

NOTES ON THE PHLEBOTOMUS OF PANAMA
(Diptera, Psychodidae)

XI. THE MALE OF *P. cruciatus* COQ. AND NOTES ON
RELATED SPECIES¹

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In 1948 we discussed the status of *Phlebotomus cruciatus* on the basis of the female, the only sex known with certainty at that time. Since then much additional material has been secured, including what we believe are males of this species. Recently Floch and Abonnenc (1950) have questioned our revalidation of *cruciatus*, so that it was felt necessary to go over carefully the basis of our action, including a re-examination of the type material in the U. S. National Museum.

On reading over our remarks of 1948, it appears that we did not make ourselves entirely clear on several points. The original description of the species by Coquillett (1907) states: "Five females. Type No. 10,155 in the U.S.N.M." A re-examination of this material by one of us (M.H.) in Dec. 1951 and Jan. 1952, shows the following situation. There are five, and only five, specimens of this species in the collection. Four are mounted on slides, the remaining one, of which only three legs remain, is pinned. The specimens are labelled as follows:

Slide A. This bears five small printed labels, showing pin-holes, glued to the left-hand side of the slide, as follows: "Biting/Apr. 15 1906/ Cacao Trece Aguas," "Alta V. Paz/Guatemala," "Schwarz and Barber coll.," "Type/No. 10,155/U.S.N.M.," and "Phlebotomus cruciatus Coq." This is the only specimen bearing a red, numbered type label, and the only specimen bearing the identification in Coquillett's handwriting. This specimen is hereby selected as lectotype of *Phlebotomus cruciatus* Coq.

Slide B. This bears three printed labels glued to the left-hand side of the slide, as follows: "Alta V. Paz/Guatemala," "18.4 Cacao/Trece Aguas," and "Barber and Schwarz Coll." Written below these is "5051/A. Dampf prp 18/IV 36." The right hand side of the slide bears a written label as follows: "Phlebotomus cruciatus Coq./♀ / Drawn by Dampf." This is the slide from which the drawing in our 1948 paper was made.

Slide C. This bears a label on the left-hand side, written by R. C. Shannon according to Dr. Stone, but no printed labels. It reads as follows: "Phlebotomus cruciatus Coq./Paratype ♀ / Cacao, Trece Aguas / Apr. 26 Alta V. Paz/Guatemala." This is the only slide of the four labelled as paratype.

¹Cost of publication is paid by the Gorgas Memorial Laboratory.

Slide D. This bears three original printed labels glued onto left-hand side of slide, as follows: "Apr. 2 Cacao/Trece Aguas," "Alta V. Paz/Guatemala," and "Schwarz & Barber coll." On the right-hand side of slide is a label in Dampf's writing reading "Phlebotomus cruciatus Coq. ♀."

Although all significant structures cannot be seen on every specimen, the pigmentation of the pleura, the rugose or papillate lobes on the ninth tergite and the ducts or spermathecae or both are visible on all specimens, and we are certain that all specimens represent a single species.

From the above we believe it is clear that at least the four mounted specimens are *P. cruciatus* Coq., that they are the specimens which were before Coquillett when he described the species, and that Slide A is the type of the species.

Floch and Abonnenc contend that the name is a *nomen nudum*, basing their opinion on the following points:

1. The original description is so inadequate that it amounts to no description.
2. The type material was from three different localities in Guatemala and taken at different times.
3. No true type exists, and there is no guarantee that the specimens examined by Fairchild & Hertig 1948 were the species named by Coquillett.
4. The material of "*cruciatus*" is in too bad a state of preservation for details to be made out.

We agree that the original description is inadequate, but so long as type material exists the name cannot be disregarded. As F. W. Edwards says (1932 p. 3) "Where a type exists a specific name must be regarded as valid from the date of its publication, even if the original description is hopelessly inadequate or even inaccurate. . . ."

All the specimens were, of course, from the same locality. Cacao was a farm in the neighborhood of Trece Aguas, Province of Alta Vera Paz, Guatemala. As shown above, a true type exists and it and the other specimens taken at the same locality are conspecific and in a reasonably good state of preservation.

Since 1948 we have seen the following additional material of *cruciatus* 1 ♂ 5 ♀ from two localities in Chiapas, Mexico, 3 ♂, 3 ♀ from three localities in Costa Rica and a long series of both sexes from several localities in Panama. All the females in the above material agree among themselves and agree as well with the types and with the Mexican and Guatemala material previously discussed in possessing the two characters which seem to most clearly separate the species from *gomezi* Nitz. To these two characters, the anterior dorsal papillate lobes on the ninth tergite and the shorter and thicker ducts of the spermathecae, must be added the possession of strongly pigmented pleura in addition to the dark mesonotum and scutellum. In *cruciatus* the postpronotum (Crampton 1925) and a strip of sclerotization lying below the lateral border of the mesonotum and above the mesothoracic spiracle, which appears to be a posterior prolongation of the postpronotum, are as heavily infuscated as the mesonotum. The sclerites before and above the base of the front coxa are also infuscated, and there is often a fainter

darkening of the other pleural sclerites. In *gomezi* the infuscation is confined entirely and sharply to the mesonotum and scutellum. This character is sharp and definite in all material we have seen, and enables the two species to be separated at a glance under low magnification.

The males which we associate with females of *cruciatus* resemble very closely the males of *gomezi*, but are distinguishable by the aforementioned infuscated pleural sclerites and by a relatively and actually larger sperm pump and heavier genital filaments. Counts of the number of hairs in the basal tuft of the coxite show considerable and overlapping variation in both species. In Panama the distribution of the two species shows interesting features. *Cruciatus* has been taken in but six localities in Panama, all but one on the Atlantic side of the continental divide. Four of these localities have yielded but one or two specimens; of the other two, Almirante, in Bocas del Toro Province has yielded the bulk of over 140 specimens while the Mojinga Swamp area near Ft. Sherman in the Canal Zone has yielded 11. *Gomezi* has been taken in nearly 70 localities on both sides of the continental divide. It appears to be absent entirely from Almirante and two of the other localities that have yielded *cruciatus*, but is fairly abundant at the remaining three localities which have each yielded a single specimen of *cruciatus*. In no case in Panama do both species occur abundantly together.

In Costa Rica *cruciatus* has been taken in three localities and *gomezi* in four, but only one place, Turrialba, has yielded both species. We have seen no Mexican or Guatemalan material of *gomezi* though *cruciatus* appears to be not uncommon and fairly widespread there. As reported previously, we have examined *gomezi* from Trinidad, Venezuela and Ecuador, and it has been reported by others from Para and S. Paulo, Brasil. It would seem likely that *cruciatus* may reach its southern limit in the Panama area, while *gomezi*, primarily a South American species, extends northward to somewhere between Costa Rica and Guatemala.

In 1948 we noted that, based on available descriptions, *P. diabolicus* Hall from Texas was separable with difficulty, if at all, from *gomezi* or *cruciatus*. Through the kindness of Dr. Alan Stone of the United States National Museum one of us (M.H.) had the opportunity to examine the mounted type material of this species and to borrow and make slide mounts of some unmounted material, including a male Paratype. This material consists of a male paratype, Uvalde, Texas, 3 Nov. 1934, A. W. Lindquist coll., Bishopp No. 20118, and 4 female specimens, Uvalde, Texas, 28 Sept. 1944, H. M. Brundrett coll., Bishopp No. 14244 (3) and Uvalde, Texas, 16 June 1943, on man, Bishopp No. 14241 (1). Two of the specimens lack abdomens, but all agree in other respects.

There seems to have been a clerical error in regard to the types of this species, leading to some subsequent contradictions, though it does not materially affect the validity of the species. In the original description the types are stated to consist of a male holotype, U.S.N.M. 51411, Uvalde, Texas, November 14, 1934, A. W. Lindquist coll., a female allotype, U.S.N.M. 51411, same data as holotype, both mounted on slides, and an unspecified number of Paratype specimens from Uvalde,

Texas mounted on card points. Earlier in Hall's paper he states that "The description is based upon specimens reared or collected at Uvalde, Tex., by A. W. Lindquist. . . ." Lindquist's paper (1936) on the early stages of this species says that engorged specimens were secured at both Uvalde and Del Rio, Texas. He mentions specimens taken November 16, 1933 and May 3, 1934. Addis (1945) in his redescription of the species used specimens collected at Uvalde, Texas by Mr. and Mrs. H. M. Brundrett, Oct. and Nov. 1944, which he says he compared with the female allotype collected by Lindquist at Uvalde, Nov. 14, 1934.

The mounted material of *diabolicus* examined in Dec. 1951 at the United States National Museum consisted of three slides, labelled as follows:

Slide A. This is a whole mounted ♂ under a circular cover glass on the right-hand end of the slide. Mounted in the balsam with the specimen is a label reading Bishopp No. 16451. In the middle of the slide is a red Type label reading "Type No. 51411 U.S.N.M." and on the left-hand end of the slide the label reads "Phlebotomus diabolicus Hall./♂ term./Uvalde, Tex./Jun. 10-'33/A. W. Lindquist/Bish./16451."

Slide B. This is a whole mounted ♀, not well cleared, also mounted on the right side of the slide and with the same Bishopp number in the balsam with the specimen. The middle of the slide bears a red type label reading "Allo. Type No. 51411 U.S.N.M." The left-hand label bears the same data as for Slide A above, except for "♂ term."

Slide C. A whole ♀ mounted under a circular cover slip in the center of the slide. The label on one end, written at right angles to the long axis of the slide, is red and reads "Phlebotomus diabolicus Hall./Uvalde, Tex. IX-15-34/A. W. Lindquist colr./Bish, No. 20118/Paratype/Type No. U.S.N.M."

There are also three other slides, each bearing a single wing, and with the same collecting data as Slides A and B above. It is to be noted that the data on none of these specimens agrees with the data published by Hall or with the "allotype" which Addis claimed to have studied. Upon enquiry neither Dr. Bishopp's office or Mr. Hall himself were able to account for the discrepancy. The matter is not of great importance, since there is no evidence that more than one species was involved. Mr. Hall's drawing seems almost certainly to have been made from Slide A, the position of the parts agreeing fairly well, and there being no other known mounted specimens of the male at that time. His figure shows the deciduous hairs of the coxite far too heavy, and the basal tuft not in sufficient detail, but is otherwise recognizable. It is possible that Addis actually studied slide C above, but erred in transcribing the data. This specimen, however is a paratype. Or perhaps he studied the true allotype, Slide B above, but took the data from Hall's paper rather than the specimen itself.

In addition to the above mounted material from the type series, there are four slides of females, presumably *diabolicus*, in United States National Museum, but taken in 1936, 1940 and 1945. They were not closely studied, except to ascertain that the spermathecae were invisible in all. Neither the allotype nor paratype slides, B and C above, showed these structures.

Examination after mounting in Panama of the male paratype and the four topotype females loaned to us, enables us to complete in some respects the descriptions of Hall and Addis. The species turns out to be distinct from both *gomezi* and *cruciatus*, although the differences are relatively slight. We give below expanded descriptions and figures of *cruciatus*, *diabolicus* and *gomezi*, and keys for their separation.

KEY TO MALES

1. Mesonotum, scutellum and pleura markedly infuscated; ascoids of fourth antennal segment one-fourth or less length of segment.....2
- Mesonotum and scutellum infuscated, pleura entirely pale; ascoids of fourth antennal segment about one-third length of segment.....**gomezi**
2. Genital pump large, the plunger heavy and with widely flaring "pavillon"; basal tuft of 9 to 25 rather heavy setae.....**cruciatus**
- Genital pump more slender, the "pavillon" of the plunger cup-shaped; Basal tuft of 8 more slender and slightly shorter setae.....**diabolicus**

KEY TO FEMALES

1. Mesonotum, scutellum and pleura markedly infuscated; ducts of spermathecae rather heavy, about four times as long as the spermathecae; ninth tergite with heavily sclerotized dorsolateral lobes bearing small to prominent conical papillae.....2
- Mesonotum and scutellum infuscated, pleura entirely pale; ducts of spermathecae over five times as long as spermathecae, quite slender; ninth tergite without sclerotized papillate lobes.....**gomezi**
2. Cibarium with 8 to 10 heavy blunt vertical teeth below the four horizontal teeth; chitinous arch diffuse in the middle; spermathecae with numerous fine annulations (not countable in available material but probably exceeding 30).....**diabolicus**
- Cibarium with more numerous small vertical teeth; chitinous arch usually clear cut and of nearly equal width throughout; spermathecae with about 15 annulations.....**cruciatus**

Phlebotomus cruciatus Coquillett

Figs. 1-4, 8, 13, 16, 19, 21, 25

1907, Ent. News, 18: 102 (♀: Cacao, Trece Aguas, Alta Vera Paz, Guatemala). Fairchild and Hertig, 1948, Ann. Ent. Soc. Amer., 41 (2): 247-252 and figs. (♀: Chiapas, Tabasco and San Luis Potosi, Mexico; Esquintla, Guatemala. Full references). Floch and Abonnenc, 1950, Inst. Pasteur de la Guyane, pub. 212, pp. 1-3.

Male.—Wing length 2.00 mm. (Chiapas specimen) and 1.59 to 1.84 mm. (Costa Rica and Panama specimens). The four males from Esquintla, Guatemala measure 1.48 to 1.63 mm. Venation as figured (fig. 25). A moderately large sandfly with mesonotum, scutellum, upper anterior border of pleura, abdominal dorsum and head quite heavily infuscated, as in *diabolicus* (fig. 12). Abdominal hairs erect, not scale like. Postspiracular setae from 15 to 30, lower mesanepisternal setae 3 to 9. Head height slightly greater than length of proboscis and a little more than two-thirds head width. Basal antennal segments and palpi as figured (fig. 16), end of third antennal segment reaching to about middle of third palpal segment when both attached to head. Newstead's scales sparse, slender and clubbed, difficult to see, but apparently confined to the middle third of the third palpal segment. Ascoids simple, exceedingly short, as figured (fig. 19), paired on all but the last three segments, which are rather abruptly shorter than the preceding segment. Cibarium with a strong arch which is usually clear cut

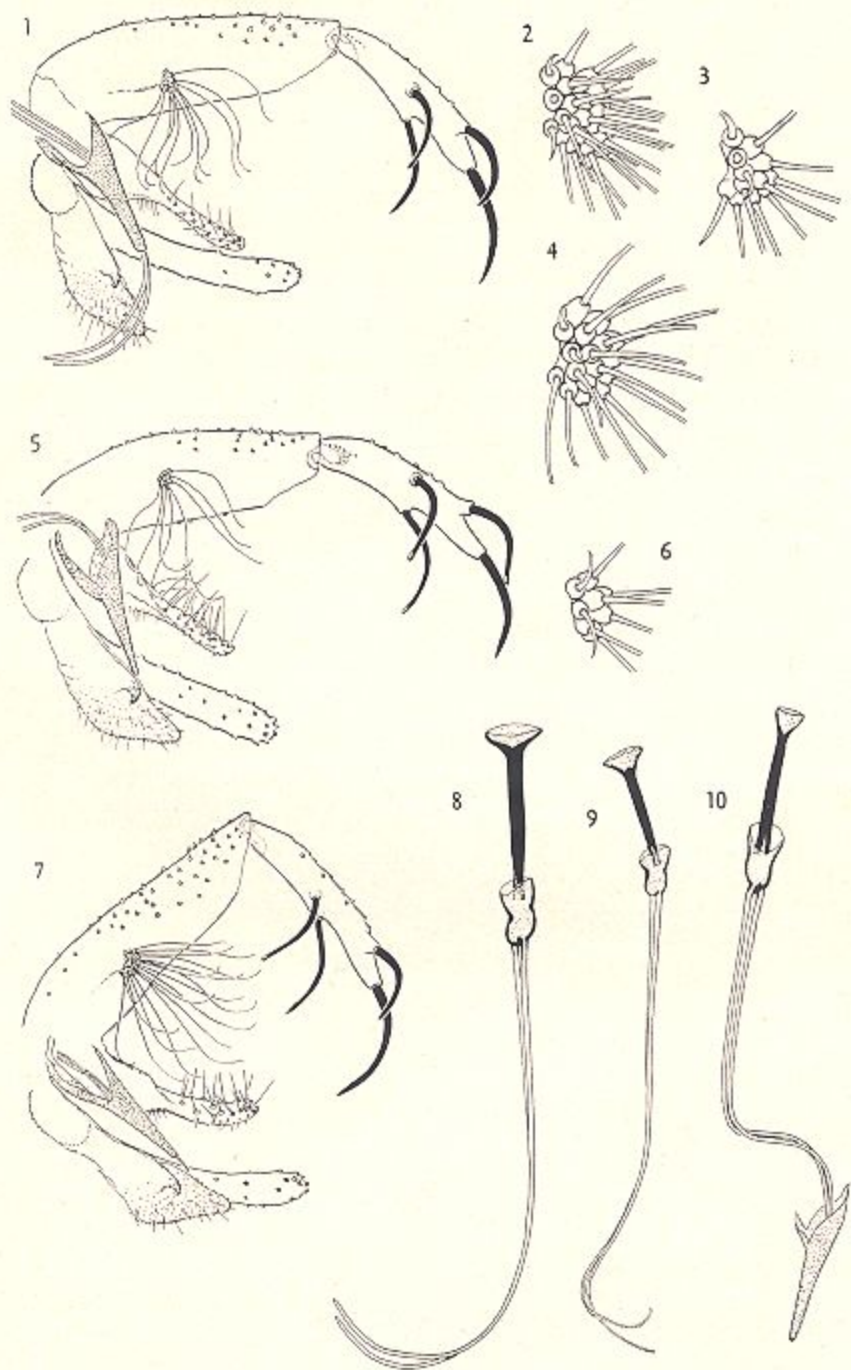
throughout, no regular cibarial teeth, but numerous minute denticles and a well-marked pigment patch. Pharynx slender, wrinkled at apex and with minute denticles. Genitalia as figured (fig. 1), the setae in the basal tuft varying from 13 to 20 except on one specimen from Guatemala which bears 25 and one from Costa Rica which has but 9 (figs. 2-4). Genital pump and filaments as figured (fig. 8), the filaments 2.7 times as long as pump. Anterior sternites as figured (fig. 21).

Female.—Wing length 2.01 to 2.16 mm. (Chiapas specimens), 1.77 to 2.05 mm. (Costa Rica and Panama specimens). The material from Mexico previously reported on by us (Chiapas, Tabasco and S. Luis Potosi) shows the same range of measurements as the Panama material. Coloration as in male. Postspiracular setae ligulate or scale-like, 21 to 33 in Chiapas specimens, 19 to 28 in Costa Rica and Panama specimens. Lower mesanepisternal setae narrowly ligulate, 6 to 12 in Chiapas specimens, 4 to 7 in Costa Rica and Panama specimens. Proboscis slightly greater than head height, the latter about two-thirds of head width. Basal antennal segments and palpi as in male, the end of third antennal segment reaching to about the middle of third palpal segment. Newstead's scales as in male, though at least in some specimens they are present also on apical third of second palpal segment. Ascoids as figured (fig. 10), with short posterior prolongations, considerably longer than in male, but not attaining ends of their respective segments; paired on all segments, or more usually, paired on all segments but the terminal one. Cibarium with a strong arch, a narrow pigment patch, four horizontal teeth and scattered small vertical teeth, as figured (fig. 13). Pharynx as in male, but stouter. Spermathecae as figured by us in 1948 (Pl. I, figs. 5, 6), the ducts opening separately into the vagina. Sides of eighth tergite without setae. Dorsum of ninth with simple setae, its anterior margin with a pair of anterior dorsolateral lobes, which are heavily sclerotized and thickly beset with conical papillae, each of which bears a minute seta. Wing clothed with hairs; a few ligulate striate scales at base.

The above description is based on an examination of the following slide mounted material, in addition to the types and the material previously listed by us: 1 ♂ 2 ♀, Sta. Maria, Cintalapa, Chiapas, Mexico, 11-12 April 1951, in tree buttresses, Fairchild and Hartmann coll.; 3 ♀, Palenque, Chiapas, Mexico 31 March 1951, one taken biting in the forest during the day, the other two at light in a Shannon trap; 1 ♂, Lagartos on highway on border between Puntarenas and Guanacaste, Costa Rica, 13 Dec. 1951, in buttress, R. Rosabal coll.; 1 ♂, 1 ♀, Turrialba, Costa Rica, 11 Feb. 1952 and 12 April 1951; 1 ♂, 1 ♀, Cruces Trail, C.Z. Forest Reserve, 5 July and 10 Aug. 1951, in buttress

EXPLANATION OF PLATE I

FIG. 1. *P. cruciatus*, male genitalia, Panama, $\times 152$. FIGS. 2-4. *P. cruciatus*, basal tufts on specimens from Guatemala, fig. 2; Panama, fig. 3, and Mexico, fig. 4, all $\times 520$. FIG. 5. *P. diabolicus*, male genitalia, paratype, $\times 152$. FIG. 6. *P. diabolicus*, basal tuft on coxite, paratype, $\times 520$. FIG. 7. *P. gomezi*, male genitalia, Panama, $\times 152$. FIGS. 8-10. Genital pumps and filaments of *P. cruciatus*, Panama, fig. 8; *P. gomezi*, Venezuela, fig. 9, and *P. diabolicus*, paratype, fig. 10, all $\times 152$.



and in Shannon trap at light; 1 ♀, Rio del Medio, Rio Gatun, Canal Zone, 13 Oct. 1949, in hollow tree; 15 ♂, 27 ♀, from near Almirante, Bocas del Toro province, Panama, various dates from April through August. We have also identified considerable additional material, over 100 specimens, from the Almirante area, but these have not been mounted.

Phlebotomus diabolicus Hall

Figs. 5, 6, 10, 12, 14, 15, 17, 22, 23, 26

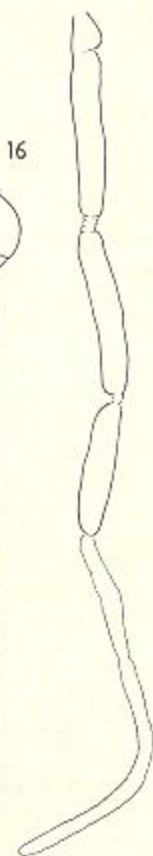
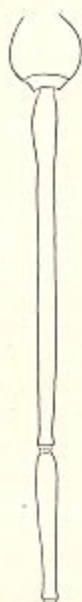
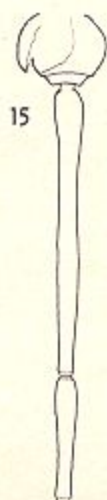
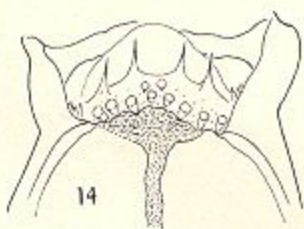
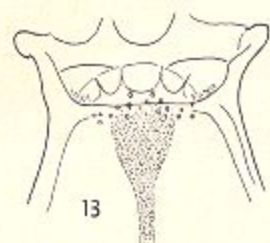
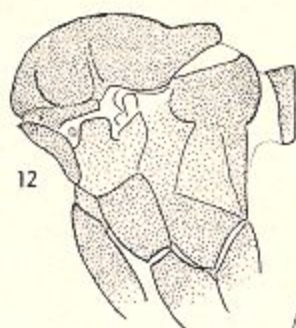
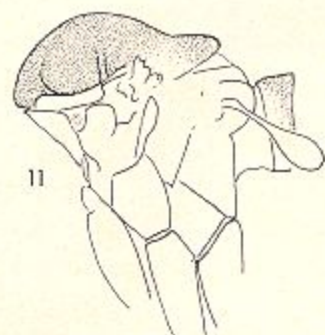
1936, Proc. Ent. Soc. Washington, 38 (2): 27-29, fig. 2 (♂, ♀; Uvalde, Texas). Lindquist, 1936, Proc. Ent. Soc. Washington, 38 (2): 29-32, figs. 1-2 (early stages; Del Rio, Sonora and Uvalde, Texas). Floch and Abonnenc, 1943, Inst. Pasteur Guyane, pub. 62, p. 6 (♂; in key only). Addis, 1943, J. Parasit., 31 (2): 125-127, Pl. 2 (♂, ♀; Uvalde, Texas); 1945, Trans. Amer. Microscop. Soc. 64 (4): 331, figs. 4, 8, 9 (♂, ♀; in keys). Packchianian, 1946, Texas Rep. Biol. Med., 4 (1): 38. Barretto, 1947, Arq. Zool. São Paulo, 5 (4): 197. Fairchild and Hertig, 1948, Ann. Ent. Soc. Amer., 41 (2): 250. Barretto, 1951, Arq. Hig. Saude Pub. 15 (46): 216. Vargas and Diaz Najera, 1952, Rev. Invest. Clin., Mexico, 4 (1): 50 (♂, Guerrero, Mexico).

Male.—Wing length 1.89 mm., venation as figured (Fig. 26). Mesonotum, scutellum, pleura and coxae all strongly infuscated (Fig. 12), as is the head, abdomen and genitalia. Abdominal setae apparently erect, not scale like. Post spiracular setae 17, lower mesanepisternal setae 3, rather broad and scale-like. Proboscis is a little less than head height, the latter a little over two-thirds head width. Palpi and basal antennal segments as figured (fig. 15). Newstead's scales on the proximal half of third and apical third of second palpal segments, slender, clubbed and fairly numerous. Ascoids very short and slender (fig. 17), paired on all but last three antennal segments, which are rather abruptly shorter than the preceding segments. Cibarium with a few minute denticles; chitinous arch well marked at sides but hardly perceptible centrally; pigment patch slender, T-shaped. Pharynx with minutely denticulate wrinkles or ridges at its posterior end. Genitalia as figured (figs. 5, 6), filaments a little more than twice as long as pump, the latter rather slender with cup-shaped plunger, as figured (fig. 10). Anterior sternites as figured (fig. 22).

Female.—Wing length 1.99 to 2.17 mm. Venation as in male. Color and vestiture as in male. Postspracular setae 12 to 16, lower mesanepisternal setae 4 to 8. Proboscis somewhat longer than head height, the latter about two-thirds of head width. Newstead's scales as in male, though present on nearly the full length of third palpal segment. Ascoids as figured (fig. 17), with very short posterior pro-

EXPLANATION OF PLATE II

FIG. 11. *P. gomezi* male, Panama, thorax, $\times 52$. FIG. 12. *P. diabolicus* male, paratype, thorax, $\times 52$. FIG. 13. *P. cruciatus*, female cibarium, Mexico, $\times 795$. FIG. 14. *P. diabolicus*, female cibarium, topotype, $\times 795$. FIG. 15. *P. diabolicus* male, basal antennal segments and palpi, paratype, $\times 152$. FIG. 16. *P. cruciatus* male, basal antennal segments and palpi, Panama, $\times 152$. FIGS. 17-19. Fourth antennal segments, female left, male right of *P. diabolicus*, Texas, fig. 17; *P. gomezi*, Panama, fig. 18, and *P. cruciatus*, male, Panama, female, Mexico, fig. 19, all $\times 350$.



17

18

19

longation, longer than in male, paired on all but the last antennal segment. Cibarium as figured (fig. 14). Pharynx as in male. Ninth tergite with dorsolateral lobes as in *cruciatu*s, but these are less heavily sclerotized and the papillae are smaller and less prominent. Setae of dorsum of ninth tergite simple; no setae on lateral aspect of eighth tergite. Spermathecae as figured (fig. 23).

Description drawn from the male paratype and four females from Uvalde, Texas previously mentioned.

Phlebotomus gomezi Nitzulescu

Figs. 7, 9, 11, 18, 20, 24

1931, Ann. Parasit. Hum. Comp. 9: 247-255, figs. 1-6, Pl. 4 (♀; San Cristobal, Venezuela). Fairchild and Hertig, 1948, Ann. Ent. Soc. Amer., 41 (2): 252-255, Pl. 1, figs. 1-3, Pl. 2, fig. 7 (♂, ♀; Panama, Costa Rica, Trinidad; full references). Floch and Abonnenc, 1950, Inst. Pasteur Guyane, pub. 212, pp. 3-5. Barretto, 1951, Arq. Hig. Saude Pub., São Paulo, 15 (46): 217.

Phlebotomus suis Rozeboom, 1940, Amer. J. Hygiene 32 (1), C: 8-11, figs. 1-5 (♂, ♀; Las Guacas, Panama).

Phlebotomus japiigny Floch and Abonnenc, 1944, Inst. Pasteur Guyane, pub. 83, pp. 2-5, figs. 2-3 (♂, ♀; near Cayenne, Fr. Guiana).

Phlebotomus trinidadensis Callan, 1947, Rev. Ent., 18 (1-2): 215-218 (Trinidad).

In 1948 we stated our belief that *P. japiigny* F. & A. was not separable from *P. gomezi* Nitz. Since then Floch and Abonnenc (1950) have reopened the question and pointed out certain characters by which they believe *japiigny* can be consistently separated from *gomezi*. This has made it necessary for us to go over our material again and check more carefully the points raised in their paper. These differences may be summarized as follows.

1. In the male, *japiigny* shows but 10 setae in the basal tuft of the coxite, constant in six specimens, while *gomezi* shows 14 to 18 in Venezuelan specimens.

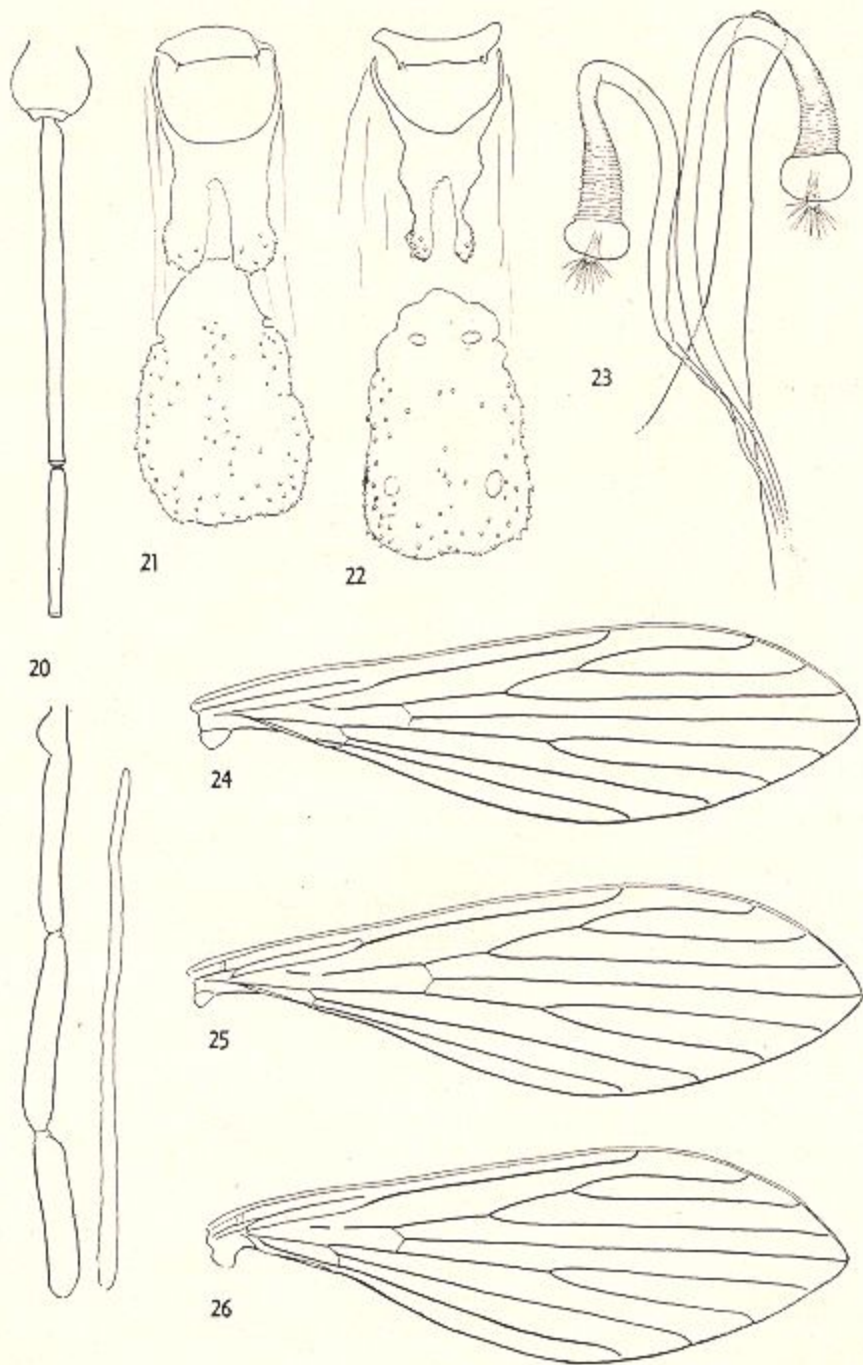
2. The length of the genital filaments relative to the genital pump in *japiigny* is 2.1, i.e., the filaments are 2.1 times as long as the pump. In *gomezi* from Venezuela the proportions vary from 3.2 to 3.4.

3. In the female the spermathecal ducts in *japiigny* measure 0.290 mm. while in *gomezi* they measure from 0.180 to 0.220.

We have counted the hairs in the basal tuft of 17 specimens, 8 from Panama, 6 from Venezuela, 2 from Costa Rica and 1 from Trinidad. The numbers range from 13 ± 2 to 19 ± 2. We found it quite difficult to count these setae on most specimens; in only four cases were the genitalia so oriented that a clear count could be made. In these cases the counts were 14, 14, 15 and 18 setae, so that disregarding several specimens on which uncertain counts of 13 setae were made, Floch and Abonnenc are correct in their statement regarding *gomezi*.

EXPLANATION OF PLATE III

FIG. 20. *P. gomezi* male, basal antennal segments and palpi, Venezuela, × 152. FIGS. 21-22. First three abdominal sternites of males of *P. cruciatu*s, Panama, fig. 21 and *P. diabolicu*s, paratype, fig. 22, × 152. FIG. 23. *P. diabolicu*s, spermathecae, drawn from specimen mounted in copal-balsam, topotype, × 585. FIGS. 24-26. Wings of males of *P. gomezi*, Panama, fig. 24; *P. cruciatu*s, Mexico, fig. 25, and *P. diabolicu*s, paratype, fig. 26, all × 43.



The ratios genital pump/genital filaments of one specimen from Trinidad, seven from Venezuela and six from Panama range from 3.0 to 3.8, the Trinidad specimen being 3.1, Venezuelan specimens 3.0-3.8, and Panama specimens 3.0-3.5. This again agrees fairly well with Barretto's (1946) figures for eight Venezuelan males quoted by Floch and Abonnenc, 3.2 to 3.4. It is to be noted, however, that though Floch and Abonnenc give 2.1 as the ratio for *japignyi*, their figure (1944) when measured gives a ratio of 2.65.

Measurements of the spermathecal ducts of 7 Panama specimens of *gomezi* give lengths ranging from 0.1715 mm. to 0.2640 mm.; single specimens from Venezuela and Trinidad a length of 0.2574 mm. This is a greater range and greater maximum length than given by Floch and Abonnenc, though still showing somewhat shorter ducts than indicated for *japignyi*, 0.290 mm. Our measurements were taken from specimens mounted in balsam. Two fresh Panama specimens were measured in water after treatment with KOH and gave measurements of 0.2244 mm. and 0.2409 mm.

These differences seem to us too slight a basis on which to maintain the species, especially since no specimens of *gomezi* appear to have been taken in French Guiana, though the species occurs in Venezuela and Trinidad, some 700 miles to the west, and has been reported from Belem at the mouth of the Amazon about 500 miles to the southeast. It is our opinion that *japignyi* is at most a race of *gomezi*, and it might be well to retain the name in this sense until series of both sexes from a wider range of localities can be studied.

Male.—Wing length 1.65 mm. to 2.00 mm., measurements based on seven specimens from Panama, four from Venezuela and two from Costa Rica. Mesonotum and scutellum heavily infuscated but pleura and coxae entirely without pigment (Fig. 11). Postspiracular setae 4 to 13, lower mesanepisternal setae 6 to 13, the counts based on the same specimens yielding the wing measurements. Head slightly infuscated, the proboscis just equalling head height, the head a little more than two-thirds as high as wide. Basal antennal segments and palpi as figured (fig. 20), end of third antennal segment reaching to middle of third palpal segment when attached to head. Newstead's scales slender, clubbed, scattered over the distal third of second palpal segment and most of third segment. Ascoids simple, short, as figured (fig. 18), paired on all but the last three antennal segments, which are rather abruptly shorter than those preceding. Cibarium with a distinct though poorly sclerotized chitinous arch; the cibarial armature represented by several rows of minute denticles; the pigment patch weak and slender. Pharynx with numerous transverse minutely denticulate ridges. Genitalia as figured (fig. 7), the basal tuft of the coxite bearing from about 13 to about 19 setae. Genital filaments from 3.0 to 3.8 times as long as pump, as figured (fig. 9). Anterior sternites as figured previously by us (1950).

Female.—Wing length 1.70 mm. to 2.20 mm., based on nine specimens from Panama, Venezuela and Costa Rica. Coloration as in male. Post spiracular setae 6 to 16, lower mesanepisternal setae 7 to 12, based on same specimens. Proboscis exceeding head height by nearly one-third its length; head height about two-thirds head width. Basal

antennal segments and palpi as in male, end of third antennal segment not reaching end of second palpal segment when both undetached. Newstead's scales as in male. Ascoids as figured (fig. 18), with a short posterior prolongation and much longer than in male, paired on all but the last antennal segment, which is longer than the penultimate segment. The slender hollow spine shown near the apex of the segment in both sexes of *gomezi* is usually visible in this species and there are sometimes two on opposite sides of the segment. They are occasionally visible on *cruciatius* but have not been seen definitely in the few specimens of *diabolicus* examined. They seem to be of the same structure as the numerous non-deciduous setae borne on the terminal segments of the antennae in most species of *Phlebotomus*. Cibarium as figured by us (1948), sometimes with the chitinous arch more pointed. Pharynx as in male, but broader. Spermathecae as figured by us in 1948, often showing fine pseudoannulations and joining in a short common duct before the vagina. Sides of eighth tergite with from one to five setae, usually two or three. Ninth tergite without dorsolateral papillate sclerotized lobes, the setae mostly simple, but with a few narrowly ligulate scale-like setae. Wing venation as in male, the wing clothed with simple setae except for a few square-ended striate scales at base.

The above description is drawn from slide mounted material from numerous localities in Panama, and from Caripito, San Cristobal and Cabimas, Venezuela; St. Augustine, Trinidad; Rio Seco, Paquera, Sta. Cruz and Puerto Jimenez, Costa Rica. We have also examined cleared but unmounted material from a number of other localities in Costa Rica and from Quevedo, Ecuador, as well as several hundred specimens from additional localities in Panama.

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