

THE WEST INDIAN SPECIES OF PHLEBOTOMUS

(Dipt. Psychodidae)

G. B. FAIRCHILD AND HAROLD TRAPIDO¹

Gorgas Memorial Laboratory, Panama

Sandflies of the genus *Phlebotomus* are a widespread and medically important group of bloodsucking midges. Their distribution covers the tropics of both hemispheres and extends well into both the north and south temperate regions. Certain species are the vectors of various forms of leishmaniasis, of Oroya fever or verruga peruana and of pappataci or sandfly fever. Leishmaniasis in several forms is widespread in the American tropics, and verruga is known from southern Colombia to southern Peru, but neither infection has been reported from the West Indies. Sandfly fever is known with certainty only from the Old World, though cases clinically indistinguishable have been reported from a number of widely scattered places in the New World. Clinically suspicious cases have occurred in Puerto Rico, though not reported as sandfly fever because of the supposed absence of *Phlebotomus* in that area.

Previous to 1938, *Phlebotomus* sandflies were not known to occur in the West Indies outside of Trinidad. In that year Bequaert (1938) reported their occurrence in Martinique in the French West Indies, although the species has not been determined. Floch and Abonnenc (1945) were the first to determine a species from the West Indies, *P. atroclavatus* from Guadeloupe. In 1947 the junior author took *Phlebotomus* on Puerto Rico and on Vieques Island. These were described by Fairchild and Hertig (1948). In the following year Trapido again secured material from a number of widely scattered localities in Puerto Rico and from St. Thomas in the Virgin Islands which is reported on more fully below.

¹The field work in connection with this investigation was done while the authors were on tour of active duty with the U. S. Army Caribbean. We are exceedingly indebted to Col. Thomas Page, M.D., Surgeon, U. S. Army Caribbean, for his interest and support of this work and for facilitating the arrangements for our trip. We are further greatly indebted to Mr. C. B. Lewis of the Institute of Jamaica for much help and advice while we were in Jamaica; to Col. Carlos Ponce R., of the Cuban Army, for his hospitality and kindness in furnishing quarters and transportation while we were in Camaguey; to Dr. Guillermo Aguayo and Lt. Howell of the University of Havana and the Cuban Hydrographic Service for enabling us to collect in the Havana area; to Major E. L. Dudley of the Institute of Inter-American Affairs Sanitary Mission in Port au Prince and to Mr. John Lynch of the Reconstruction Finance Corporation in Cap Haitien for furnishing us with good advice and indispensable transportation, and finally to Dr. Henry Carr, of the International Health Division of the Rockefeller Foundation, who very kindly furnished us with a car and driver for our whole stay in the Dominican Republic. Without the material aid furnished by these gentlemen our trip would have been very much more difficult and much less productive.

Cost of publication is paid by the Gorgas Memorial Institute.

The discovery of these potentially important insects in the West Indies made it seem advisable to find out if they were generally distributed in the area, especially on the larger islands, and, if present, likely to become of public health significance. It was felt that the question was one of special interest to the Army, due to the strategic position of the West Indies and the previous experience of our forces with sandfly fever in the Mediterranean area. Accordingly arrangements were made for the authors to return to active duty for 30 days in order to accomplish the field work.

Field work was begun on 19 May 1949, in Jamaica, where nine days were spent. Search was made for *Phlebotomus* in approximately forty localities in eight of the thirteen parishes of the island. *Phlebotomus* were found at thirteen localities in six different parishes at elevations from sea level to about 1300 ft. Searches at higher elevations up to 4200 ft. were negative. A total of 97 specimens was taken, but at only a few places were sandflies abundant. We believe they will be found throughout the island at lower elevations, especially where suitable tree habitats occur.

The time from 28 May to 5 June was spent in Cuba. Search was made in four of the six provinces, Camaguey, Matanzas, Habana and Pinar del Rio. Because of the limited time available and the large size of the island more time was consumed in travelling and less in collecting than in Jamaica. It was impossible to visit the eastern end of Cuba, though the senior author had searched the desert area around Guantanamo Bay in 1946 without result. About twenty localities were searched in Cuba, from sea level to about 1000 ft. *Phlebotomus* was found at thirteen localities in six different parishes at elevations specimens was taken, 132 of these at one locality near Camaguey, the only time we found sandflies really abundant. At this place, Finca Chiquito Ingenio, the insects were hopping about on the trunks of mango, breadfruit and sapodilla trees in an overgrown orchard. Domestic swine shared the enclosure with chickens, turkeys and peacocks, while lizards were very abundant. Only *P. cubensis* n. sp. was taken here. At Finca El Milagro, where habitats in the form of deep buttresses and hollow trees were far more abundant, sandflies were very scarce, and we took but five specimens, two of them the new *P. orestes*, and all from the same large *Ficus* tree. Jointly we searched at least a hundred habitats in this patch of forest. In Western Cuba in the Vinales Valley sandflies were also scarce, a total of eight, all taken by Trapido, resulting from some 20 hours searching. They were confined to dense thickets along a stream, a single specimen here and there. Searches of limestone cavities in the sheer cliffs characteristic of this area or in the open and rather xerophytic oak-pine forests yielded nothing.

We were from 6 June to 15 June in Hispaniola, four and a half days in Haiti, and five days in the Dominican Republic. Thirty-eight localities were searched, including both north and south coasts and the highlands up to 5200 ft. elevation. Sixteen localities yielded *Phlebotomus* at elevations up to 1900 ft. A total of 162 sandflies was taken on the island, 98 in Haiti and 64 in the Dominican Republic. Near Port au Prince in buttresses of a large *Ceiba* tree we secured some 30

specimens, mostly females, and all of them engorged with blood. Again near Cap Haitien some 30 specimens were taken in a patch of old second growth, heavily shaded, in the narrow cracks in the trunks of logwood trees. Here too the majority of females were engorged. The ruins of King Christophe's palace of Sans Souci, at Milot near Cap Haitien and Pauline Bonaparte's old palace on the outskirts of the town yielded fair numbers of *Phlebotomus* from crevices and holes in the old masonry, the only place on the trip where we found these habitats rewarding. In the Dominican Republic our best collecting was in association with trees, either large roadside Ceibas, or shade trees in coffee or cacao plantations, but nowhere were sandflies very numerous. Our single venture into the highlands yielded nothing, though we found a fine small patch of apparently virgin deciduous forest with many suitable habitats including small animal burrows. This locality was at over 5000 ft. in mainly pine forest.

Because of the very limited time available we felt that a rapid reconnaissance of as many localities and types of habitat as possible was likely to yield the best results. For this reason we concentrated on searches of daytime resting places likely to harbor sandflies and made no attempts at trapping, light collecting, house searches or the use of animal baits. Suitable daytime resting places for these insects consist of animal burrows, hollow trees, crevices between the buttressed roots of large trees, caves and crevices in and under rocks, holes in masonry walls and, in general, small cavities which are dark and humid. Since the West Indies are extremely poor in mammals and have been very extensively deforested, we expected our best collecting to be in rock crevices and holes in masonry walls. We found, however, that the crevices between the buttressed roots of trees yielded the most sandflies. In Jamaica the large silk cotton trees (*Ceiba* sp.) are believed to be the chosen abode of "duppies," an endemic form of ghost, and are hence seldom felled. Since practically all the other large trees have long since been destroyed and the silk cotton trees, especially when old, have large buttressed roots, they proved one of the most suitable habitats for *Phlebotomus* on all three islands, but especially in Jamaica. In general, habitats associated with trees seemed the most favored, though we took sandflies in rock crevices and holes in masonry walls a number of times. Animal burrows were encountered only once, in Hispaniola, and yielded no sandflies.

Collecting was done with the aid of cigarette smoke and a suction tube. Smoke was blown into the habitat and the sandflies, if any, taken up in the suction tube as they emerged. If the hole or crevice was especially dark, a flashlight was used. The sandflies were killed in chloroform tubes and transferred to dated and numbered dry shell vials. This method of collecting has proven efficient elsewhere, and enabled us to sample a maximum of localities in a minimum time. At the same time we secured a fair number of mosquitoes which are being studied and will be reported on by our colleague Mr. Pedro Galindo.

We encountered no evidence that the species of *Phlebotomus* in the West Indies feed on man. We ourselves were not exposed, but we found no one who recognized them and no local names for them, a

condition in marked contrast to that on the mainland, where many native names occur. It is also significant that, although many competent entomologists have visited or worked in these islands, including medical entomologists searching for biting insects, *Phlebotomus* has remained undetected until now. Many of the females we took contained red blood, so that some vertebrate is doubtless the host, most probably lizards, as they are the most numerous terrestrial vertebrates in the West Indies and favor similar habitats.

The material collected shows the presence of two species on each of the three islands visited. In the case of Cuba, both species appear to be new and endemic, while Hispaniola and Jamaica each have one

TABLE I
MEASUREMENTS IN MICRA

	<i>jamaicensis</i>		<i>hispaniolae</i>		<i>duppyorum</i>		<i>cubensis</i>		<i>orestes</i>		<i>christopheii</i>	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Ant. III.....	212	196	228	164	324	240	216	172	200	168	248	216
Palpi I+II.....	140	112	112	88	156	116	148	96	128	120	160	116
Palpi III.....	136	120	120	104	168	120	140	104	124	120	144	120
Palpi IV.....	108	76	92	76	116	80	88	80	92	84	100	88
Palpi V.....	308	240	284	200	368	268	280	180	296	240	336	260
Head ht.....	204	196	220	168	208	200	220	188	220	220	260	208
Clypeus.....	124	112	128	100	120	100	120	100	120	112	148	104
Proboscis.....	220	160	160	120	180	144	172	120	172	164	240	144
Eye ht.....	148	136	152	128	144	136	168	140	132	120	168	124
Wing.....	1746	1440	1656	1224	2016	1566	1710	1350	1476	1350	1854	1458
Alpha.....	468	324	450	288	504	288	378	216	216	180	450	288
Beta.....	306	252	270	180	378	306	342	252	216	198	270	198
Gamma.....	230	180	234	180	324	216	216	198	288	288	288	234
Delta.....	306	198	306	162	288	72	234	90	18	-18	162	18

peculiar species and one species probably only subspecifically distinct from the form found in Puerto Rico. The endemic Jamaican species and one of the Cuban species belong to the same group as the Puerto Rican species, but are abundantly distinct. The other Cuban species and the endemic Hispaniolan species are closely related to each other but belong to a quite different group from the other Antillean species. Including *atroclavatus*, there are thus three groups represented, all of which either occur on or have representatives on the mainland. In the case of *cayennensis*, the most widespread form, there are poorly marked subspecies on Puerto Rico, Vieques, Virgin Islands, Hispaniola and Jamaica as well as in Mexico, Panama and northern South America. *P. duppyorum* n. sp. and *P. cubensis* n. sp. also belong to the *cayennensis* group, but have developed characters sufficiently marked to be considered full species. *P. orestes* n. sp. and *P. christopheii* n. sp. have close relatives in Panama and northern South America, while *P. atroclavatus* is known from Panama, Trinidad and French Guiana.

The Table of Measurements does not separate the sexes nor are means calculated, as too few specimens were available in most cases to make this of any importance. Usually the maximum figures occurred in females, the minimum in males, but no single specimen was smallest or largest in all measurements. On the whole, the measurements appear of little value in separating these species, though the long third antennal of *duppyorum* and the relatively shorter delta in *orestes* and *christopheï* may be useful.

KEY TO WEST INDIAN SPECIES

Males

1. Coxite with a basal tuft of hairs..... 2
Coxite without a basal tuft of hairs; style with four major spines..... 4
2. Style with 4 major spines; basal tuft of 4 heavy setae..... **atroclavatus**
Style with 3 major spines and an accessory subterminal seta..... 3
3. Basal tuft of numerous fine hairs borne on a salient rounded prominence;
tips of genital filaments modified and expanded..... **christopheï**
Basal tuft of two groups of heavier hairs, less numerous and not borne on a
prominence; tips of genital filaments little modified and hardly expanded,
orestes
4. Cibarium with hardly visible vestiges of teeth, few in number; pharynx
slender; third antennal segment longer than clypeus and proboscis; genital
filaments slender..... **duppyorum**
Cibarium with rather well marked teeth or spines; pharynx stouter; genital
filaments stouter; third antennal segment considerably shorter than
clypeus and proboscis..... 5
5. Cibarium with 6 spine-like horizontal teeth; no erect teeth..... **cubensis**
Cibarium with more than six horizontal teeth and few to many erect
teeth..... **cayennensis** and subspecies

Females

1. Spermathecae with a thick, annulate common duct, the two spermathecae
without individual ducts, tapering from a swollen wrinkled base to a
slender tubular apex; cibarium with 4 long teeth; pharynx unarmed,
christopheï
Spermathecae with individual ducts many times longer than the common
duct, the latter slender..... 2
2. Heads of spermathecae pear-shaped, smooth, the ducts smooth; cibarium
with 4 very small teeth; pharynx with strong transverse ridges and long
spines..... **atroclavatus**
Heads of spermathecae subglobose, joining the ducts by a tapering, annulate
portion; cibarium with 4 or more teeth in a comb-like row; pharynx spinose
but without transverse ridges..... 3
3. Pharynx greatly expanded proximally, wine-glass shaped, finely spinose;
cibarium with 6 to 8 short fine teeth, longest in the middle..... **duppyorum**
Pharynx and cibarium not as above..... 4
4. Cibarium with 4 straight teeth in a rudimentary comb; pharynx densely
spinose at proximal end..... **cubensis**
Cibarium with 12-18 teeth in a comb-like structure; pharynx as above,
cayennensis and subspecies

Phlebotomus christopheï sp. nov.

Plate I, figs. 1 and 4; Plate II, figs. 3 and 7

Male.—A small pale sandfly without contrasting colors. Eyes relatively small, proboscis and palpi relatively long. Third antennal segment somewhat shorter than first three palpal segments. Ascoids simple, about two-thirds the length of their respective segments. Newstead's scales long and clubbed, in a large diffuse patch occupying the central third of the segment. Genitalia with three major spines

and an accessory subterminal seta, as figured. Genital pump and filaments about 1.25 times as long as coxite and style, the tips strongly modified, as figured. Cibarium without clearly visible teeth, the chitinous arch well marked but diffuse in the center. Pharynx unarmed.

Female.—External characters as in the male. Spermathecae as figured. Cibarium with four stout horizontal teeth and a number of small erect teeth below as figured. Chitinous arch high and heavily sclerotized. Pharynx unarmed. Cerci rather short and blunt.

This species is clearly related to *P. orestes*, of the present paper, from Cuba, but differs clearly in the structure of the basal tuft of the coxite as well as in other details. From the other American species of *Phebotomus* with three spines on the style these two may be distinguished from *chassigneti* Floch and Abonnenc and *pilosus* Damasceno and Causey by the presence of well developed tufts of hairs on the base of the coxite. The species of Mangabeira's subgenus *Pressatia*, *P. triacanthus* and allies, are larger species, the subterminal spine of the style borne on a distinct tubercle, with an extra accessory seta on the style, and with more complex basal tufts on the coxite and more complex parameres. *P. vesperilionis* Fairchild and Hertig and *vesiciferus* F. and H. differ in having inflated lateral lobes.

Holotype male, slide 1476, 16 km. south of Hato Mayor, Prov. Seibo, Dominican Republic, 12 June 1949. In buttresses of large Ceiba tree.

Allotype female, slide 1497, Colonia San Rafael, 21 Km. south of Sabana de la Mar, Prov. Seibo, Dominican Republic, 900 ft. elev. in buttress of large tree in coffee plantation.

Paratypes, 4 males, 1 female, same data as allotype; 1 male, 1 female, Milot, nr. Cap Haitien, Haiti, 9 June 1949, in holes in wall of room in ruined palace of Sans Souci; 1 female, 34 km. south of Sabana de la Mar, Prov. Seibo, Dominican Republic, 650 ft., in buttress of large tree in coffee plantation. All Fairchild and Trapido colls. Named in honor of Christophe, King of Haiti, in whose palace the first specimens were taken.

Phebotomus orestes sp. nov.

Plate I, fig. 2

Male.—A small pale sandfly without contrasting colors. Eyes relatively small, proboscis and palpi relatively long. Third antennal segment distinctly shorter than first three palpal segments. Ascoids simple, about half the length of their respective segments. Newstead's scales long and clubbed, in a small dense patch in the middle of the third palpal segment. Genitalia with three major spines and a subterminal seta on the style, as figured. Genital pump and filaments about one and one-half times as long as coxite and style, the tips not exerted in the available specimens, but apparently but slightly spatulate. Cibarium without visible teeth but with a well marked chitinous arch. Pharynx unarmed. Female unknown.

Holotype male and 1 male *paratype*, Finca El Milagro, between Minas and Altagracia, Camaguey Province, Cuba, 30 May 1949, Fairchild and Trapido colls. Taken in buttresses of a large tree in partly cut-over forest.

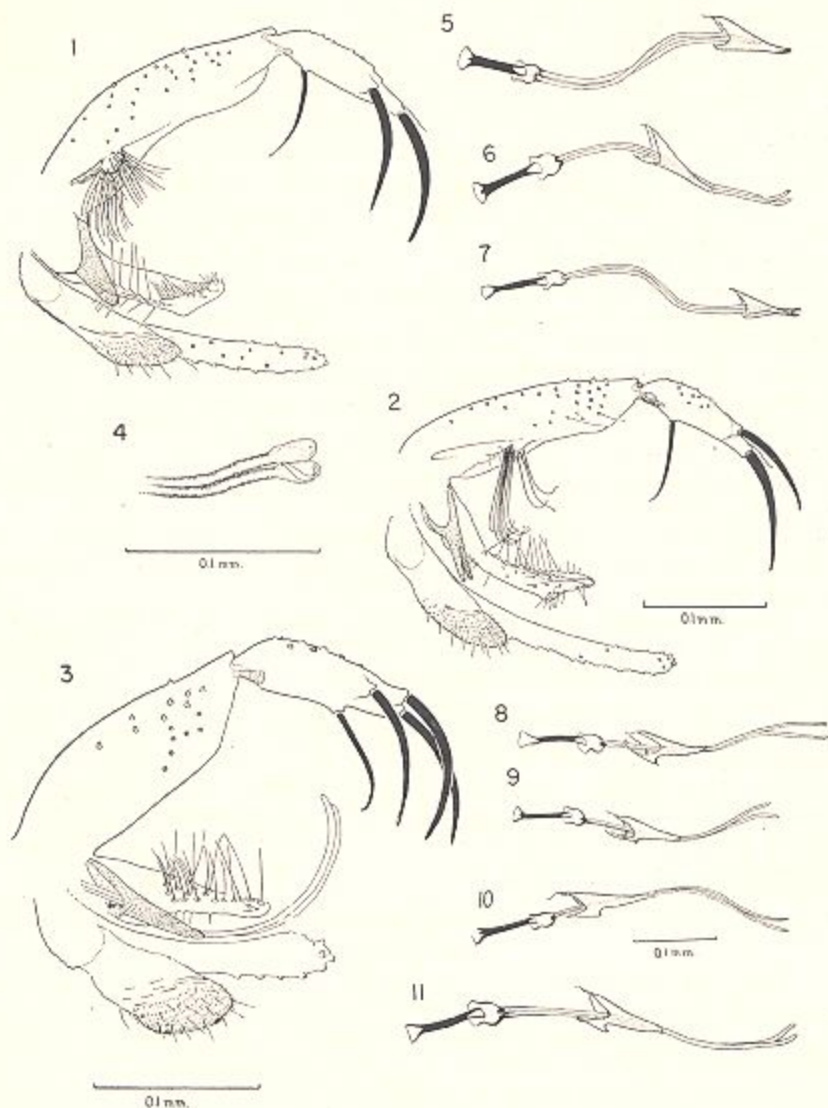


FIG. 1. *P. christophei* n. sp. Paratype, male genitalia. FIG. 2. *P. orestes* n. sp. Holotype, male genitalia. FIG. 3. *P. cubensis* n. sp. Paratype, male genitalia. FIG. 4. *P. christophei*, tips of genital filaments. FIGS. 5-11. Sperm pumps and genital filaments of: 5, *P. cayennensis viequesensis* (Virgin Islands); 6, *P. c. viequesensis* (Vieques Island); 7, *P. c. puertoricensis* (Puerto Rico); 8, *P. c. hispaniolae* n. subsp. (Dominican Republic); 9, *P. cubensis* n. sp. (Cuba); 10, *P. duppyorum* n. sp. (Jamaica); 11, *P. cayennensis jamaicensis* n. subsp. (Jamaica). Figs. 1 and 2 are to the same scale, indicated at fig. 2 and figs. 5-11 are all to the scale indicated at fig. 10.

This species seems closely related to *P. christophei* of Hispaniola and to an as yet undescribed species from Panama. From *christophei* it differs chiefly in the form of the basal tuft on the coxite and in the shape of the parameres. It also appears to lack the greatly enlarged tips to the genital filaments found in *christophei*, though since these are not exerted in our two specimens, close comparison is not possible.

Phlebotomus duppyorum sp. nov.

Plate I, fig. 10; Plate II, figs. 2, 8 and 9

Male.—A small slightly dusky sandfly with erect abdominal hairs. Eyes medium sized, third antennal segment slightly longer than first three palpal segments. Ascoids simple, about one-fourth the length of their respective segments. Newstead's scales scattered along the middle third of the segment. Genitalia with four major spines, differing from *P. cayennensis* only in the more slender and relatively shorter genital filaments. Cibarium with barely perceptible vestiges of teeth, the pharynx slender, unarmed.

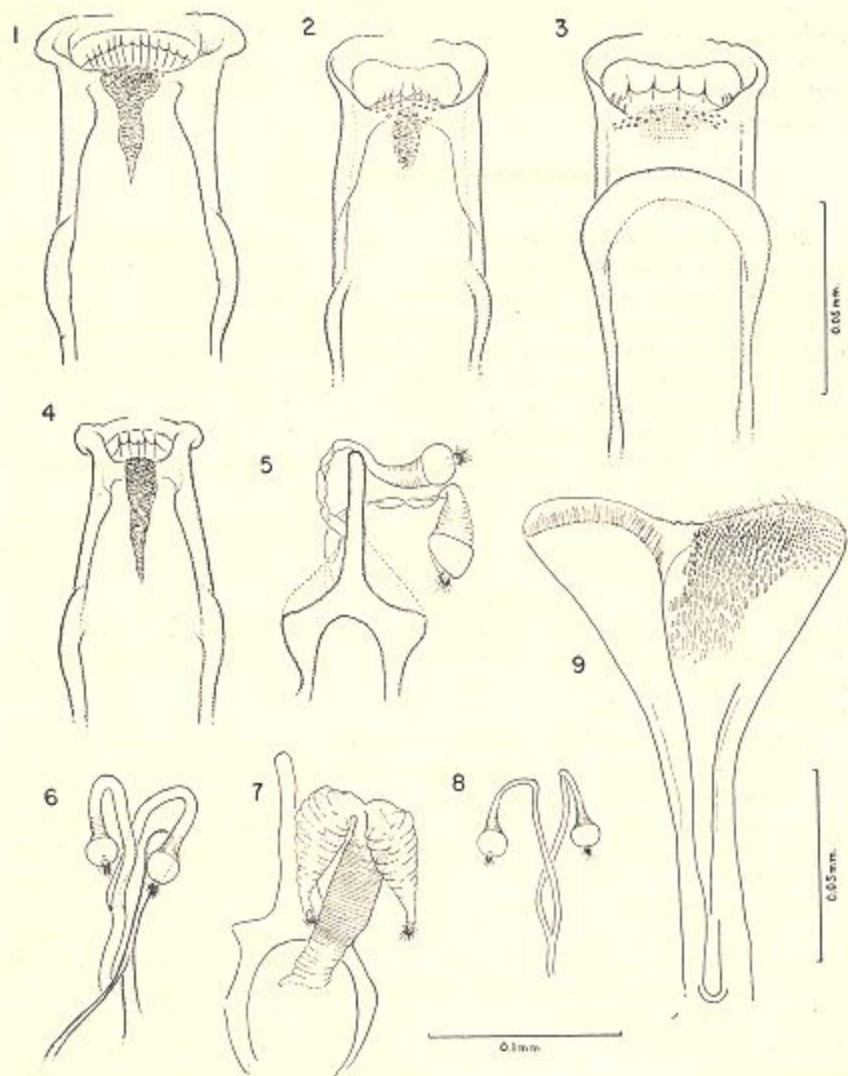
Female.—Externally like male, size slightly larger. Spermathecae as in *P. cayennensis*. Cibarium with 6 to 8 small teeth, longest in the middle, as figured. Pharynx greatly expanded proximally, wine-glass shaped, the proximal portion beset with numerous fine spines arranged in even diagonal rows.

Holotype, female, slide No. 1504, Ferry River, nr. Kingston, St. Andrew, Jamaica, 23 May 1949, in hole in root of tree near cave.

Allotype, male, slide No. 1500, Tom Cringle's tree, near Ferry River, Kingston, Jamaica, 21 May 1949, in deep buttresses of very large Ceiba tree.

Paratypes (mounted), 2 males, 2 females, slides 1429-1432, Springvale, St. Catherine, 21 May, in small cave under large boulder; 1 male, slide 1434, Springvale, St. James, 26 May, 700 ft., in buttress of Ceiba tree; 1 female, slide 1433, Schaw Castle, nr. Springvale, St. James, 26 May, 1250 ft., in buttress of *Ficus* sp. in scrubby forest; 1 male, slide 1481, Rockfort, nr. Kingston, St. Andrew, 20 May, in hole under roots of Ceiba tree; 1 male, 1 female, slides 1501, 1502, Montego Bay, St. James, 1 mi. out on Irwin road, 26 May, in buttresses of Ceiba tree; (unmounted, but examined in phenol and dried on strips of paper in vials) 2 males, same data as slide 1429; 2 males, Stony Hill, St. Andrew, 22 May, 1300 ft., in buttresses of Ceiba tree; 1 male, nr. Albion, St. Thomas, 24 May, in crevices in trunk of large *Ficus* tree; 26 males, 23 females, Melrose Hill, nr. Williams Field, Manchester, 1200 ft., 25 May, in hollows in and under roots of small tree and in buttresses of Ceiba tree; 15 males, 2 females, same data as slide 1501; 8 males, 3 females, Dee Side, Trelawney, 26 May, 350 ft., in buttresses of Ceiba tree.

This species is impossible to distinguish from the other Jamaican form without clearing and microscopic examination. The relatively longer third antennal segment is the only external character we have found to differentiate the two. The pharynx, is, however, quite unique among American *Phlebotomus*, being closely similar to such species as *P. theodori* of Palestine which Theodor (1948) places in the genus *Sergentomyia*. The male genitalia differ from *cayennensis jamaicensis* in having the genital pump smaller and the filaments shorter and considerably more



FIGS. 1-4. Female cibaria of: 1, *P. cayennensis hispaniolae* n. subsp. (Dominican Republic); 2, *P. duppyorum* n. sp. (Jamaica); 3, *P. christophei* n. sp. (Haiti); 4, *P. cubensis* n. sp. (Cuba). FIGS. 5-8. Spermathecae of: 5, *P. cayennensis jamaicensis* n. subsp. (Jamaica); 6, *P. cayennensis hispaniolae* n. subsp. (Dominican Republic); 7, *P. christophei* (Haiti); 8, *P. duppyorum* n. sp. (Jamaica). FIG. 9. Pharynx of *P. duppyorum*. Figs. 1-4 are to the scale indicated to the right of fig. 3; figs. 5-8 by the scale below fig. 8. The figures of spermathecae were drawn from specimens cleared in phenol with the exception of fig. 5 which was mounted in balsam before drawing.

slender. The male pharynx of *duppyorum* is more slender and the cibarium shows but faint vestiges of teeth, while the cibarium of *cayennensis jamaicensis* shows well marked teeth. The somewhat barbarous name was chosen to commemorate the species' marked preference for Ceiba trees, believed in Jamaica to be also the favorite domicile of "duppies," or ghosts.

***Phlebotomus cubensis* sp. nov.**

Plate I, figs. 3 and 9; Plate II, fig. 4

Male.—A small brownish sandfly with brown mesonotum and dusky wings. Abdominal hairs mixed erect and semi-recumbent. Eyes of moderate size. Third antennal segment slightly shorter than first three palpal segments. Ascoids simple, short, hardly one-fourth the length of their respective segments. Newstead's scales slender, clubbed, in a rather dense patch on the proximal third of the segment. Genitalia as in *cayennensis*, but the genital pump and filaments smaller and shorter than in any of the forms of that species. Cibarium with apparently six or seven short teeth. Pharynx with very minute teeth in groups.

Female.—Externally like the male, but larger. Spermathecae as in *cayennensis*. Cibarium with five teeth in a rudimentary comb, the middle tooth shorter than the others, and with vestiges of another pair of teeth laterally. Pharynx densely spinose, as in *cayennensis*.

Holotype, female, slide no. 1466, Finca Chiquito Ingenio, about 10 mi. East of Camaguey, Cuba, 30 May, 1949, in shallow buttresses of trees in orchard.

Allotype, male, slide 1464, same data as holotype.

Paratypes (mounted), 2 males, 1 female, slides 1465, 1467, 1468, same data as holotype; 1 female, slide 1436, Siete Palmas, 5 mi. South of Camaguey on Carretera Vertientes, 30 May, in crevices in trunk of *Ficus* tree in pasture; 1 male, slide 1437, San Vicente, Vinales valley, 1000 ft., Pinar del Rio, 3 June, in buttress of small tree in dense thickets along stream; (unmounted but examined in phenol and dried on strips of paper in vials) 127 males and females, same data as holotype; 6 males, 2 females, same locality, but from hollow dead tree; 2 males, 1 female, Finca el Milagro, between Minas and Altagracia on Nuevitas road north of Camaguey, 30 May, in buttresses and hollow trees in cut-over forest; 2 males, 1 female, Chapaste, Havana, Prov., 2 June, in crevices in trunk of *Ficus* tree; 14 males, 4 females, 7 km. west of Ceiba Mocha, Matanzas Prov., 2 June, in buttresses of large Ceiba trees in scrubby forest; 6 males, 2 females, same locality as slide 1437 but 4 June.

***Phlebotomus cayennensis jamaicensis*, subsp. nov.**

Plate I, fig. 11; Plate II, fig. 5

Male.—A small, somewhat dusky sandfly, the degree of infuscation of wings and mesonotum varying somewhat. Third antennal segment slightly shorter than first three palpal segments. Newstead's scales few, in a loose patch near the proximal third of the segment. Ascoids simple, short, about one-fifth length of their respective segments. Genitalia as in other races of *cayennensis*, but the pump and genital

filaments heavier and longer than in any of the others, being most closely approached by *viequesensis* in this respect. Cibarium with a well marked comb of short but distinct teeth, 12 to 15 in number. Pharynx unarmed.

Female.—Like the male externally and in color, third antennal segment relatively shorter than in male. Newstead's scales more numerous and in a denser patch. Spermathecae somewhat collapsed in the single available specimen, rather large, equalling or exceeding those of *viequesensis* in size. Cibarium with a comb of 13 to 15 long horizontal teeth and apparently four erect teeth in the middle. This structure differs from the cibarium of *viequesensis* apparently only in having the teeth rather heavier and longer. Pharynx rather heavily sclerotized, densely spinose at apex.

Holotype, female, slide 1480, Rockfort, nr. Kingston, St. Andrew, Jamaica, 20 May 1949; in hole under Ceiba tree.

Allotype male, slide 1479, same data as holotype.

Paratypes, 1 male, slide 1435, same locality and date as holotype, but in a shallow cave in side of quarry a few yards from Ceiba tree; 1 male, slide 1503, Ferry River, nr. Kingston, St. Andrew, Jamaica, 23 May, 1949, in crevices in rock near entrance to a large shallow cave.

This form is exceedingly close to *cayennensis viequesensis*, but appears to be larger. Additional material will be needed to be certain that the small differences noted are really significant. It appears to be rare in Jamaica, where it was found only in the immediate vicinity of Kingston, and may represent a rather recent importation, perhaps from one of the lesser Antilles.

Phlebotomus cayennensis hispaniolae subsp. nov.

Plate I, fig. 8; Plate II, figs. 1 and 6

Male.—A small, rather dark, sandfly with dusky wings. The mesonotum is quite blackish, contrasting with the paler pleura. Abdomen dusky, as are the tibiae, abdominal hairs mostly erect or semi-erect. Third antennal segment a little shorter than first three palpal segments. Newstead's scales few, in a small patch on the proximal third of the segment. Acoids simple, short, about one-fifth of their respective segments. Cibarium with a comb of 8 to 10 teeth, unusually long and well developed for a male. Pharynx apparently unarmed. Genitalia as in other races of the species, the pump and filaments indistinguishable from those of *cayennensis puertoricensis*.

Female.—Coloration, etc., as in the male, but about one-third larger throughout. Cibarium with 12 to 15 teeth, like *puertoricensis*, but the teeth apparently somewhat shorter. Pharynx spinose proximally. Spermathecae with moderate sized heads but unusually thick and short ducts, much shorter and thicker than those of *puertoricensis*.

Holotype, female, slide 1478, 16 km. South of Hato Mayor, Prov. Seibo, Dominican Republic, 12 June 1949, in buttresses of large Ceiba tree.

Allotype, male, slide 1472, 34 km. South of Sabana de la Mar, Prov. Seibo, Dominican Republic, 12 June, 1949, in buttresses of large tree in coffee plantation.

Paratypes (mounted) 1 male, 2 females, same data as allotype, slides 1473, 1470, 1471; 1 female, same data as holotype, slide 1477; 1 female, 13 km. N. W. of Ciudad Trujillo, Dominican Republic, 11 June 1949, in small hollow tree in pasture, slide 1441; 1 male, Milot, nr. Cap Haitien, Haiti, 9 June 1949, in hole in ruins, slide 1439; (unmounted, but examined in phenol and placed on slips of paper in vials) 8 males, 21 females, 19 km. West of Port au Prince on Leogane road, Haiti, 7 June 1949, in buttresses of large Ceiba trees; 12 females, 19 males, Charrier, 2 km. from Cap Haitien on Limbe road, Haiti, 8 June 1949, in buttresses and holes in logwood trees in small patch of forest; 6 males, 3 females, La Voute, 4.8 miles from Cap Haitien on Limbe road, Haiti, 9 June 1949, in buttresses of door yard trees; 3 males, 2 females, Cap Haitien, Haiti, 9 June 1949, in holes in ruins of Pauline Bonaparte's palace on point East of town; 5 males, 7 females, Milot, nr. Cap Haitien, Haiti, 9 June 1949, 400 ft., in holes in ruins of palace of Sans Souci; 1 male, 2 females, 15 km. South of Cap Haitien on Milot road Haiti, 9 June 1949, in large hollow Calabash tree; 10 males, 1 female, 16 km. South of Hato Mayor, Prov. Seibo, Dominican republic, 12 June 1949, in buttresses of Ceiba tree; 14 males, 8 females, 34 km. South of Sabana de la Mar, Prov. Seibo, Dominican Republic, 650 ft., 12 June 1949, in buttresses and under loose bark of large trees in coffee plantation; 1 female, 6 km. South of Sabana de la Mar, Prov. Seibo, Dominican Republic, 12 June 1949, in buttresses of large trees in Cacao plantation; 2 males, 2 females, Rincon, between Monsenor Nouel and La Vega, Prov. de la Vega, Dominican Republic, 13 June 1949, in hollow mango tree in old cacao plantation, 500 ft.; 2 males, Rio Verde, 12 km. South of Moca, Prov. Espaillat, Dominican Republic, 14 June 1949, in buttresses of large Ceiba tree on river bank; 4 males, 2 females, nr. Colonia Pedro Garcia, between Santiago and Puerto Plata, Prov. Puerto Plata, Dominican Republic, 14 June 1949, 1900 ft., between roots of large *Cecropia* tree in secondary forest.

This race differs from the Puerto Rican form mainly in the structure of the spermathecae, the minor differences in cibarium, etc., being possibly not significant.

Phlebotomus cayennensis puertoricensis Fairchild and Hertig

1948. *Ann. Ent. Soc. Amer.*, 41: 462.

In addition to the material previously reported (1948), we now have specimens from the following localities in Puerto Rico, collected by the junior author.

Eleven males, 2 females, Toro Negro Unit of Caribbean National Forest, near Kilometre post 47 on Route 11, northwest of Villalba, 2200 ft., 23 Sept. 1948, taken from holes and crevices among roots in roadside bank. (This is the highest elevation at which *Phlebotomus* were taken in Puerto Rico, though searched for up to 3200 ft. in the Luquillo Unit of the National Forest); 3 females, near Kilometre post 67 on Route 1, between Cayey and Aibonito, 1000 ft., 21 Sept. 1948; 2 males, 5.8 miles south of Canovanas on Route 43, 650 ft., 25 Sept. 1948, taken from a large crevice between boulders near a small stream.

Phlebotomus cayennensis viequesensis Fairchild and Hertig

1948. *Ann. Ent. Soc. Amer.*, 41: 464.

As previously noted, the junior author took this form in some numbers on St. Thomas in the Virgin Islands. All the material was taken from drainage holes in stone retaining walls in and near the town of Charlotte Amalie between 18 and 19 Sept. 1948. Collecting was difficult, as the constant strong trade winds blew the sandflies away as soon as they were driven to the entrances of the holes by tobacco smoke.

Seven males, 6 females, Denmark Hill, 19 Sept.; 1 male, Catherine Berg 88, 19 Sept.; 7 males, 9 females, Queen's Quarters, Bjerge Gade, 18 Sept.

Phlebotomus atroclavatus Knab

1913. *Ins. Ins. Mens* 1: 135; Fairchild and Hertig, 1948, *Ann. Ent. Soc. Amer.*, 41: 455.

Through the kindness of Dr. Harry D. Pratt, of the U. S. Public Health Service, we have been enabled to examine two males of this species taken by Kohler near Mt. Washington, N. W. St. Croix, Virgin Islands, 21 Sept. 1949. This extends considerably the range of this species in the West Indies, as it was hitherto known with certainty only from Guadeloupe in the French West Indies.

REFERENCES

- Bequaert, J. 1938. The distribution of *Phlebotomus* in Central and South America. *Carnegie Inst. Washington*, Pub. no. 499, p. 230.
- Floch, H., and E. Abonnenc. 1945. Description d'un phlébotome nouveau de la Guadeloupe. *Inst. Pasteur. Guyane*, Pub. no. 96, pp. 1-3.
- Fairchild, G. B., and Marshall Hertig. 1948. Notes on the *Phlebotomus* of Panama. IV. *P. atroclavatus*, *P. cayennensis*, *P. chiapanensis* and some related forms from the West Indies and Mexico. *Ann. Ent. Soc. Amer.*, 41 (4): 462-466.
- Theodor, O. 1948. Classification of the Old World species of the subfamily *Phlebotominae*. *Bull. Ent. Res.*, 39 (1): 110, Pl. XI, fig. 2.