

Distribution of *Melipona mondury* Smith 1863 (Hymenoptera: Apidae, Meliponini) from state of Bahia

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Abstract: A remarkable attention has been given to stingless bees not only because of their honey production but also for their role as pollinators as well. *Melipona mondury* popularly known as “uruçu amarela” nests in Forest environments and it is widespread through Atlantic Forest from Bahia to Santa Catarina. The goal of this study was to determine the range of this species in Bahia state. A database was established comprising the locality records of *M. mondury* in Bahia based on interviews with local inhabitants and further in the *loco sample collection*. The occurrence of *M. mondury* was recorded in 102 out of the 417 municipalities in Bahia, thereby representing 24.46% of cities from this state. This species is restricted to hot and humid areas from Atlantic forest domains, usually concentrated within areas with more than 1500 mm of annual rainfall. It is a typical species of low altitudes since 93.14% of the occurrence was recorded in areas within 0 to 400m, 65.69% below 200 m. Dense ombrophilous forests are the preferred sites for nesting of *M. mondury*, while semideciduous forests represent the extreme of their occurrence.

Key words: stingless bee, Atlantic Forest, conservation.

Distribuição de *Melipona mondury* Smith, 1863 (Hymenoptera: Apidae, Meliponini) no Estado da Bahia

Resumo: Grande interesse tem surgido pelas abelhas sem ferrão não só devido à produção de mel, mas pelo seu papel de polinizador. A *Melipona mondury* conhecida como uruçu amarela nidifica em ambiente de mata e ocorre no bioma Mata Atlântica, da Bahia até Santa Catarina. Este trabalho teve como objetivo determinar a distribuição desta espécie no Estado da Bahia. Foi montada uma base de dados com as localidades do Estado da Bahia onde há registro de *M. mondury*, as informações foram coletadas através de entrevistas com moradores da região e posterior coleta *in loco*. A ocorrência da espécie *M. mondury* foi registrada em 102 municípios baianos, do total de 417 existentes, estando presentes em 24,46% dos municípios do Estado. A espécie está restrita às áreas quentes e úmidas do Estado, nos domínios da Mata Atlântica, concentrando-se na área de ocorrência, na faixa acima de 1500 mm de precipitação anual. É uma espécie típica de baixas altitudes tendo 93,4% de sua ocorrência em áreas entre 0 e 400 m, 65,69% abaixo de 200 m. As Matas ombrófilas densas são os locais preferenciais de nidificação da *M. mondury*, sendo as Matas semidecíduais o extremo de sua ocorrência.

Palavras chave: abelha sem ferrão, Mata Atlântica, conservação.

Introduction

A great importance has been given to stingless bees because of their role in honey production and pollination. Pollinators are referred as key components of global biodiversity, providing essential environmental services in agriculture and natural ecosystems. Nonetheless, there are evidence of remarkable decline in pollinators worldwide mainly related to deforestation, fragmentation, habitat losses, harmful agricultural practices, pathogens, invasion of exotic species, and climate changes (Piha et al., 2007; Potts, 2010). Under this context, species of genus *Melipona* have been significantly affected, particularly those associated with rainforests.

The species *M. mondury*, popularly known in Brazil as “uruçu amarela” belong to the group *rufiventris*. Melo (2003) was the first to separate this species, stating that individuals from forests were different from that found in

Brazilian savannahs. Therefore, the names *M. rufiventris* and *M. mondury* were validated to discriminate the species from Brazilian savannah and from Atlantic Forest, respectively. Afterwards, this results was corroborated by studies with molecular markers such as PCR-RAPD, microsatellites and isoenzymes (Tavares et al., 2007).

M. mondury is widespread throughout Atlantic forest from Bahia, Espírito Santo, Rio de Janeiro, Minas Gerais, São Paulo, Paraná to Santa Catarina (Silveira et al., 2002). In the state of Minas Gerais, this species was included in the list of endangered species as a result of deforestation and habitat fragmentation (Campos, 1998). Indeed, the conservation status of *M. mondury* is heterogeneous along their original range and their presence is usually restricted to remaining forest fragments (Tavares et al., 2008).

The state of Bahia encompasses a wide territorial extension including rainforests in several regions, mainly along the coastline in which one of the largest Atlantic forest areas is present, being referred as some of the most important hotspots of Brazilian biodiversity. This coastal zone is characterized by dense ombrophilous vegetation that serves as proper habitats for several bee species such as those from subtribe Meliponina. The knowledge about species range is the starting point for further studies involving biogeography, genetics and ecology. Isolated data about occurrence are used in many biodiversity analyses and the establishment of database about geographical distribution of a species is an essential step in defining conservation status and management strategies (Sutherland, 2000).

Thus, the goal of this work was to determine the occurrence range of *M. mondury* in Bahia state, Brazil, providing subsidies for further conservation and proper management of this species.

Material and Methods

From 2001 to 2011 a database compiling the localities in Bahia state where *M. mondury* has been recorded was established as electronic files and filled with information according to the following methods:

(1) Interviews with local people by a questionnaire asking for name, address, bee keeping and knowledge about the “uruçu amarela” and species occurrence, for further *in loco* studies. (2) Collection of bees in the field based on the localities indicated by stingless bee keepers. We collected bees in meliponaries and trees with 10cm PET tubes, 10 bees per colony; in traps with honey or insect net. Individuals were collected, killed by ether and sent to the Entomology Laboratory of Universidade Estadual do Recôncavo da Bahia for identification. (3) Literature review about the occurrence of this species. We searched papers and thesis, in both English and Portuguese using Scholar Google tool and the query terms were: “stingless bees”, “distribution”, “occurrence”, “abelhas sem ferrão”, “distribuição” and “ocorrência”.

Climate, topographical and vegetation data were obtained from “Superintendência de Estudos Econômicos e Sociais” in Bahia (SEI, 2007) and “Instituto Brasileiro de Geografia e Estatística” (IBGE, 1992; 2007). Geographical coordinates and altitude were determined by using a GPS MLRSP 12x device. The climatic classification and the division in mesoclimates were established according to differences in humidity levels (IBGE, 1981).

Results and Discussion

The occurrence of *M. mondury* was recorded in 102 out of the 417 municipalities in Bahia, thus representing 24.46% of total cities in the state (Figure 1). Alves et al. (2012) recorded *M. scutellaris* in 102 cities from Bahia. However, both species are sympatric in a few places such as those located at northwestern boundaries of the natural range of *M. mondury*.

The distribution pattern of *M. mondury* in Bahia ranges from eastern coastal regions up to western transition zones between Atlantic and semideciduous forests (locally referred as “Mata de Cipó”), up to municipalities like Jaguaquara, Boa Nova and Ribeirão do Largo. In a north-to-south direction, this species ranges from Amargosa, Varzedo and Valença up to extreme southern of Bahia (Figure 1).

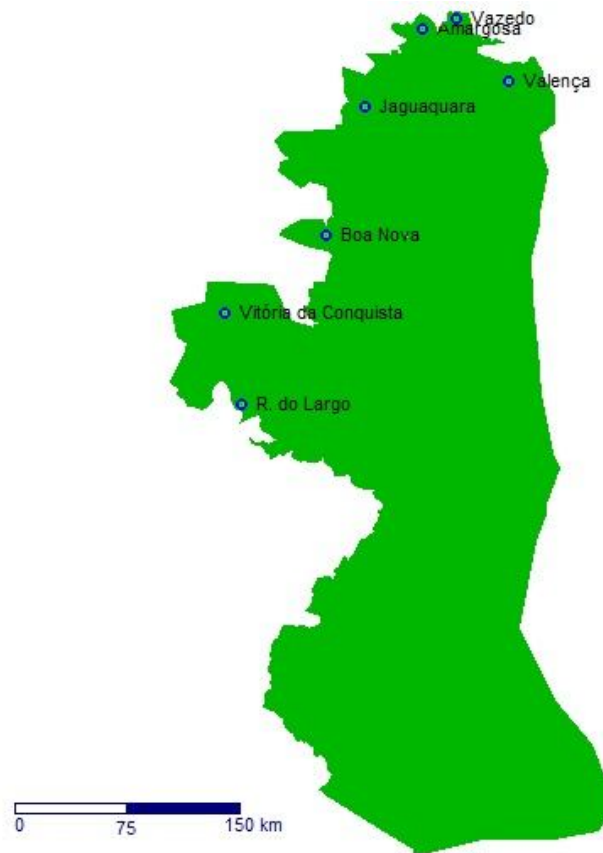


Figure 1 – Range of *Melipona mondury* in Bahia state (no scale). Source: Marcus V. C. Viana.

In Bahia, *M. mondury* is restricted to warm and humid areas, within Atlantic forest habitats. Their occurrence in municipalities of high altitude with sub-humid climate cannot be regarded as an evidence that this bee species usually inhabits this region once these localities present some variation in humidity that allows the establishment of a typical vegetation of humid areas (Table 1, Alves et al., 2012) or else are interspersed with areas of low altitudes covered by Atlantic forests, like Boa Nova and Jaguaquara. In fact, the occurrence of *M. mondury* in these municipalities is observed in eastern region corresponding to forest zones or areas with higher rainfall indexes. The same behavior was also detected in all cities along the western boundary of their range, i. e. transition zones close to semideciduous forests or semiarid habitats (Ubaíra, Santa Inês, Cravolândia, Jaguaquara, Jequié, Boa Nova, Barra do Choça, Vitória da Conquista, Itambé, Ribeirão do Largo and Macarani).

Table 1 – Natural occurrence of *Melipona mondury* in the state of Bahia

Municipalities	Elevation Variation (m)	Latitude Variation	Longitude Variation	Climates*	Vegetation in the area*	Vegetation %
102	4 a 923	12°58'18"S to 18°05'11"S	38°52'58"W to 40°50'22"W	Sub-humid to dry Humid Humid to sub-humid	Dense Ombrophilous Forest	52.73
					Semi-deciduous Seasonal Forest	24.85
					Coastal Ecosystems	10.91
					Deciduous Seasonal forest	8.48
					Cerrado/Ombrophilous Forest interface	1.82
					Caatinga/Seasonal Forest interface	0.61
					Open Ombrophilous Forest	0.61

* Source: IBGE 1992, ** Negative values are in accordance with Thornthwaite's water balance determination rules (IBGE 1981).

M. mondury can be considered a typical species of humid environments since their occurrence increases in areas with more than 1500 mm of annual rainfall. On the other hand, their occurrence in cities with lower rainfall indexes (below 1000 mm per year) such as Vitória da Conquista and Ribeirão do Largo is restricted to microclimates that present particular heavier rainfalls.

The occurrence areas of *M. mondury* include several landscapes that, altogether, compose a large mosaic of phytophysiology (Rizzini, 1979). The main vegetal formations found in this region are dense ombrophilous forests, semideciduous forests, coastal ecosystems (mangroves and “restingas”) and natural grasslands, including the several succession stages in areas of natural restoration.

In this mosaic, the dense ombrophilous forests are the preferred sites for nesting of *M. mondury*, while semideciduous forests represent extreme habitats in their range. The typical forest for the occurrence of this bee species is highly structured and composed of large trees, with straight stems and solid trunks. The canopy is continuous with a mean height of about 30 m. This type of forests presents large amounts of epiphytes, besides lianas and vines, characterizing common features of tropical rainforests (Cordeiro, 2003). The forest understory has low light intensity and it is sparsely consisted of shrubs and herbs (Peixoto and Gentry, 1990).

Batalha-Filho et al. (2011), analyzing the occurrence of *M. mandacaia* based on niche modeling stated that the range of this species is usually associated with arboreal semiarid caatinga habitats in which *Commiphora leptophloeos* (“imburana”) predominates and serves as the main substrate for their nesting. In the case of *M. mondury*, there is not a predominant plant species related to their occurrence but, rather, it is associated with the presence of several tree species that can provide a high number of nesting holes.

M. mondury is a species found in low altitudes. Most of occurrence (93.14%) was recorded in areas within 0 to 400m, 65.69% below 200 m (Table 2). This distribution pattern differs from that reported in *M. scutellaris* from Bahia that can be found from sea level in municipalities, like Camamu and Salvador, up to more than 1000 m in altitude (e.g., Barra da Estiva and Morro do Chapéu) (Alves et al., 2012).

Table 2 – Ranges, frequencies and percentages of altitude in the municipalities of occurrence of *Melipona mondury*

Altitude (m)	Municipalities	%
0 a 200	67	65.69
201 a 400	28	27.45
401 a 600	2	1.96
601 a 800	3	2.94
801 a 1000	2	1.96

Roubik (1989) proposed that the distribution of meliponins would be more affected by availability of nesting sites than by climate conditions. However, the range pattern of *M. mondury* diverges from this hypothesis once this species was absent in high altitudes independently on the presence of proper sites for nests, as reported in *M. scutellaris* (Alves et al., 2012).

Atlantic forest is a biodiversity hotspot in which conservation of vegetation covers is critical. However, the current economic and agricultural practices of local human population invariably lead to deforestation. Studies about occurrence of this bee species in the region might foster the utilization of *M. mondury* in honey and pollen production, assuring the maintenance of essential environmental services such as pollination.

Conclusion

The present paper shows that in the state of Bahia *M. mondury* occurs in warm and humid areas, within Atlantic forest habitats, from eastern coastal regions up to western transition zones between Atlantic and semideciduous forests, mainly in altitudes below 400 m. Their occurrence in municipalities of high altitudes with sub-humid climate is possible when there is some variation in humidity that allows the establishment of a typical vegetation of humid areas

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