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Scientific Note

Occupation of *Synoeca surinama* (L.) (Vespidae, Polistinae) nests by *Nasutitermes obscurus* (Holmgren) (Termitidae, Nasutitermitinae) in the Cerrado

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Abstract. The study of relationships between living beings is essential for understanding the functioning of the ecosystem for the management and conservation of biota, especially in rich and threatened biomes such as the Brazilian Cerrado. Therefore, this study aims to report the occupation of abandoned social wasp's nests by termites in this biome. In this study, the occupation of two abandoned nests of *Synoeca surinama* (L.) by the termite *Nasutitermes obscurus* (Holmgren), recorded by chance, in April 2023 in a gallery forest with the same vegetation type of the Cerrado, located in the Grande Sertão Veredas National Park in southeastern Brazil. Both social wasp nests had their cells occupied by termites, which may have been used as a satellite nest for *N. obscurus*. This is the first record of a termite species occupying a social wasp's nests; however, further studies are needed to better elucidate this relationship.

Keywords: Carton nest; conservation; foraging; social wasp; termites.

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The Cerrado occupies an area of more than 2 million square kilometers, which is approximately 24% of the Brazilian territory (Brasil 2023), being considered a global biodiversity hotspot (Myers *et al*. 2000). However, it is one of the most threatened biomes because of anthropogenic activities, mainly by land use (Ratter *et al*. 1997; Klink & Machado 2005; Sano *et al*. 2008; Grandinete & Noll 2013), which reduced it to less than half of its original area (MapBiomas 2021). Additionally, there is the fact that only 8.3% of its area is inserted in Conservation Units (Santos & Cherem 2023), a scenario that puts biodiversity at risk.

Termites are abundant insects in the Cerrado and play several ecological roles, such as nutrient cycling and soil aeration, and are even considered as ecosystem engineer species (Lavelle *et al*. 1997; Constantino 2005). Social wasps are another relevant taxon of social insects for the Cerrado due to its significant number (Souza *et al*. 2020; Vicente *et al*. 2020), which perform important ecological functions, such as pollination, predation (Mello *et al*. 2011; Jacques *et al*. 2018), and interactions with other animals (Souza *et al*. 2017; Francisco *et al*. 2022; Jacques *et al*. 2022a, 2022b; Souza *et al*. 2022a, 2022b).

The nests of social wasps (Vespidae: Polystinae) are commonly constructed by mixing insect saliva with cellulose obtained by scraping wood (Jeanne 1975; Wenzel 1998). They have different architectures (Richards & Richards 1951) and are found in various environments, such as human structures, rocks, gullies, and vegetation (Oliveira *et al*. 2017; Milani *et al*. 2020). These nests are highly resistant (Somavilla *et al*. 2012), therefore they can be occupied by other insects seeking shelter or even a place for their own nesting purposes, as documented for ants (Richards 1978; Bouwma *et al*. 2007; Souza *et al*. 2022a, 2022b). Despite the lack of information on termite occupation, it is known that termite mounds are commonly used for nesting social wasps (Zucchi *et al*. 1995; Almeida *et al*. 2014). Therefore, this study aims to report the occupation of social wasp nests by termites in the Brazilian Cerrado.

The records occurred at chance in April 2023, with one nest located near Rio Preto and another on the banks of Cachoeira do Mato Grande, both in a gallery forest with the typical same vegetation type of the Cerrado, within the Grande Sertão Veredas National Park (15°11'16.4"S 45°41'00.9"W), in the northern Minas Gerais, Brazil. Photographs were taken using a camera (Nikon 60× Optical Zoom Wide) and termite specimens were collected and identified by Dr. Reginaldo Constantino (Universidade de Brasilia - UnB). The specimens were then deposited in the Isoptera Collection of the Termite Laboratory at UnB, under number 11699. The social wasp species was identified by Dr. Orlando Tobias da Silveira (Emílio Goeldi Museum, Belém, Pará). The same active nests had been previously recorded approximately two months before as part of a social wasp inventory project in the Grande Sertão Veredas National Park (to be published). Wasp specimens were collected at the

time.

Two nests of *Synoeca surinama* (L.) (Vespidae: Polistinae) were recorded without presence of wasps at any time of development, but both nests were occupied by the termite *Nasutitermes obscurus* (Holmgren) (Termitidae: Nasutitermitinae). Nest 1 had the outer envelope ruptured and the cells were sealed by termites, forming tunnels between them (Figure 1A, B). The outer envelope of Nest 2 was intact, with an opening at the top of the nest, which was sealed by termites using fecal material (Figure 1C). When the outer envelope was removed, the sealed cells were observed, also with tunnels, similarly to Nest 1 (Figure 1D). The presence of reproductive termites, juveniles and eggs was not observed in any of the nests, being collected, in both, only soldiers and workers. Consumption of cellulosic material from wasp nest cells by termites was also not observed.

In termites, polychalism is characterized by communication between two or more nests of a colony through aerial or underground galleries (Noirot & Darlington 2000). Satellite nests can serve as a foraging support and food storage area (Holt & Easey 1985). Polychalism has already been observed for species of *Nasutitermes* (Martius 2001). The nest of *S. surinama* may have been used as a satellite nest for *N. obscurus*, being a behavioral strategy to reduce energy expenditure, since using an already built and resilient structure is theoretically less costly than establishing a new one. These arboreal termites seem to be remarkably adaptable and resilient in expanding or adapting their colonies to circumstantial changes (Thorne & Haverty 2000).

These carton nests are composed of fecal material (partially digested wood along with salivary and fecal fluids) and are built on the tree trunk or around a branch (Light 1933; Emerson 1938; Thorne *et al*. 1996). Similar to the nests of *Nasutitermes*, the nests of *Synoeca* de Saussure are built directly on tree trunks (Somavilla *et al*. 2012). These nests are produced by the mixture of insect saliva with cellulose obtained from scraping wood (Jeanne 1975; Wenzel 1998). They are highly resistant and protected, as they have an outer envelope with a single opening at the top (Somavilla *et al*. 2012). The structure and place of construction of these wasp nests may have facilitated the use of it by the termites.

The relationship between social wasps and termites is reported in different situations, such as the predation of *Polybia* Lepeletier species on workers and reproductive

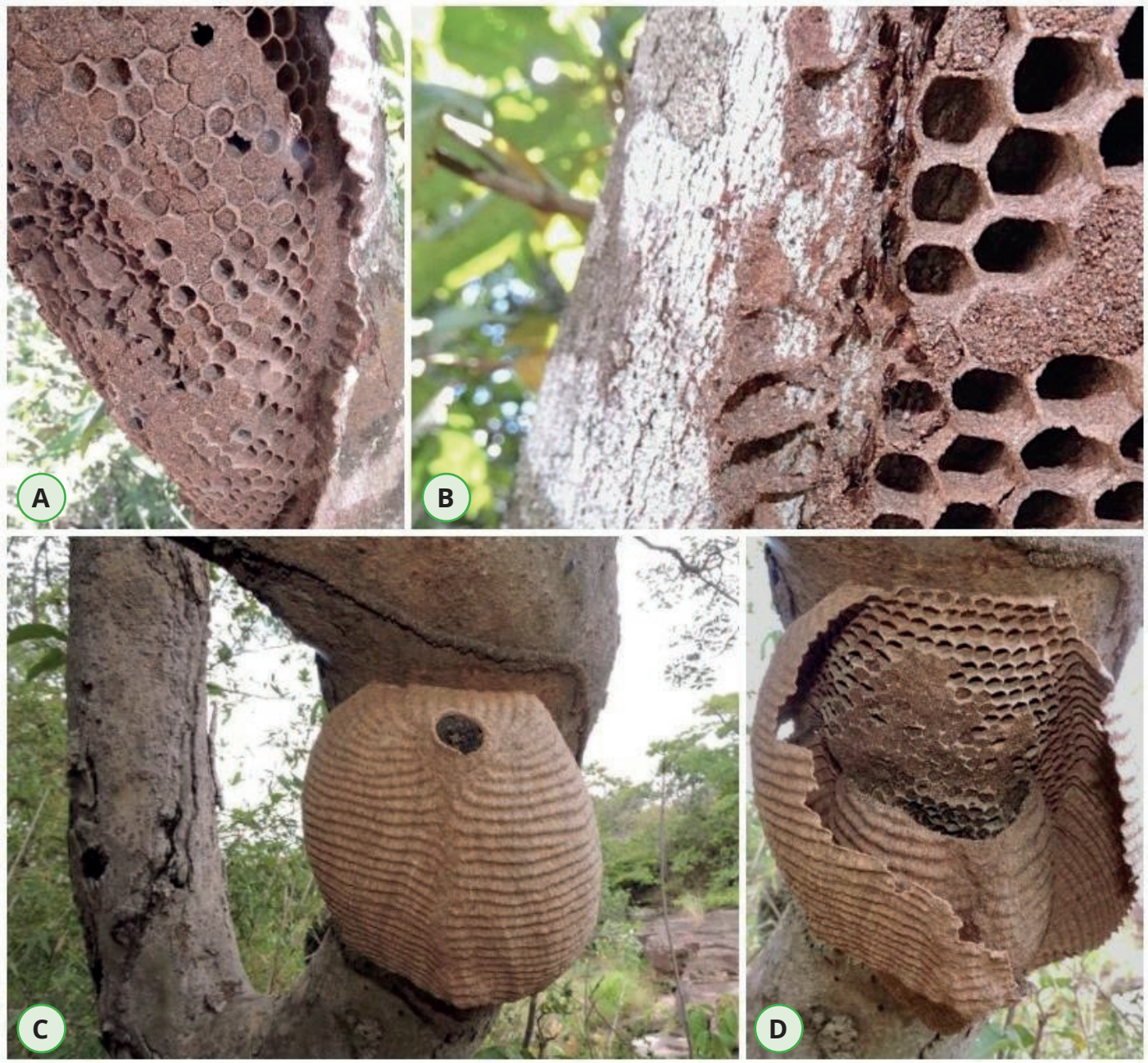

Figure. 1. Nest 1 (A and B) and Nest 2 (C and D) of *Synoeca surinama* (L.) (Vespidae: Polistinae) occupied by the termite *Nasutitermes obscurus* (Holmgren) (Termitidae: Nasutitermitinae). Source: authors.

termites, including those of the *Nasutitermes* genus, which can be found in large quantities inside wasp nests (Richards & Richards 1951; Gobbi & Machado 1985; Noll *et al*. 1997; Prezoto *et al*. 2005; Starr 2017). Wasps have also been reported in termite nests (Zucchi *et al*. 1995; Almeida *et al*. 2014); however, in the literature, the only information of termites observed in social wasp nests was reported by Sommavilla *et al*. (2012), in which soldier termites were frequenting the interior of the nest of *Polybia procellosa* Ducke along with the wasps, but this cohabitation relationship between these insects has not been elucidated.

This is the first record of a termite species occupying a social wasp nest. However, further studies are needed to better elucidate this relationship since it was not possible to state whether the termites invaded a still active nest or just occupied an abandoned one. Furthermore, understanding these relationships between social wasps and termites is relevant as it provides a better understanding of ecosystem dynamics and termite ethology. This knowledge can be used to establish management and conservation actions for biota, especially in globally recognized hotspots that are critically threatened by agricultural expansion such as the Brazilian Cerrado.

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