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SHORT NOTE

Notes on a nest of *Megachile* (*Moureapis*) *apicipennis* Schrottky (Megachilidae) constructed in an abandoned gallery of *Xylocopa frontalis* (Olivier) (Apidae)

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Abstract
Notes on a nest of the leafcutting bee *Megachile* (*Moureapis*) *apicipennis* Schrottky (Megachilidae) found in an abandoned gallery excavated by the carpenter bee *Xylocopa frontalis* (Olivier) (Apidae) are presented. A total of three linear series of three cells each and one solitary cell were found at the end of the gallery. Brood cells were lined with imbricate pieces of leaves of *Centrosema virginianum* (L.) Benth. (Fabaceae). Four males and two females of *M. apicipennis* emerged as well as individuals of three species of natural enemies: *Coelioxys otomita* Cresson (Megachilidae), *Brachymeria paraguayensis* (Brèthes) (Chalcididae) and *Melittobia australica* Girault (Eulophidae). Our results were similar to the data obtained from other species of *Megachile* (*Moureapis*) Raw.

Leafcutting bees (*Megachile* Latreille) comprise a cosmopolitan, morphologically diverse genus with 1524 recognized species distributed in more than 50 subgenera (Michener, 2007; Ascher & Pickering, 2017). Nesting habits are diversified, including use of pre-existing cavities in the ground, wood, stems, arboreal termite nests or man-made substrates (Krombein, 1967; Eickwort et al., 1981; Michener, 2007). Most *Megachile* females cut pieces of fresh leaves or petals to build their brood cells but mud and resin can also be used as nest-building materials (Krombein, 1967; Michener, 2007). This habit of using foreign material in nest construction may have driven much increase in species diversity in megachilid bees (Litman et al., 2011).

The Neotropical subgenus *Megachile* (*Moureapis*) Raw encompasses 28 species that range from Tamaulipas state, Mexico to Buenos Aires province, Argentina (Moure et al., 2012). Despite its high richness and wide distribution, only a few studies have reported the nesting biology of species from this subgenus (Ihering, 1904; Laroca, 1991; Teixeira et al., 2011; Cardoso & Silveira, 2012; Sabino & Antonini, 2017). Here we provide notes on a nest of *Megachile* (*Moureapis*) *apicipennis* Schrottky (Megachilidae) built in an abandoned nest of *Xylocopa frontalis* (Olivier) (Apidae).

The study was conducted at the edge of a secondary forest at Instituto Agronômico do Paraná – (Iapar) (25º30’33’’S; 48°48’30’’W; 64 m) in Morretes, Paraná state, southern Brazil. The area is located in the Atlantic Forest biome domain, one of the world’s biodiversity hotspots, characterized by the outstanding species richness and level of endemism and by being threatened by anthropogenic changes (Myers et al., 2000). A small crop area of yellow passion fruit, *Passiflora edulis* Sims (Passifloraceae), is located at the study site

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approximately 100 m from a shelter that consisted of a tiled roof supported by wooden pillars. In this construction, several nests of *X. frontalis* were established in dead tree trunks attached with wire to the rafter and to the wooden columns.

On 11 January 2006 around 17h00, four females of *M. apicipennis* were recorded simultaneously entering the nest entrance on the tree trunk. Females of *M. apicipennis* were also observed cutting rounded pieces from the leaves of *Centrosema virginianum* (L.) Benth. (Fabaceae) plants (Figs 1a, b) that were located just 4 m distant from the nest. The leaf pieces were then folded between the legs and transported to the nest by the females (Fig 1c). The movements of females with leaves was observed on the first day, when the nest was discovered, whereas on the second day we only observed females carrying pollen on the ventral scopae. No further observations on the nest activities were performed. After the end of the nest activities, on 17 January 2006, the nest was removed from the trunk cavity and taken to the laboratory for study. No sign of nesting activity of *X. frontalis* was observed within the gallery. A total of three linear series of three cells each and one solitary cell were found at the end of the gallery (Fig 1d). The cell series were parallel to each other and lined with imbricately arranged leaf pieces and closed basally with rounded small leaf fragments. Imagines of *M. apicipennis* (four males and two females) emerged 38 to 49 days, respectively, after the end of nesting activities. Mortality of 40% was caused by the attack of natural enemies (30%) and unknown factors (10%). Three brood cells had been attacked by the cleptoparasitic bee *Coelioxys otomita* Cresson (Megachilidae), the parasitic wasp *Brachymeria paraguayensis* (Brèthes) (Chalcididae) and the gregarious parasitoid *Melittobia australica* Girault (Eulophidae).

The nest architecture registered herein was also observed in other studies for *Megachile* (*Moureapis*) spp. (Laroca, 1991; Teixeira et al., 2011; Cardoso & Silveira, 2012; Sabino & Antonini, 2017) except for Ihering (1904). According to this author, the brood cell walls of a *M. apicipennis* nest were constructed with mud rather than with pieces of leaves. As pointed out by Cardoso and Silveira (2012) that nest was probably constructed by a species belonging to another subgenus such as *M.* (*Chrysosarus*) Mitchell. On the other hand, Laroca (1991) also described a nest of *M. apicipennis* (cited as *Pseudocentron apicipennis*) with cells arranged in linear series and built with leaf fragments as observed in the present study.

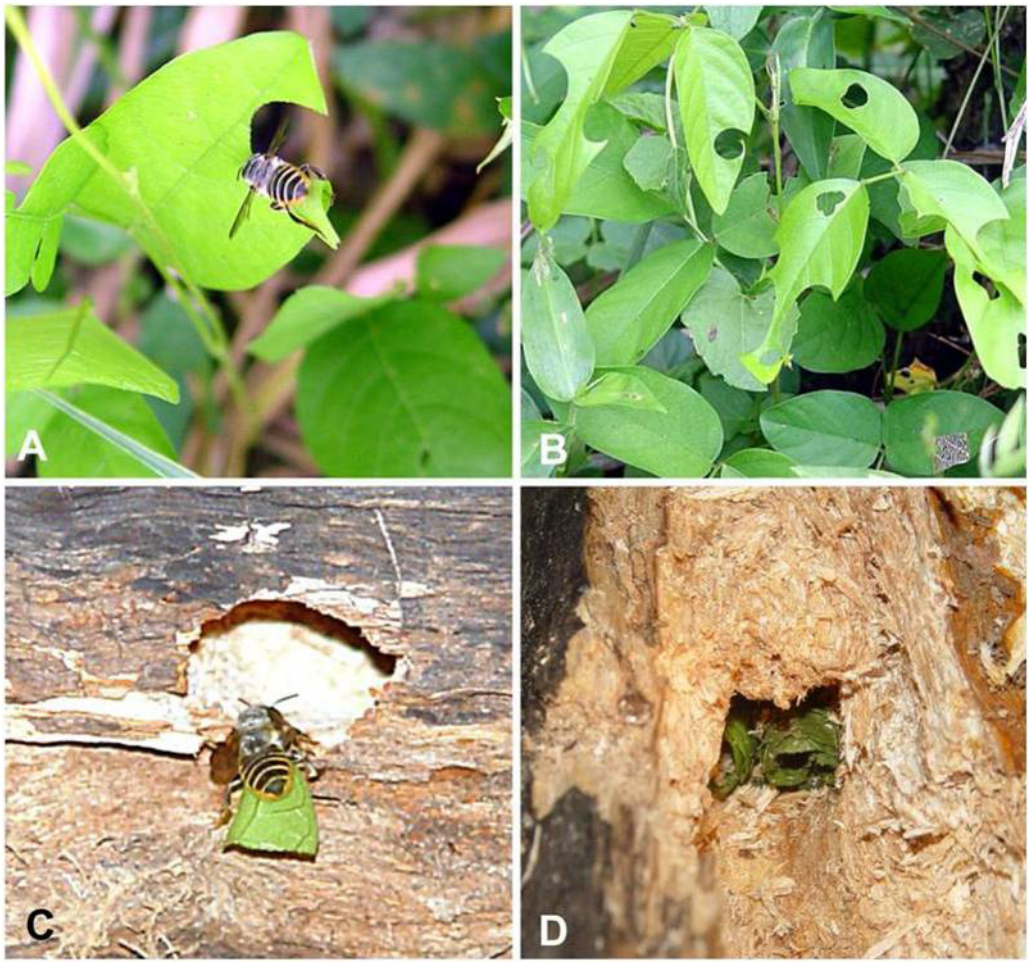

Fig 1. Nest building by females of *Megachile apicipennis*. (a) Female of *Megachile apicipennis* cutting a piece of a leaf of *Centrosema virginianum*, (b) specimen of *Centrosema virginianum* (four meter distant from the nest) showing damage to leaves done by leafcutting bees, (c) female of *Megachile apicipennis* entering the nest with a leaf piece of *Centrosema virginianum*, and (d) three cell series of *Megachile apicipennis* located at the end of the abandoned gallery of *Xylocopa frontalis* (d).

The use of leaves of leguminous species (Fabaceae) to construct brood cells was also recorded in another *M.* (*Moureapis*) species. Sabino and Antonini (2017) identified leaves of *Senna pendula* (Willd.) H.S.Irwin and Barneby and *Dalbergia miscolobium* Benth. in cells built by females of *M. maculata* Smith. Other leafcutting bee species belonging to different subgenera, in contrast, collect leaves from a high diversity of plant species ranging from eight to 20 plant families (MacIvor, 2016). The author reported that females of *Megachile* (*Eutricharaea*) *rotundata* (Fabricius) preferred leaves from Fabaceae to the other nine families whereas Rosaceae species were more used by both *Megachile* (*Megachile*) *centuncularis* (L.) and *Megachile* (*Sayapis*) *pugnata* Say. In spite of the high richness of plant species used by those three *Megachile* spp., MacIvor (2016) pointed out that almost all plant species identified from nest samples had antimicrobial properties, a feature that might inform selection among leaf types.

Four females of *M. apicipennis* were recorded entering the nest either carrying pieces of leaves or pollen without leaving the nest. However, given the lack of data on the ovary dissection of females it is not possible to conclude that the nest was communal but it is presumable that each female has constructed her own nest. As *Megachile* (*Moureapis*) species select wide cavities to nest (Laroca, 1991; Teixeira et al., 2011) it is likely to assume that communal nests among these bees may occur. Cardoso and Silveira (2012) emphasized that a single bamboo cane used as trap nest could host multiple nests built by different females. In Megachilidae, communal nests were described for *Megachile* (*Callomegachile*) *pluto* Smith, *Microthurge corumbae* (Cockerell) and *Afranthidium repetitum* (Schulz) (Michener, 1968; Messer, 1984; Garófalo et al., 1992).

Three species of natural enemies were reared from the nest of *M. apicipennis*. The cuckoo bee *Coelioxys otomita* was also registered as a cleptoparasite in *M. benigna* nests by Teixeira et al. (2011). The only host record for *Brachymeria paraguayensis* was provided by Noyes (2003) for an unidentified *Megachile* species. The generalist parasitoid *Melittobia australica* has been recorded as a natural enemy of several bee species, including five in the genus *Megachile*, as *M. Maculata* (Sabino & Antonini, 2017), as well as flies (Calliphoridae, Sarcophagidae) and species of Crabronidae, Formicidae, Pompilidae, Sphecidae, and Vespidae (Noyes, 2003). Species of *Coelioxys* Latreille and *Melittobia* Westwood were also reported parasitizing brood cells of other *M.* (*Moureapis*) species (Teixeira et al., 2011; Cardoso & Silveira, 2012; Sabino & Antonini, 2017).

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