SCIENTIFIC NOTE

Ectoparasitic Arthropods Occurring on *Rattus norvegicus* and *Rattus rattus* Collected from Two Properties on the Island of Oahu, Hawaii (Acarina, Siphonaptera, and Anoplura)

Pingjun Yang, Sandra Oshiro, and **Wesley Warashina**
Hawaii Department of Health, Vector Control Branch, 99-945 Halawa Valley Street, Aiea, HI 96701. E-mail: pingjun.yang@doh.hawaii.gov

Abstract. A survey of ectoparasites occurring on rats was carried out from August 2006 through February 2007 on two properties on the island of Oahu, Hawaii. From the property in Liliha, a total of 167 Norway rats, *Rattus norvegicus*, were examined. Two species of fleas and four species of mites were collected: oriental rat flea, *Xenopsylla cheopis*, cat flea, *Ctenocephalides felis,* tropical rat mite, *Ornithonyssus bacoti*, domestic rat mite, *Laelaps nuttalli*, spiny rat mite, *Laelaps echidninus*, and house mouse mite, *Allodermanyssus sanguineus*. From the property in Aiea, a total of 80 black rats, *Rattus rattus*, were examined. One species of flea, one species of louse, and two species of mites were collected: cat flea, *C. felis*, sucking louse, *Polyplax spinulosa,* tropical rat mite, *O. bacoti*, and house mouse mite, *A. sanguineus*. This is the first record of the house mouse mite, *A. sanguineus*, from Hawaii. *Ornithonyssus bacoti* and *A. sanguineus* were the predominant species of mites that infested both rodent species. The occurrence of other ectoparasites on the rats caught from the two sites may be affected by different rodent host and other environmental factors.

Key words: Ectoparasitic arthropods, *Rattus norvegicus*, *Rattus rattus*, Hawaii

Some residents in Hawaii like to feed wild birds and feral cats on their properties. In these places, both food and harborage are usually available for rodents. In addition, control actions are rarely taken by these residents. Consequently, these sites are most likely to become the "hot-spots" for rodents and their ectoparasites. This study reports our survey of rodent ectoparasites from this special environment created by humans.

From August 2006 through February 2007, Hawaii State Department of Health, Vector Control Branch conducted the rodent trapping on two properties, one each in Liliha and Aiea, on the island of Oahu, Hawaii. Both residents had fed wild birds and feral cats for years and their properties were heavily infested by rodents. For the Liliha property, which is about 468 square meters, a varying number of Japanese cage traps (16 to 50) baited with dried dog food were set up outside the house for 35 non-consecutive nights during the study period (the resident did not allow trapping inside the house); and for the Aiea property, which is about 930 square meters, 50 Japanese cage traps with dried dog food were set up inside the house for 6 nights. The traps were set up in the morning and collected and brought back to the laboratory on the following morning. The rats together with the trap were put in a plastic bag and killed using CO_2. Then the rats were sprayed with Sumithrin (Whitimire PT®) and ectoparasites on the rats were combed and collected. Slides of the ectoparasites were made as needed. The ectoparasites were identified using the keys provided by Pratt (1963), and Tenorio and Goff (1980). Voucher specimens were deposited in the

State Department of Health, Vector Control Branch collection facility located in Halawa Valley, Oahu, Hawaii.

From the property in Liliha, a total of 184 Norway rats, *Rattus norvegicus*, were trapped outside the house. Of these, 17 were unsuitable for collecting their ectoparasites since they died early in the traps. Two species of fleas and four species of mites were recovered from the rats (Table 1). The fleas were Oriental rat flea, *Xenopsylla cheopis* (Rothschild), and cat flea, *Ctenocephalides felis* (Bouche). The mites were tropical rat mite, *Ornithonyssus bacoti* (Hirst), domestic rat mite, *Laelaps nuttalli* Hirst, spiny rat mite, *Laelaps echidninus* Berlese, and house mouse mite, *Allodermanyssus sanguineus* (Hirst).

From the property in Aiea, a total of 80 black rats, *Rattus rattus*, were trapped from the property (inside the house). One species of flea, one species of louse, and two species of mites were recovered from the rats (Table 2). They were cat flea, *C. felis*, sucking louse, *Polyplax spinulosa* (Burmeister), tropical rat mite, *O. bacoti*, and house mouse mite, *A. sanguineus*.

This is the first record of the house mouse mite, *A. sanguineus*, from Hawaii. *Allodermanyssus sanguineus* is the vector of *Rickettsia akari*, the etiological agent of rickettsialpox in man (Mallis 1990), and considered a very important species of dermanyssid mites (Baker et al. 1956).

Xenopsylla cheopis is found throughout the Islands and is the classic vector of plague as well as endemic typhus fever (Eskey 1934; Bonnet 1948). It is surprising that no *X. cheopis* was found from *R. rattus* collected in the survey site in Aiea since *X. cheopis* parasitizes *R. rattus* and *R. norvegicus* equally (Pollitzer 1954; Haas 1965).

Both infestation rate and mean number of *O. bacoti* per rodent were high in this study (Table 1, 2). *Ornithonysuss bacoti* occurred more frequently and in greater numbers on both species of rodent hosts than other species of mites. Mitchell (1964a) recovered a very low number of *O. bacoti* from both *R. norvegicus* and *R. rattus*. This may be due to the preference of *O. bacoti* for drier habitats (Radovsky et al. 1975) and both Liliha and Aiea areas are drier than Manoa valley.

The total number of the ectoparasite species and the abundance of each species from the two survey sites were different. Two factors may be involved. First, the rodent hosts from the two survey sites were different species. Some ectoparasites prefer certain species of rodents (Haas 1965). Second, the microhabitats of the hosts at the two sites were different. The Norway rats in Liliha were caught from outside the house, while the black rats in Aiea were caught inside the house. Some ectoparasites may prefer to breed on the hosts inside the building, while other species may prefer to breed on the hosts outside buildings. Pollitzer (1954) found that the microhabitats of the hosts sometimes play an important role in determining the abundance of certain ectoparasites.

Acknowledgment

We thank Dr. M. Lee Goff for confirming the identification of the house mouse mite and comments and corrections on the manuscript. We also thank Gregory Olmsted, Mark Leong, Esmeraldo Gallegos and other field and lab staff of the Vector Control Branch for their comments on the manuscript and technical assistance.

Literature Cited

Baker, E.W., T.M. Evans, D.J. Gould, W.B. Hull, and **H.L. Keegan.** 1956. A manual of parasitic mites of medical or economic importance. National Pest Control Association. New York, N.Y. 170 p.

Bonnet, D.D. 1948. Certain aspects of medical entomology in Hawaii (Presidential address). Proceeding of the Hawaiian Entomological Society 13:225–233.

Table 1. Occurrence of ectoparasites on *Rattus norvegicus* trapped from a residential property in Liliha, Oahu, Hawaii*.

Species	Infestation rate	No. ectoparasites	Mean±SE**
Fleas			
Xenopsylla cheopis (Rothschild)	0.347	160	2.7 (0.4)
Ctenocephalides felis (Bouche)	0.012	3	–
Mites			
Ornithonyssus bacoti (Hirst)	0.832	1015	26.0 (5.3)
Laelaps nuttalli Hirst	0.084	76	5.4 (2.1)
Laelaps echidninus Berlese	0.036	19	3.2 (1.3)
Allodermanyssus sanguineus (Hirst)	0.108	71	3.9 (0.8)

* A total of 167 *R. norvegicus* was examined.
** Per infested rat.

Table 2. Occurrence of ectoparasites on *Rattus rattus* trapped from a residential property in Aiea, Oahu, Hawaii*.

Species	Infestation rate	No. ectoparasites	Mean±SE**
Fleas			
Ctenocephalides felis (Bouche)	0.013	2	_
Mites			
Ornithonyssus bacoti (Hirst)	0.538	620	14.7 (3.2)
Allodermanyssus sanguineus (Hirst)	0.388	103	3.3 (0.6)
Lice			
Polyplax spinulosa (Burmeister)	0.025	3	_

* A total of 80 *R. rattus* was examined.
** Per infested rat.

Eskey, C.R. 1934. Epidemiological study of plague in the Hawaiian Islands. Public Health Bulletin. 213, 70 p.

Haas, G.E.1965. Comparative suitability of the four murine rodents of Hawaii as hosts for *Xenopsylla vexabilis* and *X. cheopis* (Siphonaptera). *Journal of Medical Entomology*. 2: 75–83.

Hawaii Department of Health, Vector Control Branch. 1991 Vector Control Training Manual. Honolulu, 129 p.

Mallis, A. 1990. Handbook of pest control (Seven edition) Franzak & Foster Co. Cleveland Ohio. 1152 p.

Mitchell, C.J. 1964a. Ectoparasitic and commensal arthropods occurring on the rats of Manoa Valley, Oahu (Acarina, Anoplura, and Siphonaptera). Proceeding of the Hawaiian Entomological Society 18: 413–415.

Pollitzer, R. 1954. Plague. Monograph Series 22. World Health Organization, Geneva. 698 p.

Pratt, H.D. 1963. Mites of public health importance and their control. U.S. department of Health, Education, and Welfare, Public Health Service, Atlanta, Georgia, 28 p.

Radovsky, F.J., J.M. Tenorio, P.Q. Tomich, and **J.D. Jacobi.** 1975. Acari on murine rodents along an altitudinal transect on Mauna Loa, Hawaii. Technical report No. 58. Island Ecosystems IRP, U.S. International Biological Program. 11 p.

Tenorio, J.M., and **M.L. Goff.** 1980. Ectoparasites of Hawaiian rodents (Siphonaptera, Anoplura and Acari). Bishop Museum Special Publication. Bishop Museum Press, Honolulu, Hawaii. 32 p.