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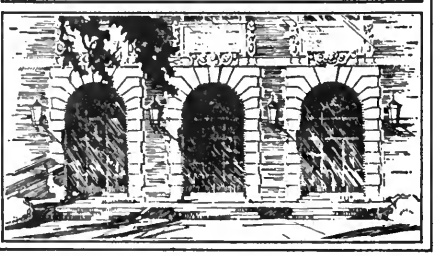

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SIPHONAPTERA COLLECTED DURING THE 1965 STREET EXPEDITION TO AFGHANISTAN

ROBERT E. LEWIS

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Zoology

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SIPHONAPTERA COLLECTED DURING THE 1965 STREET EXPEDITION TO AFGHANISTAN

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ABSTRACT

The siphonapteran fauna of the Kingdom of Afghanistan is discussed, based on collections made by the W. S. and J. K. Street-Field Museum of Natural History Expedition to that country in 1965. Pertinent literature dealing with the flea fauna of the country is reviewed. Keys to the families, subfamilies, genera, subgenera, and species are included. Each species, whether collected during the expedition or only recorded in the literature, is discussed and a list of the material collected is included at the end of each section. *Coptopsylla afghana* n. sp., *C. barbarae* n. sp., *C. janiceae* n. sp., *Rhadinopsylla kullmanni* n. sp., *Phaenopsylla hopkinsi* n. sp., *P. jordani* n. sp., *Acropsylla traubi* n. sp., *Nosopsyllus eremicus* n. sp., and *Callopsylla streeti* n. sp. are described, and all but two of the species known to the fauna are figured. The zoogeographic affinities of the various taxa are discussed and a bibliography of the pertinent literature is included.

Siphonaptera Collected During the 1965 Street Expedition to Afghanistan[1,2]

INTRODUCTION

Although the primary objective of the 1965 Street-Field Museum of Natural History Expedition to Afghanistan was to conduct a mammal survey of the country, a number of other collections of both flora and fauna were made. Notable among these were land snails, reptiles, amphibians, and ectoparasitic arthropods. A narrative and itinerary of the expedition, as well as discussions of the physiography, climate, phytogeography, and ecology of the areas visited appears in Hassinger (1968) and need not be repeated here. The expedition was in the field from July 11 to November 22, and 2,014 mammals were collected. Most of these were hosts to fleas, mites, ticks, and/or lice.

Representatives of the species of fleas collected during the expedition have been retained in the collection of the author. The remainder, including types, have been deposited in the collections of Field Museum of Natural History.

[1] Portions of this study were supported by grants from the United States Public Health Service, National Institutes of Health Grant AI-05512-01 TMP; research project N62558-5023, Office of Naval Research, U.S. Navy European Research Contracts Program, Brussels, Belgium, to the American University of Beirut, Beirut, Lebanon; and research project N00014-68-A-0101-0001, Office of Naval Research, Navy Department, Washington, D.C. 20360 to Iowa State University, Ames, Iowa, 50010.

The opinions and assertions contained herein are the private ones of the author and are not be construed as official or as reflecting the views of the Department of the Navy or the naval service at large.

[2] Journal Paper No. J-6860 of the Iowa Agriculture and Home Economics Experiment Station, Ames, Iowa. Project No. 1715.

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It is a great pleasure to extend my sincere gratitude to William S. Street and his wife, Janice K. Street, who made the expedition to Afghanistan possible through their collaboration with Field Museum of Natural History. The Streets not only supported the expedition and led it in the field, but also extended their friendship and understanding to all the members of the field party, forging bonds that have endured to the present.

I am particularly beholden to the other members of the expedition, Mr. Jerry Hassinger, the late Dr. Sana Atallah, and Mr. Hans Neuhauser, for their assistance and co-operation in collecting host animals in a manner that permitted examination for ectoparasitic arthropods. One seldom encounters mammalogists who consider mammalian ectoparasites to be of sufficient importance to justify their collection; without the collaboration of these young scientists, this aspect of the fauna of Afghanistan would certainly have been neglected.

Mr. Brian Reardon of the International Harvester Company and his service representative rendered invaluable service to the expedition in vehicular maintenance and other logistical problems, for which we are all indebted.

Thanks are also extended to various members of the Government of Afghanistan, the American Embassy, the Afghan Highway Commission, and USAID for their co-operation and assistance, as well as to the National Institutes of Health and the American University of Beirut for permission to accompany the expedition.

Appreciation is also expressed to Mrs. Barbara Drinka and Mrs. Lois Johnson for their secretarial assistance.

SYSTEMATIC TREATMENT

The Siphonaptera of Afghanistan have received relatively little attention from entomologists. For the greater part of recent history, strangers have not been encouraged to travel in the country and those who did were not usually interested in the flora and fauna. Except for a few scattered records from the northern frontier and the adjacent southern Russian provinces of Turkmeniya, Uzbekistan, and Tadzhikistan, published in Russian, there are but five publications dealing with the fleas of this country.

Jordan (1944) treated a small collection of fleas taken by the late J. L. Chaworth-Musters during his travels in northeastern Afghanistan from June to August, 1939. In addition to reporting *Xenopsylla conformis* (Wagner, 1903), from Ghazni on *Meriones erythrourus* (=*libycus erythrourus* Gray, 1842), he described a new genus, three new species, and two new subspecies. *Monopsyllus sciurorum cophinus* was described from the Paghman Mountains on *Dryomys nitedula*. It has since been made a synonym of *M. s. asiaticus* (Ioff, 1940) by Ioff and Rostigayev (1950).

Citellophilus alticola was described from a single female taken at the Shibar Pass from *Mustela* sp. The species has since been assigned to *Callopsylla* (*vide* Ioff and Rostigayev, 1950), but it has not been taken again despite extensive collecting in the area and is likely a synonym of *C. caspia* (Ioff and Argyropulo, 1934), or *C. tiflovi* Wagner, 1936.

Frontopsylla mutata also was described from the Shibar Pass from its preferred host, *Ochotona rufescens*, and *Mustela* sp. It has since been regarded as a subspecies of *F. elata* by various Russian authors (Ioff and Scalon, 1954; Ioff, *et al.*, 1965), but Peus (1966) makes an excellent case for its retention as a full species.

The genus *Phaenopsylla* was erected by Jordan for a new species of amphipsylline flea, which he named *P. mustersi* after its collector. Specimens were taken in the Paghman Mountains from *Calomyscus bailwardi*. *Amphipsylla montium* was described from four females taken from the same locality and host. The male of this species was subsequently described by Peus (1966).

Peus (1957) reported on a small collection of fleas from various localities in Afghanistan, collected by J. Klapperich in 1952 and 1953. Included were *Pulex irritans* Linné, 1758, from various localities and hosts, *Xenopsylla astia* Rothschild, 1911, from Kandahar, *Ischnopsyllus octactenus* (Kolenati, 1856), from Bashgul-Tal, Nuristan on *Pipistrellus pipistrellus, Oropsylla silantiewi* (Wagner, 1898), from the Salang Pass on *Marmota caudata,* and a new species. This he described as *Nosopsyllus (Gerbillophilus) afghanus.* The single male was collected in the environs of Kabul on *Meriones l. erythrourus.* Professor Peus was kind enough to permit me to examine this specimen, after which I was asked to deposit it in the collection of the British Museum (Natural History), Tring, England, where it presently resides.

Smit (1960) reported on a collection of fleas taken by Dr. K. Lindberg during his travels in the country, plus a few other unpublished records. In addition to three more records of *Pulex irritans,* the following species were reported from Afghanistan for the first time: *Ctenocephalides f. felis* (Bouché, 1835), from Kabul and other localities in the northern and western part of the country, *Ceratophyllus fringillae* (Walker, 1856), from two localities in the northwest, *C. hirundinis* (Curtis, 1826), from near Pul-i-Khumri on *Delichon urbica, Chiropteropsylla brockmani* Rothschild, 1915, from two localities in the southwest on *Asellia tridens,* and two subspecies of *Rhinolophopsylla unipectinata.* The nominate subspecies was reported from two localities in the southwest, while *R. u. turkestanica* Ioff, 1953, was reported from Kaftar Khaneh cave in northern Afghanistan.

Smit's 1960 study also includes a useful discussion contrasting the two subspecies of *R. unipectinata* and a brief statement concerning their distribution in the country. It closes with a list of those species already known from Afghan records.

One of the most recent works to appear on the flea fauna of Afghanistan is that of Peus (1966). In it, he treats collections made by Drs. G. and J. Niethammer in the spring of 1965. Much of this collection consisted of females, which could not be identified to species with certainty. Peus indicated these by the insertion of a (?) in the scientific name, a practice which I am continuing in the following resumé.

In addition to two *Neopsylla,* one *Rhadinopsylla (Actenophthalmus),* and one *Callopsylla,* all females, which were not identified to

species, 14 taxa are included in the report. *Xenopsylla c. conformis* (Wagner, 1903), was collected at Kinjan from *Meriones persicus*. *Ctenophyllus* (*Ochotonobius*)? *rufescens* Ioff, 1946, was reported from a single female from Unoj Pass on *Blanfordimys* (=*Microtus*) *afghanus*. *Ophthalmopsylla volgensis* ssp. also was reported from this locality from a female on *Cricetulus migratorius*. Four species of *Frontopsylla* were reported: *F.* (*Frontopsylla*)? *elatoides* from Unoj Pass on *C. migratorius*, one female; *F.* (*Profrontia*)? *ornata* Tiflov, 1937, from Unoj and Salang Pass and the Paghman Mountains on *C. migratorius*, *Apodemus sylvaticus*, and *Alticola roylei*, all females; *F.* (*Orfrontia*) *frontalis alatau* Fedina, 1946, from Unoj Pass on *Montifringilla theresae;* and *F.* (*F.*) *mutata* Jordan, 1944, from Unoj Pass on *C. migratorius*. Peus also discussed the systematic position of *F. mutata* and provided detailed illustrations of the male genitalia. Three species of *Amphipsylla* were reported: *A. anceps* Wagner, 1930, from Unoj Pass on *C. migratorius* and *M. afghanus; A. montana* Argyropulo, 1946, from Unoj and Salang Pass and the Paghman Mountains on *M. afghanus*, *A. sylvaticus*, and *A. roylei;* and *A. montium* Jordan, 1944, from the Paghman Mountains on *Calomyscus bailwardi*. Peus also described the male of *A. montium* from this collection. *Leptopsylla* (*Pectinoctenus*) *pamirensis* (Ioff, 1946), was reported from the Salang Pass on *A. sylvaticus* and *A. roylei*, and *Phaenopsylla mustersi* Jordan, 1944, from the Paghman Mountains on *C. bailwardi*. *Nosopsyllus* (*Gerbillophilus*) [*t.*] *turkmenicus* (Vlasov and Ioff, 1937), was reported from Kinjan on *Meriones persicus*, and *Ceratophyllus vagabundus* ssp. from Unoj Pass on *M. theresae*.

Sakaguti (1966) reported on a small collection of fleas taken from *Arctomys aureus* (=*Marmota caudata aurea*) from Lake Shewa in Badakshan Province. In addition to *Pulex irritans*, he also reported *Citellophilus lebedewi*, *Oropsylla segregata* (now considered a synonym of *O. silantiewi*), and an undetermined female of the genus *Amphalius*.

In summary, the five papers just reviewed establish 30 species as members of the Afghan ectoparasite fauna. Smit (1960) speculated that the fauna probably contained upward of a hundred species and subspecies based on our knowledge of the flea-fauna of the neighboring Soviet Republics. It is self-evident that no survey of such short duration can be complete, but collections made by the Street Expedition bring to 73 the species and subspecies reported from Afghanistan. Following is a key to the seven families represented by our collections, as modified from Hopkins and Rothschild (1962).

KEY TO THE FAMILIES OF FLEAS KNOWN TO OCCUR IN AFGHANISTAN

1. Outer internal ridge of midcoxa absent; mesonotum without pseudosetae under the collar; metepimeron extending far upwards, its spiracle situated much above the metepisternum; metanotum and abdominal terga without apical spines or spinelets; abdominal spiracles circular; abdominal terga II–VII with at most one row of bristles; no bristles above spiracle of t. VIII; sensilium with 14 pits each side; inner side of hindcoxa with spiniform bristles; hindtibia without an apical tooth on outside (superfamily PULICOIDEA)
PULICIDAE (p. 7)

Outer internal ridge of midcoxa usually present, though sometimes short, absent in a few instances (i.e., *Stenischia*) in which both ridges are absent on both mid- and hindcoxae; tooth at apex of hindtibia usually pointed; sensilium usually with 16 or more pits each side; mesopleural rod frequently bifid; anterior tentorial arm present or absent; pronotal and genal combs present or absent; ventral margin of pronotum usually bilobed; fifth tarsal segment with variable number of pairs of plantar bristles (superfamily CERATOPHYLLOIDEA) 2

2. Pronotal and genal combs, tergal spinelets, and pseudosetae all absent 3

Pronotal comb, tergal spinelets, and pseudosetae all usually present 4

3. Strongly sclerotized, upward-pointing clypeus present at oral angle; two antepygidial setae in both sexes of dissimilar size; females with two spermathecae.
COPTOPSYLLIDAE (p. 32)

Clypeus not forming distinct sclerite; outer dorsal bristle of forefemur somewhat shorter than inner; antepygidial bristles, spiniform bristles on inner side of hindcoxae and anal stylet of females all absent; spermatheca usually single ..... VERMIPSYLLIDAE (p. 47)

4. Metanotum without marginal spinelets, though pseudosetae may be present; in male st. IX without tendon from angle forward; female sensilium usually more or less convex and anal stylet usually with one long bristle and one or two small or minute subapical ones; (genal comb present in all species presently known from Afghanistan) ..... HYSTRICHOPSYLLIDAE (p. 49)

Metanotum with marginal spinelets; dorsal side of sensilium straight, in male ending with a transparent collar covering base of anal tergum, in female sensilium not separated from anal tergum and not raised above base of latter; anal stylet of female with one or two rather long lateral bristles in addition to apical one; in male st. IX with a tendon running forward from junction between the two arms 5

5. Head fracticipit; genal comb of two, rarely three broad, spatulate spines placed immediately behind the oral angle; parasites of bats.
ISCHNOPSYLLIDAE (p. 57)

Head fracticipit or integricipit; genal comb, if present, situated behind or below the eye 6

6. Genal comb absent; eye well developed; no arch of tentorium in front of eye (this arch is present in *Aenigmopsylla*, an extralimital genus); three bristles in ocular row, the uppermost in front of eye; no interantennal suture; antennal fossa open; club of male antenna extending on to propleurum; metanotum and some abdominal terga with spinelets; st. VIII of male narrow, sometimes small or vestigial.....CERATOPHYLLIDAE (p. 112)

With or without genal comb; arch of tentorium present though sometimes concealed by the genal comb; upper ocular bristle at or near margin of antennal fossa; interantennal suture variable, often well developed; eye often sinuate or vestigial; st. VIII of male at least moderately large.
LEPTOPSYLLIDAE (p. 65)

Superfamily PULICOIDEA

Family PULICIDAE

Representatives of this family are worldwide in distribution, either by natural occurrence or by human transport. Many of the species belonging here have been associated with the transmission of zoonotic diseases, and some rank as the principal vectors of plague. The family has been divided into four subfamilies, all represented in Afghanistan. Hopkins and Rothschild (1953) separate the subfamilies with the following key.

Key to the Subfamilies of Pulicidae

1. Club of antenna asymmetrical, the anterior segments foliaceous and inclined backward.....2

Club of antenna symmetrical and elliptical in outline.
SPILOPSYLLINAE (p. 15)

2. Pleural rod of mesothorax absent.....PULICINAE (p. 7)

Pleural rod of mesothorax present.....3

3. Falx (interantennal suture and ridge) strongly sclerotized; with a genal or a pronotal comb or vestiges of them.....ARCHAEOPSYLLINAE (p. 12)

Falx absent or feebly sclerotized; genal and pronotal combs absent.
XENOPSYLLINAE (p. 15)

Subfamily PULICINAE

Two of the four genera belonging to this subfamily occur in Afghanistan, while the other two genera are known only from Africa. The indigenous genera may be separated by the following key. Both are represented by more or less cosmopolitan species.

1. Metanotum much shorter than abdominal t. I; labial palp membranous; stylets heavy, strongly denticulate, adapted for a sedentary existence.
ECHIDNOPHAGA (p. 8)

Metanotum nearly as long or longer than abdominal t. I; labial palp stiff; stylets not so heavy or denticulate; not adapted for a sedentary existence.
PULEX (p. 10)

ECHIDNOPHAGA Olliff

Echidnophaga. Olliff, 1886, Proc. Linn. Soc. N. S. W., (2) **1**, p. 171.

Type species.—*E. ambulans* Olliff, 1886.

Most members of this genus occur in Australia and Africa, but a few are distributed in the Mediterranean Subregion of the Palaearctic and in Eastern Asia, and *E. gallinacea* is almost cosmopolitan in distribution, certainly as a result of transport on domestic animals. This is the species commonly encountered in Afghanistan. There are two additional species belonging to this genus, which, though not collected, almost certainly occur in Afghanistan. These are *E. popovi,* a parasite of badgers and certain other carnivores, and *E. oschanini,* found on certain large gerbilline rodents. Both have been reported from the USSR from ecologically similar areas.

Echidnophaga gallinacea (Westwood, 1875). Figures 1–5.

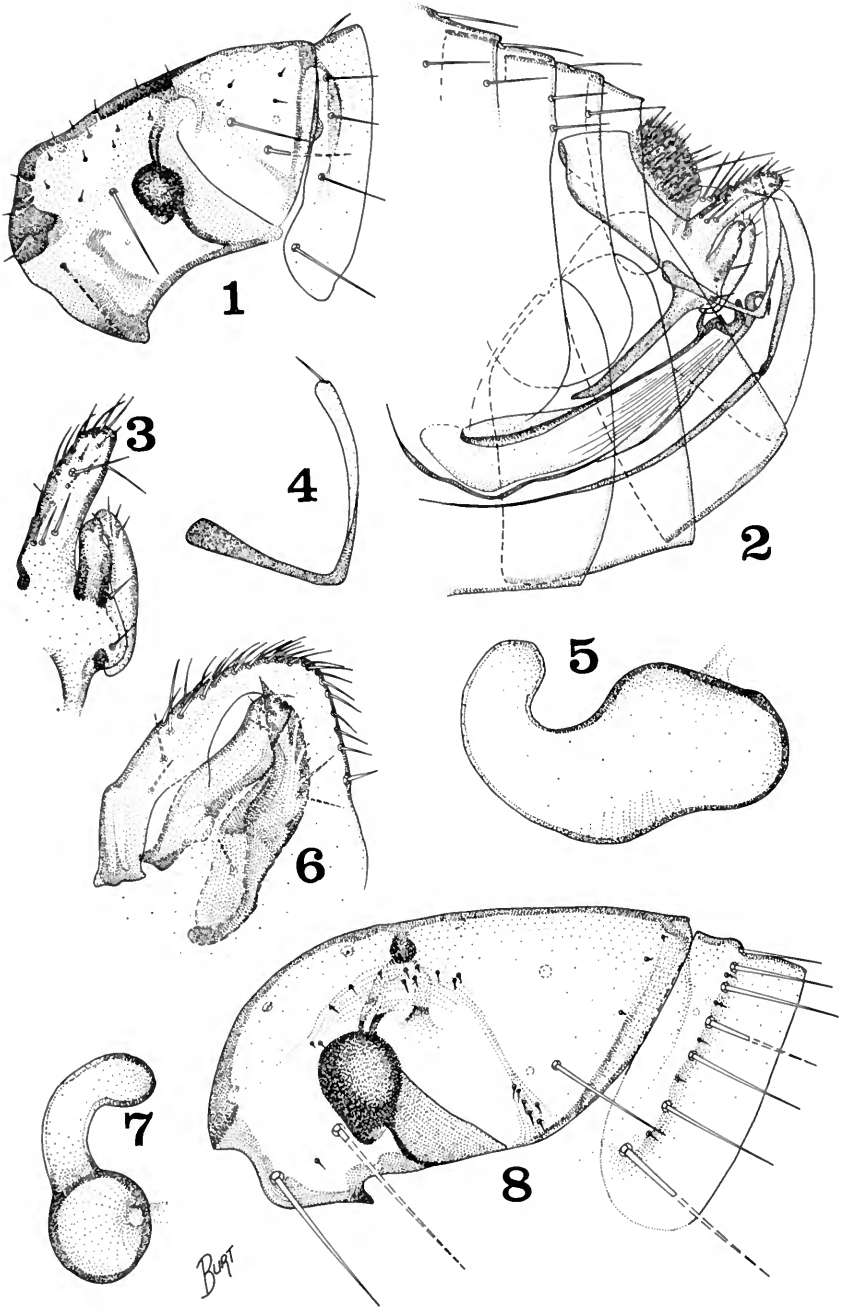
Sarcopsyllus gallinaceus Westwood, 1875, Entomol. mon. Mag., **11**, p. 246.

This small flea has an almost cosmopolitan distribution in temperate and tropical countries, where it frequently becomes a pest of economic importance among domestic fowl. It seems to occur generally throughout Afghanistan although it was not encountered in very mountainous areas. With the exception of a few specimens taken in the Kabul and Paghman localities, all collections came from elevations of less than 1,000 m. However, the species was not collected in the lowland desert steppes south of the Paropamisus and Koh-i-Baba mountain ranges. Perhaps the high temperatures and low humidities characteristic of the region prevent reproduction.

Although the species is frequently associated with gallinaceous birds, it is certainly not restricted to them as our host records amply demonstrate. The only record even indirectly referable to a bird host was the single female taken from the arm of the collector shortly after dressing doves for the kitchen. Remaining collections came from mammals belonging to the orders Insectivora and Carnivora,

---

FIGS. 1–8. *Echidnophaga gallinacea* (Westwood). **1.** Male head; **2.** Male modified segments; **3.** Male clasper; **4.** Male st. IX; **5.** Female spermatheca. *Pulex irritans* Linné. **6.** Male clasper; **7.** Female spermatheca; **8.** Male head.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except for the single record from *Meriones libycus*, certainly an accidental infestation.

Typically, these fleas were found with their mouthparts firmly embedded in the soft skin of the ears, lips, and eyelids of their hosts. Presumably, these areas are more difficult for the host to keep clean and free of parasites since ticks were commonly found there also. Large infestations usually caused a local inflammation and swelling of the tissues of the host, although isolated fleas seemed to cause little or no reaction.

Material collected.—

Herat and environs, September 18–24, 1965, from *Hemiechinus auratus*, 9 males and 13 females; from *Herpestes auropunctatus*, 4 males and 10 females; from *Canis aureus*, 1 male; from *Vulpes vulpes*, 3 females; from *Felis chaus*, 9 males and 10 females; from *Felis libyca*, 3 males and 6 females.

Kunduz and environs, August 24–29, 1965, from *Hemiechinus auratus*, 2 males and 6 females; from *Vulpes vulpes*, 2 females; from *Homo sapiens*, 1 female; from *Meriones libycus*, 1 female.

Mazar-i-Sharif and environs, September 2–6, 1965, from *Hemiechinus auratus*, 1 male and 4 females; from *Vulpes vulpes*, 3 males and 28 females.

Maimana and environs, September 8–12, 1965, from *Hemiechinus auratus*, 2 males and 3 females; from *Vulpes vulpes*, 1 male.

Paghman-Kabul area, July 15–21, 1965, from *Hemiechinus auratus*, 3 males and 6 females.

PULEX Linné

Pulex. Linné, 1758, Syst. Nat., 10th ed., **1**, p. 614.

Type species.—*P. irritans* Linné, 1758.

Five of the six known species occur in the northern portions of the Neotropical and the southwestern portion of the Nearctic Regions. The remaining form, *P. irritans*, is cosmopolitan in distribution. This is the species intimately associated with man and his habitations, although it has been recorded from a multitude of hosts, and its present distribution is likely attributable to human transport.

Pulex irritans Linné, 1758. Figures 6–8.

Pulex irritans Linné, 1758, Syst. Nat., 10th ed., **1**, p. 614.

In view of the cosmopolitan distribution of this species, it was not surprising to encounter it in Afghanistan. It was not noted in

any of the houses or hotels we visited, and our records are limited to wild hosts, although there were reports of fleas, probably of this species, in a few of the theaters in Kabul. Doubtless its association with the human population is considerably more intimate than our records indicate.

Although a number of our collections came from large rodents (for example, *Hystrix* and *Marmota*), there is little doubt that this species is mainly an ectoparasite of carnivores in Afghanistan, as it appears to be elsewhere. Porcupines normally utilize small caves or enlarge burrows of other animals as retreats and thus could easily fall prey to the more promiscuous ectoparasites of their erstwhile hosts. The association of *P. irritans* with *Marmota caudata* is more difficult to explain, although Ioff and Scalon (1954) report that it is not uncommon on these rodents at times. Assuming that *M. caudata* is not a preferred host for *P. irritans*, it seems likely that the flea is introduced by a carnivore. Ognev (1931) and a number of other Russian authors have commented on the tendency of *Vulpes corsak* to share the burrow systems of *Marmota* species within its range. Such cohabitation would offer an excellent opportunity for the introduction of *P. irritans* into *Marmota* burrows.

This is a variable species with respect to size and color, even among individuals of a given population. Considerable variation was noted in the Afghanistan collection, although nothing comparable to *P. irritans* variety "fulvus" was noted.

Material collected.—

Dasht-i-Nawar, near Hokak, August 5, 1964, from *Marmota caudata*, 18 males and 38 females, *leg.* E. Kullmann.

Hokak, July 15, 1965, from *Marmota caudata*, 11 males and 23 females, *leg.* E. Kullmann.

Faizabad, 25 km. W, August 20, 1965, from *Vulpes vulpes*, 48 males and 51 females.

Ghazni, December 8, 1964, from *Vulpes vulpes*, 8 males and 8 females, *leg.* E. Kullmann.

Herat and environs, September 18, 1965, from *Canis aureus*, 2 males and 1 female; September 19, 1965, from *Vulpes vulpes*, 6 males and 2 females.

Shibar Pass and environs, July 24–26, 1965, from *Vulpes vulpes*, 3 males and 10 females.

Kandahar, May 31, 1965, from *Hystrix indica*, 1 male and 2 females, *leg.* E. Kullmann.

Lataband, October 9, 1965, from *Hystrix indica*, 3 males and 3 females, *leg.* E. Kullmann.

Maimana, September 12, 1965, from *Rhombomys opimus*, 1 male.

Subfamily ARCHAEOPSYLLINAE

Two cosmopolitan species of the genus *Ctenocephalides* were the only representatives of this subfamily collected in Afghanistan, and it is probable that they are the only species occurring there.

CTENOCEPHALIDES Stiles and Collins

Ctenocephalides. Stiles and Collins, 1930, U.S. Publ. Hlth. Rept., Wash., **45**, p. 1, 308.

Type species.—Pulex canis Curtis, 1826.

This genus is composed of 12 species and subspecies, mostly restricted to the Ethiopian Region. Only *C. felis* and *C. canis* are of cosmopolitan distribution, and these are the taxa found in Afghanistan. They may be separated by the following characters.

1. Head blunt and smoothly rounded, lacking a pronounced frontal angle; metepisternum usually with three bristles; area between the postmedian and apical long bristles of dorsal margin of hindtibia with two small notches, each bearing a short, stout bristle ..... *C. canis* (p. 14)

   Head more acuminate apically with a more pronounced frontal angle; metepisternum usually with two bristles; area between the postmedian and apical long bristles of dorsal margin of hindtibia with one small notch bearing a short, stout bristle. ..... *C. f. felis* (p. 12)

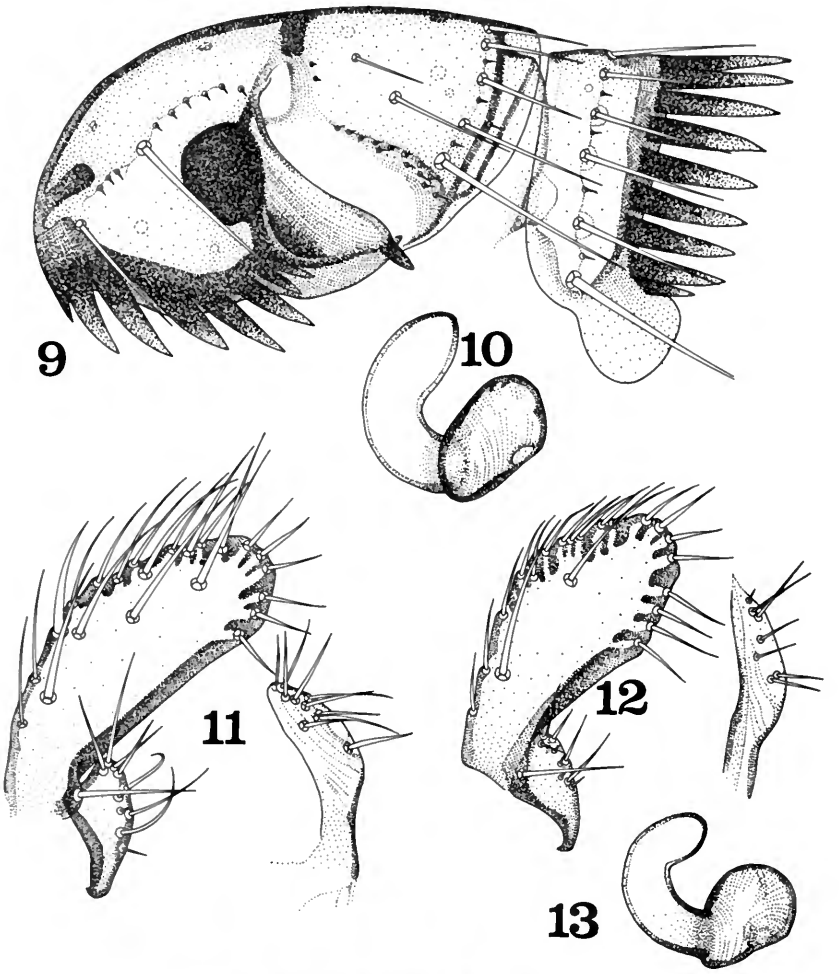
Ctenocephalides felis felis (Bouché, 1835). Figures 12–14.

Pulex felis Bouché, 1835, Nova Acta Leop.-Carol., **17**, p. 505.

The cat flea was considerably less common than anticipated and was replaced on most of its regular hosts by *C. canis*. However, *C. felis* was a common and regular ectoparasite of the mongoose wherever it occurred, and possibly, this constitutes its preferred host in this area.

Infestation rates were not as high as our records suggest because collections from a number of hosts from a given locality or for a given date have been pooled.

FIGS. 9–14. *Ctenocephalides canis* (Curtis). **9.** Male head; **10.** Female spermatheca; **11.** Male clasper and st. IX. *Ctenocephalides felis felis* (Bouché). **12.** Male clasper and st. IX; **13.** Female spermatheca; **14.** Male head.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Material collected.—

Herat and environs, September 18–24, 1965, from *Felis chaus*, 21 males and 17 females; from *Herpestes auropunctatus*, 7 males and 3 females; from *Vulpes vulpes*, 1 female.

Jalalabad, 69 km. N E, October 18, 1965, from *Herpestes auropunctatus*, 3 males and 5 females.

Kabul, September, 1963, from domestic cat, 2 males and 8 females, *leg.* E. Kullmann.

Kandahar and environs, October 30–November 7, 1965, from *Hemiechinus auratus*, 5 females; from *Herpestes auropunctatus*, 25 males and 52 females.

Ctenocephalides canis (Curtis, 1826). Figures 9–11.

Pulex canis Curtis, 1826, Brit. Entomol., 3, p. 114, figs. A to E, 8.

Ctenocephalides canis was certainly one of the most ubiquitous fleas in the country, so much so that little effort was made to collect them. All the jackals and foxes, as well as domestic cats and dogs, played host to this species.

It is difficult to explain the record from *Marmota caudata* other than to speculate that perhaps its burrow was shared with a corsak fox or some other canid that would normally play host to this species.

Material collected.—

Dasht-i-Nawar (3,000 m.), August 5, 1964, from *Marmota caudata*, 4 males and 8 females, *leg.* E. Kullmann.

Ghazni, December 8, 1964, from *Vulpes vulpes*, 15 males and 31 females, *leg.* E. Kullmann.

Herat and environs, September 19–24, 1965, from *Felis chaus*, 3 females; from *Vulpes vulpes*, 6 males and 16 females; from *Canis aureus*, 6 males and 27 females.

Kabul, September, 1965, from domestic cat and dog, 6 males and 36 females, *leg.* A. Du Pres.

Kandahar, 19–32 km. S E, October 3, 1965, from *Vulpes vulpes*, 11 males and 36 females.

Mazar-i-Sharif/Termez Road, September 2, 1965, from *Vulpes vulpes*, 1 male and 1 female.

Maimana, September 12, 1965, from *Canis aureus*, 3 males and 3 females.

Sarobi/Jalalabad Road, July 16, 1964, from *Canis aureus*, 1 male and 8 females, *leg.* E. Kullmann.

Subfamily SPILOPSYLLINAE

The six genera belonging to this subfamily are limited to the Nearctic and Palaearctic Regions, with only one genus occurring in both. The species of this genus is represented by six subspecies, only one of which occurs in the Palaearctic.

EUHOPLOPSYLLUS Ewing

Euhoplopsyllus. Ewing, 1940, Proc. Biol. Soc. Wash., **53**, p. 37. (As subgenus of *Hoplopsyllus*).

Euhoplopsyllus Ewing. Smit, 1967, Mitt. Zool. Mus. Berlin, **43**(1), p. 86. (Elevated to full generic status).

Type species.—*Pulex affinis* Baker, 1904.

Separable from members of the genus *Hoplopsyllus* by the clavate flagellum of the antennae with all segments distinct and separate from one another, not fused anteriorly; prementum with one short seta; dorsal groove of head of male with many small hairs; and st. VIII of male with a deep slit.

This genus contains four species. *E. glacialis* is known from five Nearctic subspecies and the following Palaearctic subspecies. The remaining forms are Nearctic.

Euhoplopsyllus glacialis profugus Jordan, 1925. Figures 15–18.

Hoplopsyllus glacialis profugus Jordan, 1925, Novit. Zool., **32**, p. 103.

Smit (1967) has reviewed the distribution of this species in Central Asia and mentions records from Eastern Kazakhstan, Szechwan, Tsinghai Province, Mongolia, and Tuva. It is evident that this flea occurs throughout the entire mountain and upland system of Central Asia since specimens have recently come to hand from the Mustang District of north-central Nepal from *Lepus oiostolus*.

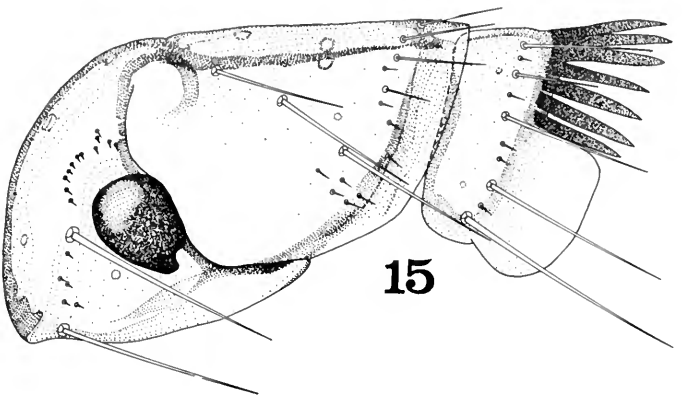
See Smit (1967) for the details concerning the elevation of *Euhoplopsyllus* to full generic status.

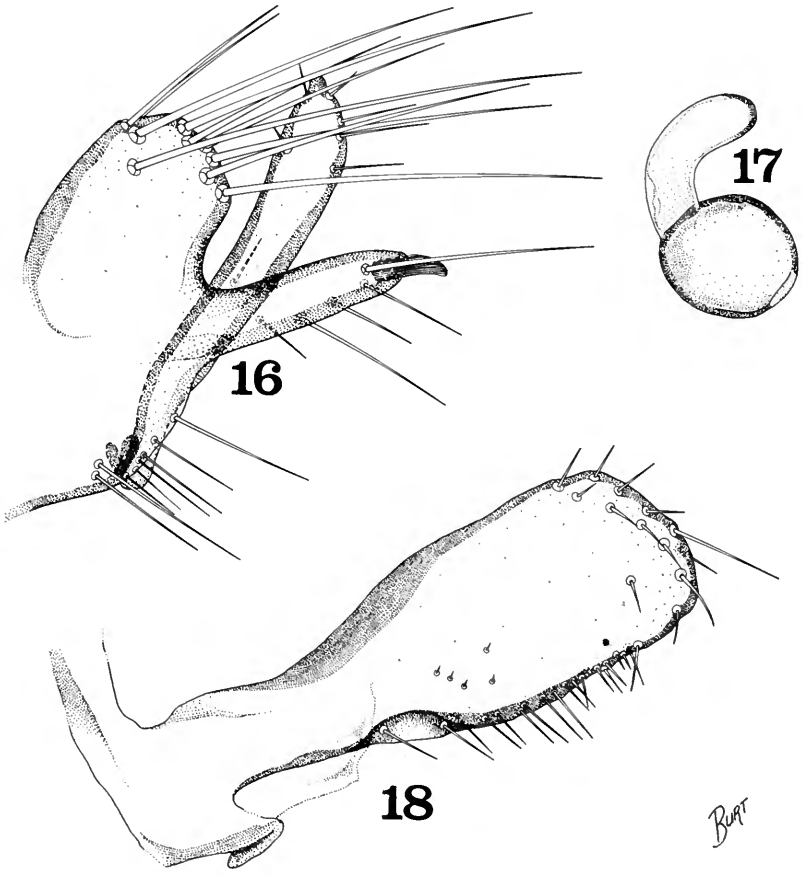
Material collected.—

Ishkamish, 23–24 km. E, August 15, 1965, from *Lepus capensis*, 6 males and 13 females.

Subfamily XENOPSYLLINAE

Though most species of the seven genera belonging to this subfamily are restricted to the Ethiopian Region or its fringes, three





FIGS. 15–18. *Euhoplopsyllus glacialis profugus* Jordan. **15.** Male head; **16.** Male clasper; **17.** Female spermatheca; **18.** Male st. IX.

species of *Synosternus* extend into or occur in Central Asia, and some species of *Xenopsylla* have a broad distribution throughout the Old World, a few being almost cosmopolitan in their occurrence. Representatives of the two genera known to occur in Afghanistan may be separated by the following characters.

1. Suture between the sternum and episternum of metathorax absent. *Synosternus* (p. 17)
   Suture between the sternum and episternum of metathorax present. *Xenopsylla* (p. 22)

SYNOSTERNUS Jordan

Synosternus. Jordan, 1925, Novit. Zool., **32**, p. 103.

Type species.—*Pulex pallidus* Taschenberg, 1880.

Closely related to *Xenopsylla*, but separable from it by the fusion of the episternum with the sternum with the subsequent obliteration of the suture.

Of the seven species assigned to this genus, three occur exclusively in the Ethiopian Region and four occur in the Palaearctic. Two of these extend into North Africa and the other two are exclusively Central Asian. Species known to occur in Afghanistan may be distinguished by the following characters.

1. Hindtibia with eight dorsal notches bearing strong bristles. *S. longispinus* (p. 17)
   Hindtibia with only six such notches.....2
2. Segment IV of hindtarsus twice as long as broad.....*S. cleopatrae* (p. 18)
   Segment IV of hindtarsus little or no longer than broad...*S. pallidus* (p. 18)

Synosternus longispinus (Wagner, 1893). Figures 22, 24–26.

Pulex longispinus Wagner, 1893, Horae Soc. Entomol. Ross., **27**, p. 355, pl. VI, fig. 1.

This species is widespread in Central Asia, ranging from Turkmeniya east to Szechwan in the Chinese Peoples Republic, according to Ioff *et al.* (1965). It is typically an ectoparasite of hedgehogs and, in Afghanistan, was only collected north of the central mountain range, although hedgehogs of the same species occur to the south of the mountains. Evidently, the mountains form a barrier that prevents the species from extending its range to the south.

Material collected.—

Herat, 80 km. N, September 23, 1965, from *Hemiechinus auratus*, 3 males and 4 females.

Mazar-i-Sharif, September 6, 1965, from *Hemiechinus auratus*, 1 male.

Synosternus pallidus (Taschenberg, 1880). Figures 19–21, 23.

Pulex pallidus Taschenberg, 1880, Die Flöhe, pp. 62, 65, pl. 1, fig. 9.

This species has an extensive range from North Africa through the Arabian Peninsula and Southwest Asia, Eastern Europe, Asia Minor, and through Central Asia to Tadzhikistan. Ioff *et al.* (1965) give records from Turkmeniya, Uzbekistan, and Tadzhikistan. While it is primarily an ectoparasite of canid carnivores, it is frequently encountered on a number of other hosts, including hedgehogs. Unlike *S. longispinus*, this species is not restricted to a particular part of the country but occurs throughout, though obviously less commonly at higher elevations.

Material collected.—

Girishk, 8 km. E, November 12, 13, 1965, from *Vulpes vulpes*, 12 males and 29 females.

Herat, 20 km. N, October 31, 1965, from *Vulpes vulpes*, 5 males and 3 females.

Kandahar and environs, October 31–November 4, 1965, from *Felis chaus*, 1 female; from *Hyaena hyaena*, 5 males and 8 females; from *Vulpes vulpes*, 2 males and 1 female.

Kunduz and environs, August 24–29, 1965, from *Hemiechinus auratus*, 70 males and 89 females; from *Vulpes vulpes*, 73 males and 102 females; from *Spermophilopsis leptodactylus* burrow, 5 males and 19 females.

Qala Bist, 16–25 km. S W, November 11, 1965, from *Vulpes vulpes*, 9 males and 47 females.

Synosternus cleopatrae (Rothschild, 1903). Figures 31–34.

Pulex cleopatrae Rothschild, 1903, Entomol. Mon. Mag., **39**, p. 84, pl. 1, figs. 4, 8; pl. 2, figs. 13, 17.

Pulex pyramidis Rothschild, 1904, Entomologist, **37**, p. 3.

The status of this species has been treated by Hopkins and Rothschild (1953), Smit (1964), and Lewis (1967). As a species, it has been taken from Spanish Sahara, Niger, Egypt, Sudan, Israel, Jor-

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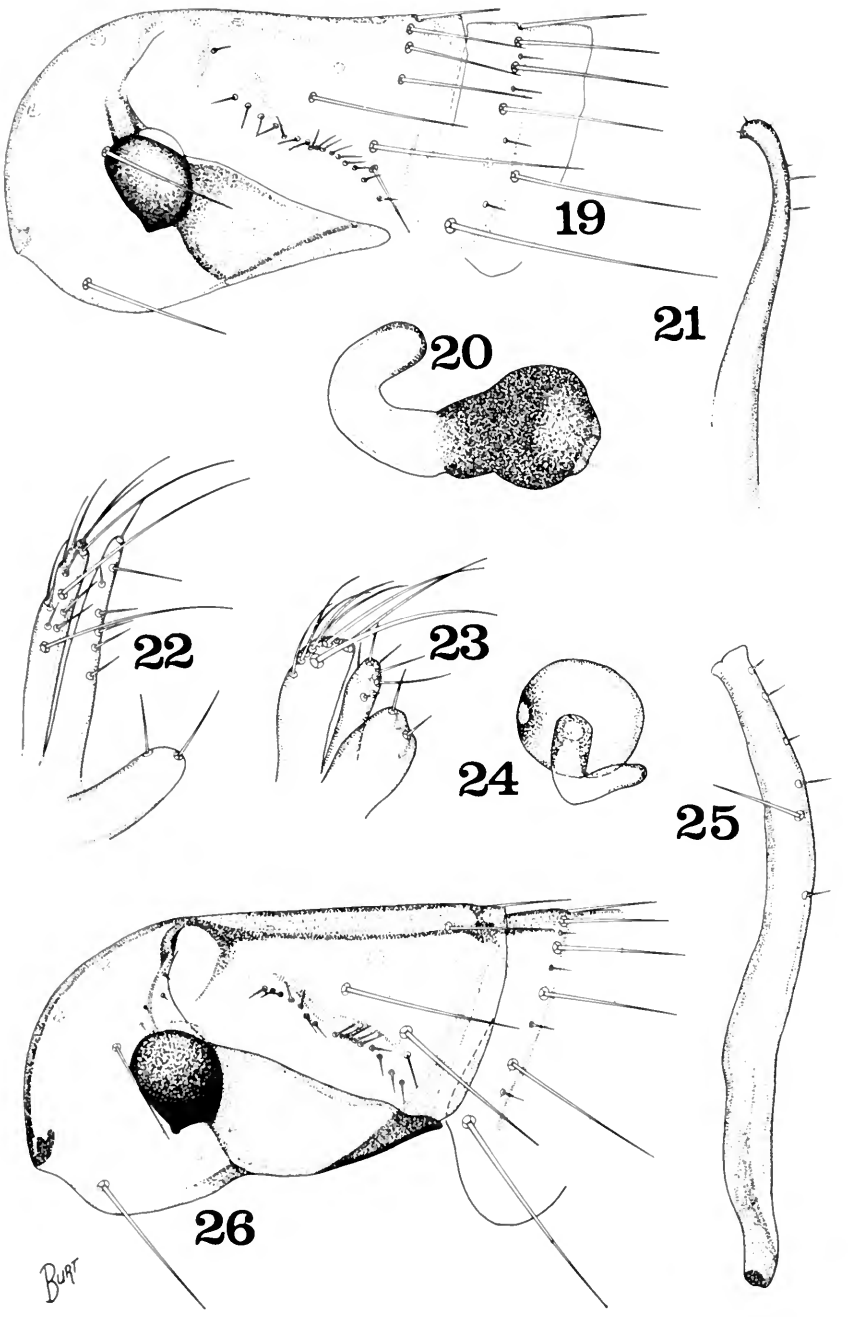
FIGS. 19–26. *Synosternus pallidus* (Taschenberg). **19.** Male head; **20.** Female spermatheca; **21.** Male st. IX; **23.** Male clasper. *Synosternus longispinus* (Wagner); **22.** Male clasper; **24.** Female spermatheca; **25.** Male st. IX; **26.** Male head.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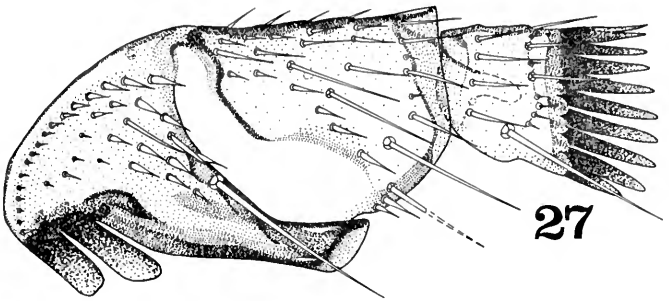
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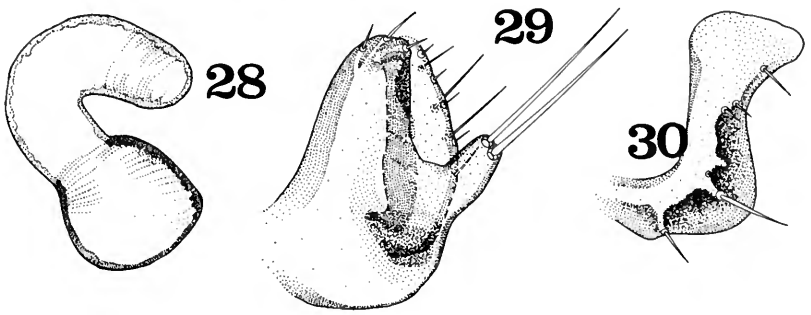
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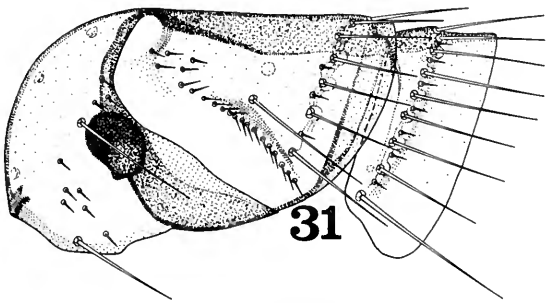
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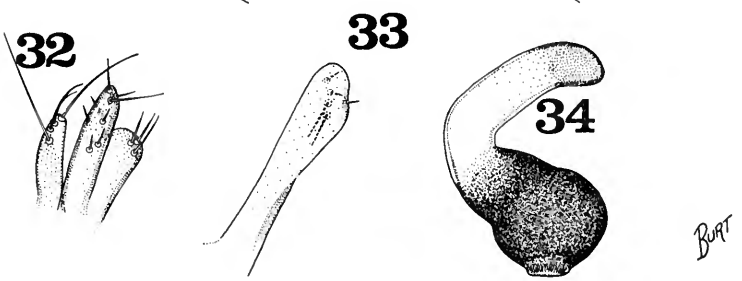
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dan, Saudi Arabia, and Iraq. After studying material in the collections of the British Museum (Natural History), Smit (1964) concluded that the subspecies *S. c. pyramidis* (Rothschild, 1904) was a valid taxon. Minor variations in the modified segments of the males were employed in separating the two subspecies. The ranges of these species overlapped along a line extending from Spanish Sahara east to Israel.

Examination of well over 1,000 males of this species from various localities in Libya, Egypt, Jordan, and Saudi Arabia failed to demonstrate the existence of two distinct populations. Collections from Afghanistan shed little light on the issue since they either come from near Jalalabad or from the environs of Kandahar south to Spin Baldak on the border with West Pakistan. By Smit's criteria for differentiation, material from the Jalalabad collections is closer to *pyramidis* than to *cleopatrae*. Specimens from the Kandahar-Spin Baldak collections, on the other hand, are unlike either of the presently known "subspecies," differing as much from both as they do from each other. Until additional material from West Pakistan, Southern Iran, and South and Central Saudi Arabia becomes available, the conservative approach of treating these irregular populations as simple variants rather than subspecies seems advisable.

This species is primarily an ectoparasite of gerbilline rodents throughout its range. It shows an ecological preference for areas with accumulations of drifting sand and tends to occur most frequently in association with psammophilous species of *Gerbillus* and *Meriones*. Numerous excavations have shown that adults occur in the burrows, rather than in the nests, of the host, being particularly abundant where burrows intersect. The biological significance of this behavioral peculiarity is not obvious, but a number of other desert species behave similarly.

Material collected.—

Jalalabad and environs, October 21, 22, 1965, from *Meriones libycus* and burrow, 17 males and 28 females.

Kandahar, 19–32 km. S E, November 1, 1965, from *Gerbillus cheesmani*, 1 male.

FIGS. 27–34. *Chiropteropsylla b. brockmani* Rothschild. **27.** Male head; **28.** Female spermatheca; **29.** Male clasper; **30.** Apex of male st. IX. *Synosternus cleopatrae* (Rothschild). **31.** Male head; **32.** Male clasper; **33.** Apex of male st. IX; **34.** Female spermatheca.

Spin Baldak and environs, October 31–November 7, 1965, from rodent burrow, 4 females; from *Gerbillus cheesmani*, 106 males and 104 females; from *Meriones crassus*, 2 females.

XENOPSYLLA Glinkiewicz

Xenopsylla. Glinkiewicz, 1907, S. B. Akad. Wiss. Wien, Abt. 1, **116**, p. 385.

Type species.—*X. pachyuromyidis* Glink. [=*P. cheopis* Rothschild, 1903].

This is a large genus consisting of about 80 species, most of which are restricted to the Palaearctic, Indian, and Ethiopian Regions. Hopkins and Rothschild (1953) split the group into eight species groups, of which two are represented in Afghanistan. Members of these two groups of species may be separated by the following characters.

1. Foretarsal segment V of male with either two or four (or more) subapical plantar spiniform bristles; t. VIII of female with only two to three long lateral bristles and sometimes some additional ventral ones..*conformis* group (p. 27)

   Foretarsal segment V of male with three subapical ventral spiniforms; t. VIII of female with a row of lateral bristles extending far upward.
   cheopis group (p. 22)

cheopis GROUP

Species of this group have a rather wide distribution throughout Africa, Asia, and India, with species also occurring in Australia and some islands of Southeast Asia. *Xenopsylla cheopis* enjoys a cosmopolitan distribution because of its association with *Rattus rattus* and *R. norvegicus*, and it is considered one of the major vectors of plague in some areas of the world. Neither *X. cheopis* nor a related species, *X. hussaini* were collected in Afghanistan, although they probably both occur there. The three species reported here may be separated by the following key.

1. Males.....2

   Females.....4

2. Dorsal margin of ejaculatory duct without conspicuous tooth; P_1 of clasper acuminate apically, with most bristles restricted to its apex...*nubica* (p. 23)

   Dorsal margin of ejaculatory duct with a conspicuous tooth; P_1 of clasper rounded apically or obtuse.....3

3. Occipital groove deep, its ventral margin undulate; P_1 of clasper with subparallel sides, rounded apically, with bristles restricted to apex and apical half of dorsal margin.....*astia* (p. 23)

Occipital groove shallow, its ventral margin not undulate; P_1 of clasper obtusely triangular, broadest in middle, with bristles restricted to dorsoapical margin..... *nesokiae* (p. 25)

4. Usually with fewer than 30 bristles on outer surface of t. VIII; hilla of spermatheca strongly ventricose, its ventral margin tending to be flattened. *nubica* (p. 23)

Usually with more than 30 bristles on outer surface of t. VIII; hilla of spermatheca ventricose but its ventral margin smoothly rounded.....5

5. Hilla of spermatheca strongly ventricose, with ventricle deeper than wide. *astia* (p. 23)

Hilla of spermatheca less strongly ventricose, its ventricle wider than deep, known only from *Nesokia*..... .....*nesokiae* (p. 25)

Xenopsylla nubica (Rothschild, 1903). Figures 37, 45–47.

Pulex nubicus Rothschild, 1903, Entomol. Mon. Mag., **39**, p. 84, pl. 2, figs. 10, 16.

Hopkins and Rothschild (1953) list numerous records of this species from various parts of Africa and it has been reported from Israel (Theodor and Costa, 1967), Jordan (Lewis, 1966), Saudi Arabia (Lewis, 1964a), and Syria (Costa Lima and Hathaway, 1946). There are also unpublished records of this species from Iraq and Iran, although it was not included by Klein (1963) in his treatment of fleas of Iran. All the Afghan records are from the desert regions south and west of the mountains and it is likely that this species does not occur much farther east than Kandahar and Spin Baldak. It still may be discovered in Pakistan if collections are made in the desert around Quetta.

This species abounds on a number of different rodents in Africa, but seems to be a specific parasite of jerboas of the genera *Jaculus* and *Allactaga* in Southwest Asia.

Material collected.—

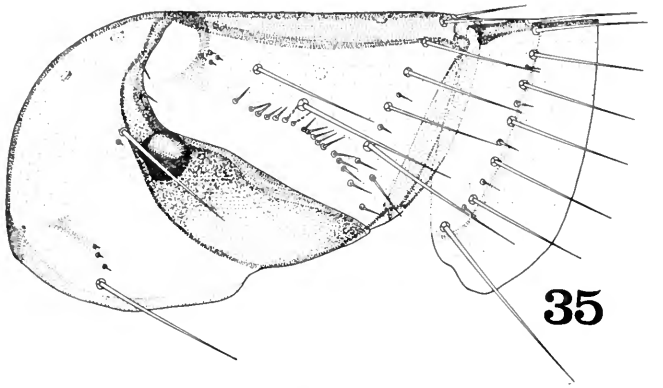
Girishk and environs, November 12, 13, 1965, from *Jaculus blanfordi* nests and burrows, 66 males and 68 females; from *Vulpes vulpes*, 1 female.

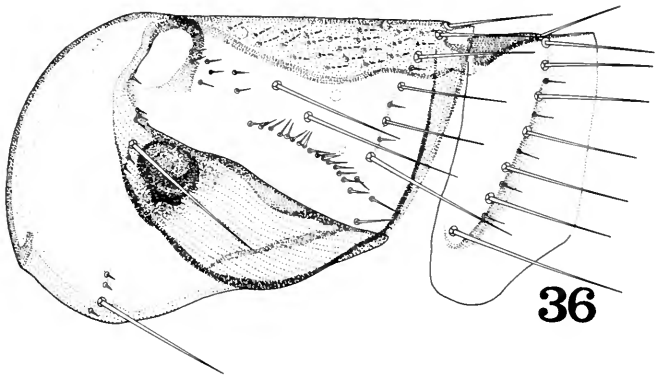
Kandahar, 16 km. S E, October 31, 1965, from *Jaculus blanfordi* nest and burrows, 1 male.

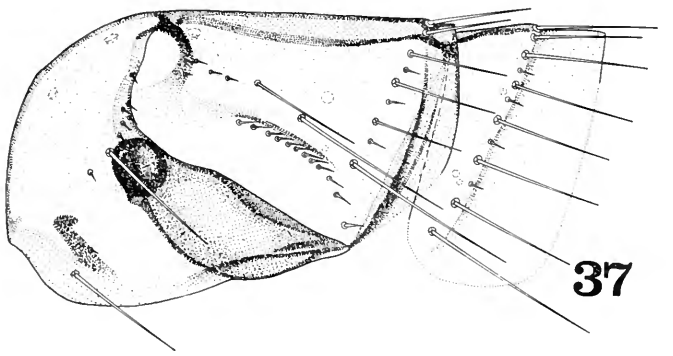
Spin Baldak, 8 km. W, October 31, 1965, from *Jaculus blanfordi* nest and burrows, 7 males and 4 females.

Xenopsylla astia Rothschild, 1911. Figures 36, 48–50.

Xenopsylla astia Rothschild, 1911, Novit. Zool., **18**, p. 117, fig. 1.







FIGS. 35–37. Male heads. **35.** *Xenopsylla nesokiae* Ioff; **36.** *X. astia* Rothschild; **37.** *X. nubica* (Rothschild).

This is a common species in India, Nepal, Pakistan, Afghanistan, and Iran, and Ioff *et al.* (1965) also report it from Turkmeniya. It has also been reported from Israel by Theodor and Costa (1967) from *Nesokia indica*. Doubtless the species occurs throughout the Arabian Peninsula, at least along the coast, and it is well established in East Africa (Hopkins and Rothschild, 1953), Ethiopia, and Sudan (unpublished personal data). In Russia, it is primarily a parasite of *Rattus*, but elsewhere, it shows a strong preference for *Nesokia indica* and various species of *Tatera*. Although both *Nesokia indica* and *Tatera indica* are common rodents in Afghanistan, *X. astia* was only collected from the latter; *Nesokia indica* was infested with its own species, *X. nesokiae* Ioff, 1946.

This species is so common in Afghanistan that it was found on most species of carnivores, either acquired from their prey or by accidental infestation. The records from *Gerbillus* and *Meriones* are doubtless attributable to the fact that *Tatera indica* frequently occupies the same habitat, and the accidental transfer must occur under such circumstances with considerable frequency.

Material collected.—

Girishk, 5 km. E N E, November 10, 1965, from *Tatera indica*, 1 male and 6 females.

Herat and environs, September 18–24, 1965, from *Felis chaus*, 1 female; from *Felis libyca*, 1 female; from *Herpestes auropunctatus*, 1 male; from *Vulpes vulpes*, 1 male and 3 females; from *Tatera indica*, 7 males and 4 females.

Kandahar and environs, October 29–November 9, 1965, from *Hyaena hyaena*, 1 female; from *Vulpes vulpes*, 4 males and 2 females; from *Vormela peregusna*, 4 males and 2 females; from rodent burrow, 2 females; from *Gerbillus nanus*, 2 females; from *Meriones crassus*, 6 males and 3 females; from *Meriones libycus*, 9 males and 19 females; from *Tatera indica*, 33 males and 60 females.

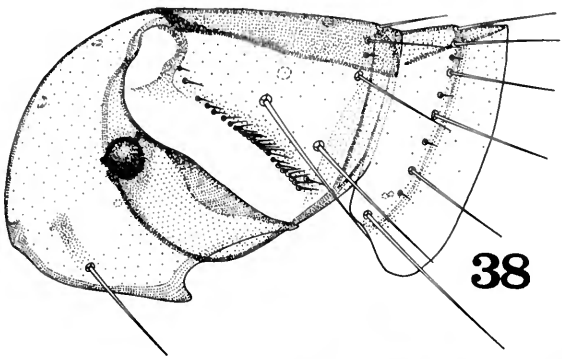
Nurgul, 41 km. E Jalalabad, October 22, 1965, from *Tatera indica*, 48 males and 86 females.

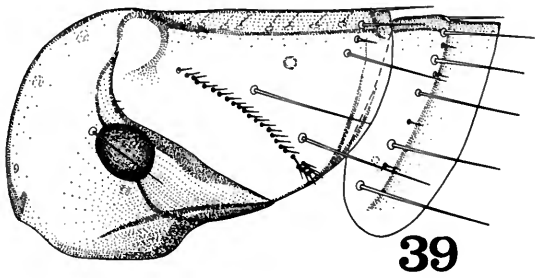
Qala Bist, 77 km. S, November 12, 1965, from rodent burrow, 1 female.

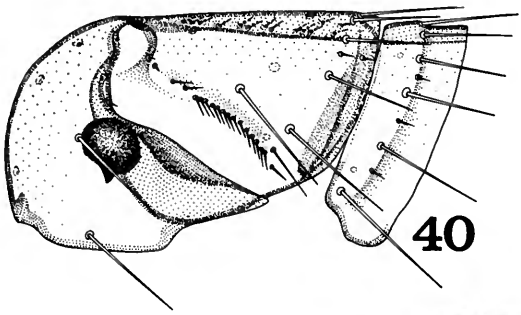
Xenopsylla nesokiae Ioff, 1946. Figures 35, 42–44.

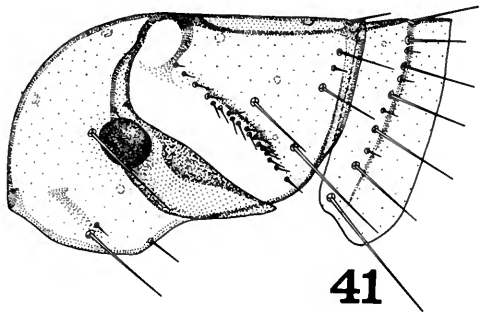
Xenopsylla nesokiae Ioff, 1946, Med. Parazit., Moskva, **15**, p. 86.

Xenopsylla nesokiae has been reported from the Tedzhen and Murgab River Valleys of Turkmeniya, east to Tadzhikistan by Ioff









FIGS. 38–41. Male heads. **38.** *Xenopsylla magdalinae* Ioff; **39.** *X. persica* Ioff; **40.** *X. c. conformis* (Wagner); **41.** *X. g. gerbilli* (Wagner).

et al. (1965). Our records indicate that the species has a rather broad range across the more arid regions of Afghanistan from Kunduz west to Herat and southeast to Girishk. It was not taken at Kandahar or any other locality south or east, and the Girishk record probably represents the southern limit of its range.

Although *X. nesokiae* is superficially similar to *X. astia*, it is easily separable in the male by the shallow groove in the head and the fact that P_1 is broader and more setose. Females are quite similar, but the spermatheca of *X. nesokiae* is more ventricose.

This is typically a parasite of *Nesokia indica*, but also may be taken on rodents occupying the same habitat as well as their predators.

Material collected.—

Girishk, 5 km. E N E, November 10, 1965, from *Nesokia indica*, 1 male and 4 females.

Herat and environs, September 19–24, 1965, from *Felis chaus*, 2 males and 2 females; from *Felis libyca*, 1 male; from *Vulpes vulpes*, 1 female; from *Meriones libycus*, 1 male; from *Nesokia indica*, 44 males and 53 females.

Kunduz and environs, August 28–30, 1965, from *Nesokia indica*, 15 males and 19 females.

Mazar-i-Sharif, 3 km. W, September 1, 1965, from *Nesokia indica*, 12 males and 9 females.

conformis GROUP

Members of this group are confined to the more arid portions of the Palaearctic, including southern Arabia and North Africa to the southern edge of the Sahara Desert. They are mainly ectoparasites of gerbilline rodents, although frequently encountered on predators.

Four species belonging to this group were taken during our collecting. There are four more, *X. skrjabini, hirtipes, buxtoni,* and *nuttalli* that very likely occur in Afghanistan also since they are known from adjacent areas of Iran and the USSR.

Following is a key to the four species collected in the country.

1. Males 2
   Females 5
2. All three processes of clasper of approximately equal length 3
   Processes of the clasper subequal in length 4

3. Apex of st. IX convex, rounded apically.....*g. gerbilli* (p. 31)

   Apex of st. IX blunt, slightly concave, its dorsoapical margin forming a point.....*persica* (p. 32)

4. Apex of st. IX smoothly rounded, acuminate; caudal margin of t. VII bearing a pronounced lobe at about the level of the antesensilial seta; dorsal portion of paramere very expanded apically.....*magdalinae* (p. 31)

   Apex of st. IX more blunt, not acuminate; caudal margin of t. VII with less pronounced lobe; dorsal portion of paramere narrower apically.
   c. conformis (p. 28)

5. Head short, almost as high as long; eye reduced; genal lobe bearing a broad, blunt projection below and behind the eye.....*magdalinae* (p. 31)

   Head not so short; eye larger; genal lobe lacking conspicuous projection...6

6. Constriction between bulga and hilla of spermatheca deep; labial palpi extending to trochanter.....*g. gerbilli* (p. 31)

   Constriction between bulga and hilla shallow; labial palpi not reaching apex of foretarsi.....7

7. Duct of bursa copulatrix heavily sclerotized, forming a right angle internally.
   persica (p. 32)

   Duct of bursa copulatrix only slightly sclerotized, short, not forming a right angle internally.....*c. conformis* (p. 28)

Xenopsylla conformis conformis (Wagner, 1903). Figures 40, 57–59.

Pulex conformis Wagner, 1903, Rev. Russe Entomol., **3**, p. 310.

This is perhaps one of the most common fleas of Central and Western Asia. Ioff *et al.* (1965) record the nominate subspecies from the Caucasus east to Inner Mongolia and include Iran and Afghanistan within its range. *Xenopsylla conformis dipodis* Ioff, 1953, is said to be a common parasite of jerboas in the deserts of Central Asia and *X. c. mycerini* (Rothschild, 1904) occurs throughout the Middle East, Arabian Peninsula, and much of North Africa. Where *X. c. mycerini* and the nominate subspecies intergrade has not been established with certainty, but Klein (1963) records the nominate form from near Mechad in Eastern Iran, while material in my collection from Iraq, Syria, and Saudi Arabia is typical *X. c. mycerini.*

This is a desert species and occurs throughout Afghanistan wherever desert conditions exist. It is a common ectoparasite of species

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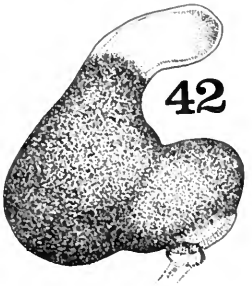
FIGS. 42–50. *Xenopsylla nesokiae* Ioff. **42.** Female spermatheca; **43.** Male clasper; **44.** Apex of male st. IX. *X. nubica* (Rothschild); **45.** Female spermatheca; **46.** Male clasper; **47.** Apex of male st. IX. *X. astia* Rothschild; **48.** Female spermatheca; **49.** Male clasper; **50.** Apex of male st. IX.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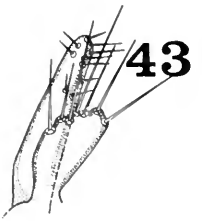
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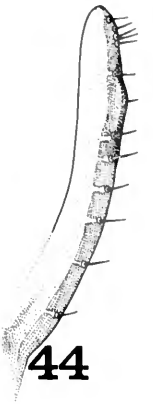
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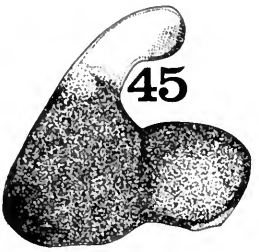
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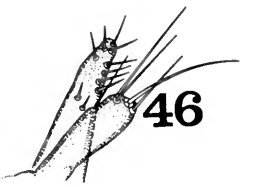
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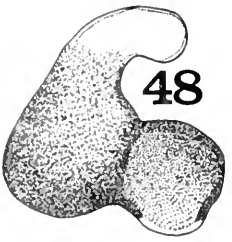
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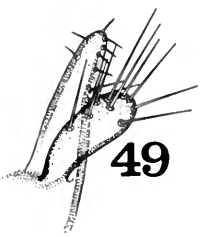
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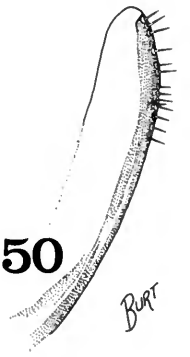
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of *Gerbillus* and *Meriones*, but also frequently occurs on other rodents associated with gerbils and jirds as well as their predators.

Material collected.—

Ghazni, 9 km. S E, October 8–10, 1965, from *Cricetulus migratorius*, 1 male and 2 females; from *Meriones libycus*, 12 males and 31 females.

Girishk and environs, November 12, 13, 1965, from *Vulpes vulpes*, 1 female; from *Allactaga hotsoni*, 3 males and 5 females; from *Jaculus blanfordi* and nest, 4 males and 13 females; from *Meriones crassus*, 8 males and 12 females.

Herat, 145 km. N, September 23, 1965, from *Meriones libycus*, 30 males and 53 females.

Herat and environs, September 19–23, 1965, from *Vulpes vulpes*, 2 females; from *Felis libyca*, 5 females; from *Meriones libycus*, 1 female; April 8, 1965, from *Meriones persicus*, 1 female, *leg.* E. Kullmann.

Kabul and environs, July 18–20, 1965, from *Cricetulus migratorius*, 3 males and 5 females; from *Meriones* sp. nest, 1 male and 1 female; from *Meriones persicus*, 2 females; from *Microtus afghanus*, 2 males and 2 females; various dates in July, September, and October, 1965, from *Meriones libycus* and nests, 61 males and 125 females.

Kandahar and environs, October 31–November 8, 1965, from *Jaculus blanfordi*, 3 males; from *Tatera indica*, 1 female; from rodent burrow, 10 females; from *Gerbillus cheesmani*, 1 male; from *Gerbillus nanus*, 2 males and 5 females; from *Meriones crassus*, 48 males and 61 females; from *Meriones libycus* and burrow, 2 males and 2 females; from *Meriones persicus*, 2 males and 1 female.

Kunduz and environs, August, 23–26, 1965, from *Meriones libycus*, 143 males and 156 females.

Maimana and environs, September 10, 11, 1965, from *Meriones zarudnyi*, 2 males and 3 females; from *Rhombomys opimus*, 1 male.

Mazar-i-Sharif and environs, September 6, 1965, from *Meriones libycus*, 2 males and 1 female.

Qala Bist and environs, November 11, 1965, from *Vulpes vulpes*, 1 female; from *Meriones crassus*, 71 males and 111 females.

Spin Baldak and environs, October 31–November 7, 1965, from *Jaculus blanfordi* and nest, 1 male; from *Gerbillus nanus*, 1 male; from *Meriones crassus*, 11 males and 15 females; from *Meriones libycus* and nest, 21 males and 21 females; from rodent burrow, 2 females.

Xenopsylla magdalinae Ioff, 1935. Figures 38, 51–53.

Xenopsylla magdalinae Ioff, 1935, Rev. Microbiol., Saratov, **14**, p. 82, figs. 2a, 3a, 4.

Xenopsylla magdalinae has been reported from various localities in the USSR from Turkmeniya east to Szechwan in the Chinese Peoples Republic (Ioff *et al.*, 1965). Our series from near Maimana is typical in all respects, but the single female from near Gardez is only provisionally referred to this species since it has an unusually large eye and certain aspects of the chaetotaxy vary from the norm. In all probability, the species is restricted to Afghanistan north of the mountains.

Evidently, *X. magdalinae* is exclusively restricted to *Ellobius* as a host.

Material collected.—

Gardez, 4 km. S, October 9, 1965, from *Ellobius fuscocapillus*, 1 female.

Maimana, 40 km. E, September 12, 1965, from *Ellobius talpinus*, 16 males and 31 females.

Xenopsylla gerbilli gerbilli (Wagner, 1903). Figures 41, 60–62.

Pulex gerbilli Wagner, 1903, Rev. Russe Entomol., **3**, p. 309.

Ioff *et al.* (1965) list three subspecies of *Xenopsylla gerbilli*. One of these, *X. g. minax*, is considered a full species by Hopkins and Rothschild (1953), and their system of classification is followed here. If *X. minax* is excluded, *X. g. gerbilli* and *X. g. caspica* Ioff, 1950, have been reported only from Turkmeniya and Uzbekistan, the latter being known from the Kyzyl Kum and Ustyurt Deserts.

This is a common flea in Afghanistan in the arid regions north of the mountains. Its preferred host seems to be *Rhombomys opimus*, but there are numerous records from other desert rodents and their predators. Though Klein (1963) does not report this species from Iran, *R. opimus* occurs there, and very likely, so does *X. g. gerbilli*.

Material collected.—

Balkh, 16 km. S, September 4, 1965, from *Allactaga elator*, 1 male and 1 female.

Herat, 145 km. N, September 23, 1965, from *Rhombomys opimus*, 15 males and 3 females.

Kunduz and environs, August 28, 1965, from *Allactaga elator*, 2 males; July 30, 1964, from *Spermophilopsis leptodactylus*, 1 male and 1 female, *leg.* E. Kullmann.

Maimana and environs, August 28–September 12, 1965, from *Vulpes vulpes*, 1 female; from *Meriones zarudnyi*, 1 female; from *Rhombomys opimus*, 77 males and 92 females.

Mazar-i-Sharif and environs, September 2, 3, 1965, from *Rhombomys opimus*, 101 males and 64 females.

Samangan, 10 km. S E, August 30, 1965, from *Allactaga elator*, 2 females.

Surch Kotal, July 17, 1964, from *Rhombomys opimus*, 2 females, *leg.* E. Kullmann.

Xenopsylla persica Ioff, 1946. Figures 39, 54–56.

Xenopsylla persica Ioff, 1946, Med. Parazit., Moskva, **15**, p. 85.

Ioff *et al.* (1965) record this species from the Bol'shoy Balkhan and Kopet Dag Mountains of Turkmeniya and the Paropamisus Mountains of Afghanistan. Our records extend the known range of the species east into the Hindu Kush, where it is probably more common than our collections indicate. *Meriones persicus* also was collected at Paghman, Ghazni, and Kandahar, but *X. persica* was not taken at these localities. Klein (1963) does not list the species from Iran, although *M. persicus* occurs there. Evidently, *X. persica* has a relatively restricted range in Southwestern Turkmeniya and Northwestern Afghanistan.

Material collected.—

Bamiyan, 5 km. W, July 28, 1965, from *Meriones persicus*, 11 males and 28 females.

Herat and environs, September 19–22, 1965, from *Vulpes vulpes*, 1 male; from *Meriones persicus*, 20 males and 26 females.

Shombul, 12 km. W Shibar Pass, July 26, 27, 1965, from *Meriones persicus*, 1 male and 16 females.

Superfamily CERATOPHYLLOIDEA

Family COPTOPSYLLIDAE

This family is represented by the single genus *Coptopsylla*, with species distributed throughout the more arid portions of the Palaearc-

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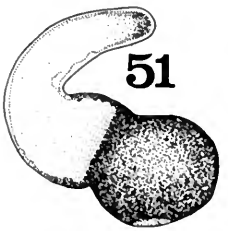
FIGS 51–62. *Xenopsylla magdalinae* Ioff. **51.** Female spermatheca; **52.** Male clasper; **53.** Apex of male st. IX. *X. persica* Ioff; **54.** Female spermatheca; **55.** Male clasper; **56.** Apex of male st. IX. *X. c. conformis* (Wagner); **57.** Female spermatheca; **58.** Male clasper; **59.** Apex of male st. IX. *X. g. gerbilli* (Wagner); **60.** Female spermatheca; **61.** Male clasper; **62.** Apex of male st. IX.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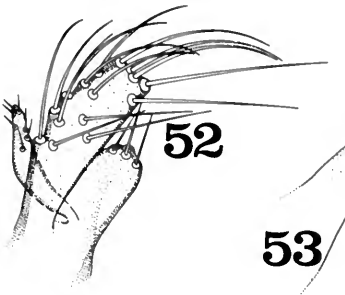
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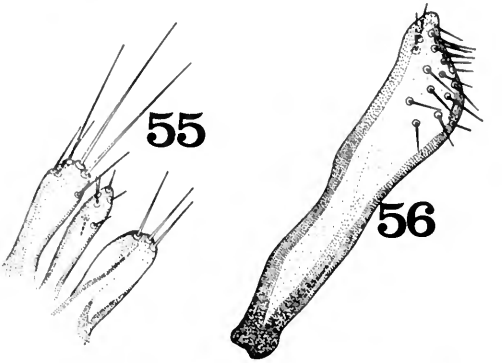
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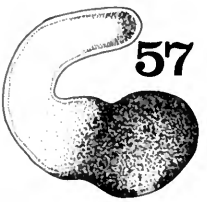
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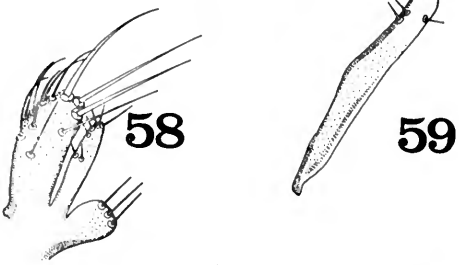
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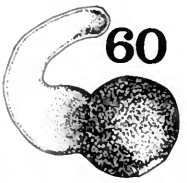
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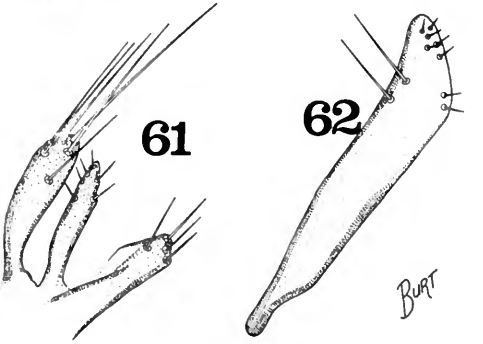
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tic, especially Central and Southwestern Asia. Two species have been reported from North Africa. All are typically ectoparasites of gerbils, and, from field observations, tend to be more commonly associated with the nest rather than the host itself.

COPTOPSYLLA Jordan and Rothschild

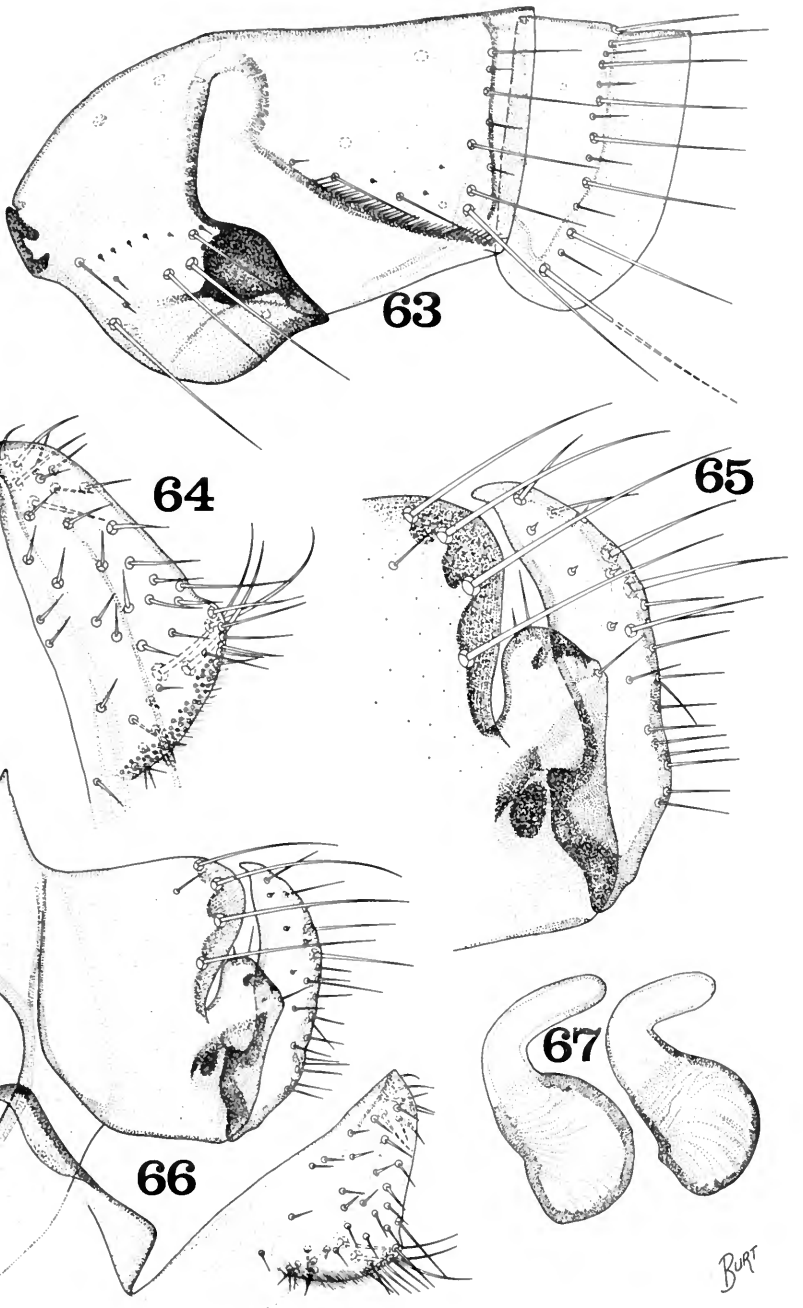
Coptopsylla. Jordan and Rothschild, 1908, Parasitology, **1**, p. 91.

Type species.—Pulex lamellifer Wagner, 1895.

Characteristics of the family obtain for the genus as well. Species known to occur in Afghanistan may be separated with the following key.

1. Males 2
   Females (females of *C. afghana* and *C. barbarae* are unknown 6
2. Fixed process of clasper not divided into two lobes, its caudal margin concave. *o. olgae* (p. 42)
   Fixed process of clasper bilobed, P_1 separated from P_2 by a sulcus of varying depth 3
3. Depth of sulcus between P_1 and P_2 at least equal to greatest width of P_2; movable process at least four times as long as broad ..... *l. lamellifer* (p. 36)
   This sulcus shallower, not as deep as greatest width of P_2; movable process less than four times as long as broad 4
4. Apex of P_2 not nearly approximating apex of P_1; widest part of movable process well above middle, with three heavy setae on caudal margin. *afghana* n. sp. (p. 39)
   Apex of P_2 approximating or extending beyond apex of P_1; widest part of movable process at or near middle, with the three setae on caudal margin not coarse 5
5. Movable process subtriangular, its cephalic margin nearly straight, lacking pronounced apical cusp; acetabular seta arising well below dorsal articulation of movable with fixed process ..... *barbarae* n. sp. (p. 36)
   Movable process more semicircular, its apex bearing a pronounced cusp; acetabular seta arising well above dorsal articulation of movable with fixed process ..... *janiceae* n. sp. (p. 42)
6. Bulga of spermatheca strongly globular, its junction with hilla acute. *o. olgae* (p. 42)
   Bulga of spermatheca less globular, more triangular in profile, its junction with hilla not acute 7
7. Ventral margin of bulga concave, deflected ventrad at junction with duct; hilla expanding gradually at junction with bulga, not forming an angle at this point ..... *l. lamellifer* (p. 36)

FIGS. 63–67. *Coptopsylla lamellifer lamellifer* (Wagner). **63.** Male head; **64.** Apex of male st. IX; **65.** Male clasper; **66.** Male modified segments; **67.** Female spermathecae.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Ventral margin of bulga straight, not deflected at junction with duct; hilla not particularly expanded at junction with bulga, forming an open angle at this point ..... *janiceae* (p. 42)

Coptopsylla lamellifer lamellifer (Wagner, 1895). Figures 63–67.

Pulex lamellifer Wagner, 1895, Horae Soc. Entomol. Ross., **29**, p. 504, fig. 1.

This species, originally described from material collected in the Bol'shoy Balkhan Mountains of southwestern Turkmeniya, has also been taken in the foothills of the Kopet Dag Mountains and the Tedzhen and Murgab River Valleys according to Ioff *et al.* (1965). Other subspecies have been described from "Transcaspia," Kazakstan, and Uzbekistan, east to the Chinese Peoples Republic. All are ectoparasites of gerbilline rodents.

The occurrence of *C. l. lamellifer* in Afghanistan was predictable and more intensive excavation of *Meriones* burrows would certainly have shown the species to have a broad distribution in the country. Our specimens came from a *Meriones libycus* colony situated along a highway in a cultivated river valley north of Kabul. Few burrows were excavated north of the Hindu Kush, but fleas of this species certainly occur in the semi-arid regions north of Kunduz and in the desert area west of Shibarghan and north of Herat.

Material collected.—

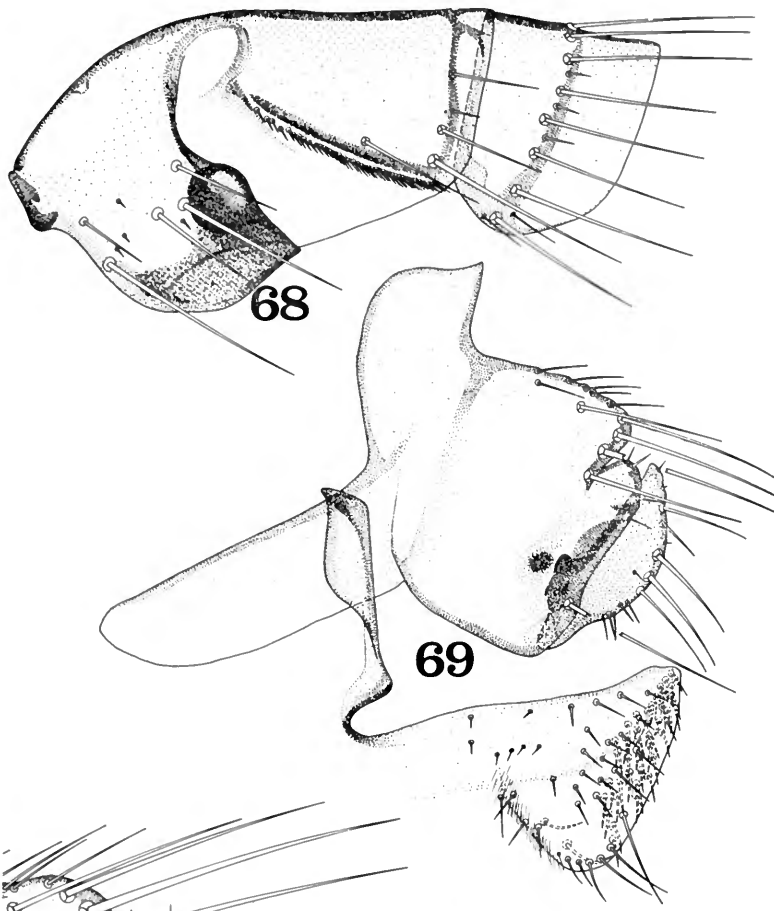
Kabul, 15 km. N W on Mazar-i-Sharif Road, October 2, 3, 1965, from *Meriones libycus* burrow, 3 males and 3 females.

Coptopsylla barbarae new species. Figures 68–71.

Diagnosis.—Similar to *C. bairamaliensis* Wagner, 1928, from which it differs in the following characters: a) L_1 of fixed process rounded apically, not pointed; b) movable process sharply pointed apically, not blunt; c) two or three major setae on caudal margin of movable process; d) st. IX triangular, its inner surface densely setose. The female of the species is unknown.

Description.—HEAD, MALE (fig. 68): Clypeus well developed, with upturned apex. Frontal row of two widely-spaced setae, one above and in front of the eye, the other low on the margin of the genal lobe. Ocular row of three setae, two placed near the eye, the other placed on the genal margin. Genal lobe deep, bluntly

FIGS. 68–71. *Coptopsylla barbarae* Lewis. **68.** Head of holotype male; **69.** Modified segments of holotype male; **70.** Clasper of holotype male; **71.** Apex of st. IX of holotype male.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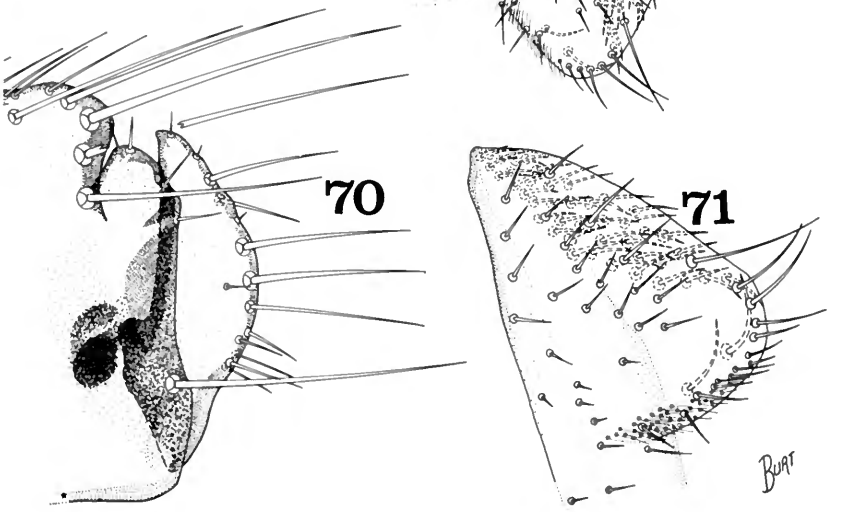
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pointed apically. Eye well developed, deeply pigmented; occipital row of three main bristles preceded by one large bristle above antennal groove. Antennal groove with a row of approximately 40 small, closely ranked bristles along dorsal margin. Labial palpi extending well beyond apex of foretrochanter.

THORAX: Pronotum with seven or eight setae per side. Mesonotum with six or seven setae per side and three or four pseudosetae under the collar. Metanotum with six or seven setae per side. Mesepisternum with one seta, mesepimeron with four or five setae, arranged in two ranks. Lateral metanotal area usually with two setae per side. Metepisternum with one seta per side, metepimeron with five to seven setae in two rows.

LEGS: Outer surface of forecoxae with about 10 setae, excluding marginals, arranged in four oblique rows. Outer surface of forefemora with four, inner surface with five submarginal setae arranged in an irregular row. Hind margin of foretibia with four subapical notches, armed with seven heavily spiniform setae. Foretarsal segment V with six pairs of lateral and four subapical plantar setae. Chaetotaxy of midcoxae limited to a few submarginal, apical setae on the outer surface and a slightly submarginal row of smaller setae extending from the base to the apex on the inner surface. Midfemur with a row of approximately 15 setae on the dorsal margin extending from base to apex. On its outer surface is a row of five submarginal setae on the dorsal distal half of the segment and another row of five larger submarginal setae along the ventral margin. On the inner surface is a row of six submarginal setae extending from the base to the apex of the segment. Midtibia with six subapical notches on its hind margin each bearing a pair of stout setae. Longest apical setae of midtibia extending about to apex of tarsal segment II. Midtarsal segments I and II of approximately equal length, each longer than segments III and IV. Midtarsal segment V with six pairs of lateral and four subapical plantar setae. Hindcoxa with a patch of about 10 subapical setae on distal half of outer surface and an apical cluster of four or five long setae forming a comb-like row on the cephaloapical angle. Hindfemur with a dorsal submarginal row of three setae and a ventral submarginal row of three setae, both situated on the apical half of the outer surface. Inner surface with a ventral submarginal row of approximately seven bristles. Hindtibia with five subapical notches in its caudal margin, each bearing a pair of heavy setae. Longest apical bristle extending about to apex of hindtarsal segment I. Hindtarsal segment I as long as segments II to IV combined. Longest two apical bristles of segment II extending beyond apex of segment V but not beyond the tarsal claws. Segment V with six pairs of lateral and two ventral plantar setae.

UNMODIFIED ABDOMINAL SEGMENTS: Abdominal tergites I through VII each with a single row of setae averaging 5, 8, 7, 7, 7, 6, and 7 per side. Antesensilial setae two, subequal, the dorsal member about half the length of the ventral. Abdominal sternite II with a single pair of bristles on ventral margin and a patch of two to five small setae midway up the lateral aspect of the segment. Sternites III through VII each with a single row of bristles averaging 5, 4, 3, 3, and 3 per side. Sternite VIII notched ventrally and bearing an irregular row of seven to nine long setae extending well up the lateral surface.

MODIFIED ABDOMINAL SEGMENTS (figs. 69–71): Fixed process of clasper divided into two lobes which overlap at their bases. L_1 of fixed process rounded apically, bearing four or five long setae and six or seven smaller bristles, mostly on the dorsal

margin. L_2 notched caudoapically, its caudal margin slightly concave. Acetabular seta arising low on the fixed process. Movable process sharply pointed apically, its cephalic margin straight, lacking a median incrassation. Caudal margin of movable process strongly convex, bearing two or three strong setae midway between apex and base as well as a few weaker setae above and below these. Sternum IX with triangular distal lobe smoothly rounded caudoventrally. Outer surface of st. IX with about 25 long, thin setae scattered at random and a submarginal row of approximately 30 small setae extending along ventral margin, upward to about the middle of the caudal margin. These bristles increase in length and diameter from the base to the caudal margin of the lobe. Inner surface of lobe bearing a dense cluster of about 40 subspiniform bristles distributed from the apex, ventrad to the caudoventral angle on the caudal portion of the segment. Penis plate broad, its apex bluntly rounded and bearing a small, upturned, sclerotized apodeme.

Type material.—Holotype male (L-7814) from *Meriones crassus*, Kandahar International Airport, Afghanistan, ± 1,000 m., November 2, 1965, R. E. Lewis. Two male paratypes with the same data. One male paratype (L-7819) from *Tatera indica*, 38 km. E Kandahar, Afghanistan, 1,006 m., November 4, 1965, R. E. Lewis. Holotype and 1 male paratype deposited in the Field Museum of Natural History. Remaining paratypes retained in the collection of the author.

The species is named for Barbara Drinka, whose secretarial assistance has greatly lightened the burden of preparing this manuscript.

This species seems to occur in the more arid parts of the desert in Afghanistan in association with gerbilline rodents. The record from *Tatera* is probably a case of accidental infestation. The true hosts for this species appear to be *Rhombomys opimus* and species of *Meriones*.

Coptopsylla afghana new species. Figures 74, 75, 77.

Diagnosis.—*C. afghana* appears most closely related to *C. iranica* Farhang-Azad, 1966. It differs in the following characters: a) one row of two to three setae on metepimeron; b) fixed process divided into two lobes; c) movable process of clasper broader subapically, its caudal margin bearing but two strong setae rather than three; d) apex of penis plate blunt, bearing a strongly sclerotized, upturned apodeme; e) apical portion of st. IX smoothly rounded caudoventrally, bearing heavier chaetotaxy. The female of the species is unknown.

Description—HEAD, MALE (fig. 77): Clypeus well defined, with upturned apex. Frontal row of one seta per side; ocular row of three setae, upper two closer to each other than to lower. Eye well developed, heavily pigmented. Labial palpi ex-

tending beyond apex of foretrochanter. Upper margin of antennal groove bounded by a row of about 40 small, closely-packed setae. Occipital row of three setae per side preceded by a single large seta above antennal groove.

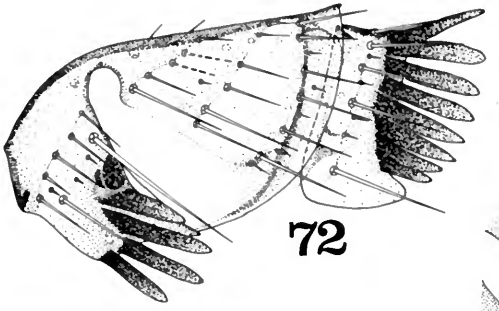
THORAX: Pronotum with six setae per side. Mesonotum with five setae and about seven pseudosetae per side. Metanotum with four or five setae per side. Mesepimeron with one seta, mesepisternum with three setae per side. Lateral metanotal area with two, metepisternum with one and metepimeron with a single row of three setae per side.

LEGS: Outer surface of procoxae with three oblique rows of 2, 2, and 3 setae discounting marginals. Forefemora with three submarginal setae on inner and outer surfaces. Outer margin of forefemur with nine heavy, spiniform setae; apical long seta extending beyond middle of foretarsal segment III. Foretarsal segment V with six pairs of lateral and four subapical plantar setae. Chaetotaxy of midcoxae restricted to cephalic margin and apex. Outer surface of midfemur with submarginal row of four setae. Midtibia with five notches in caudal margin bearing large setae that are not spiniform. Midtarsal segment II longer than segment I or III and IV combined. Midtarsal segment V with six pairs of lateral and four subapical plantar setae. Inner surface of hindcoxa with submarginal row of eight long, thin setae extending from base almost to apex. Outer surface of hindfemur with submarginal row of three setae; inner surface with submarginal row of seven or eight setae. Caudal margin of hindfemur bearing five subapical notches, apical long setae extending beyond apex of hindtarsal segment I. Hindtarsal segment I longer than segments II to IV combined. At least two apical long setae of hindtarsal segment II extending beyond base of tarsal claws. Hindtarsal segment V with six pairs of lateral and two subapical plantar setae.

UNMODIFIED ABDOMINAL SEGMENTS: Abdominal tergite I with four large setae per side. Tergites II through VII with 6, 5, 5, 5, 5, and 5 per side. Two antesensilial setae, dorsalmost seta about one-third length of ventral seta. Abdominal sternite II with one pair of ventral setae and two small lateral setae per side distant from the ventral margin. Sternites III to VII with 3, 3, 2, 2, and 2 setae per side. Sternite VIII with five setae per side.

MODIFIED ABDOMINAL SEGMENTS (figs. 74, 75): Fixed process of clasper divided into two lobes. Apex of L_1 with two long and five short setae near margin. Apex of L_2 with two small setae. Acetabular seta arising above middle of caudal margin of L_2 with another long seta arising near the dorsocaudal angle. Movable process subtriangular, its cephalic margin strongly concave. Dorsal margin of movable process bearing two setae before the dorsocaudal angle. Two strong bristles arising below dorsocaudal angle, subtended by two long, thin setae. Apex of movable process hooked; st. IX subtriangular, its apex bearing two strong bristles plus three or four weaker ones on inner surface. Numerous (12 or 13) fine setae distributed randomly over outer surface of st. IX, all remote from margin. Ventral and caudal margin of this segment bearing many minute to small setae. Two heavier bristles remote from ventral margin arising on inner surface.

FIGS. 72–77. *Rhadinopsylla* (*A.*) *kullmanni* Lewis. **72.** Head of holotype male; **73.** Modified segments of holotype male. *Coptopsylla afghana* Lewis. **74.** Clasper of holotype male; **75.** Modified segments of holotype male; **77.** Head of holotype male. *Coptopsylla o. olgae* Argyropulo. **76.** Female spermathecae.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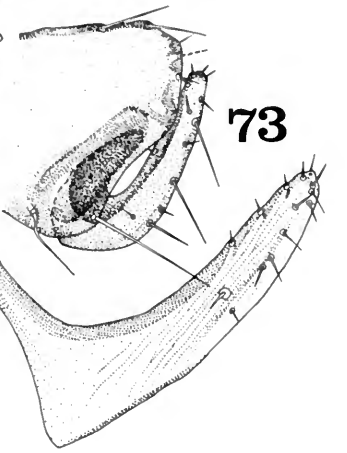
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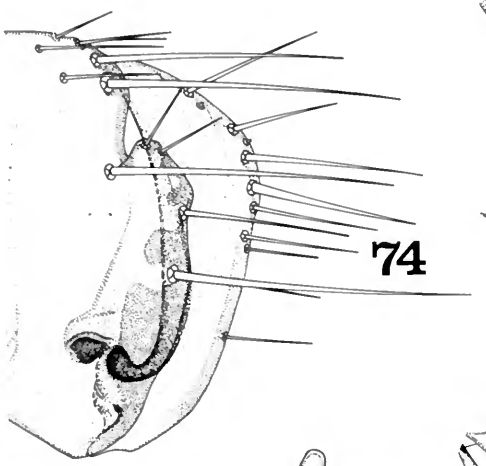
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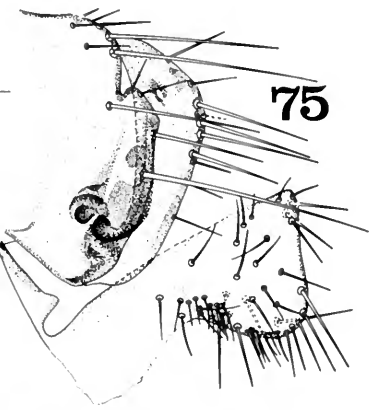
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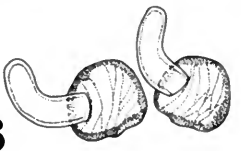
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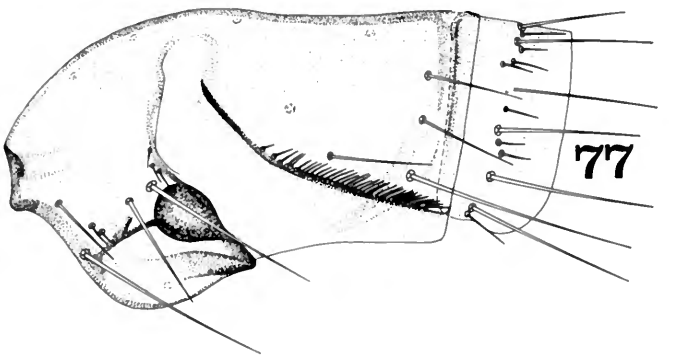
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Type Material.—Holotype male (L-7835) from *Meriones crassus*, 16–25 km. S W Qala Bist, Afghanistan, 793 m., November 11, 1965, R. E. Lewis. Deposited in Field Museum of Natural History.

Coptopsylla olgae olgae Argyropulo, 1946. Figure 76.

Coptopsylla olgae Argyropulo, 1946, Med. Parazitol., Moskva, **15**, p. 86.

This is evidently one of the rarer species of this genus, having been reported relatively infrequently and seeming to have a rather restricted distribution. It is represented in the collections of the British Museum by three males and two females from *Rhombomys opimus* collected in the region of Ashkhabad, Western Turkmeniya. Ioff *et al.* (1965) further expand the known range of the species to include the Kara Kum Desert of Turkmeniya and various other localities including Karakalpakiya, Termez, and Uzbekistan. Referral of our specimens to the nominate subspecies is based upon this geographical distribution, since a further subspecies, *Coptopsylla olgae wachschi*, has been recorded from *Meriones libycus* in Western Tadzhikistan.

Little is known about the biological requirements of this species. The area in which our specimens were collected was desert steppe, specifically along a watercourse where we encountered a rather large, colony of *Rhombomys opimus*. Other gerbilline rodents were present but no *Coptopsylla* species were obtained from them.

Material collected.—

Herat, 145 km. N, 998 m., September 23, 1965, from *Rhombomys opimus*, 2 females.

Coptopsylla janiceae new species. Figures 78–87.

Diagnosis.—Probably as closely related to *C. mofidii* Farhang-Azad, 1966, as to any other member of the genus, but differing from it in the following characters: a) fixed process not so conspicuously divided into two lobes; b) caudal margin of L_2 not concave; c) acetabular seta arising high on caudal margin of L_2; d) movable process of clasper not triangular, its apex bearing a distinct tooth; e) apical lobe of sternum IX not so acutely triangular, with fewer setae.

Description.—HEAD, MALE (figs. 78, 83): Clypeus well developed, with a pronounced upturned apex. Frontal setal row represented by a single bristle placed low on the genal margin. Ocular row of three setae, two near the eye, the third

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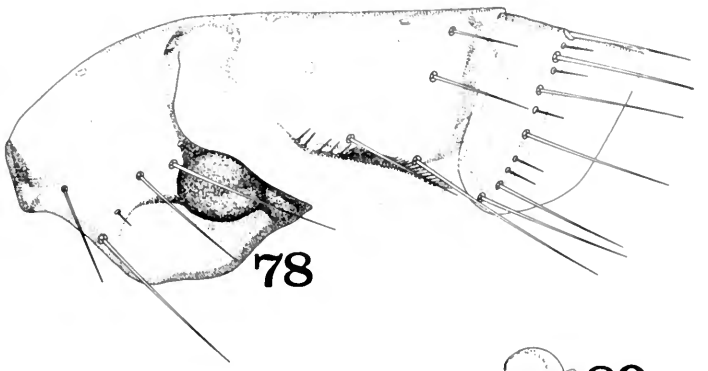
FIGS. 78–82. *Coptopsylla janiceae* Lewis. **78.** Head of holotype male; **79.** Modified segments of holotype male; **80.** Spermathecae of allotype female; **81.** Clasper of holotype male; **82.** Apex of st. IX of holotype male.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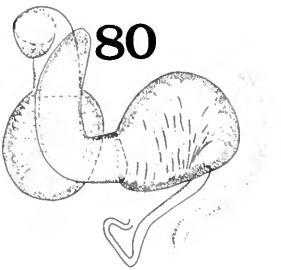
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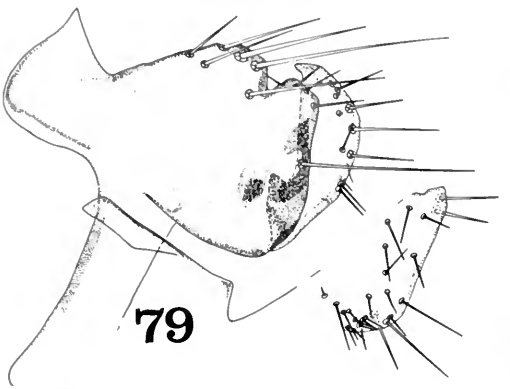
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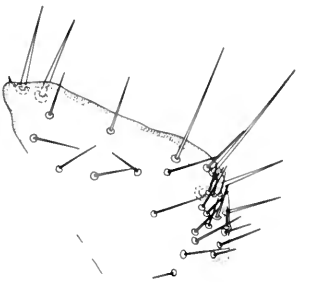

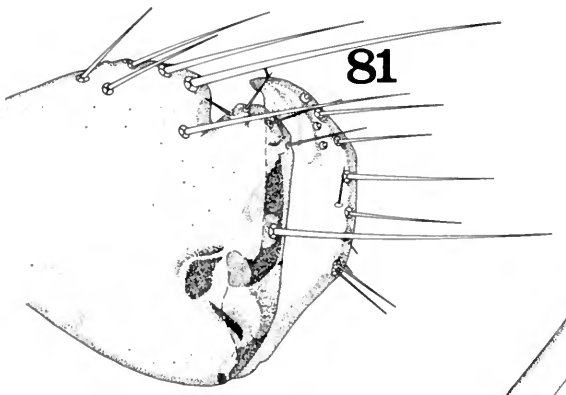
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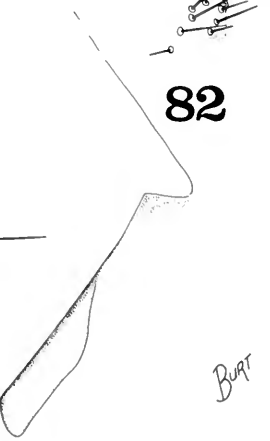
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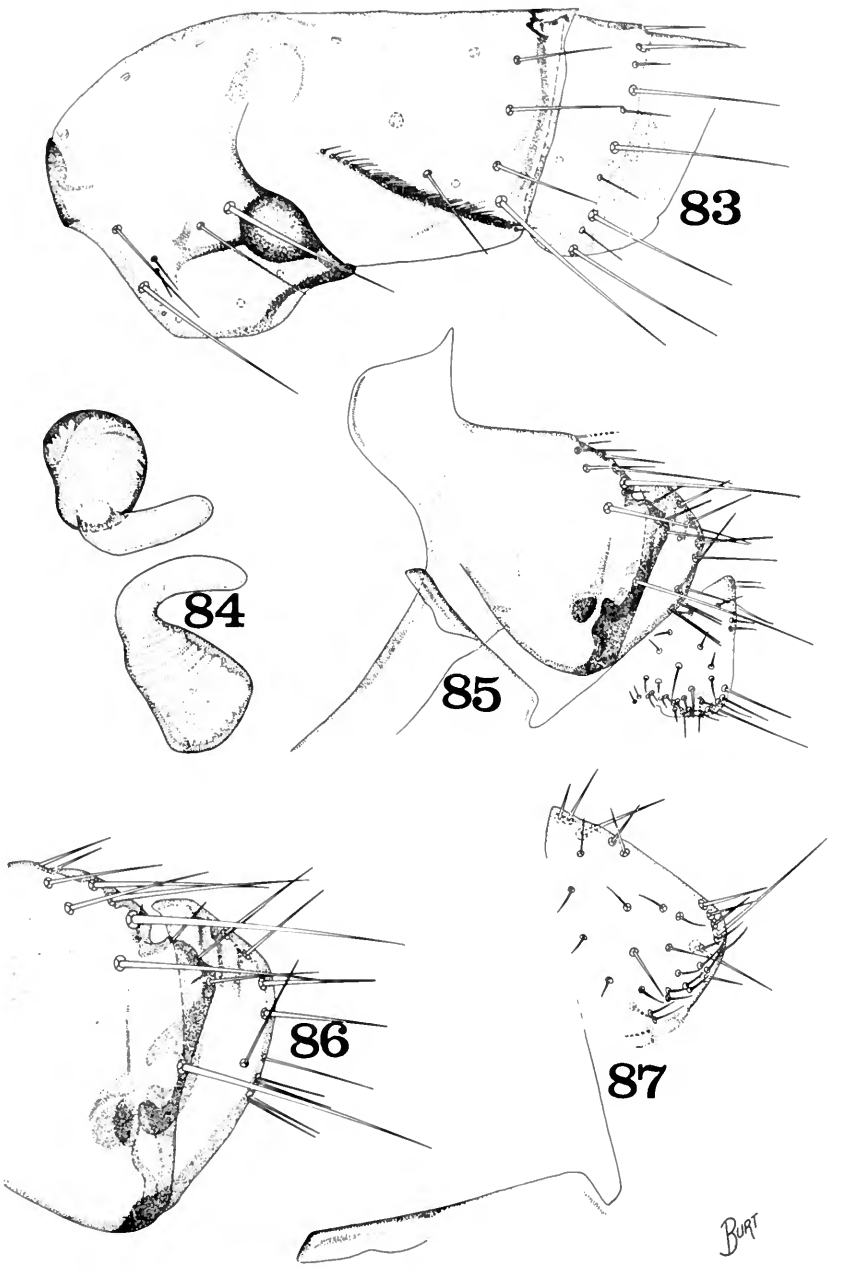
placed on the genal margin. Eye heavily pigmented, genal lobe deep vertically, with posterior notch and relatively acute apex. Occipital setal row of five bristles preceded by one long seta arising above the antennal groove. About 40 minute setae forming a row along the dorsal margin of antennal groove. Labial palpi extending well beyond the apex of trochanter.

THORAX: Pronotum with five or six setae per side. Mesonotum with four or five setae per side and six to eight small pseudosetae under the collar. Metanotum with four or five setae per side. Mesepisternum with one seta, mesepimeron usually with three. Lateral metanotal area with two long bristles. Metepisternum with one seta. Metepimeron with three to five setae arranged in two rows, usually of two and three although other combinations occur such as one and two, two and two, and one and three.

LEGS: Outer surface of forecoxae bearing about 12 fine setae distributed randomly, remote from the margin. Outer surface of forefemur with one or two submarginal setae on apical half, inner surface with an oblique row of usually five setae extending from base to ventral apex. Hind margin of foretibia with four notches bearing four heavily spiniform bristles. There are three additional spiniforms present but they arise from the surface of the tibia, not from notches. Longest apical seta of forefemur extending slightly beyond apex of foretarsal segment II. Foretarsal segment V with six pairs of lateral and four subapical plantar setae. Non-marginal setae on outer surface of midcoxa limited to three or four long bristles arising near the apex of the segment. Entire anterior margin of midcoxa lined from base to apex with thin setae. Outer surface of midfemur with a row of four submarginal setae along the ventral margin and a row of six more from base to apex on the inner surface. Hind margin of midtibia with five subapical notches, each bearing a pair of stout bristles. Longest apical seta of midtibia only slightly exceeding the apex of tarsal segment I. Midtarsal segments I and II of approximately equal length, each longer than segments III and IV combined. Tarsal segment V with six pairs of lateral and four subapical plantar setae. Hindcoxae with about 10 long setae scattered over the apical half of outer surface, inner surface with 10 to 15 long, thin setae distributed along the anterior edge of the segment away from the margin. Outer surface of hindfemur with a row of four submarginal setae on apical two-thirds of segment, inner surface with a submarginal row of seven or eight long, thin bristles. Caudal margin of hindtibia with five notches bearing one, two, or three bristles each. Longest apical bristle of hindtibia barely extending beyond apex of hindtarsal segment I. Hindtarsal segment I as long as segments II to IV combined. No long apical bristles of segment II extending beyond apex of segment V though some reach base of tarsal claws. Hindtarsal segment V with six pairs of lateral and four subapical plantar setae.

UNMODIFIED ABDOMINAL SEGMENTS: Abdominal tergites I through VII each with a single row of setae averaging 4, 6, 6, 6, 5, 5, and 5, with slightly higher counts in some females. Antesensilial setae two, the dorsal bristle slightly less than half the length of the ventral bristle in males, about one-third its length in females. Abdominal sternite II with 2, 3, or 4 small bristles on ventral margin. Lateral bristles on this segment range from one to six in males and two to 10 in females. Abdominal sternites III through VII each with a single row of bristles averaging 4, 3, 3, 3, and 5 in males, 4, 4, 4, 3, and 6 in females.



FIGS. 83–87. *Coptopsylla janiceae* Lewis. **83.** Head of paratype male; **84.** Spermathecae of paratype female; **85.** Modified segments of paratype male; **86.** Clasper of paratype male; **87.** Apex of st. IX of paratype male.

MODIFIED ABDOMINAL SEGMENTS, MALE (figs. 79, 81, 82, 85–87): Fixed process of clasper divided into two lobes by a relatively broad, shallow sinus. Apex of L_1 broadly rounded, bearing a cluster of about nine setae of varying lengths. L_2 bluntly squared apically, with acetabular bristle arising about half way down its caudal margin, well above the articulation of the movable process. Movable process scimitar-shaped, its cephalic margin concave, its caudal margin strongly convex and armed with four fairly long setae as well as four or five smaller bristles arising lower on the margin. Apex of movable process with a pronounced tooth. Sternum IX triangular, its caudal angle smoothly rounded. Outer surface of this segment bearing about 10 long, thin randomly spaced bristles and a clump of approximately 10 more concentrated along the ventral margin. On the inner surface there are two preapical, heavy bristles; four to six long bristles near the caudoventral margin, which also bears a row of four long, thin setae, the lowermost of which is the longest and curves upward. In general, the chaetotaxy of this segment is sparse when compared with other members of the genus.

MODIFIED ABDOMINAL SEGMENTS, FEMALE (figs. 80, 84): Sternum VII of this species bears a broad, smoothly rounded caudal lobe. Tergum VIII bears a short row of three or four small setae dorsally and 18 to 22 generally longer bristles per side laterally. Anal stylet short, conical, with single long apical bristle and two peg sensilia. Sclerotized duct of the bursa copulatrix shaped like a shallow "M" with rounded points. Spermathecae of approximately equal proportions. Bulga subspherical, flattened ventrally, smoothly rounded dorsoapically, its greatest depth in region of duct. Junction of hilla with bulga distinct. Hilla strongly recurved over bulga, its walls almost parallel to the smoothly rounded apex. Apical papilla of hilla absent. In general, females of this species tend to be slightly more hirsute than the males but the description of the chaetotaxy given above fits both sexes well.

Type material.—Holotype male and allotype female (L-7803) from rodent burrow, 8 km. W Spin Baldak, Afghanistan, October 31, 1965, R. E. Lewis. Paratypes: 8 males and 8 females, same data as holotype; 1 male and 2 females (L-7837) from rodent burrow, 77 km. by road S Qala Bist, November 12, 1965, R. E. Lewis; 31 males and 5 females (L-7802) from *Gerbillus cheesmani*, 8 km. W Spin Baldak, October 31, 1965, R. E. Lewis; 4 males (L-7804) from *Meriones libycus*, same locality, date, and collector as previous series; 1 male (L-7826) from *Meriones libycus*, 19 km. SSW Spin Baldak, November 7, 1965, R. E. Lewis; 1 male (L-7824) from *Gerbillus cheesmani* and 1 female from *Meriones crassus*, same locality, date, and collector as previous series; 1 female (L-7840) from *Meriones crassus*, 16 km. E Girishk, November 13, 1965, R. E. Lewis. Holotype, allotype, and all but 10 male and 4 female paratypes deposited in Field Museum of Natural History.

This species is named in honor of Janice K. Street, co-leader of the Afghan Expedition, in recognition of her contributions to the success of the expedition.

Family VERMIPSYLLIDAE

This is a family restricted to the northern hemisphere. Two genera are known only from Central Asia as ectoparasites of ungulates, including domestic livestock, such as horses, cows, and sheep. The third genus, *Chaetopsylla*, is Holarctic in occurrence, some species being known from both northern North America and northern Eurasia. At lower elevations, these fleas tend to be common as adults during the colder months; at higher altitudes, most have been taken during the spring and summer. This may be only an indication of when collectors have been active, however, because our knowledge of the biology of these fleas is relatively poor.

CHAETOPSYLLA Kohaut

Chaetopsylla. Kohaut, 1903, Alatt. Kozlem., 2, p. 37.

Type species.—*Chaetopsylla rothschildi* Kohaut, 1903.

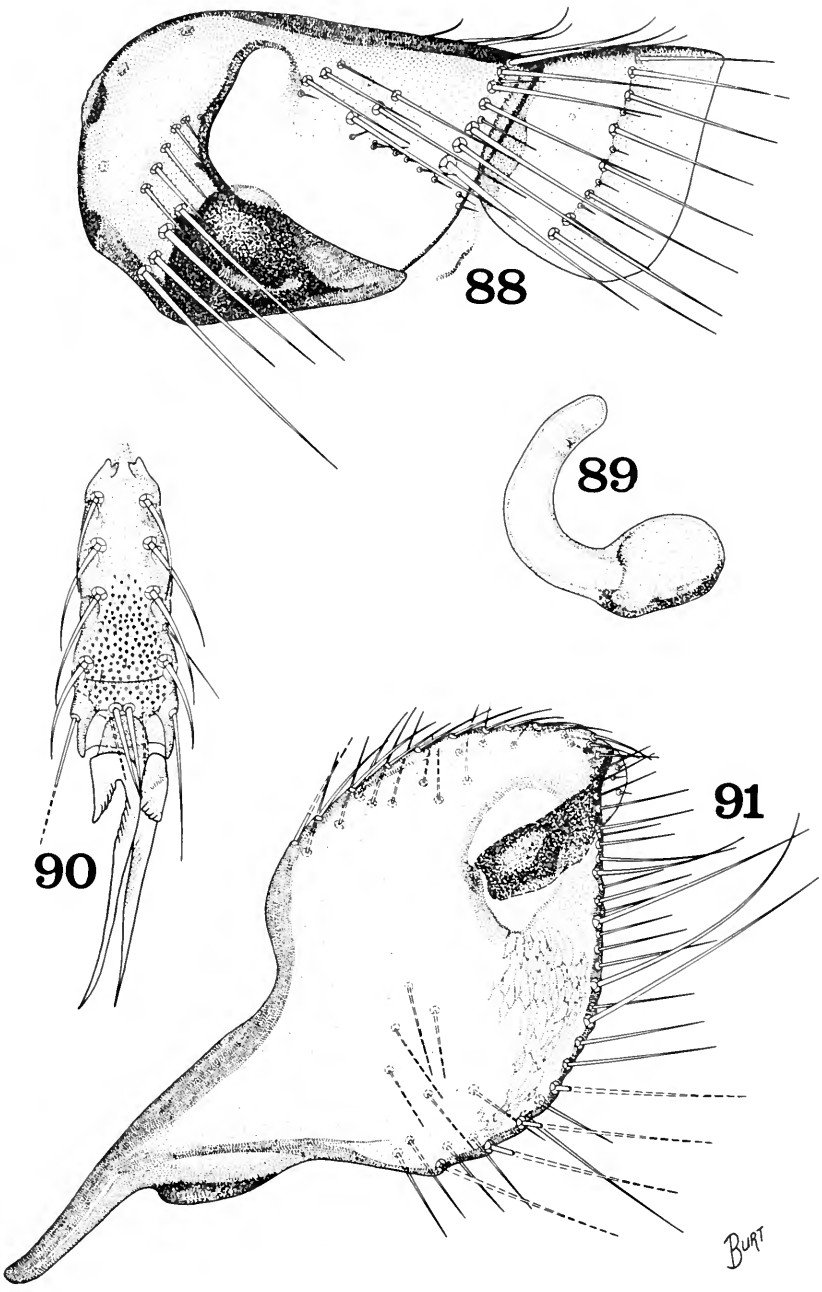
Most of the species of this genus are found in the Palaearctic Region though a few are found in the Nearctic, and at least one form is found in both regions. Though mainly parasites of carnivores, a species has recently been taken in the Himalaya Mountains of Nepal, apparently a specific parasite of mouse hares or pikas belonging to the genus *Ochotona*.

It is probable that a number of members of this genus occur in Afghanistan, though only *C. globiceps* was collected. The genus is much in need of taxonomic revision in spite of the relatively recent treatment by Hopkins and Rothschild (1956). Until the known species can be studied, there is little merit in attempting to construct a key for the genus. *C. globiceps* may presently be distinguished from other members of the genus by the fact that at least one apical seta of tarsal segment IV extends to or beyond the apex of segment V. In addition, males may be separated from most other species by the short, narrow movable process of the clasper, which arises high on the fixed process.

Chaetopsylla globiceps (Taschenberg, 1880). Figures 88–91.

Pulex globiceps Taschenberg, 1880, Die Flöhe, pp. 62, 66, pl. 2, figs. 10, 10a, 11.

According to Ioff *et al.* (1965), this species ranges from Greenland and Europe on the west to the Tien Shan Mountains in China on the east. It is an ectoparasite of foxes (*Vulpes vulpes*) and, from personal observations, seems to occur as adults mainly during the winter months. Although many foxes were taken during the expe-



FIGS. 88–91. *Chaetopsylla globiceps* (Taschenberg). **88.** Male head; **89.** Female spermatheca; **90.** Male hindtarsal segment V; **91.** Male clasper.

dition, all were collected during the warm months and but a single female was encountered.

Material collected.—

Ghazni, December 8, 1964, from *Vulpes vulpes*, 9 males and 13 females, *leg.* E. Kullmann.

Shibar Pass, July 24, 1965, from *Vulpes vulpes*, 1 female.

Family HYSTRICHOPSYLLIDAE

This is a large family of fleas, with species and genera to be found in all the zoogeographical regions. It is remarkable that representatives of only two genera, belonging to two different subfamilies, are presently known from Afghanistan and those reported here surely represent but a fraction of the species indigenous to the country.

Members of this family are parasites of insectivores and rodents, and the two genera reported may be separated by the following character.

1. Genal comb of four to eight spines (three exceptionally) which are separate from each other..... *Rhadinopsylla* (p. 54)
   Genal comb of two spines which overlap each other..... *Neopsylla* (p. 49)

NEOPSYLLA Wagner

Neopsylla. Wagner, 1903, Horae Soc. Entomol. Ross., **36**, p. 138, 140.

Type species.—*Typhlopsylla bidentatiformis* Wagner, 1893.

This is a large genus of fleas that is mainly restricted to the Palaearctic Region, although some species occur in the Indo-Malayan Subregion of the Oriental Region, and one form is known from the Nearctic Region. Members of the genus are characterized by the presence of a conspicuous frontal tubercle, two overlapping spines in the genal ctenidium, and a well-developed striarium.

Two of the species reported below belong to the *setosa* species-group as defined by Hopkins and Rothschild (1962), while the third belongs to the *stevensi* species-group. They may be separated with the following key.

1. Outer bristles on dorsal margin of hindtibia eight or more in number (excluding apical ones), set closely together and forming a well-developed false comb..... *hissarica* (p. 53)
   Outer bristles on dorsal margin of hindtibia seven or fewer in number, not forming false comb..... 2

2. Dorsal margin of distal arm of st. IX deflected ventrad near apex . *setosa* (p. 50)
Dorsal margin of distal arm of st. IX straight or nearly so. . . . *pleskei* (p. 50)

Neopsylla setosa setosa (Wagner, 1898). Figures 92–97.

Typhlopsylla setosa Wagner, 1898, Horae Soc. Entomol. Ross., **31**, p. 591, pl. X, figs. 27, 28.

This species is included in the Afghan fauna on very shaky grounds. The two females compare favorably with illustrations and descriptions of *Neopsylla setosa*, but they come from well outside the range of any known subspecies of this species and are from an atypical host. The inclusion of the species as a member of the fauna is therefore provisional.

Material collected.—

Tang-i-Garu, March 12, 1965, from *Calomyscus bailwardi*, 2 females, *leg.* E. Kullmann.

Neopsylla pleskei ariana Ioff, 1946. Figures 98–102.

Neopsylla pleskei ariana Ioff, 1946, Med. Parazitol., Moskva, **15**, p. 92.

The five subspecies of *Neopsylla pleskei* range through Central Asia from Armenia (*N. p. armeniaca*) to Transbaikalia and Outer Mongolia (*N. p. orientalis*). Ioff and Scalon (1954) list *N. p. ariana* from the Altai, Tien Shan, Pamir, and Kopet Dag Mountains, and Iran and Ioff *et al.* (1965) add Szechwan in the Chinese Peoples Republic. Including Afghanistan, this subspecies has the largest over-all distribution of any of the described forms. Within the country, this subspecies was taken from all collecting localities in the uplands, but was not encountered at lower elevations or in the more arid regions.

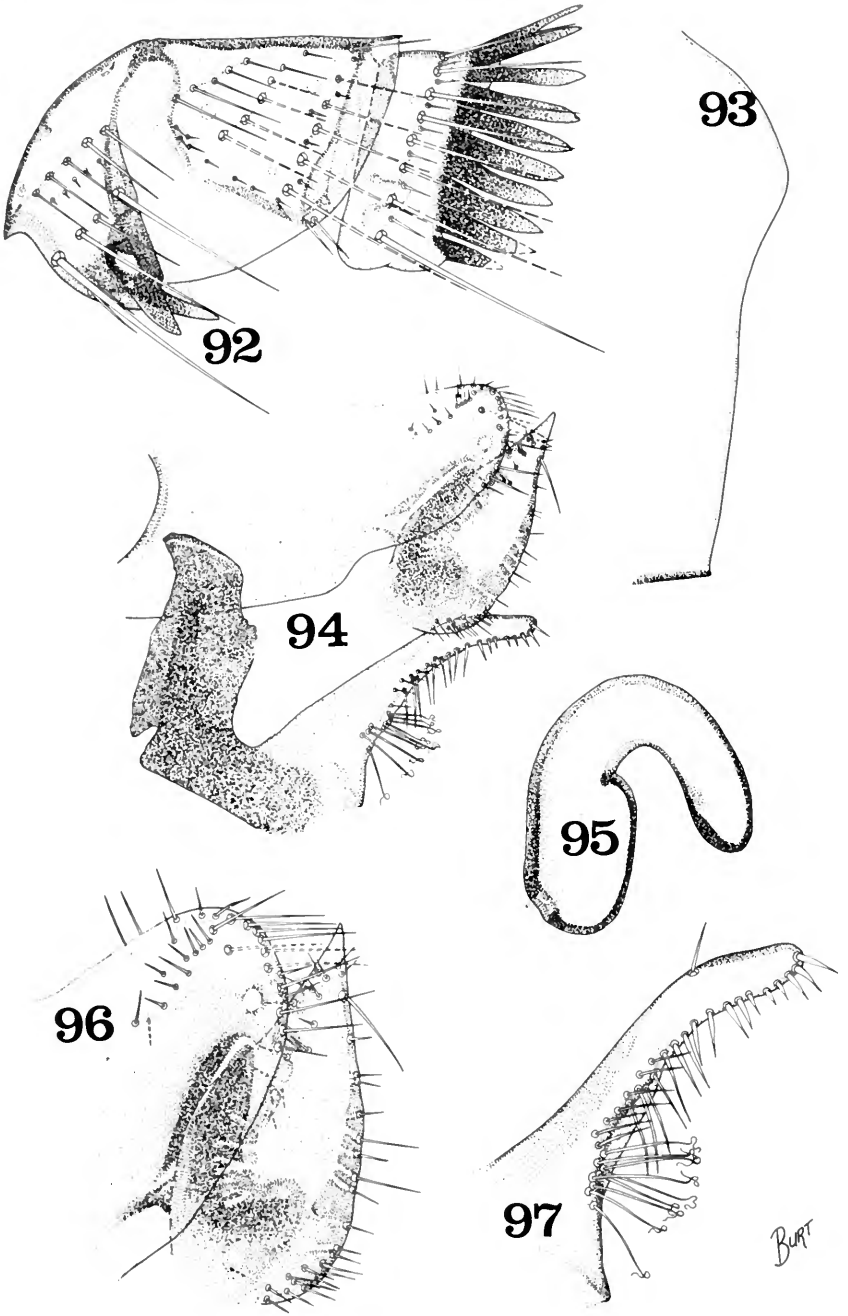
This was certainly one of the most common fleas in Afghanistan. As evidenced by our collections, it occurred on a number of unrelated rodents, but showed a decided preference for *Cricetulus migratorius* and *Microtus afghanus*.

Material collected.—

Gardez and environs, October 10, 1965, from *Cricetulus migratorius*, 2 females; from *Ellobius fuscocapillus*, 3 females.

Ghazni, 9 km. S E, October 6, 7, 1965, from *Cricetulus migratorius*, 12 males and 32 females; from *Meriones libycus*, 1 female.

FIGS. 92–97. *Neopsylla setosa setosa* (Wagner). **92.** Male head; **93.** Female st. VII; **94.** Male modified segments; **95.** Female spermatheca; **96.** Male clasper; **97.** Apex of male st. IX.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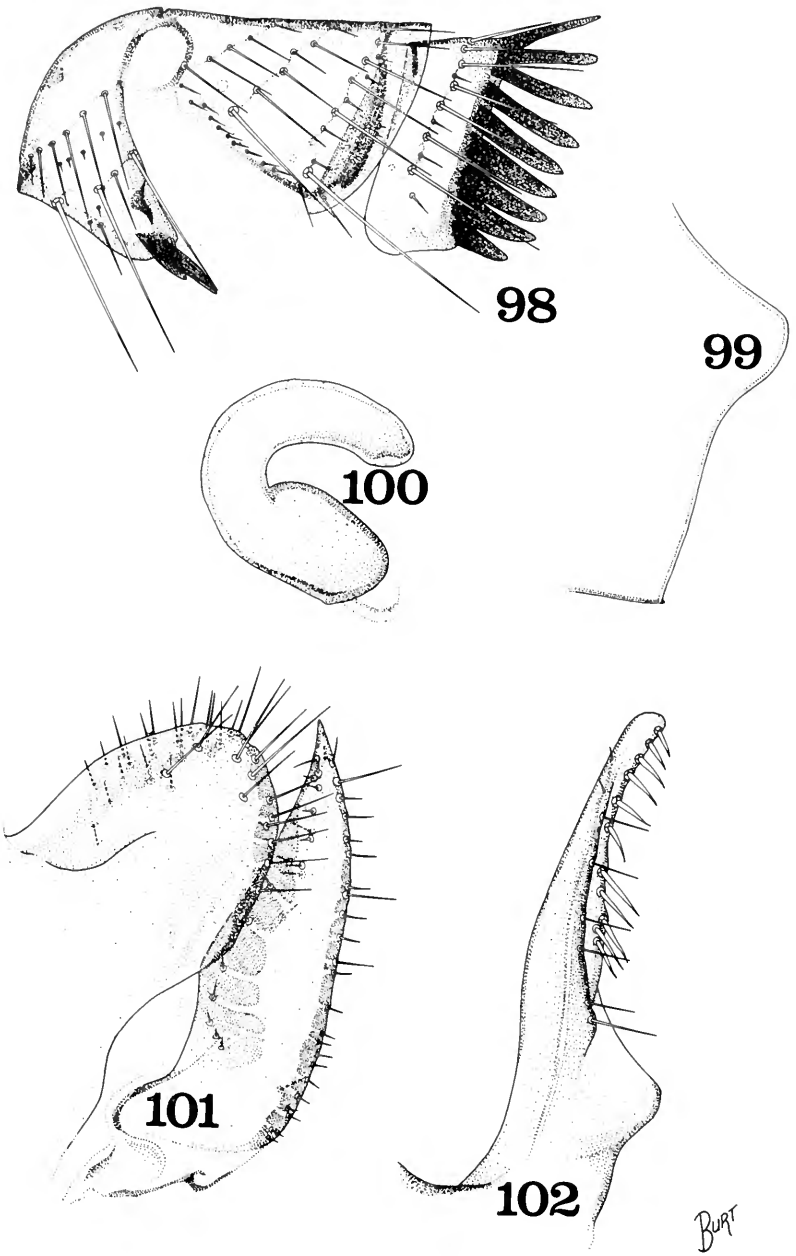

FIGS. 98–102. *Neopsylla pleskei ariana* Ioff. **98.** Male head; **99.** Female st. VII; **100.** Female spermatheca; **101.** Male clasper; **102.** Apex of male st. IX.

Ishkamish and environs, August 15–18, 1965, from *Cricetulus migratorius*, 3 males and 4 females; from *Apodemus sylvaticus*, 1 male; from *Rattus rattoides*, 1 male and 1 female.

Kabul and environs, July 19–21, 1965, from *Cricetulus migratorius* and nests, 2 males and 2 females; from *Microtus afghanus*, 6 females; October 3, 1965, from *Allactaga williamsi* burrows, 9 males and 9 females.

Sauzak Pass, September 22, 1965, from *Ochotona rufescens*, 3 males and 2 females.

Shombul, 12 km. W Shibar Pass, July 27, 1965, from *Cricetulus migratorius* nest, 2 males and 2 females.

Shibar Pass, July 19–30, 1965, from *Cricetulus migratorius* nest, 4 females; from *Microtus arvalis*, 1 female; from *Microtus afghanus* and nests, 41 males and 73 females.

Neopsylla hissarica Ioff and Sosnina, 1950. Figures 103–106.

Neopsylla hissarica Ioff and Sosnina, 1950 (in Ioff, Tiflov *et al.*), Med. Parazitol., Moskva, **19**, p. 272.

The three specimens reported here agree generally with the description of *N. hissarica* included in Hopkins and Rothschild (1962) but differ in a few minor points associated with the modified segments. The cephalic margin of the movable process of the male bears a distinct subapical incrassation and angle, causing the structure to appear more rectangular than illustrated by Ioff and Sosnina (1952). In addition, the caudal margin of this process is straight, nearly concave, and the spiniform seta on the inner surface of the caudoventral angle is distinct (this seta is not shown in the drawing in Ioff and Sosnina, 1952). The apex of the posterior arms of st. IX is more expanded in our specimen, and the row of spiniform setae is interrupted, forming two groups, one of two and the other of five bristles. In the female, the upper lobe of st. VII is much sharper apically in the undamaged specimen, and the sinus is shallower.

Ioff *et al.* (1965) indicate that this species is known from localities in Tadzhikistan from *Rattus rattoides turkestanicus* and relate it to *N. secura*, *stevensi*, and *honora*. Judging from material examined from West Pakistan, Jammu, Kashmir, and Nepal, these species are closely related, not only with *N. hissarica*, but also with *N. marleaneae* from Nepal, and perhaps all constitute local variants of one widely distributed species.

The hosts of our three specimens were trapped in mixed deciduous and coniferous forest at an approximate elevation of 1,800 m.

Material collected.—

Kamdesh, 8 km. S, October 13, 14, 1965, from *Mus musculus*, 1 female; from *Rattus rattoides*, 1 male and 1 female.

RHADINOPSYLLA Jordan and Rothschild

Rhadinopsylla. Jordan and Rothschild, 1912, Novit. Zool., **19**, p. 367.

Type species.—*Rhadinopsylla masculana* Jordan and Rothschild, 1912.

Members of this genus typically have at least four spines in the genal comb and usually five or six. The eye is vestigial and there are four to six pairs of lateral plantar bristles. Five subgenera are recognized by Hopkins and Rothschild (1962), but one of which, *Actenophthalmus*, is known to occur in Afghanistan. However, the known distribution of members of the subgenus *Rhadinopsylla s. str.* suggests that certainly one of its species will ultimately be found to occur here.

Subgenus **Actenophthalmus** C. Fox

Actenophthalmus. C. Fox, 1925, Entomol. News, **36**, p. 121.

Type species.—*Actenophthalmus heiseri* McCoy, 1911.

Similar to *Rhadinopsylla s. str.*, but the frontal angle is fairly sharp and is situated higher on the frons. The frontal setal row ends much below the frontal angle.

A single specimen belonging to this subgenus is known from Afghanistan, and it is here assigned to a new taxon. Additional collections, especially from the deserts and the mountains of the northeast are certain to expand the number of indigenous species.

Rhadinopsylla (Actenophthalmus) kullmanni new species. Figures 72–73.

Diagnosis.—Closest to *R. (A.) tenella* Jordan, 1929, from which it differs in the following characters: a) apex of fixed process of clasper not truncated; b) movable process of clasper much longer, less strongly curved cephalad and more acuminate apically; c) distal arm of st. IX relatively broad, tapering gently to a round-pointed apex. The female of the species is unknown.

Description.—HEAD, MALE (fig. 72): Frontal angle well developed but not particularly pronounced. Frontal row of four relatively weak bristles. Ocular row

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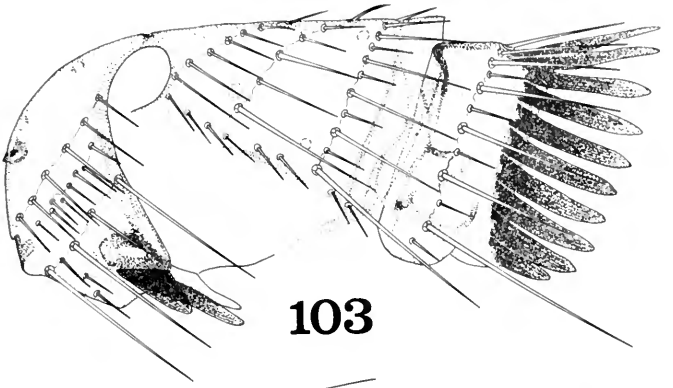
FIGS. 103–106. *Neopsylla hissarica* Ioff and Sosnina. **103.** Male head; **104.** Male clasper; **105.** Apex of male st. IX; **106.** Male modified segments.



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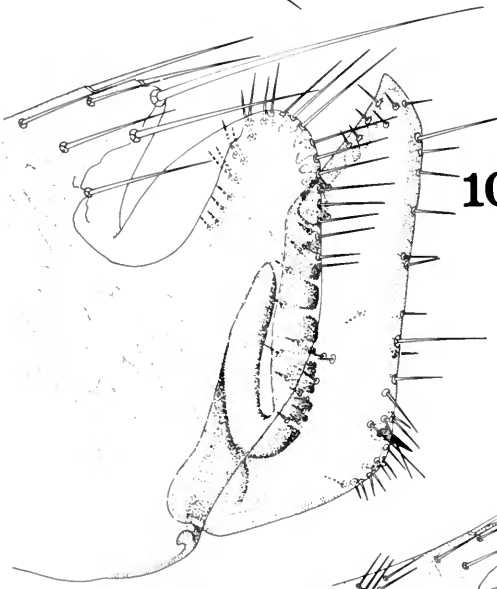

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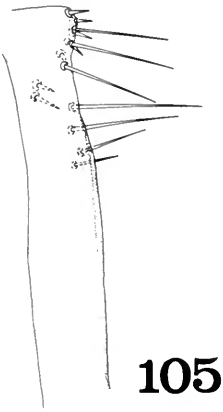

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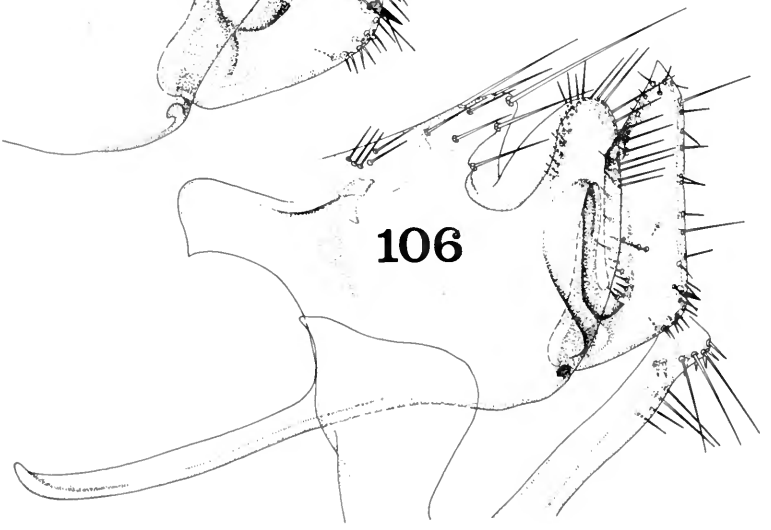

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of a large bristle arising on the dorsal margin of the vestigial eye and another slightly smaller bristle arising near the genal lobe at about the level of the uppermost spine of the genal ctenidium. Genal comb of four spines on one side and five on the other (five is certainly the normal number). Uppermost spine broader than others, its apex reaching about two-thirds the length of second spine. Postantennal portion of head with two oblique rows of five to six setae each in addition to occipital row. Labial palpi five-segmented, extending almost to apex of forecoxa.

THORAX: Pronotum with five setae per side and 18 spines in the comb including a minute spine on one side. Mesonotum with five long setae in main row each side and two pseudosetae high under mesonotal collar. Metanotum with five long setae per side in main row and one long seta on lateral metanotal area. Mesepisternum with one, mesepimeron with three long setae each side. Metepisternum with one long seta, metepimeron with an irregular row of three long setae and a well-developed striarium. Suture between metanotum and metepimeron extending to caudal margin of lateral metanotal area.

LEGS: Outer surface of procoxae with about 17 submarginal bristles arranged in five irregular rows. Outer surface of forefemur with two submarginal setae near apex, one near each margin. Inner surface with two submarginal setae near apex and one small seta equidistant between dorsal and ventral margins near base. Caudal margin of foretibia with five subapical notches. Proximal notch with one, remaining four with two heavy bristles. With a median row of six smaller setae on outer surface. Longest apical seta extending to apex of tarsal segment II. Foretarsal segments I and II of about equal length, each longer than either segments III or IV. Tarsal segment V with four pairs of lateral plantar bristles and one pair of subapical plantar bristles. Outer surface of midcoxa with eight setae on apex and along apical half of cephalic margin. Two submarginal setae on outer and three on inner surface near apex of midfemur; one seta on inner surface near base. Caudal margin of midtibia with five notches; proximal notch with one, remaining notches with two heavy bristles. Outer surface with submarginal row of five smaller bristles. Longest apical seta not quite reaching apex of tarsal segment II. Tarsal segments I and II of subequal length, slightly shorter than segments III and IV combined. Tarsal segment V with four pairs of lateral plantar setae and one pair of subapical plantar setae. Hindcoxa with 17 to 19 long setae on apical half of outer surface, inner surface with a clump of 10 spiniform setae remote from cephalic margin. Hindfemur with a row of three setae near ventral margin and one seta near apex on dorsal margin. Inner surface with one seta arising near base of segment. Hindtibia with four notches in caudal margin, each bearing a pair of heavy bristles. Longest apical seta of hindtibia extending to apex of hindtarsal segment I. Hindtarsal segment I about as long as segments II and III combined, its longest apical seta extending slightly beyond apex of segment II. Longest apical seta of segment II extending slightly beyond apex of segment IV. Segment V with four pairs of lateral and 1 pair of subapical plantar setae.

UNMODIFIED ABDOMINAL SEGMENTS: Abdominal tergites I through VII with a single main row of setae numbering 4, 6, 6, 5, 5, 5, and 4, and tergal spinelets numbering 2, 1 or 2, 1, 1, and 1. Sternite II devoid of setae except for the single bristle on the ventral margin each side. Sternite III through VII each with two setae per side and st. VIII with two setae on one side and three on the other.

MODIFIED ABDOMINAL SEGMENTS (fig. 73): Fixed process of clasper higher than wide, its apex smoothly rounded, bearing one large seta. Caudal margin with incrassation about one-third down from apex. Anterior arms of manubrium narrow and slightly upturned. Acetabular seta arising low on process. Movable process long, narrow, and slightly arcuate, extending to apex of fixed process. Distal arm of st. IX tapering gradually to a conical apex, its chaetotaxy restricted to a few scattered small setae.

Type material.—Holotype male (L-7854) from *Ochotona rufescens*, Dumandi Pass, Afghanistan, 3,000 m., May 5, 1964, *leg.* E. Kullmann.

This species is named for Dr. Ernst Kullmann of Bonn University and Kabul University in recognition of his contributions to the zoology of Afghanistan.

This is the only representative of the genus *Rhadinopsylla* known from the country, although there are certainly many species resident there. Since there is some evidence that, at least in the Middle East, adults of species belonging to this genus are more frequently taken during the winter months, this may explain why no specimens were collected by expedition personnel. Most species also show a preference for remaining in the nest while the host forages and thus are much more common than host records indicate. Future collecting efforts in Afghanistan should be directed toward the excavation of nests and host collections during the winter.

Family ISCHNOPSYLLIDAE

The 16 genera belonging to this family, though restricted to specific zoogeographic regions for the most part, cause the family to have worldwide distribution. Most genera are Palaearctic or Holarctic in occurrence, but members of some genera overlap into the Neotropical, Ethiopian, or Indian Regions. All are specific ectoparasites of bats and, with the exception of the Thaumapsyllinae, occur on bat species belonging to the Microchiroptera. Developmental stages are typically spent in bat guano, and for an adult flea to find a host, it must leave the larval habitat and climb to the bat roost. For this reason, bat fleas seldom are found on bats that roost in the open, and are mainly associated with host species that are colonial in caves, buildings, or locations where conditions permit both the development of the larval stages and access to the host animal by adults. Such habitats are relatively rare in arid countries and bat fleas are infrequently encountered, though once located, they may usually be collected in large numbers.

Our collections suggest that bat fleas are rare in Afghanistan. It was our good fortune to have a large collection of bats preserved in alcohol made available to us by Herr D. Meyer-Oehme who had devoted considerable time to surveying the fauna of the country. Although the collections were not made with ectoparasites in mind, an examination of his material yielded additional specimens of two species collected in small numbers by us, as well as one additional taxon not taken by members of the expedition.

The reader is referred to Meyer-Oehme (1965) for a report on the hosts. We are indebted to Herr Meyer-Oehme for his valuable contribution to our knowledge of the bat fleas of Afghanistan. There is little doubt, however, that fewer than half of the species occurring there are included in this report.

The three genera of bat fleas reported here may be separated by the following key which is modified from Hopkins and Rothschild (1956).

1. Metepimeron with a false comb of long spiniform bristles. *Chiropteropsylla* (p. 63)

   Metepimeron lacking a comb of any kind 2

2. Dorsomarginal area of frons densely and minutely rugulose; median ventral pair of plantar bristles of tarsal segment V arising between first lateral pair; basal abdominal sternum without lateral bristles; st. VIII of male strongly modified ..... *Ischnopsyllus* (p. 58)

   Dorsomarginal area of frons smooth except for minute hairs; metepimeron not or little higher than long; at least metasternum lacking tubercle; pleural rod of mesopleurum ending much behind center of the sclerotic dome; row of long bristles on abdominal tergites complete, lacking interruption. *Rhinolophopsylla* (p. 62)

ISCHNOPSYLLUS Westwood

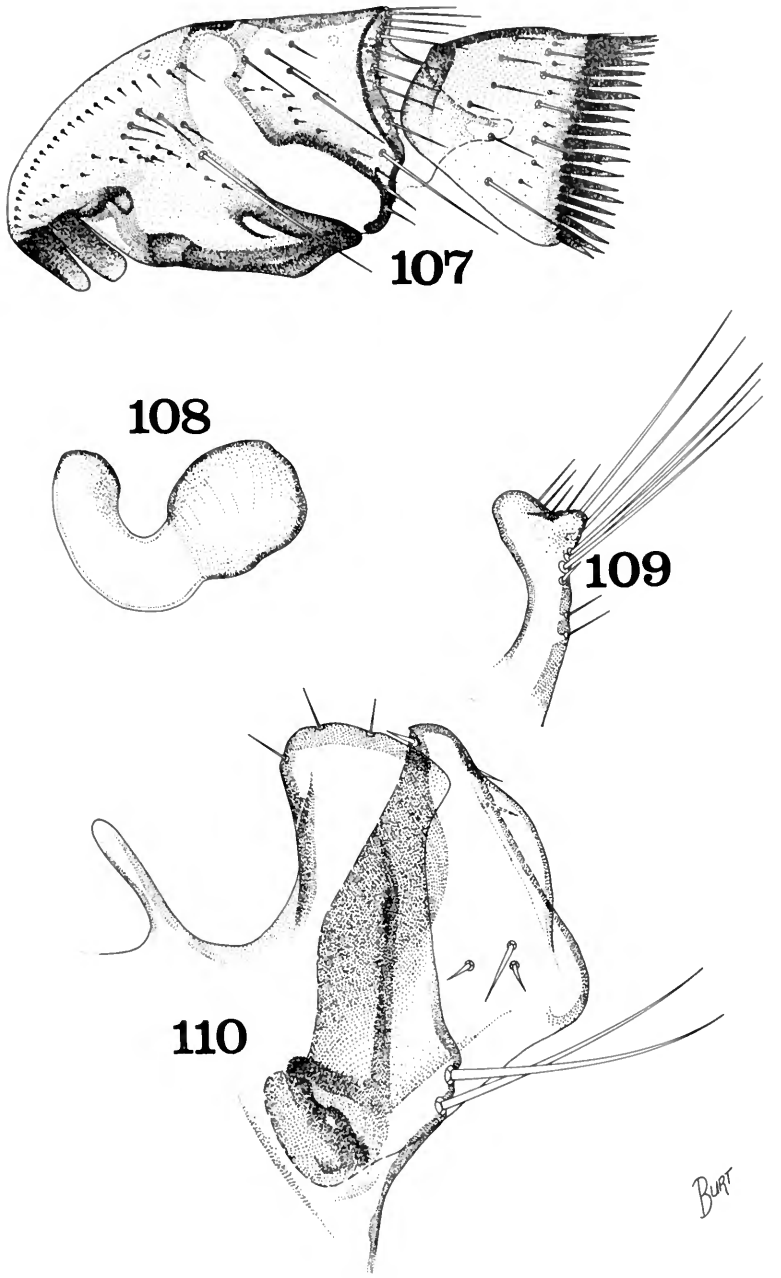
Ischnopsyllus. Westwood, 1833, Entomol. Mag., **I**, p. 362.

Type species.—Ceratophyllus elongatus Curtis, 1832.

Species of this genus are mainly Palaearctic in occurrence and show a high degree of host specificity on bats of the family Vespertilionidae. The two species included here may be separated by the following key.

1. Some of the more dorsal bristles of the meso- and metanotum elongated and semi-erect, forming a "mane" ..... *octactenus* (p. 60)

   Meso- and metanotum without elongated bristles ..... *obscurus* (p. 60)



FIGS. 107–110. *Ischnopsyllus obscurus* (Wagner). **107.** Male head; **108.** Female spermatheca; **109.** Apex of male st. IX; **110.** Male clasper.

Ischnopsyllus (Ischnopsyllus) obscurus (Wagner, 1898). Figures 107–110.

Ceratopsylla obscura Wagner, 1898, Horae Soc. Entomol. Ross., **31**, p. 584, pl. IX, fig. 21.

Hůrka (1963) has reviewed the distribution of this species and indicates that present records demonstrate its occurrence from Norway and Denmark east to the Kwantun Peninsula of China. Our records from Afghanistan extend the Central Asian distribution to the south by a few hundred kilometers.

The main host of this species of flea is *Vespertilio murinus*, although it has been taken from a few other species of vespertilionid bats. As Hůrka (1963) observes, the known range of the flea coincides almost exactly with the known range of the host.

Material collected.—

Maimana, 40 km. E, September 12, 1965, from *Vespertilio murinus*, 2 males and 3 females.

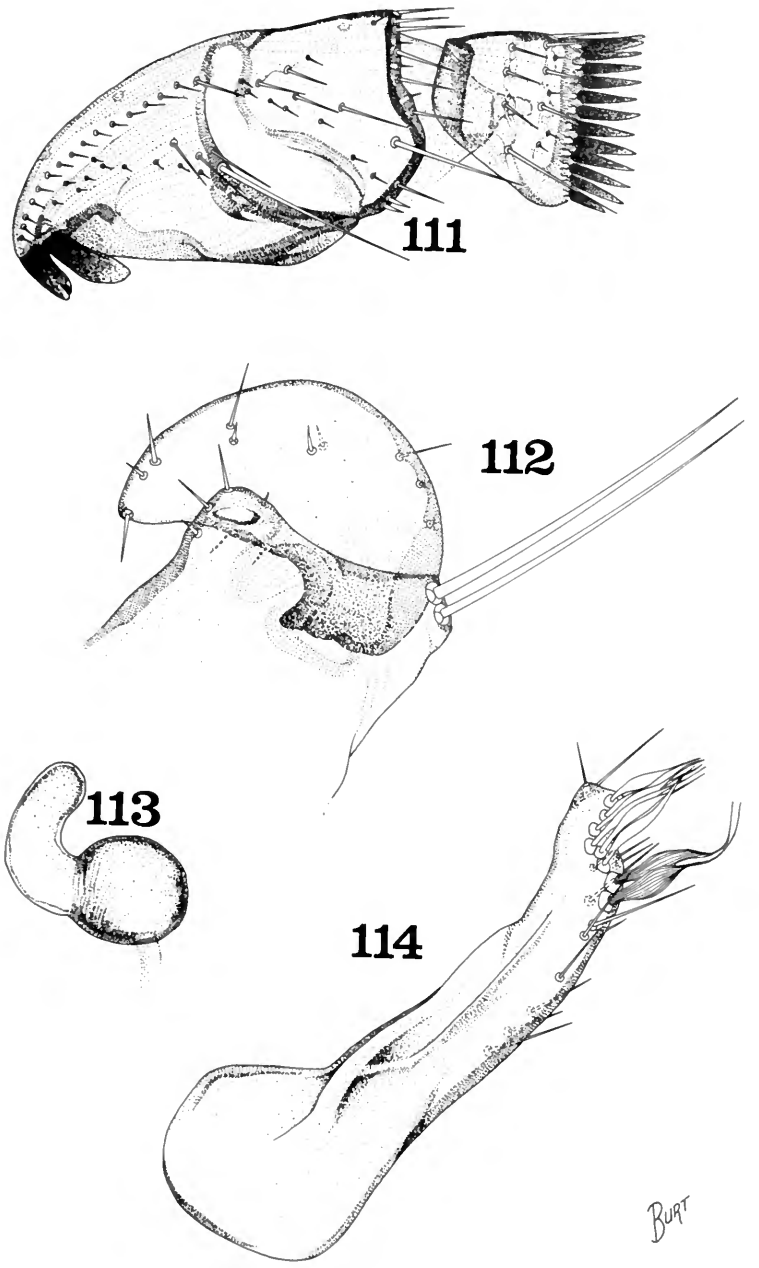
Ischnopsyllus (Ischnopsyllus) octactenus (Kolenati, 1856). Figures 111–114.

Ceratophyllus octactenus Kolenati, 1856, Parasiten der Chiroptern, Brün, p. 31.

This species is discussed in some detail by Hůrka (1963). His distribution records indicate that it is mainly a European species, with a few records known from Southeast Asia, although this may only be a reflection of collecting activity. It is mainly a parasite of *Pipistrellus pipistrellus*, but there are a number of records from other genera and species of the family Vespertilionidae as well as scattered collections from *Rhinolophus* sp.

The true identity of the *Pipistrellus* species in Afghanistan is still questionable. Ellerman and Morrison-Scott (1951) indicate at least six species of this genus that might be expected to occur there. Meyer-Oehme (1965) discusses only *P. babu* and *P. mimus glaucillus*, though he reviews the Afghan records for the entire order, indicating that a subspecies of *P. kuhli* was described from Kandahar. A separate report on the bats collected by the Street Expedition is in preparation, and until it is completed, the taxonomic status of the pipistrelle hosts must remain questionable.

The record from *Rhinopoma* is certainly a case of accidental association or perhaps a contamination from preservative re-use. The pair from "assorted bats" came from a mixed collection of vespertilionid bats preserved in alcohol.



FIGS. 111–114. *Ischnopsyllus octactenus* (Kolenati). **111.** Male head; **112.** Male clasper; **113.** Female spermatheca; **114.** Apex of male st. IX.

Most bats in the Middle East congregate in caverns or buildings since there are few trees providing suitable shelter. Personal observations indicate that neither of these refuges provide a satisfactory breeding habitat for bat fleas. Most of the caverns tend to be too dry to provide a good place for the development of the larvae, and in those which are suitable, the bat guano is usually too remote from the roost vertically to allow many of the adults to find their host. Roosts in buildings, on the other hand, tend to be too hot and dry. As a result, the adult population level of the bat flea in these areas seems to remain very low.

Material collected.—

No locality, no date, from Assorted Bats, 1 male and 1 female, *leg.* D. Meyer-Oehme.

Balkh, September 4, 1965, from *Pipistrellus kuhli,* 1 male and 3 females.

Herat, 11 km. S, September 22, 1965, from *Pipistrellus kuhli,* 1 female.

Jalalabad, June 26, 1965, from *Rhinopoma hardwickei,* 1 female, *leg.* D. Meyer-Oehme.

Kunduz, August 29, 1965, from *Pipistrellus kuhli,* 1 female.

Mazar-i-Sharif, September 5, 1965, from *Pipistrellus kuhli,* 1 female.

RHINOLOPHOPSYLLA Oudemans

Rhinolophopsylla. Oudemans, 1909, Entomol. Ber., Amst., 3, p. 3.

Type species.—*Typhlopsylla unipectinata* Taschenberg, 1880.

Three of the four species of this genus are Ethiopian in distribution. The remaining species consists of four subspecies, which collectively have a broad distribution from Europe and North Africa east to Transcaspia and Afghanistan. Of these, *R. u. unipectinata* and *R. u. turkestanica* are reported from Afghan collections. They may be separated by the following characters.

1. Caudoventral projection of st. VIII of males short, with two or three long apical setae; basal portion of distal arm of st. IX bent, broad apically, its caudal incision broad and open; ventroapical angle of st. VII of female not very acute; caudoventral angle of st. VIII sharp..... *u. unipectinata* (p. 63)

   Caudoventral projection of st. VIII of males long, with four long apical setae and many short setae preapically; basal portion of distal arm of st. IX bent at almost a right angle, narrowing apically, its caudal incision small and almost closed; ventroapical angle of st. VII of female acute; caudoventral angle of st. VIII not pointed, more rounded..... *u. turkestanica* (p. 63)

Rhinolophopsylla unipectinata unipectinata (Taschenberg, 1880). Figures 119–121.

Typhlopsylla unipectinata Taschenberg, 1880, Die Flöhe, p. 92.

As a species, this flea occurs from Western Europe and North Africa, east through Southwest Asia to Turkmeniya and Afghanistan into Northern India. Four subspecies are known, of which the nominate form occurs from Western Europe east to Western Turkmeniya, and south to Qala Bist and Kandahar in Afghanistan. Smit (1960) discusses this subspecies and contrasts it to *R. u. turkestanica*, which also occurs in Afghanistan.

Material collected.—

No locality, no date, from assorted bats, 2 females, *leg.* D. Meyer-Oehme.

Shamshir Cave, 19 km. S W Kandahar, February 28, 1965, from *Rhinopoma hardwickei*, 1 male and 2 females, *leg.* D. Meyer-Oehme; October 29, 1965, from *Mineopterus schreibersi*, 1 female.

Qala Bist, November 13, 1965, from assorted bats, 2 males and 1 female; May 26, 1961, from *Rhinolophus ferrumequinum*, 1 female, *leg.* D. Meyer-Oehme.

Rhinolophopsylla unipectinata turkestanica Ioff, 1953. Figures 115–118, 122.

Rhinolophopsylla unipectinata turkestanica Ioff, 1953, Med. Parazitol. Moskva, 1953 (**5**), p. 465.

Ioff *et al.* (1965) report this subspecies from northeastern Afghanistan and Uzbekistan (Tashkent and the Kara Kum and southern Kyzyl Kum Deserts). See discussion under nominate subspecies.

Material collected.—

Ak Kopruk, April 2, 1965, from *Rhinolophus* sp., 1 male, *leg.* D. Meyer-Oehme.

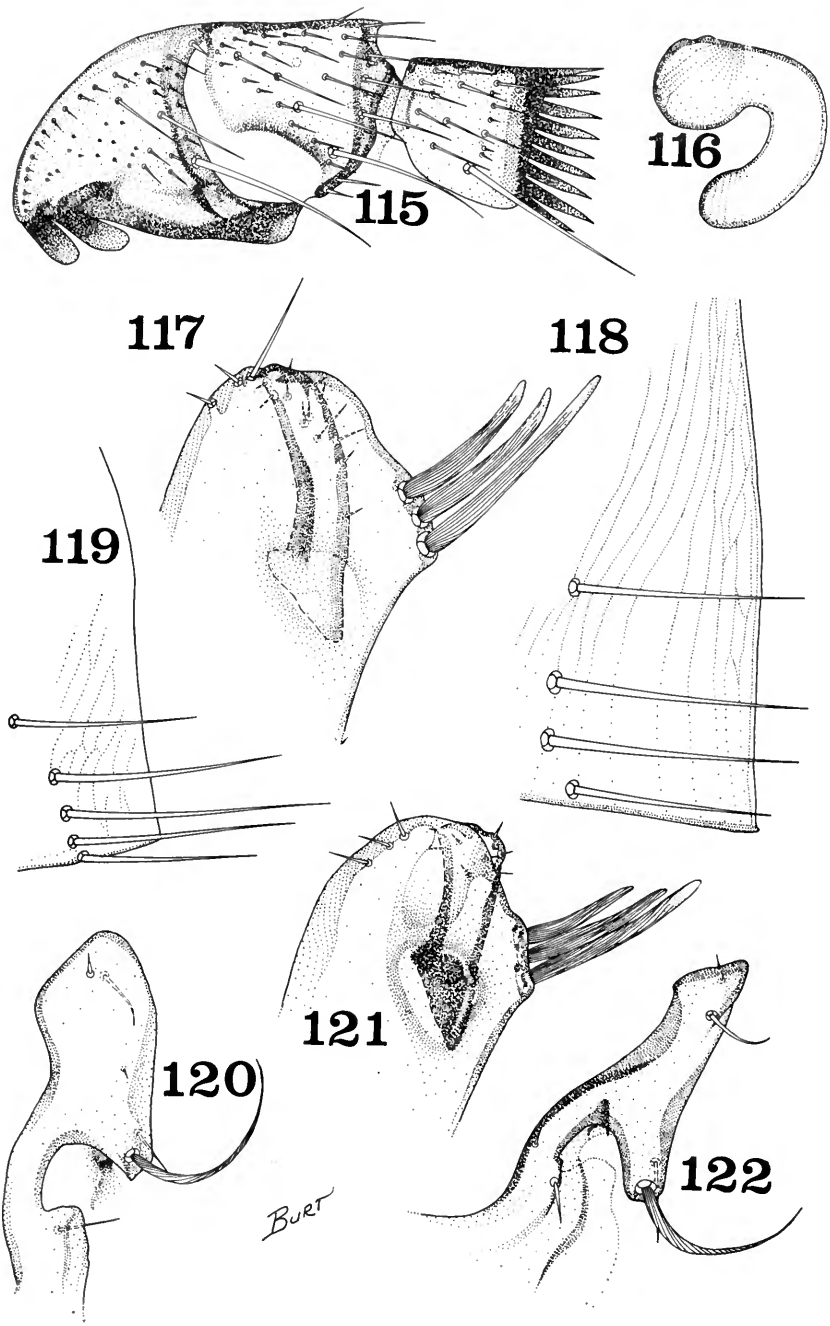
Darra Ajer, S W Mazar-i-Sharif, April 11, 1965, from *Myotis blythii*, 7 males and 5 females, *leg.* D. Meyer-Oehme.

CHIROPTEROPSYLLA Oudemans

Chiropteropsylla. Oudemans, 1908, Tijdschr. Entomol., **51**, p. 102.

Type species.—*Ceratophyllus aegyptius* Rothschild, 1903.

Mainly known from northeastern Africa and the Middle East, this genus is probably restricted to the arid Saharan type of habitat, as stated by Hopkins and Rothschild (1956). Southwestern Af-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ghanistan is likely the eastern limit to the distribution of the species reported here.

Chiropteropsylla brockmani brockmani Rothschild, 1915.
Figures 27–30.

Chiropteropsylla brockmani Rothschild, 1915, Entomol. Mon. Mag., **51**, p. 304, pl. 22, figs. 1, 2.

Although this species was not taken during our collecting, it has been reported from Afghanistan by Smit (1960) among collections made by Dr. K. Lindberg of the University of Lund, Sweden. This material, from *Asellia tridens*, came from caves in the west-central portion of the country in the environs of Farah.

Hopkins and Rothschild (1956) report the species from Somaliland and Iraq, and it has since been reported from Egypt (Lewis, 1967) from both *Asellia tridens* and *Taphozous perforatus*. At the suggestion of Hopkins and Rothschild (1956) that the Iraq female differed in certain respects from those from Somaliland, Hubbard (1956) described it as a new subspecies, *C. b. johnsoni*. As the male of the subspecies is not known, Smit (1960) was unable to state whether the specimens from Afghanistan belonged to *C. b. johnsoni* or the nominate form, and here the question must remain until further collections from Iraq decide the validity of the subspecies.

Family LEPTOPSYLLIDAE

Historically there has been much disagreement concerning the taxonomic division of the genera variously referred to the Amphipsyllidae, Ceratophyllidae, and Leptopsyllidae. Hopkins and Rothschild (1962) include all genera previously referred to the families Amphipsyllidae and Leptopsyllidae in the latter family, thus downgrading the former to subfamily status, a system followed here. Russian workers, on the other hand, include all genera of the Amphipsyllidae, Ceratophyllidae, and Leptopsyllidae of other authors in the single family Ceratophyllidae. This they divide into the following subfamilies: Ceratophyllinae, Paradoxopsyllinae, Mesopsyllinae, and Leptopsyllinae.

While it is beyond the scope of this study to discuss the phylogenetic relationships of these taxa, it is conceded that a case can be

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FIGS. 115–122. *Rhinolophopsylla u. unipectinata* (Taschenberg). **119.** Female st. VII; **120.** Apex of male st. IX; **121.** Male clasper. *Rhinolophopsylla u. turkestanica* Ioff. **115.** Male head; **116.** Female spermatheca; **117.** Male clasper; **118.** Female st. VII; **122.**Apex of male st. IX.

made for such a systematic arrangement. However, to do so groups two major families of fleas which, with our present knowledge of the order, can be fairly easily separated on the basis of anatomical characters. For this reason, the Leptopsyllidae is retained as a family distinct from the Ceratophyllidae. As here understood, this family consists of four subfamilies, three of which are represented in the Afghan fauna. These may be separated with the following key.

Key to the Afghan Subfamilies of the Leptopsyllidae

1. Genal comb well developed, of two to many teeth 2
   Genal comb absent ..... Amphipsyllinae (p. 66)
2. Frontal margin of head with a row of spiniform setae; genal comb of four or more spines ..... Leptopsyllinae (p. 109)
   Frontal margin of head without spiniform setae; genal comb of only two spines ..... Mesopsyllinae (p. 100)

Subfamily AMPHIPSYLLINAE Ioff

Amphipsyllina. Ioff, 1936, Z. Parasitenk., **9**, p. 76.

This subfamily roughly corresponds to the Paradoxopsyllinae of Ioff and other Russian authors. According to the system followed by Hopkins and Rothschild (1953, 1956, 1962) in their volumes of the *Catalogue*, there are eight genera belonging here: *Amphipsylla, Brachyctenonotus, Ctenophyllus, Frontopsylla, Odontopsyllus, Ophthalmopsylla, Paradoxopsyllus,* and *Phaenopsylla.* Six of these are known from Afghanistan.

Members of this subfamily usually have a well-developed eye (though it is absent in *Phaenopsylla* and reduced in some species of *Amphipsylla*) that is usually conspicuously emarginated ventrally. The genal comb is absent and the movable process of the males bears variously modified spiniform setae. As is true for other subfamilies of this family, the tentorium is clearly visible in front of the eye.

The six genera reported from Afghanistan are all parasites of small rodents, except those species of *Frontopsylla* parasitizing birds. The genera may be separated by the following key.

1. Eye present, though it may be reduced 2
   Eye absent ..... *Phaenopsylla* (p. 94)
2. Basal abdominal sternite with a patch of six to 15 lateral setae; eye not particularly emarginate ventrally, parasites of pikas (*Ochotona* sp.)
   Ctenophyllus (p. 88)

Basal abdominal sternite with few or no lateral setae; eye more emarginate ventrally.....3

3. Three distinct rows of preantennal setae and three rows of postantennal setae including occipital row; lateral surface of basal abdominal sternite devoid of setae (except in females of *rossica*).....*Amphipsylla* (p. 67)

Fewer than three rows of pre- and postantennal setae including occipital row; basal abdominal sternite with at least one or two lateral setae.....4

4. Two rows of preantennal setae, three rows of postantennal setae; movable process of male with at least one blunt, spiniform seta; bulga of spermatheca blunt apically, shading gradually into hilla, with duct arising at apex.
Frontopsylla (p. 78)

Postantennal portion of head with only occipital row of setae complete; movable process of male either lacking spiniform setae or, if present, they are sharp; spermatheca other than above.....5

5. Eye large, heavily pigmented, with deep ventral emargination; movable process of male with sharp, spiniform setae on caudal margin; bulga of spermatheca globular, shading gradually into hilla, its duct arising subapically.
Ophthalmopsylla (p. 93)

Eye reduced, kidney-shaped, its ventral emargination shallow; movable process lacking spiniform setae; bulga of spermatheca spherical, its junction with the hilla quite distinct.....*Paradoxopsyllus* (p. 90)

AMPHIPSYLLA Wagner

Amphipsylla. Wagner, 1909, Mitt. Kaukas. Mus., **4**, p. 196.

Type species.—Amphipsylla schelkovnikovi Wagner, 1909.

Members of this genus are mainly Asian in occurrence, although one species extends into Europe and there are a few rather confusing records from northern North America. Probably only two subspecies occur here, and both have been reported by Hopla (1965) from Alaska.

These fleas are mainly parasites of small rodents and show a distinct preference for members of the Microtinae and species of the genus *Cricetulus*. For the most part, males may be identified by the shape and chaetotaxy of the movable process and sternum nine. Females are more difficult to determine. Although the contours of the seventh sternite and the shape of the spermatheca and sclerotized duct of the bursa copulatrix are useful, females of some species cannot be determined with certainty unless accompanied by males.

It is likely that more than six species of this genus occur in Afghanistan. Keys to all species likely to be encountered here may be found in Ioff and Scalon (1954) and Ioff *et al.* (1965). Following is a key to the six species collected during the expedition. Although

Russian workers use the degree of development and position of the frontal tubercle and the position of the frontal angle as characters for dividing the species into groups, these characters seem entirely too subjective to permit accurate determinations. While there is an obvious difference between the extremes, most species exhibit sufficient variation to nullify the importance of these characters. Another character frequently used to separate groups of related species is the number of setae in the first postantennal row. Again, there is some variation in long series of specimens. For example, a species with typically only one seta in this row may have individuals with one seta on one side and two on the other. Since this occurs relatively infrequently, however, and since there are so few extragenital characters that can be used to separate the species, this character is employed in the key with the warning that exceptions are likely to be encountered.

1. Only one seta in first postantennal row.....2

   Two or more setae in first postantennal row.....4

2. St. IX of male with a single heavy apical seta which curves forward; movable process of clasper long and narrow, with three straight or slightly curved setae; female st. VII smooth, lacking a lobe or sinus; spermatheca with bulga about twice as long as broad, its ventral margin only slightly concave, its apex oblique, the duct arising subventrally.....*anceps* (p. 76)

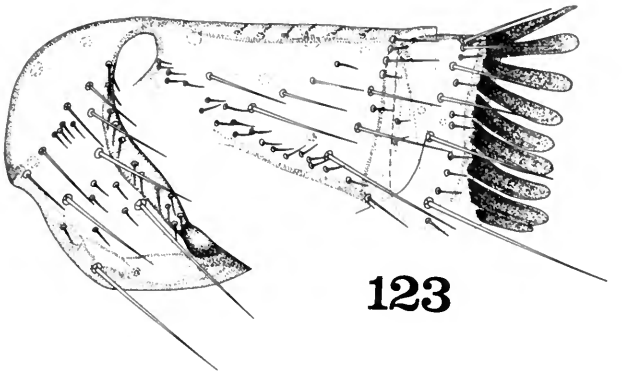
   St. IX of male broader apically and lacking the heavy, curved seta; movable process not as above; female st. VII and spermatheca not as above.....3

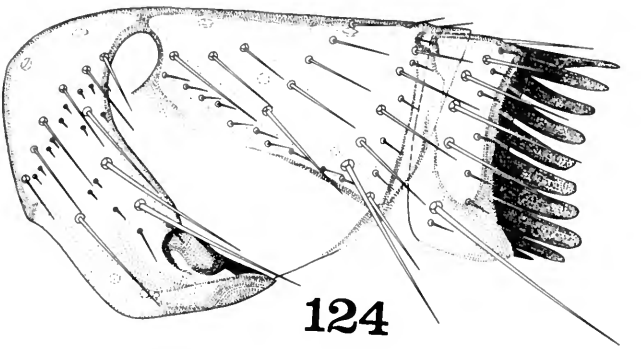
3. Movable process of male clasper twice as long as broad at its widest point, bearing four straight or slightly curved, spiniform setae; basal abdominal sternite of female with one small lateral seta per side in addition to the marginal pair in most specimens; bulga of spermatheca at least twice as long as broad, rectangular, its ventral margin slightly concave. . .*schelkovnikovi* (p. 72)

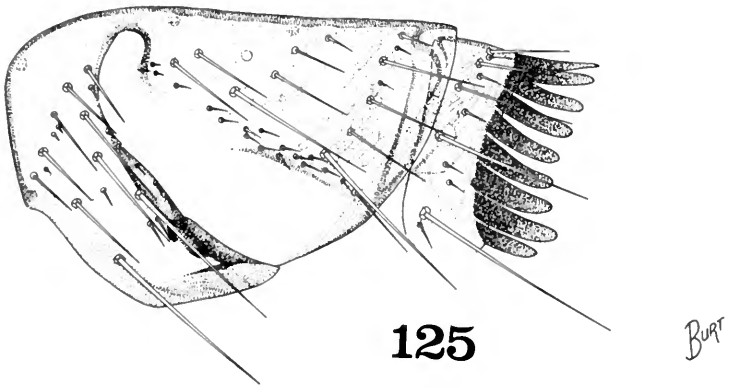
   Movable process of male clasper not much longer than broad, its apical portion almost square and bearing three spiniform setae of which the distalmost forms a distinct angle near its middle; basal abdominal sternite of female lacking lateral setae; st. VII of female with a shallow but distinct sinus in margin; bulga of spermatheca less than twice as long as wide, more oval in shape. *montium* (p. 74)

4. Distal arm of st. IX of male strongly tapered and bearing a strong apical bristle; movable process of clasper club-shaped; margin of st. VII of female lacking a lobe or incision.....5

   Distal arm of st. IX of male gradually tapering apically, lacking strong apical bristle; movable process hamate, with two heavy, spiniform setae on caudal margin; caudal margin of st. VII of female with a distinct triangular lobe; spermatheca subovate, its ventral margin concave.....*rossica* (p. 70)







FIGS. 123–125. Male heads. **123.** *Amphipsylla montium* Jordan; **124.** *A. rossica* Wagner; **125.** *A. montana* Argyropulo.

5. Movable process of male clasper with distinct angle in caudal margin, bearing a single blunt, submarginal, spiniform seta on inner surface; caudal margin of female st. VII smoothly and evenly rounded; bulga of spermatheca oval, its ventral margin only slightly concave ..... *montana* (p. 70)

Movable process of male clasper smoothly rounded, lacking caudal angle, its single submarginal, spiniform seta pointed; caudal margin of female st. VII less strongly rounded, more straight; bulga of spermatheca subovate, its ventral margin more concave ..... *parthiana* (p. 72)

Amphipsylla rossica Wagner, 1912. Figures 124, 131, 140, 142.

Amphipsylla rossica Wagner, 1912, Rev. Russe Entomol., **12**, p. 576, fig. 3.

This widespread species has been recorded by Ioff *et al.* (1965) from Czechoslovakia, north to Leningrad and Arkhangel'sk, east to the Tien Shan Mountains in Sinkiang Province of China and the Altai, and west to the Kopet Dag and Caucasus. It has also been collected in Turkey (Lewis and Lewis, 1965), Iran (Klein, 1963), and higher elevations in the Lebanon Mountains (Lewis, *unpublished data*). Although *Microtus arvalis* is thought to be the true host over much of the known range of this species, the Lebanese collections were taken from *Apodemus sylvaticus, Microtus guentheri,* and *M. nivalis.*

In Afghanistan, *M. arvalis* was only taken from the Shibar Pass locality, but it doubtless occurs elsewhere in the northeastern portion of the country as relict alpine populations. *A. rossica,* therefore, is probably a much more common faunal element of the country than present records indicate.

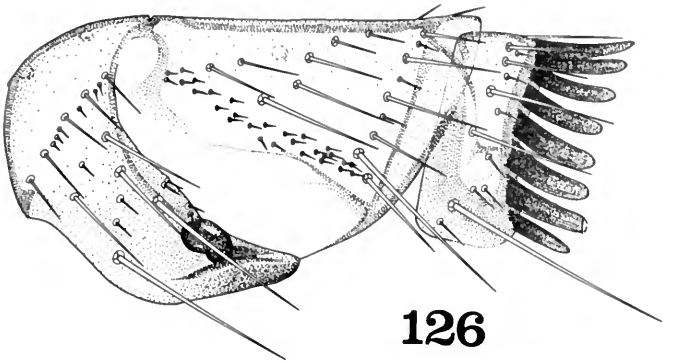
Material collected.—

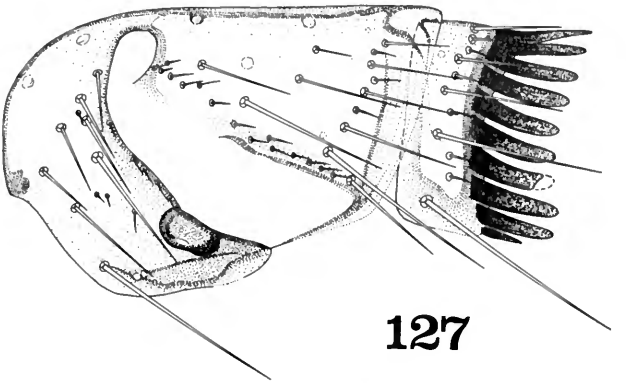
Shibar Pass, July 30, 1965, from *Microtus arvalis,* 10 males and 19 females.

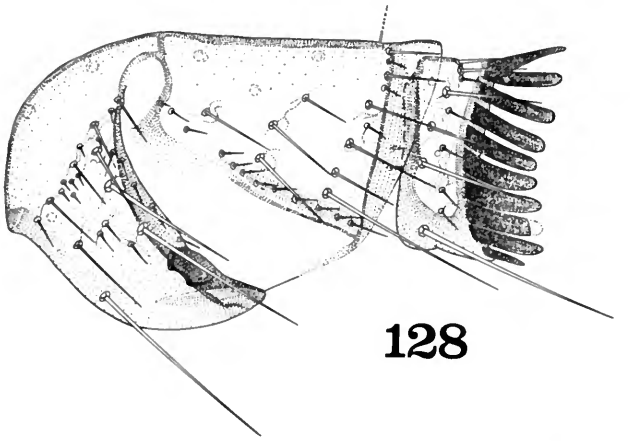
Amphipsylla montana Argyropulo, 1946. Figures 125, 132, 139, 143.

Amphipsylla montana Argyropulo, 1946, Med. Parazitol. Moskva, **15**, p. 90.

This species has been reported from the Fergana Basin of Kirgiziya and the Ishkashim (=Ishkamish) Region and Gissarskiy Mountains of Tadzhikistan by Ioff *et al.* (1965). Because of our brief stay at Ishkamish (which is on the Afghanistan side of the Amu Darya River, not in Tadzhikistan), we were unable to collect as thoroughly as we wished. No specimens of *Alticola roylei,* apparently the true host of this flea, were taken during our visit, although the proper habitat was certainly present.







FIGS. 126–128. Male heads. **126.** *Amphipsylla parthiana* Ioff; **127.** *A. schelkovnikovi* Wagner; **128.** *A. anceps* Wagner.

Our collection from the environs of Shibar Pass extends the range of this species well into Afghanistan, but sheds little further light on its status in the country.

Material collected.—

Shibar Pass, 14.5 km. W Summit, July 31, 1965, from *Alticola roylei*, 3 males and 7 females.

Shombul, 12 km. W Shibar Pass, July 27, 1965, from *Alticola roylei*, 9 males and 11 females; from *Calomyscus bailwardi*, 1 female.

Amphipsylla parthiana Ioff, 1950. Figures 126, 134, 138, 145.

Amphipsylla parthiana Ioff, 1950, Med. Parazitol., Moskva, **19**, p. 271.

To date this species has only been treated in the Russian literature, and both Ioff and Scalon (1954) and Ioff *et al.* (1965) indicate that it is known only from the Kopet Dag Range on the Turkmenian-Iranian border. Our records establish its presence in the Paropamisus and Hindu Kush Ranges, and the record from Ishkamish suggests that *A. parthiana* probably occurs in the Pamirs of Southern Tadzhikistan as well.

Within its known range, this flea has been recorded from *Microtus socialis* in the Kopet Dag, while most of our records are from the closely related *Microtus afghanus*. The range of the latter species does not include the Pamirs and, if *A. parthiana* occurs there, it is likely a parasite of *M. juldashi*. Its occurence on *M. arvalis* at the Shibar Pass is probably accidental since colonies of *M. arvalis* and *M. afghanus* were contiguous. *A. rossica* was the most common amphipsyllid flea on *M. arvalis*.

Material collected.—

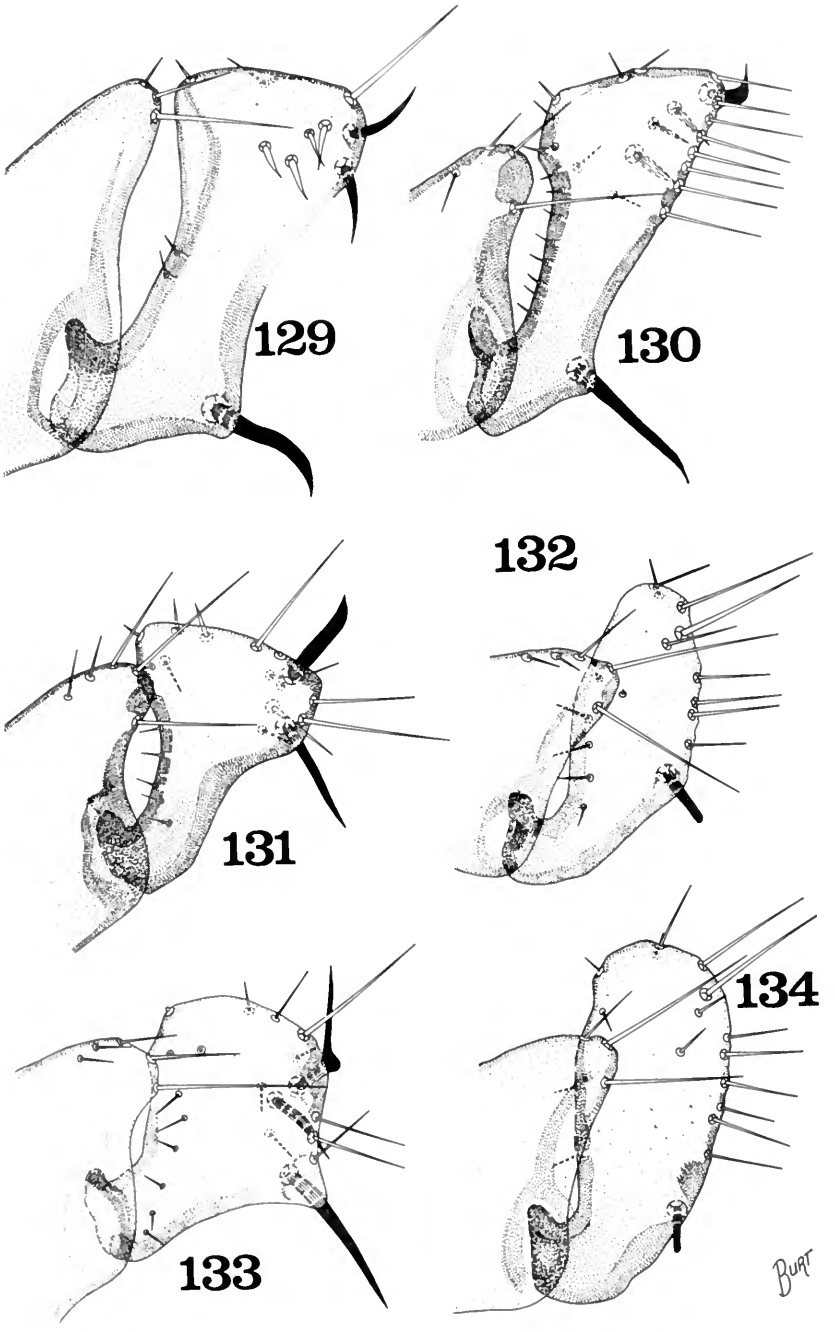
Ishkamish, 24 km. E, August 15, 1965, from *Cricetulus migratorius*, 1 male.

Sauzak Pass, September 22, 1965, from *Microtus afghanus*, 1 male and 2 females.

Shibar Pass, July 25–30, 1965, from *Microtus afghanus* and nests, 11 males and 13 females; from *Microtus arvalis*, 2 males and 6 females.

Amphipsylla schelkovnikovi Wagner, 1909. Figures 127, 129, 136, 146.

FIGS. 129–134. Male claspers. **129.** *Amphipsylla schelkovnikovi* Wagner; **130.** *A. anceps* Wagner; **131.** *A. rossica* Wagner; **132.** *A. montana* Argyropulo; **133.** *A. montium* Jordan; **134.** *A. parthiana* Ioff.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Amphipsylla schelkovnikovi Wagner, 1909, Bull. Mus. Caucase, 4, pp. 195, 197, 200, 201, fig. 2.

The subspecific status of this species is confusing. Three subspecies have been described: the nominate form from the Caucasus (Armenia, Azerbaydzhan, and Dagestan); *A. s. irana* from Iran and Middle Asia (Ashkhabad, Samarkand, Frunze, Ustyurt, and the environs of the Aral Sea); and *A. s. certa* from the Tien Shan Range to Central and Western Kazakhstan. Klein (1963) synonymized *A. s. irana* on the basis of his inability to distinguish his Iranian collections from the nominate form. After examining some of Klein's material, I am quite in agreement that, at least the specimens I have seen, more nearly resemble the nominate subspecies. Our collections from Western Afghanistan, however, agree very well with illustrations of the modified segments of the male of *A. s. irana* in Ioff *et al.* (1965, fig. 370, O). Until additional collections from the area can be examined, I prefer to honor Klein's synonymy with the observation that *A. s. irana* Ioff, 1940, may be a valid taxon and represent a southern population in the over-all range of the species.

This species is thought to have *Cricetulus migratorius* as its true host, but this specificity is borne out neither by Klein's records from *Mus, Rattus, Microtus, Meriones,* and *Vulpes* species nor by ours from *Vulpes* and *Ochotona.* Probably the species prefers Migratory Hamsters, but can exist on a number of rodent hosts.

Material collected.—

Herat, 90 km. E, September 22, 1965, from *Vulpes vulpes,* 1 male.

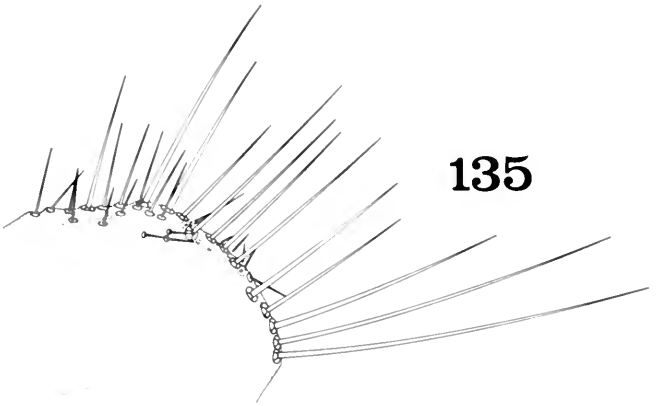
Sauzak Pass, September 22, 1965, from *Ochotona rufescens,* 6 males and 8 females.

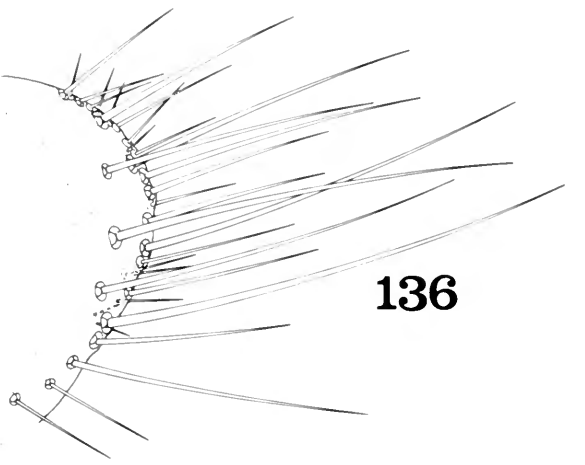
Amphipsylla montium Jordan, 1944. Figures 123, 133, 135, 141.

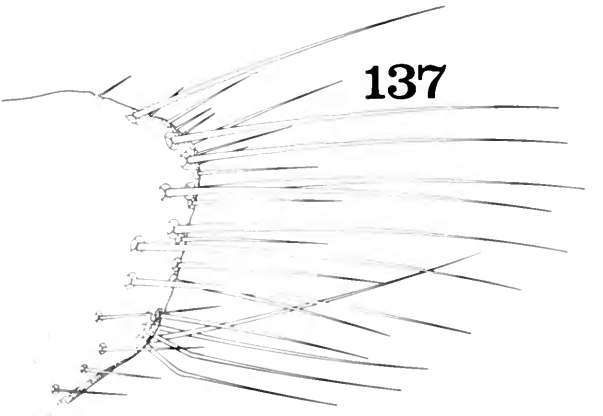
Amphipsylla montium Jordan, 1944, Proc. Zool. Soc. London, Part III, **114**, p. 365.

This species was described from four females from *Calomyscus bailwardi* collected in the Paghman Mountains west of Kabul. The male remained unknown until Peus (1966) described it from material from the same locality and host. The allotype male was deposited in the collection at Tring.

Our records confirm that this flea is almost exclusively a parasite of the Mouse-like Hamster, *Calomyscus bailwardi,* and extend its known range both north and south of the type locality. The host species, however, was collected in a number of additional localities







FIGS. 135–137. Male st. VIII. **135.** *Amphipsylla montium* Jordan; **136.** *A. schelkovnikovi* Wagner; **137.** *A. anceps* Wagner.

where it had fleas of other species. It seems clear that this flea is restricted to a relatively small area in the Hindu Kush and Koh-i-Baba Ranges in the environs of Kabul.

Material collected.—

Paghman, July 14–18, 1965, from *Calomyscus bailwardi*, 8 males and 18 females; from *Rattus rattoides*, 1 male.

Shibar Pass, 14.5 km. W of Summit, July 31, 1965, from *Calomyscus bailwardi*, 3 males and 2 females.

Shombul, 12 km. W Shibar Pass, July 26, 27, 1965, from *Calomyscus bailwardi*, 1 male and 2 females.

Tang-i-Garu, Kabul/Jalalabad Road, March 12, 1965, from *Calomyscus bailwardi*, 5 males and 4 females, *leg.* E. Kullmann.

Amphipsylla anceps Wagner, 1930. Figures 128, 130, 137, 144.

Amphipsylla anceps Wagner, 1930, Konowia, **9**, p. 280.

Ioff *et al.* (1965) record this species from the Pamir and Gissarskiy Mountains of Tadzhikistan, the Tien Shan Mountains of Kirgiziya and north-central Sinkiang, the Altai Mountains of Western Mongolia, the Tarbagatay Mountains in extreme Eastern Kazakhstan, and Szechwan in the Chinese Peoples Republic. They further state, and our records confirm, that *A. anceps* is a parasite of the Migratory Hamster, *Cricetulus migratorius*. It is evidently a species of higher altitudes, being unrecorded from its true host at lower elevations where *C. migratorius* is equally common.

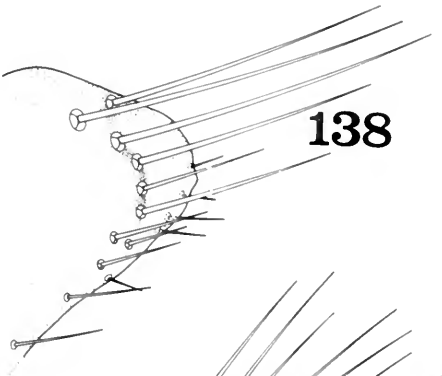
In Afghanistan, *A. anceps* seems limited to the mountains of the northeastern portion of the Hindu Kush. *Cricetulus migratorius* occurs elsewhere in the country, but, with the exception of the single (probably accidental) occurrence of *A. parthiana* near Ishkamish, it is not known to play host to other species of this genus.

Material collected.—

Ishkamish and environs, August 15–18, 1965, from *Cricetulus migratorius*, 3 males and 7 females; from *Apodemus sylvaticus*, 1 male.

Shibar Pass, July 25, 1965, from *Cricetulus migratorius* and nest, 2 males and 4 females; from *Microtus afghanus* nest, 1 male.

FIGS. 138–146. Male st. VIII. **138.** *A. parthiana* Ioff; **139.** *A. montana* Argyropulo; **140.** *A. rossica* Wagner. Female spermathecae. **141.** *A. montium* Jordan; **142.** *A. rossica* Wagner; **143.** *A. montana* Argyropulo; **144.** *A. anceps* Wagner; **145.** *A. parthiana* Ioff; **146.** *A. schelkovnikovi* Wagner.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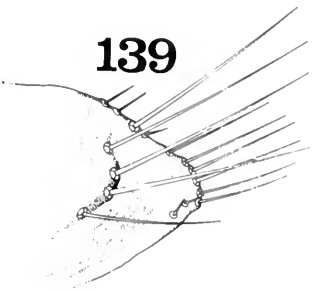
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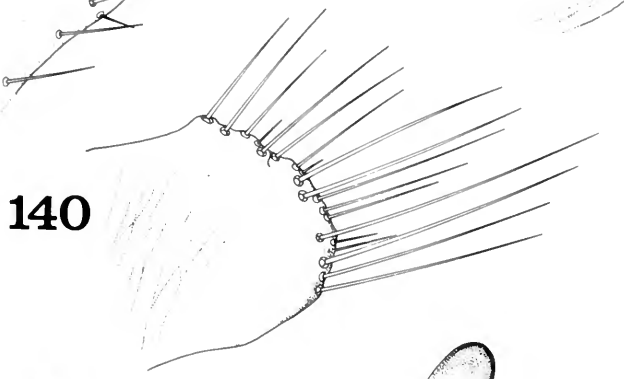
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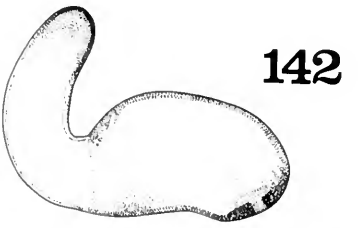
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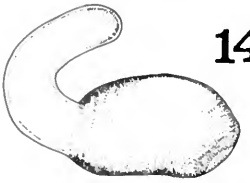
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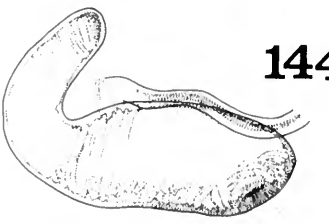
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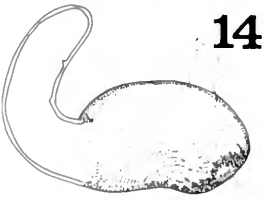
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Shombul, 12 km. W Shibar Pass, July 27, 1965, from *Cricetulus migratorius*, 4 males and 2 females.

FRONTOPSYLLA Wagner and Ioff

Frontopsylla. Wagner and Ioff, 1926, Rev. Microbiol. Epidemiol., **5**, p. 84.

Type species.—*Ceratophyllus elatus* Jordan and Rothschild, 1915.

This is a large genus of fleas that are mainly ectoparasites of small rodents in the Palaearctic, although a few species parasitize birds nesting on cliff faces or in burrows. Most of the species occur in Asia, and Russian workers have divided the genus into four subgenera. Members of three of these were either collected by the expedition personnel or have been reported from Afghanistan in the literature (Peus, 1966). For the benefit of those not having access to the Russian literature, following is a key to the subgenera adapted from Ioff and Scalon (1954). The subgenus *Mafrontia* is not represented in Afghanistan.

1. Pronotal ctenidium of more than 28 spines; parasites of birds. *Orfrontia* (p. 86)

   Pronotal ctenidium of fewer than 26 spines: usually fewer than 24; parasites of various small rodents. 2

2. Apical spinelets of metanotum much heavier and broader than those of the abdominal tergites; eye large and dark; (not reported from Afghanistan but possibly occurring there). . . . . *Mafrontia*

   Apical spinelets of metanotum similar in size and shape to those of the abdominal tergites; eye not unusually large and dark. 3

3. Movable process lacking setae and spiniform setae at ventrocaudal angle; body of clasper short; st. VIII of male broad; spermatheca with terminal orifice, without a conspicuous division between hilla and bulga.

   Frontopsylla s. str. (p. 78)

   Movable process with setae and spiniform setae at ventrocaudal angle; body of clasper longer and narrower; st. VIII of male with small ventral sinus; spermatheca with subventral orifice; hilla distinct from bulga.

   Profrontia (p. 82)

Subgenus Frontopsylla s. str. Wagner and Ioff

Frontopsylla. Wagner and Ioff, 1949, Ectoparazity, **1**, p. 55.

Members of this subgenus are parasites of pikas (*Ochotona*), ground squirrels, voles, and jerboas. They show little host speci-

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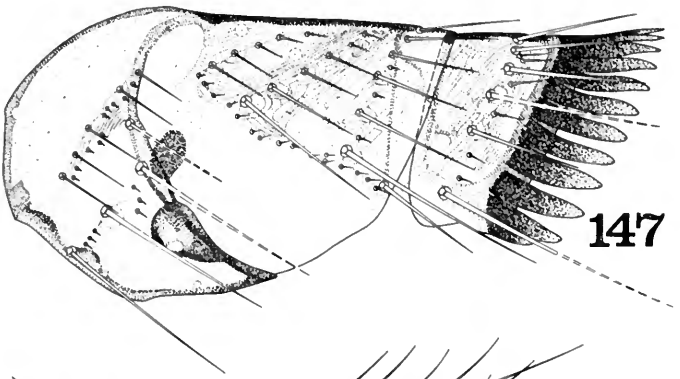
FIGS. 147–152. *Frontopsylla elatoides elatoides* Wagner. (Note: these illustrations were made from specimens presumed to belong to the nominate subspecies. See text for discussion of the occurrence of this taxon in Afghanistan.) **147.** Male head; **148.** Apex of male st. IX; **149.** Male st. VIII; **150.** Male clasper; **151.** Female spermatheca; **152.** Female st. VII.



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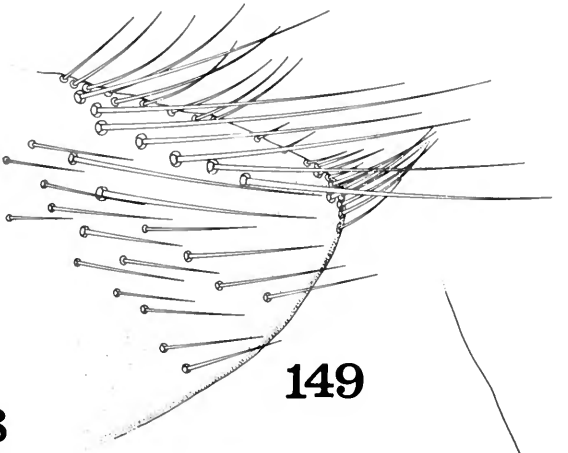

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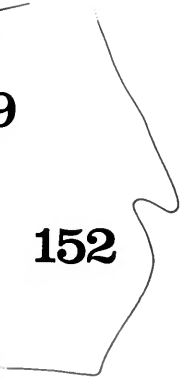

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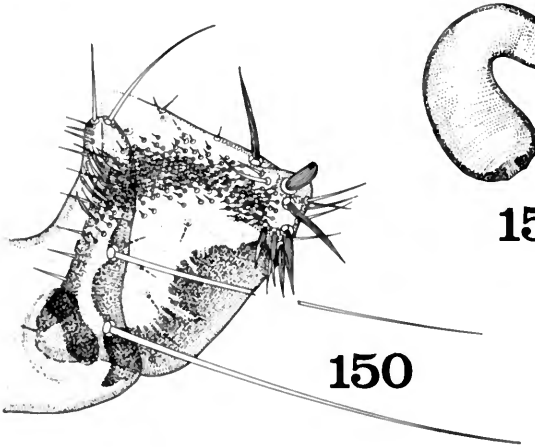

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ficity and are rather broadly distributed throughout Asia, some species being divided into a number of subspecies. One species belonging here has been reported from Northern India and Southern China. The two species reported from Afghanistan may be separated by the following key.

1. Caudoventral margin of movable process of clasper strongly ventricose; ventral margin of proximal portion of distal arm of male st. IX deeply incised; caudal margin of female st. VII with a conspicuous broad lobe, subtended by a deep, open sinus ..... *mutata* (p. 80)

   Caudoventral margin of movable process of clasper not ventricose, almost straight; ventral margin of proximal portion of distal arm of male st. IX with only a shallow incision; caudal margin of female st. VII variable but if lobed the lobe is small and triangular and subtended by a narrow sinus. *elatoides* (p. 80)

Frontopsylla (Frontopsylla) elatoides Wagner, 1928. Figures 147–152.

Frontopsylla elatoides Wagner, 1928, Annu. Mus. Zool. Acad. St. Petersb., **30**, p. 31, figs. 11, 12.

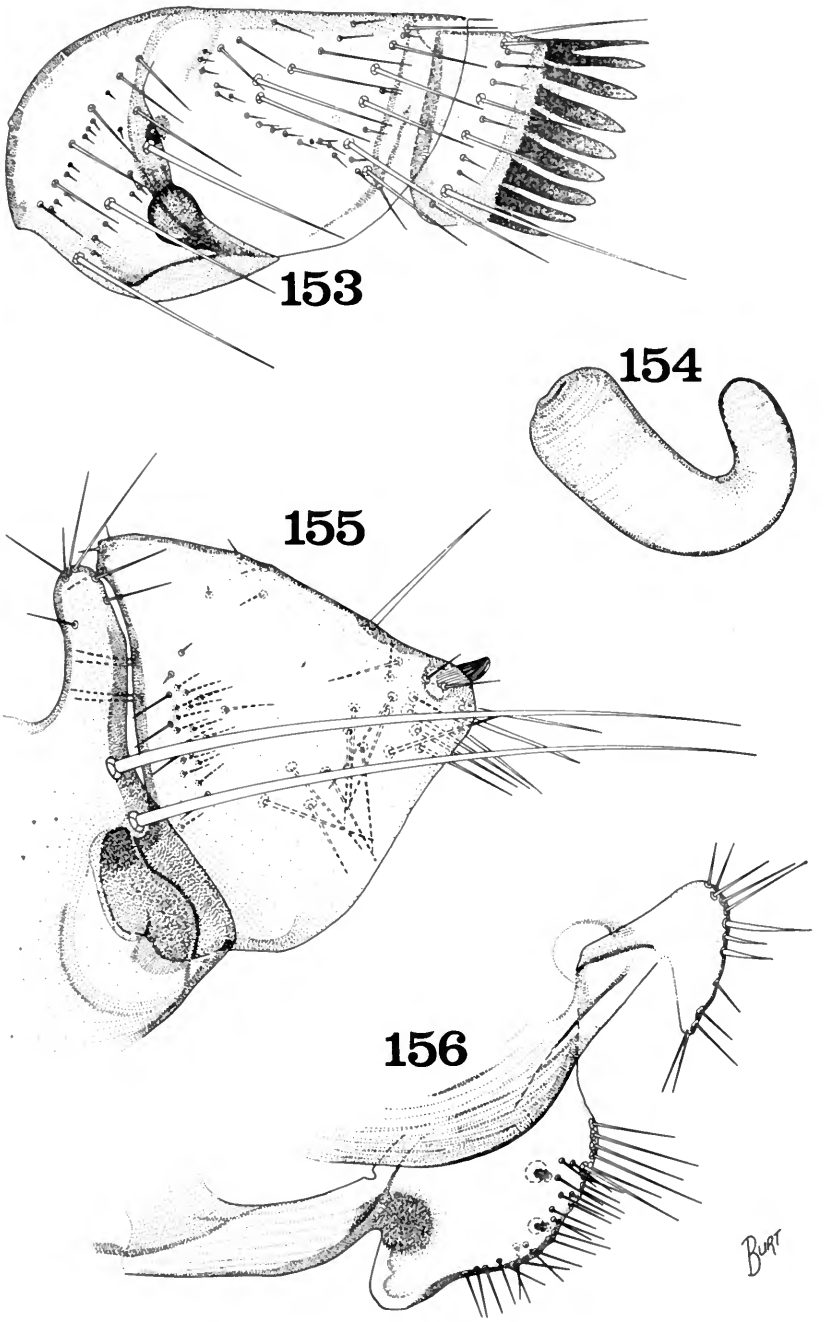
This species has been reported once from Afghanistan from a single female taken on *Cricetulus migratorius*, Unai Pass, 2,800 m., April, 29, 1965, G. and J. Niethammer (Peus, 1966).

Ioff *et al.* (1965) state that this species is mainly a parasite of *Citellus undulatus* but that it also transfers to other rodent hosts. This ground squirrel does not occur in Afghanistan; indeed, the western limit of its range is considerably to the north and east (Ognev, 1947), as are all the published records for this species. Both Ioff *et al.* (1965) and Ioff and Scalon (1954) indicate that "The females of related species of *Frontopsylla* (*hetera, elatoides, elata,* [*luculenta*]) can in some cases only be accurately identified on the accompanying males." In view of the remoteness of known records of this flea and the absence of what seems to be its preferred host, it seems unlikely that this single female is *F. elatoides*. At least further collecting efforts are required to definitely establish the presence of the species in Afghanistan.

Frontopsylla (Frontopsylla) mutata Jordan, 1944. Figures 153–156.

Frontopsylla mutata Jordan, 1944, Proc. Zool. Soc. London, Part III, **114**, p. 362.

Originally described from Shibar Pass from *Ochotona rufescens* and *Mustela* species, Peus (1966) also reports one pair from *Cricetulus*



FIGS. 153–156. *Frontopsylla* (*Frontopsylla*) *mutata* Jordan. **153.** Male head; **154.** Female spermatheca; **155.** Male clasper; **156.** Apex of male st. IX.

migratorius, Unai Pass, 2,800 m., April 30, 1965, collected by G. and J. Niethammer. Russian workers have placed *F. mutata* as a subspecies of *F. elata* but Peus (1966) reillustrated the male genitalia, and, on the basis of conspicuous differences in the chaetotaxy of the clasper and st. IX, restored it to full species status.

Our collections, combined with those of Kullmann, indicate that the species is widespread in the mountainous areas of Afghanistan, mainly as a parasite of *Ochotona rufescens*. Records from other hosts doubtless reflect co-occupancy of the habitat. Even on their preferred host, infestation was low, usually being one or two fleas per animal.

Material collected.—

Bamiyan, 5 km. W, July 28, 1965, from *Meriones persicus*, 1 female.

Band-i-Amir, October 2, 1963, from *Ochotona rufescens*, 1 female, *leg.* E. Kullmann.

Dasht-i-Nawar, South Pass, September 5, 1963, from *Ochotona rufescens*, 2 males and 1 female, *leg.* E. Kullmann.

Dumandi Pass, May 5, 1964, from *Ochotona rufescens*, 2 females, *leg.* E. Kullmann.

Paghman, March 22, 1965, from *Apodemus sylvaticus*, 1 female, *leg.* E. Kullmann.

Sauzak Pass, September 22, 1965, from *Cricetulus migratorius*, 7 males and 8 females.

Shibar Pass, July 24–30, 1965, from *Ochotona rufescens*, 2 males and 8 females; from *Vulpes vulpes*, 1 female.

Shombul, 12 km. W Shibar Pass, July 24–28, 1965, from *Ochotona rufescens*, 8 males and 7 females; from *Rattus rattoides*, 1 male.

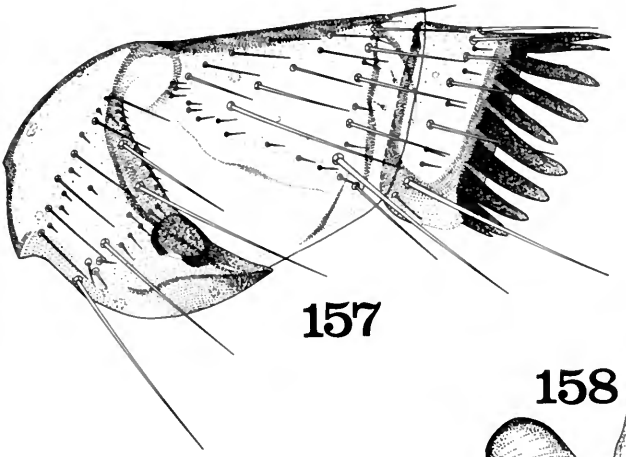
Unai Pass, October 2, 1963, from *Ochotona rufescens*, 1 female, *leg.* E. Kullmann.

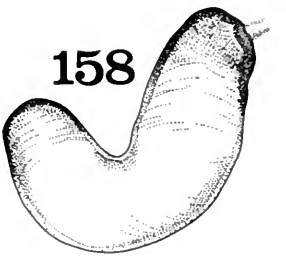
Subgenus **Profrontia** Ioff

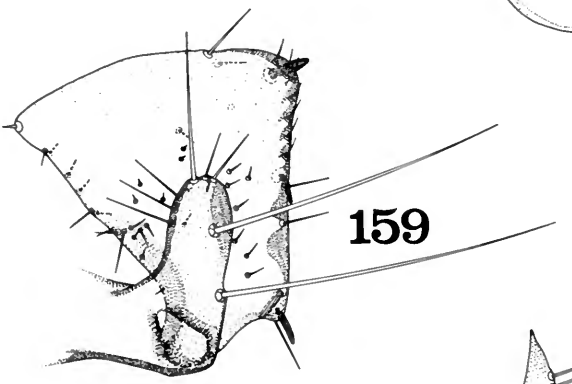
Profrontia. Ioff, 1949, Ectoparazity, 1, p. 61.

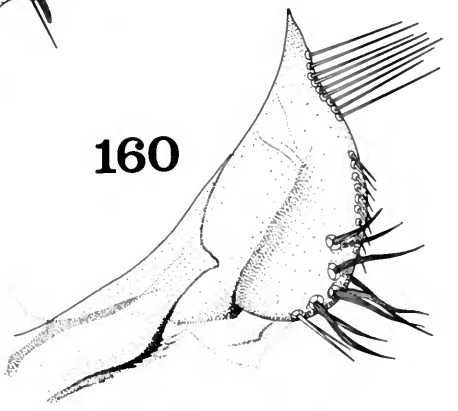
Species belonging to this subgenus are mainly parasites of murine rodents although, as our records indicate, they tend to be rather promiscuous in host selection. The two species reported from Afghanistan may be separated by the following key.

1. Caudoventral angle of movable process of clasper hooked, forming an acute angle; height of fixed process of clasper hardly more than half the length of









FIGS. 157–160. *Frontopsylla* (*Profrontia*) *ambigua* Fedina. **157.** Male head; **158.** Female spermatheca; **159.** Male clasper; **160.** Apex of male st. IX.

movable process; caudal margin of male st. VIII not incised ventrally, heavily setose apically; dorsal end of female bursa copulatrix globular; caudal margin of st. VII with a bluntly pointed lobe.....*ambigua* (p. 84)

Caudoventral angle of movable process of clasper not hooked or forming an acute angle; height of fixed process of clasper about two-thirds the length of movable process; caudal margin of male st. VII incised ventrally, sparsely setose apically; dorsal end of female bursa copulatrix not globular; caudal margin of st. VII with less pronounced lobe.....*ornata* (p. 86)

Frontopsylla (Profrontia) ambigua Fedina, 1946. Figures 157–160.

Frontopsylla (Profrontia) ambigua Fedina, 1946, Med. Parazitol., Moskva, **15**, p. 89.

Frontopsylla ambigua has been reported from Kazakstan, Kirgiziya, Tadzhikistan, and Szechwan in the Chinese Peoples Republic according to Ioff *et al.* (1965), who list it as a parasite of *Rattus rattoides turkestanicus* and *Sorex*. Ioff and Scalon (1954) state that this and related species, *F. protera* and *F. ornata*, are parasites of small mountain rodents, such as voles and woodmice.

In Afghanistan, this species seems to be widespread in the mountainous regions, occurring on a number of different small mammals, but showing a distinct preference for *Rattus rattoides* and *Apodemus sylvaticus*. These animals abound in the stone terrace walls and foundations of stone buildings, such as mills, and in such habitats, they were invariably infested with this species of flea.

Material collected.—

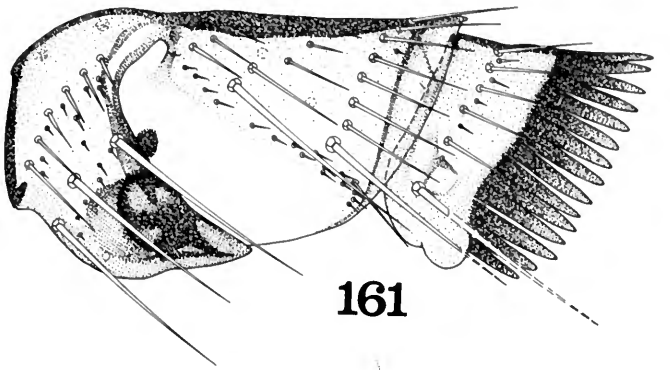
Ishkamish and environs, August 15–18, 1965, from *Apodemus sylvaticus*, 4 males and 3 females; from *Crocidura russula*, 2 females; from *Rattus rattoides*, 5 females.

Paghman and environs, July 12–18, 1965, from *Crocidura russula*, 3 females; from *Calomyscus bailwardi*, 1 female; from *Apodemus sylvaticus*, 4 males and 1 female; from *Rattus rattoides*, 3 males and 14 females.

Sauzak Pass, September 22, 1965, from *Apodemus sylvaticus*, 1 male and 1 female.

Shibar Pass, July 30, 1965, from *Microtus arvalis*, 1 male and 6 females.

FIGS. 161–165. *Frontopsylla (Orfrontia) frontalis alatau* Fedina. **161.** Male head; **162.** Female spermatheca; **163.** Female st. VII; **164.** Apex of male st. IX; **165.** Male clasper.



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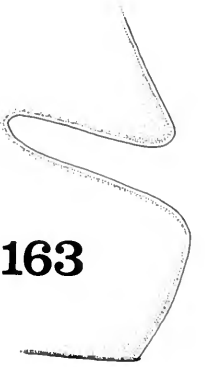

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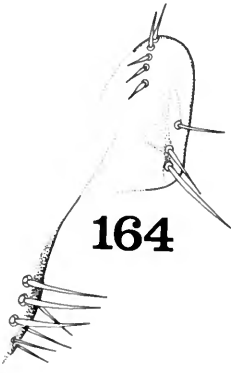

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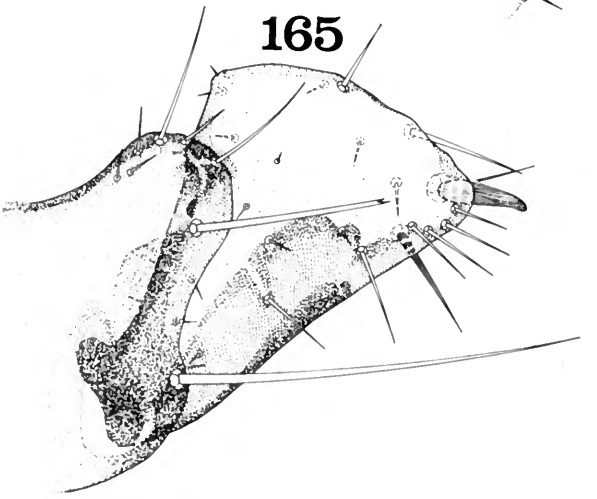

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Shombul, 12 km. W Shibar Pass, July 26, 27, 1965, from *Calomyscus bailwardi*, 1 male; from *Rattus rattoides*, 10 males and 8 females.

Frontopsylla (Profrontia) ornata Tiflov, 1937. Figures 166–170.

Frontopsylla ornata Tiflov, 1937, Trudy Kazakh. Fil. Akad. Nauk SSSR, Moskva and Leningrad, **2**, p. 196, figs. 3, 4, 5.

Although this species was not taken during the Street Expedition, it has since been reported by Peus (1966) from four females from *Cricetulus migratorius* and *Apodemus sylvaticus* collected at Unai Pass, Salang Pass, and Paghman. Unfortunately, no males were taken and, in view of the eastern Asian distribution recorded for the species (Tien Shan, Kirgiziya, Kazakhstan, and Szechwan in the Chinese Peoples Republic) by Ioff and Scalon (1954) and Ioff *et al.* (1965), further collections are needed to definitely establish the presence of this species in Afghanistan.

Subgenus **Orfrontia** Ioff

Orfrontia. Ioff, 1949, Ectoparazity, **1**, p. 50.

Species belonging to this subgenus are parasites of birds. According to Ioff and Scalon (1954), representatives occur from Central Europe to Transbaikalia. One group of species parasitizes swallows and house martins, while another group is found on birds that nest in burrows and rock crevices. Additional collecting is likely to turn up other members of this subgenus in Afghanistan, but only one has been reported to date.

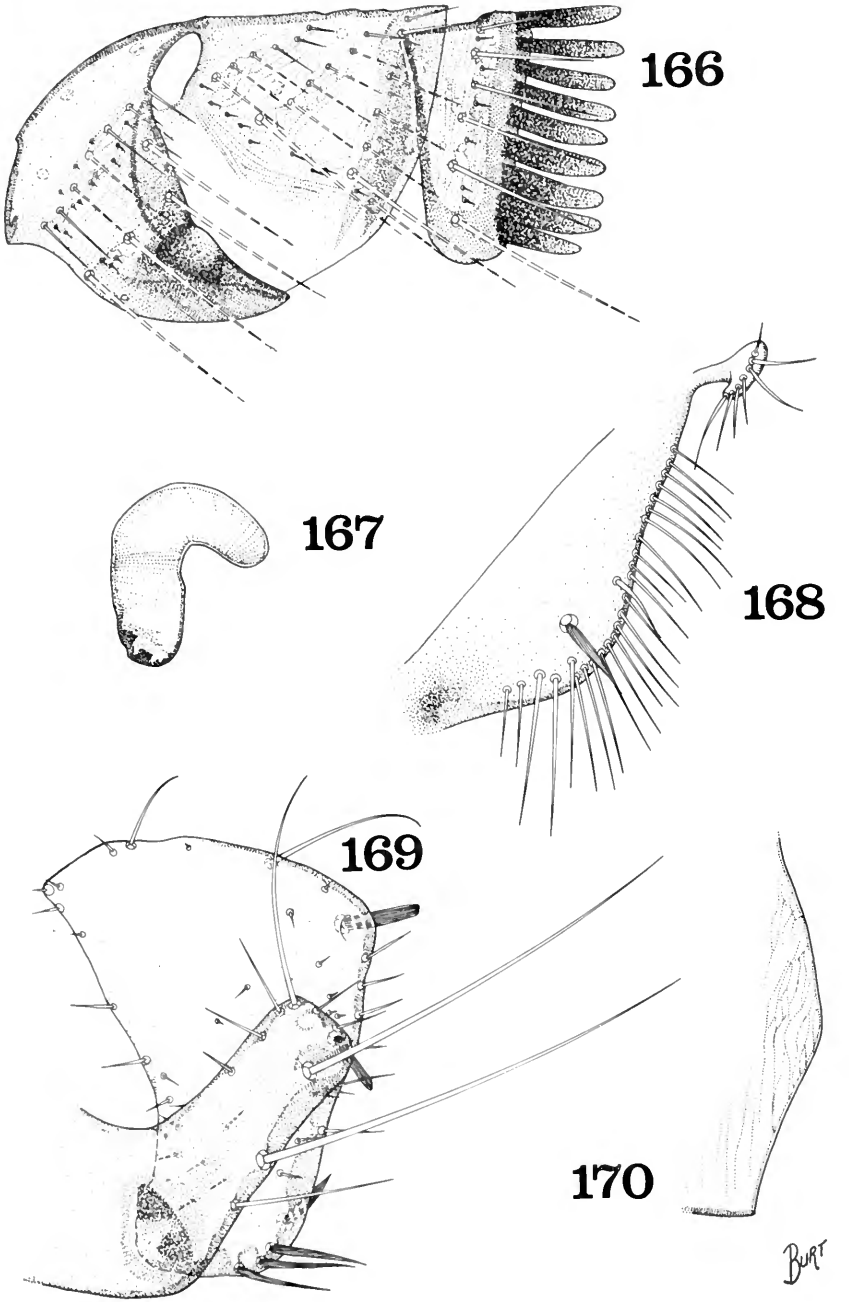
Frontopsylla (Orfrontia) frontalis alatau Fedina, 1946. Figures 161–165.

Frontopsylla (Orfrontia) frontalis alatau Fedina, 1946, Med. Parazitol., Moskva, **15**, p. 89.

This is another species not collected by the Street Expedition. It is reported by Peus (1966) from three males and two females collected at Unai Pass, 2,800 m., from *Montifringilla theresae*, April 29, 1965, G. and J. Niethammer.

Frontopsylla frontalis alatau is one of five presently recognized subspecies that occur from Central Europe to Transbaikalia as ectoparasites of various birds. This subspecies has been reported from Soviet Armenia and Azerbaidjan east to Szechwan in the Chinese Peoples Republic.

Our knowledge of bird fleas and their general distribution is considerably less advanced than for other fleas, and doubtless, further



FIGS. 166–170. *Frontopsylla* (*Profrontia*) *ornata* Tiflov. **166.** Male head; **167.** Female spermatheca; **168.** Apex of male st. IX; **169.** Male clasper; **170.** Female st. VII.

collecting in Afghanistan will establish *Frontopsylla frontalis alatau* as a common member of the fauna.

CTENOPHYLLUS Wagner

Ctenophyllus. Wagner, 1927, Konowia, **6**, p. 108.

Type species.—Ceratophyllus armatus Wagner, 1901.

This small genus of 13 species and subspecies is Holarctic in distribution as parasites of pikas (*Ochotona*). *Ctenophyllus armatus terribilis* (Rothschild) has a broad distribution in western North America. *C. ashcrafti* is known from northern California and Colorado. The remaining 11 species are found in Asia where appropriate habitat for pikas occurs.

The genus has been divided into four subgenera as follows:

Ctenophyllus s. str.	*Ochotonobius*	*Conothobius*	*Geusibia*
a. armatus	*bondari*	*conothoae*	*ashcrafti*
a. terribilis	*hirticrus*	*orientalis*	*torosa*
			triangularis
rigidus	*rufescens*		
subarmatus			
tarasovi			

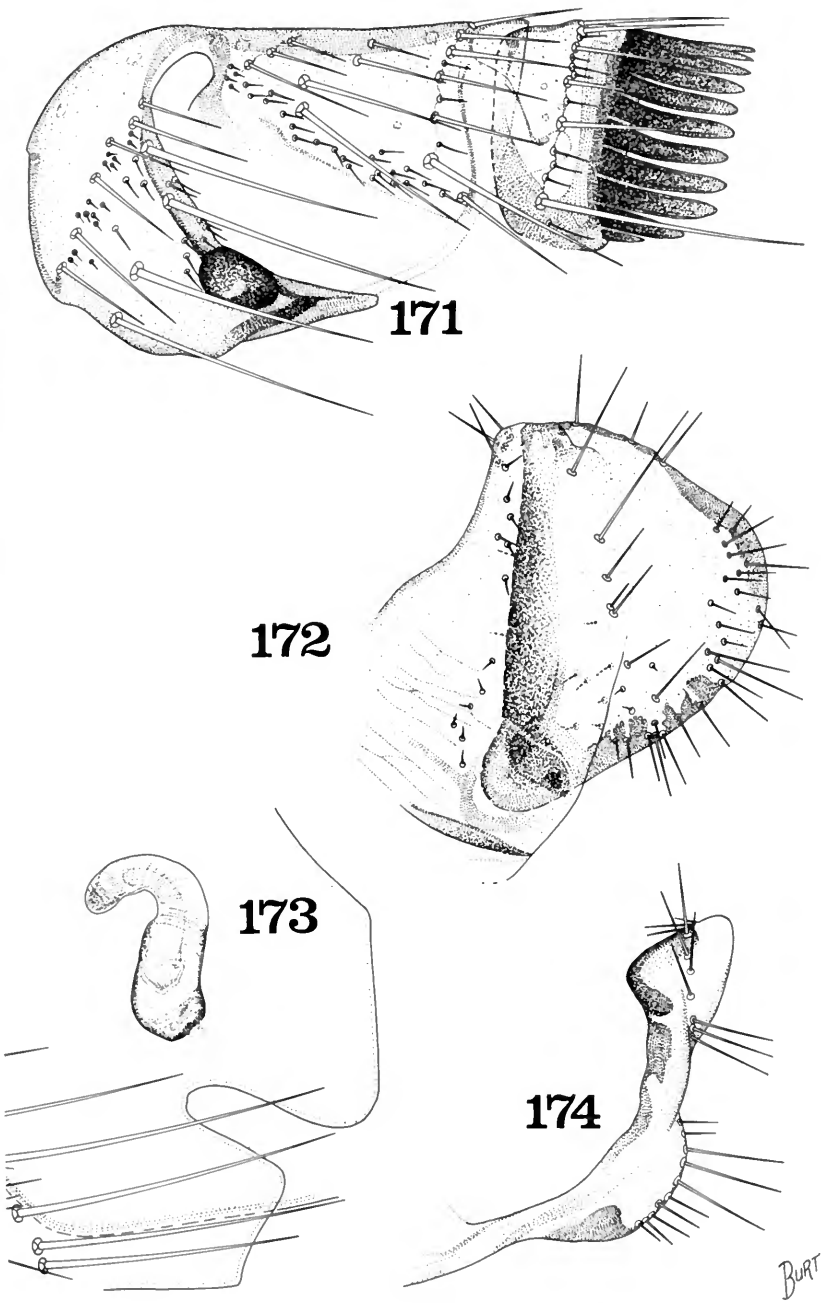
Although only *C. rufescens* was taken by the expedition, it is likely that an additional species may occur in the northeastern highlands or in the Wakhan region on other species of pikas.

Ctenophyllus (Ochotonobius) rufescens Ioff, 1946. Figures 171–174.

Ctenophyllus rufescens Ioff, 1946, Med. Parazitol., Moskva, **15**, p. 89.

Ioff *et al.* report this species only from the Kopet Dag Range in Southwestern Turkmeniya, as mainly a parasite of *Ochotona rufescens*. They also list collections from *Meriones persicus* and *Calomyscus bailwardi*, but these are probably accidental associations since all three hosts tend to occupy the same type of habitat.

Ochotona rufescens is a common mammal of the central mountains of Afghanistan, extending westward through the Paropamisus Mountains into the eastern Elburz Mountains in Iran. Although many of these animals were collected, none was parasitized by *Ctenophyllus rufescens*. All our specimens were collected by Dr. Kullmann. His collections were made in May and early June, and it is likely that these fleas do not occur as adults during the summer, being replaced by *Callopsylla tiflovi* and *Frontopsylla mutata*. In any



FIGS. 171–174. *Ctenophyllus* (*Ochotonobius*) *rufescens* Ioff. **171.** Male head; **172.** Male clasper; **173.** Female st. VII and spermatheca; **174.** Apex of male st. IX.

event, this species is certain to be of more common occurrence than our records suggest.

Material collected.—

Dasht-i-Nawar, June 20, 1963, from *Ochotona rufescens*, 1 male and 2 females, *leg.* E. Kullmann.

Dumandi Pass, May 5, 1964, from *Ochotona rufescens*, 12 males and 11 females, *leg.* E. Kullmann.

PARADOXOPSYLLUS Miyajima and Koidsumi

Paradoxopsyllus. Miyajima and Koidsumi, 1909, J. Bacteriol., (Japan), **1909**, p. 40.

Members of this genus are exclusively Palaearctic in distribution, being known from Transcaucasia to Japan. Most of the species occur in Central Asia and China south to the Himalaya Mountains. There are 18 described species. All are parasites of small rodents, and they seem more commonly encountered as adults during the winter months.

A single species of this genus was collected during the expedition, and it was one of the rarest fleas encountered. Records from adjacent Pakistan, Russia, and Nepal suggest that there are additional species to be found in Afghanistan, and its rarity in our collections may indicate that collections were made at the wrong season.

Paradoxopsyllus macrophthalmus Ioff, 1946. Figures 179–183.

Paradoxopsyllus macrophthalmus Ioff, 1946, Med. Parazitol., Moskva, **15**, p. 88.

Some of the Central Asian species of this genus are so similar that, without comparative material, positive identifications are exceedingly difficult. The three specimens from Afghanistan are, with some reservations, tentatively referred to this species. The single male differs from the illustration of *P. macrophthalmus* in Ioff *et al.* (1965) in that the movable process is more acuminate apically, and its apex extends farther beyond the apex of the fixed process. In one female, the caudal lobe of st. VII above the incision is broken off on both sides, and its original shape cannot be ascertained. In the other female, the upper lobe of st. VII is present and strongly pointed as in the illustration, but the sinus is V-shaped and open so

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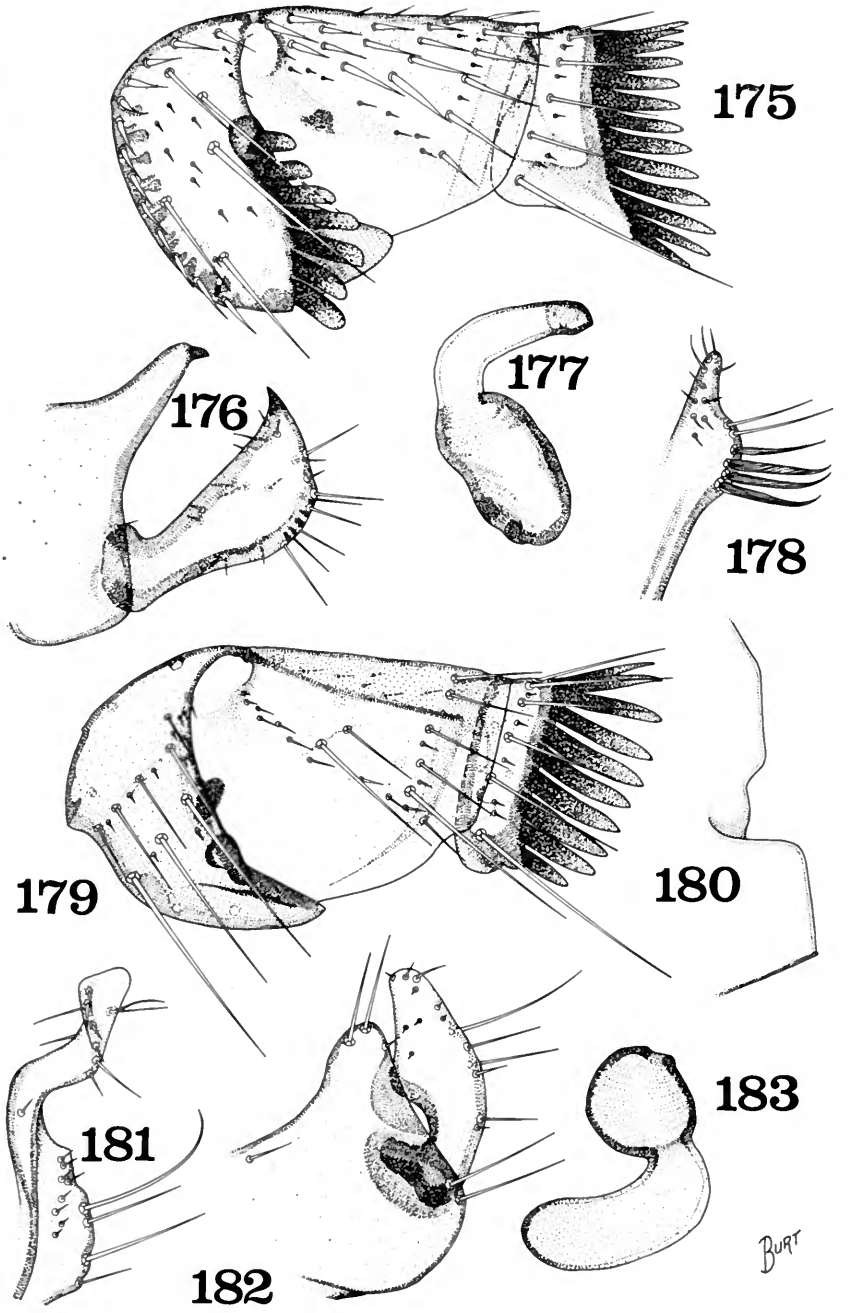
FIGS. 175–183. *Leptopsylla (Pectinoctenus) pamirensis* Ioff. **175.** Male head; **176.** Male clasper; **177.** Female spermatheca; **178.** Apex of male st. IX. *Paradoxopsyllus macrophthalmus* Ioff. **179.** Male head; **180.** Female st. VII; **181.** Apex of male st. IX; **182.** Male clasper; **183.** Female spermatheca.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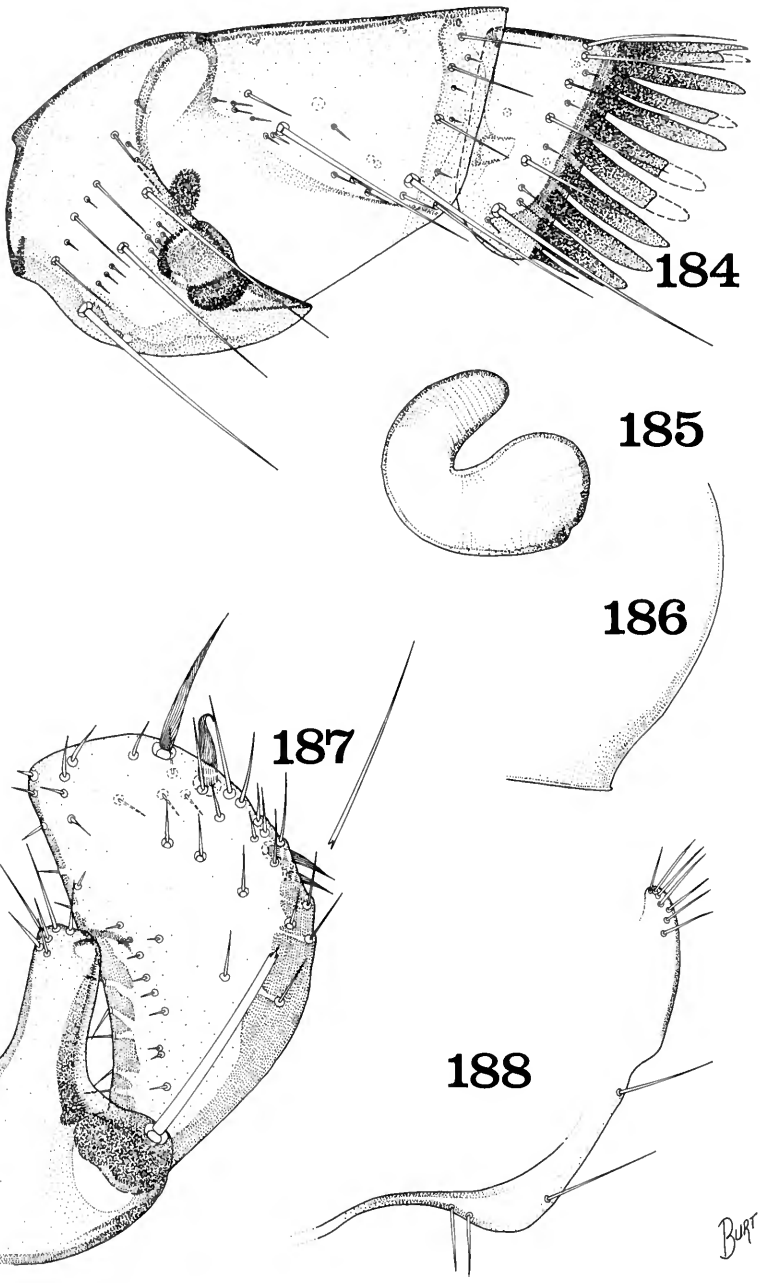


FIGS. 184–188. *Ophthalmopsylla Ophthalmopsylla volgensis volgensis* (Wagner and Ioff. **184.** Male head; **185.** Female spermatheca; **186.** Female st. VII; **187.** Male clasper; **188.** Apex of male st. IX.

that no part of the ventral margin of the upper lobe touches the dorsal margin of the lower lobe.

Ioff *et al.* (1965) record this species from the Kopet Dag Mountains, the Caucasus, and various localities in Central and Eastern Iran. It is said to be a parasite of *Calomyscus bailwardi* and *Meriones persicus*.

Material collected.—

Ghazni, 30 km. N W, October 7, 1965, from *Calomyscus bailwardi*, 1 female.

Sauzak Pass, September 22, 1965, from *Calomyscus bailwardi*, 1 female.

Shombul, 12 km. W Shibar Pass, July 27, 1965, from *Alticola roylei*, 1 male.

OPHTHALMOPSYLLA Wagner and Ioff

Ophthalmopsylla. Wagner and Ioff, 1926, Rev. Microbiol. Epidemiol., **5**, p. 88.

Type species.—*Ophthalmopsylla volgensis* Wagner and Ioff, 1926.

This is another genus of exclusively Palaearctic distribution. There are nine described species. Two of these are represented by a number of subspecies (*praefecta* with four and *volgensis* with 10), and the range of *O. volgensis* subspecies extends from Eastern Turkey and Northern Saudi Arabia to at least Western Mongolia. Desert rodents, especially jerboas, seem the preferred hosts of members of this genus, and personal experience suggests that they are only common as adults during the colder months. Collection records also suggest that the ratio of males to females is extremely low. Whether this is actually true or simply a reflection of some behavioral idiosyncrasy of the males is not known.

Ophthalmopsylla (Ophthalmopsylla) volgensis volgensis (Wagner and Ioff, 1926). Figures 184–188.

Ceratophyllus (*Ophthalmopsylla*) *volgensis* Wagner and Ioff, 1926, Rev. Microbiol., Saratov, **5**, pp. 88, 121, fig. W, pl. II, fig. 7.

This is the nominate form of 10 presently recognized subspecies, which range from the foothills of the Caucasus east to Mongolia and China and south into the Arabian Peninsula. All are typically parasites of jerboas (*Jaculus, Allactaga*), but, as our records demonstrate, they occur not infrequently on other rodents and their predators.

Subspecies of this species are practically impossible to separate in the female. Our single male is more similar to the nominate

subspecies, although it shows minor variations from the norm in the shape of the clasper and st. IX. Klein (1963) records *O.* (*O.*) *v. arnoldi* Wagner and Argyropulo, 1934, from three localities in Western Iran, but no records are yet available for the eastern part of the country, although the species is certain to exist there.

Material collected.—

Bamiyan and environs, July 31, 1963, from *Allactaga williamsi*, 4 females, *leg.* E. Kullmann; July 28, 1965, from *Meriones persicus*, 1 female.

Gardez, 4 km. S, October 9, 1965, from *Ellobius fuscocapillus*, 1 female.

Kabul, 25 km. S W, March 28, 1965, from *Meriones persicus*, 2 females, *leg.* E. Kullmann.

Shibar Pass, July 30, 1965, from *Vulpes vulpes*, 1 female.

Shombul, 12 km. W Shibar Pass, July 27, 1965, from *Meriones persicus*, 1 male.

PHAENOPSYLLA Jordan

Phaenopsylla. Jordan, 1944, Proc. Zool. Soc. London, Part III, **114**, p. 362.

Type species.—*Phaenopsylla mustersi* Jordan, 1944.

This unusual genus was described from three males and two females collected in the Paghman Mountains west of Kabul on *Calomyscus bailwardi* by the late J. L. Chaworth-Musters. Two additional species, *P. kopetdag* Ioff, 1946 and *P. tiflovi* Ioff, 1950, have since been described from the Kopet Dag Mountains of Southwestern Turkmeniya, and two more are described here.

All members of this genus seem specific ectoparasites of the Mouse-like Hamster, none having been reported from any other host. This rodent has a relatively restricted range and is known only from Southern Transcaucasia, the Elburz Mountains of Iran east and south to the mountains of Afghanistan, and Baluchistan (Ellerman and Morrison-Scott, 1951). In Afghanistan, its main ectoparasite is *Amphipsylla montium* Jordan, 1944.

Following is a key to males of the three species of *Phaenopsylla* known from Afghanistan. Of the Afghan species, the female is known only for *P. mustersi* Jordan, 1944. The new species are more closely related to each other than to any species described previously.

1. Acetabular projection of fixed process blunt, truncated apically; subapical large seta on dorsocaudal margin of movable process arising as near or nearer to the paired spiniforms than to the apex of the process 2

Acetabular projection of fixed process more pointed apically; subapical large seta on dorsocaudal margin of movable process arising nearer to the apex than to the paired spiniforms of the process..... *mustersi* (p. 95)

2. Apex of movable process broad, smoothly rounded; dorsocaudal margin only slightly concave subapically..... *hopkinsi* n. sp. (p. 98)

Apex of movable process tapered to a blunt point; dorsocaudal margin distinctly concave subapically..... *jordani* n. sp. (p. 95)

Phaenopsylla mustersi Jordan, 1944. Figures 189, 192, 193.

Phaenopsylla mustersi Jordan, 1944, Proc. Zool. Soc., London, Part III, **114**, p. 363.

At the outset of the expedition, it was anticipated that it would be possible to collect a number of these interesting fleas from the type locality at Paghman. Though a large number of *Calomyscus* was collected from many different localities, only four specimens of *Phaenopsylla* were taken; two males of *mustersi* and two other males of two new species. Either members of this genus are exceedingly rare, or we were collecting during the wrong time of the year.

Phaenopsylla mustersi is only known from the Paghman Mountains about 15 km. west of Kabul.

Material collected.—

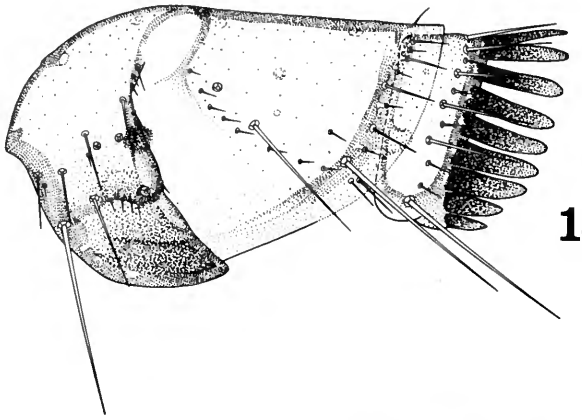
Paghman, July 15–18, 1965, from *Calomyscus bailwardi*, 2 males.

Phaenopsylla jordani new species. Figures 190, 194, 195.

Diagnosis.—Closest to the following new species from which it differs in the following characters: a) fewer small setae on the preantennal region of the head; b) four pseudosetae under the mesonotal collar rather than six; c) apex of movable process tapering to a blunt, squared point; d) dorsocaudal margin of movable process distinctly concave; e) subapical, long seta of movable process heavy, borne on a pronounced hump.

Description.—HEAD, MALE (fig. 190): Frontal tubercle present but not pronounced. Frontal row of four weak bristles, the strongest arising near the antennal groove. Ocular row of three long bristles and three intercalaries. Eye absent. Cephalic margin of antennal groove bearing eight or nine small setae in addition to those mentioned above. Postantennal portion of head with one long and six short setae along margin of antennal groove and five main setae per side in occipital row. Maxillary palpi of four long segments, extending to apex of trochanter.

THORAX: Pronotum with six main setae per side plus intercalaries and 17 spines in the comb, including one minute spine on one side. Mesonotum with five long setae in main row plus intercalaries, preceded by an irregular row of five to seven much smaller bristles. Four pseudosetae under the mesonotal collar, all near the upper third of segment. Metanotum with five long setae in main row and two



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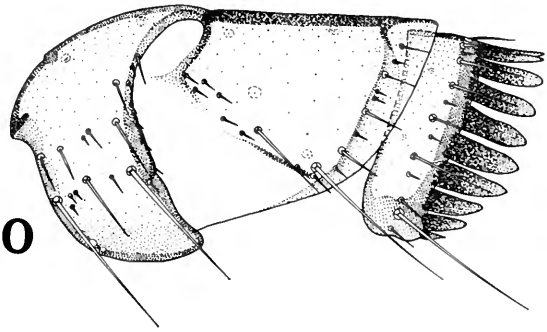

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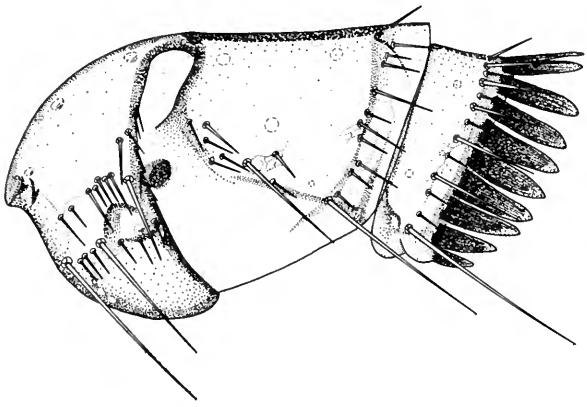

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FIGS. 189–191. Male heads. **189.** *Phaenopsylla mustersi* Jordan; **190.** *P. jordani* Lewis, holotype; **191.** *P. hopkinsi* Lewis, holotype.

marginal spinelets per side. There is also an anterior row of seven smaller bristles. Mesepisternum with one or two setae; mesepimeron with four or five setae per side. Lateral metanotal area with one or two small setae. Metepisternum with one seta; metepimeron with six or seven setae arranged in three rows of 2/3, 3, 1 bristles each.

LEGS: Outer surface of procoxae with about 20 submarginal bristles arranged in four or five irregular rows. Outer surface of forefemur with about seven small, submarginal setae. Inner surface with one small seta remote from margin. Hind margin of foretibia bearing five subapical notches, each with a pair of stout setae. Foretarsal segments I to IV about equal in length. Foretarsal segment V with five pairs of lateral and one pair of subapical plantar bristles. Outer surface of midcoxa with one long seta arising on its apex. Inner surface with about 10 setae along apical two-thirds of cephalic margin. Outer surface of midfemur with a ventral, submarginal row of four small setae. Inner surface with one small seta remote from ventral margin. Midtibia with six subapical notches in caudal margin bearing single or paired heavy setae. Midtarsal segment I slightly shorter than II and III combined. Segment IV shortest. Segment V with five pairs of lateral and one pair of ventral plantar bristles. Hindcoxa with about 11 setae distributed along the apical two-thirds of the cephalic margin. Inner surface with one minute bristle near apex. Hindfemur with two small setae near base remote from margin and two more in about the same position on inner surface. Hindtibia with six subapical notches in caudal margin, each bearing one or a pair of heavy setae. Longest apical seta extending about to apex of hindtarsal segment I, segment I almost as long as segments II through IV combined. Longest apical bristle extending to apex of segment II. Longest apical bristle of segment II extending to apex of segment IV, segment V with five pairs of lateral and one pair of ventral plantar setae.

UNMODIFIED ABDOMINAL SEGMENTS: Abdominal tergites I through VII with a main row of setae numbering 5, 6, 6, 5/6, 6/5, 5, and 5 and tergal spinelets numbering 1, 1, and 1. Basal abdominal sternite with one minute lateral seta in addition to ventral pair. Sternites III through VII with three setae each per side. Sternite VIII incised ventrally, its ventral, caudal, and caudodorsal margin fringed with a compound row of small, fine setae, interrupted irregularly by longer, stronger bristles.

MODIFIED ABDOMINAL SEGMENTS (figs. 194, 195): Fixed process of clasper oval, its dorsal projection extending slightly beyond the cephalomedian incrassation of the movable process, its acetabular lobe bluntly pointed apically, bearing two setae dorsally. Movable process triangular, its cephalic margin forming a slight angle, its apex tapering to a blunt, squared point, its dorsal margin distinctly concave. Chaetotaxy as illustrated in Figure 194. Proximal portion of distal arm of st. IX bearing two large, feather-like setae. Apex of st. IX curved outward, rimmed by a row of subspiniform bristles. Aedeagal crochet triangular, its apex slightly deflected downward.

Type material.— Holotype male (L-7660) from *Calomyscus bailwardi*, Shombul, 12 km. W Shibar Pass, Afghanistan, 2,400 m., July 27, 1965, *leg.* R. E. Lewis.

This species is named in honor of the late Dr. Karl Jordan of the British Museum (Natural History), Tring, England.

Phaenopsylla hopkinsi new species. Figures 191, 196, 197.

Diagnosis.—Closest to *P. jordani* from which it differs in the following characters: a) numerous small setae on the preantennal region of the head; b) six pseudosetae under the mesonotal collar; c) apex of movable process tapering to a rounded point; d) dorsocaudal margin of movable process straight; e) subapical, long seta of movable process weak, not borne on a pronounced hump.

Description.—HEAD, MALE (fig. 191): Frontal tubercle present but not pronounced. Frontal row of five bristles, the strongest arising near the antennal groove and with an additional weak bristle directly above it. Ocular row of three long bristles plus three or four intercalaries. Eye absent. Cephalic margin of antennal groove bearing seven or eight small setae in addition to those mentioned above. Postantennal portion of head with one long, two intermediate, and seven short setae along margin of antennal groove and seven main setae per side in occipital row. Maxillary palpi of four long segments, extending to apex of trochanter. Labial palpi of five segments, also extending to apex of trochanter.

THORAX: Pronotum with six setae per side in main row plus intercalaries and 18 spines in the comb. Mesonotum with five long setae in main row plus intercalaries, preceded by an irregular row of five smaller bristles. Six pseudosetae under the mesonotal collar, the lowermost arising well below the middle of the segment on both sides and separated from its dorsal neighbor by a wide space. Metanotum with five to six long setae in main row plus intercalaries, preceded by a row of three shorter bristles. With two marginal spinelets per side. Mesepisternum with one or two setae; mesepimeron with five setae per side. Lateral metanotal area with one or two setae. Metepisternum with one long seta; metepimeron with six or seven long setae arranged in three rows of 2/3, 3, 1 bristles each.

LEGS: Outer surface of forecoxae with about 25 submarginal bristles arranged in six or seven irregular rows. Outer surface of forefemur with nine or 10 small, submarginal setae arranged in three uneven rows. Inner surface with one small seta remote from margin on proximal one-third. Hind margin of foretibia with five subapical notches, each with a pair of stout setae. Longest apical seta of foretibia extending about to apex of foretarsal segment II. Foretarsal segment V with five pairs of lateral and one pair of subapical plantar bristles. Midcoxae with chaetotaxy restricted to about 11 submarginal setae arranged along the cephalic margin of the apical two-thirds. Midfemur with two small submarginal setae on outer surface and one on inner surface. Caudal margin of midtibia with six subapical notches bearing one or a pair of heavy setae. Longest apical seta of midtibia extending almost to apex of midtarsal segment II. Midtarsal segment

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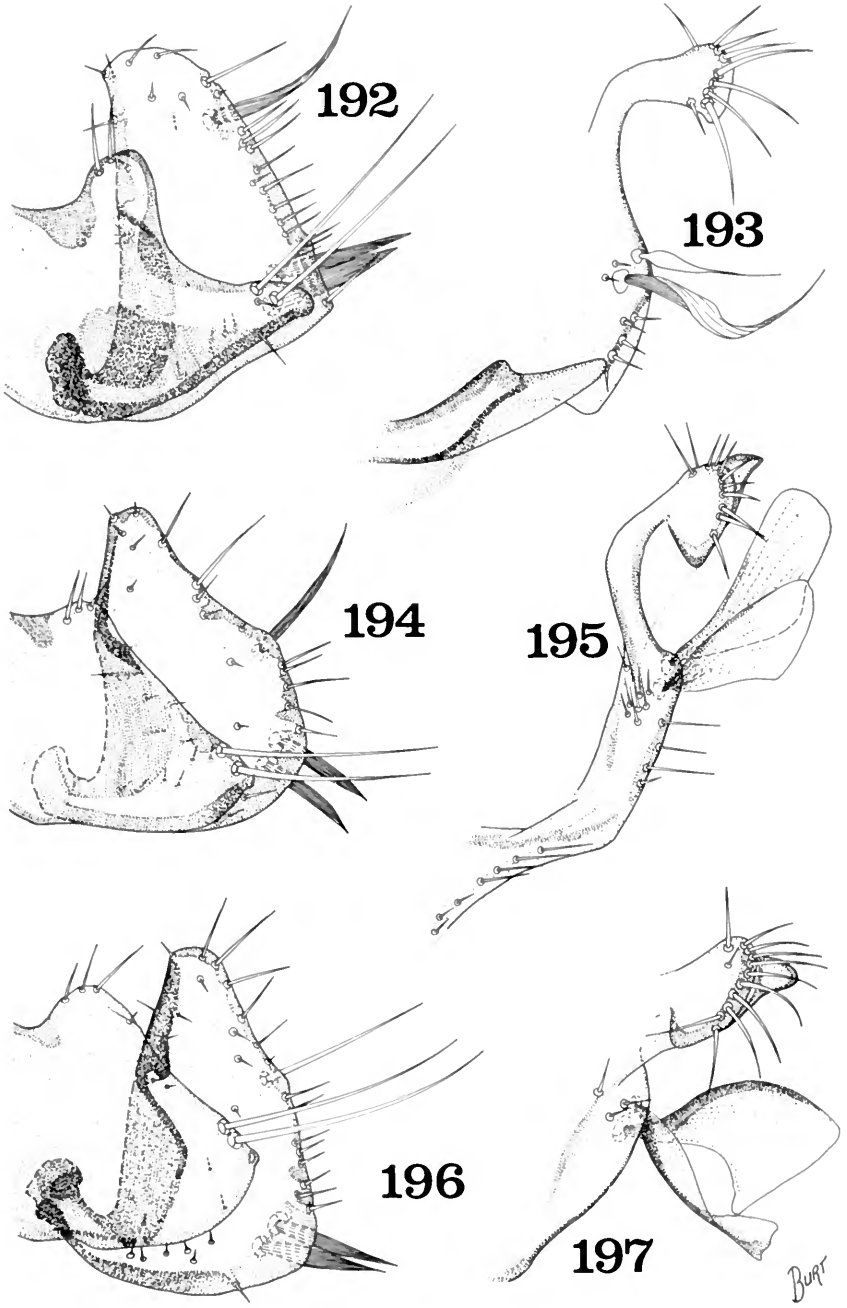
FIGS. 192–197. *Phaenopsylla mustersi* Jordan. **192.** Male clasper; **193.** Apex of male st. IX. *Phaenopsylla jordani* Lewis. **194.** Clasper of holotype male; **195.** Apex of st. IX of holotype male. *Phaenopsylla hopkinsi* Lewis. **196.** Clasper of holotype male; **197.** Apex of st. IX of holotype male.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V with five pairs of lateral and one pair of subapical plantar bristles. Hindcoxal chaetotaxy restricted to about 11 submarginal bristles along the margin and apex of apical two-thirds on outer surface and two weak, submarginal setae on inner surface of apical one-third. Chaetotaxy of hindfemur restricted to a row of four weak bristles near ventral margin on outer surface and an irregular row of three on inner surface. Hindtibia with six subapical notches in caudal margin bearing one or a pair of stout setae. Longest apical seta of hindtibia barely reaching apex of hindtarsal segment I. Hindtarsal segment I as long as segments II through IV combined. Longest apical seta of segment I extending to apex at segment II. Longest apical bristle of segment II extending to apex of segment IV. Segment V with five pairs of lateral and one pair of subapical plantar bristles.

UNMODIFIED ABDOMINAL SEGMENTS: Abdominal tergites I through VII with a main row of setae numbering 6, 7, 6, 6, 5/6, 6/5, and 5 and tergal spinelets numbering 1, 1, and 1 per side. Basal abdominal sternite with one or two minute lateral setae in addition to ventral pair. Sternites III through VII with three long setae per side. Sternite VIII incised ventrally, its ventral, caudal, and dorsal margins lined with a row of small, fine setae, interrupted irregularly by longer, stronger bristles.

MODIFIED ABDOMINAL SEGMENTS (figs. 196, 197): Fixed process of clasper conical, its dorsal projection hardly set off from margin, extending to about midway between the cephalomedian incrassation of the movable process and its apex. Acetabular lobe of fixed process with strongly ventricose ventral margin which is smoothly rounded, its dorsal margin only slightly concave and bearing two acetabular setae subapically. Movable process subovate, its caudal margin practically straight, its apex tapering to a smoothly rounded point, its dorsal margin only slightly concave. Chaetotaxy as illustrated in Figure 196. Proximal portion of distal arm of st. IX with two large feather-like setae. Apex of st. IX curved outward, rimmed by a row of long, subspiniform bristles. Aedeagal crochet beak-like, its apex deflected downward.

Type material.—Holotype male (L-7788) from *Calomyscus bailwardi*, 8 km. S Kamdesh, Afghanistan, 2,135 m., October 17, 1965, *leg.* J. Hassinger.

This species is named in honor of the late Mr. G. H. E. Hopkins whose efforts have contributed so much to our knowledge of the order Siphonaptera.

Subfamily MESOPSYLLINAE Wagner

Mesopsyllinae. Wagner, 1939, *Aphaniptera*, in Bronn's Klassen Ordn. Tierr., **5**, Abt. 3, Buch XIII, Teil f, p. 87.

This small subfamily includes three genera, *Acropsylla*, *Caenopsylla*, and *Mesopsylla*, restricted to the Palaearctic and portions of the Oriental Regions. The species are mostly parasites of small rodents, though one species of *Caenopsylla* appears to be a parasite of *Vulpes* and *Felis* species.

Members of these genera collected in Afghanistan may be separated by the following key.

1. Eye deeply emarginated ventrally; preantennal portion of head with three complete rows of bristles; postantennal portion of head with three complete rows of bristles including occipital row; parasites of murine rodents.
Acropsylla (p. 104)

Eye well developed, heavily pigmented but not emarginate ventrally; fewer than three complete rows of preantennal bristles; postantennal rows of bristles incomplete, the first row absent or containing only one seta 2

2. Spines of the genal comb divergent, not in contact along apical half of their common margin; five pairs of lateral plantar bristles, none of which is displaced onto the plantar surface; parasites of foxes and wildcats.
Caenopsylla (p. 101)

Spines of the genal comb parallel, their common margins in contact to apex; five pairs of lateral plantar bristles of which the first (proximal) is strongly displaced onto the plantar surface, arising distad of the bases of the second pair . . . . . *Mesopsylla* (p. 103)

CAENOPSYLLA Rothschild

Caenopsylla. Rothschild, 1909, Novit. Zool., **16**, p. 65.

Type species.—*Caenopsylla mira* Rothschild, 1909.

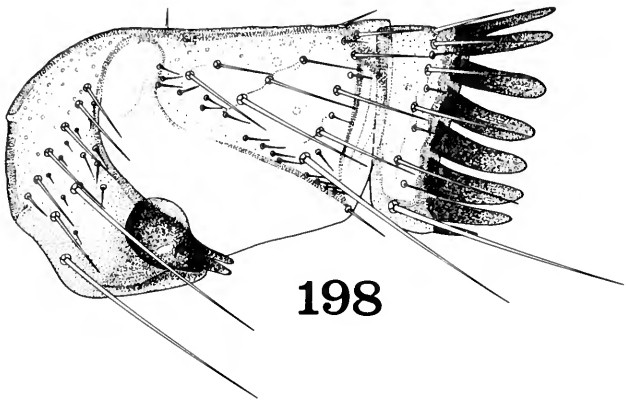
This small genus is known from only three species, two from western North Africa and one from Southwestern Asia. Members of the genus are characterized by the presence of a well-developed eye, two spines in the genal comb, and false combs of setae on the tibiae. In many respects, the species are similar to members of the genus *Ctenophyllus*, though our knowledge of generic affinities in this family leaves much to be desired.

Caenopsylla laptevi Mikulin and Zagniborodova, 1958. Figures 198–203.

Caenopsylla laptevi Mikulin and Zagniborodova, 1958, Trudy Sredne-Aziat. Nauch.-Issled. Protivochum. Inst., Alma-Ata, **4**, p. 249.

That this species occurred in Afghanistan was practically a foregone conclusion. Originally described from Turkmeniya off *Vulpes* sp. and *Felis ocreata* (=*catus*, *libyca*, or *margarita*?), it has since been shown to have a rather extensive range, including records from Iran (Klein, 1963), Saudi Arabia (Lewis, 1964a), Lebanon (Lewis, 1965), and northern Egypt (Lewis, 1965, 1967).

Based on collection records for the remaining two members of this genus from Algeria and Tunisia, it was postulated that these were fleas of rodents and that the genus evolved on the African continent (Smit, 1953). Both the species occur on unique hosts, however, *C. assimulata* on *Elephantulus rozeti* (Insectivora: Macroscelididae) and *C. mira* on *Ctenodactylus gundi* (Rodentia: Ctenodacty-



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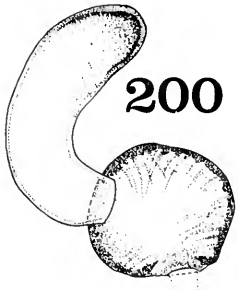

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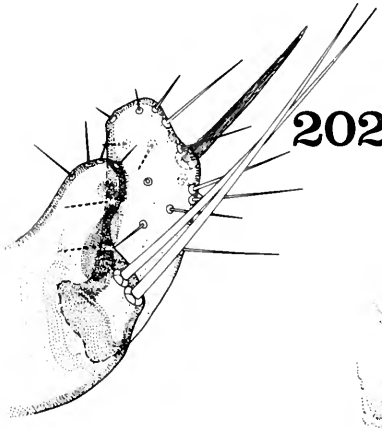

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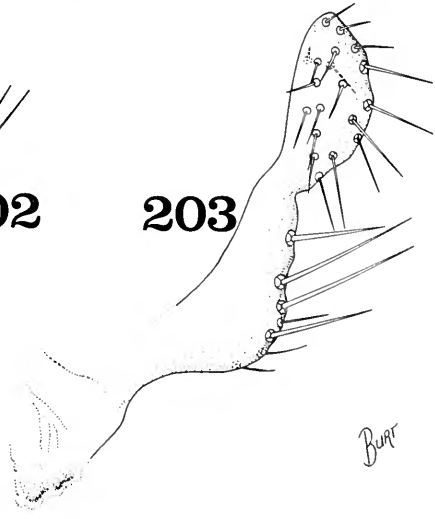

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lidae) and *Eliomys quercinus* (Rodentia: Muscardinidae), and both apparently have limited ranges. In contrast, *C. laptevi* has a large range and parasitizes less specialized hosts. Though it is still possible that *C. laptevi* is actually a parasite of rodents, there are no published records of its occurrence on them and the most likely nominee for the true host of this species is some form of *Vulpes*, probably *V. vulpes*, the European Red Fox. Single specimens from *Hyaena hyaena* and *Lepus arabicus* are certainly accidental occurrences.

Material collected.—

Girishk and environs, November 12, 13, 1965, from *Vulpes vulpes*, 4 males and 8 females.

Kandahar and environs, October 31–November 4, 1965, from *Vulpes vulpes*, 1 male and 1 female; from *Hyaena hyaena*, 1 male.

Qala Bist, 16 to 25 km. S W, November 11, 1965, from *Vulpes vulpes*, 3 males and 3 females.

MESOPSYLLA Dampf

Mesopsylla. Dampf, 1910, Zool. Jahrb., Suppl. **12**, p. 609.

Type species.—*Mesopsylla eucta* Dampf, 1910.

This is another small genus of fleas occurring mainly in Western Asia. Although only six species have been described, they are known from a total of 15 species and subspecies. Whether or not all of the subspecies of *M. eucta, hebes*, and *tuschkan* are valid is a moot question, but the fact that these three species account for the 12 subspecies recorded in the literature suggests that these species at least are highly variable in appearance.

Although reported from a number of rodent hosts, the species of this genus apparently prefer jerboas to other rodents. But their range does not wholly coincide with the distribution of members of the Dipodinae. For example, *M. tuschkan propinacta* Traub and Evans, 1967, a parasite of *Jaculus orientalis* and *J. jaculus* in Northern Egypt, seems completely isolated from related Asian subspecies, although the range of *Jaculus jaculus* extends well into the range of jerboas of the genus *Allactaga*, which should potentially be good hosts for these fleas.

FIGS. 198–203. *Caenopsylla laptevi* Mikulin and Zagniborodova. **198.** Male head; **199.** Female sclerotized duct of bursa copulatrix; **200.** Female spermatheca; **201.** Female st. VII; **202.** Male clasper; **203.** Apex of male st. IX.

Mesopsylla eucta afghana Jordan, 1944. Figures 204–207.

Mesopsylla eucta afghana Jordan, 1944, Proc. Zool. Soc. London, Part III, **114**, p. 366.

This species originally was described from one male from *Allactaga williamsi* from Shibar Pass and one male from *Allactaga elater indica* from Ghazni. Ioff *et al.* (1965) list it from Northeastern Afghanistan, but provide no additional locality records. Our specimens came only from the Kabul-Paghman area, which, with the exception of a single jerboa from Shibar Pass, was the only place where *Allactaga williamsi* was collected.

Mesopsylla eucta afghana is but one of five subspecies that collectively range from Turkmeniya to China. With our present knowledge, it appears that only the nominate form has a very broad distribution, being recorded from Turkmeniya, Uzbekistan, and Kazakhstan by Russian authors.

Material collected.—

Kabul Reservoir, September 30, October 3, 1965, from *Allactaga williamsi* and nest, 4 males and 5 females.

ACROPSYLLA Rothschild

Acropsylla. Rothschild, 1911, Novit. Zool., **18**, p. 118.

Type species.—*Acropsylla episema* Rothschild, 1911.

A small genus of only two described species, these fleas are seldom encountered. Whether this relates to collecting habits and seasonal occurrence is not known, but, in any event, our knowledge of the host preferences and distribution of the species is very poor.

The genus is presently under study by Dr. Robert Traub, whose collections from northern West Pakistan have considerably increased our knowledge of the occurrence of the various species. The material reported here belongs to a new taxon that Traub also collected in Pakistan.

Acropsylla traubi new species. Figures 212–217, 315, 316.

Diagnosis.—Similar to the other two known species of this genus in overall facies. The male sex of *A. episema* Rothschild, 1911, is unknown but females differ in that the frons of *A. traubi* is not pro-

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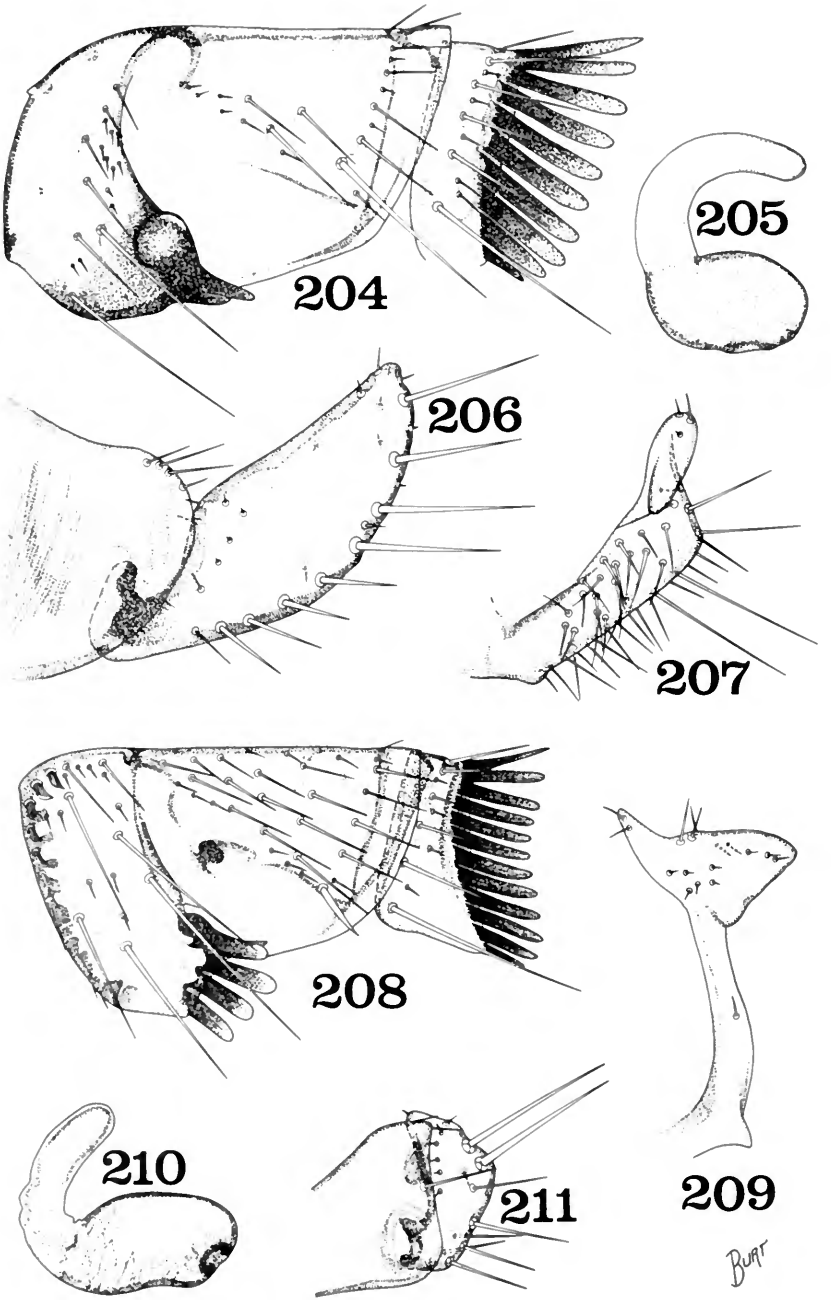
FIGS. 204–211. *Mesopsylla eucta afghana* Jordan. **204.** Male head; **205.** Female spermatheca; **206.** Male clasper; **207.** Apex of male st. IX. *Leptopsylla (Leptopsylla) nana* Argyropulo. **208.** Male head; **209.** Apex of male st. IX; **210.** Female spermatheca; **211.** Male clasper.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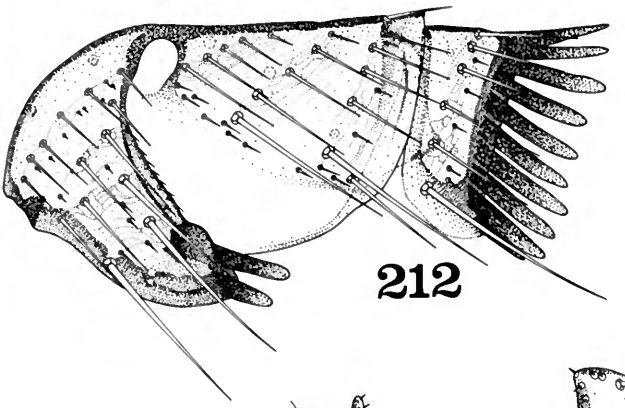
duced into a snout-like point, the margin of st. VII is more squared, frequently bearing a shallow depression, and there are minor differences in chaetotaxy. *A. traubi* differs from *A. girshami* Traub, 1950, in the male in small irregularities of chaetotaxy and shape of the movable process and st. VIII and IX. Females are exceedingly similar, slight differences in the margin of st. VII being the most constant character.

Description.—HEAD (fig. 212): Preantennal portion of head with 15 to 17 setae arranged in 4 rows, usually 9(9–7), 4(4–5), 1, and 2. Eye conspicuously sinuate ventrally. Genal comb of 2 lobate spines, not contiguous at their base, the upper spine slightly curved dorsad in some specimens. Dorsal margin of antennal groove bearing an irregular row of 8 to 14 small setae. Occipital portion of head with 2 rows of 4 to 6 setae in addition to occipital row of 5 to 7 bristles (usually 6). Labial palpi 5-segmented, extending 3/4 the length of forecoxae.

THORAX: Pronotal ctenidium of 20–21 (20[13], 21[1]) in males, 19–22 (19[1], 20[11], 21[3], 22[4]) in females. Pronotum bearing a main row of 5 setae per side in both sexes. Mesonotum with a single main row of 5 long setae per side preceded by 25–30 loosely ranked, smaller bristles. Pseudosetae under mesonotal collar 6–8 in both sexes (males 6[4], 7[4], 8[6]; females 6[13], 7[4], 8[2]). Metanotum also with 5 long setae per side in both sexes, preceded by 10–15 loosely ranked small bristles. Apical spinelets of metanotum 3/3–4/4 (3/3[7], 3/4[4], 4/4[3]) in males, 2/2–4/4 (2/2[2], 2/3[4], 3/3[9], 3/4[1], 4/4[3]) in females. Metepimeron with 8–10 setae grouped in 3 vertical rows, usually 4, 4, 1. Metepisternum usually with 1 long bristle and lateral metanotal areas usually with 2 per side. Mesopleuron with 8–12 scattered setae.

LEGS: Outer surface of forecoxae with 35–40 bristles arranged in 5 irregular, oblique rows. Outer surface of forefemur with 10–12 small setae, remote from margin. Inner surface with 1 small seta on proximal 1/3 of segment, near ventral margin. Caudal margin of foretibia bearing a false comb of 10–12 bristles. Foretarsal segment V with 5 pairs of lateral plantar bristles, the proximal pair of which is shifted to the plantar surface. Cephalic margin of mesocoxae with a row of small bristles extending from base to apex. Chaetotaxy of mesofemur limited to 8–10 small setae near the apex. Mesotibia with heavy setae on caudal margin but not a false comb. Outer surface of this segment bearing 15–18 small bristles. Segments I and II of mesotarsus of equal length. Segment V with 5 pairs of lateral plantar bristles, again with proximal pair shifted to ventral surface. Metacoxae with small bristles on inner and outer surface along apical two-thirds of cephalic margin. Chaetotaxy of metafemur limited to a few small setae on outer surface of apex and 1 small bristle near base. Outer surface of metatibia with 25–30 small bristles. Caudal margin with 5 notches bearing pairs of stout setae. Apical long seta of metatibia only 2/3 the length of metatarsal segment I.

FIGS. 212–217. *Acropsylla traubi* n. sp. **212.** Male head; **213.** Female spermatheca; **214.** Apex of male st. IX and aedeagal crochet; **215.** Male clasper; **216.** Male st. VIII; **217.** Female st. VII.



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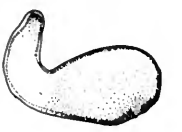

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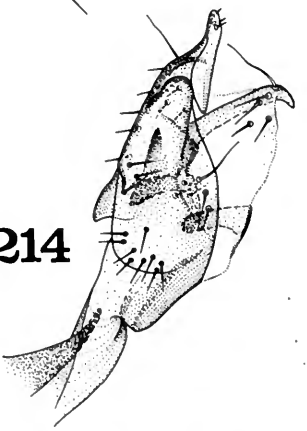

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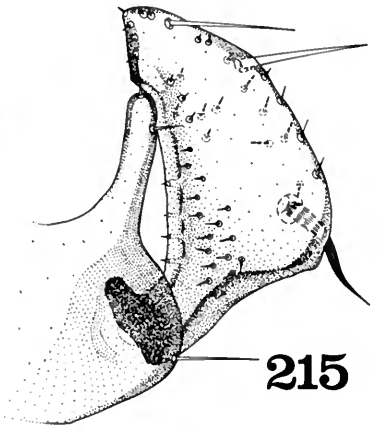

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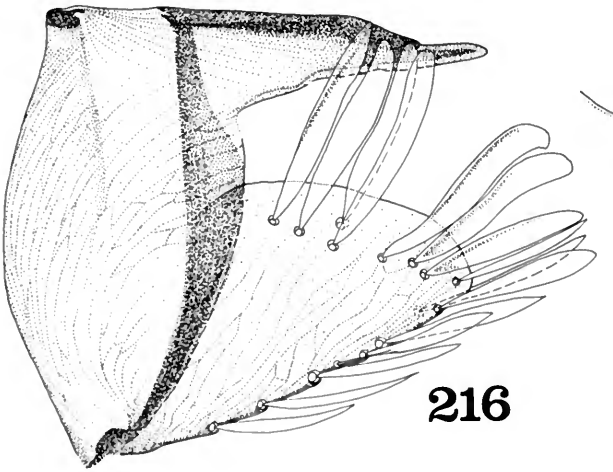

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217

UNMODIFIED ABDOMINAL SEGMENTS: Abdominal tergites I through VII of males with 1 main row of setae averaging 4, 6, 7, 6, 6, 6, and 6 per side, and marginal spinelets on tergites I through V numbering 1/1(14), 1/1(14), 1/1(14), 1/1(13) and 1/1(6), 1/0(5), 0/0(3). Abdominal tergites I through VII of females with 1 main row of setae averaging 4, 7, 7, 6, 6, 6, and 5, preceded by 2 irregular rows of small setae on tergites I and II and 1 row on tergites III through VII. Marginal spinelets on tergites I through IV numbering 1/1(19), 1/1(19), 1/1(19) and 1/1(5), 1/0(3), 0/0(11). Abdominal sternites II through VII of males with 1, 2, 2, 3, 2, and 4 setae per side. In females these number 1, 3, 3, 3, 4, and 4.

MODIFIED ABDOMINAL SEGMENTS (figs. 214–216, 315)—MALES: Fixed process long and narrow, its apex bearing a single small seta. One small acetabular seta arising over articulation of movable process. Movable process triangular, with a large, spiniform seta arising on the inner surface of its ventrocaudal angle. Remaining chaetotaxy as illustrated. Sternum VIII bilobed, its dorsal margin modified into a heavily sclerotized, notched projection which is sharply pointed apically. The function of this structure is unknown but it differs from its homologue in *A. girshami* in that the apex is bent downward and is less pointed in the latter species. Lower lobe of st. VIII broadly rounded apically, its margin bearing a fringe of broad, spatulate projections. Alveoli are just visible at the base of some of these projections and evidently they are modified setae. The sternite is strengthened dorsoventrally by a sclerotized band which extends from the cephaloventral angle, dorsad to the base of the dorsal lobe. Sternum IX as illustrated, though hardly visible in most mounted specimens unless dissected.

FEMALES (figs. 213, 217, 316): Bulga of spermatheca oval. Junction of hilla with bulga indistinct ventrally but distinct dorsally. Hilla tapering gently to a smoothly rounded apex. Marginal lobe of st. VII square to slightly concave, with rounded dorsal and ventral corners. Anal stylet tapered, about twice as long as wide, with 1 long apical seta and 2 short bristles arising on the ventral margin.

Type material.—Holotype male and allotype female (B67928) from *Mus* sp., Dir, E. side of river, Dir State, West Pakistan, August 14, 1964, *leg.* J. J. O'Keefe and R. L. Amoureux. Paratypes: 5 males and 5 females with same data but August 13–19, 1964; 4 males and 3 females, same data but W. side of river, August 22, 26, 1964 (one pair of this series came from *Suncus* sp.); 1 male and 1 female from *Mus* sp., Dir, Dir State, W. Pakistan, September 24, 1966, *leg.* R. Traub and J. J. O'Keefe; 2 males and 2 females from *Mus* sp., Malakand, Malakand Agency, W. Pakistan, September 21, 1966, *leg.* R. Traub and J. J. O'Keefe; 1 male and 1 female from *Mus* sp., Amandra, Malakand Agency, W. Pakistan, August 9, 1964, *leg.* R. L. Amoureux; and 2 males and 7 females from *Mus musculus*, 8 km. S. Kamdesh, Nuristan, Afghanistan, October 13, 1965, *leg.* S. Atallah.

Holotype, allotype and 1 pair of paratypes deposited in the United States National Museum (USNM 72242). All of the Afghan paratypes as well as one pair of Pakistan paratypes have been de-

posited in the collection of Field Museum of Natural History. Three pairs of paratypes have been retained in the collection of the author and the remaining specimens have been returned to Dr. Traub.

This new species is named in honor of Dr. Robert Traub, Colonel, U. S. Army (Ret.), Professor of Microbiology, University of Maryland, Baltimore, whose generosity made it possible to include the description of this new taxon in spite of the fact that he was entitled to priority in describing it. His loan of additional collections from West Pakistan made it possible to study the species more thoroughly than would have been feasible with the limited material from Afghanistan.

Subfamily **LEPTOPSYLLINAE** Rothschild

Leptopsyllidae. Rothschild, 1915, Entomol. Mon. Mag., **51**, pp. 80, 103.

This subfamily is a large one, containing eight presently recognized genera with representatives in all faunal regions except the Australian and Neotropical. The two subgenera of *Leptopsylla* reported here from Afghanistan are typically Palaearctic groups. They may be separated by the following key.

1. Genal comb of more than six spines which extend along the cephalic margin of the antenal groove..... *Pectinoctenus* (p. 112)

   Genal comb of six or fewer spines restricted to the genal area of the head. *Leptopsylla* (p. 109)

LEPTOPSYLLA Jordan and Rothschild

Subgenus **Leptopsylla**

Leptopsylla. Jordan and Rothschild, 1911, Novit. Zool., **18**, p. 85.

Type species.—*Pulex segnis* Schönherr, 1811.

This genus is known from 18 species and subspecies, all of which are mainly Palaearctic. One species is practically cosmopolitan (*L. segnis*) as a parasite of synanthropic rodents and another (*L. aethiopica*) occurs along the northeastern boundary of the Ethiopian Region. All are mainly ectoparasites of small rodents although many have been reported as occasional parasites of small insectivores.

Additional species probably occur in Afghanistan but the following key will separate the two species reported here.

1. Genal comb of six spines; marginal setae of frons only slightly spiniform. *sexdentata* (p. 110)

   Genal comb of four spines; marginal setae of frons strongly spiniform. *nana* (p. 110)

Leptopsylla (Leptopsylla) sexdentata (Wagner, 1930). Figures 218–222b.

Ctenopsylla sexdentata Wagner, 1930, Annu. Mus. Zool. Acad. St. Petersb., **30**, p. 531, fig. 1.

Ioff *et al.* (1965) indicate a broad distribution for this species from the Caucasus east to Dzhungaria in the Chinese Peoples Republic. They indicate that it is mainly a parasite of house mice (*Mus musculus*). Our record comes from a single collection from the shrew, *Crocidura russula*, taken in the foothills of the Pamir Mountains at the entrance of the Wakhan Corridor. It suggests that the species is rare in Afghanistan but may only reflect the fact that relatively few house mice were collected in the high mountains of the northern part of the country.

I am indebted to Dr. Traub for the loan of a male specimen from which the figures of this sex were made.

Material collected.—

Ishkamish, 32 km. S W, August 18, 1965, from *Crocidura russula*, 3 females.

Leptopsylla (Leptopsylla) nana Argyropulo, 1946. Figures 208–211.

Leptopsylla nana Argyropulo, 1946, Med. Parazitol., Moskva, **15**, p. 91.

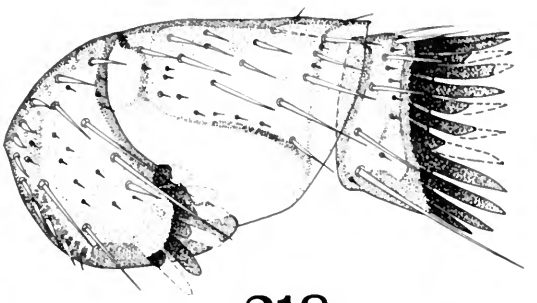
According to Ioff *et al.* (1965) this species has a broad distribution in Central Asia from the Caucasus east to Mongolia and Szechwan in China as a parasite of *Alticola*, *Microtus* (*Chionomys*), and *Cricetulus* species. The localities indicate primarily an upland or alpine distribution, and collection localities in Afghanistan are consistent enough to suggest that, in all probability, further collections from the Karakorum and Himalaya Mountains will reveal its occurrence there as well.

The Shibar Pass collections came from a number of hosts and their nests and suggest that this is not a common species in the area, at least not during midsummer. Both hosts and their nests were shared with *Neopsylla pleskei ariana* Ioff, 1946.

Material collected.—

Shibar Pass and environs, July 25–30, 1965, from *Cricetulus migratorius*, 1 female; from *Microtus afghanus* and nests, 8 males and 13 females; from *Microtus arvalis*, 1 female.

FIGS. 218–222b. *Leptopsylla (Leptopsylla) sexdentata* (Wagner). **218.** Male head; **219.** Female spermatheca; **220.** Male modified segments; **221.** Female st. VII; **222a.** Male clasper; **222b.** Apex of male st. IX.



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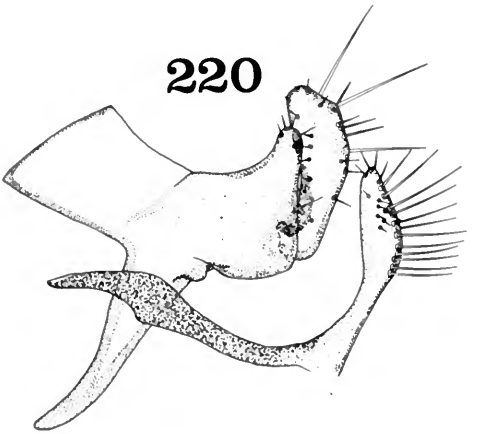

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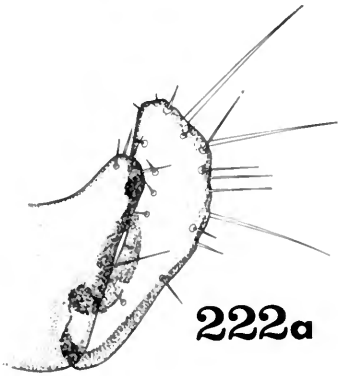

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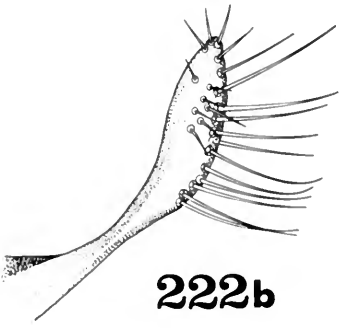


222b

Ishkamish, 24 km. E, August 15, 16, 1965, from *Cricetulus migratorius*, 7 males and 17 females.

Subgenus **Pectinoctenus** Wagner

Pectinoctenus. Wagner, 1929, Annu. Mus. Zool. Acad. Sci. Leningrad, **30**, p. 30.

This is a small subgenus of Palaearctic fleas known from six described species. All are parasites of small rodents in Central Asia. The single species reported here is likely the only member of the subgenus to be found in Afghanistan.

Leptopsylla (Pectinoctenus) pamirensis (Ioff, 1946). Figures 175–178.

Pectinoctenus pamirensis Ioff, 1946, Med. Parazit., Moskva, **15**, p. 91.

This is another species not encountered during the Street Expedition. Peus (1966) reports four females from *Apodemus sylvaticus* and *Alticola roylei* collected at the Salang Pass, May 6, 1965, by G. and J. Niethammer.

Ioff *et al.* (1965) list records from various localities in the Pamir Mountains (Khorog, Eastern Pamirs, and Gissarskiy), and it is probably distributed throughout the high mountain systems of Central Asia.

Family **CERATOPHYLLIDAE** Dampf

Ceratophyllinae. Dampf, 1908, Schr. Phys-Ökon. Ges. Königs., **49**, p. 19.

As understood here, the family Ceratophyllidae contains two subfamilies, the Foxellinae, with two exclusively Nearctic genera, and the Ceratophyllinae, with 31 genera. Although representative species of the latter subfamily occur practically throughout the world, the family as a group is mainly Holarctic, and the bulk of the genera and species are restricted to the Northern Hemisphere. Though there are obvious exceptions, most of the species belonging here are parasites of rodents and birds, and many have been associated with the transmission of diseases to man.

Our knowledge of this group of fleas is expanding rapidly, and a number of undescribed taxa are presently known, which will necessitate a thorough restudy of the higher taxonomic hierarchy within the family. Fortunately, none of these problems has yet been associated with the Afghan fauna and the systematics of the genera reported below are fairly well established. Following is a key to the ceratophyllid genera collected by the Street Expedition.

1. Labial palpi extending beyond apex of forecoxae by about a segment.....2

   Labial palpi not extending beyond apex of forecoxae, or if so, by less than a segment.....3

2. Movable process of male with spiniform bristles near caudoapical angle; caudal margin of female st. VII with small, triangular lobe subtended by a broad, shallow sinus.....*Citellophilus* (p. 134)

   Movable process of male lacking spiniform bristles; caudal margin of female st. VII with large, conical lobe subtended by a narrower, deeper sinus. *Oropsylla* (p. 114)

3. Pronotal comb of fewer than 24 spines.....4

   Prontal comb of at least 24 spines.....*Ceratophyllus* (p. 145)

4. Male st. VIII vestigial or at least reduced; movable process without spiniform setae; apex of duct of bursa copulatrix coiled or otherwise modified but not sclerotized.....6

   Male st. VIII well developed; movable process with one or more spiniform setae on caudal margin; apex of bursa copulatrix modified.....5

5. Movable process of male with long, spatulate, caudoventral projection; junction of spermathecal hilla with bulga indistinct; apex of bursa copulatrix much enlarged, coiled.....*Amphalius* (p. 113)

   Movable process of male bearing two small, blunt, spiniform setae on caudoapical margin; apex of bursa copulatrix with sclerotized, spherical body, junction of hilla with bulga distinct.....*Callopsylla* (p. 136)

6. Male st. VIII vestigial; penis rods describing more than a complete circle; one long, one short, and one minute antepygidial setae; apex of bursa copulatrix of female coiled; bulga of spermatheca globular, hilla with parallel sides. *Nosopsyllus* (p. 116)

   Male st. VIII reduced but not vestigial; penis rods describing only a complete circle, one long and two minute antepygidial setae; bursa copulatrix with an expanded uncoiled, membranous apex; bulga of spermatheca oval, hilla also oval, set off from bulga by a shallow constriction. *Monopsyllus* (p. 143)

AMPHALIUS Jordan, 1933

Amphalius. Jordan, 1933, Novit. Zool., **39**, p. 74.

Type species.—*Amphalius runatus* (Jordan and Rothschild, 1923).

This genus is reported from Afghanistan from a single, damaged female from Lake Shewa, reported by Sakaguti (1966). He was unable to determine the specimen to species but stated that it differed from other known species of the genus.

Members of this genus are mainly parasites of pikas (*Ochotona*) but occasionally occur on other hosts sharing the pikas' habitat. Evidently the Afghan species of *Amphalius* prefers higher elevations as

no specimens were taken from *O. rufescens* collected during the expedition.

OROPSYLLA Wagner and Ioff

Oropsylla. Wagner and Ioff, 1926, Rev. Microbiol. Epidemiol., **5**, p. 86.

Type species.—*Ceratophyllus silantiewi* Wagner, 1898.

This is a small genus consisting of six presently recognized species distributed through Central and Eastern Asia and North America. They are mainly parasites of marmots (*Marmota* sp.), although some species occur commonly on ground squirrels (*Citellus*) as well. Since both of these host genera have been associated with natural foci of plague, some species of *Oropsylla* have attracted considerable attention from public health workers, both in Asia and in North America.

Only one species belonging to this genus is known from Afghanistan and it seems improbable that other species will be found there.

Oropsylla silantiewi (Wagner, 1898). Figures 223–227.

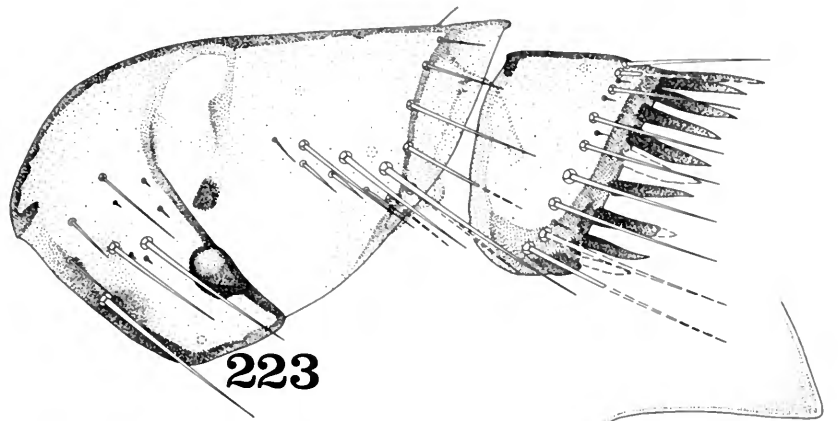
Ceratophyllus silantiewi Wagner, Horae Soc. Ent. Ross., **31**, p. 574, pl. VIII, fig. 12.

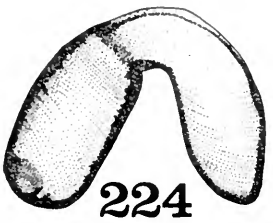
Ioff *et al.* (1965) indicate that this species is a parasite of marmots (*Marmota*), occurring where they occur, and list its range as "from the Donskoi and Cisvolga steppes in the west to the Pacific Ocean in the east and from the Cisaral steppes and Kamchatka in the north to Tien Shan and the Himalayas in the south." There seems some disagreement among mammalogists as to the number of Palaearctic species of *Marmota.* Ellerman and Morrison-Scott (1951) list three, while Gromov *et al.* (1965) list six. In any case, the range of *M. marmota* extends into the Swiss Alps and other parts of Europe, but marmots in Europe are not infested with fleas of the genus *Oropsylla.*

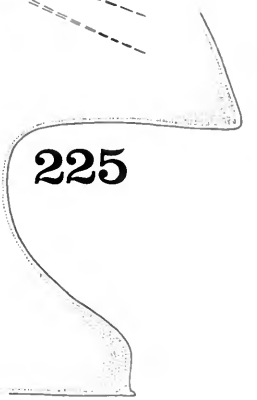
Although no marmots were taken during the Street Expedition, there were three females of *O. silantiewi* among the fleas donated by Dr. Kullmann. In addition, Dr. F. Peus kindly loaned the three males mentioned in his 1957 report on fleas of Afghanistan. Very probably, this is a common species in the high country where *Marmota caudata* occurs. It has been associated with the transmission of plague.

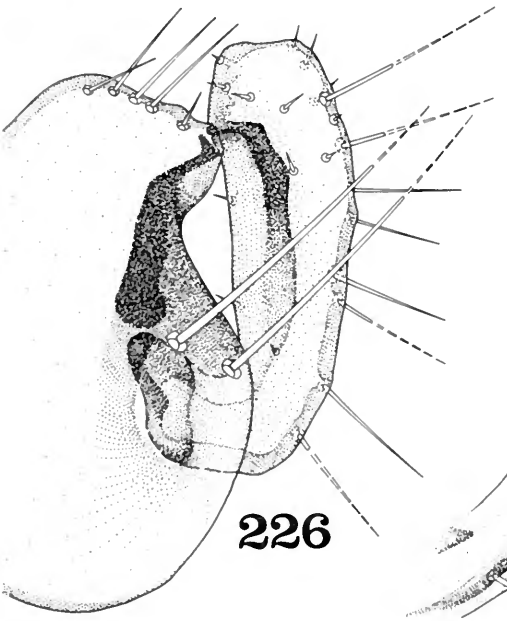
Material collected.—

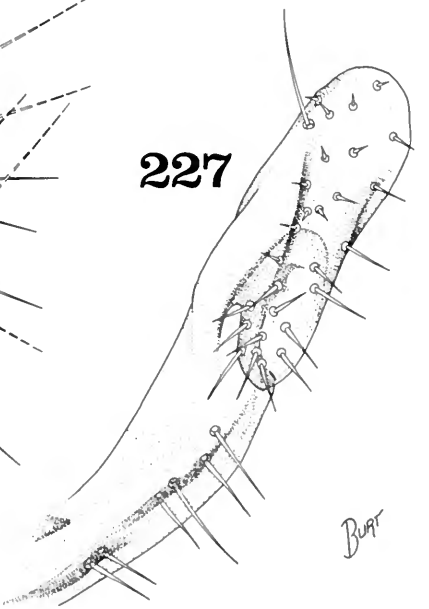
Dasht-i-Nawar, August 5, 1964, from *Marmota caudata,* 3 females, *leg.* E. Kullmann.











FIGS. 223–227. *Oropsylla silantiewi* (Wagner). **223.** Male head; **224.** Female spermatheca; **225.** Female st. VII; **226.** Male clasper; **227.** Apex of male st. IX.

NOSOPSYLLUS Jordan

Nosopsyllus. Jordan, 1933, Novit. Zool., **39**, p. 76.

Type species.—Pulex fasciatus Bosc, 1800.

This large genus consists of 59 species and subspecies occurring mainly in the Palaearctic and Oriental faunal regions. They are all typically parasites of small rodents, although predator records are not uncommon. Two species have become more or less cosmopolitan, doubtless through human agencies, and a third relict species is known only from the highlands of Eastern Africa.

The genus has been divided into four subgenera. Two of these are represented by a single species, which are extralimital to our considerations here. The remaining two subgenera have a broad overlapping distribution throughout much of the Palaearctic Region. They may be separated with the following key.

1. Apical bristles of hindtarsal segment II never extending beyond apex of segment IV, usually not beyond apex of segment III.
   Nosopsyllus s. str. (p. 116)
   Apical bristles of hindtarsal segment II extending beyond apex of segment IV.
   Gerbillophilus (p. 122)

Subgenus **Nosopsyllus** Jordan

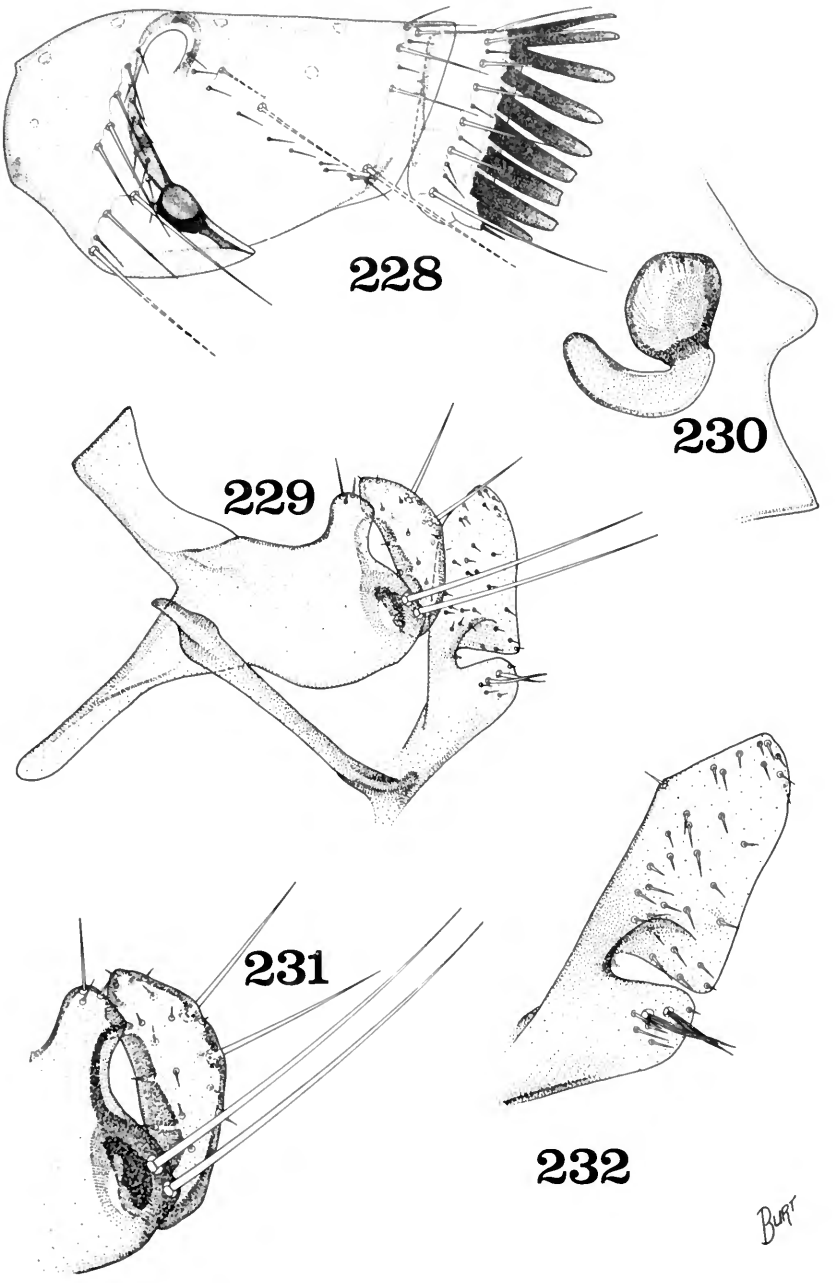
Nosopsyllus. Jordan, 1933, Novit. Zool., **39**, p. 76.

Type species.—Pulex fasciatus Bosc, 1800.

Members of this subgenus occur widely throughout the Palaearctic Region, the Indian subcontinent, and parts of Africa as ectoparasites of members of the Murinae, Microtinae, some Cricetinae and Gerbillinae, and some members of the Sciuridae. Judging from our knowledge of the fauna of adjacent Iran and the USSR, there are more than three species belonging to this subgenus that might be expected to occur in Afghanistan. Many of the species, however, are extremely difficult to differentiate and the entire genus is in dire need of systematic revision. Following is a provisional key to the three species taken by the expedition. The reader is warned to consider the possibility of related species occurring within the boundaries of the country.

1. Males.....2
   Females.....4

2. Movable process distinctly arcuate, its cephalic incrassation very high, causing apex of the process to appear square; aedeagal crochet either blunt and expanded apically or with a rounded point, not strongly deflected.....3



FIGS. 228–232. *Nosopsyllus* (*Nosopsyllus*) *fidus* (Jordan and Rothschild). **228.** Male head; **229.** Male modified segments; **230.** Female st. VII and spermatheca; **231.** Male clasper; **232.** Apex of male st. IX.

Movable process not arcuate, more conical, its cephalic incrassation lower, its apex more conical; aedeagal crochet with sharp-pointed, deflected apex. *simla* (p. 120)

3. Uppermost antepygidial bristle short but much heavier and larger in diameter than middle bristle; aedeagal crochet long, tapering to a blunt, rounded point. *punjabensis* (p. 120)

Uppermost antepygidial bristle short but much smaller in diameter than middle bristle; aedeagal crochet expanded apically, its dorsal angle acute, its ventral angle rounded smoothly. . . . . *fidus* (p. 118)

4. Caudal margin of st. VII sinuate or at most with a low poorly defined lobe; hilla of spermatheca exceedingly long, completely recurved back over bulga. *punjabensis* (p. 120)

Caudal margin of st. VII with a distinct lobe, hilla of spermatheca shorter, not completely recurved over bulga. 5

5. Caudal margin of st. VII with a small, triangular lobe; hilla of spermatheca short, hardly curving over half of bulga; upper antepygidial seta about half as long as middle seta. . . . . *fidus* (p. 118)

Caudal margin of st. VII with a large, rounded lobe; hilla of spermatheca longer, covering more than half of bulga; upper antepygidial seta less than half as long as middle seta. . . . . *simla* (p. 120)

Nosopsyllus (Nosopsyllus) fidus (Jordan and Rothschild, 1915). Figures 228–232.

Ceratophyllus fidus Jordan and Rothschild, 1915, Ectoparasites, I (1), p. 8, figs. 11, 12.

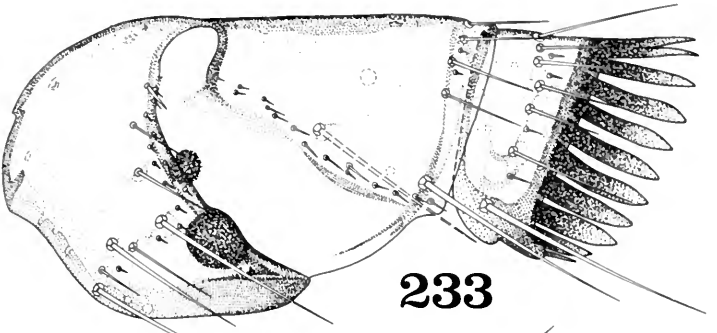
Ioff *et al.* (1965) report this species from Turkmeniya east to Inner Mongolia and Peking, China, as a parasite of house mice in steppes and fields as well as inhabited areas. Its occurrence in Afghanistan was not unexpected because it has been collected in Iran (Lewis, *unpublished data*). It is remarkable, however, that it was only collected once, and I am forced to conclude that the species probably reaches the southern limit of its range in northwestern Afghanistan.

Rattus rattoides is a rodent commonly found in association with human habitations in Afghanistan, and individuals have ample opportunity to acquire the ectoparasites of other synanthropic rodents. Although this species was host to a number of other species of fleas, it is doubtful that it is a preferred host for *Nosopsyllus fidus*.

Material collected.—

Herat, 11 km. S, September 21, 1965, from *Rattus rattoides*, 1 male.

FIGS. 233–238. *Nosopsyllus* (*Nosopsyllus*) *punjabensis* (Jordan and Rothschild). **233.** Male head; **234.** Male modified segments; **235.** Female st. VII; **236.** Male clasper; **237.** Apex of male st. IX; **238.** Female spermatheca.



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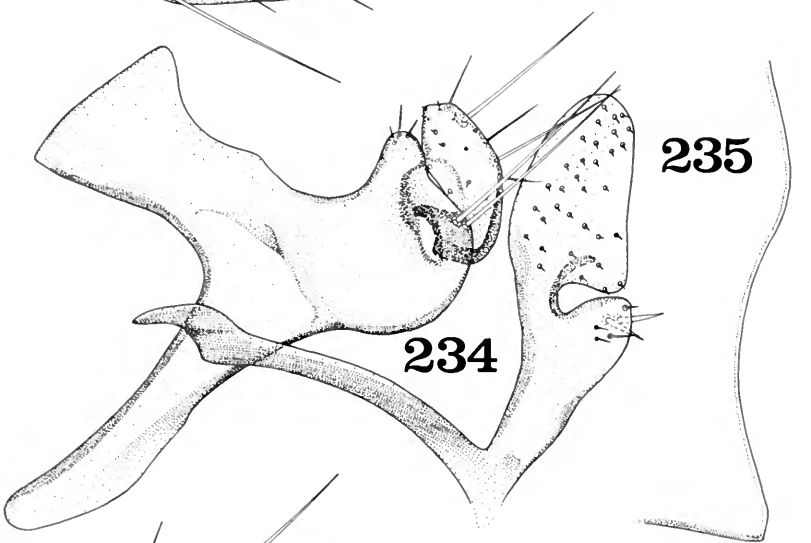

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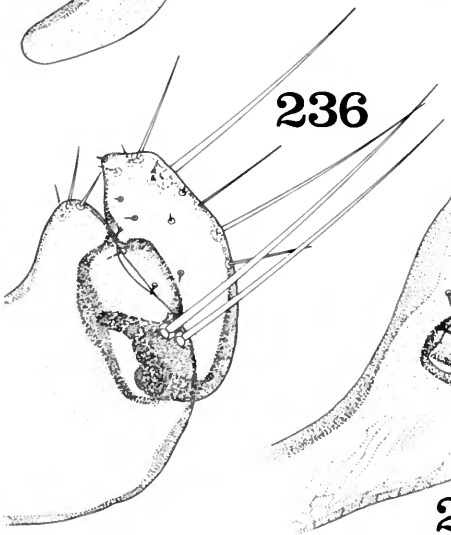

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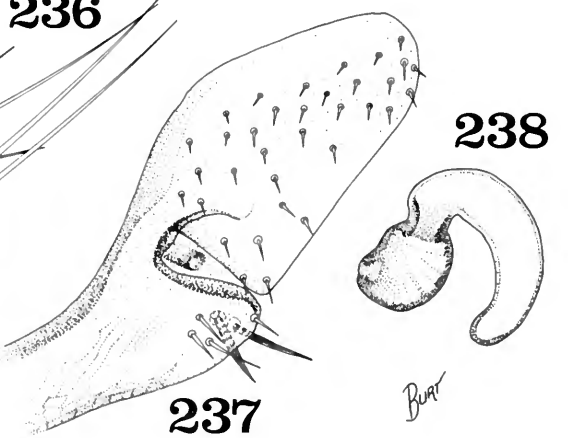

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Nosopsyllus (Nosopsyllus) punjabensis (Jordan and Rothschild, 1921). Figures 233–238.

Ceratophyllus punjabensis Jordan and Rothschild, 1921, Ectoparasites, I (3), p. 193.

This species evidently has a broad distribution since it is reported from Central India north and west to Tadzhikistan and Uzbekistan according to Ioff *et al.* (1965) and has recently been found to be common in Nepal (Lewis, *unpublished data*).

Although it shows a preference for murine hosts, such as *Rattus* and *Nesokia*, in places, *Tatera indica* seems satisfactory. The remainder of our records either represent accidental acquisitions or come from predators.

The actual vector efficiency of this species is apparently unknown, but the matter should be investigated since these fleas are so intimately associated with common synanthropic rodents.

Material collected.—

Faizabad, 25 km. W, August 20, 1965, from *Rattus rattoides*, 1 male.

Girishk and environs, November 10–12, 1965, from *Vulpes vulpes*, 1 female; from *Nesokia indica*, 5 males and 5 females; from *Tatera indica*, 1 male and 2 females.

Herat and environs, April 8, 1965, from *Meriones persicus*, 1 female, *leg.* E. Kullmann; September 18–21, 1965, from *Rattus rattoides*, 20 males and 34 females.

Kandahar and environs, October 31–November 10, 1965, from *Herpestes auropunctatus*, 1 female; from *Felis chaus*, 1 female; from *Tatera indica*, 21 males and 17 females.

Kunduz, 5 km. S, August 30, 1965, from *Nesokia indica*, 1 female.

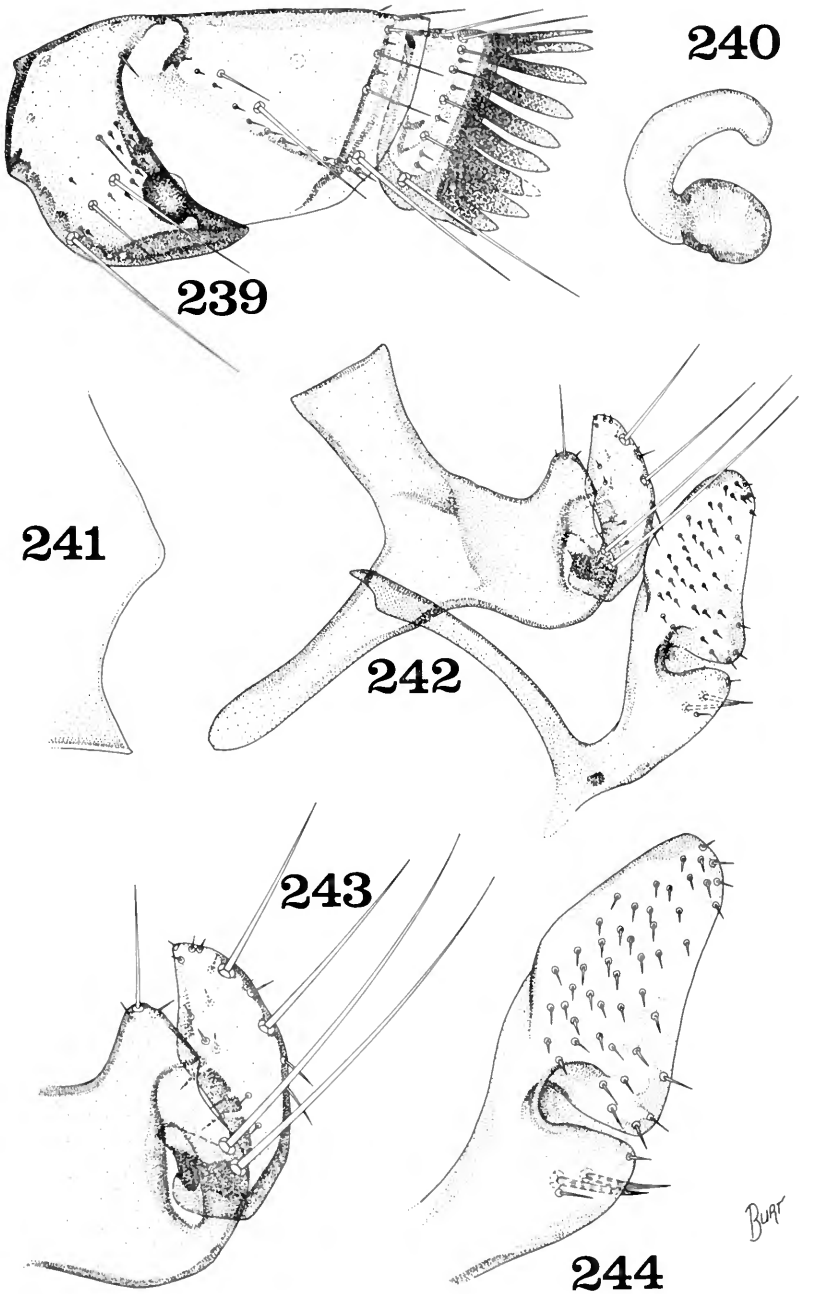
Laghman, October 20, 1965, from *Suncus murinus*, 1 male.

Qala Bist, 16 to 25 km. S W, November 11, 1965, from *Vulpes vulpes*, 1 female.

Sauzak Pass, September 22, 1965, from *Calomyscus bailwardi*, 1 female.

Nosopsyllus (Nosopsyllus) simla (Jordan and Rothschild, 1921). Figures 239–244.

FIGS. 239–244. *Nosopsyllus (Nosopsyllus) simla* (Jordan and Rothschild). **239.** Male head; **240.** Female spermatheca; **241.** Female st. VII; **242.** Male modified segments; **243.** Male clasper; **244.** Apex of male st. IX.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Ceratophyllus simla Jordan and Rothschild, 1921, Ectoparasites, I (3), p. 196.

Ioff *et al.* (1965) list this species from Central India north to Tadzhikistan, Kirgiziya, and Uzbekistan as an ectoparasite of *Rattus* [*rattoides*] *turkestanicus*. Our records, from Eastern Afghanistan, also are from this species and *Mus musculus* and substantiate a preference for murine rodents as hosts.

Evidently, this species and *N.* (*N.*) *punjabensis* are mutually exclusive, the latter form being found at lower elevations. Our collections are insufficient to detail the distribution patterns for these two taxa, but altitude certainly seems to play an important role since both are ectoparasites of *Rattus rattoides*.

Material collected.—

Kamdesh, 8 km. S, October 13, 14, 1965, from *Mus musculus*, 1 male and 1 female; from *Rattus rattoides*, 2 females.

Ishkamish and environs, August 13–15, 1965, from *Rattus rattoides*, 13 males and 10 females.

Subgenus **Gerbillophilus** Wagner

Gerbillophilus. Wagner, 1934, Konowia, **13**, p. 262.

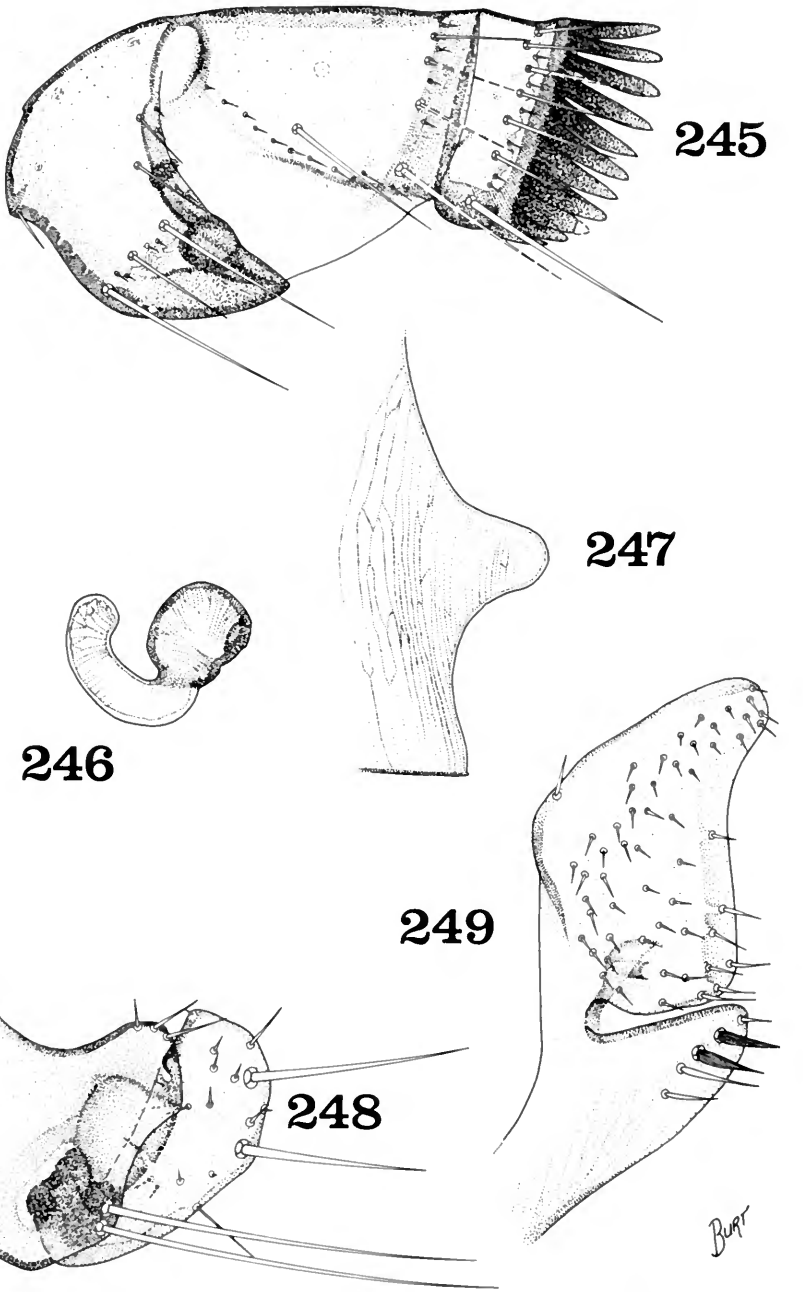
Type species.—*Ceratophyllus henleyi* Rothschild, 1904.

Members of this subgenus are exclusively parasites of gerbilline rodents in the more arid portions of the Palaearctic Region. As with members of the subgenus *Nosopsyllus*, many of the described species are exceedingly difficult to identify with certainty. This is especially so with many of the subspecies, and the following key is, at best, applicable only to species collected in Afghanistan.

1. Males 2
   Females 4

2. Movable process broad apically, truncated, cephalic incrassation about one-third down from apex; apex of st. IX smoothly rounded, subtended by a sinus which makes the apex appear deflected; aedeagal crochets broadly pointed, slightly deflected ..... *vlasovi* (p. 124)
   Movable process long and narrow, pointed apically, cephalic incrassation near middle of process; apex of st. IX rounded but sinus shallower, apex not appearing deflected; aedeagal crochets sharp, strongly hooked 3

3. Dorsal projection of fixed process broad, smoothly rounded apically, its caudal margin only slightly concave between apex and origin of antepygidial setae which do not arise on a marginal projection; movable process widest in middle, tapering gradually to a sharp point ..... *eremicus* n. sp. (p. 131)
   Dorsal projection of fixed process narrower, its apex tapered to a rounded or oblique point; movable process longer and narrower, its apex less sharply pointed ..... *turkmenicus* ssp. (p. 125)



FIGS. 245–249. *Nosopsyllus* (*Gerbillophilus*) *vlasovi* (Ioff). **245.** Male head; **246.** Female spermatheca; **247.** Female st. VII; **248.** Male clasper; **249.** Apex of male st. IX.

4. Caudal margin of st. VII bearing a relatively broad, blunt lobe subtended by a shallow, open sinus; sclerotized duct of bursa copulatrix long and straight in middle ..... *vlasovi* (p. 124)

   Caudal margin of st. VII with a narrower, longer lobe; sclerotized duct of bursa copulatrix variously bent, shorter 5

5. Caudal margin of st. VII with a long narrow lobe, its apex rounded or blunt; sclerotized duct of bursa copulatrix relatively short, C-shaped; bulga of spermatheca elongated ..... *turkmenicus* ssp. (p. 125)

   Caudal margin of st. VII with a shorter more conical lobe, its apex sharper, appearing deflected ventrad; sclerotized duct of bursa copulatrix longer, straighter; bulga of spermatheca globose, less elongated.

   eremicus n. sp. (p. 131)

Nosopsyllus (Gerbillophilus) vlasovi (Ioff, 1940). Figures 245–249.

Ceratophyllus vlasovi Ioff, 1940, Mag. Parazitol., 7, p. 214.

The sole reason for assigning these two females to this species is the shape of the caudal lobe of st. VII. Ioff *et al.* (1965) list the species from various localities in Turkmeniya, Uzbekistan, and Tadzhikistan as a parasite of various gerbilline rodents.

This species still is considered by some authors to be a subspecies of *N.* (*G.*) *monstrosus*. There are some rather conspicuous differences in the male genitalia, however, which justify calling *vlasovi* a full species. The movable process is much broader in *vlasovi* than in *monstrosus*. In addition, the acetabular setae are present in *vlasovi* but absent in *monstrosus*. The females are essentially inseparable, but such is the case with so many species in this genus that it does mitigate the case for considering *vlasovi* to be a full species.

Further collections containing males will be necessary before the presence of this species in Afghanistan can be established.

Material collected.—

Herat, 145 km. N, September 23, 1965, from *Meriones libycus*, 1 female.

Shombul, 12 km. W Shibar Pass, July 27, 1965, from *Meriones persicus*, 1 female.

Remarks on the *N.* (*G.*) *turkmenicus* Group

Included in the species presently called *Nosopsyllus* (*Gerbillophilus*) *turkmenicus* are two named subspecies. Below a third taxon originally described as a full species, *N.* (*G.*) *afghanus* Peus, 1957, is also referred to *N.* (*G.*) *turkmenicus* as a subspecies. Evidence suggesting this relationship is discussed in the appropriate place, but a

few introductory remarks seem warranted before the species and subspecies are discussed.

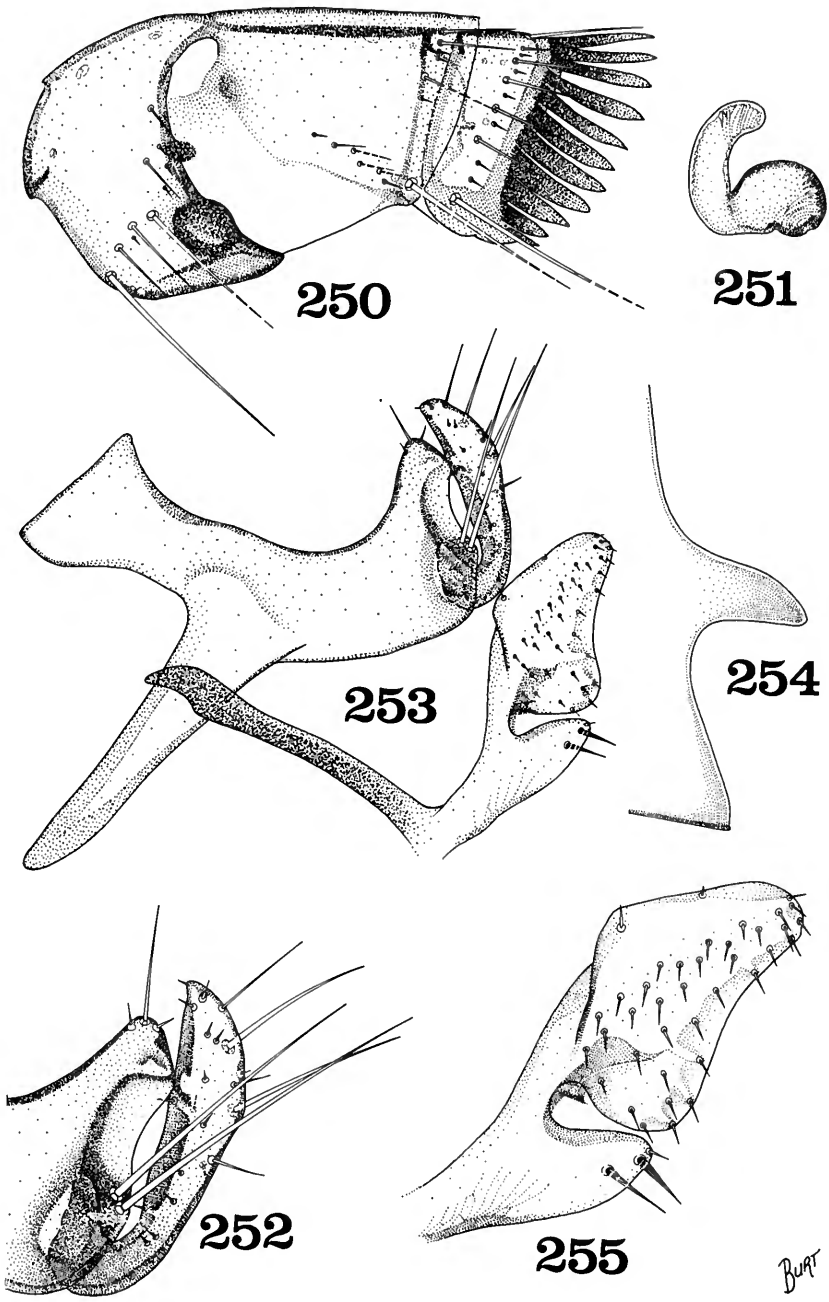
For some years, the author has been amassing material for a systematic revision of the genus *Nosopsyllus*. To this end, extensive collections have been made in the Middle Eastern countries and representatives of species indigenous to the USSR have been obtained through the co-operation of Russian colleagues at Stavropol, Irkutsk, and Alma-Ata. Limited though this representation is in individuals, it certainly represents one of the most complete collections in the world, and a taxonomic revision of the genus is in progress. *Gerbillophilus* will be the first subgenus to be treated and it is obvious from studies thus far that the specific composition of the group must be drastically altered if a workable classification is to be attained. The system followed here does not include the results of these studies since the group as a whole must be discussed before changes in the taxonomic arrangement become comprehensible. The classification employed here is that commonly in use by students in the field of flea taxonomy.

The taxon presently known as *N.* (*G.*) *turkmenicus*, however, is either an extremely widespread and variable species, ranging from Central Asia southwest into the deserts of northern Saudi Arabia and eastern Jordan, or a series of sibling species so similar, especially in the female sex, that taxonomic discrimination is not possible using the criteria usually employed by specialists in this group of insects. For this reason, a key to the subspecies collected or reported from Afghanistan has not been included, nor is it likely that one could be divised at this time. Reference to the figures of the various subspecies should permit at least tentative identification of material collected from this area, but a specialist should be consulted if confirmation is necessary.

Nosopsyllus (Gerbillophilus) turkmenicus turkmenicus (Vlasov and Ioff, 1937). Figures 250–255.

Ceratophyllus laeviceps turkmenicus Vlasov and Ioff, 1937, Trud. Sov. Izuch. Proizvod. Sil. Moskva, S. Turkmon., **9**, p. 279.

Peus (1966) reports "*Gerbillophilus turkmenicus* Vlasov and Ioff" from Kinjan from *Meriones persicus*, one male and five females, May 7, 1965, *leg.* G. and J. Niethammer. *Gerbillophilus* usually is recognized as a subgenus of *Nosopsyllus* by western workers, and citing Vlasov and Ioff as authorities implies that Dr. Peus was referring to the nominate subspecies. According to Ioff *et al.* (1965), *N.* (*G.*) *t.*



FIGS. 250–255. *Nosopsyllus* (*Gerbillophilus*) *turkmenicus turkmenicus* (Vlasov and Ioff). **250.** Male head; **251.** Female spermatheca; **252.** Male clasper; **253.** Modified segments of male; **254.** Female st. VII; **255.** Apex of male st. IX.

turkmenicus is known from parts of Turkmeniya, Uzbekistan, Tadzhikistan, Kirgiziya, and Kazakhstan. The other known subspecies, *N.* (*G.*) *t. altisetus* (Ioff, 1950), they report from the Kopet Dag and Bol'shoy Balkhan Mountains of Turkmeniya and the Paropamisus Mountains of Afghanistan.

K[j]injan (35°36′ N × 68°55′ E) is a small village to the north of the Hindu Kush at about 1,000 m. elevation. It is associated with the desert and desert steppe formation, which extends to the north into Southern Tadzhikistan. If the nominate subspecies of *N.* (*G.*) *turkmenicus* occurs in Afghanistan, it is likely to the north of the mountains. Further collecting is required to demonstrate its presence there, however, because it was not among our extensive collections from around Kunduz, Mazar-i-Sharif, and Maimana.

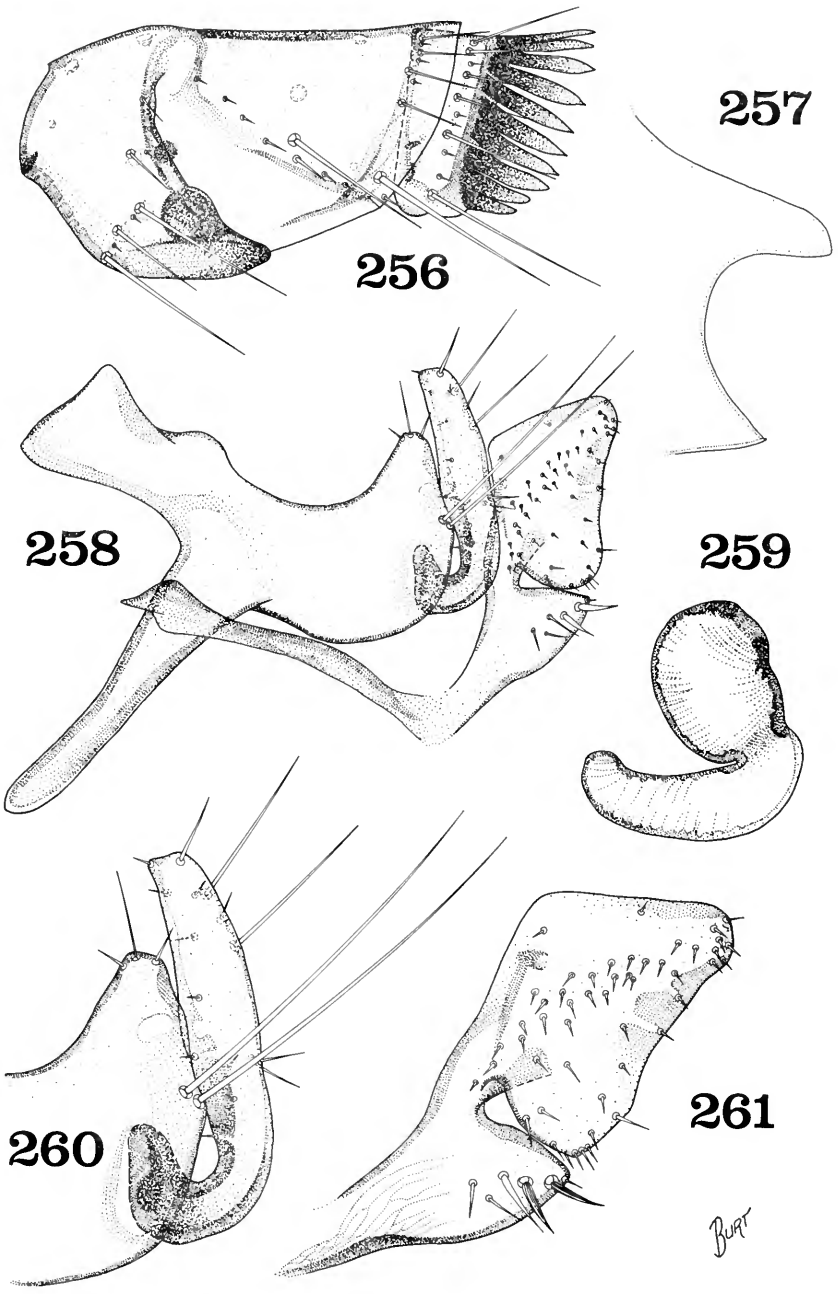
Nosopsyllus (Gerbillophilus) turkmenicus afghanus Peus, 1957 new status. Figures 256–261.

Nosopsyllus (*Gerbillophilus*) *afghanus* Peus, 1957, Beitr. Entomol., 7 (5–6), p. 605, figs. 2–5.

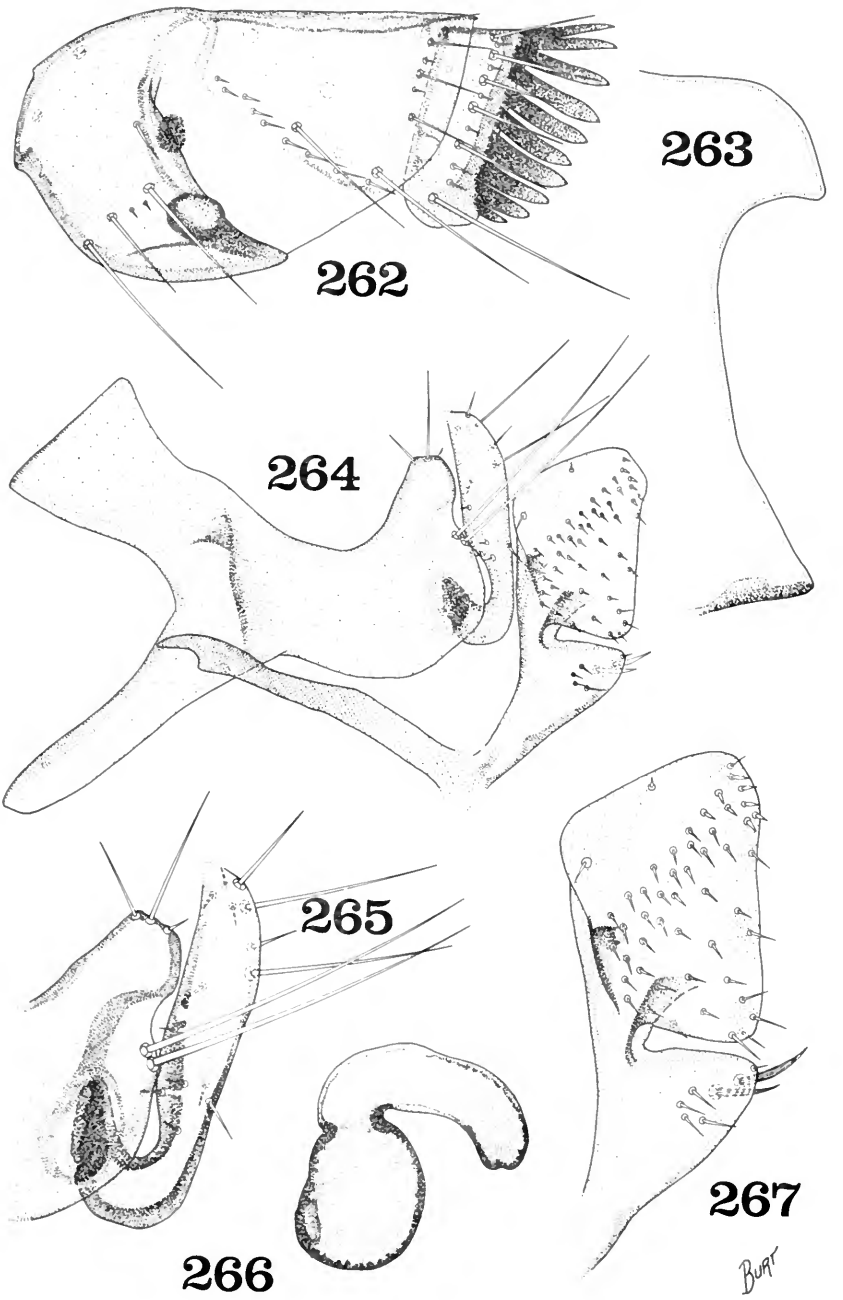
This species was originally described from a single male from the environs of Kabul from *Meriones libycus erythrourus*, November 3, 1952, *leg.* J. Klapperich. There are no subsequent references to the species in the literature and it has evidently not been taken again. A special effort was made to obtain additional material during the expedition and, as our records illustrate, the species turns out to be a dominant member of the Afghan fauna.

After comparison with a number of specimens of *N.* (*G.*) *t. turkmenicus* and *N.* (*G.*) *t. altisetus* from various localities in the USSR, it is evident that *N.* (*G.*) *afghanus* is, at the most, a subspecies of *N.* (*G.*) *turkmenicus*. In some respects, such as the shape of the clasper and st. IX, *afghanus* is intermediate between *turkmenicus* and *altisetus* and the 75 males show considerable variation in these structures. The females of *afghanus* are essentially inseparable from those of the other two subspecies and the caudal lobe of st. VII varies in development from a short, rounded projection to a long pointed extension.

Our understanding of the *N.* (*G.*) *turkmenicus-laeviceps-monstrosus-vlasovi-pringlei* species complex is very poor. It is clear, however, from studies in progress that there are probably more names in the literature than there are actual species in nature, and a generic revision is in preparation.



FIGS. 256–261. *Nosopsyllus* (*Gerbillophilus*) *turkmenicus afghanus* Peus. **256.** Male head; **257.** Female st. VII; **258.** Male modified segments; **259.** Female spermatheca; **260.** Male clasper; **261.** Apex of male st. IX.



FIGS. 262–267. *Nosopsyllus (Gerbillophilus) turkmenicus altisetus* (Ioff). **262.** Male head; **263.** Female st. VII; **264.** Male modified segments; **265.** Male clasper; **266.** Female spermatheca; **267.** Apex of male st. IX.

Material collected.—

Bamiyan, 5 km. W, July 14, 1965, from *Meriones persicus*, 1 female.

Ghazni, 9 km. S E, October 6–8, 1965, from *Cricetulus migratorius*, 1 male and 2 females; from *Meriones libycus* and nests, 19 males and 13 females.

Girishk and environs, November 13, 1965, from *Vulpes vulpes*, 1 female; from *Allactaga hotsoni*, 4 females; from *Jaculus blanfordi* nest and burrow, 2 females.

Herat and environs, April 8, 1965, from *Meriones persicus*, 2 males and 1 female, *leg.* E. Kullmann; September 19, 1965, 1 female.

Kabul/Mazar-i-Sharif Road, 12 km. N W Kabul, October 2, 1965, from *Meriones libycus* burrow, 2 males and 2 females.

Kandahar and environs, November 1–9, 1965, from *Calomyscus bailwardi*, 1 male; from *Gerbillus nanus*, 2 males and 2 females; from *Meriones libycus* and burrow, 3 males and 8 females; from *Meriones crassus*, 24 males and 24 females; from *Tatera indica*, 1 male and 4 females.

Shombul, 12 km. W Shibar Pass, July 26, 27, 1965, from *Meriones persicus*, 14 males and 8 females.

Spin Baldak, 16 km. N, November 7, 1965, from *Meriones libycus* burrow, 4 males and 7 females.

Tang-i-Garu, March 12, 1965, from *Calomyscus bailwardi*, 1 male; from *Meriones persicus*, 1 male and 4 females, all *leg.* E. Kullmann.

Nosopsyllus (Gerbillophilus) turkmenicus altisetus (Ioff, 1950). Figures 262–267.

Nosopsyllus turkmenicus altisetus Ioff, 1950, Med. Parazitol. Moskva, **19**, p. 270.

Two pairs of fleas tentatively assigned to this subspecies were collected in Nuristan. The identification is tentative because neither sex agrees completely with specimens of this subspecies from near Ashkhabad, Turkmeniya, USSR, in my collection. In the males, the claspers are similar, and the acetabular bristles arise well above the articulation of the movable process. The apex of the distal arm of st. IX is more truncate, however, than is typical for the subspecies. The caudal lobe of st. VII in the females is more truncated than in *N.* (*G.*) *t. altisetus* and is slightly deflected downward apically. Possibly these specimens represent a new species, but additional material is required before this can be decided.

Nosopsyllus (*G.*) *t. altisetus* has been reported from Akar Cheshme in the Paropamisus Mountains as well as the Kopet Dag and the Bol'shoy Balkhan Mountains of Turkmeniya (Ioff *et al.*, 1965). It is associated with various gerbilline rodents. Specimens in my collection were taken from *Meriones persicus*.

The occurrence of a member of this subgenus on a murine rodent is atypical. One might suspect a transposition of labels, but all four specimens came from one host animal and no gerbilline rodents were collected in the Kamdesh area.

Material collected.—

Kamdesh, 8 km. S, October 13, 1965, from *Mus musculus*, 2 males and 2 females.

Nosopsyllus (Gerbillophilus) eremicus new species. Figures 268–272.

Diagnosis.—Closest to *N. turkmenicus* and related species such as *N. pringlei*, but differing in the following characters in the male (females are essentially inseparable from those of related species unless accompanied by males): a) dorsal projection of fixed process broad, smoothly rounded apically and bearing only a slight concavity between apex and origin of acetabular setae; b) movable process extending beyond apex of fixed process about one-fourth its length, its apex tapering smoothly to a sharp, toothed point.

Description.—HEAD, MALE (fig. 268): Frontal tubercle normal for the genus. Frontal row consisting of a single bristle arising near the cephalic margin of the antennal groove. Ocular row of three main bristles plus intercalaries. Eye large and heavily pigmented, its longest diameter equal or slightly exceeding the distance from its caudal margin to apex of genal lobe. Postantennal portion of head with occipital row of bristles complete. Remaining chaetotaxy consisting of one long bristle arising midway along caudal margin of antennal groove and a row of seven to nine finer setae along the groove. Maxillary palpi of four segments, extending about to apex of forecoxa. Labial palpi of five segments, extending to apex of foretrochanter.

THORAX: Pronotum with six setae per side plus intercalaries and 19 to 21 spines in the comb. Mesonotum with six setae per side plus intercalaries and a few smaller setae cephalad of main row. Four or five pseudosetae per side under mesonotal collar. Metanotum with five or six setae per side plus intercalaries, preceded by a row of three smaller bristles. One marginal spinelet each side. Mesepisternum with two long setae, mesepimeron with five long setae per side. Lateral metanotal area with two long setae. Metepisternum with one, metepimeron with four to five long setae ranked in three rows with no setae above the spiracle.

LEGS: Forecoxa with about 14 setae on outer surface, arranged in five irregular rows. Outer surface of forefemur with three to seven small setae remote from margin arranged in two rows. Caudal margin of foretibia bearing a dense fringe of about 10 heavy setae, the longest apical seta reaching apex of foretarsal segment II. Foretarsal segment II the longest of the first four. Segment V with five pairs of lateral plantar setae, the proximal pair translocated onto the plantar surface, arising nearly between the origins of the second pair. Anterior margin of midcoxa with a submarginal row of four or five setae on outer surface in addition to the apical setae. Inner surface of midfemur with a row of four to five setae in a submarginal row. Caudal margin of midtibia with four subapical notches, each bearing a pair of heavy setae. Notches one and two and three and four separated by a space about three times greater than that between notches two and three. Midtarsal segments I and II similar in size, about twice as long as segment III. Segment IV shortest. Chaetotaxy of segment V as for foretarsus. Hindcoxa with a submarginal row of about five bristles on apical half. Inner surface of hindfemur with a row of five long submarginal setae extending from base to apex. Caudal margin of hindtibia with chaetotaxy as midtibia. Hindtarsal segment I almost as long as segments II to IV combined. Longest apical seta of segment II extending well beyond apex of segment IV. Hindtarsal segment V with five pairs of lateral plantar setae; the proximal pair only slightly shifted onto the plantar surface.

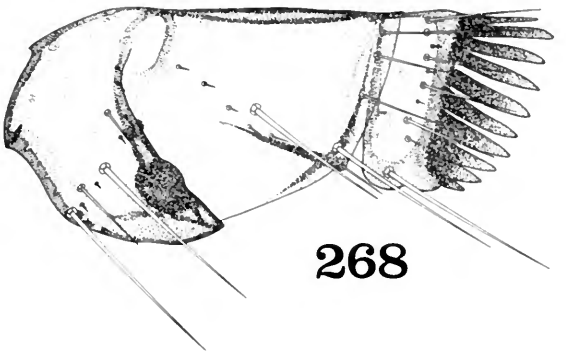
UNMODIFIED ABDOMINAL SEGMENTS: Abdominal tergites I through VII with 5, 7, 7/8, 7/6, 7/6, 7/6, 5/6 setae in main row in males, 5/6, 7/8, 7/8, 7, 6/7, 6/7, 6 in females. Marginal spinelets on tergites I to III numbering 1, 1, 1 per side in males, 2, 2, 1 in females. Abdominal sternites II through VII averaging 1, 2, 3, 3, 3, 4 setae per side in males, 1, 5, 5, 5, 5, 7 in females. St. II of females also bears from one to four small setae in a clump on each side, remote from the ventral pair.

MODIFIED ABDOMINAL SEGMENTS (figs. 269–272), MALE: Apex of dorsal projection of fixed process smoothly rounded, its caudal margin practically straight to origin of acetabular setae which arise on a slight hump. Movable process with cephalic margin practically straight, its caudal margin smoothly rounded to a sharp, toothed apex. Caudal margin of distal lobe of st. IX with a subapical concavity causing the smoothly rounded apex to appear produced caudally. Aedeagal crochet well developed with a strongly hooked apex.

FEMALE: Spermatheca with globular bulga which is flat ventrally. Hilla recurved over bulga but only covering about one-fourth of the latter. Caudal margin of st. VII with a triangular lobe of varying length, subtended by a shallow sinus.

Type material.—Holotype male and allotype female (L-7835) from *Meriones crassus*, 16–25 km. S W Qala Bist, Afghanistan, 793 m., November 11, 1965, *leg.* R. E. Lewis. Paratypes: 2 males, 8 females with the same number and data; 1 female (L-7836) from *Vulpes vulpes*, same locality and date; 4 males, 10 females (L-7840) from *Meriones crassus*, 16 km. E. Girishk, Afghanistan, November 13, 1965, *leg.* R. E. Lewis.

The name of this taxon is derived from the Greek word, *eremia*, meaning solitude or desert.



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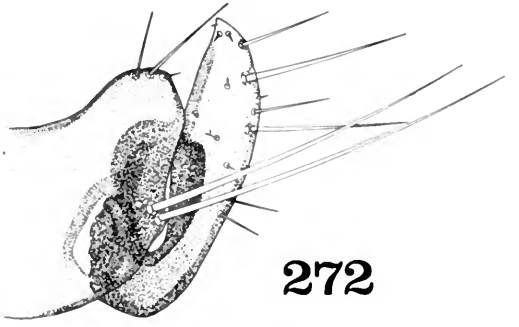

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FIGS. 268–272. *Nosopsyllus* (*Gerbillophilus*) *eremicus* n. sp. **268.** Head of holotype male; **269.** Spermatheca of allotype female; **270.** St. VII of allotype female; **271.** Apex of st. IX of holotype male; **272.** Clasper of holotype male.

CITELLOPHILUS Wagner

Citellophilus. Wagner, 1934, Konowia, **13**, p. 260.

Type species.—*Citellophilus tesquorum* (Wagner, 1898).

This genus, presently known from 23 species and subspecies, is strictly Palaearctic in occurrence. It is reported from Eastern Europe to China as ectoparasites of small rodents, especially *Citellus* species. The generic name, however, is misleading because a number of the species apparently prefer various mice as hosts, and host-specificity is not particularly strong in members of the genus.

Various of the species have been associated with plague outbreaks in the USSR, and the genus as a whole has received considerable attention. A number of undescribed species occur in collections, and this is another ceratophyllid genus that badly needs to be restudied.

Only two species of *Citellophilus* have been collected in Afghanistan, and it is unlikely that additional species occur there. The two species discussed here may be separated by the following key.

1. Movable process of male rectangular, lowermost spiniform bristle on its caudal margin separated from upper two bristles by a broad space; apical margin of female st. VII with a broadly rounded lobe or a broad sinus; hilla of spermatheca with distinct apical papilla..... *lebedewi* (p. 134)

   Movable process of male triangular, three heavy bristles on caudal margin evenly spaced; apical margin of female st. VII usually with a distinct angle; hilla of spermatheca lacking distinct apical papilla..... *trispinus* (p. 134)

Citellophilus lebedewi (Wagner, 1933)

Ceratophyllus lebedewi Wagner, 1933, Konowia, **11**, p. 273, fig. 1.

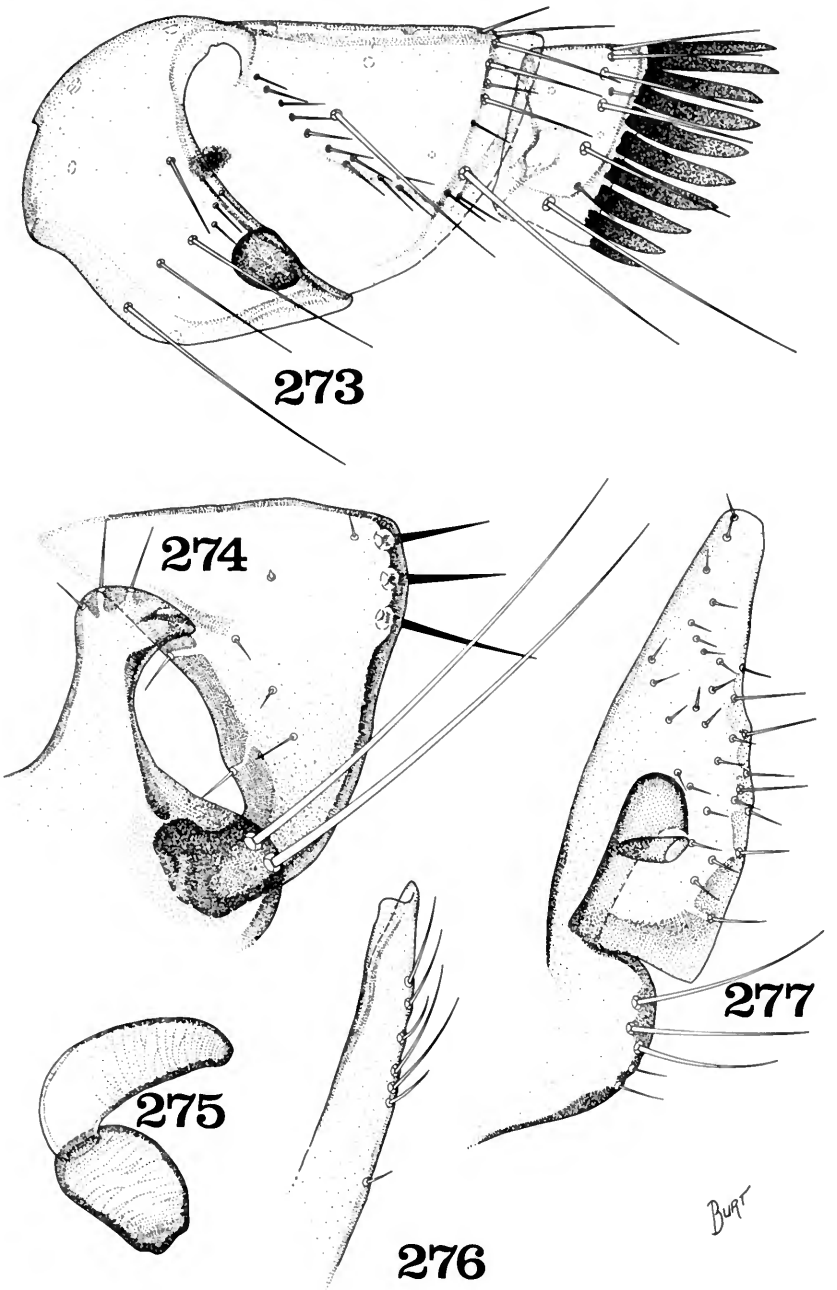
Though this species was not encountered by us, it is reported from near Lake Shewa in Badakhshan by Sakaguti (1966). Only males were taken and this author refused to speculate on the subject of which subspecies the specimens represented. The nominate form is separable from *C. l. princeps* (Ioff, 1946) in that the apical margin of the female st. VII bears a broad sinus.

This is one of the two species of this genus that normally parasitizes marmots rather than *Citellus* species and it is likely more common than records indicate.

Citellophilus trispinus (Wagner and Ioff, 1926). Figures 273–277.

Ceratophyllus trispinus Wagner and Ioff, 1926, Rev. Microbiol., Saratov, **5**, p. 70, 112, fig. I.

According to Ioff *et al.* (1965), this species ranges over most of Central Asia from Chinese Turkestan east to the Kyzyl Kum Desert



FIGS. 273–277. *Citellophilus trispinus* (Wagner and Ioff). **273.** Male head; **274.** Male clasper; **275.** Female spermatheca; **276.** Apex of male st. VIII; **277.** Apex of male st. IX.

of Uzbekistan and Kazakhstan. They further state that it is an ectoparasite of *Citellus fulvus*. No hosts of this species were taken during the expedition and only a single female specimen of this flea was collected, from an atypical host. Collections donated by Dr. E. Kullmann contained a good series, however, and the presence of the species as a member of the fauna is well documented.

J. Niethammer (1965) discusses the distribution of *Citellus fulvus* in Afghanistan and lists collections from "Rand des Ab-i-Istada" southeast of Mukur, between Mukur and Ghazni, the Dasht-i-Nawar, and from 30 km. west of Herat, where it occurs locally in sandy steppes between 1,000 and 3,000 m. The Kullmann collections come from two of these localities, and doubtless this flea occurs wherever its preferred host abounds. The collections from *Ochotona rufescens* are certainly instances of accidental transfer where *Citellus* and *Ochotona* coexist.

Material collected.—

Band-i-Amir, October 2, 1963, from *Ochotona rufescens*, 1 female, *leg.* E. Kullmann.

Dasht-i-Nawar, June 2, 1963, from *Citellus fulvus*, 10 males and 8 females, *leg.* E. Kullmann.

Mukur, May 15, 1964, from *Citellus fulvus*, 4 males and 6 females, *leg.* E. Kullmann.

Shombul, 12 km. W Shibar Pass, July 24, 1965, from *Ochotona rufescens*, 1 female.

Unai Pass, October 4, 1963, from *Ochotona rufescens*, 1 male, *leg.* E. Kullmann.

CALLOPSYLLA Wagner

Callopsylla. Wagner, 1934, Konowia, **13**, p. 262.

Type species.—*Callopsylla lagomys* (Wagner, 1898).

Another exclusively Palaearctic genus, the 17 known species are ectoparasites mainly of small rodents. Four subgenera have been erected for the various species. The nominate subgenus is the only group represented in the Afghan fauna according to present records. It is probable that one or more of the bird-infesting species of the subgenus *Orneacus* will be collected there, however, since both house

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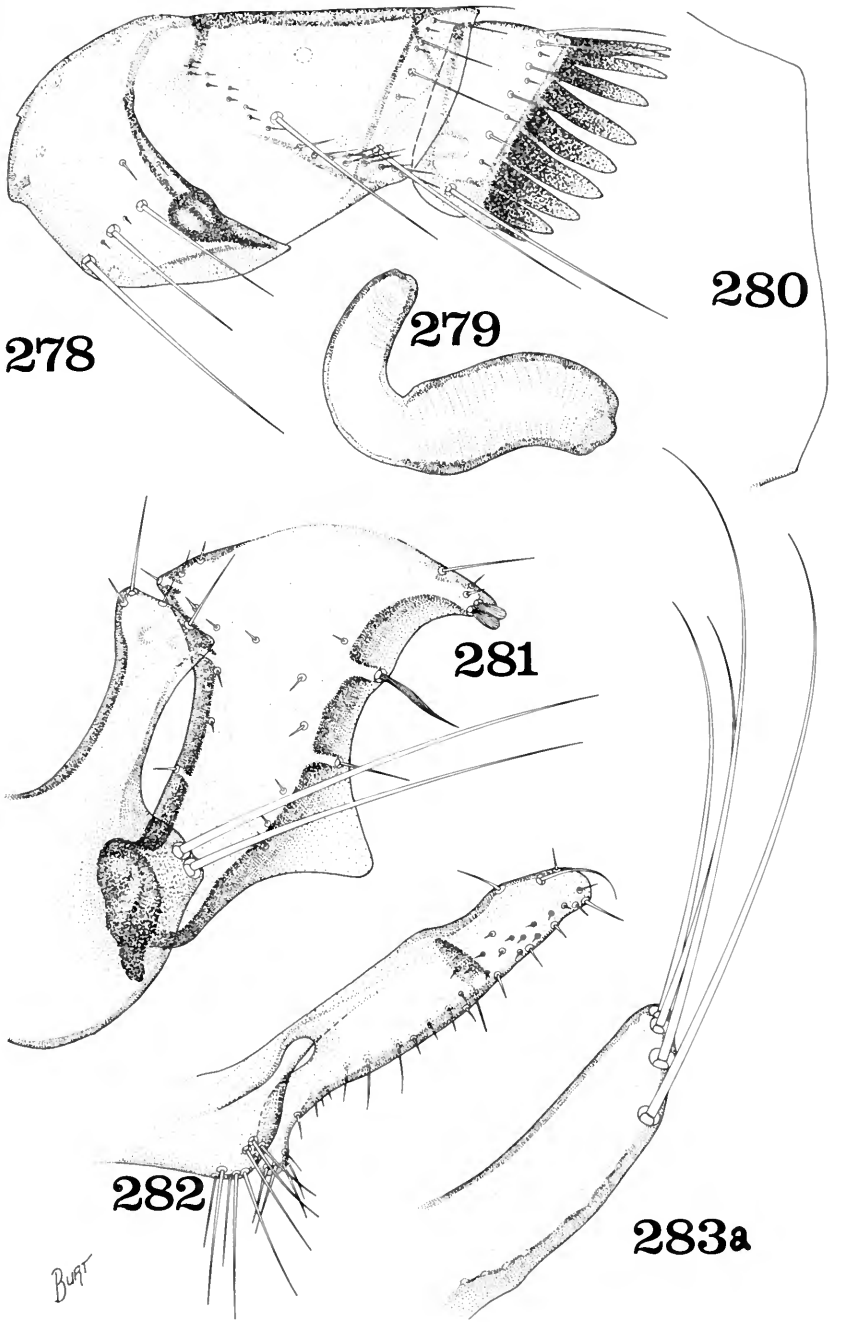
FIGS. 278–283a. *Callopsylla* (*Callopsylla*) *caspia* (Ioff and Argyropulo). **278.** Male head; **279.** Female spermatheca; **280.** Female st. VII; **281.** Male clasper; **282.** Apex of male st. IX; **283a.** Apex of male st. VIII.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martins (*Delichon urbica*) and wild pigeons (*Columba livia*) are native to the country. The remaining two monotypic subgenera, *Paracallopsylla* and *Typhlocallopsylla*, are only known from the Tibetan plateau and Siberia and likely do not occur in Afghanistan.

Three species, one of them new, were collected during the expedition. They may be separated by the following key.

1. Males 2
   Females (unknown for *streeti*) 4
2. Movable process bearing a distinct caudoventral projection 3
   Movable process hamate, lacking a caudoventral projection.
   streeti n. sp. (p. 140)
3. Caudoventral projection of movable process well developed, pointed; apex of st. IX with straight, subparallel margins, not bent caudally.
   caspia (p. 138)
   Caudoventral projection of movable process much shorter, blunt, apex of st. IX wider, bent caudally ..... *tiflovi* (p. 140)
4. Sclerotized folds of bursa copulatrix heavy and dark ..... *tiflovi* (p. 140)
   Sclerotized folds of bursa copulatrix light, less pigmented .... *caspia* (p. 138)

Callopsylla (Callopsylla) caspia (Ioff and Argyropulo, 1934). Figures 278–283a.

Ceratophyllus caspius Ioff and Argyropulo, 1934, Z. Parasitenk., **7**, p. 143.

Ioff *et al.* (1965) report this species as a parasite of voles of the genus *Alticola* in the Tien Shan and Gissarskiy Mountains and voles of the subgenus *Chionomys* in the Caucasus. It has also been reported as far south as the Lebanon Mountains and Mount Hermon in the Antilebanon Mountains (Lewis, 1962, 1964). Peculiarly, it was not reported from Iran by Klein (1963), although it is certain to occur in the Elburz Mountains.

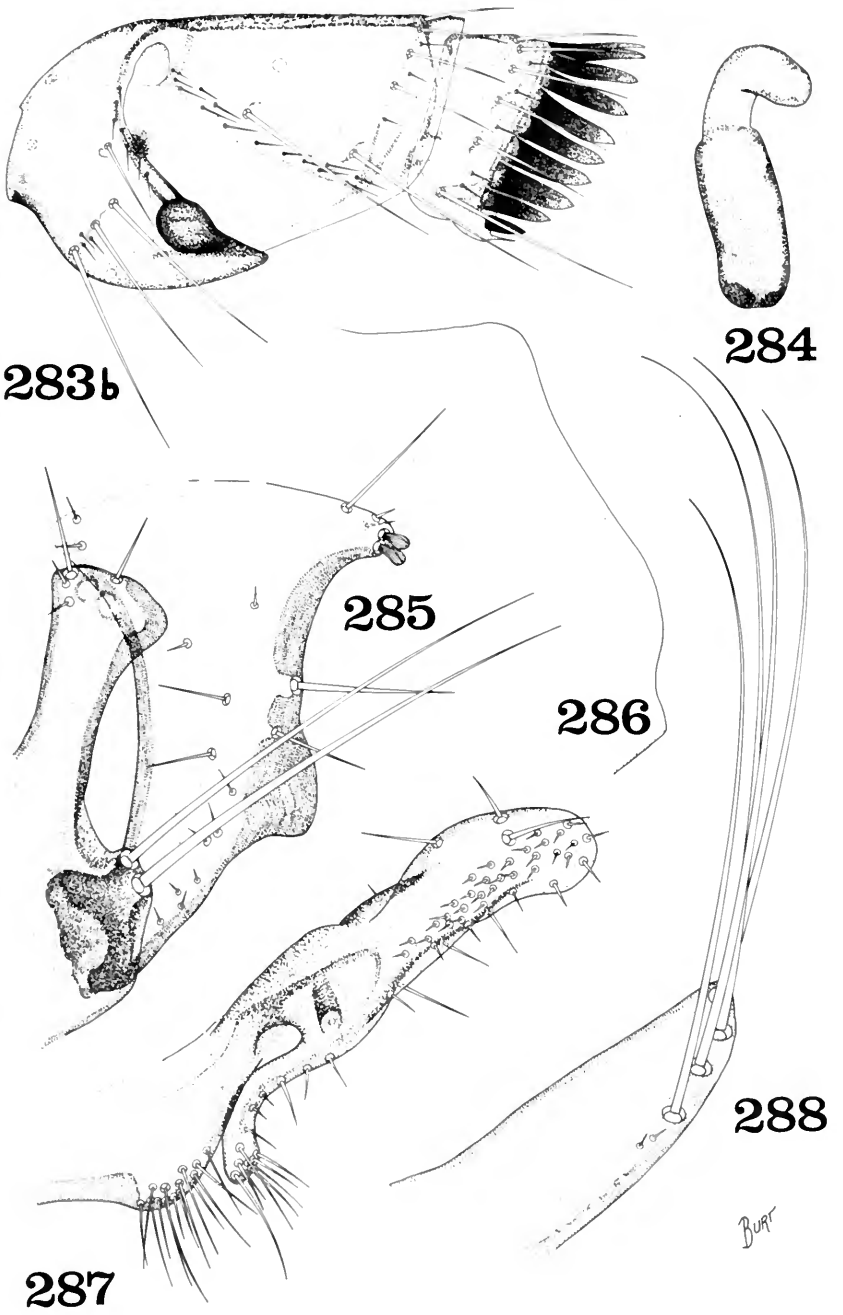
As shown by our collections, this species is not absolutely specific to microtine rodents and may be expected to occur on other small mammals associated with voles.

Material collected.—

Ishkamish and environs, August 16–18, 1965, from *Apodemus sylvaticus*, 1 female; from *Cricetulus migratorius*, 7 males and 9 females; from *Alticola roylei*, 2 females.

Shibar Pass and environs, July 25–30, 1965, from *Cricetulus migratorius* and nest, 2 males and 5 females; from *Microtus afghanus*

FIGS. 283b–288. *Callopsylla* (*Callopsylla*) *tiflovi* Wagner. **283b.** Male head; **284.** Female spermatheca; **285.** Male clasper; **286.** Female st. VII; **287.** Apex of male st. IX; **288.** Apex of male st. VIII.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and nest, 29 males and 36 females; from *Microtus arvalis*, 6 males and 3 females.

Callopsylla (Callopsylla) tiflovi Wagner, 1936. Figures 283b–288.

Callopsylla tiflovi Wagner, 1936, Z. Parasitenk., 8, p. 346, fig. 19.

Ioff *et al.* (1965) record this species from the Kopet Dag and Bol'shoy Balkhan Mountains (about 390 km. N W of Ashkhabad, Turkmeniya). They also note the occurrence of a subspecies, *C. t. elburzi* Argyropulo and Dubinin, 1948, described from the Elburz Mountains of Iran, which has since been synonymized with the nominate form (Ioff and Bondar, 1956). The species is stated to be an ectoparasite of the Afghan Pika, *Ochotona rufescens*.

Specimens collected during the expedition, plus those kindly donated by Dr. E. Kullmann, extend the known range of this species practically to the Pamirs. In addition to records from what is apparently its true host, substantial numbers are recorded from *Cricetulus migratorius* from the Sauzak Pass, east of Herat, and certainly an accidental occurrence on *Meriones persicus* at Shombul.

Material collected.—

Dasht-i-Nawar, S Pass, September 5, 1963, from *Ochotona rufescens*, 1 male; June 20, 1963, 5 males and 7 females, all *leg.* E. Kullmann.

Dumandi Pass, May 5, 1964, from *Ochotona rufescens*, 1 female, *leg.* E. Kullmann.

Herat, 96 km. E, September 16, 1965, from *Ochotona rufescens*, 1 male and 2 females.

Paghman and environs, July 13–17, 1965, from *Ochotona rufescens*, 21 males and 12 females.

Sauzak Pass, September 22, 1965, from *Cricetulus migratorius*, 14 males and 21 females; from *Ochotona rufescens*, 3 males and 6 females.

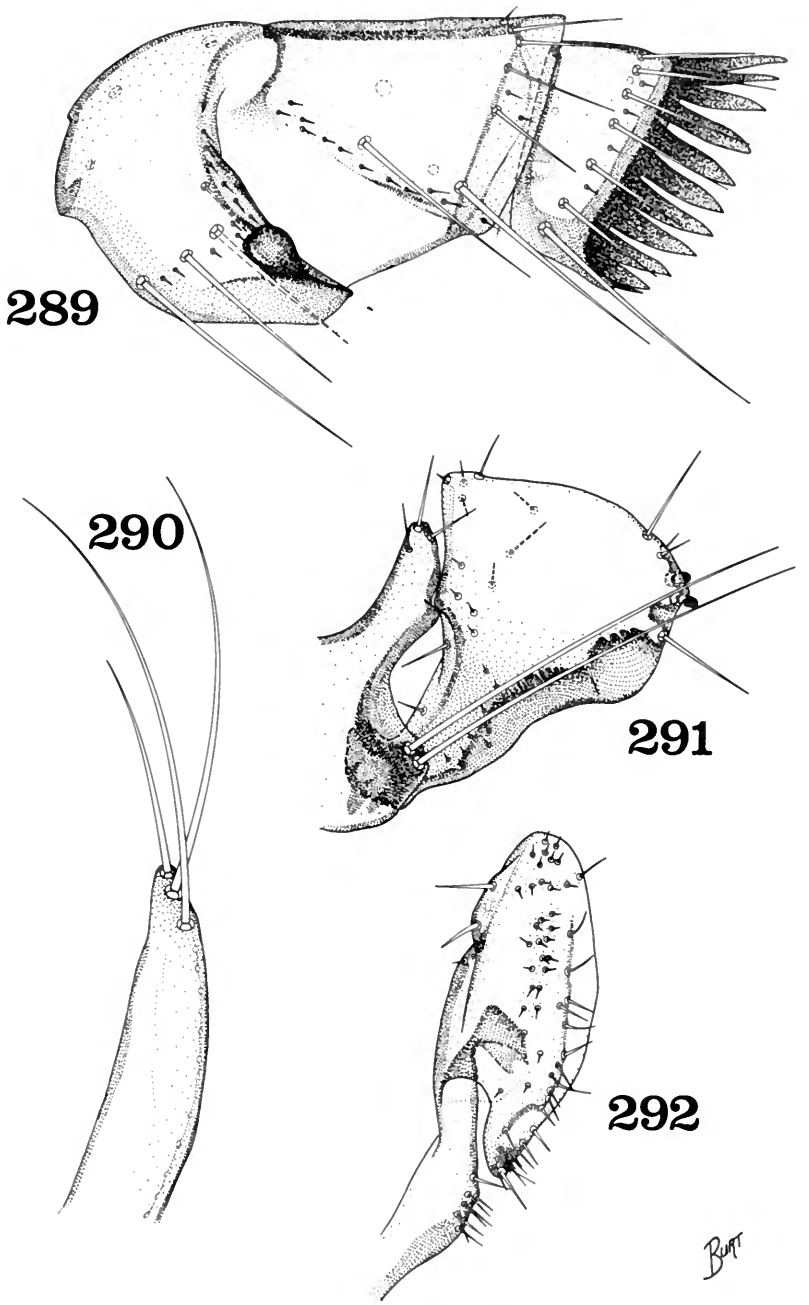
Shibar Pass, July 24–30, 1965, from *Ochotona rufescens*, 2 males and 8 females.

Shombul, 12 km. W Shibar Pass, July 24–28, 1965, from *Meriones persicus*, 2 females; from *Ochotona rufescens*, 5 males and 5 females.

Unai Pass, August 16, 1964, from *Ochotona rufescens*, 28 males and 68 females; October 4, 1963, 6 females, all *leg.* E. Kullmann.

Callopsylla (Callopsylla) streeti new species. Figures 289–292.

Diagnosis.—Not particularly similar to any known species of the subgenus, being especially distinct in: a) having the fixed process



FIGS. 289–292. *Callopsylla* (*Callopsylla*) *streeti* n. sp. Male holotype. **289.** Head; **290.** Apex of st. VIII; **291.** Clasper. **292.** Apex of st. IX.

notched for the reception of the toothlike incrassation of the movable process; b) the movable process is hamate; c) the apical lobe of the distal arm of st. IX is broadly spatulate and its caudoventral angle is less attenuated than in most other species; d) the membranous, fimbriated apical processes of st. VIII are divided into a large ventral lobe and smaller dorsal lobe.

Description.—HEAD (fig. 289): Three setae on ocular row and one small seta near anterior margin of antennal groove. Occiput devoid of setae except those in the occipital row and one large and 14 to 18 small setae along the antennal groove. Bristles of antennal pedicel extending to about flagellar segment IV. Labial palpi reaching middle of trochanter.

THORAX: Pronotal comb of 22 spines (counting the very small spine at end of the comb on each side). One row of setae on pronotum. Anterior margin of mesonotum with a row of small setae extending ventrad to about middle of mesepisternum. Main row of mesonotal setae preceded by two rows of smaller bristles. Mesonotal collar with 12 pseudosetae. Metanotum with four marginal spinelets and one row of long setae preceded by a row of short setae. Metepimeron with two rows of setae numbering two and three.

LEGS: Outer surface of forefemur with nine small setae as well as a number of marginal and submarginal bristles. Meso- and metacoxae with continuous, submarginal rows of small setae on inner surface from base to apex. Meso- and metafemora also bearing submarginal rows of fine setae from base to apex along ventral margin of inner surface. Hindtibia with seven notches in dorsal margin. Hindtarsal segment I about as long as segments II through IV combined. Hindtarsal segment V with five pairs of lateral plantar bristles, all arising along the margin.

UNMODIFIED ABDOMINAL SEGMENTS: Unmodified abdominal tergites bearing one row of large setae preceded by one row of small setae. Marginal spinelets; 2/2, 3/3, 2/2, 2/1. St. II with one seta each side, st. III through VII bearing a row of three setae each side. Antesensilial seta single, bounded each side by a minute bristle.

MODIFIED ABDOMINAL SEGMENTS (figs. 290–292): Fixed process acuminate distally, its caudal margin bearing a deep, subapical notch. Acetabular setae borne on a caudoventral projection of the clasper. Movable process broadly expanded distally, with well-developed incrassation midway down the cephalic margin and a short, blunt pair of spiniform bristles situated on the caudoapical margin. St. VIII with bipartite, fimbriated, membranous apical lobes and six apical setae. Distal arms of st. IX divided into apical and proximal lobes; form and chaetotaxy as illustrated.

Type material.—Male holotype (L-7685) from 24 km. E Ishkamish, Badakshan, Afghanistan (36° 42′ N, 71° 46′ E, 2,623 m.) from *Cricetulus migratorius* (Migratory Hamster), August 16, 1965, R. E. Lewis.

Holotype deposited in the collection of Field Museum of Natural History, Chicago, Illinois.

This species is named in honor of Mr. William S. Street, leader of the Street/Chicago Natural History Museum Expedition to Afghanistan in 1965, during which the specimen was collected.

It is doubtful if *Cricetulus migratorius* is the true host of this flea. Our collections in this area were mainly limited to the flood plain of the Amu Darya (Oxus) River, and our visit was so short that the mammal population was not sampled completely. Species of *Ochotona* and *Alticola* certainly occur in this area, and it is probable that one of these is the normal host.

See Hassinger (1968) for a description of the habitat.

MONOPSYLLUS Kolenati

Monopsyllus. Kolenati, 1857, Wien. Ent. Monatschr., **I**, p. 65.

Type species.—Pulex sciurorum Schrank, 1803.

This is one of the ceratophyllid genera that badly needs the attention of a systematist. There are presently 28 recognized species and subspecies in the Palaearctic and Nearctic Regions. They are parasites of a wide variety of small mammals, especially squirrels and dormice, though small carnivores also are parasitized.

A single species of this genus was collected in Afghanistan. It is possible that additional taxa occur there, but if they do, they probably will be found in the mountainous section of the northeast.

Monopsyllus sciurorum asiaticus (Ioff, 1940). Figures 293–297.

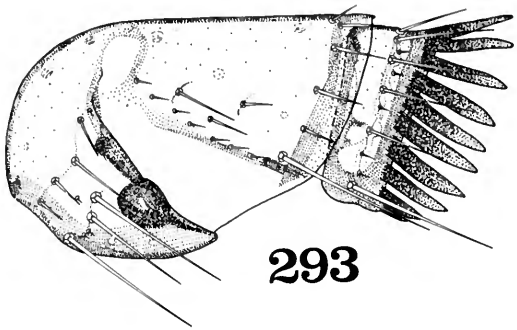
Ceratophyllus (Monopsyllus) sciurorum asiaticus Ioff, 1940, Mag. Parazitol., Leningr., **7**, p. 226.

Monopsyllus sciurorum cophinus Jordan, 1944, Proc. Zool. Soc. London, Part III, **114**, p. 360.

The seven specimens of this flea collected by the Street Expedition are topotypes for Jordan's *M. s. cophinus*. *Dryomys nitedula* abounds in the area around Kabul and Paghman, living in burrows among the rocks as well as constructing nests in the trees. No dormice from tree nests were infested, and only two taken from among the rocks had fleas. Unless they are more common during another season, it seems that this is a relatively rare flea, at least in Afghanistan.

Material collected.—

Paghman, July 14–18, 1965, from *Dryomys nitedula*, 1 male and 6 females.



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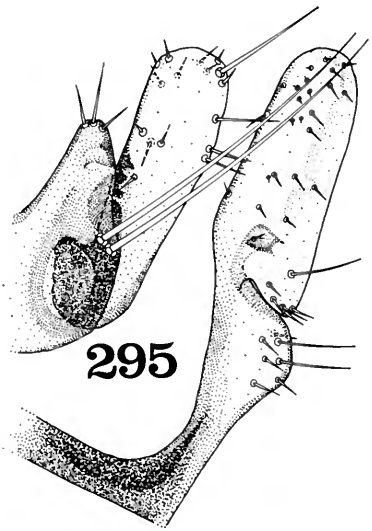

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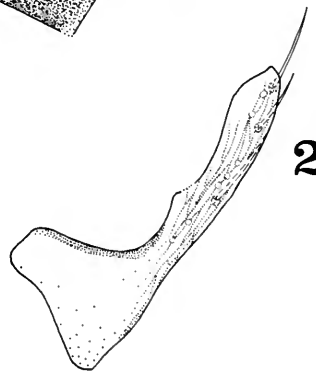

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FIGS. 293–297. *Monopsyllus sciurorum asiaticus* (Ioff). **293.** Male head; **294.** Female st. VII; **295.** Male modified segments; **296.** Female spermatheca; **297.** Male st. VIII.

CERATOPHYLLUS Curtis

Ceratophyllus. Curtis, 1832, Guide Brit. Ins., (7) 201; Brit. Entomol., **9** (104), p. 417.

Type species.—Ceratophyllus hirundinis Curtis, 1832.

This is a large genus of about 50 described species and subspecies, practically all of which are exclusively parasites of birds. Though some species seem restricted to water birds, most of the species are found on passerines or hole-nesting forms, such as swallows. Members of the genus are Holarctic in distribution, although one species, *C. gallinae,* enjoys a cosmopolitan distribution due to human transport on poultry. Adults are seldom encountered on the host, but may develop in huge numbers in the host's nest.

There has been much confusion in the literature concerning the true composition of the genus *Ceratophyllus.* Originally, species belonging to many genera and even different families were placed here. Ultimately, its bulk stimulated specialists to seek differences, thought to be of generic magnitude, in an effort to reduce the genus to managable size. Wagner (1927) began to split off groups of species, and the process was completed by Jordan (1933) and Wagner (1934). Ioff (1936) felt that such splitting was undesirable and lumped many of the genera as subgenera under *Ceratophyllus s. lat.* Originally, he included only four genera in the Ceratophyllini. These were *Rostropsylla, Dasypsyllus, Mioctenopsylla,* and *Ceratophyllus s. lat.* Under *Ceratophyllus s. lat.* were included *Citellophilus, Callopsylla, Megabothris, Amonopsyllus, Monopsyllus, Ceratophyllus s. s., Amalaraeus, Malaraeus, Pleochaetus, Nosopsyllus,* and *Gerbillophilus.* Today, *Amonopsyllus* is considered a "section" of the subgenus *Monopsyllus,* genus *Ceratophyllus* (Ioff and Scalon, 1954; Ioff *et al.,* 1965) or a possible subgenus of *Monopsyllus,* if this genus is divisible into subgenera. A similar interpretation is applicable to the relationship of *Amalaraeus* to *Malaraeus,* and *Gerbillophilus* is assigned as a subgenus of *Nosopsyllus* (Lewis, 1967, and others). Further, *Aenigmopsylla, Brevictenidia, Glaciopsyllus, Hollandipsylla, Jellisonia, Kohlsia, Libyastis, Macrostylophora,* and *Syngenopsyllus* either have been described since 1936 or were unknown to Ioff at the time of his 1936 study. Finally, a number of as yet undescribed genera belonging to this family exist in collections, and it is likely to be some time before a thorough, systematic treatment of the family can be undertaken.

Ceratophyllus as used here corresponds to *Ceratophyllus s. s.* (in the strict sense) of the arrangement discussed above. The three

species reported from Afghanistan may be separated with the following key.

1. Males 2
   Females (key adapted from Smit, 1957) 4

2. Dorsal projection of fixed process narrowed subapically; movable process hamate, with two heavy, spiniform setae arising on caudoventral margin; with five or six long setae arising on membranous lateral lobes of st. IX.
   hirundinis (p. 151)
   Dorsal projection of fixed process conical; movable process more rectangular, lacking spiniform setae; no setae on membranous lateral lobes of st. IX.... 3

3. Acetabular setae arising above dorsal articulation of movable process with fixed process; proximal lobe of distal arm of st. IX with dense cluster of setae on caudal margin; apex of st. VIII with a fringed lobe.
   v. vagabundus (p. 151)
   Acetabular setae arising below dorsal articulation of movable process with fixed process; proximal lobe of distal arm of st. IX with few setae on caudal margin; apex of st. VIII lacking a fringed lobe ..... *fringillae* (p. 146)

4. Collar of metanotum membranous ..... *hirundinis* (p. 151)
   Collar of metanotum well developed 5

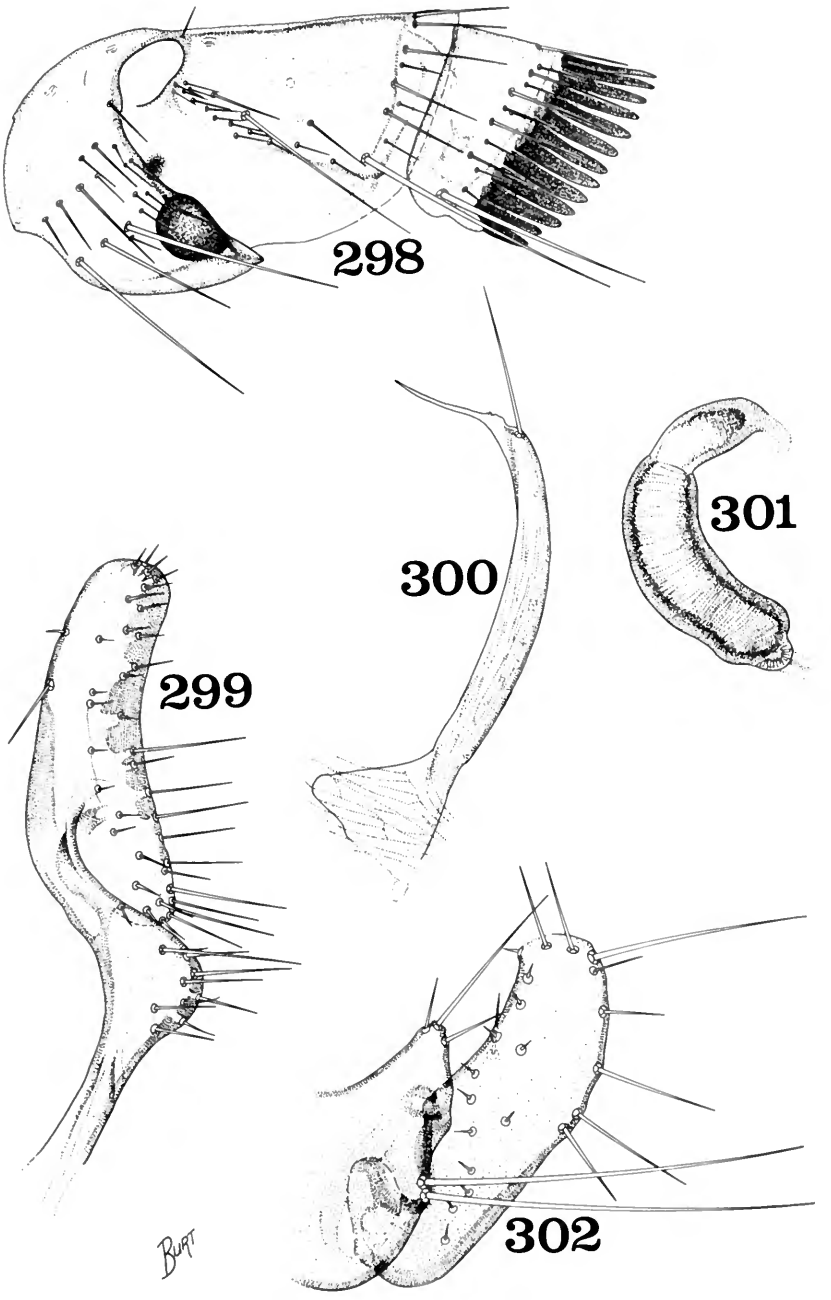
5. Posterior margin of st. VII partially almost straight; part of ductus bursae strongly sclerotized longitudinally ..... *v. vagabundus* (p. 151)
   Posterior margin of st. VII more rounded; ductus bursae not strongly sclerotized ..... *fringillae* (p. 146)

Ceratophyllus fringillae (Walker, 1856). Figures 298–302.

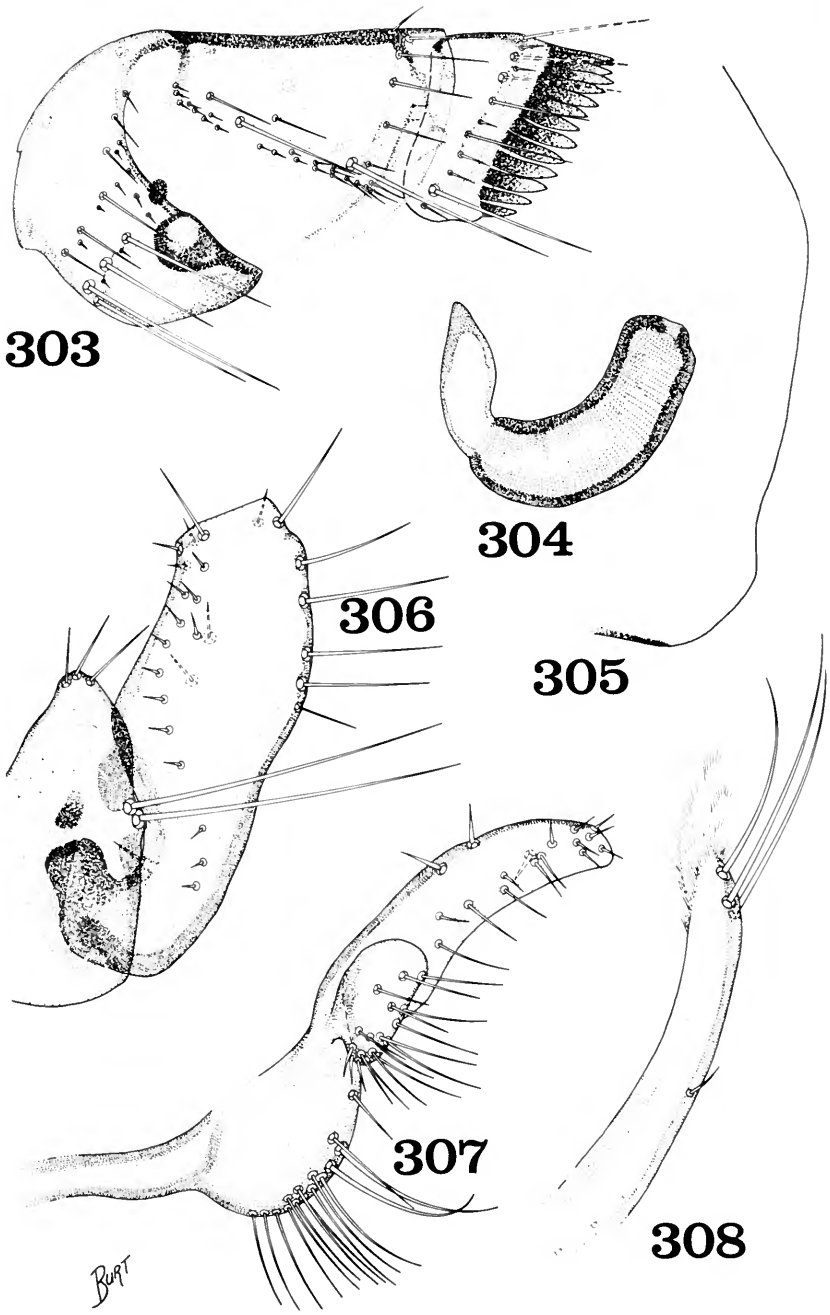
Pulex fringillae Walker, 1856, Ins. Brit., Diptera, **3**, p. 4.

This is a wide ranging species recorded from practically all the countries of Europe as well as from the eastern Mediterranean. Ioff *et al.* (1965) include the Crimea, Caucasus, Afghanistan, Kazakhstan, Tadzhikistan, and Kirgiziya in the Central Asian range of the species. Ioff and Scalon (1954), Smit (1957), and others have observed that the species is mainly a parasite of the English sparrow (*Passer domesticus*) and the starling (*Sternus vulgaris*), but that it has also been taken from the dry nests of other birds, especially passerines.

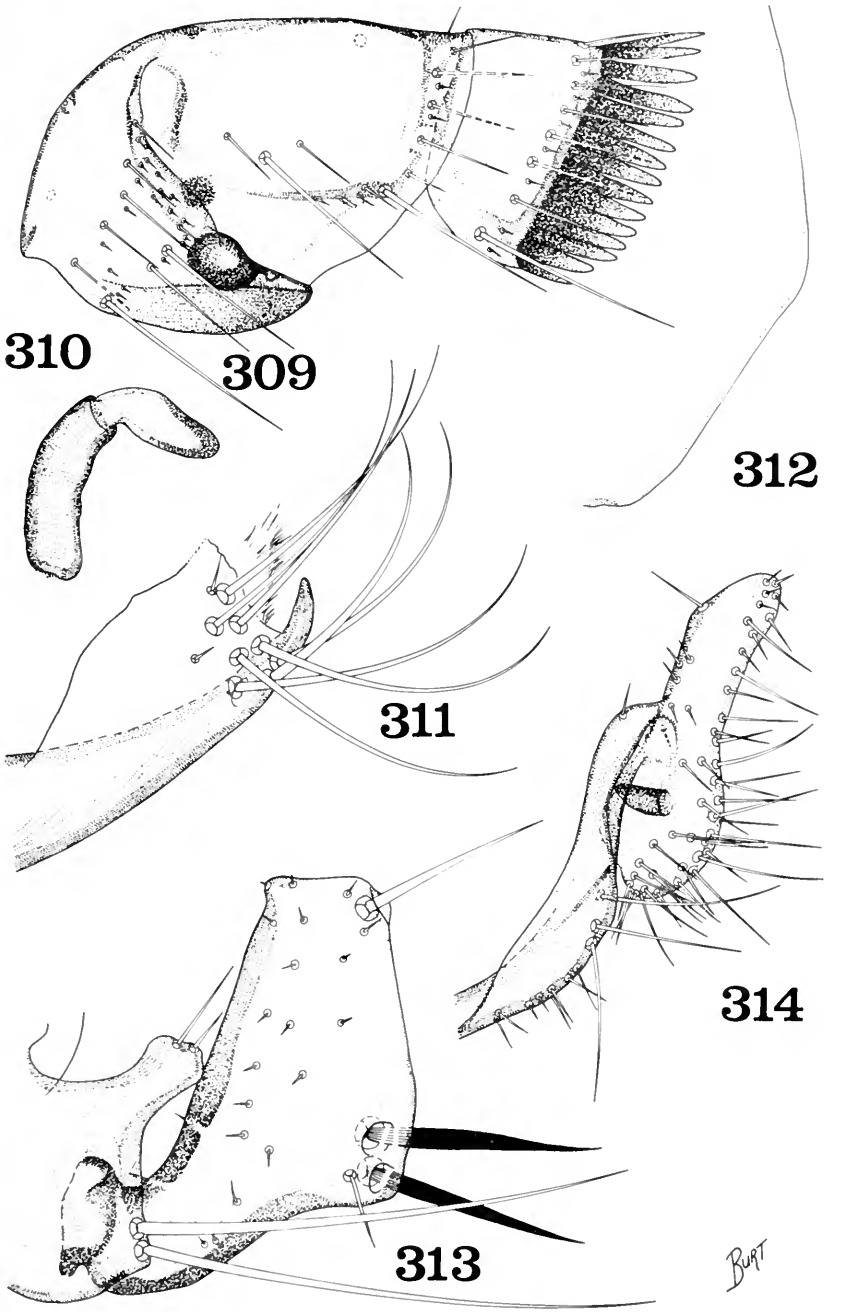
The large collection from sparrow nests taken near Kabul actually constituted but a fraction of the material available. Sparrows were nesting in holes in a stone culvert, facing within a few feet of ground level, and many of their nests were within reach. This is probably a common species throughout the country at higher elevations.



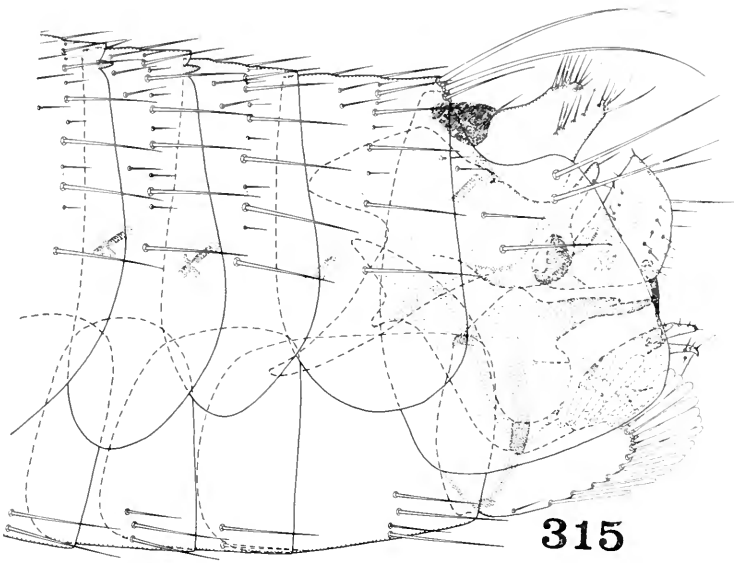
FIGS. 298–302. *Ceratophyllus fringillae* (Walker). **298.** Male head; **299.** Apex of male st. IX; **300.** Apex of male st. VIII; **301.** Female spermatheca; **302.** Male clasper.

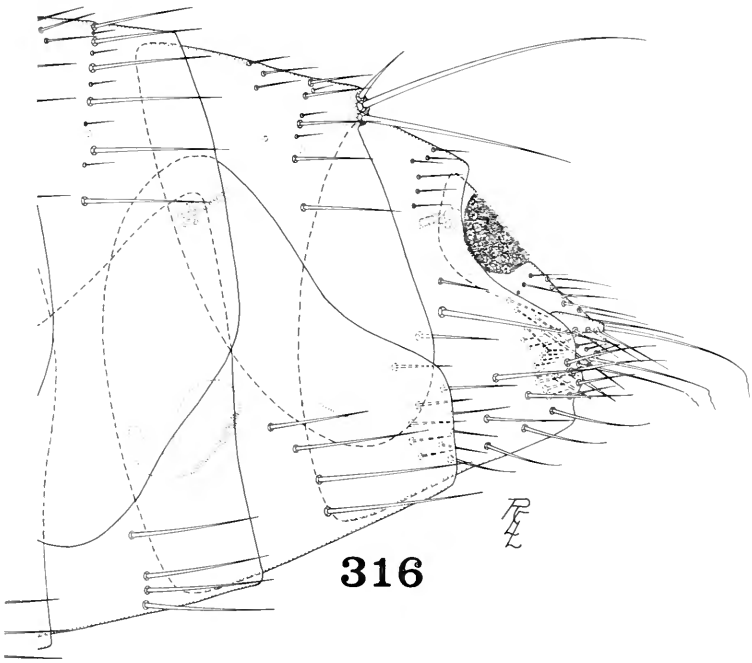


FIGS. 303–308. *Ceratophyllus vagabundus insularis* Rothschild. (See text for discussion of subspecies.) **303.** Male head; **304.** Female spermatheca; **305.** Female st. VII; **306.** Male clasper; **307.** Apex of male st. IX; **308.** Apex of male st. VIII.



FIGS. 309–314. *Ceratophyllus hirundinis* (Curtis). **309.** Male head; **310.** Female spermatheca; **311.** Apex of male st. VIII; **312.** Female st. VII; **313.** Male clasper; **314.** Apex of male st. IX.





FIGS. 315–316. *Acropsylla traubi* Lewis. **315.** Modified segments of holotype male. **316.** Modified segments of allotype female.

Material collected.—

Bamiyan, 5 km. W, July 27, 1965, from *Oenanthe* sp. nest, 1 male and 2 females.

Ishkamish, 24 km. E, August 15, 1965, from *Ptyonoprogne rupestris* nest, 5 males and 2 females.

Kabul and environs, July 20, 1965, from *Microtus afghanus*, 1 female; from *Passer domesticus* nest in soil, 35 males and 100 females.

Shombul, 12 km. W Shibar Pass, July 30, 1965, from *Passer domesticus* nest in wall, 9 males and 16 females.

Ceratophyllus vagabundus vagabundus (Boheman, 1866). Figures 303–308.

Pulex vagabunda Boheman, 1866, Ofvers, Vetenskakad. Forh., Stockh., **22**, p. 576, pl. 35, figs. 1, 1a.

This species is recorded from Afghanistan from a single female from the snow finch, *Montifringilla theresae*, collected at Unai Pass, 2,800 m. (Peus, 1966). Without males, it is impossible to establish the subspecies involved, but on distribution records, it is probably the nominate form.

C. vagabundus occurs, in one subspecies or another, over most of Europe and Asia. It is circumpolar and has been recorded from Canada according to Smit (1957). Illustrations are of *C. v. insularis* Rothschild, 1906.

Ceratophyllus hirundinis (Curtis, 1832). Figures 309–314.

Pulex hirundinis Curtis, 1832, Brit. Entomol., **9**, p. 417, figs. A, D, E8.

Although this species was not collected by the expedition, it is definitely established in the literature that *C. hirundinis* occurs in Afghanistan. Ioff *et al.* (1965) summarize its general distribution as Europe, North Africa, Kashmir, and Mongolia. In the USSR, it is known from the Kiev, Moscow, Rostov, Voronezhskaya, and Zakarpatskaya oblasts as well as from the Caucasus and the Dzhungarskiy Alatau of Central Asia. It has also been reported from Lebanon by Lewis (1962) and is a monoxenous parasite of the House Martin, *Delichon urbica*, throughout its range.

DISCUSSION

As expected, the siphonapteran fauna of Afghanistan reflects the Palaearctic character of the host fauna. There are no genera exclusively Afghan and only one, *Acropsylla*, which seems out of place geographically. Our knowledge of the species belonging to this genus is extremely poor, however, and additional unpublished records suggest that they are native to the transition zone between the southern Palaearctic and northern Oriental Regions. A detailed discussion of the genus will appear in a subsequent treatment of the Siphonaptera of Nepal.

The remaining genera reported here may be conveniently grouped under one of the following headings.

I. Species or genera of cosmopolitan distribution
II. Genera not typically Holarctic, but with Holarctic species
III. Holarctic genera
IV. Mainly Palaearctic genera with some representatives in one or more other regions
V. Exclusively Palaearctic genera with broad distribution in the region
VI. Exclusively Palaearctic genera whose species appear to be ecologically restricted

I. Species or Genera of Cosmopolitan Distribution

Although there are no genera of fleas that show a truly cosmopolitan distribution in the sense that they are represented by different species in all regions of the world, there are some species of a few genera that occur throughout most of the earth's land surface. These species seem to have been transported from their original center of evolution by human agencies and have been adaptable enough to have become established.

Only four species belonging to this group were taken in Afghanistan. *Echidnophaga gallinacea* is mainly a parasite of gallinaceous

birds, although it has been reported by various authors from a wide range of mammals as well. On birds, these fleas tend to localize on parts of the host that are devoid of feathers, especially around the eyes and on the comb or wattles, if these are present. On mammals, they are most frequently found on the ears, eyelids, and lips, where the pelage is short and sparse. Females tend to remain attached, while the males are less sedentary. The species probably has been carried over much of the world on domestic fowl.

Pulex irritans is a companion of man throughout the world, and its present distribution is likely attributable to human migrations. In many places, this species also is found on the larger carnivores, such as foxes, jackals, and badgers, and may be accidentally encountered on almost any warm-blooded animal.

Ctenocephalides felis felis and *C. canis* are the only two cosmopolitan species of a genus that is mainly Ethiopian in occurrence. Both are parasites of carnivores, especially canids and felids and, again, probably owe their present distribution to human transport on pets. *C. felis* is known to occur in three subspecies, but only the nominate form enjoys a wide distribution.

II. Genera Not Typically Holarctic, but with Holarctic Species

Most members of the genus *Euhoplopsyllus* occur in the Nearctic and Neotropical Regions, with *E. glacialis profugus* being the sole Palaearctic taxon. All species are typically ectoparasites of rabbits and hares, though records from predators or rodents sharing the same habitat are not uncommon. Recently this subspecies has been taken from the alpine desert of Mustang, Nepal, from the Woolly Hare (*Lepus oiostolus*).

The assignment of *Synosternus* species to this heading is arbitrary. Two species, *S. longispinus* and *S. robustus*, are exclusively Palaearctic. *Synosternus pallidus* occurs from Turkmeniya and Afghanistan through the Middle East and Asia Minor and across North Africa. It also occurs well into the Ethiopian Region from Sudan to Nigeria and into the Oriental Region, being known from peninsular India. *Synosternus cleopatrae* has a similar distribution, though it has not been reported from India, Turkmeniya, or Asia Minor and apparently only enters the northern edge of the Ethiopian Region. All but one of the remaining species of the genus are exclusively Ethiopian.

Some species of the genus *Xenopsylla* occur in most of the faunal regions of the world, although the majority of them are concentrated in Asia, Africa, and India. *Xenopsylla astia* has a broad distribution through India and Southeast Asia. It also occurs from Afghanistan west through the Middle East and Arabian Peninsula and has been reported from Kenya, probably as an importation on livestock. *Xenopsylla nubica* seems to be mainly an African species, but occurs in the Middle East as far east as Afghanistan. There are specimens in my collection from Iran, Iraq, Jordan, Israel, and Saudi Arabia, and the species doubtless occurs in Syria as well. *Xenopsylla conformis* has a broad range. The nominate subspecies ranges from Turkmeniya and Afghanistan, westward in the Middle East until it intergrades with *X. c. mycerini*, which extends into North Africa, at least to Algeria and Tunisia. The exact zone of intergradation has not been established with certainty, but it probably is the Tigris-Euphrates basin. The remaining four forms reported here have a much more restricted distribution, being limited to the Circumcaspian area.

III. Holarctic Genera

Included here are genera with approximately equal representation of species in both the Nearctic and the Palaearctic Regions. The genus *Ceratophyllus* is a large group of ectoparasites of birds. One species, not yet reported from Afghanistan, has practically a cosmopolitan distribution as a parasite of poultry. The three species reported here are typically Palaearctic and have a broad range from the British Isles to Central Asia. *Ceratophyllus fringillae* is mainly a parasite of passerine birds and has been collected in Afghanistan on the English sparrow and the starling. *C. hirundinis* is known only from a single collection from 15 km. west of Pul-i-Khumri on its typical host, the House Martin. The record of *C. vagabundus* ssp. is based on a single female taken from a snow finch and requires confirmation.

Members of the genus *Oropsylla* are typically parasites of ground squirrels and marmots and their distribution conforms quite well to the range of their hosts.

The genus *Monopsyllus* is an enigmatic collection of species of dubious affinities. As presently understood, the species are about equally divided between North America and Eurasia as parasites of squirrels and other small rodents. The subspecies reported here is known from a limited number of localities in Central Asia.

Most of the known species of *Chaetopsylla* are Eurasian in their distribution and are parasites of carnivores. The species reported here, *C. globiceps*, occurs over much of Europe east to Siberia, west to Greenland, and south to Lebanon. It is mainly a parasite of foxes.

IV. Mainly Palaearctic Genera With Some Representatives In One Or More Other Regions

There are three genera of bat fleas known to occur in Afghanistan. Members of the genus *Ischnopsyllus* are mainly Palaearctic in distribution, but some species occur in the Ethiopian and Oriental Regions. In spite of the high mobility of their hosts, there is little overlap into these regions. This may be attributable to the high degree of host specificity shown by most species. Both *I. obscurus* and *I. octactenus* are typical European and west Asian species.

The bulk of the species of *Rhinolophopsylla* are known from South and Central Africa, but one, *R. unipectinata*, is known from four subspecies, one North African (*R. u. arabs*), one Indian (*R. u. indica*), and two collectively with a broad distribution throughout Europe, east through Transcaspia. As Smit (1960) points out, the nominate subspecies appears to reach its most southeastern point in the southern half of Afghanistan, while *R. u. turkestanica* has a much more restricted range, probably not farther south than about 35° N.

The two species of *Chiropteropsylla* probably are mainly Palaearctic, even though one, *C. brockmani*, was originally described from specimens from Somaliland. The species has since been reported from Egypt (Lewis, 1967), Iraq (Hubbard, 1956), and Afghanistan (Smit, 1960).

Neopsylla is a large genus of fleas that parasitizes a number of small rodents. The species are mainly confined to the Palaearctic Region but a few are known from the Oriental Region (Indo-Malayan Subregion) and one (*N. inopina*) occurs in northwestern North America.

Three genera of leptopsyllid fleas are presently known from Afghanistan. *Amphipsylla* is well represented, with six species from various small mammal hosts. With the exception of two species having subspecies in North America, the genus is exclusively Palaearctic. All species of the genus *Leptopsylla* are native to the Palaearctic except *L. aethiopica*, a probable Pleistocene relict known only from Ethiopia. *Leptopsylla segnis* is cosmopolitan in its distribution as a parasite of synanthropic murine rodents. Members of the genus

Ctenophyllus are parasites of pikas (*Ochotona* sp.) and their distribution coincides with the occurrence of their hosts. Two species, *C. ashcrafti* and *C. armatus terribilis*, are known from western North America. The remaining 11 species are Asian.

The genus *Nosopsyllus* contains about 60 species, most of which occur in Asia. A number of species, however, are native to the Indian subcontinent, a relict form occurs in East Africa, and two species, *N. fasciatus* and *N. londiniensis*, are cosmopolitan. Some members of this genus are thought to be of importance in the maintenance of plague in parts of Central Asia.

V. Exclusively Palaearctic Genera With Broad Distribution In This Region

The 22 species and subspecies of *Coptopsylla* are mainly Asian, though *C. africana* and *C. wassiliewi* are known from North Africa. All are parasites of gerbilline rodents and thus are restricted in their occurrence to desert and steppe types of habitat.

Members of the genera *Mesopsylla* and *Ophthalmopsylla* are typical ectoparasites of jerboas in western and Central Asia. One subspecies of *O. volgensis* extends into the Arabian Peninsula and a subspecies of *M. tuschkan* occurs in Egypt. The remaining forms occur in the steppes and deserts of Asia.

The species of *Paradoxopsyllus* occur mainly east of the Caspian Sea as parasites of small rodents (*Ochotona, Alticola, Cricetulus*, etc.). This is also true for the species of the subgenus *Pectinoctenus* (genus *Leptopsylla*), although the species of this subgenus seem to be much more restricted and localized in occurrence.

Most of the species of *Frontopsylla* are Asian, although a few occur in Europe. One species reported here is a parasite of birds, but the remaining taxa are found on small mammals, especially rodents. Even the bird-infesting forms frequently are found in rodent burrows according to Ioff and Scalon (1954), and there are indications that members of this genus are not particularly host specific.

The species of *Citellophilus* occur throughout Europe and Asia, primarily as parasites of ground squirrels (*Citellus*) and marmots (*Marmota*). Some species show little host specificity and occur quite commonly on other rodents living in the same general habitat as their true hosts.

Most of the *Callopsylla* species are exclusively Asian in distribution, though Smit (1957) reports *C. waterstoni* from Scotland and

Switzerland. Most of the species are parasites of small rodents, though three are found on birds, one on the Siberian mole, and one on small carnivores in Tibet.

VI. Exclusively Palaearctic Genera Whose Species Appear To Be Ecologically Restricted

The three species of *Caenopsylla* show a most peculiar type of distribution. Two are known from a very limited number of specimens collected in Algeria and Tunisia. The remaining species was described from Turkmeniya, but has since been reported from Iran, Lebanon, Saudi Arabia, and Egypt (Lewis, 1967) as a parasite of carnivores. Ioff *et al.* (1965) add Azerbaydzhan to its range in the USSR.

All known species of *Phaenopsylla* are restricted to the Hindu Kush-Elburz-Kopet Dag Mountain system, and all are parasites of the Mouse-like Hamster, *Calomyscus bailwardi*. Why so many distinct taxa should have evolved in such a restricted area is not clear, but it is evident that the history of the genus is very much related to the history of the host. Perhaps the species actually represent isolated, relict populations of what was once a more widespread genus.

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