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### PARASITOLOGICAL FINDINGS AND ANTIPARASITIC TREATMENT OF CAPTIVE JAGUARUNDIS *HERPAILURUS YAGOUAROUNDI* (CARNIVORA: FELIDAE) IN A CONSERVATION CENTER IN BRAZIL

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## PARASITOLOGICAL FINDINGS AND ANTIPARASITIC TREATMENT OF CAPTIVE JAGUARUNDIS *HERPAILURUS YAGOUAROUNDI* (CARNIVORA: FELIDAE) IN A CONSERVATION CENTER IN BRAZIL

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### OPEN ACCESS



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**Abstract:** Ex situ management of wildlife provides a possibility for species maintenance, research development and environmental education. But as captive facilities are usually much smaller than the area occupied by a species in the natural habitat, cleaning might be insufficient, domestic species such as cats might be in close proximity, and wild animals in captivity are inevitably stressed, animals kept in these facilities are more at risk of acquiring parasitic infections. Therefore, an appropriate prophylactic protocol and consequent antiparasitic therapy of affected animals are fundamental for any wildlife conservation center. This report describes the procedures adopted in a conservation center for wild felines in which four adult Jaguarundis were diagnosed with severe infection with gastrointestinal parasites and flea infestation. Two animals died and based on the necropsy findings and fecal examinations, infections with *Ancylostoma caninum* and *Toxocara cati* were diagnosed, as well as severe infestations with *Ctenocephalides felis felis* fleas, all common parasites of domestic cats. We discuss the applied therapy and the adopted environmental management, along with the importance of regular health assessments and a preventive medicine program for this species in captivity.

**Keywords:** *Ancylostoma*, captivity, *Ctenocephalides*, *Toxocara*, wild felines.

*Herpailurus yagouarundi*, popularly known as Jaguarundi, is a small feline of the Neotropics. It was originally recorded from southern Texas in the United States, where it is now believed to be extinct, to the outskirts of Buenos Aires in Argentina (Caso 2013). This species occurs in a variety of biomes, including tropical forests, wetlands and savannas (Caso 2013). Its diet consists largely of small mammals, and to a smaller extent of birds and reptiles (Oliveira 1998; Guerrero et al. 2002; Tófoli 2009). In contrast to most other wild cats, the jaguarundi has a diurnal activity pattern (Maffei et al. 2007; Caso 2013).

Jaguarundis are not considered threatened according to the IUCN Red List of Threatened Species and were only recently included as vulnerable in the Brazilian list of Endangered species. The naturally low density of this species in the wild and the potential effects of habitat loss and habitat fragmentation call for intensified

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monitoring of this species (Almeida et al. 2013).

Species that are difficult to study in the wild can greatly benefit from research developed in captivity. Ensuring that these animals receive the best veterinary care and husbandry, captive individuals can be used in educational programs, be founder animals for wildlife reintroduction projects or serve for genetic reinforcement of wild populations (Kleiman 2010). The present study describes the occurrence of parasitic infections in a captive population of *Herpailurus yagouaroundi* at the “No extinction” (NEX) Conservation Center and the procedures consequently adopted at this center.

### MATERIAL AND METHODS

The NEX Center is classified as a conservation center for Neotropical felines, in accordance with Brazilian legislation (Registry number 232423). It is located at the outskirts of the nation’s capital, holds most of the feline species of Brazil, and is constantly receiving animals from and exchanging animals with the environmental authority of Brazil.

In 2010 two adult Jaguarundis (one male and one female) were brought to the NEX center from a wild animal rescue center in Manaus in Northern Brazil. They underwent a 30-day long quarantine that included one parasitological and hematological screening. In April 2011, a second pair arrived from a rescue center in Pará, also in northern Brazil. The same quarantine procedures were implemented for this pair.

The Jaguarundi enclosures include separate feeding and sleeping areas, places to hide and trunks and ropes for environmental enrichment. The floor is covered with black soil. The Jaguarundis are fed once a day with a mixture of beef or pork and domestic cat food. Occasionally, the animals are fed live chickens. The enclosures are cleaned daily with manual removal of feces and washing of sleeping chambers with water and soap. Once a week the furniture and toys are also washed with water and soap.

Three months after its arrival the male from Pará died. Due to the advanced state of decomposition of the carcass at the time of necropsy, the findings were inconclusive and are not presented in this report. During the second semester of 2011, the female that had been paired with the male from Pará died as well. Prior to their death both animals were lethargic and emaciated. The second pair also showed lethargy and weight loss, however, less pronounced, and mucous feces as well as signs of dehydration such as flaccid skin, prolonged capillary fill time and sunken eyes.



**Image 1. Visual inspection of deceased female Jaguarundi. Intense flea infestation can be observed especially in the ventral area of the neck.**

A necropsy was performed the following day including internal and external examination for parasites. The gastrointestinal tract was removed, divided into stomach, small intestine and large intestine, and each part was individually dissected. The contents of each section were removed and washed under running water in a steel 150 mesh sieve. Internal parasites were preserved in Railliet & Henry solution and identified using specific taxonomic keys (Rep 1963; Vicente et al. 1997). Severe flea infestation was observed. Fleas were kept in 70% ethanol and identified with the use of appropriate taxonomic keys (Guimarães et al. 2001) (Image 1).

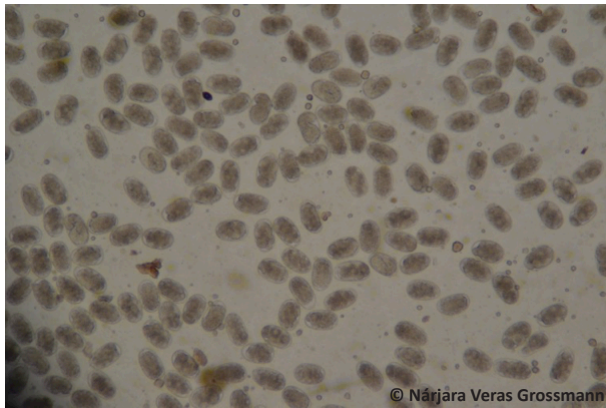
In addition, fecal samples were collected from the remaining Jaguarundis. They were analyzed using Sheather’s sucrose flotation method (Dryden et al. 2005) and then by the MacMaster (Gordon & Whitlock 1939).

### RESULTS

The ectoparasites were identified as *Ctenocephalides felis felis* and were concentrated in the ventral areas of the neck and chest and the inguinal area. Large amounts of flea dirt were observed all over the fur and skin.

The necropsy did not show any macroscopic alterations of the cardiovascular, respiratory and reproductive systems. A large number of parasites was found in the gastrointestinal tract, many still attached to the mucosa. Two nematode species were identified: *Ancylostoma caninum*, with an intensity of 35 specimens (34% males, 46% females and 20% juveniles); and *Toxocara cati*, with an intensity of 227 parasites (35% males, 40% females, and 25% juvenile forms).

In the fecal samples from both the remaining Jaguarundis, eggs resembling those of *Ancylostoma* were found. The incidence in the female was 14,200 eggs per



**Image 2.** Eggs suggestive of *Ancylostoma* observed in fecal sample (x400 magnification)

gram, and for the male 10,300 eggs per gram (Image 2). The animals were treated with a tablet containing 50mg of praziquantel, 144.0mg of pyrantel pamoate, 150mg of febantel and 0.06mg of ivermectin (Top Dog®, Ourofino Saúde Animal, Brazil), which was given orally. A second dose was administered 15 days after the first dose. Fecal samples were collected two weeks after the second dose. The exams were all negative.

Concurrently, several strategies to control the flea infestation were adopted. Jaguarundis were treated with fipronil (Frontline TopSpot®, Sanofi, Brazil); a liquid applied directly on the dorsal part of the neck. Animals in nearby enclosures were also prophylactically treated with fipronil. The Jaguarundis returned to the quarantine unit while their housing was cleaned. The enclosures, toys and furniture were thoroughly washed with water, soap and sodium hypochloride 5%. Lime was mixed with the soil covering the floor to destroy free-living stages. Only after a 30-day vacation period the animals returned to this enclosure. New infestations were not observed in the following months.

All employees were advised on the role of fomites in transmitting diseases and were instructed to not use the same footwear when moving between different enclosures. Since *Toxocara* is a zoonosis, instructions were also handed out on personal hygiene measures.

## DISCUSSION

Multi-parasitic infections are usually detrimental to an animal's health; each parasite species might have its own destructive effect on the host and worsen an already negative clinical situation (Vaumourin et al. 2015).

Experiments have shown that the introduction of a novel parasite can lead to changes in parasite resistance afterwards (Petney & Andrews 1998). Also,

since different immunological paths are used to react to internal and external parasites, it might be difficult for a host to activate both pathways simultaneously (Jolles et al. 2008; Vaumourin et al. 2015). In wild feline species there are no reports comparing multi-parasites and single parasite infections; however, in domestic cats, those who present ectoparasite infestation are more likely to host internal parasites (Beugnet et al. 2014).

Both *Ancylostoma caninum* and *Toxocara cati* have been previously described for *Puma yagouaroundi*. *Toxocara cati* was described by Noronha (2002), and *Ancylostoma caninum* by Vieira et al. (2008). These reports either describe parasite specimen from helminthological collections or found in roadkill, and thus do not provide any clinical information. Other nematode species detected in *Puma yagouaroundi* include *Molineus felineus* (Vicente et al. 1997), *Ancylostoma braziliense*, *Ancylostoma bidens*, *Oncicola onicola*, *Oncicola paracampanulata*, *Toxocara mistax*, *Echinococcus oligarthrus*, *Aelurostrongylus obstrusus*, *Toxascaris leonina* (Vieira et al. 2008), and *Angiostrongylus felineus* (Vieira et al. 2013). As for ectoparasites, *Ctenocephalides felis felis* has also been previously described in this species as well as *Adoratopsylla antiquorum antiquorum*, *Rhopalopsyllus lutzi lutzi* (Pinto et al. 2009), and *Rhopalopsyllus saevus* (Villalobos-Cuevas et al. 2016).

In the wild, most parasites cause little harm, but the stress of life in captivity increases the challenge for animals whenever they face parasitological infections (Ziman et al. 2004). Aside from stress, close proximity to other animals and humans and intense management routines (including the entry of keepers to clean, feed or enrich the environment), can lead to a greater exposure to parasites. A survey of small wild felines kept in various facilities in Brazil detected high infestation levels with *Ctenocephalides* in Jaguarundi (Adania et al. 1998) indicating that this is a common problem. The fleas were probably introduced to Jaguarundi in captivity by feral domestic animals attracted by food remains. Rendón-Franco et al. (2013) detected signs of cross transmission of *Toxocara cati* and *Trichuris campanula* in captive Jaguarundi and feral domestic cats, adding evidence to Jaguarundi's vulnerability of parasites associated to domestic fauna. On top of this Jaguarundi often show signs of chronic stress in captivity, such as stereotypies and apathy even during environmental enrichment sessions. The small size of the enclosures with insufficient cleaning results in high levels of pathogen contamination. The combination of these facts can and in our cases has been fatal to Jaguarundi.

Therefore, the sanitary management procedures have to be modified to avoid new infestations.

Parasitological monitoring programs should be adopted by zoos and sanctuaries. Regular examinations allow the detection and prevent the development of parasitic infections as severe as the ones presented here. Such examinations are also important to guide the veterinarian in developing appropriate antiparasitic strategies. Enclosure management is also an important measure to avoid situations that facilitate infection and transmission of parasites. Routine facility wide parasitological screening and therapy, if needed, should be done and animals found to have co-infestations of several parasites must be given special attention with regards to the treatment. Effective and safe treatment approaches need to be tested, especially for species rare in captivity such as the Jaguarundi. In our case no sick individuals or positive parasitological findings were reported after the proposed changes were applied at the sanctuary.

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