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SHORT NOTE

Occurrence of the small hive beetle (*Aethina tumida*) in *Melipona rufiventris* colonies in Brazil

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Abstract

The small hive beetle (SHB) *Aethina tumida*, a honey bee colony scavenger/parasite native to sub-Saharan Africa, has been recorded in Brazil since 2016 in Africanized honey bees. Now we detected the intruder parasitizing other susceptible social bees. The present study reports the first occurrence of SHB in stingless bees in Brazil, and is an alert to authorities and stingless beekeepers to prevent infestations.

The vast majority (>83%) of stingless bee species (Hymenoptera: Apidae: Tribe Meliponini) occur in the Neotropical Region, and they account for about half of the pollinators of native tropical plants, also providing pollination to important crops (Camargo, 2013).

Stingless bees in Brazil sum almost 300 species (Pereira et al., 2017). However, they have been threatened by emergent pests and pathogens previously associated only with *Apis* (Teixeira et al., 2020), and also by anthropogenic activities such as deforestation, habitat loss, and illegal trade.

Several traits make stingless bees attractive to parasites of honey bee colonies (e.g., food storage, production of volatile substances from fermenting hive products, protein-rich larvae). Possibly this is the case of the small hive beetle,

Aethina tumida Murray, 1867 (Coleoptera: Nitidulidae), a honey bee parasite native to sub-Saharan Africa, where it was first identified, and now present on almost all continents (Neumann et al., 2016). In Latin America, this invasive pest was first observed in 2012 in Mexico. It was detected in Cuba that same year and continued to spread southward, reaching El Salvador (2013), Nicaragua (2014), Costa Rica (2015), and Brazil in 2015 (Antúnez et al., 2019).

In Africa, SHB is a colony scavenger/parasite considered only a minor pest, and, in African subspecies, the beetle does not seem to have negative impacts (Neumann & Elzen 2004), what seems to be the same on African-derived honey bees present on those Latin-American countries. European-derived bees, on the other hand, suffer considerable



damage when parasitized by SHB (Neumann & Elzen 2004), suggesting a potential threat to other susceptible social bees. In Brazil, SHB has been recorded in Rio de Janeiro apiaries since 2016 (Pereira et al., 2017). Local observations indicate that problems may arise when good management practices are not adopted and hives are kept in precarious condition, culminating in high levels of infestation and a large presence of SHB in their immature, destructive stage (Pereira S. N., unpubl. data).

Although almost three hundred native bee species are known in Brazil, very few are properly managed. Stingless bees of the genus *Melipona* are important for honey production (Pereira et al., 2017). *Melipona rufiventris* (Lepeletier, 1836) is endemic to the Cerrado (savanna) biome, where it is designated as an endangered species (Silveira et al., 2018). The present study reports the first occurrence of SHB in stingless bees in Brazil.

In January (summer) and April (autumn) 2019, the Rio de Janeiro official veterinary service (OVS) received reports of SHB invasion in two meliponaries (M1 and M2) in the metropolitan area of the capital (2–3 km from the urban center). There were no nearby apiaries. Meliponary M1 kept colonies of four stingless bee species: *Tetragonisca angustula* (Latreille, 1811) ($n = 4$); *Melipona quadrifasciata* Lepeletier, 1836 ($n = 2$); *M. rufiventris* ($n = 2$); and *Melipona scutellaris* Latreille, 1811 ($n = 1$). The hives of *M. rufiventris* and *M. scutellaris* were on the balcony of a house. The other hives were in the orchard on individual stands with ant protection and individual roofs. The soil was sandy and well provided with organic matter (decomposing leaves) from fruit trees (*Mangifera indica*) and garden shrubs. The stingless bee keeper reported finding a beetle inside a *M. rufiventris* hive three weeks after splitting it. Upon inspection, OVS agents found that the colony was weak, no signs of population growth or queen. One SHB was aspirated from the middle of debris at the bottom of the hive and fixed in 70% alcohol, as well as the specimen captured by the bee keeper. No immature or other adult beetles were found.

Meliponary M2 contained hives of *M. rufiventris* ($n = 17$), *M. quadrifasciata* ($n = 14$), *Nannotrigona testaceicornis* Lepeletier, 1836 ($n = 4$), *T. angustula* ($n = 3$), and *Plebeia nigriceps* (Friese, 1901) ($n = 1$). The hives were in the backyard on individual stands, under fruit trees (*M. indica* and *Citrus* spp.) with no fruits on the ground. The soil was moist, sandy-loamy. The stingless bee keeper had found two beetles in one *M. rufiventris* hive. No larvae were present. The hive was weak and the box was precarious. At the time of the visit, OVS inspectors did not find any beetles in the hive that had been exchanged, which contained food reserves and healthy brood combs.

Beetles were confirmed to be *A. tumida* by the Biological Institute, Brazil. These results corroborate previous findings indicating that non-*Apis* bees can serve as alternative hosts for the opportunistic parasite SHB, particularly when the colony is weak or the beehive is in a poor state.

Even though there was no damage to the colonies and the infestation rate was extremely small, the possible implications underscore the importance of adopting good beekeeping practices in order to maintain strong and stress-free colonies, especially during the multiplication period, whether natural or managed. Some actions to prevent colony invaders are suggested: (i) keep beehive boxes in good condition, (ii) avoid opening the hive unnecessarily or for prolonged periods, (iii) strengthen colonies by providing non-*Apis*-origin supplemental foods, and (iv), whenever necessary, transfer workers from other healthy, strong hives. Another point worth noting is that the state of Rio de Janeiro is mainly covered by Atlantic Forest and is not endemic for *M. rufiventris*. Thus, it can be assumed that the environment may also be a predisposing factor for SHB infestation, generating stress, a fragilizing factor to health problems.

There are few reports of SHB infestation in colonies of stingless bees. In Australia, the strong *Tetragonula carbonaria* colonies quickly eliminated adult beetles, or mummified them (Greco et al., 2010). Although the lack of coevolutionary history might have prevented the development of defenses (Gonthier et al., 2019), some species can have natural defensive traits to deal with invading predators. The loss of a weak *Tetragonula* colony after splitting was reported in the Philippines (Cervancia et al., 2016). In North America, Spiewok and Neumann (2006) reported that *Bombus impatiens* colonies were affected by the infestation of SHB. In Cuba, *A. tumida* was found in natural colonies of *M. beecheii* (Peña et al., 2014). Bobadoye (2019) found SHB infestation in three *Melipona* species in Kenya (Africa) and detected similar volatile chemicals attractive to SHB. Gonthier et al. (2019) demonstrated that SHBs can complete an entire life cycle in association with nests of the solitary bee *Megachile rotundata*.

It is premature to say whether SHB has the potential to wreak havoc on stingless bee colonies in Brazil. Nevertheless, this report is an alert to authorities and producers to take precautions to avoid infestations. The absence of SHB in a meliponary located 40–50 m from infested honey bee hives, in São Paulo, Brazil (Al Toufaily et al., 2017), points to the importance of careful technical management, and good beekeeping practices to reduce vulnerability.

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Authors' contributions

SNP: conceptualization, investigation and writing;
FRFC: conceptualization, investigation and writing;

FP: conceptualization and writing

LHSA: investigation and writing

EWT: writing

Data availability statement

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

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