



Ecological Interaction Among Stingless Bees, Ants, and the Whitefly *Aleurothrixus aepim* (Goeldi)

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Abstract. Many organisms consume honeydew to meet their energy requirements. Some species of stingless bees also consume honeydew secreted by hemipterans. In this study we describe the ecological relationships among stingless bees, ants, and the whitefly [*Aleurothrixus aepim* (Goeldi)]. In order to do so, we made 30-min observations twice a day, carried out once a week for four weeks in the month of April 2009, in a cassava plantation (*Manihot esculenta* Crantz) in Valença in the state of Rio de Janeiro, Brazil. Our results show no necessary dependence between the bees and *A. aepim*. The presence of ants help protect whiteflies from their natural enemies, *A. aepim* may be benefited by this interaction and thereby increase their evolutionary success.

Keywords: Stingless bees; competition; commensal; *honeydew*; ecological interactions.

Interação Ecológica entre Abelhas sem Ferrão, Formigas, e a Mosca Branca *Aleurothrixus aepim* (Goeldi)

Resumo. Muitos organismos consomem *honeydew* para suprir suas necessidades energéticas. Algumas espécies de abelhas sem ferrão, também utilizam este recurso com esta finalidade. Com o intuito de descrever a relação ecológica entre abelhas sem ferrão, formigas e mosca branca [*Aleurothrixus aepim* (Goeldi)], fizemos 30 minutos de observação 2 vezes ao dia, uma vez por semana, durante quatro semanas no mês de abril de 2009, em plantação de mandioca (*Manihot esculenta* Crantz), em Valença estado do Rio de Janeiro, Brasil. Não foi observada uma dependência obrigatória entre abelhas sem ferrão e *A. aepim*, caracterizando esta relação como comensal. Como a presença de formigas ajuda a proteger os aleirodídeos de seus inimigos naturais, *A. aepim* pode estar sendo beneficiado por esta interação e com isso, aumentando seu sucesso evolutivo.

Palavras-chave: Abelhas sem ferrão; competição; comensalismo; *honeydew*; interações ecológicas.

The basis of the bees' diet are floral resources, nectar and pollen. However, some species collect food, such as honeydew, which are rich in non-floral carbohydrates. The dew is mainly composed by sugars and is very similar to floral nectar, in particular due to the presence of glucose and fructose (SIMOVA *et al.* 2012).

Many organisms consume honeydew to meet their energy requirements during periods of food shortage (BAKER & BAKER 1983). Studies usually report interactions between ants and honeydew-secreting hemipterans. In this interaction, the ants benefit from the honeydew, and in return, they protect the hemipterans against their natural predators, in a mutualistic relationship (SCHULTZ & MCGLYNN 2000; ODA *et al.* 2009; QUEIROZ & OLIVEIRA 2011).

The main producers of honeydew are insects of the families Membracidae, Cicadellidae, Aethalionidae, and Aleyrodidae (SCHUSTER 1981; ODA *et al.* 2009). Among the honeydew-secreting whiteflies, *Aleurothrixus aepim* (Goeldi) stands out because of the damage it causes to cassava crops (RAMAZAN & MCAUSLANE 2009; QUEIROZ & OLIVEIRA 2011).

Some species of stingless bees, mainly of the genus *Trigona*, also have a mutualistic behavior with hemipterans. Like the previously mentioned ants, they collect honeydew and protect the hemipterans from their natural enemies. In many cases, this mutualism does not imply a necessary obligatory dependence between the species involved (ODA *et al.* 2009). Among the

species of stingless bee that present a mutualistic behavior with honeydew-secreting hemipterans, we can highlight the species *Trigona hyalinata* (Lepeletier) and *Trigona spinipes* (Fabricius) (ODA *et al.* 2009). Most bees develop a commensal relationship with hemipterans, collecting honeydew, without offering the hemipterans protection against their possible predators (SCHUSTER 1981).

The present study aims to describe the ecological relations between stingless bees, ants, and the whitefly *A. aepim*. In order to do so, we made 30-min observations of the involved species' behavior, twice a day, one in the morning and another in the afternoon carried out once a week, for four consecutive weeks, through the month of April 2009; the study took place in a small cassava plantation (*Manihot esculenta* Crantz), with approximately 160 plants (average height of 1.7 meters), distributed in 100 m² of cultivated area. These studies were conducted in the city of Valença (22° 15' 54.4" S, 43° 49' 41.2" W), in the state of Rio de Janeiro, Brazil. In addition, we made collections with the entomological net after the observations to identify the bees.

We identified three species of stingless bees collecting the honeydew of *A. aepim*: *Tetragonisca angustula* (Latreille), *Tetragona* sp., and *Nannotrigona testaceicornis* (Lepeletier). In addition to the bees, were observed collecting food resources, ants the following species: *Camponotus senex* (Smith), *Camponotus rufipes* (Fabricius), *Camponotus balzani* Emery, *Camponotus* sp.

e *Cephalotes* sp. The whiteflies present at Cassava leaves showed high degree of infestation, present in over 20% of the leaf area in almost all cultivated plant, as observed in Figure 1.

Usually, places where honeydew-producing insect aggregations occur present many ant species that defend and monopolize this food source (BLÜTIGEM *et al.* 2006; RODRIGUES & CASSINO 2011). In this study, when ants on *M. esculenta* leaves noticed the presence of bees, they presented an aggressive behavior, interrupting their activities and going towards the bees. As ants moved towards the bees, the latter walked away; in subsequent attacks, the bees flew to another leaves. This occurs due to the aggressiveness and territorialism shown by the ants, which monopolize the food resources, attacking their possible competitors (KAMISKI *et al.* 2009). The presence of ants help protect whiteflies from their natural enemies (SCHULTZ & MCGLYNN 2000), AND SO *A. aepim* may be benefited by this interaction and thereby increase their evolutionary success (QUEIROZ & OLIVEIRA 2011).

During their foraging, the bees landed on leaves without ants; they were probably searching for sites with the least number of natural enemies, a behavior that decreases the competition for food resources (BLÜTIGEM *et al.* 2006). This behavior has been previously observed in the genus *Liotrigona*, whose species sought to forage on hemipterans that were furthest from ants (KOCH *et al.* 2011).

Bees forage mainly on floral resources as nectar and pollen; only in food shortage periods they seek other sources (MICHENER 2007; KOCH *et al.* 2011). This activity is directly influenced by the

resource availability and quality. When bees discover a potential food source, they tend to explore it to its maximum (MARQUES-SOUZA 2010). The ecological interaction between stingless bees and *A. aepim* recorded on this study may be essential for the survival of the bees during periods of food shortage, as the honeydew then becomes a food alternative that meets the energy requirements of bees, contributing to the maintenance of the colony. This may be reinforced by the presence of *T. angustula* collecting honeydew as an alternative food source, as this species has a clear preference for floral resources, avoiding artificial feeding (NOGUEIRA-NETO 1997).

We did not observe any bee behavior that might show resource monopolization or protection to *A. aepim*, which would characterize a mutualistic relation between the species during the honeydew collection. After landing on the *M. esculenta* leaves, stingless bees walked to the abaxial surface seeking insect aggregations with honeydew accumulated over the nymphs. Bees collected only the excess of secretion produced by these nymphs, thus characterizing a commensal relation. These results do not agree with the found by OLDA *et al.* (2009), in which the stingless bees *T. hyalinata* and *T. spinipes* have shown a mutualistic relation with honeydew-producing insects.

This study describes for the first time an interaction between stingless bees na *A. aepim*. As it was impossible to identify the importance of the honeydew to the bees, there is a need to further investigate this resource's role in the maintenance of stingless bees colonies.



Figura 1. Abelha sem ferrão *Tetragonisca angustula* (Jataí) coletando honeydew secretado por *Aleurothrixus aepim*. Foto: Alves, L.H.

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