

Co-occurrence of putatively allopatric species of the genus *Mycetophylax*: first record of *Mycetophylax simplex* (EMERY, 1888) (Hymenoptera: Formicidae) from Rio de Janeiro State, Brazil

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Abstract

This work reports the first recorded presence of *Mycetophylax simplex* (EMERY, 1888) in Rio de Janeiro state in Brazil. It also describes the discovery of co-occurrence of the two species of the genus that were previously considered allopatric species. One colony was collected at Praia das Dunas beach in Cabo Frio, Rio de Janeiro state. The co-occurrence of the three species of the genus *Mycetophylax* indicates that the species are sympatric. The known distribution of the genus *Mycetophylax* is summarized and discussed.

Key words: Ants, Attini, Formicidae, species distribution, restinga.

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Introduction

All ants in the tribe Attini engage in a mutual symbiosis with their fungal cultivars, which serve as their main food source. This relationship has been the focus of several studies that seek to understand the origin and transitions of the fungus growing habit (MEHDIABADI & SCHULTZ 2010). The 230 described species the tribe Attini comprises were divided into five agricultural systems due to correlations among ants, fungal cultivar and fungal pathogen phylogenies (see SCHULTZ & BRADY 2008 and MEHDIABADI & SCHULTZ 2010). Lower agriculture is the most abundant agricultural system and more informative for the elucidation of the events related to the first steps in the evolution of the tribe (MUELLER 2002). However, the majority of natural history studies are concerned with higher agriculturists (MEHDIABADI & SCHULTZ 2010, MUELLER & al. 2010).

The genus *Mycetophylax* EMERY, 1913 (Formicidae: Myrmicinae: Attini) practices a lower agriculture system and consists of three nominal species – *Mycetophylax morschi* (EMERY, 1888), *M. conformis* (MAYR, 1884) and *M. simplex* (EMERY, 1888) – after a taxonomic revision by KLINGENBERG & BRANDÃO (2009). The three species appear to be restricted to sand dunes on Brazilian Atlantic ocean coastlines (restinga), and according to KLINGENBERG & al. (2007) the genus *Mycetophylax* has a marked geographic distribution, where two species, *M. conformis* and *M. simplex* are allopatric and their geographic distributions along the Atlantic coastline do not overlap, whereas *M. morschi* is sympatric with the other two species. However, like other lower agriculturist species, the distribution of *Mycetophylax* is poorly known. Here we report the first record of *Mycetophylax simplex* in Rio de Janeiro state and its

co-occurrence with its congeneric putatively allopatric species *M. conformis*.

Methods

Samples analyzed in the present study were collected from sand dunes at Praia das Dunas beach (22° 54' S, 42° 02' W) in Cabo Frio, Rio de Janeiro state in September of 2010. The entrances of the colonies are located on the top of a small sand turret and surrounded by a sand crater, except in the case of *Mycetophylax morschi*, which constructs larger craters without a sand turret (WEBER 1982, DIEHL-FLEIG & DIEHL 2007). A hole of about one meter in depth was excavated exactly 10 cm from the nest mound. Afterwards, the sand walls of the hole were carefully removed until the fungus chamber had been exposed. In total, 12 colonies were excavated.

Workers and alates were used for identification using keys published by KLINGENBERG & BRANDÃO (2009) and by comparison with material collected by CARDOSO & CRISTIANO (2010), held in the reference collection of the Laboratório de Ecologia de Comunidades of the Universidade Federal de Viçosa, where all voucher specimens were deposited. In addition, the identification was confirmed by specialists (Rodrigo Feitosa, Museu de Zoologia da Universidade de São Paulo, and Vivian Sandoval, Universidade Federal de Viçosa) not involved in the present study.

Results and Discussion

In the course of developing a phylogeographical study of the *Mycetophylax* genus, we collected samples from colonies of the three species that belong to the genus throughout

the area of their known occurrence. Taking into account the species distribution described in the literature (KEMPF 1964, KEMPF 1972, DIEHL-FLEIG & DIEHL 2007, KLINGENBERG & al. 2007, KLINGENBERG & BRANDÃO 2009, CARDOSO & CRISTIANO, 2010, CARDOSO & al. 2010), and given that the nest entrances of *M. simplex* and *M. conformis* are similar (WEBER 1972, DIEHL-FLEIG & DIEHL 2007), we assumed that we were digging up a colony of *M. conformis*. However, the only chamber we found was of *M. simplex*. As a result, we obtained the first record of the occurrence of *M. simplex* in Rio de Janeiro state. In total 12 colonies were excavated in Cabo Frio, Rio de Janeiro, and five of these were *M. conformis*, six were *M. morschi* and one was *M. simplex*.

The genus *Mycetophylax* is the most poorly known and studied of the genera (KLINGENBERG & BRANDÃO 2009) in the Attini tribe. There are no records of *Mycetophylax* species in forest environments, and KLINGENBERG & al. (2007) reported, in a study of nest architecture, that *Mycetophylax* species are endemic to sand dune environments, known as restinga in Brazil. We agree with the endemic status for *Mycetophylax* species for South Atlantic coastline environments in Brazil, since the record for Paraguay cited by FOWLER (1980) is dubious and according to WILD (2007) probably refers to the common inland species *Kalathomyrmex emeryi* (FOREL, 1907). However, the limits of species occurrence throughout the area of their known distribution are controversial. WEBER (1982) reports that the *Mycetophylax* genus is distributed across the whole of South America, with its southern limit in the state of São Paulo, Brazil. Nevertheless, KEMPF published a list of Neotropical ant fauna in 1972, as well as records of *M. simplex* in São Lourenço, Rio Grande do Sul state, which is considerably further south than São Paulo state. Until relatively recently, however, *M. simplex* had not been recorded in Santa Catarina state, but KLINGENBERG & al. (2007) collected colonies of this species on Florianópolis Island and CARDOSO & CRISTIANO (2010) recorded it on the southern coast of Santa Catarina state (Fig. 1).

Regarding their surveys and data on the geographic distribution of *Mycetophylax* species obtained from collected material, KLINGENBERG & al. (2007) suggested that the species *M. simplex* and *M. conformis* are allopatric along Atlantic coastlines. These authors emphasize that *M. simplex* occurs in sand dunes at the beaches of Santa Catarina Island (Florianópolis) and Rio Grande do Sul states, and that *M. conformis* occurs in sand dunes at the beaches of Rio de Janeiro and São Paulo states. However, in this study we collected one colony of *M. simplex* in sand dunes of the Praia das Dunas beach at Cabo Frio, Rio de Janeiro state, Brazil, for the first time. The third species, *M. morschi*, occurs sympatrically with both other species of the genus, in all the states cited. Furthermore, KLINGENBERG & al. (2007) report that *M. morschi* do not have common nesting sites, occurring farther from the ocean than *M. simplex* and *M. conformis* (see KLINGENBERG & al. 2007). However, CARDOSO & al. (2010) found *M. simplex* and *M. morschi* living in the same phytophysionomies.

In our study we recorded the co-occurrence of the three species of the genus in the same locality (Praia das Dunas beach), indicating that *Mycetophylax simplex* and *M. conformis* are not allopatric. Further, we refute the hypothesis proposed by KLINGENBERG & al. (2007) that the distribution of the *Mycetophylax* species results in a partitioning

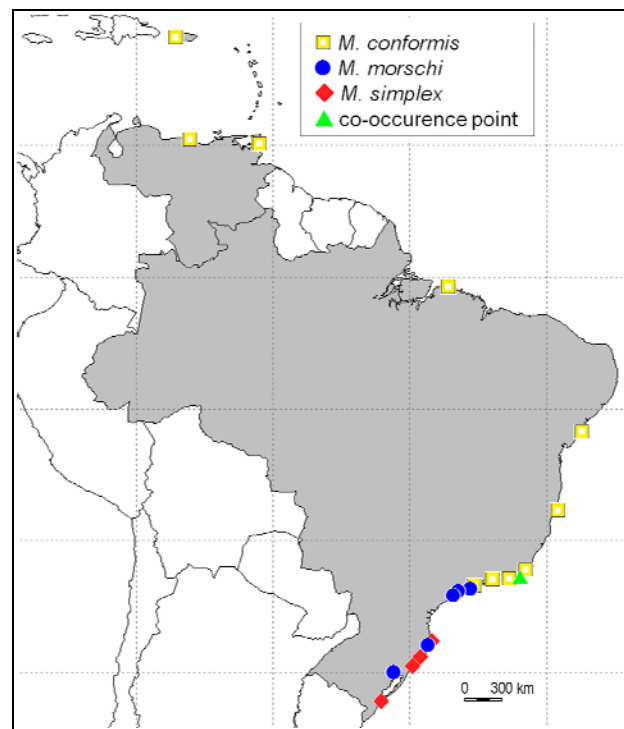


Fig. 1: New distribution map of the *Mycetophylax* species modified from KLINGENBERG & BRANDÃO (2009) with a highlighted co-occurrence of the three species in Cabo Frio (Rio de Janeiro) (green filled triangle): *M. simplex* (red filled diamonds), *M. conformis* (yellow open squares) and *M. morschi* (blue filled circles).

of the resource nesting space to reduce interspecific competition, since three species were found in the same nesting sites. Interspecific competition probably occurs among *Mycetophylax* species and evidence of this can be observed in the mean abundance shifts of these species in a composition study (CARDOSO & al. 2010). These authors report that *M. simplex* and *M. morschi* occur in the same restinga phytophysionomies and that the mean abundance of *M. morschi* is higher when the mean abundance of *M. simplex* is lower or when this species is absent.

Finally, we suggest two hypotheses for the distribution of *Mycetophylax simplex*: (I) *M. simplex* has a distribution similar to that of the species *M. morschi* proposed by KEMPF (1964), which extends from southern Rio Grande do Sul state to Cabo Frio, Rio de Janeiro state; or (II) *M. simplex* had a similar distribution to *M. morschi* in the past and its current wide distribution is restricted to Santa Catarina and Rio Grande do Sul state, while it presents a relict population in Cabo Frio, Rio de Janeiro state. Other studies on the geographic distribution and phylogeography of the *Mycetophylax* species are presently being carried out by the authors and may elucidate the natural history of the *Mycetophylax* species.

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