**Trypanoxyuris (Paraoxyuronema) lagothricis** (Nematoda: Oxyuridae) in *Lagothrix cana* (Primates: Atelidae) from Brazil

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Received October 16, 2012
Accepted January 21, 2013

**Abstract**

During necropsy of a specimen of *Lagothrix cana* (É. Geoffroy, 1812) (Primates: Atelidae) from the Brazilian Amazon, pinworms were found in the large intestine. The intensity of infection was 64 parasites (17 males and 47 females) and there were no gross pathological changes related to parasitism. After morphological analysis the parasites were identified as _Trypanoxyuris (Paraoxyuronema) lagothricis_ (Buckley, 1931) (Nematoda: Oxyuridae). This is the first record of this oxyurid species in primates in Brazil.

**Keywords:** Nematodes, primates, pinworms.

So far, 18 species of _Trypanoxyuris_ are known and have been grouped in four subgenera: _Trypanoxyuris_ (Trypanoxyuris) Vevers, 1923 with eight species occurring mainly in Cebinae, with some of them also found in primates of the families Aotidae, Atelidae and Pitheciidae; _Trypanoxyuris_ (Hapaloxyuris) Inglis & Cosgrove, 1965 with four species described from Callitrichinae; _Trypanoxyuris_ (Paraoxyuronema) Artigas, 1936 with four species from Atelidae; and _Trypanoxyuris_ (Rodentoxyuris) Quentin & Tenora, 1974 with two species found in rodents of the family Sciuridae in North America and Europe (HUGOT et al., 1996; HUGOT, 1999).

In Brazil, _Trypanoxyuris_ spp. have been reported in non-human primates since the first quarter of the twentieth century, and six species of these parasites were already confirmed parasitizing 10 species of hosts: (1) _Trypanoxyuris_ (Paraoxyuronema) _brachytelesi_ (Artigas, 1936) described from _Brachyteles arachnoides_ (É. Geoffroy, 1806) (Primates: Atelidae); (2) _T. (H.) callithricis_ (Solomon, 1933) reported in _Callithrix_ (Callithrix) _jacchus_ (Linnaeus, 1758) (Primates: Cebidae); (3) _T. (T.) clementinae_ Hugot, 1985 described from _Sapajus apella_ (Linnaeus, 1758) (Primates: Cebidae); (4) _T. (T.) microon_ (Linstow, 1907) found in _Aotus trivirgatus_ (Humboldt, 1811)
(Primates: Aotidae); (5) T. (T.) minutus (Schneider, 1866) reported in Alouatta caraya (Humboldt, 1812) (Primates, Atelidae), A. guariba clamitans Cabrera, 1940, Ateles paniscus (Linnaeus, 1758), A. belzebul (Linnaeus, 1758), A. fuscus (É. Geoffroy, 1812) and Saimiri sciureus (Linnaeus, 1758) (Primates: Cebidae), and (6) T. (T.) scleratus (Travassos, 1925) described from S. sciureus (TRAVASSOS, 1925; ARTIGAS, 1936; HUGOT, 1984, 1985; VICENTE et al., 1997; VALENÇA et al., 2000; AMATO et al., 2002; MARTINS et al., 2008; SOUZA et al., 2010). Moreover, unidentified species of Trypanoxyuris were recorded in A. caraya and S. sciureus (VICENTE et al., 1992) and eggs of these parasites were found in the feces of Aotus azarae infilatatus (Kuhl, 1820) (Primates: Aotidae) and A. guariba clamitans (SOUZA JÚNIOR et al., 2008; BARROS MONTEIRO et al., 2009). Despite these previous reports, the amount of species of Trypanoxyuris that occurs in Brazilian primates may be higher than previously recorded considering the richness of primate species in Brazil and their helminths, which have not been comprehensively studied.

In the present study, a young male specimen of Lagothrix cana (É. Geoffroy, 1812), Gray Woolly Monkey, captured in an uncertain locality in the Brazilian Amazon and kept, at first, at the Brazilian Institute of Environment and Renewable Natural Resources (IBAMA), was sent from São Luís, state of Maranhão, northeast region, to a conservation unit in the municipality of Inháuima, state of Minas Gerais, southeastern Brazil. After a short period in captivity, the animal died and necropsy was performed. A fecal sample from the specimen was processed by the spontaneous sedimentation method and eggs with morphology suggestive of oxyurids were found.

Nematodes were observed in the large intestine, fixed in 10% formalin and later cleared in lactophenol. They were sexed and mounted in nonpermanent preparation between slide and coverslip and examined by light microscopy. Preparation of en face mounts was performed according to Anderson (1958). Images of the parasites were taken by a Leica microscope and the measures were obtained through the analysis of the images in the Leica Application Suite (EZ LAZ) version 2.0 software, except for the total length of the body, which was measured with a curvimeter after the parasites were drawn with the aid of a camera lucida.

The taxonomic identification was based on morphological criteria preconized by several authors. The generic and subgeneric identifications were performed according to Hugot (1985, 1999), and the specific determination was carried out according to Buckley (1931) and Hugot (1985). The measures of 20 specimens (10 males and 10 females) are shown in Table 1; they are presented by the mean followed by standard deviation and range between parentheses. Measures are given in micrometers, except for the length of the body which is given in millimeters. The specimens studied were deposited at the taxonomic collection of the “Laboratório de Taxonomia e Biologia de Invertebrados, Universidade Federal de Minas Gerais” (DPIC).

**Taxonomic summary**

*Trypanoxyuris* (Paroxyuronyema) *lagothricis* (Buckley, 1931) Hugot et al., 1999 (Figure 1, Table 1).

(Syn.: Enterobius lagothricus Buckley, 1931, Trypanoxyuris brachytelesi Buckley, 1931) Inglis & Cosgrove, 1965

Host: Lagothrix cana (É. Geoffroy, 1812) (Primates, Atelidae), Gray Woolly Monkey.

Locality: Brazilian Amazon, undetermined locality.

Site of infection: large intestine.

Table 1. Morphometric data of *Trypanoxyuris* (Paroxyuronyema) *lagothricis* found in *Lagothrix cana* from Brazil and measures reported by other authors. Measures of *T. (P.) brachytelesi* previously recorded in Brazil are given for comparison. *Animal which came from South America and died in zoo. L = length, W = width, D = distance, NA = not available. Measures are given in micrometers, except for the length of the body which is given in millimeters.*

| Parameters                              | *Trypanoxyuris (P.) lagothricis* | *T. (P.) brachytelesi* |
|-----------------------------------------|----------------------------------|------------------------|
|                                         | Present study                    | Buckley (1931)         | Hugot (1985) | Artigas (1936) |
|                                         | Males (n = 10)                   | Females (n = 10)       | Males (n = NA) | Females (n = NA) | Females (n = 11) | Female (n = 1) |
| Body                                    | L 1.3 ± 0.1 (1.2-1.4)            | W 3.8 ± 0.2 (4.0-4.7)  | Males         | females         | females         | females         | Female         |
|                                        |                                  |                        | (n = 60)      | (n = 1)         | (n = 11)        | (n = 1)         |                |
| Esophagus                               | L 290 ± 29 (241-338)             | W 747 ± 51 (675-837)  | 350           | 700             | 756            |                |
|                                        |                                  |                        |               |                 |                |                |                |
| Esophageal bulb                         | L 59 ± 3 (54-65)                 | W 120 ± 5 (112-131)   | 60            | 110             | 126            |                |
|                                        |                                  |                        |               |                 |                |                |                |
| Nerve ring to anterior extremity        | D 88 ± 6 (82-96)                 | 170 ± 12 (150-198)    | -             | 169             | 140            |                |
|                                        |                                  |                        |               |                 |                |                |                |
| Vulva to anterior extremity             | D -                              | 1.079 ± 91 (956-1,222) | -             | 1.390±1,676     | 1,150          | 1,976          |
|                                        |                                  |                        |               |                 |                |                |                |
| Spicule                                 | L 43 ± 2 (40-46)                 | -                      | 44           | -               | -              | -              |
|                                        |                                  |                        |               |                 |                |                |                |
| Terminal spine                          | L 17 ± 2 (15-20)                 | -                      | 15           | -               | -              | -              |
|                                        |                                  |                        |               |                 |                |                |                |
| Eggs                                    | L -                              | -                      | 40 ± 2 (37-43) | 38-40           | 35             | 48-51          |
|                                        | W -                              | -                      | 21 ± 1 (19-23) | -               | 17             | 24-27          |
|                                        |                                  |                        |               |                 |                |                |                |
| Tail                                    | L -                              | -                      | 1,137 ± 157 (827-1,393) | - | 960 | 2,434 |
|                                        |                                  |                        |               |                 |                |                |                |
| Locality                                | Brazil                           | England*               | England*      | Brazil          |                |                |                |
| Host                                    | Lagothrix cana                   | Lagothrix lagotricha    | Lagothrix sp. | Brachyteles arachnoides | | |

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**References:**

- Hugot (1985)
- Buckley (1931)
- Artigas (1936)
- Pinto, H.A. et al.
Intensity of infection: 64 parasites (17 males, 47 females).
Specimens deposited: DPIC 2467.
Remarks: Trypanoxyuris (Paraoxyuronema) lagothricis was described from a single infected specimen of Lagothrix lagotricha (Humboldt, 1812) (= Lagothrix humboldtii É. Geoffroy, 1812) originated from South America and taken to a London zoo (BUCKLEY, 1931). Later, the species was reported in L. lagotricha in Venezuela and Peru, and in L. cana, also in Peru (INGLIS; DÍAZ-UNGRIA, 1960; INGLIS; DUNN, 1964; HUGOT, 1985; TANTALEAN et al., 1990). This is the first report on the occurrence of this parasite in Brazil. The measures (Table 1) and morphological features of the specimens studied, as well as the structural arrangement of the buccal cavity, the presence of ventral esophageal teeth with a small apical end, and the shape of male bursa and female ovejector are in agreement with those reported for T. (P) lagothricis by Buckley (1931) and Hugot (1985). In relation to other species of Trypanoxyuris reported in Brazilian primates, T. (P) lagothricis differs from the species belonging to subgenera Hapaloxyuris and Trypanoxyuris by presenting two lips instead of three. Moreover, T. (P) lagothricis presents measures of both males and females significantly smaller than the five other species from other subgenera previously reported in Brazil. In relation to T. (P) brachyteseli, a species described based only on female parasites and with buccal structure not studied, T. (P) lagothricis presents structures also significantly smaller. Regarding other species of the subgenus Paraoxyuronema not yet reported in Brazil, T. (P) lagothricis can be easily distinguished from T. (P) duplicidens which presents several larger measures, mainly the length of esophagus, teeth subdivided by a deep groove, and lacks a terminal spine in the male; the species reported in the present study also differ from T. (P) atelis in which presents greater total length, and ventral esophageal teeth with a verrucose ornamentation instead a small apical point (HUGOT, 1985).

The clinical manifestations verified in the infection with Trypanoxyuris as well as other pinworm infections are not significant in most cases. Anal itching and irritation, irritability, agitation, and aggressiveness of the host are the clinical signs usually verified during the course of the disease (TOFT II, 1982). However, the occurrence of high parasitic burden and erratic parasitism has been observed and, in some cases, it may be associated with the...
death of the host (MURATA et al., 2002; AMATO et al., 2002; FOX et al., 2002). In the present study, there was no evidence that infection with *T. (P.) lagothricis* was associated with the death of the specimen studied. In fact, during the necropsy of the primate, there were no gross changes such as edema, hyperemia, or mucosal lesions of the caecum, colon and rectum of the animal, at least in part, due to low intensity of infection.

Considering the biology of these oxyurids, conditions of captivity and close contact between primates may favor the transmission and maintenance of the parasite (FELT; WHITE, 2005; BARROS MONTEIRO et al., 2009). Indeed, *T. (P.) lagothricis* was first described and found in animals from zoos (BUCKLEY, 1931; HUGOT, 1985). Similarly, the specimen of *L. cana* studied was kept for an unknown period of time under illegal captivity before being confiscated.

Under an evolutionary approach, studies of primate oxyurids have provided evidence of the process of coevolution between these parasites and their hosts. Cameron (1929) was the first to find high host specificity in this group of nematodes, suggesting that each species of these parasites would occur in specific groups of primates. Evidence for this phenomenon was subsequently obtained for genera belonging to the subfamily Enterobiniiae, including *Trypanoxyuris* (BROOKS; GLEN, 1982; HUGOT et al., 1996; HUGOT, 1998, 1999).

Given the close evolutionary relationship between *Trypanoxyuris* and their platyrhine hosts, as well as reports of infection of these primates in other South American countries with species not yet recorded in Brazil, it is possible that the diversity of these oxyurids occurring in the country could be underestimated. In this regard, at least nine other species of *Trypanoxyuris*, which have already been reported in South American primates, may still be found in Brazil: *T. (T) trypanurus* Vevers, 1923 in *Pithecia* spp. (Primates: Pitheciidae); *T. (H.) goldii* (Inglis & Coosgrove, 1965) in *Callimico* spp. (Primates: Cebidae); *T. (H.) tamarini* (Inglis & Dunn, 1964) and *T. (H.) oedipi* in *Saguinus* spp. (Primates: Cebidae); *T. (P.) atelis* (Cameron, 1929) in *Ateles* spp. (Primates: Atelidae); *T. (P.) duplicidentis* (Buckley, 1931) in *Lagothrix* spp.; *T. (T) satanas* Hugot, 1985 in *Chironepotes* spp. (Primates: Pitheciidae); *T. (T) croizati* Hugot, Morand & Guerrero, 1994 and *T. (T) callicebi* Hugot & Vaucher, 1985 in *Callicebus* spp. (Primates: Cebidae). Moreover, primates belonging to the genera *Leontopithecus* Lesson, 1840, *Cebuella* Gray, 1866 (Primates: Cebidae) and *Cacajao* Lesson, 1840 (Primates: Pitheciidae) have not yet been reported infected with *Trypanoxyuris* (HUGOT, 1999), and they may be hosts of unknown species.

Overall, the study of helminth parasites from primates in Brazil is fragmented. Although the Brazilian primate fauna currently comprises 118 species (PAGLIA et al., 2012), most primate species have not yet been evaluated for infection by parasitic nematodes. So far, only 27 species of nematodes have been reported in 36 species of primates in the country, and only four nematodes species in primates of the genus *Lagobrix* (revised by VICENTE et al., 1997; PINTO et al., 2011). On the other hand, the reduction of natural habitats and illegal hunting have contributed to a substantial number of endangered primate species (26) in Brazil (CHIARELLO et al., 2008). In fact, the reduction of populations, and even extinction of hosts, can also be related to the co-extinction of parasite species (WHITEMAN; PARKER, 2005; DOBSON et al., 2008; MUNIZ-PEREIRA et al., 2009). Thus, it is possible that other species of *Trypanoxyuris* and several other parasitic interactions be eliminated before they become known. In this way, conservation of primate species is important for the maintenance of these parasite species. Furthermore, the scientific interaction between primatologists and helminthologists should be encouraged to maximize achievement on parasitological information, thereby contributing to increase the knowledge on the biodiversity of helminths from primates in Brazil.

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