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Wasp and Ant Nests: Who Really Protects Whom? New Insights From Amazonian Forests

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ABSTRACT

Studies of animal behaviour are often biased towards species that are large-bodied or have broad geographic ranges, as these are easier to observe in nature. Consequently, our understanding of behavioural ecology is shaped by such biases, even though these studies have provided important insights. Rarer or more cryptic behaviours, especially in historically neglected taxa, can nonetheless reveal key aspects of ecological and evolutionary dynamics. One such underexplored phenomenon involves nesting associations between social wasps and ants. Here we present the first photographic and video documentation of *Agelaia pallidiventris* nesting within a *Azteca* ant nest in the Brazilian Amazon. The wasps occupied chambers inside the ant nest through three circular openings, coexisting without visible aggression. The observation suggests a stable, possibly mutualistic association. This finding provides unprecedented evidence of an intimate wasp–ant nesting relationship and highlights the need for renewed natural history research. Understanding whether such interactions are commensal (e.g., where wasps gain passive protection from the ants' territoriality), parasitic (e.g., cleptoparasitism), or mutualistic (e.g., a defence system against shared predators) will illuminate the selective pressures shaping behavioural evolution in Amazonian insect communities.

RESUMO

Os estudos sobre o comportamento animal frequentemente apresentam vieses em favor de espécies de grande porte ou de ampla distribuição geográfica, uma vez que essas são mais fáceis de observar na natureza. Consequentemente, nossa compreensão da ecologia comportamental é moldada por esses vieses, embora tais estudos tenham fornecido importantes contribuições. Comportamentos mais raros ou crípticos, especialmente em táxons historicamente negligenciados, podem, no entanto, revelar aspectos fundamentais das dinâmicas ecológicas e evolutivas. Um desses fenômenos ainda pouco explorados envolve associações de nidificação entre vespas sociais e formigas. Apresentamos aqui o primeiro registro fotográfico e em vídeo de *Agelaia pallidiventris* nidificando dentro de um ninho de formigas do gênero *Azteca* na Amazônia brasileira. As vespas ocuparam câmaras internas do ninho das formigas por meio de três aberturas circulares, coexistindo sem sinais visíveis de agressão. A observação sugere uma associação estável e possivelmente mutualística. Este achado fornece uma evidência inédita de uma relação de nidificação íntima entre vespas e formigas e destaca a necessidade de interesse em estudos de história natural. Compreender se tais interações são comensais, parasíticas ou mutualísticas pode lançar luz sobre as pressões seletivas que moldam a evolução comportamental nas comunidades de insetos amazônicos.

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Advances in animal behaviour studies have clarified how fine-scale interactions drive ecological patterns and evolutionary trajectories (e.g., Delgado et al. 2018; Orians 2000). However, ethological research remains frequently biased (Kelly et al. 2025), largely towards species with greater body mass, and extensive geographic range (e.g., Ellison et al. 2021), as such traits facilitate field observations. As a result, much of our current knowledge may come from these biased studies. Even so, such studies have substantially advanced behavioural ecology and addressed important questions. However, rarer or more cryptic behaviours, particularly in historically neglected taxa (Troudet et al. 2017; Costante et al. 2022), can provide complementary insights into ecological and evolutionary processes. One such example is the potentially ecologically significant nesting associations between wasps and ants.

In the Amazon, nests of the social wasp *Polybia rejecta* (Fabricius, 1798) have been frequently recorded in close proximity to ant nests of the genus *Azteca* (Jeanne 1978; London and Jeanne 1997; Somavilla et al. 2013). This association is relatively well documented and is thought to provide mutual benefits in terms of protection against predators: wasps may act as a robust aerial deterrent against vertebrate insectivores, whereas ants may function as a biotic barrier reducing the impact of raids by army ants. However, reports of social wasps

nesting within the large nests of *Azteca* ants remain rare and are usually limited to brief notes included in original species descriptions. These records suggest that this type of nesting association remains poorly understood and insufficiently documented in the literature.

According to Richards (1978), only two species of social wasps in the genus *Agelaia* are known to nest in association with *Azteca* ants: *A. hamiltoni* (Richards 1978), and *A. myrmecophila* (Ducke, 1905). However, these notes, provided alongside the original species descriptions, contain no detailed information about the nature of the association, nor any photographic documentation. The only reference is a brief remark, for example: 'According to Dr. Hamilton, this species always nested with ants. One ant preserved is *Azteca* sp'. Another report of nesting in ant nests concerns *A. pallidiventrif* (Richards 1978), as documented by Cooper (2000). M.G. Naumann's field notes (the collector of the type specimens) report the collection of specimens on an ant nest (*Azteca* sp.), although it seems Richards did not examine those records. Moreover, Richards placed three specimens of *A. pallidiventrif* from Colombia, also collected in *Azteca* nests, under *A. myrmecophila* in the British Museum collection (Cooper 2000). These sparse records reveal the limited understanding we have of this interaction, despite its potential ecological importance.



FIGURE 1 | Individuals of the wasp *Agelaia pallidiventrif* living in close association with ants of the genus *Azteca*. The nest entrance is about 10cm wide, with no visible signs of aggression or avoidance between the species.



FIGURE 2 | Azteca nest inhabited by the wasp *Agelaia pallidiventris*. The red square and arrow show the location of the records and one of the three entrances used by the wasps within the nest's internal chambers.

Here, we report for the first time photographic and video evidence of a nesting association between the wasp *Agelaia pallidiventris* (Richards 1978) and an unidentified ant species of the genus *Azteca* (Figures 1 and 2), recorded at the end of the dry season (November 2023) in the Brazilian Amazon (lat: -5.61 long: -62.19). Although both taxa are common regional residents and typically occur in allopatry, this specific heterospecific nesting appears rare. This interaction was first observed by a researcher who has more than 20 years of experience working in the Amazon forest. He reported never having observed this interaction before, suggesting it may be a rare behaviour. He also noted that this association may have been occurring since late 2010, when he believes he observed it for the first time at this location.

Figure 1 and Videos S1 and S2 indicate that the wasps (*A. pallidiventris*) inhabit the ant nest without causing apparent harm, with no visible signs of aggression or avoidance. Furthermore, the wasps appeared to be nesting within the ant nest, occupying internal chambers accessed through three clearly visible circular openings, each about 10 cm in diameter (Figure 2). These entrances were distributed along the nest:

one at the base, near the tree trunk; another in the midsection; and a third towards the distal end of the ant nest. A high level of ant activity was observed across the nest envelope, while fewer than ten *A. pallidiventris* workers were seen guarding the wasp nest entrances. That the two species (wasp and ant) appeared to coexist harmoniously with no visible signs of aggression or disturbance suggests a stable and possibly mutualistic association (Video S1).

Unlike previous reports that lacked detailed observations, our record provides a visual documentation of this nesting association, representing a significant contribution to our understanding of ant-wasp interactions in Amazon ecosystems. It also raises important questions for future studies regarding the ecological and evolutionary implications of such close nesting relationships. What is the direction of this association: does the wasp benefit from ants' defence, do the ants gain some advantage from the wasps, or could both species be benefiting?

Addressing these questions draws attention to the complexity of evolutionary history and the selective pressures that shape behavioural evolution in these species. Some studies suggest that such interactions are often mutually beneficial, with each species potentially providing protection to the other (Somavilla et al. 2013). However, the prevalence and ecological significance of these associations in nature remain poorly understood. Only through renewed attention to careful natural history observations, combined with collaborative efforts amongst ecologists, taxonomists, evolutionary biologists and researchers from other disciplines can we begin to unravel the dynamics of biodiversity in the world's most species-rich forest.

Author Contributions

Sergio Santorelli Junior: conceptualization, visualization, writing – review and editing, writing – original draft, investigation, funding acquisition. **Alexandre Somavilla:** conceptualization, investigation, writing – original draft, writing – review and editing, visualization, validation. **João Araújo:** visualization, investigation, conceptualization. **Paulo César Salgado Barroso:** conceptualization, investigation, writing – original draft, writing – review and editing, visualization, validation. **William E. Magnusson:** conceptualization, investigation, writing – review and editing, writing – original draft, visualization, funding acquisition.

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wrote the manuscript. João Araújo identified the ecological interaction described in the study. William E. Magnusson critically revised the manuscript. Paulo César Salgado Barroso and Alexandre Somavilla identified the species involved and contributed to the writing and revision of the manuscript. All authors read and approved the final version of the manuscript. The Article Processing Charge for the publication of this research was funded by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil (CAPES) (ROR identifier: 00x0ma614).

Data Availability Statement

Data sharing not applicable to this article as no datasets were generated or analysed during the current study.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section. **Video S1:** Wasps (*Agelaia pallidiventris*) inhabiting the ant nest without causing apparent harm, with no visible signs of aggression or avoidance. **Video S2:** Wasps (*Agelaia pallidiventris*) inhabiting the ant nest without causing apparent harm, with no visible signs of aggression or avoidance.