Brief Communication / Comunicación Breve

Damage caused by social wasps (Hymenoptera: Vespidae) to commercial fruits in the Brazilian Amazon region

Daños causados por avispas sociales (Hymenoptera: Vespidae) a frutos comerciales en la región amazónica brasileña

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Abstract. Social wasps play a crucial role in ecosystems by actively foraging and preying on lepidopterans caterpillars, an important group of insects known to damage various structures of cultivated plants. However, there is a discussion about the potential damage that these wasps can cause to the fruits of some commercial species. In this research, cases of damage caused by *Polybia dimidiata* (Olivier), *Polybia liliacea* (Fabricius), *Synoeca surinama* (Linnaeus), and *Synoeca virginea* (Fabricius) to fruits of three different fruit species: guava, carambola, and murici, are recorded while they are still attached to the stem. These events occurred in the municipalities of Itacoatiara and Uarini, both located in the state of Amazonas, northern Brazil. These observations were made in the months of January 2013, December 2022, January, and February 2023. Due to their high infestation and vigorous foraging activities, it is speculated we posit that these wasp species could reach pest status, affecting the fruit harvests by stinging workers and damaging the fruits until made for marketing. However, it is crucial to emphasize that more comprehensive studies are needed to determine whether the damage caused by these vespids really represents a threat to small farmers.

Key words: Foraging activity; *Polybia dimidiata*; *Polybia liliacea*; *Synoeca surinama*; *Synoeca virginea*.

Resumen. Las avispas sociales desempeñan un papel fundamental en los ecosistemas al buscar alimento y cazar activamente larvas de lepidópteros, un grupo importante de insectos conocidos por dañar diversas estructuras de las plantas cultivadas. Sin embargo, existe una discusión sobre el daño potencial que estas avispas pueden ocasionar a los frutos de algunas especies comerciales. En esta investigación se registran casos de daños producidos por *Polybia dimidiata* (Olivier), *Polybia liliacea* (Fabricius), *Synoeca surinama* (Linnaeus) y *Synoeca virginea* (Fabricius) a frutas de tres diferentes especies frutales: guayaba, carambola y murici, mientras aún están unidas al tallo. Estos acontecimientos ocurrieron en los municipios de Itacoatiara y Uarini, ambos ubicados en el estado de Amazonas, al norte de Brasil. Las observaciones se realizaron en los meses de enero de 2013, diciembre de 2022, enero y febrero de 2023. Por su alta infestación y vigorosas actividades de búsqueda de alimento, se especula que estas especies de avispas podrían alcanzar el estatus de plaga, afectando las cosechas de frutas al picar a los trabajadores y dañar los frutos hasta hacerlos

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inadecuadas para su comercialización. Sin embargo, es crucial enfatizar que se necesitan estudios más exhaustivos para determinar si el daño causado por estos véspidos realmente representa una amenaza para los pequeños agricultores.

Palabras clave: Conducta de forrajeo; *Polybia dimidiata*; *Polybia liliacea*; *Synoeca surinama*; *Synoeca virginea.*

In the Amazon region, the cultivation of fruit species carries substantial social significance, particularly as it is predominantly carried out by small-scale producers who heavily depend on family labor (Moreira-Dantas *et al.* 2023). In the municipalities of Amazonas/Brazil, the harvested fruits are either sold fresh or in the form of pulp at local markets and fairs. To ensure more profitable sales, the fruit's integrity is a crucial criterion to be considered (Moreira-Dantas *et al.* 2023).

The state of Amazonas consistently ranks among the top three producers of starfruit [*Averrhoa carambola* L. (Oxalidaceae)] in Brazil, yielding approximately two tons of this fruit (IBGE 2017). As for guava [*Psidium guajava* L. (Myrtaceae)], the state's production hovers around 964 tons, primarily concentrated in the municipalities of Itacoatiara and Manacapuru (IBGE 2017). Regarding muruci [*Byrsonima crassifolia* (L.) Kunth (Malpighiaceae)], there is no available production data for the state of Amazonas, but some family producers in Itacoatiara market it in its fresh form or as pulp.

One major challenge confronting contemporary agricultural practices is the escalating proliferation of pest insects attacking leaves, flowers, and fruits from the early growth stages to the fruiting period. This situation requiring farmers to apply extensive insecticides, showing the urgent need for alternative strategies for pest control (Prezoto *et al.* 2019; Lopes *et al.* 2023).

In the literature, social wasps are documented as major regulators of other insect populations and also work as pollinators (Somavilla *et al.* 2016). Because of their preference for protein foraging, they have a preference for soft-bodied insects, especially caterpillars, the main group of insects that feed on cultivated plants, consequently, social wasps play a significant role in agricultural systems (Prezoto *et al.* 2021).

Foraging is a critical behavior for the survival of these social insects (Prezoto *et al.* 2021). Nevertheless, they may exhibit undesirable behaviors, leading to economic damage (Brügger *et al.* 2011). Despite the increasing amount of applied research on social wasps in recent decades, including studies conducted in the Amazon region (Somavilla *et al.* 2016; Montefusco *et al.* 2017; Lourido *et al.* 2019), information regarding the role of these wasps in small fruit farmers remains scarce. This lack of information extends to understanding both the benefits they bring and the potential damage they may cause.

In this study, we recorded the presence of four swarming social wasp species, on ripe guava fruits, starfruit, and murici fruits, which were still attached to their stems, causing damage to the fruits. The research was conducted on family-owned rural properties in the Boa Esperança Community, located in the municipality of Itacoatiara (03°09′15″S, 58°25′37″W), and Boca do Mamirauá Community, in the municipality of Uarini (64°47′36″S, 03°06′59″W), both located in the state of Amazonas, northern Brazil. These observations were conducted during the rainy season in the region, specifically in the months of January 2013, December 2022, January, and February 2023, in the morning. In Itacoatiara, approximately 12 hours were dedicated to of observation guava cultivation, 4 hours to star fruit, and murici. In the Uarini region, observations in guava cultivation were free and opportunistic. Specimens were collected, identified, and subsequently deposited in the Invertebrate Collection at the Instituto Nacional de Pesquisas da Amazônia (INPA), to document the behaviors of social wasps around the fruits, observations were carried out using the *ad libitum* method.

Although the environment hosts various species of social wasps, our observations revealed only four species inflicting damage to the fruits. Consequently, we collected and identified these species: *Polybia dimidiata* (Olivier, 1792), *Polybia liliacea* (Fabricius, 1804), *Synoeca surinama* (Linnaeus, 1767), and *Synoeca virginea* (Fabricius, 1804). The wasps exhibited behaviors considered undesirable when observed in economically valuable plantations, such as breaking the fruit peels to access the pulp (mesocarp) (Figs. 1A-F). This action creates openings where other animals, such as insects, contribute to the degradation of the fruits. It was possible to observe dipterans, hemipterans, and lepidopterans taking advantage of the openings created by the wasps.

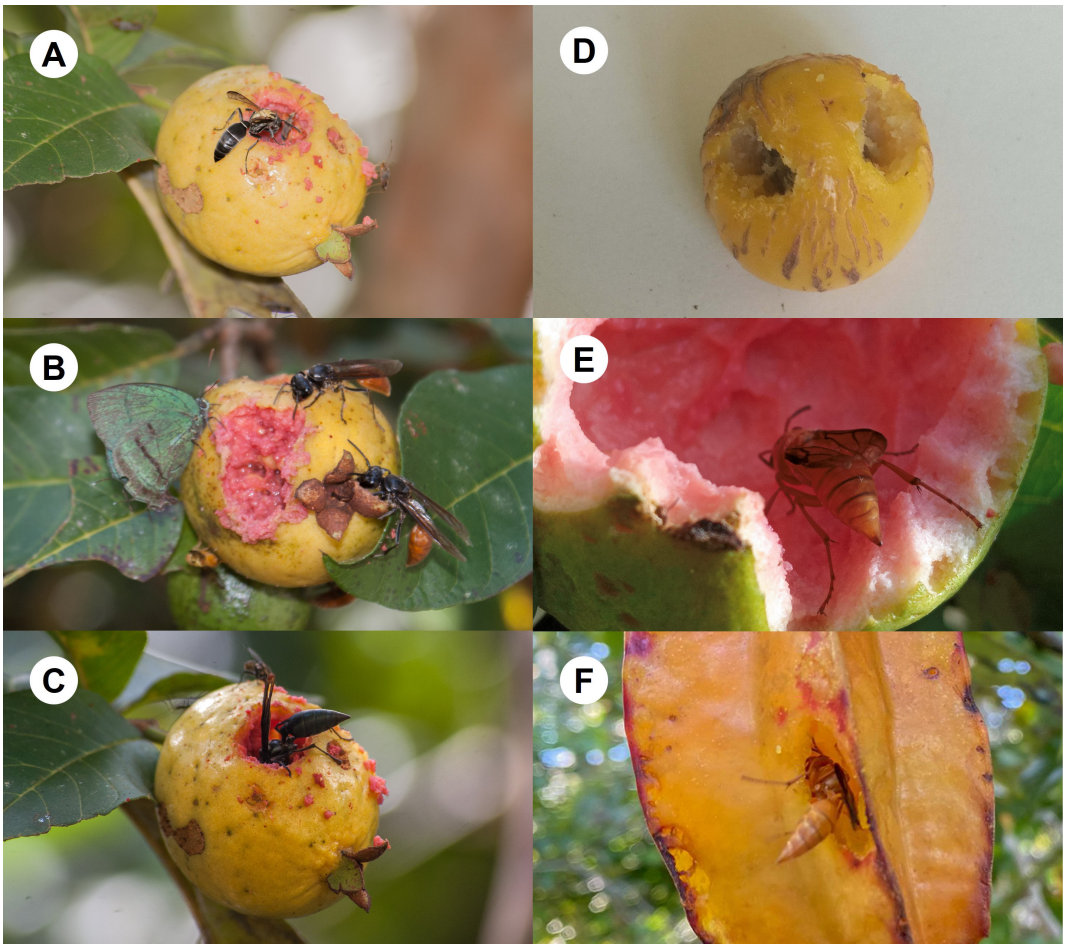

Figure 1. Fruit damage by social wasps. **A, B, C, E.** *Polybia liliacea* (Fabricius, 1804), *Polybia dimidiata* (Olivier, 1792), *Synoeca surinama* (Linnaeus, 1767), and *Synoeca virginea* (Fabricius, 1804) on guava fruits. **D.** Murici fruit damaged by social wasps. **F.** *Synoeca virginea* causing damage to starfruit. / **Figura 1.** Daño a la fruta causado por avispas sociales. **A, B, C, E.** *Polybia liliacea* (Fabricius, 1804), *Polybia dimidiata* (Olivier, 1792), *Synoeca surinama* (Linnaeus, 1767) y *Synoeca virginea* (Fabricius, 1804) en frutos de guayaba. **D.** Fruta Murici dañada por avispas sociales. **F.** *Synoeca virginea* causando daño a la carambola.

Similar behavior has been observed by other authors in unmanaged fruit plants, such as cacti (Santos *et al.* 2007), jabuticaba (De Souza *et al.* 2010), and mango (Barbosa *et al.* 2014), as well as in cultivated areas, such as cashew (Santos and Presley 2010), guava (Brügger

et al. 2011), and grapes (Oliveira *et al.* 2019). It is noteworthy that, despite the presence of wasps visiting the fruits, the highest frequency of records occurs in fallen fruits (Santos and Presley 2010; Barbosa *et al.* 2014; Brügger *et al.* 2017), which are already open due to the impact of the fall or the actions of other animals.

We can observe that only a small fraction of social wasp species is capable of breaking the fruit's skin while still on the tree, making them economically unviable. Typically, these are larger species, such as those studied in this research. This leads us to believe that these species can become pests, either due to stings during harvesting (Hickel and Schuck 1995) or mainly because of the injuries inflicted on the fruits, rendering them commercially unviable.

In order to solve the problem, De Souza *et al.* (2010) and Brügger *et al.* (2017) propose a strategy involving the identification and relocation of social wasp nests. Conversely, Hickel and Schuck (1995) argue that eradicating social wasps could potentially disrupt the delicate balance of the agroecosystem, especially in combating caterpillar pests, which are prevalent in various crops. Numerous studies have previously underscored the valuable role of social wasps in pest control, as exemplified by Prezoto *et al.* (2019). As such, the most effective approach to prevent accidents involves the implementation of personal protective equipment during fruit harvesting, alongside efforts to educate landowners about optimal management practices. This approach not only mitigates the risk of accidents but also preserves the colonies of these insects, thereby maintaining their effectiveness in pest control.

Additionally, certain phytosanitary measures employed to manage fruit fly infestations in guava and carambola may offer potential benefits in curbing the harm caused by wasps. One such measure involves the encasement of still-green fruits with a tough outer shell, a practice achievable using various materials such as popcorn bags, baking paper, paraffin paper, newspaper, microperforated plastic, or TNT, as suggested by Azevedo *et al.* (2016). However, it's worth noting that due to the associated costs and labor requirements, this method is most advisable for small orchards or when the pest infestation is particularly severe. In the case of guava, an alternative approach involves advancing the fruit harvest, thereby reducing the period during which the fruits are vulnerable to wasp attacks. This can be achieved by harvesting guava when it reaches its physiological maturity, referred to as "permanent fruit," while the skin remains rigid, as proposed by Raga and Souza-Filho (2021).

Moreover, the scientific community should actively promote outreach and educational initiatives aimed at emphasizing the ecological significance of these insects. Nevertheless, it is crucial to emphasize that further comprehensive studies to determine whether the damage inflicted by social wasps genuinely poses a threat to property owners.

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Author Contributions

GML: Investigation, writing - original draft. **AS:** Investigation, writing - review & editing. **BCB:** Writing - review & editing. **GJNdV:** Funding acquisition, writing - review & editing.

Literature Cited

Azevedo, F.R., Nere, D.R., Santos, C.A.M., Moura, E.S. and Azevedo, R. (2016) Efeito do ensacamento sobre a incidência de moscas-das-frutas e na qualidade das goiabas. *Arquivos do Instituto Biológico*, *83*(e0122014): 1-8. https://doi.org/10.1590/1808-1657000122014

Barbosa, B.C., Paschoalini, M.F. and Prezoto, F. (2014) Temporal activity patterns and foraging behavior by social wasps (Hymenoptera, Polistinae) on fruits of *Mangifera indica* L. (Anacardiaceae). *Sociobiology*, *61*(2): 239-242. https://doi.org/10.13102/sociobiology.v61i2.239-242

Brügger, B.P., Souza, L.S.A., Souza, A.R. and Prezoto, F. (2011) Social wasps (*Synoeca cyanea*) damaging *Psidium* sp. (Myrtaceae) fruits in Minas Gerais State, Brazil. *Sociobiology*, *57*(3): 533-535.

Brügger, B.P., Castro, B.M.C., Prezoto, F., Serrão, J.E. and Zanuncio, J.C. (2017) Feeding by the social wasp *Polybia scutellaris* (Hymenoptera: Vespidae) on *Syzygium jambos* (Myrtaceae) fruits in Minas Gerais, Brazil. *Florida Entomologist*, *100*(1): 172-173. https://doi.org/10.1653/024.100.0125

De Souza, A.R., Venâncio, D.F.A. and Prezoto, F. (2010) Social wasps (Hymenoptera: Vespidae: Polistinae) damaging fruits of *Myrciaria* sp. (Myrtaceae). *Sociobiology*, *55*(2): 297-299.

Hickel, E.R. and Schuck, E. (1995) Vespas e abelhas atacando a uva no Alto Vale do Rio do Peixe. *Agropecuária Catarinense*, *8*(1): 38-40.

IBGE [Instituto Brasileiro de Geografia e Estatística] (2015) Produção Agropecuária. Accessed on: 20 November 2015. Available at: https://www.ibge.gov.br/explica/producao-agropecuaria

Lopes, R.B., Vargas, G., Colmenárez, Y.C. and Faria, M. (2023) Biological control in Latin America. *Neotropical Entomology*, *52*: 119-121. https://doi.org/10.1007/s13744-023-01036-2

Lourido, G.M., Lopes, T.M.V., Somavilla, A. and Guerra, K.F.G. (2019) Social wasps as biological control agents against *Diaphania hyalinata* (Linnaeus, 1767) (Lepidoptera, Crambidae), a cucumber pest in Amazonas, Brazil. *Sociobiology*, *66*(4): 610-613. https://doi.org/10.13102/sociobiology.v66i4.3576

Montefusco, M., Gomes, F.B., Somavilla, A. and Krug, C. (2017) *Polistes canadensis* (Linnaeus, 1758) (Vespidae: Polistinae) in the Western Amazon: a potential biological control agent. *Sociobiology*, *64*(4): 442-450. https://doi.org/10.13102/sociobiology.v64i4.1936

Moreira-Dantas, I.R., Martínez-Zarzoso, I., Henning, C. and Santos, M.S. (2023) Rural credit acquisition for family farming in Brazil: Evidence from the legal Amazon. *Journal of Rural Studies*, *101*(103041). https://doi.org/10.1016/j.jrurstud.2023.103041

Oliveira, I.M., Loeck, A.E., Garcia, F.R.M. and Botton, M. (2019) Faunal analysis and injuries characterization of Polistinae (Hymenoptera, Vespidae) in Niagara Rosada vineyards in Bento Gonçalves, Rio Grande do Sul state, Brazil. *Bioscience Journal*, *35*(4): 1220-1226. https://doi.org/10.14393/BJ-v35n4a2019-42016

Prezoto, F., Nascimento, F.S., Barbosa, B.C. and Somavilla, A. (2021) *Neotropical Social Wasps: Basic and applied aspects*. Springer International Publishing, Switzerland. 473 pp. https://doi.org/10.1007/978-3-030-53510-0

Prezoto, F., Maciel, T.T., Detoni, M., Mayorquin, A.Z. and 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

Raga, A. and Souza-Filho, M.F. (2021) *Manual de moscas-das-frutas: medidas para o controle sustentável*. Fundecitrus, Araraquara. 33 pp.

Santos, G.D.M. and Presley, S.J. (2010) Niche overlap and temporal activity patterns of social wasps (Hymenoptera: Vespidae) in a Brazilian cashew orchard. *Sociobiology*, *56*(1): 121-131.

Santos, G.M.M., Cruz, J.D., Bichara Filho, C.C., Marques, O.M. and Aguiar, C.M.L. (2007) Utilização de frutos de cactos (Cactaceae) como recurso alimentar por vespas sociais (Hymenoptera, Vespidae, Polistinae) em uma área de caatinga (Ipirá, Bahia, Brasil). *Revista Brasileira de Zoologia*, *24*(4): 1052-1056.

Somavilla, A., Schoeninger, K., De Castro, D.G.D., Oliveira, M.L. and Krug, C. (2016) Diversity of wasps (Hymenoptera: Vespidae) in conventional and organic guarana (*Paullinia cupana var*. *sorbilis*) crops in the Brazilian Amazon. *Sociobiology*, *63*: 1051-1057. https://doi.org/10.13102/sociobiology.v63i4.1178