



# Geographical distribution and notes on the nests of the "uruçu-do-chão" bee, *Melipona (Melikerria) quinquefasciata* Lepeletier, in Bahia, North-eastern Brazil

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**Abstract.** The Neotropical genus of stingless bees *Melipona* Illiger is exclusive to Tropical America and has its greatest diversity in South America, with about 74 valid species. In Brazilian state of Bahia, there is an occurrence record for 12 species of *Melipona*, distributed in four subgenera. Among the *Melipona (Melikerria)* that occur in Bahia, we highlight *Melipona (Melikerria) quinquefasciata* Lepeletier. Although widely distributed in Brazil, its underground nesting habit associated with its preference for high altitude areas, make the species extremely vulnerable. This work sought to describe nests and map the occurrence of this species for the State of Bahia, since its record is limited to areas of Chapada Diamantina. The results showed the importance of knowledge of biogeography of this species, strengthening a sustainable creation that respects the area of occurrence of the species, as well as seeking alternatives and public policies for sustainable conservation, since its area of occurrence is extremely vulnerable to the expansion of the agricultural frontier in the State.

**Keywords:** Biodiversity; Neotropical; Stingless bees; Underground nests; Wallacean deficit.

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The Neotropical stingless bee, *Melipona* Illiger, is unique to Tropical America and its greatest diversity is found in South America. Currently, 74 species are recognized in *Melipona* (GRUTER 2021), of which about 40 have been reported to occur in Brazil (PEDRO 2014). *Melipona* is composed of robust bees which range in size from medium to large (at least 7 mm in length), are very hairy, with the vertex and mesosoma covered by long and plumose hairs and have wings, that generally, do not exceed the apex of the metasoma (e.g., Figure 1) (SILVEIRA *et al.* 2002). Another very interesting characteristic in *Melipona*, is the fact that they do not build real cells, meaning all individuals (queens, workers, and males) are born and develop inside cerumen brood cells of equal sizes and with the same food, i.e., the castes are determined genetically (KERR *et al.* 1966; NOGUEIRA-NETO 1997). Another important feature is that the entrance to the nest is built with geopropolis, forming radial grooves around the hole, and a narrow opening that allows the passage of only one bee at a time (KERR *et al.* 1996; NOGUEIRA-NETO 1997; SILVEIRA *et al.* 2002).

In Brazilian state of Bahia, 12 *Melipona* species, distributed across four subgenera, are recorded to occur based on the classification proposed by CAMARGO *et al.* (2013): *Melipona* Illiger, *s.str.*; *Melipona (Eomelipona)* Moure; *Melipona (Michmelia)* Moure and *Melipona (Melikerria)* Moure. Among the *M. (Me.)* that occur in state of Bahia, we highlight *Melipona (Melikerria) quinquefasciata* Lepeletier, which is morphologically characterized by an average length of 9 to 10.5 mm, five yellowish bands on the tergum, abundant metasoma hairiness, and a generally dark brown coloration. Integument of the mesoscutum is entirely black with an abundant and dense yellowish-brown pilosity with a dense tuft of rusty hairs evident at the anterolateral angle, contrasting with the rest of the mesosomal pilosity (SCHWARZ 1932) (Figure 1). Its nesting habit is underground, usually in open areas. The entrance to the nest is a small tube 2.4 to 3.9 cm tall and 1.3 to 1.4 cm in diameter (NOGUEIRA-NETO 1997).

*Melipona (Me.) quinquefasciata* is widely distributed across Brazil, where it is found from the Brazilian state of Rio Grande do Sul to the Brazilian state of Rondônia, generally occurring in areas of Cerrado (tropical savanna) and Rupestrian grassland (campo rupestre) at altitudes close to 1,400 m and/or in areas of High-altitude fields (Rupestrian grassland) in the Atlantic Rainforest domain, at altitudes of approximately 1,000 m (AZEVEDO 2008). However, due to anthropic activities, such as the expansion of agropoles and agricultural frontiers in its areas of occurrence, *M. (Me.) quinquefasciata* has already been included in some endangered species lists (MIKICH & BERNILS 2004).

In North-eastern Brazil, this species has only been reported to occur in the Brazilian states of Ceará (Chapadas do Araripe and Ibiapaba), Pernambuco and Piauí (LIMA-VERDE & FREITAS 2002; ALVES *et al.* 2006) and in state of Bahia (Boninal) (TEIXEIRA *et al.* 2005). Thus, the present study aims to expand the geographic distribution of *M. (Me.) quinquefasciata* in state of



**Figure 1.** *Melipona (Melikerria) quinquefasciata* Lepeletier, 1836. **A.** Head, anterior view; **B.** Habitus, lateral view; **C.** Habitus, dorsolateral view; **D.** Metasoma, dorsal view. Photo by: Ramon Lima Ramos.

Bahia, North-eastern, Brazil, registering its occurrence in Chapada Diamantina region, in addition to presenting the distribution of the species in this region, and presenting notes on the external and internal structure of the nests of this species.

This study involved a series of expeditions throughout the different regions of state of Bahia, covering the three phytogeographic domains that exist in this state (Atlantic Rainforest, Caatinga and Cerrado). The aim of these expeditions was to identify the stingless bees of the genus *Melipona* that occur in state of Bahia. The expeditions began in July 2000 and ended in 2005, with the performance of further complementary campaigns in 2011 and 2012.

When natural nests were located, the adult bees were collected with the aid of an entomological net at the entrance of the respective nests for species confirmation. The specimens were then packed in pots, in which a label with the data of origin was inserted and were sent to the "Laboratório de Abelhas" (LABE) of the extinct "Empresa Baiana de Desenvolvimento Agrícola", in Salvador, Bahia (EBDA). In the laboratory, the collected specimens were mounted on entomological pins, dried in a drying oven, labelled, identified, and deposited in the "Moure e Costa" bee collection at LABE. This Collection is currently under the curatorship of the "Laboratório de Bionomia, Biogeografia e Sistemática de Insetos" (BIOSIS), associated with the "Museu de História Natural da Bahia" (MHNBA/UFBA).

A Leica M165C stereoscopic microscope was used to photograph each specimen, coupled with a Leica DFC295 digital camera, containing the Leica Application Suite v4.1

Interactive Measurements Software, Montage. To construct the map, we used the geographic coordinates of the districts closest to the collection areas of *M. (Me.) quinquefasciata* deposited in the aforementioned collection. Additionally, we studied the nests by describing their external and internal structures and took several measurements of both the outside and inside of the nests (brood combs and food storage pots - honey and pollen).

At the end of the expeditions in the Chapada Diamantina region of Bahia, 114 *M. (Me.) quinquefasciata* specimens were sampled and eight nests were studied. Individuals of this species were sampled in naturally occurring nests located in the districts of Guiné and the Caraíbas, in the municipality of Mucugê; in the district of Caeté-Açu, in the municipality of Palmeiras; in Capão do Jacu, in the municipality of Boninal; at the Paraguassú farm, in the district of Cascavel, in the municipality of Ibicoara and at the Flor de Café farm in the municipality of Piatã (Figure 2).

In the year 2000, we recorded the first occurrence of *M. (Me.) quinquefasciata* in state of Bahia, in the municipality of Piatã (13°09'07" S, 41°46'21" W), included in the Chapada Diamantina region, at an altitude of 1,312 m (Figure 2), where two naturally occurring nests were found and studied (Figure 3).

The first nest was identified at the foot of a wire fence, close to a warehouse at the city hall. The external measurements of the nest: entrance diameter (1.0 cm); height from inlet tube to ground base (1.7 cm). The entrance was built with mud and it was cream-coloured. The second nest was located in an open grassy area, 2.70 m from the fence of a coffee

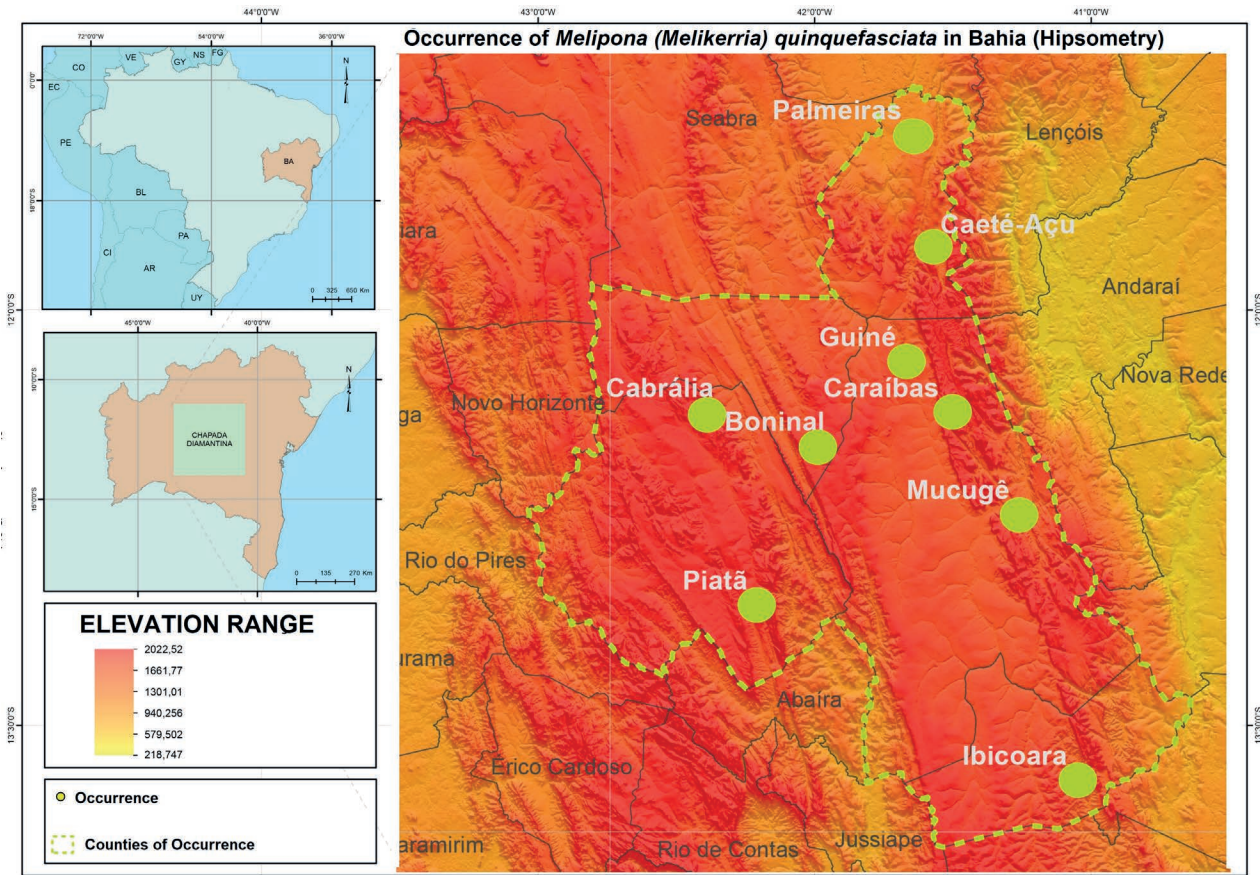


Figure 2. Geographic distribution of *Melipona (Melikerria) quinquefasciata* Lapeletier, 1836 in Bahia and altitudinal variation.



Figure 3. Nests of *Melipona (Melikerria) quinquefasciata* Lapeletier, 1836 excavated. A. Nest structure underground B. Nest excavation process C. Bees in indoor activity in the nest D. Brood discs and internal nest structure. Photo by: Rejane Carneiro.



**Figure 4.** Nests of *Melipona (Melikerria) quinquefasciata* Lapeletier, 1836 excavated and transferred to clay pots. **A.** Natural nest entrance; **B.** Nest entrance in clay pot; **C.** Clay pot that the nest was recently transferred; **D.** Environment in which the nests recently transferred to clay pots, were exposed. Photo by: Rejane Carneiro.

plantation, on the São Judas Tadeu farm, Cabralia district, 4.5 km from the city of Piatã. This nest had three entrances: the main entrance had an average diameter of 2.2 cm, the height of the tube from the ground was 5.2 cm and the thickness of the tube wall was 0.3 cm. The second entry was false and had the following measurements: diameter (0.8 cm), height from the pipe to the ground (1.6 cm) and the pipe's wall thickness was 0.25 mm. The third entrance, also false, was unfinished. We dug a hole measuring 96 cm in diameter and 2.35 m deep, where the nest was found to be connected to the inlet tube, which gradually increased in diameter as the depth increased, reaching a nest measuring 2.6 cm in diameter. It was upright and slightly tilted (10 % tilt). The nest was coated with veneered wax, very resistant, crispy and light brown in colour. Nest measured: 26.7 cm in height and 20.3 cm in diameter, with a rounded to oval shape. Twenty-one food pots were counted, 10 with honey, seven with pollen and four were empty. The measurements of the pots: the honey pots had an average diameter of 4.2 cm (variation between 3.9 and 6.0 cm) and average length of 5.5 cm (variation between 5.0 and 6.0 cm). The pots with pollen had an average of 5 cm in diameter (variation between 4.2 and 6.0 cm) and an average length of 5.9 cm (variation between 5.3 and 6.9 cm). The nest had eight combs measuring an average of 8.7 cm, arranged horizontally, one on top of the other, in the central position of the nest surrounded by food pots. The bees were very tame and spread in the air, while the nest was transferred to a clay pot (e.g., Figure 4B-D), which remained in place for eight days and was later taken to the backyard of the farm owner's house (e.g., Figure 4D). The inhabitants of the farm informed us that the nests of these bees, known in the region

as urucu-do-chão, were being destroyed by tractors, due to the incentive to grow coffee.

We found that the area of natural occurrence of *M. (Me.) quinquefasciata* in the state of Bahia is restricted to Chapada Diamantina at altitudes that vary between 1,000 and 1,400 m (Figure 2).

At the Paraguassú farm (municipality of Ibicoara), five *M. (Me.) quinquefasciata* nests were excavated (Figure 3) and transferred to clay pots (Figure 4). However, in this locality, near to the home of one of the residents, 11 more nests were found that were not excavated.

Bees such as *M. (Me.) quinquefasciata*, have a strong relationship with humans, due to the extraction of their honey which, when collected irresponsibly, can become a great risk for colonies (RIBEIRO 2008). Studies such as those by MASCENA et al. (2018), which present the best management techniques for this species, become a tool for promoting the conservation of the species, encouraging the implementation of these techniques (CARVALHO et al. 2012). Furthermore, knowing the geographic distribution of this species strengthens sustainable breeding strategies, since the natural occurrence of the species must be respected and preference given to locally occurring species when setting up meliponaries.

Another major threat is the ever advancing agricultural frontiers into the Brazilian Cerrado. PIÖKER-HARA et al. (2014) demonstrated that the loss of natural habitat directly influences the reduction of Meliponini species' nests in

this biome. This is due to the loss of natural vegetation cover, intensive soil management and reduced diversity in the ecological landscape. Furthermore, the excessive use of pesticides, especially imidacloprid, which belongs to the neonicotinoid family, act directly on innate appetitive responsiveness, learning and memory of bees of the *Melipona* (AGUIAR *et al.* 2023).

Thus, this study can help in the promotion of public policies for the conservation of this species, through more sustainable agricultural practices, meliponicultures that respect local species and the development of environmental education programs to demonstrate the importance of pollination as an ecosystem service and the problems caused by the use of pesticides in conventional agriculture.

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