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Short Communication

Infection by *Platynosomum illiciens* (= *P. fastosum*) in domestic cats of Araguaína, Tocantins, northern Brazil

Infecção por *Platynosomum illiciens* (= *P. fastosum*) em gatos domésticos de Araguaína, Tocantins, Norte do Brasil

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Abstract

Platynosomiasis is a hepatopathy caused by *Platynosomum illiciens*(= *P. fastosum*) (Trematoda: Dicrocoelidae), which occurs mainly in domestic and wild cats in tropical and subtropical areas. The objective of this study was to verify the occurrence of *P. illiciens* infection in domestic cats in the city of Araguaína, Tocantins, Brazil, using necropsy and coproparasitological tests. Additionally, we aimed to evaluate the use of two different techniques to diagnose *P. illiciens* infection in domestic cats and verify whether this parasitism was associated with individual feline characteristics. For this, 54 cats of different ages were analyzed. The percentage of infection was 33.3% (CI = 21.1-47.5%), parasite load was 9-509, mean intensity was 151.7, and mean abundance was 50.5 trematodes per animal. The risk of infection was higher for females than for males (OR = 5.00; P = 0.017). The spontaneous sedimentation coproparasitological test demonstrated the greatest sensitivity and specificity in diagnosing *P. illiciens*. This study is the first to report the occurrence of *P. illiciens* in cats in the state of Tocantins, northern Brazil.

Keywords: Trematodes, *Felis silvestris catus*, platynosomiasis, frequency of infection, Amazônia.

Resumo

A platinosomose é uma hepatopatia causada por *Platynosomum illiciens*(= *P. fastosum*) (Trematoda: Dicrocoelidae), que ocorre principalmente em felinos domésticos e selvagens de áreas tropicais e subtropicais. O objetivo deste trabalho foi verificar a ocorrência de *P. illiciens* em gatos domésticos do município de Araguaína, Tocantins, Brasil, por meio de necrópsia e exames coproparasitológicos, bem como avaliar o uso de diferentes técnicas no diagnóstico de *P. illiciens* em gatos domésticos e verificar a associação da parasitose com características individuais dos felinos. O estudo foi realizado em 54 gatos com diferentes idades, machos e fêmeas. O percentual de infecção foi de 33,3% (IC= 21,1% - 47,5%), a carga parasitária observada foi de 09-509, a intensidade média de 151,7 e a abundância média de 50,5 trematódeos por animal. As fêmeas apresentaram maior chance de infecção do que os machos (OR=5,00; P=0,017). O teste coproparasitológico que demonstrou maior sensibilidade e especificidade foi o de sedimentação espontânea. O presente estudo faz o primeiro relato da ocorrência de *P. illiciens* em gatos no estado do Tocantins, região Norte do Brasil.

Palavras-chave: Trematódeos, *Felis silvestris catus*, platinosomose, frequência de infecção, Amazônia.

Platynosomiasis, also known as "lizard poisoning," is a common feline liver disease caused by trematodes of the genus *Platynosomum* Looss, 1907. The names *Platynosomum fastosum, P. concinnum,* and *P. illiciens* were used as synonyms in several studies, however, the use of *P. illiciens* is the most correct (PINTO et al., 2018). This parasite affect the liver, gallbladder, and bile ducts of domestic and wild cats (RAMOS et al., 2017), birds (RODRIGUES, 1963; CARVALHO et al., 2007), marsupials, rodents (SOLDAN & MARQUES, 2011) and nonhuman primates (PINTO et al., 2017).

This trematode is found in tropical and subtropical regions and has already been reported in South and North America,

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Asia, Africa, Australia, the Pacific Islands, and the Caribbean (BASU & CHARLES, 2014). In Brazil, it has been reported in cities in the southeast (RAGOZO et al., 2002), northeast (BRAGA et al., 2016), central-west (RAMOS et al., 2013), and south (MICHAELSEN et al., 2012) regions. It parasitizes domestic and wild cats, with a frequency of infection of 1.91% to 40% (BRAGA et al., 2016), but there is not record in the scientific literature of the occurrence of *P. illiciens* in the state of Tocantins, northern Brazil.

The biological cycle of *P. illiciens* is complex and requires intermediate hosts (terrestrial gastropod mollusks and terrestrial isopod) and a paratenic host (reptiles and amphibians) (BASU & CHARLES, 2014; PINTO et al., 2014). Most parasitized domestic cats display no clinical signs, but at high parasite load, nonspecific signs can be observed, such as anorexia, vomiting, lethargy, jaundice, weight loss, hepatomegaly, abdominal distension, sialorrhea, petechiae, ecchymosis, and diarrhea (GAVA et al., 2015).

The laboratory diagnosis of platynosomiasis through coproparasitological examination is an important tool in veterinary clinical practice. Methods of sedimentation or flotation in a saturated solution of sugar, salt or zinc are used and although there is not still consensus as to the most suitable method for the recovery *Platynosomum* eggs in feline feces, some methods have a sensitivity of up to 100% (MATI et al., 2015; RAMOS et al., 2016). The objective of this study was to verify the occurrence of *P. illiciens* infection in domestic cats in the city of Araguaína, Tocantins, Brazil, using necropsy and coproparasitological tests. Additionally, we aimed to evaluate the use of two different techniques to diagnose *P. illiciens* in domestic cats and to verify the association of this parasitism with individual feline characteristics.

The study was carried out in the city of Araguaína, located in the Brazilian Legal Amazon, in the northern region of the state of Tocantins, Brazil (latitude 7°11'26" south, longitude 48°12'28" west, and altitude 236 m).

The material was collected from 54 domestic cats from the city of Araguaína, received by Zoonosis Control Center of Araguaína for euthanasia, and from dead animals referred for parasitological necropsy at the Laboratory of Animal Parasitology of UFT. The animals were euthanized according to the recommendations of the Brazilian Guidelines of Best Practices for Euthanasia of Animals (CFMV, 2012).

Animal age was estimated by dental evaluations, as described by Costa (2015) and the clinical signs observed were the presence of jaundice, hepatomegaly, abdominal distension, and weight loss, which are clinical signs observed in platynosomiasis. The livers were collected during necropsy and analyzed through a section of the bile ducts to verify the presence of trematodes. Animals with ≤125 trematodes were classified as having a low parasite load and animals with >125 trematodes were classified as having a high parasite load, according to Rodriguez-Vivas et al. (2004). The technique described by Pinto et al. (2014) was used to fix and mount the specimens. Specific morphological characteristics were used to identify the specimens, according to the description by Rodrigues (1963).

Coproparasitological tests were performed using stool samples collected directly from the animal rectum during necropsy, which were preserved by refrigeration in a 10% formaldehyde solution until processing. Samples were processed using the spontaneous sedimentation (HOFFMAN et al., 1934) and Sheather's flotation (SHEATHER, 1923) methods.

The percentage of infection, abundance, and mean intensity were estimated according to Bush et al. (1997). The association between the infection by *P. illiciens* and individual animal characteristics was evaluated by univariate analysis and chi-square test. The association between parasitic load and coproparasitological test was evaluated by univariate analysis result by Fisher exact test using the Epi Info 3.5.4. statistical software (DEAN et al., 1990). The sensitivity and specificity of the coproparasitological methods were calculated in a contingency table using the Open Epi software (DEAN et al., 2013), whilst considering the necropsy findings as the standard test. This program provided the calculated values of sensitivity, specificity and Kappa value.

This study was approved by the Research Ethics Committee of the Federal University of Tocantins under protocol number 23101.001759/2016-42.

Fifty-four stray of cats were analyzed, of which 33 were females and 21 were males. Eighteen (33.3%, CI = 21.1-47.5%) livers had parasites with a flat body. Of the parasitized animals, 15 (83.3%) were females and three (16.7%) were males. The parasite load ranged from nine to 509 parasites, with a mean intensity of 151.7, and a mean abundance of 50.5 trematodes per animal. Seven (38.9%) of the 18 positive animals having a high *P. illiciens* load and 11 (61.1%) low.

Of the 54 stool samples analyzed, 21 (38.9%) were positive in at least one of the diagnostic methods used. The spontaneous sedimentation method highlighted *P. illiciens* eggs in 11 (20.8%) samples. This method presented a sensitivity and specificity of 44.4% (8/18) and 91.7% (33/36), respectively. Sheather's method highlighted *P. illiciens* eggs in 10 (18.5%) samples and presented a sensitivity and specificity of 22.2% (4/18) and 83.3% (30/36), respectively (Table 1). The concordance (Kappa value) between the tests and the necropsy was low. No association was found between parasite load and coproparasitological examination using the sedimentation method (P = 0.352) or the flotation method (P = 0.515). The analysis of the association between individual animal characteristics and the presence of *P. illiciens* in the liver is shown in Table 2. Only the sex variable was associated with *P. illiciens* presence.

The percentage of infection reported in this study was close to those percentages reported in some studies conducted in the Brazilian Legal Amazon which showed percentages of infection 26.03% (RAMOS et al., 2013) and 38.3% (RAMOS et al., 2017). These localities have in common belong to the tropical climatic zone of the Brazilian territory. The prevalence of *P. illiciens* reported in feline populations of tropical and subtropical countries varies between 15% and 81% (BASU & CHARLES, 2014), which justifies the high frequency of parasitism found in our study. Likewise, the parasite load found in cats from Araguaína showed the same pattern of variation found in Brazil and other countries of tropics (RODRIGUEZ-VIVAS et al., 2004; BRAGA et al., 2016; RAMOS et al., 2017)

The low sensitivity of Sheather's test in the present study can be justified by the fact that *P. illiciens* eggs are heavy and the Sheather's test is a flotation technique, therefore, better diagnosed

Table 1. Sensitivity and specificity of the Hoffman, Pons, and Janer and Sheather's tests for the diagnosis of *Platynosomum illiciens* in domestic cats from the city of Araguaína, Tocantins, Brazil.

Tests		*Platynosomum* in the liver		Sensitivity %(CI)	Especificity %(CI)	Kappa Cohen
		Yes N=18	No N=36			
Hoffman	+	8 (44.4%)	3 (8.3%)	44.4 (24.6-66.3)	91.7 (78.1-97.1)	0.4 (0.15-0.65)
	-	10 (55.6%)	33 (91.7%)			
Sheather	+	4 (22.2%)	6 (16.7%)	22.2 (9.0-45.2)	83.3 (68.1-92.1)	0.06 (-0.18-0.31)
	-	14 (77.8%)	30 (83.3%)			

CI: Confidence interval (95%); N: number of samples; +: positive; -: negative.

Table 2. Univariate analysis to determine the risk factors for *Platynosomum illiciens* infection in cats from the city of Araguaína, Tocantins, Brazil.

Variables	N	Positive (%)	OR	CI	P
Sex					
Female	33	15(45.5%)	5.0	(1.2-20.3)	0.017
Male	21	3(14.3%)			
Age					
Young	3	1(33.3%)	1	(0.1-11.8)	0.712
Adults	51	17 (33.3%)			
Body score					
Good	16	8(50.0%)	2.38	(0.7-8.6)	0.181
Bad	27	8(29.6%)			
Clinical signs					
Yes	17	6(35.3%)	1.136	(0.3-3.8)	0.836
No	37	12(32.4%)			

N: number of samples; OR: Odds ratio; CI: Confidence interval (95%); P: p value.

by sedimentation methods. The intermittent oviposition performed by this parasite in small quantities, also explains the low sensitivity obtained in the tests used in this study (LEAL et al., 2011). The use of the spontaneous sedimentation test is well-known in veterinary medicine for the research of heavy eggs, however, during the microscopic reading process, a large number of fecal debris may decrease the sensitivity of the test. The present study analyzed only one slide per animal, but to read at least three slides per feces sample can increase sensitivity (TIBIRIÇA et al., 2009; MATI et al., 2015). The loss or non-visualization of the hepatic parasites in animals with low parasitic load may justify the specificity values observed.

Female cats were more likely to be infected with *P. illiciens* than males (OR = 5.0), a result also found by Rodriguez-Vivas et al. (2004), which can be explained by the frequent hunting to feed their offspring (SOLDAN & MARQUES, 2011; GAVA et al., 2015). The age of cats and body score not considered as factors associated with the presence of *P. illiciens* in cats, which contrasts with the observations by Rodriguez-Vivas et al. (2004), who found that cats older then two years showed an increased probability of infection, however our result may have been influenced by the small number of young animals in sample. Adult animals tend to be more likely to be infected by *P. illiciens* due to the longer exposure time and hunting activity (SOLDAN & MARQUES, 2011). In addition, the prepatent period ranges from 56 to 60 days (BRAGA et al., 2016), which may interfere with the diagnosis of young animals.

The body score was not considered a factor associated with the presence of *P. illiciens* in cats, agreeing with the observations by Rodriguez-Vivas et al. (2004). At least one clinical sign of platynosomiasis was found in six (35.3%) animals parasitized by *P. illiciens*, but this was not statistically associated with infection.

In conclusion, *P. illiciens* is a parasite of the liver of cats living in Araguaína, Tocantins, Brazil. In this study, the spontaneous sedimentation test demonstrated the greatest sensitivity and specificity in the diagnosis of *P. illiciens*. The present study is the first to report the occurrence of *P. illiciens* in cats in the state of the Tocantins, northern Brazil.

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