

NOTES ON THE PHLEBOTOMUS OF PANAMA
(Diptera, Psychodidae)

IV. *P. atroclavatus* Knab, *P. cayennensis* Floch and Abonnenc, *P. chiapanensis* Dampf and some related forms from the West Indies and Mexico¹

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With the exception of *P. atroclavatus*, the species treated in the present paper share the character, unusual for New World *Phlebotomus*, of a comb-like row of cibarial teeth. *P. chiapanensis* Dampf, if we have correctly associated the sexes, belongs to a group including *P. stewarti* Mangabeira and Galindo, *P. vexator* Coq., *P. trinidadensis* Newstead and a number of others, to which Barreto (1946, Rev. Brasil. Biol., 6(3): 427-434) has recently given a key. Of the known females of this group none have a comb-like cibarium, although with certain marked exceptions, the spermathecae are of a type rather similar to those of *chiapanensis*.

P. tenidophorus n. sp. is the most bizarre in respect to the cibarial comb, but unfortunately the male is unknown and nothing can be said of its possible relationships.

P. cayennensis is the first recorded species of American *Phlebotomus* to show well-marked geographic races, and two of these subspecies constitute the second known occurrence of *Phlebotomus* in the West Indies. The male genitalia of this complex are quite simple and offer few clues to possible relationships with other American species. *P. cayennensis* and its subspecies seem the closest of any New World *Phlebotomus* to the widespread *minutus* group of the Old World, though there are many points of difference.

Phlebotomus atroclavatus Knab

Plate I, Table I

1913, Ins. Ins. Mens., 1: 135-137, fig. 1 (2♂, 3♀; Gasparee Island, Trinidad, B. W. I.). Larrousse, 1921, Etude Syst. et Méd. des Phlebotomes, p. 7. Dyar and Nunez Tovar, 1927, Ins. Ins. Mens., 14: 154. (Venezuela.) Costa Lima, 1932, Mem. Inst. Osw. Cruz, 25 (1): 29. Bequaert, 1938, Carnegie Inst., Washington, Pub. No. 499, p. 230. Floch and Abonnenc, 1943, Inst. Past. de la Guyane, Pub. No. 62, p. 6 (in key). Barreto, 1947, Arq. Zool. S. Paulo, 5 (4): 186. Dampf, 1947, Rev. Ent. 18 (3): 296-305, figs. 1-7.

Phlebotomus (*Sergentomyia*) *atroclavata*, Franca and Parrot, 1921, Arch. Insts. Pasteur de l'Afrique du Nord, 1: 284.

Phlebotomus (*Neophlebotomus*) *atroclavatus*, Dyar, 1929, Amer. J. Hygiene, 10 (1): 120.

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- Phlebotomus tejeræ* Larrousse, 1921, Etude Syst. Med. des Phlebotomes, p. 71; 1922 Bull. Soc. Zool. France, 47: 41. Nunez Tovar, 1924, Mosq. y Phlebot. de Venezuela, p. 42 (♂, Venezuela). Galliard, 1934, Ann. Parasit. Hum. Comp., 12: 197-199, fig. 2. (Types ♂, ♀.)
- Phlebotomus guadeloupensis* Floch and Abonnenc, 1945, Inst. Pasteur de la Guyane, Pub. No. 96, pp. 1-3, fig. 1 (♂, ♀; Petits Abymes and Grands Fonds du Moule, Guadeloupe Is., French West Indies, in cavities in trees); 1945, op. cit., No. 100, p. 11. Barretto, 1947, Arq. Zool. S. Paulo, 5 (4): 202.

The Types at the U. S. National Museum consist of a male labelled "Holotype", (actually Lectotype) No. 16850 mounted on a slide and a female No. 16850 also mounted on a slide. The two females and a male preserved dry mentioned by Knab appear to have been subse-

TABLE I
MEASUREMENTS IN MICRA

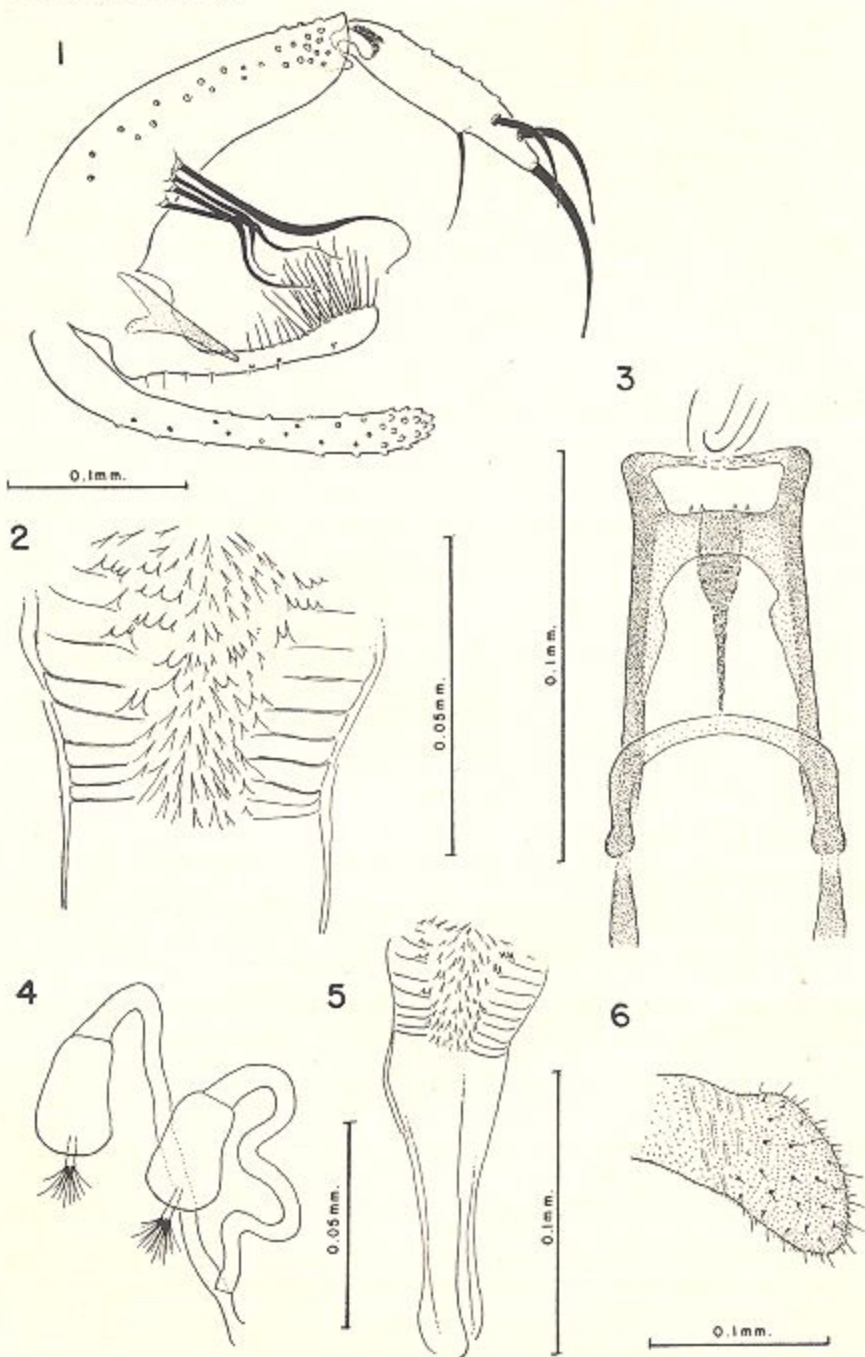
	<i>P. atroclavatus</i>						<i>P. chiapanensis</i>						<i>P. ctenidophorus</i>
	Maximum		Minimum		Mean		Maximum		Minimum		Mean		
	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	
Ant. III.....	240	228	212	208	228	220	228	220	200	188	213	204	356
Palps I-II....	120	140	100	128	116	133	140	152	124	136	135	146	180
" III.....	148	164	132	148	140	158	152	160	140	152	148	153	184
" IV.....	96	112	80	100	88	104	104	124	108	116	115	120	124
" V.....	328	400	240	348	284	377	356	356	272	296	324	328	380
Head height..	224	240	208	212	216	221	232	260	232	240	232	247	288
Clypeus.....	116	120	100	108	108	112	144	160	140	128	141	141	132
Proboscis....	152	168	152	162	152	160	188	252	150	220	178	234	232
Eye height....	180	168	160	152	168	160	176	192	152	156	165	174	180
Wing length..	1728	1656	1314	1476	1476	1566	1620	1890	1530	1710	1559	1802	2124
Alpha.....	342	468	270	378	306	414	270	342	198	234	227	290	594
Beta.....	288	324	198	270	234	288	252	306	234	288	245	293	306
Gamma.....	270	324	198	234	216	270	396	414	342	360	371	392	324
Delta.....	144	252	72	162	108	188	+36	72	-36	-36	5	29	234

quently mounted and the male, at least, has been labelled as "Paratype". Other material from Venezuela identified as *atroclavatus*, presumably by Dyar, is also present. Only the Lectotype is actually *atroclavatus*. The female from the type lot as well as several females from Venezuela are *cayennensis* Floch and Abonnenc, a species we have often found associated with *atroclavatus* in Panama and which is discussed in the latter part of this paper. The male "Paratype" and four males from Venezuela are again different, being close to or the same as *trinidadiansis* Newst.

The species has been often misunderstood, as Knab's description was quite inadequate, only the styles of the genitalia being correctly

EXPLANATION OF PLATE I

- Phlebotomus atroclavatus* Knab. Fig. 1. Male genitalia, inner aspect. Fig. 2. Apex of female pharynx. Fig. 3. Female cibarium. Fig. 4. Spermathecae. Fig. 5. Entire female pharynx. Fig. 6. Female cercus.



figured. Knab either failed to see or attached no importance to the basal tuft on the coxite, which is readily visible in his specimen. Floch and Abonnenc's description and figures of *guadeloupensis* are excellent, and the female they associate with the male appears to be the same as the one which we have also concluded was the correct one. Galliard's description and figures of the female cotype of *tejeræ* are also in agreement. The description of the male *tejeræ* Larrouse we have not seen, though the figure given by Nunez-Tovar of the style is characteristic for the present species and we see no reason for not accepting Dyar's synonymy.

We give here figures of the male genitalia (fig. 1), cibarium (fig. 3), pharynx (figs. 2, 5), spermathecae (fig. 4) and cercus (fig. 6) as well as measurements (Table I) of Panamanian material. The cibarium is quite characteristic, there being a large number of very small erect spines in transverse rows below the four small horizontal spines. These are difficult to see, and even more difficult to portray, as they are obscured by the large pigmented patch. The chitinous arch is well-defined, though poorly sclerotized, and is unusually far distal in position. The genital filaments are rather short, being but slightly longer than the coxite and style and about 3 times as long as the genital pump. The pharynx is quite unique with its evenly spaced transverse ridges, heavy spines, and basal pigmented area. The ascoids are simple, without posterior prolongations, about one third the length of their respective antennal segments in the male, but reaching to the end of the segment in the female.

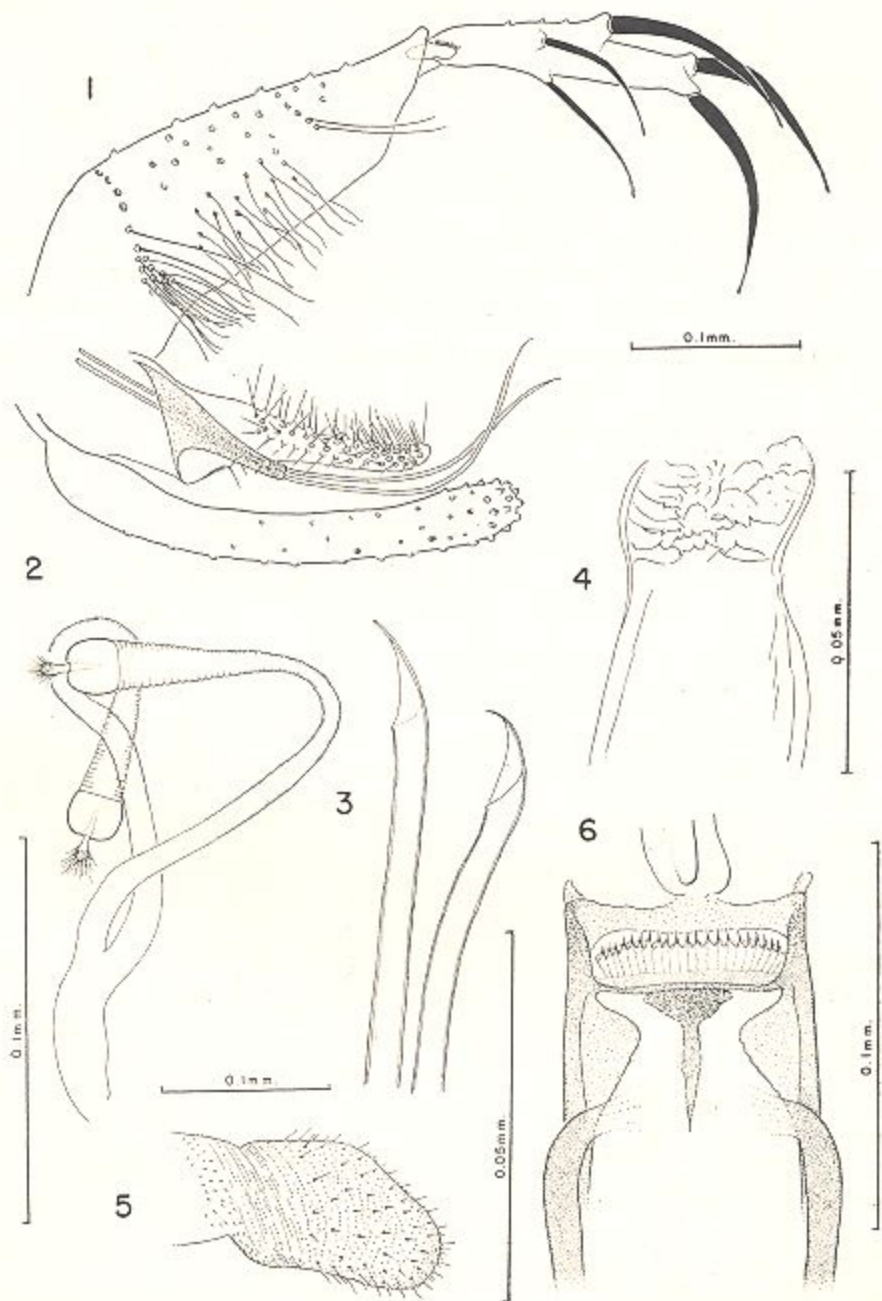
The species is quite abundant in holes and crevices in the walls of the ruins of Old Panama, and we have taken it there in nearly every month of the year. We have also taken it in a wooden building on Chepillo Island at the mouth of the Rio Bayano, on San Jose Island, one of the Pearl Islands in Panama Bay, in a shallow sea cave, and on Taboga Island in tree buttresses. Floch and Abonnenc's material came from hollows in trees on Guadeloupe Island, French West Indies. We have no evidence as to the preferred hosts, but the pronounced maritime distribution is rather striking, all our material having come from islands or from very close to the sea.

The treatment of *cayennensis* and the following three forms as subspecies may seem a bit radical, but we feel that this is the best way to indicate their relationship. The differences noted between them are slight though constant, confined to one sex, and correlated with their geographical distribution. Full specific status for each form is impractical, as the males appear to be indistinguishable, while lumping all four together as a single species ignores the quite definite and constant differences in the females.

The occurrence of *Phlebotomus* in Puerto Rico is of some interest, as it is the second instance of finding the genus in the West Indies

EXPLANATION OF PLATE II

Phlebotomus chiapanensis Dampf. Fig. 1. Male genitalia, inner aspect. Fig. 2. Spermathecae. Fig. 3. Tips of genital filaments. Fig. 4. Apex of female pharynx. Fig. 5. Female cercus. Fig. 6. Female cibarium.



P. atroclavatus, from Guadeloupe is the only other record to our knowledge, exclusive of the species recorded from Trinidad, which is faunistically not part of the West Indies. The occurrence of distinct races on Puerto Rico and Vieques may seem surprising, but insular races in other groups are common enough in the West Indies, and *Phlebotomus* is a rather fragile and sedentary insect. It is probable that other species occur both in Puerto Rico and other of the West Indian islands.

Aside from the typical subspecies, we have no hint as to the habits or preferred hosts of the other races. The West Indian forms were taken in situations similar to those the species selects in Panama. The Mexican material was unaccompanied by any habitat information.

The Guatemalan specimens of the same form were all from buttresses of large roadside trees in relatively open country.

Phlebotomus cayennensis cayennensis Floch and Abonnenc

Plates III, IV, and V, Table II

1941, Inst. Pasteur de la Guyane, Pub. No. 15, pp. 13-17, fig. 5 (♂, Cayenne, Fr. Guiana, in crevices in rocks near the coast); 1943, op. cit., Pub. No. 62, p. 5. Barretto, 1947, Arq. Zool. Est. S. Paulo, 5 (4), p. 192.

Although Floch and Abonnenc describe only the male, they have recently taken females and their description of this sex is to appear shortly. From sketches of the cibarium and spermathecae kindly sent us, there seems no doubt that our species is the same. They also have material from Venezuela.

A small pale brownish species with rather narrow pointed wings, four spines on the style and long fifth palpal segment.

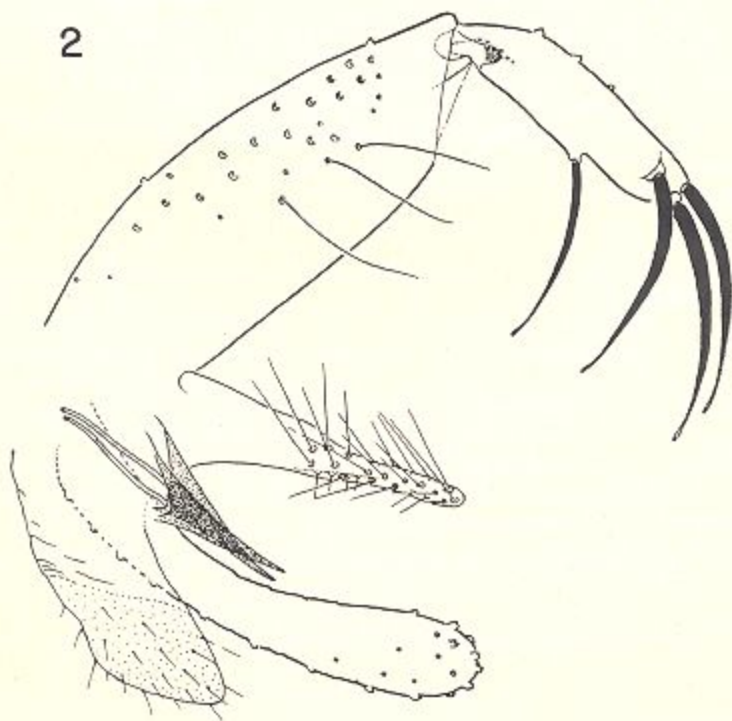
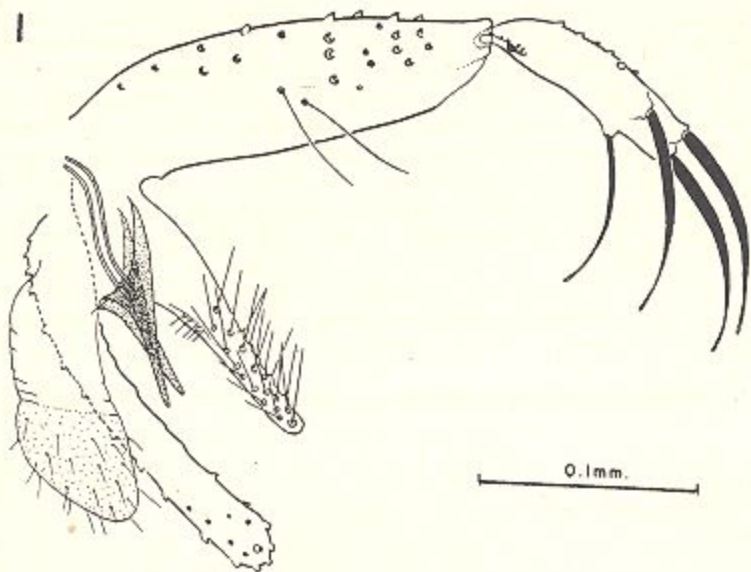
Male.—Genitalia simple, as figured, (Pl. III, fig. 1) the genital filaments short and stout, the aedeagus long and slender. Cibarium showing vestiges of the teeth found in the female. Pharynx without the spines of the female.

Female.—Spermathecae, (Pl. V, fig. 3), cibarium, (Pl. IV, fig. 1), pharynx, (Pl. IV, fig. 7), and cercus, (Pl. V, fig. 2), as figured. The unusual structure of the cibarial teeth, lack of chitinous arch and the strong spines in the pharynx are nearly unique among American species of *Phlebotomus*. The teeth in the cibarium number from 16 to 18 and there is a single row of minute erect teeth below. The antennae are also unusually short, the third segment being hardly one-third the length of the palpi. *Delta* is very long, generally exceeding one-half alpha, though Floch and Abonnenc show a shorter *delta* on their material. The ascoids are simple and short, not over half the length of their respective segments in all the forms.

We have taken this species abundantly in holes and crevices of the ruins of Old Panama, where it is probably the dominant species. A small colony was also discovered in a ground-floor concrete-walled bathroom in the senior author's house in the outskirts of Panama City,

EXPLANATION OF PLATE III

Fig. 1. *Phlebotomus cayennensis cayennensis* Floch and Abonnenc, male genitalia, inner aspect. Fig. 2. *Phlebotomus cayennensis puertoricensis*, male genitalia, inner aspect.



and specimens were repeatedly taken resting on the walls in the darker corners. The species has also been taken in buttresses of large trees in heavy forest near Pacora, R. P., in a hollow tree in scrubby xerophytic forest near Bejucó, R. P., in buttresses of a large tree at La Victoria, near Tucumén, R. P. at an altitude of about 2400 ft., and in holes and crevices of the ruins of Fort San Lorenzo, at the mouth of the Chagres River on the Caribbean coast. The specimen from La Victoria is ten to twenty percent smaller in all measurements than the rest of our material, and we have omitted it from the table of measurements, though we can find no structural differences. We believe it likely that the species feeds upon lizards, as these are the dominant vertebrates in its favored habitats. Specimens have been taken in most months of the year, but our data are insufficient to indicate seasonal variations in abundance, if any.

The female specimens mentioned as being part of the type series of *P. atroclavatus*, as well as several from Venezuela in the U. S. National Museum, are *P. cayennensis*, so that Trinidad and Venezuela may be added to the range of the species.

P. cayennensis does not seem closely related to any described American species. *P. minasensis* Mang. is somewhat similar, but does not have two terminal spines on the style, has a short *delta*, and a very short fourth palpal segment. *P. texanus* Dampf has a very different male with single terminal spine on the style. In the female of *texanus* the numerous cibarial teeth seem to be of different structure and there are several rows of erect teeth, lacking in our species. The spermathecae, though of similar shape, are larger and with shorter ducts, and the cerci are longer and more slender in *texanus*. In the structure of the cibarium and pharynx and, to a lesser extent, of the male genitalia, this species approaches the Old World species belonging to the *minutus* group. The spermathecae, however, are quite different.

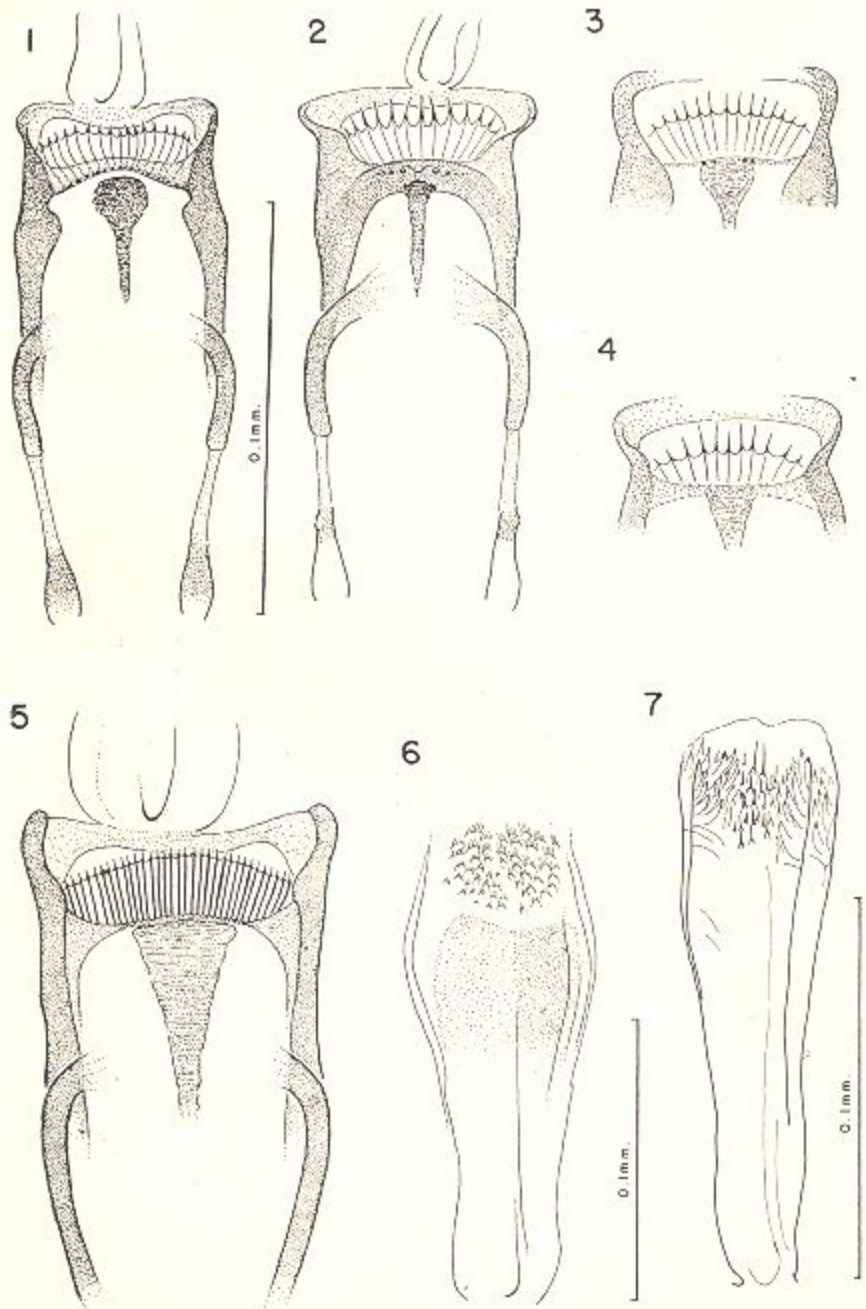
Phlebotomus cayennensis puertoricensis subsp. nov.

Plates III, IV, and V, Table II

This form differs from the typical subspecies only in details of the spermathecae (Pl. V, fig. 1), these being smaller, with longer and more slender ducts, and in having fewer (11 to 13) and longer teeth in the cibarial comb (Pl. IV, fig. 4). We have been unable to detect any erect teeth below. Measurements of wings, palpi, etc., average somewhat larger but there is considerable overlapping. We have been unable to find any characters in the male which will separate it with certainty from the males of the other subspecies, though we have the impression that the median spine of the style tends to be inserted further distally in this race.

EXPLANATION OF PLATE IV

Fig. 1. *Phlebotomus c. cayennensis* Floch and Abonnenc, female cibarium. Fig. 2. *Phlebotomus c. maciasi* subsp. nov., female cibarium. Fig. 3. *Phlebotomus c. viequesensis* subsp. nov., cibarial teeth. Fig. 4. *Phlebotomus c. puertoricensis* subsp. nov., cibarial teeth. Fig. 5. *Phlebotomus ctenidophorus* sp. nov., female cibarium. Fig. 6. Same, female pharynx. Fig. 7. *Phlebotomus c. cayennensis* Floch and Abonnenc, female pharynx.



Holotype, female.—Slide 1057, Lares, Puerto Rico, 1200 ft. alt., 15 Aug. 1947, in a cave, Jose Romero coll.

Allotype, male.—Slide 1059, same data.

Paratypes.—Two males, same data as holotype; 2 males, 3 females, Lares, Puerto Rico, 3 July 1947, in a hollow "Bucal" tree, H. Trapido and Jose Romero coll.; 3 males, 2 females, Lares, Puerto Rico, 19 July 1947, Jose Romero coll.

TABLE II
MEASUREMENTS IN MICRA

	<i>P. c. cayennensis</i>						<i>P. c. maciasi</i>				<i>puertoricensis viequesensis</i>			
	Panama						Mexico		Guatemala		Puerto Rico		Vieques Id.	
	Maximum		Minimum		Mean		Mean		Mean		Mean		Mean	
	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
Ant. III..	196	200	172	152	194	178	198	182	194	192	200	227	214	200
Palpi I-II	128	128	108	112	119	121	120	123	117	120	130	134	122	120
" III..	132	140	116	112	125	128	136	134	124	133	144	149	132	138
" IV..	112	112	96	100	105	106	98	100	93	103	104	114	101	98
" V..	340	336	272	273	304	302	300	321	268	313	310	336	298	310
Head ht..	216	240	208	212	211	227	212	234	205	214	224	234	224	220
Clypeus..	128	140	112	108	122	126	140	125	113	130	115	129	136	138
Proboscis.	168	188	132	152	152	173	168	185	145	180	152	169	146	166
Eye ht....	184	200	160	160	165	186	172	185	168	174	174	190	164
Wing.....	1548	1764	1404	1494	1461	1643	1584	1660	1450	1640	1631	1899	1512	1710
Alpha.....	378	486	324	324	343	428	405	479	396	468	396	504	414
Beta.....	306	342	234	216	204	283	279	324	234	277	290	355	234
Gamma...	216	234	144	162	165	193	198	191	185	218	225	252	180
Delta....	216	324	162	180	189	264	279	335	253	306	230	301	234

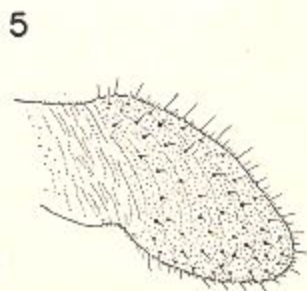
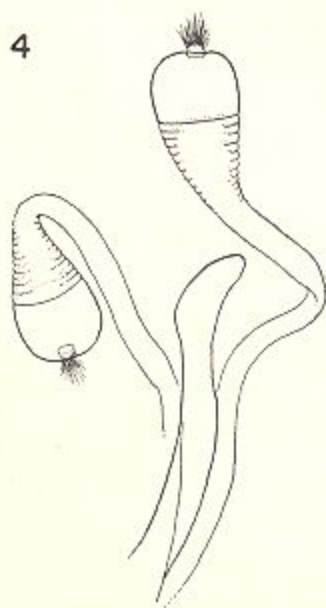
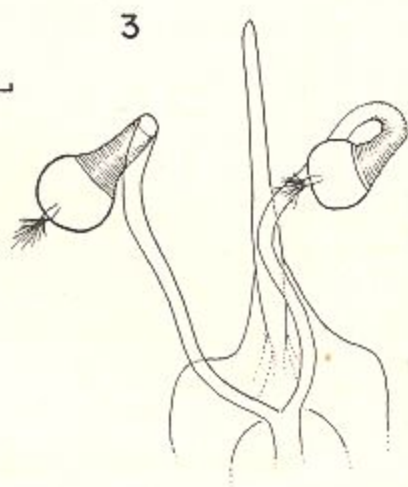
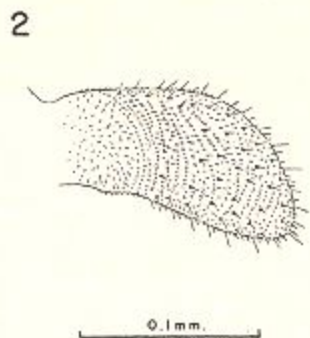
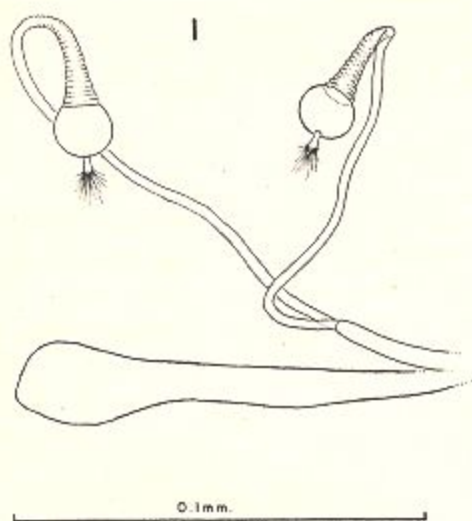
Phlebotomus cayennensis viequesensis subsp. nov.

Plates III, IV, and V, Table II

This form differs from the typical subspecies only in the structure of the spermathecae (Pl. V, fig. 4) and cibarium (Pl. IV, fig. 3) of the female. The spermathecae are considerably larger, with shorter and thicker ducts, and the cibarial teeth are longer and fewer in number. There are also four minute erect teeth in two sublateral pairs. From *P. c. puertoricensis* it differs especially in the much larger spermathecae. The cibarium also appears to have a few more teeth, 14 and 15 in the

EXPLANATION OF PLATE V

Fig. 1. *Phlebotomus c. puertoricensis* subsp. nov., spermathecae. Fig. 2. *Phlebotomus cayennensis* Floch and Abonnenc, female cercus. Fig. 3. Same, spermathecae. Fig. 4. *Phlebotomus c. viequesensis* subsp. nov., spermathecae. Fig. 5. *Phlebotomus ctenidophorus* sp. nov., female cercus.



two specimens available, but a larger series of specimens might not substantiate the slight differences indicated. This race seems smaller than the Puerto Rico form, the few measurements available showing no differences from *P. c. cayennensis*.

Holotype, female.—Slide 1051, Laguna Yanuel, Vieques Island, Puerto Rico, 17 June 1947. In a tree hole. H. Trapido and J. Andrews colls.

Paratypes.—Two males, 2 females, same data as holotype; 1 male, Isabel Segunda, Old Spanish Fort, Vieques Island, Puerto Rico, 19 June 1947. H. Trapido coll.

Phlebotomus cayennensis maciasi subsp. nov.

Plate IV, Table II

This form again differs from the typical subspecies only in characters of the female. The spermathecae are like those of the Panama subspecies, but the cibarial comb (Pl. IV, fig. 2) has much longer teeth, which tend to be fewer in number, 12 to 13 in Mexican examples, 12 to 16 in those from Guatemala. The erect teeth below the cibarial comb are larger than in Panama specimens, and the central pair are markedly larger than the others. In measurements there seem no significant differences between material from Mexico, Guatemala or Panama, though *delta* seems to average shorter in Panama material.

Holotype, female.—Slide 931, Zumpango, Guerrero, Mexico, Macias coll.

Allotype, male.—Slide 390, between Esquintla and San Jose, Guatemala, June 3, 1945, G. B. Pairchild coll. Taken in buttresses of a large roadside tree.

Paratypes.—Three males, 10 females, Zumpango Guerrero, Mexico, Macias coll.; 1 male Guerrero, Mexico; 2 males, near Esquintla, Guatemala, May 25, 1945, in buttresses of large forest trees; 2 males, 5 females between Esquintla and San Jose, Guatemala, June 3, 1945, in buttresses and hollow trees along roadside.

Phlebotomus ctenidophorus sp. nov.

Plates IV and V, Table I

We have only a single female of this species, but the structure of the cibarium (Pl. IV, fig. 5) is so unusual that we feel it should be recognizable from that alone. The cibarium is a comb-like structure bearing 34 fine teeth, the pharynx (Pl. IV, fig. 6) is armed with prominently sclerotized tubercles each bearing a row of fine spines and shows in addition a heavily pigmented patch anterior to the spines. The cerci (Pl. V, fig. 5) are of a somewhat different shape from those of *cayennensis*. The spermathecae are unfortunately badly shrunken, but appear to have been subglobose with relatively short ducts. The third antennal segment and fifth palpal segment are both quite long, while *alpha* is very long, much exceeding *beta* or *gamma*. The ascoids are simple and appear not to reach the ends of their respective antennal segments, though in our single mount they are difficult to see.

Holotype, female.—Slide, 999, Tamazunchale, San Luis Potosi, Mexico (no date), Macias coll.

We include this species here, as it seems to be related to *P. cayennensis*.

Phlebotomus chiapanensis Dampf

Plate II, Table I

1947, *Medicina*, Mexico, 27 (530): 3-7, figs. 1-6 (♀; Chiapa de Corzo, Chiapas, Mexico).

We at first confused this species with *cayennensis* but it is larger and with quite different wing measurements. The spermathecae (fig. 2), though superficially similar to *cayennensis* have a large setiferous knob at the apex, not shown in Dampf's figure. The reticulate appearance of the pharynx (fig. 4), emphasized by Dampf is clear in our material, but in addition there are small spines not shown by him. The cibarial comb (fig. 6) bears about 25 teeth, considerably more than in any of the forms of *cayennensis*. The ascoids are simple and reach nearly to the ends of the segments. Our material shows a shorter *delta* and *alpha* and a longer *gamma* than indicated by Dampf in his figure, but he gives no actual measurements of these vein segments. The late Dr. Dampf was kind enough to compare one of our specimens with the type and agreed that our determination is correct.

We have also taken what we believe to be the male of this species (fig. 1). It agrees in wing and palpal measurements, except for being somewhat smaller, and in well stained material vestiges of the cibarial comb may be seen. It is, however, so unlike the males of *cayennensis* that we were for long hesitant in accepting it as the proper male for the species. It is closely similar in the structure of the style to *P. stewarti* Mangabeira and Galindo, though the basal tuft on the coxite, of relatively slender scattered hairs, is reminiscent of the condition in *trinidensis* Newst.

We have taken this species in fair abundance in crevices in the ruins of Old Panama, our records showing captures in Feb., April, June, Sept., Nov., and Dec. Dr. Galindo has taken it also at Puerto Chitre, Herrera Prov., Panama, Aug. 9, 1945 in a rodent burrow. We also have a male and a female from Barranca, Costa Rica, H. W. Kumm coll.