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MACROPARASITES IN THREE SPECIES OF DESERT LAGOMORPHS

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MACROPARASITES IN THREE SPECIES OF DESERT LAGOMORPHS

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ABSTRACT

I studied parasites of sympatric lagomorphs from the Picacho Mountains, Arizona from May 1984 to April 1985. Forty-four desert cottontails (Sylvilagus audubonii), 36 California black-tailed jackrabbits (Lepus californicus), and 46 antelope jackrabbits (Lepus alleni) were shot and examined macroscopically for external and internal parasites. Leporids were hosts to two species of fleas, two species of ticks, three species of cestodes, and one species of nematode. Stool specimens were collected from each leporid and examined microscopically for parasite ova and coccidia. Fleas were found on 13 cottontails, 11 black-tailed jackrabbits, and 2 antelope jackrabbits. Twenty-eight lagomorphs were infested with ticks: 18 black-tail jackrabbits, 8 cottontails and, 2 antelope jackrabbits. Cysticercus pisiformis, the intermediate stage of Taenia pisiformis was recovered 20 times in the desert cottontail. Coenurus multiceps, the intermediate stage of Taenia multiceps, was found seven times in both species of hares.

INTRODUCTION

Parasitism associated with lagomorphs has been examined by Vorhies and Taylor (1933), Herman and Jankievries (1943), Erickson (1947), Phillip, Bell and Larson (1955), Lechleitner (1959), and Camin and Drenner (1978). Sheppard and Edmonds (1976), Clark and Ah (1976), and Wright, Guillot and Meleny (1981) have worked on specific parasites of lagomorphs and their relationship to other mammals. A nematode parasite, Strongyloides papillosu, has been studied in neonatal and adult rabbits as a primary infection (Nelson and Nghiem, 1974). A mange mite of wild and domestic lagomorphs, Psoroptes cuniculi, was studied extensively because of the value of laboratory rabbits (Arlian et al., 1981). Researchers (Herman and Jankievries, 1943; Erickson, 1947; Phillip, Bell and Larson 1955; and Lechleitner, 1959) have found many of the same species of parasites infesting white-sided jackrabbits (Lepus alleni), California black-tailed jackrabbits (Lepus californicus), and cottontails (Sylvilagus audubonii). However, the relationship between sympatric lagomorphs and parasites in the Southwest has not been examined.

Early parasitic forms showed little host specificity. As the parasite adapted to and evolved with the host, it became increasingly committed to that specific host (Soulsby, 1968; Levin, 1973). Parasites of related hosts which evolved from a

common ancestor underwent similar physiological and genetic adaptations as their hosts evolved. It is likely that physiological and genetic changes in the parasite were expressed as changes in morphology. Thus, host specificity of parasites in the same habitat in related hosts is predicted. Specifically, sympatric lagomorphs, even though exposed to the same parasites, will respond differently to infection and infestation by those parasites in that environment.

The purpose of my study was to identify parasites of sympatric lagomorphs and to investigate the relationship of the various parasites encountered to their hosts.

MATERIALS AND METHODS

Study Area

The study area is approximately 24,767 ha in and around the Picacho Mountains, 13 km east of Eloy, Arizona. The land is state-owned with smaller portions belonging to the Bureau of Land Management and private landowners. Grazing and recreation are the major land uses. Elevations range from 462 m on the desert floor to 1,374 on top of Newman Peak. At the lower elevations the area consists mainly of outwash plains dissected by numerous dry washes which carry water during heavy rains. Advancing upward the terrain becomes steeper and rougher with numerous outcrops, ridges, saddles, and peaks. There are two major life zones, Upper Sonoran and Lower Sonoran (Lowe, 1964). The Lower Sonoran, which covers most of the area, consists of two basic plant communities, palo verde-saguaro (Cercidium microphyllum-Carnegia gigantea) on the mountain slopes and bajadas, and creosotebush-bursage (Larrea-Ambrosia) on the flats. Along the dry washes in both of these communities there are mesquite (Prosopis juliflora) and ironwood (Olneya tesota). The Upper Sonoran life zone is represented by a desert grassland community found in higher evaluations around Newman Peak. In this area there are such plants as perennial grasses, agave (Agave spp.), staghorn cholla (Opuntia versicolor), prickly pear (Opuntia spp.), ocotillo (Fouquieria splendens), and a few juniper trees (Juniperus

spp.).

Water is available on the area in ephemeral rain pools, six Arizona Game and Fish Department (AGFD) water catchments, and several stock ponds.

Climate

Weather data taken from Eloy, Arizona from 1951-1972 show that, on the average, 172 days out of the year have maximum temperatures of 32 C and above, and 26 days have minimum temperatures of 0 C and below (Sellers and Hill, 1974). Daily maximum temperatures range from 19 C in January to 41 C in July, and daily minimum temperatures range from 2 C in January to 24 C in July (Sellers and Hill, 1974). The area has an arid climate with an annual average of 21 cm precipitation, 40% of which occurs during July, August, and September (Sellers and Hill, 1974).

Study Design

One hundred twenty-six lagomorphs were shot between May 1984 and April 1985: 44 desert cottontails, 46 antelope jackrabbits, and 36 California black-tailed jackrabbits.

Lagomorphs were immediately placed in white plastic bags after being shot to facilitate examination of external parasites which were visible against the white background. The plastic bags were sealed and placed in a cooler on ice. They were transported back to the laboratory and refrigerated for necropsy within the next 24 to 48 hours or were necropsied in the field at the end of the

daily collection period. The lagomorphs collected were weighed and measured (Nowak and Paradiso, 1983). The skins of the rabbits were examined for fleas, ticks, ear mites, and other external parasites. One flea or tick was recorded as a positive lagomorph for that external parasite.

The lagomorph was palpated thoroughly for cysts or growths and was skinned. The abdomen was opened midline from the pubic area through the sternum, exposing the peritoneal cavity and the pleural cavity. Cysts or abnormalities were recorded. The stomach was removed, placed in a twirl bag in 10% formaldehyde, labeled and stored for use in a future study of stomach parasites Obeliscoides cuniculi and Graphidium strigosum. Animals were classified as juvenile or adult, depending on maturity of the gonads.

The small intestine was incised and examined for parasites. A stool sample was taken from each rabbit and mixed with a sodium nitrate solution with a specific gravity of 1.20. Approximately 2 grams of fecal material, mixed with 10 cc of solution was allowed to stand 15 minutes. The surface was then skimmed off, placed on a slide, and examined for parasitic ova.

External parasites were sent to the Insect Identification Service, Department of Entomology, College of Agriculture, University of Arizona for identification. Internal parasites were submitted to the Department of Veterinary Science, Veterinary Diagnostic Laboratory, College of Agriculture, University of Arizona for identification.

RESULTS AND DISCUSSION

Lagomorph Condition

Lagomorphs collected were in good physical condition except one male antelope jackrabbit collected 16 September 1984. He had a severe skin disease similar to mange. He weighed 2.7 kg whereas the mean weight of antelope jackrabbits was 3.9 kg. The mean weight of cottontails and black-tailed jackrabbits was 0.7 and 2.5 kg, respectively.

Ectoparasites

Fleas

Thirteen of 44 cottontails (29.5%) and 11 black-tailed jackrabbits (30.5%) were infested with fleas, while only 2 out of 46 antelope jackrabbits (4.3%) were so infested.

Two species of fleas were found infesting lagomorphs: Hoplopsyllus affinis Baker, and Cediopsylla spp. The majority of lagomorphs parasitized by fleas were parasitized by Hoplopsyllus affinis Baker.

The flea is an important vector in the transmission of plague and tularemia. Link (1951) demonstrated that South Dakota and Nebraska were the only states west of longitude 100° where plague was not found at that time. Holdensied and Morlan (1956) studied

the presence of fleas in wild mammals in Santa Fe County, New Mexico. Three out of four black-tailed jackrabbits examined were positive for fleas. Of 170 desert cottontails which were examined, 135 were infested with Hoplopsyllus affinis and 128 with Cediopsylla inaequalis. In their study, both species of fleas were the same as those found in the black-tailed jackrabbit.

The degree of host specificity varies widely in the flea. All the preadult life of the flea is spent off the host. The egg, larval, and pupal stages are free living and newly emerged fleas are often found on animals other than their preferred hosts (Davis and Anderson, 1971).

Ticks

Twenty-eight lagomorphs were infested with ticks: eight cottontails (18%), 18 black-tailed jackrabbits (50%), and two antelope jackrabbits (4.3%) (Table 1). Two species of ticks were found: the rabbit tick, Haemaphypalis leporis palustrus Packard, and one specimen of the deer tick Dermacenter albipictus.

The rabbit tick is widely distributed in the United States from Massachusetts to California and also is found in South America. This tick may serve as a vector in transmitting Q Fever, Rocky Mountain spotted fever, and tularemia to man (Soulsby, 1968).

The deer tick was found once in my study in an antelope jackrabbit, not its normal host.

Endoparasites

Rabbit Pinworm

The rabbit pinworm, *Passaluris ambigulus*, was found five times in the desert cottontail, twice in the black-tailed jackrabbit, and once in the antelope jackrabbit (Table 1). This nematode has previously been reported in all three lagomorphs (Morgan and Hawkins, 1949; Soulsby, 1968).

I did not find pinworm ova in the five stool specimens in the animals found to be infested macroscopically with the rabbit pinworm, even though the life cycle of this parasite is direct and highly infective. Also, in the rabbits in which the stool specimen was positive for ova, no parasites were found macroscopically on necropsy.

Cestodes

The cestodes proved to be the most host-specific of the parasite studied. *Cysticercus pisiformes* which is the intermediate stage of *Taenia pisiformes*, was recovered 20 times in the study but only in cottontails (45.4%) (Table 1). Adults of this species occur in the small intestine of carnivores throughout the world. The larval stages are reported to occur in the liver and peritoneal cavity of the domestic rabbit, cottontail rabbit, hares, and various wild rodents (Morgan and Hawkins, 1949; Lapage, 1968). Carnivores which serve as hosts for this parasite such as the coyote (*Canis latrans*) and the gray fox (*Urocyon cinereoargenteus*) are common in

the study area.

Morgan and Hawkins (1949) and Davis and Anderson (1971) state that the larval stage of Cysticercus pisiformes is found only in the peritoneal cavity and liver. I found them in the peritoneal cavity with a preference for the deep pelvic area and also in the pleural cavity attached to lung tissue. Although Cysticercus pisiformes is reported as occurring in all three species of lagomorphs (Morgan and Hawkins, 1949; Lapage, 1968), I only found it in the cottontail rabbit.

Taenia multiceps was found in the hares. The intermediate stage, Coenurus multiceps, occurs in the subcutaneous tissues of rabbits, hares and rodents. The adult parasite T. multiceps occurs in the coyote and the gray fox. Coenurus multiceps was found seven times in my study, three times in the black-tail jackrabbit for an incidence of 8.3%, and four times in the antelope jackrabbit for a 8.7% incidence (Table 1). This parasite is reported to occur in the connective tissue and abdominal cavity of rabbits. Clapham (1942) suggested that the coenurus stage can occur in the central nervous system, connective tissue, abdominal cavity, and elsewhere. Coenurus multiceps were distributed as follows: four had T.multiceps in subcutaneous tissues only, one in the sternal area, one in the rib cage area, and two in the deep flank area. One hare had a large coenurus in the pleural cavity obliterating the entire left lung. Another hare had cysts in the flanks and a large coenurus filling the peritoneal cavity. The last had subcutaneous cysts in the flank and a large interperitoneal cyst attached to the

kidney.

Cittotaenia spp. are anoplocephalid tapeworms whose intermediate hosts are oribatid mites (Soulsby, 1968). Fifteen of the rabbits in my study were infested with these parasites: ten cottontails (22.7%), four black-tails (11.1%), and one antelope (2.2%).

Fecal Samples

Of the 126 fecal samples analyzed, only six samples were positive. None of the positive samples had corresponding rabbits positive for the parasites on gross inspection. None of the positive rabbits on gross inspection had the parasite in the stool, which would have been anticipated in the case of the nematodes and the Cittotaenia species. Possibly some method of detection, other than the flotation method, should have been used. The rabbit stools were very desiccated, as is usual with desert lagomorphs.

SUMMARY AND CONCLUSIONS

Parasites of wild animals were once regarded by wildlife biologists as unimportant but interesting commensals. This attitude toward parasites is changing as wildlife specialists turn their attention toward parasitic diseases. May (1983) hypothesized that parasitic infections may act as regulatory agents in natural wildlife populations. Present knowledge concerning the evolution of hosts and their parasites, genetics, adaptation, the immune response, and the phenomenon of host parasite specificity provide new tools for the study of immunoparasitology. My study has suggested a definite host parasite specificity in sympatric lagomorphs. Further studies in the genetics of the host would be of value in a better understanding of parasitic diseases in wildlife populations.

Table 1. Mean weight, ectoparasite and endoparasite infestation of lagomorphs collected in the Picacho Mountains from May 1984 through April 1985.

Lagomorph	Males	Females	$\bar{X}$ wt. (kg)	Ectoparasite Infestation		Endoparasite Infestation			
				Fleas	Ticks	Cysticercus pisiformes	Coenurus multiceps	Cittotaenia spp.	Passaluris ambigulus
Sylvilagus audubonii	26	18	0.7	13	8	20	0	10	5
Lepus californicus	21	15	2.5	11	18	0	3	4	2
Lepus alleni	20	26	3.9	2	2	0	4	1	1

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