

Scientific Note

Nesting of the leaf-cutter bee *Megachile (Ptilosarus) microsoma* Cockerell (Hymenoptera: Megachilidae) in Trinidad, West Indies

Nidificación de la abeja cortadora de hojas *Megachile (Ptilosarus) microsoma* Cockerell (Hymenoptera: Megachilidae) en Trinidad, Indias Occidentales

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Abstract. We describe some structural aspects of the nest and the female's behavior in building and provisioning it of *Megachile (Ptilosarus) microsoma*. This species has been recorded to Bolivia, Brazil, Guiana, Peru and Trinidad and Tobago and this is the first record of nesting for the species.

Key words: Anthophila, Neotropical region, nest architecture, solitary bees.

Resumen. Se describen aspectos estructurales del nido y del comportamiento de construcción y aprovisionamiento por parte de una hembra de *Megachile (Ptilosarus) microsoma*. Esta especie se ha reportado para Bolivia, Brasil, Guyana, Perú y Trinidad y Tobago y es la primera vez que aspectos de su nidificación son observados y reportados.

Palabras clave: Abejas solitarias, Anthophila, arquitectura de nido, Región Neotropical.

The genus *Megachile* Latreille (Hymenoptera: Megachilidae) encompasses more than 400 species of solitary bees in the Neotropical region (Moure *et al.* 2007; Raw 2007) and approximately 1500 worldwide (González *et al.* 2019). The modest amount that is known of their nesting biology indicates a great deal of variation in nest sites and structure and provisioning (Zillikens and Steiner 2004; MacIvor 2016; Kambli *et al.* 2017; Costa and Gonçalves 2019; Danforth 2019). The aim of this work is to present data on the nesting biology of *M. (Ptilosarus) microsoma* Cockerell, 1912 based on examination of two nests in Trinidad, West Indies. This species has been recorded to Bolivia, Brazil, Guiana, Peru and Trinidad and Tobago (Raw 2007; Moure *et al.* 2007; González *et al.* 2019).

Observations were carried out at Caura Village in Trinidad's Northern Range (10°42' N, 61°20' W, 111 m elevation). On 5 February 2008 a female *M. microsoma* was observed in an advanced stage of nesting in a cavity inside an abandoned wooden door, exposed to the weather (nest 1). The door was also inhabited by an unidentified termite species (Fig. 1a), whose burrowing activity in the wood may have facilitated its use by the bee.

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The female was monitored for two days and collected along with the nest after what appeared to be the completion of the nest.

A closer examination of the door revealed another finished nest (nest 2) 2 cm from nest 1 (Fig. 1b). We placed both nests intact into aerated plastic bottles. Nest 1 was opened on 25 February, while nest 2 was open after the emergence of adults on 10 March. Emerged bees from nest 2 and the mother female from nest 1 are deposited in the U.S. National Pollinating Insects Collection (Utah, USA) and the Land Arthropod Collection of the University of the West Indies.

During a two-hour observation period of nest 1 on the early afternoon of 6 February, the female made three foraging trips, returning with pollen each time. The following day she was active from 0810h until 1215h. On the final day she made 21 trips, eight for pollen, seven for leaf fragments and the remaining presumably for nectar, as she returned with neither pollen nor leaf fragments (Table 1). She may also have collected nectar on pollen trips. After a pollen trip, the female entered the nest headfirst, performed some unidentified activities inside the nest – maybe a general inspection as have been recorded for other solitary bee (e.g. Sabino *et al.* 2020) – for backed out and entered again, this time abdomen-first, to unload the pollen from her ventral scopa.

Nest 1 had two brood cells, each one with a female pupa. Nest 2 had eight cells from which five males emerged over a period of a few hours. Emerging males exited from both ends of the nest. Two cells were empty, while one had trace of pollen, but no sign that it had been used as a brood cell.

The nests were very different in size and form. Nest measurements are summarized in Table 2. The nests were cylindric-shaped, the cells fashioned entirely of leaf fragments. The overall sinuous form of the nests – especially nest 2 – suggest that the bees followed the form of the pre-existing cavity, possibly formed by the termites (Figs. 1, 2a). Each cell was made of leaf fragments strongly fastened together by the edges to form a cylindrical structure with a round bottom and a thinner operculum. Venation of the leaf fragments indicated that they were cut from the leaf margins. The cell opercula were sub-circular.

Dissection of brood cells from nest 1 showed that when the bee was in post-defecating larva stage pushed away feces to the brood cell walls before pupating. After some time, feces acquire a powdery consistency, adhering to the cocoon walls and occupying all the space in the brood cell except for a small central region in the joint point with the opercula (Figs. 2b-c). The cocoon was truncate at the front end, rounded at the hind end, and its inner side had a light brown color (Fig. 2d).

Some aspects of the two *M. microsoma* nests are much like those known from other members of the genus. Bent leaf fragments used to construct cell walls were also for the cell bottoms, as in other Neotropical species such as *M. brasiliensis* Dalla Torre, 1896, *M.*



Figure 1. Nests of *Megachile microsoma*. (a) Nest 1 showing the female builder, (b) Nest 2. Scale bar: 1 cm.

sejuncta Cockerell, 1927 and *M. stilbonotaspis* Moure, 1945 (Marinho *et al.* 2018). The cell opercula are like those of *M. habilis* Mitchell, 1930 (Laroca *et al.* 1987). The intercalary empty cells in nest 2 may represent a tactic to minimize the invasion by nest parasites (Krombein 1967).

The brood feces, after some time in the cell, dry and takes up a powder-like consistency. This feature contrasts with observations from other *Megachile* species, whose feces are always described as bearing a pellet-shaped format that remains adhered to the brood cell walls (e.g. Laroca *et al.* 1987; Neff and Simpson 1991).

It is noteworthy that offspring of nest 2 emerged at both ends of the column of cells. This suggests that not all brood individuals pupated facing the same direction. Alternatively, Kierat *et al.* (2017) pointed out that their smaller size allows male bees some mobility inside the brood cell before the moment of the emergence, so that they can sometimes turn in the cell and thus avoid being obstructed by a dead bee. Nest 1 would not have allowed emergence at more than one end (Fig. 1a).

The duration of pollen-foraging trips (Table 1) is within the range of European species of *Megachile* and *Osmia* Panzer, 1806 studied by Gosek (1999), with values ranging from 12.8 min to 36.3 min. It is noteworthy that pollen trips took markedly longer than those for leaf fragments and those that are presumed to have been for nectar. The time spent inside the nest was also substantially longer when the collected resource was pollen, presumably because pollen manipulation is a more involved process.

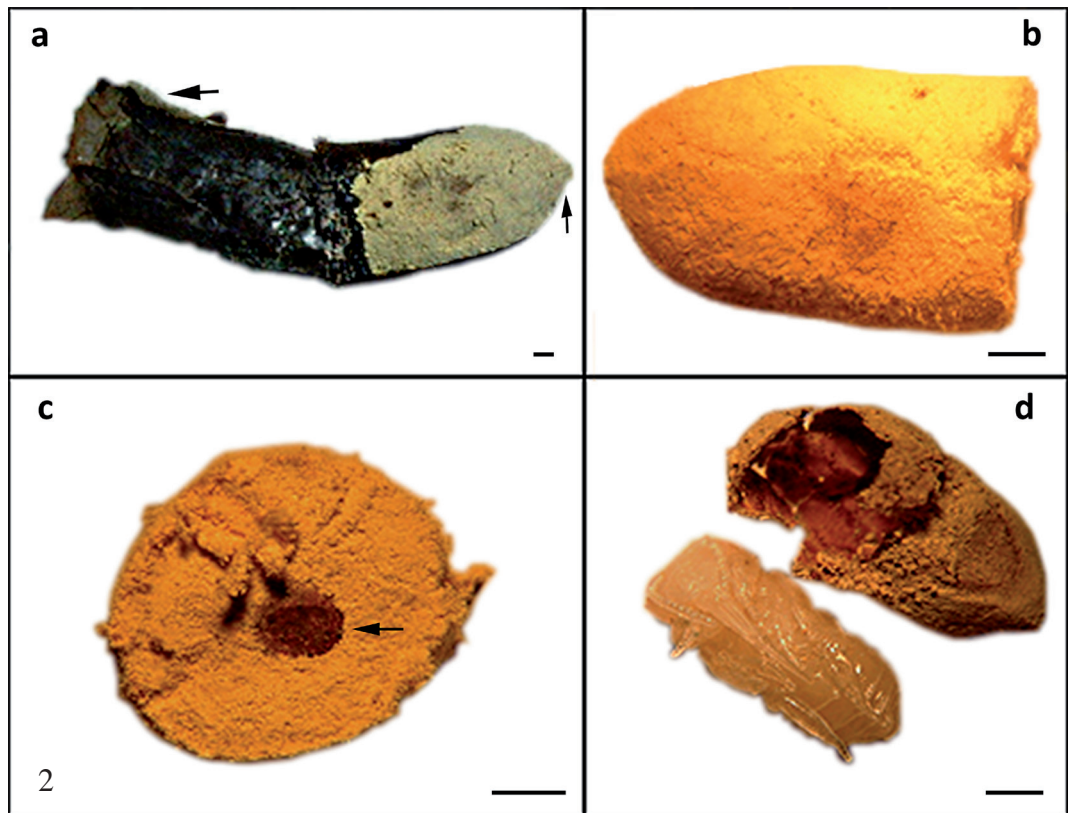


Figure 2. Brood cell of *Megachile microsoma*. (a) Partially dissected nest 1, with arrows indicating the entrance (left) and rounded bottom (right); (b) Cocoon surrounded by dried, powdery feces; (c) Central part of the cocoon showing the joint point with the operculum; (d) Female pupa extracted from her cocoon. Scale bar: 1 mm.

Table 1. Time (in minutes) taken by the female *Megachile microsoma* from nest 1 on a foraging flight and then inside the nest. When returning to the nest without any visible foraged resource (pollen or leaf fragments, she may have been collecting nectar).

	Mean ± SD	Range	n
Pollen			
Foraging	17.9±2.2	7-34	11
Inside the nest	8.7±4.2	2-48	11
Leaves			
Foraging	3.8±0.3	3-5	7
Inside the nest	2.0±0.3	1-3	6
Unknown resource			
Foraging	4.2±0.8	2-7	6
Inside the nest	2.5±0.7	1-6	6

Table 2. Measures (in millimeters) of two nests of *Megachile microsoma*. One of the three cells noted as empty in nest 2 had a slight amount of pollen.

Nest	Length	Maximum Width	Entrance diameter	Number of cells	Empty cells
1	24.5	7.4	7.0	2	0
2	70.9	9.8	7.3	8	3

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Literature Cited

Costa, C.C.F. and Gonçalves, R.B. (2019) What do we know about Neotropical trap-nesting bees? Synopsis about their nest biology and taxonomy. *Papéis Avulsos de Zoologia*, 59: 1-16.

Danforth, D., Minckley, R. and Neff, J. (2019) The Solitary Bees. Princeton University Press. Princeton and Oxford, United States. 472 pp.

González, V.H., Gustafson, G. and Engel, M. (2019) Morphological phylogeny of Megachilini and the evolution of leaf-cutter behavior in bees (Hymenoptera: Megachilidae). *Journal of Melittology*, 85: 1-123.

Gosek, J. (1999) The time used by *Megachile* Latr. and *Osmia* Panz. females (Hymenoptera, Megachilidae) to build and furnish a nest. *Pszczelnicze Zeszyty Naukowe*, 43: 339-350.

Kierat, J., Szentgyörgyi, H. and Woyciechwski, M. (2017) Orientation inside linear nests by male and female *Osmia bicornis* (Megachilidae). *Journal of Insect Science*, 17(2): 1-3.

Klambi, S.S., Aiswarya, M.S., Manoj, K., Varma, S., Asha, G., Rajesh, T.P. and Sinu, P.A. (2017) Leaf foraging sources of leafcutter bees in a tropical environment: implications for conservation. *Apidologie*, 48(4): 473-482.

Krombein, K.V. (1967) Trap-Nesting Wasps and Bees. Smithsonian Institution Press, Washington, United States. 570 pp.

- Laroca, S., Schwartz, Filho, D.L. and Zanella, F.C.V. (1987)** Ninho de *Austromegachile habilis* e notas sobre a diversidade de *Megachile* (Apoidea, Megachilidae) em biótipos neotropicais. *Acta Biológica Paranaense* 16(1, 2, 3, 4): 93-105.
- MacIvor, J.S. (2016)** DNA barcoding to identify leaf preference of leafcutting bees. *Royal Society Open Science*, 3: 150623.
- Marinho, D., Muniz, D.B. and Azevedo, G.G. (2018)** Nesting biology of three *Megachile* (Hymenoptera: Megachilidae) species from Eastern Amazonia, Brazil. *Revista Brasileira de Entomologia*, 62: 97-106.
- Moure, J.S., Melo, G.A.R. and Dal Molin, A. (2007)** Megachilini Latreille, 1802, In: Moure, J. S., Urban D, Melo GAR (Orgs), Catalogue of Bees (Hymenoptera, Apoidea) in the Neotropical Region. Sociedade Brasileira de Entomologia, Curitiba, pp. 917-1001.
- Neff, J.L. and Simpson, B.B. (1991)** Nest biology and mating behavior of *Megachile fortis* in Central Texas (Hymenoptera: Megachilidae). *Journal of the Kansas Entomological Society*, 64(3): 324-336.
- Raw, A. (2007)** An annotated catalogue of the leafcutter and mason bees (genus *Megachile*) of the Neotropics. *Zootaxa*, 1601: 1-127.
- Sabino, W., Alves-dos-Santos, I., Queiroz, E., de Faria, L., Papaj, D., Buchmann, S. and da Silva, C.I. (2020)** Nesting biology of *Centris (Paracentris) burgdorfi* (Apidae: Centridini). *Journal of Apicultural Research*, DOI: 10.1080/00218839.2020.1717760.
- Zillikens, A. and Steiner, J. (2004)** Nest architecture, life cycle and cleptoparasite of the neotropical leaf-cutting bee *Megachile (Chrysosarus) pseudanthidoides* Moure (Hymenoptera: Megachilidae). *Journal of the Kansas Entomological Society*, 77: 193-202.