





THE FIRST RECORD OF PARASITISM BY *FORCIPOMYIA*
(DIPTERA: CERATOPOGONIDAE) IN CUBAN ODONATES

**Primer reporte de parasitismo por *Forcipomyia*
(Diptera: Ceratopogonidae) en odonatos cubanos**

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ABSTRACT

Several species of biting midges of the genus *Forcipomyia* are frequently found attached to the wings of adult odonates, acting as parasites by sucking haemolymph from the wing veins. Here we report the first finding of *F. incubans* on odonates in the peninsula of Zapata, Cuba. We found the midge on the wings of *Erythrodiplax simplicicollis*, *E. umbrata*, *Crocothemis servilia*, and in the wings and body of *Perithemis domitia*, all species belonging to the family Libellulidae. This is the first record of this interaction for the Antilles.

Keywords: midges, ectoparasite, dragonflies, Anisoptera.

RESUMEN

Diversas especies de moscas del género *Forcipomyia*, se encuentran con frecuencia adheridas a las alas de los odonatos adultos, succionando hemolinfa de las venas alares como ectoparásitos. En el presente trabajo se registra por primera vez *Forcipomyia incubans* en odonatos de la península de Zapata, Cuba. Los dípteros fueron encontrados en las alas de *Erythrodiplax simplicicollis*, *E. umbrata* y *Crocothemis servilia*, así como en las alas y el cuerpo de *Perithemis domitia* (todas de la familia Libellulidae). Este es el primer reporte de esta interacción para las Antillas.

Palabras clave: mosca enana, ectoparásito, libélulas, Anisoptera.

INTRODUCTION

Adult odonates are the dominant predators in small streams and ponds (Suhling *et al.*, 2015), and a main component of freshwater ecosystems. They are prey of vertebrates, but surprisingly they have no parasitoids, except during the egg stage (e.g. Santolamazza *et al.*, 2011). However, there is a subgenus of biting midge, *Pterobosca*, genus *Forcipomyia*, with worldwide distribution, which has 23 species (Borkent and Wirth, 1997; Borkent, 2012), many of them specialised in attacking adult dragonflies. Some other species placed in different subgenera of *Forcipomyia* are also found on wings of odonates (Borkent, 2012). In Europe, *Forcipomyia paludis* is known to attack more than 70 species of dragonflies (Martens *et al.*, 2007; Vinko *et al.*, 2017; Cordero-Rivera *et al.*, 2019). In Asia, there

are several species associated to odonates like *F. latipes*, *F. fidens* (Macfie, 1936a), *F. aerobates* (Macfie, 1936b), *F. tokunagai* (Naraoka, 1999) and *F. debenhamae* (Orr and Cranston, 1997), and a review of pictures of odonates from Cambodia revealed a high incidence of one unidentified species of *Forcipomyia* (Kosterin *et al.*, 2012). Odonates from Yunnan (China) and from the Fiji islands, have been also observed with *Forcipomyia* in their wings (A. Cordero Rivera, per. obs). One species has been described from odonates from Aldabra Atoll in the Indian Ocean (Wirth and Ratanaworabhan, 1976). Apparently the subgenus *Pterobosca* is rare in Africa, with only one species described from Liberia in association with odonates (Macfie, 1926).

In America three species of the subgenus *Pterobosca* have been recorded, but only one, *F. incubans*, as a parasite of adult odonates, being common and widespread (Macfie, 1936a; Clastrier and Legrand, 1984, 1990; Marino and von Ellenrieder, 1999; Guillermo-Ferreira and Vilela, 2013). To our knowledge, this interaction between odonates and biting midges has never been recorded in the Antilles.

OBJECTIVES

- We describe the finding of *Forcipomyia* on the wings of odonates in Cuba.

MATERIALS AND METHODS

From 18-22 June 2017 and 10-13 January 2018, seven localities were visited within the Zapata Swamp in a general survey of Odonata for the region. Odonates were captured with entomological nets, identified *in situ*, and some voucher specimens were retained and preserved at the Museum Felipe Poey of the University of La Havana, Cuba.

We found that part of the individuals had small Diptera attached to the wings or body. Therefore, we collected a few of these specimens for further identification. The flies were studied at the Scanning Electron Microscopy facilities of Centro de Apoyo Científico-Tecnológico á Investigación (CACTI, University of Vigo).

The identification of the Odonata species was made through the available specialized bibliography, including Alayo (1968), Needham *et al.* (2000), Trapero-Quintana and Naranjo López (2004) and Westfall and May (2006). The flies were found to belong to the genus *Forcipomyia*, which is a worldwide parasite of odonates (Wildermuth and Martens, 2007). We compared the specimens collected with the other species of *Forcipomyia* known to occur in odonates in America, following Clastrier and Legrand (1984, 1990).

RESULTS

In June 2017, we found a midge belonging to the genus *Forcipomyia* attached to the wings of libellulids at the Hondones locality, 22.232496 N -81.106734 W (datum WGS84), but not at the other localities sampled. Species parasitized at Hondones locality included *Erythrodiplox simplicicollis*, *E. umbrata*, *Crocothemis servilia*, and *Perithemis domitia*. All midges were found attached to the wings of the odonates (Fig. 1), but in *P. domitia*, a midge was found on the thorax (Fig. 1B), which is unusual. In January 2018, we found only one male of *P. domitia* with one midge, at Maneadero, 22.405980N -81.622298 W (datum WGS84), (Hondones was not sampled). We did not find parasitism on damselflies in both sampling periods. The specimens of *Forcipomyia* collected match the description of *F. (Pterobosca) incubans* by Clastrier and Legrand (1984), the most widespread species of this genus parasitizing odonates in the American continent.

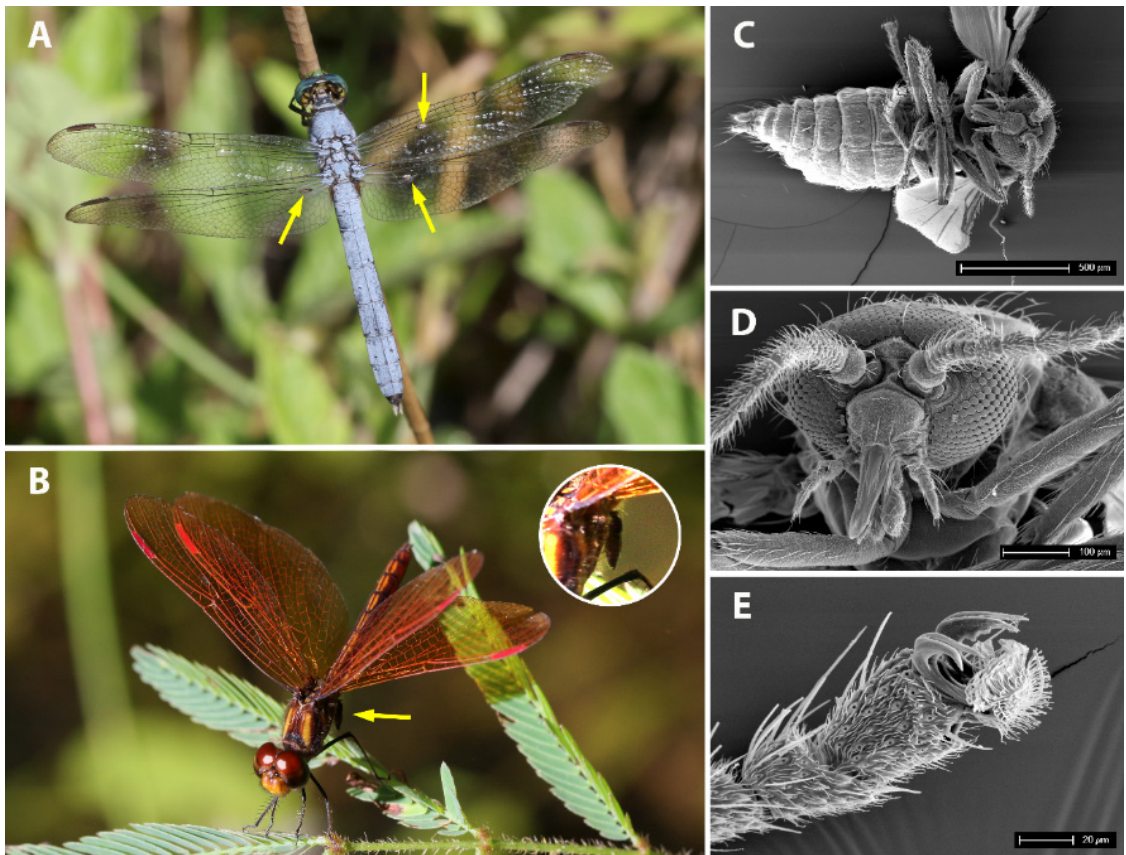


Figure 1. A-E. Parasitism by *Forcipomyia incubans* on Cuban Odonata. All pictures taken at Hondones (Zapata Peninsula). A, male *Erythemis simplicicollis* with three midges on the wings, indicated by the arrows. B, male *Perithemis domitia* with a midge on the left side of the thorax, indicated by the arrow, and shown enlarged in the circular insert. C-E, ventral view, head and leg of a midge collected from a male *E. simplicicollis*.

DISCUSSION

We report here the first case of biting-midge parasitism on Cuban odonates. *Forcipomyia* (*Pterobosca*) *incubans* is the species commonly found in America associated with Odonata wings, and a predictive model based on habitat characteristics, includes Cuba as a highly probable area for the species (Guillermo-Ferreira and Vilela, 2013). Furthermore, the species reported as being parasitized by *F. incubans* commonly belong to the genera *Erythrodiplax* and *Erythemis* (Marino and von Ellenrieder, 1999; Guillermo-Ferreira and Vilela, 2013), the same that were parasitized in Cuba. However, in some regions, *F. incubans* may parasitize other libellulids, particularly of the genera *Uracis* and *Orthemis*, or even other families like Aeshnidae (Clastrier and Legrand, 1990).

Huerta (2006) reviewed the records of *F. incubans* on Odonata, and found only two records on a zygopteran, and the majority in Libellulidae. As far as we know, the finding of a midge attached to the thorax of an odonate has not been reported in America. However, this behaviour has been observed in Brazil (Cordero-Rivera, unpublished). Some species of *Forcipomyia* that parasitize odonates have been found on the thorax of damselflies in Borneo (Orr and Cranston, 1997), and also in Europe (Wildermuth and Martens, 2007). There is one observation of several biting midges attacking an emerging dragonfly in NW Spain, including feeding on the eye and the abdomen of the dragonfly (Cordero-Rivera *et al.*, 2019). Therefore, biting midges may attack other

parts of dragonflies and not only the wings, which is the usual behaviour. It remains a future challenge to demonstrate if this interaction has deleterious effects on the odonates, or if the midges are mainly phoretic, as some have suggested (Orr and Cranston, 1997). Detailed observations of the European *F. paludis* suggest that the midges drain a significant amount of haemolymph and therefore are true parasites (Wildermuth and Martens, 2007), a fact that was assumed by the first students of this interaction (Macfie, 1926).

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