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SHORT NOTE

Sleeping behaviour of an oil-collecting bee, *Centris* (*Paracentris*) *xanthomelaena* Moure & Castro (Hymenoptera: Apidae: Centridini)

HOJ Martins[1], P Oliveira-Rebouças[2], VS Ferreira[1]

1 - Universidade Federal do Vale do São Francisco, Petrolina, Pernambuco, Brazil
2 - Universidade Estado da Bahia, Juazeiro, Bahia, Brazil

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Corresponding author
Herbeson Ovidio de Jesus Martins
Campus de Ciências Agrárias
Colegiado de Ciências Biológicas
Universidade Federal do Vale do São Francisco
Rodovia BR 407, km 12 – Lote 543
Projeto de Irrigação Senador Nilo Coelho s/nº
C1 CEP 56300-990, Petrolina-PE, Brasil.
E-Mail: herbeson.bio@hotmail.com

Abstract
Sleep aggregations have been registered for some species of solitary bees and wasps. In this note we describe the aggregation behaviour of *Centris xanthomelaena* Moure & Castro bees in their inactive periods. The dormitories were discovered close to the bee nesting sites, in a Caatinga area. We monitored the males and females at the sleeping site for 16 consecutive days in July 2017. We observed that females of *C. xanthomelaena* spent the night outside their nests, in dry branches of *Mimosa tenuiflora* (Fabaceae). Furthermore, males and females have shared the dormitories, and sometimes they formed mixed ones. Both males and females flew around the nearest dormitories during all observation days. The data about the sleep behaviour of *C. xanthomelaena* will contribute to the understanding of these aspects within the *Centris* genus.

Bee and wasp solitary species have been observed spending the night in dense clusters, and this behaviour is called sleeping aggregation (eg. Linsley, 1962). This is suggested as a preliminary stage to social behaviour, since aggregation promotes temperature increase, and the vigilance against predators (Evans & Linsley, 1962).

The sleeping aggregation was studied in some species of solitary bees as *Melissodes nigroaenea* (Smith) and *Melissoptila* aff. *bonaerensis* Holmberg (Mahlmann et al., 2014), *Oxaea austera* Gerstaecker (Oliveira & Castro, 2002), *Augochlorella neglectula* (Cockerell) (Wcislo, 2003), and *Idiomelissodes duplocincta* (Cockerell) (Alcook, 1998). Such aggregations had been reported for some species of *Centris* as: *Centris smithii* Cresson, *Centris decolorata* Lepeletier, *Centris lanipes* (Fabricius) (Starr & Vélez, 2009), *Centris burgdorfi* Friese (Sabino et al., 2017) and *Centris fuscata* Lepeletier (Azevedo & Faria Jr, 2007). This behaviour can be described, generally, for males who spend the night primarily on plant branches, cavities or flowers (Alves-dos-Santos et al., 2009; Starr & Vélez, 2009; Mahlmann et al., 2014; Sabino et al., 2017). On the other hand, females can sleep inside their nests, as a strategy to protect their offspring (Aguiar & Gaglianone, 2003; Martins et al., 2014), or atypically, outside them, as observed by Sabino et al. (2017).

There are few studies describing the nocturnal aspects and sleep aggregations of the *Centris* species. Thus, we described here the composition and aspects related to the sleeping roost of *Centris* (*Paracentris*) *xanthomelaena* Moure and Castro, which is an oil-collecting and ground-nesting solitary bee, endemic to the Brazilian semiarid region.

The sleeping roosts were identified in an area of Caatinga at the Campus de Ciências Agrárias of the Universidade Federal do Vale do São Francisco (CCA/UNIVASF) (9°19'44.2'' S, 40°33'30.1W), Petrolina, Pernambuco state, Brazil. The sleeping roosts were located close to four nesting sites, between 6 to 41 meters away from the nests.

In order to observe the activity in the dormitories, we captured and marked on the thorax (using non-toxic color pens, Uni Posca ®) six females and eight males in their sleeping site. After that, they were released. The sleeping roosts were monitored for 16 consecutive days, from 04:00 a.m. to 05:00 a.m. and from 06:00 p.m. to 08:00 p.m., in July 2017. Voucher specimens were collected, pinned and sent to specialists for identification and deposition in the Entomological Collection of the Museu Nacional, Rio de Janeiro (MNRJ).

In this study, *C. xanthomelaena* females have displayed the behaviour of sleeping outside their nests. During the nesting activity, the females looked for places close to their nests and landed on dry branches of *Mimosa tenuiflora* (Fabaceae). We observed that the females overnighted at several points around the nesting sites. *Mimosa tenuiflora* was the predominant plant in the area, but only six trees were used as dormitories by *C. xanthomelaena* specimens. The females always choose the same branch as dormitories throughout their nesting activity. Nevertheless, there was alternation among dormitories. Once selected, the same branch was used every day as a dormitory. Thus, males and females shared the same branches. The sleeping aggregation was formed by three different ways: (1) only males (Fig 2B), (2) only females (Fig 1B), and (3) males and females together in mixed clusters (Fig 1A). Sometimes we observed females sleeping alone (Fig 2C).

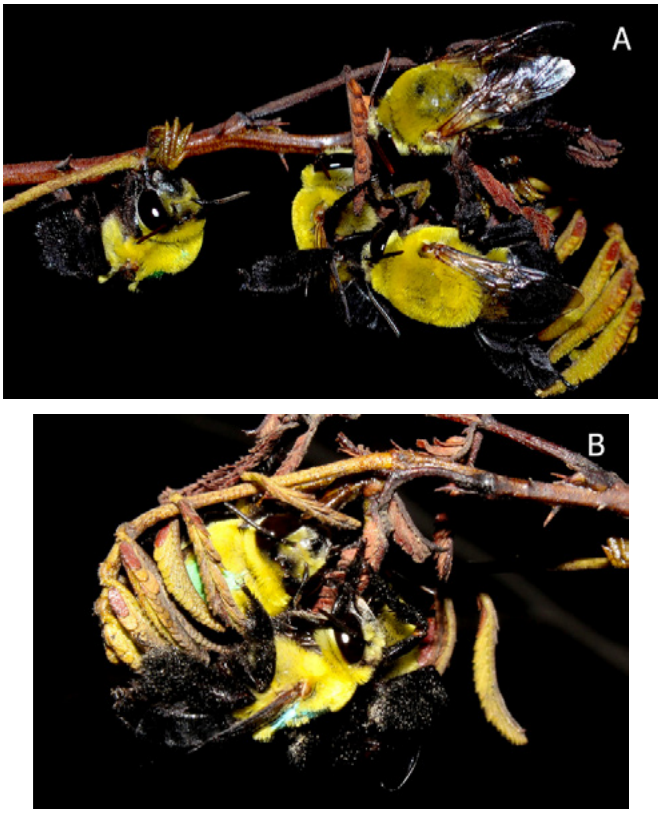

Fig 1. Main composition of sleeping aggregation on branches of *Mimosa tenuiflora* in an Caatinga area, Petrolina, Brazil, July 2017. (a) Female and males sharing the same branches as dormitory, (b) sleeping aggregation composed only by females.

The *C. xanthomelaena* females flew back to their dormitories, soon after the last trip from their nests, around 05:20 p.m. They have performed several flights and over flights around the trees, hovering over the branches, before they land at the definitive branch to spend the night, from 5:40 p.m. to 5:56 p.m.

During this period, we have observed agonistic behaviour among individuals because there were collisions among males. After landing on the chosen branch, the females performed the body grooming activity, passing the front and middle legs over the head, wings, and rubbing the hind leg pair. Males and females were grasping the substrate with the mandibles and legs, in order to keep the body held over the substrate. During the observer approach, the males exhibited the behaviour of keeping the hind legs raised (Fig 2A), as seen in males of *Ancyloscelis* males (Alves-dos-Santos, 1999), which could be a defensive behaviour.

In the morning, the females left the dormitory at 04:50 a.m., before the sunrise, performing their first trip to collect resources before going back to their nests for the first time in the day. The males remained in the dormitories longer than the females, and left them around 05:30 a.m. Unlike our register of *C. xanthomelaena* record, researchers have reported that *Centris* females usually sleep in their nests as a sentinel behaviour (Aguiar & Gaglianone, 2003; Rego et al., 2006; Martins, et al., 2014). It may be useful to those females to defend their nests against the attack of natural enemies.

The choice of the dormitories by *C. xanthomelaena* has been mainly associated with the proximity among trees and nesting sites and not associated with the plants that females use to collect floral resources. However, other studies on the *Centris* dormitories have showed that some plants species, such as *Caesalpinia* (Starr & Vélez, 2009) and *Krameria* (Sabino et al., 2017) were used as dormitories, as well as to collect floral resources.

Bee species, in general, have been reported forming clusters of individuals during the period of inactivity (Linsley, 1962; Alcook, 1998; Alves-dos-Santos et al., 2009), but in most cases these groups have been composed of males (Alves-dos-Santos et al., 2009; Wcislo, 2003; Mahlmann et al., 2014). Likewise, we observed herein, *C. burgdorfi* females were also recorded sleeping outside their nests, on flowers and fruits of *Krameria tomentosa*, and forming clusters of approximately 76 individuals, approximately (Sabino et al., 2017). In addition, both males and females of *C. xanthomelaena* shared the same dormitories, sometimes mixed ones. Mixed dormitories were also recorded by Starr and Vélez (2009) for the species *C. decolorata*, *C. smithii* and *C. lanipes* in Anguilla.

The data from the present study will contribute to the understanding of these aspects within the *Centris* genus. Future analyses will be needed to identify the pheromones associated with the dormitories and which aspects would influence the females and males to choose one of them.

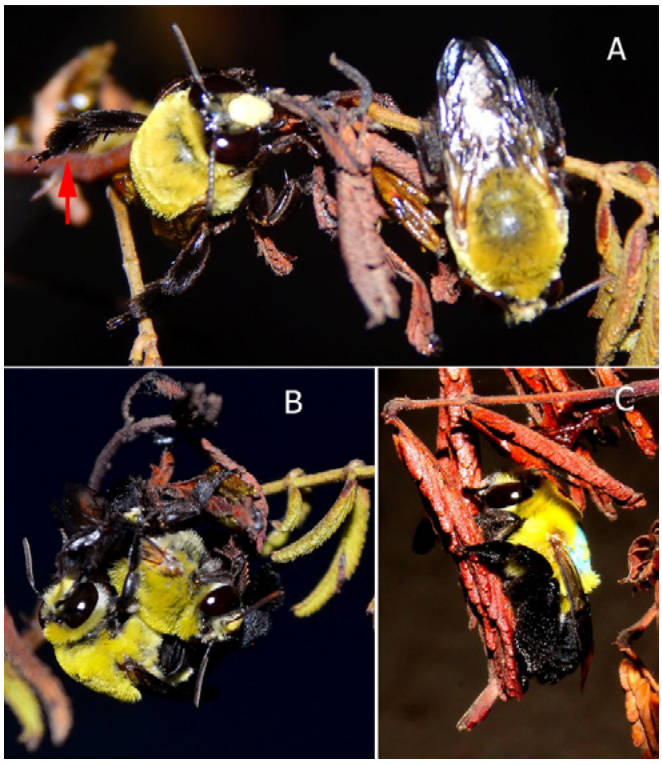

Fig 2. Behaviors observed in the sleeping aggregations on branches of *Mimosa tenuiflora* branches in a Caatinga area, Petrolina, Brazil, July 2017. (a) Male with hind leg (red arrow) raised, (b) male sleeping aggregation, (c) female sleeping alone in a branch.

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