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Helminth Parasites of Bolivian Cebid Monkeys

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ABSTRACT

Parasitological survey of 31 Bolivian cebid primates belonging to 5 genera and 6 species was carried out. The primates collected were 3 *Callicebus moloch*, 5 *Aotus azarae*, 7 *Saimiri boliviensis*, 6 *Cebus apella*, 8 *Alouatta seniculus* and 2 *A. caraya*. Of the 31 animals, 29 harbored one or more species of helminth parasites. New host records noted in this paper are as follows: *Callicebus moloch* for *Trypanoxyuris* (*T.*) sp. (Nematoda: Oxyuridae), *Aotus azarae* for *Phaneropsolus orbicularis* (Trematoda: Lecithodendriidae), *Cebus apella* for *Molineus elegans* (Nematoda: Trichostrongylidae), *Alouatta seniculus* for *Strongyloides cebus* (Nematoda: Strongyloididae).

INTRODUCTION

Records for helminth parasites of New World monkeys were compiled from various literatures by HERSHKOVITZ (1977). He listed 72 nematodes, 13 trematodes, 18 cestodes, 4 acanthocephalids and 2 pentastomid species found in 35 primate species. ISEKI *et al.* (1985) carried out a parasitological investigation on 19 Bolivian monkeys mainly from the state of Pand, northwestern Bolivia. They reported more than 20 species of helminths from 9 species of cebid and callitrichid monkeys, and noted new host records.

In 1986, we carried out a parasitological investigation on 31 Bolivian cebid monkeys in the states of Santa Cruz, and Beni, in western and northern Bolivia, respectively. This paper presents the incidence of the helminth parasites in these cebid monkeys.

MATERIAL AND METHODS

Thirty-one primates belonging to 6 species and 5 genera comprising of 3 *Callicebus moloch*, 5 *Aotus azarae*, 7 *Saimiri boliviensis*, 6 *Cebus apella*, 8 *Alouatta seniculus* and 2 *A. caraya*, were captured at 5 localities in Bolivia from August to October, 1986. The species, sex and localities of the capture of the individual animals are presented in Table 1 and Figure 1. When the primates were necropsied, the surfaces of the visceral organs were observed for parasites and then fixed in 10% formalin solution at the site of capture. Filial adult worms were preserved in 10% salined formalin. The fixed materials were brought back to the laboratory, and examined.

Helminths were processed by routine methods for morphological examination.

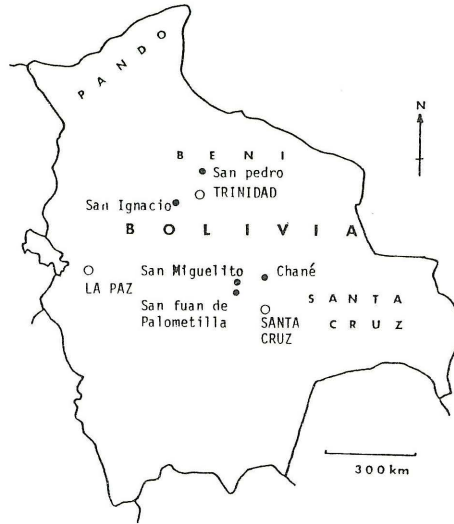


Figure 1. Map of Bolivia. Closed circles show locations where this survey was conducted

Table 1. Species, sex and localities of capture of the 31 Bolivian Primates

| Individual No. | Species | Sex | Locality |
|----------------|----------------------------|-----|-------------------------------------|
| 1 | <i>Callicebus moloch</i> | ♀ | San Ignacio, Beni |
| 2 | <i>C. moloch</i> | ♂ | San Miguelito, Santa Cruz |
| 3 | <i>C. moloch</i> | ♀ | San Miguelito, Santa Cruz |
| 4 | <i>Aotus azarae</i> | ♂ | Sun fuan de Palometilla, Santa Cruz |
| 5 | <i>A. azarae</i> | ♂ | Sun fuan de Palometilla, Santa Cruz |
| 6 | <i>A. azarae</i> | ♀ | Sun fuan de Palometilla, Santa Cruz |
| 7 | <i>A. azarae</i> | ♂ | Sun fuan de Palometilla, Santa Cruz |
| 8 | <i>A. azarae</i> | ♂ | Sun fuan de Palometilla, Santa Cruz |
| 9 | <i>Saimiri boliviensis</i> | ♀ | Chané, Santa Cruz |
| 10 | <i>S. boliviensis</i> | ♂ | Chané, Santa Cruz |
| 11 | <i>S. boliviensis</i> | ♂ | Chané, Santa Cruz |
| 12 | <i>S. boliviensis</i> | ♂ | Chané, Santa Cruz |
| 13 | <i>S. boliviensis</i> | ♂ | Chané, Santa Cruz |
| 14 | <i>S. boliviensis</i> | ♀ | Chané, Santa Cruz |
| 15 | <i>S. boliviensis</i> | ♀ | Chané, Santa Cruz |
| 16 | <i>Cebus apella</i> | ♂ | Chané, Santa Cruz |
| 17 | <i>C. apella</i> | ♀ | Chané, Santa Cruz |
| 18 | <i>C. apella</i> | ♀ | Chané, Santa Cruz |
| 19 | <i>C. apella</i> | ♀ | Chané, Santa Cruz |
| 20 | <i>C. apella</i> | ♀ | Chané, Santa Cruz |
| 21 | <i>C. apella</i> | ♂ | Chané, Santa Cruz |
| 22 | <i>Alouatta seniculus</i> | ♀ | Chané, Santa Cruz |
| 23 | <i>A. seniculus</i> | ♀ | Chané, Santa Cruz |
| 24 | <i>A. seniculus</i> | ♀ | Chané, Santa Cruz |
| 25 | <i>A. seniculus</i> | ♂ | Chané, Santa Cruz |
| 26 | <i>A. seniculus</i> | ♂ | Chané, Santa Cruz |
| 27 | <i>A. seniculus</i> | ♂ | Chané, Santa Cruz |
| 28 | <i>A. seniculus</i> | ♂ | Chané, Santa Cruz |
| 29 | <i>A. seniculus</i> | ♂ | San Ignacio, Beni |
| 30 | <i>A. caraya</i> | ♀ | San Pedro, Beni |
| 31 | <i>A. caraya</i> | ♂ | San Pedro, Beni |

RESULT AND DISCUSSION

The collected helminths are listed in Table 2, 3, and 4.

Strongyloides cebus was found in 1 of the 7 *Saimiri boliviensis* and 2 of the 8 *Alouatta seniculus*. *A. seniculus* may be added as a new host for this parasite.

Two *Molineus* species were found: *M. elegans* in all of the *S. boliviensis* and 4 of the 6 *Cebus apella*; *M. torulosus* in all of the *C. apella*. *M. torulosus* was found in the tumor of small intestine as reported by ISEKI *et al.* (1985).

Longistriata dubia was found in all of the 3 *Callicebus moloch*. *Filariopsis arator* was found in the lung of 5 *C. apella*.

Pinworms were found in all of the *C. moloch*, all of the *A. azarae*, 2 *S. boliviensis*, 4 *C. apella*, 4 *A. seniculus* and 1 *A. caraya*. *Trypanoxyuris (T.) interlabiata* from *A. azarae*, and *T.*

Table 2. Incidence of Helminth in the 31 Bolivian Primates

| Individual No. | Species | Sp. of parasites | NEMATODA | <i>Strongyloides cebus</i> | <i>Molineus elegans</i> | <i>M. torulosus</i> | <i>Longistriata dubia</i> | <i>Filariopsis arator</i> | <i>Trypanoxyuris interlabiata</i> | <i>T. minutus</i> | <i>Trypanoxyuris</i> sp. | Pinworm (unidentified) | <i>Physaloptera</i> sp. | <i>Dipetalonema gracile</i> | Unidentified larva | TREMATODA | <i>Phaneropterus orbicularis</i> | CESTODA | <i>Bertiella mucronata</i> | <i>Atrioaenia</i> sp. | Unidentified | ACANTHOCEPHALA | <i>Prosthenorchis elegans</i> | PENTASTOMIDA | <i>Porocephalus</i> sp. |
|----------------|----------------------------|------------------|----------|----------------------------|-------------------------|---------------------|---------------------------|---------------------------|-----------------------------------|-------------------|--------------------------|------------------------|-------------------------|-----------------------------|--------------------|-----------|----------------------------------|---------|----------------------------|-----------------------|--------------|----------------|-------------------------------|--------------|-------------------------|
| 1 | <i>Callicebus moloch</i> | | | | | | • | | | | • | | | | | | | | • | | | | | | |
| 2 | <i>C. moloch</i> | | | | | | • | | | | • | | | | | | | | • | | | | | | • |
| 3 | <i>C. moloch</i> | | | | | | • | | | | • | | | | | | | | • | | | | | | • |
| 4 | <i>Aotus azarae</i> | | | | | | | | • | | | | | | | | • | | | | | | • | | • |
| 5 | <i>A. azarae</i> | | | | | | | | • | | | | | | | | • | | | | | | • | | • |
| 6 | <i>A. azarae</i> | | | | | | | | • | | | | | | | | • | | | | | | • | | • |
| 7 | <i>A. azarae</i> | | | | | | | | • | | | | | | | | • | | | | | | • | | • |
| 8 | <i>A. azarae</i> | | | | | | | | • | | | | | | | | • | | | | | | • | | • |
| 9 | <i>Saimiri boliviensis</i> | | | • | | | | | | | | | | • | | | | | | | | | • | | • |
| 10 | <i>S. boliviensis</i> | | | • | • | | | | | | | | | • | | | | | | | | | • | | • |
| 11 | <i>S. boliviensis</i> | | | • | • | | | | | | | | | • | | | | | | | | | • | | • |
| 12 | <i>S. boliviensis</i> | | | • | • | | | | | | | | | • | | | | | | | | • | | • | • |
| 13 | <i>S. boliviensis</i> | | | • | • | | | | | | | • | | | | | | | | | | • | | • | • |
| 14 | <i>S. boliviensis</i> | | | • | • | | | | | | | | | • | | | | | | | | • | | • | • |
| 15 | <i>S. boliviensis</i> | | | • | • | | | | | | | • | | | | | | | | | | • | | • | • |
| 16 | <i>Cebus apella</i> | | | | | • | | • | | | | • | | | | | | | | | | • | | • | • |
| 17 | <i>C. apella</i> | | | | • | • | | • | | | | • | | | • | | | | | | | • | | • | • |
| 18 | <i>C. apella</i> | | | • | • | • | | • | | | | • | | | • | | | | | | • | | • | | • |
| 19 | <i>C. apella</i> | | | | • | • | | • | | | | • | | | • | | | | | | | • | | • | • |
| 20 | <i>C. apella</i> | | | | • | • | | • | | | | • | | | • | | | | | | | • | | • | • |
| 21 | <i>C. apella</i> | | | | • | • | | • | | | | • | | | • | | | | | | | • | | • | • |
| 22 | <i>Alouatta seniculus</i> | | | | | | | | | | | | | | | | | | | | | | • | | • |
| 23 | <i>A. seniculus</i> | | | • | | | | | | • | | | | | | | | | | | | | | | • |
| 24 | <i>A. seniculus</i> | | | | | | | | | • | | | | | | | | | | | | | | | • |
| 25 | <i>A. seniculus</i> | | | | | | | | | | | | | | | | | | | | | | | | • |
| 26 | <i>A. seniculus</i> | | | • | | | | | | | | | | | | | | | | | | | | | • |
| 27 | <i>A. seniculus</i> | | | | | | | | | • | | | | | | | | | | | | | | | • |
| 28 | <i>A. seniculus</i> | | | | | | | | | • | | | | | | | | | | | | | | | • |
| 29 | <i>A. seniculus</i> | | | | | | | | | • | | | | | | | | | | | | | | | • |
| 30 | <i>A. caraya</i> | | | | | | | | | • | | | | | | | | | | | | | | | • |
| 31 | <i>A. caraya</i> | | | | | | | | | • | | | | | | | | | | • | | | | | • |

• Positive for the parasite

Table 3. Nematodes detected from the 31 Bolivian Primates.

| Parasite | Parasite | Host | Habitat |
|-----------------------------------|--------------------|---|-------------------|
| <i>Strongyloides cebus</i> | Strongyloidea | <i>Saimiri boliviensis</i> , <i>Alouatta seniculus</i> * | Small intestine |
| <i>Molineus elegans</i> | Trichostrongylidae | <i>Saimiri boliviensis</i> , <i>Cebus apella</i> * | Small intestine |
| <i>Molineus torulosus</i> | Trichostrongylidae | <i>Cebus apella</i> | Small intestine |
| <i>Longistriata dubia</i> | Heligmosomatidae | <i>Celicebus moloch</i> | Small intestine |
| <i>Filariopsis arator</i> | Filaroididae | <i>Cebus apella</i> | Lung |
| <i>Trypanoxyuris interlabiata</i> | Oxyuridae | <i>Aotus azarae</i> | Caecum, colon |
| <i>Trypanoxyuris minutus</i> | Oxyuridae | <i>Alouatta seniculus</i> , <i>Alouatta caraya</i> | Caecum, colon |
| <i>Trypanoxyuris</i> sp. | Oxyuridae | <i>Callicebus moloch</i> * | Caecum, colon |
| Pinworm (Unidentified) | Oxyuridae | <i>Saimiri boliviensis</i> , <i>Cebus apella</i> | Caecum, colon |
| <i>Physaloptera</i> sp. | Physalopteridae | <i>Cebus apella</i> | Stomach |
| <i>Dipetalonema gracile</i> | Dipetalonematidae | <i>Saimiri boliviensis</i> , <i>Cebus apella</i> | Peritoneal cavity |
| Unidentified | (Larval stage) | <i>Cebus apella</i> | Liver |

*New host species described

Table 4. Trematodes, Cestodes, Acanthocephalid and Pentastomid from the 31 Bolivian Primates

| Parasite | Parasite | Host | Habitat |
|----------------------------------|--|--|---|
| <i>Phaneropsolus obricularis</i> | Trematoda; Lecithodendriidae | <i>Aotus azarae</i> * | Small intestine |
| <i>Bertiella mucronata</i> | Cestoda; Anoplocephalidae | <i>Callicebus moloch</i> , <i>Alouatta caraya</i> | Small intestine |
| <i>Atriotaeia</i> sp. | Cestoda; Anoplocephalidae | <i>Cebus apella</i> | Small intestine |
| Unidentified | Cestoda; | <i>Saimiri boliviensis</i> , <i>Cebus apella</i> | Small intestine |
| <i>Prosthenorchis elegans</i> | Acanthocephala; Oligacatho- rhynchidae | <i>Callicebus moloch</i> , <i>Aotus azarae</i> , <i>Saimiri boliviensis</i> , <i>Cebus apella</i> | Ileo-caecal junction |
| <i>Porocephalus</i> sp. | Pentastomida; Porocephalidae | <i>Celicebus moloch</i> , <i>Saimiri boliviensis</i> | Tissue cyst (Liver, stomach, mesentry) |

*New host species described.

(*T.*) *minutus* from *A. seniculus* and *A. caraya* were identified according to the criteria proposed by SKRJABIN *et al.* (1960) and INGLIS (1961). The finding of *Trypanoxyuris* (*T.*) sp. from *C. moloch* may be the first host record for the oxyurid. Although this worm has morphological characters of the genus *Trypanoxyuris*, it is easily distinguished from known species by its head structure. The details of its morphological character will be reported in the near future. ISEKI *et al.* (1985) also reported unidentified female pinworm from *C. moloch*. The species of other pinworms from *S. boliviensis* and *C. apella* could not be identified because only female specimens were collected.

Physaloptera sp. was found in 5 *C. apella*. HERSHKOVITZ (1977) listed 2 species of *Physaloptera*; *P. cebi* and *P. dilatata*. The female worm of *P. cebi* has three uteri, and so can be distinguished from that of *P. dilatata*. The present specimen has three uteri, however specific identification could not be made because of the lack of the description of *P. cebi*.

Dipetalonema gracile was found in 4 *S. boliviensis* and 2 *C. apella*. All the worms were found in the abdominal cavity.

Four *C. apella* were infected with nematode larvae which parasitize on the surface of the liver. These larvae could not be identified.

Phaneropsolus orbicularis (Trematoda) was found in 3 *A. azarae* and this presents a new host record.

Nine of the 31 primates were infected with cestodes. *Bertiella mucronata* was found in 1 *C. moloch* and 2 *A. caraya*, *Atriotaenia* sp. in 1 *C. apella*. The species of other cestodes collected from 2 *S. boliviensis* and 3 *C. apella* could not be identified due to incompleteness of the specimen.

Proshenorchis elegans (Acanthocephala) was found in 1 *C. moloch*, 4 *A. azarae*, all of the *S. boliviensis* and 3 *C. apella*.

Nymphs of *Porocephalus* sp. (Pentastomida) were found in 1 *C. moloch* and *S. boliviensis*.

There are many reports on the ecological and phylogenetic relationships between parasites and hosts. CAMERON (1929) stated that the phylogeny of the pinworm parallels that of the host, and that in the primates, each oxyurid species is restricted to parasitizing only the host of one genus. With regard to the New World primates, INGLIS (1961) after studying the helminths of Venezuelan monkeys caught from the wild, suggested the validity of the "CAMERON Hypothesis". In the present study, the detection of 3 species of pinworms belonging to the genus *Trypanoxyuris* in 3 different primates host species supported that "hypothesis".

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