

# Revisions of the *Drosophila macroptera* and *D. rubrifrons* species groups, with description of a new Neotropical group (Diptera, Drosophilidae)

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## Revisions of the *Drosophila macroptera* and *D. rubrifrons* species groups, with description of a new Neotropical group (Diptera, Drosophilidae).

CARLOS R. VILELA<sup>1</sup> & GERHARD BÄCHLI<sup>2</sup>

The species belonging to the *Drosophila macroptera* and *D. rubrifrons* species groups, both in the subgenus *Drosophila*, are redescribed and their male terminalia illustrated. Additionally, six new species of New World drosophilids are described: two in the *Drosophila rubrifrons* species group (*Drosophila popayan* sp. nov., from the Department of Cauca, Colombia, and the Province of Chiriquí, Panama, and *Drosophila xalapa* sp. nov., from the State of Veracruz, Mexico), three in the *Drosophila morelia* species group, new group (*D. carioca* sp. nov. and *D. fluminensis* sp. nov., both from the States of Rio de Janeiro and São Paulo, Brazil, and *D. morelia* sp. nov., from the State of Michoacán, Mexico, and the Province of Chiriquí, Panama) and one in the genus *Hirtodrosophila* (*Hirtodrosophila cowani* sp. nov., from the State of Michoacán, Mexico).

Keywords: *Hirtodrosophila*, male terminalia, Nearctic region, Neotropical region, new species.

### INTRODUCTION

The starting point for this revision was the discovery, among some drosophilid flies collected in Mexico by Bernhard Merz, of a male and a female specimens of *Drosophila* bearing a small, but distinct marginal wing cloud below apex of R<sub>2+3</sub> vein. In the key to Mexican species of *Drosophila* by Patterson & Mainland (1944) they run to the *Drosophila rubrifrons* species group. However, a clearcut decision was impossible, because some key characters as well as all available descriptions were found to be ambiguous. Subsequently, aiming to make a direct comparison we have tried to get all identified specimens belonging to the *rubrifrons* group from the National Museum of Natural History (Washington, D.C.). Afterwards, a similar loan was received from the American Museum of Natural History (New York). Soon we realized that, in some cases, among a series of specimens received from both museums as supposedly belonging to a given species a mixture of two or more species was included and only a revision of the *rubrifrons* group could solve the problem.

While the revision of the *rubrifrons* group was on the way it became clear to us that some species of the *macroptera* and the *rubrifrons* groups share many features, e.g. wing markings and abdominal pattern, and only an additional revision of the *macroptera* species group was supposed to allow clear-cut identifications. Accordingly, new loans were obtained from both museums. Some of the specimens received from the AMNH, e.g. the holotype of *Drosophila nubiluna* Wheeler, 1949, were preserved in microscope slide mounts.

Wheeler (1949), at the end of his description of *Drosophila nubiluna*, which belongs to the *rubrifrons* species group, mentioned that he had found one male speci-

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men closely related to this species, but differing in some characters. Even without proposing a formal binomial, he made a description based on this single male specimen. After checking the slide mount of the terminalia of that specimen as well as the terminalia of two additional ones housed in the American Museum of Natural History, found among pinned specimens previously identified as *D. uninubes*, we have been convinced that those three specimens did not belong either to the *rubrifrons* group or to the closely related *macroptera* group. Instead, they have quite distinct male terminalia, which apparently are not related to any of the recognized groups of species of *Drosophila* occurring in the New World.

Moreover, among specimens collected by Prof. H. Burla in Brazil and deposited in the Zoologisches Museum der Universität Zürich (Switzerland), we have found specimens of two closely related species which, together with the three specimens of the American Museum of Natural History, form a cluster of three undescribed species. Accordingly, a new group, the *morelia* species group, has been established for them. Whereas the species belonging to the *morelia* species group are distributed from Mexico to Brazil, those of the other two groups have been recorded in a rather restricted areas either of southwestern United States and Mexico (*macroptera* group) or from southern Mexico through Central America reaching northern South America (*rubrifrons* group).

As we will show below, the species belonging to the *macroptera* and *rubrifrons* groups are clearly closely related to each other, but they do not seem to be so close to the species of the *morelia* group; however, due to overlapping characters and individual variability, for most of them a clearcut distinction based on external morphology is very difficult.

Unfortunately, we were unable to localize all type specimens of the species ascribed to both the *macroptera* and *rubrifrons* species groups. Thus, as various descriptions and keys do not allow final decisions, the identities of some species still remain uncertain.

#### MATERIAL AND METHODS

The two previously recognized groups of species as well as the binomials under them are alphabetically arranged. The new group proposed herein is treated at the end, before the description of one species tentatively included in the genus *Hirtodrosophila*.

Label data attached to each specimen are cited in full with a slash indicating a label change; a backslash (\) indicates a true slash, to differentiate it from a label change. Our own notes or interpretations are included in brackets (also in other items throughout the text). Spellings of localities are based on several actual maps.

For preparations of microscope slides, illustrations, measurements, indices as well as morphological terminology see Vilela & Bächli (2000). Whenever in the same plate, all line drawings were drawn to the same scale and all photomicrographs were taken and enlarged to the same magnification.

In the item “distribution”, whenever known, directly (from the literature and/or labels) or indirectly (from search on maps), states or equivalents are cited in parentheses, following the respective countries.

Some terminalia were originally preserved as slide mounts, which were dismounted whenever necessary. First, the labels were removed by placing the slide in a Petri dish filled with water, where they were kept during enough time to the labels to be taken off. Then, after drying, the slide was placed in a dry Petri dish and xylene

was added along the margins of the coverglass, where it remained long enough for the Canada balsam to be dissolved. From time to time the partially dissolved balsam was removed with the aid of a piece of filter paper, when additional drops of xylene were added to the margins of the coverglass until it could be removed. Then, the terminalia were transferred to a depression slide containing a drop of creosote, where they were disarticulated with the aid of a pair of minuten pins, inserted into wood chopsticks, and the sclerites placed afterward in microscope slides with Canada balsam to be later used for preparing the illustrations. Refer to Vilela & Bächli (2000) for further details.

For the specimens previously dissected and having the terminalia preserved in a small piece of glycerin jelly, the medium was easily dissolved by placing the piece in cold KOH 10 % for a few minutes.

The analyzed specimens are deposited in the American Museum of Natural History, New York, USA (AMNH), the National Museum of Natural History, Washington D.C, USA (USNM), and the Zoologisches Museum, Universität Zürich-Irchel, Zürich, Switzerland (ZMUZ).

### **Genus *Drosophila* Fallén, 1823**

#### **Subgenus *Drosophila* Fallén, 1823**

#### ***Drosophila macroptera* species group**

*Drosophila macroptera* group Patterson 1943: 183 (diagnosis); Hsu 1949: 113 (male terminalia); Wheeler 1949: 188 (species included); Patterson & Stone 1952: 40 (diagnosis); Throckmorton 1962: 224, 240, 241, 268, 276, 286, 318 (phylogeny); Throckmorton 1975: 425, 449, 461 (phylogeny).

*Species included* (5). *D. alafumosa* Patterson & Mainland, in Patterson, 1943; *D. aurea* Patterson & Mainland, 1944; *D. macroptera* Patterson & Wheeler, 1942; *D. magnabadia* Patterson & Mainland, in Patterson, 1943; *D. submacroptera* Patterson & Mainland, in Patterson, 1943.

*Diagnosis* (mostly updated from Patterson 1943). Reddish grey flies; sterno-index 0.6 to 0.7; anterior scutellar setae divergent; crossveins clouded; two long tangled posterior diverticula on ejaculatory sac; ventral receptacle rather short with irregular coils; wings generally long and narrow; in most species, epandrium, surstyli and cerci devoid of microtrichia, the latter being ventromedially slightly fused to each other and anteriorly connected to epandrium by membranous tissue; surstyli dorsoanteriorly heavily sclerotized; dorsal arch of hypandrium present, although mediodistally membranous; gonopods expanded outwards in the median region, when observed in posterior view.

*Comments.* The species of the *macroptera* group share many external characters; except of *D. magnabadia*, which differs from the others by its remarkable larger body size, and *D. alafumosa* with smoky wings. The male terminalia are essential for their identification, and the females cannot be clearly put apart.

#### ***Drosophila alafumosa* Patterson & Mainland, in Patterson, 1943**

(Figs 1, 2, 10A)

*Drosophila alafumosa* Patterson & Mainland, in Patterson 1943: 187 (description, distribution); Patterson & Mainland 1944: 23 (key), 77, 96 (distribution), 95 (collection records), color plate XV (illustration); Hsu 1949: 114, 142 (male terminalia); Wheeler 1949: 188 (affiliation); Patterson & Stone 1952: 40 (affiliation), 70, 73 (distribution); Vargas 1954: 150 (distribution); Wasserman 1967: 144 (distribution).

*alafumosa*

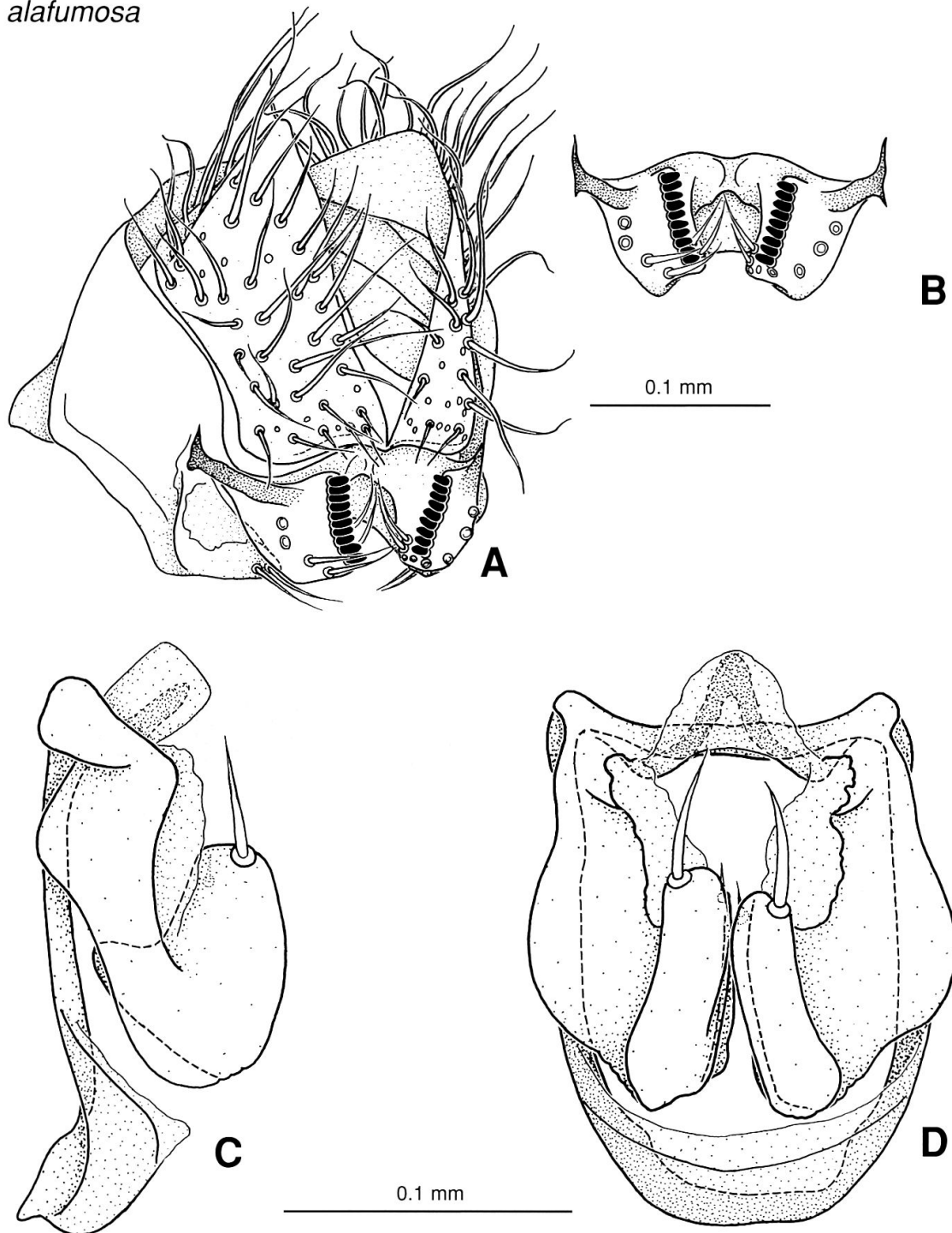


Fig. 1. *Drosophila alafumosa* Patterson & Mainland, ordinary male, March 1952, Huachinango, Puebla, Mexico. A, epandrium, cerci, surstyli and decasternum, oblique posterior view. B, surstyli and decasternum posterior view. C, hypandrium and gonopods+paraphyses, left lateral view. D, idem, posterior view.

*Material examined* (ordinary specimens only: 1 ♂ dissected, 2 ♀♀, AMNH). 1 ♂ labelled: "9 mi. SE. Huachinango Puebla MEX [Mexico] / M Wasserman WB Heed June 1952 / 2260.2". 1 ♀: same labels as the male, except for the last one = "2260.9". 1 ♀: "30 mi N. Cuernavaca Morelos / MEXICO July 1952 / M Wasserman WB Heed / 2268.9". The following two additional

labels were added to each specimen: “ ♂ [or ♀] / *Drosophila alafumosa* P. & M. Vilela & Bächli det.”.

*Type locality.* Valle de Huajumbaro, State of Michoacán, Mexico.

*Diagnosis.* Generally yellowish flies; tergites with a brownish marginal band which is medially broadened but on some tergites with a tendency to be interrupted; wing brownish, particularly in anterior half, with very dark clouds along both main crossveins; fusion line between aedeagus and aedeagal apodeme remarkably straight and strongly sloped; aedeagus distolaterally bearing a pair of short, posteriorly serrate processes.

*Redescription.* ♂. Head. Frons yellowish, frontal length 0.31 mm; frontal index = 0.90, top to bottom width ratio = 1.30. Frontal triangle brownish-yellow, about 67 % of frontal length; ocellar triangle prominent, blackish-brown, about 39 % of frontal length. Orbital plates narrow, apically diverging from eye margin, brownish, about 83 % of frontal length. Distance of or3 to or1 = 71 % of or3 to vtm, or1 / or3 ratio = 0.73, or2 / or1 ratio = 0.36, postocellar setae = 56 %, ocellar setae

*alafumosa*

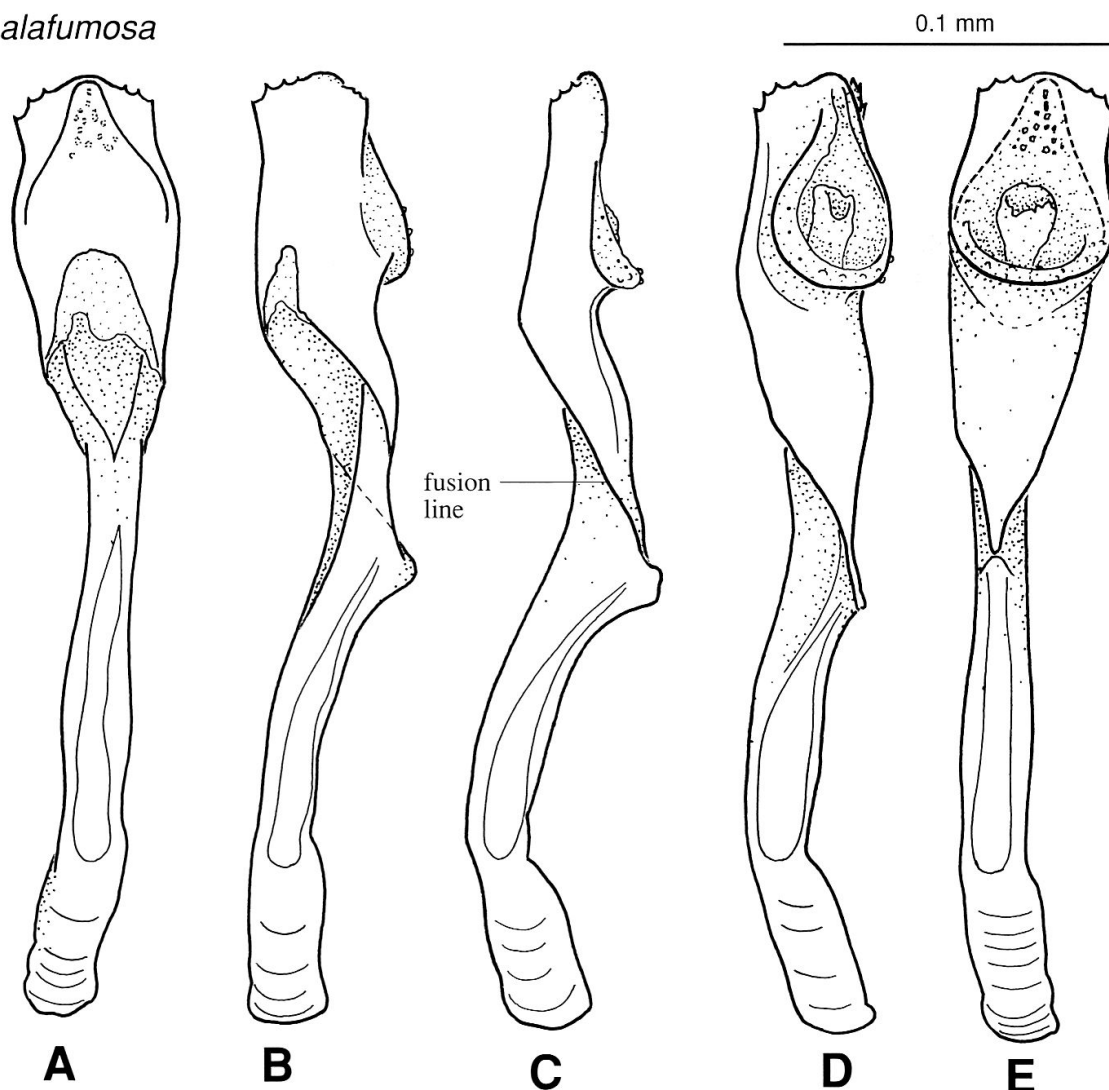


Fig. 2. *Drosophila alafumosa* Patterson & Mainland, ordinary male, March 1952, Huachinango, Puebla, Mexico. A–E, aedeagus+aedeagal apodeme, several views from dorsal through ventral.

*macroptera*

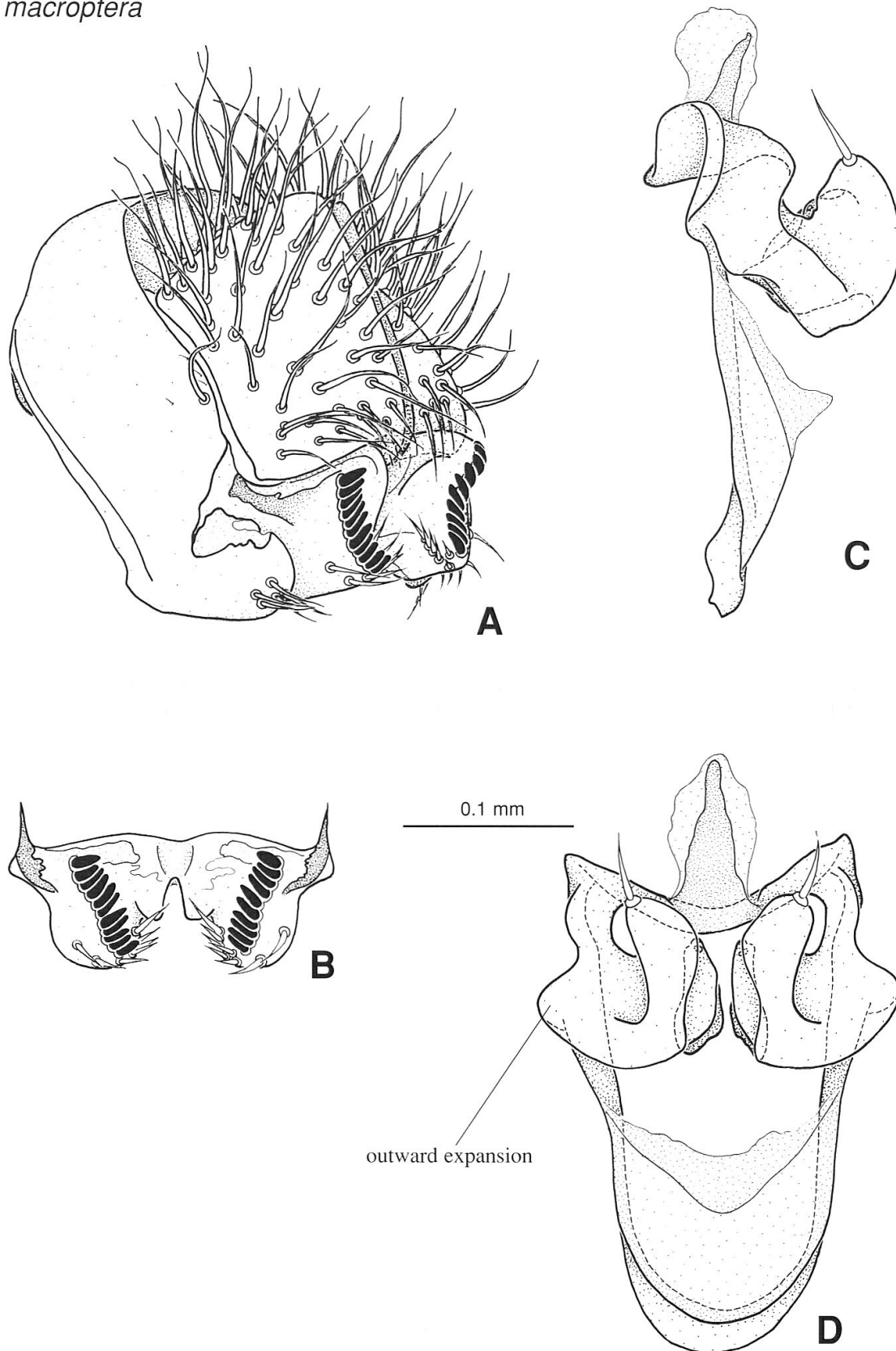


Fig. 3. *Drosophila macroptera* Patterson & Wheeler, holotype. A, epandrium, cerci, surstyli and decasternum, oblique posterior view. B, surstyli and decasternum posterior view. C, hypandrium and gonopods+paraphyses, left lateral view. D, idem, posterior view.



= 89 % of frontal length; vibrissal index = 0.89. Face pale yellowish. Carina broad, dorsally flat, almost noselike. Cheek index about 9–10. Eye index = 1.16. Pedicel yellowish. Flagellomere 1 brown. Arista with 5 dorsal, 3 ventral and about 5 small inner branches, plus terminal fork. Proboscis yellowish.

Thorax length 1.22 mm. Scutum brownish-yellow; 6 rows of acrostichal setulae. Transverse distance of dorsocentral setae 175 % of longitudinal distance; dc index = 0.64. Scutellum brownish. Scutellar setae almost equidistant; basal ones divergent; scut index = 1.14. Pleura yellowish, sterno index = 0.54. Halter and legs yellowish, preapical setae on all tibiae, ventral apical seta on mid tibia.

Wing brownish, particularly in anterior half, crossveins R-M and dM-Cu with large, oblong, dark brown shadows; length 2.83 mm, length to width ratio = 2.31. Indices: C = 3.29, ac = 2.13, hb = 0.29, 4C = 0.81, 4v = 1.71, 5x = 1.25, M = 0.48, prox. x = 0.71.

Abdomen predominantly yellowish, tergites 2–5 (–6) with a brown marginal band which is medially more or less triangularly broadened but may also be medially slightly narrowed.

♂ Terminalia (Figs 1, 2, 10A). Epandrium completely devoid of microtrichia with just 2 lower, and no upper setae; ventral lobe not microtrichose, slightly covered by surstylus. Cerci anteriorly connected to epandrium by membranous tissue, not microtrichose and devoid of ventral lobe, although ventromedially each plate is slightly projected downwards, where they are slightly fused to each other. Surstylus dorsoanteriorly heavily sclerotized, not microtrichose, bearing a straight row of 9–10 peglike prensisetae, ca. 4 inner and 4 outer setae. Decasternum as in Fig. 1B. Hypandrium slightly longer than epandrium, anterior margin rounded; posterior hypandrial process absent; dorsal arch present, mediodistally membranous; gonopod expanded outwards in the median region, when observed in posterior view, mostly fused to paraphysis, bearing one long seta near the median inner margin. Aedeagus fused to aedeagal apodeme (fusion line straight and strongly sloped), dorsoventrally flattened, distolaterally bearing a pair of short, posteriorly serrate processes; gonopore rounded; dorsal cleft ca. 1/3 length of aedeagus. Aedeagal apodeme longer than aedeagus, rod-shaped. Ventral rod vestigial. Paraphysis mostly fused to gonopod, not microtrichose, anteriorly bearing 1 seta on dorsal margin, connected to distal margin of aedeagal apodeme by membranous tissue.

♀. Measurements: Frontal length 0.32 (0.30–0.35) mm; frontal index = 0.81 (0.77–0.86), top to bottom width ratio = 1.24. Frontal triangle about 61–65 % of frontal length; ocellar triangle about 40 % of frontal length. Orbital plates about 80–83 % of frontal length. Distance of or3 to or1 = 86 % of or3 to vtm, or1 / or3 ratio = 0.75 (0.73–0.78), or2 / or1 ratio = 0.36, postocellar setae = 63 (61–65) %, ocellar setae = 94 (89–100) % of frontal length; vibrissal index = 0.89 (0.79–1.00). Cheek index about 10–13. Eye index = 1.17 (1.16–1.19). Thorax length 1.36 (1.22–1.50) mm. h index = 1.00 (0.88–1.11). Transverse distance of dorsocentral setae 200–207 % of longitudinal distance; dc index = 0.64 (0.63–0.65). Distance between apical scutellar setae about 107–130 % of that of the apical to the basal one; scut index = 1.26 (1.25–1.27), sterno index = 0.64 (0.58–0.70), mid katapisternal seta about 79–105 % of the anterior one. Wing length 3.08 (2.69–3.47) mm, length to width ratio = 2.23 (2.20–2.26). Indices: C = 3.59 (3.58–3.60), ac = 2.44 (2.38–2.50), hb = 0.27 (0.21–0.33), 4C = 0.74 (0.73–0.75), 4v = 1.74 (1.73–1.75), 5x = 1.21 (1.18–1.25), M = 0.50, prox. x = 0.67 (0.65–0.69).

*Distribution.* Mexico (States of Puebla, Morelos and Michoacán).

*Biology.* Unknown.

*Comments.* We were unable to localize any extant type specimen of *D. alafumosa*; however, the darkened wings apparently allow to tell this species apart from the remaining of its group. So, we are assuming that three (1 ♂, 2 ♀♀) out of the five specimens (3 ♂♂, 2 ♀♀) belonging the AMNH collection and collectively labelled as *D. alafumosa* belong in fact to this species, although they were not collected in the type locality. The redescription is based on those three specimens.

However, it should be noted that two out of the three males cited above we received from the AMNH as a loan, belong to *D. subbadia* Patterson, 1943 (*guarani* group) instead. They are both labelled as follows: “Mexico: Cupatitzio Nat. Park Michoacan 1610 M. VIII\242 1347.8 G.B. Mainland \ L. Morroquin”, one being partially destroyed, probably by dermestids, and the other is missing the left wing. Based on the collectors, the date and place of collection, there is a chance that, although not labelled as such, these two specimens are paratypes of *D. subbadia*, whose [type] specimens [number not specified] were collected at Laguna Pátzcuaro and Cupatitzio National Park, during the same month and year as stated on the labels (Patterson 1943:199). The holotype of *D. subbadia*, collected in Laguna Pátzcuaro [misspelled as Patzcaro in the label] in August 1942 [same month and year as in the label of those two specimens of the AMNH], is deposited in the USNM and has previously been analyzed by us, and used for its redescription (Vilela & Bächli 1990:78).

### ***Drosophila aurea* Patterson & Mainland, 1944**

*Drosophila aurea* Patterson & Mainland 1944: 46 (description, distribution), 23 (key), color plate XV (illustration); Wheeler 1949: 188 (affiliation); Patterson & Stone 1952: 40 (affiliation), 70, 73 (distribution); Vargas 1954: 150 (distribution); Heed 1956: 63 (distribution); Heed 1957: 77 (distribution); Wheeler 1970: 79.12 (distribution); Val et al. 1981: 144 (distribution).

*Type locality.* Barranca de Metlac [misspelled as Meltac in the original description], near Cordoba, State of Veracruz, Mexico.

*Distribution.* Mexico (State of Veracruz), ? El Salvador.

*Comments.* We were unable to localize any extant type specimen. The characters mentioned in the description and key by Patterson & Mainland (1944) do not allow a separation of flies of *D. aurea* from those of other species of the *macroptera* group; particularly the vibrissal index is a too variable character. The only two males supposedly belonging to *D. aurea* we have received as a loan from the AMNH, do not belong to this species but to *D. macroptera* Patterson & Mainland instead, the most widespread species of its group, and will be treated under that binomial. Five females in the same loan were included together with those two males, but we were not able to decide if they were properly identified. So, the identity of this species must rely mostly on the fine color illustration of one male imago made by Mrs. Sarah L. Martin (Patterson & Mainland 1944: plate XV). We are keeping the doubts regarding the identification of the specimens doubtfully recorded from El Salvador (Heed 1957: 77), which are probably no longer extant to be checked.

### ***Drosophila macroptera* Patterson & Wheeler, 1942**

(Figs 3–5, 25A)

*Drosophila macroptera* Patterson & Wheeler 1942: 105 (description); Sturtevant 1942: 45(key); Patterson 1943: 47 (key), 184 (description), 16, 184, 185, 239, 240 (distribution), color plate III (illustration); Patterson & Wagner 1943: 239, 241, 245 (distribution); Wharton 1943: 289, 317 (chromosomes); Patterson & Mainland 1944: 23 (key), 77, 96 (distribution), 94 (collection)

records); Hsu 1949: 113, 140 (male terminalia); Wheeler 1949: 189 (affiliation); Malogolowkin 1953: 257 (male terminalia); Patterson & Stone 1952: 41, 70, 73, 74 (distribution); Clayton & Ward 1954: 100 (chromosomes); Dudgeon 1954: 73 (distribution, yeasts); Vargas 1954: 151 (distribution); Heed et al. 1962: 73 (distribution); Throckmorton 1962: 224, 240, 241, 268, 286 (phylogeny), 342 (distribution); Throckmorton 1975: 425 (phylogeny, culture medium); Wheeler 1970: 79.17 (distribution); Clayton & Wheeler 1975: 471 (chromosomes); Val et al. 1981: 144 (distribution); Remsen & O'Grady 2002: 254, 257, 261 (phylogeny), 260 (distribution).

*Material examined* (21 ♂♂, all dissected and, unless otherwise specified, deposited in the AMNH). Male holotype [missing head and distal half of right wing; dissected by us] labelled: "D. macroptera ♂ Estes Park, Colo. [Colorado] Mainland & Wheeler 1941 Type [exceptionally large white label]" and the following 20 ordinary specimens: 1 ♂ (right wing removed, photographed [Fig. 25A] USNM): "n.m. [New Mexico] ckw. / Beulah may 3. / Drosophila rubrifrons P. & W. [misidentification] det. W.Wirth [illegible handwritten] USNM 2023298". 1 ♂ (USNM): "Beulah. n.m. may 3. (ckw.) / USNM 2023298". 2 ♂♂ [one previously dissected, terminalia preserved in glycerin jelly, with an additional label "♂ 2"]: "NEW MEXICO: San Miguel Co. 12 mi. N. Pecos Terrero Caves XI90 D. Lowrie, on cave wall". 1 ♂ [previously dissected, terminalia preserved in glycerin jelly]: "ARIZONA: Cochise Co. Chiricahua Mnts. [Mountains] Rustler's Park. VIII\2000 F1 (culture) John Jaenike, coll. / macroptera D. Grimaldi det.". 8 ♂♂: "12 mi N.E. Deckers Colorado / MR Wheeler Aug. 1950 / 2071.2 macrop." [one specimen without the last label, and to one specimen an additional label "aedeagus photographed Vilela & Bächli 2003" was added]. 1 ♂: "Reef Rd. Cochise Co. Arizona / G.B. Mainland Aug. 1941 / 1250.7". 3 ♂♂ [wings missing in one of them]: "NEW MEXICO: Silver City VIII\50". ♂: "COLORADO: Durango VIII\10\50". 2 ♂♂, originally in ethanol: AM - CC [American Museum - Cryo Collection] ID # 109393, which after being dried were labelled with the data regarding code number: "USA: Mt Lemon AZ cave nr. Bill Heed's Cabin 3.XI.2002 O'Grady et al. leg.". The following two additional labels were added to each specimen: "♂ / D. macroptera P. & W. Vilela & Bächli det.", and preceded by the red label "HOLOTYPE" for the first specimen cited above.

*Type locality.* Estes Park, Colorado, U.S.A.

*Diagnosis.* Generally yellowish flies; tergites with a broad, dark brown marginal band, medially usually reaching the previous tergite, which on some tergites leaves only small paramedian light areas; wing usually with dark brown crossveins R-M and dM-Cu which are more or less distinctly clouded; aedeagus distally most membranous and ventrally expanded, subdistally bearing a pair of ear-like serrated processes in the dorsal region.

*Redescription.* ♂. Head. Frons golden-yellow, in lower half pale yellowish, frontal length 0.36 (0.32–0.38) mm; frontal index = 0.90 (0.84–0.96), top to bottom width ratio = 1.29 (1.21–1.35). Frontal triangle diffuse, about 50–71 % of frontal length; ocellar triangle prominent, about 33–38 % of frontal length. Orbital plates apically diverging from eye margin, about 71–77 % of frontal length. Orbital setae black, or2 closer to or1 than to or3 and very close to the eye margin, distance of or3 to or1 = 75–87 % of or3 to vtm, or1 / or3 ratio = 0.77 (0.71–0.88), or2 / or1 ratio = 0.47 (0.38–0.58), postocellar setae = 62 (57–71) %, ocellar setae = 66 (63–68) % of frontal length; vibrissal index = 0.97 (0.90–1.00). Face brownish. Carina distinctly diverging downwards, evenly convex, dorsally flat, with sharp lateral edges. Cheek index about 3–6. Eye index = 1.17 (1.08–1.23). Flagellomere 1 brownish, length to width ratio = 1.17–1.33. Arista with 4–6 dorsal, 2–3 ventral and about 10 short inner branches, plus terminal fork. Proboscis brownish-yellow. Palpus pale brownish-yellow, slightly flattened, with 2 distinct apical and about 6 shorter setae along the lower margin.

Thorax length 1.21 (1.10–1.31) mm. Scutum brownish-yellow, with three faint stripes, one on the midline, broadened towards the scutellum, the other two along the dorsocentral rows, 6–8 rows of acrostichal setulae. h index = 1.00 (0.92–1.08). Transverse distance of dorsocentral setae 183–210 % of longitudinal distance; dc index = 0.62 (0.58–0.65). Scutellum brownish, scutellar setae almost equidistant;



*macroptera*

0.1 mm

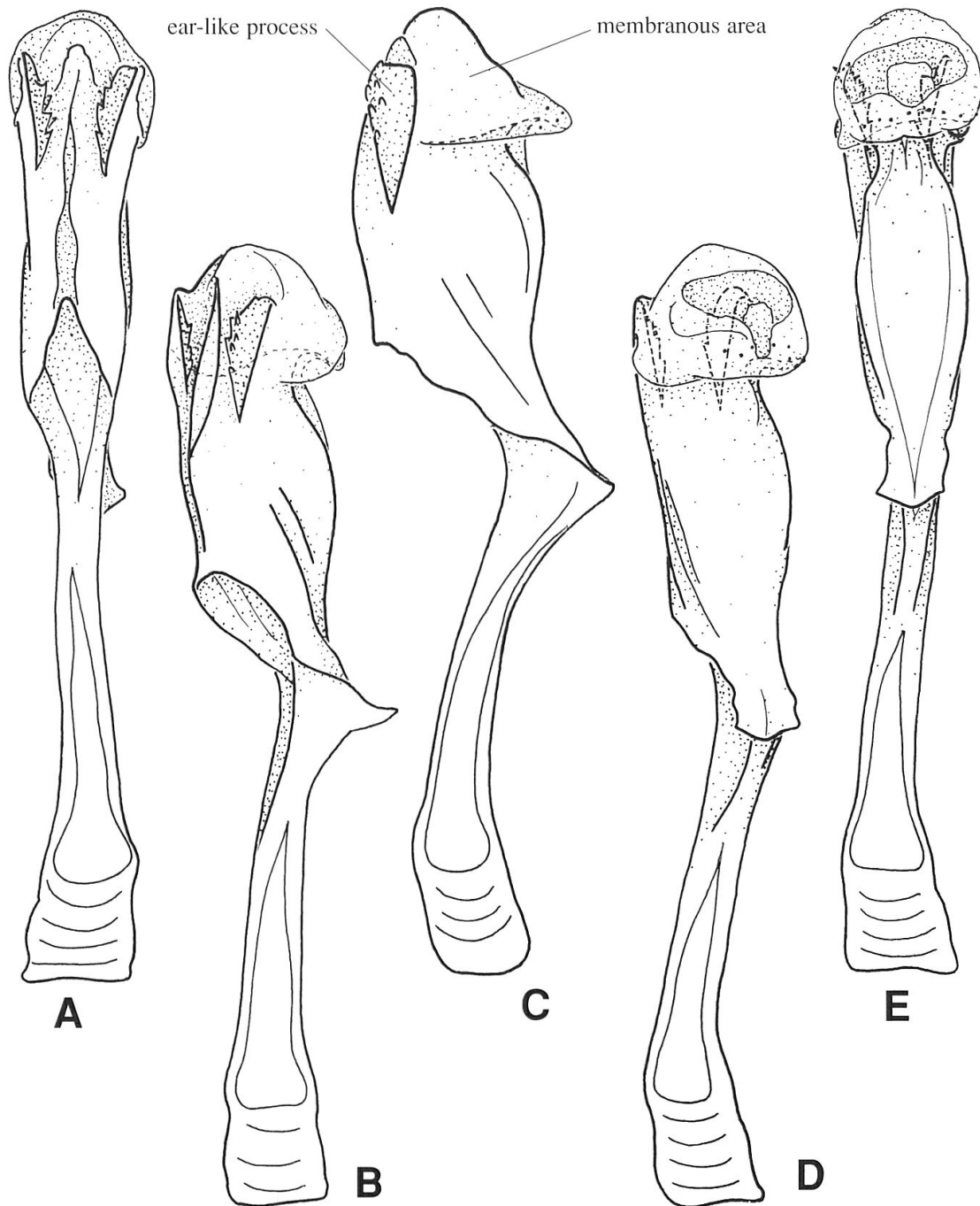


Fig. 4. *Drosophila macroptera* Patterson & Wheeler, holotype. A–E, aedeagus+aedeagal apodeme, several views from dorsal through ventral.

basal ones divergent; scut index = 1.11 (1.06–1.17). Pleura pale brownish-yellow, sterno index = 0.60 (0.50–0.65), mid katepisternal seta about 47–71 % of the anterior one. Halter yellow. Legs yellow, fine preapical setae on fore and hind tibiae, ventral apical seta on mid tibia.

Wing (Fig. 25A) hyaline, both crossveins brown and with diffuse but large shadows, length 3.36 (2.73–3.64) mm, length to width ratio = 2.41 (2.36–2.48).

Indices:  $C = 4.11$  (3.79–4.93),  $ac = 2.18$  (1.75–2.57),  $hb = 0.39$  (0.36–0.43),  $4C = 0.57$  (0.47–0.64),  $4v = 1.48$  (1.33–1.84),  $5x = 1.18$  (1.00–1.43),  $M = 0.39$  (0.30–0.44),  $prox. x = 0.53$  (0.50–0.56). Two prominent setae at apex of first costal section, dorsalmost twice as thick as ventralmost.

Abdomen with brownish-yellow ground color, tergite 2 with a diffuse marginal band which is medially narrowed or interrupted, tergites 3–6 with a blackish-brown marginal band which almost completely covers the tergite, leaving open almost only a pale basal, paramedian area.

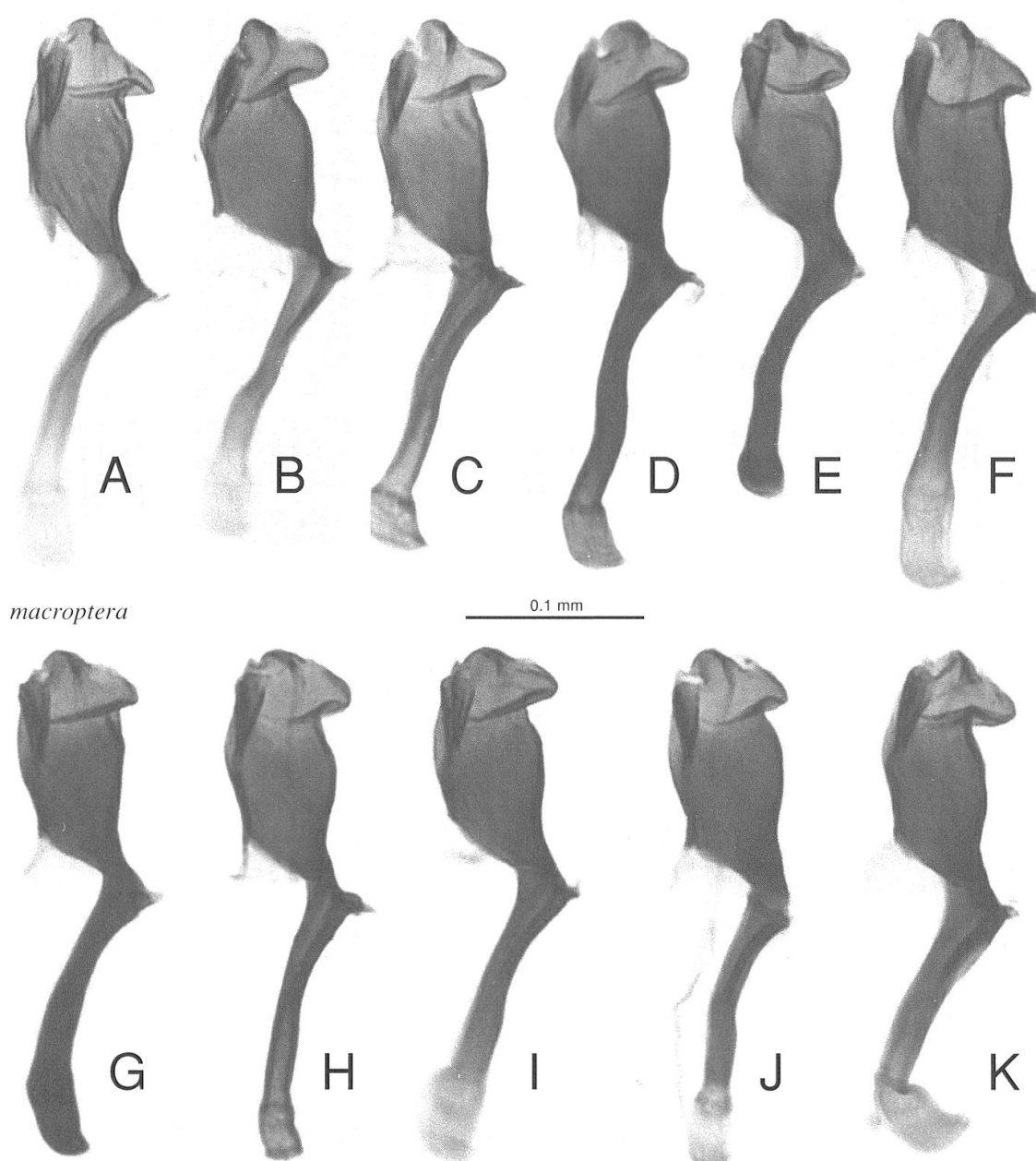


Fig. 5. Aedeagus+aedeagal apodeme of *Drosophila macroptera* Patterson & Wheeler, left lateral view. A, holotype. B–K, ordinary specimens, all from USA. B, May 3rd, Beulah, New Mexico. C, November 1990, Pecos New Mexico. D, idem. E, August 2000, Rustler's Park, Arizona. F, August 1950, Deckers, Colorado. G, August 1941, Cochise Co. Arizona. H, August 5th, 1950, Silver City, New Mexico. I, August 10th, 1950, Durango, Colorado. J, November 3rd, 2002, Mount Lemon, Arizona. K, idem.

♂ *Terminalia* (Figs 3–5). Epandrium almost completely devoid of microtrichia with about 4 lower, and just one upper setae; ventral lobe neither microtrichose nor covering surstylus. Cerci anteriorly connected to epandrium by membranous tissue, not microtrichose and devoid of ventral lobe, although ventromedially each plate is slightly projected downwards, where they are slightly fused to each other. Surstylus dorsoanteriorly heavily sclerotized, not microtrichose, bearing a slightly waved row of 10–11 peglike prensisetae, ca. 2 outer and 6 inner seta. Decasternum as in Fig. 3B. Hypandrium longer than epandrium, anterior margin rounded; posterior hypandrial process absent; dorsal arch strongly sclerotized, mediodistally membranous; gonopod remarkably expanded outwards in the median region, when observed in posterior view (Fig. 3D), mostly fused to paraphysis, and bearing one seta near the median inner margin. Aedeagus (instances of morphological variants depicted in Fig. 5) fused to aedeagal apodeme (fusion line waved and slightly sloped), distally most membranous and ventrally expanded, subdistally bearing a pair of ear-like serrated processes in the dorsal region; gonopore rounded; dorsal cleft ca. 1/3 length of aedeagus. Aedeagal apodeme longer than aedeagus, rod-shaped, laterally flattened posteriorly. Ventral rod short. Paraphysis mostly fused to gonopod, not microtrichose, anteriorly bearing 1 setulae on dorsal margin, connected to distal margin of aedeagal apodeme by membranous tissue.

*Distribution.* U.S.A. (Colorado, Arizona, New Mexico, Texas), Mexico (Chihuahua, San Luis Potosí, Jalisco, Puebla, Michoacán).

*Biology.* According to the label data cited above, all the four males collected in November [autumn], two in 1990 in New Mexico and two in Arizona in 2002, were found on cave walls. Whether or not caves are used as overwinter sites by the adults of *D. macroptera* is not yet known. According to Throckmorton (1975: 450, personal communication from W.B. Heed), it has been reared from fungus (species unspecified).

*Comments.* Some details of aedeagal morphology vary among both sympatric and allopatric specimens, particularly regarding the membranous distal end (Fig. 5). We assume this variation, which is more evident when observed in lateral view, is expected within any given species. This is the only species of the *macroptera* group which is widespread in the western Nearctic from Colorado to central Mexico. The remaining species are apparently endemic to the area around Mexico's transvolcanic belt, mainly in the State of Michoacán.

### ***Drosophila magnabadia* Patterson & Mainland, in Patterson, 1943**

(Figs 6, 7, 10B)

*Drosophila magnabadia* Patterson & Mainland, in Patterson 1943: 196 (description, distribution); Patterson & Mainland 1944: 24 (key), 50 (affiliation), 79, 96 (distribution), 95 (collection records), color plate XIII (illustration); Hsu 1949: 113, 140 (male terminalia); Wheeler 1949: 188 (affiliation); Patterson & Stone 1952: 41, 73, 74, 76 (distribution); Vargas 1954: 152 (distribution); Wheeler 1970: 79.17 (distribution); Val et al. 1981: 144 (distribution).

Material examined (3 ♂♂, 5 ♀♀). Holotype male (dissected, deposited in the USNM) labelled: "Desierto [misspelled, = Desierto] de los leones D.F. Mex. / GB Mainland July 1942 / 1342.4 / HOLOTYPE [red label] / *Drosophila magnabadia* [large yellow label] / Type No. 101,015 U.S.N.M. [red label]". Paratypes (2 ♂♂, 4 ♀♀, AMNH): same data as holotype [but yellow paratype labels and without the last red label]. Ordinary specimen 1 ♀: "MEXICO: 10 mi. W. Rio Frio, at Peña de Gato [state of Puebla] ♀ IX447 1800.10 M.R. Wheeler \ F.A. Cowan" The following two additional labels were added to each specimen: "♂ [or ♀] / *D. magnabadia* P. & M. Vilela & Bächli det."

*Type locality.* Desierto [misspelled as Desietro in the labels and as Eldesietro in the original description] de los Leones, Distrito Federal, Mexico.

*magnabadia*

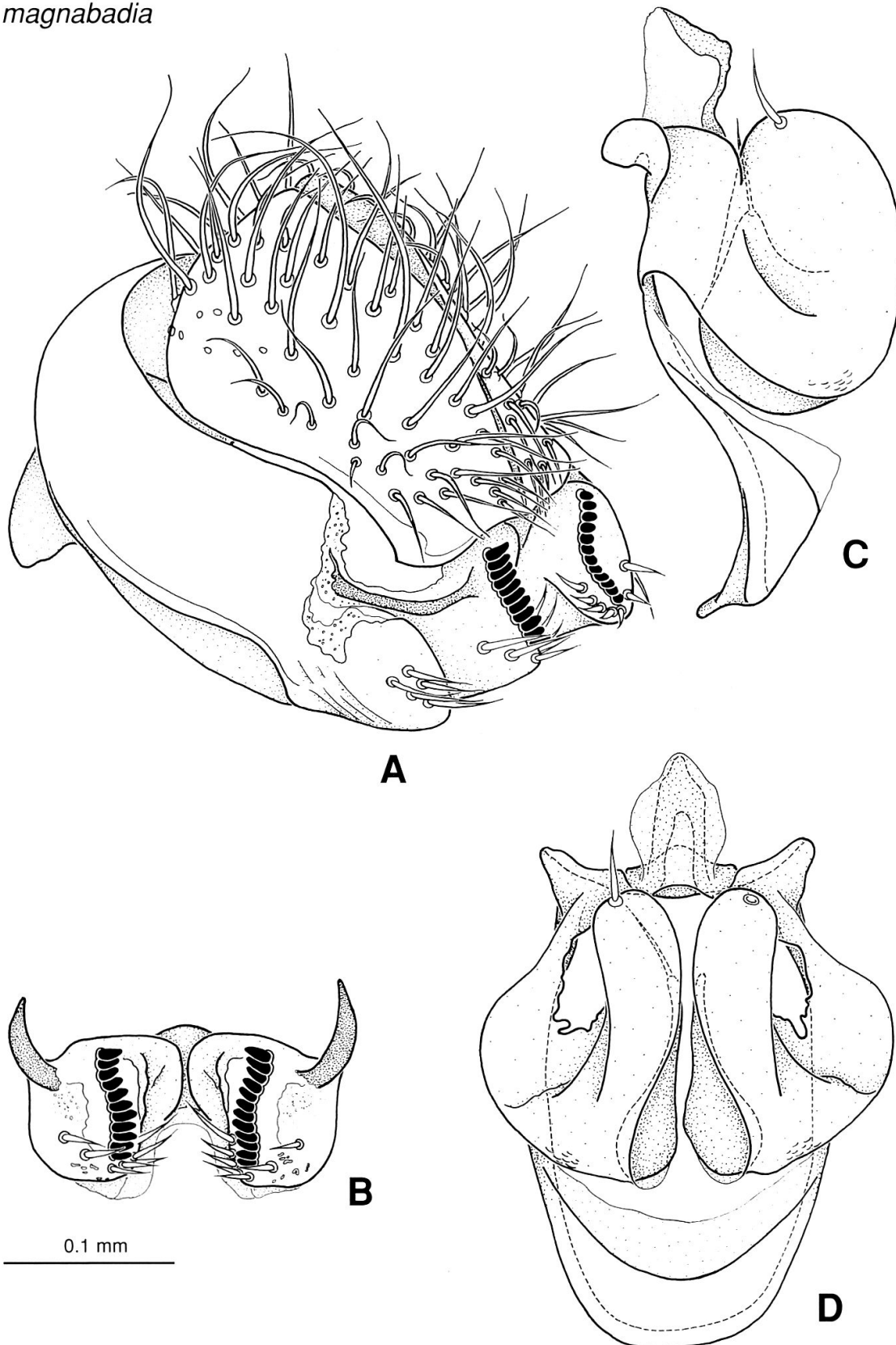


Fig. 6. *Drosophila magnabadia* Patterson & Mainland, male holotype. A, epandrium, cerci, surstyli and decasternum, oblique posterior view. B, surstyli and decasternum posterior view. C, hypandrium and gonopods+paraphyses, left lateral view. D, idem, posterior view.

*Diagnosis.* Generally yellowish, relatively large flies with long wings, frons apically darkened, scutellum brownish, tergites with a dark brown marginal band which is medially triangularly broadened, reaching preceding tergite, wing slightly brownish, with very dark clouds along both crossveins and faint shadows at tips of veins  $R_{2+3}$ ,  $R_{4+5}$ , and M; aedeagus rod-shaped, distolaterally bearing a pair of short, marginally serrate processes.

*Redescription.* ♂. Head. Frons dark brown at vertex, paler downwards, yellowish above ptilinum, frontal length 0.42 mm; frontal index = 0.81, top to bottom width ratio = 1.21 (1.19–1.23). Frontal triangle dark brown, whitish seen from above, about 55 % of frontal length; ocellar triangle prominent, blackish, about 36–40 % of frontal length. Orbital plates brownish, greyish microtrichose, about 68–78 % of frontal length. Orbital setae almost in a row, distance of or3 to or1 = 50–75 % of or3 to vtm, or1 / or3 ratio = 0.76, or2 / or1 ratio = 0.38, postocellar setae = 52–68 %, ocellar setae = 80–92 % of frontal length; vibrissal index = 0.91 (0.82–1.00). Face brownish-yellow. Carina prominent but not noselike, distinctly broadened downwards, medially slightly grooved. Cheek index about 6–7. Eye index = 1.29 (1.28–1.31). Pedicel brownish-yellow. Flagellomere 1 brown, length to width ratio = 1.40. Arista with 4 dorsal, 2 ventral and about 6–7 small inner branches, plus terminal fork. Proboscis and palpus yellow.

Thorax length 1.67 (1.61–1.72) mm. Scutum brownish, darker towards scutellum, 6 (–8) rows of acrostichal setulae. h index = 0.90 (0.86–0.95). Transverse distance of dorsocentral setae 293–321 % of longitudinal distance; dc index = 0.64. Scutellum brown, paler along the margin, distance between apical scutellar setae about 107–129 % of that of the apical to the basal one; basal ones divergent; scut index = 1.17 (1.14–1.21). Pleura brownish-yellow, sterno index = 0.66, mid katapisternal seta about 81 % of the anterior one. Halter yellow. Legs brownish-yellow, hind tibia slightly bent, preapical setae on all tibiae, ventral apical seta on mid tibia.

Wing pale brownish in the anterior half, hyaline behind, crossveins R-M and dM-Cu with a large, dark shadow, length 4.55 mm. Indices: C = 3.51 (3.46–3.56), ac = 2.27, hb = 0.19, 4C = 0.69 (0.68–0.70), 4v = 1.50 (1.43–1.57), 5x = 1.00, M = 0.35, prox. x = 0.62.

Abdomen predominantly yellow, tergites 2–6 with marginal bands which are medially extended to the previous tergite.

♂ *Terminalia* (Figs 6, 7, 10B). Epandrium completely devoid of microtrichia with ca. 5 lower, and no upper setae; ventral lobe anteriorly slightly rugose, neither microtrichose nor covering surstylus. Cerci anteriorly connected to epandrium by membranous tissue, not microtrichose and devoid of ventral lobe, although ventromedially each plate is slightly projected downwards, where they are slightly fused to each other. Surstylus dorsoanteriorly heavily sclerotized, not microtrichose, bearing a slightly convex row of 11–12 peglike prensisetae, ca. 5 inner and 2 outer setae. Decasternum as in Fig. 6B. Hypandrium as long as epandrium, anterior margin rounded; posterior hypandrial process absent; dorsal arch present, although medially mostly membranous; gonopod remarkably expanded outwards in the median region, when observed in posterior view (Fig. 6D), mostly fused to paraphysis, bearing one seta near the median inner margin. Aedeagus rod-shaped, fused to aedeagal apodeme (fusion line waved and slightly sloped), distolaterally bearing a pair of short, marginally serrate processes, subdistally membranous in ventral region and laterally bearing a collar of tiny scales; gonopore rounded; dorsal cleft ca. 1/7 length of aedeagus. Aedeagal apodeme as long as aedeagus, rod-shaped. Ventral rod shorter than aedeagal apodeme width. Paraphysis mostly fused to gonopod, not microtri-

chose, anteriorly bearing 1 seta on dorsal margin, longer than gonopod seta, connected to distal margin of aedeagal apodeme by membranous tissue.

♀. Measurements: Frontal length 0.43 (0.40–0.46) mm; frontal index = 0.77 (0.74–0.80), top to bottom width ratio = 1.20 (1.15–1.26). Frontal triangle about

*magnabadia*

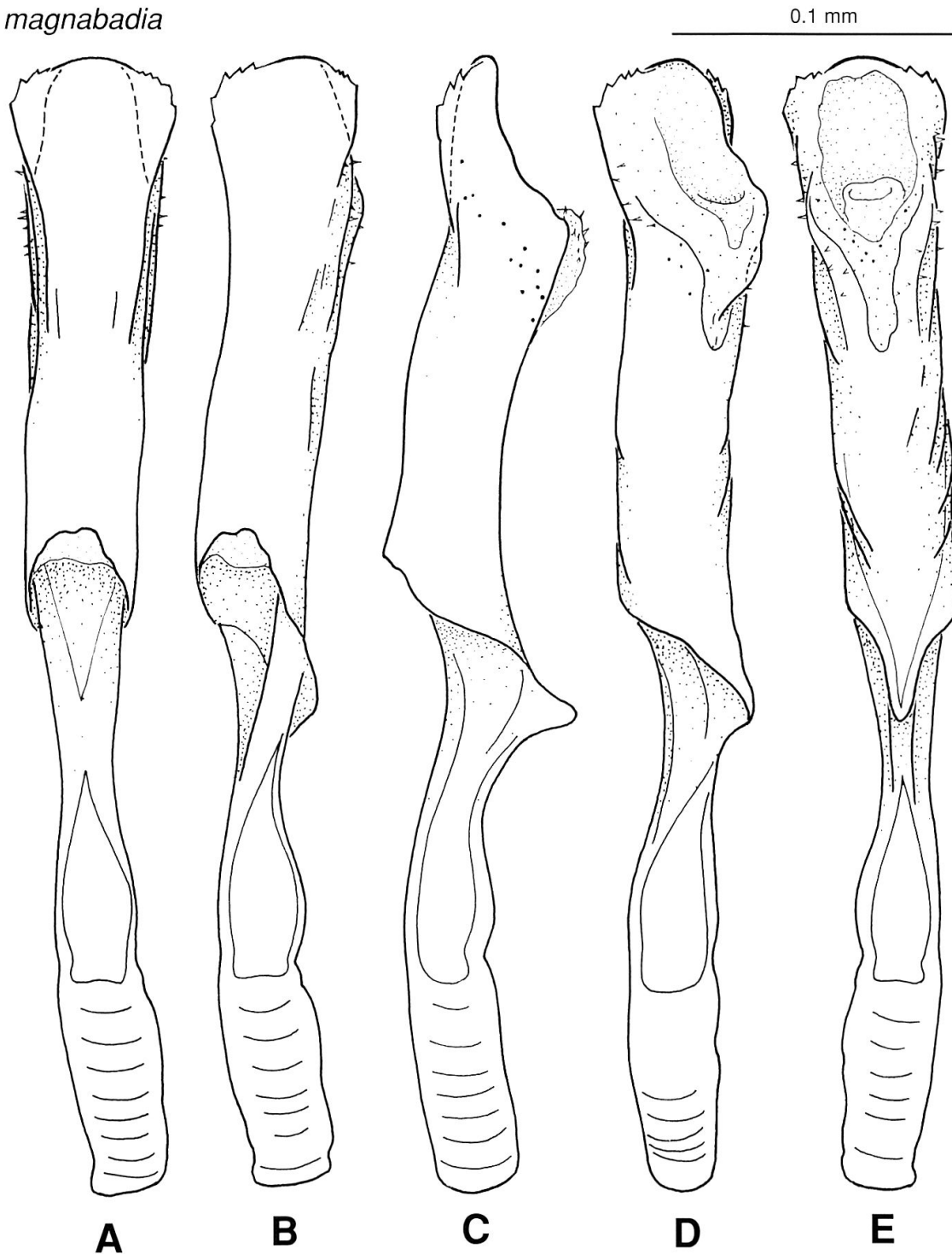


Fig. 7. *Drosophila magnabadia* Patterson & Mainland, male holotype. A–E, aedeagus+aedeagal apodeme, several views from dorsal through ventral.



48–50 % of frontal length; ocellar triangle about 32–48 % of frontal length. Orbital plates about 72–75 % of frontal length. Distance of or3 to or1 = 67–100 % of or3 to vtm, or1 / or3 ratio = 0.72 (0.71–0.75), or2 / or1 ratio = 0.32 (0.29–0.35), postocellar setae = 68–80 %, ocellar setae = 84–96 % of frontal length; vibrissal index = 0.77 (0.61–0.89). Cheek index about 5–7. Eye index = 1.29 (1.23–1.32). Thorax length 1.78 (1.66–1.87) mm. h index = 0.93 (0.87–0.95). Transverse distance of dorsocentral setae 150–223 % of longitudinal distance; dc index = 0.62 (0.58–0.64). Distance between apical scutellar setae about 93–114 % of that of the apical to the basal one; scut index = 1.18 (1.13–1.26), sterno index = 0.64 (0.63–0.65), mid katepisternal seta about 63–83 % of the anterior one. Wing length 4.30 (4.13–4.48) mm, length to width ratio = 2.34 (2.27–2.42). Indices: C = 3.44 (3.25–3.79), ac = 2.55 (2.40–2.80), hb = 0.20 (0.19–0.21), 4C = 0.72 (0.69–0.76), 4v = 1.50 (1.47–1.61), 5x = 1.03 (1.00–1.17), M = 0.40 (0.38–0.42), prox. x = 0.65 (0.61–0.69).

*Distribution.* Mexico (Michoacán, Distrito Federal, Puebla).

*Biology.* Unknown.

*Comment.* Together with the paratypes of *D. magnabadia* we received as a loan from the AMNH, there is one ordinary male specimen collected in the state of Michoacán (Mexico), also labelled as *D. magnabadia*, but noticeably smaller, which is being described as a new species of *Hirtodrosophila* at the end of this article.

### ***Drosophila submacroptera* Patterson & Mainland, in Patterson, 1943**

(Figs 8, 9, 10C–E)

*Drosophila submacroptera* Patterson & Mainland, in Patterson 1943: 186 (description, distribution); Wharton 1943: 289, 317 (chromosomes); Patterson & Mainland 1944: 23 (key), 46 (affiliation), 77, 96 (distribution), 95 (collection records), color plate XV (illustration); Wheeler 1949: 188 (affiliation); Patterson & Stone 1952: 41, 70, 73, 74 (distribution); Vargas 1954: 152 (distribution); Heed 1956: 63 (distribution); Clayton & Wasserman 1957: 127 (? chromosomes, ? distribution); Heed 1957: 77 (distribution); Throckmorton 1962: 224, 240, 241, 268, 276 (phylogeny), 342 (distribution); Wheeler 1970: 79.22 (distribution); Clayton & Wheeler 1975: 471 (chromosomes); Val et al. 1981: 144 (distribution).

Material examined (3 ♂♂). Male holotype (dissected, deposited in the USNM), labelled: “9 mi S. Taxco Guerrero [Guerrero], Mex. / GB Mainland July 1942 / 1336.16 [an additional 6 is inserted below the fourth figure] / HOLOTYPE [red label] / *Drosophila submacroptera* / TypeNo. 101,103 U.S.N.M. [red label]”. 1 ♂ (dissected, AMNH): “nr. [near] Xilitla S.L.P. [state of San Luis Potosí], Mexico / Dec. 26–8 [26–28], 1952 W.B. Heed”. 1 ♂ (dissected, AMNH): “Huatusco - 1.5 mi S Vera Cruz, Mex. [Mexico] / Jun 23–4, 1952 W.B. Heed / 2262.3”. The following two additional labels were added to each specimen: “♂ / *D. submacroptera* P. & M. Vilela & Bächli det.”.

*Type locality.* Taxco [misspelled as Taxico in the original description], State of Guerrero, Mexico.

*Diagnosis.* Generally yellowish flies, tergites with a brownish marginal band which is medially distinctly interrupted, wing slightly brownish, with faint shadows along both crossveins; furthermore, differing from *D. macroptera* by narrower cheeks and smaller body size; aedeagus subapically bearing a pair of short, dorsal processes; subdistally membranous in ventral region and laterally having a conspicuous pad-shaped area covered with sharp scales.

*Redescription.* ♂. Head. Frons golden to brownish yellow, slightly darker towards vertex, frontal length 0.31 (0.28–0.32) mm; frontal index = 0.93 (0.89–1.00), top to bottom width ratio = 1.31 (1.25–1.37). Frontal triangle indistinct, about 65–71 % of frontal length; ocellar triangle prominent, almost wholly dark brown, about 39–53 % of frontal length. Orbital plates narrow, apically dis-

*submacroptera*

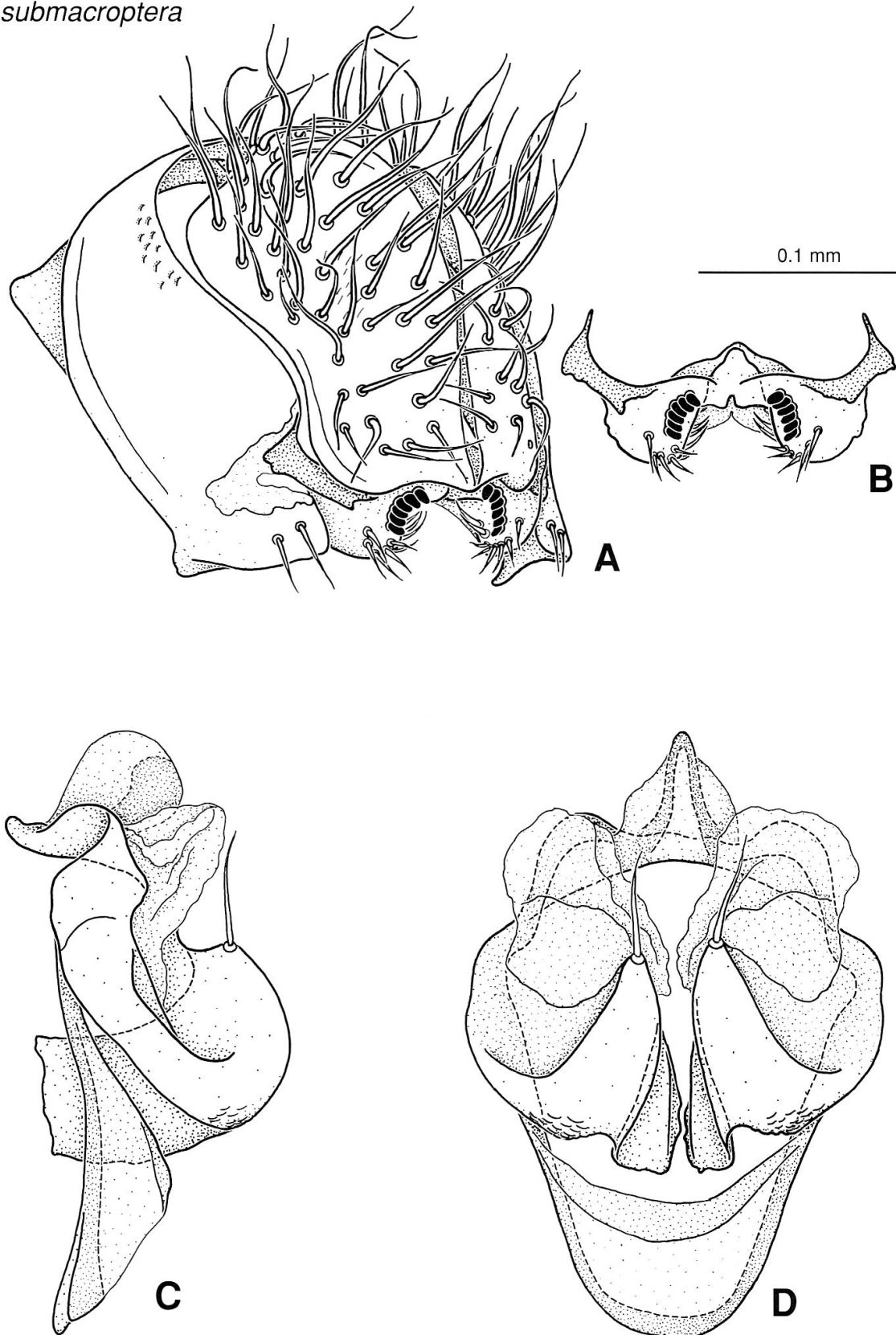


Fig. 8. *Drosophila submacroptera* Patterson & Mainland, male holotype. A, epandrium, cerci, surstyli and decasternum, oblique posterior view. B, surstyli and decasternum posterior view. C, hypandrium and gonopods+paraphyses, left lateral view. D, idem, posterior view.



tinctly diverging from eye margin, about 78–82 % of frontal length. Orbital setae almost in a row, distance of or3 to or1 = 71–100 % of or3 to vtm, or1 / or3 ratio = 0.95 (0.93–1.00), or2 / or1 ratio = 0.45 (0.42–0.50), postocellar setae = 65 (61–68) %, ocellar setae = 84 (78–94) % of frontal length; vibrissal index = 0.69 (0.60–0.73). Face yellowish-brown. Carina noselike, broadened downwards. Cheek index about 7–10. Eye index = 1.19 (1.17–1.20). Pedicel yellowish-brown. Flagellomere 1 dark brown, length to width ratio = 1.33–1.60. Arista with 3–4 dorsal, 2 ventral and about 5–6 short inner branches, plus terminal fork. Proboscis and palpus yellowish.

Thorax length 1.07 (1.05–1.09) mm. Scutum and scutellum golden to brownish yellow; 6 rows of acrostichal setulae. h index = 0.95 (0.92–1.00). Transverse distance of dorsocentral setae 190–200 % of longitudinal distance; dc index = 0.63 (0.56–0.74). Scutellar setae almost equidistant; basal ones divergent; scut index = 1.04 (1.00–1.08). Pleura yellow, sterno index = 0.59 (0.52–0.67), mid katepisternal seta about 42–67 % of the anterior one. Halter and legs yellow, preapical setae on all tibiae, ventral apical seta on mid tibia.

Wing slightly brownish in anterior half, crossveins R-M and dM-Cu very faintly shadowed; length 2.33 (2.31–2.35) mm, length to width ratio = 2.17 (2.13–2.23). Indices: C = 4.23 (4.08–4.45), ac = 1.94 (1.83–2.00), hb = 0.17 (0.17–0.18), 4C = 0.60 (0.58–0.63), 4v = 1.65 (1.63–1.68), 5x = 1.24 (1.14–1.29), M = 0.45 (0.42–0.47), prox. x = 0.52 (0.47–0.55).

Abdomen predominantly yellowish, tergite 2 usually with a pale brownish, uninterrupted marginal band, tergites 3–6 with brown marginal bands of less than half width of tergite which are medially distinctly interrupted.

♂ *Terminalia* (Figs 8, 9, 10C–E). Epandrium completely devoid of microtrichia, but dorsolaterally slightly rugose distally, with ca. 2 lower, and no upper setae; ventral lobe neither microtrichose nor covering surstylus. Cercus anteriorly connected to epandrium by membranous tissue, slightly microtrichose and devoid of ventral lobe, although ventromedially each plate is slightly projected downwards and ventrally slightly fused to each other. Surstylus dorsoanteriorly heavily sclerotized, not microtrichose, bearing a concave row of 6 peglike prenisetae, ca. 5 inner and 2 outer setae. Decasternum as in Fig. 8B. Hypandrium slightly longer than epandrium, anteriorly slightly sclerotized, anterior margin rounded; posterior hypandrial process absent; dorsal arch present, mediodistally membranous; gonopod remarkably expanded outwards in the median region, when observed in posterior view (Fig. 8D), fused to paraphysis, bearing one long seta near the median inner margin, slightly rugose anteriorly. Aedeagus rod-shaped, fused to aedeagal apodeme (fusion line straight and slightly sloped), subapically bearing a pair of short, dorsal processes, subdistally membranous in ventral region and laterally having a pair of pad-shaped areas covered with sharp scales; gonopore rounded; dorsal cleft reduced to an opening adjacent to the fusion line aedeagus+aedeagal apodeme. Aedeagal apodeme shorter than aedeagus, rod-shaped. Ventral rod shorter than aedeagal apodeme width. Paraphysis fused to gonopod, completely bare, connected to distal margin of aedeagal apodeme by membranous tissue.

*Distribution.* Mexico (States of Guerrero, San Luis Potosí, ? Hidalgo, ? Puebla, Veracruz), Guatemala, ? El Salvador.

*Biology.* Unknown.

*Comments.* The two ordinary male specimens cited above and used, together with the holotype, in the redescription of *D. submacroptera* were received as a loan from the AMNH as supposedly [erroneously] belonging to *D. aurea* and collectively labelled as such. However, after being dissected, their aedeagi (Fig. 10D, E)

proved to be virtually identical to that of the holotype of *D. submacroptera* (Fig. 10C). Clayton & Wasserman (1957: 127) were not sure about the identities of the strains they used as being *D. submacroptera*. Therefore, its occurrence in some Mexican states and in El Salvador remains uncertain.

### ***Drosophila rubrifrons* species group**

*rubrifrons* group Patterson & Mainland 1944: 48 (diagnosis); Hsu 1949: 112 (male terminalia); Patterson & Stone 1952: 41 (diagnosis, description); Nater 1953: 451 (male terminalia); Throckmorton 1962: 224, 240, 241, 268, 286, 318 (phylogeny), 342 (distribution); 1975: 426 (culture medium, distribution), 449, 461 (phylogeny).

*Species included* (8). Originally, *D. rubrifrons* Patterson & Wheeler, 1942, *D. rubidifrons* Patterson & Mainland, 1944, and *D. spadicifrons* Patterson & Mainland, 1944 have been included. Wheeler (1949: 188) arranged these three species into a subgroup a and established a new subgroup b, for *D. uninubes* Patterson & Mainland, 1943 and *D. nubiluna* Wheeler, 1949; he also described an unnamed member supposedly [erroneously] belonging to this group (Wheeler 1949: 189) and tentatively added *D. parachrogaster* Patterson, 1943. Two undescribed species belonging to this group are mentioned by Throckmorton (1962). *D. xalapa* sp. nov. and *D. popayan* sp. nov., described below, are added to the subgroup b, which we are renaming as *D. uninubes* species subgroup. The subgroup a of Wheeler (1949: 188) is hereby renamed as *D. rubrifrons* subgroup. Additionally, we are transferring *D. nubiluna* from the *uninubes* to the *rubrifrons* species subgroup. Most species belonging in this group are apparently endemic to the Mexico's transvolcanic belt, mainly in the State of Michoacán.

*Diagnosis* (updated from Patterson & Mainland 1944). Brownish flies; frons reddish-brown to dark maroon; sterno-index about 0.6; acrostichal setulae in (6–)8 rows; anterior scutellar setae divergent; crossveins clouded, some species with additional spots or shadows in the wing tip area; costal index about 4.0; abdominal tergites usually with marginal bands which are medially narrowed or interrupted (medially broadened in *D. spadicifrons*); epandrium dorsoposteriorly microtrichose; surstyli and cerci not microtrichose in most species; cerci anteriorly connected to epandrium by membranous tissue; dorsal arch of hypandrium present; aedeagus dorsoapically bearing from two to five short, backwards directed processes, which are in some cases asymmetric.

*Comments*. The epithets *rubrifrons* and *rubidifrons* suggest a reddish to dark red color of the frons, most probably expressed in living specimens. We want to emphasize that this color character is paler in the pinned flies we have analyzed.

### ***Drosophila rubrifrons* species subgroup (renamed)**

*Drosophila rubrifrons* group, sub-group a, Wheeler, 1949:188.

*Species included* (4). *D. nubiluna* Wheeler, 1949, *D. rubidifrons* Patterson & Mainland, 1944, *D. rubrifrons* Patterson & Wheeler, 1942, *D. spadicifrons* Patterson & Mainland, 1944.

*Diagnosis*. Wings with distinct shadows along the main crossveins (indistinct in *D. nubiluna*); wing tip either hyaline or faintly shadowed, or with a shadow near the tip of cell  $r_{2+3}$ , slightly reaching vein  $R_{4+5}$  in *D. rubrifrons*, and also reaching the very tip of cell  $r_{2+3}$  and part of the cell  $r_{4+5}$  in *D. nubiluna*, whose wings bear

*submacroptera*

0.1 mm

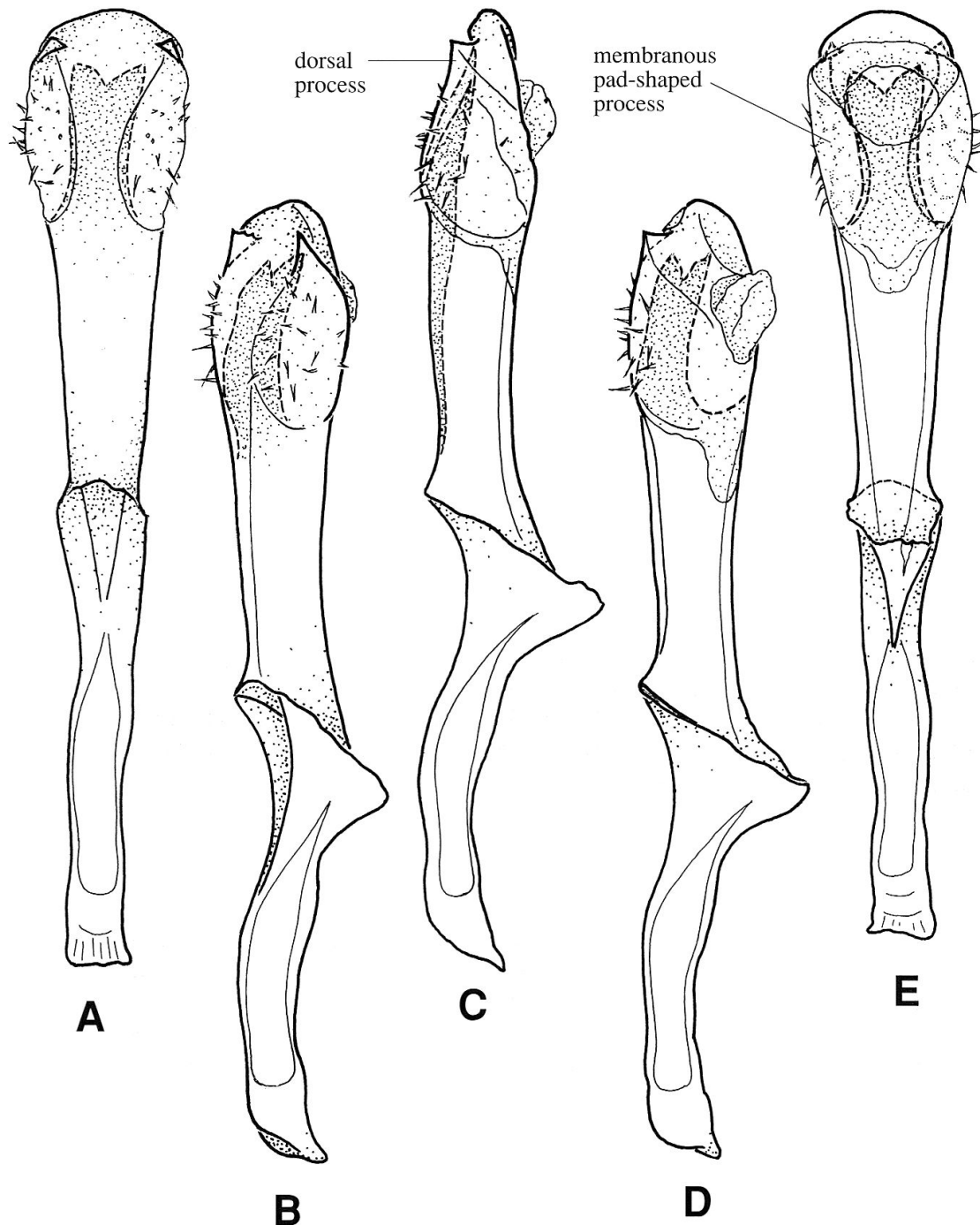


Fig. 9. *Drosophila submacroptera* Patterson & Mainland, male holotype. A–E, aedeagus+aedeagal apodeme, several views from dorsal through ventral.

additional shadows at tips of veins  $R_{2+3}$ ,  $R_{4+5}$  and M (the latter two being paler); epandrium only dorsoposteriorly but cerci mostly microtrichose; surstyli not microtrichose; aedeagus remarkably asymmetric but in *D. rubrifrons*, dorsoapically bearing two backwards directed processes, which are absent in the latter species.

***Drosophila nubiluna* Wheeler, 1949**

(Figs 11, 12, 24B, 25B, C)

*Drosophila nubiluna* Wheeler 1949: 188 (description, comparison with *D. uninubes*); Hsu 1949: 113, 139 [fig. 7, plate XV] (male terminalia); Patterson & Stone 1952: 41, 73, 108 (distribution); Vargas 1954: 152 (distribution); Wheeler 1970: 79.19 (catalog); Val et al. 1981: 149 (distribution).

*Material examined* (1 ♂, 1 ♀, preserved although incompletely [missing are: head, thorax, anterior abdomen and legs] in four slide mounts [as stated in the original description], two for each sex, deposited in the AMNH). Male holotype (preserved as two slide mounts; the terminalia slide mount was dismantled by us and the sclerites are now preserved in glycerin pinned together with the original labels): first slide labelled: "TYPE material [upper part red] / 1796.13 nubiluna ♂ genitalia [illegible handwriting]; second slide (right wing photographed [Fig. 25B]): "TYPE material [upper part red] / 1796.13, nubiluna ♂, wings, [illegible handwriting]". Female paratype ♀ (preserved as two slide mounts): first slide (right wing photographed [Fig. 25C]): "TYPE material [upper part red] / 1796.13, nubiluna ♀, wings, [illegible handwriting]"; second slide: "TYPE material [upper part red] / 1796.13, nubiluna ♀, genitalia, [illegible handwriting]". The following additional labels were added to the pin with the male terminalia and to the three remaining slide mounts: "HOLOTYPE [or PARATYPE] [red label] / ♂ [or ♀] / *Drosophila nubiluna* Wheeler Vilela & Bächli det."

*Type locality*. Morelia, State of Michoacán, Mexico.

*Diagnosis*. Yellowish flies with hunchbacked mesonotum, wing with a large dark spot near tip of cell  $r_{2+3}$ , not covering the tip of vein  $R_{2+3}$ , and more or less dark clouded crossveins; aedeagus long, bent, tube-shaped and remarkably asymmetric, as seen in laterodorsal view; subapically bearing a lateral, blunt, backwards and slightly leftwards directed process, and apically with a long, sharp, backwards and also slightly leftwards pointed process.

*Redescription*. ♂. (updated from Wheeler, 1949). Wing hyaline with a triangular spot near tip (Fig. 25B, C), beginning slightly behind the end of cell  $r_{2+3}$ , going back somewhat across cell  $r_{4+5}$  and filling the wing tip where it is less distinct; both crossveins, particularly dM-Cu, with a more or less diffuse shadow; length 2.99 mm, length to width ratio = 2.31. Indices: C = 3.70, ac = 1.95, hb = 0.18, 4C = 0.65, 4v = 1.59, 5x = 1.63, M = 0.51, prox. x = 0.45.

♂ *Terminalia* (Figs 11, 12, 24B). Epandrium dorsodistally microtrichose, with 3 lower, and ca. 2 upper setae; ventral lobe dorsally membranous, neither microtrichose nor covering surstylus. Cercus anteriorly connected to epandrium by membranous tissue, mostly microtrichose and devoid of ventral lobe, although ventromedially each plate is slightly projected downwards. Surstylus dorsoanteriorly strongly sclerotized, not microtrichose, bearing an almost straight row of 12–13 peg-like prensisetae, ca. 7–8 inner and 7 outer setae. Decasternum as in Fig. 11B. Hypandrium longer than epandrium; anterior half is missing in the specimen; dorsal arch present; gonopod well developed, partially fused to paraphysis, bearing two large setae near the median inner margin; left gonopod is partially missing in the specimen. Aedeagus fused to aedeagal apodeme, long, bent, tube-shaped, remarkably asymmetric, as better seen in laterodorsal view (Fig. 12B); subapically bearing a lateral, blunt, backwards and slightly leftwards directed process, and apically with a long, sharp, backwards and also slightly leftwards pointed process; laterally with a small membranous area between the two processes; dorsal cleft reduced to an opening adjacent to the fusion line aedeagus+aedeagal apodeme. Aedeagal apodeme twice as short as aedeagus, slightly flattened laterally. Ventral rod as wide as aedeagal apodeme width. Paraphysis fused to gonopod, posteriorly bearing 1 seta near dorsal margin and ca. 5 setulae medially on inner surface, connected to distal margin of aedeagal apodeme by membranous tissue.

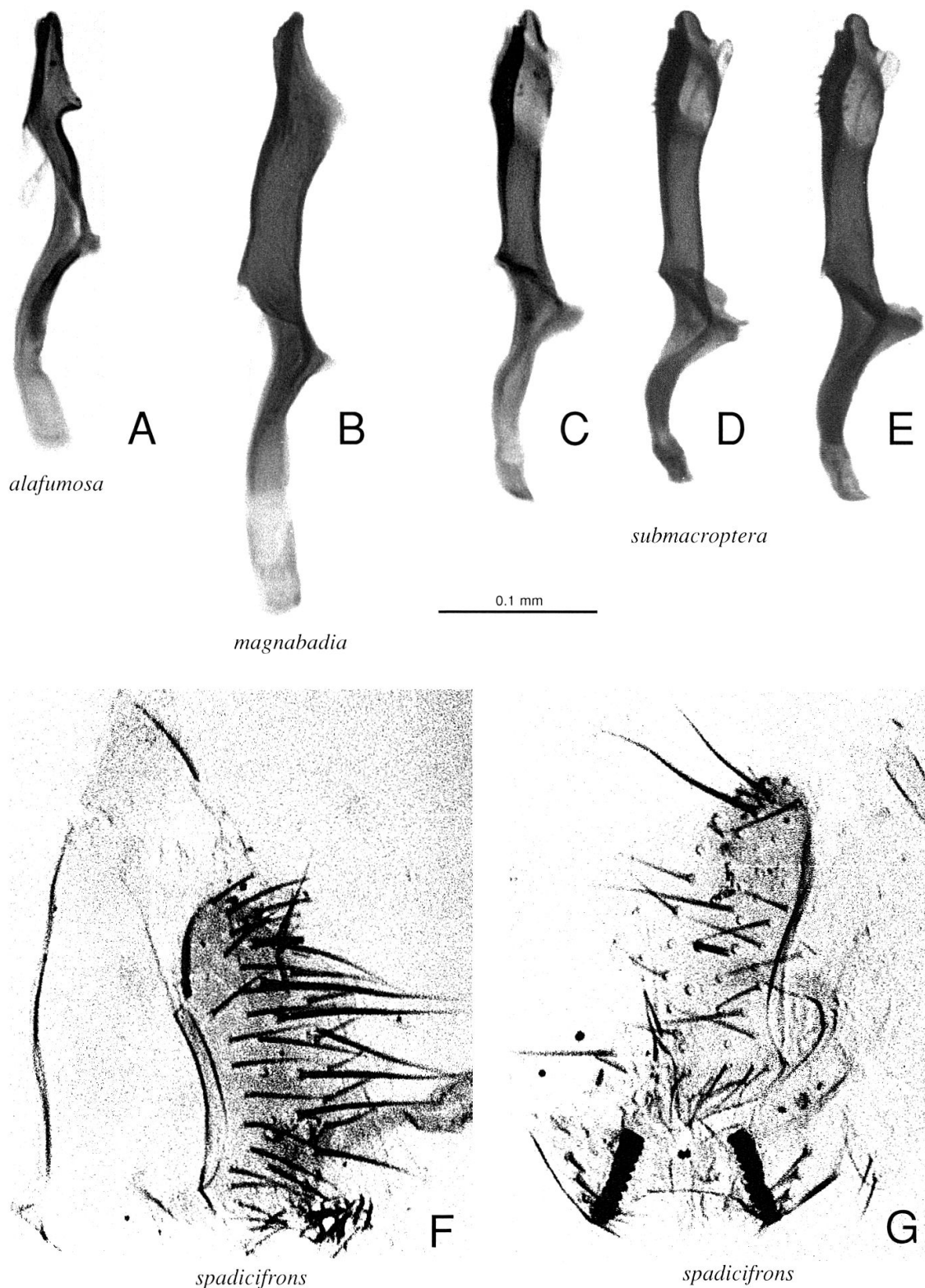


Fig. 10. A–E, Aedeagus+aedeagal apodeme, left lateral view, of: A, *Drosophila alafumosa* Patterson & Mainland, ordinary male, March 1952, Huachinango, Puebla, Mexico. B, *Drosophila magnabadia* Patterson & Mainland, holotype. C, *Drosophila submacroptera* Patterson & Mainland, holotype. D, idem, ordinary male December 26–28th, 1952, Xilitla, San Luis Potosí, Mexico. E, idem, ordinary male, June 23–24th, 1952, Huatusco, Veracruz, Mexico. F–G, *Drosophila spadicefrons*, Valle de Huajumbaro, Michoacán, Mexico, 31.VII.1942. F, upper left half of epandrium and left cercus, lateral view. G, idem, remaining part of epandrium, right cercus and surstyli, posterior view.



*nubiluna*

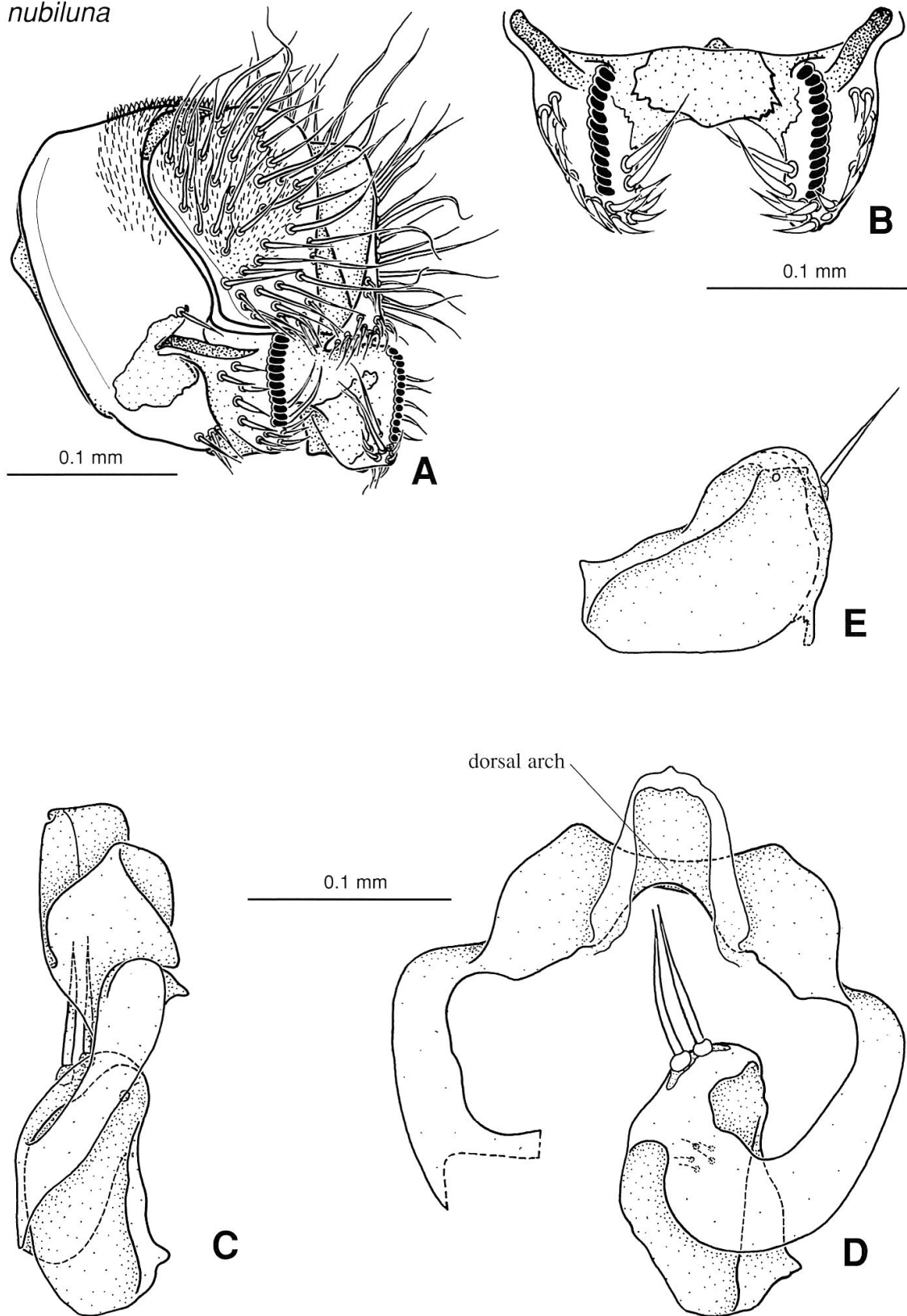


Fig. 11. *Drosophila nubiluna* Wheeler, male holotype. A, epandrium, cerci, surstyli and decasternum, oblique posterior view. B, surstyli and decasternum posterior view. C, hypandrium and right gonopod+paraphysis, right lateral view [anterior half missing]. D, idem, posterior view. E, isolated left paraphysis with remnants of left gonopod, including seta, outer lateral view.

*Distribution.* Mexico (State of Michoacán).

*Biology.* Unknown.

*Comments.* Its aedeagus is more similar to that of *D. rubidifrons* than to those of the other species in the group. This species seems to be endemic in the type locality area, which is included in the Mexico's transvolcanic belt.

### ***Drosophila rubidifrons* Patterson & Mainland, 1944**

(Figs 13, 14, 24A)

*Drosophila rubidifrons* Patterson & Mainland 1944: 48 (description), 23 (key); Wheeler 1949: 188 (affiliation); Patterson & Stone 1952: 41, 73, 75 (distribution); Vargas 1954: 152 (distribution); Val et al. 1981: 149 (distribution).

*Material examined* (1 ♂). Male holotype (dissected, deposited in the USNM) labelled: "1335.8 / Laguna Tempoala [misspelled, = Zempoala] Nat.[Nacional] Parque MEXICO / GB Mainland July 1952 / HOLOTYPE [red label] / *Drosophila rubidifrons* TypeNo. 101,019 U.S.N.M. / ♂ / *Drosophila rubidifrons* P. & M. Vilela & Bächli det."

*Type locality.* Parque Nacional Lagunas de Zempoala [cited as Laguna Tempoala in the label and as Lago Zempoala Parque Nacional in the original description], State of México, Mexico.

*Diagnosis.* Generally yellowish flies, frons laterally dark brown, mesonotum greyish brown, with four dark brown stripes, tergites with broad, dark marginal bands which are medially distinctly interrupted; aedeagus long, bent, tube-shaped, remarkably asymmetric, as seen in laterodorsal view, subapically bearing a larger lateroventral, leftwards pointed process, and apically with a smaller backwards pointed process.

*Redescription.* ♂. Head. Frons reddish-brown, dull, paler downwards, yellowish above antennae, frontal length 0.33 mm; frontal index = 0.86, top to bottom width ratio = 1.32. Frontal triangle blackish-brown, short, about 53 % of frontal length; ocellar triangle prominent, blackish, about 42 % of frontal length. Orbital plates narrow, apically distinctly diverging from eye margin, blackish-brown, about 79 % of frontal length. Orbital setae black, almost in a line, or2 slightly closer to or1 than to or3, distance of or3 to or1 = 75 % of or3 to vtm, or1 / or3 ratio = 0.79, or2 / or1 ratio = 0.27, postocellar setae = 68 %, ocellar setae = 84 % of frontal length; vibrissal index = 1.00. Face pale yellowish. Carina distinctly broadened downwards, dorsally flat, convex. Gena yellow. Cheek index about 5–6. Eye index = 1.21. Occiput blackish. Antennae brown. Length to width ratio of flagellomere 1 = 1.80. Arista with 5 dorsal, 2 ventral and about 10 small inner branches, plus terminal fork. Proboscis brownish-yellow.

Thorax length 1.19 mm. Scutum brown, slightly greyish, with 4 diffuse darker stripes inside and outside of the dorsocentral rows. 6 rows of acrostichal setulae. Transverse distance of dorsocentral setae 181 % of longitudinal distance; dc index = 0.58. Scutellum brown, laterally yellowish, distance between apical scutellar setae about 83 % of that of the apical to the basal one; basal ones divergent; scut index = 1.21. Pleura pale brownish, mid katepisternal seta about 63 % of the anterior one. Halter yellow. Legs yellow, fine preapical setae on all tibiae, ventral apical seta on mid tibia.

Wing hyaline but diffusely brownish in anterior half; both crossveins brown and distinctly shadowed, length 2.98 mm, length to width ratio = 2.36. Indices: C = 3.81, ac = 2.00, hb = 0.19, 4C = 0.67, 4v = 1.71, 5x = 1.38, M = 0.46, prox. x = 0.50.

Abdomen with yellow ground color; tergites 2–6 with broad marginal bands which are medially interrupted and lateroventrally covering the whole width; the bands on tergites 2 and 6 diffuse and narrower.

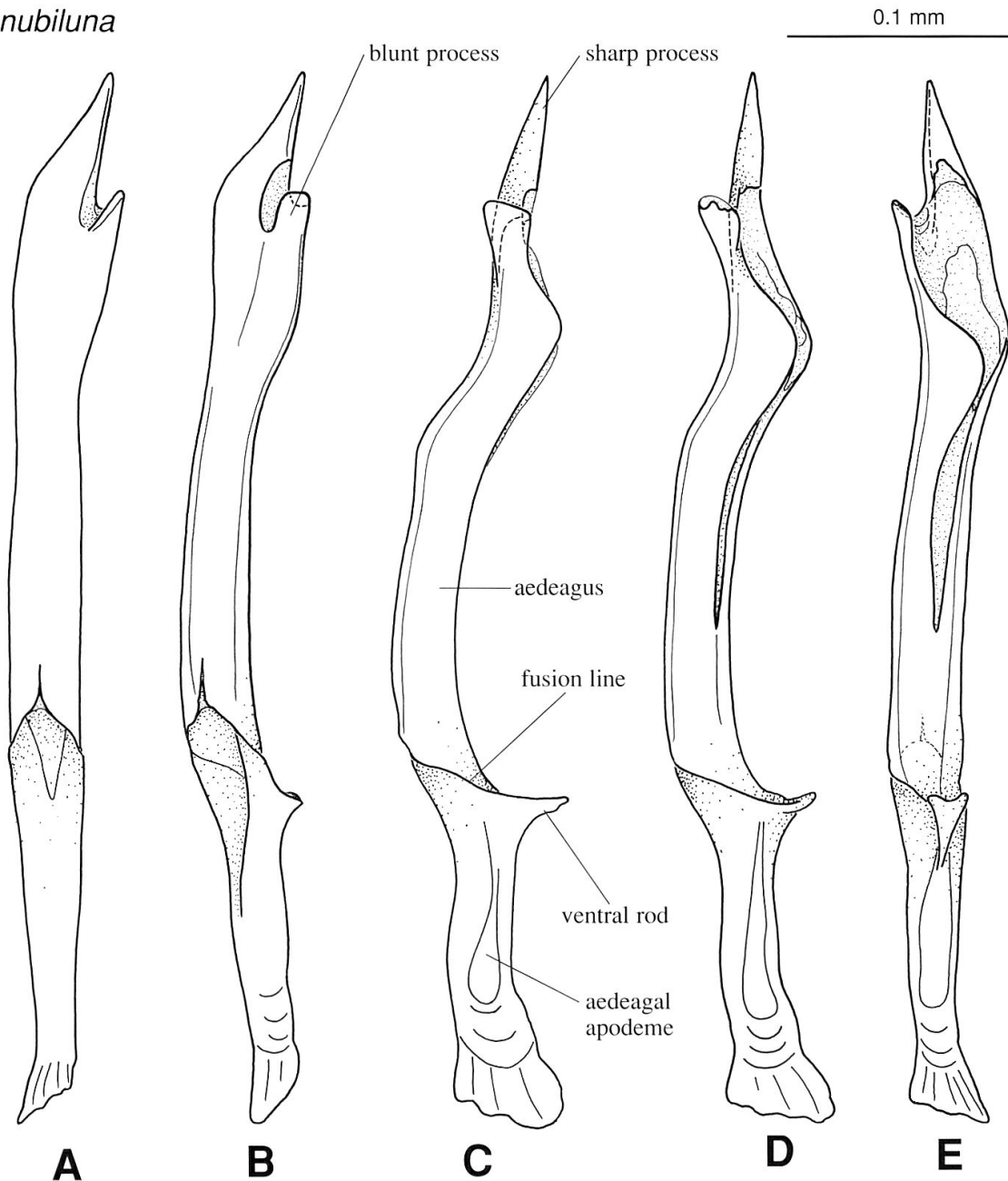
*nubiluna*

Fig. 12. *Drosophila nubiluna* Wheeler, male holotype. A–E, aedeagus+aedeagal apodeme, several views from dorsal through ventral.

♂ *Terminalia* (Figs 13, 14, 24A). Epandrium distally microtrichose, with 3–4 lower, and no upper setae; ventral lobe dorsally membranous, neither microtrichose nor covering surstylus. Cercus anteriorly connected to epandrium by membranous tissue, mostly microtrichose and devoid of ventral lobe, although ventromedially each plate is slightly projected downwards. Surstylus not microtrichose, dorsoanterioly strongly sclerotized, bearing an almost straight row of 10 peglike prenisetae, ca. 7–8 inner and 4 outer setae. Decasternum as in Fig. 13B. Hypandrium longer than epandrium, anterior margin straight; posterior hypandrial process absent; dorsal arch present, mediodistally membranous; gonopod well developed, fused to paraphysis, bearing one seta near the median inner margin. Aedeagus fused to aedeagal apodeme.



*rubidifrons*

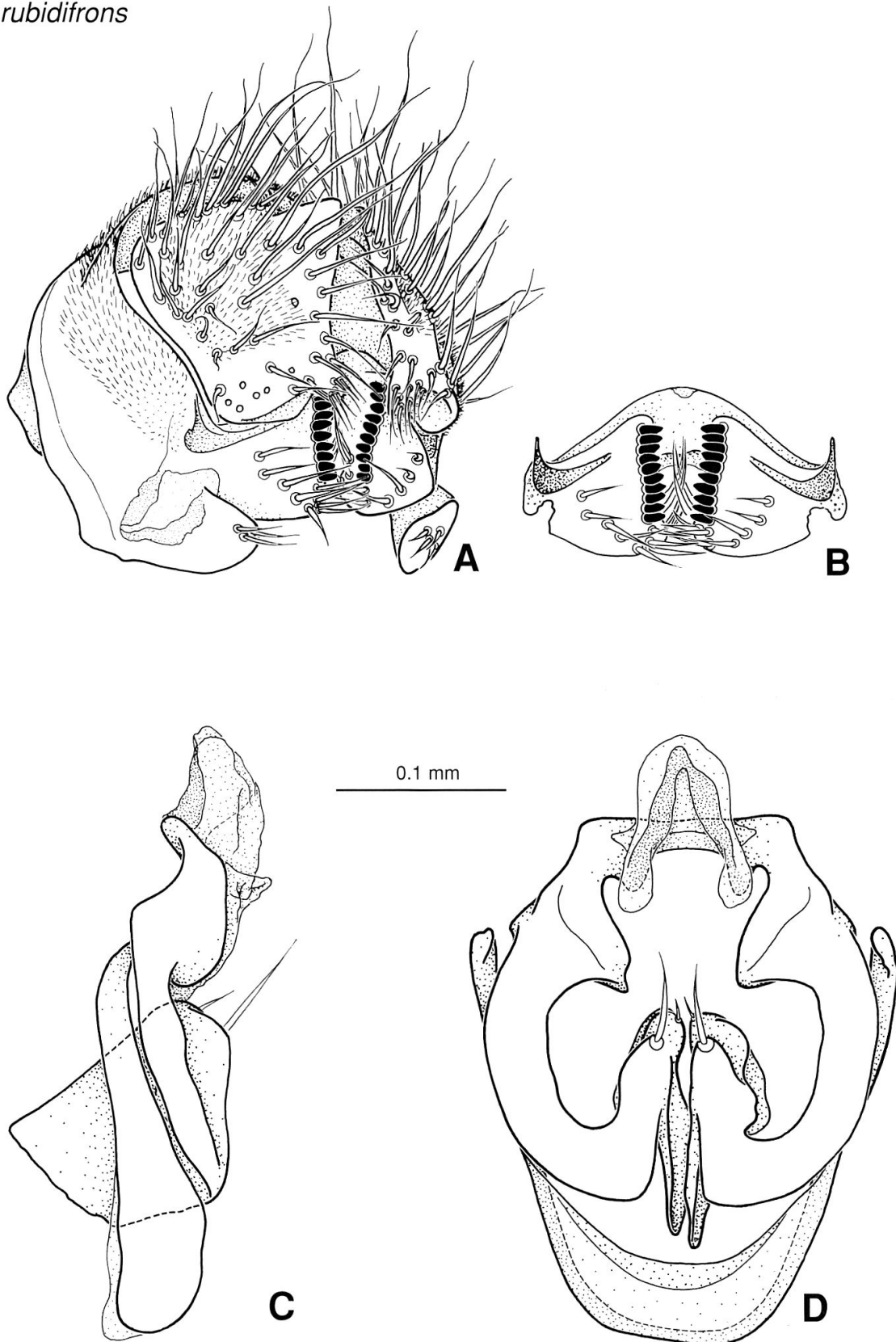


Fig. 13. *Drosophila rubidifrons* Patterson & Mainland, male holotype. A, epandrium, cerci, surstyli and decasternum, oblique posterior view. B, surstyli and decasternum posterior view. C, hypandrium and gonopods+paraphyses, left lateral view. D, idem, posterior view.

gal apodeme, long, bent, tube-shaped, remarkably asymmetric, as better seen in laterodorsal view (Fig. 14B); subapically bearing a larger lateroventral, leftwards pointed process, and apically with a smaller backwards pointed process; laterally with a scaled, elliptical, membranous area between the two processes; dorsal cleft reduced to an opening adjacent to the fusion line aedeagus+aedeagal apodeme. Aedeagal apodeme twice as short as aedeagus, laterally flattened. Ventral rod as long as adjacent aedeagal apodeme width. Paraphysis fused to gonopod, anteriorly bearing 1 seta on dorsal margin, connected to distal margin of aedeagal apodeme by membranous tissue.

*Distribution.* Mexico [State of México].

*Biology.* Unknown.

*Comments.* It is only known from the type locality, which is included in Mexico's transvolcanic belt.

### ***Drosophila rubrifrons* Patterson & Wheeler, 1942**

(Fig. 15)

*Drosophila rubrifrons* Patterson & Wheeler 1942: 107 (description); Sturtevant 1942: 18, 31, 281 (collection records), 47 (key); Patterson 1943: 50 (key), 187 (description), 189, 239, 240 (distribution), color plate VI (illustration); Patterson & Mainland 1944: 23 (key), 78, 96 (distribution), 95 (collection records); Hsu 1949: 112, 139 (male terminalia); Wheeler 1949: 188 (affiliation); Patterson & Stone 1952: 41, 73, 75, 108 (distribution); Malogolowkin, 1953: 258 (male terminalia); Clayton & Ward 1954: 100 (chromosomes, collection record); Vargas 1954: 152 (distribution); Heed et al. 1962: 73 (distribution); Wheeler 1970: 79, 22 (catalog); Clayton & Wheeler 1975: 471 (chromosomes); Val et al. 1981: 149 (distribution).

*Type locality.* Rustler's Park, Chiricahua Mountains, Arizona, U.S.A.

*Diagnosis.* Generally yellowish flies, frons reddish, gena broad, tergites with broad, dark marginal bands which are medially interrupted; epandrium with 4 lower, and no upper setae; dorsally not narrow (twice the width of that of *D. spadiceifrons*) in lateral view; anterior margin straight (not remarkably sinuate as in *D. spadiceifrons*); aedeagus distally expanded as seen in ventral view, devoid of distal processes and subdistally expanded ventrad as seen in ventral view.

♂ *Terminalia* (Fig. 15). Based on Malogolowkin's drawings (1953: 258, figs 46–49). Epandrium dorsally slightly microtrichose, with 3 lower, and 1–2 upper setae; ventral lobe neither microtrichose nor covering surstylus. Cercus anteriorly connected to epandrium by membranous tissue. Surstylus not microtrichose, bearing a straight row of 10 peglike prensisetae, ca. 4–6 inner and 3–4 outer setae. Hypandrium as long as epandrium, anterior margin rounded; posterior hypandrial process absent; dorsal arch present; gonopod fused to paraphysis, bearing one seta near the median inner margin. Aedeagus fused to aedeagal apodeme, distally expanded, as seen in ventral view; submedially expanded ventrally, as seen in lateral view. Aedeagal apodeme as long as aedeagus, rod-shaped. Ventral rod as long as aedeagal apodeme width. Paraphysis fused to gonopod.

*Distribution.* U.S.A. (States of Arizona and New Mexico), Mexico (Distrito Federal).

*Biology.* In the original description, Patterson & Wheeler (1942: 108) stated that the type specimens were found feeding on fungus [identification not stated]. According to Throckmorton (1975: 450, personal communication from W.B. Heed), it has been reared from fungus (species unspecified).

*Comments.* We were unable to localize any extant type or even correctly identified ordinary specimen of this species. However, based in the some evidences

detailed below, we suppose that the illustrations of the male terminalia provided by Malogolowkin (1953) are based on a specimen collected in one out of the only three places from where this species had been recorded at that time (Rustler's Park [Arizona, USA] or Gila National Forest [New Mexico, USA] or Distrito Federal [Mexico]), according to Patterson & Stone (1952: 75). Malogolowkin (1953: 245) stated she received material donated by M.R. Wheeler, most probably identified by him. Moreover, as Patterson & Stone (1952: 41, 42) stated that they have never been able to breed any of the species of the *rubrifrons* group on laboratory food, not many specimens should be available. For comparison purposes with the remaining species of its group, we have redrawn (Fig. 15) some of the original illustrations of Malogolowkin (1953). We believe they will allow, in the future, the correct identification of eventually collected male specimens.

### *Drosophila spadificrons* Patterson & Mainland, 1944

(Fig. 10F, G)

*Drosophila spadificrons* Patterson & Mainland 1944: 49 (description), 23 (key); Hsu 1949: 112, 139 (male terminalia); Wheeler 1949: 188 (affiliation); Patterson & Stone 1952: 41, 73, 75, 108 (distribution); Vargas 1954: 152 (distribution); Wheeler 1970: 79.22 (catalog); Val et al. 1981: 149 (distribution).

*Material examined* (1 ♂ [partially in a slide mount], 1 ♀). 1 pinned and putative type specimen (previously dissected, without abdomen, deposited in the AMNH), supposedly a ♂: "MEXICO: Valle de Huajumbro [misspelled, = Huajumbaro], Michoacán 2387 M. [sic] 1343.6, VI\31\42, G. B. Mainland \ L. Morroquin / probably type specimen Vilela & Bächli det." Microscope slide mount ♂ (only part of terminalia [hypandrium and aedeagus are missing]; evidences are that this microscope slide mount belongs to the pinned specimen cited above): "1343.6 D. spadificrons [red-bordered label] / probably type specimen Vilela & Bächli det.". Putative pinned type specimen (not dissected) ♀: same data as putative male type specimen. The following two additional labels were both added to the pinned specimens and to the slide mount: "♂ [or ♀] / *Drosophila spadificrons* P. & M. Vilela & Bächli det.".

*Type locality*. Mil Cumbres, State of Michoacán, Mexico.

*Diagnosis*. Generally yellowish flies, posterior part of the orbital plates dark brown, slightly elevated; mesonotum brownish, with a diffuse dark median stripe; tergites with dark marginal bands which are medially broadened, reaching the basal margin; epandrium with 2 lower, and no upper setae; dorsally narrower (less than half the width of that of *D. rubrifrons*) in lateral view; anterior margin remarkably sinuate (straight in *D. rubrifrons*).

*Redescription*. ♂. Head. Frons reddish-brown, dull, frontal length 0.36 mm; frontal index = 0.90, top to bottom width ratio = 1.40. Frontal triangle brown, with three dark brown areas, one on front of the anterior ocellus, the other two along the lateral margins of the ocellar triangle, about 63 % of frontal length; ocellar triangle blackish-brown, prominent, about 37 % of frontal length. Orbital plates brown, narrow, apically divergent from eye margin, slightly prominent in the uppermost third, laterally distinctly elevated from eye margin, about 84 % of frontal length. Orbital setae black, or2 slightly closer to or1 than to or3, close to the eye margin, distance of or3 to or1 = 87 % of or3 to vtm, or1 / or3 ratio = 0.63, or2 / or1 ratio = 0.50, ocellar setae = 83 % of frontal length; vibrissal index = 1.00. Face brown. Carina prominent, noselike, broad but almost parallel-sided, dorsally flat, laterally with sharp edges. Cheek index about 6–7. Eye index = 1.19. Occiput brown, darker in the uppermost part. Pedicel yellowish-brown. Flagellomere 1 brown, length to width ratio = 1.40. Arista with 4–5 dorsal, 3 ventral and about 4–5 inner

*rubidifrons*

0.1 mm

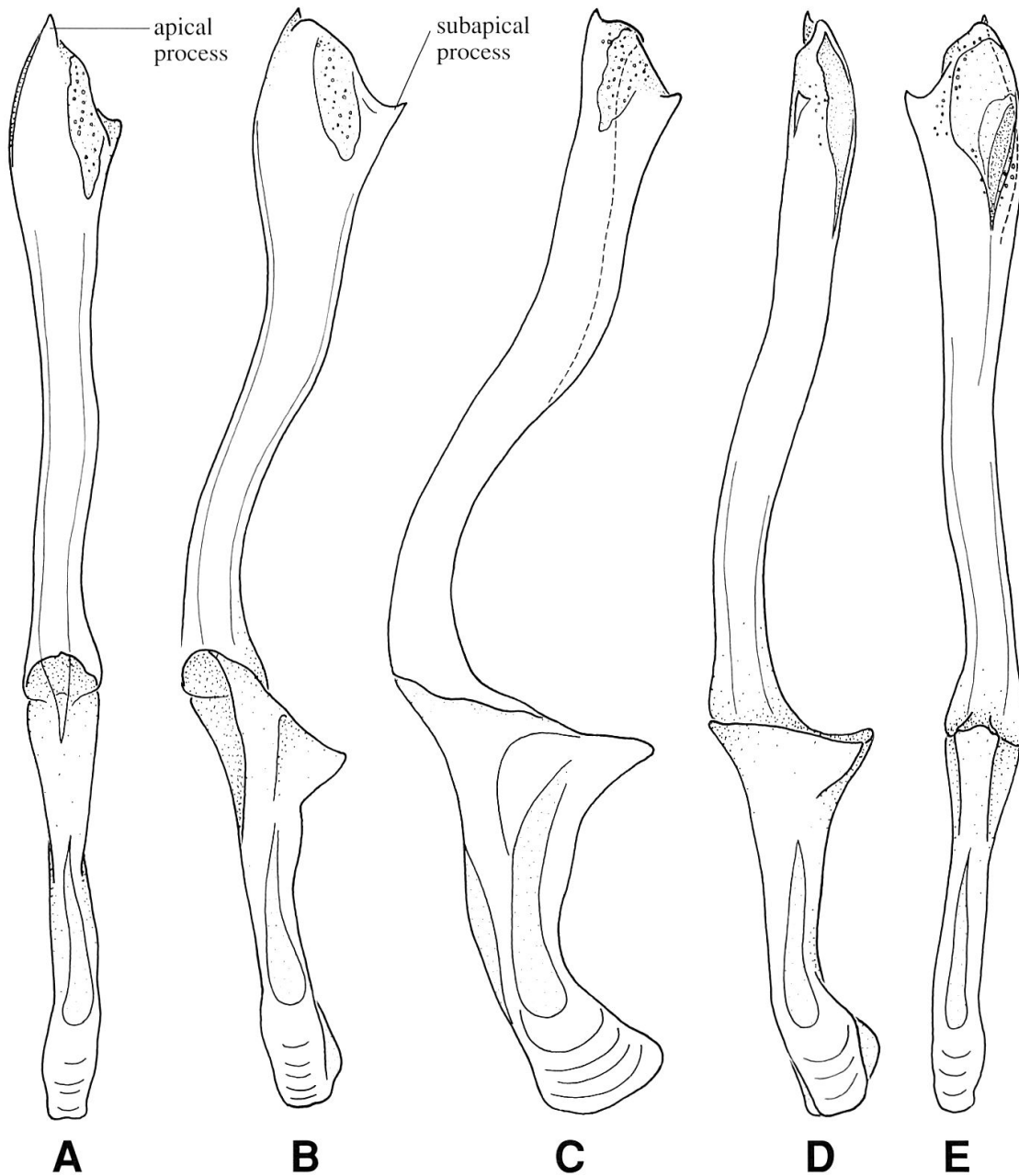


Fig. 14. *Drosophila rubidifrons* Patterson & Mainland, male holotype. A–E, aedeagus+aedeagal apodeme, several views from dorsal through ventral.

branches, plus small terminal fork. Proboscis brownish-yellow. Palpus with 4–5 black setae along the lower margin.

Thorax length 1.24 mm. Scutum brown, subshiny, with a diffuse median stripe which is darker and broader towards the scutellum. 6–8 rows of acrostichal setulae. Transverse distance of dorsocentral setae 153 % of longitudinal distance; dc index = 0.69. Scutellum slightly darker than scutum, distance between apical scutellar setae about 86 % of that of the apical to the basal one; basal ones distinctly divergent. Pleura yellowish, sterno index = 0.62, mid katepisternal seta strong, about

94 % of the anterior one. Halter brownish. Legs yellowish, fine preapical setae on all tibiae, ventral apical seta on mid tibia.

Wing hyaline in basal half, diffusely brownish striped in apical half, veins brown, darker brown stripes along cell  $r_{2+3}$ , both main crossveins broadly clouded, length 2.94 mm, length to width ratio = 2.27. Indices:  $C = 3.33$ ,  $ac = 2.57$ ,  $hb = 0.28$ ,  $4C = 0.82$ ,  $4v = 1.64$ ,  $5x = 1.00$ ,  $M = 0.41$ , prox.  $x = 0.77$ .

Abdomen with yellowish ground color, tergites 2–6 with broad marginal bands which are slightly broadened in the midline and not interrupted.

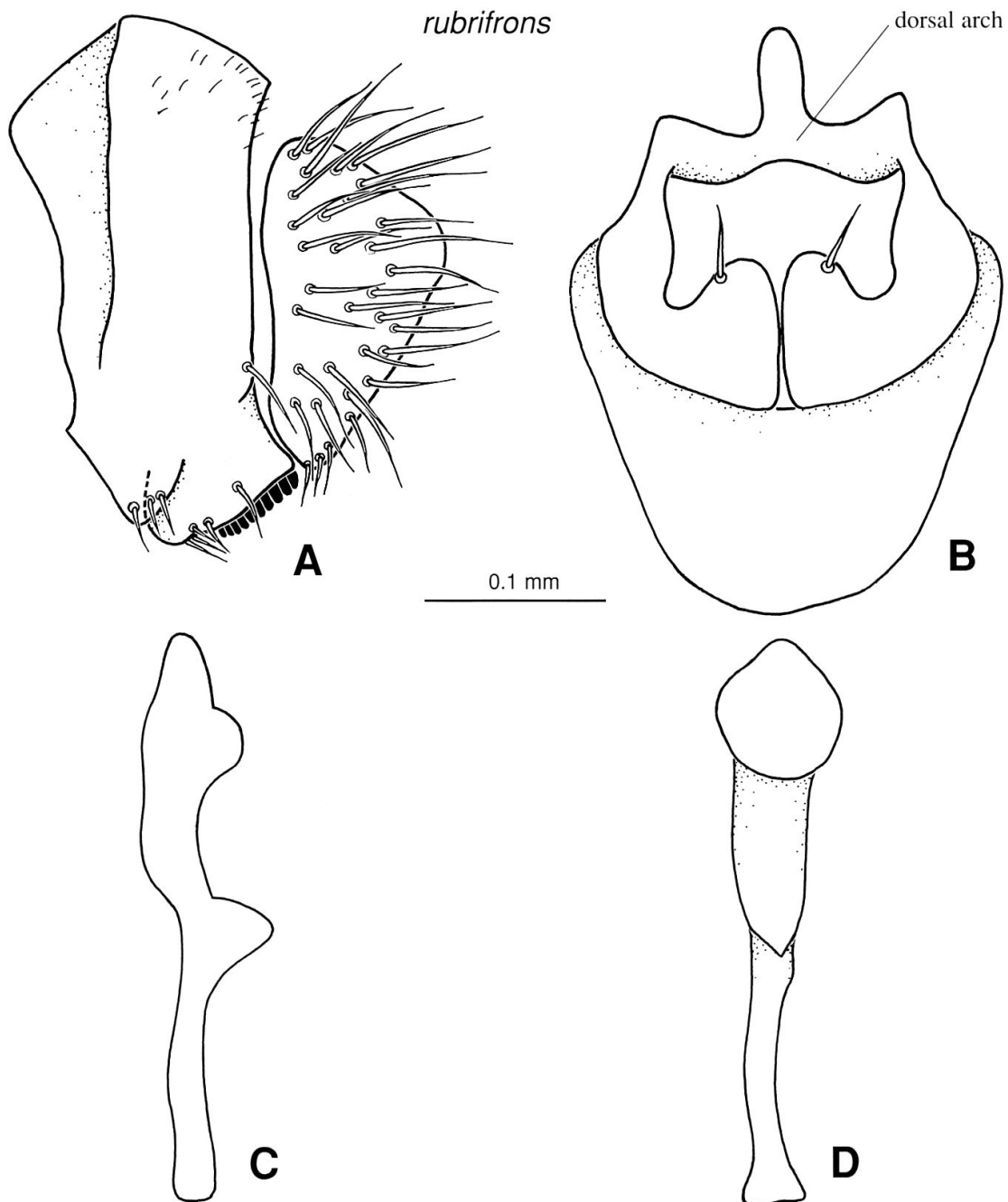


Fig. 15. *Drosophila rubrifrons* Patterson & Wheeler, male (redrawn from Malogolowkin 1953:258). A, epandrium, cerci, and surstyli, left lateral view. B, hypandrium and gonopods+paraphyses, posterior view. C, aedeagus+aedeagal apodeme, left lateral view. D, idem, ventral view.

♂ *Terminalia* (Fig. 10F, G, and based on Hsu, 1949: 112, 139, plate XV, fig. 5, and on his slide mount deposited at the AMNH [collection code = 1343.6]). Epan-drium with 2 lower, and no upper setae; in lateral view, dorsally narrower (less than half the width of that of *D. rubrifrons*; compare figs 5 and 6 of Hsu 1949:139), ante-rior margin remarkably sinuate (straight in *D. rubrifrons*), ventral lobe not cover-ing surstylus. Cercus anteriorly connected to epan-drium by membranous tissue. Surstylus bearing a straight row of 10–11 peglike prensisetae, ca. 7–8 inner and 4 outer setae. Hypandrium, aedeagus, and aedeagal apodeme unknown.

♀. Measurements: Frontal length 0.32 mm; frontal index = 0.79, top to bot-tom width ratio = 1.25. Frontal triangle about 67 % of frontal length; ocellar trian-gle about 33 % of frontal length. Orbital plates about 78 % of frontal length. Dis-tance of or3 to or1 = 75 % of or3 to vtm, or1 / or3 ratio = 0.73, or2 / or1 ratio = 0.55, postocellar setae = 63 %, ocellar setae = 95 % of frontal length; vibrissal index = 0.86. Cheek index about 8–9. Eye index = 1.21. Thorax length 1.38 mm. h index = 1.00. dc index = 0.71. Apical scutellar setae equidistant; scut index = 1.13. Wing length 3.15 mm, prox. x = 0.62.

Oviscapt triangular, apically very narrow.

*Distribution.* Mexico (State of Michoacán).

*Biology.* Unknown.

*Comments.* We were unable to localize any extant type specimen labeled as such. The redescription given above is based on two double-mounted pinned spec-imens (1 intact ♀ and 1 fly without abdomen, probably a ♂), previously identified as *D. spadiceifrons*; apparently collected at the type locality, as discussed below, and showing the particular but subtle elevation of the posterior portion of the orbital plates [near the eye margin where the vertical setae lie], as mentioned in the key and the original description by Patterson & Mainland (1944: 23, 49).

Below we present some evidences favouring our hypothesis that those two specimens could belong to the original type series, but for some unknown reason were not labelled as such. No specimen identified as *D. spadiceifrons* was found in the collections of the USNM (W.N. Mathis, pers. comm.). In the collections of the AMNH there are only two specimens labelled as *D. spadiceifrons* as cited above, both of them collected on July 31st, 1942 at Valle de Huajumbaro, exactly the same date as cited in the original description. Although the collection date and the state [Michoacán] are identical, the locality name in the original description (Mil Cum-bres) differs from that on the labels (Valle de Huajumbro [misspelled]). However, according to the maps of Michoacán, Huajumbaro [probably west of it] is located within or very close to [the Sierra de] Mil Cumbres, which is cited as type locality in the original description. Mil Cumbres [Spanish, meaning “Thousand Peaks”] is a mountainous area, located west of Mexico City, between Ciudad Hidalgo and Morelia [capital of Michoacán], covered with thick pine forests, and crossed by one winding section of Highway # 15. Between the peaks there are valleys, and Valle [valley] de Huajumbaro could be one of those. Moreover, Patterson & Mainland (1944:10) stated that “Our own collecting [in Mexico] was done from a truck, which made it necessary to stay near the main highways and better class of gravel roads”. In addition, there also exist in the collections of the AMNH a slide preparation labelled “1343.6 *D. spadiceifrons*” which clearly has been used by Hsu (1949:139, fig. 5) as basis for the illustration of the male terminalia. The slide mounting con-tains only the external terminalia (epandrium, cercus and surstylus); part of the left side [Fig. 10F] is separated from that of the right side [Fig.10G]) and according to D. A. Grimaldi (pers. comm.) the cited code number, as detailed in the field/lab



notebook deposited in the AMNH, means: “near rubrifrons” “=spadicifrons” “G.B. Mainland coll, Valle de Huajumbro [Huajumbaro], Michoacan”. The collection place matches well with that cited by Hsu (1949:112) for the specimen he illustrated as *D. spadicifrons*. So, we are assuming that the slide mounting of the male terminalia [collection code = 1343.6] belongs to the specimen without abdomen [collection code = 1343.6], which must therefore be a male, both of them belonging to the collection of the AMNH. It must be kept in mind that most of the specimens of the collection originally kept at the Zoology Department of the University of Texas at Austin, mainly those collected by J.T. Patterson, M.R. Wheeler and G.B. Mainland, were transferred during the decade of 1980 to the AMNH. Some of them had been previously transferred to the USNM. Although the remains of the male terminalia of *D. spadicifrons* in the slide mount housed in the AMNH are weakly stained, we took two photomicrographs (Figs 10F, G) that in some way would complement the drawing made by Hsu (1949:139).

This species seems to be endemic in the type locality area, which is included in the Mexico’s transvolcanic belt.

### ***Drosophila uninubes* species subgroup (renamed)**

*Drosophila rubrifrons* group, sub-group b, Wheeler, 1949: 188.

*Species included* (4). *D. parachrogaster* Patterson & Mainland, 1943, *D. popayan* sp. nov., *D. uninubes* Patterson & Mainland, 1943, *D. xalapa* sp. nov.

*Diagnosis.* Wings with diffuse shadows around the main crossveins and with one more or less dark shadow near tip of cell  $r_{2+3}$  not reaching vein  $R_{4+5}$ , except in *D. parachrogaster*, where it is hyaline; epandrium dorsodistally microtrichose; surstyli and cerci not microtrichose, except in *D. xalapa* sp. nov. where the cerci bear few scattered microtrichia; hypandrium in lateral view remarkably bent anterad, except in *D. xalapa* sp. nov. where it is straight; aedeagus symmetric and dorsoapically bearing from two to five short, backwards directed processes.

### ***Drosophila parachrogaster* Patterson & Mainland, in Patterson, 1943**

(Figs 16, 17, 24C, D)

*Drosophila parachrogaster* Patterson & Mainland, in Patterson 1943: 197 (description), 25, 31 (collection records); Wharton 1943: 290, 318 (chromosomes); Patterson & Mainland 1944: 24 (key), 50 (affiliation), 95 (collection records), color plate XVI (illustration); Hsu 1949: 113, 141 (male terminalia); Wheeler 1949: 188 (affiliation); Patterson & Stone 1952: 76, 78, 108 (distribution); Nater 1953: 468–470 (male terminalia); Vargas 1954: 152 (distribution); Throckmorton 1962: 224, 240, 241, 268, 276 (phylogeny), 342 (collection record); Wheeler 1970: 79.20 (catalog); Clayton & Wheeler 1975: 487 (chromosomes); Val et al. 1981: 149 (distribution).

*Material examined* (4 ♂♂, 12 ♀♀). Male holotype (dissected, deposited in the USNM): “Laguna Patzcaro [misspelled, = Pátzcuaro] Mich., Mex. Aug. 1942 / G.B. Mainland / HOLOTYPE [red label] / 1344.23 ♂ / *Drosophila parachrogaster* P. & M. / TypeNo. 101,017 U.S.N.M.”. Paratypes (AMNH): 3 ♂♂, 2 ♀♀, same data as holotype (but with yellow paratype label). Ordinary specimens (5 ♀♀, AMNH): 1 ♀: “30 mi N. Cuernavaca Morelos / MEXICO July 1952 / WBHeed MWasserman / 2268.9”; 1 ♀ [head missing]: “19 mi E Morelia Mich. Mex. / MR Wheeler FA Cowan Sept. 1947 / 1796.20 [handwriting illegible]”. 1 ♀: “MEXICO, 2 mi. N. Uruapan Michoacán 1800 M. [sic], VIII 24 1348.8, G.B. Mainland \ L. Morroquin “. 2 ♀♀ [right wing missing in one]: “30 mi. E. Mexico City, MEXICO / June 1952 WBHeed MWasserman / rubidi.[sic] 2265.6 b”. Ordinary specimens (5 ♀♀ with identical labels, ZMUZ): “MEXICO: Chihuahua Gage R. Santa Clara x.1942 G.B.Mainland coll. / ♀ / *Drosophila parachrogaster* P.M.

*parachrogaster*

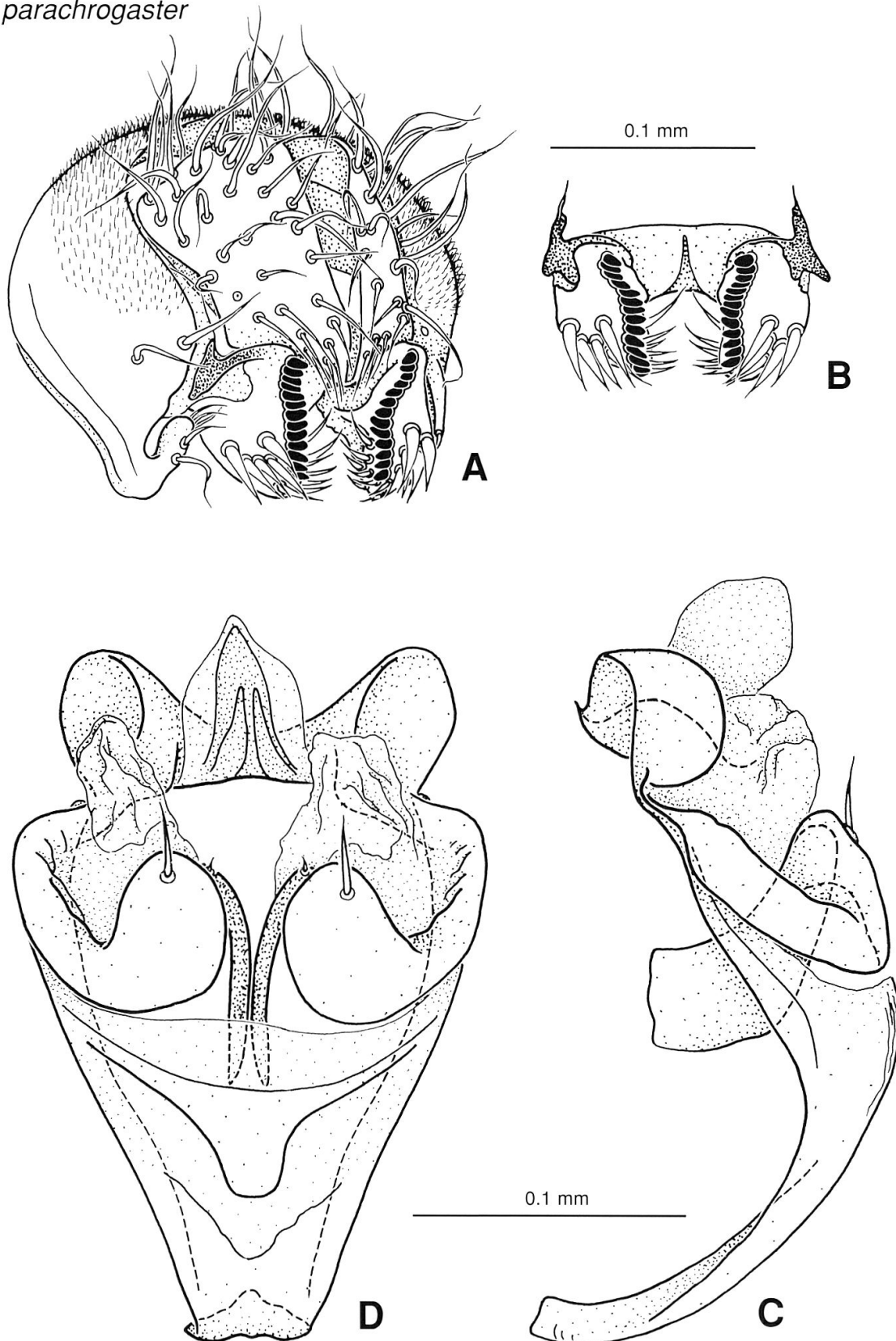


Fig. 16. *Drosophila parachrogaster* Patterson & Mainland, male holotype. A, epandrium, cerci, surstyli and decasternum, oblique posterior view. B, surstyli and decasternum posterior view. C, hypandrium and gonopods+paraphyses, left lateral view. D, idem, posterior view.



G. Bächli det.”. The following two additional labels were added to the specimens [the first one only if needed]: “♂ [or ♀] / *Drosophila parachrogaster* P&M Vilela & Bächli det.”.  
*Type locality*: Laguna Pátzcuaro, Michoacán, Mexico.

**Diagnosis.** Generally yellowish flies; mesonotum with faint stripes; abdomen with distinctly interrupted marginal bands; wings with faintly clouded crossveins; aedeagus dorsoapically bearing three short, sharply pointed backwards directed processes, and ventroapically with a pair of lateral, short, backwards pointed processes; lateroventrally membranous at distal region, which is covered with a collar of tiny scales.

**Redescription.** ♂. Head. Frons dull brown, with a narrow yellowish band above antennae, frontal length 0.28 (0.27–0.33) mm; frontal index = 0.93

*parachrogaster*

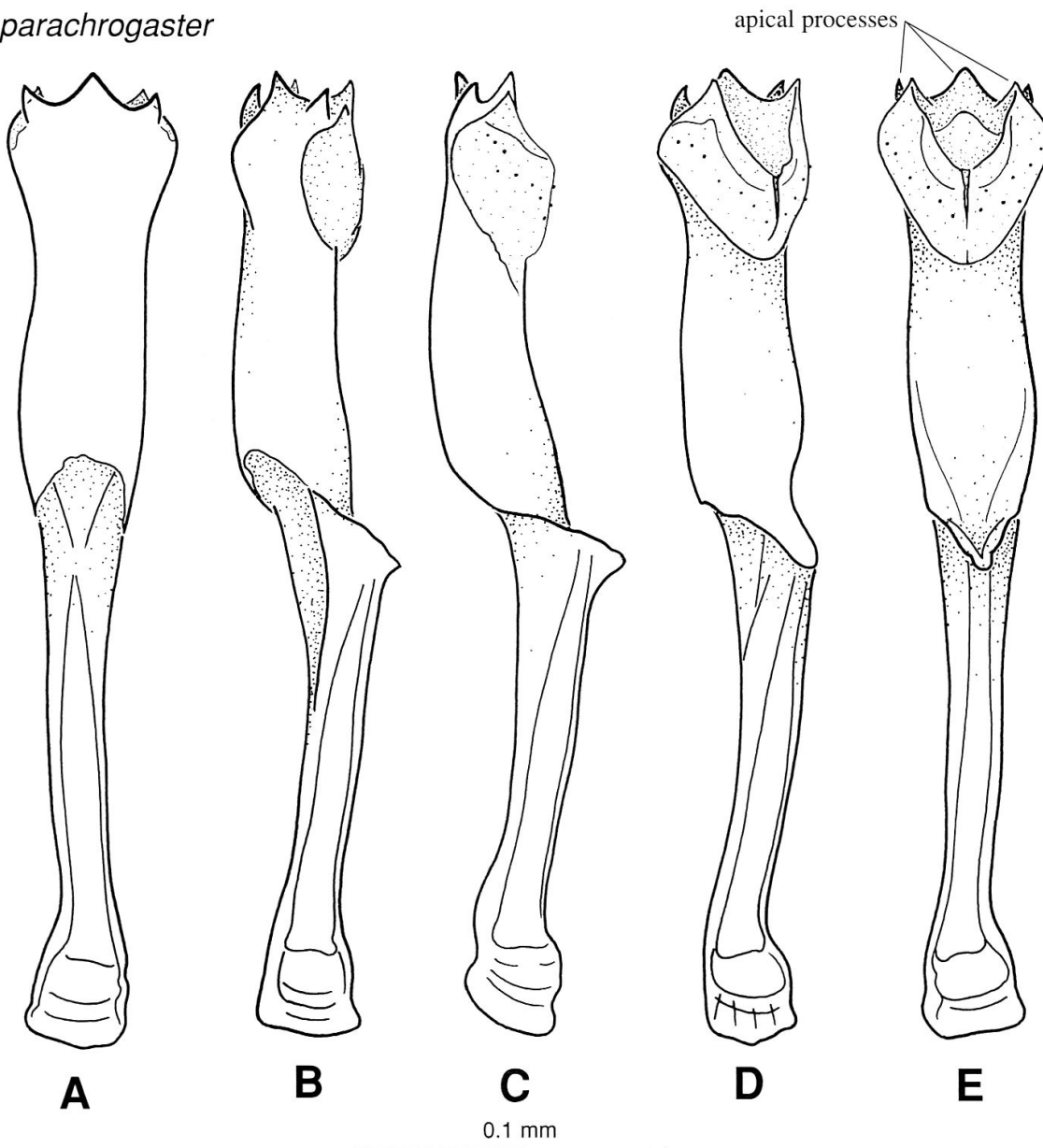


Fig. 17. *Drosophila parachrogaster* Patterson & Mainland, male holotype. A–E, aedeagus+aedeagal apodeme, several views from dorsal through ventral.

(0.90–0.94), top to bottom width ratio = 1.37 (1.29–1.41). Frontal triangle brown, subshiny, short, rather indistinct, about 50–58 % of frontal length; ocellar triangle prominent, brown, subshiny, about 44–47 % of frontal length. Orbital plates brown, subshiny, apically slightly diverging from eye margin, about 81–87 % of frontal length. Orbital setae black, or2 closer to or1 than to or3 and close to the eye margin, distance of or3 to or1 = 71–83 % of or3 to vtm, or1 / or3 ratio = 0.81 (0.69–0.91), or2 / or1 ratio = 0.51 (0.50–0.56), postocellar setae = 60 (56–69) %, ocellar setae = 80 (68–88) % of frontal length; vibrissal index = 0.86 (0.78–0.90). Face brown. Carina distinctly diverging downwards, evenly convex. Cheek index about 6–8. Eye index = 1.15 (1.13–1.18). Pedicel brownish. Flagellomere 1 darker brown, length to width ratio = 1.20. Arista with 3 dorsal, 1–2 ventral and about 7 small inner branches, plus terminal fork. Proboscis brownish-yellow.

Thorax length 0.95 (0.90–1.07) mm. Scutum yellowish, (6–)8 rows of acrostichal setulae. h index = 1.08 (1.00–1.13). Transverse distance of dorsocentral setae 170–189 % of longitudinal distance; dc index = 0.66 (0.65–0.67). Scutellar setae nearly equidistant; basal ones divergent; sterno index = 0.52 (0.50–0.53), mid katepisternal seta about 50–78 % of the anterior one. Pleura pale yellowish-brown. Halter yellow. Legs brownish-yellow, fine preapical setae on all tibiae, ventral apical seta on mid tibia.

Wing hyaline, both crossveins diffusely shadowed, length 2.19 (2.06–2.38) mm, length to width ratio = 2.34 (2.30–2.36). Indices: C = 4.10 (3.01–4.20), ac = 2.01 (1.83–2.20), hb = 0.40 (0.36–0.45), 4C = 0.62 (0.59–0.65), 4v = 1.68 (1.65–1.72), 5x = 1.24 (1.17–1.33), M = 0.45 (0.41–0.50), prox. x = 0.56 (0.53–0.59).

Abdomen pale brownish, tergites 2–6 with diffuse, broad, dark brown marginal bands which are medially interrupted.

♂ *Terminalia* (Figs 16, 17, 24C, D). Epandrium dorsodistally microtrichose, with 5 lower, and 2 upper setae; ventral lobe finger-shaped, curved, neither microtrichose nor covering surstylus. Cercus anteriorly connected to epandrium by membranous tissue, not microtrichose and devoid of ventral lobe, although ventromedially the plates are slightly fused to each other and projected downwards. Surstylus dorsoanteriorly strongly sclerotized, not microtrichose, bearing a slightly waved row of 13 peglike prensisetiae, ca. 6 thin inner and 6 thicker outer setae. Decasternum as in Fig. 16B. Hypandrium longer than epandrium, in lateral view remarkably bent anterad, anterior margin narrow; posterior hypandrial process absent; dorsal arch present, well developed, W-shaped, mediodistally membranous; gonopod partially fused to paraphysis, bearing one seta near the median inner margin. Aedeagus fused to aedeagal apodeme, tube-shaped; dorsoapically bearing three short, sharply pointed backwards directed processes, and ventroapically with a pair of lateral, short, backwards pointed processes; lateroventrally membranous at distal region, which is covered with a collar of tiny scales; dorsal cleft reduced to an opening adjacent to the fusion line aedeagus+aedeagal apodeme. Aedeagal apodeme slightly longer than aedeagus, rod-shaped. Ventral rod shorter than aedeagal apodeme width. Paraphysis partially fused to gonopod, anteriorly bearing 1 setula on dorsal margin, connected to distal margin of aedeagal apodeme by membranous tissue.

*Distribution.* Mexico (States of Chihuahua, Durango, Zacatecas, México and Michoacán).

*Biology.* Unknown.

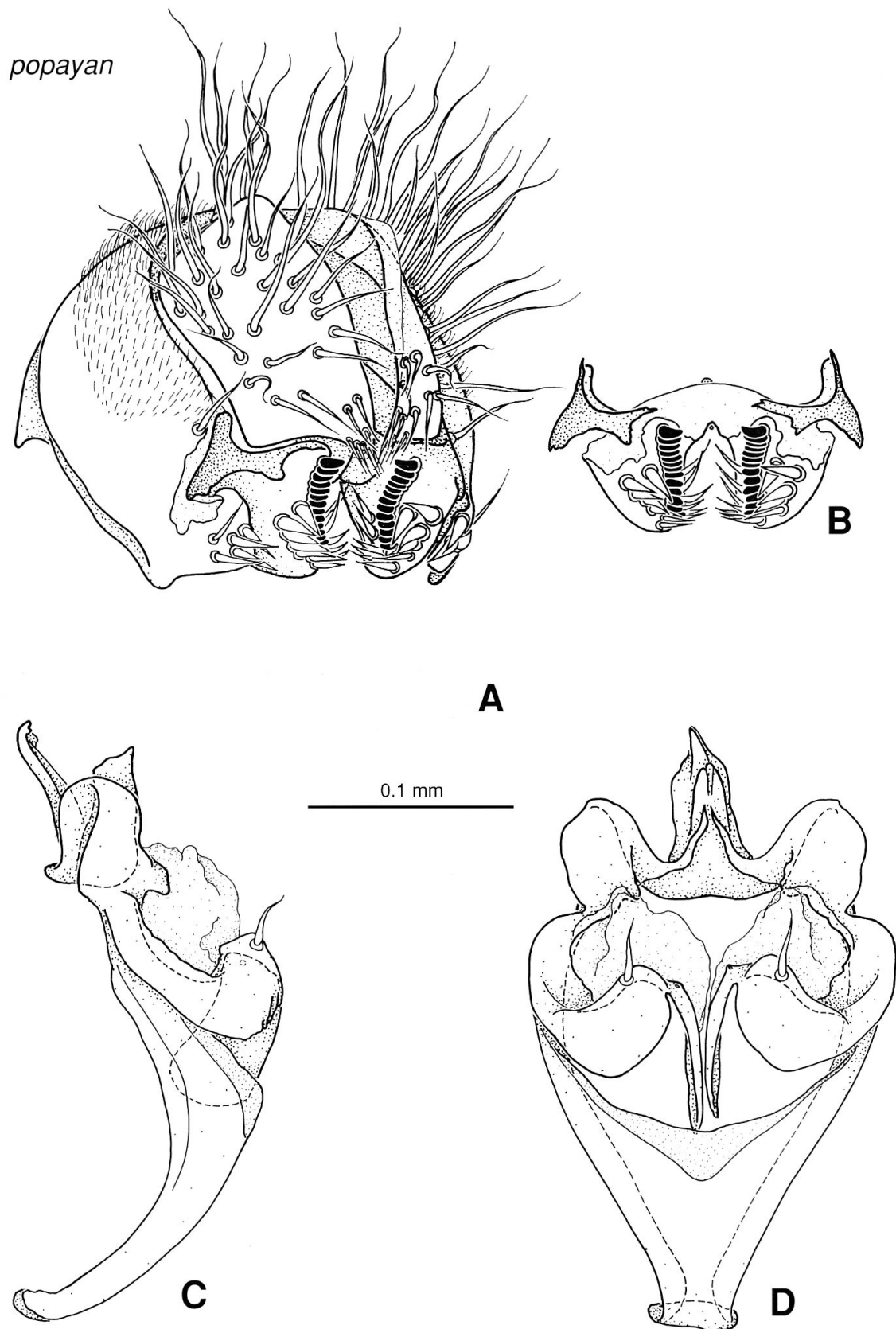


Fig. 18. *Drosophila popayan* sp. nov., male holotype. A, epandrium, cerci, surstyli and decasternum, oblique posterior view. B, surstyli and decasternum posterior view. C, hypandrium and gonopods+paraphyses, left lateral view. D, idem, posterior view.

***Drosophila (Drosophila) popayan* sp. nov.**

(Figs 18, 19, 24K–N, 26D, E)

*Material examined* (3 ♂♂, 1 ♀). Male holotype (AMNH, dissected, right wing removed) labelled: "30 klm [sic] N Popayan COLOMBIA / MRWheeler Collector Mar. 1958 HOLOTYPE / ♂ / *Drosophila popayan* Vilela & Bächli det.". Paratypes (AMNH, 2 ♂♂, right wing removed, dissected) labelled: "Boquete Chiriqui P.[Panama] Panama / WBHeed MWasserman August 1958. One female (ZMUZ) from Venezuela, which is doubtfully assigned to this species, is not being considered a paratype (see comments).

*Type locality*. Popayan, Department of Cauca, Colombia.

*Diagnosis*. Wing patches and abdominal pattern very similar to *D. uninubes*; aedeagus slightly bent, laterally expanded at tip; subapically bearing a pair of dorsal, backwards directed, tiny processes; lateroapically with a pair of inward curved processes; lateroventrally membranous at distal region, which is covered with a collar of tiny scales.

*Description*. ♂. Head. Frons reddish-brown, yellowish-brown above antennae, frontal length 0.28 (0.27–0.29) mm; frontal index = 0.87 (0.84–0.89), top to bottom width ratio = 1.34 (1.32–1.37). Frontal triangle about 56 % of frontal length; ocellar triangle prominent, dark brown, greyish microtrichose, about 44 % of frontal length. Orbital plates narrow, apically diverging from eye margin, dark brown, greyish microtrichose, about 81 % of frontal length. Orbital setae black, or2 halfway of the other two, slightly closer to eye margin than or1, distance of or3 to or1 = 57 % of or3 to vtm, or1 / or3 ratio = 0.76 (0.71–0.79), or2 / or1 ratio = 0.42 (0.36–0.50), postocellar setae = 70 (63–75) %, ocellar setae = 88 % of frontal length; vibrissal index = 0.85 (0.82–0.90). Face brownish-yellow. Carina distinctly diverging downwards, dorsally flat, convex. Cheek index about 7–9. Eye index = 1.19 (1.12–1.23). Antennae brown. Arista with 4 dorsal, 2 ventral and about 7 short inner branches, plus terminal fork. Proboscis brownish.

Thorax length 1.02 (0.96–1.11) mm. Scutum yellowish, subshining. 6 rows of acrostichal setulae. h index = 0.85 (0.79–0.92). Transverse distance of dorsocentral setae 180 % of longitudinal distance; dc index = 0.68 (0.62–0.71). Scutellar setae almost equidistant; basal ones divergent; scut index = 1.00. Pleura pale yellowish, sterno index = 0.53 (0.52–0.55), mid katapisternal seta about 64–67 % of the anterior one. Halter yellow. Legs yellow, preapical setae on all tibiae, ventral apical setae on mid tibia.

Wing (Fig. 26D, E) hyaline; a bowlike, diffuse brown patch close to the tip of cell  $r_{2+3}$ , a narrow, longish brown patch at the tip of vein  $R_{4+5}$ , both crossveins diffusely shadowed; length 2.26 (2.17–2.38) mm, length to width ratio = 2.23 (2.19–2.29). Indices: C = 3.27 (3.07–3.43), ac = 2.28 (2.17–2.33), hb = 0.32 (0.29–0.38), 4C = 0.70 (0.67–0.72), 4v = 1.48 (1.40–1.61), 5x = 1.31 (1.14–1.50), M = 0.44 (0.40–0.50), prox. x = 0.50 (0.45–0.56).

Abdomen shiny, with yellowish ground color and more or less distinct, narrow marginal bands which are medially narrowed but not interrupted.

♂ *Terminalia* (Figs 18, 19, 24K–N). Epandrium dorsodistally microtrichose, with 5 lower, and just one upper setae; ventral lobe dorsally membranous, neither microtrichose nor covering surstylus. Cerci anteriorly connected to epandrium by membranous tissue, not microtrichose and devoid of ventral lobe, although ventro-medially each plate is slightly projected downwards. Surstylus dorsoanteriorly heavily sclerotized, not microtrichose, bearing an almost straight row of 13 peglike prenisetae, ca. 6 thin inner and 6–7 thicker outer setae. Decasternum as in Fig. 18B. Hypandrium longer than epandrium, in lateral view remarkably bent anterad, ante-

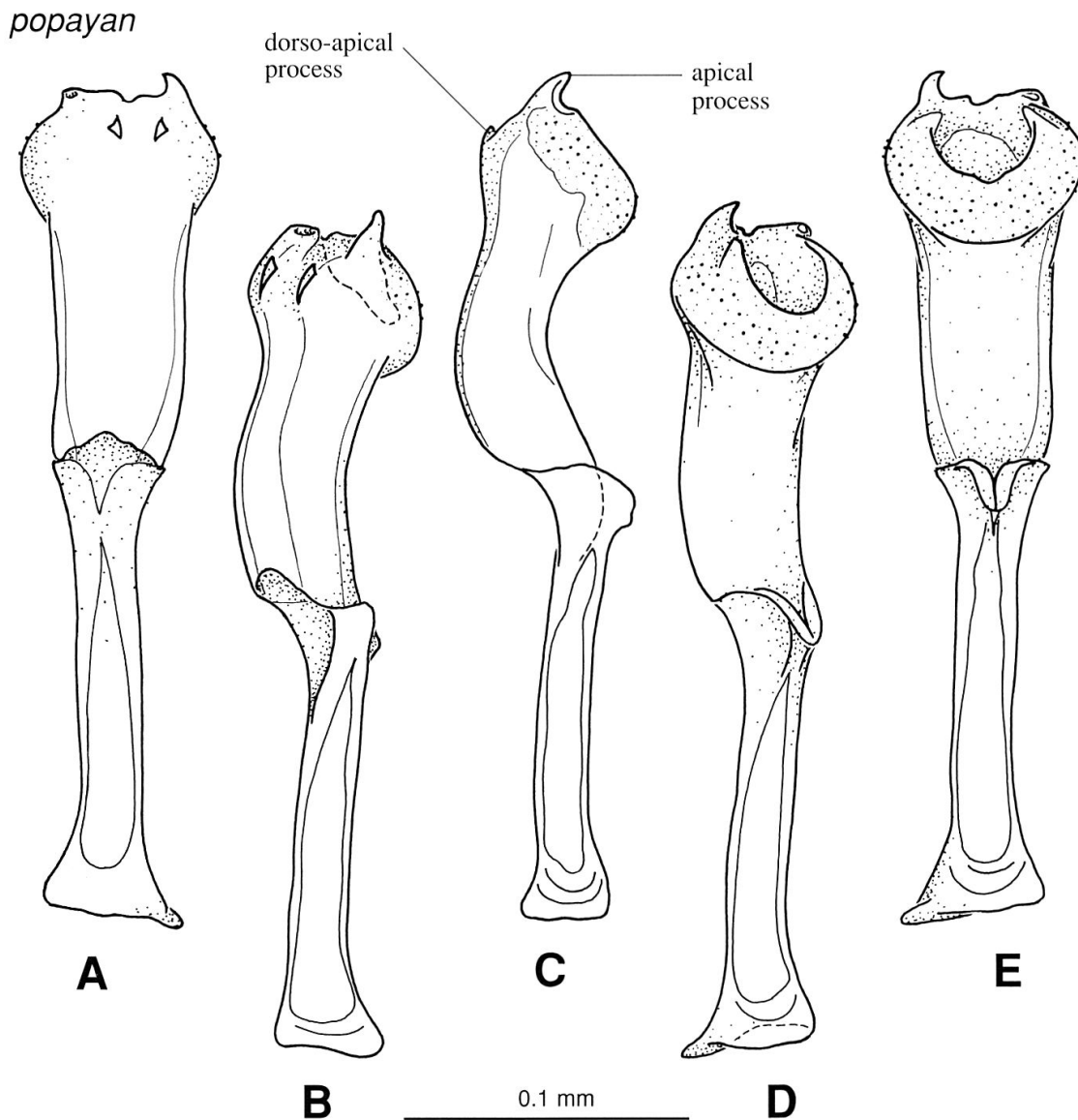


Fig. 19. *Drosophila popayan* sp. nov., male holotype. A–E, aedeagus+aedeagal apodeme, several views from dorsal through ventral.

rior margin very narrow; posterior hypandrial process absent; dorsal arch present, well developed, M-shaped, strongly sclerotized; gonopod fused to paraphysis, bearing one seta near the median inner margin. Aedeagus fused to aedeagal apodeme, slightly bent, laterally expanded at tip; subapically bearing a pair of dorsal, backwards directed, tiny processes; lateroapically with a pair inward curved processes [the right one is missing on holotype but not on the paratypes; the absence could be by an accident or a developmental defect]; lateroventrally membranous at distal region, which is covered with a collar of tiny scales; dorsal cleft reduced to an opening adjacent to the fusion line aedeagus+aedeagal apodeme. Aedeagal apodeme slightly longer than aedeagus, rod-shaped, anteriorly slightly expanded laterally. Ventral rod shorter than aedeagal apodeme width. Paraphysis mostly fused to gonopod, anteriorly bearing 1 setula on dorsal margin, connected to distal margin of aedeagal apodeme by membranous tissue.



*Distribution.* Panama (Province of Chiriquí), Colombia (Department of Cauca), ? Venezuela (State of Aragua, 1 ♀).

*Biology.* Unknown.

*Etymology.* The epithet *popayan* is a noun in apposition taken from the type locality.

*Relationship.* Closely related to *D. uninubes*, but the much smaller subapical pair of dorsal processes of the aedeagus readily differentiate this species.

*Comments.* The male holotype and the two male paratypes of *Drosophila popayan*, sp. nov. were found among 18 pinned flies collectively identified as *Drosophila uninubes* and received as a loan from the AMNH. In the collection of the ZMUZ, we have discovered one female specimen labelled: Venezuela, Pittier N.P. [Parque Nacional Henri Pittier, state of Aragua] Pico Guacamaya 1830 [altitude in m] T. Pape leg. \ X1323 [code number]" which somewhat resembles the male types of *Drosophila popayan* sp. nov. However, as no reliable diagnostic feature has yet been detected in females of most species belonging to the *uninubes* subgroup, that specimen is only doubtfully assigned to *D. popayan* sp. nov. and therefore is not being considered a paratype.

### ***Drosophila uninubes* Patterson & Mainland, in Patterson, 1943**

(Figs 20, 21, 24G–J, 26B, C)

*Drosophila uninubes* Patterson & Mainland, in Patterson 1943: 201 (description); Patterson & Mainland 1944: 24 (key), 79, 96 (distribution), 95 (collection records), color plate XVI (illustration); Hsu 1949: 113, 139 (male terminalia); Wheeler 1949: 188 (affiliation); Patterson & Stone 1952: 41, 73, 76, 108 (distribution); Nater 1953: 468–470 (male terminalia); Vargas 1954: 153 (distribution); Heed 1956: 63 (distribution); Heed 1957: 77 (distribution); Throckmorton 1962: 224, 240, 241, 268 (phylogeny), 342 (collection record); Val et al. 1981: 149 (distribution).

*Material examined* (5 ♂♂). Male holotype (dissected, deposited in the USNM: "Laguna Patzcaro [misspelled, = Pátzcuaro] Mich., Mex., Aug. 1942 / G.B. Mainland / HOLOTYPE [red label] / 1344.15 / *Drosophila uninubes* / Type No. 101,022 U.S.N.M." Male paratype (AMNH): same data as holotype (but yellow paratype label; without last label). 1 ♂ (AMNH): "20 mi. NE Pachuca Hidalgo / MEXICO / M Wasserman WB Heed June 1952 / 2259.11". 1 ♂ (AMNH): "19 mi E. Morelia, Mich. Mex. / MR Wheeler FA Cowan Sept. 1947 / 1795.4 ". 1 ♂ (ZMUZ, dissected, photographed): "MEXICO: Hidalgo Jacala viii.1943 G.B. Mainland coll. / ♂ / *D. uninubes* / *Drosophila uninubes* P. & M. - G. Bächli det." The following two additional labels were added to each specimen: "♂ / *Drosophila uninubes* P. & M. Vilela & Bächli det."

*Type locality.* Laguna Pátzcuaro, State of Michoacán, Mexico.

*Diagnosis.* Generally yellowish flies, tergites with a narrow, brownish, medially interrupted marginal band, wing with slightly clouded crossveins, a faint apical patch at the end of  $R_{4+5}$  and a large dark patch near tip of cell  $r_{2+3}$ , which is bowl-like, connected with the apical patch, and does not reach vein  $R_{4+5}$ ; aedeagus slightly bent; subapically bearing a pair of dorsal, pointed, backwards directed processes, and apically with three, tiny, blunt processes, the middle one slightly turned dorsad; lateroventrally membranous at distal region, which is covered with a collar of tiny scales.

*Redescription.* ♂. Head. Frons reddish-brown, yellowish-brown above antennae, frontal length 0.29 (0.23–0.33) mm; frontal index = 0.87 (0.78–0.95), top to bottom width ratio = 1.32 (1.28–1.37). Frontal triangle blackish-brown, greyish, about 50–71 % of frontal length; ocellar triangle prominent, blackish-brown, greyish, about 40–47 % of frontal length. Orbital plates narrow, apically diverging from eye margin, dark brown, greyish, about 70–88 % of frontal length. Orbital setae black, or2 halfway of the other two, slightly closer to eye margin than or1, distance

*uninubes*

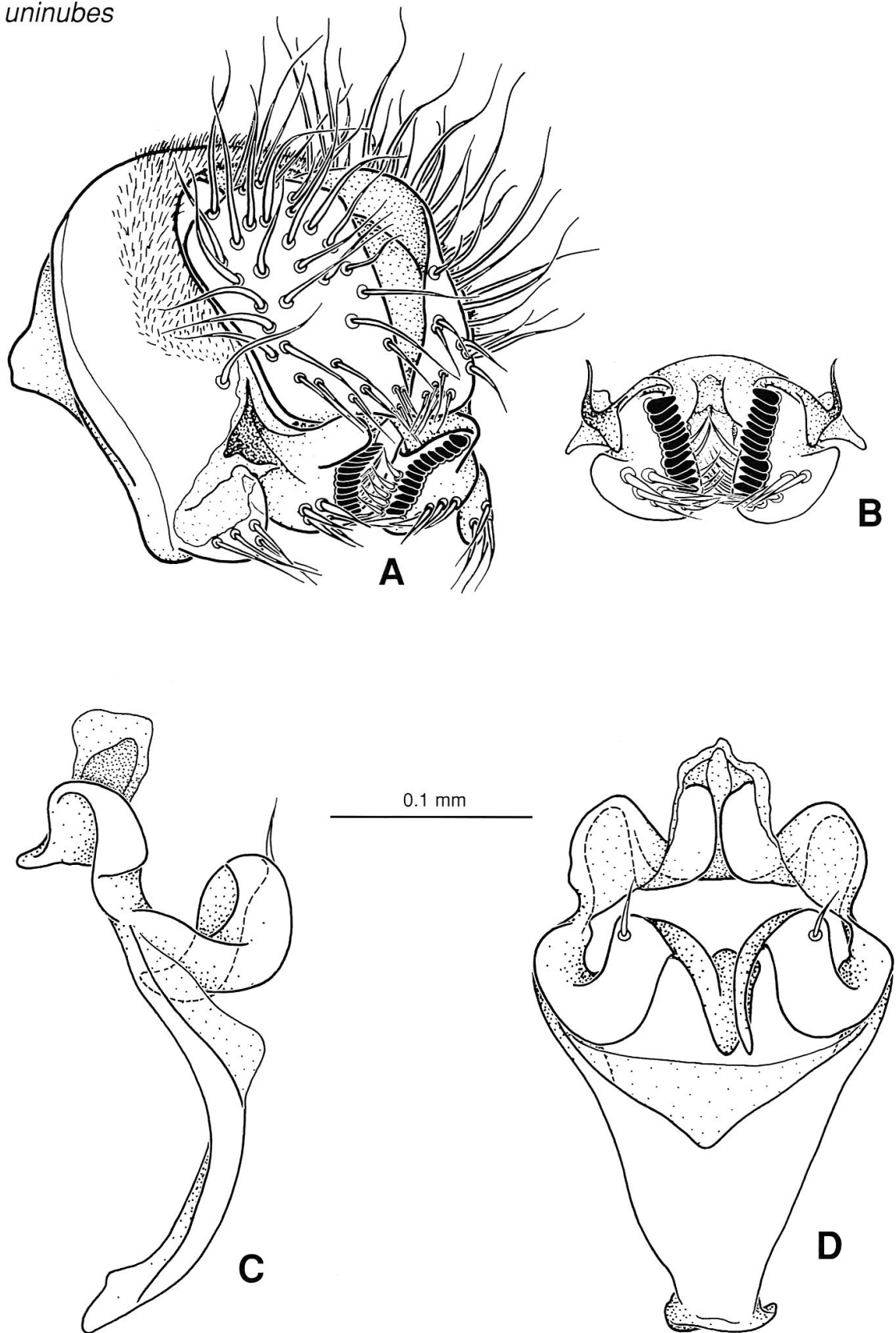


Fig. 20. *Drosophila uninubes* Patterson & Mainland, male holotype. A, epandrium, cerci, surstyli and decasternum, oblique posterior view. B, surstyli and decasternum posterior view. C, hypandrium and gonopods+paraphyses, left lateral view. D, idem, posterior view.

of or3 to or1 = 44–75 % of or3 to vtm, or1 / or3 ratio = 0.77 (0.67–1.00), or2 / or1 ratio = 0.40 (0.33–0.50), postocellar setae = 67 (63–75) %, ocellar setae = 89 (68–106) % of frontal length; vibrissal index = 0.83 (0.73–0.91). Face brownish-yellow. Carina convex, distinctly diverging downwards, dorsally flat. Cheek index about 6–10. Eye index = 1.16 (1.12–1.23). Antennae brown, length to width ratio of flagellomere 1 = 1.30. Arista with 3–5 long dorsal, 2 long ventral and about 7 short inner branches, plus terminal fork. Proboscis brownish-yellow.

Thorax length 1.07 (0.90–1.18) mm. Scutum yellowish-brown, (6–)8 rows of acrostichal setulae. h index = 0.88 (0.79–1.00). Transverse distance of dorsocentral setae 150–186 % of longitudinal distance. dc index = 0.69 (0.61–0.75). Scutellar setae almost equidistant; basal ones divergent; scut index = 1.02 (0.87–1.18). Pleura pale brownish-yellow, sterno index = 0.53 (0.48–0.60), mid katepisternal seta about 58–73 % of the anterior one. Halter yellow. Legs yellow, fine preapical setae on all tibiae, ventral apical seta on mid tibia.

Wing (Figs 26B, C) hyaline, with slightly clouded crossveins, a faint apical patch at the end of vein  $R_{4+5}$  and a large dark patch near tip of cell  $r_{2+3}$ , which is bowlike, connected with the apical patch, and does not reach vein  $R_{4+5}$ ; length 2.42 (2.17–2.63) mm, length to width ratio = 2.27 (2.19–2.38). Indices: C = 3.65 (3.07–4.17), ac = 2.26 (2.00–2.60), hb = 0.31 (0.25–0.42), 4C = 0.66 (0.57–0.72), 4v = 1.56 (1.40–1.72), 5x = 1.26 (1.13–1.57), M = 0.44 (0.38–0.61), prox. x = 0.53 (0.45–0.67).

Abdomen shiny, with yellowish ground color and more or less distinct, narrow marginal bands which are medially interrupted.

♂ *Terminalia* (Figs 20, 21, 24G–J). Epandrium dorsodistally microtrichose, with 4 lower, and just one upper setae; ventral lobe partially membranous, neither microtrichose nor covering surstylus. Cercus anteriorly connected to epandrium by membranous tissue, not microtrichose and devoid of ventral lobe, although ventro-medially each plate is slightly projected downwards. Surstylus dorsoanteriorly strongly sclerotized, not microtrichose, bearing an almost straight row of 13 peg-like prensisetae, ca. 6 thin inner and 6 thicker outer setae. Decasternum as in Fig. 20B. Hypandrium longer than epandrium, in lateral view bent anterad [less than that of *D. parachrogaster* and *D. popayan* sp. nov.], anterior margin narrow; posterior hypandrial process absent; dorsal arch present, well developed, W-shaped, mediodistally membranous; gonopod fused to paraphysis, bearing one seta near the median inner margin. Aedeagus fused to aedeagal apodeme, tube-shaped, slightly bent; subapically bearing a pair of pointed backwards directed, dorsal processes, and apically with three, tiny, blunt processes, the middle one slightly turned dorsad; lateroventrally membranous at distal region, which is covered with a collar of tiny scales; dorsal cleft reduced to an opening adjacent to the fusion line aedeagus+aedeagal apodeme. Aedeagal apodeme longer than aedeagus, rod-shaped. Ventral rod shorter than aedeagal apodeme width. Paraphysis fused to gonopod, completely bare, connected to distal margin of aedeagal apodeme by membranous tissue.

*Distribution* (only those records confirmed). Mexico (States of Hidalgo and Michoacán).

*Biology*. Unknown.

*Comments*. The male holotype and two male paratypes of *Drosophila popayan* sp. nov. were found among a total of 18 pinned flies (13 ♂♂, 5 ♀♀) collectively identified as *D. uninubes*, and received as a loan from the AMNH (see under "material examined" in the description of *D. popayan* sp. nov.). Among the remaining ten

male specimens there are two males also labelled "Boquete, ChiriquíP. [Province of Chiriquí] PANAMA / WBHeed MWasserman August 1958" that belong to another new species which is morphologically similar to both *D. uninubes* and *D. popayan* sp. nov. and is described below as *D. morelia* sp. nov. (*morelia* group, new group; further details in its description under "material examined" and "comments"). Additionally, three specimens (1 ♂, 2 ♀♀; male fly missing, except terminalia in

*uninubes*

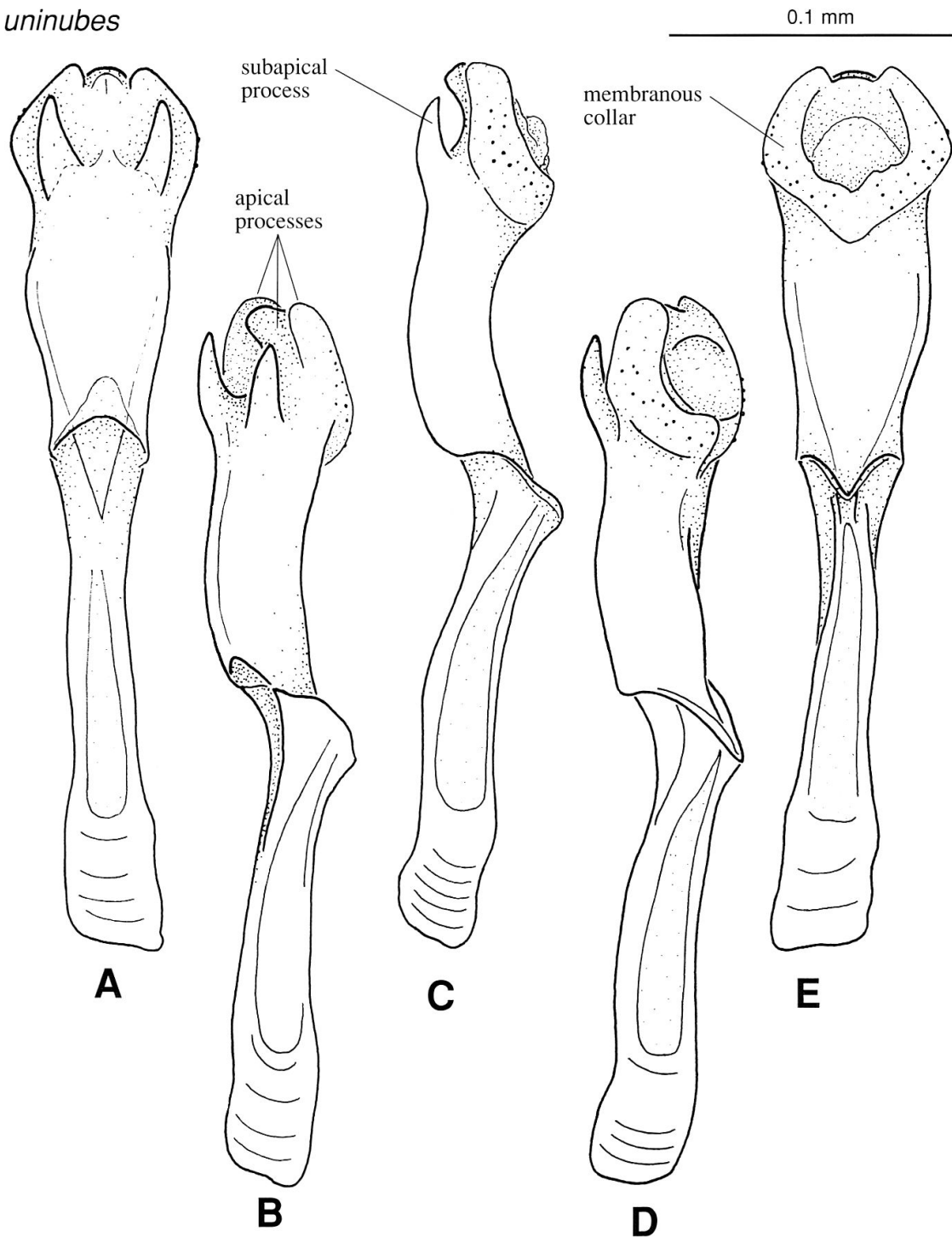


Fig. 21. *Drosophila uninubes* Patterson & Mainland, male holotype. A–E, aedeagus+aedeagal apodeme, several views from dorsal through ventral.

microvial and some remains of two legs glued on the cardboard triangle) out of the 13 remaining specimens (8 males, 5 females) with the identical following label: "Guatemala April 1959" are not being considered to belong to *D. uninubes*, although they clearly belong to the *uninubes* subgroup. Although the male wings are missing we suppose they have a cloud near the wing tip because they had been collected together with 2 spot-winged females and misidentified as *D. uninubes*. After this manuscript has been submitted we have realized that these 3 specimens from Guatemala together with 5 specimens (4 ♂♂, 1 ♀) from San Cristobal, Chiapas, Mexico (also received from the same loan as being *D. uninubes*) are not members of *D. uninubes*, but belong to another undescribed sibling species, so they will be described in a forthcoming paper. In short, only three out of 13 male specimens received as a loan from the AMNH as being *Drosophila uninubes* belong to this species indeed, one of them being a paratype (see "material examined"). Based on the available males housed in the AMNH and the NMNH, we consider that *D. uninubes* is probably endemic to the Mexico's transvolcanic belt (mainly around the state of Michoacan) and other records in the literature must be regarded as dubious. Two females from Guatemala and 1 female from San Cristobal (Chiapas, Mexico) out of the 5 female specimens housed in the AMNH and cited above are being tentatively considered to belong to a new species which will be described in a forthcoming paper. The remaining two females with spotted wings, one from Aguascalientes [state of Aguascalientes, 27.VIII.1947] and one from Atlixco [state of Puebla, 05.IX.1947] are just being ascribed to the *uninubes* subgroup.

***Drosophila (Drosophila) xalapa sp. nov.***

(Figs 22, 23, 24E, 26A)

Material examined (1 ♂, 1 ♀). Male holotype (dissected, right wing removed, photographed, deposited in the ZMUZ) labelled: "MEXICO Veracruz Xalapa (= Jalapa) Bot. Garden 20.II.98 B. Merz / [right wing in microslide] / HOLOTYPE [red label] / ♂ / *Drosophila xalapa* Vilela & Bächli det.". 1 ♀: same data as holotype, but is not being considered a paratype (see comments).

*Type locality.* Xalapa, State of Veracruz, Mexico.

*Diagnosis.* Generally yellowish flies, tergites with a narrow, brownish marginal band which is medially interrupted; wing with diffusely shadowed crossveins and one small, oblong, faint patch near tip of cell  $r_{2+3}$  at the end of vein  $R_{2+3}$ ; surstylus bearing an upper-positioned row of 7 peglike prensisetae; hypandrium straight in lateral view; ventral rod of aedeagal apodeme noticeably longer than in the remaining species in the group.

*Description.* ♂. Head. Frons golden yellow, yellowish-brown above antennae, frontal length 0.27 mm; frontal index = 0.80, top to bottom width ratio = 1.25. Frontal triangle about 69 % of frontal length; ocellar triangle prominent, blackish-brown, greyish, about 44 % of frontal length. Orbital plates narrow, apically slightly diverging from eye margin, brown, whitish-grey, about 81 % of frontal length. Orbital setae black, or2 halfway of the other two, slightly closer to eye margin than or1, distance of or3 to or1 = 50 % of or3 to vtm, or1 / or3 ratio = 0.67, or2 / or1 ratio = 0.40, postocellar setae = 69 %, ocellar setae = 88 % of frontal length; vibrissal index = 0.67. Face brownish-yellow. Carina distinctly diverging downwards, dorsally flat, noselike. Cheek index about 7. Eye index = 1.17. Antennae brown, flagellomere 1 slightly silvery seen from below, length to width ratio of flagellomere 1 = 1.80. Arista with 4–5 dorsal, 2 ventral and about 8 short inner branches, plus terminal fork. Proboscis yellowish, palpus brownish, with about 4 ventral setae.



*xalapa*

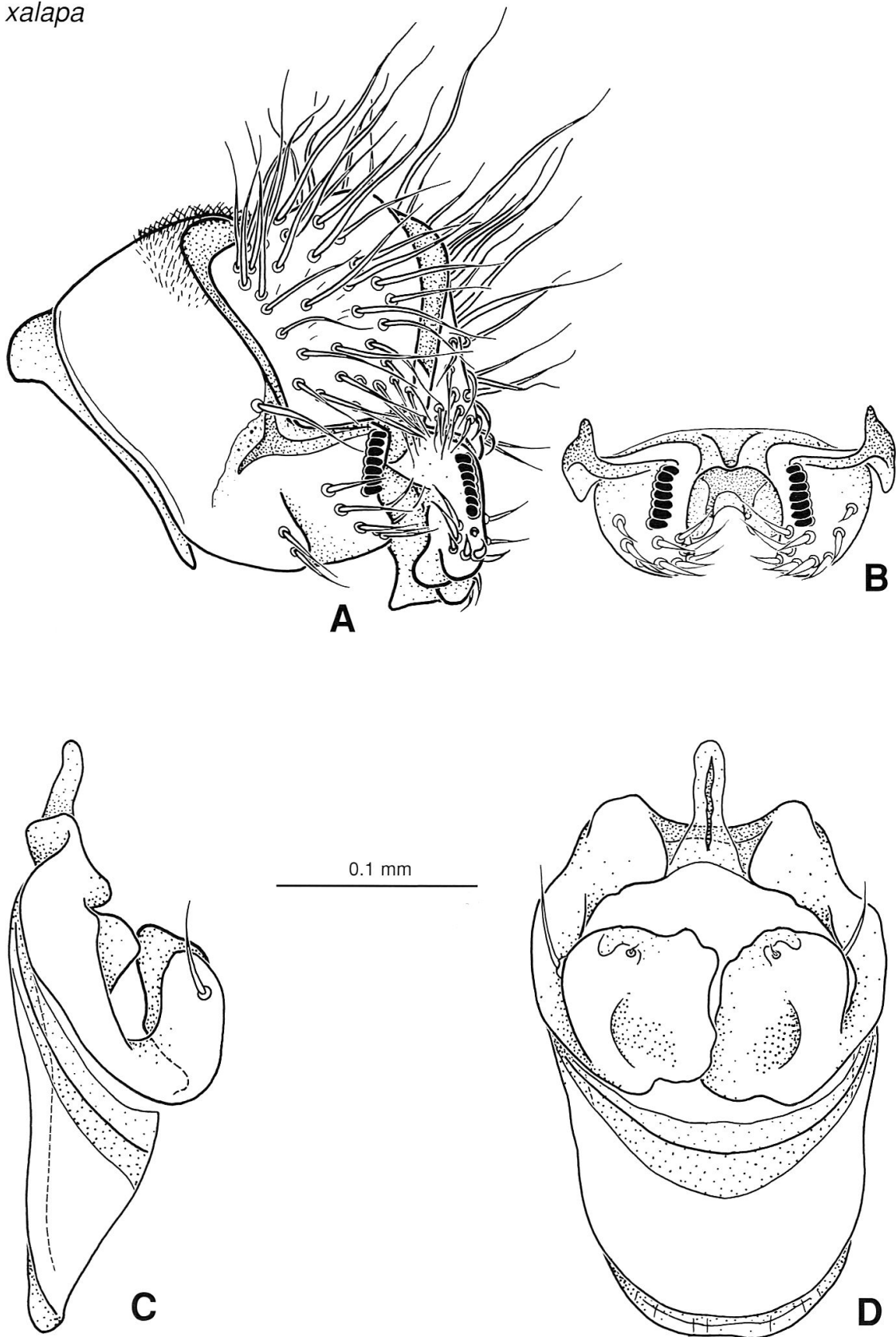


Fig. 22. *Drosophila xalapa* sp. nov., male holotype. A, epandrium, cerci, surstyli and decasternum, oblique posterior view. B, surstyli and decasternum posterior view. C, hypandrium and gonopods+paraphyses, left lateral view. D, idem, posterior view.

*xalapa*

0.1 mm

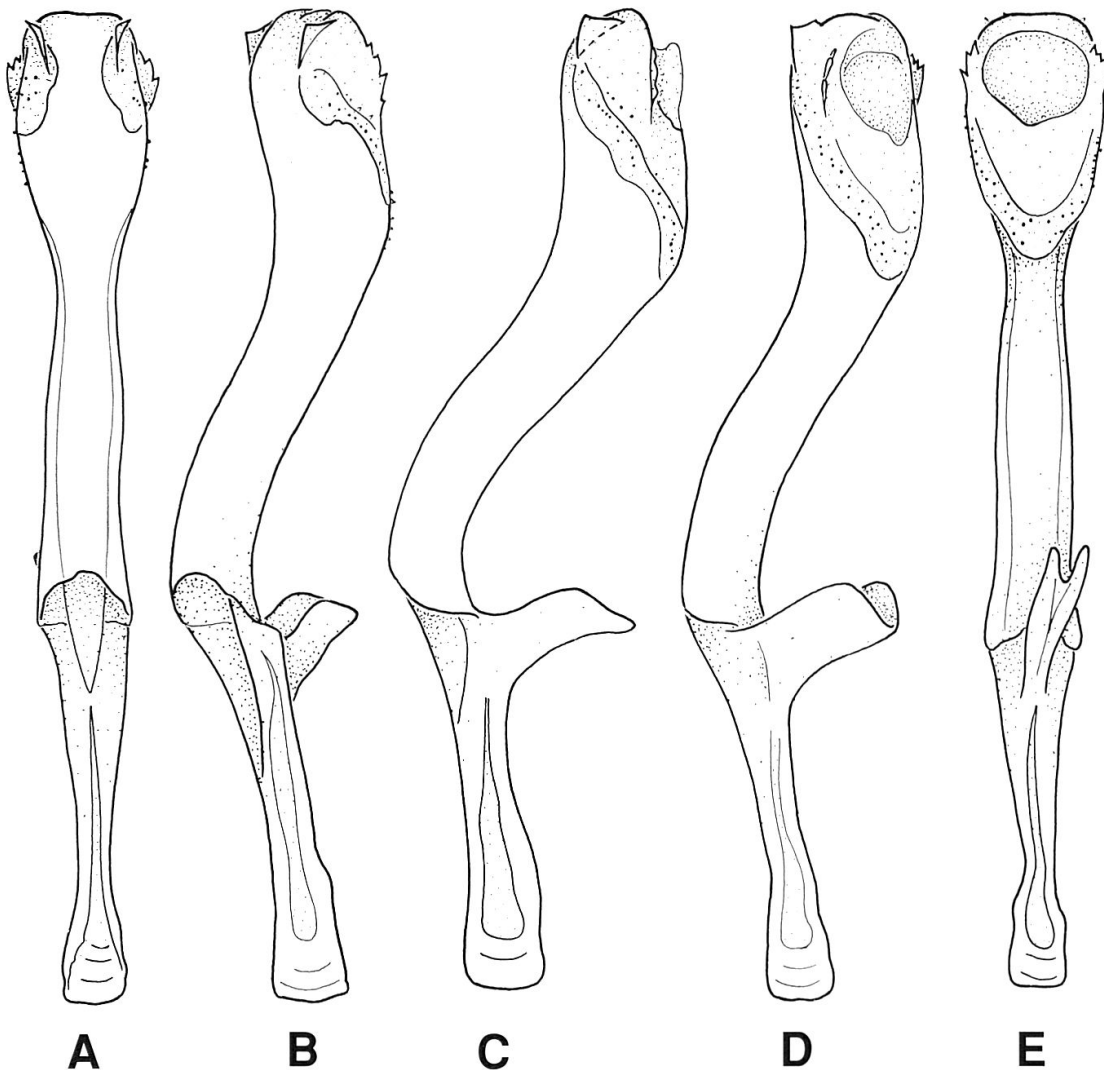


Fig. 23. *Drosophila xalapa* sp. nov., male holotype. A–E, aedeagus+aedeagal apodeme, several views from dorsal through ventral.

Thorax length 1.04 mm. Scutum brownish-yellow, somewhat darker on scutellum; 6 rows of acrostichal setulae. h index = 0.92. Transverse distance of dorsocentral setae 173 % of longitudinal distance. dc index = 0.65. Scutellar setae almost equidistant; basal ones divergent; scut index = 1.07. Pleura pale brownish-yellow, slightly darker in upper half, sterno index = 0.52, mid katepisternal seta about 64 % of the anterior one. Halter yellow. Legs yellow, fine preapical setae on all tibiae, ventral apical seta on mid tibia.

Wing (Fig. 26A) hyaline, and one small, oblong, faint patch near tip of cell  $r_{2+3}$  at the end of vein  $R_{2+3}$ , both crossveins diffusely shadowed, length 2.35 mm, length to width ratio = 2.16. Indices: C = 3.62, ac = 2.17, hb = 0.31, 4C = 0.72, 4v = 1.78, 5x = 1.50, M = 0.50, prox. x = 0.61.

Abdomen with yellow ground color, tergites 2–6 with a medially more or less interrupted brown marginal band, which is broadened on both sides of the medial interruption.

♂ *Terminalia* (Figs 22, 23, 24E). Epandrium slightly microtrichose in the dorso-posterior region, with 3 lower, and just one upper setae; ventral lobe partially fused to surstylus, neither microtrichose nor covering surstylus. Cerci anteriorly connected to epandrium by membranous tissue, slightly microtrichose and devoid of ventral lobe, although ventromedially each plate is slightly projected downwards. Surstylus dorsoanteriorly strongly sclerotized, not microtrichose, bearing an almost straight, upper-positioned, row of 7 peglike prensisetae, ca. 5 inner and 4 outer setae. Decasternum as in Fig. 22B. Hypandrium slightly longer than epandrium, in lateral view straight (unlike that of the remaining species of its subgroup, where it is strongly bent anterad), anterior margin rounded; posterior hypandrial process absent; dorsal arch present, medianly membranous; gonopod fused to paraphysis, bearing one seta near the median inner margin. Aedeagus fused to aedeagal apodeme, long, bent, tube-shaped; dorsoapically bearing a pair of tiny backwards directed processes; subdistal margins of ventral area slightly serrated; membranous at distal region, which is covered with a collar of tiny scales; dorsal cleft reduced to an opening adjacent to the fusion line aedeagus+aedeagal apodeme. Aedeagal apodeme shorter than aedeagus, rod-shaped. Ventral rod twice as long as aedeagal apodeme width, grooved. Paraphysis fused to gonopod, anteriorly bearing 1 setula near dorsal margin, connected to distal margin of aedeagal apodeme by membranous tissue.

*Distribution.* Mexico (State of Veracruz).

*Biology.* Unknown.

*Etymology.* The epithet *xalapa* is a noun in apposition, referring to the type locality.

*Relationship.* Although it shares some characters with most of the species of the *uninubes* subgroup, such as distally spotted wing, with one dark shadow at cell  $r_{2+3}$  usually just below the tip of vein  $R_{2+3}$ , cerci not microtrichose, and aedeagus with a membranous area at distoventral region, which is covered with a collar of tiny scales, it can not be positioned closer to any of them.

*Comments.* Our search for the identification of this species, which at first has come to our attention because of the small, but distinct, diffuse brown cloud close to the distal end of its wing cell  $r_{2+3}$ , prompted the revisions presented in the present paper. One female specimen collected together with the male holotype of *D. xalapa* sp. nov. also bears a similar brown cloud near the wing tip. However, as no reliable diagnostic feature has so far been detected in females of most species belonging of the *uninubes* subgroup, that specimen is only doubtfully assigned to *D. xalapa* sp. nov. and therefore is not being considered a paratype.

### ***Drosophila morelia* species group (new group)**

*Species included* (3). *D. carioca* sp. nov., *D. fluminensis* sp. nov., *D. morelia* sp. nov.

*Diagnosis.* Yellowish flies; carina narrow, noselike, sulcate; tergites with a dark marginal band which is medially triangularly broadened, almost reaching the previous tergite, but usually very narrowly interrupted along the midline; wing with an usually distinct shadow along both crossveins and a more or less large, characteristic shadow across the distal wing half, leaving pale areas between the tips of the veins, hb index small, at most 0.29; surstylus and gonopod partially microtrichose; dorsal arch of hypandrium absent; aedeagus long, arch-shaped, parallel to ventral rod and bearing a dorsodistal, thin, curved frontwards process; aedeagal

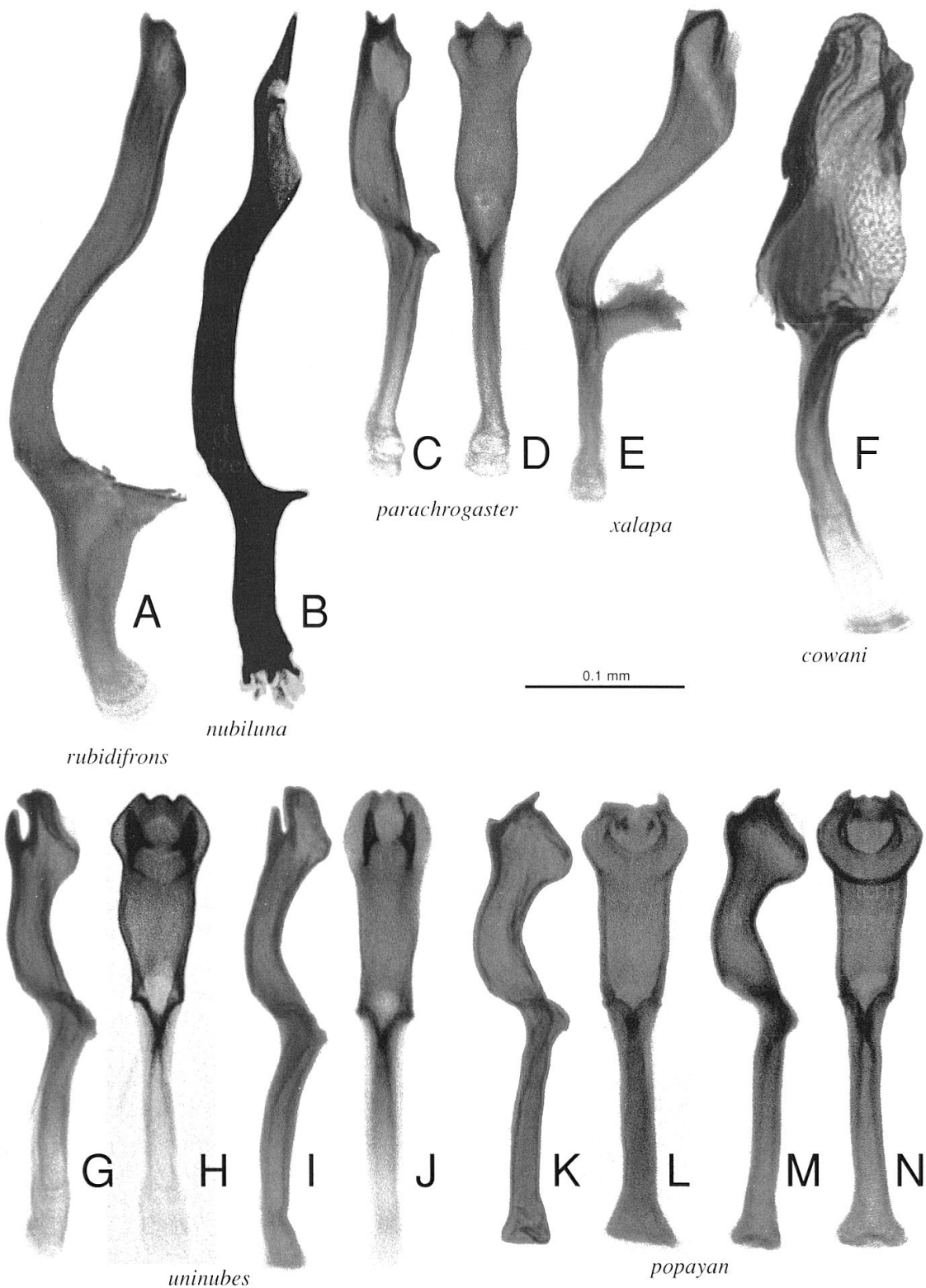


Fig. 24. Aedeagus+aedeagal apodeme, left lateral view, of: A, *Drosophila rubidifrons* Patterson & Mainland, holotype. B, *Drosophila nubiluna* Wheeler, holotype. E, *Drosophila xalapa* sp. nov., holotype. F, *Drosophila cowani* sp. nov., holotype. – Aedeagus+aedeagal apodeme, left lateral (at left) and dorsal (at right) views, of: C, D, *Drosophila parachrogaster* Patterson & Mainland, holotype. G, H, *Drosophila uninubes* Patterson & Mainland, holotype. I, J, *Drosophila uninubes* Patterson & Mainland, Jacala, Hidalgo, Mexico, VIII.1943. K, L, *Drosophila popayan* sp. nov., holotype. M, N, *Drosophila popayan* sp. nov., paratype, August 1958, Boquete, Panama.

apodeme wider than longer; ventral rod long; paraphysis linked to the very distal margin of ventral rod, and devoid of setulae.

*Comments.* The great external similarity between *D. morelia* sp. nov. and most species of the *rubrifrons* group, especially regarding the presence of one anterodistal wing shadow, is likely to be a convergence rather than an evidence of close relationship. As far as we know, there is only one Neotropical species (*Drosophila crassa* Patterson & Mainland, 1944) whose male terminalia (illustrated by Vilela & Bächli, 1990: 265) share, although superficially, some features with the species of the *morelia* group, as it follows: cerci anteriorly fused to epandrium; epandrium, cerci and surstylus microtrichose; paraphysis devoid of setulae and proximally linked by membranous tissue to the very distal margin of ventral rod and not directly to the distal margin of aedeagal apodeme; hypandrium devoid of dorsal arch. However, as in the case of the wing shadows those few similarities may not necessarily be an indicative of close relationship.

***Drosophila (Drosophila) carioca* sp. nov.**

(Figs 27, 28, 33A, 34B, D, E)

Material examined (5 ♂♂, 16 ♀♀, deposited in the ZMUZ). Male holotype (dissected, right wing removed, photographed, deposited in the ZMUZ) labelled: "Brasilia [Brazil] Rio de Janeiro [city, above Botanic Garden] XII. 1953 H. Burla leg. / 847 / ♂ / [right wing in microslide] / HOLOTYPE / *Drosophila carioca* Vilela & Bächli det. / [terminalia in microvial]". Paratypes (4 ♂♂, 16 ♀♀). 2 ♂♂, 6 ♀♀ (2 ♀♀ dissected): same data as holotype. 1 ♂: "Brasilia [Brazil] Cantareira [Parque Estadual da Cantareira, São Paulo city] \S.P. [State of São Paulo] VIII. 1954 da Cunha leg." 1 ♂, 10 ♀♀: same data as preceding specimen but collection month = XI.1954. *Type locality.* Rio de Janeiro city [above the Botanic Garden], State of Rio de Janeiro, Brazil.

*Diagnosis.* Generally yellowish flies, tergites with rather faint triangular bands which are medially distinctly interrupted; wing distal fourth with a large, but faint, shadow, except for the hyaline very tip of cell  $r_{2+3}$ , which is proximally better defined than that of *D. morelia* sp. nov., which with it may be confused regarding the wing pattern; crossvein dM-Cu with a wide brownish shadow; aedeagus smaller than that of *D. fluminensis*, sp. nov. and much smaller than that of *D. morelia* sp. nov., distally covered with tiny scales.

*Description.* ♂. Head. Frons golden yellow, slightly greyish to silvery microtrichose, frontal length 0.36 (0.32–0.39) mm; frontal index = 1.07 (1.00–1.21), top to bottom width ratio = 1.36 (1.28–1.45). Frontal triangle indistinct, about 57–62 % of frontal length; ocellar triangle prominent, about 33–39 % of frontal length. Orbital plates narrow, distinctly diverging from eye margin, greyish subshiny, about 74–78 % of frontal length. Orbital setae black, relatively fine, almost in a row, or2 slightly closer to or1 than to or3 and to the eye margin, distance of or3 to or1 = 87–100 % of or3 to vtm, or1 / or3 ratio = 0.92 (0.79–1.20), or2 / or1 ratio = 0.49 (0.28–0.57), postocellar setae = 66 (61–74) %, ocellar setae = 88 (79–96) % of frontal length; vibrissal index = 0.42 (0.31–0.50). Carina narrow, high, sulcate, nose-like. Cheek index about 6–9. Eye index = 1.18 (1.12–1.26). Antennae yellowish. Length to width ratio of flagellomere 1 = 1.71. Arista with 3–5 long dorsal, 2 long ventral and about 7 short inner branches, plus terminal fork. Proboscis yellowish.

Thorax length 1.29 (1.13–1.45) mm. Scutum and scutellum brownish, subshiny. 6(–8) rows of acrostichal setulae. h index = 1.08 (1.00–1.15). Transverse distance of dorsocentral setae 183–227 % of longitudinal distance; dc index = 0.68 (0.64–0.72). Distance between apical scutellar setae about 80–100 % of that of the



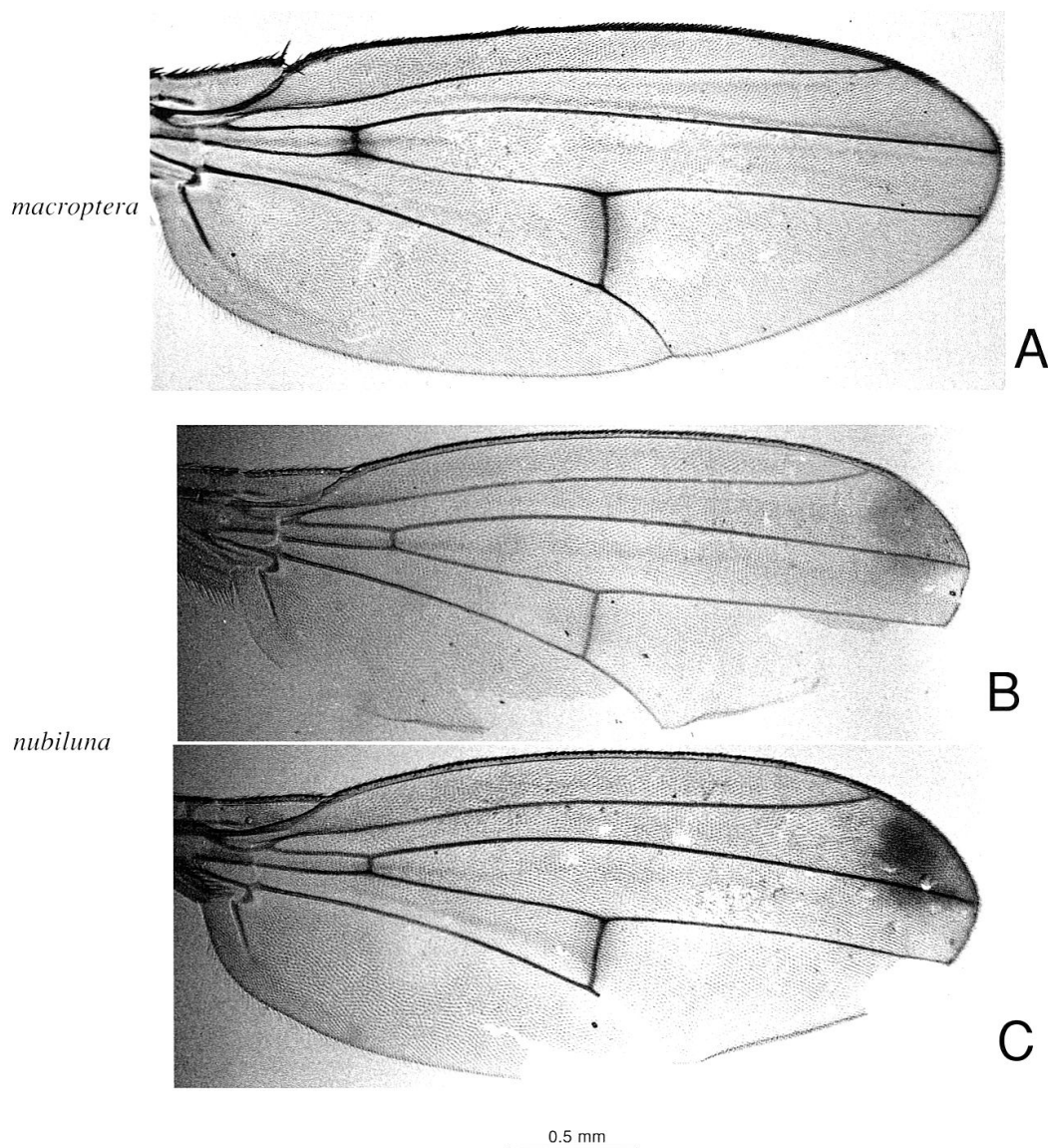
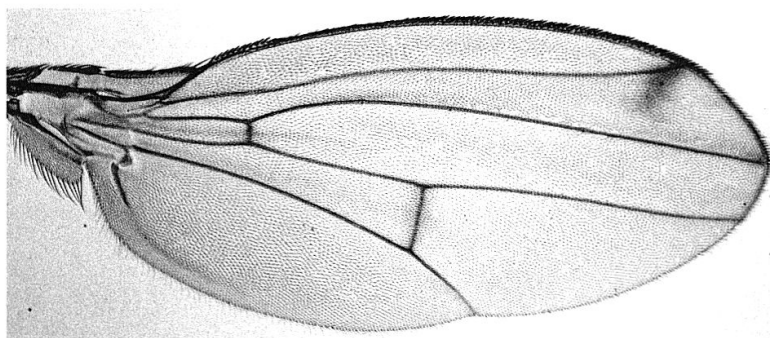


Fig. 25. Right wings, dorsal view, of: A, *Drosophila macroptera* Patterson & Wheeler, ordinary male, May 3rd, Beulah, New Mexico, USA. B, *Drosophila nubiluna* Wheeler, holotype ♂. C, idem, paratype ♀.

apical to the basal one; basal ones divergent; scut index = 1.08 (1.04–1.13); sterno index = 0.69 (0.67–0.71), mid katepisternal seta about 32–40 % of the anterior one. Halter brown. Legs yellow, preapical setae on all tibiae, ventral apical seta on mid tibia.

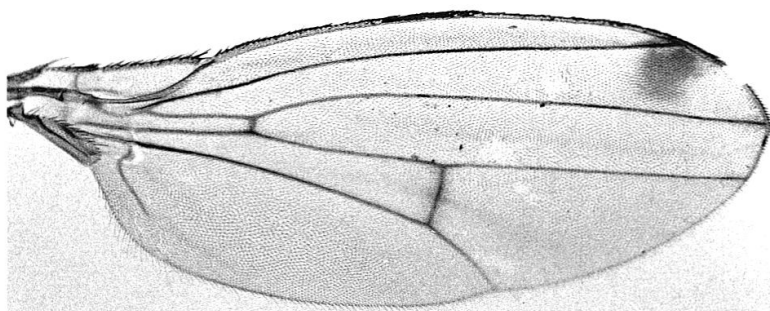
Wing (Fig. 34B) diffusely brownish, usually with large brownish shadows along the crossvein dM-Cu and at the tip of vein  $R_{2+3}$ ; tips of veins  $R_{4+5}$  and M with diffuse shadows; the shadow on vein  $R_{2+3}$  is diffusely extended to, in some specimens confluent with, the shadows on the tips of the veins  $R_{4+5}$  and M, forming a dark wing tip spot but leaving open transparent areas along the costa; length 2.86 (2.48–3.33) mm, length to width ratio = 2.39. Indices: C = 4.91 (4.44–5.40), ac = 1.81 (1.43–2.00), hb = 0.28 (0.21–0.36), 4C = 0.47 (0.43–0.50), 4v = 1.32 (1.22–1.39), 5x = 1.24 (0.90–1.50), M = 0.36 (0.28–0.40), prox. x = 0.43 (0.40–0.47).

*xalapa*



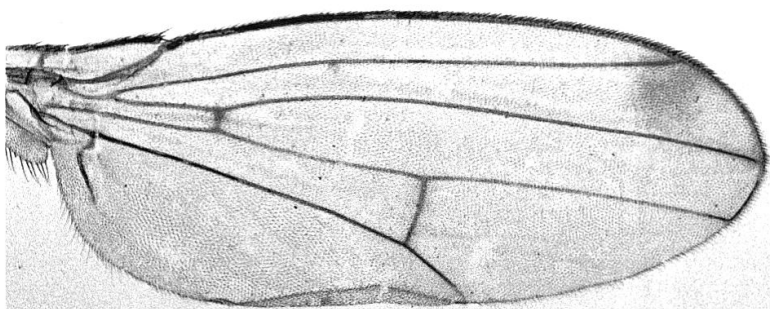
A

*uninubes*



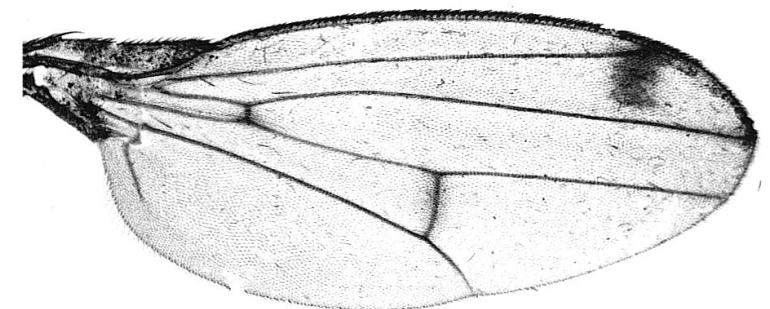
B

*uninubes*



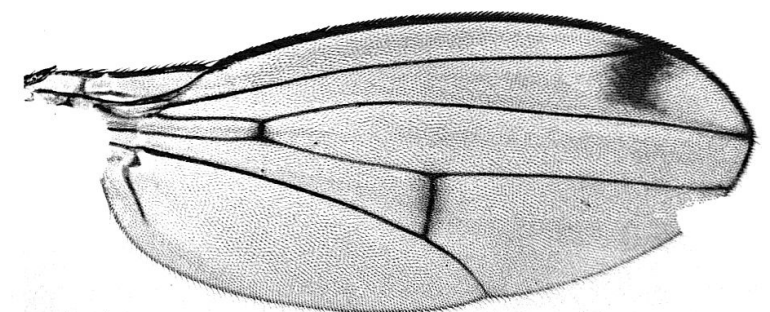
C

*popayan*



D

*popayan*



E

0.5 mm

Fig. 26. Right wings of males, dorsal view, of: A, *Drosophila xalapa* sp. nov., holotype. B, *Drosophila uninubes* Patterson & Mainland, holotype. C, idem, Jacala, Mexico. D, *Drosophila popayan* sp. nov., holotype. E, idem, August 1958, Boquete, Chiriqui, Panama.

*carioca*

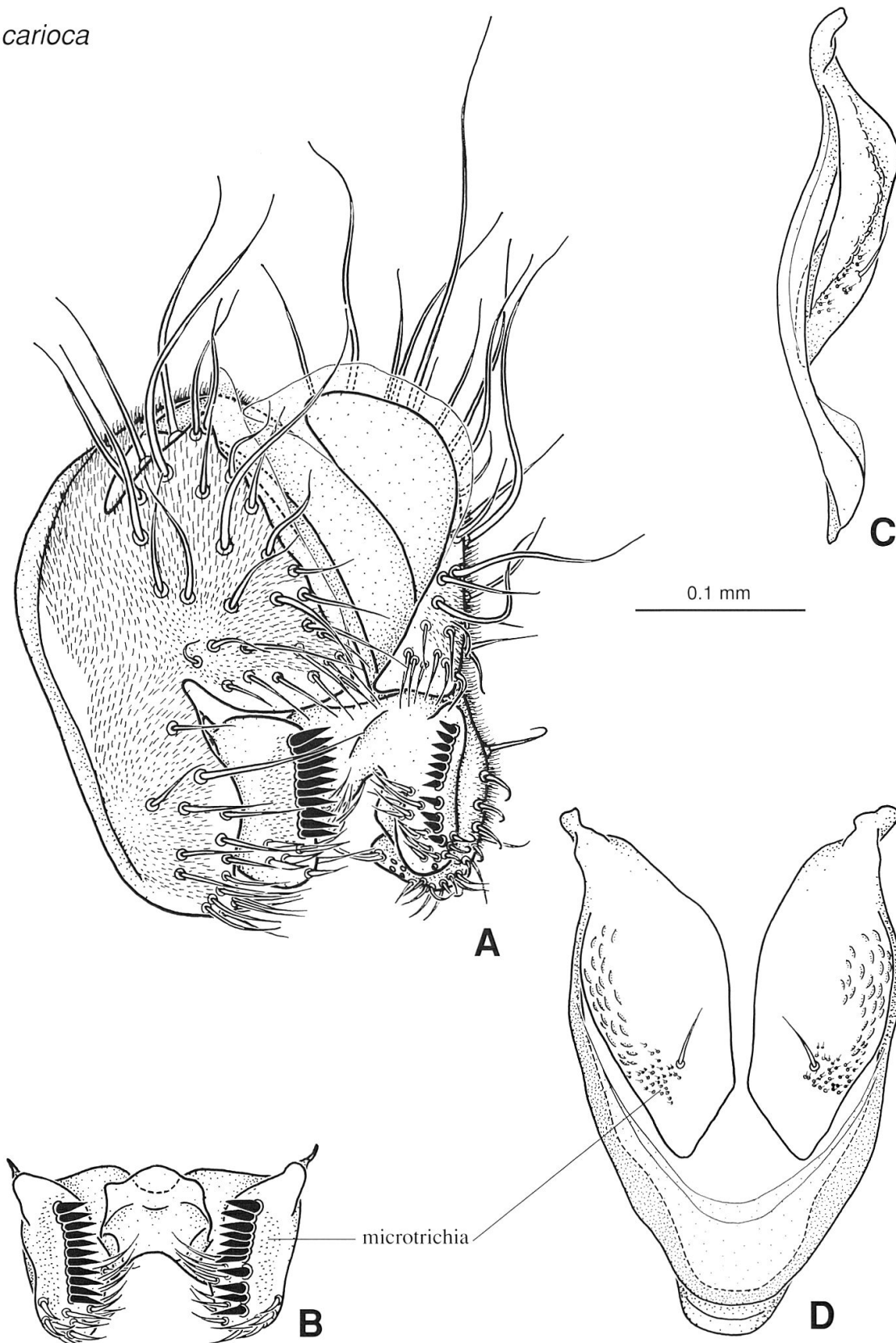


Fig. 27. *Drosophila carioca* sp. nov., male holotype. A, epandrium, cerci, surstyli and decasternum, oblique posterior view. B, surstyli and decasternum posterior view. C, hypandrium and gonopods, left lateral view. D, idem, posterior view.

Abdomen with yellow ground color, tergites 2–6 with a medially more or less interrupted, more or less brown marginal band, which is triangularly broadened on both sides of the medial interruption.

♂ *Terminalia* (Figs 27, 28, 33A). Epandrium mostly microtrichose, with ca. 24 lower, and no upper setae; ventral lobe mostly microtrichose not covering surstylus. Cerci anteriorly fused to epandrium, mostly microtrichose and devoid of ventral lobe, although ventromedially each plate is slightly projected downwards. Surstylus partially microtrichose, bearing an almost straight row of 11 sharply pointed, peglike prensisetae, ca. 13 inner and 3–4 outer setae. Decasternum as in Fig. 27B. Hypandrium as long as epandrium, anteriorly narrow, anterior margin rounded; posterior hypandrial process absent; dorsal arch absent; gonopod linked to paraphysis by membranous tissue, rugose at outer half, subproximally bearing one small seta. Aedeagus fused to aedeagal apodeme, long, arch-shaped, parallel to ventral rod; distal half twice as wide as anterior half, as seen in lateral view; bearing a dorsodistal, thin, curved frontwards process, dorsally covered with tiny scales; subdistal margins of ventral area serrated; distolaterally covered with tiny scales; dorsal cleft reduced to an opening adjacent to the fusion line aedeagus+aedeagal apodeme. Aedeagal apodeme extremely reduced, just 1/9 length of aedeagus, laterally flattened. Ventral rod as long as aedeagal apodeme width, grooved. Paraphysis linked to gonopod by membranous tissue, devoid of setulae, conspicuously connected to distal margin of ventral rod by membranous tissue.

♀. Differences to male: Frons golden to greyish microtrichose.

Measurements: Frontal length 0.39 (0.35–0.43) mm; frontal index = 1.08 (1.00–1.14), top to bottom width ratio = 1.37 (1.26–1.43). Frontal triangle about 56–70 % of frontal length; ocellar triangle about 32–35 % of frontal length. Orbital plates about 74–76 % of frontal length. Distance of or3 to or1 = 87–89 % of or3 to vtm, or1 / or3 ratio = 0.78 (0.75–0.82), or2 / or1 ratio = 0.54 (0.43–0.64), post-ocellar setae = 71 (67–74) %, ocellar setae = 90 (83–104) % of frontal length; vibrissal index = 0.41 (0.32–0.47). Cheek index about 6–9. Eye index = 1.19 (1.16–1.22). Thorax length 1.50 (1.39–1.57) mm. h index = 1.05 (1.00–1.09). Transverse distance of dorsocentral setae 173–217 % of longitudinal distance; dc index = 0.70 (0.65–0.76). Distance between apical scutellar setae about 81–94 % of that of the apical to the basal one; scut index = 1.13 (1.12–1.14), sterno index = 0.70 (0.64–0.73), mid katapisternal seta about 29–46 % of the anterior one. Wing length 3.51 (3.39–3.68) mm, length to width ratio = 2.39 (2.33–2.48). Indices: C = 4.19 (3.89–4.44), ac = 1.85 (1.78–2.00), hb = 0.25 (0.22–0.28), 4C = 0.50 (0.48–0.53), 4v = 1.19 (1.11–1.27), 5x = 0.97 (0.83–1.10), M = 0.30 (0.28–0.32), prox. x = 0.40 (0.38–0.44).

♀ *Terminalia* (Figs 34D, E). Valve of oviscapt apically blunt, most straight ventrally, with ca. 5–9 discal ovisensilla and ca. 18–21 marginal peglike, sharp ovisensilla; discal ones gradually increase in size from the tiny proximalmost to the large dorsalmost, which is just slightly shorter than the subterminal ovisensillum; three distally positioned thin ovisensilla unusually longer than adjacent marginal ones. Inner spermathecal capsule somewhat spherical (slightly longer than wide) and slightly sclerotized; introvert absent.

*Distribution.* Brazil (States of Rio de Janeiro and São Paulo).

*Relationship.* Closely related to *D. fluminensis* sp. nov., and *D. morelia* sp. nov. It differs from the first mainly in having one smaller shadow along the crossvein dM-Cu, which does not reach the middle area of cell  $r_{3+4}$ . The latter species has a paler and diffuse shadow along the crossvein dM-Cu.

*carioca*

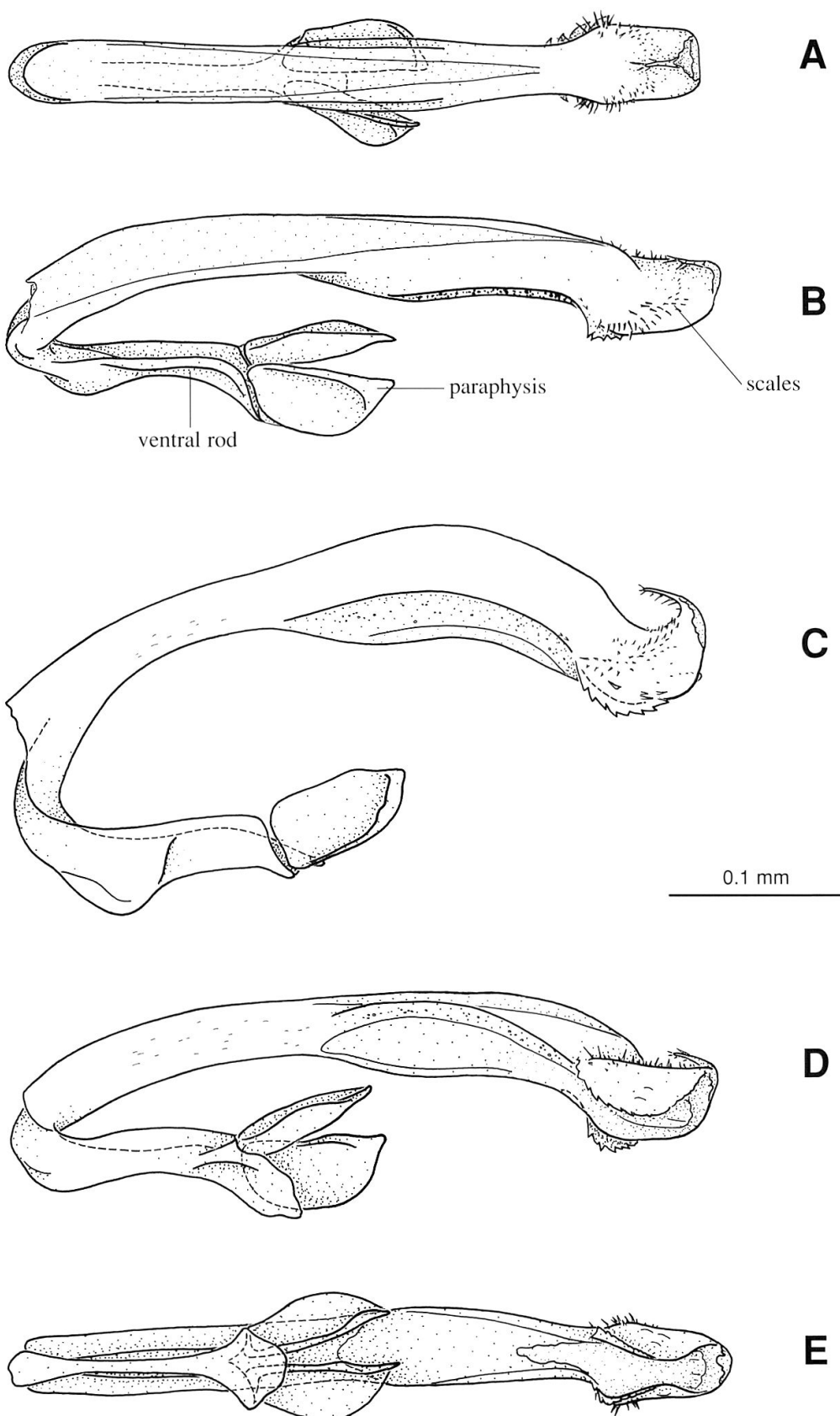


Fig. 28. *Drosophila carioca* sp. nov., male holotype. A–E, aedeagus+aedeagal apodeme, and paraphyses, several views from dorsal through ventral.



*Etymology.* The epithet *carioca* is an adjective, from Tupi (a South American Indian language), meaning an inhabitant of the city of Rio de Janeiro, the type locality.

***Drosophila (Drosophila) fluminensis* sp. nov.**

(Figs 29, 30, 33B, 34C)

Material examined (5♂♂, deposited in the ZMUZ). Male holotype (dissected, right wing removed, photographed) labelled: "Brasilia [Brazil] Rio de Janeiro [city, above Botanic Garden] XII. 1953 H. Burla leg. / ♂ / [right wing in microslide] / [terminalia in microvial]". Paratypes (4♂♂). 2♂♂: same data as holotype.". 1♂: "Itatiaia VI.1954 H. Burla coll D. itacalopteroideis [manuscript name] ♂ 556 / slide No.432 / slide No.433". 1♂: "Brasilia [Brazil] Cantareira [Parque Estadual da Cantareira, São Paulo city] \S.P. [State of São Paulo] VIII. 1954 da Cunha leg." The following two additional labels were added to each type specimen: "HOLOTYPE [or PARATYPE] [red label] / ♂ [or ♀] / *Drosophila fluminensis* Vilela & Bächli det.".

*Type locality.* Rio de Janeiro city [above the Botanic Garden], State of Rio de Janeiro, Brazil.

*Diagnosis.* Generally yellowish-brown flies; frons yellow but darkened towards the vertex, thorax brownish, tergites usually with a blackish marginal band which is medially more or less triangularly expanded but medially narrowly interrupted; wing with distinct, expanded dark areas, forming three incomplete cross-bands across both main crossveins and the wing tip, leaving a small pale area at the wing tip; aedeagus of intermediate size, between the smallest one (*D. carioca* sp. nov.) and the largest one (*D. morelia* sp. nov.), and distolaterally covered with tiny scales. The presence of a large cloud in the middle of the wing, visible even with naked eyes, will readily differentiate this species.

*Description.* ♂. Head. Frons pale yellowish, dull, brownish in upper third, silvery seen from below, frontal length 0.37 (0.32–0.41) mm; frontal index = 1.09 (1.00–1.20), top to bottom width ratio = 1.39 (1.25–1.43). Frontal triangle indistinct, about 47–52 % of frontal length; ocellar triangle prominent, brown, subshiny, about 31–38 % of frontal length. Orbital plates narrow, distinctly diverging from eye margin, brownish in upper half, subshiny, about 68–81 % of frontal length. Orbital setae black, relatively fine, almost in a row, or2 slightly closer to or1 than to or3 and to the eye margin, distance of or3 to or1 = 62–88 % of or3 to vtm, or1 / or3 ratio = 0.80 (0.71–0.86), or2 / or1 ratio = 0.52 (0.50–0.58), postocellar setae = 64 (57–68) %, ocellar setae = 89 (79–100) % of frontal length; vibrissal index = 0.53 (0.46–0.58). Face brownish-yellow. Carina narrow, high, sulcate, noselike. Cheek index about 6–9. Eye index = 1.15 (1.13–1.18). Pedicel yellow. Flagellomere 1 white, length to width ratio = 1.57. Arista with 4 long dorsal, 2 long ventral and about 5–7 short inner branches, plus terminal fork. Proboscis yellowish-brown. Clypeus brown.

Thorax length 1.29 (1.15–1.36) mm. Scutum and scutellum yellowish-brown; 6–8 rows of acrostichal setulae. h index = 1.11 (1.05–1.20). Transverse distance of dorsocentral setae 164–192 % of longitudinal distance; dc index = 0.70 (0.67–0.72). Scutellar setae almost equidistant; basal ones strongly divergent; scut index = 1.10 (1.03–1.13). Pleura brownish, sterno index = 0.72 (0.69–0.73), mid katepisternal seta about 38–50 % of the anterior one. Halter brown. Legs brownish-yellow, tibiae pale brownish, tarsi yellow, preapical setae on all tibiae, ventral apical seta on mid tibia.

Wing (Fig. 34C) diffusely brownish, veins brown, with three darker areas which may be confluent, more-or-less diffusely filling the wing tip: crossvein dM-Cu with a large, dark shadow which is broadly extended to the vein R<sub>4+5</sub>, crossvein R-M with a large, dark shadow which is diffusely extended along the basal half of



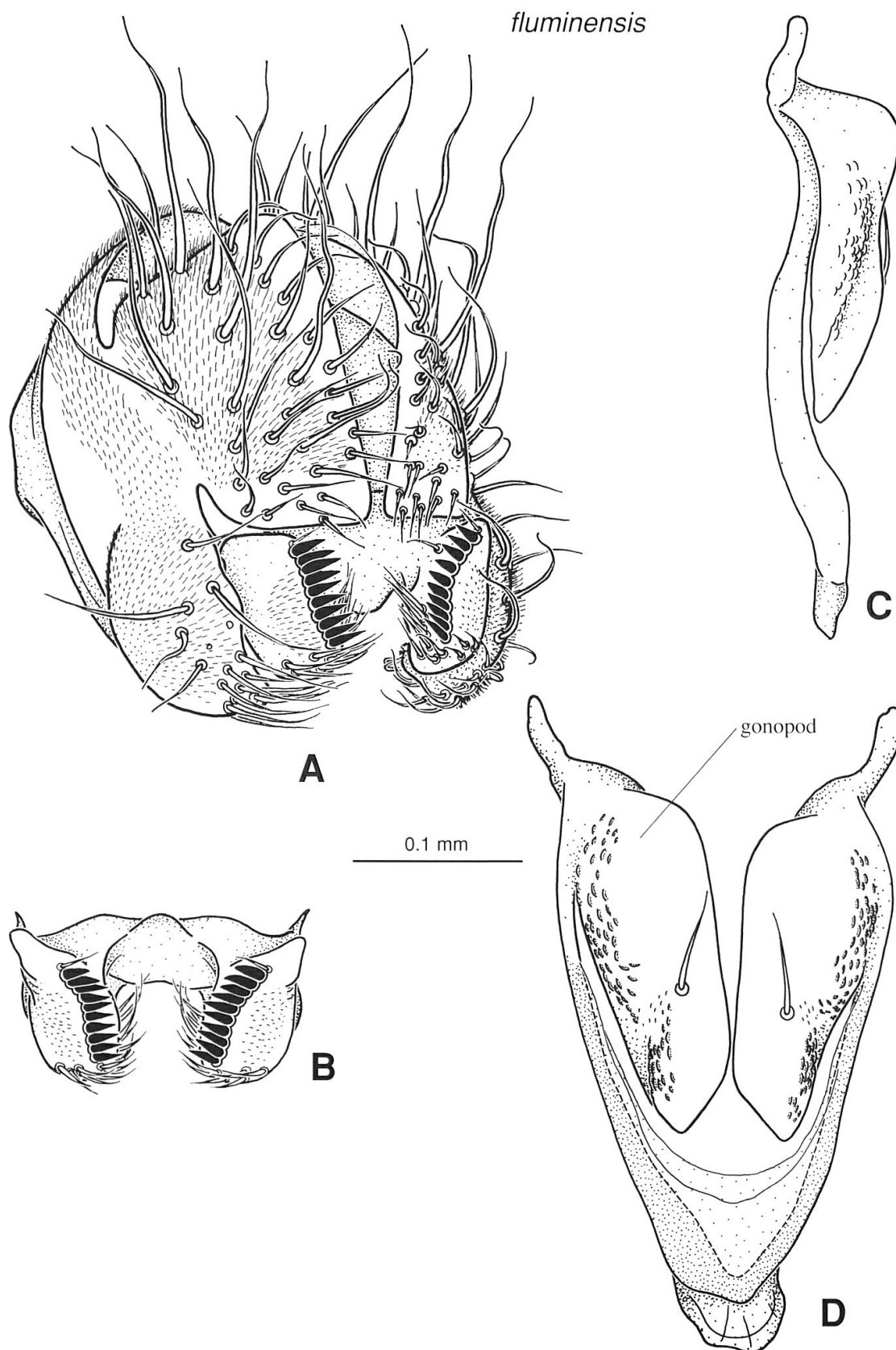


Fig. 29. *Drosophila fluminensis* sp. nov., male holotype. A, epandrium, cerci, surstyli and decasternum, oblique posterior view. B, surstyli and decasternum posterior view. C, hypandrium and gonopods, left lateral view. D, idem, posterior view.

*fluminensis*

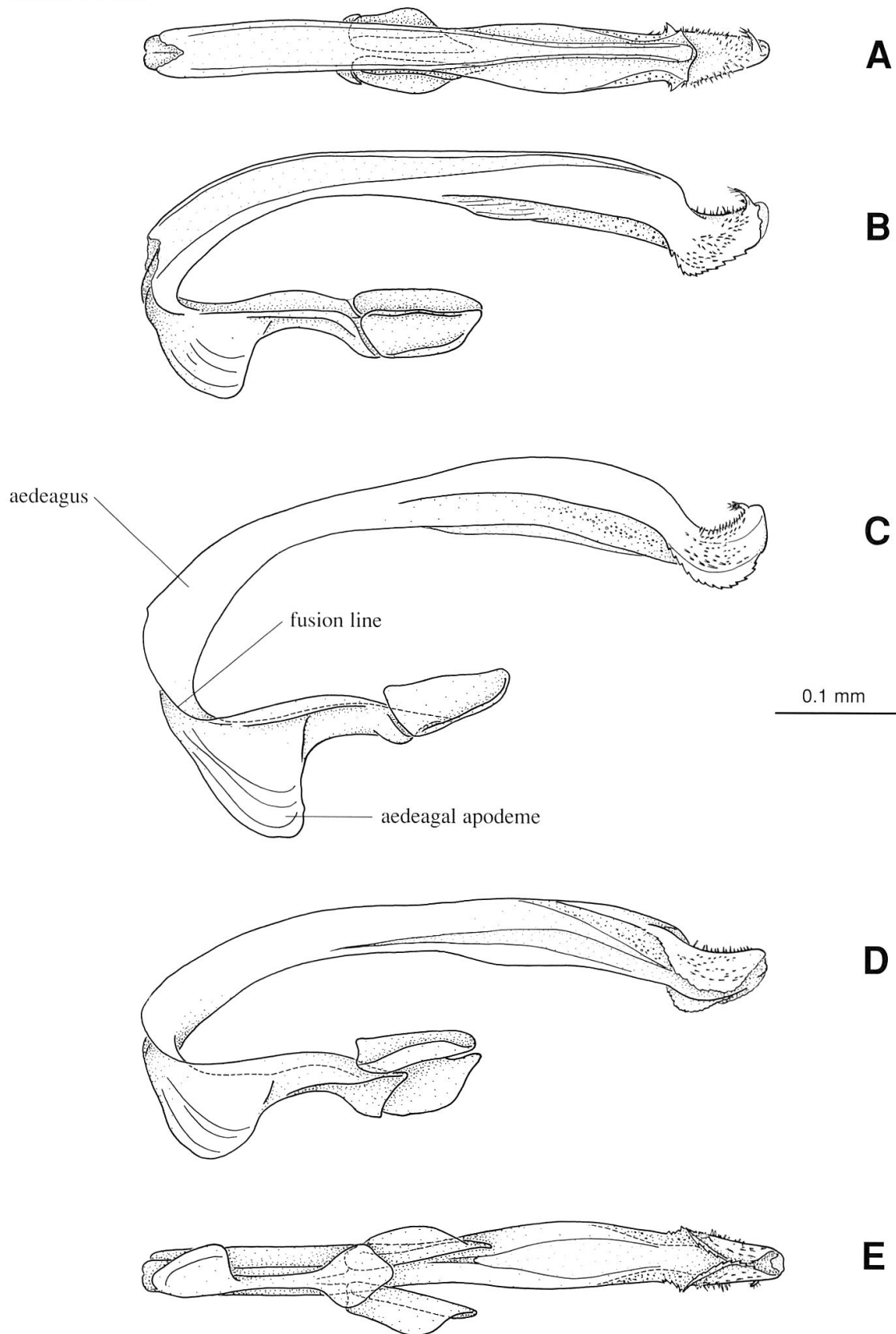


Fig. 30. *Drosophila fluminensis* sp. nov., male holotype. A–E, aedeagus+aedeagal apodeme, and paraphyses, several views from dorsal through ventral.

cell c-II, an oblique, dark shadow at the tip of  $R_{2+3}$ , reaching almost to the vein  $R_{4+5}$ , tips of veins  $R_{4+5}$  and M with diffuse shadows which may be confluent and then diffusely fill more or less the wing tip; length 3.06 (2.87–3.15) mm, length to width ratio = 2.43 (2.37–2.50). Indices:  $C = 3.82$  (3.71–4.00),  $ac = 2.09$  (2.00–2.13),  $hb = 0.26$  (0.19–0.29),  $4C = 0.56$  (0.54–0.57),  $4v = 1.38$  (1.20–1.93),  $5x = 0.92$  (0.82–1.00),  $M = 0.30$  (0.29–0.31),  $prox. x = 0.40$  (0.34–0.43).

Abdomen with yellow ground color, tergites 2–6 with a medially more or less interrupted brown marginal band, which is triangularly broadened on both sides of the medial interruption.

♂ *Terminalia* (Figs 29, 30, 33B). Extremely similar to those of *D. coroica* sp. nov. and *D. morelia* sp. nov., from which they differ by subtle differences, especially regarding the size and the distal end of the aedagus, as seen in lateral view (compare Figs 33A–D). Epandrium mostly microtrichose, but less than in *D. carioca*, with ca. 21 lower, and no upper setae; ventral lobe mostly microtrichose not covering surstylus. Cercus anteriorly fused to epandrium, mostly microtrichose and devoid of ventral lobe. Surstylus distally microtrichose, bearing an almost straight row of 10 sharply pointed, peglike prensisetae, ca. 9 inner and 3–4 outer setae. Decasternum as in Fig. 29B. Hypandrium longer than epandrium, anteriorly narrow, anterior margin rounded; posterior hypandrial process absent; dorsal arch absent; gonopod linked to paraphysis by membranous tissue, rugose at outer half, submedially bearing one seta. Aedeagus longer than that of *D. carioca* sp. nov. but shorter than that of *D. morelia* sp. nov., fused to aedeagal apodeme, long, arch-shaped, parallel to ventral rod; distal half twice as wide as the narrowest part of anterior half [as it occurs in *D. carioca* sp. nov., but not in *D. morelia* sp. nov.], as seen in lateral view; bearing a dorsodistal, thin, curved frontwards process [shorter than in *D. carioca* sp. nov.], dorsally covered with tiny scales; subdistal margins of ventral area serrated; distolaterally covered with tiny scales; dorsal cleft reduced to an opening adjacent to the fusion line aedeagus+aedeagal apodeme. Aedeagal apodeme reduced, just 1/5 length of aedeagus, laterally flattened. Ventral rod as long as aedeagal apodeme width, grooved. Paraphysis linked to gonopod by membranous tissue, devoid of setulae, conspicuously connected to distal margin of ventral rod by membranous tissue.

*Distribution.* Brazil (States of Rio de Janeiro and São Paulo).

*Relationship.* Closely related to *D. carioca* sp. nov., and *D. morelia* sp. nov. It differs from the first mainly in having one larger shadow along the crossvein dM-Cu, which reaches the middle area of cell  $r_{3+4}$ . The latter species has a paler shadow along the crossvein dM-Cu.

*Etymology.* The epithet *fluminensis* is a Latin adjective, meaning an inhabitant of the State of Rio de Janeiro, which includes the type locality.

### *Drosophila (Drosophila) morelia* sp. nov.

(Figs 31, 32, 33C, D, 34A)

*Drosophila* sp. similar to *D. nubiluna*; Wheeler 1949: 189 (description and comparison with *D. nubiluna*).

*Material examined* (3 ♂♂, deposited in the AMNH). Male holotype (preserved although incompletely [missing are: head, thorax, anterior abdomen and legs] as three slide mounts; the abdomen slide mount was dismounted by us and the sclerites are now preserved in glycerin pinned together the original labels) labelled in the first slide: "1796.18 nubiluna ♂ wings [illegible handwriting]", in the second slide: "1796.18 nubiluna ♂ abdomen [illegible handwriting]", in the third slide: "1796.18 nubiluna ♂ antennae cone broken [illegible handwriting]". 2 ♂♂ paratypes (dissected, slide mount, one photographed [Fig. 33D]: "Boquete Chiriqui P. PANAMA / WBHeed MWasserman August 1958". The following two additional labels were added to the

two extant slides, to the empty pin bearing the original label and the microvial with the terminalia, and to the male paratypes: "HOLOTYPE [or PARATYPE] [red label] / *Drosophila morelia* Vilela & Bächli det.". According to D.A. Grimaldi (pers. comm.) the code number (1796.18) on the labels of the holotype of *Drosophila morelia* sp. nov., as detailed in the field/lab notebook currently deposited in the AMNH, means: "smoky tip" = nubiluna  $\beta$  of workbook "traps among brush [sic] at edge of soft + hardwood forests, rather high in mountains @ 19 mi. E. of Morelia, Mich., Mex., coll. a. m., 8–30–47" "M.R.Wheeler and F.A. Cowan".

*Type locality.* Morelia, State of Michoacán, Mexico.

*Diagnosis.* Generally yellowish flies, frons yellow but slightly darkened towards vertex, tergites with a dark brown marginal band which is medially triangularly broadened, reaching the previous tergite, but is medially distinctly interrupted, wing with a faint shadow along the crossvein dM-Cu and a faint band across the wing tip, leaving pale areas between the tips of  $R_{2+3}$ ,  $R_{4+5}$  and M; aedeagus larger than that of *D. fluminensis* sp. nov. and much larger than that of *D. carioca* sp. nov., distolaterally devoid of tiny scales; peglike prensisetae of surstylus not sharply pointed as in *D. carioca* sp. nov. and *D. fluminensis* sp. nov.

*Description.* ♂. Head. Frons golden yellow, yellowish-brown above antennae, frontal length 0.33 (0.32–0.34) mm; frontal index = 0.97 (0.90–1.05), top to bottom width ratio = 1.30 (1.26–1.33). Frontal triangle about 47–60 % of frontal length; ocellar triangle prominent, blackish-brown, greyish, about 37–40 % of frontal length. Orbital plates narrow, apically slightly diverging from eye margin, brown, whitish-greyish, about 80–84 % of frontal length. Orbital setae black, or2 halfway of the other two, slightly closer to eye margin than or1, distance of or3 to or1 = 56–62 % of or3 to vtm, or1 / or3 ratio = 0.77 (0.76–0.79), or2 / or1 ratio = 0.59 (0.54–0.64), postocellar setae = 76 (60–74) %, ocellar setae = 92 (90–95) % of frontal length; vibrissal index = 0.34 (0.31–0.36). Face brownish-yellow. Carina distinctly diverging downwards, dorsally flat, noselike. Cheek index about 6–9. Eye index = 1.16 (1.15–1.18). Antennae brown, flagellomere 1 slightly silvery when seen from below, length to width ratio of flagellomere 1 = 1.50. Arista with 4–5 dorsal, 2 ventral and about 8 short inner branches, plus terminal fork. Proboscis yellowish, palpus brownish, with about 4 ventral setae.

Thorax length 1.22 (1.15–1.29) mm. Scutum brownish-yellow, somewhat darker on scutellum; 6 rows of acrostichal setulae. h index = 1.13. Transverse distance of dorsocentral setae 172–183 % of longitudinal distance. dc index = 0.70 (0.68–0.72). Distance between apical scutellar setae about 108–127 % of that of apical to basal one, basal ones divergent; scut index = 1.06. Pleura pale brownish-yellow, slightly darker in upper half, sterno index = 0.68, mid katapisternal seta about 41 % of the anterior one. Halter yellow. Legs yellow, fine preapical setae on all tibiae, ventral apical seta on mid tibia.

Wing (Fig. 34A) hyaline, with a roundish, diffuse brown patch close to the tip of  $R_{2+3}$ , almost reaching backwards vein  $R_{4+5}$ , both main crossveins diffusely shadowed; length 2.74 (2.45–2.94) mm, length to width ratio = 2.42 (2.33–2.57). Indices: C = 4.05 (3.06–4.43), ac = 1.92 (1.75–2.25), hb = 0.21 (0.17–0.25), 4C = 0.56 (0.48–0.69), 4v = 1.27 (1.19–1.36), 5x = 1.26 (1.14–1.38), M = 0.36 (0.31–0.39), prox. x = 0.41 (0.38–0.45).

Abdomen with yellow ground color, tergites 2–6 with a medially more or less interrupted brown marginal band, which is triangularly broadened on both sides of the medial interruption.

♂ *Terminalia* (Figs 31, 32, 33C, D). Extremely similar to those of *D. carioca* sp. nov. and *D. fluminensis* sp. nov., from which they differ by subtle differences,

*morelia*

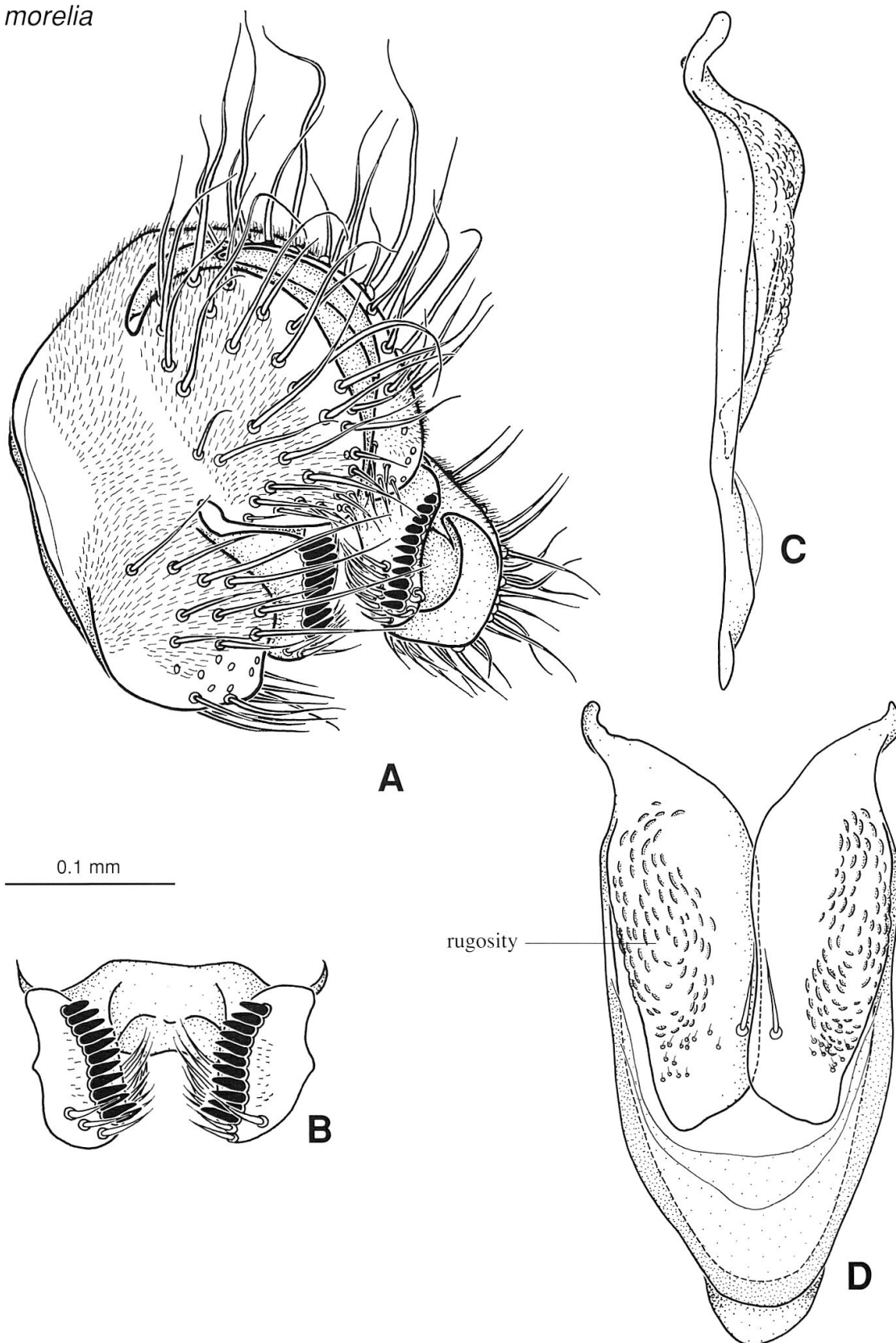


Fig. 31. *Drosophila morelia* sp. nov., male holotype. A, epandrium, cerci, surstyli and decasternum, oblique posterior view. B, surstyli and decasternum posterior view. C, hypandrium and gonopods, left lateral view. D, idem, posterior view.

especially regarding the size and the distal end of the aedagus, as seen in lateral view (compare Figs 33A–D). Epandrium mostly microtrichose, with about 27 lower, and no upper setae; ventral lobe mostly microtrichose, partially covering surstylus. Cercus anteriorly fused to epandrium, mostly microtrichose and devoid of ventral lobe. Surstylus slightly microtrichose distally, bearing an almost straight row of

*morelia*

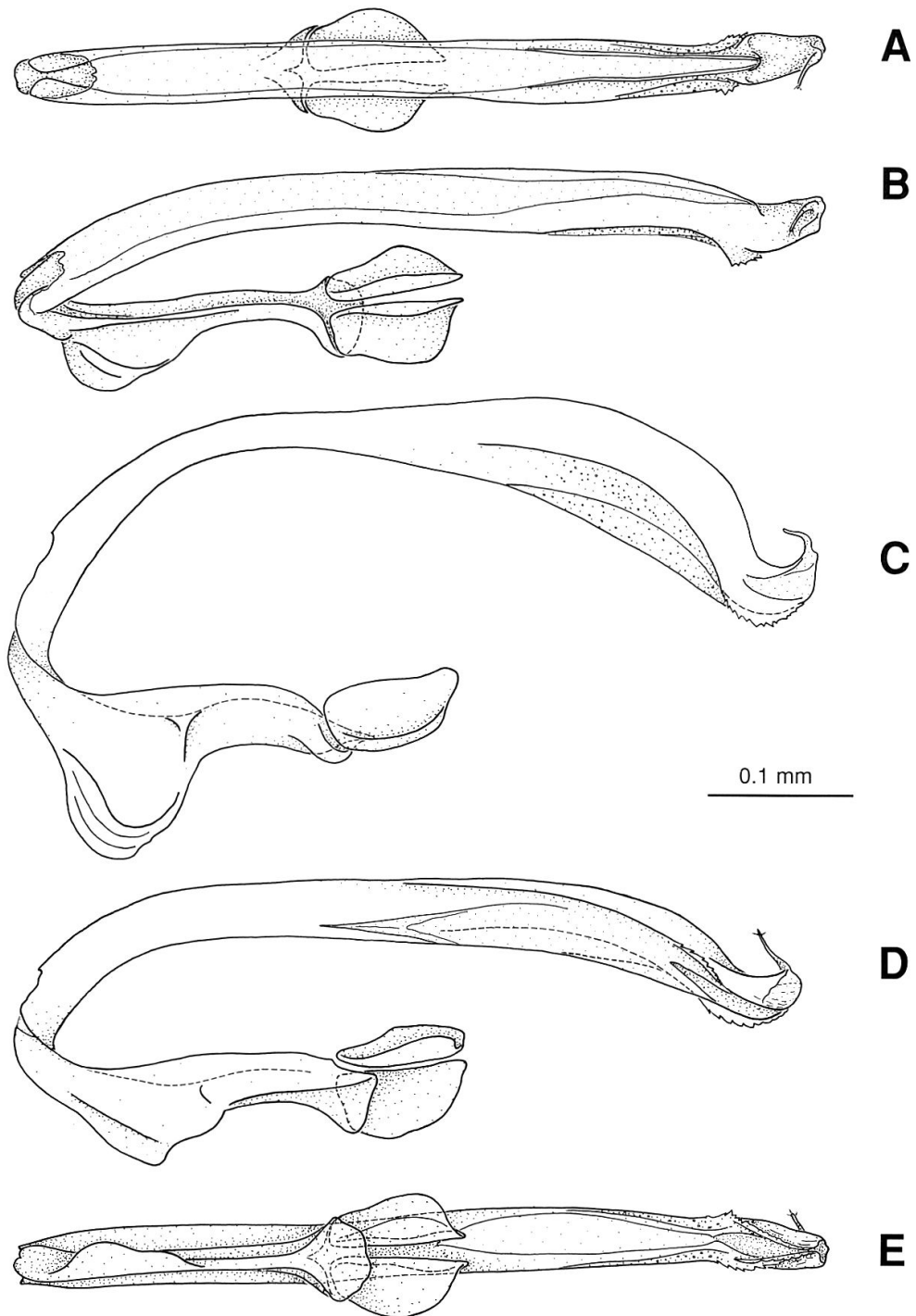


Fig. 32. *Drosophila morelia* sp. nov., male holotype. A–E, aedeagus+aedeagal apodeme, and paraphyses, several views from dorsal through ventral.



11–12 peglike prensisetae, roundish at tip, ca. 6–8 inner and 3 outer setae. Decasternum as in Fig. 31B. Hypandrium longer than epandrium, subproximally narrower, anterior margin rounded; posterior hypandrial process absent; dorsal arch absent; gonopod mostly rugose, linked to paraphysis by membranous tissue, subproximally bearing one seta near inner margin and tiny setulae near outer margin. Aedeagus fused to aedeagal apodeme, long, arch-shaped, parallel to ventral rod; distal half ca. thrice as wide as the narrowest part of anterior half as seen in lateral view [in *D. carioca* sp. nov. and *D. fluminensis* sp. nov. it is just twice as wide]; bearing a dorsodistal, thin, curved frontwards process, dorsally with only ca. 2–3 tiny scales; subdistal margins of ventral area serrated; distolaterally devoid of tiny scales [covered with tiny scales in *D. carioca* sp. nov. and *D. fluminensis* sp. nov.]; dorsal cleft reduced to an opening adjacent to the fusion line aedeagus+aedeagal apodeme. Aedeagal apodeme extremely reduced, just 1/5 length of aedeagus, laterally flattened. Ventral rod as long as aedeagal apodeme width, grooved. Paraphysis linked to gonopod by membranous tissue, devoid of setulae, conspicuously connected to distal margin of ventral rod by membranous tissue.

*Distribution.* Mexico (State of Michoacán) and Panama (Province of Chiriquí).

*Relationship.* Closely related to *D. carioca* sp. nov., and *D. fluminensis* sp. nov., from which it differs mainly because the shadow along the wing crossvein dM-Cu is paler and diffuse (darker and more delimited in the other two species), the distolateral region of aedeagus is devoid of tiny scales, which are present in the species cited above, and the aedeagus is longer and anteriorly narrower (in lateral view) than the aedeagi of the remaining species.

*Etymology.* The epithet *morelia* is a noun in apposition, referring to the type locality.

*Comments.* Two out of the four males labelled "Boquete, ChiriquíP. [Province of Chiriquí] PANAMA / WBHeed MWasserman August 1958", collectively identified as *Drosophila uninubes* in a loan received from the AMNH, do not belong to the *rubrifrons* group, but are specimens of *Drosophila morelia* sp. nov. (*morelia* group) instead. They have been used in the description and are now considered paratypes of this new species.

### Genus *Hirtodrosophila* Duda

#### *Hirtodrosophila cowani* sp. nov.

(Figs 24F, 35, 36)

Material examined (1 ♂) Male holotype (dissected, the head is partially glued [whitish glue] on the thorax, whose right side is partially missing, including the right wing [probably destroyed by dermestids], deposited in the AMNH) labelled: "19 mi E Morelia Mich. Mex. / MR Wheeler FA Cowan Sept. 1947 / 1796.10 magnabadia [misidentification] ♂ / *Hirtodrosophila cowani* Vilela & Bächli det. / HOLOTYPE".

*Type locality.* 19 miles East of Morelia, State of Michoacán, Mexico.

*Diagnosis.* Yellowish fly, head and thorax with a whitish tinge, carina distinct but very narrow, arista with only one ventral branch; tergites with dark brown marginal bands which are medially more or less triangularly expanded towards the previous tergite; wing with faintly shadowed crossveins; aedeagus mostly membranous, with texture of a raspberry fruit, completely different from that of any Neotropical drosophilid we have ever seen.

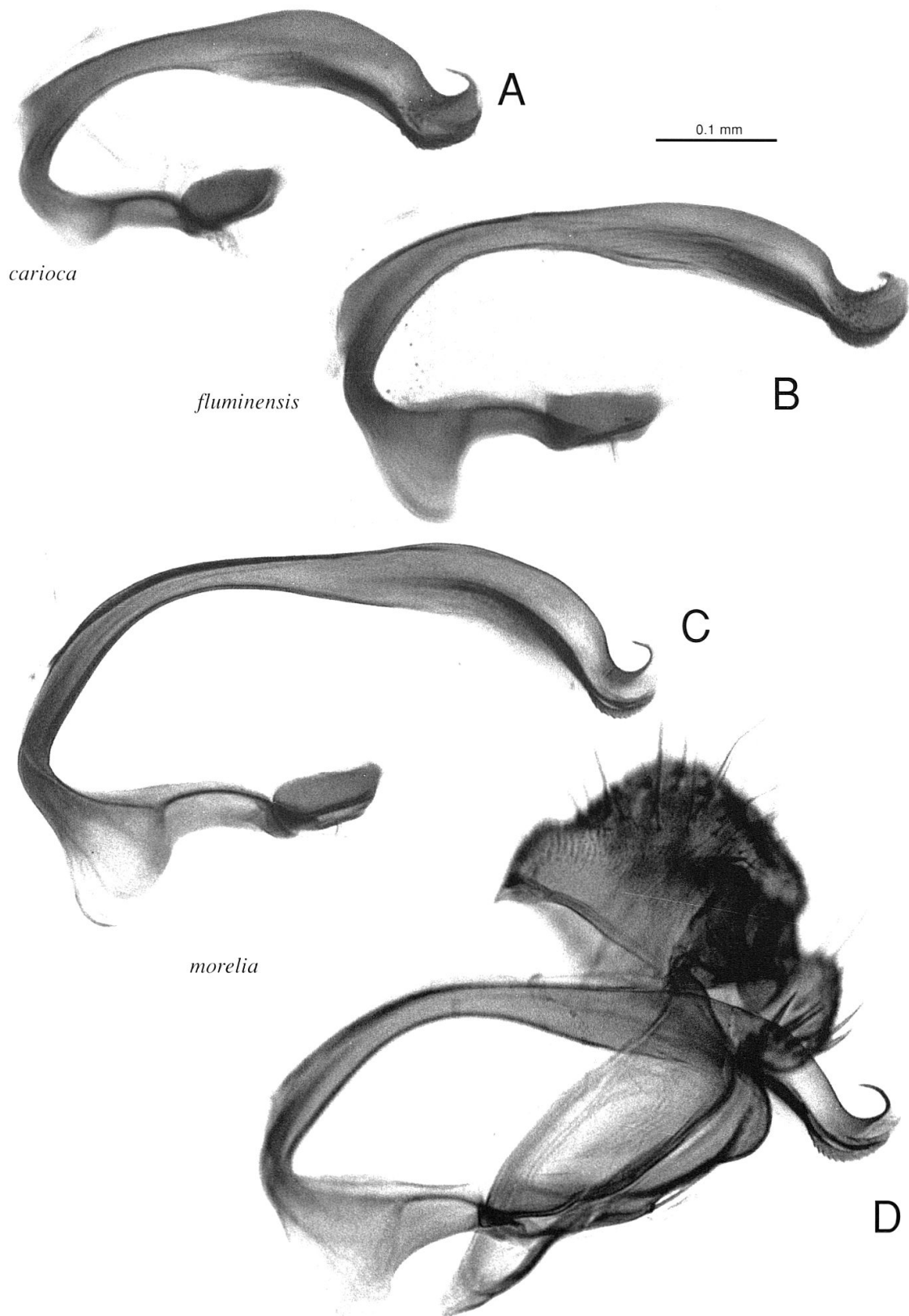


Fig. 33. A–C, Aedeagus+aedeagal apodeme, and paraphyses, left lateral view, of A, *Drosophila carioca* sp. nov., holotype. B, *Drosophila fluminensis* sp. nov., holotype. C, *Drosophila morelia* sp. nov., holotype. D, complete male terminalia, left lateral view, of *Drosophila morelia* sp. nov., para-type.

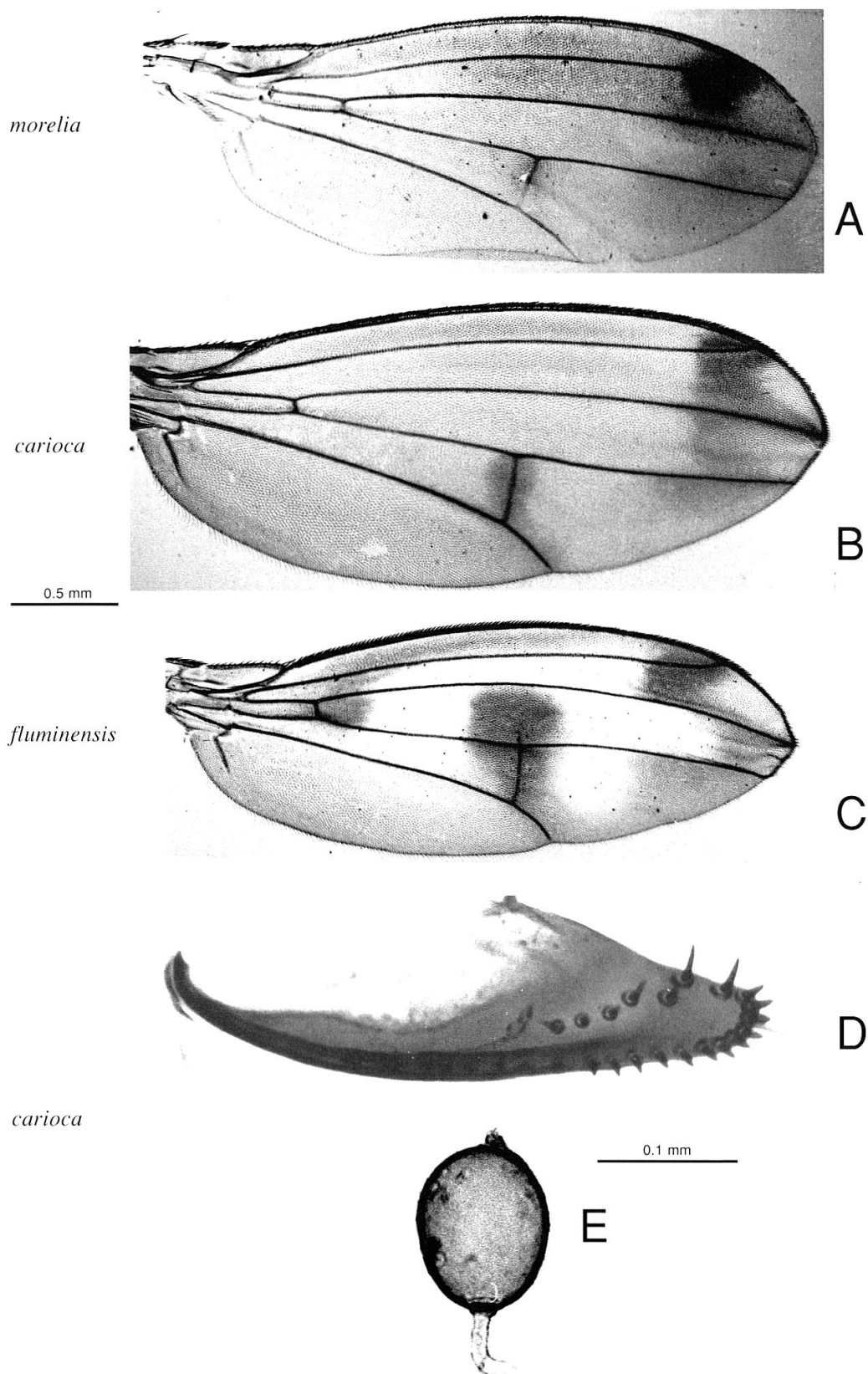


Fig. 34. A–C, right wings, dorsal view, of: A, *Drosophila morelia* sp. nov., holotype. B, *Drosophila carioca* sp. nov., holotype, C, *Drosophila fluminensis* sp. nov., holotype. D, left oviscapt valve of *Drosophila carioca*, sp. nov., paratype, December 1953, Rio de Janeiro, state of Rio de Janeiro, Brazil. E, inner capsule of spermatheca of *Drosophila carioca*, sp. nov., same specimen as in 36D.

*cowani*

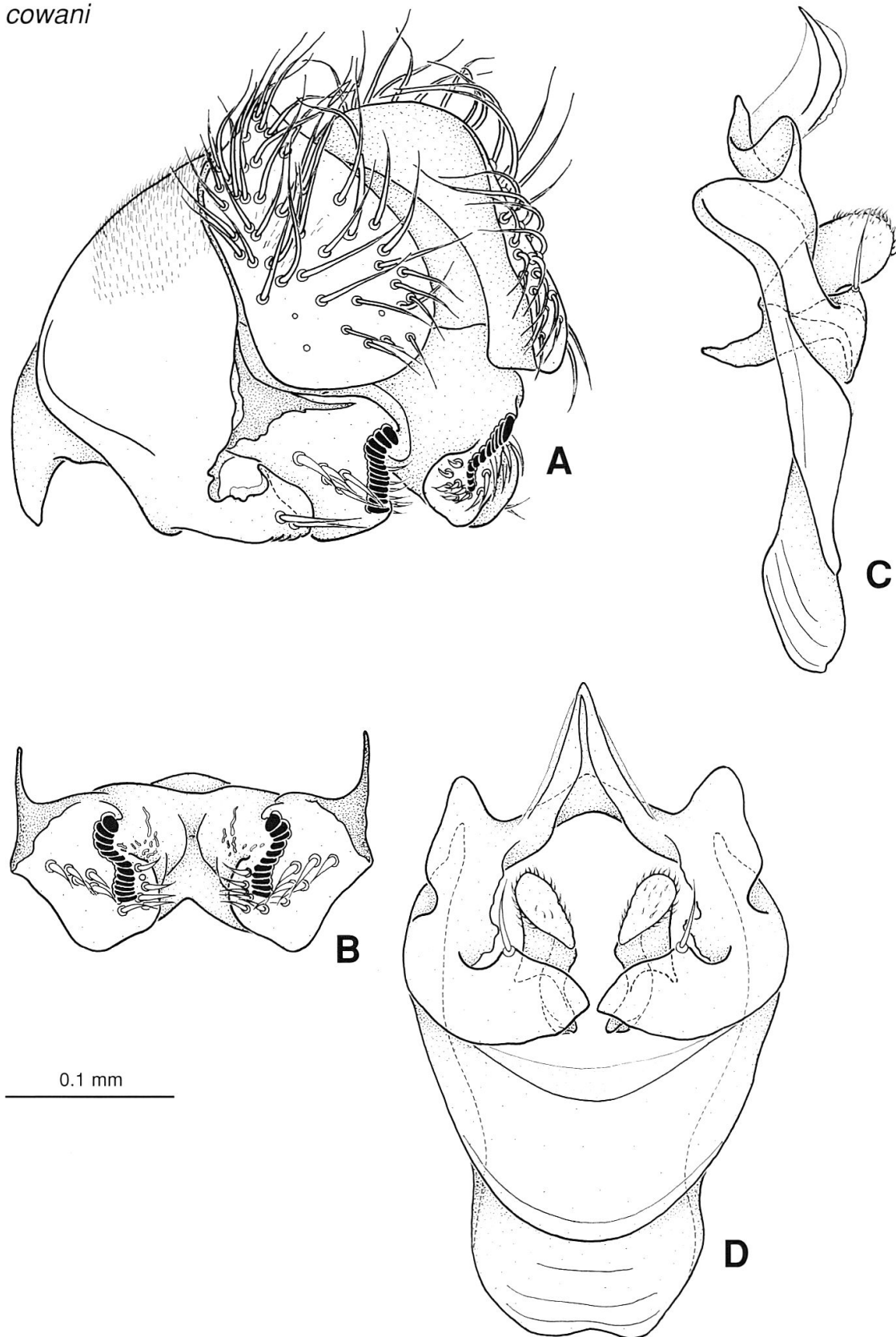


Fig. 35. *Hirtodrosophila cowani* sp. nov., male holotype. A, epandrium, cerci, surstyli and decasternum, oblique posterior view. B, surstyli and decasternum posterior view. C, hypandrium, gonopods and paraphysis, left lateral view. D, idem, posterior view.

*Description.* ♂. Head. Frons yellowish, brownish towards vertex, slightly whitish laterally, frontal length 0.36 mm; frontal index = 1.17, top to bottom width ratio = 1.44. Frontal triangle dark brown, about 48 % of frontal length; ocellar triangle prominent, dark brown, about 38 % of frontal length. Orbital plates brownish, slightly silvery microtrichose, apically diverging from eye margin, about 75 % of frontal length. Orbital setae almost in a row, distance of or3 to or1 = 75 % of or3 to vtm, or1 / or3 ratio = 0.81, or2 / or1 ratio = 0.31, postocellar setae = 48 %, ocellar setae = 76 % of frontal length; vibrissal index = 0.42. Face whitish. Carina prominent but not noselike, very narrow. Gena whitish, rather broad, index about 6. Eye index = 1.21. Pedicel yellowish. Flagellomere 1 brownish, length to width ratio = 1.80. Arista with 3 dorsal, 1 ventral and about 5 short inner branches, plus small terminal fork. Proboscis and palpus pale yellowish.

Thorax length 1.17 mm. Scutum whitish yellow, with a faint brownish median stripe in anterior half; 6–8 rows of acrostichal setulae. h index = 1.00. Transverse distance of dorsocentral setae 190 % of longitudinal distance; dc index = 0.64. Scutellum whitish yellow, scutellar setae almost equidistant; basal ones divergent; scut index = 1.21. Pleura, halter and legs pale yellowish, short preapical setae on mid and hind tibiae, ventral apical seta on mid tibia (forelegs damaged).

Wing hyaline, crossveins R-M and dM-Cu with a diffuse shadow, length 2.62 mm, length to width ratio = 2.14. Indices: C = 3.20, ac = 2.14, hb = 0.27, 4C = 0.63, 4v = 1.50, 5x = 1.28, M = 0.46.

Abdomen yellowish, tergites 2–6 with a broad, dark brown marginal band, which is medially broadened, reaching the previous tergite.

♂ *Terminalia* (Figs 24F, 35, 36). Epandrium dorsodistally microtrichose with 2 lower, and no upper setae; ventral lobe dorsally membranous, neither microtrichose nor covering surstylus. Cercus anteriorly connected to epandrium by membranous tissue, slightly microtrichose and devoid of ventral lobe. Surstylus dorsoanteriorly strongly sclerotized, not microtrichose, bearing a sinuate row of 11–13 peglike prensisetae, ca. 6 inner and 5–6 outer and stronger setae. Decasternum as in Fig. 35B. Hypandrium as long as epandrium, anterior margin slightly concave; posterior hypandrial process absent; dorsal arch well developed; gonopod mostly fused to paraphysis, bearing one seta near the submedian inner margin. Aedeagus, except dorsally, mostly membranous and rugose [the texture somewhat reminds that of a raspberry], partially fused to aedeagal apodeme; distolaterally bearing a pair of pad-shaped membranous expansions; dorsodistally bearing a pair of strongly sclerotized, serrated processes, which are preceded by strongly sclerotized stripes; lateral margins adjacent to gonopore strongly sclerotized; dorsal cleft ca. 1/5 length of aedeagus. Aedeagal apodeme slightly longer than aedeagus, bent, rod-shaped. Ventral rod vestigial. Paraphysis mostly fused to gonopod, distally microtrichose, devoid of setulae, connected to distal margin of aedeagal apodeme by membranous tissue.

*Distribution.* Mexico (State of Michoacán).

*Relationship.* In the key of Patterson (1943) this species runs to *Hirtodrosophila orbospiracula* (Patterson & Wheeler, 1942), but this specimen differs in the following characters: wing indices, presence of whitish areas on frons and mesonotum, brown line on fore coxa and abdominal bands that always reach previous tergite. We were unable to relate it to any of the so far described species of *Hirtodrosophila*.

*Etymology.* The epithet *cowani* is a genitive patronym, honoring one of the collectors of the holotype.

*cowani*

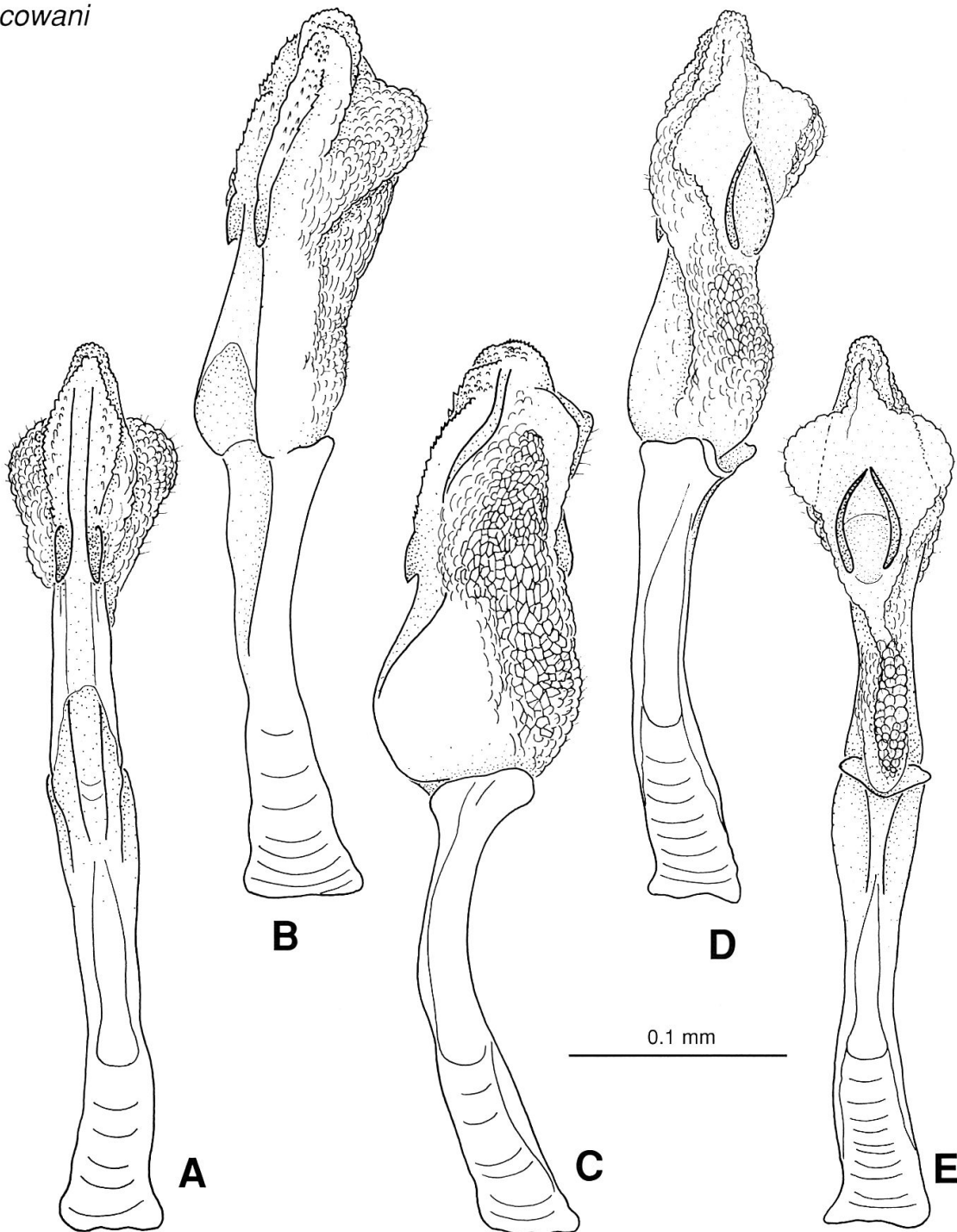


Fig. 36. *Hirtodrosophila cowani* sp. nov., male holotype. A–E, aedeagus+aedeagal apodeme, several views from dorsal through ventral.

*Comments.* It is tentatively included in the genus *Hirtodrosophila*, mostly because it runs to this genus in the keys for Mexican drosophilids and it has an arista with just one lower branch, although it remarkably differs by having a well developed dorsal arch posteriorly to hypandrium and one mostly membranous and quite unique aedeagus.



## ZUSAMMENFASSUNG

Die Arten der *Drosophila macroptera*-Gruppe und der *D. rubrifrons*-Gruppe, Untergattung *Drosophila*, werden beschrieben und ihre männlichen Terminalia illustriert. Zusätzlich werden sechs für die Wissenschaft neue neotropische Arten beschrieben und illustriert: zwei in der *rubrifrons*-Gruppe (*D. popayan* sp. nov., aus Kolumbien (Department Cauca) und Panama (Provinz Chiriquí), und *D. xalapa* sp. nov., aus dem Staat Veracruz, Mexico), drei in der *Drosophila morelia*-Gruppe, die neu aufgestellt wird (*D. carioca* sp. nov. und *D. fluminensis* sp. nov., beide aus den Staaten Rio de Janeiro und São Paulo, Brasilien, und *D. morelia* sp. nov., aus Mexico (Staat Michoacán) und Panama (Provinz Chiriquí) und eine in der Gattung *Hirtodrosophila* (*H. cowani* sp. nov., aus dem Staat Michoacán, Mexico).

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