and stability of the ixovotoxin must wait until a larger supply of tick eggs is available.

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FURTHER RECORDS OF SIPHONAPTERA FOR BRITISH COLUMBIA

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British Columbia is a very large province, containing a number of well-defined faunal regions which as yet have been inadequately explored with respect to their Siphonaptera. Recent studies have brought to light a number of new or confirmative records, which form the basis of this paper. In the majority of cases, determinations have been made or confirmed by various specialists. Without doubt, further collections from some of the more northerly regions will reveal many interesting forms not hitherto recorded, with every probability that a number of them will be new to science. In view of the fact that bubonic plague is now known to be established in Canada, the study of fleas assumes great importance, and it is hoped that within a few years it will be possible to present a fairly complete picture of the distribution of Siphonaptera in this country.

The present list brings the total of species and varieties of fleas to eighty-six, which is probably still far short of the actual number present in this province. A few species are included on the basis of collections from Waterton Lakes National Park, Alberta, but as the fleas were obtained within a mile or so of the British Columbia border, and the host animals are indigenous to this province, the fleas may be assumed to occur here also.

Fam. PULICIDAE Stephens 1829.

(1) *Cediopsylla inaequalis inaequalis* (Baker) 1895.

From brush rabbit, *Sylvilagus* sp., collected at Waterton Lakes Park, Alta., June 23, 1938 (G. P. Holland). Determined by Glen M. Kohls.

Fam. VERMIPSYLLIDAE Wagner 1889

(2) *Trichopsylla* (= *Arctopsylla*) *ursi* (Rothschild) 1902.

Formerly recorded west of Calgary, not far from B.C. Our specimens were taken from grizzly bear, *Ursus horribilis* ssp., at Wigwam, B.C.,

May 10, 1939 (E. R. Buckell). Another series, also from *U. horribilis* was collected at Azure Lake, B.C., Nov. 10, 1939 (H. Mobley); some of the blood-engorged females in this lot are of tremendous size, being 8.5 mm. in length.

Fam. DOLICHOPSYLLIDAE Baker 1905.

(3) *Aetheopsylla septentrionalis* Stewart and Holland 1940.
Taken from black marmot, *Marmota monax petrensis* Howell, at Wigwam, B.C., May 21, 1939 (E. R. Buckell). The new genus and species was established for a single female of this interesting flea (5). It is possible that it may prove to be a synonym of *Oropsylla* sp., possibly *O. arctomys* (Baker), but final decision in this regard will have to wait until further collections have been made.

(4) *Megarthroglossus divisus* (= *longispinus* Baker 1895) var. *exsecatus* Wagner, 1936. This variety was established from a single female flea, taken at Avola, B.C., on *Tamiasciurus hudsonicus streatori* (Allen). Since then, single specimens have been collected at Vavenby, Rayleigh and Nicola, each time from the same species of squirrel. On September 27, 1940, however, 257 specimens were recovered from a single squirrel's nest, taken at Rayleigh. It seems that these small, blind fleas tend to remain in the nests and seldom travel on the host animal. In searching this nest it was noted that the fleas crawled fairly rapidly through the debris, but in no case did they jump.

(5) *Callistopsyllus paraterinus* Wagner 1940.
Taken from white-footed mouse, *Peromyscus maniculatus* ssp., probably *artemisiae* (Rhoads), at Eagle River, B. C., May 24, 1934 (E. R. Buckell). A single male specimen was collected, and Wagner considers it to be new, and has described it as such (8). He states that it may, however, prove to be the male of *C. terinus* (Rothschild), which is known from three female specimens collected at Mabel Lake, B.C., ex *Citellus columbianus columbianus* (Ord).

(6) *Trichopsylloides oregonensis* Ewing 1938 (= *Phaneris hubbardi* Jordan 1939). A single male specimen, which is probably referable to this species was collected on a mink, *Mustela vison* ssp., at Cultus Lake, B.C., Nov. 9, 1940 (D. Leavens). This is not the normal host, as these fleas are usually found on mountain beaver, *Aplodontia* sp., which are doubtless preyed upon by mink. Specimen examined and determination confirmed by Dr. Wm. L. Jellison.

(7) *Tarsopsylla coloradensis* (Baker) 1895.
Taken from flying-squirrel, *Glaucomys sabrinus alpinus* (Richardson), at Tetana Lake, Hazelton, B. C., May 11, 1938 (J. S. Fletcher). Specimen identified by Wagner, who stated in 1936 (6) that he suspected this species would be found in British Columbia.

(8) *Opisodasys pseudarctomys* (Baker) 1904.
Ceratophyllus acasti Rothschild was described in 1905 from a single

female reputed to have been taken at Quesnel, B.C. Later this flea was reduced to synonym with *Opisodasys pseudarctomys* (Baker) by Jordan (2), and the locality record questioned. *O. pseudarctomys* is a flea ordinarily found on eastern flying-squirrels, and the most westerly record that could be relied upon was from Red Deer, Alberta. In British Columbia, flying-squirrels are regularly parasitized by *Opisodasys vesperalis* (Jordan). The type locality of this flea is Okanagan Landing, B.C., but there are specimens in the Kamloops Laboratory taken at Grey Creek, Paul Lake (north-east of Kamloops), Loughboro Inlet, and Tetana Lake, near Hazelton. However, on October 8, 1940, a juvenile flying-squirrel, *Glaucomys sabrinus* ssp. was taken at Blackpool, B.C., about 50 miles north of Kamloops, by G. P. Holland; this squirrel yielded seventeen fleas, all of which were the eastern *Opisodasys pseudarctomys*. As Quesnel is only about 150 miles from Blackpool, it may well be that the locality record for *Ceratophyllus acasti* is valid.

(9) *Foxella ignota albertensis* (Jordan and Rothschild) 1915.

From brown pocket gopher, *Thomomys fuscus* ssp., taken at Waterton Lakes, June 22, 1938 (G. P. Holland). This is readily distinguished from *F. i. recula* (Jordan and Rothschild) by the terminalia of the male.

(10) *Diamanus montanus* (Baker) 1895.

Taken from wolverine, *Gulo luscus* (Linnaeus), at Eagle River, May 21, 1934 (E. R. Buckell). Determined by M. A. Stewart.

(11) *Amphalius necopinus* (Jordan) 1925.

This rare flea was known only from the types, collected from *Ochotona muiri* (*O. schisticeps muiri* Grinnell and Storer) in California. Our specimens were collected from pika, *Ochotona princeps* ssp., at Salmo, B.C., May 29, 1936 (T. K. Moilliet), and at Banff, Alta., July 14, 1939 (J. D. Gregson), also from pika. The specimens have been examined by Dr. Karl Jordan, and the determinations confirmed.

(12) *Ceratophyllus celsus celsus* Jordan 1926.

This bird flea was known previously only from a single male, taken at Okanagan Falls, B.C. A large series was collected from nests of sand martin, *Riparia riparia* Linnaeus, at Kamloops, June 29, 1939 (G. P. Holland). Determination was confirmed by Dr. Jordan, who will describe the female.

(13) *Megabothris lucifer* (Rothschild) 1905.

From grey meadow mouse, *Microtus nanus canescens* Bailey, taken at Kamloops, B. C., August 30, 1934 (G. J. Spencer). Identified by Dr. Wagner, who described the hitherto unknown male from this material (7).

Fam. HYSTRICHOPSYLLIDAE Tiraboschi 1904.

(14) *Nearctopsylla hygini columbiana* Wagner 1940. (8)

A single male, taken from Scheffer's mole, *Scapanus orarius schefferi* Jackson, at Vancouver, December 9, 1938 (G. J. Spencer).

(15) *Corypsylla ornata* Fox 1908.

Collected from *Scapanus orarius schefferi* Jackson at Vancouver, B.C., in 1938 (G. J. Spencer). Specimens identified by Dr. Wagner. Also represented in the Kamloops collection from the same species of mole, collected at Agassiz (R. Glendenning).

(16) *Ctenopsyllus segnis* (Schönherr) 1811 (= *Leptopsylla musculi* Duges).

From house-mouse *Mus musculus musculus* Linnaeus, collected at Kelowna, October 4, 1939 (Constance D. Mail). This is the European mouse flea, well-known in other parts of North America, where it became established upon the introduction of the European house-mouse. This constitutes the first British Columbia record.

(17) *Epitedia* (=*Neopsylla*) *scapani* (Wagner) 1936.

Described from males only (7) but now females have been collected from Scheffer's mole, *Scapanus orarius schefferi* Jackson at Vancouver, B.C., February 28, 1939 (G. J. Spencer), and described by Wagner (8). In the Kamloops collection there are additional specimens of this flea from: *Peromyscus maniculatus* ssp., Caulfield, B.C., July 8, 1936 (J. D. Gregson); Townsend's mole, *Scapanus townsendi* (Bachman), Chilliwack, January 3, 1940 (H. Fulton); shrew, *Sorex* sp., Chilliwack, April 27, 1940 (J. D. Gregson), and from weasel, *Mustela* sp., Cultus Lake, September 17, 1940 (D. Leavens).

(18) *Meringis shannoni* (Jordan) 1929.

Taken at Okanagan Landing, from pocket mouse, *Perognathus lordi lordi* (Gray) and white-footed mouse, *Peromyscus maniculatus artemisiae* (Rhoads), August 10 and 11, 1940 (G. P. Holland).

Fam. ISCHNOPSYLLIDAE Wahlgren 1907.

(19) *Rhinolophopsylla palposa* (Rothschild) 1904.

Collected from big brown bat, *Eptesicus fuscus fuscus* (Beauvois) at Kamloops, August 14, 1938 (G. P. Holland), known formerly from the females only. Wagner has now described the male from this material (8).

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The writer wishes to express his thanks to the following authorities, who have either identified species, or confirmed his determinations: Dr. Julius Wagner, of Belgrade, Yugoslavia; Dr. M. A. Stewart, of the University of California at Davis; Dr. Karl Jordan, of the Rothschild Museum at Tring, Hertfordshire, England; and Dr. Wm. L. Jellison and Mr. Glen M. Kohls, of the Rocky Mountain Laboratory at Hamilton, Montana.

To assist the writer in his studies on the fleas of this province, Professor G. J. Spencer of the University of British Columbia has very kindly sent him his entire collection for study, including new material recently identified by Dr. J. Wagner, and has loaned the writer all his literature on the order. Where duplicate material permits, two complete collections will be developed, one at the University of British Columbia and one at this laboratory. Types

of any new forms which may be described during the course of this work will be deposited in the Canadian National Collection at Ottawa.

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ECTOPARASITES OF BIRDS AND MAMMALS IN BRITISH COLUMBIA

VI. A Preliminary List of Parasitic Mites

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The study of mites has been neglected by zoologists for many years for the good reason that they form one of the smallest and most difficult of animal groups. The final item of identification with many species is the length and contour, from the lateral aspect, of the stylets of the mouth. When the whole mite is one millimetre or less in length, its stylets are infinitely smaller. Moreover, the animals generally die in a retracted condition with the suctorial apparatus concealed in the cephalothorax, and it requires fine technique to get them extruded. Therefore until quite recently, there have been very few names in acarology in North America and it is difficult to obtain identifications. For many years Dr. Nathan Banks was practically the only authority and he is now succeeded by Dr. H. Ewing of the United States National Museum. Moreover, the literature on mites is very scattered and difficult to acquire. Consequently the following list contains only a few names, some of them being only of family and genus; it has not been possible to arrive at specific identifications.

I am deeply indebted to Dr. H. Ewing for his kindness in checking the few determinations I was able to make and for examining the bulk of my material.

Mites are both terrestrial and aquatic; remarkably little is known about the latter. They breathe both with and without trachea. The land mites may be plant feeders or parasitic upon mammals, birds and reptiles or predaceous upon other mites or any small arthropods. Like spiders, they have eight legs