# Multiparasitism in *Sapajus nigritus* (Goldfuss 1809) (Primates: Cebidae) kept illegally in home captivity in the state of Santa Catarina, Brazil – Case report

# Multiparasitismo em *Sapajus nigritus* (Goldfuss 1809) (Primates: Cebidae) mantido ilegalmente em cativeiro domiciliar no estado de Santa Catarina, Brasil – Relato de caso

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**ABSTRACT**
A young male of *Sapajus nigritus* (Goldfuss, 1809), received assistance at the veterinary clinic of the Universidade do Oeste de Santa Catarina - UNOESC after being rescued from irregular possession at home by the Environmental Military Police. During the general physical examination, the patient was dehydrated and very thin, with skin lesions, alopecia, generalized pruritus, and sinking of one of the eyes. Laboratory examination

confirmed a case of multiparasitism. The fecal examination confirmed parasitism by three endoparasites, the protozoan *Balantidium coli*, a cestode of the family Anoplocephalidae, and a nematode of the genus *Strongyloides*. Ectoparasite search confirmed parasitism by *Ctenocephalides felis* and mites of the genus *Cheyletiella*. The treatment included therapy with albendazole and fipronil, drugs known to be effective. The report highlights the potential risk of the proximity between humans and non-human primates because of illegal possession of wild animals and prompts the discussion of information that benefits biodiversity conservation, veterinary medicine, and public health.

**Keywords:** Black capuchin, *Balantidium coli*, *Ctenocephalides felis*, public health.

**RESUMO**

Um jovem macho de *Sapajus nigritus* (Goldfuss, 1809), foi recebido para atendimento na clínica veterinária da Universidade do Oeste de Santa Catarina - UNOESC após ser resgatado em posse irregular em domicílio pela Polícia Militar Ambiental. Ao exame físico geral o paciente se apresentava desidratado e magro, com lesões cutâneas, alopecia, prurido generalizado e afundamento de um dos olhos. Exames laboratoriais confirmaram um caso de multiparasitismo. O exame de fezes confirmou parasitismo por três endoparasitas, o protozoário *Balantidium coli*, o cestódeo pertencente à família Anoplocephalidae e o nematoide pertencente ao gênero *Strongyloides*. A pesquisa de ectoparasitas confirmou parasitismo por *Ctenocephalides felis* e por ácaros do gênero *Cheyletiella*. Para o tratamento foi implementada a terapia com albendazol e fipronil, fármacos que apresentaram efetividade no tratamento. O relato evidencia o potencial risco da proximidade estabelecida entre o ser humano e os primatas não humanos oriundos da posse ilegal de animais silvestres, trazendo à discussão informações em benefício da conservação da biodiversidade, da medicina veterinária e na saúde pública.

**Palavras-chave**: Macaco-prego, *Balantidium coli*, *Ctenocephalides felis*, saúde pública.

## 1 INTRODUCTION

Considering the phylogenetic proximity that non-human primates (NHPs) have to humans, pathogen transmission can result in important public-health problems (PHILLIPS *et al*., 2004; DE PAULA *et al*., 2005; JOHNSON-DELANEY, 2009; ALCÂNTARA *et al*., 2016). Until now, six groups of organisms have been found infecting non-human primates: viruses, bacteria, fungi, protozoans, helminths, and arthropods (NUNN and ALTIZER, 2006; AGOSTINI *et al*., 2018). Due to a series of problems, including behavioral ecology, public health, and conservation, it is important to understand the diversity, dissemination, and evolution of parasites in wild animals (NUNN and ALTIZER, 2005). Nevertheless, the inventory of parasites that infect several taxa, including New World NHPs, is far from being complete, highlighting the need for interdisciplinary studies to determine and treat these parasites (SOLÓRZANO-GARCÍA and LEON, 2018).

Species that are more adaptable to coexist with humans, such as small primates, can facilitate the sharing of pathogens, such as viruses and parasites, including some zoonoses (PEREIRA *et al*., 2020). The monkeys most kept as pets are New World primates: *Saimiri* sp., *Callithrix* sp., *Saguinus* sp. *Nigritus* sp. and *Sapajus* sp. (REDMOND, 2005). In the past years, robust capuchin monkeys (*Sapajus* spp.) have become the medium-sized primates most found in captivity in Brazil (ELLIS; and ELLIS, 1988; KIERULFF *et al*., 2005). Because they have great cognitive ability and dexterity, these monkeys are sold as pets and become one of the main targets of illegal trade (ESTRADA *et al*., 2017; GOMES, 2019). A survey conducted in the Wildlife Screening Centers of the Brazilian Institute of Environment and Renewable Natural Resources (IBAMA) indicates that, between 1999 and 2006, 4,621 primates were confiscated, 28.1% of which were robust capuchin monkeys (LEVACOV; JERUSALINSKY and FIALHO, 2011). This large number is the result of rescues and apprehensions of illegally traded animals (KIERULFF *et al*., 2005).

The species *Sapajus nigritus* (Goldfuss, 1809), commonly known as the black capuchin (macaco-prego in Portuguese), inhabits remnants of different sizes and degrees of conservation in the Atlantic Forest between the Southeast and South regions (CULOT *et al*., 2019). Its distribution extends from south of the Doce River (Minas Gerais and Espírito Santo) to the states of southern Brazil, as well as northeastern Argentina (PRINTES; LIESENFELD and JERUSALINSKY, 2001; FRAGASZY; VISALBERGHI and FEDIGAN, 2004; VILANOVA *et al*., 2005). This species is opportunistic, which helps it remain in fragmented environments (BERNARDO and GALETTI, 2004), and has a complex social structure, frequently interacting with other individuals of the same group (FRAGASZY; VISALBERGHI and FEDIGAN, 2004). These characteristics can expose them to high levels of parasitism (NUNN and ALTIZER, 2006), which is important because they can serve as reservoirs of a variety of infectious agents that are of public health concern (LAROQUE *et al*., 2014).

Knowing the geographic distribution, ecology, feeding habits and parasite fauna of NHPs contributes to applying more precise and effective protective measures for both captive and free animals (PEREIRA *et al*., 2020). However, studies concerning parasitism in NHPs kept illegally in captivity and its consequence to the host are still scarce, especially in Brazil (CHIARELLO *et al*., 2008; ALCÂNTARA *et al*., 2016; FALCÃO *et al*., 2018). This work aimed to report a case of multiparasitism in an individual of black capuchin that had been illegally kept in captivity, including its diagnosis and treatment.

## 2 CASE REPORT

A young male black capuchin (*Sapajus nigritus*), weighing 910 g was received for assistance at the Veterinary Clinic (CLINIVET) of the Universidade do Oeste de Santa Catarina - UNOESC, campus of São Miguel do Oeste, after being rescued by the 2nd Squad of the 2nd Company of the 2nd Battalion of the Environmental Military Police in the urban perimeter of the municipality of Maravilha, extreme west of the state of Santa Catarina, Brazil. The patient had skin lesions and alopecia. The environmental military police officer reported that the monkey was rescued from irregular possession in a house where it coexisted with dogs and cats. The patient lacked a history of vaccination and control of endoparasites, and its food consisted of homemade food and fruits. During the general physical examination, the patient was dehydrated, very thin, with generalized pruritus and sinking of one of the eyes.

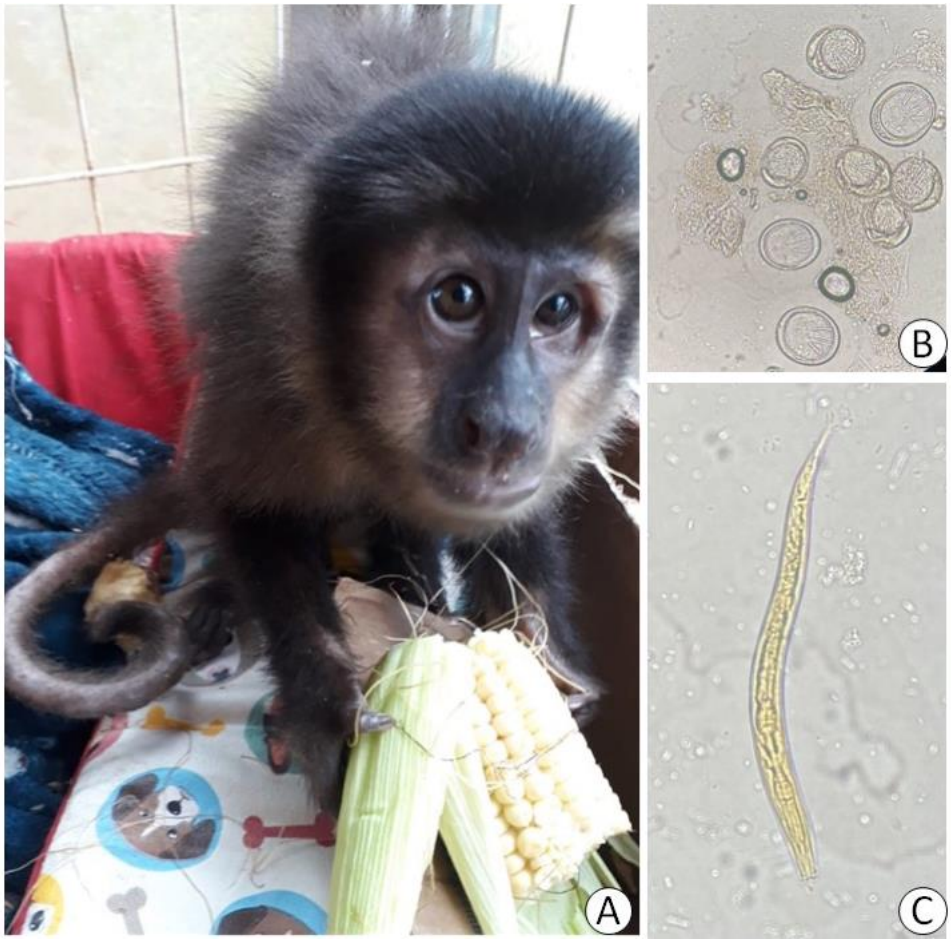
A specific dermatological examination revealed dry, opaque, and brittle hair with areas of alopecia and hair rarefaction at the tail (Figure 1A). The skin had widespread pyodermitis and erythema, with papules on the face and pustules in the abdominal region. The clinical examination revealed ectoparasites attached to the skin, which were manually collected using tweezers and placed in microtubes with 70% ethanol. Additionally, to conclude the definitive diagnosis, deep skin scraping was conducted with a scalpel blade until producing capillary bleeding. This technique aims to look for scabies-causing mites. The collected material was sent for parasitological analysis at the parasitology laboratory of the veterinary clinic.

After the initial clinical evaluation, the animal remained hospitalized and received appropriate nutrition plus vitamin supplementation (Metacell) to reestablish an acceptable body score. Feces were collected and sent for coproparasitological analysis. The samples were processed through two techniques using dry feces: fluctuation by centrifugation with zinc sulfate (FAUST *et al*., 1938) and Baermann (BAERMANN, 1917). The analysis occurred through micrometry and morphology using a binocular microscope at the 40x objective. The morphological identification of the finds was conducted based on records in the literature (TAYLOR; COOP and WALL, 2017).

The parasitological examination of the skin through deep skin scraping followed by analysis under an optic microscope did not reveal samples of scabies. However, ectoparasites were observed during the clinical examination. A morphological analysis determined that they consisted of mites of the genus *Cheyletiella* and fleas of the species *Ctenocephalides felis* (Bouché, 1835).

The fecal examination determined parasitism by three types of endoparasites, the protozoan *Balantidium coli* (Malmsten, 1857), a cestode of the family Anoplocephalidae (Figure 1B), and a nematode to the genus *Strongyloides* (Figure 1C).

Figure 1. A: Specimen of *Sapajus nigritus* (Goldfuss, 1809) rescued from irregular captivity by the Environmental Military Police in the urban perimeter of the municipality of Maravilha-SC, extreme west of the state of Santa Catarina, Brazil. Results from the fecal examination, B: Eggs of cestodes; C: Rhabditiform larvae.




Source: Personal archive.

After the evaluation and analyses were concluded, the animal received a topical treatment with fipronil (Frontline) to eliminate the ectoparasites and a single dose of albendazole for endoparasitism. After two weeks of treatment, a new coproparasitological analysis was conducted and revealed negative results for parasitism. Later, the animal was returned to the Environmental Military Police for the applicable procedures.

## 3 DISCUSSION

The parasitological researches were carried out by means of examinations and by research of ectoparasites. The results revealed a case of multiparasitism. In the stool

examination, parasitism was found by three types of endoparasites, being a protozoan, a cestode and a nematode. In an endoparasite, reaching the taxonomic classification was possible at the species level, being the protozoan *Balantidium coli* (Mamasten, 1857), the only cestode was the class level (Cestoda Class), the nematode, also identified at the class level (Nematode class). No parasitological examination of the skin performed by means of skin scraping followed by analysis under optical microscopy, no scabies were observed. However, during the clinical examination, specimens of ectoparasites were observed. Through analysis it was found that flea mites are morphologically defined. The mite was identified as belonging to the genus Cheyletiella and the fleas identified as *Ctenocephalides felis* (MONTEIRO, 2017).

*Ctenocephalides felis* (Bouché, 1835) is one of the most important ectoparasites of dogs and cats worldwide due to its geographic distribution and hematophagous habits. Moreover, it can transmit pathogens, such as mycoplasmosis (WOODS *et al*., 2005), and compromise the animal's welfare directly through the bite or the pruritus that follows. Additionally, anemia and allergic dermatitis can also occur (HALLIWELL, 1979). Anemia usually occurs during a heavy infestation, especially in young animals (HARVEY; FRENCH and MEYER, 1982). Antiparasitic medication is used for control, but acquired resistance to these drugs has been reported (RUST and DRYDEN, 1997; LINARDI and SANTOS, 2012).

The genus *Cheyletiella* consists of surface mites with tropism through the keratin layer of the skin, feeding on tissue remains and lymph. Parasitized individuals usually present scaling dermatitis, sometimes with the formation of papules and crusts. This parasite can infect several mammal species, including humans, and can be transmitted from one host species to another, which demonstrates the epidemiological importance of each parasitized host (MONTEIRO, 2017). Thus, the diagnosis and treatment are fundamental to avoid the spread from one animal to another, including humans.

The protozoan *B. coli* is an intestinal parasite (large intestine), which infects a variety of species, such as pigs, humans, primates, ruminants, and equines (HEADLEY; KUMMALA and SUKURA, 2008). However, pigs and non-human primates are the most important reservoirs, favoring the perpetuation of this zoonosis (NAKAUCHI, 1999). This pathogen is found worldwide and causes, in humans, a disease known as balantidiasis, which can lead to death, especially in situations of immunosuppression (KLINE *et al*., 2013). The infected host eliminates infecting forms of the protozoan

through the feces, which can be a source of infection to any other susceptible host, thus favoring the propagation of the disease (DA SILVA BARBOSA *et al*., 2016).

The Cestoda was classified, based on the morphology of the eggs, in the Class Cestoda. According to Servian *et al*. (2020), some cestodes are important in primates, such as the genus Bertiella, considered a typical intestinal parasite of these animals. However, parasitism is not restricted to them, being considered a zoonosis. The risk of human contamination is directly related to the proximity to primates, the primary hosts.

In the examination of fresh feces, a rhabtidoid larva was observed, and through morphological analysis (GONZÁLEZ-HORNA and IGLESIAS-OSORES, 2017) it was possible to classify it in the Nematoda Class. Considering the biology of the gastrointestinal system parasites, when the animal is parasitized by the *Strongyloides* genus, parthenogenetic females lay larval eggs, which can still hatch in the intestinal lumen and eliminate larvae in the feces. These larvae may be of the rhabditiform type, which suggests a possible infection by the genus.

The *Strongyloides* genus includes about 50 species, most of which are host-specific. The species *Strongyloides stercoralis* can parasitize dogs, cats, and humans and is considered a zoonosis (MONTEIRO, 2017). In this report, the species could not be determined. However, according to Pereira *et al*. (2010), *S. stercoralis* can parasitize several non-human primates. The parasitism usually does not cause clinical manifestations when the parasite load is low (MATI *et al*., 2013), which agrees with the present report, in which the animal coexisted with dogs and cats but did not show clinical symptoms that were compatible with the infection. However, according to Catão-Dias (2003), in some situations, the infection can become pathogenic, especially in conditions of immunosuppression, which may occur due to inadequate eating habits, simultaneous diseases, and situations of continuous stress, among other factors. In more serious situations, the infection can cause the death of the animal (MONTEIRO, 2017).

Finally, this study highlights the potential risk of the proximity between humans and illegally possessed NHPs (ESTRADA *et al*., 2017; GOMES, 2017). Parasitological studies with animals that are phylogenetically close to humans are crucial because they discuss information that benefits biodiversity conservation and veterinary medicine, with close contact with strategies of public health maintenance (LAROQUE *et al*., 2014; PEREIRA *et al*., 2020).

## 4 CONCLUSIONS

The lack of reports about parasites and diseases that affect Brazilian primates, associated with the gradual increase of human-animal contact, either through anthropogenic actions based on deforestation or by the increasing interest in primates as pets, highlights the importance of this work. Wild animals of any species can be reservoirs of several diseases with zoonotic potential and many are still unknown, which makes it fundamental to invest in research concerning parasites and other pathogens to understand the parasite-host relationship.

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