

Case Report

Tunga penetrans in Giant anteater (*Myrmecophaga tridactyla*) from ArgentinaDante L. Di Nucci^{a,*}, María Cecilia Ezquiaga^b, Agustín M. Abba^b^a Fundación Temaikèn, Ruta 25 Km 0,700, Belén de Escobar, Buenos Aires Province, Argentina^b Centro de Estudios Parasitológicos y de Vectores, CONICET, UNLP, Boulevard 120 s/n entre 60 y 64 (1900), La Plata, Buenos Aires Province, Argentina

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ABSTRACT

Tunga penetrans (Siphonaptera, Tungidae) is a flea that infests humans and a variety of domestic and wild animals. Burrowing of the female flea under the skin causes tungiasis, a disease that manifests in skin lesions that if untreated, can progress to severe complications. In this paper, we report the first case of *T. penetrans* in a wild giant anteater (*Myrmecophaga tridactyla*) from Argentina. We describe the lesions and discuss the potential role of the giant anteater as a host or reservoir for this flea.

Tungiasis is an ectoparasitic disease of humans and a variety of domestic and wild animals caused by infestation of fleas belonging to the genus *Tunga* (Siphonaptera, Tungidae). It is a disease that manifests in characteristic skin lesions that can result in severe complications such as deformation of digits and loss of toenails, tetanus, and gangrene (Greco et al., 2001; Eisele et al., 2003; González et al., 2003; Heukelbach et al., 2004). The adult female flea burrows into the skin and awaits mating from a male. Once fertilized, her body enlarges forming a neosome under the skin (Linardi and De Avelar, 2014).

In humans infested by the gravid female, *T. penetrans* produces individual lesions last about 4 to 6 weeks and are often associated with considerable morbidity. The fleas are distributed mainly in the feet and hands and can result in difficulty walking and gripping (Eisele et al., 2003). The infestation on humans is often more severe in younger individuals (Muehlen et al., 2003; González et al., 2004; Oscherov et al., 2008). These symptoms and lesions were also described in wild jaguars (Widmer and Azevedo, 2012).

The genus *Tunga* includes 14 species of fleas distributed around the tropics (De Avelar et al., 2013; Ezquiaga et al., 2015b). Of these, only *T. penetrans* and *T. trimamillata* commonly infest both humans and domestic animals. Recently, a new species from Brazil, *T. hexalobulata*, was described as also parasitizing bovines (De Avelar et al., 2013). The remaining species are parasites of wild mammals, most of which are rodents and xenarthrans (Linardi and Guimarães, 2000; Whiting et al., 2008; Pampiglione et al., 2009; De Avelar, 2010; Ezquiaga et al., 2015b). A recent review of the neosomes of tungid species (Linardi and De Avelar, 2014) described their morphology, taxonomy, geographical distribution, hosts, prevalence, sites of attachment, and impact on wild and domestic animals.

In June 2014, a young (estimated 45 days old), male, giant anteater

(*Myrmecophaga tridactyla*) was transferred by the Department of Wildlife (Ministerio de Ambiente y Desarrollo Sustentable, Argentina) to the Temaikèn Foundation for veterinary care and hand-rearing because its mother was killed by hunters. The anteater was original from northwest Argentina, an area near Copo National Park in Santiago del Estero Province (25°58'00"S; 61°53'00"W). This area is located within the dry Chaco ecoregion, characterized by subtropical climate with marked dry seasons and 500–700 mm annual rainfall and an average elevation of 150 m. The average temperatures in the winter are 15 °C with occasional frost. In the summer, the temperatures average 28 °C, with maximums sometimes exceeding 50 °C.

Once the giant anteater arrived at the veterinary hospital, he was restrained and induced with a facemask delivering 5% Isoflurane in oxygen (Piramal Healthcare UK Limited, UK). The specimen was then maintained under anesthesia with 2.5% Isoflurane in oxygen for a complete physical examination. The animal presented with multiple pale white, circular, raised, papular lesions less than 3 mm diameter. The pale raised lesions had a black central area surrounded a halo of erythematous skin were presumptively identified as flea neosomes. Most of the lesions were located on the plantar hind foot and on the dorsal surface of the fore foot (Fig. 1).

The neosomes were removed with and preserved in 70% ethanol, and later identified using a stereoscopic microscope according to Linardi and De Avelar (2014). We identified 6 neosomes as *T. penetrans* (Fig. 2). Data regarding the morphology and morphometry of neosomes presented in this case are: size (length, width, height) 5.2, 4.6, 3.3 (n = 3); shape of abdomen globular; lateral view of the head and thorax in relation to the abdomen evaginated and shape of caudal disk flattened.

After surgery, the anteater was treated with Ivermectin 0.2 mg/kg

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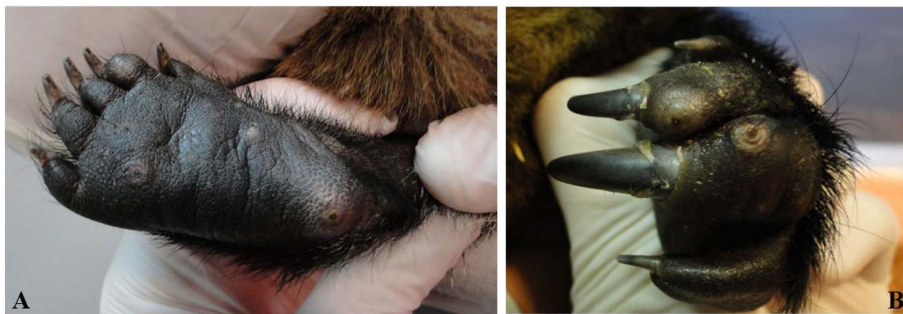


Fig. 1. Lesions of *Tunga penetrans* in the surface plantar of the hind foot (a) and the dorsal surface of the fore foot (b) of *Myrmecophaga tridactyla* from Santiago del Estero province, Argentina.

SC (Ivomec, Merial Argentina), with a second dose repeated 14 days later and reintroduced with approximately twelve months of life.

The lesions in this anteater were very similar to those caused by *T. penetrans* infestation in both human and in domestic animals. With the typical lesions having a blackened central point (the posterior end of the flea), surrounded by a whitish halo (thinned epidermis over the enlarged flea) and a slight erythematous of the surrounding skin (inflammatory zone). In other species, these initial lesions can progress to a crusty or wart-like appearance, with concurrent pathogenic bacterial or mycotic infections (Pampiglione et al., 2009). In this case, the infestation was classified of low intensity with less than 20 lesions and acute with the only the papular white/pale yellow lesions with a central black punctum. No chronic or infected lesions with brown or black circular crusts or surrounding necrosis of the epidermis were noted (Widmer and Azevedo, 2012).

We speculate the infestation of *T. penetrans* in this young anteater may be due to the mother's sleeping habits. Giant anteaters do not dig true burrows, but instead occupy sheltered places, generally under dense clumps of shrubs (Eisenberg, 1989). This species generally sleep in small depressions, which they make with their claws in the sandy soil under the shrubs (Medri and Mourão, 2005). As in other species, the eggs of *T. penetrans* are typically expelled by the gravid female and fall to the ground. In the dry season the eggs hatch in the loose and dry soil, allowing the larva to emerge and contaminate these anteaters sleeping areas (Pampiglione et al., 2009).

In Argentina, *T. penetrans* has been recorded in humans, domestic animals, and a few species of xenarthrans, including *Chaetophractus villosus*, *C. vellerosus*, *Dasyus hybridus*, *Cabassous chacoensis* and *Tolypeutes matacus* (González et al., 2003; Lareschi et al., 2005; Ezquiaga et al., 2008; Ezquiaga, 2013; Ezquiaga et al., 2015a,b). In one study in Buenos Aires province has been reported as prevalence of infestation by *T. penetrans*, 25% for *C. villosus* and 7.7% for *D. hybridus* (Ezquiaga et al., 2008). In dry Chaco ecoregion, a high prevalence of *T. penetrans* has been reported in the local human communities (González et al., 2004).

This is the first report of *T. penetrans* in *M. tridactyla* from Argentina. However, *Tunga penetrans* was recently recorded for the first time on *M. tridactyla* in Brazil, this flea was found near Uberlandia, in Minas Gerais state (Frank et al., 2012) and, subsequently was found in São José de Rio Preto, São Paulo (Andrade Cruvinel et al., 2014), around 1000 km northeast from Santiago del Estero province.

Little is known about the impact of tungiasis on wild animals. *T. penetrans* was found on hosts belonging to eight different orders of mammals, including Cingulata, Pilosa, Artiodactyla, Perissodactyla, Carnivora, Rodentia, Primates, and Proboscidea (Linardi and De Avelar, 2014). However, in spite of the broad spectrum and category of hosts, the pig is considered the most important animal reservoir for *T. penetrans* (Linardi and De Avelar, 2014).

The sylvatic life cycle of *T. penetrans* in wildlife in Argentina and the epidemiological importance of anteaters in the life cycle of *T. penetrans*

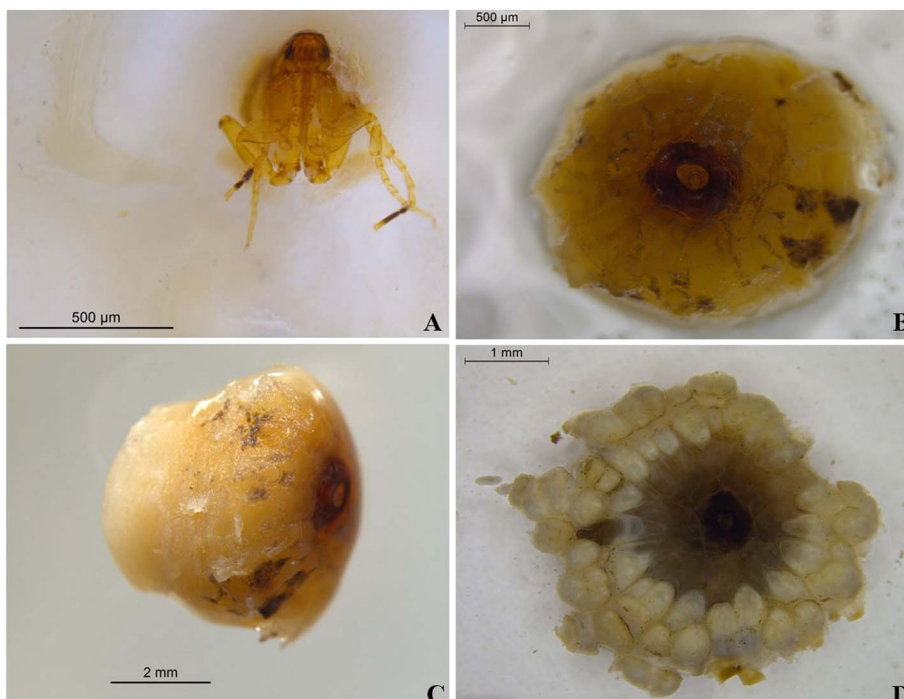


Fig. 2. Excised neosome of *Tunga penetrans*. (a) Ventral view with details of head and thorax. (b) Dorsal view. (c) Lateral view. (d) Ventral view, showing the reaction of the host skin.

is currently unknown. It is possible that this species could act as a potential disseminator of the flea due to their large territories of 2.7 km² to 25 km² (Montgomery and Lubin, 1977).

Conflict of interest

The authors declare that they have no conflict of interest.

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