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Nest descriptions of *Megalopta aegis* (Vachal) and *M. guimaraesi* Santos & Silveira (Hymenoptera, Halictidae) from the Brazilian Cerrado

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ABSTRACT. Nest descriptions of *Megalopta aegis* (Vachal) and *M. guimaraesi* Santos & Silveira (Hymenoptera, Halictidae) from the Brazilian Cerrado. We present the first data on the nesting biology of *Megalopta aegis* and *M. guimaraesi* from southeastern Brazil. Nests were collected in the Área de Proteção Ambiental Água Limpa, Bauru, São Paulo state. Our data suggest that nest architecture is conserved throughout all species of *Megalopta*. Two nests of *M. guimaraesi* consisted of a single female with brood. Of three *M. aegis* nests, two contained single females with brood and the third nest contained three adult females, with three times more brood than any single female nest. This observation suggests that social behavior in *M. aegis* is facultative, as known for other *Megalopta* species.

KEYWORDS. Augochlorini; bees; nesting biology; nocturnal.

RESUMO. Descrição dos ninhos de *Megalopta aegis* (Vachal) e *M. guimaraesi* Santos & Silveira (Hymenoptera, Halictidae) do Cerrado. Apresentamos os primeiros registros da biologia de nidificação de *Megalopta aegis* (Vachal) e de *M. guimaraesi* Santos & Silveira, do sudeste do Brasil. Os ninhos foram coletados na Área de Proteção Ambiental Água Limpa, Bauru, estado de São Paulo. Os dados sugerem que a arquitetura do ninho em *Megalopta* seja conservada entre suas espécies. Dois ninhos de *M. guimaraesi* continham apenas uma única fêmea com imaturos. Dos três ninhos de *M. aegis*, dois possuíam uma única fêmea com imaturos e o terceiro ninho continha três fêmeas adultas com três vezes mais imaturos do que nos ninhos com apenas uma fêmea. Essa observação sugere que o comportamento social em *M. aegis* seja facultativo, semelhante a outras espécies de *Megalopta*.

PALAVRAS-CHAVE. Abelhas noturnas; Augochlorini; biologia de nidificação.

Megalopta Smith 1853 is a genus of sweat bees (Halictinae, Augochlorini), widespread in the Neotropics below ~1300 m, from central Mexico through northern Argentina (Moure et al. 2007 and references therein). *Megalopta* are unusual bees in that they forage in dim-light conditions (post-sunset and pre-sunrise) when most other bees do not forage (reviewed in Wcislo & Tierney 2009). Individuals of *Megalopta* utilize dead wood as nesting substrates, a habit also known in some other augochlorine genera: *Augochlora* Smith 1853 (Wcislo et al. 2003 and references therein); *Neocorynura* Schrottky 1910 (Brosi et al. 2006 and references therein) and *Xenochlora* Engel, Brooks & Yanega 1997 (Tierney et al. 2008a). *Xenochlora* and *Megalopta* form a monophyletic group (Engel 2000), which is not closely related to the remaining augochlorine wood nesters, suggesting that this behaviour has independently evolved in Augochlorini at least three times (for a comparative study of augochlorine nesting, see Eickwort & Sakagami 1979).

In Central America, the nesting biology of *Megalopta atra* Engel 2006, *M. ecuadoria* Friese 1926 and *M. genalis* Meade-Waldo 1916 has been described (see Wcislo et al.

2004; Tierney et al. 2008b). The genus shows its highest species richness in South America, yet very little is known about the natural history of *Megalopta* from this region. Sakagami & Moure (1967) briefly described the nesting habits of one species of *Megalopta* collected in Jataí, Goiás State, Brazil, although the authors assert that: "...it is virtually impossible to make correct identifications of most *Megalopta* species, because of poor original descriptions by earlier writers, difficulty in comparing type specimens and occurrence of cephalic polymorphism" (*op cit.*, p. 128). Apart from this record, no other work has described the nests of South American *Megalopta*.

Santos & Silveira (2009) recently concluded a taxonomic review of the *Megalopta* of Minas Gerais State and here we provide the first description of the nesting biology of *Megalopta aegis* (Vachal, 1904) and *M. guimaraesi* Santos & Silveira, 2009 from Brazilian Cerrado. We present these notes as a contribution to understanding the biology and ecology of these dim-light bees.

We collected nests at the end of the dry season (8–11 October 2008) from a protected area of Cerrado habitat,



Figs. 1–5. 1, Nest entrance of *Megalopta* from Bauru; 2, Internal view of nest three, *Megalopta guimaraesi*; 3, Larva of *Megalopta aegis* collect in nest one; 4, Ventral view of male pupa of *Megalopta guimaraesi* collect in nest three; 5, Ventral view of female pupa of *Megalopta aegis* collected in nest five.

adjacent to the Bauru campus of the Universidade Estadual Paulista São Paulo State, Brazil (Área de Proteção Ambiental Água Limpa: 22°21'S; 49°00'W; altitude: 580m). The Cerrado biome largely consist of tropical savannah interspersed with mosaic patches of forest, woodland and scrubland (Silva & Bates 2002), and we found nests in the understory of *Cerradão*, a closed canopy forest, typical of the Bauru region (Cavassan *et al.* 1984).

Collections were made during daylight hours when all nest members were assumed to be present, beginning no less than two hours after sunrise and ceasing at least two hours before sunset. Nests were identified by searching for circular entrance collars (constructed from pith) at the terminal end of dead stems, lianas, and branches (Fig. 1) hanging in the bottom two meters of the forest understory; the entrance collar often has a slightly different colour from the surrounding wood, so nests are often characterized by a conspicuous series of differently-coloured concentric circles. Presence of *Megalopta* within wood substrates was initially verified in the field, using a medical otoscope to observe the inner nest tunnel. If the tunnel was very clean (with no visible signs of decomposition, fungi or other arthropods) and/or we observed brood cells or an adult bee we then plugged the entrance. Intact nests were cooled to ~5° C, to anaesthetize adults, prior to being split longitudinally with a knife. Nest substrate and tunnel dimensions were measured and the number of adults and immatures were recorded and then preserved in ethanol. Substrates were discarded and vouchers of adults were deposited in “Coleção Entomológica Padre Jesus Santiago Moure”, Departamento de Zoologia, Universidade Federal do Paraná (UFPR). Photographs were taken using a camera

Leica DFC 500 attached to a stereomicroscope Leica MZ16 and images were treated using the software Auto-Montage Pro (Syncroscopy) of the Projeto *Taxon line*, Rede Paranaense de Coleções Biológicas of the UFPR.

Five nests of *Megalopta* were collected in dead tree stems/branches (Fig. 2) ranging in diameter from 29–35 mm ($n = 3$) for *M. aegis*, and 19–23 mm ($n = 2$) for *M. guimaraesi*. Nests consisted of linear tunnels excavated from the pith (*M. aegis*: 74–335 mm long, 9–16 mm wide; *M. guimaraesi*: 54–115 mm long, 8 mm wide), and except for size did not differ from nests of other known *Megalopta* (see illustrations in Wcislo *et al.* 2004). Members of this genus possess relatively robust mandibles, and massive mandibular adductor muscles, presumably adapted for the manipulation of wood particles. Most tunnels were un-branched (tunnel width slightly larger than the body width of an adult bee), but for Nest #5 of *M. aegis* there were two adjacent tunnels (stem diameter = 29 mm). Brood cells were constructed from pith and lined interiorly with a hydrophobic coating. Cells are usually adjacent to and aligned along the same longitudinal axis as the main tunnel, and are accessed via a circular opening, of similar diameter to the nest entrance collar. Multiple cells were often constructed next to each other in a linear end-to-end manner, which together form part of the tunnel wall, even though each cell maintains its own form, which is surrounded and packed with additional pith.

Four of the five nests collected (Nests # 1–4) contained one adult female. No adult males were present in any of the collected nests. All single female nests contained at least two brood cells (maximum of three), one of which was open (in two nests the open cell was being provisioned with pollen),

and the remainder contained immature brood. *M. aegis* single female: Nest #1—one open empty cell, one large larva (Fig. 3); Nest #4—one open cell with pollen being provisioned, one egg. *M. guimaraesi* single female: Nest #2—one open cell with pollen being provisioned, one pre-pupa; Nest #3—one open empty cell, one large larva, one male pupa (Fig. 4).

The only social colony (Nest #5) contained three *M. aegis* adult females and seven brood cells with immatures of mixed stages: one open empty cell, one egg, one medium larva, one large larva, one female pupa (Fig. 5) and two male pupae. This latter nest was approximately triple the length (335 mm) of any solitary nest (*M. aegis*: 74–103 mm; *M. guimaraesi*: 54–115 mm), with at least a threefold increase in the number of brood (six immatures) compared with solitary female nests (\leq two immatures—all but one solitary nest contained a single immature).

The nest architecture of *M. aegis* and *M. guimaraesi* does not differ in substantial ways from that of other known *Megalopta* (*cf.* Wcislo *et al.* 2004; Tierney *et al.* 2008b). Thus, it seems that nest architecture is consistent throughout the geographic range of this genus and conserved within the genus. Likewise, the census data from our collections are comparable with data on social organization from other *Megalopta* (*e.g.*, Smith *et al.* 2007; Wcislo *et al.* 2004; Wcislo & Gonzales 2006; Tierney *et al.* 2008b), in that some nests contained solitary females while one nest contained a small social group, indicating that this behavior is also flexible in this species.

We hope that these data will spur further interest in these bees, as well as other dim-light bee taxa, in particular the rare con-generic social parasite *Megalopta (Noctoraptor)* Engel, Brooks & Yanega 1997 of which very little is known (Biani & Wcislo 2007), as well as the closest diurnal relative *Xenochlora*, which also nests in dead tree stems and is restricted to the Amazonian basin (Tierney *et al.* 2008a). The systematics of the genus *Megalopta* are currently complicated by the fact that taxonomic descriptions have historically been derived from specimens collected at light traps, rather than from intact nests, and thus intra-specific morphological variation has confounded taxonomic identifications (Sakagami & Moure 1965; Tierney *et al.* 2008a), and has made it difficult to associate conspecific males and females.

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