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THE SUCKING LICE (ANOPLURA) OF EGYPT
I. SPECIES INFESTING RODENTS *

by

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This paper is based on study of Egyptian anopluran material collected by Dr. Harry Hoogstraal and his associates in the Department of Medical Zoology, United States Naval Medical Research Unit Number Three, Cairo, Egypt, U.A.R. Prior to these extensive collections, only 4 species of rodent-infesting Anoplura were recorded from Egypt. Twelve additional species, of which 7 have been described as new (Johnson 1957, 1960), are now known from Egypt as a result of NAMRU-3 efforts.

The present study, part of a faunal survey aimed at elucidating vertebrate-ectoparasite relationships and their epidemiological role in Egypt (Hoogstraal 1956, 1958), will, we trust, aid

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and stimulate further study of local anopluran populations and their public health importance.

In order to facilitate identifications, this report provides keys to genera and species as well as illustrations, descriptions, and Egyptian records of anopluran species occurring on Egyptian rodents. Species synonymies cite the original description plus papers dealing with distribution of the species within Egypt.

In an appendix at the end of this paper are included two methods for preparing Anoplura for study and an illustrated, annotated list of parts used in determination of species discussed in this paper.

The 16 species of sucking lice known to occur on Egyptian rodents are members of 3 genera in the family Hoplopleuridae Ferris: *Hoplopleura* Enderlein, *Polyplax* Enderlein, and *Eulinognathus* Cummings.

KEY TO GENERA OF RODENT-INFESTING ANOPLURA FOUND IN EGYPT

- 1. Second abdominal segment with sternal plate extended laterally on each side to articulate with corresponding paratergal plate (fig.3) *Hoplopleura*
 Second abdominal segment with sternal plate never thus extended (fig. 6) 2
- 2. Paratergal plates and spiracles present on abdominal segment 8; head never with tubercles or hooks (fig. 6) *Polyplax*
 Paratergal plates and spiracles lacking on segment 8 and paratergal plates lacking on segment 7 (in Egyptian species); head with hooks or tubercles ventrally (fig. 66) *Eulinognathus*

GENUS HOPLOPLEURA ENDERLEIN

Hoplopleura Enderlein, 1904, Zool. Anz., Leipzig, vol. 28, p. 221.
Haematopinus (*Polyplax*), Neumann, 1909, Arch. Parasitol., Paris, vol. 13, p. 531.

Hoplopleura, Fahrenholz, 1912, Jahresb. Niedersach. Zool. Ver. Hannover (1910-1912) Abhandl. 2-4 p. 44. Ferris, 1921, Contributions toward a monograph of the sucking lice, pt. 2, p. 59.

Ferrisiella Ewing, 1929, Manual of External Parasites, p. 198, (Type: *Hoplopleura ochotonae* Ferris).

Ctenura Ewing, Loc. cit., p. 199, (Type: *Hoplopleura pectinata* Cummings).

Euhoplopleura Ewing, loc. cit., p. 199, (Type: *Hoplopleura trispinosa* Kellogg and Ferris).

Ctenoppleura Ewing, loc. cit., p. 200, (Type: *Hoplopleura cryptica* Ferris).

Type species of genus: *Pediculus acanthopus* Burmeister, by orig. design.

Description: There is no external evidence of eyes. The antennae are clearly 5-segmented and never strongly sexually dimorphic although in the male the third segment may bear a short stout dorsal seta. The sensoria of the fourth and fifth antennal segments are large and contiguous. The sternal plate of the thorax is present. The first pair of legs is small, with a slender claw, the second pair is larger with a stouter claw and the third pair is much larger, flattened and with a very broad flattened claw. The sternal plate of the second abdominal segment and usually the sternal plate of the third abdominal segment are extended laterally to articulate with the corresponding paratergite; these two plates are always narrow. The first sternal plate of the third abdominal segment usually has two groups of 2-4 enlarged, stout setae. The paratergites never show an indication of partial longitudinal division into dorsal and ventral parts; the paratergites of segment 2 are not produced into a long blade-like extension.

A single species of *Hoplopleura* occurs in Egypt. This is a normal parasite of the cosmopolitan *Mus musculus*, the house mouse.

HOPLOPLEURA CAPTIOSA JOHNSON

(Figs. 1-5)

Hoplopleura captiosa Johnson, 1960, U.S.D.A. Tech. Bull. 1211, p. 23.

Distinguishing characters: The thoracic sternal plate has a narrow but apically rounded posterior extension. Paratergal plates III-VI have the posterior margin bilobed, each of the two lobes is truncate, the 2 apical setae are short except for paratergal plate III which has both of the apical setae extending beyond the apices of the lobes. In the female paratergal plate VII has one long acute dorsal lobe, the ventral lobe is short or absent, and paratergal plate VIII has one long acute dorsal lobe. In the male, paratergal plate VII has a long dorsal lobe and no ventral lobe, and paratergal plate VIII lacks both lobes. The female has three sternal and three tergal plates on each of the typical abdominal segments. The male has two sternal and one tergal plates on each of the typical abdominal segments. Both sexes have two groups of two enlarged setae each on the first sternal plate of abdominal segment 3, and the abdomen has several setae laterally off the sternal plates.

The holotype female, allotype male, and several male and female paratypes were taken from *Mus musculus* ssp., Egypt: Western Desert Governorate, Shooting Club, 3 miles north of Faiyum. Other paratypes were taken from *M. musculus* from various parts of the world, and from the following Egyptian localities: Giza Province, Abu Rawash, Imbaba; and Minya Province, Samalut.

GENUS POLYPLAX ENDEREIN

Polyplax Enderlein, 1904, Zool. Anz., Leipzig, vol. 28, pp. 142, 223.
Eremophthirius Glinkiewicz, 1907, Sitzungs. K. Akad. Wissensch. Math. Naturw. Cl., 1, Abt. v. 116, p. 381, (type: *Eremophthirius wernerii* Glinkiewicz).
Haematopinus (Polyplax), Neumann, 1909, Arch. Parasitol., Paris, vol. 13, p. 529.
Polyplax, Ferris, 1923, Contributions toward a monograph of the sucking lice, pt. 4, p. 183. Ewing, 1935, Proc. Biol. Soc. Wash., vol. 48, p. 201.
Eremophthirius, Ewing, loc. cit., p. 201.
Polyplax, Fahrenholz, 1938, Ztschr. Parasitenk., vol. 10, p. 239.

Eremophthirius, Fahrenholz, loc. cit., p. 242.
Symoca Fahrenholz, loc. cit., p. 245 (type: *Polyplax brachyrrhynchus* Cummings).
Polyplax, Ferris, 1951, the sucking lice, p. 199, Johnson, 1960, U.S. D.A. Tech. Bull. 1211 p. 48.

Type species of genus: *Pediculus spinulosus* Burmeister, by orig. design.

Description: The antennae are 5-segmented, and with or without the third antennal segment of the male modified and bearing a short, stout apical seta. The thorax usually, but not always, has a distinct sternal plate; and the pronotum is present, though it may be weakly developed. The anterior legs are small and weak, with a slender claw; the middle legs are larger, with a stouter claw, and the posterior pair still larger, with a stouter claw which may be somewhat flattened, but the leg proper is never strongly compressed. The abdomen has paratergal plates on segments 2-8, except in one aberrant species which may not belong in *Polyplax*, and spiracles are always present on segments 3-8. Abdominal tergal and sternal plates are usually present. The female always has two rows of setae on terga 4-7 and sterna 3-7; the male has one row of setae on each tergum and 1-2 rows on sterna 2-3, and one row on the remaining sterna. The sternal plates of abdominal segments 2-3 are never produced laterally to articulate with or approximate the paratergal plates of these segments.

KEY TO THE SPECIES OF POLYPLAX FOUND IN EGYPT

1. Setae of paratergites III-VI all definitely shorter than plate bearing them (fig. 10) 2
 Setae of these paratergites all longer than the plate bearing them, or approaching the length of the plate, or with 1 seta on at least 1 of these plates longer than the plate 4
- 2(1) Only the ventral apical angle of paratergites III-VI produced into a short point (fig. 10), on *Rattus* *spinulosa*
 Both apical angles of paratergites III-VI produced into short points (fig. 62) 3

- 3(2) Paratergites III-VI posteriorly emarginate, the setae borne close to apices of these emarginations (fig. 16); male pseudopenis articulated with tips of parameres (fig. 19), on *Arvicomthis* *abyssinica*
- These paratergites not emarginate (fig. 62); pseudopenis enclosed within parameres (fig. 64) on *Gerbillus* spp. *kaiseri*
- 4(1) Thoracic sternal plate with distinct handle-like prolongation extending anteriorly between the first coxae, this prolongation as sclerotized as remainder of plate and at least one-fourth length of plate (fig. 28) 5
- Thoracic sternal plate usually lacking a median prolongation, if present, it is poorly sclerotized and not so long 6
- 5(4) Ventral and dorsal posterior angles of paratergites III-VI very short in both sexes, scarcely projecting as lobes (fig. 21); abdominal plates well developed, on *Pachyuromys* *wernerii*
- Posterior angles of paratergites III-VI produced into definite lobes, although these are shorter in male than in female (fig. 25); abdominal plates definitely reduced, on *Gerbillus* *gerbilli*
- 6(4) Paratergites III-VI all with at least one of apical setae nearly or quite as long as plate bearing them 7
- At least one pair of paratergites of segments 3-6 with both apical setae obviously much shorter than plates bearing them 10
- 7(6) Thoracic sternal plate not especially reduced, marginally free from body wall 8
- Thoracic sternal plate reduced, not free from body wall at any point, merely a more deeply pigmented area 9
- 8(7) Head elongate and acutely pointed apically (fig. 57); paratergites III-VI very long and narrow, with paired apical setae all approxi-

- mately equalling length of plates bearing them (fig. 57), on *Acomys* spp. *oxyrrhyncha*
- Head not elongate, blunt apically (fig. 12); paratergite IV with one apical seta as long as or longer than plate bearing it, remaining setae on plates III-VI much shorter than plates (fig. 11), from laboratory white mice *serrata*
- 9(7) Lateral postantennal head margins convex (fig. 51); third pair of legs with tarsus lightly pigmented and of about the same length as tibia (fig. 54), on *Acomys russatus* *hoogstraali*
- Lateral postantennal head margins straight, parallel (fig. 46); third pair of legs with tarsus narrow, deeply pigmented, much longer than tibia (fig. 50), on *Acomys dimidiatus* *brachyrrhyncha*
- 10(6) Female lacking tergal and sternal plates on abdomen except for those associated with genital plates and 1 or 2 very small plates at base of abdomen; male with abdominal plates present but very reduced; parameres of male genitalia markedly and smoothly convex from base to apex (fig. 42), on *Nesokia* *asiatica*
- Female with usual number of tergal and sternal abdominal plates, although these may be reduced in both sexes; male parameres never smoothly convex from base to apex 11
- 11(10) Female with last tergal row containing 3-5 setae; pair of setae on anteroventral head plate reaching beyond base of a second antennal segment (fig. 38) 12
- Female with last tergal row containing only two setae; the pair of setae on the anteroventral head plate very short, not reaching base of second antennal segment (male unknown), on *Sekeetamys* *caluri*
- 12(11) Abdominal plates reduced (fig. 38), on *psammomys* *vacillata*
- Abdominal plates normal, not reduced (fig. 32), on *Meriones* spp. *paradoxa*

POLYPLAX SPINULOSA (BURMEISTER)

(Figs. 6-10)

Pediculus spinulosus Burmeister, 1839, Genera Insectorum, vol. 1, Rhynchota, no. 8.

Polyplax spinulosa, O'Mahoney, 1946, Entom Month. Mag., vol. 82, p. 231. Johnson, 1960, U.S.D.A. Tech. Bull. 1211, p. 54.

Distinguishing characters: The antennae are strongly sexually dimorphic, the first antennal segment of the male is much enlarged, and the third segment is apicodorsally prolonged and bears a short stout seta. The gular area is elevated and the gular folds are present. The head has marked postantennal and occipital angles. The thoracic sternal plate has the lateral margins roughly parallel and the posterior margin produced into a blunt point. Paratergal plates III-VI are triangular, with only the dorsal posterior angle produced into a short tooth, and each of these plates has its two apical setae shorter than the plate. The abdomen has well developed tergal and sternal plates. The male has two plates ventrally on each of abdominal segments 2 and 3. The male genitalia have the parameres short and convex, and the pseudopenis is about the same length as the parameres and articulated with their tips.

P. spinulosa was described from specimens collected from *Rattus norvegicus* in Europe. It has a cosmopolitan distribution on domestic rats.

Egyptian records include the following: From *Rattus norvegicus*: Suez Governorate, Fayid and Ras Forit. From *Rattus rattus*: Damietta Province, Fariskur. Sinai Governorate, El Arish. Gharbiya Province, Shirbin. Qena Province, Isna. Giza Province, Imbaba and Giza zoo. Faiyum Province, Kom O Shim. Cairo Governorate, Maadi.

POLYPLAX SERRATA (BURMEISTER)

(Figs. 11-15)

Pediculus serratus Burmeister, 1839, Genera Insectorum, vol. 1, no. 6.

Polyplax serrata, Johnson, 1960, U.S.D.A. Tech. Bull. 1121, p. 55.

Distinguishing characters: This species is similar to *P. spinulosa* except as follows: The thoracic sternal plate is produced posteriorly into a definite though rounded point, and the anterior and lateral margins are convex. Paratergal plates III-VI have both posterior angles produced into short points, and the pairs of apical setae on these paratergites are all short except that the ventral apical seta on paratergite IV is a long as, or longer than the plate bearing it. The male genitalia have the parameres very short, not convex, and the pseudopenis is longer than the parameres.

P. serrata was described from specimens taken from *Mus musculus* in Europe. It is typically a parasite of *Apodemus* species, but apparently it is now adapted to wild *Mus musculus* in the Palearctic Region (Europe and Western Asia). The only verifiable records of *P. serrata* on *M. musculus* outside Europe and Asia are from laboratory white mice.

The only Egyptian record is as follows: From laboratory white mice (*Mus musculus*), Cairo, NAMRU-3 animal house.

POLYPLAX ABYSSINICA FERRIS

(Figs. 16-19)

Polyplax abyssinica Ferris, 1923, Contributions toward a monograph of the sucking lice, pt. 4, p. 230, fig. 150. Briscoe, 1956, Amer. Midland Nat., vol. 55, p. 403. Johnson, 1960, U.S.D.A. Tech. Bull. 1121, pp. 59-60.

Distinguishing characters: The antennae are sexually dimorphic, the male has the basal segment enlarged, and the third segment prolonged apicodorsally with a short, stout apical seta on the prolongation. The postantennal angles are not marked; the occipital angles are well developed. The thoracic sternal plate has the anterior margin more-or-less straight, and the lateral margins smoothly convex to the sharply rounded posterior apex. Paratergal plates III-VI have their posterior margins emarginate, with the apical setae borne near the apices of the emarginations and not as long as the plates bearing them. Abdominal sternal and tergal plates are reduced, particularly in width (in a longitudinal plane), so that they occupy less than the median half of

the abdomen. The male has two rows of setae and two plates ventrally on each of abdominal segments 2 and 3. The male genitalia have the parameres short and convex; the pseudopenis is triangulate, very broad and short, and articulating with the apices of the parameres.

The types (females only) of *P. abyssinica* were taken from *Arvicanthis abyssinicus nubilans* from Uganda.

Egyptian records include the following: From *Arvicanthis n. niloticus*: Giza Province, Imbaba and Nahya. Qalyubia Province, Qalyub. Minufiya Province, Ashmun. Faiyum Province, near desert edge.

POLYPLAX WERNERI (GLINKIEWICZ)
(Figs. 20-24)

Eremophthirius wernerii Glinkiewicz, 1907, Sitzungsber. K. Akad. Math. Naturw. Cl., Abt. v. 116, p. 381, figs.

Polyplax wernerii, Ferris, 1923, Contributions toward a monograph of the sucking lice, pt. 4, p. 202, fig. 127. Johnson, 1960, U.S. D.A. Tech. Bull. 1211, p. 63.

Distinguishing characters: The sensoria of antennal segments 4 and 5 are not contiguous. The antennae are sexually dimorphic, with the basal segment of the male much enlarged and the third segment prolonged dorsoapically, with a short, stout seta on the prolongation. Postantennal and occipital angles are marked. The gular area is raised, and the gular folds present. The thoracic sternal plate has an anterior handle-like prolongation which is as sclerotized as the remainder of the plate and is one-fourth as long as the rest of the plate. Paratergal plates III-VI have the posterior angles barely produced into points; plates III and IV have one of the apical setae longer than the plate, and the remaining setae on plates III-VI are much shorter than the plate. The abdomen has the tergal and sternal plates well developed. The male has one plate and one row of setae ventrally on each of abdominal segments 2 and 3. The male genitalia have the basal plate expanded anteriorly, the parameres are convex, and the pseudopenis is narrowly triangular, but little longer than the parameres and articulated with their tips.

P. wernerii was described from male and female specimens taken from *Pachyuromys duprasi natronensis*, Egypt: Western Desert Governorate, Wadi Natroun.

It has since been taken from *P. duprasi natronensis* from the same area and from the Western Desert Governorate, Bir Victoria.

POLYPLAX GERBILLI FERRIS

(Figs. 25-29)

Polyplax gerbilli, Ferris, 1923, Contributions toward a monograph of the sucking lice, pt. 4, p. 203, figs. 128, 129. Briscoe, 1956; Amer. Midland Nat., vol. 55, p. 403. Johnson, 1960, U.S.D.A. Tech. Bull. 1211, p. 65.

Distinguishing characters: The sensoria of antennal segments 4 and 5 are not contiguous. The antennae are sexually dimorphic; in the male the basal segment is somewhat enlarged and the third segment is prolonged and bears a short, stout, apical seta. Postantennal and occipital angles are present. The gular area is raised and the gular folds are present. The thoracic sternal plate has a handle-like anterior prolongation. Paratergal plates III-VI have both posterior angles produced into lobes, the ventral lobe being much the larger; the apical setae are short, scarcely projecting beyond the apical lobes except that III and IV have one of the apical setae much longer than the plates. The tergal and sternal plates of the abdomen are reduced. The male has one plate and one row of setae ventrally on each of abdominal segments 2 and 3. The basal plate of the male genitalia is somewhat broadened anteriorly, the parameres are convex, the pseudopenis is elongate-triangular, longer than the parameres and articulated with their tips.

P. gerbilli was described from male and female specimens collected from *Gerbillus pyramidum* subsp., Khartoum, Sudan. The holotype is a female.

Egyptian records include the following: From *Gerbillus p. pyramidum*: Asyut Province, Manfalut. Faiyum Province, Fannus, Sinnuris. Giza Province, Abu Rawash and vicinity. Qena Provin-

ce, Isna, Wadi Nassim. From *Gerbillus pyramidum elbaensis*: Southern Desert Governorate, Gebel Elba, Wadi Kansisrob. From *Gerbillus gerbillus* subspp.: Alexandria Governorate, Muntazah, Giza Province, Giza pyramids and Imbaba. Red Sea Governorate, Wadi El Asyuti. Western Desert Governorate, Sidi Barrani and Mersa Matruh. From *Gerbillus (Dipodillus) campestris haymani*: Western Desert Governorate, Siwa Oasis. From *Gerbillus (Dipodillus)* sp.: Western Desert Governorate, near Faiyum.

P. gerbilli is the typical anopluran parasite of *Gerbillus pyramidum*, although it also successfully parasitizes other members of the genus *Gerbillus*.

POLTPLAX PARADOXA JOHNSON

(Figs. 30-32)

Polyplax paradoxa Johnson, 1960, U.S.D.A. Tech. Bull. 1121, p. 72.

Distinguishing characters: (Male unknown). The sensoria of antennal segments 4 and 5 are contiguous. Postantennal and occipital angles are not apparent. The gular area is not raised, and the pair of anteroventral setae on the anteroventral head plate are much longer than the basal segment of the antennae. Paratergal plates III-VI have one of the posterior angles produced into a large lobe; one of the pair of apical setae on plate III is very long, and the apical setae of plates IV-VI are approximately half the length of the corresponding plate. The posteriormost tergal row of setae on the abdomen contains four setae. The abdominal plates are not especially reduced.

This species was described from females only from *Meriones* spp. from the following localities: Western Desert Governorate, near Sidi Barrani. Southern Desert Governorate, Bir Abraq. Sinai Governorate, St. Cathrine's Monastery. Palestine, Wadi Menaich. Cairo Governorate, near Heliopolis.

P. paradoxa and the next two species are very closely related and parasitize related genera of mammals.

POLYPLAX CALURI JOHNSON

(Figs. 33-35)

Polyplax caluri Johnson, 1960, U.S.D.A. Tech. Bull. 1121, p. 74.

Distinguishing characters: (Male Unknown). The sensoria of

antennal segments 4 and 5 are contiguous. The postantennal and occipital angles are not apparent. The gular region is not raised, and the pair of setae on the anteroventral head plate are very short, not longer than the length of the basal antennal segment. Paratergal plates III-VI have one of the posterior angles produced into a subacute lobe; one of the pair of apical setae on plate III is very long, and the apical setae of plates IV-VI are less than one-fourth the length of the plate bearing them. The posteriormost tergal row of the abdomen contains two setae. The abdominal plates are not especially reduced.

P. caluri was described from females only, found on *Sekeetamys calurus*, Egypt: Sinai Governorate, near St. Cathrine's Monastery.

POLYPLAX VACILLATA JOHNSON

(Figs. 36-40)

Polyplax vacillata Johnson, 1960, U.S.D.A. Tech. Bull. 1211, p. 76.

Distinguishing characters: The sensoria of antennal segments 4 and 5 are contiguous. The antennae are slightly sexually dimorphic, the male having an enlarged seta dorsally on each of segments 3 and 4. Postantennal and occipital angles are not marked. The gular region is not raised, and the pair of setae on the anteroventral head plate are longer than the basal antennal segment. Paratergal plates III-VI have neither of the posterior angles especially prolonged; one of the pair of apical setae on plate III is very long; the ventral apical seta on plates IV-VI are almost as long as the plates bearing them, and the dorsal seta is shorter. In the female, the posteriormost tergal row of setae of the abdomen contains three to five setae. The abdominal plates are markedly reduced. The male genitalia have the pseudopenis enclosed within the parameres.

P. vacillata was described from a series of males and females from *Psammomys o. obesus*, Egypt: Western Desert Governorate, 26 miles west of Sidi Barrani, and from Mersa Matruh. The holotype is a female.

POLYPLAX ASIATICA FERRIS

(Figs. 41-45)

Polyplax asiatica Ferris, 1923, Contributions toward a monograph of the sucking lice, pt. 4, p. 233, fig. 152D. Johnson, 1960, U.S.D.A. Tech. Bull. 1211, p. 81.

Distinguishing characters: The sensoria of antennal segments 4 and 5 are contiguous. The antennae are not at all sexually dimorphic. The postantennal and occipital angles are not marked, and the gular area is not raised. Paratergal plates III-VI have one the posterior angles prolonged into an acute lobe; one of the pair of apical setae on plates II and III is very long; the apical setae on plates IV-VI are about as long as the plates bearing them. The female lacks abdominal plates except for one or two very small ones basally and the regular genital plates. The male has the abdominal plates much reduced. The male genitalia have the pseudopenis enclosed within the convex parameres.

The holotype female and allotype male of *P. asiatica* were taken from a shrew, *Crocidura caerulea*, Rangoon, Burma. Also included in the type series were female specimens from *Nesokia indica*, Baluchistan. *Nesokia* is the normal host, the record from the shrew resulting from contamination.

Egyptian records include the following: From *Nesokia indica suilla*: Faiyum Province, Sinnuris and Ezbet Ayub Ali. Beheira Province, Kom El Hanash. Western Desert Governorate, Wadi Natroun.

POLYPLAX BRACHYRRHYNCHA CUMMINGS

(Figs. 46-50)

Polyplax brachyrrhynchus Cummings, 1915, Proc. Zool. Soc. London. (2), p. 246, figs. 1-3. Johnson, 1960, U.S.D.A. Tech. Bull. 1211, p. 81.

Distinguishing characters: The head is long and slender, truncate before the antennae, and with postantennal and occipital angles marked. The postantennal margins are straight and parallel. The sensoria of antennal segments 4 and 5 are large and contiguous. The third antennal segment of the male bears a stout seta

set on an apical prolongation. A very narrow, indistinct thoracic sternal plate is present. The tarsal claws and tibiotarsal segment of the third pair of legs are long and heavily sclerotized, with the tarsus longer than the tibia. The paratergal plates are poorly sclerotized, III-VII have one posterior angle produced into a short point, the apical setae are all longer than the plates bearing them. The male has two plates and two rows of setae on abdominal sternal segments 2 and 3. Dorsally some of the abdominal setae are short, broad and clavate; ventrally the setae are thin. The male genitalia have the pseudopenis enclosed within the parameres. The body is very long and slender.

This species was described from a large number of males and females collected from *Acomys cahirinus*, Asyut, Egypt.

Additional Egyptian records include the following: From *Acomys d. dimidiatus*: Sinai Governorate, St. Cathrine's Monastery and vicinity. From *Acomys dimidiatus hunteri*: Southern Desert Governorate, Gebel Elba and Wadi Gumbait. From *Acomys dimidiatus megalodus*: Red Sea Governorate, Ain Sukhna and Wadi Sayal (North Galala Range). From *Acomys r. russatus*: Sinai Governorate, St. Catherine's Monastery.

It is questionable whether *P. brachyrrhyncha* normally occurs on *Acomys russatus*.

POLYPLAX HOOGSTRAALI JOHNSON

(Figs. 51-56)

Johnson, 1960, U.S.D.A. Tech. Bull. 1211, p. 83.

Distinguishing characters: This species is very closely related to *P. brachyrrhyncha*. The head is longer than broad, truncate anterior to the antennae, and the postantennal and occipital angles are present, though not marked. The postantennal margins are noticeably convex. The sensoria of antennal segments 4 and 5 are large and contiguous. The third antennal segment of the male is prolonged apically, with a short, stout seta set on the prolongation. A narrow thoracic sternal plate is present. The tarsal claw and tibiotarsus of the third pair of legs are enlarged, but the tarsus is no longer than the tibia. The paratergal plates are poorly

sclerotized with neither of the posterior angles of plates III-VII produced into points. In the female one of the apical setae of plates III-V is slightly shorter than the plate bearing it; in the male, plate IV has only one apical seta, not two. Many of the setae of the abdominal dorsum are heavy, but none are definitely clavate. The male genitalia have the parameres enclosing the pseudopenis. The body is rather long and slender.

P. hoogstraali was described from the male holotype, female allotype, and a series of male and female paratypes collected from *Acomys r. russatus*: Egypt: Sinai Governorate, St. Cathrine's Monastery. A small percentage of the paratype specimens were obtained from *A. dimidiatus* from St. Cathrine's Monastery. It is probable that the specimens from *A. dimidiatus* represent either mechanical contaminations or transitory infestations.

POLYPLAX OXYRRHYNCHA CUMMINGS

(Figs. 57-60)

Polyplax oxyrrhynchus Cummings, 1915, Proc. Zool. Soc. London, (2), p. 251, figs. 4-6, 8, 9, 11-13. Johnson; 1960; U.S.D.A. Tech. Bull. 1211, p. 89.

Distinguishing characters: The head is more than twice as long as broad and acutely pointed anterior to the antennae. The antennae are not sexually dimorphic. The thoracic sternal plate is well developed, bluntly pointed posteriorly and with the lateral margins more-or-less parallel. The paratergal plates are long and narrow; the female has one of the posterior angles of plates III-VI produced into a short point, and in both sexes, the pairs of apical setae are as long as the plates bearing them. The abdominal plates are well developed; the male has two plates and two rows of setae on abdominal sterna 2 and 3. None of the dorsal abdominal setae are very heavy and short. The male genitalia have the pseudopenis enclosed by the parameres. The body is long and slender.

P. oxyrrhyncha was described from a long series of males and females from *Acomys cahirinus*, Asyut, Egypt.

Additional Egyptian records are as follows: From *Acomys d. dimidiatus*: Sinai Governorate, Wadi Feiran and St. Cathrine's

Monastery. From *Acomys dimidiatus hunteri*: Southern Desert Governorate, Bir Abra, Gebel Elba, and Wadi Kansisrob. From *Acomys r. russatus*: Sinai Governorate, Wadi El Sheikh, near St. Cathrine's Monastery.

It is possible that the single specimen taken from *A. russatus* represents an abnormal occurrence. *P. oxyrrhyncha* normally occurs with *P. brachyrrhyncha* on the same host animal.

POLYPLAX KAISERI JOHNSON

(Figs. 61-65)

Polyplax kaiseri Johnson, 1960, U.S.D.A. Tech. Bull. 1211, p. 93.

Distinguishing characters: The head is short and broad, with postantennal and occipital angles present but not marked. The sensoria of antennal segments 4 and 5 are small and widely separated. The basal antennal segment of the male is enlarged and the third segment prolonged apically and bearing a short, stout, apical seta. The thoracic sternal plate is roughly triangular, and at times it has a membranous anterior extension. Paratergal plates III-VI have the posterior angles only slightly produced into points, and the pairs of apical setae are very short. The abdominal plates are not reduced, and the male has two plates and two rows of setae on sternal abdominal segments 2 and 3. The male genitalia have the pseudopenis enclosed by the parameres.

The holotype female and allotype male were taken from *Gerbillus (Gerbillus) gerbillus*, Egypt: Eastern Desert, Wadi El Asyuti. Paratypes were taken from the same locality and host and from *Gerbillus (G.) g. gerbillus*, *Gerbillus (Dipodillus)* spp. *G. (D.) dasyrus*, *G. (D.) campestris* subsp. and *Gerbillus p. pyramidum*, from various localities in Egypt, Palestine, Libya and Morocco.

Only nine of the 150 specimens reported in the original description were males. *P. kaiseri* is a normal parasite of both *Gerbillus (G.) gerbillus* and *Gerbillus (Dipodillus)* species. The records from *Gerbillus pyramidum* may represent straggling.

GENUS EULINOGNATHUS CUMMINGS

Eulinognathus Cummings, 1916, Ann. and Mag. Nat. Hist., 8 s. (97), vol. 17, p. 90.

Bathyergicola Bedford, 1929, 15. Ann. Rep. Director Vet. Serv., Dept. Agric. Union South Africa, vol. 1, p. 505 (type: *Bathyergicola hilli* Bedford). Ferris, 1952, Contributions toward a monograph of the sucking lice, pt. 5, p. 311.

Eulinognathus, Ferris, loc. cit., p. 318. Ferris, 1951, The sucking lice, p. 169 (sinks *Bathyergicola*).

Type species of genus: *Eulinognathus denticulatus* Cummings, by orig. design.

Description: The antennae are 5-segmented and not sexually dimorphic in the Egyptian species. Often tubercles are present on the venter of the first antennal segment and dorsally and/or ventrally on the head (fig. 66). The thoracic sternal plate is at times lacking, if present, it is not marginally separate from the thoracic integument. The pronotum is lacking. Relative sizes of the pairs of legs are variable; the Egyptian species have the first pair small, and the second and third pairs much larger and subequal. Spiracles are present on abdominal segments 3-7 or 3-8 (3-7 in the Egyptian species). Paratergal plates are present on at least segments 3-6, usually 2-6 sometimes 2-7 (2-6 in the Egyptian species). Males have one row of setae on each abdominal segment both dorsally and ventrally except the second dorsal segment which may have two rows. Females have one to two rows on these segments. Well defined tergal and sternal abdominal plates are lacking.

Eleven species are known from Asia, Africa and South America. Two of the seven African species occur in Egypt on jerboas.

KEY TO SPECIES OF *EULINOGNATHUS*
FOUND IN EGYPT

1. Thoracic sternal plate of irregular shape, elongate triangular or merely a thin rod; ventrally with only one seta laterally beside paratergites III-VI (fig. 66), on *Jaculus* *aculeatus*
Thoracic sternal plate diamond-shaped; ventrally with two to three setae in each lateral group beside paratergites III-VI (fig. 70), on *Allactaga* *hesperius*

EULINOGNATHUS ACULEATUS (NEUMANN)

(Figs. 66-69)

Haematopinus (Pölyplax) aculeatus Neumann, 1912, Bull. Soc. Zool. France, vol. 37, p. 143, figs. 5, 6.

Eulinognathus aculeatus, Johnson, 1957, J. Egyptian Pub. Hlth. Assoc. vol. 32, p. 275, figs. 1, 2, 7, 11; 13. Johnson; 1960; U.S.D.A. Tech. Bull. 1211, p. 101

Distinguishing characters: The head has small hook-like tubercles anteroventrally and the first antennal segment has tubercles ventrally and dorsally. The thoracic sternal plate is much reduced, narrowly rectangular or elongate-diamond-shaped. Paratergal plates are present on segments 2-6; spiracles are present on segments 3-7. The female has two rows of setae on each typical abdominal segment both dorsally and ventrally; ventrally these rows are interrupted laterally so that there is one isolated seta beside each of paratergal plates III-VI. The male has one row of setae on each of the abdominal segments except that segment 2 has two rows dorsally; and as in the female, there is one isolated seta beside each of paratergal plates III-VI ventrally.

The type specimens of *E. aculeatus* were taken from «*Dipus*» (a species of *Jaculus*) from Djerba, Tunisia.

Egyptian records include the following: From *Jaculus jaculus elbaensis*: Southern Desert Governorate, Wadi Na'am and Bir Abraq. From *Jaculus j. jaculus*: Giza Province, Beni Salama, Imbaba. Qena Province, Isna, Wadi Nassim. Asyut Province, Manfalut. From *Jaculus o. orientalis*: Western Desert Governorate, Mersa Matruh and Burg el Arab.

EULINOGNATHUS HESPERIUS JOHNSON

(Figs. 70-73)

Eulinognathus hesperius Johnson, 1957, J. Egyptian Pub. Hlth. Assoc., vol. 32, p. 280, figs. 5, 6, 8, 10, 15.

Distinguishing characters: This species is like *E. aculeatus* except as follows: The thoracic sternal plate is well defined and square in shape. The abdominal rows contain more setae, and the ventral lateral groups of setae next to paratergal plates III-

VI contain two to four setae in the female and two to three setae in the male.

This species was described from the holotype male, allotype female and several male and female paratypes collected from *Al-lactaga tetradactyla*, Egypt: Western Desert Governorate, Burg el Arab. It has not been reported subsequently.

APPENDIX

I. AN EXPLANATION OF MORPHOLOGICAL TERMS USED IN THIS PAPER

The parts listed below will be found labelled on figures 12, 13, 14, 32, 49.:

1. Anteroventral head plate (AV.P.). This plate is found in many species of Anoplura. If present, it delimits, roughly the gular area (see No. 4).
2. Basal plate of the male genitalia (B.P.). The basal apodeme of the aedeagus.
3. Coxa (C.). The basal segment of the leg; which is flattened and closely attached to the body wall and probably not movable.
4. Gular area (GU.). The median portion of the venter of the head. It may at times be raised above the level of the remainder of the head venter, and limited by the gular folds (see No. 5), or if not elevated, its general position is often marked by the anteroventral head plate (see No. 1).
5. Gular fold (GU.F.). Ventral folds which begin medially at the juncture of the head and thorax, then diverge to run diagonally on each side to the base of the antennae (see No. 4).
6. Occiput (O.). The posteriormost dorsal part of the head. It is often constricted and bounded anteriorly on both sides by the occipital angles.
7. Occipital angles (O.A.). See No. 6.
8. Parameres of the male genitalia (P.). The lateral, paired, aedeagal sclerites which have their bases articulating with

the basal plate of the aedeagus. The parameres either enclose the pseudopenis (see no. 12) or the pseudopenis articulates with their tips.

9. Paratergal plates (II, III, etc.). Small sclerites present on each side on some or all of abdominal segments 2-8. The spiracles open medially on these plates.
10. Postantennal angles (P.A.A.). The lateral angles just posterior to the bases of the antennae on each side of the head.
11. Pronotum (PRN.). This sclerite, if present, is reduced to a small, narrow plate just posterior to the posterior apex of the head.
12. Pseudopenis of the male genitalia (PSP.). The unpaired, median sclerite of the aedeagus which either lies between the parameres (see No. 8), or is articulated with their tips.
13. Sensoria of the antennae (SN.). Sensory areas found posterodorsally on the fourth and fifth antennal segments.
14. Spiracle (SPR.). Pairs of spiracles are present dorsolaterally on the mesothorax and laterally on some or all of abdominal segments 3-8. If paratergal plate are present (see No. 9), the spiracles open on the plates.
15. Sternal plates of the abdomen (ST.P.). The transverse ventral abdominal plates. They differ in number per segment and in development according to the species or genera involved. A row of setae is usually present of the posterior margin of each plate. The sternal plates of segments 7, 8, and 9 may be partially or completely fused.
16. Tarsal claw (T.C.).
17. Tergal plates of the abdomen (T.PL.). The transverse dorsal abdominal plates. They differ in number per segment as do the sternal plates (see No. 15).
18. Thoracic sternal plate (TH.P.). The median ventral plate of the thorax. At times this plate is missing or is merely a somewhat more heavily sclerotized area on the thorax. Usually it is well sclerotized and the margins are partially free from the body wall.
19. Tibiotarsus (T.T.). The semi-fused tibia and tarsus. A line of division between these two segments is commonly present on the ventral side, but there is seldom any indication of a divi-

sion dorsally. The ventral apical angle of the tibia is usually produced to form a thumb-like structure opposing the tarsal claw.

II. THE PREPARATION OF ANOPLURA FOR STUDY

Freshly collected Anoplura should be placed in a vial containing 70 to 80 percent alcohol (preferably ethyl alcohol). Formalin should not be used since it fixes the tissues and the specimens cannot be cleared. A collection label should be placed in the vial with the lice, and must include the collection number. It is desirable also to include the date, collector, locality of collection and host (if determinable), on this label. The lice from a single host should be placed in a single vial to prevent mixing of specimens from different host species. Great care should be taken with all implements used in collecting the lice, so that mechanical contamination of collections with specimens not belonging to these collections will not occur. Anoplura without host data are of very limited value. Because of this, it is suggested that the host animals be determined by a competent mammalogist.

Since Anoplura are relatively soft-bodied insects, they are not easy to mount without distortion of the parts. The method given below has given consistently good results in the hands of a practiced technician.

1. Puncture the specimens on the ventral side of the abdomen using a fine needle. Place them in a 10 percent solution of potassium hydroxide, heat, but never boil, until the body contents may be gently pressed out with a curved needle.

2. Place the specimens in a cell slide of 10 percent acetic acid solution for at least one-half hour. They may be left safely overnight.

3. Transfer to acid fuchsin stain. Use about 3 drops of stain to a cell slide and fill the cell with distilled water. The time required for staining specimens varies. Leave the specimens in the stain until the legs are evenly stained. (This step may be omitted if the specimens are heavily sclerotized and dark in color).

4. Transfer the specimens to 95 percent ethyl alcohol. Ave-

rage specimens should be left in the solution for 15 minutes, but larger specimens take longer and it is preferable to use a change of alcohol for a second 15 minute period. While the specimens are in alcohol, remove any particles of dirt or body contents that were not seen before staining.

5. Place the specimens in clove oil for clearing, from one to five minutes, never longer.

6. Mount in balsam. A male and a female specimen may be placed on one slide *if* confident they are of the same species. Anoplura may be mounted either dorsally or ventrally, but if only a few specimens are available it is preferable to mount them ventral surface up. If a long series is available, mount some specimens ventrally and some dorsally. Specimens should be oriented so that the head points downward (toward the technician), so that when studied with a compound microscope, the specimens will have the head pointing away from the investigator.

7. Use two labels, one on each side of the slide. One label should be used for the name of the louse, and the other label for the collection data. Collection data placed on this label should include the following; catalogue number, scientific name of the host, locality of collection, date of collection, and the name of the collector.

Another mounting technique for Anoplura has recently been given us by Dr. T. Clay of the British Museum (Natural History). It is as follows:

1. Place specimens in cold KOH for about 24 hours.

2. Remove to water for about one hour. At this point, carefully puncture the abdomen ventrally, just posterior to the thorax, and press body contents out with a flattened needle.

3. Place specimens in 40% ethyl alcohol plus a few drops of carbol fuchsin (do not overstain) for about one hour.

4. Place specimens in 80% ethyl alcohol for half an hour and then in 96% ethyl alcohol for half an hour.

5. Remove to clove oil for about 2 hours (but no longer).

Note: clove oil does not harden specimens too badly.

6. Mount in Canada balsam.

SUMMARY

In consequence of recent host-ectoparasite investigations by the Medical Zoology Department of NAMRU-3, the present study has resulted in raising the number of sucking lice (Anoplura) of rodents known from Egypt from 4 to 16, of which 7 have been described as new. Included in this report are keys, illustrations, and structural characters for identifying each species, as well as host and distribution records, literature references, an illustrated guide to anopluran terminology, and suggestions for preparing specimens for study.

Rodent-infesting Anoplura now known from Egypt are the following:

- Hoplopleura capitosa* Johnson, 1960 (from *Mus*)
Polyplax spinulosa (Burmeister, 1839) (from *Rattus*)
Polyplax serrata (Burmeister, 1839) (from laboratory mice)
Polyplax abyssinica Ferris, 1923 (from *Arvicanthis*)
Polyplax weneri (Glinkiewicz, 1907) (from *Pachyuromys*)
Polyplax gerbilli Ferris, 1923 (from *Gerbillus* spp.)
Polyplax paradoxa Johnson, 1960 (from *Meriones* spp.)
Polyplax caluri Johnson, 1960, (from *Sekeetamys*)
Polyplax vacillata Johnson, 1960 (from *Psammomys*)
Polyplax asiatica Ferris, 1923 (from *Nesokia*)
Polyplax brachyrrhyncha Cummings, 1915 (from *Acomys dimidiatus*)
Polyplax hoogstraali Johnson, 1960 (from *Acomys r. russatus*)
Polyplax oxyrrhyncha Cummings, 1915 (from *Acomys dimidiatus*)
Polyplax kaiseri Johnson, 1960 (from *Gerbillus* spp.)
Eulinognathus aculeatus (Neumann, 1912) (from *Jaculus* spp.)
Eulinognathus hesperus Johnson, 1957 (from *Allactaga*).

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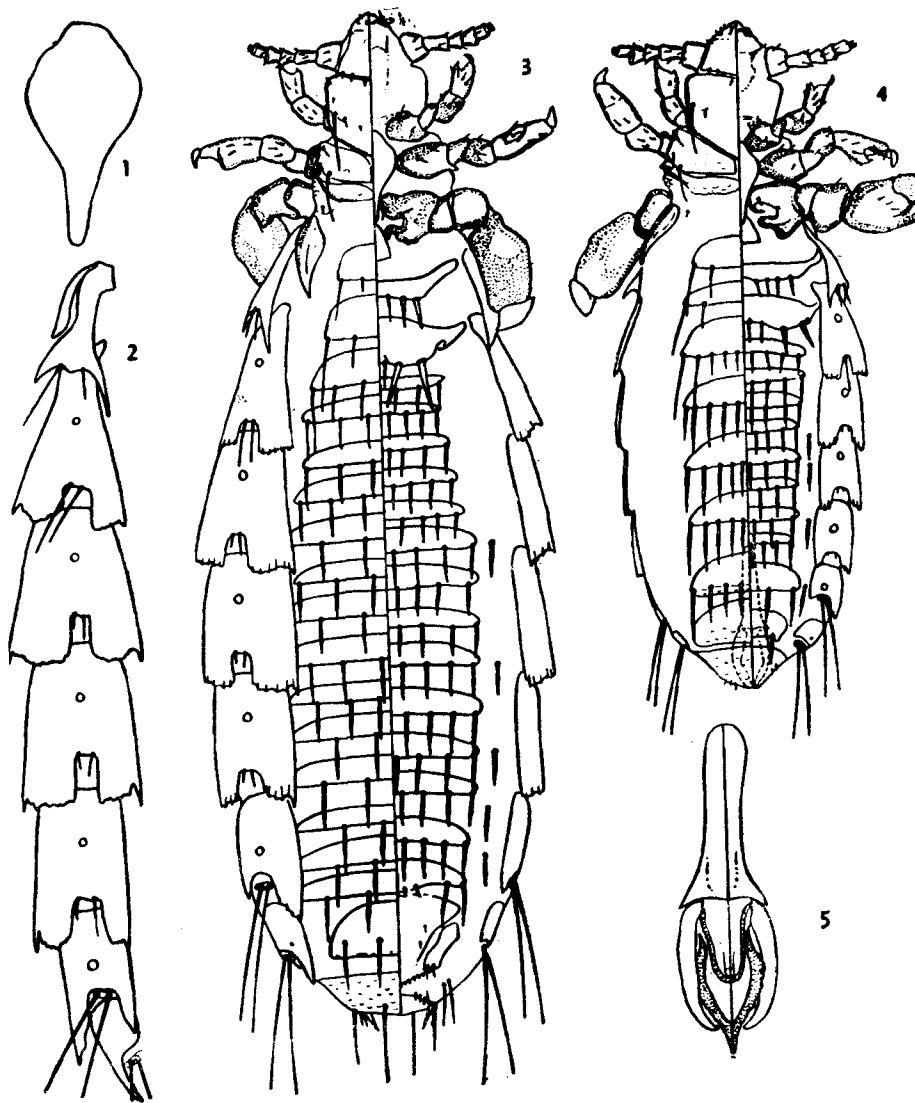
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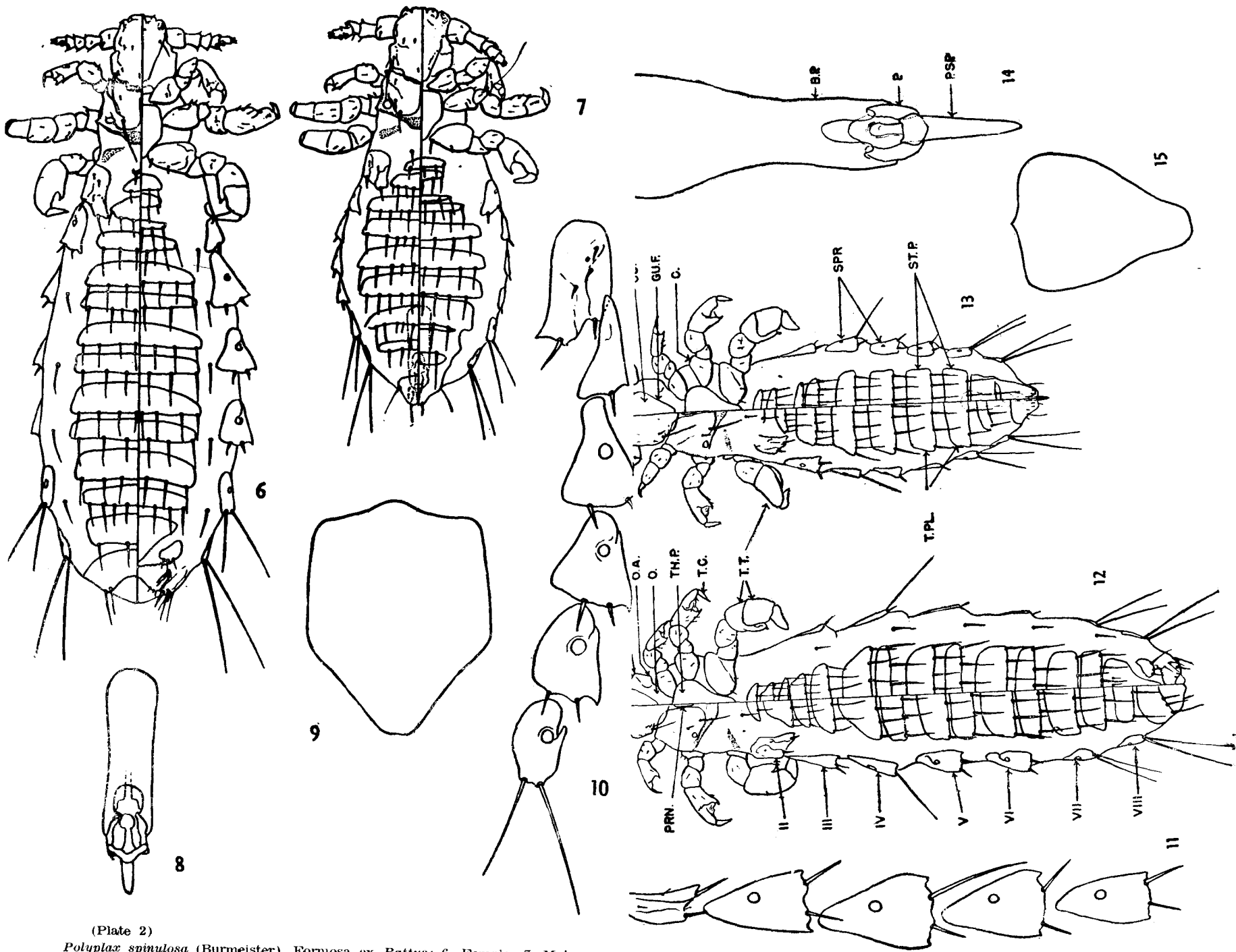
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(Plate 1)

Hoplopleura captiosa Johnson, holotype female, allotype male. 1, Thoracic sternal plate, holotype. 2, Paratergal plates, holotype. 3, Female. 4, Male: 5, Male genitalia.

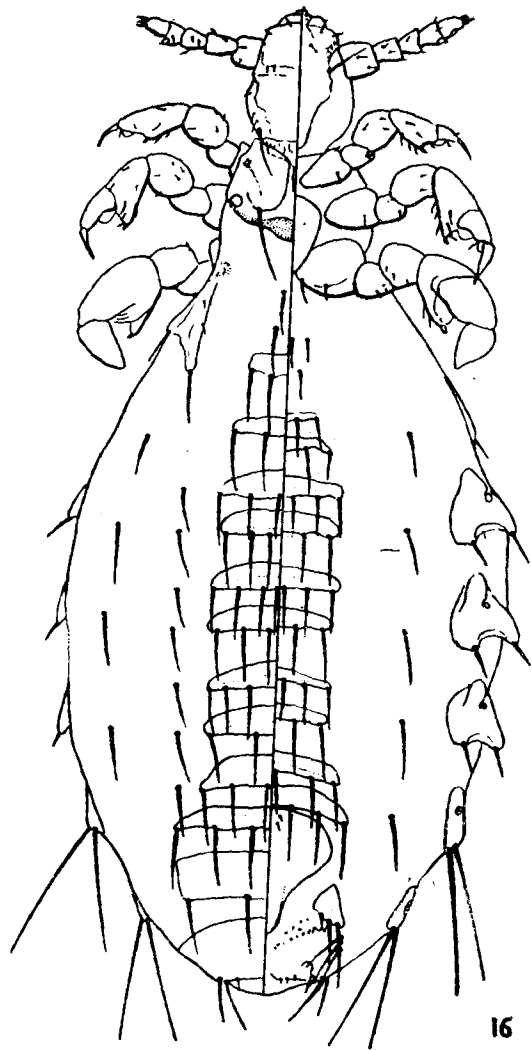


(Plate 2)

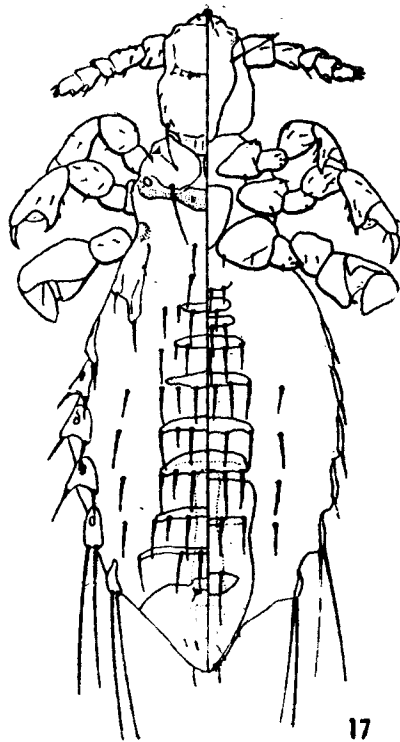
Polyplax spinulosa (Burmeister), Formosa ex *Rattus*: 6, Female. 7, Male. 8, Male genitalia. 9, Thoracic sternal plate, female. 10, Paratergal plates II-VII, female.

(Plate 3)

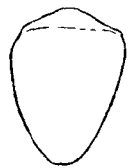
Polyplax serrata (Burmeister), Korea ex *Apodemus*: 11, Paratergal plates II-VI, female. 12, Female. 13, Male genitalia. 15, Thoracic sternal plate, female.



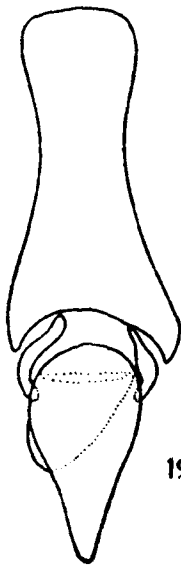
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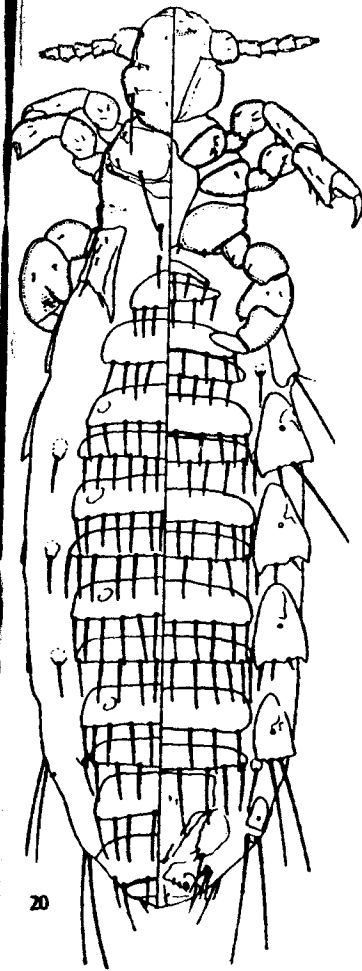
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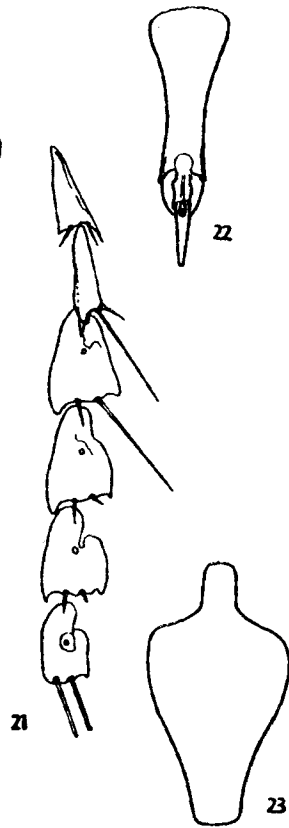
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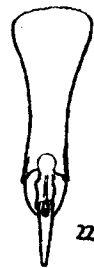
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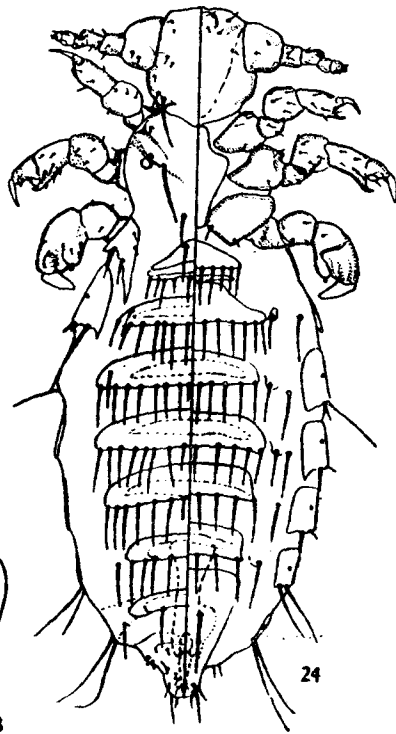
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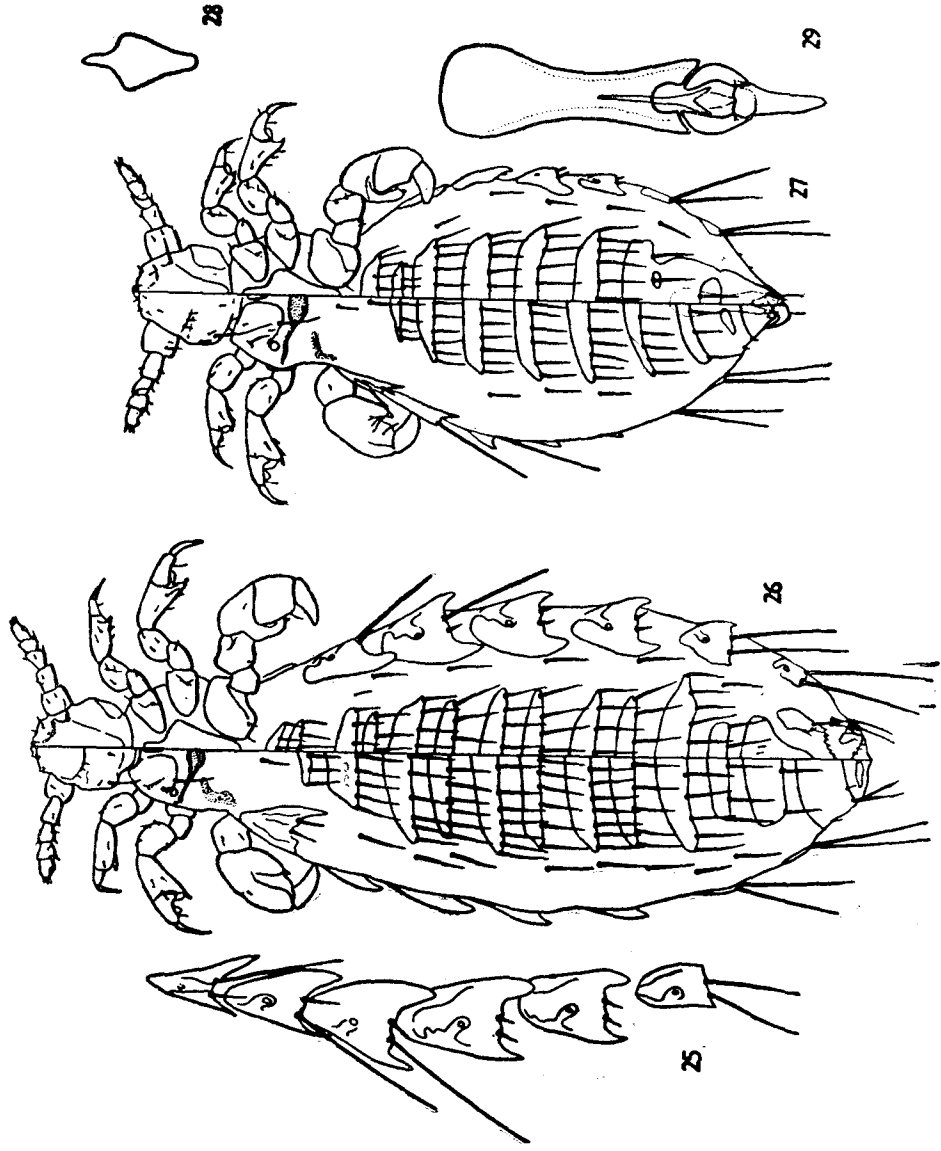
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(Plate 5)

Poitypiax weneri (Glink.), Egypt ex *Pachyuromys*: 20, Female. 21, Paratergal plates II-VII, female. 22, Male genitalia. 23, Thoracic sternal plate, female. 24, Male.

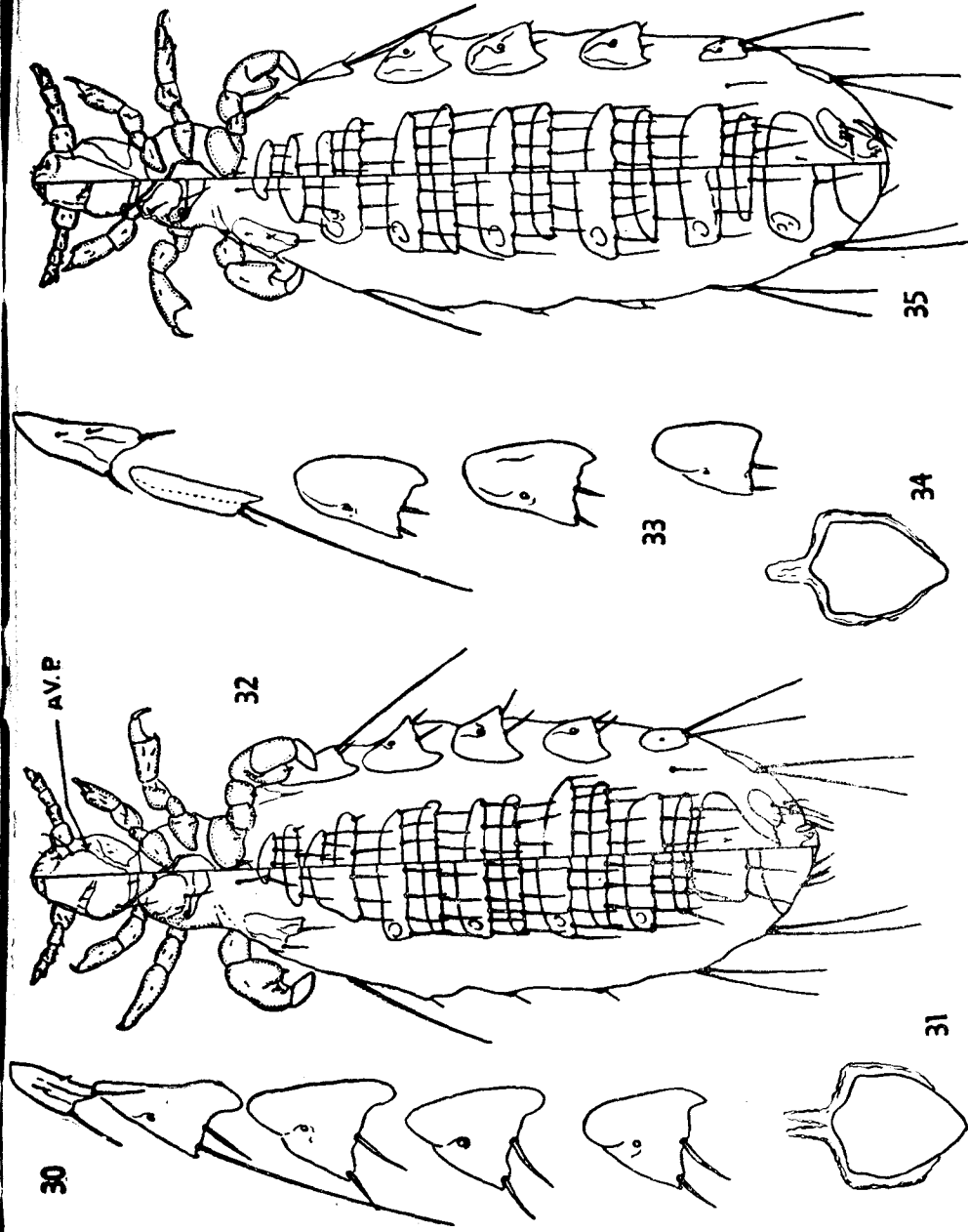
(Plate 4)

Polyplax abussinica Ferris, Egypt ex *Arvicantis*: 16, Female. 17, Male.



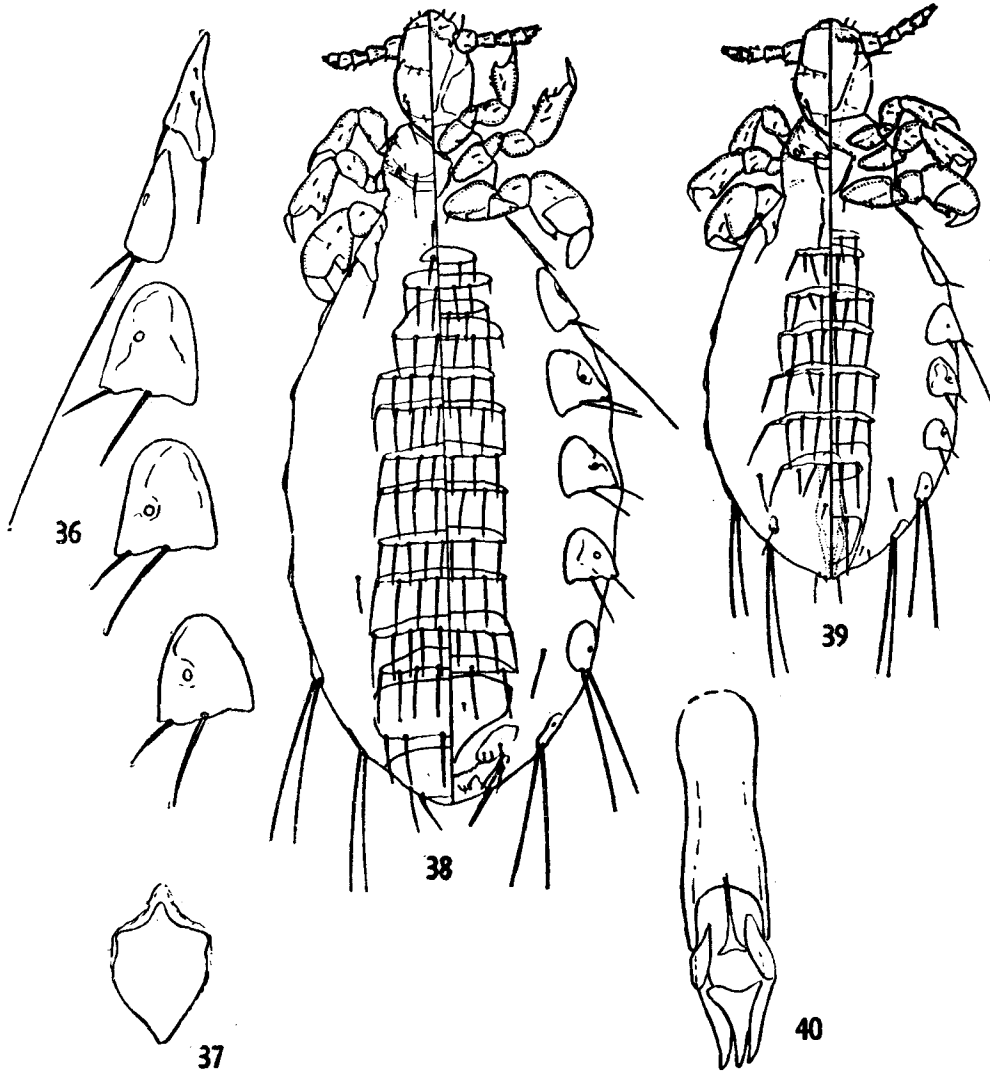
(Plate 6)

Polypterus gerbilli Ferris, Egypt ex *Gerbillus*, 25, Paratergal plates, female, 26, Female, 27, Male, 28, Thoracic sternal plate, female, 29, Male genitalia.



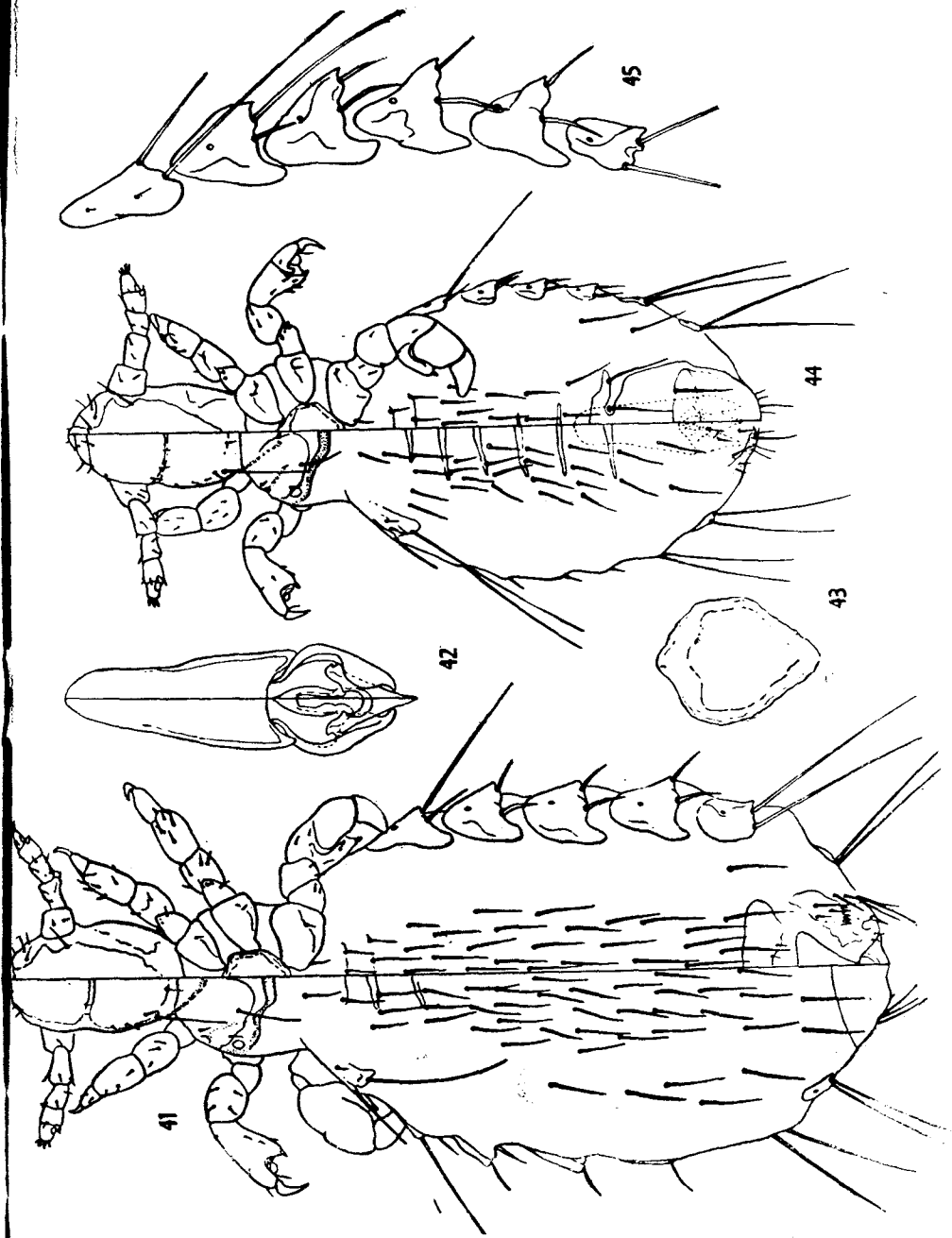
(Plate 7)

Polypterus paradoma Johnson, holotype female, 30, Paratergal plates II-VI, 31, Thoracic sternal plate, 32, Female, 33, Paratergal plates II-VI, 34, Paratergal plates II-VI, 35, Female.



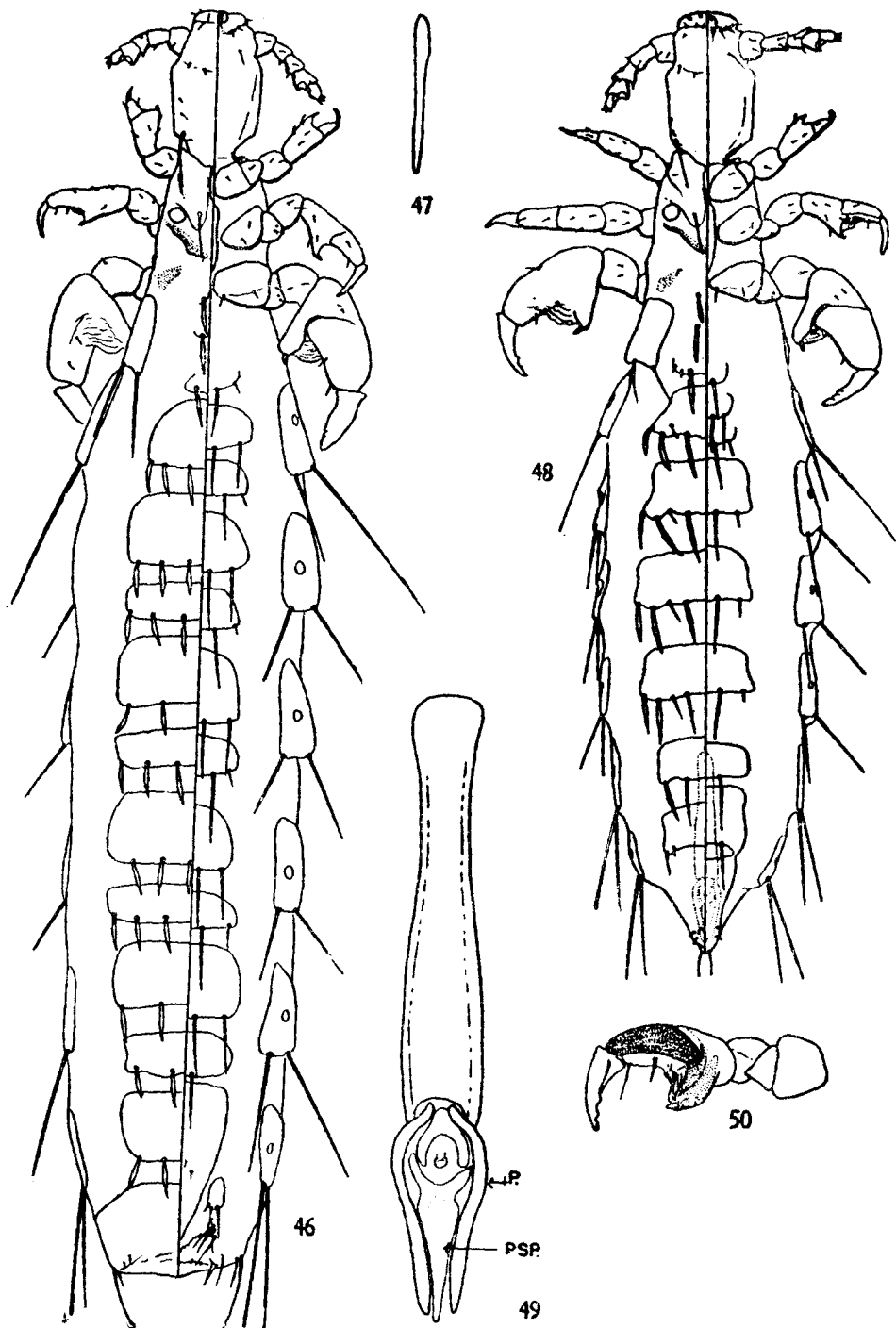
(Plate 8)

Polypiax vacillata Johnson, holotype female, allotype male: 36, Paratergal plates II-VI, female 37, Thoracic sternal plate, female. 38, Female. 39, Male. 40, Male genitalia.

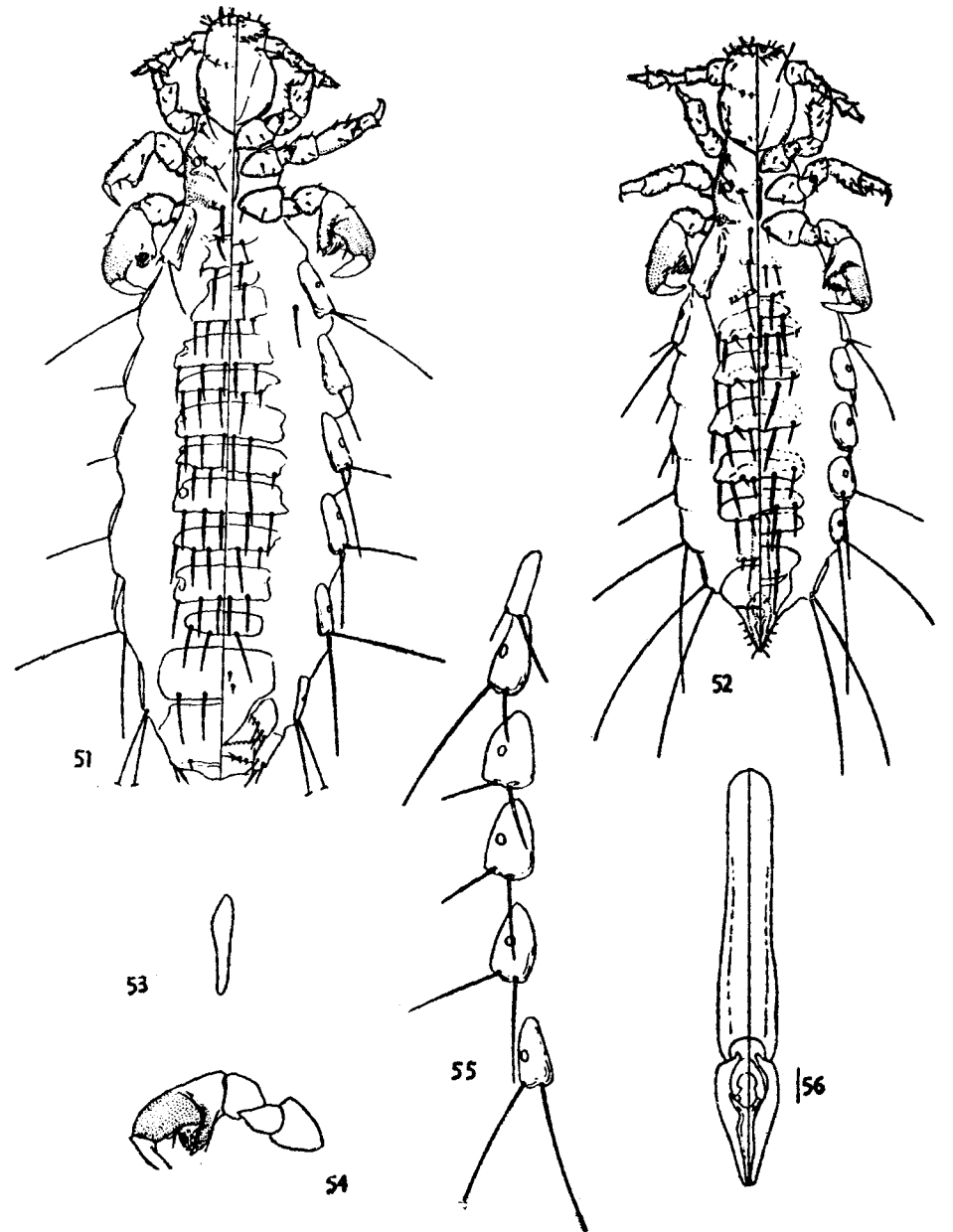


(Plate 9)

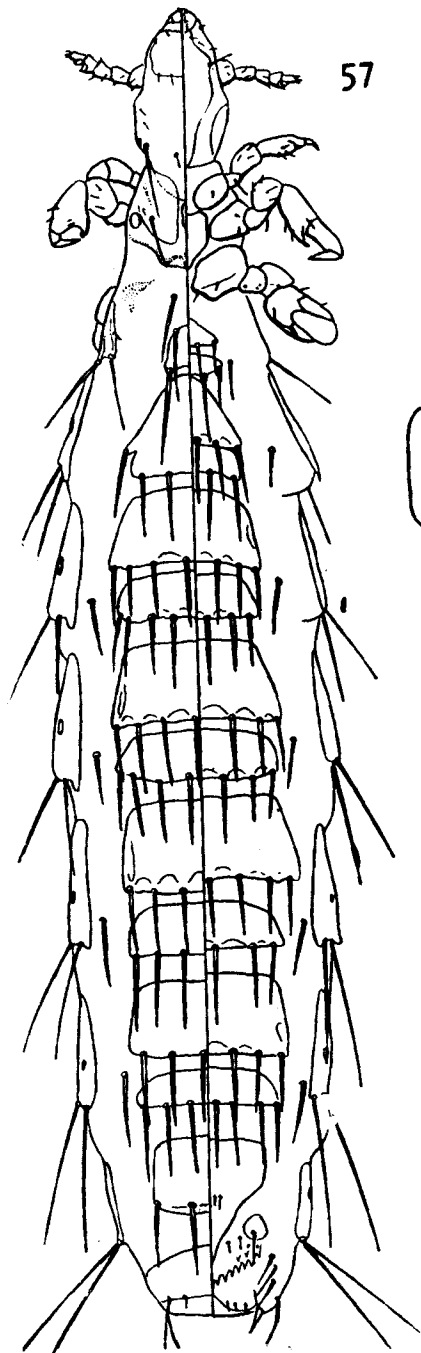
Polypiax asiatica Ferris, Egypt ex Nesokia. 41, Female. 42, Male genitalia. 43, Thoracic sternal plate, female. 44, Male. 45, Paratergal plates II-VII, female.



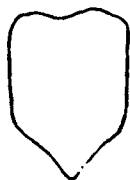
(Plate 10)
Polyplax brachyrrhyncha Cumings, Egypt ex *Acomys*: 46, Female; 47, Male; 48, Female; 49, Genitalia; 50, Tibiotarsus of third leg.



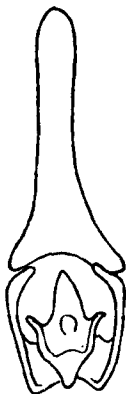
(Plate 11)
Polyplax hoogstraali Johnson, holotype male, allotype female. 51, Female; 52, Male; 53, Thoracic sternal plate, female; 54, Tibiotarsus of third leg; 55, Paratergal plates II-VII, female; 56, Male genitalia.



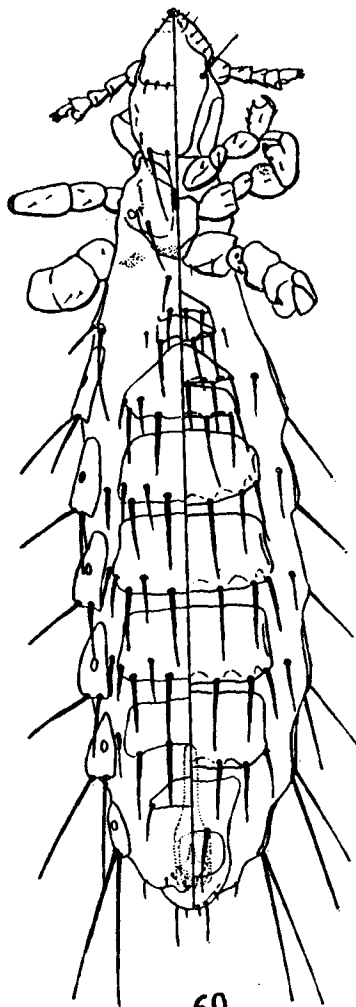
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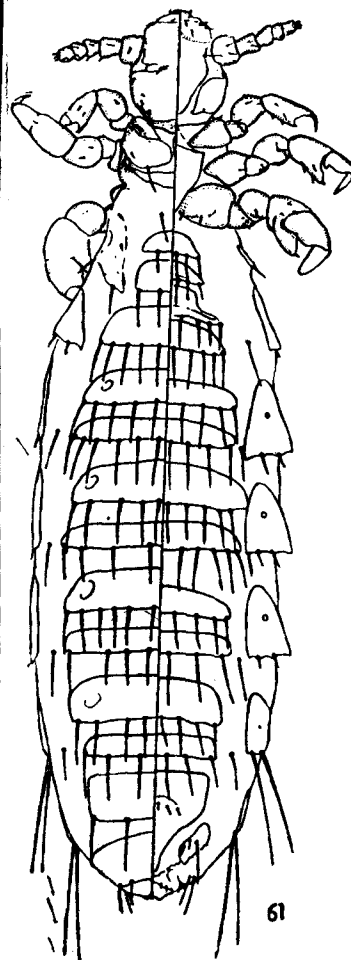
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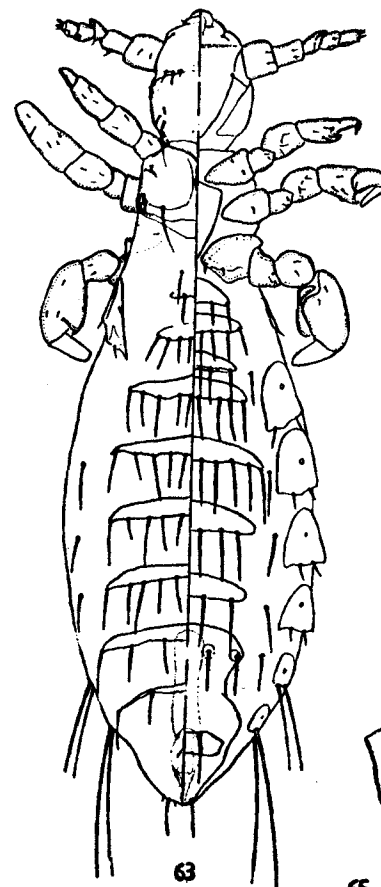
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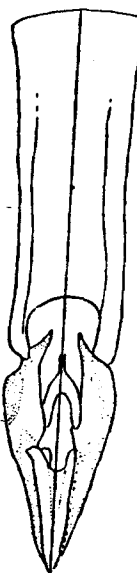
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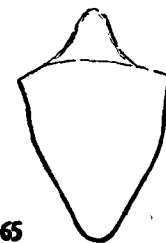
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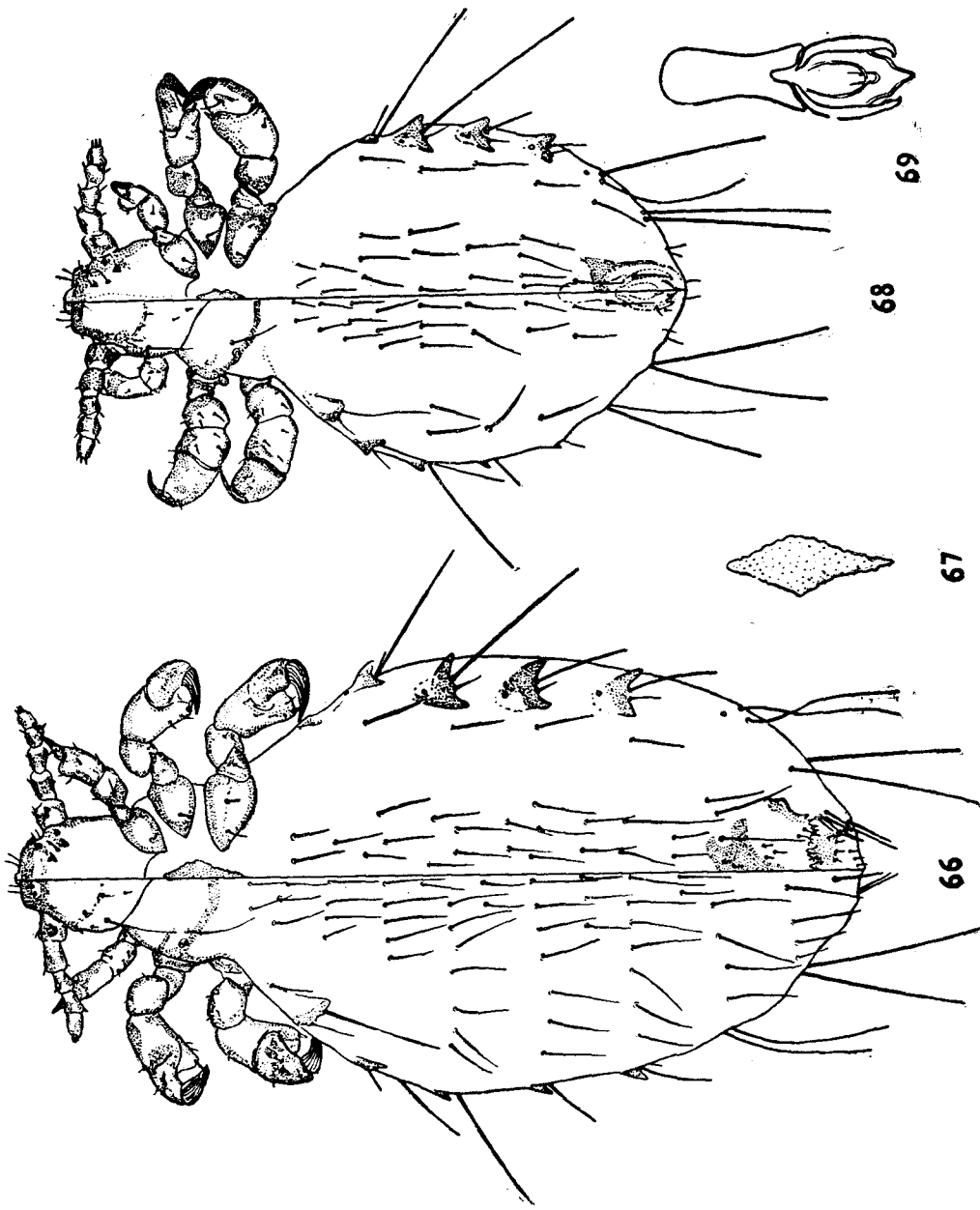
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(Plate 13)

Polyplax kaiseri (Johnson, holotype female, paratype female, allotype male.
61, Holotype female. 62, Paratergal plates II-VII, paratype female. 63, Male.
64, Male genitalia. 65, Thoracic sternal plate, paratype female.

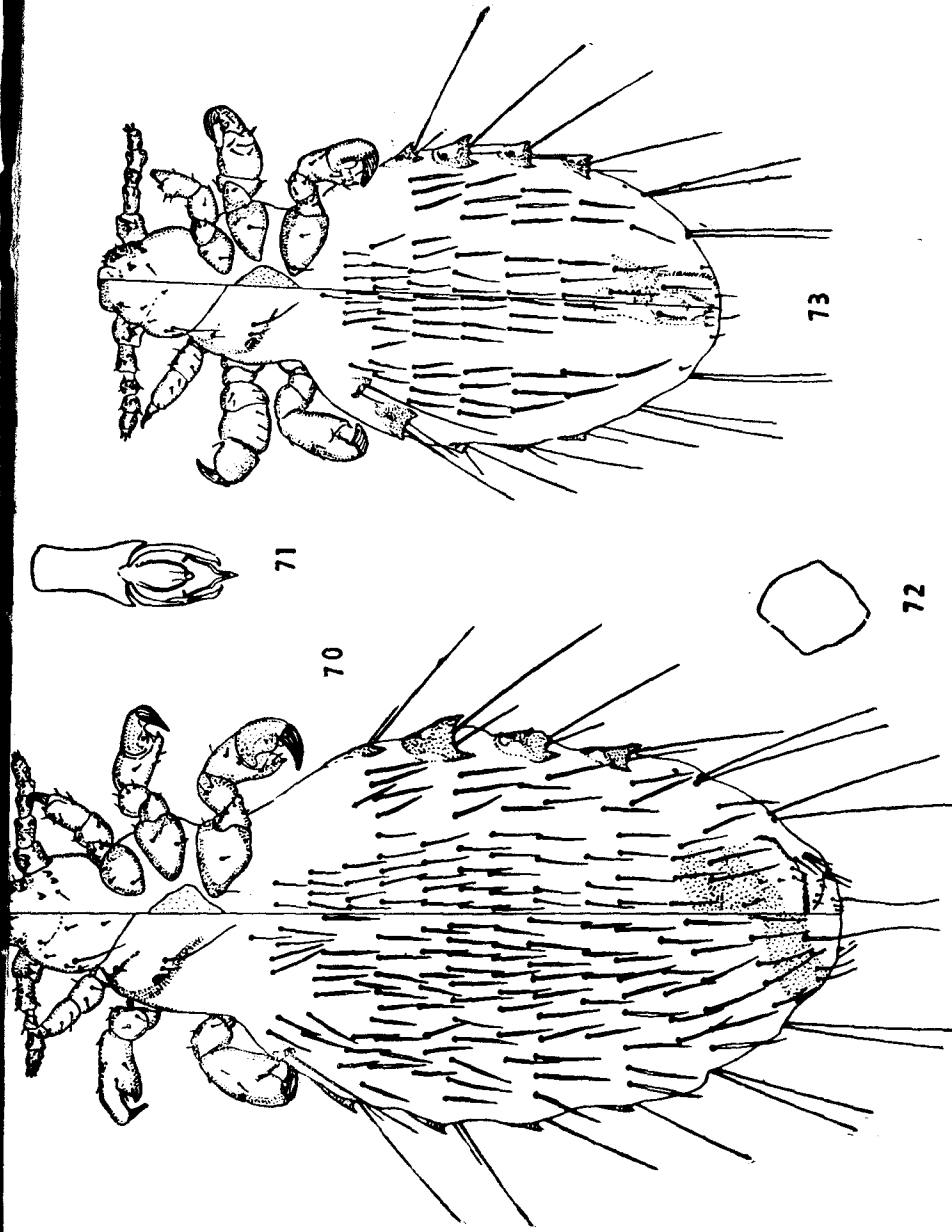
(Plate 12)

Polyplax oxyrrhyncha Cummings, Egypt ex *Acomys*: 57, Female. 58, Thoracic sternal plate, female. 59, Male genitalia. 60, Male.



(Plate 14)

Eulimnathus aculeatus (Neumann). Egypt ex *Jaculus*. 66, Female. 67, Detail of sternal plate, female. 68, Male. 69, Male genitalia.



(Plate 15)

Eulimnathus hesperius Johnson, holotype male, allotype female. 70, Female. 71, Male genitalia. 72, Thoracic sternal plate, female. 73, Male.

