



Reuse of a *Polistes* sp. (Hymenoptera: Vespidae: Polistinae) nest by solitary hymenopterans (Vespidae: Eumeninae and Crabronidae)

Reutilización de un nido de *Polistes* sp. (Hymenoptera: Vespidae: Polistinae) por himenópteros solitarios (Vespidae: Eumeninae y Crabronidae)

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Abstract.- Evidence exists in the literature that some species of solitary wasps reuse eusocial vespid nests. However, there are few reports of this type of nesting by groups such as Eumeninae (Vespidae) and Crabronidae. The aim of this study is to report a nesting of *Pachodynerus nasidens* Latreille, 1817 (Vespidae, Eumeninae) and *Trypoxylon* sp. Latreille, 1796 (Crabronidae, Crabroninae) on an abandoned nest of *Polistes* sp. (Vespidae, Polistinae). The observation took place on July 14, 2023, in an anthropized area of Atlantic Forest biome, at the "Fazenda Escola" of the Federal Institute of Science, Education and Technology of Southern Minas Gerais (IFSULDEMINAS), Inconfidentes campus, southern Minas Gerais state, Brazil. Fifteen specimens of *P. nasidens* and one specimen of *Trypoxylon* sp. emerged from cells covered with mud, under laboratory conditions. Our results contribute with additional insights into this interaction across different ecological conditions. The existing literature documents the use of *Polistes* nests by *P. nasidens* and *Trypoxylon* in Brazilian biomes other than the Atlantic Forest. However, it is not currently possible to measure the frequency of such occupations. Therefore, given what was observed, we suggest conducting further studies to better elucidate the ecological and ethological aspects of this reuse.

Key words: *Crabronidae*, *Eumeninae*, *nesting*, *resource*.

Resumen.- Existen pruebas en la literatura de que algunas especies de avispas solitarias reutilizan nidos eusociales de véspidos. Sin embargo, hay pocos informes de este tipo de nidificación en grupos como Eumeninae (Vespidae) y Crabronidae. El objetivo de este estudio es informar sobre una nidificación de *Pachodynerus nasidens* Latreille, 1817 (Vespidae, Eumeninae) y *Trypoxylon* sp. Latreille, 1796 (Crabronidae, Crabroninae) en un nido abandonado de *Polistes* sp. (Vespidae, Polistinae). La observación tuvo lugar el 14 de julio de 2023, en un área antropizada del bioma de la Mata Atlántica, en la "Fazenda Escola" del Instituto Federal de Ciencia, Educación y Tecnología del Sur de Minas Gerais (IFSULDEMINAS), campus Inconfidentes, sur del estado de Minas Gerais, Brasil. Quince especímenes de *P. nasidens* y un espécimen de *Trypoxylon* sp. emergieron de células cubiertas de barro, en condiciones de laboratorio. Nuestros resultados aportan información adicional sobre esta interacción en diferentes condiciones ecológicas. La literatura existente documenta el uso de nidos de *Polistes* por *P. nasidens* y *Trypoxylon* en biomas brasileños distintos de la Mata Atlántica. Sin embargo, actualmente no es posible medir la frecuencia de tales ocupaciones. Por lo tanto, teniendo en cuenta lo observado, sugerimos la realización de nuevos estudios para dilucidar mejor los aspectos ecológicos y etológicos de esta reutilización.

Palabras clave: *Crabronidae*, *Eumeninae*, *nidificación*, *recurso*.

Solitary wasps of the subfamilies Masarinae and Eumeninae, use clay to build new nests or to seal pre-existing natural or artificial cavities,

which are also used for nesting (Carpenter & Marques, 2001). This behavior is similar to that observed in other Hymenoptera families, such



as Crabronidae (Coville *et al.*, 2015; Buschini, 2007).

On the other hand, most species of the eusocial Polistinae (Hymenoptera: Vespidae), popularly known in Brazil as "marimbondos" or "cabas" (Noronha *et al.*, 2021), build their nests from plant fibers (Wenzel, 1998; Barbosa *et al.*, 2021). Their nests are used for food storage (O'donnell & Jeanne, 1992; Breed *et al.*, 2012), protection against bad weather (Schmolz *et al.*, 2000), thermal homeostasis of the colony (Jones & Oldroyd, 2006; Hozumi *et al.*, 2010) and protection against predators (Smith *et al.*, 2001).

Due to the features of social wasp nests mentioned above, they may serve as actual ecosystems that are reused by spiders (Araújo & De Maria, 2008), ants (Souza *et al.*, 2022), bees (Pinto, 2005), termites (Jacques *et al.*, 2023) and even other social wasps (Gil, 1988). However, there are few records of the reuse of social wasp nests by wasps from the Eumeninae subfamily (Rau, 1944; Jacques, *et al.*, 2022) and the Crabronidae family (Rau & Rau, 1916; Nelson & Starr, 2016).

The aim of this study is to provide additional information on the reuse of a social wasp nest by Eumeninae and Crabronidae, in anthropogenic areas within the Atlantic Forest biome.

Material and methods

The record took place at random on July 14, 2023 in an anthropized area of Atlantic Forest biome, at the "Fazenda Escola" of the Federal Institute of Science, Education and Technology of Southern Minas Gerais (IFSULDEMINAS), Inconfidentes *campus*, southern Minas Gerais state, Brazil.

The nest was reached using a ladder and collected with an entomological net, then taken to the IFSULDEMINAS Zoology Laboratory. The nest was stored in a plastic container, for around 60 days, with a textile mesh lid to maintain the oxygen flow and allow the emergence of the specimens. The length, width and diameter of the nest were measured using a ruler, followed

by a description of the number and region of empty cells sealed with clay. After emergence, the adults were stored in 70% alcohol. They were then pinned, labeled, mounted, and incorporated into the IFSULDEMINAS Biological Collection of Social Wasps (CBVS) (Record number: 11703-2023 to 11717-2023).

The identification of specimens was performed using a stereoscopic microscope. Specimens of the subfamily Eumeninae were identified using the keys of Carpenter & Garcete-Barrett (2003) and Willink & Roig-Alsina (1998). Specimens of Crabronidae were identified using the keys of Goulet & Huber (1993) and Jesus *et al.* (2019). Identification at the genus level based on the architectural features of social wasp nests was conducted using the key provided by Barbosa *et al.* (2021).

Results

A nest of *Polistes* sp. was recorded in a metal eave, about four meters off the ground. The vegetation next to the nest was composed of pastureland and a fragment of Montane Seasonal Semideciduous Forest, a phytophysiology of

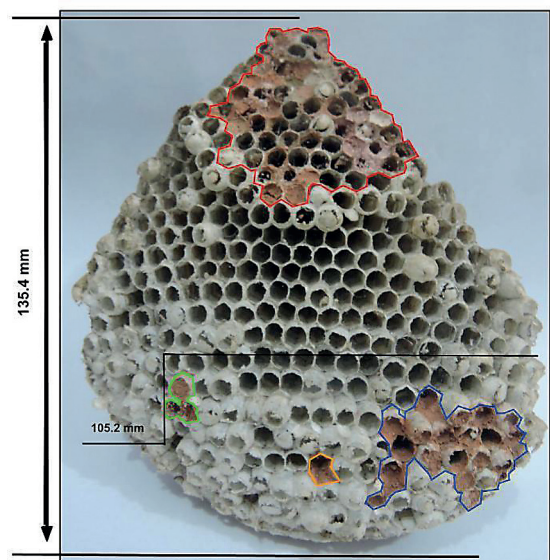


Figure 1. *Polistes* sp. nest with four areas (highlighted in red, orange, green and blue) demonstrating different areas with breeding cells sealed with mud.

the Atlantic Forest. The nest is 13.5 cm long, 10.5 cm wide, 2.2 cm thick and has 521 breeding cells (with average size of 5 mm each), with four areas sealed off with mud (Figure 1). A total of 78 breeding cells were found sealed. Fifteen specimens of *Pachodynerus nasidens* Latreille, 1812 (Vespidae, Eumeninae) and one specimen of *Trypoxylon* sp. (Crabronidae, Larinae) emerged.

Discussion

The reuse of abandoned *Polistes* spp. nests by *Pachodynerus nasidens* may probably lie in energy saving, since the production of new nesting structures is energetically demanding, as has been suggested for species of the genus *Zeta* Sausuure, 1855 (Rocha & Raw, 1982). Considering that both *P. nasidens* and the genus *Polistes* as a whole are widely distributed in Brazil, it is possible that this nest reuse occurs in different ecological conditions and affecting the nests of different species of *Polistes*, as it has already been reported in different biomes, such as Caatinga (Jacques *et al.* 2022), and the Atlantic Forest (i.e. the present study). Nevertheless, it is still not possible to infer the frequency of this behavior.

Energy saving may also be an advantage for *Trypoxylon* sp., but other possible benefits of nesting in an abandoned *Polistes* nest can be listed: 1) The brood cells of this genus are 5 mm in diameter, similar to the cavities used by *Trypoxylon* (Pinto, 2005; Salustiano *et al.*, 2021); thus, the nest's architecture is probably an attraction for other hymenopterans (Wenzel, 1998). 2) *Polistes* species deposit secretions on the supporting peduncles of their nests, which repel ants, (Kojima, 1993), which may reduce predation. 3) Due to their hydrophobic composition, which reduces an excessive humidity that could stimulate the settlement and growth of harmful organisms (Hozumi *et al.*, 2010).

The species of *Pachodynerus* Saussure, 1870 use agriculturally important lepidopterans to feed their larvae (Laplante *et al.*, 2020), there-

fore, the preservation of social wasp nests in agricultural ecosystems is advantageous, due to the possible biological control carried out by these hymenoptera.

Conclusions

Our results contribute with additional insights into this interaction across different ecological conditions. The existing literature documents the use of *Polistes* nests by *Pachodynerus nasidens* and *Trypoxylon* sp. in Brazilian biomes other than the Atlantic Forest. However, it is not currently possible to measure the frequency of such occupations. Therefore, given what was observed, we suggest conducting further studies to better elucidate the ecological and ethological aspects of this reuse.

Literature

- Araújo, D.P. & De Maria, M. (2008). Nesting of jumping spiders (Araneae, Salticidae) inside abandoned wasps nests (Hymenoptera, Aculeata). *Revista Brasileira de Zoologia*, 10(2): 171–173.
- Barbosa B.C., Maciel, T.T. & Prezoto, F. (2021). Nesting Habits of Neotropical Social Wasps. Pp. 85–98, *in* Prezoto, F., Nascimento, F.S., Barbosa, B.C. & Somavilla, A. (Eds.). *Neotropical Social Wasps*. Cham: Springer. xiii + 472 pp.
- Breed, M.D., Cook, C. & Krasnec, M.O. (2012). Cleptobiosis in Social Insects. *Psyche*, 2012(1)484765: 1–7.
- Carpenter, J.M. & Marques, O.M. (2001). *Contribuição ao Estudo dos Vespídeos do Brasil*. Cruz das Almas: Publicações Digitais da Universidade Federal da Bahia, 3. CD-ROM.
- Carpenter, J.M. & Garcete-Barrett, B.R. (2003). A key to the Neotropical genera of Eumeninae (Hymenoptera: Vespidae). *Boletín del Museo Nacional de Historia Natural del Paraguay*, 14(1-2): 52–73.
- Coville, R.E., Griswold, C. & Coville, P.L. (2015). Notes on the habits of the spider

- hunting wasps *Trypoxylon lactitarse* Saussure, 1867 and *T. menkeanum* Coville, 1982 (Hymenoptera: Crabronidae) in Costa Rica. *The Pan-Pacific Entomologist*, 91(3): 257–273.
- Goulet, H. & Huber, J.T. (1993). *Hymenoptera of the World: An identification guide to families*. Ottawa: Agriculture Canada. 680 pp.
- Hermes, M.G. & Somavilla, A. (2024). Vespidae. *Catálogo Taxonômico da Fauna do Brasil*. [Consulted: 17.v.2024]. <<http://fauna.jbrj.gov.br/fauna/faunadobra-sil/70337>>.
- Hozumi, S., Mateus, S., Kudô, K., Kuwahara, T., Yamane, S. & Zucchi, R. (2010). Nest Thermoregulation in *Polybia scutellaris* (White) (Hymenoptera: Vespidae). *Neotropical Entomology*, 39(5): 826–828.
- Jacques, G.C., Ferreira, W.D., Moura, P.A., Teofilo-Guedes, G. & Souza, M.M. (2022). Nesting of the keyhole wasp *Pachodynerus nasidens* (Latreille, 1812) (Vespidae, Eumeninae) in a nest of a paper wasp (Vespidae, Polistinae). *Journal of Hymenoptera Research*, 93: 125–130.
- Jacques, G.C., Francisco, S.C.C., Rubim, L.G.T. & Souza, M.M. (2023). Occupation of *Synoeca surinama* (L.) (Vespidae, Polistinae) nests by *Nasutitermes obscurus* (Holmgren) (Termitidae, Nasutitermitinae) in the Cerrado. *Entomobrasilia*, 16(e1054): 1–4.
- Jesus, J.M., Onody, H.C., Ramos, K.S., Andrade, T.O., Santos, A.D. & Brandão, C.R.F. (2019). Crabronidae and Sphecidae (Hymenoptera: Apoidea) type specimens deposited in the Museu de Zoologia da Universidade de São Paulo, Brazil. *Papéis Avulsos de Zoologia*, 53(e20195917): 1–23.
- Jones, J.C. & Oldroyd, B.P. (2006). Nest thermoregulation in social insects. *Advances in Insect Physiology*, 33: 153–191.
- Kojima, J. (1993). A latitudinal gradient in intensity of applying ant-repellent substance to the nest petiole in paper wasps (Hymenoptera: Vespidae). *Insect socialia*, 40(4): 403–421.
- Laplante, K., Hobbs, W. & Dale, A. (2020). Red and Black Mason Wasp (suggested common name) *Pachodynerus erynnis* (Lepeletier) (Insecta: Hymenoptera: Vespidae). *UF-IFAS EDIS*, EENY-760: 1–5.
- Nelson, D.M. & Starr, C.K. (2016). Comparative nesting success of the keyhole mud-dauber (Hymenoptera, Crabronidae, *Trypoxylon nitidum*) in different substrates. *Journal of Hymenoptera Research*, 52: 163–167.
- Noronha, S.C.B., Moura, P.A., Gouvêa, T.P., Teofilo-Guedes, G. & Souza, M.M. (2021). Marimbondos (Hymenoptera: Vespidae) na cultura popular brasileira. *Ethnoscintia*, 6(3): 140–158.
- O'donnell, S. & Jeanne, R.L. (1992). The effects of colony characteristics on life span and foraging behavior of individual wasps (*Polybia occidentalis*, Hymenoptera: Vespidae). *Insectes Sociaux*, 39: 73–80.
- Pinto, N.P.O. (2005). Estudo de Caso: A Reutilização de Células de Ninho Abandonado de *Polistes (Aphanilopterus) simillimus* Zikán, 1951 (Hymenoptera: Vespidae, Polistinae) por *Tetrapedia (Tetrapedia) diversipes* Klug, 1810 (Hymenoptera: Apidae, Apinae). *Revista de Etologia*, 7(2): 67–74.
- Buschini, M.L.T. (2007). Life-history and sex allocation in *Trypoxylon* (syn. *Trypargilum*) *lactitarse* (Hymenoptera; Crabronidae). *Journal of Zoological Systematics and Evolutionary Research*, 45(3): 206–213.
- Rau, P. & Rau, N. (1916). The Biology of the mud-daubing wasps as revealed by the contents of their nests. *Journal Of Animal Behavior*, 6(1): 27–63.
- Rau, P. (1944). The use of old *Polistes* nests by

- Odynerus foraminatus* and *Ancistrocerus fulvipes* for nesting purposes. *Canadian Entomologist*, 76(6): 129.
- Rocha, I.R.D. & Raw, A. (1982). Dinâmica das populações da vespa solitária *Zeta argillacea* (Linnaeus, 1758) (Hymenoptera: Eumenidae). *Anais da Sociedade Entomológica do Brasil*, 11(1): 57–78.
- Salustiano, V.S., Silva, D.F., Tavares, I.S., Curto, A.S., Silva, J.A. & Neves, C.M.L. (2021). Amostragem de vespas solitárias em diferentes dispositivos artificiais em policultivos, Alagoas –AL. *Diversitas Journal*, 6(1): 411–420.
- Schmolz, E., Bruèders, N., Daum, R. & Lamprecht, I. (2000). Thermoanalytical investigations on paper covers of social wasps. *Thermochimica Acta*, 361: 121–129.
- Smith, A.R., O'Donnell, S. & Jeanne, R.L. (2001). Correlated evolution of colony defence and social structure: A comparative analysis in eusocial wasps (Hymenoptera: Vespidae). *Evolutionary Ecology Research*, 3: 331–344.
- Souza, M.M., Teófilo-Guedes, G., Bueno, E.T., Milani, L.R. & Souza, A.S.B. (2020). Social Wasps (Hymenoptera, Polistinae) from the Brazilian Savanna. *Sociobiology*, 67: 129–138.
- Souza, M.M., Junqueira, L.A., Jacques, G.C., Teófilo-Guedes, G.S. & Zanuncio, J.C. (2022). *Camponotus renggeri* (Formicidae) predated *Agelaia vicina* (Vespidae) nest and occupied *Parachartergus pseudapicalis* (Vespidae) nest. *Sociobiology*, 69(2)e7883: 1–4.
- Wenzel, J.W. (1998). A generic key to the nests of hornets, yellowjackets, and paper wasps worldwide (Vespidae: Vespinae, Polistinae). *American Museum Novitates*, 3224: 1–39.
- Willink, A. & Roig-Alsina, A. (1998). Revisión del género *Pachodynerus* Saussure (Hymenoptera: Vespidae, Eumeninae). *Contributions of the American Entomological Institute*, 30(5): 1–117.