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Philornis fasciventris (Wulp) (Diptera: Muscidae): Description of the Male, Larva and Puparium, with Notes on Biology and Host Association

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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 R4+5 (and sometimes also on the ventral and/or dorsal surfaces of CuA1). Dodge & Aitken (1968) distinguished the puparium of the aitkeni group from all other congeners by the exserted 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 rufigauda Cuvier descriitor (Galbulidae), and unidentified species of Philornis from the nests of Chelidoptera tenebrosa (Pallas) descriitor (Bucconidae), Trogon viridis descritor Linnaeus. (Trogonidae) and Momotus momotus descritor (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):descritor), 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; halters 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.** Dorsocentrales 2:4, the two first post-sutural ones short; acrostichals 0.1; three postpronotals; one presutural and one postabdominal intra-alaris; one strong prealar, subequal to anterior notopleural seta; one presutural and two postabdominal supra-alaris. 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. Kaeptipers 1:2, the postero-superior one about twice as long as the others. Lower calyper 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 posterorevolaris, posterodorsal and dorsal rows of setae; fore tibia with one median and one submedian anterodorsal setae; dorsal surface with a strong preapical dorsal setae. Mid femur with an anterodorsal row of fine setae and two posterior preapical ones; mid tibia with one median posterior setae; and one preapical dorsal setae; ventral and anterodorsal surfaces with a long apical setae. Hind femur with a complete row of anterodorsal setae; anterodorsal surface with a complete row of fine and sparse setae, posterior surface with one preapical seta. Hind tibia with one median short anterodorsal setae and five anterodorsal 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. Stermite 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° 05W, 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). Cylindrical, 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.
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 ± 0.6 (sd), range 3-5, n = 78 nests; nesting period (days): mean = 32 ± 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. molest*a 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. 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.
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.

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