

New Species of Fleas (Siphonaptera) from Panama

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New Species of Fleas (Siphonaptera) from Panama¹

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ABSTRACT

Collecting data and hosts are given for nine species taken in Chiriquí Province at elevations of 5,000 feet or more. *Jellisonia johnsonae*, *Pleochaetis altmani* Kohl-sia keenani, and *Kohlsia traubi* are new species; the last-named, occurring almost exclusively on *Peromyscus n. nudipes*, was the most common flea encountered in Chiriquí. The previously unknown male of *Hoplopsyllus*

glacialis exoticus (new status; =*H. exoticus* Jordan and Rothschild) is described, and *Juxtapulex echidnophagoides* Wagner, *Pleochaetus d. dolens* (Jordan and Rothschild), *Kohlsia g. graphis* (Rothschild), and *Strep-sylla dalmati* Traub and Barrera are reported for the first time from Panama.

During the course of a rodent ectoparasite survey, several hundred fleas have been collected from rodents indigenous to Panama. Of special interest is a group of fleas collected in the mountains of the Province of Chiriquí, consisting of four species new to science, the hitherto undescribed male of *Hoplopsyllus glacialis exoticus* Jordan and Rothschild, 1933, and four species previously unrecorded from Panama.

Juxtapulex echidnophagoides Wagner

Juxtapulex echidnophagoides Wagner, 1933, Mitteil. Zool. Mus. Berlin 18: 343, figs. 1A, 2-6; Hopkins and Rothschild, 1953, Cat. Rothschild Coll. Fleas 1: 100-2.

TYPE DATA.—Type specimens ex *Tatusia novem-cincta* (= *Dasyptus novemcinctus*), La Trinidad at foot of Turrialba, 1,600 m., 25 km. east of Cartago, Costa Rica, collected by O. Garlepp.

PANAMANIAN MATERIAL STUDIED.—A total of 52 males and 87 females ex four specimens of *Didelphis marsupialis etensis* J. A. Allen at Casa Tilley below Cerro Punta, elevation 5,300 feet, 21-24 January 1960; also 8 males and 11 females ex *Didelphis marsupialis etensis* at La Amenaza near Bambito, elevation 5,800 feet, 14 February 1960; 80 males and 57 females ex *Dasyptus novemcinctus fenestratus* Peters at Casa Tilley, 30 January 1960; 1 male and 1 female ex *Canis familiaris*, 23 January 1960.

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REMARKS.—It is of some interest to note that more than 150 specimens of *Didelphis marsupialis* ssp. collected in the lowlands of Panama were free of *J. echidnophagoides*, while the five specimens of *D. marsupialis etensis* collected above 5,000 feet were parasitized with this flea. All 50 specimens of *Dasybus novemcinctus fenestratus* collected at low elevations were also free of this flea, while the single specimen collected above 5,000 feet was heavily infested with *J. echidnophagoides*.

Barrera (1955) makes reference to specimens determined by Traub which were collected in Boquete, Panama, from "gato."

Hoplopsyllus glacialis exoticus Jordan and Rothschild, new combination
(Plates 1 and 2)

Hoplopsyllus exoticus Jordan and Rothschild, 1923, Ectoparasites 1: 311-12, fig. 314; Hopkins and Rothschild, 1953, Cat. Rothschild Coll. Fleas 1: 192-3.

TYPE DATA.—Described from a single female ex *Felis* sp. collected at Boquete, Panama, 14 September 1901, by J. H. Batty.

PANAMANIAN MATERIAL STUDIED.—Five males and seven females (Coll. No. 6163) ex *Sylvilagus brasiliensis gabbi* (J. A. Allen) at Casa Tilley below Cerro Punta, elevation 5,300 feet, 1 May 1960; two males and one female (Coll. No. 5743) ex *Didelphis marsupialis etensis* J. A. Allen at Casa Tilley, 21 January 1960; one male (Coll. No. 5759), *ibid.*, but 24 January 1960. All specimens were collected in the Province of Chiriquí, Panama, by C. M. Keenan and V. J. Tipton.

Specimens deposited in the U. S. National Museum, British Museum (Natural History), Gorgas Memorial Laboratory, and the private collections of Lt. Col. Robert Traub and the senior author.

DIAGNOSIS.—*Hoplopsyllus glacialis exoticus* is somewhat like both *H. glacialis foxi* Ewing and *H. manconis* Jordan in that P^2 is long and slender, and in all three species F is similar in size and shape and the spines of the pronotal comb are pointed. However, the stoutest apical bristle on the distal arm of the male ninth sternum is short, as in *H. manconis*, and does not reach the apicoventral angle as is the case in *H. glacialis foxi*. In *H. manconis* P^1 is very short, while it is at least half as long as P^2 in *P. glacialis exoticus*. The ventral process of the eighth sternum is very prominent and bears 12 to 13 bristles in *H. glacialis exoticus*, whereas in the other species it is poorly developed and bears only 2 to 4 bristles. The ventral portion of the caudal margin of the female seventh sternum is more deeply excavated than in either of the other two species.

DESCRIPTION.—*Head, Male* (plate 1, fig. 1): Frontoclypeal margin broadly rounded, convexity very shallow; preantennal area with double to triple row of microsetae; with one row of two stout bris-

les. Eye ovate, heavily pigmented. Maxillary lobe extends to apex of fourth segment of maxillary palpus. Labial palpus four-segmented. Club of antenna elliptical; setae of second segment reach to midpoint on club. Postantennal area with falx, occipital groove prominent; row of small bristles on caudal margin with intercalary setae; two long bristles on margin of antennal fossa.

Thorax (plate 1, fig. 2): Pronotum with row of five long bristles; pronotal comb of about 16 long, acuminate spines. Mesonotum (MSN.) with three irregular rows of setae arranged 6-3-6 plus one or two setae between first two rows; last row with intercalary microsetae. Mesepisternum (MPS.) devoid of bristles. Mesepimere (MPM.) with four stout bristles, two ventral, one over pleural rod. Lateral metanotal area (L.M.) large; with one bristle. Metepisternum (MTS.) with single dorsocaudal bristle; ventrocaudal margin produced as angulate process. Metepimere (MPM.) with medial row of five to seven bristles; subcaudomarginal row of five to six bristles.

Legs: Procoxa with about 40 bristles. Profemur with about 10 external, thin, medial setae. Protibia with six dorsomarginal notches bearing paired bristles plus row of medial bristles. Protarsus with fifth segment longest, fourth shortest; four pairs lateral plantar bristles; one pair unequal subapical bristles. Mesocoxa with well-developed internal rods. Mesofemur with one thin seta on inner aspect; two marginal, two submarginal setae on apicoventral area. Mesotibia with eight dorsomarginal notches bearing bristles as follows (base to apex): 2-2-1-2-2-1-2-3; plus five or six submarginal or medial bristles. Mesotarsus with second segment longest, fourth shortest; bristle on apex of third segment extends beyond apex of fourth segment. Metacoxa with internal rods well developed; anteroventral area with 12 to 13 medial bristles; comb of seven short, spini-form bristles on inner aspect of same area. Metafemur with two subapical bristles on ventral margin. Metatibia similar to mesotibia except 9 to 10 submarginal or medial bristles. Metatarsus with first segment longest, fourth shortest; second segment with apical bristle extending beyond midpoint of fifth segment.

Abdomen: Terga without apical spinelets; with one row of bristles on each tergum except for first tergum, which has two rows. First two sterna with one bristle each; sterna 4 to 7 with two bristles each. One minute bristle dorsad, two minute bristles ventrad of single, long, antensilliary bristle.

Modified Abdominal Segments, Male (plates 1 and 2, figs. 3-5, 10): Eighth tergum reduced to narrow sclerite cephalad of sensillum. Eighth sternum (8S.) well developed, covering most of genitalia; with seven to eight medial bristles; several very thin setae at caudoventral angle; with mesoventral, subtruncate process bearing 10 to 12 apical, marginal, or submarginal bristles. Manubrium acuminate, curved dorsad. Immobile process of clasper divided; process

* Terminology used is that of Traub (1950).

proper (P^1) short, subtruncate, with 10 to 12 apical or subapical bristles; P^2 long, narrow, bearing apical tooth plus four long ventromarginal bristles. Finger (F.) of clasper long, narrow; arises ventrad of origin of P^2 on process proper; bearing five to six thin marginal setae on apical half; a row of six to seven marginal setae on basoventral margin. Proximal arm of ninth sternum resembling inverted human

foot. Distal arm of ninth sternum broad; incrassate; with four stout apical bristles, the stoutest of which does not reach apicoventral margin; six to seven fine apical setae; 10 to 12 ventromarginal setae.

Aedeagus (plate 2, fig. 9): Aedeagal apodeme (A.E.A.) narrow; middle plate of aedeagal apodeme conspicuous. Proximal spur absent. Median dorsal lobe (M.D.L.) well defined; dorsal margin fairly

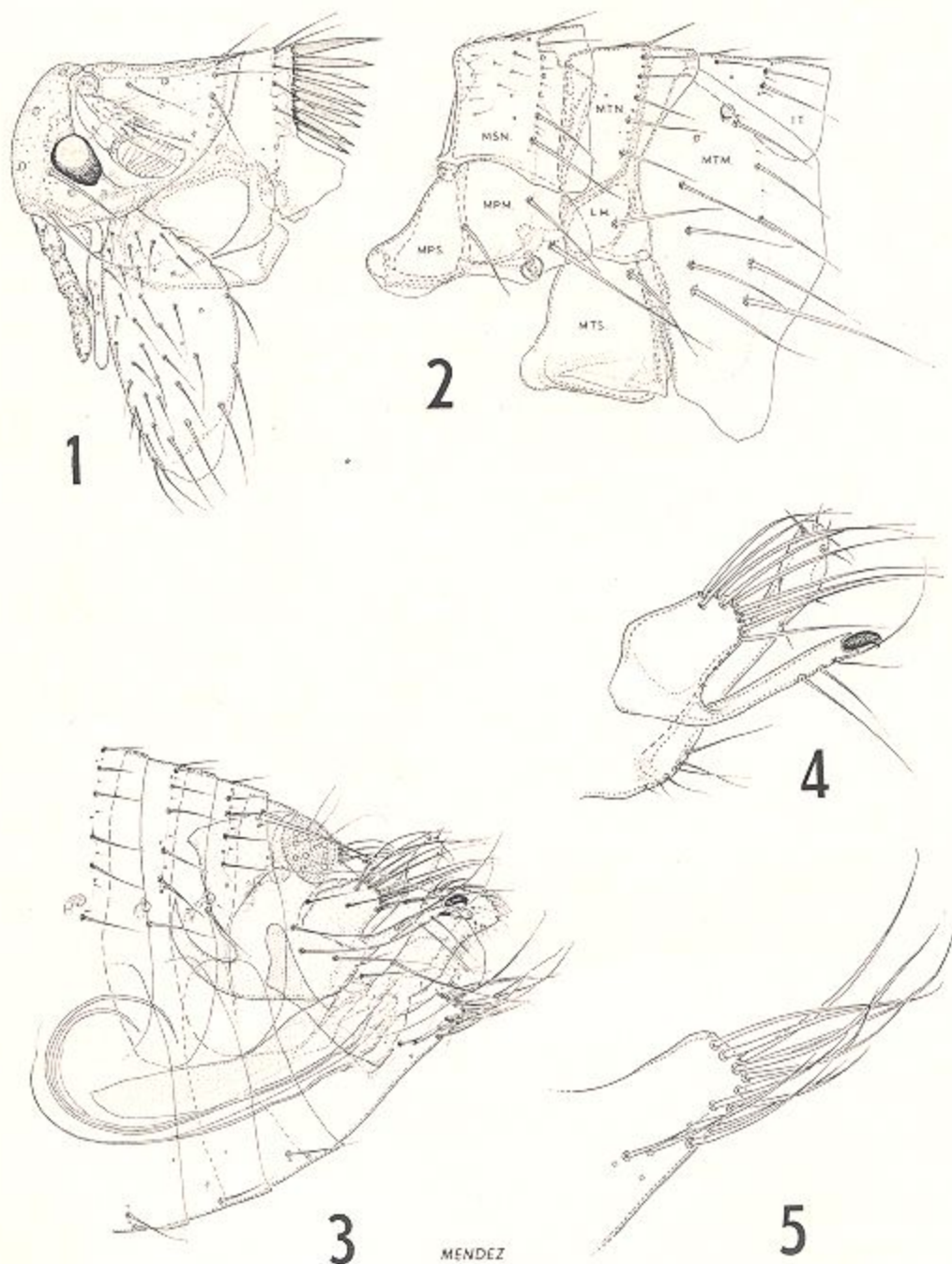
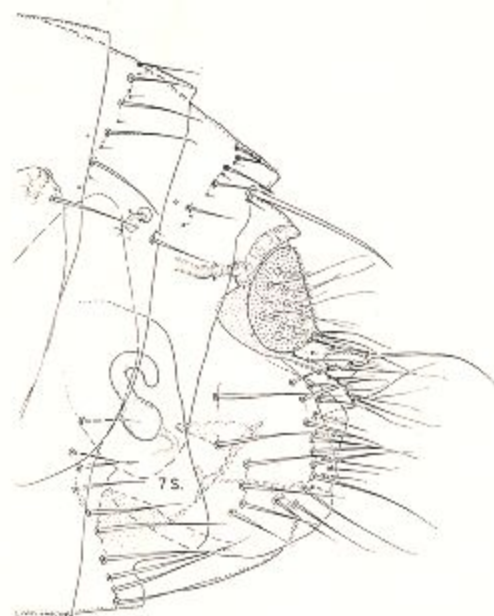


PLATE 1.—*Hoplopsyllus glacialis exoticensis* Jordan and Rothschild, 1923, male. FIG. 1.—Head, prothorax, and procoxa. FIG. 2.—Mesothorax, metathorax, and first abdominal tergum. FIG. 3.—Modified abdominal segments. FIG. 4.—Process and movable finger of clasper. FIG. 5.—Eighth sternum.

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well sclerotized; recurved apically to form structure resembling lip of pitcher. Poorly defined lateral lobe (L.L.) cephalad of lip. Dorsal arm of inner tube (D.I.T.) subparallel to dorsal margin of median dorsal lobe. Sclerotized inner tube (S.I.T.) originates near narrow, well-sclerotized, crescent sclerite

(C.S.), terminates near crochet. Crochet (CR) narrow sclerite swollen at midpoint to form knoblike structure. Pseudocrochet (P.S.C.) large but poorly sclerotized; caudal margin truncate. Vesicle of aedeagus (V.) horseshoe-shaped sclerite. Wall of aedeagal pouch (P.W.) not greatly distended.



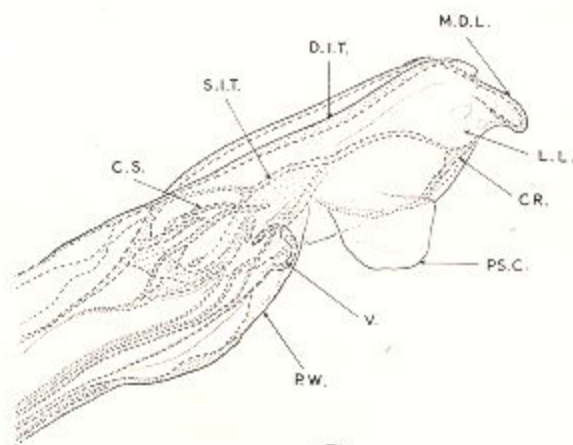
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PLATE 2.—*Hoplopsyllus glacialis exoticus* Jordan and Rothschild, 1923. FIG. 6.—Female, modified abdominal segments. FIG. 7.—Female, spermatheca. FIG. 8.—Female, anal stylet and ventral and lobe. FIG. 9.—Male, apex of aedeagus. FIG. 10.—Male, distal arm of ninth sternum.

Modified Abdominal Segments, Female (plate 2, figs. 6-8): Ventral portion of caudal outline of seventh sternum deeply excavated; a well-sclerotized cone-shaped area dorsad of excavation; with row of eight to nine bristles. Eighth tergum (8T.) with row of five stout bristles just caudad of outline of seventh sternum; with about 18 to 20 submarginal bristles. Eighth sternum (8S.) a poorly defined, fingerlike extension ventrad of margin of eighth tergum. Dorsal anal lobe of proctiger (D.A.L.) with four to five bristles dorsad, three bristles ventrad of insertion of anal stylet. Anal stylet (A.S.) about three times as long as wide; with long apical bristle, shorter ventral bristle. Ventral anal lobe (V.A.L.) with well-sclerotized dorsal margin bearing five to six bristles. Spermatheca subglobular; tail long, strongly recurved. Bursa copulatrix (B.C.) with well-sclerotized duct.

REMARKS.—Hopkins and Rothschild (1953) suggested that further collecting would show *H. exoticus* to be a subspecies of *H. glacialis*. Although the male eighth sternum appears to be sufficiently distinct to warrant the retention of *H. glacialis exoticus* as a full species, we are of the opinion that extensive collecting in Central America and Mexico will reveal intermediate forms.

Jellisonia johnsonae, new species

(Plates 3 and 4)

TYPE DATA.—Holotype male (Coll. No. 5844) ex *Scotinomys teguina episcopi* Enders and Pearson at Finca Pitty near Cerro Punta, elevation 6,000 feet, 31 January 1960; allotype female (Coll. No. 5976) ex *Peromyscus nudipes nudipes* (J. A. Allen) on lava flow above El Hato, elevation 5,000 feet, 10 February 1960. Paratypes: one male *ibid.* holotype; two males *ibid.* allotype; 7 males and 15 females ex (8) *Scotinomys teguina episcopi*; 3 males and 10 females ex (6) *Reithrodontomys sumichrasti vulcanius* Bangs; three males ex animal nest; one female ex *Reithrodontomys mexicanus garichensis* Enders and Pearson; all collected in February and May 1960 (except one pair collected in January) between Bambito and Cerro Punta by C. M. Keenan and V. J. Tipton in the Chiriqui Province, Panama.

Holotype male and allotype female deposited in the United States National Museum. Paratype specimens in the British Museum (Natural History), the private collections of the senior author and Lt. Col. Robert Traub, and Gorgas Memorial Laboratory.

DIAGNOSIS.—*Jellisonia johnsonae*, n. sp., is close to but distinct from *Jellisonia hayesi hayesi* Traub. In the male the protuberance which bears the acetabular bristles is almost medial in position on the immovable process, while it is basad in *J. hayesi hayesi*. The dorsal margin of the distal arm of the ninth sternum is bent almost at a right angle, giving the distal arm a boomerang shape, and the ventral margin is without a lobe. In *J. hayesi hayesi* the dorsal margin of the distal arm of the ninth sternum is

only slightly curved, and there is a very distinct ventral lobe. The base of the crochet is angulate, not globular as in *J. hayesi hayesi*. In the female the sinus of the posterior margin of the seventh sternum is shallow, while *J. hayesi hayesi* has a deep sinus and a pronounced dorsal lobe.

DESCRIPTION.—*Head, Male* (plate 3, fig. 1): Frontoclypeal margin rounded; with small but distinct frontal tubercle; three rows preantennal bristles arranged 6(7)-4-3; first and sixth bristles of first row much smaller than other bristles; with intercalary microsetae in all three rows; variolate area dorsal to both preantennal and postantennal bristles. Eye with outer ring heavily pigmented, but center portion lightly pigmented. Genal process subacuminate; rounded apically. Maxillary lobe extends almost to midpoint on distal segment of maxillary palpus. Maxillary palpus four-segmented; with numerous microsetae. Labial palpus five-segmented; reaches almost to apex of procoxa. Setae of two basalmost antennal segments short. Postantennal area with three rows of bristles arranged 3(4)-4(5)-5; with intercalary microsetae between bases of bristles of last row. Row of small setae on margin of antennal fossa.

Thorax, Male (plate 3, fig. 2): Pronotum with row of five to six long bristles; microsetae interspersed between bases of longer bristles; pronotal comb of about 18 teeth. Mesonotum (MSN.) with three rows of bristles; first row incomplete, arranged 3-7-4; small setae scattered on anterior marginal area; phragmina trigonate. Mesepisternum (MPS.) with one long plus (usually) two small medial setae; additional one or two setae near tip of second pronotal tooth; phragma thickened. Mesepimere (MPM.) with seven setae. Metanotum (MTN.) with two distinct rows of bristles, arranged 6-5; intercalary microsetae between larger bristles of caudad row; three or four additional bristles cephalad of rows of bristles; anterior margin with three setalike spines. Lateral metanotal area (L.M.) with long dorso-caudal bristle plus shorter medial bristle. Pleural arch narrow. Metepisternum (MTS.) with single dorso-caudal bristle; squamulum short, trigonate. Metepimere (MTM.) with variable number of bristles, but usually two rows of three bristles each plus two additional bristles; one proximad to stigma, remaining bristle posterior to cephalad row of bristles.

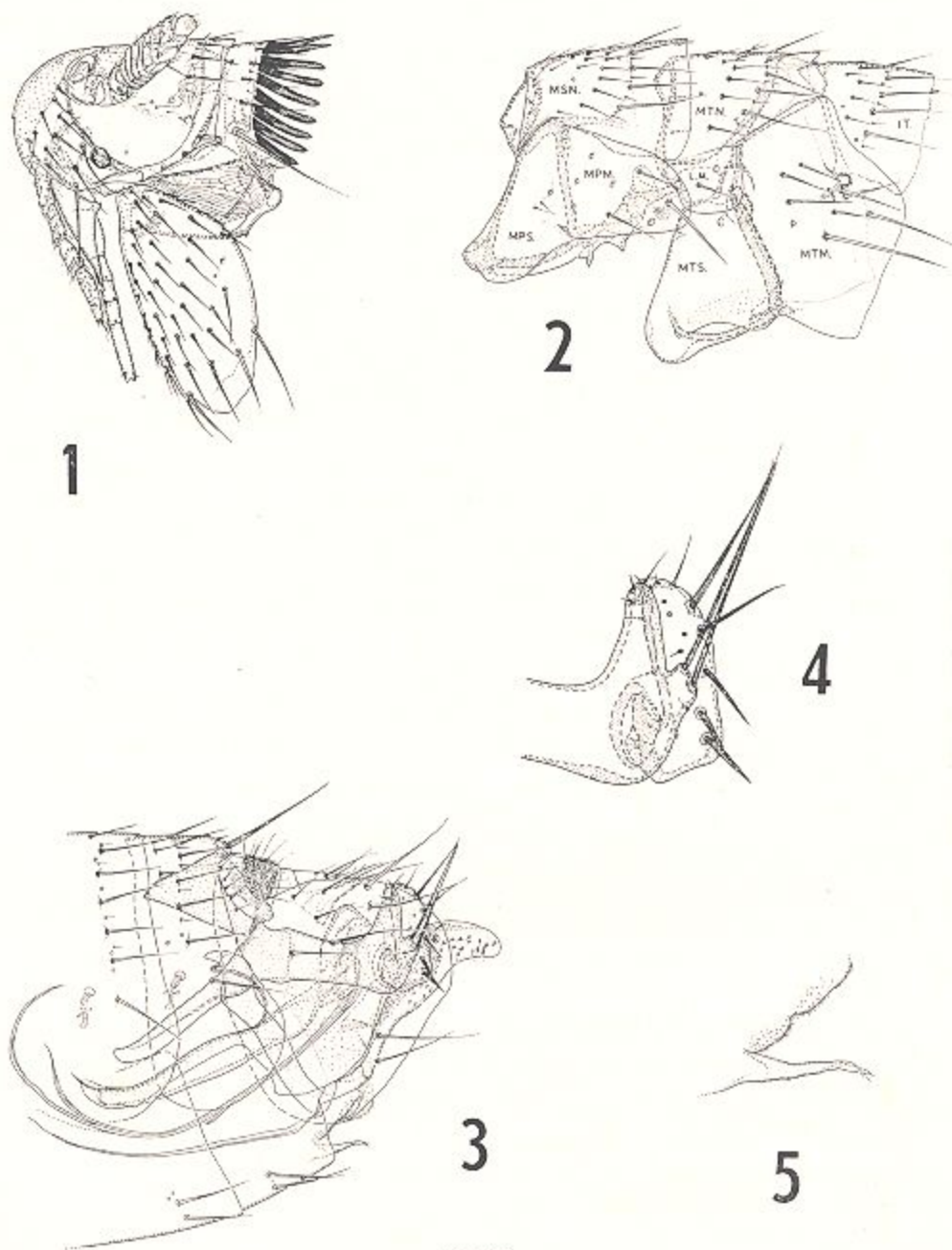
Legs: Procoxa with 36 to 38 stout bristles scattered over outer surface. Profemur with seven to eight thin, external, medial setae plus five to six dorsomarginal bristles. Protibia with eight dorso-marginal notches bearing bristles as follows (base to apex): 2-2-2-2-1-1-1-3; plus seven submarginal-medial bristles. Protarsus with fifth segment longest, fourth shortest. All distal tarsal segments with four pairs lateral plantar bristles; fifth pair medial; no tarsal bristles reach beyond apex of next tarsal segment. Meso- and metacoxae with well-sclerotized internal rods; patches of microsetae on basal areas. Meso- and metafemora with one external, medial

seta each. Meso- and metatibia with 10 dorsomarginal notches bearing bristles as follows (base to apex): 2-2-1-1-2-1-1-1-1-3; plus eight submarginal or medial bristles. Meso- and metatarsi with first segment longest, fourth shortest.

Abdomen: First tergum with two rows bristles arranged 3-4; with one apical spinelet. Terga 2 to 4 with two rows bristles arranged 3(4)-7; with 2(1) apical spinelets. Terga 5 to 7 with two rows bristles arranged (1)2-(6)7. Sterna 3 to 7 each with row

of two bristles. One long antesensillary bristle between two very small spiniform bristles.

Modified Abdominal Segments, Male (plates 3 and 4, figs. 3-5, 10): Eighth tergum large, almost entirely covering genitalia; with four moderately long medial bristles plus three long bristles cephalad of process of clasper. Eighth sternum greatly reduced to short, narrow process devoid of setae but with apical filaments. Intersegmental membrane large, spiculose. Immobile process (P.) of clasper con-

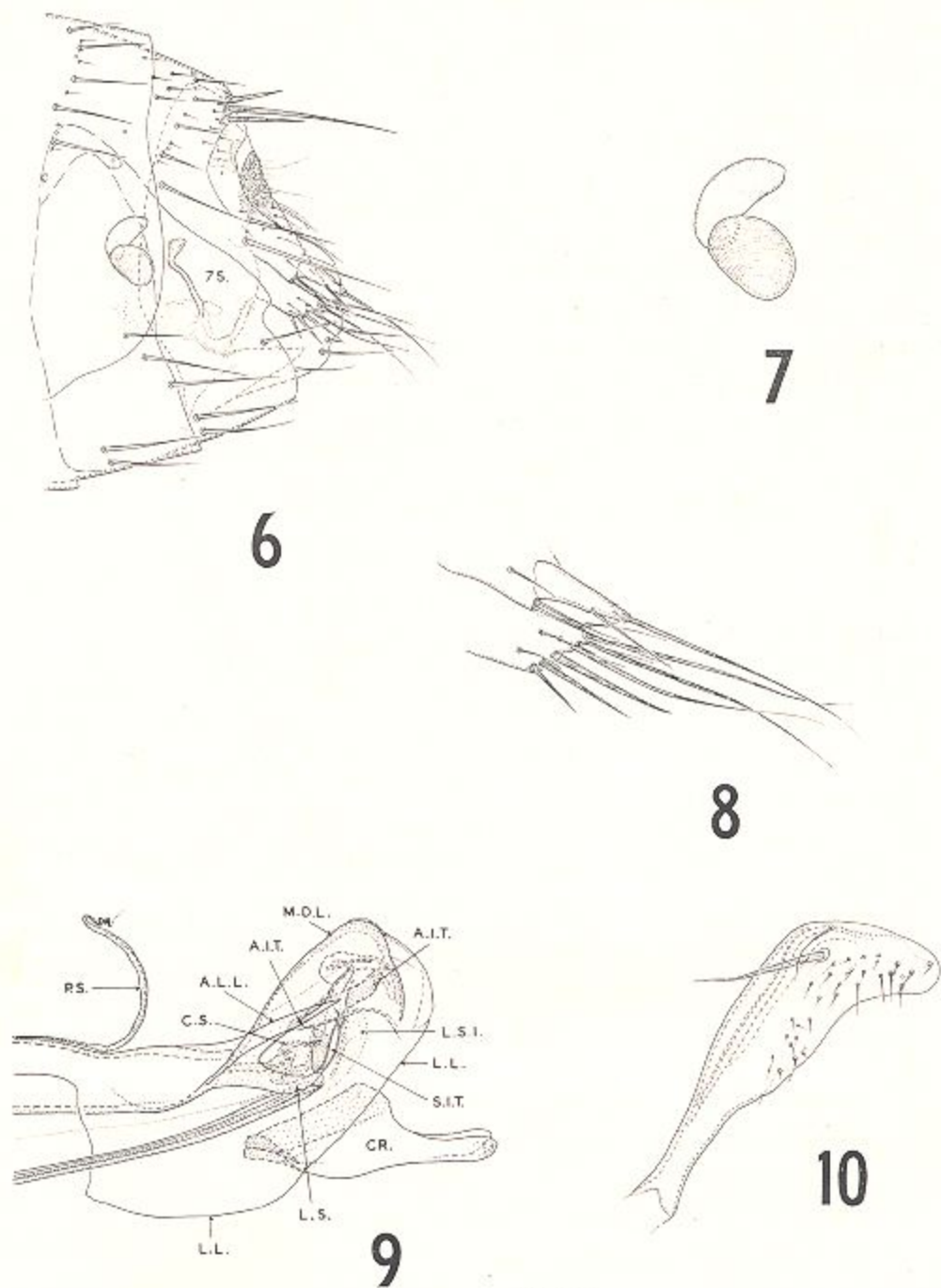


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PLATE 3.—*Jellisonia johnsonae*, new species, male. FIG. 1.—Head, prothorax, and procoxa. FIG. 2.—Mesothorax, metathorax, and first abdominal tergum. FIG. 3.—Modified abdominal segments. FIG. 4.—Process and movable finger of clasper. FIG. 5.—Eighth sternum.

shaped; with three thin subapical setae; caudal margin with short, truncate process about at midpoint between base and apex from which arise two long acetabular bristles. Movable finger (F.) about $1\frac{1}{2}$ to 2 times as broad as immovable process (measured halfway between base and apex); with very thin setae on straight, cephalad margin; with medial row of fine setae plus three or four apical-subapical setae;

caudal margin convex to level of acetabular bristles, then becoming slightly concave; with five stout bristles arranged 2-1-2; the two dorsalmost bristles marginal, inserted fairly close together; third bristle submarginal, inserted at about level of acetabular bristles; two ventralmost bristles stout, shorter than dorsalmost, with medial insertion. Mammbrium long, narrow, swollen somewhat basally, forming one lobe



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PLATE 4.—*Jellisonia johnsonae*, new species. FIG. 6.—Female, modified abdominal segments. FIG. 7.—Female, spermatheca. FIG. 8.—Female, anal stylet and ventral anal lobe. FIG. 9.—Male, apex of aedeagus. FIG. 10.—Male, distal, arm of ninth sternum.

of trilobate sclerite of which large tergal apodeme of ninth tergum constitutes another lobe; proximal arm of clasper forms third, much elongated lobe. Apical one-fourth of proximal arm of ninth sternum somewhat beak-shaped. Distal arm of ninth sternum boomerang-shaped; dorsal margin turned almost at right angle; apex rounded; apicoventral margin concave but medioventral margin convex; one long, cephalad-projecting bristle near bend in dorsal margin, plus smaller submarginal seta dorsad of first; 30 to 31 small spiniforms scattered over ventral half of medial surface.

Aedeagus (plate 4, fig. 9): Aedeagal apodeme (A.E.A.) about two times length of aedeagus proper. Proximal spur (P.S.) prominent. Median dorsal lobe (M.D.L.) well sclerotized. Lateral lobes (L.L.) well developed; extending from near proximal spur ventrad, thence abruptly caudad to crochet, then dorsad to lie in juxtaposition with dorsocaudal angle of median dorsal lobe. Crochet (CR.) broad, well sclerotized basally; reduced abruptly at about midpoint to finger-shaped, slightly incrassate process with rugose apex. Sclerotized inner tube (S.I.T.) narrow, saberlike. Lateral sclerotization of inner tube (L.S.I.) poorly defined. Armature of inner tube (A.I.T.) sinuate; proximal end rounded; distal end subacuminate. Accessory lateral lobe of aedeagus (A.L.L.) very pronounced; long, acuminate. Lateral ventral sclerite (L.S.) of apodemal strut long, narrow. Crescent sclerite (C.S.) small. Penis rods recurved but not coiled.

Modified Abdominal Segments, Female (plate 4, figs. 6-8): Seventh sternum (7S.) with dorsocaudal margin concave; ventral portion of caudal margin produced into short, obtuse lobe followed by rather shallow sinus; ventral lobe slightly convex; with row of five bristles caudad of incomplete row of two bristles. Spermatheca with tail nearly as broad as head; tail slightly longer than head. Anal stylet about three times longer than wide at base; with long apical bristle plus shorter ventromarginal seta.

Dorsal anal lobe (D.A.L.) with dorsomarginal bristles. Ventral anal lobe (V.A.L.) much narrower than dorsal anal lobe; with about three dorsomarginal bristles; one long apical bristle; three medial setae.

REMARKS.—This species is named for Dr. Phyllis T. Johnson, in recognition of her outstanding contributions in furthering the knowledge of South and Central American Siphonaptera.

Pleochaetis altmani, new species

(Plates 5 and 6)

TYPE DATA.—Holotype male (Coll. No. 6311) ex *Reithrodontomys sumichrasti vulcanius* Bangs at Cerro Barú, elevation 10,000 feet, 2 May 1960; allotype female (Coll. No. 5986) ex *Oryzomys fulvescens vegetus* Bangs at Finca Martínez near Cerro Punta, elevation 6,800 feet, 12 February 1960. Paratypes: one male *ibid.* holotype; one male (Coll. No. 6025)

ex *Peromyscus nudipes nudipes* (J. A. Allen) at Finca Martínez, elevation 6,800 feet, 14 February 1960. All specimens collected by C. M. Keenan and V. J. Tipton in the Province of Chiriquí, Panama.

Holotype male and allotype female deposited in the U. S. National Museum. Paratype males in the British Museum (Natural History) and the private collection of the senior author.

DIAGNOSIS.—*Pleochaetis altmani*, n. sp., is very close to *P. schmidti* Traub but may be distinguished as follows: The movable finger of the clasper is approximately 10 times longer than wide at the level of the apex of P and the margins are subparallel, while in *P. schmidti* the movable finger is approximately 6 times longer than wide and the apical half is swollen; the neck of the aedeagus is longer than wide in *P. altmani*, whereas it is very short in *P. schmidti*; the crochet of *P. altmani* is broad basally and the lateral lobes of the aedeagus are distended, while in *P. schmidti* the crochet is only slightly wider at the base than at the middle and the lateral lobes are only slightly distended; the caudal margin of the female seventh sternum is produced into a beaklike dorsal lobe, whereas the dorsal lobe is truncate in *P. schmidti*.

DESCRIPTION.—**Head, Male** (plate 5, fig. 1): Frontoclypeal margin rounded, with small but distinct frontal tubercle; presetal area variolate; with four irregular rows of bristles arranged (11)12-4-3-1. Eye lightly pigmented. Genal process subacuminate; rounded apically. Maxillary lobe extends beyond middle of distal segment of maxillary palpus. Apical setae of second antennal segment much less than one-half length of club. Postantennal area with four rows setae arranged 3-3-2-6, with additional long bristle near margin of antennal fossa between rows 1 and 2; small intercalary setae between bases of bristles of last row; small setae on margin of antennal fossa.

Thorax (plate 5, fig. 2): Pronotum with row of five long bristles; pronotal comb of 18 spines. Mesonotum (MSN.) with three irregular rows of bristles arranged 6-5-4 (distorted on opposite side); small setae scattered on anteromarginal area. Mesepisternum (MPS.) with about eight thin, anterodorsal setae plus four medial bristles. Mesepimere (MPM.) with six bristles (one broken off on opposite side). Metanotum (MTN.) with three irregular rows of bristles arranged 3-6-5; intercalary setae between bases of bristles of last row. Lateral metanotal area (L.M.) with row of three bristles. Metepisternum (MTS.) with single, long bristle. Metepimere (MTM.) with two rows of three bristles each; plus two bristles not identified with rows.

Legs: Procoxa with patch of five or six internal microsetae in basal angle; approximately 39 stout external bristles on medial surface, excluding marginals. Meso- and metacoxae with strongly sclerotized internal rods; several marginal, medial bristles on anteroventral angle; with patch of four to five microsetae on anterodorsal angle plus three adjacent

marginal microsetae; dorsocaudal area with three to four, widely separated, external microsetae on mesocoxa; metacoxa with four microsetae on dorsocaudal margin; patch of three microsetae over proximal end of internal rods. Profemur with four external, medial setae; one long ventromarginal bristle; 6 dorsomarginal setae plus 11 adjacent submarginal setae; single seta on inner surface. Meso- and metafemora with single medial seta plus usual marginal setae. Protibia with seven dorsomarginal notches with bristles arranged (base to apex) 2-2-2-2-1-2-2; plus 10 submarginal to medial setae; mesotibia with eight dorsomarginal notches with bristles arranged (base to apex) 2-2-1-2-2-1-2-2; plus 15 to 16 submarginal to medial setae; metatibia with nine dorsomarginal notches with bristles arranged (base to apex) 2-2-1-2-2-1-1-2-2; plus 18 submarginal to medial setae. Protarsus with fifth segment longest, fourth shortest. Meso- and metatarsi with first segment longest, fourth shortest. No bristles reach beyond apex of next segment.

Abdomen: Apical spiniclets single on terga 1 and 5, paired on terga 2 to 4. Terga with two rows of bristles, usually arranged (5)7-(6)7 but with reduction in number of bristles of first row progressing caudally; tergum 7 has two bristles in first row; intercalary microsetae between bases of bristles of second row. Basal sternum with one submarginal bristle; sterna 3 to 7 with row of three (occasionally four) stout bristles preceded by patch of one to four weaker bristles.

Modified Abdominal Segments, Male (plates 5 and 6, figs. 3-5, 10): Eighth tergum well developed; with four stout, dorsomarginal bristles; five medial bristles plus six small setae ventrad of sensillum. Eighth sternum (plate 5, fig. 5) reduced, slender; with long apical bristle; two ventromarginal bristles. Immobile process (P.) of clasper narrow; bearing moderately long, apical bristle; one small, subapical bristle; one minute medial seta; dorsal portion of posterior margin slightly concave; deep sinus dorsad of acetabular bristles. Movable finger (F.) of clasper approximately 10 times longer than wide, measured at apex of P; extending about one-third its length distad of immobile process; subclavate to clavate; anterior margin only slightly concave for most of its length but bent abruptly cephalad near its apex to form beak bearing single seta; dorsocaudal angle broadly rounded; with moderately long, submarginal bristle; seven to eight smaller bristles around base of long bristle; plus seven small bristles scattered over medial surface; caudal margin slightly concave at midpoint. Proximal arm of ninth sternum bent caudad subapically; incrassate. Distal arm with proximal portion not swollen into lobe; with eight short marginal to submarginal setae; two moderately long bristles; two long bristles; apical half of caudal margin strongly concave; with eight submarginal setae; 11 or 12 smaller setae scattered over medial surface; dorsal margin with narrow, sclerotized band bearing three thin setae.

Aedeagus (plate 6, fig. 9): Aedeagal apodeme with conspicuous middle plate; apical appendage very short; neck (N.) longer than wide; proximal spur (P.S.) well developed, directed caudad for half its length, then dorsad. Apodemal strut with dorsal lobe (D.S.) sinuate; rounded apically; medial lobe (M.S.) broad; arrow-shaped; lateral ventral lobe (L.S.) long; curved dorsad. Crescent sclerite (C.S.) slender but well sclerotized. Median dorsal lobe (M.D.L.) strongly sclerotized; apex beak-shaped. Sclerotized inner tube (S.I.T.) shaped like inverted boot. Lateral sclerotization of inner tube (L.S.I.) hornlike. Crochet (CR.) lightly sclerotized, with very broad base; dorsal margin almost straight; ventral margin concave; apex slender, subacuminate. Lateral lobes (L.L.) well developed; distended ventrally. Penis rods strongly recurved but not coiled.

Modified Abdominal Segments, Female (plate 6, figs. 6-8): Seventh sternum (7S.) with dorsal portion of caudal margin concave; dorsal lobe somewhat beak-shaped; margin excavated ventrad of lobe; row of five long bristles caudad of four shorter bristles; three additional bristles caudad of row. Eighth tergum with row of short setae cephalad of stigma; long bristle ventrad of sensillum; several other smaller setae ventrad and caudad of sensillum. Eighth sternum subacuminate; with three long bristles. Ninth sternum caudal margin bilobate; with two moderately long bristles on apex of ventral lobe. Dorsal anal lobe with several medial bristles. Anal stylet bearing long apical bristle; shorter, subapical bristle on dorsal margin; similar subapical bristle on ventral margin. Ventral anal lobe with two long apical bristles; several shorter marginal bristles. Spermatheca head slightly more than one-half as broad as long; narrower at tail end than at other extremity; tail bent sharply at right angles to head.

REMARKS.—*Pleochaetis altmani* was collected at elevations in excess of 6,500 feet. Further collecting at high elevations will likely reveal its true host relationship.

This species is named for Major Robert M. Altman, who has made some valuable contributions to the knowledge of the ectoparasites of Panama.

Pleochaetis dolens dolens (Jordan and Rothschild)

Ceratomyllus dolens Jordan and Rothschild, 1914, *Novit. Zool.* 21: 257, figs. 1, 2.

Pleochaetis dolens, Jordan, 1923, *Novit. Zool.* 39: 77.

Pleochaetis dolens dolens, Traub, 1950, *Zool. Mem. Chicago Nat. Hist. Mus.* 1: 34-36, pls. 18, 19.

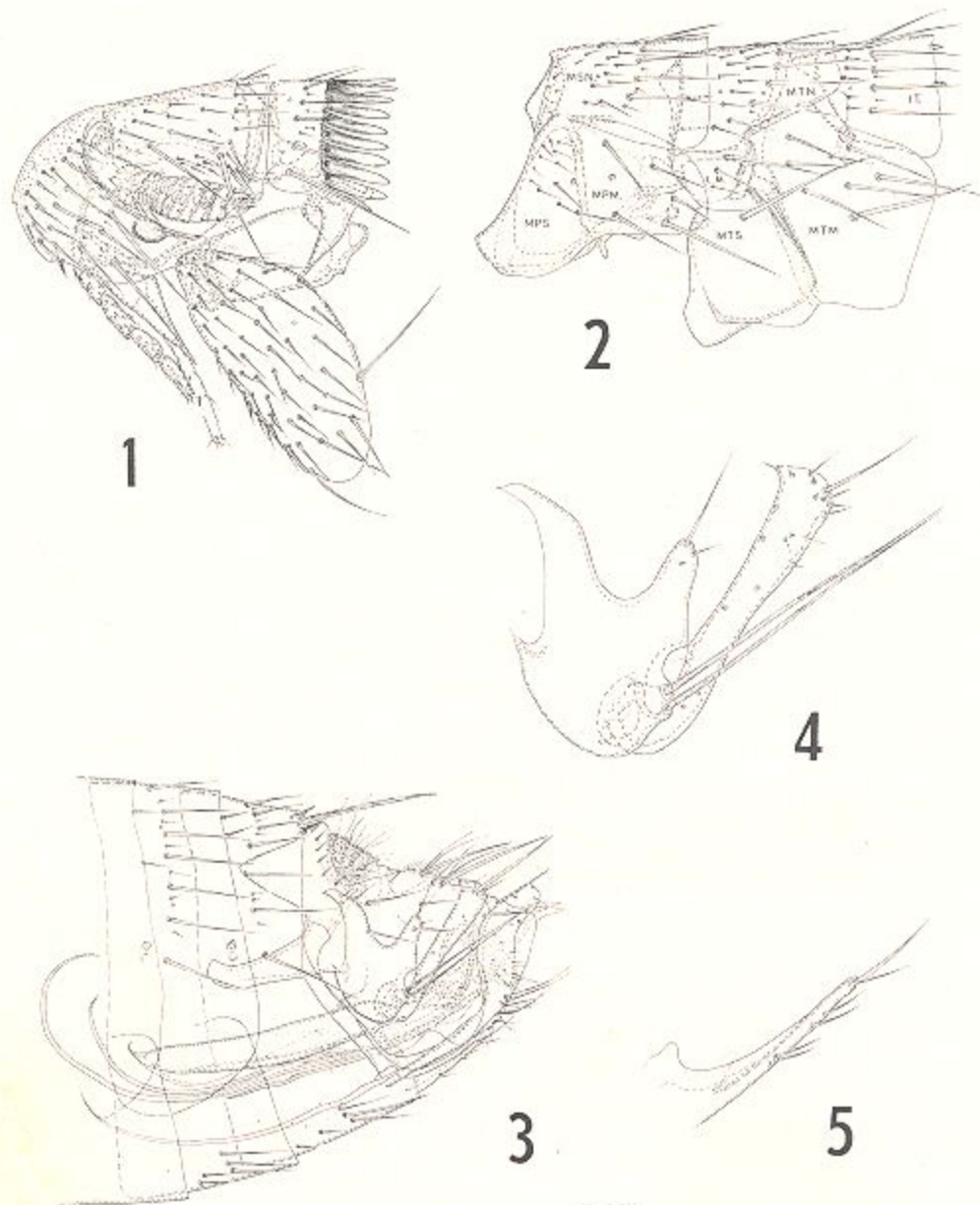
TYPE DATA.—Male and female ex *Guerlinguetus hoffmani* Thomas (= *Sciurus granatensis hoffmani* Peters) at Irazú, Costa Rica, elevation 2,800 feet; collected by O. Garlepp. Other records include specimens ex *Sciurus variegatoides bangsi* Dickey from El Salvador, and ex *Glaucomys goldmani* Nelson and *Orthogeomys grandis* Thomas from Guatemala (Traub 1950).

PANAMANIAN MATERIAL STUDIED.—A total of 48

males and 69 females ex several hosts, as follows: 30 males and 34 females ex (34) *Peromyscus nudipes nudipes* (J. A. Allen); 6 males and 9 females ex (7) *Sciurus granatensis chiriquensis* Bangs; 6 males and 5 females ex (8) *Reithrodontomys sumichrasti vulcanius* Bangs; 3 males and 5 females ex (4) *Reithrodontomys mexicanus garichensis* Enders and Pearson; 1 male and 3 females ex *Scotinomys teguina episcopi* Enders and Pearson; 1 male and 3 females ex (2) *Oryzomys alfaroi alfaroi* (J. A. Allen); 6 females ex (5) *Oryzomys fulvescens vegetus* Bangs; 1 male and 1 female ex (2) *Didelphis marsupialis etensis* J. A. Allen; 1 male ex *Mus musculus brevi-*

rostris Waterhouse; 1 female ex *Mustela frenata panamensis* Hall; 1 female ex *Procyon lotor pumilus* Miller; and 1 female ex rodent nest. All specimens were collected in January, February, and May 1960, above 5,000 feet, in Chiriquí.

REMARKS.—All our specimens fall within the range of intraspecific variation as described by Traub (1950). However, it may be of some interest to point out that our specimens agree more closely with those illustrated by Traub from El Salvador (ex *Sciurus variegatoides bangsi* Dickey) than with those from Guatemala, and that additional collecting will likely reveal continuous variation.



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PLATE 5.—*Pleochaetis altmani*, new species, male. FIG. 1.—Head, prothorax, and procoxa. FIG. 2.—Mesothorax, metathorax, and first abdominal tergum. FIG. 3.—Modified abdominal segments. FIG. 4.—Process and movable finger of clasper. FIG. 5.—Eighth sternum.

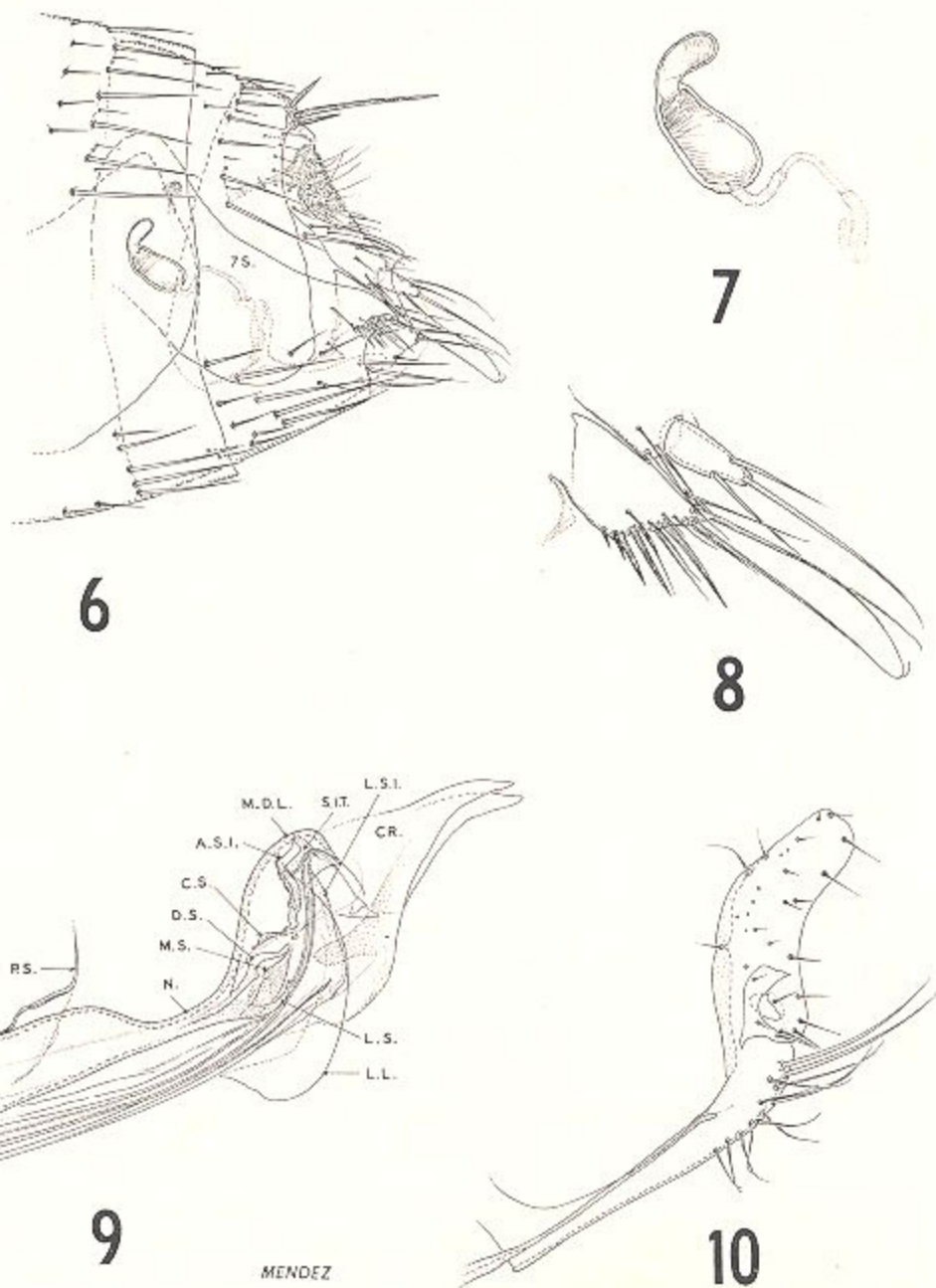


PLATE 6.—*Pleochaetis altmani*, new species. FIG. 6.—Female, modified abdominal segments. FIG. 7.—Female, spermatheca. FIG. 8.—Female, anal stylet and ventral anal lobe. FIG. 9.—Male, apex of aedeagus. FIG. 10.—Male, distal arm of ninth sternum.

Kohlsia keenani, new species

(Plates 7 and 8)

TYPE DATA.—Holotype male (Coll. No. 5790) ex *Peromyscus nudipes nudipes* (J. A. Allen) at lava flow above El Hato, elevation 5,000 feet, 28 January 1960. Allotype female (Coll. No. 5779) ex *P. n. nudipes* at Casa Tilley below Cerro Punta, elevation 5,300 feet, 27 January 1960. Paratypes: male and female (Coll. No. 5818) ex *Oryzomys devius* Bangs, 30 January 1960; two females (Coll. No. 5821), 30 Janu-

ary 1960, and (Coll. No. 5986), 12 February 1960, respectively, ex *Oryzomys fulvescens vegetus* Bangs, and one female (Coll. No. 5823), 30 January 1960, all at Finca Martinz above town of Cerro Punta, elevation 6,800 feet; one male (Coll. No. 5738) ex *Peromyscus n. nudipes*, 20 January 1960, and two females (Coll. No. 5742), 21 January 1960, and (Coll. No. 6230), 4 May 1960, respectively, ex *Oryzomys alfaroi alfaroi* (J. A. Allen) at Casa Tilley; one female (Coll. No. 5844) ex *Scotinomys teguina episcopi* Enders and Pearson, 31 January 1960, below

Finca Pitty, elevation 6,000 feet. All specimens collected in the Province of Chiriquí, Panama, by C. M. Keenan and V. J. Tipton.

Holotype male and allotype female deposited in the U. S. National Museum. Paratypes deposited in the British Museum (Natural History), the private collections of the senior author, Lt. Col. Robert Traub, and Gorgas Memorial Laboratory.

DIAGNOSIS.—*Korisia keenani*, n. sp., is near *K. gammonsi* Traub, 1950, but is readily separated as follows: The distal arm of the ninth sternum bears a single bristle on the dorsal margin which is somewhat less stout than in *Jellisonia* sp. but is absent in *K. gammonsi*; in *K. gammonsi* the eighth sternum has a concave dorsal margin and two long subapical bristles on the ventral margin plus three shorter bristles proximad to these, while in *K. keenani* the dorsal margin is not concave but has a median hump and there are two long median bristles in addition to five long ventromarginal bristles; the vertex of the trigonate crochet is elongate and the sides are concave, whereas in *K. gammonsi* the caudal point of the crochet is more elongate than the vertex and the dorsal margin is almost straight; the seventh sternum of the female has a deep caudal sinus and a truncate dorsal lobe, as compared with an acuminate dorsal lobe and a sharp, but shallow, sinus in *K. gammonsi*. In addition, the preantennal area of the head is pointed and bears 14 bristles, whereas the head of *K. gammonsi* is somewhat pointed but bears 20 bristles on the preantennal area.

DESCRIPTION.—*Head, Male* (plate 7, fig. 1): Anterior margin of head somewhat pointed; with prominent frontal tubercle; micropunctations cephalad of 14 stout bristles on preantennal area; microsetae along anterior margin of antennal fossa. Eyes subovate; ventromarginal area more heavily pigmented than center and dorsal margin. Genal process subacuminate, but with apex rounded. Maxillary lobe acuminate; reaches almost to midpoint of distal segment of maxillary palpus. Maxillary palpus four-segmented. Labial palpus five-segmented, reaching about three-fourths length of fore coxa. Postantennal area with three rows of bristles arranged 4-5-5; with intercalary setae between first and second rows and between bristles of third row; microsetae arranged along posterior margin of antennal fossa. Antenna with patch of microsetae on proximal end of first segment; medial apical setae of second segment much less than one-half length of club.

Thorax, Male (plate 7, fig. 2): Pronotum with row of five bristles; intercalary fine setae between larger bristles; about 24 spines in pronotal comb; ventralmost spine about one-half width of other spines. Mesonotum (MSN.) with three irregular rows of setae arranged 7(8)-5-4; plus row of seven fine setae on flange; intercalary setae between bristles of last row. Mesepisternum (MPS.) with three stout bristles, one fine medial seta, additional three fine setae in dorsal area. Mesepimere (MPM.) with three stout bristles on anterior half, three more near vinculum.

Metanotum (MTN.) with three irregular rows of bristles arranged 4-6-4; plus two or three setae preceding first row. Lateral metanotal area (L.M.) broader than long; with three bristles, dorsalmost longest, ventralmost thin, weak. Metepisternum (MTE.) with one long bristle near dorsocaudal angle; squamulum well developed. Pleural arch well sclerotized. Metepimere (MTM.) with eight bristles arranged in irregular row of four, straight row of three, plus single bristle.

Legs, Male: Procoxa with 32 to 34 stout bristles, exclusive of marginals. Outer surface of profemur with six to seven thin setae; inner surface with single seta. Protibia with seven dorsal notches with bristles arranged (base to apex) 2-2-2-2-1-2-3. Fifth tarsal segment longest, fourth shortest; six pairs plantar bristles, first and sixth pairs displaced medially. Mesocoxa with strongly sclerotized internal rods; patches of microsetae over proximal end of internal rods, on anterodorsal angle; row of three microsetae on caudobasal angle; single seta on outer surface of mesofemur; long marginal bristle on ventrodorsal margin; usual dorsomarginal, apical bristles. Trochanter with very prominent knob. Mesotibia with eight dorsal notches with bristles arranged (base to apex) 2-2-1-2-2-1-2-3; one apical bristle reaches apex of first tarsal segment; 12 medial bristles plus apicoventromarginal bristles; first tarsal segment longest, fourth shortest; six pairs plantar bristles, sixth pair medially displaced; no bristles reach beyond apex of next segment. Metacoxa with highly sclerotized internal rods; patches of microsetae over proximal end of rods, and in anterodorsal angle; three to four marginal microsetae on caudodorsal margin; several heavy bristles on anteroventral angle. Metafemur with single external seta; nine dorso-caudal notches on metatibia with bristles arranged (base to apex) 2-2-1-2-2-1-1-2-3; with 13 medial setae; first tarsal segment longest, fourth shortest; six pairs plantar bristles, sixth pair medially displaced; no tarsal bristles reach beyond apex of next segment.

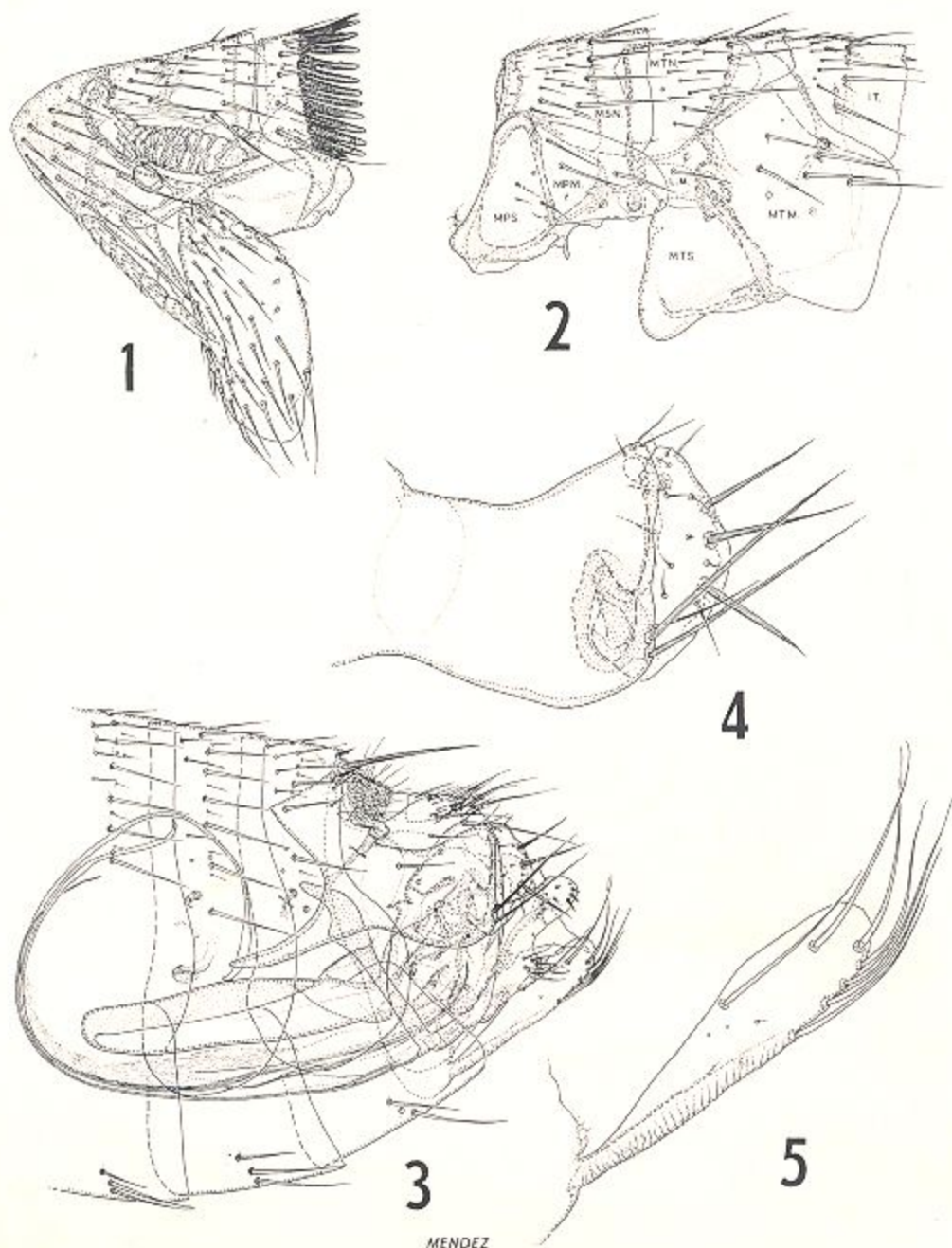
Abdomen: Spinelets on tergum 2 paired; terga 3 to 5 with single spinelets; tergum 1 with three rows bristles arranged 2-5-5; terga 2 to 7 with bristles arranged in two rows, first row ranging from seven on tergum 2 to two bristles on tergum 7, second row of (usually) seven much stouter bristles. Basal sternum with one bristle; sterna 3 to 7 with three bristles. Middle antensensillar bristle about eight times length of the other two.

Modified Abdominal Segments, Male (plates 7 and 8, figs. 3-5, 10): Tergum 8 well developed; covers genitalia almost completely; with row of four stout bristles preceded by two shorter bristles; one weak seta at level of anterior margin of clasper. Sternum 8 with large, club-shaped process; subacuminate apex bearing five ventromarginal bristles plus two long medial bristles; proximoventral margin dentate. Proximal arm of ninth sternum with long, subacuminate apex. Distal arm of ninth sternum bilobed; promi-

ventral lobe bearing four stout marginal bristles plus four to five weaker, submarginal bristles; apical lobe bearing four spiniform bristles plus four to five medial bristles; dorsal margin with hump bearing prominent bristle on dorsocaudal angle. Immobile process (P.) of clasper with dorsal margin rising gradually to apex; dorsocaudal margin sloping caudoventrally at about same angle; remainder of caudal margin almost straight; with slight concavity; with about five weak apical, subapical setae; paired aceta-

bular bristles on caudoventral angle. Movable finger (F.) of clasper about as long as immobile process; cephalad margin slightly concave; bearing two or three fine setae; apex truncate; caudal margin convex, bearing three stout submarginal bristles with intercalary setae between them; with four to five medial setae.

Aedeagus (plate 8, fig. 9): Aedeagal apodeme approximately twice as long as aedeagus proper; middle plate of aedeagal apodeme prominent; broad distally;



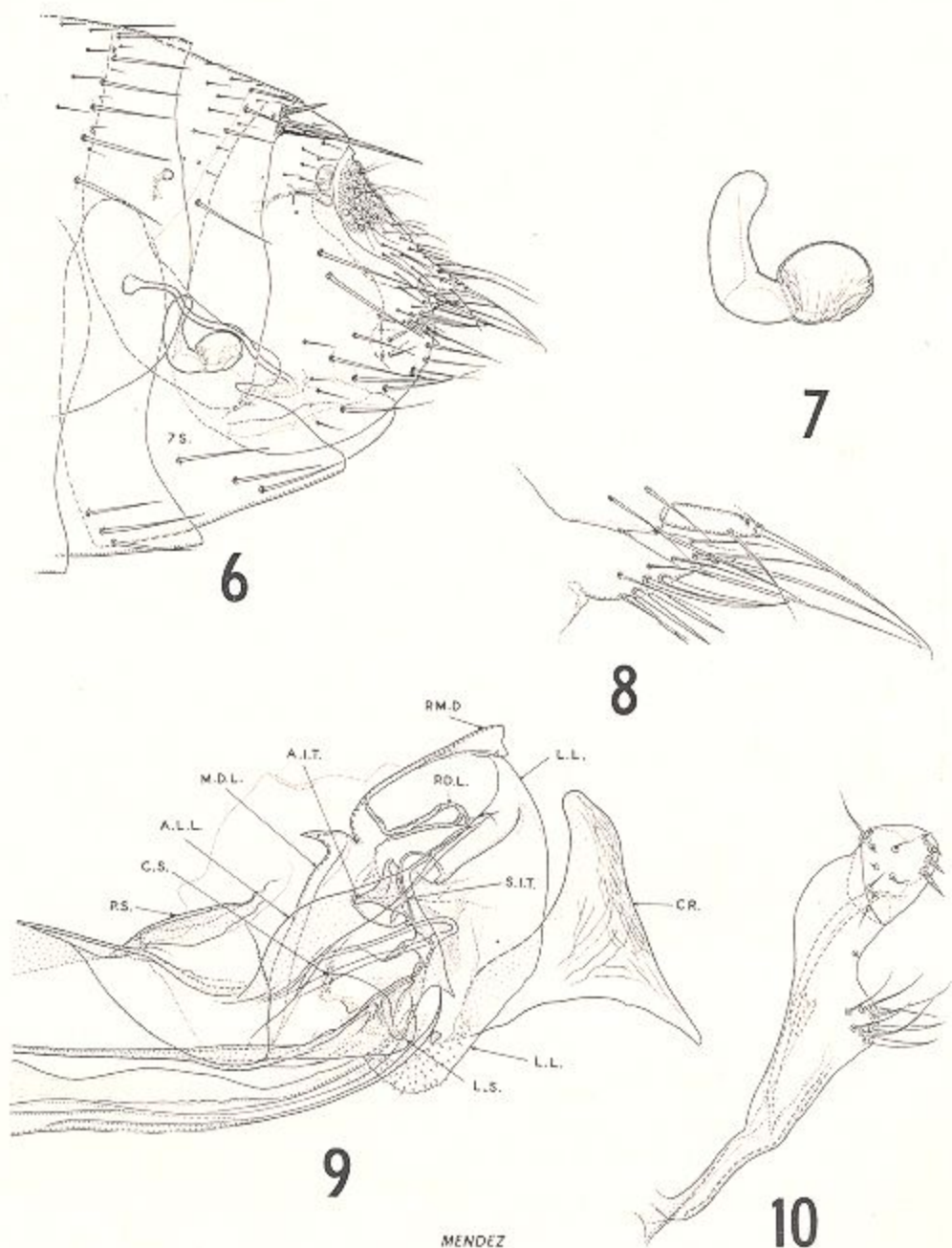
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PLATE 7.—*Kohlsia keenani*, new species, male. FIG. 1.—Head, prothorax, and procoxa. FIG. 2.—Mesothorax, metathorax, and first abdominal tergum. FIG. 3.—Modified abdominal segments. FIG. 4.—Process and movable finger of clasper. FIG. 5.—Eighth sternum.

becoming acuminate at point near broad proximal spur (P.S.). Accessory lateral lobe (A.L.L.) of aedeagus swollen medially, acuminate distally. Crescent sclerite (C.S.) well defined. Dorsal margin of median dorsal lobe (M.D.L.) strongly sclerotized; with prominent beaklike process followed by invagination; forms indistinct, bilobed, primary median dorsal lobe (P.M.D.) at apex; ventral margin of median dorsal lobe with deep convolution which forms secondary paradorsal lobe opposite beaklike process of dorsal margin. Sclerotized inner tube

(S.I.T.) narrow; oriented vertically. Armature of inner tube (A.I.T.) resembling slightly tipped bell. Lateral lobe of aedeagus (L.L.) large flap extending from lateroventral curved lobe of apodemal strut (L.S.) to primary median dorsal lobe of aedeagus (P.M.D.); with proximoventral angle spiculate. Crochet (CR.) well developed; trigonate; dorsal and ventral margins deeply concave; caudal margin concave but with slight hump near dorsal apex; submarginal area reticulate.

Modified Abdominal Segments, Female (plate 8,



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PLATE 8.—*Kohlsia keenani*, new species. FIG. 6.—Female, modified abdominal segments. FIG. 7.—Female, spermatheca. FIG. 8.—Female, anal stylet and ventral anal lobe. FIG. 9.—Male, apex of aedeagus. FIG. 10.—Male, distal arm of ninth sternum.

figs. 6-8): Sternum 7 (7S.) produced into prominent, subtruncate dorsal lobe followed by deep sinus; caudally sloping ventral lobe; with three medial bristles. Tergum 8 with about 10 small bristles cephalodorsad of spiracle; two long bristles ventrad of sensillum; about five long bristles plus five more smaller bristles on ventral half of tergum 8. Sternum 8 reduced to inconspicuous ventral flap. Dorsal anal lobe of proctiger with several marginal, medial bristles. Anal stylet about four times longer than wide; bearing single, long apical bristle; shorter ventral bristle; ventral anal lobe acuminate apically but ventral margin rounded; bearing 10 stout marginal bristles plus 3 to 4 weaker submarginal bristles. Spermatheca with small, subglobular head; tail almost twice length of head, bent at right angles with tip slightly overhanging head. Bursa copulatrix with its duct well sclerotized.

REMARKS.—This species is named for Mr. Charles M. Keenan, an indefatigable field worker and a most pleasant field companion.

Kohlsia traubi, new species

(Plates 9 and 10)

TYPE DATA.—Holotype male and allotype female (Coll. No. 6195) ex *Peromyscus nudipes nudipes* (J. A. Allen) at Casa Tilley below town of Cerro Punta, elevation 5,300 feet, 3 May 1960. Paratypes: 104 males and females from same host and same general locality as holotype and allotype, collected at elevations between 5,000 and 6,800 feet in January, February, and May 1960. One male and one female (Coll. No. 5791) ex *Oryzomys alfaroi alfaroi* (J. A. Allen) on lava flow above El Hato, elevation 5,000 feet, 28 January 1960. All specimens collected by C. M. Keenan and V. J. Tipton in Chiriquí, Panama. In addition, two males and two females in the private collection of Lt. Col. Robert Traub (Coll. No. RT B-1445) are designated paratypes. They were collected from "small gray forest rat" in March 1941 at Volcán, Panama, by H. C. Mathes.

Holotype and allotype deposited in the U. S. National Museum. Paratype specimens deposited in the British Museum (Natural History) and in the private collections of the senior author, Lt. Col. Robert Traub, and Gorgas Memorial Laboratory.

DIAGNOSIS.—*Kohlsia traubi*, n. sp., is very near *K. whartoni* Traub and Johnson, 1952, but may be differentiated on the basis of the following characters: The eighth sternum of *K. whartoni* is truncate and bears several bristles, while in *K. traubi* it is subacuminate and bears only two to three bristles; the apex of the distal arm of the ninth sternum is somewhat globular in *K. whartoni*, but is subacuminate in *K. traubi*; on the caudal margin of the process of the clasper there is a slight protuberance which bears the acetabular bristles in *K. whartoni*, but the same margin in *K. traubi* is straight; the crochet of *K. traubi* lacks the fanglike projection of the ventral margin present in *K. whartoni*; the primary median dorsal lobe of *K. traubi* is not as greatly dilated as

it is in *K. whartoni*; and in the female the ventral lobe of the seventh sternum is less pronounced in *K. traubi*.

DESCRIPTION.—*Head, Male* (plate 9, fig. 1): Anterior margin of head broadly rounded; with frontal tubercle; preantennal area micropunctate cephalad of 14 to 15 bristles; microsetae on margins of antennal fossa. Eye subovate; margin more heavily pigmented than medial area. Genal process subacuminate; rounded apically. Maxillary lobe reaches almost to midpoint of distal segment of maxillary palpus. Maxillary palpus four-segmented. Labial palpus five-segmented; reaching to about two-thirds length of fore coxa. Postantennal area with three rows bristles arranged 3(4)-5-5; with intercalary setae between bases of bristles of last row. Antenna with patch of microsetae on proximal end of first segment; medial, apical setae on second segment not elongate.

Thorax (plate 9, fig. 2): Pronotum with row of five to six bristles; intercalary fine setae between bases of bristles; about 18 spines in pronotal comb. Mesonotum (MSN) with irregular row of seven bristles followed by row of four stout bristles with intercalary microsetae; row of two to three setae on flange; four subapical pseudosetae. Mesepisternum (MPS.) with two to three stout bristles plus one or two fine medial setae; three more fine setae on dorsal area. Mesepimere (MPM.) with seven stout bristles. Metanotum (MTN.) with three rows bristles usually arranged 4-6-5. Lateral metanotal area (L.M.) broader than long; with two to three stout bristles. Metepisternum (MTS.) with one long bristle. Squamulum well developed. Pleural arch well sclerotized. Metepimere (MTM.) with six long bristles.

Legs: Procoxa with about 30 stout bristles exclusive of marginals. Outer surface of profemur with six to eight thin setae; inner surface with single seta. Protibia with seven dorsomarginal notches bearing bristles arranged (base to apex) 2-2-2-2-1-2-3; plus eight medial bristles. Fifth pro-tarsal segment longest, fourth segment shortest; six pairs plantar bristles, first and sixth pairs medially displaced. Meso- and metacoxae with strongly sclerotized internal rods; patches of microsetae over proximal end of internal rods, and on anterodorsal angles; row of microsetae on caudobasal angle of mesocoxa; several stout bristles on anteroventral angle of metacoxa. Meso- and metafemora with single external seta; usual dorsomarginal, apical setae. Meso- and metatibiae with eight dorsocaudal notches bearing bristles arranged (base to apex) 2-2-1-2-2-1-2-3; 12 medial bristles (13 on metatibiae). Meso- and metatarsi with first segment longest, fourth shortest; first and sixth pairs of plantar bristles medially displaced.

Abdomen: Terga 1 to 4 with apical spinelets; usually paired on tergum 2. Tergum 1 with two rows bristles arranged (5)6-5(7); plus one or two bristles cephalad of rows; terga 2 to 7 with row of five to seven stout bristles preceded by row of two to five

smaller bristles; intercalary setae between bristles of last row. Basal sternum with one seta per side. Sterna 3 to 7 with row of three to four bristles on each side. Dorsal antesensillial bristle about three times longer than ventral bristle.

Modified Abdominal Segments, Male (plates 9, 10, figs. 3-5, 10): Tergum 8 indistinct, somewhat expanded; reaches caudally to margin of clasper;

with four bristles cephalad of sensillum plus four medial bristles in dorsocaudal area, of which ventralmost is very long. Sternum 8 with well-developed process bearing two subapical bristles plus one long subbasal bristle (shape of process, position and number of bristles variable, as indicated in plate 9, figures 5, 5a, 5b). Distal arm of ninth sternum with heavily sclerotized mesal rod extending almost to

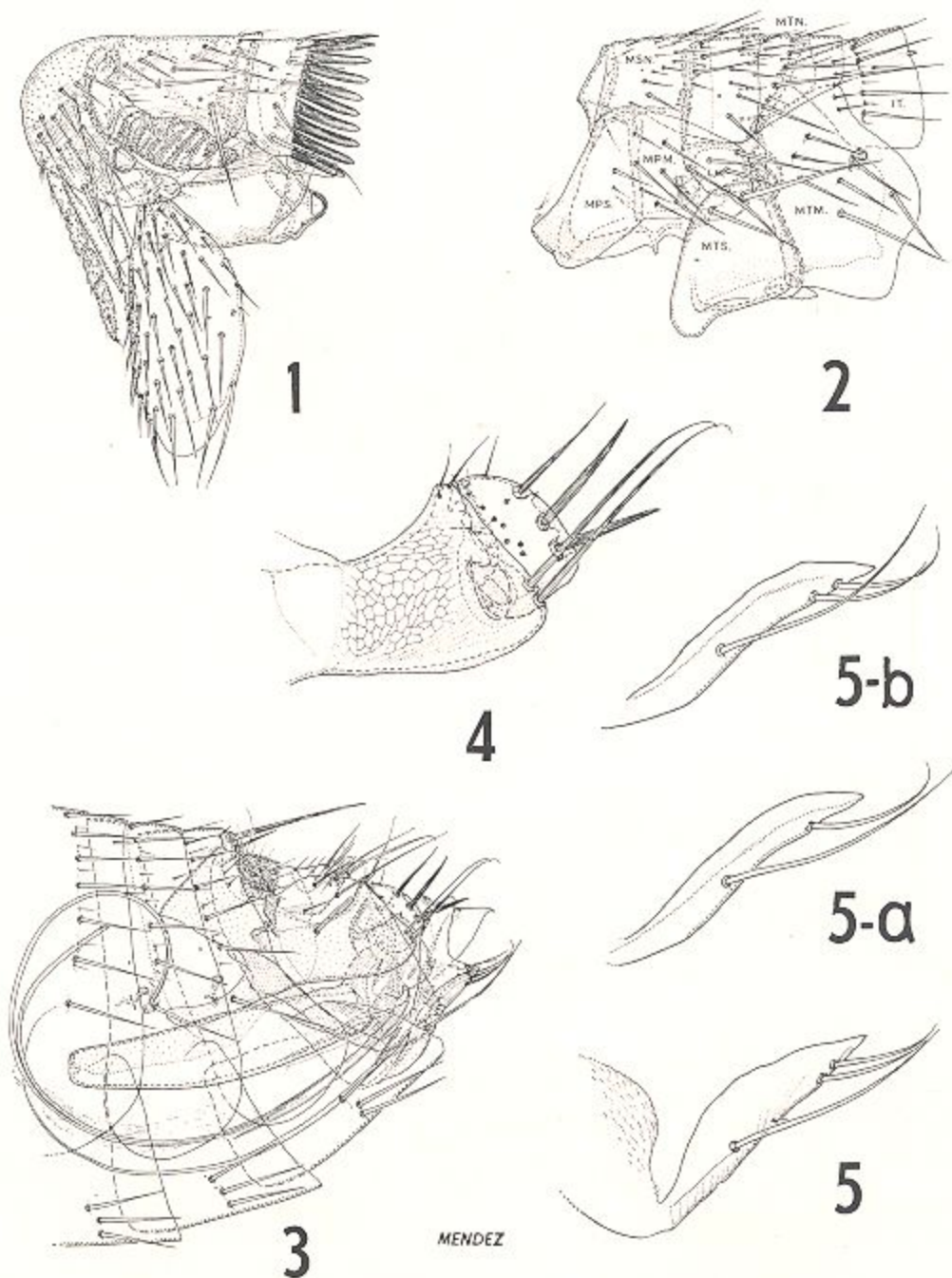


PLATE 9.—*Kohlsia traubi*, new species, male. FIG. 1.—Head, prothorax, and procoxa. FIG. 2.—Mesothorax, metathorax, and first abdominal tergum. FIG. 3.—Modified abdominal segments. FIG. 4.—Process and movable finger of clasper. FIG. 5.—Eighth sternum. FIGS. 5a, 5b.—Variation of eighth sternum.

apex; with conspicuous ventral lobe bearing two to three stout marginal bristles plus six to seven smaller medial bristles; ventral margin of apical half of arm straight; apex rounded; with 10 to 12 weak submarginal bristles; one longer subapical bristle on dorsal margin. Immovable process (P.) of clasper reticulate; apex short, subrounded; caudal margin almost straight, slightly concave. Movable finger

(F.) of clasper about same length as immovable process; cephalad margin with three to four small protuberances into each of which a small bristle is inserted; two or three small apical, subapical microsetae; caudal margin evenly rounded; with small subapical seta followed by three stout submarginal bristles; seven to eight medial microsetae.

Aedeagus (plate 10, fig. 9): Aedeagal apodeme

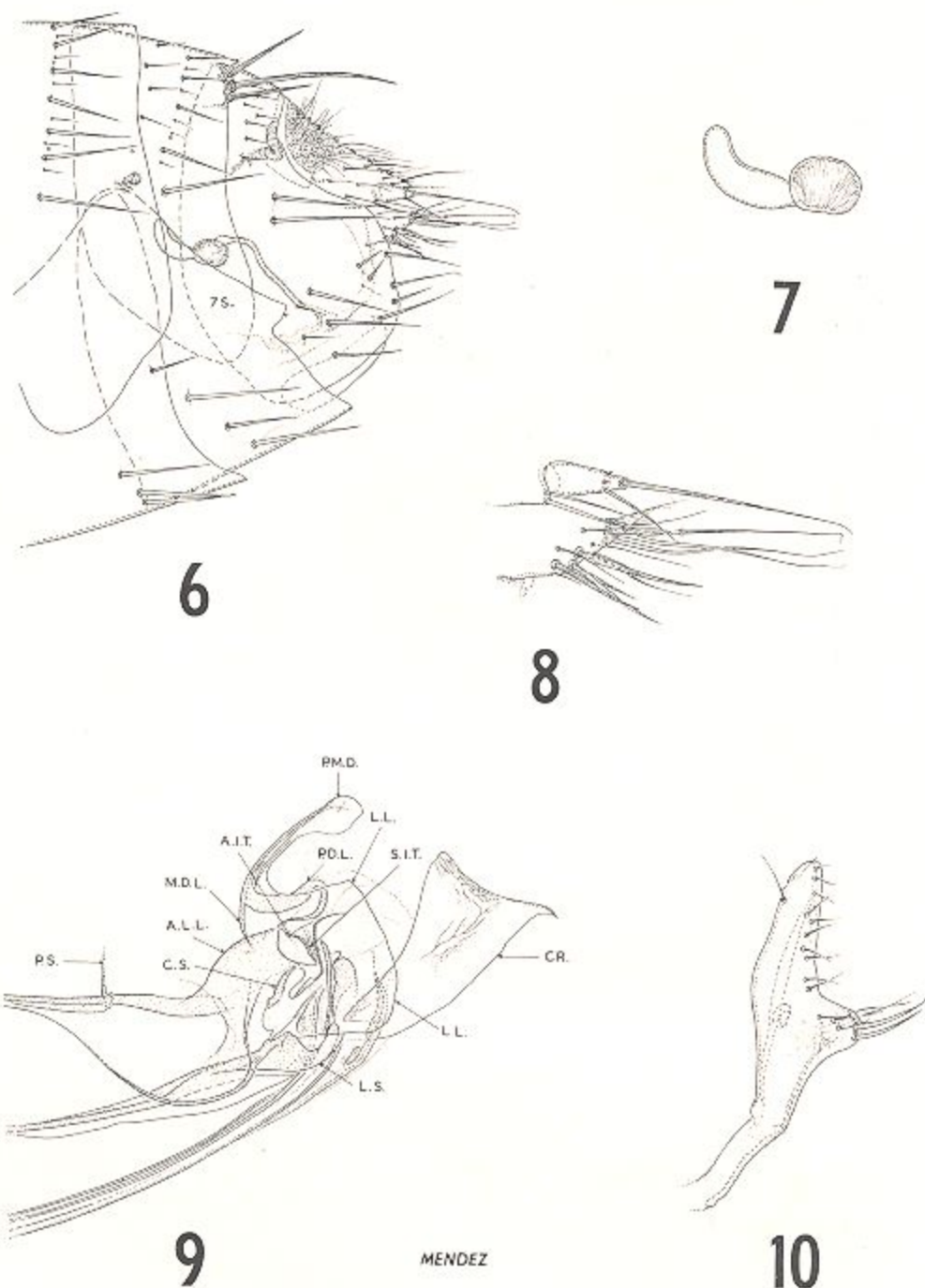


PLATE 10.—*Kohlsia traubi*, new species. FIG. 6.—Female, modified abdominal segments. FIG. 7.—Female, spermatheca. FIG. 8.—Female, anal stylet and ventral anal lobe. FIG. 9.—Male, apex of aedeagus. FIG. 10.—Male, distal arm of ninth sternum.

MENDEZ

about three times as long as aedeagus proper; middle plate of aedeagal apodeme rather poorly defined; proximal spur (P.S.) very small, inconspicuous, seta-like, with smaller accessory spur caudad of proximal spur. Accessory lateral lobe (A.L.L.) of aedeagus indistinct distally but apparently truncate. Crescent sclerite (C.S.) distinct; with cephalodorsal "fin." Median dorsal lobe (M.D.L.) with double convolution forming cleaverlike primary median dorsal lobe (P.M.D.); rounded primary paradorsal lobe (P.D.L.). Sclerotized inner tube (S.I.T.) narrow; sinuate. Armature of inner tube (A.I.T.) narrow; curved; with ventrad leaflike sclerite. Lateral lobe of aedeagus (L.L.) well developed; with convex caudal margin. Crochet (C.R.) conical; longer than broad; caudodorsal angle reticulate; caudoventral angle subtenuis. Penis rods strongly recurved, but not coiled. Pod-shaped sclerotization near end of aedeagal apodeme.

Modified Abdominal Segments, Female (plate 10, figs. 6-8): Seventh sternum (7S.) with short, nipple-like dorsal lobe; remainder of caudal margin almost straight; produced caudad ventrally to form subacuminate ventral lobe; with medial row of four bristles per side. Eighth tergum (8T.) with about seven weak bristles cephalodorsad of spiracle; two long bristles ventrad of sensillum; ventromedial row of three stout bristles preceded by two weaker bristles. Eighth sternum inconspicuous; caudad process about twice as long as broad. Ninth sternum inapparent. Dorsal anal lobe of proctiger with eight or nine weak medial bristles plus dorsomarginal bristles; two ventral bristles directly ventrad of anal stylet. Anal stylet about $2\frac{1}{2}$ times longer than wide; long apical bristle; weaker ventromarginal bristle; with one or two subapical microsetae. Ventral anal lobe with two stout marginal, three stout submarginal, two or three weak medial bristles. Head of spermatheca about $1\frac{1}{2}$ times longer than broad; tail more than $1\frac{1}{2}$ times longer than head; tail curved gently so that its tip is at right angles with head. Bursa copulatrix well sclerotized; cephalad end dilated.

REMARKS.—This species is named for Lt. Col. Robert Traub, an astute student of the Siphonaptera and a generous friend and advisor.

Kohlsia traubi was the most common flea encountered in Chiriquí, and was collected at all elevations where *Peromyscus nudipes nudipes* was found.

Kohlsia graphis graphis (Rothschild)

Ceratophyllus graphis Rothschild, 1909, Novit. Zool. 16: 62, pl. 10, figs. 3, 4.

Kohlsia graphis graphis, Traub, 1950, Zool. Mem. Chicago Nat. Hist. Mus. 1: 50-51; pl. 29, fig. 6; pl. 30, figs. 5-7.

TYPE DATA.—Type specimens ex *Sciurus deppiei* (sic) from Nicaragua. Known only from the original type material.

PANAMANIAN MATERIAL STUDIED.—Four specimens ex *Sciurus granatensis chiriquensis* Bangs, as follows: One male and one female (Coll. No. 6010)

from La Amenaza near Bambito, elevation 5,800 feet, 14 February 1960; one female (Coll. No. 5997) at Finca Martinz near Cerro Punta, elevation 6,800 feet, 12 February 1960; one female (Coll. No. 5762) at Casa Tilley, 27 January 1960.

REMARKS.—There were no fleas removed from 63 specimens of *Sciurus granatensis* ssp. collected in the lowlands of Panama, and only 3 out of 15 specimens of *S. g. chiriquensis* collected above 5,000 feet were infested with *Kohlsia graphis graphis*. We were unable to collect other species of squirrels (*Microsciurus* sp.) at high elevations; and it may be that this flea is not so rare as collection records would indicate, but rather that the true host is difficult to collect.

Strepsylla dalmati Traub and Barrera

Strepsylla dalmati Traub and Barrera, 1955, Fieldiana: Zool. 37: 541-4; pl. 10, figs. 1-3; pl. 11, fig. 1; pl. 13, fig. 1.

TYPE DATA.—Holotype male ex *Peromyscus guatemalensis* from "Jalapa, five miles east of Mataquesuintla, La Soledad Grande, Guatemala;" elevation 8,300 feet, collected by Luis de la Torre, 21 March 1952.

PANAMANIAN MATERIAL STUDIED.—One male (Coll. No. 6312) ex *Reithrodontomys sumichrasti vulcanius* Bangs on Cerro Barú, elevation 10,500 feet, 2 May 1960; one male (Coll. No. 5815) ex *Peromyscus nudipes nudipes* (J. A. Allen) at Finca Martinz near Cerro Punta, elevation 6,800 feet, 30 January 1960; one female (Coll. No. 5819), *ibid.*, but ex *Oryzomys fulvescens vegetus* Bangs.

REMARKS.—The female is not described, as it is difficult, if not impossible, to associate accurately single females with single males collected from different hosts.

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