



Brigham Young University Science Bulletin, Biological Series

Volume 12 | Number 1

Article 1

10-1970

Mites and lice of the National Reactor Testing Station

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Recommended Citation

Allred, Dorald M. (1970) "Mites and lice of the National Reactor Testing Station," *Brigham Young University Science Bulletin, Biological Series*: Vol. 12 : No. 1 , Article 1.

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**MITES AND LICE OF THE
NATIONAL REACTOR TESTING STATION**

by

Dorald M. Allred



BIOLOGICAL SERIES—VOLUME XII, NUMBER 1

OCTOBER 1970

BRIGHAM YOUNG UNIVERSITY SCIENCE BULLETIN
BIOLOGICAL SERIES

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MITES AND LICE OF THE NATIONAL REACTOR TESTING STATION¹

Dorald M. Allred*

INTRODUCTION

This is the fourth in a series of reports on arthropods of the National Reactor Testing Station in Idaho (Allred, 1968 a & b, 1969). A fifth paper by Atwood (1970) deals with the plants of the sites where the arthropods were studied. The initial publication of the series (Allred, 1968a) discusses the location and physical characteristics of the NRTS, the study areas and procedures, and lists the kinds of vertebrates examined. The reader is referred to that report for details not included herein.

The National Reactor Testing Station is situated approximately 30 miles west of Idaho Falls in southeastern Idaho. The central and southern parts are typified by basalt flows which are exposed in some areas. The northern section is primarily lake and eolian deposits, and exposed basalt flows are less evident. Annual precipitation averages less than 10 inches, and the vegetation is characteristic of the cool, northern desert, shrub-type biome. Twelve principal study sites established on the basis of their predominant vegetation were studied periodically: (1) *Chrysothamnus-Artemisia*-grasses; (2) *Artemisia-Chrysothamnus*-grasses; (3) *Elymus*; (4) *Oryzopsis-*

Stipa; (5) *Juniperus*; (6) *Chrysothamnus-Tetradymia-Artemisia*; (7) *Chrysothamnus-Artemisia-Eurotia*; (8) *Artemisia-Atriplex*; (9) *Chenopodium-Eurotia*; (10) *Artemisia-Opuntia*; (11) *Chrysothamnus-grasses-Tetradymia*; (12) *Juniperus-Chrysothamnus-Eurotia-Artemisia*. Twenty-eight other sites similar to the major ones but with minor variations of plant associations occupying smaller geographic areas were studied less frequently.

Most of the mammals were captured with live-catch or break-back traps. Rabbits, carnivores, and birds were shot, and reptiles were captured by hand or in can pit-traps. Ectoparasites were retrieved from their hosts by the cooling and warming method described by Allred (1968a).

Financial support for these studies was provided by U.S. Atomic Energy Commission Contract AT(11-1)-1559 with Brigham Young University. Logistics (in part) were provided through the AEC Operations Office at Idaho Falls, Idaho. The chigger mites and many of the mesostigmatids were identified by Mr. Morris Goates, and the lice by Dr. W. L. Jellison.

PARASITE-HOST ASSOCIATIONS

Entries in the listings below may be interpreted by using the first two lines of the listing of mite-host associations as an example (each specific entry is indicated in boldface type):

Androlaelaps leviculus (Mar-Aug) 13 dny 1 ♂ 17 ♀:
Androlaelaps leviculus = the species of parasite collected.
(Mar-Aug) = the inclusive period of time when the parasites were found.
13 dny 1 ♂ 17 ♀ = the total number of parasites of each developmental stage and sex that were collected (la = larva, pny = protonymph, dny = deuto-

nymph, im = immature, ♂ = adult male, ♀ = adult female).

Dipodomys ordii 2 (808) 1.5 - ♀: Jun Jul:

Dipodomys ordii = a specific host on which parasites of the species listed above it were found.

2 = number of hosts infested with parasites of that particular species.

(808) = total number of hosts examined.

1.5 = the parasite-host index (total number of parasites of that

¹BYU-AEC Report No. C00-1559-5.

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species found on that particular host, divided by the number of hosts of the species infested with those parasites).

♀ = the specific stage of development and/or sex of parasite found on that host.

Jun Jul = the specific months when these parasites were found on that host.

Asterisks preceding the names of the hosts indicate that of all of those listed, they are the ones most commonly infested. Except where indicated otherwise, the hosts are mammals.

Mite-Host Associations

Androlaelaps leviculus (Mar-Aug) 13 dny 1 ♂ 17 ♀
Dipodomys ordii 2 (808) 1.5 - ♀: Jun Jul
Eutamias minimus 1 (398) 1.0 - ♀: Aug
 * *Onychomys leucogaster* 2 (63) - 4.5 - dny ♀: Mar Aug
 * *Peromyscus maniculatus* 7 (1866) 2.6 - dny ♂ ♀: Mar June-Aug

Androlaelaps sp. (Jul-Sep) 3 dny 1 ♂ 7 ♀
Dipodomys ordii 3 (808) 1.0 - ♀: Jul-Aug
Onychomys leucogaster 1 (63) 4.0 - dny ♀: Aug
Perognathus parvus 1 (434) 1.0 - ♂: Aug
Peromyscus maniculatus 2 (1866) 1.5 - ♀: Aug Sep

Bernia marita (Aug-Nov) 2 la
Eremophila alpestris (bird) 1 (84) 1.0: Nov
Peromyscus maniculatus 1 (1866) 1.0: Aug

Brevisterna sp. (Aug) 2 dny
Neotoma cinerea 1 (14) 2.0

Chatia ochotona (Aug-Oct) 21 la
Neotoma cinerea 1 (14) 7.0: Aug
Plecotus townsendii 1 (78) 14.0: Oct

Dermanyssus gallinae (Feb-Jun) 1 ♂ 14 ♀
Asyndesmus lewis (bird) 1 (2) 1.0 - ♀: May
Dendrocopos villosus (bird) 1 (1) 4.0 - ♀: Jun
 * *Eremophila alpestris* (bird) 5 (84) 1.6 - ♂ ♀: Feb Apr
Turdus migratorius (bird) 1 (11) 1.0 - ♀: Jun

Dermanyssus sp. (Apr-Jun) 2 pny 2 ♀ 1 ?
Eremophila alpestris (bird) 3 (84) 1.0 - pny ♀: Apr
Piranga ludoviciana (bird) 1 (16) 1.0 - ? : Jun
Dipodomys ordii 1 (808) 1.0 - ♀: Apr

Eubrachyla elaps circularis (Mar-Jun) 4 ♀
Peromyscus maniculatus 3 (1866) 1.3: Mar Jun

Eubrachyla elaps crowei (Mar-Oct) 202 ♀
Dipodomys ordii 2 (808) .5: Sep
 * *Onychomys leucogaster* 22 (63) 8.8: Mar Jun-Aug Oct
Peromyscus maniculatus 5 (1866) 1.6: Mar Aug Oct

Eubrachyla elaps debilis (Jan-Dec) 1 pny 12 dny 1 ♂ 998 ♀
Crotalus viridis (snake) 1 (95) 1.0 - ♀: Jun
Centrocercus urophasianus (bird) 1 (18) 1.0 - ♀: Feb
Dipodomys ordii 1 (808) 5.0 - ♀: Mar Jul Aug
Onychomys leucogaster 3 (63) 5.3 - ♀: Mar
Perognathus parvus 5 (474) 1.2 - ♀: May Jun Sep
 * *Peromyscus maniculatus* 222 (1866) 4.6 - pny dny ♂ ♀: Jan-Sep Nov Dec

Eubrachyla elaps sp. (Feb-Nov) 1 pny 10 dny
Dipodomys ordii 1 (808) 1.0 - dny: Apr
Peromyscus maniculatus 1 (1866) 9.0 - dny: Feb May Jun Nov ? host - pny: Jul

Euschoengastia cordiremus (Jul-Oct) 19 la
Dipodomys ordii 1 (808) 7.0: Jul Aug
Peromyscus maniculatus 2 (1866) 6.0: Oct

Euschoengastia criceticola (Oct) 1 la
Peromyscus maniculatus 1 (1866) 1.0

Euschoengastia decipiens (Mar-Dec) 488 la
Zonotrichia leucophrys (bird) 1 (33) 3.0: Sep
 * *Dipodomys ordii* 13 (808) 7.0: Mar-May Jul Aug Oct
Eutamias minimus 4 (398) 2.8: Oct
 * *Lepus californicus* 2 (125) 11.0: Dec
Neotoma cinerea 1 (14) 3.0: Sep
 * *Perognathus parvus* 12 (474) 13.6: May Aug-Oct
 * *Peromyscus maniculatus* 14 (1866) 5.9: Apr May Jul-Nov
Sylvilagus idahoensis 1 (13) 56.0: Nov
 * *Sylvilagus nuttallii* 3 (28) 14.0: Oct-Dec
Thomomys talpoides 1 (8) 15.0: Sep

Euschoengastia fasolla (Oct) 8 la
Eutamias minimus 2 (398) 4.0

Euschoengastia lancei (Jul) 8 la
Peromyscus maniculatus 1 (1866) 8.0

Euschoengastia luteodema (Dec) 5 la
Lepus californicus 1 (125) 5.0

- Euschoengastia oregonensis* (Jul) 11 1a
Salpinctes obsoletus (bird) 1 (17) 11.0
- Euschoengastia pomerantzi* (Oct) 1 1a
Eutamias minimus 1 (398) 1.0
- Euschoengastia radfordi* (Apr-Dec) 80 1a
 * *Amphispiza belli* (bird) 4 (38) 2.3: Apr
Centrocercus urophasianus (bird) 1 (18) 4.0: Nov
Chordeiles minor (bird) 1 (5) 2.0: Aug
Eremophila alpestris (bird) 2 (84) 2.5: Apr Nov
Junco oreganus (bird) 1 (30) 11.0: Oct
Lanius ludovicianus (bird) 1 (20) 1.0: Apr
Leucosticte tephrocotis (bird) 1 (25) 3.0: Nov
Dipodomys ordii 1 (808) 5.0: Oct
 * *Lepus californicus* 5 (125) 4.6: Dec
Perognathus parvus 1 (474) 1.0: May
Peromyscus maniculatus 1 (1866) 6.0: Aug
Sylvilagus nuttallii 2 (28) 3.0: Oct Dec
- Euschoengastia sciuricola* (May-Oct) 7 1a
Eutamias minimus 2 (398) 2.0: Oct
Marmota flaviventris 1 (6) 3.0: May
- Euschoengastia* sp. (Aug-Oct) 19 1a
Dipodomys ordii 3 (808) 1.0: Aug Oct
Microtus montanus 1 (25) 8.0: Aug
Perognathus parvus 2 (474) 2.5: Aug
Peromyscus maniculatus 2 (1866) 1.5: Sep Oct
- Haemogamasus ambulans* (Mar-Oct) 8 dny 1 ♂ 80 ♀
 * *Dipodomys ordii* 10 (808) 1.4 - ♀: Jun Jul
Eutamias minimus 1 (398) 1.0 - dny: Mar
 * *Onychomys leucogaster* 6 (63) 5.7 - dny ♂ ♀: Jun-Aug Oct
Perognathus parvus 2 (474) 1.0 - ♀: Jun Aug
 * *Peromyscus maniculatus* 31 (1866) 1.2 - ♀: Mar Jun-Aug Oct
Reithrodontomys megalotis 1 (39) 1.0 - ♀: Aug
Thomomys talpoides 1 (8) 1.0 - dny ♀: ?
- Haemogamasus longitarsus* (Jun) 7 ♀
 * *Onychomys leucogaster* 3 (63) 1.0
Peromyscus maniculatus 4 (1866) 1.0
- Haemolaelaps casalis* (Jun-Oct) 1 ♀ 1 ?
Perognathus parvus 1 (474) 1.0: Oct
Peromyscus maniculatus 1 (1866) 1.0: Jun
- Haemolaelaps glasgowi* (Jan-Nov) 26 pny 64 dny 57 ♂ 1062 ♀
Eremophila alpestris (bird) 1 (84) 1.0 - ♀: Mar
 * *Dipodomys ordii* 72 (808) 2.1 - pny dny ♂ ♀: Mar-Aug Oct Nov
 * *Eutamias minimus* 24 (398) 4.9 - pny ♀: Mar Jun-Oct
- Microtus montanus* 7 (25) .1 - ♂ ♀: Jan Jun-Aug Nov
 * *Onychomys leucogaster* 36 (63) 5.4 - pny dny ♂ ♀: Mar Apr Jun-Oct
 * *Perognathus parvus* 33 (474) 2.8 - pny dny ♂ ♀: Apr-Oct
 * *Peromyscus maniculatus* 281 (1866) 2.1 - pny dny ♂ ♀: Jan-Nov
Plecotus townsendii 1 (78) 5.0 - ♀: Apr
Reithrodontomys megalotis 1 (39) 1.0 - ♀: Aug
Spermophilus townsendii 9 (60) .3 - ♀: Apr-Jul
Thomomys talpoides 1 (8) 1.0 - ♀: Jun
- Haemolaelaps* sp. (Mar-Jun) 1 pny 1 ♂
Dipodomys ordii 1 (808) 1.0 - ♂: Mar
Peromyscus maniculatus 1 (1866) 1.0 - pny: Jul
- Hirstionyssus bisetosus* (Sep) 2 ♀
Neotoma cinerea 1 (14) 2.0
- Hirstionyssus hilli* (Mar-Aug) 17 ♀
Eutamias minimus 1 (398) 1.0: Jul
Onychomys leucogaster 1 (63) 1.0: Mar Jun
 * *Perognathus parvus* 5 (474) 2.6: May Jul Aug
Peromyscus maniculatus 2 (1866) 1.0: Jul Aug
- Hirstionyssus incomptus* (Mar-Nov) 91 ♀
 * *Dipodomys ordii* 37 (808) 21.0: Mar Jun-Oct
Eutamias minimus 1 (398) 1.0: Jun
Perognathus parvus 2 (474) 2.0: Jun Jul
Peromyscus maniculatus 6 (1866) 1.2: Jun-Aug Nov
- Hirstionyssus isabellinus* (Nov) 1 ♀
Microtus montanus 1 (25) 1.0
- Hirstionyssus longichelae* (Jun-Oct) 6 ♀
Dipodomys ordii 1 (808) 1.0: Jun
Peromyscus maniculatus 1 (1866) 1.0: Jun
 * *Thomomys talpoides* 2 (8) 2.0: Jun Oct
- Hirstionyssus neotomae* (Sep-Oct) 48 ♀
Eutamias minimus 1 (398) 4.0: Oct
Neotoma cinerea 1 (14) 44.0: Sep
- Hirstionyssus thomomys* (Mar-Oct) 7 ♀
Onychomys leucogaster 1 (63) 1.0: Jul
Peromyscus maniculatus 1 (1866) 1.0: Sep
 * *Thomomys talpoides* 3 (8) 1.7: Mar Jun Oct
- Hirstionyssus triacanthus* (Apr-Oct) 185 ♀
Sceloporus graciosus (lizard) 1 (314) 1.0: Sep
Chordeiles minor (bird) 2 (5) 1.5: Aug
Dipodomys ordii 111 (808) 2.4: Apr-Oct
Eutamias minimus 5 (398) 1.0: Jul Oct
Neotoma cinerea 1 (14) 1.0: Sep
Perognathus parvus 2 (474) 2.0: Jun Jul
Peromyscus maniculatus 5 (1866) .8: Jun-Aug
Spermophilus townsendii 2 (60) 1.0: Jun

- Hirstionyssus utahensis* (Mar-Nov) 54 ♀
Dipodomys ordii 2 (808) 1.5: Jun Aug
 * *Eutamias minimus* 9 (398) 2.8: Jul Aug
Onychomys leucogaster 1 (63) 1.0: Jun
Perognathus parvus 5 (474) 1.0: Jun Jul
 * *Peromyscus maniculatus* 74 (1866) .3: Mar Jun-Sep Nov
Spermophilus townsendii 1 (78) 1.0: Jul
- Hirstionyssus* sp. (Mar-Oct) 71 dny 36 ♂ 14 ♀
Dendrocopos villosus (bird) 1 (1) 1.0 - ♂: ?
Dipodomys ordii 18 (808) 2.9 - dny ♂ ♀: Jun-Oct
Eutamias minimus 5 (389) 1.4 - dny ♂: Jun Jul Sep Oct
Microtus montanus 1 (25) 1.0 - dny: ?
Neotoma cinerea 2 (14) 4.0 - dny ♂ ♀: ?
Onychomys leucogaster 1 (63) 1.0 - dny ♀: Mar Apr
Perognathus parvus 6 (474) .7 - dny ♂ ♀: May-Aug
Peromyscus maniculatus 23 (1866) .8 - dny ♂ ♀: Jun-Aug
Thomomys talpoides 3 (8) 4.0 - dny ♂: ?
- Hypoaspis lubrica* (Aug) 1 ♀
Perognathus parvus 1 (474) 1.0
- Ischyropoda armatus* (May-Oct) 3 dny 25 ♂ 186 ♀
Crotalus viridis (snake) 1 (95) 1.0 - ♀: Sep
 * *Dipodomys ordii* 33 (808) 1.1 - ♂ ♀: Jun-Sep
Lepus californicus 1 (125) 1.0 - dny: Oct
Microtus montanus 3 (25) .7 - ♀: Jul Aug
 * *Onychomys leucogaster* 23 (63) 3.0 - dny ♂ ♀: Jun-Oct
 * *Perognathus parvus* 14 (474) 1.0 - ♂ ♀: May-Sep
 * *Peromyscus maniculatus* 61 (1866) 1.3 - dny ♂ ♀: May-Oct
Sorex merriami 1 (9) 7.0 - ♀: Aug
Thomomys talpoides 1 (8) 1.0 - ♀: Oct
- Ischyropoda furmani* (Jan-Aug) 3 ♂ 25 ♀
 * *Dipodomys ordii* 9 (808) 1.2 - ♀: Jun-Aug
Onychomys leucogaster 2 (63) 1.0 - ♀: Aug
Perognathus parvus 5 (474) 2.6 - pny dny ♂ ♀: Jun-Aug
Peromyscus maniculatus 9 (1866) 1.0 - ♂ ♀: Jan Jun-Aug
- Ischyropoda* sp. (Apr-Sep) 5 pny 55 dny 14 ♂ 23 ♀
Dipodomys ordii 7 (808) 2.3 - pny dny ♂ ♀: Jun-Sep
Eutamias minimus 3 (398) 1.0 - dny ♀: Aug Oct
Neotoma cinerea 1 (14) 2.0 - dny ♂ ♀: Jun Aug
Onychomys leucogaster 7 (63) 5.6 - dny ♂ ♀: Jun Aug
Perognathus parvus 5 (474) 2.6 - pny dny ♂ ♀: Jun-Aug
- Peromyscus maniculatus* 15 (1866) 1.4 - pny dny ♂ ♀: Jan Jun-Aug
Sorex merriami 1 (9) 3.0 - dny: Aug
Spermophilus townsendii 1 (60) 1.0 - dny: Apr
- Kleemania* sp. (Apr-Sep) 154 ♀
Chordeiles minor (bird) 1 (5) 1.0: Aug
 * *Dipodomys ordii* 8 (808) 6.5: Jun-Sep
Eutamias minimus 1 (398) 1.0: Jul
Microtus montanus 1 (25) 12.0: Aug
Neotoma cinerea 1 (14) 1.0: Sep
 * *Onychomys leucogaster* 5 (63) 3.8: Jun-Aug
 * *Perognathus parvus* 7 (474) 4.3: Apr Jun-Sep
 * *Peromyscus maniculatus* 32 (1866) 1.2: Jun-Sep
Sorex merriami 1 (9) 1.0: Aug
- Lecuwenhoekia americana* (Jul) 6 1a
Dipodomys ordii 1 (808) 6.0
- Listrophorus* sp. (Mar-Nov) 960
Chordeiles minor (bird) 1 (5) 1.0: Aug
 * *Dipodomys ordii* 53 (808) 18.1: Mar-May Aug-Nov
Peromyscus maniculatus 1 (1866) 2.0: Jun
- Macronyssus unidens* (Feb-Mar) 1 1a 1 pny 1 dny 1 ♂ + others
Plecotus townsendii 35 (78) ?
- Odontacarus linsdalei* (Jul) 6 1a
Dipodomys ordii 1 (808) 6.0
- Odontacarus micheneri* (Jul) 10 1a
Dipodomys ordii 1 (808) 10.0
- Ornithonyssus bacoti* (Oct) 1 ♀
Dipodomys ordii 1 (808) 1.0
- Ornithonyssus sylviarum* (Jul-Sep) 16 ♀
Amphispiza belli (bird) 2 (38) 2.0: Jul
Oreoscoptes montanus (bird) 1 (13) 2.0: Jul
 * *Poocetes gramineus* (bird) 3 (13) 1.3: Jul
Zonotrichia leucophrys (bird) 1 (33) 4.0: Sep
- Radfordia bachai* (Aug) 1 1a
Dipodomys ordii 1 (808) 1.0
- Trombicula arenicola* (Jul-Oct) 325 1a
Dipodomys ordii 26 (808) 12.5
- Trombicula bakeri* (Jul-Aug) 21 1a
Dipodomys ordii 1 (808) 21.0
- Trombicula belkini* (Jul-Aug) 167 1a
Phrynosoma douglassi (lizard) 1 (19) 7.0: Aug
 * *Sceloporus graciosus* (lizard) 19 (314) 8.4: Jul Aug

Trombicula doremi (Jul-Aug) 98 1a

- * *Dipodomys ordii* 24 (808) 3.6: Jul Aug
- Onychomys leucogaster* 1 (63) 1.0: Aug
- Perognathus parvus* 5 (474) 2.0: Aug

Trombicula sp. (Aug-Oct) 12 1a

- Sceloporus graciosus* (lizard) 1 (314) 1.0: Aug
- Dipodomys ordii* 3 (808) 3.0: Aug Oct
- Onychomys leucogaster* 1 (63) 1.0: Aug
- Peromyscus maniculatus* 1 (1866) 1.0: Aug

Louse-Host Associations

Enderleinellus sp. (prob. *suturalis*) (Apr-Oct) 1 ♂ 3 ♀

- Perognathus parvus* 1 (434) 1.0 - ♀: Oct
- Peromyscus maniculatus* 1 (1866) 1.0 - ♂: Aug

- * *Spermophilus townsendii* 2 (60) 1.0 - ♀: Apr Jul

Fahrenholzia pinnata (Mar-Nov) 63 ♂ 137 ♀

- Sceloporus graciosus* (lizard) 1 (314) 1.0 - ♀: Aug

- * *Dipodomys ordii* 86 (808) 1.8 - ♂ ♀: Mar Apr Jun-Nov

- Eutamias minimus* 4 (398) 1.5 - ♂ ♀: Jun Jul Oct

- * *Perognathus parvus* 15 (474) 1.6 - ♂ ♀: May-Aug Oct

- Peromyscus maniculatus* 11 (1866) 1.4 - ♂ ♀: Apr Jun-Sep

- Sylvilagus idahoensis* 1 (13) 1.0 - ♂: Nov

Fahrenholzia sp. (prob. *pinnata*) (Jun-Oct) 1 ♂ 4 ♀ 47 im 1 ?

- * *Dipodomys ordii* 27 (808) 1.0 - ♀ im: Jun-Aug

- Eutamias minimus* 1 (398) 1.0 - im: Jul
- Onychomys leucogaster* 1 (63) 1.0 - im: Jun

- Perognathus parvus* 6 (474) 2.2 - ♂ ♀: im: May-Aug Oct

- Peromyscus maniculatus* 2 (1866) 2.0 - im ? : Jun-Jul Oct

Geomydoecus sp. (Oct) 4 ♂ 9 ♀ 2 im

- Thomomys talpoides* 1 (8) 15.0

Haemodipsus setoni (Feb-Jul) 21 ♂ 28 ♀ 18 im

- Lepus californicus* 2 (125) 12.0 - ♂ ♀ im: May Jul

- Peromyscus maniculatus* 1 (1866) 1.0 - ♀: Mar

- * *Sylvilagus nuttallii* 2 (28) 21.0 - ♂ ♀ im: Feb

Hoplopleura acanthopus (Mar-Aug) 8 ♂ 20 ♀

- Microtus montanus* 6 (25) 4.7

Hoplopleura arboricola (Mar-Oct) 136 ♂ 257 ♀ 1 im

- Sceloporus graciosus* (lizard) 1 (314) 2.0 - ♀: Sep

- Ereunetes mauri* (bird) 1 (6) 1.0 - ♀: Aug

- Dipodomys ordii* 2 (808) 3.5 - ♂ ♀: Mar Jul

- * *Eutamias minimus* 83 (398) 4.0 - ♂ ♀: Mar May-Aug Oct

- Marmota flaviventris* 2 (6) 1.0 - ♂: Jun

- Perognathus parvus* 1 (474) 5.0 - ♂ ♀: Aug

- Peromyscus maniculatus* 16 (1866) 2.1 - ♂ ♀: Mar Jun-Aug

- Spermophilus townsendii* 2 (60) 4.0 - ♂ ♀ im: Jun-Jul

Hoplopleura erratica (Jul-Oct) 1 ♂ 4 ♀

- * *Eutamias minimus* 4 (398) 1.0 - ♂ ♀: Jul-Aug Oct

- Perognathus parvus* 1 (474) 1.0 - ♀: Jul

Hoplopleura hesperomydis (Jan-Dec) 16 ♂ 440 ♀

- Ereunetes mauri* (bird) 1 (6) 8.0 - ♂ ♀: Mar Jun Aug

- Dipodomys ordii* 7 (808) 1.3 - ♂ ♀: Jun Aug

- Eutamias minimus* 7 (398) 1.1 - ♂ ♀: Mar Jun Aug

- Microtus montanus* 2 (25) 1.0 - ♂ ♀: Jun Aug

- Onychomys leucogaster* 1 (63) 1.0 - ♀: Jul

- Perognathus parvus* 3 (474) 2.0 - ♂ ♀: Aug

- * *Peromyscus maniculatus* 167 (1866) 3.4 - ♂ ♀: Jan-Dec

- Reithrodontomys megalotis* 1 (39) 2.0 - ♂ ♀: May

Neohaematopinus inornatus (Aug) 2 ♂ 2 ♀

- Neotoma cinerea* 2 (14) 2.0

Neohaematopinus laeviusculus (Apr-Aug) 68 ♂ 107 ♀ 60 im

- Eutamias minimus* 2 (398) 1.0 - ♂: Jul-Aug

- Marmota flaviventris* 2 (6) 1.0 - ♀: May

- Perognathus parvus* 1 (474) 2.0 - ♂ ♀: Jul

- Peromyscus maniculatus* 5 (1866) 2.8 - ♂ ♀: Mar-Jun Aug

- * *Spermophilus townsendii* 26 (60) 8.5 - ♂ ♀ im: Apr-Jul

Neohaematopinus marmota (Apr-Aug) 25 ♂ 26 ♀ 13 im

- * *Marmota flaviventris* 4 (6) 14.0 - ♂ ♀ im: May-Jun

- Peromyscus maniculatus* 4 (1866) 2.3 - ♂ ♀: Apr Aug

Neohaematopinus pacificus (May-Nov) 21 ♂ 46 ♀

- * *Eutamias minimus* 27 (398) 2.1 - ♂ ♀: May-Aug Oct Nov

- Perognathus parvus* 2 (474) 1.5 - ♂: Jul

- Peromyscus maniculatus* 4 (1866) 1.8 - ♂ ♀: Feb Mar Aug

- Reithrodontomys megalotis* 1 (39) 1.0 - ♀: Aug

- Spermophilus townsendii* 1 (60) 2.0 - ♀: Jul

Neohaematopinus sp. (Aug) 1 ?

- Dipodomys ordii* 1 (808) 1.0

Neotrichodectes interruptofasciatus (Apr-Nov) 19 ♂
15 ♀ 23 im
Taxidea taxus 2 (5) 28.5

Polyplax auricularis (Jan-Dec) 331 ♂ 669 ♀
Sceloporus graciosus (reptile) 2 (314) 1.0 - ♂:
Sep
Ereunetes mauri (bird) 1 (6) 1.0 - ♀: Aug
Dipodomys ordii 4 (808) 1.0 - ♂ ♀: Jul-Aug Nov
Eutamias minimus 7 (398) 1.0 - ♂ ♀: Mar Jun-
Aug
Neotoma cinerea 1 (14) 1.0 - ♀: Jun
Perognathus parvus 2 (474) 1.0 - ♀: Jun Aug
* *Peromyscus maniculatus* 224 (1866) 4.3 - ♂ ♀:
Jan-Dec
* *Spermophilus townsendii* 5 (60) 1.0 - ♂ ♀: Apr
Jun-Jul
Sylvilagus nuttallii 1 (28) 1.0 - ♀: Aug

Polyplax spinulosa (Jul) 1 ♂
Microtus montanus 1 (25) 1.0

Polyplax sp. (Jun-Jul) 2 ♀
Microtus montanus 2 (25) 1.0

Mallophaga (Jan-Oct) 35 ♂ 70 ♀ 68 im 6 ?
Buteo regalis (bird) 1 (4) 24.0 - ♂ ♀ im: Aug
Centrocercus urophasianus (bird) 2 (18) 2.5 - ♀
im: Jul

Circus cyaneus (bird) 1 (1) 1.0 - im: Apr
Didodomys ordii 3 (808) 1.0 - ? : Apr Sep-Oct
Eremophila alpestris (bird) 1 (84) 4.0 - ♂ ♀: Jul
Ereunetes mauri (bird) 4 (6) 2.5 - ♀ im: Mar
Jun-Aug
Eutamias minimus 6 (398) 3.2 - ♀ im: Mar Jun-
Aug
Falco sparverius (bird) 1 (6) 1.0 - ♂: Jun
Junco oreganus (bird) 1 (30) 1.0 - im: Apr
Lepus californicus 1 (125) 9.0 - ♂ ♀: Apr
Lynx rufus 1 (8) 2.0 - im: Jan
Oreoscoptes montanus (bird) 1 (13) 1.0 - ♀: Jul
Perognathus parvus 5 (474) 3.4 - ♂ ♀ im: ? :
Apr-May Jul-Aug
Peromyscus maniculatus 9 (1866) 1.9 - ♂ ♀ im:
Mar-May Jul-Aug
Pica pica (bird) 1 (8) 1.0 - im: Feb
Plecotus townsendii 1 (78) 4.0 - im: Apr
Reithrodontomys megalotis 1 (39) 15.0 - ♂ ♀
im: Apr
Sceloporus graciosus (lizard) 1 (314) 3.0 - ♀ im:
Jun
Spermophilus townsendii 5 (60) 7.6 - ♂ ♀ im:
Apr-Jun
Spinus pinus (bird) 1 (23) 1.0 - ? : Jun
Sterna neglecta (bird) 1 (7) 1.0 - im: Jul
Zenaidura macroura (bird) 1 (23) 2.0 - ♂ im:
Jul

HOST-PARASITE RELATIONSHIPS

(* = the mite and/or louse which occurred most commonly on that host; H = new host record based on replications—other associations listed may represent new records, but are not so indicated because of infrequent occurrence considered accidental infestations or contaminations).

Reptiles

Crotalus viridis
Eubrachyla elaps debilis
Ischyropoda armatus
Phrynosoma douglassi
Trombicula belkini
Sceloporus graciosus
Hirstionyssus triacanthus
* *Trombicula belkini*
Fahrenholzia pinnata
Hoplopleura arboricola
Polyplax auricularis
Mallophaga

Birds

Amphispiza belli
* *Euschoengastia radfordi*
Ornithonyssus sylviarum
Asyndesmus lewis
Dermanyssus gallinae

Buteo regalis
Mallophaga
Centrocercus urophasianus
Eubrachyla elaps debilis
* *Euschoengastia radfordi*
Mallophaga
Circus cyaneus
Mallophaga
Chordeiles minor
Euschoengastia radfordi
Hirstionyssus triacanthus
Klemania sp.
Listrophorus sp.
Dendrocopos villosus
* *Dermanyssus gallinae*
Hirstionyssus sp.
Eremophila alpestris
Bernia marita
* *Dermanyssus gallinae*
Euschoengastia radfordi
Haemolaelaps glasgowi
Mallophaga
Ereunetes mauri
Hoplopleura arboricola
H. hesperomydis
Polyplax auricularis
Mallophaga

Falco sparverius
 Mallophaga
Junco oreganus
Euschoengastia radfordi
 Mallophaga
Lanius ludovicianus
Euschoengastia radfordi
Leucosticte tephrocotis
Euschoengastia radfordi
Oreoscoptes montanus
Ornithonyssus sylviarum
 Mallophaga
Pica pica
 Mallophaga
Piranga ludoviciana
Dermanyssus sp.
Poocetes gramineus
Ornithonyssus sylviarum
Salpinctes obsoletus
Euschoengastia oregonensis
Spinus pinus
 Mallophaga
Sternella neglecta
 Mallophaga
Turdus migratorius
Dermanyssus gallinae
Zenaidura macroura
 Mallophaga
Zonotrichia leucophrys
Euschoengastia decipiens
 * *Ornithonyssus sylviarum*

Mammals

Dipodomys ordii
Androlaelaps leviculus
Dermanyssus sp.
Eubrachylaelaps crowei
E. debilis
Euschoengastia cordiremus
 * *E. decipiens*
E. radfordi
Haemogamasus ambulans
 * *Haemolaelaps glasgowi*
 * *Hirstionyssus incomptus*
H. longichelae
H. triacanthus
H. utahensis
 * *Ischyropoda armatus*
I. furmani
 * *Klemania* sp.
Leeuwenhoekia americana
 * *Listrophorus* sp.
Odontacarus linsdalei
O. micheneri
Ornithonyssus bacoti
Radfordia bachai
 * *Trombicula arenicola*

T. bakeri
 * *T. doremi*
 * *Fahrenholzia pinnata*
Fahrenholzia sp.
Hoplopleura arboricola
H. hesperomydis - H
Neohaemotopinus sp.
Polyplax auricularis
 Mallophaga
Eutamias minimus
Androlaelaps leviculus
Euschoengastia decipiens - H
E. fasolla
E. pomerantzi
E. schuricola
Haemogamasus ambulans
 * *Haemolaelaps glasgowi*
Hirstionyssus hilli
H. incomptus
H. neotomae
H. triacanthus - H
H. utahensis
Ischyropoda sp. - H
Klemania sp.
Fahrenholzia pinnata
Fahrenholzia sp.
 * *Hoplopleura arboricola*
H. erratica
H. hesperomydis - H
Neohaematopinus laeviusculus
 * *N. pacificus*
Polyplax auricularis - H
 Mallophaga
Lepus californicus
Euschoengastia decipiens
E. luteodema
 * *E. radfordi*
Ischyropoda armatus
Haemodipsus setoni
 Mallophaga
Lynx rufus
 Mallophaga
Marmota flaviventris
Euschoengastia sciuricola
Hoplopleura arboricola
Neohaematopinus laeviusculus
 * *N. marmotae*
Microtus montanus
Euschoengastia sp.
 * *Haemolaelaps glasgowi*
Hirstionyssus isabellinus
Ischyropoda armatus - H
Klemania sp.
 * *Hoplopleura acanthopus* - H
H. hesperomydis
Polyplax spinulosa
Polyplax sp.
Neotoma cinerea

- Brevisterna* sp.
Chatia ochotona
Euschoengastia decipiens
Hirstionyssus bisetosus
 * *H. neotomae*
H. triacanthus
Ischyropoda sp.
Klemania sp.
 * *Neohaematopinus inornatus* - H
Polyplax auricularis
Onychomys leucogaster
Androlaelaps leviculus
 * *Eubrachylaelaps crowei*
E. debilis - H
Haemogamasus ambulans
H. longitarsus - H
 * *Haemolaelaps glasgowi*
Hirstionyssus hilli
H. thomomys
H. utahensis
 * *Ischyropoda armatus*
I. furmani
Klemania sp.
Trombicula doremi
Fahrenholzia sp.
Hoplopleura hesperomydis
Perognathus parvus
Androlaelaps sp.
Dermanyssus gallinae
Eubrachylaelaps debilis - H
 * *Euschoengastia decipiens*
E. radfordi
Haemogamasus ambulans
Haemolaelaps casalis
 * *H. glasgowi*
 * *Hirstionyssus hilli*
H. incomptus
H. triacanthus
H. utahensis - H
Hypoaspis lubrica
 * *Ischyropoda armatus*
I. furmani - H
 * *Klemania* sp.
Trombicula doremi - H
Enderleinellus sp.
 * *Fahrenholzia pinnata*
Fahrenholzia sp.
Hoplopleura arboricola
H. erratica
H. hesperomydis
Neohaematopinus laeviusculus
N. pacificus
Polyplax auricularis
Mallophaga
Peromyscus maniculatus
Androlaelaps leviculus
Bernia marita
Eubrachylaelaps circularis
E. crowei
 * *E. debilis*
Euschoengastia cordiremus
E. criceticola
 * *E. decipens*
E. lanei
E. radfordi
 * *Haemogamasus ambulans*
H. longitarsus
Haemolaelaps casalis
 * *H. glasgowi*
Hirstionyssus hilli
H. incomptus
H. longichelae
H. thomomys
H. triacanthus
 * *H. utahensis*
 * *Ischyropoda armatus*
I. furmani
 * *Klemania* sp.
Listrophorus sp.
Trombicula sp.
Enderleinellus sp.
Fahrenholzia pinnata - H
Fahrenholzia sp.
Haemodipsus setoni
Hoplopleura arboricola - H
 * *H. hesperomydis*
Neohaematopinus laeviusculus
N. marmotae
N. pacificus
 * *Polyplax auricularis*
Mallophaga
Plecotus townsendii
Chatia ochotona
Haemolaelaps glasgowi
 * *Macronyssus unidens*
Mallophaga
Reithrodontomys megalotis
Haemogamasus ambulans
Haemolaelaps glasgowi
Hoplopleura hesperomydis
Neohaematopinus pacificus
Mallophaga
Sorex merriami
Ischyropoda armatus
Klemania sp.
Spermophilus townsendii
 * *Haemolaelaps glasgowi*
Hirstionyssus triacanthus
H. utahensis
Ischyropoda sp.
Enderleinellus sp.
Hoplopleura arboricola
 * *Neohaematopinus laeviusculus*
N. pacificus
Polyplax auricularis
Mallophaga

Sylvilagus idahoensis
 Euschoengastia decipiens
 Fahrenheitia pinnata
Sylvilagus nuttallii
 * *Euschoengastia decipiens*
 E. radfordi
 * *Haemodipsus setoni*
 Polyplax auricularis
Taxidea taxus

Neotrichodectes interruptofasciatus
Thomomys talpoides
 Euschoengastia decipiens
 Haemogamasus ambulans
 Haemolaelaps glasgowi
 Hirstionyssus longichelae
 * *H. thomomys*
 Ischyropoda armatus
 Geomydoecus sp.

ECOLOGICAL CONSIDERATIONS

Degree of Host Infestation

The degree of infestation of mammals differed relative to their geographic distribution (Table 1).
A greater percentage of *Peromyscus maniculatus* was infested with mites in Area 12 than in other areas, with the lowest percentages in Areas 6, 10 and 11. *Perognathus parvus* in Areas 1 and 5 were the most heavily infested, whereas those in Area 7 were the least. In Area 5 *Eutamias minimus* were heavily infested, whereas in Area 3 none were infested. The greatest infestation rate for *Dipodomys ordii* was in Area 8 and the lowest in Area 4. Except in Area 5, no two species of mammals in the same area had a high

rate of infestation with mites. The same was true for the lowest rates of infestation.
A greater percentage of *Dipodomys ordii* was infested with lice in Areas 6 and 8, and fewer animals in Areas 5 and 10 were infested than in other areas. The greatest percentage of infested *Eutamias minimus* was in Areas 2 and 10, and fewest in Area 7. No significant differences were noted for *Perognathus parvus* except in Areas 7, 9 and 10, where no infested animals were found even though 108 were examined. A greater percentage of *Peromyscus maniculatus* was infested in Area 4, and fewer infested animals were found in Area 11 than in other areas. On the basis of frequency and degree of infestation, the areas where louse infestation was optimum for *Dipodomys ordii*

Table 1. Percentage of hosts¹ infested with mites and lice in each of 12 major study areas.

Host	% ² of hosts infested in each study area ³											
	1	2	3	4	5	6	7	8	9	10	11	12
MITES												
<i>Dipodomys ordii</i>	71		50	45	58	87		97	77	71	89	53
<i>Eutamias minimus</i>	10	6	0		24		6			4		
<i>Perognathus parvus</i>	35	16	21		38		15	24		20		
<i>Peromyscus maniculatus</i>	42	32	60		45	14	50	26	45	18	18	79
LICE												
<i>Dipodomys ordii</i>	17		17	12	6	21		23	8	6	16	14
<i>Eutamias minimus</i>	20	32	24		24		6			40		
<i>Perognathus parvus</i>	8	8	3		8		0	3		0		
<i>Peromyscus maniculatus</i>	27	29	23		30	12	18	22	11	12	8	21

¹Only those hosts that were widely distributed geographically are included.
²To nearest whole percent.
³Data not included when less than 10 hosts from the area were examined.

are 6, 8 and 11, for *Eutamias minimus* 2 and 3, and for *Peromyscus maniculatus* 2 and 5. Considering lice of all species, hosts in Area 2, 5 and 9 were more heavily infested than those in other areas.

In each of the 12 study areas, a greater percentage of the hosts belonging to *Dipodomys ordii*, *Perognathus parvus*, and *Peromyscus maniculatus* were infested with mites than with lice. The reverse situation occurred with *Eutamias minimus*. Four exceptions to these conditions wherein about equal percentages of hosts were infested with mites and lice were *Eutamias minimus* in Areas 5 and 7, and *Peromyscus maniculatus* in Areas 2 and 6.

Host Abundance and Species Variety

The number of species parasites which occurred on a particular kind of host generally was in direct proportion to the number of hosts examined (Table 2).

Table 2. Number of mammals examined and number of species of mites and lice found on each kind.

Host		No. species	
Species	No. examined	Mites	Lice
<i>Peromyscus maniculatus</i>	1866	25	9
<i>Dipodomys ordii</i>	808	25	5
<i>Perognathus parvus</i>	474	17	8
<i>Eutamias minimus</i>	398	14	7
<i>Lepus californicus</i>	125	4	1
<i>Plecotus townsendii</i>	78	3	0
<i>Onychomys leucogaster</i>	63	13	2
<i>Spermophilus townsendii</i>	60	4	5
<i>Reithrodontomys megalotis</i>	39	2	2
<i>Sylvilagus nuttalli</i>	28	2	2
<i>Microtus montanus</i>	25	5	4
<i>Neotoma cinerea</i>	14	8	2
<i>Sylvilagus idahoensis</i>	13	1	1
<i>Sorex merriami</i>	9	2	0
<i>Thomomys talpoides</i>	8	6	1
<i>Marmota flaviventris</i>	6	1	3

Mammals of three species did not fit the expected ratio of direct proportion with reference to mites—*Peromyscus maniculatus* and *Sylvilagus idahoensis* had fewer species of mites than would be expected, and *Onychomys leucogaster* more species than expected. I assume that the numbers of *Peromyscus* examined approached the upper end of the “numbers examined—species present” ratio, whereas the unexpected ratios for *Sylvilagus* and *Onychomys* may be related to their behavior patterns and/or habitat.

Lice are more host specific than mites, fleas or ticks. Consequently the sucking lice in this study were more restricted in host distribution than fleas or mites, but followed the similar trend of number of

species found in direct proportion to number of hosts examined. Exceptions were *Plecotus townsendii* on which no lice were found, and *Spermophilus townsendii*, *Microtus montanus* and *Marmota flaviventris*, which possessed more species of lice than expected.

Degree of Infestation by Sex of Host

Some significant differences in the rate of infestation on mammals of different sexes were noted for parasites of some species (Table 3).

Table 3. Comparative rates of infestation by mites and lice on the different sexes of mammals of some species.

Parasite and host	Parasite-host index	
	♂ hosts	♀ hosts
Mites		
<i>Eubrachylaelaps crowei</i>		
<i>Onychomys leucogaster</i>	5.4	5.0
<i>Eubrachylaelaps debilis</i>		
<i>Peromyscus maniculatus</i>	2.2	3.3
<i>Euschoengastia decipiens</i>		
<i>Dipodomys ordii</i>	10.4	3.0
<i>Perognathus parvus</i>	19.9	4.0
<i>Peromyscus maniculatus</i>	6.0	5.2
<i>Haemogamasus ambulans</i>		
<i>Dipodomys ordii</i>	1.3	1.2
<i>Onychomys leucogaster</i>	3.5	2.4
<i>Peromyscus maniculatus</i>	1.2	1.3
<i>Haemolaelaps glasgowi</i>		
<i>Dipodomys ordii</i>	1.6	1.6
<i>Eutamias minimus</i>	1.8	7.3
<i>Microtus montanus</i>	1.6	1.1
<i>Onychomys leucogaster</i>	6.0	2.4
<i>Perognathus parvus</i>	1.8	2.9
<i>Peromyscus maniculatus</i>	1.8	1.6
<i>Spermophilus townsendii</i>	2.8	2.5
<i>Hirstionyssus incomptus</i>		
<i>Dipodomys ordii</i>	1.4	3.2
<i>Hirstionyssus triacanthus</i>		
<i>Dipodomys ordii</i>	2.6	2.5
<i>Hirstionyssus utahensis</i>		
<i>Eutamias minimus</i>	4.7	1.5
<i>Peromyscus maniculatus</i>	2.0	5.3
<i>Ischyropoda armatus</i>		
<i>Dipodomys ordii</i>	2.0	1.6
<i>Onychomys leucogaster</i>	2.6	2.5
<i>Perognathus parvus</i>	1.0	1.1
<i>Peromyscus maniculatus</i>	1.4	1.2
<i>Ischyropoda furmani</i>		
<i>Dipodomys ordii</i>	1.3	1.0

Table 3. (Continued)

Parasite and host	Parasite-host index	
	♂ hosts	♀ hosts
<i>Peromyscus maniculatus</i>	1.0	1.0
<i>Klemania</i> sp.		
<i>Dipodomys ordii</i>	2.1	2.5
<i>Peromyscus maniculatus</i>	1.6	1.0
<i>Listrophorus</i> sp.		
<i>Dipodomys ordii</i>	20.0	17.6
<i>Trombicula arenicola</i>		
<i>Dipodomys ordii</i>	9.0	1.2
<i>Trombicula belkini</i>		
<i>Sceloporus graciosus</i>	6.7	8.3
<i>Trombicula doremi</i>		
<i>Dipodomys ordii</i>	3.0	4.0
Lice		
<i>Fahrenholzia pinnata</i>		
<i>Dipodomys ordii</i>	2.0	1.6
<i>Hoplopleura arboricola</i>		
<i>Eutamias minimus</i>	4.7	4.0
<i>Hoplopleura hesperomydis</i>		
<i>Peromyscus maniculatus</i>	4.1	4.1
<i>Neohaematopinus laevisculus</i>		
<i>Spermophilus townsendii</i>	12.6	5.1
<i>Neohaematopinus pacificus</i>		
<i>Eutamias minimus</i>	2.4	1.4
<i>Polyplax auricularis</i>		
<i>Peromyscus maniculatus</i>	3.6	2.4

Males of *Dipodomys ordii* and *Perognathus parvus* were more heavily infested with mites of *Euschoen-gastia decipiens* than were females. Relative to mites of *Haemolaelaps glasgowi*, females of *Eutamias mini-mus* were more heavily infested, whereas the males of *Onychomys leucogaster* were more heavily infested. For *Hirstionyssus utahensis*, male *Eutamias minimus* were more heavily infested, whereas female *Peromys-cus maniculatus* were more heavily infested. Males of *Dipodomys ordii* were more heavily infested with mites of *Trombicula arenicola* than were females.

For the most part, a greater percentage of the male hosts were more heavily infested with lice than were the females. This was most evident with *Polyplax aur-icularis* on *Peromyscus maniculatus*. In every case but one (*Hoplopleura hesperomydis* on *Peromyscus mani-culatus*) the louse-host index was higher for males than for females, although the difference was not sig-nificant except for *Neohaematopinus laevisculus* on *Spermophilus townsendii*.

Seasonal Occurrence

Complete seasonal occurrences of the mites and lice are given in the listings in the sections "Mite-Host Associations" and "Louse-Host Associations." Their occurrence on commonly collected hosts is summar-ized in Tables 4 and 5.

I assume that a direct correlation exists between the number and kinds of hosts examined and the number of kinds of parasites found. This was true ex-cept for October when proportionately more species of mites and lice were found than would be expected from the number of hosts examined. The number of species of parasites taken during July and August were equal, although more hosts were examined in August than in July. The number of kinds of parasites in relationship to the number of kinds of hosts ex-aminated was in direct correlation for other months ex-cept for April, July and November when fewer kinds of mites, and in June when fewer lice were found than expected from the number of kinds of hosts ex-aminated. In February more kinds of lice were found than expected.

The absence of Mallophaga on so many birds was unusual, particularly on *Amphispiza belli*, *Lanius ludovicianus*, *Leucosticte tephrocotis*, and *Zono-trichia leucophrys*.

For the sucking lice an unusual situation was the apparent absence of these parasites during specific months. Lice were found on *Peromyscus maniculatus* every month, yet were absent on other of their com-mon hosts at times when one would expect them to be present. Significant examples of absence are in May for *Dipodomys ordii*, August and December for *Lepus californicus*, and September for *Perognathus parvus*.

Reproduction In Mites

An egg or larva was observed within the idiosoma of mites of seven species. Females of *Eubrachyla-laps crowei* were gravid with eggs during June, July, August and October, and with larvae from June to October, inclusive. Females of *E. debilis* contained eggs from February through December (except in September and October), and larvae during the same period except October. Mites of *Haemolaelaps glas-gowi* were gravid with eggs from March through October, and with larvae for the same period except in May and September. Mites of *Hirstionyssus hilli* contained eggs in August, those of *H. incomptus* in June and July, those of *H. neotomae* in September, and those of *H. thomomys* in October.

The cosmopolitan species *Haemolaelaps glasgowi*, which occurs on such a variety of hosts, was common on mammals of five species at the NRTS, but those taken from *Dipodomys ordii* contained the greatest

Table 4. Seasonal infestation of some common hosts¹ with mites² and lice.²

Host	No. vertebrates examined and parasites ³ present											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Reptiles												
<i>Crotalus viridis</i>					47	33	2	1	6	6		
						M			M			
<i>Sceloporus graciosus</i>				1	14	102	53	65	77	5		
							M	M	M			
Birds												
<i>Amphispiza belli</i>				15	8		5	2	8			
<i>Eremophila alpestris</i>	6	3	4	29	7	7	7	3	7	7	2	3
		M	M	M			L				M	
<i>Junco oreganus</i>			1	12					8	9		
				L						L		
<i>Lanius ludovicianus</i>			1	19								
<i>Leucosticte tephrocotis</i>	5	5									16	
<i>Spinus pinus</i>	3									1		17
						L						
<i>Zenaidura macroura</i>				2	14	5	2					
							L					
<i>Zonotrichia leucophrys</i>					6				26	1		
Mammals												
<i>Dipodomys ordii</i>			50	20	26	183	175	245	60	64	13	
			LM	LM	M	LM	LM	LM	LM	LM	LM	
<i>Eutamias minimus</i>			51	4	7	53	137	103	7	25	6	
			LM		L	LM	LM	LM	M	LM	L	
<i>Lepus californicus</i>	6		8	13	3	10	13	27	11	7	7	20
				LM	L		L			LM		M
<i>Microtus montanus</i>	8		1			1	5	7		2	1	
			L			L	L	L				
<i>Onychomys leucogaster</i>			7	1		15	13	14	5	6	1	1
			M	M		LM	LM	M	M	LM		
<i>Perognathus parvus</i>				14	66	117	122	130	19	6	1	
				LM	LM	LM	LM	LM	M	LM		
<i>Peromyscus maniculatus</i>	5	43	114	40	13	439	514	475	69	82	41	40
	LM	LM	LM	LM	LM	LM	LM	LM	LM	LM	LM	LM
<i>Reithrodontomys megalotis</i>			6	1	3	1	9	17		4		
				L	L			L				
<i>Spermophilus townsendii</i>			5	5	8	33	8					
				LM	LM	LM	LM					
<i>Sylvilagus nuttallii</i>		7	1		1	4	4	4	2	2	1	3
		L										

¹Only those are listed wherein a total of 20 or more animals were examined of those species which are common hosts for mites or lice.

²All species.

³L = lice, M = mites.

Table 5. Numbers of species of mites and lice collected each month relative to numbers and kinds of mammals.

Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
No. hosts examined	19	50	243	98	121	856	1001	1022	173	198	71	64
Kinds hosts examined	3	2	9	8	8	10	10	9	7	9	8	4
Kinds parasites found:												
Mites	3	4	13	8	10	19	25	25	16	21	8	4
Lice	2	4	8	7	8	8	11	11	4	8	5	2

percentage of gravid females (13%) when compared with those on *Peromyscus maniculatus* (7%), *Onychomys leucogaster* (5%), *Perognathus parvus* (4%), and *Eutamias minimus* (3%).

Consortism

Where sufficient numbers of parasites were found to make comparisons, different degrees of species consortism were noted (Table 6).

Mites of *Euschoengastia decipiens*, although found on a variety of hosts, were seldom in association with mites of other genera. All of the common species except *Trombicula arenicola* occurred as the only species of mite on their hosts in more than half the collections. *Euschoengastia radfordi*, *E. decipiens* and *Hirstionyssus incomptus* frequently were associated with other species of the same genus.

Consortism between lice of different species was not as common as with other ectoparasites. Lice of the species *Polyplax auricularis* occurred as the only

ones on their host a greater percentage of the time than did other lice. All of the commonly collected species except *Neohaematopinus pacificus* occurred as the only lice on their hosts in more than half of the collections. A significant correlation occurred with *N. pacificus* which was associated with *Hoplopleura arboricola* in 43 percent of its collections. A similar correlation was noted between *Hoplopleura hesperomydis* and *Polyplax auricularis*. Significant intrageneric associations were noted for *Hoplopleura* and *Neohaematopinus*.

Geographic Distribution

The distribution of parasites of most species was directly correlated with the distribution of the host on which the parasites were most commonly found. Of the mites, *Eubrachyla elaps debilis*, *Hirstionyssus incomptus*, *Listrophorus* sp. and *Trombicula arenicola* were more widely distributed than expected, and *Euschoengastia radfordi*, *Bernia marita* and *Ornithonyssus sylvianus* were more geographically restricted than were the hosts on which they were found.

Lice of the species *Neohaematopinus pacificus*, and especially those of *Hoplopleura erratica*, were more geographically restricted than the hosts on which they were most commonly found.

The numbers of species of mites and lice found in each study area are shown in Table 7. Although fewer species than expected were found in every area, the greatest deviations from the average numbers of species present were Areas 5 and 7 for the mites and Areas 4 and 8 for the lice.

Radiation Influence

Animals differed in their degree of infestation with ectoparasites in an irradiated area when compared with an ecologically similar nonirradiated one (Table 8).

Animals of *Eutamias minimus* and *Peromyscus maniculatus* were less frequently infested with mites in the irradiated area than in the nonirradiated one. The mite-host index was about equal for *Eutamias minimus* in the two areas, but was higher for *Peromyscus maniculatus* in the irradiated one.

Fewer species of lice were found, a smaller percentage of mammals were infested, and a lower louse-host index for *Eutamias minimus* occurred in the irradiated area. Although the louse-host index was lower for *Peromyscus maniculatus*, a higher percentage of the mammals were infested and more species of lice were found in the irradiated area.

Unusual Host Records

Routine processing of many animals for ectoparasites creates a potential for error and contamination

Table 6. Frequency of intrageneric and species associations for some commonly collected mites and lice.

Parasite	% ¹ of times found:	
	As only species ² on host	With species of same genus
Mites		
<i>Trombicula belkini</i>	100	0
<i>Euschoengastia radfordi</i>	94	17
<i>Hirstionyssus incomptus</i>	84	11
<i>Klemania</i> sp.	83	0
<i>Eubrachyla elaps debilis</i>	80	1
<i>Haemogamasus ambulans</i>	79	0
<i>Euschoengastia decipiens</i>	79	11
<i>Listrophorus</i> sp.	77	0
<i>Hirstionyssus utahensis</i>	77	5
<i>Trombicula doremi</i>	75	6
<i>Ischyropoda armatus</i>	67	2
<i>I. furmani</i>	67	8
<i>Hirstionyssus triacanthus</i>	66	4
<i>Haemolaelaps glasgowi</i>	55	1
<i>Trombicula arenicola</i>	39	9
Lice		
<i>Polyplax auricularis</i>	73	0
<i>Fahrenholzia pinnata</i>	67	0
<i>Hoplopleura arboricola</i>	64	9
<i>Hoplopleura hesperomydis</i>	60	18
<i>Neohaematopinus laevisculus</i>	53	6
<i>Neohaematopinus pacificus</i>	34	6

¹Nearest whole percent.
²Of mites or of lice, respectively.

even though the greatest care is exercised. Consequently, many of the host records in the list of host-parasite relationships must be considered as tentative, especially when they represent only one or two collections. On the other hand, some of the records represent sufficient replications to be valid, and consequently must be considered as new. These are *Euschoengastia decipiens*, *Hirstionyssus triacanthus* and *Ischyropoda* sp. on *Eutamias minimus*; *Ischyropoda armatus* on *Microtus montanus*; *Eubrachylaelaps debilis* and *Haemogamasus longitarsus* on *Onychomys leucogaster*; and *E. debilis*, *Hirstionyssus utahensis*, *Ischyropoda furmani* and *Trombicula doremi* on *Perognathus parvus*.

Table 7. Numbers of species of mites and lice found in the major study areas in proportion to the kinds and numbers of hosts examined.

Study Area	No. hosts examined ¹		No. species mites		No. species lice	
	Individuals	Species	Expected ²	Found	Expected ²	Found
1	169	6	45	18	12	6
2	155	4	29	13	10	5
3	311	7	25	12	12	7
4	40	3	25	9	9	3
5	117	4	41	12	10	5
6	51	3	41	13	10	6
7	57	4	25	14	10	5
8	148	5	41	14	10	7
9	93	3	41	13	9	5
10	39	4	45	17	10	5
11	39	4	41	13	10	4
12	49	3	41	15	10	5

¹Only those are included that are known to be common hosts of mites or lice.
²Based on number and kinds of hosts examined in relationship to parasites found on these hosts in at least one other study area.

Table 8. Differences in degree of infestation by mites and lice on mammals of two species in irradiated and nonirradiated areas.

Area	No. hosts examined	% hosts infested with:		No. species present		Parasite-host index	
		Mites	Lice	Mites	Lice	Mites	Lice
<i>Eutamias minimus</i>							
38 (control)	18	67	39	4	7	1.2	13.1
13 (irradiated)	20	30	30	4	4	1.5	1.7
<i>Peromyscus maniculatus</i>							
37 (control)	22	95	14	5	2	.6	11.0
13 (irradiated)	80	50	26	9	4	26.0	4.3

New records for lice, which likely are not contaminations, are *Fahrenholzia pinnata* on *Peromyscus maniculatus*, *Hoplopleura acanthopus* on *Microtus montanus*, *H. arboricola* on *P. maniculatus*, *H. hesperomydis* on *Dipodomys ordii* and *Eutamias minimus*, and *Polyplax auricularis* on *E. minimus*.

Taxonomic Considerations of the Lice

I have taken the liberty to include some applicable comments made by Dr. William T. Jellison relative to his identifications of the lice.

Enderleinellus sp.—These probably were of ground squirrel origin, and likely are *E. suturalis*.

Fahrenholzia pinnata.—This is a characteristic parasite of *Dipodomys*. The specimens from *Perognathus*

were only tentatively relegated to this species by Jellison. On the Idaho specimens the upper left-hand pleural plate is consistently longer than on typical *F. pinnata*.

Haemodipsus setoni.—Lice relegated to this species were taken from *Lepus* and *Sylvilagus*. A different species likely occurs on each of these hosts, but so far no distinction has been recognized.

Hoplopleura erratica.—Western chipmunks have two louse parasites—*H. erratica arboricola* and *Neohaematopinus pacificus*. The Idaho specimens are closer to the subspecies *H. e. erratica*, typical of *Tamias*, than to the western *H. c. arboricola*.

Polyplax auricularis.—This typically infests *Peromyscus* and mice of several other genera, and Jellison seriously questions the records from *Dipodomys*, *Perognathus* and *Spermophilus*.

DISCUSSION

Community Relationships

In the 12 major study areas where collections were made during all seasons, the degrees of infestation of each species of hosts were not consistent between different areas. However, in Areas 7 and 10 the degree of infestation was lower for more species than for the other areas. The same predominant plants were present in Areas 7 and 10 and in some of the other areas, but total composition and edaphic differences likely exist which affect parasite infestation of the host as well as its nest.

Species Variety

For those ectoparasites that are not considered host specific, the number of species of ectoparasites found on a particular species of host was proportionate to the number of hosts examined. The fewer kinds of mites than expected to be found on *Peromyscus maniculatus* is unusual in consideration of the abundance, distribution and habits of these rodents. The greater number of species of mites than expected on *Onychomys leucogaster* is not unusual in light of its carnivorous habits. The unusual number of species of lice on *Spermophilus*, *Microtus* and *Marmota* is unexpected because of the apparent host specificity of these ectoparasites and the habitat and behavior of their hosts.

Sexual Differences

Where degree of infestation according to sex of host differed for a given species, the males were more often and more heavily infested than the females, although this varied somewhat with the species of parasite. This may be related to the reproductive, nesting and food-getting activities of the different hosts. The greater degree of infestation of males is contrary to

an assumption that females are potentially apt to be more heavily infested because they spend more time associated with the nest because of their reproductive activities. The nest is assumed to be the principle reservoir of many ectoparasites of the nest-building rodents. On the other hand, the wandering activities of the males may provide for greater potential contact with ectoparasites seeking a host. Furthermore, the nest itself may contain plant materials and dusts which act as pesticides against the ectoparasites.

Seasonal Occurrence

The summer months (July and August) are expected to represent the optimum period for the greatest number of species of ectoparasites on the hosts inasmuch as this is the time when populations of hosts are attaining their peak, and environmental conditions should be optimum for ectoparasite reproduction. The decline in September and subsequent increase in October likely is related to the maturation of immatures produced by the mid-summer adults. The expected decline in winter months occurred for the mites, but populations of lice in February were higher than expected. This latter situation may be due to the optimum environmental conditions of the nest as a result of animal hibernation, or decreased amounts of activity outside of the nest.

Consortism

Whether the degree of consortism is directly related to the species of ectoparasite involved or to edaphic or other environmental factors is not known. For the lice, considered as being more host specific than the mites, individual species seldom occurred with other lice, especially with those of the same genus. Although mites of different species frequently

were associated together, those of two species represented the extremes of consortism. Chigger mites of *Euschoengastia decipiens* seldom were found in association with other mites, whereas the mesostigmatid *Eubrachylaelaps crowei* was almost always found in association with other species. The occurrence of mites of two species of the same genus on the same host was not considered common in proportion to the number of times each species was found, but was much more common in the mites than with the lice.

Geographic Distribution

One may assume that the distribution of an ectoparasite should be in direct relationship to the distribution of its common hosts, especially with the lice where host specificity is more evident than with the mites. Such was the case with most of those mites and lice studied. Based on host relationships, however, mites of three species were more widely distributed than expected, whereas those of three other species were more restricted than expected. Undoubtedly environmental factors other than the host are influential on these mites. No correlation with a

predominant type of vegetation was evident, and highest and lowest populations were found in two communities which contained the same species of predominant plants. On the other hand, other species which occurred in greatest numbers were associated with plant associations wherein greater cover and organic debris were present.

Radiation Effects

The effects of radiation, *per se*, on the rate of ectoparasite infestation are not known. However, in one disturbed area fewer ectoparasites occurred than in an ecologically similar undisturbed area. This situation occurred for lice and mites on *Eutamias minimus*, but was different for ectoparasites on *Peromyscus maniculatus*. Although fewer mice were infested with mites in the irradiated area than in the undisturbed area, the mite-host index was higher. Exactly the reverse situation occurred with lice on *P. maniculatus*. I believe that the differences in rates of infestation are not due to the effects of radionuclides, but rather to the physical disturbance of the habitat, i.e., destruction of plants and soil manipulation.

SUMMARY

Mites of 47 species and lice of 16 species were taken from reptiles of 3 species, birds of 23 species, and mammals of 18 species at the National Reactor Testing Station between June, 1966, and September, 1967. Mammals differed in degree of infestation relative to their geographic distribution at the station. The number of species of ectoparasites which occurred on a particular kind of host generally was in direct proportion to the number of hosts examined, but exceptions occurred in some instances. In some cases the rate of infestation differed relative to the sex of the host. The greatest numbers of species of mites and lice were found during July and August, fewest species of mites from December through Feb-

ruary, and fewest kinds of lice during December and January. Host preferences for mites of some species were evident during their reproductive and nonreproductive periods. Consortism among the ectoparasites differed in degree by species. Except for mites of seven species and lice of two species, the geographic distribution of the ectoparasites was in direct proportion to the distribution of the host on which they were commonly found. Mammals of two species differed in their frequency of infestation with ectoparasites in an irradiated area when compared to an ecologically similar nonirradiated control area. Ten new host records for mites and six for lice were established.

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