Opportunistic Occupation of Nests of *Microcerotermes* spp. Silvestri (Termitidae: Termitinae) by *Partamona seridoensis* Camargo & Pedro (Apidae: Meliponini) in the Brazilian Tropical Dry Forest

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**Abstract**

Social bees make use of natural or animal-built structures to protect their colonies from environmental stressors. Here, particularly attractive shelters are active termite nests because they provide a stable climatic environment for inquilines. Several social bee species form obligatory associations with termites, among these the stingless bee *Partamona seridoensis* (Apidae: Meliponini), whose distribution is limited to the Tropical Dry Forest in the Brazilian Northeast. So far, colonies of this meliponine species have been found mainly in arboreal nests of the termite *Constrictotermes cyphergaster*, which suggests a tight relationship between these two social insect species. The present study was conducted in an area of the Tropical Dry Forest in the Brazilian State of Rio Grande do Norte, where *P. seridoensis* naturally occurs albeit the absence of *C. cyphergaster*. We registered 14 colonies of *P. seridoensis*, all occupying active arboreal nests of termites of the genus *Microcerotermes*. The only other termites with arboreal nests present in the study area, *Nasutitermes corniger*, never housed *P. seridoensis*. This selective preference of the bees for *Microcerotermes* nests might be due to differences between termites concerning defense mechanisms or concerning thermal stability within the nests. Our study indicates that the occurrence of *P. seridoensis* is not restricted to the presence of *C. cyphergaster* in the Brazilian Tropical Dry Forest, and suggests that the bees opportunistically use the best nesting substrates available in the environment.
(Zanella, 2000). Nesting inside of termite nests, which provide a stable microclimate, might be a selective advantage for meliponine species facilitating colony survival in the Brazilian Tropical Dry Forest (Carvalho et al., 2014).

To this day, colonies of P. seridoensis have been found mainly in arboreal nests of Constrictotermes cyphergaster Silvestri 1901 (Termitidae, Nasutitermitinae) (Lorenzon et al., 1999; Barreto & Castro, 2007; Fernandes, 2011; Miranda et al., 2015), despite the abundant occurrence of two other termite genera with the same nesting habit, Nasutitermes Dudley 1890 (Termitidae, Nasutitermitinae) and Microcerotermes Silvestri 1901 (Termitidae, Termitinae), in the Caatinga (Martius, 1999; Vasconcellos et al., 2010; Viana Junior et al., 2014). This fact suggests a tight relationship between P. seridoensis and C. cyphergaster. However, what happens if C. cyphergaster does not occur at a certain location, either owing to the lack of adequate feeding- and nesting substrates (Leite et al., 2011; Bezerra-Gusmão et al., 2013), or due to its extermination in man-modified environments? Do the associated bees also not occur at these locations? Or do they opportunistically switch to other host species?

The present study was performed to answer this question. Surveys were conducted between February and November of 2015 at the Experimental Field-Station Rafael Fernandez of the Brazilian Federal University at Mossoró (UFERSA), Rio Grande do Norte, Brazil (5° 03’ S, 37° 24’ W). The field-station comprises a total area of 416 ha, divided into a central area for experimental agriculture surrounded by a belt of native Caatinga vegetation, partly in regeneration after destruction by fire in the 1980ies. In the course of a bee survey at the field-station, various specimens of P. seridoensis had been collected at flowers (Airton Torres Carvalho, personal communication, April of 2012), indicating the presence of colonies of this meliponine species in the vicinity.

We located colonies of P. seridoensis through active search in the areas with native Caatinga vegetation (total sampling effort: 60 hours). The termite nests housing meliponine colonies were identified to the species-level based on species-specific external morphological characteristics of the nests (Constantino, 1999). In total, we found 14 colonies of P. seridoensis, all nesting in active arboreal nests of termites of the genus Microcerotermes, 13 associated with Microcerotermes indistinctus Mathews 1977 and one with Microcerotermes strunckii Sörensen 1884.

To evaluate whether this observed association between P. seridoensis and Microcerotermes spp. was related to the dominance of this termite genus in the study area, we estimated the abundance of arboreal nests of all termite species present in the area. For this, we chose randomly five transects of 200 m each within the area covered by native Caatinga vegetation. All arboreal termite nests within 10 m to the left and right of the transect (total sampling area = 20,000 m²) were identified to the species-level according to Constantino (1999). In total, we located 34 nests of M. indistinctus and 5 nests of Nasutitermes corniger Motschulski 1855. The estimated abundance of M. indistinctus nests in the study area (17 nests/ha) was almost seven times that of N. corniger nests (2.5 nests/ha), pointing to a strong dominance of Microcerotermes at the university’s field-station. We found no nests of C. cyphergaster within the sampling area.

Our study is the first report of an association between P. seridoensis and termites of the genus Microcerotermes, therewith demonstrating that the occurrence of this meliponine species is not at all restricted to the local availability of C. cyphergaster. Apparently, the bees occupy nests of other termite species, selecting opportunistically the best nesting substrates available in the respective environment.

Despite the presence of N. corniger in the study area, the absence of P. seridoensis nests associated with this termite species suggests that some feature other than availability of arboreal termite nests affects the choice of the nesting substrate by the bees. Here, differences between termite species concerning their defense mechanisms might impose different levels of difficulty for nest invaders. The defense secretions of Nasutitermes soldiers together with the pheromone-mediated coordination of aggressive attacks compose a much more efficient defense strategy than that of Microcerotermes, which relies mainly on biting and piercing the opponents with the mandibles (Prestwich, 1979; Prestwich, 1984; Leponce et al., 1999; Quinet et al., 2005). Second, it might be more difficult for invaders to isolate themselves successfully from the termites in Nasutitermes nests, given that the openings between chambers are much wider than in nests of Microcerotermes (Deligne & Pasteels, 1982). These facts taken together suggest that invasions by P. seridoensis may be easier in Microcerotermes nests than in Nasutitermes nests.

Additionally to differences in nest defense, differences between Microcerotermes and Nasutitermes concerning the physical nest characteristics might influence the choice by P. seridoensis. Owing to the bees’ need for nesting substrates that minimize the thermal stress of the outside environment (Jones & Oldroyd, 2007), differences between termite nests concerning their quality of thermal insulation may bias the bees’ nest-site selection. Whereas Nasutitermes build carton nests using wood particles in the construction, Microcerotermes use mainly soil and sand particles for building their nests (Emerson, 1938). This inclusion of mineral material results in an increased material density (Amelung et al., 2002) and, consequently, in an increased heat capacity of the material used for nest construction (John et al., 2005). Hence, in environments with elevated ambient temperatures, as is the case in the Brazilian Tropical Dry Forest, Microcerotermes nests may be more attractive for inquilines owing to the fact that more thermal energy is necessary to heat-up the building materials compared to Nasutitermes nest. Thus, the observed selective preference for Microcerotermes over Nasutitermes nests by P. seridoensis in the study area may be a result of both the ease of invasion and thermal stability.
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References


