

NOTES ON TABANIDAE (DIPT.) FROM PANAMA

X.¹ THE GENUS *TABANUS* LINN., AND RESUME OF THE TABANIDAE OF PANAMA²

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Genus *Tabanus* Linnaeus

1758, Syst. Nat., 10th ed., p. 601. Latreille, 1810, Consider. General, p. 443 (Type, *T. bovinus* Linn.). Kertész, 1908, Cat. Dipt., III, p. 217. Sarcoof, 1921, Gen. Insect., Fasc. 175, Taban., p. 54. Enderlein, 1922, Mitt. Mus. Berlin, X, 2, p. 347; Op. cit., 1925, XI, 2, p. 355. Bequaert, 1930, The African Republic of Liberia and the Belgian Congo, II, p. 903. Kröber, 1934, Rev. Ent., IV, 3, p. 292.

There seems no good reason for including the many references to the name to be found in the literature, nor do I feel it wise to list the numerous names which have been placed in the synonymy of *Tabanus* by various authors. Names in this group are being removed from and replaced in the synonymy so often that it seems better not to further complicate matters.

A single species, *T. globulicallosus* Kröber (Stett. Ent. Zeit., XCII, p. 302) has been omitted, as, although described from Panama, I have been unable to recognize it from the description.

KEY TO SUBGENERA OF TABANUS

1. Pre-scutellum and disc of scutellum densely covered with black pubescence which is more or less completely surrounded by a ring of white pubescence. Eyes bare. Vertexal tubercle weakly developed or absent in the female, present in the male. **Bellardia**
No black pile on scutellum, rarely a small tuft on pre-scutellum. 2
2. Wings prominently clouded with brown, rarely largely black, generally with the cross-veins surrounded by hyaline fenestrae. Frons mostly very narrow, the callus ridge like. Eyes bare, unbanded in life, **Philipotabanus**
Wings fumose, hyaline, entirely black or spotted on the cross veins, or frons otherwise. 3
3. Abdomen with 1 or 3 pale longitudinal stripes or rows of truncate contiguous triangles. Fore tibiae bicolored. Eyes bare in the female, bare or hairy in the male, green with 2 or 3 dark bands in life. Wings hyaline, fumose or with faint clouds on cross veins. **Neotabanus**
Abdomen unstriped, or eye with but one band in life. 4
4. Eyes definitely pilose in both sexes, generally dark with 2 or more green bands in life. Vertexal tubercle present, usually prominent. **Hybomitra**
Eyes bare in the female, or vertexal tubercle absent. **Tabanus**

¹Part IX these Annals, September, 1942, p. 289.

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KEY TO FEMALES OF TABANUS

1. Wholly black species with deep black wings. Third antennal segment with a rather long tooth dorsally and a prominent angle below. Large species 20 mm. or more long. **erebus**
Not black species, the wings hyaline or fumose. 2
2. Prescutellum with a small tuft of black pubescence. Large brown species mostly over 15 mm. long, the antennae with a strong dorsal tooth, the abdomen with 2 or 3 rows of light spots. 3
Prescutellum concolorous with rest of thorax. 4
3. Palpi exceedingly short and thick. Abdomen brown, dark haired, but with a pair of pale haired dorsolateral stripes formed of large confluent rounded spots extending from the first to sixth tergites. **importunus**
Palpi stout, but the apex drawn out into a slender point. Abdomen with a median series of pale haired triangles as well as the dorsolateral series, the latter of smaller, less confluent spots. **ferifer**
4. Frons very narrow, callus ridge like, third antennal segment with a strong dorsal tooth. Legs black, abdomen orange rufous, the terminal segments often black. Wings strongly smoky. Large species, generally over 15 mm. **bigoti**
Smaller more slender species, seldom reaching 15 mm. Legs not wholly black. Frons broader, the callus at most club shaped. 5
5. Wings, including the costal cell, entirely hyaline. Frons quite broad, the callus as wide as high. 6
Wings fumose, or the veins brown margined, or the costal cell yellowish or brownish. Frons narrower, the callus generally higher than wide. 7
6. Annulate portion of third antennal segment longer than basal portion. Frontal callus yellow, rounded, rather flat. Thorax grey, rather prominently striped. Abdomen dark with a row of pale grey median triangles and a pair of dorsolateral rows of oblique grey patches. **praepilatus**
Annulate portion of third antennal segment shorter than basal part. Frontal callus black, rather protuberant. Thorax unstriped. Abdomen yellow, with three rows of faint pale haired spots. **rhizophorae**
7. Antennae exceedingly slender, the third joint wholly black, with the short dorsal tooth very close to the base. Slender, long winged species, the wings evenly fumose, the abdomen brown, with a median row of non-contiguous pale haired triangles. **umbraticolus**
Smaller, stouter species, the wings with all veins narrowly brown margined, the antennae with third joint largely or wholly yellow, stouter, and the abdomen not so marked. 8
8. Abdomen yellow, dark haired, and with a prominent broad median yellow haired stripe from base to apex, rarely with indications of faint lateral stripes. **rixator**
Abdomen dirty brownish yellow, with three very faint narrow pale haired stripes. **nerus**

***Tabanus bigoti* Bellardi**

(Figs. 4 and 5)

1859, Sagg. Ditt. Mess., I, pp. 58-59 (New name for *T. apicalis* Macq. 1847, nec. Wied. 1828. Description drawn from Macquart's type specimen, which was headless). Osten Sacken, 1886, Biol. Centr.-Amer., Dipt., I, p. 48 (♀; Nicaragua). Hine, 1925, Occ. Pap. Mus. Zool. Univ. Michigan, No. 162, p. 29 (♀; Honduras).

Tabanus apicalis Macquart, 1847, Mém. Soc. Sci. Lille, (1846), p. 36; 1847, Dipt. Exot., Suppl. II, p. 20 (♀; du Mexique). Not *T. apicalis* Wied. 1828.

Tabanus appretialis Kröber, 1934, Rev. Ent., IV, 3, p. 306 (New name for *T. apicalis* Macq. 1847).

Under this name I include provisionally the species occurring in Panama. There seem to be two very similar forms, but their proper relationships cannot be worked out until much more

material from both South and Central America is available. The two forms may be separated as follows:

- Antennae largely reddish. Pollinosity of face and frons, and beard yellowish brown. Frontal callus brown. Upper branch of third vein with a long appendix..... form A
 Antennae largely black. Pollinosity of face and frons, and beard greyish or white. Frontal callus black. Upper branch of third vein without an appendix..... form B

Which, if either, of these forms is true *bigoti* it is impossible to say. I have seen specimens very similar to both forms from Honduras and Mexico.

Panama records: Form A. El Valle, Coclé Province, April 13, 1941; May 3, 1942; Cerro Campana, Panama Prov., June 11, 1939; Rio Pequeni, Madden Lake, C. Z., Aug. 21, 1940; Cerro Pirre, Darien Prov., March 18, 1940; Buena Vista, Chiriqui Mt., March, 1926 (J. D. Smith). Form B. Cerro Azul, Panama Prov., May 17, 1941.

Tabanus erebus Osten Sacken

(Fig. 1)

- 1886, Biol. Centr.-Amer., Dipt., I, p. 50 (♀; Nicaragua and Chiriqui Volcano, Panama). Kertész, 1900, Cat. Taban., p. 48. Williston, 1901, Biol. Centr.-Amer., Dipt., Suppl. p. 257. Aldrich, 1905, Cat. N. Amer. Dipt., p. 203. Kertész, 1908, Cat. Dipt., III, p. 240. Surcouf, 1921, Gen. Insect., Taban., p. 67. Kröber, 1930, Zool. Anz., LXXXVI, p. 298 (= ? *Catachlorops* sp.); 1934, Rev. Ent., IV, 3, p. 304 (= ? *Phaeotabanus alteripennis* Wlk.).
Astigmatophthalmus satanus Kröber, 1931, Rev. Ent., I, 3, p. 297, fig. 11 (♀; Turrialba, Costa Rica and Chiriqui, Panama); 1934, Op. cit., IV, 2, p. 270. Stone, 1938, U. S. Dept. Agric., Misc. Publ. No. 305, p. 88.

This species is one of the largest in our fauna, and is readily recognized by its wholly black color, including the wings. It seems to be related to the North American *T. atratus* Fab., to which Osten Sacken compared it, and might with some justice be combined with that and related species into a group of sub-generic rank, were it not for a number of species which form perfect intergrades with a large and rather heterogeneous complex of South American forms which are as yet poorly known.

The antennal tooth is very variable in length, and may even reach the first terminal annulus.

Distribution: Recorded from Nicaragua, Costa Rica and Panama. I have seen 6 ♀ from Costa Rica in the Hine Coll.

Panama records: 1 ♀ Barro Colorado Is., May 10, 1926 (Greene); 1 ♀ Cabima, Panama, May 20, 1911 (Busck). 5 ♀ Rio Pequeni, May 11, 1940. 1 ♀ El Valle, Coclé Prov., April 13, 1941. 1 ♀ Cerro Azul, nr. Pacora, May 17, 1941. 2 ♀ El Valle, Coclé Prov., May 3, 1942.

***Tabanus ferrifer* Walker**

(Fig. 3)

1850, *Insect. Saund.*, I, Dipt., p. 30 (♀; ? Barbadoes); 1854, *List Dipt. Brit. Mus.*, V, Suppl. 1, p. 189. Osten Sacken, 1858, *Cat. Dipt. N. Amer.*, p. 21; 1876, *Mem. Boston Soc. Nat. Hist.*, II, pt. 4 (4), p. 476; 1878, *Cat. Dipt. N. Amer.*, 2nd ed., p. 61. Kertész, 1900, *Cat. Taban.*, p. 49. Aldrich, 1905, *Cat. N. Amer. Dipt.*, p. 203. Kertész, 1908, *Cat. Dipt.*, III, p. 241. Surcouf, 1921, *Gen. Insect.*, *Taban.*, p. 68. Dunn, 1929, *Am. J. Trop. Med.*, IX, 6, p. 501 (Baranquilla, Colombia).

Tabanus (Lophotabanus) ferrifer Kröber, 1930, *Zool. Anz.*, LXXXVI, pp. 262-263, fig. 7 (♀; Venezuela); 1934, *Rev. Ent.*, IV, 3, p. 295 (Barbadoes, Panama, Colombia, Venezuela). Bequaert, 1940, *Rev. Ent.*, XI, 1-2, pp. 298-299, fig. 3; 1940, *Bull. Ent. Res.*, XXX, 4, p. 449 (Trinidad).

Tabanus (Lophotabanus) druyvesteijni Szilády, 1926, *Biol. Hung.*, I, (7) p. 26, Pl. 4, fig. 20 (♂, ♀; Trinidad, Surinam, Panama). Kröber, 1929, *Zool. Anz.*, LXXXIII, pp. 130-131, fig. 10 (Venezuela, Panama, Trinidad, Surinam, Bolivia, Paraguay, Argentina); 1930, *Op. cit.*, LXXXVI, p. 263; 1934, *Rev. Ent.*, IV, 3, p. 295.

Hybstraba ornativentris Kröber, 1929, *Konowia*, VIII, p. 182, Pl. II, figs. 10, 11. (as synonym of *T. (L.) druyvesteijni*).

This species and *T. importunus* Wied. appear to be related on the one hand to the subgenus *Bellardia* (*Lophotabanus* Szil.) and on the other hand to a large group of South American species whose relationships are as yet not worked out. *Ferrifer* is fairly abundant in Panama where it flies mainly during the dry season, and on account of its large size constitutes a serious stock pest.

Distribution: I have seen material from British Honduras, Panama, Trinidad, Venezuela and Pará, Brazil. The species is also recorded from Bolivia, Paraguay and Argentina, but all material from that area I have seen personally is a distinct though closely allied species.

Panama records: El Real, Darien Prov., to Capira, Panama Prov., mostly in April, May and June, but scattered captures in Nov., Dec., Jan., Feb., July and August. Apparently quite abundant nearly everywhere.

***Tabanus importunus* Wiedemann**

(Fig. 2)

1828, *Auss. Zweifl. Insekt.*, I, p. 127 (♀; Brasil). Walker, 1854, *List Dipt. Brit. Mus.*, V, p. 219. Kertész, 1900, *Cat. Taban.*, p. 54. Lutz, 1912, *Comm. Lin. Teleg. Matto Grosso, Zool.*, Anexo, 5, p. 4; 1909, *Inst. Osw. Cruz em Mangueiros*, p. 30. Surcouf, 1921, *Gen. Insect.*, *Taban.*, p. 71. Kröber, 1929, *Ann. Mus. Wien*, XLIII, p. 246; 1934, *Rev. Ent.*, IV, 3, p. 310. Lutz, 1914, *Mem. Inst. Osw. Cruz*, VI, 2, p. 70. Fischer, 1933, *Rev. Ent.*, III, 1, p. 134.

Odontotabanus importunus Lutz, 1928, *Est. Zool. Parasit. Venezolanas*, p. 57. (Venezuela).

Tabanus albidicollis Macquart, 1850, *Dipt. Exot.*, Suppl. IV, p. 32 (Guyana).

Tabanus semisordidus Walker, 1854, *List Dipt. Brit. Mus.*, V, p. 208 (♀; Santarem, Brasil).

This species appears to be fairly abundant locally in the

Republic, though its season of flight, from March to May is rather short.

Distribution: I have seen specimens from the Brazilian states of Amazonas, Pará, Rio de Janeiro and Matto Grosso, and from Paraguay, Venezuela, Surinam and British Guiana. Kröber records it also from Peru.

Panama records: Moja Pollo, Chagres River region, March to May 1940, fairly abundant. 1 ♀ Moja Pollo, Sept. 1, 1940.

***Tabanus praepilatus* sp. nov.**

(Fig. 11)

Female.—Length 11–16 mm., of wing, 11–14 mm.

Eyes bare, dull greenish with a single transverse narrow dark stripe which does not reach the lateral eye margin. Frons broad, about $3\frac{1}{4}$ times as high as wide, convergent below, pale yellowish grey pollinose. Frontal callus nearly circular, narrower than frons, yellow to dark brown. Median callus a short unconnected streak, sometimes obsolete. No vertexal tubercle or spot. Subcallus yellowish pollinose, without tubercle or spot, and without erect hairs. Fronto-clypeus and genae greyish pollinose, the latter sparsely white bearded beneath. First two antennal segments straw colored, black haired, not inflated. Basal part of third segment dull brownish, nearly as wide as long, the dorsal angle rather obtuse but with a rather sharp apex. Annulate portion blackish, considerably longer than basal portion. Palpi whitish, dorsally black haired, moderately inflated basally, but slender and pointed apically. Proboscis brown, the labella membranous, short, hardly half length of proboscis.

Mesonotum pale brown with three fairly distinct stripes and the sides grey haired. Scutellum concolorous, grey haired. Pleura and coxae pale grey, white haired. Legs pale brown, whitish pollinose and pale haired, tarsi darker. Wings entirely hyaline; subepaulet with macrotrichia, costa and first vein throughout and subcosta in the middle above with macrotrichia, and often a few hairs on the base of the second vein. Beneath only the costa and subcosta are setose. No appendix on upper branch of third vein. Abdomen greyish brown, black haired, and with a row of rather broad contiguous grey mid-dorsal truncate triangles, a dorso-lateral row of contiguous oblique grey patches, and the sides and hind margins of the segments grey. Beneath the venter is uniformly pale grey pollinose and whitish haired.

Holotype ♀ and 1 ♀ Paratype from Bejuco, Panama Province, Panama, April 21, 1940. 1 ♀ Paratype, same locality, June 18, 1939. 4 ♀ Paratypes Aguadulce, Coclé Province, Panama, August 10, 1940 (C. M. Johnson coll.); 1 ♀ Corozal, C. Z., June 29, 1911 (A. Busck, in U. S. N. M.). Holotype and 2 Paratypes to be deposited in the M. C. Z., Harvard University, Cambridge, Mass. Other Paratypes in author's coll. and U. S. N. M.

This species appears to have no very close relatives in Panama, but approaches in general appearance certain Nearctic species such as *abactor* Philip and *erythraeus* Big., from which it differs in broader frons, and details of antennal shape and color pattern.

***Tabanus nereus* sp. nov.**

(Fig. 9)

Female.—Length 9–11 mm., of wing, 9.5–10.5 mm.

Eyes bare, in life green with a narrow transverse median band and the lower margin purple. Frons moderately broad, about $3\frac{1}{2}$ times as high as wide, very slightly narrowed below, and covered with yellowish brown pollen. Frontal callus rounded to pear shaped, higher than wide, a little more than half as wide as frons, dull yellow. Median callus a short streak unconnected with the basal callus. Vertexal tubercle entirely absent. Subcallus greyish brown pollinose, without hairs. Fronto-clypeus and genae grey, sparsely white haired. First and second antennal segments moderately inflated, pale brownish, black haired. Basal part of third segment reddish, longer than broad and longer than the concolorous annulate portion; dorsal angle well marked but obtuse. Palpi white, somewhat inflated basally, the apical two thirds very slender, blunt pointed and almost spatulate or clubbed, hairs mostly black and rather long. Proboscis brownish, the membranous labella more than half the length of the proboscis.

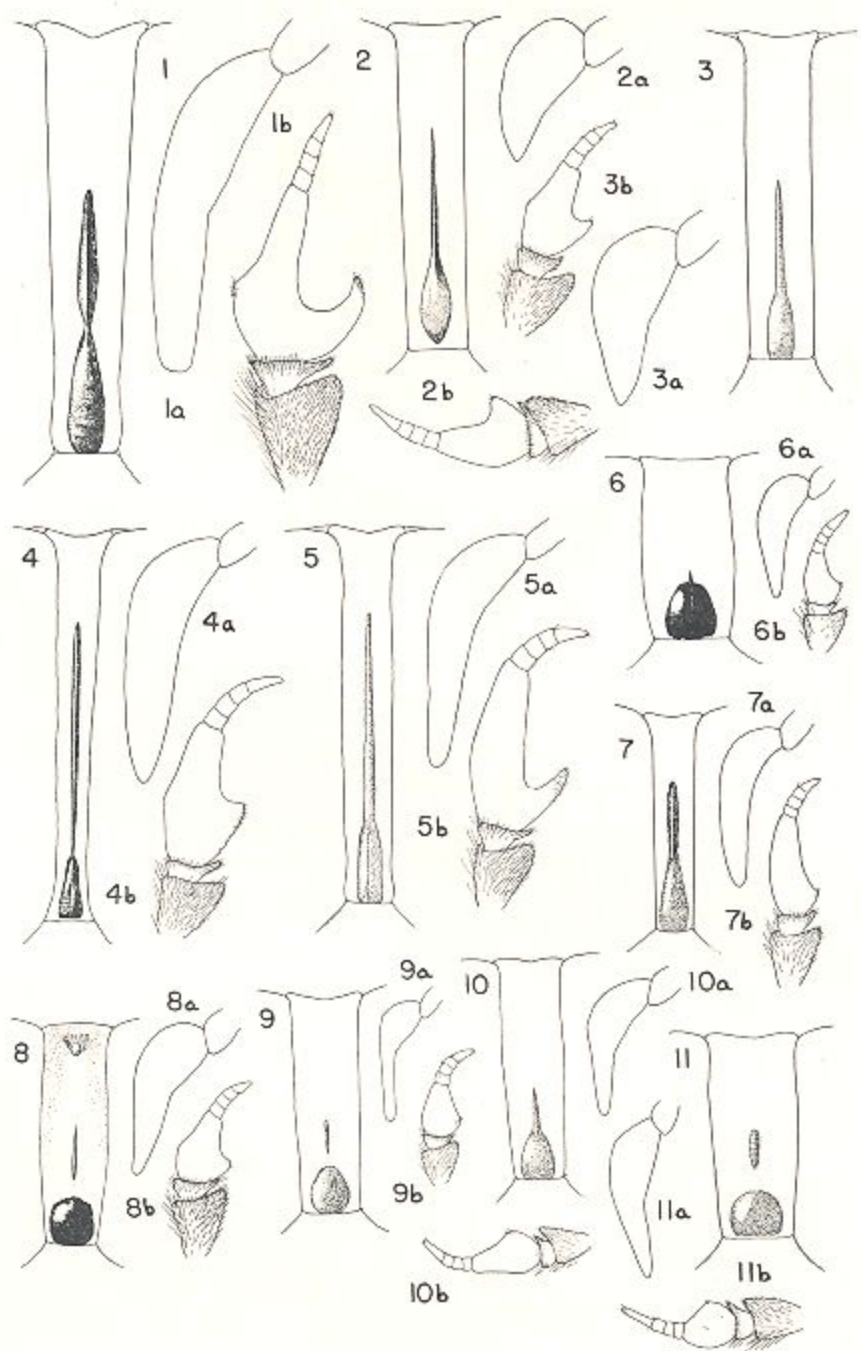
Mesonotum dull yellowish brown with a sparse vestiture of yellowish hairs but no distinct stripes. Scutellum concolorous. Pleura, sternum and coxae greyish pollinose and sparsely white haired. Legs pale brown or yellowish, the tarsi dusky. Femora pale haired, tibiae and tarsi dark haired. Wings with subepaulet, costa, subcosta and basal section of fifth vein with macrotrichia above, only costa and subcosta hairy beneath. Wings lightly fumose, all veins narrowly dark margined. No appendix on upper branch of third vein. Abdomen dirty yellowish brown, dark haired, and with three very faint stripes of paler hairs on the first to fifth tergites. Venter pale pinkish grey, immaculate.

Holotype ♀, Thatcher Ferry, Balboa, C. Z., June 27, 1939. 2 ♀ Paratypes, Old Panama, Jan. 2, 1941. This little species, although rather inconspicuous, can be quickly separated from

EXPLANATION OF FIGURES IN PLATE I

All figures are of the frons, antennae and palpi of female specimens, and are all to the same scale. The figures of wings are drawn from specimens mounted in balsam, and are to a somewhat smaller scale than the other figures.

Figs. 1, 1a, 1b—*Tabanus erebus* O. S. 2, 2a, 2b—*T. importunus* Wied. 3, 3a, 3b—*T. ferrifer* Walk. 4, 4a, 4b—*T. bigoti* Bell. form B. 5, 5a, 5b—*T. bigoti* Bell. form A. 6, 6a, 6b—*T. rhizophorae* n. sp. Paratype. 7, 7a, 7b—*T. umbraticolus* n. sp. Paratype. 8, 8a, 8b—*T. (Hybomitra) quadripunctatus* Macq. 9, 9a, 9b—*T. nereus* n. sp. Paratype. 10, 10a, 10b—*T. rixator* n. sp. Paratype. 11, 11a, 11b—*T. praepilatus* n. sp. Paratype.



its allies by the unusual palpi. It appears to be related to *rhizophorae* and *rixator* and perhaps to the nearctic group of *nigrovittatus*.

***Tabanus rixator* sp. nov.**

(Fig. 10)

Female.—Length 11–12 mm., of wing, 9.5–10 mm.

Eyes bare, in life uniformly yellowish green, without dark markings. Frons yellowish grey pollinose, about $4\frac{1}{4}$ times as high as basal width, slightly narrowed below. Frontal callus yellow, higher than wide, pear shaped, narrower than frons, and prolonged above in a slender line about its own length. Vertexal tubercle absent. Subcallus yellowish grey pollinose, without hairs. Fronto-clypeus and genae greyish, dark haired above, white haired below. First two antennal segments very moderately inflated, yellowish, black haired. Basal part of third segment reddish orange, longer than wide, the dorsal angle rather prominent and marked by a tuft of black hairs. Annulate portion concolorous, considerably shorter than basal portion. Palpi whitish, inflated basally, but with a slender apex, mostly black haired. Proboscis pale brown, a little longer than palpi, the labella membranes, over $\frac{2}{3}$ length of proboscis.

Mesonotum dark grey, yellowish grey pollinose, unstriped. Scutellum concolorous or slightly paler. Pleura, sternum and coxae pale grey pollinose and white haired. Legs wholly pale brown, the femora pale haired, the tibiae and tarsi dark haired. Subepaulet, costa, subcosta and first and fifth veins above with macrotrichia; all veins prominently brown margined. No appendix on upper branch of third vein. Abdomen light yellowish brown, darker towards apex, dark haired and with a fairly broad (.75 mm.) dull yellow middorsal stripe from first to sixth tergites. In well preserved specimens there is also a pair of faint pale dorsolateral stripes formed of a row of small unconnected rounded spots. Venter pale brown, mostly pale haired.

Holotype ♀ and 1 ♀ Paratype, Paitilla Point, Panama, Republic of Panama, July 7, 1940; 1 ♀ Paratype, Venado Beach, Canal Zone, June 22, 1939; 1 ♀ Paratype, Tapia, Panama Prov., Panama, May 5, 1941; 5 ♀ Paratypes, El Real, Darien Prov., Panama, August 15, 1930 (L. H. Dunn); 1 ♀ Paratype, Rio Abajo, Panama Prov., Panama, 1930 (L. H. Dunn).

The relationships of this little species appear to be with the *nigrovittatus* group of North America, it being especially close to *T. fuscicostatus* of Hine, from which the clear costal cell but brown margined veins will distinguish it. It also might be confused with small specimens of *T. haemogogus* Will., but the yellow uniform stripe and unbanded eyes should serve to distinguish the present species.

***Tabanus rhizophorae* sp. nov.**

(Fig. 6)

Female.—Length 11–12 mm., of wing, 9–10 mm.

Eyes bare, unicolorous, blackish with green reflections in life. Frons pale greyish pollinose with scattered dark hairs, about $2\frac{1}{2}$ times as high as the basal width, very slightly wider in the middle than at the base and vertex. Basal callus somewhat higher than wide, about $\frac{1}{2}$ the width of the frons, its lower margin contiguous with the basal suture of the frons, and the upper third narrowed into a fine point that may be drawn out into a short fine line, but which never extends more than half way to the vertex. No vertexal tubercle or bare patch. Subcallus whitish pollinose, without hairs. Antennae pale yellowish, the third segment more orange with the annulate portion dusky. First segment markedly swollen, its apex noticeably wider than the basal part of the third segment. Second segment with a dorsal spine, both segments clothed above with black hairs which are especially dense on the dorsal and distal parts. Third segment relatively narrow and with but a weak and obtuse dorsal angle; the annulate portion somewhat shorter than the basal portion. Clypeus and genae straw colored with white pollen and sparse white hairs. Palpi pure white, markedly inflated basally, but with the apical third abruptly narrowed and drawn out into a slender point. Palpi clothed with rather sparse hairs, black and white mixed in about equal proportions. Proboscis short, longer than the palpi but about equal to the antennae, pale brown, the labella fleshy, without shiny plates, and equalling over $\frac{2}{3}$ the total length of the proboscis.

Mesonotum dark grey with whitish pollinosity and short, sparse dark hairs. Sides and venter of thorax yellowish grey with abundant white hairs. Scutellum concolorous with mesonotum, or somewhat reddish distally. Wings completely hyaline, the veins and stigma yellowish. Subepaulet rather inflated and beset with black macrotrichia. The costa, subcosta, and first longitudinal vein beyond the arculus above also bear black macrotrichia. All cells but the anal open. No appendix on third vein. All legs entirely straw yellow, the femora with mostly white hairs, the tibiae and tarsi with black.

Abdomen dirty yellowish grey, without prominent markings. The first two segments are more yellowish, the third to last rather dusky with lighter hind margins. In the best preserved specimen the abdomen is clothed with sparse hairs which are for the most part black, but with very small and indistinct patches of pale hairs indicating a median series of spots and a pair of dorsolateral lines. In all the other specimens, these hairs have been rubbed off so that this faint indication of a pattern has been lost. Beneath the abdomen is as above, but with uniformly pale hairs.

Male.—Coloration as in the female, except that the mesonotum has a slight yellowish tinge, and the abdomen shows three fairly distinct longitudinal stripes of yellow hairs. Eyes contiguous, bare, the large facets occupying somewhat more than $\frac{1}{2}$ the total eye area, not sharply differentiated from the small facets, and the largest facets not more than twice the diameter of the smallest. The tubercle at vertex between the eyes is deeply sunk and barely visible.

Holotype ♀, Allotype ♂ and 5 ♀ Paratypes collected by sweeping saltmarsh grass in a small patch of Mangrove trees on the tide flats between Old Panama and San Francisco de la Caleta, Republic of Panama, May 1, 1939. 1 ♀ Paratype, Paitilla Point, Panama, R. de P., Feb. 1, 1929 (C. H. Curran collector); 2 ♀ Paratypes, Paitilla Point near Panama City, July 7, 1940; 2 ♀ Paratypes, Old Panama, April 20, 1940, Jan. 1, 1941; 1 ♂ Paratype, Old Panama, Dec. 24, 1939. Holotype, Allotype and 2 Paratypes to be deposited in the M. C. Z., Harvard University, Cambridge, Mass. 1 Paratype in the U. S. National Museum, 1 Paratype in the American Museum of Natural History and the other Paratypes in the author's collection.

This and two other species described herein seem to form a group of species which appears to be most nearly related to *T. nigrovittatus* and allies of the Nearctic region. Like their Nearctic relatives, they are frequenters of coastal salt marshes.

***Tabanus umbraticolus* sp. nov.**

(Fig. 7)

Female.—Length 13–16 mm., of wing, 13–14 mm.

Eyes bare, dull bronzy in life, without bands. Frons yellowish grey, a little more than $5\frac{1}{2}$ times as high as wide. Frontal callus yellowish brown, drop shaped, merging imperceptibly into a raised ridge which extends about $\frac{2}{3}$ the distance to the vertex. Vertexal tubercle absent. Subcallus yellowish grey pollinose, without hairs. Frontoclypeus and genae pale grey, sparsely pale haired. First antennal segment pale yellowish brown, black haired, rather inflated, wider than the base of the third segment. Basal part of third segment over twice as long as greatest breadth, the dorsal angle acute but short, and very close to base. Annulate portion hardly half length of basal portion. Whole third segment, except extreme base, black. Palpi pale brown, slender, black haired. Proboscis dark brown, less than head height, the membranous labella more than half its length.

Mesonotum light brown, very faintly striped. Pleura, sternum and coxae grey pollinose and white haired. Legs pale brown, the fore femora, apices of tibiae and tarsi a little darker. Wings rather long and narrow, pale smoky brown. Subepaulet, costa and first vein with macrotrichia above, subcosta with a few macrotrichia in the middle. No appendix on third vein. Abdomen orange brown, darker apically, dark haired and with a median row of broad pale yellowish haired triangles on the first to sixth tergites. These triangles do not appear to be contiguous, and apparently are easily lost, as they are fully apparent only in a few of my specimens. Beneath the abdomen is reddish yellow, pale haired and greyish pollinose.

Holotype ♀ and 6 ♀ Paratypes, Boquete, Chiriqui Province,

Panama, May 7-10, 1939. 2 ♀ Paratypes, Boquete, March-April, 1941 (Mrs. T. B. Monniche).

This species agrees with a specimen in the Hine coll. (Chiriqui, A. H. Jennings) labelled "*T. simplex* Wilk., comp with type," but it does not agree very well with Walker's description (1850, *Insecta Saund.*, Pt. 1, pp. 34-35, ♀, Colombia). Kröber in his catalogue (1934) places *simplex* as a doubtful synonym of *T. (Lophotabanus) bifloccus* Hine from Cuba. Hine's type comparisons have not proven infallible, and I prefer to redescribe the present species pending more definite information. The species seems closest to *haemagogus* Will., from which it may be distinguished by narrower frons, more slender antennae, and uncontiguous abdominal triangles.

Subgenus *Hybomitra* Enderlein

- 1922, Mitt. Mus. Berlin, X, 2, p. 347 (Type *H. solax* End. = *Tabanus rhombicus* O. S.); 1925, Op. cit., XI, 2, p. 364. Stone, 1938, U. S. Dept. Agric. Misc. Pub. No. 305, p. 36 (= *Tabanus* L.). Philip, 1941, Can. Ent., LXXIII, pp. 7-8.
- Hypopelma* Enderlein, 1922, Mitt. Mus. Berlin, X, 2, p. 351 (Type *T. quadripunctatus* F.); 1925, Op. cit., XI, 2, p. 355 (as *Hypopelma lapsus*), 409 (corrected to *Hypopelma*). Kröber, 1931, Zool. Anz., XCIV, p. 69.
- Dasyphyrtia* Enderlein, 1922, Mitt. Mus. Berlin, X, 2, p. 351 (Type *T. maculipennis* Macq. = *T. quadripunctatus* var. *amabilis* Wilk.); 1925, Op. cit., XI, 2, p. 393. Kröber, 1932, Rev. Ent., II, p. 299.
- Theriopectes* Osten Sacken, 1876, Mem. Boston Soc. Nat. Hist., II, Pt. 4, No. 4, p. 425. Enderlein, 1925, Mitt. Mus. Berlin, XI, 2, p. 357 (in part). (Not *Theriopectes* Zeller 1842).
- Sziladyia* Enderlein, 1925, Zool. Anz., LXII, p. 287 (nom. nov. for *Theriopectes* End. and authors, nec. Zeller. Type *T. aterrimus* Meig.). Kröber, 1932, Rev. Ent., II, 2, p. 201. Bequaert, 1930, Harvard African Exp., p. 904. Borgmeier, 1933, Rev. Ent., III, p. 302. Kröber, 1934, Rev. Ent. IV, 3, p. 291 (? in part).
- Poecilosoma* Lutz, 1909, Inst. Oswaldo Cruz em Manguinhos, p. 29 (with *P. punctipenne* Macq., *P. quadripunctatum* Macq., *P. histrio* Wied., and *P. cinereum* Wied.); 1913, Brazil Medico, No. 45, p. 6. reprint (in key, no species); 1914, Mem. Inst. Osw. Cruz, VI, 3, p. 167 (reprinting of 1913 paper); 1914, Mem. Inst. Osw. Cruz, VI, 2, p. 72 (in list, with *quadripunctatum* Fab. and *punctipenne* Macq.). Bequaert, 1924, Psyche, XXXI, 1, p. 30, (Type *Tabanus quadripunctatus* Fab. 1805). Enderlein, 1925, Mitt. Mus. Berlin, XI, 2, p. 404 (= *Atylotus* O. S.). Not *Poecilosoma* Hubner 1816.
- Poeciloderes* Lutz, 1921, Bol. Inst. Osw. Cruz, I, p. 15. (with *quadripunctatus* (Lutz) but without indication of author or synonymy). Borgmeier, 1933, Rev. Ent., III, p. 299. (Type, *T. quadripunctatus* Fab.). Kröber, 1934, Rev. Ent., IV, 3, p. 297 (Subgenus of *Tabanus* with 10 Neotropical species).
- Poecilochlamys* Lutz, 1922, Zoologia Medica, Publ. Sep. da Folha Medica, Rio de Janeiro, pp. 9 and 11 (with a brief diagnosis, and in Key. No species); 1928, Est. Zool. Parasit. Venezolanas, p. 57 (in list with *P. quadripunctatus* Fab.).

Only one species of the present group occurs in Panama, the widespread *T. quadripunctatus* Fab. Philip (l. c.) has discussed the proper name for this group at some length, and his selection of *Hybomitra* End. seems to be the best way out of the tangle. While Philip treats the group as a full genus, there seem to me

to be too many intergrading forms, and I prefer to consider it merely a subgenus. Kröber (1929, 1931) has described a number of forms from Central and South America, but I have seen specimens of none of them.

Tabanus (Hybomitra) quadripunctatus Fabricius

(Fig. 8)

Tabanus quadripunctatus Fabricius, 1805, Syst. Antliat., p. 99 (no sex; South America). Wiedemann, 1821, Dipt. Exot., I, p. 77 (♀); 1828, Aussereurop. Zweifl. Ins. I, p. 151 (♀; Brazil). Walker, 1854, List Dipt. Brit. Mus. V., Suppl. 1, p. 219. Schiner, 1868, Reise Novara, Zool., II, Abt. 1, vol. B, Dipt. p. 86 (♂; ♀). Osten Sacken, 1878, Cat. North Amer. Dipt., p. 57. Williston, 1895, Kansas Univ. Quart., III, pt. 3, p. 195 (Rio de Janeiro); 1901, Biol. Centr.-Amer., Dipt., I, Suppl. pp. 257 and 259 (Mexico). Kertész, 1900, Cat. Taban., p. 67. Hunter, 1901, Trans. Amer. Ent. Soc., XXVII, p. 143. Aldrich, 1905, Cat. North American Dipt., p. 207. Ad. Lutz, 1907, Centralbl. Bakt. Parasit., Abt. 1, Orig., XLIV, p. 140. Kertész, 1908, Cat. Dipt., III, p. 272. Ad. Lutz and Neiva, 1909, Mem. Inst. Osw. Cruz, I, pp. 30 and 32 (States of Espirito Santo and Rio de Janeiro, Brazil). Hine, 1917, Trans. Amer. Ent. Soc., XLIII, p. 294 (♂; ♀; Costa Rica; Guatemala; Brazil, British Guiana). Surcouf, 1921, Gen. Insect., Taban., p. 81.

Tabanus (Theriplectes) quadripunctatus Osten Sacken, 1886, Biol. Centr.-Amer., Dipt., I, p. 48 (♂; ♀; Guatemala; Costa Rica).

Theriplectes quadripunctatus Speiser, 1904, Insekten-Börse, XXI, p. 148.

Poecilosoma quadripunctatum Lutz, 1909, Inst. Osw. Cruz em Manguinhos, p. 29. Ad. Lutz and Neiva, 1914, Mem. Inst. Osw. Cruz, VI, p. 72. Neiva and Penna, 1916, Mem. Inst. Osw. Cruz, VIII, p. 94. Ad. Lutz, Araujo and Fonseca, 1918, Mem. Inst. Osw. Cruz, X, pp. 167, 168 and 169 (Paraguay; Missions, Argentina; States of Rio Grande do Sul, Sta. Catharina and Paraná, Brazil). Kröber, 1931, Zoolog. Anzeiger, XCIV, pp. 70 and 77, figs. 10-11 (♂; ♀; Costa Rica; Venezuela; Peru; Ecuador; Brazil; Bolivia; Uruguay; Mexico).

Poecilochlamys quadripunctatus Ad. Lutz, 1928, Est. Zool. Paras. Venezolanas, p. 57, Pl. IX, fig. 7 (♀; Venezuela).

Tabanus (Poeciloderas) quadripunctatus Kröber, 1924, Rev. de Entomologia, Rio de Janeiro, IV, p. 298. Galvao, 1935, Rev. Biol. Hyg. Sao Paulo, VI, pp. 121-125 (life history).

Hybopelma quadripunctatus Enderlein, 1922, Mitt. Zool. Mus. Berlin X, p. 351.

Hypopelma quadripunctatus Enderlein, 1925, Mitt. Zool. Mus. Berlin, XI, p. 355 (Missprint corrected on p. 409.).

Tabanus nigro-punctatus Bellardi, 1859, Saggio Ditter. Messicana, I, p. 67, Pl. II, fig. 8 (♀; Mexico; Cordova, Huastec).

Tabanus elegans Thunberg, 1827, Nova Acta Soc. Sci. Upsal., IX, p. 61, Pl. I, fig. 5 (no sex; no locality).

Tabanus punctipennis Macquart, 1838, Dipt. Exot., I, pt. 2, p. 185 (♀; Goyaz, Brazil). Walker, 1854, List Dipt. Brit. Mus., V, Suppl. 1, p. 218. Kertész, 1900, Cat. Taban., p. 66. Hunter, 1901, Trans. Amer. Ent. Soc., XXVII, p. 143. Kertész, 1908, Cat. Dipt., III, p. 271. Ad. Lutz and Neiva, 1909, Mem. Inst. Osw. Cruz, I, pt. 1, p. 32 (States of Rio de Janeiro and Minas Geraes, Brazil). Surcouf, 1921, Gen. Insect., Taban., p. 80. Hine, 1925, Occas. Pap. Mus. Zool. Univ. Michigan, No. 162, p. 32 (Costa Rica).

Poecilosoma punctipenne Ad. Lutz and Neiva, 1914, Mem. Inst. Osw. Cruz, VI, p. 72. Ad. Lutz, Araujo and Fonseca, 1918, Op. cit., X, pp. 168 and 169 (States of Sta. Catharina and Parana, Brazil).

Hypopelma punctipennis Enderlein, 1925, Mitt. Zool. Mus. Berlin, XI, p. 356.

Tabanus maculipennis Macquart, 1834, Hist. Nat. Ins. Dipt., I, p. 198 (♀; Brazil). Walker, 1854, List Dipt. Brit. Mus., V, Suppl. 1, p. 218. Kertész, 1900, Cat. Taban., p. 59; 1908, Cat. Dipt., III, p. 258. Ad. Lutz and Neiva, 1909, Mem. Inst. Osw. Cruz., I, pt. 1, p. 32 (State of Rio de Janeiro, Brazil). Surcouf, 1921, Gen. Insect., Taban., p. 74. Not of Wiedemann.

Bellardia maculipennis Rondani, 1863, Arch. per la Zool. Modena, III, pt. 1, p. 81.

Dasyphyra maculipennis Enderlein, 1922, Mitt. Zool. Mus. Berlin, X, p. 344; 1925, Op. cit., XI, p. 393.

Tabanus amabilis Walker, 1848, List Dipt. Brit. Mus., I, p. 154.

There seems no reason why this species should not be placed with the North American forms with hairy eyes and vertexal tubercle. *T. reinwardtii* Wied. is in many respects the closest species though the vertexal tubercle is rather poorly developed. *T. quadripunctatus* F. shows considerable variation in this respect, however, and some specimens show a very weakly developed tubercle. The variety *amabilis* Wlk. with extensively white basal abdominal tergites, has not been so far taken in Panama.

Distribution: I have seen material from the states of Paraná, Matto Grosso, Sao Paulo, Rio de Janeiro, Bahia and Goyaz, Brasil, and from Peru, Brit. Guiana, Venezuela, Panama and Mexico. Kröber gives the range as Mexico to Uruguay.

Panama records: Summit, C. Z., Dec. 26, 1929 (Dunn); Moja Pollo, Chagres River region, Jan., May, June, July and November, 1940. The species is apparently not common in Panama.

Subgenus *Philipotabanus* subg. nov.

Phaeotabanus Kröber, 1930, Zool. Anz. LXXXVI, p. 273 (in part); 1934, Rev. Ent. IV, 3, p. 304 (in part).

This group is erected for a number of Central and South American species of *Tabanus* included by Kröber in the subgenus *Phaeotabanus* of Lutz, and corresponds in the main to Kröber's group *reticulatus* of that subgenus. *Tabanus ebrius* Osten Sacken, 1886, is selected as sub-genotype. The type of *Phaeotabanus* Lutz is *Tabanus litigiosus* Walker, 1850, selected by Bequaert (1924); and it and a number of related forms differ sufficiently from *Tabanus sens. lat.* to require full generic standing in my opinion. *P. litigiosus* Wlk., *semiflavus* Kröb. and *limpidapex* Wied. have the subepaulet bare, costa, subcosta and first vein with macrotrichia above, and the labella bear shiny chitinized plates. *Tabanus ebrius* O. S., *fascipennis* Macq., *reticulatus* Kröb., *tenuifasciatus* Kröb. and some other related forms have macrotrichia upon the subepaulet and the labella entirely fleshy.

Kröber seems to have placed a number of not very closely related forms in *Phaeotabanus*, mostly on the basis of their pictured wings and apparent lack of other distinguishing features. Thus the bare subepaulet, fleshy labella and setose

fifth vein of *T. fuscipennis* Wied. set it apart, while the broad frons, curiously spotted wings and setose subepaulet of *P. multiguttatus* Kröb. and probably also *P. austeni* Kröb., which I have not seen, would place them very close to *T. venustus* O. S. from North America. I have not sufficient material to do more than point out the fact that *Phaeotabanus* Kröber is a very heterogeneous group, and to segregate the present complex, as it includes all the Panamanian species.

Philipotabanus may be defined as follows:

Small to medium sized flies, 7 to 15 mm. long. Eyes bare, unicolorous dull greenish in life. Frons narrow to very narrow; frontal callus club shaped or ridge like, vertexal tubercle absent or represented by a small bare spot. Subcallus and face normal, not bare or swollen. Antennae *Tabanus*-like, rather slender, without unusual features. Palpi rather long and very slender, proboscis not or barely equalling head height, the labella fleshy, at least half length of proboscis. Thorax, abdomen and legs brown or black, the last generally unicolorous. Wings with subepaulet bearing macrotrichia, as do the costa, subcosta, and first vein above, and the costa and subcosta beneath. All cells but the anal open; no appendix on third vein. The wings are always marked with brown, in a pattern which has a tendency to leave the areas around the cross veins hyaline, except in *fascipennis* Macq. and allied species.

The male of only one species, *ebrius*, appears to have been taken, and a description of it will be found under that species.

The species of this group are very puzzling. Either there are many rather restricted species, or a few very variable forms. I have, after considerable hesitation, decided to consider the various forms as distinct species, as I am unable to group them satisfactorily with the material at hand. Use of any single character for grouping results in a group heterogeneous for practically all other characters, i. e., there seems to be little or no correlation between the various available characters. Furthermore, there appears to be very little intermediacy, each form being rather clear cut, so that the lumping of all the forms under one species, as Hine (1925) did, only begs the question. With the accumulation of further material from a long series of localities, it may well be possible to define a few species, each with a number of local races. All the specimens I have seen are much alike in structure, differing mainly in size, intensity of body coloring, and development or reduction of the basically similar wing pattern. I have before me 6 apparently distinct forms from Panama, as well as 2 others from other localities. Of these, I have been able to assign names to 4, but not with any degree of certainty. Lacking Mexican material,

I have hesitated to use either *caliginosus* Bell. or *alteripennis* Wlk. for Panama material. Kröber did not recognize any of the earlier names in this group, and redescribed *ebrius* O. S., so it is possible that some of his many names may refer to those species.

In Panama the members of the group are not uncommon during the earlier part of the rainy season in heavily forested areas. Occasionally they become annoyingly abundant, and will bite man readily, though the bite is not very painful and leaves little after effect.

The forms occurring in Panama, together with such other material as is before me, may be separated by the following key, used in conjunction with the accompanying figures.

KEY TO SPECIES OF SUBGENUS PHILIPOTABANUS

1. Whole wing black, except apex, anal cell, and median area at apices of basal cells extending to the costa (Venezuela)..... *fascipennis*
Wing otherwise marked, but areas around the cross-veins always hyaline.
(See figures)..... 2
2. Wing pattern of dark streaks and spots. Abdomen orange brown to nearly black. Scutellum dark brown, thoracic stripes prominent.
12-14 mm..... *ebrius*
Without the above combination of characters..... 3
3. Abdomen mainly yellowish or light brown..... 4
Abdomen mainly blackish, or dark brown..... 8
4. Legs blackish. Abdomen with a small middorsal white triangle on the fourth tergite or unicolorous. Apex of wing along costa distinctly dusky. 7-9 mm..... *magnificus*
At least the last two pairs of legs yellowish or reddish. Over 10 mm..... 5
5. Fore legs darker than the others. Wing pattern clear cut and distinct.
Antennal tooth rather short. 11 mm. (Bolivia)..... *reticulatus*
All legs light. Wing pattern rather faded. Antennal tooth well marked..... 6
6. Abdomen with small white mid-dorsal triangles on tergites 2 to 4. Dark area of wing extending into base of second submarginal cell. *ptero-graphicus*
Abdomen without light triangles. Second submarginal cell all hyaline, rarely with a very small spot near the base..... 7
7. Small species, 11-12 mm..... *chrysothrix*
Large species, 15-16 mm..... *elviae*
8. No dark spot at base of second submarginal cell. Third antennal segment unusually broad. Abdomen dark reddish brown. (Br. Honduras)..... *kompi*
A dark spot at base of second submarginal cell which is broadly connected with cross-band..... *medius*

Tabanus (Philipotabanus) ebrius Osten Sacken

(Fig. 14)

- Tabanus ebrius* Osten Sacken, 1886, Biol. Centr.-Amer., Dipt. X, p. 49, Pl. I, fig. 8 (♀; Irazu, Costa Rica; Volcan de Chiriqui, Panama). Williston, 1901, Biol. Centr.-Amer. Dipt., I, Suppl., p. 259 (= *caliginosus* Bell.). Kertész, 1900, Cat. Taban., p. 48. Surcouf, 1921, Gen. Insect., Taban., p. 63. Hine, 1925, Occ. Pap. Mus. Zool. Univ. Michigan, No. 162, p. 30 (= *caliginosus* Bell.; Boquete, Panama).
- Tabanus erebus* Hine (nec. *T. erebus* Osten Sacken) 1917, Trans. Am. Ent. Soc., XLIII, p. 295 (confusion of *erebus* and *ebrius*).
- Tabanus (Phaeotabanus) ebrius* Kröber, 1930, Zool. Anz., LXXXVI, p. 277; 1934, Rev. Ent. IV, 3, p. 305.
- Tabanus (Phaeotabanus) ocelligerus* Kröber, 1930, Zool. Anz., LXXXVI, pp. 296-297, figs. 18, 18a (♀; Costa Rica); 1934, Rev. Ent., IV, 3, p. 305.

This species is distinguishable readily from others of the group in Panama by the distinctive wing pattern and prominently striped thorax. A male before me may be designated as Allotype.

Eyes contiguous. The large facets much larger than the small and sharply demarcated from them. The area of large facets is definitely pubescent, the small facets bare, and the former occupies about $\frac{2}{3}$ of the total eye area. A very small tubercle is present between the eyes at vertex. Antennae missing. Palpi short, rather inflated, curved. Coloration as in the female, the thorax and abdomen with longer hairs, and the abdomen pointed.

Allotype ♂, Boquete, Chiriqui Prov. Panama, May-June, 1940 (Mrs. T. B. Monniche coll.). Certain specimens have the abdomen almost black, and I had at first considered them to be a distinct form, but more material has shown a complete intergradation of characters.

Distribution: Costa Rica and Panama, at higher elevations.

Panama records: Volcan de Chiriqui, 2000-3000 ft. (Champion; Osten Sacken's Types). Boquete, May 15, 1923 (Gauge coll., in Hine coll.), labelled "*ebrius* comp. with type." Boquete, Chiriqui Prov., May 8-9, 1939. (Many females); May-June, 1940 (Mrs. T. B. Monniche); June, 1941 (Mrs. T. B. Monniche). Cerro Punta, Chiriqui Prov., 6000 ft., Feb.-Mar., 1940 (T. T. Howard coll.).

Tabanus (Philipotabanus) magnificus Kröber

(Fig. 13)

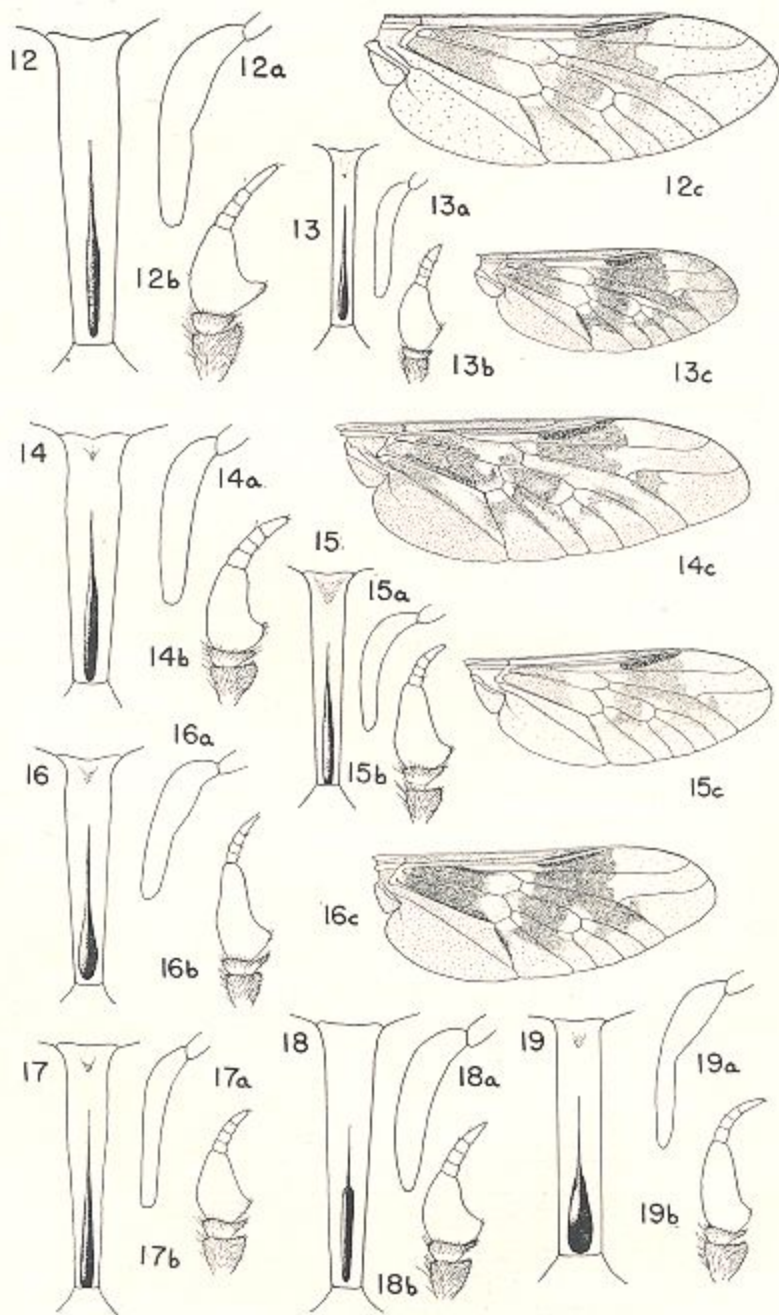
Tabanus (Phaeotabanus) formosus Kröber, 1930, Zool. Anz., LXXXVI, p. 209, figs. 21, 21a. (♀; Ecuador) (not *T. formosus* Walk. 1848). Bequaert, 1940, Rev. Ent., XI, 1-2, p. 291.

Tabanus (Phaeotabanus) magnificus Kröber, 1934, Rev. Ent., IV, 3, p. 305 (Ecuador, Costa Rica, Colombia).

This is very much the smallest species of the group in Panama, being easily mistaken at first glance for a species of *Chrysops*. It is a persistent biter in forested regions, appearing to prefer the ears and nose, like *Chrysops*. The eyes are bronzy in life, without bands.

EXPLANATION OF FIGURES IN PLATE II

Figs. 12, 12a, 12b, 12c—*T. (Philipotabanus) elviae* n. sp. Paratype. 13, 13a, 13b, 13c—*T. (P.) magnificus* Kröber. 14, 14a, 14b, 14c—*T. (P.) ebrius* O. S. 15, 15a, 15b, 15c—*T. (P.) pterographicus* n. sp. Paratype. 16, 16a, 16b, 16c—*T. (P.) medius* Kröber. 17, 17a, 17b—*T. (P.) chrysothrix* n. sp. Paratype. 18, 18a, 18b—*T. (P.) kompi* n. sp. Paratype. 19, 19a, 19b—*T. (P.) fuscipennis* Macq.



Distribution: Kröber records it from Costa Rica, Colombia, Ecuador and Santo Domingo. I have seen specimens in the Hine Collection and U. S. N. M. from Higuito, Costa Rica (Schild), and Livingston, Guatemala, May 6 (Barber and Schwartz). I have also specimens from Guayaquil, Ecuador, and Surotka, C. R., May, 1924 (J. C. Bradley). As Bequaert has noted (l. c. 1940) the species probably does not occur in the West Indies.

Panama records: El Valle, Coclé Prov., May 20, 1939. New San Juan, Chagres River region, June 28, 1939. Cerro Campana, Panama Prov., July 2 and 11, 1939. Police Station, Rio Pequeni, C. Z., May 11 and Aug. 21, 1940. Cerro Azul, Panama Prov., May 17, 1941. Changuinola Dist., Bocas del Toro Prov., May 19, 1924 (F. R. Swift coll.). Boqueron River, May, 1907 (Busck coll.). Cano Saddle, Gatun, C. Z., May-June, 1923 (Shannon coll.). Mohinga Swamp, Gatun, C. Z., Aug. 26, 1940.

Tabanus (Philipotabanus) medius Kröber

(Fig. 16)

Tabanus (Phaeotabanus) intermedius Kröber, 1930, Zool. Anz., XC, p. 81 (♀; Suiza de Turrialba, Costa Rica) (not *T. intermedius* Walk., 1848; not *T. intermedius* Egger 1859.).

Tabanus (Phaeotabanus) medius Kröber, 1934, Rev. Ent., IV, 3, p. 305.

Rather extensive material from Panama before me seems to agree quite closely with Kröber's description. It differs from all the other Panama forms except certain dark specimens of *ebrius* in the nearly black abdomen, and from that species by different antennae and different wings. This species and *magnificus* Kröb. seem about equally abundant, but although both occur together in a number of localities, one is always much more abundant. Thus at El Valle and Cerro Azul both occur, but *magnificus* is dominant, while in the Chagres River region *medius* is abundant, *magnificus* rare. *Magnificus* is also abundant on the Rio Pequeni and on Cerro Campana, where *medius* has not been taken, while *medius* is common on the Cerro Macaracas and at Camp Pital, in Chiriqui, where *magnificus* has not been taken. Neither of these species seems to have been taken in the Volcan area. The other two Panama forms are known only from a few specimens, all taken in company with one or both of the above.

Panama records: Moja Pollo, Chagres River region, May 15 to Sept. 1, 1940. New San Juan, Chagres River region, June

28, 1939. Cerro Macaracas, Veraguas Prov., July 15, 1940 (E. R. and M. T. Dunn coll.). Camp Pital, Chiriqui Prov., July 11, 1929 (L. H. Dunn). El Valle, Coclé Prov., June 18, 1939. Quipo, R. P., July, 1922, (J. P. Chapin). Barro Colorado Is., C. Z., June 29, 1923 (R. C. Shannon). Cerro Azul, Panama Prov., May 17, 1941. Cabima, R. P., May 25, 1911 (Busck).

***Tabanus (Philipotabanus) pterographicus* sp. nov.**

(Fig. 15)

Female.—Length 10 mm., of wing, 10 mm.

Eyes bare, bronzy in life. Frons narrow, about $9\frac{1}{2}$ times as high as basal width, widest at vertex, pale yellowish brown. Frontal callus linear, brown, extending nearly to vertex, where there is a small, bare, slightly raised and discolored area. Subcallus, fronto-clypeus and genae pale yellowish grey pollinose, the last with sparse pale brownish hairs. Antennae as figured, orange yellow, the annulate portion darker, and with dark hairs on the first two and angle of the third segments. Palpi as figured, pale brown, black haired. Proboscis brown, the labella about $\frac{2}{3}$ of total length, fleshy.

Mesonotum light brown, stripes nearly obsolete, dark haired; scutellum concolorous, lighter at apex, white haired. Pleura and sternum paler, sparsely brown and whitish haired. Legs yellowish brown, the fore pair darker, all black haired. Wings as figured. Abdomen dirty yellowish brown, dark haired, darker at apex, and with small but well marked triangles of white hairs on hind margins of first to fourth tergites. Venter lighter, sternites obscurely pale margined.

Holotype ♀, Moja Pollo, Chagres River region, Jan. 1, 1940. 1 ♀ Paratype, same locality, Dec. 6, 1939. To be deposited in the M. C. Z., Harvard Univ., Cambridge, Mass.

This species may be distinguished from *reticulatus* Kröb. by the very different antennae, narrower convergent frons, and lack of apical wing infuscation. From *medius* Kröb. it differs in much lighter color, narrower frons, smaller size and reduced wing picture. The season of flight also appears to be quite different though with but two specimens this cannot be given much weight. *Pallidetinctus* Kröb., described from Panama, I have not been able to recognize in my material. It may have been based on specimens of either this or the next species, but if so, the description leaves very much to be desired.

***Tabanus (Philipotabanus) chrysothrix* sp. nov.**

(Fig. 17)

Female.—Length 10–10.5 mm., of wing, 10 mm.

Differs from the preceding species only in the following respects. Scutellum and abdomen largely clothed with golden hairs, without

contrasting tergal triangles of white hairs. Body color more rufous. Legs largely orange haired. Wing markings further reduced, lacking the extension in to the second submarginal cell.

Holotype ♀ Police Station, Rio Pequeni, Panama, May 11, 1940. 3 ♀ Paratypes, Cabima, Panama, May 19 and 21, 1911 (August Busck coll.). Holotype to be deposited in the M. C. Z., Harvard Univ., Cambridge, Mass. Paratypes in the U. S. N. M.

This form, while agreeing with *reticulatus* Kröb. and *ptero-graphicus* sp. nov. in size and general coloration, approaches the two following species in the wing pattern.

***Tabanus (Philipotabanus) elviae* sp. nov.**

(Fig. 12)

Female.—Length 14–15 mm., of wing, 13 mm.

Eyes bare, probably unicolorous bronzy in life. Frons orange brown pollinose, about $8\frac{1}{2}$ times basal width, wider at vertex. Frontal callus linear, not reaching base of frons. Vertex with a slightly discolored area. Subcallus, fronto-clypeus and genae concolorous, orange brown, the last with a sparse orange beard. Antennae as figured, orange throughout, the first two segments and angle of the third with reddish brown hairs. Palpi as figured, pale orange brown with black hairs.

Mesonotum orange brown, stripes obsolescent; scutellum orange with golden hairs. Pleura and sternum paler, mostly orange haired. Legs reddish, mostly golden haired, the fore pair dark haired. Wings as figured. Abdomen orange brown, reddish brown haired, the hind margins of the tergites paler and with golden hairs, forming indistinct triangles in the mid-line.

Holotype ♀ and 4 ♀ Paratypes, Buena Vista, Chiriqui Volcano, 1000 ft., Panama, March (J. D. Smith coll.). To be deposited in the M. C. Z., Harvard Univ., Cambridge, Mass.

The large size, reduced wing pattern and golden or coppery body pubescence should serve to distinguish this form. It is in many respects a large edition of *chrysothrix*, but the antennae are quite different.

***Tabanus (Philipotabanus) kompi* sp. nov.**

(Fig. 18)

Female.—Length 11–13 mm., of wing, 10.5–12 mm.

Eyes bare, probably bronzy in life. Frons narrow, about 8 times as high as wide, yellowish grey pollinose. Frontal callus linear, chestnut brown, hardly a vestige of a vertexal bare spot. Subcallus, fronto-clypeus and genae brownish grey, the last with a sparse pale brown beard. Antennae as figured, orange, the annulate portion darker, the first two segments and angle of third dark haired. Palpi as figured, pale brown, black haired.

Mesonotum dark brown, dark haired, the stripes obsolescent. Scutellum concolorous, its posterior margin sparsely silver haired. Pleura and sternum grey and brown haired. Legs yellowish brown, the fore pair darker, all with mostly dark hair. Wings as figured. Abdomen cinnamon brown, sometimes lighter, especially on the first few tergites, dark brown to black haired. The third and fourth tergites, sometimes also the second, bear silvery haired median triangles, that on the fourth much the largest. Venter paler, sparsely pale haired, especially the light hind margins of the sternites.

Holotype ♀ and 14 ♀ Paratypes from Stann Creek, British Honduras, March 19, 1940 (W. H. W. Komp coll.); 8 ♀ Paratypes, Silk Grass, British Honduras, March 17, 1940 (Komp. coll.). Holotype and 3 Paratypes to be deposited in the M. C. Z., Harvard Univ., Cambridge, Mass., other Paratypes in the U. S. N. M. and author's collection.

I have also seen three specimens from Tela, Rep. of Honduras (Bates coll.) which I place provisionally here. The wing pattern is the same, but the frons is wider and the whole insect much paler, quite yellowish. They are much like *chrysothrix*, but the frons is broader, wing darker, the hyaline area about the end of the discal cell smaller and more circumscribed, and the antennal tooth much longer. The present species is closest to *elviae* in wing pattern, but approaches *medius* Kröber in body color.

Tabanus (Philipotabanus) reticulatus Kröber

Tabanus (Phaeotabanus) reticulatus Kröber, 1930, Zool. Anz., LXXXVI, pp. 298-299, figs. 20, 20a (♀; Peru, Pichis Weg, Pto Yessup); 1934, Rev. Ent., IV, 3, p. 305.

Two from Prov. Sara, Bolivia (Steinbach) are before me, which agree fairly well with the description. They differ from the other species here considered in the more open hyaline spot at the apex of the discal cell, short antennal tooth, and rather broader more parallel sided frons. The apical infuscation of the wing is much fainter than that shown in Kröber's figure.

Tabanus (Philipotabanus) pallidetinctus Kröber

Tabanus (Phaeotabanus) pallidetinctus Kröber, 1930, Zool. Anz., LXXXVI, pp. 297-298, figs. 19, 19a (♀; Panama); 1934, Rev. Ent., IV, 3, p. 305.

I have been unable to recognize this species in my material. The entirely dark costa is unusual, and precludes its identification with either *pterographicus* or *chrysothrix*, to which it seems most closely related. It is quite distinct from anything I have seen from the Chiriqui region.

Panama records: Chiriquicito, March (Kröber).

***Tabanus (Philipotabanus) fascipennis* Macquart**

(Fig. 10)

Tabanus fascipennis Macquart, 1845, Dipt. Exot., Suppl. 1, p. 35, Pl. 4, fig. 1. (♀; New Grenada).*Tabanus (Phaeotabanus) fascipennis* Kröber, 1930, Zool. Anz., LXXXVI, p. 278, figs. 1, 1a. (Bogota, Venezuela); 1934, Rev. Ent., IV, 3, p. 305.

A series of specimens in the U. S. N. M. from Choroní, Venezuela (Lichy) enables me to supplement Kröber's description in a few points. The frons is rather narrower, about $5\frac{1}{2}$ times as high as basal width. The abdomen is wholly black, with a small white haired triangle on only the fourth tergite in my specimens. The peculiar angle of the palpi shown in Kröber's figure is present also in my material, but the antennae are a little broader than shown. The species may occur in Eastern Panama, where very little collecting has been done.

RESUME OF THE TABANIDAE OF PANAMA

In previous papers (1939-1942) the genera occurring in Panama have been discussed in some detail, and the various species figured. It remains only to give some brief notes on the Tabanid fauna of the Republic as a whole, its classification and relation to the fauna of other areas, a few remarks on the environment, and a check list of the known forms.

No work of this nature is wholly the product of its author, and though the sources of the author's ideas can be partly gleaned from the literature cited, by far the most important contributions are those resulting from conversations and correspondence with other enthusiasts. In the present case, much of whatever is useful or original in this series of papers has been the result of such discussions with Dr. Joseph Bequaert, Dr. C. B. Philip, Dr. L. L. Pechuman, Mr. R. C. Shannon and Dr. Alan Stone. To these and many others I am also indebted for the loan and gift of much valuable material, without which this study would hardly have been possible.

I have also been unusually fortunate in having been able to study a large proportion of the Central American Tabanidae available in American collections, but I have been naturally handicapped by the inaccessibility of the types of European authors. The Panama material in the following collections has been examined: U. S. National Museum; American Museum of Natural History; Museum of Comparative Zoology, Harvard University; J. S. Hine collection, Ohio State University; and

the collection of Dr. Joseph Bequaert at the Harvard Medical School. In addition, the collections made by Major L. H. Dunn and preserved at the Gorgas Memorial Laboratory in Panama have been constantly available. My own field work in Panama, extending over three years, has yielded an estimated 20,000 additional specimens.

The climate and physiography of the Republic is quite diversified, but little or no detailed work on the subject appears to be available. Most of the existing temperature and rainfall records refer to the area adjacent to the Panama Canal, but are to a certain extent characteristic of the whole area. The year is divided into two seasons, "wet" and "dry." The wet season begins generally sometime in May and continues usually until the latter part of December. On the Atlantic side of the isthmus there is some rain more or less throughout the year, the "dry" season being only relatively so, but on the Pacific side, from the Canal Zone west at least to Costa Rica, there may be no rain at all from December to the end of May. East of the Canal Zone the conditions appear to be to some extent reversed, the Atlantic coast becoming progressively dryer towards the Colombian border, while the Pacific coast becomes wetter. Total annual rainfall ranges from 100, or often more, inches on the Atlantic side, to 70 inches at Panama City. Farther westward along the Pacific coast, the rainfall is probably even less.

Physically the country is encroached upon at either end by the Costa Rican and Colombian mountain systems. In Chiriqui Province the country is dominated by the Volcan de Chiriqui, an extinct volcanic peak close to 12,000 ft. high, which forms the eastern end of the chain of Costa Rican volcanoes. In Darien Province a spur of the Colombian Andes enters the country, elevations of somewhat over 8000 feet being reached. Between these two systems the country is traversed lengthwise by a sort of backbone range of hills, lowest at the Canal Zone, generally higher towards the Costa Rican and Colombian borders, but seldom exceeding 4,000 or 5,000 feet. This central ridge lies for the most part nearer the Atlantic or Caribbean coast, so that the Pacific side has a wider strip of relatively level land.

A great deal of the Republic is still covered with heavy forest, but about the Canal Zone and along the Pacific coast west of the Canal much of it has been cleared at one time or another

for agriculture, and then allowed to grow up again into an utterly impenetrable second growth. True llanos, rolling grass-covered plains, are increasingly evident westward of the canal, and some of these at least are a natural feature of the country, though it seems very probable that their original area has been much increased by the annual fires which are set by the inhabitants to improve the grazing, as this area is largely a cattle section.

Swamps, both fresh and tidal, are found along both coasts, but other than the artificial Gatun and Madden Lakes, there seem to be but few large bodies of fresh water. The tidal mangrove swamps form one of the most interesting habitats, and quite a number of Tabanids seem to be wholly or largely confined to them. Altitude, here as elsewhere, has an important influence on vegetation, and the tops of even relatively low hills, 2500-3000 feet, are kept moist and green throughout the dry season by often almost constant cloud caps. The so-called fog forest developing on these hills yields very interesting collecting, and quite a number of Tabanids seem confined to these areas.

Since most Tabanids are haematophagous, Bequaert (1940, p. 264) has suggested that the paucity of large mammals in the Antilles may well be the cause of the depauperate Tabanid fauna found here. Panama, being continental, has a considerable number of large native mammals, in addition to a good population of horses and cattle. Two genera of deer, *Odocoileus* and *Mazama*, tapir, (*Tapirella bairdi*), two genera of peccary (*Pecari* and *Tayassu*), the capybara (*Hydrochoerus*), puma, jaguar and ocelot are all large enough to be attractive to Tabanids, while there are a host of smaller mammals as well as several large reptiles such as the iguana lizard, various species of freshwater and marine turtles, and large snakes. Observations of the feeding habits of Tabanids on wild animals are naturally not often made, but the capture of a specimen of *Fidena isthmiae* Fairch. feeding on a large snake (*Epicrates* or *Constrictor* sp.) by Mr. W. H. W. Komp is worthy of note. Tabanids have previously been recorded as feeding on both crocodiles and sea turtles. (Bequaert, 1940).

The relationships of the Panama Tabanid fauna to that of neighboring areas must be largely a matter of guesswork, since little intensive collecting has been done anywhere in Tropical America. My own collecting in Panama has been largely confined to the central part of the Isthmus, so that many species

coming into the country from Costa Rica and Colombia have undoubtedly been missed. Nevertheless, the information available tends to show that the Central American elements in the fauna are slightly in the ascendency. Thus of the 59 Panama species known to occur in other areas also, 12 or about 20% are known from South America but not from Central America, 17 or about 30% are known from Central America but not from South America, while 30 or about 50% are known from both South and Central America. The 30 species known at present only from Panama can only tentatively be classed as true endemics, since many or most of them may be found in neighboring areas when more collecting has been done.

A comparison of the total number of species known from Panama with similar lists from other areas, indicates that the fauna is a relatively rich one. The land surface of the Republic is estimated to be between 31,500 and 33,800 square miles (*Encyclopaedia Britannica*, 11th Ed.), and 89 species are known to occur within its boundaries. Bequaert (1940a) gives the following figures for the Antilles: Antilles as a whole, 95,000 sq. mi. and 42 species; Cuba, 44,000 sq. mi. and 12 species; Hispaniola, 28,250 sq. mi. and 17 species. The Republic of Honduras, which has been little explored, contains 46,000 sq. mi. and Bequaert lists (1940a) 22 species as occurring there. The same author lists (1940b) 23 species from Trinidad, with an area of only 1,734 sq. mi. In North America, where the Tabanids have been much more extensively studied and collected, Johnson lists (1925) 85 species for the 6 New England states, with an area of 64,800 sq. mi., and my own list of Florida species (1937), to which several species have been subsequently added, comprises 66 species from an area of about 59,000 sq. mi.

CLASSIFICATION: HISTORICAL

The classification of the Tabanidae, in spite of a number of attempts to place it on a sound basis, still remains in a very chaotic condition, and there seems no immediate prospect of improvement. The characters hitherto used to group the species into genera and higher categories seem for the most part quite inadequate, and a complete re-study of the whole family in a search for more and better characters will be necessary before any real progress can be made.

Three main systems of classification of the family exist. Of these the oldest divides the family into two subfamilies,

Pangoniinae and *Tabaninae*, each of which is divided into a variable number of genera. The most recent attempt to apply this system to the world fauna is that of Surcouf in the *Genera Insectorum* (1921). Here the *Tabaninae* comprise 18 genera of which 9 are monotypic, while the Genus *Tabanus* with three subgenera contains 1140 species. In the *Pangoniinae*, Surcouf recognizes 42 genera, of which 16 are monotypic, while *Chrysops* and *Pangonius*, the two largest genera, are listed as containing 200 and 109 species respectively. While Surcouf recognizes a number of the groups proposed by Lutz (1909) in the *Pangoniinae*, he does not recognize Lutz' divisions of the *Tabaninae*.

The first important departure from the old system was proposed by Adolfo Lutz in a series of papers (1909 et seq.) dealing with the Brazilian fauna. He replaced the old subfamilies *Pangoniinae* and *Tabaninae* by the names *Opisthacanthae* and *Opisthanoplae*, and divided the former into the subfamilies *Pangoniinae*, *Silviinae* and *Chrysopinae*, and the latter into the subfamilies *Tabaninae*, *Lepiselaginae* and *Diachlorinae*. The *Tabaninae* was further divided into two series on the basis of the presence or absence of a long tooth on the third antennal segment, the *Schistocerae* having a long tooth, the *Haplocerae* lacking it. The two series were then divided into genera largely on the basis of eye coloration, the *Schistocerae* containing 9 genera, of which 6 were new, and the *Haplocerae* consisting of 9 roughly parallel genera, of which 8 were new. Lutz' system had a number of features to recommend it, and many of his groups seem to express natural relations, but the system was founded on a rich but limited fauna, while Lutz was often unfortunate in his choice of distinguishing characters. Many of his names were first published in lists of species, while others appeared in keys without species, and in no case were genotypes specifically selected. This led to considerable confusion and misunderstanding and the loss of several of Lutz' names.

In 1922 and 1925 G. Enderlein published what was intended to be a world-wide revision of the family. Following Lutz in the use of *Opisthacanthae* and *Opisthanoplae* Enderlein goes much further, dividing the family into 10 subfamilies, 19 tribes, and 170 genera. His classification is rather arbitrary, in many cases separating quite closely allied forms. Very few new characters are used, dependence being placed mainly on the various possible groupings of already known characters. The

system has been widely criticized (Bequaert 1924, Kröber, 1932, Stone, 1938); but Enderlein has selected genotypes throughout, so that in many cases his groups are recognizable. He was, however, not always careful, and in a number of cases genotypes had previously been selected by others. A number of his supposedly new species, upon which he based new genera, have also proven to be synonyms; and in other cases his genotypes and genera were based on misdetermined material. In one case at least, he placed the same species in three different genera. Enderlein recognized only a few of Lutz' genera, sinking the majority of them more or less at random.

Beginning about 1925, Otto Kröber published a long series of papers dealing exhaustively with the family, the Neotropical fauna alone occupying about 40 titles. In two papers (1932 and 1934) his system of classification, as far as the Neotropical region is concerned, is set forth. For the most part he follows Enderlein with minor changes, recognizing many of Lutz' generic names. He used 83 generic and subgeneric names for the Neotropical fauna. While Kröber's work is a great improvement over that of Enderlein and Lutz, he also has failed to discover any new characters which can be used for classification, and his system remains very largely artificial.

Dr. J. Bequaert (1930) in discussing the African *Tabanidae* recognizes 3 subfamilies, the *Coenomyiinae*, *Pangoniinae* and *Tabaninae*, and divides the second of these into 3 tribes, the *Pangoniini*, *Chrysopini* and *Scepsidini*, and the *Tabaninae* into the *Tabanini* and *Haematopotini*. This treatment is strongly contrasted with that of Enderlein and Kröber, and has all the advantages of great simplicity. I feel, however, that the very diverse elements to be found, especially in the *Pangoniini* and *Tabanini* of Bequaert are susceptible of more detailed analysis. I realize, however, the danger, especially when dealing with a limited fauna, of too fine a division, and feel that in dealing with the Panama species a middle course is advisable.

Dr. C. B. Philip has recently published (1941) a very stimulating scheme of classification of the Nearctic *Tabanidae*, with most of which I find myself in hearty agreement. He divides the Nearctic forms into 3 subfamilies, 9 tribes, and 29 genera. Of these, 2 subfamilies, 8 tribes, and 11 genera also occur in Panama. Philip separates the genus *Diachlorus* from *Stenotabanus*, placing them in separate tribes; but I believe this to be

unnecessary, and include both in the *Diachlorini*. I also believe *Chlorotabanus* to be rather closely related to the other *Dichelacerini* through such forms as *Cryptotylus*, and not worthy of tribal treatment.

Failing any entirely satisfactory existing system, it has been found quite impossible to come to any final decision as to the correct placement of a number of the Panama forms. While I have had the opportunity of examining a great deal of Neotropical material, as well as a large majority of the described Nearctic species, and a fair number of Old World forms, still I am very far from being in a position to erect any comprehensive scheme of classification for the whole family. The arrangement here adopted for the Panama species is therefore entirely tentative, and the key to supra-specific categories will probably not hold for extra-limital forms. I have used in the key a number of characters hitherto very seldom noticed in the family, but which seem to me in many cases to indicate relationships much better than most of the characters previously employed.

CLASSIFICATION OF THE SPECIES OCCURRING IN PANAMA

I have reverted to the terms *Pangoniinae* and *Tabaninae* for the main divisions of the family as it is represented in Panama, as the numerous subfamilies of Enderlein and Kröber do not seem to me sufficiently definable, nor do they appear to be at all of equal rank. In the *Pangoniinae* I recognize only two tribes as occurring in Panama, the *Chrysopini*, corresponding to the subfamily *Silviinae* of Kröber's catalogue (1934) and the *Pangoniini*, which includes all three tribes of the *Pangoniinae* of Kröber's catalogue. Among the *Tabaninae*, I recognize 5 tribes as follows: the *Lepiselagini*, corresponding to Kröber's subfamily of the same name; the *Diachlorini*, corresponding in part to Kröber's *Diachlorinae* and *Stenotabaninae*; the *Bolbodimyini* of Philip; the *Dichelacerini*, which includes part of Kröber's *Psolidini* and most of his *Dichelacerini* plus *Chlorotabanus* of his *Tabanini*; and the *Tabanini*, which includes part of Kröber's *Bellardiini*, *Dichelacerini* and *Tabanini*. I give below a key to the tribes and a key to the genera occurring in Panama, with the reservation that they will not always work in dealing with extra-limital forms.

KEY TO TRIBES

1. Hind tibiae with apical spurs. Subcosta always bare both above and below. Labella always with shiny sclerotized plates. 2. **Pangoniinae**
Hind tibiae without apical spurs. Subcosta generally hairy, at least with some hairs beneath. 3. **Tabaninae**
2. First two antennal segments often together as long or longer than third. Third antennal segment of a long basal part and 4 terminal annuli. Proboscis seldom exceeding headheight. **Chrysopini**
First two antennal segments seldom together equalling half the length of the third. Third antennal segment of 7 or 8 distinct subequal annuli. Proboscis often much exceeding head height. **Pangoniini**
3. Subepaulet bare, rarely with a few scattered bristles. 4
Subepaulet clothed with macrotrichia like those on the costa. **Tabanini**
4. Third antennal segment with a long dorsal tooth or spine, or the labella shiny and sclerotized and the whole insect greenish in life. . . **Dichelacerini**
Third antennal segment never with a long dorsal spine, generally weakly angulate or subcylindrical, or labella wholly membranous. 5
5. Palpi shiny, flattened, the outer surface convex, the inner concave, those of the male nearly as large as in female, greatly inflated. All tibiae inflated. Wings black on basal half to two-thirds, hyaline apically. Largely black and shiny species with shiny facial callosities. Labella wholly membranous. **Lepiselagini**
Palpi pollinose, slender or inflated, but not flattened, those of the male small. 6
6. Subcallus and first antennal segment greatly inflated, shiny; face normal, pollinose. Body and wings largely black. Labella with small shiny plates at base. Palpi slender, pollinose. Upper branch of third vein turned abruptly forward. **Bolbodimyini**
Subcallus and first antennal segment not inflated. Upper branch of third vein normal. Wings never predominantly black. **Diachlorini**

KEY TO GENERA

1. Hind tibiae with apical spurs. Subepaulet without macrotrichia, subcosta bare both above and below. Labella always with shiny sclerotized plates, 2. (**Pangoniinae**)
Hind tibiae without apical spurs. Subepaulet, wing veins and labella variable. 6. (**Tabaninae**)
2. Third antennal segment of an often ringed but consolidated basal part and four terminal annuli. Proboscis short, seldom much exceeding head height. Mostly small species of less than 12 mm. length and with mottled wings. **Chrysops**
Third antennal segment of 7 or 8 distinct annuli; the first two segments never equalling $\frac{1}{2}$ the length of the third. Proboscis often elongate. Larger species mostly over 12 mm.
3. Eyes bare. Face not produced and snout-like, proboscis not longer than hind tibia, generally much shorter. First posterior cell closed; fork of third vein generally with an appendix. **Esenbeckia**
Eyes pilose. Face more or less produced and snoutlike. Proboscis longer than hind tibia, often as long as whole insect, more or less extensile, the basal portion coiled within the head capsule. 4
4. Third antennal segment of seven annuli, bipectinate, the first six annuli bearing long dorsal and ventral finger like processes. Brown insects with the first posterior cell of the wing closed and long petiolate. . **Pityocera**
Third antennal segment without such finger-like processes. 5
5. First and fourth posterior cells closed and petiolate. Wings often with dark markings. **Scione**
First posterior cell closed or narrowly open, fourth always open. Wings hyaline or smoky, never with prominent dark markings. **Fidena**
6. Subepaulet without macrotrichia, or the macrotrichia much less dense than on the costa, generally thin and scale-like. Third antennal segment often with a prominent dorsal tooth or long spine. Labella often with shiny sclerotized plates. 7

- Subepaulet with macrotrichia similar to those on the costa, often inflated. Dorsal tooth of third antennal segment usually short, rarely reaching beyond first annulus. Labella fleshy, without shiny sclerotized plates. . . . 16
7. Basal part of third antennal segment with a strong dorsal angle or minute tooth. 8
- Basal part of third antennal segment with a strong dorsal tooth or long slender spine. 12
8. Labella short, with shiny sclerotized plates. Vertexal tubercle and frontal calli absent in female, the first present in the male. Eyes brownish in life, without iridescent markings. Whole insect green or greenish in life. **Chlorotabanus**
(If frontal callus present, see *(Cryptotylus)*.)
At least basal frontal callus present. Eyes almost always with iridescent green or purple markings. 9
9. Labella with at least small shiny plates at base. Largely black insects with wings partly or largely black. Facial area and palpi swollen, and shiny, or first antennal segment greatly inflated. 10
- Labella wholly membranous. Tibiae normal, or only the fore pair inflated. Palpi and first antennal segment never as above. 11
10. Palpi very broad and flattened, the integument shiny. First antennal segment normal. Thorax and abdomen with bright green metallic scales, **Lepiselaga**
Palpi very slender, pollinose. First antennal segment greatly inflated. Upper branch of third vein turned abruptly forward, joining the costa closer to the second vein than to the wing apex. No green metallic scales. **Bolbodimyia**
11. First antennal segment more or less elongate, usually not less than $\frac{1}{2}$ the length of the third segment. Basal part of third segment usually obscurely annulate, sometimes with a blunt dorsal angle. Frontoclypeus usually shiny. Mesopleura pearly pollinose. Subcosta bare above, fifth vein spinose above. **Diachlorus**
First antennal segment short, less than $\frac{1}{4}$ length of third segment. Frontoclypeus rarely shiny. Mesopleura not pearly pollinose. Subcosta and fifth vein variable. (See also couplet 13). **Stenotabanus**
12. Third antennal segment with a strong angle or moderately long dorsal tooth which does not reach the first annulus. 13
- Third antennal segment with a long slender forward pointing spine, which reaches at least to the first terminal annulus. 14
13. No vertexal tubercle in either sex. Labella with shiny plates. Whole insect greenish in life, unicolorous. **Cryptotylus**
Vertexal tubercle present, at least in female. Labella without shiny plates, though sometimes small and compact. Whole insect not greenish, generally with contrasting markings. **Stenotabanus**
14. Eyes pilose under a hand lens. Labella small and compact, though not showing shiny plates. **Di cladocera**
Eyes bare under a hand lens. Labella showing shiny sclerotized plates. . . . 15
15. Stout, often hairy species; at least the fore tibiae more or less inflated and the hind tibiae with a fringe of long hairs. Antennae rather short and stubby. Palpi inflated. **Stibasoma**
Usually slender species. Tibiae neither inflated nor fringed. Antennae moderate to very long. Palpi slender to almost thread-like. **Dichelacera**
16. All tibiae greatly inflated. Palpi inflated and shiny. Basal portion of third antennal segment nearly 4 times as long as annulate portion. Whole insect shining blue black, only mesonotum greyish pollinose. Subepaulet with sparse macrotrichia in female, none in male. . . . **Selasoma**
Tibiae and palpi normal. Basal portion of third antennal segment seldom if ever twice as long as annulate portion. 17
17. At least 3 small but well marked ocelli present. Eyes bare, unicolorous in life. Scutellum and mesonotum with white or yellow hairs, abdomen black or brown, with various white markings. **Leucotabanus**
Without ocelli, with or without a vertexal tubercle. Eyes bare or pilose in one or both sexes. **Tabanus**

CHECK LIST OF THE TABANIDAE OF PANAMA

Subfamily Pangoniinae

Tribe Chrysopini

- Chrysops alleni* Fairch.
calogastra Schin.
chiriguensis Fairch.
incisa Macq.
melaena Hine
mexicana Kröb.
soror Kröb.
variegata (de Geer).

Tribe Pangoniini

- Esenbeckia chagresensis* Fairch.
illota osoroi Fairch.
prasiniventris (Macq.)
translucens (Macq.)
Fidena fulvosericata Kröb.
gracilis Kröb.
howardi Fairch.
isthmiae Fairch.
pyrausta (O. S.)
Pityocera festae Gig.-Tos.
Scione aureopygia Fairch.
claripennis Ricardo.
maculipennis (Schiner).

Subfamily Tabaninae

Tribe Dichelacerini

Dichelacera

- (*Dichelacera*) *analis* Hine
marginata Macq.
regina Fairch.
(*Psaldia*) *fulminea* (Hine)
(*Catachlorops*) *transposita* (Walk.)
Dicladocera badia Kröb.
Stibasoma apicimaculata Fairch.
chionostigma (O. S.)
fulvohirtum (Wied.)
theotaenia panamensis
Curran
venenata (O. S.)
Cryptotylus limonius (Townsend.)
luteoflavus (Bell.)
unicolor (Wied.)
Chlorotabanus inanis (Fab.)
mexicanus (Linn.)

Tribe Lepiselagini

- Lepiselaga crassipes* (Wied.)
Selasoma tibiale (Fab.)

Tribe Bolbodimyini

- Bolbodimyia erythrocephala* (Bigot)

Tribe Diachlorini

- Diachlorus curvipes* (Fab.)
jobbinsi Fairch.

Stenotabanus

- (*Stenotabanus*) *calvitiis* Fairch.
constabulorum
Fairch.

- fulvistriatus* (Hine)
joculator Fairch.
lerida Fairch.
maculifrons (Hine)
minusculus (Kröb)
pequeniensis
Fairch.
plenus (Hine)
(*Aegialomyia*) *changuinola*
Fairch.
patillensis Fairch.
(*Brachytabanus*) *longipennis* Kröb.

Tribe Tabanini

- Leucotabanus canithorax* Fairch.
flavinotum (Kröb.)
leucaspis (Wied.)

Tabanus

- (*Tabanus*) *bigoti* Bell.
erebus (O. S.)
ferrifer Walk.
globulicallosus Kröb.
importunus Wied.
nereus Fairch.
praepilatus Fairch.
rhizophorae Fairch.
rixator Fairch.
umbraticolus Fairch.
(*Bellardia*) *albicirculus* Hine
de-filippii Bell.
piraticus Fairch.
pseudoculus Fairch.
oculus Walk.
(*Hybomitra*) *quadripunctatus* Fab.
(*Neotabanus*) *angustivittis* Kröb.
amplifrons Kröb.
dunnii Fairch.
enanus Fairch.
funatipennis Kröb.
lineola var *carneus*
Bell.
var *plangens* Walk.
var *stenocephalus*
Hine
maya Beq.
unistriatus Hine
vittiger var *guate-*
malanus Hine
(*Philipotabanus*) *chrysothrix*
Fairch.
ebrius O. S.
elviae Fairch.
magnificus Kröb.
medius Kröb.
pallidinctus
Kröb.
ptero-graphicus
Fairch.

ADDENDA

Since the publication of some of the earlier papers in this series, certain information has come to hand which necessitates a few changes and additions. In the paper on *Dichelacera* and related genera (1940), further study of more material has convinced me that *Psalidia* End. and *Catachlorops* Lutz had best be considered merely as subgenera of *Dichelacera* Macq. As suggested in that paper (p. 693) *Tabanus fulmineus* Hine 1920 is nothing but a dark form of *ocellata* End. 1925 in which the subapical hyaline areas in the wing are almost obsolete, hence the species takes Hine's name. I have examined Hine's types in Columbus, Ohio. *Bellardia furcata* Bigot 1892 is an additional possible synonym for the species. On p. 689 of the same paper *Tabanus umbratus* Hine was suggested as a possible earlier name for *Di cladocera badia* Kröber. I have since seen Hine's type, and it is a quite distinct species of *Catachlorops*. Three additional females of *D. badia* have since been taken (El Valle, Coclé Prov., R. P.), and the wings are somewhat more strongly marked than shown in my figure, which was drawn from a long preserved specimen.

I have also seen specimens of *Tabanus venenatus* O. S. (1 ♀, El Volcan, Chiriqui, R. P., F. E. Lutz coll., and 1 ♂; 1 ♀, near Caracas, Venezuela). It appears to be best placed in the genus *Stibasoma* where it forms a member of a group including *T. planiventris* Wied and *T. viridiventris* Macq. These species are placed by Kröber in *Amphichlorops* Lutz, but the genotype of that genus, *T. flavus* Macq., appears to be much more closely related to *Catachlorops* than it does to the present group. If further study should indicate the desirability of separating this small group of greenish insects from *Stibasoma*, the name *Rhabdotylus* Lutz, with *T. planiventris* Wied. as type is available.

Additional locality records which extend the ranges of two species have also come to hand. *Dichelacera analis* Hine is represented by a female from Rio Curitingua, Nicaragua (Ivan Sanderson coll.), and *T. (Neotabanus) dunni* Fairch. by a female from the Pacific coast of the same country (W. H. W. Komp coll.).

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