Ectoparasites of Pine Voles, *Microtus pinetorum*, from Clark County, Illinois

D. David Pascal, Jr.
and
John O. Whitaker, Jr.
Department of Life Sciences
Indiana State University
Terre Haute, Indiana 47809

Introduction

In studies on pine voles, only Hamilton (1938) and Benton (1955), both working in New York, attempted to collect and identify external parasites. Hamilton noted the mite, *Laelaps kochi* Oudemans, 1936 and lice of the genus *Hoplopleura* to be particularly numerous. Benton reported *Hoplopleura acanthopus* (Burmeister, 1839) and *Androlaelaps fahrenholzi* (Berlese, 1911) as the most abundant pine vole ectoparasites. Ferris (1921) reported *H. acanthopus* from pine voles in New York and Iowa. Another louse, *Polyplax spinulosa* (Burmeister, 1839), was found to infest pine voles in Georgia (Morlan, 1952), although *Rattus norvegicus* and *R. rattus* are the true hosts for this louse (Pratt and Karp, 1953; Wilson, 1961). The occurrence on pine voles was accidental.

Mite records (other than chiggers) on *Microtus pinetorum* have been summarized by Whitaker and Wilson (1974), but include LAELAPIDAE: *Androlaelaps fahrenholzi* (Berlese, 1911), *Laelaps kochi* Oudemans, 1936, *Haemogamasus longitarsus* (Banks, 1910), *H. liponyssoides* Ewing, 1925, *H. ambulans* (Thorell, 1872), *Laelaps alaskensis* Grant, 1947, and *Eulaelaps stabularis* (Koch, 1836); GLYCYPHAGIDAE: *Glycyphagus hypudaei* (Koch, 1841) and *Orycteroxenus soricis* (Oudemans, 1915); LISTROPHORIDAE: *Listrophorus pitymys* Fain and Hyland, 1972; MYOBIIDAE: *Radfordia ensifera* (Poppe, 1896) and *R. lemnina* (Koch, 1841); CHEYLETIDAE: *Eucheyletia bishoppi* Baker, 1949.

In addition, Smiley and Whitaker (1979) reported the following pygmephorid mites from *Microtus pinetorum from Indiana: Pygmephorus equitrichosus* Mahunka, 1975, *P. hastatus* Mahunka, 1973, *P. scalopi* Mahunka, 1973 and *P. whitakeri* Mahunka, 1973.

Pine voles have numerous chiggers (Trombiculidae). *Neotrombicula goodpasteri* (Brennan and Wharton, 1950), *N. lipovskyi* (Brennan and Wharton, 1950), *N. microti* (Ewing, 1928), *N. whartoni* (Ewing, 1929), *Euschoengastia peromysci* (Ewing, 1929), *E. ohioensis* Farrell, 1956, *E. carolinensis* Farrell, 1956, and *E. diversa* Loomis, 1956 (Brennan and Wharton, 1950; Farrell, 1956; Kardos, 1954; Loomis, 1956; MacCreary, 1945; Manischweitz, 1966).

Although once thought to be primarily a bat chigger, *Leptotrombidium myotis* (Ewing, 1929) has been reported from pine voles (Loomis, 1956; Manischewitz, 1966). However, this record may be the more recently described *L. peromysci* Vercammen-Grandjean and Langston, 1976.

Ctenophthalmus pseudagyrtes Baker, 1904 is the most commonly reported flea from the pine vole, and has been collected in many areas (Benton and Cerwonka, 1960; Benton and Krug, 1956; Ellis, 1955; Geary, 1959; Holland and Benton, 1968; Jameson, 1943; Jameson, 1947; Jordan, 1928; Layne, 1958; MacCreary, 1945; Mathewson and Hyland, 1964; Morlan, 1952; Whitaker and Corthum, 1967; and Wilson, 1961).

Other fleas reported from pine voles are *Stenoponia americana* (Baker, 1899), *Atyphloceras bishopi* (Jordan, 1933), *Rhadinopsylla orama* Smit, 1957, *Doratopsylla blarinae* C. Fox, 1914 (probably accidental), *Opisodasys pseudarctomys* (Baker, 1904),

Orchopeas leucopus (Baker, 1904), *Orchopeas howardi* (Baker, 1895), and *Peromyscopsylla catatina* (Jordan, 1928), (Benton, 1955; Ellis, 1955; Geary, 1959; Holland and Benton, 1968; Jameson, 1947; MacCreary, 1945; Morlan, 1952; Poorbaugh and Gier, 1961; and Wilson, 1957).

The pine vole is known to harbor the tick *Dermacentor variabilis* (Say, 1821), (Clifford, Anastos, and Elbl, 1961; Mellot and Connell, 1965; Sonenshine, Atwood, and Lamb, 1966; Wilson, 1961).

Mumford and Whitaker (1982) presented more recent information on average numbers of ectoparasites per host and percent of hosts parasitized for 28 pine voles from Indiana. Included were many of the species mentioned above but also MACRONYSSIDAE: *Ornithonyssus bacoti* (Hirst, 1913); PYGMEPHORIDAE: *Bakerdania* sp., *Pygmephorus equitrichosus* Mahunka, 1975, *P. hastatus* Mahunka, 1973, *P. scalopi* Mahunka, 1973, *P. whitakeri* Mahunka, 1973; MYOCOPTIDAE: *Myooptes musculinus* (Koch, 1844), *M. japonensis canadensis* Radford, 1955; CYRTOLAELAPIDAE: *Cyrtolaelaps* sp; and Anoetidae sp. In addition, they recorded the myobiid, *Radfordia hylandi* Fain and Lukoschus, 1977, probably the same species earlier recorded as *R. lemnina.*

The purpose of this study was to determine the ectoparasite community from a population of pine voles from Clark County, Illinois, and to determine whether their abundance varied with age or sex of the voles, and if parasite abundance or frequency varied with season.

Materials and Methods

A 450 x 399 meter tract in a woodlot in Clark County, Illinois, was divided into 3 x 3 meter plots, of which 125 were randomly selected for trapping. Plots in stream beds were omitted, leaving 116 sample plots for study (Pascal, 1974). Plots were sampled from April-December, 1968. Twelve traps were set per plot, underground across the floor of burrows when burrows were present, at the surface when not. Traps were baited with peanut butter and checked each day for one week. Pine voles were placed in individual plastic bags in the field. Voles and plastic bags were examined in the laboratory with a 10-30X zoom dissecting microscope for external parasites. The fur was brushed with dissecting needles. Parasites were preserved in alcohol and later transferred to Nesbitts Solution with acid fuchsin stain added. After a few days they were mounted in Hoyers Solution and the cover slips were ringed with Euparal.

Results

A total of 1948 ectoparasites and other associates was found on 80 (93.0%) of the Clark County pine voles examined (Table 1). The average number of ectoparasites per vole was significantly higher (36.4) for voles collected during the spring and summer months than for those taken in the fall and winter (19.1) (chi square = 164.77**, 1 df). There was no significant difference between the frequency of infested voles from the spring-summer period (93.6%) and that of the fall-winter period (92.6%) (chi square = 0.001, 1 df). Subadult voles had a significantly lower average number of ectoparasites per vole (15.1) than adults (21.9) (chi square = 35.92**, 1 df). The only juvenile vole trapped during the study, a male taken in June, harbored 232 ectoparasites. The average number of ectoparasites per vole was significantly higher for males (27.2) than for females (17.6) (chi square = 83.06**, 1 df).

The ectoparasites are listed in order of decreasing abundance, and both the average number per vole of each parasite and the average number per infested vole are given (Table 1). Further discussion occurs below concerning some of the ectoparsites.

TABLE 1. Ectoparasites of 86 pine voles, *Microtus pinetorum*, examined from Clark County, Illinois.

Parasites	No. voles	Percent	No.	Av. no. per vole	Av. no. per infested vole
Mites					
Androlaelaps fahrenholzi	45	52.3	703	8.2	15.6
Euschoengastia ohioensis	63	73.3	473	5.5	7.5
Glycyphagus hypudaei	15	17.4	416	4.8	27.7
Haemogamasus longitarsus	22	25.6	85	1.0	3.9
Laelaps kochi	26	30.2	54	0.6	2.1
Pygmephoridae	22	25.6	40	0.5	1.8
Myocoptes japonensis	7	8.1	26	0.3	3.7
Hypoaspis sp.	15	17.4	21	0.2	1.4
Haemogamasus liponyssoides	5	5.8	16	0.2	3.2
Euschoengastia diversa	7	8.1	12	0.1	1.7
Haemogamasus harperi	7	8.1	11	0.1	1.6
Eulaelaps stabularis	9	10.5	10	0.1	1.1
Neotrombicula whartoni	6	7.0	10	0.1	1.7
Wichmannia sp.	3	3.5	8	0.1	2.7
Neotrombicula lipovskyi	5	5.8	7	0.1	1.4
Radfordia lemnina	4	4.7	5	0.1	1.3
Dermacarus hylandi	1	1.2	1	0.01	1.0
Euschoengastia peromysci	1	1.2	1	0.01	1.0
Eutrombicula alfreddugesi	1	1.2	1	0.01	1.0
Haemogamasus ambulans	1	1.2	1	0.01	1.0
Eucheyletia bishoppi	1	1.2	1	0.01	1.0
Cheyletidae	1	1.2	1	0.01	1.0
Ornithonyssus bacoti	1	1.2	1	0.01	1.0
Fleas					
Ctenophthalmus pseudagyrtes	17	19.8	32	0.04	1.9
Peromyscopsylla hamifer	1	1.2	1	0.01	1.0
Epitedia wenmanni	1	1.2	1	0.01	1.0
Doratopsylla blarinae	1	1.2	1	0.01	1.0
Stenoponia americana	1	1.2	1	0.01	1.0
Ticks					
Dermacentor variabilis	9	10.5	9	0.1	1.0

Laelapidae

Androlaelaps fahrenholzi (Berlese, 1911), a laelapid mite, was the most abundant ectoparasite, with 349 females, 91 males, and 263 nymphs collected. Adults and nymphs were found together on 33.3% of the infested voles, females and nymphs on 24.4% and females only on 22.2%. *Androlaelaps fahrenholzi* was taken from pine voles throughout the study, but was significantly more abundant in the spring and summer months (17.5 per vole) than in the fall and winter (6.0 per vole) (chi square = 209.09**, 1 df). The percentage of voles infested with *A. fahrenholzi* during the spring-summer period (68.8%) was not significantly different from that of the fall-winter period (48.6%) (chi square = 0.98, 1 df). Adult mites did not vary significantly in infestation frequency between spring-summer (62.5%) and fall-winter (44.3%) (chi square = 0.93, 1 df)., but nymphs were taken at significantly higher frequencies in the spring and summer (62.5%) than in the fall and winter (28.6%) (chi square = 4.25*, 1 df). The higher infestation frequency of nymphs during this period may indicate an increase in mite reproduction at this time. Adult pine voles had a significantly higher average number of individuals per vole (8.1) than subadult voles (3.3) (chi square = 52.54**, 1 df). Male voles showed a higher average number of individuals per vole (9.9) than did females (4.4) (chi square = 86.4**, 1 df). The higher abundance of both life stages

on male voles may reflect more mobility by males, resulting in more opportunities to pick up unattached mites.

Fourth and fifth in abundance were two additional laelapid mites, *Haemogamasus longitarsus* (Banks, 1910) (76 females, 5 males, and 4 nymphs) and *Laelaps kochi* Oudemans, 1936 (38 females, 9 males, 4 protonymphs, and 3 deutonymphs). Adults of *H. longitarsus* were significantly more abundant during the spring and summer (1.7 per vole) than during the fall and winter (0.8 per vole) (chi square = 11.35**, 1 df). The average number per vole of adult *H. longitarsus* on subadult voles was 0.6 and on adult voles it was 0.9, a difference that was not significant (chi square = 2.51, 1 df). Male voles showed a significantly higher average abundance of adult mites per vole (1.3) than females (0.7) (chi square = 7.26**, 1 df). Adults of *L. kochi* showed no significant difference in the average number per vole for the spring-summer (0.8) and fall-winter (0.50) (chi-square = 1.53, 1 df). There was, however, a significantly higher incidence of infestation during the spring and summer (50.0%) when compared to fall-winter (21.4%) (chi-square = 3.91*, 1 df). Subadult voles had the same average number of adult *L. kochi* per vole (0.5) as adults. An average number per vole of 0.6 was found for male and female voles alike.

Some other laelapid mite species taken were *Haemogamasus liponyssoides* Ewing, 1925 (3 females and 13 nymphs), *Haemogamasus harperi* Keegan, 1951 (3 females, 2 males, and 6 nymphs), *Eulaelaps stabularis* (Koch, 1836) (10 females), and *Haemogamasus ambulans* (Thorell, 1872) (1 male).

Chiggers (Trombiculidae)

The parasite second in abundance was the chigger, *Euschoengastia ohioensis* Farrell, 1956. It had the greatest frequency of any parasite and was the only parasite found to have a significantly higher average abundance during the fall and winter months (6.6 per vole) than during the spring-summer period (0.9 per vole) (chi-square = 76.45**, 1 df). Frequency of infestation was also significantly higher during the fall-winter months (84.3%) than during spring and summer (25.0%) (chi square = 6.23**, 1 df). This species also had a significantly higher average number per vole on subadults (6.9) than on adults (5.1) (chi-square = 9.04**, 1 df). Whereas most parasites encountered were more abundant on male voles, *E. ohioensis* had a significantly higher average abundance per vole on females (70) than on males (4.3) (chi-square = 27.57**, 1 df). These results indicate more active reproduction in fall and winter, and that infestation probably occurs in the nest since female and subadult voles are more heavily infested.

Other chiggers found were *Euschoengastia diversa* Loomis, 1956, *Euschoengastia peromysci* (Ewing, 1929), *Neotrombicula whartoni* (Ewing, 1929), *Neotrombicula lipovskyi* (Brennan and Wharton, 1950), and *Eutrombicula alfreddugesi* (Oudemans, 1910). The specimen of *E. alfreddugesi* was taken in July; the others in October through December.

Glycyphagidae

Adults and tritonymphs of *Glycyphagus hypudaei* (Koch, 1841) (Glycyphagidae) have been taken in Europe (Turk and Turk, 1957; Rupes, 1967), but have not been reported from North America. The hyopial form (deutonymph), however, has been found on a variety of North America mammals (Fain and Whitaker, 1973). Adults of each sex, tritonymphs and deutonymphs, apparently all of this species, were found on pine voles during the present study, although the adults and tritonymphs do not precisely fit the previous descriptions. This was the third most abundant ectoparasite found on the pine voles. A total of 107 adult males, 102 adult females, 181 tritonymphs, and 26 deutonymphs was collected. Adults of both sexes were taken from each of

five voles (5.8%), with an average abundance of 21.4 and 20.4 per infested vole for males and females, respectively. Tritonymphs were found on eight voles (9.3%), five of which also harbored adults. The average number of tritonymphs per infested animal was 22.6. Hypopi were recovered from eight voles (9.3%), with an average of 3.3 per infested vole. All three life stages were found together on only one vole. The average number of individuals per vole (all life stages included) was significantly higher during the spring-summer period (10.3) than during the fall and winter (3.6) (chi-square = 121.80**, 1 df). The abundance of adult mites was also significantly higher in spring and summer than during fall and winter, with average numbers per vole of 3.4 and 2.2 respectively (chi-square = 7.20**, 1 df). The tritonymphs showed a similar pattern, with an average of 6.8 per vole in the spring-summer and 1.0 in the fall-winter (chi-square = 206.74**, 1 df). The deutonymphs showed no significant seasonal difference. The frequency of voles infested with *G. hypudaei* (all life stages included) also was significantly higher in the spring-summer period (37.5%) than during the fall-winter period (12.9%) (chi square = 4.50*, 1 df). The average number of *G. hypudaei* per vole (all life stages included) for the subadult voles (1.8) was significantly lower than for adults (4.4) (chi square = 29.13**, 1 df). Adult mites averaged 2.9 per vole on the adult voles, but none were taken from subadult voles, again a significant difference (chi square = 61.36**, 1 df). Deutonymphs had a significantly higher abundance on subadults (0.6 per vole) than on adults ((0.2 per vole) (chi-square = 7.22**, 1 df). The one juvenile pine vole caught during the study harbored one deutonymph, 75 tritonymphs, and 22 adults. Male pine voles had a significantly higher average number of *G. hypudaei* (all life stages included) per vole (8.4) than females (2.1) (chi-square = 150.23**, 1 df). The deutonymphs, however, had a significantly higher abundance on females (0.5 per vole) than on males (0.1 per vole) (chi-square = 11.65**, 1 df). The significance of the numbers of life stages other than deutonymphs in this sample is not understood at this time.

Another glycyphagid mite collected during this study was a single deutonymph of *Dermacarus hylandi* Fain, 1969, a species that has been reported only from *Tamias striatus* (Fain et al., 1971; Fain and Whitaker, 1973) and *Clethrionomys gapperi* (Fain, 1969).

Other mites

A few other kinds of mites were found (Table 1). Some deserve further mention. All anoetids appeared to be *Wichmannia.* One of two cheyletids taken appears to be *Eucheyletia bishoppi* Baker, 1949. The second could not be identified because of its poor condition. *Radfordia hylandi* Fain and Lukoschus, 1977 was the only myobiid species found (five specimens taken, all females). *Myocoptes japonensis* Radford, 1955 was the only myocoptid mite recovered (20 females, two males, and four immatures.)

Several species of Pygmephoridae were collected. Species identified from this material by S. Mahunka are *Bakerdania jonesi* Mahunka, 1975, *B. plurisetosa* Mahunka, 1975, *Pseudopygmephorus quadratus* (Ewing, 1917), *Pygmephorus equitrichosus* Mahunka, 1975, *P. hastatus* Mahunka, 1973, *P. scalopi* Mahunka, 1973, and *P. whitakeri* Mahunka, 1973.

It is interesting that no listrophorid mites were collected. Listophorid mites, particularly *Listrophorus mexicanus*, are often abundant on microtine rodents (Fain and Hyland, 1974; Whitaker, 1982), and *Listrophorus pitymys* was described from *Microtus pinetorum* from Rhode Island. We have since seen specimens of *Listrophorus pitymys* from pine voles from Georgia and Kentucky (Whitaker, unpublished) and New York (Whitaker and French, unpublished). However, no listrophorids were taken from this host from Illinois during the present study nor from Indiana (Whitaker, 1982).

Fleas

Ctenophthalmus pseudagyrtes Baker, 1904, the normal flea of the pine vole, was the only species collected from more than one animal (16 of each sex taken). Other fleas taken (one male each) were *Peromyscopsylla hamifer* (Rothschild, 1906), *Epitedia wenmanni* (Rothschild, 1904), *Doratopsylla blarinae* C. Fox, 1914, and *Stenoponia americana* (Baker, 1899).

Ticks

Dermacentor variabilis (Say, 1821) was the only tick found (5 larvae).

Discussion

Species not previously taken on this host are the laelapid mite *Haemogamasus harperi,* the pygmephorid mites *Bakerdania jonesi, B. plurisetosa,* and *Pseudopygmephorus quadratus*, and the fleas *Peromyscopsylla hamifer* and *Epitedia wenmanni*. Mites other than chiggers not previously taken from Illinois are GLYCYPHAGIDAE: *Glycyphagus hypudaei, Dermcarus hylandi*; LAELAPIDAE: *Eulaelaps stabularis, Haemogamasus harperi, H. longitarsus*; MYOBIIDAE: *Radfordia hylandi*; PYGMEPHORIDAE: *Bakerdania jonesi, B. plurisetosa, Pseudopygmephorus quadratus.*

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