

Scientific Note

Unveiling a New Association: First Record of Psocoptera in Social Wasp Nests

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Edited by: **Alberto M. Silva-Neto**

Received: March 10, 2025. Accepted: May 12, 2025. Published: June 04, 2025.

Abstract. Social wasp nests provide stable microhabitats that can support diverse arthropod communities. This study reports the first record of psocopterans associated with social wasp colonies, highlighting a potential commensal relationship. We analyzed 88 colonies and nests between 2016 and 2018 in secondary urban forest fragments in Brazil. A total of 219 psocopterans were recorded in 15 nests, with *Liposcelis bostrychophila* Badonnel, 1931 being the most abundant species. The presence of nymphs and adults in both active and abandoned nests suggests that these insects exploit the nests regardless of colony activity. These findings emphasize the role of social wasp nests as important microhabitats and provide new insights into the ecological interactions within these structures, contributing to a broader understanding of arthropod biodiversity.

Keywords: Ecological interaction, Neotropical region, Polistinae.

Understanding the ecological interactions between organisms that share microhabitats is essential for comprehending ecosystem dynamics (Del-Claro 2024). In this context, the nests of social wasps present complex structures that serve not only as shelters for the colony but also as microenvironments colonized by a diversity of other organisms (Barbosa et al. 2021).

Recent studies indicate that nest architecture, along with the location and behavior of social wasps, creates stable conditions of temperature, humidity, and protection, favoring interactions with opportunistic organisms (Barbosa et al. 2023; Maciel et al. 2023a; Maciel et al. 2023b; Maciel et al. 2024). However, information on interactions between non-parasitic-lice (Psocoptera) and social wasps remains scarce.

Most psocodeans are minute insects, including both free-living lice and ectoparasites, belonging to the order Psocodea (Silva-Neto et al. 2024). The non-parasitic group of this order feeds on fungi, decaying organic matter, pollen, algae and debris, adopting a saprophagous lifestyle (Silva-Neto & García-Aldrete 2020; Silva-Neto et al. 2024). This study presents the first recorded associations between psocopterans and social wasp colonies, contributing to a broader understanding of the ecological relationships between these species.

Eighty-eight colonies and nests of social wasps were collected between 2016 and 2018 in urban fragments with secondary forests in the cities of Juiz de Fora, Minas Gerais, in five localities, and one locality in Maceió, Alagoas, both located within the Atlantic Forest biome in Brazil (see Tab. 1 for locality details). All colonies were inspected, stored in plastic containers covered with voile fabric, and maintained in the laboratory. When necessary, adults of wasps were removed with forceps, and the nests were kept and monitored for 30 days at room temperature (~28 °C) and 70% relative humidity.

To confirm the studied species, the identification key proposed by Somavilla & Carpenter (2021) was used for social wasps. Psocoptera were identified based on the original description of with *Liposcelis bostrychophila* Badonnel, 1931 (Badonnel 1931) and with morphological information present in Lienhard (1990); Li et al. (2011) and Yang et al. (2015). Both groups were confirmed by specialists. The social wasps and Psocoptera specimens were deposited in the Invertebrate Collection of the National Institute for Amazonian

Research (INPA), Brazil.

Data on the abundance of individuals in active colonies and abandoned nests were analyzed using the Mann-Whitney test after normality verification. Statistical analyses were performed using R software, version 4.4.0 (R Core Team 2024).

A total of 219 psocopteran individuals were recorded in 15 nests (14 in Juiz de Fora and 1 in Maceió), belonging to 12 species of social wasps (Tab. 1). The species *L. bostrychophila* (Fig. 1) was predominant in nest collected in Juiz de Fora/MG, with 213 individuals, suggesting a generalist association. Additionally, a colony collected in Maceió/AL harbored another *Liposcelis* Motschulsky, 1852 species, with six individuals. Nymphs and adults were observed in all analyzed nests.

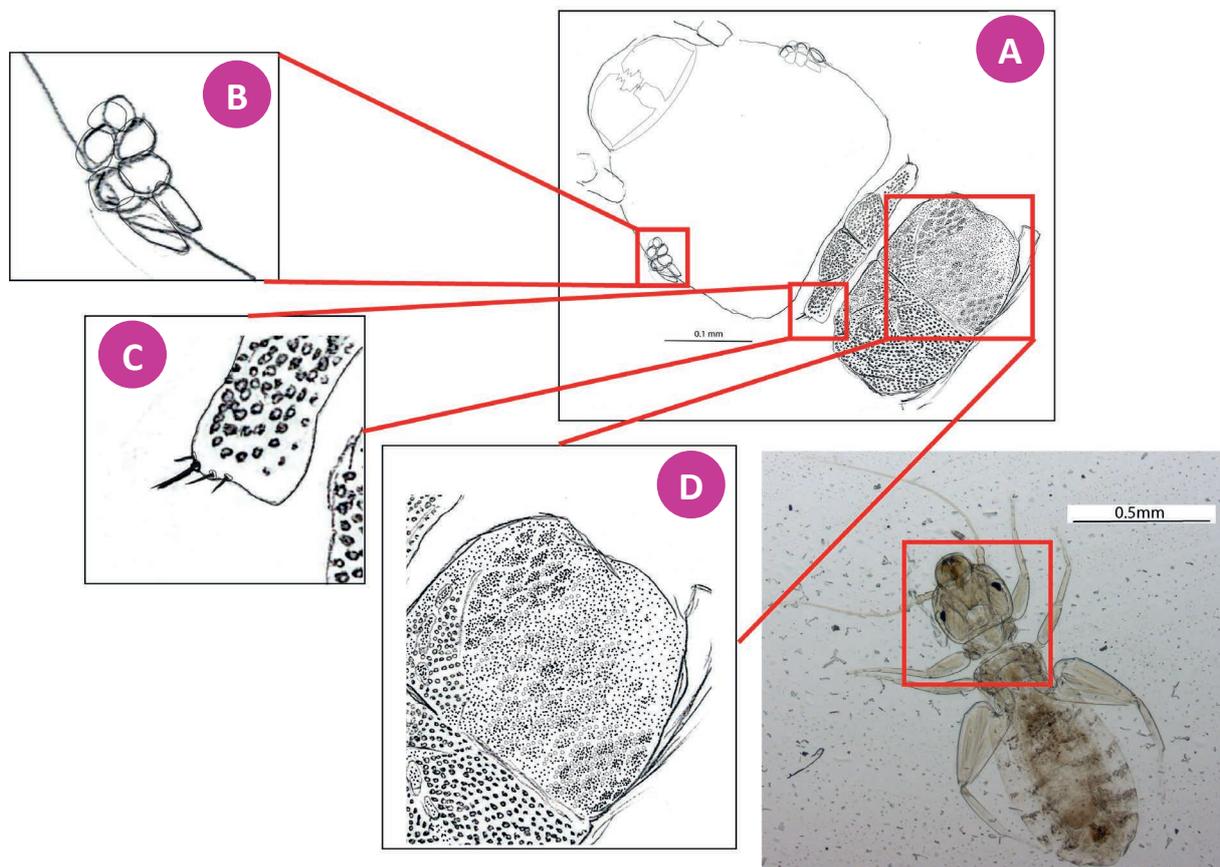
Social wasp nests offer protected microhabitats that provide a stable microclimate and organic resources, such as the cellulose used in nest construction and the meconium deposited at the bottom of the cells, which can also promote fungal growth (Mayorga-Ch et al. 2021). These factors may favor the colonization by psocopterans which feed on these fungi and decomposing organic matter, which can be corroborated by records in ants (Lienhard 1990; Georgiev et al. 2020) and bird nests (New 1972; García-Aldrete 1984; Baz 1990); as well as other minute organisms, such as springtails, which have already been recorded in social wasp colonies feeding on these resources (Machado et al. 1988; Maciel et al. 2024).

Although the exact nature of this interaction remains unclear, the recurring presence of *L. bostrychophila* and the *Liposcelis* sp. in all nests analyzed suggests a possible commensal relationship. Furthermore, the analysis of psocopteran abundance in active and abandoned nests revealed no significant differences between the groups ($U = 26.5$; $z = 0.1158$; $p = 0.90$), with similar mean values between colonies (4.37) and nests (3.63). This indicates that the presence and quantity of these insects do not appear to be influenced by the colony's activity status.

These findings reinforce the importance of studies on social wasp nests as relevant microhabitats for arthropods, revealing the potential for new, previously unknown discoveries. The consistent presence of *Liposcelis* spp. in all analyzed nests strengthens this association and highlights the significance of these environments for local biodiversity conservation.

Table 1. List of Psocoptera Species Associated with Social Wasps (Polistinae) in the Brazilian Atlantic Forest.

| Social Wasps | Psocoptera | Colonial state | Psocoptera (N) | Location | Geographical Coordinates |
|--|--|----------------|----------------|-----------------|--------------------------|
| <i>Mischocyttarus drewseni</i> de Saussure, 1857 | <i>Liposcelis bostrycophila</i> Badonnel, 1931 | Active | 7 | Juiz de Fora/MG | 21°43'28"S - 43°16'47"W |
| <i>Mischocyttarus drewseni</i> de Saussure, 1857 | <i>Liposcelis bostrycophila</i> Badonnel, 1931 | Abandoned | 11 | Juiz de Fora/MG | 21°43'28"S - 43°16'47"W |
| <i>Mischocyttarus iheringi</i> Zikán, 1935 | <i>Liposcelis bostrycophila</i> Badonnel, 1931 | Active | 13 | Juiz de Fora/MG | 21°46'02"S - 43°22'34"W |
| <i>Mischocyttarus socialis</i> (de Saussure, 1854) | <i>Liposcelis bostrycophila</i> Badonnel, 1931 | Active | 1 | Juiz de Fora/MG | 21°43'28"S - 43°16'47"W |
| <i>Polistes ferreri</i> de Saussure, 1853 | <i>Liposcelis bostrycophila</i> Badonnel, 1931 | Abandoned | 51 | Juiz de Fora/MG | 21°45'50"S - 43°22'52"W |
| <i>Polistes simillimus</i> Zikán, 1948 | <i>Liposcelis bostrycophila</i> Badonnel, 1931 | Abandoned | 34 | Juiz de Fora/MG | 21°47'47"S - 43°23'23"W |
| <i>Polistes</i> sp. 1 | <i>Liposcelis bostrycophila</i> Badonnel, 1931 | Abandonad | 17 | Juiz de Fora/MG | 21°46'02"S - 43°22'34"W |
| <i>Polistes</i> sp. 2 | <i>Liposcelis bostrycophila</i> Badonnel, 1931 | Abandonad | 3 | Juiz de Fora/MG | 21°45'50"S - 43°22'52"W |
| <i>Polistes</i> sp. 3 | <i>Liposcelis bostrycophila</i> Badonnel, 1931 | Abandonad | 2 | Juiz de Fora/MG | 21°45'50"S - 43°22'52"W |
| <i>Polybia bistriata</i> (Fabricius, 1804) | <i>Liposcelis</i> sp. | Abandoned | 6 | Maceió/AL | 9°36'47"S - 35°45'37"W |
| <i>Polybia fastidiosuscula</i> de Saussure, 1854 | <i>Liposcelis bostrycophila</i> Badonnel, 1931 | Abandonad | 15 | Juiz de Fora/MG | 21°47'36"S - 43°22'54"W |
| <i>Polybia platycephala</i> Richards, 1978 | <i>Liposcelis bostrycophila</i> Badonnel, 1931 | Abandonad | 4 | Juiz de Fora/MG | 21°43'28"S - 43°16'47"W |
| <i>Polybia platycephala</i> Richards, 1978 | <i>Liposcelis bostrycophila</i> Badonnel, 1931 | Abandoned | 23 | Juiz de Fora/MG | 21°43'28"S - 43°16'47"W |
| <i>Polybia platycephala</i> Richards, 1978 | <i>Liposcelis bostrycophila</i> Badonnel, 1931 | Abandoned | 29 | Juiz de Fora/MG | 21°43'28"S - 43°16'47"W |
| <i>Protopolybia exigua</i> (de Saussure, 1854) | <i>Liposcelis bostrycophila</i> Badonnel, 1931 | Abandoned | 3 | Juiz de Fora/MG | 21°46'02"S - 43°22'34"W |


Figure 1. Example of *Liposcelis* species observed in social wasp colonies and nests. Characteristics of *Liposcelis bostrycophila* Badonnel, 1931. A. Dorsal view of the head and thorax B. Eyes with 7 ommatidia C. Pronotum bristles D. Thorax sculpturing.

Funding Information

This work was supported by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES), the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) and The Fundação de Apoio ao Desenvolvimento do Ensino, Ciência e Tecnologia do Estado de Mato Grosso do Sul (FUNDECT).

Authors' Contributions

BCB: Investigation, Validation, Writing - review & editing; TTM: Investigation, Validation, Writing - review & editing; DML: Investigation, Validation, Writing - review & editing.

Conflict of Interest Statement

The authors declare that they have no conflicts of interest.

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