

NEMATODES OF RODENTS IN THE UNITED STATES WITH NOTES ON
NEMATODE PARASITES OF RODENTS IN KANSAS

by

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INTRODUCTION

Nematodes, or roundworms, are members of the class Nematoda, phylum Aschelminthes. These animals are found world wide as both parasitic and free living forms. They abound in individual numbers, and as different species. The body is unsegmented and spindle shaped. The digestive system consists of a mouth, esophagus, simple intestine, and anus. Parasitic nematodes of vertebrates have been found in the tissues, fluids, and body cavities of their host, showing a marked ability of adaptation.

Rodents were chosen as the host animals because of their wide spread distribution, abundant numbers, and small size which facilitates ease in capturing and handling. Many of the early studies on the parasites of rodents were related to parasites of economic importance to man and domestic animals. Although helminths are usually not fatal to rodents, they reduce the host's vitality, which in turn may lessen the chance of host survival.

The ecological importance of rodents as a part or whole of the basic food source for many carnivores has brought about a new phase of study in rodent parasitology. Recent work has become centered on the rodent's usual worm burden, and also the role played by the rodent as a distributing agent, intermediate host, and reservoir for helminths that may infect other forms of wildlife.

The literature dealing with the nematode parasites of rodents in the United States is found in different journals, and scientific papers. Therefore, an attempt has been made to combine these reports and produce a host catalogue showing the geographical location where the animal was captured, and the nematodes harbored. Host classification is by genus and specific

name. This has been done in order to keep the host catalogue consistent, and to eliminate the possibility of confusion through use of subspecies names. Such a list that is up to date will aid in future investigation and identifications of rodent nematodes. Earlier work of this type was performed by Hall (1916), Oldham (1931), Harkema (1936), Erickson (1938), Rausch and Tiner (1948), Landis (1952), and Doran (1955).

Accompanying the host catalogue for the United States is a list of nematodes collected from Kansas rodents by the author. The majority of these rodents were collected within a 50 mile radius of Manhattan, Kansas, with the exception of the Ord's kangaroo rat Dipodomys ordii Woodhouse, and Eastern wood rat Neotoma floridana Ord collected from Kearny County.

REVIEW OF LITERATURE

The following literature review relates to the major work to date on the helminths of rodents in the United States. Numerous other articles concerning the description of new species and host records have been listed in the literature cited.

Hall (1916) introduced the first host-parasite catalogue of rodents in the United States. His monograph concerned the nematodes parasitic in the orders Rodentia, Lagomorpha, and Hydracoidea of North America. He described 34 species of nematodes from rodents. York and Maplestone (1926) published "The Nematode Parasites of Vertebrates" which included descriptions of all known parasitic nematode genera of rodents.

Oldham (1931) surveyed and compiled the information concerning helminths of three species of rats Rattus norvegicus Berkenhout, Rattus rattus

Linnaeus, and Rattus alexandrinus Geoffroy which are widely distributed. Harkema (1936) reported the parasites found in North Carolina rodents. Included in his work was an extensive coverage of the internal and external parasites found in the rodents and lagomorphs of North America. A host-parasite catalogue by Erickson (1938) provided an accessible index to the helminths of native North American mice.

Rausch and Tiner (1948) studied the helminths from the family Scuridae of the north central United States. They included the earlier work of Katz (1938) on the helminths from the fox and gray squirrels of Ohio.

Landis (1952) surveyed the helminths of small mammals representing the orders Insectivora, Lagomorpha, and Rodentia, near Manhattan, Kansas.

Doran (1955) summarized the host and geographical distribution records of the protozoa and helminths reported from North American rodents. Voge (1956) reported the occurrence and distribution of nematodes found in the wild mammals of California.

Grundmann (1957) studied the nematodes of mammals inhabiting the Great Salt Lake Desert of Utah. Rodents comprised the majority of animals collected. They inhabited biomes from the desert floor to the alpine biome of the surrounding mountains. This extensive distribution of the rodents revealed a direct relationship to their increased nematode burden. Frandsen and Grundmann (1961) continued the work on Utah rodents, and demonstrated little if any morphological divergence in parasite species with respect to the subspecies of rodents inhabited.

Yamaguti (1961) has made an extensive systematic study based on the morphological characteristics, of all the known parasitic worms of the world.

MATERIAL AND METHODS

The small mouse-like rodents were collected by placing common snap traps, baited with a peanut butter oatmeal mixture, in runways and in the openings of burrows. Squirrels and rats were collected using a .22 caliber rifle. The beaver and muskrat carcasses were obtained from a professional trapper. Collecting of rodents began in March of 1963 and extended to February of 1964. They were collected within a 50 mile radius of Manhattan with the exception of the Eastern wood rat Neotoma Floridana Ord and Ord's kangaroo rat, Dipodomys ordii Woodhouse collected from Kearny County.

Traps were set in the late afternoon and checked early the next morning. This schedule was used to reduce the loss of bait, and trapped animals from scavengers and heat. It was found that spraying the front and back sides of the traps with a florescent paint enabled them to be easily seen if moved from the original set. Also, the use of white cloth markers at each trap prevented loss of traps and reduced the time required for trap collection.

If time permitted, rodents were examined for nematodes immediately after being captured. If this was not possible, the rodents were preserved by freezing. It was noted that freezing killed and relaxed the nematodes.

At necropsy, a mid-ventro incision was made from the anal region to the anterior tip of the lower jaw. The tongue, esophagus, stomach, intestines, heart, lungs, diaphragm, liver and urinary bladder were removed and placed in a Petri dish containing tap water. The abdominal and thoracic cavities were flushed out with tap water, and the fluid checked for nematodes under a dissecting microscope. The stomach, small intestine, caecum and large intestine were separated and each was slit longitudinally, and then placed

with its contents in a bottle of water. The bottle was capped, and vigorously shaken two to three minutes, after which the contents were poured into a conical shaped glass. Nematodes and heavier particles settled to the bottom, while much of the lighter debris remained suspended, and was easily decanted. The remaining sediment was placed in a Petri dish and examined under a dissecting microscope.

The tongue, esophagus, stomach, and intestinal walls, diaphragm and urinary bladder, were placed between two pieces of $3\frac{1}{2}$ x $5\frac{1}{2}$ inch safety glass. The two pieces of glass were then pressed firmly together, flattening the tissue. This permitted the penetration of light, and enabled examination for nematodes embedded in the tissue. Nematodes located in tissues were carefully removed by the use of dissecting needles.

The liver, heart, and lungs were examined grossly for abscesses, and discolored areas.

The nematodes were preserved in Ward's Fixative prepared as follows:

Alcohol 95%	24cc
Formaldehyde	15cc
Acetic acid	5cc
Glycerine	10cc
Water	46cc

Live specimens were fixed by immersion in Ward's fixative heated to slightly below boiling point. The author found, that by using the above solution as a preservative, the cuticle of the nematode was cleared and remained pliable. This was used to replace the older method of 70% alcohol as a preservative, which required a clearing process of the nematode in a glycerine alcohol solution.

Semi-permanent mounts were made for identification of the nematodes.

This was accomplished by removing the nematodes from the fixative, placing them in a drop of lactophenol on a slide, and covering with a coverslip. This technique facilitated mounting, and allowed the nematodes to be recovered for future study.

RESULTS

Seventy mammals representing 11 genera and 13 species, of the order Rodentia were examined for nematodes. Members of the following 13 species were examined; beaver Castor canadensis Kuhl, Ord's kangaroo rat Dipodomys ordii Woodhouse, prairie vole Microtus ochrogaster Wagner, pine vole Microtus pinetorum Le Conte, eastern wood rat Neotoma floridana Ord, muskrat Ondatra zibethicus Linnaeus, wood mouse Peromyscus leucopus Rafinesque, deer mouse Peromyscus maniculatus Wagner, Norway rat Rattus norvegicus Berkenhout, western harvest mouse Reithrodontomys megalotis Baird, fox squirrel Sciurus niger Linnaeus, hispid cotton rat Sigmodon hispidus Say and Ord, and the southern lemming-mouse Synaptomys cooperi Baird (Table I).

Nematodes from Dipodomys ordii

Three Ord's kangaroo rats collected near Lakin, Kansas were examined by the author for nematodes. The following species were recovered.

Capillaria americana Read, 1949

Host: Dipodomys ordii

Habitat: Small intestine

Location: Lakin, Kansas

Table I. Hosts and their nematode parasites collected in Kansas

Nematode parasite(s)	Hosts and Nematode parasite(s)	: Hosts examined : Hosts infected : Infected : Nematodes per host			
		number	number	%	maximum number
<u>Castor canadensis</u> (Beaver)	2	0	0	0	0
<u>Dipodomys ordii</u> (Ord's kangaroo rat)	3				
<u>Capillaria americana</u> Read, 1949	2	66.6		43	
<u>Capillaria</u> (larva)	1	33.3		2	
<u>Subulura</u> sp.	1	33.3		1	
<u>Trichuris dipodomis</u> Read, 1956	3	100.0		159	
<u>Microtus ochrogaster</u> (Prairie vole)	27				
<u>Capillaria muris-sylvatici</u> Diesing, 1851	2	7.4		2	
<u>Syphacia obvelata</u> Rudolphi, 1802	19	70.3		83	
<u>Trichuris opaca</u> Barker and Noyes, 1915	3	11.1		3	
<u>Microtus pinetorum</u> (Pine vole)	1				
<u>Syphacia obvelata</u> Rudolphi, 1802	1	100.0		1	
<u>Neotoma floridana</u> (Eastern wood rat)	2				
<u>Gongylonema</u> (larva)	1	50.0		15	
<u>Spiruroides</u>	1	50.0		1	
<u>Ondatra zibethicus</u> (Muskrat)	2	0	0.0	0	

Table I (cont.).

Hosts and Nematode parasite(s)	Hosts examined : number	Hosts infected : number	Infected : %	Nematodes per host : maximum number
<u>Peromyscus leucopus</u> (Wood mouse)	5			
<u>Spiruracera zapi</u> Erickson, 1938		1	20.0	1
<u>Syphacia peromysci</u> Harkema, 1936		1	20.0	14
<u>Peromyscus maniculatus</u> (Deer mouse)	6			
<u>Gongylonema peromysci</u> Kruidenier and Peebles, 1958		2	33.3	3
<u>Syphacia peromysci</u> Harkema, 1936		2	33.3	7
<u>Rattus norvegicus</u> (Norway rat)	6			
<u>Heterakis spumosa</u> Schneider, 1866		6	100.0	13
<u>Trichosomoides crassicauda</u> (Bellingham, 1845) Railliet, 1895		2	33.3	3
<u>Reithrontomys megalotis</u> (Western harvest mouse)	3	0	.	
<u>Sciurus niger</u> (Fox squirrel)	8			
<u>Heligmodendrium hassalli</u> Price, 1929		8	100.0	231
<u>Physaloptera</u> (larva)		1	12.5	4
<u>Strongyloides robustus</u> Chandler, 1942		1	12.5	2
<u>Trichostrongylus calcaratus</u> Ransom, 1911		7	87.5	43
Unidentified larva		1	12.5	2

Table I (concl.).

Nematode parasite(s)	Hosts examined : number	Hosts infected : number	Infected : %	Nematodes per host : maximum number
<u>Sigmodon hispidus</u> (Hispid cotton rat)	1			
<u>Physaloptera</u> sp.		1	100.0	1
<u>Physaloptera</u> (larva)		1	100.0	1
<u>Synaptomys cooperi</u> (Southern lemming-mouse)	4	0		

Two of the three, 66.6 percent incidence, kangaroo rats were found to be infected with Capillaria americana. A total of 52 worms was recovered. Read (1949) described this species from the flying squirrel Glaucomys volans, the gray squirrel Sciurus carolinensis, and the white-footed mouse Peromyscus maniculatus.

Capillaria sp. (larva)

Host: Dipodomys ordii

Habitat: Small intestine

Location: Lakin, Kansas

A larval nematode of the genus Capillaria was collected from the small intestine of a kangaroo rat.

Subulura sp.

Host: Dipodomys ordii

Habitat: Stomach

Location: Lakin, Kansas

A single specimen of the genus Subulura was recovered from the stomach of a kangaroo rat. The author was unable to find a report of this genus from the kangaroo rats. Because insufficient numbers of specimens were collected, the specimen cannot be identified to species.

Trichuris dipodomis Read, 1956

Host: Dipodomys ordii

Habitat: Caecum and large intestine

Location: Lakin, Kansas

A total of 181 worms were collected from the ceca and large intestines of the three kangaroo rats. A 100 percent incidence of infection was attained, with an average of 60.3 worms per rat.

This species was described by Read (1956) from specimens collected from the Ord's kangaroo rat Dipodomys ordii.

Nematodes from Microtus ochrogaster

A total of 27 prairie voles were collected in the vicinity of Manhattan, Kansas and harbored the following nematodes.

Capillaria muris-sylvatici Diesing, 1851

Host: Microtus ochrogaster

Habitat: Small intestine

Location: Manhattan, Kansas

Of the 27 prairie voles examined by the author, two were infected with Capillaria muris-sylvatici, an incidence of 7.3 percent. Two worms were collected from each of the infected voles.

Read (1949) was the first to report the presence of this species in North American rodents. His specimens were obtained from the vole Microtus pennsylvanicus.

Syphacia obvelata Rudolphi, 1802

Host: Microtus ochrogaster

Habitat: Caecum and large intestine

Location: Manhattan, Kansas

This was the most common species collected from the prairie voles, a total of 213 worms was recovered from 19 animals. The incidence of infection was 70.3 percent, with an average of 11.2 worms per infected animal.

Hall (1916) reported this nematode as having a cosmopolitan distribution, and as a common parasite of wild rodents.

Trichuris opaca Barker and Noyes, 1915

Host: Microtus ochrogaster

Habitat: Caecum

Location: Manhattan, Kansas

Six Trichuris opaca were recovered from the caecum of three prairie voles. The incidence of infection was 11.1 percent with an average of two worms per infected vole.

The type species described by Barker and Noyes (1915) was obtained from the muskrat Ondatra zibethicus.

Nematode from Microtus pinetorum

Syphacia obvelata Rudolphi, 1802

Host: Microtus pinetorum

Habitat: Caecum

Location: Manhattan, Kansas

A single specimen of Syphacia obvelata was collected by the author from the caecum of a pine vole.

Nematodes from Neotoma floridana

One adult and one immature eastern wood rat were collected near Lakin, Kansas. The immature specimen didn't harbor nematodes.

Gongylonema sp. (larva)

Host: Neotoma floridana

Habitat: Stomach, small intestine, caecum and large intestine

Location: Lakin, Kansas

Fifteen larval Gongylonema were recovered from the adult wood rat. Eleven of these larvae were collected from the stomach, one from the small intestine, one from the caecum, and two from the large intestine.

Spiruroidea

Host: Neotoma floridana

Habitat: Esophagus

Location: Lakin, Kansas

A nematode of the superfamily Spiruroidea was collected from the esophagus of the adult wood rat. The author was unable to find description or report relative to nematodes from the superfamily occurring in wood rats. Because of the lack of previous information concerning this nematode, it was classified only to superfamily.

Nematodes from Peromyscus leucopus

Two of the five wood mice collected near Manhattan had nematode

infections.

Spiruracerca zapi Erickson, 1938

Host: Peromyscus leucopus

Habitat: Stomach

Location: Manhattan, Kansas

One specimen of this nematode was collected from the stomach of a wood mouse. This produced a 20 percent incidence of infection.

Erickson (1938) described this species from the jumping mouse Zapus hudsonius.

Syphacia peromysci Harkema, 1936

Host: Peromyscus leucopus

Habitat: Caecum

Location: Manhattan, Kansas

A 20 percent incidence of infection was noted for Syphacia peromysci. Fourteen worms were collected from the caecum of a wood mouse.

Harkema (1936) described the type species which he collected from the wood mouse Peromyscus leucopus.

Nematodes from Peromyscus maniculatus

A total of six deer mice collected from the Manhattan area was examined for nematodes.

Gongylonema peromysci Kruidenier and Peebles, 1958

Host: Peromyscus maniculatus

Habitat: Stomach mucosa

Location: Manhattan, Kansas

Four Gongylonema peromysci were collected from the stomach mucosa of two deer mice. Of the six deer mice examined this gave a 33.3 percent incidence of infection. This species was also collected by Landis (1952) who recorded it as Gongylonema sp.

Gongylonema collected from mice of the genera Peromyscus and Reithrodontomys were first described by Kruidenier and Peebles in 1958.

Syphacia peromysci Harkema, 1936

Host: Peromyscus maniculatus

Habitat: Caecum

Location: Manhattan, Kansas

A total of 13 Syphacia peromysci, a 33.3 percent incidence, was collected from the caecum of two deer mice. There was an average of 6.5 worms per infected animal.

Nematodes from Rattus norvegicus

Six norway rats were collected from the Wamego city dump, and examined for nematode infections.

Heterakis spumosa Schneider, 1866

Host: Rattus norvegicus

Habitat: Large intestine, caecum, and small intestine

Location: Wamego, Kansas

Of the six norway rats examined, 100 percent were infected. A total of 35 Heterakis spumosa was collected, averaging 5.8 worms per animal.

Hall (1916) reported the caecum of the rat as the preferred habitat, but the author recovered the greatest number of worms from the large intestine.

Trichosomoides crassicauda (Bellingham, 1845) Raillet, 1895

Host: Rattus norvegicus

Habitat: Urinary bladder

Location: Wamego, Kansas

A total of six Trichosomoides crassicauda was collected from the urinary bladder of two rats. This provided an average of three worms per infected animal, and a 33.3 percent incidence of infection.

Bellingham (1845) described the species, and noted that the male was often found parasitic, in the uterus of the female.

Nematodes from Sciurus niger

Of the rodents examined by the author, the greatest number of nematode species was collected from eight fox squirrels.

Heligmodendrium hassalli Price, 1929

Host: Sciurus niger

Habitat: Small intestine, stomach, and caecum

Location: Manhattan, Kansas

A total of 544 Heligmodendrium hassalli were collected. Of these, 538 were recovered from the small intestine, and the remaining six from the stomach and caecum. This was the most prevalent nematode found in the fox squirrel by the author. The incidence of infection was 100 percent, with an average of 68 worms per animal.

The type species was collected from the gray squirrel Sciurus carolinensis, and described by Price in 1929.

Physaloptera sp. (larva)

Host: Sciurus niger

Habitat: Stomach

Location: Manhattan, Kansas

A larval nematode of the genus Physaloptera was collected from the stomach of a fox squirrel.

Strongyloides robustus Chandler, 1942

Host: Sciurus niger

Habitat: Small intestine

Location: Manhattan, Kansas

Two specimens of Strongyloides robustus were collected from the small intestine of a fox squirrel. This gave a 12.5 percent incidence of infection.

Chandler (1942) described this species from the fox squirrel Sciurus niger.

Trichostrongylus calcaratus Ransom, 1911

Host: Sciurus niger

Habitat: Small intestine, and stomach

Location: Manhattan, Kansas

Eighty-four Trichostrongylus calcaratus were collected from seven fox squirrels. Four worms were recovered from the stomach, and the remaining 80 from the small intestine. Incidence of infection was 87.5 percent, with an average of 12 worms per infected animal.

The type species was collected from the cottontail rabbit Sylvilagus floridanus, and described by Ransom in 1911.

Unidentified larva

Host: Sciurus niger

Habitat: Small intestine

Location: Manhattan, Kansas

A small larval nematode, which the author was unable to identify, was collected from the small intestine of a fox squirrel.

Nematodes from Sigmodon hispidus

One specimen of the hispid cotton rat was collected near Manhattan, and examined for nematodes.

Physaloptera sp.

Host: Sigmodon hispidus

Habitat: Small intestine

Location: Manhattan, Kansas

A nematode of the genus Physaloptera was collected from the small intestine of a hispid cotton rat. The author was unable to find any reports in the literature of a Physaloptera from the cotton rat. Having only one specimen, the author has classified the above nematode as Physaloptera sp. —

Physaloptera (larva)

Host: Sigmodon hispidus

Habitat: Small intestine

Location: Manhattan, Kansas

A nematode larva of the genus Physaloptera was collected from the small intestine of a hispid cotton rat.

The following rodents were examined by the author, and found to be free of nematode infections: Two beavers Castor canadensis; two muskrats Ondatra zibethicus; three western harvest mice Reithrodontomys megalotis; and four southern lemming-mice Synaptomys cooperi.

DISCUSSION

Numerous surveys of rodent helminths in the United States have been made. The majority of these surveys have been performed on rodents in a limited area. To be of value in assisting research the information gained

from these scattered surveys, must be combined into a host-parasite catalogue.

The first host-parasite catalogue dealing with the nematodes of United States rodents was made by Hall in 1916. Oldham (1931) surveyed the literature and compiled a catalogue of the known helminths collected from the following three species of common rats Rattus norvegicus, Rattus rattus, and Rattus alexandrinus. The parasites from North Carolina rodents were studied by Harkema (1936). He included a list of the known internal and external parasites of North American rodents and lagomorphs of that time. A host-parasite catalogue of native North American mice was completed by Erickson in 1938. Helminths from rodents of the family Sciuridae, of the north central United States were studied by Rausch and Tiner in 1948.

The extensive work by Doran (1955), produced the most complete United States rodent-nematode catalogue available at the present time.

Nematodes and their incidence of infection were reported from 70 Kansas rodents by the author. The number of rodents collected was insufficient to yield an accurate incidence of infection for the population. This is accompanied by a host-parasite catalogue summarizing rodent nematodes of the United States reported from 1955 until the present date. The name of the nematode is followed by the host or hosts, the person who reported the infection, and the geographic location at which the rodent was collected.

An earlier survey was conducted on Kansas rodents by Landis in 1952. While both Landis (1952) and the author reported Gongylonema peromysci from Peromyscus maniculatus, Syphacia obvelata from Microtus ochrogaster, Syphacia peromysci from Peromyscus maniculatus, and Heterakis spumosa from Rattus norvegicus, the following differences were noted in the two surveys;

Gongylonema sp. from Microtus ochrogaster, Aspicularis tetraptera from Mus musculus, and Rictularia coloradensis from Peromyscus leucopus and Peromyscus maniculatus as reported by Landis. Capillaria americana, Trichuris dipodomis, Subulura sp. from Dipodomys ordii; Capillaria muris-sylvatici, Syphacia opaca from Microtus ochrogaster; Gongylonema larvae, Spiruroidea from Neotoma floridana; Spiruracerca zapi from Peromyscus leucopus; Trichosomoides crassicauda from Rattus norvegicus; Heligmodendrium hassalli, Physaloptera larva, Strongyloides robustus, Trichostrongylus calcaratus from Sciurus niger; and Physaloptera sp. from Sigmodon hispidus, as reported by the author.

The author was unable to find any noteworthy differences between the nematodes of Kansas rodents, and the rodent nematodes reported from other areas.

The importance of a rodent-nematode catalogue is directly related to the increasing number of rodent helminth surveys. While descriptions of nematodes are not dealt with in such a catalogue, it serves as a reference, giving the name of the nematode, the host, geographical location, and the reporting author. This information supplies the investigator with an accessible index to previous reports, which aid in identification and reduce the possibility of synonymy.

As descriptions of new nematode species, accompanied by reports of new rodent hosts are accumulated, the necessity of keeping the catalogue up to date presents the need of further studies of this type.

- Syphacia eutamii Tiner, 1948. Eutamias dorsalis, (Kruidenier and Peebles, 1957) Arizona. E. dorsalis, (Grundmann, 1957) Utah. E. quadrivittatus, E. minimus, (Leiby, 1961) Colorado. Citellus townsendii, (Leiby, 1962) Idaho.
- Syphacia peromysci Harkema, 1936. Peromyscus leucopus, (Hall and Sonnenberg, 1955) Kentucky, Maryland. P. maniculatus, (Kruidenier and Peebles, 1957) Arizona. P. maniculatus, (Grundmann and Frandsen, 1959) Utah. P. maniculatus, Reithrodontomys megalotis, (Grundmann and Frandsen, 1960) Utah. P. maniculatus, (Leiby, 1962) Idaho. P. leucopus, P. maniculatus, (Olsen, 1964) Kansas.
- Syphacia obvelata Rudolphi, 1802. Microtus pennsylvanicus, Mus musculus, (Hall and Sonnenberg, 1955) Kentucky, Maryland. Citellus lateralis, Microtus longicauda, M. pennsylvanicus, (Leiby, 1961) Colorado. Microtus montanus, (Leiby, 1962) Idaho. Microtus pinetorum, M. ochrogastrer, (Olsen, 1964) Kansas.
- Syphacia samorodini Erickson, 1938. Peromyscus maniculatus, Reithrodontomys megalotis, (Grundmann, 1957) Utah.
- Syphacia sp. Pitymys pinetorum, (Hall and Sonnenberg, 1955) Maryland.
- Syphacia sp. Citellus beecheyi, (Voge, 1956) California.
- Syphatineria eutamii Tiner, 1948. Eutamias amoenus, E. dorsalis, E. minimus, (Frandsen and Grundmann, 1961) Utah.
- Trichosomoides crassicauda (Bellingham, 1845) Railliet, 1895. Rattus norvegicus, (DeGiusti, 1957) Michigan. Rattus norvegicus, (Olsen, 1964) Kansas.
- Trichostrongylus calcaratus Ransom, 1911. Sciurus niger, (Olsen, 1964) Kansas.

- Trichuris citelli Chandler, 1945. Citellus beecheyi, (Voge, 1956)
California.
- Trichuris dipodomis Read, 1956. Dipodomys ordii, (Read, 1956) New Mexico.
D. ordii, D. microps, (Grundmann, 1957) Utah. D. ordii, (Olsen, 1964)
Kansas.
- Trichuris fossor Hall, 1916. Thomomys talpoides, T. umbrinus, (Frandsen
and Grundmann, 1960) Utah.
- Trichuris neotomae Chandler, 1945. Neotoma fuscipes, (Voge, 1956)
California.
- Trichuris opaca Barker and Noyes, 1915. Pitymys pinetorum, (Hall and
Sonnenberg, 1955) Maryland. Microtus ochrogaster, (Olsen, 1964)
Kansas.
- Trichuris peromysci Chandler, 1946. Peromyscus californicus, (Voge, 1956)
California.
- Trichuris stansburyi Frandsen and Grundmann, 1961. Peromyscus maniculatus,
(Frandsen and Grundmann, 1961) Utah.
- Trichuris sp. Microtus pennsylvanicus, (Hall and Sonnenberg, 1955)
Maryland.
- Trypanoxyuria deserti Read and Millemann, 1953. Dipodomys merriami, D.
morroensis, D. panamintinus, (Voge, 1956) California.
- Wellcomia evoluta Linstow, 1899. Marmota flaviventer, (Frandsen and
Grundmann, 1961) Utah.
- Wellcomia perognathi Kruidenier and Mehra, 1958. Perognathus intermedius,
(Kruidenier and Mehra, 1958) Arizona.

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NEMATODES OF RODENTS IN THE UNITED STATES WITH NOTES ON
NEMATODE PARASITES OF RODENTS IN KANSAS

by

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The majority of rodent helminth surveys in the United States, have been conducted on rodents collected from a limited area. The literature dealing with these surveys is found in a number of different journals and scientific papers.

Hall (1916) was the first to compile a host-parasite catalogue of the known nematodes reported from United States rodents. Following major contributions, of this type were by Oldham (1931), Harkema (1936), Erickson (1938), Rausch and Tiner (1948), and Doran (1955).

Seventy Kansas rodents were examined, and the following nematodes representing 12 genera, 14 species, and one superfamily were collected by the author. Capillaria americana Read, 1949; Capillaria muris-sylvatici Diesing, 1841; Gongylonema peromysci Kruidenier and Peebles, 1958; Heligmodendrium hassalli Price, 1929; Heterakis spumosa Schneider, 1866; Physalotera sp.; Spiruracerca zapi Erickson, 1938; Spiruroidea; Strongyloides robustus Chandler, 1942; Subulura sp.; Syphacia obvelata Rudolphi, 1802; Syphacia peromysci Harkema, 1936; Trichosomoides crassicauda (Bellingham, 1840) Railliet, 1895; Trichostrongylus calcaratus Ransom, 1911; Trichuris dipodomis Read, 1956; Trichuris opaca Barker and Noyes, 1915. These nematodes have been compared with the nematodes reported from an earlier survey of Kansas rodents by Landis (1952), and the following differences and similarities noted; Gongylonema peromysci from Microtus ochrogaster, Aspicularis tetraptera from Mus musculus, and Rictularia coloradensis from Peromyscus leucopus and Peromyscus maniculatus were reported by Landis (1952). Capillaria americana, Trichuris dipodomis, Subulura sp. from Dipodomys ordii; Capillaria muris-sylvatici, Syphacia opaca from Microtus ochrogaster; Gongylonema larvae, Spiruroidea from Neotoma floridana;

Spiruracerca zapi from Peromyscus leucopus; Heligmodendrium hassalli, Physaloptera larva, Strongyloides robustus, Trichostrongylus calcaratus from Sciurus niger; and Physaloptera sp. from Sigmodon hispidus, were reported by the author. Gongylonema peromysci from Peromyscus maniculatus, Syphacia obvelata from Microtus ochrogaster, Syphacia peromysci from Peromyscus maniculatus, and Heterakis spumosa from Rattus norvegicus, were reported from both surveys.

As an aid to future rodent nematode surveys a host-parasite catalogue has been prepared, which summarizes the rodent nematodes of the United States reported from 1955 to the present date. Included in this catalogue are; name of the nematode, host or hosts, the person reporting the infection, and the geographic location at which the rodent was collected.