

## SCIENTIFIC NOTE

## Conopid Flies (Diptera: Conopidae) Parasitizing *Centris (Heterocentris) analis* (Fabricius) (Hymenoptera: Apidae, Centridini)

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### Conopídeos (Diptera: Conopidae) Parasitando *Centris (Heterocentris) analis* (Fabricius) (Hymenoptera: Apidae, Centridini)

**RESUMO** - Parasitas de abelhas adultas são quase exclusivamente moscas e dentre os mais importantes estão os conopídeos. Nesta comunicação relata-se pela primeira vez a associação de espécies de *Physocephala* (Diptera: Conopidae) com *Centris (Heterocentris) analis* (Fabricius). De uma amostra de 26 fêmeas e nove machos da espécie hospedeira encontrados mortos em ninhos-armadilha vazios, no campus da Universidade de São Paulo, Ribeirão Preto, SP, emergiram 35 parasitóides pertencentes a nove espécies de *Physocephala*. Os dados mostram que *C. analis* é hospedeiro para várias espécies de conopídeos e sugerem que tais parasitóides podem desempenhar um papel importante na regulação populacional dessa espécie de abelha.

**PALAVRAS-CHAVE:** Parasitismo, associação parasita-hospedeiro, abelha, ninhos-armadilha

**ABSTRACT** - Parasites of adult bees are almost exclusively flies and the most important of them are conopids. This note registers for the first time the association of species of *Physocephala* (Diptera: Conopidae) with *Centris (Heterocentris) analis* (Fabricius). From 26 females and nine males of the host species found dead inside trap-nests on the campus of the University of São Paulo, Ribeirão Preto, Brazil, 35 parasitoids were obtained belonging to nine species of *Physocephala*. The data show that *C. analis* is a host to several conopid flies, and suggest that such parasitoids can play an important role in population control of this bee species.

**KEY WORDS:** Parasitism, parasite-host association, bee, trap-nest

Conopid flies are parasitoids of insects, usually aculeate Hymenoptera, with a worldwide distribution (Askew 1971, Smith & Peterson 1987). Probably, they are the most important of dipterous parasitoids of adult bees, both females and males. Female flies attack the bees inserting an egg on or within the bee's abdomen while they are foraging at flowers or while in flight. The larva develops inside the abdomen of the host by feeding on internal tissue and hemolymph (Pouvreau 1974, Müller *et al.* 1996). Development of the larval parasitoid takes about 10-12 days after oviposition when the host is killed and the parasite pupates *in situ* (Smith 1966, Pouvreau 1974). The pupa remains inside the host and, for temperate species, the parasitoid hibernates where its host dies, usually outside the nest (Smith & Van Someren 1970, Schmid-Hempel & Müller 1991), before emerging at the following spring. Species of the conopid genus *Physocephala* have been recorded in association with bee species of several genera such as *Anthidium*, *Anthophora*, *Eucera*, *Megachile*, *Halictus*, *Apis*, *Xylocopa*, *Bombus*, and

*Eulaema* (Linsley 1958, Hurd 1978, Katayama & Maeta 1998, Schmid-Hempel 2001, Otterstatter *et al.* 2002, Rasmussen & Cameron 2004). Recently, two *Physocephala* species, *Physocephala bipunctata* Macquart and *Physocephala inhabilis* Walker, were recorded in association with *Epicharis bicolor* Smith e *Centris vittata* Lepelletier (Vilhena & Rocha-Filho inf. pes.).

*Centris (Heterocentris) analis* Fabricius is a solitary bee that has a broad geographic range extending from Mexico to Brazil (Moure 1960). Like other species of *Heterocentris*, nesting by *C. analis* occurs on a variety of preexisting cavities (Camillo *et al.* 1995, Vieira de Jesus & Garófalo 2000). In a detailed study of the nesting behavior of *C. analis* in trap-nests, Vieira de Jesus & Garófalo (2000) observed that the bees construct their nests with plant material and an oily substance. Completed nests have one to four brood cells arranged in a linear series, usually followed by a vestibular cell, an empty cell found between the last brood cell and the nest plug. The innermost cells of the nests produce

females, and the outermost cells produce males. Nests are parasitized by the wasp *Leucospis cayennensis* Westwood, the most frequent parasite, and by the bees *Coelioxys* sp. (Megachilidae) and *Mesocheira bicolor* Fabricius (Apidae) (Gazola & Garófalo 2003). Nesting activities occur with higher frequency in the hot and wet season (September-April), and several generations per year can be produced. The goal of this note is to register for the first time the association of species of *Physocephala* with *C. analis*.

While monitoring the nesting activities of *C. analis* females on the campus of the University of São Paulo – Ribeirão Preto (between 21°05' - 21°15'S and 47°50' - 47°55'W), state of São Paulo, Brazil, the trap-nests, tubes made with black cardboard, with one of the end closed with the same material, were inspected daily with an otoscope and those occupied by females were recorded. The tubes were inserted into horizontal holes drilled into eight wooden plates (28 x 24 x 4 cm) and they were 5.8 cm in length and 0.6 cm in internal diameter. The plates were placed along shelves in a shelter built near the laboratory. The shelves were 1.2 and 1.5 m above the ground. During the inspections of trap-nests, several females and some males that utilized the trap-nests as a place to rest during the night were found dead within empty trap-nests. These individuals were immediately collected, transferred to small glass vials and taken to the laboratory. In the laboratory, the vials were kept at room temperature (21°C-29°C) and observed daily to verify the occurrence of parasitoids attacking such bees. When a parasitoid emerged, it was left in the same vial for 24h. Thereafter, it was killed with ethyl acetate. Voucher specimens were deposited at the Entomological Collection of the Departamento de Biologia, Faculdade de Filosofia, Ciências e Letras de Ribeirão Preto, USP, and duplicates of some specimens are deposited in the Entomological Collection of the Museu Nacional, Universidade Federal do Rio de Janeiro, RJ.

From December 2004 to May 2005 and from January to June 2006, when *C. analis* females were nesting, 26 females and nine males were found dead and all had been parasitized by conopid flies. Most individuals (19 females and five males) were attacked from December 2004 to April 2005 (Table 1). The interval between the collection date of the dead female or male and the parasitoid emergence ranged from 19 to 53 days. The largest intervals were observed for parasitoids that emerged from males attacked in June/2006 and females that nested in May/2006 (Table 1). This result must be related with the temperature which decreases as the cold and dry season approaches. Of the 35 parasitoids emerged, 10 were *Physocephala soror* Kröber (five males, four females and one not sexed), one was *P. bipunctata* (not sexed), six were *P. inhabilis* (three males and three females), five were *Physocephala rufithorax* Kröber (four males and one female), two were *Physocephala cayennensis* Macquart (one female and one male), one was *Physocephala aurifrons* Walker (one male), one was *Physocephala bennetti* Camras (not sexed), three were *Physocephala spheniformis* Camras (one male and two females), and six other individuals were not identified (*Physocephala* sp.) (four males and two females). Except for *P. aurifrons*, *P. bipunctata* and *P. bennetti*, which were represented by only one individual, specimens of all other species attacked both females and males of *C. analis*.

To date, besides the association of *P. bipunctata* with *E. bicolor* and *P. inhabilis* with *C. vittata* (Vilhena & Rocha-Filho inf. pes.) an other available information indicate *P. bennetti* associated with *Xylocopa submordax* Cockerell and *Xylocopa frontalis* Olivier, in Trinidad (Camras 1996), and *P. rufithorax* attacking *Eulaema* sp. males attracted to chemical baits, in Peru (Rasmussen & Cameron 2004). The observations reported here show that *C. analis* is a host to a large number of conopid flies and an alternative host for *P. bipunctata*, *P. inhabilis*, *P. bennetti* and *P. rufithorax*. From the relationship between

Table 1. Number of dead bees found in trap-nests, number of emerged conopid flies, and duration between the collecting of dead males and females of *C. analis* and emergence of the parasitoids.

| Months/year   | No. of bees found dead within empty trap-nests | Number of emerged parasitoids | Duration (in days) between the collecting of dead host and the emergence of the parasitoids |            |
|---------------|--|-------------------------------|---|------------|
|               |  |                               | Range   | x ± sd     |
| December/2004 | 2  |                               |   |            |
| January/2005  | 7  | 4                             | 22 - 25   | 23.3 ± 1.5 |
| February      | 3 (+1) *                                       | 6                             | 23 - 28   | 26.2 ± 1.8 |
| March         | 3 (+3)   | 3 (+2)**                      | 23 - 25   | 24.0 ± 1.0 |
| April         | 4 (+1)   | 3 (+2)                        | 19 - 27   | 23.4 ± 3.7 |
| May           | 0  | 3 (+1)                        | 27 - 33   | 29.2 ± 2.6 |
| January/2006  | 1  |                               |   |            |
| February      | 0  | 1                             | -   | 26         |
| March         | 2  |                               |   |            |
| April         | 2 (+1)   | 4                             | 26 - 30   | 27.7 ± 2.1 |
| May           | 2  | (1)                           | -   | 28         |
| June          | (3)  | 1                             | -   | 46         |
| July          | 0  | 1 (+3)                        | 44 - 53   | 49.0 ± 3.7 |

\* number of males found dead and parasitized; \*\* parasitoids emerged from males.

the period of host death and conopid fly emergence it can be concluded that all parasitoid species are multivoltine and have their phenologies synchronized with that of the host.

Conopid parasitism in natural population of bumblebees (*Bombus* sp.) is very common in Europe, where incidence of parasitism range between 30% and 70% (Schmid-Hempel et al. 1990). This parasitic association has been studied under several aspects and some results have shown that the parasitoid increases the worker mortality (Schmid-Hempel & Schmid-Hempel 1988, 1990), alters foraging behavior (Heinrich & Heinrich 1983, Müller & Schmid-Hempel 1993) and, consequently reduces the size of colonies (Müller & Schmid-Hempel 1992, MacFarlane et al. 1995). Work to clarify similar aspects in the *C. analis*-conopid interaction is currently in progress.

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