

Ectoparasites and other associates of some insectivores and rodents from New Brunswick

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Ectoparasites and other associates were examined from seven species of insectivores and nine species of rodents from Mount Carleton Provincial Park, New Brunswick. The most abundant forms found were (at least 2.0 per host individual) the following: *Orycterxenus soricis* and *Amorphacarus hengererorum* on *Sorex cinereus* and on *Sorex (Microsorex) hoyi*; *A. hengererorum* and *O. soricis* on *Sorex fumeus*; *O. soricis*, *Miyatrombicula esoensis*, and *Ixodes angustus* on *Sorex gaspensis*; *O. soricis*, *I. angustus*, *Pygmephorus horridus*, and *Protomyobia americana* on *Blarina brevicauda*; *M. esoensis*, *Protomyobia claparedei*, and *Glycyphagus hypudaei* on *Sorex palustris*; *Orycterxenus canadensis*, *O. soricis*, *P. horridus*, *G. hypudaei*, *Ctenophthalmus pseudagyrtis*, and *Haemogamasus ambulans* on *Condylura cristata*. More abundant ectoparasites of the rodents were as follows: *G. hypudaei*, *Listrophorus mexicanus*, *M. esoensis*, *Neotrombicula harperi*, and *Radfordia lemnina* on *Clethrionomys gapperi*; *G. hypudaei*, *L. mexicanus*, *M. esoensis*, *N. harperi*, and *Laelaps kochi* on *Microtus chrotorrhinus*; *L. mexicanus*, *G. hypudaei*, *Radfordia hylandi*, *Laelaps alaskensis*, *M. esoensis*, *Polyplax alaskensis*, *L. kochi*, *N. harperi*, and *Myocoptes j. japonensis* on *Microtus pennsylvanicus*; *Listrophorus synaptomys*, *Hoplopleura acanthopus*, *L. alaskensis*, *G. hypudaei*, *M. esoensis*, *I. angustus*, *R. hylandi*, and *N. harperi* on *Synaptomys cooperi*; all of these except the last one on *Synaptomys borealis*; *M. esoensis* on *Peromyscus maniculatus*; *Dermacarus newyorkensis* on *Zapus hudsonius*; *D. newyorkensis*, *N. harperi*, *Radfordia ewingi*, and *G. hypudaei* on *Napaeozapus insignis*; *Dermacarus hylandi*, *N. harperi*, *Megabothris acerbus*, and *M. esoensis* on *Tamias striatus*.

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Les ectoparasites et autres parasites ont été étudiés chez sept espèces d'insectivores et neuf espèces de rongeurs du Parc provincial du Mont Carleton au Nouveau-Brunswick. Les formes les plus abondantes (au moins 2,0 parasites par hôte) sont: *Orycterxenus soricis* et *Amorphacarus hengererorum* chez *Sorex cinereus* et *Sorex (Microsorex) hoyi*, *A. hengererorum* et *O. soricis* chez *Sorex fumeus*, *O. soricis*, *Miyatrombicula esoensis* et *Ixodes angustus* chez *Sorex gaspensis*, *O. soricis*, *I. angustus*, *Pygmephorus horridus* et *Protomyobia americana* chez *Blarina brevicauda*, *M. esoensis*, *Protomyobia claparedei* et *Glycyphagus hypudaei* chez *Sorex palustris*, *Orycterxenus canadensis*, *O. soricis*, *P. horridus*, *G. hypudaei*, *Ctenophthalmus pseudagyrtis* et *Haemogamasus ambulans* chez *Condylura cristata*. Les ectoparasites les plus abondants chez les rongeurs sont: *Glycyphagus hypudaei*, *Listrophorus mexicanus*, *Miyatrombicula esoensis*, *Neotrombicula harperi* et *Radfordia lemnina* chez *Clethrionomys gapperi*, *G. hypudaei*, *L. mexicanus*, *M. esoensis*, *N. harperi* et *Laelaps kochi* chez *Microtus chrotorrhinus*, *L. mexicanus*, *G. hypudaei*, *Radfordia hylandi*, *Laelaps alaskensis*, *M. esoensis*, *Polyplax alaskensis*, *L. kochi*, *N. harperi* et *Myocoptes j. japonensis* chez *Microtus pennsylvanicus*, *Listrophorus synaptomys*, *Hoplopleura acanthopus*, *L. alaskensis*, *G. hypudaei*, *M. esoensis*, *Ixodes angustus*, *R. hylandi* et *N. harperi* chez *Synaptomys cooperi*, les mêmes espèces sauf *N. harperi* chez *S. borealis*, *M. esoensis* chez *Peromyscus maniculatus*, *Dermacarus newyorkensis* chez *Zapus hudsonius*, *D. newyorkensis*, *N. harperi*, *Radfordia ewingi* et *G. hypudaei* chez *Napaeozapus insignis*, *Dermacarus hylandi*, *N. harperi*, *Megabothris acerbus* et *Miyatrombicula esoensis* chez *Tamias striatus*.

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Introduction

The purpose of this paper is to present information on the ectoparasites and other arthropod associates from seven species of insectivores and nine species of rodents from Mount Carleton Provincial Park, in Northumberland and Restigouche Counties, New Brunswick.

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Two host species of particular interest are included: the Gaspé Shrew, *Sorex gaspensis*, and the Pygmy Shrew, *Sorex (Microsorex) hoyi*. The Gaspé Shrew, *S. gaspensis*, was described by Anthony and Goodwin (1924) from the Gaspé Peninsula of Quebec, but since then few specimens have been taken. Peterson and Symansky (1963) took one near Mount Carleton in central New Brunswick and, in 1974, seven individuals were collected on Cape Breton Island, Nova Scotia

TABLE 1. Ectoparasites and other associates of six species of shrews and one species of mole from Mt. Carleton Provincial Park, New Brunswick*

	<i>Sorex</i>				<i>Microsorex hoyi</i> (n = 22)	<i>Blarina brevicauda</i> (n = 18)	<i>Condylura cristata</i> (n = 11)
	<i>cinereus</i> (n = 23)	<i>fumeus</i> (n = 28)	<i>gaspensis</i> (n = 67)	<i>palustris</i> (n = 7)			
Siphonaptera (fleas)							
<i>Corrodopsylla hamiltoni</i>	1, 4.3, 0.04	—	—	—	—	—	—
<i>Doratopsylla blarinae</i>	—	—	—	—	—	1, 5.6, 0.1	—
<i>Ctenophthalmus pseudagyrtes</i>	—	2, 7.1, 0.1	—	—	—	8, 22.2, 0.4	30, 27.3, 2.7
<i>Epitedia wenmanni</i>	—	1, 3.6, 0.04	—	—	—	—	—
<i>Megabothris asio asio</i>	—	—	—	—	—	—	5, 27.3, 0.5
<i>Nearctopsylla genalis</i>	—	—	—	—	—	—	6, 27.3, 0.5
<i>Hystrichopsylla tahavuana</i>	—	—	—	—	—	1, 5.6, 0.1	—
Ixodidae (hard ticks)							
<i>Ixodes angustus</i>	13, 39.1, 0.6	16, 39.3, 0.6	150, 68.7, 2.2	2, 28.6, 0.3	23, 50.0, 1.0	38, 50.0, 2.1	10, 27.3, 0.9
Mites							
Glycyphagidae							
<i>Orycteroxenus soricis</i>	436, 69.6, 19.0	175, 53.6, 6.3	1475, 67.2, 22.0	2, 14.3, 0.3	879, 68.2, 40.0	17 395, 94.4, 966.4	200, 9.1, 18.2
<i>Orycteroxenus canadensis</i>	—	—	—	—	1, 4.5, 0.05	—	33 300, 90.9, 3027.2
<i>Glycyphagus hypudaei</i>	—	1, 3.6, 0.04	16, 4.5, 0.2	26, 42.9, 3.7	—	—	204, 27.3, 18.5
<i>Xenoryctes nudus</i>	—	3, 10.7, 0.1	—	—	—	—	1, 9.1, 0.1
<i>Xenoryctes latiporus</i>	—	—	—	—	—	9, 5.6, 0.5	—
Myobiidae							
<i>Amorphacarus hengererorum</i>	53, 26.1, 2.3	203, 35.7, 7.3	10, 3.0, 0.1	9, 57.1, 1.3	52, 13.6, 2.4	1, 5.6, 0.1	—
<i>Protomyobia claparedei</i>	10, 13.0, 0.4	—	—	69, 85.7, 9.9	—	—	—
<i>Protomyobia brevisetosa</i>	—	37, 14.3, 1.3	—	—	—	—	—
<i>Protomyobia americana</i>	—	—	—	—	1, 4.5, 0.05	78, 38.9, 4.3	—
<i>Blarinobia simplex</i>	—	—	—	—	—	18, 5.6, 1.0	—
<i>Eadiea condylurae</i>	—	—	—	—	—	—	5, 18.2, 0.5
Laelapidae							
<i>Androlaelaps fahrenheitzi</i>	—	2, 7.1, 0.1	—	—	—	10, 44.4, 0.6	7, 36.4, 0.6
<i>Haemogamasus ambulans</i>	—	4, 14.3, 0.1	2, 3.0, 0.03	3, 28.6, 0.4	2, 9.1, 0.1	1, 5.6, 0.1	27, 63.6, 2.5

TABLE 1. (concluded)

	<i>Sorex</i>				<i>Microsorex hoi</i> (n = 22)	<i>Blarina brevicauda</i> (n = 18)	<i>Condylura cristata</i> (n = 11)
	<i>cinereus</i> (n = 23)	<i>fumeus</i> (n = 28)	<i>gaspensis</i> (n = 67)	<i>palustris</i> (n = 7)			
<i>Haemogamasus liponyssoides</i>	2, 8.7, 0.1	5, 10.7, 0.2	1, 1.5, 0.01	—	—	14, 38.9, 0.8	2, 18.2, 0.2
<i>Echinonyssus talpae</i>	7, 21.7, 0.3	8, 17.9, 0.3	21, 20.9, 0.3	2, 28.6, 0.3	3, 13.6, 0.2	8, 22.2, 0.4	—
<i>Echinonyssus blarinae</i>	—	—	—	—	—	6, 11.1, 0.3	—
<i>Myonyssus jamesoni</i>	—	—	—	1, 14.3, 0.1	—	—	—
<i>Eulaelaps stabularis</i>	—	—	—	—	—	8, 27.8, 0.4	2, 18.2, 0.2
<i>Echinonyssus isabellinus</i>	—	—	—	—	—	2, 11.1, 0.1	1, 9.1, 0.1
Pygmephoridae							
<i>Pygmephorus horridus</i>	7, 13.0, 0.2	27, 42.9, 1.0	39, 34.3, 0.6	9, 42.9, 1.3	15, 31.8, 0.7	89, 83.3, 4.9	32, 63.6, 2.9
<i>Pygmephorus whitakeri</i>	1, 4.3, 0.04	5, 17.9, 0.2	6, 4.5, 0.1	—	—	1, 5.6, 0.1	—
<i>Pygmephorus moreohorridus</i>	1, 4.3, 0.04	2, 7.1, 0.1	2, 3.0, 0.03	2, 14.3, 0.3	1, 4.5, 0.05	7, 33.3, 0.4	4, 18.2, 0.4
<i>Bakerdania</i> sp.	1, 4.3, 0.04	1, 3.6, 0.04	2, 3.0, 0.03	—	3, 13.6, 0.02	6, 16.7, 0.3	—
<i>Pygmephorus</i> sp.	—	1, 3.6, 0.04	—	—	—	1, 5.6, 0.1	—
<i>Pygmephorus nidicolus</i>	—	—	1, 1.5, 0.01	—	—	1, 5.6, 0.1	—
<i>Pygmephorus lutterloughae</i>	—	—	—	—	—	5, 11.1, 0.3	1, 9.1, 0.1
<i>Pygmephorus johnstoni</i>	—	—	—	—	—	1, 5.6, 0.1	—
Cyrtolaelapidae							
<i>Cyrtolaelaps</i>	3, 13.0, 0.1	9, 21.4, 0.3	28, 19.4, 0.4	1, 14.3, 0.1	4, 18.2, 0.2	29, 55.6, 1.6	21, 54.5, 1.9
<i>Euryparasitus</i> sp.	1, 4.3, 0.04	4, 10.7, 0.1	1, 1.5, 0.01	—	—	7, 33.3, 0.4	5, 36.4, 0.5
Trombiculidae (chiggers)							
<i>Miyatrombicula esoensis</i>	43, 39.1, 1.9	9, 10.7, 0.3	474, 67.2, 7.1	35, 57.1, 5.0	30, 59.1, 1.4	7, 16.7, 0.4	—
<i>Neotrombicula harperi</i>	1, 4.3, 0.04	—	—	—	—	—	—
Other mites							
<i>Proctolaelaps</i> sp.	2, 8.7, 0.1	6, 14.3, 0.2	6, 9.0, 0.1	—	4, 13.6, 0.2	12, 38.9, 0.7	2, 18.2, 0.2
Anoetidae	—	1, 3.6, 0.04	21, 9.0, 0.31	1, 14.3, 0.1	1, 4.5, 0.05	2, 11.1, 0.1	—

*Data represent total number of hosts infested, percent of hosts infested, and mean number of parasites per host examined.

TABLE 2. Associates that occur as a "major" parasite of one or more hosts (major parasite as considered here is one that occurred at 0.5 or more per host)*

	<i>Sorex cinereus</i>	<i>Microsorex hoyi</i>	<i>Sorex fumeus</i>	<i>Sorex gaspensis</i>	<i>Blarina brevicauda</i>	<i>Sorex palustris</i>	<i>Condylura cristata</i>
<i>Orycteroxenus soricis</i>	1	1	2	1	1		3
<i>Amorphacarus hengererorum</i>	2	2	1			5	
<i>Miyatrombicula esoensis</i>	3	3		2		2	
<i>Ixodes angustus</i>	4	4	5	3	4		8
<i>Pygmephorus horridus</i>		5	4	4	2	4	4
<i>Protomyobia brevisetosa</i>			3				
<i>Cyrtolaelaps</i> sp.					5		7
<i>Protomyobia americana</i>					3		
<i>Protomyobia claparedei</i>						1	
<i>Glycyphagus hypudaei</i>						3	2
<i>Orycteroxenus canadensis</i>							1
<i>Ctenophthalmus pseudagyrtes</i>							5
<i>Haemogamasus ambulans</i>							6
<i>Blarinobia simplex</i>					6		
<i>Haemogamasus liponyssoides</i>					7		
<i>Proctolaelaps</i> sp.					8		
<i>Androlaelaps fahrenheitii</i>					9		9

*Numbers 1 to 9 represent order of importance from most to least.

(Roscoe and Majka 1976). Kirkland and Van Deusen (1979), who summarized available information on this species, believed that few specimens existed beyond the 23 examined by them. The Pygmy Shrew is relatively rare throughout most of its range.

There is apparently no published information on the ectoparasites of either of these two species. Also, there are few data on ectoparasites from two of the rodent species, *Microtus chrotorrhinus* and *Synaptomys borealis*.

Whitaker and Wilson (1974) summarized information on parasitic and phoretic mites of North American mammals. More recent papers giving information on parasites of some of these hosts are Amin (1976), Timm (1974, 1975), Timm et al. (1977), Wassel et al. (1978), and Whitaker et al. (1975).

Methods and materials

The hosts were collected in June and July of 1980 in sunken cans and in snap traps. Ectoparasites were collected in the field using a zoom dissecting microscope and needles to manipulate the fur. Numbers seen of each type were counted, or if in numbers they were too large to count, they were estimated. The entire body of the host was carefully examined giving us confidence that these estimates were reasonably accurate. Parasites were preserved in alcohol with glycerine added, cleared and stained in Nesbitt's solution with acid fuchsin added, and mounted in Hoyer's solution, and slides were ringed with Euparal.

Results and discussion

Insectivores

Information on the ectoparasites of the insectivores is summarized in Table 1; included are seven species of fleas, one tick, four chiggers, five glycyphagid mites, six myobiid mites, eight laelapid mites, eight (or more) pygmephorid mites, and some miscellaneous mites. The pygmephorid mites (*Pygmephorus* at least) and cyrtolaelapid mites are phoretic. The fleas, ticks, glycyphagid, myobiid, laelapid, and trombiculid mites are parasitic. Although the relationship of the "other" mites to the host is not known, they are apparently not parasitic. Included here are records of 35 species of parasites and other associates.

In addition, some mites were identified only to genus. *Bakerdania* sp. (Pygmephoridae) undoubtedly comprises more than one species. These mites are being studied by Robert L. Smiley and J. O. Whitaker. The *Pygmephorus* sp. from *Blarina* is new and is being described by the same authors. Deutonymphs of *Cyrtolaelaps* and *Euryparasitus* (Cyrtolaelapidae) were common on insectivores and were apparently phoretic. It is likely that more than one species is involved in both cases. Other mites listed only to genus in the table were *Proctolaelaps* sp. and hypopi of the family Anoetidae.

The four species found on all seven insectivore hosts were the tick, *Ixodes angustus* (mostly larvae), the glycyphagid hypopial mite, which is generally abundant on shrews, *Orycteroxenus soricis*, and the phoretic

mites, *Pygmephorus horridus* and *Pygmephorus moreohorridus*. Species found on but a single host included six flea species, one glycyphagid mite, three myobiid mites, two laelapid mites, one pygmephorid mite, and two species of chiggers.

Previous information on parasitic and phoretic mites (other than chiggers) of North American mammals has been summarized by Whitaker and Wilson (1974), and information on fleas of the eastern United States was summarized by Benton (1980). We know of no such recent summary for ticks and chiggers. Records of *Pygmephorus* were summarized by Smiley and Whitaker (1978). In addition, Whitaker et al. (1975) gave records of ectoparasites of *Sorex cinereus*, *S. fumeus*, *S. palustris*, and *Blarina brevicauda* from North Carolina; Amin (1976) reported *Eulaelaps stabularis*, *Haemogamasus liponyssoides*, and *Ixodes muris*; Stunkard et al. (1975) reported *Protomyobia brevisetosa* from *Sorex cinereus*; and Yates et al. (1979) reported *Androlaelaps fahrenheitsi* from *Condylura cristata* from Vermont. *Xenoryctes nudus* was described from *Sorex fumeus* from North Carolina by Fain and Whitaker (1975). Thomas et al. (1980) reported *O. soricis*, *Haemogamasus ambulans*, *Echinonyssus talpae*, and *Neotrombicula microti* from *Sorex palustris* from Prince Edward Island. Jones and Thomas (1980) reported on ticks from mammals from New Brunswick.

Since the Gaspé Shrew, *S. gaspensis*, had not been previously examined for ectoparasites (mites at least), all 17 forms constitute new host records. The most abundant forms found were *O. soricis*, *Miyatrombicula esoensis*, *I. angustus*, and *P. horridus*.

Likewise, this is the first report of ectoparasites of the Pygmy Shrew, *Microsorex hoyi*, so here also, all 14 species constitute new host records. The more abundant forms on this host were *O. soricis*, *Amorphacarus hengererorum*, *M. esoensis*, *I. angustus*, and *P. horridus*.

Sixteen forms were reported from the masked shrew, *S. cinereus*; *O. soricis*, *A. hengererorum*, *M. esoensis*, and *I. angustus* were most abundant. New host records for mite species other than chiggers were *Pygmephorus whitakeri*, and *P. moreohorridus*.

Twenty-one forms were found on the Smoky Shrew, *S. fumeus*. The most abundant were *A. hengererorum*, *O. soricis*, *P. brevisetosa*, *P. horridus*, and *I. angustus*. New host records are *Glycyphagus hypudaei*, *P. whitakeri*, and *P. moreohorridus*.

Thirteen forms were found on *S. palustris*; *Protomyobia claparedei*, *M. esoensis*, *G. hypudaei*, *P. horridus*, and *A. hengererorum* were the most abundant. New host records are *G. hypudaei*, *Myonyssus jame-soni*, and *P. moreohorridus*.

On *B. brevicauda*, 29 forms were found, including

the following species of mites not previously reported from this host: *A. hengererorum*, *Echinonyssus isabellinus*, *P. moreohorridus*, *Pygmephorus lutterloughae*, and *Pygmephorus nidicolus*. The most abundant forms were *O. soricis*, *P. horridus*, *Protomyobia americana*, *I. angustus*, and *Cyrtolaelaps* sp. The *Protomyobia* from *B. brevicauda* was originally described as *P. claparedei americana* (McDaniel 1967) but is now considered as a full species, *P. americana*.

Twenty forms were found on the Star-nosed Mole, *C. cristata*, with *Orycteroxenus canadensis*, *G. hypudaei*, *O. soricis*, *P. horridus*, *Ctenophthalmus pseudagyrtes*, and *H. ambulans* being the most abundant. Species of mites not previously reported from this host are *O. soricis*, *X. nudus*, *E. stabularis*, *E. isabellinus*, *P. moreohorridus*, and *P. lutterloughae*.

We know of no previous records of mites from New Brunswick; thus, all mites recorded here are new records for the province.

In order to compare community structure, major parasites (here considered as those that were found at rates of more than 0.5 per host) were listed (Table 2), No. 1 being most abundant, No. 2 the second most abundant, etc. Two identical major parasite communities then would have the same parasites listed in the same order.

Examination of these data indicates that parasite communities of *B. brevicauda*, *S. palustris*, and *C. cristata* are very different from one another and from the other three species of *Sorex* and *M. hoyi*. However, the latter four species were close. *Orycteroxenus soricis* and *I. angustus* were major parasites of all four species, whereas *A. hengererorum*, *M. esoensis*, and *P. horridus* were major parasites of three. These are the smaller and more terrestrial of the shrews involved, with *S. cinereus* and *Microsorex* being the smallest. We conclude that this illustrates ecological relationships among the parasite communities. Superficially, at least, this apparently supports the work of Diersing (1980), who recently placed *Microsorex* in the genus *Sorex*. However, *Microsorex* is still separated from other species at the subgeneric level; thus, the close relationship of the parasite community would not appear to have arisen because of close taxonomic relationship. Rather, this similarity of arthropod faunas is probably because the shrews share similar habitats and present the most similar habitat for the parasites: fur length, host size, behavior, etc.

Sorex palustris, the Water Shrew, is quite different from the other shrews in being much larger and aquatic, and its parasite community differs accordingly. Although it does share three major parasites with *Microsorex*, its community is much different from the other long-tailed shrews (*Sorex*, *Microsorex*).

TABLE 3. Ectoparasites and other associates of five species of microtine rodents from Mt. Carleton Provincial Park, New Brunswick*

	<i>Clethrionomys gapperi</i> (n = 18)	<i>Microtus chrotorrhinus</i> (n = 17)	<i>Microtus pennsylvanicus</i> (n = 13)	<i>Synaptomys cooperi</i> (n = 6)	<i>Synaptomys borealis</i> (n = 4)
Siphonaptera (fleas)					
<i>Megabothris quirini</i>	5, 5 (0.27, 18.5)	7, 4 (0.41, 23.5)	1, 1 (0.07, 7.7)	7, 4 (1.17, 66.7)	1, 1 (0.25, 25.0)
<i>Ctenophthalmus pseudagyrtes</i>		2, 2 (0.12, 11.8)		2, 1 (0.33, 16.7)	1, 1 (0.25, 25.0)
<i>Peromyscopsylla catatina</i>		1, 1 (0.06, 5.9)			
<i>Catallagia borealis</i>		1, 1 (0.06, 5.9)			
<i>Epitedia wenmanni wenmanni</i>		2, 2 (0.12, 11.8)		1, 1 (0.17, 16.7)	1, 1 (0.25, 25.0)
Anoplura (sucking lice)					
<i>Polyplax alaskensis</i>			43, 2 (3.31, 15.4)		
<i>Hoplopleura acanthopus</i>				126, 3 (21.00, 50.0)	12, 1 (3.00, 25.0)
Acarina-Ixodidae (ticks)					
<i>Ixodes angustus</i>	9, 7 (0.50, 38.9)	5, 4 (0.29, 23.5)		35, 3 (5.83, 50.0)	36, 3 (9.00, 75.0)
Acarina (mites)					
Glycyphagidae					
<i>Glycyphagus hypudaei</i>	715, 15 (39.72, 83.3)	115, 9 (6.76, 52.9)	562, 13 (43.23, 100.0)	98, 4 (16.33, 66.7)	290, 4 (72.50, 100.0)
<i>Orycteroxenus soricis</i>		1, 1 (0.06, 5.9)			5, 2 (1.25, 50.0)
<i>Orycteroxenus canadensis</i>		1, 1 (0.06, 5.9)			
Laelapidae					
<i>Echinonyssus isabellinus</i>	1, 1 (0.06, 5.6)	12, 5 (0.71, 29.4)	4, 4 (0.31, 30.8)	2, 2 (0.33, 33.3)	
<i>Echinonyssus</i> sp.	1, 1 (0.06, 5.6)				
<i>Haemogamasus ambulans</i>	2, 2 (0.11, 11.1)	9, 8 (0.53, 47.1)	8, 3 (0.62, 23.1)	1, 1 (0.17, 16.7)	
<i>Haemogamasus reidi</i>	1, 1 (0.06, 5.6)				
<i>Haemogamasus liponyssoides</i>		2, 2 (0.12, 11.8)		2, 1 (0.33, 16.7)	
<i>Androlaelaps fahrenheitzi</i>	3, 3 (0.17, 16.7)	15, 6 (0.88, 35.3)	23, 8 (1.77, 61.5)	1, 1 (0.17, 16.7)	1, 1 (0.25, 25.0)
<i>Laelaps alaskensis</i>		17, 9 (1.00, 52.9)	53, 10 (4.08, 76.9)	135, 6 (22.50, 100.0)	26, 4 (6.50, 100.0)
<i>Laelaps kochi</i>		47, 10 (2.76, 58.8)	37, 9 (2.85, 69.2)	1, 1 (0.17, 16.7)	
<i>Eulaelaps stabularis</i>	1, 1 (0.06, 5.6)	10, 6 (0.59, 35.3)		1, 1 (0.17, 16.7)	
Listrophoridae					
<i>Listrophorus mexicanus</i>	174, 7 (9.67, 38.9)	4233, 16 (235.17, 94.1)	5117, 6 (393.62, 46.2)	2, 2 (0.33, 33.3)	

TABLE 3. (Concluded)

	<i>Clethrionomys gapperi</i> (n = 18)	<i>Microtus chrotorrhinus</i> (n = 17)	<i>Microtus pennsylvanicus</i> (n = 13)	<i>Synaptomys cooperi</i> (n = 6)	<i>Synaptomys borealis</i> (n = 4)
<i>Listrophorus synaptomys</i>				181, 4 (30.17, 66.7)	41, 3 (10.25, 75.0)
Myobiidae					
<i>Radfordia hylandi</i>		10, 2 (0.59, 11.8)	138, 6 (10.62, 46.2)	30, 1 (5.00, 16.7)	14, 2 (3.50, 50.0)
<i>Radfordia lemnina</i>	106, 10 (5.90, 55.6)				
<i>Radfordia</i> n.sp.		3, 1 (0.18, 5.9)			
<i>Protomyobia brevisetosa</i>			1, 1 (0.07, 7.7)		
Myocoptidae					
<i>Myocoptes j. japonensis</i>	21, 5 (1.17, 27.8)	21, 5 (1.24, 29.4)	38, 4 (2.92, 30.8)		
<i>Myocoptes squamosus</i>	7, 2 (0.39, 11.1)	19, 4 (1.12, 23.5)	5, 3 (0.38, 23.1)		
<i>Trichoecius tenax</i>	7, 5 (0.39, 27.8)	6, 3 (0.35, 17.6)	16, 3 (1.23, 23.1)		
<i>Trichoecius</i> sp.		1, 1 (0.06, 5.9)			
Pygmephoridae					
<i>Pygmephorus horridus</i>	3, 2 (0.17, 11.1)	6, 5 (0.35, 29.4)		4, 2 (0.67, 33.3)	2, 2 (0.50, 50.0)
<i>Pygmephorus moreohorridus</i>			1, 1 (0.07, 7.7)		
<i>Bakerdania</i> sp.		1, 1 (0.06, 5.9)		3, 2 (0.50, 33.3)	
Trombiculidae (chiggers)					
<i>Miyatrombicula esoensis</i>	170, 14 (9.44, 77.8)	189, 13 (10.5, 76.5)	44, 3 (3.38, 23.1)	49, 2 (8.17, 33.3)	31, 2 (7.75, 50.0)
<i>Euschoengastia blarinae</i>	1, 1 (0.06, 5.6)	2, 1 (0.12, 5.9)			
<i>Euschoengastia setosa</i>		28, 3 (1.64, 17.6)			
<i>Neotrombicula microti</i>	3, 1 (0.17, 5.6)				
<i>Neotrombicula harperi</i>	136, 5 (7.56, 27.8)	54, 2 (3.00, 11.8)	30, 1 (2.31, 7.7)	90, 2 (15.00, 33.3)	
Other mites					
<i>Proctolaelaps</i> sp.	1, 1 (0.06, 5.6)	1, 1 (0.06, 5.9)		1, 1 (0.17, 16.7)	
Anoetidae		1, 1 (0.06, 5.9)			1, 1 (0.25, 25.0)
Cyrtolaelapidae					
<i>Cyrtolaelaps</i> sp.	2, 1 (0.11, 5.6)	5, 5 (0.28, 29.4)			
<i>Euryparasitus</i> sp.		4, 3 (0.22, 17.6)	1, 1 (0.07, 7.7)	3, 2 (0.50, 33.3)	1, 1 (0.25, 25.0)

*For each species of parasite found on a given mammal species, the data represent the number of individual parasites found and the number of hosts parasitized, with the average number of parasites per host examined and the percent frequency in parentheses.

TABLE 4. Ectoparasites and other associates of four species of rodents from Mt. Carleton Provincial Park, New Brunswick*

	<i>Peromyscus maniculatus</i> (n = 11)	<i>Zapus hudsonius</i> (n = 7)	<i>Napaeozapus insignis</i> (n = 15)	<i>Tamias striatus</i> (n = 1)
Siphonaptera				
<i>Orchopeas leucopus</i>	17, 6 (1.55, 54.5)			
<i>Megabothris asio</i>	2, 2 (0.18, 18.2)	1, 1 (0.14, 14.3)		
<i>Megabothris acerbus</i>				5, 100.0 (5.00)
<i>Ctenophthalmus pseudagyrtus</i>	1, 1 (0.09, 9.1)			
Anoplura				
<i>Hoplopleura hesperomydis</i>	15, 2 (1.36, 18.2)			
Acarina (ticks)				
<i>Ixodes angustus</i>	6, 4 (0.55, 36.4)	1, 1 (0.14, 14.3)		
Acarina (mites)				
Glycyphagidae				
<i>Dermacarus hylandi</i>				3500, 100 (3500.00)
<i>Dermacarus newyorkensis</i>		435, 7 (62.14, 100.0)	2192, 11 (146.13, 73.3)	
<i>Glycyphagus hypudaei</i>	5, 1 (0.45, 9.1)		40, 1 (2.67, 6.7)	
<i>Xenoryctes latiporus</i>		2, 1 (0.29, 14.3)		
<i>Dermacarus</i> sp. adult	8, 1 (0.72, 9.1)			
Laelapidae				
<i>Androlaelaps casalis</i>	1, 1 (0.09, 9.1)			
<i>Androlaelaps fahrenheitzi</i>	8, 3 (0.72, 27.3)		23, 4 (1.53, 26.7)	
<i>Eulaelaps stabularis</i>	1, 1 (0.09, 9.1)			
<i>Haemogamasus ambulans</i>		1, 1 (0.14, 14.3)		
Myobiidae				
<i>Radfordia ewingi</i>			46, 4 (3.07, 26.7)	
<i>Radfordia subuliger</i>	9, 5 (0.82, 45.5)			
Myocoptidae				
<i>Trichoecius</i> sp.	1, 1 (0.09, 9.1)			
<i>Gliricoptes zapus</i>			11, 2 (0.73, 13.3)	
Pygmephoridae				
<i>Pygmephorus horridus</i>			1, 1 (0.07, 6.7)	
<i>Bakerdania</i>	1, 1 (0.09, 9.1)			

TABLE 4. (Concluded)

	<i>Peromyscus maniculatus</i> (n = 11)	<i>Zapus hudsonius</i> (n = 7)	<i>Napaeozapus insignis</i> (n = 15)	<i>Tamias striatus</i> (n = 1)
Trombiculidae				
<i>Miyatrombicula esoensis</i>	66, 10 (6.00, 90.0)		10, 2 (0.67, 13.3)	3 (3.00, 100.0)
<i>Euschoengastia setosa</i>	9, 2 (0.81, 18.2)			
<i>Neotrombicula harperi</i>			157, 3 (10.47, 20.0)	5 (5.00, 100.0)
Other mites				
Anoetidae				
		2, 2 (0.29, 28.6)		
Cyrtolaelapidae				
<i>Cyrtolaelaps</i> sp.	9, 2 (0.82, 18.2)			
<i>Euryparasitus</i> sp.			2, 3 (0.13, 13.3)	
<i>Proctolaelaps</i>	1, 1 (0.09, 9.1)	1, 1 (0.14, 14.3)	6, 1 (0.40, 6.7)	
<i>Macrocheles</i>	1, 1 (0.09, 9.1)	1, 1 (0.14, 14.3)		

*For each species the data represent the number of individual parasites found and the number of hosts parasitized, with the average number of parasites per host examined and the percent frequency in parentheses.

The Star-nosed Mole, *C. cristata*, is a well-adapted burrower. Among the shrews considered here, *B. brevicauda* is the shrew that most closely duplicates the behavior and habitat of *Condylura*; thus, it is probably not accidental that these two share more parasites (five) than *Blarina* does with the rest of the shrews.

Overall, it appears that insectivoran parasite community relationships of New Brunswick reflect ecological factors more closely than taxonomic relationships.

Nine rodent species were examined, including five microtines, one cricetine, two zaptodids, and one sciurid (*Tamias*) (Tables 3 and 4).

Microtine rodents

The most abundant taxa (those occurring at rates of 1.00 per host or more) on *Clethrionomys gapperi* were *G. hypudaei*, *Listrophorus mexicanus*, *M. esoensis*, *Neotrombicula harperi*, *Radfordia lemnina*, and *M. j. japonensis*. New mite host records are *M. squamosus* and *T. tenax*.

Those on *M. chrotorrhinus* are *L. mexicanus*, *M. esoensis*, *G. hypudaei*, *N. harperi*, *Laelaps kochi*, *M. j. japonensis*, *Euschoengastia setosa*, *M. squamosus*, and *Laelaps alaskensis*. All mites listed in Table 3 for this species are apparently new host records, except for *L. alaskensis* and *L. kochi*.

Most abundant taxa on *Microtus pennsylvanicus* were

L. mexicanus, *G. hypudaei*, *Radfordia hylandi*, *L. alaskensis*, *M. esoensis*, *Polyplax alaskensis*, *L. kochi*, *N. harperi*, *M. j. japonensis*, *A. fahrenheitzi*, and *T. tenax*. New mite host records for *M. pennsylvanicus* are *P. brevisetosa* and *P. moreohorridus*.

Taxa found on the two species of *Synaptomys* were similar, with *Listrophorus synaptomys*, *Hoplopleura acanthopus*, *L. alaskensis*, *G. hypudaei*, *M. esoensis*, and *I. angustus* being among the most abundant species on both. *Neotrombicula harperi* and *Megabothris quirini* were important on *Synaptomys cooperi* but were found at a lower rate or not at all on *S. borealis*, whereas *O. soricis* was important on *S. borealis* and not on *S. cooperi*.

Species found on all the microtines were the flea, *M. quirini*, the mites, *G. hypudaei* (although some of these are probably *Glycyphagus microti*, recently described by Spicka and O'Connor (1979)) and *A. fahrenheitzi*, and the chigger, *M. esoensis*. Occurrence of the two species of *Laelaps* is interesting. *Laelaps alaskensis* was most abundant on *Synaptomys* (22.50 and 6.50 per host on *S. cooperi* and *S. borealis*, respectively), followed by *M. pennsylvanicus* (4.08) and *M. chrotorrhinus* (1.00). *Laelaps kochi* was found at rates of 2.85 and 2.76 on *M. pennsylvanicus* and *M. chrotorrhinus*, but only one individual was taken from *Synaptomys*.

Wassel et al. (1978) presented data on ectoparasites of

S. cooperi from Indiana. New mite host records for this species presented here are *E. isabellinus*, *H. ambulans*, *E. stabularis*, *L. mexicanus*, *R. hylandi*, and *P. horridus*. All mites except *A. fahrenheiti* and *L. alaskensis* taken from *S. borealis* during the present study constitute new host records.

Other rodents (Table 4)

Peromyscus maniculatus

The most abundant taxa on this host were the chigger, *M. esoensis*, the flea, *Orchopeas leucopus*, and the louse, *Hoplopleura hesperomydis*. *Trichoecius* sp. had not been previously reported from this host species, and it is being described as new.

Zapus hudsonius

The only abundant species on the Meadow Jumping Mouse was the hypopial mite, *Dermacarus newyorkensis*. *Xenoryctes latiporus* is a new host record.

Napaeozapus insignis

Abundant parasites or associates of the Woodland Jumping Mouse were *Dermacarus newyorkensis*, *N. harperi*, *Radfordia ewingi*, *G. hypudaei*, and *A. fahrenheiti*. New mite host records are *G. hypudaei*, *Gliricoptes zapus*, and *P. horridus*.

The single chipmunk taken harbored four species (Table 4), with *Dermacarus hylandi* being very abundant.

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