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Strongyloides sp. Infection in a Brown Capuchin (Sapajus apella L.): Case Report

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Strongyloids are widespread helminths commonly causing chronic, asymptomatic infections, which under certain circumstances can became severe, even fatal. The diverse clinical picture accompanying acute cases is often confusing in the search for a diagnosis. The aim of this work is to document the case of strongyloid infection in a monkey from the Sofia Zoo and supply morphometric data on its causative agent. Strongyloid eggs and rhabditiform larvae were found in feces of a brown capuchin. The eggs were 48-56 µm in length, and 25-27 µm in width, and the larval sizes were 495-598 µm and 19-24 µm respectively. We assume they were of the species Strongyloides fuelleborni, although the diagnosis is not definitive. Morphometric data regarding found eggs and larvae could be useful basis for future research, and combined with molecular analyses, would provide reliable diagnostic tools in the field of strongyloid infections.

Key words: brown capuchin, soil-transmitted helminths, *Strongyloides fuelleborni,* morphometric data

Introduction

The genus *Strongyloides* (Nematoda: Rhabditida) consists of widespread helminths with complicated life cycle. Strongyloids are facultative parasites, can also develop as free-living organisms depending on environmental conditions: Only the female individuals parasitize, they are localized in the small intestines of the hosts, where release eggs. Eggs or first stage larvae (L1) are released into the external environment with feces. There, for a few days, L1 develop to rhabditiform larvae, which under unfavorable conditions (low temperature, humidity and oxygen concentration) turn into invasive filariform larvae. Filariform larvae penetrate their hosts by the oral or percutaneous route, migrate to the lungs, where molt and differentiate into male and female individuals. After copulation, the males die, and the females, passing through the trachea and pharynx, are swallowed and end up in the small intestine. Under favorable conditions of the external environment, rhabditiform larvae do not become

filariform, but give a free-living generation of male and female individuals. After their copulation, the females release embryonated eggs, which further develop depending on external conditions as parasitic or free-living generation [8]. Due to these peculiarities, strongyloid infections cannot be directly transmitted between hosts [7]. They are among the so-called soil-transmitted infections [4], their source is the environment (soil, water, and food) contaminated with parasitic forms.

Strongyloids are about 50 species and can infect most of the vertebrates around the world, including humans [15]. Strongyloidosis in humans is commonly chronic, asymptomatic infection, but a change in immune status of the hosts can lead to an increase in parasite burden, hyper-infection syndrome, dissemination, and even death [11]. In animals, the disease occurs acutely mainly at a young age, and the symptoms are diverse and related to the ways of penetration and migration of the parasites in the body: they generally are characterized by diarrhoea, vomiting, malabsorption, and bronchopneumonia [2, 9]. In adult individuals or in weak infections, it is often asymptomatic or accompanied only by decreased appetite, skin eczemas, weight loss or growth retardation [8]. With asymptomatic and chronic course, strongyloidosis remains undiagnosed, and the diverse clinical picture accompanying acute cases is often confused diagnosis and unrecognition of the disease.

In order to succeed in the fight against parasitoses, special attention must be paid to their accurate diagnosis, to develop adequate guidelines for epidemiological studies and to obtain reliable data that enable health services to determine current ways to prevent and control them [13]. Accumulation of basic knowledge regarding all aspects of different parasitic diseases would contribute to this. In connection with the above, the aim of the present work was set, namely to document the case of strongyloid infection in a brown capuchin and supply morphometric data on its causative agent in present materials.

Materials and Methods

It concerns an 8-year-old female brown capuchin, born and kept in the Sofia Zoo. Visible weakening of the capuchin in the winter of 2022, followed by the medical check-up has revealed unclear organism inflammation. That was the reason why zoo officials approached us with a request for parasitological tests of the animal. Fecal sample of the monkey was evaluated for presence of parasites by the common flotation, sedimentation and Baermann techniques [5]. Imaging and measurement of parasite forms were performed using a Motic Images Plus 3.0 camera connected to an Amplival microscope, with accompanying software.

Results and Discussion

Examination of fresh fecal samples (same day of collection) revealed presence of nematode eggs, and 72 hours later nematode larvae were observed. Eggs were elongated elliptical in shape, 48-56 μm in length, 25-27 μm in width, with a thin smooth wall, contained a fully developed motile larvae (**Fig. 1**).

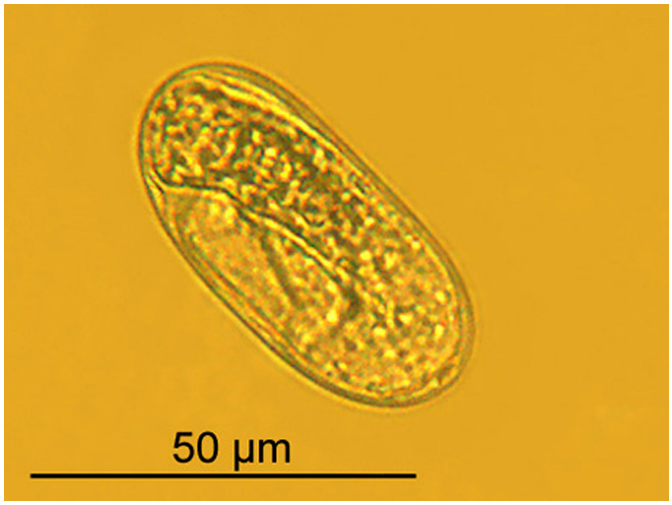

Fig. 1. *Strongyloides* sp. egg found in feces of a brown capuchin

Larvae were without sheath, 495-598 µm in length and 19-24 µm in width, with three small lips around the mouth opening and pointed tail (**Fig. 2**).

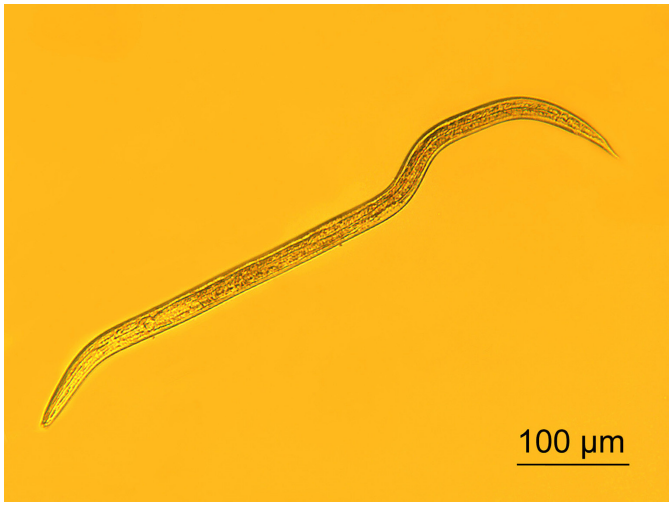

Fig. 2. Rhabditiform larva found in feces of a brown capuchin

Oesophagus of the larvae was 126-146 µm in length and 12-13 µm in width, rhabditiform, with club-shaped anterior portion, post-median constriction and posterior bulbus (**Fig. 3**). Genital primordium was situated between the second and third part of the body, and anus – at 44 – 50 µm from the tail end (**Fig. 4**).

The morphometric characteristics of the observed eggs and larvae gave reason to consider that it was a strongyloid infection. *Strongyloides* spp. are generally host-specific [14]. Among the species isolated from primates, *Strongyloides stercoralis* (Bavay, 1876), *Strongyloides fuelleborni* von Linstow, 1905, and *Strongyloides fuelleborni kellyi* (Viney et al., 1991) are found in Old World monkeys, apes, and/

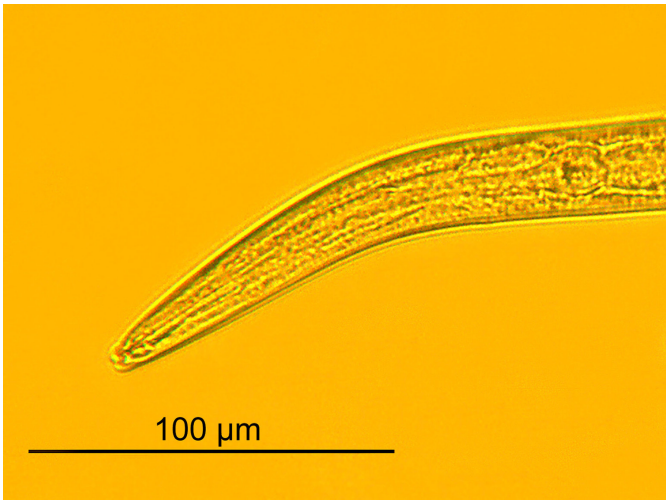

Fig. 3. Rhabditiform larva found in feces of a brown capuchin – anterior end

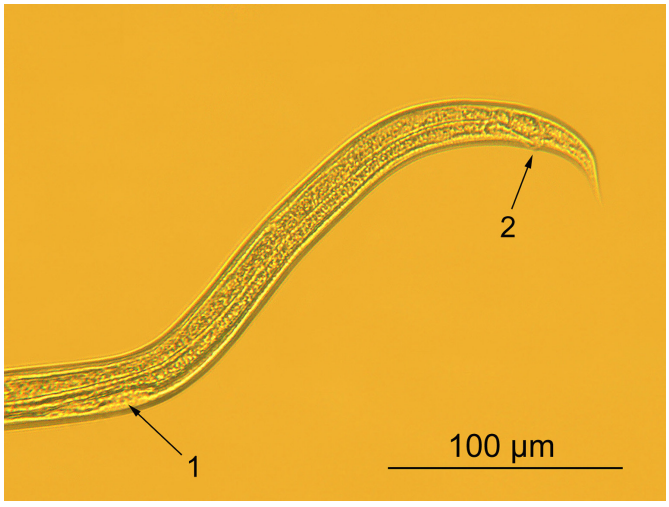

Fig. 4. Rhabditiform larva found in feces of a brown capuchin – posterior end

or humans, while *Strongyloides cebus* Darling, 1911, is considered the only natural species found in New World monkeys [10]. The possibility that the parasites found in the present case were *S. stercoralis* was excluded due to the peculiarities of the life cycle of the species: the eggs hatch in the host intestine and only larvae passed out in the feces [9], and in the present case we found both eggs and larvae. The probability that the parasites are of the species *S. f. kellyi* also was rejected, as this species so far has been found only in humans from New Guinea [1, 3]. *Strongyloides fuelleborni* normally is a parasite of non-human primates in Africa and Asia and of humans in Africa [1]. It was also reported in zoo primates from Europe [6]. In this connection, we assumed that the strongyloides in the present case were most likely of the *S. fuelleborni* species. However, the fact that the monkey, the object of the study, lives in a zoo, where the probability for exchange of parasites between different species of animals is greater

[12] assumes that the found parasites could also be from another strongyloid species. Such, for example, could be *Strongyloides westeri*, which despite its specificity to ungulates has zoonotic potential [5].

Based on the established diagnosis, the capuchin was treated for two consecutive days with Ivermectin - orally at a dose of 0.200 mg/kg, as well as with anti-inflammatory drugs. The treatment carried out visibly improved the condition of the animal. Twenty days after treatment, control fecal samples were examined and no parasites were detected.

Conclusion

Strongyloid eggs and rhabditiform larvae found in the feces of a brown capuchin from Sofia Zoo are most likely of the species *S. fuelleborni*. However, in this case diagnosis based on microscopic examination and host specificity alone cannot be definitive. Morphometric data regarding found strongyloid eggs and larvae would be a useful basis for future research, and combined with molecular analyses, would provide reliable diagnostic tools in the field of these infections.

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References

1. Ashford, R. W., G. Barnish, M. E. Viney. Strongyloides fuelleborni kellyi: Infection and disease in Papua New Guinea. – *Parasitol. Today*, **8**, 1992, 314-318.

2. Basso, W., L. M. Grandt, A. L. Magnenat, B. Gottstein, M. Campos. *Strongyloides stercoralis* infection in imported and local dogs in Switzerland: from clinics to molecular genetics. – *Parasitol. Res*., **118**, 2019, 255-266.

3. Bradbury, R. S. *Strongyloides fuelleborni kellyi* **in New Guinea: neglected, ignored and unexplored**. – *Microbiol. Australia*, **42**, 2021, 169-172.

4. Caldrer, S., T. Ursini, B. Santucci, L. Motta, A. Angheben. Soil-transmitted helminths and anaemia: A neglected association outside the Tropics. – *Microorganisms*, **10**, 2022, 1027.

5. Foreyt, W. J. *Veterinary Parasitology: Reference Manual. 5th Edition*. Iowa, Blackwell Publishing, 2017, 235 pp.

6. Gomez, M. S., M. Gracenea, I. Montoliu, C. Feliu, A. Monleon, J. Fernandez, C. Ensenat. Intestinal parasitism – protozoa and helminthes in primates at the Barcelona Zoo. – *J. Med. Primatol*., **25**, 1996, 419–423.

7. Grove, D. I. Strongyloidiasis: Is it transmitted from husband to wife? – *Br. J. Vener. Dis*., **58**, 1982, 271–272.

8. Kamburov, P., I. Vasilev, D. Georgieva, I. Kamenov, V. Koinarski. *Veterinary-medical parasitology* (Ed. P. Kamburov), Sofia, Agropress, 1994, 462 pp. [in Bulgarian]

9. Lowenstine, L. J., K. G. Osborn. Respiratory system diseases of nonhuman primates. In: – In: *Nonhuman primates in biomedical research*. Elsevier Inc., 2012, 413–481.

10. Mati, V. L. T., F. C. Ferreira Junior, H. A. Pinto, A. Lane de Melo. *Strongyloides cebus* (Nematoda: Strongyloididae) in Lagothrix cana (Primates: Atelidae) from the Brazilian Amazon: Aspects of clinical clinical presentation, anatomopathology, treatment, and parasitic biology. – *J. Parasitol.,* **99**, 2013, 1009-1018.

11. Mejia, R., T. B. Nutman. Screening, prevention, and treatment for hyperinfection syndrome and disseminated infections caused by *Strongyloides stercoralis*. – *Curr. Opin. Infect. Dis.,* **25***,* 2012, 458–463.
12. Panayotova-Pencheva, M. Parasites in captive animals: A review of studies in some European zoos. – *Zool. Gart*., **82**, 2013, 60–71.
13. Panayotova-Pencheva, M. Biodiversity of endoparasites in domestic cats and dogs from the Sofia city, Bulgaria. **–** *Acta Morphol. Anthropol*., **29**, 2022, 53-61.
14. Parasites – Strongyloides. Centers for Disease Control and Prevention. Available at: https://www.cdc.gov/parasites/strongyloides/biology.html
15. Viney, M. E., J. B. Lok. – In: *The biology of Strongyloides spp. WormBook: The online review of C. elegans biology*, Pasadena (CA): WormBook, 2005-2018. Available from: https://www.ncbi.nlm.nih.gov/books/NBK19795/