, 0–1-septate, measuring $13\text{--}29 \times 6\text{--}9 \mu\text{m}$, with no regeneration in the conidiophores, occurring as a mycoparasite on *Clavaria* species (Basidiomycota). In *D. peruamazonicum*, the conidia are broadly fusiform, ovoid to ellipsoidal, with one thick and dark septum, rarely 2-septate, measuring $12\text{--}34 \times 7\text{--}10 \mu\text{m}$, with conidiophores that do not regenerate. The characteristics of the Brazilian specimens agree with the description of the holotype (Matsushima 1993), differing only in the size of the conidiophores, which were smaller than the Peruvian specimen ($62.5\text{--}175 \times 5 \mu\text{m}$ vs. $130\text{--}500 \times 4\text{--}6 \mu\text{m}$).

The material from Marajó represents the first record of *D. peruamazonicum* from Brazil and the second worldwide, 31 years after the original description of the species. In Brazil, seven species of this genus have already been



Figure 2. *Diplococcium peruamazonicum*. a-b) Conidiophores with conidium. c-g) Conidia. Bars: a-e (20 μm); f-g (10 μm).

recorded in the Amazon (Pará) and Caatinga (Bahia) biomes (CRIA 2024). The presence of *D. perumazonicum* in the Brazilian Amazon suggests that this species may have a broader distribution, underscoring the importance of conducting more comprehensive fungal inventories in this biome.

Key to species of *Diplococcium* occurring in Brazil

1. Conidia verruculose, oblong to cylindrical, $9\text{--}25 \times 4.5\text{--}6 \mu\text{m}$, 1–4-septate, pale brown; conidiophores simple, $93\text{--}215 \times 4\text{--}5 \mu\text{m}$*D. verruculosum*
- 1'. Conidia smooth.....2
2. Conidia versicolor, subellipsoid, 2(–3)-septate, central cells dark brown, end cells paler, $17\text{--}25 \times 7\text{--}9 \mu\text{m}$; conidiophores simple, $170\text{--}250 \times 7\text{--}12 \mu\text{m}$*D. laxisporum*
- 2'. Conidia concolor, with all the cells of the same color.....3
3. Conidiophores simple or branched.....4
- 3'. Conidiophores always simple.....6
4. Conidia aseptate, limoniform to ovoid, pale brown, reddish to dark brown, $7.5\text{--}22 \times 5\text{--}12 \mu\text{m}$; conidiophores $135\text{--}189 \times 12\text{--}16.5 \mu\text{m}$*D. variegatum*
- 4'. Conidia septate.....5
5. Conidia 1-septate, constricted at the septa, ellipsoidal, subcylindrical, $6\text{--}9 \times 3\text{--}4 \mu\text{m}$; conidiophores $200\text{--}400 \times 2.5\text{--}4 \mu\text{m}$*D. spicatum*
- 5'. Conidia 1–5-septate, not or slightly constricted at the septa, cylindrical to ellipsoidal, $11\text{--}55 \times 5\text{--}15 \mu\text{m}$; conidiophores up to $250 \times 4\text{--}6 \mu\text{m}$*D. varieseptatum*
6. Conidia 0–12-septate, mostly 1-septate, constricted at the septa, cylindrical, ellipsoid to oblong, $10\text{--}77 \times 6\text{--}10 \mu\text{m}$; conidiophores $120\text{--}300 \times 4.5\text{--}9 \mu\text{m}$*D. heteroseptatum*
- 6'. Conidia 1–3-septate.....7

7. Conidia mostly 1–2-septate but occasionally 3-septate, oblong to ellipsoid, broadly rounded at both ends, $12\text{--}22 \times 6\text{--}9 \mu\text{m}$; conidiophores $120\text{--}280 \times 7.5\text{--}9 \mu\text{m}$*D. dendrocalami*
- 7'. Conidia mostly 1–2-septate, broadly fusiform, ovate to ellipsoid, $12\text{--}34 \times 7\text{--}10.5 \mu\text{m}$; conidiophores $130\text{--}500 \times 4\text{--}6 \mu\text{m}$*D. perumazonicum*

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Author contributions

DSF performed the analysis and identification of the fungus and wrote the manuscript; EGN contributed to the collection of substrates for analysis and revised the manuscript; HMPS contributed to the revision of the manuscript; JSM revised the manuscript and confirmed the species. All authors provided critical feedback, revised the manuscript, and approved the final version.

