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Nixon Wilson
University of Northern Iowa, Cedar Falls

Wendel J. Johnson
University of Wisconsin - Green Bay, Marinette County

ECTOPARASITES OF ISLE ROYALE, MICHIGAN

Nixon Wilson[1] and Wendel J. Johnson[2]

Isle Royale National Park is a rocky archipelago of approximately 200 islands and islets in northwestern Lake Superior. Politically it belongs to the State of Michigan situated 50 miles to the southeast. The main island lies parallel to the Canadian shore, which is from 12 to 15 miles to the northwest. It is 45 miles long, and 9 miles wide at its broadest point. A review of the climatological, vegetational, and geological features of the island is given by Mech (1966).

Most of the material included in this paper was collected incidently by Johnson during a three-year study (1966-68) of the food habits of the red fox (*Vulpes vulpes* (Linnaeus)), and population dynamics of three of its principal prey species--the snowshoe rabbit (*Lepus americanus*), red squirrel (*Tamiasciurus hudsonicus*), and deer mouse (*Peromyscus maniculatus*) (see Johnson, 1969). The remaining material (1960-61) was collected by L. D. Mech during his studies of gray wolf (*Canis lupus* Linnaeus)--moose (*Alces alces*) relationships (see Mech, 1966).

Previous references to ectoparasites from Isle Royale are few. Hickie (1936) and Mech (1966) mentioned a tick (*Dermacentor albipictus*) occurring on moose, Sillman (1955) published a photograph of *Cuterebra* larvae collected from deer mouse, and Rupeš et al. (1971) recently described a new species of *Dermacarus* from a red squirrel. Lawrence et al. (1965) studied the ectoparasites of northern Michigan mammals and recorded seven species from the island, including the sucking louse, *Neohaematopinus sciurinus* Mjöberg (= *semifasciatus* Ferris ?), which we do not list.

In the present paper 20 species of ectoparasites are listed from Isle Royale, 12 for the first time. Four are new records for the State of Michigan and several are range extensions for species. The ectoparasite fauna is diverse for such a small, isolated area with a limited number of vertebrate species. The island appears to occupy a critical position in the distribution and speciation of some Siphonaptera.

In the following list, the collector is listed with the records only if someone other than Johnson. The majority of specimens are in the collection of the senior author; a few are in the B. P. Bishop Museum, Honolulu, Hawaii, Field Museum of Natural History, Chicago, Illinois, and Entomological Research Collection, Purdue University, Lafayette, Indiana.

LIST OF ECTOPARASITES

Class ACARI

Order METASTIGMATA

Family IXODIDAE

Dermacentor albipictus (Packard).–2 ♂♂, 8 ♀♀, ex *Alces alces* (Linnaeus), Siskiwit Bay, 17.III.1960, L. D. Mech; 2 ♂♂, 1 ♀, 28 NN, ex *A. alces*, 31.I.1961, LDM; 7 ♂♂, 5 ♀♀, 5 NN, ex *A. alces*, 13.III.1961, LDM; 1 ♀, II.1968. This is the common winter tick of cervids in North America and no doubt is the species referred to by Hickie (1936) as abundant on moose during the winter, on Isle Royale. Mech (1966) discusses its relationship to moose on the island and adequately summarizes the findings of other workers on the subject. Mech's notes with the material collected in January 1961, state that the specimens were found in a ten cm diameter area, on the left shoulder of the moose.

The adults cited above are typical *albipictus* and not the form *nigrolineatus*.

[1]Department of Biology, University of Northern Iowa, Cedar Falls, Iowa 50613.

[2]Ecosystems Analysis, University of Wisconsin–Green Bay, Marinette County Campus, Marinette, Wisconsin 54143. Supported in part by National Science Foundation Grant GB-5124 and the National Park Service. Journal Paper No. 4156 of the Purdue Agricultural Experiment Station.

Haemaphysalis leporispalustris (Packard).–All from *Lepus americanus* Erxleben. 2 ♀♀, 6.VI.1967; 6 ♂♂, 11 ♀♀, 2 NN, several hosts, 7.V-26.X.1968. In North America the rabbit tick is encountered on leporids more frequently than any other tick. These are the first records from Isle Royale although the species is recorded from surrounding areas.

Ixodes marxi Banks.–All from *Tamiasciurus hudsonicus* (Erxleben). 1 N, 16.VI.1966; 2 ♀♀, 9.VI.1967. Tree squirrels are the favorite hosts for this tick. It was not reported previously from the island; however, there are records from nearby localities.

Order MESOSTIGMATA
Family **LAELAPIDAE**

Androlaelaps fahrenholzi (Berlese).–7 ♀♀, 1 DN, ex *Peromyscus maniculatus* (Wagner), VI.1966; 12 ♀♀, ex several *P. maniculatus*, VI-IX.1966; 3 ♀♀, ex *Tamiasciurus hudsonicus*, 20.VII.1966; 1 ♀, ex *T. hudsonicus*, 7.V-26.X.1968. This is a cosmopolitan species collected most often on rodents. It was reported from Isle Royale (Lawrence et al., 1965).

Haemogamasus ambulans (Thorell).–All from *Peromyscus maniculatus*. 1 ♀, VI.1966; 1 ♀, 7.V-26.X.1968. *H. ambulans* is recorded from a variety of rodents and a few insectivores with *Microtus* the most commonly recorded host genus. There are records from the Upper Peninsula, but none from Isle Royale.

The specific name of this species, and the following one, is used in the sense of Evans and Till (1966 and Redington (1971), and not Keegan (1951).

Haemogamasus reidi Ewing.–2 ♀♀, 1 DN, ex several *Tamiasciurus hudsonicus*, 7.V-26.X.1968. This species is listed from even a greater variety of hosts than *H. ambulans*. In the eastern United States tree squirrels are reported as hosts more frequently than any other animal. There are records from other areas of Michigan, but not Isle Royale.

Order PROSTIGMATA
Family **TROMBICULIDAE**

Trombicula (Neotrombicula) harperi Ewing and **Trombicula (Neotrombicula) microti** Ewing.–Many LL, ex *Peromyscus maniculatus*, VIII.1967. Specimens of both species were identified from a sample of many larvae attached near the base of the ears of the host. *T. (N.) harperi* slightly outnumbered *T. (N.) microti* in the sample mounted.

These two species are very similar and Brennan and Jones (1959) discussed their suspected synonymy, in which case *T. (N.) harperi* has priority. Lawrence et al. (1965) recorded both species from Iron County in the Upper Peninsula.

Order ASTIGMATA
Family **LABIDOPHORIDAE**

Dermacarus tamiasciuri Rupeš, Yunker, and Wilson.–1 hypopus, ex *Tamiasciurus hudsonicus*, 7.V-26.X.1968. *D. tamiasciuri* recently was described from Isle Royale on the basis of the above specimen (Rupeš et al., 1971). This family of mites has received little attention in North America and probably many additional species remain to be described.

Class **INSECTA**
Order ANOPLURA
Family **HOPLOPLEURIDAE**

Polyplax auricularis Kellogg and Ferris.–1 N 2, ex *Peromyscus maniculatus*, VI-IX.1966. *P. auricularis* is recorded mostly from different species of *Peromyscus*; all records are from western states, western Canada or Mexico, except for one from New York. Lawrence et al. (1965) did not record the genus from the Upper Peninsula and Cook and Beer (1958, 1968) did not find it on over 4,000 *P. maniculatus* examined for lice from Dakota and Lake Counties, Minnesota. As pointed out by Cook and Beer (1955), some species of *Polyplax* appear to have distributions not coincident with that of their hosts. This apparently is the case with *P. auricularis*.

Order SIPHONAPTERA
Family **HYSTRICHOPSYLLIDAE**

Epitedia wenmanni wenmanni (Rothschild).—1 ♂, 3 ♀♀, ex *Peromyscus maniculatus,* 20.III.1967; 2 ♂♂, 2 ♀♀, ex several *P. maniculatus,* 7.V-26.X.1968; 1 ♂, 1 ♀, ex several *Tamiasciurus hudsonicus,* 7.V-26.X.1968; 1 ♀, ex *Mustela erminea* Linnaeus, 29.VIII.1968. This species is recorded from a variety of mammals with the majority of records from mice of the genus *Peromyscus.* It was recorded from Isle Royale by Lawrence et al. (1965).

Hystrichopsylla dippiei subspecies.—2 ♂♂, 1 ♀, ex several *Peromyscus maniculatus,* 7.V-26.X.1968. This large flea is reported from a variety of mammals, mostly rodents and insectivores. This is the first record from Michigan and the easternmost for the species in the United States. *H. d. dippiei* Rothschild is recorded from New Brunswick, Canada (Brown, 1968).

There is some question as to whether the two males are the same subspecies. They exhibit differences in the shape of sternum VIII and in the arrangement of apical spiniform setae and number of tubercles on the inner angle of sternum IX (Figs. 1,2). Neither specimen appears to be any of the species or subspecies listed by Holland (1957). In his key they come closest to *H. d. truncata* Holland and *H. d. spinata* Holland; however, they differ from these subspecies in the shape of sternum VIII, the additional tuberculations, of two types, at the inner angle of sternum IX, and the slightly different shape of the clasper processes (Figs. 1-3). Also, both subspecies have a western distribution. The fact the males from Isle Royale have tuberculations on the inner angle of sternum IX indicates they are not *H. d. dippiei,* the subspecies expected on geographical grounds.

It is likely that an undescribed subspecies occurs on Isle Royale; however, a large series of specimens needs to be studied and the limits of variation established before this can be said for certain. A detailed study of the genus in North America is desirable.

Rhadinopsylla difficilis Smit.—3 ♀♀, ex several *Tamiasciurus hudsonicus,* 7.V-26.X.1968; 1 ♀, ex *Mustela erminea,* 29.VIII.1968. These determinations are considered tentative inasmuch as no males were available for study. Smit (1957) described several closely related species of *Rhadinopsylla* from North America and distinguished them from *Rhadinopsylla fraterna* (Baker), which some specimens were confused with in the past. All of the new species were described from a few specimens and/or from a few localities. The genus *Rhadinopsylla* is in need of thorough revision in North America, when sufficient specimens are collected.

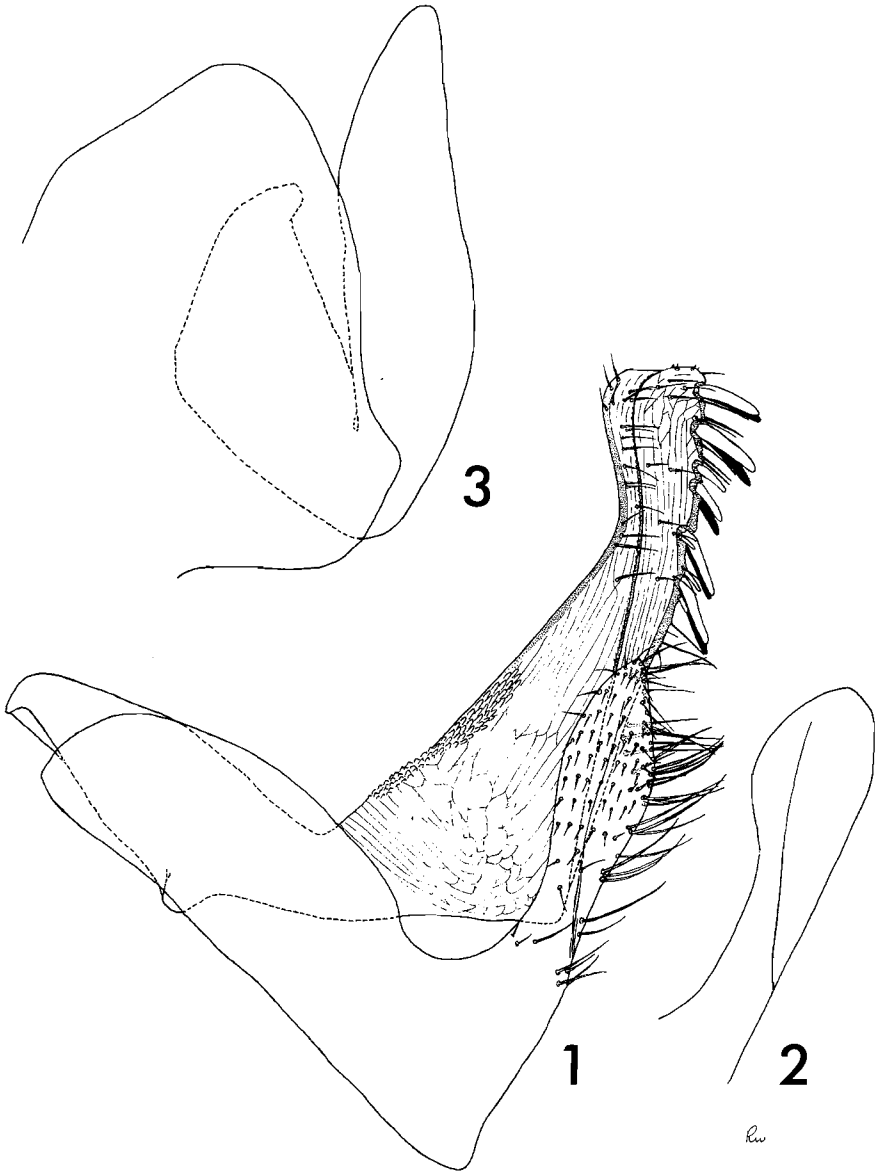
Family **CERATOPHYLLIDAE**

Monopsyllus vison (Baker).—All from *Tamiasciurus hudsonicus.* 5 ♀♀, 20.VII.1966; 1 ♂, 4 ♀♀, 8.VIII.1967; 5 ♂♂, 15 ♀♀, several hosts, 7.V-26.X.1968. *T. hudsonicus* is the true host of this flea. It was reported from Isle Royale and other localities in the Upper Peninsula by Lawrence et al. (1965).

Monopsyllus wagneri (Baker).—2 ♀♀, ex *Peromyscus maniculatus,* Conglomerate Bay, 9.VII.1966; 3 ♂♂, 4 ♀♀, ex several *P. maniculatus,* 7.V-26.X.1968; 1 ♀, ex *Tamiasciurus hudsonicus,* 7.V-26.X.1968. Mice of the genus *Peromyscus* are the principal hosts of this species. Lawrence et al. (1965) recorded the species from Isle Royale, but they failed to collect it in the Upper Peninsula. The records from Isle Royale are as far northeast as any published. Other easternmost records are from eastern and south-central Wisconsin (Knipping et al., 1950, Haas and Dicke, 1959, Haas, 1970) and northeastern Illinois (Layne, 1958).

The specimens from Isle Royale are closest to the form "systaltus" as illustrated by Johnson (1961), from Minnesota, South Dakota, and Wyoming (Fig. 4).

Orchopeas caedens caedens (Jordan).—2 ♂♂, 2 ♀♀, ex *Tamiasciurus hudsonicus,* Windigo I., 13.III.1960, L. D. Mech; 1 ♀, ex *T. hudsonicus,* 20.VII.1966; 16 ♂♂, 58 ♀♀, ex several *T. hudsonicus,* 7.V-26.X.1968; 2 ♀♀, ex *Mustela erminea,* 29.VIII.1968; 1 ♀, ex *Lepus americanus,* 7.V-26.X.1968.



Figs. 1-3. *Hystrichopsylla dippiei* subspecies, male. 1, Sternum VIII and IX. 2, Outline of sternum VIII (setae omitted) showing variation. 3, Clasper processes (setae omitted). Figures 1 and 3 from same specimen.

This species has a widespread distribution in North America and is recorded most often from *T. hudsonicus.*

Buckner (1964) extended the range of *O. c. caedens* into southeastern Manitoba and mentioned a record of *O. c. durus* (Jordan) from western Ontario. His material from Manitoba displayed some evidence of intergrading with *O. c. durus.* The specimens from Isle Royale appear to be *O. c. caedens,* which is an additional extension of the range eastward (Fig. 5). Lawrence et al. (1965) recorded the same subspecies from Isle Royale and the Upper Peninsula.

The specimens from *M. erminea* are probably indicative of its feeding habits and that from *L. americanus* probably an accidential occurrence.

Orchopeas leucopus (Baker).–All from *Peromyscus maniculatus.* 4 ♂♂, 2 ♀♀, 5 hosts, Windigo I., 19-20.II.1960, L. D. Mech; 2 ♂♂, 3 ♀♀, 3 hosts, Windigo I., 3.III.1960,

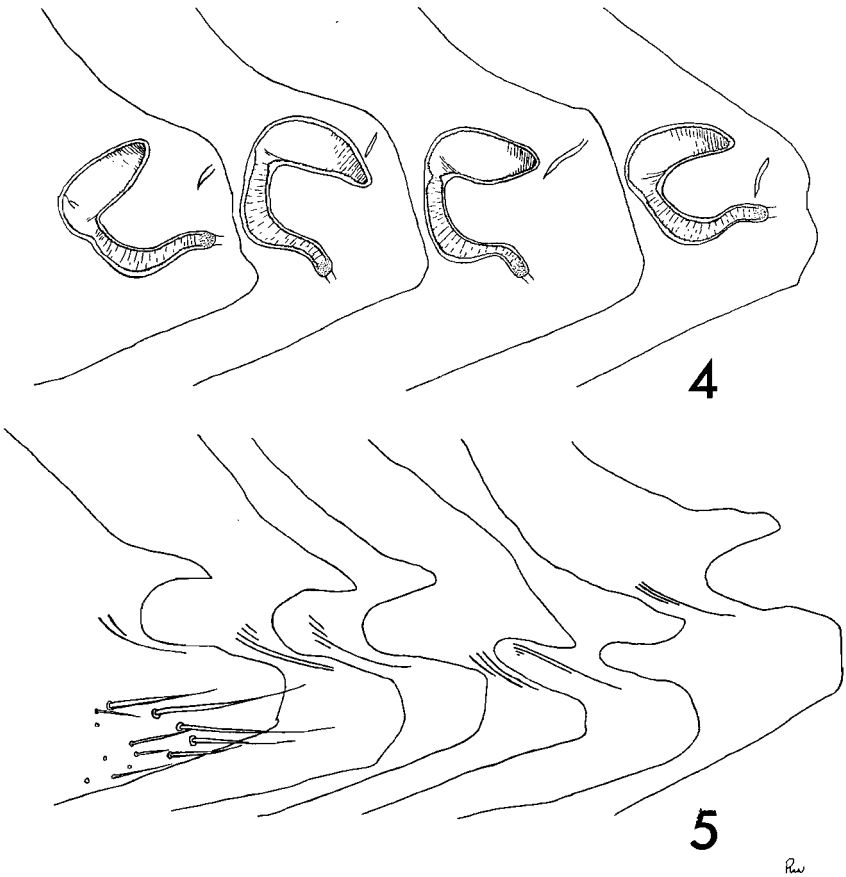


Fig. 4. Variation in sternum VII, spermatheca, and ductus bursae of *Monopsyllus wagneri* (Baker), female.

Fig. 5. Variation in sternum VII of *Orchopeas caedens caedens* (Jordan), female.

LDM; 2 ♀♀, VI.1966; 1 ♀, 9.VII.1966; 1 ♀, VIII.1967; 2 ♂♂, 14 ♀♀, several hosts, 7.V-26.X.1968. The genus *Peromyscus* is reported most frequently as a host for this widespread flea and there are reports from nearby areas although not from Isle Royale.

Family **LEPTOPSYLLIDAE**

Peromyscopsylla hesperomys hesperomys (Baker).–1 ♀, ex 3 *Peromyscus maniculatus*, Windigo I., 3.III.1960, L. D. Mech. *Peromyscus leucopus* (Rafinesque) and *P. maniculatus* are listed most frequently with this subspecies. The species was not recorded from the Upper Peninsula or nearby surrounding areas and this record appears to be the northernmost for the subspecies. Johnson and Traub (1954) reported intergrades between this subspecies and a western one, *P. h. adelpha* (Rothschild), in North Dakota, South Dakota, and Wyoming.

Family **ISCHNOPSYLLIDAE**

Myodopsylla insignis (Rothschild).–3 ♂♂, 2 ♀♀, ex *Myotis lucifugus* (Le Conte), Mott I., 18.VIII.1967. *M. insignis* is widely distributed in northeastern North America with the majority of records from bats of the genus *Myotis*. It was recorded from Iron County in the Upper Peninsula (Lawrence et al., 1965).

Order DIPTERA
Family **CUTEREBRIDAE**

Cuterebra sp.–Several *P. maniculatus* carried *Cuterebra* larvae. They were found in deer mice as early as 1 August and as late as 11 October; the maximum number in a deer mouse was three.

Sillman (1955) and Lawrence et al. (1965) listed the genus from Isle Royale.

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