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Gastrointestinal parasites of maned wolf (*Chrysocyon brachyurus*, Illiger 1815) in a suburban area in southeastern Brazil

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Abstract

We examined 42 maned wolf scats in an unprotected and disturbed area of Cerrado in southeastern Brazil. We identified six helminth endoparasite taxa, being Phylum Acantocephala and Family Trichuridae the most prevalent. The high prevalence of the Family Ancylostomatidae indicates a possible transmission via domestic dogs, which are abundant in the study area. Nevertheless, our results indicate that the endoparasite species found are not different from those observed in protected or least disturbed areas, suggesting a high resilience of maned wolf and their parasites to human impacts, or a common scenario of disease transmission from domestic dogs to wild canid whether in protected or unprotected areas of southeastern Brazil.

Keywords: Chrysocyon brachyurus, impacted area, parasites, scat analysis.

Parasitas gastrointestinais de lobo-guará (*Chrysocyon brachyurus*, Illiger 1815) em uma área suburbana no sudeste do Brasil

Resumo

Foram examinadas 42 fezes de lobo-guará em uma área desprotegida e perturbada do Cerrado no sudeste do Brasil. Nós identificamos seis táxons de helmintos endoparasitas, sendo o Filo Acantocephala e a Família Trichuridae os mais prevalentes. A alta prevalência da Família Ancylostomatidae indica uma possível transmissão por cães domésticos, que são abundantes na área de estudo. No entanto, nossos resultados indicam que as espécies de endoparasitas encontradas não são diferentes daquelas observadas em áreas protegidas ou menos perturbadas, o que sugere uma alta resiliência do lobo-guará e seus parasitas aos impactos humanos ou um cenário comum de transmissão de doenças de cães domésticos para um caníideo selvagem, seja em áreas protegidas ou desprotegidas do sudeste do Brasil.

Palavras-chave: Chrysocyon brachyurus, área impactada, parasitas, análise fecal.

1. Introduction

In Brazil the maned wolf (*Chrysocyon brachyurus*) is endangered with extinction, being the infectious diseases one of the major threats to the species (Machado et al., 2008). However, it is not easy to know whether parasitic infections represent a great harm to this species in Brazil, since few studies involving gastrointestinal parasites of *C. brachyurus* have been performed in nature (Dietz, 1984; Mattos et al., 2005; Braga et al., 2010; Curi et al., 2010, 2012; Santos et al., 2012). It is also worth noting that these studies were performed in officially protected areas of the Brazilian savanna (Cerrado), the typical habitat of this species. The Cerrado protected areas cover only 2.2% of this biome (Klink and Machado, 2005), hence, it is important to assess the species' status outside nature reserves, where the maned wolf is also widely distributed (Queirolo et al., 2011). This study is the first to analyse the gastrointestinal parasites of *C.brachyurus* in an unprotected (suburban) area of the Cerrado near a large urban center in southeastern Brazil. The main questions that we addressed here are: do the gastrointestinal parasites found in this location differ from those found in less disturbed areas? What these parasites indicate or suggest about the resilience of maned wolf or the parasite themselves to man-made disturbances?

2. Material and Methods

2.1. Study area

The study site is a 2 × 8 km rectangular area (1,610 ha) located in Calçada ridge (Serra da Calçada), in the metropolitan area of Belo Horizonte, Minas Gerais, southeastern Brazil (see Figure 1). The region is a contact zone between Cerrado and Atlantic Forest biomes and is considered a conservation priority area (Drummond et al., 2005). Although this area is located in the buffer zone of two protected areas, the Rola Moça Ridge State Park (Parque Estadual da Serra do Rola Moça - PESRM) and the Fechos Ecological Station (Estação Ecológia de Fechos - EEF), a large portion of the natural areas in this region have been completely eliminated or altered by mining activities and real state expansion (Massara et al., 2012).

2.2. Data collection and analysis

We searched monthly (from October 2006 to January 2008) for maned wolf scats in several unpaved roads existing in the study area (Massara et al., 2012). Feces were stored (10g) and analysed in laboratory. Three usual methods were performed for endoparasite diagnostic: sedimentation (Hoffman et al., 1934), flotation in a saturated solution of sodium chloride (Willis, 1921) and centrifugation with formol-ether (Ritchie, 1948). At least two microscope slides were prepared for each method. When helminth eggs were found and identified at the lesser taxonomic level, five randomly selected eggs of each taxa were measured and compared with the morphology described by Soulsby (1968). The sample sufficiency was assessed graphically plotting sample size (number of scats) against the randomized (n=100) number of observed taxa found in feces. The observed richness (Sobs Mao Tau) was compared with the estimated richness, using the first-order Jackknife estimator. These analyses were performed in program EstimateS (Colwell, 2005).

3. Results

We collected 42 maned wolf fecal samples from which we identified six endoparasite taxa (see Figure 2). The rarefaction curve has stabilized (see Figure 3), indicating

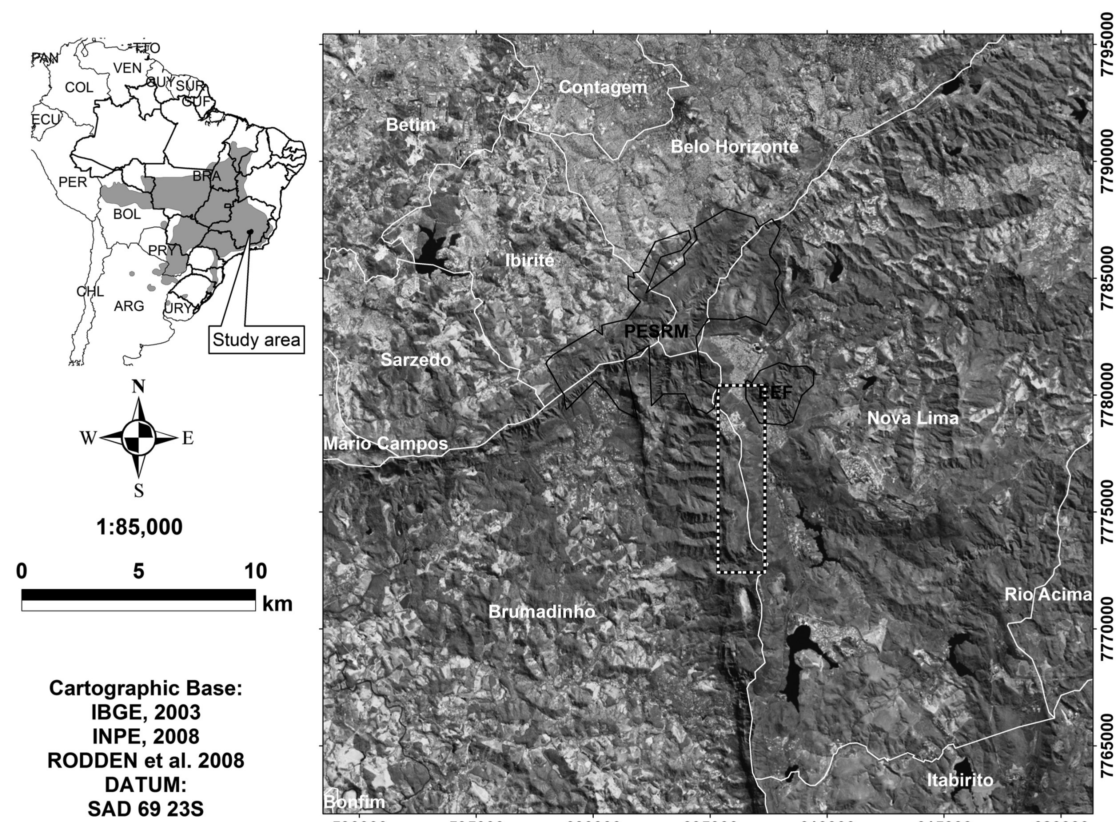

Figure 1. Location of the study area (rectangle, main figure) in Serra da Calçada, State of Minas Gerais, southeastern Brazil. White lines are municipalities divisions; dark grey are natural vegetation areas, light grey are anthropogenic disturbance area; black contours are the protected areas closest to the study area. The urban area of Belo Horizonte is the large light grey area in the north. The geographic distribution of the maned wolf is shown in the insert (grey area). Source: IBGE (2003), INPE (2008) and Rodden et al. (2008).

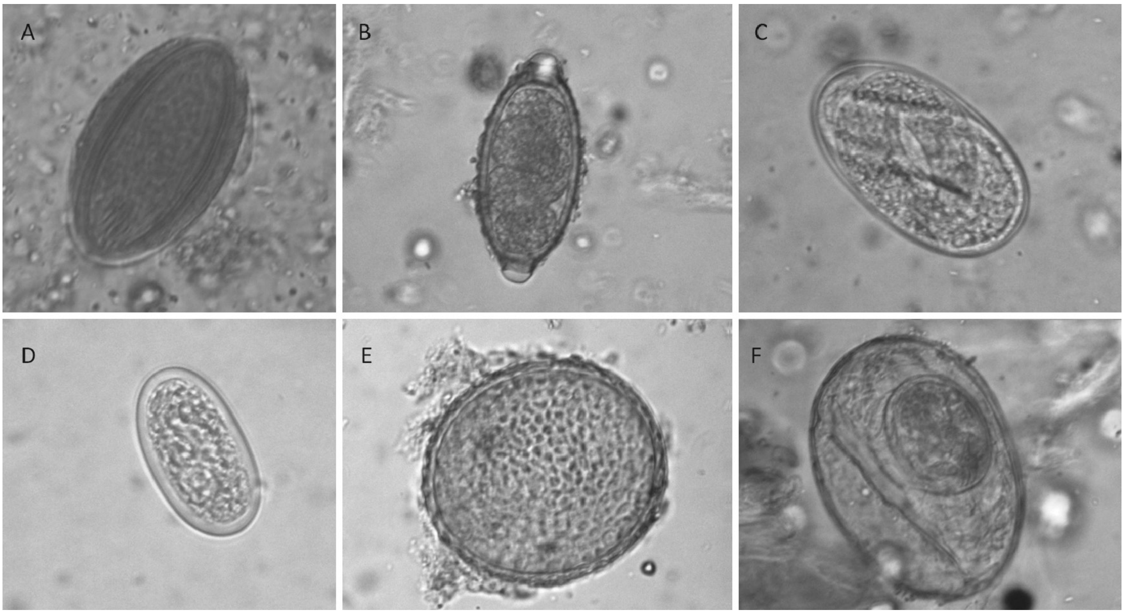

Figure 2. Eggs of helminth parasites found in maned wolf scats collected in Serra da Calçada between October 2006 and January 2008. (A) Phylum Acanthocephala; (B) *Capillaria* cf. *hepatica*; (C) Family Ancylostomatidae; (D) Family Physalopteridae; (E) *Toxocara* cf. *canis*; (F) Family Hymenolepididae.

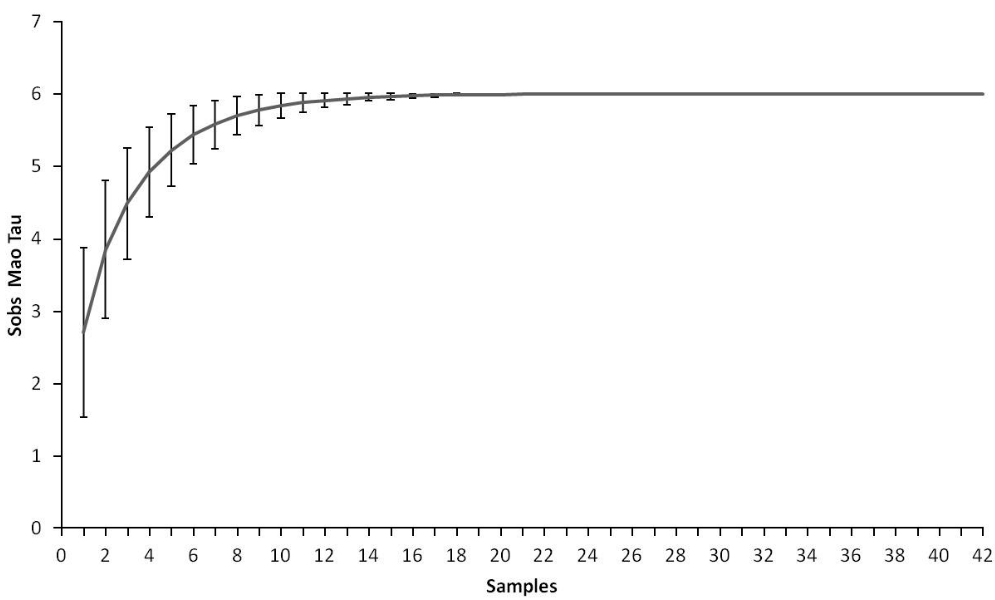

Figure 3. Randomized number of observed parasites species (Sobs Mao Tau ± 95% CI) derived from maned wolf scats collected (samples) in Serra da Calçada.

that the sample size (42 feces) was sufficient to estimate endoparasite richness of the local population (estimated richness = 6 ± 0 95% CI). The Phylum Acanthocephala (81.0%), Family Trichuridae (78.6%) and Family Ancylostomatidae (35.7%) were the most prevalent endoparasite taxa found in the maned wolf scats (see Table 1).

4. Discussion

The Phylum Acantocephala and Family Trichuridae have terrestrial arthropods (Phylum Acanthocephala; Urquhart et al., 1998) and rodents (Phylum Acanthocephala and Family Trichuridae; Petrochenko, 1971; Urquhart et al., 1998) as hosts, items that are commonly found in the diet of *C. brachyurus* from this area (Massara et al., 2012).

The Family Ancylostomatidae can also be found in wild or domestic canids and cats (Urquhart et al., 1998; Ragozo et al., 2002). However, we could not assert whether the maned wolves of the study area are natural hosts of this parasite or whether the infection is coming from sympatric domestic dogs and cats (exotics). The second alternative seems to be more likely as already suggested by Santos et al. (2012). Dogs, domestic stray or errant, were commonly seen on a daily basis in the study area, where there is no efficient surveillance. Further, it is estimated that there are about 1,050 dogs in the study area (Belo Horizonte, 2011; Brumadinho, 2012; Nova Lima, 2012). The role of dogs as reservoirs and sources of pathogens for wild canids is well known (Laurenson et al., 2004). The high number of domestic dogs inside this area may interfere in the dynamics of biological communities and can also spread diseases to other wildlife species (Vanak and Gompper, 2009; Paschoal et al., 2012; Hughes and Macdonald, 2013).

Our results indicate that the endoparasite community of the *C. brachyurus* is directly related to its diet and potential vectors of diseases found in the area, such as the domestic dogs. The Families Trichuridae and Ancylostomatidae and the Phylum Acanthocephala are also among the endoparasites most frequently found in other studies (see Table 2). Similarly, both richness and composition of species found in this study do not differ much from these studies (see Table 2). It seems, therefore, that *C. brachyurus* is not being affected by a different parasite set from those already identified in studies

Table 1. Prevalence (and corresponding number of scats) of helminth parasites in scats and average size of eggs (L= length; W= width; µ) found in maned wolf scats collected in Serra da Calçada between October 2006 and January 2008.

Phylum	Order/Family	Species	Prevalence (n of scats)	Morphometry Mean and SD*
Acanthocephala	_	_	80.95%(34)	L:83.18±4.81 W:49.01±4.15
Nematoda	Trichurida/ Trichuridae	*Capillaria* cf. *hepatica*	78.57%(33)	L:62.92±6.44 W:29.52±3.87
Nematoda	Strongylida/ Ancylostomatidae	_	35.71%(15)	L:61.05±8.99 W:39.02±7.80
Nematoda	Spirurida/ Physalopteridae	_	30.95%(13)	L:43.13±7.34 W:26.61±2.62
Nematoda	Ascaridida/ Ascarididae	*Toxocara* cf. *canis*	28.57%(12)	L:68.00±3.72 W:60.73±3.53
Platyhelminthes	Ciclophyllidea/ Hymenolepididae	_	16.66%(7)	L:79.55±8.28 W:63.69±6.45

*SD= Standard deviation.

Table 2. Studies conducted in protected areas of the Cerrado (except the present study) that evaluated the endoparasites found in fecal samples of the maned wolf.

Taxonomy*	Studies						
	Dietz (1984)	Mattos et al. (2005)	Braga et al. (2010)	Curi et al. (2010)	Curi et al. (2012)	Santos et al. (2012)	Present study
Phylum Platyhelminthes							
Class Cestoda							
Order Cyclophyliidea							
Family Dipylidiidae							
Dipylidium sp.	X	X					
Family Hymenolepididae				X	X	X	X
Hymenolepis sp.		X					
Family Anoplocephalidae						X	
Order Pseudohyllidea							
Family Diphyllobothriidae							
Spirometra sp.				X			

*The symbol “X” corresponds to the lowest taxonomic level identified in each study. The Taxonomy follow Vicente et al. (1997), Vieira et al. (2008), Muniz-Pereira et al. (2009) and EOL (2013).

Table 2. Continued...

Taxonomy*	Studies						
	Dietz (1984)	**Mattos et al. (2005)**	**Braga et al. (2010)**	**Curi et al. (2010)**	**Curi et al. (2012)**	**Santos et al. (2012)**	**Present study**
Class Trematoda							
Order Digenea							
Family Dicrocoeliidae							
Platynossomun sp.				X			
Phylum Nematoda							
Superfamily Ancylostomatoidea							
Family Ancylostomatidae		X		X	X	X	X
Ancylostoma sp.	X						
Ancylostoma caninum			X				
Superfamily Ascaridoidea							
Family Ascarididae		X					
Toxocara sp.	X						
Toxocara cf. *canis*							X
Ascaris sp.			X				
Family Physalopteridae					X		X
Physaloptera sp.				X		X	
Superfamily Strongyloididae							
Family Strongyloididae		X					
Strongyloides sp.			X			X	
Superfamily Trichinelloidea							
Family Trichuridae		X		X	X	X	
Capillaria cf.*hepatica*							X
Trichuris sp.	X						
Trichuris cf. *trichiura*			X				
Trichuris vulpis			X				
Superfamily Oxyuroidea							
Family Oxyuridae							
Oxyuris sp.	X						
Phylum Acanthocephala				X	X	X	X
Class Archiacanthocephala							
Order Oligacanthorhynchida							
Family Oligacanthorhynchidae							
Prosthenorchis sp.		X					
Phylum Aplicomplexa							
Class Conoidasida							
Order Eucoccidiorida		X					
Family Eimeriidae							
Eimeria sp.	X						
Phylum Amebozoa							
Class Tubulinea							
Order Tubulinida							
Family Amoebidae							
Amoeba sp.			X				
Total number of parasites	6	8	6	7	5	7	6
Total of samples	7	17	49	10	6	33	42

*The symbol "X" corresponds to the lowest taxonomic level identified in each study. The Taxonomy follow Vicente et al. (1997), Vieira et al. (2008), Muniz-Pereira et al. (2009) and EOL (2013).

carried out in less disturbed areas, reinforcing the high plasticity of the species and its parasites to human impacts (Santos et al., 2003; Massara et al., 2012). Other explanation lies in the fact that both protected and unprotected areas in southeastern Brazil holds abundant populations of dogs (Paschoal et al., 2012; Massara et al., 2012), and the same patterns of transmission from dogs should warrant the presence of parasite communities similar to those from protected (Curi et al., 2010, 2012) and suburban areas. However, it is important to note that this study did not assess the infestation degree or the number of each parasite taxon in the fecal samples. Thus, in order to better understand the relationship between wild canids, domestic dogs and their gastrointestinal parasites, we highlight the importance of further studies, mainly outside protected areas, examining the real parasite impacts (especially those introduced and maintained by exotic host species) on wild canid populations.

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