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SHORT NOTE

Congregation Sites and Sleeping Roost of Male Stingless Bees (Hymenoptera: Apidae: Meliponini)

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Abstract

Very little is known about stingless bee reproductive biology or male behaviour. In this note we provide the first observations on the male aggregations (congregation sites and roosting sites) of some stingless bee species. Our observations show that males of two stingless bee species can congregate on the same site. We also report for the first time the substrates used by stingless bee males for resting at night, that at least one species forms large sleeping roosts composed of hundreds of individuals, and that sleeping roost locations are not reused on subsequent nights.

Introduction

Male bees (Hymenoptera: Apoidea) patrol nests containing receptive females or aggregate at rendezvous sites in order to find sexual partners (Alcock et al., 1978; Eickwort & Ginsberg, 1980; Paxton, 2005). Particularly in the eusocial bees, *i.e.*, honeybees (Apidae: Apini) and stingless bees (Apidae: Meliponini), males can form mating swarms at specific areas, where they wait for virgin queens (Nogueira-Neto, 1954; Kerr et al., 1962; Zmarlicki & Morse 1963; Sommeijer & de Bruijn, 1995; Koeniger & Koeniger, 2000).

Male stingless bees reach sexual maturity about two to three weeks after eclosure, after which they permanently leave their nests (Engels & Engels, 1984; van Veen et al., 1997). They then join mating swarms close to nests containing virgin queens or nests in the process of being founded (Nogueira-Neto, 1954; Kerr et al., 1962; Nogueira-Ferreira & Soares, 1998; van Veen & Sommeijer, 2000). Still, in some stingless bee species (*Melipona*), males can congregate in non-nest associated congregation sites such as concrete retaining wall or beekeepers cabin which are periodically visited by workers and queens (Sommeijer & de Bruijn, 1995; Sommeijer et al., 2003; Cortopassi-Laurino, 2007). Apart from these facts little is known about the reproductive behaviour of male stingless bees. Nothing is known about where males rest overnight after visiting such reproductive aggregations, although males of solitary bees are known to frequently spend the night on plants, alone or in groups under leaves (Kaiser, 1995; Alcock, 1998; Alves-dos-Santos et al., 2009). Furthermore, we know that solitary bee males may exhibit site fidelity by returning to a particular sleeping roost on the successive nights (Kaiser, 1995; Alcock, 1998; Alves-dos-Santos, 1999; Oliveira & Castro, 2002; Alves-dos-Santos et al., 2009).

The present short note contributes to the knowledge

of reproductive behaviour (mating swarms) and sleeping roosts of males of some stingless bee species. As observations of such events are rare and have low predictability, we put together several sporadic observations we carried out during the course of other studies on stingless bee biology.

Non-nest associated congregation sites

In a meliponary located in the city of Pilar do Sul, São Paulo state, in October 2009, males of *Melipona quadrifasciata quadrifasciata* Lepeletier and *Plebeia droryana* (Friese) were observed aggregating at a congregation site, the leaves and twigs of an Oriental Raisin tree *Hovenia dulcis* (Rhamnaceae), approximately 4-5 m above ground. This congregation of males was observed on four consecutive days.

Males of both species periodically joined and departed the congregation site between about 08:00h and about 17:00 h. The congregation was formed of dozens of males of both *M. q. quadrifasciata* and *P. droryana*. However, it is unclear what the role of the frequent joining and leaving of individual males was. Near the congregation site several phorid flies (Diptera: Phoridae) were sitting on or near the branch used by *M. q. quadrifasciata* males. Such parasitic flies may have an important role in the mortality of stingless bee males (Simões et al., 1980; Brown, 1997; Sommeijer et al., 2003). The visit of some *M. quadrifasciata* workers carrying white resin on their corbiculae was noted, but no interactions between them and the males were observed. No virgin queens were observed at the congregation site. It remains uncertain why males of *M. q. quadrifasciata* and *P. droryana* chose to congregate at the same site.

Another male congregation site was observed in the city of Mossoró, state of Rio Grande do Norte, for one day in March 2009. *Melipona subnitida* (Ducke) males gathered on a branch of a cashew tree *Anacardium occidentale* (Anacardiaceae). This congregation occurred in a meliponary containing approximately 90 hives of this species, and was observed between 10:00 and 17:00h. The males were either sitting in the congregation site or flying close to it (Figure 1A) and received visits from a wasp (*Polybia* sp.) with which they performed trophallaxis (Figure 1B). One virgin queen with a distended abdomen was also observed at the congregation. However, this queen did not attract any males during her stay. The queen remained on the branch but in a very agitated manner, tightly circling a small point on the branch for approximately 20 minutes, and then flew away. The reason for the presence of virgin queens in non-nest associated congregation sites is unclear because their presence does not result in copulation attempts by the males (Sommeijer & de Bruijn, 1995; Sommeijer et al., 2003). Occasionally, worker bees were observed flying over the congregation site, landing briefly and disappearing afterwards. The presence of workers at some congregation sites of stingless bee males appears to be common; they perform trophallaxis with the males (Cortopassi-Laurino, 2007) or carry resins on their corbiculae to be distributed over the congregation site (Sommeijer et al., 2003). However, the adaptive significance of the behaviour of such workers at the congregation site remains unclear.

Sleeping roosts

Overnight aggregations of bee males have been described previously for solitary bee species that exhibit site fidelity by returning to a particular sleeping roost on the successive nights (Kaiser, 1995; Alcock, 1998; Alves-dos-Santos, 1999; Oliveira & Castro, 2002; Alves-dos-Santos et al., 2009). At Ribeirão Preto, the meliponary garden of the FFCLRP was daily inspected from June 03 to September 05 2010 for sleeping roosts between 17:00 h and 07:00 h. This meliponary contained approximately 150 colonies, including *Scaptotrigona depilis* (Moure), *Tetragonisca angustula* (Latreille), *Frieseomelitta varia* (Lepeletier), *M. scutellaris* (Latreille), *M. quadrifasciata* and *Nannotrigona testaceicornis* (Lepeletier). We searched for sleeping roosts on branches below 2 m. When a sleeping roost was found, the arrangement of the individuals was recorded and the location

Fig. 1 (A) Congregation site of *Melipona subnitida* males on a branch of *Anacardium occidentale* (Anacardiaceae) at Mossoró, state of Rio Grande do Norte; (B) *Polybia* sp. wasp visiting the congregation.

Table 1. Features of the sleeping roosts for male stingless bees (Hymenoptera: Meliponini).

Stingless bee species	Substrates	plant species or locations	number of males	aggregation type
Scaptotrigona aff. *depilis*[1]	tree branch	*Ocimum basilicum* Lamiaceae)	3	solitary
	tree branch	*Citrus limonia* (Rutaceae)	5	solitary
	tree branch	*Cosmos* sp. (Asteraceae)	3	solitary
Melipona scutellaris[2]	flower petal	*Montanoa pyramidata* (Asteraceae)	1	solitary
Frieseomelitta varia[3]	metal wire	metal wire	± 250	Cluster

[1] - November 19, 2010; [2] - June 03, 2010; [3] - March 2011.

was marked and monitored during subsequent nights so as to observe whether the males returned to it. We found *S. depilis* males at FFCLRP sleeping on branches of *Ocimum basilicum* (Lamiaceae), *Citrus limonia* (Rutaceae) and *Cosmos* sp. (Asteraceae) (Figure 2A). Each of these plants was used as sleeping roosts by three to five males, but they remained separated from each other (Table 1). None of roosts were re-used in subsequent nights. A single *M. scutellaris* (Latreille) male was also found sleeping on a daisy flower (*Montanoa pyramidata*: Asteraceae) (Figure 2B).

Additionally, in a private meliponary approximately 1.2 km from the FFCLRP-USP campus, a sleeping roost of *F. varia* males was observed in March 2011. There were three hives of this species on the site. The sleeping roost comprised approximately 250 *F. varia* males on any one night. The males were sitting on a metal wire (Table 1, Figure 2C) approximately 2 m from one of the three colonies of this species at the site. They were first observed at 22:00 h, and again at 01:30 h.

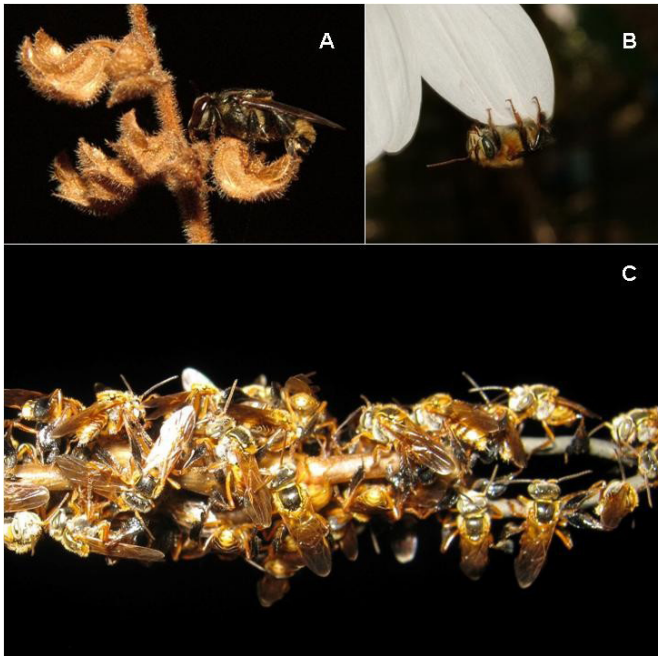

Fig. 2 Sleeping roost of males of: (A) *Scaptotrigona* aff. *depilis*; (B) *Melipona scutellaris*; (C) *Frieseomelitta varia*.

The *F. varia* males remained densely grouped. Occasionally, some males moved their hind legs or walked slowly on the wire and even over other males. They did not react to contact with entomological tweezers during the collection of some individuals. On the following morning at approximately 08:00 h, some males were still at the sleeping roost site, but they gradually left the site over the course of the morning. Neither additional aggregations nor other sleeping roosts were reported thereafter.

To our knowledge these are the first report of sleeping roosts of stingless bee males. The causes that led males of *S. depilis*, *M. scutellaris* and *F. varia* to choose their sleeping roosts remain unclear. There is still much to learn about the biology of stingless bee males and this report will help other researchers to find and study them.

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