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ARTHROPODOUS ECTOPARASITES FROM SOME
NORTHERN MICHIGAN MAMMALS¹

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IN 1953 and 1954, and during the immediately preceding years, an epizootic of tularemia occurred among beavers, *Castor canadensis*, in the Upper Peninsula of Michigan and in adjacent states⁵. From 1953 to 1955 an ecological study was made of the possible vectors and reservoir animals that might have been involved in the outbreak.

One part of this investigation was to collect and identify the parasitic arthropods from mammals that could have been associated with the epizootic. The results of this part of the research are reported in the following annotated listing.

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METHODS

Large mammals were obtained by selective live-trapping in appropriate habitats, by the collection of carcasses from "die-off" areas, and

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⁵ Lawrence, W. H., L. D. Fay, and S. A. Graham, 1956. Report on the beaver die-off in Michigan. *Jour. Wildlife Mgt.*, 20: 184-87.

from local fur trappers. Small mammals were collected by live-trapping on previously established two-acre grids. Each grid, made up of 99 trapping points at $\frac{1}{2}$ -chain intervals, was located in each of the three major vegetative types adjacent to an area where beavers had died. These types were mixed hardwood forest, mixed conifer-hardwood lowlands, and sedge marsh.

Large animals that were trapped alive were brought into the laboratory, anesthetized with sodium pentobarbitol, and examined for ectoparasites. The procedure was essentially the same for both living and dead animals. (1) A careful visual examination was made, especially around the mouth, ears, and genitalia. As they were found, the parasites were removed. (2) The fur over the entire body was then carefully parted and additional parasites collected. (3) Still other parasites were recovered by combing the fur with a fine-toothed comb. Each anesthetized animal was marked for future identification and, upon recovery from the anesthetic, was released in the area where it was trapped.

Small mammals collected on the grids were examined in the field. These were removed from the traps, placed on a white enameled tray, and covered by an inverted glass funnel. A small amount of ether was introduced to anesthetize both the animal and the ectoparasites. Many of the parasites left the animal and fell to the pan. The animals were then examined in the same manner as the large mammals, and the parasites collected were dropped into preserving fluid and taken into the laboratory for study. The animals were toe clipped for future identification, allowed to recover, and released at the point of capture.

Small ectoparasites were mounted on microscope slides, identifications were made, and the slides were labeled. Large ectoparasites were stored in vials containing 70 per cent alcohol. Duplicate specimens were placed in collections of The University of Michigan Museum of Zoology. Other specimens are in the collections of the School of Natural Resources, University of Michigan, and of the authors.

ECTOPARASITES AND THEIR HOSTS

ORDER ACARINA

FAMILY IXODIDAE

Dermacentor albipictus (Packard).—From *Odocoileus virginianus*; Iron County.

Dermacentor variabilis (Say).—From *Mustela erminea*, *Lynx rufus*, *Marmota monax*, *Peromyscus maniculatus*, *Clethrionomys gapperi*, *Microtus pennsylvanicus*, *Zapus hudsonius*, and *Erethizon dorsatum*; Iron and Houghton counties.

Haemaphysalis leporis-palustris (Packard).—From *Sorex arcticus*, *Microtus pennsylvanicus*, and *Lepus americanus*; Iron County.

Ixodes angustus Neumann.—From *Eutamias minimus**, *Tamias striatus**, *Peromyscus maniculatus*, and *Clethrionomys gapperi**; Iron County.

Ixodes banksi Bishopp.—From *Lutra canadensis*, *Castor canadensis*, *Ondatra zibethica*, and from beaver lodges and muskrat houses; Alger, Baraga, Dickinson, Gogebic, Houghton, Iron, Marquette, and Ontonagon counties.

Ixodes cookei Packard.—From *Sorex palustris**, *Mustela vison*, *Mephitis mephitis*, *Lynx rufus**, and *Erethizon dorsatum*; Alger, Chippewa, Houghton, Iron, and Schoolcraft counties.

Ixodes marksii Banks.—From *Eutamias minimus** and *Tamiasciurus hudsonicus*; Iron County.

Ixodes muris Bishopp and Smith.—From *Sorex arcticus**, *S. cinereus**, *S. palustris**, and *Zapus hudsonius*; Iron County. From *Z. hudsonius*; Houghton County.

SUPERFAMILY PARASITOIDEA

Euhaemogamasus liponyssoides (Ewing)†.—From *Sorex arcticus**, *S. cinereus*, *Blarina brevicauda*, *Peromyscus maniculatus*, and *Microtus pennsylvanicus*; Iron County.

Eulaelaps stabularis (Koch)†.—From *Blarina brevicauda*, *Peromyscus maniculatus*, and *Microtus pennsylvanicus*; Iron County.

Haemogamasus alaskensis Ewing.—From *Condylura cristata** and *Microtus pennsylvanicus*; Iron County.

Haemolaelaps glasgowi (Ewing).—From *Mephitis mephitis*, *Marmota monax*, *Eutamias minimus*, *Castor canadensis*, *Peromyscus maniculatus*, *Clethrionomys gapperi*, *Microtus pennsylvanicus*, *Ondatra zibethica*, and *Zapus hudsonius*; Gogebic, Houghton, and Iron counties, and Isle Royale.

Ichoronyssus britannicus (Radford)†.—From *Myotis* sp.; Iron County.

Laelaps alaskensis Grant†.—From *Sorex cinereus**, *Mustela erminea**, *Clethrionomys gapperi**, *Microtus pennsylvanicus**, *Ondatra zibethica**, and *Napaeozapus insignis**; Iron and Houghton counties.

Laelaps kochi Oudemans†.—From *Sorex cinereus**, *Mustela erminea**, and *Microtus pennsylvanicus*; Iron County.

Laelaps multispinosus Banks.—From *Mustela vison**, *Castor canadensis**, *Microtus pennsylvanicus**, and *Ondatra zibethica*; all Upper Peninsula counties.

Myonyssus jamesoni Ewing and Baker†.—From *Sorex arcticus**; Iron County.

Neoichoronyssus carnifex (Koch)†.—From *Microtus pennsylvanicus*; Iron County.

FAMILY LISTROPHORIDAE

Listrophorus americanus Radford.†.—From *Ondatra zibethica*; all Upper Peninsula counties.

Listrophorus sp.—From *Clethrionomys gapperi* and *Microtus pennsylvanicus*; Iron County.

Probalidocarpus canadensis Lawrence†.—From *Castor canadensis*; Gogebic, Houghton, Iron, and Ontonagon counties.

* Indicates new host record.

† Indicates new record for Michigan.

FAMILY TROMBICULIDAE

Euschoengastia blarinae (Ewing)†.—From *Sorex cinereus**; Iron County. From *Peromyscus maniculatus**; Gogebic County.

Euschoengastia setosa (Ewing)†.—From *Peromyscus maniculatus**; Iron County.

Trombicula harperi Ewing†.—From *Sorex arcticus**, *Eutamias minimus**, *Tamias striatus**, *Tamiasciurus hudsonicus*, *Peromyscus maniculatus*, *Clethrionomys gapperi*, *Microtus pennsylvanicus*, *Ondatra zibethica**, *Zapus hudsonius**, and *Erethizon dorsatum**; Iron County.

Trombicula microti Ewing†.—From *Microtus pennsylvanicus* and *Zapus hudsonius*; Iron County.

Trombicula myotis Ewing†.—From *Peromyscus maniculatus** and *Ondatra zibethica**; Iron County.

Trombicula waynensis Brennan and Wharton†.—From *Ondatra zibethica**; Iron, Gogebic, and Houghton counties.

Trombicula (*Miyatrombicula*) sp.—From *Sorex arcticus*, *Eutamias minimus*, *Tamias striatus*, *Tamiasciurus hudsonicus*, *Peromyscus maniculatus*, *Clethrionomys gapperi*, and *Ondatra zibethica*; Iron County.

FAMILY MYOBIDAE

Amorphacarus henegererorum Jameson†.—From *Sorex arcticus*, *S. cinereus*, and *Marmota monax*; Iron County.

Protomyobia clapedi (Poppe)†.—From *Sorex cinereus*; Iron County.

FAMILY PYEMOTIDAE

Resinacarus sp.—From *Condylura cristata*, *Sorex arcticus*, *S. cinereus*, and *S. palustris*; Iron County.

ORDER SIPHONAPTERA

Corrodopsylla curvata (Rothschild)†.—From *Sorex arcticus**, *S. cinereus*, *S. palustris*, *Blarina brevicauda*, "chipmunk," and *Castor canadensis**; Iron County. From *S. arcticus**; Houghton County.

Ctenophthalmus pseudagyrtis Baker.—From *Eutamias minimus*, *Tamias striatus**, *Peromyscus maniculatus*, *Clethrionomys gapperi*, *Microtus pennsylvanicus*, *Ondatra zibethica*, and *Zapus hudsonius**; Iron County.

Doratopsylla blarinae C. Fox†.—From *Blarina brevicauda*; Iron County.

Eptedia wemmanni (Rothschild)†.—From *Sorex cinereus**, *Peromyscus maniculatus*, *Clethrionomys gapperi*, and *Microtus pennsylvanicus*; Iron County. From *S. cinereus**; Houghton County. From *Tamiasciurus hudsonicus*; Isle Royale.

Megabothris acerbus (Jordan).—From *Eutamias minimus** and *Tamias striatus*; Iron County.

Megabothris asio megacolpus (Jordan)†.—From *Mustela erminea**, *Peromyscus maniculatus*, *Clethrionomys gapperi**, *Microtus pennsylvanicus*, and *Ondatra zibethica**; Iron County. From *Tamias striatus**; Houghton County.

Megabothris quirini (Rothschild)†.—From *Mustela erminea*, *Mephitis mephitis*, *Eutamias minimus*, *Castor canadensis**, *Peromyscus maniculatus*, *Clethrionomys gapperi*, *Microtus pennsylvanicus*, *Ondatra zibethica**, and *Zapus hudsonius**; Gogebic, Houghton, and Iron counties.

Monopsyllus eumolpi eumolpi (Rothschild)†.—From *Eutamias minimus*; Houghton and Iron counties. From *Clethrionomys gapperi*; Iron County.

Monopsyllus vison (Baker)†.—From *Mustela vison*, *Marmota monax**, "chipmunk," and *Castor canadensis**; Schoolcraft, Iron, and Gogebic counties, and Isle Royale.

Monopsyllus wagneri systaltus (Jordan)†.—From *Peromyscus maniculatus*; Isle Royale.

Myodopsylla insignis (Rothschild)†.—From *Myotis* sp.; Iron County.

Nearctopsylla genalis (Baker).—From *Mustela vison*; Iron County.

Orchopeas caedens caedens (Jordan)†.—From *Mustela vison*, *Eutamias minimus**, and *Tamiasciurus hudsonicus*; Iron and Schoolcraft counties, and Isle Royale.

Orchopeas leucopus (Baker)†.—From *Peromyscus maniculatus*, *Clethrionomys gapperi*, *Microtus pennsylvanicus*, and *Zapus hudsonius**: Houghton and Iron counties.

Oropsylla arctomys (Baker)†.—From *Mephitis mephitis* and *Marmota monax*; Iron County.

Peromyscopsylla catatina (Jordan)†.—From *Eutamias minimus**; *Peromyscus maniculatus**, *Clethrionomys gapperi*, and *Microtus pennsylvanicus*; Iron County.

Peromyscopsylla hamifer hamifer (Rothschild)†.—From *Microtus pennsylvanicus*; Iron County.

Saphiopsylla bishopi (Jordan)†.—From *Microtus pennsylvanicus*; Iron County.

Tamioiphila grandis (Rothschild).—From a "chipmunk"; Iron County.

ORDER ANOPLURA

Hoplopleura acanthopus (Burmeister)†.—From *Peromyscus maniculatus**, *Clethrionomys gapperi**, and *Microtus pennsylvanicus**; Houghton, Iron, and Schoolcraft counties.

Hoplopleura arbovicola Kellogg and Ferris†.—From *Eutamias minimus*; Iron County.

Hoplopleura erratica (Osborn)†.—From *Tamias striatus*; Iron County. From *Peromyscus maniculatus**; Houghton County.

Hoplopleura hesperomydis (Osborn)†.—From *Eutamias minimus**; Houghton County. From *Tamias striatus** and *Peromyscus maniculatus*; Iron County.

Hoplopleura sciuricola Ferris†.—From *Tamiasciurus hudsonicus*; Schoolcraft County. From *Peromyscus maniculatus**; Houghton County.

Neohaematopinus sciurinus Mjoberg†.—From *Tamiasciurus hudsonicus*; Schoolcraft County and Isle Royale.

Enderleinellus marmotae Ferris†.—From *Marmota monax*; Iron County.

ORDER MALLOPHAGA

- Damalina lipewoides* (Megnin)†.—From *Odocoileus virginianus*; Iron County.
Eutrichophilus setosus (Giebel)†.—From *Erethizon dorsatum*; Iron, Houghton, and Gogebic counties.
Trichodectes mephitidis (Packard)†.—From *Mephitis mephitis*; Iron County.
Trichodectes otomaculatus Paine†.—From *Procyon lotor*; Iron County.
Trichodectes sp.—From *Mustela erminea*; Iron County.

ORDER HEMIPTERA

- Cimex pilosellus* (Horvath).—From *Myotis* sp.; Iron County.

ORDER COLEOPTERA

- Platysyllus castoris* Rits†.—From *Castor canadensis*; all Upper Peninsula counties.
Leptinellus validus (Horn)†.—From *Castor canadensis* and *Ondatra zibethica*; Gogebic, Houghton, Iron, and Marquette counties.

ORDER DIPTERA

- Cuterebra emasculator* Fitch.—From a "chipmunk"; Iron County.
Cuterebra sp.—From *Eutamias minimus*, *Tamias striatus*, *Microtus pennsylvanicus* and *Ondatra zibethica*; Iron County. From *Peromyscus maniculatus*; Isle Royale.

DISCUSSION

The rediscovery of *Ixodes banksi* Bishopp⁶ was especially interesting, and observations that this species was found only on the beaver, mink, and muskrat suggested that it could be a vector of tularemia among aquatic mammals. Subsequent laboratory tests showed that the etiological agent of tularemia, *Pasteurella tularensis*, could persist for long periods in this species of tick. The disease agent was transmitted on two occasions by allowing nymphs to feed on infected muskrats, allowing the ticks to molt, and then feeding the resulting adults upon uninfected laboratory animals. Transovarian transmission was not demonstrated, however.

The material presented includes several range extensions, state

⁶ Lawrence, W. H., 1954. The recent epizootic among Michigan beavers. Paper presented at the Sixteenth Midwest Wildlife Conference, St. Louis, Missouri.

records, and new host records. These records will be quite evident to students of each group. However, some host records are so unusual that they should be pointed out. *Trombicula waynensis* is normally a parasite of birds. It is here reported from the muskrat (*Ondatra zibethica*)—the first record of this species from a mammal. *Trombicula myotis* is a parasite of bats and is here reported from *Peromyscus maniculatus* and from muskrats.

Fleas are normally not parasitic on beavers and most infestations of the beaver are probably accidental. During the course of this investigation, however, *Corrodopsylla curvata*, *Megabothris quirini*, and *Monopsyllus vison* were collected from this host.

Laelaps multispinosus is commonly a parasite of the muskrat, and the finding of this mite on mink and beaver was probably owing to the close association of these three animals. Muskrats were trapped inside active beaver lodges during this investigation, and they are a food species for the mink. Thus, parasites may be transferred from one species to the other, especially from the prey to the predator.

The tick, *Ixodes banksi*, probably shares the same type of host relationship to the beaver, muskrat, and mink as does *L. multispinosus*. The presence of this tick on these hosts and in beaver lodges indicates that the preferred host is probably the beaver and that muskrats and others are infested accidentally.

SUMMARY

Collections of ectoparasites from twenty-six species of mammals in the Upper Peninsula of Michigan show that these animals harbor the following ectoparasites: 8 species of ticks, 11 species of laelaptoid mites, 3 species of hair mites, 7 species of chiggers, 2 species of Myobiidae, 1 species of Pyemotidae, 7 species of sucking lice, 5 species of chewing lice, 18 species of fleas, 1 species of Cimicidae, 2 species of beetles, and 2 species of warble flies.

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