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THE RODENT-INFESTING ANOPLURA (SUCKING LICE) OF THAILAND, WITH REMARKS ON SOME RELATED SPECIES

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During 1952-55, Robert E. Elbel, Malaria Control Adviser in the North Eastern Provinces, conducted wild-mammal- and bird-ectoparasite surveys for the U.S. Operations Missions to Thailand, International Cooperation Administration. This first such comprehensive survey in Thailand has proved to be a major contribution to mammalogy, ornithology, and entomology. Mr. Elbel's collections are the result of one of the first wholehearted attempts to sample populations of a large and representative percentage of the rodent and rodent-ectoparasite species native to Southern Asia, and have therefore provided medical entomology with valuable and unique information on this area of the world.

The present paper is an account of the Anoplura collected by Mr. Elbel and his associates, and of a collection made by D. C. and E. B. Thurman in northeastern Thailand. Of the 18 species represented, 8 are new.² To date only 4 species of Anoplura have been recorded from Thailand. Of these 4, only 1 was not included in Mr. Elbel's collections (*Hoplopleura pectinata* Cummings from *Rattus surifer*, Trong, Lower Thailand).

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² One of the new species collected during the survey will be described in another paper, and is not mentioned here.

I am indebted to Mr. Elbel for submitting the Thai Anoplura collection for study and deposit in the collections of the U.S. National Museum. Ernestine B. Thurman and the late D. C. Thurman, Jr., kindly donated their collections of Thai Anoplura, which have served as a valuable supplement to Mr. Elbel's collections.

As dictated by the distribution of its hosts, the Thai anopluran fauna is mainly attributable to the Oriental Region, but contains elements from the Palaearctic and Australian Regions as well. One of the species, *Polyplax spinulosa* (Burmeister), has a cosmopolitan distribution on *Rattus* species.

Probably at least half the species of rodent-infesting Anoplura in Thailand have now been collected. The Anoplura of the primates and ungulates in Thailand remain completely unknown, and those from all the surrounding areas are very poorly known.

The description of a new species of *Neohaematopinus* taken from a flying squirrel from Borneo is included in this paper because this species is very closely allied to one taken from Thai flying squirrels. I am indebted to Lt. Col. Robert Traub, M.S.C., U.S. Army, for donating the specimens from Borneo.

David H. Johnson, curator of mammals, U.S. National Museum, determined the hosts reported in this paper. Skins and skulls of these mammals are in the collections of the Division of Mammals. I wish to thank Dr. Johnson for his very necessary and helpful cooperation.

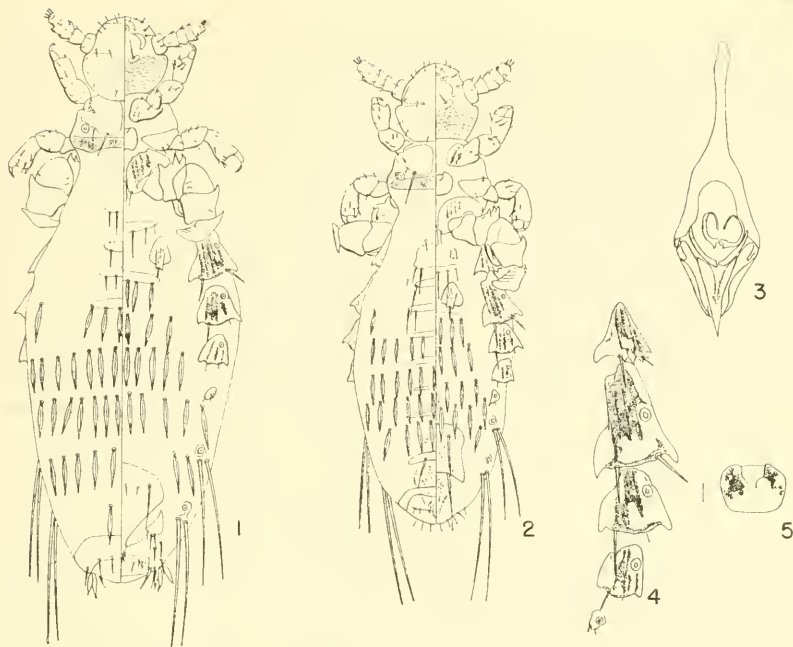
Unless otherwise indicated, all the specimens reported are from Thailand. If there are only two elements in a locality name, they represent the province and the village (Ban) or mountain. If three or more elements are included, they represent the province, the district (Muang), and the village or subvillage or mountain. Provincial names are given in small capital letters. Transliteration of the names follows the U.S. Army Gazetteer for Thailand (1944) with emendations by H. G. Deignan.

Collector's names (Elbel and his associates) have been omitted except in data pertaining to the holotype of each of the new species. Individuals and organizations who cooperated with Mr. Elbel in obtaining the material were: Boonsong Lekagul and H. G. Deignan; and the Banpong Plague Laboratory, the Khorat Plague Laboratory, and the Nakhon Sawan Plague Laboratory.

Enderleinellus corrugatus, new species

FIGURES 1-5

TYPE DATA: Holotype male from *Tamiops maccllellandi*, CHAIYAPHUM: Phukhieo, Ban Kaeng, Ban Lat, January 16, 1952, RE-355,



FIGURES 1-5.—*Enderleinellus corrugatus*, new species: 1, Paratype ♀; 2, Holotype ♂; 3, Genitalia, holotype ♂; 4, Paratergal plates II-VI, paratype ♀; 5, Thoracic sternal plate, holotype ♂.

R. E. Elbel, collector. One paratype female from *Tamiops macclellandi*, CHIENGMAI: Chiengmai, Ban Den, February 6, 1952, D. C. and E. B. Thurman collectors.

Holotype deposited in the collections of the U.S. National Museum, type-catalog No. 64381.

DIAGNOSIS: *E. corrugatus* is close to *E. malaysianus* Ferris and *E. dremomydis* Ferris. The thoracic sternal plate and male genitalia are much like those of *malaysianus*. It is easily distinguished from *malaysianus* in that paratergal plates II-V are heavily ridged and the spiracles are not particularly enlarged. *E. corrugatus* has the head almost as broad as long but not noticeably longer, and has spiracles on abdominal segments 3-8, not 3-5 as does *malaysianus*. In *corrugatus*, large distinct paratergal plates are present on segments 2-5, a very small plate is present on segment 6, and areas of sclerotization occur around the spiracles on segments 7 and 8. *E. malaysianus* completely lacks plates on segments 6-8. *E. corrugatus* is distinct from *E. dremomydis*, which has paratergal plates on segments 2-6, in that *dremomydis* lacks rugosities on these plates, has the plates differently shaped, and has different setation.

DESCRIPTION: Male: Head almost as broad as long; with marked postantennal angles; lateral margins slightly convergent posteriorly; broadly rounded anteriorly; venter very scaly; rostrum opening ventrally; antennae set well back from anterior head margin; segments of antennae distinct and as broad or broader than long. Thorax about as long as head; sternal plate oval, heavily sclerotized laterally. Legs with first and second pairs with well-developed tarsal thumb opposing claw; coxae of first and third pairs noticeably rugose. Abdomen with medium-sized spiracles on segments 3-8; large paratergal plates on segments 2-5; a very small plate on segment 6; small sclerotizations around spiracles of segments 7 and 8. Paratergal plate II with one apical seta; plate III with two setae about half length of plate; plate IV with one seta somewhat shorter than plate and one minute seta; plate V with one short and one minute seta; plate VI with two minute setae. Dorsally with one row of setae per segment, a narrow plate associated with each row; setae on segments 4-7 large and inflated, these rows continuous across dorsum and containing 10, 11, 12, and 8 setae, respectively. Ventrally with plates associated with rows of setae on segments 2 and 3 only; setae of segments 3-6 inflated. Genitalia having basal plate with posterior arms about as long as undivided anterior part; endomeral piece broadly U-shaped, with median fracture; pseudopenis elongate-triangular, posterior part lacking rugosities.

Female: Head, thorax, and legs as in male. Abdomen with paratergal plates as in male. Ventrally, plates associated with rows of setae on segments 2 and 3 only; segments 3-7 with setae inflated; 6 setae in rows on segments 3 and 4; 9-11 setae in rows on segments 5-6; segment 7 lacking setae medially, with 2 setae laterally on each side. Dorsally, plates associated with anterior 4 rows of setae; setae of segments 4-8 inflated; rows on segments 5-7 containing 11-14 setae, extending completely across dorsum. Genitalia as in figure 1.

Lengths: Male 0.58 mm.; female 0.71 mm.

Enderleinellus dremomydis Ferris

Enderleinellus dremomydis Ferris, Contributions toward a monograph of the sucking lice, pt. 1 (1919), p. 29, fig. 16, 1920; The sucking lice, p. 108, 1951.

This species was described from two females found on *Dremomys pernyi*, West Szechuan, China.

NEW RECORD: One female from *Dremomys rufigenis*, LOEI: Dan Sai, Kok Sathon, Phak Khi Nak Mountain, March 29, 1955, RE-5189.

This Thai record is the first since the original description. The specimen agrees well with the original description and the female paratype in the U.S. National Museum collections. The male of *dremomydis* remains unknown.

Enderleinellus kumadai Kaneko

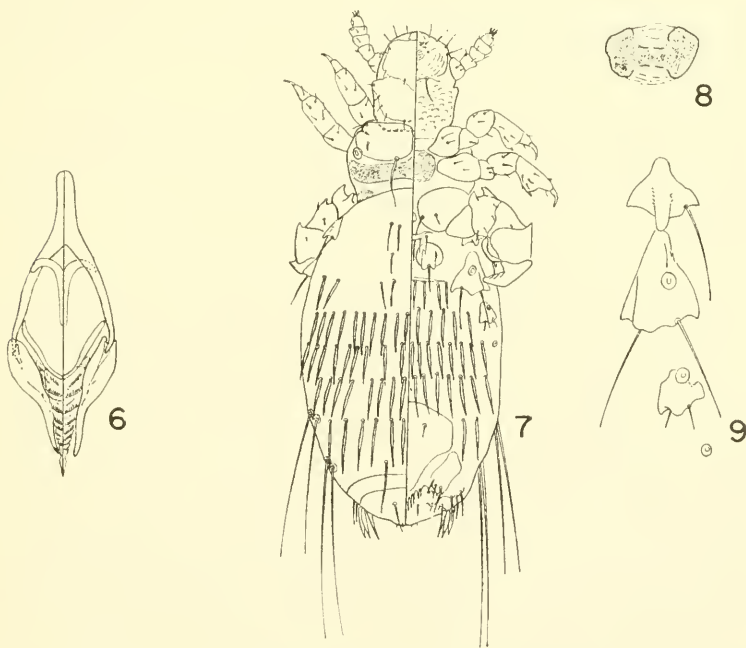
FIGURES 6-9

Enderleinellus kumadai Kaneko, Bull. Tokyo Medical and Dental Univ., No. 1, p. 49, figs. 1, 1-8, and 2, 1-2, 1954.

Kaneko described this species from the holotype male, allotype female, and four male and seven female paratypes, collected from *Callosciurus erythraeus thairwanensis*, O-shima, Tokyo, Japan. The host squirrels are native to Formosa and had escaped from a zoo during World War II to become established on O-shima.

NEW RECORDS: Three males, one female from *Callosciurus* sp., NAKHON SAWAN: Bon Phot Phisai, Tha Ngiu, March 30, 1953, RE-1740. Two females, same data, but RE-1741. One male, one female, same data, but RE-1743. One female from *Callosciurus finlaysoni*, CHAIYAPHUM: Phukcio, Ban Kaeng, Ban Non Taolek, January 16, 1952, RE-361.

The specimens reported above agree quite well with Kaneko's original description and figures. *E. kumadai* is related to *E. malaysianus* Ferris, *E. menetensis* Ferris, and *E. larisci* Ferris—all from Asian squirrels; it may be separated from *malaysianus* in having paratergal plates on segments 2-4 (2-5 in *malaysianus*); and it differs



FIGURES 6-9.—*Enderleinellus kumadai*: 6, Genitalia, ♂; 7, ♀; 8, Thoracic sternal plate, ♂; 9, Paratergal plates, ♂.

from *menetensis*, which also has three paratergal plates, in that spiracles are located on segments 3-5, not 3-6 (or 3-8), and the thoracic sternal plate has the sclerotized portion dumbbell-shaped in *kumadai* rather than entire, and in that the apical setae of paratergal plate III are longer than the plate in *kumadai*. *E. kumadai* is closest to *E. larisci* but is easily separated as follows: *E. larisci* lacks definite postantennal angles on the head and has no apical setae on paratergal plates II and IV. *E. kumadai* has one apical seta on plate II and two on plate IV. In male *larisci* the endomeres are broadly separated and the pseudopenis very small, whereas *kumadai* has the endomeres joined medially (although a fracture line is visible in some specimens), and the pseudopenis is large and as long as the parameres.

The Thai specimens of *kumadai* were compared with two male and two female paratypes in the collection of Captain John E. Scanlon.

Enderleinellus malaysianus Ferris

Enderleinellus malaysianus Ferris, Contributions toward a monograph of the sucking lice, pt. 1 (1919), p. 12, figs. 3-4, 1920; The sucking lice, p. 110, 1951.—Werneck, Mem. Inst. Oswaldo Cruz, vol. 45, pp. 281, 302, 1947.

Ferris described *malaysianus* from material collected off *Callosciurus caniceps* and *Callosciurus prevosti* from Malaya, Lower Siam, and Borneo. The holotype is from *C. caniceps*, St. Lukes Island, Mergui Archipelago, Malaysia.

NEW RECORD: One female from *Callosciurus caniceps*, NAKHON SAWAN: Pak Nôm Pho, Khao Khat, May 4, 1953, RE-2503.

This female has spiracles considerably smaller than the holotype and paratypes in the U.S. National Museum, but agrees well in other respects.

Enderleinellus menetensis Ferris

Enderleinellus menetensis Ferris, Contributions toward a monograph of the sucking lice, pt. 1 (1919), p. 14, figs. 5-6, 1920; The sucking lice, p. 110, 1951.—Werneck, Mem. Inst. Oswaldo Cruz, vol. 45, p. 281, 1947.

Ferris described *E. menetensis* from a series of males and females taken from *Menetes berdmorei rufescens*, Koh Kut Island, Southeast Siam. The holotype is a male.

NEW RECORD: One male, one female from *Menetes berdmorei*, KANCHANABURI: Latya, May 17, 1952, F-752.

These specimens agree well with the original description and figures except that both sexes have more numerous setae on the abdomen dorsally and ventrally, chiefly by reason of having three to five setae in each lateral group rather than one or two. Spiracles are present on abdominal segments 3-8 in the present specimens. The spiracles are very small and hard to see unless the specimen is in a favorable

position. The paratype female in the U.S. National Museum collections has apparent spiracles only on segments 3-6. It is possible that this species has a variable number of spiracles.

Hoplopleura malabarica Werneck

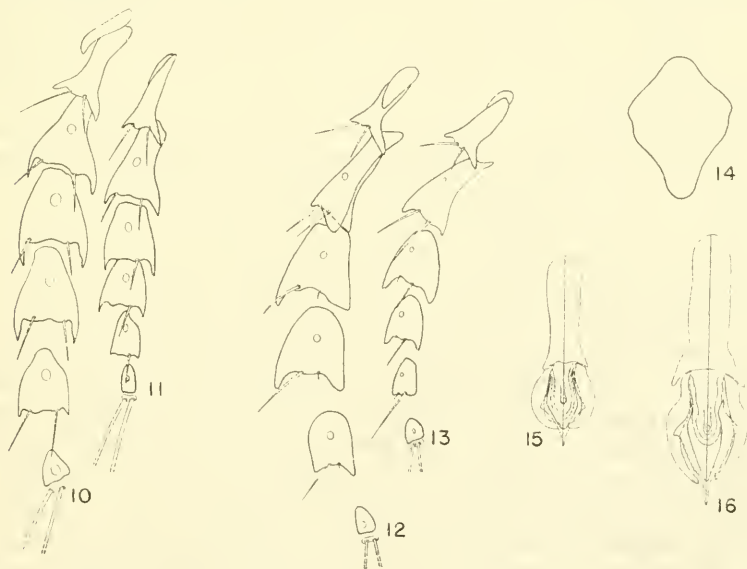
FIGURES 12-14, 16

Hoplopleura malabarica Werneck, Rev. Brasileira Biol., vol. 14, No. 1, p. 113, figs. 8-12, 1954.

Werneck's type series consisted of the male holotype, female allotype, and one male and four female paratypes from *Bandicota malabarica* Shaw, Colombo, Ceylon, July 28, 1944, collected by C. D. Radford.

NEW RECORDS: Many specimens in 27 collections from *Bandicota* sp., *Bandicota bengalensis* ssp., and *Bandicota indica* ssp. from the following localities: CHAIYAPHUM: Phukhieo, Ban Kaeng, Ban Lat. KANCHANABURI: Tamaka, Luk Kae; Tamaka, Tharua; Latya, Ban Nua; Bo Phloi; and Kanchanaburi District. LOPBURI: Khao Oerawan Mt. NAKHON SAWAN: Pak Nam Pho, Khao Khat Mt. RAT BURI: Banpong, Pakraet; Banpong, Boekphrai; and Paktho, Phuchik.

H. malabarica is a parasite of *Bandicota* species, and although *Rattus* species may be found in similar ecological situations together with *Bandicota*, in only one instance did Elbel collect *malabarica* from *Rattus*.



FIGURES 10-16.—*Hoplopleura malabarica* and *H. hirsuta*: 10, Paratergal plates, *H. hirsuta*, ♀; 11, Same, ♂; 12, Same, *H. malabarica*, ♀; 13, Same, ♂; 14, Thoracic sternal plate, *H. malabarica*, ♂; 15, Genitalia, *H. hirsuta*, ♂; 16, Same, *H. malabarica*, ♂.

Werneck compared *malabarica* to *H. hirsuta* Ferris (from *Sigmodon* in the New World). The long series of individuals of *malabarica* collected by Elbel makes possible an expanded diagnosis and comparison of this species with *hirsuta*.

In most respects the two species are similar. The thoracic sternal plate is identical and the shape of the paratergal plates very similar. The lateral setae of the abdomen (those occurring off the tergal and sternal plates) are noticeably heavier in *hirsuta*, although a comparison of actual specimens is necessary to satisfactorily show this difference. The form of the paratergal plates and their setation is highly variable in both species. Female *malabarica* always have one long apical seta on plates IV-VI (on VI this seta may be very long); the second apical seta on the above plates is minute or absent. One abnormal female examined had two long setae on paratergal plate IV. In *hirsuta* females plates IV-VI always have two long setae (fig. 10). Paratergal plate VI of *hirsuta* usually has two apical angles, although in occasional specimens there are no free angles. *Malabarica* females have a dorsal angle on plate VI, but usually the ventral angle is rounded and not free. Generally, *hirsuta* females have more setae in the abdominal rows. Werneck draws and describes the female of *malabarica* as having neither tergal nor sternal plates on the typical abdominal segments. This condition was not true of the Thai specimens, the plates being invariably present although often extremely narrow and incomplete. In *hirsuta* females there are always three or more setae laterally off each abdominal plate both dorsally and ventrally, while *malabarica* females have but one or two setae in these positions.

In males of the two species the setation of the paratergal plates is extremely variable. In both *hirsuta* and *malabarica* the male usually has one long seta on plates IV-VI with the second seta minute or absent (compare figs. 11 and 13). However, *hirsuta* males may have two long setae on one or all of plates IV-VI, and both types may be found in a single collection. None of the *malabarica* males examined had more than one long apical seta on plates IV-VI. *Malabarica* males generally have fewer setae in the abdominal rows than *hirsuta* males have. Werneck's drawing of male *malabarica* shows no tergal abdominal plates. All the Thai males have a normal number of narrow tergal plates. The male genitalia of *malabarica* and *hirsuta* differ in small but constant fashion. In *hirsuta* the parameres (fig. 15) are strongly curved apically so that were the tips joined by an imaginary line the parameres would form an almost perfect semicircle apically. In *malabarica* the parameres are not so strongly curved inward. The pseudopenis of *hirsuta* is usually not serrate, and the angle at its broadest point is usually about halfway between the base of the

pseudopenis and the inner aspect of the tip. In *malabarica* the pseudopenis is serrate, and the angle at its broadest point is always much nearer the base of the pseudopenis than it is to the joining of the inner aspect of the tip.

Specimens of *malabarica* illustrated were from *Bandicota bengalensis*, RAT BURI, Banpong, Boekphrai. Drawings of male and female paratergal plates of *hirsuta* were taken from specimens from Florida, and the male genitalia from a specimen from the Panama Canal Zone—all from *Sigmodon*.

Hoplopleura pacifica Ewing

Hoplopleura pacifica Ewing, Bernice P. Bishop Museum Bull., No. 14, p. 9, figs. 1b-c, 1924.—Hopkins, Proc. Zool. Soc. London, vol. 119, p. 481, 1949.

Hoplopleura oenomydis, Ferris, Bernice P. Bishop Museum Bull., No. 98, p. 121 (in part), 1932; The sucking lice, p. 139 (in part), 1951.—Pritchard, Journ. Parasit., vol. 35, p. 374, 1947.

Hoplopleura pacifica was described from five males and seven females collected off *Rattus hawaiiensis* [*Rattus exulans hawaiiensis*], Hawaiian Islands.

NEW RECORDS: A long series of specimens from *Rattus rattus* ssp. from the following provinces: Chiangmai, Rat Buri, Chaiphum, Nakhon Ratchasima (=Khorat), and Chiang Rai.

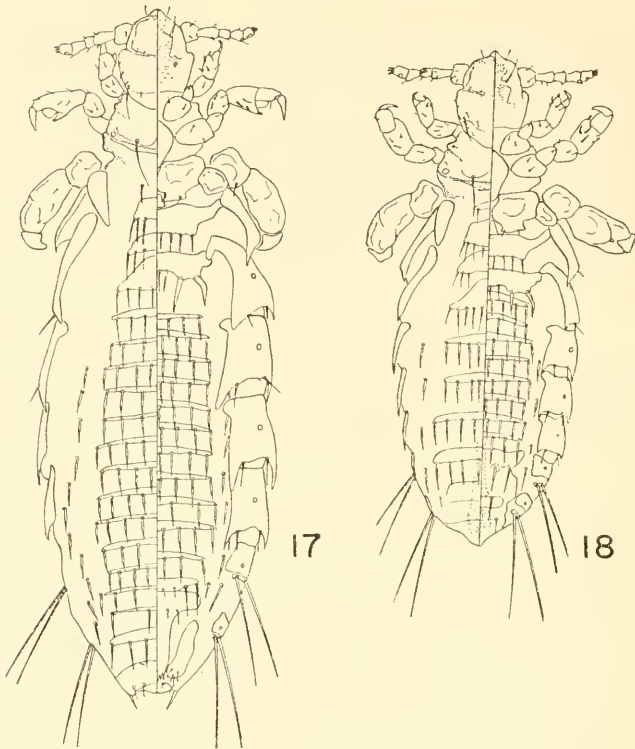
H. pacifica is the characteristic louse parasite of Thai *R. rattus*. Hopkins (1949) records all *Hoplopleura* specimens from *Rattus* species as *pacifica*, not *H. oenomydis* Ferris, and notes that *H. oenomydis* is restricted, so far as is known, to the African murine genus *Oenomys*.

Diagnoses and descriptions of *oenomydis* and *pacifica*, together with host records, are being prepared for publication by Captain John E. Scanlon; therefore, no diagnoses are included in this paper.

Hoplopleura thurmanae, new species

FIGURES 17-19, 22-23, 25

TYPE DATA: Holotype female from *Tamiops maccllelandi*, LOEI: Dan Sai, Na Phung, Ban Khok, Namlang Mountain, May 29, 1955, RE-5416, R. E. Elbel collector. Allotype male, same data, but June 3, 1955, RE-5512. Paratype male, same data but May 23, 1955, RE-5290. Paratype female, same data, but May 29, 1955, RE-5415. Paratype female, same data, but June 6, 1955, RE-5555. Paratype female, same data, but June 1, 1955, RE-5460. Four male, one female paratypes from *Tamiops maccllelandi* ssp., CHAIYAPHUM: Phukhieo, Ban Kaeng, Ban Lat, January 16, 1952, RE-355. Four male, four female paratypes, same data, but January 18, 1955,



FIGURES 17-18.—*Hoplopleura thurmanae*, new species: 17, Holotype ♀; 18, Allotype ♂.

RE-369-371. One male, one female paratypes from *Tamiops rodolphei*, locality as above, December 19, 1952, RE-931. One female paratype from *Tamiops rodolphei*, Phukheio, Ban Kaeng, Ban Non Taolek, December 14, 1952, RE-900. One male paratype from *Tamiops* sp., KANCHANABURI: Bo Phloi, March 26, 1952, RE-563. One male, five female paratypes from *Tamiops maccelandii*, CHIENGMAI: Chiangmai, Ban Den, February 6, 1952, D. C. and E. B. Thurman collectors, TT-23-24.

Holotype deposited in the U.S. National Museum, type-catalog No. 64382.

Also examined: One male, three females from *Mentes bermorei* sp., KANCHANABURI: Bo Phloi, July 16, 1952, Y-308.

This species is named for my friend and colleague, one of the collectors, Dr. Ernestine B. Thurman.

DIAGNOSIS: This species is very closely related to *Hoplopleura erismata* Ferris from *Callosciurus* species. The female of *H. thurmanae*

has the posterior angles of paratergal plates IV-VI produced into acute points that are almost as long as the apical setae. In *erismata* the apical angles of paratergal plates IV-V are very short, obviously much shorter than the apical setae, and paratergal plate VI has scarcely any angles. In the male of *thurmanae*, the apical angles of paratergal plates IV-VI are not so long as in the female, but definitely longer than in *erismata*. *H. thurmanae* also differs from *erismata* in the shape of the thoracic sternal plate (compare figs. 25 and 26). In *thurmanae* the plate has definite lateral and anterior angles; in *erismata* the lateral angles are smoothed out so that the lateral and anterior margins form a continuous curve. Male genitalia of the two species are quite different (compare figs. 23 and 24).

DESCRIPTION: Female: Head rounded anteriorly, postantennal angles definite but rounded; postantennal head margins slightly convergent posteriorly. Thorax with thoracic sternal plate diamond-shaped, the posterior angle more produced than the anterior angle. Abdomen with outermost of the two modified setae on the first sternal plate of segment 3 usually definitely bent. Typical abdominal segment with three narrow sternal and tergal plates; both dorsally and ventrally with one seta laterally on each side, off the plates. Paratergal plates as in figure 22; plates IV-V produced inward anteriorly toward the midline both dorsally and ventrally. Plates IV-VI with apical angles produced into long acute points which are almost as long as the apical setae; plate VII lacking posterior angles but not much reduced.

Male: Head as in female except third antennal segment with a short stout dorsal seta. Thorax as in female. Abdomen with outermost of the two modified setae on the first sternal plate of segment 3 usually definitely bent. Sternal and tergal plates as in genus, narrowed but not strongly reduced; one or two setae laterally off tergal plates of segments 4-6, and one seta laterally on sternites 4-6, midway between the two sternal plates of each of these segments. Paratergal plates IV-VI and sometimes VII anteriorly produced inward toward midline both dorsally and ventrally. Plate VII not noticeably reduced; plates IV-VI with posterior angles produced into points that are not so long as in female, being no more than half the length of the apical setae. Genitalia with parameres poorly sclerotized, particularly basally; pseudopenis with triangular flanges on each side at about middle, its apex triangular, slightly serrate.

Lengths: Female 1.15-1.2 mm.; male 0.85 mm.

One collection of *H. thurmanae* was taken from *Menetes*, but that this is a normal occurrence needs to be confirmed.

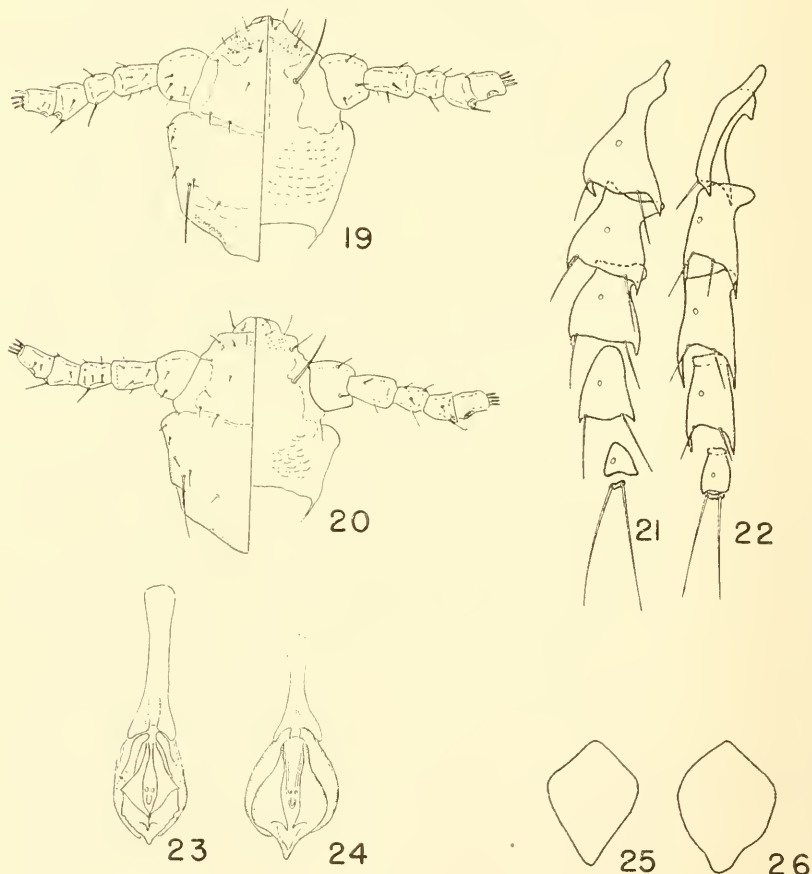
Hoplopleura erismata Ferris

FIGURES 20-21, 24, 26

Hoplopleura erismata Ferris, Contributions toward a monograph of the sucking lice, pt. 2, p. 113, figs. 72B, 72E, 72F, 1921; The sucking lice, p. 136, 1951.

Ferris described *erismata* from Thailand from *Callosciurus ferrugineus*, *C. caniceps*, and *Tamiops* sp. Holotype female from *C. ferrugineus*, Southeast Siam. It is very likely that the specimens taken from *Tamiops* were actually *H. thurmanae*.

NEW RECORDS: Two males, two females from *Callosciurus finlaysoni tacherdi*, NAKHON RATCHASIMA (=KHORAT): Sikhui, Pakchong, June



FIGURES 19-26.—*Hoplopleura thurmanae*, new species, and *H. erismata*: 19, Head, *H. thurmanae*, holotype ♀; 20 Same, *H. erismata*, ♀; 21, Paratergal plates II-VI, *H. erismata*, ♀; 22, Same, *H. thurmanae*, holotype ♀; 23, Genitalia, *H. thurmanae*, allotype ♂; 24, Same, *H. erismata*, ♂; 25, Thoracic sternal plate, *H. thurmanae*, holotype ♀; 26, Same, *H. erismata*, ♀.

6, 1952, Y-216-221. Five females from *Callosciurus caniceps*, CHIANG RAI: Chiang Saen Khao, Ban Sop Luak, March 2, 1953, RE-2340. One male from *C. caniceps*, KAMPHAENG PHET: Khlong Khlung, Ban Hua Thanon, April 4, 1953, RE-2365. Two males, five females from *C. caniceps*, NAHKON SAWAN: Pak Nam Pho, Khao Khat Mt., May 13, 1953, RE-2539. One female from *C. caniceps*, LOEI: Dan Sai, Kok Sathon, Phu Lom Lo Mt., February 28, 1955, RE-4824. A series of males and females from *Callosciurus finlaysoni*, Dan Sai, Kok Sathon, Phu Lom Lo Mt. and Phak Khi Nak Mt., February and March 1955, RE-4800, 5018, 5058, 5063, and 5105. A series of males and females from *C. finlaysoni*, Dan Sai, Na Phung, Ban Khok, Namlang Mt., May and June 1955, RE-5399, 5486, 5546, and 5585.

H. erismata is easily determined by reference to the original description and drawings by Ferris. It should be added that in the male, paratergal plates IV-VI (not IV and V as in the female) have the anterior angles strongly produced toward the midline of the body. The paired modified setae on the first sternal plate of abdominal segment 3 are often not so strongly developed as in most species of *Hoplopleura*, although this is not always the case, and sometimes the outer setae may be not only heavy but noticeably bent.

Lengths: Male 0.95-1.1 mm.; female 1.3-1.5 mm.

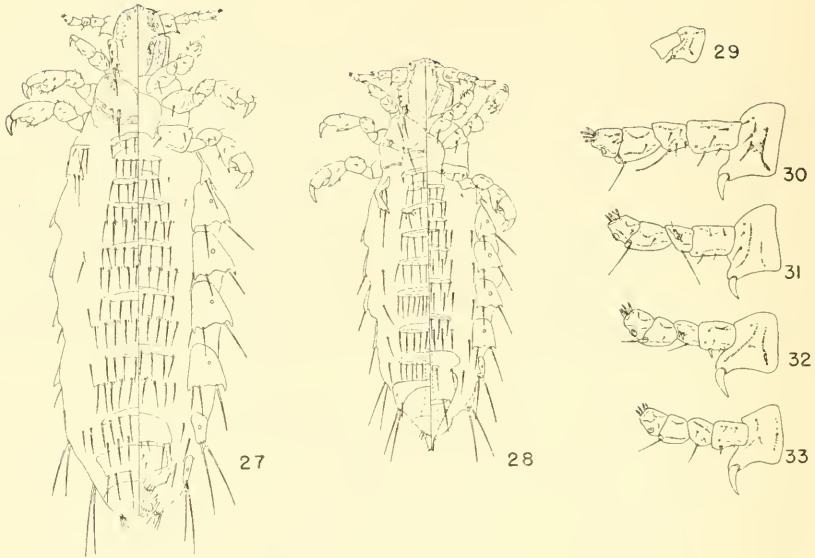
Neohaematopinus callosciuri, new species

FIGURES 27-28, 34b, 35c, 42-43

Neohaematopinus sciurinus, Ferris, Contributions toward a monograph of the sucking lice, pt. 4, pp. 244, 245, 1923 (in part, records from *Callosciurus*).—Hopkins, Proc. Zool. Soc. London, vol. 119, pp. 459, 460, 1949 (records from *Callosciurus*).

TYPE DATA: Holotype male, allotype female, and two male and four female paratypes from *Callosciurus finlaysoni*, LOEI: Dan Sai, Kok Sathon, Phu Lom Lo Mt., February 26, 1955, RE-4800, R. E. Elbel collector. A series of 179 male and female paratypes from *Callosciurus finlaysoni*, *C. caniceps* and *C. erythraeus* from the following provinces: Loei, Chaiphaphum, Rat Buri, Kanchanaburi, Nakhon Sawan, Nakhon Ratchasima, Prachuap Khiri Khan, Chiang Rai, Kamphaeng Phet, and Lop Buri, collected 1952-55. Two male and one female paratypes from *C. erythraeus*, Formosa: Ma-an Lio, April 12, 1952, D. H. Johnson collector, DJ-7274. One male and two female paratypes, same data, but April 19, 1952, H. J. Stanton collector, JHS-6. One male paratype, same data, but April 16, 1952, JHS-3.

Holotype deposited in the collection of the U.S. National Museum. type-catalog No. 64383.



FIGURES 27-33.—*Neohaematopinus callosciuri*, new species, *N. sciurinus*, and *N. semifasciatus*: 27, *N. callosciuri*, allotype ♀; 28, *N. callosciuri*, holotype ♂; 29, Abnormal antenna, *N. sciurinus*, ♀; Florida from *S. niger*; 30, Antenna, *N. sciurinus*, ♀, Texas from *S. niger*; 31, Same, ♂; 32, Antenna, *N. semifasciatus*, ♂, Alaska from *T. hudsonicus*; 33, Same, ♀.

I have also seen material of this species from *Callosciurus notatus*, North Borneo: Mount Kinabalu, Tenompok, June 18, 1951, collected by Traub.

DIAGNOSIS: *N. callosciuri* is very similar to *N. sciuri* Jancke and *N. sciurinus* (Mjöberg), differing only in the shape of the basal antennal segment and size of its posteroapical enlarged seta. It is separable from *sciurinus* in that the enlarged seta on the first antennal segment is not as large in *callosciuri* (compare figs. 41 and 42). *N. callosciuri* is distinct from *sciuri* in that the apical enlarged seta is borne on a slight prolongation of the basal antennal segment, whereas in *sciuri* the basal segment is not modified and the enlarged seta is set back from the margin (compare figs. 40 and 42). *N. callosciuri* differs from both *sciuri* and *sciurinus* in having a flattened, rather indistinct (but always present) tubercle on the venter of the basal antennal segment.

DESCRIPTION: Male: Head broadly rounded anteriorly; postantennal angles marked; posterior head margins only slightly convergent posteriorly. Basal antennal segment produced posteroapically and bearing a stout seta; ventrally basal segment with flattened tubercle; third segment modified, bearing two short, stout setae apically. Thorax broader than long, about as long as head; sternal plate with

posterior angles produced into points, plate about as broad as long, its shape varying considerably. Legs typical of genus. Abdomen; ventrally, segment 2 with two plates; segment 3 with well-developed plate associated with anterior row of setae; vestige of a plate associated with second row of setae; segments 4-6 with one plate, associated with first of two rows of setae; lateral seta near paratergal plates on each side of segments 3-6. Dorsally, posterior plate of second segment emarginate medially and bearing several stout setae laterally on each side; remaining segments with one plate associated with single row of setae; segments 4-7 with one seta laterally off plate on each side. Paratergal plates with both posterior angles toothed; apical setae varying in length. Genitalia similar to other related species.

Female: Head as in male except third antennal segment unmodified. Thorax and legs as in male. Abdomen having two rows of setae on segments 2-6 both dorsally and ventrally; plate associated with anterior row of each segment; posterior row with small areas of sclerotization around each setal base. Paratergal plates as in male. Genitalia not diagnostic.

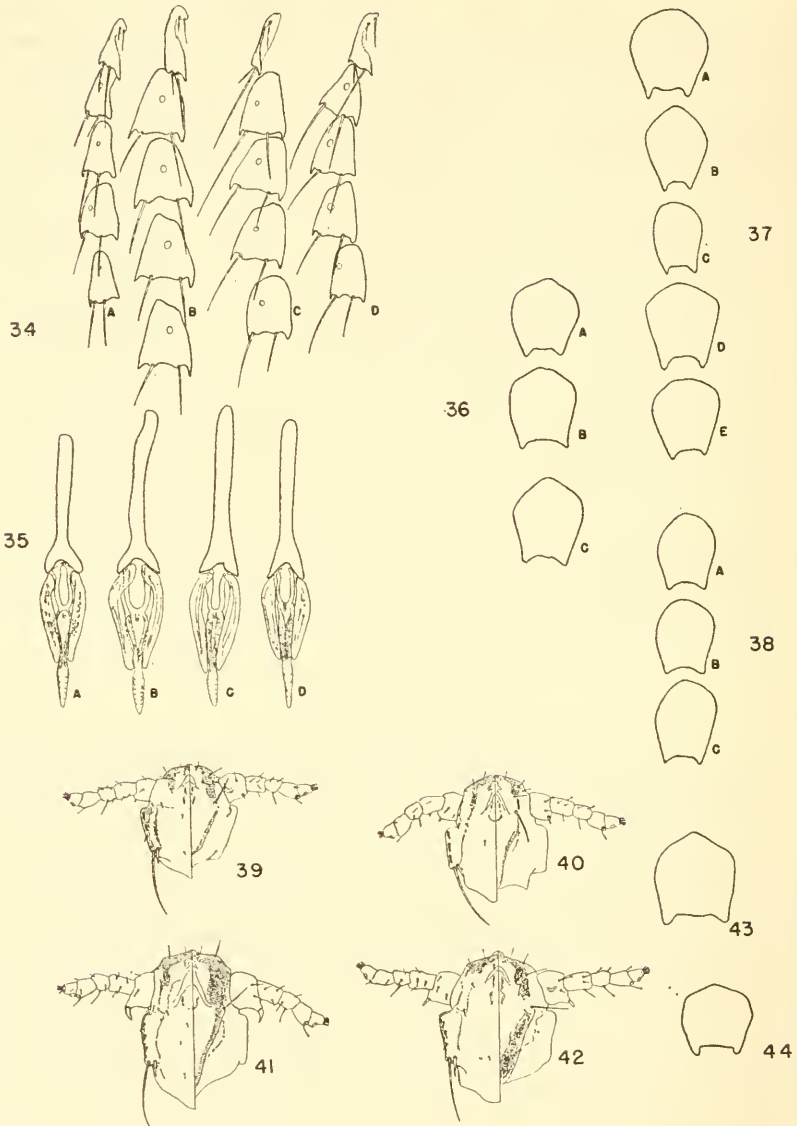
Lengths: Male 1.5-1.7 mm.; female 2.1-2.2 mm.

Neohaematopinus cognatus, new species

FIGURES 34a, 35d, 39, 44

Neohaematopinus sciurinus, Ferris, Contributions toward a monograph of the sucking lice, pt. 4, p. 245 (in part, records from *Menctes berdmorei*), 1923.—Hopkins, Proc. Zool. Soc. London, vol. 119, p. 460 (records from *M. berdmorei*), 1949.

TYPE DATA: Holotype male, allotype female from *Menctes berdmorei*, LOEI: Dan Sai, Kok Sathon, Phu Lom Lo Mt., 8,000 ft., February 22, 1955, RE-4765, R. E. Elbel, collector. Three female paratypes with same data as holotype. A long series of paratypes, all from *Menctes berdmorei*, as follows: CHAIYAPHUM: Phukheio, Ban Kaeng, Ban Non Taolek, two females, January 16, 1952, RE-357. Phukheio, Ban Song, January 15, 1953, one female, RE-993. KANCHANABURI: Ban Nua, May 7, 1952, one male, three females, F-721, F-722, F-730. Tamuang City, May 12, 1952, one male, F-741. Kanchanaburi City, June 11, 1952, two females, F-878, F-881. Bo Phloi, March 13, 1952, three males, five females, RE-516. July 16, 1952, one female, Y-308. PHET BURI: Khao Yoi, Nong Chum Phon, July 14, 1952, four females, F-981. NAKHON SAWAN: Phayuhakhiri, Ban Phayuhadaen, March 6, 1953, five males, five females, RE-1645. Wat Sai (forest), March 29, 1953, two males, one female, RE-1699. Pak Nam Pho, Khao Khat, April 10, 1953, one male, one female, RE-1738. May 7, 1953, five males, five



FIGURES 34-44.—*Neohaematopinus callosciuri*, new species, and related forms: 34, Paratergal plates, ♀ : a, *N. cognatus*; b, *N. callosciuri*; c, *N. sciurinus*; d, *N. sciuri*, England from *S. vulgaris*; 35, Genitalia, ♂ : a, *N. sciuri*, England from *S. vulgaris*; b, *N. sciurinus*; c, *N. callosciuri*; d, *N. cognatus*, holotype; 36, Thoracic sternal plate, *N. sciuri*, ♀, from *S. carolinensis*: a, *N.* Carolina; b, Georgia; c, Maryland; 37, Same, *N. sciurinus*, ♀, from *S. niger*: a, Maryland; b, Same; c, Ohio; d, Georgia; e, Texas; 38, Same, *N. semifasciatus*, ♀, from *Tamiasciurus*: a, Alaska; b, Same; c, Montana; 39, Head, *N. cognatus*, allotype ♀; 40, Same, *N. sciuri*, ♀; 41, Same, *N. sciurinus*, ♀; 42, Same, *N. callosciuri*, allotype ♀; 43, Thoracic sternal plate, *N. callosciuri*, allotype ♀; 44, Same, *N. cognatus*, allotype ♀.

females, RE-2517. May 8, 1953, one female, RE-2520. May 8, 1953, three males, two females, RE-2521. May 20, 1953, one male, one female, RE-2574. May 21, 1953, one male, RE-2577. May 21, 1953, one male, two females, RE-2580. LOPBBURI: Khao Oerawan Mt., July 27, 1953, two males, one female, RE-2843.

Holotype deposited in the collections of the U.S. National Museum, type-catalog No. 64384.

DIAGNOSIS AND DESCRIPTION: In all ways *N. cognatus* is similar to *N. callosciuri* except that the basal segment of the antenna of both the male and female of *cognatus* lacks an enlarged posterior apical seta, but has a slightly enlarged seta set in from the apex, and that the basal segment is not prolonged posteroapically.

Lengths: Male 1.4 mm.; female 1.8 mm.

Neohaematopinus sciurinus and related forms

FIGURES 31, 33

For a number of years there has been confusion as to what name or names should apply to a group of *Neohaematopinus* species found on members of *Sciurus* and related genera of squirrels. Ferris (1951) reviewed the situation and reasoned that more than one species might be present but that final decisions would have to await the collection of further material. Names proposed in this group include the following:

1. *Haematopinus sciurinus* Mjöberg, 1891, type host *Sciurus niger*, the North American fox squirrel. (*Acanthopinus antennatus* Osborn, 1910, from the same host, is a junior synonym of *sciurinus* Mjöberg.)

2. *Neohaematopinus antennatus semifasciatus* Ferris, 1916, type host *Sciurus douglasi* (now known as *Tamiasciurus douglasi*), the pine or red squirrel. Ferris (1923) wrongly synonymized *semifasciatus* under *sciurinus* Mjöberg.

3. *Neohaematopinus sciuri* Jancke, 1931, type host *Sciurus vulgaris*, the European squirrel.

4. *Neohaematopinus callosciuri*, type host *Callosciuris finlaysoni* from Thailand.

5. *Neohaematopinus cognatus*, type host *Menetes berdmorei* from Thailand.

At least a partial explanation of the confusing species tangle has been found through a study of the specimens described in this paper as *N. callosciuri* from *Callosciurus* spp., and *N. cognatus* from *Menetes* spp., plus numerous specimens of *Neohaematopinus* in the U.S. National Museum from North American *Sciurus carolinensis*, *S. niger*, and *Tamiasciurus* spp., and specimens from British *Sciurus vulgaris* (lent by T. Clay of the British Museum). Since very limited material

has been collected from North American *Sciurus* species other than from *S. carolinensis* and *S. niger*, it is necessary to exclude such specimens from the following discussion.

Slight but constant differences in the antennae, coupled with constant host associations, afford a reliable method for distinguishing species of the complex.³ A search for genitalic characters, size differences, and other morphologic differences among the various species of the *sciurinus* complex has been fruitless. The thoracic sternal plate varies greatly in shape and size (figs. 36-38, 43, 44); the male genitalia are similar (fig. 35, *a-d*); and patterns of chaetotaxy, although somewhat variable, are similar for all the species.

There are two groups, based on the antennal characters: the *sciurinus*-like species have the basal antennal segment prolonged posteroapically, with an enlarged seta on the prolongation (figs. 41, 42); and the *sciuri*-like species lack the prolongation and may lack the enlarged apical seta (figs. 39, 40).

Neohaematopinus sciurinus and related species

1. *N. sciurinus* Mjöberg is found on *Sciurus niger* in North America. It is characterized by having the basal antennal segment prolonged posteroapically, with this prolongation bearing a spinelike apical seta, by lacking a short spinelike seta on the posterior margin of the second antennal segment, and by having the fourth segment longer than the fifth (fig. 30). Specimens have been examined as follows: From *Sciurus niger*: Texas, Kansas, Florida, Georgia, South Carolina, Maryland, and Ohio.

2. *N. semifasciatus* Ferris is found on *Tamiasciurus douglasi* and *T. hudsonicus* in North America. This species has the basal antennal segment with the posteroapical prolongation and seta as in *sciurinus*, but the second antennal segment has a short spinelike seta on the posterior margin, and the fourth segment is equal in length to the fifth (fig. 32). Specimens have been examined as follows: From *Tamiasciurus douglasi*: California and Oregon. From *Tamiasciurus hudsonicus*: Tennessee, Montana, and Alaska.

3. *N. callosciuri* is found on *Callosciurus* species in Southeast Asia and Malaysia. It is characterized by having a tubercle on the venter of the basal antennal segment, by the posteroapical prolongation and its seta being smaller than in *sciurinus*, and by lacking a stout spine-like seta on the second antennal segment (fig. 42). The Asian specimens from *Callosciurus* and probably those from *Lariscus*, reported by Ferris (1923) as *sciurinus*, are referable to *N. callosciuri*.

³ One female *sciurinus* examined has an abnormal seta on the basal antennal segment on one side (fig. 29), and several *sciurinus* specimens in three collections are recorded as from "red squirrel." All the "red squirrels" may have been misdetermined, and in one case the specimens were collected in Kansas where *Tamiasciurus* (red squirrel) does not occur.

Neohaematopinus sciuri and related species

1. *N. sciuri* Janeke apparently occurs on both European *Sciurus vulgaris* and North American *Sciurus carolinensis*. At least, the North American specimens are morphologically indistinguishable from the European ones. This species is characterized by not having the posteroapical prolongation on the basal antennal segment, and by having a stout spinelike seta at the posteroapical angle (fig. 40). Specimens have been examined as follows: From *Sciurus vulgaris*: England. From *Sciurus carolinensis*: New York, Rhode Island, Maryland, District of Columbia, Virginia, North Carolina, Georgia, Florida, Mississippi, and Ohio. Also examined was one collection supposedly from "southern fox squirrel," South Carolina.

2. *N. cognatus* is found on *Menetes berdmorei*, Thailand. This species is like *sciuri* in not having the basal antennal segment prolonged posteroapically. It is further characterized by having the stout seta of the basal segment set in from the apex and by having a tubercle on the venter of the basal antennal segment (fig. 39). Thai specimens from *M. berdmorei* reported by Ferris (1923) as *sciurinus* are referable to *N. cognatus*.

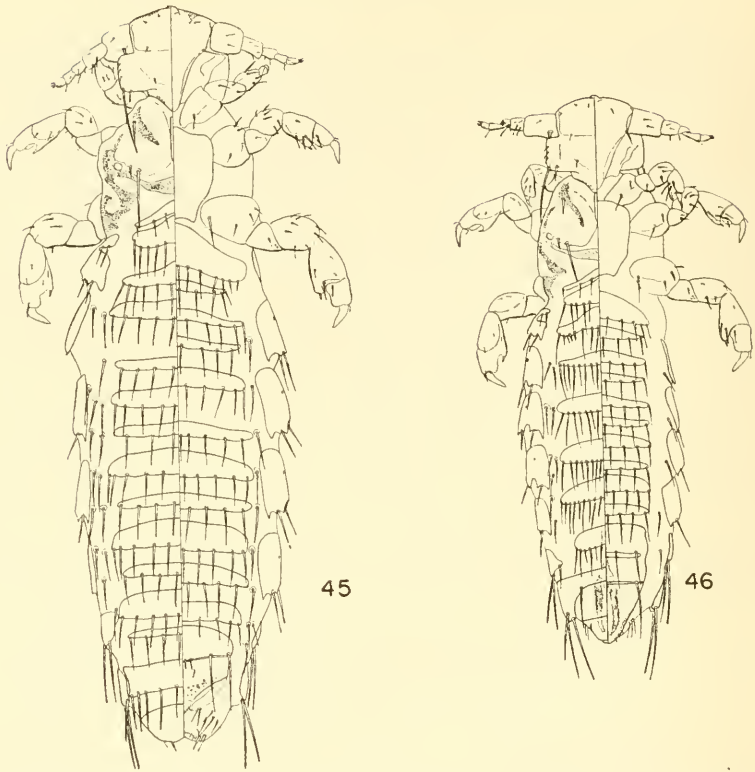
Neohaematopinus capitaneus, new species

FIGURES 45-47, 50, 56-57, 60

TYPE DATA: Holotype male, allotype female from *Hylopetes phayrei*, CHAIYAPHUM: Phukhieo, Ban Khon San, December 24, 1952, RE-953 and 959, R. E. Elbel collector. Two male, two female paratypes with same data as holotype. One male, six female paratypes from *Hylopetes phayrei*; Phukhieo, Ban Kaeng, Ban Lat, January 17, 1952, RE-362.

Holotype deposited in the collections of the U.S. National Museum, type-catalog No. 64385.

DIAGNOSIS: This species is near *sciuropteri* (Osborn) from North American *Glaucomys*. *N. capitaneus* is larger than *sciuropteri* (lengths: *sciuropteri* ♂ 1.25-1.6 mm., ♀ 1.6-1.9 mm.; *capitaneus* ♂ 1.8-2.2 mm., ♀ 2.5-2.8 mm.). The thoracic sternal plate has the posterior angles not produced into such long points in *capitaneus* and is wider in relation to its length (compare figs. 59 and 60). The male genitalia differ considerably in the 2 species. *N. capitaneus* has the pseudo-penis rugose and the penis extending only about one-fourth the length of the parameres (compare figs. 54 and 56); and the terminal lobes of the abdomen are not so well developed as in *sciuropteri*. Particularly in the female of *capitaneus*, typical paratergal plates have small acute projections on either side of the apical setal bases. The female genitalia have the lateral setigerous lobes of the eighth



FIGURES 45-46.—*Neohaematopinus capitaneus*, new species: 45, Allotype ♀; 46, Holotype ♂.

segment (“gonopods”) elongate in *capitaneus* (fig. 47), whereas these lobes are smaller and more nearly vertical in *sciuropteri* (fig. 49).

DESCRIPTION: Male: Head broader than long, anterior margin very broadly rounded so that antennae are set near apex of head. Postantennal angles very prominent, postantennal margins parallel; occipital region strongly constricted; gular area strongly raised; basal antennal segment longer than broad, with stout seta dorsally, set well in from margin; third antennal segment modified, bearing 2 short stout apical setae. Thorax longer than head and somewhat broader. Thoracic sternal plate large, subrectangular, posterior corners produced into short points. Legs as in other members of the genus. Abdomen with 1 tergal and 2 sternal plates on each segment, typical sternal plate with row of 7 to 8 setae; typical tergal plate with row of 16-20 setae; 1 to 3 setae laterally off each plate dorsally and 1 seta laterally off second plate of each segment ventrally. Third tergal plate with posterior margin emarginate medially and with groups of stout lateral setae on each side. Paratergal plates large, with 2 apical setae; paratergal plate VII extended somewhat dorsally so that

one of the lateral abdominal setae arises from it; plate VII dorsally continuous with tergal plate of segment 8. Genitalia with narrow basal plate; parameres of approximately same width throughout most of their lengths, acute apically, subapically with lateral triangulate lobe; penis opening above proximal fourth of parameres; pseudopenis with distal half rugose.

Female: Head as in male except basal antennal segment as broad as long and third antennal segment not modified. Thorax and legs as in male. Abdomen with tergal and sternal plates well developed, two plates per segment dorsally and ventrally, typical ones each bearing a row of 6 to 10 setae; second sternal plate of segment 7 with 3 or 4 short medial setae flanked by 2 long setae; 1 or 2 lateral setae off each plate. Paratergal plates much as in male, but plate VIII not joined to tergal plate of that segment; plates III-VI with posterior corners produced into short acute lobes, smaller acute lobes on each side of setal bases. Genitalia as in figure 47; genital plate (of segment 8) heavily spiculated; lateral setigerous lobes elongate.

Lengths: Male 1.8-2.2 mm.; female 2.5-2.8 mm.

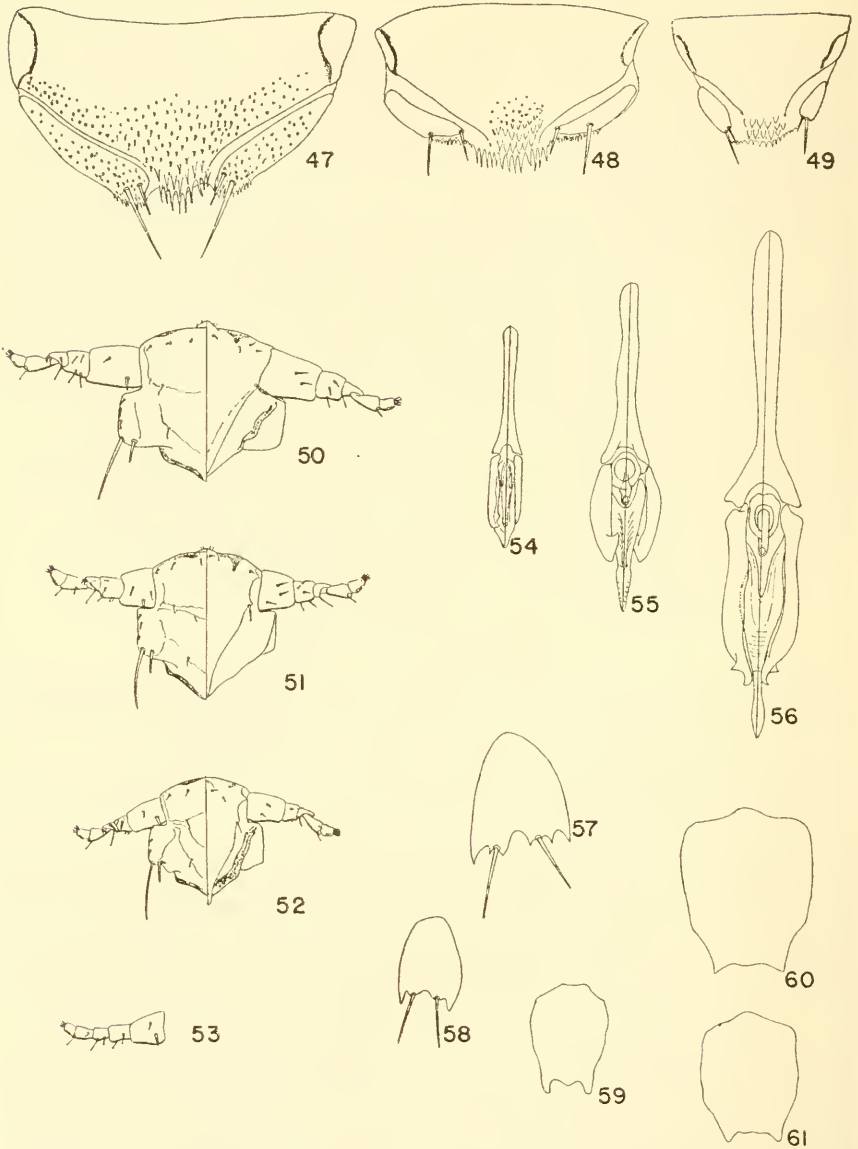
Neohaematopinus kinabalensis, new species

FIGURES 48, 51, 55, 61-63

TYPE DATA: Holotype male, allotype female from *Hylopetes sagitta harrisoni*, British North Borneo: Mount Kinabalu, Tenompok, 5,000 ft., June 31, 1952, R. Traub collector, RT-B-9089.

Holotype deposited in the collections of the U.S. National Museum, type-catalog No. 64386.

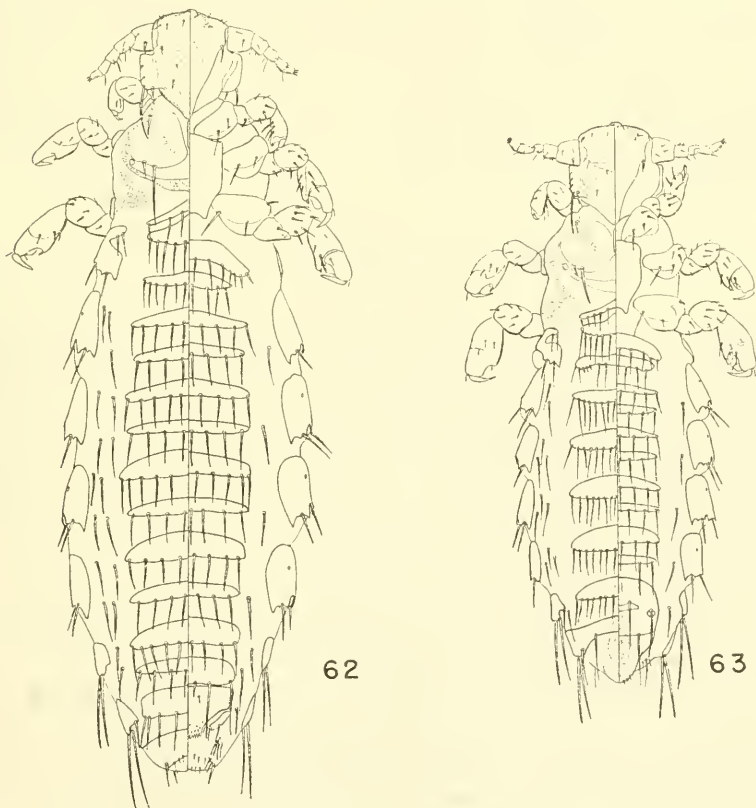
DIAGNOSIS: *N. kinabalensis* is closely allied to *sciuropteri* (Osborn) and *capitaneus*. It is somewhat larger than *sciuropteri*, and smaller than *capitaneus*. *N. kinabalensis* differs from *capitaneus* in that the basal antennal segment is as broad as long in the male, whereas in *capitaneus* this segment is longer than broad (compare figs. 50 and 51). The male genitalia are quite different in the two species. In *kinabalensis* the parameres are short, not enclosing the pseudopenis for most of its length, and their outer margins are convex (compare figs. 55 and 56). Females of *capitaneus* and *kinabalensis* are quite similar, differing mainly in the genital area. The lateral setigerous lobes of the eighth segment ("gonopods") are smaller and more widely separated in *kinabalensis*, the lip of the vulva between these lobes is only slightly convex, and the genital plate is not so heavily spiculated (compare figs. 47 and 48). *N. kinabalensis* differs from *sciuropteri* in having the thoracic sternal plate differently shaped, with the posterior points not so long (compare figs. 59 and 61). *N. kinabalensis* males have the basal antennal segment as broad as long, not longer than broad as in *sciuropteri* (figs. 52, 53). The male genitalia



FIGURES 47-61.—*Neohaematopinus capitaneus*, new species, *N. kinabalensis*, new species, and *N. sciuropteri*: 47, Genital plate, *N. capitaneus*, allotype ♀; 48, Same, *N. kinabalensis*, allotype ♀; 49, Same, *N. sciuropteri*, ♀, Florida from *Glaucomys*; 50, Head, *N. capitaneus*, holotype ♂; 51, Same, *N. kinabalensis*, holotype ♂; 52, Same, *N. sciuropteri*, ♂; 53, Antenna, *N. sciuropteri*, ♀; 54, Genitalia, *N. sciuropteri*, ♂; 55, Same *N. kinabalensis*, holotype ♂; 56, Same, *N. capitaneus*, holotype ♂; 57, Paratergal plate, *N. capitaneus*, paratype ♀; 58, Same, *N. sciuropteri*, ♀; 59, Thoracic sternal plate, *N. sciuropteri*, ♀; 60, Same, *N. capitaneus*, allotype ♀; 61, Same, *N. kinabalensis*, allotype ♀.

of the two species differ in that in *sciuropteri*, the penis opens much further distad, the parameres have straight lateral margins, and the apical lobes of the abdomen are much better developed than in *kinabalensis* (compare figs. 54 and 55). The female genitalia differ in that in *sciuropteri* the lateral setigerous lobes of the eighth segment ("gonopods") are almost vertical rather than slanted and end anterior to the lip of the vulva, which is straight and not heavily spiculated (compare figs. 48 and 49).

DESCRIPTION: Male: Head almost as broad as long, broadly rounded anteriorly, antennae set near apex; marked postantennal and occipital angles; postantennal margins straight and parallel. Basal antennal segment as broad as long, with short stout seta on dorsal surface; segment 3 modified and bearing two short stout setae. Thorax longer and broader than head; sternal plate roughly rectangular and with posterior angles drawn into short acute points. Legs as in other members of the genus. Abdomen with two sternal plates



FIGURES 62-63.—*Neohaematopinus kinabalensis*, new species: 62, Allotype ♀; 63, Holotype ♂.

and one tergal plate per segment, these plates well developed. Typical sternal plate with 7 to 9 setae along posterior margin; tergal plates with 15 such setae; ventrally 1 lateral seta off the plate on each segment; dorsally with 2 or 3 lateral setae. Paratergal plates with apical setae shorter than the plates; posterior margin with posterolateral angles acutely pointed and with each setal base usually flanked by shorter points. Tergal plate of segment 8 joined with paratergal plates VIII. Genitalia with penis opening at about proximal third of parameres; parameres broadly convex laterally, their apices folded over pseudopenis dorsally; pseudopenis serrate distally, extending well beyond apices of parameres. Terminal lobes of abdomen not enlarged or elongate.

Female: Head as in male except third antennal segment normal. Thorax and legs as in male. Abdomen with two well-developed sternal and tergal plates on each typical segment; plates with row of 7 to 10 setae. Ventrally each segment with one lateral seta off plates on each side; dorsally with one to two such setae off each plate on each side. Paratergal plates as in male except plate VIII not joined to tergal plate of segment 8. Genitalia: Lateral setigerous lobes of segment 8 ("gonopods") lying almost horizontally, widely separated, margin of vulva between them only somewhat convex; genital plate not heavily spiculated.

Lengths: Male 1.67 mm.; female 2.25 mm.

Neohaematopinus elbeli, new species

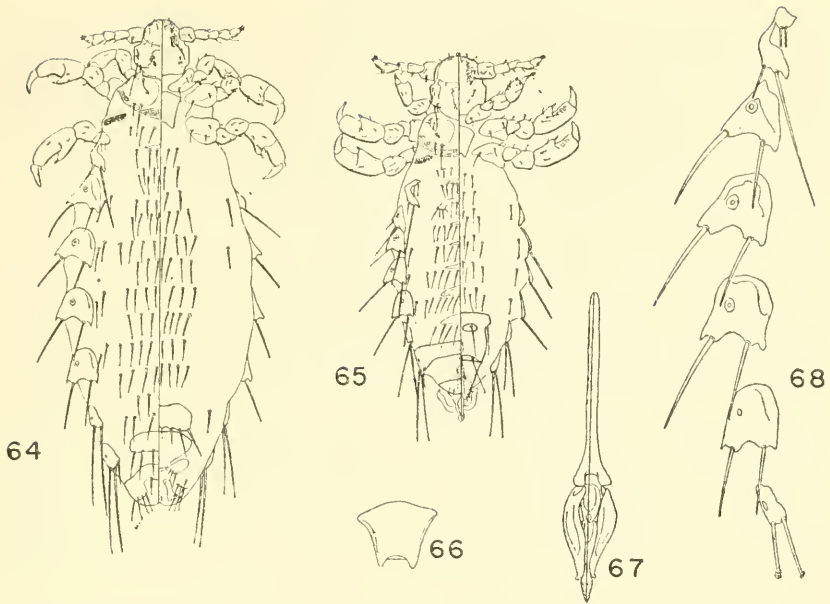
FIGURES 64-68

TYPE DATA: Holotype male, allotype female from *Dremomys rufigenis*, LOEI: Dan Sai, Kok Sathan, Phak Khi Nak Mt., March 19, 1955, RE-4977, R. E. Elbel collector. One male, one female paratypes with same data as holotype. One male paratype, Dan Sai, Na Haeo, Ban Bo, May 15, 1955, RE-5236. Three male paratypes, Ban Bo, May 19, 1955, RE-5279. All specimens were taken from *Dremomys rufigenis*.

Holotype deposited in the collections of the U.S. National Museum, type catalog No. 64387.

This species is named for the collector, Robert E. Elbel, whose magnificent collections of Thai ectoparasites have made known a fauna completely neglected in the past.

DIAGNOSIS: *N. elbeli* is a member of the group of *Neohaematopinus* species that have the posterior angles of the thoracic sternal plate produced into points, and paratergal plates IV-VI with no more than two apical setae. It is closest to *N. inornatus* (Kellogg and Ferris), which also has the abdominal plates much reduced, but is distinct in that the head is almost as broad as long in *elbeli*; the thoracic sternal



FIGURES 64-68.—*Neohaematopinus elbeli*, new species: 64, Allotype ♀; 65, Holotype ♂; 66 Thoracic sternal plate, allotype ♀; 67, Genitalia, paratype ♂; 68, Paratergal plates II-VII, allotype ♀.

plate is much broader than in *inornatus*, and the paratergal plates are more strongly sclerotized.

DESCRIPTION: Male: Head broadly rounded anteriorly, almost as broad behind antennae as entire head is long; postantennal angles rounded, postantennal margins convex. First antennal segment not modified although there is one large seta dorsally, set in from the margin; third antennal segment modified and with two short, stout apical setae. Thorax noticeably broader than long. Sternal plate broader anteriorly than posteriorly, slightly broader than long, with its posterior angles produced into points. Legs as in other members of the genus. Abdomen entirely lacking sternal plates except for those associated with the genital segments. Tergal plates present on segments 2-7, plates reduced except for the second plate, which is emarginate medially and bears a lateral group of setae on each side. Paratergal plates large and well sclerotized, each with two apical setae; plate VIII joined dorsally to tergal plate of segment 8; apical angles of plates III-VI produced into short points. Genitalia as in figure 67; basal plate narrow, expanded posteriorly, twice as long as the parameres; parameres with outer margins broadly convex (extended in holotype); pseudopenis narrow.

Female: Head as in male except third antennal segment not modified. Thorax and legs as in male. Abdomen lacking plates except for one tergal plate on segments 2, 8, and 9, and the usual sternal plates on the genital segments. Paratergal plates as in male, except plate VIII not joined to tergal plate of segment 8. Typical abdominal segments with two rows of setae. Genitalia not diagnostic.

Lengths: Male 1.2 mm.; female 1.5 mm.

Neohaematopinus petauristae Ferris

Neohaematopinus petauristae Ferris, Contributions toward a monograph of the sucking lice, pt. 4, p. 258, figs 166, 167A, 167C-E, 1923.

Petauristophthirus petauristae, Eichler, Boll. Soc. Ent. Italiana, vol. 79, p. 12, 1949.

Neohaematopinus petauristae, Ferris, The sucking lice, p. 195, 1951.

Ferris described *petauristae* from male and female specimens taken from *Petaurisia inornata*, Kashmir. The holotype is a female. The record below is the first since the original description.

NEW RECORD: Two males, two females from *Petaurista taylora*, PRACHUAP KHIRI KHAN: BAN Khlua Klang, December 14, 1952, RE-2032.

Polyplax asiatica Ferris

Polyplax asiatica Ferris, Contributions toward a monograph of the sucking lice, pt. 4, p. 233, fig. 152D, 1923; The sucking lice, p. 206, 1951.—Hopkins, Proc. Zool. Soc. London, vol. 119, p. 483, 1949.—Johnson, Bull. Brooklyn Ent. Soc., vol. 53, p. 77, figs. 1-5, 7, 1958.

The holotype female and allotype male of *Polyplax asiatica* were collected from *Crocidura caerulea*, Rangoon, Burma. Ferris also reported several females from *Nesokia indica* (as *N. hardwicki*) from Baluchistan.

NEW RECORD: One female from *Bandicota bengalensis*, KANCHANABURI: Kanchanaburi City, June 10, 1952, F-875.

P. asiatica is probably very rare on *Bandicota bengalensis*, the normal louse parasite of this rat being *Iiplopleura malabarica* Werneck. Ferris and Hopkins have reported *asiatica* from *Nesokia indica*, *Rattus concolor*, and *Bandicota malabarica*. *Nesokia*, which is closely related to *Bandicota*, is probably the primary host, although *asiatica* appears to be well adapted to life on other related genera of rodents. Its occurrence on *Crocidura*, a shrew, was almost certainly fortuitous.

Polyplax cannomydis, new species

FIGURES 69-72, 74

TYPE DATA: Holotype male, allotype female from *Cannomys badius minor* (bamboo rat), RAT BURI: Banpong, Boekphrai, June 18, 1955, Y-236, R. E. Elbel and Banpong Plague Lab. personnel, collectors. Two male, four female paratypes with same data as holotype. One female paratype from *C. badius minor*, KANCHANABURI: Tamaka,

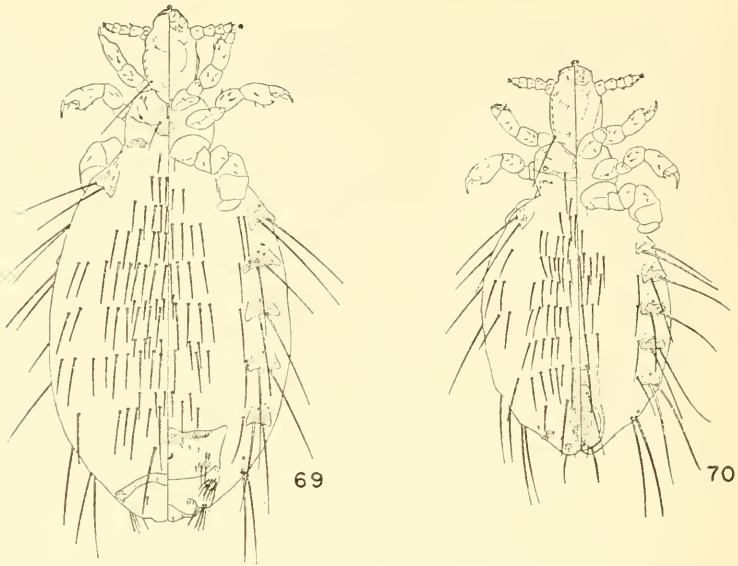
Tharua, February 1, 1952, RE-485. Three male, seven female paratypes from *C. badius minor*, KANCHANABURI: Tha Khanun, Hin Laem, October 27 and 29, 1952, RE-1308 and RE-1329.

Holotype deposited in the collections of the U.S. National Museum, type-catalog No. 64388.

DIAGNOSIS: *P. cannomydis* is immediately separable from all other described members of the genus *Polyplax* by the lack of any vestige of paratergal plates on the eighth abdominal segment, by the absence of plates on the abdomen, except on the genital segments and by the very large and flattened tarsal claw on the third leg.

DESCRIPTION: Male: Head elongate, preantennal region strongly sclerotized and produced so that antennae are inserted well posteriorly to the head apex; gular region apparently not raised, although a lateral longitudinal fold may represent the limits of a greatly broadened gular area; postantennal head margins slightly convex; occipital region constricted; antennae normal, basal segment not enlarged and third segment unmodified. Thorax broader than head and not as long; sternal plate obsolescent, represented by a small area of deeper pigmentation. First pair of legs small, with slender claw; second pair similar and only somewhat larger; third pair much larger than others, with large, flattened claw. Abdomen entirely devoid of plates except the ventral genital plate of segments 7 and 8. Ventrally with one row of 2 setae on segment 2; one irregular row of 9 to 10 setae on segment 3 (these setae may represent coalescence of two original rows); segments 4-6 with one row of 5 to 6 setae plus 1 lateral seta on each side near paratergal plates. Dorsally with 1 row of setae per segment; segments 3-5 with one median row of 10 to 12 setae, plus 1 or 2 lateral setae on each side; segments 6 and 7 with row of 11 to 14 setae; segment 8 with row of 4 setae. Paratergal plates present on segments 2-7; plate II poorly sclerotized, with no apparent division into two parts; plates III-VII sclerotized only apically, with posterior angles rounded; each bearing two very long apical setae. Segment 8 lacking paratergal plates but with spiracles and usual two long lateral setae on each side below spiracle. Genitalia with parameres enclosing proximal half of stout wedge-shaped pseudopenis.

Female: Head, thorax, and legs as in male. Abdomen lacking plates except the genital plate of the eighth segment. Dorsally, segment 2 with one row of setae; segment 3 with two rows; segment 4 with one row, plus 2 lateral setae on each side; segments 5-7 with two rows, anterior row of 6 to 9 short setae, posterior row of 10 to 14 much longer setae, and with 1 or 2 setae laterally on each side. Ventrally segments 2-4 with one row of setae; 5-7 with two rows, anterior row of 2 to 5 short setae, posterior rows of 4 to 8 longer setae;



FIGURES 69-70.—*Polyplax cannomydis*, new species: 69, Allotype ♀; 70, Holotype ♂.

segments 3-7 with 1 or 2 lateral setae near paratergal plate on each side. Paratergal plates as in male. Genitalia (fig. 72) not typical of *Polyplax* species. Genital plate (of segment 8) rectangular, lip of vulva smooth, not beset with fimbriate processes; lateral setigerous lobes of segment 8 ("gonopods") merely more heavily pigmented areas occurring laterally on genital plate, not protruding as lobes, with 2 or 3 setae on the pigmented area. Laterally, below vulva, lobe on each side bearing many setae; below these, the usual lateral setigerous lobes of segment 9 ("gonopods"). Spermatheca heavily sclerotized, appearing as a ring-shaped sclerite.

Lengths: Male 1.5 mm.; female 2.0 mm.

The affinities of *cannomydis*, new species, are difficult to outline. There is a very real question as to whether it belongs in *Polyplax* or whether it should be segregated as the type of a new genus. The female external genitalia of *cannomydis* are not of the usual *Polyplax* type. In typical *Polyplax* the genital plate has a triangular median sclerotization flanked by definite lateral setigerous lobes ("gonopods"), and the tip of the vulva is always fimbriate to varying degree (fig. 73). *P. cannomydis* has the setigerous lobes incorporated into the genital plate and the lip of the vulva smooth. The well-marked setigerous lobes occurring laterally between the vulva and the setigerous lobes of the ninth segment are unusually well developed in *cannomydis*, although typical *Polyplax* species do have groups of setae in these positions. Not only are the female genitalia different

from other *Polyplax*, but *cannomydis* lacks paratergal plates on the terminal abdominal segments.

Two genera, both closely related to *Polyplax*, share certain characteristics with *cannomydis*:

Proenderleinellus Ewing (only included species: *calvus* (Waterston)) shows relationships to *cannomydis* in the form of the male genitalia, in lacking abdominal plates, and in having the third pair of legs greatly enlarged, although in *calvus* the claw is not flattened. The female genitalia are somewhat similar in the two species, but *calvus* has the lip of the vulva strongly fimbriate (fig. 75). Further, males and females of *calvus* have two rows of setae on each abdominal segment ventrally and dorsally while *cannomydis* follows the *Polyplax* pattern by having only one row ventrally on segments 4-7 in the male.

Like species of *Eulinognathus* Cummings, *P. cannomydis* lacks the terminal paratergal plates and the female genitalia resemble *E. denticulatus* Cummings. However, species of *Eulinognathus* lack the pronotum (which, if present, is always reduced to a very narrow median longitudinal strip in the Anoplura); the pronotum is present in species of *Polyplax*, and the legs of *cannomydis* also are more nearly like *Polyplax* than any species of *Eulinognathus*.

Although the generic concept of *Polyplax* must be broadened in order to include *cannomydis*, I feel that such broadening is the proper course at this time. Ferris (Contributions toward a Monograph of the Sucking Lice, pt. 4, 1923) grouped the various species of *Polyplax*, although without discussing the groups, in what appears to be the most logical pattern. It would be impossible to justify the establishment of a new genus to receive *cannomydis* without naming four or five other new genera to contain the various groups of *Polyplax*. *Polyplax* is certainly a complex assemblage of species but there is serious doubt as to whether any purposes would be served by splitting it into several genera.

Polyplax spinulosa (Burmeister)

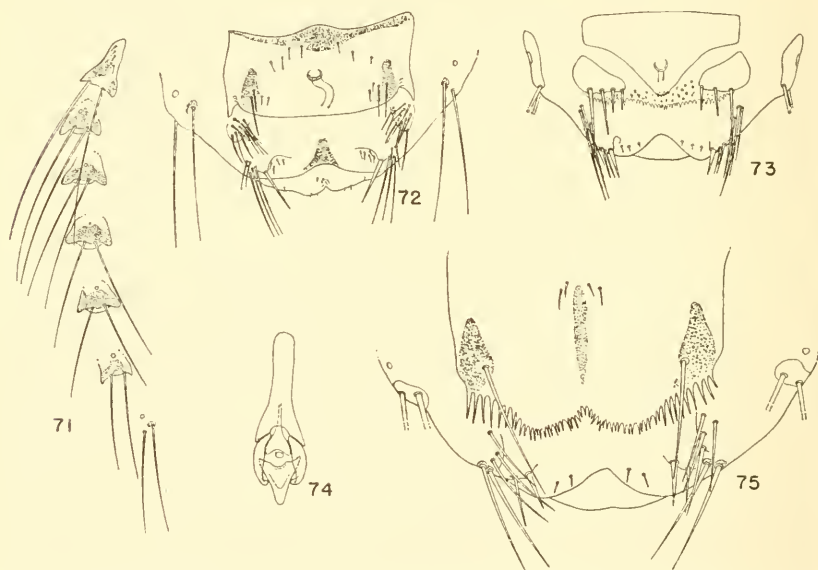
FIGURE 73

Pediculus spinulosus Burmeister, Genera quaedam insectorum . . . , Rhynchota, vol. 1, No. 8, 1839.

Polyplax spinulosa, Ferris, Contributions toward a monograph of the sucking lice, pt. 4, p. 187, figs. 119, 120A, D, F, H, 1923.

P. spinulosa is a parasite of *Rattus* species throughout the world, particularly *R. rattus* and *R. norvegicus*. *P. spinulosa* proved to be a rare species on Thai *Rattus*, being taken in 12 collections from *Rattus rattus* ssp., once from *Rattus norvegicus*, and once from a "badger," which probably acquired the louse from one of its *Rattus* victims.

NEW RECORDS: Two females from *R. rattus* ssp., RAT BURI: Banpong, Pakraet, February 23, 1952, RE-464. One male, one female, same data, but July 2, 1952, F. 949. Two males, one female, same data, but RE-465. One female from *R. rattus* ssp., RAT BURI: Banpong, 2 km. west of city, June 25, 1952, F. 935. One male from *R. norvegicus*, Bangkok, June 1, 1952, Y. 206. One male from *R. rattus* ssp., KANCHANABURI: Tha Khanun, Hin Laem, October 29, 1952, RE-1333. One female from "badger," NAKHON RATCHASIMA (= KHORAT): Khorat (city), February 8, 1953, RE-1722. One female from *R. rattus* ssp., locality as above, February 10, 1953, RE-1723. Two males, 4 females, same data, but February 13, 1953, RE-1725. One female, same data, but January 30, 1953, RE-1781.



FIGURES 71-75.—*Polyplax cannomydis*, new species, *P. spinulosa*, and *Proenderleinellus calvus*: 71, Paratergal plates, *P. cannomydis*, allotype ♀; 72, Genitalia, *P. cannomydis*, allotype ♀; 73, Same, *P. spinulosa*, ♀, Tanganyika from *R. rattus*; 74, Genitalia, *P. cannomydis*, holotype ♂; 75, Genitalia, *P. calvus*, ♀, Tanganyika, from *Cricetomys*.