MITES FOUND ON MICE OF THE GENUS PEROMYSCUS IN UTAH. I. GENERAL INFESTATION[1]

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INTRODUCTION

The part that many of the Acarina, particularly the ticks, play as vectors and intermediate hosts of diseases of man and animals is well known. Most of the mites, however, are little known with regards to their host relationships and disease transmission potentials. Parasitic mites have been implicated in the transmission of scrub typhus, rickettsialpox, neurotropic viruses, tularemia, plague, filariasis, hepatozoan and haemosporozoan parasites, and are suspected vectors of endemic typhus. Other mites are known to be intermediate hosts of tapeworms. It may be assumed that any mite that sucks blood or tissue fluids is a potential vector of the diseases of the hosts upon which it feeds.

Rodents of many species on which the Acarina feed serve as reservoirs of such diseases as trypanosomiasis, typhus, rickettsialpox, plague, tularemia and Rocky Mountain spotted fever, all of which affect man. El-Gindy (1951), Chandler and Melvin (1951), Packchanian (1938), Harkema (1936) and others have contributed to our knowledge concerning mice of the genus *Peromyscus* as hosts for protozoan and other diseases that affect man and other mammals. Units of the United States Public Health Service have found sylvatic plague in native mice of the species *P. boylii*, *P. leucopus*, *P. maniculatus* and *P. truei* throughout western United States (Allred, 1952). These few examples demonstrate the importance of these mice as reservoirs of pathogenic organisms.

The study of acarine ectoparasites received impetus with the advent of World War II. The stationing of troops in areas where scrub typhus, plague and other diseases occurred required that much attention be given to the reservoirs and vectors of these diseases in those areas. Early studies of mite-host relationships in North America were at most limited to incidental collections until the outbreak of plague in San Francisco in 1900 when the study of rodents, their endemic diseases and their ectoparasite vectors was accelerated. Subsequently, investigations by plague suppressive units, members of federal and state health services and others have contributed greatly to our knowledge of these host-ectoparasite relationships.

When mice of the species *P. maniculatus* were implicated with sylvatic plague near Salt Lake City in September of 1948, a study of host-parasite relationships was made by the Utah State Health Commission and the United States Public Health Service, principally in Salt Lake County. Many of the ectoparasites that were collected

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were identified at the United States Public Health Laboratory at Atlanta, Georgia, but the results of that study with reference to the mites collected were never published. A few records obtained during that plague survey are included in this paper.

The objectives of the study reported herein were to determine (1) the frequency of infestation of native mice of the genus *Peromyscus* by mites, (2) the kinds of mites that occur on these mice, (3) the host specificity, (4) the geographic distribution, and (5) other biological and ecological aspects of the mites.

According to Durrant (1952), six species of white-footed mice of the genus *Peromyscus* occur in Utah. The deer mouse, *P. maniculatus*, is statewide in distribution. The canyon mouse, *P. crinitus*, occurs throughout the western, eastern and southern portions of Utah, but is absent in the Wasatch and Uinta mountains and High Plateau Provinces of the Middle Rocky Mountain Area. These high mountains and plateaus are located in a strip from north to south through the central part of the state (see Durrant, 1952:480). The piñon mouse, *P. truei*, occurs in the same general geographic area as does the canyon mouse. The brush mouse, *P. boylii*, occurs only in the southern and eastern portions of Utah. The cactus mouse, *P. eremicus*, occurs only in the southwestern corner of Utah, principally in Washington County, and the long-nosed deer mouse, *P. nasutus*, occurs in San Juan County, south of the San Juan River.

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METHODS

A total of 3296 mice was examined for ectoparasites. This num-

ber included 2907 *P. maniculatus*, 201 *P. eremicus*, 67 *P. crinitus*, 59 *P. truei*, 37 *P. boylii*, and 25 specimens not identified past the genus. No *P. nasutus* were collected. The study was in progress for five years, from September, 1948 to August, 1953, inclusive. Relatively few collections of mice were made during 1950. Animals were collected all months of the year throughout the entire state with the exception of the period from September, 1948 to August, 1949 when collections were restricted to Davis, Salt Lake and Utah counties.

Mice were trapped with Museum Special snap traps and other types designed to capture animals alive. Each host found dead in the trap was placed into a tightly sealed paper bag until it was examined for ectoparasites. Each live-trapped mouse was placed into a gallon-size, wide-mouth glass jar and killed with chloroform. Ectoparasites were collected by brushing the mice in a large, white enamel-ware pan. Each host was processed separately in order to maintain specific data, except in a few cases when several carcasses of the animals of both sexes of the same species were placed in the same collection bag. Mice and their containers were examined under a directing microscope when possible.

Although mites were not found on every mouse, a total of 3695 mites was collected.

RESULTS

TABLE I

Number of Infested Mice *(Peromyscus maniculatus)* Collected Over a Five-year Period, 1948-1953

Month	No. Mice Collected			Mice Infested					
	Male	Female	Total	Male		Female		Total	
				No.	%	No.	%	No.	%
Jan.	12	11	23	2	17	2	18	4	17
Feb.	20	16	36	3	15	6	38	9	26
Mar.	44	36	80	18	41	20	56	38	48
Apr.	67	59	126	25	37	13	22	38	29
May	83	61	144	41	49	19	31	60	40
June	178	138	316	54	30	38	28	92	29
July	109	64	173	16	15	11	17	27	16
Aug.	221	175	396	47	21	42	24	89	22
Sept.	29	20	49	7	24	4	20	11	22
Oct.	66	52	118	8	12	9	17	17	14
Nov.	32	24	56	4	13	7	29	11	21
Dec.	12	12	24	4	33	3	25	7	29
Total	873	668	1541	229	26	174	26	403	26

Table 1 shows the comparative numbers of male and female *P. maniculatus* found infested during the five-year period. The numbers given in the table opposite each month are the total mice examined during that specific month for the five-year period. The differences between the numbers of male and female mice that were infested during certain months may be indicative of the trends in popu-

lations of mites or the variable activities of the hosts. Over a five-year period, equal numbers of male and female *P. maniculatus* were found infested. Considerably more females than males of this species were infested by mites during February, March and November, while more males than females were infested during April and May.

Table 2 shows the numbers of male and female mice of five species found infested during the five-year study. These data indicate that mice of certain species had a relatively higher infestation of

TABLE II
Number and Species of Infested Mice, 1948-1953

Species of *Peromyscus*	Total Mice Collected			Mice Infested					
	Male	Female	Total	Male		Female		Total	
				No.	%	No.	%	No.	%
truei	26	14	40	9	34	6	43	15	38
crinitus	28	24	52	6	21	12	50	18	35
boylii	12	15	27	9	75	14	93	23	84
eremicus	50	50	100	20	40	15	30	35	35
maniculatus	873	668	1541	227	26	175	26	402	26
Total	989	771	1760	271	27	222	28	493	28

mites than did others. In Utah, fewer *P. maniculatus* and more *P. boylii* were infested than were any other species of *Peromyscus*. Considerably more female than male *P. crinitus*, *P. boylii* and *P. truei*, and more male than female *P. eremicus* were infested by mites.

Table 3 shows that more young than adult mice were infested. This is expected because the young spend more time in the nests than the adults. Frequent association with the nest normally allows a greater chance of infestation by nest-dwelling mites. More young mice were infested during May and June than during other months of the year.

TABLE III
Comparative Numbers of Young and Adult Infested Mice (All Species), 1948-1953

Age	No. Mice Examined			Mice Infested					
	Male	Female	Total	Male		Female		Total	
				No.	%	No.	%	No.	%
Young	95	70	165	37	39	30	43	67	41
Adult	205	150	355	57	28	47	31	104	29
Total	300	220	520	94	31	77	35	171	33

Table 4 deals with the comparative numbers of infested *P. maniculatus* taken from specific localities. During comparative months, more mice were infested in some geographic areas than in others.

TABLE IV
Comparative Numbers and Localities
of Infested Mice *(P. maniculatus)*

Date		Locality	No. Mice Examined	Mice Infested	
				No.	%
Mar.	1949	Salt Lake City	28	18	64
	1953	Chimney Rock Pass	35	8	23
Apr.	1949	Salt Lake City	45	14	31
	1953	Chimney Rock Pass	32	7	22
May		Lucin, 10 miles north of	29	5	17
		Chimney Rock Pass	29	22	72
June	1951	Price	24	11	46
		Palmyra Forest Camp	32	28	88
	1952	Lucin, 10 miles north of	44	9	20
	1953	Chimney Rock Pass	22	2	9
July	1952	Aspen Grove	24	4	17
		Bear Valley Junction	26	9	35
Aug.	1951	Pleasant Creek Picnic Area	24	10	42
		Roosevelt, 7 miles west of	51	6	12
		Duchesne, 22 miles west of	25	7	28
		Dinosaur National Monument	38	6	16
		Sheep Creek	32	5	16
		Aspen Grove	26	2	8
	1952	Fish Lake	42	6	14
		Torrey	47	16	34
		Paradise Valley	41	15	37
		Elkhorn Ranger Station	40	2	5
		Laketown	23	4	17
Oct.	1948	Salt Lake City	45	9	20
	1952	Lucin, 10 miles north of	40	5	13

There also were variations in the degree of infestation in the same areas during different months. Although the numbers of mice collected in some areas were not large, the differences between the numbers of mice that were infested are indicative that the degree of infestation varies between mice from different localities, and between mice of the same locality during different seasons.

TABLE V
Comparative Yearly Numbers of Infested
Male and Female Mice *(P. maniculatus)*

	No. Mice Examined			Mice Infested					
	Male	Female	Total	Male		Female		Total	
				No.	%	No.	%	No.	%
1948	75	57	132	14	19	13	23	27	21
1949	89	62	151	46	52	31	50	77	51
1951	247	196	443	87	35	69	35	156	35
1952	303	215	518	66	22	46	21	112	21
1953	158	139	297	16	10	19	13	35	11

Table 5 shows the numbers of male and female *P. maniculatus* infested during comparative years. Collections for 1950 were not in-

cluded because an insufficient number of individual records were kept. This table shows that the degree of infestation of mice varied during successive years. Considerably more *P. maniculatus* were infested in 1949 and 1951 than in 1948, 1952 and 1953. During 1953, the numbers of mites on rodents were considerably reduced when compared with those of previous years.

DISCUSSION

The variations in the numbers of mice infested by mites probably are due to the nesting, reproductive and food acquiring habits of

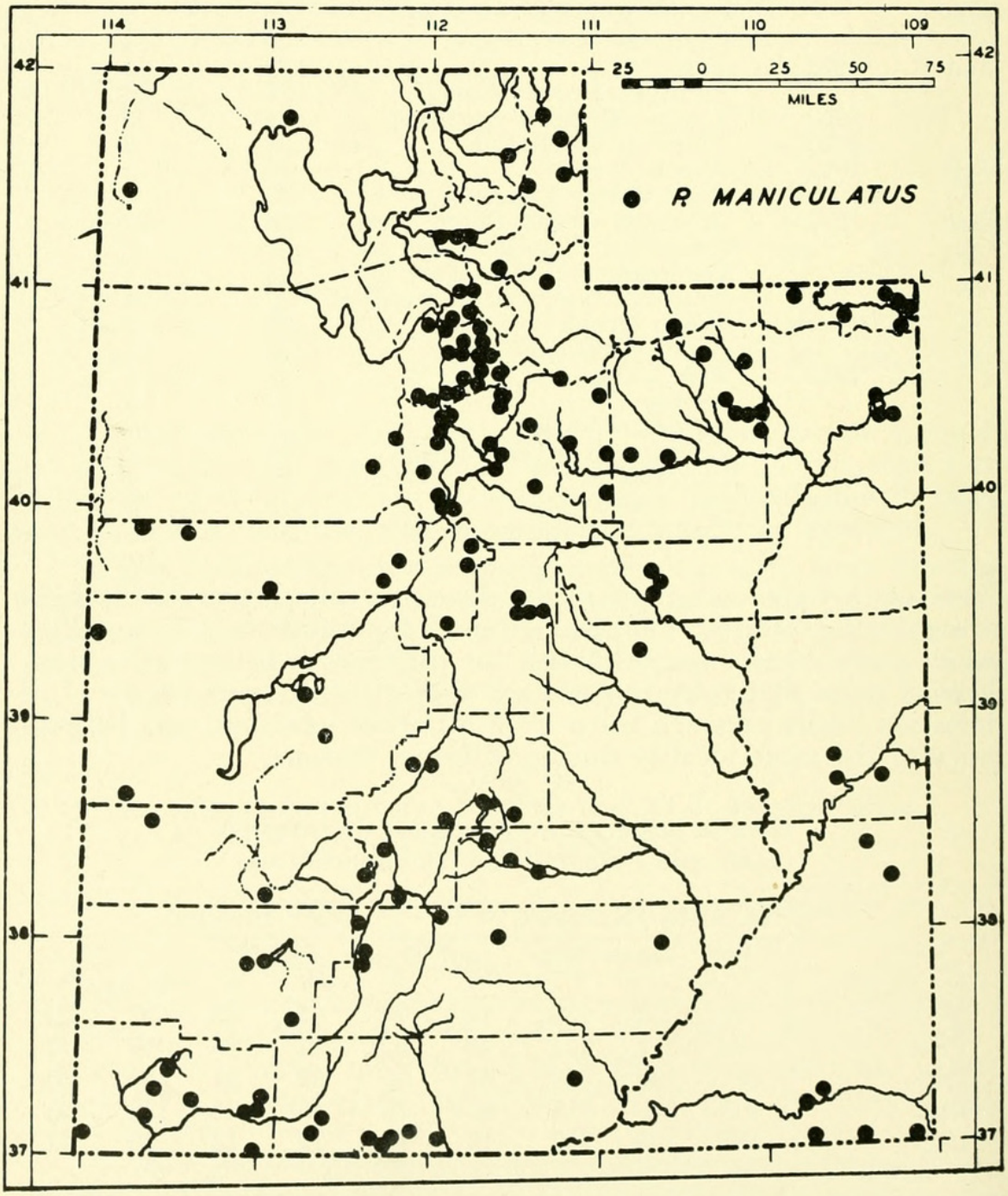

Figure 1. Collection localities of mice of the genus *Peromyscus*.

the hosts, and the reproductive cycles of the acarine consortes. These variations may be closely correlated with the host's association with its nest which is believed to be a major center of reproduction of parasitic mites and a major source of infestation of the mice.

Mice of certain species were infested by mites more frequently than others. Those mice that live at higher elevations, where moist habitats are abundant outside of the nest for long periods, are apt to be infested by mites from areas other than the nest. Mites may be more abundant in specific areas where mice gather food, and may crawl onto the body of a passing mouse. At lower elevations and in

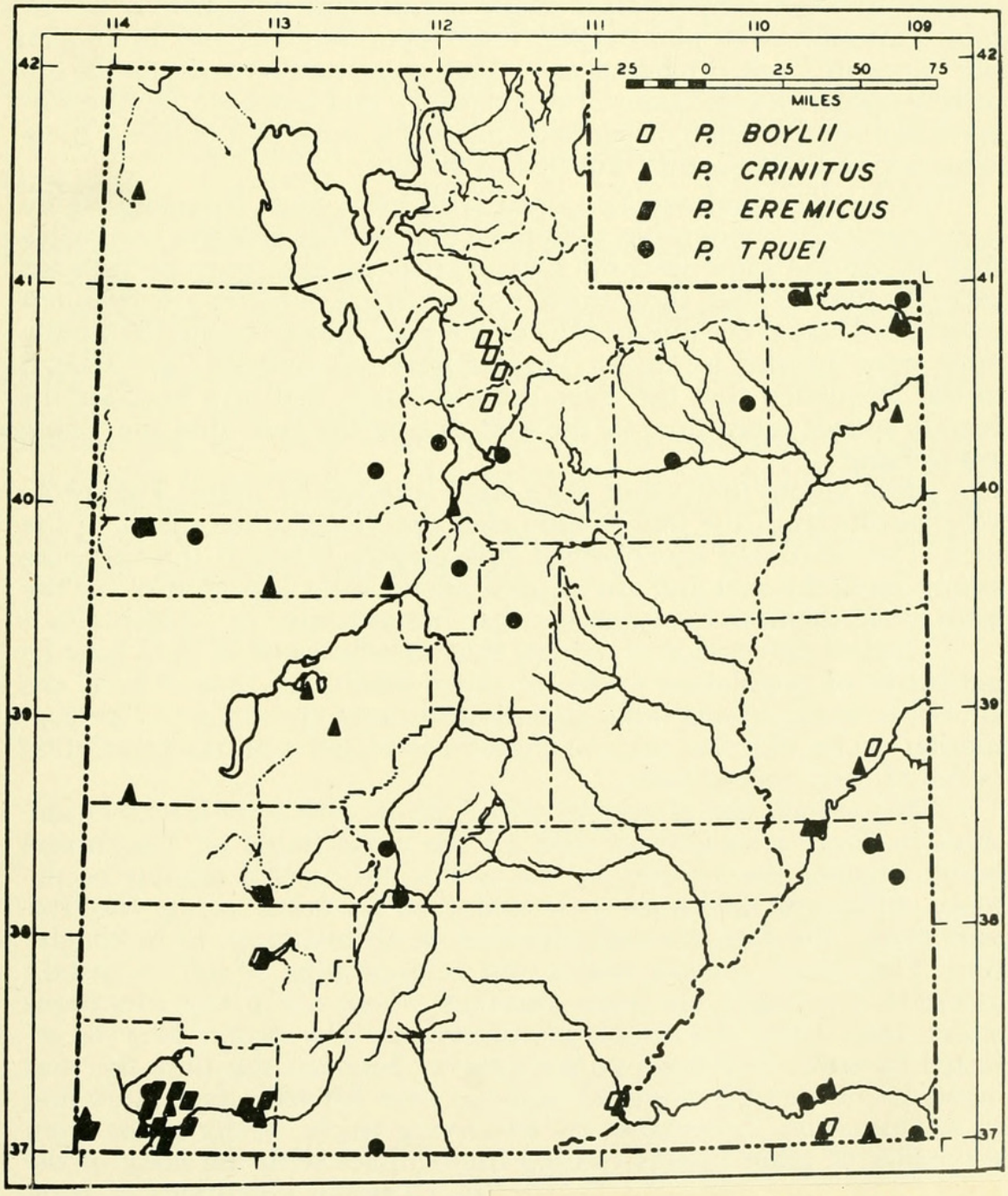

Fig. 2. Collection localities of mice of the genus *Peromyscus*.

other habitats where moisture conditions outside the nest are not favorable, the mice become infested almost solely by mites that are restricted to the environs of the nest *Peromyscus boylii* was infested more frequently by mites than were other species of *Peromyscus*. *Peromyscus truei* was second in the degree of mite infestation, while *P. crinitus*, *P. eremicus* and *P. maniculatus* followed in order in the degree of infestation. Although little evidence is available to explain this phenomenon, it may be correlated with the distribution and habits of the mice. *Peromyscus maniculatus* is widely distributed and occurs in most types of habitats, whereas the other species of *Peromyscus* in Utah generally are restricted in their distribution to certain communities or plant types. The Upper Sonoran and Transition life zones in Utah provide areas which apparently most closely approach optimum conditions of temperature and moisture for the survival and reproduction of parasitic mites, for mice that occur in these areas are most frequently infested by mites.

Those mice that are associated with nests most frequently may be infested with more mites than mice that seldom visit the nest. Mice that utilize the same nest for long periods of time may be infested more frequently than those mice that construct new nests at frequent intervals. During certain months of the year, more female than male mice were infested by mites. These differences probably are related to the frequency that the mice are associated with the nest, for the female spends more time in the nest during the time that the young are nursing.

More young than adult mice were infested by mites. This probably results from the longer time that the young mice spend in the nest. The relatively short period that elapses between the time the young leave the nest and are trapped allows little opportunity for the mice to rid themselves of mites, either intentionally or accidentally.

The low percentage of rodents that were infested in 1953 may be indicative of population cycles of mites similar to those which are known to occur among other invertebrates and vertebrates. The population cycles of mites may be closely correlated with the population cycles of their rodent hosts.

This report, one of several which deals with mite-host relationships in Utah, is concerned with all the mites found on the animal hosts, whether the association was accidental or of a regular occurrence. Although 3296 mice were examined for mites during the five-year study, the data are not sufficient, in all instances, to be conclusive. They show certain trends and relationships which in certain instances seemingly are quite variable. There are many conditions which may affect the degree of infestation. The results may be affected by such conditions as the interval between the time the host leaves its nest and is captured, and the time between its capture and its examination. Infestation by free-living mites, or by mites from scavenger or other insects coming into contact with the body of the mouse also may influence the results. Different conditions of trapping and collection affect the results, even though standardized meth-