

NOTES ON THE PARASITES OF COTTONTAIL RABBITS IN ILLINOIS

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Limited data on the parasites of the Mearns cottontail rabbit, *Sylvilagus floridanus mearnsi* Allen, are recorded here as a contribution to the knowledge of parasites of Illinois wildlife. These data were collected during an investigation of the biology of the cottontail in central Illinois from August, 1947, to June, 1948.

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METHODS

Rabbits included in this survey were collected in Champaign, Coles, and Fayette counties. Of the 58 animals examined, 44 were adults and 14 were juveniles. Ages were determined after a method described by Hale (1949). Rabbits classified as juveniles ranged from a probable age of four to nine months. All

rabbits which showed no epiphyseal cartilage in the long bones were classified as adults and probably exceeded nine months of age. Because of other demands on time and because some rabbits were badly shot up, it was not possible to make complete examinations of all specimens. Fifty-eight animals were examined for ticks, 31 for fleas, and 25 for helminths. Fecal samples from all 58 rabbits were examined for coccidia.

The following techniques were applied during complete examinations. Rabbits were collected in the field with shotguns, placed in paper sacks, and transported to the laboratory for examination. In the laboratory, ectoparasites were removed and placed in 70% alcohol. Larvae of *Taenia pisiformis* were recovered from the liver and within the body cavity. Other intestinal helminths were recovered by scraping the contents of the alimentary tract into enamel pans and decanting in water. Some fecal material from each colon was preserved by freezing or was subjected to sugar flotation and placed in 2.5% potassium dichromate for examination for coccidia.

Ectoparasites were submitted to the Section of Faunistic Surveys and Insect Identification of the Illinois Natural History Survey for identification. Helminths were examined under a low-power micro-

scope and identified with the use of Erickson's key (1947). When necessary, helminths were cleared in phenol, stained with haematoxylin, and mounted in clarite. Identifications of *Eimeria* were accomplished by comparison with the original descriptions of Honess (1939), Carvalho (1942), Da Fonseca (1933), and Carini (1940), and cross-checking against the revision by Carvalho (1943).

RESULTS

ECTOPARASITES

Ectoparasites are important vectors of certain diseases of bacterial, helminth, rickettsial, and viral etiology. Because such diseases may cause die-offs of animals and because some are transmissible to human beings, it seems desirable to collect and identify the arthropod parasites of the common forms of wildlife, especially where little or no survey work has been done.

Ticks.—The rabbit tick, *Haemaphysalis leporis-palustris* (Packard), is the principal vector of tularemia among wild animals (Francis, 1937). Green (1939) reported that during

the cold months of the year when ticks were in hibernation, cottontail rabbits in Minnesota were relatively free from tularemia. Eddy (1942) stated that larvae and nymphs of *H. leporis-palustris* were active throughout the year in Oklahoma. Portman (1944) found that rabbit ticks hibernated during January and February in northern Missouri but were active throughout the year in the southern part of the state. Yeatter and Thompson (1943) reported that the number of cases of tularemia in human beings in Illinois tended to be greater in years when the weather was warm at the start of the rabbit hunting season (November 11 in recent years) than when it was cold, presumably because high temperature delayed the hibernation of rabbit ticks.

Table 1 summarizes the records of rabbit ticks collected during the period of August, 1947-May, 1948. Absence of these ticks from the 31 rabbits examined during November through February seemed to indicate that the ticks were then in hibernation. Nevertheless, because the number of rabbits examined was small

TABLE 1.—Infestation of Rabbits by *Haemaphysalis leporis-palustris* in Central Illinois.

Month	Number rabbits examined	Number rabbits infested	Average number ticks per host
August, 1947.....	1	1	2.0
September.....	8	6	71.0
October.....	2	1	20.0
November.....	24	0	0.0
December.....	5	0	0.0
January, 1948.....	1	0	0.0
February.....	1	0	0.0
March.....	2	1	27.0
April.....	5	1	4.0
May.....	9	5	3.2

and records for other years were lacking, no final conclusion could be drawn in regard to hibernation dates of rabbit ticks in Illinois.

Recently developed therapy has made tularemia a much less feared disease than in the past (Peterson and Parker, 1946; and Ecke and Ecke, 1948). The disease, however, is still serious and creates a substantial drain on our economy. Human contact with tularemia should be avoided whenever possible. As a control measure, Yeatter and Thompson (1952) advised delay in opening of the rabbit hunting season in Illinois, at least in the central and southern counties, until early December. In view of the relatively short duration of infection prior to death in rabbits (7 to 14 days for most laboratory infections) and the probable hibernation period of ticks in Illinois, as suggested by this study, it seems probable that such delay would reduce greatly the tularemia hazard for rabbit hunters. The hunting season could be extended to February 15 to compensate for the late opening without materially affecting the cottontail breeding season (Ecke, 1955).

Two other species of ticks were found. On October 1, 1947, ten *Ixodes dentatus* Marx, a true rabbit tick, were recovered from a rabbit collected in Coles County, representing the first record of the species from Illinois. On May 5, 1948, one *I. sculptus* Neumann, a ground squirrel tick, was taken from a rabbit in Champaign County.

Fleas.—The role of rabbit fleas in the transmission of disease has not been investigated adequately. Francis (1937) mentioned fleas as

minor agents in the spread of tularemia among rabbits. Prince and McMahon (1946) found that guinea pigs remained negative for tularemia after exposure for 32 days to infected fleas of two species. Green (1942: 44) stated, "Fleas are found on rabbits in southern Minnesota during the winter; but, although these insects can transmit tularemia, they appear to do so rarely."

Live-trapping of rabbits in Champaign County during the winter of 1947-48 indicated that the intensity of flea infestations might vary significantly in different habitats. Thus, on one trapping area on the South Campus of the University of Illinois, nearly every rabbit of 30 or more examined during the winter of 1947-48 was heavily infested with fleas; on an area of farmland less than 5 miles east of the first, no fleas were observed during the repeated handling of 72 rabbits.

Of 31 rabbits examined from August, 1947, to May, 1948, 18 were infested with fleas, chiefly *Cediopsylla simplex* (Baker). One rabbit collected on October 1, 1947, harbored three *Odontopsyllus multispinosus* Baker, and another rabbit collected on April 1, 1948, had a single rat flea, *Nosopsyllus fasciatus* (Bose).

Chiggers.—Several chiggers, *Trombicula whartoni* Ewing, were recovered from the ears of a rabbit collected in November, 1947. The rabbit is known to be a common winter host for trombiculid mites (Ewing, 1929), and it is probable that more mites would have been found with a more thorough search.

Botflies.—A rabbit collected Sep-

tember 13, 1947, had a botfly larva (second instar), probably *Cuterebra buccata* (Fabricius), under the skin in the connective tissue on the inner aspect of the left hind leg. The area of attachment was highly inflamed, but the irritation was local.

ENDOPARASITES

Surveys of the endoparasites of cottontail rabbits in the Midwest include those of Morgan and Waller (1940) in Iowa and Erickson (1947) in Minnesota. Apparently no previous records of the endoparasites of Illinois cottontails have been published.

Helminths.—Thirteen adult and 12 juvenile rabbits were examined for helminth parasites (Table 2). *Whipworms*, *Trichuris leporis* (Froelich), were found only in adult rabbits. Stomach worms, *Obelescoides cuniculi* (Graybill), rabbit tapeworms, *Cittotaenia* sp., and larvae of dog tapeworm, *Taenia pisiformis* (Bloch), were found in both age groups. Two cecal worms, *Heterakis* sp., were recovered from an adult rabbit.

Damage resulting from helminth parasitism appeared to be restricted chiefly to areas of attachment.

Slight tissue scarification observed in some livers and other organs probably resulted from the migration of *T. pisiformis* larvae. All animals examined were fat and appeared to be in healthy condition.

Coccidia.—Coccidiosis, infection by protozoa of the genus *Eimeria*, is a common disease of domestic rabbits and frequently is reported as causing serious losses of young animals. The importance of the disease in populations of wild rabbits is unknown. Infections are common to all species of native rabbits and at least one investigator, Boughton (1932), concluded that *Eimeria* was capable of causing epizootics.

From a total of 58 adult and post-nestling rabbits examined during this study, 53 (91.4%) were infected with one to six species of *Eimeria*. Each of the 14 juveniles and 39 (88.6%) of the 44 adults had coccidia. Only 32 (all collected in Champaign County) of the 58 rabbits examined had fecal samples subjected to the careful scrutiny necessary for identification of the species of *Eimeria* (Table 3). Identification of coccidia was made by microscopic examination of the oocysts. In the instance of two forms

TABLE 2.—Occurrence of Helminth Parasites in 25 Rabbits from Champaign, Coles, and Fayette Counties, August, 1947-June, 1948.

Rabbits		Species of parasite				
Age	Number	<i>Obelescoides cuniculi</i>	<i>Trichuris leporis</i>	<i>Taenia pisiformis</i>	<i>Cittotaenia</i> sp.	<i>Heterakis</i> sp.
Adult.....	13	5 (2.2)*	4 (2.5)	6 (1.7)	3 (1.0)	1 (2.0)
Young.....	12	3 (9.3)	0 (0.0)	4 (5.8)	5 (1.4)	0 (0.0)

* First figure is number infested rabbits; average number parasites per infested rabbit in parenthesis.

TABLE 3.—Species of *Eimeria* from 32 Infested Rabbits, Champaign County, November, 1947 to May, 1948.

Date rabbits collected	<i>Eimeria</i>					
	<i>environ</i>	<i>neoleporis</i>	<i>sylvilagi</i>	<i>media</i>	<i>perforans</i> *	<i>pintoensis</i> *
Nov. 30, 1947.....			X			
" " ".....		X				
Feb. 12, 1948.....					X	
Feb. 13 ".....	X				X	
" " ".....	X					
Feb. 15 ".....			X			
" " ".....	X					
" " ".....	X	X			X	X
" " ".....	X	X				X
" " ".....	X					X
" " ".....			X		X	
" " ".....			X			
" " ".....			X			
Feb. 22 ".....			X			
" " ".....	X	X	X			
Mar. 6 ".....			X			
Mar. 28 ".....	X		X	X		
April 1 ".....					X	
" " ".....					X	
" " ".....	X	X	X	X		
" " ".....	X	X				
" " ".....		X	X	X		
" " ".....			X	X		
May 5 ".....	X					
" " ".....	X	X				
" " ".....	X	X				
" " ".....	X	X				
" " ".....	X					
May 10 ".....	X					
Total rabbits						
32.....	16	10	10	3	6	4
Per cent infected.....	50.0	31.3	31.3	9.4	18.8	12.5

* Identified tentatively from unsporulated oocysts.

identified tentatively as *E. perforans* and *E. pintoensis*, only the unsporulated oocysts were available for study. Unfortunately, cultures which contained these organisms had been stored at low temperatures which made subsequent sporulation impossible.

During the study, a single fatality

of a cottontail rabbit was attributed to coccidiosis. A litter of six young rabbits about 13 days old, one of three litters to be reared in the laboratory, was removed from the nest on May 3, 1948. On the seventh day of captivity, one of the litter developed a severe diarrhea and during the following 24 hours lost weight

rapidly and became partially paralyzed. As death was imminent, it was sacrificed and examination revealed the presence of severe intestinal coccidiosis. This animal obviously had become infected before leaving the nest. A collective sample of the droppings from the remaining litter mates indicated a mild infection with *E. environ*, but no other young rabbits died from coccidiosis during several weeks of captivity.

Further studies are needed to permit an appraisal of the importance of coccidiosis as a cause of mortality among cottontail rabbits. None of the 58 sub-adult and adult rabbits collected for examination appeared to be suffering ill effects from coccidia, although several were quite heavily infected. It is possible that, as appears true of domestic rabbits, cottontail rabbits develop a tolerance for coccidia after the first few weeks of life. As at least 90% of the adult cottontail rabbits in central Illinois appear to be carriers of the disease, the great majority of

young rabbits probably are exposed to infection before leaving the nest.

SUMMARY

A survey of the parasites of the Mearns cottontail rabbit was made in central Illinois from August, 1947, to June, 1948. Fifteen of 27 rabbits examined during the months of March through October were infested by rabbit ticks, *Haemaphysalis leporis-palustris*. Rabbit ticks were not found on any of the 31 rabbits examined during November through February. The tick *Ixodes dentatus* is recorded for the first time from Illinois. Eighteen of 31 rabbits examined from August through May were infested by fleas, chiefly *Cediopsylla simplex*. Of 25 rabbits examined for internal parasites, 10 were parasitized by *Taenia pisiformis*, 8 by *Obelescoides cuniculi*, 8 by *Cittotaenia* sp., and 4 by *Trichuris leporis*. Fifty-three of 58 specimens examined for coccidia were infected with one or more species of *Eimeria*.

LITERATURE CITED

- BOUGHTON, R. V. 1932. The influence of helminth parasitism on the abundance of the snowshoe rabbit in Western Canada. *Can. Jour. Res.*, 7(5): 524-547.
- CARINI, A. 1940. Eimerias da lebre silvestre do Brasil. *Arq. Biol. Sao Paulo*, 24:218-219.
- CARVALHO, JOSE CANDIDO M. 1942. *Eimeria neoleporis* n. sp. occurring naturally in the cottontail and transmissible to the tame rabbit. *Ia. St. Coll. Jour. Sci.*, 16(3):409-410.
- 1943. The coccidia of wild rabbits of Iowa. *Ia. St. Coll. Jour. Sci.*, 18(1):103-135.
- DA FONSECA, FLAVIO. 1933. *Eimeria pintoensis* sp. n., parasita do coelho silvestre (*Sylvilagus minensis*). *Mem. Inst. Butantan*, 1932, 7:175-177.
- ECKE, D. H., and DEAN H. ECKE. 1948. Tularemia and undulant fever treated with atabrine. *Ill. Med. Jour.*, 93(6): 318-320.
- ECKE, DEAN H. 1955. The reproductive cycle of the Mearns cottontail in Illinois. *Amer. Midl. Nat.*, 53(2):294-311.
- EDDY, GAINES W. 1942. Notes on the seasonal history of the rabbit tick, *Haemaphysalis leporis-palustris*, in Oklahoma. *Proc. Ent. Soc. Wash.*, 44(7):145-149.
- EWING, H. E. 1929. Birds as hosts for the common chigger. *Amer. Nat.*, 63(684):94-96.
- ERICKSON, ARNOLD B. 1947. Helminth parasites of rabbits of the genus *Sylvilagus*. *Jour. Wildl. Mgt.*, 11(3): 255-263.

- FRANCIS, EDWARD. 1937. Sources of infection and seasonal incidence of tularemia in man. U. S. Pub. Health Serv. Repts., 52(4):103-113.
- GREEN, ROBERT G. 1939. Diseases of wild animals and birds. Proc. 1st and 2nd Wildl. Conf. Short Course, Minn. Wildl. Fed., pp. 7-8.
- 1942. Tularemia as a hunter's problem. Cons. Volunteer (Minn. Dept. Cons., St. Paul.), 3(17): 41-45.
- HALE, JAMES B. 1949. Aging cottontail rabbits by bone growth. Jour. Wildl. Mgt., 13(2):216-225.
- HONESS, RALPH F. 1939. The coccidia infesting the cottontail rabbit, *Sylvilagus nuttalli grangeri* (Allen), with descriptions of two new species. Parasit., 31:281-284.
- MORGAN, B. B., and E. F. WALLER. 1940. A survey of the parasites of the Iowa cottontail (*Sylvilagus floridanus mearnsi*). Jour. Wildl. Mgt., 4(1): 21-26.
- PETERSON, R. L., and R. R. PARKER. 1946. Tularemic pneumonia: treatment with streptomycin. U. S. Pub. Health Serv. Repts., 61(34):1231-1234.
- PORTMAN, RONALD W. 1944. Winter distribution of two ectoparasites of the cottontail rabbit in Missouri. Jour. Econ. Ent., 37(4):541.
- PRINCE, F. M., and M. C. McMAHON. 1946. Tularemia. Attempted transmission by each of two species of fleas: *Xenopsylla cheopis* (Roths.) and *Diamanus montanus* (Baker). U. S. Pub. Health Serv. Repts., 61(3): 79-85.
- YEATTE, RALPH E., and DAVID H. THOMPSON. 1943. Cottontails, tularemia and weather. Ill. Cons., 8(4): 6-7:36.
- 1952. Tularemia, weather, and rabbit populations. Ill. Nat. Hist. Surv. Bull., 25(6):351-382.