John O. Whitaker, Jr.

Department of Life Sciences
Indiana State University
Terre Haute, Indiana 47809

and

Chris Maser

USDI Bureau of Land Management
Forestry and Sciences Laboratory
3200 Jefferson Way
Corvallis, Oregon 97331

Parasitic mites of voles of the genera Microtus and Clethrionomys from Oregon[1]

Abstract

The more important mites found in the fur of seven species of voles from Oregon were *Laelaps kochi, L. alaskensis, Androlaelaps fahrenholzi,* and *Echinonyssus isabellinus* on *Microtus montanus*; *L. kochi, Haemogamasus occidentalis, Euryparasitus* sp., and *A. fahrenholzi* on *M. oregoni*; *Haemogamasus reidi* and *A. fahrenholzi* on *M. logicaudus*; *H. occidentalis, L. alaskensis,* and *A. fahrenholzi* on *M. richardsoni*; *Euryparasitus* sp., *A. fahrenholzi, Haemogamasus* sp. #2, and *Glycypagus hypudaei* on *Clethroionomys californicus,* and *E. isabellinus, H. reidi,* and *A. fahrenholzi* on *C. gapperi.*

The mite faunas of *Microtus* spp. and those of *Arborimus albipes, A. longicaudus,* and *Lagurus curtatus* were compared. Most of the mite faunas differed considerably from one another. Pairs of hosts having the most similar mite-faunas were *Arborimus albipes-Clethrionomys,* and *M. townsendi-M. montanus.* The most distinctive mite-fauna was that of the red tree vole, *Arborimus longicaudus,* which lives high above ground, primarily in large Douglas-fir trees, *Pseudotsuga menziesii.*

Introduction

During studies of Oregon mammals, long-tailed voles, *Microtus longicaudus*; montane voles, *M. montanus*; creeping voles, *M. oregoni*; Townsend voles, *M. townsendi*; water voles, *M. richardsoni*; California red-backed voles, *Clethrionomys californicus*; and southern red-backed voles, *C. gapperi*, were examined for the presence of mites. The purpose of the study was to determine the species of mites parasitizing these voles. Observations were also made to determine how the composition of mite-faunas correlated with the host-relations, and with host-habitat relationships.

We have previously presented information on the larger mites parasitizing three other species of voles from Oregon: white-footed vole, *Arborimus albipes*; red tree vole, *A. longicaudus*; and sage vole, *Lagarus curtatus* (Whitaker and Maser 1979). The mite found in greatest numbers on all three of these voles was *Androlaelaps fahrenholzi.* Second in number was *Euryparasitus* sp. (not parasitic) on *A. albipes*, and *Glycyphagus hypudaei* on the other two hosts.

[1]The present paper is a partial contribution of the Oregon Coast Ecological Survey, Puget Sound Museum of Natural History, University of Puget Sound, Tacoma, Washington.

TABLE 1. Mites found in the fur of four species of **Microtus** from Oregon.

	Microtus montanus Infested No. mites				**Microtus oregoni** Infested No. mites				**Microtus townsendi** Infested No. mites				**Microtus longicaudus** Infested No. mites			
	No.	%	Total	x	No.	%	Total	x	No.	%	Total	x	No.	%	Total	x
No. examined			98				76				15				28	
Laelapidae																
Androdaelaps fahrenholzi	59	60.2	317	3.23	8	10.5	20	0.26	8	53.3	21	1.40	8	28.6	102	3.64
Eubrachylaelaps debilis	1	1.0	1	0.01					1	6.7	1	0.07				
Eulaelaps stabularis	2	2.0	4	0.04	1	1.3	3	0.04	2	13.3	2	0.13	1	3.6	1	0.04
Haemogamasus occidentalis	5	5.1	40	0.41	12	15.8	55	0.72	5	33.3	6	0.40	2	7.1	5	0.18
H. reidi	7	7.1	11	0.11					9	60.1	28	1.87	7	25.0	9	0.32
Haemogamasus sp. #2					6	7.9	74	0.97	1	6.7	1	0.07				
Echinonyssus isabellinus	18	18.4	85	0.87					2	13.3	4	0.27				
E. obsoletus									2	13.3	6	0.40				
Hypoaspis mites									2	13.3	3	0.20				
Laelaps alaskensis	53	54.1	351	3.58												
L. kochi	60	61.2	252	2.57	23	30.3	134	1.76	2	13.3	13	0.87	20	71.4	102	3.64
Myobiidae																
Radfordia hylandi					1	1.3	1	0.01								
Glycyphagidae																
Dermacarus hylandi	21	1.0	6	0.06												
D. ondatrae					1	1.3	1	0.01								
Glycyphagus hypudaei	7	7.1	65	0.66	1	1.3	3	0.04	1	6.7	1	0.07				
Listrophoridae																
Listrophorus mexicanus	1	1.0	34	0.35	1	1.3	50	0.66	1	6.7	1	0.07				
Others																
Cyrtolaelaps sp.	1	1.0	1	0.01									1	3.6	1	0.04
Eurypariasitus sp.					10	13.2	15	0.20								
Macrocheles	1	1.0	1	0.01					1	6.7	1	0.07				
Procotolaelaps sp.					1	1.3	1	0.01								
Anoetidae					1	1.3	8	0.11								
Cyrtolaelapid									1	6.7	1	0.07				

Materials and Methods

The voles were caught in museum snap traps. Mites were collected by brushing the voles with a fine-bristled toothbrush, then examining them with a 16-power handlens while blowing the fur. Mites found by the latter method were picked off with forceps. This procedure was satisfactory for the larger mites, but was not so effective for the smaller ones. Mites were preserved in 70-percent ethanol, cleared and stained in Nesbitt's solution containing acid fuchsin, and mounted in Hoyer's solution.

Results and Discussion

Data for five species of *Microtus* and two species of *Clethrionomys* are given in tables 1 and 2 and, for coparative purposes, mites that occurred at rates of 10 percent or more on any one species are listed in order of decreasing abundance (Table 3).

The numbers of species that occurred on 10 percent or more of the samples ranged from two to four (Table 3). (*Listrophorus maxicanus* was omitted from consideration because it appeared that it, along with some of the other small mites, was too often overlooked.) Two of the hosts exist under specialized conditions: (1) *Largurus*, which occurs in areas unusually arid for a vole, was one of the voles least commonly infested by mites (only two species of mites occurred on 10 percent or more of the sample), and (2) *Ariborimus longicaudus*, which occurs high in Douglas-fir (*Pseudotsuga menziesii*) trees, yielded mites of only five species, including a myobiid mite, *Radfordia arborimus*, recently described as a result of these studies (Fain and Whitaker 1975). *Lagurus curtatus* harbored mites of 10 species although only 2 were common. Except for *Microtus longicaudus*, which also had 2 species of commonly occurring mites, the other hosts had 3 or 4, and 4 to 18 total species.

Overall, hosts with more numerous species also had a higher proportion of commonly occurring mites. The average total numbers were 8, 8.8, and 12.3 species of mites on hosts with 2 ($n=2$), 3 ($n=4$), and 4 ($n=4$) commonly occurring mites.

Androlaelaps fahrenholzi was the most abundant parasite on three of the hosts; *Laelaps kochi* on three; and *Haemogamasus reidi*, *H. occidentalis*, *Echinonyssus isabillinus*, and *Haemogamasus* sp. #2 each one one (Table 3).

Androdaelaps fahrenholzi is a widely distributed, abundant species and is found on a wider range of hosts than is any other parasitic mite in North America (Whitaker and Wilson 1974). It may, however, represent a complex of species. *Androlaelaps fahrenholzi* was the only mite found on all 10 voles considered here (Table 3), and occurred at rates greater than 10 percent on voles of all the 10 species considered, ranging from 10.5 percent on *Microtus oregoni* to 88.2 percent on *Arborimus longicaudus*. It was the most common mite on three species of voles, including *Arborimus longicaudus*, *A. albipes*, and *Lagaurus curtatus* (the mean number per host also was high on both species of *Arborimus*; 15.55 and 28.9). *Androlaelaps fahrenholzi* was the second most abundant mite on four hosts—three species of *Microtus* and *Clethrionomys californicus*; fourth most abundant on *Microtus oregoni*, but third on *Clethrionomys gapperi* and *M. richardsoni*. Mean numbers per host ranged from 0.26 on *M. oregoni* to 28.9 on *A. longicaudus*.

Haemogamasus ambulans was previously reported from *Microtus longicaudus* by Whitaker and Maser (1979) and from *Sorex yaquinae* by Whitaker *et al.* (1980). The specimens involved all appeared to be the species of *Haemogamasus* reported here

TABLE 2. Mites found in the fur of **Microtus richardsoni** and two species of **Clethrionomys** from Oregon.

	Clethrionomys californicus				**Clethrionomys gapperi**				**Microtus richardsoni**			
	Infested		No. mites		Infested		No. mites		Infested		No. mites	
	No.	%	Total	x	No.	%	Total	x	No.	%	Total	x
No. examined			94				8				9	
Laelapidae												
Androlaelaps fahrenholzi	20	21.3	184	1.96	3	37.5	7	0.88	2	22.2	3	0.33
Echinonyssus isabellinus	3	3.2	4	0.04	6	75.0	19	2.38	1	11.1	20	2.22
E. obsoletus	1	1.1	1	0.01								
Eulaelaps stabularis	7	7.4	8	0.09								
Haemogamasus occidentalis	3	9.6	12	0.13					4	44.4	33	3.67
H. reidi	9	9.6	12	0.13	5	62.5	9	1.13	1	11.1	2	0.22
Haemogamasus sp. #2	21	22.4	89	0.95								
Laelaps Alaskensis									4	44.4	16	1.78
Myobiidae												
Protomyobis brevisetosa	1	1.1	1	0.01								
Mycoptidae												
Myocoptes japonensis	1	1.1	1	0.01					1	11.1	1	0.11
Glycyphagidae												
Glycyphagus hypudaei	10	10.6	121	1.29	1	12.5	1	0.13	1	11.1	1	0.11
Listrophoridae												
Listrophorus mexicanus	1	1.1	80	0.85					2	22.2	28	3.11
Others												
Cyrtolaelaps sp.	3	3.2	3	0.03								
Euryparasitus sp.	27	28.7	45	0.48					1	11.1	1	0.11
Macrochelidae	1	1.1	1	0.01								
Bakerdania sp.	1	1.1	7	0.07					2	22.2	2	0.22
Pygmephorus designatus	1	1.1	3	0.03								

as *Haemogamasus* sp. #2. *Haemogamasus ambulans* apparently has not been found in Oregon.

The three species of *Haemogamasus* exhibited much variation in numbers among the 10 voles. *Haemogamasus* sp. #2 was not taken on six of the hosts; had a low prevalence (less than 10 percent infestation) on two, and occurred commonly on only two, *Clethrionomys californicus* and *Arborimus albipes*. *Haemogamasus occidentalis*, a common parasite of western small mammals, occurred on six of the hosts. It was not the predominant mite on any, but was the second most common on *Microtus richardsoni* and *M. oregoni*. It occurred at a high mean number per individual (3.67) on *M. richardsoni*. *Haemogamasus reidi* was not recorded from three of the host species, occurred at a low rate on three, and was common on *Microtus townsend*, *M. richardsoni*, and *Clethrionomys gapperi*. One vole, *Arborimus longicaudus*, had no *Haemogamasus* at all, whereas *Microtus townsendi* and *M. richardsoni* had two (*H. occidentalis* and *H. reidi* in each case). Three species, *Microtus montanus*, *M. longicaudus*, and *Lagurus curtatus*, had zero, one, or two species of *Haemogamasus*, but none occurred at high rates.

Echinonyssus isabellinus occurred on five of the species, commonly on three, *Microtus montanus*, *M. townsendi*, and *Clethrionomys gapperi*.

Laelaps alaskensis and/or *L. kochi* occurred commonly on five species, all *Microtus*. *Laelaps kochi* was found on all the species of *Microtus* except *M. richardsoni* and only on this genus. It had the highest percentage occurrence in three of the species, but was fourth on *M. townsendi*. The mean number per host was rather high in all cases, ranging from 0.87 in *M. townsendi* to 3.64 in *M. longicaudus*. *Laelaps alaskensis*, often common on voles, was first on *Microtus richardsoni*, and third on *M. montanus* and occurred at high rates (both in percent occurrence and means). This species, however, did not occur on any of the other eight vole species.

The one myobiid included as commonly found was *Radfordia arborimus* (Fain and Whitaker 1975), described as a result of these studies.

Glycyphagus hypudaei was the second most widely occurring species, found on nine of the hosts (none was found on *M. longicaudus*Q. It was the second most commonly occurring species on *Arborimus longicaudus* and on *Lagurus*. It occurred at a frequency of 10 percent or more on six of the hosts: *Clethrionomys californicus*, *C. gapperi*, *Microtus richardsoni*, *Arborimus albipes*, *A. longicaudus*, *and Lagurus curtatus*.

Mites of the genus *Euryparasitus* are not parasitic. Nymphs are common on small mammals, but their relationship to the host is not known. *Euryparasitus* (probably more than one species) occurred on six of the voles, and on more than 10 percent of the individuals of four: *Microtus oregoni*, *Clethrionomys californicus*, *Microtus richardsoni*, and *Arborimus albipes*. It was second in occurrence on *Clethrionomys californicus* and *Arborimus albipes*. At least one species of histiostomatid mite occurred on three of the species and at the 10-percent rate on *Microtus richardsoni* and *Arborimus longicaudus*. Histiostomatids are phoretic in the deutonymphal stage on a variety of animal hosts.

Thus, there was some similarity between the host communities, but by no means can it be said that mites moved freely between hosts. If that were the case, mite communities should be similar. As a means of comparing community structure, mites were listed by decreasing percent occurrence for each host (Table 3). No two host species had the same order of occurrence of mites, nor even the same mites in differing order.

As mentioned before, *Arborimus longicaudus* differs the most ecologically from the

TABLE 3. Mites of the 10 species of voles listed in order of decreasing percent occurrence. For each host species, parasite species listed above the line occurred at frequencies greater than 10 percent. (This table includes mites that occurred at rates of 10 percent or more on any one species.)

Microtus					Clethrionomys		Arborimus		Lagurus
montanus	**longicaudus**	**oregoni**	**townsendi**	**richardsoni**	**gapperi**	**californicus**	**albipes**	**longicaudus**	**curtatus**
kochi	kochi	kochi	reidi	alask	isab	H. sp.	fahr	fahr	fahr
fahr	**fahr**	occid	fahr	occid	reidi	Eury	Eury	hypud	**hypud**
alask	reidi	Eury	**occid**	**fahr**	**fahr**	fahr	H. sp.	anoe	reidi
isab	Eury	**fahr**	isab	reidi	hypud	**hypud**	**hypud**	**Radf**	isab
reidi		H. sp.	kochi	hypud		reidi	occid		Eury
occid		hypud	hypud	Eury		occid			
hypud		anoe	H. sp.	anoe		isab			
n 98	28	76	15	9	8	94	33	17	98
sp. 13	6	13	14	10	4	18	7	5	10
10% 4	2	4	3	3	3	4	3	4	2

Key to abbreviations:

kochi = **Laelaps kochi**
fahr = **Androdaelaps fahrenholzi**
alask = **Laelaps alaskensis**
isab = **Echinonyssus isabellinus**
reidi = **Haemogamasus reidi**
occid = **Haemogamasus occidentalis**
hypud = **Glycyphagus hypudaei**
Eury = **Euryparasistus** sp.
H. sp. = **Haemogamasus** sp. #2
ano = **anoetid** sp.
Radf = **Radfordia arborimus**
n = No. hosts examined
sp. = Total parasite species found
10% = No. parasites occurring at greater than 10% frequency.

other vole species, a separation reflected in the mite community because only five species of mites were taken. The two most widespread mites, *A. fahrenholzi* and *G. hypudaei*, were the only species that occurred in a relatively large percentage of the individuals.

There was a close relationship of mite communities between *Microtus townsendi* and *M. montanus*. Seven species of mites were found on *M. townsendi* and on *M. montanus*; six of them occurred on both, but *Haemogamasus* sp. #2 occurred only on *M. townsendi* and *Laelaps alaskensis* occurred only on *M. montanus*. The close mite community relationship between *M. townsendi* and *M. montanus* is plausible because both species of voles are constrained by runways and inhabit moist to wet areas, and they share wide-ranging mite species that occur on both sides of the Cascade Range. *Haemogamasus* sp. #2, on the other hand, occurs only west of the Cascade crest, as does its host, *M. townsendi*, and *Laelaps alaskensis* occurs from the crest of the Cascade Range eastward, as does its host, *M. montanus* (Maser and Storm 1970).

A second close mite community relationship was that between *Clethrionomys californicus* and *Arborimus albipes*. Five species occurred on *A. albipes*. The same five species occurred on *C. californucus*, plus two additional species: *Haemogamasus reidi* and *Haemogamasus* sp. #2. Both *C. californicus* and *A. albipes* are largely fossorial and share a similar geographical distribution—south of the Columbia River from the crest of the Cascade Range westward. They are, in fact, sympatric in some areas. That *C. californicus* had two additional mite species is not surprising because this vole has a wider latitude of habitats than does *A. albipes* (Maser *et al.* 1981).

Microtus oregoni and *M. richardsoni* also showed community similarities. Each had seven mites species, five shared. *M. oregoni* is largely fossorial and is not closely tied to aboveground runway systems. *M. richardsoni*, on the other hand, is primarily a semi-aquatic stream dweller of the high Cascades (above 6,000 ft.), and is more rigidly governed by its aboveground runways. These voles are sympatric, however, in some lower elevation areas along the western flank of the Cascades (Maser and Storm 1970).

Clethrionomys gapperi showed similarities with *Lagurus curtatus*. *Clethrionomys gapperi* harbored four species of mites. These four and one additional species were found on *L. curtatus*. Both *C. gapperi* and *L. curtatus* occur east at the Cascade Range and are narrowly allopatric in portions of the Blue Mountains of northeastern Oregon.

The *Microtus longicaudus* mite community differed considerably from other *Microtus* communities. *Microtus longicaudus*, in Oregon, consists of four clearly defined subspecies that essentially represent four different geographical areas (Hall 1981, Maser and Storm 1970). The subspecies, *abditus*, occurs only in northwestern Oregon, west of the Cascade Range. *Microtus longicaudus angusticeps* extends from northwestern California northward into southwestern Oregon, but only along the coast. *Microtus longicaudus* (= *M. longicaudus mordax*) occurs east of the Cascade Mountains, throughout the rangelands of central and southeastern Oregon. Of the four subspecies, *abditus* occupies the wettest areas—primarily riparian areas—and is not dependent on runways. The subspecies, *angusticeps*, inhabits grassy areas and is dependent on aboveground runways. *Microtus longicaudus halli* is essentially a species of grassy riparian areas within the coniferous forest and may or may not be dependent on aboveground runways. The subspecies, *longicaudus* (=*mordax*), occurs from riparian areas in ponderosa pine, *Pinus ponderosa*, forests into dry sagebrush, *Artemisia* spp., regions. This subspecies is not constrained by runways. The mites from *M. longicaudus* came from different subspecies

from widely scattered localities within Oregon which, when coupled with the small sample size (28), may account for lack of similarity with other *Microtus* communities.

Finally, *Arborimus longicaudus* is not only the most specialized vole within the state but also the most widely removed from the other voles (Johnson 1973). The latter is true because it is the only vole that is almost strictly arboreal (Maser *et al.* 1981). Even its cogener, *A. albipes*, is primarily terrestrial (Johnson and Maser 1982, Voth *et al.* 1983). Thus it is not surprising that this community is quite different from others.

The most similar communities were not of the taxonomically most closely related forms. The *Microtus longicaudus* community differed considerably from the other *Microtus* communities. The two species of *Clethrionomys* shared only one major mite species. Mites of *C. californicus* were similar to those of *A. albipes*. The second species of *Arborimus*, *A. longicaudus*, was the most ecologically isolated species of all. This analysis indicates a rather low degree of similarity between these voles' parasite communities, and also relatively little similarity between taxonomically related forms.

Parasitic or phoretic species not previously reported from Oregon are *Hypoaspis miles*, *Dermacarus ondatrae*, and *Myocoptes japonensis*.

New parasitic or phoretic host records are: *Eubrachylaelaps debilis*, *Haemogamasus occidentalis*, *Glycyphagus hypudaei*, *Dermacarus hylandi* (?), and *Listrophorus mexicanus* on *Microtus montanus*; all the records from *Microtus oregoni*, except *A. fahrenholzi*; all records from *Microtus townsendi*, except *Haemogamasus*; *Eulaelaps stablularis* on *Microtus longicaudus*; *Androlaelaps fahrenholzi*, *Haemogamasus occidentalis*, *H. reidi*, *Mycoytes japonensis*, *Glycyphagus hypudaei*, and *Listrophorus mexicanus* from *Microtus richardsoni*; and all records from *Clethrionomys californicus*, except *Echinonyssus obsoletus*.

Although some sense can be made from our analysis of the mite community relationships from the 10 species of voles that we examined, there are some apparent problems with the interpretation of such data. Larger host sample sizes are necessary, particularly in an area as diverse as Oregon because the hosts were collected throughout the State. The communities should be analyzed on the basis of host subspecies, georgraphic distribution, habitat affinities, and physiographic provinces (Franklin and Dyrness 1973, Maser and Storm 1970).

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