



SHORT NOTE

A scientific note on the presence of functional tibia for pollen transportation in the robber bee *Lestrimelitta limao* Smith (Hymenoptera: Apidae: Meliponini)

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Abstract

Stingless bees belonging to the *Lestrimelitta* genus shows a unique foraging ecology for the group. Instead of collecting food from flowers, these bees steal their food from other stingless bees' hives. Associated with this ecological feature there are morphological characteristics such as the modification of the tibia and loss of corbicula. The highly modified hind tibia is considered not functional for all species of this genus. However, observations of the pillaging attacks under controlled environment allowed us to verify workers carrying pollen using the hind tibia. This scientific note is the first record of pollen transportation on the legs by stingless bees from *Lestrimelitta* genus. This observation contradicts the current assumption that robber bees' tibia have missed their total function as a result of the cleptoparasitic behavior.

The robber stingless bees (genus *Lestrimelitta*) have an unusual foraging ecology. There is no record of these bees visiting flowers, but all record suggests that they gather their food exclusively by raiding other stingless bees colonies (Nogueira-Neto, 1970; Wille, 1983; Sakagami et al., 1993). Through mass attacks the workers rob all kind of nest resources such as pollen, honey, cerumen, and especially larval food (Nogueira-Neto, 1970; Wille, 1983; Sakagami, et al., 1993).

The uncommon foraging strategy of this genus influenced the evolution of unique behavioral and morphological traits in robber stingless bee workers (Sakagami et al., 1993). One of these traits, considered an adaptation for the cleptoparasitic behavior, is the absence of functional corbicula in the workers of *Lestrimelitta* species (Kerr, 1951; Sakagami and Laroca, 1963; Wille, 1983; Michener, 2000). According to these authors, the corbicula of robber bees' workers is highly modified and lost its role for transporting pollen. In order to transport the pollen, the

workers secrete a liquid, that dissolves the pollen and then swallow it, transporting it in the crop, mixed with nectar (Kerr, 1951; Sakagami ad Laroca, 1963; Wille, 1983; Roubik, 1989).

To study the cleptoparasitic behavior of *Lestrimelitta limao* Smith we placed one colony of this species in a greenhouse (6,4m x 9m x 3,5m) along with three potential hosts' species: *Tetragonisca angustula* (Latreille), *Frieseomelitta varia* (Lepeletier) and *Nannotrigona testaceicornis* (Lepeletier). The species used in this study were collected at Ribeirão Preto, São Paulo State, Brazil, identified by a specialist in stingless bees (Dr. Sidnei Mateus) and samples kept in the collection of the Laboratory of Animal Behavior of FFCLRP (University of São Paulo). We also placed a variety of flowering plants and artificial feeders (filled with a water/sucrose solution 50% v/v) in order to offer food sources to the flower visiting species. The closed environment allowed the detailed observation of *L. limao* raids since the very beginning of the attacks. The greenhouse observations were conducted from 2 to 3 hours



daily during one year and were carried out at the University of São Paulo *campus* Ribeirão Preto, Brazil.

During our study, fifteen attacks to the host colonies were witnessed. Among several details of *L. limao* attacks observed, we recorded a specific behavior that contradicts the current knowledge about the biology of the robber bee. During one raid to a *F. varia* colony it was possible to observe numerous robber bee workers carrying the pollen from the host nest in their hind tibia (Fig 1c). The workers were observed manipulating pollen straight from the pollen pots (Fig 1b) and some specimens of *Lestrimelitta* were collected in order to confirm the resource transported. This observation is of interest since it shows that even though the tibia of robber bees workers are highly modified and lack the corbicula, the ability to transport pollen using this structure is maintained. Interestingly, in different raids towards other host species it was possible to observe the robber bee workers transporting pollen in their crop, as described by Kerr (1951). These results show that in certain conditions *L. limao* workers use both strategies to transport pollen back to their colonies.

The pollen stored in the nest differs from the pollen in the flowers, since the former is manipulated by workers and in some species are fermented by the action of microorganisms (Menezes et al. 2012). The consistency of the stored pollen also differs from the freshly collected one, this difference could explain the transport strategy chosen by the robber bee, but this hypothesis remains to be tested. The consistency of the stored pollen also has interspecific differences. While in *F. varia* the stored pollen is dry and unfermented, in *Scaptotrigona* spp the pollen has a pasty consistency and acid smell as a result of fermentation (Menezes et al. 2012). Therefore, the ability to use different strategies to transport pollen can allow *L. limao* workers to explore a wide range of host species.

Workers of all stingless bees are able to carry pollen in their crop during the provisioning of brood cells and also during the reproductive nest swarming (Nogueira-Neto 1954; Zucchi et al., 1999). Moreover, some nonparasitic bees (e.g. *Ceratina* and *Xylocopa*) are similarly able to transport pollen on the crop and in their scopa (Roubik 1989) showing that this ability of resource transportation on the legs and in the crop is not restricted to Meliponini bees. Our observation also demonstrates the potential of closed environments, such as greenhouses, to study details of the cleptoparasitic behavior that are difficult or sometimes impossible to study under natural conditions.

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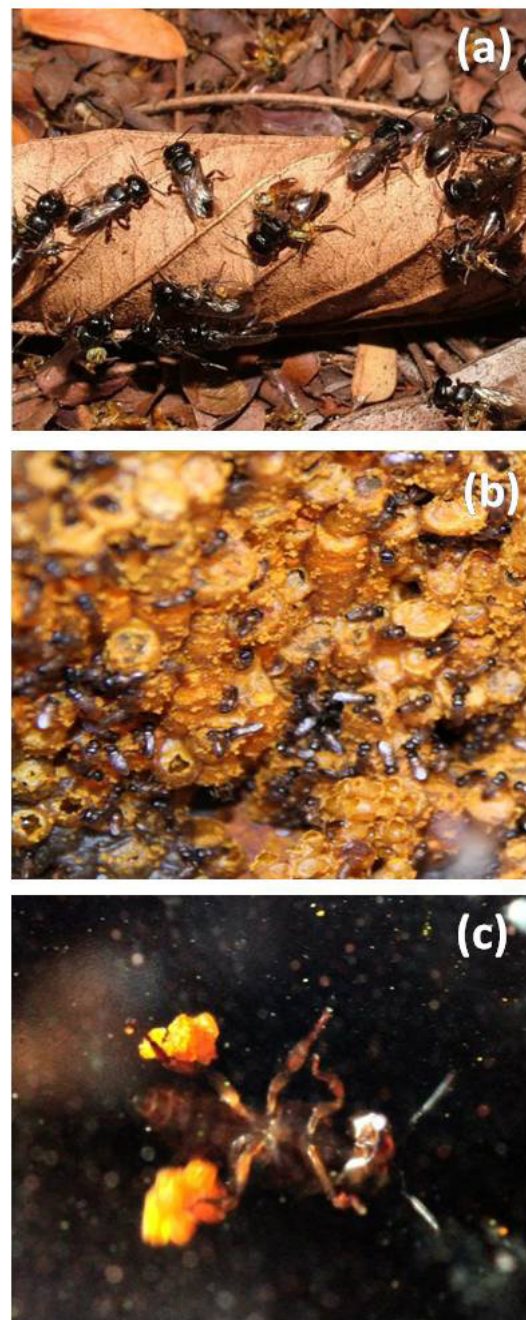


Fig 1. Pillage of stingless bees nests by the robber bee *Lestrimelitta limao*. (a) Aggressive reaction of the host *Tetragonisca angustula*. (b) Workers collecting pollen in a *Frieseomelitta varia* nest attack. (c) A *Lestrimelitta limao* worker carrying pollen at the hind tibia during its raid.

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