Scientific Note

New records of the association between *Polybia rejecta* (Fabricius, 1798) (Hymenoptera: Vespidae) and *Azteca chartifex* Emery, 1896 (Hymenoptera: Formicidae) for the Caatinga and Amazon forest

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Abstract. Some neotropical social wasps are associated with certain vertebrates and other insects, like ants. These interactions have been reported for decades, but little is known about these associations in the caatinga biome. This study describes the first association record between the nests of *Polybia rejecta* wasps and *Azteca chartifex* ants in the caatinga of Piauí state and presents new records for Amazonas. This study supports the hypothesis that the association between the social wasps *P. rejecta* and *A. chartifex* ants is more common than previously documented. This new finding reinforces this association between different species not only for the Amazon and atlantic forest, but also for the caatinga biome.

Keywords: species interactions, interspecific relationship, tolerance, wasp nest, ant nest.

Wasps have evolved noticeably different means of defense against predatory ants such as (1) the selection of a safe nest site and using long thorns to anchor their nest (Jeanne 1975; Dejean et al. 1998a), (2) the architectural properties of their nests which can be protected by an envelope or connected to the substrate through a long, thin, easy-to-defend petiole (Jeanne 1975), and (3) adaptive behavior such as constant vigilance, instantaneous escape, rapid movements, repellent chemicals smeared onto the nest petiole, the active guarding of the nest entrance, and agonistic defense with the use of venom or by ejecting the ants (Jeanne 1970, 1975, 1978; Post & Jeanne 1981; Kojima 1993; Dejean et al. 1998b; Togni & Giannotti 2010; Grangier & Lester 2011).

Predation by ants, particularly army ants (Dorylinae) has been known to have a significant impact on the ecology and evolution of neotropical social wasps (Jeanne 1970, 1975, 1978; Young 1979; Chadab-Crepet & Rettenmeyer 1982; Corbara et al. 2009; Le Guen et al. 2015). However, several social wasp species protect themselves from army ants by, paradoxically, forming associations with arboreal ants, which implies appropriate nest site selection by foundresses or swarms. Indeed, by constantly patrolling their host tree, arboreal ants “control” their branches and leaves and may be able to exclude other ants, including army ants (Chadab-Crepet & Rettenmeyer 1982; Dejean et al. 1998b; Corbara et al. 2009). For instance, workers of the territorially dominant arboreal ant *Azteca chartifex* Emery, 1896 defend access to their host tree by attacking army ants at its base, causing the columns to deviate (Chadab-Crepet & Rettenmeyer 1982).

Although they probably represent a limited number of wasp species, examples of ant associations are easily found in the Neotropics. Because they are frequently associated with arboreal ants, mostly *A. chartifex*, the nests of the polistine social wasp *Polybia rejecta* (Fabricius, 1798) are protected from army ant raids (Richards 1978; Chadab-Crepet & Rettenmeyer 1982; Corbara et al. 2009; Somavilla et al. 2013; Souza et al. 2013); in turn, the wasps protect the ant nests from bird predation (Le Guen et al. 2015).

In 2013, we presented a report (Somavilla et al. 2013) on the associations between wasps, ants, and birds in central Brazilian

Amazon, with information about behavior, nest locations and photographs of active and abandoned colonies. The same association between *P. rejecta* nests and ant colonies of an unidentified species of the genus *Azteca* was reported for southern Brazilian Amazon (Richards 1978) and the Mamirauá Sustainable Development Reserve, in central Brazilian Amazon (Silveira et al. 2008). Jeanne (1978) found 47 *P. rejecta* nests in Santarém, eastern Brazilian Amazon, mostly near other wasp nests and, in some cases, associated with *Azteca* ants.

In the active colonies of *P. rejecta*, any disturbance caused by the collector when approaching the colony, usually resulted in aggressive behavior by the wasps (Somavilla et al. 2013). On the other hand, the ants are usually aggressive after direct disturbances in the colony, resulting in rapid recruitment of a large number of ants.

Most occurrence records of the association between *P. rejecta* and *A. chartifex* are in the Amazon biome (Jeanne 1978; Corbara et al. 2009; Somavilla et al. 2013; Servigne et al. 2018), but this seems to be changing. This association has been previously recorded in areas of transition between cerrado and amazon (Richards 1978), atlantic forest (Souza et al. 2013) and in areas of transition between atlantic forest and caatinga (Virgínio et al. 2015) (Tab. 1). Here we provide more records for the Brazilian Amazon (Fig. 1A), for an area of transition between atlantic forest and caatinga, and record the association between *P. rejecta* and *A. chartifex* for the first time in the caatinga (Fig. 1B) (Tab. 1).

In conclusion, the *P. rejecta* and *A. chartifex* nesting association appears to be more common than previously documented. Our findings support that this association between different species occurs not only in the Amazon but also in the other biomes like atlantic forest, caatinga, and cerrado. The association requires a significant level of tolerance by the associated ants, although they can be aggressive when disturbed by an external source. However, further experimentation or analysis has not yet been conducted to formally document the benefits of this interspecific relationship. Thus, further studies in ethology and ecology should be undertaken to assess whether this relationship is merely a case of tolerance between the two hymenopteran species or there is some kind of symbiosis between them.

Figure 1. A) and B) *Polybia rejecta* nest associated with a colony of *Azteca chartifex* ants. A) At Bosque da Ciência, INPA, Amazon Forest, B) At Sete Cidades National Park, Caatinga biome.

Table 1. Records of associations between *Polybia rejecta* (Hymenoptera: Vespidae) and *Azteca chartifex* (Hymenoptera: Formicidae) with localities and references.

Number of colonies	Locality	Biome	Coord.	Reference
01	Sete Cidades National Park, Piripiri, Piauí	Caatinga	04°05'57"S; 41°42'34"W	New record
02	Bosque da Ciência, INPA, Manaus, Amazonas	Amazon Forest	03°05'49"S; 59°59'11"W	New record
01	Campus II, INPA, Manaus, Amazonas	Amazon Forest	03°05'42"S; 59°27'23"W	New record
01	Balbina, Presidente Figueiredo, Amazonas	Amazon Forest	01°51'18"S; 59°59'06"W	New record
01	Canutama National Forest, Canutama, Amazonas	Amazon Forest	06°31'58"S; 64°23'27"W	New record
01	Paudalho, Pernambuco	Transition Caatinga and Atlantic Forest	07°53'31"S; 35°10'37"W	New record
05	Ducke Reserve, Manaus, Amazonas	Amazon Forest	02°55'10"S; 59°58'48"W	Somavilla et al. (2013)
01	Mamirauá Sustainable Development Reserve, Tefé, Amazônia	Amazon Forest	02°59'38.07"S; 64°56'08.37"W	Silveira et al. (2008)
01	Santarém, Pará	Amazon Forest	-	Jeanne (1978)
02	Base Camp, Nova Xavantina, Mato Grosso	Transition Cerrado and Amazon Forest	12°50'S; 51°47'W	Richards (1978)
12	Parque Estadual do Rio Doce, Marliéria, Timóteo and Dionísio, Minas Gerais	Atlantic Forest	19°45' to 19°30'S and 42°38' to 48°28'W	Souza et al. (2013)
04	Timbaúba, Monte Alegre, Rio Grande do Norte	Transition Caatinga and Atlantic Forest	06°05'14"S; 35°21'44"W	Virgínio et al. (2015)
18	Petit Saut, French Guiana	Amazon Forest	05°03'39"N; 53°02'36"W	Corbara et al. (2009)
05	Petit-Saut, Sinnamary and Kourou, French Guiana	Amazon Forest	05°03'39"N, 53°02'36"W	Servigne et al. (2018)

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