Cyathus species (Basidiomycota: Fungi) from the Atlantic Forest of Pernambuco, Brazil: taxonomy and ecological notes

Especies de Cyathus (Basidiomycota: Fungi) del bosque atlántico de Pernambuco: taxonomía y notas ecológicas

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Abstract. Cyathus specimens were collected over a one-year period in 4 remnants of the Atlantic Forest in Pernambuco, Brazil. According to traditional morphological analysis, the following species were identified: C. intermedius, C. montagnei, C. setosus and C. triplex. These 4 species had previously been recorded from Brazil, but C. setosus is reported for the first time from northeastern Brazil. The holotype of C. setosus was examined and we found differences in the spore dimensions from those described in the original publication. An identification key for the species of Cyathus recorded from Pernambuco is provided.

Key words: bird’s nest fungi, Gasteromycetes, Neotropical mycota, taxonomy.

Introduction

Few studies in Brazil have focused on the taxonomy of Nidulariaceae Dumort. (bird’s nest fungi), which include the genera Crucibulum Tul. et C. Tul., Cyathus Haller and Nidularia Fr. et Nordholm (Baseia and Milanez, 2001a, b, 2003; Cortez et al., 2006; Trierveiler-Pereira and Baseia, 2009; Trierveiler Pereira et al., 2009). Members of these genera usually produce small basidiomata (up to 20 mm) on soil, dung, rotten wood or other plant debris (Brodie, 1975).


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Trierveiler-Pereira et. Baseia, was recently described (Trierveiler-Pereira et al., 2009). Eight species have been reported from the state of Pernambuco, in northeastern Brazil (Trierveiler-Pereira and Baseia, 2009).

The aim of this work is to report the occurrence of Cyathus species in 4 areas of Atlantic forest in the state of Pernambuco and discuss some ecological aspects of these species.

Materials and methods

Cyathus specimens were surveyed from June, 2008 to May, 2009 in 4 remnants of Atlantic forest in the state of Pernambuco, Brazil: “Parque Dois Irmãos” (DI), “Reserva Ecológica Carnijó” (CA), “Mata do Estado” (ME) and “Parque Ecológico João de Vasconcelos Sobrinho”, also known as “Brejo dos Cavalos” (BC). These areas correspond to lowland coastal forests (DI, CA), and highland humid forests (ME, BC). The precipitation in these areas is higher during autumn and winter, especially from May to August.
Fungal specimens were collected in selected stands and kept in plastic containers with individualized compartments for transport (Lodge et al., 2004). Later, the collected material was analyzed and identified at Laboratory of Diversity and Taxonomy, Department of Mycology, UFPE (Brazil). Colors on the species descriptions were coded according to Kornerup and Wanscher (1978).

Peridium and peridioles were cut by hand with a razor blade and sections were mounted in 3% KOH and 3% aqueous solution of phloxine. Line drawings were made with a camera lucida. The abbreviation ‘Lw’ corresponds to the arithmetical means of length and width. Voucher specimens are kept at URM and the holotype of *C. setosus* (DAOM) was also analyzed. Herbaria acronyms follow Thiens (2011).

**Descriptions**


Basidiomata broadly obconic, without stipe, 5.5-8.0 mm high and 4.0-8.0 mm wide at the mouth; outer surface of the peridium not plicate, yellowish brown (KW 5E6), densely hirsute, becoming glabrous in age, hairs yellowish brown (KW 5E6); inner surface not plicate, dark blond (KW 5D4), shiny. Peridioles ellipsoid to globose in outline, gray (KW 5F1), shiny, 2.0-2.5 mm diam., one-layered cortex with thin tunica. Basidiospores ellipsoid to subglobose, hyaline, smooth, 17-22 (24) × 10-15 μm, thick-walled, walls 2-3 μm thick.

**Taxonomic summary**

**Distribution.** Pantropical (Brodie, 1975; Gómez and Pérez-Silva, 1988); in Brazil known from Rio Grande do Sul, São Paulo, Bahia, Pernambuco and Pará (Trierveiler-Pereira and Baseia, 2009).

**Studied specimens.** **Brazil:** Pernambuco, Caruaru, Brejo dos Cavalos, 20.VI.2008, Trierveiler-Pereira 35, 39, URM 82054, 82055; ibid, 25.VIII.2008, Trierveiler-Pereira 164, URM 82057; ibid, 03.VI.2009, Baltazar et al., 241, URM 82058; São Vicente Férrer, Mata do Estado, 26.VI.2008, Trierveiler-Pereira 51, URM 82056. Additional specimens:

**Brazil:** Pernambuco, Recife, 11.VI.1953, Gayão s/n, URM 658; Igarassu, Reserva Florestal da Usina São José, VII.2003, Baseia s/n, URM 77570.

**Remarks:** *C. montagnei* is similar to *C. striatus* due to its plicate exoperidium and basidiospores size. According to Brodie (1975), it is possible to differentiate these 2 species since *C. striatus* is brownish externally and yellowish brown internally. Moreover, *C. striatus* is a rare species in the tropics.


Basidiomata obconic, slender obconic to funnel-shaped, stipe very short or absent, 7.0-10 mm high and 5.0-9.0 mm wide at the mouth; outer surface of the peridium finely to strongly plicate, yellowish brown (KW 5E5) to brownish beige (KW 6E3), woolly, hairs long, blond (KW 4C4), becoming glabrous in age; inner surface finely to strongly plicate, grayish brown (KW 5E3), silvery. Peridioles ellipsoid to subcircular in outline, olive brown (KW 4F4) to yellowish brown (KW 5F4), shiny, 1.4-2.7 mm diam., one-layered cortex with tunica. Basidiospores ellipsoid, subglobose to ovoid, hyaline, smooth, 17-22 (24) × 10-15 μm, thick-walled, walls 2-3 μm thick.

**Taxonomic summary**

**Distribution.** Neotropical and subtropical (Brodie, 1984; Esqueda et al., 2011); in Brazil known from Roraima (Jennifer Wilkinson - personal communication).
Figure 1. Cyathus setosus. A-B, Brazilian material; C-F, holotype; A-D, basidiomata; E, peridioles; F, peridiole in transversal section. Scale bars: 2.5 mm.
Figure 2. Basidiospores (A-D) and peridioles (E-H) of *Cyathus* species from Pernambuco. A, E: *Cyathus intermedius*; B, F: *Cyathus montagnei*; C, G: *Cyathus setosus*; D, H: *Cyathus triplex*. Scale bars: A-D= 10μm; E-H= 1 mm).

**Remarks.** *C. setosus* is characterized by the presence of dark setae, small base emplacement, broadly obconic and dark basidiomata, outer surface not plicate and inner surface faintly plicate, and large peridioles without tunica. The cortex is two-layered and this feature is clearly observed in the Brazilian material. The dark setae, diagnostic feature of this species, microscopically consist of hyphal pegs of dark brown, thick walled hyphae (3-6 μm wide). As observed by Brodie (1967) in his original description the spore size may vary. However, he described the species with basidiospores 17-24 × 10-14 μm, whereas the Brazilian material has smaller dimensions (13-15 × 8.0-12 μm). According to our analysis of the holotype, the basidiospores are (-15) 16-20 × (10-) 10.5-12 (-13) μm (n = 50; L × W = 17.15 × 11.5 μm). Brodie (1967) described the peridioles as angular in outline, but we have also observed ellipsoid peridioles in the holotype collection.

The occurrence of *C. setosus* in Brazil was reported by Brodie (1984), but the exact location was not specified. However, the collector number given in this publication (#78010) corresponds to a collection from the state of Roraima, northern Brazil (DAOM 200851). This study reports the first occurrence of *C. setosus* from northeastern Brazil.

*Cyathus triplex* Lloyd, Mycol. Writ. 2, Nidulariaceae: 23 (1906)

(Figs. 1D, H)

Basidiomata obconic, without stipe, 6.0-10 mm high and 3.5-8.0 mm wide at the mouth; outer surface of the peridium not plicate, yellowish brown (KW 5E5), woolly, hairs, brownish orange (KW 5C5), that seem anastomosed; inner surface slightly ridged length wise, grayish brown (KW 5F3). Peridioles ellipsoid in outline, grayish brown (KW 5F2), shiny, 2.0-2.5 mm diam., two-layered cortex with thin tunica. Basidiospores ellipsoid, hyaline, smooth, 13-18 × 8.0-10 μm, thick-walled, walls 1.5-2.5 μm thick.

**Taxonomic summary**

**Distribution.** Pantropical (Brodie, 1975); in Brazil known from São Paulo, Pernambuco and Pará (Trierveiler-Pereira and Baseia, 2009).

**Studied specimens. Brazil:** Pernambuco, Recife, Parque Dois Irmãos, 09.VII.2008, Trierveiler-Pereira et Baltazar 68, URM 82062; Moreno, RPPN Carnijó, 08.VII.2008, Trierveiler-Pereira 80, URM 82063. Additional specimen: **Brazil:** Pernambuco, Recife, Parque Dois Irmãos, 1.2004, Baseia s/n, URM 77567.

**Remarks.** *C. triplex* is characterized by the peridium not plicate, peridioles with tunica and two-layered cortex. The species is similar to *C. setosus*, but dark setae are absent and the tunica is present. *Cyathus pallidus* is also a similar species, but it has lighter basidiomata, smaller basidiospores and one-layered cortex (Brodie and Dennis, 1954).

**Discussion**

In this study, *Cyathus* basidiomata were usually collected during the rainy season (winter). Most specimens were collected from June to August, although *C. setosus* was also collected in May and October. Herbarium data (Trierveiler-Pereira and Baseia, 2009) show that different species were collected at different times of the year, even in the drier months (*C. pallidus* and *C. triplex* were collected in January). Based on these observations, we can conclude that while investigating the diversity of *Cyathus* in this region, collections should be carried out during the entire year.

The specimens examined in this study were more common in lowland coastal forests (DI and CA), although *C. montagnei* was only found in highland humid forests (BC and ME). However, Trierveiler-Pereira and Baseia (2009) examined specimens of *C. montagnei* from lowland coastal forests which indicates that this species is not restricted to highland forests.

The identified species were found on rotten wood (fallen trunks or twigs), and curiously, 1 specimen of *C. setosus* was found on the petiole of a palm leaf (*Bactris acanthocarpa* Mart.). Most *Cyathus* species recorded from Pernambuco were collected on rotten wood (*C. intermedius*, *C. montagnei*, *C. pallidus*, *C. striatus* and *C. triplex*), although there are also reports from dung (*C. limbatus*), soil (*C. pygmaeus*) and other unusual substrata (*C. julietae* from *Mangifera indica* L. seeds and *C. montagnei* from *Coccus nucifera* L. fruit.).

The diversity of *Cyathus* species represented in this study is lower than we expected, since other species previously known from the state were not detected during field expeditions. Other tropical and cosmopolitan species which are known from Brazil, such as *C. berkeleyanus*, *C. poepiggi* and *C. stercoreus*, are also expected to occur in Pernambuco.
Key to *Cyathus* species known from Pernambuco, Brazil

1. Peridioles with one-layered cortex.................................................................................................................................................. 2
   1'. Peridioles with two-layered cortex.............................................................................................................................................. 7
2. Basidiospores up to 15 μm in length.................................................................................................................................................. 3
   2'. Basidiospores larger................................................................................................................................................................. 5
3. Basidiospores 8-10 × 5-6 μm.......................................................................................................................................................... *C. julietae*
   3'. Basidiospores larger................................................................................................................................................................. 4
4. Basidiomata 6.5-8.0 mm high, outer surface with long hairs, peridioles 2.0-2.25 mm diam....................................................... *C. pallidus*
   4'. Basidiomata 4.0-6.0 mm high, outer surface almost smooth, peridioles 1.5-1.75 mm diam..................................................... *C. pygmaeus*
5. Peridium walls n ot plicate.......................................................................................................................................................... *C. intermedius*
   5'. Peridium walls plicate externally and internally.................................................................................................................. 6
6. Peridium internally yellowish brown............................................................................................................................................. *C. striatus*
   6'. Peridium internally shiny gray ................................................................................................................................................... *C. montagnei*
7. Peridium plicate externally and internally.............................................................................................................................. 7
   7'. Peridium not plicate or faintly plicate internally..................................................................................................................... 8
8. Dark setae present at the apex of peridium................................................................................................................................... *C. setosus*
   8'. Dark setae absent............................................................................................................................................................ *C. triplex*

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Literature cited