University of Baghdad
College of Science
IRAQ NATURAL HISTORY MUSEUM
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FLEAS and PLAGUE in IRAQ and the ARAB WORLD

by

C. Andresen Hubbard

Tigard, Oregon, U.S.A.

Part II.

Iraq nat. Hist. Mus. Publ. No. 19, Sept.-Nov., 1960.

Ar-Rabitta Press, Baghdad
1960

ADDENDA and CORRIGENDA

I. The following drawing was sent by the author separately and was, unfortunately, overlooked until it came to the editor's notice late after the printing of the proper section, **"Stenoponia tripectinata"**, in which the drawing should have been included. The editor expresses his apologies to the author and the reader, and hopes that this error can be corrected effectively by inserting this paper between pages 66 and 67.

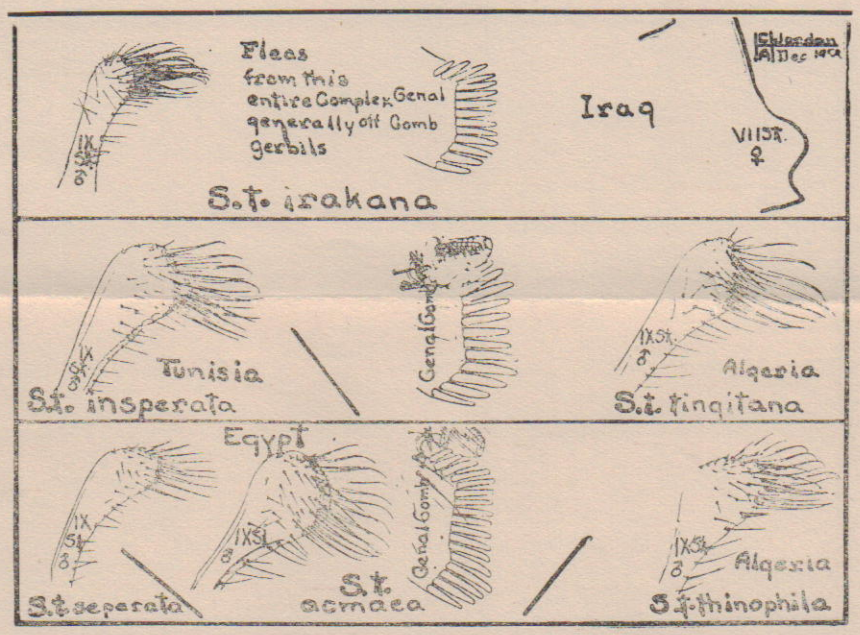
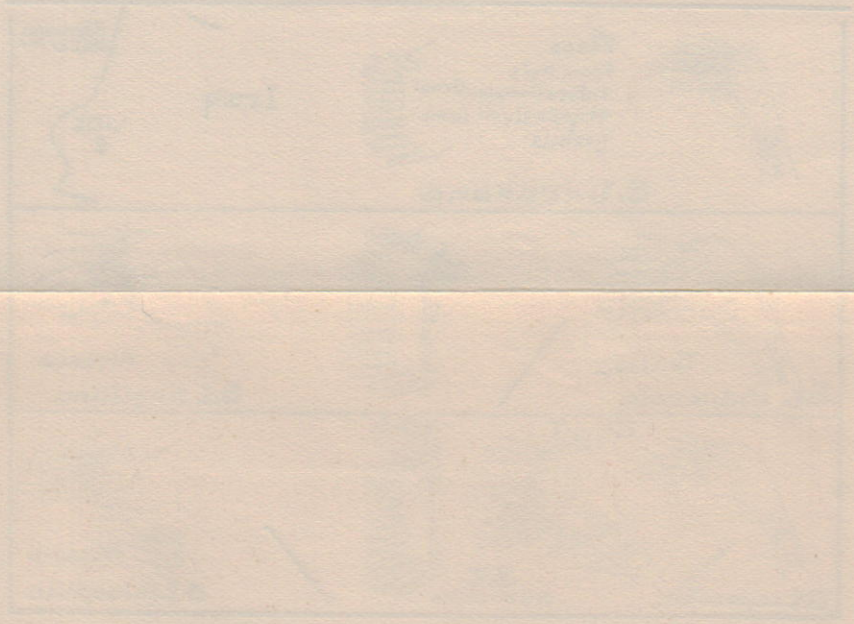


Fig. 21 a.

II. The author wishes to make the following corrections after a British Museum announcement:

"L. incerta (from Sudan) is **L. hoogstraali"**
(The author gave no description for **L. hoogstraali.** Editor)

"C. f. meridionalis and **C. numidus** (from Algeria) are both **C. f. farreni".** The reader is asked to substitute the subspecies name **farreni** for **meridionalis** (p. 112) and remove the write up on **C. numidus.**



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CONTENTS OF PART II

ERRATA

Page 4, Line 2: Read COPTOPSYLLIDAE instead of COPTOPSYLLAE

A PRELIMINARY WORD ABOUT PART II

In the following pages, bibliography will be brought to a minimum. This course is due to the publication in 1946 by Imprensa Nacional, Rio de Janeiro, Brazil, of "Monografias do Instituo Oswaldo Cruz, No. 4, PULGAS", written by A. da Cost Lima and C.R. Hathaway. This bibliography on fleas is the greatest published up to the time the British Museum released the first volume of "AN ILLUSTRATED CATALOGUE OF THE ROTHSCHILD COLLECTION OF FLEAS IN THE BRITISH MUSEUM" during May of 1953. Volume II was released during May of 1956. This "Catalogue" is being written by G.H.E. Hopkins and Miriam Rothschild. These two biographical sources on fleas will long be unexcelled.

The illustrations in this paper are NOT original with the author, but are copies from various sources, usually the original drawings with the original descriptions. In case of the descriptions, many of these are modifications of the original or actual quotes. Where descriptions or illustrations are missing, due to their being unavailable, the author has allowed space for their later entry.

Records are either those of the writer or are borrowed from the "Catalogue", "Pulgas", or from Wassilief's paper on the Fleas of Tunisia. Only records from Iraq are the author's. These were gathered from December 1952 through July 1953, while a Fulbright Research Scholar in Iraq. Because of his familiarity with the country of Iraq and the fleas of this state, the writer lists collections from it first. After these listings, the remaining Arab states, countries, and areas are listed alphabetically.

The specimens of fleas collected by the writer while researching in Iraq are equally divided between the British Museum, Iraq Museum of Natural History, and the United States National Museum. He has retained none of the collected material. For personal study, the student should contact the closest of the mentioned museums.

Keys on fleas to date have many pitfalls. Many are satisfactory only to the author that built them. This writer much prefers a pictorial key. So, as far as possible, he has included illustrations of all fleas mentioned or left space for the illustrations to be added by the student when they become available. The keys which follow are not the work of the writer but have been adapted to the Arab World from keys of world wide coverage from the "Catalogue". Where this adaptation seemed confusing or impossible, no key is present.

PROBLEMS

It will be noted through the following pages that tremendous amount of work need to be done on fleas and plague in the Arab World.

FIRST, the large numbers of different rodents need to be tested for plague susceptability.

SECOND, many more fleas than have been recorded, must be native to the great spaces of the Arab World. These should be found and named.

THIRD, those fleas known, and the new ones as they are named, should be tested for plague transmission efficiency.

FOURTH, the bird fleas need study badly in the Arab World, as do the fleas of bats, squirrels, and the black "Spalax" mole rat.

FIFTH, control of plague and fleas, and the education of the Arabs who live close to the soil to avoid rodents and their fleas.

Order SIPHONAPTERA

The Order Siphonaptera, sometimes also known as Aphaniptera and Suctoria, consists of a series of wingless insects commonly known as fleas. In these the body is compressed laterally so that these ectoparasites can easily glide through the hair or feathers of the host. The mouthparts are modified for piercing and sucking with which the flea draws blood, its sole food, from the host. The antennae are 3-jointed, and situated on the sides of the head in the antennal grooves. The basal joint is such that the antennae can be revolved out of the groove to any position. The one most commonly seen is that with the antennae up over the head in the position of a pair of horns. Eyes, when present, are always simple, but the size and shape varies. The flea eye may be a vestige, in which case the amount of pigment present is always variable with the species. Many fleas are blind. The legs have 5-jointed tarsi and well developed coxae. Metamorphosis is complete, running through egg, larva, pupa, generally in a cocoon, and adult.

Hopkins and Rothschild in the "Catalogue" give the following key to the superfamilies and families of fleas which the author has adapted to those of the Arab World.

1. Outer internal ridge of mid coxa absent; mesonotum without bristle-like spines under the collar; metepimeron extending far upwards, its spiracle placed much above the metepisternum; metanotum and abdominal terga without apical spines or spinelets; spiracles circular; abdominal terga II-VII with at most one row of bristles; no bristles above spiracle of tergum VIII; pygidium with either 8 or 14 pits each side; hind tibia without an apical tooth on outside (PULICOIDEA) 2

   Outer internal ridge of mid coxa usually present, sometimes short. Tooth at apex of hind tibia generally pointed, rarely rounded; pygidium sometimes with 14 but usually with 16 or more pits each side. (CERATOPHYLLOIDEA) 3

2. Inner side of hind coxa without spiniform bristles; pygidium with 8 pits on each side ..... TUNGIDAE

   Inner side of hind coxa with spiniform bristles; pygidium with 8 pits on each side ..... PULICIDAE

3. Of the two dorsal apical bristles of the fore femur the outer one almost invariably the longer 4

4. At oral angle of head a strongly sclerotized clypeus pointing upwards; no combs, vestigial abdominal combs or pseudosetae;

in both sexes 2 antepygidial bristles not grossly dissimilar in size; female with 2 spermatheca ..... COPTOPSYLLAE

Not as above 5

5. Metanotum without marginal spinelets; an arch of tentorium visible on frons, except in species with the genal comb vertical; in male sternite IX without tendon from angle forwards; in female pygidium usually more or less convex and anal stylet usually with 1 long apical bristle and 1 or 2 small or minute subapical ones ..... HYSTRICHOPSYLLIDAE

Metanotum with spinelets; dorsal side of pygidium straight, in male ending with a transparent collar covering base of anal tergum, in female pygidium not separated from anal tergum and not raised above base of latter; anal stylet of female with 1 or 2 rather long lateral bristles in addition to apical one; in male sternite IX with a tendon running forwards from the junction between the two arms; 1 spermatheca 6

6. Fracticipit; antennal fossa closed, club of male antenna not extending on to propleurum 7

Integricipit; and with interantennal suture at most indicated 8

7. Head without comb or with a vertical comb of many spines or a comb of few spines behind or below the vestigial eye .... LEPTOPSYLLIDAE

Head with 2 (extremely rarely 3) broad spines, which may be pointed or extremely obtuse, immediately behind the oral angle (all regions on bats) ..... ISCHNOPSYLLIDAE

8. No genal comb; in front of eye no arch of tentorium visible; 3 bristles in ocular row, the uppermost in front of eye; no interantennal suture; antennal fossa open; club of male antenna extends on to propleurum; metanotum and some of abdominal terga with spinelets; sternite VIII of male narrow, sometimes quite small or vestigial ..... CERATOPHYLLIDAE

While the above modified key is the most recent to be published, a much simpler key to the families of fleas was issued by Fox and Ewing in 1943. It follows:

1. Thorax not greatly reduced, thoracic terga taken together, longer than first abdominal tergum; gravid females moderately, if at all, enlarged 2

Thorax greatly reduced, thoracic terga taken together, shorter than first abdominal tergum; females sometimes with a reduced number of abdominal spiracles, and when gravid, abdomen greatly distended ..... HECTOPSYLLIDAE

2. Gena, not divided by a vertical suture; head without helmet 3

3. Typical abdominal terga each with more than one transverse row of setae; fronto-epicranial groove frequently present 4

Typical abdominal terga each with but one transverse row of setae; fronto-epicranial groove usually absent; eyes usually present ..... PULICIDAE

4. Head seldom elongated, ventral flaps absent. Not parasitic on bats .. 5

Head usually elongated, always with 2 or 3 ventral flaps on each side adjacent to fronto-genal angle. Parasitic on bats. .... ISCHNOPSYLLIDAE

5. Cephalic comb absent; frons not reduced; abdominal combs rarely present; abdominal apical spines rarely numerous .... DOLICHOPSYLLIDAE

Cephalic combs present; frons frequently reduced; abdominal combs frequently present; abdominal apical spines frequently numerous ..... HYSTRICHOPSYLLIDAE

Much of the systematic work on fleas is unsatisfactory, and many of the keys so far built are of little value. Opinions in this matter are in a state of continual change because of continued research. Some investigators are attempting to solve the problem of the taxonomy of the flea by adding many new subfamilies and subgenera. Other investigators codemn such procedure, claiming such a course is a matter of convenience rather than a necessity, and lacks depth of understanding. Time, perhaps, will solve this problem of the systematics of the fleas.

Family TUNGIDAE

Eye with internal sinus. Antennal club elliptical in outline. Second spiracle enclosed in second link-plate and placed in a small recess of the metathorax far above the ventral margin of the mesopleurum. Inner side of hind coxa without spiniforms, armed only with small hairs. Pygidium with 8 pits on each side. No antepygidial bristles. Female without anal stylet.

Subfamily TUNGINAE

Anterior apical corner of hind coxa projecting downwards as a broad tooth; no tooth at base of hind femur. Male: Penis very long and narrow, articulated and elbowed in the middle; processes of the clasper like a narrow pair of pinchers. Female: spiracles of abdominal segments II-IV minute, barely even vestigial, those on V-VIII very much enlarged.

Genus **Tunga** Jarocki, 1838

Tunga Jarocki 1838, Zoology, p. 50-52. Genotype: *Pulex penetrans* Linn., 1758.

HEAD: Distinctly angular. Maxillae reduced and completely hidden in head. Mandibles large. Eye oval and heavily pigmented. Head is without bristles, although some fine setae along top of head in female. Inner surface of hind coxa is without patch of spinelets, these being replaced by a few scattered minor bristles. Plantar bristles slender on segment V of tarsus. Female without spiracles on abdominal segments II and III. No long setae on enlarged male VIII st.

This genus is represented in the Arab World by but a single species which follows.

1. Tunga penetrans (Linn.), 1758

Pulex penetrans. Linnaeus, 1758, Syst. Nat. 10th ed., p. 614 (America from *Homo*).

Tunga penetrans (Linnaeus). Hopkins and Rothschild, 1953, C.R.C.F., p. 39, figs., 21, 22A, 23, 26A, 28, 37; Pls. 6A,B, 7A-C, 8B.

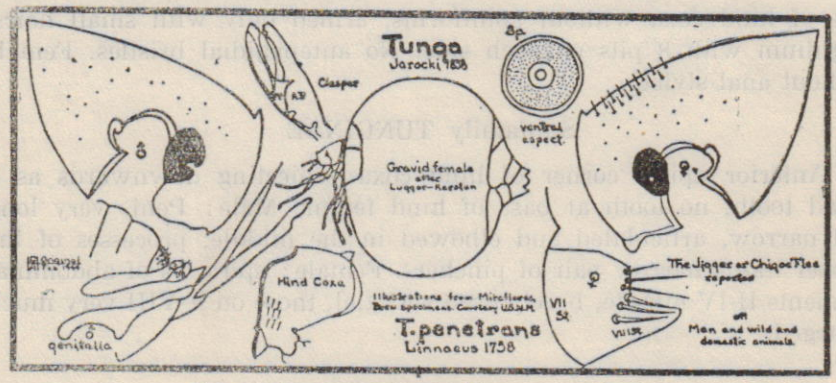
The "Catalogue" offers no records from the Arab World, but in the following, Tunisia is reported as harboring the flea.

Tunga penetrans (Linnaeus). Costa Lima and Hathaway, 1946, Pulgas, p. 129.

HEAD: Distinctly shaped and very angulate. The eye is long oval and heavily pigmented. Head devoid of any bristles, with the exception of a number of minute hairs located on the anterio-dorsal angle of head of female.

THORAX: Reduced and without pronotal comb.

LEGS: Weak; hind pair not well-fitted for hopping. Apex of the coxa is modified into a stout tooth.



(Fig. 1) Tunga penetrans. (Sp. = spermatheca)

MODIFIED SEGMENTS: Male. Clasper a pincher in which posterior process is larger than anterior process. Female. Specimens available for study had apical margin of VII st. nicely concave below, VIII st. armed apically with 3 stout and 3 medium bristles. Spermatheca is spherical.

LENGTH: Small fleas usually under 1 mm. in length.

Medical Importance: This flea has been reported off a variety of animals, but the important records are from man. Most generally, the fleas attack man between the toes, under the nails, or in the soles of the feet. Once burrowed in, the females increase in size, cause intense itching and inflammation. Ulceration may take place. As secondary infection, tetanus or gangrene may result. Carl Baker in 1904 suggested that a good sharp knife point, a little excavating, and a good antiseptic were required to rid humans of these insects.

Biology: The life history of this flea is the most interesting in the Siphonaptera. The female, after copulation, burrows into the skin of the host. In her burrow she feeds and continues to develop eggs. Her body becomes greatly distended, many times its original size and spherical in shape. The eggs hatch in 3 or 4 days, the entire life cycle runs about 17 days.

Hopkins and Rothschild, 1933, add: distended female globular, head and thorax not concealed; cone formed by posterior abdominal segments much broader than long. Genal process only just extending over edge of antennal groove. Second segment of antenna with 4 bristles. Base of maxilla with 3 relatively large stout bristles on its anterior margin. Lacinia of maxilla much longer than maxillary palp. First, third and fourth segments of maxillary palp of almost equal length, second segment nearly 1½ times length of third, fourth segment with rounded apex, hardly at all tapered; bristles of palp numerous and coarse (almost spiniform), Legs deteriorating in distended females. Tarsi persist in most specimens. Fifth tarsal segment long and slender, about eight times as long as broad, with 2 pairs of very slender lateral bristles besides the pre-apical lateral hairs. Spermatheca conical, commonly transparent except for surface of terminal portion, which is circular and bears a ring densely pitted with minute pores. Male: Phallosome (penis) long and narrow, elbowed and articulated in the middle; process of the clasper a narrow pair of claws like those of a crab.

ARAB RECORDS:

TUNISIA

No further locality given. Probably off man.

Family PULICIDAE

There is no internal sinus in the eye. Spiracles to the posterior of the metepimeron smaller. A row or patch of spiniform bristles on the inner surface of the hind coxa. Fourteen pits in the pygidium. Antepygidial bristles usually 2 but occassionally 1, 3 or even 4. Anal style present in female.

Key to the subfamilies of **Pulicidae**

1. Club of antenna asymmetrical, the anterior segments foliaceous and leaning backwards 2

   Club of antenna symmetrical, elliptical in outline ..... *Spilopsyllinae*

2. Pleural rod of mesothorax absent ..... *Pulicinae*

   Pleural rod of mesothorax present 3

3. Falx (interantennal surture) strongly sclerotized; with a genal or pronotal comb or vestiges of them ..... *Archaeopsyllinae*

   Falx absent or feebly sclerotized; no trace of genal or pronotal comb ..... *Xenopsyllinae*

Subfamily PULICINAE

Pleural rod of mesothorax missing. Club of antenna asymmetrical. Frons angulate, small tubercle may be at angle, no apical bristles at anterior apical corner of hind coxa, the corner projecting as a broad, smooth tooth ..... *Echidnophaga*

Frons smoothly rounded, no tubercle ..... *Pulex*

Genus **Echidnophaga** Olliff, 1886

Echidnophaga. Olliff, 1886, Proc. Linn. Soc. N.S.W. (2), I, 171. Type species (by monotypy): *E. ambulans* Olliff.

The antenna club is asymmetrical, the anterior segments foliaceous and leaning towards posterior. The terminal spermatheca orifice extremely large. Metanotum much shorter than abdominal t. I. The unsegmented labial palp soft and membranous. Head angulate, with or without a small tubercle at angle. No apical bristles on anterior apical corner of hind coxa, the corner projecting as a broad, smooth tooth.

Two species are known from the Arab World:

E. gallinacea, of world wide distribution, and with occiput having well developed lobe in female and spiracle of t. VIII shorter than second segment of hind tarsus. A very small flea.

E. murina, generally limited to around the inner end of the Mediterranian Sea, in which the second segment of the maxillary palp much longer than the third and the frontal angle distinct.

2. Echidnophaga gallinacea (Westwood), 1875

Sarcopsyllus gallinaceus, Westwood, 1875, Ent. mon. Mag. II, p. 246 (Ceylon, from domestic fowl).

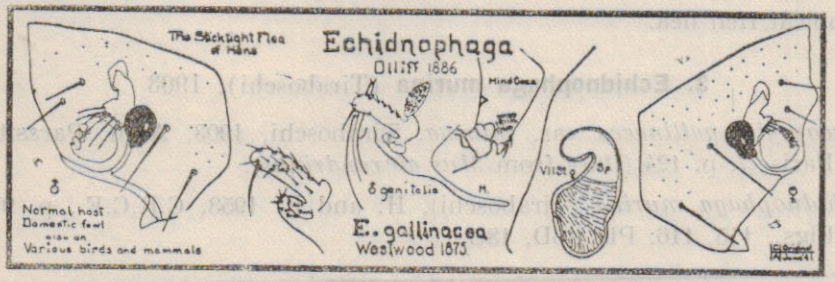
Echidnophaga gallinacea Westw. H. and R., 1953, C.R.C.F., p. 88, Figs. 110-113.

HEAD: Frons strongly angulate, occiput with 2 strong bristles. Occipital lobe very well developed in female. Eye black, round. No genal comb or frontal tubercle.

PRONOTUM: Without comb.

TARSUS: Fifth segment with 3 heavy lateral bristles equally spaced. 2 sub-apical plantar bristles which are stout.

MODIFIED SEGMENTS: Male. The clasper has 3 processes, P. 1, the flap, long and bristly, P. 2, the anterior process and P. 3, the posterior process, together like a pincher and but half as long as P. 1. Apical bristle of P. 1 very long and pointing almost vertically downwards. Manubrium long and slender. Female. VII st. almost flat, slightly concave. Spermatheca broader ventrally than dorsally, very characteristic in shape.



(Fig. 2) Echidnophaga gallinacea. (Sp. = permatheca; M. = manubrium)

ARAB RECORDS: The following from H. and R. 1953, p. 91.

MOROCCO

From *Canis*, June 24, 1905, by W. Riggenbach, 3 females.

Rabat, by R. de Brettes, from *Gallus domesticus* (fowl), November 18, 1936, many of both sex; from *Canis familiaris* (dog), November 15, 1936, many females.

Port Etienne, from *Gallus domesticus* (fowl), June 9, 1923, by Th. Monod, 1 male, 4 females.

Mogador, from *Canis aureus maroccanus* (jackal), by Escalera, 1 female

SUDAN

Bahr-el-Ghazal, March 1909, from Wellcome Res. Coll., Khartoum, 1 male, many females.

Pongo River, Bahr-el-Ghazal, round eyes of fowl, May, 1910, by Capt. Drew, 4 males, 2 females.

SYRIA

Region de Damas, from *Erinaceus auritus* (hedgehog), by H.G. Kerville, 3 females.

TUNISIA

Djerba off cats and rats by Wassilieff, 1933.

YEMEN

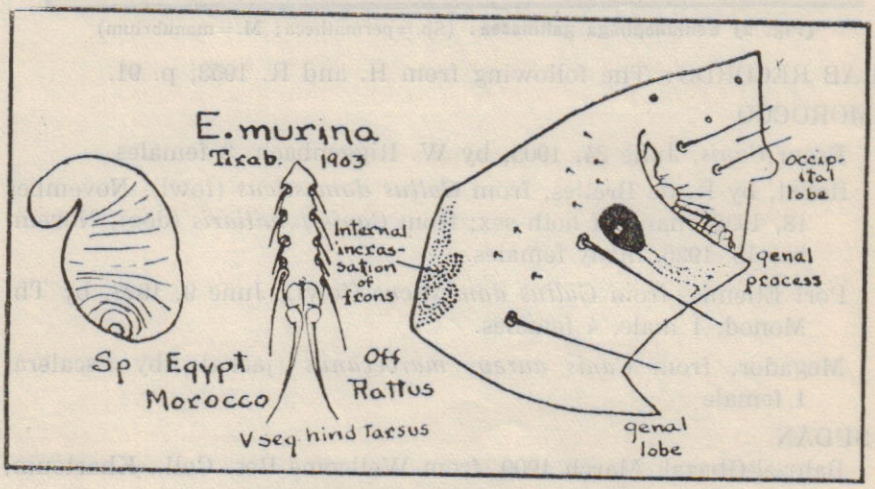
Sok al Khamis, from Canis, 1913, by G.W. Bury, 1 male.

REMARKS: First described from Ceylon off domestic fowl, this flea is now known to be world wide in distribution. It is one of the smallest fleas to come to the attention of the collector. The male is well under 1 mm. in length; the female about 1 mm. These fleas easily escape detection because they bury their head and sometimes their thorax deep in the skin of their host, so cannot fall off the host when it is brushed down by the collector. In the Arab World collectors should look for this flea upon rodents, insectivora, their predators, and birds and domestic fowl. This flea is commonly called the Sticktight or Tropical Hen flea.

3. **Echidnophaga murina** (Tiraboschi), 1903

Sarcopsylla gallinacea var. *murina*. Tiraboschi, 1903, Arch. Parasit., Paris, 7, p. 124 (Italy from *Mus alexandrinus*).

Echidnophaga murina (Tiraboschi), H. and R. 1953, C.R.C.F., p. 97, Figs., 115, 116; Pls. 16D, 18C.



(Fig. 3) Echidnophaga murina. (Sp. = spermatheca)

HEAD: Shape of internal incrassations of frons characteristic as is the apical angle. Head longer than in *E. gallinacea;* frons strongly angulate in both sexes, internal incrassations long and slender; occiput with 2 strong bristles, occipital lobe very small in female.

PRONOTUM: Without comb.

TARSUS: Three equally spaced large lateral bristles on fifth tarsal segment, sub-apical plantar bristle usually single but tarsus of midleg occassionally with 2 such bristles on one or both sides.

MODIFIED SEGMENTS: Male. Clasper almost identical with *E. gallinacea*. Female. Spermatheca head broader and tail smaller than in *E. gallinacea*.

LENGTH: Male 1-1½ mm., female 1½-2 mm.

ARAB RECORDS: The following from H. and R. 1953, p. 98.

EGYPT

Kom Ombo, from *Rattus rattus* (rat), November 1911, by Dr. Petrie, 1 female.

MOROCCO

Marrakesh, from *Rattus alexandrinus* (Roof Rat), September 28, 1923 and October 3, 1923, by R. P. Dullfus, 1 male, 6 females.

Genus **Pulex** Linn., 1758

Pulex. Linnaeus, 1758, Syst. Nat., 10th ed., I, 614. Type species by subsequent designation (Baker, 1904, p. 371): *P. irritans* Linn.

Asymmetrical antennal club. No pleural rod of mesothorax. Metanotum as long as t. I of abdomen. The 4 segmented labial palp stiff, the anterior margin more or less sclerotized. Anterior margin of head smoothly rounded and without a tubercle. A vestigial genal comb sometimes present.

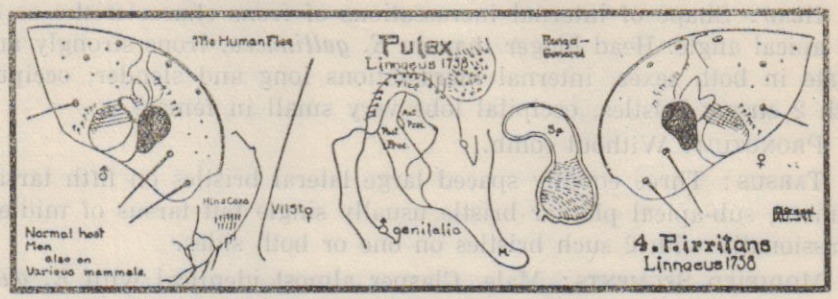
But a single species is known from the Arab World. This is *P. irritans*, the Human flea, which is of world wide distribution.

4. **Pulex irritans** Linn., 1758

Pulex irritans. Linnaeus, 1758, Syst. Nat., 10th ed., I, p. 614 (in Europe, America).

Pulex irritans Linn., H. and R., 1953, C.R.C.F., p. 105, Figs. 3-6, 18A, 20B, 75, 124, 125; Pls. 1, 4A, 21B, 22A-C.

HEAD: Frons nicely rounded. Eye black, large, conspicuous, grape-seed shaped. More dorsal internal incrassation of frons poorly developed, hardly projecting inwards from margin. Falx extending down to base of antennal fossa (antennal groove). One small spinelet sometimes present considered to be vestigial genal comb. Gena with 2 strong bristles, occiput with but 1.



(Fig. 4) Pulex irritans.

PRONOTUM: Without comb.

COXA: Inside of hind coxa near the apex, there is a patch of small spiniforms.

MODIFIED SEGMENTS: Male. Clasper with P. 1, the flap, U shaped, very large and completely covering P. 2 and P. 3; P. 2 and P. 3 being about three quarters the length of the flap, the two together pincher shaped. Female. VII st. with small upper lobe which may extend slightly beyond lower apical face. Spermatheca with sub-globular head which is rather small, and the tail longer than the head.

LENGTH: Male 2 mm., female 3 mm.

ARAB RECORDS:

IRAQ

Baghdad, the writer collected a large number of both sexes in the building of the Museum of Natural History, during April 1953.

The following records are from H. and R. 1953, p. 110.

Baghdad, from Arab woman, December 22, 1936, by J. Lazar, 2 pair.

Nasiriyah, Euphrates, from Arab enclosure, July 1916, by W.S. Patton, a series.

Amara, River Tigris, caught on self, July 1914, P.A. Buxton, a series.

Kurna, from *Nesokia* (mole rat), July 1918, by P.A. Buxton, a pair.

ALGERIA

El Kantara, from house of a native, April 7, 1920, by Karl Jordan and Charles Rothschild, 3 pair.

Hammam Rirha, 1910, L.W.R. and E.H., 1 male.

Biskra, from *Homo* (man), February 1908, by J. Steinbach, 1 female.

Hammam-Meskoutine, in a bed, May 4, 1914, by W.R. and K.J., 3 females.

EGYPT

Cairo, from *Erinaceus auritus* (hedgehog), March 17, 1903, by N.C.R., 1 male.

Meir, Dirut, March 20, 1912, by Harding King, 1 female.

Mena House, Cairo, from *Felis zerda*, March 15, 1903, by N.C.R., a series.

Native Village, Libyan Desert near Cairo, November 9, 1909, by Dr. Wakeling, a series.

Camp in Libyan Desert, April 4, 1912, by Harding King, 1 female.

Camel Camp, El Arish, Sinai, from *Homo*, 1920, by Mrs. Flower, 1 female.

Port Said, from *Homo*, August 23, 1937, 1 female.

JORDAN

Petra, from *Canis aureus* (jackal), by J. Bequaert, 1 female.

Hebron, from *Canis familiaris* (dog), July, 1923, P.A. Buxton, 2 males.

Ramallah, from *Meles taxus* (badger), August 10, 1928, by Dr. Theodore, a pair.

Near the Dead Sea, from *Meles taxus*, T.A. Cockburn, a series.

MOROCCO

S. Morocco, from *Canis aureus* (jackal), September 29, 1906, by M. Riggenbach, 2 females.

Mogador, from *Vulpes niloticus* (fox), June 24, 1905, by W. Riggenbach, many of both sexes; from *Canis aureus maroccanus* (jackal), by Escalera, a pair.

Port Etienne, from *Canis familiaris* (dog), by Th. Monod, 2 pair.

TUNISIA

From *Felis* sp., 1908, by Mon. Blanc, 1 male, 3 females.

From *Vulpes niloticus* (fox), by Mon. Blanc, 2 females.

Subfamily ARCHAEOPSYLLINAE

Antennal club asymmetrical, with anterior segments foliaceous and leaning towards posterior. Mesothorax with pleural rod. A strongly sclerotized interantennal ridge. With genal and pronotal comb or vestiges of them.

Two genera of the subfamily are recorded from the Arab World:

Genal comb with not more than 3 teeth, these being the most posterior ones; pronotal comb with fewer than 8 teeth; P. 1 of clasper with numerous bristles but no flattened spiniforms; Spermatheca large, the tail and head separated only dorsally and inconspicuously by a constriction and the head with a second constriction ..... *Archaeopsylla*

Teeth of genal comb usually much more numerous, but if the comb is reduced the retained teeth are the most anterior ones; genal comb horizontal, its posterior teeth much below level of eye; metanotum about as long as first abdominal tergum .... *Ctenocephalides*

Genus **Archaeopsylla** Dampf, 1908

Archaeopsylla. Dampf, 1908, Schr. phys.-okon. Ges. Konigs. 49, 18. Type species: *Archaeopsylla erinacei* (Leach 1832) (= *Pulex erinacei* Bouche, 1835).

Not more than 3 teeth in the genal comb, these representing small posterior ones. A pronotal comb of not more than 6 teeth, at times reduced to one or even wanting. Four segmented labial palps, which reaches beyond apex of third segment of maxillary palp. Mesothoracic pleural rod confluent with anterior margin before reaching upper angle. Metasternum separate from metepisternum. Furcation of inner internal rod of mid coxa far above middle. Basal abdominal sternum without bristles.

Two species of the genus are reported from the Arab World:

Metasternum separate from metepisternum. Furcation of inner internal of spine on genal process to anterior edge of eye; VII st. of female with 4 bristles on the two sides together ..... *e. erinacei*

Male with greatest length of P. 1 of clasper same as distance from base of spine at tip of genal process to front margin of head; female with 5 bristles on VII st. ..... *e. maura*

5. Archaeopsylla erinacei erinacei (Bouche), 1835

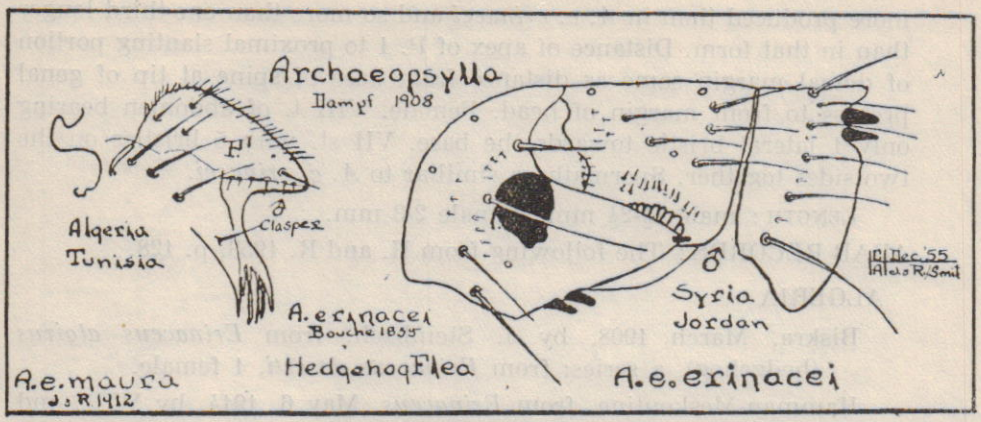
Pulex erinacei. Bouche, 1835, Nova Acta Leop.-Carol. 17, 507 (no locality, from Igel).

Archaeopsylla erinacei erinacei (Bouche), H. and R., 1953, C.R.C.F., p. 123, Fig. 132; Pl. 23A,B.

Head: Gena armed with 4 bristles, one over the dark grape-seed shaped eye, a genal comb of from 1 to 3 spiniforms, usually 2, and the genal process with a well developed dark spiniform which is rarely absent. Post-antennal region with 3 rows of bristles numbering 1, 2 and 4. Antennal groove with many minute bristles.

Pronotum: the comb may be absent or it may consist of up to 9 teeth.

Modified Segments: Male. P. 1 of clasper triangular, its postero-ventral angle much less produced than in *A. e. maura*, the distance from its apex to the proximal slanting portion of the dorsal margin equal to the distance from the base of the spine on the genal process



(Fig. 5) Archaeopsylla e. erinacei.

to the anterior edge of the eye; the ventral edge of P. 1 continues downwards as a broad membranous appendage which is slit at the margin into filaments.

Female. VIII t. of abdomen with 1 or 2 lateral bristles located towards the base. VII st. usually with 2 bristles on each side. Spermatheca broad, head twice as long as tail and beyond the center strongly constricted on the dorsal surface.

LENGTH: male 1½-2½ mm., female 2-3 mm.

ARAB RECORDS: The following from H. and R. 1953, p. 127.

JORDAN

Jerusalem, from *Erinaceus r. sacer* (hedgehog), by Dr. Theodore, 3 pair.

SYRIA

Dejeroud, from *Erinaceus auritus* (hedgehog), by H.G. Kerville, 1 female.

Oasis de Damas, from *Erinaceus europaeus*, by H.G. Kerville, 1 female.

Kizik-Khan, from *Erinaceus r. sacer*, by Dr. Theodore, 2 females.

6. Archaeopsylla erinacei maura Jordan and Rothschild, 1912

Archaeopsylla erinacei maura. J. and R., 1912, Novit. Zool. 18, 551, Fig. 1 (Monchique. Algarve, Portugal, from *Erinaceus europaeus*).

Archaeopsylla erinacei maura J. and R., H. and R. 1953, C.R.C.F., p. 127, Fig. 133.

HEAD: As for *A. e. erinacei*.

MODIFIED SEGMENTS: Male. P. 1 of clasper with the apex much

more produced than in *A. e. erinacei* and so more than one-third longer than in that form. Distance of apex of P. 1 to proximal slanting portion of dorsal margin same as distance from base of spine at tip of genal process to front margin of head. Female. VIII t. of abdomen bearing only 1 lateral bristle towards the base. VII st. with 5 bristles on the two sides together. Spermatheca similiar to *A. e. erinacei*.

LENGTH: male 1½-2½ mm., female 2-3 mm.

ARAB RECORDS: The following from H. and R. 1953, p. 128.

ALGERIA

Biskra, March 1908, by J. Steinbach, from *Erinaceus algirus* (hedgehog), a series; from *Erinaceus deserti*, 1 female.

Hamman-Meskoutine, from *Erinaceus*, May 6, 1914, by W.R. and K.J., 9 females.

Lallal Marnia, Province of Oran, from *Erinaceus algirus*, by R.W. and E.H., 9 females.

MOROCCO

Mazagan, from *Erinaceus europaeus*, April 1901, by W. Riggenbach, a large series; by E. Roubaud, 2 pair.

Rabat, from *Aethechinus algirus*, January 1931, by F. Nemeth, many; from *Erinaceus*, by R. Ph. Dollfus, 1 male, 2 females.

TUNISIA

Ain Droham, Khroumirie, from *Erinaceus algirus*, by H.B. Kerville, 4 females.

From *Erinaceus algirus*, by B. J. Collins, a pair.

Genus **Ctenocephalides** Steles and Collins, 1930

The genal comb is horizontal and normally extends the entire length of the lower margin of the head, the posterior teeth (when present) much below level of the eye. Teeth sometimes greatly reduced in number in which case it is the anterior teeth that are retained. Pronotal comb with many teeth. Episternum and sternum separated in metathorax. Metanotum about at long as first abdominal tergum.

Three species of the genus are reported from the Arab World.

The common cat flea with its sloping frons and 8 genal teeth .... *C. felis*

The common dog flea with its rounded frons and 8 genal teeth ..... *C. canis*

Yemen specimens with rounded frons and 2 or 3 genal teeth ..... *C. arabicus*

The more elaborate key of Hopkins and Rothschild follows:

1. Genal comb with not more than 3 spines **2**
   Genal comb with at least 6 spines **3**

2. Fifth segment of all tarsi in both sexes with 4 or 5 sub-apical spiniform plantar bristles (Yemen) ..... *arabicus*

3. Interval between postmedian and apical long bristles of dorsal margin of hind tibia containing 2 small notches each with a short stout bristle; metepisternum usually with 3 bristles ..... *canis*

   The upper short stout bristle absent or replaced by a hair; metepisternum with 1 or 2 long bristles **4**

4. Frons oblique and strongly curved; longest apical bristle of segment II of hind tarsus reaching beyond segment IV except in notably long headed species; basal abdominal sternite with a pair of ventral bristles; genal process with a strong apical spine; segment V of fore tarsus (claw excluded) two-thirds length of II-IV together; head often long; occiput bearing (besides sub-apical row) a long bristle above middle of antennal fossa and a second nearly as long towards base of fossa; fore tarsal segment V of the male often (always in some subspecies) with only 2 spiniform plantar bristles; abdominal st. III-VI in female with 2 subventral bristles each side. Long headed, no part of frons of male vertical; dorsal incrassation of frons long and narrow. Fore tarsal segment V of male with only 2 sub-apical spiniform bristles ..... *felis felis*

   Female without bristles just above antennal fossa; pronotal comb generally with 14 spines ..... *felis strongylus*

7. Ctenocephalides arabicus (Jordan), 1925

Ctenocephalus arabicus. Jordan, 1925, Novit. Zool. 32, p. 97, Fig. 6 (Wasil, Yemen, Arabia, from *Procavia syriaca jayakari*).

Ctenocephalides arabicus (Jordan) 1925, H. and R., C.R.C.F., 1953, p. 142, Figs. 147, 148.

HEAD: Fairly well rounded, eye large, conspicuous, black; 2 genal bristles, stout and 6 or so minute ones; about 6 bristles and several minute ones on post-antennal region. Genal comb of 1 to 3 spines which vary much in size and the number usually different on the two sides of the head.

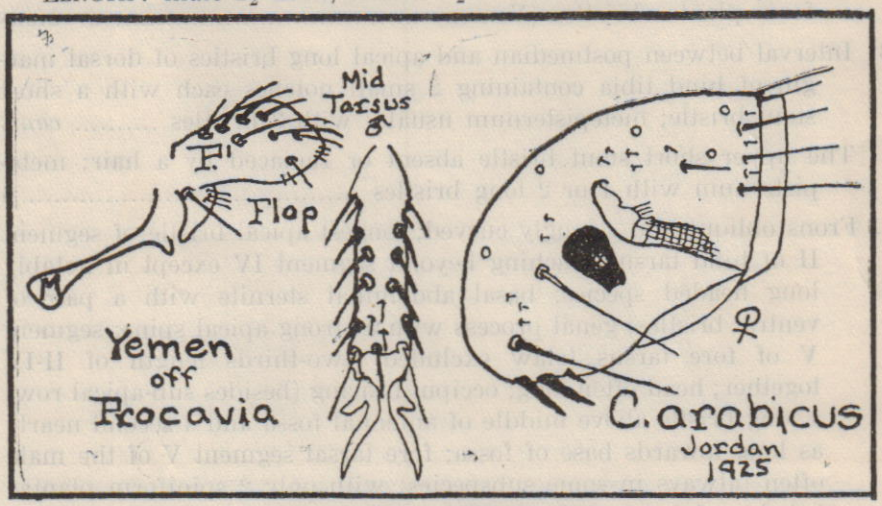
PRONOTUM: In the male the comb consists of 9 teeth, in the female 11 or 12.

TARSUS: The fifth tarsal segment of all legs in both sexes with 4 or 5 sub-apical plantar bristles, no other known species having more than 2 except sometimes on the fore tarsus of the male.

MODIFIED SEGMENTS: Male. P. 1 of the clasper with 7 or 8 bristles on the outer surface. This the "flap" is fairly symmetrical and broadest

pre-apically. Female: t. VIII on outer surface with an apical row of 7 or 8 bristles, preceded by 4-6 bristles and at apical margin 2, on inside 4-6.

LENGTH: male 1½ mm., female 2½ mm.



(Fig. 6) Ctenocephalides arabicus.

ARAB RECORDS: The following from H. and R., 1953, p. 143.

YEMEN

Wasil, Yemen, from *Procavia capensis jayakari*, 1913, by G.W. Bary, 1 male, 4 females.

8. Ctenocephalides canis (Curtis), 1826

Pulex canis Curtis, 1826, British Entomology, 3, p. 114, figs. A-E, 8 (England, from dog).

Ctenocephalides canis (Curtis), H. and R., 1953, C.R.C.F., p. 146, Figs. 74A, 154, 156, 158-60; Pls. 5A, 24C, D, 27C.

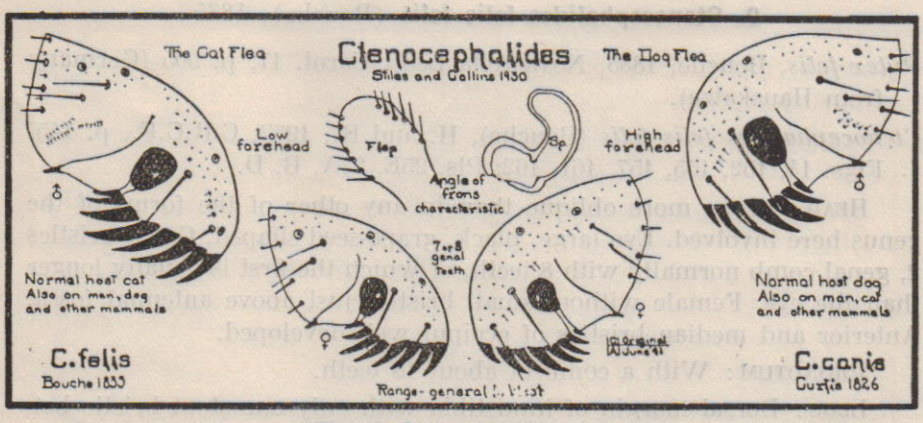
HEAD: Frons strongly rounded in both sexes. Bristles more numerous than in other species. Eye large, black, oval. There are 2 genal bristles and a genal comb of 7 or 8 teeth. Occiput with well developed anterior bristle, the median bristle accompanied by a smaller one, and sub-apically a row of 10-12 bristles on the two sides together. Many minute bristles above antennal fossa in male, few sometimes in female. Genal comb of 7 or 8 black teeth.

PRONOTUM: With a comb of about 16 black teeth.

LEGS: Segment V of all tarsi in both sexes with 2 sub-spical plantar spiniform bristles of which one is long and the other short. Hind tibia with 7 or 8 dorsal notches, there being 2 notches each bearing a stout bristle between the postmedium notch and the apex, the upper stout bristle rarely replaced by a small hair.

MODIFIED SEGMENTS: Male. P. 1, the flap, of clasper, has on outer surface 9-14 bristles including submarginal ones, the process from 1½-2 times as long as broad; manubrium of clasper markedly dilated at apex.

LENGTH: male 2 mm., female 2½ mm.



(Fig. 7) Ctenocephalides canis.

ARAB RECORDS:

IRAQ

Hilla, the writer secured this flea only off *Lepus babylonicus* (rabbit) at Hilla, April 26, 1953, a pair.

The following records from H. and R., p. 168.

Nasiriyah, Euphrates, from Arab inclosure, April 1916, by W.S. Patton, 1 male, 3 females.

Kurna, from *Nesokia* (mole rat), May 1918, by P.A. Buxton, 2 males, 6 females.

Baghdad, from dog, January 1936, by J. Lazar, 2 females; near Baghdad, March 1922, by J. Boyd, many.

ALGERIA

Algiers, March 1914, by Dr. Nisson, 1 female.

Biskra, from 'dead bird', March 1908, by J. Steinbach, 1 male.

El Kantara, from house of Arab, April 1920, by K.J. and N.C.R., 4 males, many females.

JORDAN (Palestine)

Hebron, from dog, June 1923, by P.A. Buxton, 2 males.

Athlit, 10 miles south of Haifa, summer 1934, a pair.

MOROCCO

Mogador, from *Vulpes niloticus* (fox), June 1905, by W. Riggenbach, 1 male.

TUNISIA

Tunis, off dogs, cats, rats, by Wassilieff, 1933.

YEMEN

Sok al Ghamis, from *Canis*, 1913, by G.W. Bury, many.

9. Ctenocephalides felis felis (Bouche), 1835

Pulex felis, Bouche, 1835, Nova Acta Leop.-Carol. 17, p. 505 (Germany from Hauskatze).

Ctenocephalides felis felis (Bouche), H. and R., 1953, C.R.C.F., p. 145, Figs. 14, 152, 155, 157, 161, 162; Pls. 25E, 27A, B, D.

HEAD: Frons more oblique than in any other of the forms of the genus here involved. Eye large, black, grape-seed shaped. Genal bristles 2, genal comb normally with 8 teeth, of which the first is usually longer than the eye. Female without small bristles just above antennal fossa. Anterior and median bristles of occiput well developed.

PRONOTUM: With a comb of about 18 teeth.

LEGS: Dorsal margin of hind tibia with only one stout bristle between the post median and apical notches. Fifth tarsal segment of all legs in both sexes with 2 sub-apical plantar spiniform bristles. Spiracles much smaller than in *C. canis*.

MODIFIED SEGMENTS: Male. Manubrium of clasper only a little dilated apically.

LENGTH: male 2 mm., female 2½ mm.

ARAB RECORDS:

IRAQ

Baghdad, the writer found this flea of general distribution in and about the city on *Felis domestica* (house cat) during 1953.

Hilla, from *Felis chaus* (wild cat), by the writer, March 1, 1953, a female.

The following records from H. and R., p. 148-149.

Baghdad, from *Felis domestica*, by J. Lazar, 1 male, 5 females.
Amara, from *Mungos persicus* (mongoose), by P.A. Buxton, 1917, 5 females.

ALGERIA

El Kantara, from house of Arab, May 1920, by K.J. and N.C.R., 1 female.

Biskra, from *Canis familiaris* (dog), March 1908, by L.W.R. and E.H., 1 female.

Bains Romanis, Algiers, February 1893, by E. Saunders, 1 male.

Guelt-est-Tel, central plateau, from *Rhinolophus ferrumequinum*, by W.R. and K.J., 1 female.

Port of Algiers, from *Mus decumanus* (Norwegian Rat), by H. Foley, 2 females.

SAUDI ARABIA

Jidda, from domestic cat, 1948, by R. Meinertzhagen, 3 pair.

W. Arabia, from *Upupa epops* (Hoopoe), 1948, by R. Meinertzhagen, 1 female.

EGYPT

Natron Valley, from *Erinaceus auritus* (hedgehog), April 1904, by N.C.R., 1 female.

Albamar, Natron Valley, from *Ictidonyx libyca*, (African Polecat) March 1903, by N.C.R., 3 pair.

Cairo, from *Erinaceus auritus*, March 1903, 1 male, 8 females.

El Arish, Sinai, from *Homo* (man), 1920, by Mrs. Flower, 1 female.

From *Corvus c. sardonicus* (crow), April 1948, by R. Meinertzhagen, 1 female.

JORDAN (PALESTINE)

Berseba, from wild cat, November 1922, by Dr. Theodore, a pair.

Ain-Harod, from lynx, July 1934, by Dr. Theodore, 1 male.

Rehoboth, Miabaa, from *Lepus c. aegyptius* (rabbit), January 1922, from J. Waterston, 1 female.

Arhof, July 1923, by P.A. Buxton, 1 female.

Athlit, 10 miles south of Haifa, summer 1934, 2 pair.

LIBYA

Merg, Cyrenaica, from *Felis*, 1922, by E. Hartert, 2 females.

MOROCCO

Mogador, by W. Riggenbach, from *Canis*, July 1905, 2 females; from *Lynx caracal*, August 1904, 3 males, many females; from *Felis l. ocreata* (wild cat), December 1903, 4 males, many females; from *Genetta genetta* (Genet), many of both sexes.

Port Etienne, from *Felis domestica* (house cat), September 1923, by Monod, 1 male, 3 females.

Rabat, from *Canis familiaris* (dog), November 1936, by R. de Brettes, 8 females; from *Oryctolagus cuniculus* (rabbit), October 1938, by F. Neineth, 1 female.

TUNISIA

From *Felis*, 1908, by Mon. Blanc, 2 males, 4 females.

YEMEN

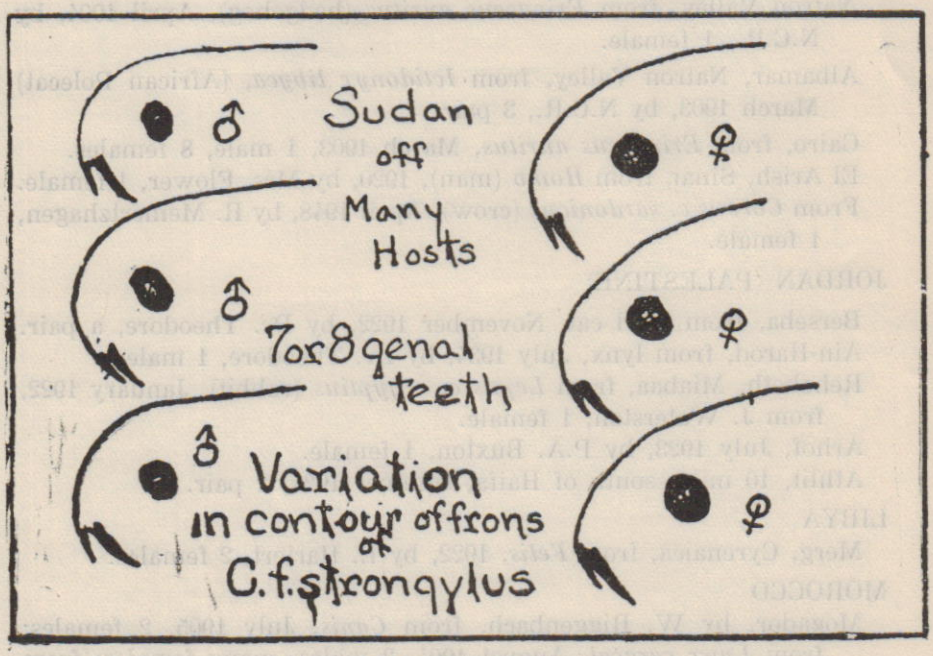
Sok al Khamis, July 1913, by G.W. Bury, 3 males, 1 female; from calf, 1 pair from civet cat.

10. Ctenocephalides felis strongylus (Jordan), 1925

Ctenocephalus felis strongylus. Jordan, 1925, Novit. Zool. 32, 98 (Voi, Kenya Colony, from *Canis lateralis*).

Ctenocephalides felis strongylus (Jordan), H. and R. 1953, p. 155, Pl. 26 A-F.

Normally this subspecies is much more round-headed than *C. felis felis*, in many males the head quite as short as in *C. canis*, from which *strongylus* is easily separable by the different chaetotaxy of the hind tibia.



(Fig. 8) Ctenocephalides f. strongylus.

Following Arab records from Hopkins and Rothschild, p. 156.

SUDAN

From Wellcome Research College, Khartoum, off *Canis familiaris* (dog), at Rumbek, Bar-el-Ghazal, November 1908, 1 female, 2 females; at Rumbek off lion cubs, May 1909, 2 males; at Gondokoro, May 1909 (no host mentioned), many.

Magangani, Blue Nile, off *Caracal c. nubica* (sheep), from J. Bequaert 1 female.

Kamisa, Dinda River, off *Lepus* sp., W.A. Lowe, 1 male.

Singa, Sennar Province, off man, May 1912, W.E. Marshall, 1 female.

Jebel Owi, N.E. Jebel Marra, Darfur, off *Dipodillus lowei*, February 1921, H. Lynes, 1 male, 7 females.

Marra, "Grant's pack of dogs', Sep. 1921, H. Lynes, 4 males, 1 female.

S.E. Jebel Marra, Darfur, off *Vulpes pallida*, Nov. 1921, H. Lynes, 1 female.

Kulme, Wadi Aribo, Darfur, off *Vulpes pallida*, Aug.-Sept. 1927, H. Lynes, many.

Subfamily XENOPSYLLINAE

Antennal club asymmetrical, anterior segments foliaceous and leaning towards posterior, minute hairs on the inner surface. Mesothoracic pleural rod present. Interantennal ridge and suture absent or feebly sclerotized. There is a central tuber which is partly concealed by the eye if such is present. No dorsal incrassation of frons. No genal or pronotal comb. The small two processed clasper of the male does not form a pincher; the third process poorly differentiated is not separated by a suture from the small body of the clasper and the manubrium. Antepygidial bristle of the female always separated from the apical margin of the seventh abdominal tergum.

The subfamily is represented in the Arab World by four genera:

1. Genal lobe long, sharp and hook-like; Pronotum much longer than mesonotum ..... *Pariodontis*

   Genal lobe short, obtuse or absent; pronotum shorter than mesonotum **2**

2. Bristles of body black, many rather short, 2 or 3 on genal process well behind level of eye and 3 rows on occiput; first pair of plantar bristles on segment V of fore tarsus ventral. *Parapulex*

   Bristles not black, nearly always pale colored and slender, none on genal process behind level of eye **3**

3. Suture separating sternum and episternum present or at least represented by an internal ridge. Hind coxa narrowing suddenly below middle of posterior margin ..... *Xenopsylla*

   No suture present between sternum and episternum. P. 1 of clasper more or less cylindrical, very small; diameter of head of spermatheca at most equal to that of eye ..... *Synosternus*

Genus **PARAPULEX** Wagner, 1910

Parapulex. Wagner, 1910, Hor. Soc. ent. ross. 39, 510. Type species:

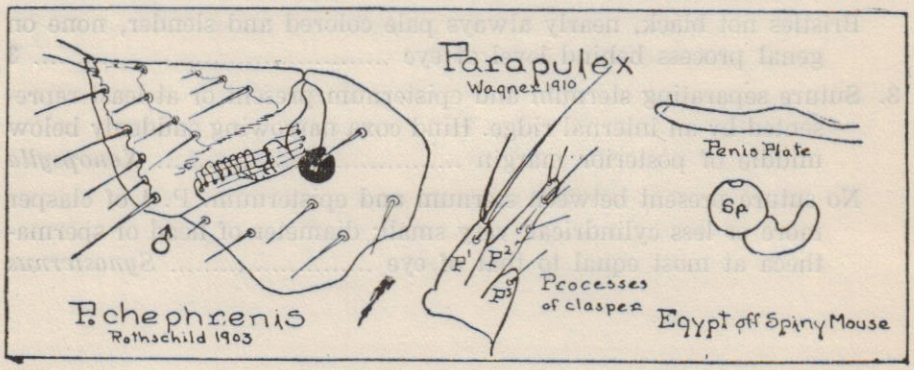
P. chephrenis Rothsch.

The sharp bristles are stout, black, and very conspicuous. Head well rounded with distinct bristle pattern: on frons 2 bristles a considerable distance in front of eye, another pair below eye, a single bristle much farther back, and another (or two) near the apex of the genal process; occiput with oblique anterior and median rows besides the sub-apical row, all of these bristles on head black and conspicuous. The eye is located at the antennal fossa, stands posteriorly straight, and does not project over the fossa. Central tuber very large, larger than club of the antenna. Club of the antenna with segmentation faintly indicated in middle of outer surface of ventral side. Labial palp shorter than fore coxa. Maxillary palp short, its first segment longer than the second. Mesonotum longer than metanotum. Prosternum not strongly convex between fore coxae. Pleural rod of mesothorax distant from anterior margin of pleurum. Anterior median projection of metasternum rounded. Uppermost bristle of anterior row of metepimeron immediately below the spiracle, the row being farther back than in *Xenopsylla*. Spiracle of t. VIII not extending to dorsal margin. Mid coxa broad, its hind margin almost semicircular. Inner internal rod of hind coxa more curved than usual. Tarsal segment V not dilated towards apex, its first pair of lateral bristles somewhat shifted ventrad and bent inwards, especially on fore tarsus.

Male. With 3 sub-apical plantar spiniforms on fore tarsus, 2 bristles that are not markedly spiniform on other tarsi.

Female. Orifice of spermatheca mid-terminal.

But a single species is reported from the gtnus. It is African.



(Fig. 9) Parapulex chephrenis.

11. Parapulex chephrenis (Rothschild), 1903

Pulex chephrenis. Rothschild, 1903, Ent. mon. Mag. 39, p. 86, pl. 1, fig. 7; pl. 2, figs. 14, 18 (Cairo, Egypt, from *Acomys cahirinus*).

Parapulex chephrenis (Rothschild). H. and R. 1953, C.R.C.F., p. 204, figs. 196, 197; Pls. 33A, b, 37A.

Bristles very conspicuous, black, stout and nearly all sharply pointed.

HEAD: Cheatotaxy distinctive. Frons with 2 bristles located a considerable distance in front of the eye, another pair below the eye, a single bristle much farther back and another near the apex of the genal process. Post-antennal region with oblique anterior and median rows, besides the sub-apical row, the anterior row containing 3 in the male, 4 in the female, the median row containing 4 in the male, 5 in the female, the posterior row, 6 in the male, 7 in the female. Eye round and black, at antenna fossa. Central tuber very large.

PRONOTUM: the comb of from 12 to 14 teeth in the male and 15 to 16 in the female.

LEGS: Hind coxa armed with 2 bristles posteriorly near apex, its false comb consisting of 4-7 small and inconspicuous spiniforms. Hind femur very strongly and rather abruptly convex ventrally before the middle, with 2 bristles on its inner side, and 2 on its outer side near ventral margin and a lateral one near the apex. Hind tibia with 6 dorsal notches and 8 dorso-lateral bristles. The longest bristle of hind tarsal segment II extends to the base of V.

MODIFIED SEGMENTS: Male. Clasper with three processes extending like fingers, the middle one P. 2, long and slender, P. 1 about half as long, P. 3 a third as long. The rod-shaped P. 1 bears 3 bristles of which the one at the very apex is very long. P. 2 is long and slender and tapers gradually to the apex and bears 5 slender, inconspicuous bristles. P. 3 is short, triangular and bears 1 apical bristle.

Female. VII st. armed with 4 or 5 bristles. Apical margin not diagnostic. Outer surface of VIII t. armed with 3 bristles which are lateral and a row of 5 or 6, the inner surface armed with a row of 4 or 5. Head of spermatheca globular, its tail separated by a deep constriction. Base of tail symmetrically swollen to an oval shape and about two-thirds as wide as the head.

LENGTH: male 1.4 mm., female 1.7-2.2 mm.

ARAB RECORDS: From H. and R., 1953, p. 205.

EGYPT

Cairo, January 1901, by N.C.R. and A. Woolaston, from *Acomys cahirinus* (Spiny Mouse), a pair; from *Jaculus jaculus* (jerboa),

a pair; from *Acomys cahirinus* (Spiny Mouse), by J. Tragardh, a pair.

Near Cairo, from *Acomys cahirinus*, March 1901, by N.C.R. and A.W., 2 females.

Wady Ferran, from *Acomys c. dimidiatus*, 1 female. From *Acomys cahirinus*, January 1912, by A. Bacot, 9 females.

Wadi Feiran, Sinai, from *Acomys* sp., August 1950, by H. Hoogstraal, a pair.

Genus **SYNOSTERNUS** Jordan, 1925

Synosternus. Jordan, 1925, Novit. Zool. 32, 103. Type species: '*S. pallidus* Tasch. 1880'.

Separable from all other Xenopsyllinae of the Arab World by the fusion of the sternum and the episternum of the metathorax. Anterior occipital bristle absent. Mesonotum shorter than or as long as metanotum. Hind femur with ventral longitudinal groove ending at a subbasal tooth. Segment V of all tarsi in both sexes with 2 sub-apical plantar spiniform bristles and 4 lateral pairs spiniforms of which the third and fourth are separated by a wide space occupied by a slender bristle.

Male. Apex of ejaculatory duct turned dorsad; proximally of this hook the duct constricted, and beneath the hook a rough longitudinal brush or a patch of teeth. P. 1 of clasper more or less cylindrical, several times as long as broad.

Female. Spermatheca generally very small with its head broader than the base of tail.

Two species are reported from the Arab World.

Hind tibia with 6 dorsal notches bearing strong bristles.
Segment IV of hind tarsus twice as long as broad ..... *cleopatrae*
Segment IV of hind tarsus not or only very little longer than broad, outer surface of hind tibia with a row of 6-12 bristles; t. I of abdomen with 1 row of bristles ..... *pallidus*

12. **Synosternus pallidus** (Taschenberg), 1880

Pulex pallidus. Taschenberg, 1880, Die Flohe, pp. 62, 65. pl. 1, fig. 9 (Egypt, from *Herpestes ichneumon*).

Synosternus pallidus. (Taschenberg), H. and R., 1953, C.R.C.F., p. 212, figs. 198, 204, 210, 211, 215,; Pls. 37C, 38A.

HEAD: Head well rounded. Eye large, black, oval with anterior spur. Ocular bristle slightly anterior to upper margin of eye. A second bristle at genal margin below eye level. Post-antennal region with

2 major bristles. Labial palp extending to about apex of fore coxa.

PRONOTUM: without a comb.

LEGS: About 20 bristles on fore coxa. Hind coxa with 2 or 3 bristles. A row of from 7-15 bristles on inside of hind femur, but 1 on outside. 6-12 subdorsal bristles on outside of hind tibia, its dorsal margin with 6 notches. Third pair of lateral bristles of segment V of tarsus placed a little beyond one-third. All tarsi have a number of minute plantar hairs proximal to the 2 sub-apical bristles.

MODIFIED SEGMENTS: Male, P. 1 of clasper three times as long as broad, acuminate, more rounded dorsally than ventrally, armed with 5-7 long bristles; P. 2 much smaller than P. 1, slightly swollen towards apex and with a number of very small apical bristles; P. 3 obliquely truncate, with a minute bristle at dorso-apical angle and another at ventro-apical margin or ventral angle. Lorsal tubercle of ejaculatory duct about as high as broad; beyond the tubercle but on the ventral side about 6 relatively large teeth; the upturned apical portion of the duct denticulated dorsally. Apical arm of st. IX slender, forming a very shallow sigmoid curve, gradually narrowed towards the tip which is turned up to form a hook and bears two minute hairs. There are 3 other minute hairs along the ventral margin of the apical portion.

The penis-plate is extremely narrow at the base. It broadens gradually to a blunt and faintly concave apex.

Female. Apical outline of VII st. not diagnostic. T. VIII armed with 9-14 bristles on the outer surface, of which 2-5 are lateral, inner surface with an apical row of 9-16. Spermatheca with spherical head, only about $1\frac{1}{2}$ times diameter of base of the tail. The tail is about twice as long as the diameter of the head, its base only slightly swollen and slightly darkened.

ARAB RECORDS:

IRAQ

Baghdad west, from hedgehog, April 1953, a female, and 15 miles north on Tigris River, from a rabbit (*Lepus babylonicus*), May 1953, a female, by the writer.

Following records from H. and R., 1953, p. 215.

Amara, from *Erinaceus calligone* (hedgehog), September 1917, a pair and from *Canis aureus* (jackal), December 1917, 1 female, by P.A. Buxton.

ALGERIA

Beni Abbes, l'Erg Oranais, Sahara. from *Fennecus z. zerda* (fox), by H. Foley, a pair.

EGYPT By N. C. Rothschild.

Cairo, from *Erinaceus auritus*, March 1907, many.

Der Macarius (Wady Natrun), from *Vulpes famelica* (fox), February 1903, many.

Zaghig, from *Canis zerda* (Fox), March 1903, 4 males, 3 females; Natron Valley (or Wady Natrun), February 1903, many.

Natron Valley, from *Erinaceus auritus*, April 1903, 6 males.

JORDAN (Palestine)

Rehoboth, from *Erinaceus r. sacer* (hedgehog), March 1928, by Dr. Theodor, 2 pair.

SUDAN

Kerma, Dongola Province, 'Egypt', from *Vulpes v. aegyptiaca* (fox), February 27 and March 1, 1904, by N.C.R., 2 males, 12 females; Kerma, from *Gerbillus pygargus* (gerbil), March 1904, by N.C.R., 2 males, 3 females.

Gebel Auli, White Nile, from *Erinaceus albiventris* (hedgehog), May 1900, by H.F. Witherby, 2 males.

White Nile, from *Erinaceus albiventris*, by H.F. Witherby, 7 females.

Shendi, from *Erinaceus aethiopicus* (hedgehog), January, February, May 1901, 2 males, 4 females; from *Vulpes niloticus* (fox), March 1901, 2 males, 11 females. by N.C.R. and A.F. Woolaston.

Um Kedada, from *Erinaceus albiventris*, March 1922, by H. Lynes, 3 pair.

Kulme, Wadi Aribo, Darfur, from *Vulpes pallida* (fox), August 1921, by H. Lynes, 1 male.

Roseires, 1906, by Ch. Alluaud, 2 pair.

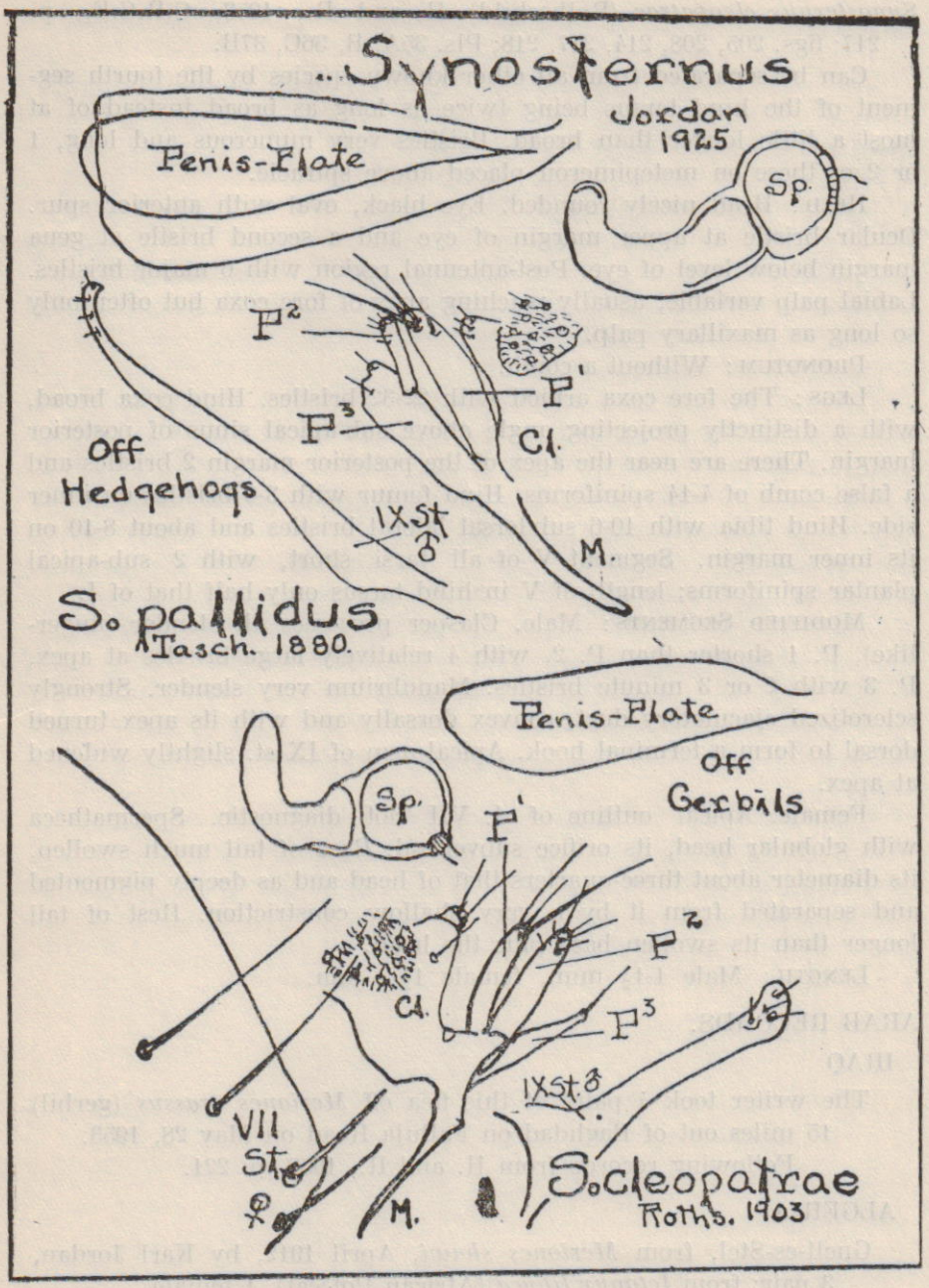
Singa, Sennar Province, from Homo (man), December 1912, by W.E. Marshall, 1 female.

YEMEN

Hodeida, from *Lepus* sp. (rabbit), January 1951, by H. Hoogstraal, 2 females.

13. **Synosternus cleopatrae** (Rothschild), 1903

Pulex cleopatrae Rothschild, 1903, Ent. mon. Mag. 39, 84, pl. 1, fig., 4, 8; pl. 2, figs. 13, 17 (near Shendi, Sudan, from *Gerbillus pygargus*).



(Fig. 10) Synosternus pallidus and S. cleopatrae.

Synosternus cleopatrae (Rothschild). H. and R., 1953, C.R.C.F., p. 217; figs. 205, 208, 214, 217, 218; Pls. 35A, B, 36C, 37B.

Can be separated from all other known species by the fourth segment of the hind tarsus being twice as long as broad instead of at most a little longer than broad. Bristles very numerous and long, 1 or 2 of these on metepimeron placed above spiracle.

HEAD: Head nicely rounded. Eye black, oval with anterior spur. Ocular bristle at upper margin of eye and a second bristle at gena margin below level of eye. Post-antennal region with 6 major bristles. Labial palp variable, usually reaching apex of fore coxa but often only so long as maxillary palp.

PRONOTUM: Without a comb.

LEGS: The fore coxa armed with 22-32 bristles. Hind coxa broad, with a distinctly projecting angle above sub-apical sinus of posterior margin. There are near the apex of the posterior margin 2 bristles and a false comb of 4-14 spiniforms. Hind femur with 3-6 bristles on inner side. Hind tibia with 10-6 subdorsal lateral bristles and about 8-10 on its inner margin. Segment V of all tarsi short, with 2 sub-apical plantar spiniforms; length of V in hind tarsus only half that of I.

MODIFIED SEGMENTS: Male. Clasper processes all slender (finger-like), P. 1 shorter than P. 2, with 4 relatively large bristles at apex, P. 3 with 2 or 3 minute bristles. Manubrium very slender. Strongly sclerotized ejaculatory duct, convex dorsally and with its apex turned dorsal to form a terminal hook. Apical arm of IX st. slightly widened at apex.

Female. Apical outline of st. VII not diagnostic. Spermatheca with globular head, its orifice subventral. Base of tail much swollen, its diameter about three-quarters that of head and as deeply pigmented and separated from it by a very shallow constriction. Rest of tail longer than its swollen base plus the head.

LENGTH: Male 1-1½ mm., female 1½-2 mm.

ARAB RECORDS.

IRAQ

The writer took 4 pairs of this flea off *Meriones crassus* (gerbil) 15 miles out of Baghdad on Falluja Road on May 28, 1953. Following records from H. and R., 1953, p. 221.

ALGERIA

Guelt-es-Stel, from *Meriones shawi*, April 1912, by Karl Jordan, 3 pair; from *Ictonyx libyca* (African Polecat). 1 female.

El-Golea, from gerbil, December 1935, by L. Foley, 1 female.

Djama, from *Gerbillus p. hirtipes* (gerbil), February 1920, by K.J. and C.N.R., 2 males.

Southern Oued Mya, Sahara, on bed in tent, May 1912, by E. Hartert, 1 female.

Ain-Sefra, Province of Oran, by W.R. and E.H., from *Meriones shawi*, April, May 1913, many; from *Gerbillus campestris rozsikae*, May 1913, many; from *Meriones schousboeii*, May 1913, 10 pair; from *Gerbillus p. hirtipes*, May 1913, many.

Touggourt, from *Gerbillus n. garamantis*, March 1920, by K.J. and N.C.R., 1 made.

Fort Miribel, 138 km. south of El Golea, from *Gerbillus c. cozsikae* (gerbil), by E.H., 1 male, 4 females.

Beni-Abbes, Sahara Oranais, from *Gerbillus pyramidum* and *G. p. hirtipes*, by H. Foley, many.

Biskra, by J. Steinbach, February to March 1908, from *Gerbillus p. hirtipes*, 1 male; from *Meriones trouessarti*, 2 males; from *Meriones l. ausiensis*, a pair.

EGYPT

By N. Charles Rothschild February through March 1903.

Bir Victoria, from *Gerbillus p. tarabuli*, many; from *Lepus c. rothschildi* (rabbit), 1 male.

Mt. Muluk, from *Meriones selysii*, 2 males, 3 females.

Natron Valley, from *Meriones selysii*, 5 males, 1 female.

Zaghig, from *Gerbillus p. tarabuli*, many; from *Meriones selysii*, 2 males, 5 females; from *Gerbillus gerbillus*, many; from *Jaculus jaculus* (jerboa), 2 males.

Albumar, Natron Valley, from *Ictonyx libyca* (African Polecat), 5 females.

Wady Natron, Lower Egypt, 2 females.

Bir Victoria, Natron Valley, from *Jaculus jaculus*, by N.C.R. and F. Henley, a female.

Siwa Oasis, West Desert Prov., from nest of gerbil, March 1951, by H. Hoogstraal, 1 male.

SUDAN

Shendi, by N.C. Rothschild and A.F. Woolaston, March 1901, from *Gerbillus pygargus* (gerbil), many; from *Gerbillus tatera*, 7 females; from *Gerbillus watersi*, 1 female; from *Jaculus jaculus* (Jerboa), 1 pair; from *Lepus rothschildi* (rabbit), 4 males, 2 females; from *Erinaceus aethiopicus* (hedgehog), 1 female.

Khartoum, by A Balfour, January 1906, from *Gerbillus gerbillus*, 8 males, 1 female; from *Jaculus jaculus* (jerboa), a pair.

Kerma, Dongola Province, from *Gerbillus pygargus*, February and March 1904, by N.C.R., many.

Shereik, by N.C. Rothschild, January 1904, from *Gerbillus pygargus*, many; from *Gerbillus gerbillus*, many; from *Meriones schousboeii*, 5 males; from *Acomys witherbyi*, (Spiny Mouse), 1 male, 3 females.

TUNISIA

Bir Pistor, off gerbils, by Wassilieff, 1933.

Genus **PARIODONTIS** Jordan and Rothschild, 1908

Pariodontis. Jordan and Rothschild, 1908, Parasitology, I, 13. Type species: *Paradonis riggenbachi* Rothsch.

Differing from all other known genera of Pulicidae by the great length of the thorax (pronotum much longer than mesonotum), and also by the very long and sharp genal lobe.

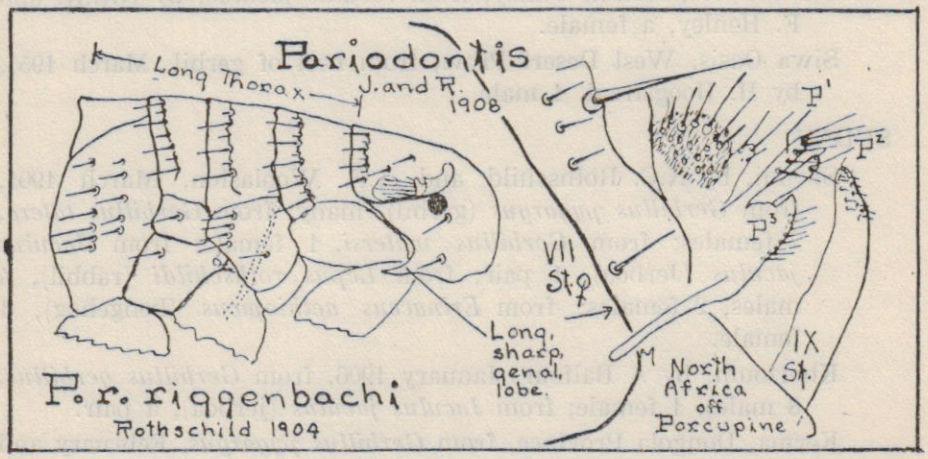
Falx present but not always distinct. Central tuber smaller than the eye and strongly sclerotized. The 2 ocular bristles small and sometimes absent. Bristles on side of thorax and abdomen very short and stout. Spiracles larger than in any other genus of the subfamily. Pygidium convex. False comb of hind coxa nearer apex than in other genera.

Male. Clasper with 3 processes of which P. 1 and P. 2 are rod-like.

Female. Spermatheca small, its head subglobular (wider than long), the tail relatively long with base barely swollen.

But a single species is known from the Arab World.

Spircles very large; anterior occipital bristle well developed (Africa) ..... *P. r. riggenbachi*



(Fig. 11) Pariodontis riggenbachi.

14. **Pariodontis riggenbachi riggenbachi** (Rothschild), 1904

Pulex riggenbachi Rothschild, 1904, Novit. Zool. II, p. 611, pl. 8, figs. 19, 20; pl. 9, fig. 24 (Deelfontein, Cape Colony, from *Hystrix cristata*).

Pariodintis riggenbachi riggenbachi (Rothschild). H. and R., 1953, C.R.C.F., p. 243; figs. 239, 240; Pls. 34A, C, 38B.

HEAD: Easily distinguished by the very long, triangular and sharp genal lobe. Falx present but sometimes hard to see. Central tuber smaller than eye. Eye round, black. Of 2 ocular bristles, anterior one well developed. Occiput armed with 5 or 6 bristles to the side. Labial palp about as long as maxillary palp, not reaching to apex of fore coxa, a little longer in female than in male.

THORAX: Pronotum longer than mesonotum, armed with 12 bristles but without a comb. Spiracles very large. Bristles on side of thorax very short and stout.

LEGS: Bristles on outer surface of fore coxa short but not stout. Hind femur evenly convex beneath. Tarsi long and slender, hind tarsal segment I more than twice length of V and mid tarsus II longer than V. Segment V of all tarsi widened apicad, the third pair of lateral bristles placed just beyond middle, 2 stout spiniforms sub-apical, plantar bristles in both sexes, and 2 or 3 much smaller plantar bristles proximal to them.

MODIFIED SEGMENTS: Male. Clasper with 3 processes of which P. 1 is linear and as long as the third segment of the hind tarsus and armed with 6 to 9 bristles of which 3 or 4 are apical long ones. P. 2 is shorter than P. 1 and narrowed almost to a point and armed on the outer side with a patch of 3 to 5 minute conical spiniforms and at the apex a number of small bristles of which one is fairly long. P. 3 is broad, triangular, and pointed bearing a regular row of 7-11 bristles along its slightly convex ventral margin and another bristle near the base of P. 2. Apical arm of st. IX variable in outline but usually somewhat dilated distally and sometimes strongly so, apical two-fifths with small bristles which are numerous at apex.

Female. St. VII with 10-12 bristles on the two sides together, the apical outline a flat oblique surface. VIII t. armed on each side with 2 short, stout, lateral bristles and a regular marginal row of 10-12 long ones on its outer side and a row of 6-9 much smaller ones on its inner side. Anal stylet nearly twice length of ventral surface of anal sternum. Head of spermatheca small, symmetrical, with mid-terminal orifice, broader than long, tail long and narrow, slightly swollen at base and apex.

LENGTH : male, 2.7-4.2 mm., female 3.8-5.2 mm.

ARAB RECORDS : From H. and R., 1953, p. 236.

ALGERIA

From Fac. Med. Parasitol., 2 females.

Hammam Meskoutine, from *Hystrix cristata* (Porcupine), February 1911, by L.W.R. and E.H., many.

MOROCCO

Mogador, from *Hystrix cristata*, November 1904, by W. Riggenbach, 1 male, many females.

Mazagan, 7 hours S.S.E., from *Hystrix cristata*, by W. Riggenbach, 4 males, 2 females.

TUNISIA

Considered by Wassilieff to be in Tunisia.

Genus **XENOPSYLLA** Glinkiewicz, 1907

Xenopsylla. Glinkiewicz, 1907, S.B. Akad. Wiss. Wien, Abt. I, 116, 385. Type species (by monotypy) : *X. pachyuromyidis* Glink. (=*cheopis* Roths.).

Separable from *Pariodontis* by the much stouter build and the absence of the long, sharp genal lobe, from *Paralulex* by the spiniform bristles of the latter genus and the more numerous bristles on its frons, and from *Synosternus* by the presence of at least some vestige of the suture separating the sternum and episternum of the metathorax. Oral margin not produced downwards into a hook-like genal lobe. Frons normally with 2 bristles, the most dorsal close in front of eye. The antennal club not segmented in ventral half. Pronotum shorter than mesonotum, which is shorter than t. I of abdomen. Metepisternum separated from metasternum by a suture, or at least by an internal horizontal ridge. Prosternum convex between fore coxae. Anterior median projection of metasternum pointed. Spiracle of t. VIII not extending to dorsal margin of segment.

The genus *Xenopsylla* is represented in the Arab World by three groups :

The **cheopis** group containing :
X. cheopis; *X. nubica*; *X. astia*.

The **nilotica** group containing : X. nilotica

The **conformis** group containing :
X. regis; *X. c. conformis*; *X. c. mycerini*; *X. ramesis*; *X. taractes*.

15. **Xenopsylla cheopis** (Rothschild), 1903

Pulex cheopis Rothschild, 1903, Ent. mon. Mag. 39, 85, pl. 1, figs. 3, 9, pl. 2, figs. 12, 19 (near Shendi, Sudan, from *Acomys witherbyi*).

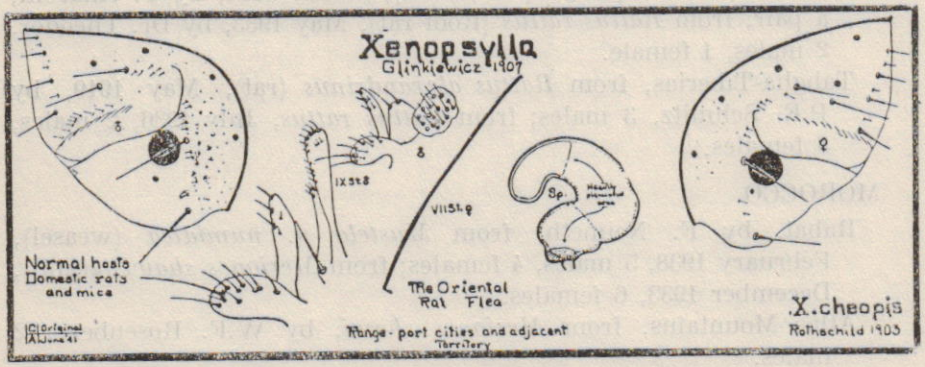
Xenopsylla cheopis (Rothschild), H. and R., 1953, C.R.C.F., p. 248, figs. 20A, 76, 199, 220, 246, 255, 259, 266, 286, 305-8, 310, 391; Pls. 2, 22D-F, 39A, 40E.

HEAD: Frons nicely rounded, occiput flat. Eye large, round, black. 2 large genal bristles, one above the eye, the other close to genal margin. Post antennal region with an anterior bristle, a median one and a marginal row of about 6, the most ventral one very long. Minute bristles between the marginal ones and on edge of antennal groove. Labial palp reaching to or near apex of fore coxa.

PRONOTUM: Without pronotal comb.

TARSUS: Segment V of fore and mid tarsi with 3 sub-apical plantar bristles, the hind tarsus with but 2.

MODIFIED SEGMENTS: Male. The male is separable from all members of the Arab World group by the apical arm of st. IX not having a strongly sclerotized ventral strip but being equally sclerotized throughout. P. 1 of the clasper rather broad, triangular, with apical margin concave and armed with 8-12 bristles arranged somewhat longitudinally and extending well basad of the middle of the process. P. 2 finger-like and extending well beyond P. 1 and armed apically with a few small bristles. Manubrium usually shorter than sum of mid-tarsal segments I-IV. Neck of ejaculatory duct with a very small dorsal tooth. Dorsal portion of paramere very broad, its apex truncate and somewhat convex. Apical arm of IX st. variable, usually broadening considerably towards the apex, which is usually not turned up.



(Fig. 12) Xenopsylla Cheopis.

Female. VII st. with slightly concave marginal outline, and armed with from 4-8 bristles on the side. Spermatheca more or less U shaped, the base of its tail barely broader than its head and the lower margin of the former projecting little if at all below the line of the lower margin of the latter.

LENGTH: Male 1,5 mm., Female 2 mm.

ARAB RECORDS:

IRAQ

The writer collected 2 males of this flea at Babylon, April 25, 1953 and a pair at Baghdad, April 15, 1953, from Norwegian rats (*Rattus norvegicus*).

The following from H. and R., 1953, p. 255, 258.

Baghdad, from brown rat, February 1936, by J. Lazar, a male.

Imp. Bur. Ent., April 1925, a pair.

Basra, from rats, 1920, Bombay N.H. Soc., many.

Kurna, from *Nesokia* (mole rat), May 1918, by P.A. Buxton, 5 males, 3 females.

Amara, from *Rattus norvegicus* (Norwegian Rat), January 1917, by P.A. Buxton, 4 females.

ADEN

Shiekh Othman, from rat, November 1906 to May 1908, by A. Mackae, 6 males, 7 females.

ALGERIA

Algers, from *Rattus norvegicus*, April 1929, by H. Foley, many.

EGYPT

From *Acomys cahirinus* (Spiny Mouse), Lister Institute, 3 males.

JORDAN (Palestine)

Rehoboth, from *Epimys* (*Rattus*-rat), March 1912, by T. Aharoni, a pair; from *Rattus rattus* (Roof rat), May 1933, by Dr. Theodor, 2 males, 1 female.

Tabgha-Tiberias, from *Rattus alexandrinus* (rat), May 1919, by P.E. Schmitz, 3 males; from *Rattus rattus*, July 1936, 2 males, 8 females.

MOROCCO

Rabat, by F. Neimeth, from *Mustela n. numidica* (weasel), February 1938, 5 males, 4 females; from *Meriones shawi* (gerbil), December 1933, 6 females.

Atlas Mountains, from *Meriones shawi*, by W.F. Rosenberg, 2 males.

Mogador, from hedgehog, by Escalera, 1 pair.

SUDAN

Shendi, by N.C. Rothschild and A.F. Woolaston, February and March 1901, from *Acomys witherbyi* (Spiny Mouse), male holotype; from *Arvicanthis n. testicularis* (Nilecat), 4 males, 8 females; from *Gerbillus tatera* (gerbil), 2 females; from *Genetta dongolana* (Genet), 1 female.

Merowe, from *Arvicanthis n. testicularis*, March 1904, by N.C.R., 1 male, 2 females.

Khartoum, from *Rattus alexandrinus*, by Wellcome Research College, a pair.

Jebel Marra, N.E., Darfur, by H. Lynes, from *Rattus n. macrolepsis* (rat), February 1921, a pair; S.E. Foothills, April 1921, a pair; S.W. Foothills, March 1921, 3 males, 1 female.

Kulme, W. Darfur, from *Sorex* sp. (shrew), September 1921, by H. Lynes, 1 male.

Kulme, Wadi Aribo, Darfur, from *Graphiurus orobinus*, June 1921, by H. Lynes, 1 female.

El Fasher, 60 miles S.W. Darfur, from *Rattus n. macrolepsis*, February 1921, by H. Lynes, 3 females.

Niurnya, Central Jebel Marra, from *Rattus n. macrolepsis*, March 1921, by H. Lynes, 1 male.

Duggu, Darfur, from *Rattus n. macrolepsis*, May 1921, by H. Lynes, 3 males, 1 female.

SYRIA

Region de Damas, from *Rattus r. alexandrinus*, by H.G. Kerville, 1 female.

TUNISIA

Tunis, off rats, by Wassilieff, 1933.

YEMEN

Sok al Khamis, from Jerboa, August 1913, by G.W. Bury, 9 males, 10 females.

From *Psammomys obesus*, (Fat Sand Rat), February 1951, by H. Hoogstraal, 1 male; from *Rattus*, January 1951, by H. Hoogstraal, 2 pair.

16. **Xenopsylla nubica** (Rothschild), 1903

Pulex nubicus Rothschild, 1903, Ent. mon. Mag. 39, p. 84, pl. 2, figs. 10, 16 (Shendi, Soudan, from *Arvicanthis testicularis*).

Xenopsylla nubica (Rothschild). H. and R., 1953, C.R.C.F., p. 273, figs. 256, 261, 265, 276, 288, 332, 333; Pl. 41G.

This species approaches *astia* but can be distinguished from it by the absence of a dorsal tooth on the apex of the ejaculatory duct and the presence of a semi-detached rod on the dorsal portion of the paramere. The spermatheca is so characteristic because of the enormously swollen base of its tail that it could only be confused with *astia*, from which it differs in the base of the tail being usually more ventricose and the swelling having a distinct tendency to be triangular in outline, not almost spherical as in *astia*; in addition, *nubica* usually has less than 28 bristles on each side of st. VIII.

HEAD: Head nicely rounded. Pre-antennal region with 2 bristles, 1 at eye position, 1 at genal margin and below eye level. Post-antennal region with a sub-apical row with 12-15 bristles on the two sides together.

PRONOTUM: With 15-16 bristles in the male, 16-18 in the female.

LEGS: Posteriorly near apex of hind coxa 3 bristles. On the inner surface of the hind femur 6-7 bristles in the male, 6-9 in female; on outer surface 2 on male, 3 on female. Hind tibia with 6 dorsal notches bearing strong bristles. Segment V of fore and mid tarsi with 3 sub-apical plantar spiniform bristles.

MODIFIED SEGMENTS: Male. P. 1 of clasper finger-shaped with 5 or 6 bristles, the rounded area proximal to its base membranous and without distinct surface sculpture; P. 2 also finger-shaped and not much longer than P. 1, tapering, straight or feebly bent down apically. The manubrium not quite so long as segments II-IV of hind tarsus together. The neck of the ejaculatory duct curved down like a slightly bent finger, without a dorsal hook but with a conspicuous ventral straight projection near the vesicle and a small blunt ventral tooth a little distal to this projection. The broadly triangular apex of the dorsal portion of the paramere has a semi-detached rod.

Female. Apical margin of VII st. not diagnostic, but is armed with 11-17 bristles on the two sides together. Spermatheca with ventricose base of tail variable but always broad, sometimes almost twice as wide as the head, the ventral outline of the swelling with a strong tendency to be subtriangular rather than sub-spherical as in *astia*.

LENGTH: Male 1½-2 mm., female 2-2½ mm.

ARAB RECORDS:

IRAQ

Basra, 40 miles N.W., from *Jaculus loftusi* (Jerboa), January 1953, by Robert Hatt for the writer, 2 pairs.

EGYPT

The following from H. and R., 1953, p. 276. March 1903 by N.C. Rothschild in Natron Valley.

Bir Victoria, from *Gerbillus gerbillus* (gerbil), 1 male; from *Jaculus jaculus*, 3 males.

Bir Hooker, from *Lepus c. rothschildi* (rabbit), 1 female.

Zaghig, from *Jaculus jaculus*, many; from *Gerbillus gerbillus*, 7 females.

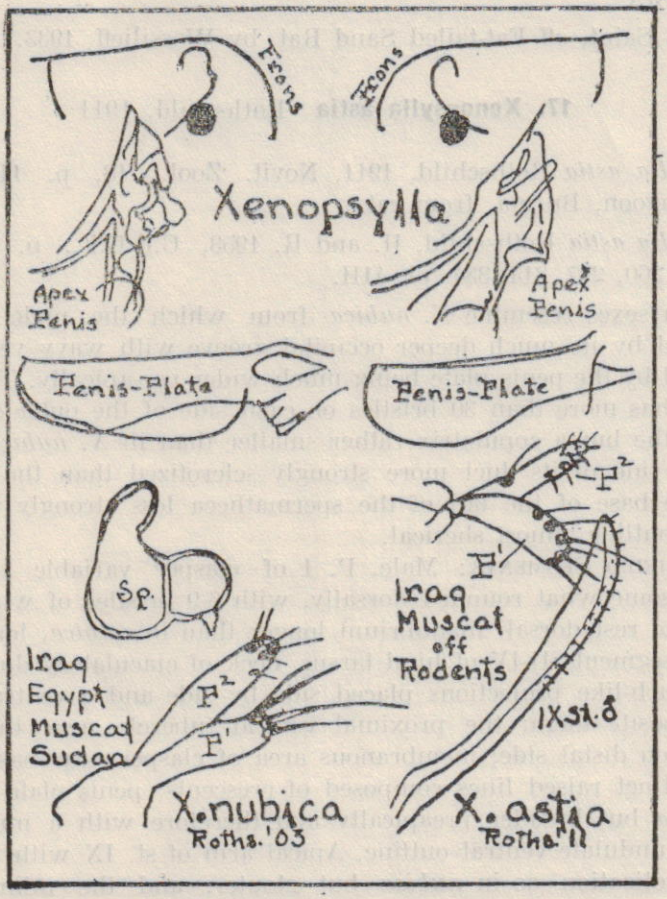
Bir Hooker, by F. Henley, 2 females each from *Gerbillus gerbillus* and *Jaculus jaculus*, March 1903.

MUSCAT

From *Rattus norvegicus*, by A.S. Tayakai, 1 female.

SUDAN

Shendi, by N.C. Rothschild and A.F. Wollaston, February and March 1903, from *Arvicanthis n. testicularis* (Nile Rat) male holotype; from *Gerbillus robustus*, 2 males, 4 females; from



(Fig. 13) Xenopsylla nubica and X. astia.

Gerbillus, 1 female; from *Gerbillus pygargus*, 1 male; *Genetta dongolana* (Genet), a pair; from *Herpestes albicauda* (Mongoose), 1 male.

Khartoum, from *Jaculus j. gordoni* (Jerboa), by A. Balfour, 1 male.

Nakheila, River Atbara, 1904, by N.C. Rothschild, 2 males by H. Lynes, March and April 1921.

Um Kedada, Darfur, from *Erinaceus* sp. (hedgehog), 2 pairs.

Kurra, Darfur, from *Rattus n. macrolepsis* (rat), 1 female.

El Fasher, Darfur, from *Rattus n. macrolepsis*, 1 female.

Kulme, Darfur, from *Rattus n. ugandae*, 1 female.

Kheira, Darfur, from *Taterillus butleri* (gerbil), 2 pairs.

Jebel Marra, Darfur, from gerbil, 1 male; from *Gerbillus lowei*, 2 pairs.

Kallogitting, Jebel Marra, 4000 ft., from *Felis l. ocreata* (cat) 1 pair.

TUNISIA

Fort Saint, off Fat-tailed Sand Rat, by Wassilieff, 1933.

17. Xenopsylla astia Rothschild, 1911

Xenopsylla astia Rothschild, 1911, Novit. Zool., 18, p. 117, fig. 1 (Rangoon, Burma, from rats).

Xenopsylla astia Rothschild, H. and R. 1953, C.R.C.F., p. 276; figs. 257, 260, 277, 314, 334; pl. 41H.

Both sexes resemble *X. nubica* from which the male is easily separated by its much deeper occipital groove with wavy ventral outline, and by the penis plate being much wider per-apically. The female usually has more than 30 bristles on each side of the outer surface of t. VIII, the bursa copulatrix rather smaller than in *X. nubica* and the anterior side of its duct more strongly sclerotized than the posterior side, the base of the tail of the spermatheca less strongly ventricose and its outline almost sherical.

Modified Segments: Male. P. 1 of clasper variable in width, usually some what rounded dorsally, with 6-9 bristles of which 2 are apical the rest dorsal; manubrium longer than in *nubica*, longer than total of segments II-IV of hind tarsus, neck of ejaculatory duct with 2 dorsal barb-like projections placed side by side and a ventral projection opposite them; the proximal ventral tubercle near the vesicle concave on distal side; membranous area of clasper near base of P. 1 with distinct raised lines composed of crescents; penis plate like that of *nubica* but broader preapically and therefore with a much more strongly undulate ventral outline. Apical arm of st. IX with a ribbon-like sclerotization as in *nubica* but stouter, and the minute hairs rather more numerous.

Female: Apical outline of st. VII not diagnostic. St. IV-VII of abdomen usually with more than 13 bristles on the two sides together, and outer surface of t. VIII rarely with fewer than 30 including the marginal row. Base of the tail of the spermatheca usually less ventricose than in *nubica* and with a tendency to be subtriangular.

LENGTH: Male 1½-2 mm., female 2-2½ mm.

ARAB RECORDS:

IRAQ

Baghdad, the writer collected this flea off *Nesokia i. buxtoni* (Mole rat), February 1953, 6 pair, 7 miles N.E. from *Gerbillus d. dasyurus* (Gerbil), May 1953, 2 males; 20 miles out Kut Road from *Gerbillus d. dasyurus*, May 1953, 3 males.

Hilla, from *Nesokia i. buxtoni*, April 1953, 1 male, 8 females; 5 miles W. at police station under date palms, from *Tatera bailwardi* (Date Rat), April 1953, 3 males, 2 females.

Babylon Junction, under date palm trees, from *Tatera bailwardi*. April 1953, a pair.

The following from H. and R., 1953, p. 278.

Amara, by P.A. Buxton, from *Tatera* sp., February 1918, 2 males, 7 females; from *Felis chaus* (Wild Cat), December 1917, 1 female; and without locality from *Nesokia i. buxtoni*, July 1918, 1 female, and from *Tatera bailwardi*, November 1917, 2 females.

Hinaidi, from *Nesokia i. buxtoni*, May 1922, by J. Boyd, a pair.

MUSCAT

From *Rattus norvegicus* (Norwegian Rat), by A. Tayakai, 1 female.

The **nilotica** Group of the genus **Xenopsylla**

Apical arm of st. IX of nearly even width throughout (Sudan), base of tail of spermatheca very distinctly swollen; VII st. with at least 19 bristles on the two sides together (Sudan) ..... *nilotica*.

18. Xenopsylla nilotica (Jordan and Rothschild), 1908

Leomopsylla niloticus Jordan and Rothschild, 1908, Parasitology, I, p. 50, pl. 5, fig. 3 (Nakheila, Atbara River, from *Gerbillus robustus*).

Xenopsylla nilotica (Jordan and Rothschild), H. and R. 1953, C.R.C.F., p. 314; figs. 251, 252, 301, 319, 382, 385, 386; Pl. 45G.

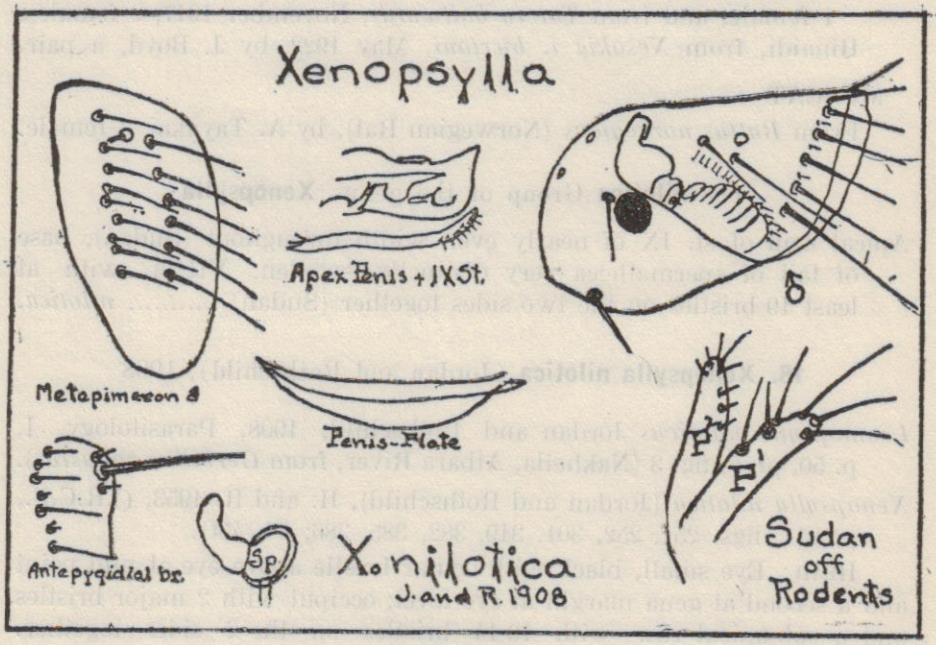
HEAD: Eye small, black with ocular bristle above eye at mid point and a second at gena margin at eye level; occiput with 2 major bristles and a sub-apical row with 13-14 bristles on the 2 sides together. Numerous small bristles at antennal groove.

PRONOTUM: Without comb.

LEGS: Fore coxa armed with 24-30 bristles. Hind coxa with 2 bristles near apex, 4-5 in male, 5-7 in female on inner surface. Dorsal margin of hind tibia with 6 notches of which the 3rd to 6th are close together, outer surface with 8-11 subdorsal bristles. One apical bristle of segment II of hind tarsus reaches to apex of V and at least 1 other beyond apex of IV. Segment V two-thirds length of II. Segment I of fore tarsus less than twice as long as broad.

MODIFIED SEGMENTS: Male. St. VIII with 16-20 bristles to the side. Apical arm of st. IX is strongly elbowed near the base, and of almost even width throughout except for the gradually narrowing apex. The upwards curve is about at the mid point. P. 1 and P. 2 of the clasper are both narrow, P. 1 a little longer than hind tarsal segment III and bearing 7-9 bristles at the apex. P. 2 is a little shorter than P. 1 and gradually narrows to the apex. Apical portion of the ejaculatory duct with prominent rounded swelling or tubercle on dorsal side. Anterio-dorsal angle of dorsal portion of paramere forming an acute angle, posterio-ventral angle lacking.

Female: Apical outline of st. VII not diagnostic but armed with 19-28 bristles on the two sides together. Each side of t. VIII with 22-27 bristles on the outer surface including the marginal row, and a row of 8-10 on the inner surface. Anal stylet small, half length of hind tarsal segment IV. Head of spermatheca oblique, higher than long, its



(Fig. 14) Xenopsilla nitotica.

longest diameter twice that of the slightly but distinctly swollen base of the tail.

LENGTH: Male 1½ mm., female 2 mm.

ARAB RECORDS: The following from H. and R., 1953, p. 316.

SUDAN

Nakheila, Atbara River, from *Gerbillus robustus* (Gerbil), February 1904, by N.C. Rothschild, the male holotype and 12 males and 8 females.

Shendi, by N.C. Rothschild and A.F. Woolaston, February 1901, from *Arvicanthis testicularis* (Nile Rat), 1 male; from *Gerbillus robustus*, 3 females; from *Gerbillus* sp., 1 male; from *Gerbillus tatera*, 4 males; from *Genette dongola* (Genet) 1 female.

Kerma, from *Gerbillus pygargus*, February 1904, by N .C. Rothschild, 1 male.

The **conformis** Group of the genus **Xenopsylla**

X. regis	Aden
X. conformis conformis	Iraq
X. conformis mycerini	North Africa
X. taractes	North Africa
X. ramesis	North Africa

19. **Xenopsylla regis** (Rothschild), 1903

Pulex regis. Rothschild, 1903, Novit. Zool. 10, p. 312, pl. 5, figs. 1, 3, 4, 7, 9, (South Arabia, from *Meriones rex*).

Xenopsylla regis (Rothschild), H. and R., 1953, C.R.C.F., p. 330, figs. 303, 398, 411, 412; Pl. 45A.

HEAD: Differs from all other species of *Xenopsylla* in that the genal margin of the head forms a triangular blunt genal lobe above the base of the fore coxa, but this distinction is difficult to see unless the head and pro-thorax are partly separated; separable in both sexes from any other member of the *conformis* group by the continuous row of occipital bristles which number 12-16 on the two sides. Eye round, black. Ocular bristle above eye.

MODIFIED SEGMENTS: Male. Lobe of margin of t. VII behind antepygidial bristle only indicated. St. VIII with 2-4 ventral bristles and 1 long one. Processes of clasper crowded together; P. 2 not reaching to apex of P. 1 which is club shaped, has about 12 bristles and is nearly three times as long as broad; P. 3 very short. Penis-plate broad pre-apically and broad near the base. Ventral arm of st. IX nearly

as in *conformis* but slightly more curved upwards in the middle.

Female: Spermatheca small, its head globular, constriction between its head and tail deep, base of tail not much narrower than head. Outer surface of t. VIII with 3-4 lateral bristles and an apical row of 7-9, inner surface with 6-8.

LENGTH: Male 1.3 mm., female 1.8 mm.

ARAB RECORDS: The following from H. and R., 1953, p. 332.

Aden, Lahadj (Lahej), south Arabia, from *Meriones rex* (Gerbil), December 1899, by C. von Erlanger and O. Neumann, a series of both sexes.

20. Xenopsylla conformis conformis (Wagner), 1903

Pulex conformis. Wagner, 1903, Rev. Russ. Ent. 3, 310 (Sultan-benta, River Murghab, Transcaspia, from small owl).

Xenopsylla conformis conformis (Wagner). H. and R., 1953, C.R.C.F., Figs. 316, 329, 413, 415, 421, 424, 434; Pl. 39B.

HEAD: Nicely rounded but much longer than deep. Genal bristles 1 over eye, 1 at genal margin. Eye oval, black. Subapical row of bristles on occiput widely interrupted above long ventral bristle.

LEGS: Hind tibia is armed with a stout bristle between the fourth and fifth pairs of dorsal bristles. Two or 3 of the apical bristles of segment II of hind tarsus extending beyond segment IV and one of these beyond V.

MODIFIED SEGMENTS: Male. Processes of clasper crowded together. P. 3 about half length of P. 1. Second apical marginal bristle from below on P. 1 much stouter than that at the ventro-apical angle; dorsal hump of ejaculatory duct high, sloping steeply distally. Projection of margin of t. VII behind antepygidial bristle well developed. Penis-plate less rounded apically than usual.

Female: VII st. with 8 bristles on the two sides together. Spermatheca with rather small head and broad base to tail; constriction between the two unusually shallow.

LENGTH: Male 1½ mm., female 2 mm.

ARAB RECORDS:

The writer's records are the first to appear from the Arab World.

IRAQ

The writer collected during April 1953 at:

Ramadi, 10 miles W., from *Meriones crassus* (Gerbil), 15 pairs.

Baghdad, 20 miles W., from *Meriones crassus*, 1 male, 2 females; 9 miles N., from *Gerbillus d. dasyurus* (Gerbil), 10 pairs.

21. Xenopsylla conformis mycerini (Rothschild), 1904

Pulex mycerini. Rothschild, 1904, Entomologist, 29, p. 1, pl. 1, figs. 1, 2, 4 (Bir Victoria, Natron Valley, Egypt, from *Gerbillus tarabuli* and *Pachyuromys d. natronensis*).

Xenopsylla conformis mycerini (Rothschild), H. and R., 1953, C.R.C.F., p. 334, figs. 244, 304, 400, 418, 423, 426; Pl. 44H.

HEAD: The rostrum is somewhat longer than the maxillary palpus, but does not reach the apex of the fore coxa. The second segment of the maxillary palpus is shorter than the fifth, being one fifth longer than the first. The subapical row of bristles of the occiput contains 4 bristles on each side, besides a dorsal one, the first and second bristles being spaced wide apart. Beneath the first bristle there is a rather thin hair. Above the center of the antennal groove there is 1 long bristle.

MODIFIED SEGMENTS: Male. Distinguishable from *X. c. conformis* by P. 1 of clasper being narrower, with a more rounded apex and in which the second apical marginal bristle from below is about the same thickness as that at the ventro-apical angle; in addition the dorsal hump on the apical part of the ejaculatory duct is lower and distally more slanting.

Female: Not distinguishable from *X. c. conformis*.

LENGTH: Male 1.5 mm., female 2 mm.

ARAB RECORDS:

From H. and R., 1953, p. 335.

ALGERIA

Fort Miribel, 138 km. south of El Golea, Sahara, from *Gerbillus c. rozsicae* (Gerbil), April 1912, by E. Hartert, 2 females.

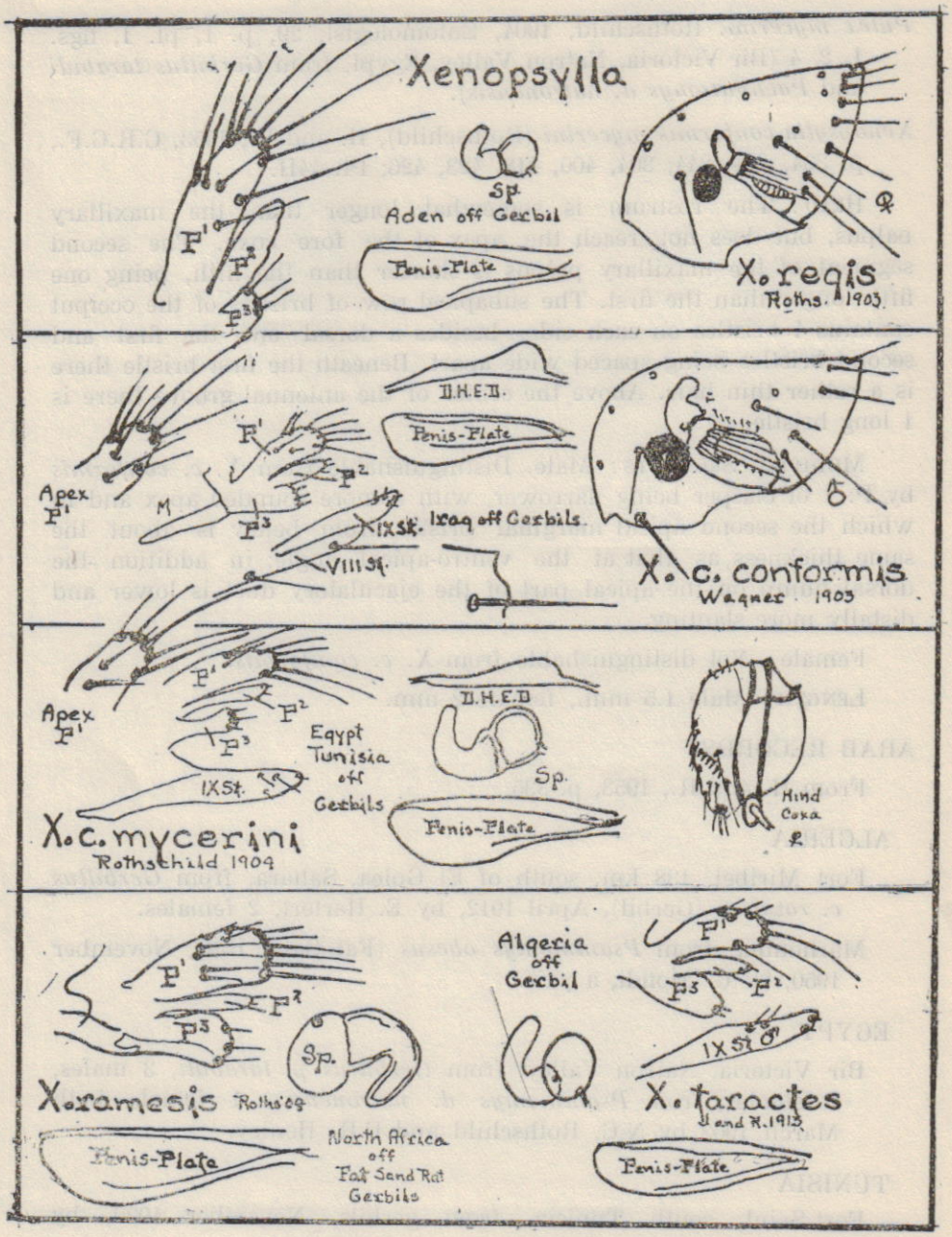
Marhouma, from *Psammomys obesus* (Fat Sand Rat), November 1950, by C. Mofidi, a pair.

EGYPT

Bir Victoria, Natron Valley, from *Gerbillus p. tarabuli*, 3 males, 7 females; from *Psammomys d. natronensis*, 1 female both March 1903 by N.C. Rothschild and F.R. Henley.

TUNISIA

Fort-Saint, south Tunisia, from gerbils, November 1930, by Wassilieff, 3 males, 7 females.



(Fig. 15) Xenopsylla regis, X. c. conformis, X. c. mycerini and X. taractes.

22. **Xenopsylla ramesis** (Rothschild), 1904

Pulex ramesis, Rothschild, 1904, Entomologist, 27, p. 2, pl. 1, fig. 3 (Bir Victoria, Natron Valley, Egypt, from *Pachyuromys d. natronensis* and *Gerbillus tarabuli*).

Xenopsylla ramesis (Rothschild). H. and R., 1953, C.R.C.F., p. 336, figs. 406, 416, 428, 429; Pl. 44E.

Closely related to *X. c. mycerini*, the rostrum, however, is only so long as the maxillary palp reaching to the apical third or fourth of the forecoxa.

LEGS: Separable from other members of the group by minute hairs between fourth and fifth pairs of dorsal bristles on hind tibia, combined with 2 sub-apical ventral bristles on hind femur's outside, and in female short bristles of hind tarsus.

MODIFIED SEGMENTS: Male. Lobe of t. VII behind antepygidial bristle short and blunt. St. VIII with 2-3 lateral bristles, one above the other and a ventral row of 3 on each side. Process of clasper crowded together; P. 1 large and broad, with a truncate apex and bearing a total of 14-16 bristles of which 2 or 3 apical ones are about as long as the lateral bristles of the median abdominal terga, while the lateral ones are variable in number and position but tend to form a transverse row; P. 2 reaches apex of P. 1; P. 3 truncate with rounded angles, reaching to about three quarters of P. 1, the uppermost of its 3 apical bristles very small; penis-plate broad with obliquely convex apex.

Female: Labial palp extending to about apex of coxa. St. VII with 2 bristles to the side, III-IV with 3; t. VIII with 4 lateral bristles. Spermatheca with strongly swollen base of tail, its head slightly larger than in *conformis* and distinctly more oblique, the constriction between head and tail shallow.

LENGTH: Male 1-1½ mm. female 2 mm.

ARAB RECORDS: From H. and R., 1953, p. 337-338.

ALGERIA

Biskra, by J. Steinbach, March 1908, from *Meriones shawi* (gerbil), 3 males, 2 females; from *Meriones crassibulla*, 1 male; from *Meriones ausiensis*, 4 males, 3 females and by Walter Rothschild, February 1911, from *Meriones sp.*, 1 female.

Hammam Rirha, 1911, by Walter Rothschild, 1 female.

Khenchela, from *Meriones shawi*, May 1912, by Karl Jordan, 3 males, 5 females.

Timgad, from *Gerbillus campestris*, April 1920, by Karl Jordan

and N. C. Rothschild, many, and from *Apodomys campestris* (Wood Mouse), 1 female.

Djama, from *Gerbillus campestris*, February 1920, K.J. and N.C.R., 1 female.

Ain-Sefra, Province of Oran, from *Meriones shawi*, May 1913, by Walter Rothschild and E. Hartert, a pair and from *Meriones schouesboei*, a pair; from *Gerbillus campestris*, 1 male, 3 females.

Beni-Ounif de Figuig, from *Gerbillus* sp. June 1939, by H. de Balzac, 1 male, 3 females.

Mecharia, Sud-Oranais, from *Mustela n. numidica* (Weasel), June 1930, 4 females.

Tamanrasset, 'Air', from *Psammomys o. algericus* (Fat Sand Rat), March 1923, by A. Buchanan, many.

Tamanrasset, Hoggar, from *Psammomys o. algericus*, by H. Foley, 1 male.

EGYPT

Bir Victoria, Natron Valley, from *Pachyuromys d. natronensis* (Fat Sand Rat), March 1903, by N.C.R. and F.R.H., 4 males, 8 females.

MOROCCO

Rabat, from *Oryctolagus cunuculus* (Rabbit), November 1938, by F. Nerneth, 2 pair.

Goulmine, from *Meriones* sp., December 1936, by J. de Lepiney, 4 males, 7 females.

TUNISIA

Whole of North Africa according to Wassilieff, 1933.

23. Xenopsylla taractes Jordan and Rothschild, 1913.

Xenopsylla taractes. Jordan and Rothschild, 1913, Novit. Zool., 20, p. 144, fig. (half-way between Ouargha and El-Golea, central western Sahara, from *Meriones schouesboei*.

Xenopsylla taractes J. and R., H. and R. 1953, C.R.C.F., p. 342, figs. 403, 417, 439-41.

The male can be separated from all members of the group, with the exception of *X. ramesis*, by the presence of a small hair between fourth and fifth pairs of dorsal bristles on the hind tibia, combined with the absence of a group of bristles on st. VIII, and the presence of 2 sub-apical ventral bristles on the outside of hind femur; most easily separable from *ramesis* by P. 1 of clasper being much narrower.

Male. Segment II of the maxillary palps shorter than segment I of the mid tarsus, maxillary and labial palps both short, latter not reaching apex of fore coxa. Two bristles of segment II of hind tarsus extending beyond segment IV. The triangular projection of margin of t. VII is moderately well developed. St. VIII is armed with 2 bristles on each side, one behind the other; st. IX with the pre-apical dorsal bristles much more proximal than in most members of the group. The processes of the clasper are crowded together; P. 1 club shaped, curved, more than three times as long as broad, 3 of its apical bristles long and stout and the middle one of these the stoutest. P. 2 is much shorter than P. 1. P. 3 is about half as long as P. 1. The penis-plate tapers more gradually to base than in most species of the group.

Female. Apparently known only to Wagner who described it insufficiently under *Xenopsylla lybica* in 1933 in Mitt. Zool. Mus. Berl. 18, p. 348 with figs. 7, 8 from Tunisia off *Zorilla lybica* (African Polecat).

LENGTH: Male 1.5 mm.

ARAB RECORDS: From H. and R., 1953, p. 344.

ALGERIA

Half way between Ouargha and El-Golea, from *Meriones schouesboei*, March 1912, by E. Hartert, 2 males.

Subfamily SPILOPSYLLINAE

Club of antenna symmetrical, elliptical in outline. Genal and pronotal combs present or absent. Pleural rod of mesothorax present. Central tuber absent. Male always with a single blunt spiniform bristle at apex of P. 1 of clasper. This is the only group of the Pulicidae in which the club of the antenna is symmetrical.

But a single genus of the sub-family is so far recorded from the Arab World. It is *Spilopsyllus* which is characterised as follows.

Genus **SPILOPSYLLUS** Baker, 1905

Spilopsyllus. Baker, 1905, Proc. U.S. nat. Mus. 29, 129, 131. Type species: '*leporis*'.

Symmetrical club of antenna with its un-foliaceous first segments characteristic. Frons angulate in its upper half. 2 segmented labial palps. Very large preoral tubercle. Lacinia of maxilla much broader than maxillary palp. Numerous subvertical, blunt, black spines make up the genal comb. Pronotal comb prominent. Pleural rod of mesothorax present, dorsally joining anterior margin of mesopleurum. Antepygidial bristle marginal. Segment V of all tarsi having 4 pairs of lateral bristles, and the usual pair of unequal spiniforms.

Male. P. 2 and P. 3 of clasper forming pincher. Apical arm of IX sternite narrow and only slightly dilated at apex.

Female. Orifice of spermatheca terminal. In the dorsal wall of the oviduct a large groove filled with a mass of filaments, and on ventral side of duct a corresponding mass of glandular papillae.

But a single species is reported from this genus in the Arab World. It was taken off a rabbit in Morocco.

24. Spilopsyllus cuniculi (Dale), 1878

Pulex cuniculi Dale, 1878, History Glanville's Wootton, p. 291 (Dorset England, from rabbits).

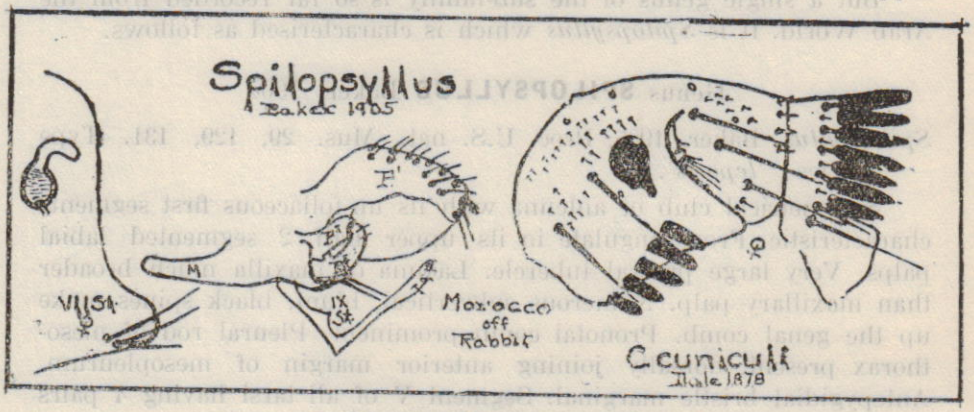
Spilopsyllus cuniculi (Dale), 1878, H. and R., 1953, C.R.C.F., p. 173, Figs. 78B, 163-165; Pls. 29A,B, 32D.

HEAD: As a whole well rounded, frons angulate in its upper half. Eye prominent and black. Genal comb usually of 5 broad, blunt, black teeth. 2 large bristles on the gena at level with top of eye. Postantennal region with 3 large bristles, a series of medium ones on the posterior margin, and a large number of minute ones placed over most of head. Pre-oral tubercle very large.

PRONOTUM: With a comb of about 16 black spines.

LEGS: Four pairs of lateral bristles on segment V of all tarsi and apical half of ventral surface with numerous hairs besides the usual pair of unequal spiniform bristles. Hind tibia with 6 dorsal notches including the apical one.

MODIFIED SEGMENTS: Male. The ventral projection of the clasper is short and armed with 1 or 2 long apical bristles. P. 1 is $1\frac{1}{4}$ times as long as broad and roughly ovate, nearly as strongly convex below as above and armed apically with a strong spiniform bristle and dorsally and laterally with a number of medium bristles. P. 2, the upper



(Fig. 16) Spilopsyllus cuniculi

process of the pinchers has a strong ventral tooth. P. 3, the lower process, curves upwards. Apical arm of sternite IX very slightly dilated distally and bears about 10 thin, short bristles on its apical third.

Female. Sternite VII with small rounded lower lobe which is rather strongly sclerotized and above the lobe the margin is slightly and gradually incurved. The crooked tail of the spermatheca is longer than the oval egg-shaped body.

ARAB RECORDS: From H. and R., 1953, p. 175.

MOROCCO

Rabat, from *Oryctolagus cuniculus* (Rabbit), November 1938, by F. Nerneth, 6 males, 5 females.

Family COPTOPSYLLIDAE

The head is not divided by a "dorsal sulcus" above the antennal groove. At oral angle of the head there is a strongly sclerotized clypeus which points upwards, the clypeus in this family being a fairly well defined separate sclerite. The eyes are large and black. There are no combs, vestigial abdominal combs, or pseudosetae. The internal ridge of the mid coxa usually present but sometimes short. Tooth at apex of hind tibia generally pointed, rarely rounded. Of the 2 dorsal apical bristles of the fore femur which guard the femoro-tibial joint the outer one is almost always the longer. Pygidium usually with 16 or more pits on each side. Both sexes have 2 antepygidial bristles which are about the same size. The females have 2 spermathecae.

The family is represented in the Arab World by but a single recorded genus.

Genus **COPTOPSYLLA** Jordan and Rothschild, 1908

Coptopsylla. Jordan and Rothschild, 1908, Parasitology I, p. 91. Type species: *Pulex lamellifer* Wag. (1895).

Frons truncate; no distinct tubercle. Antennal groove open, the genal process being very short; no distinct internal incrassation. Club of antenna long, segmented all round. Labial palp very long, consisting of 5 segments. No bristle beneath the eye level at genal margin.

Thorax with 1 row of bristles on tergites; the mesonotum bearing some long thin spines before the apex. Epimeron of mesothorax nearly horizontal, covering the stigma. Sternum of metathorax long in a dorso-ventral direction.

Abdominal tergites with 1 row of bristles, except the first which bears 2; seventh tergite with a long and a short bristle on the tubercle placed at the apical edge, the latter being excised where the tubercle is placed; the edge between the tubercles of the two sides produced backwards. There are 2 spermathecae.

Internal rod-like incrassation of mid coxa of legs forked below the middle. Hind coxa without comb, and excised posteriorly before apex, the angle distinct. First fore and mid tarsal segment shorter than second. Fifth tarsal segment with 5 lateral bristles. Eighth abdominal tergite in female bearing some hairs above the stigma. Stylet with an apical bristle and a short one before apex situated in a notch. The clasper of the male is divided into 2 lobes by a deep sinus.

The genus is represented in the Arab World by the three following species.

25. **Coptopsylla smiti** Hubbard, 1956

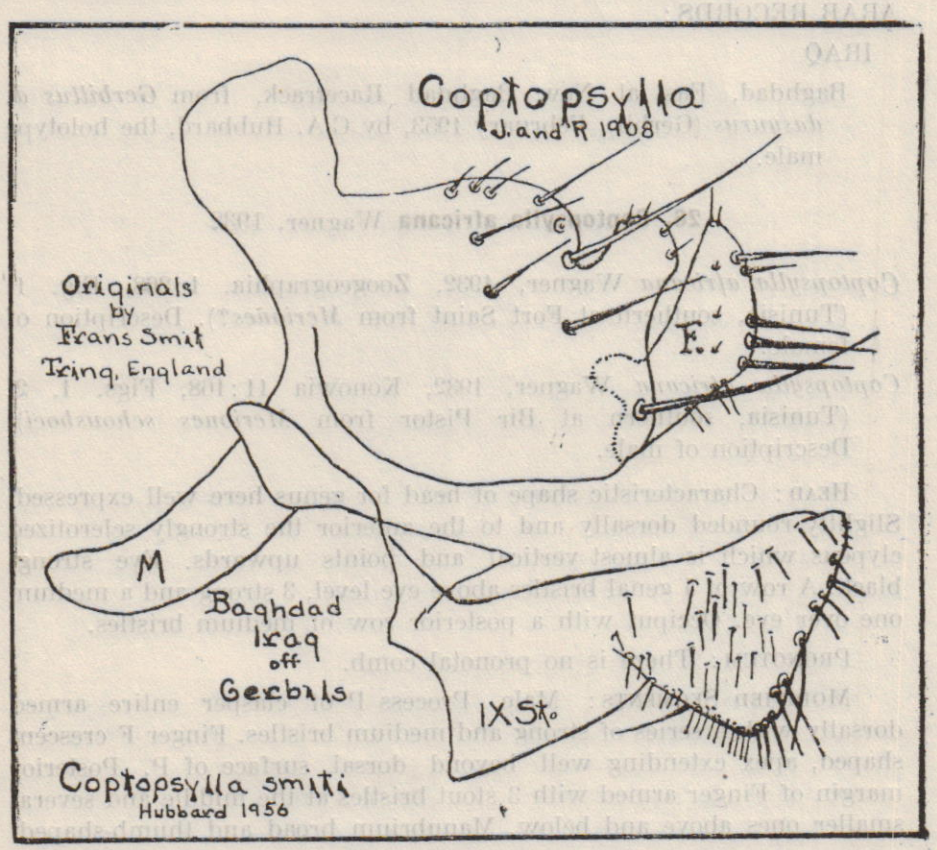
Coptopsylla smiti Hubbard, 1956, Iraq Nat. Hist. Mus. Publ. No. 11.

Described by the writer from material taken at New Baghdad Racetrack, Baghdad, January, 1953.

HEAD: Very characteristically shaped in the family and the genus and made more so by the presence of the clypeus which points upwards. There appears to be 2 major bristles in front of the large black eye and a much more prominent one adjacent to the anterior genal margin. Occiput with a posterior row of medium bristles. There is no genal comb.

PRONOTUM: Pronotal comb wanting.

MODIFIED SEGMENTS: Male. The body of the clasper is divided



(Fig. 17) Coptopsylla smiti

into two lobes by a deep sinus which is wider than that found in any of the subspecies of *lamellifer*. On the side of the clasper are 3 slender bristles and along the dorsal margin of the anterior lobe are 3 long bristles and 5 short ones, while the apex of the posterior lobe bears 4 small bristles. There is 1 strong acetabular bristle low down near the posterior margin of the clasper. The Finger, which is roughly triangular, measure about three times as long as broad. Its posterior margin is slightly angulate. There are 3 strong bristles at the widest point. The apex of the Finger is acute. A fourth prominent bristle is located about one third down from the apex toward the other three. Sternite IX is complicated, as is usual with the members of the genus; the apex of its distal arm is expanded into a large and much bristled triangular area.

Female. Unknown.

LENGTH: Male 2.5 mm.

ARAB RECORDS:

IRAQ

Baghdad, East at New Baghdad Racetrack, from *Gerbillus d. dasyurus* (Gerbil), February 1953, by C.A. Hubbard, the holotype male.

26. Coptopsylla africana Wagner, 1932

Coptopsylla africana Wagner, 1932, Zoogeographia. 1:268, Fig. 1. (Tunisia, southern at Fort Saint from *Meriones*?). Description of female.

Coptopsylla africana Wagner, 1932, Konowia 11:168, Figs. 1, 2. (Tunisia, southern at Bir Pistor from *Meriones schousboei*). Description of male.

HEAD: Characteristic shape of head for genus here well expressed. Slightly rounded dorsally and to the anterior the strongly sclerotized clypeus which is almost vertical and points upwards. Eye strong, black. A row of 4 genal bristles above eye level, 3 strong and a medium one over eye. Occiput with a posterior row of medium bristles.

PRONOTUM: There is no pronotal comb.

MODIFIED SEGMENTS: Male. Process P of clasper entire armed dorsally with a series of strong and medium bristles. Finger F crescent shaped, apex extending well beyond dorsal surface of P. Posterior margin of Finger armed with 3 stout bristles at the middle and several smaller ones above and below. Manubrium broad and thumb-shaped.

Female. Apical outline of VII sternite almost vertical with a small

lobe about one third up; 5 medium bristles along dorsal margin. Spermatheca double.

Remarks: The original description in the German carries a large amount of information on the location of the various bristles in this species. The writer has not included this data.

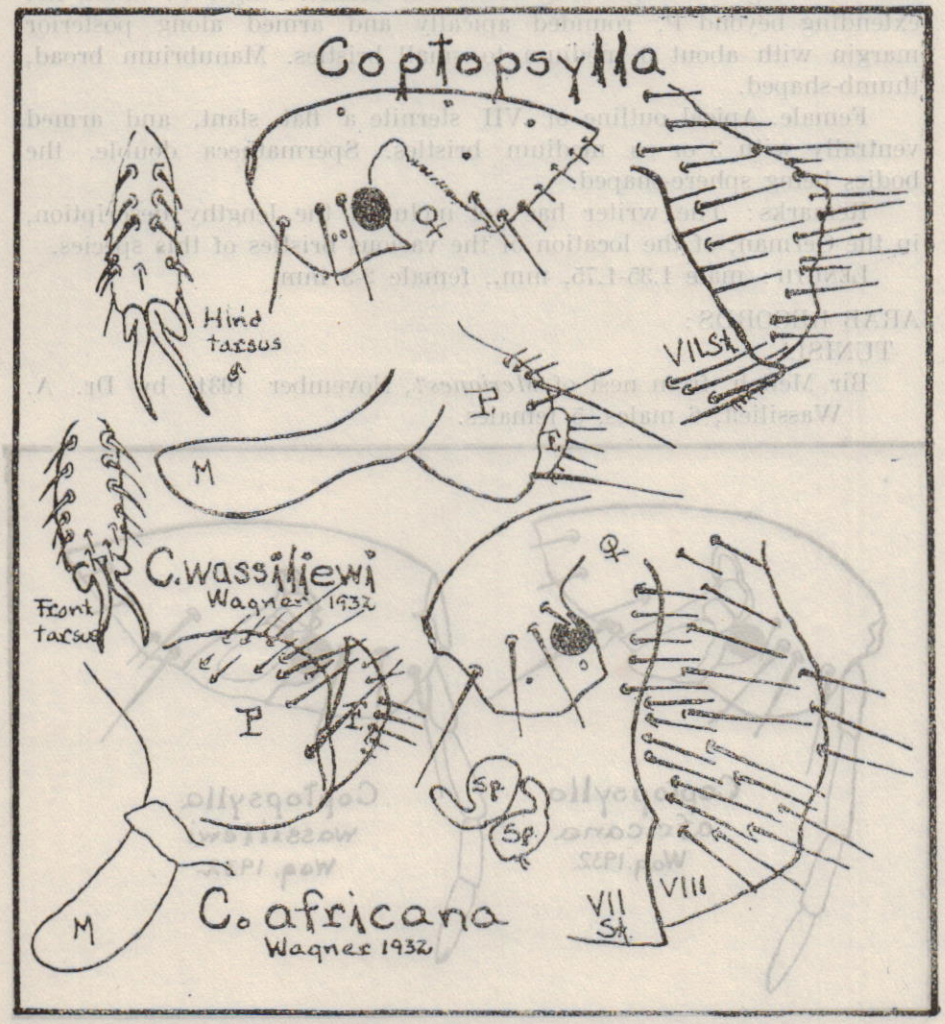
LENGTH: not recorded.

ARAB RECORDS:

TUNISIA

Fort Saint, from *Meriones*? by Dr. A. Wassilieff.

Bir Pistor, from *Meriones schouesboci* (Gerbil), by Dr. A. Wassilieff.



(Fig. 18) Coptopsylla wassiliewi and C. atricana.

27. Coptopsylla wassiliewi (Wagner), 1932

Neocoptopsylla wassiliewi Wagner, 1932, Konowia 11:172, Figs. 3-7. (Tunisia, Bir Mellah, from Nest of *Meriones*?).

HEAD: Characteristic shape of head for genus, but clypeus said to be very prominent. Eye large and black. Ocular row of bristles consists of 3 strong bristles at level of upper margin of eye. Occiput with a marginal row of medium bristles.

PRONOTUM: There is no pronotal comb.

MODIFIED SEGMENTS: Male. Process of clasper large and entire, and armed with a few dorsally located bristles, one being quite long and matching it a single long acetabular bristle. Finger F. small, not extending beyond P, rounded apically and armed along posterior margin with about 6 medium to small bristles. Manubrium broad, thumb-shaped.

Female. Apical outline of VII sternite a flat slant, and armed ventrally with 3 or so medium bristles. Spermatheca double, the bodies being sphere-shaped.

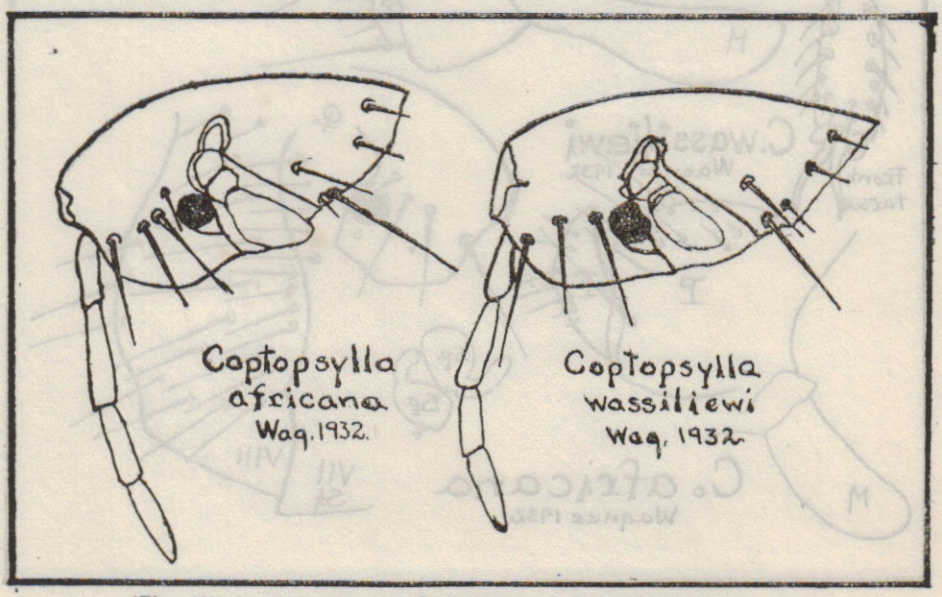
Remarks: The writer has not included the lengthy description, in the German, of the location of the various bristles of this species.

LENGTH: male 1.35-1.75, mm., female 2-3 mm.

ARAB RECORDS:

TUNISIA

Bir Mellah, from nest of *Meriones*?, November 1931, by Dr. A. Wassilieff, 6 males, 5 females.



(Fig. 19) Anterior parts of **C. africana** and **C. wassiliewi** compared.

Family ISCHNOPSYLLIDAE

Technically the bat fleas of the Arab World hold a taxonomic position at this point. However, the author, to keep them separate from the rodent fleas and the bird fleas, places them at the last of the series. There under the title "Bat Fleas of the Arab World" students will find:

The genus **Ischnopsyllus** with the species:

28. *octactenus*
29. *consimilis*
30. *hispanicus*

The genus **Araeopsylla** with the species:

31. *wassifi*

The genus **Lagaropsylla** with the species:

32. *incerta*

The genus **Rhinolophopsylla** with the species:

33. *unipectinata unipectinata*
34. *unipectinata arabs*

The genus **Chiropteropsylla** with the species:

35. *aegyptia*
36. *brockmani johnsoni*

which are now known to be found in North Africa and east of the Suez to Persia (Iran).

Family HYSTRICHOPSYLLIDAE

Eyes usually absent, but in the case of vestiges, never large or heavily pigmented. The antennal groove is open. Segmentation of the antennal club complete, that is, distinct all the way around. Usually there are both genal and pronotal combs, but in a few genera one or both may be missing. Under the apical margin of the mesonotum pseudo-bristles are found, but apical spinelets are missing. The anterior abdominal terga, however, do bear apical spinelets. Antepygidial bristles are usually present. The pygidium is convex and armed with hairs between the pits.

The VIII tergum of the male is unmodified, while the VIII sternum is variously expanded. Clasper with a single Finger. There are no typical acetabular bristles. The posterior arm of sternum IX is usually simple. There is no apodemal rod attached to the angle of sternum IX.

In the female the spermatheca may be single or in a few cases double, and an anal stylet is present.

The family is represented in the Arab World by up to 5 subfamilies, or as few as 3, depending upon one's view of existing synonymy and content. The subfamilies embrance 5 genera.

Subfamily HYSTRICHOPSYLLINAE

Fronto-epicranial groove distinct. Frons not greatly reduced, forming at least one-half of anterior margin of head and not dorsal in position. Gena seldom much enlarged and nearly always longest in a horizontal direction. No frontal tubercle or frontal notch. Labial palps of small number of segments. The genal comb may have more than 6 teeth. Hind coxae with or without a row or patch of spinelets on inner surface. The abdomen may have 1 or more combs of teeth, some of them being composed of short apical spines.

The genus *Typhloceras* is the only member of the subfamily so far recorded from the Arab World.

Genus **TYPHLOCERAS** Wagner, 1903

Typhloceras Wagner, 1903, Hor. Soc. Ent.: ross. 36, 152. Type species: *T. poppei* Wagner.

Much like miniature *Hystrichopsylla*, but with well developed eyes, the genal comb composed of straight blunt teeth (normally 4), and the vestigial abdominal combs composed of very widely separated spinelets.

Head well rounded and armed on both post and pre-antennal region with three rows of well defined bristles, and 4 genal teeth, separated by a space from a much smaller peg-like tooth at the eye. Genal teeth strikingly blunt, their sides almost parallel. Labial palp 6 segmented. Three antepygidial bristles, the middle one much the longest in the male while in the female the difference between this and the most ventral bristle is much less. Bristles of the tibia not forming false combs. Apical arms of the two sides of st. IX in the male not fused together, a preapical row of dark colored spiniform bristles on the posterior margin; st. VIII much less reduced than in *Hystrichopsylla*.

Key to the Known Species of *Typhloceras* in the Arab World.

Second and third tooth of genal comb alike in breadth; space between eye and fourth tooth of genal comb sub-equal to width of broadest tooth ..... *poppei*

Third and fourth tooth of genal comb distinctly narrower than second; space between eye and fourth tooth twice width of broadest tooth ..... *f. favosus*

37. Typhloceras poppei Wagner, 1903

Typhloceras poppei Wagner, 1903, Hor. Soc. Ent. Ross., 36:154, fig. 1, est. 2, fig. 10.

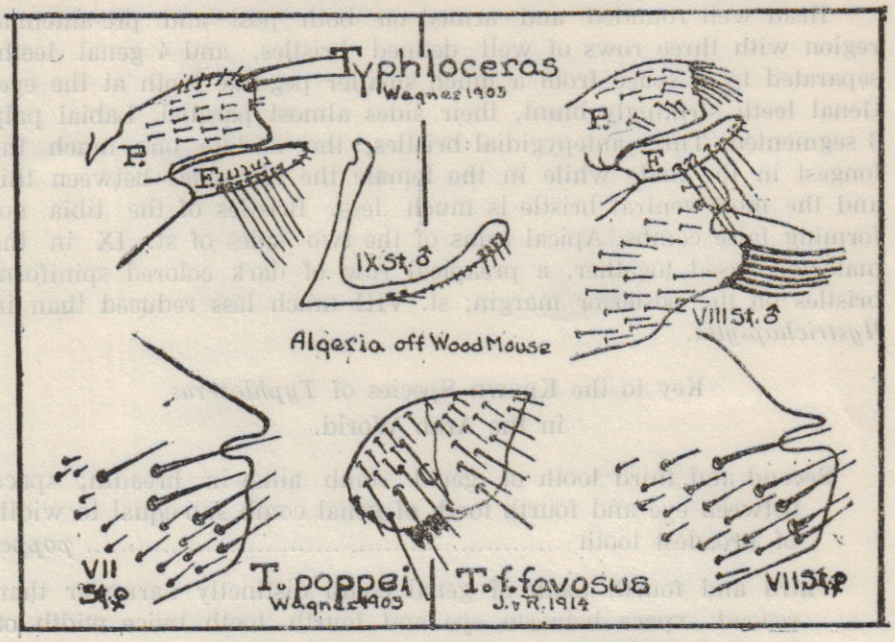
HEAD: Gena armed with a comb of 4 black teeth and 3 rows of bristles, the lower row oblique and of 4 long strong bristles, the second row less oblique and of 5 medium bristles and the frontal row of 6 or so medium bristles. Occiput with 3 rows of bristles mixed strong, medium and small.

PRONOTUM: With comb of from 23 to 24 teeth.

The reticulation of the surface is most apparent on the ventral side of the abdomen in the neighbourhood of the bristles. VIII abdominal sternite with broad ventral lobe.

MODIFIED SEGMENTS: Male. The broad process of the clasper has at the upper distal angle 2 or so strong bristles and a series of medium ones. The dorsal margin is curved. Finger fairly straight, somewhat thumb-shaped; armed on posterior border with up to 12 strong bristles. Swollen apical portion of IX sternite armed with 4 short, stout, dark bristles and many minute ones.

Female. Apical outline of VII st. sinuate, the sinus shallow, lobe



(Fig. 20) Typhloceras poppei and T. f. favosus,

above small, projecting, lobe below shorter than upper one, its almost vertical border undulate.

LENGTH: in both sexes about 2½ mm.

ARAB RECORDS:

ALGERIA

Bou-Medine, near Tlemcen, off *Apodemus sylvaticus hayi* (Wood Mouse), by A. Ruddle, Spring 1913, 1 male.

38. Typhloceras favosus favosus Jordan and Rothschild, 1914

Typhloceras favosus Jordan and Rothschild, 1914, Nov. Zool., 21: 236, figs. 1, 2 (from *Crocidura russula*, Alger).

The original description with slight modification follows.

MALE: The eighth abdominal sternite has a broader ventral lobe than in *T. poppei*, the lobe, moreover, bearing a regular row of six long bristles. The broad process of the clasper has at its upper distal angle a bunch of 5 or 6 long bristles. Its dorsal margin is slightly more curved than in *T. poppei*, and the process is rather narrower. The short ventral projection of the clasper is less rounded. The finger is proximally narrower and less straight. Its ventral margin is convex

from the apex to about the center, and bears a row of 6 long bristles, this row being far distant from the short ventral projection of the clasper. The outer arm of the ninth sternite differs from that of *T. poppei* in the widened apical portion being broader, whereas the rest of the arm appears to be narrower.

FEMALE: These differ from *T. poppei* in the sinus of the seventh abdominal sternite and the eighth tergite being deeper, in the bristles of the abdomen being less pointed, and those on the eighth tergite fewer in number. The pronotal comb contains only 21 teeth (in the male 22, in *T. poppei* 23 or 24). Moreover the reticulation of the surface, which in *T. poppei* is most apparent on the ventral side of the abdomen in the neighborhood of the bristles, is in *T. favosus* female also distinct on the back of the therax and abdomen and on the sides of the thorax. This difference likewise holds good in the male as regards the thorax.

LENGTH: about 2½ mm. in each sex.

ARAB RECORDS:

ALGERIA

Alger, from *Crocidura russula* (Shrew), April 5, 1913, by A. Ruddle, a male, the type; from *Apodemus s. hayi* (Wood Mouse) and *Mus algirus* (House Mouse), March 21 and April 1, 1912, by Karl Jordan, 2 females.

Subfamily STENOPONIINAE

No frontal tubercle. The eye is absent or vestigial. Labial palps short, not extending much beyond the apex of the maxilla, Antennal club short. There is a genal comb, as well as a pronotal and an abdominal. The comb on the first abdominal tergite has teeth as long as those in the pronotal comb. There are rows of short, stout teeth on the second to fifth abdominal tergites. There are three or four antepygidial bristles in the male and 4-6 in the female.

Posterior border of the tibia with numerous heavily pigmented bristles. The fifth tarsal segment with 4 pairs of lateral plantar bristles and a basal median pair.

Females usually with but one spermatheca.

Genus **STENOPONIA** Jordan and Rothschild, 1911

Stenoponia. Jordan and Rothschild, 1911, Proc. Zool. Soc. London, p. 391. Type species: *Hystrichopsylla tripectinata* Tiraboschi 1902.

Rostrum shorter than maxillary lobe. Labial palps are two segmented. The genal comb is made up of 10 or more teeth on each side. No eyes.

The pronotal comb is of many stout teeth which fringe the whole length of the posterior margin. There are 4 or more rows of bristles on each thoracic nota. Abdominal tergite I is with a well developed comb. There are many apical spinelets on terga II-V.

VIII sternite of male unmodified except for a slight posterior expansion.

The male genitalia without heavily pigmented spines.

Females usually with but 1 spermatheca.

During February of 1958 Dr. Karl Jordan, at the age of 96 years and as the most renown of World flea students, released in Bulletin of British Museum (Natural History). Entomology, No. 6 his "A Contribution to the Taxonomy of *Stenoponia*". A resumé of this paper follows.

"The *Stenoponia tripectinata* complex range from the Azores to Iraq. From west to east in the Arab World the ten new subspecies fall as follows:

Morocco, *S. t. megaera*
Algeria, *S. t. tripectinata*, *tenax*, *megaera*, *tingitana*, *thinophila*
Tunisia, *S. t. insperata*
Libya, *S. t. barcana*
Egypt. *S. t. separata*, *blanda*, *acmaea*.

The main distinction of the *tripectinata* complex is the gradual extension of the genal comb along the antennal fossa. A specimen which shows no indication of this development can always be recognized as belonging here by some other somatic difference: the labial palp consists always of one segment; the oral margin and the first segment of the maxillary palp are of approximately equal length, and the anterior area of the mesosternum is divided by a well defined band-like sclerotization into an upper and a lower portion.

The **Stenoponia tripectinata** complex: Its Subspecies and their Differences.

I. Above the point where the left and right oral margins meet there is a more or less distinctly projecting angle; the distance from the base of the uppermost spine of the genal comb is longer than the oral margin. The total number of spinelets on abdominal terga II-VI, counting both sides together, is more than 30 in both sexes.

1. All populations in which at most one spine is moved upward at the antennal fossa out of line with the preceding ones. Pronotal comb varying in the male from 35 to 40 spines, in the female 36 to 43 spines; male abdominal comb 32 to 38 spines, female 35 to 41 spines.

39. Stenoponia tripectinata tripectinata (Tiraboschi), 1902

One genal spine on antennal fossa. Variation of genal spines in male comb 11 to 13, female 11 to 14; antepygidial bristles, male 3 to 5, female 4 to 5. Abdominal spinelets vary from 49 to 70 in male, in female 42 to 67. In the male the ventral branch of the IX sternite is bent backwards, contrasting in direction with the narrow proximal portion of the branch and varying much in the degree of convexity of the upper side. Abdominal tergum VI of male with one or more spinelets, most of which are lateral, situated above the spiracle of VII t.

ARAB RECORDS:

ALGERIA

Khenchela, east end Aures Mts. off *Mus musculus* (House Mouse), by Karl Jordan, 7 males, 3 females, May 1912.

Hammam Meskoutine, west of Guelma off *Lemniscomys barbarus* (Spiny Mouse) and off *Mus musculus* by Karl Jordan, 9 males, 10 females, April 1914.

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2. All populations in which two genal spines at the upper end of the genal comb are along the antenna fossa.

40. Stenoponia tripectinata tenax Jordan, 1958

Two genal spines on antenna fossa. Labial palp of the male is approximately one-fifth shorter than the first segment of the maxillary palp and one-eighth shorter than oral margin, in the female one-fourth and one-fifth respectively. Male genal comb 12 or 13 spines, female 13. Antepygidial bristles in male 3 or 4, female 5. Pronotal comb of male 35-36 teeth, female 36, abdominal comb of male 30-33 spines, female 38. Total number of abdominal spinelets about 54. The IX sternite of the male is similiar to that of *tripectinata* but is longer and the dorsal side less incurved.

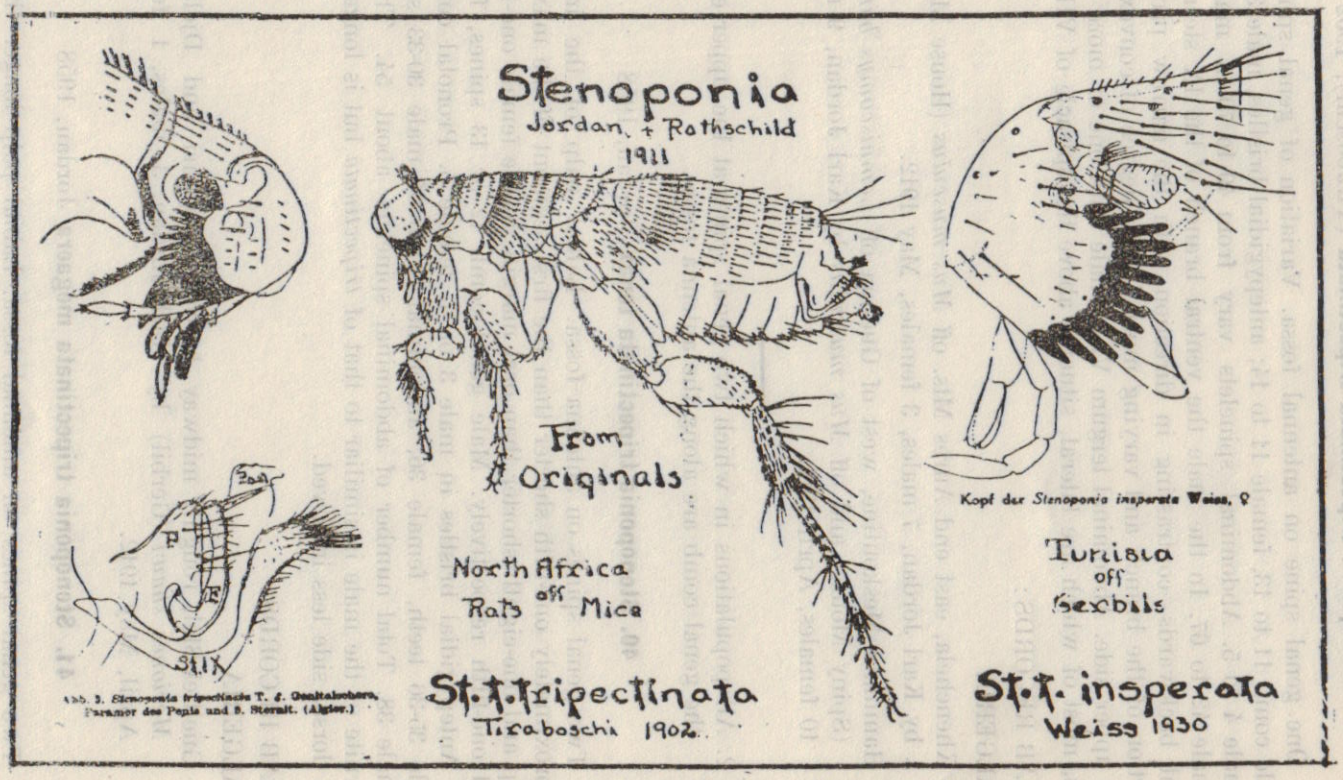
ARAB RECORDS:

ALGERIA

Guelt-es-Stel, roughly midway between Boghari and Djelfa off *Meriones shawi* (Gerbil) by Karl Jordan, 3 males, 1 female, April, May 1912.

41. Stenoponia tripectinata megaera Jordan, 1958

Two genal spines on antennal fossa. Labial palp longer than in *tenax*, as long as the oral margin. Genal comb of male with 11, 12 or 13



(Fig. 21) Stenoponia t. tripectinata and St. t. insperata.

spines, female 11 to 14. Antepygidial bristles 4 in males, in females 5 to 7, the prevalence of 6 and 7 in a set of antepygidials characterizes this subspecies. Abdominal spinelets average 47 in males, 43 in females. In the male the enlarged apical part of IX sternite is dorsally more or less strongly convex, its apical margin slanting downwards and backwards, the most distal point being ventral or subventral.

ARAB RECORDS:

ALGERIA

Djebel Mourdjadjo (behind Port Oran), off *Dipodillus campestris* (Gerbil) by Alan Ruddle, 5 males, 12 females, April 1913.

MOROCCO

Casablanca, 25 miles northeast in Nefifik Forest off *Dipodillus campestris* by J. Bruneau, 5 males, 3 females, date missing.

42. Stenoponia tripectinata barcana Jordan, 1958

Two genal spines on antennal fossa. Forehead shorter than in the three preceding subspecies. Frontal tubercle not quite effaced. Labial palp as in *megaera*, somewhat longer than in *tenax*. Genal comb in male 11 or 12 spines, female 13. Antepygidial bristles 3 in males, 4 or 5 in females. Pronotum inclusive of comb as long as metanotum. Abdominal spinelets, male 32 to 44, female 36 to 43, the number being smaller than in *tenax* and *megaera*. Dilated apex of ventral arm of sternite IX of male rather strongly convex on the upper side, apical margin rounded, without angle, most distal point below middle. Heel of manubrium of clasper gradually widened, less abruptly than in *megaera*. The slanting upper margin of the lobe above the subventral sinus of VII sternite of the female somewhat abruptly incurved.

ARAB RECORDS:

LIBYA

Barca peninsula, Cyrenaica off *Spalax e. aegyptiacus* (Mole Rat) by W. Scott, 2 pairs, April 1946.

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3. Three or four genal spines placed along the antennal fossa, sometimes the base of the lowest of these not completely above the preceding one. Number of spines in genal comb varies in male from 11 to 14 (not 15) and in the female from 13 to 15. Pale area of metepisternum always distinctly longer than vertically broad.

43. Stenoponia tripectinata tingitana Jordan, 1958

Three genal spines on antennal fossa. Labial palp less than two-thirds the length of the oral margin. Genal comb in male with 12 to 14 teeth, female, 13 or 14. Pronotum inclusive of comb a little shorter than metanotum. Spines in pronotal comb, male, 33 to 36, female, 36 or 37, abdominal comb in male with 30 to 34 spines, in female 36 or 37. Abdominal spinelets average 37 in male, 36 in female which is less than in the four preceding subspecies. Antepygidial bristles in males 3 or 4, in females 5. Dorsal surface of dilated apical portion of the ventral arm of IX sternite male extending farther distad than underside, the greater portion of the long setae ventral and subventral.

ARAB RECORDS:

ALGERIA

Rabelais, near Orleansville off *Meriones shawi* (Gerbil), by H. Heim de Balzac, 4 males, 1 female, January 1930.

44. Stenoponia tripectinata insperata (Weiss), 1930

Three or four genal spines along the antennal fossa. Genal comb in the male with 12 or 13 spines, in female 14 or 15. Antepygidial bristles in male 3, in females 4. Abdominal spinelets average 44. Pronotal comb in male average 34, in female 35 spines. The abdominal comb averages 31 spines in the male, 35 in the female. The dilated apex of the ventral branch of the IX sternite male is dorsally more convex than its ventral surface is concave, not subcircular in outline, its apical margin rounded, the long bristles below the highest point of upper side. Manubrium of clasper without heel.

ARAB RECORDS:

ALGERIA

Birkra off *Meriones shawi* (Gerbil) by J. Steinback, a series, March 1908.

TUNISIA

Tunis (Carthage area) off *Gerbillus campestris* (Gerbil); Bir Mellah (Kairouan area) off *Meriones shawi* and *Dipodillus campestris*, a series, 1933.

45. Stenoponia tripectinata irakana Jordan, 1958

Three or four genal spines along the antennal fossa, the total number being 14. Abdominal spinelets are 46 in male, average 54 in females. Spines in pronotal comb 36 in male, 37 or 38 in female. Abdominal

comb of 35 spines in male, 35 to 38 in females. Antepygidial bristles 3 in male 4 in female. Apex of the ventral arm of IX sternite male almost symmetrical, proximally to the broadest point more incurved ventrally than dorsally.

ARAB RECORDS:

IRAQ

Baghdad (Karradat Marriam) off *Mus musculus praetextus* (House Mouse) by C.A. Hubbard, 1 male, January 28, 1953.

Baghdad (New Baghdad Racetrack) off *Gerbillus lofthusi* (Gerbil) by C.A. Hubbard, 1 female, February 5, 1953.

Falluja (Haur-al-Hasa) off *Jaculus jaculus lofthusi* (Jerboa) by D.L. Harrison, 1 female, December 1954.

46. Stenoponia tripectinata seperata Jordan, 1958

Three or four genal spines along the antennal fossa. This subspecies is particularly distinguished by the narrowness of the club of the IX sternite of the male. The genal comb of the male is of 12 or 13 spines, the female 14 or 15. Antepygidial bristles are 3 in male, 4 in female. Pronotal comb of 36 spines in both male and female. Abdominal comb of 32 spines in male, 36 in female. The club of the ventral arm of the IX sternite male similiar to that of *barcana* but narrower.

ARAB RECORDS:

EGYPT

Mersa Matruh, 37 miles west, 1 male, January 13, 1933,
Sidi Barrani, 19 miles east, 1 female, January 13, 1933, both by H. Hoogstraal from burrows of undetermined rodents.

II. Head anteriorly much more rounded than in the preceding, the frontal angle vestigial or effaced. The average of the total number of spinelets on abdominal terga II to V is 30 or less; VI without spinelets in either sex. Club of IX sternite of male almost symmetrical as in *insperata* and *irakana*.

4. Genal comb of 14 spines in both sexes. Abdominal tergum V in both sexes with one or two spinelets on at least one side.

47. Stenoponia tripectinata blanda Jordan, 1958

Genal comb of 14 teeth of which three or four are along antennal fossa. Spines of pronotal comb of male 15 or 17, female 17, 18, 19. The length of the convex dorsal surface of the club of the IX sternite of

Antepygidial bristles with broad interspace between the two groups on the side.

3 genal teeth ..... *L. algira*

Leptopsylla taschenbergi

L. t. taschenbergi ..... North Africa?? and Europe
L. t. amitina ..... Algeria and Europe
L. t. calamana ..... Eastern Algeria

Leptopsylla algira

L. a. algira ..... Coastal belt of Algeria
L. a. tuggurtensis ..... South of eastern end of Atlas Mts. in Algeria

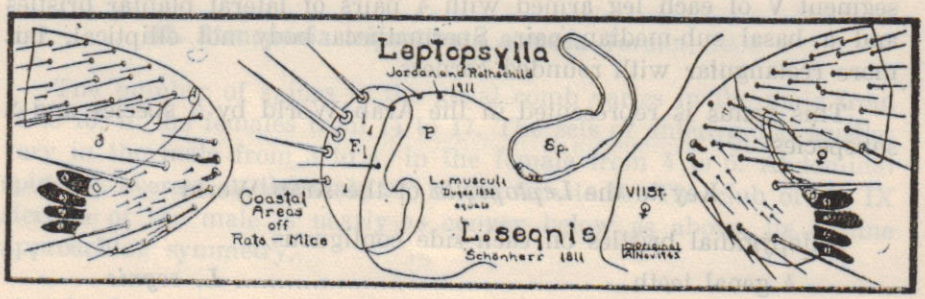
50. Leptopsylla segnis Schonherr, 1811

Pulex segnis Schonherr, 1811, Kogl. Svenska Vetenskaskad. Nya. Handl. (2nd s.), 32:98, Pl. V, figs. A, B.

This is the common European mouse flea which has been distributed throughout most of the ports of the World on the Norwegian rat and House mouse. It is instantly recongnized by the 4 heavy genal teeth, the 2 black spiniform on the frons, the vestigial eyes and its host, the house rats and mice.

Modified Segments: Male. Finger F with rounded convex posterior margin armed with 4 or 5 bristles, of which 3 are longer than the others. Distal end of posterior arm of IX sternite is expanded, posterior margin bearing a number of hair-like setae. Three antepygidial bristles to the side, shortest one the inner, the medium one the outer, contiguous.

Female: Apical outline of sternite VII without a sinus, the single lobe having a somewhat undulate slant. There are 4 antepygidial bristles to the side which are contiguous. Spermatheca with body



(Fig. 22) Leptopsylla segnis.

somewhat rectangular, corners rounded off, tail broader at base than at apex and curved.

Medical Importance: While this flea is considered a vector of plague, Eskey and Haas found that only 5 out of 28 fed upon plague positive guinea pigs became infected. There is no record of any of the 5 infected fleas having freed themselves of the infection, or of succeeding in transmitting plague.

ARAB RECORDS:

ALGERIA

Algers. According to Jordan and Rothschild, Nov. Zool., 19:360 Billet recorded this flea off rats in Algers, Phillippeville, and Bone on p. 111, Bull. Soc. Path. Exot. 1. 2. (1908).

51. Leptopsylla taschenbergi taschenbergi Wagner, 1898

Ctenopsylla taschenbergi Wagner, 1898, Hor. Soc. Ent. Ross. 31:577.
Leptopsylla taschenbergi taschenbergi Wagner, Jordan, Ano 1950 (Dec. 1951), Pub. en "EOS", Revista Esp. de Ent. p. 19-23.

Jordan states of this much discussed flea in 1950 that in the male sternite VIII bears all the bristles in the apical area, there being at most some minute hairs in or near the middle; the number of bristles varies from 16 to 20. The ventral apical sclerite of the penis offers an easily seen subspecific difference. This process, one to each side, is movable up and down as in other *Leptopsyllidae*, curved and apically dilated, the ventral area ends with a truncate-sinuate process, which is a little longer than broad and slightly variable in shape; from this process the apical margin extends forwards and forms with the prolongation of the dorsal margin of the median portion of the sclerite a very sharp angle; along this dorsal margin runs a transparent crest which widens distally more or less. The line indicating the dorsal margin of the sclerite is single, a thin line branching off at the beginning of the apical dilation and running on the inner side to the dorsal side of the apical projection. Finger F. as long as Process P. Process armed apically with a few small bristles and a heavy bristle above insertion of Finger. Finger flat on surface towards process and concave on posterior border. Armature of Finger consists of a few small bristles at apex and 6 major bristles about equally spaced along posterior border.

Female: VII sternite is deeply and broadly sinuate, the lobe above the sinus being triangular and rather long.

ARAB RECORDS:

ALGERIA

This subspecies is assigned to Algeria by Costa Lima and Hathaway on page 195 of "Pulgas".

NORTH AFRICA

Frans Smit in a foot note on page 26 Overgedrukt uit het Tijdschrift voor Entomologie, Deel 93, 1950 says "*L. taschenbergi*, a European species which extends into North Africa".

Both of these assignments may refer to *L. taschenbergi amitina* which follows.

52. Leptopsylla taschenbergi amitina J. and R. 1914

Leptopsylla amitina Jordan and Rothschild 1914, Nov. Zool., 21:273, fig. 2 (Oran, Algeria off *Apodemus s. hayi*).

Leptopsylla taschenbergi amitina Jordan and Rothschild. Jordan, Ano 1950 (1951, Dec.), Pub. en "EOS", Revista Esp. de Ent. p. 24-26.

According to Jordan in 1950, sternum VIII of the male bears on each side of the body from 9 to 14 bristles, and as a rule 1 or 2 bristles placed near the division of the segment are separated from the more distal bristles by a variable distance. The Finger F differs markedly from that of *L. t. taschenbergi* in its proportions and the position of the lower bristles of the posterior margin. The apical ventral movable sclerite of the penis is distally more curved than in *taschenbergi* or *calamana*; the apical ventral process is conical as in *calamana*, but directed upwards, the ventral area bulges out subapically, forming a rounded elbow, the dorsal margin of the sclerite is indicated by a double line which runs upwards in an even curve and is continuous with the double line of the apical process; the crest is usually broad and rounded.

Jordan also states that although no females are known from North Africa, those from Europe show a variability of the VII sternite which is considerable and most specimens have a distinct sinus which is narrower than in *t. taschenbergi*; the lobe varies very much in length and width.

ARAB RECORDS:

ALGERIA

Bou-Medine, Oran, April 1913, off *Apodemus s. hayi* (Wood Mouse) by W. Rothschild, E. Hartert and A. Ruddle, the holotype male.

53. Leptopsylla taschenbergi calamana Jordan, 1950

Leptopsylla taschenbergi calamana Jordan, 1950, Ano (Dec. 1951), Pub. en "EOS", Revista Esp. de Ent. p. 23-24, fig. 4-5 (Hammam Meskoutine, Algeria, off *Apodemus s. hayi*).

The original description with slight modification follows:

Having now a large series of the male of *L. t. amitina* all of which agree with the type in the shape of the ventral apical sclerite of the penis, the different apex of this sclerite in the Hammam Meskoutine males has become a characteristic distinction.

Male clasper as in *L. t. amitina*, the basal third of F narrower than in *taschenbergi* and the lower bristles of the posterior side much farther away from the base. The ventral area of the ventral apical sclerite of the penis ends apically with a conical process, which is longer than broad and has a rounded apex; the dorsal margin of the sclerite is marked by a double line which is continuous with the double line of the apical process; the apex of the sclerite is rather deeply concave between the process and the crest. Sternum VIII as in *amitina*, usually with 1 or 2 bristles isolated and placed near the division of the segment into a right and left half; the total number of bristles on each half varies from 13 to 18, the average being smaller than in *t. taschenbergi* and larger than in *t. amitina*.

In the female the apical margin of sternum VII is either without sinus and lobe or the sinus is small and the lobe above it short, which is remarkable because of the variability of the sternum is much greater in *L. t. amitina*.

ARAB RECORDS:

ALGERIA

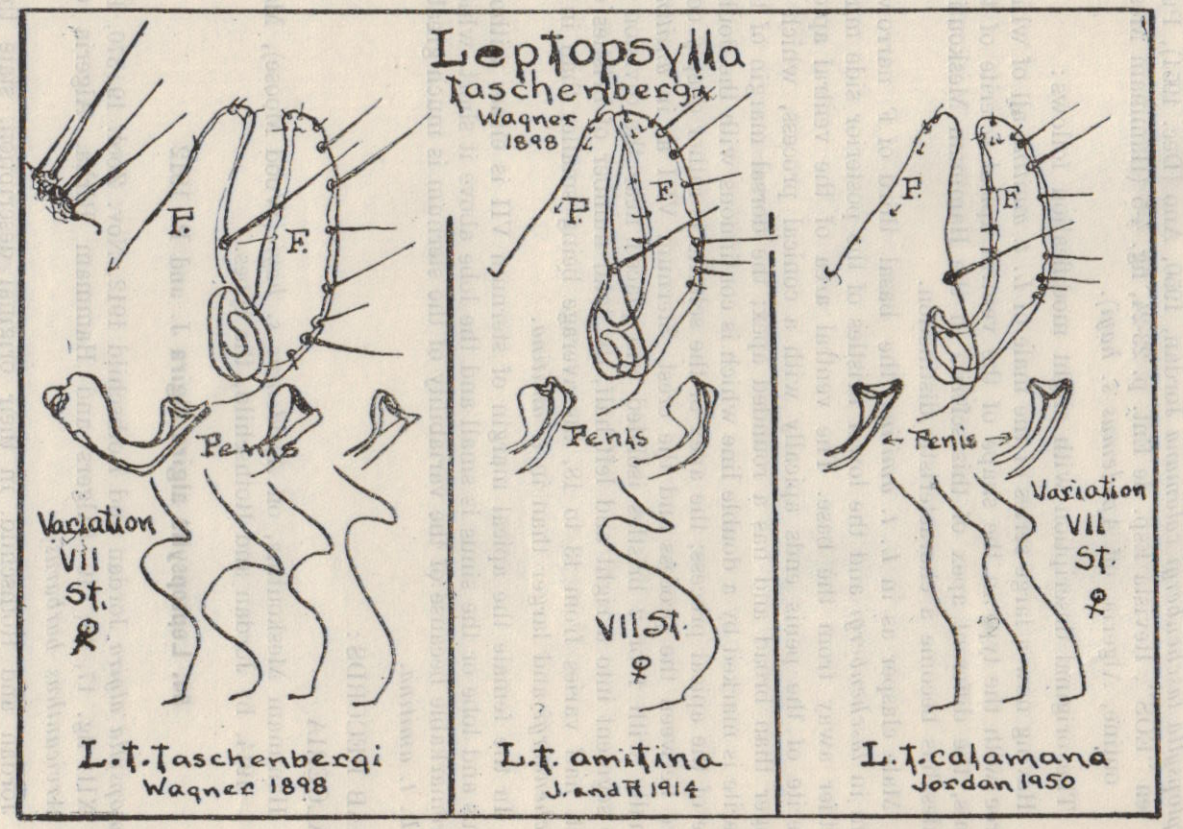
Hammam Meskoutine, off *Apodemus s. hayi* (Wood Moose), May 1914, by Jordan and Rothschild, the types.

54. Leptopsylla algira algira J. and R. 1912

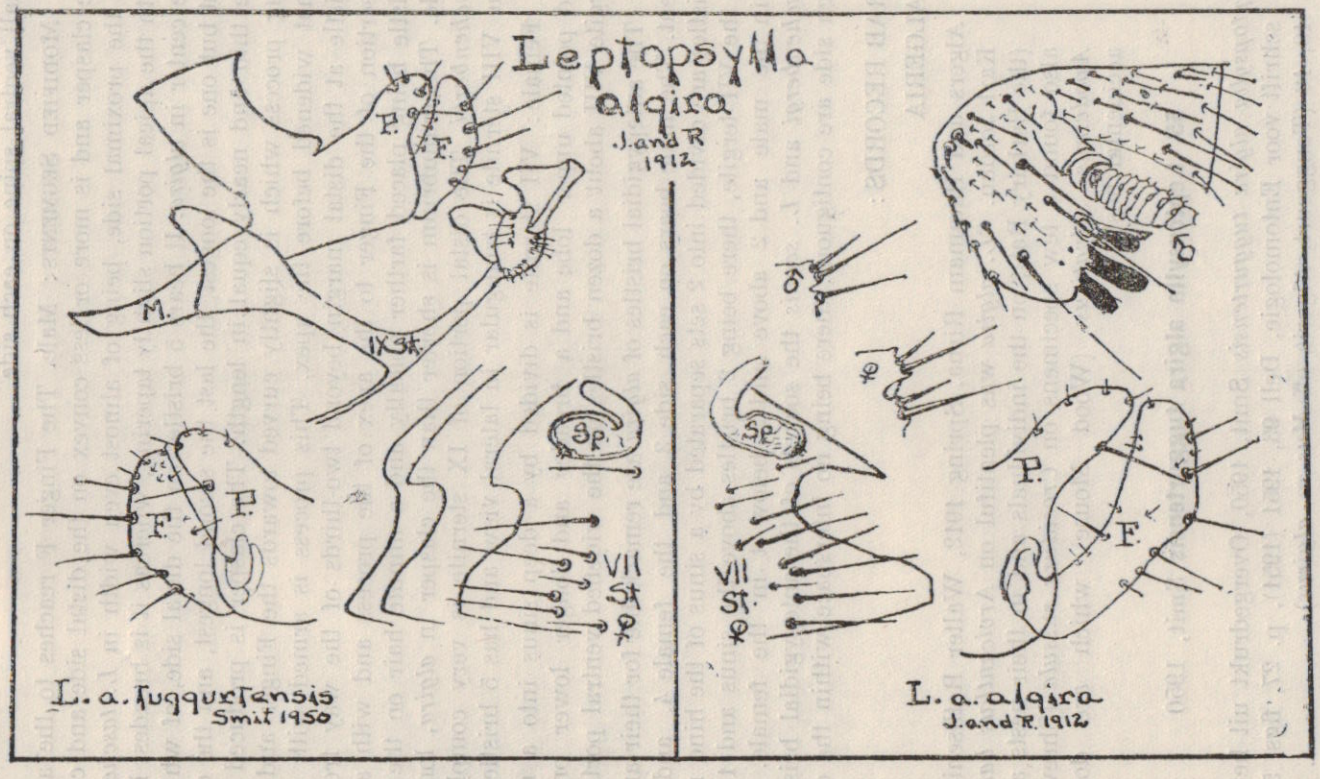
Leptopsylla algira Jordan and Rothschild 1912, Nov. Zool. 19:370, Pl. XII. fig. 17, 18, 19 (Algers and Hammam Rirha, Algeria off *Arvicanthus barbarus*).

Jordan and Rothschild, in their original description, state that this species differs from *L. taschenbergi* in the smaller number of teeth in the pronotal comb and the difference in the modified abdominal segments of both sexes.

These authors further state:



(Fig. 23) Leptopsylla t. taschenbergi. L. t. amitina, and L. t. calamana.



(Fig. 24) Leptopsylla algira tuggurtensis and L. a, algira.

THORAX: The pronotal comb is made up of 22 teeth besides a small ventral spine on each side.

MODIFIED SEGMENTS: Male. The Finger F reaches to the apex of the clasper and is more or less convex on the distal side and concave on the proximal side, being of almost even width in *L. taschenbergi* with the apical portion slightly tapering, whereas it is broadest beyond the center in *algira*. It bears 5 bristles on the distal side, of which the last but one is the longest, the last the second longest, and the other 3 are thin and nearly equal in length. The clasper is produced into a long process which is slightly curved towards the Finger and somewhat widened before the apex. This process is armed with a long bristle at the distal margin beyond two-thirds of the way from the insertion of the Finger to the apex of the process and with a small bristle being placed farther apically and a minute hair on the dorsal side. The manubrium is shorter than the clasper in *algira*, longer in *taschenbergi*. The distal portion of IX sternite is very complicated. The VIII sternite is triangular in lateral view and has 5 bristles.

Female: VII sternite is divided by a deep sinus into a narrow and pointed upper lobe and a broader and longer lower one. On tergite VIII about a dozen bristles on the widened ventral portion.

The antepygidial bristles of *algira* are remarkable for their arrangement. The male bears on each side 3 and the female 4, and these bristles are divided into 2 sets separated by a sinus of the hind margin of the VII tergite, there being 2 bristles above the sinus and 1 below it in the male and 2 above and 2 below it in the female. In *L. taschenbergi* and *L. segnis* the sockets of the antepygidial bristles of each side are contiguous, there being no interspace within the cluster.

ARAB RECORDS:

ALGERIA

Algers and Hammam Rirha, Spring 1912, Walter Rothschild and Karl Jordan. "*L. algira* was plentiful on *Arvicanthus barbarus*, (the Barbary Rat), on the individuals and in their nests and we also found a few specimens on *Crocidura russula* (Shrew) and *Apodemus sylvaticus* (Wood Mouse) which are doubtless accidental hosts.

55. Leptopsylla algira tuggurtensis Smit, 1950

Leptopsylla algira tuggurtensis Smit, 1950, Overgedrukt uit het Tijdschrift voor Entomologie, Dell 93, 1951 (1951), p. 27, figs. 5, 6, 7, 10, 12 (Touggourt, Algeria off *Mus m. algirus*).

This subspecies differs from *L. a. algira* in the male by the rela-

tively very short and broad processes of the clasper and in the female by the shape of the apical outline of the seventh sternite.

MODIFIED SEGMENTS: Process and Finger both relatively short and broad. The Finger is at most 2½ times as long as broad at its widest point and is much more evenly crescentic than in the case of *L. a. algira*. The bristle on the posterior margin of the process of the clasper is inserted on the lower half of this process, while the bristle is placed much more apically in *L. a. algira*. Ventral margin of clasper almost flush with that of the manubrium, while this margin is more or less rounded in *L. a. algira*. The forked setiferous lobe of the ninth sternite agrees with that of *L. a. algira*, it also has a bifurcate or trifurcate bristle at the apex of its dorsal process. The paramere ventral arm is narrowed in its middle part and spatulate at the apex, while in *L. a algira* this arm is more of an even width.

Female: Sinus of the posterior margin of the VII sternite rather shallow, the lobe above the sinus well marked, but very much smaller than in *L. a. algira*; the lobe is not longer than basally broad and usually has a rather sharp-pointed apex.

ARAB RECORDS:

ALGERIA

Touggourt, from *Mus m. algirus* (Algerian Field Mouse), March 1920, by Jordan and Rothschild, the types and many others.

Biskra, from *Mus*?, March 1914, by W. Rothschild and E. Hartert, a female.

Djama, from *Gerbillus campestris* (Gerbil), February 1920, by Jordan and Rothschild, 2 females.

Subfamily CTENOPHTHALMINAE

The prominent frontal tubercle projects far beyond the anterior border of the head. Eyes only rudiments. Genat comb of 3 teeth. Labial palpi do not extend beyond the apex of the fore coxae; they are armed on the distal segment with a curved apical bristle. Fifth tarsal segment of the fore and middle legs is armed with 4 pairs of lateral plantar bristles and a basal and a distal submedian pair. There are 3 antepygidial bristles to the side, the middle the longest, the lowermost much longer than the uppermost.

The subfamily is represented in the Arab World by but a single genus.

Genus **CTENOPHTHALMUS** Kolenati, 1856

Ctenophthalmus Kolenati, 1856, Die Parasiten der Chiropten, p. 33.
The genotype: *Ctenophthalmus bisoctodentatus* Kolenati, 1863.

The clypeal tubercle in this genus is very prominent. There is no trabecula centralis. The eyes are vestigial. The genal comb consists of 3 teeth, sharp and crowded close together. They slope to the ventral and posterior. The bristle on the apex of the distal segment of the labial palps is curved. There are 4 pairs of lateral plantar bristles and a basal submedian pair on tarsi V of fore and mid legs, while tarsi V of the hind legs bears 3 lateral pairs and a proximal subventral pair.

The genus is represented in the Arab World by two species.

C. russulae russulae so far reported only from Algeria.
C. congener allousei so far reported only from Iraq.

56. Ctenophthalmus russulae russulae J. and R. 1912

Ctenophthalmus russulae Jordan and Rothschild, 1912, Nov. Zool., 19: 365, Pl. X. fig. 12 and 13 (Algers, Algeria, off *Crocidura russula*).

Some portions of the original description with some modification follows:

HEAD: The frons bears an anterior row of 5 bristles and a posterior row of 3 long ones. The eye is vestigial. The first tooth of the genal comb is sharply pointed. The occiput bear a row of 4 bristles running from the vertical part of the antennal groove across the pale lateral (sensory) dot towards the posterior dorsal pale dot. Above the antennal groove there is 1 long median bristle. The subapical row contains 4 bristles on each side, the interspace between the first and second being large.

THORAX: The pronotal comb consists of 15-17 teeth.

MODIFIED SEGMENTS: Male. Finger F somewhat rectangular but along anterior face an undulation which in the upper half becomes almost a lobe. It is armed with about 12 short bristles on the dorsal edge, 3 at the apex and 4 at the ventral margin. The clasper is distally divided by a narrow rounded sinus into 2 short rounded lobes of which the upper one (P1) bears 2 very long and 3 much shorter and thinner bristles. Below the lower process (P2) there is 1 long bristle at the edge of the clasper. The manubrium is narrowed quite gradually to a sharp point and evenly curved, the point being curved upwards. The ninth sternite has a rather slender vertical arm, whose apex, however, is much widened. The horizontal arm is boat shaped in a lateral aspect and bears many small bristles in the distal half.

Female: The seventh sternite is divided by a narrow sinus into a very broad truncate-emarginate upper lobe and a small lower one, and bears a row of 4 or 5 bristles and proximally to it 3 or 4 smaller ones. These bristles vary in size, but the 2 below the sinus always remain large.

LENGTH: Male 2 mm. female 2-2.4 mm.

ARAB RECORDS:

ALGERIA

Algers, off *Crocidura russula* (Shrew), March, April, May 1912 and May 1908, by W. Rothschild and Jordan, 18 males, 27 females. Other hosts mentioned by Jordan at this location were *Mus algirus* (Algerian Field Mouse), *Apodemus sylvaticus* (Wood Mouse), and *Gerbillus campestris* (Gerbil).

57. Ctenophthalmus congener allousei Hubbard, 1956

Ctenophthalmus congener allousei Hubbard, 1956, Iraq Nat. Hist. Mus. Publ. No. 11, p. 3.

This flea was described by the writer from materials taken at Sirsang, Iraq, off *Microtus* during June of 1953. It is closely related to *Ct. congener secundus* Wagner from which the female cannot be separated, but in the male the Finger is different and characteristic, and the longest bristle on the apex of the second segment of the hind tarsus reaches a little beyond the apex of the third segment, while in *secundus* it hardly reaches the apex of the third segment.

MODIFIED SEGMENTS: Male. The anterior apical angle of the Finger is equal in length to the posterior apical angle, while in *secundus* the anterior apical angle is longer. The widened part of the Finger is less square than in *secundus*, and in *secundus* the posterior margin is markedly concave in its lower half as against fairly straight in *allousei*.

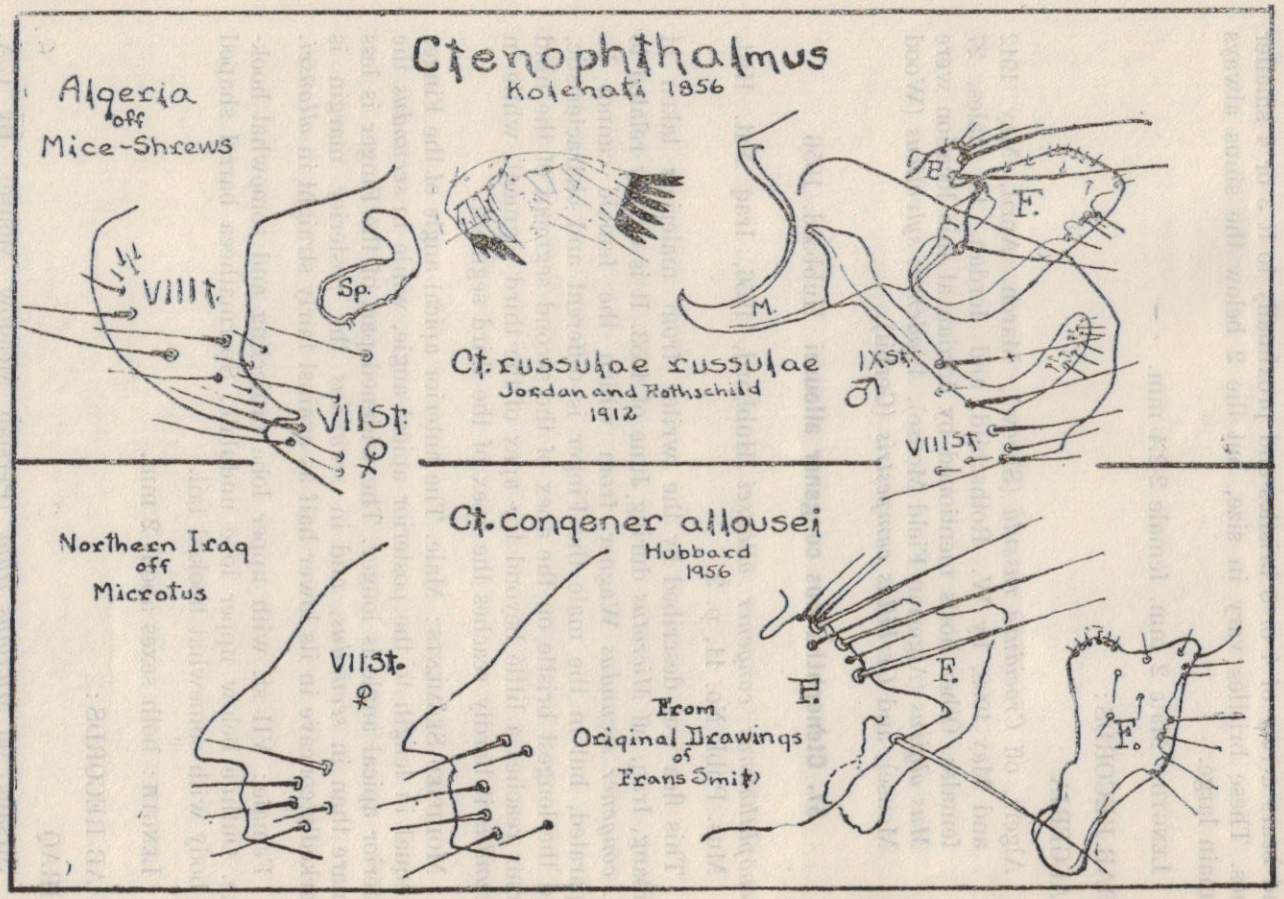
Female: VII st. with upper lobe projecting and somewhat hook-like. Outline below upper lobe undulate. Spermatheca barrel shaped in body with somewhat hooked tail.

LENGTH: both sexes about 2 mm.

ARAB RECORDS:

IRAQ

Sirsang, off *Microtus irani* (Persian Meadow Mouse), By C.A. Hubbard, June 28, 1953, 1 male, 2 females.



(Fig. 25) Ctenopthalmus r. russulae and Ct. congener allousei.

Subfamily RHADINOPSYLLINAE

The eyes are vestigial. The genal comb in members from the Arab World so far reported number 5 teeth. Metepimerum with a densely striated patch. Anterior dorsal corner of metasternum acutely rounded, and directed upwards. There are two rows of bristles to each abdominal tergum. The pygidium is convex. Females with two unequal antepygidial bristles; males with none. Genitalia of males without pigmented spines.

The subfamily is represented in the Arab World by but one reported genus.

Genus **RHADINOPSYLLA** Jordan and Rothschild, 1912

Genotype: *R. masculana* J. and R. 1912.

Male and female. Frons without tubercle, or this quite external, not placed in a groove. Antennal groove completely closed above, there being no sulcus across the vertex and the internal incrassation being only vestigial. A genal comb of 5 teeth. Eye barely traceable. Labial palpi with 5 segments, the last segment posteriorly with a curved apical bristle as in true *Ctenophthalmus*. Pronotum with comb. Episternum of metathorax prolonged downwards, hind edge of sternum shortened; epimerum of metathorax narrower and dorsally more rounded than in *Ctenophthalmus*, very densely striated above the ventral margin; its stigma much more frontal than in the allied forms, being placed nearly half-way between the oblique upper edge and the anterior edge of the metepimerum. Metanotum without the short strong apical spines found on the proximal abdominal tergites, but with minute teeth. No antepygidial bristles in the male, but 2 on each side in the female, both being long. Pygidium strongly convex in both sexes. Legs slender, particularly the femora. Basal internal rod of mid-coxa broad, bearing a mesial carina and therefore somewhat recalling a shoulder-blade, the corresponding rod of the hind-coxa narrow and quite short. Hind-coxa with a patch of short spiniform bristles on the inner surface. The fifth segment of all tarsi with 4 pairs of lateral bristles.

The genus is represented in the Arab World by but a single known species, *R. masculana*, described from Algeria.

58. **Rhadinopsylla masculana** J. and R. 1912

Rhadinopsylla masculana Jordan and Rothschild, 1912, Nov. Zool., 19:367 Pl. XI. fig. 14, 15, 16 (Khenchela, Algeria, off *Meriones shawi*).

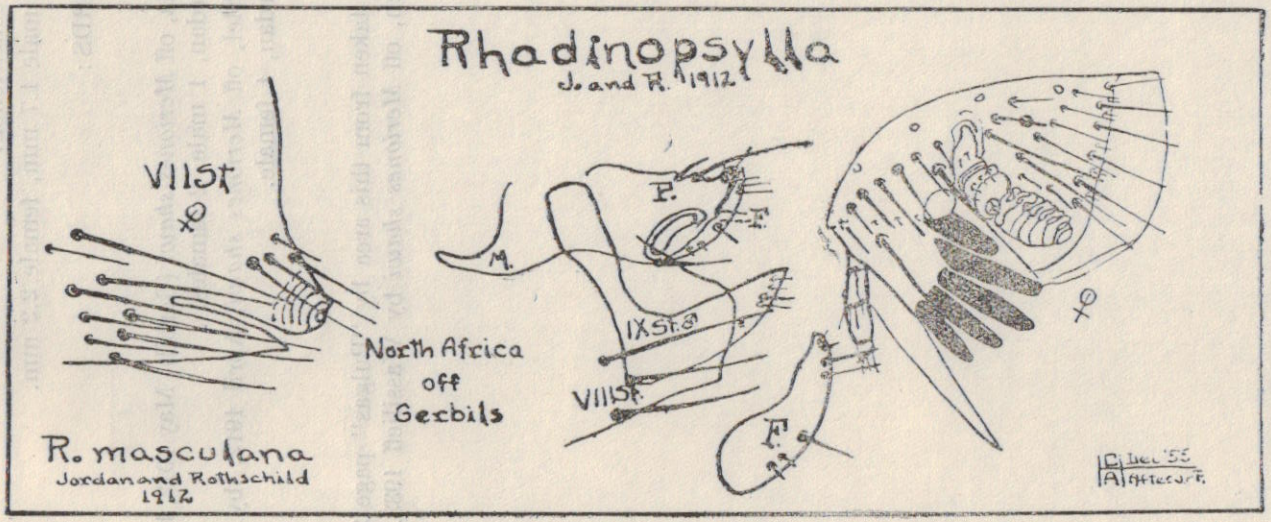
The original description in part and with some modification follows:

HEAD: The head of the male differs from the female in that the frons is more convex between antennal groove and frontal corner, and in the occiput being longer. The frontal part of the head in both sexes bears an anterior row of 6 bristles and between this row and the comb 2 longer bristles. The first tooth of the comb is the smallest, the last the broadest, and the third and fourth the longest. The antennal groove extends farther upwards in the male than in the female; the optical dorsal outline of the head is slightly incrassate above antennal groove, but not interrupted. The occiput has 3 rows of bristles. There is no row of short bristles along the antennal groove. The eye is traceable at the base of the uppermost tooth of the comb. The maxillary palpus is as long as the rostrum or even a little longer, both reaching to the trochanter or close to the apex of the fore-coxa. The apical segment of the labial palpus is much shorter than the preceding one, being scarcely twice as long as broad.

THORAX: The pronotal comb consists of 13 or 14 teeth, the ventral ones being much shorter than the others and being placed farther away from the basal margin so that the bases of the teeth form a curved oblique line.

MODIFIED SEGMENTS: Male. The Finger F is narrow, evenly curved, somewhat tapering, with the distal side convex. The bristles are all thin and short, the one placed in the center of the distal surface being the longest. The clasper is longer than it is broad, with the dorsal and ventral margins almost parallel, the distal margin slanting upwards, the lower angle quite effaced and the upper one extended to near the apex of the Finger. The clasper bears one moderately strong bristle below the insertion of the finger, a small and thin one above the insertion and several other thin ones at and near the apex of the process. There are also several large bristles at the dorsal margin, one of which is particularly strong and long. The manubrium is broad proximally and narrow distally, its ventral margin being moderately convex. The ninth sternite is boomerang-shaped; the ventral, horizontal portion is particularly broad proximally and gradually tapers to a point distally, the dorsal margin being slightly incurved and the ventral margin gradually rounded. This sternite is armed with numerous small bristles.

Female: The seventh sternite bears 8-9 bristles on each side, and is divided by a deep and very narrow sinus into two lobes. The upper lobe is strongly chitinised, with the ridges unusually prominent. The lower lobe is much narrower and tapers to a point. The spermatheca has a head not much wider than the beginning of the tail, and the



(Fig. 26) Rhadinopsylla masculana.

apex of the tail is strongly chitinised and separated from the rest of the tail by a constriction.

LENGTH : male 1.7 mm, female 2.2 mm.

ARAB RECORDS :

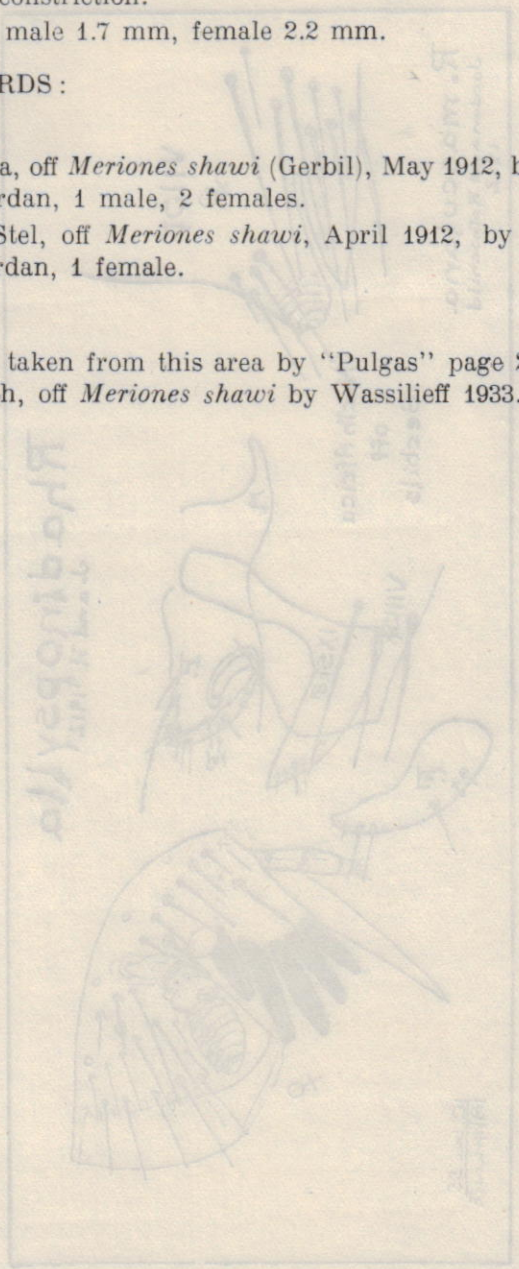
ALGERIA

Khenchela, off *Meriones shawi* (Gerbil), May 1912, by W. Rothschild and Jordan, 1 male, 2 females.

Guelt-es-Stel, off *Meriones shawi*, April 1912, by W. Rothschild and Jordan, 1 female.

TUNISIA

Reported taken from this area by "Pulgas" page 231.
Bir Milleh, off *Meriones shawi* by Wassilieff 1933.



Family DOLICHOPSYLLIDAE

The head is sedom divided into a posterior and anterior part by the presence of a fronto-epicranial groove. The gena is not greatly enlarged and not divided by a suture. There are no head combs. Forehead without helmet, seldom elongated and always without ventral flaps. The eyes may be well developed, vestigial or absent. Thorax not greatly reduced; thoracic terga taken together longer than abdominal tergum I. Typical abdominal terga each with more than 1 transverse row of bristles. Abdominal apical spines frequently present but rarely numerous. Abdominal combs absent. Females without a reduced number of abdominal spiracles, and when gravid not greatly distended.

It is to be noted in passing that some authors consider the family name Dolichopsyllidae by Baker to be a synonym of Ceratophyllidae by Rothschild.

Subfamily DOLICHOPSYLLINAE

Head either divided or not divided by development of fronto-epicranial groove. Frontal notch, or frontal tubercle, or both notch and tubercle present. Eyes either well developed and pigmented, or reduced and poorly pigmented, vestigial or absent. Labial palpus varying much in length, frequently surpassing the apex of trochanter I. Pronotal comb always present but may be of very short poorly pigmented spines. Antepygidial bristles varying in number on a side from 1 to 5. Plantar bristles on last segment of tarsi varying much in number and position, the first pair being frequently shifted ventrally so that they are out of line with the others.

To date but two genera of the subfamily have been reported from the Arab World.

Genus **CAENOPSYLLA** Rothschild, 1909

Caenopsylla Rothschild, 1909, Nov. Zool., 16:65.

Type species: *Caenopsylla mira* Rothschild, 1909.

According to the original description this genus shows affinities on the one hand to *Ceratophyllus* and on the other to *Ctenopsyllus*, and reads:

"Frons strongly curved, especially in the male, with a tubercle. Eye present, but not fully developed. Genal process with two spines. Antenna and antennal groove as in *Ceratophyllus*. Pronotum much

wider above than at the sides, with a comb of curiously deflected spines. Mesonotum with setiform spines between the postmedian series of bristles and the apical margin. Metanotum with some short apical spines, similar spines being present on the three anterior tergites of the abdomen. The internal incrassation at the anterior edge of the metasternite narrow, being longer than it is broad. The tibia resemble those of *Ctenopsyllus* in the exterior dorsal bristles being numerous and forming a kind of comb, although these bristles are not of such even length as in *Ctenopsyllus*; the hind tibia bears only 3 long dorsal bristles, the first being placed in the second notch, the second in the center, and the third near the apex. The fifth hindtarsal segment has 5 lateral bristles, of which the first is very slightly bent inward".

Two species of the genus are known from the Arab World,

(1) *C. mira* from Algeria (2) *C. assimulata* from Tunisia

59. Caenopsylla mira Rothschild, 1909

Caenopsylla mira Rothschild, 1909, Nov. Zool., 16:65, figs. 9, 11, 12 off *Ctenodactylus gundi*, Algeria).

HEAD: Squarish in male, rounded in female. Gena in both sexes with 2 teeth, the upper much thinner than the lower, and a row of 3 bristles the outer ones the longest, the row well above eye position; in the male a second row consisting of a single long bristle at margin of antennal groove and a third row of 5 medium bristles; in the female a second row of 4 medium bristles. Occiput in male armed with 2 major bristles and 2 medium bristles and a marginal row of 4 medium bristles with minute ones in between. There are a number of minute bristles along the antennal groove. Occiput in female armed with 2 long bristles, 4 medium bristles and a row of 3 medium marginal bristles with minute ones in between. Segments 2-4 of the 5 segmented labial palp are all of subequal length and slightly shorter than segments 1 and 5. Pedicellus with 3 short bristles.

PRONOTUM: In both sexes much longer dorsally than ventrally. The comb is made up of 14 teeth which are strongly curved and the 4 dorsal teeth on each side are directed backwards and downwards, also the 2nd and 3rd from above are only slightly spatulate. Besides the comb there is a row of 12 bristles on the two sides together.

LEGS: The false comb on the hind tibia consists of 12 stout bristles, hence is very distinct. The five pairs of lateral plantar bristles are fairly stout; there are about 30 minute bristles on the plantar surface.

MODIFIED SEGMENTS: Male. Tergum VIII roughly triangular, its dorsal margin undulate, apically sharp; 2 long bristles near the dorsal

margin. Manubrium fairly broad and tapering strongly at the apex. Body of clasper with a deep sinus in its dorsal margin, which divides off the fixed process as a very distinct lobe which bears apically 5 slender bristles. Most of the posterior margin of the clasper is slightly convex. There are 4 acetabular bristles. The Finger is elongate, four times as long as its maximum width. Armature of Finger consists of a number of small bristles and a fairly large one at the posterior margin about one-fourth its length from the apex. Apex of proximal arm of sternum IX triangular, the narrow arm widening only a little towards its junction with the distal arm. The distal arm bears ventrally a large number of small, medium and long bristles; its divided off apical part is triangular.

Female: Apical margin of sternite VII undulate and at apex a shallow sinus in the shape of a U, the upper limb of the U slightly longer than the lower; armed with a row of 7 long bristles to the side and above the sinus close to margin 2 medium bristles. Spermatheca with squarish to roundish body and finger-like tail which is hooked close to body.

LENGTH: Male 2-2¼ mm. female 2¼-2½ mm.

ARAB RECORDS:

ALGERIA

Biskra, off *Ctenodactylus gundi* (Gundi), the types.

El Kantara, off *Eliomys q. munbyanus* (Garden Dormouse) a male, Spring 1920, by Jordan and Rothschild.

TUNISIA

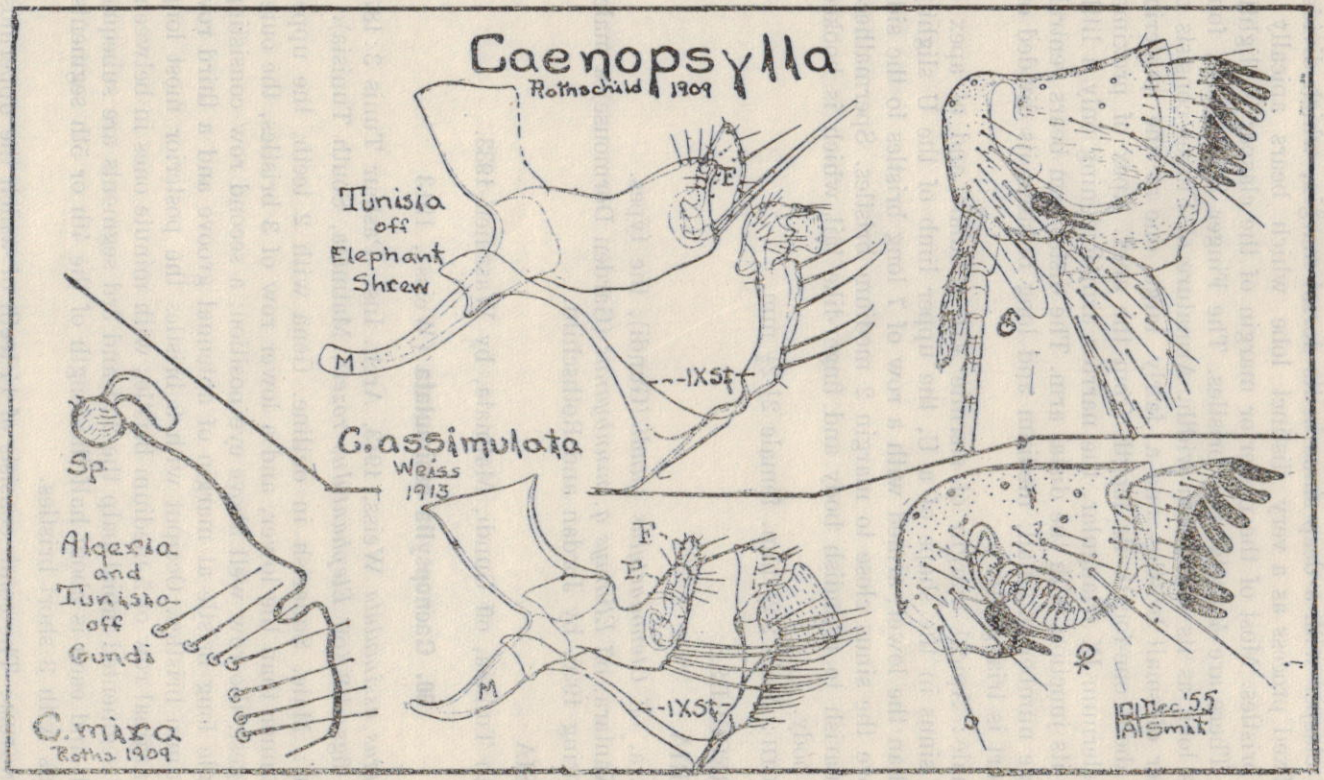
South Tunisia, off Gundi, Matmata, by Wassilieff 1933.

60. Caenopsylla assimulata (Weiss), 1913

Typhloceras assimulata Weiss, 1913, Arch. Inst. Pasteur Tunis 3:187-196, figs. 1-3 (off *Elephantulus rozeti*, Matmata, South Tunisia).

HEAD: Male. Squarish in outline. Gena with 2 teeth, the upper much thinner than the lower, and a lower row of 3 bristles, the outer ones longest, the row well above eye position; a second row consisting of a single long bristle at margin of antennal groove and a third row of 5 medium bristles. Occiput with 3 bristles the posterior most long and a marginal row of 5 medium bristles with minute ones in between. Of the 5 segmented labial palp the 2nd and 3rd segments are subequal in length and each is about half the length of the 4th or 5th segments. Pedicellus with 3 short bristles.

PRONOTUM: The comb consists of 14 teeth of which the uppermost is much the stoutest and points obliquely downwards. The 3 lowest



(Fig. 27) Caenopsylla assimulata and C. mira.

teeth lie very close together. The upper 4 teeth are slightly curved and the 2nd and 3rd from above are somewhat spatulate all being directed downwards like the 3rd tooth from below. There are also 12 bristles (6 to the side) in a single row.

LEGS: Hind tibia with an indistinct false comb of 8 bristles along the posterior margin. Five pairs of lateral plantar bristles on the 5th segment of the hind tarsus are rather slender; on the plantar surface about 20 minute bristles.

MODIFIED SEGMENTS: Male. Tergum VIII armed with 3 long bristles. Manubrium of clasper long and narrow, not tapering in its apical portion. Body of clasper with sub-parallel dorsal and ventral margins, its apical half directed upwards; 4 slender bristles along the dorsal margin near the apex; posterior margin of clasper slightly concave; 2 acetabular bristles. Finger spindle-shaped, two and a half times as long as its maximum width. Armature of Finger consists of a number of small bristles and a fairly large one at the posterior margin about one-third its length from the apex. Apex of proximal arm of sternum IX squarish; the greater part of this arm very narrow but it widens to a triangle with a rather long base. The distal arm bears ventrally 5 long bristles. Its structure is complicated.

LENGTH: Male 1½ mm.

The female of this species is unknown:.

ARAB RECORDS:

As late as 1953 only the holotype male was known. It is deposited in the Museum of Natural History, Paris, France.

TUNISIA

South Tunisia, Matmata, off *Elephantulus rozeti*, March 1913, by Weiss, the holotype male.

It has been suggested that this flea may occur on the Gundi.

Genus **MYOXOPSYLLA** Wagner, 1927

Genotype: *Ceratophyllus laverani* Rothschild 1911

Myoxopsylla Wagner, 1927, Konowia 7:109, 113.

HEAD: Nicely rounded with pre-antennal region armed with what might be called 4 rows of bristles, the lower or ocular row of 2 long, strong bristles, the inner one well above the eye, the outer one at genal margin even with about center of eye; a second row of 2 medium bristles, one at margin, the other half way across; a third row of 2 medium bristles, one at mid point, the other towards antennal groove; and a fourth row of 2 smaller bristles closer to antennal groove.

Postantennal region with 2 strong bristles, one in the apical row with 4 medium bristles. Two other medium bristles on area and long the antennal groove a number of minute bristles. Trabecula centralis as in *Ceratophylli*. Antepygidial bristles 2 in male, 3 in female. VIII abdominal sternite small and weak. Spermatheca normal. The armature of the fifth tarsal segment consists of five pairs of lateral plantar bristles, the third pair of which are moved inwards considerably towards the median line; between the fifth pair there is a pair of median bristles.

The genotype has been reported from North Africa.

61. Myoxopsylla laverani (Rothschild), 1911

Ceratophyllus laverani Rothschild, 1911, Ann. Sci. Nat. Zool., (9) 12:207, figs. 1, 2.

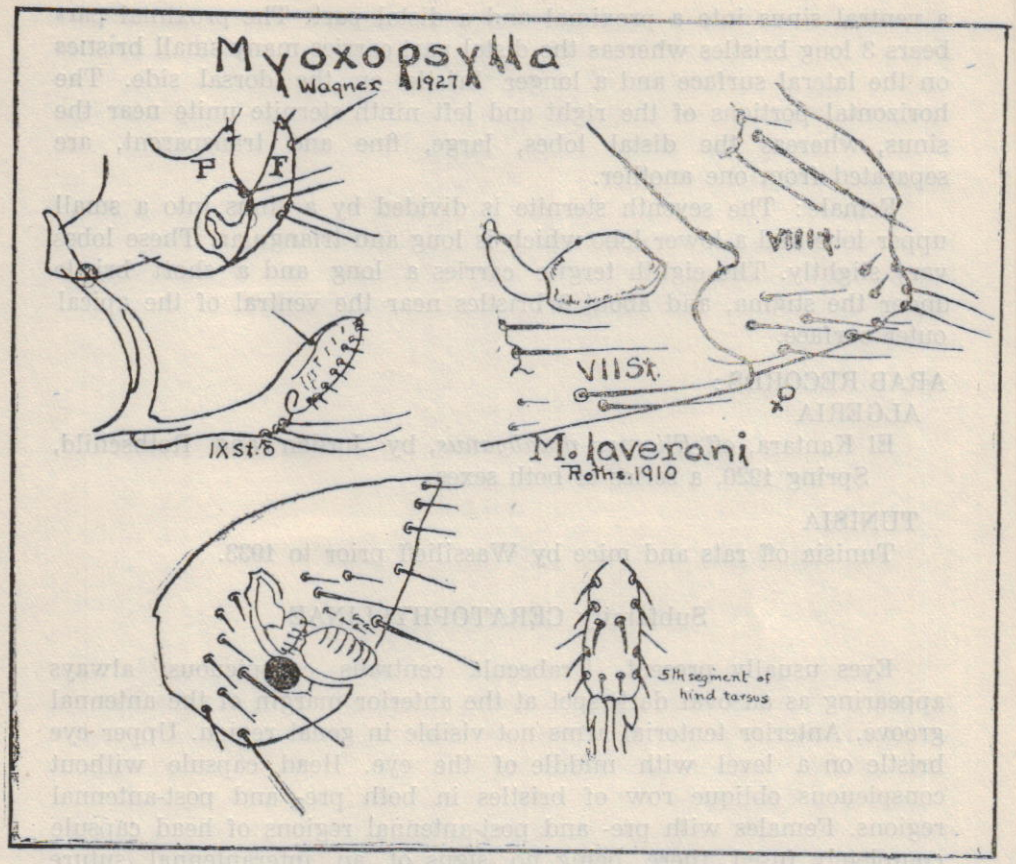
The author's translation of the original description as well as the included illustrations follow:

HEAD: The head is strongly rounded, the area below the frontal tubercle slants backwards in the male but remains vertical in the female. The armature consists of two bristles at eye level, a third at the side of the antennal groove, the first two mentioned being inclined towards each other. There is a second row of three or four bristles and farther above, two or three smaller bristles. The postantennal region is armed with three or so bristles of different lengths and a posterior row of five bristles to the side. The rostrum reaches to the apex of the anterior coxa.

THORAX: The pronotal comb consists of from 20 to 22 teeth. There are also 12 bristles. The dorsal surface of the mesothorax carries a row of 9 or 10 long bristles and anterior to it a number of supplementary bristles and numerous short hairs. There are also four or five spines in the nature of bristles (apical spinelets) in front of the apical side of the mesonotum. The dorsal surface of the metathorax carries a row of 9 or 10 long bristles preceded by 10 or 12 short bristles, and an apical spine on each side. The epimeron of the metathorax carries from 5 to 7 bristles.

ABDOMEN: The dorsal segmenst each carry two rows of bristles.

LEGS: The middle and posterior coxa carry one apical bristle on inner and outer surface, as well as a lateral bristle on the inner surface near the base. The posterior tibia is armed with one lateral row of seven bristles on the outer side and four or five on the inner side. The first segment of the middle tarsus is almost the same length as the second, the first posterior tarsal segment is as long as the posterior tibia or possibly a little shorter. The longest apical bristle of the



(Fig. 28) Myoxopsylla laverani.

second posterior tarsal segment does not reach the apex of the third segment.

In all the tarsi the first pair of bristles of the fifth segment are found on the ventral surface, placed between the second pair.

MODIFIED SEGMENTS: Male. The eight tergite bears 5 long bristles on the apical margin and 4 or 5 on the lateral side. The eighth sternite is small, gradually diminishing towards the apex which is pointed. The clasper is broad being greatly expanded above the insertion of the finger. This posterior bulge carries the 2 long acetabular bristles, while its process P is high dome-shaped and armed with 3 or so small bristles. The Finger F is long and saber shaped and of greatest diameter at the mid point. Its armature consists of 3 long bristles, 2 close together at the mid point and the third near the apex. A few small bristles are scattered elsewhere. The vertical part of the ninth sternite is quite strongly curved and the horizontal part is divided by

a ventral sinus into a proximal and a distal part. The proximal part bears 3 long bristles whereas the distal part carries many small bristles on the lateral surface and a longer bristle on the dorsal side. The horizontal portions of the right and left ninth sternite unite near the sinus, whereas the distal lobes, large, fine and transparent, are separated from one another.

Female: The seventh sternite is divided by a sinus into a small upper lobe and a lower lobe which is long and triangular. These lobes vary slightly. The eighth tergite carries a long and a short bristle under the stigma, and about 9 bristles near the ventral of the apical outer surface.

ARAB RECORDS:

ALGERIA

El Kantara, off *Eliomys munbyanus*, by Jordan and Rothschild, Spring 1920, a series of both sexes.

TUNISIA

Tunisia off rats and mice by Wassilieff prior to 1933.

Subfamily CERATOPHYLLINAE

Eyes usually present. Trabecula centralis conspicuous, always appearing as an oval dark spot at the anterior margin of the antennal groove. Anterior tentorial arms not visible in genal region. Upper eye bristle on a level with middle of the eye. Head capsule without conspicuous oblique row of bristles in both pre- and post-antennal regions. Females with pre- and post-antennal regions of head capsule completely fused, there being no signs of an interantennal suture remaining.

The VIII tergite of the male highly specialized, being expanded into a huge plate, almost completely enclosing the external claspers. VIII sternite variously reduced, frequently to a slender rod-like sclerite which usually has characteristic bristles and membranous appendages. Males almost always with acetabular bristles at or near the insertion of the finger. Hind coxa without a patch of spiniforms on the inner surface.

The subfamily is so far represented in the Arab World by 2 reported genera.

Genus **NOSOPSYLLUS** Jordan, 1933

Nosopsyllus Jordan, 1933, Nov. Zool. 39:76-77.

Genotype: *Pulex fasciatus* Bosc d JAntic, 1801.

Eye well developed. Ocular bristle on level with or slightly above

upper margin of eye. Frontal tubercle small, acuminate. Pronotal comb present.

Male. Sternite VIII vestigial. The ventral arm of sternite IX divided by a narrow sinus. Finger without heavily pigmented spines.

Female. Bursa copulatrix with long sclerotized duct, the upper end of which is rolled up into a spiral. Spermatheca with large head, strongly rounded above; tail narrower, curled up around the head.

Eleven species and subspecies of the genus have been collected in the Arab World, 4 by the writer.

They are distributed as follows:

ALGERIA
- *N. barbarus.*
- *N. fasciatus.*
- *N. h. mauretanicus.*
- *N. h. oranus.*
- *N. maurus.*

JORDAN
- *N. sincerus.*

SUDAN
- *N. maurus.*

EGYPT
- *N. h. henleyi.*

IRAQ
- *N. bunnii.*
- *N. durii.*
- *N. medus.*
- *N. pringlei.*

TUNISIA
- *N. barbarus.*
- *N. maurus.*

62. Nosopsyllus fasciatus (Bosc.), 1801

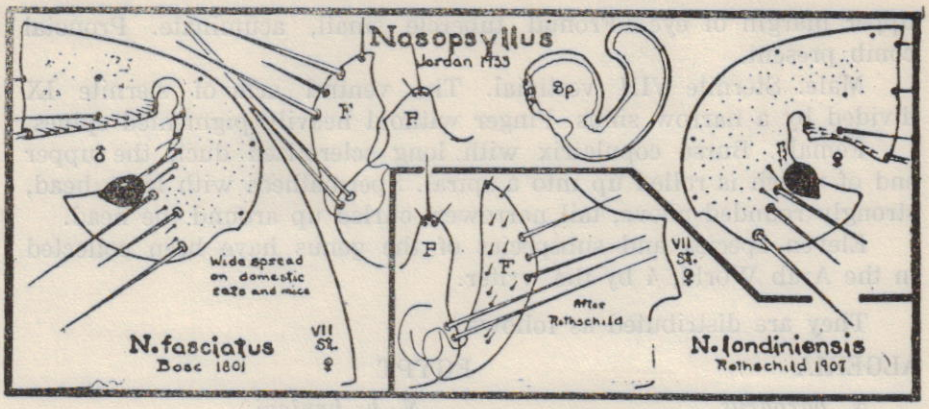
Pulex fasciatus Bosc., 1801, Bull. de Sci. p. Soc., Philo. No. 44, Vol. II, p. 156.

This, the common European rat flea, is found in various parts of the World where it has been carried by the Norwegian rat. Although Billet reports it off rats taken at Algers, Philippeville and Bone, the determination may have been in error and the flea may have been *N. barbarus* which follows and which resembles *fasciatus* very much.

N. fasciatus is characterized as follows:

Head nicely rounded. Three stout genal bristles in a row at upper eye level. Eye large, grape seed shaped and black. Pronotal comb of 18 to 20 teeth.

Modified Segments: Male. Finger F is evenly rounded posteriorly, the posterior margin bearing 2 stout bristles, between which there is a much smaller one and 1 or 2 other small ones at the apex. Process P of the clasper is broad, with a prominent posterior angle, and armed at apex with 2 or 3 small bristles. Two long acetabular bristles above insertion of Finger. Three antepygidial bristles on each side, middle one about three times as long as upper bristle, lower one reduced to a small seta.



(Fig. 29) Nosopsyllus fasciatus (left)

Female. Apical margin of VII sternite is irregularly rounded or slanting, Head of spermatheca is globular, tail about 1½ times as long as head and curved around it. Three antepygidial bristles on each side, uppermost being shorter than others.

LENGTH: male 2½ mm., female 3½ mm.

ARAB RECORDS:

ALGERIA

Algers. Billet records this flea as taken off rats in Bull. Soc. Path. Exot. 1.2. (1908) p. 111.

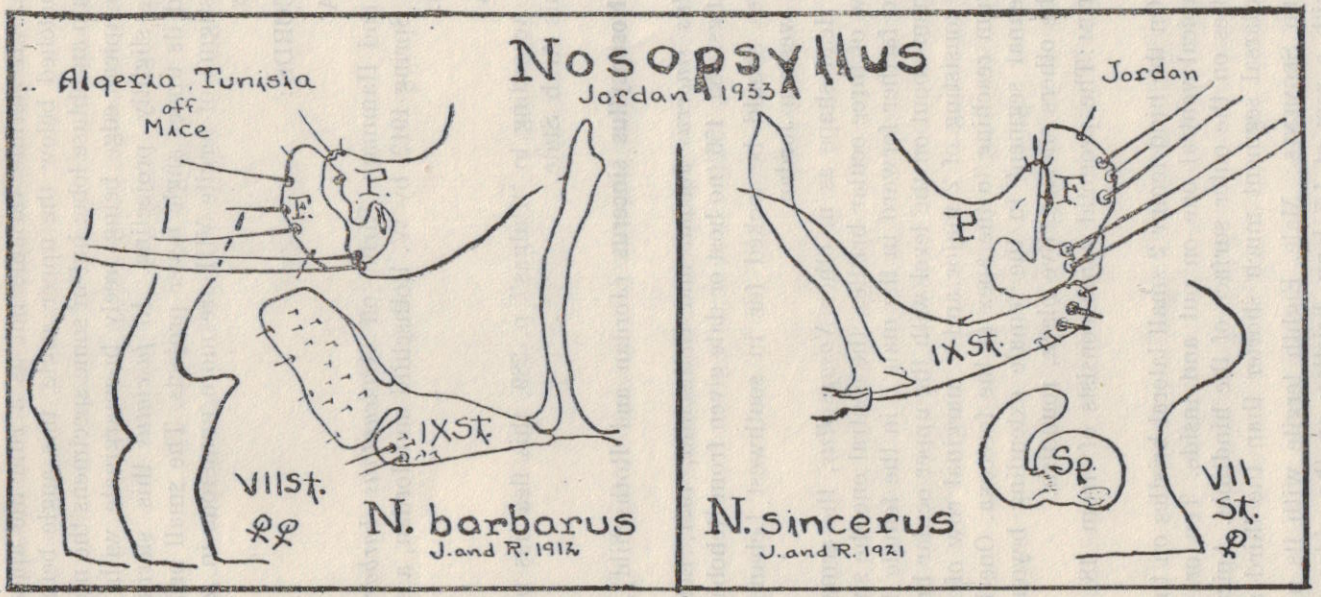
63. Nosopsyllus barbarus J. and R., 1912

Ceratophyllus barbarus Jordan and Rothschild, 1912, Nov. Zool., 19:361 Pl. VI. figs. 1 and 2 (Algers, Algeria, off *Arvicanthus barbarus*).

The original description follows with some slight modification.

Both sexes resemble *N. faciatus* Bosc. (1801), differing only in the modified segments. Although the differences are not very striking, they appear to be constant, inasmuch as they are present in all the specimens of the long series studied by the describers.

MODIFIED SEGMENTS: Finger F one-sixth shorter than in *fasciatus*, and the 2 large bristles placed at the distal margin have a distinctly more ventral position in *barbarus*, the lower one placed exactly in the middle of the Finger or a trifle below it in *barbarus* and above the center in *fasciatus*, the distances being measured in straight lines from the socket of the lower long bristle of the clasper to the median bristle, and from there to the tip of the finger. The process of the clasper is more rounded than in *fasciatus*, and its distal angle less sharp.



(Fig. 30) Nosopsyllus barbarus and **N. sincerus.**

Female. VII sternite variable but as a rule the apical margin is distinctly notched below the upper angle, this angle being sometimes produced into an obtuse lobe; but in some specimens the notch is almost absent, the apical edge being freely bi-emarginate with the rounded upper angle slightly projecting. In *fasciatus* this sternite is never notched and its upper angle never projects. The small bristles situated above the stigma of tergite VIII are more numerous in *fasciatus* than in *barbarus*.

ARAB RECORDS:

ALGERIA

Algers and Hammam Rirha off *Arvicanthus barbarus* (Barbary Rat), Spring 1912, by W. Rothschild and Jordan, a series of both sexes.

TUNISIA

Tunis. According to "Pulgas" p. 289, this flea has been collected in this Arab State.

64. Nosopsyllus sincerus (Jordan and Rothschild), 1921

Ceratophyllus sincerus Jordan and Rothschild, 1921, Ectoparasites I, p. 170, figs. 155, 156 (no host or date given from Rehobat, Palestine).

This flea should be looked for in southwest Lebanon, northeast Egypt, and western Jordan.

HEAD: Head shape as in other *Nosopsyllus*, the armature consisting of a row of three ocular bristles, the central one the shortest; above the row and farther forward in the male 5 in the female 3 bristles, the lowest of them about on the level with the upper ocular bristle. Occipital bristles consisting of 2 major and a marginal row of several short ones. Rostrum reaching to the apex of the forecoxa. One bristle of the second antennal segment in the female extending beyond middle of the club, the others shorter. Eye black, roundish.

PRONOTUM: The pronotal comb consists of from 18 to 20 black teeth.

LEGS: On the hind femur 2 small lateral bristles on the inner side, and 1 subapical ventral one on out and inside. Ten or 11 subdorsal lateral bristles on the outer surface of the hindtibia. Apical bristles of second hindtarsal segment much shorter than the third segment.

MODIFIED SEGMENTS: Male. Eighth tergite with its upper margin slanting, with a row of 4-5 long bristles; on the sides 3-4 bristles. Clasper deeply curved downward and long; its manubrium horizontal, narrow, forming an acute angle with the dorsal portion of the IX

tergite. The process is dome-shaped and armed with 3 small bristles. It is under-cut posteriorly and the acetabular bristles are placed on a prominence of the clasper. The Finger is with frontal margin almost straight from base to apex, the distal margin strongly rounded in upper half; above center of distal margin 2 heavy bristles, between which there is a small one, the lower bristle the longer, as long as the finger and as thick as the marginal bristles of the VIII tergite; both heavy bristles remaining thick to near the tip, which is somewhat obtuse; upper bristle nearly twice as far from tip of clasper as from the lower bristle. Sternite IX with apex of vertical arm narrow and armed with 2 short, stout bristles placed proximally to the ventral sinus of the horizontal arm.

Female. Seventh sternite with 16 bristles on the two sides together; apex broadly sinuate, the lower lobe appearing more pointed than the upper, 2 long ones below it and 11-12 on the ventral portion. Spermatheca typical for the group.

LENGTH: Male 1.6 mm., female 2.5 mm.

ARAB RECORDS:

Originally described from Rehobat, Palestine, the writer knows of no records from the present Arab States.

65. **Nosopsyllus henleyi henleyi** (Rothschild), 1904

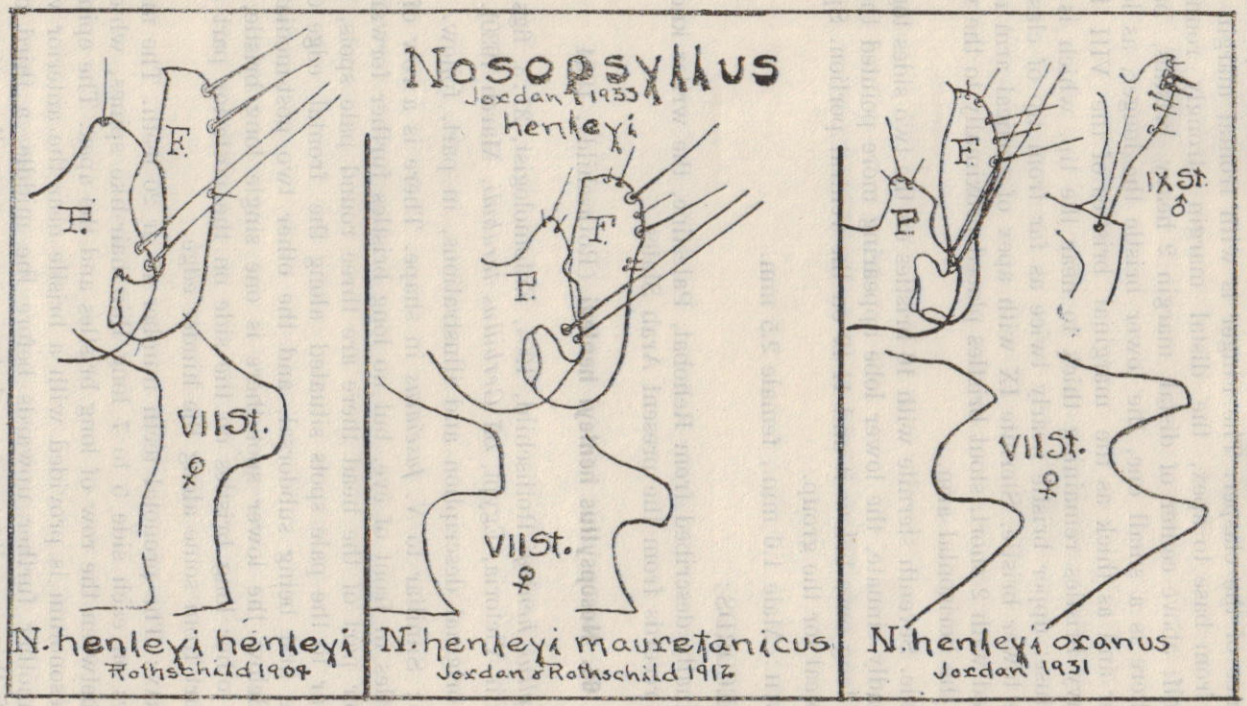
Ceratophyllus henleyi Rothschild, 1904, Entomologist, 37:3, figs. 5, 6, 7, 8, (Bir Victoria, Egypt, off *Gerbillus tarabuli*, March 1930).

The original description and illustrations, in part, follow.

HEAD: Similiar to *N. fasciatus* in shape. There is a row of three long bristles in front of eye, but no long bristles further forward. On the hinder part of the head there are three round pale spots, which are similar to the pale spots situated along the frontal edge of the head, the first being subdorsal, and the other two post-median and lateral. Below the lower spot there is one single long bristle, there being no other long bristles on the side on the posterior part of the head, apart from some along the hinder edge.

THORAX: The pronotal teeth number 19 or 20 teeth. The mesonotum bears on each side 5 to 7 long thin hair-like spines, which are situated between the row of long bristles and the apex. The epimerum of the mesonotum is provided with a bristle near the anterior ventral corner, another further upwards before the middle, a third on the level with this near the apex, and two more near the stigma. The metanotum bears 2 heavy obtuse apical spines on each side.

LEGS: The hind femur bears on the inner side 6 or 7 bristles.



(Fig. 31) Nosopsyllus h. henleyi, N.h. mauretanicus, and N.h. oranus.

There are also several bristles on the mid femur. The hind tibia is on the outer side furnished with a row of bristles situated near the dorsal bristles, and with a row of 4 further towards the ventral side. On apical dorsal bristle of the fore tibia reaches nearly to the apex of the the ventral edge there are 2 or 3 pairs of thin bristles. The longest second tarsal segment, and the longest ventral spine to the base of the same segment. Both the ventral and dorsal long apical bristles, of the second hind tarsal segment reach to the base of the fifth. The fourth segment of the fore tarsus is very short and broad.

MODIFIED SEGMENTS: Male. The eighth abdominal tergite of the male bears between the stigma and the hinder vertical margin a number of long bristles. The eighth sternite of the male is very small, and has on the apex at each side an elongate process, which bears a bristle at its end. The process of the clasper P bears 3 bristles at its top. The finger F is straight from the apex to near the middle. On the hinder side there are 4 bristles at the apex and 2 small ones above the middle. The IX sternite of the male is shaped as in *N. faciatus*, being deeply sinuate. Proximally of the sinus there are 2 rather stout spine-like bristles besides 2 hairs. The distal portion is covered with very short spine-like bristles.

Female. The VII sternite is ventrally sinuate on each side, the lobe above the sinus being truncate. The VIII tergite bears 2 long bristles below the stigma, and the process articulated with the anal segment is almost conical in shape, and nearly three times as long as broad.

LENGTH: Male, 3.2 mm., 2.4 mm.

ARAB RECORDS:

EGYPT

Bir Victoria, from *Gerbillus tarabuli* and *Pachyuromys d. natronensis*, by Rothschild and Henley, March 1903, 1 male, 4 females.

TUNISIA

Fort-Saint off *Psammomys* by Wassilieff, prior to 1933.
Bir Mellah off *Psammomys* by Wassilieff, prior to 1933.

66. Nosopsyllus henleyi mauretanicus (Jordan and Rothschild), 1912

Ceratophyllus henleyi mauretanicus Jordan and Rothschild, 1912, Nov. Zool., 19:364, Pl. VIII. fig. 7 and 9 (Khenchela, Algeria, off *Dipodillus campestris*).

The original description with slight modification follows:

Male and female. The specimens from southern Algeria differ slightly, though perceptably, from those of Egypt, and which are *N. h.*

henleyi (Roths.) 1904. The eighth tergite of the male of *N. h. henleyi* bears 6 bristles along the upper margin and 8 or more on the side. In this subspecies there are 4 bristles and a hair at the margin, and 4-6 at the sides, of which 2 or 3 are small. The seventh abdominal sternite varies in both subspecies individually, but there is an obvious difference in the shape of this segment in the two subspecies. The sinus of the segment is shallow and the lobe above it short and broad in *N. h. henleyi*, while the sinus is deeper, the upper lobe longer and much more pointed in this subspecies.

ARAB RECORDS:

ALGERIA

Khenchela, off *Dipodillus campestris* (Gerbil), May 1912, by W. Rothschild and Jordan, a pair.

Biskra, off *Meriones shawi* (Gerbil), March 1908, by J. Steinbach, a pair.

67. Nosopsyllus henleyi oranus (Jordan), 1931

Ceratophyllus henleyi oranus Jordan, 1931, Nov. Zool., 36:233, figs. 1-4 (Rabelais near Orleansville, from *Meriones shawi*).

The original description with the original illustrations follow.

Male and female. Close to *N. h. mauretanicus* J. and R. 1912.

MALE: Exopodite (Finger) F much longer, projecting far above process P of clasper; it bears two long bristles, of which the lower one, placed at $\frac{3}{4}$, is shorter and stouter than the upper, much less drawn out, more spiniform. St. VIII represented by a short cone which bears a bristle nearly as thick as the acetabular bristles, but only as long as the distance from the anterior angle of st. IX to the apex of the median lobe of this segment; in some specimens the bristle accompanied on one side of the body by a small one. In *N. h. mauretanicus* st. VIII is membraneous and has no definite shape, whereas in *N. h. henleyi* Roths. 1904, it is similiar to that of *N. h. oranus*, but with the bristle very small.

FEMALE: Probably not constantly different than in this sex of *N. h. mauretanicus*; VII st. variable in the shape of the two lobes, particularly the upper one; the number of bristles on this sternite (the two sides together 22 to 26. Bristles on tergite VIII, below stigma 2 small and 3 large to 5 small and 4 large, on widened area (each side) 22 to 34.

ARAB RECORDS:

ALGERIA

Rabelais near Orleansville, from *Meriones shawi* by H. De Balzac January 1930, 2 pairs.

68. Nosopsyllus maurus (Jordan and Rothschild), 1912

Ceratophyllus maurus Jordan and Rothschild, 1912, Nov. Zool., 19:362, Pl. VII figs. 3, 4 and 5 (Khenchela, Algeria, off *Meriones shawi*).

The original description in part and with some modification follows:

Male and female nearest to *Nosopsyllus henleyi* Roths. (1904), from which it is easily distinguished by the modified segments.

THORAX: Pronotal comb of 19-22 teeth and an additional small spine on each side. In the male the dorsal bristles of the meso- and metanotum, and of the first and second abdominal tergites, are semi-erect, and being long and numerous, represent a mane, this mane also being found in *N. henleyi*.

ABDOMEN: The male has 2 antepygidial bristles on a rather strongly produced cone, the upper bristle being short and obtuse and the lower one long. In the female there are 3 antepygidial bristles, of which the dorsal one is two-fifths and the ventral one five-sixths the length of the central one.

MODIFIED SEGMENTS: Male. The Finger F greatly widens from the base upwards, being broadest beyond the center. Its proximal edge is almost straight, apart from the central angle, while the distal margin is strongly convex beyond the center. The oblique upper portion of the distal margin is notched in the middle and bears a moderately large bristle between this notch and the upper proximal angle. Besides this bristle there are only a very few slender ones and some minute hairs on the Finger. Process P of the clasper is broad and short. The 2 bristles near the insertion of the Finger are thinner than the longest bristles of the eighth tergite. Manubrium straight with a rounded apex. Ninth sternite is of the type found in *N. fasciatus*, and has in its armature 2 short strong spiniforms.

Female. VII sternite varies in outline but its apical margin is always evenly incurved, the upper angle being either pointed or more or less rounded off, and sometimes hardly projects as a lobe.

ARAB RECORDS:

ALGERIA

Khenchela, off *Meriones shawi* (Gerbil), May 1912, by W. Rothschild and Jordan, a good series of both sexes.

Baghdad, West (Karradet Mariam), off House Mouse, February 5, 1953, 2 males, 3 females; March 31, 1953, 1 female.

Babylon, off *Rattus norvegicus* (Rat), April 25, 1953, 2 females; all above records by the writer and from.

Baghdad, off *Rattus norvegicus*, (no date), by Yosuf Lazar, 2 pairs.

70. **Nosopsyllus pringlei** Hubbard, 1956

Nosposyllus pringlei Hubbard, 1956, Iraq Nat. Hist. Mus. Publ. No. 11, p. 7.

This flea was taken by the writer about Baghdad, Iraq, and about 100 miles to the west beyond Ramadi, during his work in Iraq in 1953.

HEAD: Nicely rounded in the female but flattened dorsally in the male. Eye black, oval. Gena armed with a major ocular bristle and one of same size at margin of gena at level of eye. In the male there is a second row of medium bristles on the gena. Post-antennal region with 2 major bristles and a marginal row of a few medium bristles.

PRONOTUM: The comb consists of 19 teeth in the male and 19-22 in the female.

MODIFIED SEGMENTS: Male. Manubrium fairly broad, longer than the clasper. Fixed process of the clasper long and remarkably rounded off apically, there being no trace of an angle at the posterior margin. Finger long, straight and narrow, about 5 times as long as its maximum width. There are 2 strong bristles on the upper half of the posterior margin, and several smaller ones along the margin. The distal arm of the IX sternite is broad. Penis with a downward pointing acute apex, its membranous ventral portion densely covered with minute spicules.

Female. Posterior margin of sternite VII drawn out into a long and sharp process, and is armed with a main row of about 6 bristles preceded by a few smaller ones. Tergite VIII smoothly rounded between the spiracle and the ventro-posterior angle, no distinct angle being produced. Body of spermatheca longer than broad, the tail rather short.

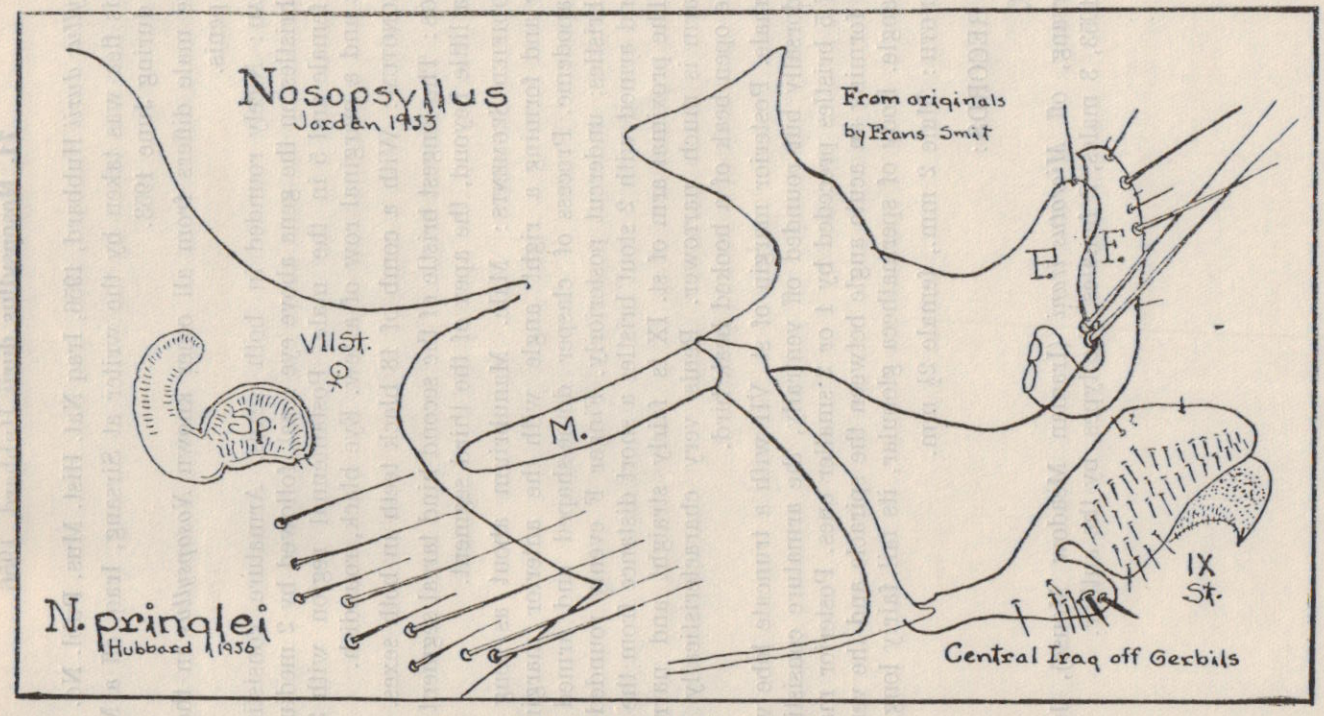
LENGTH: Male 2 mm., female 2½-3 mm.

ARAB RECORDS:

IRAQ

Baghdad East, 7 miles northeast, off *Gerbillus d. dasyurus* (Gerbil), 1 male; 9 miles northeast, same host, 1 female;

Ramadi, 15 miles west, off *Meriones crassus* (Big Gerbil), 4 females, all by the writer during March and April 1953.



(Fig. 33) Nosopsyllus pringlei.

71. **Nosopsyllus durii** Hubbard, 1956

Nosopsyllus durii Hubbard, 1956, Iraq Nat. Hist. Mus. Publ. No. 11, p. 9

This flea was taken by the writer at Sirsang, Iraq, off a Meadow Mouse during June 1953.

The male differs from all other known *Nosopsyllus* in the shape of the penis.

HEAD: Nicely rounded in both sexes. Armature consisting of 3 major bristles on the gena above eye level, followed by 2 medium ones in the female and 5 in the male. Postantennal region with 2 major bristles and a marginal row of a few. Eye black, roundish.

PRONOTUM: With a comb of 18 black teeth in both sexes.

LEGS: The longest bristle of the second hind tarsal segment reaches to, or a little beyond, the apex of the third segment.

MODIFIED SEGMENTS: Male. Manubrium about as long as the clasper and forming a right angle with the anterior margin of the tergal apodeme. Process of clasper dome-shaped and armed with 3 small bristles; undercut posteriorly. Finger F evenly rounded posteriorly and armed with 2 stout bristles a short distance from the pointed apex. The proximal arm of st. IX is fairly straight and narrow, the distal arm is much narrower. Penis very characteristically shaped, like the open beak of a hooked beak bird.

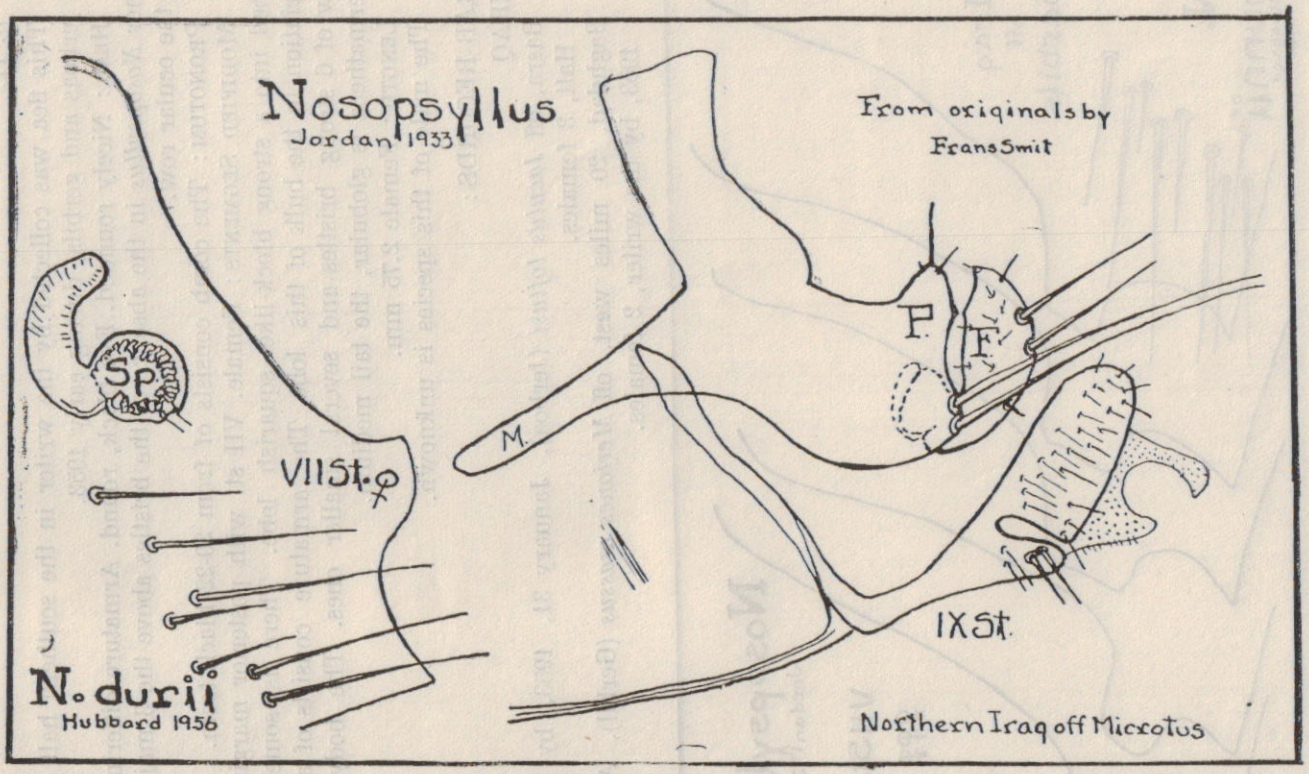
Female. Posterior margin of st. VII with a truncate lobe which is acute dorsally but rounded off ventrally, the armature consisting of a row of 5 bristles preceded by 1 or 2 smaller ones. Posterior margin of t. VIII forming an acute angle between the spiracle and the ventroposterior angle. Body of spermatheca globular, its tail fairly long.

LENGTH: Male 2 mm., female $2\frac{1}{2}$ mm.

ARAB RECORDS:

IRAQ

Sirsang, off *Microtus irani* (Iranian Meadow Mouse), June 28, 1953, 3 males, 2 females, the types, by the author.



(Fig. 34) Nosopsyllus durii.

72. **Nosopsyllus bunnii** Hubbard, 1956

Nosopsyllus bunnii Hubbard, 1956. Iraq Nat. Hist. Mus. Publ. No. 11, p. 11.

This flea was collected by the writer in the southern half of Iraq off jerboas and gerbils, during early 1953.

HEAD: Nicely rounded. Eye black, round. Armature differing from other *Nosopsyllus* in the absence of the bristles above the 3 major ones in the ocular row.

PRONOTUM: The comb consists of from 20-22 black teeth.

MODIFIED SEGMENTS: Female. VII st. with posterior margin developed into a strong block-like squarish lobe. There is some slight variation in the bulk of this lobe. The armature consists of a main row of 6 strong bristles and several smaller ones. The body of the spermatheca is globular, the tail medium.

LENGTH: Female 2.75 mm.

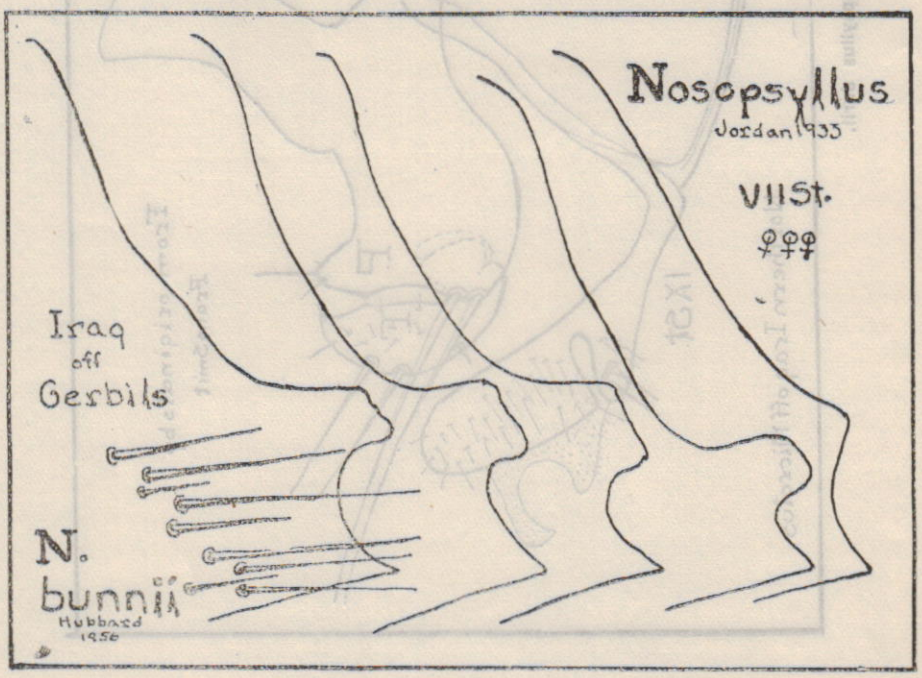
The male of this species is unknown.

ARAB RECORDS:

IRAQ

Basra, off *Jaculus loftusi* (Jerboa), January 31, 1953, by Robert Hatt, 3 females.

Baghdad, 20 miles west, off *Meriones crassus* (Gerbil), April 4, 1953, by the writer, 2 females.



(Fig. 35) Nosopsyllus bunnii.

BIRD FLEAS OF THE ARAB WORLD

Between pages 307 and 320, Costa Lima and Hathaway record in "Pulgas" 60 species and subspecies of world bird fleas. Of these only three species are recorded from the Arab World, both from Algeria. This gives evidence of the great deal of work needed in the Arab countries upon the fleas of the birds of this vast territory.

Collectors of bird fleas should realize that the procedure is quite unlike that of collecting rodent fleas. Seldom does one find fleas on the adult birds, but the nests may have large numbers. Birds which nest in burrows such as the bee-eaters, or in hollows in trees as the house sparrows, the owls, and the woodpeckers, have their fleas so confined that the collector needs only to open the nest to recover them. It is well to keep the nesting materials in plastic bags because in time practically all the flea larvae will pupate, then emerge as adults.

Generally bird fleas are studied from the point of pure science, for to date bird fleas have not been associated with plague. However, those which attack poultry may become a nuisance and even result in lack of egg production in the hens.

Genus **CERATOPHYLLUS** Curtis, 1829

Ceratophyllus Curtis, 1829, A Guide to an Arrangement fo British Insects, Column 201, No. 1136; 1832, British Entomology v. 9, No. 417; Jordan 1933, Nov. Zool. 39:75. Genotype: *Ceratophyllus hirundinis* Curtis.

The eye is well developed in this genus. The ocular bristle is placed on a level with or above upper margin of the eye. Pre-antennal region of the head with two rows of bristles of which the upper consists of 3 to 6, while the lower consists of 3 much longer ones. Labial palps not reaching beyond the apex of the forecoxa, usually about as long as maxillary palps. Pronotal comb with 24 or more teeth. Male with one long and two minute antepygidial bristles, VIII t. with spiculose dorsal area (sometimes restricted to margin), VIII st. rodlike with apical bristles (often spiniforms) and apical flap. Apex of vertical arm of IX st. widened posteriorly, ventral arm with the antemedian rounded dilation and the proximal angle of apical lobe setiferous. In lateral aspect the anal sternite narrow, longer than tergite, with bristles dorsal and apical. Female with one long and two minute antepygidial bristles. Bursa copulatrix and spermatheca variable, body usually cylindrical, tube-like, several times as long as broad.

Members of this genus are generally found to be parasites on birds.

At this writing only three species have been reported from the Arab World, each from Algeria off house martins.

73. **Ceratophyllus hirundinis** (Curtis), 1832

Pulex hirundinis Curtis, 1832, Bristish Ent., 3 (addenda).

Ceratophyllus hirundinis Curtis, 1832, British Ent., 9:417, figs., A. D, E. 8.

According to Jordan and Rothschild writing in 1920, the male of this flea has the eighth abdominal sternite reduced to a narrow rod-like sclerite, which bears some long bristles or spines at the apex, and the basal abdominal sternite is usually armed with one lateral bristle. The bristles at the apex of the eighth sternite long and slender. The triangular exopodite (finger) is widest below the middle, with two stout spiniform bristles at the widest point and close together.

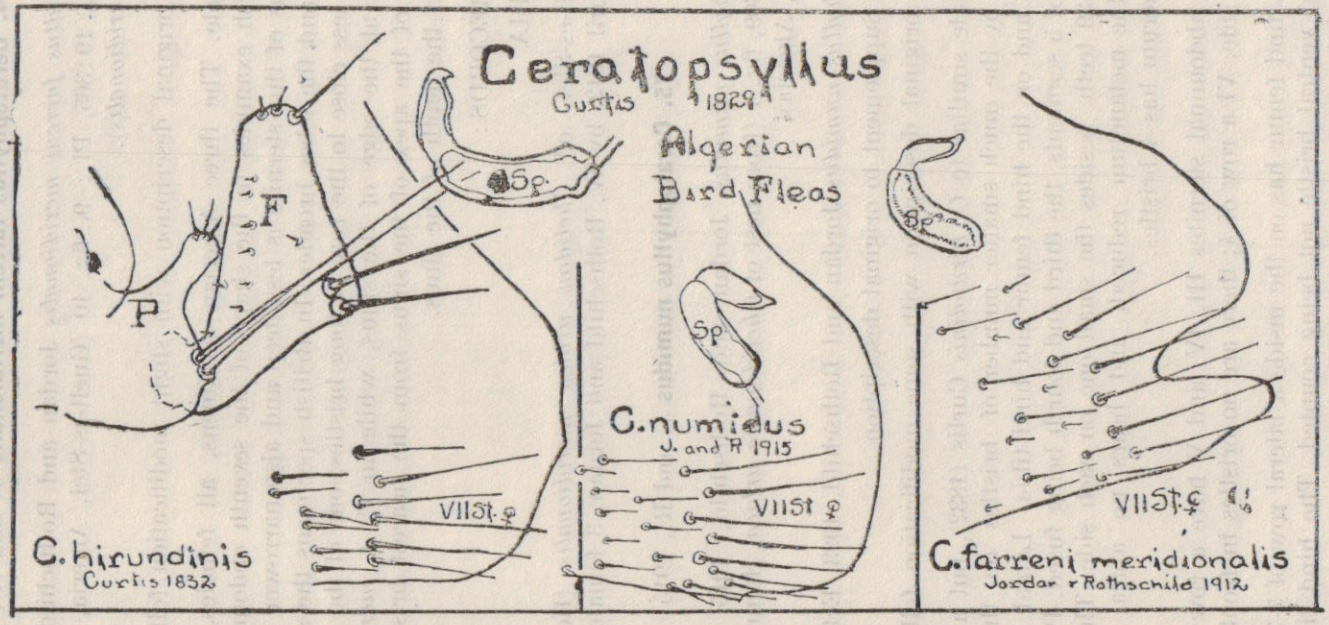
In the female the first and second row of bristles on the occiput represented at most by two bristles each; stylet with two long, lateral bristles. Basal abdominal sternite without lateral patch of bristles. The upper angle of the widened portion of the eighth abdominal tergite more or less rounded, not acuminate. Seventh sternite rounded to subtruncate. Head of spermatheca long, narrow, hose-shaped, concave above, convex below. A large number of bristles on eighth tergite below stigma.

These authors further state in 1923 that the specimens taken in Algeria are evidently true *hirundinis*. That further researches must decide whether the species is resident in Algeria, or whether these individuals were left by migrating European Martins. Specimens at hand have only two long bristles in front of the eye. The pronotal comb contains 32 teeth. In the female there are 50 bristles on the two sides of sternite VII. Below last stigma there are about 12 bristles and some minute hairs. On the widened portion of the eighth tergite about 33 bristles on the outer surface and two on the inner. Stylet is short and broad and has two lateral bristles of which the dorsal one is rather thick and long. At the angle of the ninth tergite, below the stylet, four bristles. Pronotum measured at the eighth tooth longer than this spine.

ARAB RECORDS:

ALGERIA

Hammam-Meskoutine, April, from the nest of *Delichon urbica* (House Martin), by Jordan and Rothschild.



(Fig. 36) Ceratophyllus hirundinis, C. numidus and C. farreni meridionalis.

74. Ceratophyllus farreni meridionalis J. and R., 1912

Ceratophyllus farreni meridionalis Jordan and Rothschild, 1912, Nov. Zool., 19:365, Pl.: 9, fig. 10 (Guelt-es-Stel, Algeria, off *Chelidon u. meridionalis*).

The original description with slight modification follows:

Female. The three Algerian specimens, all females, differ from the British examples in the shape of the seventh abdominal sternite. The sinus of this sternite is less deep and also narrower than in *C. f. farreni*, and the lobes broader. In British specimens the sinus extends more or less close to the row of long bristles, one of the bristles often standing at the edge of the sinus, while in *C. f. meridionalis* the distance of the apex of the sinus from the nearest bristle equals at least half the depth of the sinus.

ARAB RECORDS:

ALGERIA

Guelt-es-Stel, off *Chelidon urbica meridionalis* (House Martin) April 1912, by W. Rothschild and Jordan, 3 females.

75. Ceratophyllus numidus J. and R., 1915

Ceratophyllus numidus Jordan and Rothschild, 1915, Nov. Zool., 22:309, fig. 1 (from nest of *Chelidonaria urbica*, Hammam-Meskoutine, Algeria).

Ceratophyllus numidus Jordan and Rothschild, 1923, Ectoparasites I: 292. Supplement to original description.

The original description with some modification follows.

Female similiar to *C. hirundinis* Curtis (1832), but at once distinguished by the much smaller number of bristles on the abdominal sternites and on the hind femur and hind tibia. Labial palp with 4 instead of 5 segments, the third and fourth being fused. Pronotal comb with 27-29 teeth, besides the small one on each side. The apical portion of the metanotum reduced, and bears no apical spines. The metepimerum has 4 bristles.

The abdominal sternites III, IV, and V have a row of 3 bristles on each side, VI a row of 4; there are no bristles in front of this row.

The hind femur has on the inside a lateral row of 5-7 bristles, the subapical ventral bristle not being counted. The hind tibia bears 4-5 lateral bristles on the outer surface, the lateral row of the inner surface containing 5-6 bristles. The apical outline of the seventh sternite is

strongly rounded and armed with 9 major bristles, 10 or so medium bristles and about 10 small ones on each side. The eighth tergite bears 5 bristles below the stigma and about 20 on the widened lower portion. The pygidium is shorter than its distance from the base of the stylet. The tail of the spermatheca is longer and somewhat broader than in *C. hirundinis*.

SUPPLEMENT: The frontal tubercle is more prominent than in *C. hirundinis*. The pronotum measured at the eighth tooth is only as long as this spine. On the mesopleurite there are 8-10 bristles, on the eighth tergite 3-5 bristles below the stigma and further down 16-21 on the outer surface and 4 the inner, these numbers being much smaller than in *C. hirundinis*. The stylet is much longer than in *C. hinrundinis* and bears 1 or 2 lateral bristles, of which the longer one is shorter and thinner than in *C. hirundinis*. At the angle of the ninth tergite, below the stylet only 2 bristles.

ARAB SECORDS:

ALGERIA

Hammam-Meskoutine, off *Chelidonaria urbica* (martins), May 17, 1914, by Jordan and Rothschild, the holotype female; April 1920, 2 females.

76. Ceratophyllus haesidatoris desideratus Weiss, 1919

To this date siphonapteran taxonomists have been unable to properly place this flea because of terminology used, faulty description and inappropriate illustrations. It is here added in an addendum, to be placed generically when specialists have so placed it.

The following description is a free translation from the original French paper.

Ceratophyllus haesidatoris desideratus Weiss, 1919, Arch. Inst. Pasteur, Tunis 11:24.

HEAD: Frons appears elongated; frontal notch present. Clear zones or circles with minute bristles on the median line. There is a row of very small bristles behind the antennal groove, and a large reclining bristle on the postantennal region. On the anterior side of the antennal groove is a row of very short and fine bristles. The eye is imperfectly pigmented. The antennae are three segmented; the first in the shape of a "horn of plenty", and displays on its posterior side short, fine bristles. The second segment is very short and at its summit it bears stiff, fine bristles which barely touch the third segment which is elongated. The maxillae in profile appear as scalene triangles and are almost as long as the femur and trochanter of the front legs.

THORAX: The pronotal comb consists of 21 or 22 black teeth, the first on each side being rudimentary .....

ABDOMINAL SEGMENTS: First tergite with 2 teeth, second with 2, third with 2, fourth and fifth with 1, remaining tergites with none. The bristles on tergites 2, 3, 4, 5 are long alternated with short, and number 12 to 13 of the long bristles.

The sternites have 4 or 5 bristles to the side. There are three antepygidial bristles, the middle one strong and long, one rudimentary. Stigma placed close to the first bristle of each tergite. Pygidium is blackish, satiny, and with clear pits.

LEGS: Trochanter remarkably developed and very rough on inner side. Of the tarsi of the anterior legs the first and second segments are the same length, as are the third and fourth segments. The terminal segment is about as long as the first.

MODIFIED SEGMENTS: The manubrium is short and straight towards the anterior extremity. The writer here leaves the complicated description by Weiss of the modified segments and describes them from the original illustration. Process of clasper rounded apically into a protruberence which bears apically about 3 bristles. The process expands greatly towards the posterior. The Finger is very large in proportion to the process, and much longer. Apically the finger is generally rectangular but with apical corners expanded. There are some 6 bristles on the apical portion of the Finger. The articulation of Finger with process is not shown. At its base the Finger is much broader than the apex.

The female has as yet not been described.

LENGTH: 2-2½ mm.

ARAB SECORDS:

TUNISIA

Kebili, south Tunisia, off *Pasamamys algirus* and *Mus alexandrinus*, by A. Weiss, the type material.

BAT FLEAS OF THE ARAB WORLD

Volume II of the Catalogue of the Rothschild Collection of Fleas released by the British Museum in May 1956 carries a 187 page (pp. 188-375) study of the Family Ischnopsyllidae to which all bat fleas so far recorded belong. This review is amazing in its thoroughness and illustrations. Some 75 species and subspecies of bat fleas of the world are considered. Nine of these are described or reported from the Arab World.

Bat fleas form one of the major yet hardly touched siphonapteran problems of the Arab World. In the small rooms of the old college "Mustansiriyah" on the east bank of the Tigris River in Baghdad, Iraq, the writer flushed thousands of Trident bats. These were, as other bats can be, captured by insect net. Ruins, caves, attics, deserted buildings all can be bat rookeries. Dining in the Semiramis Hotel in Beirut, Lebanon, one evening, the writer observed bats leaving the cornice of the building across the street for a whole hour. Their presence is seasonal. Their food being insect, the bats are most plentiful at the season of the greatest abundance of insects.

Although hardly seeming logical, the life cycle of bat fleas is the same as other fleas. The adult flea lays her eggs on the bat but being non sticky, the eggs fall to the floor of the rookery. Here they hatch into larvae, which feed in the droppings of the bats, then pupate, emerge as fleas to climb up the walls to find the bats upon which to feed. It is difficult to say how the fleas find the bats, the loss must be great.

Family ISCHNOPSYLLIDAE

Members of this family are distinguished from all other fleas by the character of the genal comb, which is preoral, being placed at the extreme anterior end of the ventral margin of the head. It is composed of two broad, flat spines which are usually broadly rounded at the apex. The head is always fracticipit and very long and slender. The eyes are more or less vestigial and usually represented merely by an incrassation of the margin of the antennal groove. Posterior margin of maxilla generally at least as long as anterior margin, giving the maxilla a highly characteristic truncate apex. In some cases the maxilla is shorter and acute. Pronotal comb always present and a strong tendency for combs or false combs to be present on other segments. Combs of pseudosetae always present under collar of mesonotum. Tarsal seg-

ment V with only 4 pairs of lateral bristles, one pair being either displaced to the median area of the sole or lost.

Subfamily ISCHNOPSYLLINAE

Characteristics generally the same as for the family. Represented in the Arab World by the following five genera, all found on bats.

Chiropteropsylla, *Ischnopsyllus*, *Lagaropsylla*, *Araeopsylla*, *Rhinolophopsylla*.

Key to the Known Genera of **Ischnopsyllinae.**

Reported from the Arab World. Modified from the "Catalogue"

1. Metepimeron with a false comb of long spiniform bristles ..... *Chiropteropsylla*
   Metepimeron without any comb ..... (2)
2. Antepygidial bristles unmodified, long, single
   Frons with a conspicuous submarginal pale band
   No band of striae behind this band .....(3)
3. Dorsal marginal area of frons densely and minutely rugulose .....(4)
   This area quite smooth .....(5)
4. Pale submarginal band of frons narrow, its posterior outline usually diffuse; at least 4 abdominal combs well developed .... *Ischnopsyllus*
5. Metepimeron much higher than long ..... *Lagaropsylla*
   Metepimeron not higher than long .....(6)
6. The 2 lower bristles on abdominal terga separated by an interspace from the more dorsal bristles ..... *Araeopsylla*
   The row of long bristles on the abdominal terga not interrupted ..... *Rhinolophopsylla*

Genus **ISCHNOPSYLLUS** Westwood, 1833

Ischnopsyllus Westwood, 1833, Entomological Magazine, I, 362. Type species: *Ceratophyllus elongatus* Curtis.

Distinguished from all other known bat fleas of the Arab World by having the dorsal marginal area of the frons densely and minutely rugulose. The head is much longer than high. The maxilla truncate. Both teeth of the genal comb are blunt. Frons with a deciduous tubercle, its dorsal marginal area rugulose, the contrasting pale band mostly submarginal, not very broad and its posterior margin neither sharply defined nor followed by a band of alternating dark and pale

striae. The arch of the tentorium visible in front of vestigial eye. Well developed are the 4 to 6 abdominal combs and the pronotal and metanotal combs. There is no false comb on the metepimeron. One slender antepygidial bristle. No lateral bristles on basal abdominal sternum. The ventral pair of plantar bristles on segment V of tarsi placed between members of the first lateral pair.

It is suggested that the members of this genus are very host specific, parasitizing a single genus of bats or even a single species.

Three species of the genus have so far been reported from the Arab World; *I. octactenus* from Morocco

I. hispanicus from Morocco

I. consimilis from Egypt

Key to the Known Species of **Ischnopsyllus.**
Reported from the Arab World.
(Modified for the area from the "Catalog")

1. With 8 combs on the thorax and abdomen ..... (2)

2. Preoral tuber comparatively broad and short, especially in females; metasternum usually without squamalum (a small sclerite, shaped like a link-plate, situated at or near the anterior dorsal corner of the metasternum); movable process of clasper narrow at base and much broader distally; penis-plate with dorsal margin mostly straight and apex not upturned; tendon of st. IX making about half a convolution and those of the penis little more than one ..... (3)

3. Males ..... (4)
   Females ..... (7)

4. Clasper with Finger crescentic and manubrium slender and curved; st. VIII narrow and some of its bristles strongly flattened ..... (5)
   Clasper with apex of Finger more rectangular; st. VIII broad and without markedly flattened bristles ..... (6)

5. Fixed process of clasper represented by a well marked angle; penis with straight tip ..... *octactenus*
   Fixed process completely absent, the angle being rounded off; penis with upturned tip ..... *consimilis*

6. Bristles of st. VIII not conspicuously long; Finger not shaped as above but with posterior and apical margins forming an almost smooth curve, the postero-distal angle being completely rounded off ..... *hispanicus*

7. Anal stylet slender, about three times or more as long as broad ..... (8)

8. Comb of t. I with only about half as many spines as that of the metanotum ..... (9)

9. Preoral tuber only slightly bent ..... (10)
Preoral tuber bent at about a right angle, more than a third of its length beyond the bend ..... (11)

10. Dilated part of duct of spermatheca narrow ..... *hispanicus*

11. Apical margin of st. VII almost perfectly straight with no trace of lateral lobe ..... *consimilis*
Apical margin of st. VII distinctly convex or with a rounded lateral lobe ..... *octactenus*

28. Ischnopsyllus octactenus (Kolenati), 1856[1]

?*Pulex vespertilionis* Duges, 1832. Ann. Sci. nat. 27, 161. "Hopelessly unrecognizable.

Ceratophyllus octactenus Kolenati, 1856, Parasiten der Chiroptern, Brunn, p. 31 ('Mahren and Schweiz', from *Vesperugo pipistrellus*).

Ischnopsyllus (*Ischnopsyllus*) *octactenus* (Kolenati), 1856, H. and R. 1956, C.R.C.F. II, p. 272, Figs. 426, 464, 467, 468.

Male separable from all other known species of the genus except *I. consimilis* by the presence of a conspicuous "mane" of much elongated and semi-erect bristles on the postero-dorsal area of the mesonotum and distinguishable from *consimilis* by the presence of conspicuous angle representing the fixed process of the clasper. Female distinguished from *consimilis* by the different shape of the apical margin of st. VII.

Head and pronotum as illustrated. Combs containing in both sexes the following number of teeth: 28-32, 25-32, 11-18, 20-28, 16-22, 13-18, 9-16, and 9-13.

Modified Segments: Male. Finger roughly crescentic, the posterior apical angle completely smoothed off; manubrium curved. Acetabular bristles placed at the ventral apical angle of the clasper. Pygidium with the posterior margin drawn out into a small, smooth ventral lobe. St. VIII with basal portion much reduced. St. XI with proximal lobe of its apical arm elongated conically with rounded apex, broadest immediately beyond the base.

(1) See page 57.

Female. The anal stylet is about twice as long as broad. Diameter of dilated portion of duct of spermatheca little more than that of bursa copulatrix. Combs of t. IV-VI with 13-18, 9-14, and 9-13 teeth. Apical margin of VII st. entirely without a lateral lobe, the ventral third of the margin slightly convex.

LENGTH: in both sexes from $2\frac{1}{4}$ to $2\frac{3}{4}$ mm., which is small for a bat flea.

ARAB RECORDS:
MOROCCO

Mazagan (near Casablanca), from *Pipistrellus kuhli* (bat), July 14, 1901, by W. Riggenbach, 1 male.

29. Ischnopsyllus consimilis (Wahlgren), 1904

Ceratopsylla consimilis Wahlgren, 1904, Swed. Zoo. Exp., 1 (10):3 (from *Rhinopoma microphyllum*, Cairo, Egypt).

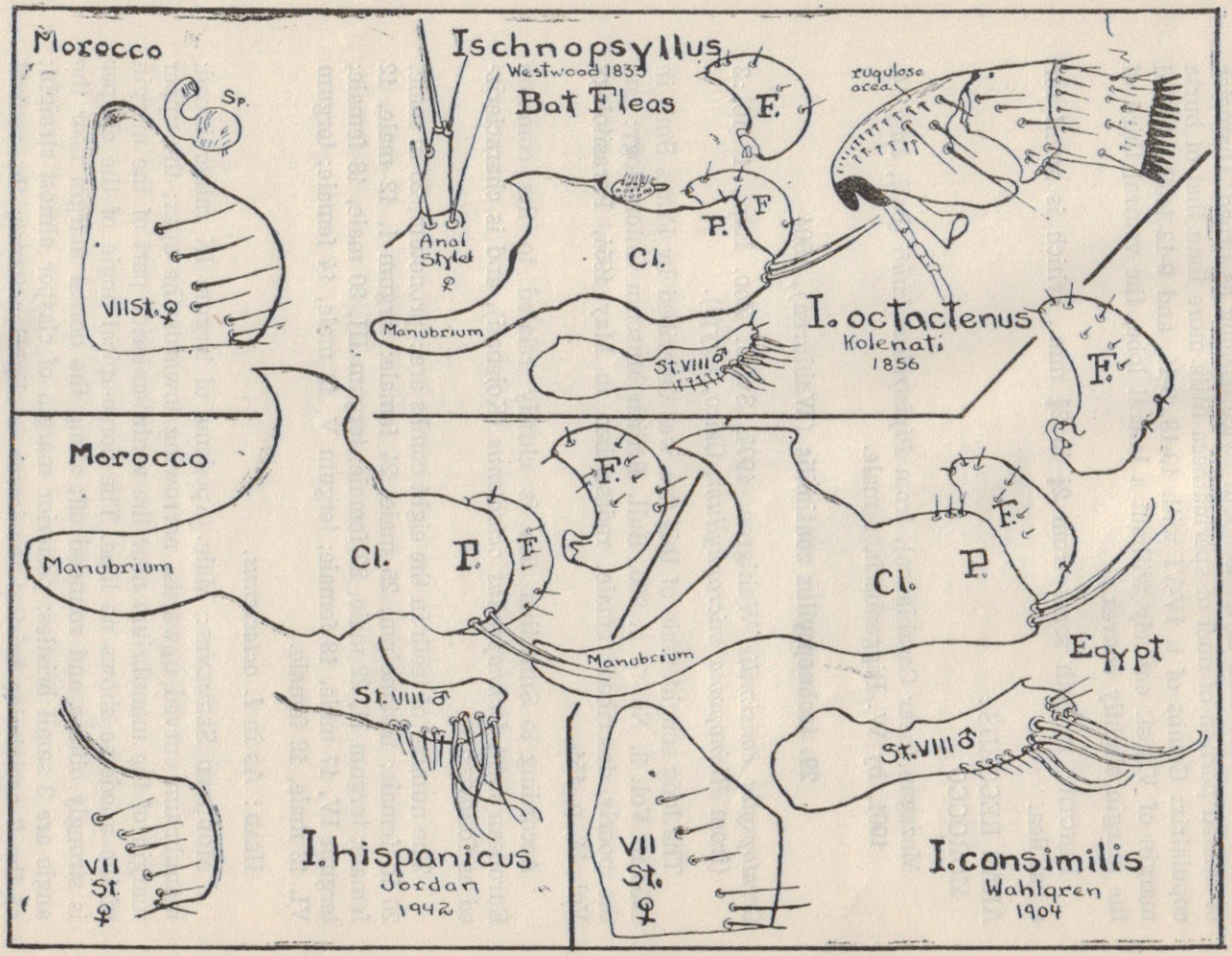
The long sought male of this flea was described by Frans Smit in 1953 in Vol. 3, No. 5. p. 206, Bull. British Museum Entomology; and the poorly described female, redescribed in May 1954, Parasitology Vol. 44, p. 151.

According to Smit this flea is closely related to the common European form *Ischnopsyllus octactenus* (Kolenati), and is characterized as follows:

The number of teeth in the eight combs are: pronotum, 25 in male, 26 in female; metanotum, 25 male, 24 female; tergum I, 12 male, 12 female; tergum II, 22 male, 20 female; tergum III, 20 male, 18 female; tergum IV, 17 male, 18 female; tergum V, 13 male, 14 female; tergum VI, 13 male, 12 female.

HEAD: As in *I. octactenus*.

MODIFIED SEGMENTS: Male. Apodeme of tergum IX rather broad; manubrium curved upwards, narrowing towards the apex; the upper margin of the manubrium near the ventro-anterior part of the margin of the apodeme shows no lobe. The dorso-apical angle of the clasper is strongly obtuse and rounded off; along the dorsal margin near the angle are 3 small bristles; posterior margin of clasper almost straight; of the 2 acetabular bristles the lower is slightly stouter; the ventral margin of the clasper forms a rather straight line. Finger crescentic, the lower half of the posterior margin fairly straight. Sternite VIII fairly broad and straight, its proximal part being widened; the dorsal



(Fig. 37) Ichnopsyllus hispanicus and I. consimilis.

margin of the distal part concave, its apical margin obliquely rounded, and at the angle where the dorsal and apical margin meet there is a minute spiniform bristle. On apico-ventral part of the sternum a curved row of 6 blade-shaped bristles and in front of these, at the ventral margin, 2 more flattened bristles which are heavily pigmented; further proximad along the margin some 6 curved bristles. Sternite IX with the distal arm apically divided into a setiferous upper lobe and a lower non-setiferous one; the latter lobe which is the outer one, is elongated and widest in its middle; the upper part of the widened apical portion of the inner lobe much longer than the lower part. Aedeagus crochet with an upturned apex.

Female. Sternite VII with posterior margin straight below the marked angle of this margin.

LENGTH: Male 2 mm., female?

ARAB RECORDS:

EGYPT

Cairo, from *Rhinopoma microphyllum* (bat), by Swedish Zoological Expedition to Egypt and the White Nile, 1901, the type female.

Simbellawein, Lower Egypt, from *Pipistrellus kuhli* (bat), February 24, 1947, by P. Tomich, a male.

30. Ischnopsyllus hispanicus Jordan, 1942

Ischnopsyllus hispanicus Jordan, 1942, Eos, Madr., 18, 243, fig. 1 (Sevilla, Spain, from *Myotis nattereri*).

Ischnopsyllus (*Ischnopsyllus*) *hispanicus* Jordan, H. and R. 1956, C.R.C.F. II, 286, fig. 483.

Hispanicus is immediately separable from *octactenus* and *consimilis*, the two preceding bat fleas, by the absence of the "manes" on the mesonotum and the metanotum.

Preoral tuber of moderate breadth, only slightly bent and the portion distal to the bend very short. Number of teeth in the combs: 30, 24, 12, 18, 15, 13, 13, and 11 in the only known male, and in the two known females, 29, 23, 7 (10), 16, 14, 12 (13), 10 (8), and 8 (6).

Said to be close to European *I. simplex* with which it is usually compared.

Male. Terminal margin of st. VIII more oblique than in *I. s. simplex* the two bristles at the ventral angle, and 1 at the terminal

margin less broadened, an oblique row of 4 long pre-apical bristles (no bristle between most dorsal of these and the one at terminal margin), dorsal margin distally rather strongly convex. Pygidium about as long as broad, its posterior margin incurved and the dorsal and the ventral angles equally and slightly produced. The dorsal margin of the body of the clasper almost evenly rounded, no conspicuous anterior angle nor large bristle behind it as in *simplex;* manubrium narrower; Finger narrower but much like that in *octactenus*. Penis without hook at ventral angle. Dorsal lobe of apical arm of st. IX distally broader and more rounded than in *simplex*, ventral lobe convex in middle above and below, narrower to base and apex.

Female. Inseparable from that of *I. s. simplex*.

LENGTH: Both sexes from 2 to 2½ mm. which is small for a bat flea.

ARAB RECORDS: From C.R.C.F. II p. 287.

MOROCCO

Mazagan (near Casablanca), from bat, April 1901, by W. Riggenbach, 1 female*.

*Footnote p. 287, C.R.C.F. "Placed here, rather than under *I. s. simplex* solely on geographical grounds".

Genus **ARAEOPSYLLA** Jordan and Rothschild, 1921

Araeopsylla Jordan and Rothschild, 1921, Ectoparasites, I, 146.
Type species: *Ischnopsyllus scitulus* Roths.

Said to be near to *Ischnopsyllus* because of the gap between the lower 2 long bristles on the middle abdominal terga and the more dorsal ones, but immediately separable from *Ischnopsyllus* by the absence of the rugulose dorso-marginal area on the frons.

Frontal tubercle of frons deciduous, the pale band almost wholly marginal, without rugulose area and without band of striae behind pale band. The occiput and thoracic segments with dorsal tuberculiform incrassations, dorsal part of abdominal terga forming conspicuous band like sclerotizations and sterna also sclerotized but much less so. The maxillae are obliquely truncate; the genal processes very strongly sclerotized apically, their upper margin curved and the tip usually blunt; both teeth of genal comb blunt. A clear space in the genal process probably represents the vestigial eye; there is no arch of the tentorium visible in front of it. The ocular bristles is very large. There is a strong tendency in the genus for the bristles to be spiniform, in particular a false comb of 4 spiniform and subspiniform

bristles always present at ventral end of posterior margin of occiput behind the antennal fossa. All combs vestigial except on pronotum. Metepimeron not much higher than long, not reaching dorsum, without false comb. The antepygidial bristle long. Basal abdominal sternum with ventral bristles but lateral bristles lacking. There is an interspace, sometimes very wide, between the 2 or 3 lower bristles on abdominal t. IV-VI or II-VII and the more dorsal bristles. The upper angle of the free antero-ventral margin of the mesosternum with tuberculiform sclerotization; metasternum without such a tubercle. The pleural rod of the mesopleurum ends much behind the center of the sclerotic dome filling its dorsal apex. Median ventral pair of bristles on segment V of tarsi placed between members of first lateral pair.

The genus is represented in the Arab World but by a single reported species, *A. wassifi* reported off a bat taken in Egypt.

31. Araeopsylla wassifi Traub, 1954

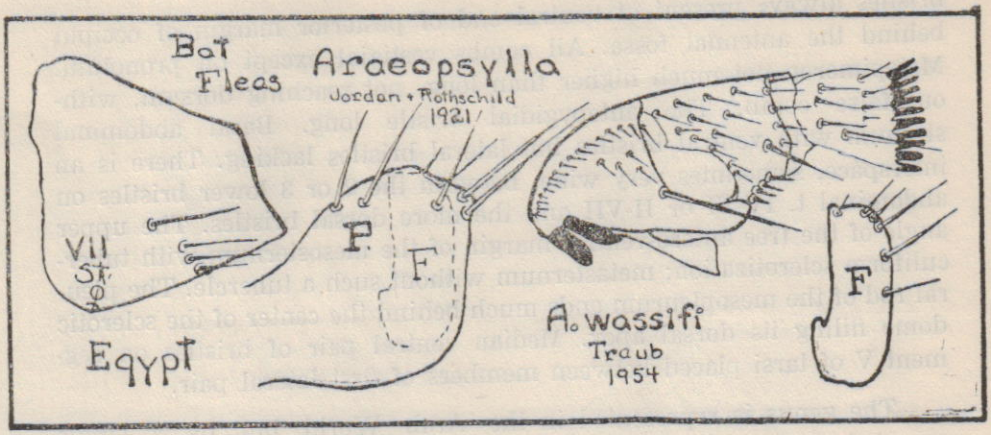
Araeopsylla wassifi Traub, 1954, Proc. ent. Soc. Wash. 56, 161, figs. 7, 11, 13, 15-20 (Abu Rawash, Giza Province, Egypt, from *Tadarida aegyptiaca*).

Araeopsylla wassifi Traub, H. and R., C.R.C.F. II, 331, figs. 531, 535, 537, 552, 555-558.

Incrassations of dorsum very well developed. The submarginal row of bristles of the frons composed of about 17, of which the last one or two are a little thickened. None of the bristles on the frons are as much as half as long as the ocular bristle. The gap which is found between the dorsal and ventral groups of bristles is about 1½ times as long as the long bristle of the ventral group.

Male. St. VIII with an apical row of 4 bristles and a subtruncate apex. Clasper quite ovate, being so because of the almost complete absence of an acetabular projection. Finger about three times as long as wide, its sides subparallel. The manubrium is slightly curved backwards. The dorsal portion of the penis is produced into a finger-like lobe and the apex falcate with irregular posterior margin.

Female. Apical margin of t. VIII long, fairly straight, the angle at which it meets the ventral margin often far more than a right angle. Apical margin of st. VII slightly concave. Ventral margin of st. VIII thickened, darkened in fully mature specimens. Anal stylet about three times as long as broad. Spermatheca with tail about 1½ times as long as the head.



(Fig. 38) Araeopsylla wassifi.

ARAB RECORDS: From C.R.C.F. II, p. 334.

EGYPT

Abu Rawash, Giza Province, from *Tadarida aegyptiaca* (bat), October 1952, by H. Hoogstraal, a pair.

Genus **Lagaropsylla** Jordan and Rothschild, 1921

Lagaropsylla Jordan and Rothschild, 1921, Ectoparasites, I, 152.

Type species: *Ceratophyllus signata* Wahlgren

Differing from all other long-headed Ischnopsyllidae, in which the antepygidial bristle is single and frons with pale band but without rugulose area, by having the shape of the metepimeron of much greater vertical height than its horizontal length.

Frons with deciduous tubercle and almost wholly marginal pale band, without rugulose area and without band of dark and light striae. Conspicuous dorsal tuberculiform incrassations on occiput and thoracic segments and also with band-like sclerotization of their more dorsal portions. Obliquely truncate maxilla. Genal process as in *Araeopsylla*. Genal teeth blunt although the posterior one has an oblique apex. Very large ocular bristle. No arch of tentorium in front of vestigial eye. Bristles on occiput above posterior end of antennal groove not spiniform. Combs vestigial except on pronotum. Metepimeron much higher than long, almost reaching dorsum of first abdominal segment, armed with numerous bristles. Antepygidial bristle long. Upper angle of free antero-ventral margin of both mesosternum

and metasternum with tuberculiform sclerotizations. Mesopleural rod ends in the center of the sclerotic dome filling the apex. The median ventral pair of bristles on segment V of tarsi placed between members of the first lateral pair.

This genus is represented in the Arab World by but one reported species, *L. incerta* off a Molossid bat taken in the Sudan.

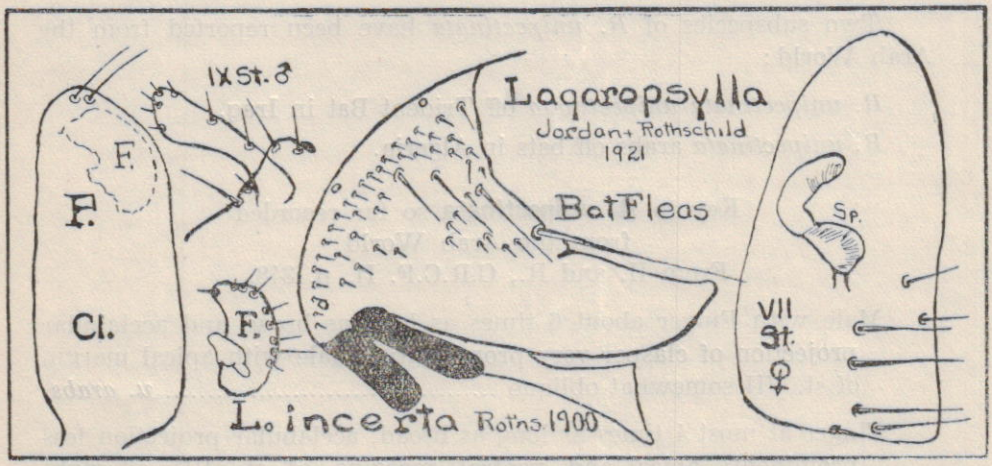
32. Lagaropsylla incerta (Rothschild), 1900

Ceratophyllus incerta Rothschild, 1900, Ent. Rec. 12, 38, pl. 2, figs. 2, 5, 6 (Tamatave, Madagascar, from *Nyctinomus brachypterus*).

Lagaropsylla incerta (Rothschild). H. and R., 1956, C.R.C.F. II, p. 343, figs. 312, 347, 559, 564. 572, 573.

Preoral tuber highly variable but usually short, stout, and of almost uniform width from base to bend and with a short apical portion slightly tapered and a little bent down. 21 to 27 very sharp teeth in the pronotal comb. Basal abdominal sternum without lateral bristles, its ridges bent cephalad ventrally in the male, in the female the reversal of the direction of the ridges takes place about a third of the distance from the dorsal to the ventral margin, the ridges below this strongly oblique.

Male. T. VIII with a few bristles, st. VIII with about 12. The straight apical portion of the apical arm of st. IX more than four times as long as wide in the middle. Body of the clasper about 2¼ times as long as wide. Anterior margin of the manubrium and of apodeme of t. IX forming an angle of about 125 degrees. Finger elongated reniform.



(Fig. 39) Lagaropsylla incerta.

Female. St. VII with sinus wide and shallow or absent. Spermatheca with short head and long tail, the apical part of the tail not markedly swollen.

ARAB RECORDS: From C.R.C.F. II, p. 346.

SUDAN

Torit, Equatoria, 2,000 ft., from Molossid Bat, January 1951, by H. Hoogstraal, a pair.

Genus **RHINOLOPHOPSYLLA** Oudemans, 1909

Rhinolophopsylla Oudemans, 1909, Ent. Ber. Amst., 3, 3.
Type species: *Typhlopsylla unipectinata* Tasch.

Similiar to *Ischnopsyllus* but without the rugulose area on the frons. This genus is another of the longheaded members of Ischnopsyllidae. The frons bears a deciduous tubercle but is without rugulose area or transverse bands of striae. The pale band is narrow and marginal and sub-marginal. Tentorial arch visible in front of vestigial eye. No dorsal tuberculiform incrassations. The maxillae are truncate. No false comb on the longer than high metepimeron. Antepygidial bristle long. Matanotum and abdomen usually with vestigial combs. Abdominal terga without a wider gap between the 2 most ventral long bristles and the more dorsal ones than between any other 2 adjacent bristles. Fifth tarsal segment with one pair of stout lateral bristles shifted to the median area of the ventral surface and placed between the members of the first lateral pair.

Two subspecies of *R. unipectinata* have been reported from the Arab World:

R. unipectinata unipectinata off Trident Bat in Iraq.

R. unipectinata arabs off bats in Algeria.

Key to **R. unipectinata** so far recorded
from the Arab World
From H. and R., C.R.C.F. II, p. 348.

Male with Finger about 6 times as long as broad and acetabular projection of clasper very prominent; female with apical margin of st. VII somewhat oblique ..... *u. arabs*

Finger at most 4 times as long as broad, acetabular projection less prominent; apical and ventral margins of st. VII at right angles ..... *u. unipectinata.*

33. Rhinolophopsylla unipectinata unipectinata (Taschenberg), 1880

Typhlopsylla unipectinata Taschenberg, 1880, Die Flohe, p. 92 (Switzerland, from *Rhinolophus hipposideros*).

Rhinolophopsylla unipectinata unipectinata Taschenberg. H. and R. 1956, C.R.C.F. II, p. 354, figs. 313, 348, 574, 576, 584, 585.

This subspecies is distinguished from *u. arabs*, which follows, by the combination of a relatively short Finger, blunt ended acetabular bristles and in the female by the fact that the apical margin of st. VII is at right angles to the ventral margin with its bristles very near its apical margin.

Vestigial combs on metanotum and first three abdominal terga.

Male. The body of the clasper measured from the ventral angle of the posterior margin about twice as long as it is broad in the middle. The 3 acetabular bristles are markedly unequal in size, stout, blunt ended. The acetabular projection is poorly developed. Finger with subparallel and almost straight anterior and posterior margins although the anterior margin may be slightly concave and the posterior sometimes freely convex. This Finger is less than four times as long as broad. The manubrium is very broad and slightly curved forwards. The penis has its upper lobed somewhat in the shape of the head of a bird, its terminal margin strongly convex proximally but concave more distally, forming a very prominent 'beak', the lower lobe strongly curved upwards. The ventral lobe of st. VIII narrow and subcylindrical, and bearing 2 long apical bristles and several smaller ones. Bend of st. IX is a smooth curve, the apical expansion of the apical arm subtriangular, its proximal margin much more expanded proximad than in *u. arabs*.

Female. The apical margin of the VII st. is almost at right angles to the ventral margin, its bristles placed near the apical margin.

LENGTH: Both sexes vary from 2½ to 3 mm.

ARAB RECORDS:

IRAQ

Baghdad. During the month of May 1953, the writer collected and examined 250 specimens of the Trident Leaf-nosed Bat taken in the tiny study rooms of the old college, Mustansiriyah, which has stood on the east bank of the Tigris river since 1233 A.D. The bats here were countless and the ceilings could not be seen for them. In spite of the large numbers examined only 4 fleas were recovered 3 of which are recorded herewith.

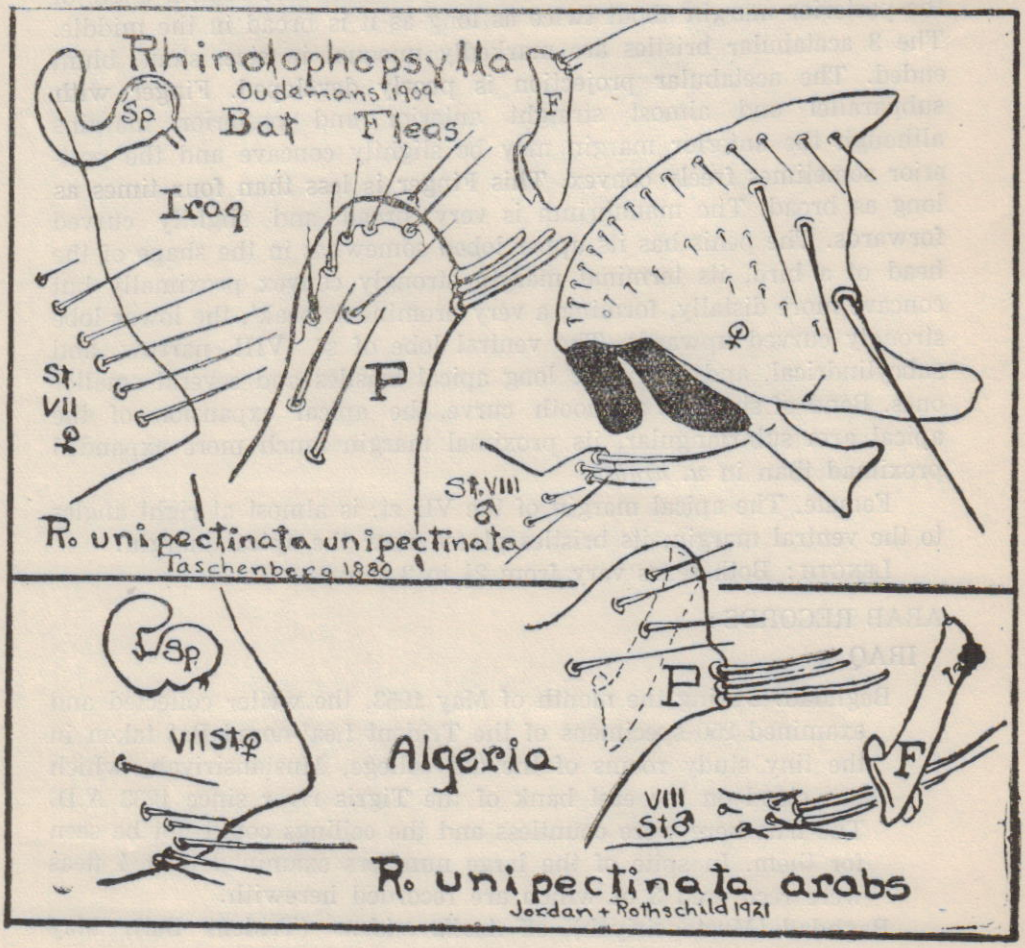
Baghdad (Mustansiriyah), off *Asella tridens* (Trident Bat), May 1953, 2 males, 1 female.

34. Rhinolophopsylla unipectinata arabs J. and R., 1921

Rhinolophopsylla unipectinata arabs Jordan and Rothschild, Ectoparasites 1:147, figs. 122, 123 (from *Rhinolophus ferrum-equinum*, Guelt-es-Stel, Algeria).

The original description with some modification follows.

Male. The process of the clasper is much shorter than in European specimens, the distance of the ventral notch of the clasper from the apex of the pygidium being 40. while the distance from the base of the ventral one of the three bristles of the clasper is only 24, the figures in European examples being 40 and 30. The three heavy bristles



(Fig. 40) Rhinolophopsylla unipectinata unipectinata and R. unipectinata arabs.

of the clasper are placed on a prominence, their lengths being 21, 16, 15. The Finger is longer than in European specimens (*Rh. unip. unipectinata*) (24:20), being one-fifth longer than the clasper is broad at the narrowest point proximally to the bristles. The apical lobe of the IX sternite is narrower than in the European form, the relative measurements of length and breadth being 19:9 in Europe and 19:7 in Algeria; the dorsal margin of this lobe is but slightly incurved in *arabs*. The paramere of the penis is divided, as in the other forms, into two lobes; the upper one resembles the head and neck of a bird, and is in *arabs* much less convex dorsally that in the European form; the lower lobe is less chitinized than the upper, flat, broad, rounded at the apex, being longer in *arabs*.

Female. Not different from European forms except in the shape of the seventh abdominal sternite which is ventrally much longer, the apical margin slanting strongly, the bristles at some distance from apical margin.

ARAB RECORDS:

ALGERIA

Guelt-es-Stel, off *Rhinolophus ferrum-equinum*, April 1912, by Karl Jordan, the type male and a female.

Oudna Mesnil, off bat from Paris Museum.

Guelt-es-Stel, off *R. ferrum-equinum*, June 1912, by W.R. and K.J. 1 female.

Guelt-es-Stel, off *Rhinolophorus*, October 1920, by L. Seurat, a pair.

Genus **Chiropteropsylla** Oudmans, 1908

Chiropteropsylla, Oudmans, 1908, Tijdschr. Ent. 51, 102.

Type species: *Ceratophyllus aegyptius* Roths.

Separable from other Ischnopsyllidae by the presence of a large and conspicuous false comb on the metepimeron.

The head is elongated. Frons without a permanent tubercle, but with contrasting pale band which is almost entirely marginal and is not backed by a band of striae; without rugulose area. Maxilla truncate. Arch of tentorium reduced to a vestige. Teeth of genal comb blunt, the anterior truncate the posterior with rounded apex. No dorsal tuberculiform incrassations. Metanotum and abdomen with vestigial combs. Metepimeron enormous, bearing a highly developed false comb of spiniform bristles. First abdominal tergum much reduced owing to the great size of the metepimeron. Single antepygidial bristle long. Fifth tarsal segment with one pair of the stout lateral

bristles shifted to a median area of the ventral surface between the members of the first lateral pair.

Two species of the genus have been reported from the Arab World, *C. aegyptia* from *Egypt*, *C. brockmani johnsoni* from Iraq.

Key to the Known Species of Chiropteropsylla Reported from the Arab World.

False comb of metepimeron of 14-16 very sharp teeth, frons about as long as high ..... *aegyptia.*

False comb of 8-10 much blunter teeth, frons longer than high ..... *brockmani.*

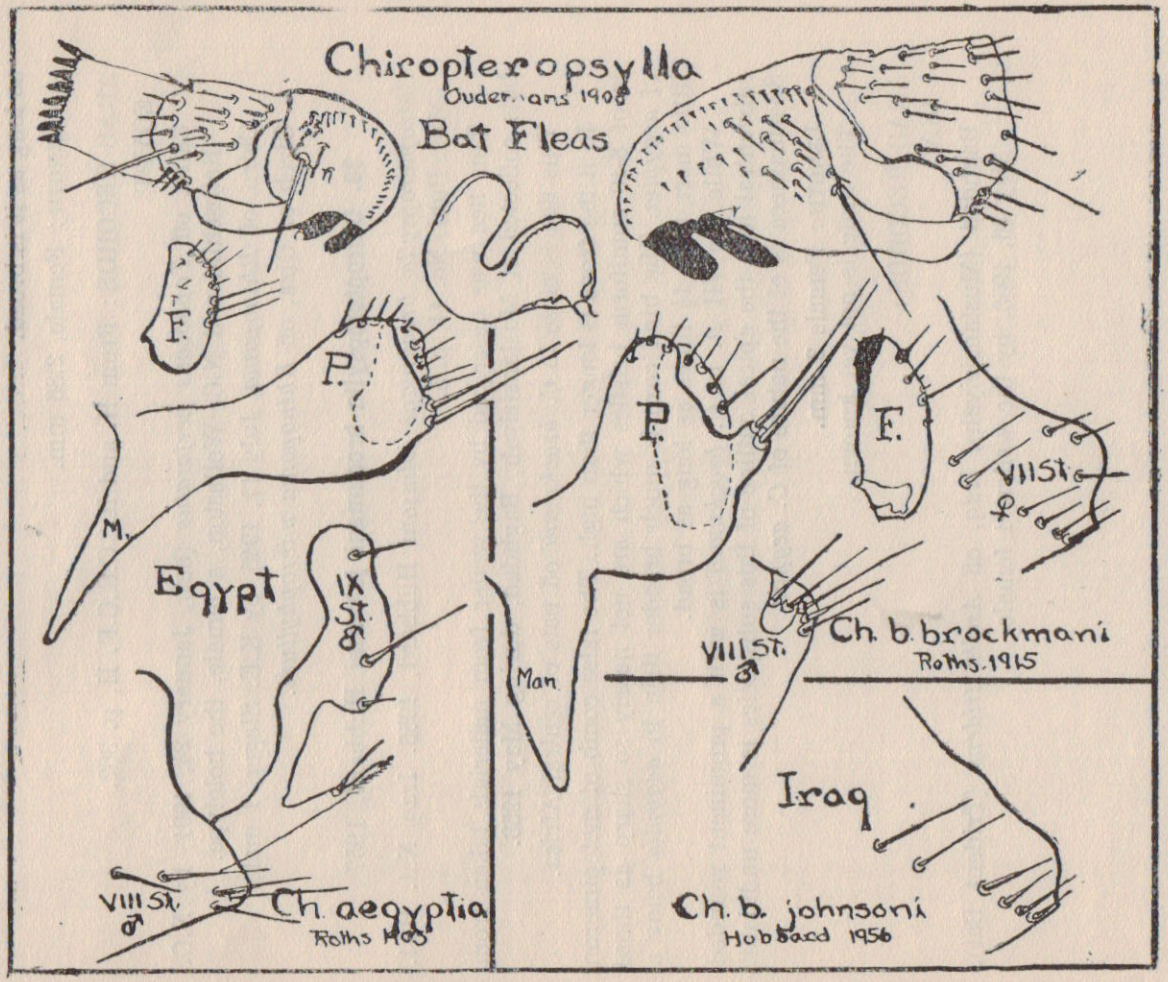
35. Chiropteropsylla aegyptia (Rothschild), 1903

Ceratopsylla aegyptius Rothschild, 1903, Ent. Mon. Mag., 2 (14) (39). 83, est. 1, fig. 1 (Egypt, from *Rhinopoma macrophyllum*).

Chiropteropsylla aegyptia (Rothschild), H. and R. 1956, C.R.C.F. II,

The original description with some modification follow.

The head is strongly rounded in front, the frontal outline forming almost a semicircle. The ante-oral flaps are longer than in any other member of the genus (1903) that has come to notice. The second flap being rather longer than half the vertical diameter of the head, measured from just in front of the antennal groove. The anterior portion of the head bears a series of short bristles parallel to the frontal outline. The more dorsal bristles of this row gradually increase in length and become more strongly chitinised, the last six being spine-like. Below these spine-like bristles are a few more of the same size. The genal process is very long and slender, being strongly chitinised. The post antennal portion of the head is densely covered with fine hairs on its dorsal surface. This portion also bears a row of bristles near the hinder edge, and one long bristle towards the center. The pronotal comb consists of 18 teeth. The mesonotum is clothed above with numerous bristles, and bears on each side two short spine-like projections. The metanotum is somewhat shorter than the mesonotum, appearing in side view to be acuminate in shape, and bearing at the apex on each side a short spine. The metathoracic epimeron is very characteristic. It is very large and pentagonal in shape, the posterior edge being longest. This is somewhat rounded and bears a series of 14 strongly chitinised spines arranged in the form of a comb. They differ, however, from those of the pronotum in being genuine spines and not processes of the chitin. The first abdominal tergite is greatly reduced in size, presumably on account of the large development of the metathoracic epimeron. The first, second, third and fourth tergites bear on each side



(Fig. 41) Chiropteropsylla aegyptia and C. brockmani Johnsoni.

one short spine. The seventh tergite bears on each side one long apical bristle and two very short bristles close to it. The sternites of segments three to seven bear four bristles on each side. The bristles of the fore-coxa are rather stout. The first pro-tarsal segment is nearly three times as long as it is broad.

LENGTH: Female, 2.86 mm.

ARAB RECORDS: From H. and R., C.R.C.F. II, p. 362.

EGYPT

Cairo, off *Taphozous perforatus* (bat), January 24, 1901, by N.C. Rothschild and N.C. Wollaston, a female, the holotype.

Cairo, off *Rhinopoma*, July 17, 1945, by K.E. Stager, 1 male.

Gizeh or Giza, off *Rhinopoma microphyllum*.

36. Chiropteropsylla brockmani johnsoni Hubbard, 1957

Chiropteropsylla brockmani johnsoni Hubbard, 1956. Iraq Nat. Hist. Mus. Publ. No. 11, p. 5.

This flea was described by the writer from materials taken from bats collected at Mustansiriyah, Baghdad, during May 1953.

This flea is close to *C. brockmani* off bats of central Africa.

In it the frons is longer than high. The false comb of metepimeron is of 8-10 spiniform bristles which are not nearly so sharp as those of *aegyptia*. The hind coxa is much broader than in *aegyptia* being a little more than 1½ times as long as broad.

While the VII st. in *C. brockmani* is with a prominent rounded subventral lobe the apical outline of this subspecies is more undulant. Spermatheca is of the nature of *C. aegptia*.

LENGTH: Female 3 mm.

The male is not yet known.

ARAB RECORDS:

IRAQ

Baghdad (Mustansiriyah), Iraq, off *Asella tridens* (Trident Bat), May 26, 1953, by the writer, 1 female.

THE SHREWS

Crocidura
Leptopsylla algira

Crocidura leucodon
Leptopsylla segnis
Nosopsyllus fasciatus
Typhloceras f. favosus
Typhloceras poppei

Crocidura r. mauretanica
Ctenophthalmus r. russulae
Nosopsyllus barbarus

Crocidura r. russula
Ctenophthalmus r. russulae
Leptopsylla algira
Leptopsylla segnis
Nosopsyllus barbarus
Nosopsyllus fasciatus
Typhloceras favosus

THE BATS

"Bat"
Ischnopsyllus hispanicus

Nyctinomus brachypterus
Lagaropsylla incerta

Rhinopoma microphyllum
Chiropteropsylla aegyptia
Ischnopsyllus consimilis

Taphozous perforatus
Chiropteropsylla aegyptia

Rhinolophus (Phyllotis)
Rhinolophopsylla unipectinata

Tadarida aegyptiaca
Araeopsylla wassifi

Rhinolophus f. equinum
Rhinolophopsylla u. arabs
Rhinolophopsylla u. unipectinata

Rhinolophus g. augur
Xenopsylla nubica

Rhinolophus hipposideros
Rhinolophopsylla u. unipectinata

Pipistrellus kuhli
Ischnopsyllus octactenus

MAN

Homo sapiens
Tunga penetrans
Echidnophaga gallinacea
Pulex irritans
Ctenocephalides felis
Ctenocephalides canis
Synosternus pallidus
Xenopsylla cheopis
Nosopsyllus fasciatus

The Host Index

AVES

Delichon urbica meridionalis

Ceratophyllus farreni meridionalis

Delichon urbica urbica

Ceratophyllus farreni meridionalis
Ceratophyllus hirundinis
Myoxopsylla laverani
Nosopsyllus fasciatus

MAMMALIA

ELEPHANT SHREW

Elephantulus rozeti

Caenopsylla assimulata

THE HEDGEHOGS

Aethechinus algirus

Archaeopsylla erinacei maura

Aethechinus algirus algirus

Archaeopsylla erinacei maura
Synosternus pallidus
Xenopsylla ramesis

Atelerix albiventris

Synosternus pallidus
Xenopsylla nubica

Atelerix spiculus

Ctenocephalides canis
Echidnophaga gallinacea
Synosternus pollidus
Xenopsylla cheopis

Atelerix spinifex

Ctenocephalides canis
Synosternus pallidus

Erinaceus

Archaeopsylla erinacei
Ctenocephalides felis
Echidnophaga gallinacea
Synosternus pallidus
Xenopsylla nubica

Erinaceus collaris

Synosternus pallidus

Erinaceus europaeus

Archaeopsylla erinacei maura
A. e. erinacei

Hemiechinus calligoni

Echidnophaga gallinacea

Paraaechinus aethiopicus

Synosternus cleopatrae
Synosternus pallidus

THE DORMOUSE

Glis glis

Leptopsylla taschenbergi
Myoxopsylla laverani
Pulex irritans

THE SPALAX MOLE RATS

Members of the genus **Spalax** are found here and there over the Arab World. Their fossorial habits reminds one of the American mole, and also they can only be caught with an American mole trap. Any kind of a trap or barrier placed in their burrow is simply burrowed under and thrown out of the burrow. The American "Out of Sight" mole trap, stradles the mole runway and as the animal burrows through, the trap grasps the animal in its scissors jaws and crushes it to death.

There are no records of fleas off this animal from the Arab World, so its study should provide a new field particularly since, throughout Asia, four genera of fleas not so far recorded from the Arab countries have been recorded off this animal.

THE SPINY MOUSE

Acomys cahirinus

Parapulex chephrenis

Acomys dimidiatus

Parapulex chephrenis

THE WOOD MOUSE

Apodemus sylvaticus algirus

Ctenophthalmus r. russulae
Nosopsyllus henleyi mauretanicus
Leptopsylla algira
Nosopsyllus barbarus
Stenoponia tripectinata
Typhloceras favosus
Typhloceras poppei
Xenopsylla ramesis

Apodemus sylvaticus hayi

Leptopsylla taschenbergi
Nosopsyllus barbarus
Stenoponia tripectinata

THE NILE RAT

Arvicanthis niloticus testicularis

Synosternus cleopatrae
Xenopsylla cheopis
Xenopsylla nilotica
Xenopsylla nubica

Arvicanthis barbarus

Leptopsylla algira
Nosopsyllus barbarus
Stenoponia tripectinata

THE RABBITS

Orycolagus cuniculus
Ctenocephalides canis
Ctenocephalides felis
Echidnophaga gallinacea
Pulex irritans
Spilopsyllus cuniculi
Xenopsylla cheopis

Lepus europaeus
Pulex irritans
Spilopsyllus cuniculi

Lepus rothschildi
Xenopsylla nubica

THE PORCUPINES

Hystrix
Synosternus pallidus

Hystrix cristata
Pariodontis riggenbachi

Hystrix africaeaustralis
Pariodontis riggenbachi

THE JERBOA

Dipus
Xenopsylla cheopis

Dipus sagitta
Xenopsylla cheopis
Xenopsylla mycerini

Jaculus
Synosternus cleopatrae

Jaculus j. deserti
Nosopsyllus h. mauretanicus
Synosternus cleopatrae
Xenopsylla nubica

Jaculus j. gordoni
Xenopsylla nubica

Jaculus j. jaculus
Parapulex chefrenis
Synosternus cleopatrae
Xenopsylla cheopis
Xenopsylla nubica

Jaculus orientalis
Nosopsyllus maurus
Xenopsylla nubica

THE GARDEN DORMOUSE

Eliomys munbyanus
Caenopsylla mira
Myoxopsylla laverani

Eliomys quercinus
Leptopsylla segnis
Myoxopsylla laverani
Nosopsyllus fasciatus

Eliomys m. occidentalis
Myoxopsylla mira

Eliomys q. gymnesicus
(Myoxus nitela)
Myoxopsylla laverani
Nosopsyllus fasciatus

Eliomys q. pallidus
Myoxopsylla fasciatus

THE HOUSE MOUSE

Mus musculus sp.

Leptopsylla segnis
Leptopsylla taschenbergi
Nosopsyllus barbarus
Nosopsyllus fasciatus
Pulex irritans
Spilopsyllus cuniculi
Stenoponia tripectinata
Xenopsylla cheopis

THE NESOKIAN MOLE RAT

Nesokia indica buxtoni

Xenopsylla astia
Xenopsylla cheopis

RATS OF THE GENUS **RATTUS**

Rattus norvegicus
(Norwegian Rat)

Ctenocephalides felis
Ctenocephalides canis
Echidnophaga gallinacea
Leptopsylla segnis
Nosopsyllus fasciatus
Nosopsyllus medus
Pulex irritans
Spilopsyllus cuniculi
Stenoponia tripectinata
Synosternus pallidus
Xenopsylla astia
Xenopsylla cheopis

Rattus rattus alexandrinus
(Alexandrine Rat)

Ctenocephalides felis
Echidnophaga gallinacea
Echidnophaga murina
Leptopsylla segnis
Nosopsyllus barbarus
Nosopsyllus fasciatus
Pulex irritans
Xenopsylla cheopis

Rattus rattus rattus (Black Rat)

Ctenocephalides felis
Ctenocephalides canis
Echidnophaga gallinacea
Leptopsylla segnis
Nosopsyllus fasciatus
Pulex irritans
Stenoponia tripectinata
Synosternus pallidus
Xenopsylla astia
Xenopsylla cheopis
Xenopsylla nubica

Rattus coucha

Echidnophaga gallinacea
Pulex irritans
Xenopsylla cheopis

Rattus rattus rufescens

Xenopsylla astia
Xenopsylla cheopis

THE GERBILS

Gerbillus campestris
Ctenophthalmus r. russulae
Leptopsylla algira
Nosopsyllus henleyi mauretanicus
Nosopsyllus barbarus
Stenoponia t. insperata
Stenoponia t. tripectinata
Xenopsylla mycerini
Xenopsylla ramesis

Gerbillus c. rozsikae
Synosternus cleopatrae
Xenopsylla mycerini
Xenopsylla ramesis
Xenopsylla regis

Gerbillus lowei
Ctenocephalides felis strongylus
Nosopsyllus h. mauretanicus
Xenopsylla nubica

Gerbillus pyramidum hirtipes
Nosopsyllus h. mauretanicus
Stenoponia tripectinata
Synosternus cleopatrae

Meriones l. libycus
Meriones shawi
Nosopsyllus h. oranus
Nosopsyllus h. mauretanicus
Nosopsyllus maurus
Coptopsylla wassiliewi
Rhadinopsylla masculana
Stenoponia t. insperata
Stenoponia t. tripectinata
Synosternus cleopatrae
Xenopsylla cheopis
Xenopsylla nubica
Xenopsylla ramesis

Meriones schouesboei henlei
Nosopsyllus h. mauretanicus
Synosternus cleopatrae
Xenopsylla ramesis
Xenopsylla taractes

Meriones rex
Xenopsylla regis

Tatera bailwardi
Xenopsylla astia

THE FAT-TAILED GERBIL

Pachyuromys duparsi
Nosopsyllus h. mauretanicus
Xenopsylla mycerini

Pachyuromys d. natronensis
Nosopsyllus henleyi henleyi
Xenopsylla mycerini
Xenopsylla ramesis

THE FAT SAND RAT

Psammomys obesus obesus
Coptopsylla africana
Xenopsylla ramesis

Psammomys obesus algericus
Ceratophyllus hesidatoris desideratus
Xenopsylla ramesis

THE MEADOW MICE

Microtus irani
Nosopsyllus durii
Ctenophthalmus congener allousei

THE HYRAX

Procavia syriaca jayakari
Ctenocephalides arabicus

THE CARNIVORA

Canis familiaris (Dog)
Ctenocephalides canis
Echidnophaga gallinacea
Ctenocephalides felis
Nosopsyllus fasciatus
Pulex irritans

Fennecus zerda (Fennic Fox)
Ctenocephalides canis

Poelictis libyca libyca (African Pole Cat)
Nosopsyllus maurus
Synosternus cleopatrae
Myoxopsylla laverani

Caracal caracal
Pulex irritans

Hyaena
Synosternus pallidus

Meles taxus
Pulex irritans

Felis domestica (Cat)
Ctenocephalides felis
Ctenocephalides canis
Echidnophaga gallinacea
Pulex irritans
Tunga penetrans
Xenopsylla cheopis

Felis chaus
Xenopsylla astia

Genetta (Genet)
Xenopsylla cheopis
Xenopsylla nubica
Ctenocephalides f. strongylus
Ctenocephalides canis

Herpestes (Mongooses)
Synosternus pallidus
Ctenocephalides canis
Ctenocephalides felis
Echidnophaga gallinacea

General Index for Part II

(This index excludes synonyms and hosts, and is intended only for scientific names of fleas appearing in this volume).

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نشرة رقم (١٩)

البراغيث والطاعون في العراق والعالم العربي

تاليف

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