

Ectoparasites of *Neotoma cinerea* and *N. fuscipes* from Western Oregon

Abstract

Ectoparasite communities of *Neotoma cinerea* and *N. fuscipes* from western Oregon were described. Mites and fleas occurring on the two hosts were similar whereas the tick and louse communities differed. *Orchopeas sexdentatus*, *Aplodontopus* sp., *Androlaelaps fahrenheitzi*, and *Haemogamasus reidi* were major associates on both hosts. Other important species included *Neohaematopinus inornatus*, *Echinonyssus neotomae*, *Miyatrombicula cynos*, *Neotrombicula cavicola*, and *Euschoengastia oregonensis* on *N. cinerea* and *Myocoptes neotomae* and *Euschoengastia pomerantzi* on *N. fuscipes*.

Introduction

There has been much information published on the ectoparasites of Oregon mammals. Whitaker and Maser (1985) have recently summarized their data on the ectoparasitic and phoretic mites (excluding chiggers) known from Oregon, and information on mites and other parasitic groups has been presented by Hansen (1964), Easton and Goulding (1974), Easton (1975, 1983), Lewis and Maser (1978), Gresbrink and Hopkins (1982), Emerson *et al.* (1984), and Hopkins (1985).

Ectoparasites of the woodrats (*Neotoma* spp.) occurring in the state, however, have not been examined in detail. Whitaker and Maser (1985) reported the occurrence of various laelapid mites on Oregon woodrats, Hubbard (1947) summarized information on their fleas, and Walters and Roth (1950) reported on the invertebrate nest associates of *N. fuscipes* in Oregon. Information on their chiggers and smaller mites is scarce or lacking entirely.

The purpose of this paper is to present information on the ectoparasites of the bushy-tailed woodrat (*Neotoma cinerea*) and the dusky-footed woodrat (*N. fuscipes*) from western Oregon. A third species, occurring only in southeastern Oregon, *N. lepida*, was not examined.

Study Area and Methods

All woodrats were collected from May to October 1984 in the western Cascades province of western Oregon as defined by Franklin and Dyrness (1973). Bushy-tailed woodrats were collected on

talus, rock outcrops, and under bridges in the western hemlock (*Tsuga heterophylla*) zone (Franklin and Dyrness 1973) in the vicinity of H. J. Andrews Experimental Forest in Lane and Linn Counties. This area is characterized by a mature Douglas fir (*Pseudotsuga menziesii*) overstory, Pacific rhododendron (*Rhododendron macrophyllum*)-vine maple (*Acer circinatum*) understory, and salal (*Gaultheria shallon*)-Oregon grape (*Berberis nervosa*) ground cover. Dusky-footed woodrats were collected at their stick houses near Tiller, Douglas County. This area lies within the mixed conifer zone (Franklin and Dyrness 1973) and is characterized by a Douglas fir overstory, Pacific madrone (*Arbutus menziesii*) understory, and Pacific poison oak (*Rhus diversiloba*) ground cover.

Ectoparasites were removed from the fur with the aid of a dissecting microscope, a fine probe, and forceps. Follicular mites and other imbedded forms were forced from the skin with fine forceps. After manual inspection, animals were processed with a washing technique (Whitaker 1982) to collect any additional parasites. All ectoparasites were preserved in 70 percent ethanol, cleared and stained in Nesbitt's solution, and mounted in Hoyer's solution for later identification.

Results and Discussion

At least 44 ectoparasitic and phoretic species were found on Oregon woodrats (Table 1). Mites were best represented with 32 species, followed by fleas (6 species), ticks (5 species), and lice (1 species). Although fewer *Neotoma cinerea* were examined (N = 30 vs 35), this species harbored

¹Present address: Life Science Department, Chemeketa Community College, Salem, Oregon 97309

TABLE 1. Ectoparasites of the woodrats, *Neotoma cinerea* and *N. fuscipes*, from western Oregon

	<i>Neotoma cinerea</i> (N = 30)				<i>Neotoma fuscipes</i> (N = 35)			
	Occurrence No.	%	Number Total	Av.	Occurrence No.	%	Number Total	Av.
Siphonaptera								
<i>Anomopsyllus falsicalifornicus congruens</i>					3	9	6	0.2
<i>Atyphloceras multidentatus multidentatus</i>	4	13	6	0.2	2	6	2	0.1
<i>Ceratophyllus (Amonopsyllus) ciliatus protinus</i>	1	3	1	<0.1				
<i>Megarthroglossus procus procus</i>	2	7	7	0.2	4	11	5	0.1
<i>Orchopeas sexdentatus cascadenis</i>	28	93	240	8.0	32	91	207	5.9
<i>Rhadinopsylla (Micropsylla) sectilis goodi</i>	1	3	1	<0.1				
Anoplura								
<i>Neohaematopinus inornatus</i>	8	27	159	5.3				
Acarina								
Ixodidae								
<i>Dermacentor occidentalis</i>	3	10	4	0.1	11	31	66	1.9
<i>Ixodes angustus</i>	8	27	10	0.3				
<i>I. ochotonae</i>	1	3	1	<0.1				
<i>I. pacificus</i>	4	13	10	0.3	1	3	1	<0.1
<i>I. spinipalpis</i>					7	20	28	0.8
Acaridae								
<i>Tyrophagus</i> sp.					1	3	1	<0.1
Anoetidae								
anoetid (?)	1	3	120	4.0				
Ascidae								
<i>Proctolaelaps</i> sp.	1	3	2	0.1	2	6	5	0.1
Cheyletidae								
<i>Cheyletus</i> sp.	3	10	3	0.1				
<i>Eucheyletia bishoppi</i>	3	10	9	0.3				
Chortoglyphidae								
<i>Aplodontopus</i> sp.	12	40	5076	169.2	35	100	28647	818.5
Cyrtolaelapidae								
<i>Cyrtolaelaps</i> sp.	1	3	9	0.3				
<i>Euryparasitus</i> sp.	1	3	2	0.1	1	3	1	<0.1
Glycyphagidae								
<i>Dermacarus spermophilus</i>	2	7	4	0.1	7	20	41	1.2
<i>Xenoryctes</i> sp. near <i>nudus</i>					2	6	11	0.3
Laelapidae								
<i>Androlaelaps casalis</i>	1	3	1	<0.1				
<i>A. fahrenheitsi</i>	17	57	87	2.9	12	34	57	1.6
<i>Echinonyssus neotomae</i>	11	37	152	5.1				
<i>E. obsoletus</i>	1	3	1	<0.1				
<i>E. utahensis</i>	2	7	9	0.3				
<i>Eulaelaps stabularis</i>					1	3	1	<0.1
<i>Haemogamasus reidi</i>	11	37	85	2.8	14	40	91	2.6
<i>Hypoaspis lubrica</i>	3	10	5	0.2	1	3	4	0.1
Myobiidae								
<i>Radfordia neotomae</i>	6	20	73	2.4	7	20	20	0.6
Myocoptidae								
<i>Myocoptes neotomae</i>	2	7	11	0.4	17	49	119	3.4
Pygmephoridae								
<i>Bakerdania</i> sp.	1	3	10	0.3	2	6	2	0.1
<i>Pygmephorus whitakeri</i>	1	3	1	<0.1				
Trombiculidae								
<i>Chatia setosa</i>	8	27	16	0.5	1	3	1	<0.1
<i>Comatacarus americana</i>					2	6	3	0.1
<i>Euschoengastia oregonensis</i>	14	47	88	2.9				
<i>E. peromysci</i>	7	23	55	1.8	6	17	22	0.6
<i>E. pomerantzi</i>	4	13	31	1.0	10	29	165	4.7
<i>E. simulans</i>					5	14	15	0.4
<i>Miyatrombicula cynos</i>	2	7	305	10.2				
<i>Neotrombicula cavicola</i>	16	53	108	3.6	1	3	3	0.1
<i>N. microti</i>	5	17	37	1.2				

a more diverse ectoparasite community (37 species) than *N. fuscipes* (27 species).

Fleas

Orchopeas sexdentatus cascadiensis was the most abundant flea on both woodrats. The species is the major flea of the entire genus *Neotoma*. The wandering habits of woodrats, their associations with other hosts, and the fact that they spend a significant amount of time in their nests make them susceptible to a wide diversity of fleas, often in great numbers (Hubbard 1947). *Neotoma cinerea* and *N. fuscipes* are host to more than 50 species of fleas throughout their range. Of the fleas recorded in the present study, only *Rhadinopsylla sectilis goodi* and *Ceratophyllus (Amonopsyllus) ciliatus protinus* were not reported by Hubbard (1947) or Easton (1983) for these hosts. *Rhadinopsylla sectilis goodi* is a parasite primarily of deer mice (*Peromyscus maniculatus*) and ground squirrels (*Spermophilus* spp.), while most members of the genus *Ceratophyllus* are parasitic on tree and ground squirrels in western North America (Smit 1983).

Lice

A single species, *Neohaematopinus inornatus*, was quite common on *N. cinerea* and has previously been reported from this host in Oregon (Hansen 1964, Emerson *et al.* 1984). *Neohaematopinus neotomae* has been reported from *N. fuscipes* in California (Linsdale and Tevis 1951) but no lice were found on this host during the present study.

Ticks

The most common ticks were *Ixodes angustus* and *I. pacificus* on *N. cinerea* and *Dermacentor occidentalis* and *Ixodes spinipalpis* on *N. fuscipes*. Easton and Goulding (1974) reported *I. angustus* from both hosts and *I. pacificus* from *N. fuscipes* in western Oregon. The occurrence of *Ixodes ochotonae* is a new record for Oregon although it has previously been reported from California and Washington.

Mites

The most important mites (> 1.0 per host) on *N. cinerea* were, in descending order of abun-

dance, *Aplodontopus* sp., *Miyatrombicula cynos*, *Echinonyssus neotomae*, an anoetid (?), *Neotrombicula cavicola*, *Euschoengastia oregonensis*, *Androlaelaps fahrenheitzi*, *Haemogamasus reidi*, *Radfordia neotomae*, *Euschoengastia peromysci*, *Neotrombicula microti*, and *Euschoengastia pomerantzi*. Major associates of *N. fuscipes* were *Aplodontopus* sp., *Euschoengastia pomerantzi*, *Myocoptes neotomae*, *Haemogamasus reidi*, *Androlaelaps fahrenheitzi*, and *Dermacarus spermophilus*.

State distribution records for Oregon included *Aplodontopus* sp., *Xenoryctes* sp. near *nudus*, *Hypoaspis lubrica*, *Radfordia neotomae*, and *Myocoptes neotomae*. Members of the genus *Aplodontopus* are small elongate mites collected from the hair follicles of the tails of woodrats, some ground squirrels, and the mountain beaver (*Aplodontia rufa*). Those found on woodrats are the deutonymphal stage of a possibly undescribed adult chortoglyphid found only in the nest of the host. Their status is currently under study. *Hypoaspis lubrica* has been reported from a wide variety of hosts throughout the United States (Whitaker and Wilson 1974). *Radfordia neotomae* was originally described from *N. fuscipes* in California (Jameson and Whitaker 1975), but males have not previously been collected or described. *Myocoptes neotomae* has been collected on *N. floridana* in Indiana (Cudmore, in press) and was recently described as a new species from that host (Fain *et al.* 1983). *Xenoryctes* sp. near *nudus* and *Anoetidae* (?) may represent new species and are also under investigation.

Ectoparasites not previously reported for these hosts included *Aplodontopus* sp., *Eucheyletia bishoppi*, *Androlaelaps casalis*, *Echinonyssus obsoletus*, *E. utahensis*, *Radfordia neotomae*, and *Pygmephorus whitakeri* for *N. cinerea*, *Xenoryctes* sp. near *nudus* and *Eulaelaps stabularis* for *N. fuscipes*, and *Dermacarus spermophilus*, *Hypoaspis lubrica*, and *Myocoptes neotomae* for both species. Easton (1975) reported the chiggers, *Miyatrombicula cynos*, *Neotrombicula harperi*, and *N. cavicola* from *N. cinerea* and *Neotrombicula cavicola* from *N. fuscipes* collected in western Oregon.

If incidental forms are eliminated (i.e. one or two occurrences on either host), the ectoparasite communities of these two hosts are quite similar: 17 species in common, 6 unique to *N. cinerea*, and 3 unique to *N. fuscipes*. *Aplodontopus* sp.,

Myocoptes neotomae, and *Radfordia neotomae* are restricted to the genus *Neotoma* and were found on both hosts.

Most notable among the differences between the ectoparasite communities of these two hosts were the presence of 1) three species of *Echinonyssus* on *N. cinerea*, none on *N. fuscipes*; 2) *Ixodes angustus* only on *N. cinerea*, *I. spinipalpis* only on *N. fuscipes*; 3) *Neohaematopinus inornatus* only on *N. cinerea*; and 4) *Euschoengastia oregonensis* and *Neotrombicula microti* only on *N. cinerea*, *Euschoengastia simulans* and *Comatacarus americana* only on *N. fuscipes*.

In Oregon, *N. fuscipes* occurs in the Willamette Valley north to the Columbia River and throughout much of southwestern Oregon, whereas *N. cinerea* is nearly ubiquitous. Although their ranges overlap extensively in southwestern Oregon, *N. cinerea* is most closely associated with northern conifer forest types (especially in rocky habitat), whereas *N. fuscipes* is most closely associated with southern brushy chaparral vegetation types (Maser *et al.* 1981). Some differences in the ectoparasite communities of these two hosts may, therefore, be the result of differences in habitat rather than host preference of the parasites. This may be particularly true for some chiggers which are often described as habitat specific rather than host specific.

The taxonomic affinities of *N. cinerea* and *N. fuscipes* are not clear. Earlier authors (Mer-

riam 1894, Goldman 1910) believed these two species to be widely divergent and placed them in separate subgenera. Burt and Barkalow (1942) also supported separation at the subgeneric level based on bacular differences. A more recent investigation however (Carleton 1980), suggested that *N. fuscipes* and *N. cinerea* share a common ancestry and may be more closely related than previously believed. Ectoparasite community similarities would seem to support this contention; however, comparable data are lacking for most other *Neotoma* species.

Acknowledgments

I acknowledge the help provided by the following individuals who identified or confirmed identifications of woodrat associates: R. E. Lewis, Department of Entomology, Iowa State University, Ames (fleas); N. Wilson, Department of Biology, University of Northern Iowa, Cedar Falls (ticks), and W. J. Wrenn, Department of Biology, University of North Dakota, Grand Forks (chiggers). J. O. Whitaker, Jr. reviewed the manuscript and confirmed identifications of most mites. F. F. Gilbert and C. Maser critically read and improved the manuscript. Funding for this study was provided by U.S. Forest Service contract #PNW-83-32 awarded to F. F. Gilbert, Wildlife Biology, Washington State University, Pullman. This paper is Old Growth Wildlife Habitat Program Contribution No. 47.

Literature Cited

- Burt, W. H., and F. S. Barkalow, Jr. 1942. A comparative study of the bacula of woodrats (subfamily Neotominae). *J. Mamm.* 23:287-297.
- Carleton, M. D. 1980. Phylogenetic relationships in Neotomine-Peromyscine rodents (Muroidea) and a reappraisal of the dichotomy within New World Crincetinae. *Misc. Publ. Mus. Zool. University of Michigan* 157:1-146.
- Cudmore, W. W. In press. Nest associates and ectoparasites of the eastern woodrat, *Neotoma floridana*, in Indiana. *Can. J. Zool.*
- Easton, E. R. 1975. Ectoparasites in two diverse habitats in western Oregon. II. Chiggers (Acari: Trombiculidae). *J. Med. Ent.* 12:295-298.
- . 1983. Ectoparasites in two diverse habitats in western Oregon III. Interrelationships of fleas (Siphonaptera) and their hosts. *J. Med. Ent.* 20:216-219.
- Easton, E. R., and R. L. Goulding. 1974. Ectoparasites in two diverse habitats in western Oregon. I. *Ixodes* (Acarina: Ixodidae). *J. Med. Ent.* 11:413-418.
- Emerson, K. C., C. Maser, and J. O. Whitaker, Jr. 1984. Lice (Mallophaga and Anoplura) from mammals of Oregon. *Northw. Sci.* 58:153-161.
- Fain, A., F. S. Lukoschus, W. W. Cudmore, and J. O. Whitaker, Jr. 1983. Two new Myocoptidae (Acari, Astigmata) from North American rodents. *J. Parasitol.* 70:126-130.
- Franklin, J. F., and C. T. Dyness. 1973. Natural vegetation of Oregon and Washington. U.S.D.A. For. Ser. Gen. Tech. Rep. PNW-8. Pac. Northwest For. and Range Exp. Stn., Portland, Oregon.
- Goldman, E. A. 1910. Revision of the woodrats of the genus *Neotoma*. *N. Amer. Fauna* 31:1-124.
- Gresbrink, R. A., and D. D. Hopkins. 1982. Siphonaptera: Host records from Crater Lake National Park, Oregon. *Northw. Sci.* 56:176-179.
- Hansen, C. G. 1964. Ectoparasites of mammals from Oregon. *Great Basin Nat.* 24:75-81.

- Hopkins, D. D. 1985. Host associations of Siphonaptera from central Oregon. *Northw. Sci.* 59:108-114.
- Hubbard, C. A. 1947. Fleas of western North America. The Iowa State College Press, Ames.
- Jameson, E. W., Jr., and J. O. Whitaker, Jr. 1975. Three new species of *Radfordia* (Myobiidae: Acarina) from rodents (Muridae and Cricetidae). *J. Med. Ent.* 12:341-344.
- Lewis, R. E., and C. Maser. 1978. *Phalacroscylla oregonensis* sp. n., with a key to the species of *Phalacroscylla* Rothschild, 1915 (Siphonaptera: Hystrihopsyllidae). *J. Parasitol.* 64:147-150.
- Linsdale, J. M., and L. P. Tevis. 1951. The dusky-footed woodrat. A record of observations made on the Hastings Natural History Reservation in central California. University of California Press, Berkeley and Los Angeles.
- Maser, C., B. R. Mate, J. F. Franklin, and C. T. Dyrness. 1981. Natural history of Oregon coast mammals. U.S.D.A. For. Ser. Gen. Tech. Rep. PNW-133. Pac. Northwest For. and Range Exp. Stn., Portland, Oregon.
- Merriam, C. H. 1894. A new subfamily of murine rodents—the Neotominae—with description of a new genus and species and a synopsis of known forms. *Proc. Acad. Nat. Sci., Philadelphia.* 46:225-252.
- Smit, F. G. A. M. 1983. Key to the genera and subgenera of Ceratophyllidae. In R. Traub, M. Rothschild, and J. F. Haddow. The Rothschild Collection of Fleas. The Ceratophyllidae: Key to the Genera and Host Relationships. Academic Press, New York. Pp. 1-36.
- Walters, R. O., and V. D. Roth. 1950. Faunal nest study of the woodrat, *Neotoma fuscipes*. *J. Mamm.* 31:290-292.
- Whitaker, J. O., Jr. 1982. Ectoparasites of mammals of Indiana. *Ind. Acad. Sci. Monogr.* No. 4.
- Whitaker, J. O., Jr., and C. Maser. 1985. Mites (excluding chiggers) of mammals of Oregon. *Great Basin Nat.* 45:67-76.
- Whitaker, J. O., Jr., and N. Wilson. 1974. Host and distribution lists of mites (Acari), parasitic and phoretic, in the hair of wild mammals of North America, north of Mexico. *Am. Midl. Nat.* 91:1-67.

Received 9 August 1985

Accepted for publication 8 September 1985