

## SYSTEMATICS, MORPHOLOGY AND PHYSIOLOGY

*Philornis fasciventris* (Wulp) (Diptera: Muscidae): Description of the Male, Larva and Puparium, with Notes on Biology and Host AssociationMÁRCIA S. COURI<sup>1</sup>, TROY G. MURPHY<sup>2</sup> AND RICHARD HOEBEKE<sup>3</sup><sup>1</sup>Museu Nacional, Univ. Federal do Rio de Janeiro, Quinta da Boa Vista, 20940-040, RJ, Brazil, mcouri@terra.com.br  
research fellow of Conselho Nacional de Desenvolvimento Científico e Tecnológico, CNPq<sup>2</sup>Dept Neurobiology and Behavior, Cornell University, Ithaca, New York, 14853, USA, tgm3@cornell.edu<sup>3</sup>Dept Entomology, Cornell University, Ithaca, New York, 14853, USA, erh2@cornell.edu*Neotropical Entomology* 36(6):889-893 (2007)*Philornis fasciventris* (Wulp) (Diptera: Muscidae): Descrições do Macho, Larva e Pupário, com Notas sobre a Biologia e Associação com o Hospedeiro

RESUMO - O macho, larva e pupário de *Philornis fasciventris* (Wulp) são descritos pela primeira vez, assim como os hábitos larvais e associação com o hospedeiro. O material foi coletado em Yucatan, México no ninho de *Eumomota superciliosa* (Sandbach) (Coraciformes: Momotidae), primeiro hospedeiro registrado para essa espécie. *E. superciliosa* é também novo registro de hospedeiro para *Philornis*.

PALAVRAS-CHAVE: Novo registro, morfologia, imaturo, relação com hospedeiro

ABSTRACT - The male, larva and puparium of *Philornis fasciventris* (Wulp) are described for the first time, as well as the larval habit and host association. The material was collected in Yucatan, Mexico in a nest of the turquoise-browed motmot, *Eumomota superciliosa* (Sandbach) (Coraciformes: Momotidae), first host record for this species. *E. superciliosa* is also a new host record for *Philornis*.

KEY WORDS: New record, morphology, immature, host relation

The interesting relationship of *Philornis* Meinert with birds was summarized by Couri (1999) and Teixeira (1999). Although the majority of described species are well known in the literature, the habits of the larvae and the type of association with birds are still scarcely known; these types of biological data are available only for about 50% of the species (Couri 1999).

*Philornis fasciventris* (Wulp) was included by Dodge (1963) in the *aitkeni* group of species, characterized by the wide, parallel-sided, frons in the female; the nearly contiguous eyes of the male with enlarged upper facets; and the presence of cilia at the base of wing vein R<sub>4+5</sub> (and sometimes also on the ventral and/or dorsal surfaces of CuA<sub>1</sub>). Dodge & Aitken (1968) distinguished the puparium of the *aitkeni* group from all other congeners by the exerted thoracic anterior spiracles and by the absence of a perispiracular depression on the caudal segment. The *aitkeni* group has free-living, coprophagous larvae, all occurring in avian host nests.

Most of the nine species included in the *aitkeni* group are known only from the female. Morphology of the puparium is known only for *P. aitkeni* Dodge and host associations are recorded only for this species and for *P. rufoscutellaris* Couri.

A consensus tree based on a phylogenetic analysis of *Philornis* by Couri *et al.* (2007) demonstrates that species in the *aitkeni* group fall out at the base of the cladogram,

with basal polytomies. These polytomies are mainly due to a lack of information. Because the species of the *aitkeni* group exhibit plesiomorphic (primitive) characters shared among other Muscidae, more critical information is needed on the male, female, and basic natural history of the group to draw phylogenetic inferences.

There are documented records of coprophagous *Philornis* larvae found in the nests of various avian hosts: *P. aitkeni* and *P. rufoscutellaris* from the nests of *Galbula ruficauda* Cuvier descriptor (Galbulidae), and unidentified species of *Philornis* from the nests of *Chelidoptera tenebrosa* (Pallas) descriptor (Bucconidae), *Trogon viridis* descriptor Linnaeus. (Trogonidae) and *Momotus momotus* descriptor (Linnaeus.) (Momotidae).

Previously, *P. fasciventris* was known only from the female and included in the *aitkeni* group, with its placement based solely on the wide, parallel-sided, frons. The female can be recognized by the yellow antennae and palpi; black genal (cheek) setae; brown mesonotum with grayish pollinosity and four brown vittae; yellow postpronotum and scutellar apex; brown abdomen with grey pollinosity, and brown median stripe on tergites 2-4; female width of frons at level of anterior ocellus 0.25 of head width; and hind tibia with one median anterodorsal seta and five fine, short anteroventral setae on middle third (Couri 1999).

This paper presents the results of a morphological study of the male, larva and puparium of *P. fasciventris* and provides the first authenticated record of the avian host and host association for this species.

## Materials and Methods

The material was collected by TM during a study of the behavioral ecology of the turquoise-browed motmot [*Eumomota superciliosa* (Sandbach) descriptor], from the detritus on the bottom of the earthen tunnel-nest of this bird species. The collection site is near the Ria Lagartos Biosphere reserve in northern Yucatan, Mexico (21° 33' N, 88° 05' W). The area is characterized by a tropical deciduous thorn forest.

TM studied the turquoise-browed motmot for four seasons (1999-2002) and monitored the progress of approximately 100 nests each year (Murphy 2006; in press, a). This species nests in terminal chambers of tunnels built into earthen banks (0.4 - 2.2 m in depth, mean = 1.3 m). Nest contents were checked with a lipstick-shaped video camera equipped with an infrared light source. The camera allowed TM to clearly observe the contents in the chambers at the end of the long tunnel nests. After nestlings hatched, almost all nests were observed to have some larvae in the detritus on the bottom of the nest chamber. In many nests, the detritus undulated with hundreds of larvae. The detritus is comprised of the nestling's fecal material, coughed-up pellets, rejected food items, and also from dead nestlings. According to TM's observations, the larvae apparently eat detritus as there was no evidence that the larvae were consuming or parasitizing the nestlings. When nestlings were removed from the nest with numerous *Philornis* larvae, the nestling's skin showed no marks or lesions.

A total of 11 adults (nine females and two males), eight larvae, and three puparia were collected. The dissected male terminalia was placed in glycerin in a microvial and pinned with the respective specimen.

The color photographs were made using Syncroscopy/JVC Auto-Montage equipment and an optical Leica M 420 microscope.

### *Philornis fasciventris* (Wulp)

**Male (n = 2).** Length. Body: 5.8 mm, wing: 5.7 mm

**General color.** Ground-color dark brown; fronto-orbital plate, parafacial, gena and occiput silvery-white pruinose. Palpus yellow, brownish at base. Antenna yellow, pedicel a little brownish. Arista yellow at base and brownish **apical**. Dorsum of mesonotum blackish-brown with four longitudinal vittae; postpronotum and scutellum concolorous with rest of mesonotum; calypters dirty white, with margins brown; haltere whitish yellow. Wing clear. Legs brown, posterior tibia light brown. Abdomen brown with some yellowish areas.

**Head.** Eyes strongly approximated, almost touching at middle and with some sparse and short cilia. Frontal row with

six pairs of setae, the one at lunule longer. Inner and outer vertical setae not developed. Antenna inserted at middle level of eye; flagellomere about 1.8 times the length of pedicel. Arista plumose. Palpus very little enlarged to apex.

**Thorax.** Dorsocentrals 2:4, the two first post-sutural ones short; acrostichals 0:1; three postpronotals; one presutural and one postsutural intra-alars; one strong prealar, subequal to anterior notopleural seta; one presutural and two postsutural supra-alars. Notopleuron with two setae, the anterior one longer. Scutellum laterally setulose and with one pair of basal and one pair of apical setae, both long and strong. Katepisternals 1:2, the postero-superior one about twice as long as the others. Lower calypter about 2.2 the length of upper one. Wing veins with two cilia on dorsal surface of R4+5 and five cilia on ventral surface; CuA1 bare. Fore femur with posteroventral, posterodorsal and dorsal rows of setae; fore tibia with one median and one submedian anterodorsal setae; dorsal surface with a strong preapical dorsal seta. Mid femur with an anteroventral row of fine setae and two posterior preapical ones; mid tibia with one median posterior setae; and one preapical dorsal seta; ventral and anterodorsal surfaces with a long apical setae. Hind femur with a complete row of anterodorsal setae; anteroventral surface with a complete row of fine and sparse setae, posterior surface with one preapical seta. Hind tibia with one median short anterodorsal seta and five anteroventral on middle third, one preapical dorsal and one strong apical ventral seta.

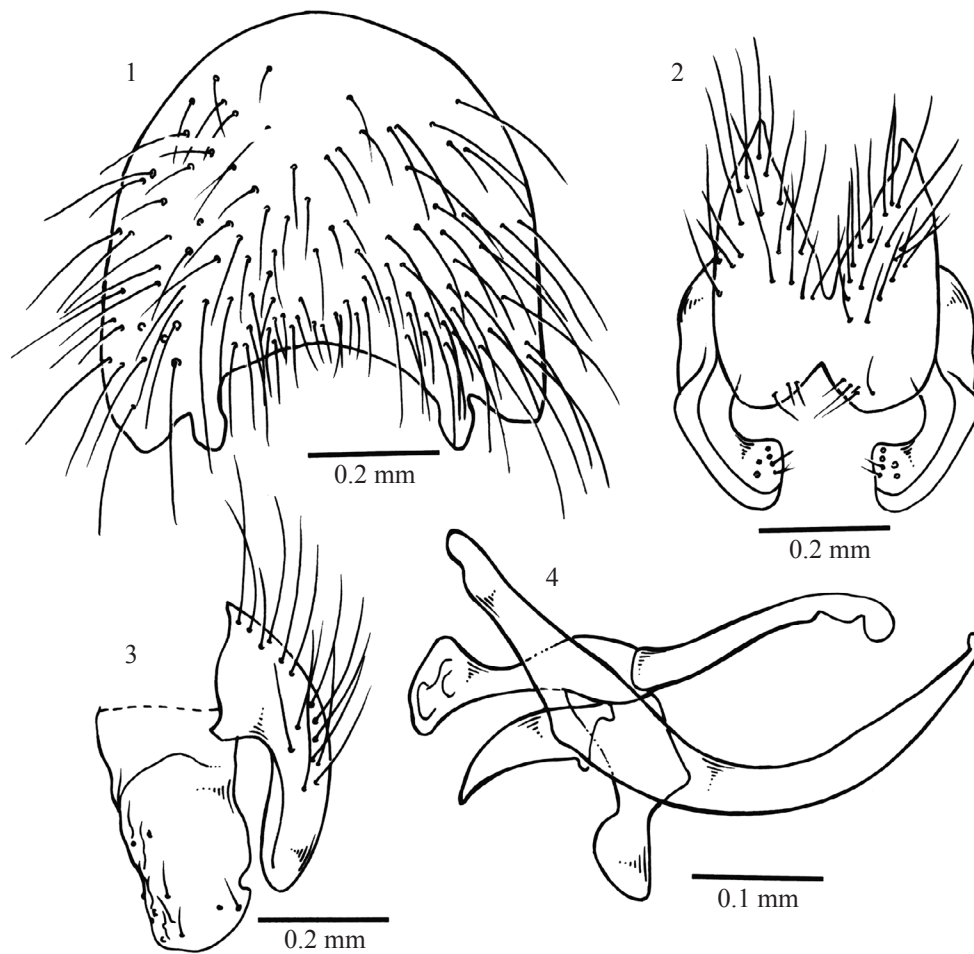
**Abdomen.** Tergite 5 with a discal and a preapical row of fine setae. Sternite 5 almost as high as large, covered with mid to long setae in almost all its extension, except on a small basal area (Fig. 1).

**Terminalia.** Cercal plate with a deep median incision; surstyli large (Figs. 2 and 3). Aedeagus as in Fig. 4.

**Material examined.** MEXICO: Yucatan, nr. Ria Lagartos, Biosphere reserve, 21°33'N 88° 05'W, August 2000, Troy Murphy, ex detritus at bottom of earthen tunnel-nest of turquoise-browed motmot (*Eumomota superciliosa*). One male (Cornell University Insect Collection), one male (Museu Nacional, Rio de Janeiro). Larvae and puparia also deposited in the Cornell University Insect Collection (Ithaca, NY).

**Larva (n = 8).** Length: (1.6-1.8 cm). Cylindric, anterior end narrower than posterior (Fig. 5). Spine bands in four irregular rows. Anterior spiracle protruded (Fig. 6). Posterior spiracles separated by a distance about twice of their diameter (Fig. 7). Spiracular slits C-shaped (Fig. 8).

**Puparium (n = 3).** Length: 8.0 mm. Reddish brown (Fig. 9), ornamented with a row of short spines at the limits of each segment, sometimes forming a double row (Fig. 10). Anterior spiracle protruded, with six finger-shaped short projections (Fig. 11). Posterior end convex. Posterior spiracle sub-terminal (Fig. 9). Anal region as in Fig. 12.



Figs. 1-4. *Philornis fasciventris*. Fig. 1) male: sternite 5; Fig. 2) male: cercal plate and surstili, dorsal view; Fig. 3) male: cercal plate and surstili, lateral view; Fig. 4) male: aedeagus, lateral view.

**Host.** *Eumomota superciliosa* (Sandbach) (Coraciiformes: Momotidae); common name: turquoise-browed motmot (local names: pájaro reloj in the Yucatán, guardabarranco in Nicaragua and torogoz in El Salvador).

**Host association.** Larvae coprophagous; free-living in the nest.

**Summary of host avian biology.** The turquoise-browed motmot breeds colonially in the Yucatan Peninsula of Mexico in sinkholes and fresh-water wells. Colony sizes range from two to 60 pairs, with colonies of 10-20 pairs being most common (Murphy in press, b). The turquoise-browed motmot is primarily an insectivore (Orejuela 1980), but also consumes a wide variety of small vertebrate prey. Breeding begins in May or June at the onset of the rainy season and highly dependent altricial chicks receive food from both parents for an extended period (clutch size: mean =  $4.0 \pm 0.6$  (sd), range 3-5,  $n = 78$  nests; nestling period (days): mean =  $32 \pm 2.9$  (sd), range 27-41,  $n = 78$  nests). Unlike many species of birds that invest in nest sanitation, motmot nestlings do not appear to produce fecal sacs and parents do not remove organic matter from the nest.

It does not appear that flies negatively impact nestling growth, as there were no signs of parasitism. However, it is unclear how to classify the relationship between *Philornis fasciventris* descriptor (Wulp) and the turquoise-browed motmot. By consuming detritus, the fly larvae may potentially reduce the microbe population in the detritus, and motmots may mutualistically benefit from their presence. Alternatively, the relationship could be commensal if the presence of *P. fasciventris* does not impact the fitness of the motmots. Future study is necessary to test these and other hypotheses.

**Comments.** *Philornis* larvae are known only for a few species [eg. *P. torquans* (Nielsen) with all instars described by Skidmore (1985) and *P. carinatus* Dodge described by Couri (1991)]. Brief comments on the larval stages of *P. falsificus* Dodge & Aitken and *P. nielseni* Dodge were provided by Nielsen (1913), *P. molesta* Meinert by Meinert (1890), and *P. porteri* Dodge by Skidmore (1985). The morphology of the puparium is known for a larger number of species (see Skidmore 1985).

Larvae and pupae of *P. fasciventris* and *P. aitkeni* are very similar, differing by the separation of the posterior



Figs. 5-12. *Philornis fasciventris*. Fig. 5) larva: general aspect; Fig. 6) larva: anterior end with anterior spiracles; Fig. 7) larva: posterior end; Fig. 8) larva: posterior spiracle and spiracular slits; Fig. 9) puparium: general aspect; Fig. 10) puparium: detail of spiracles ; Fig. 11) puparium: anterior end; Fig. 12) puparium: caudal segment, anal region.

spiracles (closer to each other in *P. aitkeni*, separated by about the width of one spiracle, while in *P. fasciventris* they are separated by a distance of two spiracles). The arrangement of the spines and the shape of the posterior spiracular slits are also very similar.

#### Acknowledgments

MSC is grateful to all staff colleagues at the California Academy of Sciences, San Francisco, California for the facilities with the Auto-Montage equipment (Figs. 5-12), to Conselho Nacional de Desenvolvimento Científico e Tecnológico for the support provided (process number 300370/2004-0), and to Fundação Carlos Chagas Filho de Amparo à Pesquisa do Estado do Rio de Janeiro, FAPERJ for financial support for her project (proc. nr.

E-26/170.529/2003). Field research by TM was supported by National Science Foundation (DDIG-0206584).

#### References

- Couri, M.S. 1991. *Philornis carinatus* Dodge, 1968 (Diptera, Muscidae) data on morphology, biology and taxonomy. Rev. Bras. Entomol. 35: 109-112.
- Couri, M.S. 1999. Myiasis caused by obligatory parasites, p.51-70. Ia. *Philornis* Meinert (Muscidae). In J.H. Guimarães & N. Papavero (eds.), Myiasis in man and animals in the Neotropical Region. Bibliographic database, Editora Pleiade, FAPESP, São Paulo, 308p.
- Couri, M.S., C.J.B. Carvalho & P. Löwenberg-Neto. 2007. Phylogeny of *Philornis* Meinert (Diptera, Muscidae) species

- and track analysis of the species in South America. *Zootaxa* 1530: 19-26.
- Dodge, H.R. 1963. A new *Philornis* with coprophagous larva, and some related species (Diptera: Muscidae). *J. Kans. Entomol. Soc.* 36: 239-247.
- Dodge, H.R. & T.H.G. Aitken. 1968. *Philornis* flies from Trinidad (Diptera, Muscidae). *J. Kans. Entomol. Soc.* 41: 134-154.
- Meinert, F. 1890. *Philornis molesta*, en paa Fugle snyltende Tachinarie. *Vidensk. Medd. Dan. Naturhist. Foren.* 1: 301-317.
- Murphy, T.G. 2006. Predator-elicited visual signal: why the turquoise-browed motmot wag-displays its racketed tail. *Behav. Ecol.* 17: 547-553.
- Murphy, T.G. (in press) a. Racketed-tail of the male and female turquoise-browed motmot: male but not female tail length correlates with pairing success, performance, and reproductive success. *Behav. Ecol. Sociobiol.*
- Murphy, T.G. (in press) b. Lack of assortative mating for tail, body size, or condition in the monomorphic elaborate turquoise-browed motmot (*Eumomota superciliosa*). *The Auk*.
- Nielsen, J.C. 1913. On some South-American species of the genus *Mydaea*, parasitic on birds. *Vidensk. Medd. Dan. Naturhist. Foren.* 65: 251-256.
- Orejuela, J.E. 1980. Niche relationships between turquoise-browed motmots *Eumomota-superciliosa* and blue-crowned motmots *Momotus-momota* in the Yucatan Peninsula Mexico. *Wilson Bull.* 92: 229-244.
- Skidmore, P. 1985. The biology of the Muscidae of the world. *Ser. Entomol.* 29: 1-550.
- Teixeira, D.M. 1999. Myiasis caused by obligatory parasites, p.51-70. *Ib.* General observations on the biology of the species of the genus *Philornis* Meinert, 1890 (Diptera, Muscidae). In J.H. Guimarães & N. Papavero (eds.), *Myiasis in man and animals in the Neotropical Region*. Bibliographic database, Editora Pleaide, FAPESP, São Paulo, 308 p.

Received 21/XI/06. Accepted 21/VII/07.

---