

GASTROINTESTINAL HELMINTHS OF THE RACCOON,  
PROCYON LOTOR, IN SOUTHERN ILLINOIS

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ABSTRACT.-- Thirty-six raccoons, Procyon lotor, collected from several ecologically similar counties in southern Illinois, were examined for gastrointestinal helminths. The 34 infected raccoons harbored one or more of the following species: Ascaris columnaris, \*Physaloptera rara, Placoconus lotoris, \*Gnathostoma procyonis, \*Fibricola cratera, Pharyngostomoides adenocephala, Mesocestoides sp., Atriotaenia procyonis, and Macracanthorhynchus ingens. An asterisk (\*) preceding the parasite name indicates a new locality record.

The raccoon, Procyon lotor, is an important wildlife entity in Illinois, both from the standpoint of adding to the economy and in providing opportunity for scientific investigation. This mammal also serves as a reservoir for parasites which constitute important zoonoses of man and domestic animals. Leptospirosis, tularemia, Chaga's disease and rabies have been reported from raccoons. Thus, parasites harbored by raccoons are important not only to parasitologists and wildlife personnel, but also to veterinarians and physicians.

The first extensive review of the literature concerning the parasites of North American carnivores was published by Stiles and Baker (1935) and includes a list of the helminths reported from raccoons. A subsequent checklist of raccoon helminths was reported by Stains (1956).

Few reports on raccoon parasites are based on comprehensive surveys. Chandler (1942) reported 8 species of helminths from 13 raccoons in east Texas and McNeil and Krogdsale (1953) recovered 4 helminths species from 29 raccoons in southwest Washington. Babero and Shepperson (1958) found 16 species of helminths in 6 raccoons in central Georgia. Clark and Herman (1959) examined 260 raccoons from Patuxent Research Refuge, Maryland over a 30 year period and listed 4 species of protozoans, 27 nematodes, 20 trematodes, 7 cestodes, 3 acanthocephalans, and 15 arthropods as raccoon parasites. Thirteen species of helminths were recovered from 16 raccoons on Cape Island, South Carolina by Harkema and

Miller (1962). Later, Harkema and Miller (1964) reported 39 helminth species from 320 raccoons taken from various localities in the southeastern United States. Nineteen helminth species were recovered from 365 raccoons collected in Alabama by Johnson (1970). Other reports on helminths from this host are restricted either to descriptions of new species or lists of helminths in a few raccoons made in connection with more extensive studies on other mammalian hosts.

To our knowledge, the only report of gastrointestinal parasites of raccoons from Illinois is that presented by Leigh (1940), who examined a total of 6 hosts collected between 1935 and 1937 from the northern part of the state. Inasmuch as the parasitic fauna of P. lotor from southern Illinois has not been reported, the present investigation was undertaken to determine the incidence of gastrointestinal helminths in hosts from this area.

#### MATERIALS AND METHODS

Thirty-six raccoons were collected between 1958 and 1963 from seven ecologically similar counties (Franklin, Jackson, Jefferson, Macoupin, Perry, Union, and Williamson) in southern Illinois by personnel of the Cooperative Wildlife Research Laboratory, Southern Illinois University at Carbondale. The majority of animals collected were trapped; a few were road-killed. Organs of the gastrointestinal tract, stomach through large intestine, of each raccoon were examined separately for helminths. 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 Mayer's acid carmalum and cleared in beechwood creosote. Nematodes were cleared in glycerine and examined as temporary mounts. Acanthocephalans were stained with Grenacher's alcoholic borax carmine and cleared in beechwood creosote.

#### RESULTS AND DISCUSSION

Thirty-four of the 36 hosts examined harbored one or more of the helminths listed in Table 1. All of the specimens encountered were common raccoon parasites that have been reported from widely scattered geographic areas of North America.

##### Nematodes

##### Ascaris columnaris Leidy, 1856

This nematode was found as a single infection in 1 host and as a mixed infection with one or more parasites in 22 hosts. It was originally described from the striped skunk, Mephitis mephitis, by Goodey and Cameron (1923), and later reported from the raccoon by Olsen and Fenstermacher (1938). Leigh (1940) found 4 of 6 raccoons from northern Illinois parasitized by

Ascaris sp. (probably A. columnaris). This nematode also has been reported from P. lotor in Iowa (Morgan and Waller, 1940), Washington (McNeil and Krogdsdale, 1953) and Georgia (Babero and Shepperson, 1958).

Physaloptera rara Hall and Wigdor, 1918

This nematode was encountered as a single infection in 5 raccoons and as a mixed infection in 20 raccoons. Hosts infected with this species contained large numbers of specimens in the stomach along with a few nematodes in the anterior portion of the small intestine. Leigh (1940) recovered 63 specimens of Physaloptera turgida Rudolphi, 1819, from a single raccoon in northern Illinois. Morgan (1941) re-examined Leigh's specimens and reported that they appeared to be P. rara. Physaloptera rara has been reported from raccoons in Wisconsin (Morgan, 1941; Schiller and Morgan, 1949), Iowa (Morgan, 1942), Georgia (Babero and Shepperson, 1958; Sawyer, 1958), South Carolina (Harkema and Miller, 1962), and North Carolina, South Carolina, Georgia and Virginia (Harkema and Miller, 1964).

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

This hookworm occurred only as a mixed infection. Orliepp (1925) established the genus Arthrocephalus with A. gambiensis from an African mongoose as type. Later, Schwartz (1925) described Uncinaria lotoris, a hookworm from a raccoon taken in Maryland. Chandler (1942) transferred this species to Arthrocephalus. Because of differences in the morphology of the buccal capsules of A. gambiensis and A. lotoris, Webster (1956) transferred A. lotoris to a new genus Placoconus. In a careful study of the two genera Arthrocephalus and Placoconus, Balasingam (1964) provided further evidence to support Webster's view. Placoconus lotoris has been reported from Procyon lotor in Texas (Chandler, 1942), Michigan (Stuewer, 1943), Washington (McNeil and Krogdsdale, 1953), Oregon (Senger and Weiland, 1955), Georgia (Babero and Shepperson, 1958; Jordan and Hayes, 1959), Michigan (Schultz, 1962), North Carolina, South Carolina, Georgia and Virginia (Harkema and Miller, 1964), and Alabama (Johnson, 1970). Leigh (1940) reported Arthrocephalus sp. (probably Placoconus lotoris) from two raccoons in northern Illinois.

Gnathostoma procyonis Chandler, 1942

This species occurred only as a mixed infection. Specimens were found attached to large nodules in the stomach wall resulting in marked hypertrophy. Other localities from which G. procyonis has been reported include: Texas (Chandler, 1942), Georgia (Babero and Shepperson, 1958; Jordan and Hayes, 1959), Louisiana (Ash, 1962), North Carolina, South Carolina, Georgia, Florida and Virginia (Harkema and Miller, 1964) and Alabama (Johnson, 1970). The occurrence of G. procyonis in raccoons from

Illinois constitutes a new locality record.

#### Trematodes

##### Fibricola cratera Barker and Noll, 1915

Only two species of trematodes were encountered in the present study and both were diplostomids. One of these, Fibricola cratera, was previously reported as Fibricola texensis from raccoons in Texas (Chandler, 1942), Georgia (Babero and Shepperson, 1958), and South Carolina (Harkema and Miller, 1962). According to Harkema and Miller (1964), subsequent studies of their specimens and the life history investigations by Cuckler (1940), Leigh (1954), and Ulmer (1955) indicate that F. texensis is a synonym of F. cratera. Other reports of F. cratera in raccoons include those of Morgan and Waller (1940) from Iowa and Harkema and Miller (1964) from South Carolina, North Carolina and Florida. In the present study, F. cratera occurred as a mixed infection. The occurrence of this fluke in raccoons from Illinois constitutes a new distribution record.

##### Pharyngostomoides adenocephala Beckerdite, Miller and Harkema, 1971.

Pharyngostomoides adenocephala was the second diplostomid fluke encountered. This fluke occurred only as a mixed infection. Two species of Pharyngostomoides have been described from P. lotor. Pharyngostomoides procyonis was first described by Harkema (1942) from raccoons in North Carolina and subsequently reported from raccoons in east Texas by Chandler (1942). The second species, Pharyngostomoides ovalis, was described by Chandler and Rausch (1946) from raccoons in Michigan. Later, Dubois (1963) synonymized P. ovalis with P. procyonis. Harkema and Miller (1964) noted distinct morphological variations in adult P. procyonis recovered from raccoons in North Carolina, South Carolina, Georgia, Florida, and Virginia and suggested that further studies might reveal two species. Later, Beckerdite, Miller and Harkema (1971) demonstrated that two species of Pharyngostomoides were included in the original description of P. procyonis. A new species, P. adenocephala was described and P. procyonis redescribed. These two forms may be differentiated on the basis of size, shape, presence or absence of glands around the pseudo-suckers, and presence or absence of an ejaculatory duct. Pronounced differences in the life histories of these two forms were also noted. The finding of P. adenocephala in raccoons from Illinois represents a new locality record for this parasite.

#### Cestoda

##### Mesocestoides sp.

Specimens of Mesocestoides were found only in mixed infections. Several species of Mesocestoides have been reported from raccoons and other carnivores. Mesocestoides variabilis has been

recorded from raccoons in Texas (Chandler, 1942), North Carolina, South Carolina, Georgia and Florida (Harkema and Miller, 1964), and Alabama (Johnson, 1970). Babero and Shepperson (1958) and Jordan and Hayes (1959) identified specimens from Georgia raccoons as M. lineatus. Ogren (1956) reported M. corti from Illinois raccoons.

The present taxonomic criteria for differentiating species of this genus is inadequate. Morphological differentiation is slight and variability of characteristics extensive. In a study of the genus Mesocestoides, Voge (1955a) concluded that on the basis of available data, M. corti and M. variabilis cannot be satisfactorily differentiated and proposed that both species be regarded as synonyms of M. corti. Wood and Haldeman (1957) stated that "...many of the presently named species are in reality morphological manifestations of the adaptive potential of the parasite to a variety of hosts over a wide range of localities."

Since there appears to be no well-defined criteria for separating the members of this genus, the specimens reported in the present study are tentatively identified as Mesocestoides sp.

Atriotaenia (Ershovia) procyonis (Chandler, 1942) Spassky, 1951 (= Oochoristica procyonis Chandler, 1942)

Atriotaenia procyonis was found only as mixed infections. This cestode has a wide geographic distribution. It has been reported from raccoons in Texas (Chandler, 1942), Wisconsin (Schiller and Morgan, 1949), California (Voge, 1955b), Georgia (Babero and Shepperson, 1958; Jordan and Hayes, 1959), Ohio (Gallati, 1959), Michigan (Schultz, 1962), North Carolina, South Carolina, Georgia, Florida, and Virginia (Harkema and Miller, 1964), and Alabama (Johnson, 1970). Leigh (1940) found a single raccoon from northern Illinois infected with Oochoristica sp. (probably A. procyonis).

Acanthocephala

Macracanthorhynchus ingens Linstow, 1879

Macracanthorhynchus ingens was the only acanthocephalan recovered and always occurred as a mixed infection. This species has been reported from raccoons in Texas (Chandler, 1942; Moore, 1946), Pennsylvania (Chandler and Melvin, 1951), Connecticut (Penner, 1954), Maryland (Herman, 1955), Virginia (Holloway, 1957), Georgia (Babero and Shepperson, 1958; Jordan and Hayes, 1959), North Carolina, South Carolina, Georgia, and Florida (Harkema and Miller, 1964), West Virginia (Shoemaker, 1966) and Alabama (Johnson, 1970). The occurrence of M. ingens in raccoons from Illinois constitutes a new distribution record.

Table 1. - Gastrointestinal helminths found in 36 raccoons in southern Illinois

Species of helminth	Location in host	No. of animals infected	Percent infected
Nematodes			
<u>Ascaris columnaris</u>	Small intestine	23	63.9
<u>Physaloptera rara</u>	Stomach and small intestine	25	69.4
<u>Placoconus lotoris</u>	Small intestine	19	52.8
<u>Gnathostoma</u> <u>procyonis</u>	Stomach	2	5.6
Trematodes			
<u>Fibricola cratera</u>	Small intestine	6	16.7
<u>Pharyngostomoides</u> <u>adenocephala</u>	Small intestine	2	5.6
Cestodes			
<u>Mesocestoides</u> sp.	Small intestine	9	25.0
<u>Atriotaenia</u> <u>procyonis</u>	Small intestine	5	13.9
Acanthocephalans			
<u>Macracanthoryhynchus</u> <u>ingens</u>	Small intestine	5	13.9

#### ACKNOWLEDGMENTS

The authors wish to thank Dr. Willard D. Klimstra, Director of the Cooperative Wildlife Research Laboratory, Southern Illinois University, Carbondale, Illinois for providing the raccoons utilized in this study.

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