

INTESTINAL HELMINTHS OF THE STRIPED SKUNK, Mephitis mephitis
(Schreber), IN SOUTHERN ILLINOIS

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ABSTRACT -- Fifty-seven striped skunks, Mephitis mephitis, from southern Illinois were examined for intestinal helminths. Infected skunks harbored one or more of the following species: Alaria taxideae, Mesocestoides corti, Oschmarenia (Morosovella) mephitis, Ascaris columnaris, Placoconus lotoris, Physaloptera maxillaris, and Macracanthorhynchus ingens. Alaria taxideae constitutes a new distribution record.

The omnivorous feeding habits of striped skunks, Mephitis mephitis, coupled with their insectivorous and carnivorous tendencies (Lantz, 1923; Dixon, 1925; Hamilton, 1936; Selko, 1937; Llewellyn and Uhler, 1952; and Verts, 1967) expose them to a wide variety of parasites. The importance of these hosts in the epizootology of diseases of wildlife species as well as certain zoonoses, especially rabies and leptospirosis, has resulted in an increasing recent interest in their parasites not only by parasitologists and wildlife personnel, but also by veterinarians and physicians.

The first extensive review of the literature on the parasites of North American carnivores was published by Stiles and Baker (1935) and includes a list of the helminths reported from mustelids. Erickson (1946) provided lists of the hosts of, and a key to, the North American species of helminths of mustelids and reported on the incidence of these helminths in Minnesota. Subsequent continuing checklists of the helminths of M. mephitis in North America included the reports of Verts (1967) and Dyer (1969).

Although the biology and habitats of striped skunks have been studied extensively in Illinois, little information on their parasitic fauna is available. Levine et al. (1962) reported Skrjabinogylus chitwoodorum in the sulci and fissures beneath the dura mater in 2 of 184 M. mephitis examined from northern Illinois. Parasitism of the central nervous system may be a possible explanation for skunks found free of rabies despite their reported antemortem behavior suggesting it (Ewing and Hibbs, 1966; Lynd and Short, 1952). To our knowledge, the only report of intestinal parasites of striped skunks in Illinois is that given by Verts (1967) who examined a total of 153 hosts collected between 1960 and 1962 from northwestern Illinois and listed the intestinal helminths found in 29 skunks. Inasmuch as the parasitic fauna of M. mephitis has not been reported from southern Illinois, the present investigation was undertaken to determine the incidence of intestinal helminths in hosts from this area.

MATERIALS AND METHODS

As a result of a survey of the occurrence of rabies, 57 striped skunks, collected from several ecologically similar counties (Jackson, Jefferson, Perry, Union, and Washington) in southern Illinois between 1958 and 1960 by personnel of the Cooperative Wildlife Research Laboratory of Southern Illinois University at Carbondale, were examined for intestinal helminths. The majority of hosts were trapped; a few were road-killed. As the primary purpose for collecting intestinal tracts of these hosts involved studies of their food habits, the parasites were fixed in either 10% neutral formalin or 70% ethanol. Trematodes and cestodes were stained with either Ehrlich's hematoxylin or Mayer's acid carmalum, destained, dehydrated and gradually cleared by successive treatment for several hours in 25, 50, 75 and then 100% beechwood creosote. Fast green in 95% ethanol was sometimes used to counterstain various structures. Nematodes were cleared in glycerine and studied in temporary mounts. The anterior ends of some specimens were removed and mounted in glycerine-jelly for en face studies. Acanthocephalans were pricked by means of fine pins to permit passage of staining fluids and prevent opacity. They were then stained with Mayer's acid carmalum and processed by the methods mentioned above for trematodes and cestodes.

RESULTS AND DISCUSSION

TABLE 1. Intestinal helminths recovered from 57 striped skunks in southern Illinois

Species of helminth	Location in host	No. animals infected	Per cent infected
TREMATODES			
<u>Alaria taxideae</u>	Small intestine	2	3.5
CESTODES			
<u>Mesocestoides corti</u>	Small intestine	7	12.3
<u>Oschmarenia (Morosovella) mephitis</u>	Small intestine	2	3.5
NEMATODES			
<u>Ascaris columnaris</u>	Small intestine	21	36.8
<u>Placoconus lotoris</u>	Small intestine	6	10.5
<u>Physaloptera maxillaris</u>	Stomach	55	96.4
ACANTHOCEPHALANS			
<u>Macracanthorhynchus ingens</u>	Small intestine	3	5.3

Seven species of helminths were recovered. These included one trematode, two cestodes, three nematodes, and one acanthocephalan (Table 1). Fifty-six skunks were infected with one or more species of helminths; 45 were infected with nematodes, 6 with nematodes and tapeworms, 3 with nematodes and acanthocephalans, and 2 with nematodes, tapeworms and flukes.

Trematodes

Alaria taxideae Swanson and Erickson, 1946

This species was the only fluke encountered. It occurred as a mixed infection with Ascaris columnaris and Mesocestoides corti in one host and with A. columnaris, Placoconus lotoris and M. corti in the second host. Infection of A. taxideae were light in both hosts; the average number of flukes per host was 4.3.

Our report of A. taxideae is apparently the sixth known occurrence of this trematode in M. mephitis and its occurrence in Illinois constitutes a new distribution record. This parasite has previously been reported from striped skunks in Minnesota (Swanson and Erickson, 1946; Erickson, 1946), Maryland (Goldberg, 1954), Michigan (Chandler, 1954), Louisiana (Babero, 1960), and North Dakota (Dyer, 1970). This species has a wide host distribution in mustelids and is known to occur in Spilogale putorius, Mustella erminea, M. frenata and Taxidea taxus in Minnesota (Swanson and Erickson, 1946; Erickson, 1946) and T. taxus in North Dakota (Leiby, Sitzmann, and Kritsky, 1971).

The life history of A. taxideae is unknown, but possibly it is the same as for other species of Alaria. Pearson (1956) reviewed the literature on several species of Alaria whose life cycles have been ascertained. Essentially they involve 1) a snail first intermediate host, 2) a vertebrate second intermediate host that harbors the mesocercariae, 3) a collector or paratenic host, that makes the mesocercariae more readily available to the definitive host because of its habitat and food habits, and 4) the definitive host in which the diplostomula and adults develop.

Cestodes

Mesocestoides corti Hoeppli, 1925 (= M. variabilis Mueller, 1928; M. manteri Chandler, 1942)

This tapeworm always occurred as a mixed infection. It was found with Ascaris columnaris in 4 hosts, A. columnaris and Placoconus lotoris in 2 hosts, and A. columnaris, P. lotoris and Alaria taxideae in 1 host. This cestode has been reported from Mephitis mephitis in California (Mueller, 1928; Voge, 1953, 1955; Mead, 1963), Minnesota (Erickson, 1946), Wisconsin (Rausch and Tiner, 1949), Louisiana (Babero, 1960), northwestern Illinois

(Verts, 1967), North Dakota (Dyer, 1970) and from several other mammalian hosts including Canis latrans, Lynx rufus, Martis pennanti, Mephitis macroura, Mus musculus, Procyon lotor, Spilogale gracilis, S. putorius, Urocyon cinereoargenteus, U. litteralis, and Vulpes macrotis.

The present taxonomic criteria for differentiating species of the genus Mesocestoides are inadequate. Morphological differentiation is slight and variability of characters extensive. In a study of this genus, Voge (1955a) concluded that on the basis of available data M. corti and M. variabilis cannot be satisfactorily differentiated and that M. manteri is a dwarf form of M. variabilis. For these reasons, she proposed that M. manteri and M. variabilis be regarded as synonyms of M. corti.

The complete life history of Mesocestoides is not known. A survey of the literature reveals numerous reports of tetrathyridia, the stage infective to carnivores, in the liver, mesenteries, cardiac muscle and body cavity of various amphibians, reptiles, and mammals (Voge, 1953; Specht and Voge, 1965; Grundmann, 1956; James and Ulmer, 1967). In this report, infected skunks presumably acquired M. corti by ingesting vertebrates infected with tetrathyridia. Of the various carnivores examined in this laboratory, M. mephitis appears to be the important definitive host in southern Illinois.

Oschmarenia (Morosovella) mephitis (Skinker, 1935)
Spassky, 1951 (= Oochoristica mephitis Skinker, 1935)

This species occurred as a mixed infection with Ascaris columnaris in one host and with A. columnaris and Placoconus lotoris in the second host. This parasite has been reported from striped skunks in Georgia (Skinker, 1935), Illinois (Leigh, 1940; Verts, 1967), Massachusetts (Self and McKnight, 1950), Florida (Loftin, 1961) and North Dakota (Dyer, 1970). Rankin (1946) also found this parasite in Urocyon cinereoargenteus. This life history of this tapeworm is not completely known. The larvae probably develop in beetles.

Nematodes

Ascaris columnaris Leidy, 1856

This nematode was found as a single infection in 11 hosts and as a mixed infection with Mesocestoides corti in 3 hosts, M. corti and Alaria taxideae in 1 host, Placoconus lotoris in 2 hosts, P. lotoris and M. corti in 2 hosts, P. lotoris, M. corti and A. taxideae in 1 host and P. lotoris and Macracanthorhynchus ingens in 1 host. This parasite has been reported from M. mephitis in Quebec (Choquette, 1951; Webster and Wolfgang, 1956), Maryland (Dikmans and Goldberg, 1949), Louisiana (Babero, 1960), California (Mead, 1963), northwestern Illinois (Verts, 1967) and North Dakota (Dyer, 1970). Early stages in the life cycle of this species reside in the lungs of the host.

Physaloptera maxillaris Molin, 1860

This species was the most common nematode collected. Marked hypertrophy of the stomach wall was observed in heavy infestations. This nematode has been reported from M. mephitis in Quebec (Choquette, 1951; Webster and Wolfgang, 1956; Webster and Beaugard, 1965), Maryland (Dikmans and Goldberg, 1949; Goldberg, 1954), Louisiana (Babero, 1960), California (Mead, 1963), northwestern Illinois (Verts, 1967) and North Dakota (Dyer, 1970). It has also been reported in other Mustelidae from North America. Insects probably are the intermediate hosts of this parasite.

Placoconus lotoris (Schwartz, 1925) Webster, 1956 (= Uncinaria lotoris Schwartz, 1925; Arthrocephalus lotoris (Schwartz, 1925) Chandler, 1942).

This hookworm occurred as a single infection in 2 skunks and as a mixed infection with Ascaris columnaris in 1 host, A. columnaris and Mesocestoides corti in 2 hosts, and A. columnaris, M. corti and Alaria taxideae in 1 host. Infections were light in all hosts; the average number per hosts was 5.2. This nematode has been reported in M. mephitis from Maryland (Dikmans and Goldberg, 1949), Quebec (Choquette, 1951; Webster and Wolfgang, 1956), Louisiana (Babero, 1960) and northwestern Illinois (Verts, 1967).

The first report of a hookworm with buccal capsule formed of articulating plates was that of Ortlepp (1925) who established Arthrocephalus with A. gambiensis from an African mongoose as type. Subsequently, Schwartz (1925) described Uncinaria lotoris, a hookworm with an articulated buccal capsule from a North American racoon, Procyon lotor. Chandler (1942) transferred this species to Arthrocephalus. Later, Webster (1956) pointed out that in A. gambiensis there is a dorsal cone but no teeth, while in A. lotoris the dorsal cone is absent and ventral teeth are present. On the basis of these differences, Webster transferred A. lotoris to a new genus Placoconus.

Acanthocephalans

Macracanthorhynchus ingens (Linstow, 1879)

This parasite occurred as a single infection in 2 hosts and as a mixed infection with Ascaris columnaris in 1 host. This acanthocephalan has been reported in M. mephitis from Maryland (Goldberg, 1954), Louisiana (Babero, 1960) and northwestern Illinois (Verts, 1967). It has also been reported from other Mustelidae in North America. The life cycle for M. ingens was worked out experimentally by Moore (1946). Development occurred in grubs of Phyllophaga crinita, P. hirtiventris, Ligyris sp. and in Rana pipiens.

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