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# Nest Inhabitants and Ectoparasites of Northern Flying Squirrels, Glaucomys sabrinus (Shaw), from Northeastern Oregon

## Abstract

Two species of laelapid mites, *Haemogamasus reidi* and *Echinonyssus* sp. (near *cynomys*), along with an apparently undescribed species of glycyphagid, were the most abundant organisms in nests of the northern flying squirrel (*Glaucomys sabrinus* (Shaw)), in northeastern Oregon. A flea, *Opisodasys vesperalis*, the species of *Echinonyssus* mentioned above, and a species of Acaridae (near *Acotyledon paradoxa*) were the most abundant organisms on the squirrels. Of the 29 taxa found on the squirrels, 15 were also found in the nests. Forms found in the nests but not on the squirrels included laelapid mites of two species: cheyletid mites, including a new genus and two new species, one in the genus *Eucheyletia* (both are being described by Smiley and Whitaker): one glycyphagid mite; fleas of three species; argastid (soft) ticks; and several miscellaneous insects and other invertebrates. Forms found on squirrels but not in nests included six species of fleas, four species of chiggers, and *Dermacarus* sp.

## Introduction

There is relatively little information available concerning arthropods that inhabit nests of mammals, and there has been no systematic study dealing with nest inhabitants of the northern flying squirrel (*Glaucomys sabrinus* (Shaw)). The ectoparasites of flying squirrels are also inadequately known (Whitaker and Wilson 1974), but Day and Benton (1980) have studied flea populations of the southern flying squirrel (*Glaucomys volans* (Linnaeus)).

The objective of the present study was to determine the invertebrates associated with the nests of northern flying squirrels in Umatilla, Union, and Wallowa counties, northeastern Oregon, and to compare the results with ectoparasites on flying squirrels from the same area—some from the same nests.

## Methods and Materials

Flying squirrels and nests were collected from kestrel nest boxes from March through July. Nest materials and the squirrels' fur were examined for invertebrates under a

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dissecting microscope. Invertebrates were cleared and stained in Nesbitt's Solution containing acid fuchsin. They were mounted in Hoyer's Solution and coverslips were ringed with euparal.

### Results

Twenty-nine nests were examined (Table 1). The major nest inhabitants were a species of laelapid mite, *Haemogamasus reidi*, and a species of glycyphagid mite, probably new. The third most abundant form was another species of laelapid mite, *Echinonyssus*, near *E. cynomys*, also probably new. A mite, *Dermanyssus gallinoides*, normally associated with birds was the fourth most abundant nest inhabitant. Its occurrence is not illogical, however, because the squirrels were nesting in boxes normally used by birds, and because the squirrels often nest in tree cavities used by birds.

TABLE 1. Inhabitants of 29 nests of northern flying squirrels (**Glaucomys sabrinus**) and associates of the fur of 31 northern flying squirrels (46 squirrels were examined for fleas) taken from March through July in Umatilla, Union, Wallowa counties, Oregon.

| | Nest inhabitants | | | | Squirrel associates | | | |
|---|---|---|---|---|---|---|---|---|
| Names of organism | No. of organisms | | Occurrence in nests | | No. of organisms | | Occurrence on squirrels | |
| Siphonaptera (Fleas) | | | | | | | | |
| **Opisodasys vesperalis** (Jordon) | 74 | 2.60 | 13 | 44.8 | 619 | 13.45 | 46 | 100.0 |
| **Orchopeas** caedens **caedens** (Jordan) | 14 | 0.48 | 4 | 13.8 | 9 | 0.20 | 8 | 17.4 |
| **Megarthroglossus divisus** Jordon | 8 | 0.28 | 4 | 13.8 | 4 | 0.09 | 3 | 6.5 |
| **Ceratophyllus niger** C. Fox | 6 | 0.21 | 1 | 3.4 | — | — | — | — |
| **Catallagia decipiens** Rothschild | 1 | 0.03 | 1 | 3.4 | — | — | — | — |
| **Tarsopsylla octodecimdentata coloradensis** (Baker) | 1 | 0.03 | 1 | 3.4 | — | — | — | — |
| **Delotelis hollandi** Smit | — | — | — | — | 2 | 0.04 | 1 | 2.2 |
| **Hystrichopsylla o. occidentalis** Holland | — | — | — | — | 2 | 0.04 | 1 | 2.2 |
| **Orchopeas sexdentatus** spp. (Baker) | — | — | — | — | 2 | 0.04 | 1 | 2.2 |
| **Callisopsyllus terinus** (Rothschild) | — | — | — | — | 1 | 0.02 | 1 | 2.2 |
| **Monopsyllus cyrturus** (Jordan) | — | — | — | — | 1 | 0.02 | 1 | 2.2 |
| **Orchopeas caedens durus (Jordan)** | — | — | — | — | 1 | 0.02 | 1 | 2.2 |
| Flea larvae | 67 | 2.30 | 13 | 44.8 | — | — | — | — |
| Anoplura (sucking lice) | | | | | | | | |
| **Neohaematopinus sciuropteri** (Osborn) | 2 | 0.07 | 2 | 6.9 | 76 | 2.50 | 9 | 29.0 |
| **Hoplopleura trispinosa** (Kellogg & Ferris) | 1 | 0.03 | 1 | 3.4 | 22 | 0.71 | 3 | 9.7 |
| **Microphthirus uncinatus** (Ferris) | — | — | — | — | 2 | 0.06 | 2 | 6.5 |
| Mallophaga, unidentified (biting lice) | 1 | 0.03 | 1 | 3.4 | 1 | 0.03 | 1 | 3.2 |
| Acarina (mites and ticks) Laelapidae | | | | | | | | |
| **Haemogamasus reidi** Ewing | 1282 | 44.20 | 20 | 68.9 | 27 | 0.90 | 9 | 29.0 |
| **Echinonyssus** (near) **cynomys** (Radford) | 593 | 20.70 | 20 | 68.9 | 253 | 8.20 | 14 | 45.2 |
| **Haemogamasus pontiger** (Berlese) | 48 | 1.70 | 3 | 10.3 | — | — | — | — |
| **Androlaelaps casalis** (Berlese) | 1 | 0.03 | 1 | 3.4 | — | — | — | — |
| **Androlaelaps fahrenholzi** (Berlese) | 1 | 0.03 | 1 | 3.4 | 4 | 0.13 | 3 | 9.7 |
| **Echinonyssus longichelae** Allred & Beck | — | — | — | — | 1 | 0.03 | 1 | 3.2 |
| Glycyphagidae | | | | | | | | |
| Glycyphagid, unidentified, probably new | 975 | 33.60 | 12 | 41.4 | 1 | 0.03 | 1 | 3.2 |
| **Gohieria** n.sp. | 18 | 0.62 | 6 | 20.7 | — | — | — | — |
| **Dermacarus tamiasciuri** Rupes, Yunker & Wilson | — | — | — | — | 8 | 0.26 | 1 | 3.2 |
| Dermanyssidae | | | | | | | | |
| **Dermanyssus gallinoides** Moss | 83 | 2.90 | 9 | 31.0 | 12 | 0.39 | 3 | 9.7 |
| Cheyletidae | | | | | | | | |
| new gen., n. sp. | 67 | 2.30 | 11 | 37.9 | — | — | — | — |
| **Eucheyletia** n. sp. | 4 | 0.14 | 1 | 3.4 | — | — | — | — |

TABLE 1. (Continued)

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Acaridae | | | | | | | | |
| **Acotyledon** (near) **paradoxa** Oudemans | 2 | 0.07 | 2 | 6.9 | 145 | 4.70 | 4 | 12.9 |
| **Myianoetus** sp. | 1 | 0.03 | 1 | 3.4 | — | — | — | — |
| Trombiculidae | | | | | | | | |
| **Euschoengastia oregonensis** (Ewing) | — | — | — | — | 6 | 0.19 | 3 | 9.7 |
| **Neotrombicula microti** (Ewing) | — | — | — | — | 5 | 0.16 | 3 | 9.7 |
| **Euschoengastia peromysci** (Ewing) | — | — | — | — | 3 | 0.10 | 2 | 6.5 |
| **Euschoengastia sciuricola** (Ewing) | — | — | — | — | 1 | 0.03 | 1 | 3.2 |
| Other mites | | | | | | | | |
| Suborder | | | | | | | | |
| Oribatida | 15 | 0.52 | 6 | 20.7 | 2 | 0.06 | 1 | 3.2 |
| Chortoglyphidae | 2 | 0.07 | 2 | 6.9 | 2 | 0.06 | 1 | 3.2 |
| **Caloglyphus** sp. | 1 | 0.03 | 1 | 3.4 | — | — | — | — |
| **Proctolaelaps** sp. | — | — | — | — | 1 | 0.03 | 1 | 3.2 |
| Miscellaneous unidentified | 11 | 0.38 | 7 | 24.1 | — | — | — | — |
| Ixodidia (ticks) | | | | | | | | |
| Argasidae (soft-backed ticks) | 2 | 0.07 | 2 | 6.9 | — | — | — | — |
| **Ixodes angustus** Neumann | 2 | 0.07 | 2 | 6.9 | 3 | 0.10 | 3 | 9.7 |
| Miscellaneous non-parasitic invertebrates | | | | | | | | |
| Collembola (springtails) | 4 | 0.14 | 2 | 6.9 | — | — | — | — |
| Diptera (flies) | 2 | 0.07 | 2 | 6.9 | — | — | — | — |
| Formicidae (ants) | 2 | 0.07 | 2 | 6.9 | — | — | — | — |
| Thysanoptera (thrips) | 2 | 0.07 | 1 | 3.4 | — | — | — | — |
| Homoptera (hoppers) | 1 | 0.03 | 1 | 3.4 | — | — | — | — |
| Unidentified insects | 3 | 0.10 | 1 | 3.4 | — | — | — | — |
| Unidentified arachnids | 2 | 0.07 | 2 | 6.9 | — | — | — | — |

The fifth most abundant nest inhabitant was a flea, *Opisodasys vesperalis*, a characteristic parasite of flying squirrels in western North America (Hubbard 1947). Of the 67 flea larvae found, the majority was probably of this species. Cheyletid n. gen., n. sp., and *Haemogamasus pontiger* were seventh and eighth in abundance.

*Gohieria* (Glycyphagidae), the ninth most abundant nest organism, was represented by 5 adult females and 13 tritonymphs. This genus is poorly known, although *Gohieria fusca* (Oudemans 1903) was described long ago. *Gohieria fusca* occurs in stored food, a habitat similar to that of nests. Volgin (1961) described *G. longiseta* and *G. orientalis* from the European flying squirrel, *Pteromys volans* (Linnaeus). Finding *Gohieria* on both genera of flying squirrels, *Pteromys* and *Glaucomys*, could indicate an evolutionary relationship between these genera.

The remaining nest-inhabiting arthropods occurred in small numbers. They included several species of mites, ticks, lice (Anoplura), springtails (Collembola), thrips (Thysanoptera), ants (Formicidae), flies (Diptera), and fleas. Two of the three lice were *Neohaematopinus sciuropteri*, a host-specific species of *Glaucomys*.

Thirty-five categories of organisms were found in the nests; they totaled 3299 individuals, or 113.8 per nest. The three most abundant species, however, were mites. Mites comprised 2850, or 86.4 percent of all the individual organisms.

Twenty-nine species of organisms were found on the 31 flying squirrels examined (Table 1). They totaled 1216 individuals, or 41.9 per host individual. The most abundant were the fleas, *Opisodasys vesperalis* (619 individuals), and the mites, *Echinonyssus* near *cynomys* (253 individuals). Acarids, near *Acotyledon paradoxa*, were the third most abundant form (145 individuals). Fourth was the flying squirrel louse, *Neohaematopinus sciuropteri*; 76 individuals (2.5 per squirrel) were found on 29 percent of the squirrels. Twenty-two individuals (0.71 per squirrel) of another louse, *Hoplopleura trispinosa*, were also present on 9.7 percent of the hosts. Twenty-seven

individuals of *Haemogamasus reidi*, 2 oribatids, 2 chortoglyphids, 1 glycyphagid, 3 *Ixodes angustus*, 3 *Androlaelaps fahrenholzi*, 12 *Dermanyssus gallinoides*, 1 mallophagan, and fleas, were all forms that were also found in the nests.

The following 14 taxa were found on the squirrels but not in the nests: 6 species of fleas—*Delotelis hollandi, Hystrichopsylla occidentalis, Orchopeas sexdentatus* ssp., *Callisopsyllus terinus, Monopsyllus cyturus, Orchopeas caedens durus* (1 or 2 individuals each); the mite *Dermacarus tamiasciuri* (8 individuals, 0.3 per squirrel, on 1 squirrel); 4 species of chiggers—*Euschoengastia oregonensis* (6 individuals on 3 squirrels), *Neotrombicula microti* (5 individuals on 3 squirrels), *Euschoengastia peromysci* (3 individuals on 2 squirrels), *Euschoengastia sciuricola* (1 individual on 1 squirrel): *Microphthirius uncinatus* (2 individuals on 2 squirrels); and 1 specimen each of *Echinonyssus longichelae* and *Proctolaelaps* species.

Thus, in general, the major associates of the squirrels were similar to the major nest organisms. Of the 29 taxa found on the squirrels, 15 were also found in the nests.

Forms found in the nests but not on the squirrels (at least in numbers greater than one) were argasid ticks, glycyphagids, and cheyletid mites. Argasid or soft ticks move onto a host to take blood meals, but only for short periods, thus explaining their absence on the squirrels. The cheyletid mites apparently are predators. Adult glycyphagid mites normally remain in the nest, whereas their hypopi use a host for transportation, as was the situation we found. Although a few lice were found in the nests, they were more abundant on the squirrels, because lice attach themselves firmly to a host and often remain in place for long periods. The various insects found in the nests would not be expected to occur on the squirrels.

Chiggers and hypopi of *Dermacarus* were on the squirrels but not in the nests, probably because they, too, form relatively long-term attachments to a host.

Mites previously reported from northern flying squirrels were *Haemogamasus ambulans, H. reidi, Echinonyssus occidentalis*, and *Laelaps kochi* (Allred and Beck 1966, Keegan 1951, Redington 1970, Scholten *et al.* 1962, Strandtmann and Morlan 1953). All other mites from northern flying squirrels constitute new host records.

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