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SHORT NOTE

A Technique for Transferring Nests of *Polybia* (Hymenoptera: Vespidae: Epiponini) Wasps in Anthropized Environment

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Abstract

Social wasps are model organisms in studies related to evolution and social behavior origin. They show high degree of sinanthropism and due to their feeding habits, they play important ecological roles. However, wasps are considered dangerous, hence their nests are destroyed by humans. The aim of this study was to develop a technique for transferring the nests of some *Polybia* (Lepeletier, 1836) species located in human constructions to protected places. Nests were removed in the morning blowing ether into the nest entrance and closing them with cotton. They were separated from the substrate with a spatula. Nests were immediately attached to the new substrate with hot silicone glue and installed in the new place. Transferred nests were monitored for one month to verify the efficiency of the technique. Following the transference, individuals kept foraging and repairing/constructing new cells. Workers performing colony tasks are evidence that the technique was efficient and that the colony was adapted to the new local.

Epiponini is composed of swarming social wasps which include19 genera (Carpenter & Marques, 2001; Carpenter, 2004; Noll et al., 2021). The most widespread genus is *Polybia*, with 56 species and 19 subspecies distributed across the Neotropical region (Jeanne, 1991; Carpenter et al., 2000; Noll et al., 2021). *Polybia* nests are sessile or suspended, constructed with mud or vegetable fiber with a brown or gray envelope. Nests have a circular entry located in the peripheral or in the lower region which is aligned to connect with internal combs (Richards, 1978; Wenzel, 1998). The secondary combs are sessile and attached to the preceding envelope, and the new cells are constructed in the lower portion (phragmocyttarous nests) (Wenzel, 1998; Somavilla, 2012; Noll et al., 2021; Barbosa et al., 2021).

These social wasps are model organisms in studies of evolution and social behavior origin due to the specialization expressed by workers (age polyethism) (Carpenter, 1991). Furthermore, they play important ecological roles in pollination, biological control, and as environmental bioindicators (Prezoto & Machado, 1999; Urbani et al., 2006; Rocha et al., 2010; Brock et al., 2021). This is possible due to their different dietary habits throughout their life. Larval stages consume mainly protein (caterpillars, adult forms of insects, or other arthropods), while adult wasps have a carbohydrate-based diet, such as nectar (Akre & Davis, 1978; Hunt, 1991, 1998; Spradbery, 1973).

As they display these roles, wasps can be useful to humans (Prezoto et al., 2007, 2011; Brock et al., 2021); many species are well adapted and associated with anthropogenic environments, exhibiting a high degree of sinanthropism (Fowler, 1983; Lima et al., 2000; Prezoto et al., 2007; da Silva et al., 2019; Barbosa et al., 2020, 2021). Despite their positive roles in the environment, wasps are considered dangerous (mainly because they sting and the misinformation about their importance), hence their nests are destroyed by humans (Fowler, 1983; Prezoto et al., 2007, 2011; Sumner et al., 2018; Brock et al., 2021; Elisei et al., 2021). An alternative to avoid accidents between wasps and humans, or to prevent nest destruction, is to remove and transfer their nests to other localities (Prezoto et al., 2007, 2011).

However, few attempts have been made to develop techniques to transfer their nests (Prezoto et al., 2016). There is still a lack of information regarding the basic biological aspects of many species of social wasps, this is likely associated with the fact that information is often difficult to be collected due to the inaccessibility of their nesting sites (Barbosa et al., 2021).

Thus, the goal of this study was to develop an effective technique for transferring nests of some *Polybia* species found in human constructions to protected places, enabling their use in behavior studies and avoiding their elimination.

This work was performed at São Paulo University, Ribeirão Preto campus, SP – Brazil between 2016 and 2017. For this study, four nests of *Polybia occidentalis* (Olivier, 1792), four of *Polybia paulista* (H. von. Ihering, 1896), one of *Polybia ignobilis* (Haliday, 1836), and one of *Polybia fastidiosuscula* de Saussure, 1854 were used (Fig 1) (Barbosa et al., 2021; Somavilla & Carpenter, 2021).

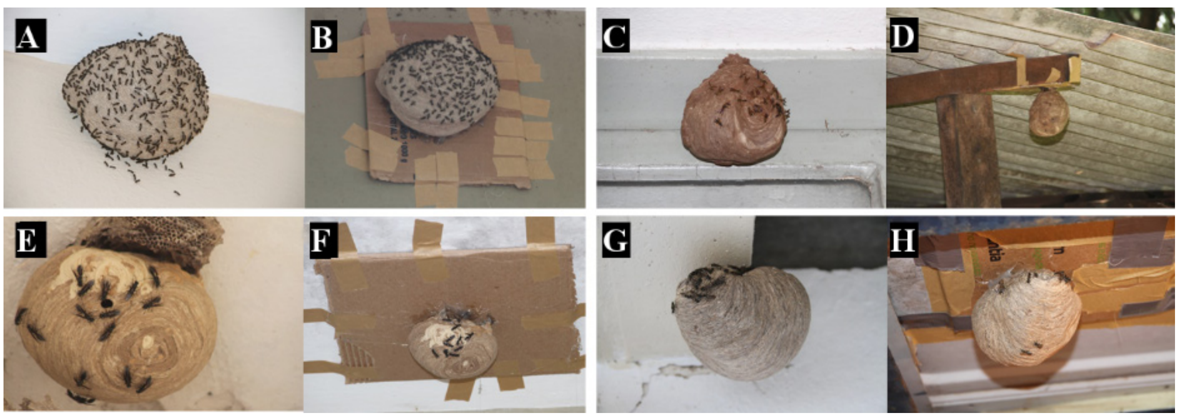

Fig 1. Nests that were transferred - A, C, E, and G. Nests after the transfer - B, D, F, and H. Nests of the four *Polybia* species used in this work. A and B – *Polybia paulista*; C and D – *Polybia fastidiosuscula*; E and F – *Polybia ignobilis*; G and D – *Polybia occidentalis.*

The nests were removed in the morning between 06:00 and 09:00 a.m. To perform the nest transference procedure we always wore latex gloves and beekeeper clothes. The first step was to blow ether into the nest entrance and close it with a cotton ball. The cotton can be moistened with ether; this is an alternative when it is not possible to blow the chemical compound (Fig 2). To start the removal (one to two people to perform the procedure), the nests were carefully handled in a way to prevent the external envelope structure to be destroyed. Then, using a spatula, the envelope was separated from them substrate where it was located. At last, the nests were immediately attached to the new substrate (piece of cardboard) with hot silicone glue (can be used hot glue gun or a lighter to heat the glue) (Fig 2). All the nests were in masonry construction, only one of the *P. paulista* nests was in a metal structure and the *P. fastidiosuscula* was in a wood substrate. Although not all the nests were attached to the same substrate, all of them were transferred in the same way.

Fig 2. Steps performed to transfer nests. A- Blowing ether in the nest entrance; B- Removing the nest from the old substrate; C- Putting glue in the nest base; D- Attaching the nest in the new supporting; E- Taking the nest to the new place, and F- Attaching the nest in the new place

Nests were then transferred to the new site (by walking or by car). The nests were transferred attached to the new substrate but without protection around. Because of the ether, the individuals were not aggressive during the course. The cardboard with nests was attached to a place preferably protected from the rain with silver tape. The minimum distance of transference between the original site and the new one was 1000 meters and the maximum was 2500 meters. During this process, there was only a small loss of individuals, the ones that already were over the nest surface when the procedure started. The nests that were transferred were monitored for one month to verify the efficiency of the procedure; furthermore, the *P. occidentalis* nests were used inother experiments, hence they were followed for three months (Prato, 2018; Prato et al., 2021).

Following the transference procedure, wasps continued to perform their foraging activities, started to repair the damages, and build new cells. Workers performing their usual activities are indicative that they were already used to the new place. Thus, it was confirmed that this technique is efficient because of the minimal invasive manipulation done to the transferred nests.

Polybia nests are built directly in the substrate (only the top part of the nest is in contact with the nesting place), differently from other Epiponini species, in which all the nest is attached to the structure, such as in the genera *Metapolybia* and *Synoeca* (Wenzel, 1998; Noll et all., 2021; Kudô, 2021). This facilitates the nest transference process for *Polybia* nests, as it is possible to separate their nests from the substrate without major damage.

An important factor that must be considered is the type of environment where the nest is located and the new area where the nest will be placed because each species has different preferences for substrate or feeding habits (Cruz et al., 2006; Santos et al., 2007; Almeida et al., 2014; da Silva et al., 2019; Barbosa et al., 2020, 2021). These features can directly affect the success of the colony (Dejeanet al., 1998; Santos et al., 2007). Within *Polybia*, some species are generalist regarding the nesting substrate (Souza et al., 2012; Oliveira et al., 2017; Barbosa et al., 2020). Furthermore, *Polybia* is the genus of Epiponini that are more frequently found in anthropic environments (Detoni et al., 2018; da Silva et al., 2019). This generalist feature of nesting and adaptation to urban areas increases the chances to be in contact with humans (and accidents). However, they also represent good candidates for biological control studies in different crops, including urban agriculture. At last, it is possible to use them for investigating the influences of urbanization on generalist insects in comparison with preserved places.

Thus, this technique may work as an alternative to help to preserve those wasp species, which are often found in high-risk areas, by transferring them to more protected localities. Hence, the technique can be used as a tool to promote the conservation of them in anthropized environments. Lastly, our method will facilitate future studies using nests that were initially present in sites that are hard to reach or even relocate colonies to perform experiments in different environmental contexts.

Declaration of competing interest

None.

Authors' Contributions

Conceptualization [Amanda Prato, Rafael Carvalho da Silva and Sidnei Mateus]; Methodology [Amanda Prato, Sidnei Mateus and Rafael Carvalho da Silva]; Formal Analysis and investigation [Amanda Prato, Rafael Carvalho da Silva, Sidnei Mateus and Fabio S. Nascimento]; Writing-original draft preparation [Amanda Prato and Fabio S. Nascimento]; Writing-review andediting [Amanda Prato, Rafael Carvalho da Silva, Sidnei Mateus and Fabio S. Nascimento].

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References

Akre, R.D. & Davis, H.G. (1978). Biology and pest status of venomous wasps. Annual Review of Entomology, 23: 215-238.

Almeida, S.M., Andena, S.R. & Anjos-Silva, E.J. (2014). Diversity of the nests of social wasps (Hymenoptera: Vespidae: Polistinae) in the Northern Pantanal, Brazil. Sociobiology, 61: 107-114.

Barbosa, B.C., Maciel, T.T., Gonzaga, D.R. & Prezoto, F. (2020). Social wasps in an urban fragment: seasonality and selection of nesting substrates. Journal of Natural History, 54: 1581-1591.

Barbosa, B.C., Maciel, T.T. & Prezoto, F. (2021). Nesting Habits of Neotropical Social Wasps. In F. Prezoto; F.S. Nascimento, B.R, Correa & A. Somavilla (Eds.). Neotropical Social Wasps: Basic and Applied Aspects (pp. 85-98). Springer, Cham.

Brock, R.E., Cini, A. & Sumner, S. (2021). Ecosystem services provided by aculeate wasps. Biological Reviews, 96: 1645-1675

Carpenter, J.M., Kojima, J.I. & Wenzel, J.W. (2000). *Polybia*, Paraphyly, and Polistine Phylogeny. American Museum of Natural History, 3298: 1-24.

Carpenter, J.M. (1991). Phylogenetic relationships and the origin of social behavior in the Vespidae. In: Ross GK &

Matthews RW. The social biology of wasps. New York: Cornell University Press, 7-32.

Carpenter, J.M. & Marques, O.M. (2001). Contribuição ao estudo dos vespídeos do Brasil (Insecta, Hymenoptera, Vespoidae, Vespidae). Cruz das Almas, Universidade Federal da Bahia. Publicações digitais.

Carpenter, J.M. (2004). Synonymy of the genus *Marimbonda* Richards, 1978, with *Leipomeles* Mobius, 1856 (Hymenoptera: Vespidae; Polistinae), and a new key to the genera of paper wasps of the new world. American Museum of Natural History, 3465: 1-16.

Cruz, J.D., Giannotti, E.., Santos, G.M.M., Bichara, C.C.F. & Rocha, A.A. (2006). Nest site selection and flying capacity of Neotropical Wasp *Angiopolybia pallens* (Hymenoptera: Vespidae) in the Atlantic Rain Forest, Bahia State, Brazil. Sociobiology, 47: 739-750.

da Silva, R.C., da Silva, A.P., Assis, D.S. & Nascimento, F.S. (2019). Occurrence and nesting behavior of social wasps in an anthropized environment. Sociobiology, 66: 381-388.

Dejean,A.,Corbara, B. & Carpenter, J.M. (1998) Nesting site selection by wasps in the Guianese rain forest. Insectes Sociaux, 45: 33-41.

Detoni, M.F.D.F.S., Barbosa, B.C., Maciel, T.T., dos Santos, S.J.L. & Prezoto, F. (2018). Long-and short-term changes in social wasp community structure in an urban area. Sociobiology, 65: 305-311.

Elisei, T., Junior, C.R., Prezoto, F. (2021). Economic Importance of Neotropical Social Wasps. In F. Prezoto; F.S. Nascimento, B.R, Correa & A. Somavilla (Eds.), Neotropical Social: Basic and Applied Aspects (pp. 443-457). Springer, Cham.

Fowler, H.G. (1983). Human effects on nest survivorship of urban synanthropic wasps. Urban Ecology, 7: 137-143.

Hunt, J.H. (1991). Nourishment and the evolution of the social Vespidae. In: Ross GK & Matthews RW. The social biology of wasps. New York: Cornell University Press, 426-450.

Hunt, J.H., Rossi, A.M., Holmberg, N.J., Smith, S.R. & Sherman, W.R. (1998). Nutrients in social wasp (Hymenoptera: Vespidae, Polistinae) honey. Annals of the Entomological Society of America, 91: 466-472.

Jeanne, R.L. (1991). The swarm-fouding Polistinae. In: Ross GK & Matthews RW. The Social Biology of Wasps. New York: Cornell University Press, 191-231.

Kudô, K. (2021). The Biology of Swarm-Founding Epiponine Wasp, *Polybia paulista*. In F. Prezoto; F.S. Nascimento, B.R, Correa & A. Somavilla (Eds.). Neotropical Social: Basic and Applied Aspects (pp. 127-145). Springer, Cham.

Lima, M.A.P., Lima, J.R. & Prezoto, F. (2000). Levantamento dos gêneros, flutuação das colônias e hábitos de nidificação de vespas sociais (Hymenoptera, Vespidae) no Campus da UFJF, Juiz de Fora, MG. Revista Brasileira de Zoociências, 1,2.

Noll, F.B., da Silva, M., Soleman, R.A., Lopes, R.B., Grandinete, Y.C., Almeida, E.A., Wenzel, J.W. & Carpenter, J.M. (2021). Marimbondos: systematics, biogeography, and evolution of social behaviour of neotropical swarm-founding wasps (Hymenoptera: Vespidae: Epiponini). Cladistics, 37: 423-441.

Oliveira, T.C.T., Souza, M.M. & Pires, E.P. (2017). Nesting habits of social wasps (Hymenoptera: Vespidae) in forest fragments associated with anthropic areas in southeastern Brazil. Sociobiology, 64: 101-104.

Prato, A. (2018). Variação dos hidrocarbonetos cuticulares e produtos de glândulas exócrinas em operárias de *Polybia occidentalis* (Hymenoptera: Vespidae, Epiponini). Dissertação (Mestrado em Ciências) – Faculdade de Filosofia, Ciências e Letras, Universidade de São Paulo. Ribeirão Preto, p. 65.

Prato, A., da Silva, R.C., Assis, D.S., Mateus, S., Hartfelder, K. & Nascimento, F.S. D. (2021). Juvenile hormone affects age polyethism, ovarian status, and cuticular hydrocarbon profile in workers of a *Polybia occidentalis* wasp. Journalof Experimental Biology, 224: jeb240200.

Prezoto, F. & Machado, V.L.L. (1999). Transferências de colônias de vespas *(Polistes simillimus* Zikán, 1951) (Hymenoptera, Vespidae) para abrigos artificiais e sua manutenção em uma cultura de *Zea mays*. Revista Brasileira de Entomologia, 43: 239-241.

Prezoto, F., Ribeiro, C.J., Oliveira, S.A. & Elisei, T. (2007). Manejo de vespas e marimbondos em ambiente urbano. In: Pinto, A.S., Rossi, M.M. & Salmeron, E. Manejo de Pragas Urbanas, 1: 123-126.

Prezoto, F., Souza, A.R., Santos-Prezoto, H.H., Silva, N.J.J. & Rodrigues, V.Z. (2011). Estudos comportamentais em vespas sociais: da história natural à aplicação. In: Torezan-Silingardi HM & Stefani V. Temas Atuais em Etologia e Anais do XXIX Encontro Anual de Etologia. SBEt.

Prezoto, F., Barbosa, B.C., Maciel, T.T. & Detoni, M. (2016). Agroecossistemas e o serviço ecológico dos insetos na sustentabilidade. In: Resende LO; Prezoto F; Barbosa BC & Gonçalves EL. Sustentabilidade: Tópicos da Zona da Mata Mineira, 19-30.

Richards, O.W. (1978). The social wasps of the Americas, excluding the Vespinae. London: British Museum (Natural History).

Rocha, J.R.M., Almeida, J.R., Lins, G.A. & Durval, A. (2010) Insects as indicators of environmental changing and pollution: A review of appropriate species and their monitoring. Holos Environment, 10: 250-262.

Santos, G.M.M., Bichara, C.C.F., Resende, J.J., Cruz, J.D. & Marques, O.M. (2007). Diversity and community structure of social wasps (Hymenoptera: Vespidae) in three ecosystems in Itaparica Island, Bahia State, Brazil. Neotropical Entomology, 36: 180-185.

Somavilla, A., Oliveira, M.L. & Silveira, O.T. (2012). Guia de identificação dos ninhos de vespas sociais (Hymenoptera, Vespidae, Polistinae) na Reserva Ducke, Manaus, Amazonas, Brasil. Revista Brasileira de Entomologia, 56: 405-414.

Somavilla, A. & Carpenter, J.M. (2021). Key to the Genera of Social Wasps (Polistinae) Occurring in Neotropics. In F. Prezoto; F.S. Nascimento, B.R, Correa & A. Somavilla (Eds.), Neotropical Social: Basic and Applied Aspects (pp. 327-336). Springer, Cham.

De Souza, A.R., De F.A. Venâncio, D., Prezoto, F. & Zanuncio, J.C. (2012). Social wasps (Hymenoptera: Vespidae) nesting in eucalyptus plantations in Minas Gerais, Brazil. Florida Entomologist, 95: 1000-1002.

Spradbery, J.P. (1973). An Account of the Biology and Natural History of Solitary and Social Wasps. Universidade Washington Press, Seattle.

Sumner, S., Law, G. & Cini, A. (2018). Why we love bees and hate wasps. Ecological Entomology, 43: 836-845.

Urbani, A., Sparvoli, E. & Turillazzi, S. (2006). Social paper wasps as bioindicators: a preliminary research with *Polistes dominulus* (Hymenoptera: Vespidae) as a trace metal accumulator. Chemosphere, 64: 697-703.

Wenzel, J.W.A. (1998). Generic Key to the nests of hornets, Yellowjackets, and paper wasps Worldwide (Vespidae: Vespinae, Polistinae). American Museum Novitates, 3224: 1-39.