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Parasitism of *Cuterebra* sp. (Diptera: Oestridae s.l.) on rodents of Central Panama

Parasitismo de *Cuterebra* sp. (Diptera: Oestridae s.l.) en roedores de Panamá Central

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Abstract. In this study, which we carried out between January 2007 and July 2008 on populations of 3 species of wild mammals in Tonosí, Los Santos province, Panama, we report the presence of larvae of *Cuterebra* sp. parasitizing *Zygodontomys brevicauda*, *Liomys adspersus,* and *Oligoryzomys fulvescens*; the prevalence values recorded in these rodent species were 1.77, 2.15, and 1.17, respectively. This is the first record of *Cuterebra* sp. as parasite of rodents in Panama, and *L. adspersus* represents a new host record.

Key words: myiasis, *Cuterebra*, rodents, Panama.

Resumen. Entre enero 2007 y julio 2008 se desarrolló una investigación en las poblaciones de roedores silvestres de la localidad de Tonosí (Los Santos, Panamá central), encontrándose larvas de *Cuterebra* spp. parasitando a los roedores *Zygodontomys brevicauda, Liomys adspersus* y *Oligoryzomys fulvescens*, con una prevalencia de 1.77%, 2.15% y 1.71%, respectivamente. Este es el primer reporte de *Cuterebra* sp., parasitando roedores en Panamá, y el primero en presentar a *L. adspersus* como hospedero.

Palabras clave: miasis, *Cuterebra*, roedores, Panamá.

Introduction

The genus *Cuterebra* s.s. includes obligate dermal parasites of New World mammals, especially lagomorphs and rodents (Wood, 1987; Pape 2001), as well as raccoons (Slansky and Huckabee, 2006), cats (Slansky, 2007), and humans (Cornet et al. 2003; Plotinsky, et al. 2007). According to Catts (1982) and Wood (1987), this genus comprises 60 species, which mainly have been studied in the Nearctic.

As in other species of Oestridae, myiasis is very complicated; females do not directly oviposit eggs onto the hosts. Instead, the females place the eggs on grass, shrubs, stones or soil near rodent burrows. These eggs then become attached to the rodents when they walk over the sites (Catts, 1982; Baird, 1997). Hatching is stimulated by body heat and enter the host through openings (mouth, nose, eyes or anus) (Hunter and Webster, 1973; Gringrich, 1981; Catts, 1982; Slansky, 2006). When the maggots complete their development in the host, the larvae exit through the skin and continue the pupal stage in the soil (Catts, 1982; Wood, 1987).

In the Neotropics, there is little known about *Cuterebra* species, specifically about their principal host or their impact on rodent population dynamics. The aim of this work is to provide more information on the behavior and host for this genus in Panama.

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Materials and methods

This study was carried out in January 2007 and July 2008, as part of field activities of a project dealing with hantavirus in several sites in Central Panama. We selected 6 sample sites in Tonosí County (Los Santos Province, Panama) (Fig. 1). These sites contained various seasonal

Province: Los Santos, Herrera and Veraguas
● Site of study: Agua Buena

Figura 1. Map of localities in Panama, Los Santos Province, Tonosi.

crops (rice, corn, Cucurbitaceae), as well as secondary forest, pastures, stubble fields, and nearby towns. Samples were taken monthly in 4 day periods, using 600 Sherman traps and bait of corn, rice, sorghum, honey and peanut butter. Traps were placed in lines of 10, each one separated by 10 meters; collecting sites included towns, fields and forest.

Traps were placed between 15:00 hrs. to 07:00 hrs. Identification of captured rodents followed Reid (1997), and reproductive age was determined. Larvae were extracted and placed in containers of 75% alcohol. In addition, 3 bots from *Z. brevicauda* were bred in the laboratory. These bots were placed in a terrarium (15 cm wide x 22 cm large and 18 cm high) with soil. The warble and the fly were identified with the key of Wood (1987).

Results

A total of 2 699 rodents were caught, representing 5 species and 2 families (Muridae and Heteromyidae). *Zygodontomys brevicauda* was the most abundant species with 2 084 individuals (77.2% of total). We recovered 48 bots that infested 43 rodents. Only 3 species of rodents were infested by *Cuterebra* sp: *Z. brevicauda*, *Oligoryzomys fulvescens* and *Liomys aspersus*, with a prevalence of 1.77%, 1.71% and 2.15%, respectively (Table 1). In addition, 97% of the infested rodents were parasitized with 1 larva, usually in the neck, scapular area, lower abdomen or hind legs. No warbles were found on *Sigmodon hispidus* and *Oryzomys concolor*.

Fifty-eight percent of the parasitized rodents were males. All infested rodents were captured during the rainy season (May-December). One of the 3 bred larvae completed its development after 24 days in the pupal stage.

Discussion

Specimens collected in this study were similar to *C. austeni*; nevertheless, to the best of our knowledge there are no keys for identifying adults or larvae of Neotropical *Cuterebra*, and we prefer do not assign it to species.

We report infestations of *Cuterebra* on 3 species of rodents and the first record of *L. adspersus* as host of a *Cuterebra* warble. It is possible that *L. adspersus* also acts as a natural host for botflies. However, there is no evidence of this due to the limited research on rodents in Panama and to the restricted distribution of this rodent (Gonzalez et al., 2004). Other *Liomys* species (*L. irroratus*) has been reported as a host of *Cuterebra fontinella* in United States (Parker and Chaney, 1979). With regard to *Z. brevicauda*, previous reports implicate *Cuterebra apicalis* as parasitizing this species in Trinidad (Everad and Aitken, 1972).

The low prevalence of parasitism in the rodents studied is consistent with previous studies. In a study conducted in New Mexico, Wilson et al. (1997) found 3.1% *C. austeni* parasitism on *Peromyscus truei* and 1% on *P. leucopus*, while Bowman (2000) determined a 2.3% of infestation on *P. maniculatus* and 5.4% on *Clethirionomys gapperi* in Canada.

Although the climate and species of flies and hosts in the Neotropics are very different from those in the Nearctic, levels of parasitism are similar. Low levels have been reported by Disney (1969) in Belize (1.4% of *C. chiquibulensis* in *Ototylomys phyllotis* and 2.1% of *C. flaviventris* in *Sigmodon hispidus*), by Manrique-Saide et al. (2000) in southern Mexico (13.1% for *Cuterebra* sp. in *O. phyllotis*), and recently by Adler et al. (2003) in Panama (4.6% for *Cuterebra* sp infesting

Table 1. Species of rodents collected in Tonosí during January 2007-July 2008

Species	*Individuals (No.)*	*with Cuterebra*	*Prevalence (%)*
Liomys adspersus	93	2	2.15
Oligorizomys fulvecens	233	4	1.71
Oecomys concolor	18	0	0
Sigmodon hispidus	271	0	0
Zygodontomys brevicauda	2084	37	1.77
TOTAL	**2699**	**43**	**1.59**

Proechymis semispinosus).

In contrast, studies on populations of *P. leucopus* from Tennessee and Kentucky islands reported high levels of infestations varying from 0-82% (Kollar, 1995). Likewise, in South America, Brigada et al. (1992) reported prevalences of 2.8-25% in *Akodon molinae* infested by *Rogenhofera bonaerensis*, while Vieira (1993), determined values of 11% for this fly in *Thalpomys cerradensis* and *Bolomys lastrurus*, and 7% in *Oryzomys subflavus* by *Metacuterebra* (=*Cuterebra*) *apicalis* from Brazil. Mid-level infestation (25.7%) was found in *Oryzomys russatus* caused by *Metacuterebra* (=*Cuterebra*) *apicalis* from Brazil (Bergallo et al., 2000).

Previous records suggest an evolutionary tension between fly population levels and the impact on host populations. The number of parasitized rodents increased relative to the number of captures (and vice versa); this could suggest that the response of flies is density depended on the host population. Nevertheless, more studies are necessary to conclude this point. On the other hand, even though the larvae can kill some rodents, the effect on the population is low because of the low level of prevalence and mortality. This is best understood by considering that the bots need live animals for their development, at least until the end of their third stage (Wood, 1987; Slansky, 2007).

Information about the effects of parasites on rodents is scarce; nevertheless, rodent mortality attributed to botflies is not very common (Catts, 1982; Wood, 1987). Death occurs due to tissue and muscle damage, especially in young animals. Botflies can also cause behavioral effects; diminished mobility increases starvation and the ability to obtain food. Smith (1978), who found traces of *Cuterebra* tissues in owl pellets and fox scats, explained that there are various behavioral implications associated with this phenomenon.

The highest number of parasitized rodents captured occurred during the wet season, in contrast to Adler et al. (2003), who captured parasitized rodents throughout the whole year, but with increases during the dry season. Such differences could be attributed to the anthropogenic influences observed in our sampling sites, where agricultural activities associated with rain determine the increase of resources, which promote a rise in the rodent population, and consequently, in the *Cuterebra* population. However, the lack of information about the duration of each stage, preclude establishing the recruitment period, and we cannot determine if infestation was during the last weeks of the dry season or during the beginning of wet season.

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