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A new host for *Philornis torquans* (Diptera, Muscidae) from the Brazilian Cerrado

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Abstract. *Philornis* larvae and pupae were collected in nestlings of *Neothraupis fasciata* (Lichtenstein), the White-banded Tanager (Passeriformes, Thraupidae), in three breeding seasons, between October and November 2003-2005 in a reserve in central Brazil. Here, we present biological data, diagnosis to the recognition of the species and a key to the segregation of species occurring in the Cerrado. The larvae were intradermic in the nestlings and the pupae were collected in the nests after the birds have abandoned them. The immatures collected were taken to the laboratory and reared under laboratory conditions, until emergence. The species identified as *Philornis torquans* (Nielsen), is here firstly recorded from the Brazilian Cerrado, and firstly recorded its association with *N. fasciata*. With this record, the number of *Philornis* species occurring in the Cerrado rises to three.

Key-Words. Larvae; Cerrado vegetation; Myiasis; New record; Parasites.

INTRODUCTION

The association of *Philornis* Meinert (Diptera, Muscidae) larvae with at least 115 bird species, mostly in the Neotropics is well known (Dudaniec & Kleindorfer, 2006). *Philornis* is distributed in Central and South America and south of the USA, with at least 50 species recorded so far (Carvalho *et al.,* 2005).

The first apparent mentions to this association in Brazil seems to date to the 17th century, first in 1618 by A.F. Brandão in *Cacicus cela* (Linnaeus) (Passeriformes, Icteridae) in Pernambuco and then in 1648 by Georg Marcgrave, also in the northeastern of Brazil (Teixeira, 1999).

The larvae can be coprophagous in the nests, semi-hematophagous or intra-dermic hematophagous in the nestlings (Couri, 1984, 1985). However, there are only few records with intradermic larvae attacking adults. For example, breeding female of *Thamnophillus palliatus* (Lichtenstein) was parasitized with *Philornis glaucinis* Dodge & Aitken larva (Mendonça & Couri, 1999).

Because of the damage that *Philornis* larvae can cause to their hosts, the number of publications recording parasitized birds has also been increased. Despite all the importance of this relationship, the association is known only for about 40% of the *Philornis* species (Teixeira, 1999). Likewise, little is known about their biology and the real damage that they can cause to the nestlings, as even in severe infestations with a high number of subcutaneous larvae, the nestling can survive. The surviving nestlings often have deformed beaks, reduced growth rates, and anaemia and in some cases, mortality can reach 100% per nest (Fessl *et al.,* 2001). Bulgarella *et al.* (2015) considered that the accidental introduction of *Philornis downsi* (Dodge & Aitken) represents a threat to the conservation of birds in the Galapagos Islands, especially for endemic species. The authors also reported the parasitism of *P. downsi* in two hosts in mainland Ecuador – the Streak-headed Woodcreeper *(Lepidocolaptes souleyetii)* and the Fasciated Wren *(Campylorhynchus fasciatus).*

The first records of *Philornis* species to the Brazilian Cerrado were *P. angustifrons* and *P. deceptivus* Dodge & Aitken, both subcutaneous parasites in nestlings of both *Suiriri affinis* (Burmeister) and *S. islerorum* Zimmer, Whittaker & Oren (Passeriformes, Tyrannidae) (Higgins *et al.,* 2005). Both host species are considered to be endemic to the Cerrado biome (Sick, 1997; Silva & Bates, 2002). Duca *et al.* (2009) had firstly recorded *Neothraupis fasciata* as a host of *Philornis,* but the species was not identified. The authors also

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observed an average of 2.5% (± 1.9) of the causes of *N. fasciata* nestlings death in the nest to the parasitism of *Philornis* larvae. Also, for another sympatric tanager, the White-rumped Tanager *(Cypsnagra hirundinacea),* 15 nests had nestlings parasitized by *Phylornis* sp. larvae, but it did not cause any nest failure.

This paper records the third *Philornis* species to the Brazilian Cerrado and a new association with a bird host, *Neothraupis fasciata*. We discuss some biological data, provide characters to the recognition of *P. torquans* and present a key to the identification of *Philornis* species occurring in the Cerrado.

MATERIAL AND METHODS

Study species

The White-banded Tanager *Neothraupis fasciata* (Lichtenstein, 1823) (Passeriformes, Thraupidae) is endemic to South America, occurring in Suriname, Brazil, Bolivia, and Paraguay (Sick, 1997). Though *N. fasciata* is widespread in the Cerrado, its populations are declining moderately rapidly as a result of habitat loss and degradation for agricultural development and is considered currently "near threatened" (IUCN, 2017). Furthermore, models predict a 27-31% decline of its distributional range due to global warming (Marini *et al.,* 2009a), and a low representation in reserves currently and in the future (Marini *et al.,* 2009b).

Data collection

The flies specimens were collected at the Estação Ecológica Águas Emendadas (ESECAE), Distrito Federal, Brazil, a protected area in the Brazilian Cerrado, during a nesting monitoring program (Marini *et al.,* 2012). *Neothraupis fasciata* is a common species in this reserve were it breeds during the wet season from September to January (Duca & Marini, 2011), and where its biology has been studied in detail (Duca & Marini, 2011, 2014a, b). The larvae and pupae were collected by one of authors (CD) from nestlings of *N. fasciata* during October-November 2003-2005 (Figs. 1-4). The larvae were intradermic in the nestlings and the pupae were collected

Figures 1-4. (1) Nest of *Neothraupis fasciata* (Lichtenstein), (Passeriformes, Thraupidae) with parasitized nestlings; (2) Nestling of *Neothraupis fasciata* (Lichtenstein), (Passeriformes, Thraupidae) parasitized with *Philornis torquans* (Nielsen) subcutaneous larvae; (3) Head (dorsal view) of a nestling of *Neothraupis fasciata* (Lichtenstein), (Passeriformes, Thraupidae) with parasitized with *Philornis torquans* (Nielsen) subcutaneous larvae; (4) Head (dorsal-lateral view) of a nestling of *Neothraupis fasciata* (Lichtenstein), (Passeriformes, Thraupidae) with parasitized with *Philornis torquans* (Nielsen) subcutaneous larvae.

in the nests after the birds have abandoned them. The immatures collected were taken to the laboratory and reared under laboratory conditions until emergence The specimens (82 males and 82 females) were housed in the Coleção Entomológica do Departamento de Zoologia da Universidade de Brasília (DZUB), labeled: Brazil, Distrito Federal, Planaltina, Estação Ecológica de Águas Emendadas, Charles Duca col.: 30.xi.2003 (12 males, 13 females); 01.xii.2003 (9 males, 5 females); 02.xii.2003 (26 males, 22 females); 12.xi.2004 (15 males, 16 females, emerged in 13-21.xi.2004); 15.xi.2004 (7 males, 9 females); 16.xi.2004 (5 males, 2 females, emerged in 24-26.xi.2004); 31.x.2004 (8 males, 15 females, emerged in 01.xi.2004).

Laboratory methods

Male and female terminalia of *Philornis* were clarified in KOH 10% for 48 hours, immersed in glycerin on blades for dissection. Line drawings were made under optical microscope using a camera lucida. Digital images of the species were made using a Leica MZ16 stereomicroscope and the software program AutoMontage Pro by Syncroscopy, Version 5.03.0061. The terminology follows McAlpine (1981).

RESULTS

Philornis torquans can be recognized by the following combination of characters (Figs. 5-6): body length 6.5-7.0 mm; general color dark-brown with greyish pollinosity; width of frons at level of anterior ocellus 0.06-0.09 of head width in male and 0.19-0.22 in female; antenna and palpus yellow; cheek yellow haired; scutum with four vittae; halter yellow; legs yellow in male and brown in female; wing clear, sometimes with a faint brown mark on r-m and sometimes also on dm-cu cross vein; abdomen brown with tergite 1 and 2 yellow; hind tibia variably curved in male with 4-6 anterodorsal setae and 2-3 anteroventral setae on middle third. Female with 2-3 anterodorsal setae on middle third. Larva intradermal. Puparium brown, posterior concavity deep, with rugose margins; spiracular slits "U or "V shaped (Dodge, 1968; Couri, 1999; Couri *et al.,* 2009).

Male terminalia. Sternite 5 higher than wide with scattered setae on all disc (Fig. 7); cercal plate with anterior and posterior margins deep (Fig. 8); anterior margin of hypandrium sinuose, with two projections; aedeagal apodeme enlarged at apex (Fig. 9).

Female ovipositor and spermathecae as in Fig. 10.

Key to *Philornis* adult species occurring in the Brazilian Cerrado

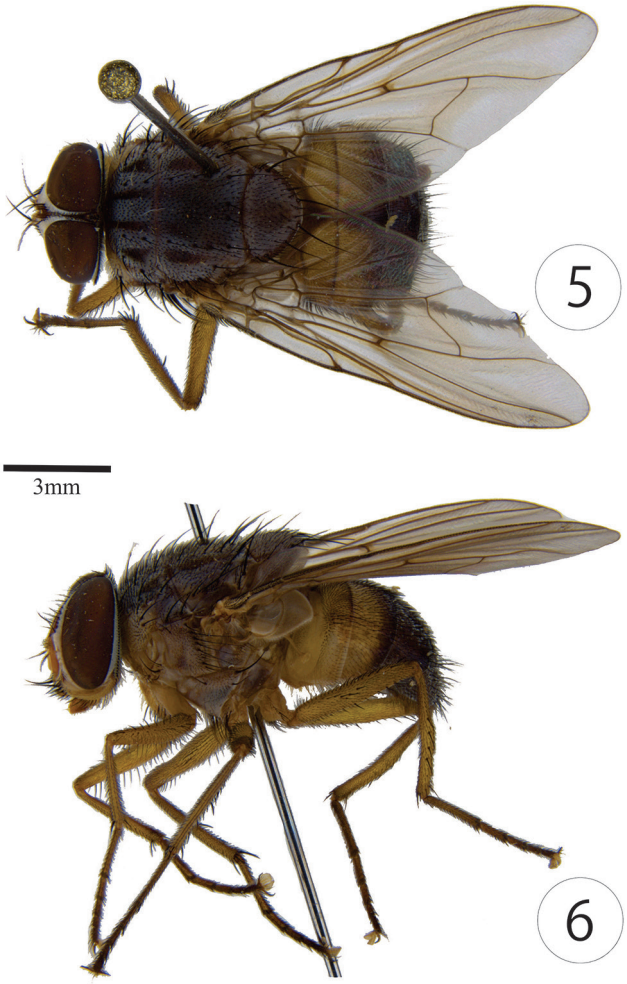
1. Scutum yellowish brown ..... *P. angustifrons* (Loew)
1'. Scutum brown to dark brown with grayish pollinosity 2
2. Hind tibia with 2-4 anterodorsal setae on middle third; legs yellow with darker tarsi in both sexes ..... *P. deceptivus* Dodge & Aitken
2'. Hind tibia with 4-6 anterodorsal setae in male and 2-3 in female; male hind tibia somewhat bowed; legs yellow in male and brown in female; calypter white with margin of upper one brown..... *P. torquans* (Nielsen)

DISCUSSION

The main cause of nest loss in *N. fasciata* was predation (Duca & Marini, 2011), as expected for tropical birds (Marini, 2017). Other threats that affected reproduction were parasitism by *Philornis* sp on nestlings and brood parasitism by *Molothrus bonariensis* (Gmellin, 1789) (Passeriformes, Icteridae).

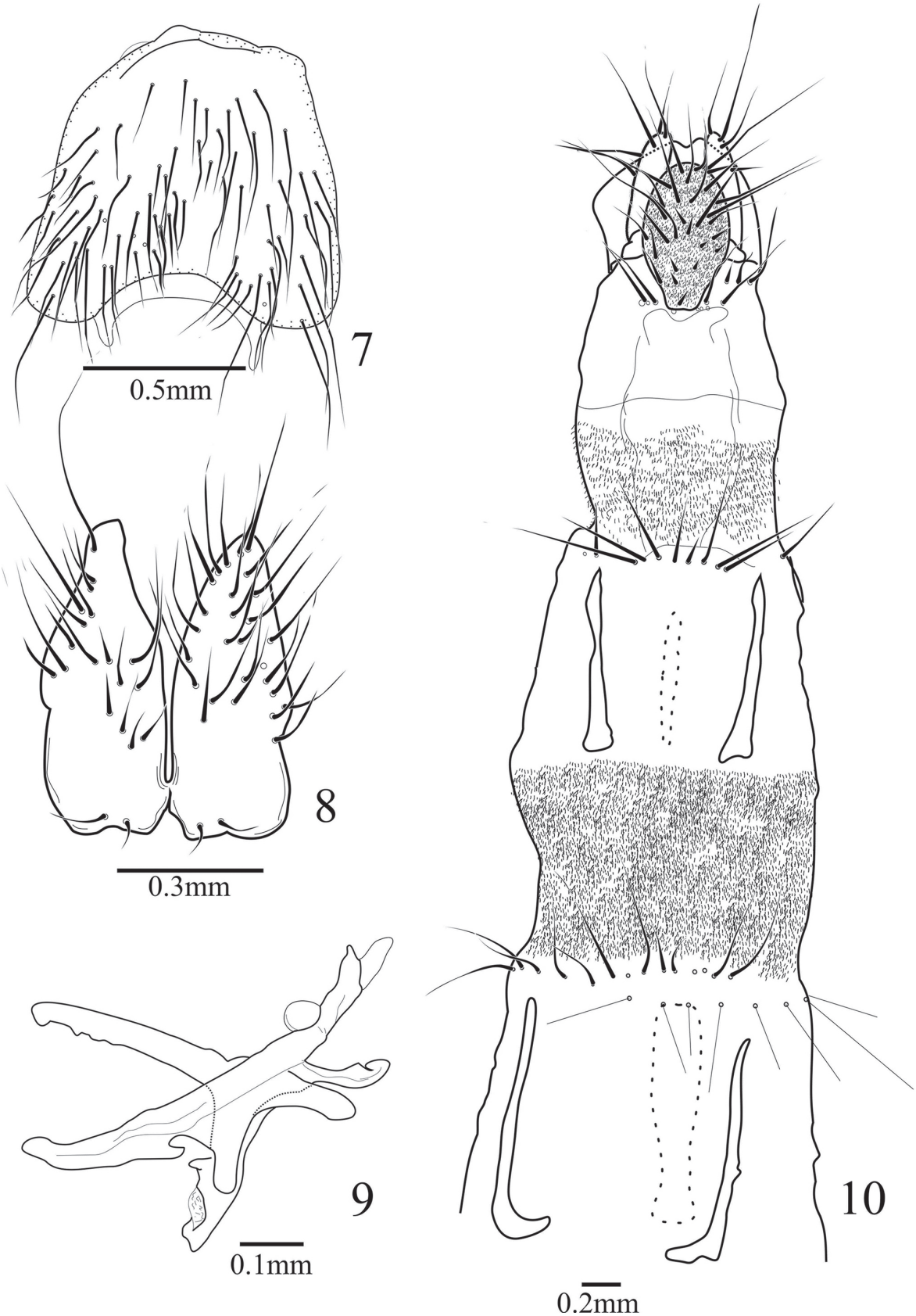
Philornis torquans was known to parasitize only seven hosts, whereas *P. angustifrons* and *P. downsi* have 28 and 27 hosts, respectively (Löwenberg-Neto, 2008). Other Thraupidae species also parasited by *Philornis* sp. include *Ramphocelus carbo* (with three *Philornis* species), *Thraupis episcopus* (with two), and *Schistochlamys melanopis, Tachyphonus rufus* and *Thraupis palmarum* (with one each) (Löwenberg-Neto, 2008), and *Gubernatrix cristata* (with one) (Domínguez *et al.,* 2014).

Over the past decades larvae of *Philornis* species have been causing enormous damage to birds in South and Central America. In some regions, as the Galapagos



Figures 5-6. (5) *Philornis torquans* (Nielsen), adult male, dorsal view; (6) *Philornis torquans* (Nielsen), adult male, lateral view.

Island, they are being incriminated as a major cause of the decline of wild bird populations (Luz *et al.,* 2013). *Philornis downsi,* for example, was accidentally introduced in Galapagos and since then it has been the main cause of the decline of landbird species on the Galapagos Islands (Fessl *et al.,* 2001). Because of this association, some bird species only found in the Galapagos are now threatened, including the Darwin's finches



Figures 7-10. (7) *Philornis torquans* (Nielsen), sternite 5, dorsal view; (8) *Philornis torquans* (Nielsen), cercal plate, dorsal view; (9) *Philornis torquans* (Nielsen), aedeagal complex, lateral view; (10) *Philornis torquans* (Nielsen), ovipositor, dorsal and ventral view.

(Passeriformes, Thraupidae) and the Mockingbirds (Passeriformes, Mimidae). Likewise, Argentina is giving particular attention to this problem, with several studies, including investigations on the effects of climate variability on the lifecycles of *Philornis* species and the impact on the health of their bird hosts (Couri *et al.,* 2009; Antoniazzi *et al.,* 2011; Silvestri *et al.,* 2011; Manzoli *et al.,* 2011). Considering this, information on the biology of *Philornis* species is essential to support control methods.

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