PARASITES OF COTTONTAIL RABBITS IN LYON COUNTY, KANSAS

A Thesis

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by

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INTRODUCTION

The eastern cottontail rabbit, Sylvilagus floridanus, is a common Kansas mammal. Cottontails comprise a significant part of the diet of carnivorous animals of the state, but more importantly, they are considered a game animal by man. Thus, rabbit populations are under constant scrutiny by sportsmen and game managers. These populations appear to undergo periodic fluctuations from year to year and even from summer to winter within a given year. The actual causes of these fluctuations are still generally unknown. It is assumed that parasites could be a factor affecting the population. Therefore, the primary objective of this study was to collect parasites from a sample of the cottontail rabbit population in Lyon County, Kansas. Another objective was to determine if seasonal differences existed in the quantitative occurrence of selected parasites. For this reason rabbits were collected from 21 January 1973 to 11 January 1974 in order to get a sample from all seasons.

A taxonomic and bibliographic report by Stiles (1896) of the adult tapeworms of rabbits is one of the first reports of cottontail parasites. Hall's (1916) work on nematodes is another preliminary study, and Schwartz and Shook (1928) reported on the parasites and diseases of the domestic rabbit. A contribution to the knowledge of cestodes of North American rabbits was made by Arnold (1938).

Parasite studies concerning cottontails, Sylvilagus spp., have been conducted in the midwest by Roberts (1932) in Texas; Ward (1934), Eddy (1943), and Smith (1940) in Oklahoma; Morgan and Waller (1940) in Iowa; Whitlock (1939) and Haugen (1943) in Michigan; Portman (1944) in Missouri; Erickson (1947) in Minnesota; Ecke and Yeatter (1956) in Illinois; Franklin, Simmons and Cosgrove (1966) in Kansas; and Novlesky and Dyer (1970) in South Dakota.

Studies elsewhere in the United States have been by McClure (1932) and Reilly and Dell (1955) in New York; Harkema (1936) in North Carolina; Herman and Jankiewiez (1943) in California; Bell and Chalgren (1943) in the eastern United States; Llewellyn and Handley (1945) and McGinnes (1964) in Virginia; Rankin (1946) in Massachusetts; and Moore and Moore (1947) in Alabama.

Parasites of the marsh rabbit, Sylvilagus palustris, were reported by Blair (1936) and Tomkins (1935) in Florida life history studies. Philip, Bell, and Larson (1955) and Lechleiter (1959) mentioned parasites found on the jack rabbit, Lepus californicus. Hansen (1965) listed helminth and arthropod parasites of the jack rabbit in Kansas.

Lyon County, Kansas, is located in the east central portion of the state. The terrain of the county is generally undulating and hilly with limestone common throughout the area occurring as outcroppings on hilltops. Two major flood plains are present and associated with the Neosho and Cottonwood rivers which flow through the county. Rainfall

ranges from 30 - 38 inches per year and most of it occurs during the growing season. The warmest month is July with an average temperature of 79 F and the coolest month is January with an average temperature of 31 F (Plummer, O'Conner, and Goebel, 1953).

MATERIALS AND METHODS

Collection of rabbits was confined within the boundaries of Lyon County. Various methods were employed to collect the rabbits, but live traps were used during cool weather. The traps, baited with soybeans, apples, carrots, or rabbit urine, were an enclosed rectangular type with a vertical sliding door which would close after the rabbit entered the trap and touched the release. The traps measured $7\frac{1}{4}$ x $7\frac{1}{2}$ x 24 inches and were constructed of one inch pine (Fig. 1).

Fig. 1. Live trap used to capture cottontail rabbits.

Shooting was another method of collecting. One rabbit was shot with a .12 guage shotgun, but a .22 caliber rifle was used to collect other rabbits. Cottontails were shot along roadways early in the morning or in the evenings as they were sighted from an automobile.

Three "road-killed" rabbits were also picked up for the study.

Rabbits captured alive were taken to the laboratory, killed and examined immediately for parasites. Specimens collected by other methods were placed in plastic bags and frozen until they could be examined. The rabbits were weighed, sexed, and aged in the laboratory. Aging was based on overall size, weight, and pelage coloration after Schwartz (1959). Parasites collected were those visible to the naked eye during examination of the rabbits. External parasites were collected by combing the hair. It was necessary to first anesthesize the external parasites of the live-trapped rabbits since parasites attempted to leave them when the rabbit was killed. Ether was placed in a plastic bag with the body of the rabbit for 20 minutes because fleas were observed to revive if exposed to the ether for a shorter period of time.

The internal organs were removed and examined for endoparasites. Organs included the liver, lungs, stomach, small intestine, and large intestine. After the internal organs were removed, the body cavity was examined. The liver and lungs were examined by teasing apart the tissues. The intestines were cut longitudinally and the contents were washed out over a 1/16 inch mesh screen by running tap water. After the intestines were clean, the inner gut linings were examined. Parasites were collected from the screen, counted, and preserved in 70 per cent alcohol until identified.

Permanent mounts were made of representatives of each of the types of parasites collected. These slides were necessary for proper identification as well as serving as a permanent record of the specimens.

Ectoparasites were identified from the following sources: Haemaphysalis leporispalustris and Cediopsylla simplex, after U. S. Dept. HEW (1967); Hoplopsyllus affinis, after Hubbard (1947); Trombicula sp., after Ewing (1944) and Cheng (1973); and Cuterebra sp., after Davis and Anderson (1971).

Endoparasites were identified from the following sources: Taenia pisiformis, after Wardle (1952); Cittotaenia sp., after Wardle (1952) and Dr. M. F. Hansen at Kansas State University; Obeliscoides cuniculi and Dermatoxys veligera, after Hall (1916) and Dr. Hansen; and Trichuris leporis after Hall (1916).

Seasons were designated as follows: Winter--December, January, February; Spring--March, April, May; Summer--June, July, August; Fall--September, October, November.

Seasonal differences between occurrences of parasites were tested statistically by application of the t test at P=.05.

RESULTS

Eighty-eight cottontail rabbits were collected during the study; 39 were males and 49 were females. Sixteen females were pregnant (Table I). The number of embryos present in females ranged from two to nine. Sixty-two per cent of the rabbits collected in the summer were juveniles and 29 per cent of the fall specimens were juveniles.

Trapping success was variable. Twenty-six rabbits were trapped in 1292 trap nights from 21 January 1973 to 26 May 1973. Trapping response was especially poor in May when only three rabbits were trapped in 227 trap nights. From May to September rabbits were collected by methods other than trapping. Trap nights were not recorded after September. The use of a shotgun was not as satisfactory as use of a rifle since damage to the animal was less and collecting range was increased with the rifle.

Apples seemed to be the best bait used. Soybeans were successful as a bait in cold weather.

Collection of rabbits was difficult in the summer, especially in August. Numerous rabbits were sighted along roadsides in July, but they were not seen in August. An estimated 750 miles were driven in August and only five rabbits were sighted; only two were collected. Variation of the time of day and route driven made little difference in the number of rabbits sighted. No rabbits were sighted when driving after dark using automobile headlights for illumination.

Table I. Relative ages, sex, number of pregnant females, and mean number of embryos per female by seasons for 88 cottontail rabbits collected in Lyon County, Kansas.

	WINTER	SPRING	SUMMER	FALL	TOTAL
Relative Ages					
Adults	26	16	8	14	64
Juveniles	0	0	13	7	20
Unknown	1	0	0	3	4
Sex					
Males	13	13	11	12	39
Females	14	13	10	12	49
No pregnant	2	12	2	0	16
Mean embryos/female	4.0	4.7	5.0	0	

External Arthropod Parasites

Ectoparasites consisted of two species of fleas, one species of tick, one genus of bot fly larva, and one genus of mite.

Fleas

The fleas collected were Cediopsylla simplex and Hoplopsyllus affinis. According to Hubbard (1947) these are the most common fleas collected on cottontail rabbits in the United States. Nearly all studies involving collection of cottontail ectoparasites reported the presence of Cediopsylla simplex (Fig. 2). Eddy (1943) listed this

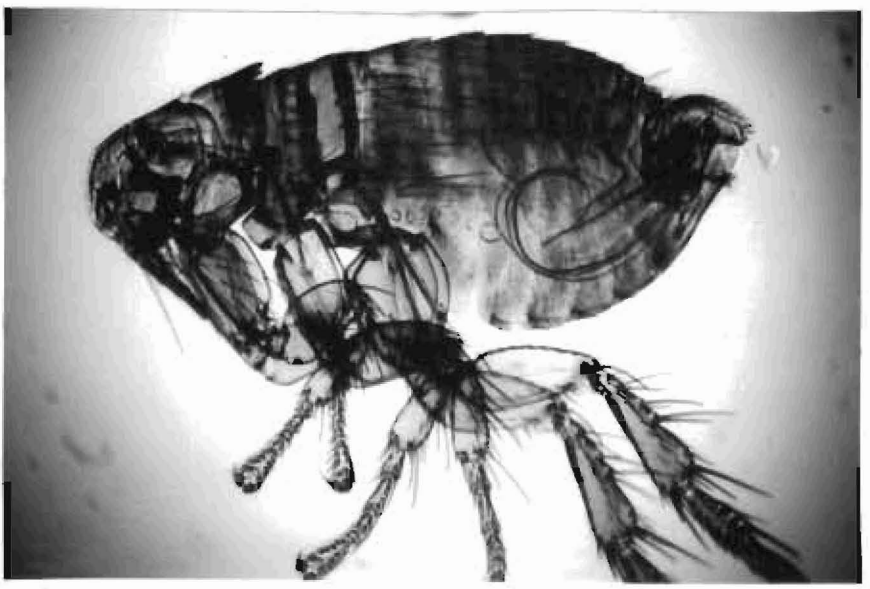

Fig. 2. Cediopsylla simplex (about 40 X).

species from Oklahoma cottontails; Portman (1944) reported both species from Missouri; and seven other authors mentioned C. simplex in

their studies. Hoplopsyllus affinis was reported by many investigators, but with less frequency than C. simplex. The occurrence of the two species of fleas from this study shows H. affinis occurring less frequently than C. simplex (Table II). The mean number of both species of fleas per rabbit decreased from winter to fall (Fig. 3). Both species were most numerous in the spring. Figure 3 also shows that Hoplopsyllus affinis was not numerous in any season and was absent in the summer. Only one specimen of each species of flea was collected in the fall. C. simplex was collected from only three rabbits in the summer, but one of these rabbits harbored 62 C. simplex, the greatest number occurring on a single rabbit in any season. Both species of fleas were found on all areas of the rabbit body, but were usually concentrated in greatest numbers around the head and throat region.

Ticks

The rabbit tick, Haemaphysalis leporispalustris (Fig. 4) was the only tick collected. Ward (1934) found this tick on cottontail, swamp, and jack rabbits. Eddy (1943) found the same tick on cottontails he examined. Both investigations occurred in Oklahoma. This tick was also reported to infest Missouri cottontails (Portman, 1944). Harkema (1936), Morgan and Waller (1940), Haugen (1943), Bell and Chalgren (1943), Smith and Cheatum (1944), Llewellyn and Handly (1945), and Ecke and Yeatter (1956) all reported the occurrence of H. leporispalustris on cottontail rabbits.

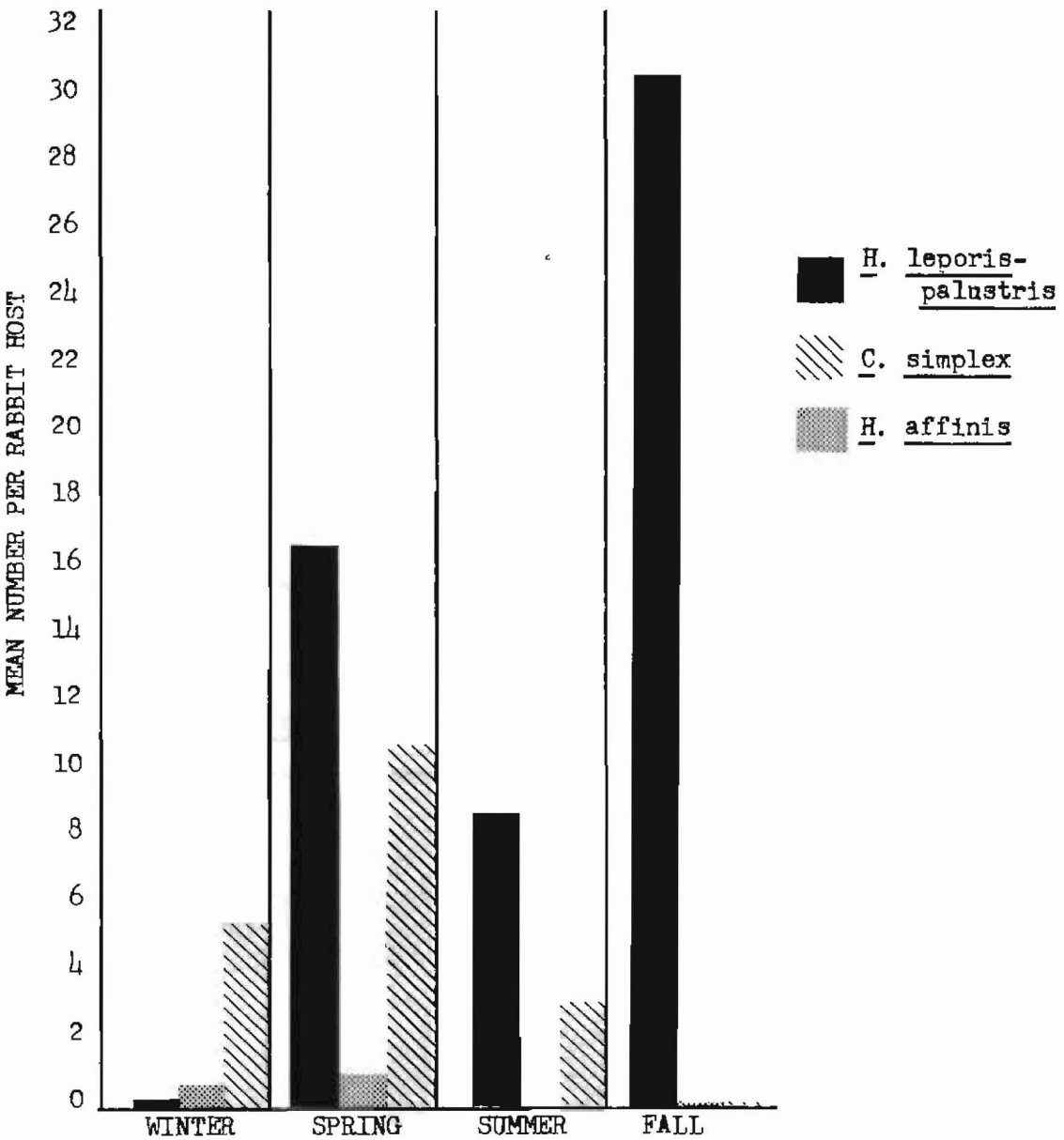

Fig. 3. Mean number of fleas and ticks per rabbit host by season.

Table II. Percentage occurrence by seasons of ecto- and endoparasites of cottontail rabbits from Lyon County, Kansas.

	WINTER	SPRING	SUMMER	FALL
Ectoparasites				
Cediopsylla simplex	56	69	14	4
Hoplopsyllus affinis	37	31	0	4
Haemaphysalis leporispalustris	11	75	76	92
Trombicula sp.	7	0	10	42
Cuterebra sp.	0	0	29	4
Endoparasites				
Taenia pisiformis	70	88	43	46
Cittotaenia sp.	56	44	67	75
Obeliscoides cuniculi	37	89	43	83
Trichuris leporis	56	44	38	33
Dermatoxys veligera	56	50	48	17

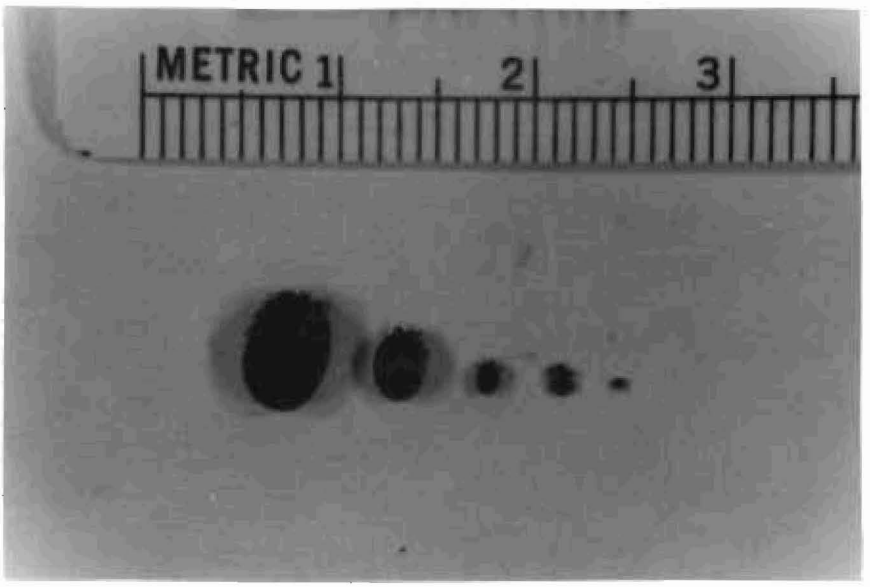

Fig. 4. The rabbit tick, Haemaphysalis leporispalustris. The tick on the right is a larva; the tick on the left is a fully engorged adult.

Ticks increased in frequency from winter to fall (Table II). No ticks were found on rabbits collected between 18 December and 18 May. The mean number of ticks per rabbit was only 0.2 in winter (Fig. 3), but increased to 30.8 by fall. One rabbit collected on 5 September harbored 141 H. leporispalustris. The only nestling cottontail collected harbored one tick. Most of the engorged ticks were found attached to the head and ears.

Mites

Chigger mites were collected and identified as Trombicula sp. (Fig. 5). The frequency of occurrence of this mite on each rabbit was not recorded, but the percentage of hosts infested was recorded

(Table II). Ward (1934) reported Trombicula irritans, the harvest mite,

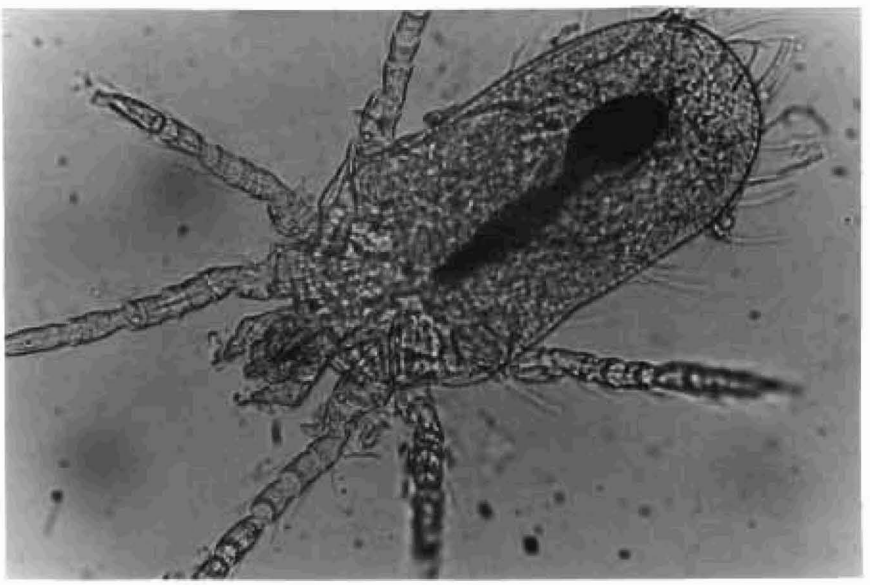

Fig. 5. The chigger mite larva, Trombicula sp. (about 60 X).

on all rabbits he collected in summer and early autumn. Bell and Chalgren (1943), Llewellyn and Handly (1945), and McGinnes (1964) listed Trombicula microti in their studies. Ecke and Yeatter (1956) found Trombicula whartoni. These mites were usually recovered from inside the ear of the rabbit, but in extreme infestations they were found around the eyes, between the toes, and in the flank region. All mites collected were in the six-legged larval stage. Scale or scab formation was common on the skin where the mites were concentrated. Mites were absent from 16 December to 8 July. The greatest percentage of occurrence was in the fall (Table II).

Warbles

Warbles are caused by the larvae of the bot fly, Cuterebra sp., (Fig. 6) which live in cysts in subcutaneous tissues. Haugen (1943)

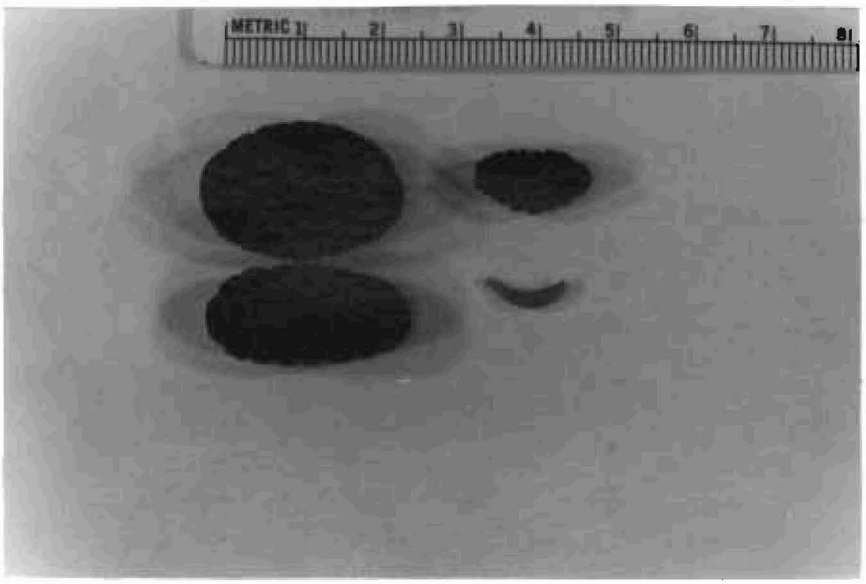

Fig. 6. Bot fly larvae, Cuterebra sp..

reported Cuterebra cuniculi and C. buccata. Harkema (1936) found C. fontinella in several cottontails he examined. Michigan cottontails were infected with C. horripilum (Geis, 1957). Cuterebra sp. has been reported in jack rabbits in Kansas (Hansen, 1965), and Nevada (Philip, Bell and Larson, 1955).

The warbles in this study were usually located in the throat and chest region of the body. One cottontail had four larvae, one of which was in the groin area. One warble lesion contained several small fly larvae which were not identified. All larvae were collected in the

summer and fall from 8 July to 25 October. Twenty-nine per cent of the rabbits examined in the summer had bot fly larvae (Table II). Of these, 75 per cent were juvenile rabbits. The peak incidence of warbles was from 15 July to 22 August when 50 per cent of the rabbits collected were infected.

Internal Helminth Parasites

Endoparasites consisted of two species of tapeworms, one species of stomach nematode, and two species of large intestine nematodes.

Tapeworms

The larval form of Taenia pisiformis, commonly called the rabbit bladderworm, was collected in this study and is the most common cestode of wild carnivores. It is common where rabbits serve as a source of food for either domesticated or wild carnivores (Davis and Anderson, 1971). The larvae appear as glistening white fluid-filled bladders and are often quite conspicuous (Fig. 7). The larvae are called Cysticercus pisiformis by some authors since the larva occur as a cysticercus in the rabbit host. The larvae collected in this study were located in the abdominal and pleural cavities attached to and encysted in the mesenteries. They were usually concentrated near the rectal region of the large intestine. Some of the livers examined had grayish-white spots which Morgan and Waller (1940) and Whitlock (1939) suggested may have resulted from migration of Taenia pisiformis larvae through the liver.

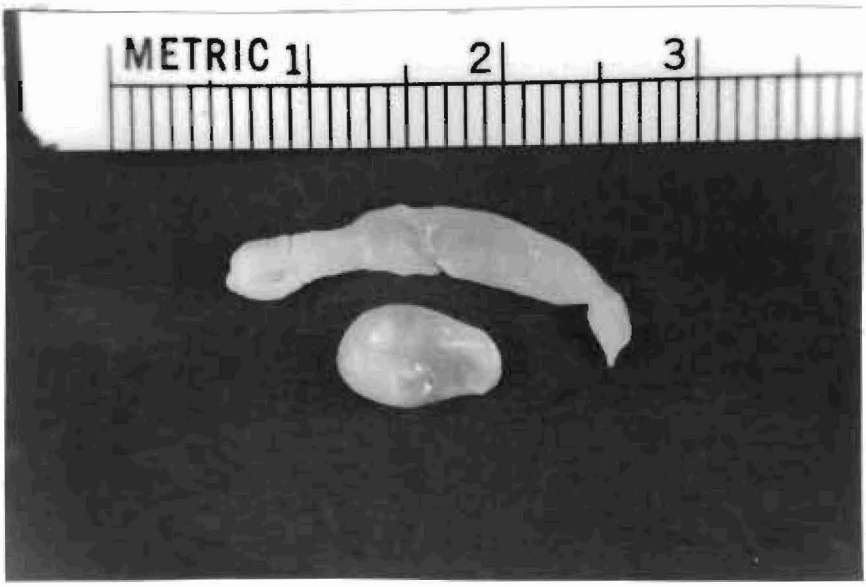

Fig. 7. Larvae of Taenia pisiformis, called bladderworms.

There were usually from one to three T. pisiformis larvae in each rabbit. The greatest number infecting one rabbit was 73. The mean number per rabbit per season was never less than 2.6 (Fig. 8). Whitlock (1939) reported a percentage of infection from 60 to 70 per cent. The percentages of infection in this study varied from 43 to 88 per cent (Table II).

The most common adult tapeworm collected was of the genus Cittotaenia (Fig. 9). These tapeworms were white in color and often as broad as 11 mm; the longest specimen of this type was 135 mm. The cestodes were usually located in the anterior portion of the small intestine, although they were also found in the stomach and large intestine. Damage to the intestinal wall was not apparent. The largest number of

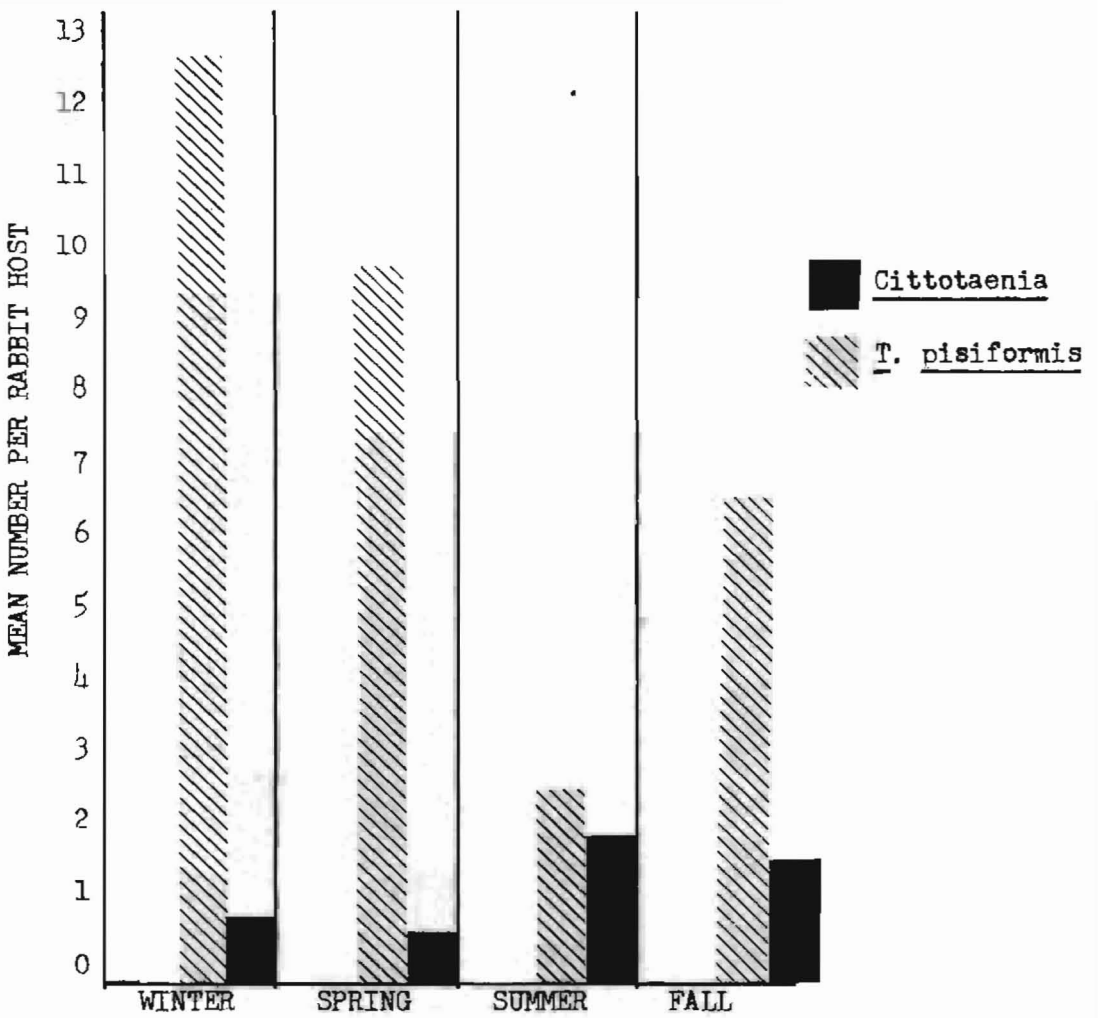

Fig. 8. Mean number of internal parasites per rabbit host by season.

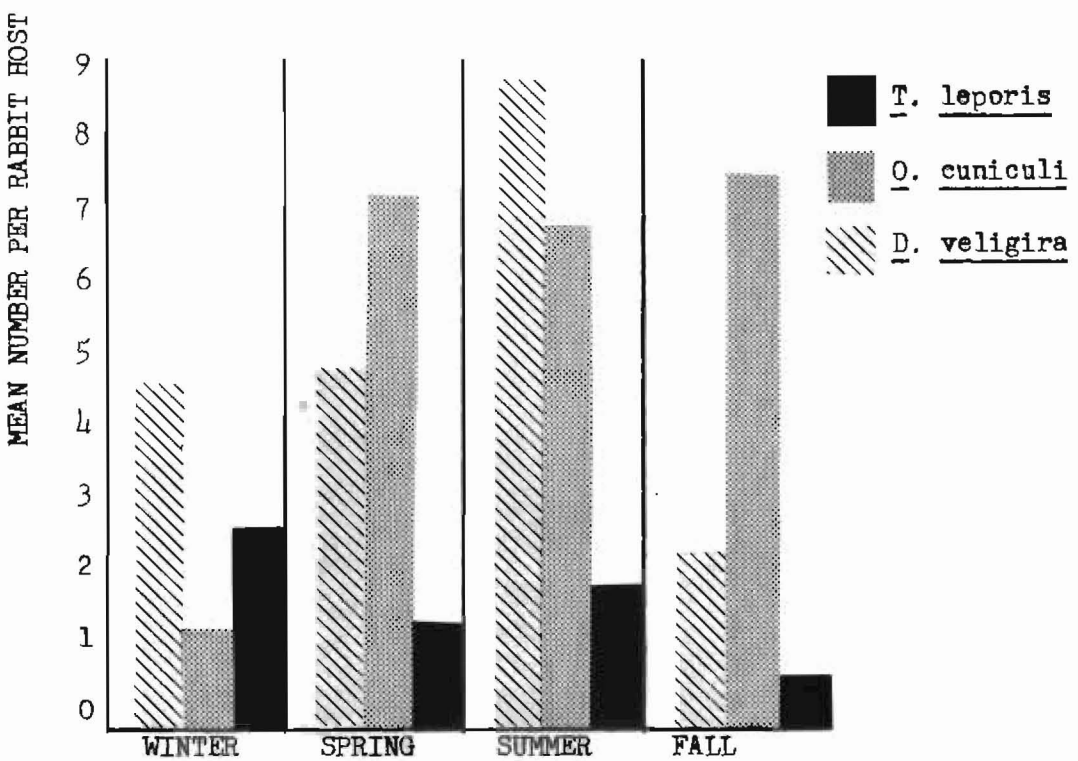
MEAN NUMBER PER RABBIT HOST
9
8
7
6
5
4
3
2
1
0
WINTER
SPRING
SUMMER
FALL
T. leporis
O. cuniculi
D. veligira

Fig. 8. (Cont'd)

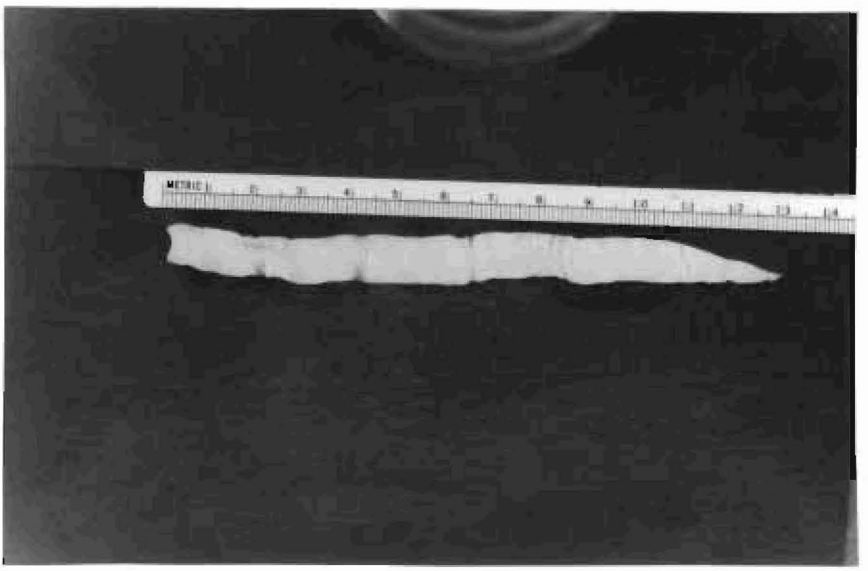

Fig. 9. Adult tapeworm of the genus Cittotaenia.

Cittotaenia in a single host was 12 and the percentage of occurrence ranged from 44 to 75 (Table II).

Cittotaenia is a common genus of cestode occurring in rabbits. Erickson (1947) listed four species in the rabbit genus Sylvilagus. Based on his work, the specimens in this study were probably Cittotaenia variabilis. Arnold (1938) recognized C. variabilis as being common to Sylvilagus floridanus in Kansas.

Stomach Nematodes

The stomach worm, Obeliscoides cuniculi, was common in the rabbits examined. O. cuniculi in this study were most abundant in spring and fall and declined in summer and winter (Fig. 8). The greatest number of these nematodes in a single rabbit was 42. Percentage of occurrence

in hosts is shown in Table II. These nematodes were brownish-red and usually imbedded in the mucosa of the stomach wall. None were more than 20 mm in length. Many authors reported O. cuniculi in their studies; Smith (1940) and Ward (1934) described this nematode in the cottontails of Oklahoma.

Intestinal Nematodes

The whipworm, Trichuris leporis, was one of the intestinal nematodes collected. The body of T. leporis consists of a long slender portion approximately 10 mm long attached to the lining of the cecum and a thicker portion which is free in the lumen of the organ (Fig. 10).

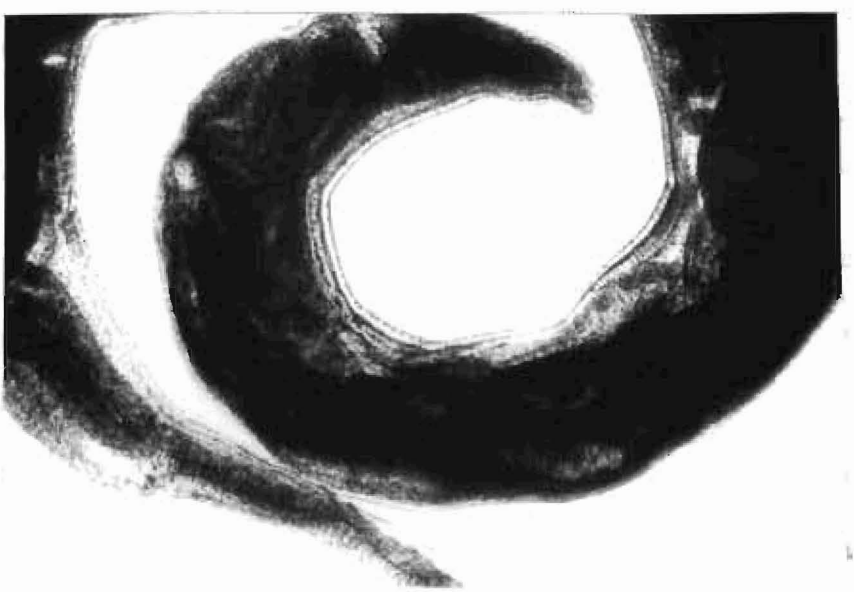

Fig. 10. Trichuris leporis, showing the thicker portion and the narrowing to the slender anterior portion (about 40 X).

The total length of the longest whipworm collected was 27 mm. This

nematode is common in domestic rabbits (Schwartz and Shook, 1928) as well as in cottontail and jack rabbits where it was reported by many authors. Ecke and Yeatter (1956) found T. leporis only in adult cottontails. In this study 82 per cent of the cottontails with T. leporis were adults (Table III). Generally, the frequency of occurrence

Table III. Age of rabbits infected with endoparasites. Numbers indicate percentages of total number of hosts infected.

PARASITE	ADULTS	JUVENILES
Dermatoxys veligera	92	8
Taenia pisiformis	93	7
Cittotaenia sp.	78	22
Obeliscoides cuniculi	76	24
Trichuris leporis	82	18

was from one to five, but one rabbit had 29 whipworms. The overall percentage of occurrence did not vary greatly from season to season (Table II).

The nematode collected most frequently from the large intestine was Dermatoxys veligera. It is a white roundworm and occurs in the cecum. Males are eight to 11.5 mm and females are 16 to 17 mm long (Hall, 1916). Whitlock (1939) called D. veligera the rabbit pinworm, but other authors were not in agreement as to the common name. Moore and Moore (1947) collected D. veligera from 60 per cent of the rabbits

they examined. Other authors also found D. veligera, but the percentages were not as great. In this study this roundworm occurred in an average of 52 per cent of the rabbits in winter, spring, and summer then the percentage decreased to 17 per cent by fall (Table II). The greatest number of D. veligera in any rabbit was 87. Only three of the 30 rabbits with this nematode were juveniles (Table III).

The incidence of endoparasite infection in this study was higher in adults than in juveniles (Table III).

DISCUSSION AND CONCLUSIONS

Rabbits collected by live trapping were more suitable for this study than those collected by other methods. Ectoparasites remained on the host until the rabbit was killed. Also, the internal organs of the rabbit were undamaged and the endoparasites were still alive. This was helpful in parasite detection.

The intensity of infestations by both species of fleas varied seasonally. Cediopsylla simplex occurred in greater numbers than Hoplopsyllus affinis, but the mean number of each species per rabbit was greater in the spring than in any other season (Fig. 3). Occurrences of both species of fleas collected in the fall were significantly different from occurrences in winter and spring. A significant difference was noted when summer occurrence was compared with winter and spring occurrences of H. affinis. Other seasonal comparisons were not significant. Bell and Chalgren (1943) reported the largest number of fleas, including C. simplex and H. affinis, occurring on rabbits in April and May. Harkema (1936) found C. simplex on cottontails throughout the year, but most prevalent in February, March, and April. Morgan and Waller (1940) described an increase of H. affinis with the advent of warm weather. It appears that two species of fleas were numerous on Lyon County cottontails in winter, but increased in the spring to a peak before decreasing throughout the summer. Infestation was at a yearly low in the fall.

Chigger mites probably occur on rabbits earlier than 8 July in Kansas. They may have been overlooked early in the summer since they are quite small and usually concealed in the ears. Bell and Chalgren (1943) found Trombicula microti on cottontails by 1 April. The scaly condition in the ears of rabbits is caused by a fluid secretion from the mites which spreads into the dermis (Davis and Anderson, 1971).

Incidence of Cuterebra larvae in Michigan cottontails during 1951 rose rapidly to a peak in late August and early September, then gradually tapered off. The last warbles were seen in late October and early November (Geis, 1957). This seasonal fluctuation does not coincide with the incidence in Lyon County. In Michigan, 53 per cent of the rabbits were infected between 11 August and 10 September while the peak incidence in Lyon County was from 15 July to 22 August. The high incidence of warbles in juveniles (75 per cent) in the Lyon County study was comparable to Michigan where the incidence was consistently higher in juveniles than in adults. Effects of warbles on the Michigan cottontails included decreased growth rate, increased white-blood-cell counts, general weakness, and death (Geis, 1955). Jack rabbits in Nevada were found to have maximum infestation of Cuterebra larvae in mid-August. Infested hares were observed to be weakened and distressed (Philip, et. al., 1955). Only one of the cottontails collected in Lyon County appeared to be in poor condition. This was the rabbit infested with four Cuterebra larvae.

The smaller unidentified larvae noted in the Cuterebra lesion may have been blow fly larvae. Blow flies are often attracted to warble pores, causing a secondary form of myiasis which can cause death (Davis and Anderson, 1971). Several cases in which blow flies entered lesions caused by larvae of Cuterebra were reported by Roberts (1932) in Texas jack rabbits. He concluded that myiasis in jack rabbits is not uncommon in nature. Yuill and Eschle (1963) suggested that the skin of adult rabbits is too dense to be penetrated by flies. This may account for more Cuterebra larvae being found in juvenile than in adult cottontails in Lyon County.

The rabbit tick, Haemaphysalis leporispalustris, probably hibernates during the winter months in Lyon County since none were collected between 18 December and 18 March. There was no significant difference between the spring occurrence and that of fall and summer. Comparisons of spring, summer, and fall with winter occurrences were significantly different. The summer occurrence was also significantly different from fall occurrence. Eddy (1943) found that the rabbit ticks were active throughout the year in Oklahoma. Portman (1944) stated that H. leporispalustris hibernates during January and February in northern Missouri, but is active throughout the year in the southern part of the state. He felt that the southern part of Missouri is about the northern limit of year-round activity for the rabbit tick. Further north, in Illinois, Ecke and Yeatter (1956) found ticks to be absent

from cottontails examined during November through February. No final conclusion can be made regarding the hibernation of rabbit ticks in Kansas without samples from other years. The activity of H. leporispalustri is important since this tick is a proven vector of tularemia and spotted fever among rabbits (Portman, 1944).

Smith and Cheatum (1944) reported substantial mortality of cottontail rabbits in New York resulting from H. leporispalustris and other ticks. Their study was conducted on an island overpopulated with rabbits. This allowed the tick infestations to become extreme within that particular cottontail population. None of the Lyon County rabbits seemed ill-affected by tick infestations.

Taenia pisiformis appears to be more abundant in the winter than in spring, summer, or fall (Fig. 8). However, the winter occurrence is significantly different from summer, but not from fall and spring. Harkema (1936) found a general decrease in this parasite in the winter months. He suggested that rabbits tend to lose internal parasites in the winter months when food is scarce and the host resorts to a bark diet. Summer occurrences were significantly different from spring occurrences. Other seasonal comparisons were not significantly different in this study.

Herman and Jankiewiez (1943) agreed that Morgan and Waller were correct in suggesting the cause of gray spots in rabbit livers. Later studies revealed that T. pisiformis larvae actually develop in the liver

and after about 30 days migrate to the liver surface. Then they fall free into the coelom and become encapsulated in the mesentery (David and Anderson, 1971).

The occurrence of Cittotaenia appears generally lower in the winter and spring than in summer and fall (Fig. 8). However, all seasonal comparisons were tested and found to be not significantly different. Perhaps samples from other years would show a lower occurrence in winter which would agree with Harkema (1936).

The decrease of Obeliscoides cuniculi in the winter months agrees with Clancy, Jungherr, and Sime (1940) and Harkema. However, this winter decrease was significantly different only when compared to spring and fall occurrences. No significant difference existed between comparisons with other seasons.

The occurrence of Dermatoxys veligera was not significantly different from season to season. This agrees with the findings of Clancy, et. al. (1940). Apparently adult cottontails harbor approximately the same number of D. veligera throughout the year.

The occurrence of Trichuris leporis in the winter was significantly different from occurrence in the fall. Comparisons of other seasons were not significantly different. This is another endoparasite which appears to infect adult cottontails with nearly the same incidence throughout the year.

The greater percentage of occurrence of all endoparasites in adult cottontails, in contrast to occurrence in juveniles (Table III), generally

agrees with other studies which differentiated between ages (Ecke and Yeatter, 1956). Perhaps the cottontail rabbit must reach a certain size or age before becoming infected with many of these parasites.

Parasites could definitely be a factor affecting the population of cottontail rabbits in Lyon County, Kansas. The results of this study have shown that there are seasonal differences in the occurrence of several of the common cottontail parasites. Further study might show a correlation between the seasonal fluctuation of some parasites and the fluctuation of the cottontail population. Data collected from several years would show if there was correlation from year to year between parasite load and rabbit population density. This would be especially interesting in the case of ectoparasites since they exhibited the greatest seasonal fluctuation in this study. Also, ectoparasites such as fleas and ticks are often vectors of bacterial diseases. Conversely, endoparasites generally tend to infect the host with nearly the same frequency from season to season and are less likely to transmit diseases from rabbit to rabbit.

Further study should be concentrated on the effects of fleas, ticks, and bot fly larvae on the Kansas cottontail rabbit population.

SUMMARY

1. Eighty-eight cottontail rabbits were collected from 21 January 1973 to 11 January 1974 in Lyon County, Kansas. Primary methods of collection were live trapping and shooting.

2. The following ectoparasites were collected:

Fleas--Cediopsylla simplex and Hoplopsyllus affinis

Tick--Haemaphysalis leporispalustris

Mite--Trombicula sp.

Bot fly--Cuterebra sp. (larva)

3. The following endoparasites were collected:

Tapeworms--Taenia pisiformis (larva) and Cittotaenia sp.

Roundworms--Obeliscoides cuniculi, Trichuris leporis, and Dermatoxys veligera

4. There was a greater seasonal fluctuation in the occurrences of ectoparasites than in the occurrences of endoparasites. Occurrence of two of the endoparasites did not vary significantly from season to season.

5. Adult rabbits harbored more endoparasites than juvenile rabbits. Infestation of ectoparasites did not vary greatly according to the age of the rabbits.

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