

Food and External Parasites of the Norway Rat, *Rattus norvegicus*, in Indiana

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Abstract

Major ectoparasites of the Norway Rat in Indiana are the sucking louse, *Polyplax spinulosa*, the laelapid mites, *Androlaelaps fahrenheitsi* and *A. casalis*, and the myobiid mite *Radfordia ensifera*. A number of other species were found in the fur, some of them parasitic, some not. Grain seeds (primarily wheat) and corn were the most important foods. These, plus other cultivated foods (Sorghum and Soybeans) totaled 62.1% of the volume of food in stomachs. It was estimated that *Rattus norvegicus*, in Indiana, eats a total of about 7000 tons of harvested crop foods on farms and at grain elevators per year.

Introduction

The Norway Rat, *Rattus norvegicus*, is a very common animal, and often a major pest, but there is relatively little information on the food and external parasites of this species in Indiana. Wilson (14) examined 69 rats of this species for fleas, ticks and sucking lice. He reported 292 lice, *Polyplax spinulosa* (Burmeister) on this species from Lagrange, Marion and Tippecanoe Counties, Indiana, two ticks, *Dermacentor variabilis*, and four fleas, one *Ctenophthalmus pseudagyrtes*, one *Orchopeas howardii* and two *O. leucopus* from *R. norvegicus* from Indiana. However, 44 of the lice were from laboratory rats, rather than wild individuals. There are three earlier records of fleas from *R. norvegicus* in Indiana, the cat flea, *Ctenocephalides felis* (1), *Xenopsylla cheopis* (1, 13) and *Nosopsyllus fasciatus* from Marion County (13). *Xenopsylla cheopis* and *Nosopsyllus fasciatus* are both typically found on rats, but Wilson (16) found neither. There are apparently no records of mites from *R. norvegicus* from Indiana, although there are a number of records of mites from this species from elsewhere. Mite records for this species have been summarized by Whitaker and Wilson (15), and only a few of the more comprehensive reports will be specifically cited here.

The most pertinent paper geographically, would be that of Goode and Kocher (4). Those authors examined 392 live trapped Norway Rats from Louisville, Kentucky and recorded 3473 ectoparasites. Major forms included were 2512 lice, *Polyplax spinulosa* (6.41 per rat) on 281 rats (71.7% of them), 187 fleas, *Nosopsyllus fasciatus* (0.48) on 63 rats (16.1%), 167 mites, *Ornithonyssus bacoti* (0.43) on 41 rats (10.5%), 135 fleas, *Xenopsylla cheopis* (0.34) on 55 rats (14.0%), 69 mites, *Laelaps echidnina* (0.18) on 24 rats (6.1%). Sixty-three rats (16.1%) were entirely free of parasites.

A total of 8082 Norway Rats from Georgia was examined (10). Numbers of hosts parasitized, and numbers of individuals of major parasites are given below. ANOPLURA: *Polyplax spinulosa* (5440, 76,913).

SIPHONAPTERA: *Xenopsylla cheopis* (3056, 22,797); *Echidnophaga gallinacea* (1620, 18,324); *Leptopsylla segnis* (1680, 10,648); *Ctenocephalides felis* (238, 413); *Polygenis gwyni* (19, 23); *Orchopeas howardii* (4, 4); *Nosopsyllus fasciatus* (2, 3); and *Ctenophthalmus pseudagyrtes* (2, 2). ACARINA (Mites): *Ornithonyssus bacoti* (1365, 14,978); *Laelaps echidnina* (180, 1788); *Androlaelaps fahrenheitz* (90, 229); *A. casalis* (100, 175); *Hypoaspis lubrica* (29, 104); *Eulaelaps stabularis* (18, 71); *Macrocheles* sp. (5, 5); *Androlaelaps morlani* (1, 2); *Cheyletus eruditus* (46, 123); *C. malaccensis* (4, 4); *Radfordia ensifera* (1, 1). ACARINA (Chigger Mites): *Eutrombicula alreddugesi* (1, 1). ACARINA (Ticks): *Dermacentor variabilis* (52, 241); *Hae-maphysalis leporis-palustris* (5, 5); *Amblyomma maculatum* (4, 6); *A. americanum* (2, 2).

Mellot and Connell (9) reported the mites *Echinolaelaps echidnina*, *Androlaelaps fahrenheitz*, *Ornithonyssus bacoti* and *Radfordia ensifera*, and the tick *Dermacentor variabilis* from *R. norvegicus* from New Jersey, but did not indicate abundance.

It is well known that Norway Rats are adaptable and will eat a large variety of items, and of course they are a major pest causing millions of dollars of damage in consumed or contaminated foods, especially stored grain. However, very few (if any) studies are available in which the food habits of this form have been studied via stomach analysis, either in Indiana or elsewhere. There are statements in the literature which refer to the food habits of the species, "Rats are omnivorous in their diet, eating any plant and animal foods that are available (8), and the rat is omnivorous. It is fond of garbage and food refuse, and is always attracted to a low open garbage pail. It feeds upon food stores wherever they may be found near the ground. It often visits a poultry house, and may destroy eggs in nests accessible to it. It will catch and kill baby chicks. In fact, it eats almost anything" (5).

Lantz (65) states The Norway Rat . . . "is the worst mammal pest in the United States, the losses from its depredations amounting to many millions of dollars yearly—to more, indeed, than the losses from all other injurious mammals combined. . . . It destroys grains when newly planted, while growing, and in the shock, stack, mow, crib, granary, mill, elevator, or ship's hold, and also in the bin and feed trough. It invades store and warehouse, and destroys fur, laces, silks, carpets, leather goods and groceries. It attacks fruits, vegetables and meats in the markets, and destroys by pollution ten times as much as it eats. It carries disease germs from house to house and bubonic plague from city to city. It causes disastrous conflagrations; floods houses by gnawing lead water pipes; ruins artificial ponds and embankments by burrowing; destroys the farmer's pigs, eggs and young poultry; eats the eggs and young of song and game birds; and damages foundations, floors, doors and furnishings of dwellings."

The purpose of this paper is to present information on the food and external parasites of the Norway Rat, *Rattus norvegicus*, in Indiana.

Results and Discussion

The major ectoparasites or other associates of the Norway Rat in Indiana (Table 1) are the sucking louse, *Polyplax spinulosa*, *Androlaelaps fahrenheiti* (Laelapidae), *Radfordia ensifera* (Myobiidae), *Androlaelaps casalis* (Laelapidae) and *Trichouropoda* sp. nr. *orbicularis*. No fleas, one chigger and only two ticks were taken, indicating these forms are not common parasites of *R. norvegicus* in Indiana. Indeed, other than for sucking lice, Norway Rats are surprisingly clean of ectoparasites. Of the 146 examined, only 86 or 58.9% were found to harbor parasites or other associates of any kind. Some of the forms taken on *R. norvegicus* in other parts of the country, were not taken or were taken in low numbers. Such forms among the mites were *Alliea laruei*, *Liponyssoides sanguineus*, *Eulaelaps stabularis*, *Laelaps echidnina* and *L. nuttalli*. The latter two species are very common parasites of *Rattus norvegicus* in many localities, yet none at all were found in Indiana. *Laelaps echidnina* was recorded in 25 separate papers

TABLE 1. *Ectoparasites (and other associates) from the fur of 146 Norway Rats, Rattus norvegicus, from Indiana. Asterisk denotes probable parasitic form.*

	Number of Parasites		Hosts Parasitized	
	Total	Mean	Number	Percent
LICE				
* <i>Polyplax spinulosa</i> -----	2056	14.08	70	47.9
MITES				
* <i>Androlaelaps fahrenheiti</i> -----	212	1.45	44	30.1
* <i>Radfordia ensifera</i> -----	69	0.47	17	11.6
<i>Trichouropoda</i> sp. nr. <i>orbicularis</i> ----	40	0.27	16	11.0
<i>Proctolaelaps hypudaei</i> -----	23	0.16	6	4.1
<i>Pygmephorus whitakeri</i> -----	22	0.15	1	0.7
* <i>Hypoaspis</i> sp. -----	21	0.15	6	4.1
Anoetidae -----	18	0.12	9	6.7
* <i>Androlaelaps casalis</i> -----	18	0.12	15	10.3
Chortoglyphidae -----	11	0.08	8	5.6
Oribatid mites -----	10	0.07	4	2.7
Tyroglyphidae -----	13	0.09	5	3.4
* <i>Ornithonyssus bacoti</i> -----	8	0.05	4	2.7
<i>Macrocheles merdarius</i> -----	6	0.04	3	2.1
<i>Pygmephorus designatus</i> -----	5	0.03	1	0.7
* <i>Ornithonyssus sylviarum</i> -----	4	0.03	4	2.7
* <i>Zibethacarus ondatrae</i> -----	4	0.03	1	0.7
<i>Euryparasitus</i> sp. -----	4	0.03	3	2.1
<i>Macrocheles mammifer</i> -----	3	0.02	3	2.1
Phytoseiidae -----	3	0.02	3	2.1
* <i>Hypoaspis lubrica</i> -----	3	0.02	2	1.4
* <i>Androlaelaps morlani</i> -----	1	0.01	1	0.7
* <i>Hirstionyssus butantanensis</i> -----	1	0.01	1	0.7
* <i>Androlaelaps</i> sp. -----	1	0.01	1	0.7
Glycyphagidae (adult) -----	1	0.01	1	0.7
<i>Pygmephorus scalopi</i> -----	1	0.01	1	0.7
* <i>Cheyletus eruditus</i> -----	1	0.01	1	0.7
<i>Macrocheles</i> sp. -----	1	0.01	1	0.7
CHIGGER MITES				
* <i>Eutrombicula alfreddugesi</i> -----	1	0.01	1	0.7
TICKS				
<i>Dermaacentor variabilis</i> -----	2	0.01	1	0.7

from North American localities (15), although most of these records were from southern states, with a few from seacoast states of the northeast. However, *L. echidnina* is found on *R. norvegicus* in Ohio (7) and Quebec (3). Rats from Providence, R.I. were examined (11) and 21% were found to be infested with *L. echidnina*. Large numbers of this species were found on *Rattus norvegicus* from New Jersey (12). No difference was discerned in abundance on old versus young rats but average numbers per rat were much higher in warmer months than in colder months. Sixty-nine mites of this species were included among 3473 ectoparasites from 392 live trapped Norway Rats from Louisville, Kentucky (4). All of the 12 reports of *L. nuttalli* are for southern states (15).

Data from Indiana rats (mostly from central Indiana) can be compared to those from Louisville (4), just to the south and across the Ohio River from southern Indiana. The louse, *Polyplax spinulosa*, was the most common parasite taken during both studies. The percentage of hosts parasitized was lower in Indiana, but the overall average number per host was higher. However, there the similarity ended, as none of the other four more abundant parasites of rats from Louisville, 2 mites and 2 fleas, were abundant on Indiana rats, and three of them, including the two fleas and the mite *L. echidnina*, were not found at all. The other mite, *O. bacoti*, was found in low numbers (rate of 0.05 per rat, and on 2.7% of the rats). This is a common mite on the house mouse, *Mus musculus* in Indiana (2, 14); but is much less common on *Rattus* in Indiana or Louisville (0.43 per rat, and on 10.5% of the rats). It is not clear why rat fleas were not found on Indiana rats, but perhaps they are more common in the south. It would be interesting to examine rats from extreme southern Indiana. Possibly, rat fleas tend to move off the dead host faster than other fleas, but this seems unlikely; some fleas would have been taken if they were very common on central Indiana rats.

The two most common species of mites on rats from Indiana were *Androlaelaps fahrenheitzi* and *Radfordia ensifera*. *A. fahrenheitzi* is a common mite on many species of mammals. It seems peculiar that it was not taken in numbers on Louisville rats, since it is large and easily seen. *Radfordia ensifera*, a myobiid mite, is small and easily overlooked. One needs to use a dissecting microscope to examine the fur and skin of the rats while brushing the hair back with dissecting needles to find many mites of this species. I suspect that it was simply overlooked in the Louisville studies, especially since few other small mites were taken in numbers in that study either.

A fairly large number of forms was taken, at least 31, although not all have been identified to species. Also, not all of these were parasitic. Parasitic forms consisted of 1 species of louse, 12 species of mites and one species of tick. Many of the forms taken in low numbers must be considered as stragglers or accidentals, presumably having wandered onto the rats either before or after death. A few forms, *Trichouropoda* sp. and the species of *Macrocheles*, and *Pygmephorus* appear to be regular, though not abundant associates. Some of these may form phoretic relationships with the rats.

TABLE 2. *Foods eaten by 115 rats, Rattus norvegicus, from Indiana.*

Item	Percent Volume	Percent Frequency
Grain seeds (mostly wheat) -----	39.7	46.1
Corn -----	20.2	27.8
Flesh -----	6.3	10.4
Green Vegetation -----	5.3	12.2
Mast -----	5.0	6.1
Unidentified material -----	5.0	2.6
Miscellaneous vegetation -----	4.8	12.2
Clover flowers (<i>Trifolium sp.</i>) -----	3.9	8.7
Garbage -----	3.2	5.2
Grass seeds -----	2.1	3.5
Unidentified seeds -----	1.2	1.7
Sorghum seeds -----	1.1	1.7
Soybean seeds -----	1.1	1.7
Muscoidea -----	0.6	1.7
Dipterous larvae -----	0.2	3.5
Coleoptera -----	0.1	2.6
Formicidae (ant) -----	0.1	2.6
Earthworm -----	0.1	0.9
Unidentified insect -----	0.1	3.5
Coleopterous larvae -----	0.1	2.6
Adult Lepidoptera -----	0.1	0.9
	100.3	

Food Habits

Most of the rats examined during this study were taken in and around farms and grain storage areas, and this is reflected in the food habits data. The two top foods were grain seeds (mostly wheat) and corn, these two items totalling 59.9% of the volume of food in stomachs. These foods, plus the sorghum and soybean seeds in stomachs brings to 62.1% the total amount of cultivated crop foods in the sample. This was not grain left in the fields after harvesting; it was processed grain. If one considers that the amount of food per stomach might average 5 grams, that the stomach might be filled at least 3 times per day, and that approximately 60% of the food is of grain then it can be estimated that each rat might consume 9 grams of harvested grain per day x 365 days = 3285 grams per year. Assuming 25 rats per farm and 80 per grain elevator (probably low estimates), one can arrive at a rough estimate of the yearly amount of cultivated grains consumed per year by rats in Indiana. There are approximately 75,000 major farms in Indiana and approximately 770 granaries. Using the figures of 25 and 80 times these numbers the rat population of farms and grain elevators of the state was estimated at 1,936,600. Each rat destroys 3285 grams (7.2 lbs) per year. This calculates to 13,943,520 pounds (about 7000 tons) per year.

Other items were eaten, but most were of plant origin. Total animal material included 7.7% of the volume, mostly of flesh. Garbage comprised 3.2% of the total volume, but some of the other materials particularly flesh and unidentified material may have been of garbage.

In addition trace amounts of the following foods were found, each in one stomach: Unidentified insect larvae, Lepidopterous pupae, Hemiptera, *Chenopodium* seeds, Feathers, Cicadellidae, Phalangida, Cryptophagidae, Diptera.

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