NOTES ON THE PHLEBOTOMUS OF PANAMA (Diptera, Psychodidae)[1]

X. *P. aragaoi, P. barrettoi* AND TWO NEW SPECIES

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The species here considered are quite similar in both sexes, being separated by relatively small differences in the genitalia and the spermathecae. We have had considerable difficulty in associating the sexes, our conclusions being at variance with those of Floch and Abonnenc (1943) in certain cases. The matter can only be settled by careful rearings, but we believe our associations are at least more probable. The numbers of pleural setae and shape of the anterior abdominal sternites have proved useful in associating the sexes of these species.

In studying this small group, we are again impressed with the lack of correlation between the secondary sexual characters of the two sexes. Thus the styles of *aragaoi* C. L., *barretto* Mang. and *runoides* n. sp. are exceedingly similar, while that of *carpenteri* n. sp. is quite different. The spermathecae of *aragaoi, barrettoi* and *carpenteri* are very similar, but those of *runoides* are entirely different. It seems quite impossible as yet to predict the structures of one sex from a knowledge of those of the other sex. These four species share certain characters, such as the long ascoids with short proximal prolongations, the large eyes and broad heads, similar palpi, four-spined styles and absence of basal setae on the coxites or modifications of the parameres and the very similar cibaria. Aside from the four species from Panama, the following species appear to be closely related and are included in the subjoined keys on the basis of their published descriptions: *P. heckenrothi* Floch and Abonnenc, *P. inflatus* Floch and Abonnenc and *P. texamus* Dampf. A number of other species may belong here, such as *P. lutzianus* C. L., *P. brasiliensis* C. L., *P. coutinhoi* Mang. and *P. pascalei* Cout. & Barr., but we prefer not to include them until adequate material of both sexes is available to us.

KEY TO MALES

1. Tips of genital filaments simple 2
   Tips of genital filaments modified, hooked, twisted or inflated 3
2. Median spine of style on a well-marked tubercle, inserted closer to the basal paired spines than to the terminal spine ..... **barretoi**
   Median spine not on a tubercle, inserted half-way between basal spines and terminal spine ..... **texanus**
3. Tips of genital filaments expanded. Ascoids paired on all but last two antennal segments 4
   Tips of genital filaments hooked or twisted. Ascoids paired on all but last three antennal segments 5

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4. Tips of genital filaments in shape of a spear head, lanceolate. Basal spines of style not paired, the dorsal one close to the median spine. Fifth palpal segment shorter than third and fourth together . . . . . **runoides**

Tips of genital filaments inflated before the apex, the latter drawn out into a long hook. Basal spines of style paired, at the same level. Fifth palpal segment longer than third and fourth together . . . . . **inflatus**

5. Tips of genital filaments twisted like a cork-screw or a pig's tail. Parameres broad and flattened. Aedeagus very heavy and stout, bluntly and abruptly tapered at apex. Spines of style of a basal pair at nearly same level, a median dorsal spine on a short tubercle, and a terminal spine, ... **aragoai**

Tips of genital filaments hooked like a button-hook. Parameres slender, more or less clubbed, curved upwards. Aedeagus very long and slender. Spines of style of a single basal, a median dorsal on a short tubercle, a subterminal and a terminal, the last two nearly paired so that the end of the style is unevenly Y-shaped . . . . . **carpenteri**

KEY TO FEMALES

1. Spermathecae tubular, the spermathecae not sharply differentiated from their ducts, the former twisted like a cork-screw for a part of its length . . . 2

Spermathecae globular or pear shaped, large and sharply differentiated from their ducts 3

2. Terminal annulate or wrinkled portion of spermathecae about four times as long as wide, not twisted. Twisted portion of two and a half or three complete turns. Ducts joined to form a short common duct . . . . . **runoides**

Terminal annulate or wrinkled portion of spermathecae about twice as long as wide. Twisted portion irregular and apparently of greater extent. Ducts opening separately into vagina. (*P. aragaoi* of Floch and Abonnenc), ... **inflatus?**

3. Ducts of spermathecae with wart-like or pustulate excrescences on proximal half, the ducts about eight times as long as greatest transverse diameter of spermathecae. Delta of wing venation short, one-fifth or less of alpha . . . . . **heckenrothi**

Ducts of spermathecae smooth or annulate, not pustulate, less than three times as long as greatest transverse diameter of spermathecae 4

4. Ducts of spermathecae finely annulate. Spermathecae gourd-shaped or pear-shaped, the terminal knob a flattened raised plaque. Genital fork with small lateral expansions near apex of stem. Delta about half alpha; beta plus gamma about two-thirds alpha . . . . . **carpenteri**

Ducts of spermathecae smooth. Spermathecae spherical or oval. Stem of genital fork without lateral expansions 5

5. Terminal knob of spermatheca small and discrete. Ducts about 2.5 times greatest transverse diameter of spermathecae . . . . . **texanus**

Terminal knob of spermatheca a large plaque or diffuse patch of hairs 6

6. Spermathecae nearly spherical, the terminal knob a diffuse patch of hairs. Ducts about 2.6 or more times greatest transverse diameter of spermathecae, very thin-walled and tenuous. Stem of genital fork slender and cylindrical. Delta less than one-half alpha . . . . . **aragaoi**

Spermathecae oval, the terminal knob a raised, discrete, pigmented plaque. Ducts about three times greatest transverse diameter of spermathecae, relatively thick-walled. Stem of genital fork broad and flattened, its tip shallowly bifid. Delta over one-half alpha, the latter very long, at least twice beta plus gamma. Head unusually wide and flattened at vertex, nearly twice as wide as high . . . . . **barrettoi**

In dealing with females of the three species *aragaoi*, *barrettoi* and *carpenteri*, whose spermathecae and cibaria are so similar, we believe certain minor characters may be of use in separating them, especially when, as is often the case, the spermathecae are much shrunken. We give below a key based on external characters, and including *P. runoides* for the sake of completeness.

1. Wing with alpha and delta very long, the latter considerably more than half the former. Five to seven lower mesanepisternal setae. Vertex of head flattened . . . . . **barrettoi**
   Wing with alpha and delta shorter, delta less than half length of alpha. Four or less, usually one to three lower mesanepisternal setae 2
2. Antennae with paired ascoids on all but the last two segments in both sexes. Setae on dorsal aspect of ninth tergite narrowly ligulate . . . . . **runoides**
   Antennae otherwise. Setae on ninth tergite simple, slender 3
3. Antennae with paired ascoids on all but the last three segments. Delta more than one-third alpha . . . . . **carpenteri**
   Antennae with paired ascoids on all segments, or with but a single ascoid on the terminal segment. Delta shorter, one-third alpha or less . . . . . **aragaoi**

Phlebotomus aragaoi Costa Lima

Plate I, figs. 1–8; Plate IV, fig. 23

1932, Mem. Inst. Osw. Cruz, 26 (1): 48, figs. 34, 60, 128–130 (♂; Minas Gerais, Brazil, from armadillo burrows). Barretto, 1947, Arq. Zool. Est. S. Paulo, 5 (4): 185–186 (full references). Floch and Abonnenc, 1943, Inst. Pasteur Guyane Francaise, pub. no. 61, pp. 11–14, figs. 6–7 (♂, ♀; Montabo, Fr. Guiana, from burrow of Paca); 1947, Bol. Ent. Venezolana, 6 (1): 18–19 (♂, in key). Barretto, 1950, An. Fac. Med. Univ. S. Paulo, 25: 109, 116 (♂, ♀; in key). Damasceno, Arouck and Causey, 1949, Rev. Serv. Esp. Saude Pub., Brasil, 1949: 819.

Male.—Wing length 2.03 to 2.12 mm. (Panama specimens), 1.89 to 2.03 mm. (Paraguay specimens). A rather large sandfly with moderately infuscated mesonotum, pleura and coxae. Abdominal hairs erect. Postspiracular setae 8–10, lower mesanepisternal setae 1 or none in Panama specimens, the Paraguayan material showing up to 14 post spiraculars and 1–3 lower mesanepisternals. Head height slightly less than length of proboscis and about three-fifths width of head. Basal antennal segments and palpi as in female, the end of third antennal segment reaching to or beyond end of fourth palpal segment. Newstead's scales scattered over distal third of second and all of third palpal segments. Ascoids as figured, paired on all but the terminal three segments of antennae. Cibarium with about eight small horizontal teeth and scattered small vertical teeth. Pharynx unarmed. Genitalia as figured, the filaments about twice as long as the pump, the plunger of the latter with small cup-like terminal expansion.

Female.—Wing length 2.178 to 2.27 mm. (Panama), 2.02 to 2.09 mm. (Paraguay); venation as figured. Similar to male in color and vestiture, showing 7–11 postspiraculars and 0–2 lower mesanepisternals in Panama material and 9–16 postspiraculars in those from Paraguay. Lateral aspect of eighth tergite with 0–2 setae, dorsal aspect of ninth tergite with fine simple setae. Proboscis about equalling head height; height of head about five-sevenths its width. Basal antennal segments and palpi as figured, third antennal segment reaching to level of end of third palpal segment when both attached to head. Ascoids as in male, paired on all segments but the last three, which are rather abruptly shorter than the next preceding segments. Cibarium as figured. Pharynx unarmed. Spermathecae as figured. Wings clothed with hairs and a few scales at base.

We have examined the following material of this species: 7 males and 7 females taken in a light trap at Mojinga swamp, near Ft. Sherman, Canal Zone, Sept. 1951 and Jan., Oct. and Dec. 1952, in light traps at

Gatun, C. Z., Sept. 1951 and Madden Dam, C. Z. Sept. 1951, F. S. Blanton coll.; 31 males and 4 females, Aca-Poi, San Pedro, Paraguay, the males from animal burrows, the females from animal burrows and a Shannon trap at light, various dates in April and May 1950, M. Hertig coll.; 8 males and 3 females from Brazil, the females numbered 838, all determined as *aragaoi* by Dr. O. Mangabeira but with no other data; 1 male, no. 810, Montabo, Fr. Guiana, "8–4–48," burrow, named and presented by Dr. H. Floch.

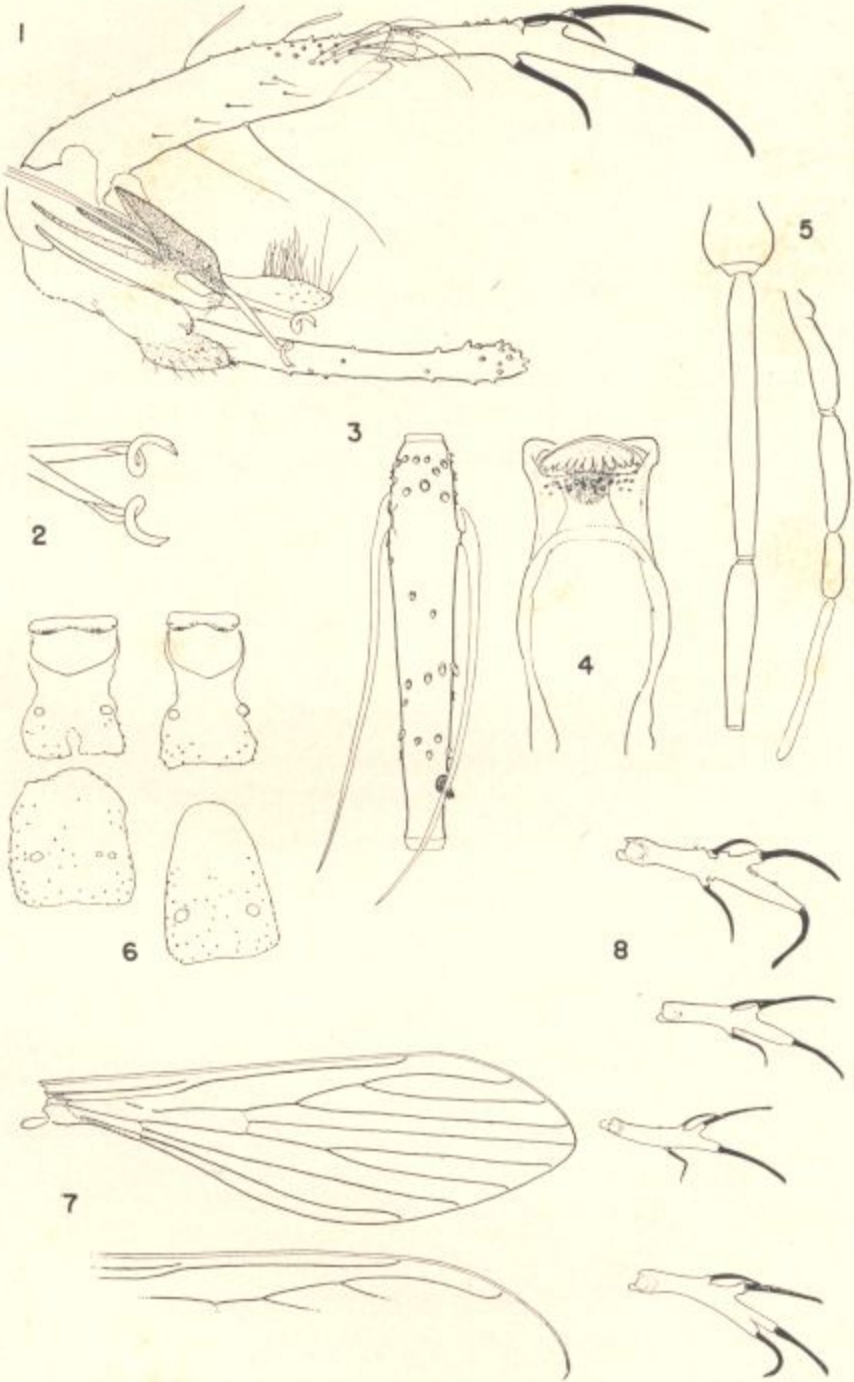
We associate the sexes on the basis of the following considerations. Both sexes have been taken together in Panama and in Paraguay and we have specimens from Brazil presumably taken together. Two of the other three similar Panama species, *carpenteri* and *runoides*, have been taken in a number of other localities in the absence of *aragaoi*, while the third species, *barrettoi*, differs in both sexes in the longer delta and alpha of the wing venation, broader, flattened head and more numerous lower mesanepisternal setae. The non-sexual structural differences from *carpenteri* and *runoides* are slight, consisting in differences in the shape of the first two sternites and in shorter average delta of the wing venation.

The specimens thought by Floch and Abonnenc (1943, 1945) to be the females of *aragaoi* are very similar to those we believe to be the females of *P. runoides* n. sp., described herein. We think it very probable that these specimens are in reality the females of *P. inflatus* F. & A. 1944. The latter was described from males from burrows at Montabo, Fr. Guiana, the same locality which yielded the supposed females of *aragaoi*.

P. heckenrothi Floch and Abonnenc (1942, Inst. Pasteur Guyane, pub. no. 38, pp. 8–10, fig. 4 and 1945, op. cit. pub. no. 100, p. 10–11, Pl. 4), described from 2 females from a burrow at Montabo, Fr. Guiana, is close to our specimens of *aragaoi*, differing so far as we can tell only in having considerably longer ducts to the spermathecae, and in having scattered wart-like protuberances on the proximal half of the ducts. In our material, both from Paraguay and Panama, the proximal portion of the ducts is exceedingly thin-walled and tenuous, and the ducts open separately into the vagina, a fact not clear in the accompanying figure. In one specimen, both duct and spermatheca are filled with a granular substance, giving them a somewhat irregular or roughened appearance, not to be confused with the discrete warts or papules shown by Floch and Abonnenc in their second figure of *heckenrothi* (1945).

EXPLANATION OF PLATE I

Phlebotomus aragaoi. FIG. 1. Male genitalia, × 145. FIG. 2. Tips of genital filaments, × 293. FIG. 3. Segment IV of male antenna showing ascoids, × 350. FIG. 4. Female cibarium, × 350. FIG. 5. Female palpus and basal antennal segments, × 152. FIG. 6. First three abdominal sternites, female left, male right, × 89. FIG. 7. Wings, male above, female below, × 35. FIG. 8. Styles of, from top to bottom, *barrettoi*, *aragaoi*, *runoides* n. sp. and *carpenteri* n. sp., × 89.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Phlebotomus barrettoi Mangabeira

Plate II, figs. 9–13; Plate III, fig. 21; Plate IV, fig. 22

1942, Mem. Inst. Osw. Cruz, 37 (2): 148–152, figs. 58–62 (♂; Aura, Belem, Para, Brasil, in armadillo burrow). Barretto, 1947, Arq. Zool. Est. S. Paulo, 5 (4): 189 (full references). Floch and Abonnenc, 1945, Inst. Pasteur Guyane, pub. no. 106, pp. 6–7, fig. 4 (♂; Fr. Guiana). Damasceno, Arouck and Causey, 1949, Rev. Serv. Esp. Saude Pub., Brasil, 1949: 819. Rodriguez, 1950 [1952], Rev. Ecuatoriana Hig. Med. Trop., 7 (3–4): 25 (♂; Ecuador).

Male.—Wing length 2.31 to 2.36 mm.; venation as figured. A large sandfly with mesonotum, pleura and coxae moderately infuscated. Abdominal setae erect. Postspiracular setae 11–14, lower mesanepisternal setae 5–7, hair-like. Head height about one-third greater than length of proboscis and about three-fifths of head width. Basal antennal segments and palpi as in female, the end of third antennal segment reaching to about the end of the fourth palpal segment when both are attached to head. Newstead's scales scattered over distal half of second and all of third palpal segments. Ascoids as figured, paired on all but the terminal three segments of antennae, which are not abruptly shortened. Cibarium with a row of very fine, barely visible horizontal teeth and scattered minute vertical teeth. Pharynx unarmed. Genitalia as figured, the filaments about three times as long as the pump, simple.

Female.—Wing length 2.39 to 2.57 mm., venation as figured. A little larger than the male, but similar in color and vestiture. Lateral aspect of eighth tergite with from one to four setae; dorsal aspect of ninth tergite with slender setae. Proboscis about equalling head height from vertex to base of clypeus. Head about three-fifths as high as wide, the vertex markedly flattened. Basal antennal segments and palpi as figured, the end of third antennal segment reaching barely to middle of third palpal segment. Newstead's scales as in male. Ascoids as in male, paired on all segments but the last, where a single ascoid is present. Cibarium as figured. Pharynx unarmed, with weak wrinkles or ridges. Spermathecae as figured. Wings clothed with hairs, except for a few ligulate square-ended scales at base.

We have examined the following material of this species: 1 male, Brasil No. 1075, O. Mangabeira det; 2 males and 4 females, Mojinga swamp, near Ft. Sherman, Canal Zone, Nov. 1951 and Jan. and May 1952; and 1 female, Gatun, Canal Zone, 29 Aug. 1951; all the Canal Zone specimens taken in mosquito light traps by F. S. Blanton.

The males agree in detail with Mangabeira's description, with the specimen determined by him, and with Floch and Abonnenc's description. We associate the sexes on the basis of the very long alpha and delta of the wing venation, on the unusually numerous lower mesanepisternal setae and on the very characteristic and unusual flat head and

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EXPLANATION OF PLATE II

Phlebotomus barrettoi. FIG. 9. Male genitalia, × 145. FIG. 10. Female head, frontal view, × 89. FIG. 11. Segment IV of male antenna showing ascoids, × 350. FIG. 12. Wings, male above, female below, × 35. FIG. 13. Palpus and basal antennal segments of female, × 152.


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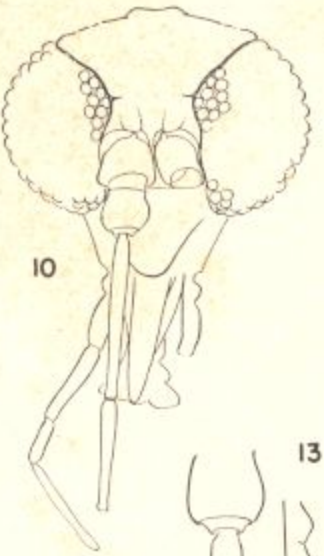
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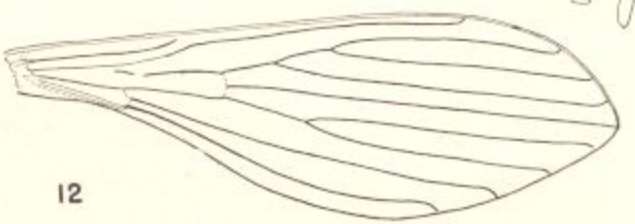
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large eyes, a character noted in the original description and marked in both sexes. The large eyes and widened head seem characteristic of this group, but they are most marked in *barrettoi*. The first and second abdominal sternites are about as in *aragaoi* and not sufficiently distinct to warrant figuring.

Phlebotomus carpenteri sp. nov.

Plate III, figs. 14–20; Plate IV, fig. 24

Male.—Wing length 2.09 to 2.27 mm.; venation as figured. A large sandfly with the mesonotum rather strongly infuscated, the pleura, coxae and abdomen more lightly brownish. Abdominal setae erect, hair like. Postspiracular setae 12–16, lower mesanepisternal setae 3–4. Head about one-third wider than height from base of clypeus to vertex and a little higher than length of proboscis. Palpi and basal antennal segments as figured; end of third antennal segment reaching about end of third palpal segment when both undetached. Newstead's scales cylindrical, but slightly enlarged apically, scattered over most of the length of the third and apical half of the second palpal segment. Ascoids long, as figured, paired on all but the terminal three segments, which are not abruptly shortened. Wing venation as figured. Cibarium with about eight small and slender horizontal teeth and numerous fine vertical teeth. Pharynx unarmed. Genitalia as figured, the filaments slightly more than twice as long as the pump, the latter with apex of plunger not greatly expanded, cup shaped. First and second sternites as figured.

Female.—Wing length 2.15 to 2.47 mm. Similar to male in color and vestiture. Lateral aspect of eighth tergite without setae, dorsal aspect of ninth tergite with only sparse hair-like setae, no scales. Cerci rather long. Proboscis a little less than head height, the head much wider than high. Basal antennal segments and palpi as in male, when attached to the head the third antennal reaches to about the end of third palpal. Newstead's scales as in male. Ascoids as in male, but paired on all segments, including the terminal one, or the terminal segment may have but one ascoid. Cibarium as figured. Pharynx unarmed. Spermathecae as figured. Wing venation as figured; wing clothed with setae except for striate, square-ended scales at base.

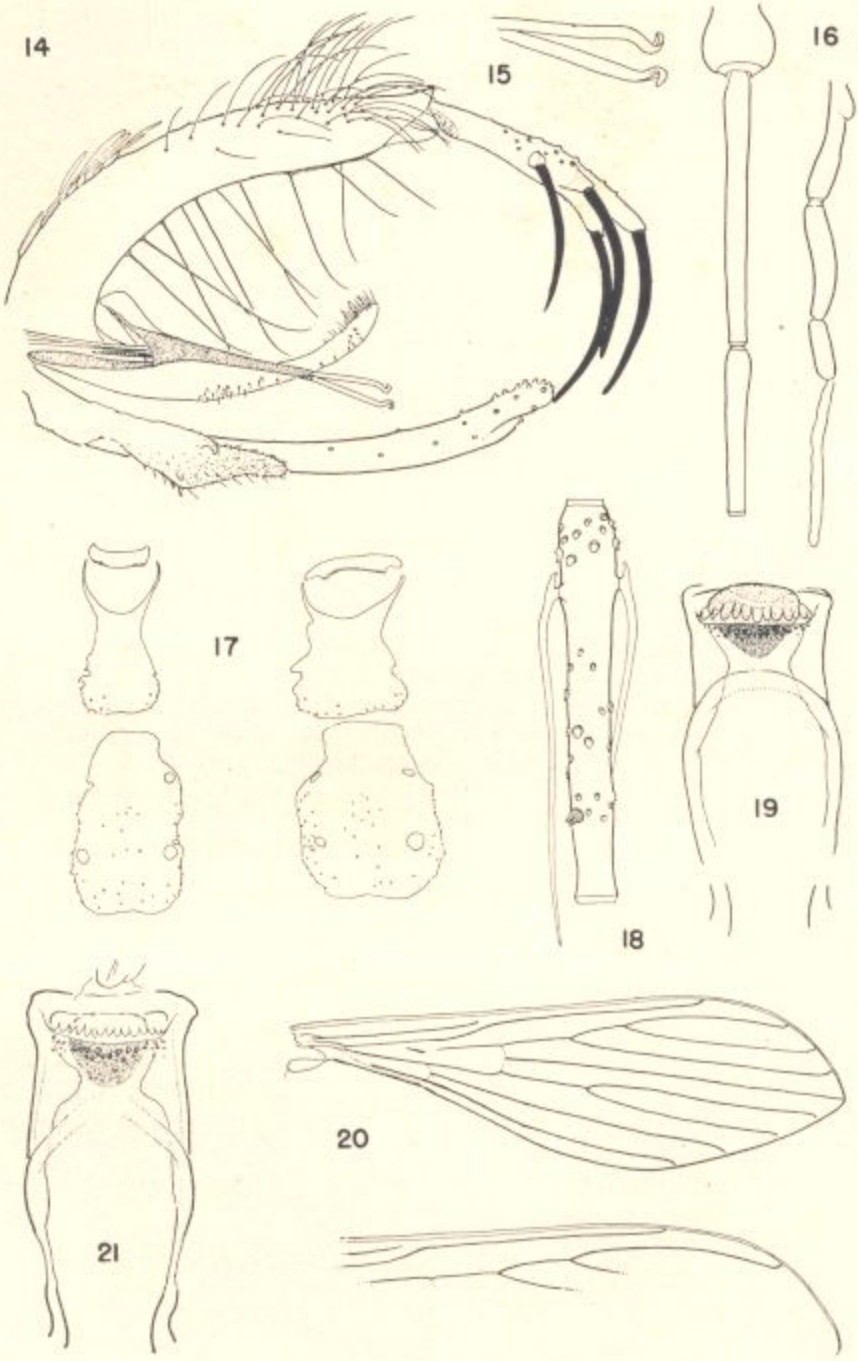
Holotype male, slide 1345, Chiva Chiva, Canal Zone, October 1948, in mosquito light trap. Col. S. J. Carpenter coll.

Allotype female, slide 2301, vicinity of Pacora, Panama Province, Panama, 13 August 1950, in animal burrow in forest. M. Hertig coll.

EXPLANATION OF PLATE III

Phlebotomus carpenteri n. sp. FIG. 14. Male genitalia, holotype, × 145. FIG. 15. Tips of genital filaments, same specimen, × 293. FIG. 16. Palpus and basal antennal segments of male, × 152. FIG. 17. First three sternites, male left, female right, × 89. FIG. 18. Segment IV of male antenna, showing ascoids, × 350. FIG. 19. Female cibarium, × 350. FIG. 20. Wings, male above, female below, × 35.

Phlebotomus barrettoi. FIG. 21. Female cibarium, × 350.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Paratypes, 16 males and 33 females mounted on slides from the following localities: Old Panama, 9 Aug. 1943, in holes in ruins (1 ♀); Rio Chico Hydrographic Sta., upper Rio Pequeni, Panama, 20 March 1948, in animal burrow (1 ♀); Chiva Chiva, Canal Zone, October 1948, light trap (2 ♂ 1 ♀); Paraiso, Canal Zone, Oct. 1948, light trap (1 ♀); Tocumen Airport, Panama, 22 Jan. 1949, light trap (1 ♂); Juan Mina, Canal Zone, Jan., Aug., Sept., Nov., Dec., 1949, Jan., Feb., Apr., Oct., Nov., 1950, in light traps (13 ♂, 25 ♀); vic. Pacora, Panama, 13 Aug. 1950, in animal burrows in forest (3 ♀); Mojinga swamp, nr. Ft. Sherman, Canal Zone, 5 Sept., 1951, in light trap (1 ♀).

In addition we have identified and stored unmounted or discarded over 300 specimens of both sexes from the above and about 20 additional localities in Panama and the Canal Zone. We have material from Darien (Patiño Point), Panama, Cocle (El Valle), Colon, Bocas del Toro (Almirante) and Los Santos (Las Tablas) Provinces, from both coasts of the isthmus in the Canal Zone, and from Costa Rica (Suerre, Guapiles). The species is most abundant along the Pacific coast at low elevations (no specimens from Cerro Campana or La Victoria in the hills, and but one from El Valle) and in the Canal Zone on both coasts. We have but a single specimen from Almirante, in the wet Atlantic coast rain forest, where much collecting has been done.

With the exception of a specimen from crevices in masonry and a few from animal burrows, all our material has come from fan-type mosquito light traps or Shannon traps with gasoline lanterns, so that we know nothing of the feeding preferences. The species has been taken in all months of the year and our records do not indicate any very marked seasonal variation in numbers.

Most of the light trap material was collected under the direction of Col. S. J. Carpenter, M.S.C., to whom the species is gratefully dedicated, and his successor Lt. Col. F. S. Blanton, who has contributed the bulk of material taken in the last year and a half.

Phlebotomus runoides sp. nov.

Plate IV, fig. 25; Plate V, figs. 26–33

Male.—Wing length 1.99 to 2.34 mm. A medium sized sandfly, the mesonotum, dorsum of abdomen and coxae moderately infuscated. Abdominal setae erect or semi-erect. Postspiracular setae 8–16, lower mesanepisternal setae 1–3. Head height nearly twice length of proboscis, the head very much wider than high, though vertex not flattened. Basal antennal segments as figured, the end of third antennal segment reaching to middle of fifth palpal segment when both are attached to

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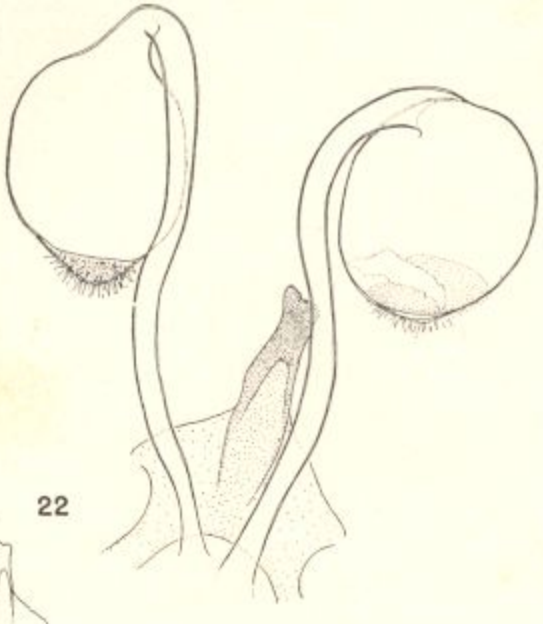
EXPLANATION OF PLATE IV

Phlebotomus barretoi. FIG. 22. Spermathecae, × 293, and genital fork, × 145. Drawn after mounting in balsam from a Panama specimen.

Phlebotomus aragaoi. FIG. 23. Spermathecae, × 293, and genital fork, × 145. Drawn in phenol from a Paraguayan specimen.

Phlebotomus carpenteri n. sp. FIG. 24. Spermathecae, allotype, × 293, and genital fork, × 145. Drawn after mounting in balsam.

Phlebotomus runoides n. sp. FIG. 25. Spermathecae, allotype, × 293. Drawn in phenol after KOH.



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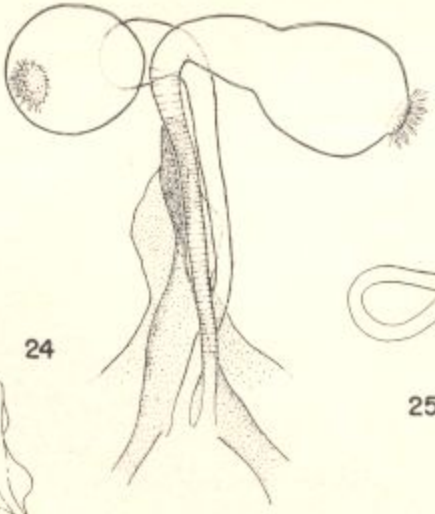

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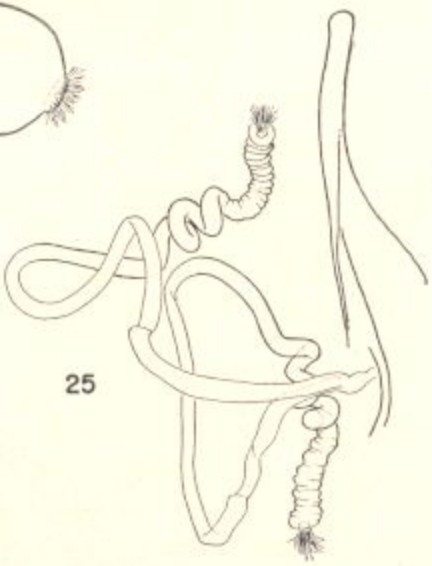

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the head in a mounted specimen. Newstead's scales rather long and slender, scattered over apical half of second and most of third palpal segments. Ascoids long, reaching or exceeding the ends of their respective segments and with a short proximal prolongation, present on all but the last two segments, which are shorter than those preceding. Wing venation as figured. Cibarium with about eight slender horizontal teeth and fairly numerous small vertical teeth; pharynx unarmed. Genitalia as figured, the filaments a little more than twice as long as the pump.

Female.—Wing length 2.01 to 2.26 mm. Similar to male in color and vestiture. Lateral aspect of eighth tergite with generally one or two setae, often with none. Ninth tergite with narrowly ligulate setae. Proboscis considerably less than head height, the head wider than high. Third antennal segment shorter, palpi considerably longer than in male, so that the end of the third antennal segment reaches only to middle of fourth palpal when both are attached to head. Ascoids as in male, absent from last two antennal segments, which are shorter than the one preceding. Cibarium as figured; pharynx unarmed. Spermathecae as figured. Wing as in male, clothed with hairs and a few ligulate square-ended scales at base.

Holotype male, slide 3593, Almirante, Bocas del Toro Province, Panama, 25–27 July, 1951. Taken between buttressed roots of forest trees. A. Quiñonez coll.

Allotype female, slide 772, La Victoria, Cerro Jefe, Panama Province, Panama, 2400 ft. elev., 23 Jan. 1947, in buttresses in forest.

Paratypes, 33 males and 24 females mounted on slides from the following localities: Barro Colorado Island, Canal Zone, 25 July 1944, taken in animal burrows by O. Mangabeira (7♂, 3♀); La Victoria, Cerro Jefe, near Pacora, Panama, 16 Dec. 1948, 1–2 Sept. 1950, in burrows, buttresses and at light (3♂, 2♀); Cerro Campana, Panama prov., Panama, 10 July 1949, in buttresses by L. E. Rozeboom (1♂); Juan Mina, Chagres river region, Canal Zone, 13, 22 and 27 Dec. 1949, in light trap by H. Trapido (3♂, 2♀); Mojinga swamp, near Ft. Sherman, Canal Zone, in mosquito light traps by F. S. Blanton, 15, 28 Aug. 1951 (5♂, 4♀), 4, 5 Sept. 1951 (12♂, 9♀), 27 Nov. 1951 (1♀), 18 Dec. 1951 (3♀), 31 Jan. 1952 (2♂); Almirante, Bocas del Toro Province, Panama, 27 Oct. 1951, in Shannon trap at light (1♀).

In addition to the above mounted specimens we have processed, identified and stored unmounted 42♂ and 35♀ from Mojinga swamp light traps, taken in Sept. (20), Oct. (14), Nov. (27), Dec. (13) and Jan. (3) and have identified but discarded 3♂ and 3♀ from the same locality taken in Dec. (1), Jan. (2) and Feb. (3). A single female from

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EXPLANATION OF PLATE V

Phlebotomus runoides n. sp. FIG. 26. Male genitalia and genital pump and filaments, holotype, both × 145. FIG. 27. Tips of genital filaments, × 292. FIG. 28. Segment IV of male antenna showing ascoids, × 350. FIG. 29. Basal antennal segments and palpi, male right, female left, both × 152. FIG. 30. Female cibarium, allotype, × 350. FIG. 31. Same, × 520. FIG. 32. First three sternites, female left, male right, × 89. FIG. 33. Wings, male above, female below, × 35.

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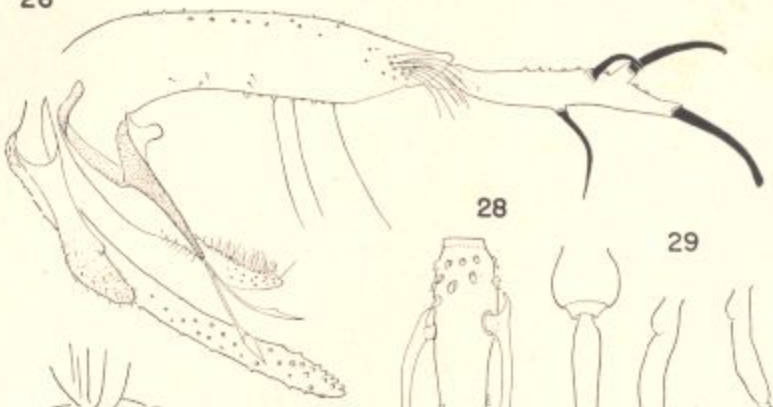

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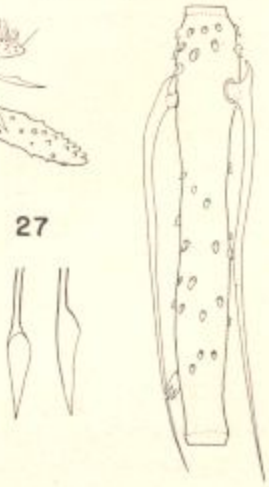

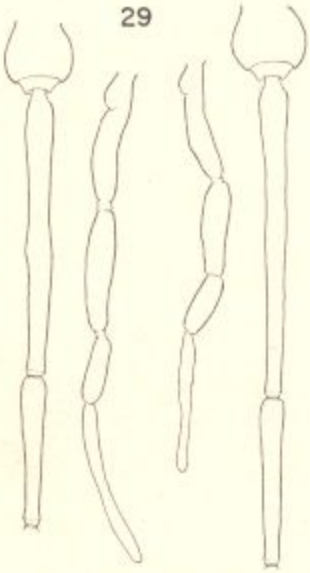

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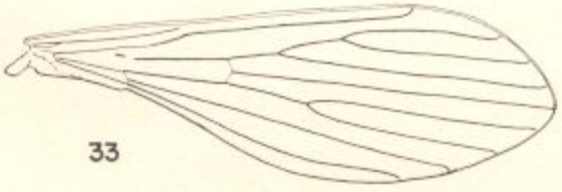

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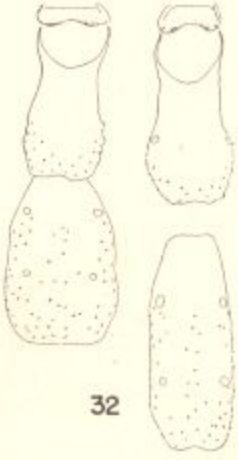

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Suerre, Guapiles, Costa Rica, 22 July 51, in armadillo burrow, R. Rosabal coll. has also been processed and stored.

The association of the sexes in this case is based on the similarity of structure, more especially of the first and second sternites, and the frequent appearance of both sexes in collections in the absence of other similar species. The females are closely similar to those believed by Floch and Abonnenc to be the females of *aragaoi* (1943, 1945). There are, however, certain differences. The spermathecal ducts of our species join close to the vagina and open to the outside through a common orifice, while Floch and Abonnenc's figure (1945) shows the ducts opening separately. The spermathecae themselves seem relatively longer, more defined and more clearly annulate in our species, and delta appears to be a little longer.

The male of *runoides* is separable from the males of the other species discussed here on the basis of the structure of the tips of the genital filaments, which are expanded into the shape of spear heads or javelin points, and on minor differences in the shape of the parameres and arrangement of the spines on the style. It seems closest to *P. inflatus* Floch and Abonnenc (1944), differing mainly in the lesser development of the same type of modification of the tips of the genital filaments. In *inflatus* the apices of the spear heads are attenuated into a long hooked filament, and the aedeagus is longer and more slender.

The association of the sexes in *carpenteri* and *runoides* has been rather difficult, as the external non-sexual characters are quite similar. The sternites in *runoides* are more elongate and slender and both sexes lack ascoids only on the last two segments of antennae. In *carpenteri* the sexes are dimorphic in respect to this character, the males lacking ascoids on the last three segments, while the females have ascoids on all segments, though there may be only a single ascoid on the terminal segment. *Carpenteri* has been taken in twenty-three localities, but in only four of these was *runoides* also found. The latter has been secured in three additional localities unaccompanied by *carpenteri*. It is of course, quite possible that we have reversed the sexes in this case, but only rearing tests will assure certainty.

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