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Short Communication

# On the nesting biology of eumenine wasps yet again: *Minixi brasilianum* (de Saussure) is a builder and a renter. . . at the same time! (Hymenoptera, Vespidae, Eumeninae)

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ABSTRACT

Our understanding of eumenine nesting biology is still elusive. The use of two nesting strategies, namely renting and building, are reported concomitantly for the first time for *Minixi brasilianum* (de Saussure, 1875). Ecological factors such as resource availability and protection against potential enemies may play an important role in eumenine nesting biology.



In recent years, our understanding of Eumeninae evolution has significantly increased. The phylogenetic account of Hermes et al. (2014) provided a first attempt at a natural tribal classification of the subfamily, which triggered subsequent efforts to enhance the taxonomy and classification of the group at lower hierarchical levels (*e.g.* Grandinete et al., 2015). However, many groups still lack modern systematic revisions, and many aspects of eumenine biology remain elusive.

A recent paper by Hermes et al. (2013) summarized general aspects of eumenine nesting biology, with special reference to the genus *Pirhosigma* Giordani Soika. Some species in this taxon use vegetable matter to camouflage their spherical mud nests, probably to prevent parasitism by natural enemies. Also mentioned therein is the use of vegetable matter by other eumenine lineages, but with different purposes, such as the use of masticated fibers for nest construction or particles of leaves for cell partition.

The nesting biology of eumenine wasps, however, is far from thoroughly studied or comprehended. The three general categories attributed to eumenine nesting strategies, namely excavators, renters and builders (Iwata, 1976), are challenged by the plasticity observed for some species (Evans and Matthews, 1974), but the use of two strategies at the same time is newly reported herein.

*Minixi brasilianum* (de Saussure, 1875) belongs in a clade of exclusively Neotropical elements within the tribe Eumenini (Hermes et al., 2014), characterized by wasps that build exposed spherical mud nests. This species, however, was recently collected with trap-nests, challenging the previous nesting classification.

Females of *M. brasilianum* were observed during nest construction in trap-nests in riparian forests of the Volta Grande Reservoir (20°01′54″′ S/48°13′17″ W) at the border of Minas Gerais and São Paulo States, Brazil. Three trap-nests were used by different females in January 2014, of which one presented three pots (cells) and two presented just one pot (cell). The trap-nests used by the females were made of postcard paper placed inside wooden blocks (Fig. 1), and were 1.2 cm in diameter and 10 cm deep. They were placed on an average height of 1.5 m. Each nest was established in different sites of the riparian forest, which show different plant composition. A considerable amount of trap-nests were also occupied by other eumenine species.

The pots (cells) built inside the trap-nests were rounded and made out of mud, and had an average diameter of 1.1 cm (Fig. 2). Only males emerged from the trap-nests with a single pot (cell); from the nest with three cells, one male and two females emerged. The nests and specimens are deposited at the *Laboratório de*

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**Figs. 1–2.** (1) Wooden blocks with trap-nests made out of postcard paper; (2) a trap-nest with three mud pots, showing the combination of building and renting strategies by *Minixi brasilianum*.

*Biodiversidade* of *Universidade Federal de Ouro Preto*, except for one male and one female, which are deposited at the *Laboratório de Sistemática e Biologia de Hymenoptera* of *Universidade Federal de Lavras*.

As is usual for members of the Eumenini, their nests bear a jug-like aperture through which the females insert their elongated metasoma to lay one single egg and, after doing so, provision them mainly with lepidopteran larvae. However, one question remains: how are these females able to build, oviposit and provision their nests in such way with considerable lack of space availability inside a trap-nest?

Species in the genera *Ancistrocerus* Wesmael, *Euodynerus* Dalla Torre and *Pachodynerus* de Saussure may represent the cases in which nesting behavior plasticity seems to be more widespread (Cooper, 1979; Krombein, 1979; Willink and Roig-Alsina, 1998 and references therein). Some species in these genera may behave as excavators, renters or builders. Also, they may take advantage of other structures, such as abandoned nests of other eumenines (*e.g.* *Montezumia* de Saussure and *Zeta* de Saussure) (Bertoni, 1911, 1921) and sphecids (*Sceliphron* Klug) (Freeman and Jayasingh, 1975). Building behavior, however, has long been attributed to those eumenines that build exposed nests, which included the whole Eumenini, some Odynerini and some Zethini (tribes in the sense of Hermes et al., 2014), excluding those taxa that use mud to modify pre-existing cavities. While it is true that none of the pot-builders has been previously reported nesting in cavities, what has been reported is the building of complete mud cells within such cavities, as is the case of *Ancistroceroides ambiguus* (Spinola) (cited as *Odynerus ambiguus* in Claude-Joseph, 1930). The same is true for *Ancistrocerus catskill* (de Saussure) and *A. spilogaster* Cameron (J.M. Carpenter, personal communication).

Plasticity in nesting biology had been addressed previously in Eumeninae (*e.g.* Evans and Matthews, 1974; Cooper, 1979). These authors also pointed out that it is difficult to establish behavioral patterns for major groups; this raises the question whether or not we should keep referring to the Eumeninae as exhibiting only three well defined nesting categories. We advocate that we should not. The case presented here is the first record of a pot-building eumenine species using two strategies at the same time (despite some renting species using mud to make cells inside cavities, as mentioned above), and considering the great diversity in this taxon, one should expect more similar cases to be discovered when biology studies are carried out. This statement may be even better supported if the phylogenetic relationships of the Eumeninae as a whole are considered: the building behavior is retained by several odynerine (derived) lineages, but what really seems to be favored when building a nest is opportunity.

It seems that the nesting biology of eumenine wasps tends to be influenced by ecological factors, such as resource availability (*e.g.* nesting sites, mud, prey) and protection against potential enemies. This behavioral plasticity may prove to be largely present among other eumenine lineages, although more general aspects of their nesting biology, such as the persistence of building spherical jug-like cells inside a pre-existing cavity may still shed light on our higher-level knowledge of the subfamily as a whole, and even resolve taxonomic issues.

## Conflicts of interest

The authors declare no conflicts of interest.

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