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Gastrintestinal helminths Of *Cerdocyon thous* (Linnaeus, 1766 - Smith, 1839) from the caatinga area of the Paraíba State, Brazil

Helmintos gastrintestinais de *Cerdocyon thous* (Linnaeus, 1766) Smith, 1839 provenientes da área de caatinga do Estado da Paraíba, Brasil

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Abstract

The crab eating fox, *Cerdocyon thous* (Linnaeus, 1766 – Smith, 1839), is a medium sized canid which is found in almost every region of Brazil. It is the only registered native canid specie to be found in the semi-arid Northeastern region of the country. This study had as its objectives: the identification of the helminth fauna common to *Cerdocyon thous* found in the Caatinga of the state of Paraíba; and the determination of the ecological indications of helminthic infection, hoping to make a favourable addition to the understanding of this little known biome. In this study, 58 animals that were found as 'roadkill' on the highways in the municipality of Patos were used. The gastrointestinal helminths from these animals were colected. All the animals in this study were infected with helminths. 16 species of helminths were identified, two being trematodes, one being a cestode, one being an acanthocephalus, and the remaining twelve being nematodes. In this study a new specie, named *Pterygodermatites pluripectinata* n. sp. was discovered and its host and location described.

Key words: Caatinga, *Cerdocyon thous*, helminth fauna, ecological descriptors

Resumo

O cachorro-do-mato Cerdocyon thous (Linnaeus, 1766), canídeo de porte médio, com distribuição em quase todo território brasileiro, com ocorrência no semi-árido Nordestino. No presente estudo objetivou identificar a helmintofauna nesta especies animal, provenientes da região da Caatinga, estado da Paraíba. Para maior abrangência da pesquisa, foi determinado, também, os indicadores ecológicos de infecção helmíntica, contribuição favorável para o conhecimento da biodiversidade do bioma. Para tal, foram utilizados 58 animais encontrados por atropelamento em rodovias nas proximidades do município de Patos, dos quais foram retirados o trato gastintestinal, e posteriormente, realizada a colheita de helmintos; todas os animais necropsiados estavam parasitados. Foram identificados diferentes classes, sendo dois Trematóda, um Cestóda, um Acantocéfala e 12 Nematoda, totalizando 16 espécimens. Neste estudo, uma nova espécie denominada Pterygodermatites pluripectinata n. sp. foi descrita, além da descrição de novos registros de hospedeiros e localizações.

Palavras-chave: Caatinga, *Cerdocyon thous*, helmintofauna, indicadores ecológicos

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Introduction

Caatinga is an uniquely brazilian biome, that reaches all states in the Northeastern region, as well as the Minas Gerais state, in the Southeastern region of Brazil, with a total area of 734.478 Km^2. Despite being an homogeneous biome, its biodiversity is scarce, although recent studies show a superior existence of ecotypes and species than that observed in other biomes. It has unique climatic and pedological conditions, counting with a considerable number of endemic species (SILVA et al., 2003).

The mammalian class is the one with the smaller number of species notifications registered in this biome, probably due to the dificculty in occupying niches. Amogst the canids, only *Cerdocyon thous* (Linnaeus, 1766 - Smith, 1839) has its occurrence registered in Caatinga, though other species in this family are occasionaly in ecotone areas of surrounding biomes. This is probably due to the generalized aspect of *C. thous*, even being capable of benefiting from the anthropic actions, exploiting food waste from household animal creations (SILVA et al., 2003).

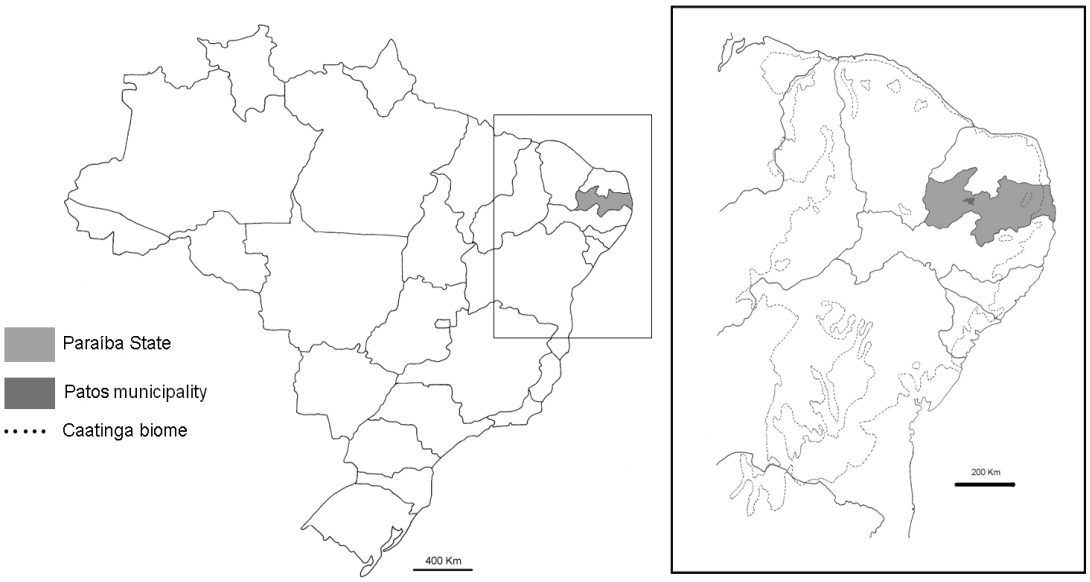
In wild animais, parasitic infections cause damage to the host's healthiness, being less frequent when compared to domestic animals In natural conditions, the parasite/host balance is in such a way that the parasitic load is usually compatible with the survival of the animal. Considering that scientific reports about helminthic infections in *C. thous* are rare in national literature, and mostly focused on describing new species, this research focused on identifying the helminth fauna of *Cerdocyon thous* derived from the Caatinga area in the Paraíba state and determining the ecological descriptors of its infection. With these results, the contribution to the knowledge of the region's invertebrate biodiversity in expanded.

Materials and Methods

Animals and local of the experiment

58 crab eating foxes (*C. thous*) were used, found in highways from the northeastern semiarid region, near the Patos municipality, in the Paraíba state, 320 Km away from the coastline, geographically located at 06º46'19" S to 07º38'32" S, and 36º42'52" W to 38º08'56" W, respectivelly at the following highways: BR-230, BR-361, BR-110 and PB-238 (Figure 1). The canids were in a good state of conservation. These were later conducted to the Veterinary Parasitology Laboratory, located in the Center of Health and Rural Tecnology of the Universidade Federal de Campina Grande (UFCG), in the municipality of Patos. Necropsies of the animals were conducted in order to remove the gastrointestinal tract. For the quantification, generic and specific identification of the helminths, all the material was sent to the Parasitic Diseases Laboratory, located in the Preventive Veterinary Medicine and Animal Reproduction Department of the Universidade Estadual Paulista "Júlio de Mesquita Filho" - UNESP, Jaboticabal campus - SP.

Figure 1. Map of Brazil. Enlargement of the Caatinga biome. Image is courtesy of the author: Hoppe et al. 2009, modified.



Source: Hoppe et al. (2009).

Colection of the samples

At the necropsy, the stomach, small intestine and large intestine were separated using double ligatures between their anatomical segments. The contents were removed and the mucosae were scraped. The collected material was washed in strainers (0,297 mm and Tyler 48) and the solid portion was fixed and preserved in an acetic formaldehyde solution (UENO; GONÇALVES, 1998). After this procedure, the helminths were removed from the gastrointestinal contents with the aid of a stereomicroscope, placed in glass flasks and preserved in acetic formaldehyde solution for their identification. Other organs, such as spleen, liver and pancreas were directeed to other researchers for anatomical studies.

Identification of the helminthic fauna

The counting and generic identification of the parasites of each segment of the digestive tract was performed. The nematode specimens were clarified with 80% acetic acid and Beechwood creosote, placed between lamina and coverslip for the visualization and measurement of the morphological caracteristics. The cestodes and trematodes were stained with carmine chloride after compression. For the achievement of the morfometric data, 10 specimens of each gender of helminths were separated, placed between lamina and coverslip amd measured. In case of helminths with less than 10 specimens collected, the measuremente was made *in totum*. With the aid of a Carl-Zeiss® binocular microscope equiped with camera lucida and the use of a curvimeter, ilustrations and measures were, respectivelly, obtained. All of the identified specimens were separated by sex, counted and, later, bottled and labeled. Vouchers and paratypes were sent to the Helminthology Museum of Fundação Oswaldo Cruz (FIOCRUZ), Rio de Janeiro, to enter the Helminthological Colection (CHIOC), under the trusteeship of Doctor Marcelo Knoff, for cataloguing.

In order to study the sinlofe, when needed, the parasites were previously treated with a clarifying solution and severed with a scalpel blade at the end of the esophagus at the middle portion. The resulting

material was analised in binocular microscopes, in temporary preparations, following the methods propsed by Durette-Desset (1969).

The parasites were identified according to Ortlepp (1922), Travassos (1937), Machado-Filho (1950), Yamaguti (1961), Travassos, Freitas and Kohn (1969), Quentin (1969), Durette-Desset (1970; 1983), Anderson, Chabaud and Wilmott (1983), Bray, Jones and Andersen (1994) and Vicente et al. (1997).

Analysis of the results

After finishing the identification and counting of the helminths, a descriptive analysis of the infection indicators stablished by Bush et al. (1997) was performed and the data was related in details, as described below:

Prevalence = Number of hosts infected by the involved specie / Number of hosts examined

Abundance = Number of involved specimens / Number of hosts examined

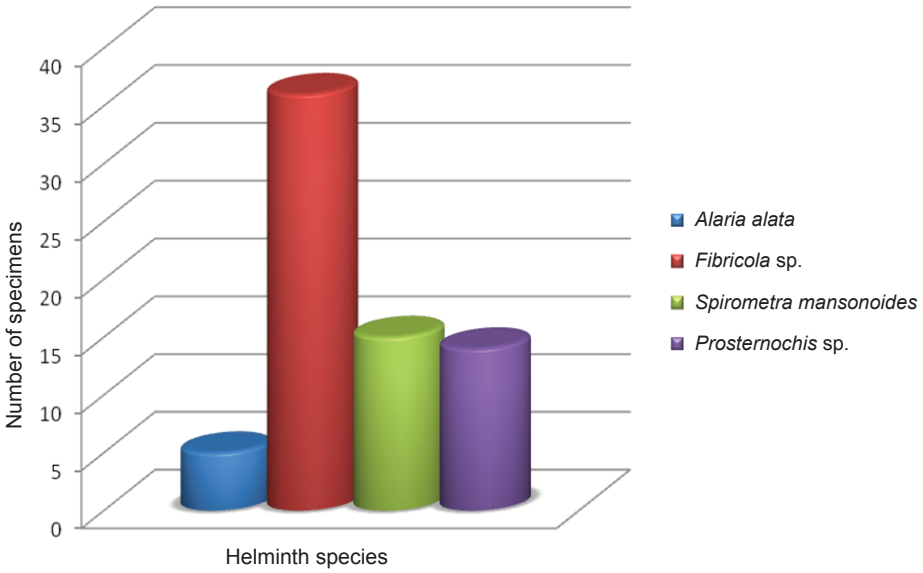
Medium intensity = Number of specimens from the involved specie / Number of hosts infected by such specie

Intensity variation = minimum and maximum number of specimens from the involved specie observed in the infected hosts

Results and Discussion

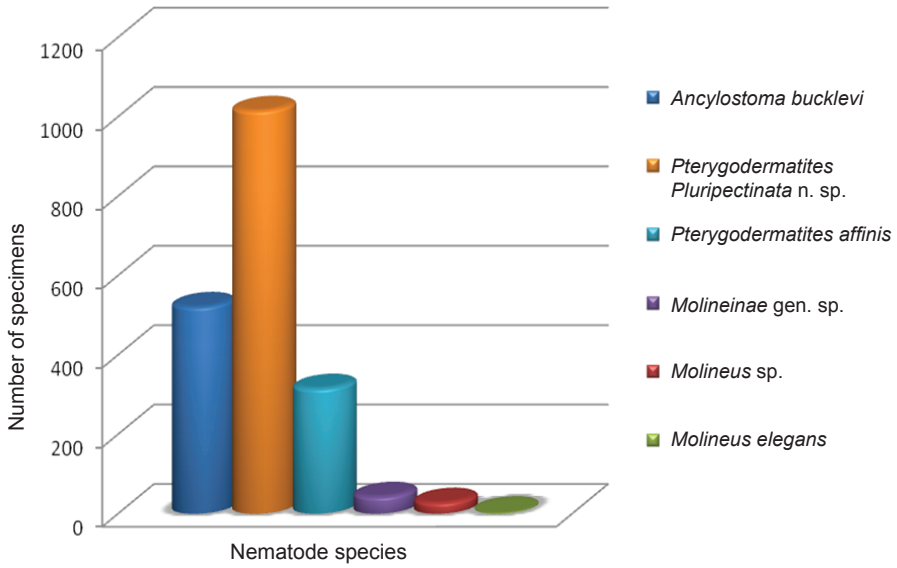
All of the necropsied crab eating froxes were infected with helminths distributed in all three segments of the gastrointestinal tract, mainly in the small intestine. 16 specimens of helminths were identified: two trematodes, one cestode, one acanthocephalus and 12 nematodes (Figure 2, 3 and 4), with a total of 2.050 identifications (Tables 1 and 2). A small parasitic diversity was shown, with a minimum of one and a maximum of six different species. In all 58 animals the intensity of infection was relatively low, ranging from three to 112 specimens per animal.

Figure 2. Total number of trematodes, cestodes and acanthocephalus in 58 crab eating foxes (*C. thous*), derived from the semi-arid region of the Paraíba state, Brazil.



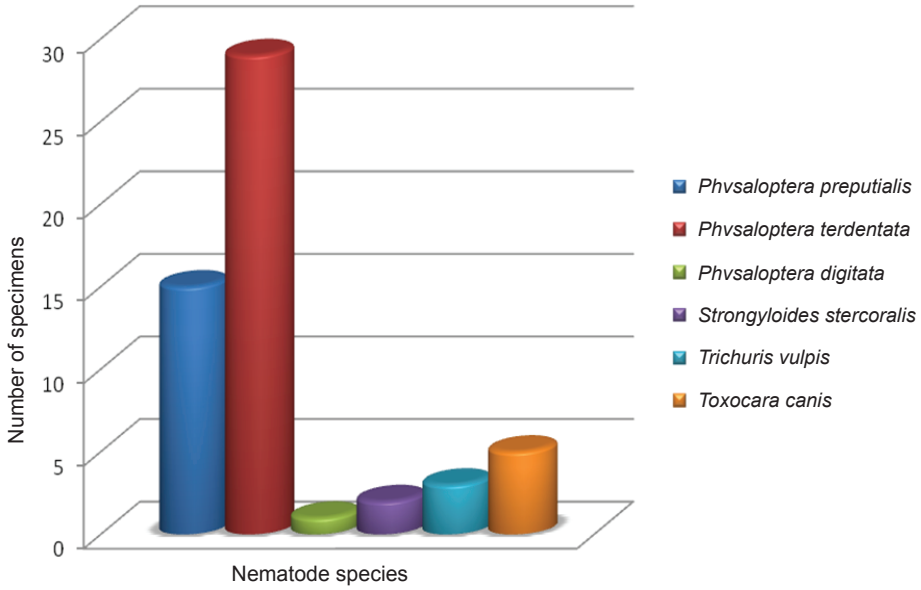
Source: Elaboration of the authors.

Figure 3. Total number of nematodes in 58 crab eating foxes (*Cerdocyon thous*), derived from the semi-arid region of the Paraíba state, Brazil.



Source: Elaboration of the authors.

Figure 4. Total number of nematodes in 58 crab eating foxes (*Cerdocyon thous*), derived from the semi-arid region of the Paraíba state, Brazil.



Source: Elaboration of the authors.

Table 1. Total number of trematode and cestode species in 58 crab eating foxes (*Cerdocyon thous*), derived from the semi-arid region of the Paraíba state, Brazil.

Systematic position	Habitat	Specimens	Total	Medium intensity	
				Minimum	Maximum
Trematoda					
Diplostomidae					
Alarinae					
Alaria alata	SI	5	5	1	2
Diplotominae					
Fibricola sp.	SI	36	36	0	36
Cestoda					
Pseudophyllidea					
Diphyllobothriidae					
Spirometra mansonoides	SI	15	15	1	4
Total			56		

Source: Elaboration of the authors.

Table 2. Total number of nematodes and acanthocephalus in 58 crab eating foxes (*C. thous*), derived from the semi-arid region of the Paraíba state, Brazil.

Systematic position	Habitat	Male	Female	Imature	Total	Medium intensity	
						Minimum	Minimum
Acanthocephala							
Oligacanthorhynchidae							
Prosthenorchis sp.	SI	4	10	0	14	1	10
Nematoda							
Rhabditoidea							
Strongyloididae							
Strongyloides stercoralis	SI	0	2	0	2	0	2
Trichinelloidea							
Trichuridae							
Trichuris vulpis	LI	1	2	0	3	0	3
Ancylostomatoidea							
Ancylostomatidae							
Ancylostoma buckleyi	SI	165	356	0	521	1	87
Trichostrongyloidea							
Molineidae							
Molinaeinae gen. sp.	STO	14	29	0	43	1	8
Molineus sp.	SI	7	21	0	28	3	25
Molineus elegans	SI	3	0	0	3	0	3
Ascaridoidea							
Ascarididae							
Toxocara canis	SI	0	3	2	5	1	3
Physalopteroidea							
Physalopteridae							
Physaloptera praeputialis	STO	4	11	0	15	1	6
Physaloptera terdentata	STO	13	16	0	29	1	14
Physaloptera digitata	STO	1	0	0	1	0	1
Ricturariidae							
Pterygodermatites pluripectinata n. sp.	SI	435	575	5	1015	2	88
Pterygodermatites affinis	SI	105	126	84	315	1	55
Total		752	1151	91	1994		

Recalling that: STO: Stomach; SI: Small Intestine; LI: Large Intestine.
Source: Elaboration of the authors.

Regarding the generic composition of the infections, 16 helminth species were identified, diverging from results found by other authors (VICENTE et al., 1997; HORTA-DUARTE et al., 2004; RODRIGUES et al., 2006; GRIESE 2007; RUAS et al., 2008), mainly according to the number of nematode species.

The helminths that showed the highest prevalence were: *Pterygodermatites pluripectinata* n. sp. (93,1%); *Ancylostoma buckleyi* (84,48%); *Pterygodermatites affinis* (43,1%); Molineinae gen. sp. (25,86%); *Spirometra mansonoides* (15,51%); *Physaloptera terdentata* (12,06%); *Physaloptera preputialis* (10,34%); *Alaria alata* (6,89%); *Prosthenorchis* sp. (6,89%); *Toxocara canis* (5,17%); *Molineus* sp. (3,44%). *Molineus elegans, Physaloptera digitata*, *Strongyloides stercoralis*, *Trichuris vulpis* and *Fibricola* sp. presented a prevalence of 1,72% each.

The average intensities of infection were the following: *Fibricola* sp. (36); *Pterygodermatites pluripectinata* n. sp. (18,79); *Molineus* sp. (14); *Pterygodermatites affinis*

(12,6); *Ancylostoma buckleyi* (10,63); *Physaloptera terdentata* (4,14), *Prosternorchis* sp. (3,5); *Molineus elegans* (3); *Trichuris vulpis* (3); *Molineinae* gen. sp. (2,86); *Physaloptera preputialis* (2,5); *Strongyloides stecoralis* (2); *Spirometra mansonoides* and *Toxocara canis* (1,66); *Alaria alata* (1,25) and *Physaloptera digitata* (one specimen by host). The prevalence, intensity and parasitic abundance indexes are described in Table 3.

Table 3. Infection indicators (prevalence, average intensity and abundance) in 58 crab eating foxes (*C. thous*), derived from the semi-arid region of the Paraíba state, Brazil.

Helminth species	Prevalence (%)	Average intensity	Abundance
Trematoda			
Alaria alata	6,89	1,25	0,08
Fibricola sp.	1,72	36	0,62
Cestoda			
Spirometra mansonoides	15,51	1,66	0,22
Acanthocephala			
Prosthenorchis sp.	6,89	3,5	0,24
Nematoda			
Strongyloides stercoralis	1,72	2	0,03
Trichuris vulpis	1,72	3	0,05
Ancylostoma buckleyi	84,48	10,63	8,98
Molinaeinae gen. sp.	25,86	2,86	0,74
Molineus sp.	3,44	14	0,48
Molineus elegans	1,72	3	0,05
Toxocara canis	5,17	1,66	0,08
Physaloptera praeputialis	10,34	2,5	0,25
Physaloptera terdentata	12,06	4,14	0,5
Physaloptera digitata	1,72	1	0,01
Pterygodermatites pluripectinata n. sp.	93,1	18,79	17,5
Pterygodermatites affinis	43,1	12,6	5,53

Source: Elaboration of the authors.

The abundance of helminths were: *Pterygodermatites pluripectinata* n. sp. (17,5); *Ancylostoma buckleyi* (8,98); *Pterygodermatites affinis* (5,53) and the remaining species of identified helminths presented na abundance ranging from 0,01 to 0,74 specimens per examined host, as shown in Table 3. Regarding platyhelminths, a low intensity was observedand only *Fibricola* sp. Showed expressive variation, due to the fact that only one host was infected.

Amongst nematodes, the species that showed significant intensity (minimum and maximum, respectivelly) were *Ancylostoma buckleyi* (1-87), *Pterygodermatites pluripectinata* n. sp. (2-88), *Pterygodermatites affinis* (1-55), *Molineus* sp. (3-25), *Physaloptera terdentata* (1-14) and the acanthocephalus *Prosthenorchis* sp. (1-10). The remaining species showed

The distribution of the parasitic diversity in the crab eating foxes ranged from one to six helminth species per animal, with the following percentage: one specie (3,45%), two species (29,32%), three species (27,58%), four species (27,58%), five species (10,35%) and six species (1,72%). The parasites that presented higher infection indicators were *Pterygodermatites pluripectinata n. sp.* and *Pterygodermatites affinis*, due to the fact that these parasites possesses a big diversity of intermediate

hosts, such as insects from the Gryllidae family (crickets) and also the fact that crab eating foxes usually feed on these insects.

Regarding *Ancylostoma buckleyi*, its expressive prevalence is assigned to its ability to infect the hosts through a percutaneous way, and the fact that its larvae are resistant in environments with a humid micro-climate. In the semi-arid region the access to water is restricted, so the animals usually group near few water reservoirs, such as small lakes and ponds, favoring the maintenance of the parasite's cycle. *Trichuris vulpis* and *Toxocara canis*, show a direct life cycle, linked to the feeding habits of the crab eating foxes, which also eat fruits and small animals, making it difficult for these helminths to complete their cycle, as shown by their low prevalence rates. The insignificant prevalence of *Strongyloides stercoralis* could be due to the age of the animals, mostly adults, since this parasite is more commom in young ones.

The prevalences found in this study differ from the observations made by Gortazar et al. (1998) and Richards, Harris and Lewis (1995) for *Pterygodermatites affinis, Trichuris vulpis* and *Toxocara canis* in other canids, as well as for *Ancylostoma buckleyi* and *Alaria alata* in *C. thous* in Brazil (GRIESE, 2007; RUAS et al., 2008). *Alaria alata, Spirometra mansonoides, Toxocara canis* and *Strongyloides stercoralis* are responsible for catarrhal duodenitis, human brain sparganosis, visceral larva migrans and enteritis, respectivelly. Since crab eating foxes are hosts of these parasites, and in times when water and food are scarce tend to visit peri-domiciliary areas, they possess a significant zoonotic potential. These foxes can also serve as reservoirs for other parasites, such as *Pterygodermatites affinis, Pterygodermatites pluripectinata* n. sp. and *Ancylostoma buckleyi,* all showing high prevalence, acting as a source of infection for domestic dogs and wild canids in the Paraíba state semi-arid region and possibly in other regions of the country. The hookworms ar generally associated with zoonosis, mainly *Ancylostoma caninum* and *A. braziliense*, suggesting the possibility that *Ancylostoma buckleyi* might also cause diseases in humans.

Conclusion

All *Cerdocyon thous* collected were parasitized and 16 helminth species were identified in the 58 necropsied animals. Amongst these species, the highest prevalences were related to *Ancylostoma buckleyi*, *Pterygodermatites affinis* and *Pterygodermatites pluripectinata* n. sp. From the identified helminths, 13 species represented the first notification on this particular host. *Pterygodermatites pluripectina* was considered a new specie (n. sp.). in the Caatinga biome, an incredibly rich helminthic fauna, previously unknown, in *C. thous* was identified in the semi-arid region of the Paraíba state.

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