

NEW OR LITTLE-KNOWN NEOTROPICAL TIPULIDAE (DIPTERA). III

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In the present paper I am considering various species of Neotropical Tipulidae, virtually all of which were collected in Ecuador by Luis Peña Guzman in 1965 and in 1977. Two of the species are from São Paulo, Brasil where they were taken by John Lane and Evoneo Berti Filho. I express my deep thanks and appreciation to these friends for their interest in securing these flies. It is expected that the consideration of the extensive Peña materials from Ecuador will be continued in further papers under the above general title. Types of the species are preserved in the Alexander Collection, Smithsonian Institution, Washington, D.C.

TIPULINAE

Leptotarsus (Longurio) bertii, sp.n.

General coloration of head and thorax yellow; abdomen yellow, conspicuously patterned with black; antenna of male nearly equal in length to the body, flagellar verticils short and inconspicuous.

Male. — Length about 15 mm.; wing 12.5 mm.; antenna about 14.5 mm. Rostrum yellow, with a small apical tubercle tufted with sparse long black setae; palpi with basal two segments yellow, distal two black, terminal segment slightly longer. Antenna of male long, as shown by the measurements; proximal half yellow, outer segments more infuscated to black; flagellar segments cylindrical throughout, with relatively short erect setae over their entire length, the vestiture yellow and shorter on the more basal segments, the longest subequal to the diameter of the segment, on outer segments setae darker and slightly longer. Head above brownish yellow; anterior vertex narrow, vertical tubercle small, produced anteriorly.

Thoracic dorsum almost uniformly polished yellow, praescutum more orange yellow, with very small inconspicuous setae on the interspaces. Pleura yellow, the entire mesepisternum and sternum abruptly polished black. Halteres with stem yellow, outer half of knob dark brown. Legs with coxae and trochanters yellow; femora obscure yellow, tips conspicuously black, narrowest on posterior pair; tibiae yellow, tips more narrowly blackened; tarsi with basitarsi brownish yellow to

¹Contribution from the Entomological Laboratory, University of Massachusetts.

brown, outer tarsal segments black; claws small, simple. Wings with prearcular and costal fields, with the stigma, medium brown, disk uniformly light brown; veins darker brown. Longitudinal veins beyond cord with trichia. Venation: R_5 subequal to R_{2+3} , the latter in alignment with the longer R_4 ; m and the petiole of cell M_1 subequal.

Abdominal tergites chiefly obscure yellow, with a continuous central black stripe, posterior borders of segments narrowly black; sternites black; eighth and ninth segments black; styli of hypopygium brownish black. Male hypopygium (Fig. 1) with posterior border of tergite, t , with a U-shaped emargination, much smaller than the obtuse lobes. Dististyles, d , apparently fused basally, as shown, *id.*, *od.*

Holotype. — σ , Cantareira, São Paulo, Brasil, November 8, 1976 (Berti).

This interesting crane fly is named in honor of the collector, Evoneo Berti Filho, to whom we are indebted for many favors. The striking coloration of the thoracic pleura and sternum should be noted. The general characters of the hypopygium are about as figured. Attention is called to the apparent partial fusion of the two dististyles of the hypopygium (lower figure, d). This condition should be examined more closely in further materials to determine whether there is an approximation or actual fusion of the segments.

Tipula (Microtipula) anomalina, sp.n.

General coloration of head and thorax almost uniformly medium brown, thoracic pleura pale yellow ventrally; legs uniformly brown; wings pale brown, cell C more yellowed, stigma dark brown; abdomen basally dark brown, patterned with obscure yellow; outer segments, including hypopygium, light yellow, seventh segment brownish black; male hypopygium with tergite and eighth sternite as described; dististyles distinctive, outer style long and slender, beyond midlength with two approximated points.

Male. — Length about 13 mm.; wing 10.6 mm.; antenna about 5.8 mm.

Frontal prolongation of head yellow; palpi black. Antennae relatively short, as shown by the measurements; scape and pedicel yellow; first flagellar segment dark brown, basal third paler brown; remaining segments black, moderately incised, basal enlargement small. Head light brown.

Thoracic dorsum almost uniformly medium brown, the four praescutal stripes scarcely indicated. Pleura ventrally pale yellow, dorsal areas slightly darker. Halteres dark brown. Legs with coxae and trochanters pale yellow, concolorous with the pleura; a single leg (posterior) remains, uniformly medium brown. Wings almost uniformly pale brown, cell C more yellowed, Sc brownish yellow; stigma conspicuous, dark brown; veins dark brown to brownish black. Veins posterior to R chiefly glabrous, including R_5 ; radial veins beyond cord and M_1 with numerous trichia. Venation: Petiole of cell M_1 , nearly twice m ; $m-cu$ at fork of M_{2+4} ; cell $2nd A$ long and narrow.

Abdomen dark brown, first tergite and bases of succeeding ones obscure yellow, outer segments, including hypopygium, more uniformly light yellow, seventh segment brownish black; eighth sternite clear yellow, base broadly dark brown. Male hypopygium (Fig. 2) with ninth tergite, *9t*, relatively small (shown more enlarged in figure), its area only about one-fourth that of the eighth sternite; posterior border shallowly emarginate, the short lobes with longer setae; outer end bearing three long rods, lateral pair small, slender, with microscopic spinules at apex; central tergal rod directed cephalad, as shown. Basistyle, *b*, with a blackened corrugated lobe on mesal face, as common in the subgenus. Dististyles *d*, terminal; outer style, *od*, long and slender, base dilated; beyond midlength on mesal face with two approximated blackened points, as shown; outer third of style more narrowed, terminating in a slightly angulated point; inner style, *id*, a shorter clavate lobe, its inner margin with long setae. Eighth sternite, *s*, large and conspicuous, light yellow; cephalic fourth darkened, lacking the abundant setae on all other parts, as shown by the dots; posterior border farther produced caudad into a stout lobe, as shown. Phallosome, *p*, relatively short and stout, at base with narrow blackened rods, their ends corrugated, as shown.

Holotype. — ♂, Dureno, Ecuador, 150 meters, September 23-28, 1977 (Peña).

Tipula (Microtipula) anomalina is most readily recognized by hypopygial characters, as described, especially the ninth tergite, eighth sternite and the dististyles, the last being quite distinctive.

***Tipula (Microtipula) baecostyla*, sp.n.**

General coloration of head and thoracic dorsum brown, pleura light yellow; antennae relatively short, less than the wing; legs with coxae and trochanters greenish yellow, remainder medium brown; wings with stigma and cells *C* and *Sc* dark brown, remainder of disk paler brown; abdomen with tergites dark brown, sternites yellow, seventh segment conspicuously dark brown, hypopygium yellowed; male hypopygium with dististyle single, very small, appearing as a gently curved blade, its outer end blackened; eighth sternite relatively large, posterior border narrowed into a depressed-flattened blade.

Male. — Length about 10 mm.; wing 10.5 mm.; antenna about 7 mm. Frontal prolongation of head dark brown above, light yellow on sides; nasus lacking; palpi obscure yellow, outer end of the very long terminal segment brownish black. Antennae relatively short for the subgenus, as shown by the measurements; scape and pedicel obscure yellow, flagellum black; flagellar segments with small basal enlargements, verticils relatively short, beyond midlength on outer face with a single longer verticil. Head medium brown; anterior vertex broad.

Thorax with pronotum and mesonotum almost uniformly dark brown; pleura, including the dorsopleural membrane uniformly light yellow. Halteres with stem light brown, knob dark brown. Legs with coxae light yellow; trochanters pale green; remainder of legs medium brown throughout; tarsal claw on lower face at near midlength with a long erect spine. Wings with cells *C* and *Sc*, with the stigma,

dark brown, distal ends of outer radial cells more weakly darkened, remainder of wing uniformly pale brown; restricted oblitative areas before stigma and across the basal quarter of cell *1st M*₂ into the adjoining cells; veins dark brown. *Rs* and outer radial veins with abundant trichia, lacking on all basal and posterior veins. Venation: Cell *2nd A* long and very narrow.

Basal abdominal tergites dark brown, intermediates yellowed basally, more clearly delimited on outer segments; sternites clear light yellow; seventh segment dark brown, the posterior border of the sternite abruptly yellow; hypopygium yellowed, basal third of eighth sternite pale brown. Male hypopygium (Fig. 3) with the ninth tergite, *t*, broken in the unique type specimen, outer lateral angles produced, about as shown, with blackened sublateral points, midregion destroyed on slide mount. Dististyle, *d*, single, very small, appearing as a gently curved blade, outer end blackened, tip acute, inner face at base slightly produced. Phallosomic structure, *p*, as shown. Eighth sternite, *s*, distinctive, relatively large, light yellow, basal third darkened; posterior border rounded, the central area farther produced into a paler depressed-flattened blade, as shown; vestiture abundant but very small and inconspicuous.

Holotype. — ♂, Dureno, Ecuador, 150 meters, September 23-28, 1977 (Peña).

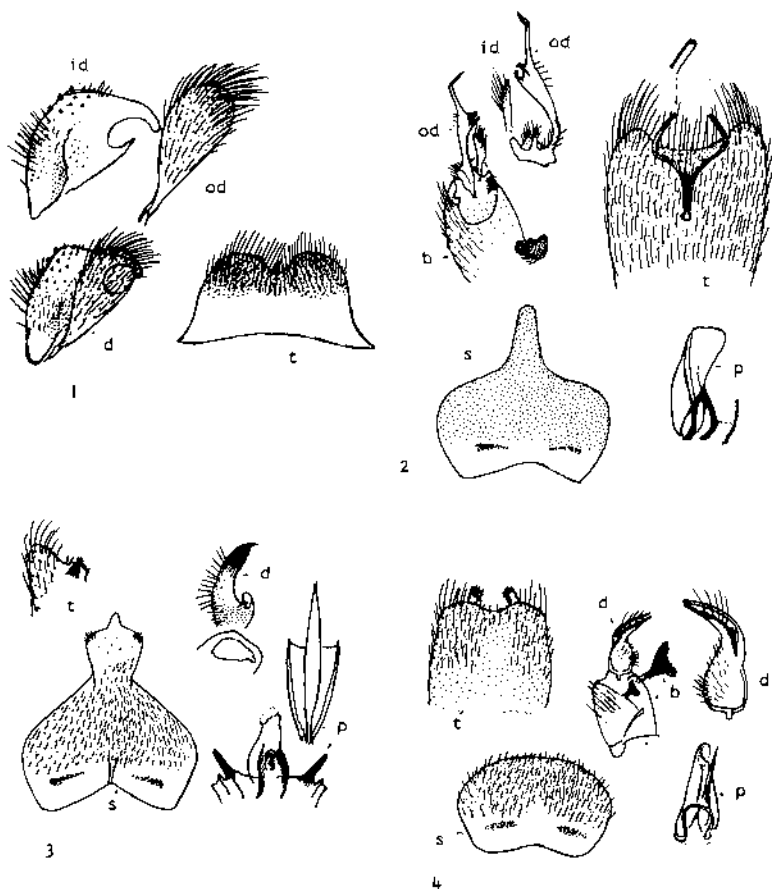
The most similar species is *Tipula (Microtipula) prolixisterna* Alexander, likewise from Ecuador. This has the eighth sternite of the hypopygium similarly produced but quite different in conformation, and with the details of the tergite and dististyle distinct.

***Tipula (Microtipula) bigracilis*, sp.n.**

General coloration of head and thorax gray, abdominal tergites black, sternites and hypopygium chiefly yellow; male hypopygium with a single dististyle, oval, bearing two long extensions.

Male. — Length about 14 mm.; wing 10.5 mm.; antenna about 5 mm. Frontal prolongation of head obscure yellow, slightly darker above, nasus and conspicuous setae black. Antennae relatively short for species in this subgenus; scape medium brown, pedicel brown basally, remainder brownish black, flagellum uniformly black, basal enlargement small; verticils short, slightly more than one-third the longest segments. Head with front and very narrow eye margins light gray, remainder dark brown.

Pronotum light gray. Mesonotal praescutum and scutellum uniformly dark plumbeous gray, postnotum light gray. Pleura uniformly clear light blue gray, dorsopleural membrane light brown. Halteres with stem dark brown, knob black. Legs with coxae light gray; trochanters obscure yellow; remainder of legs black. Wings subhyaline, the large stigma dark brown; veins black. Veins *C* and *R* with relatively short black trichia, with fewer on outer radial branches, lacking on *Rs* and all veins posterior to *R*. Venation: Petiole of cell *M*₁, about two and one-half times *m*; *m-cu* at fork of *M*₃₊₄; cell *2nd A* long and narrow.



FIGURES 1-4. — 1. *Leptotarsus (Longurio) bertii* sp.n., male hypopygium; 2. *Tipula (Microtipula) anomalina* sp.n., male hypopygium; 3. *Tipula (Microtipula) baestyla* sp.n., male hypopygium; 4. *Tipula (Microtipula) bigracilis* sp.n., male hypopygium.

Symbols. Venation, Figs. 8, 9, veins, C, costa; Sc, subcosta; R, radius, Rs, radial sector.

Male hypopygium. — b, basistyle; id, inner dististyle; md, middle dististyle; od, outer dististyle; d, dististyle; a, aedeagus; ant, antenna; p, phallosome; s, sternite; t, tergite; vb, ventral lobe of basistyle.

Abdominal tergites black, the first pruinose; lateral borders narrowly obscure yellow; sternites yellow, chiefly concealed by the tergites; hypopygium, including the ninth segment and posterior border of eighth sternite yellow; tergite and basal two-thirds of eighth sternite dark brown. Male hypopygium (Fig. 4) with the ninth tergite, *t*, small, its area only about one-third that of the eighth sternite; posterior border shallowly emarginate, lateral lobes low, on lower surface with a short lobe that is tipped with small setae. Basistyle, *b*, with basal lobe subtriangular, blackened. Dististyle, *d*, single, the body of style oval, its outer third a slender straight spine with sparse blackened points on outer margin at base; distal half of style with a long gently curved slender rod that lies above and parallels the outer spine. Phallosome, *p*, simple, bearing a slender spine. Eighth sternite, *s*, large, posterior border very slightly rounded; surface with abundant short setae except on the anterior border behind the impressed areas.

Holotype. — ♂, Dureno, Ecuador, 150 meters, September 23-28, 1977 (Peña).

The present fly is quite distinct from all other generally similar species in hypopygial structure, especially the single dististyle with a unique conformation. The unusual range in hypopygial structure in species of *Microtipula* has been discussed in various earlier papers by the writer, especially in *Revista de Entomologia*, 16: 330-356 (1945) and 16: 415-440 (1945) and in *Studia Entomologica*, 12: 219-221 (1969). The Alexander and Alexander, *Catalogue of Diptera of the Americas south of the United States*, part 4: 32-39; 1970, provides a list of known species.

***Tipula (Microtipula) camura*, sp.n.**

General coloration of head brownish gray; mesonotal praescutum yellow with four brownish gray stripes, pleura chiefly obscure yellow; legs brownish black to black; wings almost uniformly medium brown, stigma and cell *Sc* darker brown; abdominal tergites brownish black, sternites paler brown, seventh segment dark brown; male hypopygium with tergite terminating in two slender divergent rods; outer dististyle with base dilated, outer portion slender, at about two-thirds the length bent at a right angle; inner style a slender rod.

Male. — Length about 14 mm.; wing 11.5 mm.; antenna about 5 mm. Frontal prolongation of head obscure yellow; palpi obscure yellow, terminal segment brownish black outwardly. Antennae relatively short, as shown by the measurements; scape and pedicel obscure yellow, first flagellar segment yellowish brown, remainder black; flagellar segments only slightly emarginate, basal enlargements small. Head above brownish gray.

Pronotum brownish yellow. Mesonotal praescutum obscure brownish yellow with four brownish gray stripes, the central pair separated by a narrow paler gray line; scutum brownish gray, posterior sclerites similarly darkened, posterior borders

of scutellum and mediotergite very weakly yellowed. Pleura with anterior sclerites and meron obscure yellow, pteropleurite and pleurotergite slightly grayish. Halteres pale brown, knob brownish black. Legs with coxae and trochanters obscure yellow, remainder of legs brownish black to black; claws long and slender, beneath with a single spine at near midlength. Wings almost uniformly medium brown, stigma and cell *Sc* darker brown; restricted obliterative areas at outer end of *Rs* and across base of cell *1st M*₂; veins brown. Trichia on *Rs* and outer branches of *R*, *M*, and very sparsely on *M*₃. Venation: Cell *2nd A* very narrow.

Abdominal tergites brownish black, lateral borders and extreme bases of intermediate segments paler brown; sternites light brown, segment seven uniformly dark brown, hypopygium chiefly yellowed; eighth tergite and base of eighth sternite brown, remainder of hypopygium chiefly yellowed. Male hypopygium (Fig. 5) with tergite, *t*, small, its area about one-half or less than the eighth sternite; posterior border with two slender slightly divergent rods, their apices and inner margins with abundant black setae. Dististyles, *d*, distinctive, as shown; outer style expanded at base, narrowed beyond, at about two-thirds the length bent at a right angle, as shown; inner style a slender rod, about one-half the total length of the outer style. Basistyle, *b*, with a blackened lobe near base of inner face as common in the subgenus. Eighth sternite, *s*, darkened basally, outer two-thirds yellow, margin convexly rounded.

Holotype. — ♂, Junction of Coca and Napo Rivers, Ecuador, May 3-4, 1965 (Peña).

The present fly is readily told by the distinctive hypopygial characters, especially both dististyles, that have suggested the specific name applied to the fly.

Tipula (Microtipula) erebus sp.n.

General coloration of head and thorax dark gray; legs black; wings with costal border dark brown, remainder of disk paler brown; cell *2nd A* relatively broad; abdominal tergites intense polished black, laterally vaguely patterned with paler.

Female. — Length about 11 mm.; wing 13 mm.; antenna about 2.8 mm. Frontal prolongation of head dark gray, nasus elongate, concolorous; palpi black, terminal segment subequal in length to the combined basal three. Antennae black, apex of pedicel slightly brightened; flagellar segments cylindrical, longer than their verticils. Head dark gray.

Pronotum dark gray. Mesonotal praescutum almost uniformly brownish gray, the four brown stripes scarcely distinguishable from the ground, scutum similarly brownish gray; scutellum, postnotum and the pleura more uniformly gray; dorsopleural membrane brown. Halteres with stem brown, knob brownish black. Legs with coxae dark gray; trochanters light brown; remainder of legs black; claws small, simple, strongly curved. Wings with cells *C* and *Sc*, prearcular field and stigma uniformly dark brown, with a narrow similar seam over the anterior cord, remainder of disk paler brown; restricted whitened areas at inner end of stigma and across base of cell *1st M*₂. Veins beyond cord and outer end of cell *1st M*₂ with

trichia, including also *Rs* and outer ends of *M* and *2nd A*. Venation: *Rs* gently curved, about one-half longer than *R*₃₊₄; petiole of cell *M*, about twice *m*; *m-cu* at or shortly beyond fork of *M*₃₊₄; cell *2nd A* relatively broad, at midlength subequal in width to cell *1st A* at this point.

Abdominal tergites intense polished black, intermediate segments with a very vague paler area near lateral margins; intermediate sternites chiefly black, basal and posterior segments with more light brown areas. Abdomen of the unique type broken and twisted near outer end, with a mass of smooth dull black eggs protruding. From near the abdominal apex extends a small light orange bilobed structure presumed to be the cerci, these provided with yellow setae.

Holotype. — ♀, Loja — Zamora, Ecuador, 2500-2800 meters, October 28, 1977 (Peña).

Other generally similar species include especially *Tipula* (*Microtipula*) *apollyon* Alexander, Bolivia, and *T. (M.) volens* Alexander, Peru, both having cell *2nd A* of the wings broad, as in the present fly, differing in body coloration, especially the thorax. Other regional species having the wing pattern generally as in the present fly but with cell *2nd A* long and very narrow include *T. (M.) anomalina* sp.n., Ecuador; *T. (M.) camura* sp.n., Ecuador; *T. (M.) cithariformis* Alexander, Ecuador; *T. (M.) extensistyla* sp.n., Ecuador, and *T. (M.) icasta* Alexander, Ecuador, all distinct in the body coloration.

***Tipula* (*Microtipula*) *extensistyla*, sp.n.**

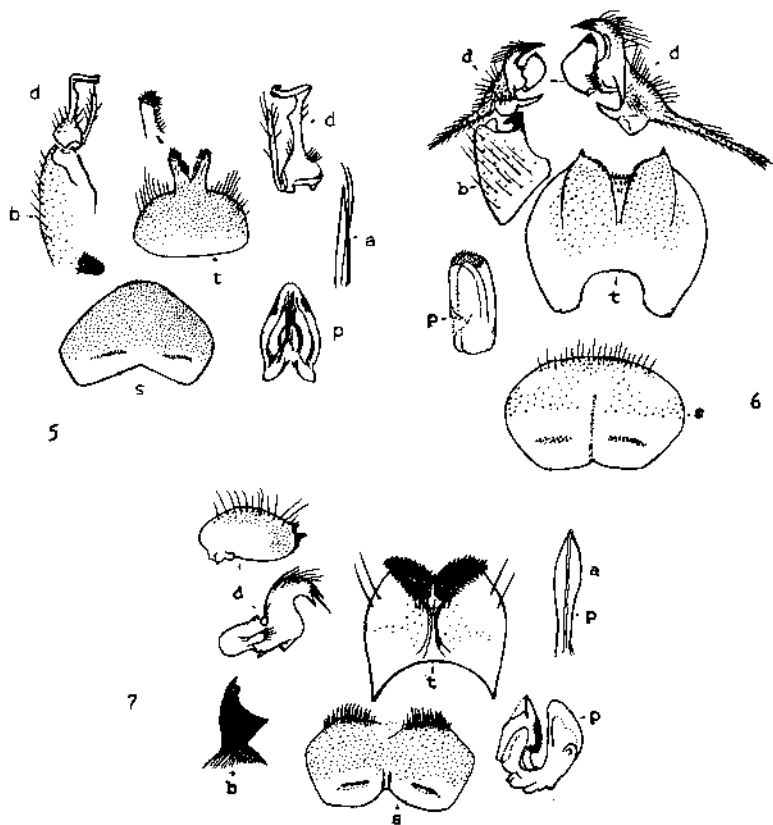
Size medium (wing, ♂, 11.5 mm.); antennae elongate, nearly as long as the wing; head gray; mesonotal praescutum brownish yellow with three broad black stripes; posterior notum black, yellowed posteriorly; pleura light yellow; wings unpatterned; basal abdominal tergites chiefly brownish black to black, yellowed laterally, sternites clear light yellow, eighth segment brownish black, forming a ring; male hypopygium with the dististyle suggesting in appearance a long-tailed bird, as shown.

Male. — Length about 15 mm.; wing 11.5 mm.; antenna about 11 mm. Frontal prolongation of head brown, above gray pruinose; palpi with proximal three segments brown, the third yellowed at tip, terminal segment elongate, black. Antennae elongate, as shown by measurements; scape and pedicel brown, flagellum black; flagellar segments slender, bases dilated, outer ends less evidently enlarged; verticils and a single seta on upper margin beyond midlength of segment long and conspicuous. Head gray.

Pronotum brown. Mesonotal praescutum with three broad black stripes, interspaces inconspicuously brownish yellow; scutum black, very sparsely pruinose; scutellum and postnotal mediotergite black, very slightly pruinose, parascutella and pleurotergite abruptly yellow. Pleura, including dorsopleural membrane, light

yellow. Halteres long and slender, black, base of stem orange yellow. Legs with coxae and trochanters light yellow; remainder of legs broken. Wings before cord pale brown, cells *C* and *Sc* and those beyond the cord slightly darker brown, stigma still darker; veins dark brown. Outer radial branches with abundant trichia; veins *M*, *Cu* and all basal veins posterior to *R* glabrous. Venation: Base of *R*₂ very short, the outer section virtually obliterated, pale yellow, the vein suberect, cell *Sc*, correspondingly small; petiole of cell *M*, slightly longer than *m*.

Basal abdominal segment light yellow; second segment brownish yellow basally, narrowly blackened medially, apex black; succeeding tergites brownish black to black, obscure yellow laterally; basal sternites clear light yellow, segment seven



FIGURES 5-7. — 5. *Tipula (Microtipula) camura* sp.n., male hypopygium; 6. *Tipula (Microtipula) extensistyla* sp.n.; male hypopygium; 7. *Tipula (Microtipula) perissopyga* sp.n.; male hypopygium.

black, forming a narrow ring, eighth segment more brownish black; ninth segment almost uniformly yellow, the tergite patterned with pale brown. Male hypopygium (Fig. 6) with the tergite *t*, very large, its expanse on microscope slide exceeding the combined basistyle and dististyle; posterior border emarginate, each lateral lobe extended into a small point. Dististyle, *d*, distinctive, as shown; main body of style having the general appearance of a bird being posteriorly extended into a long slender tail-like point that is nearly as long as the remainder of style; beak blackened, terminating in an acute point, outer margin with conspicuous elongate setae to form an appressed crest. Eighth sternite, *s*, large, posterior border gently rounded, with relatively sparse small setae.

Holotype. — ♂, Dureno, Ecuador, 150 meters, September 23-28, 1977 (Peña).

The present fly is quite distinct from other presently known species in the hypopygial structure, especially the dististyle, as described and figured.

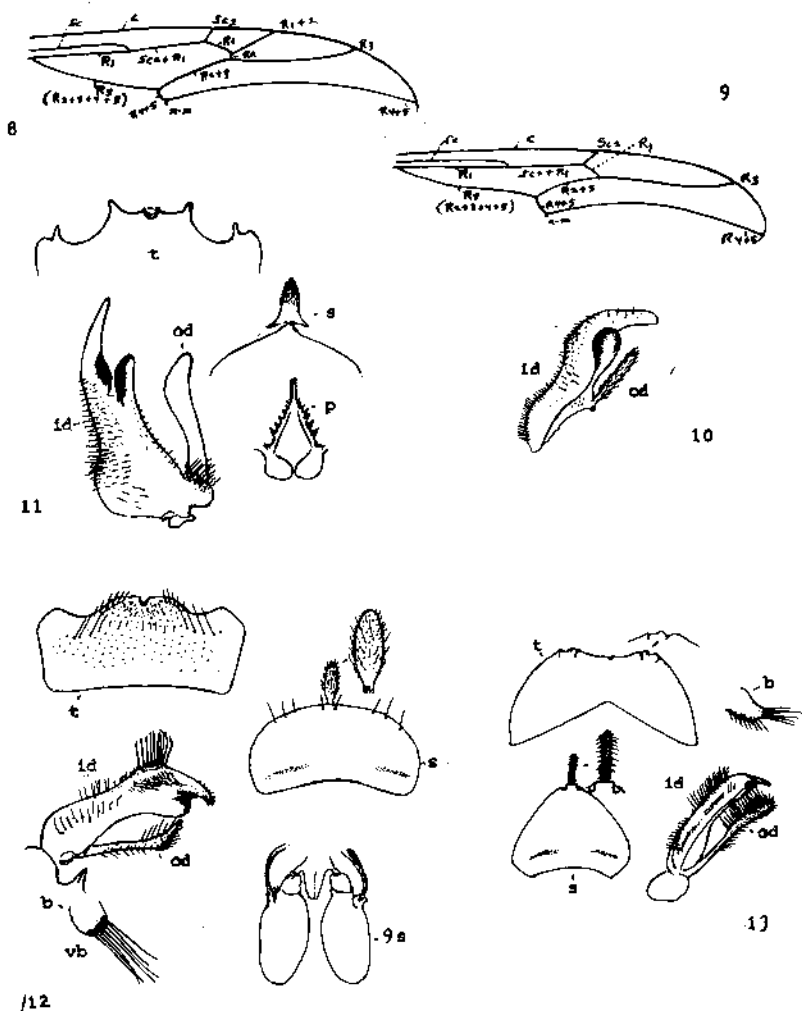
***Tipula (Microtipula) perissopyga*, sp.n.**

Head and thoracic dorsum almost uniformly light gray, thoracic pleura obscure yellow; legs black; wings faintly infuscated, anterior border dark brown; first abdominal segment yellow, remaining tergites brownish black to black, bases of intermediate segments vaguely more yellowed, fifth and succeeding segments uniformly black; male hypopygium with tergite ending in two terminal cushions comprised of numerous black setae; dististyles distinctive, as described.

Male. — Length about 13 mm.; wing 19.5 mm.; antenna about 8.5 mm. Rostrum black; palpi black, proximal segment slightly paler, terminal segment long, exceeding the combined proximal three. Frontal prolongation of head black, remainder of head light gray; nasus slender. Antennae black, pedicel vaguely more yellowed, with long black setae; flagellar segments with small inconspicuous basal enlargements; intermediate segments nearly three times their longest verticils.

Pronotum light gray. Mesonotum almost uniformly light gray, including the pleurotergites. Pleura uniformly obscure yellow, including the dorsopleural membrane. Halteres with stem obscure yellow, knob brownish black. Legs with coxae obscure yellow; trochanters clear light yellow; remainder of legs black; claw small, with a single erect point shortly beyond midlength. Wings faintly infuscated, prearcular field, cells *C* and *Sc* and the stigma dark brown; ends of outer radial cells paler brown; small brown clouds at base of *Rs* and over *m-cu* and *R₅*; veins brownish black. Costal fringe very short and inconspicuous; trichia on outer radial and medial veins, including *Rs*, more sparse on 2nd *A*.

First abdominal segment yellow, remaining tergites brownish black to black, the intermediate segments with bases vaguely more yellowed; basal sternites clear light yellow, apices narrowly but conspicuously black; beyond the fifth segment abdomen uniformly black, including the hypopygium. Male hypopygium (Fig. 7) with the tergite, *t*, distinctive, especially the two terminal cushions that are comprised of very



FIGURES 8-13. — 8. Venation of radial field of wing, *Tipula (Eumicrotipula) diodonta* Alexander. 9. same as last, *Tipula (Eumicrotipula) flavopedicellaris* sp.n.; 10. *Tipula (Eumicrotipula) flavopedicellaris* sp.n.; male hypopygium. 11. *Tipula (Eumicrotipula) euprepia* sp.n., male hypopygium. 12. *Tipula (Eumicrotrichia) hadrotrichia* sp.n., male hypopygium. 13. *Tipula (Eumicrotipula) pulchriflava* sp.n., male hypopygium.

numerous black setulae. Eighth sternite, *s*, about three times larger than the tergite. Basistyle, *b*, at apex extended into a blackened structure, shaped as shown. Dististyles, *d*, distinctive; outer style an oval lobe, the anterior end with two blackened extensions; outer margin with scattered long pale setae, as shown; inner style strongly sinuous, the apex extended into an acute point, subtended by two powerful unequal spines. Phallosome, *p*, complex, as shown by the figures.

Holotype. — σ , East Papallacta, Ecuador, October 6-8, 1977 (Peña).

Other generally similar species include *Tipula* (*Microtipula*) *palaeogama* Alexander, Ecuador and *T. (M.) volens* Alexander, Peru, differing especially in hypopygium structure, including the tergite and both dististyles.

Tipula (*Eumicrotipula*) *euprepia*, sp.n.

General coloration of head and thorax yellow, praescutum with vague pale brown stripes; antennae with proximal three segments light yellow, remainder dark brown with more blackened bases; legs yellowish brown, outer tarsal segments brownish black, claw with a single small erect point at near midlength; wings clear light yellow before the cord, outer third almost uniformly pale brown, including the stigma; vein R_2 long, straight, nearly equal to the combined veins R_{2+3} and R_3 , the latter vein nearly straight; basal segments of abdomen chiefly yellow, outer segments patterned with brown; male hypopygium with dististyles unusually glabrous, including the inner style.

Male. — Length about 18 mm.; wing 19 mm.; antenna about 5 mm. Frontal prolongation of head yellow, subequal in length to remainder of head, nasus long and slender; palpi brown, long, exceeding the prolongation. Antennae with proximal three segments light yellow, remainder dark brown, basal enlargements black, relatively small. Head brownish yellow, adjoining the eyes narrowly clear yellow, vestiture pale; frontal lobe rounded.

Pronotum yellow, vaguely patterned with very pale brown. Mesonotal praescutum yellow with four pale brown stripes that are narrowly bordered by slightly darker brown; scutal lobes obscure yellow, vaguely more darkened anteriorly; scutellum and mediotergite yellow pollinose. Pleura uniformly yellow, the dorsal membrane clearer yellow. Halteres with stem yellow, knob weakly darkened. Legs with coxae and trochanters yellow; remainder of legs yellowish brown, outer tarsal segments brownish black; claw with a small erect point at near midlength. Wings before cord clear light yellow, outer third almost uniformly pale brown, including the stigmal region, the infuscation also including the broad outer margins of cells *Cu*, *1st A* and *2nd A*; a vague pale brown cloud at near the basal fourth of cell *Cu*; small whitened areas before stigma and at basal section of M_{1+2} , larger in cell *1st M*; veins yellow. Longitudinal veins beyond cord with conspicuous trichia; vein R_{1+2} whitened, glabrous except at base; more sparse trichia in outer ends of *Cu* and *Anal* veins. Venation: R_2 long, nearly equal in length to the combined veins R_{2+3} and R_3 ; vein R_3 nearly straight, outer end gently decurved to margin, cell R_2 more

extensive than cell R_3 ; petiole of cell M , about one-third longer than m .

Basal five abdominal segments yellow, tergites of segments two through five with a narrow continuous brown central line; segments six to eight chiefly brown, more restricted on six, seven with two paired yellow areas on outer border; eighth sternite brown, apical appendage pale. Male hypopygium (Fig. 11) with the tergite, t , large transverse; posterior border slightly produced into a very low quadrate extension, its lateral angles appearing as small points, each lateral angle of the tergite with a single similar point, as shown; tergite subglabrous, with relatively few microscopic setae. Outer dististyle, od , nearly glabrous, placed on the inner margin of the larger inner style, appearing as a narrow blade, the apex only slightly enlarged; inner style, id , broadest at base, gradually narrowed outwardly, produced into a long slender beak; lower beak short, apex obtuse, blackened. Phallosome, p , small, the lateral margins with a few conspicuous spines. Eighth sternite, s , unusually glabrous; basal plate broad, at apex with a semidetached smaller lobe, outer half with abundant dense microscopic setules.

Holotype. — σ , East Papallacta, Ecuador, October 6-8, 1977 (Peña).

The present fly is most readily distinguished from other generally similar regional species by the distinctive pattern of the wings and in the details of hypopygium structure. It is much like *Tipula (Eumicrotipula) perflavidula* sp.n., likewise from Ecuador, differing in details of body and antennal coloration and especially in wing pattern and hypopygium.

***Tipula (Eumicrotipula) flavopedicellaris*, sp.n.**

Antenna relatively short, less than one-half the wing, black, the pedicel abruptly yellow; mesonotal praescutum yellowed with four black stripes, their anterior ends variegated by yellow; pleura and posterior sclerites of the notum chiefly light gray patterned by darker, dorsopleural membrane yellowed; legs black, femoral bases narrowly yellowed, claws very small; wings brown, all cells patterned with yellow areas; vein R_{1+2} atrophied; abdomen chiefly black; male hypopygium with inner dististyle subglabrous, blackened, vestiture sparse.

Male. — Length about 10-10.5 mm.; wing 11.5-13 mm.; antenna about 4-4.4 mm.

Frontal prolongation of head gray, with abundant long black setae; palpi black. Antennae relatively short, less than one-half the wing or body; black, pedicel abruptly yellow; flagellar segments with relatively short basal verticils. Head with the transverse anterior vertex yellowed, posterior parts of head gray, on either side with brown areas.

Pronotum yellowish gray, patterned with three small blackened areas. Mesonotal praescutum yellow with four black stripes, intermediate pair confluent, anterior ends of each more expanded, with an obscure yellow linear area; scutum gray, each lobe with a major brownish black area; scutellum light gray, parascutella darker;

postnotal mediotergite gray, posterior border broadly black, pleurotergite light gray, darker above. Pleura light gray, variegated by darker, especially dorsally and on meron; dorsopleural membrane yellowed. Halteres with stem yellow, knob medium brown. Legs with coxae and trochanters light gray; remainder of legs black, femoral bases yellowed, including about one-fifth the segment or less; claws very small, smooth. Wings with the ground brown, all cells patterned with yellow areas; cell *R* with three yellow marks, more extensive in the holotype, anteriorly exceeding the darkened ground; cell *M* similarly with three yellow areas in the type, in one paratype the outer one smaller to virtually obliterated; veins brown. Venation: Vein R_{1+2} entirely lacking; petiole of cell *M*, from about one-third to one-half *m*.

Abdomen with basal tergite light gray, remaining segments, including the hypopygium, black. Male hypopygium (Fig. 10) badly damaged and only certain structures are clearly apparent. Dististyles, *d*, as shown; outer style, *od*, a long straight blade, apex rounded; inner style, *id*, about as shown; subglabrous and conspicuously blackened, vestiture including sparse series of erect short yellow setae over basal half, remainder of base of style with sparse darker hairs as shown.

Holotype. — ♂, Tulcan-El Canelo, Ecuador, 3250 meters, September 11, 1977 (Peña). Paratypes, 2 ♂♂, East Papallacta, Ecuador, October 6-8, 1977 (Peña).

The present fly is told from other generally similar regional species having variegated wings and vein R_{1+2} lacking by the relatively short antennae, blackened legs, and the hypopygial structure, especially the inner dististyle, as described and figured.

Among the approximately 250 Neotropical species of the subgenus presently known, about 40 have vein R_{1+2} of the wings atrophied, as in the present fly. Figure 8 shows the radial venation in two species, *Tipula (Eumicrotipula) diodonta* Alexander (Fig. 8) with vein R_{1+2} preserved and *T. (E.) flavopedicellaris* (Fig. 9), the present fly, having this vein atrophied. For the use of other students of the Tipulidae, I am listing the species that have vein R_{1+2} atrophied.

Tipula (Eumicrotipula) absona Alexander, Ecuador; *T. (E.) accumulator* Alexander, Guatemala; *T. (E.) aglossa* Alexander, Bolivia; *T. (E.) andromache* Alexander, Venezuela; *T. (E.) atameles* Alexander, Peru; *T. (E.) atroscapa* Alexander, Brasil; *T. (E.) atrovelutina* Alexander, Paraguay; *T. (E.) belemensis* Alexander, Brasil; *T. (E.) chicana* Alexander, Ecuador; *T. (E.) consonata* Alexander, Ecuador; *T. (E.) costaricensis* Alexander, Costa Rica; *T. (E.) diardis* Alexander, Argentina; *T. (E.) efficax* Alexander, Ecuador; *T. (E.) emerita* Alexander, *T. (E.) estella* Alex-

ander, Mexico; *T. (E.) expleta* Alexander, Bolivia; *T. (E.) fatidica* Alexander, Ecuador; *T. (E.) flavidula* Alexander, Ecuador; *T. (E.) flavopedicellaris* sp.n., Ecuador; *T. (E.) fraudulenta* Alexander, Ecuador; *T. (E.) iguazuensis* Alexander, Argentina; *T. (E.) immerens* Alexander, Venezuela; *T. (E.) kathema* Alexander, Peru; *T. (E.) legitima* Alexander, Peru; *T. (E.) longuriorides* Alexander, Bolivia; *T. (E.) macrotrichiata* Alexander, Brasil-type of the subgenus *Eumicrotipula* Alexander; *T. (E.) mordax* Alexander, Brasil; *T. (E.) nethis* Alexander, Peru; *T. (E.) nigriscapa* Alexander, Surinam; *T. (E.) nolens* Alexander, *T. (E.) notoria* Alexander, Ecuador; *T. (E.) novatrix* Alexander, Peru; *T. (E.) obirata* Alexander, Ecuador; *T. (E.) obscuricincta* Alexander, Mexico; *T. (E.) olssoniana* Alexander, Venezuela; *T. (E.) palitans* Alexander, Peru; *T. (E.) perstudiosa* Alexander, *T. (E.) petiolaris* Alexander, Ecuador; *T. (E.) serval* Alexander, Brasil; *T. (E.) votiva* Alexander, Bolivia.

Tipula (*Eumicrotipula*) *hadrotrichia*, sp.n.

General coloration of thorax obscure light yellow with poorly indicated praescutal stripes, pleura and pleurotergite light yellow; legs with femora black, bases narrowly yellow; wings light yellow basally, beyond the cord pale brown; basal abdominal segments chiefly yellowed, outwardly patterned with brown; male hypopygium with inner dististyle stout, outer margin with a dorsal crest or row of about a dozen powerful erect spinoid setae; eighth sternite nearly glabrous, terminating in a small median spatulate blade.

Male. — Length about 17-18 mm.; wing 16.5-17 mm.; antenna about 4.3-4.6 mm.

Frontal prolongation of head long, light yellow, conspicuously brown on lower half of sides, nasus yellow; palpi black. Antennae with scape and pedicel light yellow; first flagellar segment yellow medially, both ends weakly darkened, remainder of flagellum black; flagellar segments with longest basal verticils about two-thirds the segment. Head posteriorly obscure yellow.

Thorax above obscure light yellow, praescutum with four yellow stripes, interspaces more orange. Pleura and pleurotergite light yellow. Halteres with stem yellow, base of knob weakly more darkened. Legs with coxae and trochanters yellow; femora black, bases narrowly yellow; tibiae brown, outer ends broadly more blackened; tarsi black; claws very small, curved to the acute tip, without armature. Wings with cells before cord light yellow, beyond cord pale brown to produce a weak dimidiate effect, stigma very slightly darker; veins before cord yellowed, slightly darker in the more darkened apex; outer end of R_{1+2} and areas before stigma and across the base of cell $1st M_2$ and adjoining cells restrictedly whitened; trichia on veins beyond cord excepting R_{1+2} , basad of cord veins glabrous excepting the outer

ends of *M* and *Cu* and the Anals, more extensive on 2nd *A*. Venation: *m-cu* close to fork of *M*₃₊₄, basal section of *M*₁ punctiform or slightly longer (in one paratype).

Basal abdominal tergites yellow, weakly darkened medially, becoming more conspicuous on the second segment; intermediate tergites obscure yellow, dark brown medially, less conspicuous on lateral borders, the outer segments more uniformly dark brown, sternites chiefly yellow. Male hypopygium (Fig. 12) with the tergite, *t*, short and narrow, posterior border broadly yellow, with four very low lobes, as shown; anterior three-fourths of plate darkened, with sparse microscopic setulae. Basistyle, *b*, with ventral lobe, *vb*, bearing long terminal setae. Lobes of ninth sternite, *9s*, conspicuous, appearing as large orange oval paired appendages. Outer dististyle, *od*, long and slender; inner style, *id*, distinctive, unusually stout, the outer apical lobe more slender; dorsal crest including a row of about 12 powerful erect setae at summit of a low narrow lobe, as shown. Eighth sternite, *s*₈, with apical lobe a small median spatulate blade that bears microscopic marginal setulae and very sparse long yellow bristles; surface of plate virtually glabrous, with three or four long yellow setae along outer margins.

Holotype. — ♂, Sebundoi, Ecuador, 2600 meters, September 11-15, 1977 (Peña). Paratypes, ♂, West Sebundoi, 3000 meters, September 11, 1977; ♂, La Alearia, Ecuador, 2700 meters, September 14-15, 1977 (Peña).

The present species is most readily distinguished by the wing pattern and the structure of the hypopygium, especially the conformation and armature of the inner dististyle.

***Tipula (Eumicrotipula) perflavidula*, sp.n.**

General coloration of head and thorax orange, praescutum vaguely patterned; antennae yellow, flagellar segments narrowly blackened basally; halteres yellow; legs yellow, outer tarsal segments black; wings with basal two-thirds clear light yellow, including the veins, cells beyond the cord and the Anals very pale brown; a restricted darkened and white pattern, chiefly along the cord.

Female. — Length about 16.5 mm.; wing 18 mm.; antenna about 3 mm.

Frontal prolongation of head somewhat shorter than the remainder, obscure orange; nasus distinct; palpi brown. Antennae with scape orange, pedicel and proximal two flagellar segments light yellow, succeeding segments yellow, their bases narrowly black. Head dull orange; vertical tubercle low, narrowly silvery on sides.

Pronotum dull orange. Mesonotal praescutum with ground yellow, with two nearly confluent more orange stripes, the lateral stripes narrow; scutum dull orange; scutellum and postnotum lighter yellow. Pleura, including the dorsopleural membrane, dull orange, clearer ventrally. Halteres elongate, light yellow, the elongate knobs slightly darker. Legs with coxae yellow, posterior coxae and all trochanters paler yellow; femora yellow, tips slightly darker; remainder of legs yellow, outer three tarsal segments black. Wings with basal two-thirds, excluding the anal field, clear light yellow, including the veins; cells beyond cord and most of cells *Cu* and the

Anal very pale brown, the bases light yellow, the color continued as narrow seams almost to the ends of both Anal veins; very small to scarcely evident brown clouds at midlength of vein *R*, near ends of veins *Sc*₁ and *R*₁₊₂ in the stigmal area, and especially as a narrow but conspicuous seam on anterior cord and basal section of *M*₂; veins whitened, bases of cells 1st *M*₂ and *M*₃ similarly whitened, contrasting with the dark pattern, remaining veins clear light yellow. Outer veins with long trichia, including the outer radial field and distal ends of all outer median branches; scattered trichia on outer sections of *Cu*₁ and on 2nd *A*, lacking on 1st *A*. Venation: Vein *R*₃ not decurved, straight or slightly upcurved; petiole of cell *M*₁ about two-fifths *m*.

Abdomen basally obscure orange yellow, outwardly chiefly dark brown or brownish black. Ovipositor with valves horn-yellow; cerci straight, long and slender; hypovalvae broader, compressed.

Holotype. — ♀, South Cuenca, Azuay Province, Ecuador; Cordillera Tinajilla, 3100 meters, March 18-20, 1965 (Peña). Allotype, broken ♂, East Papallacta, Ecuador, October 6-8, 1977 (Peña).

Several regional members of the subgenus are generally similar to the present fly, differing especially in details of wing pattern. The most similar of these species are *Tipula (Eumicrotipula) agrippina* Alexander, Ecuador; *T. (E.) amblythrix* Alexander, Peru; *T. (E.) clavaria* Alexander, Peru; *T. (E.) coronaria* Alexander, Ecuador; *T. (E.) euprepia* Alexander, Ecuador; *T. (E.) flavidula* Alexander, Ecuador; *T. (E.) runtunensis* Alexander, and *T. (E.) pulchriflava* sp.n., Ecuador.

***Tipula (Eumicrotipula) pulchriflava*, sp.n.**

Entire body yellow, mesonotal praescutum with four more reddened stripes, eighth abdominal segment brown; antennae of male elongate, slightly more than one-third the wing, proximal three segments light yellow, remainder black, the basal enlargements of the segments more intensely so; halteres yellow; legs chiefly yellow, femoral bases broadly blackened, outer tarsal segments black; wings clear light yellow, costal cells and stigma more saturated yellow, veins yellow, a brown cloud on basal section of vein *M*₂; male hypopygium with both dististyles narrow, with conspicuous setae; eighth sternite glabrous, subtriangular, apex with a narrow straight rod that bears abundant erect setae.

Male. — Length about 19 mm.; wing 18.5 mm.; antenna about 7.5 mm. Palpi black, terminal segment about one-half longer than the penultimate. Antennae with proximal three segments clear light yellow, remainder of flagellum black, the basal enlargements somewhat more intense; segments slightly longer than the verticils. Frontal prolongation of head yellow, with a conspicuous black lateral line; remainder of head yellow, sides of posterior vertex vaguely more darkened.

Pronotum yellow. Mesonotal praescutum light yellow with four more reddish brown stripes, the intermediate pair very inconspicuously bordered by darker;

posterior sclerites of notum yellow. Pleura uniformly yellow. Halteres yellow, the knobs more intensely so. Legs with coxae and trochanters yellow; fore femora with more than the basal third black, remainder paling through brownish yellow to clear yellow; tibiae obscure yellow; proximal two tarsal segments yellowed, apex of second and remaining segments black; claws smooth, with an erect straight basal spine. Wings with cells before cord clear light yellow, cells *C* and *Sc*, with the stigma, more saturated yellow; cells beyond cord and posterior borders of anal cells weakly darkened; a conspicuously darkened cloud over basal section of vein M_2 ; restricted whitened obliterative areas at proximal end of stigma and at base of cell 1st M_2 and outer end of *R*; veins yellow; small inconspicuous trichia on veins beyond cord and at outer ends of both Anal veins. Venation: *Rs* long; petiole of cell *M*, longer than *m*; *m-cu* on M_2 shortly beyond base.

Abdomen yellow, eighth segment brown. Male hypopygium (Fig. 13) with the tergite, *t*, short and narrow, the lateral extensions slender; posterior border nearly transverse, with minute lobes. Dististyles as shown; outer style, *od*, narrowed on basal third, the posterior end about twice as wide, with conspicuous yellow setae, the inner series longer, exceeding the diameter of the blade; inner style, *id*, narrow, apical beak slender, blackened basally; outer margin with a crest of long pale setae. Eighth sternite, *s*, subtriangular, narrowed outwardly, terminating in a straight rod that is covered with short erect setae; main body of sternite glabrous, virtually without setae or punctures.

Holotype. — ♂, Sebundoi, Ecuador, 2600 meters, September 11-15, 1977 (Peña).

This unusually attractive fly is told from other generally similar yellow species by the details of body, wing and antennal coloration and in hypopygial details, especially the dististyles and eighth sternite.

Tipula (Eumicrotipula) subjubilans, sp.n.

General coloration of thorax yellow, conspicuously patterned with polished black, as described; antenna with scape black, pedicel light brown; legs with femora obscure yellow, tips narrowly black; wings yellow, conspicuously variegated with brown, including four darkened areas in cell *Sc* and three in cell *M*; vein R_{1+2} , atrophied the cell narrow; abdomen brownish black, patterned with brownish yellow.

Female. — Length about 10 mm.; wing 11 mm.; antenna about 2.1 mm.

Frontal prolongation of head relatively short, obscure yellow, clearer below; nasus virtually lacking, represented by a small tubercle; palpi black. Antennae with scape black, pedicel light brown; flagellum black, base of first segment paler brown; flagellar segments nearly cylindrical, the basal enlargements reduced, longest verticils shorter than the segment. Head light brown; vertical tubercle small, anterior end weakly emarginate.

Pronotum yellow. Mesonotal praescutum obscure yellow, with three major

polished black areas at the anterior end and on the sides; scutal lobes black, median area narrowly yellow; scutellum yellow, the depressed parascutella more obscure yellow; postnotum polished black. Pleura with dorsopleural membrane, pteropleurite and sternopleurite yellow, the anepisternum narrowly blackened, connecting the wing base with the fore coxae; metapleural region and meron narrowly blackened. Halteres with stem yellow, knob brownish black. Legs with coxae blackened, the small posterior pair obscurely more yellowed; trochanters yellow; femora obscure yellow, tips narrowly black; tibiae and tarsi light brown; claws small, simple. Wings yellow, conspicuously variegated with brown, the yellow color more intense in the costal and subcostal cells, arcular region and as two areas over vein *Cu*; cell *Sc* with four brown areas that are slightly smaller than the yellow ground; cells *R* and *M* pale brown and yellow, the latter with three darkened areas; beyond the cord cells brown, variegated with yellow, including a major area in the subbasal outer radial field and in the bases of the outer median cells; cell *M* with three darkened areas that are more extensive than the ground interspaces, this pattern extended behind into cell *Cu*; cells *Cu* and the Anals chiefly very pale brown variegated by the pale yellow ground; veins in the ground areas, brown in the patterned markings. Macrotrichia on most longitudinal veins beyond the cord, including all radial branches and also veins *M*₁, *M*₂, *M*₃, distal section of *M*₄ and the outer section of *Cu*; Anal veins glabrous excepting four trichia at near midlength of 2nd *A*. Venation: *R*₁₊₂ entirely atrophied, the cell long and narrow; vein *R*₃ straight; petiole of cell *M*₁ about one-half longer than *m*₁; basal section of *M*₄ perpendicular, from about one-third to one-fifth vein *M*₃₊₄.

Abdomen with basal tergite light yellow, remaining tergites chiefly brownish black, the extreme posterior borders narrowly paler brown or brownish yellow; sternites black, posterior borders more broadly brownish yellow. Ovipositor with genital shield and the long slender cerci horn yellow, nearly straight, bases of hypovalvae polished black.

Holotype. — ♀, East Papallacta, Ecuador, October 6-8, 1977 (Peña).

The more similar regional species include *Tipula (Eumicrotipula) jubilans* Alexander and *T. (E.) nolens* Alexander, both from Ecuador. The former has vein *R*₁₊₂ preserved while the latter has it atrophied, as in the present fly. All three species differ in body coloration as described under their individual accounts.

LIMONIINAE

Epiphragma (Epiphragma) delectabilis, sp.n.

Thoracic dorsum light brown, more darkened posteriorly, pleura chiefly blackened, including a broad dorsal stripe; halteres and legs yellow; wings yellow, more saturated along the costal border; a conspicuous darkened pattern, including ocelliform marks in cells *R* and *M*; two darkened marks beyond midlength of cell

Cu, not in transverse alignment with the ocellate area at origin of *Rs*.

Female. — Length about 11 mm.; wing 10.5 mm. Rostrum light brown; palpi intensely black. Antennae slender; scape and pedicel yellow, basal segments of flagellum very pale brown, the elongate outer segments black. Head above yellowish brown, darker ventrally; front chestnut brown, irregularly elevated.

Pronotum narrowly orange anteriorly with a delicate darkened central line. Mesonotal praescutum anteriorly light brown, more pruinose posteriorly, with a delicate capillary blackened median line, sides narrowly but conspicuously blackened; scutal lobes brownish pruinose, narrowly blackened medially; scutellum brownish pruinose; postnotum reddish brown. Pleura chiefly blackened, including a broad dorsal stripe, ventrally patterned with light brown. Halteres clear light yellow. Legs with fore coxae light brown, yellowed apically, remaining coxae black; trochanters yellowed; remainder of legs light yellow, outer two tarsal segments vaguely darkened; claws very small, narrowed into acute points. Wings with ground yellow, costal border more saturated yellow; darkened wing pattern unusually reduced in cells *C*, *Sc*, *R* and *M*, including ocelliform markings in cells *R* and *M*, centering at arculus, origin of *Rs* and the anterior cord, the markings narrowed anteriorly, especially in cell *C*; supernumerary crossvein in cell *C* conspicuously darkened, beyond the cord with conspicuous marginal brown areas, smallest at wing apex; a circular area at fork of *M*_{1,2}, its center darker; cell *Cu* with two conspicuous approximated brown spots at near two-thirds the length, not in alignment with the ocellus at origin of *Rs*; cell *1st A* and *2nd A* with transverse lines, additional to larger spots at ends of the veins; additional to the darker wing pattern longitudinal pale brown seams over vein *Rs*, all outer medial branches and at outer end of *M*; broader and more conspicuous similar clouds over vein *Cu* and the basal two-thirds of the cell; veins yellow in the ground areas, darker in the brown pattern, especially the origin of *Rs*, cord and outer end of cell *1st M*₂. Venation: *Rs* long-spurred at origin; basal section of vein *M*₃ about twice *m*.

Abdominal tergites chiefly medium brown, proximal segments basally narrowly yellowed; basal sternites darkened, the outer ones patterned with obscure yellow at apex and subbasally. Ovipositor with basal plate yellowed, darker apically; hypovalvae and cerci more horn-yellow.

Holotype. — ♀, Cuenca-Grl Plaza, Ecuador, 2200-2400 meters, October 18-19, 1977 (Peña).

This unusually attractive species of the genus is most similar to *Epiphragma* (*Epiphragma*) *delicatula* Osten Sacken, of Venezuela and Colombia, differing evidently in coloration, especially the wings.

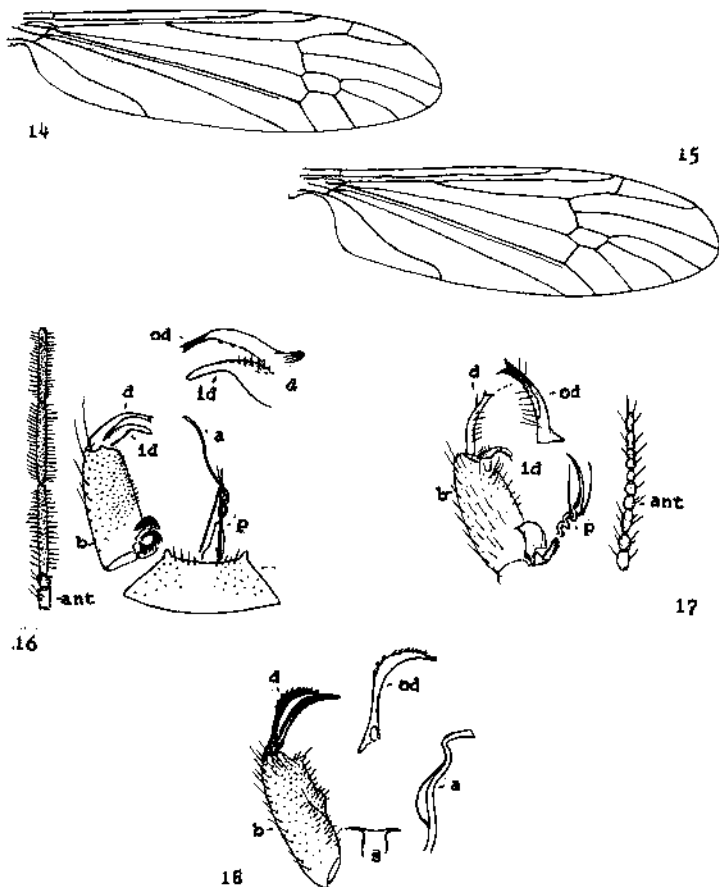
***Shannonomyia multisetosa*, sp.n.**

Head and thorax dark brown, pleura paler; antennae of male very long, exceeding three-fourths the length of the wing, flagellar segments with abundant erect setae; wings medium brown, stigma darker; male hypopygium with tergite transverse,

posterior border nearly truncate, the lateral angles extended into small lobules.

Male. — Length about 5.2 mm.; wing 5.5 mm.; antenna about 4.3 mm.

Rostrum dark brown; palpi black. Antennae (Fig. 16) elongate, black throughout; scape and pedicel unusually small; flagellar segments very long-cylindrical, the first longest, progressively shorter outwardly, terminal segments very small, oval; flagellar segments with abundant erect black setae over their entire length, the setae of the intermediate and outer segments longer and more con-



FIGURES 14-18. — 14. *Rhabdomastix laneana* sp.n., venation. 15. *Rhabdomastix caparaoensis* sp.n.; venation. 16. *Shannonomyia multisetosa* sp.n.; antenna, male hypopygium. 17. *Shannonomyia exilipes* sp.n., male hypopygium. 18. *Atarba (Atarba) sigmoidea* sp.n., male hypopygium.

spicuous, the longest exceeding one-fourth the length of the segment; additional to the major setae with numerous microscopic setulae. Head dark brown, sparsely pruinose.

Thoracic dorsum dark brown, paler laterally, especially the praescutum. Pleura and posterior notum paler, more brownish yellow, clearer yellow ventrally. Halteres with stem pale, knob weakly darkened. Legs with fore coxae darkened; remaining coxae and trochanters yellowed; femora dark brown, paler basally, remainder of legs dark brown; claws long and very slender. Wings medium brown, stigma darker brown; veins brown. Longitudinal veins beyond the general level of origin of *Rs* with abundant trichia. Venation: *Sc* relatively short, *Sc*₁ ending about opposite four-fifths *Rs*, *Sc*₂ subequal; elements of cord in transverse alignment, *m* arcuated; *m-cu* at near two-thirds cell 1st *M*₂.

Abdomen dark brown, ninth segment more brownish yellow. Male hypopygium (Fig. 16) as shown; outer dististyle, *od*, with apex bidentate. Aedeagus, *a*, long and strongly sinuous as in the genus. Ninth tergite, *t*, transverse; posterior border nearly truncate, lateral angles produced into very small lobules.

Holotype. — ♂, Reventador, Ecuador, 1750 meters, October 3-5, 1977 (Peña).

The present fly is most readily distinguished by the male antennae, as described and figured. Among the approximately 80 regional members of the genus presently known a few have lengthened antennae but are distinct in the vestiture of the flagellar segments. Species having the antennae very long include *Shannonomyia dampfi* Alexander, Mexico; *S. myersiana* Alexander, Jamaica, and *S. nudipennis* Alexander, Jamaica, the extreme length being in *myersiana*. Several other species have somewhat shorter antennae. It may be noted that in contrast with the few species with long antennae an even greater number have the organ unusually short, much smaller than is found in allied genera.

Shannonomyia (Roraimomyia) exilipes, sp.n.

Wings and halteres lacking; general coloration of entire body brown to brownish gray; antenna of male 10-segmented, intermediate flagellar segments globular, slightly shorter than the verticils; legs long and slender, all tibiae longer than the femora; male hypopygium with the outer dististyle setiferous, apex bidentate.

Male. — Length about 6.5 mm; antenna about 0.65 mm. Rostrum brownish gray; palpi black. Antenna (Fig. 17) apparently with only ten segments, black throughout; intermediate flagellar segments globular, slightly shorter than the verticils. Head brownish gray; eyes unusually small, posterior vertex broad.

Thorax brown, very sparsely pruinose. All dorsal sclerites consolidated, the sutures not or scarcely evident, including the one between the pronotum and mesonotum. Both the wings and halteres entirely atrophied. Legs long and

slender; coxae and trochanters relatively large, brownish yellow; remainder of legs long and slender; femora light brown, tips more blackened; tibiae and tarsi black; all tibiae longer than the femora.

Abdominal tergites dark brown, proximal sternites slightly paler brown. Male hypopygium (Fig. 17) with the outer dististyle, *od*, setiferous, apex bidentate, the points subequal. Phallosome, *p*, with the aedeagus sigmoid, as in the genus.

Holotype. — ♂, Azuay Province, south of Cuenca, Cordillera Tinajillas, Ecuador, 3200 meters, March 15, 1965 (Peña).

The name *Roraimomyia* Alexander (Ann. Ent. Soc. America, 28: 323; 1935) was proposed as a subgenus of *Limnophila* Macquart but now is placed in *Shannonomyia* Alexander, chiefly based on hypopygial characters. The two presently known species differ from all other Tipulidae at present known in the total loss of both the wings and halteres. Other genera in the family, such as *Chionea* Dalman, 1816, that have lost the wings have well-developed halteres. The present fly differs from the subgenotype, *permonstrata* Alexander, from Mount Roraima, in extreme northern Brasil, in structural characters, including the antennae and the elongate legs.

Atarba (Atarba) sigmoidea, sp.n.

General coloration of thorax brownish yellow, patterned with darker brown, ventral pleurites clear yellow; antennae relatively long, flagellum black, vestiture of segments short, the punctures very dense; wings chiefly yellowish brown to pale brown, stigma darker; longitudinal veins beyond the cord with abundant trichia; male hypopygium with lateral angles of tergite slender; outer dististyle with about ten slender subappressed spines; aedeagus long, strongly arcuated to sigmoid, upper margin at near midlength with a long flattened crest.

Male. — Length about 6.5 mm.; wing 7.1 mm.; antenna about 2.8 mm.

Rostrum dark brown; palpi black. Antennae with scape and pedicel obscure yellow, flagellum black; proximal flagellar segments long-cylindrical, the outer ones progressively shorter; normal vestiture short, very abundant, punctures dense; each outer segment with one or two longer verticils that are shorter than the diameter of the segment. Head brownish gray.

Pronotum obscure yellow. Mesonotal praescutum obscure brownish yellow, the slightly darker stripes barely differentiated; scutal lobes darker brown; scutellum obscure yellow, postnotum darker. Pleura dorsally narrowly brown, ventral sclerites clear yellow. Halteres with stem yellow, with long erect setae, knob brown. Legs with coxae and trochanters light yellow; femora yellow, clearer basally, outer ends light brown; tibiae and tarsi obscure yellow, tips narrowly darkened, outer tarsal segments dark brown. Wings with prearcular region yellowed, remainder of disk yellowish brown to pale brown; stigma brown; vague paler brown clouds over

anterior cord and along vein *Cu*; veins light brown, yellowed in prearcular field. Longitudinal veins beyond cord with abundant trichia, lacking on the elements comprising cell *1st M*, excepting vein *M*₃₊₄; vein *2nd A* with trichia on outer three-fourths, *1st A* with two or three near tip. Venation: *Sc*₁ ending opposite origin of *Rs*; *m-cu* about one-fourth its length beyond the fork of *M*.

Abdomen brown, subterminal segments darker; hypopygium brownish yellow. Male hypopygium (Fig. 18) with the outer angles of the sternite, *s*, produced laterad into slender straight spines. Outer dististyle, *od*, blackened, before midlength slender, thence widened and curved, outer margin of distal half with about ten or eleven slender subappressed spines, as shown; inner style somewhat longer, narrow, boomerang-shaped. Aedeagus, *a*, distinctive, subequal to or longer than the basistyle, strongly arcuated to sigmoid, at near midlength on upper margin with a long flattened expansion or crest.

Holotype. — ♂, Tarqui, Ecuador, 2800 meters, March 16, 1965 (Peña).

The present fly is most readily distinguished by hypopygial characters, including the outer dististyle and aedeagus. Other somewhat similar species include *Atarba (Atarba) quasimodo* Alexander, Venezuela; *A. (A.) pallidapex* Alexander, Peru; *A. (A.) religiosa* Alexander, Mexico, and some others.

***Rhabdomastix laneana*, sp.n.**

General coloration of body dark brown; antennae of female short, first flagellar segment subequal in length to the combined second and third segments; wings light brown, costal border and stigma darker brown; macrotrichia on certain veins, including *R*₄ and *R*₅; veins *R*₁₊₂ and *R*₃ widely separated at margin, the distance nearly twice vein *R*₃.

Female. — Length about 7 mm.; wing 7 mm.; antenna about 1.2 mm.

Rostrum and palpi black. Antennae with scape and pedicel dark brown, flagellum paler, especially outwardly; first flagellar segment subequal in length to the combined segments two and three; remaining segments long-oval; terminal segment longer than the penultimate. Head dark brown, very sparsely pruinose; eyes small, anterior vertex very broad.

Pronotum dark brown. Mesonotal praescutum and scutal lobes brown, posterior notal sclerites darker. Pleura brown, paler ventrally. Halteres dark brown. Legs with coxae and trochanters yellow; remainder of legs brown; outer two tarsal segments subequal in length. Wings (Fig. 14) light brown, costal border and stigma darker brown; veins brown. Macrotrichia on certain veins, including about six on *R*₄, abundant and crowded on *R*₅; trichia on distal sections of *M*₁₊₂ and *M*₃, very sparse on *M*₄ and distal section of *Cu*₁. Venation: Veins *R*₁₊₂ and *R*₃ widely separated at margin, the distance on costa nearly twice vein *R*₃; in *caparaoensis* (Fig. 15) veins *R*₁₊₂ and *R*₃ more approximated, the distance about one-half vein *R*₃.

Abdomen dark brown.

Holotype. — ♀, Campos do Jordao, São Paulo, Brasil, 4800 feet, December 1945 (John Lane).

The most similar regional species is *Rhabdomastix caparaoensis* Alexander, described from Minas Geraes, Brasil, the two flies differing evidently in the venation and trichiation of the veins in the radial field (Fig. 15, *caparaoensis*). The wide separation of veins R_{1+2} and R_3 in *laneana* should be emphasized.

Gnophomyia (Gnophomyia) platystyla, sp.n.

General coloration of entire body black, head and thorax more pruinose; halteres and legs blackened; wings faintly infuscated, extreme base yellowed, the darkened stigma restricted to outer end of cell C; male hypopygium with the outer dististyle broadly flattened, including the outer end.

Male. — Length about 8-9 mm.; wing 7-8 mm.; antenna about 2-2.1 mm.

Rostrum, palpi and antennae black, the last having the outer flagellar segments elongate, exceeding their verticils. Head black, pruinose.

Thorax with mesonotal praescutum, scutum and postnotum dark plumbeous to blackened, pronotal angles restrictedly clear light yellow; scutellum light gray pruinose. Pleura blackened, sternopleurite and meron more gray pruinose. Halteres blackened. Legs with coxae black, pruinose, trochanters black; remainder of legs dark brown to brownish black. Wings faintly darkened, extreme base yellowed; stigma more blackened, restricted to outer end of cell C between veins Sc_1 and R_{1+2} ; veins black. Venation: *r-m* near extreme outer end of R_5 ; *m* with a short spur projecting into cell *1st M*₂, in the holotype specimen this being at the angulation of vein M_3 .

Abdomen black. Male hypopygium (Fig. 19) with the outer dististyle, *d*, broadly flattened, including the outer end, glabrous; inner style, *id*, with relatively long erect setae on outer fourth.

Holotype. — ♂, Junction of Coca and Napo Rivers, Ecuador, April 30, 1965 (Peña). Paratypes, 2 ♂♂, Pompeya, Ecuador, May 1965 (Peña).

The present fly is generally similar to other regional species, including *Gnophomyia (Gnophomyia) lata* Alexander and *G. (G.) latilobata* Alexander, both from Peru, all differing from the others in hypopygial structure, especially the conformation of the outer dististyle. *G. (G.) latissima* Alexander, Ecuador, has the outer dististyle somewhat as in the present fly, differing in other hypopygial details, especially the inner dististyle and phallosome, and in the coloration of the body, legs and wings.

Gonomyia (Progonomyia) melampodia, sp. n.

Head light gray; thorax chiefly blackened; legs black; wings whitened subhyaline with a restricted darker pattern, including the very small brown stigma; petiole of cell R_3 (R_{2+3+4} and R_{3+4}) subequal in length, R_2 erect; $m-cu$ near the fork of M ; male hypopygium with posterior border of tergite extended into a conspicuous blackened lobe; three dististyles present.

Male. — Length about 6 mm.; wing 6.9 mm.

Female. — Length about 7 mm.; wing 7.2 mm.

Rostrum and palpi black. Antennae black throughout; flagellar segments oval. Front light gray, anterior vertex weakly darkened, remainder of head light gray.

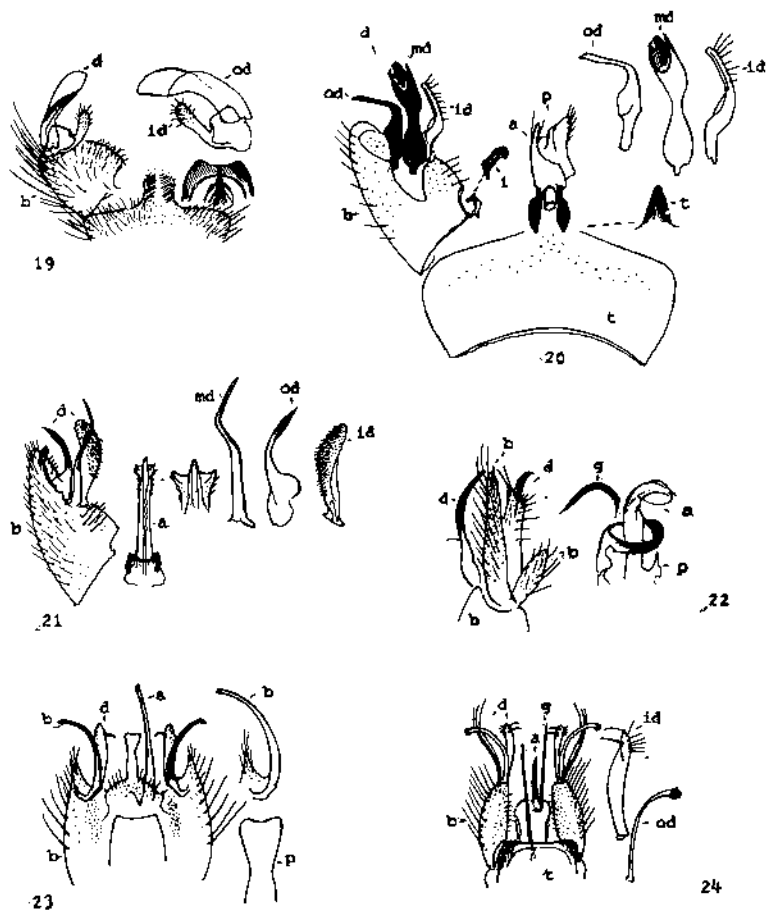
Pronotum black, medially sparsely pruinose; scutellum light yellow, central part weakly darkened. Mesonotal praescutum chiefly covered by four confluent brown stripes, separated by capillary black lines; posterior sclerites of notum clear light gray; postnotal mediotergite blackened posteriorly, pleurotergite chiefly blackened, anterior portion paler. Pleura black, heavily light gray pruinose, variegated by yellow areas on the dorsal sternopleurite and more extensively on the ventral pteropleurite and meral region; dorsopleural membrane narrowly clear light yellow. Halteres with stem obscure yellow, knob brownish black. Legs with coxae and trochanters black, sparsely gray pruinose; remainder of legs black. Wings whitish subhyaline with a restricted darker pattern, including the very small oval stigma; paler brown washes over basal half of vein Cu , involving both cells M and Cu ; a darkened spot over the angulated base of Rs , more evident in the allotype, a very narrow darkening over the cord; veins brownish black. Longitudinal veins beyond level of origin of Rs with trichia, including also the outer portions of both anal veins. Venation: Sc_1 ending opposite or shortly beyond origin of Rs (in type), Sc_2 retracted, more so in the type, Sc_3 correspondingly long; Rs with the base erect, spurred at bend, longer in the allotype; R_{2+3+4} subequal in length to the erect vein R_2 and R_{3+4} beyond, being placed close to midlength of the anterior branch (stem of cell R_3); petiole of cell 2nd M_2 subequal to or slightly shorter than M_{1+2} ; $m-cu$ at or slightly before the fork of M .

Abdomen in both sexes black throughout. Male hypopygium (Fig. 20) with the ninth tergite, t , about one-third larger than the basistyle, transverse, posterior border nearly straight, at midline produced into a conspicuous blackened lobe, t , in subfigure. Three dististyles, d , as shown, the middle lobe, md , dilated on outer half, terminating in three spines and flattened blades. Interbase, i , very small, as shown. Phallosome, p , short and stout, differing from most other species in the subgenus.

Holotype. — East Papallacta, Ecuador, October 6-8, 1977 (Peña). Allotype, ♀, with the holotype.

The present fly is distinct in the body and leg coloration, in the venation, especially the radial field, and in the male hypopygium, including the dististyles and the phallosome. In the venation and general features of the hypopygium it is somewhat as in *Gonomyia*

(*Progonomyia*) *hyperplatys* Alexander, likewise from Ecuador, but is distinct.



FIGURES 19-24. — 19. *Gnomyia* (*Gnomyia*) *platystyla* sp.n., male hypopygium. 20. *Gnomyia* (*Progonomyia*) *melampodia* sp.n.; male hypopygium. 21. *Gnomyia* (*Progonomyia*) *tridens* sp.n.; male hypopygium. 22. *Gnomyia* (*Gnomyia*) *napoensis* sp.n., male hypopygium. 23. *Gnomyia* (*Lipophleps*) *basistylata* sp.n., male hypopygium. 24. *Gnomyia* (*Lipophleps*) *insolita* sp.n., male hypopygium.

Gonomyia (Progonomyia) tridens, sp.n.

Size relatively large (wing about 7 mm.); head and thorax gray, patterned with brown; conspicuous yellow areas on pronotum, pretergites, posterior mesonotal sclerites and especially as a conspicuous stripe on the pleura; legs brown, blackened outwardly; wings subhyaline to pale brown, stigma very slightly darker; *Sc*, ending about opposite basal third of *Rs*, *R*₂ faintly indicated; abdominal tergites dark brown, sternites and hypopygium paler brown; male hypopygium with three subapical dististyles, as described and figured; aedeagus diagnostic, long and slender, near apex on either side with a subtriangular flange, the apex appearing tripartite, suggesting the specific name.

Male. — Length about 6-6.5 mm.; wing 6.8-7.3 mm.

Female. — Length about 7 mm.; wing 7 mm.

Rostrum and palpi black. Antennae with scape dark brown, remaining segments black; flagellar segments oval, progressively narrower outwardly, those of the outer half linear. Head gray, the mid vertex extensively pale brown.

Pronotum obscure yellowish gray, with a narrow dark brown median line; pretergites yellow. Mesonotum light gray, praescutum with a broad brown median line, lateral stripes and areas on the scutal lobes much paler brown, the lower apical angles light yellow; scutellum with mediotergite gray basally, posterior border and parascutella obscure yellow; postnotum gray medially, anterolateral area of mediotergite light yellow, dorsal pleurotergite more obscure yellow. Pleura gray, with a broad longitudinal light yellow stripe on dorsal sternopleurite and lower metapleura. Halteres with stem obscure yellow, knob dark brown. Legs with coxae dark brown, pruinose; trochanters paler brown; femora and tibiae brown, tarsi black. Wings very pale brown to subhyaline, stigma very slightly darker; veins dark brown. Longitudinal veins beyond general level of origin of *Rs* with numerous trichia; both Anal veins with trichia on outer third or fourth. Venation: *Sc*, ending near basal third or fourth of *Rs*; vein *R*₂ faintly indicated, beyond midlength of petiole of cell *R*₃; *m-cu* before fork of *M*.

Abdominal tergites dark brown, sternites and male hypopygium paler brown. Male hypopygium (Fig. 21) with the basistyle, *b*, produced beyond the area of insertion of the dististyles, before the obtuse apex with a slender sclerotized rod, as shown. Three dististyles, *d*, as shown; outer style, *od*, a slender slightly curved rod from a dilated base, apex blackened, sharply pointed; intermediate style, *md*, longest, appearing as a slender rod, gently bent into three sections, narrowed to a point; inner style, *id*, stout, the surface with abundant short retrorse spinoid setae. Aedeagus, *a*, long and slender, before apex on either side extended into a subtriangular flange, provided with sparse setae, the apex appearing tripartite, suggesting the specific name.

Holotype. — ♂, North Perucho, Ecuador, September 18-19, 1977 (Peña). Allotopotype, ♀, pinned with one paratype. Paratopotypes, one ♂, pinned with allotype; one ♂, with holotype.

The present fly is most readily distinguished by hypopygial characters, including the tripartite apex of the aedeagus, as described and figured.

Gonomyia (Gonomyia) napoensis, sp.n.

General coloration of thoracic dorsum and abdomen dark brown; wings pale brown, stigma very slightly darker; veins R_s and R_{2+3+4} long, cell M_2 open by atrophy of basal section of vein M_3 ; male hypopygium as described and figured.

Male. — Length about 4.4 mm.; wing 4.3 mm.

Female. — Length about 4.5 mm.; wing 4.4 mm. Rostrum obscure yellow; palpi black. Antennae relatively long, black. Head anteriorly light yellow, darker behind.

Pronotum above pale yellow or whitened, dark brown on sides; pretergites white. Mesonotum almost uniformly brownish black, praescutal borders narrowly white. Pleura dark brown above, ventral half yellowish brown. Halteres elongate, stem brown, knob black. Legs with coxae and trochanters yellowed; remainder black. Wings pale brown, stigma very slightly darker; veins dark brown. Venation: Sc_1 ending about opposite origin of R_s ; R_{2+3+4} unusually long, only slightly shorter than R_s ; R_3 oblique, about one-fourth R_4 ; cell M_2 open by atrophy of basal section of M_3 ; $m-cu$ shortly before fork of M .

Abdomen above dark brown, sternites slightly paired. Male hypopygium (Fig. 22) with the basistyle, b , terminating in two conspicuous setiferous lobes, the outer one elongate, subequal to the longest dististyle. Dististyles, d , about as figured, the long outer style gently curved on distal half, outer margin before midlength with a single strong seta. Phallosome, p , complex, as shown; basal sheath with two conspicuous apophyses (one shown detached, g); apex of aedeagus expanded.

Holotype. — ♂, Junction of Coca and Napo Rivers, Ecuador, April 27, 1965 (Peña). Allotopotype, ♀, with the type.

There are only about half a dozen species among the Neotropical Gonomyias that have cell M_2 of the wings open as in the present fly, these including *Gonomyia (Gonomyia) anserina* Alexander, Peru; *G. (G.) basispina* Alexander, Panama; *G. (G.) illicis* Alexander, Argentina; *G. (G.) je juna* Alexander, Peru; *G. (G.) remigera* Alexander, Mexico, and *G. (G.) tuberculata* Alexander, Mexico, all being most readily distinguished from the present fly by hypopygial structure. Also, the venation with the unusually long R_{2+3+4} is significant.

Gonomyia (Lipophleps) basistylata, sp.n.

Rostrum orange yellow; antennae black, scape large, oval; mesonotum chiefly gray, scutellum light yellow; pleurotergite and pleura light yellow, the latter patterned with brownish gray; legs brownish black; wings pale brown; male hypopygium

with outer apical angle of basistyle produced into an acute point, together with a long gently curved darkened arm that exceeds the dististyle in length.

Male. — Length about 5 mm.; wing 5 mm. Rostrum orange yellow; palpi black. Antennae intensely black; scape very large, oval; verticils of proximal flagellar segments long. Head gray.

Pronotum light yellow. Mesonotal praescutum and scutal lobes uniformly dark gray, central area of scutum paler gray; a small yellow area on posterior border of each scutal lobe; scutellum clear light yellow, with a central brown spot at base; postnotal mediotergite gray, pleurotergites light yellow, continuous with a dorsopleural membrane. Pleura light yellow, restrictedly patterned dorsally with darker, with a brownish gray area on anepisternum; lower darkenings include the meron and ventral sternopleurite. Halteres with base of stem yellow, remainder broken. Legs with fore coxae brown, remaining coxae light yellow; trochanters yellowish brown; remainder of legs brownish black. Wings pale brown, base and costal cells narrowly light yellow; no stigmal darkening; veins light brown. Sparse macrotrichia on *R*, longer and more numerous on *R*₁; veins before cord chiefly without trichia, present on outer ends of both Anal veins; beyond cord a few trichia on outer end of vein *R*₃, more numerous on other outer veins. Venation: *Sc*, ending shortly before origin of *Rs*; cell 1st *M*₂ narrowed at base; *m-cu* at fork of *M*.

Abdomen brown, the large hypopygium more yellowish brown. Male hypopygium (Fig. 23) with the tergite relatively small, broad basally, narrowed outwardly, apex truncated. Basistyle, *b*, with outer angle produced into an acute point, on inner side at its base with a long gently curved darkened arm that is longer than the dististyle, the apex subobtusate, blackened. Dististyle, *d*, elongate, before apex with an erect modified seta.

Holotype. — ♂, Loja - Malacatos, Ecuador, 1900 meters, August 21-22, 1977 (Peña).

The present species is most readily distinguished by the hypopygial structure. *Gonomyia (Lipophleps) diacanthophora* Alexander, Peru, has the hypopygial structure generally the same but with the details quite distinct.

***Gonomyia (Lipophleps) insolita*, sp.n.**

General coloration of thoracic dorsum black, scutellum yellow; pleura brownish gray with a broad yellow longitudinal stripe; halteres light yellow; legs dark brown; abdomen yellow, the tergites medially broadly brown; male hypopygium with basistyle elongate, at apex with two long dististyles; phallosome with aedeagus and apophyses long, spinelike.

Male. — Length about 5 mm.; wing 5 mm. Rostrum yellow, palpi black. Antennae black; flagellar verticils very long. Head gray.

Mesonotal praescutum black, dark gray pruinose; scutum gray; scutellum light yellow, parascutella black; postnotal mediotergite brownish black, pleurotergites and dorsal pteropleurite yellow; dorsopleural membrane light yellow. Pleura brownish gray, paler on metapleura, with a broad light yellow longitudinal stripe.

Halteres light yellow. Legs with coxae and trochanters yellow; remainder of legs dark brown. Wings faintly darkened, especially the stigmal region; veins brown. Venation: *Sc*, ending shortly before origin of *Rs*.

Abdomen with tergites brown medially, the lateral margins and the sternites yellow. Male hypopygium (Fig. 24) distinctive. Tergite, *t*, with posterior border nearly truncate, outer lateral angles with abundant short setae. Basistyle, *b*, elongate, narrowed to the truncated outer end where the two dististyles, *d*, are placed; outer style, *od*, longer, slender, at apex with microscopic setulae; inner style broader, the usual two modified setae present. Outer end of basistyle with three very long setae that exceed the dististyles in length, as shown. Phallosome with the long needlelike aedeagus *a*, and a very similar apophysis, *g*.

Holotype. — σ , Cuenca-Grl Plaza, Ecuador, 2200-2400 meters, October 18-19, 1977 (Peña).

Generally similar to species such as *Gonomyia (Lipophleps) senaria* Alexander, Bolivia, Peru and some others, differing from all in hypopygial structure, especially the styli. The exact homologies of the two so-called dististyles are uncertain, one perhaps being an apical lobe of the basistyle, as in *Gonomyia (Lipophleps) basistylata* Alexander, as described and figured in this paper (Fig. 23).