

NEMATODE PARASITES OF MAMMALS.

FROM SPECIMENS COLLECTED IN THE NEW YORK
ZOOLOGICAL PARK, 1932.

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OUTLINE.

- I. INTRODUCTION.
- II. ACKNOWLEDGMENTS.
- III. SYNOPTIC LIST OF MAMMALS FROM WHICH NEMATODE PARASITES WERE COLLECTED.
- IV. SYNOPTIC LIST OF NEMATODE PARASITES.
- V. BIBLIOGRAPHY.

I. INTRODUCTION.

Recent advances in Parasitology have encouraged research in this field at the Animal Hospital Laboratory of the New York Zoological Park, and a systematic study of the nematode parasites collected from mammals during the year has revealed much interesting data concerning parasites of animals in captivity. Three nematodes, new to our collection, have been described, and several others held for further study. Specimens new to our collection are *Citellina marmotae* Manter, 1930, from the Woodchuck (*Marmota monax*); *Passalurus nonanulata* Skinker, 1931; and *Dermatoys veligera* (Rudolphi, 1819), both from a cotton tail rabbit (*Sylvilagus sylvaticus*) wild in the park. Among those held for further study are *Trichuris* sp.; *Trichostrongylus* sp.; *Physaloptera* sp.; and a very interesting species of *Rictularia* from the small intestine of a Kinkajou (*Potos flavus*). A comparative study of the species of *Rictularia* is in progress, and only a few important measurements and characters will be given in this report.

The technique and methods of procedure are the same as those described previously, McClure (1932).

In Part III. the systematic arrangement of the hosts is that adopted by Flower (1929). The scientific and trade names, together

with the dates of arrival and deaths are given, and the time in captivity may be ascertained. The number, name, with the location within the host, of each parasite is given.

In Part IV. the zoological order of the nematodes is adopted from Yorke and Maplestone (1926), and the species are listed alphabetically. The species previously described, McClure (1932) and (1933) will only be listed, whereas species new to our collection will be briefly described. In all cases the species will be followed by a list of the hosts from which the nematodes were collected.

II. ACKNOWLEDGMENTS.

Grateful acknowledgments are due to the New York Zoological Society for the publication; Dr. Charles V. Noback, Park Veterinarian, for the material; Dr. B. G. Chitwood, U. S. Department of Agriculture, Washington, D. C. for examination and helpful suggestions in the description of various species; and Dr. Horace W. Stunkard, New York University, for assistance in the preparation of the manuscript.

III. SYNOPTIC LIST OF MAMMALS FROM WHICH NEMATODES WERE COLLECTED.

ORDER PRIMATES.

Family CERCOPITHECIDAE.

Cercopithecus diana, (Diana monkey) arrived 11/21/27; died 1/14/32.

1 *Subulura distans*, cecum.

Cercopithecus cephus, (mustache monkey) arrived 9/11/31; died 8/23/32.

1 *Subulura distans*, cecum.

Cercopithecus sabaesus, (green monkey) arrived 4/25/29; died 6/25/32.

63 *Subulura distans*, cecum.

Cercopithecus sabaesus, (green monkey) arrived 5/8/29; died 8/9/32.

3 *Subulura distans*, cecum.

Cercopithecus sabaesus, (green monkey) arrived 10/11/31; died 1/1/32.

29 *Subulura distans*, cecum.

3 *Trichuris* sp., cecum.

Macaca mulatta, (Rhesus monkey) arrived 4/26/32; died 12/3/32.

6 *Subulura distans*, cecum.

Macaca mulatta, (Rhesus monkey) arrived 5/31/32; died 10/18/32.

1 *Subulura distans*, cecum.

Papio cynocephalus, (yellow baboon) arrived 10/12/29; died 3/8/32.

48 *Subulura distans*, cecum.

7 *Trichuris* sp., cecum.

Family CEBIDAE.

Cebus capucina, (white-faced sapajou) arrived 3/27/31; died 6/3/32.

8 *Dipetalonema gracile*, body cavity.

Cebus capucina, (white-faced sapajou) arrived 3/30/32; died 6/26/32.

1 *Physaloptera* sp., stomach.

Cebus capucina, (white-faced sapajou) arrived 10/17/21; died 12/11/32.

3 *Physaloptera* sp., stomach.

Cebus capucina, (white-faced sapajou) arrived 12/3/31; died 6/21/32.

1 *Physaloptera* sp. (larva), stomach.

Cebus fatuellus, (brown capuchin-monkey) arrived 9/6/30; died 11/3/32.

1 *Physaloptera* sp., stomach.

ORDER CARNIVORA.

Family FELIDAE.

Felis canadensis, (Canadian lynx) arrived 3/2/28; died 6/17/32.

6 *Toxascaris leonina*, intestine.

Felis rufa, (bobcat) arrived 1/5/29; died 3/16/32.

4 *Toxascaris leonina*, intestine.

Family CANIDAE.

Vulpes velox, (swift or kit fox) arrived 8/25/31; died 1/15/32.

5 *Toxocara* sp., intestine.

Family PROCYONIDAE.

Potos flavus, (kinkajou) arrived 6/10/32; died 10/23/32.

1 *Rictularia* sp., intestine.

ORDER RODENTIA.

Family SCIURIDAE.

Callosciurus prevostii, (Prevost's squirrel) arrived 9/30/32; died 11/9/32.

3 *Physaloptera* sp., stomach

Marmota monax, (woodchuck) arrived 5/24/32; died 6/14/32.

Many *Citellina marmotae*, cecum.

3 *Trichostrongylus* sp., intestine.

Family ERETHIZONTIDAE.

Erethizon dorsatum, (Canadian albino porcupine) arrived 9/29/31; died 10/28/32.

1 *Wellcomeia evoluta*, intestine.

Coendou prehensilis, (prehensile-tailed porcupine) arrived 12/23/31; died 1/20/32.

1 *Trichostrongylus* sp., intestine.

ORDER LAGOMARPHA.

Family LEPORIDAE.

Sylvilagus sylvaticus, (cottontail rabbit) killed in N. Y. Zool. Park 11/20/32.

- 1 *Dermatoxys veligera*, intestine.
 75 *Passalurus nonanulatus*, intestine.

ORDER PERISSODACTYLA.

Family EQUIDAE.

- Equus zebra*, (mountain zebra) arrived 9/4/20; died 10/23/32.
 Many *Parascaris equorum*, intestine.
Equus zebra, (Hartmann's mountain zebra) arrived 9/8/22; died 2/3/32.
 Many *Dictyocaulus arnfieldi*, lungs.
 Many *Parascaris equorum*, intestine.

ORDER ARTIODACTYLA.

Family BOVIDAE.

- Bison bison*, (American bison) arrived 2/5/19; died 4/25/32.
 2 *Setaria labiato-papillosa*, body cavity.

Family CERVIDAE.

- Dama dama*, (fallow deer) arrived 6/10/31; died 7/12/32.
 12 *Oesophagostomum venulosum*, intestine.
 1 *Trichuris* sp., cecum.
Dama dama, (fallow deer) arrived 7/2/18; died 6/23/32.
 1 *Oesophagostomum venulosum*, intestine.

IV. SYNOPTIC LIST OF NEMATODE PARASITES.

Superfamily TRICHUROIDEA Railliet, 1916.

Family TRICHURIDAE Railliet, 1915.

Subfamily TRICHURINAE Ransom, 1911.

- Trichurus* sp. 53

Superfamily STRONGYLOIDEA Weinland, 1853; Hall, 1916.

Family STRONGYLIDAE Baird, 1853.

Subfamily OESOPHAGOSTOMINAE Railliet, 1915.

- Oesophagostomum venulosum* (Rudolphi, 1809) 54

Family TRICHOSTRONGYLIDAE Leiper, 1912.

Subfamily TRICHOSTRONGYLINAE Leiper, 1908.

- Trichostrongylus* sp. 54

Family METASTRONGYLIDAE Leiper, 1908.

Subfamily METASTRONGYLINAE Leiper, 1908.

- Dictyocaulus arnfieldi* (Cobbold, 1884) 54

Superfamily OXYUROIDEA Railliet, 1916.

Family OXYURIDAE Cobbold, 1864.

Subfamily OXYURINAE Hall, 1916.

<i>Citellina marmotae</i> Manter, 1930.....	54
<i>Passalurus nonanulatus</i> Skinker, 1931.....	55
<i>Dermatoxys veligera</i> (Rudolphi, 1819).....	56

Subfamily SYPHACIINAE Railliet, 1916.

<i>Wellcomia evoluta</i> (Linstow, 1899).....	57
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Family SUBULURIDAE Yorke and Maplestone, 1926.

Subfamily SUBULURINAE Travassos, 1914.

<i>Subulura distans</i> (Rudolphi 1809).....	57
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Superfamily ASCAROIDEA Railliet and Henry, 1915.

Family ASCARIDAE Baird, 1853.

Subfamily ASCARINAE (Railliet and Henry, 1912) Travassos, 1913.

<i>Toxocara</i> sp.....	57
<i>Toxascaris leonina</i> (Linstow, 1902).....	57
<i>Parascaris equorum</i> (Goeze, 1782) Yorke and Maplestone, 1926.....	58

Superfamily SPIUROIDEA Railliet and Henry, 1915.

Family RICTULARIIDAE Railliet, 1916.

Subfamily RICTULARIINAE Hall, 1913.

<i>Rictularia</i> sp.....	58
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Family PHYSALOPTERIDAE Leiper, 1908.

Subfamily PHYSALOPTERINAE Railliet, 1893.

<i>Physaloptera</i> sp.....	58
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Superfamily FILARIOIDEA Weinland, 1858; Stiles, 1907.

Family FILARIIDAE (Cobbold, 1864) Claus, 1885.

Subfamily SETARIINAE Yorke and Maplestone, 1926.

<i>Setaria labiato-papillosa</i> (Aless., 1838).....	59
<i>Dipetalonema gracile</i> (Rudolphi, 1909).....	59

Trichuris sp.

The specimens representing the genus *Trichuris* are retained for further consideration.

No. ¹	Hosts.
321	<i>Cercopithecus sabaeus</i> , (green monkey).
322	<i>Papio cynocephalus</i> , (yellow baboon).
323	<i>Dama dama</i> , (fallow deer).

Oesophagostomum venulosum (Rudolphi, 1809).

A detailed description of this species may be found on page 11, McClure (1932).

No.	Hosts.
324, 325,	<i>Dama dama</i> (fallow deer).

Trichostrongylus sp.

The specimens representing the genus *Trichostrongylus* are retained for further study.

No.	Hosts.
326,	<i>Coendou prehensilis</i> , (Prehensil-tailed porcupine).
327,	<i>Marmota monax</i> , (woodchuck).

Dictyocaulus arnfieldi (Cobbold, 1884).

A detailed description of this species may be found on page 39, McClure (1933).

No.	Host.
328,	<i>Equus zebra</i> , (Hartmann's mountain zebra).

Citellina marmotae Manter, 1930.

The males vary in length from 1.6 mm. to 4.6 mm. and in breadth from 211 μ to 229 μ . The body is attenuated both anteriorly and posteriorly. The cuticle is transversely striated at intervals of about 6 μ near the posterior end of the oesophagus, in the larger specimens. The cervical alae are not well developed, but the cuticle around the head and neck is often swollen to form a narrow ring. The nerve ring is located from 174 μ to 230 μ from the anterior end. The excretory pore is located posterior to the oesophageal bulb. The head has a diameter of about 48 μ . The mouth has 6 delicate outer lips, each lobe of each lip bears on its edge a pointed tooth-like process, and 3 well developed conical inner lips, forming a triradiate mouth aperture. There is no complicated armature of chitinous bristles in the short vestibule. There are 6 head papillae, located laterally. The oesophagus is club-shaped, varying in length from 265 μ to 352 μ exclusive of the bulb, and in width from 39 μ to 41 μ at the anterior end and from 35 μ to 39 μ at the posterior end. The oesophageal bulb varies in length from 95 μ to 103 μ and in width from 78 μ to 82 μ . The oesophageal bulb is equipped with a denticular apparatus, and communicates with the intestine by means of a valve which projects into the lumen of the intestine. Immediately following the oesophageal bulb for a distance of about 530 μ the intestine is greatly en-

¹ The numbers preceding the hosts are those of the preserved specimens, deposited in the Animal Hospital Laboratory of the New York Zoological Park.

larged having a diameter of about $159\ \mu$, then gradually narrows to a diameter of about $53\ \mu$, and runs straight to the anal opening.

The cuticular striation disappears at the origin of the bursal membrane just anterior to the cloacal aperture. The bursa is well developed, originating from $145\ \mu$ to $206\ \mu$ anterior to the anus, and extending beyond the anus from $103\ \mu$ to $111\ \mu$. The bursa is supported by three prominent rays, a thick dorsal ray about $75\ \mu$ long and about $16\ \mu$ thick at the base, with the end directed ventrally, and two lateral rays projected at right angles to the body, with their ends directed posteriorly. There is no transverse ridge on the dorsal aspect of the dorsal ray as described by Hall (1916) for *Oxyuris triadiata*. There are two ventral accessory copulatory membranes, each supported by a single ray. There are three caudal papillae, two large laterals, adanal in position, suggestive of the prebursal papillae of the strongyles, and one median postanal, located between the two ventral accessory copulatory membranes. There is only one spicule, long and slender, varying in length from $178\ \mu$ to $215\ \mu$ (Manter gives $240\ \mu$ to $290\ \mu$) and about $12\ \mu$ wide at the base. There is no gubernaculum present. The cloacal aperture is from $103\ \mu$ to $107\ \mu$ from the posterior extremity of the dorsal ray.

The females vary in length from 3 mm. to 5.5 mm. and in breadth from $247\ \mu$ to $300\ \mu$. The body is attenuated both anteriorly and posteriorly. The cuticle is transversely striated at intervals of about $7\ \mu$ near the posterior end of the oesophagus. The head diameter is about $52\ \mu$. The cephalic structures are similar to those described for the male. The oesophagus varies in length from $335\ \mu$ to $388\ \mu$ exclusive of the bulb, and in width from $91\ \mu$ to $95\ \mu$. The nerve ring is located from $224\ \mu$ to $260\ \mu$ from the anterior end of the oesophagus. The excretory pore is just anterior to the vulva.

The vulva is a transverse slit located from .9 mm. to 1.3 mm. from the anterior end, between two well developed lips. There is a short vagina about $265\ \mu$, (Manter gives $700\ \mu$) connected to a long uterus directed posteriorly, which divides near the anus to form two uteri terminated by the ovaries. The tail tapers to a fine point, measuring about $688\ \mu$ long, and $128\ \mu$ wide at the anus in the largest specimens. The ova are thin shelled measuring $41.3\ \mu$ by $76\ \mu$.

No. Host.

329, *Marmota nonax*, (woodchuck).

Passalurus nonanulatus Skinker, 1931.

The males vary in length from 2.7 mm. to 3.5 mm., and in breadth from $176\ \mu$ to $229\ \mu$. The body is typical oxyurid in shape, having the posterior half slightly coiled. The cuticle is finely striated transversely at intervals of about $7.7\ \mu$ near the posterior end of the oesophagus. Two cervical alae present, each contains a distinct notch from $247\ \mu$ to $270\ \mu$ from the anterior end. The excretory pore is located behind the oesophageal bulb about $529\ \mu$ from the anterior end of the body, in the center of a slit-like cavity about $78\ \mu$ long. The head has a diameter of about $27\ \mu$, bears 4 submedian papillae and 2 amphids. The mouth is simple, having three well-defined lips. The pharynx is prominent,

having a posterior diameter of about $20\ \mu$, a depth of about $12\ \mu$, and armed with three curved teeth. The oesophagus is club-shaped, increasing in size posteriorly, varying in length from $260\ \mu$ to $301\ \mu$; its anterior diameter varies from $25\ \mu$ to $29\ \mu$, and its posterior diameter $50\ \mu$ to $53\ \mu$. This portion is separated from the oesophageal bulb by a neck-like constriction about $26\ \mu$ long and $25\ \mu$ in diameter. The oesophageal bulb is almost spherical having a diameter of about $94\ \mu$, and contains a tripartite chitinized dental apparatus. The nerve ring is located about $158\ \mu$ from the anterior end of the body.

The tail is very long, always curved ventrally, somewhat widened to last pair of caudal papillae, then suddenly narrowed and ends in a long process from $190\ \mu$ to $206\ \mu$ in length. There are 3 pairs of caudal papillae; two pairs of large contiguous sissile, one adanal and the other slightly postanal; and one pair of smaller papillae supporting the posterior end of the caudal alae, from $124\ \mu$ to $165\ \mu$ posterior to the anus. The spicule is short, about $113\ \mu$ in length. No gubernaculum present.

The females vary in length from 4 mm. to 6.5 mm. and in breadth from $406\ \mu$ to $494\ \mu$. The body is slender, oxyurid in shape, having a long attenuated posterior extremity. The cuticle is transversely striated at intervals of about $8\ \mu$ near the posterior end of the oesophagus. The cervical alae are notched at $353\ \mu$ to $406\ \mu$ from the anterior end. The excretory pore is located from .882 mm. to 1 mm. from the anterior end of the body, in the center of a slit-like cavity about $254\ \mu$ long. The head has a diameter of about $37\ \mu$. The general cephalic characters are similar to those described for the male. The oesophagus, exclusive of the neck and bulb varies in length from $375\ \mu$ to $433\ \mu$; has an anterior diameter from $37\ \mu$ to $41\ \mu$; a posterior diameter from $70\ \mu$ to $86\ \mu$; the neck varies in length from $33\ \mu$ to $37\ \mu$ and has a diameter of about the same dimensions; the bulb is almost spherical having a diameter from $132\ \mu$ to $153\ \mu$. The nerve ring is located about $206\ \mu$ from the anterior end of the body.

The vulva is located from 1.2 mm. to 1.4 mm. from the anterior end of the body. The vagina extends posteriorly and divides to form two uteri. The tail is long and slender, varying in length from 1.3 mm. to 1.4 mm. and is terminated by a long thin process about $176\ \mu$ in length. The eggs are thin shelled, about $103.6\ \mu$ by $56.5\ \mu$ (an average of ten).

No. Host.

3210, *Sylvilagus sylvaticus*, (cotton tail rabbit).

Dermatoxys veligera (Rudolphi, 1819) Schneider, 1866.

There was only one specimen found, a male, which measured in length 8.5 mm. and in breadth about $353\ \mu$, near the middle of the body. The body is rather straight, and curved ventrally at the posterior end. The cuticle is finely striated transversely at intervals of about $3.4\ \mu$ near the posterior end of the oesophagus. Two cervical alae are present and extend to the middle of the oesophageal bulb. The excretory pore is located behind the oesophageal bulb, about 1.82 mm. from the anterior end of the body. The head has a diameter of about $117\ \mu$. The mouth has three well developed lips each bearing two papillae. There are three teeth projecting from the shallow buccal cavity. The

oesophagus, exclusive of the bulb, is about 776 μ long, 87 μ wide at the anterior end and 132 μ wide at the posterior end. The narrowest part being somewhat anterior to the middle and about 70 μ in width. The oesophageal bulb is distinct, but not constricted. It is about 263 μ long and 212 μ wide. The nerve ring encircles the oesophagus about 186 μ from the anterior end.

The tail is somewhat pointed and is about 170 μ long. The bursa is formed by two wide caudal alae about 723 μ long and meets posterior to the conical termination of the body proper. A series of 12 distinct cuticular crests are located in the mid-ventral line about 330 μ anterior to the anus. Between this and the anus are two rows of small shields or bosses. The papillae in the specimen are not distinct, however, certain prominences indicate the following: four preanal, the first pair just anterior to the second; one pair adanal; and two pairs and one large single papillae postanal, one pair and the single papillae are located just posterior to the anus. The two other large papillae are somewhat lateral. Between these are two large cuticular shields. The spicule is small, about 86 μ long. No gubernaculum present.

No. Host.

3211, *Sylvilagus sylvaticus*, (cotton tail rabbit).

Wellcomia evoluta (Linstow, 1899).

A brief description of this species may be found on page 16, McClure (1932). However, head papillae have been observed and other slight modifications may follow later.

No. Host.

3212, *Erethizon dorsatum*, (Canadian albino porcupine).

Subulura distans (Rudolphi, 1908).

A brief description of this species may be found on page 19, McClure (1932)

No. Hosts.

3213, 3214, 3215, *Cercopithecus sabaeus*, (Green monkey).

3216, *Cercopithecus diana*, (Diana monkey).

3217, *Cercopithecus cephus*, (mustache monkey).

3218, 3219, *Macaca mulatta*, (Rhesus monkey).

3220, *Papio cynocephalus*, (yellow baboon).

Toxocara sp.

No. Host.

3221, *Vulpes velox*, (swift or kit fox).

Toxascaris leonina (Linstow, 1902).

A brief description of this species may be found on page 21, McClure (1932).

No. Hosts.

3222, *Felis canadensis*, (Canadian lynx).

3223, *Felis rufa*, (bobcat).

Parascaris equorum (Goeze, 1782) Yorke and Maplestone, 1926.

A brief description of this species may be found on page 43, McClure (1933).

No.	Hosts.
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3224,	<i>Equus zebra</i> , (mountain zebra).
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3225,	<i>Equus zebra</i> , (Hartmann's mountain zebra).
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Rictularia sp.

There was only one specimen present, a female, 22 mm. long and 1.5 mm. wide near the posterior end. The body is club-shaped, the posterior end being the largest. The cuticle is striated transversely at intervals of about 20 μ near the posterior end of the oesophagus. Along practically the entire ventral surface on each side there are two rows of cuticular combs or spines, 92 in number, 45 anterior to the vulva and 47 posterior. There is a gradual transformation from the combs to the spines, which are limited to the posterior region. The last spine is about 2 mm. from the posterior extremity. The cervical papillae are very inconspicuous and located about 1.04 mm. from the anterior end of the body. The excretory pore is located about 248 μ anterior to the cervical papillae. The mouth is dorso-ventral, bordered with small blunt teeth. The head diameter at the base of the buccal cavity is about 264 μ . The buccal cavity is about 88 μ deep and 106 μ wide at its base. From the dorsal wall of the buccal cavity projects a transverse ridge, tooth-like in appearance. The head bears an internal circle of 6 papillae, an external circle of 8 papillae, and two amphids. The anterior muscular part of the oesophagus is .74 mm. long and 106 μ wide; the posterior glandular part is 3 mm. long and about 300 μ maximum width. The entire length of the oesophagus is 3.74 mm. The nerve ring is located about 406 μ from the anterior end of the oesophagus.

The vulva is located on the ventral side, midway between the two rows of spines, about 6.95 mm. from the anterior end of the body, about 3.21 mm. behind the posterior end of the oesophagus. There is a short vagina, about 124 μ and an elongated egg-sac about 617 μ maximum thickness. The uteri are united for a distance of about 2.65 mm. then divide to form two very long coiled uteri terminated by the ovaries. The reproductive organs fill the entire body cavity. The tail is about 617 μ long, blunt, and terminated by a minute spine. The ova are not fully developed.

No.	Host.
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3226,	<i>Poto flavus</i> (kinkajou).
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Physaloptera sp.

For various reasons the species of the genus *Physaloptera* are listed sp. and are held for further consideration.

No.	Hosts.
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3227,	<i>Callosciurus prevostii</i> , (Prevost's squirrel).
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3228,	<i>Cebus fatuellus</i> , (Brown capuchin-monkey).
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3229, 3230, 3231,	<i>Cebus capucina</i> , (white-faced sapajou).
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Setaria labiato-papillosa (Alless., 1838).

A brief description of this species may be found on page 45, McClure (1933).

No.	Host.
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3232,	<i>Bison bison</i> , (American bison).
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Dipetalonema gracile (Rudolphi, 1809).

For a brief description of this species see page 25, McClure (1932).

No.	Host.
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3233,	<i>Cebus capucina</i> , (white-faced sapajou).
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