MEMOIRS OF THE INDIAN MUSEUM

Vol. VII, No. 4.

REPORT ON THE PARASITIC NEMATODES IN THE COLLECTION OF THE ZOOLOGICAL SURVEY OF INDIA.

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Calcutta:

PUBLISHED BY THE DIRECTOR, ZOOLOGICAL SURVEY OF INDIA.
PRINTED AT THE BAPTIST MISSION PRESS.

DECEMBER, 1922.

Price Eight Rupees.

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Received for publication November 23, 1921.

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INTRODUCTION.

The following report deals with an extensive collection of nematodes kindly submitted to us for determination by Dr. N. Annandale, Director of the Zoological Survey of India. It comprises material belonging to the Indian Museum, Calcutta, and material, collected since August, 1916, belonging to the Zoological Survey. A

large proportion of this material was collected from animals, mostly Indian, in the Zoological Garden, Calcutta. This applies to the majority of the species for which no locality is given.

It is difficult to judge to what extent the range of hosts of a parasite may be affected by the presence of a number of suitable hosts in more or less close proximity under artificial conditions in a menagerie. It has been observed that wild animals tend to lose their original parasitic infections after a short time in captivity; but there are some indications in the present collection that a parasite hitherto only known to occur in one or two hosts may, under these conditions, have been enabled to extend its range to hosts with which it would not normally have come into contact. As instances we may mention particularly the cases of *Ascaris lumbricoides* and the various species of *Heterakis*, especially *H. longecaudata*; while it seems probable that the species of *Ancylostoma*, *Belascaris* and *Toxascaris* enjoy exceptional opportunities in this respect in a menagerie where many kinds of carnivores are kept near to each other. The lists of hosts that we have been able to compile for these forms seem to bear out this suggestion.

As regards the position of parasites in their hosts, there was a certain amount of vagueness in many of the original labels. Often the label indicated the "intestines," but this term appears to have been applied somewhat widely to include most of the abdominal and thoracic viscera, and on this account we have decided, in many cases, to omit any mention of the site of election. The species of *Heterakis* from birds, for example, are usually found in the caeca of their hosts, and to mention the "intestines" conveys no information of any value.

The present report deals mainly with nematodes from vertebrate hosts, although two forms found in invertebrates are described. The material submitted to us also included a number of Mermithidae, but we have not attempted as yet to deal with these, and have thought it advisable to publish without unnecessary delay the results of our work on the more strictly parasitic forms. These include members of nearly every superfamily, and, while the number of new species is not large, the collection is valuable for the light it throws on a number of imperfectly known forms, and for the general idea it furnishes of the parasitic nematode fauna of India.

Throughout the report the names used for the hosts, so far as Indian animals are concerned, are for the most part those given in the *Fauna of British India* (Mammalia, by W. T. Blanford, 1888—1891; Birds, Vols. I--II, by E. W. Oates, 1889—1890, and Vols. III—IV, by W. T. Blanford, 1895—1898; Reptilia and Batrachia, by G. A. Boulenger, 1890; Fishes, by F. Day, 1889). The names of hosts (other than domestic animals) which are not indigenous in the Indian Empire are marked with an asterisk (*).

This genus appears to form a link between the subfamilies Ancylostominae and Necatorinae.

Subfamily *NECATORINAE*, Lane, 1917.

Genus **Necator**, Stiles, 1903.

Necator americanus (Stiles, 1902).

We have to record the occurrence of this species in a new host, *viz.* a young African rhinoceros * (*R. bicornis*), which had lived in the Zoological Gardens, Calcutta for a very short time. The animal was captured in the Tanganyika Territory (formerly German East Africa) and was brought to India by Mr. E. W. Harper, to whom we are indebted for this information.

Careful comparison of this material with specimens of *Necator americanus* from man in the collection of the British Museum reveals no difference except that the female specimens from the rhinoceros are slightly the longer. They measure from 11 to 13 mm. in length and 0·4 mm. in thickness, as against 10 to 12 mm. and 0·4 mm. respectively in the case of the specimens from man.

The subfamily Necatorinae was proposed by Lane (1917 *a*) to replace the older subfamily Bunostominae, Looss, 1911. The difference between these two groupings is that, according to Lane, the genus *Uncinaria* approaches more nearly to the *Necator* and *Bunostomum* group than to the Ancylostominae, among which it was placed by Looss. It is interesting to recall that of the subfamily Necatorinae, if *Uncinaria* be left out of account, all the members except *Necator* occur in herbivorous animals only,[1] and, in consequence, the occurrence of *Necator* in the rhinoceros is not so astonishing as it might appear at first sight. All the species of *Ancylostoma* occur in carnivores, and all except *Ancylostoma duodenale* and *A. ceylanicum* in carnivores only. It seems probable, therefore, that the original hosts of the species now found in man were carnivores. It is also almost certain that *Necator americanus* was introduced into America with the African slaves, and if this is the case, man may have acquired his earliest infestations with this parasite from some wild herbivore inhabiting Africa.

Family TRICHOSTRONGYLIDAE, Leiper, 1912.

Subfamily *TRICHOSTRONGYLINAE*, Leiper, 1908.

Genus **Haemonchus,** Cobb, 1898.

Haemonchus contortus (Rud., 1803).

This species occurred in the Markhor (*Capra falconeri*) in the Zoological Gardens, Calcutta.

Haemonchus cervinus, sp. nov.

The collection includes several females of a species of *Haemonchus* from a spotted deer (*Cervus axis*). The specimens are in poor condition. They measure from 13 to

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[1] Since the preparation of this paper, *Necator* has been recorded from the pig in Trinidad (Ackert and Payne, *Amer. Jl. of Hyg.*, II, 1, Jan., 1922). The authors regard the form found in pigs as a new species, which they have named *N. suillus*.