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Scientific Note

Foraging of *Protopolybia exigua* (Saussure, 1854) (Vespidae: Polistinae) on *Salvinia auriculata* Aubl. (Salviniaceae) in an urban environment in Southeast Brazil

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Abstract: There is limited information regarding the plant species from which social wasps extract fibers as raw material for nest construction, as well as their foraging behavior for such materials. To address this gap, the present study documented the foraging behavior of the social wasp *Protopolybia exigua* (Saussure, 1854) on *Salvinia auriculata* Aubl. (Salviniaceae) in an urban environment, in Minas Gerais state, southeastern Brazil. *Salvinia auriculata* is an aquatic macrophyte capable of rapidly covering the surface of water bodies, resulting in significant ecological and economic impacts, such as negative effects on the biodiversity, structure, and functioning of aquatic ecosystems. Observations revealed the consistent removal of plant material from the leaves of *S. auriculata* by the wasps over five consecutive days, as well as their use of the plant as a platform for water collection. This behavior appears to be circumstantial; therefore, further research is needed to determine the frequency with which social wasps utilize plant material from macrophytes, quantify the extent of damage caused to the plants, and explore the potential role of social wasps in controlling populations of these plants.

Keywords: Insect-plant interaction, ethology, nests, aquatic macrophytes.

Resumo: (Forrageamento de *Protopolybia exigua* (Saussure, 1854) (Vespidae: Polistinae) em *Salvinia auriculata* Aubl. (Salviniaceae) em um ambiente urbano no sudeste do Brasil): Há poucas informações sobre as espécies vegetais das quais as vespas sociais extraem fibras como matéria-prima para a construção de ninhos, bem como sobre seu comportamento de forrageamento para obter esses materiais. Para preencher essa lacuna, o presente estudo documentou o comportamento de forrageamento da vespa social *Protopolybia exigua* (Saussure, 1854) em *Salvinia auriculata* Aubl. (Salviniaceae) em um ambiente urbano, no estado de Minas Gerais, sudeste do Brasil. *Salvinia auriculata* é uma macrófita aquática capaz de cobrir rapidamente a superfície de corpos d'água, resultando em impactos ecológicos e econômicos significativos, como efeitos negativos sobre a biodiversidade, a estrutura e o funcionamento dos ecossistemas aquáticos. As observações revelaram a remoção consistente de material vegetal das folhas de *S. auriculata* pelas vespas durante cinco dias consecutivos, bem como o uso da planta como plataforma para coleta de água. Esse comportamento parece ser circunstancial portanto, são necessárias mais pesquisas para determinar a frequência com que as vespas sociais utilizam material vegetal de macrófitas, quantificar a extensão dos danos causados às plantas e explorar o papel potencial das vespas sociais no controle das populações dessas plantas.

Palavras-chave: Interação inseto-planta, etologia, ninhos, macrófitas aquáticas.

The nests or colonies of social wasps (Vespidae: Polistinae), commonly referred to as "caixas de marimbondo" (Noronha et al., 2021), are constructed using plant fibers obtained from the stems and leaves of various plant species (Richards, 1978; Prezoto et al., 1994; Hunt, 2007; Milani et al., 2020) or materials sourced from abandoned nests (Rubim et al., 2023). During the colony-building process, water plays a critical role, as wasps use it to soften plant fibers, which are then scraped with their mandibles to produce a cellulose pulp. This pulp, combined with wasp's saliva, serves as the raw material for constructing their nests (Wenzel 1991, 1998).

There is limited information in the literature regarding the plant species utilized by social wasps, even if the species is abundant and widely distributed, such as *Salvinia auriculata* Aubl. (Salviniaceae). This species is a floating aquatic fern composed of iterative units known as ramets (Miranda & Schwartsburd, 2019). Each ramet consists of two floating, photosynthetic leaves and one submerged leaf that functions as a root (Sculthorpe, 1967). Species of this genus exhibit highly efficient vegetative growth (Coelho et al., 2005), enabling them to rapidly colonize the surface of water bodies and cause significant ecological and economic impacts (Coetzee & Hill, 2020), such as negative effects on the biodiversity, structure, and functioning of aquatic ecosystems (Wahl, Diaz, & Kaller, 2021a; Wahl, Diaz, & Kaller, 2021b; Wahl, Kaller, & Diaz, 2021).

In addition to the limited information on the plant species utilized by social wasps, there is a lack of data regarding the fiber extraction behavior of many vespids, including *Protopolybia exigua* (Saussure, 1854), a species widely distributed across Brazil (Richards, 1978; Somavilla & Carpenter, 2021). *Protopolybia exigua* occurs in various biomes, such as the Cerrado (Francisco et al., 2023), Caatinga (Jacques et al., 2023), and Atlantic Forest (M. M. Souza et al., 2020). Additionally, it inhabits synanthropic environments, including urban (G. K. Souza et al., 2013) and agricultural areas (Medeiros et al., 2019). This adaptability to diverse habitats provides access to a broad range of plant species for foraging and colony construction.

The nest architecture of *P. exigua* is classified as stelocitarous caliptodome, a structure consisting of multiple combs with intercalated envelopes attached to a central peduncle or several smaller ones. The nest features a small opening between the combs, enabling internal movement of the wasps, and a single entrance to the external environment (Somavilla et al., 2012). Species of this genus commonly utilize the leaves of surrounding vegetation, incorporating them into the nest structure so that the leaf itself serves as an envelope. This adaptation is facilitated by the production of oral secretions, which bond the leaves to the brood cells (Wenzel, 1998). In this context, the objective of the present study was to document the foraging behavior of *P. exigua* on *S. auriculata* plants in an urban environment in southeastern Brazil.

The observations were conducted opportunistically in an urban area of Ritápolis (21°01'23.96"S, 44°19'12.19"W), Campos das Vertentes, Minas Gerais, Brazil, located within the ecotone between the Cerrado and Atlantic Forest biomes, in September 2023, which marks the end of the dry and cold season in the study region. Behavioral data were collected using the ad libitum method (Del-Claro, 2004). On the first day, a 30-minute continuous observation session was performed in the afternoon (12:00–14:00h) to quantify foraging time. This was followed by four consecutive days of 10-minute daily observations to monitor behavior, totaling one hour and ten minutes of recorded data. Individuals of *S. auriculata* were collected in ponds adjacent to the Rio das Mortes in the same region. After this procedure, these plants were transferred to a 52.5 L aquarium located in the outdoor garden of a residential property for botanical analysis. Then, the foraging behavior of *P. exigua* were recorded in the plants kept in the aquarium using a Nikon D90 camera. Social wasps were identified using dichotomous keys (Richards, 1978) and by comparison with specimens in the social wasp collection (CBVS) at the Federal Institute of Education, Science, and Technology of Southern Minas Gerais, Campus Inconfidentes, where the specimens were deposited. Plant identification was based on the study by Miranda & Schwartsburd (2019).

The *P. exigua* specimens alternated between removing plant material—"scraping" the foliar tissue from the floating leaves of *S. auriculata* using their mandibles—and flying in the same direction, presumably toward their colony. The average individual foraging time was 15.9 seconds (n = 13). Up to three individuals were observed simultaneously extracting foliar tissue from *S. auriculata* (Fig. 1).

Although the *P. exigua* colony was not located, the observed behavior was consistent with that exhibited by social wasps during nest foundation, repair, or expansion (Rubim et al., 2023). It is therefore likely that the material extracted from *S. auriculata* was used for constructing the nest envelope and/or brood cells. Social wasp nests are constructed using plant fibers available in the environments where colonies are located (Jeanne, 1975). According to Alvarenga et al. (2010), wasps of the *Protopolybia* (Ducke, 1905) exhibit synanthropic behavior and often nest in urban gardens. Therefore, the use of *S. auriculata* as a fiber resource may have been facilitated or conditioned by the availability of these plants, as well as the presence of water in a location and season when such resources are limited for social wasps (M. M. Souza & Prezoto, 2006; Jacques et al., 2023).

The selection of this plant species by *P. exigua* may have been seasonal and opportunistic, since there was an easily accessible resource available at the time of colony founding during a period of low resource availability for social wasps (Oliveira et al., 2024). Similar to other social wasp species that generally utilize the resources available around the area where the nest is being built (Richards, 1978; Taylor et al., 2011). This is consistent with what has been suggested for prey selection in the diet of these insects (Prezoto et al., 2019; Crispim et al., 2023; Renne et al., 2024). Alternatively, this behavior may have been induced by specific characteristics of the plant, as individuals of social wasps communicate using chemical signals and may exhibit preferences for certain substrates (plants) for nesting (Sguarizi-Antonio et al., 2022).

Figure 1: *Protopolybia exigua* (Vespidae: Polistinae) individuals foraging plant material on *Salvinia auriculata* (Salviniaceae) plants maintained in an aquarium. Yellow arrows point to the foliar damage caused by the foraging activity and dashed lines delimit the damaged area on a healthy leaf.

Although the removal of tissue did not appear to cause the death of the *S. auriculata* ramets, it likely resulted in some form of damage to the plant. Removal of photosynthetic tissue, even in small quantities, negatively impacts aquatic macrophytes by interfering with their growth and development (Lodge, 1991). Therefore, the damage caused by *P. exigua* to *S. auriculata* requires further investigation, particularly regarding plant growth and the potential for biocontrol of these invasive weeds. However, any consideration of *P. exigua* as a biological control agent should be approached with caution, as its ecological impacts on non-target species and broader ecosystem dynamics must be rigorously evaluated through controlled experimental studies. In addition to removing plant material, *P. exigua* used the floating leaves of *S. auriculata* as a platform for water collection (Fig. 2A), a behavior also observed in *Polybia occidentalis* (Olivier, 1791) (Fig. 2B). However, no plant material removal was recorded for the latter species.

The use of macrophytes as platforms for water collection by hymenopteran insects has previously been reported by Lima et al. (2022) in the southern Pantanal of Mato Grosso do Sul. Oliveira et al. (2023) and Oliveira & Souza (2023) observed that these insects actively forage for prey sheltered in *S. auriculata* plants in southeastern Brazil. Thus, aquatic macrophytes may serve as important foraging substrates, providing various resources critical to social wasps.

Figure 2: Social wasp (Vespidae: Polistinae) individuals using floating leaves of *Salvinia auriculata* (Salviniaceae) for water collection; A - *Protopolybia exigua*; B - *Polybia occidentalis*.

Future studies should not only investigate the frequency with which social wasps utilize plant material from macrophytes but also explore the broader ecological role of these plants in wasp behavior and population dynamics. Furthermore, assessing the damage caused by this behavior to the plants would allow to evaluate the potential use of wasps in controlling macrophyte populations.

References

Alvarenga, R. B., Castro, M. M., Santos-Prezoto, H. H., & Prezoto, F. (2010). Nesting of social wasps (Hymenoptera, Vespidae) in urban gardens in Southeastern Brazil. *Sociobiology*, *55*(2), 445–452.

Coelho, F. F., Lopes, F. S., & Sperber, C. F. (2005). Persistence strategy of *Salvinia auriculata* Aublet in temporary ponds of Southern Pantanal, Brazil. *Aquatic Botany*, *81*(4), 343–352. https://doi.org/10.1016/j.aquabot.2005.02.001

Coetzee, J. A., & Hill, M. P. (2020). *Salvinia molesta* d.mitch. (salviniaceae): impact and control. *CABI Reviews*, (2020). https://doi.org/10.1079/PAVSNNR202015033

Crispim, F., da Silva, G. T.-G., Clemente, M. A., & Souza, M. M. (2023). Predação de louva-deus (Mantodea) pela vespa social *Polistes cinerascens* Saussure, 1854 (Hymenoptera). *Revista Acta Ambiental Catarinense*, *20*(1), 01–06. https://doi.org/10.24021/raac.v20i1.7493

Del-Claro, K. (2004). *Comportamento Animal: Uma introdução à ecologia comportamental*. Livraria Conceito: Jundiaí. https://doi.org/10.13140/RG.2.1.2114.1846

Francisco, S. C. C., Gouvêa, T. P., Rubim, L. G. T., Jacques, G. C., & Souza, M. M. (2023). Social wasps (Vespidae: Polistinae) in Cerrado and Caatinga conservation units, Minas Gerais, Brazil. *Biota Neotropica*, *23*(4), e20231563. https://doi.org/10.1590/1676-0611-BN-2023-1563

Hunt, J. H. (2007). *The evolution of social wasps*. Oxford University Press, Oxford.

Jacques, G. C., Barbosa, L. D., Gouvêa, T. P., Simões, N. A., Silva, G. T., Silveira, O. T., & Souza, M. M. (2023). Influence of dry season on social wasp communities (Hymenoptera: Polistinae) in Deciduous Forest. *Sociobiology*, *70*(2), e8361–e8361. https://doi.org/10.13102/sociobiology.v70i2.8361

Jeanne, R. L. (1975). Behavior during swarm movement in *Stelopolybia areata* (Hymenoptera: Vespidae). *82*(2), 259–264. https://doi.org/10.1155/1975/28510

Lima, M. C., Santos, P. G., Pereira, M. C., & Antonialli-Junior, W. F. (2022). Composição da fauna de Hymenoptera associada a macrófitas aquáticas no Pantanal Sul-Matogrossense. *Entomology Beginners*, *3*, e029. https://doi.org/10.12741/2675-9276.v3.e029

Lodge, D. M. (1991). Herbivory on freshwater macrophytes. *Aquatic Botany*, *41*(1-3), 195–224. https://doi.org/10.1016/0304-3770(91)90044-6

Medeiros, H. R., Grandinete, Y. C., Manning, P., Harper, K. A., Cutler, G. C., Tyedmers, P., Righi, C. A., & Ribeiro, M. C. (2019). Forest cover enhances natural enemy diversity and biological control services in Brazilian sun coffee plantations. *Agronomy for Sustainable Development*, *39*(6), 50. https://doi.org/10.1007/s13593-019-0600-4

Milani, L. R., Prezoto, F., Clemente, M. A., Gomes, P. P., & Souza, M. M. (2020). Nesting behaviour of a Neotropical social wasp *Mischocyttarus saussurei* Zikan, 1949 (Hymenoptera, Vespidae). *Sociobiology*, *67*(1), 121–125. https://doi.org/10.13102/sociobiology.v67i1.4842

Miranda, C. V., & Schwartsburd, P. B. (2019). *Salvinia* (salviniaceae) in southern and southeastern brazil—including new taxa, new distribution records, and new morphological characters. *Brazilian Journal of Botany*, *42*(1), 171–188. https://doi.org/10.1007/s40415-019-00522-5

Noronha, S. C. B., Moura, P. A., Gouvêa, T. P., Teofilo-Guedes, G., & Souza, M. M. (2021). Marimbondos (Hymenoptera: Vespidae) na cultura popular brasileira. *Ethnoscientia-Brazilian Journal of Ethnobiology and Ethnoecology*, *6*(3), 140–158. https://doi.org/10.18542/ethnoscientia.v6i3.10625

Oliveira, G., & de Souza, M. (2023). New records of predation of *Samea multiplicalis* (Guenée, 1854) (Lepidoptera: Pyralidae) by social wasps (Hymenoptera: Vespidae) on *Salvinia auriculata* (Aublet, 1775) (Salviniales: Salviniaceae) in Brazil. *Revista Chilena de Entomología*, *49*(3), 527–531. https://doi.org/10.35249/rche.49.3.23.11

Oliveira, G., Rubim, L., & Souza, M. (2023). First record of *Polybia scutellaris* (White, 1841) (Hymenoptera: Vespidae) predating on *Samea multiplicalis* (Guenée, 1854) (Lepidoptera: Pyralidae), an herbivore of *Salvinia* spp.(Salviniaceae). *Brazilian Journal of Biology*, *83*, e271130. https://doi.org/10.1590/1519-6984.271130

Oliveira, G., Rubim, L. T. G., Vieira, L., Costa Alvarenga, M. J., & Souza, M. M. (2024). First record of *Polybia scutellaris* (White, 1841) (Hymenoptera: Vespidae) predation on *Thrips tabaci*, Lindeman, 1889 (Thysanoptera: Thripidae) in urban kale cultivation in Southeastern Brazil. *International Journal of Tropical Insect Science*, *44*(6), 3051–3055. https://doi.org/10.1007/s42690-024-01386-3

Prezoto, F., Giannotti, E., & Machado, V. (1994). Atividade forrageadora e material coletado pela vespa social *Polistes simillimus* Zikán, 1951 (Hymenoptera, Vespidae). *Insecta*, *3*(1), 11–19.

Prezoto, F., Maciel, T. T., Detoni, M., Mayorquin, A. Z., & Barbosa, B. C. (2019). Pest control potential of social wasps in small farms and urban gardens.

Insects, *10*(7), 192. https://doi.org/10.3390/insects10070192

Renne, D., Pereira, E. C., Teófilo-Guedes, G., & de Souza, M. M. (2024). Pulgões (hemiptera, aphididae) parasitados como recurso alimentar para vespas sociais (hymenoptera, vespidae). *Revista Acta Ambiental Catarinense*, *21*(1), 01–06. https://doi.org/10.24021/raac.v21i1.7860

Richards, O. W. (1978). *The social wasps of the Americas excluding the Vespinae*. British Museum, London, UK.

Rubim, L. G. T., Araújo, L. C. S., Castro Jacques, G., & Souza, M. M. (2023). Reutilização do material de ninho abandonado de vespa social por *Parachartergus fraternus* (Gribodo, 1892) (Vespidae: Polistinae) em Cerrado. *Acta Biológica Catarinense*, *10*(4), 82–85. https://doi.org/10.21726/abc.v10i4.2077

Sculthorpe, C. D. (1967). *The biology of aquatic vascular plants*. S. London: Edward Arnold Ltd.

Sguarizi-Antonio, D., Michelutti, K. B., Soares, E. R. P., Batista, N. R., Lima-Junior, S. E., Cardoso, C. A. L., Torres, V. O., & Antonialli-Junior, W. F. (2022). Colonial chemical signature of social wasps and their nesting substrates. *Chemoecology*, *32*(1), 41–47. https://doi.org/10.1007/s00049-021-00361-5

Somavilla, A., & Carpenter, J. M. (2021). Key to the genera of social wasps (Polistinae) occurring in Neotropics. In F. Prezoto, F. S. Nascimento, B. C. Barbosa, & A. Somavilla (Eds.), *Neotropical social wasps: Basic and applied aspects* (pp. 327–336). Springer. https://doi.org/10.1007/978-3-030-53510-0_18

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. https://doi.org/10.1590/S0085-56262012000400003

Souza, G. K., Pikart, T. G., Jacques, G. C., Castro, A. A., Souza, M. M., Serrão, J. E., & Zanuncio, J. C. (2013). Social wasps on *Eugenia uniflora* Linnaeus (Myrtaceae) plants in the urban area of Viçosa, Minas Gerais State, Brazil. *Sociobiology*, *60*(2), 204–209. https://doi.org/10.13102/sociobiology.v60i2.204-209

Souza, M. M., & Prezoto, F. (2006). Diversity of social wasps (Hymenoptera: Vespidae) in semideciduous forest and Cerrado (Savanna) regions in Brazil. *Sociobiology*, *47*(1), 135–147.

Souza, M. M., Teofilo-Guedes, G. S., Milani, L. R., Souza, A. S. B., & Gomes, P. P. (2020). Social wasps (Vespidae: Polistinae) from the Brazilian Atlantic forest. *Sociobiology*, *67*(1), 1–12. https://doi.org/10.13102/sociobiology.v67i1.4597

Taylor, B. J., Nordheim, E. V., Schueller, T. I., & Jeanne, R. L. (2011). Recruitment in Swarm-Founding Wasps: *Polybia occidentalis* Does not Actively Scent-Mark Carbohydrate Food Sources. *Psyche: A Journal of Entomology*, *2011*(1), 378576. https://doi.org/10.1155/2011/378576

Wahl, C., Diaz, R., & Kaller, M. (2021a). Invasive floating fern limits aerial colonization and alters community structure of aquatic insects. *Wetlands*, *41*(5), 60. https://doi.org/10.1007/s13157-021-01457-y

Wahl, C., Diaz, R., & Kaller, M. (2021b). Nutrients enhance the negative impact of an invasive floating plant on water quality and a submerged macrophyte. *Journal of Aquatic Plant Management*, *59*(2), 57–65. https://doi.org/10.57257/japm-20215957

Wahl, C., Kaller, M., & Diaz, R. (2021). Invasion of floating fern alters freshwater macroinvertebrate community structure with implications for bottom-up processes. *Hydrobiologia*, *848*(10), 2523–2537. https://doi.org/10.1007/s10750-021-04571-4

Wenzel, J. W. (1991). Evolution of nest architecture. In K. Ross & R. Matthews (Eds.), *The social biology of wasps* (pp. 480–519). Cornell University Press. https://www.jstor.org/stable/10.7591/j.ctv3s8r7j.19

Wenzel, J. W. (1998). Generic key to the nests of hornets, yellowjackets, and paper wasps worldwide (Vespidae: Vespinae, Polistinae). *American Museum Novitates*, *3224*, 1–39.