

Notes on oil sources for the bee genus *Caenonomada* (Hymenoptera, Apidae, Tapinotaspidini)

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ABSTRACT. Notes on oil sources for the bee genus *Caenonomada* (Hymenoptera, Apidae, Tapinotaspidini). It is reported for the first time oil collecting by bees of the genus *Caenonomada* on flowers of Plantaginaceae. Females of *Caenonomada unicalcarata* were observed collecting oil on flowers of *Angelonia cornigera*, and males and females of *Caenonomada bruneri* and *C. aff. unicalcarata* were observed on flowers of *Angelonia* and *Monopera* (Plantaginaceae). The record of *Caenonomada* on Plantaginaceae suggests the use of trichomatic oil glands as a primitive condition in the tribe Tapinotaspidini.

KEYWORDS. Oil-bees; oil-flowers; glandular trichomes; Neotropical.

RESUMO. Notas sobre fontes de óleos florais do gênero *Caenonomada* (Hymenoptera, Apidae, Tapinotaspidini). Pela primeira vez é reportado a coleta de óleo por *Caenonomada* em Plantaginaceae. Fêmeas de *Caenonomada unicalcarata* foram observadas coletando óleo em flores de *Angelonia cornigera*, e fêmeas e machos de *Caenonomada bruneri* e *Caenonomada aff. unicalcarata* em flores de *Angelonia* e *Monopera* (Plantaginaceae). O registro de *Caenonomada* em Plantaginaceae sugere uma condição mais primitiva para o uso de glândulas tricômáticas de óleo na tribo Tapinotaspidini.

PALAVRAS-CHAVE. Abelhas coletoras de óleos; flores produtoras de óleos; glândulas tricômáticas; Neotropical.

Among oil-collecting bee groups, the tribe Tapinotaspidini is the most diversified in terms of morphological structures and adaptations to collect oil. Their oil collecting apparatuses are mainly composed of patches of specialized setae on fore and/or mid legs, except for *Tapinotaspoides* which possesses specialized setae on the sterna (Roig-Alsina 1997; Cocucci *et al.* 2000). Regarding their host plant families, the genus *Monoeca* is associated to Malpighiaceae (Rozen *et al.* 2006; Sigrist & Sazima 2004), *Chalepogenus* to Solanaceae, Calceolariaceae, Iridaceae (Vogel 1974; Cocucci & Vogel 2001; Cocucci *et al.* 2000), and Malpighiaceae (Aguiar, unpublished), *Tapinotaspis* to Plantaginaceae, Iridaceae and Solanaceae (Cocucci 1991, Cocucci & Vogel 2001, Cocucci *et al.* 2000), *Lanthanomelissa* to Iridaceae (Cocucci & Vogel 2001, Truyllo *et al.* 2002; Rozen *et al.* 2006), *Arhysoceble* to Plantaginaceae (Vogel & Machado 1991), Malpighiaceae (Faria-Mucci *et al.* 2003) and Krameriaceae (Aguiar, unpublished), *Trigonopedia* to Malpighiaceae (Aguiar, unpublished) and the genera of the *Paratetrapedia* lineage (*Xanthopedia*, *Lophopedia*, *Tropidopedia* and *Paratetrapedia* s. str.) are mainly associated to Malpighiaceae (Sazima & Sazima 1989; Sigrist & Sazima 2004; Pedro 1994), with some records on Orchidaceae (Mickeliunas *et al.* 2006) and Krameriaceae (Simpson 1989). Differently from the remaining genera, the oil collecting apparatus of *Tapinotaspoides* are associated to non-floral

glandular trichomes of diverse plant families (Melo & Gaglianone 2005).

Based on the setal morphology of the fore legs, Roig-Alsina (1997) suggested that species of *Caenonomada* could be associated to plant families with trichromatic oil glands. The oil collecting apparatus of *Caenonomada* is located on fore tarsomeres 1-4 and is composed of stiff flattened setae on the outer surface and finely branched setae on the inner surface of the tarsomeres. This morphology is somewhat similar to that present in species of *Chalepogenus* and *Centris hyptidis* (Roig-Alsina 1997; Cocucci *et al.* 2000). The only record of oil source for *Caenonomada* was reported by Cocucci *et al.* (2000), who collected one female of *Caenonomada bruneri* on flowers of *Cypella gracilis* (Iridaceae) and also observed pollen grains of this plant on the bee's scopae.

We report here anecdotal observations of males and females of *Caenonomada* on oil-flowers of three species of plants, currently placed in Plantaginaceae. The bee vouchers collected on Mato Grosso do Sul were deposited at Coleção Entomológica Padre Jesus Santiago Moure, Departamento de Zoologia, Universidade Federal do Paraná, and the bee vouchers collected on Piauí were deposited on Museu de Zoologia da Universidade de São Paulo. Plant material was deposited at Herbário do Departamento de Botânica (UPCB), Universidade Federal do Paraná.



Fig. 1. Females of *Caenomada unicalcarata* visiting flowers of *Angelonia cornigera* in an area of Caatinga vegetation at São Miguel do Tapuío, Piauí, northeastern Brazil. The photography at right, although not in focus, shows how the bee positions itself during foraging, touching the plant reproductive structures with its head.

The first set of observations was carried out on February 24, 2004, between 11:30 and 13:00, in an abandoned pasture field composed by herbaceous plants and some scattered trees, in an area of Chaco vegetation, near Porto Murtinho (Mato Grosso do Sul, Brazil). Females of *Caenomada bruneri* Ashmead, 1899 were seen on flowers of *Angelonia salicariifolia* Bonpl., and males of *Caenomada* aff. *unicalcarata* (Ducke, 1908) and one female *C. bruneri* on flowers of *Monopera perennis* (Chodat & Hassl.) Barringer. The few observed visits were fast and no detailed notes of the female behavior were taken. A few females of *Centris (Hemisiella) tarsata* Smith, 1874 were also observed and collected on flowers of *A. salicariifolia*.

Specimens of both species of *Caenomada* collected while visiting other plant species at the site were examined to check for the presence of pollen of Plantaginaceae in their bodies. Pollen grains from anthers of the dry plant vouchers were mounted in glycerin-jelly slides and compared to that deposited on the bees' head. Both plant species have a very similar pollen morphology (small, tricolporate grains), as already observed by Santos (1997). Ten out of 14 females and seven out of nine males of *C. aff. unicalcarata* had identical pollen grains on the upper clypeus and supra-clypeal area. In the case of *C. bruneri*, 16 out of 33 females had pollen of Plantaginaceae on their face.

More recently (April 2008), numerous females of *Caenomada unicalcarata* were observed visiting and collecting oil on flowers of *Angelonia cornigera* (Fig. 1) in an

area of Caatinga at São Miguel do Tapuío, Piauí, in northeastern Brazil. A large number of males of *C. unicalcarata* were also observed flying around the flowers, probably in search for females. Machado *et al.* (2002) studied the pollination of *Angelonia cornigera*, but did not report the presence of *Caenomada* on the flowers.

The records of *Caenomada* collecting oil on *Angelonia* are in accordance with the suggestion of Roig-Alsina (1997) that the oil-collecting apparatus of this genus is morphologically adapted to trichromatic glands. Although the basal lineages in the phylogeny of Tapinotaspidini are not well resolved, the association of *Caenomada* with Plantaginaceae suggests the use of trichomatic oil glands as a primitive condition in the tribe.

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REFERENCES

- Cocucci, A. 1991. Pollination biology of *Nierembergia* (Solanaceae). *Plant Systematics and Evolution* **174**: 17–35.
- Cocucci, A.; A. Sersic & A. Roig-Alsina. 2000. Oil-collecting structures in Tapinotaspidini: their diversity, function and probable origin (Hymenoptera: Apidae). *Mitteilungen der Münchner Entomologischen Gesellschaft* **90**: 51–74.
- Cocucci, A. & S. Vogel. 2001. Oil-producing flowers of *Sisyrinchium* species (Iridaceae) and their pollinators in southern South America. *Flora* **196**: 26–46.

- Faria-Mucci, G.; M. A. Melo & L. A. O. Campos. 2003. A fauna de abelhas (Hymenoptera, Apoidea) e plantas utilizadas como fonte de recursos florais, em um ecossistema de campos rupestres em Lavras Novas, Minas Gerais, Brasil, p. 241–256. In: G. A. R. Melo & I. Alves-dos-Santos (eds). **Apoidea Neotropica: homenagem aos 90 anos de Jesus de Santiago Moure**. Editora Unesc, Criciúma, xvi+320 p.
- Machado, I. C.; S. Vogel & A. V. Lopes. 2002. Pollination of *Angelonia cornigera* Hook. (Scrophulariaceae) by long-legged, oil-collecting bees in NE Brazil. **Plant Biology** 4: 352–359.
- Melo, G. A. R. & M. C. Gaglianone. 2005. Females of *Tapinotaspoidea*, a genus in the oil-collecting bee tribe Tapinotaspini, collect secretions from non-floral trichomes (Hymenoptera, Apidae). **Revista Brasileira de Entomologia** 49: 167–168.
- Mickeliunas, L.; E. Pansarin & M. Sazima. 2006. Biologia floral, melitofilia e influência de besouros Curculionidae no sucesso reprodutivo de *Grobya amherstiae* Lindl. (Orchidaceae: Cyrtopodiinae). **Revista Brasileira de Botânica** 29: 251–258.
- Pedro, S. R. M. 1994. Interações entre abelhas e flores em uma área de cerrado no NE do estado de São Paulo: abelhas coletoras de óleo (Hymenoptera: Apoidea: Apidae), p. 243–255. In: **Anais do I Encontro sobre Abelhas**. Ribeirão Preto, Universidade de São Paulo, Faculdade de Filosofia, Ciências e Letras de Ribeirão Preto.
- Roig-Alsina, A. 1997. A generic study of the bees of the tribe Tapinotaspini, with notes on the evolution of their oil-collecting structures (Hymenoptera, Apidae). **Mitteilungen der Münchner Entomologischen Gesellschaft** 87: 3–21.
- Rozen, J. G.; G. A. R. Melo; A. J. C. Aguiar & I. Alves-dos-Santos. 2006. Nesting biologies and immature stages of the tapinotaspine bee genera *Monoeca* and *Lanthanomelissa* and of their osirine cleptoparasites *Protosiris* and *Parepeolus* (Hymenoptera: Apidae: Apinae). **American Museum Novitates** 3501: 1–60.
- Santos, F. A. R. 1997. Scrophulariaceae do Brasil: morfologia polínica e suas implicações taxonômicas. Ph. D. dissertation. Instituto de Biociências, USP, São Paulo, 187 pp.
- Sazima, M. & I. Sazima. 1989. Oil-gathering bees visit flowers of eglandular morphs of the oil-producing Malpighiaceae. **Botanica Acta** 102: 106–111.
- Simpson, B. B. 1989. Krameriaceae. Flora Neotropica. **Monograph** 49: 1–109.
- Sigrist, M. R. & M. Sazima. 2004. Pollination biology of twelve species of Neotropical Malpighiaceae: stigma morphology and its implications for the breeding system. **Annals of Botany** 94: 33–41.
- Truylio, B.; B. Harter-Marques & W. Engels. 2002. Biologia floral e polinização de *Sysyrinchium micranthum* (Iridaceae) na região do Planalto das Araucárias do Rio Grande do Sul, Brasil. **Biociências** 10: 11–24.
- Vogel, S. 1974. Ölblumen und ölsammelnde Bienen. **Tropische und subtropische Pflanzenwelt** 7: 1–267.
- Vogel, S. & I. C. Machado. 1991. Pollination of four sympatric species of *Angelonia* (Scrophulariaceae) by oil-collecting bees in NE. Brazil. **Plant Systematics and Evolution** 178: 153–178.