

NOTES ON THE PHLEBOTOMUS OF PANAMA XIII. THE VEXATOR GROUP,  
WITH DESCRIPTIONS OF NEW SPECIES FROM PANAMA  
AND CALIFORNIA<sup>1</sup>

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The species here considered were placed in the subgenus *Brumptomyia*, group *brumpti*, series *vexator* by Fairchild (1955). Of this series, we have selected for discussion only those species whose males bear a definite tuft of setae on the inner base of the coxite. This character is proving to be somewhat artificial, at least in this series, as selection of the species on this basis brings together forms that in other respects appear to be more closely related to species lacking the basal tuft. Thus in *P. durani* Vargas and Diaz Najera the male lacks a basal tuft, while the female has spermathecae and cibarium similar to *P. chiapanensis* Dampf. It is possible in this case, however, that the male and female are not properly associated and that the latter in reality belongs to the *cayennensis* group. The great diversity in wing venation and spermathecal structure also suggests that future study may show that the present grouping based on male characters is rather artificial. We retain it here largely as a matter of convenience.

The geographic distribution of the species treated here is of some interest. All but two of the species occur on the western sides of the continents or in Central America, from California to Peru, the exceptions being *vexator* Coq. in eastern North America and *quinquefer* Dyar in southeastern South America. No less than four species are Nearctic, three others Mexican and five Andean, with three species in Central America including Panama. No species are known from the Amazon basin or the north coast of South America.

The host preferences of several of the species are known. *P. peruensis* Shannon, *pescei* Hertig, and *sanguinarius* n. sp. bite man with avidity, the first two at least entering houses to do so in Peru. *P. hartmanni* n. sp. has also been taken biting in the forest in Panama on a few occasions. *P. peruensis* also appears to bite dogs (Hertig 1942, p. 47), and we have recently taken *P. sanguinarius* in fair numbers biting a horse, although our records show it as only occasionally taken in horse-baited mosquito traps, probably because the latter have seldom been used in its favored habitats. *P. noguchii* Shann. appears to bite only small rodents, mainly *Phyllotis*, and will feed on nothing else in the laboratory (Hertig 1942, p. 40). *P. vexator* has been taken several times feeding on snakes in nature (Shannon 1913) and Hertig (unpublished) has successfully reared

the species in the laboratory using snake, turtle, alligator and lizard as the source of blood meals. Nothing positive is known concerning the feeding habits of the other species, though the association of *P. stewarti* Mang. and Galindo with the burrows of the California ground squirrel suggests this rodent as a host. Galindo (personal communication) informs us that he has seen engorged specimens of *stewarti* collected in a field mouse nest in Kern Co., Calif. by T. H. G. Aiken, which would tend to confirm the rodent feeding habits of this species.

The early stages of none of the species have been described in detail, though Hertig has reared *peruensis*, *noguchii*, *vexator*, and more recently, *sanguinarius*, from eggs from wild caught females. All the larvae appear to have four caudal setae in the fourth instar.

*P. ballistinii* Hertig, placed in this series provisionally by Fairchild (1955) is omitted, as the male has armed parameres and highly modified setae in the basal tuft of the coxite and is unlikely to be confused with any of the species treated here.

KEY TO FEMALES

1. Cibarium with a comb of about 25 slender teeth. Pharynx armed with irregular spines. . . . . 2  
Cibarium with 4 or rarely 6 more or less triangular teeth. Pharynx unarmed or minutely spinulose 3
2. Common duct of spermathecae about one-sixth as long as individual ducts, slender. . . . . **californicus**  
Common duct about one-third as long as individual ducts, rather broad. . . . . **chiapanensis**
3. Cibarium with 4 large teeth and 2 smaller ones between the lateral large teeth. Wing long and narrow, beta over four-fifths alpha. Spermathecae tubular, with a small oblate head and slender terminal knob. . . . . **vexator**  
Cibarium with but 4 horizontal teeth. . . . . 4
4. Beta of wing venation very short, less than one-third alpha. Wing always relatively broad, less than 3.5 times as long as broad. . . . . 5  
Beta longer, over one-half alpha. Wing generally narrower. . . . . 8
5. Fourth palpal segment short, less than two-thirds length of third, fifth palpal segment clearly less than half length of third. . . . . 6  
Fourth palpal segment longer, at least three-fourths length of third; fifth segment at least twice as long as third. . . . . 7
6. Spermathecae small, deeply annulate, the terminal knob prominent; ducts very slender. . . . . **hartmanni**  
Spermathecae large, weakly and shallowly annulate, the terminal knob set in a cup-like depression. Ducts thicker. . . . . **sanguinarius**
7. Spermathecae with distinct hemispherical head and tapering finely annulate body. Chitinous arch broad and diffuse with a median anterior process. . . . . **peruensis**

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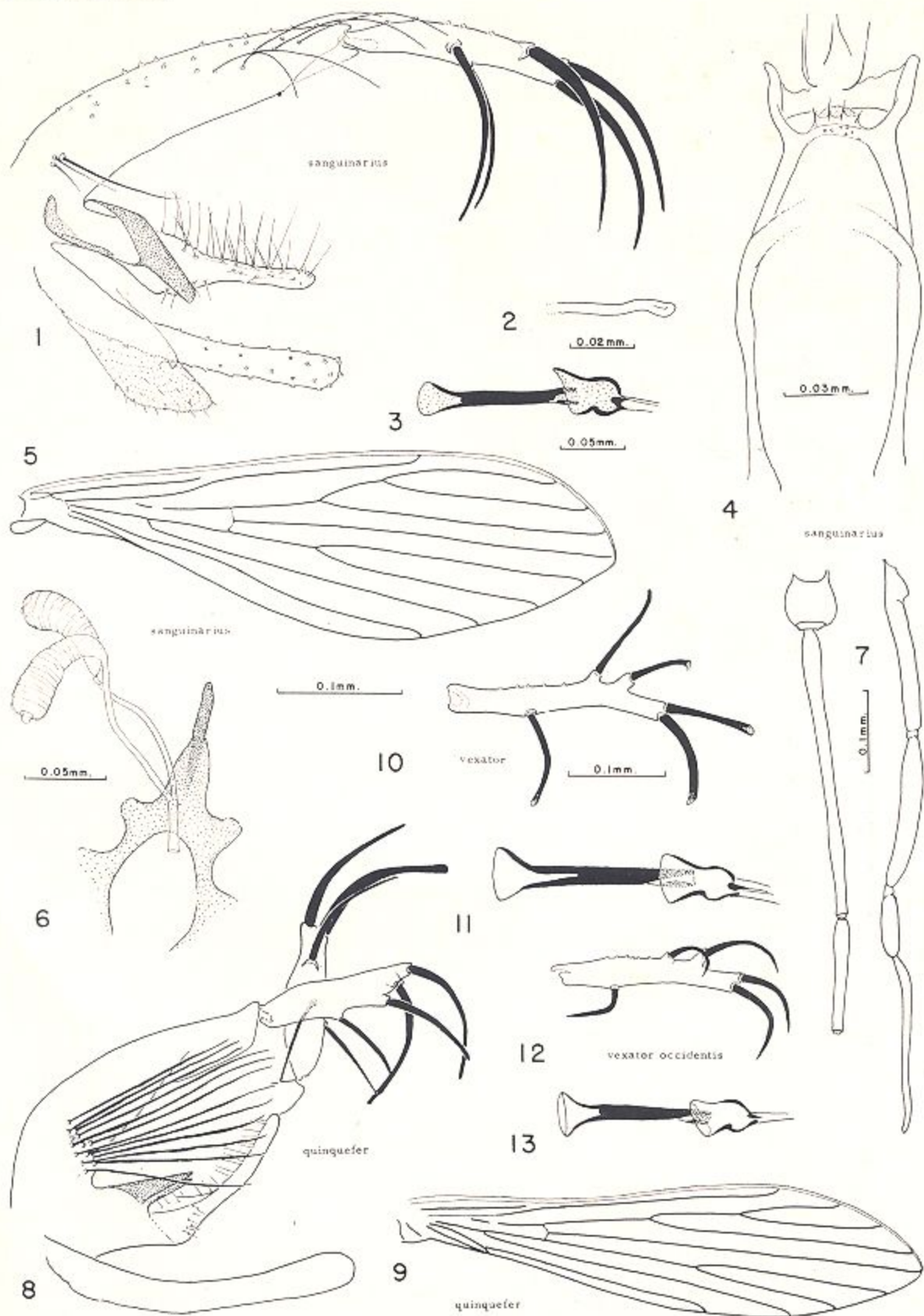
- Spermathecae slender, almost tubular, the body not annulate, irregularly wrinkled. Chitinous arch absent or barely visible. . . . . **pescei**
8. Spermathecae with a well-marked hemispherical head and carrot-shaped annulate body, the terminal knob large. Cibarium without chitinous arch. . . . . **stewarti**
- Spermathecae otherwise. . . . . 9
9. Spermathecae small, carrot shaped, rather irregularly annulate with poorly differentiated head. 10
- Spermathecae tubular, with a well marked oblate or spherical head. . . . . 11
10. Eyes unusually small. Wing narrow, over 3.5 times as long as greatest width; gamma and beta subequal to alpha, delta short, approaching zero. Spermathecae with unusually long and slender terminal knob. . . . . **osornoi**
- Eyes of average size. Wing broader, barely over 3 times as long as broad; gamma and beta together about equaling alpha. Delta longer, about one-fourth alpha. Spermathecae with small club-shaped knob. . . . . **noguchii**
11. Spermathecae and ducts over 7 times as long as stem of genital fork, the bodies of spermathecae more slender than ducts, finely annulate; no common duct. . . . . **oppidanus**
- Spermathecae and ducts much shorter, less than 4 times length of stem of genital fork. . . . . 12
12. Spermathecal ducts broad, the body of spermathecae smooth and not differentiated from the ducts. Spermathecae and ducts about 3.5 times as long as stem of genital fork. . . . . **vindicator**
- Ducts more slender, the tubular, finely and faintly annulate spermathecal bodies more slender than ducts. Spermathecae and ducts hardly twice length of stem of genital fork. . . . . **vexator occidentis**

## KEY TO MALES

1. Wing fairly broad, less than 3.5 times as long as broad, venation with beta very short, less than one-third alpha. . . . . 2
- Wing broad or narrow, venation with beta over one-half alpha. . . . . 5
2. Basal tuft on coxite of 5 or fewer rather weak and slender setae. . . . . 4
- Basal tuft on coxite of many more than 5 setae. Median spine of style much closer to apex than to basal spines. Alpha about 4 times beta. . . . . 3
3. Parameres very slender with relatively few and short setae on terminal half only, the basal half narrowed. Lateral lobes straight, clearly longer than coxites. Basal tuft of about 20 broad blade-like spines. . . . . **peruensis**
- Parameres stouter, not narrowed at base, their whole dorsal surface beset with longer and more numerous setae. Lateral lobes curved, subequal or but slightly longer than coxites. Basal tuft of fewer and more slender setae. . . . . **pescei**
4. Sperm pump small and slender, the genital filaments from 3.8 to 5 times as long as pump, their tips drawn out into fine points. Aedeagus slender, acute. . . . . **hartmanni**
- Sperm pump larger and heavier, the genital filaments from 2.1 to 3.7 times as long as pump, tips blunt and bent. Aedeagus stout, blunt. . . . . **sanguinarius**
5. Basal spines on style unpaired, inserted at markedly different levels. Basal tuft on coxite of 5 or fewer setae. Wing narrow, about 4 times as long as greatest width. . . . . 6
- Basal spines on style paired, inserted at or close to same level. . . . . 8
6. Genital filaments over 6 times as long as genital pump, the latter with deep "pavillon." Parameres slender, upcurved, slightly clubbed, bearing setae only on apical third. . . . . **oppidanus**
- Genital filaments less than 5 times length of pump, the latter with shallow "pavillon." Parameres shorter, not upcurved, bearing dorsal setae nearly throughout their length. . . . . 7
7. Genital filaments at least 4.5 times as long as pump. Style long and cylindrical, all but the basal spine inserted well distal of middle of style. . . . . **vexator**
- Genital filaments less than 4 times as long as pump. Style shorter and stouter, the next to basal spine inserted close to middle of style. . . . . **vexator occidentis**
8. Basal tuft on coxite of less than 5 setae. Tips of genital filaments hooked. Wing narrow, delta short, less than one-fifth alpha; beta long, subequal to alpha. . . . . **stewarti**
- Basal tuft of more numerous setae. . . . . 9
9. Third antennal segment long, considerably exceeding head height from vertex to base of clypeus. 10
- Third antennal segment shorter, subequal or less than head height. . . . . 11
10. Wing narrow, at least 4 times as long as wide, alpha much less than twice beta, delta short, less than one-fifth alpha. Eyes small. Basal tuft of short stout setae. Parameres slender, slightly clubbed; lateral lobes clearly longer than coxites. . . . . **noguchii**
- Wing broader, less than 3.5 times as long as wide, alpha more than twice beta, delta about one-fourth alpha. Eyes of average size. Basal tuft of very numerous long slender setae. Parameres stouter, the apex less clubbed, somewhat bent downwards; lateral lobes clearly shorter than coxites. . . . . **osornoi**
11. Lateral lobes long and upcurved, clearly longer than coxites. Basal tuft of about 8 slender setae set on a small sclerotized plate. Parameres flattened and widened before the acute apex and with a large setulose lobe dorsally at base. . . . . **vindicator**
- Lateral lobes subequal or shorter than coxite. Parameres and basal tuft otherwise. . . . . 12
12. Basal tuft of about a dozen very long and heavy spine-like setae set in several transverse rows. Parameres slender, upcurved, nearly as long as coxites. . . . . **quinquefer**
- Basal tuft of shorter and much more slender setae. Parameres much shorter. . . . . 13
13. Basal tuft of about a dozen stiff setae closely set on a small eminence; inner aspect of remainder of coxite with but a few rather long setae. Parameres rather evenly tapered to an acute apex. . . . . **californicus**
- Basal tuft of about a dozen lax setae in an indefinite transverse patch, hardly distinguishable from the numerous setae clothing inner aspect of whole coxite. Parameres less acutely pointed. Wing broader, less than 4 times as long as broad. . . . . **chiapanensis**

## EXPLANATION OF PLATE I

FIGS. 1-7, *P. sanguinarius* n. sp.: fig. 1, male genitalia; fig. 2, tip of genital filament; fig. 3, genital pump, all slide 4262; fig. 4, female cibarium, slide 3944; fig. 5, male wing, slide 3146; fig. 6, spermathecae, drawn in phenol from a specimen from Quebrada Bonita, Colon Prov., Panama, subsequently discarded; fig. 7, female palpi and basal antennal segments, slide 3943. FIGS. 8-9, *P. quinquefer* Dyar: fig. 8, male genitalia, Type no. 41593, U. S. N. M.; fig. 9, male wing, slide 2582 det. as *P. richardsi* C. L. by Mangabeira. FIGS. 10-11, *P. vexator* Coq.: style and genital pump, slides 1562 and 1563. FIGS. 12-13, *P. vexator occidentis* n. subsp.: style and genital pump, style from a specimen collected by Mangabeira and Galindo, pump from slide 3167.





**Phlebotomus californicus** n. sp.

Figs. 20-23.

This species is very similar to *P. chiapanensis* Dampf from Mexico and Central America, differing only in the following respects: Male with basal tuft better defined, of about a dozen stiff setae set on a small eminence, the inner aspect of remainder of coxite with but a few rather long setae (fig. 20). Genital filaments three times length of pump (fig. 23). Paired basal spines of style stouter, at middle of style, the single median spine halfway between them and apex. Female with cibarium as in *chiapanensis*, but spermathecae with common duct more slender and much shorter.

Holotype male, slide 3165, Fort Yuma, Imperial Co., Calif., 28 October 1948, light trap, R. Coleman coll. Allotype female, slide 3170. Same data as holotype. Paratype male, slide 3166. Same data as holotype.

In addition, we have a female, slide 3169, Ukiah, Mendocino Co., Calif., 29 July 1948, W. W. Wirth coll. which may be this species, but since the head is missing and the spermathecae collapsed, certainty is impossible.

**Phlebotomus chiapanensis** Dampf

1947, *Medicina*, Mexico, 27(530):3-7, figs. 1-6 (♀; Chiapa de Corzo, Chiapas, Mexico). Fairchild and Hertig, 1948, *Ann. Ent. Soc. Amer.*, 41(4):467, Pl. 2, figs. 1-6 (♂, ♀; Panama and Costa Rica). Vargas and Diaz Najera, 1952, *Rev. Invest. Clin.*, Mexico, 4(1):50 (Guerrero, Mexico).

This species has been adequately figured and described by Dampf (1947) and ourselves (1948). We have material from about a dozen localities on the Pacific coast of Panama, from Barranca, Costa Rica and from La Libertad, El Salvador, 14 June 1953. It has been taken in crevices in masonry most frequently, occasionally in tree buttresses and animal burrows, and in light traps, but is not very abundant. Specimens are at hand from nearly every month of the year.

**Phlebotomus hartmanni** n. sp.

Figs. 14-19, 25.

*Male*. Wing length 1.8 to 2.1 mm., venation as figured. Mesonotum, pleura and abdomen lightly infuscated. Abdominal setae erect. Postspiracular setae 10, lower mesanepisternals 5, the latter slender, not ligulate. Proboscis a little less than head height, the eyes large. Palpi with segments II and III subequal, IV less than two-thirds of either, V longer than any preceding segment but shorter than any two. Third antennal segment long, extending to end of third palpal segment and beyond tip of proboscis on intact head. Newstead's scales scattered over middle half of ventral surface of third palpal segment. Ascoids slender, simple, much shorter than their respective segments, present on all but the terminal segment of antenna. Wing as

figured. Cibarium slender, without teeth and with but a faint indication of chitinous arch. Pharynx slender, unarmed. Genitalia as figured, the filaments slender, about 3 times length of pump, their apices simple, very slender.

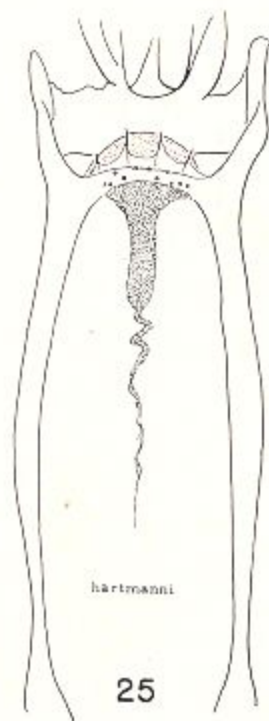
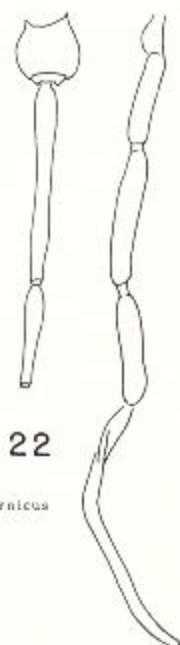
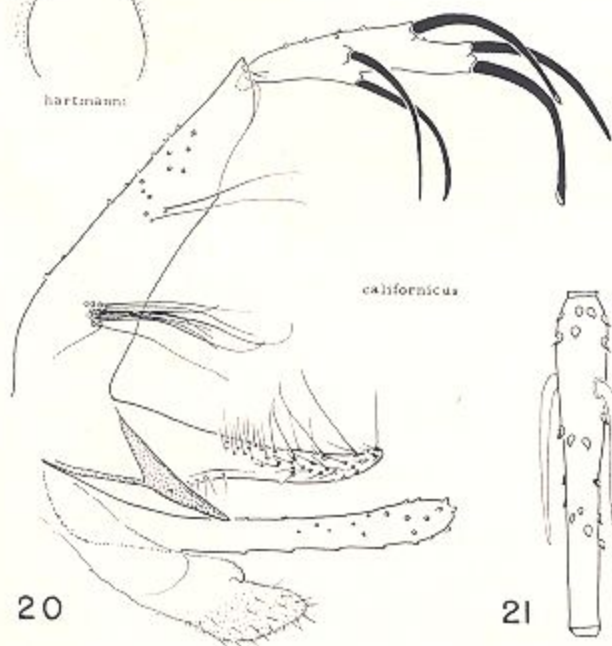
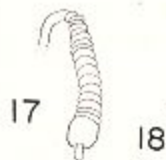
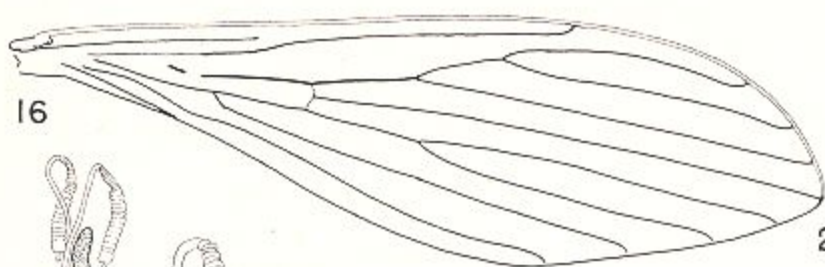
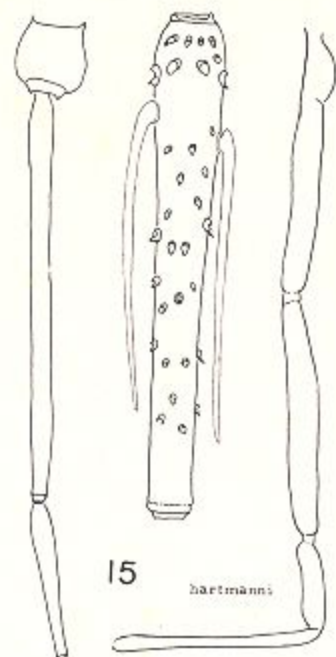
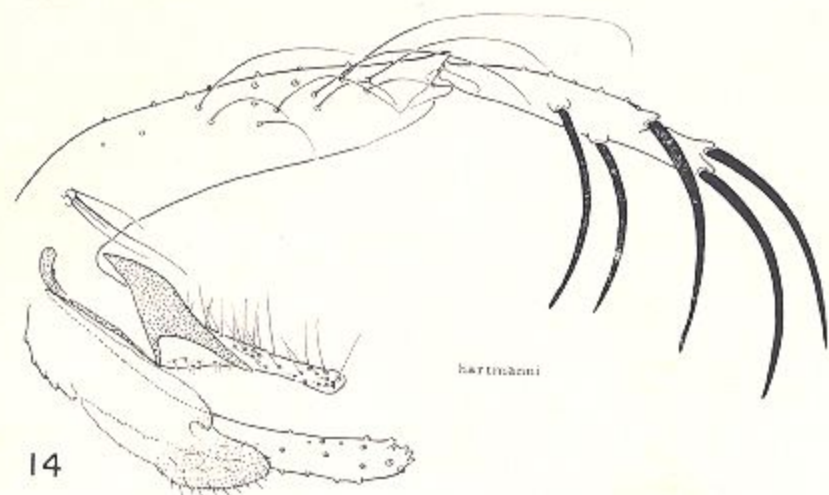
*Female*. Wing length 1.79 to 2.3 mm., venation as in male. Color and vestiture as in male. Proboscis considerably exceeding head height, eyes relatively smaller. Palpi with segments II and III proportionally somewhat longer, IV hardly one-half either, V equal or less than III. Third antennal segment reaching to middle of palp III, failing to reach end of proboscis on intact head. Newstead's scales more numerous than in male, on distal two-thirds of palp III. Ascoids longer than in male, nearly as long as their respective segments, present on all but terminal segment. Wing as in male. Cibarium as figured. Pharynx broad and well-sclerotized, unarmed, its posterior end with numerous fine ridges. Spermathecae and genital fork as figured. A few setae on sides of eighth tergite, setae on dorsum of ninth tergite narrowly ligulate, anterior lateral setae on seventh sternite reduced to short acute spines.

Holotype male, slide 3997, Cerro Campana, Panama Prov., Panama, 24 April 1952, light trap, F. Blanton coll. Allotype female, slide 2904, same data as holotype. Paratypes, 11 ♂ 5 ♀, same data as holotype; 8 ♀, Cerro Campana, Panama Prov., Panama, Yellow Fever Sta. C, 10 February 1951, Shannon trap at light, Hertig, Galindo and Fairchild colls.; 2 ♀, Camp Piña, C. Z., 7 and 9 May 1955, in mosquito light trap in forest canopy, G. Field coll.; 1 ♀, Ft. Sherman Reservation, S-8 Road, C. Z., 31 March 1955, light trap, G. Field coll.; 1 ♀, Almirante, Bocas del Toro Prov., Panama, 11 December 1951, biting man at night, Mejia coll.; 1 ♀, Cerro Sta. Rita, Colon Prov., Panama, 6 May 1948, in animal burrow, Fairchild coll. In addition to the above slide-mounted material, we have the following specimens preserved in alcohol after treatment with KOH. 1 ♂, Almirante, 3 June 1952, taken at night in tree tops; 1 ♂, Cerro Campana, 16 August 1954, light trap; 4 ♂ 2 ♀, Cerro Campana, 18 August 1954, light trap; 3 ♀, Cerro Campana, 19 September 1952, light trap;

## EXPLANATION OF PLATE II

FIGS. 14-19 and 25, *P. hartmanni* n. sp.: fig. 14, male genitalia, slide 3997; fig. 15, female palpi, basal antennal segments and seventh antennal segment showing ascoids, slide 2907; fig. 16, male wing, slide 3997; fig. 17, spermathecae, slide 2904, with single spermatheca enlarged from slide 4009; fig. 18, tip of genital filament, slide 3995; fig. 19, genital pump, slide 3994; fig. 25, female cibarium, slide 2907. FIGS. 20-23, *P. californicus* n. sp.: fig. 20, male genitalia, slide 3166; fig. 21, seventh antennal segment showing ascoids, slide 3170; fig. 22, basal antennal segments and palpi, slide 3170; fig. 23, genital pump, slide 3165. FIG. 24, *P. stewarti* Mangabeira and Galindo, paratype, genital pump.





1 ♂, Cerro Campana, 17 August 1954, light trap;  
1 ♀, Camp Piña, C. Z., 10 May 1955, light trap;  
1 ♀, Camp Piña, 13 July 1955, light trap.

The collections from Cerro Campana were made at elevations of 2000 feet or more, in wet montane forest, those from the other localities in heavy wet Atlantic Coast forest. The species is named in honor of Sr. Ratibor Hartmann, our assistant, whose skill in mounting *Phlebotomus* has greatly facilitated our work.

### *Phlebotomus imperatrix* Alexander

1944, Rev. Ent., 15(3): 316-317, fig. 3 (♀; Huacapistana, Tarma, Dept. Junin, Peru). Dampf, 1947, Rev. Ent. 18(3): 305-316, figs. 1-8 (Redescription of type).

We have seen no specimens referable to this species. From Dampf's careful redescription of the unique type, it is evident that it is closely related to *peruensis* and *pescei*, and the male would be expected to fall in the group under discussion. It appears to differ from these two species chiefly in the proportions of the palpal segments. In *imperatrix* the fourth palpal segment is less than half the length of either the second or third segments, while in *peruensis* and *pescei* it is always at least two-thirds their lengths and usually longer. The fifth palpal segment is also both actually and relatively shorter in *imperatrix*. There are also some minor differences in the internal head structures, whose validity is difficult to assess on the basis of available material. The type locality is considerably removed from the known distribution of *peruensis* and *pescei*, and at a considerably lower elevation. The similarity of *imperatrix* to *sanguinarius* n. sp. and *hartmanni* n. sp. is even closer, and except for the greater size of *imperatrix*, we are unable to point out characters which will separate them. Final placement of the species must continue to await further material.

### *Phlebotomus noguchii* Shannon

Figs. 30, 34.

1929, Jour. Exp. Med., 49(6): 996 (June). 1929, Amer. Jour. Hyg., 10(1): 84-85, figs. 1, 3, 6-8 (♂; ♀; Verrugas Canyon, Rimac Valley, Peru). Hertig, 1938, Amer. Jour. Hyg., 28(3): 463-468, figs. 2, 4, 6. 1943, Amer. Jour. Hyg., 37(3): 249, fig. 15. Barretto, 1947, Arq. Zool. Est. S. Paulo, 5(4): 214-215 (Full references). Rozeboom, 1947, Proc. Ent. Soc. Washington, 49(7): 181, figs. 6-8.

We have little to add to previous descriptions of the species, except for giving a figure of the spermathecae (fig. 30) and genital pump (fig. 34). We have seen material only from Peru: Cañon del Pato, Ancash, 21 July 1945, 2 ♂; Tornamesa to Matucana, Rimac Valley, Lima, April 1951, in caves, A. Herrero coll., 8 ♂, 3 ♀.

### *Phlebotomus oppidanus* Dampf

Figs. 26-29.

1944, Rev. Soc. Mexicana Hist. Nat., 5(3-4): 247-248, figs. 1-8, 14. (♀; San Jacinto, Mexico, D.F.). Barretto, 1947, Arq. Zool. Est. S. Paulo, 5(4): 215.

A series of 14 ♂ 12 ♀ from a single locality enables us to describe and figure the hitherto unknown male of this species, which proves to be similar to, but clearly distinct from *vexator*.

*Male*. Wing length 1.7-2.0 mm. Mesonotum moderately infuscated, pleura pale. Abdominal setae apparently erect. Postspiracular setae 3 to 10, lower mesanepisternals 3 to 5, at least the latter narrowly ligulate. Proboscis not equaling head height. Palpi with segments II, III and IV subequal, V long, equal to or greater than any two preceding. Third antennal segment long, at least twice the fourth segment and reaching middle of third palpal segment and slightly beyond tip of proboscis on intact head. Newstead's scales in a dense cluster on inner aspect of third palpal segment somewhat proximal to middle. Ascoids slender, without posterior prolongation, not reaching ends of their respective segments, present on all but terminal segment. Wings as figured (fig. 28). Cibarium slender, without teeth and with a very faint chitinous arch. Pharynx slender, unarmed. Genitalia as figured (fig. 26), the filaments over 6 times length of pump (fig. 29), their apices drawn out into a slender point (fig. 27).

Description based on 14 ♂ taken in rock crevices and a small cave about 1 km. east of Gruta de Garcia, 20 miles N. W. of Monterrey, Nuevo Leon, Mexico, 9 and 11 September 1955, H. Trapido and P. Galindo colls.

### *Phlebotomus osornoi* Ristorcelli and Van Ty

1941, Ann. Parasit. Hum. Comp., 18: 260-263, figs. 4, 5 (♀; Valle de Capuli, Prov. Nariño, Colombia). Rozeboom, 1947, Proc. Ent. Soc. Washington, 49(7): 177-182, figs. 1-5 (♂, ♀; Tuquerres, Colombia).

We have not seen this species, but from the descriptions it appears to be related to *P. peruensis*, *noguchii* and *quinquefer*, from all of which it can be separated in the male by the shape of the parameres, and in the female by the elongate knob on the apex of the spermathecae.

### *Phlebotomus peruensis* Shannon

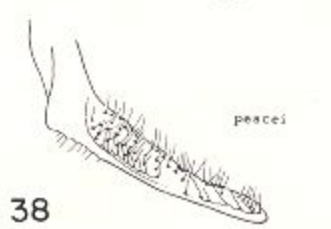
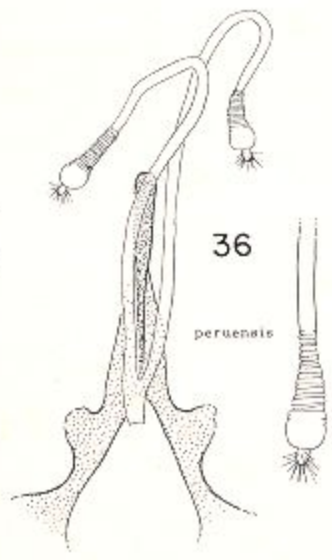
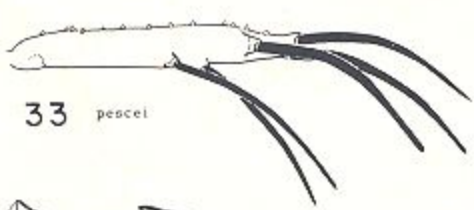
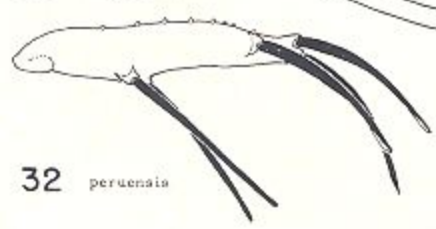
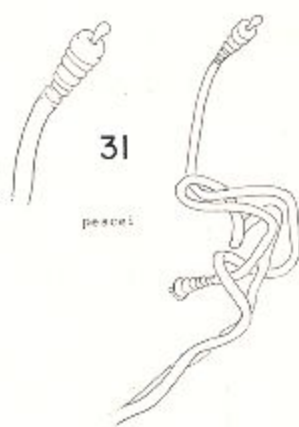
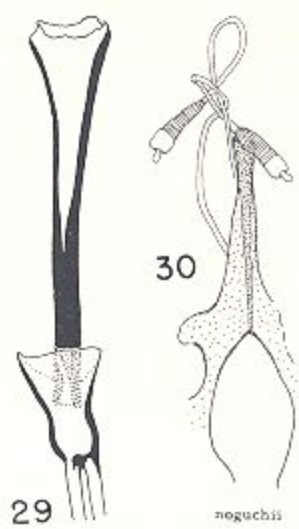
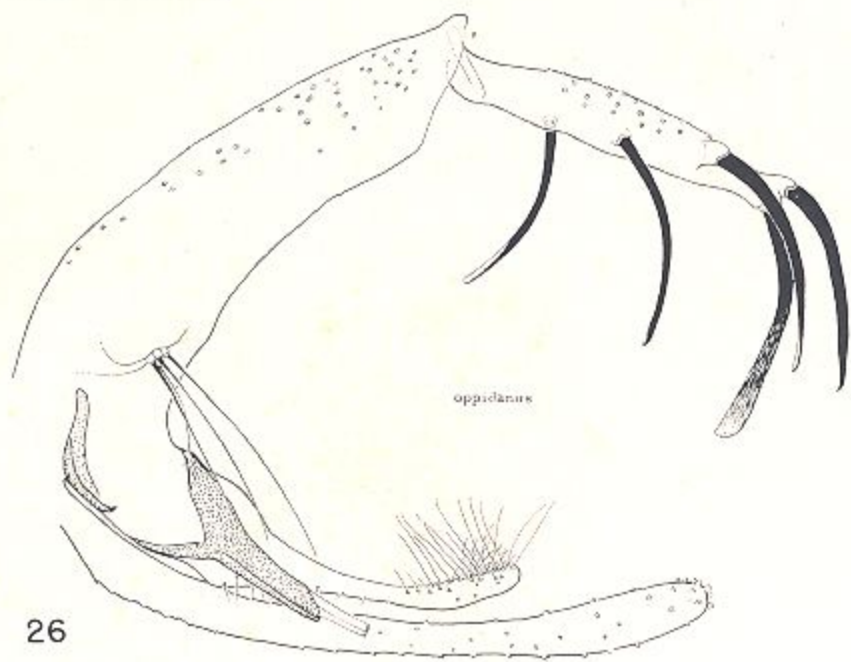
Figs. 32, 36, 37.

1929, Jour. Expt. Med., 49(6): 996 (♂, ♀; Matucana, Peru) (June). Shannon, 1929, Amer. Jour. Hyg., 10(1): 85-87, Pl. I, figs. 4, 10; Pl. II, figs. 5, 6. (♂, ♀;

#### EXPLANATION OF PLATE III

FIGS. 26-29, *P. oppidanus* Dampf: fig. 26, male genitalia, slide 4894; fig. 27, tip of genital filament, slide 4897; fig. 28, male wing, slide 4897; fig. 29, genital pump, slide 4884. FIGS. 30, 34, *P. noguchii* Shannon: fig. 30, spermathecae, slide 3144; fig. 34, genital pump, slide 3134. FIGS. 31, 33, 35, 38, *P. pescei* Hertig: fig. 31, spermathecae, slide 1158; fig. 33, style, slide 1156; fig. 35, genital pump, unnumbered specimen from Huancayo, Peru; fig. 38, paramere, slide 1156. FIGS. 32, 36, 37, *P. peruensis* Shannon: fig. 32, style, slide 3138; fig. 36, spermathecae, slides 3139 left, and 1099 right; fig. 37, paramere and base of coxite, composite of slides 855 and 856.







Matucana, Peru) (July). Hertig, 1943, Amer. Jour. Hyg., 37(3): 249-250, fig. 16 (♀; description of head). Barretto, 1947, Arq. Zool. Est. S. Paulo, 5(4): 217 (Full references).

There is little to add to previous descriptions of this species, except to give figures of the spermathecae (fig. 36), the basal tuft of coxite (fig. 37) and style (fig. 32). Aside from material from various localities in the Rimac Valley above Lima, Peru, we have specimens from the following localities, all in Peru: 2 ♂, Huancalle, Dept. Cuzco; 1 ♂, Cuzco, 21 November 1947, in rocky gully 8 km. S. of city, M. and A. Hertig colls.; 1 ♂, Chancos, Dept. Ancash, 22 July 1945, Hertig and A. Herrero colls.

### *Phlebotomus pescei* Hertig

Figs. 31, 33, 35, 38.

1943, Amer. J. Hyg., 37(3): 248-249, figs. 10-14 (♀; Hacienda Pincos, Pincos Valley, Andahuaylas, Dept. Apurimac, Peru). Dampf, 1947, Rev. Ent., 18(3): 306-307. Barretto, 1947, Arq. Zool. Est. S. Paulo, 5(4): 218.

This species is exceedingly close to *P. peruensis* Shann. We are unable to point out characters other than the spermathecae and male genitalia which will separate the two with certainty; the characters of the cibarium used by Hertig being somewhat variable.

*Male.* Wing length 2.3-3.0 mm. Mesonotum moderately infuscated, pleura paler. Abdominal setae apparently erect. Postspiracular setae about 8, lower mesanepisternals 3. Proboscis considerably exceeding head height. Palpi with segments II and III subequal, IV shorter, V subequal to II plus III. Third antennal segment long, reaching on intact head to middle of palp III and to end of proboscis, about twice as long as fourth segment. Newstead's scales scattered along middle third of third palpal segment. Ascoids not visible on available material. Wing as figured by Hertig, with beta very short, as in *peruensis*. Cibarium without teeth, the chitinous arch apparent only at sides. Pharynx slender, unarmed. Genitalia as figured (fig. 33), the filaments about 3.5 times length of pump, their tips simple.

Description based on the following material from Peru: 4 ♂, Rio Cunas, 9 mi. W. of Huancayo, Dept. Junin, 11,000 ft. elev., 25 December 1943, in shallow cave, Hertig and Fairchild colls.; 2 ♂, Pincha, Huancayo, 13 August 1945, in house, Hertig coll.; 1 ♂, Las Huatatas, 3 km. from Ayacucho, Dept. Ayacucho, December 1944, in mill cave, V. Ayulo coll.

Female similar to male in external characters. Cibarium and head structures as figured by Hertig. Spermathecae (fig. 31) similar to *peruensis*, but without the fine annulations of the latter. We have studied females from the following localities in Peru: 1 ♀, Pincos, Dept. Andahuaylas, 10-11 May 1940, H. Pesce coll. (cotype); 1 ♀, Dept. Andahuaylas, May 1940, H. Pesce coll. (Probably a cotype); 4 ♀, Rio

Cunas, Huancayo, Dept. Junin, 25 December 1943, in shallow caves, Hertig and Fairchild colls.; 1 ♀, Rio Pampas bridge, Dept. Ayacucho, December 1944, Ayulo coll.; 5 ♀, Oilantaytambo, Dept. Cuzco, 2790 metres elev., 18 November 1947, in railroad station, M. and A. Hertig colls.; 4 ♀, Pisac, Dept. Cuzco, more or less 3000 metres elev., 20 November 1947, in chapel, M. and A. Hertig colls.

### *Phlebotomus quinquefer* Dyar

Figs. 8-9.

*Phlebotomus (Brunptomomyia) quinquefer* Dyar, 1929, Amer. Jour. Hyg., 10(1): 114, figs. 1-2. (♂; Ignazu Falls, Misiones, Argentina.) Barretto, 1947, Arq. Zool. Est. S. Paulo, 5(4): 220. (Full references.)

*Phlebotomus richardi* Costa Lima, 1936, Rev. Med. Cir. Brasil, 44: 288, (♂; Crato, Ceara, Brasil). Barretto, 1947, Arq. Zool. Est. S. Paulo, 5(4): 220. (Full references.) Barretto and Pessoa, 1946, Livro de Homenagem a R. F. d'Almeida, No. 7, p. 88. (São João, Espírito Santo, Brasil.) Barretto, 1950, Arq. Hyg. Saude Publica, S. Paulo, 15(46): 225. (Ceara and Espírito Santo, Brasil.) (New synonymy.)

We have examined the holotype of *P. quinquefer* Dyar in the USNM. The specimen is much folded and distorted, but one of us (M.H.) was enabled to make a camera lucida sketch of the genitalia, which is reproduced here (fig. 8). The basal tuft is shown as it if was on the external surface of the coxite. It is actually on the inner aspect, but drawn thus for clarity. Dyar's figure was apparently a free-hand sketch, and bears only a vague general resemblance to the specimen, which accounts for the species not having been subsequently recognized. Dyar made no mention of the wings in his description and we made no notes when examining the Type. The ascoids are short, about half the length of their respective segments, and the eyes are small.

Through the courtesy of Dr. M. P. Barretto we have recently received a mounted male of *P. richardi* C. L. labelled "Brasil, Esp. Santo, Vila Alegre, em luz, Zikan coll. s.d." The genitalia agree closely with our drawing of the type of *quinquefer*. In this specimen the filaments are somewhat more than 3 times as long as the pump, apparently with unmodified tips. The fifth palpal segment appears to be slightly shorter than the second and third together, while the fourth segment is about three-fourths as long as the third. The first flagellar segment of the antenna is shorter than the first three palpal segments, and about twice as long as the second flagellar segment. The ascoids are apparently simple and short, though difficult to see on the unstained specimen. The proboscis is much shorter than head height. The wing is long and narrow, with alpha only slightly longer than beta and delta short, as shown (fig. 9).

### *Phlebotomus sanguinarius* n. sp.

Figs. 1-7.

*Male.* Wing length 1.7 to 2.0 mm., venation as



figured. Head and mesonotum rather heavily infuscated, pleura, abdomen and legs dusky. Abdominal setae partly recumbent. Post spiracular setae 11 to 15, slender; mesanepisternals 4, narrowly ligulate. Proboscis a little less than head height, the eyes large. Palpi with segments II and III subequal, IV about half length of either, V longer than any preceding, but not as long as any two preceding segments. Third antennal segment long, reaching to middle of fourth palpal segment and well beyond tip of proboscis on intact head. Ascoids simple, short, hardly half length of their respective segments, present on all but terminal segment. Cibarium slender, unarmed, without chitinous arch. Pharynx slender, pigmented, unarmed. Genitalia as figured, the pump rather heavy and filaments stout, from 2.1 to 3.7 times length of pump, their tips with a slight kink before the blunt apex.

*Female.* Wing length 1.9 to 2.2 mm., venation as in male. Head, mesonotum, legs and abdomen rather strongly infuscated, pleura paler. Pleural setae as in male. Proboscis considerably longer than head height, eyes medium. Palpi with segment III generally a little longer than II, IV usually less than half III, V subequal to III. Third antennal segment relatively though not actually shorter than in male, reaching to middle of third palpal segment but not to end of proboscis on intact head. Ascoids simple, longer than in male, though not attaining ends of their respective segments, present on all but terminal segment. Cibarium as figured. Pharynx broad, well sclerotized and pigmented, unarmed. Spermathecae and genital fork as figured. Dorsum of ninth tergite with narrowly ligulate curved setae, sides of eighth tergite with a group of setae, anterolateral setae of seventh sternite short and spine-like.

Holotype male, slide 4262, Almirante, Bocas del Toro Prov., Panama, light trap, 28 October 1952. Allotype female, slide 3943, Almirante, biting man at night in tree tops, 26 March 1952.

Paratypes, 23 ♂, 46 ♀ mounted on slides, as follows: *Panama*: 2 ♀, slides 66, 68, Chiriqui Pt., Bocas Prov., 1 April 1943, biting man, Marucci and Wood colls.; 2 ♀, slides 361, 362, Pinogana, Darien Prov., 20 February 1943, biting man, Marucci and Wood colls.; 5 ♀, slides 372, 373, 428, 885, 886, El Valle, Coclé Prov., 31 March 1945 and 12 April 1947, biting man, C. D. Michener and H. Trapido colls.; 2 ♀, slides 864, 865, Santa Fe, Veraguas Prov., 20 March 1947, biting man, Fairchild and Galindo colls.; 3 ♀, slides 1383, 1528, 1529, Gatuncillo, Chagres River, 1 February 1945 and 15-16 March 1945, in horse baited stable trap, H. Trapido coll.; 2 ♂ 2 ♀, slides 989, 990, 1001, 1457, Rio Pequeni, Madden Lake area, 28 September 1947 and 26 March 1949, ♂♂ in hole in bank, ♀♀ biting man and in rock crevice, H. Trapido and P. Galindo colls.; 2 ♀, slides 666, 3390, Cruces Trail, C. Z., Forest Reserve, 27 September 1945 and 29 July 1951, in

hollow tree with bats and in tree buttresses, M. Hertig coll.; 1 ♂, slide 788, Robalo, Bocas Prov., 30 January 1947, in buttress, P. Galindo coll.; 1 ♂, slide 1328, Rio Puente, Madden Lake area, 11 November 1948, in rock crevices, P. Galindo coll.; 1 ♀, slide 1597, Cacique, Colon Prov., 19 September 1949, biting man in daytime in forest, R. Hartmann coll.; 1 ♀, slide 1742, Rio del Medio, Colon Prov., 14 October 1949, biting man in daytime in forest, R. Hartmann coll.; 1 ♀, Juan Mina, C. Z., slide 2061, 20 December 1949, in light trap, H. Trapido coll.; 4 ♂, slides 3641, 3819, 3820, 4264, Mojinga Swamp, Ft. Sherman reservation, C. Z., 5 September and 4 December 1951, 29 October 1952, in light traps, F. S. Blanton coll.; 6 ♂ 1 ♀, slides 2111, 2112, 2114, 2125, 2128, 2129, Coiba Island, El Maria and ridge back of Penal Colony, 11, 12, 16, 17 January 1950, in tree buttresses, R. Hartmann coll.; 3 ♂ 2 ♀, slides 2364, 2365, 2381, 2382, 2403, La Victoria, Cerro Jefe, Panama Prov., 29 August, 1-2 September 1950, in Shannon trap at light, M. Hertig and P. Galindo colls.; 15 ♀, slides 2305, 2551-2565, Cerro Campana, Panama Prov., 9 August 1950, biting man at ground level, and 24 August 1950, in Shannon trap at light, Hertig and Fairchild colls.; 2 ♂ 5 ♀, slides 4262, 3146, 3185, 3197, 3198, 3943, 3944, Almirante, Bocas Prov., 26 March, 16, 23, 31 May, 28 October 1952, in buttresses, at light, and biting man in tree tops, A. Quinoñez, W. Hils and H. Trapido colls. *Costa Rica*: 3 ♂, slides 2946 to 2948, Turrialba, 12 April 1951, in buttresses and crevices in boulders, P. Galindo and R. Rosabal coll. *Honduras*: 3 ♀, slides 4376, 4377, 4415, Lancetilla Valley, Tela, 23 September, 28 October, 30 December 1953, biting in forest at night, W. Hils, coll.

In addition we have 1 ♂, 9 ♀, slides 2915, 2920, 2921, 2926, 2931, 2937, 2939, 2940, 2950, Palo Santo, Chiriqui Prov., 2-3 March 1951, in Shannon trap at light, and 14 March 1951, biting man in house, R. Hartmann coll. which are excluded from the Paratype series because of their markedly greater size, wing length 2.7-3.0 mm., although we can detect no other differences from the type series.

Of determined, but unmounted material we have close to 900 specimens, less than 10% of which are males. The species bites man avidly in the forest at night and occasionally during the day, both at ground level and in the tree tops. It also bites horses and enters horse-baited stable traps in small numbers. We have taken it in about 40 localities and in every month of the year, though it appears to be very much more abundant in areas of forest with heavy rainfall, being rarely taken on the drier Pacific side of the Isthmus or in open areas cleared of forest. It is not taken in appreciable numbers in the usual daytime resting places, even in localities where it has been taken biting in abundance. We have reared both sexes in the laboratory from eggs secured from wild caught females.



**Phlebotomus stewarti** Mangabeira and Galindo

Fig. 24.

1944, Amer. Jour. Hyg., 40(2): 185-188, figs. 19-21 (♂, ♀; Alameda and Contra Costa Counties, Calif.).  
Barretto, 1947, Arq. Zool. Est. S. Paulo, 5(4): 225.

Through the courtesy of Dr. L. W. Quate we have been able to examine 1 ♀, 7 ♂ paratypes of this species from Calaveras Creek, Marsh Creek and Livermore, Calif., and 2 ♂, 2 ♀ from Caliente Creek, Kern Co., Calif., 18 May 1941, Bohart and MacSwain colls. The females are fragmentary but probably belong to this species. We have also seen 1 ♂ labelled "Marsh Creek, Calif. XI-21-43 Galindo and Mangabeira colls.", probably also a paratype but not so labelled, deposited in the Gorgas Memorial Laboratory collections by Dr. Galindo. We give here a figure of the genital pump (fig. 24) of this specimen for comparison with *P. californicus* n. sp.

**Phlebotomus vexator** Coquillett

Figs. 10-11.

1907, Ent. News, 18: 102 (♂, ♀; Plummer's Island, Md.). Shannon, 1913, Proc. Ent. Soc. Washington, 15(4): 165-167 (Paris, Va.). Hall, 1936, Proc. Ent. Soc. Washington, 38(2): 29 (Ansley, La.). Dampf, 1947, Rev. Soc. Mex. Hist. Nat., 8(1-4): 205-212, Plates 26, 27. Addis, 1945, Trans. Amer. Microscop. Soc., 64(4): 331. Barretto, 1947, Arq. Zool. Est. S. Paulo, 5(4): 229 (Full references).

We have studied a series of 2 ♂ 6 ♀ from Plummer's Island, Md., 6 August 1949, M. Hertig coll. The excellent figures of both sexes given by Dampf (1947) can hardly be improved upon, and we add only figures of the style (fig. 10) and genital pump (fig. 11) for comparison with the California subspecies. Specimens reported as *vexator* from California by Mangabeira and Galindo (1944) appear to us to be distinct on the basis of minor but apparently constant characters, and are discussed below.

**Phlebotomus vexator occidentis** n. subsp.

Figs. 12-13.

*Phlebotomus vexator*, Mangabeira and Galindo, 1944, Amer. Jour. Hyg., 40(2): 183-185, figs. 1-8, 22-26 (♂, ♀; Contra Costa and Alameda Counties, Calif.).  
Addis, 1945, Trans. Amer. Microscop. Soc., 64(4): figs. 5, 12

This subspecies is very similar to *vexator* Coq., differing in the following respects: Male with genital filaments shorter, less than 4 times length of pump (fig. 13); style (fig. 12) shorter and stouter, the two subapical spines farther apart and the most basal one of this pair closer to the basal spine than in *vexator*. Basal tuft of coxite of 4 setae. Female with spermathecae shorter, more slender, less than twice as long as stem of genital fork. Cibarium narrower, with but 4 horizontal teeth, lacking the sublateral shorter teeth found in *vexator*.

Holotype male, slide 3167, Alturas trap station, Modoc Co., Calif., August 1948, light trap, R. Coleman coll. Allotype female, slide 3164,

Topaz Lake, Mono Co., Calif., 1 August 1948, light trap, R. Coleman coll. Paratypes, 2♂ 3♀, Marsh Creek, Contra Costa Co., Calif., 19 and 25 September 1948, Galindo, Mangabeira and Reeves coll.; 1♂ 4♀ same data as allotype; 1♀, same data as holotype; 1♀, Strawberry Canyon, Alameda Co., Calif., November 1948, light trap, W. W. Wirth coll.; 1♀, Fillmore, Ventura Co., Calif., 6 June 1948, light trap, R. Coleman coll.; 1♀, Livermore, Calif., 19 October 1943, in *Citellus beecheyi* burrow, P. Galindo and O. Mangabeira colls. In addition, we have another specimen with same data as the last paratype which lacks both head and spermathecae, but is probably this species. Finally, we have examined, through the courtesy of Dr. L. W. Quate, a series of 18♂, 50♀, Hooper estate, Woodside, California, collected by T. N. Lauret, 1 and 15 June, 3 and 22 August and 5, 7 and 9 September 1956. These specimens were identified in phenol and stored unmounted in alcohol. Holotype and allotype to be deposited in USNM, paratypes in coll. L. W. Quate and in the Gorgas Memorial Laboratory.

The record of *Phlebotomus* from Modoc Co. extends the range of the genus considerably farther north in the New World, to beyond 41° N. latitude. The previous northernmost record appears to have been Plummer's Island, Md., at about 39° N.

**Phlebotomus vindicator** Dampf

1944, Rev. Soc. Mex. Hist. Nat. 5: 248 (♀, Chapultepec, D. F., and Cuautla, Morelos, Mexico); Rev. Soc. Mex. Hist. Nat. 8(1-4): 205 (♂). Vargas and Diaz Najera, 1953, Rev. Inst. Salub. Enferm. Trop., 13(4): 313.

We have a single female from Cañon de Lobos, between Cuernavaca and Yautepec, Morelos, Mexico, 4100 ft. elev., 20 Sept. 1955, taken in a small cave, Galindo and Trapido colls. We have nothing to add to Dampf's excellent description.

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