

Hey, am I safe here? Nesting behavior of social wasps (Vespidae, Polistinae) associated with water bodies

Ei, estou seguro aqui? Comportamento de nidificação de vespas sociais (Vespidae, Polistinae) associado a corpos d'água

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ABSTRACT

Nesting is crucial for the survival of social wasps and is influenced by various biotic and abiotic factors that affect the selection of nesting sites and substrates. Although some studies reported the presence of nests near aquatic environments, the factors behind this behavior remain unclear. This study aimed to report social wasp nesting near water bodies in different regions of Brazil between 2010 and 2025. Different species exhibited this behavior across various vegetation types and regions. It is hypothesized that nesting near water may function as a defense strategy against predators, especially ants, and offer easy access to water for biological needs. However, this strategy may also pose risks, as rising water levels can lead to colony loss by drowning, as observed in a case reported here. Further studies are necessary to better understand the advantages and disadvantages of nesting near aquatic environments in social wasps.

Keywords: flooded ecosystems, freshwater, survival.

RESUMO

A nidificação, crucial para a sobrevivência das vespas sociais, é influenciada por diversos fatores bióticos e abióticos, que afetam a seleção de locais e substratos para nidificação. Embora alguns estudos tenham relatado a presença de ninhos próximo a ambientes aquáticos, os fatores que motivam tal comportamento ainda não são claros. Este estudo teve como objetivo relatar a nidificação de vespas sociais próximo a corpos d'água em diferentes regiões do Brasil, entre 2010 e 2025. Diferentes espécies apresentaram esse comportamento em diversos tipos de vegetações e regiões. Supõe-se que a nidificação perto da água possa funcionar como uma estratégia de defesa contra predadores, especialmente formigas, além de proporcionar fácil acesso à água para necessidades biológicas. No entanto a estratégia também pode representar riscos, pois o aumento repentino do nível da água pode levar à morte da colônia por afogamento, como observado em um relato de caso no presente estudo. Pesquisas adicionais são necessárias para melhor compreender as vantagens e potenciais desvantagens da nidificação de vespas sociais próximo a ambientes aquáticos.

Palavras-chave: água doce, ecossistemas alagados, sobrevivência.

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INTRODUCTION

Nesting is essential for the survival of social wasps (Vespidae: Polistinae) (WENZEL, 1998; SOMAVILLA *et al.*, 2012) and is influenced by a range of factors, including substrate selection

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(VIRGÍNIO *et al.*, 2016; SGUARIZI-ANTONIO *et al.*, 2021); predator defense mechanisms such as camouflage (MILANI *et al.*, 2020); interactions with other animals (SOUZA *et al.*, 2024; CARVALHO *et al.*, 2025); aggressive behaviors (SILVA *et al.*, 2023); chemical defenses (JEANNE, 1970); and nest architecture (RICHARDS & RICHARDS, 1951; SOMAVILLA *et al.*, 2012).

Several biotic and abiotic factors are known to influence nest site selection, including rainfall variation (SOUZA & PREZOTO, 2006); altitude (RIBEIRO *et al.*, 2019); fragmentation of native vegetation (GRAÇA & SOMAVILLA, 2018); proximity of forest remnants to agricultural areas (PALANDI *et al.*, 2025); degree of habitat disturbance (OLIVEIRA *et al.*, 2017); and food resource availability (SANTOS *et al.*, 2007). Although previous studies have reported the nesting of social wasps in habitats closely associated with aquatic ecosystems (SANTOS *et al.*, 2007; SOUZA *et al.*, 2012; JACQUES *et al.*, 2022, FRANCISCO *et al.*, 2024), the ecological and behavioral drivers of this phenomenon remain poorly understood.

Aquatic-terrestrial transitional zones, which may be continental or coastal, natural or artificial, and subject to periodic or permanent flooding by shallow water or saturated soils, are ecologically significant habitats (JUNK *et al.*, 2013). These ecosystems play a key role in carbon storage, hydrological regulation, and water retention, acting like natural sponges that absorb rainwater and gradually release it during dry periods (DURIGAN *et al.*, 2022). Their rich plant diversity and moist soils also provide critical resources and refuges for wildlife (NUNES *et al.*, 2022), making them important areas for studies on animal behavior, including the nesting of social wasps, which contribute to various ecosystem services (BROCK *et al.*, 2021).

In this context, the present study aims to report the occurrence of social wasp nesting associated with water bodies in different regions of Brazil. Additionally, we present a case report that highlights a potential negative consequence of this behavior on the survival of these wasps.

MATERIAL AND METHODS

Records were obtained opportunistically from different localities within the Amazon, Caatinga, Cerrado, and Atlantic Forest biomes between 2010 and 2025. In addition, a nesting colony of *Polybia scutellaris* (White, 1841) was monitored near a marginal lagoon of the Rio das Mortes (21°07'36"S; 44°13'36"W), in the municipality of Santa Cruz de Minas, Minas Gerais, southeastern Brazil. This colony was observed weekly from October 2022 to January 2023 and is presented here as a case study.

RESULTS AND DISCUSSION

In total, 12 colonies representing 10 species of social wasps were recorded nesting in flooded or water-associated environments (table 1, figure 1).

Table 1 – Nesting records of social wasp species in water bodies in Brazil.

Species	Substrate / height above water surface	Location / State / Year	Coordinates	Biome
<i>Parachartergus fraternus</i> (Gribodo, 1892)	<i>Salix humboldtiana</i> Willd / 130 cm	Barroso, MG, 2010	21°11'05"S 43°58'22"W	Atlantic forest/ cerrado
<i>Polybia occidentalis</i> (Olivier, 1791)	Unidentified pteridophyte / 50 cm	São Gonçalo do Sapucaí, MG, 2012	21°53'39"S 45°35'30"W	Atlantic forest

continued...

Continuation of table 1

Species	Substrate / height above water surface	Location / State / Year	Coordinates	Biome
<i>Protopolybia exigua</i> (de Saussure, 1854)	Unidentified tree / 100 cm	Refúgio Biológico Rio Pandeiros, MG, 2013	15°41'55"S 44°34'59"W	Cerrado
<i>Clypearia apicipennis</i> (Ducke, 1910)	Unidentified tree / 80 cm	Manaus, AM, 2013	3°02'40"S 59°58'01"W	Amazon forest
<i>Brachygastra augusti</i> (de Saussure, 1854)	Poaceae sp. / 40 cm	Parque Nacional Grande Sertão Veredas, MG, 2023	15°05'34"S 45°49'41"W	Cerrado
<i>Brachygastra lecheguana</i> (Latreille, 1824)	Poaceae sp. / 30 cm	Parque Nacional Grande Sertão Veredas, MG, 2023	15°05'34"S 45°49'41"W	Cerrado
<i>Polybia scutellaris</i> (White, 1841)	<i>Mimosa</i> sp. / 170 cm	Santa Cruz de Minas, 2023	21°07'36"S 44°13'36"W	Atlantic forest/ cerrado
<i>Polybia paulista</i> H. von Ihering, 1896	Unidentified tree / 180 cm	Santa Cruz de Minas, 2024	21°07'35"S 44°13'44"W	Atlantic forest/ cerrado
<i>Polybia platycephala</i> (Richards, 1978)	Arecaceae / 160 cm	Tiradentes, MG, 2023	21°07'18"S 44°09'29"W	Atlantic forest/ cerrado
<i>Polybia sericea</i> (Olivier, 1791)	<i>Anacardium</i> sp./ 15 cm	Lagoa de Jenipabu, RN, 2017	5°42'21"S 35°12'26"W	Restinga (atlantic forest)
<i>Polybia sericea</i> (Olivier, 1791)	Unidentified shrub / 10 cm	Parque Estadual da Mata Seca, MG, 2021	14°51'04"S 43°56'34"W	Caatinga
<i>Polybia sericea</i> (Olivier, 1791)	Unidentified shrub / 30 cm	Santo Antônio do Itambé, MG, 2025	18°28'26"S 43°18'07"W	Atlantic forest

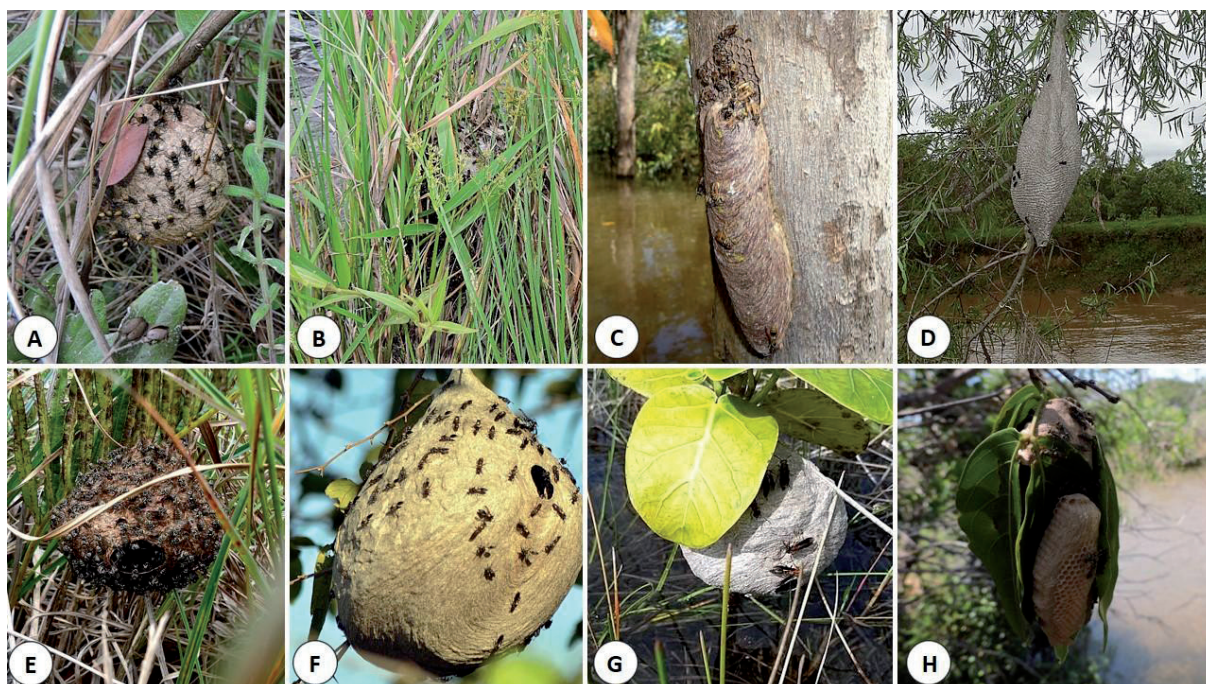


Figure 1 – Selected species of social wasps from the tribe Epiponini exhibiting nesting behavior in flooded areas across different regions of Brazil: A) *Brachygastra augusti*; B) *Brachygastra lecheguana*; C) *Clypearia apicipennis*; D) *Parachartergus fraternus*; E) *Polybia occidentalis*; F) *Polybia paulista*; G) *Polybia sericea*; H) *Protopolybia exigua*. Source: Research data (2025).

Apparently, nesting behavior near water bodies is not merely occasional, as evidenced by records across multiple Brazilian regions and vegetation types. This is further supported by previous studies reporting the presence of social wasps nesting in aquatic environments such as riparian (including swamp and gallery forests), marshes, *veredas*, and *igarapés* (DINIZ & KITAYAMA, 1994; SANTOS *et al.*, 2007; SOUZA *et al.*, 2010; SOUZA *et al.*, 2014; SOMAVILLA *et al.*, 2015; FRANCISCO *et al.*, 2018; SOUZA *et al.*, 2024).

Substrate selection in these environments does not appear to show specificity for particular plant species. While it is well known that social wasps choose nesting substrates based on a variety of factors – such as plant morphology (e.g., presence of spines) (MOURA *et al.*, 2022), leaf rigidity (SOUZA *et al.*, 2024), stem texture (MARQUES & CARVALHO, 1993), coloration (SILVA *et al.*, 2023), and even chemical similarity between the plant and the nest material (SGUARIZI-ANTONIO *et al.*, 2021) – in water-associated nesting behavior, proximity to the water surface seems to be the main selection criterion. In our records, this distance ranged from 10 to 180 cm.

The height of social wasp nests relative to the ground varies considerably and is likely associated with foraging efficiency and predator avoidance (SOMAVILLA *et al.*, 2012; SILVA *et al.*, 2022). Therefore, both the height above ground and the distance from the water surface appear to be ecologically relevant factors for social wasps.

By nesting at the edges or directly above water bodies, social wasps may limit predator access to their colonies, particularly from ants, which are considered one of their main natural enemies and a key selective pressure shaping nest architecture (JEANNE, 1975, 1979; SMITH *et al.*, 2001; BARBOSA *et al.*, 2021). All the species recorded in our study belong to the tribe Epiponini, which comprises swarm-founding wasps. Most Epiponini species lack the Van der Vecht's gland, responsible for secreting ant-repellent substances found in independent-founding species (JEANNE, 1970, SMITH *et al.*, 2001) and exhibit distinct nest architectures compared to other groups (RICHARDS, 1978). This absence may have led to the selection of alternative defensive strategies, such as specific nest structures and aggressive behavior (SMITH *et al.*, 2001; JEANNE, 2021; SILVA *et al.*, 2023).

This condition supports the hypothesis that nesting in flooded areas may represent an adaptive strategy to protect colonies from ant predation, as ants generally do not cross water barriers (SCHÖNING *et al.*, 2006). Therefore, this hypothesis deserves further investigation.

In addition, immediate access to water is essential for the survival of wasp colonies. The proximity of this resource is crucial for nest maintenance and growth, as wasps use water to soften plant fibers, which they process as raw material for nest construction (WENZEL, 1991, 1998), and also for nest thermoregulation (GIANNOTTI *et al.*, 1995).

On the other hand, this nesting behavior may pose risks and negatively affect colony survival in the event of sudden increases in water levels, which can submerge and destroy the nest. This was observed in the case study presented herein, where a colony of *Polybia scutellaris* (White, 1841) was completely submerged and destroyed during a flood of the Rio das Mortes (figure 2). Despite the sudden rise in water level, the individuals of *P. scutellaris* did not abandon the nest (figure 2E, F), which ultimately resulted in the drowning and death of the entire colony.

This behavior contrasts with that typically observed when colonies are attacked by ants, during which individuals tend to abandon the invaded nest and relocate to establish a new colony (JEANNE, 1979; MACIEL *et al.*, 2016).

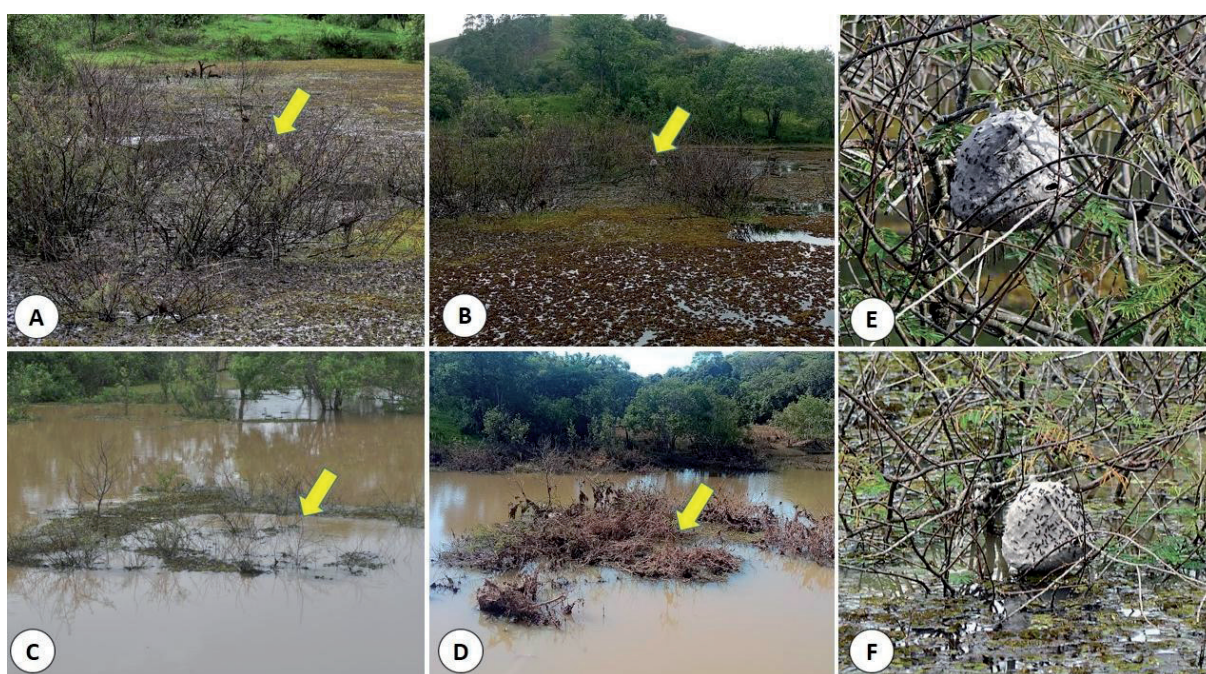


Figure 2 – Nesting of *Polybia scutellaris* on a *Mimosa* sp. shrub in a marginal lagoon of the Rio das Mortes, southeastern Brazil: A-D) sequence showing the rise in water level and subsequent death of the *P. scutellaris* colony. A) Before the flood; B) onset of flooding; C) peak flood level; D) after the flood. Yellow arrows indicate the position of the *P. scutellaris* colony. E) Detail of the colony before the flood; F) water level reaching the base of the colony during the flood. Source: primary (2025).

CONCLUSION

Therefore, although the habit of nesting near water bodies appears to be advantageous in terms of colony defense against predators and immediate access to water, it may also pose significant risks of colony destruction and mortality, particularly in areas prone to sudden water level rises, especially during the rainy season.

Thus, although different species exhibit this behavior, the recorded death of the *P. scutellaris* colony due to flooding was an isolated and occasional event. Future studies could monitor social wasp colonies located near water bodies in order to quantify the frequency of colony loss caused by rising water levels.

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