View metadata, citation and similar papers at core.ac.uk

brought to you by CORE

provided by Eastern Illinois University

Eastern Illinois University
The Keep

Masters Theses

Student Theses & Publications

1986

Ectoparasites of Geomys Bursarius Illinoensis

Rick L. Miller
Eastern Illinois University

This research is a product of the graduate program in Zoology at Eastern Illinois University. Find out more about the program.

Recommended Citation
Miller, Rick L., "Ectoparasites of Geomys Bursarius Illinoensis" (1986). *Masters Theses*. 2639.
https://thekeep.eiu.edu/theses/2639

This is brought to you for free and open access by the Student Theses & Publications at The Keep. It has been accepted for inclusion in Masters Theses by an authorized administrator of The Keep. For more information, please contact tabruns@eiu.edu.

THESIS REPRODUCTION CERTIFICATE

TO: Graduate Degree Candidates who have written formal theses.

SUBJECT: Permission to reproduce theses.

The University Library is receiving a number of requests from other institutions asking permission to reproduce dissertations for inclusion in their library holdings. Although no copyright laws are involved, we feel that professional courtesy demands that permission be obtained from the author before we allow theses to be copied.

Please sign one of the following statements:

Booth Library of Eastern Illinois University has my permission to lend my thesis to a reputable college or university for the purpose of copying it for inclusion in that institution's library or research holdings.

25 July 1986 [redacted]

Date Author

I respectfully request Booth Library of Eastern Illinois University not allow my thesis be reproduced because _____

_____

_____

_____ _____

Date Author

m

ECTOPARASITES OF

GEOMYS BURSARIUS ILLINOENSIS

(TITLE)

BY

Rick L. Miller

THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF

MASTER OF SCIENCE

IN THE GRADUATE SCHOOL, EASTERN ILLINOIS UNIVERSITY
CHARLESTON, ILLINOIS

1986
YEAR

I HEREBY RECOMMEND THIS THESIS BE ACCEPTED AS FULFILLING
THIS PART OF THE GRADUATE DEGREE CITED ABOVE

25 July 1986
DATE

[redacted]
ADVISER

25 July 1986
DATE

[redacted]
DEPARTMENT HEAD

Table of Contents

ECTOPARASITES OF *GEOMYS BURSARIUS ILLINOENSIS*

ABSTRACT

This study was conducted to determine what ectoparasitic organisms are found on the pairie pocket gophers, *Geomys burasrius*, occurring in an isolated population in northeastern Illinois. The study area was a five hectare grassland community composed predominately of sandy soil, located in northeastern Iriquois Co., two miles north and three miles east of Beaverville, IL.

A total of 19 pocket gophers were captured from October 2 to November 17, 1983. Blood was collected and smears were made in the field. Hosts were examined for ectoparasites in the laboratory. Six hundred and nine ectoparasitic organisms were isolated representing a mean of 32.1 parasites per host.

Mites were the most abundant ectoparasite, accounting for 41.4% of the total removal. Two genera were isolated. *Haemolaelaps* spp. were most numerous occurring on 17 hosts, while the genus *Hirstionyssus* spp. was less numerous, occurring on 4 hosts. An average of 13.3 mites was found per host.

Lice were also numerous, representing 40.7% of the ectoparasite recovery. *Geomydoecus illinoensis* was the only species collected. It was isolated from 15 to 19 host animals. An average of 13.1 lice per host was found throughout.

A less abundant ectoparasite was the flea *Foxella ignota*, accounting for only 5.7% of the total. It was found on 16 host animals, supporting an average of 5.7 per individual.

No ticks were found. Examination of the blood smears and other blood samples yielded no evidence of microfilarial or protozoan parasites.

Parasite distribution varied with sex of the host. Males supported more parasites than the females. Furthermore, lice were associated most often with the males, while mites were most often found on female host. In general, most ectoparasites were concentrated around the head and neck of the host. Other researchers have demonstrated much larger parasitic yields in similar hosts than was found in this study. Variables such as climate, host species, season, and recovery technique can account for this difference. It was also observed that generally one species of ectoparasite was found per host.

ACKNOWLEDGMENTS

I would like to thank Dr. Bill T. Ridgeway for his guidance and support throughout my research. Without his expert assistance, I feel this project would not have been possible. I also thank Dr. R.D. Andrews, Dr. M.A. Goodrich, and Dr. P.J. Docter for their constructive criticism. Lastly, a special thanks to Gene Strole for typing the numerous drafts of my thesis.

INTRODUCTION

The Prairie Pocket Gopher, Geomys bursarius (Shaw), is a small fossorial rodent ranging throughout regions west of Mississippi River to the eastern edge of the Dakotas, Nebraska, and Kansas (Blair. 1977). Populations extend south to southern Missouri and north to northeastern Minnesota. Scattered populations of Geomys bursarius illinoensis exist in southern Wisconsin and northwestern Illinois (Mohr, 1935). Pocket gophers inhabit a range of soil types, but seem to prefer loose sandy soils (Merriam 1895). The rodent's diet consists of tubers, bulbous roots,and succulent plants and they are commonly associated with the destruction of cash crops and garden plants. On uncultivated land, however, the animals may be most beneficial in that their burrowing and deposition of organic matter below ground contributes to soil quality (Hall, 1955).

The pocket gopher, more specifically members of the family Geomyidae, are known host reservoirs for diseases of both humans and animals (Benenson, 1980). One such disease is Listeriosis, which is recognized as one of the more important bacterial diseases of human, domestic animals, and wildlife. Another is Query (Q) Fever, which is a rickettsial infection found world wide in distribution, and can be disabling in man. Other infectious diseases that utilize rodents in general as reservoir hosts include: Sylvatic Plague, Lymphocytic choriomeningitis,

Eperythrozoonisis and the Encephalitids. In most, if not all, of the examples cited, transmission from reservoir host to "target host of consequence" requires a suitable arthropod vector. Such vectors are likely to be actual ectoparasites of the reservoir host, or nidicolous forms associated with it. This study was undertaken to establish gopher-ectoparasite relations in one Illinois population in order to understand their potential in epidemiologic conditions.

Little study has been done on pocket gopher host-parasite relationships. Of the nine genera of the family Geomyidae, the majority of investigations involve the western United States genus Thomomys. Information on the genus Geomys is limited.

Most available ectoparasite research concentrates on pocket gopher-louse interactions. A single genus of louse, Geomydoecus, is found exclusively on pocket gophers (Ellsworth, 1919). Rogers and Emerson (1971) describe the species Geomydoecus illinoensis which they found only on populations of Geomys bursarius illinoensis in northwestern Illinois.

Geomydoecus oregonus was isolated by Rust (1974) from Thomomys bottae. He found a mean of 357 lice per gopher from a sample of 393 hosts. Average numbers ranged from 86 per individual in juveniles to 544 in adult males. the maximum number removed from a single host was 1,941, while only five animals were devoid of lice. Seasonal louse

concentrations were found to peak in June through July. Rust also demonstrated a distinct increase in louse numbers found on males when compared to females. This is probably due to decreased body size and increase louse passage from female to offspring. Lice were consistently concentrated around the head and anterior dorsal body, with 92.5% of the lice being found 55% of the animal's surface. Rust further established that most gophers have only one louse species, with exceptions occurring where hosts have extensive geographical distributions. T. bottae are prone to confinement in more or less isolated natural populations, (Blair 1968).

An earlier study conducted Rust (1973) revealed six different ectoparasitic arthropods removed from populations of Thomomys. A single louse species, Geomydoecus oregonus was found on 98.6% of the hosts. One species of flea, Foxella ignota, was found, occurring on 0.5% of the population. Four mite species were isolated, Geomylichus sp., Hirstionyssus femuralis, Haemolaelaps geomys, and Leeuwenhoekia delosa. In general, mite concentrations were abundant except for Leeuwenhoekia delosa, which was scarce. The low number of fleas and absence of ticks on T. bottae suggested that they may be either geographically or ecologically separated from those ectoparasites.

Szabo (1969), working in Hungary, revealed three species of fleas on experimental gopher populations, Citellophillis martioni, C. simplex, and Ctenophthalmus

orientallis. He concluded that usually a single species will be found per host and that the host environment determines the flea species present rather than the suitability of the host itself.

Hellenthal and Price (1976) established results similar to those of Szabo in their work with the Yellow Faced Pocket Gopher, Pappageomys castanops. They utilized the geographical distribution of six louse taxa of the genus Geomydoecus as criteria for subspeciation of the host. Based on their findings, the Yellow Faced Pocket Gopher was divided into northern and southern subspecies. Each subspecies supported different louse taxa with little overlap. The northern subspecies supported Geomydoecus expansus and three morphologically similar lice but lacks Geomydoecus subnubili and Geomydoecus martini. The southern subspecies group supports Geomydoecus subnubili, usually with Geomydoecus martini, but without Geomydoecus expansus alone. Geomydoecus expansus was the only louse found in both geographical areas.

MATERIALS AND METHODS

From October 2 to November 17, 1983 Geomys bursarius illinoensis were trapped from a single population on and adjacent to Iroquois County conservation Area, 2 miles north and 3 miles east of Beaverville Il. The area consist of dry sandy soils promoting a grassland community.

Burrows were located by removing the sand mounds, which are produced by burrow excavation, and probing beneath for the looser soil of the burrow opening. Upon location the burrow opening was cleaned out and a gopher trap was placed within the burrow and anchored by wire to a solid object. Each trap was checked every 30 minutes over a 24 hour period. All captures were removed and, if alive, killed using anesthesia. Heart blood was immediately removed with a three ml. syringe and 20 gauge needle and placed in a tube wetted with either sodium citrate of heparin solution. The animal was immediately properly labelled and sealed in a plastic bag. All animals were refrigerated for later examination.

Two thin blood smears were made for each blood sample. All slides were properly labeled and stained with Giemsa solution. Each was examined for the presence off microfilaria and other blood parasites. Knott's blood sedimentation preparations (Brown & Neva, 1983) were also made from each sample.

Ectoparasite removal was carried out in the lab under controlled conditions. A few drops of ether were placed in

each bag containing a host before examination to prevent parasite escape. Individual hosts were carefully removed to a white enamel pan to be examined for ectoparasites. The interior of the plastic bag holding each host was scrutinized for ectoparasites that might have fallen off the host. All ectoparasites found were identified and data recorded. A combing technique was as follows for each individual. Using a fine toothed comb; starting at the anus and combing anteriorly on the ventral surface to the throat and nose, including the inner thighs and legs. Then laterally around the nose on to the face where special attention was given to the areas of the eyes, ears, and lateral pouches. Combing then continued from the base of the tail, anteriorly, on the dorsal surface to the head. Special care was made to comb against the nap of the fur to secure maximum parasite recovery. The tail of each animal was viewed under a disecting scope for evidence of tail mites. A disecting scope was also utilized to view the comb after every stroke to allow for easier location of ectoparasites. Upon location of a parasite; it was removed with a small brush and placed in a labeled vial of 70% alcohol and 4% glycerine. Number and species totals were recorded for each host. Glass slide whole mounts of each kind of parasite observed were made to aid in identification. Identification of ectoparasites was carried out utilizing the keys and descriptions in 1) A Manual of External Parasites, by Ellisworth (1919), 2) A Revision of

the genus Geomydoecus of the New World Pocket Gopher, by Price and Emerson (1971), and 3) A Manual of Acarology, by Krantz (1978). Examples of all species collected will be submitted to the parasite collection of the National Museum.

RESULTS

A total of 609 ectoparasitic organisms were isolated from 19 host animals. This represents a mean of 32.1 parasites per host (Table 1).

Mites were found to be the most abundant ectoparasite, accounting for 41.4% for the total removal. Two genera were found: Haemolaelaps sp. which were most numerous, was isolated from 17 host animals, Hirstionyssus sp. was less abundant occurring on four hosts. Overall, an average of 13.3 mites were found per host. Haemolaelaps averaged 12.7 per host and Hirstionyssus averaged 0.58 per host.

Lice were also numerous, representing 40.7% of the total ectoparasite yield. A single species, Geomydoecus illinoensis, was isolated from 15 of the 19 host animals. In some cases infestation was excessive, while in others it was minimal. An average of 13.1 lice per host was found throughout.

Geomydoecus illinoensis exhibits marked sexual dimorphism. The male is slightly larger with a total body length of 1.25 to 1.41 mm as compared with 1.24 to 1.38 mm for the female. Both sexes have a broad head with a distinct hair groove. Overall, the female has a wider head, ranging 0.44 - 0.49 mm and the male ranging only 0.40 - 0.44 mm.

Antennae also differ between the lice sexes. The second segment in the female is expanded into lateral processes. In the male, all three segments are enlarged

TABLE 1

Ectoparasites Found on Geomys Bursariuis Illindensis
Collected at Iroquois County, Illinois, 1983

Host#	Mites	Lice	Fleas	Total	Weight (gm)	Sex
1	1	3	11	15	317.2	♂
2	6	6	4	16	193.1	♂
3						
4	49	28	2	79	215.5	♀
5	16	0	2	18	146.0	♀
6	0	0	1	1	157.5	♀
7	1	3	15	19	195.2	♀
8	28	0	13	41	169.8	♀
9	66	0	0	66	272.0	♂
10	33	11	0	44	187.5	♀
11	8	4	9	21	168.7	♀
12	2	4	1	7	265.9	♂
13	6	10	4	20	222.0	♀
14	4	7	1	12	170.9	♂
15	1	19	8	28	289.2	♂
16	1	11	9	21	281.2	♂
17	9	36	10	55	217.0	♂
18	0	10	1	11	164.8	♂
19	20	14	0	34	144.2	♂
20	1	82	18	101	349.5	♂
Totals	252	248	109	609		
$\bar{X}$# Per Host	13.3	13.1	5.74	32.1	217.2	
$\bar{X}$# Per ♂	10.1	17.5	5.73	33.3	242.3	
$\bar{X}$# Per ♀	17.6	7.0	5.75	30.4	182.8	

with the first supporting lateral processes. The third segment of the male is tipped and curved with a short spine.

The abdomen of both sexes is swollen with the first three segments having pleural plates. The genital armature is very large and surrounded by a large U-shaped chitinous strip. The male abdomen is lined by median tergocentral setae with the gentalia supporting and apically divided triangular endomeral plate. The female has tergocentral setae on segment VII equal to those on segment VI. The genital chamber sac has irregular lines forming not over three to five highly irregular loops, sometimes none.

The least abundant ectoparasite was the flea, Foxella ignota, accounting for only 5.7% of the total. It was found on 16 host animals, with little variation in number, supporting an average of 5.7 per individual.

Foxella ignota is a medium size flea averaging 2.7 to 3.0 mm in length. Eyes are absent and it possesses bristles on the head and posterior tibiae. The antepygidal bristles differ from male to female. The female has three and the male has two. A row of alternatingly long and short bristles compose the pronotal comb which supports 10 to 11 spines.

No ticks were seen on the hosts collected. Examination of the thin blood smears yielded no evidence of the presence of microfilaria or protozoan parasites. Knotts preparations were negative.

DISCUSSION

Throughout the study there was approximately a 2-2-1 ratio of mites, lice and fleas with respect to numbers of each on an individual host. Mites and lice, on average, were twice as abundant as fleas. This may be accounted for by the largers size of the flea. The larger the parasite the more host area it requires; therefore, high flea concentrations are less likely to be sustained on a small host such as the pocket gopher.

In general, fleas were found in equal proportions among male and female host. This was probably due to lack of difference in surface area among males and females. This was not the case with the mites or lice. Mites were found to occur more often on female host while the lice were restricted mostly to the male host. The female has an increased potential for loss to nesting material and migration to offspring. Males do not spend substantial periods with the nest and rarely associate with the young.

It was further noticed that mites and fleas were rarely found on the same host. The host environment probably should be ruled out as a variable due to its homogeneity. Therefore, the difference may lie within individual differences among the hosts or parasite in compatibilities. Of these two options, host incompatibility seems more reasonable.

Location of the ectoparasites on the hosts also varied. The fleas were relatively dispersed over the animals surface

while lice and mites were concentrated at the head and neck regions. This observation is supported by Rust (1974) who found similar results in his experimental populations. Reasoning for this difference in distribution should include the fact that the flea is highly mobile whereas the mites and lice are more stationary. This may make the mites and lice more vulnerable to self grooming behavior of the host. Due to the physical structure of the pocket gopher, it is unable to preen the areas of the head and neck, therefore allowing for high parasite infestation of these areas. Rust (1974) also stated that in cases of new infestation, where parasite concentrations are low, the region of the head and neck are first infested.

Rust (1974) notes an average of 357 lice per host. This figure is overwhelming when compared to the 13.1 lice per host found in this study. The floation and combing techniques which Rust utilized my have been more effective than combing alone; however, other variables must be considered. Previous research indicates a spring increase exists in parasite populations. This study was conducted in late fall when parasite populations were probably depressed as was most host activity. During this period, the host utilized deeper burrows which support different microenvironmental conditions. For example; decreased temperature and increased carbon dioxide concentrations have been found to affect parasite populations. Another

potential variable is the difference in climate and soil conditions.

Rust's study was conducted in California where the temperature is consistently higher and the soil is wetter due to irrigation. A last source of error might be parasite loss after death. In Rust's work the animals were examined and released, whereas in this study they were sacrificed. I do not believe this to be a significant source of parasite loss because most animals were still alive when captured. Averages for mite and flea comparisons were not available.

It can also be observed that generally one species of each ectoparasite is found per host. With the possible exception of the mites where more than one species may be observed. Szabo (1969) revealed the same observation in the Hungarian pocket gopher. He believes this to be the result of that host environment rather than the host itself.

Literature Cited

Bailey, V. 1895. The pocket gophers. Bull. #5, Division of Ornithology and Mammology, U.S. Dept. of Agriculture, Wash. Gov. Print Office. 47 p.

Beneson, Abram S. (Ed.) 1980. Control of communicable diseases in man. 13th Edition. American Public Health Association, Washington, D.C., 444 p.

Blair, W. Frank. 1968. Vertebrates of the United States. McGraw-HIll Pub. Co., NY, 819 p.

Bland, R.G. 19k78. How to know the insects, the pictured key nature series. Winchester C. Brown Pub. Co., Debuque, IA, 360 p.

Brown H.W., and F.A. Neva. 1983. Basic Clinical Parasitology. 5th Edition. Appleton-Centry-Crofts, Norwalk, CN, 339 p.

Ellisworth, H.E. 1919. A manual of external parasites. Charles C. Thomas Pub. Co., Springfield, IL, p. 77.

Hall, E.R. 1955. Handbook on Mammals of Kansas, Misc. Publ. #7. Univ. Kans. Natl. His. Mus. Lawrence, KS, 303 p.

Hellenthal, R.A., and R.D. Price. 1976. Louse-host associations of Geomydoecus (Mallophaga; Trichodectidae) with the Yellow Faced Pocket Gopher, Pappogeomys castanops. J. Med. Ent. 13:331-336.

Hubbard, C.A. 1947. Fleas of western North America. The Iowa State College Press, Ames, IA, 533 p.

Krantz, G.W. 1978. A manual of Acarology. Oregon State University Book Stores, Corvalis, OR, 50 pp.

Merriam, C.H. 1895d. North American fauna no. 8 division of Ornithology and Mammology U.S. Dept. of Agriculture. Wash. Gov. Print. Office. 258 p.

Mohr. C.O. 1935. Distribution of the Illinois pocket gopher Geomys bursarius illinoensis. J. Mamm. 16:131-134.

Orr, R.T. 1971. Vertebrate biology. Saunders Pub. Co., Philadelphia, PA, 544 p.

Price, R.D., and K.C. Emerson. 1971. A Revision of the genus Geomydoecus (Mallophaga: Trichodectidae) of the new world pocket gophers (Rodentia: Geomyidae). J. Med. Ent. 8:228-257.

Rust, R.W. 1973. Ectoparasites and nidicolous acari of the pocket gopher Thomomys bottae. Pan. Pac. Entomol. 49: 59-60.

Rust, R.W. 1974. The population dynamics and host utilization of Geomydoecus oregonus, a parasite of Thomomys bottae. Oecologia. 15:287-304.

Swan, L.A., and C.S. Papp. 1972. The common insects of North America. Harper and Row Pub. Co., New York, NY, 750 p.

Szabo, I. 1969. On the coexistance of fleas (Siphonaptera) on mammals in Hungary. Parasitol. Hung. 2:79-118.

Szabo, I. 1976. The past and the future tasks of Hungarian Siphonaptera research. Allattani Kozl. 63:147-153.