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Revision of Nearctic Bibionidae Including Neotropical Plecia and Penthetria (Diptera)*

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ABSTRACT: A monographic study of all the known Nearctic species of the Dipterous family Bibionidae, including the Neotropical Plecia and Penthetria, bringing up to date the taxonomy and known data concerning these flies. Keys to the genera of the New World and keys to species as follows: *Penthetria*, New World species based upon males; *Plecia*, New World species based largely upon males; *Bibio*, keys to both males and females; *Bibiodes*, key to species; *Philia*, keys to both males and females. New species: *Penthetria appendicula, distincta; Bibio albipennis beameri, carolinus, townesi; Philia tingi.* Nomenclatorial changes: *Bibio carolinus*, n. n. for *B. afer* McAtee; *Bibio neojacobi*, n. n. for *B. jacobi* Hardy (nec Villeneuve); *Plecia confusa* Loew for *P. ruficollis* Fabr. 1805. Synonymy: *Dilophus* Meigen syn. of *Philia* Meigen; *Eupeitenus* Marquart syn. of *Penthetria* Meigen; *Penthera* Philippi syn. of *Plecia* Wied.; *Rhinoplecia* Bellardi syn. of *Plecia* Wied.; *Spodius* Loew syn. of *Hesperinus* Walker; *Bibio currani* Hardy syn. of *Bibio bryanti* Johnson; *Bibio currani* var. *nigrita* Curran syn. of *bryanti* var. *nigrita* Curran; *Bibio fumidus* Coquillett syn. of *inaequalis* Loew; *Bibio fuscipennis* Macquart syn. of *femoratus* Wied.; *Bibio hirtus* Loew syn. of *albipennis hirtus* Loew; *Bibio humeralis* Walker syn. of *xanthopus* Wied.?; *Bibio jacobi rufitibialis* Hardy syn. of *neojacobi rufitibialis* Hardy; *Bibio lacteipennis* Curran (nec Zett) syn. of *bryanti* Johnson; *Bibio lucens* Hardy syn. of *nigripilus* Loew; *Bibio lugens* Loew syn. of *xanthopus* Wied.; *Bibio macateei* James syn. of *xanthopus* Wied.; *Bibio obscurus* Loew syn. of *xanthopus* Wied.; *Bibio pallipes* Say syn. of *abbreviatus* Loew?; *Bibio scita* Walker syn. of *xanthopus* Wied.?; *Bibio senilis* Wulp syn. of *femoralis* Wied.; *Bibio signatus* Hardy syn. of *xanthopus palliatus* McAtee; *Bibio simplicis* Curran syn. of *inaequalis* Loew; *Bibio tenuipes* Coquillett syn. of *albipennis tenuipes* Coquillett; *Bibio thoracica* Say syn. of *rufithorax* Wied.; *Bibio variabilis* Loew syn. of *nervosus* Loew; *Penthetria costalis* Walker syn. of *nigerrima* (Bellardi); *Penthetria longipes* Loew syn. of *heteroptera* (Say); *Philia dimidcatus* Loew syn. of *spinipes* (Say); *Philia occipitalis* Coquillett syn. of *breviceps* (Loew); *Plecia flavimaculata* Hunter syn. of *flavimacula* Walker; *Plecia funebris* (Fabr.) syn. of *plagiata* Wied.?; *Plecia heteroptera* Macquart syn. of *plagiata* Wied.; *Plecia minor* Jaennicke syn. of *similis* Rondani; *Plecia rostrata* Bellardi syn. of *rostellata* Loew; *Plecia thoracicus* Say syn. of *spinipes* (Say); *Plecia velutina* Macquart syn. of *maura* Walker; *Plecia vittata* Bellardi syn. of *plagiata* Wied.

* Part II of the thesis submitted to the Department of Entomology and the Faculty of the Graduate School of the University of Kansas in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

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INTRODUCTION

SINCE McAtee's monograph of the Bibionidae[1] comparatively little attention has been given to this family in America. Doctor M. T. James, Doctor C. H. Curran, Mr. W. L. McAtee and the writer have made contributions to the literature since that time, a good many species have been added and many systematic changes have been made, so that a revisional study of this group is now badly needed. The foundation work on American Bibionidae was done in the early part of the nineteenth century by Say, Macquart, Loew, Walker, Fabricius, Wiedemann and Jaennicke and many of the types of the early species have been lost or are not at the disposal of American workers; consequently a good many of these have been difficult if not impossible to place. The earlier descriptions, for the most part, are very inadequate and do not present substantial specific characters. While making this study the writer has examined all of the available types of New World species and has had specimens compared with types in European museums whenever possible. The types of some species have not been located and accurate placement of these is questionable.

The Bibionidae are almost world wide in distribution, some genera such as *Plecia, Philia* and *Penthetria* are more abundant in the tropics and but poorly represented in temperate climates, while species of *Bibio* are numerous in temperate regions, and rather rare in the tropics. The genus *Bibiodes* is apparently confined to North America and *Bibionellus* is known only from Bolivia. The geographical regions of South and Central America contain very interesting species complexes, various species of the genus *Plecia* appear to be especially restricted in their distribution.

In position the Bibionidae stand between the Mycetophilidae and the Scatopsidae. For some time the latter were included in the family Bibionidae; this accounts for Malloch's *Forbesomyia* [2] being described as a Bibionidae. Enderline [3] separated the two families in 1912 and Melander [4] in 1916 applied the separation to the American species but neglected to treat *Forbesomyia,* which is distinctly a Scatopsidae. Alexander's *Cramptonomyia* [5] has been placed in the Pachyneuridae, along with its closest relative, the *Pachyneura.* The

1. 1921, Proc. U. S. Nat. Mus. 60, 1-27.
2. 1913-15, New genus of Bibionidae, Bull. Ill. State Lab. of Nat. Hist. Vol. X, pp. 233-5.
3. 1912, Zur Kenntnis der Zygophthalmen. Zoöl. Anz. XI, 261-82.
4. 1916, Bull 130, State Coll. Wash. Agri. Expt. Sta.
5. 1931, New genus of Bibionidae. Bull. Brooklyn Ento. Soc. Vol. XXVI, 7-11.

genus *Hesperinus* approaches rather closely some of the Mycetophilidae, but the presence of the complete second basal cell of the wing and the lack of well-developed spurs of the posterior tibiae places it as a primitive Bibionidae. The genus *Eupeitinus* Macquart [6] is obviously the same as *Penthetria* Meigen, as is discussed in the synonomy under *Penthetria*. The name *Eupeitinus* has been used by Van der Wulp [7] when he identified *Eupeitinus atra* Macquart from Wisconsin and by Walker [8] who referred two specimens to this species; this is obviously a synonym of *Penthetria heteroptera* (Say). Coquillett [9] reëstablished the genus, but McAtee [10] stated that the species used by Coquillett belonged to a new genus (*Axymia*) of Tipulidae. The genus *Axymia* has since been placed in the family Anisopodidae. Enderline [11] recently keyed the genera *Axymia* and *Pachyneura* as Bibionidae, but this is either an error or a difference in interpretation of the family limitations.

ECONOMIC IMPORTANCE

Several species of Bibionidae are considered major pests in various parts of Europe and the Far East, and perhaps further investigations of the life histories of our American species may prove them of more significance than normally considered. Because of the diversity of feeding habits of the larvae and their occurrence in such enormous numbers in local areas they may be potential pests of quite a wide range of crops. The larvae, for the most part, feed on decaying organic matter and upon roots of grasses and other plants and they most commonly occur in manures, in decaying leaves, in other plant materials and in grassy meadows and pasture lands. Many species appear to be omnivorous in feeding habits and may feed as scavengers, later changing to living plant tissues. It is probable that in many instances where the larvae have been found doing damage they have been carried to the plants in fertilizer. Severe infestations have been reported following heavy applications of manure or humus to the soil.

The information concerning the economic status of our American species is very meager and it is entirely speculative as to their actual importance. There have been numerous reports of their injurious

6. 1838, Dipt. Exot. Vol. I, pp. 84-5.
7. 1869. Tijds. V. Ent., Vol. 5, p. 80.
8. 1848, List of Dipt. in British Mus. 1.
9. 1909, Re-discovery of the Bibionid Genus Eupeitenus, Ent. News, V. XX, No. 3, p. 106.
10. 1931, Description of a New Genus of Nemocera (*Axymia furcata*). Proc. Ent. Soc. of Wash. Vol. 23, p. 49.
11. 1936, Dipt. Tierw. Mittel. VI.

activities and many observations have been recorded which suggest that they may be injurious. Damage to celery, wheat and potatoes has been reported from Alberta, Canada, by Strickland.[12] He states: "In 1914, when the celery was dug on October 24th, it was found that the soft pulp between the fibrovascular bundles of the stalks had been eaten away to an average depth of 1.5 mm. (1/16 inch). The work of the individual larva does not extend for more than about one-fourth inch between two of the vascular ridges. A large number of larvae swarm around infested plants, however, so that the whole of the portion of the plant which is below ground—some nine inches in length— may be affected. Towards the base of the plant, damage is most severe, and the excavations are often confluent, extending for two or three inches in length between the ridges, . . . Rarely the larvae burrow deeply into the pulp thus forming small tunnels, . . . The attacked areas turn brown during the late summer and autumn and are the seat of infection for various fungus diseases and small dipterous larvae, such as *Drosophila* which soon render the plants unfit for the market."

The damage to wheat in Canada occurred usually before the plants had sprouted above the ground, but sometimes the attacks occurred after they were well above the ground. Concerning the potato damage in Canada, Professor Strickland stated in correspondence that the larvae were found in very large numbers in a potato patch near Edmonton: "Insofar as I could judge the potatoes had been damaged by wire worms and the larvae had entered in this manner, but they were sufficiently numerous to entirely hollow out some of the tubers." Several reports of potato injury have been made, for instance, the writer has observed rather severe damage done by *Bibio melanopilosus* Hardy larvae in gardens at Spanish Fork, Utah.

There are occasional reports of injury in vegetable gardens, in grain fields and to forage crops, but most of these are entirely unconfirmed by experimental data. It is not at all uncommon to find the adults emerging in enormous numbers from fields of grain, potatoes, alfalfa, and other crops, but it is seldom that any actual damage is evident. To date, however, no checks have been set up to obtain a direct comparison between infested and noninfested plots.

In Europe Bibionidae are occasionally destructive to cereal and other crops. Experiments have shown that the larvae prefer barley, rye, sugar beets, and hops to all other plants. *Bibio hortulanus*

12. 1916, Agri. Gaz. Canada, 3, 600-603.

Linnaeus (Die Gartenhaarmücken) is no doubt the most important economic species. This fly has at various times been reported doing serious damage to crops in Germany, Denmark, Bavaria and Poland. Maier[13] in 1936 reported losses of ninety percent of the rye crops in fields near Berlin and other parts of Prussia due to this pest. He states that the injury usually occurs in spring just after the cereals have sprouted but sometimes occurs after the crop is several inches high. The *Bibio* larvae were found to work about two inches below the surface and attacked the stems below the first node. His observations showed that fields in high areas were most frequently attacked and in all cases were near woods. Muller[14] found that *B. hortulanus* females oviposited under crop remnants on beet and potato fields and the larvae fed on potato tubers, sugar beets, garden plants and especially germinating cereals. Sugar beets are subject to severe injury in Western Europe and the young shoots of the beet seedlings are sometimes entirely eaten.

Aside from these crops the larvae have been reported attacking the roots of oats, wheat (in many instances the damage being so severe that the fields had to be plowed up and resown), lettuce, seedling cabbage, grasses, young flowering plants, tomatoes, young conifers, seedling ash, larch, spruce and other nursery stock as well as forage crops, pasture lands and bowling greens. Morris[15] estimated that 32.5 percent of the insect population of the permanent pasture lands of Cheshire, England, were Bibionidae larvae; a population of almost 1,200,000 individuals per acre.

Adult Bibionidae have been reported doing damage to blooming fruit trees, but this seems rather absurd and there is no actual evidence to this effect. Field observations and study of their mouthparts seem to contradict this, and on the contrary, they are probably beneficial in distributing pollen. They are thought to feed upon juices of plants. Sabrosky[16] states, that he has observed *Bibio painteri* James feeding in association with the Chrysomelidae beetle, *Gastroidea cyanea* Melsh. He reports that "numerous Bibionids had their mouthparts appressed against the freshly cut edges of the leaves (cut by the beetles), apparently sucking the plant juices." This is one of the few observations that have been made of the actual feeding habits of the adults.

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13. 1936, Nachr. Bl. dtsch. Pfl. Sch. Dienst. 16, 10.
14. 1930, Ueber Die Lebensweise und Bekampfung der Gartenhaarmücken. Fortschr. Landw. 613.
15. 1920, Ann. Appl. Biol.
16. 1935, Jour. Kan. Ent. Soc. No. 4, 145-6.

CONTROL MEASURES

The best recommendations for prevention of Bibionid injury seem to be to remove all debris from the fields and to plow deeply in the fall and again before spring planting. When the eggs or larvae are turned under, the adults are unable to reach the surface and those that are turned up will die of exposure or be eaten by birds. In areas where infestation is common the use of artificial fertilizers instead of natural manures seems to be the most practical measure. Many recommendations for traps and use of chemical poisons and repellents have been made by various writers, but most of these would not be practical unless infestations were severe. Robek[17] recommends placing slices of potatoes on end in the soil as attractants for the larvae. After three or four days these slices are then removed and thrown into hot water. Other traps are by means of old roots buried in the soil and dug up early in March when the larvae are feeding on them. Vassiliev[18] states that the adults may be captured in great numbers in fermenting molasses. Molz[19] says that potato skins steeped in a one percent solution of arsenious acid give an attractive and effective poison bait. Goidanich[20] has reported that complete protection for seed potatoes is obtained by dipping them in a one percent suspension of lead arsenate in water with addition of thirty percent gypsum. Sudeikin[21] has recommended spraying infested land with a solution of chili saltpeter in early spring, and harrowing in autumn or early spring after spreading quicklime on the field. Hornik[22] reports that a 1-2 percent spray of tobacco extracts containing 7 percent nicotine sulphate applied to the soil at about 55 gallons to the acre killed 42-52 percent of the larvae as compared with a 6 percent death rate in untreated soil. Bovien[23] states that the most effective control measure is to dust the manures and leaves with chemicals such as arsenicals and lime. Abraham[24] reports that excellent results were obtained by using calcium cyanamide as a top dressing at the rate of 180 to 280 pounds per acre and that the young plants were unharmed. (This procedure certainly would not be practical under ordinary field conditions.)

17. 1930, Muchnice dubnova. Ochr. Rost. X, No. 3, 73-74.
18. 1915, Herald of Sugar Industry. Kiev. XVI, No. 22, 511.
19. 1920, Zeitschr. Angew. Entom. VII, 92-96.
20. 1933, Un. Nuovo metodo di difesa delle Patate da Semina Contro il. Italia Agric. LXX, No. 2, 183-186.
21. 1913, Pests of Agri. Plants in Gov't of Voronezh. pub. by Zemstvo, Voronezh.
22. 1931, Ochr. Rost., XI, No. 3-4, 115-120.
23. 1932, Tidsskv. Planteavl. XXXVIII, 488-498.
24. 1936, Nachr. Bl. dtsch. PflSchDienst, 16, No. 2, 22.

Theobald [25] states that vaporite and injections of carbon bisulphide into the soil gave a satisfactory kill. Maier [26] applied a top dressing of potash to drive the larvae to lower depths "but no definite estimate of the value of this measure could be made because of subsequent frosts." Boning [27] found that the larvae of *B. hortulanus* L. were very resistant to damp soils and water immersion, making the older recommendation of flooding lands an impractical control method. He states that the larvae survived a twenty-four-hour immersion in water without apparent injury. They died in two to three hours when exposed on a hard surface in the dry air but lived for two days in quite dry soil.

BIOLOGICAL CONTROL

Robins, pheasants, poultry, starlings, chaffinches and rooks et al. have been reported by various authors to feed upon Bibionidae, and insectivorous birds are no doubt instrumental in keeping them in check. Lyonet[28] reported finding a mite on a Bibionid and a filarial worm inside one. Keilin[29] reported a Gregarine, *Schneideria mucronata* Leger, occurring in the mid-gut and anterior caeca of Bibionid larvae together with a bacterial disease. Morris[30] reported a *Schneideria* in the posterior caecum of a *Philia febrilis* Linn. larva, and two cysts full of spores were found free in the body of the same larva. Another parasite, probably a *Glugea,* was found infesting the epithelium of the alimentary canal of *Bibio johannis* Linnaeus; such a *Microsporidian* was mentioned in Keilin's paper invading the epithelial cells of the mid-gut and caeca of Scatopsid larvae. Morris described the larva and pupa of a Phoridae (*Hypocera incrassata* Mg.) parasite of *Bibio marci* Linn. The Plantesygdromme i Danmark[31] states that *Bibio ferruginatus* Linn. and *B. hortulanus* Linn. had been causing injury to barley and that they suddenly disappeared; studies at this time showed up to 100 percent of the larvae to be parasitized by a Diapriid (*Spilomicrus sp.*). Malloch[32] mentions a hymenopterous parasite, but the host relationship was questionable. Adrianov[33] reports the larvae of *Agriotes* (Elateridae) killing *Bibio marci* L. larvae.

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25. 1909, Journ. of Board of Agri., Oct., 567.
26. 1936, Nachr. Bl. dtsch. PflSchDienst, 16, No. 1, 10.
27. 1931, Pra Kt. Bl. Pflanzenbau u. Pflanzenschutz, IX, No. 7-8, 145-160.
28. 1832, Recherches sur les Insects (Mem. Pesth.).
29. 1919, Ent. Monthly Mag. (3) v.; 92-96.
30. 1921, Bull. of Ento. Res. XII, 231.
31. 1932, Tidsskr. Planteavl. 39.
32. 1917, Bull. Ill. State Lab. of Nat. Hist. XII.
33. 1914, Report of Pests of Field Crops, pub. by the Zemstvo of Gov't of Kaluga, 67-88.

WING VENATION

The interpretation of the wing veins is the same as that used in Dorilaidae, however, the venation is much more generalized. The subcostal vein is weak in most genera and often ends before the wing margin. R_1 and $_2$ are fused and in higher genera R_3 and $_4$ are also apparently fused in the first branch of radius. The genera *Hesperinus* and *Penthetria* show the more primitive position of vein R_{3+4}, in a more horizontal position and forking off from the distad portion of the posterior branch of radius. *Penthetria appendicula* n. sp. possesses a stub of a vein just above the forking off from the main stem (fig. 122c) which probably represents a remnant of the base of R_3, suggesting that it originally forked off from vein R_2. In the genus *Plecia* R_{3+4} has moved cephalad and is more vertical in position, approaching vein R_{1+2}. In *Plecia incurvata* Hardy the tip of R_{3+4} fuses with R_{1+2} (fig. 147b). In higher genera vein R_{3+4} has apparently migrated basally and disappeared in the axil of the radial sector, fusing with R_{1+2} or dropping out entirely. This basad migration is easily traced from the Bibionidae through the Mycetophilidae and Blepharoceridae. Vein R_5 is simple and in the genus *Bibiodes* (fig. 205e) this vein joins with media for a short distance, obliterating the r-m crossvein. Media is three branched, the portion interpreted as m-cu crossvein by Comstock-Needham is now known as the base of M_{3+4} and the base of Cu_1 of Comstock-Needham is the m-cu crossvein. Cu_1 and first A are usually strong veins and often converge at their apices so that the cubital cell is narrowed in the wing margin.

FEMALE REPRODUCTIVE SYSTEM

The following is the information gathered by dissection of the reproductive system of *Philia orbatus* (Osten Sacken). The gravid females have the entire abdomen filled with eggs and each ovary contains two to several hundred eggs. All of the eggs are of approximately the same size and are deposited in one mass at a single oviposition. From ventral view the eggs are usually in two main rows, from dorsal view most of the eggs are seen in end view and are arranged in several transverse rows, those in the posterior portion of the ovaries are usually lying flat and pointed toward the oviduct. No distinct ovarioles are visible and the lateral oviducts are very short with the common oviduct extending anteriorly about one-third the length of the ovaries. From all appearance the eggs are emptied directly into the common oviduct which opens into the

genital cavity of the eighth segment. The spermathecae are triple, conspicuous, large and black and branch off from the ventral portion of the median oviduct posterior to the ovaries. The accessory glands are distinctively shaped, green in color and attached to the ventral side of the common oviduct (fig. 110a). The eggs in about the middle of the ovaries enter the oviduct first, small end of egg pointed posteriorly, then the others are released in a sequence according to their natural position.

OVIPOSITION

Copulation usually takes place about twelve hours after emergence and the gravid female soon begins looking for a suitable place to oviposit; she flies very slowly with some difficulty, usually spending much of her time near the ground in grasses and weeds. The average length of life appears to be about three days, the male usually dies shortly after copulation and the female after oviposition. In studying oviposition habits gravid females are confined in cages or cloth covered glass jars in which has been placed a few inches of moist earth. The female then selects a suitable spot and begins digging out a burrow by means of the fossorial spurs of her front tibiae. The tarsi fold back and the fly digs by moving the front legs up and down in front of her head, scraping out the earth until the hole is large enough for her body, then she squeezes into it and gradually works downward to a depth of one to four inches. At the bottom of this burrow the fly enlarges the chamber and deposits her egg mass. After oviposition the female appears entirely exhausted and soon dies, usually never leaving the burrow.

EGGS

Each egg mass ordinarily contains two to three hundred eggs, these are cylindrical, oblong, rounded on each end and larger on one end. When first laid the eggs are pale whitish to faintly yellowish, but slowly turn darker, especially at the ends, as they grow older. The eggs are faintly shining and microscopically sculptured, being covered with very minute projections. The sculpturing of the chorion may show specific characteristics if studied in detail. The eggs are .50 to .90 mm. in length, and .10 to .20 mm. in width, depending upon the species. Under laboratory conditions the eggs of *Bibio* hatch in twenty to forty days, depending, of course, upon the season. Most all of the eggs hatch at approximately the same time and the larvae develop at an even rate, accounting for the sudden large swarms of adult flies which appear in the spring. The length of the incubation period varies with the species and with the ecological conditions.

LARVAE

The earliest description of a larva and pupa of *Bibio* was that of Reaumur.[34] This early work figures and describes the larvae and pupa of *Bibio marci* Linnaeus. "St. Marks fly." The earliest work encountered in America is the account by Kellogg, 1893, Trans. Kan. Acad. Sci. which discusses the larvae and pupae of *B. tristis* Williston and the account by Needham[35] of *Bibio fraternus* Loew, in which he describes and figures the larva and pupa. The paper by Girault[36] is also commendable and gives some very valuable observations on the life history of the March fly. The contributions of H. M. Morris[37, 38, 39] on the immature stages of English Bibionidae are by far the best works on this subject.

The first instar larvae of *Bibio* vary in length from 1.3 mm. to 1.8 mm. The head is comparatively large and more heavily sclerotized than the rest of the body. The trunk is divided into twelve distinct segments, each segment, as well as the head, bearing numerous long setae on all first instar *Bibio* that have been recorded. The first instar larvae of *Philia* differ from *Bibio* in having only short setae. The larvae are pale yellowish in color, with the contents of the alimentary canal usually plainly visible through the integument as a dark median line. The body is cylindrical in shape and usually slightly curved. From all observations that have been made the first instar larvae bear but a single pair of spiracles, these are situated on the twelfth segment of the trunk. *Bibio johannis* Linnaeus required nineteen days, under laboratory conditions, before moulting to the second stage according to Morris.[40]

With the first moult the larvae lose all of the long setae on the body and develop characteristic microscopic scalelike spicules on the cuticula. The head of the second instar is not so proportionately large as in the first. The full grown larvae vary from six to twenty-eight millimeters in length, according to the species. The head is protruded, barely longer than wide and shining brown, darker, more strongly sclerotized than the trunk. The anterior portion of the head is darker in color and bears several strong setae, the hind portion is lighter brown and bare, capable of being retracted into the first segment of the trunk. Eyes are lacking and the antennae are

34. 1741, Memoires des Insects, 5; 70.
35. 1902, American Naturalist, vol. XXXVI, 181-185.
36. 1905, Can. Ent. 37; 322.
37. 1917, Ann. of Applied Bio. IV, 91-114.
38. 1921, Bull. of Ento. Research, XII, 221-232.
39. 1922, Bull. of Ento. Research, XIII, 189-195.
40. 1917, Ann. Applied Bio. IV, 94.

small and setiferous. The mandibles are strong and heavily sclerotized; the number of the teeth appears to vary in different species and the shape of these structures may prove of taxonomic importance. The inner surface of each mandible possesses a characteristic clump of fine long hairs near its median portion (fig. 111a). The maxillae are short and stout and bear numerous strong spinelike setae at the apices of the palpi and the endite lobes of stipes (fig. 111b). The labium is quite characteristic in different species, the mentum is usually about one and one-half times the width of the submentum, slightly concave on apical margin and lighter in color, less heavily sclerotized than the submentum. The submentum is rather dark in color with a lighter median area and a small clump of short spines in the distal portion of this pale area. The apex of the submentum is slightly to deeply concave, reaching almost to the distal margin of the mentum in some species and much beyond in others. The labrum is divided into two lobes by a median indentation at the apex, the distal portion is armed with short, stout teethlike spines while the under portion is thickly covered with short closely set setae.

The body of the mature larva is subcylindrical, slightly flattened dorsoventrally with a slight downward curvature of the body as seen from lateral view. The trunk is distinctly twelve segmented, the first segment is the longest and sometimes may appear partially divided, but as Morris has pointed out, the imaginal disks prove it to be a single segment. The body possesses ten pairs of spiracles, a pair being located on all segments of the trunk except two and eleven. The spiracles are usually darker in color than the rest of the integument and may be partially protruded. The posterior pair are two to four times as large as any of the other spiracles, they are more dorsal in position and appear to have two or more openings. The other spiracles are laterally placed and each has just a single opening. The first pair is located toward the posterior margin of the segment and is larger than the others (except twelve), while those of segments three to ten tend to be situated nearer the anterior margins. The integument is covered with characteristic rows of spines and processes as well as microscopic scalelike spicules. These spicules are of varying sizes and shapes and from the little investigation that this phase has received it would appear that these may represent specific characters for distinguishing the larvae. The spicules differ chiefly in the number and position of the short, sharp pointed spines which they bear, or as in the case of *Bibio lacteipen-*

nis Zett. (fig. 112a) the lack of spines. In other species that have been studied the spicules have from one to seven or eight pointed processes (figs. 111c-120a). On most any larval slide it is possible to pick out spicules bearing different numbers of spines but the greater share of them tend to fit a specific pattern. Mr. P. C. Ting, San Francisco, Cal., has made investigations along this line and was the first to call it to the attention of the writer.

Concerning the digestive system of *Bibio marci* Linn. Morris states: "The alimentary canal takes an almost straight course through the body, but has a loop near the posterior end, in the hind gut. The largest part of the alimentary canal is the mesenteron, which bears three large caeca at its anterior end, one lying on each side and the third, which is the largest, places ventrally. The four malpighian tubes join the alimentary canal at the junction of the mesenteron and hind gut, entering the canal by a short common duct on the dorsal side. There is no posterior caecum such as is found in connection with the alimentary canal of *Bibio johannis*."

PUPA

The pupae are rather long and slender, slightly tapering toward the posterior portion, the cuticle is pale white, smooth and transparent in the newly formed pupae, the darker parts of the head and thorax showing plainly through the integument; the abdomen remains pale in color until after emergence. The females are usually larger in size and may be distinguished from the males by the small eyes and more abruptly narrowed anterior end. The large, slightly protruded eyes of the male will characterize this sex as in the adults. The anterior portion of the pupal case is often armed with small projections. The head is pressed down flat against the anterior part of the thorax and the short antennae are extended laterally over the eyes. The thorax is short and the legs and wing cases are closely pressed together on the venter. When the adult emerges the mesonotum splits down the longitudinal ridge at the middle of the dorsum allowing the fly to escape. The pupal stage requires approximately two weeks for the species which have been studied.

MALE GENITALIA

The genital structures of the male Bibionidae are very important taxonomically, especially in genera other than *Bibio*. In the *Plecia*, *Penthetria* and *Philia* the genital characters serve as the only criteria for separating many of the species. The characters that are most useful in the systematics of the family are: The depth and shape

of the cleft on the posterior margin of the ninth sternum or the general shape of the entire sclerite; the lateral margins may be strongly or weakly produced and the posterior margin is sometimes strongly developed. The degree of concavity or convexity of the posterior and anterior margins of the ninth tergum and the relationship of the length of sclerite to its width. The shape and development of the harpagones is usually distinctive for the species and all degrees of specialization are seen in these structures throughout the family. In the genus *Philia* the exact shapes of the harpagones are sometimes difficult to discern, giving rise to various interpretations according to the angle from which they are viewed. It is especially necessary in the latter genus to relax the genitalia before the true relationship of the parts can be observed. The accessory structures of the aedeagus and the shape of the cerci are often of importance in distinguishing species.

FOSSIL BIBIONIDAE

The chances for Diptera of this kind being preserved would be very slight, their comparatively soft integument and the dissolution of chitin in the presence of moisture would prevent the fossilization of more than a representation of the forms. Because of this it is difficult to estimate the probable abundance on a basis of the specimens that have been fossilized. *Protoplecia* Handlirsch dates back to upper Liassic (Middle Jurassic) and represents the oldest known member of this family. There is some question as to whether or not this is properly placed and it possibly belongs to some related family and does not represent a primitive Bibionidae. Only a single species, *Bibio sereri* Massalongo is listed by Handlirsch [41] from Eocene deposits, so these flies were either rare at this time or conditions were not favorable for fossilization. The Bibionidae apparently enjoyed their heyday in the middle and late Tertiary period. From the fossil evidence they must have been one of the most numerous groups of insects at that time. Bibionidae remains are very abundant in most Oligocene and Miocene deposits although they are not at all common in the Baltic Amber. These flies are among the most characteristic fossils of the Florissant shales and Creed formations of Colorado. Most of the fossil Bibionidae belong in present-day genera and most of the species appear to approach our modern forms very closely, some may even be identical.

Freak individuals are rather common in the Bibionidae. It is not

41. 1908, Die Fossilen Insekten; 961.

at all unusual to find malformations of various appendages, especially the legs, or to find distortions of the head and body. Many specimens have been observed wherein certain leg joints have been atrophied, strongly bowed, or entirely lacking. James [42] reports finding a gynandromorphic specimen of *Bibio monstri* James. Wheeler [43] records a specimen of *Philia tibialis* (Loew) with an antenniform appendage branching from the fore coxa.

SYSTEMATIC TREATMENT

The Bibionidae are readily distinguished from other Nematocera by the absence of the discal cell in the wing, the presence of the two basal cells, and the forking of the radial-sector at or beyond the m-cu crossvein. Ocelli present on a well developed prominence. Antennae (except in *Hesperinus*) rather short, with rounded compact segments, situated below the compound eyes close to the oral margin. Spurs of front tibiae of *Bibio, Bibiodes* and *Bibionellus* strongly developed. The front tibiae of *Philia* are ornamented with two or more sets of spines.

KEY TO THE GENERA OF THE NEW WORLD

1. Third longitudinal vein (main branch of radius) furcate 2
   Third longitudinal vein not furcate (posterior branch of radius simple); front tibiae with large apical spurs or two or more sets of spines 4
2. Antennae very elongate, third segment as long or longer than the next two segments. *Hesperinus* Walker, p. 382
   (Europe, North and South America)
   Antennae more robust, third segment not greatly lengthened 3
3. Vein R_{3+4} short, almost vertical, male harpagones usually small and vertical. *Plecia* Wiedemann, p. 390
   (Cosmopolitan)
   Vein R_{3+4} rather elongate, almost horizontal, harpagones large and lateral *Penthetria* Meigen, p. 384
   (probably world wide)
4. Anterior tibiae produced apically to form two spurs 5
   Anterior tibiae not produced at apices, but with two or more series of spines (fig. 219a) ..... *Philia* Meigen, p. 497
   (Cosmopolitan)
5. Third and fourth longitudinal veins coalesced for a short distance, obliterating r-m crossvein (fig. 205c) ..... *Bibiodes* Coquillett, p. 494
   (North America)
   Third and fourth veins not coalesced, joined by the radio-medial crossvein (fig. 201a) 6
6. Front tibiae each with a conspicuous blunt tubercle in the middle beneath; costa greatly produced, reaching about halfway from R_5 to M_1 .... *Bibionellus* Edwards, p. 496
   (South America)
   Front tibiae without the mid-tubercles; costa ending at the tip of R_5. *Bibio* Latreille, p. 444

42. 1936, Some New Western Bibionidae. Am. Mus. Nov. No. 832.
43. 1896, Arch. f. Entw. Mech. d. Org., V. 3, 26-108, pl. 16.

Hesperinus Walker

Hesperinus Walker, 1848, List of spec. of Dipt. Ins. in Coll. Brit. Mus. 1, 81.
Spodius Loew, 1858, Berl. Ent. Zeitschr. II, 101.

This is the most primitive genus of present-day Bibionidae, it is closely related to the Mycetophilidae in many respects. It is easily distinguished from all other genera in the family by its elongate antennae and the unusual developments of the male harpagones. The wing venation is very similar to *Plecia,* however, the cubital cell is more consistently open wide in the wing margin, vein Cu_1 scarcely curving downward at its apex.

In the Mycetophilidae the genera *Hesperodes* and *Platyura* are related to *Hesperinus.*

Genotype: *Hesperinus brevifrons* Walker.

Hesperinus brevifrons Walker

(Plate XXIX, figs. 121 a-e)

Hesperinus brevifrons Walker, 1848, List of the specimens of Dipterous Insects in the collection of the British Museum. I, 81.

MALE.—Rather slender Bibionidae with long stiltlike legs and elongate antennae. Head and body brown to black with gray pruinose markings. Pile of the body very sparse, short and yellow, the thorax being practically devoid of pile, that of the abdomen more dense posteriorly. Palpi, trochanters, coxae, femora and stems of halteres ochraceous. The antennae, rest of the legs and knobs of halteres pale to dark brown. Antennae twelve segmented, first two segments (scape and pedicel) short; third segment longer than the next two; with rather dense pale pubescence and stronger black hairs intermixed, the latter usually arranged in whirls. Wings dusky hyaline, veins brownish-black, stigma lighter in color and more grayish, distance between anterior crossvein and fork of fourth vein twice the length of the crossvein (fig. 121a). *Genitalia:* This is one of the most interesting and distinctive structures (in Bibionidae) that has been examined by the writer. The unusual development of the clasping structures is really remarkable and no doubt is a generic as well as a specific character. The harpagones are developed into two large lateral arms (figs. 121c-d), the dorsal arm is developed into two projections; one is longer, more flattened laterally and the other is short and developed only about half way up the dorsal lobe on the underside. The cleft on hind margin of ninth sternum is U-shaped, narrowing down considerably at the base, extending nearly one third the length of the segment (fig. 121e). The ninth

tergum is gently concave on hind margin (fig. 121b). The entire genitalia is rather densely haired, these hairs are larger, more spine-like on the distal portion of the ninth sternum. The ninth segment is very noticeably swollen, being much larger than the other segments of the abdomen.

FEMALE.—Differs from the male in having the antennae much shorter but other characters are constant for both sexes, except the genital characters and the enlarging of the male abdomen.

Type locality: St. Martin's Falls, Hudson Bay.

Type in the British Museum.

McAtee reports specimens from Current Creek Valley, Uintah National Forest, Utah. As far as is known by the writer this is the only report for the state. Specimens have been examined from Lake City, Colo., 6-29-37 (C. L. Johnston); Alberta (Strickland), Alaska and New Hampshire.

Hesperinus flagellaria Garrett

Hesperinus flagellaria Garrett, 1925, Sixty-one New Diptera, Cranbrook Courier Print, p. 11.

The writer is unable to distinguish *flagellaria* from *brevifrons* Walker and the two are probably synonymous.

Following is the original description:

"MALE.—Dark brown except the sides of the back of the head, between the dorsal vitta, which are pale dull brown; antennae long, about as long as the abdomen, all yellow brown, 12 segmented, the scape short, cup shaped flagellum cylindrical, segment one very long, about 9 times the length of scape two, flag two less than half one, the rest gradually diminishing to the tip, each with two or three bristly hairs; palpi yellow and large; segment one small; two about equals four, and three half of their length. Wings hyaline, veins brown, stigma black. Hypopygium constructed much as in genus Bibio but larger, eyes bare, tibial spurs very small, legs long. Female similar but the antennae are shorter, only about as long as the thorax; flagellum one about 5 times scape two; flag two less than half of one, segment 8, 9, 10, 11 about as broad as long; 5 and 6 twice as long as broad. Palpi segment one very small, and three nearly equals the length of two which is equal to four."

Type locality: Cranbrook, B. C., Canada.

Type in Garrett Collection.

Penthetria Meigen

Penthetria Meigen, 1803, Illiger's Magaz. II, 264.
Eupeitenus Macquart, 1838, Dipt. Exot. Nouv. ou peu Connus I, 85.
Plecia spp. of many authors refer to this genus.

Entirely opaque black species, usually rather thickly covered with black hair, especially on sternopleurae, hypopleurae, upper portions of propleurae, legs and abdomen. Rostrum not greatly produced, much shorter than the length of antennae. Antennae eleven to twelve segmented. Legs long and slender, posterior tarsal subsegments somewhat swollen in the males of most species. Vein R_{3+4} horizontal or nearly so in position and elongate compared to *Plecia*, Harpagones lateral in position, rather large and conspicuous; for the most part the genital structures do not show great differentiation from a typical pattern.

The species of the genus are very much alike superficially and the genital structures must be relied upon for most specific determinations.

KEY TO NEW WORLD PENTHETRIA

(Based upon males)

1. Hind margin of ninth tergum straight or nearly so..(Mexico) *nigerrima* (Bellardi), p. 388
   Hind margin of ninth distinctly concave or deeply cleft..... 2
2. Ninth tergum deeply cleft on hind margin, the cleft extending at least two-thirds the length of the sclerite..... 3
   Cleft of ninth tergum not extending over one-third the length of the sclerite..... 4
3. Vein R_{3+4} normal, without an appendix at base; ninth tergum almost completely divided into two plates by the deep clefts of the posterior and anterior margins, only a narrow strip of sclerite joins the lateral lobes (fig. 123a); harpagones rather short and broad (fig. 123b).....(Guatemala) *distincta* n. sp., p. 385
   Vein R_{3+4} with an appendix near base; ninth tergum not so deeply cleft (fig. 122b); harpagones slender, more elongate (fig. 122a).....(Costa Rica) *appendicula* n. sp., p. 384
4. Cleft of ninth tergum broadly V-shaped, margins straight (fig. 125a).
   (Mexico) *mexicana* (Hardy), p. 387
   Cleft U-shaped, margins rounding..... 5
5. Harpagones slender, acutely pointed; posterior median margin of ninth sternum developed into a pair of strong lobes; sclerotized portion above aedeagus with a small niche in middle (fig. 127a).....(South America) *nigrita* Perty, p. 389
   Harpagones more broad, square tipped; posterior median margins of ninth not produced; sclerotized portion above aedeagus terminating in a small blunt point in the middle (fig. 124a).....(North America) *heteroptera* (Say), p. 386

Penthetria appendicula n. sp.

(Plate XXIX, figs. 122a-c)

This species differs from all known New World *Penthetria* in being more densely haired; vein R_{3+4} with an appendix at base; ninth tergum deeply cleft on hind margin and harpagones slender.

Entirely black, densely pilose species. Antennae eleven to twelve segmented, rostrum not greatly produced. Mesonotum rather thickly covered with long black hairs, scutellum bare or nearly so. Hum-

eral ridges very faintly yellowish tinged; propleurae each with a very dense patch of black hairs on upper portion; sternopleurae and hypopleurae thickly covered with long, thin hairs; sternopleurae finely rugulose and covered with fine yellow pubescence in addition to the long black hairs. All tarsi slender, posterior pair only slightly swollen, hind basitarsi almost equal in length to the next three subsegments of tarsi. *Wings:* Lightly yellow-brown fumose, vein R_{3+4} with a strong appendix at its base (fig. 122c); stigma slightly darker than the wing membrane; the third, fourth and fifth costal sections are about equal in length. Fork of first and second medial veins situated well beyond the r-m crossvein; base of M_{3+4} about half the length of the m-cu crossvein; cubital cell slightly narrowed in the wing margin by the downward curve of vein Cu_1. *Genitalia:* The ninth tergum is about twice as wide as long and deeply cleft, about two-thirds its length on hind margin (fig. 122b). Ninth sternum moderately concave in middle but with a membranous apex which makes the hind margin almost straight. Harpagones slender and rather elongate (fig. 122a).

Length: body, 8 mm.; wings, 9-9.4 mm.

FEMALE.—Aside from sexual characters the female differs in consistently having twelve segments in the antennae and the mesonotum less conspicuously haired.

Holotype male: Volcan Poas, Costa Rica, April 21, 1916 (A. Alfaro). Allotype female: La Carpentera, Costa Rica, April, 1924 (H. W. Atkinson). One paratype male, same data as holotype; two paratypes, one male, one female, same locality and date as allotype (W. M. Mann) and six paratype males, San Cristobal, Costa Rica, 5,400 ft., May 27, 1928 (F. G. Wallace).

Holotype, allotype and two paratypes returned to United States National Museum; three paratypes returned to the University of Minnesota, the rest retained in the Snow Entomological Collection.

Penthetria distincta n. sp.

(Plate XXIX, figs. 123a-b)

This species is related to *appendicula* Hardy but is distinguished by its dark fumose wings, lack of appendix at base of fourth vein, very deeply concave posterior and anterior margins of ninth tergum and shorter more broad harpagones; species not so thickly haired.

Antennae twelve segmented, wings brown fumose, stigma concolorous with the membrane; cubital cell widely open in wing margin, vein Cu_1 scarcely curved downward at its tip. All tarsi slender,

subsegments of hind tarsi but slightly swollen. *Male genitalia:* The ninth tergum is about twice as wide as long, densely haired and almost completely divided into two plates by the clefts of the anterior and posterior margins, only a narrow bridge of sclerite joins these two lateral plates (fig. 123a). The ninth sternum is moderately concave, the posterior lateral margins are rather strongly produced; these lobes are slightly undulated on outside margins. Harpagones broad, rounding apically (fig. 123b).

Length: body, 7-8.7 mm.; wings, 8-9.4 mm.

Female fits the above description except for sexual characters; the hind tarsi are, however, more slender, not at all swollen.

Holotype male: Antigua, Guatemala, June 24, 1923 (E. G. Smyth). Allotype female and five paratypes, four males, one female, same data as type (Smyth and D. G. Eisen); eleven paratype males, Guatemala City, Guat., May 2, 1923 (E. G. Smyth), two males, Agama, Guatemala (D. C. Eisen) and one male, Volcan Sta Maria, Guatemala (Schaus and Barnes).

Holotype, allotype and ten paratypes returned to the United States National Museum, others retained in Snow Entomological Collection.

Penthetria heteroptera (Say)

(Plate XXIX, figs. 124a-d)

Bibio heteroptera Say, 1823, Jour, Acad. Nat. Sci. Phil. III, 78.
Penthetria atra Macquart, 1834, Hist. Nat. des. Ins. vol. I, 175.
Eupeitenus ater Macquart, 1838, Dipt. Exot. Nouv. ou peu Connus. I, 85.
Plecia longipes Loew, 1858, Berl. Ent. Zeitsch. 2, 109-110.

E. ater Macquart was taken from a cabinet name of Serville but the original description was published by Macquart. There can be little doubt that this is the same genus and species which he had previously described as *Penthetria atra.*

P. heteroptera is distinguished from related species by the concave hind margin of the ninth tergum and the broad heavily sclerotized bridge behind the aedeagus.

MALE.—Opaque black, rather thickly black haired species. *Head:* Ocellar triangle very prominent; compound eyes divided into an upper and lower portion by a transverse depression near lower one-third to one-fourth of the eye. Antennae eleven segmented, including the knoblike tip segment. Rostrum not greatly produced, folded beneath the head in normal position. Mesonotum more sparsely haired, abdomen very densely pilose. Posterior femora and tibiae somewhat clavate, hind basitarsi slightly swollen and almost equal to next three subsegments of tarsi in length. Wings smoky brownish

to black, stigma black. The distance between the r-m crossvein and the fork of M_1 and M_2 is usually about equal to the length of Rs from r-m crossvein to fork of main branch of radius, these lengths may vary a good deal. Vein Cu_1 curved downward moderately toward its apex, somewhat narrowing the cubital cell. *Genitalia:* Thickly black pilose, ninth sternum cleft about one third its length on hind margin with a pair of moderate swellings medianly and a shallow broadly U-shaped cleft between these; these areas are developed into rather strong lobes in *nigrita* Perty. Harpagones slender and gently curved inward, somewhat square at apices, with a small acute point above. The genital chamber just above aedeagus is sclerotized and distinctive in shape, terminating in a blunt point medianly (fig. 124a). The ninth tergum is nearly twice as wide as long, with a broad U-shaped concavity on hind margin (fig. 124c).

Length: body and wings, 7-7.4 mm.

The female is more sparsely haired and specimens usually show more variation in wing venation. *Female genitalia:* The eighth sternum is completely divided into two plates by a narrow median membranous area, the posterior margin of these plates is developed into a large rounding lobe (fig. 124b). The hind margin of ninth tergum is straight or nearly so, the anterior margin is very deeply cleft so that only a very narrow strip of sclerite joins the two lateral lobes. Cerci elongated (fig. 124d); entire genitalia densely haired.

Type locality: Maryland.

Type probably lost.

This species is widely distributed in the Nearctic region north of Mexico; it has been identified from the following states and Canadian provinces: Colorado, Florida, Georgia, Iowa, Kansas, Louisiana, Maine, Manitoba, Maryland, Massachusetts, Michigan, Missouri, Nebraska, New York, North Carolina, Ontario, Ohio, Pennsylvania, Quebec, South Carolina and South Dakota.

Penthetria mexicana (Hardy)

(Plate XXX, figs. 125a-b)

Plecia mexicanus Hardy, 1937, Proc. Utah Acad. Sci. XIV, 199.

This species is related to *nigerrima* (Bellardi) and to *heteroptera* (Say), it is distinguished from the first by the broadly V-shaped cleft on the hind margin of ninth tergum (fig. 125a), and by the lack of development of the hind margin of ninth sternum. It is distinguished from *heteroptera* (Say) by shape of the sclerotized portion above the aedeagus and by the broadly rounding harpagones.

Antennae ten segmented in male, pleurae and sternum of thorax

reddish black in ground color, metanotum faintly tinged on the margins. Humeral ridges yellowish brown. In all specimens examined the cubital cell has been closed, or nearly so at its apex. The posterior tarsal subsegments are slightly swollen but not so much as in *nigerrima*. *Male genitalia:* Ninth tergum much wider than long, the V-shaped cleft extending one-fourth to one-third the length of the segment. Ninth sternum moderately concave medianly, hind margin without strong median lobes. Harpagones broad, gently curved and rounding apically (fig. 125b). Sclerotized portion above aedeagus shaped somewhat as in *nigerrima*.

Length: body, 7.2-7.6 mm.; wings, 7.4-7.8 mm.

Type locality: Guadalajara, Mexico.

Type in collection of H. J. Reinhard.

The writer has identified a series of toptoypes and specimens from Tamasopa, San Luis Potosi, Mexico, Dec. 4, 1909 (F. C. Bishopp).

Penthetria nigerrima (Bellardi)

(Plate XXX, figs. 126a-b)

Plecia nigerrima Bellardi, 1859, Saggio di Dit. Mes. I, 14-15.

Plecia costalis Walker (nec Wiedemann), 1858, Trans. Ent. Soc. Lond. V., 422. (Syn. by Edwards).

This species is related to *heteroptera* (Say) and is most conveniently separated by use of genital characters. The wings are most consistently yellow-brown fumose instead of blackish; the humeral ridges are usually yellowish tinged and the hind metatarsi more distinctly swollen, about equal in width to the tip of tibiae. The almost straight posterior margin of ninth tergum, the shape of the harpagones, ninth sternum and sclerotized portion above aedeagus will distinguish it.

Male genitalia: Ninth tergum wider than long, hind margin straight or nearly so (fig. 126b). Posterior median margin of ninth sternum developed into a pair of moderate lobes, harpagones broad and rounded apically. Sclerotized portion above aedeagus characteristically developed into a pair of slender lateral wings (fig. 126a).

The female genital structures compare with *heteroptera* (Say) except that the ninth tergum is divided into two lateral plates, not joined by a narrow strip of sclerite.

Length: body, 6.7-8 mm.; wings, 7.4-9.2 mm.

Type locality: Orizaba, Mexico.

Type at the Paris Museum.

The writer has studied topotypic specimens, also specimens from the following localities in Mexico: Mexico City (O. W. Barrett); Cuautla, June 3, 1922 (E. G. Smyth); Coapa D. F., Aug. 29, 1922 (E. G. Smyth); Hocomilco, April (W. M. Mann); Envir de Guadalajara, Estat de Jalisco, 1901 (M. Diguet); Cordoba, Dec. 17-Jan. 15, 1907-1908 (Fred'k. Knab).

Penthetria nigrita (Perty)

(Plate XXX, figs. 127a-b)

Penthetria nigrita Perty, 1830, Delectus Anim. Articularotum.

The description of *nigrita* is insufficient to positively identify the species, however, if Perty actually had a Penthetria before him there can be little doubt but that it was the common South American species.

Following is the original description:

"Aterrima, opaca; alis infuscatis, venis obscurioribus. Lg. 3'". Latit. alar. expans. 10¼'".

"Habitat in Provincia Piauhionsi.

"Magnitudine et statura *Penthetriae holosericeae* Meig. cui valde affinis videtur, quam vero ipsam non vidi. Toto atra, opaca, abdominis dorso parum nitidulo. Alae praesertim ad basin, ubi venae concurrunt, infuscatae, venis et membrana juxta vennae obscurioribus. Halteres et pedes atri."

This species is inseparable from the North American *heteroptera* (Say) except by genital characters and geographic distribution. The median lobes of the ninth sternum are more strongly produced, the median cleft more narrowly U-shaped and deeper and the harpagones are more slender and acute at their apices; the sclerotized portion behind the aedeagus has a small incision at apex (fig. 127a). The ninth tergum is wider than long with a broadly U-shaped concavity on hind margin, extending about one-third its length (fig. 127b).

Length of male: body, 7.4-8 mm.; wings, 9-9.4 mm.

Length of female: body, 8-8.7 mm.; wings, 7.4-10 mm.

Type located in the Zoölogical Museum at Munich.

The writer has identified this species from the following localities in South and Central America:

Bolivia: Germain (Lichtwardt).

Brazil: Sao Paulo.

Colombia: ac. 33501 (Felipe Ovalle Q.); Bogota, March 25-June 21, 1934-1937 (Apolinar, Bequaert, Peterson, Osorro); Quatiquia

R., Villaviceneio, Nov.-Dec. 1914 (Dr. A. Balfour); Guarini (Peterson).

Ecuador: El Angel, 3000 ft., 1903 (P. Rivet); Minza Chica, V. Tungurahua, 3750 M., 2-14-IV, 1939 (F. M. Brown); Pichincha Prov., 3000 M., XI-5, 1938 (F. M. Brown); Uyambicho, XI-18, 1938, 2700 M. (F. M. Brown); Tungurahua, Banos 1600-1900 M. (W. M. MacIntyre).

Peru: Huacapistana, Rio Tarma, 1-2, June, 1920 (Cornell University Exp. Lot 569).

Venezuela: El Junquito, D. F. Jan. 15, 1939 (G. V. Berthier).

Plecia Wiedemann

Plecia Wiedemann, 1828, Aussereurop, Zweifl. Ins., 1, 72.
Rhinoplecia Bellardi, 1859, Mem. Roy. Ac. Sci. Torino (2), 19, 216.
Penthera Philippi, 1865, Verh. Zoöl.-Bot. Ges. Wien. 53, 603.

The species of this genus vary a great deal in color and size, from opaque black or cinereous to partially or chiefly shining rufous and from a body length of 2.1 mm. to 12.0 mm. Species usually rather sparsely haired on mesonotum and pleurae although some may be entirely covered with dense black pile. The rostrum, sclerotized portion of face below eyes, is short to greatly produced. In the subgenus *Rhinoplecia* the rostrum is developed about as long or longer than the length of the antennae. This character is considered of minor importance and several species such as *curvistylata* Hardy, *maura* Walker, and *seminitens* Edwards appear to be on the borderline between *Plecia* (Rhinoplecia) and *Plecia* (Plecia). The number of antennal segments varies from seven to twelve, the females often having one more segment than the males. The legs are slender, elongate, usually black and thickly haired. Wings hyaline to blackish fumose, the radial sector forks beyond the radio-medial crossvein, the anterior branch (R_{3+4}) is short and rather vertical in position. The best specific characters are found in the male genital structures. The shapes of the ninth tergum and sternum are distinctive. The female genitalia also show specific characters but just how diagnostic these are has not been thoroughly worked out; this is the first comparative study of the female structures that has been made.

This genus is allied to *Crapitula* and *Penthetria* but is distinguished by the wing venation and the position of the male harpagones. The short, almost vertical vein R_{3+4} and the more vertical harpagones will separate *Plecia;* the ninth segment and genital appendages show much greater differentiation than in the related genera.

While studying the *Plecia* the writer has examined large numbers of specimens from many geographical regions in South, Central and North America which fit perfectly the original descriptions of several apparently well founded species. These have always been placed with a query because of the noticeable generality of their definition and the wide geographical range over which they extend. The most notable in this group are *Plecia confusa* Loew, *P. rufithorax* Walker, *P. bicolor* Bellardi and *P. collaris* Fabr. *Plecia confusa* Loew was long known as *P. ruficollis* Fabr., Wiedemann identified specimens as this from Brazil. A few years later H. Loew stated that it was very unlikely that the South American species could be the same as that from Africa and proposed the name *confusa* for it. Since that time this name has been used to indicate those specimens having a short rostrum and the thorax entirely rufous, even including the North American specimens under this name. Study of the male genital structures through this series proved that it is actually a complex of many species; this has also proved to be the case in the *rufithorax, bicolor* and *collaris* groups. These important structures have received but little attention in the *Plecia* and this accounts for the "lumping" of well defined species.

The genus is almost world wide in distribution although the larger share of species are confined to the tropical regions. Only two *Plecia* (*americana* Hardy and *nearctica* Hardy) are known from America north of Mexico.

Genotype: *Hirtea fulvicollis* Fab., 1828, Auss. Zweifl. Ins. 1, 72.

KEY TO PLECIA

(Based largely upon males)

1. Thorax polished, at least on the dorsum, sometimes with three to four shining vittae, or dorsum rufous and pleurae black 2
   Thorax subopaque to gray dusted, if subshining the notum is at least lightly pruinose, pleurae usually concolorous with dorsum 12
2. Mesonotum with three to four shining stripes which are distinctly separated by opaque or dusted longitudinal lines, usually black species 3
   Mesonotum not divided into stripes by opaque lines, usually at least in part rufous, 9
3. Wings smoky with a conspicuous pale yellow fascia across the middle; ninth sternum of male genitalia very large and extending around to the dorsal portion of the segment ..... 3a *pictipennis* Edwards, p. 426
   Wings uniformly fumose or chiefly hyaline, ninth sternum not so developed 4
   3a. Stripes of mesonotum shining black ..... *pictipennis pictipennis* Edwards, p. 426
   Shining stripes of mesonotum reddish ..... *pictipennis rufovittata* Edwards, p. 427
4. Harpagones of male genitalia not bilobed 6
   Harpagones bilobed 5
5. Inner (lower) lobe of each harpago much smaller than outer and below it (fig. 160a). Harpagones slender from lateral view with only one lobe visible (fig. 160b); sternum with a U-shaped median cleft; median process of ninth tergum projected beyond posterior margin of segment ..... *persimilis* Hardy, p. 424
   Inner lobe projecting on the same level or above outer, almost as strong; sternum with

a broad flat topped median development (fig. 174a). Harpagones broad from lateral view, both lobes visible (fig. 174b). Median process of tergum not so developed.
seminitens Edwards, p. 437

6. Three longitudinal stripes on mesonotum, middle stripe undivided; ninth tergum not cleft on hind margin (fig. 155a); harpagones broad.....*nitidicollis* Edwards, p. 420
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7. Rostrum developed twice as long as the antennae, much longer than the head; ninth tergum of male cleft almost half its length (fig. 166d).
(Mexico) *quadrivittata* Williston, p. 430
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rufimarginata Hardy, p. 433
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plagiata Wiedemann, p. 427
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18. Head and body rather thickly black haired; ninth sternum very irregular on hind margin, with three pairs of lobes besides a median moundlike development, median pair of lobes finely toothed on inner margins (fig. 154c).....*nigra* (Philippi), p. 419
Species not so hairy, hypopygium different..... 19
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punctulata Hardy, p. 429
Larger species, not as above 20
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marginata Edwards, p. 417
Entirely black, face scarcely produced below eyes, hind margin of ninth sternum with two pairs of well developed lobes (fig. 156a). Ninth tergum with a sharp triangular process in middle on hind margin (fig. 156b).....*nitidipes* Edwards, p. 421

22. Costal margin sharply contrasting with the rest of wing 23
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Entire dorsum rufous (bicolor group) 30
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37. Harpagones with only two lobes 38
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43. Posterior median margin of ninth sternum with one or more distinct processes or developments, at least with a moundlike gibbosity in middle..... 44
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44. With two such processes, sometimes a somewhat membranous development between these 45
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panamaensis Hardy, p. 422
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51. Median process of ninth sternum blunt and rounding apically, somewhat membranous 52
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51a. Tergum gently concave on posterior margin (fig. 172d).
rufithorax concava Hardy, p. 435
Cleft of tergum with almost straight sides, scarcely rounded (fig. 171b).
rufithorax rufithorax Walker, p. 434
52. Tergum with a strong pointed process in middle on hind margin (fig. 161b), harpagones small (fig. 161a).....*pertinens* Hardy, p. 425
Tergum without such a development..... 53
53. Bottom of cleft on hind margin of tergum straight (fig. 167c).....*rectiora* Hardy, p. 431
Bottom concave or with small convexity in center..... 54
54. Tergum with a slight convexity in the middle of the broad concavity (fig. 143d); harpagones rather narrowly pointed (fig. 143e).....*gibbosa* Hardy, p. 409
Without such a median convexity (fig. 168d); harpagones not so sharply pointed (fig. 168c) .....*rostellata* Loew, p. 432
55. Ninth tergum moderately cleft 56
Never more than small V-shaped cleft on hind margin of tergum, or without cleft, 58
56. Tergum with a prominent median process on hind margin; harpagones small..... 57
Tergum without such a development, cleft broad and flat bottomed, *rectiora* Hardy, p. 431
57. Tergum with a more U-shaped concavity, median process well developed and stout (fig. 161b); bases of harpagones as wide as lobe of posterior lateral margin of ninth sternum (fig. 161a) ..... *pertinens* Hardy, p. 425

Hind margin of tergum more V-shaped, median process smaller, more spinelike (fig. 158b); harpagones very small (fig. 158a).....*parvistylata* Hardy, p. 423

58. Sternum cleft on hind margin..... 59
Sternum broadly convex on hind margin, harpagones very irregular (atypical specimens may run here).....*xenia* Hardy, p. 443

59. Tergum with a small V-shaped indentation (fig. 129c); sternum cleft almost one-half its length (fig. 129d) (some atypical specimens of this species run out here).
americana Hardy, p. 395
Tergum developed into a slight triangular point medianly (fig. 138d); ninth sternum with a small median cleft (fig. 138c).....*dentata* Hardy, p. 405

Plecia (Plecia) alacris Curran

(Plate XXX, figs. 128a-d)

Plecia alacris Curran, 1934, Bull. Amer. Mus. Nat. Hist. LXVI, 310, 311.

MALE.—*Head:* Rostrum shorter than the head and scarcely visible except from underneath. *Thorax:* Entirely yellow-orange on the mesonotum, pleurae slightly darker with a few indistinct brownish markings. Legs and abdomen black with black hair. *Wings:* Brownish yellow fumose, costal cell and stigma slightly darker, veins brown. Humeral crossvein and branch of radial sector (vein R_{3+4}) oblique, slanting straight into the costa (fig. 128a). The fork of the veins M_1 and $_2$ situated before basal one-third of the distance from the radio-medial crossvein to the fork of the radial sector and before the end of the subcosta. Vein R_{1+2} runs somewhat parallel with the costa through the stigmal area. Halteres with black knobs, stems pale. *Genitalia:* Ninth sternum very short in proportion to its width, almost twice as wide as long, slightly longer on the lateral margins; posterior median margin of segment with a large blunt development (fig. 128b). Harpagones appearing simple from ventral view, only one rather acutely pointed lobe visible. From a lateral view a second, lower lobe is visible; this lobe is strong, toothlike and projects inward (fig. 128c). Ninth tergum with a small V-shaped excavation on the hind margin and another deeper concavity on the anterior margin, the two median points almost dividing the segment into two parts (fig. 128d).

Length: body, 6-6.5 mm.; wing, 6.5 mm.

Female unknown.

Described from British Guiana, type in American Museum.

The writer has examined a paratype male, also one male from Paraguay.

Plecia (Plecia) americana Hardy

(Plate XXX, figs. 129a-d)

Plecia americana Hardy, 1940, Journ. Kan. Ent. Soc. 13; 15-16.

This species is related to *confusa* Loew but is of smaller size, the antennal segments are more compacted and the development of the

ninth sternum and tergum will distinguish it. Following is the original description of the male hypopygium:

"*Male genitalia:* Ninth sternum deeply concave on posterior margin, cleft about one-half the length of the segment, with a membranous mound in the middle; posterior lateral margins moderately produced; harpagones very small (fig. 129d). Ninth tergum broad, with a small V-shaped excision in the middle on the hind margin (fig. 129c)."

Male length: body, 4.5-5.3 mm.; wings, 5-6 mm.

Female genitalia: The eighth sternum is developed into a pair of strong, heavily sclerotized lobes joined by a comparatively narrow bridge medianly at the anterior portion of the segment (fig. 129a). Ninth tergum narrow, about one-fourth as long as wide, on lateral margins; posterior margin almost straight, very slightly concave. Cerci large and round, densely covered with strong bristles and hairs (fig. 129b). Lateral margins of ninth tergum greatly developed and curved inward giving support to the walls of the genital chamber.

Length: body, 5-6 mm.; wings, 7 mm.

Type locality: Florida.

Type in the United States National Museum collection.

This species is known also from Georgia, Mexico, North Carolina, South Carolina, Texas and Alabama.

Plecia (*Rhinoplecia*) *avicephaliforma* Hardy

(Plate XXX, figs. 130a-d)

Plecia avicephaliforma Hardy, 1940, Journ. Kan. Ent. Soc. 13; 16.

Following is the original description:

"This species is related to *quadrivittata* Williston in having four shining stripes down the mesonotum, the median stripe being divided by a narrow gray line. It differs from this species in having the rostrum shorter than the head; the scutellum opaque (shining in *quadrivittata*); vein R_{2+3} (R_{3+4}) curved or bowed before entering the costa. The male genitalia is very distinctive, as is pointed out in the description; the specimens are also slightly smaller.

"*Male.*—Entire black species. *Head:* Antennae nine segmented, the segments short and compressed; rostrum about equal to the antennae in length, shorter than the head. *Thorax:* Opaque, lightly pruinose, except for shining stripes on dorsum; upper portions of sternopleurae with sparse brownish hairs, mesonotal furrows and margins of notum with scattered yellowish hairs. Legs and abdo-

men with brown to black pile. *Wings:* Brownish fumose, veins dark brown, stigma but slightly darker than membrane; vein R_1 ends at about two thirds the distance from end of subcosta and R_{2+3} (R_{3+4}), vein R_{2+3} (R_{3+4}) strongly curved into the costa (fig. 130a). Radiomedial crossvein situated at about the middle of the distance from the m-cu crossvein and the fork of media.

"*Male genitalia:* Sternum rather broad, developed apically into two pairs of small lobes, the lateral pair larger more rounding, the median pair small, sometimes scarcely divided and simulating a single development (fig. 130b). Harpagones simple, with a long beaklike tooth projecting inwardly (avicephaliform) as seen from a lateral view (fig. 130c); scarcely visible from ventral view. Tergum gently concave with a broad flat topped development medianly (fig. 130d).

"Length: body, 3.3-3.7 mm.; wings, 4 mm.

"Female unknown."

Type locality: Diamantina, Minas Geraes, Brazil.

Type in Cornell University Collection.

Plecia (*Rhinoplecia*) *biarmata* Hardy

(Plate XXX, figs. 131a-b)

Plecia (*Rhinoplecia*) *biarmata* Hardy, 1942, Can. Ento. LXXIV, 105-106.

"This species is related to *bicolor* Bellardi and cannot be separated from that species without use of the male genitalia. The fork of the Rs arises at the end of vein R_{1+2}; R_{3+4} arises vertically for a short distance than slants gradually into the costa in the male, more obliquely in female. These characters may be variable and would not present a convenient means of separation.

"Male Genitalia: The genitalia of this species are extremely diversified, the ninth sternum is very broad, with a medial projection which is concave on its posterior margin. The claspers are large and divided into two well developed lobes visible from above; the outer arms being more stoutly developed (fig. 131b). The ninth tergum is gently concave on its posterior margin (fig. 131a).

"In the female the metapleurae, hypopleurae, ptero and propleurae are rufescent tinged; the antennae are eleven segmented, with the segments rather compressed.

"Length: male, body, 4.5 mm.; wings, 4.7-5 mm.

"Female, body 5 mm.; wings, 6-6.5 mm."

Type locality: Crontena, Costa Rica.

Type in Cornell University collection.

Plecia (*Rhinoplecia*) *bicolor* Bellardi

(Plate XXX, figs. 132a-e)

Plecia bicolor Bellardi, 1859, Saggio di Ditterologia Messicana, pt. 1, 16.

MALE.—*Head:* Rostrum developed to form a beak, longer than the head and extending backward beneath the face. Antennae nine segmented, brown to black with a slight yellowish tinge at the base of the segments; segment three equal to the first two in length, other segments more nearly equal. Ocellar tubercle very prominent, as is the case in most species of this genus. Compound eyes divided into upper and lower portions by a slight indentation of the lower third or fourth. *Thorax:* Dorsum bright orange, with three longitudinal grooves which converge slightly before the scutellum. Pleurae velvety brown to black. Halteres brownish black. *Legs:* Slender, brownish black with dense, short black hair. All femora and posterior tibiae straight or nearly so. Basitarsi about equal in length to the next three tarsal subsegments, pulvilli yellow. *Wings:* Brownish yellow fumose, costal cell brown, stigma not noticeably differentiated. Fork of third vein arising before the end of second vein, slanting rather sharply toward the costa. Fork of the fourth vein but little before the middle of the base of vein M_{3+4} and fork of the third vein. Cubital cell widely open. *Abdomen:* Subopaque brownish black with dense dark hairs. *Genitalia:* Ninth sternum narrowing posteriorly with a rounding concavity on the posterior margin (fig. 132b). Claspers very broad and irregularly toothed on the inner margin, two large sharp pointed teeth above and several below as seen from a lateral view (fig. 132a). The claspers are folded down in their normal position so they are somewhat difficult to see from a ventral view. Ninth tergum developed on its hind margin into two long armlike projections, these fold toward the genital chamber in their normal position so the tergum must be tilted up slightly to see them (fig. 132c).

Length: body, 4 mm.; wing, 4.5 mm.

FEMALE.—Other than in the secondary sexual characters and slightly larger size the female does not differ a great deal from the male. *Genitalia:* Eighth sternum produced into two pairs of strong posterior lobes, the outer lobes are rounded apically, the inner pair are elongated, slender and greatly curved outwardly; these processes arise from the upper portion of the sternum. The eighth sternum is deeply cleft medianly with only a narrow strip of sclerite joining the two plates at their bases. This cleft broadens posteriorly and the margins are straight (fig. 132e). Ninth tergum deeply U-shaped

on hind margin, this cleft extends three fourths the length of the tergum. The cerci are elongated and slender (fig. 132d).

Length: body, 5 mm.; wing, 6.3 mm.

Type located at University of Turin.

Specimens examined from the type locality of the species, Cordova (Cordoba) and Orizaba, Mexico (Frederick Knab), also Teapa, Tabasco, Mex., Jan., 1903, and Barro Colorado Isld., Canal Zone, Feb. 18, 1929 (C. H. Curran).

Plecia (*Rhinoplecia*) *biformis* Hardy

(Plate XXXI, figs. 133a-d)

Plecia (*Rhinoplecia*) *biformis* Hardy, 1942, Can. Ento. LXXIV, 106.

"This species is related to *rufithorax* Walker by having the thorax entirely rufous and the rostrum produced longer than the length of the antennae. The genitalia also show relationship but the specific characters are very pronounced in both sexes.

"*Male genitalia:* The posterior lateral margins of the ninth sternum are not produced and the hind median margin is developed into two prominent lobes, each is divided at its apex, a V-shaped cleft separates the two developments (fig. 133a); the sternum is slightly grooved longitudinally down the middle. The harpagones are strongly produced on upper apical edges and each is developed into a sharp pointed tooth below. The upper lobe is much larger, more obtuse while the lower is smaller more acute, instead of the lower portion of the apex being the more strongly developed as in *rufithorax*. The ninth tergum is much shorter than the sternum and rather deeply concave on posterior margin, posterior lateral margins rather acutely pointed, not so rounding as in *rufithorax*. The bottom of the cleft has a slight membranous portion and the margins are covered with dense short hair (fig. 133b).

"Length: body, 4.5-5 mm.; wing, 5.5 mm.

"*Female genitalia:* The eighth sternum is developed into a pair of median lobes on hind margin, with a deeply V-shaped cleft between; this cleft extends nearly half the length of the segment. Posterior lateral margins broadly rounding, covered with dense fine hairs on the sides; the sternum is almost twice as wide as long (fig. 133c) and differs from *rufithorax* in the development of the posterior margin. The ninth tergum has a broad troughlike cleft extending half the length of the segment, the lateral lobes are rather square-topped (more undulated in *rufithorax*) and are densely covered with fine hair. Cerci broad and rounding (fig. 133d).

"Length: body, 7 mm.; wing, 7.5-8 mm."

Type locality: Trinidad.

Type in the Snow Entomological Collection.

Plecia (Rhinoplecia) brazilana Hardy

(Plate XXXI, figs. 134a-c)

Plecia (Rhinoplecia) brazilana Hardy, 1942, Can. Ento. LXXIV, 106-107.

"This species is related to *collaris* Fab. by having the anterior portion of the dorsum blackish. It is distinguished from other species in this complex by having the posterior margin of the ninth sternum concave and by the blunt median lobe of the ninth tergum.

"MALE.—*Head:* Rostrum greatly produced, almost twice as long as head and about three times as long as the antennae. Antennae yellow-brown to dark brownish, composed of nine segments. Compound eyes divided by a transverse groove at about lower one-third. *Thorax:* Dorsum rufous with a dark brown to black discoloration on the anterior portion in the middle, pleurae reddish brown to black, muck darker in color than the dorsum. Sternopleurae shining on the lower halves, pleurae otherwise subopaque. Stems of halteres reddish to slightly brownish, knobs brown. *Legs:* Bases of femora yellowish, verging into rufiscent brown apically, legs otherwise brown to black; pile short, dense and black. Basitarsi about equal to the next three subsegments in length. *Wings:* Brownish fumose, anterior branch of radial sector (R_{3+4}) arising slightly beyond the end of R_{1+2} and extending almost vertically into the costa. Fork of media arising at about one third the distance between the r-m crossvein and the fork of the Rs. Cubital cell widely opened (fig. 134a). *Abdomen:* Faintly shining on the venter, opaque above. *Genitalia:* Ninth sternum rather broad with a moderate concavity on the posterior border in the middle, developed into a heavily sclerotized point on each posterior lateral margin. Claspers simple, bluntly pointed and slightly curved outward (fig. 134b). Ninth tergum somewhat divided into two portions by a V-shaped groove in the middle on the posterior margin, out of which arises a blunt, almost square-topped development (fig. 134c).

Length: body, 3.8-4 mm.; wing, 4.6-4.8 mm.

"FEMALE.—Differs in having the rostrum even more elongate, the femora are more yellow basically, R_{3+4} arises vertically for a very short distance, then slants obliquely into the costa. Antennae eleven-segmented.

"Length: body, 4.3 mm.; wings, 5.4 mm."

Type locality: West Border, Matto Grosso, Brazil.
Type in United States National Museum.

Plecia (*Rhinoplecia*) *collaris* (Fabricius)

(Plate XXXI, figs. 135a-e)

Hirtea collaris Fabricius, 1805, Syst. Ant. 54.

The type of this species has apparently been lost and the species is unindentifiable from the original description. The common South and Central American species of the *collaris* group is no doubt what Fabricius had before him; this is described here.

The complexity of the male harpagones and development of the ninth sternum makes this species easy to recognize. The black spot on the dorsum of the thorax is also more extensive than in other members of the group.

MALE.—*Head:* Rostrum developed longer than the antennae and folded beneath the face. Antennae eight segmented, scape yellow, other segments black. *Thorax:* Mesonotum bright orange with a large dark brown to black spot covering the anterior one-third of the dorsum. Humeral ridges yellowish. Pleurae brownish, tinged with rufous. Stems of halteres reddish, knobs brown. Legs and abdomen brown to black. *Wings:* Yellowish fumose, slightly brown costally, veins and stigma brown. Vein R_{3+4} (fork of third vein) arising beyond end of R_{1+2}, the lower one-half of the vein vertical, the apical portion slanting rather abruptly into the costa. Fork of M_1 and $_2$ at about one-third the distance from basal portion of M_{3+4} to the fork of the Rs. *Genitalia:* Ninth sternum slightly wider at bottom, gradually slanting toward the apex, terminating in a bilobed projection. Harpagones very broad and irregular; seen from above as a stout dorsal development, and a basal, slightly pointed process (fig. 135e). From a lateral view the claspers appear to be bilobed (fig. 135c), the upper lobe more broad and beaklike, the lower produced laterally, pointing dorsally in its normal position. Ninth tergum gently concave with a projection in the center, this in turn having a small concavity (somewhat V-shaped) on its posterior edge (fig. 135d).

Length: body, 5.5-6.5 mm.; wings, 6-6.5 mm.

FEMALE.—Antennae ten segmented, rostrum slightly longer, otherwise like the male except for sexual differences. *Genitalia:* The ninth tergum is broadly U-shaped on posterior margin, posterior lateral margins rounding (fig. 135a). Cerci thickly haired and elongated in shape. The eighth sternum is abnormally developed,

not completely divided medianly, with a narrow sclerite joining the two plates near the base of segment. The sternum is produced into a pair of strong, obtuse lobes near median portion on hind margin and another pair of acutely pointed lobes just below these on their inner margins, another strong process extends in toward the genital chamber, this structure is attached to the upper portion of the eighth sternum on top side (fig. 135b).

Length: body, 5-7.5 mm.; wing, 7-8 mm.

Type locality given as "America meridionali."

Present location of type unknown by this writer.

The writer has identified the species from the following localities:

Argentina: Posados, Missiones Terr. 13-15, i, 1927—63 (F. and M. Edwards); B. Aires—Tigre, I, 1938 (F. Schade).

Bolivia: Rosario Lake, Rogague, Oct. 28-Nov. 9, 1921 (W. M. Mann, Mulford Biol. Expl.).

Brazil: Sao Paulo, Oct. 16, 1934 (L. T. F.); Santa Maria, State of Rio Grande do sul (T. White); Corumba, Matto Grosso, Dec. 14-23, 1919 (R. G. Marris); Brasilien Nova Teutonia, 27° 11′ B. 52° 23′ (F. Plaumann).

Colombia: Bet. Queremal and Buenaventura, alt. 3,500-4,000 ft., Feb. 12, 1935 (H. F. Schwarz); Cali District, Cauca Valley, alt. 3,260 ft., Feb. 20, 1935 (H. F. Schwarz); Popayan, alt. 6,800 ft., Feb. 15, 1935 (E. I. Huntington and H. F. Schwarz); Medellin (H. Daniel).

Honduras: Subirana Yoro, Dec. 21, 1932 (Stadelmann).

Panama: Patilla Pt. Can. Zone, Jan. 15, 1939 (C. H. Curran); Porto Bello, Feb. 15, 1911 (E. A. Schwarz).

Paraguay: Accession numbers 5 and 182 (Zurcher leg.) Tacuru-Pucu, 2-7 Apr. (D. Wees); Villarica, X, 1936 (F. Schade).

Plecia (*Plecia*) *confusa* Loew

(Plate XXXI, figs. 136a-d)

Plecia confusa Loew, 1858, Berl. Ent. Zeit. 11, 109.

This is a change of name for *P. ruficollis* Fabricius, 1805, Systema Antiliatorum, p. 53 (Middle America); as distinguished from *Plecia ruficollis* Fabricius, 1781, Species Insectorum Vol. 2, 410 (Cape of Good Hope).

Loew's type of *confusa* has apparently been lost, as it was not to be located in the European Museums, so it has been necessary to erect Wiedemann's specimen from Bahia, Brazil, as a neotype. Wiedemann determined this species as *ruficollis* Fabr. and Loew

later changed the name. This species has been studied by the late Doctor Edwards and drawings of the male genitalia sent to the writer. This proved to be identical with a Brasilian *Plecia* already at hand. This species is larger in size than any other in this complex, known to the writer, and it is unique in the development of the male genitalia.

MALE.—*Head:* Rostrum short, less than one-half the length of head. Palpi four segmented, the segments long and slender. Antennae ten segmented, counting the distinct apical tip; the first segment of flagellum about twice as long as wide, other segments rounding, slightly oblong. *Thorax:* Entirely deep yellow to orange. Mesonotum with two longitudinal furrows which converge slightly before the scutellum; lateral mesonotal slopes flat, and a slightly concave area present just behind the humeral ridges. Sternopleurae with a sparse patch of short brown to black hairs just above middles, thorax otherwise chiefly bare. Knobs of halteres brown, stems pale. Legs and abdomen dark brown to black with dense black hair. Femora thickened apically, tibiae straight or nearly so; basitarsi equal to scarcely longer than succeeding three tarsal subsegments. *Wings:* Yellow-brown fumose, costal cell and stigma more browned; vein R_{1+2} ending but slightly before the end of R_{3+4}; anterior branch of radial sector (vein R_{3+4}) oblique with a slight curve toward its base (fig. 136d). Fork of M_1 and$_2$ at basal one-third of the distance between the r-m crossvein and the fork of the Rs. *Genitalia:* Ninth sternum much wider than long; posterior lateral margins developed into strong, hairy clasperlike lobes; hind margin slightly undulated in the middle, otherwise almost straight (fig. 136a). Two unmounted specimens show minute teethlike bumps on the inner edges of the lobes, these are not visible on genitalia mounted on a slide and are probably obscured by the flattening out of the structure. Cerci slender, spinose and much longer on inner margin.

Length: body, 7.5-9 mm.; wing, 8.5.-9.5 mm.

FEMALE.—The antennae are slightly longer and eleven segmented, including nipplelike tip which is not so pronounced as in the male; palpi yellow-brown, about as long as the antennae. Otherwise like the male, except for shorter body and longer wings.

Length: body, 6-7 mm.; wing, 11-12 mm.

Neotype locality: Bahia, Brazil.

Neotype at Vienna.

Specimens have been examined from Rio Colorado, Bolivia, Sept.

1921-22 (Mulford Bio.-Expl.); Boa Vista Tapajos, Para. (Townsend); Barro Colo. Isld., Canal Zone, II, 13, 1929 (C. H. Curran); Bet. Queremal and Buenaventura, Colombia, alt. 35-4000 ft., XII-11-1935 (A. E. Schwarz); Chanchamayo E. Peru (Rosenberg); Piches and Perene Vs Peru, 2,000-3,000 ft. (Lima); LaChorerra Puta, Mayo Distr. Peru, 17-20, Aug., 1920 (Cornell Univ. Exped. Lot 569) and Igrapinna, Bahia, Brazil, 23-29 June, 1919.

Plecia (*Plecia*) *costalis* Wiedemann

Plecia costalis Wiedemann, 1830, Ausereuropiasche Zweiflug. Ins. 2, 618. (nec *costalis* Walker.)

MALE.—Redescription of type. Black; rostrum short, much shorter than antennae; antennae nine segmented. Body entirely opaque. Thorax with very sparse, pale pile; upper portions of sternopleurae with long dark hairs. Male genitalia undissected, but the ninth tergum is deeply V-shaped cleft. The harpagones appear to be small and inconspicuous. Wings brown fumose, veins darker brown; costal margin, humeral crossvein, subcosta, base of wing and bases of R and R_{1+2} oblique. Fork of media situated before middle of distance from r-m crossvein to fork of radial sector. Halteres brown.

FEMALE.—Entirely opaque black. *Head:* Rostrum not greatly produced, slightly over one-half the length of the antennae; antennae eleven segmented, shorter in length than the palpi; compound eyes covered with short hair. *Thorax:* Dorsum with sparse, recumbent, brownish pile; sternopleurae each with a dense patch of black hairs above; stems of halteres yellow-brown, knobs brown. Legs and abdomen densely black pilose. *Wings:* Largely brown to blackish fumose with the costal margin and base of wing bright yellow (this is a striking characteristic of the species). Vein R_{3+4} oblique, with a very slight curve near its base; vein M_{3+4} situated at about the basal third of the distance from the r-m crossvein to the fork of the Rs.

Length male: 9.8-10.5 mm.; wing, 11-12 mm.

Female: body, 11-12 mm.; wing, 14.5-15.4 mm.

Described from Brazil. The writer has seen specimens from Petroplis, Rio de Janeiro. It has also been reported from Parana. Three specimens from the type series have been examined, one male and two females. Kindly loaned by Zoölogisches Museum der Universitat Berlin.

Plecia (*Plecia*) *curvistylata* Hardy

(Plate XXXI, figs. 137a-d)

Plecia (*Plecia*) *curvistylata* Hardy, 1942, Can. Ento. LXXIV, 107.

"This species is probably closer to the *collaris* group as the anterior portion of the mesonotum is discolored. This discolored area is, however, only slightly darkened and not distinctly blackened as in others of the complex. This species is also of much smaller size, the rostrum is not quite as long as the antennae and R_{3+4} is more decidedly curved before entering the costa (fig. 137a). The male genitalia will distinguish it.

"*Male genitalia:* Posterior lateral margins of the ninth sternum not developed, hind margin with a gentle concavity in the middle. Harpagones elongate and curved inward (fig. 137b), only their bases visible from ventral view (fig. 137c). Ninth tergum deeply concave on hind margin, wider than long (fig. 137d).

"Length: body, 3-3.5 mm.; wing, 3.6-4 mm."

Type locality: Cuernavaca, Morelos, Mexico.

Type to be returned to the British Museum.

Plecia (*Rhinoplecia*) *dentata* Hardy

(Plate XXXI, figs. 138a-d)

Plecia (*Rhinoplecia*) *dentata* Hardy, 1942, Can. Ento. LXXIV, 107.

"This species approaches *rufithorax* Walker and can be separated conveniently only by use of the male genitalia, these structures differ very distinctly. The wing venation also differs as follows: The fork of the radial sector (R_{3+4}) arises vertically toward the costa then makes a sharp turn into the wing margin (fig. 138a); fork of media situated slightly before middle of the distance between r-m crossvein and fork of Rs; Cu strongly curved downward, narrowing the cubital cell.

"*Genitalia:* Posterior margin of ninth sternum with a U-shaped concavity. Posterior lateral margins rather strongly developed. Harpagones large, blunt with a small beaklike apex as seen from ventral view (fig. 138c); from a lateral view a toothlike development is visible on the dorsal surface (fig. 138b). Apices of harpagones covered with dense short, brownish pile and long hairs. The exact shape of the clasping structures is difficult to discern and many interpretations may be had according to the angle from which they are viewed. If tilted downward the inner margin of the apex will appear much more blunt and rounding than shown in the figure.

Ninth tergum but little wider than long, with a small convexity on the posterior margin (fig. 138d).

"Length: body, 5-6 mm.; wings, 6.5 mm."

Type locality: Chontales, Nicaragua (Janson).

Type will be returned to British Museum.

Plecia discolor Van der Wulp

Plecia discolor Van der Wulp, 1881, Amer. Dip. I, Tijdschr. Ent. XXIV, 143.

The description of this species is too inadequate to place it properly, it belongs in either the *bicolor* or *collaris* group and may prove to be the same as *collaris* (Fabricius) but until the type can be located and studied its true position will remain questionable.

Type locality: Argentina.

Type probably at Amsterdam or Leiden.

Plecia (*Rhinoplecia*) *disparis* Hardy

(Plate XXXI, figs. 139a-b)

Plecia (*Rhinoplecia*) *disparis* Hardy, 1942, Can. Ento. LXXIV, 108.

"Related to *Plecia bicolor* Bell, but differing distinctly in the male genital structures; the wings also appear to be more lightly fumose.

"*Male genitalia:* Ninth sternum broad with a well developed median process on its posterior border (fig. 139a), apodeme of ninth sternum greatly developed and rounding at the apex, sometimes appearing to be a second lobe of the harpagones from a lateral view; harpagones broad, bluntly tipped. Aedeagus large and rounding with two heavily sclerotized supporting processes laterally. Ninth tergum moderately concave, the bottom of the concavity almost straight (fig. 139b).

"In other characters this species cannot be separated from *bicolor* Bell.

"Length: body, 5.3 mm.; wing, 6 mm."

Type locality: Upper Putamyo River, Colombia.

Type in the United States National Museum.

Plecia (*Rhinoplecia*) *ecuadorensis* Hardy

(Plate XXXII, figs. 140a-c)

Plecia (*Rhinoplecia*) *ecuadorensis* Hardy, 1942, Can. Ento. LXXIV, 108.

"This species is related to *rufithorax* Walker and can only be separated by the marked structural differences in the male genitalia. The specimens are of slightly larger size and vein R_{3+4} is curved rather sharply near the base (as is fig. 138a).

"*Male genitalia:* Approaches *xenia* Hardy in having the posterior lateral margins of ninth sternum strongly developed and the ninth tergum with a narrow slitlike invagination extending over one-third the length of the segment down the middle. Ninth sternum gradually convex on the hind margin with a strong acutely pointed development medianly (fig. 140). Harpagones large and somewhat irregular but without such processes as possessed by *xenia,* developed into a rather acute point apically above, as seen from a ventral view and with a sharp toothlike point above from a lateral view (fig. 140b). Ninth tergum longest on the lateral margins, gently concave on the posterior margin; segment wider than long (fig. 140c). The genitalia differs from *xenia* in the development of the tergum, sternum and harpagones.

"The female genitalia have not been dissected.

"Male length: body, 6-6.5 mm.; wing, 7-8 mm.

"Female length: body, 7-7.5 mm.; wing, 8-8.5 mm."

Type locality: Ecuador, S. America.

Type to be returned to the British Museum. At present in the Snow Entomological Collection.

The species has also been recorded from Pasto, Colombia.

Plecia ecuadorensis micans Hardy

(Plate XXXII, figs. 141a-b)

Plecia ecuadorensis var. micans Hardy, 1942, Can. Ento. LXXIV, 108-109.

"This variety differs from the type species in having the mesonotum and lower portions of the sternopleurae shining reddish instead of opaque yellow-orange; the variety is also smaller in size. The females are sometimes marked with black on the dorsum, one specimen has the entire thorax deeply black tinged.

"*Female genitalia:* Ninth tergum with a broad, flat bottomed cleft on hind margin; posterior lateral margins rounded. Cerci rounded apically, longer than wide (fig. 141b). Eighth sternum distinctly divided into two plates by a deep cleft extending down the middle longitudinally, posterior margins of each plate produced into a large rounding median lobe and a moundlike swelling toward the sides; segment about twice as wide as long (fig. 141a).

"Male length: body 3.5-4 mm.; wing, 5-5.5 mm.

"Female length: body, 5 mm.; wing, 6.5 mm.

"These would certainly appear to belong to a different species but the male genitalia are identical. This is the only example the writer has encountered in the *rufithorax* group in which the thorax is not opaque."

Type locality: Guayaquil, Ecua.

Type in the United States National Museum Collection.

This variety has also been recorded from Hulgra, Ecuador.

Plecia (Rhinoplecia) edwardsi Hardy

(Plate XXXII, figs. 142a-b)

Plecia edwardsi Hardy, 1940, Journ. Kan. Ent. Soc. 13, 17.

Following is the original description:

"This is a sexually dimorphic species related to *Plecia seminitens* Edwards, the males differing in having the mesonotum almost entirely shining, not divided into stripes by gray vittae, only a small slightly grayed spot behind the humeral ridges and a narrow line of gray along lateral margins of mesonotum. The median groove of the notum is as deep as the lateral ones; the posterior tarsal segments are noticeably swollen and rounding. The genitalia are also very different, *edwardsi* does not have the posterior margin of the ninth tergum nearly straight and the harpagones bilobed as does *seminitens* Edwards. The females differ in having the thorax entirely rufous. Vein R_{2+3} (R_{3+4}) is markedly curved in the males and more oblique in the females.

"*Male genitalia:* Ninth sternum slightly convex on median posterior margin with a moundlike membranous gibbosity in the middle, posterior lateral margins not greatly developed, irregular, with two to three small rounded developments. Harpagones simple and vertical in position, not lateral as in *seminitens*, terminating in a small point apically and a blunt rounded projection on inner side (fig. 142a). Ninth tergum deeply U-shaped concave (fig. 142b).

"Male length: body, 2.5-3 mm.; wing, 3-3.2 mm.

"Female length: body, 2.7-3 mm.; wing, 3.5-3.7 mm.

"Type locality: Jussara, Angro Dos Reis, Brazil."

Type in the Snow Entomological Collection.

Plecia fulvimacula Walker

Plecia fulvimacula Walker, 1848. List of Dipt. Brit. Mus. I, 116.

Plecia flavimaculata Hunter, 1900, Trans. Amer. Ent. Soc. XXVI, 297. (This is an erroneous spelling for *fulvimacula*).

From the description this appears to belong to the *collaris* group. The writer is unable to place it, so is quoting the original description.

"Nigra, thoracis lateribus fulvo maculatis, metathorace rufofusco, abdomine picco, antennis nigris, femoribus basi piceis, alis nigrofuscis.

"Body black, shining; feelers black; chest with a large tawny spot

on each side above the base of the wing; hind chest reddish brown; abdomen dull piceous: legs black, shining; thighs piceous towards the base: wings dark brown, specially towards the fore border, where there is a small narrow black band; veins and poisers piceous. Length of the body 4 lines; of the wings 8 lines."

Type locality: Venezuela.

Type in British Museum.

Type in the United States National Museum.

Doctor John Smart has recently informed the writer that the *fulvimacula* type appears in the British Museum collection under the genus *Dilophus*; if this is correctly placed it seems strange that Walker should have described it as a *Plecia*.

Plecia (*Rhinoplecia*) *gibbosa* Hardy

(Plate XXXII, figs. 143a-e)

Plecia (*Rhinoplecia*) *gibbosa* Hardy, 1942, Can. Ento. LXXIV, 109.

"This species is closely related to *rostellata* Loew because of the structural similarities. The rostrum is not so long as in that species, being about as long as the head, slightly shorter than the antennae and the genitalia of both sexes differ considerably. The harpagones are more sharply pointed, the median lobe of the sternum is membranous and rather square-topped; the hind margin is produced into a pair of rounded lobes at the base of the claspers and the posterior lateral lobes are more strongly developed, extending over one half the length of the claspers. From end view the hind margin of the tergum is seen to fold back, producing a broad shelflike portion extending around the upper part of the genital chamber; the median portion is developed into a strong point (fig. 143c). The mesonotum of the male has sparse, short black hairs on the sides; propleurae and anterior part of mesopleurae and sternopleurae with somewhat obscure brown markings. Abdomen more sparsely haired, with fine, light brown pile; also of smaller size. In addition to the above the posterior lateral margins of ninth sternum are developed, hind margins with a median gibbosity of a somewhat membranous nature. Harpagones simple, with beaklike apices (fig. 143e). Ninth tergum concave on the posterior margin, with a small convexity in the bottom of the cleft (fig. 143d).

"*Female genitalia:* Eighth sternum completely divided into two plates by the median cleft. Median lobes of hind margin rounded; lateral lobes square topped, extending less than one-half the height of the median pair; segment much wider than long (fig. 143b). The

lateral lobes of *rostellata* are acutely pointed and the entire segment is differently shaped. Ninth tergum about four times as wide as longest point, with a very broad, deep cleft on hind margin and a distinct convexity in the bottom of the cleft (fig. 143a). This sclerite differs strikingly from *rostellata* in that the anterior lateral margins are not at all produced and the bottom of the cleft not square.

"Male length: body, 5.5-6 mm.; wings, 6.5 mm.

"Female length: body, 7 mm.; wings, 8 mm."

Type locality: S. Bernardino, Paraguay.

Type in the United States National Museum.

The species has also been recorded from San Jose, N. Arg.

Plecia (Rhinoplecia) grisea Edwards

(Plate XXXII, figs. 144a-b)

Plecia (*Rhinoplecia*) *grisea* Edwards, 1938, Ann. Mag. Nat. Hist. Ser. 11, No. 10, 322-323.

The following are diagnostic points taken from the original description with a few additions by the writer: Black, without markings; only the stems of halteres pale; antennae eight segmented; rostrum about as long as antennae; thorax almost uniformly dusted, even on scutal stripes, appearing gray when viewed from the front; sternopleurae with a few short pale hairs; wings smoky. Female coloring as in male, head gray dusted, vein R_{3+4} (R_4 of Edwards) more oblique than in male. Antennae eleven segmented. The male specimen examined has a faint reddish tinge on margins of mesonotum, scutellum, postnotum, metapleurae and hypopleurae. The abdomen is also yellow haired.

Male genitalia: Ninth sternum with a blunt, median development on hind margin, posterior lateral margins produced. Harpagones rather large and terminating in a blunt point (fig. 144a). Ninth tergum gently concave, with a small bumplike swelling in the middle (fig. 144b). Doctor Edwards has stated that the tergum has a broad V-shaped excavation and a small bilobed process at bottom of V. The tergum of the specimen examined hardly fits this. The writer is unable to find any bilobed condition in the median process, from a dorsal view. By tipping the segment forward this bump appears to be slightly notched in the middle and the process spoken of may fold backwards so it would not be visible in some specimens.

Wing length: male, 7 mm.; female, 9 mm.

Doctor Edwards has suggested that this might be a variety of *maura* Walker, but this writer would consider them very distinct

species, the ninth tergum and the sternum as well as the characters given by Edwards separate them.

Type locality: Nova Teutonia, Brazil.

Type in British Museum.

Specimen examined from the type locality, presented by Doctor Edwards.

Plecia (Plecia) imperialis Schiner

(Pllate XXXII, figs. 145a-b)

Plecia imperialis Schiner, 1867, Diptera, Reise der Osterreichischen Fregatte um die Erde. 22.

This species is readily recognized by the blackish costal margin of the wings and the distinctive genital characters.

MALE. — Large, opaque black, chiefly bare species. Compound eyes not divided by a transverse depression; face densely black haired. Rostrum not greatly produced, little over half the length of antennae. *Thorax:* Very faintly grayed, sternopleurae bare or with but a few short hairs. Mesonotum with but a few scattered hairs and with two rather faint longitudinal furrows which converge slightly before the scutellum. *Wings:* Largely yellowish, the costal margin broadly blackish from base to apex; stigma concolorous with the membrane of the costal margin. Vein R_{3+4} short, almost vertical, very slightly curved. *Genitalia:* Ninth sternum about as long as wide, posterior lateral margins produced into a pair of elongated hairy lobes; posterior median margin square topped with a concavity at the base of each clasper. Harpagones rather small, shining black and slender, folded inward toward genital chamber in normal position (fig. 145a). The ninth tergum is almost completely divided into two lobes by deep clefts on its posterior and anterior margins, only a very narrow bridge of sclerite joins the two lateral lobes; the posterior margin of tergum is armed with strong bristles (fig. 145b).

Length: body and wings, 9.3-10 mm.

Schiner states that the female is comparable to the male but is of larger size and other than sexual characters the yellow coloring of the wings is more extensive.

Type locality: Colombia.

Type in Vienna Natural History Museum.

The writer has a male specimen from Fusagasuga, Colombia (Apolinar Maria).

Plecia (Rhinoplecia) impilosa Hardy

(Plate XXXIII, figs. 146a-b)

Plecia impilosa Hardy, 1940, Journ. Kan. Ent. Soc. 13, 17-18.

Following is the original description:

"This species is related somewhat to *grisea* Edwards and *maura* Walker, it differs in coloration and is not so consistantly grayed as *grisea;* the wings are more yellowish and the genital characters are distinctive.

"MALE.—Chiefly black species. *Head:* Rostrum developed, longer than the antennae, antennae eight segmented; compound eyes not noticeably divided into two portions. *Thorax:* Chiefly bare, with only microscopic hairs on upper portions of sternopleurae and on dorsum. Humeral ridges brick-red; margins of mesonotum, scutellum, metanotum, pteropleurae, metapleurae and hypopleurae with an ochraceous to reddish tingue, this sometimes extends along the mesonotal furrows. Mesonotum chiefly gray dusted, this pruinosity is more distinct on the front sides and in the middle of the furrows; mesopleurae and sternopleurae grayed, the latter subshining on lower portions. Notum with two rather deep furrows and with a faint median one between, these terminate in a pitlike area just before the scutellum. Legs and abdomen black with dense black pile. *Wings:* Yellow fumose, costal cell and stigma brown, veins dark brown to black; vein R_{2+3} (R_{3+4}) gently curved into the costa.

"*Genitalia:* Ninth sternum broad, posterior lateral margins strongly produced, posterior median margin with a U-shaped concavity and a moundlike elevation in the middle. Harpagones rather sharply pointed, as seen from a ventral view (fig. 146a). Ninth tergum deeply concave, the cleft extending over one-half the length of the segment; with a broad, somewhat square protuberance in the center (fig. 146b).

"Length: body, 6-7 mm.; wing, 7-8 mm.

"FEMALE.—The reddish tinge is more pronounced and more extensive, marking off four opaque black stripes down the dorsum; pleurae entirely tinged; pile even more microscopic; antennae eleven segmented and the wings are more yellow fumose.

"Length: body, 8-9 mm.; wing, 9.5-10 mm."

Type locality: West border, Matto Grosso, Brazil.

Type in United States National Museum Collection.

Plecia (Plecia) incurvata Hardy

(Plate XXXIII, figs. 147a-c)

Plecia (Plecia) incurvata Hardy, 1942, Can. Ento. LXXIV, 110.

"This species belongs in the *confusa* complex but differs strikingly from all other species known to the writer. The male genitalia resembles *parvistylata* Hardy in having the posterior lateral margins of the sternum produced but the harpagones are more elongate and the ninth tergum more deeply concave (fig. 147c) but not developed clasperlike as in *confusa* Loew. The compound eyes are distinctly divided into upper and lower portions by a partitioning line or groove running across the middle. This is the first time the writer has observed this character in the *confusa* complex. The wing venation is also distinct in this species.

"MALE.—*Head:* Antennae entirely black, consisting of ten segments, including a nipplelike tip. Rostrum slightly over one-half the length of the antennae. Mesonotal furrows not so deep as in *parvistylata*. *Wings:* Vein R_{1+2} merging with R_{3+4} at its tip, far removed from the end of the subcostal vein; R_{3+4} arising vertically to the costa. Fork of media situated at about basal one-fourth of the distance between r-m crossvein and the fork of the radial sector. Vein R_5 strongly curved inwardly toward anterior margin behind the fork of the Rs (fig. 147b). Wings dark brown fumose on costal margin, stigma barely discernible from the membrane. *Genitalia:* Ninth sternum moderately concave medianly on hind margin, posterior lateral margins developed into clublike lobes (fig. 147a). Harpagones rather small, elongate and projecting inward, usually only bases visible from ventral view (those figured in fig. 147a are slightly out of position to show their shape). Ninth tergum deeply cleft, about three-fourths its length (fig. 147c); tergum extending much beyond hind margin of the ninth sternum.

"Length: body, 5.5 mm.; wing, 6.5-7 mm.

"Female unknown."

Type locality: Guadeloupe Island, West Indies.

Type in the United States National Museum.

Plecia (Rhinoplecia) lateralis Hardy

(Plate XXXIII, figs. 148a-c)

Plecia lateralis Hardy, 1940, Journ. Kan. Ent. Soc. 13; 18-19.

Following is the original description:

"This species is near *grisea* Edwards separating most conveniently by use of the male genitalia; the antennae of the male are nine

segmented instead of eight, the furrows of the notum more distinct, humeri and scutellum not reddish tinged, vein R_{2+3} (R_{3+4}) more vertical, the occiput is densely black haired, the sternopleurae with conspicuous dark hairs above and the abdomen dark haired.

"MALE.—In addition to the above, the rostrum is very thick and pronounced, slightly shorter than the antennae. *Thorax:* Notum rather evenly gray pruinose, slightly more grayed in the furrows and on the margins. Pleurae opaque brown to black; legs and abdomen brown; halteres brownish yellow. *Wings:* Brown fumose, stigma concolorous with the membrane. Vein R_1 (R_{1+2}) ending beyond the middle of the distance from subcosta to vein R_{2+3}; R_{2+3} almost vertical with but a very slight curve near base; fork of media situated just before middle of distance from r-m crossvein to the fork of Rs.

"*Genitalia:* The ninth sternum is broader than long, with a troughlike concavity in the middle on the hind margin, posterior lateral margins not produced. The harpagones are rather long, appearing simple from ventral view, and more lateral in their position (fig. 148a); in this respect they are more like *Penthetria* than any other *Plecia* which have been observed. From a lateral view an inward developed process can be seen near their bases (fig. 148b). Ninth tergum with a slight convexity in the middle on hind margin (fig. 148c). Entire genitalia densely haired.

"Length: body, 5.5 mm.; wing, 5.5 mm.

"Female unknown."

Type locality: San Miguel, Hidalgo, Mexico.

Type in Cambridge Museum of Comparative Zoölogy.

Plecia (Rhinoplecia) lindneri Edwards

(Plate XXXIII, figs. 149a-c)

Plecia lindneri Edwards, 1931, Konowia, Bd. X. Heft 1, 75-76.

This species belongs in the *collaris* group by having the anterior portion of the mesonotum blackish, the dorsum of the thorax being otherwise rufous. It is very characteristic in that the thorax is entirely opaque instead of shining and the genital structures are distinctive.

The following is the original description:

"Head blackish, but considerably dusted with gray. Eyes almost or quite bare in both sexes. Ocellar tubercle large. Few or no hairs on face near antennae or on clypeus. Antennae with scape and basal half of first flagellar segment ocherous-brown, rest darker brown; flagellum 5-segmented in male, 8-segmented in female. Mouth-parts

(with clypeus) bent backwards at rest, almost as long as head. Thorax dull, with gray dusting over the whole surface; colour of integument (beneath the gray pollen) mainly red above, but with a large blackish area on front of mesonotum, pronotal angles remaining reddish. Scutellum in male with a black median line. Pleurae mainly blackish and almost bare; a few very short reddish-brown hair. Hypopygium of male normal in size, ninth tergite with a shallow median emargination forming two rounded lobes. Legs dark brownish, femora lighter except towards tips; pubescence short. All femora rather short, but slender except towards tips; all tibiae slender. Wings smoky, somewhat darker in costal cell, stigma indistinct. Venation normal. Halteres with reddish stem and black knob."

Length of body, 6-7 mm.; wing, 7.5-9 mm.

The following description of the male genitalia is added: The ninth sternum is much longer than wide with the posterior median margin greatly developed beyond bases of harpagones; the posterior lateral margins are not greatly produced. The harpagones are strong, elongated and bluntly tipped from ventral view, plainly visible and extending slightly beyond the apex of the ninth segment (fig. 149a); from lateral view the harpagones are seen to possess two acute teeth on inner edges (fig. 149b). The internal apodemes are well developed and simulate secondary lobes of the harpagones. From lateral view, looking into the genital chamber, their apices are heavily sclerotized and may actually serve as clasping structures. The ninth tergum has a moderately V-shaped concavity on hind margin (fig. 149c).

Type locality: El Cairo, Northwest, Santa Cruz de la Sierra, Bolivia.

The writer has identified the species from West border Matto Grosso, Brazil, May 31 (R. C. Shannon) and Asupisu to Miriantiriani, Cam. del Pichia, Peru, July 9, 1920 (Cornell Exped. Lot 607, Sub. 132).

Plecia (*Rhinoplecia*) *lopesi* Hardy

(Plate XXXIII, figs. 150a-c)

Plecia lopesi Hardy, 1940, Journ. Kan. Ent. Soc. 13, 19-20.

This species is related to *bicolor*, but is readily distinguished by the genital characters. The specimens are of larger size than *bicolor* and the wings are darker fumose; the dorsum of the thorax is not so shining and that of the male is tinged with brownish. Following is the original description of the male genitalia:

"*Male genitalia:* Ninth sternum with a sharp triangular shaped projection in the middle on its posterior edge, posterior lateral margins not greatly developed, claspers broad and rather sharply pointed from ventral view (fig. 150b). Ninth tergum gently and broadly concave on posterior margin (fig. 150c)."

Length: body, 6.5-7 mm.; wing, 7.5-8 mm.

Female.—Specimens slightly larger in size, dorsum of thorax more brightly colored; the pleurae slightly tinged with reddish and the antennal segments more compacted. Otherwise like the male.

Length: body, 7 mm.; wing, 9-9.5 mm.

Type locality: Eug. Lefevre, San Paulo, Trav., Brazil.

Type in Snow Entomological Collection.

Plecia (*Rhinoplecia*) *maculata* Hardy

(Plate XXXIII, figs. 151a-b)

Plecia (Rhinoplecia) maculata Hardy, 1942, Can. Ento. LXXIV, 110-111.

"This species approaches *rostellata* Loew in the development of the rostrum and its larger size but is very different from this species. The blackened pleurae and dark brown costal section of the wing together with its distinctive genitalia will separate it.

"MALE.—*Head:* Antennae black with a barely perceptible brownish tinge, eight-segmented, the last five segments of the flagellum almost round. Rostrum much longer than the antennae, mouth parts entirely black. *Thorax:* Opaque, mesonotum rufous with a median brown to black stripe extending backward from the anterior part of the dorsum, this is divided down the middle by a fine rufous line. Mesonotum also with a brownish discolored area on each side behind the middle. Scutellum with a black spot in the center. Pleurae chiefly brown to black with rufous markings on the hind portions of the sterno and mesopleurae and the middle of the pteropleurae. Knobs of halteres black, stems pale. Thorax entirely bare, with but microscopic pubescence. *Wings:* Brown fumose at base and on anterior margins, anterior veins dark brown. Posterior portion of wing almost hyaline, just slightly fumose. Vein R_{3+4} arising almost vertically into the costa (fig. 151c). Fork of media at about the basal one third to one fourth the distance between the r-m crossvein and the fork of the Rs. Cu_1 sharply curved downward at its tip. Abdomen shining black with dense black pile. *Genitalia:* Ninth sternum large and very irregularly developed on posterior edge, posterior lateral margins produced into rather strong lobes. Harpagones of medium size with only bases visible from a ventral

view (fig. 151a), developed into a beaklike point on the inner side, as seen from a lateral view (fig. 151b). Ninth tergum deeply and narrowly concave, the cleft extending to about the basal one third of the segment (fig. 151d).

"Length: body, 8.5-9 mm; wing, 9 mm.

"Female unknown."

Type locality: W. Indies, E. Coast, Trinidad, Mayaro.

Type will be returned to the British Museum.

The species has also been recorded from Port of Spain, Trinidad.

Plecia marginata Edwards

Plecia marginata Edwards, 1920, Mission Arc. Meridien Amer. Sud. 10, 148.

The original description is in French, the following is a translation:

"Body 6 mm.-8 mm.; wing 11 mm.-13 mm. Head with its appendages dull black, scape of the antennae more pale. Thorax: mesonotum dull black with a narrow but continuous orange border; scutellum and postnotum orange; pleurae dark brown, more or less intermixed with brownish orange. Abdomen reddish brown above and below, clothed with short pale pubescence. Feet ochraceous brown; extremities of the femora, tibiae and tarsi dark brown, with blackish pile. Wings slightly brownish tinged, veins brown, stigma round, of a brownish gray color. Venation as in *P. nitidipes* Edwards. Stems of halteres ochraceous, knobs dark."

Described from Equador.

Type in British Museum.

The writer has not seen this species but it should be easily recognized by the orange border on the mesonotum and the reddish pleurae and abdomen.

Plecia (*Rhinoplecia*) *maura* Walker

(Plate XXXIII, figs. 152a-d)

Plecia maura Walker, 1837, Trans. Linn. Soc. London, XVII, 336.
Plecia velutina Macquart, 1844, Dipt. Exot. Suppl. 1, 149.

This is a very large entirely black species, the mouthparts are produced about as long as the antennae; antennae of male eight segmented, female eleven segmented. *Thorax:* Opaque, almost devoid of pile, with only a few microscopic yellow hairs, upper portion of sternopleurae likewise. Legs and abdomen subshining with dense black pile. *Wings:* Brown to black fumose, darker along costal margin, stigma only faintly discernible. Vein R_{3+4} short and almost vertical in male, longer, more oblique in female. *Male*

genitalia: The ninth sternum and harpagones are very much like those of *grisea* Edwards but the posterior lateral margins of the sternum are not so developed and the median protuberance is more acutely pointed, with a membranous swelling behind; hind median margin also more concave (fig. 152a). The ninth tergum is more deeply concave and no median development is present (fig. 152b).

Female genitalia: Ninth tergum broadly H-shaped, a narrow sclerotized bridge connecting the two lateral lobes of the segment. Cerci large, conspicuous and rounding (fig. 152d). Eighth sternum very characteristic in shape, posterior median margin produced into two pairs of strong lobes, the inner pair rounding and densely haired, the two outer lobes are sharply pointed from ventral view (fig. 152c), shining black and bare. From lateral view the outer lobes are greatly flattened and extended into the genital chamber to give support to the oviposition apparatus.

Male length: body, 8-9.5 mm.; wing, 9-11 mm.

Female length: body, 8.5-10 mm.; wing, 10.5-13 mm.

Type locality: Brazil.

Type in British Museum.

Specimens have been examined with Brasilien Nova Teutonia 27° 11′ S. lat., 52° 23′ W. long. (Fritz Plaumann); Parque do Estado S. Paulo, Oct. 25, 1934 (L. Trav.); Angra dos Reis Est. do Rio (D. Mendes); Angra-Jussaral, Dec. 1926 Travassos and Oticica (J. Lins); Petropolis, Rio de Janeiro, Brazil, Oct. 24-27, 1919 (Cornell Univ. Exped.).

Plecia (*Rhinoplecia*) *nearctica* Hardy

(Plates XXXIII-XXXIV, figs. 153a-e)

Plecia nearctica Hardy, 1940, Journ. Kan. Ent. Soc. 13, 20-21.

This species is related to *bicolor* Bellardi but the male genital structures are very distinctive, the bilobed harpagones and strong development of the posterior median margin of the ninth sternum separate it from other known species. Following is the original description of the male genitalia:

"*Male genitalia:* Ninth sternum somewhat narrowed distally with a small concavity on the posterior margin of the middle (fig. 153b). Claspers bilobed, both arms terminating in a beaklike point; the outer lobe is much stouter and vertical in position, visible from dorsal view; the inner lobe is smaller, more narrow and horizontal in position, directing inwardly and visible only from a lateral view

(fig. 153c); the claspers are densely haired. The ninth tergum is gently concave on the posterior margin (fig. 153a)."

Length: body, 4-5 mm.; wing, 4.5-5.3 mm.

Female genitalia: The eighth sternum terminates in a pair of rounding lobes, median cleft deep, extending almost to base of sternum; a sharp tooth is present on inside margin of each of the median lobes. A pair of sclerotized processes surround the vaginal opening, arising from the median portion of the genital chamber (fig. 153d). The ninth tergum is broad, its posterior margin with a deep U-shaped cleft (fig. 153e).

Length: body, 5-6.3 mm.; wing, 5.5-7.3 mm.

Type locality: Galveston, Texas.

Type in Snow Entomological Collection.

This species is widely distributed in the South, having been recorded from the following states and Central American countries: Costa Rica, Guatemala, Honduras, Louisiana, Mexico, Mississippi and Texas; apparently more common in Texas, Louisiana and Mississippi.

Plecia (Plecia) nigra (Philippi)

(Plate XXXIV, figs. 154a-c)

Penthera nigra Phil., 1866, Aufzahlung der Chilenischen Dipteren, Verh. Zoöl. Bot. Ges. Wien. v. XV, 639-640.

MALE.—Opaque black with a very characteristic vestiture of long black hair over the entire body, including the eyes. *Head:* Rostrum rather short, not one-half the length of the antennae. Antennae ten segmented, including the nipplelike tip. Compound eyes divided slightly below the median horizontal line, separating them into an upper and lower portion. Lower portion of eyes, occiput, face and ocellar tubercle densely haired. *Thorax:* Thickly haired on the dorsum, hypopleurae, middle of pteropleurae and upper portions of sternopleurae. Scutellum almost bare, only sparsely haired; halteres testaceous with blackish tinge. *Wings:* Yellow-brown fumose, veins dark brown, stigma but slightly darker than the membrane. Vein R_{3+4} oblique, scarcely curved (fig. 154a); fork of media situated before the middle of the distance from the r-m crossvein to the fork of the radial sector. *Genitalia:* Ninth sternum very irregular on hind margin, with three pairs of rounded lobes besides a median moundlike development; posterior lateral margins strongly produced, the median pair of lobes finely toothed on the inner margins (fig. 154c). Harpagones long and slender, folded downward into the

genital chamber in normal position. Ninth tergum gently concave, with a very prominent median process (fig. 154b).

Length: body, 4.7-5 mm.; wing, 6-6.2 mm.

Female unknown.

Type locality: Chile.

Type probably in the Santiago National Museum.

This is the only species of *Plecia* which has been recorded from Chile. The writer has examined a specimen from Corral, Valdivia, presented by the late Doctor Edwards of the British Museum.

Plecia (*Rhinoplecia*) *nitidicollis* Edwards

(Plate XXXIV, figs. 155a-c)

Plecia nitidicollis Edwards, 1931, Ann. Mag. Nat. Hist. Ser. 10, v. VII, 260-261.

Black species; rostrum greatly produced, longer than the antennae and equal to or longer than the head. *Thorax:* Mesonotum with three brightly shining stripes separated by opaque lines running down the notal furrows, median stripe undivided, median furrows very faint; chiefly bare with only sparse black hairs on the upper portion of the sternopleurae, lower portion of sternopleurae subshining. *Wings:* Brownish to smoky fumose, stigma faintly discernible; vein R_{3+4} gently curved into the costa; fork of media situated at about the basal one-third of the distance from the r-m crossvein to the fork of Rs. Hind tibiae clavate, posterior tarsal subsegments slightly swollen. *Male genitalia:* Ninth sternum broad, very faintly concave on hind margin. Harpagones broad, ending in two rather blunt points as seen from a ventral view (fig. 155b), produced inwardly into a large rounded lobe from a lateral view (fig. 155c). Ninth tergum with a slight concavity on hind margin and with a pair of inward projections in the middle (fig. 155a), these are triangular shaped as seen from an end view.

Length: body, 5-5.4 mm.; wings, 6-6.7 mm.

FEMALE.—The median stripe is sometimes divided by a faint grayish line down the middle furrow. Hind tibiae straight, all tarsi slender. The dorsum of the thorax is sometimes rather dull, only subshining. *Genitalia:* Ninth tergum about twice as wide as long, cleft one-third to one-fourth its length on both anterior and posterior margins; cleft of anterior margin broadly U-shaped, that of hind margin with a broad flat bottom and almost straight sides. From ventral view the eighth sternum is about twice as wide as long, the posterior median lobes not strongly developed; the sternum is divided into two plates by a median longitudinal cleft. A pair of

large black sclerotized plates occupy the ventral portion of the genital chamber just above the lobes of the eighth sternum; these plates are attached to the bases of the ninth tergum and probably serve as egg guides.

Species described from Castro, Parana, Brazil.

Type in the British Museum.

The writer has examined two paratopotypes; also specimens from the following localities: Eng. Lefevre (Est. de S. Paulo) I-XI-1937 (N. Santos-Lopes et Oiticica) and San Paulo-Cantareira (Serra), 7-9-1934 (S. Trav).

Plecia (*Plecia*) *nitidipes* Edwards

(Plate XXXIV, figs. 156a-d)

Plecia nitidipes Edwards, 1920, Mission Arc. Meridien Amer. Sud. 10, 147-148.

This species was described from females and the male has heretofore been unknown. All of the specimens of this complex that the writer has examined from Ecuador have belonged to one species and specimens of this series have been compared with the type by Doctor Edwards and declared to certainly belong to *nitidipes*.

MALE.—*Head:* Rostrum not developed, antennae ten segmented. *Thorax:* Entirely opaque, with short recumbent yellow pile on dorsum, erect brown to black hairs on upper portion of the sternopleurae, sides of mesonotum and area behind humeral ridges coarsely rugulose, mesonotum noticeably but not deeply furrowed. Legs and abdomen brown to black the latter with thin pale pile. *Wings:* subhyaline, but faintly smoky; fork of third vein (R_{3+4}) oblique, with a gentle curve into the costa; fork of media situated near the middle of the distance between the r-m crossvein and the fork of the Rs. *Genitalia:* Posterior margin of ninth sternum with two pairs of processes, two strongly developed lateral lobes and two median lobes; the area between the median lobes is concave with a small bump in the center. These processes are covered with strong hairs and bristles. Harpagones long and slender with a beaklike point on the inner apices (fig. 156a). The harpagones are folded down into the genital chamber in their normal position and usually cannot be seen from ventral view. The ninth tergum is deeply excavated on the posterior margin and possesses a characteristic pointed protuberence in the middle (fig. 156b). The genitalia of this species show that it is close to *plagiata* Wd. The only notable difference being the central toothlike projection of the tergum.

Length: body, 6-6.5 mm.; wings, 7.5-9 mm.

FEMALE.—Larger specimens, body 8.6 mm.; wings, 12 mm., antennae eleven segmented. *Genitalia:* Eighth sternum completely divided into two plates by a longitudinal median cleft, posterior margins produced into a pair of densely haired, rounded lobes (fig. 156c). Ninth tergum very broad and narrow, four times as wide as its greatest length; densely haired with a characteristic spinelike process in middle on hind margin (fig. 156d).

Described from Ecuador.

Type in British Museum.

Specimens have been examined from Quito, Ecuador, 2850 ft.. (F. Campos); Canar, Ecuador, 2600, April (Lichtwardt); Cuicocha, 3300 m., Imbabura, Ecuador, May 27-31, 1939 (F. M. Brown); Cumbre Tililac, Chimborazo, 4200 m., Ecuad., June 21, 1939 (F. M. Brown); Urbina Cerra, Chimborazo, Ecuad. 3650 m., April 18, 1939 (F. M. Brown).

Plecia (*Rhinoplecia*) *panamaensis* Hardy

(Plate XXXIV, figs. 157a-d)

Plecia (Rhinoplecia) panamaensis Hardy, 1942, Can. Ento. LXXIV, 111-112.

"This species can be separated from *rufithorax* Walker only by the genital characters but these structures are so distinct that there can be no doubt of its identity, even in undissected specimens. The long processes on the hind margin of the ninth sternum will separate it readily from any species known to the writer.

"*Male genitalia:* Posterior margin of ninth sternum produced into two long outward projecting prongs with a deep V-shaped cleft between; on the outer margins of these median developments, just below their middles, a slender sclerotized rod extends underneath the apical margin of the segment to attach to the body wall at the bases of claspers (fig. 157c). These rods probably serve for muscle attachments. Harpagones rather strong, somewhat broadened apically, pointed inwardly on their apices from a ventral view. Posterior lateral margins of tergum slightly developed; segment broader than long, with a small V-shaped excavation in the middle on the hind margin, as seen from a dorsal view (fig. 157b). The tergum folds back on the posterior edge producing a broad flat area before the anal region. If the genitalia are tilted forward the ridges at the back will give a different perspective than the one figured.

'Length male: body, 5.2-5.8 mm.; wing, 6 mm.

"*Female genitalia:* Eighth sternum almost twice as wide as long, the posterior median pair of lobes rather acute and slightly concave

on inner margins; hind margin of each plate with a distinct concavity in middle and a broad rounding outer lobe (fig. 157a). Ninth tergum only twice as wide as its greatest length, deeply cleft on hind margin, with only a narrow strip of sclerite joining the two lateral plates (fig. 157d).

"Length female: body, 6.7 mm.; wing, 7.4 mm."

Type locality: Cano Saddle, Gatun L. Panama.

Type in the United States National Museum.

The species has also been recorded from the following localities in Panama: Boqueron River, Cabima, Tubernilla, Canal Zone and Barro Colorado.

Plecia (*Plecia*) *parvistylata* Hardy

(Plate XXXIV, figs. 158a-b)

Plecia (Plecia) parvistylata Hardy, 1942, Can. Ento. LXXIV, 112.

"Related to *confusa* Loew but more closely approaching *incurvata* Hardy structurally. It separates from either of these by the shape of the ninth tergum and the harpagones.

"MALE.—Beak shorter than antennae and scarcely visible. Antennae nine segmented, brownish yellow. Thorax deep orange; the outside median furrows of the mesonotum are more deeply grooved and the legs more densely haired than any which have been observed in the *confusa* complex. The legs are shining black and very densely covered with long black hair. *Genitalia:* Ninth sternum gently concave on the posterior margin, posterior lateral margins rather strongly developed into knoblike lobes; harpagones very small and folded inwardly, pointed on the outer apical edge (fig. 158a). Ninth tergum only moderately concave with a strong median projection on hind margin (fig. 158b).

"Length: body, 4.5-5 mm.; wing, 6 mm.

"Female unknown."

Type locality: Antigua, Guatemala.

Type in the United States National Museum.

Plecia (*Rhinoplecia*) *perplexa* Hardy

(Plate XXXIV, figs. 159a-d)

Plecia (Rhinoplecia) perplexa Hardy, 1942, Can. Ento. LXXIV, 112.

"Related to *bicolor* Bell. and *collaris* (Fabr.) but easily separated by the unusual development of the male genitalia. The male has a small black area on the anterior portion of the dorsum placing it in the *collaris* group but in the female this is but faintly darkened.

"*Male genitalia:* Ninth sternum wider than long, longest on a

median line, with two moderate developments on hind margin near median portion. Between these median lobes is a slightly convex area. The posterior lateral margins of sternum are scarcely produced. Harpagones broad at their bases, each terminating in a narrow fingerlike development apically, minutely shagreened on inner surfaces. A clasperlike process projects outward from each side of the aedeagus, developed almost as long as the harpagones and plainly visible from ventral view (fig. 159c). These are apparently accessory lobes of the aedeagus and appear to be attached to this organ by membrane along their inner sides, however, they terminate basally in two appendages which might serve for muscular attachments (fig. 159d), suggesting that they are possibly functional as clasping structures. Ninth tergum with a V-shaped excavation on posterior margin, from a dorsal view (fig. 159a); the hind margin is folded inward and developed into two rounded lobes as seen from an end view (fig. 159b).

"Male length: body, 4.3 mm.; wing, 4.8 mm.

"Female length: body, 4.3 mm.; wing, 5.5 mm."

Type locality: Cuba, 226 (Loew).

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Type in Cambridge Museum of Comparative Zoölogy.

The species has also been recorded from Buenos Aires, Trinidad Mts., Cuba.

Plecia (*Rhinoplecia*) *persimilis* Hardy

(Plate XXXV, figs. 160a-e)

Plecia persimilis Hardy 1940, Journ. Kan. Ent. Soc. 13; 21-22.

This species is related to *seminitens* Edwards but has the wings yellow to yellow-brown fumose instead of dark smoky fumose and the legs are more consistantly rufous tinged. The posterior median margin of the ninth sternum is not produced as in *seminitens* and the harpagones are more acute apically. Harpagones bilobed, as seen from ventral view (fig. 160a), the inner lobe is small, sharply pointed and situated just beneath the large outer lobe; this inner lobe is not visible from lateral view (fig. 160b). The posterior lateral margins of the ninth sternum are not produced and the median margin possesses a small U-shaped cleft. Ninth tergum somewhat produced on posterior median margin into a flat topped development (fig. 160d).

Length: body, 3.5-4.6 mm.; wing, 5.5-6.4 mm.

Female genitalia: Eighth sternum over two times as wide as long,

posterior median lobes well developed and rounding (fig. 160e). The ninth tergum is about three times as wide as long, rounding on the sides and with a broad deep cleft on hind margin, the bottom of this cleft is somewhat undulated (fig. 160e).

Length: body, 6-6.7 mm.; wing, 8 mm.

Type locality: Sao Paulo, Cantareira, (Serra) Brazil.

Additional topotypes have been studied.

Type in the United States National Museum.

Plecia (Plecia) pertinens Hardy

(Plate XXXV, figs. 161a-g)

Plecia (Plecia) pertinens Hardy, 1942, Can. Ento. LXXIV, 112-113.

"This species is related to *confusa* Loew in having the rostrum shorter than the head and thorax entirely yellowish to orange-red and possesses only minor differences other than those of the male genitalia. The antennae of the male are nine segmented, the upper portions of the sternopleurae are pale haired. The fork of the radial sector (vein R_{3+4}) slightly bent in the middle (figs. 161e, f), not so nearly straight as in *confusa*. Vein R_{1+2} ending about half way between the end of the subcostal vein and R_{3+4} not ending close to this vein as in *confusa*. In the allotype the bend in R_{3+4} is closer to the base of the vein and R_{1+2} is still more remote from this vein (fig. 161f).

"*Male genitalia:* Ninth sternum wider than long, posterior lateral margins developed into two rather strong lobes (fig. 161a), with a convexity in the depression. Harpagones very small and undeveloped appearing rather obtuse from a ventral view. From a lateral view the harpagones are developed into a small point on inner apices (fig. 161c). Ninth tergum concave on posterior margin with a heavily sclerotized, blunt protuberance in the middle (fig. 161b).

"Male length: body, 5.3 mm.; wing, 6 mm.

"*Female genitalia:* Eighth sternum with a U-shaped cleft extending two-thirds the length of the segment, posterior median lobes well developed and rounding, outside of these and extending dorsally in toward the genital chamber are a pair of long, slender lobes (fig. 161d), these probably serve as egg guides. The ninth tergum is twice as wide as its greatest length with a broadly V-shaped cleft extending three-fourths its length on hind margin (fig. 161g).

"Female length: body, 6.5 mm.; wing, 7.5-8 mm."

Type locality: Venta de Zopilote, Guerrero, Mex., 2800 ft., Oct.

Type to be returned to the British Museum of Natural History. At present in the Snow Entomological Collection.

The species has also been recorded from State of Colima, Mexico. Guatemala City and Moca, Guatemala. Also from Tegucigalpa, Honduras.

Plecia (*Rhinoplecia*) *pictipennis* Edwards

(Plate XXXV, figs. 162a-c)

Plecia pictipennis Edwards, 1931, Ann. Mag. Nat. Hist. Ser. 10, V. VII, 260.

This species is easily distinguished by its wing markings, the following is the original description:

"*Head* dark grey, heavily pruinose. Antennae black (damaged in all specimens). Mouth-parts black shorter than head, but bent back beneath head as in other species of the subgenus *Rhinoplecia*. *Thorax* with ground-colour dark ochreous-grey, heavily pruinose. Mesonotum with three conspicuous shining black stripes, middle stripe divided by a narrow dull grey line. *Abdomen* dull black. Hypopygium of male mainly formed of the large sternite, which extends even to the dorsal surface; tergite small, quadrate, with one shining black triangular projection in middle. *Legs* short and stout, dark reddish brown, tip of tibiae and tarsi blackened; hind femora much thickened on apical half. *Wings* smoky, scarcely darker towards costa except on stigma. A conspicuous pale yellow fascia across middle of wing from R_1 to tip of Cu_2, broadening out towards base of wing at m-cu, and just extending into lower basal cell; another pale yellow area at base of anal cell, including the angle. Halteres with ochreous stem and black knob.

"Length of body 5-5.5 mm.; wing, 6.5-7.5 mm."

The following description of the male genitalia should be added to this: Ninth sternum very broad, the lateral margins curving around and meeting the ninth tergum on the dorsal side of the segment, occupying as much of the dorsum as the short tergum (fig. 162c). This is the only time the writer has observed this character. Posterior lateral margins of sternum densely matted with short black hair, median portion strongly convex. Harpagones very irregular and appearing somewhat flat topped from ventral view and acutely pointed apically from a lateral view (figs. 162a, b). Because of the irregularity of this structure it is possible to see different perspectives than the ones shown in the figures, depending on the particular angle from which it is viewed. Ninth tergum very small compared with the sternum. The lateral margins of the sternum occupying about one-half the area normally covered by the

tergum. Tergum developed into an acute heavily sclerotized point medianly on posterior margins (fig. 162c). Lateral margins densely haired.

Type locality: Brazil, Castro, Parana.

The writer has examined a paratype male from the British Museum.

Plecia pictipennis var. *rufovittata* Edwards

Plecia (Rhinoplecia) pictipennis rufovittatus Edwards, 1938, Ann. Mag. Nat. Hist. Ser. 11, No. 10, 323.

This differs from the typical variety in having the stripes of the dorsum reddish instead of black.

Specimens have been examined from the type locality, Nova Teutonia, Brazil. Type in British Museum.

Plecia (Plecia) plagiata Wiedemann

(Plate XXXV, figs. 163a-d)

Plecia plagiata Wiedemann, 1824, Analecta Entom. p. 11.
Plecia funebris Fabricius?, 1805, Syst. Antl. 54, 14.
Plecia heteroptera Macquart, 1845, Dipt. Exot. Supl. 1, Mem. del. Soc. Roy. De Lille.
Plecia vittata Bellardi (nec Wiedemann), 1862, Ditt. Mess., Turino App. 7, 4. *P. bellardi* Townsend, 1912, Can. Ento. 44, 289. (?)

The type of *funebris* has been lost and the original description is inadequate but it is probably the same as *plagiata* Wiedemann, but as the identity of the latter is more positive it is better to use this name.

Townsend states that he believes Schiner's synonymy is incorrect and that *vittata* Bellardi is distinct and as that name was preoccupied by Wiedemann's *vittata* he proposes the new name *bellardi*. He gives no specific reason for his assumption except "there is no brownish tinge to the wings, which vary from a dense to a dilute black, with an iridescent greenish to violent reflection in oblique lights. Wiedemann describes the darker parts of the wings of *plagiata* as blackish brown. Schiner gives no reason whatever for placing *vittata* Bell, as a synonym of *plagiata*." The variations in the wing fumosity have been seen to cover the characteristics given by Townsend. The writer has attempted to obtain a specimen of Townsend's series, but the late Doctor E. P. Van Duzee stated in correspondence: "The Diptera in the California Academy of Science collection were destroyed by the San Francisco fire, following the earthquake and were lost."

P. plagiata is an easily distinguished species with a wide range of distribution in the Neotropical region.

MALE and FEMALE.—Entirely black species. *Head:* Rostrum produced but much shorter than the head or antennae. Antennae of male ten-segmented, that of female eleven. Palpi equal to antennae in length. *Thorax:* Entirely opaque black. Mesonotum with two rather deep longitudinal furrows and no apparent median furrow. Notum with sparse recumbent yellow pile. Pleurae chiefly bare except for the brownish hairs on the upper half of sternopleurae. Legs and abdomen densely covered with black pile. *Wings:* With dark brown bands along the veins, leaving the inner portions of most of the cells hyaline. The costal, subcostal and cell R_4 entirely brown. Radial cell (first basal) brown except for a small hyaline spot at the base; all other cells have a clear area in the center. Fork of third vein (R_{3+4}) arising almost vertically into the costa, merging with R_{1+2} at its tip. *Male genitalia:* Posterior lateral margins of ninth sternum greatly produced. Hind margin with two developments. Harpagones long and slender (fig. 163a), folding down into the genital cavity in normal position. Ninth tergum deeply concave, almost separated into two parts, without a central toothlike process (fig. 163b).

Female genitalia: Eighth sternum almost completely divided by a median cleft, only a narrow sclerotized bridge joins the two on anterior edge. The posterior margins are produced into a pair of rounded lobes, at the outer base of each of these is a shallow depressed area (fig. 163c). Ninth tergum three times as wide as its longest portion; with a deep, broadly U-shaped concavity on hind margin (fig. 163d). Cerci almost oval, densely haired.

Length: body, 6-7 mm.; wing, 7-9.3 mm.

Described from Brazil; type in Copenhagen.

Two specimens from type series have been examined. The species is very abundant in the American tropics, having been examined from the following areas: Brazil, British Guiana, Colombia, Costa Rica, Dutch Guiana, Honduras, Mexico, Panama, Peru, and Venezuela. Edwards also records this from Nicaragua and Guatemala.

Plecia (Rhinoplecia) pruinosa Hardy

(Plate XXXV, figs. 164a-b)

Plecia pruinosa Hardy, 1940, Journ. Kan. Ent. Soc. 13, 22-23.

This species is related to *grisea* Edwards but the distinctive genital structures of the male will distinguish it from all known species. The rostrum is more elongate than in *grisea,* the femora are pale basally, halteres are black and the wings smoky brown fumose. Following is the original description of the male genitalia:

"*Genitalia:* Posterior margin of ninth sternum developed into a pair of heavily sclerotized, outward projecting, clasper-like lobes and a pair of smaller, rounded lobes on posterior lateral margins. Harpagones comparatively small and situated toward the middle of the sternum, scarcely visible from ventral view, arising from behind the membranous area and with two acute points apically (fig. 164a). Tergum with a V-shaped excavation in the middle of the hind margin, two obtuse points curving inwardly at apex of tergum (fig. 164b); the hind margin is developed into a broad strongly sclerotized shelf-like area extending into the genital chamber, probably giving support to the anal area."

Length: body, 4.5 mm.; wing, 5.2 mm.

"*Female.*—The scape, pedicle and bases of first flagellar segments are yellow; the entire thorax is faintly yellowish tinged, the margins and humeral ridges are distinctly yellow, as are the trochanters and femora; otherwise like the male.

Length: body, 4.6 mm.; wing, 5.6 mm."

Type locality: Pico Turquino, Cuba.

Type in Cambridge Museum of Comparative Zoölogy.

Plecia (*Rhinoplecia*) *punctulata* Hardy

(Plate XXXV, figs. 165a-b)

Plecia punctulata Hardy, 1940, Journ. Kan. Ent. Soc. 13, 23-24.

Following is the original description:

"Somewhat related to *nitidipes* Edwards but differing in a great many respects. The rostrum is developed as long or longer than the antennae; the dorsum is covered with minute punctules; the ninth sternum is not developed into two pairs of lobes on hind margin and the posterior lateral margins not at all produced; the tergum is not so deeply concave and the lateral margins are developed into a pair of narrow lobes posteriorly (fig. 165a).

"*Male.*—In addition to the characters given above: Entirely black, opaque to subopaque, dorsum sometimes in part shining and usually appearing faintly pruinose, especially on the margins. This appearance is caused by the finely punctulate texture. Stems of halteres yellow-brown, knobs brown to black. *Wings:* yellow-brown fumose, veins and stigma brown; vein R_{2+3} (R_{3+4}) gently curved into the costa; crossvein r-m situated at about the middle of the distance between m-cu and fork of media.

"*Genitalia:* Ninth sternum scarcely developed on hind margin, only two small swellings toward the middle. Harpagones elongate and strong, produced about as long as the sternum and rather

abruptly tapering on the inner margins near their apices (fig. 165e). Ninth tergum divided into two halves by a median groove or invaginated area; posterior lateral margins produced into a pair of narrow lobes; median margin with a strong pointed process (fig. 165a) which folds inward toward the genital chamber.

"Length: body, 3.2-3.6 mm.; wing, 3.7-4 mm.

"*Female.*—The stigma is concolorous with the wing membrane, vein R_{2+3} (R_{3+4}) more oblique, curved but slightly near its base; antennae eleven segmented; humeral ridges and hind margins of mesonotum tinged with rufous; otherwise like the male, except for sexual characters.

"Length: body, 4-4.3 mm.; wing, 4.6-5 mm."

Type locality: Diamantina, Minas Geraes, Brazil.

Type in Cornell University Collection.

Plecia (Rhinoplecia) quadrivittata Williston

(Plate XXXVI, figs. 166a-e)

Plecia quadrivittata Williston, 1900, Bio. Cent. Amer. III. Suppl. I.

This appears to be a rather common species in the states of Guerrero and Colima in Mexico. The writer has examined a large series which fits the original description. Williston's description is very complete with the exception of the male genitalia. The original is quoted: "*Male.* Black throughout. Head lightly gray-pollinose; face prolonged in front of the eyes about as far as the vertex projects backwards; eyes elongate oval, the ocellar tubercle prominent. Thorax and scutellum lightly dusted with grayish, opaque, the mesonotum with four shining black stripes, the lateral ones abbreviated in front, the narrowly separated median ones behind. Abdomen moderately shining. Wings uniformly brown; the anterior branch of the third vein is at an angle of about forty-five degrees, arising nearly opposite the end of the second vein and terminating in the costa a little less than its own length from the tip of the second vein; penultimate section of the third vein a little longer than the length of the anterior cross-vein; furcation broad in the margin; anal cell wide open. Proboscis longer than the distance from the vertex to the lower end of the face. Length 6-7 millim.

"*Female.* Larger; abdomen opaque brownish-black."

Male genitalia: Ninth sternum with a blunt median process on hind margin, posterior lateral margins moderately produced. Harpagones simple, folded inward in normal position, rather acutely pointed (fig. 166b). Accessory structures of aedeagus rather complex (fig. 166c). Ninth tergum cleft about one-half the length of

the segment, the lower portion of the cleft is very narrow (fig. 166d).

Female genitalia: Eighth sternum broad, heavily sclerotized on posterior portion, more lightly so on anterior half. Posterior margin produced into two strong lobes near middle, with two small median developments between and a large rounding swelling at each side (fig. 166a); sternum divided into two plates by the median cleft. Ninth tergum concave on hind margin, posterior lateral margins rounding. Anterior lateral margins strongly produced into a long sclerotized process which extends beneath the eighth abdominal tergum (fig. 166c).

The species was described from Rincon, Guerrero.

The writer has examined a large series from Cuernavaca, Mexico, Oct. 22, 1922 (E. G. Smyth), and Colima, Vulcano, Mexico (L. Conrad).

Cotypes in British Museum collection and American Museum.

Plecia (*Rhinoplecia*) *rectiora* Hardy

(Plate XXXVI, figs. 167a-c)

Plecia (*Rhinoplecia*) *rectiora* Hardy, 1942, Can. Ento. LXXIV, 113.

"The mouthparts of this species are intermediate between *P. confusa* Loew and *rufithorax* Walker. They are about equal to the antennae in length, the mesonotum is only faintly furrowed and the legs and abdomen are brown with a faint reddish tinge. The species, however, can be separated conveniently only by using the male genitalia; these structures differ from any other species in the complex.

"*Genitalia:* Ninth sternum more strongly produced on the posterior lateral margins, these lobes extend beyond the median edge of the segment about three-fourths the length of the harpago. Harpagones simple, pointed apically (fig. 167a); accessory plates at each side of aedeagus large and well developed, each with a strong outward projecting spine on outer margin near apex (fig. 167b) as seen in end view. Ninth tergum with a broad flat bottomed excavation on the hind margin, this cleft has a very minute niche in middle as seen from dorsal view (fig. 167c). The hind margin of the tergum is folded over into the genital chamber, broadly produced, rounded on the sides and developed into an inward projecting point from end view.

"Length: body, 5.5-6 mm.; wing, 7.4 mm.

"Females are slightly larger in size, body, 7-7.4 mm.; wing, 9-10 mm."

Type locality: S. Luiz Ricamar, Est Maranhao, Brazil.

Type in Snow Entomological Collection.

The species has also been recorded from Sapucay and Villarica, Paraguay.

Plecia (Rhinoplecia) rostellata Loew

(Plate XXXVI, figs. 168a-d)

Plecia rostellata Loew, 1858, Berl. Ent. Zeit. II.

Plecia rostrata Bellardi, 1859, Ditt. Mess. 1, 15, 3. (Syn. by Schiner).

The specimens described here fit the original description and the wing figured by Loew and no doubt belong to the species he had in mind. The description of the species was based upon the female so it is difficult to be absolutely sure of its identity, this is the only Brazilian form known to the writer which conforms entirely to Loew's description.

MALE.—*Head:* Rostrum produced as long as the head, longer than the antennae; antennae eight segmented, yellowish with a light brown tinge toward the apical segments; the segments are porportioned as in most other members of the genus. *Thorax:* Entirely yellowish orange; halteres yellowish at their bases, black at their tips. Legs and abdomen brown to black with dense short black hairs. *Wings:* Yellow-brown fumose, costal cell and stigma brown. Fork of radial sector (vein R_{3+4}) arising at end of R_{1+2} and extending almost vertically into the costa. Fork of media located at about one-third the distance from the r-m crossvein to the fork of the Rs. *Genitalia:* Ninth sternum with a convex rounded projection in the middle on the hind margin, posterior lateral margins rather strongly developed but much less than one-half the height of the claspers. Harpagones broad and rather blunt from a ventral view (fig. 168c). Ninth tergum deeply but gently concave on posterior margin; tergum widest at upper one-fourth of the segment (fig. 168d); hind margin not developed as in *gibbosa* Hardy.

Length: body, 6-6.5 mm.; wing, 7-7.5 mm.

FEMALE.—Fits the description of the male (aside from sexual characters) with the exception of the eleven segmented antennae (counting nipplelike tip); the antennae are also darker brown and the specimens are larger. *Female genitalia:* Eighth sternum divided into two plates by median cleft, posterior median lobes rounding and slightly convergent; lateral lobes acutely pointed and arising very close to median lobes; sternum much wider than long (fig. 168a). Ninth tergum deeply cleft on hind margin, this cleft is flat

bottomed and the lateral lobes are broad and rounding; anterior lateral margins produced inwardly into a pair of long projections (fig. 168b).

Length: body, 6.5-7 mm.; wing, 8.5-9.5 mm.

Type locality: Brazil.

Type probably in the Zoölogical Museum at Berlin.

Specimens have been examined from Rio de Janeiro, Brazil, L. Trav., May, 1935 (Lopes), and June 20, 1918 (R. Flacher); Diamantina, State of Minas Geraes, Brazil, Nov. 14-18, 1919 (Cornell University Exped.) and Aqua Preta, Bahia, Brazil, 12-8-39 (Pedrito Silva).

Plecia (Rhinoplecia) rufimarginata Hardy

(Plate XXXVI, figs. 169a-b)

Plecia rufimarginata Hardy, 1940, Journ. Kan. Ent. Soc. 13, 24.

This species is related to *edwardsi* Hardy but the rostrum is as long as the antennae and the male genitalia are very different. The pleurae, margins of mesonotum and legs of both sexes are lightly yellowish tinged. The fork of media is at about half the distance between r-m crossvein and fork of Rs, instead of near basal third as in *edwardsi*. This is the smallest *Plecia* known to the writer. Following is the original description of the male genitalia:

"*Male genitalia:* Ninth sternum slightly wider than long, posterior margin concave, with three median projections; the two lateral ones are heavily sclerotized, vertical in position and densely haired; the median is more membranous and projects inward toward the genital chamber and is bare (fig. 169b). The harpagones are simple and terminate in an acute point on the inner margins. Ninth tergum with but a single concavity on posterior margin (fig. 169a)."

Male length: body, 2.1-2.3 mm.; wings, 2.6 mm.

Female length: body, 2.6-2.7 mm.; wings, 3.2 mm.

Type locality: Paraiso, Panama.

Type in the United States National Museum Collection.

Plecia (Rhinoplecia) rufiscutella Hardy

(Plate XXXVI, figs. 170a-b)

Plecia rufiscutella Hardy, 1940, Journ. Kan. Ent. Soc. 13; 24-25.

The male genitalia places this species near *nitidipes* Edwards. It is easily recognized by the bright orange-red scutellum of both sexes. The rostrum is more elongate, the wings differ and the genital characters are distinct from *nitidipes*. Following is the original description:

"*Male.—Head:* Rostrum produced longer than the head, antennae broken on holotype specimen. *Thorax:* Opaque black with a faint reddish tinge on the lateral margins; scutellum bright orange-red. Almost bare species, with only brown hairs on the upper portions of the sternopleurae and a dense patch of black hair on each humerus. Mesonotal furrows very faint, sides and hind portions of notum rugose; the rugosity appearing in sunken areas, one on each side and one just before the scutellum. Legs and abdomen subshining black with black pile; halteres black. *Wings:* The wing venation is much the same as in *plagiata* Wiedemann but the fumose borders of the veins are more yellow and not so dark. Vein R_{2+3} (R_{3+4}) gently curves into the costa. R_1 is situated two-thirds the distance between subcosta and R_{2+3} (R_{3+4}); fork of media at or slightly beyond one-half the distance from the r-m crossvein to the fork of Rs.

"*Genitalia:* Ninth sternum very broad and rather long, posterior lateral margins produced into two large flat-topped lobes, posterior median margin with two narrow processes. Harpagones very slender and elongate, vertical in position (fig. 170b). Ninth tergum concave on hind margin, posterior lateral margins with a distinct emargination, anterior margin very deeply cut inward almost dividing the segment (fig. 170a); cerci very broad and rounding.

"Length: body, 7.5 mm.; wing, 9.5 mm."

"*Female.*—Antennae eleven segmented, thorax brownish with a faint shade of red; scutellum yellow-orange; legs slightly reddish tinged, otherwise like the male.

"Length: body, 8-9 mm.; wing, 12 mm."

Type locality: Moyombamba Region, Peru.

Type in the American Museum.

Plecia (Rhinoplecia) rufithorax Walker

(Plate XXXVI, figs. 171a-d)

Plecia rufithorax Walker, 1848, List of Dipt. in Brit. Mus. I. 116.

This species has also caused a great deal of controversy in that it has long been common practice to place almost all Neotropical *Plecia* of medium size, long rostrum and rufous thorax under this name. Walker's type was a female from Jamaica and all the males the writer has examined from this island have been conspecific. Doctor Edwards has also compared females with the type, so the species here described is no doubt *rufithorax*.

MALE.—*Head:* Rostrum produced as long as the head and longer than the antennae, antennae eight segmented; the pedicel, scape and basal one-half of first flagellar segment yellow, otherwise brownish

yellow; ocellar tubercle very prominent. *Thorax:* Entirely yellowish to orange-rufous. Mesonotum sometimes lightly speckled with brownish; notum with two distinct longitudinal furrows, and one faint median furrow, the lateral ones converge slightly before the scutellum. Halteres with brown knobs and yellow stems. Legs and abdomen brown to black with black hairs. *Wings:* Brownish yellow fumose, stigma but little darker than the membrane, veins brown. Fork of radial sector (vein R_{3+4}) arising just beyond the end of R_{1+2} and extending almost vertically into the wing margin (fig. 171c). Fork of M_1 and $_2$ at about basal one-third of distance between the radio-medial crossvein and the fork of the radial sector. *Genitalia:* Ninth sternum slightly broader than long with a median process on hind margin, this process terminates in two small lateral projections with a small depressed area between. Posterior lateral margins of sternum only slightly developed. Harpagones broad and flat apically ending in two points (fig. 172a). Ninth tergum with an almost rectilinear excavation on hind margin, the sides and bottom of this area but slightly rounded (fig. 171b).

Length: body, 4.6-5.4 mm.; wing, 5.5-6 mm.

Female genitalia: Ninth tergum about three times as wide as long with a broadly U-shaped cleft on hind margin and a slight convexity in the middle of this cleft; posterior lateral margins somewhat undulated (fig. 171a). Eighth sternum divided into two plates by a median cleft, median lobes elongated and pointed apically, posterior lateral margins wavy, lateral lobes rounded (fig. 171d).

Female length: body, 5.5 mm.; wing, 6-6.7 mm.

Described from the Island of Jamaica.

Type in British Museum.

The writer has studied specimens from the type locality .

Plecia rufithorax concava Hardy

(Plate XXXVII, figs. 172a-f)

Plecia rufithorax concava Hardy, 1942, Can. Ento. LXXIV, 114.

"The specimens here discussed are considered a subspecies of *rufithorax* because of the apparent close relationship shown in the genital structures of both sexes. The males differ chiefly in having the ninth tergum moderately concave, broadly U-shaped on hind margin (fig. 172d). The ninth sternum and harpagones appear to be identical (fig. 172a). The female genitalia show considerably more differentiation than those of the male. The cleft of ninth tergum is broadly U-shaped on hind margin (fig. 172e) instead of being wide and flat bottomed as in typical *rufithorax* and the posterior

lateral margins of the tergum are broadly rounded, not indented. The tergum is almost twice as wide as long. Eighth sternum developed into two prominent lobes near middle on hind margin, these are characteristically notched on their outer margins (fig. 172f). Specimens of both sexes are also of larger size than the typical *rufithorax,* the female of *concava* being almost twice as large.

"Length: male body, 6 mm.; wing, 6.7-8 mm.

"Female: body, 7.4-8.6 mm.; wing, 9.4-10.7 mm."

Type locality: * Holotype male and allotype female on same pin, Cacao Trece Aguas, Alta V. Paz, Guatemala, Aug. 4, '06 (Schwarz-Barber.) Paratypes: One female, same data; one male Cayuga, Guat., April 1915 (Wm. Schaus); one male, one female, Orizaba, Mexico (Mann); four males, one female, Tegucigalpa, Honduras, April-June, 1917-18 (F. J. Dyer); one male, same locality, June 6, 1909; one female, La Cieba, Brit. Honduras, Oct. 18, 1916 (F. J. Dyer); one male, Rep. Honduras, Tabasco, 15 April, 1924 (C. H. Curran); one female, Prieta, Rep. Hond., 6 Apr., '24 (J. Bequaert); and one male, one female, Claremont, Jamaica, March 10, 1931 (E. L. Bell).

Type in United States National Museum.

Plecia (*Rhinoplecia*) *rugosa* Hardy

(Plate XXXVII, figs. 173a-c)

Plecia rugosa Hardy, 1940, Journ. Kan. Ent. Soc. 13, 25-27.

Following is the original description:

"This species seems to approach *rufimarginata* Hardy in general characters but is easily separated by the finely shagreened surface of the mesonotum, its slightly larger size and very different genitalia.

"*Male.—Head:* Rostrum produced about as long as antennae, folded beneath the face. Antennae nine segmented, the segments short and compressed. *Thorax:* Mesonotum shining, entire surface finely shagreened, somewhat more coarsely so on the lateral and anterior margins, more smooth posteriorly. Mesonotal furrows very distinct, terminating in a small depressed area just before the scutellum. Dorsum almost bare, a few scattered yellow hairs on the margin of the notum. Pleurae chiefly opaque, upper portions of sternopleurae also shagreened, with numerous long brown hairs; lower portions of sternopleurae shining and bare. Halteres black, stems yellow-brown. Legs and abdomen dark brown to black, covered with long black pile, tarsal joints slender. *Wings:* Uniformly yellow-

* The type localities were left out of the original description, so these are recorded here

brown fumose, stigma but little darker than membrane, veins brown. Fork of third vein, R_{2+3} (R_{3+4}), curved moderately into the costa; fork of media situated just before one-half the distance from r-m crossvein to the fork of the radial sector. Vein Cu_2 (Cu_1) scarcely sloped downward at its tip, anal cell as wide at apex as at middle.

"*Genitalia:* Ninth sternum broader than long, posterior lateral margins not developed; hind margin with two moderately developed erections having a U-shaped concavity between them; median portion developed into a somewhat membranous area which fits above the aedeagus. Harpagones with a somewhat beaklike point apically, on inner side (fig. 173a). Ninth tergum about as long as wide, narrowing somewhat on apical one-third, hind margin with a small indentation (fig. 173b); hind margin of tergum developed inwardly to form a broad plate before the anal region, as seen from lateral or end view; this plate terminates in two strongly sclerotized, inward projecting points (fig. 173c).

"Length: body, 3-3.3 mm.; wing, 3.5 mm.

"*Female.*—Differs from the male in having the thorax entirely rufous and abdominal sterna lightly tinged with yellowish and first two abdominal segments yellow.

"Length: body, 4.5 mm.; wing, 4.6 mm."

Type locality: Bet. Queremal and Buenaventura, Columbia.

Type in the American Museum Collection.

Plecia (Rhinoplecia) seminitens Edwards

(Plate XXXVII, figs. 174a-c)

Plecia seminitens Edwards, 1938, Ann. Mag. Nat. Hist. Ser. 11, V. 2, 321-322.

The following is the original description of the male:

"Male. Black, only stem of halteres and base of femora brownish. Eyes bare, undivided and without any obviously differentiated lower area of smaller facets. Mouth-parts and clypeus folded back under head as usual in this subgenus, but not noticeably elongate; palpi shortish, each of the four segments very little longer than broad. Antennal flagellum short, 6-segmented, terminal segment the largest. Mesonotum with three brightly shining stripes; shoulders and front ends of a pair of narrow deep grooves between the stripes with coarse gray dusting; median stripe not obviously grooved down the middle; similar coarse gray dusting on most of pleurae, but lower half of sternopleurae shining black; a small patch of hair in middle of sternopleurae, pteropleura bare. Abdomen shining. Femora somewhat clubbed on distal half; hind tibiae slightly and uniformly

thickened. Wings with uniform dark smoky tint; R_4 short and vertical. Hypopygium: tergite pubescent, posterior margin nearly straight, in middle with a small bare shining black triangular process which is curved inwards; styles large and lateral in position, divided distally into two lobes, the upper lobe broad, flat and rounded, the lower small, narrow and thumb-like. Length of body or wing 4 mm."

The writer has studied a metatype male and makes the following addition to the description: Ninth sternum with a broad flat topped median process on hind margin; inner lobe of harpagones projecting at about level or slightly above the outer lobe from ventral view (fig. 174a), narrower and slightly longer than the thick outer lobe; harpagones broad from lateral view, with both lobes visible (fig. 174b), although the outer (stronger) lobe folds inward making it necessary to tilt the structure in order to view it. Median process of ninth tergum scarcely produced beyond posterior margin of the segment (fig. 174c), and flat topped in the specimen studied.

Doctor Edwards stated (in correspondence) that he felt quite sure the female described as *seminitens* belongs to a different species, however, it is possible that they are correctly associated as several dimorphic species have been found in this group, so the description is quoted here: "Female (?). Resembles the male in most respects, notably its small size, shining black lower half of sternopleura and almost uniformly dark wings, but differs as follows:—Mouth-parts even shorter. Antennal flagellum dark brownish, 8-segmented (apart from the nipple-like tip). Mesonotum wholly light reddish. R_4 more oblique. Length of body or wing 5 mm."

Type locality: Nova Teutonia, Brazil.

Type in the British Museum.

The writer has studied a topotype.

Plecia (*Rhinoplecia*) *serrata* Hardy

(Plate XXXVII, figs. 175a-c)

Plecia (*Rhinoplecia*) *serrata* Hardy, 1942, Can. Ento. LXXIV, 114.

"This species is related to *vittata* Wiedemann and *bicolor* Bellardi but separates from all other members of this genus by its unique genitalia.

"MALE.—Antennae nine segmented, the terminal segments small and nipplelike. Rostrum as long as the head, longer than the antennae. Pleurae brown to black with a faint rufous tinge. Dorsum entirely rufous, halteres black. Legs chiefly black, bases

of femora somewhat yellowish. Wings smoky fumose, vein R_{3+4} almost vertical, but slightly curved into the costa. Fork of veins M_1 and $_2$ situated at about the basal one-third of the distance from the radio-medial crossvein to the fork of the radial sector. Stigma concolorous with the membrane. *Genitalia:* Ninth sternum with a pair of pointed lobes on the posterior margin in the middle, posterior lateral margins of sternum not developed. Harpagones strong, very broad, with numerous small pointed teeth on the inner apical edges, as seen from the ventral view (fig. 175a), almost square topped from a lateral view (fig. 175b). Ninth tergum with a small concavity medianly on the hind margin (fig. 175c).

"Length: body, 4 mm.; wing, 4.7 mm.

"Female unknown."

Type locality: Villarica, Paraguay.

Type at Michigan State College.

Plecia (*Rhinoplecia*) *similis* Rondani

(Plate XXXVII, figs. 176a-c)

Plecia similis Rondani, 1850, Nuovi Ann. Delle. Sci. Nat. Ser. III, tom II, 193.

Plecia minor Jaennicke, 1867, Neue Exot. Dipt. Abhandl, d. Senckenb. Naturl. G. Bd. VI, 318.

The species at hand fits the original description better than any other Brazilian species and all of the specimens examined from the type locality have been the same. This is also the species which is considered *similis* in the British Museum.

Entirely black species. *Head:* Rostrum strongly produced, longer than the antennae in both sexes. Antennae nine segmented in the male, eleven segmented in the female, the latter more compacted. *Thorax:* Dorsum faintly shining with three longitudinal furrows down the middle, the median groove weak. Pleurae opaque, lower half of sternopleurae faintly shining, upper portion of sternopleurae with sparse pale hair. Wings subhyaline, basal and costal portion lightly fumose. Fork of third vein (R_{3+4}) curved into costa; fork of M_1 and $_2$ situated just before one-half the distance between the r-m crossvein and the fork of the radial sector. *Male genitalia:* Ninth sternum longer than wide with a well developed median process on the hind margin, this development is bifid apically. Harpagones broad and blunt, especially from a ventral view (fig. 176a). From a lateral view a blunt arm projects inward slightly on outer margin, from this view a large hollowed out area can be seen in the center (fig. 176b). Ninth tergum concave on posterior

margin with a somewhat membranous development in the center (fig. 176c).

Male length: body, 4.5-5 mm.; wing, 5-6 mm.

Female length: body, 5.5-6 mm.; wing, 7 mm.

Type locality: San Sebastian.

Type probably at the University of Bologna.

Specimens have been examined from S. Jose Cos. Campos., July, 1933 (H. S. Lopes); Brazil, S. Paulo Est. S. Paulo, July 9, 1928; Ctr. Brazil, Oct. 22, 1924 (Flacher); and Toinville, Brazil (Lichtwardt).

Plecia (*Rhinoplecia*) *trilobata* Hardy

(Plate XXXVII, figs. 177a-d)

Plecia (*Rhinoplecia*) *trilobata* Hardy, 1942, Can. Ento. LXXIV, 114-115.

"This species is near *bicolor* Bellardi but the male genitalia are so distinctive that its identity can not be mistaken. The antennae are distinctly yellowed in this species and the pleurae are somewhat tinged with rufescent. These characters alone, however, would not separate it conveniently.

"MALE.—Antennae nine segmented, counting knoblike tip. Rostrum produced slightly longer than the antenae. Compound eyes divided by a shallow furrow on lower one-third. Wings comparatively short, about equal to the length of body, vein R_{3+4} gently curved. Hind tarsi somewhat swollen, subsegments short. *Male genitalia*: Ninth sternum rather elongate compared with its width, its posterior margin undulated (fig. 177a). Harpagones three lobed, two arms visible from ventral view, the third only seen from lateral. Dorsal arms long and curved, median arms small with two apical points; ventral lobes large and rounding, the surface densely pitted (fig. 177b). Ninth tergum broad, with a small V-shaped concavity from a direct dorsal view (fig. 177c); the inner top edge of the segment is developed inward into a broad flat area and two sharp points (fig. 177d); this can only be seen by looking directly down into the genital chamber.

"Length: body, and wings, 4.7-5 mm.

"FEMALE.—Antennae eleven segmented; bases of femora somewhat yellowed; pleurae more rufous tinged, all tarsi slender.

"Length: body, 5.8 mm.; wing, 6.4 mm."

Type locality: British Guiana, Upper Courantyne R., King Frederick William IV Falls.

Type to be returned to the British Museum.

Plecia (*Rhinoplecia*) *uberta* Hardy

(Plate XXXVII, figs. 178a-c)

Plecia (*Rhinoplecia*) *uberta* Hardy, 1942, Can. Ento. LXXIV, 115.

"This species is related to *collaris* by having the anterior portion of the dorsum blackish, it is distinguished by its small, acutely pointed harpagones, small median development on the hind margin of the ninth sternum and the V-shaped cleft of the posterior margin of ninth tergum.

"MALE.—*Head:* Rostrum well developed, as long as the head and longer than the antennae. Antennae eight segmented, slightly yellowish tinged, most segments longer than wide and rather loosely joined. Compound eyes not divided by a transverse depression. *Thorax:* Mesonotum and scutellum chiefly rufous, anterior portion of dorsum black. Pleurae yellow-brown to blackish; humeral ridges largely yellow; halteres black, stems pale. All tarsi slender, posterior basitarsi not at all swollen, equal in length to the next four subsegments. *Wings:* Brownish yellow fumose, stigma slightly darker than the membrane. Anterior fork of Rs (R_{3+4}) straight and almost vertical. Cubital cell widely open in the wing margin. *Genitalia:* Ninth sternum with a blunt median projection on the posterior margin, lateral margins not developed. Harpagones small, slender and rather sharply pointed (fig. 178c), folded downward in normal position, scarcely visible from ventral view unless plate is tilted back (fig. 178a). Ninth tergum broader than long with a deep V-shaped concavity on posterior margin (fig. 178b).

"Length: body, 6-6.5 mm.; wing, 7.5-8 mm."

Type locality: Lombardia, Honduras.

Type in United States National Museum.

This species has also been reported from Motzorongo, V. C., Cordoba and Teapa, Tabasco, Mexico.

Plecia (*Rhinoplecia*) *varabilis* Hardy

(Plate XXXVIII, figs. 179a-c)

Plecia (*Rhinoplecia*) *varabilis* Hardy, 1942, Can. Ento. LXXIV, 115-116.

"This species can be separated from *rufithorax* Walker only by the male genitalia. It is easily distinguished by the characteristic development of the ninth sternum and the small V-shaped cleft on the hind margin.

"The rostrum is well developed, longer than the antennae and folded beneath the face in resting position, compound eyes without a transverse groove on lower portion. Antennae of male eight seg-

mented, of female ten segmented, antennae as well as pleurae and sides of abdomen often tinged with yellow. *Male genitalia:* Ninth sternum broad; posterior lateral margins strongly developed, reaching much beyond the bases of the harpagones. Hind margin of sternum with a characteristic knoblike development in the middle (fig. 179a). Harpagones well developed, with several irregular teeth or bumps apically (fig. 179b). Ninth tergum but little wider than long, hind margin with a small V-shaped excavation in the middle (fig. 179c).

"The specimens in the type series show considerable variation in color, the typical coloration being yellow-orange without maculations, varying from this to dark rufous with irregular dark spots. Some of the female specimens in the series conform with the latter but they appear to be slightly teneral and this is probably not characteristic.

"Length: body, 5-6.7 mm; wing, 5.3-8.6 mm."

Type locality: Barro Colo. Isld., Canal Zone.

Type in American Museum of Natural History.

This species has been recorded from various localities in Panama and Guatemala.

Plecia (*Rhinoplecia*) *vittata* Wiedemann

(Plate XXXVIII, figs. 180a-c)

Plecia vittata Wiedemann, 1828, Aus. Zweifl. Ins. I, 75.

The late Doctor Edwards of the British Museum compared specimens with the female type and sent the writer a male specimen from his series; this conformed with a Brazilian species in the writers collection.

This species is related to *bicolor* Bellardi and is best separated from that species by the male genitalia. The wings are clearer than in *bicolor,* the costal area is somewhat smoky near the apices of the wing in males; the legs seem more consistently black and the genitalia more shining, the specimens are also slightly larger.

Male genitalia: Ninth sternum broad and rounded, with a slight inward dip on hind margin. Harpagones very stout and irregular in shape (fig. 180a) somewhat pointed apically but inner margin developed into a large blunt projection, visible from a lateral view (fig. 180b). Hind margin of ninth tergum developed into two obtuse lobes, these fold back slightly toward the anal area. Ninth tergum wider than long (fig. 180c).

The female can be separated from *bicolor* only on size and geographical distribution.

Male length: body, 5-5.5 mm.; wing, 6 mm.

Female length: body, 6.5-7.5 mm.; wing, 8 mm.

Type locality: Brazil.

Type in Berliner Museum.

Specimens have been examined from Brazilien Nova Teutonia, 27° 11′ B. 52° 23° L. 1938 (Fritz Plaumann); M. do Governo, Oct. 31 (J. Melzes) and Rio de Janeiro, Brazil, Oct. 1919 (Cornell Univ. Exped. Lot 569). Edwards also reports it from Santa Catharina, Brazil.

Plecia (*Rhinoplecia*) *xenia* Hardy

(Plate XXXVIII, figs. 181a-e)

Plecia (*Rhinoplecia*) *xenia* Hardy, 1942, Can. Ento. LXXIV, 109-110.

"This is related to *rufithorax* Walker but the male genitalia are very different; the fork of the radial sector (vein R_{3+4}) is somewhat more sharply curved at its middle (near fig. 161e) and the fork of the media arises just before the middle of the distance between the r-m crossvein and the fork of the Rs.

"*Male genitalia:* Posterior lateral margins of the ninth sternum strongly produced, extending almost as long as posterior median margin of sternum; the segment is gradually convex, with a small development in the middle on hind margin (fig. 181d). This is scarcely visible from a ventral view. Harpagones well developed and very irregular in shape, covered with numerous teethlike points and bumps (fig. 181c). Ninth tergum about as high as long, longest in middle, gently convex, with a narrow slitlike invagination medianly on the posterior margin (fig. 181b).

"Male length: body, 4-5 mm.; wing, 4.5-6 mm.

"*Female genitalia:* Eighth sternum twice as wide as long with the posterior lateral margins more elongate than the rounded median lobes (fig. 181e). Ninth tergum about half as long on lateral margins as its width, deeply cleft on both anterior and posterior margins with only a narrow bridge of sclerite joining the lateral plates; lateral plates strongly produced anteriorly (fig. 181a).

"Female length: body 5-6 mm.; wing, 5.5-6 mm."

Type locality: Higuito San Mateo, Costa Rica.

Type in United States National Museum.

The species has also been recorded from San Jose, San Carlos, and Santa Ana, Costa Rica.

Plecia femorata Macquart, 1838, Dipt. Exot. Nouv. ou peu connus, Mem. de la Soc. Sci. Lille i, i, 90. Described from Brazil but cannot be placed.

Bibio Geoffroy

Bibio Geoffroy, 1764, Hist. Ins. V. 2, 571.

The genus is characterized by the development of the tibial spurs and the presence of the radio-medial crossvein separating the third and fourth longitudinal veins (R_5 and M). The subcostal vein is usually well developed and extends to or near the costal margin. The first branch of radius consists of radial veins one to four inclusive fused together, while the posterior branch is interpreted as the fifth radial vein. The comparative length of the r-m crossvein with the length of the basal portion of vein R_5 (Rs) is a very important taxonomic character. The veins beyond radius (so-called posterior veins) are usually lighter in color and are often concolorous with the membrane. The costa ends at or but slightly beyond the end of vein R_5. The antennae are rather short and composed of six to ten short, broad, closely pressed segments; each segment bearing one or two rows of strong hairs in addition to fine pubescence. The eyes of the male are contiguous on the front while those of the female are broadly separated. The femora and tibiae of the males are usually swollen, never long, and slender as in the more primitive genera. In many species the subsegments of the posterior tarsi are greatly dilated.

For the most part the genital structures of the male *Bibio* are not as important taxonomically as in other genera and in many groups the specific characters of the genitalia are very obscure and difficult to differentiate; in some cases no noticeable specific differences appear to be present.

Genotype: *Tipula hortulana* Linn., 1762, Hist. Abregee Ins. Vol. 2, p. 568.

KEY TO SPECIES OF MALE BIBIO

1. Inner spur of front tibiae short, not more than one-half the length of outer..... 2
   Inner spur of front tibiae long, conspicuously more than one-half the length of outer, 9
2. Crossvein r-m one-third to one-fourth the length of basal part of Rs..... 3
   Crossvein r-m at least one-half the length of the basal part of Rs..... 22
3. Legs entirely black or dark brownish red, never rufous..... 4
   At least the tibiae in part yellow; posterior basitarsi scarcely over two times as long as wide 6
4. Posterior basitarsi one-third to one-fourth as wide as long; hind femora averaging 2 mm., hind tibiae 1.8 mm.; smaller species, length of wing 4.5-6.5 mm..... 5
   Posterior basitarsi five to six times as long as wide; hind femora averaging from 2.5-2.9 mm.; hind tibiae 2.4-2.6 mm.; usually larger species, length of wing 6-9 mm. 7
5. Wings dusky to smoky hyaline..... 5a *melanopilosus* Hardy, p. 473
   Wings hyaline to yellowish fumose; pile of dorsum yellow.
   albipennis var. *tenuipes* Coquillett, p. 453

   5a. Pile of thorax and legs chiefly black; humeral ridges tinged with yellow. Wing 5-6 mm. ..... *melanopilosus melanopilosus* Hardy, p. 473

Pile of thorax, coxae and femora yellow; humeral ridges black; slightly larger species. Wing 6-6.5 mm. ..... *melanopilosus* var. *biseptus* Hardy, p. 473

6. Femora black, thorax and abdomen mostly black pilose..... *curtipes* James, p. 462
Femora more rufous, abdomen at most gray pilose, thorax with some yellow pile. *kansensis* James, p. 469

7. Wings dusky ..... *albipennis beameri* n. sub. sp., p. 451
Wings hyaline 8

8. Sclerites of abdomen not overlapping. comparatively short, revealing white or gray conjunctiva ..... *conjunctivus* Hardy, p. 460
Sclerites overlapping, conjunctiva black..... 8a *albipennis* Say, p. 451

8a. Pile usually longer and more abundant, especially on males (western). *albipennis hirtus* Loew, p. 452
Pile shorter and less abundant (eastern)..... *albipennis albipennis* Say, p. 451

9. Legs black or dark reddish brown..... 10
Legs rufous or bicolored..... 13

10. Pile of thorax black..... 11
Pile of thorax yellow, or with some yellow pile intermixed..... 12

11. Crossvein r-m one-fourth the length of Rs..... *necotus* Hardy, p. 476
Crossvein r-m equal to the length of Rs..... *criorhinus* Bellardi, p. 462

12. Posterior veins concolorous with membrane; inner spurs of front tibiae nearly equal to the outer ..... *mickeli* Hardy, p. 474
Posterior veins dark; inner spurs of front tibiae shorter, about three-fourths the length of the outer ..... *utahensis* Hardy, p. 489

13. Only femora rufous ..... *femoratus* Wiedemann, p. 463
More of legs yellow to rufous 14

14. Larger species, (wing 7.5-9.5 mm.); pile chiefly dark..... 15
Smaller species (wing 4-6 mm.); pile usually pale..... 17

15. Femora (at least basally) dark brown to black, contrasting in color from posterior tibiae; pile gray to black..... *nervosus* Loew, p. 477
Femora rufous, dark tipped, concolorous with posterior tibiae..... 16

16. Wings chiefly hyaline, posterior basitarsi not enlarged..... *xanthopus* Wiedemann, p. 491
Wings yellowish fumose, posterior basitarsi enlarged..... *velorum* McAtee, p. 490

17. Subsegments of hind tarsi long and slender, metatarsi about seven times as long as wide and about three times as long as inner spurs of hind tibiae (fig. 191a). Posterior veins concolorous with the membrane; dorsum of female rufous. Posterior femora average 2.6 mm. in length, posterior tibiae 2.4 mm..... *fraternus* Loew, p. 465
Subsegments of hind tarsi rather short and thick, metatarsi from two and one-half to four and one-half times as long as wide, scarcely over twice as long as tibial spurs. Posterior veins darker than membrane in most species; dorsum of female black. Posterior femora average 1.7-2 mm. in length, tibiae 1.5-1.7 mm..... 18

18. Posterior veins concolorous with the membrane..... 19
Posterior veins darker than the membrane..... 20

19. Pile of thorax and abdomen chiefly black..... *nigripilus* Loew, p. 480
Pile chiefly yellow ..... *abbreviatus* Loew, p. 450

20. Pile chiefly yellow, legs almost entirely rufous or yellow..... 21
Pile black, legs chiefly reddish brown to black..... *velcidus* Hardy, p. 490

21. Eyes divided into an upper and lower portion by a transverse depressed area just below middle line; wings hyaline or slightly yellow fumose; spurs of posterior tibiae thick and blunt at apex, hind metatarsus not quite three times as long as wide (fig. 188a) ..... *carri* Curran, p. 458
Transverse depression near lower one-fourth of compound eye; wings dusky to smoky; spurs of posterior tibiae more slender and acute, metatarsus four times as long as wide (fig. 195a). (Some atypical specimens will run here). *Knowltoni* var. *paltidus* Hardy, p. 470

22. Posterior basitarsi distinctly enlarged, almost to equally as large as the end of the femora 23
Posterior basitarsi not distinctly swollen 40

23. Legs brown to black, not distinctly bicolored..... 24
Legs distinctly bicolored or entirely yellow to rufous..... 27

24. Thorax and legs entirely dark haired..... *slossonae* Cockerell, p. 486
Thorax and legs pale haired, sometimes with a few scattered black hairs on the dorsum 25

25. Larger species, wing 8.6-9.3 mm.; wings brownish fumose..*rufithorax* Wiedemann, p. 483
Smaller species, wing 4.5-5.5 mm.; wings pale yellow fumose..... 26
26. Stigma dark brown, posterior veins darker than membrane. Posterior basitarsus about three times as long as wide (fig. 196b); all tibial spurs acute; outer spur of front tibiae extending about one-third the length of the basitarsus (fig. 196a), *longipes* Loew, p. 472
Stigma light yellow, posterior veins concolorous with the membrane. Hind basitarsus scarcely over twice as long as wide (fig. 202b); tibial spurs more blunt; outer spur of front tibia half as long as the basitarsus (fig. 202a).....*sericatus* Hardy, p. 484
27. Femora entirely black or very dark; basal constriction never yellow. Stigma obsolete 28
Femora bicolored or entirely rufous..... 29
28. Pile of thorax black. Wings slightly yellowish hyaline.....*monsteri* James, p. 475
Pile of thorax yellow. Wings hyaline.....*labradorensis* Johnson, p. 471
29. Femora chiefly rufous, not more than apices dark..... 33
Basal constriction of femora yellow, otherwise black or dark reddish brown..... 30
30. Pile black ..... *bryanti* var. *nigrita* Curran, p. 457
Pile pale or yellow 31
31. Posterior basitarsi strongly swollen, rather globular, only two and one-half times as long as wide and broader than apices of femora; tibiae strongly dilated; posterior veins darker than membrane .....*flukei* Hardy, p. 464
Posterior basitarsi not greatly dilated, more cylindrical, at least three and one-half times as long as wide; posterior veins concolorous with membrane..... 32
32. Wings whitish or grayish hyaline; femora black apically.....*pingreensis* James, p. 481
Wings dark yellow fumose; apex of femora brown.....*tenellus* Hardy, p. 486
33. Femora entirely yellow to rufous, not tipped..... 38
At least apices of femora narrowly black tipped..... 34
34. Pile black; femora only slightly tipped; wings hyaline.....*bryanti* Johnson, p. 456
At least some yellow pile on dorsum, that of pleurae, coxae and femora always pale, 35
35. Smaller species (wing 4-5 mm.); wings yellowish hyaline, posterior veins darker than membrane .....*fluginatus* Hardy, p. 464
Larger species (wing 7-8.5 mm.); wings yellowish fumose..... 36
36. At least posterior tibiae concolorous with femora, not with a dark brown to black stripe running the entire length; posterior veins concolorous with membrane..... 37
Anterior tibiae dark reddish brown to black, middle tibiae dark reddish to brown, posterior tibiae with dark brown to black strip running the entire length dorsally. Posterior veins yellow-brown .....*columbiaensis* Hardy, p. 459
37. Tibiae, hind femora and basal tarsal joints pale, with dark tips..*inaequalis* Loew, p. 468
Only femora dark tipped .....*fumipennis* Walker, p. 466
38. Larger species, wing 6.5-8.5 mm.; genitalia black..... 39
Smaller species, wing 4.5 mm.; ninth sternum bright yellow, coxae and trochanters yellow .....*townesi* n. sp., p. 487
39. Pile of thorax black; wings hyaline .....*bryanti* Johnson, p. 456
Pile of thorax yellow; wings brownish yellow fumose.....*inaequalis* Loew, p. 468
40. Legs distinctly bicolored or rufous, at least bases of tibiae light colored..... 42
Legs entirely dark 41
41. Legs shining black; wings dark yellow-brown fumose.....*carolinus* Hardy, p. 457
Legs dark reddish brown to black; wings whitish hyaline .....*similis* James, p. 485
42. Only femora rufous .....*holti* McAtee, p. 467
More of legs yellow to rufous..... 43
43. Femora dark brown to black contrasting from paler tibiae, at least bases of tibiae yellow to rufous 44
Femora rufous, not thus contrasting, usually entirely rufous, if darkened apically the tibiae are also darkened 48
44. Larger species, wing 7-8.5 mm..... 45
Smaller species, wing 4-5.5 mm. 47
45. Wings hyaline 46
Wings yellow-brown fumose; sometimes only bases of tibiae yellow rufous, pile dense, yellow. Humeral crossvein obsolete ..... 45a *neojacobi* n. n., p. 476
45a. Only the bases of tibiae yellowish to rufous, legs otherwise black.
neojacobi neojacobi n. n., p. 476
Tibiae, first two tarsal subsegments and bases of femora rufous.
neojacobi rufitibialis Hardy, p. 477

46. Posterior veins concolorous with the membrane; pile dense black..*vestitus* Walker, p. 491
Posterior veins darker than membrane; pile yellow.....*atripilosus* James, p. 455
47. Pile of dorsum long, dense black with yellow hairs intermixed, or pile of dorsum entirely yellow; wings hyaline to dusky. Inner spurs of front tibiae about one-fourth the length of the outer ..... 47a *nigrifemoratus* Hardy, p. 478
Pile very sparse and short, chiefly black; wings yellow fumose. Inner spurs of front tibiae about one-half the length of outer.....*cognatus* Hardy, p. 459
47a. Pile of dorsum chiefly black.....*nigrifemoratus nigrifemoratus* Hardy, p. 478
Pile of dorsum entirely yellow.....*nigrifemoratus* var. *gilvus* Hardy, p. 479
48. Larger species (wing 6-9.5 mm.); posterior basitarsi as long as next two subsegments and five times as long as wide..... 51
Smaller species (wing 4-5 mm.); posterior basitarsi shorter than next two subsegments and less than four times as long as wide..... 49
49. Middle and anterior legs marked with brown, anterior tibiae black basally; dorsum of female black ..... 49a *knowltoni* Hardy, p. 469
Middle and anterior legs concolorous with posterior legs; dorsum of female slightly rufous 50
49a. Wings yellowish .....*knowltoni knowltoni* Hardy, p. 469
Wings dusky .....*knowltoni* var. *paltidus* Hardy, p. 470
50. Tibiae with gray to black pile contrasting with silky yellowish pile of femora; eyes mostly pale pilose .....*alexanderi* James, p. 453
Tibiae with softer yellow pile; eyes black pilose.....*painteri* James, p. 480
51. Crossvein r-m only one-half the length of the basal part of Rs; posterior veins entirely obsolete; tarsal joints very slightly swollen, not nearly as broad as end of femora; pile of dorsum dark yellow-brown; femora and tibiae dark on apical portion .....*conus* Hardy, p. 461
Crossvein r-m over one-half, usually equal to base of Rs; tarsal joints slender.... 52
52. Pile of dorsum black .....*tristis* Williston, p. 488
Pile of dorsum chiefly yellow 53
53. Wings chiefly hyaline to dusky; tibiae and tarsi of front two pairs of legs darker than femora, which are light reddish yellow; posterior legs entirely reddish yellow, joints darker .....*alienus* McAtee, p. 454
Wings slightly yellow fumose, tibiae and tarsi, of at least posterior legs, concolorous with femora 54
54. Thorax and abdomen entirely black. Posterior veins darker than the membrane. 54a *xanthopus* Wiedemann, p. 491
Posterior margin of thorax, parts of pleurae, coxae and abdomen with dark reddish coloration. Posterior veins concolorous with membrane.....*rufalipes* Hardy, p. 482
54a. Pile pale, less abundant; wings yellowish fumose; pleurae of female often in part yellow to rufous .....*xanthopus xanthopus* Wiedemann, p. 491
Pile more abundant, gray to black; wings somewhat smoky; pleurae of female black (western) .....*xanthopus palliatus* McAtee, p. 492

KEY TO THE SPECIES OF FEMALE *Bibio*

1. Inner spurs of front tibiae short, not more than one-half the length of the outer... 2
Inner spurs conspicuously more than one-half the length of the outer..... 8
2. Crossvein r-m at least one-half the length of the basal section of the radial-sector, 16
Crossvein r-m short, not more than one-third the length of the basal section of the radial-sector 3
3. Legs entirely black, or dark brownish red, never rufous..... 4
Legs chiefly rufous, posterior basitarsi just one and one half-times as long as second tarsal subsegment 6
4. Posterior basitarsi scarcely over three times as long as wide; smaller species (wing 4-6 mm.) 5
Posterior basitarsi almost six times as long as wide; usually large species (wing 5.5-9.5 mm.) 7
5. Wings dusky to smoky hyaline ..... 5a *melanopilosus* Hardy, p. 473
Wings hyaline to yellowish; pile of dorsum yellow..*albipennis* var. *tenuipes* Coquillett
5a. Pile of thorax, coxae and femora chiefly black, humeral ridge tinged with yellow; legs somewhat rufous.....*melanopilosus melanopilosus* Hardy, p. 473
Pile of thorax, coxae and femora pale, humeral ridge black; legs entirely black; slightly larger species, length of wing 6-6.5 mm, *melanopilosus biseptus* Hardy, p. 474

6. Thorax and abdomen chiefly black pilose; inner spurs of front tibiae about one-half the length of the outer ..... *curtipes* James, p. 462
Thorax and abdomen with grayish yellow pile; inner spurs not more than one-fourth the length of the outer ..... *kansensis* James, p. 469
7. Humeri each with large conspicuous red spot in addition to the yellow of humeral ridges; pleurae with rufous markings. Wings smoky..... *conjunctivus* Hardy, p. 460
Thorax entirely black, except for pale humeral ridges..... 7a *albipennis* Say, p. 451
7a. Wings hyaline 7b
Wings dusky ..... *albipennis beameri* n. sub. sp., p. 451
7b. Pile usually longer and more abundant, especially on males (western). *albipennis hirtus* Loew, p. 452
Pile shorter and less abundant (eastern)..... *albipennis albipennis* Say, p. 451
8. Femora lighter in color than tibiae and tarsi, dorsum of thorax black..... 9
Femora not thus contrasting, if tibiae are of darker color, the dorsum is rufous... 11
9. Tibiae and tarsi dark reddish brown; wings yellow fumose; all leg joints dark tipped ..... *velorum* McAtee, p. 490
Tibiae and tarsi black, only tibial spurs rufous. Wings blackish..... 10
10. Coxae and trochanters rufous, anterior pair lighter..... *mickeli* Hardy, p. 474
Coxae and trochanter entirely black..... *femoratus* Wiedemann, p. 463
11. Wings smoky, blackish costally..... *basalis* Loew, p. 456
Wings slightly yellowish hyaline to yellow-brown..... 12
12. Wings only slightly yellowish hyaline; inner tibial spur but slightly over one-half the length of outer 13
Wings yellow-brown; inner tibial spurs always conspicuously over one-half the length of outer 14
13. Smaller species, wing 4-5 mm. in length; leg joints somewhat shortened giving the legs a drawn up appearance; inner spurs of front tibiae but slightly over one-half the length of the outer ..... *carri* Curran, p. 458
Larger species, wing 7-8 mm.; leg joints not shortened, 13a *xanthopus* Wiedemann, p. 491
13a. Pleurae wholly dark..... *xanthopus palliatus* McAtee, p. 492
Pleurae in part yellow to rufous..... *xanthopus xanthopus* Wiedemann, p. 491
14. Smaller species, wing 4.5-6.5 mm..... 15
Larger species, wing 7.5-9.5 mm..... *nervosus* Loew, p. 477
15. Hind metatarsi six to seven times as long as wide, tibial spurs extend about one-third the length of metatarsi; thorax chiefly rufous, sometimes with only a slight tinge of red on the dorsum ..... *fraternus* Loew, p. 465
Hind metatarsi not more than three to four times as long as wide, spurs of hind tibiae extending almost half the length of metatarsi; thorax black, *abbreviatus* Loew, p. 450
16. At least the mesonotum chiefly rufous..... 17
Top of thorax chiefly or entirely black, never with more than anterior margins of humeral ridges pale 26
17. Dorsum of thorax or the pleurae with dark brown to black markings; thorax never entirely rufous 18
Entire thorax rufous 22
18. Legs dark brown to black; larger species..... 19
Legs rufous to yellowish 20
19. Length of head behind the eyes much shorter than length of the eyes (fig. 201b); face not tuberculate in middle; head and prothorax finely shagreened; scutellum shining black ..... *rufithorax* Wiedemann, p. 483
Length of head behind eyes longer than length of eyes (fig. 187a); face tuberculate in the middle; head and prothorax brightly polished and smooth; scutellum rufous. *carolinus* n. n., p. 457
20. Larger species, wing 8-9 mm. Wings dark yellow fumose....*fumipennis* Walker, p. 466
Smaller species, wing 5-7 mm. Wings chiefly hyaline or but lightly yellow fumose, 21
21. Dorsum of thorax entirely reddish yellow; posterior tibiae not noticeably clavate. *alexanderi* James, p. 453
Dorsum of thorax with black markings; posterior tibiae clavate...*painteri* James, p. 480
22. Abdomen as well as thorax and legs chiefly reddish or testaceous, with only minor dark markings 23
Abdomen black 25

23. Tibiae and tarsi brownish red, darker in color from yellowish red femora.
rufalipes Hardy, p. 482
Tibiae and tarsi yellow to rufous, not darker than femora 24
24. Larger species, wing 7-8.5 mm., wings yellowish in both sexes ....*inaequalis* Loew, p. 468
Smaller species, wing 5-6 mm., wings of female smoky yellow fumose, of male hyaline .....*townesi* Hardy, p. 487
25. Hind coxae blackish, wings dusky fumose .....*alienus* McAtee, p. 454
Hind coxae rufous, wings yellowish fumose .....*longipes* Loew, p. 472
26. Entire anterior margin of mesonotum pale; pleurae and abdomen in part reddish; legs including coxae and trochanters bright yellow .....*lobatus* Hardy, p. 471
Only humeral ridges pale 27
27. Only femora rufous .....*holti* McAtee, p. 467
More of legs yellow to rufous 28
28. Smaller species, wing 5-7 mm. (only *monstri* and *flukei* from 6-7 mm.) 29
Larger species, wing 7.5-9 mm 36
29. Wings dusky hyaline to smoky gray fumose 30
Wings hyaline to yellow fumose 31
30. Coxae and trochanters black, femora of male black .....*nigrifemoratus* Hardy, p. 478
Coxae and trochanters rufous, femora of male refous ....*knowltoni paltidus* Hardy, p. 470
31. Coxae and trochanters rufous; pleurae usually with rufous markings. Posterior veins darker than the membrane 33
Coxae, trochanters and pleurae black or tinged with dark reddish brown 32
32. Posterior veins concolorous with the membrane, coxae and trochanters black 34
Posterior veins darker than the membrane, coxae and trochanters tinged with dark reddish brown (atypical specimens of this species will key out here) ..*carri* Curran, p. 458
33. Wings dark yellow fumose, legs rather slender, the joints more elongate; crossvein r-m slightly longer than basal part of the Rs; posterior basitarsi of male swollen.
slossonae Cockerell, p. 486
Wings hyaline to slightly yellow fumose; legs more robust; crossvein r-m slightly shorter than basal part of Rs; posterior basitarsi of male not swollen.
knowltoni knowltoni Hardy, p. 469
34. All femora brownish yellow, much darker in color than tibiae; posterior veins pale brown, darker than the membrane .....*flukei* Hardy, p. 464
Femora yellow to rufous, not darker than tibiae; posterior veins concolorous with the membrane 35
35. Tibiae and tarsi broadly black tipped, last four tarsal subsegments chiefly black. Larger than succeeding species; wing 6-7 mm .....*monstri* James, p. 475
Leg joints chiefly rufous, not extensively tipped, smaller species, wing 4.5-5.5 mm.
sericatus Hardy, p. 484
36. Wings yellowish fumose 37
Wings dusky hyaline .....*xanthopus palliatus* McAtee, p. 492
37. Crossvein r-m about one-half the length of the Rs; wing 7-7.5 mm.; posterior veins concolorous with membrane; legs chiefly yellow; posterior tarsal subsegments of male slightly swollen .....*conus* Hardy, p. 461
Crossvein over one-half, usually equal to Rs; wing usually 8-9 mm 38
38. Posterior veins darker than membrane; posterior basitarsi of male not swollen.
38a *xanthopus* Wiedemann, p. 491
Posterior veins concolorous with the membrane; posterior basitarsi of male strongly swollen .....*bryanti* Johnson, p. 456
38a. Pleurae of female wholly dark; male with the hair more copious and longer, usually darker sometimes wholly black (western), *xanthopus palliatus* McAtee, p. 492
Pleurae of female often in part yellow to rufous; male with less abundant and shorter hair, usually pale on thorax and abdomen.
xanthopus xanthopus Wiedemann, p. 491

Bibio abbreviatus Loew

(Plate XXXVIII, figs. 182a-c)

Bibio abbreviatus Loew, 1864, Diptera Americae Septentrionalis indigena, Centuria, 5, No. 9, Compl. Work, p. 217.

Bibio abbreviatus Van der Wulp, 1881, Tijds. V. Ent. 24, 145. This is a homonym.

This species is related to *fraternus* Loew and is distinguished by the shorter and thicker tarsal subsegments of the male and the black dorsum of the female.

MALE.—Head and appendages, body (except pale humeral ridges) and coxae black, the pile of the head black, that of the body and legs pale; femora and succeeding leg joints, excepting front tibiae and the last two or three tarsal joints, yellow to rufous with dark tips, the anterior tibiae and last two to three tarsal subsegments dark brown to black. *Leg:* Spurs of anterior tibiae rufous, the inner spurs almost equal to the outer in length. Subsegments of hind tarsi comparatively short and thick, the metatarsi are about two and one-third times as long as the inner spurs of posterior tibiae (fig. 182b). *Wings:* Hyaline, anterior veins and stigma brown, posterior veins concolorous with membrane, radio-medial crossvein equal to the basal part of the posterior branch of radius. *Genitalia:* Ninth tergum deeply V-shaped on hind margin, the cleft extending over half the length of the segment (fig. 182c). Ninth sternum broad, cleft about one-third the length of the segment on hind margin. Claspers rather narrow (fig. 182a).

FEMALE.—Females differ in having pale yellow fumose wings; posterior veins yellowed, slightly darker than the membrane. Coxae and trochanters yellow to rufous; the pleurae sometimes having yellowish markings. The hair of the female is more sparse and the hind metatarsi are slightly more slender.

Length of wing, 4-6 mm.

Type locality: District of Columbia.

Type in Cambridge Museum of Comparative Zoölogy.

This species is rather wide spread. Specimens have been studied from the following states and Canadian provinces: Ohio, South Dakota, Michigan, Kansas, North Carolina, New York, Maryland, Missouri, Virginia, Iowa, Georgia, Quebec and Ontario. Also type locality.

Bibio articulatus Say, *B. pallipes* Say or *B. baltimoricus* Macquart might be the same as this species, or one or more of them the same as *fraternus* Loew. None of these descriptions refers to the character of the tarsal subsegments so they cannot be separated. Specimens determined as *B. pallipes* Say, in various collections studied have

proved to be the same as *abbreviatus*, but Say's type is apparently lost and the determinations must be questioned.

Bibio albipennis Say

(Plate XXXVIII, fig. 183a)

Bibio albipennis Say, 1823, Desc. Dipt. U. S., Journ. Acad. Nat. Sci. Phila., vol. 3; 78; 1859 Compl. Writings, vol. 2 p. 69.

MALE.—Entirely shining black, except for pale humeral ridges. *Legs:* Inner spurs of front tibiae short, approximately one third of the length of the outer. Spurs of hind tibiae thick and blunt, inner spur extending about one third the length of the metatarsus (fig. 183a). Posterior metatarsi not swollen and about twice the length of the second joint, metatarsi about six times as long as wide. Hind femora average 2.9 mm. in length, hind tibiae 2.6 mm. Legs sometimes verging into brownish black but more consistently shining black. Pile of eyes dark brown to black, long and copious, that of the face gray; body, coxae and femora with pale yellowish to gray hair; tibiae and tarsi with short dark hair. *Wings:* Whitish hyaline; stigma and anterior veins dark brown, posterior veins lighter brown, darker than the membrane; radio-medial crossvein about one fourth the length of the basal part of the posterior branch of radius.

FEMALE.—The female differs in usually having reddish brown markings on the pleurae (sometimes entire body tinged), and the pile much more sparse and shorter.

Length of wing, 7-9.5 mm.

Type locality: Pennsylvania.

Type probably lost.

The type form seems to range east of the Rocky Mountains; the species is the most common of the Nearctic Bibionidae.

Bibio albipennis beameri n. sub. sp.

(Plate XXXVIII, figs. 184a-b)

This has been considered the same as *afer* McAtee[44] (nec Loew). It fits the description as being related to *albipennis* but differs in having the wings dusky fumose. Examination of the type of *afer* proved that these are not related. That the specimen described as *afer* McAtee is actually related to *Bibio rufithorax* Wiedemann.

In working with this form the writer has often debated its possible rank. In Kansas and the middle west it appears to be a distinct species but as there is such a great amount of variation over large series of *albipennis* Say and it is not uncommon to find dusky winged

44. 1923, Proc. Ent. Soc. Wash. Vol. 25, No. 3, 63.

variants, it is perhaps better to include this character in the specific concept.

The subspecies differs from typical *albipennis* in having the wings darker fumose and being smaller in size; the posterior median margin of the ninth sternum in the male is also more pronounced. The specimens are more sparsely pilose than *albipennis,* markedly more so than the subspecies *hirtus* Loew; wings yellow-brown to smoky fumose instead of milky white as in the typical form. The type series, from Kansas, are all of smaller size than *albipennis;* variants have been examined from other localities which verge into this subspecies. The females have a tinge of dull red on the legs, pleurae and abdomen; the hind portions of the humeri are dull red and the wings more brownish fumose.

Male genitalia: Ninth sternum broader than long with a pronounced gibbosity in the middle on hind margin; harpagones rather slender and curved (fig. 184a). Ninth tergum deeply cleft, with a small membranous portion in the bottom of the cleft (fig. 184b).

Length of male: body and wings 6 mm.

Length of female: body and wings 6.7 mm.

Holotype male, allotype female and one hundred and thirty-eight paratypes, one hundred and five males, thirty-three females, Douglas County, Kansas, May 11, 1931 (R. H. Beamer). All are in the Snow Entomological Collection.

Bibio albipennis hirtus Loew.

Bibio hirtus Loew, 1864, Dipt. Amer. Sept. indig., Cent. 5, No. 2, 1864, compl. work, p. 213.

Similar to *albipennis*, the only distinction being the more copius and longer hair, especially in the males. In some cases the hair is much darker. The legs of the males are usually never tinged with brownish red; the females are usually entirely shining black. The anterior veins of the wing in both sexes are usually black and the posterior veins gray.

There is no sharp distinction between these two subspecies and in various localities they may intergrade. Generally *hirtus* seems to be confined to the western portion of North America and *albipennis* to the eastern.

Type locality: California.

Type in Cambridge Museum of Comparative Zoölogy.

Bibio albipennis var. *tenuipes* Coquillett

(Plate XXXVIII, fig. 185a)

Bibio tenuipes Coquillett, 1902, Proc. U. S. Nat. Mus., V. 25, p. 95. New combination.

This is apparently just a variety of *albipennis*. The only essential difference is its smaller size. This varies a great deal and so many intergrading forms appear in any large series of *albipennis* that no specific boundary can be set up. The *tenuipes* variety does not appear to be restricted in geographical distribution so can hardly be subspecific.

MALE.—Chiefly shining black, except for yellow humeral ridges and rufous tibial spurs. Pile of the eyes black, that of the under side of the head gray; thorax, abdomen, trochanters and femora with pale yellow to gray pile, that of tibiae and tarsi chiefly black. Legs rather shortened and appearing somewhat drawn up. Inner spurs of front tibiae very short, about one fourth the length of the outer (fig. 185a); hind femora clavate, tibiae only slightly so, outer edges almost straight; posterior basitarsi not enlarged and comparatively short, about one and one-half as long as the next segment. Wings hyaline, tinged with yellow in the costal cell and with gray in the marginal and basal cells; anterior veins and stigma dark brown, posteriors lighter.

FEMALE.—The female differs in having all pile short, pale yellow and legs tinged rather extensively with rufous; front femora strongly swollen and the wings more yellow fumose.

Type locality: Arizona.

Type in the United States National Museum.

The writer has identified the variety from Texas, Utah, Washington and Wisconsin. McAtee reports it from Colorado and New Mexico.

Bibio alexanderi James

Bibio alexanderi James, 1936, Some New Western Bibionidae, Amer. Mus. Nov. No. 382, p. 1-2.

This species is related to *fraternus* Loew and to *painteri* James, the shorter inner spurs of front tibiae will distinguish it from the first species and the more slender posterior tibiae and the short, sparse yellow pile of the eyes will separate it from the latter.

MALE.—Head and appendages, body (excepting the pale humeral ridges), coxae and trochanters black. Pile of eyes rather short and chiefly yellowish, that of remainder of head pale yellow to gray, with some black pile on the lower part of the occiput; pile of body and

legs chiefly yellow, quite dense and long. *Legs:* Femora, tibiae and first one or two joints of tarsi yellow-rufous, very slightly darkened at the end of the joints; remainder of tarsi dark brown to black. Inner spurs of the front tibiae not quite one-half the length of the outer; posterior basitarsi not enlarged, about twice the length of the second segment. *Wings:* Slightly dusky fumose, clouding somewhat deeper along the costal margin; veins and stigma brown, posterior veins but little lighter than the anteriors; radio-medial crossvein equal to the basal part of posterior branch of radius, basal section of M_2 faint.

FEMALE.—The females differ sharply from the males in that the entire dorsum of the thorax (excepting dark brown to black pronotum), coxae and trochanters are yellow to rufous and the pleurae are quite extensively rufous with black markings. Pile more sparse.

Length of wing, 6 mm.

Type locality: Boulder Creek Bottoms, near Valmont, Colorado.

Type in American Museum of Natural History.

The author has identified specimens from Stillwater, Oklahoma, March, 1936 (A. E. Prichard).

Bibio alienus McAtee

Bibio alienus McAtee, 1923, Descriptions of Bibio from the Carolinas. Proc. Ent. Soc. Wash., Vol. 25, No. 3, 62-63.

The writer having not definitely identified this species prefers to give McAtee's original description.

"*Male.*—Head and body black, the humeral ridges yellowish; short, erect hair upon eyes black; longer, flexuous hair of occiput dark, of thorax and abdomen whitish. The legs have the coxae, trochanters, tibiae and tarsi of first two pairs brownish to blackish, all femora reddish-yellow, hind legs of this color throughout, the joints more or less blackish distally. Wings nearly hyaline, a little fumose along costa, the stigma moderate in size, dark brown. Length of wing: 5-5.5 mm.

"*Female.*—Head black, abdomen brownish-black, thorax and most of legs reddish-yellow, front tibiae, hind coxae and tips of other leg joints blackish; hair of head, thorax and legs rather bristly, that of abdomen somewhat softer, pale reddish. Wings dusky fumose, darker costally, the stigma and veins near costa blackish. Length of wing: 7 mm."

McAtee states that the male of this species is close to *nervosus* Loew but that the pile of the occiput, eyes and thorax is longer and

more copious, and the wings are darker. From his description they would seem to differ by the posterior tibiae and tarsi contrasting in color from those of the anterior legs.

The female seems to be near *longipes* Loew but differs in that the hind coxae are blackish, and the wings more dusky.

Type locality: Raleigh, North Carolina.

Type in United States National Museum.

Bibio atripilosus James

(Plate XXXVIII, figs. 186a-b)

Bibio atripilosus James, 1936, Amer. Mus. Nov. No. 832, 2.

Near *vestitus* Walker but differing in that the pile of the thorax, abdomen and legs is dense, pale yellow and the femora are mostly black, slightly reddish apically.

MALE.—Head and appendages, body (humeral ridges yellowish), and trochanters black. Pile of eyes, upper part of face and occiput copius black; that of the under part of the face long, dense, yellow-gray; that of the body, coxae and femora whitish to yellow-gray; first two to three segments of the abdomen with dense patches of gray pile on lateral margins. *Legs:* Femora chiefly black, rufous apically; front femora each with a rufous stripe running longitudinally, bordered by black above and below. Tibiae rufous with brownish markings medially and apically. Inner spurs of front tibiae short, about one-third the length of the outer. Basitarsi about twice as long as the succeeding joint, first two basal joints of tarsi yellowish-black at apices, next three subsegments verging into black. *Wings:* Hyaline, anterior veins and stigma dark brown, posterior veins light brownish yellow; crossvein r-m equal in length to the basal part of Rs. *Genitalia:* Cleft of ninth sternum very shallow and broad, distinctly shaped, the inner margins being indented giving a steplike appearance; the sternum is produced into an acute point on each inner margin at base of harpagones. Harpagones broad medially, each with a long apical point and a short tooth developed on the inner edge (fig. 186a). Ninth tergum gently concave on posterior margin, segment about twice as wide as long on median line. Cerci strongly developed and quite heavily sclerotized (fig. 186b). Pile of genitalia long and yellow.

Length of wing, 7 mm.

Female unknown.

Type locality: Boulder, Colorado.

Type in the American Museum.

This author has identified specimens from Petersboro, Utah, 4-27-35 (F. H. Gunnell); Price, Utah, 7-14-35 (F. C. Harmston) and Paradise, Utah, 5-4-37 (G. F. Knowlton).

Bibio basalis Loew

Bibio basalis Loew, 1864, Dipt. Amer. Sept. indig., Cent. 5, No. 11, Comp. work, p. 217.

FEMALE.—Head and body black, coxae rufous, the posterior ones somewhat darker than anteriors; femora, tibiae (except front pair which are shining black, with rufous spurs) reddish, with black tips; basitarsi yellow with black tips, other tarsal joints chiefly black. Inner spurs of front tibiae long, but slightly shorter than outer. Pile of head, body, coxae and femora yellow to reddish yellow; that of tibiae and tarsi brown to black. Wings dusky fumose, darker costally; anterior veins and stigma black, posteriors brown; r-m crossvein equal in length to basal part of Rs.

Length: wing, 5.5-9 mm.

Male unknown.

Type locality: New Hampshire.

Females fitting the description of this species have been examined from British Columbia, Massachusetts, New Hampshire and Utah. McAtee reports a female answering the description (except for size) from Manning, South Carolina, with a wing length of 5.5 mm. This is a rather wide range, and since the males of the species are unknown and the original description is so meager, their identification is by no means certain.

Type in Cambridge Museum of Comparative Zoölogy.

Bibio bryanti Johnson

Bibio bryanti Johnson, 1929, Diptera of Labrador, Psyche, XXXVI, 133.
Bibio lacteipennis Curran (nec Zetterstedt), 1924, Can. Ent. LVI, 250.
Bibio currani Hardy, 1937, Proc. Utah Acad. Sci. XIV, 200-201.

B. currani was a change of name for *lacteipennis* Curran (nec Zetterstedt). New synonomy based upon a study of the type.

Following is the original description of the male:

"Head, antennae and palpi black, pile of eyes long and brown. Thorax black, shining with long black pile. Abdomen black with whitish pile. Legs reddish, with yellowish hairs, coxae and knees black, inner spur of front tibiae about one-half the length of outer one, the posterior tibiae and metatarsi enlarged, the latter about as long as the second and third joints combined. Wings hyaline, the costa, stigma and first and second veins brown. Halteres dark brown."

FEMALE.—With shorter more sparse pile, a few yellowish hairs intermixed with darker pile. Posterior metatarsi not so enlarged as in the male although the hind femora are equally as strong.

Length of wing 8-10 mm.

Type locality: Nain, Labrador.

Type in Cambridge Museum of Comparative Zoölogy.

Also has been recorded from Rama, Labrador and Mt. Revelstoke, B. C.

Bibio bryanti var. *nigrita* Curran

Bibio lacteipennis var. *nigrita* Curran, 1924, Can. Ent. LVI, 250. New combination.

This differs from the typical *bryanti* in having the femora shining black, the posterior pair are somewhat reddish toward bases.

Type locality: Mt. Revelstoke, B. C.

Type in Canadian National Museum.

Bibio carolinus n. n.

(Plate XXXVIII, figs. 187a-d)

Bibio afer McAtee (nec Loew), 1923, Proc. Ent. Soc. Wash., vol. 25, No. 3. Change of name. *B. afer* preoccupied by Loew, 1854, Neue Beitrag Zur Kent. der Dipt. II.

This species is related to *rufithorax* Wiedemann. Refer to description notes on that species for distinguishing characteristics.

MALE.—Shining black species, except for yellow humeral ridges and reddish tibial spurs. McAtee, in the original description, states that there is a yellowish stripe on the inner side of each hind tibiae, but this appears to be exceptional as most specimens have the legs entirely shining black. Pile of the head, excepting some gray pile on the occiput, and of tibiae and tarsi brownish to black; that of thorax, coxae and abdomen chiefly grayish yellow; pile of femora mixed black and yellow. *Legs:* Inner spurs of front tibiae short, about one-third the length of the outer spurs. The legs have the appearance of being somewhat shortened; posterior tarsal subsegments (fig. 187d). *Wings:* Dusky fumose, all veins and stigma blackish, radio-medial crossvein short, not over one-fourth the length of the basal part of the posterior branch of radius. *Genitalia:* Cleft of ninth sternum broad and shallow. Harpagones slender and rather elongate, curved inward (fig. 187b). Ninth tergum deeply V-shaped on hind margin, cleft three-fourths the length of the segment (fig. 187c).

Length of wing: 6.3-6.5 mm.

FEMALE.—Females differ from males in being of larger size, the pile is much more sparse and that of the abdomen is chiefly yellow;

the pleurae and humeri have dull rufous markings. The length of the head behind the compound eyes is longer than the eye length and the middle of the face behind the antennae with small tubercles (fig. 187a). Head, propleurae, mesopleurae and sternopleurae chiefly bare. Scutellum bright reddish.

Length of wing: 8-9.3 mm.

This is the first report that has been made of the female. Only males were present in the type series.

Type locality: Raleigh, North Carolina.

Type in the United States National Museum.

The writer has studied the type and additional specimens from the type locality May 6-8, 1925 (C. S. Brimley); also specimens from St. Augustine, Florida, March 24, 1939 (W. Benedict).

Bibio carri Curran

(Plate XXXVIII, figs. 188a-b)

Bibio carri Curran, 1927, Descriptions of Nearctic Diptera. Can. Ent. vol. LIX, No. 4, p. 80.

The male of this species has never heretofore been recorded or described. The writer has examined numerous males taken in copulation at the type locality and at Lethbridge.

MALE.—Head and appendages, body (humeral ridges slightly yellowed posteriorly), coxae and trochanters shining black; eyes with yellow-brown pile; pile of body and legs chiefly yellow and rather sparse, some darker hairs on the tibiae. *Legs:* Robust, the joints seeming somewhat shortened giving them a drawn up appearance, average length of posterior femora 1.6 mm., posterior tibiae 1.5 mm.; femora and tibiae yellow to rufous, dark brown to black apically. Inner spurs of front tibiae a little over half the length of the outer; posterior metatarsi not at all swollen but the subsegments of tarsi are rather short and thick, metatarsi lighter in color than the other subsegments; posterior metatarsi not quite three times as long as wide, about twice as long as inner spurs of hind tibiae and next subsegments (fig. 188a); spurs of hind tibiae short, thick and blunt at apices. Posterior femora clavate, tibiae not noticeably so. *Wings:* Chiefly hyaline, with a slight tinge of yellow fumosity; radio-medial crossvein equal to the length of the basal part of the posterior branch of radius. Anterior veins and stigma yellow-brown, posterior veins lighter in color. *Hypopygium:* Ninth tergum with a narrow median cleft on hind margin, extending not quite half the length of segment (fig. 188b). Harpagones slender, acute at apices.

Length of wing, 4-4.2 mm.

FEMALE.—The female of this species is considerably larger than the male, the wing measuring 5-6 mm. The coxae, trochanters, abdomen and sometimes the thorax are tinged with dark reddish brown. Pile more sparse and shorter; otherwise like the male.

Type locality: Medicine Hat, Alberta.

Type in Canadian National Museum.

The author has examined specimens from this locality and from Lethbridge, Alberta, May 6, 1923 (L. H. Seamens).

Bibio cognatus Hardy

Bibio cognatus Hardy, 1937, New Bibionidae from Nearctic America, Proc. Utah Acad. Sci. XIV, 199-200.

This species is related to *nigrifemoratus* Hardy but is distinguished by its wholly black pile, yellow fumose wings and six segmented antennae. The palpi of the type appeared to be just three segmented but a small first segment may have been overlooked.

Following is the original description:

"*Male.*—Head black, body chiefly black, posterior border of humeral ridge yellow, pleura and ninth sternite tinged with dark reddish-brown. Coxae, trochanters, femora and proximal half of anterior tibiae reddish-brown, tibiae of the hind two pairs of legs, and all tarsi yellow-red tipped with brown apically; hind femora clavate, tibiae hardly so; posterior metatarsi not enlarged, about one and one-half to twice the length of the next segment; apical half and spurs of the anterior tibiae yellow, inner spurs above one-half the length of the outer. Pile of the head and body sparse and black, that of the posterior part of the abdomen (genital segments), and legs reddish-brown; radio-medial crossvein equal in length to basal part of the radial-sector; fork of the fourth longitudinal vein arising just beyond M-cu crossvein (base of M_3). Length of wing, 4 mm."

Female unknown.

Type locality: Ellery Lake, Tioga Pass, California.

Type in United States National Museum.

Bibio columbiaensis Hardy

Bibio columbiaensis Hardy, 1938, Can. Ent. LXX, 207-208.

This species is related to *fumipennis* Walker. It is distinguished by the pale femora and darker tibiae and tarsi, longer inner spurs on front tibiae and V-shaped cleft on hind margin of ninth tergum.

Following is the original description:

"*Male.*—Head, thorax (except yellow anterior margin of humeral ridges), coxae, trochanters and abdomen black. Head with dense,

long, black hair on the face and copious black pile on the eyes. Ocellar tubercle strongly developed, higher than that of *fumipennis*. Pile on dorsum of thorax yellow gray with some darker hairs intermixed, some hairs darker at bases. Pile of pleurae yellow, that of abdomen dense, yellow gray. All tibiae darker than femora, all femora rufous with black tips. Anterior and middle tibiae rufescent with a dark reddish-brown to black stripe running its entire length on the dorsal edge; entire apical one-third to one-half of tibiae sometimes reddish-brown to black. Posterior basitarsi enlarged but cylindrical and not globular, other tarsal segments swollen. Front and mid tarsi chiefly black, somewhat yellowed basally, yellow brown apically, other tarsal segments black. Pile of coxae, trochanters and femora yellow, that of tibiae and tarsi yellow red. Wings yellow fumose, somewhat darker costally; r-m crossvein slightly shorter than the basal part of the Rs. Humeral crossvein distinct.

"*Genitalia:* Genital cleft extending but a little over one third the length of the segment. Styli narrow and with distinct tufts of dark hair basodorsally. Superior plate (ninth tergum) deeply angulate emarginate, the cleft extending slightly more than half its length; apices obtuse, with edges gently rounded. The ninth tergum of *Bibio fumipennis* cleft over three-fourths its length, the cleft more broad basally and not angulate."

Length of wing: 7-7.2 mm.

Female unknown.

Type locality: Jesmond, B. C.

Type in Canadian National Museum.

Bibio conjunctivus Hardy

Bibio conjunctivus Hardy, 1937, Proc. Utah Acad. Sci. XIV, 200.

This species is related to *albipennis* Say but the sclerites of the abdomen are small and reveal the light gray to dusky conjunctiva; the humeral ridges of both sexes are bright yellow and the female has a conspicuous yellow-red spot on each humeri. Following is the original description:

"*Male.*—Eyes and labellum light brown, the former with copious brown pile, the rest of the head and dorsum of the thorax, excepting the bright humeral ridges and pale stalks of halteres, shining black. The pleurae, sclerites of the abdomen and legs rufiscent-black; all but femora, tibiae and tarsi of the legs and the genitalia, with copious long yellow gray pile, and with dense patch of hair on the mesopleura; pile of the genitalia dark reddish to black, that of the

femore yellow to yellowish-brown, that of the tibiae and tarsi dark brown to black. Posterior femora and tibiae clavate, posterior metatarsi not swollen and slightly longer than succeeding two segments. Inner spur of front tibiae almost one-half the length of the outer. Wings milky hyaline, costal cell with a milky clouding; veins and stigma brown, radio-medial crossvein about one-fourth the length of the basal part of the radial sector.

"*Female.*—The female differs from the male in having a bright yellow-red spot on the sides of the humeri; pleurae with rufous markings; legs and sclerites of the abdomen tinged with rufous; posterior tibiae not clavate and wings fumose, milky basally.

"Length of wing, 7-8 mm."

Type locality: Plummer I., Maryland.

Bibio conus Hardy

Bibio conus Hardy, 1938, Can. Ent. LXX, 208-209.

Following is the original description:

"The species resembles somewhat *B. xanthopus* Widemann but differs distinctly in having the r-m crossvein one-half the length of the basal part of the radial sector; posterior veins concolorous with the membrane, the posterior tarsal segments slightly swollen but not approaching in size the end of the femora and tibiae.

"*Male.*—Head, thorax (except yellow humeral ridges), abdomen, coxae and trochanters black. Antennae with eight segments, pile of eyes, occiput, palpi and antennae black, that of face dark brown. Thorax rather sparsely pilose, pile of dorsum yellow-brown, that of pleurae, venter, abdomen (somewhat darker on genitalia), coxae, trochanter and femora yellow-gray, with a few yellow-brown hairs intermixed on femora. Pile of tibia and tarsi yellow to yellow-brown intermixed. Front and mid femora brownish black with a yellow tinge, lighter in the middle and darker on dorsal and ventral edges. Hind femora and all tibiae yellow basally with brown to black tips (tibial spurs rufous), hind femora darkened on apical half. The first two tarsal segments chiefly yellow, the last three chiefly black. Hind femora and tibiae clavate, inner spurs of front tibiae fumose, anterior veins and stigmata dark brown, posteriors concolorous with the membrane. Humeral crossvein pale and slightly interrupted just before the costa. Halteres brownish.

"*Female.*—The female differs in having the wings yellow fumose, pile of dorsum more yellowed, pleurae, coxae, trochanters and labellum with a yellow tinge; legs chiefly yellow to rufous, hind tibiae

straight or nearly so, tarsal segments slender, and cerci of genitalia yellowish."

Length of wing, 7-8 mm.

Type locality: Churchhill, Manitoba.

Type in University of Minnesota Collection.

Bibio criorhinus Bellardi

Bibio criorhinus Bellardi, 1859, Dipterologia Messicana, I, 17.

McAtee reports identifying a male of this species from the Graham Mountains, Arizona, June 1914 (E. G. Holt) and gives the following short description.

"Black except the subequal spurs of front tibiae, and the hind tibiae and tarsi which are rufescent, and narrow bases of front tarsal joints which are yellowish; head, body and coxae clothed with long dark hairs; those of the rather elongate legs shorter. Length of wing, 7 mm."

Type locality: Mexico.

Type in "Collesione del Musco Zoölogico di Parigi".

The writer has a Utah species which runs out as *criorhinus* but it is very probably not that species. A Mexican species has also been examined, the male of which fits the *criorhinus* description. The female, however, differs strikingly from any forms which have been observed from the temperate zone. Further acquaintance with materials from Central and South America will no doubt clarify this matter.

Bibio curtipes James

Bibio curtipes James, 1936, Amer. Mus. Novit. No. 832, 5-6.

This species approaches *melanopilosus* Hardy but differs in having the legs more extensively yellow, the posterior basitatsi very short, wings less dusky and some pale hair on the thorax and abdomen.

The following is the original description:

"*Female.*—Head, with appendages, thorax and abdomen, wholly black; pile of head black; that of thorax black, intermixed with white; that of abdomen black on the disc, both dorsally and ventrally, a little whitish laterally. Legs yellow, short, the segments thick; the coxae slightly darkened, the apical two or three tarsal segments moderately so; pile very largely black. Halteres black. Inner claw of anterior tibiae about one-half the length of the outer one. Posterior femora clavate, the tibiae not so. Posterior basitarsi barely longer than the second tarsal segment. Wings slightly infumated; the anterior veins blackish, the posterior ones yellowish,

but distinctly darker than the membrane; stigma distinct, black. Crossvein r-m one-fourth the length of the basal part of vein Rs. Length, 6-7 mm.

"*Male.*—Eyes with moderately long and moderately dense black pile. Coxae, trochanters, and femora black; the tibiae and tarsi brownish yellow, the latter more darkened apically. The pile of the body may be entirely black, or there may be a little pale pile on the dorsum of the thorax and on the abdomen laterally. Otherwise as in the female."

Type locality: Boulder, Colorado. Also recorded from Walsenburg, Colo. and Bothwell, Utah.

Type in American Museum.

Bibio femoratus Wiedemann

(Plate XXXIX, fig. 189a)

Bibio femorata Wiedemann, 1828, Ausz. Zweifl. Insekton, 1, 79.
Bibio fuscipennis Macquart, 1838, Dipt. Nouv. ou peu connus, vol. 1.
Bibio senilis Wulp, 1869, Nogiets over Noord-Amer. Dipt., Tijdsc. voor Ento. 12, 81-82.

This species is easily recognized by the bright red, contrasting femora and the long inner spurs of front tibiae (fig. 189a).

MALE.—Entirely shining black species, except for the conspicuously rufous femora and the ruficent tibial spurs and humeral ridges; bases of tarsal joints sometimes rufous, and in occasional specimens the entire tibiae are tinged; femora narrowly black tipped. Hair of the head dark, some yellow-gray pile on the face; that of the body, coxae and femora long, pale yellow; tibiae and tarsi with short brown to black hairs. *Wings:* Hyaline to pale yellow fumose, more fumose costally; anterior veins and stigma dark brown, posteriors light brown; r-m crossvein about equal to basal part of vein Rs.

FEMALE—The female differs in having the pile more sparse, shorter and entirely yellow, except on the tibiae and tarsi; the wings yellow-brown fumose to smoky black.

Length of wing, 7-9 mm.

Type locality given as North America.

Type in Vienna Museum.

This species is very wide spread. Specimens have been examined from the following states and provinces: British Columbia, Colorado, Connecticut, Illinois, Iowa, Kansas, Maryland, Mississippi, Massachusetts, New Hampshire, New Jersey, New York, North Carolina, Oklahoma, Ohio, Pennsylvania, Quebec, Saskatchewan, Utah, Virgina and Washington. The females from Iowa have very black wings.

Bibio fluginatus Hardy

Bibio fluginata Hardy, 1937, Proc. Utah Acad. Sci. XIV, 201.

Following is the original description:

"*Male.*—Head, body, (with the exceptions of pale humeral ridges) and coxae black; tergites of the abdomen somewhat yellowed laterally; femora and succeeding leg joints, except the last three tarsal segments, yellow to rufous with slight dark tips; anterior tibiae somewhat darkened at the base of the spurs. Inner spurs of anterior tibiae shortened, one-third to one-fourth the length of the outer; posterior femora and tibiae rather strongly clavate, the latter slightly thicker; posterior basitarsi noticeably enlarged but not strongly swollen or globular. Pile rather short and more sparse than in most species, that of head dark, that of body, coxae and femora yellow, of tibiae and tarsi yellow to brown intermixed. Knobs of halteres brown, stems ochraceous. Wings yellow fumose, anterior veins and stigma dark brown, posterior veins pale brownish yellow; cross-vein r-m equal in length to basal part of Rs.

"Length of wing, 4 mm.

"Female unknown."

Type locality: Salmon Arm, British Columbia.

Type in the United States National Museum.

Bibio flukei Hardy

(Plate XXXIX, fig. 190a)

Bibio flukei Hardy, 1937, Proc. Utah Acad. Sci. XIV, 202.

This species is readily recognized by the bicolored legs and short globose posterior metatarsi of the male. Following is the original description of the male with additional leg characters:

"*Male.*—Head and appendages, body (except yellow humeral ridges), coxae, trochanters, anterior femora and basal three to four tarsal segments, black; mid and posterior femora yellow on their basal half (basal constriction), dark brown to black on the apical half, front femora dark reddish brown; all tibiae and basitarsi chiefly yellow, all except anterior tibiae, with dark tips. Inner spurs of front tibiae very short, not over one-fourth the length of the outer, posterior femora and tibiae clavate, the latter strongly so, swollen apically, much larger than the femora; posterior basitarsi greatly enlarged and more or less globular, not greatly lengthened and equally as thick as the femora. Pile of the head brown to black, that of the body and legs sparse yellow, some dark pile on the tarsi. Wings yellow fumose, anterior veins and stigma brown,

posterior veins yellow; r-m crossvein equal to the basal part of the Rs; fourth vein arising before m-cu crossvein.

"Length of wing, 6-6.5 mm."

The outer spurs of front tibiae extend about half the length of the metatarsi; the outer spurs of hind tibiae are slender and acutely pointed while the inner are shorter and obtuse. Hind metatarsi only about two and one-half times as long as wide (fig. 190a). Hind femora average 2.5-2.7 mm., hind tibiae 2-2.2 mm.

FEMALE.—Legs more yellowish, all femora brownish, yellow instead of so extensively black, tibiae and first two subsegments of tarsi yellow. Hind tibiae not so clavate, tarsal subsegments slender, metatarsi five times as long as wide.

Length of wing, 7 mm.

Type locality: Cameron Pass, Colorado.

Type in the American Museum.

The writer has examined a good series of specimens from the type locality: Aug. 19-22, 1940 (R. H. Beamer, C. W. Sabrosky) and specimens from Monarch Pass, Colorado, alt. 11,362 ft., Sept. 5, 1938 (D. E. Hardy, A. T. Hardy). It has also been recorded from Pingree Park, and Tennessee Pass, Colorado.

Bibio fraternus Loew

(Plate XXXIX, figs. 191a-b)

Bibio fraternus Loew, 1864, Dipt. Amer., Sept. indig., Cent. 5, No. 8, Compl. Work, p. 216.

Specimens in the Snow Entomological collection determined *articulatus* Say by C. F. Adams belong to *fraternus* but as Say's description is inadequate and his type is apparently lost the position of *articulatus* must be questioned.

This species is related to *abbreviatus* Loew but is distinguished by the more elongate, slender metatarsi and the rufous colored dorsum of the females.

MALE.—Head and appendages, body, coxae and trochanters black. *Legs:* Chiefly yellow to rufous, joints dark tipped; anterior tibiae sometimes dark brown to black. Inner spurs of front tibiae almost as long as the outer. Subsegments of posterior tarsi slender and elongated, metatarsi about three times the length of the inner spurs on hind tibiae and about seven times as long as wide, about equal in length to the next three subsegments (fig. 191a). Posterior femora average 2.6 mm. in length; posterior tibiae, 2.4 mm. Pile of head dark gray to black, body and legs, excepting tibiae and tarsi, with long yellow pile; tibiae and tarsi with short black hairs. *Wings:*

Chiefly hyaline, sometimes slightly yellow fumose, anterior veins and stigma brown, posterior veins very pale, almost concolorous with the membrane. Crossvein r-m equal to basal part of the posterior branch of radius. Ninth tergum with a V-shaped cleft on hind margin, extending about half the length of the segment (fig. 191b).

Length of wing 5-6 mm.

FEMALE.—Differs in having all pile, except that of tibiae and tarsi, short, sparse and pale. The coxae, trochanters and dorsum of the thorax are rufous, pleurae usually with rufous markings. Wings yellow to yellow-brown fumose, anterior veins darker than the membrane.

Length of wing, 5.8-6.6 mm.

Type locality: District of Columbia.

Type in Cambridge Museum of Comparative Zoölogy.

This species is very widespread and has been seen from the following states and Canadian provinces: Colorado, Connecticut, Illinois, Iowa, Kansas, Kentucky, Maryland, Manitoba, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, New Jersey, New York, North Carolina, Nova Scotia, Ohio, Oklahoma, Ontario, Tennessee, Utah, Virginia, and Wisconsin. The writer has studied the type.

Bibio fumipennis Walker

Bibio fumipennis Walker, 1848, List of the specimens of Dipterous Insects in the collection of the British Museum, 1, 122.

MALE.—Head and body (excepting yellow posterior edge of humeral ridges), coxae and trochanters black. Head with copious dark pile, that of the body and legs yellow (tibiae and tarsi reddish yellow). *Legs:* Femora and succeeding leg joints yellow to rufous, only the femora dark tipped. Inner spurs of front tibiae but slightly over one-third as long as outer; posterior femora and tibiae clavate; posterior metatarsi enlarged and swollen but not globular, about as long as next two subsegments. *Wings:* Slightly yellowish fumose, anterior veins and stigma brown, posterior veins concolorous with membrane; crossvein r-m almost equal to the basal part of the Rs.

FEMALE.—Related to *rufithorax* Wied. but differing in that the legs are yellow to rufous and the wings dark, yellow-brown fumose. Head and appendages black, dorsum of thorax and legs, rufous; pleurae with dark brown to black markings; halteres yellow-brown; abdomen dark brownish red, cerci yellow. Pile short, chiefly red-

dish yellow. Wings yellow fumose, darker costally, anterior veins and stigma yellow-brown, posterior veins concolorous with the membrane.

Length of wing, 7.5-9 mm.

This is the first time the female of this species has been described or reported, as far as is known by this writer.

Type locality: St. Martin Falls, Albany River, Hudson Bay.

Type in British Museum.

Specimens have been examined from Alaska, Alberta, British Columbia, New York, Ontario and Utah. It has also been reported from New Hampshire.

Bibio holtii McAtee

(Plate XXXIX, fig. 192a)

Bibio holtii McAtee, 1921, Proc. U. S. Nat. Mus. vol. 60, Art. 11, p. 11.

Related to *femoratus* Wied. but easily separated by the short inner spurs of front tibiae.

MALE.—Head, body, coxae and trochanters black; femora bright yellow to rufous, tibiae and tarsi, except for rufous anterior tibial spurs, brown to black. Pile of the head, tibiae and tarsi dark, otherwise yellow. *Legs:* Inner spurs of front tibiae short, about one-third to one-fourth the length of the outer (fig. 192a); posterior femora and tibiae clavate, hind metatarsi slightly enlarged. *Wings:* dusky or slightly yellow fumose; anterior veins and stigma brown, posterior veins concolorous with the membrane; r-m crossvein almost equal to the basal part of Rs.

Length of wing, 6-7 mm.

FEMALE.—The female differs in having dark yellow fumose wings, and shorter pile. This is the first report of the female.

Length of wing 8 mm.

Members of this species are the strongest fliers of the Bibionidae that have been observed by the writer, they are usually taken in mountain regions hovering high above the ground, ordinarily well out of reach of the insect net.

Type locality: Graham Mts., Arizona.

Type No. 24700 in United States National Museum.

Specimens have been examined from many localities in the following western states and Canadian province: Arizona, British Columbia, Colorado, Oregon, Utah, Washington and Wyoming.

Bibio inaequalis Loew

(Plate XXXIX, figs. 193a-d)

Bibio inaequalis Loew, 1864, Dipt. Amer. Sept. indig., Cent. 5, No. 3, Compl. Work, 213-214.

Bibio fumidus Coquillett, 1899, Report on Diptera of the Commander Islands, 343.

Bibio simplicis Curran, 1923, Can. Ent., Vol. 55, p. 245. New synonomy based upon comparison of type males.

The typical specimens of *inaequalis* from the Far North are larger and not so brightly rufous as our Eastern United States specimens, and the temperate region form may prove to be a distinct subspecies.

MALE.—Head, body (except pale humeral ridges), coxae and trochanters black; femora and succeeding leg joints reddish-brown to rufous with dark tips; anterior tibiae and last three tarsal segments usually darker. *Legs:* Inner spurs of anterior tibiae not one-half the length of the outer (fig. 193b); femora swollen, the posterior ones and tibiae clavate; posterior metatarsi enlarged and slightly longer than the next two subsegments. Pile of head brown to black, that of body and coxae pale yellow, of the succeeding leg joints yellowish-red, with some darker hairs on the tibiae and tarsi. *Wings:* Pale yellowish fumose, anterior veins and stigma brown, posterior veins, except yellowed basal portions, concolorous with the membrane; r-m crossvein about equal in length to basal part of R_5. *Genitalia:* Ninth sternum cleft almost half its length, sides of cleft almost straight, bottom undulated. Harpagones long and slender, strongly curved (fig. 193d). Ninth tergum almost as long as wide, deeply cleft on hind margin; cleft extending about three-fourths the length of the sclerite (fig. 193c).

FEMALE.—The female differs in having shorter, all yellow pile and only the head black; notum and pleurae rufous, sometimes with discolored vittae on the dorsum; abdomen yellow-brown; femora and succeeding leg joints more yellow.

Length of wing, 6-7.5 mm.

Type locality: Sitka, Alaska.

Type in Cambridge Museum of Comparative Zoölogy.

The species has been reported from Unalaska, Iditarod and Saldovia, Alaska, Copper Island and Karagi Island, Kamchatka; Nordegg, Alta.; and Banff, Alta.

The writer has examined the type series and has also identified specimens from Labrador, Newfoundland, Wyoming, New York and Massachusetts.

Bibio kansensis James

(Plate XXXIX, fig. 194a)

Bibio kansensis James, 1936, Amer. Mus. Novit. No. 832; 6.

This species is closely related to *curtipes* James but differs in having more pale hair on the thorax and abdomen and legs more rufous. The following is the original deschiption with additional notes on the leg characters.

"*Female.*—Black, the pile of the body mostly grayish; legs short, thick, a somewhat obscure yellow in color, the coxae and trochanters darkened, the pile of the legs grayish to black, that of the tibiae stubby; the inner spur of the anterior tibiae not more than one fourth the length of the outer one; posterior basitarsi flattened, barely longer than the second tarsal segment. Wings dusky hyaline; veins brown, heavier near the costa; stigma brown; cross-vein r-m one-third to one-fourth the length of the basal part of the radius sector. Length, 5-6 mm. (the type specimens studied by the writer measured 4-4.3 mm., wing and body).

"*Male.*—Similar to the female; the pile of the body tends to be longer and darker, and the legs are slightly darkened."

The outer spur of front tibiae extends about two-thirds the length of the metatarsus; spurs of middle tibiae slender, acutely pointed, extending half the length of the metatarsus; spurs of hind tibiae thick and broadly rounding at apices. Hind metatarsus not much over twice as long as wide and about one and one-half times as long as the next subsegment (fig. 194a).

Type locality: Kirwin, Kansas.

Type in American Museum of Natural History.

Up to date this species has only been reported from Kansas. The writer has studied paratopotypes.

Bibio knowltoni Hardy

Bibio knowltoni Hardy, 1937, Proc. Utah Acad. Sci. XIV, 202-203.

This species is related to *abbreviatus* Loew. It is distinguished by the short inner spurs of front tibiae and the dark posterior veins of the wing. Following is the original description:

"*Male.*—Head and appendages, body (excepting pale humeral ridges), coxae and trochanters black; posterior femora and tibiae yellow to rufous, with dark tips, the former clavate; middle femora and tibiae slightly darker in color and front femora and tibiae dark rufous with black markings; basal half of anterior tibiae entirely black, spurs rufous. Inner spurs one-third to one-fourth the length

of the outer; metatarsi of all legs yellow basally and dark brown to black apically; other segments brown to black; posterior metatarsi not swollen and rather short, about one and one-half times the length of the next segment. Pile of the eyes brown, that of the face gray, some dark pile on the occiput and that of the thorax and abdomen copious, long, grayish yellow; pile of femora yellow, of the tibiae and tarsi darker costally, veins and stigma brown, the anteriors darker than the posteriors; r-m crossvein about equal in length to the basal parts of the Rs.

"*Male Genitalia.*—Genitalia quite bare with but sparse yellow hairs. Superior plate (ninth tergum) broad, its posterior margin deeply concave, the cleft extending about two-thirds the length of the segment. Stylus narrow and pointed.

"Female.—The female differs in having shorter, all pale pile and the coxae and trochanters rufous; the pleurae sometimes has slight rufous markings. Wings more yellowed.

"Length of wing 4.5-6 mm."

Type locality: Granger, Utah.

Type in the United States National Museum.

Added distribution: Pullman, Washington and Paradise Valley Mt., Rainier, Washington, Aug. 30, 1928 (M. D. L.)

Bibio knowltoni var. *paltidus* Hardy

(Plate XXXIX, fig. 195a)

Bibio knowltoni var. *paltidus* Hardy, 1937, Proc. Utah Acad. Sci. XIV, 203.

Following is the original discussion of this variety with additional notes on the leg characters for the species:

"This variety differs from *knowltoni* in that the wings are dusky to smoky hyaline and not yellow fumose, the veins and stigma black, somewhat lighter basally. Males are much more densely pilose, and the pile of the body and coxae chiefly gray. Posterior legs of male red instead of yellow as in the preceding variety."

Subsegments of posterior tarsi rather short and broad, metatarsi three and one-half to four times as long as wide and about twice as long as tibial spurs (fig. 195a). Posterior femora average 2 mm. in length, posterior tibiae 1.7 mm.

Type locality: Provo, Utah.

Type in Brigham Young University Collection, Provo, Utah.

The species has been identified from numerous localities in Utah.

Bibio labradorensis Johnson

Bibio labradorensis Johnson, 1929, Diptera of Labrador, Psyche, vol. XXXVI, No. 2, 133.

This species is related to *monstri* James but is distinguished by the hyaline wings and the yellowish pile on the thorax.

MALE.—Head and appendages, body (except pale humeral ridges), coxae, trochanters and femora black; tibiae and tarsi chiefly yellow; anterior tibiae and three apical joints of tarsi somewhat brownish. *Legs:* Inner spurs of anterior tibiae short, not more than one-third to one-fourth the length of the outer; posterior femora and tibiae clavate, tarsal joints swollen, the metatarsi very noticeably enlarged and cylindrical. Pile of the head chiefly brown, some gray pile on the face; that of body and legs yellowish. *Wings:* Hyaline, anterior veins and stigma light yellow to brownish, posterior veins concolorous with the membrane; crossvein r-m about equal in length to the basal section of the posterior branch of radius.

Length of wing, 6 mm.

Female unknown.

Type locality: Nain, Labrador.

Type in Cambridge Museum of Comparative Zoölogy.

The species has been observed from Camp 327, Alaska. Alaska Engineer Commission, 5-11-12, (J. M. Aldrich); Alberta, Canada, and Bedley, B. C., July 25, 1923 (C. B. Garrett).

Bibio lobatus Hardy

Bibio lobata Hardy, 1937, Proc. Utah Acad. Sci. XIV, 203.

This species is somewhat related to *knowltoni* Hardy but is distinguished by the yellow to red coxae and trochanters, the yellowish anterior portion of mesonotum and the pale tinge to the pleurae and abdomen. Following is the original description:

"*Female.*—Head chiefly black, appendages yellow-brown; meta and mesonotum black, tinged with yellow on the posterior margin, pronotum yellow on its lateral margins, marked with dark brown to black above; humeral ridges bright yellow; pleurae and abdomen yellow-red; legs, except darker yellow-brown anterior tibiae, bright yellow, segments slightly brownish tipped. Inner spurs of front tibiae short, one-third to one-fourth the length of the outer; front femora strongly swollen, hind femora clavate; hind tibiae straight, posterior basitarsi two times the length of the next segment. Pile short, sparse and yellow, except for some darker hairs on the tibiae and tarsi. Knobs of halteres ochraceous, stems yellow. Wings

slightly yellow fumose, veins and stigma yellow to light brown; r-m crossvein about equal to basal part of the Rs.

"Length of wing, 6.5-7.5 mm.

"Male unknown."

Type locality: Sierra Co., California.

Type in American Museum of Natural History.

Bibio longipes Loew

(Plate XXXIX, figs. 196a-b)

Bibio longipes Loew, 1864, Dipt. Amer. Sept. indig., Cent. 5, No. 12, Compl. Work, 217-218.

This species is related to *slossonae* Cockerell but has the thorax and legs pale haired. This is one of the few species of Bibio which occur in the fall of the year.

MALE.—Usually entirely shining black, except for pale humeral ridges and tibial spurs; in some specimens the posterior tibiae and tarsi are rutilous. Pile of head copious, brown to black, that of body pale yellow to reddish. *Legs:* Inner spurs of anterior tibiae very short, not over one-fourth the length of the outer; each inner spur sharply pointed; outer spur extends about one-third the length of the long slender metatarsus (fig. 196a). Hind legs elongate, femora and tibiae clavate; posterior metatarsi swollen and cylindrical, about three times as long as wide, spurs of hind tibiae acute (fig. 196b). *Wings:* Hyaline to slightly yellow fumose, veins and stigma brown, the anteriors darker; crossvein r-m equal to basal part of the posterior branch of radius.

FEMALE.—The female differs in having the entire thorax, coxae and succeeding leg joints yellow to rufous (last three tarsal joints somewhat brownish). Abdomen sometimes tinged with rufous. Wings more yellow fumose. Pile all pale and shorter.

Length of wing, 5.3-5.6 mm.

Type locality: District of Columbia.

Type in Cambridge Museum of Comparative Zoölogy.

The species has been examined from the following states and Canadian provinces: Alberta, Colorado, Manitoba, Maryland, Massachusetts, Minnesota, New Brunswick, New York, North Carolina, Nova Scotia, Ohio, Ontario, Utah, Virginia and Washington. It has also been reported from Arizona and New Jersey.

The specimens from Utah and Colorado have the dorsum of female discolored with blackish.

Bibio melanopilosus Hardy

(Plate XXXIX, figs. 197a-c)

Bibio melanopilosus Hardy, 1936, Proc. Utah Acad. Sci. vol. XIII, 195.

This species differs from *curtipes* James in that the pile and legs are entirely black, legs never extensively yellow.

MALE.—Chiefly shining black, except for a slight tinge of reddish-brown on the humeral ridges and the rufous tibial spurs. Pile chiefly black, with a few yellow hairs intermixed on the dorsum. *Legs:* Rather short; inner spurs of front tibiae very short, not over one-fifth to one-fourth the length of the outer; hind femora clavate, tibiae hardly so; posterior metatarsus not swollen and less than twice the length of the next subsegment. Metatarsus one-third to one-fourth as wide as long; spurs of hind tibiae very flat, blunt and rounding (fig. 197b); hind femora average, 2.0 mm. in length, hind tibiae 1.8 mm. *Wings:* Dusky hyaline, slightly darker costally, subcostal cell brownish fumose. Veins and stigma dark brown, posteriors not so dark as the anteriors; r-m crossvein one-fourth the length of the basal part of Rs. Basal portion of m-cu crossvein and median portion of m partially interrupted (fig. 197a).

FEMALE.—The female differs in having shorter, less dense pile with some grayish pile on the abdomen and the face. Wings more dusky, veins and stigma blackish. Legs tinged with rufous, front femora strongly swollen and rutilous. Hind femora average 1.7 mm. in length, tibiae, 1.5 mm.

Length of wing, 5-6 mm.

Type locality: Spanish Fork, Utah.

Type in Brigham Young University Collection, Provo, Utah.

The species has been observed to be especially common in Utah County, Utah (it is the most abundant species found in the vicinity of Spanish Fork and Provo, around the last of April), and has been examined from numerous localities in Utah.

Bibio melanopilosus var. *biseptus* Hardy

Bibio melanopilosus var. *bisepta* Hardy, 1937, Proc. Utah Acad. Sci. XIV, 204.

Following is the original description:

"*Male.*—Entirely shining black, except slightly tinged tibial spurs, with pale yellow to gray pile on the body, coxae and femora; eyes black pilose; face chiefly gray; tibiae and tarsi black haired. Pile of the dorsum short and sparse, otherwise quite long and more copious. Inner spurs of front tibiae not over one-fourth the length

of the outer; posterior femora clavate, tibiae straight or nearly so; posterior metatarsus not swollen, first segment about one and one-half the length of the succeeding segment. Wings dusky hyaline, smoky costally; veins and stigma black, anteriors darker than posteriors; r-m cross-vein about one-fourth the length of Rs. Palpi four jointed, the second joint enlarged, larger than the others. First two joints of antenna smaller in width than succeeding segments, although equal in length.

"*Female.*—The female differs in having generally shorter pile (all pale on the head), propleurae with a fringe of long yellow hairs, and the wings more dusky. Anterior tibial spurs of the female are often entirely black.

"The adults of this species were taken in large numbers on *Dactylis glonerata* L. and the larvae were found in the roots of this grass. The adults were observed for a period of several hours but they gave no indication of feeding."

Type locality: Brigham Young University Campus, Provo, Utah.

Type in Brigham Young University Collection.

This variety is common in Utah.

Bibio mickeli Hardy

Bibio mickeli Hardy, 1927, Proc. Utah Acad. Sci. XIV, 204-205.

This species is related to *femoratus* Wied. and to *utahensis* Hardy, it is distinguished by the pale posterior veins of the wing and by the rufous coxae and trochanters of the females. Following is the original description:

"*Male.*—Entirely shining black, except for yellow humeral ridges, rufous tibial spurs, yellow bases of metatarsi and sometimes a slight tinge of red on the tibiae. Pile of head black, that of face very dense; pile of body, coxae and femora pale yellow, long, and copious; that of the tibiae and tarsi chiefly black and more bristly. Inner spurs of front tibiae long, almost as long as outer; hind femora and tibiae clavate; hind basitarsi not swollen, at least twice as long as second tarsal segment. Wings hyaline, anterior veins and stigma dark brown, posterior veins concolorous with the membrane; cross-vein r-m equal in length to the basal part of the Rs.

"*Male Genitalia.*—Coxites broad, genital cleft over one-third the length of the segment. Styli narrow and tapering. Superior plate gently concave, cleft not over one-fourth the length of the tergite. Pile of genitalia yellowish to reddish, longer pile on posterior margin of ninth sternite.

"*Female.*—The female differs in having shorter pile, yellow on the head; coxae (at least anterior pair), trochanters and femora rufous; wings yellow-brown fumose, anterior veins and stigma black, posteriors brown.

"Length of wing, 8-9 mm."

Type locality: Prontenac, Minnesota.

Type in University of Minnesota Collection.

Species is now known from the following states and Canadian province: British Columbia, California, Utah and Wyoming.

Bibio monstri James

(Plate XXXIX, figs. 198a-c)

Bibio monstri James, 1936, Amer. Mus. Novit. No. 832; 3.

This species is related to *labradorensis* Johnson but is distinguished by the black femora and black pile of the thorax.

MALE.—Head, thorax, abdomen, coxae, trochanters, femora and apical three tarsal joints black; tibiae and basitarsi yellow to rufous with dark tips, anterior tibiae somewhat darker, usually with black markings. *Legs:* Inner spurs of front tibiae not over one-fourth the length of the outer; posterior femora and tibiae clavate, the latter strongly so; posterior basitarsi swollen and longer than succeeding two subsegments. Pile of head, dorsum of thorax, coxae, trochanters, middle and front femora black; posterior femora, all tibiae and tarsi grayish to yellow pilose; pile of pleurae and anterior part of abdomen gray to blackish, yellow-gray to whitish on abdomen posteriorly. *Wings:* Chiefly hyaline with a slight tingle of yellow fumosity, darker costally; anterior veins yellow to brown, stigma pale yellow, posterior veins concolorous with the membrane; crossvein r-m about one-half the length of the basal part of Rs. *Genitalia:* The cleft of the ninth sternum extends about one-third the length of the segment; the distal portion of the sternum with characteristic patches of long hairs on outer edges, otherwise rather sparsely pilose (fig. 198a). Harpagones narrow (fig. 198b) and chiefly light colored, with a black spot basally. Ninth tergum deeply cleft, the cleft extending about three-fourths its length (fig. 198c).

Length of wing, 5.6-6 mm.

FEMALE.—The female differs in having the wings more yellow fumose, femora rufous and the pile short, yellow to reddish. This is the first report of this sex.

Type locality: Trail Ridge Road, Rocky Mountain National Park, Colorado, 12,200 feet. Paratypes were from Estes Park, Au-

gust, 1892 (Snow). The writer has examined a series of paratypes and specimens from Pikes Peak, Colorado, August 8, 1904; Mt. Audubon, Colorado, 7-20-36 (Alexander), and Logan, Utah, 5-5-37 (F. C. Harmston). The type is in the American Museum of Natural History.

Bibio necotus Hardy

Bibio necotus Hardy, 1937, Proc. Utah Acad. Sci. XIV, 205-206.

This species is characterized by the elongate inner spurs of front tibiae and the short radio medial crossvein. It is the only species known to the writer that possesses this combination of characters. Following is the original description:

"*Male.*—Chiefly shining black except for a slight tinge of rufous on the humeral ridges, tibial spurs and tibiae. Pile very dense, long and brown to black. Inner spurs of front tibiae but little shorter than outer spurs; posterior femora and tibiae slightly clavate; hind metatarsi not enlarged, about twice as long as succeeding segment. Wings hyaline, anterior veins and stigma brown, posterior veins pale brown to yellow; r-m cross-vein about one fourth the length of the basal part of the Rs.

"Length of wing, 7.5-9 mm.

"*Female.*—The female differs in having shorter, more sparse and yellow-gray pile on the thorax and abdomen. Posterior tibiae not clavate. Otherwise fitting the description of the male."

Type locality: San Francisco, California. Larval host plant, *Erigeron glaucus.*

Type in Cornell University Collection.

Added distribution: Pullman, Washington, and Berkeley, California, March 16, 1931.

Bibio neojacobi n. n.

Bibio jacobi Hardy, 1938, Can. Ent. LXX, 209. Name preoccupied by *Bibio jacobi* Villeneuve, 1924, Encyc. Ent. Dipt. I, 5.

This species is related to *atripilosus* James but is distinguished by its yellow-brown fumose wings. Following is the original description:

"*Male.*—Head, thorax (excepting yellowed humeral ridges) and abdomen black. Pile of head chiefly black, with some gray hairs on the face, that of thorax and abdomen yellow. Legs chiefly shining black with the bases of the tibiae and basitarsi yellowish, spurs rufous. Anterior femora strongly swollen, inner spurs of anterior tibiae short, approximately one-third the length of the outer. Pos-

terior femora and tibiae clavate. Posterior basitarsi not strongly swollen and rather elongate, twice as long as second tarsal segment. Pile of coxae, trochanters and femora yellow, that of tibiae and tarsi chiefly brown to black. Wings yellow brown fumose, r-m crossvein equal in length to the basal part of the radial sector. Posterior veins and stigmata brown, anterior veins yellow to yellow brown. Humeral crossvein obsolete and interrupted, being but a short pale stump arising from the subcostal vein.

"Length of wing, 7-7.5 mm.

"Female unknown."

Type locality: Dunn Peak, British Columbia.

Type in Canadian National Museum.

Bibio neojacobi var. *rufitibialis* Hardy

Bibio jacobi var. *rufitibialis* Hardy, 1938, Can. Ent. LXX, 209-210.

This variety differs from the typical in having the base of femora rufous with apices brunneous and the tibiae and first two to three subsegments of tarsi chiefly rufous.

Male genitalia: Ninth sternum rather broad, cleft a little over one-third its length; harpagones slender, acute at apices. Ninth tergum with a U-shaped cleft on hind margin, extending two-thirds its length. Pile of genitalia brown to black.

Type locality: Dunn Peak, B. C.

Type in Canadian National Museum.

Bibio nervosus Loew

(Plate XXXIX, figs. 199a-c)

Bibio nervosus Loew, 1864, Dipt. Amer. Sept. indig., Cent. 5, No. 4. Compl. work, 214.
Bibio variabilis Loew, 1864, Dipt. Amer. Sept. indig., Cent. 5, No. 7. Compl. work, 215-216.
Type in Cambridge Museum.

Comparison of Loew's types of *nervosus* and *variabilis* proved these to be conspecific and the name *nervosus* is given page priority. McAtee[73] states that *nervosus* Loew is very similar to *xanthopus* Wied. but differs in having duskier wings and broader front tibiae, it actually runs into the group having the inner spurs of front tibiae elongated, almost equal to the outer in length. It is distinguished from *xanthopus* by the long inner spurs.

MALE.—Head, body, coxae and femora (for the most part) black; the middle and hind femora often rufous basally, sometimes femora almost entirely rufous; middle and hind tibiae and first one to three joints of all tarsi, rufous basally and dark apically, the last two to

73. 1921, Proc. U. S. N. M. 60, Art. II, 13.

three tarsal joints usually entirely dark. *Legs:* Inner spurs of anterior tibiae relatively long, being but slightly shorter than the outer (fig. 199c); posterior femora and tibiae slightly clavate, posterior basitarsi not enlarged, twice as long as second tarsal subsegment. Pile usually gray to black rather long and dense, some specimens have chiefly yellow pile on the dorsum. *Wings:* Hyaline, anterior veins and stigma brown, posteriors concolorous with the membrane; crossvein r-m equal in length to basal part of Rs. *Genitalia:* Pile of genitalia mostly long and dark with some yellow hair intermixed. Ninth sternum broad and short, cleft extending a little over one-third the length of the segment (fig. 199b). Harpagones comparatively narrow and apparently pointed from the ventral view. Ninth tergum cleft to about its middle, and V-shaped (fig. 199a).

FEMALE.—The female differs in having shorter, all yellow, pile; all leg joints rufous with dark tips (coxae sometimes dark), and the wings yellow to yellow-brown fumose.

Length of wing, 6.5-10 mm.

Type locality: Sitka, also New Hampshire specimen in type series.

Type in Cambridge Museum of Comparative Zoölogy.

The species is more common in the western portion of the United States but has a rather wide range. The writer has studied the type series and has identified specimens from the following states, possessions and provinces: Alaska, Alberta, British Columbia, California, Idaho, Kansas, Manitoba, Michigan, Missouri, Montana, New Brunswick, Newfoundland, Ontario, Oregon, Quebec, Utah and Washington.

Bibio nigrifemoratus Hardy

Bibio nigrifemoratus Hardy, 1937, Proc. Utah Acad. Sci. XIV, 206.

This species is related to *atripilosus* James but is distinguished by its smaller size, the dense black pile of the dorsum, shorter inner spurs of front tibiae, yellowish fumose wings and shorter radiomedial crossvein. Following is the original description:

"*Male.*—Head, body (except pale humeral ridges), coxae, trochanters and femora (for the most part) black; posterior and midfemora chiefly black or brownish red, usually slightly rufous apically; front femora with a longitudinal stripe of rufous down their middles; front tibiae rufous, except for darkened portion at the base of the spurs, mid and hind tibiae and joints rufous, slightly darker apically, other tarsal segments brownish. Inner spurs of

front tibiae very short, being but one-fifth to one-fourth the length of the outer; posterior femora and tibiae clavate, the latter slightly thicker; posterior basitarsi not swollen and two times as long as next segment. Pile of eyes and occiput copious, black, that of face gray to black; dorsum of thorax with long, black pile, intermixed with yellow, in a few cases the yellow pile is predominant; pile of pleurae, coxae and femora yellow to gray; that of tibiae and tarsi brown, with yellow hairs intermixed. Wings hyaline to slightly yellow fumose, or dusky, anterior veins and stigma dark brown, posterior veins light brown to yellowish gray; r-m crossvein one-half to equal in length to the basal part of the Rs.

"Length of wing 4.5-5 mm.

"*Female.*—The female differs in having all pile short and yellow, all femora yellow to rufous, anterior coxae slightly so, and the wings more dusky yellow fumose."

Length of wing, 5-5.5 mm.

Type locality: Monte Lake, British Columbia.

Type in Canadian National Museum.

Bibio nigrifemoratus var. *gilvus* Hardy

Bibio nigrifemoratus var. *gilvus* Hardy, 1937, Proc. Utah Acad. Sci. XIV, 206.

This variety differs in having the pile of dorsum entirely yellow, that of pleurae, coxae, femora and abdomen gray to yellow. Hairs of tibiae and tarsi reddish brown. Femora often tinged with reddish-brown at their apices.

Type locality: Ogden, Utah.

Type in the United States National Museum.

Added distribution: Idaho: Moscow (J. M. Adrich). Montana: East Shore, Flathead Lake, April 21, 1934 (R. D. Kichmann). Utah: Petersboro, April 27, 1938 (Knowlton, Hardy, Stains); Cache Jc., June 27, 1938 (Knowlton, Hardy, Stains); Kanosh, June 27, 1938 (Knowlton, Harmston); Trenton, April 27, 1938, on Alfalfa (Knowlton, Hardy); Centerville, April 27, 1939 (Knowlton, Harmston); Pleasant View, April 25, 1939 (Knowlton, L. D. Bischoff); Sardine Canyon, April 22, 1939 (Knowlton, L. D. Bischoff) and Mantua, April 22, 1939 (Knowlton, Bischoff).

Bibio nigripilus Loew

Bibio nigripilus Loew, 1864, Dipt. Amer. Sept. Indig., Cent. 5, No. 10, Compl. work, 214-215.

Bibio lucens Hardy, 1937, Proc. Utah Acad. Sci. XIV, 203-204. This appears to be a synonym. The original description states that the hind metatarsi are one and one-half times as long as next subsegments but the types have not been compared to see if this character is good.

MALE.—Head, body (except yellow humeral ridges), coxae and trochanters shining black. Femora, tibiae (front tibiae brownish) and tarsi yellow to rufous, all joints dark tipped. *Legs:* Inner spurs of front tibiae but slightly shorter than outer; posterior femora and tibiae clavate; posterior basitarsi not swollen, about two times as long as second tarsal subsegments. Pile of head and thorax chiefly black, long and copious; that of coxae gray to black; of the femora and succeeding leg joints yellow-red; the pile of the abdomen gray on the anterior half and yellow posteriorly. Knobs of halteres brown, stems ochraceous. *Wings:* Hyaline, slightly fumose costally; anterior veins and stigma brown, posteriors concolorous with the membrane; crossvein r-m almost as long as basal part of Rs.

Length of wing, 5-6 mm.

Female unknown.

Type locality: Winnipeg, Canada.

Type in Cambridge Museum of Comparative Zoölogy.

Specimens fitting the description of *nigripilus* have been examined from Great Falls, Virginia, IV-23-19 (C. T. Greene); Montreal, New York; Bellmore, Indiana, July 2, '89 (A. E. Thomas); C. Mo., May (C. V. Riley); Jackson, Minn., 28 May, 1907; Covey Hill, Que., 31-5-1924, (P. Armstrong) and Brookings, South Dakota, April 24, 1925 (N. C. Severin). *B. lucens* was described from Ontario and Minnesota.

Bibio painteri James

Bibio painteri James, 1936, Amer. Mus. Novit. No. 832, p. 2.

This species is very close to *alexanderi* James. The following is James' discussion of it with added notes on leg characters:

"Related to *alexanderi*. It differs as follows: The dorsum of the thorax, in the female, is extensively marked with black; the extent of the black is variable, and may cover the large part of the dorsum. The pile of the tibiae is pale in both sexes and similar to that of the femora. In the male, the posterior tibiae, as well as the femora are clavate. The eyes are black-haired, and there is usually a considerable amount of pale pile on the lower part of the occiput."

The inner spurs of front tibiae almost half as long as the outer,

the outer spurs extending less than half the length of the metatarsi. Inner spurs of hind tibiae rather blunt, outer ones slender and acute. Hind metatarsi less than four times as long as wide.

Length: body and wings, 4.2-4.7 mm.

Type locality: Manhattan, Kansas.

Type in American Museum.

The writer has studied paratopotypes and has identified specimens from Stillwater, Oklahoma, 3-25-39 (K. C. Emerson); Columbus, Ohio, 23-IV-34 (R. H. Painter) also from Arizona and Colorado.

Bibio pingreensis James

(Plate XXXIX, fig. 200a)

Bibio pingreensis James, 1936, Amer. Mus. Novit. No. 832, p. 4.

Following is the original description with added notes on the leg characters:

"Related to *inaequalis* Loew, but the posterior basitarsi are not so noticeably enlarged and the legs are differently colored; it is more robust than *longipes* and the structure of the posterior tarsi is different.

"*Male.*—Head, with appendages, thorax and abdomen black. Head wholly black-haired, the eyes with copious black hair. Thorax, abdomen, and legs with long yellowish pile; a little gray pile on the mesopleura; some short black pile on the tibiae and tarsi. Coxae, trochanters, femora and anterior tibiae black; the spurs on the anterior tibiae yellow, the inner spur one-third the length of the outer one; posterior femora strongly clavate, the constricted basal part yellowish; middle tibiae brown; posterior tibiae yellowish to brown; tarsi brown, the basitarsi yellowish to brown. Posterior basitarsi slightly enlarged, but cylindrical, rather than globular, as in the related species. Wings whitish or slightly grayish hyaline; the strong veins brown; the posterior ones barely discernible from the membrane; crossvein r-m about one-half as long as the basal section of vein Rs. Length, 7-8 mm.

Outer spurs of front tibiae extending less than half the length of the metatarsi. Spurs of middle tibiae slender and acute; outer spurs of hind tibiae acute, inner ones rather blunt at apices. Hind metatarsi more than three and one-half times as long as wide (fig. 200a). Hind femora average 3.4 mm.; hind tibiae 2.7 mm.

Type locality: Mummy Pass, Alpine Zone, Pingree Park, Colorado.

Type in the American Museum.

Specimens have been identified from Cameron's Pass, Colorado, Aug. 20, 1940 (R. H. Beamer) and Logan Canyon, Utah, 9-11-37 (G. F. Knowlton, F. C. Harmston).

Bibio rufalipes Hardy

Bibio rufalipes Hardy, 1937, Proc. Utah Acad. Sci. XIV, 207.

This species is related to *xanthopus* Wiedemann but is distinguished by the concolorous posterior veins of wing, the reddish markings on the thorax and abdomen of the males and the wholly rufous thorax and legs of the females.

Following is the original description:

"*Male.*—Head chiefly black, appendages brownish; pile of eyes short and brown, that of face long, copious gray. Dorsum of thorax, for the most part, black, humeral ridges yellow, posterior margin rufous; pleurae with some rufous markings or tinges of reddish. Abdomen black, except lateral margins of tergites which are reddish. Pile of thorax and abdomen long, grayish yellow, more yellow hair on the posterior part of the abdomen. Coxae and trochanters somewhat tinged with red or reddish-brown; femora, tibiae (except more brownish anterior tibiae) and first two to three tarsal joints of legs chiefly yellow, with some darker hairs on the tibiae and tarsi. Inner spurs of anterior tibiae very short, not over one-fourth the length of the outer; posterior femora and tibiae clavate, the latter rather strongly swollen, larger than the femora in width; posterior basitarsi not enlarged, about as long as next two segments. Wings slightly yellow-fumose, anterior veins and stigma yellow-brown, posterior veins concolorous with the membrane; cross-vein r-m about equal in length to the basal part of the Rs.

"*Female.*—The female differs in having the entire thorax, coxae and trochanters rufous, the abdomen testaceous, or with a reddish cast; the tibiae and tarsi darker in coloration than the femora, those of the anterior legs dark red-brown to black, other tibiae and tarsi darker rufous to brown. All pile shorter and yellow, and wings darker fumose.

"Length of wing, 6-6.5 mm."

Type locality: Waco, Texas.

Type in United States National Museum.

Bibio rufithorax Wiedemann

(Plates XXXIX-XL, figs. 201a-f)

Bib-(io) rufithorax Wiedemann, 1828, Ausz. Zweifl. Ins. 1, 78.
Bibio thoracica Say, 1824, Expd. to St. Peters Riv. vol. 2, 368, 1859, Compl. writ. vol. 1, 250.

These are probably the same species but as Say's type is lost Wiedemann's name is used.

Doctor Max Beier of the Wein Museum kindly made comparative studies of Wiedemann's type so this species can now be accurately placed.

This species is related to *Bibio carolinus* Hardy and the females of these have heretofore been considered one species. The males key out near *longipes* Loew by having the posterior basitarsi swollen but otherwise they are very different from this species. It differs from *carolinus* by having the posterior basitarsi of male swollen (fig. 201e); in both sexes only the posterior portion of humeral ridges are yellow and the mesonotum has three characteristic, broad, finely shagreened areas. The pleurae are more densely pale haired; and the vertex has shorter hairs behind the ocelli in the male; *carolinus* has very elongate hairs on this portion of the head. The sides of scutellum and upper lateral margins of metanotum are ruficent in *carolinus* males, entirely black in *rufithorax*. The females differ markedly in that the length of the head behind the eyes is much shorter than the length of the eyes (fig. 201b) instead of longer than the eye length (fig. 187a), and no tubercles are present in the middle of the face behind the antennae as in *carolinus*. Head and prothorax finely shagreened, giving a dull appearance; entire head and prothorax of *carolinus* brightly polished, chiefly smooth. The propleurae with characteristic vertical striations, somewhat concentrically arranged. The head, propleurae, mesopleurae and sternopleurae more densely pale haired in *rufithorax*, almost bare in *carolinus*. The specimens of both sexes are also larger in size and the male genitalia are very different.

MALE.—In addition to the above characters the males are almost entirely black. *Head:* Compound eyes are divided into an upper and lower portion by a transverse indentation near the lower margins; the pile of the eyes is rather dense and brown in color, that of face chiefly yellow. Antennae nine segmented, the segments rather closely compacted; first segment (scape) is about equal to the third in length, the second (pedicel) is almost two times as long as the scape. *Thorax:* Mesonotum with three broad, dull vittae, brought

about by a shagreened condition of the cuticula; the median vitta extends almost the entire length of the mesonotum, less distinct in front and behind; the lateral vittae are separated from the median by a polished stripe on each side and from the lateral margin by another broader shining stripe. Halteres brownish, with a faint tinge of yellow. *Legs:* Entirely shining black, front tibiae long and slender, equal to femora in length, inner spur much less than one-half the length of the outer (fig. 201d). *Wings:* Brown fumose on anterior margin, yellow on posterior; anterior veins and stigma brown, posterior veins yellow-brown. Crossvein r-m equal in length to the basal portion of vein M_{1+2}, situated well before the branch of M_{3+4}. Cubital vein ending much before the wing margin, anal vein not extending much beyond the base of m-cu crossvein (fig. 201a). Veins in posterior portion of wing, although lighter in color are much thicker than anterior veins. Abdomen rather thickly pale pilose. *Genitalia:* Ninth sternum with a median cleft over one-third its length, and a moundlike gibbosity in the middle of the cleft; sternum broader than long. Harpagones rather short, bent down into a blunt beaklike process apically (fig. 201c). Ninth tergum deeply V-shaped cleft, about two-thirds its length (fig. 201f).

Length of wings, 11-11.4 mm.

Type locality: Pennsylvania.

Type in Vienna Museum.

Specimens have been examined from South Port, North Carolina, April, 1934 (Harris-Wray); Winnabow, N. C., 4-15-1937 (Harris-Wray); Virginia Beach, Virginia, May 17, 1907 (I. J. Condit); it also has been reported from Washington, D. C., South Carolina, Texas and Florida.

Bibio sericatus Hardy

(Plate XL, figs. 202a-b)

Bibio sericata Hardy, 1937, Proc. Utah Acad. Sci. XIV, 207.

This species is related to *longipes* Loew but is easily separated by the pale stigma and almost obsolete posterior veins, by the blunt tibial spurs and shortened subsegments of tarsi. Following is the original description with additional notes on the leg characters:

"*Male.*—Chiefly shining black, except rufous tibial spurs, yellow humeral ridges and sometimes slight tinge of rufous on the tibiae and basitarsi. Pile of eyes black, that of face gray to brown; that of body and legs for the most part yellow, somewhat reddish-yellow on tibiae and tarsi. Inner spurs of front tibiae short, about one-fourth the length of the outer; posterior femora clavate, tibiae hardly

so; segments of posterior tarsi swollen and rather globular; basitarsi conspicuously swollen and more short (not so elongate as *longipes*), being about one and one-half times as long as the next segment. Wings slightly yellow fumose, darker costally; anterior veins dark brown, stigma yellowed, almost obscure; posterior veins concolorous with the membrane, or but slightly more yellowed; crossvein r-m equal to basal part of Rs."

The inner spur of front tibia is blunt, somewhat rounding at its apex, the outer is about as thick as the metatarsus and extends about half its length (fig. 202a). The spurs of hind tibiae are blunt and thick, especially the inner spur; the posterior metatarsus is scarcely over twice as long as wide (fig. 202b).

"*Female.*—The female differs in having only the coxae and trochanters of the legs black, the other joints being yellow to rufous, and in having all pile short, sparse and yellow.

"Length of wing, 4.5-5.5 mm."

This species occurs in the late summer and early fall.

Type locality: Mt. Rainier, Washington.

Type returned to Mr. J. Wilcox, Alhambra, California.

Added distribution: Yahk, Lamb Creek, B. C., Aug. 9, (C. Garrett); Oliver, B. C., Aug. 27 (C. Garrett); Cranbrook, B. C., Sept. 29 (C. Garrett).

Bibio similis James

Bibio similis James, 1936, Amer. Mus. Novit. No. 832, 5.

This species approaches rather closely to *albipennis* Say but is distinguished by the longer r-m crossvein in the wing.

MALE.—Shining black, except for reddish tibial spurs and yellowed bases of metatarsi. Pile of head gray to black, that of body, coxae and femora chiefly pale yellow, a few long, gray hairs on the anterior portion of the abdomen; tibiae and tarsi with short black and pale hairs intermixed. *Legs:* Inner spurs of anterior tibiae short, not over one-fourth the length of the outer; posterior femora and tibiae clavate, posterior basitarsi not swollen, about twice as long as next tarsal subsegments. *Wings:* Whitish hyaline, anterior veins and stigma black, posterior veins somewhat lighter, r-m crossvein almost as long as the basal part of the posterior branch of radius.

Length of wing, 7-8 mm.

Female unknown.

Type locality: Boulder, Colorado.

Type in the American Museum.

James also reports this species from Rifle, Colorado, and Fort

Duchesne, Utah. The writer has identified specimens from Ft. Collins, Colorado; South Fork, Provo Canyon, Utah (Hardy); Logan Canyon, Utah, 5-16-34 (Thatcher); Plain City, Utah, 5-6-35 (G. F. Knowlton) and Logan, Utah, 5-26-33 (Thatcher).

Bibio slossonae Cockerell

Bibio slossonae Cockerell, 1909, Fossil Insects from Colorado. The Entomologist, vol. 42, p. 174. Change of name for *B. gracilis* Walker.
Bibio gracilis Walker, 1848, (nec Unger), List Dipt. Ins. Brit. Mus., vol. 1, 123.

This species is related to *longipes* Loew but is distinguished by the black pile of the male and black dorsum of thorax of female.

MALE. — Head and appendages, thorax (except pale humeral ridges) and abdomen shining black; the legs dark reddish-brown to black, with a few yellowish hairs intermixed on the femora. *Legs:* Inner spurs of front tibiae short, one-third to one-fourth the length of the outer; posterior femora clavate, elongate; posterior basitarsi greatly swollen. *Wings:* Yellow fumose to yellow hyaline; anterior veins and stigma brown, posterior veins more yellowish; r-m cross-vein slightly longer than the basal part of Rs.

Length of wing, 4.7-5.3 mm.

FEMALE.—The female differs in having all hair short and pale; the legs yellow to rufous, slightly darkened apically, and the pleurae usually tinged with rufous.

Type locality: Nova Scotia.

Type in British Museum.

Specimens have been examined from Alberta, British Columbia, California, Colorado, Manitoba, Michigan, Minnesota, Newfoundland, New York, Saskatchewan, South Dakota, Wisconsin and Wyoming.

Bibio tenellus Hardy

Bibio tenella Hardy, 1937, Proc. Utah Acad. Sci. XIV, 208.

This species is related to *pingreensis* James and is distinguished by the dark yellow fumose wings and the reddish-brown apices of femora. Following is the original description:

"*Male.*—Head, body (except pale humeral ridges), coxae and trochanters black; front femora chiefly black with but slight rufous tinge; middle and anterior femora dark reddish-brown on the apical half and slightly yellowed on the basal constriction; middle and hind tibiae and the first two segments of all tarsi yellow, darkened apically; last three tarsal segments dark brown to black; anterior tibiae yellowed basally, dark brown medianly; tibial spurs rufous to yel-

low. Inner spur of front tibiae very short, one-third to one-fourth the length of the outer; posterior femora and tibiae clavate, tibiae slightly thicker than femora; posterior basitarsi distinctly elongate, not noticeably swollen or globular, at least two times as long as the second tarsal segment. Pile of eyes rather short and black, that of the face copious, brown, that of the thorax, abdomen and legs, for the most part, copious, long and yellow; tibiae and tarsi with some darker pile intermixed. Halteres yellow-brown, much lighter in color than thorax. Wings dark yellow-fumose, anterior veins and stigma yellowish-brown, posterior veins yellowed and concolorous with the membrane; r-m crossvein almost equal in length to the basal part of the Rs.

"Length of wing, 6-6.6 mm.

"Female unknown."

Type locality: Healy, Alaska.

Type in United States National Museum.

Bibio tournesi n. sp.

(Plate XL, fig. 203a)

This species is related to *fluginatus* Hardy and *inaequalis* Loew. The males are readily distinguished by the bright yellow ninth sternum and harpago bases, yellow coxae and trochanters, sparsely pilose eyes and more hyaline wings. *B. fluginatus* Hardy has the r-m crossvein shorter to about equal to basal portion of vein Rs, crossvein r-m is distinctly longer than base of Rs in *tournesi*. The females may be separated from *inaequalis* by their smaller size and smoky yellow wings.

MALE.—Eyes very sparsely covered with short pale pile, lower one-fourth of each compound eye divided off by a transverse depression. Antennae eight segmented, second segment (pedicel) yellowish. Face rather thickly gray pilose. Thorax chiefly shining black with scattered yellow hairs, sometimes the median portion of mesonotum is rufous in ground color. Humeral ridges and posterior margin of pronotum and propleurae pale yellowish. Halteres yellow-brown to black, stems more pale. *Legs:* Almost entirely yellow, apices of tibiae slightly darkened, spurs rufous; apical two to three tarsal subsegments faintly brownish. Inner spurs of front tibiae short, about one-third the length of the outer; outer spurs extend almost half the length of the metatarsi. Spurs of hind tibiae slender and acute. Posterior metatarsi distinctly thickened, about equal in width to the apex of the tibiae; metatarsi about four times as long

as wide and longer than next two subsegments. Femora and tibiae slender, posterior femora average 2 mm. in length, posterior tibiae average 1.7 mm. *Wings:* Hyaline with a faint yellowish tinge, stigma and anterior veins brown, posteriors brownish yellow, darker than membrane. Basal portion of vein Rs, shorter than crossvein r-m. Abdomen mostly shining black, lateral margins of terga often with a faint yellowish tinge. *Hypopygium:* Ninth sternum bright yellow, cleft extending almost half the length of the segment. Harpagones elongate and slender, gently curved downward (fig. 203a); bases yellow, otherwise brown to black. Ninth tergum gently concave on hind margin.

Length: body, 4.2-4.4 mm.; wing, 4.4-4.6 mm.

FEMALE.—Head rufous tinged in ground color, rather thickly covered with yellow hairs. Head behind compound eyes almost twice as long as the eye length. Thorax entirely yellow; posterior metatarsi slender and elongate; wings pale yellowish fumose. The abdomen is entirely yellow-brown with the sterna more distinctly yellowish.

Length: body, 4.4 mm.; wing, 5.5 mm.

Holotype male, Westerly, R. I., July 29, 1937 (N. Chapman). Allotype female, Hancock, N. Y., Aug. 11, 1935 (H. K. Townes). Two paratype males, same data as holotype; one paratype male, Canterbury, Connecticut, July 25, 1937 (N. Chapman) and five paratype males, Lake Mohonk, Ulster Co., N. Y., Aug. 1, 1936 (H. K. Townes).

Holotype, allotype and three paratypes returned to Doctor H. K. Townes, others retained in the Snow Entomological Collection.

Bibio tristis Williston

Bibio tristis Williston, 1893, in Kellogg, V. L., Insect notes, Trans. Kansas Acad. Sci. 113-114.

Related to *xanthopus* Wiedemann but distinguished by the dense black pile on the dorsum of thorax.

MALE.—Head, thorax (except yellowed humeral ridges), abdomen, coxae and trochanters black, with rather copious black pile. *Legs:* Femora, tibiae and tarsi chiefly rufous with dark tips; sometimes apical halves of femora and tibiae somewhat darkened; pile of legs gray to black, that of tibiae and tarsi shorter and darker than that of femora. Hind femora and tibiae clavate, hind basitarsi not swollen, about equal in length to next two subsegments. Inner spurs of front tibiae short, about one-fourth to one-fifth the length of the outer. *Wings:* Dusky hyaline, r-m crossvein almost equal in length

to the basal part of Rs. Anterior veins and stigma brown, posteriors brownish yellow.

FEMALE.—According to Williston the female has the pile chiefly black and has the middle and hind coxae in part black. It will probably key out near *xanthopus* but since this writer has not examined a female and the original description is rather meager its exact position is unknown.

Type locality: Western Kansas.

Location of type unknown. No specimens of the type series are at the University of Kansas or Kansas State College.

The species has been reported from Kansas and Graham Mts., Arizona. Males apparently belonging here have been examined from Pullman, Washington, 24 April, '01; Wellsville, Utah, 6-3-37 (F. C. Harmston) and Provo, Utah, V-9-37 (D. E. Hardy).

Bibio utahensis Hardy

Bibio utahensis Hardy, 1937, Proc. Utah Acad. Sci. XIV, 208-209.

This species is related to *mickeli* Hardy but is separated by the dark posterior veins and shorter inner spurs of front tibiae. Following is the original description:

"MALE.—Entirely shining black, except for pale humeral ridges and tibial spurs. Pile of the eyes black, that of face gray; of the thorax chiefly black; pile of coxae and femora gray to yellow; that of tibiae and tarsi black; of abdomen gray to black anteriorly, yellow posteriorly. Inner spurs of front tibiae about three-fourths the length of the outer; posterior femora and tibiae slightly clavate, posterior basitarsi not swollen, and rather elongate, as long as next two tarsal segments. Wings chiefly hyaline, slightly dusky anteriorly; anterior veins gray to brown; r-m crossvein one-half to equal the length of the Rs.

"Length of wing, 6-7 mm."

Female unknown.

Type locality: Provo River, Provo, Utah.

Type in Brigham Young University collection at Provo, Utah.

Additional distribution: Utah: Logan Canyon, May 15, 1938 (D. E. Hardy, A. T. Hardy); Richmond, May 13, 1938 (D. E. Hardy); Spanish Fork, May, 1938 (Knowlton, Hardy); Logan, May 8, 1938 (D. E. Hardy); Mantua, May 3, 1937 (G. F. Knowlton); Honeyville, April 29, 1939 (G. F. Knowlton, D. L. Bischoff); Washington: Pullman, May 6, 1899.

Bibio velcidus Hardy

Bibio velcida Hardy, 1937, Proc. Utah Acad. Sci. XIV, 209.

This species is related to *abbreviatus* Loew but is distinguished by having the pile of the body chiefly black and the legs dark reddish brown to black, the male genitalia have not been dissected. Following is the original description:

"MALE.—Head, body (except yellowed humeral ridges), coxae and trochanters shining black. Femora and succeeding leg joints dark reddish brown to black, slightly lighter basally; the constriction of the posterior femora and tibiae dark rufous; basal part of tarsal segments yellow. Spurs of front tibiae rufous, the inner spurs about three-fourths as long as the outer; posterior femora and tibiae clavate; posterior basitarsi not enlarged, not much over one and one-half times as long as the second tarsal segment. Pile chiefly black, long and copious; some yellow pile on the posterior half of the abdomen or sometimes sparsely intermixed on the thorax and femora. Wings slightly yellow fumose, anterior veins and stigma dark brown, posteriors light brown-yellow; crossvein r-m equal in length to the basal part of the Rs.

"Length of wing, 6-7 mm."

Type locality: Low Bush, Ontario.

Type in Canadian National Museum.

Bibio velorum McAtee

Bibio velorum McAtee, 1923, Proc. Ent. Soc. Wash., vol. 25, No. 3, 62.

This species appears somewhat related to *nervosus* Loew and is characterized by the rufous femora and the yellowish fumose wings. The following is the original description:

"Inner spur of front tibiae fairly long but still much shorter than outer; head, body and coxae black, humeral ridges yellowish; wings almost uniformly yellowish fumose; stigma small, blackish.

"*Male.*—Rather long erect hair on eyes, much longer hair of occiput and top of thorax dark, of sides of thorax, coxae and abdomen pale, grayish. Hind legs elongate, femora and tibiae clavate, metatarsi enlarged, the apices of all joints and whole of last two tarsal joints dark, remaining portions reddish, tibiae and tarsi brownish to black; hair of legs tending to agree in shade with integument from which it springs but that of front legs wholly dark grayish. Length of wing: 8-8.5 mm.

"*Female.*—Pubescence in general shorter and more bristly than in male but all tibiae and tarsi tend to be darker than the femora, all joints dark-tipped. Length of wing: 10-11 mm."

Type locality: Jefferson, North Carolina.

Type in the United States National Museum.

The writer has studied the type and has identified the species from Grandfather Mt. top, North Carolina, Oct. 8, 1936 (D. L. Wray). Specimens have also been seen that seem to belong here from Pingree Park, Colorado, 9,000 feet, August 19, 1929 (D. A. Wilbur) and Cameron Pass, Colorado, Aug. 21, 1940 (G. F. Knowlton).

Bibio vestitus Walker

Bibio vestita Walker, 1848, List. Dipt. British Mus., pt. 1, p. 122.

The original description does not mention the length of the inner spurs of front tibiae, so the identification of this species can not be positive.

The following description is taken from McAtee:

"Head, body, and legs black, clothed with black hairs, abundant and long over head, body, coxae and femora, shorter on remaining joints of legs; tibiae and tarsal joints rufous with dark tips, the last two joints of tarsi almost or wholly dark; front tibiae reddish brown, the spurs very unequal; wings nearly hyaline, stigma and anterior veins brown, the cells bounded by latter more obscure than remainder of wing, posterior veins almost hyaline. Length of wing, 7 mm."

Type locality: Nova Scotia.

Type in British Museum.

McAtee reports this species from St. John, New Brunswick, June 9, 1901 (W. McIntosh). The author has a male specimen from Mirror Lake, Uintah Mountains, Utah (Hardy) which fits the above description very well.

Bibio xanthopus Wiedemann

(Plate XL, fig. 204a)

Bib (io) xanthopus Wiedemann, 1828, Ausz., Zweifl. Ins., I, 80.

Bibio canadensis Macquart, 1838, Dipt. Exot. i, 129. Questionable synonomy, original description is inadequate.

Bibio scita Walker, 1848, List Dipt. Brit. Mus. Pt. 1, 122. Questionable synonomy based only upon description.

Bibio humeralis Walker, 1848, List Dipt. 1, 121-122. Questionable synonomy based only upon description. See note on *B. macateei* James.

Bibio lugens Loew, 1864, Dipt. Amer. Sept. indig., Cent. 5, No. 5, Compl. Work, 214-215. New synonomy based upon study of type No. 12518 in Cambridge Museum.

Bibio obscurus Loew, 1864, Dipt. Amer. Sept. indig., Cent. 5, No. 5, Compl. Work, 124. New synonomy based upon study of type in Cambridge Museum.

Bibio macateei James, 1936, Amer. Mus. Nov. 832, 4. New synonomy based upon examination of holotype and allotype in American Museum.

McAtee suggested that *obscurus* Loew was probably the same as *xanthopus*. Examination of the type No. 12521 in the Cambridge Museum of Comparative Zoölogy proved this assumption to be cor-

rect. The type differs from typical *xanthopus* only in having the wings more lightly fumose and the posterior veins not so dark, there are such variations, however, in the fumosity of the wings of this species that this cannot be considered a specific character.

Doctor James states *macateei* "is apparently the species which McAtee refers, with a query, to *humeralis* Walker" as Walker's species is unidentifiable from description he preferred to describe it as new. It is based upon the slightly paled anterior margin of mesonotum of the female, the specific variations through a series of *xanthopus* shows this to be an intergrading factor. This synonomy must therefore include *humeralis* although examination of Walker's type may prove it to be distinct.

Bibio xanthopus is related to *nervosus* Loew but is distinguished by the shorter inner spurs of front tibiae.

MALE.—Head, body (except yellow humeral ridges) and coxae black, femora and succeeding leg joints yellow to rufous with dark tips, the tibial spurs rufous. *Legs:* Inner spurs of front tibiae short, about one-third to one-half the length of outer spurs; outer spurs extending but little over one-third the length of the front metatarsi (fig. 204a). Posterior femora and tibiae slightly clavate, hind metatarsi not swollen, about twice as long as second subsegment of tarsi and five times as long as wide. Apical spurs of hind tibiae slender and acutely pointed. *Wings:* Hyaline to yellow fumose, anterior veins and stigma dark brown, posterior veins more pale. Crossvein r-m about equal to the basal portion of vein Rs.

FEMALE.—Differs in having shorter, all pale pile, wings darker fumose and coxae and pleurae usually in part rufous or tinged with brown.

Length of wing, 5.5-9.5 mm.

Type locality: New York.

Type in Vienna Natural History Museum.

This is an exceedingly variable species and many of its intergrades present rather complex problems. It is widely distributed, having been identified from most all of the states and Canadian provinces, it is one of the most common Bibionidae in the Northern states.

Bibio xanthopus palliatus McAtee

Bibio xanthopus palliatus McAtee, 1921, U. S. N. M., v. 60, Art. 11, p. 16.

Bibio signatus Hardy, 1937 Proc. Utah Acad. Sci. v. XIV, 208. New synonomy based upon study of *xanthopus palliatus* type.

At the time *signatus* was described the writer was only acquainted with the typical forms of *xanthopus* (those having the inner spur of front tibiae short), *signatus* was proposed for that group having the

inner spur about equal to the outer in length. Since then all stages of intergrades between the two have been examined proving that these are not distinct species; examination of McAtee's type established this as a synonym of his subspecies.

This subspecies has caused a great deal of controversy because of the variability of the species. The following is McAtee's discussion of it: "Differs from the typical subspecies in darker colors, more abundant pubescence, and somewhat greater average size. The pleura of the female usually are wholly dark. The male has more abundant, longer, and darker hair, sometimes wholly black. This subspecies bears somewhat the same relation to the eastern race of *xanthopus* that *hirtus* does to *albipennis*.

"Length of wing, 7.5-9.5 mm."

The inner spurs of front tibiae vary from one-third the length of the outer as in typical *xanthopus* to almost as long as the outer as characterize the *signatus* form, this makes it necessary to key this subspecies in two different groups. Specimens are usually dusky winged and have been known as *nervosus* Loew. Mr. P. C. Ting states that the larvae of *xanthopus* and *xanthopus palliatus* are quite different, he informed the writer (and has kindly submitted mounted specimens for study) that the dorsum of the anal segment is heavily sclerotized on specimens of *palliatus* and the spinules are elongate (fig. 119a), while the larvae of *xanthopus* consistently lack the heavy sclerotization on the dorsum of the anal segment and the body spinules have more teeth and their bases are short and broad (fig. 118a).

Type locality: Moscow, Idaho.

Type in the United States National Museum.

This subspecies is very common in the west, having been identified from numerous localities in the following states and provinces: British Columbia, California, Idaho, Nevada, Oregon, Utah and Washington.

SPECIES NOT IDENTIFIABLE, DESCRIPTIONS INADEQUATE

Bibio brunnipes (Fabricius), 1794, Ent. Syst. 4, 250 (Tipula). Described from Newfoundland.

Bibio castanipes Jaennicke, 1867, Neue exotische Dipteren, ab. d. senckenb, naturf. Gesellsch. 6, 317. Described from Illinois.

Bibio orbatus Say, 1823, Journ. Acad. Nat. Sci. Phil. III, 78, 1859. Comp. writings II, 69-70. Described from Pennsylvania and although it is not known just what Say had before him it is certainly not to be confused with *orbatus* of the genus *Philia* and *Philia orbatus*

(Wiedemann), 1826, Ausz. Zweifl. Ins. I. is a synonym of *Bibio orbatus* Say.

Bibio rufipes (Fabricius), 1781, Spec. Insectorum II, 410 (Tipula). Described from Newfoundland.

Bibio striatipes Walker, 1848, List. Dipt. Brit. Mus. I, 122-123. Described from St. Martin Falls, Albany River, Hudson Bay.

Bibiodes Coquillett

Bibiodes Coquillett, 1904, Proc. Ent. Soc. Wash. 6, 171.

The members of this genus are similar in many respects to the *Bibio*, they possess the strongly developed spurs on front tibiae but the inner spurs are always rather weak. The wing venation is very different and the two genera are best distinguished by this character. In *Bibiodes* the third longitudinal vein (the posterior branch of the radius) coalesces with the fourth vein (medius) for a short distance near the middle of the wing obliterating the radio-medial crossvein (fig. 205c). The harpagones of the males are characteristically bilobed and show good specific characters. The species are much smaller than any known *Bibio*, wing length averaging from 3.5-4 mm.

GENOTYPE: *Bibiodes halteralis* Coquillett

KEY TO THE SPECIES OF *Bibiodes*

1. Thickened portion of costal margin extending about half way from stigma to apex of wing; femora conspicuously swollen; antennae shorter.....*femorata* Melander, p. 495
   Thickened portion of costal margin extending much more than half way from stigma to apex of wing; legs less robust, antennae longer..... 2
2. Halteres yellow; tarsal joints slender; inner processes of harpagones strongly developed, longer than outer lobes (fig. 207a).....*halteralis* Coquillett, p. 496
   Halteres dark, at least apically; tarsal joints somewhat swollen; inner processes not strongly developed, about the same size as outer lobes (fig. 205a), *aestiva* Melander, p. 494

Bibiodes aestiva Melander

(Plate XL, figs. 205a-c)

Bibiodes astiva Melander, 1912, The Dipterous Genus Bibiodes, Bull. Amer. Mus. Nat. Hist., vol. 31, 438.

MALE.—Head and appendages, body, coxae, femora, anterior tibiae and tarsi, excepting tibial spurs, shining black with sparse, rather long pale hair, shorter and somewhat brownish on the tarsi. *Legs:* Anterior tibial spurs rufous, the inner spur much shorter than outer, being less than a fourth as long; tibiae and tarsi of the posterior legs yellowish or rufous to reddish brown, the joints darker apically; the tibiae of the mid-legs sometimes entirely black; posterior tarsi somewhat swollen. Stems of halteres pale, knobs black. *Wings:* Hyaline to slightly yellowish fumose, stigma and anterior veins dark

brown, posterior veins light yellowish brown, costal cell (submarginal) yellowish fumose. *Genitalia:* Pile of genitalia chiefly yellow; ninth sternum broad, posterior margin cleft about one-third the length of the segment, cleft broadly U-shaped. Aedeagus broad and blunt, appearing quite heavily sclerotized. Harpagones developed into two lobes (fig. 205a), the outer (main lobe) rather long and sharply pointed, more heavily sclerotized than the inner; the inner lobe is lighter in color and not so distinctly tapered. The two lobes are very nearly equal in size, although very different in shape. Ninth tergum gently convex on both margins and about twice as broad as long. Cerci with but slightly rounded edges, almost square in shape (fig. 205b).

Length of wing, 3.5-4 mm.

Female unknown.

Type locality: Washington.

Type in American Museum of Natural History.

The species has been identified from Idaho, Montana, Oregon, Wyoming, British Columbia, and Manila, Utah, June 26, 1939 (G. F. Knowlton, F. C. Harmston).

Bibiodes femorata Melander

(Plate XL, figs. 206a-b)

Bibiodes femorata Melander, 1912, Bull. Amer. Mus. Nat. Hist., vol. 31, 338.

MALE.—Shining black or brownish black with long, rather copious, gray to yellow pile; tibial spurs rufous; halteres brownish, stems slighter paler than knobs. Wings hyaline, anterior veins and stigma brown, posterior veins yellow. *Genitalia:* Ninth sternum cleft about one-third its length, gently convex in the central portion of cleft. Harpagones bilobed, with the two lobes unequal in size and shape, the smaller development is situated on the ventral portion of the harpago, is almost horizontal in position, directed inwardly and is somewhat obtuse at apex. The larger lobes are dorsal in position, almost twice the size of the ventral lobes and produced into beaklike points, on inner apices (fig. 206a). Ninth tergum but slightly wider than long, gently concave on posterior margin (fig. 206b).

Length of wing, 3.5 mm.

FEMALE.—Pile chiefly yellow, rather long on dorsum and femora. Body dark brownish to black, the specimen at hand has a distinct brownish tinge. Leg joints pale yellowish, tarsi somewhat more brown, femora distinctly swollen. Anterior veins and stigma pale brown, posterior veins concolorous with the membrane. Halteres yellowish.

This is the first female of the genus that has been observed by the author, and as far as is known none have heretofore been reported.

Type locality: Austin, Texas.

Type in American Museum of Natural History.

The writer has examined topotypic specimens, also specimens from Union City, Tenn. (G. I. Reeves).

Bibiodes halteralis Coquillett

(Plate XL, figs. 207a-b)

Bibiodes halteralis Coquillett, 1904, New North American Diptera, Proc. Ent. Soc. Wash., vol. 6, No. 3, 171.

MALE.—Head and appendages, body (with the exception of yellowed humeral ridges), coxae and femora shining black with pale yellow pile. *Legs:* Tibiae and tarsi of all legs dark rufous to reddish brown, joints darker apically; inner spurs of front tibiae very short, being about one-fifth the length of the outer; posterior tarsi not at all swollen or enlarged. Knobs of halteres yellow, their stems somewhat darker. *Wings:* Chiefly hyaline, anterior veins and stigma brown, posterior veins concolorous with the membrane. *Genitalia:* Pile yellow, more sparse than in *B. aestiva Melander.* Ninth sternum rather deeply cleft on hind margin, slightly concave at the bottom of cleft. The harpagones are strongly developed, the two lobes are very unequal in size and shape. The ventral lobe is much larger than the dorsal, is broad and rather blunt with a distinct longitudinal groove at apex; the ventral lobes are nearly horizontal in position. The dorsal lobes are more slender and acute at apices (fig. 207a). Ninth tergum much broader than long, gently concave on posterior margin (fig. 207b).

Length of wing, 3.5 mm.

Type locality: San Mateo Co., California.

Type in United State National Museum.

The species also has been reported from Los Angeles, California (Coquillett) and Claremont, California (Baker). The author has also examined specimens from Cherry Valley, California, Jan. 11, 1938 (Christenson, Clancy); Dundurn, Saskatchewan, 16-5-1923 (R. M. King), Silvery City, New Mexico, (Kellog), and Phoenix, Arizona, 4-IX-31 (E. M. Painter).

Bibionellus Edwards

Bibionellus Edwards, 1935, Stylops, Roy. Ent. Soc. of London, vol. 4, pt. I, 19.

Following is the original description of the genus and species:

"Allied to *Bibio,* differing chiefly as follows:—Wings with the costa greatly produced, reaching about half-way from R_5 to M_1 (as

in *Dilophus;* in most *Bibio* the costa ceases abruptly at tip of R_5, this being the case also in *Bibiodes*). Front tibia in both sexes with a conspicuous blunt tubercle in middle beneath (rather larger in male than in female); front femur with a slight enlargement beneath before the tip, this enlargement bearing a group of microscopic tubercles."

GENOTYPE: *Bibionellus tibialis* Edwards.

Bibionellus tibialis Edwards

Bibionellus tibialis Edwards, 1935, Stylops. vol. 4, part 1, 19-20.

"*Male.*—Head black behind and beneath. Eyes broadly in contact and constructed as usual in this family, but quite bare. Rostrum not at all produced. Antennae yellowish, very short, the flagellum composed of only 5-6 segments; palpi of moderate length, brownish. *Thorax* shining, with short and very scanty black hair; mesonotum light reddish, scutellum and postnotum blackish, pleurae dark brown. *Abdomen* shining blackish, with scanty dark hair. Hypopygium differing from the usual type of the genera *Bibio* or *Dilophus,* the styles being ventro-lateral in position, without a conspicuous emargination between them (much as in *Plecia*). *Legs* blackish-brown, including all coxae. Front tibia with a very long outer apical spine (as in *Bibio*), the inner spur very much shorter. Hind femur slender and cylindrical on basal half, much swollen on apical half; hind tibia slender on basal third but greatly swollen on apical half or more, with two moderately long and slender spurs. Hind tarsi slender, much shorter than tibia. *Wings* rather smoky, with darker stigma, all veins somewhat darker than membrane, base narrowly whitish. Base of Rs and r-m subequal in length and quite short, less than a quarter as long as R_1. M_2 and Cu_1 reaching margin. Halteres blackish.

"Wing-length 3.5-4 mm.

"Female. Differs from male in having the head, thorax, coxae, femora and tibiae wholly yellowish. Eyes quite small."

Type locality: Bolivia, Yungas von Coloico.

Type in British Museum.

Philia Meigen

Philia Meigen, 1800, Nouv. Class. Mouch., 20.

Dilophus Meigen, 1803, Illiger's Mag. 1, vol. 2, 269.

Acanthocnemis Blanchard, 1852, in C. Gay Hist. Chile Zoöl. v. 7, 355. This name was previously used by Hawle and Corda, 1848, in Crustacea and later by Signoret, 1865, in Geocoridae.

The names *Philia* and *Dilophus* have been in dispute since 1908 when Hendel pointed out that many of Meigen's 1803 genera were

the same as those described in 1800. The discussion of the status of *Dorilas* vs. *Pipunculus* will also apply to these genera. The original description of *Philia* is unmistakable and Becker had examined the Meigen types and declared the two congeneric.

The genus *Philia*, in North America, is characterized by the presence of two to three sets of strong spines on the front tibiae. The members of the genus are comparatively small and represent but slight range in size among the various species. They seldom have a wing length of over 6-6.5 mm. in our North American species. The female of several species are inseparable unless accompanied by the male and it is very desirable, and in some cases a necessity, to have both sexes present in order that an accurate identification may be made. Such species as *tingi n.* sp., *spinipes* Say, *orbata*, O. S., *stigmatera* Say, *serotina* Loew, and *arizonaensis* Hardy may be readily identified without dissection of the male genitalia, but in most other species it is essential that these structures be examined. The subcostal vein is weak and the first four radial veins are apparently fused in the anterior branch of radius, the posterior branch (R_5) is simple. The basal portion of R_5 is short compared to the r-m crossvein, being scarcely one-third its length. The posterior veins of wing are usually brownish in color while the anteriors are concolorous with the membrane. The costa extends almost half the distance from R_5 to M_1 in most species.

GENOTYPE: *Tipula febrilis* Linnaeus.

KEY TO THE SPECIES OF MALE *Philia*

1. Front tibiae each with three series of spines (fig. 219a)..... 2
   Front tibiae with only two series of spines..... 3
2. Costa extending but a short way beyond end of vein R_5; top series of tibial spines with two teeth, middle set with three teeth; entirely black species. *tingi* n. sp., p. 513
   Costa extending half the distance between tips of vein R_5 and M_1; top series with three teeth, middle set with four; dorsum of thorax chiefly rufous..*spinipes* (Say), p. 510
3. Wings dusky to black .....*serotina* (Loew), p. 509
   Wings chiefly hyaline 4
4. Rostrum (the sclerotized portion of the face below the eyes) produced nearly, or distinctly, as long as the antennae ..... 4a *stigmatera* (Say), p. 511
   Rostrum distinctly shorter than the antennae..... 5
   4a. Veins of costal margin brown; female dorsum rufous. *stigmatera stigmatera* (Say), p. 511
   Veins of costal margin and stigma almost obsolete, dorsum of female black. *stigmatera nigra* Hardy, p. 511
5. Legs chiefly yellow or pale rufous .....*arizonaensis* Hardy, p. 500
   Legs chiefly dark brown to black, coxae never yellow..... 6
6. Pile of the legs and body dark, harpagones each with a broad inner, lateral development (fig. 212a) .....*orbata* (Osten Sacken), p. 507
   Pile of the legs and body pale..... 7
7. Posterior margin of ninth tergum straight or nearly so..... 8
   Posterior margin of ninth tergum decidedly concave or emarginate..... 11
8. Harpagones broadly flat-topped from lateral view (fig. 211b), *oklahomensis* Hardy, p. 506
   Harpagones not as above 9

9. Ninth tergum about as long on median line as across hind margin (fig. 208d), cleft of ninth sternum about one-third the length of the segment; stigma obsolete.
9a *breviceps* (Loew), p. 501
Ninth tergum distinctly broader than long 10
9a. Dorsum of female thorax yellow to rufous .....*breviceps breviceps* (Loew), p. 501
Dorsum of female chiefly black, only humeri rufous, *breviceps atelestes* Hardy, p. 502
10. Cleft of ninth sternum broad and shallow, not over one-fourth the length of the segment; ninth tergum not much wider than long; stigma faint or obsolete.
tibialis (Loew), p. 512
Cleft of ninth sternum about half the length of the segment; ninth tergum conspicuously wider than long, three to four times as wide; stigma distinct.
proxima (McAtee), p. 508
11. Cleft of sternum less than one-third the length of the segment; harpagones not greatly thickened apically; thorax of female chiefly rufous 12
Cleft of sternum at least one-third the length of the segment; harpagones usually conspicuously thickened apically, narrowed basally 13
12. Cleft of sternum about one-fourth the length of the segment; harpagones appearing sharply pointed from ventral view, broadly flat-topped from lateral view (some atypical specimens may run here) .....*oklahomensis* Hardy, p. 506
Cleft of sternum usually about one-third the length of the segment; harpagones with rather distinct beaklike apices, not square-topped from lateral view.
strigilata (McAtee), p. 512
13. Cleft of sternum reaching nearly to the base of segment .....*secta* (McAtee), p. 508
Cleft not over one-half the length of the segment 14
14. Ninth tergum conspicuously angulate emarginate, (fig. 210a), *emarginata* (McAtee), p. 503
Ninth tergum gently to decidedly concave, not with a V-shaped cleft 15
15. Ninth tergum not much wider than long, cleft of ninth sternum sometimes expanding at the bottom 16
Ninth tergum about two times as wide as long, posterior veins and stigma concolorous with membrane or nearly so .....*obesula* (Loew), p. 505
16. Stigma present, cleft of ninth sternum usually expanding basally (fig. 209a), apex of each harpago with a nitch beneath; tergum gently concave on hind margin.
caurina (McAtee), p. 502
Stigma obsolete, cleft of sternum narrowed basally, usually expanding at the top; tergum more distinctly concave .....*jamesi* Hardy, p. 504

KEY TO THE FEMALE *Philia*

1. Front tibiae with three series of spines (fig. 219a) 2
Front tibiae with only two series of spines 3
2. Costa extending but a short distance beyond end of vein R_5; top series of tibial spines with two teeth, middle set with three; thorax black .....*tingi* n. sp., p. 513
Costa extending half way between tips of veins R_5 and M_1; top series with three teeth, middle set with four; thorax entirely rufous .....*spinipes* (Say), p. 510
3. Wings dark 4
Wings chiefly hyaline 5
4. Thorax, coxae, and femora rufous .....*serotina* (Loew), p. 509
Thorax black, legs dark reddish brown to black .....*orbata* (Osten Sacken), p. 507
5. Rostrum (sclerotized portion of the face below eyes) produced, nearly or distinctly as long as the antennae ..... 5a *stigmatera* (Say), p. 511
Rostrum not produced, distinctly shorter than the antennae 6
5a. Dorsum of thorax rufous .....*stigmatera stigmatera* (Say), p. 511
Dorsum of thorax chiefly black .....*stigmatera nigra* Hardy, p. 511
6. Thorax chiefly rufous above 7
Thorax chiefly black, never more than humeri rufous 10
7. All tibiae yellow, concolorous with femora .....*arizonaensis* Hardy, p. 500
All tibiae dark reddish to brown, darker than femora 8
8. Teeth of prothoracic comb broad and blunt, comb comprised of seven to ten teeth; v comb very prominent, higher than the eye height .....*strigilata* (McAtee), p. 512
Teeth of comb not so well developed and more numerous, smaller and more acute, usually twelve to sixteen teeth, (rarely 9-10); comb not so prominent 9

9. Pleurae entirely rufous or yellow, middle comb of front tibiae with large broad teeth ..... *oklahomensis* Hardy, p. 506
Pleurae usually with dark markings, teeth of middle comb not so well developed. *breviceps* (Loew), p. 501
10. Legs entirely black except for yellowish front coxae..... *fulvicoxa* (Walker), p. 503
More of legs yellow to rufous..... 11
11. Middle and hind femora dark ..... *emarginata* (McAtee), p. 503
All femora pale 12
12. Middle and hind tibiae and tarsi pale..... *proxima* (McAtee), p. 503
Middle and hind tibiae and tarsi dark..... 13
13. Humeri dark brown to black..... *jamesi* Hardy, p. 504
Humeri rufous....*obesula* (Loew), *secta* (McAtee), *tibialis* (Loew), *caurina* (McAtee), *breviceps atelestes* Hardy

Philia arizonaensis Hardy

Philia arizonaensis Hardy, 1937, Proc. Utah Acad. Sci. Vol. XIV, 209-210.

Following is the original description:

"*Male.*—The male of this species is very distinctive in having the coxae, trochanters, femora and tibiae (except reddish brown front tibiae) pale yellow to rufous; tarsi brown. Eyes light brown with very short, sparse, dark pile, face with yellow-gray pile. First two segments of antennae, basal joints of palpi, and oral margin yellowish, other segments of antennae and palpi brown to black. Dorsum of thorax chiefly black, humeral ridges and posterior margin of dorsum tinged with yellow; pleurae dark with rufous markings; abdomen fuscous. Knobs of halteres dark yellow, stems pale. Wings slightly yellow fumose, costal cell deeply yellow fumose; anterior veins brown, stigma yellow brown, posterior veins but slightly yellowed. *Male Genitalia:* Genital cleft (ninth sternum) shallow, not over one-fifth to one-fourth the length of the segment. Stylus (clasper) rather narrow, not broadly tipped. Superior plate (ninth tergum) gently concave on the posterior margin, slightly wider than long. Pile of genitalia sparse and yellow.

"*Female.*—The female differs in having the thorax entirely yellow to rufous, abdomen lighter, reddish brown and the wings more yellow fumose.

"Length of wing, 3-4 mm."

Type locality: Huachuca Mts., Arizona.

Type in United States National Museum.

The writer has seen additional specimens from the type locality, Aug. 18, 1938 (R. H. Beamer) also from Tajique, New Mexico, June 25, 1940 (R. H. Beamer, D. E. Hardy) and Austin, Nev., Aug. 12, 1940 (D. E. Hardy).

Philia breviceps (Loew)

(Plate XL, figs. 208a-d)

Dilophus breviceps Loew, 1859, Dipt. Amer. Sept. indig., Cent. 9, No. 50, Compl. Works, vol. 2, p. 200.

Dilophus occipitalis Coquillett, 1904, Invert. Pacifica I, 20.

D. occipitalis is based upon the female sex. The writer has examined the type at the United States National Museum and it appears to be the same as *breviceps* Loew.

MALE.—Shining black, legs sometimes with a brownish tinge. Pile of eyes very short and dark, that of face longer, gray; thorax almost devoid of pile, except for two rows of dorso-central hairs; pile of coxae and femora long, yellow, that of tarsi and tibiae yellow to gray. Anterior thoracic comb usually with twelve to fourteen acutely pointed teeth. Knobs of halteres fuscous, stems paler. Wings hyaline, anterior veins yellow to yellow-brown, stigma usually obsolete, posterior veins entirely concolorous with the membrane. *Genitalia:* Ninth sternum moderately narrow, not broadly expanded; genital cleft about one-third the length of the segment and narrowing slightly basally (fig. 208a). Harpagones somewhat thickened apically, bluntly pointed and rather flat topped from lateral view (fig. 208c). Ninth tergum about as long as wide on median line, anterior margin but gently concave, almost straight (fig. 208d). Pile of the genitalia sparse and pale.

FEMALE.—Pile yellow; head black; dorsum of thorax (except area of thoracic combs), anterior coxae and all femora yellow to rufous. Middle and hind coxae, tibiae and tarsi dark rufous to brown; pleurae with brown to black markings; abdomen deep brown to sordid yellow; the sterna being slightly lighter than the terga. Prothoracic comb with twelve to eighteen teeth, shorter than the eye height; knobs of halteres fuscous, stems pale. Wings yellow fumose, anterior veins and large stigma yellow-brown to dark brown; posterior veins slightly darker than the membrane.

Length of wing, 3.5-4.5 mm.

Type locality: New Hampshire.

Type in Cambridge Museum of Comparative Zoölogy.

The species has been identified from Alabama, Illinois, Louisiana, Mississippi, North Carolina, Ohio, Oregon, Quebec and Wisconsin. It has also been reported from Ontario and New York.

Philia breviceps var. *atelestes* Hardy

Philia breviceps var. *atelestes* Hardy, 1937, Proc. Utah Acad. Sci., vol. XIV, 210.

The females of this variety have the dorsum of thorax entirely black except for the rufous humeri, the abdomen is dark brown to black. Legs and pleurae of the males are for the most part lighter in color than typical *breviceps*, usually being distinctly reddish in ground color.

Type locality: Meach Lake, Quebec.

Philia caurina (McAtee)

(Plate XL, figs. 209a-c)

Dilophus caurinus McAtee, 1921, Notes on Nearctic Bibionid Flies, Proc. U. S. Nat. Mus. vol. 60, p. 19.

The following is the original description:

"*Male.*—Entirely shining or subshining black, eyes with copious long dark hair, hair of other parts of body and of coxae and femora long, pale; of tibiae and tarsi shorter, more bristly, tending to be darker especially on tarsi; genital segments cleft about half its length, the cleft often distinctly expanded at bottom, superior plate only about three times as long as wide along hind margin which is slightly concave; wing grayish hyaline, veins near costa and large stigma pale brown.

"*Female.*—Head and thorax black, abdomen brown, with pale hairs; humeri, front (sometimes all) coxae, and femora yellow to rufous with pale hair, tibiae and tarsi brownish to black, color of hair corresponding to depth of coloring of joints; halteres with pale stalks and dark knobs; wings clear to yellowish hyaline, sometimes with transverse dusky clouding at level of stigma, veins near costa and stigma brownish, others nearly hyaline.

"Length of wing, 4.5-6 mm."

Upon dissecting the genitalia from a paratype male of *caurina* the writer finds that McAtee has misinterpreted the width and length of the ninth tergum as well as the depth of the cleft of ninth sternum. The following corrections and additions should be made to his description: Cleft of ninth sternum (genital cleft) slightly over one-third the length of the segment, cleft expanding basally, narrowed apically (fig. 209a). Harpagones with well developed heads, narrowing basally; apices of claspers thickened, apical portions pointed underneath, and with a ridge or tooth under the point (fig. 209b). Ninth tergum (superior plate) slightly wider than long, posterior margin gently concave (fig. 209c).

Type locality: Popoff Island, Alaska.

The author has examined the type series at the United States National Museum.

It is very common and widely distributed, especially throughout northern United States and Canada. Specimens have been examined from British Columbia, Michigan, New Mexico, Ohio, Utah and Washington.

Philia emarginata (McAtee)

(Plate XL, figs. 210a-b)

Dilophus emarginatus McAtee, 1921, Proc. U. S. Nat. Mus., 60, 20.

Following is the original description with added notes on the male genitalia:

"*Male.*—Body shining black, legs more brownish, the front tibiae darker; close-set hair of eyes dark, longer hair of underside of head, body and greater part of legs pale, of front tibiae and tarsi dark; genital segment with a cleft half its length, rounded expanded at the bottom, superior plate decidedly not transverse, about as long as wide across hind margin which is distinctly angularly emarginate; wings hyaline, veins near costa brown, stigma nearly obsolete.

"*Female.*—Humeri obscurely castaneous, thorax otherwise, and head shining black, abdomen velvety brownish black; legs rufous more or less suffused with brown, the front coxae and femora palest; all hairs pale; wings hyaline, veins near costa distinct, stigma brown.

"Length of wing, 4.5 mm."

The cleft of ninth sternum does not extend quite half the length of the segment (fig. 210b) and the bottom of the cleft is slightly convex. Harpagones simple, slightly enlarged apically and each with a small indentation just below apex. The cleft of ninth tergum (superior plate) extends about one-fourth the length of the plate (fig. 210a).

Type locality: Samoa, California.

The author has examined the type and allotype at the United States National Museum, also one male topotype specimen, same data and in the same collection as the type. This was evidently overlooked by the author of the species.

Philia fulvicoxa (Walker)

Dilophus fulvicoxa Walker, 1848, List of Dipt. Brit. Mus. I, 117.

The writer does not know this species. It is based upon a female specimen which appears to be distinctive in having the legs chiefly black. The following is the original description:

"Niger, thoracis dorso serrato, coxis anticis fulvis, alis limpidis, fusco unimaculatis.

"Body black, shining; eyes red: feelers black: a toothed ridge along the chest: abdomen dull black: legs black; fore hips tawny: wings colourless; a large, irregular, light brown spot under the brand, which is dark brown; fore border veins piceous; the other veins tawny; poisers piceous. Length of the body 2 lines; of the wings 5 lines."

Type locality: St. Martins Falls, Albany River, Hudson's Bay.

Type in British Museum.

Philia jamesi Hardy

Philia jamesi Hardy, 1937, Proc. Utah Acad. Sci. XIV, 210-211.

Species somewhat related to *tibialis* (Loew) but is distinguished by the concave posterior margin of the ninth tergum and the more deeply cleft ninth sternum. Following is the original description:

"*Male.*— Male shining black; eyes with dark hair, that of face yellow-gray; pile of dorsum dark gray to brown (sometimes chiefly yellow), that of pleurae, abdomen, coxae and femora yellow to reddish, of tibiae and tarsi yellow to brown. Knobs of halteres black, stems yellowish. Wings hyaline, anterior veins yellow to yellow-brown, stigma and posterior veins concolorous with the membrane, obsolete. *Male Genitalia:* Superior plate (ninth tergum) rather deeply and evenly convex, cerci rather large and chiefly membranous. Tenth tergite represented by a small slightly chitinized area on the membrane. Genitalia for the most part light haired (some darker hair on the 9th sternite) and with fine yellowish pubescence. The inner edges of the genital cleft being densely yellowish white pubescence. Genital cleft (ninth sternum) slightly convex centrally, and narrowed basally, usually expanded at the top. Coxite rounding apically with dense, fine, pale hair on the inner edges and longer and darker hair on the apices. Stylus (harpago) pointed, point appearing somewhat flattened on the dorsal view of the genitalia.

"*Female.*—The female differs in having the coxae, and femora rufous and tibiae and tarsi brownish red; humeri dark reddish-brown to black. Abdomen fuscus to black; wings slightly yellowish, anterior veins and stigma dark brown, posteriors concolorous with the membrane.

"Length of wing, 4-5 mm."

Type locality: Masonville, Colorado.

Type returned to Colorado State College.

Added distribution: LaSal, Utah, 7-24-40 (G. F. Knowlton, F. C. Harmston); Rondeau Prov. Pk., Kent. Co., Ontario, June 8, 1935 (Steyskal); and Livingston Co., Mich. Hamburg, Aug. 12, 1934 (Geo. Steyskal).

Philia obesula (Loew)

Dilophus obesulus Loew, 1869, Dipt. Amer. Sept. indig., Cent. 9, No. 60, Compl. Work, vol. 2, p. 200.

The following is the description given by McAtee:

"*Male.*—Lower surface of head black with long pale hair, eyes with shorter more abundant dark hair, thorax and abdomen shining black with long, sparse, pale hair; genital segment with a U-shaped cleft about half its length, superior plate transverse, about four times as broad as long, its hind margin slightly concave; legs reddish brown to black, in general pale haired but hairs on tibiae and tarsi (especially the front ones) often in part or wholly dark; wings and veins nearly hyaline, slightly fumose costally, stigma almost obsolete.

"*Female.*—Head black with short pale hair; humeri rufous, thorax elsewhere above shining black with sparse pale hair; pleura brownish-black more or less spotted with paler; abdomen velvety brownish black with abundant pale hair; coxae and femora (and sometimes the front tibiae) yellow to rufous, pale haired; trochanters, tibiae darker haired; wings nearly hyaline, veins near costa brown, rather large stigma nearly black. Females from western localities usually have more or less dusky clouding transversely in the wing at the level of the stigma.

"Length of wing, 4-5 mm.

Upon dissecting the genitalia of specimens identified as *obesula* Loew by McAtee and a large series recognized as this species by the writer it has been found that the length of the ninth tergum (superior plate) has been misinterpreted by the previous workers. This is very easily done because of the normal position of the eighth tergum which usually partially covers the dorsal portion of the ninth. If the genitalia are unrelaxed the true relationship of these segments cannot be determined. The ninth tergum is but slightly over two times as wide as long, instead of four times.

Type locality: District of Columbia.

Type in Cambridge Museum of Comparative Zoölogy.

This is a widely distributed species, McAtee reports it from Maryland, Virginia, Pennsylvania, North Dakota, Colorado, Indiana and

Idaho. The writer adds the following states and provinces: California, Manitoba, Quebec, British Columbia, Ontario and Michigan.

Philia oklahomensis Hardy

(Plate XL, figs. 211a-d)

Philia oklahomensis Hardy, 1937, Proc. Utah Acad. Sci. XIV, 211.

This species is distinguished by the shallow cleft on posterior margin of ninth sternum, the broad flat-topped harpagones of male (fig. 211b) and the entirely rufous thorax and strong development of thoracic combs of the female. Following is the original description:

"*Male.*—Chiefly shining black; humeral ridges yellowed, legs with rufous tinge; stems of halteres yellow, knobs brown. Pile of body short and yellow, that of legs somewhat reddish. Wings (fig. 211c) hyaline, slightly yellow fumose costally; anterior veins brown, stigma pale, usually obsolete; posterior veins concolorous with the membrane. *Male Genitalia:* Coxite comparatively short and broad with a raised area longitudinally down the middle of the pons coxalis; genital cleft (cleft of ninth sternum) rather shallow, being about one- fourth the length of the segment (fig. 211a). Stylus (harpago) appearing pointed from ventral or dorsal view. Posterior margin of superior plate (ninth tergum) gently concave, sometimes appearing straight because of the tenth tergite beneath; (reëxamination shows that the hind margin of ninth tergum is straight, a lighter median area was first interpreted as a concavity); plate slightly wider than long. Cerci larger, pointed apically (fig. 211d). Pile of genitalia short and yellow.

"*Female.*—Differs in having the entire thorax, coxae, trochanters and femora yellow to rufous; tibiae and tarsi dark reddish to brown, and wing yellow fumose.

"Length of wing, 4-4.5 mm."

Type locality: Locust Grove, Oklahoma.

Type returned to Oklahoma A. & M. College.

This species is common in Oklahoma and Texas during March and early April. No fall specimens have been seen so it might have just one generation.

Philia orbata (Osten Sacken)

(Plate XLI, figs. 212a-c)

D. (ilophus) orbatus Osten Sacken, 1859, in Le Conte's edition of The Complete Writings of Thomas Say on the Entomology of North America, vol. 2, p. 70.

This species is related to *stygius* Say, but is readily distinguished from this Mexican species by its much smaller size, shorter rostrum and different arrangement of the median set of teeth on front tibiae.

MALE.—Head, body and legs shining, brownish to black. Pile entirely black, that of hind femora sometimes gray. Compound eyes divided into an upper and lower portion by a transverse indentation near lower margins. Rostrum produced but little over half the length of antennae. Antennae short, segments compacted, eleven segmented with a knoblike tip. Knobs of halteres brown, stems ochraceous. Wings slightly yellowish hyaline, more distinctly yellow costally; anterior veins yellow-brown, stigma dark brown; posterior veins but slightly more yellowed than the membrane, almost concolorous. Front tibiae armed with two sets of teeth, the median set possesses four strong spines in a transverse row. *Genitalia:* Pile of genitalia black, rather dense along the posterior margin of the ninth tergum. Cleft of ninth sternum extends about one-third the length of segment, the middle of the cleft is slightly convex. The harpagones each have a broad inner lateral development (fig. 212a), which is characteristic of the species. The ninth tergum is gently concave and very short, three to four times as wide as long. The cerci are well developed and usually extended. The tenth segment (anal region) is slightly sclerotized on the margins (fig. 212b).

FEMALE.—The female differs in having the wings yellow-brown fumose to dusky black; anterior veins and stigma dark brown, posteriors darker than the membrane. The rostrum is about equal to the length of compound eyes.

Length: body, 3.5-3.8 mm.; wings, 4-4.2 mm.

Type locality: Florida.

Present location of type is unknown.

This species is widely distributed throughout Southeast and Central United States, specimens have been examined from numerous localities in the following states: Alabama, Florida, Georgia, Kansas, Louisiana, Mississippi, North Carolina, Oklahoma (on cotton in Payne Co.), South Carolina and Texas.

Philia proxima (McAtee)

(Plate XLI, figs. 213a-c)

Dilophus proximus McAtee, 1921, Proc. U. S. Nat. Mus. 60, Art. 11, 22.

MALE.—Head, body and legs shining black, sometimes faintly reddish black in ground color. Pile of body yellowish, eyes with short brown to black pile. Lower one-third of compound eyes separated off by a transverse groove across the eye. Wings hyaline to somewhat milky, anterior veins and stigma brown, posteriors concolorous with the membrane. *Genitalia:* Ninth sternum cleft almost half its length on hind margin, the cleft is slightly convex in the middle (fig. 213a). Harpagones broad and rounded, with a distinct indentation on under sides near apices (fig. 213c) and a longitudinal groove on upper edges. Ninth tergum about three times as wide as long (not four times as in original description), hind margin straight or but very gently concave with the anterior margin somewhat convex (fig. 213b).

Following is the original description of females:

"*Female.*—Head and thorax except humeri shining black, and abdomen velvety brown, all with short pale hair; humeri and legs chiefly yellow to rufous, tibiae and tarsi, especially of the front legs deeper colored, sometimes black; in pale specimens the trochanters, distal tarsal joints and apices of other tarsal joints only are black, hair of legs except tarsi pale; wings hyaline, veins near costa and stigma brown.

"Length of wing, 3-5 mm."

Upon dissection of a paratype male of this species it was found that the cleft of ninth sternum (genital cleft) is but slightly over one-third the length of the segment. The harpagones are rather distinctive, having a developed beak at apices.

McAtee reports the species from Colorado, and Hunters Creek, Wyoming. The author has studied the type at the United States National Museum and has seen topotype specimens from Hunters Creek, also specimens from Two-gwo-to-ee Pass, Wyoming, IX-12-95 (W. M. Wheeler).

Philia secta (McAtee)

Dilophus sectus McAtee, 1921, Proc. U. S. Nat. Mus. vol. 60, Art. 11, p. 22.

The original description is given:

"*Male.*—Body shining black, legs brownish black; eyes with short, close-set, dark hair; body and legs with longer, sparse pale hair, except on tarsi where it is chiefly dark; genital segment cleft nearly

to its base, superior plate about three times as wide as long, distinctly concave posteriorly; wings hyaline, veins near costa and nearly obsolete stigma yellowish brown.

"Female.—Head shining black, with a few short pale hairs; thorax chiefly shining black, with short, sparse pale hairs, humeri yellowish-rufous and indistinct patches on pleura and scutellum yellowish brown; abdomen velvety brownish-black, with pale hairs; coxae and femora yellowish rufous; trochanters, tibiae and tarsi fuscous to black, those of anterior legs darkest; hair of legs chiefly pale except on tarsi; wings as in male, stigma somewhat more distinct.

"Length of wing, 4.5-5.5 mm."

McAtee reports it from Franconia, New Hampshire, and from White Mts. (Morrison). The author has examined the type at the United States National Museum.

Philia serotina (Loew)

(Plate XLI, figs. 214a-b)

Dilophus serotinus Loew, 1861, Dipt. Amer. Sept., Cent. 1, No. 15, Compl. Work, 9-10.

This species is easily recognized by its dusky to black fumose wings and large size.

MALE.—Chiefly shining black. Pile of eyes black, that of face gray, of thorax, coxae, trochanters, femora and posterior half of abdomen yellow to gray; pile of tibiae and tarsi black. Knobs of halteres black, stalks pale. Wings dusky to blackish, darker costally, anterior veins black, posteriors gray. *Genitalia:* Pile of genitalia dense, brownish yellow. Cleft of ninth sternum extending slightly over one-third its length. Inner edges (when viewed from a ventral aspect) of apical portion of ninth sternum with a developed process. Harpagones with a strongly produced beaklike apex (fig. 214a). Ninth tergum gently concave, about as wide as long (fig. 214b).

FEMALE.—The female has the thorax (except black scutellum and some black markings on the pronotum), coxae, trochanters and femora rufous, hind coxae somewhat darker than front. Pile all pale. Wings usually somewhat darker; otherwise like male.

Length of wing, 4.5-8.5 mm.

Type locality: Illinois.

Type in Cambridge Museum of Comparative Zoölogy.

This species has a rather wide range; the writer has examined the type, also material from British Columbia, Kansas, Louisiana, Maryland, Missouri, Oregon, Virginia and Washington. It has also been recorded from Mississippi.

Philia spinipes (Say)

(Plate XLI, figs. 215a-b)

D. (ilophus) spinipes Say, 1823, Dis. Dipt. U. S., Journ. Acad. Nat. Sci. Phila., vol. 3, 79-80. 1859 Compl. Writings, vol. 2, p. 71.

D. (ilophus) thoracicus Say, 1823, Des. Dipt. U. S., Journ. Acad. Nat. Sci. Phila., vol. 3, p. 80. 1859 Compl. Writings, vol. 2, pp. 71-72.

Dilophus dimidistus Loew, 1869, Dipt. Amer. Sept. indig., Cent. 8, No. 3, Compl. Work, vol. 2, p. 118.

McAtee states that the variation in size and color of this species sufficiently covers the other two forms which were described having three series of spines on the front tibiae; the types have not been studied so this cannot be verified.

MALE.—Rostrum long, about one-half to three fourths as long as the antennae, extended proboscis longer than the antennae. Lower part of compound eyes and face black, upper part reddish brown. Dorsum of thorax chiefly bright rufous, scutellum and pronotum usually black; pleurae reddish brown with black markings. *Legs:* Front tibiae with three sets of spines, top set with three spines, middle set with four, apical set with eleven or twelve (fig. 215a). Apical spur slightly longer than the spines at apex. Front and middle coxae and femora rufous, remainder of legs brown to black; abdomen velvety black. Pile chiefly black, somewhat gray on the femora. Knobs of halteres black, stem paler. Wings dusky to yellow-brown fumose, darker costally; anterior veins dark brown, posteriors and stigma light brown. *Genitalia.*—Pile of genitalia brown to black. Cleft of ninth sternum extends about one-third the length of the segment (fig. 215b). Harpagones pointed apically, broadened at their bases. Cerci large and rounding. In the specimen dissected the ninth tergum had been torn, McAtee states that this plate is about three times as wide as long with hind margin rounded angulate.

FEMALE.—The female has the thorax entirely rufous (sometimes with a few dark markings on the pronotum and scutellum), the rostrum is in part yellow to rufous and the abdomen velvety brown; otherwise like the male.

Length of wing, 4.5-6 mm.

Type locality: Missouri.

Location of type not known to this writer.

Specimens have been examined from a number of localities in the following states: California, Florida, Indiana, Louisiana, Maryland, Minnesota, Mississippi, Missouri, New Jersey, New York,

North Carolina, Tennessee, and Virginia; also reported from New England.

Philia stigmatera (Say)

(Plate XLI, figs. 216a-b)

D. (Ilophus) stigmaterus Say, 1823, Desc. Dipt. U. S., Journ. Acad. Nat. Sci. Phil., vol. 3, pp. 79-80. 1859 Compl. Writings, vol. 2, pp. 70-71.

The species is readily distinguished by the elongate rostrum which is about as long as the antennae; *spinipes* (Say) and *tingi* n. sp. also have the rostrum developed but these species have three series of spines on the front tibiae.

MALE.—Eyes reddish brown with short dark pile; remainder of head and body shining black, with yellow pile; body sometimes with a tinge of rufous. The legs vary from dark rufous to brownish black with rather abundant yellow to reddish hair. Wings hyaline, anterior veins yellow-brown, posteriors concolorous with the membrane; stigma small and almost obsolete. Knobs of halteres dark, stems pale. *Genitalia:* Ninth sternum cleft about one-third its length, harpagones simple and obtuse at apices (fig. 216a). Ninth tergum wider than long, hind margin gently concave (fig. 216b).

FEMALE.—The female differs in having the thorax and legs chiefly yellow to rufous, pronotum, scutellum and pleurae sometimes with dark markings; spines of front tibiae and tips of tarsal joints brown. Abdomen velvety brown, genitalia more or less tipped with yellow. Wings more yellowish fumose, stigma distinct brown.

Length of wing, 3.5-5 mm.

Type locality: Missouri.

Location of type unknown to the writer.

Specimens have been examined from Alberta, Arizona, British Columbia, Colorado, Indiana, Iowa, Michigan, New Mexico, Nova Scotia, Quebec, South Dakota, Utah and Wisconsin.

Philia stigmatera nigra Hardy

Philia stigmaterus var. *nigra* Hardy, 1937, Proc. Utah Acad. Sci. vol. XIV, p. 212.

The females have the dorsum of thorax, except the humeri, chiefly shining black instead of rufous as in the typical *stigmatera*. The anterior veins of the wings of the males are more consistently lighter in color in *nigra*. This is probably best considered a subspecies.

Type locality: Polk Co., Minnesota.

Type in University of Minnesota collection.

Added distribution: The Pas, Manitoba, Aug. 11, 1937 (R. H. Daggy) and Gillam, Manitoba, Aug. 10, 1937 (D. G. Denning).

Philia strigilata (McAtee)

(Plate XLI, figs. 217a-b)

Dilophus strigilatus McAtee, 1921, Proc. U. S. Nat. Mus. vol. 60, Art. 11, pp. 24-25.

The males of this species are somewhat related to *oklahomensis* Hardy but the cleft of ninth sternum is deeper and the harpagones acutely pointed.

MALE.—Shining black (except reddish brown compound eyes), legs sometimes brownish. Pile pale yellow except for the short black pile on the eyes. Knobs of halteres black, stems pale. Wings hyaline, costal cell slightly yellowed; anterior veins concolorous with the membrane. *Genitalia:* Cleft of ninth sternum extends about one third the length of the segment. Harpagones rather thickened but not greatly enlarged apically, terminating in a beak (fig. 217b). Ninth tergum about twice as wide as long on a median line (fig. 217a).

FEMALE.—The female is similar to *breviceps* Loew but differs in having the prothoracic comb more conspicuously developed. The teeth are fewer in number (usually 7-10), longer, more broad and blunt. The female differs from the male in having the thorax, coxae and femora chiefly rufous; pronotum and thoracic comb, pleurae and hind coxae usually marked with black. Wings yellowish to dusky fumose, anterior veins and large stigma dark brown, posteriors slightly more yellowed than membrane.

Length of wing, 4.5-5 mm.

Type locality: California.

Type in the United States National Museum.

The species is common in California and has been identified from numerous localities in that state.

Philia tibialis (Loew)

(Plate XLI, figs. 218a-c)

Dilophus tibialis Loew, 1869, Dipt. Amer. Sept. indig., Cent. 9, No. 61, Compl. Work, vol. 2, p. 200.

This species is recognized by the shallow cleft of ninth segment, the straight hind margin of ninth tergum and the almost obsolete stigma and paler anterior veins.

MALE.—Head and body shining, legs brownish red to black. Pile rather long and chiefly pale, that of eyes, tibiae and tarsi somewhat darker. Wings hyaline, slightly fumose costally; anterior veins brown, stigma almost obsolete; posterior veins concolorous with the membrane. *Genitalia:* Ninth sternum broad, cleft extending less

than a third the length of the segment. Harpagones rounded apically (fig. 218a). Ninth tergum wider than long, the posterior edge straight or nearly so (fig. 218b). Pile of genitalia pale and very short.

FEMALE.—Female differs in having the humeri, pleurae (in part), coxae and all femora yellow to rufous; middle and hind coxae and all tibiae and tarsi brownish to black. Wings slightly yellowed, stigma distinct.

Length of wing, 4.5-6.5 mm.

Type locality: Sitka, Alaska.

Type in Cambridge Museum of Comparative Zoölogy.

This species is very abundant in the North. Specimens have been examined from numerous localities in the following possessions, states and provinces: Alaska, Alberta, British Columbia, California, Idaho, Manitoba, Michigan, Minnesota, Montana, Ontario, Oregon, Quebec, South Dakota, Utah, Washington and Wisconsin.

Philia tingi n. sp.

(Plate XLI, fig. 219a)

This species is related to *spinipes* (Say) by having three series of toothlike spines on each of the front tibiae. It is readily distinguished by the short costa, the black coloration, the blunt, rounding teeth of thoracic combs, its much smaller size and the shorter head length of the females.

FEMALE.—*Head:* Entirely shining black, rather thickly black haired. The rostrum is produced longer than the antennae and the extended mouthparts reach almost three times the antennal length. Antennae short, the segments compacted, apparently eleven segmented. The segments of the flagellum are so compressed that it is difficult to discern their articulations. The rostrum is shorter than the antennae in *spinipes* and the mouthparts are not so elongated. The compound eyes are longer than the length of head behind the eyes, eyes of *spinipes* much shorter, more rounded. *Thorax:* Shining black, except the faintly reddish thoracic combs. Teeth of thoracic combs short and blunt, anterior comb composed of ten to twelve teeth, comb scarcely divided in the middle. Dorsocentral and marginal hairs long and thin, mesopleurae and sternopleurae with scattered long marginal pile; all thoracic pile yellowish. *Legs:* Largely black, only the front tibiae rufous; front femora and coxae faintly reddish tinged in the median portions; all tibiae and metatarsi with a very faint rufous cast in the black ground color. Front

tibiae with three series of spines (fig. 219a), the top set is situated on the upper third of the segment and contains just two teeth; the middle set is at about the median portion and has three teeth; the third or apical set is made up of eight spines counting the apical spur. All tibial spines are rather broad and blunt, the apical spur is shining black and much larger than the spines at the ends of the tibiae. *Philia spinipes* (Say) has three teeth in the top set and four in the median, the spines are more acute and the apical set contains eleven or twelve teeth. *Wings:* Entirely hyaline, anterior veins and stigma brown, posteriors concolorous with the membrane. The costa extends but a short distance beyond the tip of vein R_5 (posterior branch of radius), about one-fifth the distance between tips of R_5 and M_1; the costa of *spinipes* half the distance between these veins. The abdomen is blackish brown, the sclerites and conjunctiva of the venter are faintly tinged with yellowish. Cerci black, covered with thick yellow pile.

Length: body and wings, 3.4-3.5 mm.

MALE.—Compound eyes sparsely brown to black haired, lower one-third to one-fourth of each eye is divided off by a transverse depressed area. Rostrum longer than antennae and covered with dense black hair and mouthparts produced as in female. Body and legs entirely black.

Length: body and wings, 3-3.1 mm.

Holotype female, Cronise Lk., San B. Co., Calif., April 28, 1937, No. 300 (P. C. Ting). Allotype male and two paratype females, same data as type. These specimens were collected on the blossoms of Prosopis.

The writer takes pleasure in naming this species after Mr. P. C. Ting, State of California, Department of Agriculture, who has contributed much valuable information concerning the immature stages of Bibionidae.

Holotype and allotype returned to Mr. Ting, paratypes in Snow Entomological Collection.

The following species are unidentifiable from the original descriptions:

Philia longiceps (Loew), 1861, Dipt. Amer. Sept. indig., Cent. 1, 14, Compl. Work, p. 9. Described from Illinois. This might possibly be *breviceps* (Loew).

Philia pusillus (Wiedemann), 1828, Ausz. Zweifl. Ins. vol. I, 77. (United States?).

Philia serraticollis Walker, 1848, List Dipt. Brit. Mus., pt. I, 117. Described from St. Martin Falls, Albany River, Hudson Bay.

Plecia bimaculata Walker, 1856, Insecta Saunder. I, 422. United States given as type locality. McAtee states that this may be a Philia.

ACKNOWLEDGMENTS*

The writer wishes to express his sincere appreciation for the invaluable assistance given by Doctors H. B. Hungerford and R. H. Beamer at the University of Kansas and the able direction and stimulation of Doctors G. F. Knowlton of the Utah State Agricultural College and V. M. Tanner of the Brigham Young University. It was under Doctor Knowlton's supervision that the study of Dorilaidae first began in earnest and the interest he has always shown in this work has been a constant inspiration. For any degree of completeness attained by this study the writer is indebted to the assistance and enthusiasm of Doctor Beamer. The biological surveys of the summers of 1939 and 1940, under his direction, produced a wealth of material and much valuable field data, without which this paper would have been very incomplete. Gratitude is expressed for the kind coöperation given the writer during his recent trip through the east studying the types by Messers. C. F. W. Muesebeck, D. G. Hall, P. W. Oman, C. T. Greene and Dr. Alan Stone of the United States National Museum; Mr. E. T. Cresson of the Philadelphia Academy of Sciences; Dr. C. H. Curran, American Museum of Natural History; Mr. N. Banks, Cambridge Museum; Dr. Richard Dow, Boston Society of Natural History, and Doctors W. J. Gerhard and E. Liljeblad, Field Museum in Chicago.

For their coöperation in furnishing information concerning specimens in European museums as well as for loaning materials for study the writer expresses appreciation to: Dr. Marton Aczel of The Royal Hungarian Institute; the late Dr. F. W. Edwards and Dr. John Smart of the British Museum; Dr. Hans Sachtleben and the late Dr. Walther Horn of the Deutschen Entomologischen Institut; Dr. Max Beier, Naturhistorisches Museum, Wien; Dr. E. Seguy, Museum National, Paris; Dr. K. Delkeskamp, Zoölogisches Museum der Universitat, Berlin, and Dr. Pius Sack, Frankfurt am Main.

Thanks are especially expressed: to the staff of the Division of Insect Identification of the National Museum under Mr. Muesebeck, for the advice offered by these men has contributed a great deal to this paper; to Dr. C. P. Alexander for suggestions concerning the interpretation of wing venation terminology and to Dr. W. J. Brown of the Canadian National Museum for supplying data on the types of Curran's species.

The writer is deeply grateful to his wife, Agnes T. Hardy, for typing of the manuscript, aid in proofreading and making drawings, companionship in the field and wholehearted interest and assistance in this work.

The data presented in this paper have been gathered from the examination of more than thirty thousand specimens supplied by the major collections of the United States and Canada, by many of the European museums, and by a number of collectors in South and Central America. The author is indebted to all who have contributed to this study by the loan of material. Coöperation has been general, but special gratitude must be expressed to the United States National Museum, the American Museum of Natural History, the Philadelphia Academy of Sciences, the Cambridge Museum of Natural History, and the Boston Society of Natural History. Specimens have also been received from: Utah State Agricultural College; Brigham Young University; Canadian Museum; Dr. M. T. James, Colorado State Agricultural College; Doctors J. C. Bradley, P. P. Babiy and Mr. L. L. Pechuman, Cornell University; Mr. J. Wilcox, Alhambra, California; Dr. C. L. Fluke, University of Wisconsin; Professor H. E. Jaques, Iowa Wesleyan College; Professor F. A. Urquhart, Royal Ontario Museum of Zoölogy; Dr. S. W. Bromley, Stamford, Connecticut; Dr. H. B. Mills, Montana State College; Professor H. J. Reinhard, Texas A. and M. College; Professor C. W. Sabrosky, Michigan State College; Professor G. J. Spencer and Mr. J. K. Jacob, University of British Columbia; Mr. C. Garrett, Cranbrook, British Columbia; Mr. Ian Moore, San Diego, California; Mr. P. C. Ting, San Francisco, California; Dr. C. E. Mickel and Mr. D. Denning, University of Minnesota; Professor E. H. Strickland, University of Alberta; Mr. G. Steyskal, Detroit, Michigan; Dr. W. E. Shull, University of Idaho; Dr. R. D. Shenefelt, Washington State College; Dr. H. K. Townes, formerly at Cornell University; Dr. D. M. Rees, University of Utah; Dr. R. H. Painter and Professor D. A. Wilbur, Kansas State College; Dr. C. S. Brimley, North Carolina Department of Agriculture; Mr. Charles F. Henderson, Whittier, California; Dr. H. C. Severin, South Dakota State College; Professor C. L. Hayward, Brigham Young University; Mr. Pedrito Silva, Instituto de Cacau da Bahia; Mr. M. P. Reidel, Frankfurt Oder; Dr. H. de Souza Lopes, Instituto Oswaldo Cruz; Mr. Fritz Plaumann, Nova Teutonia, Brazil; Dr. Edward S. Thomas, Ohio State Museum; Dr. C. H. Ballou, Estacion Experimental de Agricultura, Venezuela; Dr. J. N. Knull, Ohio State Unversity; Mr. Mont A. Cazier, American Museum; and Dr. T. H. Frison, University of Illinois.

* These acknowledgments also refer to the author's studies of the Dorilaidae.

INDEX TO GENERIC AND SPECIFIC NAMES

* n. n.=new name.

**c. n.—change of name.

PLATE XXIX

FIG. 110. *Philia orbata* (Osten Sacken). a. female reproductive system, right ovary, dorsal view; c. o. = common oviduct, ac. gl. = accessory glands, sp. = spermathecae.

FIG. 111. *Bibio marci* Linn. (Drawings copied from Morris) a. right mandible of larva; b. right maxilla of larva; c. spicules on cuticula of larva.

FIG. 112. *Bibio lacteipennis* Zett. a. portion of larval cuticula (after Morris).

FIG. 113. *Bibio johannis* Linn. a. larval cuticula (after Morris).

FIG. 114. *Bibio pomonae* Fab. a. larval cuticula (after Morris).

FIG. 115. *Bibio venosus* Mg. a. larval cuticula (after Morris).

FIG. 116. *Philia febrilis* (Linn.) a. larval cuticula (after Morris).

FIG. 117. *Bibio melanopilosus* var. *bisepta* Hardy. a. spicules of larva.

FIG. 118. *Bibio xanthopus* Wiedemann. a. spicules of larva.

FIG. 119. *Bibio xanthopus palliatus* McAtee. a. spicules of larva.

FIG. 120. *Bibio sp?* a. spicules of larva.

FIG. 121. *Hesperinus brevifrons* Walker. a. wing; b. ninth tergum of male; c. lateral view of harpago and distal portion of ninth sternum and tergum; d. harpago. dorsal view; e. left harpago and portion of ninth sternum, ventral.

FIG. 122. *Penthetria appendicula* n. sp. a. male hypopygium, ventral; b. ninth tergum of male, dorsal; c. portion of wing.

FIG. 123. *P. distincta* n. sp. a. ninth tergum of male; b. male hypopygium. ventral.

FIG. 124. *P. heteroptera* (Say). a. male hypopygium, ventral; b. eighth sternum of female; c. ninth tergum of male; d. female genitalia, dorsal.

PLATE XXIX

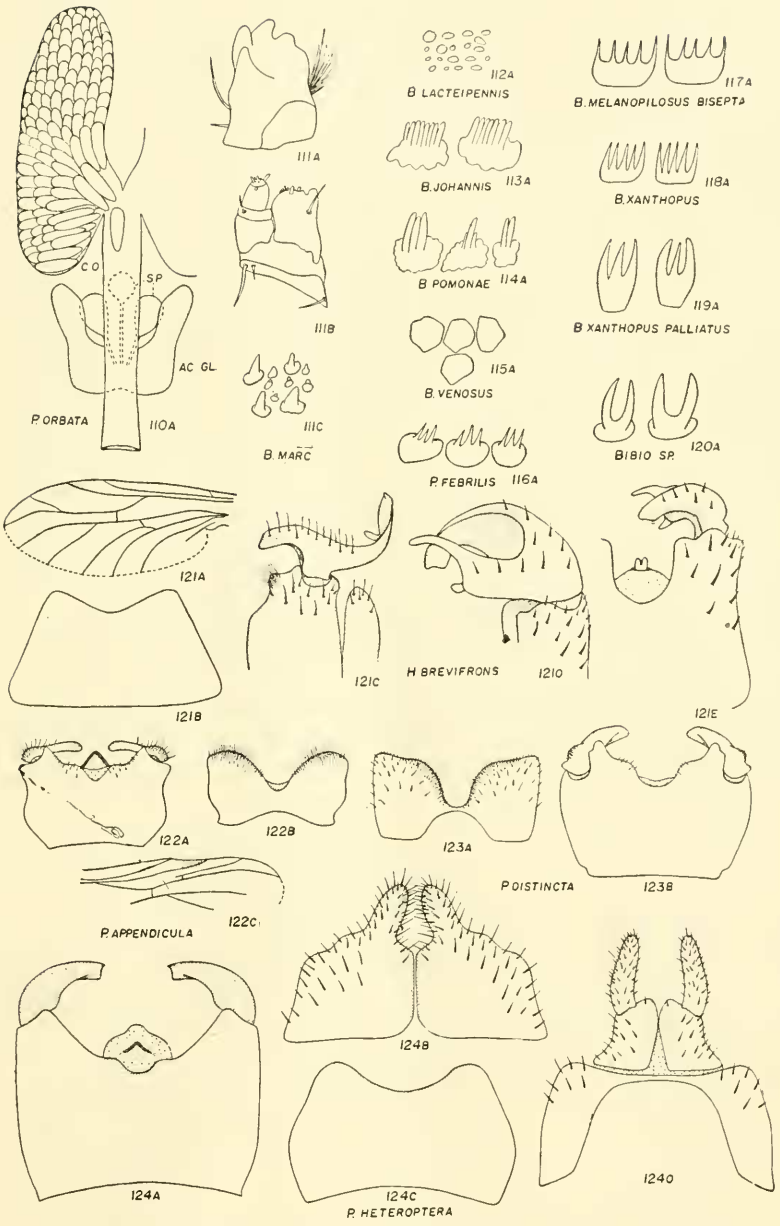

CO
SP
AC GL
P. ORBATA
110A
111A
111B
111C
B. MARC
112A
B. LACTEIPENNIS
113A
B. JOHANNIS
114A
B. POMONAE
115A
B. VENOSUS
116A
P. FEBRILIS
117A
B. MELANOPILOSUS BISEPTA
118A
B. XANTHOPUS
119A
B. XANTHOPUS PALLIATUS
120A
BIBIO SP.
121A
121B
121C
H. BREVIFRONS
121D
121E
122A
122B
123A
P. DISTINCTA
123B
P. APPENDICULA
122C
124A
124B
124C
P. HETEROPTERA
124D

PLATE XXX

FIG. 125. *P. mexicana* (Hardy). a. ninth tergum of male; b. male hypopygium, ventral.

FIG. 126. *P. nigerrima* (Bellardi). a. male genitalia, ventral; b. ninth tergum of male.

FIG. 127. *P. nigrita* Perty. a. male genitalia, ventral; b. ninth tergum of male.

FIG. 128. *Plecia alacris* Curran. a. costal margin of wing; b. male hypopygium, ventral; c. lateral of harpago; d. ninth tergum of male.

FIG. 129. *P. americana* Hardy. a. eighth sternum of female; b. ninth tergum and cerci of female; c. ninth tergum of male; d. male hypopygium, ventral.

FIG. 130. *P. avicephaliforma* Hardy. a. costal margin of wing; b. male hypopygium, ventral; c. harpago, lateral; d. ninth tergum of male.

FIG. 131. *P. biarmata* Hardy, a. ninth tergum of male; b. male hypopygium, ventral.

FIG. 132. *P. bicolor* Bellardi. a. male harpago, lateral; b. male hypopygium, ventral; c. ninth tergum, dorsal; d. ninth tergum and cerci of female; e. female genitalia, ventral.

PLATE XXX

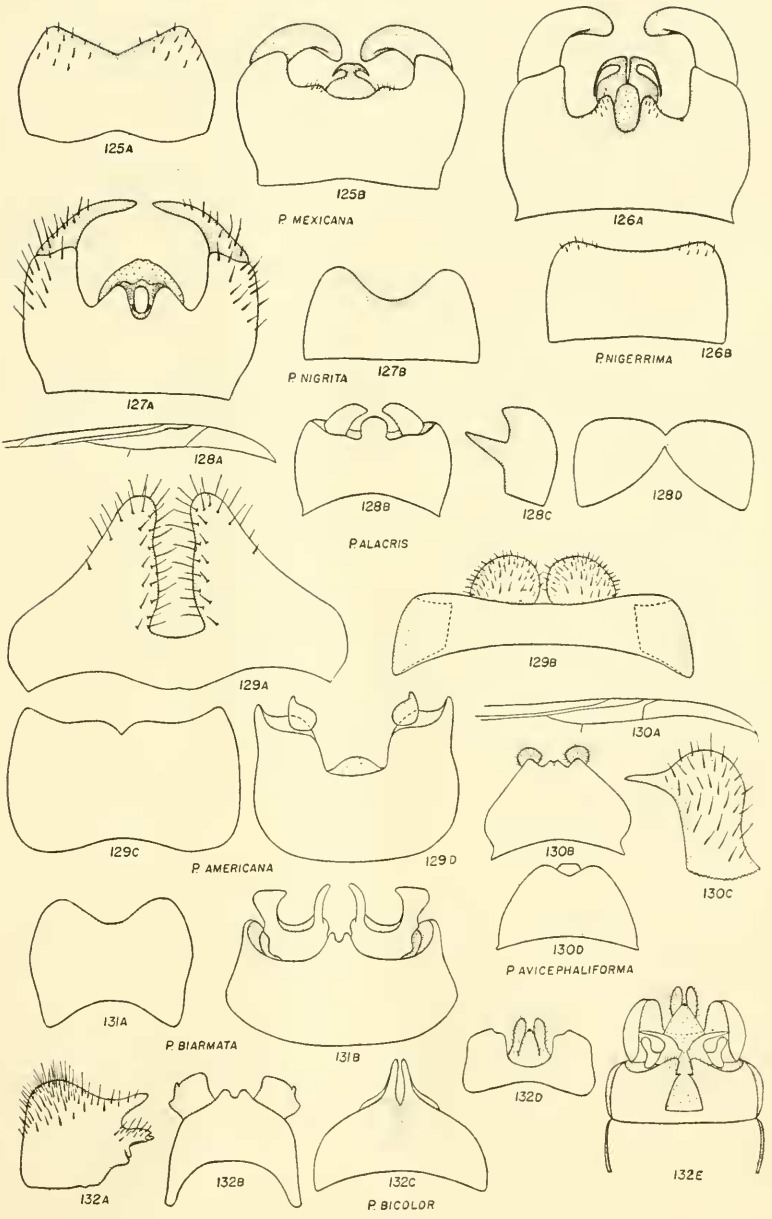

125A
125B
P. MEXICANA
126A
127A
P. NIGRITA
127B
P. NIGERRIMA
126B
128A
128B
P. ALACRIS
128C
128D
129A
129B
130A
129C
P. AMERICANA
129D
130B
130C
130D
P. AVICEPHALIFORMA
131A
P. BIARMATA
131B
132A
132B
132C
P. BICOLOR
132D
132E

PLATE XXXI

FIG. 133. *P. biformis* Hardy. a. male hypopygium, ventral; b. ninth tergum of male; c. eighth sternum of female; d. female genitalia, dorsal.

FIG. 134. *P. brazilana* Hardy. a. wing; b. male hypopygium, ventral; c. ninth tergum of male.

FIG. 135. *P. collaris* (Fabricius). a. female genitalia, dorsal view; b. female genitalia, ventral; c. harpago, right lateral; d. ninth tergum of male; e. male hypopygium, ventral.

FIG. 136. *P. confusa* Loew. a. male hypopygium, ventral; b. lateral of male harpago; c. ninth tergum and cerci of male; d. costal margin of wing.

FIG. 137. *P. curvistylata* Hardy. a. costal margin of wing; b. harpago, lateral; c. male hypopygium, ventral; d. ninth tergum of male.

FIG. 138. *P. dentata* Hardy. a. costal margin of wing; b. lateral view of harpago; c. male hypopygium, ventral; d. ninth tergum of male.

FIG. 139. *P. disparis* Hardy. a. male hypopygium, ventral; b. ninth tergum of male.

PLATE XXXI

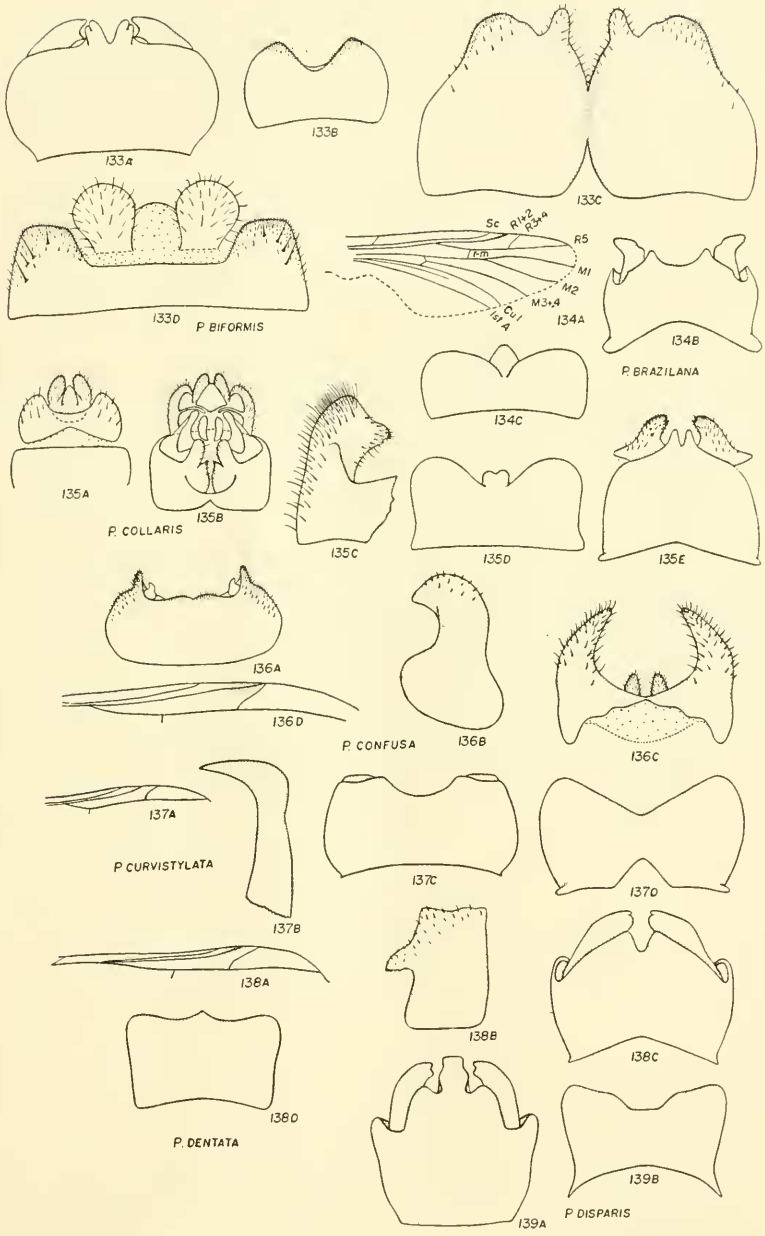

133A
133B
133C
133D
P. BIFORMIS
Sc
R1+2
R3+4
R5
r-m
M1
M2
M3+4
Cu1
1st A
134A
134B
P. BRAZILANA
134C
135A
135B
P. COLLARIS
135C
135D
135E
136A
136D
P. CONFUSA
136B
136C
137A
P. CURVISTYLATA
137B
137C
137D
138A
138B
138C
138D
P. DENTATA
139A
139B
P. DISPARIS

PLATE XXXII

FIG. 140. *P. ecuadorensis* Hardy. a. male hypopygium, ventral; b. harpago, lateral; c. ninth tergum of male.

FIG. 141. *P. ecuadorensis micans* Hardy. a. eighth tergum of female; b. female genitalia, dorsal.

FIG. 142. *P. edwardsi* Hardy. a. male hypopygium, ventral; b. ninth tergum of male.

FIG. 143. *P. gibbosa* Hardy, a. ninth tergum of female; b. eighth sternum of female; c. ninth tergum of male, and view; d. ninth tergum of male, dorsal; e. ninth sternum and harpagones of male, ventral.

FIG. 144. *Plecia grisea* Edwards. a. ninth sternum and harpagones of male, ventral; b. ninth tergum of male.

FIG. 145. *P. imperialis* Schiner. a. male hypopygium ventral view showing left harpago folded down in natural position; b. ninth tergum of male.

PLATE XXXII

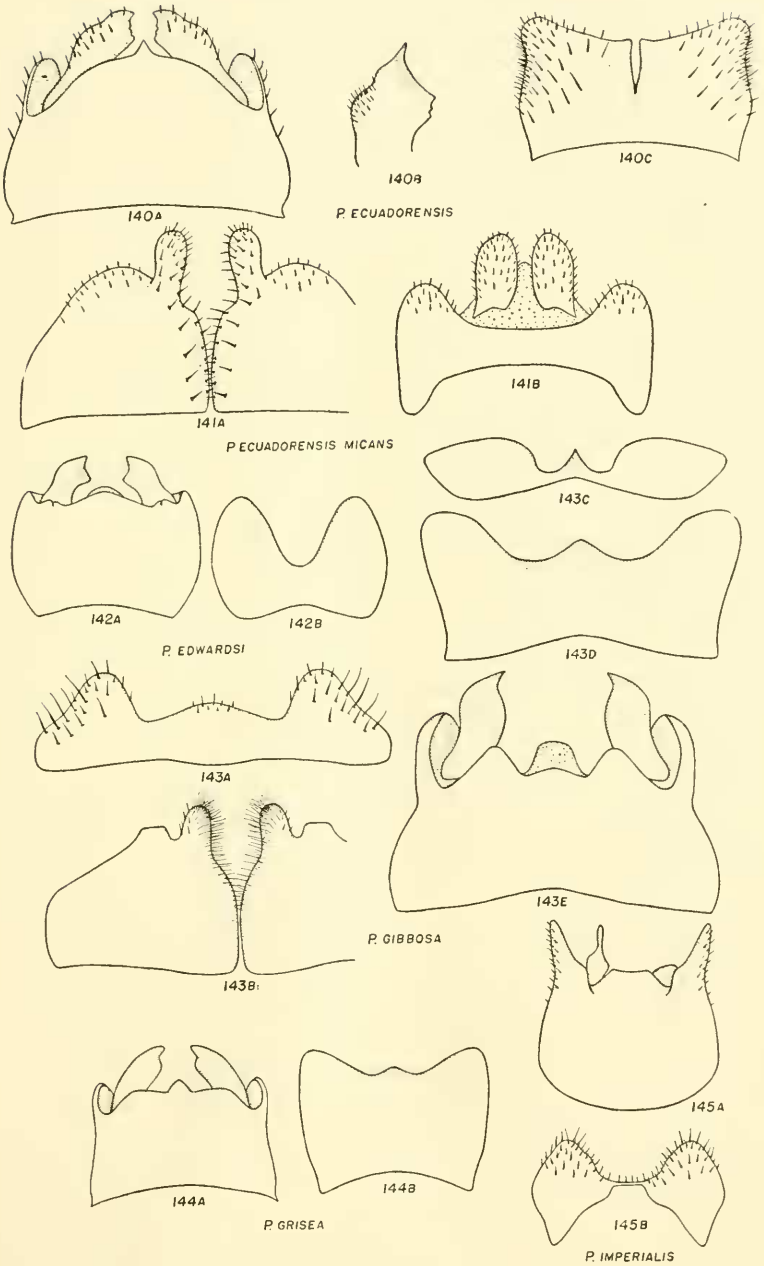

140A
140B
140C
P. ECUADORENSIS
141A
141B
P. ECUADORENSIS MICANS
142A
142B
P. EDWARDSI
143C
143D
143A
143E
P. GIBBOSA
143B
145A
144A
144B
P. GRISEA
145B
P. IMPERIALIS

PLATE XXXIII

FIG. 146. *P. impilosa* Hardy. a. hypopygium of male, ventral; b. ninth tergum of male.

FIG. 147. *P. incurvata* Hardy. a. male hypopygium, ventral; b. costal margin of wing; c. ninth tergum of male.

FIG. 148. *P. lateralis* Hardy. a. ninth sternum and harpagones of male, ventral; b. harpago, lateral; c. ninth tergum of male.

FIG. 149. *P. lindneri* Edwards. a. ninth sternum and harpagones of male, ventral; b. harpago, lateral; c. ninth tergum of male.

FIG. 150. *P. lopesi* Hardy. a. antenna; b. ninth sternum and harpagones, ventral; c. ninth tergum of male.

FIG. 151. *P. maculata* Hardy. a. male hypopygium, ventral; b. harpago, lateral; c. costal margin of wing; d. ninth tergum of male.

FIG. 152. *P. maura* Walker. a. ninth sternum and harpagones of male, ventral; b. ninth tergum of male; c. eighth sternum of female; d. female genitalia, dorsal.

FIG. 153. *P. nearctica* Hardy. a. ninth tergum of male; b. male hypopygium, ventral; c. male harpago, lateral; d. eighth sternum of female; e. ninth tergum and cerci of female, tergum flattened to show shape. (See also Fig. 153 on Plate XXXIV.)

PLATE XXXIII

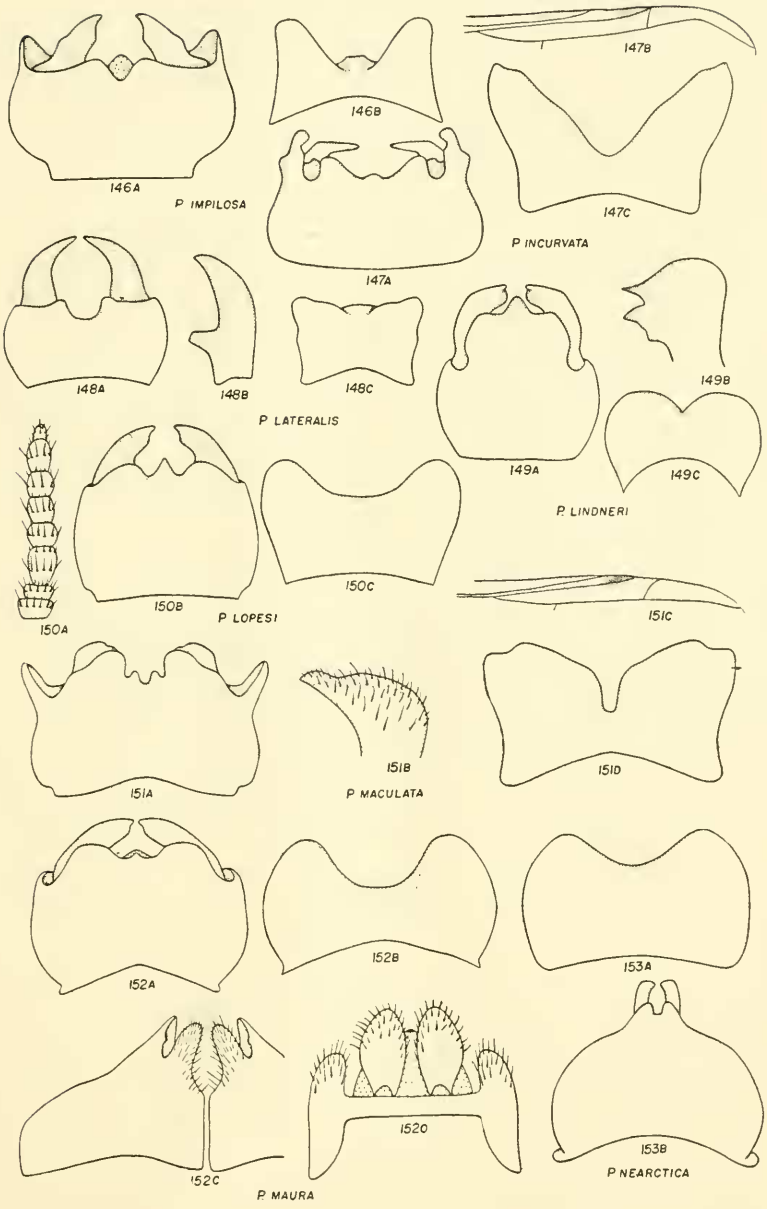


PLATE XXXIV

FIG. 153. *P. nearctica* Hardy. a. ninth tergum of male; b. male hypopygium, ventral; c. male harpago, lateral; d. eighth sternum of female; e. ninth tergum and cerci of female, tergum flattened to show shape. (See also Fig. 153 on Plate XXXIII.)

FIG. 154. *P. nigra* (Philippi). a. costal margin of wing; b. ninth tergum of male; c. ninth sternum and harpagones of male.

FIG. 155. *P. nitidicollis* Edwards. a. ninth tergum of male; b. male hypopygium, ventral; c. harpago, lateral.

FIG. 156. *P. nitidipes* Edwards. a. male hypopygium, ventral; b. ninth tergum of male; c. female genitalia, ventral; d. ninth tergum of female.

FIG. 157. *P. panamaensis* Hardy. a. eighth sternum of female; b. ninth tergum of male; c. male hypopygium, ventral; d. ninth tergum of female.

FIG. 158. *P. parvistylata* Hardy. a. ninth sternum and harpagones of male; b. ninth tergum of male.

FIG. 159. *P. perplexa* Hardy. a. ninth tergum of male, dorsal; b. ninth tergum, end view; c. male hypopygium, ventral; d. male hypopygium, dorsal view with tergum removed.

PLATE XXXIV

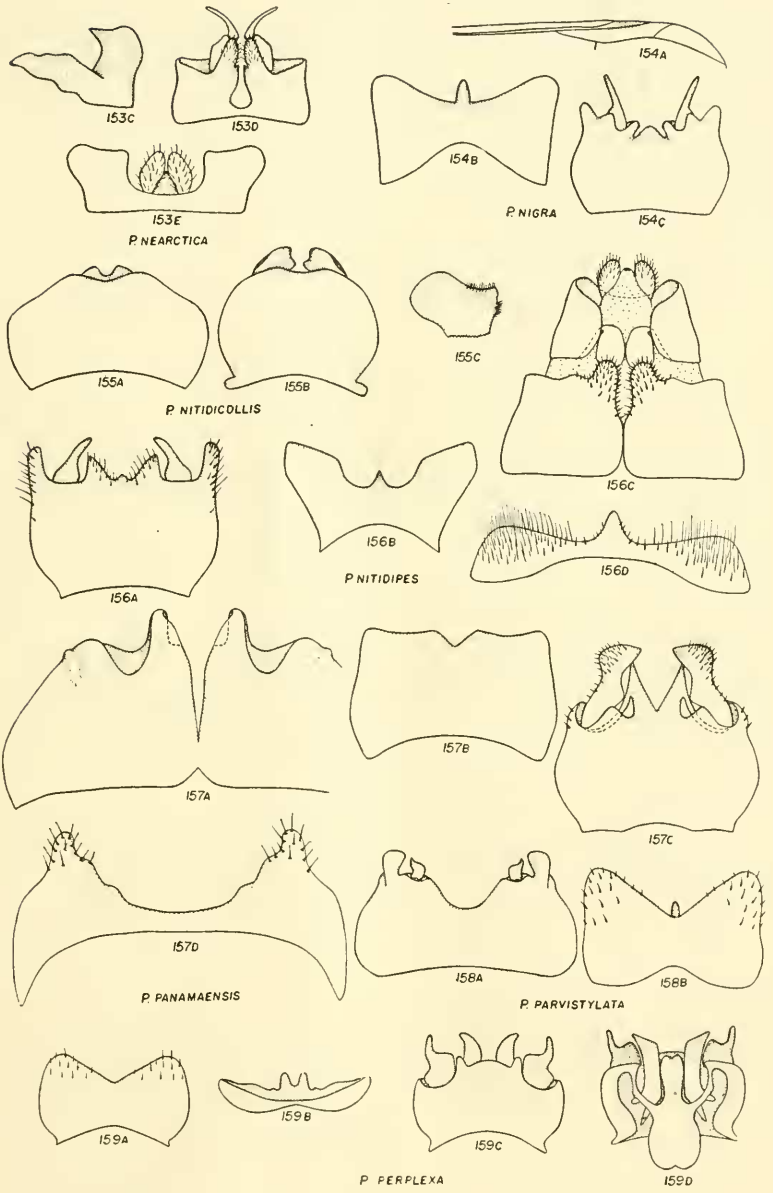

153C
153D
153E
P. NEARCTICA
154A
154B
154C
P. NIGRA
155A
155B
P. NITIDICOLLIS
155C
156C
156A
156B
P. NITIDIPES
156D
157A
157B
157C
157D
P. PANAMAENSIS
158A
158B
P. PARVISTYLATA
159A
159B
159C
159D
P. PERPLEXA

PLATE XXXV

FIG. 160. *P. persimilis* Hardy. a. ninth sternum and harpagones of male; b. harpago, lateral; c. female genitalia, ventral; d. ninth tergum of male; e. ninth tergum of female.

FIG. 161. *P. pertinens* Hardy, a. male hypopygium, ventral; b. ninth tergum of male; c. harpago, lateral; d. female genitalia, ventral; e. costal margin of male wing; f. costal margin of female wing; g. female genitalia, dorsal.

FIG. 162. *P. pictipennis* Edwards. a. male hypopygium, ventral; b. harpago, lateral; c. ninth tergum and sternum of male; dorsal view showing dorsal extension of sternum.

FIG. 163. *P. plagiata* Wiedemann. a. male hypopygium, ventral; b. ninth tergum of male; c. eighth sternum of female; d. female genitalia, dorsal.

FIG. 164. *P. pruinosa* Hardy. a. male hypopygium, ventral; b. ninth tergum of male.

FIG. 165. *P. punctulata* Hardy. a. ninth tergum of male; b. male hypopygium, ventral.

PLATE XXXV

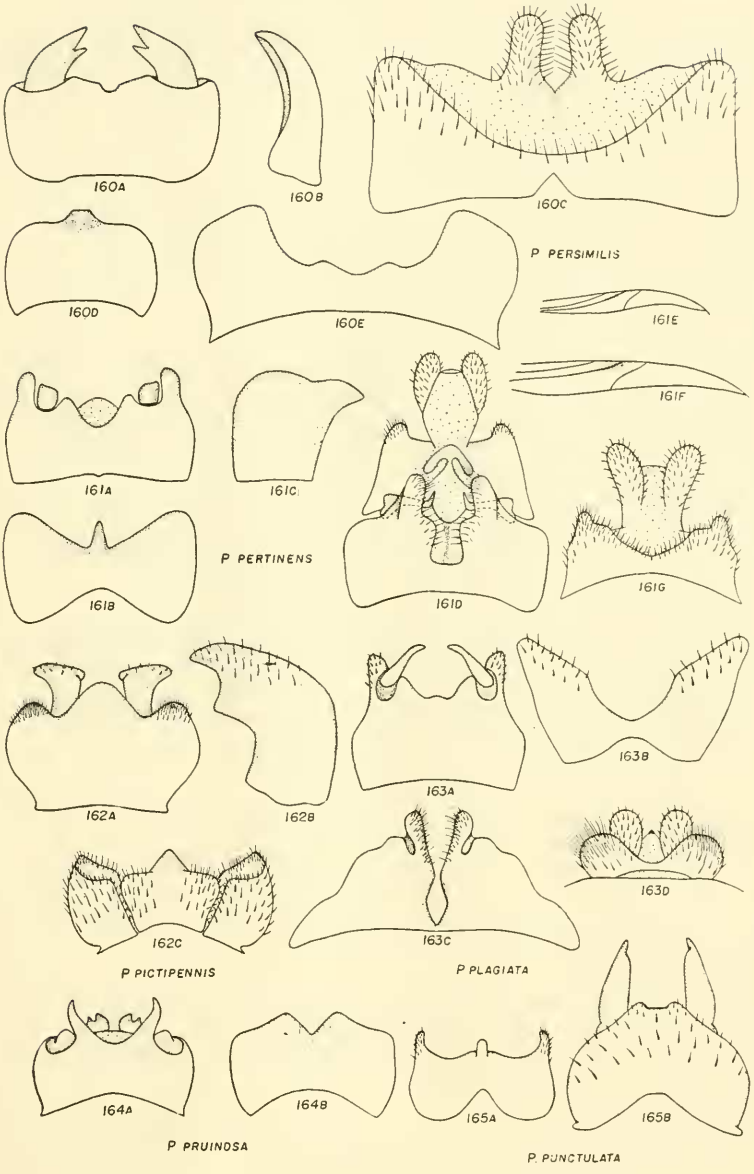

160A
160B
160C
160D
160E
P PERSIMILIS
161E
161F
161A
161C
161D
161G
P PERTINENS
161B
162A
162B
163A
163B
162C
163C
163D
P PICTIPENNIS
P PLAGIATA
164A
164B
165A
165B
P PRUINOSA
P PUNCTULATA

PLATE XXXVI

FIG. 166. *P. quadrivittata* Williston. a. eighth sternum of female; b. male hypopygium, ventral; c. aedeagus and accessory structures; d. ninth tergum of male; e. ninth tergum and cerci of female.

FIG. 167. *P. rectiora* Hardy. a. male hypopygium, ventral; b. accessory plate at side of aedeagus; c. ninth tergum of male.

FIG. 168. *P. rostellata* Loew. a. eighth sternum of female; b. ninth tergum of female; c. male hypopygium, ventral; d. ninth tergum of male.

FIG. 169. *P. rufimarginata* Hardy. a. ninth tergum of male; b. male hypopygium, ventral.

FIG. 170. *P. rufiscutella* Hardy. a. ninth tergum of male; b. male hypopygium, ventral.

FIG. 171. *P. rufithorax* Walker. a. ninth tergum of female; b. ninth tergum of male; c. costal margin of wing; d. eighth sternum of female.

PLATE XXXVI

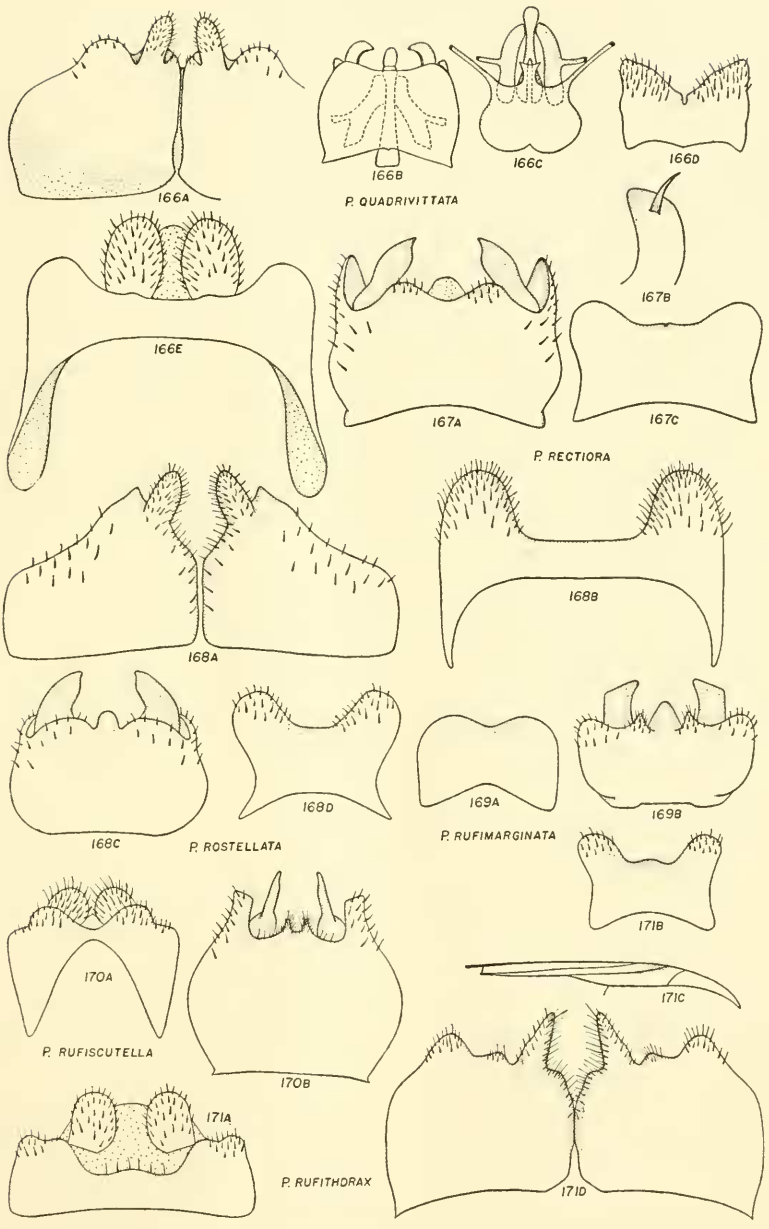

166A
166B
P. QUADRIVITTATA
166C
166D
166E
167B
167A
167C
P. RECTIORA
168A
168B
168C
168D
P. ROSTELLATA
169A
169B
P. RUFIMARGINATA
171B
170A
P. RUFISCUTELLA
170B
171C
171A
P. RUFITHORAX
171D

PLATE XXXVII

FIG. 172. *P. rufithorax concava* Hardy. a. male hypopygium, ventral; b-c. variations in appearance of median process of ninth sternum, caused mostly by amount of tilting; d. ninth tergum of male; e. ninth tergum of female; f. eighth sternum of female.

FIG. 173. *P. rugosa* Hardy. a. male genitalia, ventral; b. ninth tergum of male, dorsal; c. ninth tergum, end view.

FIG. 174. *P. seminitens* Edwards. a. male genitalia, ventral; b. harpago, lateral; c. ninth tergum of male.

FIG. 175. *P. serrata* Hardy. a. male hypopygium, ventral; b. harpago, lateral; c. ninth tergum of male.

FIG. 176. *P. similis* Rondani. a. male hypopygium, ventral; b. harpago, lateral; c. ninth tergum of male.

FIG. 177. *P. trilobata* Hardy. a. male hypopygium, ventral; b. harpago, lateral; c. ninth tergum of male, dorsal; d. ninth tergum, end view somewhat diagrammatic.

FIG. 178. *P. uberta* Hardy. a. male hypopygium, ventral; b. ninth tergum of male; c. harpago, lateral; d. ninth tergum of female; e. eighth sternum of female.

PLATE XXXVII

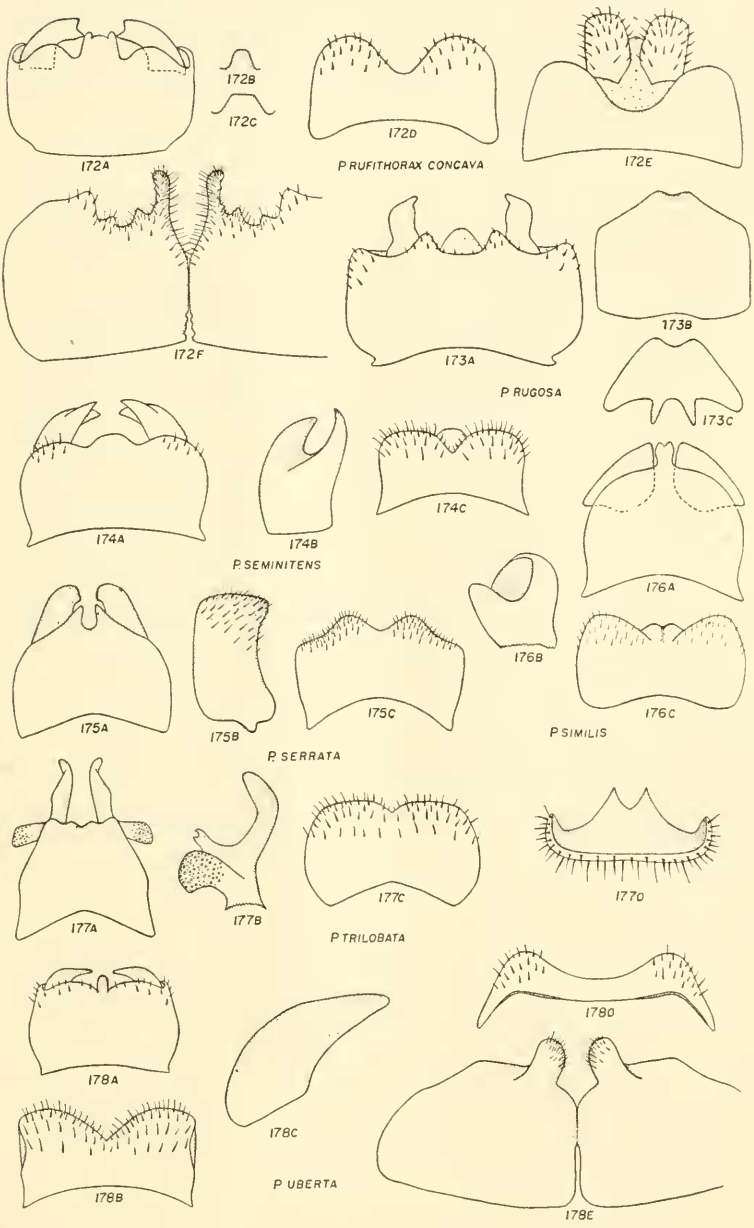


PLATE XXXVIII

FIG. 179. *P. varabilis* Hardy. a. male hypopygium, ventral; b. harpago, lateral; c. ninth tergum of male.

FIG. 180. *P. vittata* Wiedemann. a. male hypopygium, ventral; b. harpago, lateral; c. ninth tergum of male.

FIG. 181. *P. xenia* Hardy. a. ninth tergum of female; b. ninth tergum of male; c. harpago, lateral; d. male hypopygium, ventral; e. eighth sternum of female.

FIG. 182. *Bibio abbreviatus* Loew. a. ninth sternum and harpagones of male; b. posterior tarsus and apex of tibia of male; c. ninth tergum of male.

FIG. 183. *B. albipennis* Say. a. posterior basitarsus and tibial spurs.

FIG. 184. *B. albipennis beameri* n. sub. sp. a. ninth sternum and harpagones of male; b. ninth tergum of male.

FIG. 185. *B. albipennis* var. *tenuipes* Coq. a. anterior tibia of male.

FIG. 186. *B. atripilosus* James. a. ninth sternum and harpagones of male; b. ninth tergum and cerci of male.

FIG. 187. *B. carolinus* n. n. a. head of female, lateral; b. ninth sternum and harpagones of male, ventral; c. ninth tergum of male; d. posterior tibia and tarsus of male.

FIG. 188. *B. carri* Curran. a. posterior tarsus and tibial spur, lateral; b. ninth tergum of male.

PLATE XXXVIII

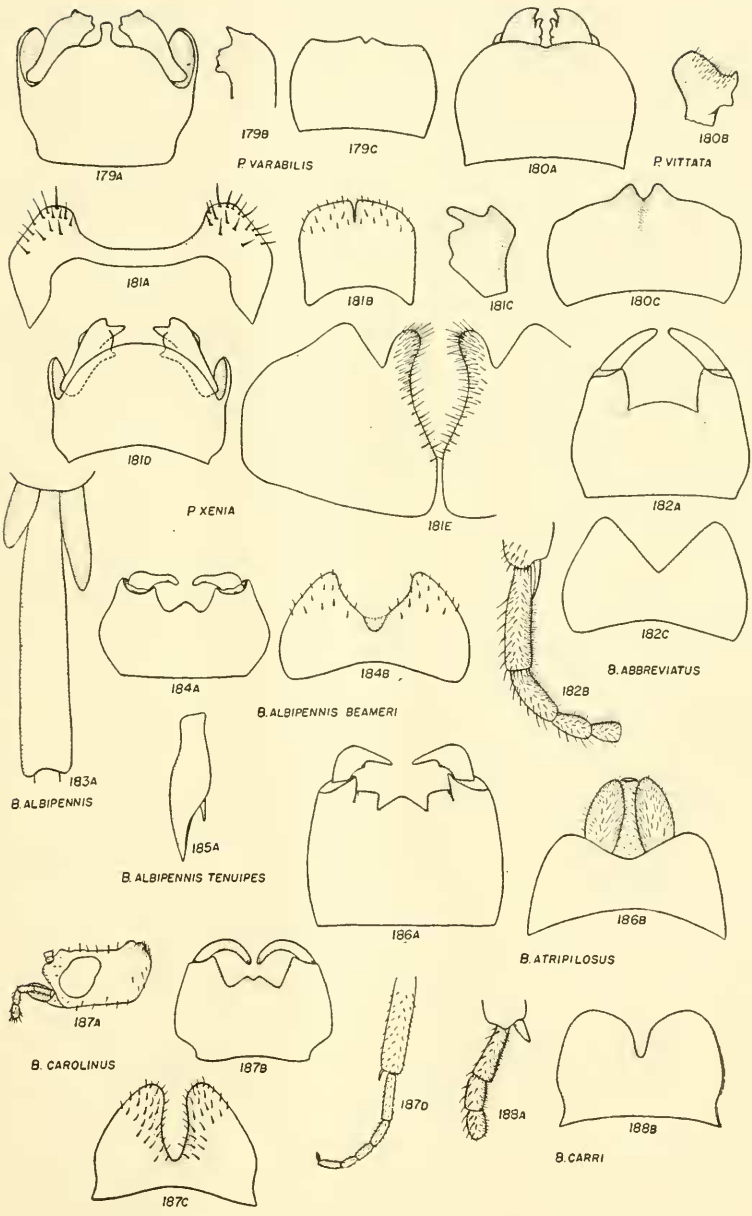


PLATE XXXIX

FIG. 189. *B. femoratus* Wiedemann. a. anterior tibia of male.

FIG. 190. *B. flukei* Hardy. a. posterior basitarsus and tibial spurs of male.

FIG. 191. *B. fraternus* Loew. a. posterior tarsus and tibial spurs of male, lateral; b. ninth tergum of male.

FIG. 192. *B. holti* McAtee. a. anterior tibia of male.

FIG. 193. *B. inaequalis* Loew. a. front tibia, lateral; b. front tibia, dorsal; c. ninth tergum of male; d. ninth sternum and harpagones.

FIG. 194. *B. kansensis* James. a. posterior metatarsus and apex of tibia of male, lateral.

FIG. 195. *B. knowltoni* var. *paltidus* Hardy. a. posterior tarsus and apex of tibia, lateral.

FIG. 196. *B. longipes* Loew. a. apex of front tibia and metatarsus of male; b. posterior metatarsus and tibial spurs of male.

FIG. 197. *B. melanopilosus* Hardy. a. wing; b. posterior metatarsus and tibial spurs of male; c. head of male.

FIG. 198. *B. monstri* James. a. ninth sternum and harpagones of male; b. harpago, dorsal; c. ninth tergum of male.

FIG. 199. *B. nervosus* Loew. a. ninth tergum of male; b. ninth sternum and harpagones; c. anterior tibia of male.

FIG. 200. *B. pingreensis* James. a. posterior metatarsus and tibial spurs of male.

FIG. 201. *B. rufithorax* Wiedemann. a. wing; b. head of female; c. ninth sternum and harpagones of male; d. front tibia; e. posterior tarsus of male; f. ninth tergum of male. (See also Fig. 201 on Plate XL.)

PLATE XXXIX

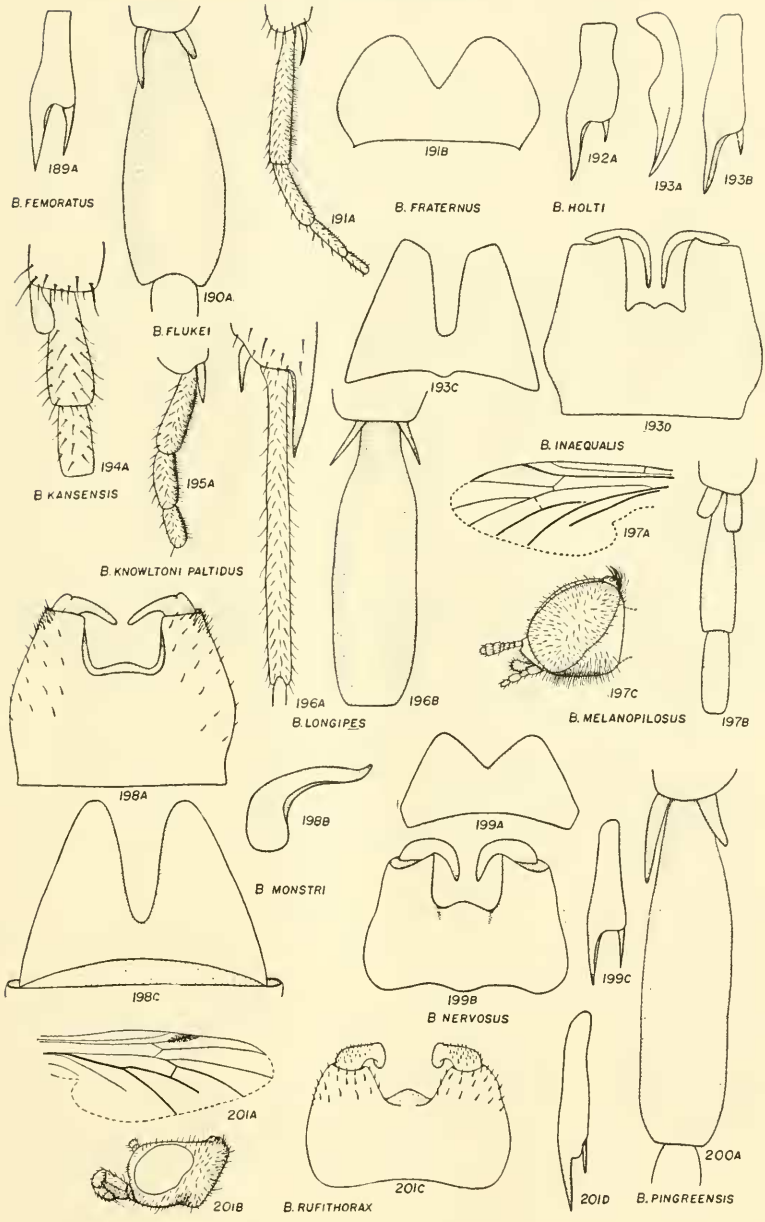

189A
B. FEMORATUS
190A
B. FLUKEI
191A
191B
B. FRATERNUS
192A
193A
193B
B. HOLTI
193C
193D
B. INAEQUALIS
194A
B. KANSENSIS
195A
B. KNOWLTONI PALTIDUS
196A
196B
B. LONGIPES
197A
197B
197C
B. MELANOPILOSUS
198A
198B
B. MONSTRI
198C
199A
199B
B. NERVOSUS
199C
200A
B. PINGREENSIS
201A
201B
201C
B. RUFITHORAX
201D

PLATE XL

FIG. 201. *B. rufithorax* Wiedemann. a. wing; b. head of female; c. ninth sternum and harpagones of male; d. front tibia; e. posterior tarsus of male; f. ninth tergum of male. (See also Fig. 201 on Plate XXIX.)

FIG. 202. *B. sericatus* Hardy. a. anterior metatarsus and tibial spurs of male; b. posterior metatarsus and tibial spurs.

FIG. 203. *B. townesi* n. sp. a. male genitalia, lateral.

FIG. 204. *B. xanthopus* Wiedemann. a. anterior tibia of male.

FIG. 205. *Bibiodes aestiva* Melander. a. male hypopygium, ventral; b. ninth tergum and cerci of male; c. wing.

FIG. 206. *B. femorata* Melander. a. male hypopygium, ventral; b. ninth tergum of male.

FIG. 207. *B. halteralis* Coquillett. a. male hypopygium, ventral; b. ninth tergum of male, showing left harpago and portion of sternum in dorsal view.

FIG. 208. *Philia breviceps* (Loew). a. male hypopygium, ventral; b. harpago, dorsal; c. harpago, lateral; d. ninth tergum of male.

FIG. 209. *P. caurina* (McAtee). a. ninth sternum and harpagones; b. harpago, lateral; c. ninth tergum of male.

FIG. 210. *P. emarginata* (McAtee). a. ninth tergum of male; b. ninth sternum and harpagones.

FIG. 211. *P. oklahomensis* Hardy. a. ninth sternum and harpagones, ventral; b. harpago, lateral; c. wing; d. ninth tergum of male.

PLATE XL

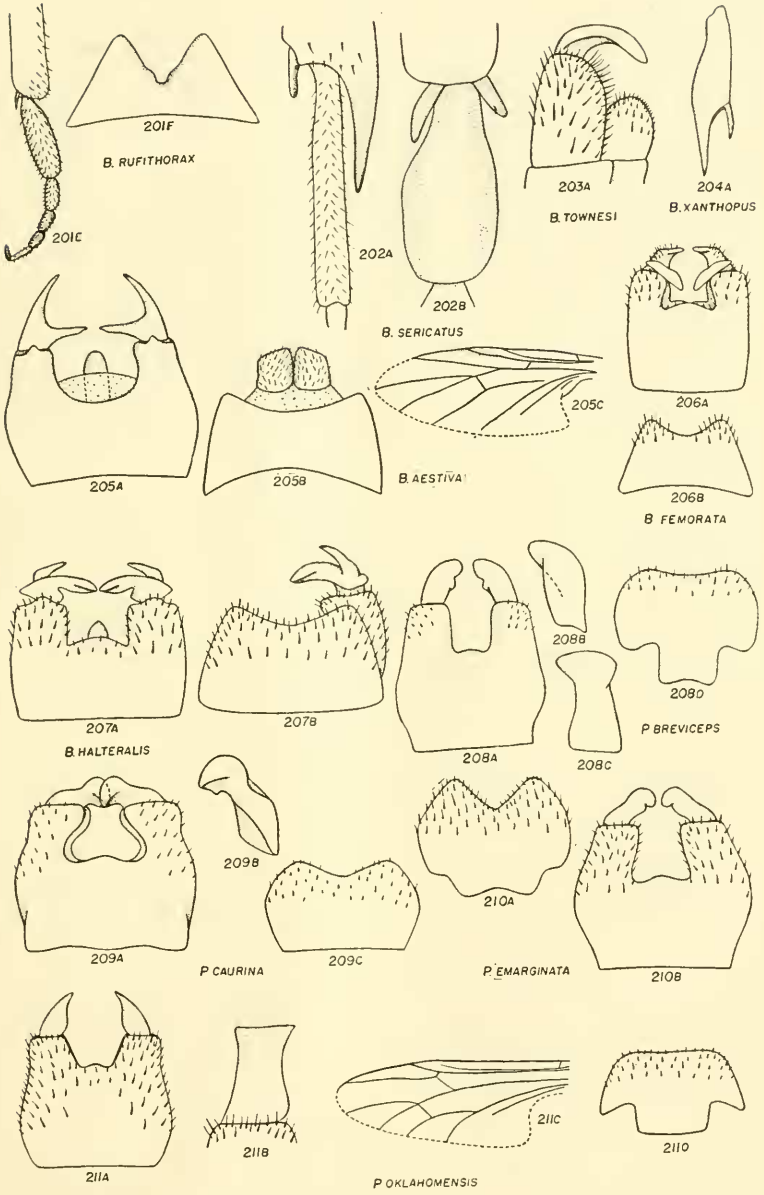

201C
201F
B. RUFITHORAX
202A
202B
B. SERICATUS
203A
B. TOWNESI
204A
B. XANTHOPUS
205A
205B
B. AESTIVA
205C
206A
206B
B. FEMORATA
207A
B. HALTERALIS
207B
208A
208B
208C
209D
P. BREVICEPS
209A
209B
P. CAURINA
209C
210A
P. EMARGINATA
210B
211A
211B
211C
P. OKLAHOMENSIS
211D

PLATE XLI

FIG. 212. *P. orbata* (Osten Sacken). a. ninth sternum and harpagones, ventral; b. male genitalia, dorsal; c. accessory structures above aedeagus.

FIG. 213. *proxima* (McAtee). a. ninth sternum and harpagones; b. ninth tergum of male; c. harpago, lateral.

FIG. 214. *P. serotina* (Loew). a. ninth sternum and harpagones; b. ninth tergum of male.

FIG. 215. *P. spinipes* (Say). a. front tibia of male; b. ninth sternum and harpagones.

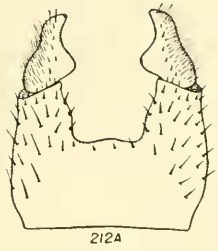
FIG. 216. *P. stigmatica* (Say). a. ninth sternum and harpagones; b. ninth tergum of male.

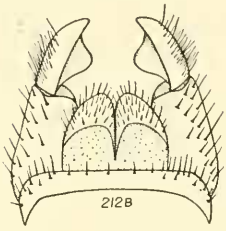
FIG. 217. *P. strigilata* (McAtee). a. ninth tergum of male; b. ninth sternum and harpagones.

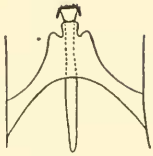
FIG. 218. *P. tibialis* (Loew). a. ninth sternum and harpagones; b. ninth tergum of male.

FIG. 219. *P. tingi* n. sp. a. anterior tibia of male.

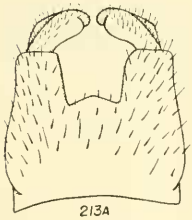
PLATE XLI

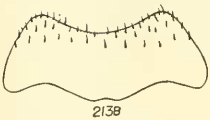

212A


212B


212C

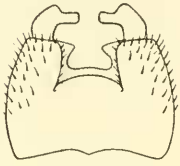
P. ORBATA

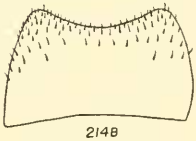

213A


213B


213C

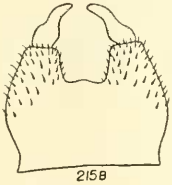
P. PROXIMA


214A

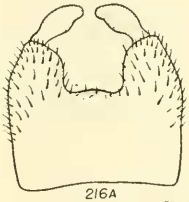

214B

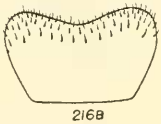
P. SEROTINA


215A

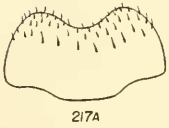

215B

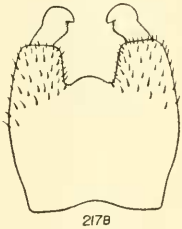
P. SPINIPES


216A

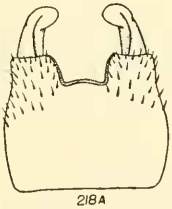

216B

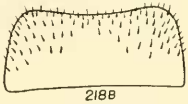
P. STIGMATICA


217A

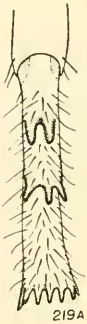

217B

P. STRIGILATA


218A


218B

P. TIBIALIS


219A

P. TINGI