

Association among wasps' colonies, ants and birds in Central Amazonian

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Abstract: Some neotropical vespids are known for their association with other insects and vertebrate taxa. In the present study about the wasp diversity in the Ducke Reserve, Manaus, Brazil five active colonies and an abandoned one of *Polybia rejecta*, and one active colony of *Synoeca virginea* were found associated with ant nests of *Azteca* aff. *chartifex* (Formicidae). A single colony of *Polybia rejecta* was found beside nests of *Cacicus cela* (Passeriformes: Icteridae). These associations appear to be related both to protection of the wasps nests by the ants and the protection of the ants nests by the wasps, as well as to protection of the bird nests by the wasps. The wasps take advantage of the tolerance of the ants, nesting near their colonies to obtain protection, so escaping attack by other ant species that feed on the immature wasps. Birds in turn take advantage of protection by these wasps against potential predators. This work adds new data to the study of associations of wasp species found in Central Brazilian Amazon, with descriptions of observed behaviors and photographs of such associations.

Keywords: *Azteca* ants, *Cacicus cela*, nests, *Polybia rejecta*, *Synoeca virginea*.

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Resumo: Alguns vespídeos neotropicais são conhecidos por realizarem associações com outros táxons de insetos e vertebrados. Neste estudo sobre diversidade de vespas na Reserva Ducke, Manaus, Brasil foram localizadas cinco colônias ativas e uma abandonada de *Polybia rejecta* e uma colônia ativa de *Synoeca virginea* todas associadas aos ninhos de *Azteca* aff. *chartifex* (Formicidae). Uma única colônia de *Polybia rejecta* foi localizada ao lado de ninhos de *Cacicus cela* (Passeriformes: Icteridae). Essas associações parecem estar relacionadas tanto à proteção dada pelas formigas aos ninhos de vespas e vice-versa, quanto à proteção dada pelas vespas aos ninhos de pássaros. As vespas usam a tolerância das formigas e nidificam próximo às suas colônias para obtenção de proteção contra formigas predadoras que se alimentam das formas imaturas das vespas. Por outro lado, os pássaros podem usar a proteção das vespas contra possíveis predadores. Os comportamentos observados foram descritos e fotos destas associações foram feitas; este trabalho acrescenta novos dados ao estudo das associações realizadas por espécies de vespas encontradas na Amazônia Central brasileira.

Palavras-chave: formiga *Azteca*, *Cacicus cela*, ninhos, *Polybia rejecta*, *Synoeca virginea*.

Introduction

The social insects, including ants, bees, wasps and termites, play a part in multiple and important ecological interactions, arousing great scientific interest (Vilela et al. 2008). Some neotropical vespids are known to maintain associations with other insect and vertebrate taxa, like birds and bats (Jeanne 1970, Richards 1971, Wilson 1975, Richards 1978). Because social wasps often defend their nests by inflicting painful stings or bites, some animals associate with them for protection against potential predators (Carpenter & Marques 2001).

There are associations among different species of wasps, wherein a less bellicose species tends to be associated with a more aggressive one (Richards 1978). *Polistes e Mischocyttarus*, for example, are considered less aggressive, unlike the *Polybia* wasps (Richards 1978). In Central America, *Polistes carnifex* (Fabricius, 1775) has a habit of nesting with *Polybia occidentalis* (Oliver, 1791) and *Mischocyttarus immarginatus* Richards, 1940 nests in association with *P. occidentalis* and *P. diguetana* Buysson, 1905 (Corn 1972, Windsor 1972, Gorton 1978, London & Jeanne 1997). *M. immarginatus* was also observed in association with *Synoeca*, *Brachygastra* and *Metapolybia* (Starr 1988). Delabie (1990) reported that the aggressive wasps *Polistes versicolor* (Olivier, 1791) and *Agelaea angulata* (Fabricius, 1804) were associated with colonies of *Azteca* species.

Agelaea myrmecophila (Ducke, 1905) and some species of *Mischocyttarus* build their colonies associated with "ant plants" of the Boraginaceae and Melastomataceae families (Richards 1945, Zikán 1949). In the Peruvian Amazon, some species of *Angiopolybia*, *Mischocyttarus*, *Polistes*, *Polybia* and *Pseudopolybia* nest on "ant plants", mostly of the genera *Maieta* and *Tococa* (Herre et al. 1986). Several ant species have been found associated with domatia of plant species of the genus *Tococa* (Melastomataceae) (Bizerril & Vieira 2002). The ant *Pheidole minutula* Mayr, 1878 has an obligate association with *Maieta*, *Cidemia* and *Tococa* (Vasconcelos 1991). In return for refuge or food, the ants protect their host-plants against herbivores (Davidson & Mckey 1993, Cabrera & Jaffe 1994, Bronstein 1998, Vasconcelos & Davidson 2000, Alvarez et al. 2001, Michelangeli 2003).

Associations among wasps and birds occur in the Neotropics and are easily noticed, but little understood. Usually, these associations are considered commensalism, since the bird benefits, but there is no record of any advantage to wasps (Beier & Tungbani 2006, Quinn & Ueta 2008). In Central America, birds commonly nesting in association with wasps build significantly more nests in trees containing *Polybia* colonies than in trees without this wasp (Joyce 1993). In Southern Brazilian Amazon, nests of *Galbula ruficauda* Cuvier, 1816 have been found associated with some colonies of *Polybia* and *Apoica* (Fry 1972). *Campylorhynchus rufinucha* (Lesson, 1838) and *Uraeginthus bengalus* (Linnaeus, 1766) birds have higher reproductive success when they are associated with nests of the social wasps *Polybia rejecta* (Fabricius 1798) and *Ropalida cincta* (Lepelletier, 1836), respectively (Joyce 1993, Beier & Tungbani 2006). In the Peruvian Amazon, nests of the bird *Cacicus cela* (Linnaeus, 1758) were recorded near social wasps colonies, which provide protection from mammals (primates), snakes and even other birds, decreasing the predation of *C. cela* eggs and youngs, thus increasing the reproductive success of this species (Robinson 1985).

Most such observations were reported over thirty years ago; since then, few similar studies have been published. The present study is the first to report associations between wasps, ants, and birds in the Central Amazon, with information about behavior, nest locations and photographs for active and abandoned colonies of *Polybia rejecta*, for one active colony of *Synoeca virginea* associated with ant nests of *Azteca* aff. *chartifex*, and one colony of *Polybia rejecta* associated with nests of *Cacicus cela* (Passeriformes: Icteridae).

Material and Methods

1. Study area

The associations were recorded in the Reserva Ducke, situated in the Central Brazilian Amazon. The reserve has a total area of approximately 100 km² of *terra firme* rainforest, and is located northeast of Manaus, Amazonas, Brazil, at km 26 on the Manaus-Itacoatiara Highway (02° 55' to 03° 01' S and 59° 53' to 59° 59' W) (Baccaro et al. 2008). The climate is humid tropical, with annual relative humidity of about 80% and mean annual rainfall from 1750 to 2500 mm (Ribeiro & Adis 1984). The mean annual temperature is 26 °C and there is a little thermal variation during the year (Marques Filho et al. 1981).

2. Collecting technique

The observations were made within a PPBio (Brazilian Program for Biodiversity Research) grid of 5 × 5 km (02° 58' 893" S and 059° 57' 677" W), as well as along some trails and margins of creeks (*igarapés*) outside the grid and at camps borders and near the reserve headquarters: main headquarters (02° 55.100' S and 059° 58.480' W) and south headquarters (03° 00.460' S / 059° 56.863' W). In general, observations were performed by three collectors, from 8:00 AM to 4:00 PM, totaling about 120 hours and approximately 100 km of trails sampled over 16 days (eight days in August and eight in October 2010).

We collected some specimens from nests of wasps and ants, which were identified and deposited in the Zoological Collection of the National Institute for Research in the Amazon (INPA). Nests were photographed *in situ* using a Sony Cyber-shot DSC-H5 camera, and localities were georeferenced using a GPS.

Results and Discussion

1. Wasps associations with ants

We found five active and one abandoned colony of *Polybia rejecta* (Fabricius, 1798) and an active colony of *Synoeca virginea* (Fabricius, 1804), all associated with ant nests of *Azteca* aff. *chartifex* Forel, 1896. Two of the *P. rejecta* colonies were located at the reserve's main headquarters, one in the PPBio grid and three at the south headquarters. The *S. virginea* colony was at the south headquarters.

The five active colonies of *P. rejecta* were situated about 10-20 cm from *Azteca* nests (Figures 1a, b, 2a). Three were built in twigs and leaves of the tree andiroba (*Carapa guianensis* Aublet - Meliaceae), whereas two nests were built in leaves of the jambeiro (*Eugenia malaccensis* L. - Myrtaceae). The distance between the abandoned colony of *P. rejecta* and its adjacent *Azteca* nest (Figure 2b) was about 15 cm, both built in a unidentified vine.

The same association between *P. rejecta* nests and ant colonies of unidentified species in the genus *Azteca* was reported in Southern Brazilian Amazon (Richards 1978) and in the Mamirauá Sustainable Development Reserve, in Central Brazilian Amazon (Silveira et al. 2008). In the former, two of ten wasp nests found were located in trees with ant colonies. Jeanne (1978) found 47 nests of *P. rejecta* in Santarém, in Eastern Brazilian Amazon, mostly near other wasp nests and in some cases associated with *Azteca* ants.

In the active colonies of *P. rejecta* observed in this study, any disturbance caused by the collector resulted in aggressive behavior by the wasps. They would fly about 5 m around the colony, inflicting many stings on the collector. The ants, on the other hand, were aggressive only after their colony had been touched by the collector, at which time they quickly recruited large numbers and climbed on to whatever body part of the collector happened to be in contact with the colony, inflicting painful bites.



Figure 1. A) and B) *Polybia rejecta* nest associated with a colony of *Azteca* ants.



Figure 2. A) *Polybia rejecta* nest associated with a colony of *Azteca* ants. B) Abandoned colonies of *Polybia rejecta* and the ant *Azteca*.

The colony of the wasp *S. virginea* was located about 10 cm from an *Azteca* aff. *chartifex* nest in an unidentified species of Myrtaceae, and there was a large concentration of ants on the wasp colony envelope (Figures 3a, b). This type of association has been recorded by Ducke (1910) and Richards (1978). The wasps did not show aggressive behavior when their nest was disturbed by the collector; on the contrary, they sought refuge inside their nest. The same pattern was

not observed for the *Azteca* ants, which responded aggressively just as in the cases mentioned above, biting the collector. While the wasps took refuge inside the nest, the ants remained defending the nest, walking in circles, seemingly looking for the cause of the disturbance.

We did not observe ants entering the nests of either wasp species; however, it was common to see them remaining on or near the envelope, usually moving in a circle around the nest surface but



Figure 3. A) *Synoeca virginea* wasp nest. B) Details of *Azteca* aff. *chartifex* colony associated with wasp nest.



Figure 4. A) and B) Association between *Polybia rejecta* wasp colony and *Cacicus cela* (Yellow-rumped Cacique) bird nest.

not reaching its interior. Furthermore, aggressive behavior was not observed between wasps and ants, which did not seem disturbed by each other's presence.

We hypothesize that one advantage of these associations is the protection given by the ants to the wasps, contributing to the wasps' reproductive success, since ants may repel the approach of predators to the colony. Richards & Richards (1951) reported that nesting in

association with *Azteca* ants may be one of the few defense modes found in tropical wasps against attacks by predatory army-ants (Ecitoninae). According to Jeanne (1978) nest aggregation is common in this kind of wasp. In the presence of ants, wasps receive protection against predators, especially birds and monkeys (Delabie 1990), when they build nests in trees near arboreal ants, particularly *Azteca* species (Bondar 1939). Apparently, the wasps take advantage of

the ants' tolerance, nesting near their colonies to obtain protection. Considering that no authors to date have proposed a benefit to the ants of the proximity to wasps, it appears that in this case the wasps receive the greater benefit from this association.

2. Wasps Association with birds

Associations among social wasps and birds are often found in nature (Dejean & Fotsó 1995, Beier & Tungbani 2006). Much is known about the species of birds that nest near wasp colonies, but little is known about the wasps, which are rarely identified to species. Silveira et al. (2008) reported a nest colony of the bird *Cacicus cela* (Linnaeus, 1758), known as Yellow-rumped Cacique (Passeriformes: Icteridae) close to a *Polybia rejeta* wasp nest in the Mamirauá Sustainable Development Reserve, in Central Brazilian Amazon and Robinson (1985) reported nests of *C. cela* in the Peruvian Amazon associated with colonies of the social wasps *Agelaia fuscipennis* Cameron, 1901 and *Chartergus chartarius* (Oliver 1791). Robinson (1985) demonstrated that the wasps offer protection to the birds against predation by mammals (mainly primates), serpents and other bird species.

We observed one colony of *Polybia rejeta* associated with nesting colonies *Cacicus cela*, the yellow-rumped Cacique, (at the Ducke Reserve main headquarters) (Figures 4a, b). During the 16 days in which we frequented the locality, the wasps did not show any aggressive behavior toward the *C. cela* or their nests. Later, reserve guards reported that the birds remained there throughout the reproductive season, leaving only after the chicks fledged the nests. Quick field observations and the information reported in the literature suggest that the protection given to birds by wasps is not retributed by the birds, as in a case of commensalism, but more studies are needed, including experimental approaches to unveil the kind of association existing between these groups.

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