A preliminary study of the Siphonapterous Ectoparasites found on the mammals of the families Cricetidae and Muridae in Utah County

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Brigham Young University - Provo

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A Preliminary Study of the Siphonapterous Ectoparasites
Found on the Mammals of the Families Cricetidae
and Muridae in Utah County

An Abstract of
A Thesis
Submitted to
the Faculty of the department of Zoology
Brigham Young University

In Partial Fulfillment
Of the Requirements for the Degree
Master of Science

by
Vernon J. Tipton
June, 1949
ABSTRACT

The purpose of this study was to determine the species of fleas infesting the mammals of the families Cricetidae and Muridae in Utah County. This was accomplished by establishing twelve collecting stations throughout the county from which 198 mammals were collected. From these hosts, 392 fleas were collected representing three families, nineteen genera, and twenty-four species. Four species are new to the State of Utah and twenty-two species are recorded from Utah County for the first time.
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This Thesis by Vernon J. Tipton is accepted in its present form by the Department of Zoology and Entomology as satisfying the Thesis requirement for the degree of Master of Science.

May, 1949          Signed
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The writer is grateful to Dr. D. Elden Beck, department of Zoology and Entomology, for direction and advice in this study and especially for his time, freely given, in making the photographic illustrations. Dr. Vasco M. Tanner, head of the Department of Zoology and Entomology, has shown continued interest and support in all phases of this project. Dr. C. Lynn Hayward has helped materially in the problems of mammalian ecology and taxonomy and offered helpful suggestions in the preparation of the permanent slides. Dr. Bertrand Harrison, of the Department of Botany, assisted in interpretation of certain plant ecological characteristics of the collecting stations. In the mechanics of the preparation of this manuscript I am indebted to Professor Ralph Britsch of the English department. In conjunction with the field operations, continued assistance was provided at all times by the writer's student associates, Mr. Dorald M. Allred and Mr. Dale S. Rupert.

Dr. C. Andresen Hubbard of Pacific University at Forest Grove, Oregon, Dr. William L. Jellison, parasitologist at the Rocky Mountain Laboratory in Hamilton, Montana, and Dr. Frank M. Prince, medical entomologist for
the Public Health Service in San Francisco, California, were all very gracious and willing to aid in the verification and identification of material sent to them by the writer.
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INTRODUCTION

For many years the importance of fleas as vectors of disease has been recognized. While introduced rats heretofore have been publicized as having played the major role in harboring fleas of medical importance, Eskey and Haas (1931) have shown that certain of our native mice and rats are potentially just as dangerous. It is the purpose of this paper to give a taxonomic and distributional account of the fleas occurring on both native and introduced mice and rats in Utah County.
There has been no attempt to give an account of the fleas of Utah County as such, nor has there been any attempt to record the fleas found on the mammals of the families Cricetidae and Muridae in Utah. Literature pertaining to the fleas of Utah is very meager and until recently consisted only of check lists of Utah fleas.

Dr. J. Sedley Stanford (1931) was the first to publish a checklist of Utah fleas. More extensive collecting by Dr. Stanford resulted in his next paper (1944) in which fifty-eight species and subspecies of fleas are listed. Although most of Dr. Stanford's collecting was done at Logan and Salina, he did spend some time on Mt. Timpanogos in Utah County collecting ectoparasites. Dr. Stanford's work has furnished a stepping stone for some of the later workers who are now adding materially to the literature of Utah Siphonaptera.

A public health survey in states west of the 102nd meridian conducted by Dr. Frank M. Prince (1943) of the Public Health Service revealed the presence of some fleas of medical importance in Utah County as well as other sections of the state. His study was concerned only with the fleas found on the species of rats of the genus Rattus.

Harold E. Stark (1948) completed a master's thesis at the University of Utah concerned with a study of the
taxonomy and distribution of the fleas of Utah. In this work all previous records of fleas collected throughout the state were noted, including records from Utah County.

C. Andresen Hubbard (1947), who has done much to foster interest in the study of Siphonaptera in the west, published a text, *Fleas of Western North America*, which has proved to be indispensable to the study of western fleas. He has included in his book an alphabetically arranged index to the fleas of Western North America and a host index, both of which are very useful to the beginning taxonomist. He records several species of fleas from Utah collected by himself, most of which are from the southern part of the state. Although Dr. Hubbard did no collecting in Utah County, he does record in his book some fleas collected in this county by other workers. His own records for the state, plus those of other Siphonapterists, mark this as a valuable contribution.

There are other workers in the west who, though not concerned primarily with fleas in Utah, have had a certain amount of influence on work done in this state. Among these are C. F. Baker, who described nine of the twenty-five species listed in this paper. It may be of interest to note also that of these twenty-five species listed, eleven have been described by the foreign workers, Karl Jordan, N. C. Rothschild, and Julius Wagner.
METHODS AND PROCEDURE

**Field Technique**

The collection of Siphonapterous parasites entails the capture of the parasite-hosts and the taking of the nests of these hosts. This necessitates the use of such items as traps, bait, guns, and other selected types of equipment. Because the type of equipment and its proper utilization serves a very important function in the collecting of ectoparasites, it would not be amiss to discuss such equipment and its use here.

The equipment used in the field to collect the hosts consisted of large live traps (Fig. 2.), small box-type live traps (Fig. 2.), museum special snap traps, and a 4.10 gauge shotgun.

The large live traps, constructed by the National Live Trap Company, Tomahawk, Wisconsin, were of heavy wire mesh and were collapsible. Even though large (6 1/2 x 6 1/2 x 19"), the collapsible feature rendered them somewhat compact, and a half—a—dozen to a dozen could be carried without undue discomfort to the trapper. The large traps proved themselves to be indispensable for the capture of woodrats, but smaller animals would escape because of the size of the mesh.

The small box—type live traps, manufactured by H. B.
Sherman and Company, Gainsville, Florida, were of metal construction and were completely enclosed. They were of two types, rigid and collapsible. The rigid type, as used in this study, was more durable.

Among the "museum special" traps were a few small snap-type mouse traps. The "museum specials" were preferable to the smaller traps because the snap-wire of the museum special trap usually caught the mouse in such a fashion as to leave the skull uninjured and suitable for purposes of taxonomy. The museum specials also were able to catch and hold larger mice than the smaller traps. The small snap traps were utilized to an advantage when a situation presented itself where there was not adequate room for a larger trap such as a museum special.

The shotgun was a useful instrument for taking those species of mice and rats which are diurnal in habit. Except for procuring house rats, the shotgun proved to be a less effective method than trapping.

Baits of several varieties were used to ascertain which was best. The type of bait depended to a great extent on the animal for which the trap was being set. For all-round results and under all kinds of atmospheric conditions, quick-cooking rolled oats proved superior. The oats could be used dry in warm weather when there was no wind. If there were either rain or wind the oatmeal could be chewed up into a paste. Used in this manner, it would be neither washed nor blown away. Peanut butter was sometimes substituted for the oatmeal in inclement weather as
it seemed to adhere to the trap a little better. Peanut butter also seemed to retain its palatability for a longer period of time than did the oatmeal during wet weather. After experimenting with baits and noting a wide variety of results from various baits used, we may assume that bait is just as important as any other item of the necessary equipment.

In placing traps in a given area there were a number of factors to be taken into consideration. In level desert country plot-trapping was used, and in connection with plot-trapping snap traps were generally used. A plot measured 2/10 of a hectare in area (150' x 150'). The arrangement of traps in a plot was as follows: ten rows of traps, each row fifteen feet apart and each trap fifteen feet apart. If the area was rocky or situated among ledges, the traps were placed in the most likely situation. In trapping for Microtus, traps were placed in runways. In forested areas traps were placed at intervals of twenty-five feet from each other with disregard to pattern plot. The large live traps were usually placed in caves or at the mouths of holes frequented by rats and larger rodents.

Traps were usually left in an area for a period of five consecutive days and nights, with visits being made each morning and night when feasible. It was felt that a fair sampling of the mice of an area could be had in a period of five days.

Animals caught in snap traps were picked up as soon as possible after capture and put into paper sacks, the tops
of which were twisted very tightly to prevent the escape of any fleas. If the animals were in live traps and were still alive, they were anesthetized in the field. In order to accomplish this a one-pound can of ether and some large wide-mouthed jars were carried with the other equipment. Anesthesia was accomplished by the use of ether. The animal was placed in a closed container, and ether was applied by use of a cotton ball soaked in ether. As soon as an animal was dead, the contents of the jar were emptied into a sack and the top of the sack tightly twisted. Nearly all animals were taken to the laboratory in paper sacks.

Nests of rodents proved to be a fruitful place for collecting fleas. The nests of the various species of rodents occurred in such diverse situations that it is difficult to give a general collecting technique for all nests. Usually, however, there is involved first the location of the nest and secondly its removal and transportation to the laboratory. Whenever a nest was removed, care was taken that sufficient substratum was included with the nest. Fleas utilize this layer of the nest to a great extent for early stages of their development. In carrying the nest from the field to the laboratory care was used to prevent injuring the specimens.

The containers for transporting nests to the laboratory were commodious, tough, and capable of being closed in order that fleas could not escape. Heavy-weight paper grocery sacks of various sizes proved excellent for nest collecting.
Laboratory Technique

The examination of hosts for fleas and their removal involved a variety of equipment. If the animals were alive upon their arrival in the laboratory, they were placed on a sheet of white paper under a bell jar and anesthetized with ether. The fleas were then very easily found and transferred to a container of alcohol. A large white pan was useful as an aid in removing fleas from hosts. The pan was deep enough (at least eight inches) to prevent fleas from hopping out and large enough (at least twenty inches in diameter) to accommodate some of the larger rodents. The dead animals, whether killed in the laboratory or in the field, were shaken vigorously over the pan. Any fleas falling into the pan could be easily seen against the white background. The animal host was then placed under a strong light and examined very closely. It was then placed in a paper sack and left in a refrigerator for a period of two or three days at which time it was again examined very closely for fleas. The paper sacks in which animals were carried to the laboratory were always examined very closely.

Live fleas were removed from the pan by the use of an aspirator. Fleas are damaged less if picked up with an aspirator. If the fleas were dead, a dissecting needle dipped in alcohol was used to pick them up. All fleas were placed in seventy percent ethyl alcohol contained in two dram vials.

After all fleas had been removed from a host, the
host was disposed of; however, if the identity of the host was not certain, a skin and skull were prepared to insure proper identification.

The nests which were brought into the laboratory were placed in a Berlese funnel (Fig. 1). They were allowed to remain in the funnel for two or three days. All evidence indicates that the majority of specimens are removed in the first eight to ten hours. The collected organisms falling into the container were separated and the fleas from this collection placed in two dram vials containing seventy percent alcohol.

In developing a technique to prepare specimens for permanent mounts there are several important considerations. Important taxonomic characters must stand out clearly, and the specimens must be arranged on the slides in such a position as to facilitate easy identification. Mouthparts and legs must be separated and outstretched. Oftimes important taxonomic characters are broken or rendered useless because the specimens become brittle while they are in the various solutions through which they must pass in order to become cleared and dehydrated. The technique used is essentially that supplied the writer by Dr. William L. Jellison with some minor modifications.

The fleas were removed from the seventy-percent alcohol in which they had been preserved and stored, and then placed in water where they were allowed to remain for twenty-four hours. Caustic potash (NaOH) was used to dissolve
Fig. 1.—Berlese funnel

Fig. 2.—Types of traps used
musculature and visceral organs of the flea. A two percent solution of NaOH maintained at room temperature (72° F.) seemed to give the best results. The fleas were allowed to remain in the potash for a period of from twenty-four to seventy-two hours depending upon degree of chitinization as well as the species of flea undergoing preparation. Close attention is required during the period of clearing as the fleas are often overcleared which makes them difficult to identify. From this point the steps are as follows:

Water—24 hours.

Glacial acetic acid—24 hours. (To neutralize any remaining potash.)

Water—24 hours.

25% ethyl alcohol—24 hours.

50% ethyl alcohol—24 hours.

75% ethyl alcohol—24 hours.

A solution consisting of one-part 95% ethyl alcohol and one-part n-butyl alcohol—2 hours.

N-butyl alcohol—1 hour.

Carbol–xylol—24 hours.

Xylol—24 hours.

From the xylol the specimens were mounted on a good grade of microscope slide (Gold Seal). Cover slips were gently lowered to prevent spermathecae and other taxonomic characters from occupying abnormal positions. Mounting media was either Canada balsam, clarite, or a fifty percent solution of piccolite. The latter proved to be a good media which was very inexpensive and which discolored very little upon drying.
Two labels were attached, one to each slide in the following manner:

<table>
<thead>
<tr>
<th>Field No.</th>
<th>Utah Siphonaptera</th>
</tr>
</thead>
<tbody>
<tr>
<td>Museum No.</td>
<td>Host.</td>
</tr>
<tr>
<td>Species</td>
<td>Locality.</td>
</tr>
<tr>
<td>Sex</td>
<td>Date.</td>
</tr>
<tr>
<td>Determined by Vernon J. Tipton</td>
<td>Collector Vernon J. Tipton</td>
</tr>
</tbody>
</table>

It was found that best results could be had if slides were dried at room temperature.

**Photographic Equipment and Supplies**

Photomicrographic equipment: Bausch and Lomb photomicrographic camera.

**Film:** Super panchro-press, type B, 5 x 7.

**Magnification:** Bausch and Lomb microscope number TK7813.

Ocular on microscope 15x, objective 10x.

**Light Source:** Ribbon filament lamp, 6v, 108w, m.c.p., Mazda projection type, lamp was eighteen inches from concave surface of microscope mirror.

Wratten filter #22 was used.

**Exposure:** Three seconds at F-64.

**Developer:** DK 50. Film was left in developer four to five minutes. Temperature of developer was maintained at 71° - 72° F.
COLLECTING STATIONS

James W. Bee (1947) lists nineteen species and subspecies of rodents belonging to the families Cricetidae and Muridae in Utah County. Of these, fifteen have been collected by the writer. Twelve collecting stations were established throughout the county. These stations represent four distinct bio-ecological situations.

Station number 1 was established in the montane forest in an area known as Big Tree Camp, which is located on Mt. Timpanogos, 3.2 miles northwest of Aspen Grove and at an elevation of 7700 feet. The soil here is rich in organic material but forms only a thin veneer over a rocky substratum. The dominant vegetation consists of groves of aspen (Populus tremuloides), interspersed with a few white fir (Abies concolor). Hayward (1945) gives a more detailed description of the communities of this area.

Station number 2 was established at Aspen Grove also in the montane forest on Mt. Timpanogos. Aspen Grove is located 4.85 miles northwest of Wildwood resort at an elevation of 6800 feet. Here, as in station 1, the soil is a thin layer but very rich in organic material. Coniferous forest consisting of white fir (Abies concolor) and Douglas fir (Pseudotsuga taxifolia), with some aspen (Populus tremuloides) forms the main cover. The North Fork of Provo River flows through Aspen Grove, and it was along this
stream that most of the collecting was done.

The third station was located at the mouth of Rock Canyon, two miles northeast of the Brigham Young University campus and at an elevation of 5400 feet. The terrain here is very rugged. Huge cliffs and steep ledges, with a great many crevices caused by weathering, afford a suitable habitat for various species of Peromyscus. There are also abandoned mine shafts and natural caves where woodrats are rather abundant. The soil was almost nil at the point in the canyon where the collecting was done. As this station is in the chaparral, the dominant vegetation consists of the Gambel oak (Quercus gambelii). Hayward (1948) discusses in more detail the plants and animals of the chaparral situation.

Station number 4 was at the mouth of Provo River, which empties into Utah Lake some four miles from the center of Provo City. This station is at an elevation of 4490 feet. The soil of the harbor area is heavy loam containing much moisture. Along the banks of the river and the shore of the lake are Typha-Scirpus communities in which Microtus abound. Much of the cover above the Typha bordering the lake is made up of weedy annuals.

Station 5 was established in the Left Fork of Hobble Creek Canyon thirteen miles northeast of Springville at an elevation of 6000 feet. This particular area is under cultivation, but it borders sagebrush (Artemisia tridentata) and oak (Quercus gambelii) communities. The soil is very rocky and dry.
Station 6 was established three miles east of Springville, in a small canyon known as Spring Creek Canyon and at an elevation of 5100 feet. The soil is largely organic in nature and is considerably deeper than the soil of the previous chaparral station. The vegetation for the area is primarily scrub oak (Quercus gambelii) and forms a very dense cover in this area. The traps were set along the base of cliffs which rise rather abruptly from the floor of the canyon.

Station 7 was located immediately south of Springville city upper cemetery, at an elevation of 4800 feet, in an area that is vastly different from the surrounding countryside. It is primarily sandy, and weathering agents have eroded deep gullies in the land. Large springs originate near these gullies, and the water spreads out over a large area to make a sizeable pond with a wide band of swampy area around the pond's edge. The gullies of the sandy area and the swampy region furnish two vastly different habitats, and a wide variety of animal life may be found here.

Station 8 was established near the highway midway between Santaquin and Goshen in an area of ledges and boulders at an elevation of 4800 feet. The area is characterized by its barren appearance, with little soil and a few weedy annuals.

Station number 9 was four miles west of Elberta, a few hundred yards from the Elberta-Tintic highway. The elevation is approximately 5300 feet. The soil is typical
of that area, dry and rocky. Some sage (*Artemisia tridentata*) and scattered junipers (*Juniperus utahensis*) constitute the cover.

Station number 10 was located at a point known as Chimney Rock Pass. This area is five miles north and five miles west of Elberta at an elevation of 5000 feet. The soil of the area is lose and sandy, providing a habitat suitable for the kangaroo rat (*Dipodomys ordii*). It is typically desert with little or no moisture during the summer months. Sagebrush (*Artemisia tridentata*) forms almost a complete cover, with a sprinkling of Utah juniper (*Juniperus utahensis*) and a few patches of western wheat grass (*Agropyron smithii*). Chimney Rock itself is a large outcropping of granite which rises abruptly to an elevation two hundred feet above the valley floor.

Station number 11 was located on the eastern rim of Cedar Valley about twelve miles southwest of Lehi at an elevation of 5200 feet. The soil here is extremely loose and sandy and is honeycombed with holes made by the kangaroo rat (*Dipodomys ordii*). This area is characterized by a dense grove of Utah juniper (*Juniperus utahensis*), which constituted the main cover of the area. Occurring in patches under the junipers is the Indian rice grass (*Oryzopsis hymenoides*), which formed a large part of the diet of the mice of the area.

Station number 12 was established about one mile to the north of station 11. This station was very similar to station 10 in elevation, type of cover, and soil.
ANNOTATED LIST OF COLLECTING STATIONS

1. Big Tree Camp, Mt. Timpanogos
2. Aspen Grove, Mt. Timpanogos
3. Mouth of Rock Canyon
4. Mouth of Provo River
5. Sumisons Ranch, Left Fork of Hobble Creek Canyon
6. Spring Creek Canyon, east of Springville
7. Big Hollow, on Highway 50 between Springville and Mapleton
8. Tintic-Goshen Highway, three miles west of Goshen
9. Four miles west of Elberta
10. Chimney Rock Pass, Cedar Valley
11. West slope of Lake Mountain, 12 miles southwest of Lehi
12. West slope of Lake Mountain, 11 miles southwest of Lehi
MORPHOLOGY

It is not the purpose of this paper to give a detailed discussion of the morphology of fleas. Snodgrass (1946) gives a detailed and accurate account of Siphonapteran morphology. Only the main morphological characteristics used in this study will be discussed here. The flea, like other insects, is divided into three body regions: head, thorax, and abdomen. All of the characteristics used in the classification of the fleas are found on these body regions.

Head:

Some fleas possess a sulcus or heavily sclerotized ridge passing over the head from one antennal groove to the other. When the sulcus is present, the head is thus divided into well-defined preantennal and postantennal regions. The presence or absence of the sulcus is a characteristic often used to divide the order Siphonaptera into two suborders. The antennae of fleas vary in shape, in length, and in some other respects. Certain of these variations are used for taxonomic purposes only occasionally. The presence or absence of a frontal notch or tubercle located on the preantennal margin of the head is often used as a feature in classification. In some fleas the lower portion of the preantennal region is greatly modified into broad
teeth termed collectively as the cephalic ctenidia. The feeding apparatus of fleas is of the piercing-sucking type and is used rather infrequently in determining fleas. Fleas may or may not have eyes. The amount of pigmentation in the eye of the flea may vary. The row of bristles on the lower part of the gena is referred to as the ocular row, and the bristles may vary in size, number and position, and are often used as specific differences. Other bristles and setae on the head are also used as definitive characteristics in taxonomy.

**Thorax:**

Fleas are apterous insects bearing legs as the only appendages on the thorax. The bristles on the legs vary in size and number, and are frequently of importance in separating genera. Most fleas bear a series of tooth-like projections on the pronotum which together constitute the pronotal ctenidia. The presence or absence of this pronotal ctenidia and the number of teeth present often constitute specific differences. The length of the segments of the thorax in relation to the length of the segments of the abdomen is frequently used as a family difference. Length of the fore coxa as compared to the labial palpus may also be a determining factor in classifying fleas to genera.

**Abdomen:**

The fact that the abdomen bears the genital structure renders it of vast taxonomic importance. The number of rows of bristles on each segment of the abdomen and the antepygidial bristles are also of great importance. The
segments of the abdomen consist of a dorsal tergite and a ventral sternite. The segments are numbered consecutively beginning with the first just caudad to the metathorax. The VII tergite usually bears upon it stout bristles varying in number from one to four and varying also in length. As they are in close proximity to the pygidial area, they are called the antepygidial bristles. In the male the claspers and the intromittent organ become highly modified in various species of fleas, and these characteristics, along with the IX sternite, are used almost exclusively by some taxonomists as specific differences. Bristles and spiniform processes found on the finger of the clasper and the IX sternite vary widely in number and position. In the female the spermatheca is considered by some to vary sufficiently in shape and size so as to be used advantageously for taxonomic purposes. The apical outline of the VIII sternite is also used rather frequently to determine species.
KEY TO THE FEMALE SPECIES AND SUBSPECIES OF FLEAS FOUND ON THE MAMMALS OF THE FAMILIES CRICETIDAE AND MURIDAE IN UTAH COUNTY

Page

1. Pronotal ctenidia absent (Fig. 9) .................................................. Anomiopsyllus amphibolus 32
   Pronotal ctenidia present (Fig. 8) .................................................. 2

2. Cephalic ctenidia present .............................................................. 15
   Cephalic ctenidia absent ............................................................... 3

3. Setae on head few in number, fewer than 20 (Fig. 8) ...................... 5
   Setae on head numerous, more than 20 (Fig. 6) ............................ 4

4. Spermatheca single, eye absent (Fig. 7) ........................................... Stenistomera alpina 79
   Spermatheca double, eye present (Fig. 6) ...................................... Atyphloceras multidentatus 34

5. Tail of spermatheca with apical appendage (Fig. 45) .................... 9
   Tail of spermatheca without apical appendage ................................ 6

6. Tail communicates with head of spermatheca medially.
   Head appears to have a bilobed appearance (Fig. 10). ..................... Megarthroglossus sp. 54
   Tail communicates with head of spermatheca medially, marginal
   outline of head of spermatheca uniform ...................................... 7

7. Apical end of tail of spermatheca swollen or enlarged .................. Diamanus montanus 36
   Apical end of tail of spermatheca not swollen or enlarged ............. 8

8. Four bristles or less in the dorsal preantennal row of bristles ...... 23
   More than four bristles in the dorsal preantennal row of bristles .... Megabobhris abantis 52

9. Diameter of head and tail of spermatheca at point of junction equal
   or almost so, head and tail elongate and narrow ......................... Monopsyllus wagneri wagneri 61
   Diameter of head of spermatheca greater than diameter of tail of
   spermatheca .................................................................................. 10
<table>
<thead>
<tr>
<th>Page</th>
<th>Description</th>
<th>Identification</th>
<th>Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.</td>
<td>Head of spermatheca globular in shape</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Head of spermatheca elongate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Eye absent</td>
<td>FoxellaIgnota</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>Eye present</td>
<td>OropsyllaIdahoensis</td>
<td>72</td>
</tr>
<tr>
<td>12.</td>
<td>Outer surface of forefemur with one or no lateral bristles</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Outer surface of forefemur with several small lateral bristles</td>
<td>MalaraeusTelchinum</td>
<td>50</td>
</tr>
<tr>
<td>13.</td>
<td>Dorsal margin of head of spermatheca definitely... convex, ventral margin weakly concave</td>
<td>Opisodasyskeeni</td>
<td>65</td>
</tr>
<tr>
<td></td>
<td>Dorsal and ventral margins of head of spermatheca parallel or nearly so....</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td>Mesanotum and metanotum with two rows of bristles</td>
<td>OrchopeasLeucopus</td>
<td>67</td>
</tr>
<tr>
<td></td>
<td>Mesanotum and metanotum with three rows of bristles</td>
<td>OrchopeasSexdentatusagilis</td>
<td>69</td>
</tr>
<tr>
<td>15.</td>
<td>Cephalic ctenidia with two teeth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16.</td>
<td>Cephalic ctenidia with more than two teeth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17.</td>
<td>Teeth not overlapping</td>
<td>Peromyscopsyllahesperomys</td>
<td>74</td>
</tr>
<tr>
<td>18.</td>
<td>Teeth overlapping</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19.</td>
<td>Tail projecting deep into the lumen of the spermatheca</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tail not projecting deep into the lumen of the spermatheca</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20.</td>
<td>Caudally directed process immediately ventral to the antepygidal bristles</td>
<td>EpitediaStanfordi</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>No caudally directed process</td>
<td>Epitediawenmanni</td>
<td>40</td>
</tr>
<tr>
<td>21.</td>
<td>More than ten bristles in the postantennal region</td>
<td>Meringisparkeri</td>
<td>56</td>
</tr>
<tr>
<td></td>
<td>Fewer then ten bristles in the postantennal region</td>
<td>Phalacropsyllaallos</td>
<td>75</td>
</tr>
<tr>
<td>22.</td>
<td>Cephalic ctenidia with four teeth</td>
<td>Micropsyllasecticilis</td>
<td>59</td>
</tr>
<tr>
<td></td>
<td>Cephalic ctenidia with more than four teeth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23.</td>
<td>Apex of tail of spermatheca concave on anal side</td>
<td>Micropsyllagoody</td>
<td>58</td>
</tr>
<tr>
<td></td>
<td>Apex of tail of spermatheca not concave</td>
<td>Rectofrontiaraterna</td>
<td>77</td>
</tr>
<tr>
<td>23.</td>
<td>Long diameter of head of spermatheca twice that of the short diameter</td>
<td>MalaraeusSimomus</td>
<td>48</td>
</tr>
<tr>
<td></td>
<td>Long diameter of head of spermatheca half again that of short diameter</td>
<td>Malaraeuseuphorbi</td>
<td>46</td>
</tr>
</tbody>
</table>
KEY TO THE MALE SPECIES AND SUBSPECIES OF FLEAS FOUND ON
THE MAMMALS OF THE FAMILIES CRICETIDAE AND MURIDAE
IN UTAH COUNTY

1. Pronotal ctenidia absent (Fig. 9).......................... 32
   Pronotal ctenidia present (Fig. 8)......................... 2

2. Cephalic ctenidia present................................. 15
   Cephalic comb absent...................................... 3

3. Setae on head few in number (Fig. 8)................. 5
   Setae on head numerous (Fig. 6)......................... 4

4. Setae on head very coarse, eye absent (Fig. 7)..... 79
   Setae on head of normal size, spermatheca double,
   eye present (Fig. 6).............................. Atyphloceras multidentatus 34

5. Finger of clasper without heavy dark spiniform pro-
   cesses.................................................. 10
   Finger of process with heavy dark spiniform pro-
   cesses.................................................. 6

6. Two spiniform processes of unequal length........ 65
   More than two spiniform processes....................... 7

7. Spiniform processes of uniform length.............. 9
   Spiniform processes not of uniform length........... 8

8. Two short spiniform processes dorsal to one long
   spiniform process, all quite widely separated........ 52
   Two short spiniform processes dorsal to one long
   spiniform process, all evenly spaced and close to-
   gether................................................. Monopsyllus wagneri wagneri 61

9. Three evenly spaced spiniform processes............ 50
   Form short evenly spaced spiniform processes...... 67
   One short spiniform process above four evenly spaced
   short spiniform processes................................. Orchopeas sexdentatus agilis 69
10. Eye normal ........................................ 12
   Eye greatly reduced or entirely absent .......... 11

11. More than ten setae on preantennal area .......... 42
    Fewer than ten setae on preantennal area ....... Megarthroglossus sp. 54

12. Small dark spiniform process on the IX sternite...
    Spiniform process on the IX sternite absent ...... 13
    Malaraeus sinomus 48

13. Spring of penis long and curved ....... Diamanus montanus 36
   Spring of penis short or lacking .............. 14

14. VIII sternite bearing two long apical bristles longer than the sternite
    VIII sternite long and slender, bearing two apical bristles much shorter than sternite .... 72
    Cropsylla idahoensis

15. Cephalic ctenidium with more than two teeth .... 20
    Cephalic ctenidium with two teeth .......... 16

16. Teeth not overlapping ... Peromyscopsylla hesperomys 74
    Teeth overlapping ................................ 17

17. IX sternite with two widely separated spiniform processes ... 56
    IX sternite with several spiniform processes .... 18
    Meringis parkeri

18. IX sternite with eight uniform black spiniform processes ... 75
    IX sternite with 12 spiniform processes of varying length ...................................... 19
    Phalocropsylla allos

19. Caudally directed process below antepygidal bristles ............... 38
    Caudally directed process absent .......... 40
    Epitedia stanfordi

20. Cephalic ctenidium with more than four teeth .... 21
    Cephalic ctenidium with four teeth .......... Micropsylla sectilis 59

21. Cephalic ctenidium with five teeth ............. 22
    Cephalic ctenidium with 6 to 8 teeth H. g. dippiei 44

22. IX sternite with several short lateral and caudal setae .......... 58
    IX sternite with 3 or 4 short setae directed caudad .......... 77
    R. fraterna
Fig. 4.—Typical genitalia of male flea

1. Antepygidial bristles
2. Pygidial area
3. Caudally directed process
4. Manubrium
5. Penis
6. Spring
7. IX sternite
8. Movable finger of the clasper
9. Process of the clasper
Fig. 5.—Typical genitalia of female flea

1. VII sternite
2. Head of spermatheca
3. Tail of spermatheca
4. Style
Fig. 6.—Atymphloceras multidentatus, head

Fig. 7.—Stenistomera alpina, head
Fig. 8.—Opisodasyx keeni, head

Fig. 9.—Anomiopsyllus amphibolus, head
Fig. 10—*Megarthroglossus*, sp., spermatheca

Fig. 11.—*Orchopeas sexdentatus agilis*, spermatheca
DISTRIBUTION AND TAXONOMY

As this paper is concerned in the main with distribution and taxonomy, the descriptions of each species will be limited to those morphological characteristics deemed important in classifying fleas. Hubbard (1947) lists the important taxonomic characteristics for each species and some descriptive material used here was taken from that source. The synonomy and publications dealing with each species are listed as found in Hubbard's study (1947). The relative abundance of each species is given where possible. The "New Records" fleas collected by the writer are so listed.

The numbers in parentheses following collecting localities are collecting station numbers.
Anomopsyllus amphibolus Wagner


The most distinguishing characteristic of this flea is the absence of the pronotal ctenidia and the almost complete lack of setae on all regions of the body. There are two long and one short bristles at the eye position. The eye is lacking. There is one row of weak bristles to each abdominal tergite, and one antepygidal bristle to each side. Two black spiniform processes on the finger of the clasper are accompanied by a few short bristles. The IX sternite is blunt apically and armed with four spine-like bristles directed caudad. The spermatheca is globular, the tail crooked and has no apical appendage. The apical outline of VII sternite consists of two rounded lobes. The ventral lobe is the smaller of the two.

ABUNDANCE:

Seldom taken in any great numbers.

RANGE:

Known only from the type locality at Salina, Sevier County, Utah, where it was taken from Neotoma desertorum (wood rat). The records listed here extend the range of this species to include Utah County.

RECORDS:

<table>
<thead>
<tr>
<th>Field No.</th>
<th>Locality</th>
<th>Date</th>
<th>Host</th>
<th>Number collected</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Springville (6)</td>
<td>1-21-48</td>
<td>N. cinerea</td>
<td>0</td>
</tr>
<tr>
<td>44</td>
<td>Springville (6)</td>
<td>4-29-48</td>
<td>N. cinerea</td>
<td>0</td>
</tr>
<tr>
<td>192</td>
<td>Chimney Rock (10)</td>
<td>10-9-48</td>
<td>N. lepida</td>
<td>0</td>
</tr>
</tbody>
</table>
Fig. 12.—Anomiopsyllus amphibolus, female
Atypiloceras multidentatus C. Fox

Fig. 13

1914 Ceratophyllum multidentatus C. Fox, U.S. Pub. Health
Ser. Hyg. Lab. Bull. No. 97, Fig. 51.
1915 Atypiloceras multidentatus Jordan and Rothschild,
Ectoparasites I, p. 59.
1940 Atypiloceras multidentatus I. Fox, Fleas of Eastern
U.S., p. 80.

The prominent apical spinlets of the abdominal ter-
gites and the modified segments distinguish this flea from
others. The VIII sternite is rounded apically and is armed
ventrally with seven bristles. The IX sternite is enlarged
apically and armed with two small bristles. The spermatheca
is double in number.

ABUNDANCE:

Abundant in some areas.

RANGE:

The Pacific coast states and Utah.

NEW RECORDS:

<table>
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<tr>
<th>Field No.</th>
<th>Locality</th>
<th>Date</th>
<th>Host</th>
<th>Males</th>
<th>Females</th>
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<tr>
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<td>Springville(6)</td>
<td>2-14-48</td>
<td>N. cinerea</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>
Fig. 13. —Atyphloceras multidentatus, female
Diamanus montanus Baker  
Figs. 14,15

1895 Pulex montanus Baker, Can. Ent. 27:32  
1904 Ceratophyllus acutus Baker, Invert. Pacifica I., p. 40  

The genital structure presents the distinguishing characteristics of this species. The finger of the clasper is long and slender and projects dorsally beyond the process of the clasper. Six weak bristles are borne upon the posterior margin of the finger. There are two long stout bristles on the process of the clasper at its junction with the finger of the clasper, and four weak bristles dorsally. The head of the spermatheca is globular. The apical end of the tail of the spermatheca is angular in shape.

ABUNDANCE:

Never taken from mice or rats in large numbers.

RANGE:

This flea is common in most of the western states.

NEW RECORDS:

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<th>Field No.</th>
<th>Locality</th>
<th>Date</th>
<th>Host</th>
<th>Number collected</th>
</tr>
</thead>
<tbody>
<tr>
<td>44</td>
<td>Springville (6)</td>
<td>4-29-48</td>
<td>N. cinerea</td>
<td>Males 1, Females 0</td>
</tr>
<tr>
<td>283</td>
<td>Proco (3)</td>
<td>11-6-48</td>
<td>N. cinerea</td>
<td>Males 1, Females 0</td>
</tr>
</tbody>
</table>
Fig. 14.—*Diamanus montanus*, male

Fig. 15.—*Diamanus montanus*, female
Epitedia stanfordi Traub
Fig. 17,18


This species is very similar to E. wenmanni. E. stanfordi has a caudally directed process immediately ventral to the antepygidial bristles, which is not true of E. wenmanni.

ABUNDANCE:
Rather common.

RANGE:
Utah.

NEW RECORDS:

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<th>Field No.</th>
<th>Locality</th>
<th>Date</th>
<th>Host</th>
<th>Number collected</th>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Males</td>
</tr>
<tr>
<td>1</td>
<td>Provo (3)</td>
<td>3-2-47</td>
<td>P. maniculatus</td>
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<tr>
<td>257</td>
<td>Lehi (12)</td>
<td>10-30-48</td>
<td>P. maniculatus</td>
<td>1</td>
</tr>
<tr>
<td>272</td>
<td>Lehi (12)</td>
<td>11-1-48</td>
<td>P. maniculatus</td>
<td>1</td>
</tr>
<tr>
<td>274</td>
<td>Lehi (12)</td>
<td>11-2-48</td>
<td>P. maniculatus</td>
<td>1</td>
</tr>
<tr>
<td>275</td>
<td>Lehi (12)</td>
<td>11-2-48</td>
<td>P. maniculatus</td>
<td>1</td>
</tr>
<tr>
<td>276</td>
<td>Lehi (12)</td>
<td>11-2-48</td>
<td>O. leucogaster</td>
<td>0</td>
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<tr>
<td>298</td>
<td>Provo (3)</td>
<td>2-19-49</td>
<td>P. truei</td>
<td>0</td>
</tr>
</tbody>
</table>
Fig. 16.—*Epitedia stanfordi*, male genital structure

Fig. 16.—*Epitedia stanfordi*, female abdomen
Epitedia wenmanni Rothschild
Figs. 18, 19

1904 Ctenophthalmus wenmanni Rothschild, Nov. Zool., 11:642

The IX sternite of the male of this species is armed with twelve short black spiniform processes. The four dorsal spiniform processes are on the posterior margin and are longer than the rest which are on the lateral portion of the IX sternite. The tail of the spermatheca projects deeply into the lumen of the head of the spermatheca.

ABUNDANCE:

Quite common.

RANGE:

Pacific and Rocky Mountain states.

NEW RECORDS:

<table>
<thead>
<tr>
<th>Field No.</th>
<th>Locality</th>
<th>Date</th>
<th>Host</th>
<th>Males</th>
<th>Females</th>
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<tbody>
<tr>
<td>301</td>
<td>Provo Harbor</td>
<td>3-10-49</td>
<td>M. musculus</td>
<td>4</td>
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<tr>
<td>314</td>
<td>Provo Harbor</td>
<td>4-1-49</td>
<td>P. maniculatus</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>316</td>
<td>Provo Harbor</td>
<td>4-1-49</td>
<td>M. montanus</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>
Fig. 18.—*Epitedia wenmanni*, male genital structure

Fig. 19.—*Epitedia wenmanni*, female abdomen
Foxella ignota Baker

Figs. 20, 21

1895 Pulex ignotus Baker, Can. Ent., 27:110
1895 Typhlopsylla americana Baker, Can. Ent. 27:189

The eye of this flea is rudimentary. There are four stout bristles in the lower preantennal row and four to six in the dorsal preantennal row. The process of the clasper is narrow and conical. The finger of the clasper is very long and narrow. Spermatheca of female has a globular head and an apical appendage on the tail.

ABUNDANCE:

Very abundant.

RANGE:

Western United States and Canada.

NEW RECORDS:

<table>
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<th>Field No.</th>
<th>Locality</th>
<th>Date</th>
<th>Host</th>
<th>Number collected</th>
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<tbody>
<tr>
<td>116</td>
<td>Big Tree Camp (1)</td>
<td>8-10-48</td>
<td>C. gapperi galei</td>
<td>Males Females</td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td>1     0</td>
</tr>
</tbody>
</table>
Fig. 20. — *Foxella ignota*, male genital structure

Fig. 21. — *Foxella ignota*, female abdomen
Hystrichopsylla gigas dippiei Rothschild

1902 Hystrichopsylla dippiei Rothschild, Ent. Record 14(3):63
1914 Hystrichopsylla dippiei, C. Fox, U.S. Pub. Health Serv. Hyg. Lab. Bul. 97, Fig. 52.
1919 Hystrichopsylla dippiei Chapin, Bul. Brooklyn Ent. Soc. 14:52
1921 Hystrichopsylla dippiei Chapin, Proc. Ent. Soc. Wash. 23(2)

This flea is readily recognized by its huge size. It is thought to be the largest flea known. Some males are as long as 6 mm. and females are 3 mm. There are generally six teeth in the cephalic ctenidia and the pronotal ctenidia bears about forty-six teeth. The IX sternite of the male usually bears seven spiniform processes projecting caudad. The female has two spermathecae.

ABUNDANCE:

This flea is not abundant on the host but often may be taken three or four at a time from a single nest.

RANGE:

Western United States and Canada.

NEW RECORDS:

<table>
<thead>
<tr>
<th>Field No.</th>
<th>Locality</th>
<th>Date</th>
<th>Host</th>
<th>Number collected</th>
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<td>Springville(6)</td>
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<td>N. cinerea</td>
<td>Males: 0</td>
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<td></td>
<td></td>
<td></td>
<td>Females: 3</td>
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<td>221</td>
<td>Tintic Road(9)</td>
<td>10–14–48</td>
<td>P. maniculatus</td>
<td>Males: 0</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Females: 1</td>
</tr>
<tr>
<td>222</td>
<td>Springville(7)</td>
<td>10–22–48</td>
<td>M. montanus</td>
<td>Males: 0</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Females: 1</td>
</tr>
</tbody>
</table>
Fig. 22. — *Hystrichopsylla gigas dippiei*,
   male genital structure

Fig. 23. — *Hystrichopsylla gigas dippiei*,
   Female abdomen
Malaraeus euphorbi Rothschild  
(Figs. 24-25) 

1905 Ceratophyllus euphorbi Rothschild, Nov. Zool., 12:165

Hubbard (1947) described the VIII tergite of this species as bearing "four bristles at dorsal edge from stigma to apex.... There are, moreover, about five more bristles further down and a vertical row near the ventral margin.... The finger of the clasper is long, almost straight on proximal side but evenly rounded on distal side. It bears five bristles on distal side, of which ventral one is stoutest and uppermost is longest." The spermatheca is barrel-shaped and bears a small apical appendage on the tail.

ABUNDANCE:

Rare.

RANGE:

British Columbia and Utah.

NEW RECORDS:

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<th>Host</th>
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<td>Females 0</td>
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<td>Females 1</td>
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</table>
Fig. 24.—Malaraeus euphorbi, male
genital structure

Fig. 25.—Malaraeus euphorbi, female abdomen
Malaraeus sinomus Jordan
Figs. 26-27

1933 Malaraeus sinomus Jordan, Nov. Zool., 39:76

This species is closely related to Malaraeus telchinum. The finger of the clasper is rounded apically and armed with a sharp straight spine directed caudo-ventrally. There are four shorter bristles above the spine. The IX sternite is rounded ventrally and armed with a patch of bristles and one short spiniform process. Spermatheca is barrel-shaped.

ABUNDANCE:
Not abundant.

RANGE:
Rocky Mountains and West Coast states.

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</table>
Fig. 26. *Malaraeus sinomus*, male genital structure

Fig. 27. *Malaraeus sinomus*, female abdomen
Malaraeus telchinum Rothschild

Fig. 28

1936 Malaraeus telchinum Wagner, Can. Ent., 68:202
1940 Malaraeus telchinum Hubbard, Pac. Univ. Bul. 37:6:2

The genital structure of this flea bears the distinguishing characteristics. The finger of the clasper of the male bears three stout, spike-like bristles between two long bristles. There are three short bristles on the apex of the process of the clasper, and two long bristles at the junction with the finger. The spermatheca has a convex dorsal margin and a slightly concave ventral margin.

ABUNDANCE:

Frequently taken from deer mice and other wild mice.

RANGE:

Through Rocky Mountains to the coast states.

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<td>M. montanus</td>
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</table>
Fig. 28.—*Malaraeus telchinum*, male genital structure
Megabothris abantis Rothschild

Fig. 29

1933 Megabothris abantis Jordan, Nov. Zool., 39:77
1936 Megabothris abantis Wagner, Can. Ent. 68:201

The finger of the clasper bears upon the distal edge three heavy spines, of which the ventral one is longest. This characteristic plus the rounded apex of the manubrium mark this flea. The apical end of the penis has a ridged appearance. The spermatheca is barrel-shaped.

ABUNDANCE:

Not abundant.

RANGE:

Pacific coast states and east into the Rocky Mountains.

NEW RECORDS:

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<tr>
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<td>Big Tree Camp(1)</td>
<td>9-23-48</td>
<td>C. gapperi galei</td>
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<td>0</td>
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</table>
Fig. 29.—*Megabothris abantis*, male genital structure
This species is near *Megarthroglosses divisus* but the VIII sternite of the male and spermatheca of the female are distinct. However, they are not sufficiently different to provide specific distinction from the study at this time. Further comparisons should allow for proper taxonomic disposition at a later date.

**ABUNDANCE:**

Not known.

**RANGE:**

Not known.

**NEW RECORDS:**

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<td></td>
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<td>Females</td>
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<td>N. cinerea</td>
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<td>N. cinerea</td>
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<td>N. cinerea</td>
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Fig. 30.—*Megarthroglossus* sp., male genital structure

Fig. 31.—*Megarthroglossus* sp., female abdomen
The IX sternite of the male is unique and clearly distinguished. It is armed ventrally with a claw-like, black spiniform process. Hubbard (1947) states "The deeply incurved posterior face of the IX sternite is armed with four bristles evenly spaced, and at the posterior-dorsal angle a black spiniform" process is found. At the apex of the IX sternite are two short bristles. Apical outline of VII sternite of female is straight. Spermatheca is pyriform in shape and is broadest toward the point of junction of tail and head.

ABUNDANCE:

Very abundant on kangaroo rats and some desert mice.

RANGE:

It ranges in most of the western states.

NEW RECORDS:

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<tr>
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<td>10-31-48</td>
<td>P. manipulatus 1</td>
<td>males 1 females 0</td>
</tr>
<tr>
<td>274</td>
<td>Lehi (12)</td>
<td>11-2-48</td>
<td>P. manipulatus 1</td>
<td>males 1 females 0</td>
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<tr>
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<td>P. manipulatus 0</td>
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<td>O. leucogaster 3</td>
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</table>
Fig. 32.—Meringis parkeri, male genital structure

Fig. 33.—Meringis parkeri, female abdomen
Micropsylla goodi Hubbard

This species differs from M. sectilis in the presence of five teeth in the cephalic ctenidia. The IX sternite has the shape of a stout hook. Other characteristics are quite similar in the two species.

ABUNDANCE:

Considered to be rare.

RANGE:

Washington, Oregon, California, and Utah.

NEW RECORDS:

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</table>
Micropsylla sectilis Jordan and Rothschild

Fig. 35

1923 Rhadinopsylla sectilis Jordan and Rothschild, Ectoparasites I, p. 314
1936 Rectofrontia sectilis Wagner, Can. Ent., 68:203
1941 Micropsylla sectilis Hubbard, Pac. Univ. Bul., 37:10:144

The presence of four cephalic teeth on both sides of the head distinguishes this flea from other species of the genus. Finger of the clasper is armed with three short bristles. The IX sternite slightly swollen apically and armed posteriorly along the swollen portion with many small bristles of uneven length. The tail of the spermatheca is concave apically. (The male collected by the writer had four cephalic teeth on one side of the head and five teeth on the other side.)

ABUNDANCE:

Considered to be quite rare.

RANGE:

The range of this flea extends from the midwest through the Rocky Mountains.

NEW RECORDS:

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<td></td>
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<td>0</td>
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</table>
Fig. 34.—*Micropsylla goodi*, male

Fig. 35.—*Micropsylla sectilis*, male
Monopsyllus wagneri wagneri Baker  
Figs. 36-37

1928 Ceratophyllus peromysci Stewart, Can. Ent. 60:148

The finger of the clasper of this species is characteristically shaped and is armed posteriorly with three spiniform processes. The ventral spiniform is about twice as long as the dorsal two. The spermatheca is peculiar to this species in having diameter of head and tail approximately the same.

ABUNDANCE:
Very abundant.

RANGE:
Ranges through the Western United States and Canada.

NEW RECORDS:

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<td>59</td>
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<td>83</td>
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<td>P. maniculatus</td>
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<td>C. gapperi galei</td>
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<td>P. maniculatus</td>
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<td>R. norvegicus</td>
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(Dr. J. S. Stanford, 1943, lists one specimen taken from P. maniculatus on Mt. Timpanogos.)
Fig. 356. — *Monopsyllus wagneri wagneri*, male

Fig. 37. — *Monopsyllus wagneri wagneri*, female
Nosopsyllus fasciatus Bosc.

1895 Pulex fasciatus Baker, Can. Ent., 27:111
1940 Nosopsyllus fasciatus I. Fox, Fleas of the Eastern U.S., p. 73
1940 Nosopsyllus fasciatus Holland, Ent. Soc. B.C., No. 36
1943 Nosopsyllus fasciatus Prince, Publ. Health Repts, 58:700

Hubbard (1947) gives the following description for this species:

This common species, found generally wherever there are house rats and mice, needs little introduction. In both male and female the species can be differentiated from all other fleas by characteristic Modified Segments, and their presence upon their normal hosts, the house rats and mice. MALE: Three antepygidial bristles on each side, middle one about three times as long as upper bristle, lower one reduced to a small seta. Process P of clasper is broad with a prominent posterior angle, armed at apex with 2 or 3 small bristles. Finger is evenly rounded posteriorly, the posterior margin bearing 2 stout bristles, between which there is a much smaller one and 1 or 2 others at the apex. FEMALE: Three antepygidial bristles on each side, uppermost being shorter than others. Apical margin of VII st. is irregularly rounded or slanting. Head of spermatheca is globular, tail about 1½ times as long as head and curved around it.

RECORDS:

Prince (1943) reports this flea from Provo and Payson in Utah County taken from Rattus norvegicus.
Both male and female of this species are very distinct. The male bears two black spiniforms of unequal length on the finger of the clasper. The ventral spiniform is about twice as long and is more slender than the dorsal spiniform process. The upper lobe of the apical outline of the VII sternite is in the form of a hook. The head of the spermatheca is barrel-shaped, and the tail of the spermatheca bears a distinctive appendage.

ABUNDANCE:

Very abundant wherever deer mice abound.

RANGE:

Common throughout the western states.

NEW RECORDS:

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<td>Males 0 Females 1</td>
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<tr>
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</table>
Fig. 38. — *Opisodasys keeni*, male

Fig. 39. *Opisodasys keeni*, female.
Orchopeas leucopus Baker

Figs. 40–41

1905 Ceratophyllus aeger Rothschild, Nov. Zool., 12: 166

The setae on the head of this flea help to identify it. There is present a preantennal row of three bristles, three stout setae on the postantennal region, and numerous small setae along the margin of the antennal groove. Finger of the clasper of the male bears four short stout spiniform processes along the posterior margin. The lower lobe of the IX sternite bears a short spiniform. The apical outline of the VII sternite of the female is in the form of two distinct lobes of about the same length. The spermatheca is barrel-shaped with a crooked tail.

ABUNDANCE:

Not usually taken in great numbers.

RANGE:

Abundant in the east and ranges west to the Pacific coast.

NEW RECORDS:

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<tr>
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<td>P. maniculatus</td>
<td>0</td>
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<tr>
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<tr>
<td>222</td>
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</table>
Fig. 40. — *Orchopeas leucopus*, male

Fig. 41. — *Orchopeas leucopus*, female
Orchopeas sexdentatus agilis Rothschild
Figs. 42-43

pl. VII, Figs. 16-18
1929 Ceratophyllus sexdentatus agilis Jordan, Nov. Zool.,
35:30.

This flea is characteristic of the genus and may
be separated from the other members of the genus in that
agilis has five short black spiniform processes on the
finger of the clasper. Females of this genus are hard to
classify to species status. The apical outline of the
VII sternite varies somewhat. The apical outline consists
of two long lobes. The ventral lobe is generally longer
and more pointed than the dorsal one.

ABUNDANCE:

Very abundant on woodrats and usually taken in
large numbers.

RANGE:

Rather common throughout most western states.

NEW RECORDS:

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<tr>
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<td>N. cinerea</td>
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</tr>
<tr>
<td>292</td>
<td>Provo (3)</td>
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<td>N. cinerea</td>
<td>3</td>
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<tr>
<td>296</td>
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<tr>
<td>313</td>
<td>Provo (3)</td>
<td>3-11-49</td>
<td>N. cinerea</td>
<td>1</td>
</tr>
</tbody>
</table>
Fig. 42.—*Orchopeas sexdentatus agilis*, male

Fig. 43.—*Orchopeas sexdentatus agilis*, female
Oropsylla idahoensis Baker

Figs. 44-45


27:413


1906 Ceratophyllus poeantis Baker, Prov. U.S. Nat. Mus. 29:134


29:134

1927 Ceratophyllus bertholfi C. Fox, Amer. Ent. Soc. Phil.

Trans., 53:200

1929 Ceratophyllus idahoensis Jordan, Nov. Zool., 35:32


1936 Oropsylla Idahoensis Wagner, Can. Dne., 63:198

The finger and process of clasper in the male and the spermatheca of the female are the distinguishing features of this flea. Hubbard (1947) described the finger of the clasper as having a "rounded posterior border armed with two stout bristles and several smaller ones." The process of the clasper is blunt dorsally and bears four stout bristles directed dorsally. The spermatheca is made distinctive by having a long apical appendage on the tail. The head of the spermatheca is round to ovate.

ABUNDANCE:

Common.

RANGE:

Throughout the Western United States and Canada.

NEW RECORDS:

Field

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</table>
Fig. 44.—Oropsylla idahoensis, male

Fig. 45.—Oropsylla idahoensis, female
Peromycopsylla hesperomys Baker

1914 Ctenopsyllus hesperomys C. Fox, U.S. Publ Health Ser. Hyg. Lab., Bul. 97, pl. XX.
1933 Leptopsylla hesperomys Stewart, Jour. N. Y. Ent. Soc., 41:260
1940 Peromycopsylla hesperomys I. Fox, Fleas of East.U.S., p. 84.

Characteristic of this flea is the presence of two distinct teeth in the cephalic ctenidia and the many heavy spiniform-like bristles on the head. The VIII sternite of the male is armed apically with four bristles not of uniform length. The body of the spermatheca is oval and gradually merged into a tail which turns posteriorly over the head of the spermatheca.

ABUNDANCE:

Abundant in non-desert areas.

RANGE:

Ranges through the Eastern states, Rocky Mountains, and Pacific Coast states.

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<th>Females</th>
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<td>Big Tree Camp(1)</td>
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</table>

Hubbard (1947) states "The IX sternite of the male is expanded apically and armed at the posterior-ventral angle with a row of eight short, heavy black spiniform processes."

Apical outline of the VII sternite of the female is bi-lobed. The head of the spermatheca is pear-shaped. Tail of spermatheca is not bent back over the head of the spermatheca.

ABUNDANCE:

Very abundant in woodrat nests during the fall months of the year.

RANGE:

Montana, Wyoming and Utah.

NEW RECORDS:

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<th>Locality</th>
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<td>Neotoma cinerea</td>
<td>Males 1</td>
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<tr>
<td>284</td>
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<td>11-13-48</td>
<td>Neotoma cinerea</td>
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<tr>
<td>285</td>
<td>Provo (3)</td>
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<td>Neotoma cinerea</td>
<td>Males 2</td>
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<tr>
<td>292</td>
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<td>11-25-48</td>
<td>Neotoma cinerea</td>
<td>Females 10</td>
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<tr>
<td>313</td>
<td>Provo (3)</td>
<td>3-11-49</td>
<td>Neotoma cinerea</td>
<td>Males 1</td>
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</tbody>
</table>
Fig. 46.—*Phallacropsylla allos*, male

Fig. 47.—*Phallacropsylla allos*, female
Rectofrontia fraterna Baker

Fig. 49

1895 Typhlopsylla fraterna Baker, Can. Ent. 27:189
1913 Rhadinopsylla fraterna Rothschild, The Ent., 46:297
1923 Rhadinopsylla fraternus J. and R., Ectoparasites I, p. 314
1936 Rectofrontia fraterna Wagner, Can. Ent. 68:203

The presence of four or five genal teeth, two rows of bristles on the gena (two stout bristles ventrally and five weak bristles dorsally), and three rows of bristles on the post antenial region distinguish this flea from others of the genus. Finger of clasper and IX sternite bear stout bristles but no spiniform processes. Spermatheca of female is irregular in shape.

ABUNDANCE:
Considered to be rare.

RANGE:
Apparently throughout the United States.

NEW RECORDS:

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<td>N. cinerea</td>
<td>Males Females</td>
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<td></td>
<td></td>
<td></td>
<td>0 1</td>
</tr>
</tbody>
</table>
Fig. 48.—*Peromyscopsylla hesperomys*, female

Fig. 49.—*Rectofrontia fraterna*, female

*(illustration inverted)*
Stenistomera alpina Baker

Figs. 50-51


Five rows of peculiarly shaped bristles on the pre-
antennal portion of the bullet-shaped head distinguish this
blind flea from others. The bristles are coarse and heavily
pigmented and taper out to a fine filament. The finger of
the clasper has two black spiniform processes. One black
spiniform process is found on the apex of the IX sternite.
The apical outline of the VII sternite is nearly straight.
The spermatheca has a barrel-shaped head and a crooked tail.

ABUNDANCE:

These fleas are rare and nearly always taken from
Neotoma.

RANGE:

Apparently ranges through Rocky Mountains west to
the Coast states.

NEW RECORDS:

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<th>Locality</th>
<th>Date</th>
<th>Host</th>
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<tbody>
<tr>
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<td>N. cinerea</td>
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<td>Males 0</td>
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<td>Provo (3)</td>
<td>3-11-48</td>
<td>N. cinerea</td>
<td>Males 1, Females 2</td>
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</tbody>
</table>
Fig. 50. — *Stenistomera alpina*, male

Fig. 51. — *Stenistomera alpina*, female
SUMMARY AND CONCLUSIONS

By the use of traps, guns, and other equipment, twenty-nine nests and 198 mammals of the families Cricetidae and Muridae were collected at twelve collecting stations throughout the county. From these mammals and nests, 392 fleas were collected representing three families and nineteen genera. Of this total number, fifty-five percent were females. Four species are new distrib- uational records to the State of Utah, and twenty-two species are new records to Utah County.
HOST–FLEA RELATIONSHIPS

Clethrionomys gapperi galei (Merriam) 13 mammals, no nests collected

Megabothris abantis
Foxella ignota
Monopsyllus wagneri wagneri

Micrurus montanus nexus, Hall & Hayward 5 mammals, 7 nests collected

Hystichopsylla gigas dippiei
*Epitedia wenmanni
Malaraeus telchinum

Micrurus montanus nanus (Merriam) 2 mammals, no nests collected

Micrurus longicaudus mordax (Merriam) 13 mammals, no nests collected

Megabothris abantis
Peromyscopsylla hesperomys

Micrurus richardsoni macropus (Merriam) 2 mammals, no nests collected

Peromyscus maniculatus sonoriensis (Le Conte) 100 mammals, no nests collected

Orchopeas leucopus
Megabothris abantis
Meringis parkeri
Orchopeas sexdentatus agilis
**Monopsyllus wagneri wagneri
Epitedia stanfordi
**Opisodasys keeni
Hystichopsylla gigas dippiei
*Epitedia wenmanni
Malaraeus telchinum
Micropsylla sectilis
Oropsylla idahoensis
Micropsylla goodi
Malaraeus euphorbi

No asterisks indicate fleas were taken from host only.
* indicates specimens were taken from nest only.
** indicates specimens were taken from both nests and hosts.
Peromyscus boylii utahensis, Durrant  2 mammals and no nest collected

Peromyscus truei nevadensis, Hall & Hoffmeister  6 mammals, no nest collected

Epitedia stanfordi
Malaraeus telchiniun
Malaraeus sinomus

Neotoma cinerea acraia (Elliot)  8 mammals, 17 nests collected

** Diamanus montanus
* Megarthroglossus sp.
* Phalocropsylla allos
** Orchopeas sexdentalis agilis
Hystrichopsylla gigas dippiei
Anomiopsyllus amphibolus
Atyploceratida multidentatus
* Rectofrontia fraterna

Neotoma lepida lepida, Thomas  6 mammals, 2 nests collected

Orchopeas sexdentatus agilis
Monopsyllus wagneri wagneri
Anomiopsyllus amphibolus

Reithrodontomyx megalotis megalotis (Baird)  2 mammals, no nest collected

Orchopeas leucopus

Onychomys leucogaster brevicaudus, Merriam  1 mammal, no nest collected

Meringis parkeri
Monopsyllus wagneri wagneri
Epitedia stanfordi

Ondatra zibethica osoyoosensis (Lord)  3 mammals, no nests collected

Rattus rattus norvegicus (Erxleben)  16 mammals, 1 nest collected

** Monopsyllus wagneri wagneri

Mus musculus musculus, Linnaeus  19 mammals, 1 nest collected

** Monopsyllus wagneri wagneri
Opisodasys keeni
** Epitedia wernmanni
LIST OF FLEA-HOSTS

1. Clethrionomys gapperi galei (Merriam)
2. Lemmiscus curtatus intermedius (Taylor)
3. Microtus montanus nanus (Merriam)
4. Microtus montanus nexus Hall & Hayward
5. Microtus longicaudus mordax (Merriam)
6. Microtus pennsylvanicus modestus (Baird)
7. Microtus richardsoni macropus (Merriam)
8. Mus musculus musculus Linnaeus
9. Neotoma cinerea acraia (Elliot)
10. Neotoma lepida lepida Thomas
11. Ondatra zibethica osoyoosensis (Lord)
12. Onychomys leucogaster brevicaudus Merriam
13. Peromyscus boylii utahensis Durrant
14. Peromyscus maniculatus sonoriensis (Le Conte)
15. Peromyscus truei nevadensis Hall & Hoffmeister
16. Phenacomys intermedius intermedius Merriam
17. Rattus norvegicus norvegicus (Erxleben)
18. Rattus rattus rattus Linn.
19. Reithrodontomys megalotis megalotis (Baird)
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<td>Opisodasys keeni (Baker)</td>
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<td>Stenistomera alpina (Baker)</td>
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REFERENCES CITED


