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## Research Note

# New host and distribution expansion for *Pterygodermatites (Multipectines) affinis*

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**Summary**

The present study reports the first case of infection by *Pterygodermatites affinis* in *Lycalopex gymnocercus*, and the first report of this nematode in Argentina. Examining 80 foxes from Buenos Aires province, specimens of this species were recovered from 21.25 % of the small intestines and eggs were found in 7.5 % of the fecal samples.
**Keywords:** Argentina; South America; wild mammals; *Pterygodermatites affinis;* Pampas fox; *Lycalopex gymnocercus*

## Introduction

Quentin (1969) divided the genus *Rictularia* Froelich, 1802 into *Pterigodermatytes* Wedl, 1861, and *Rictularia* Froelich, 1802. Furthermore, this author classified the genus *Pterygodermatites* into five sub-genera: *Paucipectines*, *Neopaucipectines, Pterygodermatites, Mesopectines* and *Multipectines*. Of these, *Multipectines* is a parasite of carnivores. The Canidae family originated during the Eocene, in the area that is now North America (Wang *et al*., 2004). Early canids started spreading to South America during the Pliocene period (Wang & Tedford, 2007). Hoppe *et al.* (2010) suggested that parasites of the subgenus *Multipectines* originated in North America and then dispersed to the other continents with ancestral canids, and later they could have adapted to other carnivore families, such as Felidae and Mustelidae.

In the Neotropical region, the subgenus *Multipectines* has been registered only in two host species, crab-eating fox (*Cerdocyon thous*) and Geoffroy's cat (*Oncifelis geoffroyi*) (Beldomenico *et al*., 2005; Duarte, 2007; Hoppe *et al*., 2010; Lima *et al*., 2013), despite the large diversity of carnivore species present there (Wang & Tedford, 2007).

The Pampas fox, *Lycalopex gymnocercus* Fisher, 1914, is the most abundant wild canid from South America, inhabiting grasslands and open woodlands, and also areas highly modified by extensive ranching and agricultural activities (Lucherini *et al*., 2004). It is an omnivorous predator showing an opportunistic behavior, as dietary items vary according to seasonal availability and geographic location (Farias & Kittlein, 2008).

There are reports on heminths infecting *L. gymnocercus* (Blood & Lelijveld, 1969; Szidat, 1971; Schmidt & Martin, 1978; Martínez, 1985; Martínez *et al*., 2000, 2005; Rigonatto *et al*., 2000; Lucherini *et al*., 2004; Fuchs *et al*., 2006; Fiorello *et al*., 2006; Ruas *et al*., 2003, 2008; Scioscia *et al*., 2013; Scioscia *et al*., 2014), but none confirmed the presence of adults or eggs of the genus *Pterygodermatites*. Here we report the first finding of *Pterygodermatites (M) affinis* in Argentina and add *L. gymnocercus* as new definitive host of this nematode species, providing a prevalence estimate for rural areas of southern Buenos Aires province, Argentina.

## Materials and Methods

The study was conducted in rural areas located in seven departments of southern Buenos Aires province, Argentina, encompassing the ecoregions El Espinal (southwest-El Caldén subregion) and

La Pampa (southcentral and southeast) (Burkart *et al*., 1999). El Caldén subregion of El Espinal is semi-arid, whereas the sampled area of La Pampa eco-region has a humid semi-humid climate.
We used 80 complete intestine samples from road killed *L. gymnocercus* and dead animals provided by licensed hunters during 2010 and 2013. Sample collection and transport was permitted by the Ministerio de Asuntos Agrarios and Dirección de Flora y Fauna of Buenos Aires Province.
The intestinal tracts were carefully removed from each carcass and subsequently isolated by ligatures (at pylorus and rectum). Each sample was individually packed, labeled with relevant information and kept at −20 °C prior to processing.
The fecal samples were obtained from each rectum and processed for coproparasitological analysis. Each sample was analyzed by two methods of eggs concentration: Ritchie sedimentation (Young *et al*., 1979) and Sheather flotation (Benbrook & Sloss, 1965).
Examination of the intestinal content was performed using the sedimentation and counting technique described by Eckert *et al*. (2001) with modifications described by Scioscia *et al*. (2013). Obtained sediments were examined in small portions of 5 – 10 ml round petri dishes with magnifier lens at 65×.
The nematodes collected were washed in saline solution and conserved in 4 % formalin solution, until morphological examination. The worms were cleared in lactophenol, examined microscopically and identified following Anderson *et al*. (2009), Quentin (1969) and Baruš *et al*. (1996). The identification of specimens recovered was based on the morphological characteristics of seven males and six females adults, and of the eggs. The morphometric data were expressed in micrometers unless noted otherwise.

**Results**

A total of 80 Pampas foxes (36 females and 44 males) were necropsied. The foxes belonged to different departments of the province of Buenos Aires, corresponding 29 to the Pampa eco-regions and 51 to the Espinal. All foxes were classified as adults according to their size.
Eighty-four adult nematodes of the genus *Pterygodermatites* were collected, 57 females and 27 males; 82 from foxes of El Espinal and 2 from La Pampa. They were all in the small intestines of 17 foxes (overall prevalence = 21.25 %; 5 males and 12 females) ranging in number from 1 to 19. The mean intensity was 4.94 and mean abundance 1.05. Prevalence estimates in El Espinal and La Pampa ecoregions were 29 % and 7 %, respectively.
On the basis of morphological examination, the specimens were identified as *Pterygodermatites* (*Multipectines*) *affinis* (Jägerskiöl, 1904).
Male (Fig. 1): body length 7191.43 µm (range, 2030 – 12075) (n=7), width 243 µm (150 – 315) (n=5). Lenght of oesophagus 1143.33 µm (900 – 1460) (n=3), muscular part 285 µm (n=1) and glandular part 615 µm (n=1). Distance of the nerve ring from anterior end 160 µm (n=1). Subventral rows of cuticular plates com-

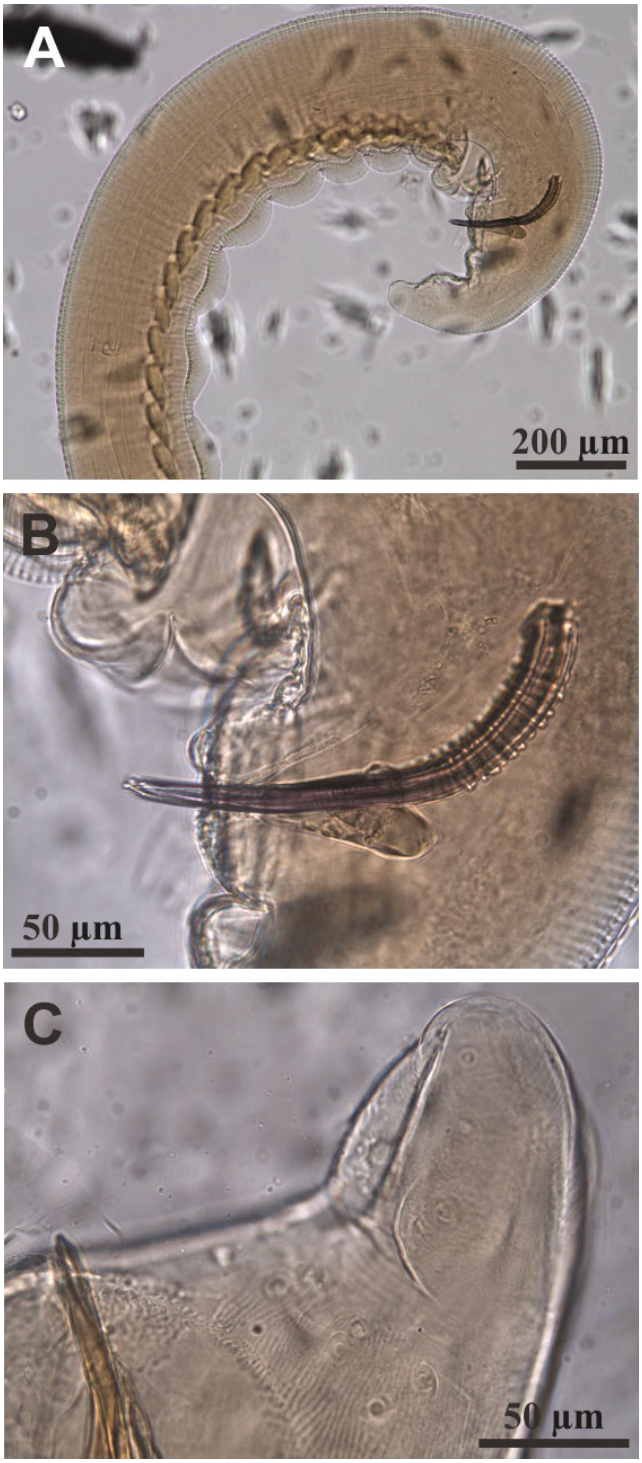


Fig. 1. Male of *Pterygodermatites* (*Multipectines*) *affinis* (A) Posterior body end, caudal cuticular fans, spicules, gubernaculum, in lateral view. (B) Posterior body end, spicules, gubernaculum in lateral view. (C) Posterior body end, caudal pedunculated papillae and one pair of sessile papillae at the tail tip, in ventral-lateral view

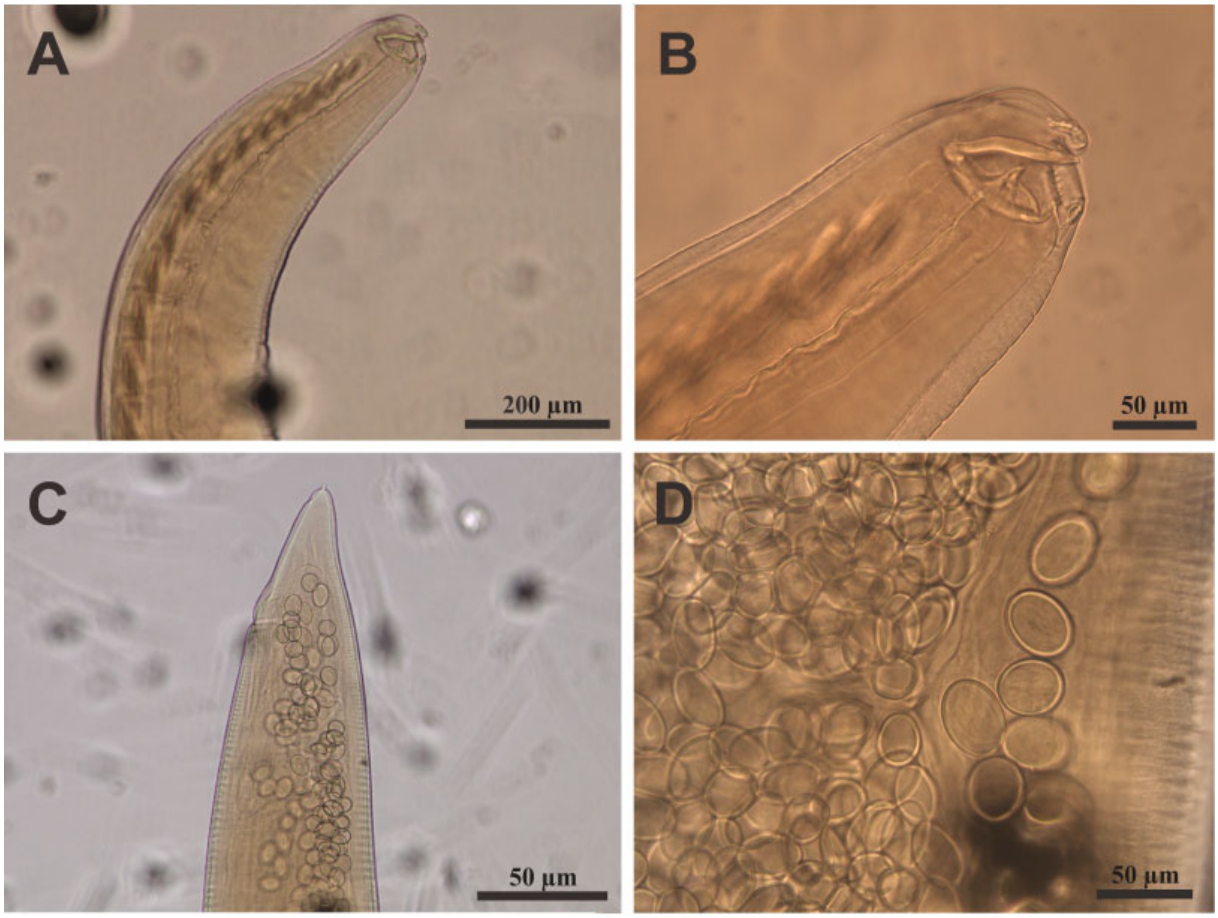


Fig. 2. Female of *Pterygodermatites (Multipectines) affinis* (A) Anterior body end, in lateral view. (B) Buccal capsule, in lateral view. (C) Posterior body end straight,coniform, and terminating by peak process. (D) Eggs in the uterus

posed of 112 (107 – 120) (n=7) cuticular blade-like projections, hiding the excretory pore opening. Tail length 235 µm (180 – 320) (n=4). Posterior end mildly coiled. On its medioventral line, anteriorly to cloaca**,** 8 (7 – 9) (n=7) caudal cuticular fans are distributed in a row. Caudal lateral alae present, divided into one pair of long precloacal-postcloacal alae and in one pair of short postcloacal alae, both separated by a space between them. Caudal papillae distributed in 3 groups: three pairs of long, pedunculate, pre-cloacal papillae, five pairs of short, post-cloacal, pedunculated papillae and one pair of sessile papillae at the tail tip. Two of the five pairs of pedunculate, post-cloacal papillae are medial to the others, close to the ventral groove. The spicules are equal in size and shape, short and keen, 223.43 µm (195 – 240) (n=7) long and 14 µm (12 – 15) (n=3) width, proximal 1/3 of spicules surrounded by 16 – 18 sclerotized rings (n=7). Gubernaculum well sclerotized present (n=7). Oral opening shifted markedly towards the dorsal side of the head end, shaped in a horizontal half-moon, with lateral processes oriented apically. At the upper margin of the mouth opening, a massive half-circular apophysis exceeds. There are cephalic papillae (inner and external circle) clustered in pairs and 2 amphids. The buccal capsule (vestibulum) oriented dorsoventrally. In lateral situation, the width of the sclerotinized vestibulum is 47.29 (35 – 55), maximum depth of vestibulum is 35 (25 – 39) (n=7). From the bottom of the oesophageal funnel, 3 sclerotinized teeth exceed into the mouth cavity (1 dorsal tooth and 2 lateroventral teeth). The shape of the dorsal tooth is sharply triangular with a narrow peak. The two lateroventral teeth are always shorter, attaining approximately a half of the total length of the dorsal tooth. The armament of the mouth opening also includes a series of small teeth, placed regularly in the mouth edges, 5 – 6 in number. The vestibulum is convex, and the apophysis is adjoined to the upper sclerotinized part of the vestibulum wall, and exceeds sharply in dorsal direction.

Female (Fig. 2): body length 13852.5 µm (9420 – 20095) (n=6), width 328.33 µm (165 – 475) (n=6). Length of the oesophagus 2371 µm (1655 – 2980) (n=5), muscular part 353.75 µm (250 – 415) (n= 4) and glandular part 2128.33 µm (1405 – 2565) (n=3). The distance of the nerve ring from the anterior ending is 310 (220 – 400) (n=3). Along the body there are 2 longitudinal lateroventral crests extend, composed of combs and spines, in total crests con-

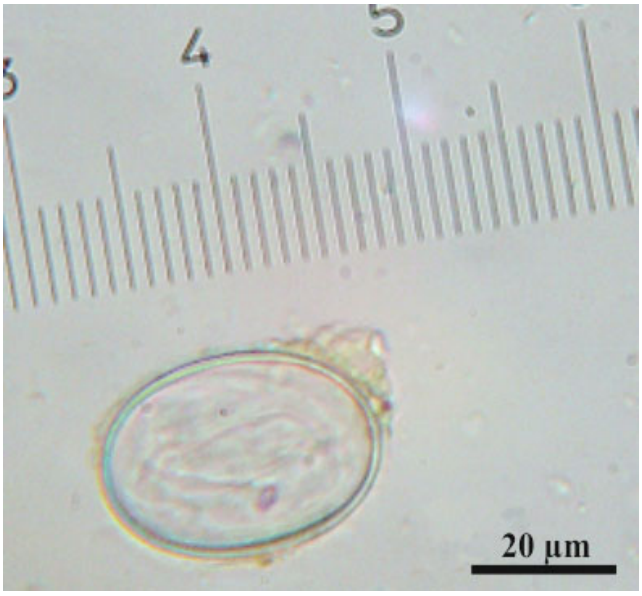


Fig. 3. Egg larval of *Pterygodermatites (Multipectines) affinis* in a fecal sample

tain 132 (123 – 140) (n=6) pairs. There are 57 (51 – 61) pairs of prevulvar combs and 75 (70 – 79) pairs of postvulvar spines. Posterior body end straight, tapering subsequently in coniform shape, and ending in a peak process. Anus is situated at distance of 253.5 µm (225 – 295) (n=6) from the tail end. Vulva pre-equatorial. Mature eggs *in utero* 36.25 (35 – 38) x 26.75 µm (25 – 29) (n=4). Location and shape of the mouth opening, number and distribution of cephalic papillae and amphids, shape and detailed structure of the buccal capsule (vestibulum) are quite identical in females and males. Sexual dimorphism in the morphology of the head end is entirely absent. In lateral situation, the width of the vestibulum is 63 µm (60 – 75), and the maximum depth of vestibulum is 41 µm (38 – 45) (n=5).

The coproparasitological study showed a prevalence of 7.5 % (6/80) of *Pterygodermatites* sp. eggs (1/6 with both techniques; 4/6 with Sheather flotation only and 1/6 with Ritchie sedimentation only). Larvated eggs 44 (37 – 53) x 34 µm (29 – 50) (n=16) (Fig. 3). Just in three foxes there were *Pterygodermatites* sp. eggs in feces and also there were adults of *P. affinis* in small intestine.

**Discussion**

Prior to this study, only three species of the subgenus *Multipectines* were reported in South America: *Pterygodermatites affinis,* described in *C. thous* from Brazil (Duarte, 2007; Lima *et al*., 2013); *P. cahirensis* in *O. geoffroyi* from Argentina (Beldomenico *et al*., 2005) and recently a new species *P. pluripectinata* described in *C. thous* from Brazil (Hoppe *et al*., 2010). In Argentina, there are no published studies confirming the presence of *P. affinis* in domestic or wild definitive hosts. Therefore, this study is the first to report the infestation by *P. affinis* in Argentina and adds *L. gymnocercus* to the list of definitive hosts of this nematode species.

*Pterygodermatites affinis* was cited by several authors in different carnivores from many regions of the world, e.g. *Vulpes vulpes* and *Genetta genetta* in Europe (Miquel *et al.,* 1993; Gortázar *et al*., 1998; Di Cerbo *et al*., 2008; Vergles Rataj *et al*., 2013). In Asia, this species was reported parasitizing dogs, cats, *V. vulpes* and *Canis aureus* (Dalimi *et al*., 2006; Schuster *et al*., 2009; Alagaili *et al*., 2011). In Africa, Canaris and Gardner (2002) found *P. affinis* in dogs and Lahmar *et al.* (2014) in *C. aureus* and *V. vulpes*. In North America, *P. affinis* was found in *Puma concolor* (Rausch *et al.,* 1983) and in *Canis latrans* (Pence & Meinzer, 1979; Liccioli *et al.,* 2012).

In the present study, we report a high prevalence (21.25 %), compared to that recorded in other wild canids (e.g. Alagaili *et al*., 2011; Liccioli *et al*., 2012), but lower than reported in *C. thous* in Brazil (43.1 %) (Lima *et al*., 2013). This, and its presence in the two eco-regions studied, could indicate that it is a frequent parasite of this fox species. Prevalence and mean intensity were higher in El Espinal, which may be due to the preference of *P. affinis* towards semiarid habitats (Gortázar *et al*., 1998; Di Cerbo *et al*., 2008; Lima *et al*., 2013).

The life cycle of this nematode is indirect (Quentin *et al*., 1976). Several paratenic hosts have been reported (Gupta & Pande, 1977). The low intensity of *P. affinis* found in the intestine, as well as the irregular egg shedding in the feces and the limited sensitivity of the techniques used, may explain the absence of eggs in fecal samples of *L. gymnocercus* that were harbouring adults in the intestines.

The taxonomy of the species of subgenus *Multipectines* is confounded by inadequate descriptions. The first information on the two closely related species *Rictularia cahirensis* from *Felis catus* f. *domesticus* and *R. affinis* from *V. vulpes* from Egypt was published by Jägerskiöld (1904). A remarkable opinion was published later by Gibbs (1957) who recognized the validity only of the taxon *R. cahirensis* while *R. affinis* [and the species *R. splendida* (Hall, 1913)] was considered by him to be a younger synonyms. However, Quentin (1969) places the 3 above species and other taxa in the genus *Pterygodermatites* Weld, 1861, subgenus *Multipectines* Quentin, 1969 [type species *P. (M) affinis*]. Years later, Young and Pence (1979) redescribed *P. cahirensis* and they agree with the conclusions of Gibbs (1957) that *P. (M) splendida and P. (M) affinis* are synonyms of the *P. cahirensis*, suggesting that there was only a single rictulariid species parasitizing carnivores, *P. (Multipectines) cahirensis*. However, Baruš *et al*. (1996) reexamined *P. affinis* and several other species within the genus *Pterygodermatites* and determined that *P. cahirensis* was a valid species occurring mainly in felids. They differentiate these two species (*P. affinis* and *P. cahirensis*) on the features of shape and structure of the sclerotized capsule. In addition, they found that sclerotinized vestibulum is always of a constant shape and does not show any sexual dimorphism. In *P. affinis* the vestibulum is convex, and the apophysis is adjoined to the upper sclerotinized part of the vestibulum wall, and exceeds sharply in dorsal direction. In contrast,

in *P. cahirensis*, the vestibulum is concave, and the apophysis is thickened and ends in a round form (from lateral view). Similarly to Jägerskiöld (1909) and Baruš *et al*. (1996), we found in *P. affinis* that the dorsal tooth is always long and sharply projecting in apical direction. Two subventral teeth adhere to it, which are equally sharp always markedly shorter than the single dorsal tooth. In contrast, *P. cahirensis* has 3 oesophageal teeth, all of almost identical height, and they are shorter than those in *P. affinis* (cf. Jägerskiöld, 1909; Baruš *et al*., 1996).

*Pterygotermatites affinis* has no zoonotic relevance and is associated with clinical signs in the definitive host only in cases of severe infections (Bowman *et al*., 2002), which were not documented in the present study. *Lycalopex gymnocercus* can be a source of infection for domestic dogs and wild carnivores in the province of Buenos Aires and possibly in other regions of the country.

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