

**CASE REPORT**


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**FIRST REPORT OF *Dicrocoelium* SP. IN HOARY FOX  
(*Lycalopex vetulus* Lund 1842) (CARNIVORA: CANIDAE)  
FECES**

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**ABSTRACT**

The hoary fox (*Pseudalopex vetulus*), endemic to Brazil's Cerrado region, is a wild canid species facing ecological pressures from urbanization and habitat fragmentation. These pressures increase the risk of pathogen transmission between wild and domestic animals, particularly in rural and peri-urban areas. This study reports the first report of *Dicrocoelium* sp. and *Hepatozoon* spp. infections in a wild female hoary fox in Southeast Brazil. The fox, presented with neurological disorders, dehydration, and poor nutritional condition, was hospitalized and subjected to a series of parasitological and clinical tests. Blood smears and fecal examinations revealed the presence of *Hepatozoon* sp. gametocytes and a significant number of *Dicrocoelium* eggs. The fox received treatment with albendazole, enrofloxacin, and N-acetylcysteine, showing progressive improvement before being reintroduced to its habitat. This study highlights the significance of parasitic infections in wild canids, emphasizing the need for further research on the ecological and health impacts of such infections. It also underscores the importance of comprehensive fecal and hematological examinations in the clinical assessment of wild fauna and raises awareness about the potential of wild canids as reservoirs for zoonotic parasites.

**KEY WORDS:** Zoonosis; one health; canids; dicrocoeliosis.

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## INTRODUCTION

*Lycalopex vetulus* (Lund, 1842), also known as hoary fox [English], raposa-do-campo, raposinha-do-campo, jaguamitinga ou jaguapitanga [Portuguese], is a wild canid, found in the neotropical region of the world. It is endemic in Brazil, mainly in the Brazilian savannah-like Cerrado (Dalponte et al., 2023). However, urbanization and fragmentation of habitats have been identified as risk factors for wild canids, causing important changes and leading to adverse environmental impacts due to their ecological importance (Liu et al., 2016; Theodorou, 2022).

These changes may have a significant effect in terms of health since the proximity of these wild animals to other domestic animals allows the transmission of pathogens in both ways, mainly in rural and peri-urban areas, as already reported for *L. vetulus* (Curi et al., 2010; Acosta-Jamett et al., 2024).

*Dicrocoelium* sp. (Trematoda: Dicrocoeliidae) is a helminth parasite responsible for dicrocoeliosis, a disease primarily associated with herbivores, but which can also be observed in humans, with zoonotic potential (Manga-González et al., 2001). *Hepatozoon* spp. (Apicomplexa: Hepatozoidae) parasites are found in diverse habitats with a wide range of hosts with complex transmission cycles, which are still poorly understood (Ferrari et al., 2022). We report the first occurrence of *Dicrocoelium* and *Hepatozoon* spp. infections in *L. vetulus* in Southeast Brazil, offering new insights into the parasite fauna of the hoary fox and detailing the associated clinical abnormalities.

## MATERIAL AND METHODS

A wild female hoary fox was referred to the Veterinary Hospital of the Federal University of Lavras, located in Lavras, Minas Gerais, Brazil. The blood sample was collected for screening of *Leishmania* infection by Dual Path Platform (DPP®). Muscle creatine kinase was also determined since the animal presented concurrent muscle and nervous tissue involvement. Blood smears were prepared using venous blood collected via venipuncture of the cephalic vein and peripheral blood from the inner surface of the ear, followed by microscopic evaluation. Over seven days of hospitalization, fecal samples were examined daily for parasites using the sedimentation technique. Additionally, thoracic and abdominal radiographs were taken.

## RESULTS

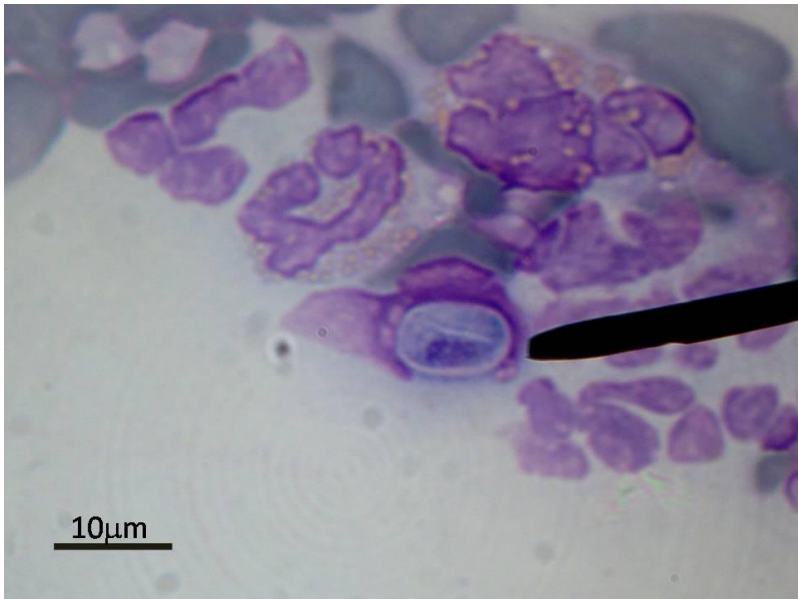
### *Clinical manifestations*

The fox presented with significant neurological disorders, dehydration, and low body weight, indicating poor nutritional condition, profound

weakness, diarrhea, and mild respiratory signs. Body temperature was within the normal range. Due to the severity of its clinical presentation, the animal was hospitalized. On the second day of hospitalization, although there was a slight improvement, the fox exhibited severe loss of appetite and continued weakness.

#### *Parasitological Tests*

Direct microscopy blood smear revealed nucleated protozoan gametocytes measuring 9.8 – 10.5µm long × 5.3 - 5.8µm wide compatible with *Hepatozoon* sp. (Figure 1).



*Figure 1.* Blood smear of a hoary fox (*Lycalopex vetulus* Lund, 1842) showing nucleated protozoan gametocytes measuring 9.8 - 10.5µm long × 5.3 - 5.8µm wide, compatible with *Hepatozoon* sp.

Diagnosis was based on microscopic identification and quantitative analysis of eggs present in the feces. Over one week, there was an increased number of trematode eggs at the intensity of 10 - 30 eggs per gram of feces (EPG) (Figure 2).

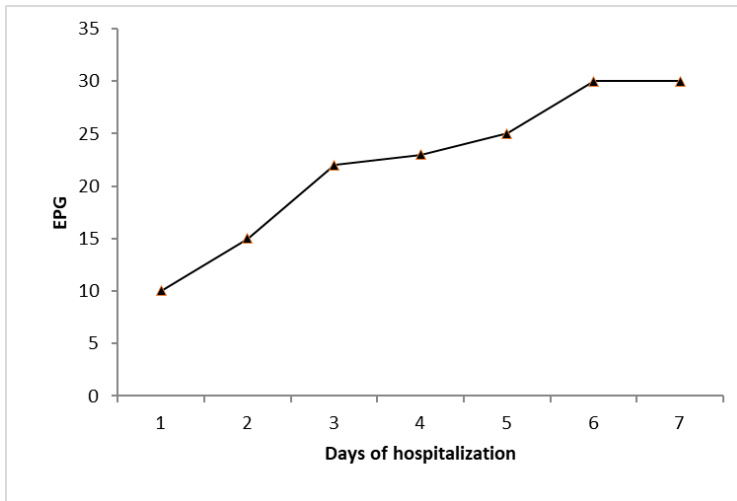


Figure 2. Number of *Dicrocoelium* sp. eggs per gram of feces (EPG) of a hoary fox over seven days of hospitalization in a veterinary hospital.

Eggs were operculated, measuring 39 - 42 $\mu$ m long  $\times$  24 - 28 $\mu$ m wide, thick-walled, yellowish-brown, and compatible with *Dicrocoelium* sp. (Figure 3).

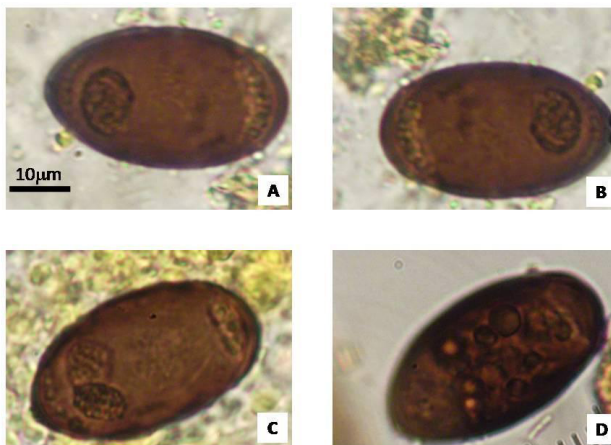


Figure 3. Eggs of *Dicrocoelium* sp. recovered on hoary fox feces.

No other abnormalities were noted: thoracic and abdominal radiographs were unremarkable, *Leishmania* serology was negative, and creatine kinase was within the physiological range.

The fox was given albendazole (30mg/kg of body weight), enrofloxacin (5mg/kg of body weight during five consecutive days), and N-acetylcysteine (20mg/kg of body weight also during five days) with progressive improvement after the beginning of the treatment. The hoary fox was then handed over to a competent authority to reintroduce it to its habitat.

## DISCUSSION

Parasites are recognized as a vital component of global biodiversity. Understanding the factors influencing infection patterns among wild hosts is crucial for grasping the evolution and impact of parasitism in natural populations (Acosta-Jamett et al., 2024). Parasites significantly shape host ecology and evolution, affecting ecosystems by altering host life histories and distributions. They can negatively impact host fitness and regulate populations, making them essential in species endangerment and recovery. While conservation biology acknowledges their importance, our understanding of parasites' roles in ecosystems is still evolving, with increasing recognition of their impact on ecosystem structure and function (Gupta et al., 2020).

Dicrocoeliosis is a zoonotic trematode infection usually associated with herbivorous mammals, caused by *Dicrocoelium* sp., a parasitic fluke that typically infects the gallbladder and bile ducts of herbivores (Cengiz et al., 2010). Definitive hosts shed operculate eggs with a thick dark brown cuticle in their feces. Land snails and ants serve as the first and second intermediate hosts in their life cycles, and definitive hosts become infected by eating infected ants. Although rare, dicrocoeliosis can occur in humans, primarily due to inadvertent ingestion of ants or undercooked infected liver from herbivores (Cengiz et al., 2010).

The high number of *Dicrocoelium* eggs in the fox feces detected during the seven days of hospitalization requires careful interpretation. *Dicrocoelium* typically does not infect carnivores, so their presence is likely due to the secondary passage of eggs from feeding on the feces of infected hosts. However, this hypothesis is questionable due to the persistent egg shedding over seven days, which cannot be attributed to coprophagia. Infection in dogs is confirmed by the initial finding of *Dicrocoelium* eggs with an intensity of 1-3 EPG and subsequent examinations yielding similar results (Nesvadba, 2006). In this report, the *Dicrocoelium* eggs were recorded with an intensity of 10 - 30 EPG for up to seven consecutive days. Furthermore, the health status of the fox suggested clinical dicrocoeliosis. Clinical signs in dogs infected by *Dicrocoelium*, similar to those described in the literature for other infected animals and humans, include digestive disturbances, recurrent diarrhea, abdominal pain, weight loss, poor general health, loss of temperament, and reduced performance in working dogs (Cengiz et al., 2010). The potential risk

of human infection and the actual pathogenic impact on species other than domestic ruminants remain to be clearly addressed.

Parasites of the genus *Hepatozoon* are intracellular apicomplexan blood parasites that infect various vertebrate hosts, including domestic dogs and wild canids (Smith, 1996). Transmission occurs through ingesting infected invertebrate hosts and via ticks (Smith, 1996; Baneth et al., 2007; Johnson et al., 2007; Demoner et al., 2016). Gametocytes of *Hepatozoon* sp. were found in the blood smear of the hoary fox. Two distinct species of *Hepatozoon* can infect canids: *H. canis* and *H. americanum*. Canine hepatozoonosis has been recorded in several regions of Brazil and can also affect wild canids. Various studies have shown that, although *H. canis* is present throughout Brazil, its prevalence is highly variable.

The most common signs of hepatozoonosis in domestic animals are anemia, lethargy, weight loss, weakness, and cachexia (Baneth et al., 2007; Lima et al., 2017). However, the pathogenic impact on wildlife is mostly unknown (Smith, 1996). Although this fox did not exhibit anemia, other clinical signs consistent with canine hepatozoonosis were present. Due to the co-infection with *Dicrocoelium*, it was not possible to attribute specific clinical signs to one infection over the other.

The results of this study provide new insights into the parasite fauna of the vulnerable hoary fox native to Brazil. This is the first report of *Dicrocoelium* infection in *L. vetulus* and the first record of *Hepatozoon* spp. in hoary foxes in the studied geographic area. This report underscores the importance of fecal and hematological investigations and clinical assessments of wild fauna. Additionally, as the prevalence of *Dicrocoelium* in Southeast Brazil is unknown, it alerts veterinarians to the presence of *Dicrocoelium* and *Hepatozoon* in the region. Furthermore, it highlights the potential of *Dicrocoelium* as a new parasite of wild canids such as foxes. More studies are needed to explore the role of these wild carnivores as potential reservoirs of diseases of veterinary interest.

## CONFLICT OF INTEREST

The authors declare no conflict of interest to disclose.

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