

Culex pseudostigmatosoma, *Cx. yojoae*, and *Cx. aquarius*:
New Central American species in the subgenus *Culex*
(DIPTERA: CULICIDAE)

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ABSTRACT. The adult, pupa, and larva of three new species in the genus *Culex*, subgenus *Culex*, are described and illustrated. Adults of *Culex pseudostigmatosoma* n. sp. are highly ornamented and similar to *Cx. stigmatosoma* Dyar. *Culex pseudostigmatosoma* is known to occur from Mexico to Panama. Adults of *Culex yojoae* n. sp. are moderately ornamented and similar to *Cx. coronator* Dyar and Knab. *Culex yojoae* is known only from its type locality in central Honduras. Adults of *Culex aquarius* n.sp. are unornamented and similar to many species in the region. It has been collected in Costa Rica and Panama. The larvae of the three species are similar to those of *Cx. chidesteri* Dyar (illustrated from confirmed material). The four similar larvae are separated in a key.

A review of members of the subgenus *Culex* in Central America has shown that three new species occur there. Two of the species were present as unidentified, numbered specimens in the Mosquitoes of Middle America Project collection assembled by the late John N. Belkin and associates. The third species was recognized from material collected by the author.

MATERIALS AND METHODS

The descriptions use the morphological terms and abbreviations of Harbach and Knight (1980, 1981) with modifications of Harbach et al. (1983). Colors are described in the usual way with words and also with a color measurement system (Kueppers 1982). This measurement system is based on the color mix of standard pigments used in the printing process and is explained in detail in Strickman (1988). Briefly, color charts were compared with specimens while viewing both under unfiltered, 5 volt, tungsten light. The closest matching color was expressed as a mixture of three of the following four pigments: black (B), magenta (M), cyan (C), and yellow (Y). Each pigment was quantified by its percentage coverage of plain, white paper. Together, the minute dots of the three pigments blend to form the impression of a single color. Hence, B₁₀M₂₀C₉₉ was a mixture of 10% coverage of white paper with black, 20% with magenta, and 99% with cyan, representing a sky blue color. Qualitative evalua-

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²The views of the author do not purport to represent the position of the Department of the Army or the Department of Defense.

tion of color was done to provide an objective reference to color in a few selected body areas of each species. This system is not intended to provide exact measurements for comparisons between species, but to establish representative benchmarks between objective descriptions of color and subjective names of colors.

The discussion of each species includes the means of distinguishing adult females and male genitalia as far as possible from those of other members of the subgenus in Central America north of Panama. No attempt was made to distinguish the pupae from those of other species because this stage has not been adequately described for many other members of the subgenus in the region.

Larvae of the new species were compared with those of a similar species, *Cx. chidesteri* Dyar. Special care was taken to use material definitely identified as *Cx. chidesteri* because of the uncertainty of many descriptions of this species. Specimens of *Cx. chidesteri* examined included nine larvae from three collections in Panama (country of the type locality). Males from these collections had genitalia which matched those of the lectotype (Stone and Knight 1957) of this species. All material examined, including type specimens, are deposited in the United States National Museum, Smithsonian Institution.

TAXONOMIC TREATMENT

Culex (Culex) pseudostigmatosoma New Species (Figs. 1-16, 18; Tables 1, 2)

Diagnosis.-- The adult of this species closely resembles *Cx. stigmatosoma* Dyar in having broad basal and apical white bands on all five hindtarsomeres, a complete pale band on the proboscis, and white scales frequently present on the maxillary palpus of the female. Male genitalia are characterized by four rodlike setae, a foliform seta, and a narrow seta on the subapical lobe; by a strongly developed dorsal arm and a large, laterally directed ventral arm on the lateral plate of the phallosome; and by the presence of peg-shaped spines laterally on the paraproc crown. The larva has a long siphon with six to eight tufts, each with two to 11 branches; thoracic and abdominal integument is spiculate.

Female (Figs. 1-5, 18).-- *Head*: Proboscis dark brown ($B_{90}M_{30}C_{40}$) with complete white band beyond middle. Palpomere 3 of maxillary palpus with dark scales, palpomere 4 with dark scales to near tip and white or dingy white scales at tip (occasionally absent). Clypeus dark brown ($B_{99}M_{10}C_{50}$), without scales. Pedicel and basal 0.5 of flagellomere 1 yellowish; 3 or 4 pale scales on mesal surface of pedicel. Occiput and vertex with dark brown integument, dark brown erect scales, yellowish or white decumbent scales. Ocular scales white, expanding to a broad white spot on postgena. *Thorax*: Mesonotum (Fig. 1) with brown integument ($B_{70}Y_{90}M_{70}$); acrostichal line and areas laterad of posterior scutal fossal scales and posterior dorsocentral scales without scales; decumbent scales over most of mesonotum golden yellow; anterior acrostichal and lateral scutal fossal scales white; spot of white scales at junction of posterior scutal fossal and posterior dorsocentral scale areas; scattered white scales on prescutellum; scutellum with narrow, white, decumbent scales on each lobe; mesopostnotum light brown. Pleuron (Fig. 2) with light brown integument ($B_{30}Y_{70}M_{40}$), lighter than mesonotum; anteprenotum with dark setae and golden-yellow curved, decumbent scales; postpronotum with irregular row of dark setae, yellowish curved decumbent scales below setae, becoming concentrated into patch at posterior end of row; proepis-

ternum with row of light-colored setae; paratergite with dark setae and yellowish decumbent scales; mesanepisternum with up to 16 white scales on postspiracular area; mesokatepisternum with prominent mesopleural ridge, prealar, upper mesokatepisternal, and lower mesokatepisternal setae light-colored, upper and lower mesokatepisternal scales white, upper and lower mesanepimeral setae light-colored, upper and lower mesanepimeral scales white, integument of mesanepimeron usually paler posteriorly and ventrally. *Legs*: Dark areas brown ($B_{99}Y_{10}M_{40}$). Forecoxa with white scales dorsally, incomplete covering of oval brown scales on anterior surface, setae dark; foretrochanter with translucent scales; forefemur with brown scales dorsally and anteriorly, dingy white scales posteriorly and ventrally, apical fringe of dingy white scales; foretibia brown dorsally, dingy white ventrally and on narrow basal and wider apical bands; foretarsomeres brown with basal and apical dingy white bands, bands progressively narrower on apical articulations, foretarsomere 5 with pale scales scattered over entire surface. Midcoxa with translucent scales and vertical band of brown scales, setae dark; midtrochanter with translucent scales; midfemur dark brown dorsally and anteriorly with dark scales extending posteriorly near apex, white posteriorly and ventrally with white apical fringe of scales; midtibia dark brown dorsally, white ventrally with narrow basal white band and wide apical white band; midtarsomeres with basal and apical white bands, progressively narrower toward distal end of tarsus, midtarsomere 5 with white scales basally and light brown scales apically. Hindcoxa with translucent scales and light-colored setae; hindtrochanter with brown and translucent scales; hindfemur dark brown dorsally, white ventrally and in apical fringe, distally dark scaling gradually expands over anterior and posterior surfaces to surround segment near apex, border between dark and pale scales is a ventrally directed diagonal line (Fig. 18); hindtibia dark brown except for narrow basal and wider apical white bands; hindtarsus as in Fig. 5. *Wings*: Scales on anterior of costa dark brown, spot of white scales on posterior of costa basad of humeral crossvein, continuing as line of dingy white scales on posterior of costa for about 0.3 length of wing; white scales sometimes reduced in number or absent. *Abdomen*: Tergal banding as in Figs. 3 and 4, sometimes with banding less extensive than in illustration, especially on segments VI and VII; basal bands on dorsum white, dark scales brown ($B_{99}Y_{50}M_{40}$). Sterna with white to yellowish scales basally, light brown scales apically.

Male (Figs. 6-8)--. Similar to female except as follows: *Head*: Proboscis with complete band surrounding false articulation. Palpomeres 2 and 3 with sparse pale scales and exposed pale integument ventrally, dark-scaled dorsally; articulation between 2 and 3 pale and scaleless dorsally; palpomeres 4 and 5 dark-scaled with pale band at base of palpomere 4 (yellowish or white dorsally, white ventrally), complete line or scattered white scales on midventral line of palpomere 4, band of white scales at base of palpomere 5. *Abdomen*: Tergal banding as in Figs. 6 and 7; banding more extensive than in female.

Male genitalia (Figs. 9-13)--. *Segment IX* (Fig. 13): Covered with aculeae slightly longer than diameter of alveolus of larger setae; single row of 6-12 stout curved setae on each tergal lobe. *Proctiger* (Fig. 12): Basal lateral arms, cercal sclerites, and tergum X lightly sclerotized; paraproct usually more heavily sclerotized with irregularly bumpy surface; 2-4 cercal setae; spines of paraproct crown heavily sclerotized, row of about 6 peglike laterally, remainder longer and sharply pointed. *Lateral plate* (Figs. 10, 11): Dorsal arm heavily sclerotized, V-shaped in cross section with apex of V directed laterally; denticles of lateral plate short and triangular, restricted to ventral portion of area between dorsal process and ventral arm; ventral arm round and flat, in plane perpendicular to plate, edge sculptured. *Gonocoxopodite* (Fig. 9): Surface of in-

tegument covered with aculeae; subapical lobe undivided, seta *a* sharp with tip bent dorsally, seta *b* stouter with more of end bent, seta *c* also stout, curved slightly with end recurved, seta *d-f* finer with end sharply hooked, seta *g* foliform with striations, seta *h* fine and curved.

Pupa (Figs. 14, 15; Table 1).-- *Cephalothorax*: Tracheoid area, sometimes pinna of trumpet and maxillary palpus darkly pigmented; dorsal side of mesothoracic wing and dorsal and posterior portions of scutum moderately darkened. *Abdomen*: Area of darkened integument progressively narrower and lighter posteriorly to segment VI. Dorsal surface reticulate with minute spiculation on median portion of each tergum. Ventral surface reticulate with minute spicules on lines of reticulations of sterna I-V; spicules present but less developed on sterna VI-VIII. Central portion of posterior margin of sternum II with several irregular rows of triangular spicules larger than other ventral spicules. Buttress of paddle with small serrations, darkened; midrib darkened. Genital lobe darkened; ventral side of genital lobe of male reticulate and sparsely, minutely spiculate; genital lobe of female sometimes minutely spiculate on posterior part of ventral surface. *Chaetotaxy*: As in Table 1 and Figs. 14, 15.

Larva (Fig. 16; Tables 2, 7).-- *Head*: Antenna darkened at base and from apex to short distance proximad of seta 1-A; in life antenna appears to have broad pale band. Collar and black-spot area heavily darkened. Lateralia slightly darkened laterally. *Thorax*: Densely spiculate with spicules denser on dorsal than ventral side. *Abdomen*: Integument spiculate, individual spicules finer than on thorax; smallest spicules on segment VIII. Segment X darkened on anterior, dorsal, and posterior edges; covered with long spicules extending onto posterior membranous areas; saddle often longer than in illustration. Siphon darkened at base and narrowly darkened at tip; spiracular opening with single long tooth and sometimes with second, shorter tooth. *Quantitative characters*: As in Table 7. *Chaetotaxy*: As in Table 2 and Fig. 16.

Type Data.--The type series consists of 6 females and 10 males, 2 dissected male genitalia, 13 associated pupal exuviae, and 9 associated larval exuviae. Holotype male (HONC 226-17; WRBU Acc. 1179) mounted on a paper point; associated larval and pupal exuviae mounted on a slide; genitalia dissected with phallosome intact (WRBU Prep. 88/391) mounted on a slide. The type specimens were collected by the author on September 10, 1986, as larvae in Honduras, La Paz Department, at a location designated on the map (Defense Mapping Agency Series E752 x 2658IV) as Llano Guagololo (14°17'N, 87°48'W), near the town of San Pedro de Tutule. The site was a pond at 1,500 m elevation, approximately 50 x 20 m, with mud and sand bottom and dense emergent vegetation around the margin. The water was turbid, as though finely divided silt had been suspended in it. The surroundings of the pond were a parklike environment with scattered pines and light grazing activity. A color photograph of the site is deposited with the collection records and a negative is on file at the Walter Reed Army Institute of Research under number 89(PN)10-33A.

Other material examined.-- 49♀, 34♂, 16♂G, 49P, 115L in 17 collections. **Mexico**: Chiapas: Tuxtla Gutierrez, 2,100 m, 19 Aug 1964, E. Fisher and D. Verity coll. no. MEX 131, pond, 2L. Veracruz: 2.5 km E of Córdoba, 900 m, 13 Jul 1964, E. Fisher and D. Verity coll. no. MEX 23, large ground pool, 6♂, 2♂G, 4P, 18L. **Guatemala**: Escuintla: Palin, 1000 m, 16 Jul 1964 V.P. Cowsill coll. no. GUA 47, large ground pool, 1♂, 1♂G, 1P; 6 km. S of Amatitlan, 1,200 m, 16 Jul 1964, V.P. Cowsill coll. no. GUA 49, large ground pool, 1P, 3L. **Guatemala**: Guatemala City, 1,500 m, 1 Sep 1964, W. Almengor and V.P. Cowsill coll. no. GUA 115A, 1P, 4L. **El Salvador**:

Laguna de las Ranas, Dec 1941, 2♀, 1♂, 1♂G. Honduras: La Paz: 9 km NE of San Pedro de Tutule, 1,500 m, 23 Mar 1984, A.R. Gillogly coll. no. HONC 23, WRBU Acc. 1076, pond, 2♀, 2P, 5L; Tierra Colorada, 1,780 m, 27 Jul 1986, D. Strickman coll. no. HONC 109, WRBU Acc. 1179, ground pool overflow from seepage, 1♀, 1♂, 1♂G, 2P, 2L; Hacienda Soluteca, 1,440 m, 3 Oct 1986, D. Strickman coll. no. HONC 260, WRBU Acc. 1179, flooded stream margin, 1♂, 1♂G, 1P, 1L; Montecillos, 1,440 m, 3 Oct 1986, D. Strickman coll. no. HONC 262, ground pool, HONC 263, pond, HONC 266, ground pool, WRBU Acc. 1179, 12♀, 7♂, 2♂G, 8P, 8L. Costa Rica: Cartago: 3 km S of Paraiso, 1,200 m, 7 Dec 1962, C.L. Hogue and W.A. Powder coll. no. CR 84, pond, 12♀, 7♂, 4♂G, 2P, 12L; Orosi, 1,210 m, 17 Jul 1971, J. Belkin, coll. no. CR 264, ground pool, 2♀, 5♂, 2♂G, 11P, 8L. Panama: Chiriqui: 3 km W of El Hato del Volcan, 1,340 m, 12 Mar 1964, A. Quinonez coll. no. PA 636, large ground pools, 1♂, 1P, 26L; coll. no. PA 639, swampy lake margin, 9♀, 4♂, 2♂G, 13P, 21L; 15 km NE of El Hato del Volcan, 1,850 m, A. Quinonez coll. no. PA 640, ground pools, 1♀, 1♂, 2P, 5L.

Distribution.-- Larvae of this species have been collected at high elevations (900-1,850 m) from Veracruz, Mexico, south to Chiriqui, Panama. Many of the larval habitats were ponds with muddy water, but specimens were also collected from smaller ground pools and clear water.

Etymology.-- This species is named *Cx. pseudostigmatosoma* because of the close resemblance to the adult of *Cx. stigmatosoma*.

Discussion.-- Females of *Cx. pseudostigmatosoma* and *Cx. stigmatosoma* are distinct from all other Central American members of the subgenus in possessing a complete pale band on the proboscis and broad basal and apical white bands on each hindtarsomere. *Culex pseudostigmatosoma* can be distinguished from *Cx. stigmatosoma* on the basis of the shape of the border between pale and dark areas on the anterior side of the apical portion of the hindfemur (Figs. 17, 18). In *Cx. stigmatosoma* (34 specimens examined from 14 collections in Guatemala, El Salvador, Honduras, and Costa Rica; 137 specimens from the United States) the shape of the border is roughly a right angle (Fig. 17); whereas, in *Cx. pseudostigmatosoma* the border is oblique to the axis of the femur (Fig. 18).

The male genitalia of *Cx. pseudostigmatosoma* are distinct from other species in the subgenus in Central America. Only *Cx. laticlasper* Galindo and Blanton resembles *Cx. pseudostigmatosoma* in the shape of the lateral plate. However, *Cx. pseudostigmatosoma* is easily distinguished from *Cx. laticlasper* by the following characters of the former: dorsal and basal processes of the lateral plate less prominent, the dorsal arm longer and less curved, and the gonostylus narrower.

Culex pseudostigmatosoma was designated "*Cx. (Cux.)* Species 85" in John Belkin's collection from the Mosquitoes of Middle America Project (Heinemann and Belkin 1977a, 1977b, 1977c, 1978). Two other references to the species can be confirmed. The first was made by Kumm and Zuniga (1942). Their specimens of *Cx. pseudostigmatosoma* were listed as *Cx. stigmatosoma* from Laguna de las Ranas, El Salvador. The second reference (Strickman 1989) presented characteristics of larval movement, referring to *Cx. pseudostigmatosoma* as *Cx. "Species A"*.

Culex (Culex) yojoae New Species
(Fig. 19-34; Tables 3, 4)

Diagnosis.-- The adults of *Cx. yojoae* are similar to those of the *Cx. coronator* group, with an incomplete band on the proboscis and narrow basal and apical bands on each hindtarsomere. The male genitalia have three rodlike setae, a fine seta, a foliform seta, and another fine seta on the subapical lobe; a lateral plate with the ventral arm large, round, and directed laterally. The larva has a long siphon with five or six tufts, each with two to five branches; the integument of the thorax is spiculate but that of most of the abdomen is not.

Female (Figs. 19-23).-- *Head*: Proboscis brown ($B_{90}Y_{20}M_{30}$) with dingy white scales on ventral side beginning from base to 0.3 length and terminating at 0.75 length, pale scales extend dorsally on middle 0.25, sometimes nearly forming a complete band. Maxillary palpus same shade of brown as proboscis. Clypeus brown. Antennal pedicel brown; basal 0.5 of flagellomere 1 pale. Integument of vertex and occiput brown ($B_{80}Y_{60}M_{50}$); postocciput pale; decumbent scales of vertex and occiput yellowish, erect scales dark brown; ocular and postgenal scales dingy white or white. *Thorax*: Mesonotum as in Fig. 19; with brown ($B_{50}Y_{80}M_{60}$) integument, darker on acrostichal and dorsocentral lines; no scales between dorsocentral and acrostichal areas and adjacent to posterior scutal fossal and lateral prescutellar areas; background scales golden brown; sparse lighter scales present only in lateral prescutellar area. Scutellum with white, yellowish, or golden brown scales. Pleuron as in Fig. 20; scales consistently sparse; large thoracic and scutellar setae dark brown, pattern of integumental pigmentation varies in intensity; antepronotum with brown setae, integument darker than that of remainder of pleuron; postpronotum with brown setae and decumbent scales similar to those on mesonotum; proepisternum with paler setae; paratergite with dark brown setae and sparse scales similar to those on mesonotum; mesanepisternum bare; mesokatepisternum with golden brown setae on prealar knob, paler setae on upper and lower areas, scales dingy white and not numerous, mesanepimeron with paler setae, dingy white scales in upper and middle portions. *Legs*: Forecoxa with dingy, yellowish scales in small patch dorsally, brown scales on remainder of anterior surface; forefemur with brown scales dorsally and anteriorly, dingy white scales ventrally and posteriorly, pale scales surround segment basally, apical fringe of white scales not complete anteriorly or entirely absent; foretibia brown dorsally, dingy white ventrally, apical patch of pale scales surround segment; each tarsomere of foretarsus with narrow basal and apical bands of lighter scales contrasting moderately with brown scaling, foretarsomere 5 pattern difficult to distinguish. Midcoxa with dingy white scales on anterior side, a few dark gray scales ventrally; midfemur brown dorsally and anteriorly, dingy white posteriorly and ventrally, apical fringe of sparse pale scales; midtibia brown dorsally, dingy white ventrally, apical fringe of dingy white scales; midtarsomeres with basal and apical bands wider and more distinct than on foretarsus, pattern on midtarsomere 5 difficult to distinguish. Hindcoxa with row of translucent scales; hindfemur dark dorsally and anteriorly, white ventrally and posteriorly, dark scales surround segment near tip forming approximately right angle with pale scales, apical fringe of dingy white scales; hindtibia brown dorsally, dingy white ventrally; apex surrounded by broad patch of white scales; hindtarsus as in Fig. 23, dark scales brown ($B_{99}C_{50}$) as on rest of leg. *Wings*: Costa and bases of other veins with brown scales. A few pale scales sometimes present at humeral crossvein. *Abdomen*: Terga as in Figs. 21 and 22, dark scales brown ($B_{99}Y_{30}M_{30}$), pale bands dingy white, purer white laterally, sometimes bands on segments V-VII reduced. Sterna pale basally, dark apically.

Male (Figs. 24-26).-- Similar to female except as follows: *Head*: Proboscis with complete dingy white band, extending farther basally on ventral side. Maxillary palpus with area at base of palpomere 3 without scales and pale, this area wider on dorsal than on ventral side; bands of pale brown scales at articulations of palpomeres 3 and 4 and palpomeres 4 and 5, sometimes wider on ventral than on dorsal side; variably developed line of pale, translucent to white scales on ventral side of palpomere 4. *Thorax*: Scales sparser on pleuron, contrast greater between dark and pale areas of mesonotal integument, lateral prescutellar dark areas of integument extend onto lateral lobes of scutellum. *Legs*: Hindtarsus as in Fig. 26, hindtarsomere 5 often pale on entire ventral surface. *Abdomen*: Terga as in Figs. 24 and 25; basal banding more extensive.

Male genitalia (Figs. 27-31).-- *Segment IX* (Fig. 31): Minute aculeae on entire surface. Tergal lobes deeply cleft; 10-13 curved setae directed laterally on each lobe, setae arranged in roughly double irregular rows. *Proctiger* (Fig. 30): Lateral teeth of paraproct crown with rounded tips, remainder finely pointed. Paraproct, cercal sclerite, basal lateral arm, and tergum X lightly sclerotized. Cercal setae 1 or 2 on each side. *Lateral plate* (Figs. 28, 29): Dorsal process prominent, darkened, upturned; denticles concentrated on ventral portion of plate, bluntly pointed, triangular in outline; ventral arm bent perpendicular to main plane of plate, from dorsal view ventral arm roughly round in outline with sculpturing at apical side; dorsal arm darkened, V-shaped in cross-section, from lateral view triangular in outline and bluntly pointed. *Gonocoxopodite* (Fig. 27): Gonocoxite covered with aculeae and large setae; subapical lobe undivided; seta *a* stout, bent at tip; seta *b* stouter and slightly longer than *a*, also bent at tip; seta *c* longer than *b*, less stout, curved slightly along shaft, bent slightly at tip; seta *d-f* fine, hooked at tip; seta *g* foliform, striate; seta *h* fine, curved.

Pupa (Figs. 32, 33; Table 3).-- *Cephalothorax*: Scutum and mesothoracic and metathoracic wings slightly darkened; maxillary palpus variably darkened, tracheoid area and pinna of trumpet heavily darkened, remainder of trumpet slightly darkened. Pinna broadly flared, anterior side shallowly folded toward center of trumpet; flattened dorsoventrally. *Abdomen*: Lightly pigmented on segments I-VII, progressively lighter posteriorly; areas around sternal folds more heavily pigmented, particularly on segment III. Posteromedian portion of sternum II with stout spicules, these progressively smaller away from posteromedian area. Reticular pattern on other segments, with small spicules on reticulations in median portions of terga and sterna, spicules larger on sterna than terga. Genital lobes of female not spiculate, genital lobes of male with minute spicules ventrally. Paddle slightly darkened on anterior portion of buttress of paddle and on midrib; fine serrations on anterior 0.5 of buttress.

Larva (Fig. 34; Tables 4, 7).-- *Head*: Antenna moderately darkened at base and from region of seta 1-A to tip; spicules beyond seta 1-A sparse or absent. Head capsule slightly to heavily darkened on lateralia and along interior border of frontal ecdysial line; heavily darkened in black-spot area and collar. *Thorax*: Pro- and mesothorax with large, dark spicules dorsally, progressively smaller and sparser ventrally until absent on midventral line; metathorax with smaller, sparser spicules dorsally, also becoming progressively sparser ventrally until absent on midventral line; spiculation noticeably finer in 10 of 23 larval exuviae examined. *Abdomen*: Segments I-VII without spicules; segment VIII with sparse, fine spicules; segment X spiculate, with spicules progressively larger dorsally and posteriorly, spiculation reduced to minute teeth on reticular pattern of cuticle in anteroventral quadrant. Siphon heavily darkened at base, sometimes at tip; tooth of spiracular apodeme sometimes branched.

Type Data and Distribution.-- Holotype male reared from larva, glued to paper point; associated male genitalia (completely dissected, preparation number 88/396), pupal and larval exuviae mounted on slides; collection number HONC 250-14, WRBU Acc. 1179. The type series also includes 11 females, 15 males, 3 male genitalia, 24 pupal exuviae, 24 larval exuviae and 3 whole larvae, from the same collection.

Culex yojoae is known only from the type locality, La Joya, Cortés Department, Honduras 14° 55' N, 87° 57' W, where it was collected by the author on October 1, 1986. This location was within a kilometer of Lake Yojoa at 640 m amid cleared, fallow fields with scattered trees. The larval site was a roadside ditch with stagnant water 5 cm deep extending 100 x 5 m. The water was clear, but objects in the water (including the larvae) were coated with red, flocculent material. A color photograph of the site is filed with the collection records at the Walter Reed Biosystematics Unit. The negative, number 89(PN)9-33, is filed at the Walter Reed Army Institute of Research. Motion pictures were taken of individual larvae from the type series prior to preservation. The results of that work are published elsewhere (Strickman 1989), with reference to *Cx. yojoae* as *Cx. "Species B"*.

Etymology.-- *Culex yojoae* is named for Lake Yojoa, a large natural lake adjacent to the type locality. The lake is located on the Atlantic slope of the central cordillera of Honduras.

Discussion.-- The adult female of *Cx. yojoae* is similar to Central American members of the Declarator and Coronator groups. The smaller number of scales on the pleuron and the presence of apical dark bands on the abdominal sterna distinguish *Cx. yojoae* from similar species in the region.

In the male genitalia, the distinctive form of the lateral plate is shared by a number of other species in the region. The presence of seta *d-f* on the subapical lobe of *Cx. yojoae* separates it from most of these species. The remaining species can be distinguished as follows: *Cx. interrogator* Dyar and Knab has a narrow foliform seta *g*; *Cx. stigmatosoma* Dyar has larger denticles and dorsal process on the lateral plate.

Culex (Culex) aquarius New Species
(Fig. 35-50; Tables 5, 6)

Diagnosis.-- Adults of this species generally resemble *Cx. mollis* Dyar and Knab and *Cx. inflictus* Theobald in the reduction of light banding on the legs and abdomen. The male genitalia are very similar to those of *Cx. salinarius* Coquillett and *Cx. spinosus* Lutz in having four rodlike setae, a foliform seta, and a narrow seta on the subapical lobe; large hooked dorsal process of the phallosome; and long curved basal lateral arms of the proctiger. The larva has a long siphon with six tufts, each with two to five branches; the integument of the thorax, but not that of most of the abdomen, is spiculate.

Female (Figs. 35-39).-- *Head*: Proboscis brown ($B_{99}Y_{20}M_{30}$) with paler scales ($B_{30}Y_{30}M_{20}$) on middle 0.3 of ventral side, pale scales not forming distinct band and not easily observed. Maxillary palpus brown, similar in shade to proboscis. Clypeus dark brown ($B_{99}M_{20}$). Pedicel light brown with darker area on median side and at apex; basal 0.5 of flagellomere 1 also light brown, remainder of antenna dark brown. Decumbent scales of vertex light brown, those of occiput white; erect forked scales

darker brown, integument of vertex and occiput usually dark brown ($B_{99}M_{20}$); broad white scales on ocular line and postgena. *Thorax*: Integument of mesonotum (Fig. 35) brown ($B_{80}Y_{80}M_{60}$) with covering of fine, golden brown scales; lighter scales sparse or absent, if present then restricted to anterior acrostichal, anterior dorsocentral, lateral prescutellar, supraalar, and prescutellar areas. Indistinct spot of lighter scales on posterior dorsocentral area. Scutellum with sparse golden brown scales on median lobe, white scales on lateral lobes. Bare areas of integument adjacent to dorsocentral, posterior scutal fossal, and posterior dorsocentral scales. Median prescutellar area bare. Pleuron as in Fig. 36. Antepronotum with golden brown setae and sparse golden brown scales; integument brown ($B_{99}Y_{20}M_{30}$). Other areas of pleuron with integument usually lighter brown ($B_{60}Y_{70}M_{60}$). Postpronotum with golden brown scales and setae. Proepisternum with light golden brown setae, dingy white scales. Paratergite with golden brown setae, sometimes with golden brown scales. Mesanepisternum without scales. Mesokatepisternum with setae of prealar knob light golden brown; upper scales white, setae light golden brown; lower scales white, setae pale. Mesanepimeron with upper scales white, setae dingy white; lower scales white, lower seta pale golden brown. *Legs*: Brown areas of legs $B_{80}Y_{80}M_{70}$. Forecoxa with dingy white scales dorso-posteriorly, brown scales on remainder, setae golden brown. Forefemur brown dorsally and posteriorly, yellowish white ventrally and anteriorly; apical fringe of white scales not complete on anterior side. Foretibia brown dorsally, dingy white ventrally with apical fringe of white scales 2 to 3 scales wide. Apices of apical scales of each foretarsomere slightly paler than remainder of scales. Midcoxa with band of white scales on anterior face, few brown scales at edge of patch ventrally, setae golden brown. Midfemur brown on anterior, white on posterior; apical fringe of white scales not complete on anterior side. Midtibia brown on anterior, dingy white on posterior; apical fringe of white scales incomplete dorsally. Midtarsomeres with apical scales slightly paler than scales on remainder of subsegments. Hindcoxa with translucent scales, pale setae. Hindfemur brown dorsally, white ventrally; dark scales extend ventrally at apical end of segment, forming approximately right angle border between pale and dark scaling; apical fringe of dingy white scales incomplete anteriorly. Hindtibia brown dorsally, dingy white ventrally with apical patch of dingy white scales surrounding segment apically. Hindtarsus as in Fig. 39, banding on tarsomeres sometimes absent. *Wings*: Brown scales on anterior side of costa, pale scales on posterior side in short line including humeral crossvein. Paler scales extend distally on posterior side of costa, but these only slightly paler than brown scales on anterior side. *Abdomen*: Background scales brown ($B_{80}Y_{80}M_{70}$). Basal bands on dorsum dingy white, sometimes reduced to incomplete band one scale wide; bands whiter laterally on segments VI-VIII. Sterna mainly brown, with basolateral patches of dingy white scales.

Male (Figs. 40-42).-- Similar to female except as follows: *Head*: Proboscis with pale scales on middle 0.25 of ventral side, not extending to dorsal side; greater contrast between pale and dark scales than in female. Maxillary palpus with pale area without scales on apex of palpomere 2 and base of palpomere 3; broad pale brown scales on apical 0.5 of lateral side of palpomere 3; patch of white scales on ventral side at base of palpomere 4; line of white scales on ventral side of palpomere 4 from midpoint to about 0.67 length of palpomere; ventral patch of white scales at base of palpomere 5. Decumbent scales of vertex white. *Thorax*: More white scales on posterior dorsocentral and lateral prescutellar areas; all scales of scutellum white. *Legs*: Hindtarsus as in Fig. 42. *Abdomen*: Tergal banding as in Figs. 40 and 41; basal pale bands more extensive than in female.

Male genitalia (Figs. 43-47).-- *Segment IX* (Fig. 47): Tergal lobes narrow, shallowly cleft, with 3-8 setae in single row, integument of lobe bare of aculeae medially, aculeae present on other surfaces. *Proctiger* (Fig. 46): Tenth tergum and cercal sclerite lightly sclerotized, basal lateral arms, paraproct, and paraproct crown darker. Basal lateral arm long and curved, without hook at tip. Acetabulum about 0.5 size of paraproct crown. Paraproct crown covered with spines progressively longer toward apex, all sharp at tip. Cercal setae 2-4. *Lateral plate* (Fig. 44, 45): Dorsal process a stout hook with sharp tip directed ventromesally. Denticles curved, pointed at tip, directed laterally, V-shaped in cross section. Ventral arm a small pointed peg, smaller than denticles. Dorsal arm large with ventral lobe directed mesally, narrowing to blunt point at tip of sclerite. *Gonocoxopodite* (Fig. 43): Gonocoxite with covering of short aculeae and sparser long setae. Subapical lobe undivided; seta *a* a rod with curved apex; seta *b* a slightly curved rod, gently recurved at tip; seta *c* similar to *b* but longer and thinner; seta *d-f* narrow and sharply hooked at tip; seta *g* foliform with distinct striations; seta *h* thin, curved.

Pupa (Figs. 48, 49; Table 5).-- *Cephalothorax*: Striations of median keel pronounced. Trumpet with pinna and tracheoid area moderately darkened, remainder slightly darkened; pinna sometimes not much darker than meatus. Maxillary palpus moderately darkened. Anterior portions of scutum, mesothoracic wing, and metathoracic wing slightly darkened. *Abdomen*: Segments I-VI progressively lighter. Terga II-VIII with minute reticulations, these with minute spicules in central portions of terga. Sterna II-VIII also with reticulations and spicules, but the spicules larger and extend further laterally, reticulations heavier. Posterior border of sternum II spiculate and darkened more than surrounding areas. Sternal folds of segments III-VII darkened. Genital lobe of female smooth; genital lobe of male minutely spiculate on venter. Buttress of paddle with minute serrations on basal 0.5.

Larva (Fig. 50; Tables 6, 7).-- *Head*: Antenna slightly darkened beyond seta 1-A and at base. Posterior of lateralia and anterior and mesal edges of frontal ecdysial line slightly darkened; black-spot area, anteroventral edge of head capsule, and collar heavily darkened. *Thorax*: Integument of dorsum with small, barely visible, sparse spicules which become progressively smaller and sparser posteriorly until apparently absent or extremely minute in region of metathoracic setae; spicules absent from integument of venter. *Abdomen*: Dorsum of segments I and II with minute spicules in median portion, segments III-VII without spicules; segment VIII with spicules as illustrated; segment X slightly darkened, tergum with darker portions on anterior and posterior edges, spiculate medially, expanding to cover entire posterior, spicules larger medially and posteriorly, antero-lateral portion with minutely spiculate reticulation in cuticle; siphon slightly darkened with base and tip more heavily darkened, spiracular apodeme without teeth within spiracular opening.

Type data.-- Holotype male reared from larva, glued to paper point; male genitalia (completely dissected), larval and pupal exuviae mounted on slides; collection number CR 300-13. The type series also includes 8 females, 4 males, 3 male genitalia, 14 pupal exuviae, 3 larval exuviae, and 4 whole larvae, from the same collection.

The type series was collected near San Isidro de Coronado, San Jose Province, Costa Rica (9°59'N, 83°59'W) by D.W. and S.J. Heinemann on July 30, 1971, at an elevation of 1,520 m (Heinemann and Belkin 1977a: 255). The site, with abundant algae and vegetation, was a roadside ditch in a grazing area.

Other material examined.-- 6♀, 5♂, 3♂G, 11P, 71L. **Costa Rica:** Alajuela: Turrucare, 490 m, 31 Jul 1971, A. Berrios Arias and S.J. Heinemann coll. no. CR 308, streamside rock holes, 1♀, 2♂, 1♂G. **Panama:** Chiriqui: 15 km NE of El Hato del Volcan, 1,850 m, 13 Mar 1964, A. Quinonez coll. no. PA 640, 1♀, 2♂, 1♂G, 4P, 25L; 1,800 m, PA 642, swampy area, 2♀, 2P, 16L; 7 km NE of El Hato del Volcan, 1,600 m, 13 Mar 1964, A. Quinonez coll. no. PA 643, swampy stream margin, 2♀, 1♂, 1♂G, 5P, 18L; 6 km NW of El Hato del Volcan, 1,300 m, 16 Mar 1964, A. Quinonez coll. no. PA 646, swampy area, 2L; 10 km NE of El Hato del Volcan, 1,700 m, 18 Mar 1964, A. Quinonez coll. no. PA 648, small stream pools, 10L.

Distribution.-- *Culex aquarius* has been collected in the highlands of Costa Rica and western Panama at elevations ranging from 490 to 1,850 m. Larval habitats included small pools, swampy areas, stream pools, and rock holes.

Etymology.-- This species is named *aquarius*, Latin for "of water." The name is intended to be in contrast to *Cx. salinarius* (Latin for "of salt"), which has very similar male genitalia.

Discussion.-- Identification of females of *Cx. aquarius* is difficult because of indistinct and variable ornamentation. If narrow bands are present on the hindtarsi, then similar species in the region could be distinguished as follows:

Culex chidesteri: More pale scales on anterior dorsocentral, lateral scutal fossal, and supraalar areas of mesonotum; hindtarsal bands more prominent.

Culex inflictus: Decumbent scales on vertex darker; pale scales absent from prescutellar area and scutellum.

Culex lactator Dyar and Knab: Light band of proboscis more prominent; distinctive pattern of pale scales on mesonotum; abdominal bands more prominent.

Culex laticlasper Galindo and Blanton: Decumbent scales of vertex darker.

Culex mollis: Decumbent scales of vertex darker; pale scales absent from prescutellar area; scales less numerous on pleuron.

Culex restuans Theobald: Spots of pale scales on posterior dorsocentral area of mesonotum; hindtarsal bands more prominent; abdominal bands more prominent.

If pale bands on the hindtarsi are absent, then *Cx. dohenyi* Hogue and *Cx. nigripalpus* Theobald can be distinguished by their lack of scale-patches on the mesanepimeron and by more prominent abdominal bands; *Cx. interrogator* can be distinguished by more prominent abdominal bands; and *Cx. quinquefasciatus* Say can be distinguished by coarser scutal scales and more prominent abdominal bands.

Male genitalia of *Cx. aquarius* are very similar to those of *Cx. salinarius* and *Cx. spinosus*. Although neither of these species occur where *Cx. aquarius* has been collected, they are considered here because of the uncertain distribution of the new species. *Culex salinarius* differs from *Cx. aquarius* in the former's greater development of the ventral expansion of the dorsal arm; *Cx. spinosus* is distinguished by its curved ventral arm and larger dorsal process.

Culex aquarius was designated *Cx. (Cux.) "Species 72"* in the Mosquitoes of Middle America Project. The species was referred to in collection records from Costa Rica and Panama (Heinemann and Belkin 1977a, 1978). No other reference to this species has appeared in the literature.

LARVAL IDENTIFICATION

The larvae of the three new species and *Cx. chidesteri* are distinct from other Central American members of the subgenus in possessing a long siphon (siphon index greater than 4.5) and five or more siphon tufts. These species would key to couplet 11 (p. 18) in the revision of Bram (1967). In Central America, the larvae may be separated to species using the following key.

1. Nine or more siphon tufts; spiracular apodeme ratio (length of spiracular apodeme divided by dorsal siphon length) 0.21 or less; saddle index 5.18 or more (Fig. 51) *Cx. chidesteri*
- 1'. Eight or fewer siphon tufts; spiracular apodeme ratio 0.22 or more; saddle index 5.02 or less..... 2
- 2(1). Integument of abdominal segments III-VII spiculate; seta 8-C with 5 or more branches (Fig. 16) *Cx. pseudostigmatosoma*
- 2'. Integument of abdominal segments III-VII not spiculate; seta 8-C with 4 or fewer branches 3
- 3(2). Spiracular apodeme with tooth in spiracular opening; seta 3-P double (Fig. 34) *Cx. yojoae*
- 3'. Spiracular apodeme without tooth in spiracular opening; seta 3-P single (Fig. 50)..... *Cx. aquarius*

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FIGURE LEGENDS

Figs. 1-2. Dorsal view of mesonotum and scutellum (Fig. 1) and lateral view of pleuron (Fig. 2) of ♀ *Culex pseudostigmatosoma*. Drawn from Honduran specimen HONC 262-15, WRBU Acc. 1179. Scale bar is 1.0 mm.

Figs. 3-8. Adult *Culex pseudostigmatosoma*. Drawn from Honduran specimens HONC 262-15 (♀) and 260-10 and 226-30 (♂), WRBU Acc. 1179. Scale bars are 1.0 mm and do not apply to magnified insets. 3. Dorsal view of ♀ abdomen. 4. Lateral view of ♀ abdomen. 5. Anterior view of ♀ hindtarsus and apex of hindtibia. 6. Dorsal view of ♂ abdomen. 7. Lateral view of ♂ abdomen. 8. Anterior view of ♂ hindtarsus and apex of hindtibia.

Figs. 9-15. Male genitalia (Figs. 9-13) and pupal exuviae (Figs. 14, 15) of *Culex pseudostigmatosoma*. Drawn from Honduran specimen HONC 226-17, WRBU Acc. 1179 (phallosome), Honduran specimens HONC 260-10 and 226-24, WRBU Acc. 179 (dissected genitalia), and Costa Rican specimens CR 84-102 and 103 and Honduran specimen HONC 260-10, WRBU Acc. 1179 (pupa). Scale bars are in millimeters. 9. Mesal view of gonocoxopodite. 10. Lateral and mesal views of lateral plate. 11. Dorsal view of phallosome. 12. Dorsal view of proctiger. 13. Dorsal view of ninth tergal lobes. 14. Anterior lateral quadrant of pupal cephalothorax (CT). 15. Metathorax and abdomen (P=paddle; each magnified inset is 0.05 mm across).

Fig. 16. Larva of *Culex pseudostigmatosoma*. Drawn from Costa Rican specimens CR 84, CR 85, CR 84-102, and CR 84-103. Scale bar is 1.0 mm; scale does not apply to enlargements of dorsomentum, spiracular apodeme, pecten spine, or comb scale; each magnified inset of spiculation is 0.07 mm across. (A=antenna; C=head; CS=comb scale; Dm=dorsomentum; M=mesothorax; P=prothorax; PMPC=posterior median process; PS=pecten spine; S=siphon; SAd=spiracular apodeme; T=metathorax.)

Figs. 17, 18. Anterior view of apical portion of hindfemur of ♀ *Culex stigmatosoma* (Fig. 17) and *Culex pseudostigmatosoma* (Fig. 18). Scale bar is 1.0 mm. Drawn from Honduran specimens (WRBU Acc. 1179) HONC 94-45 (*Culex stigmatosoma*) and HONC 262-15 (*Culex pseudostigmatosoma*).

Figs. 19, 20. Dorsal view of mesonotum and scutellum (Fig. 19) and lateral view of pleuron (Fig. 20) of ♀ *Culex yojoae*. Drawn from Honduran specimens HONC 250-10 and 250-15, WRBU Acc. 1179. Scale bar is 1.0 mm.

Figs. 21-26. Adult *Culex yojoae*. Drawn from Honduran specimens HONC 250-10 and 250-15 (♀) and HONC 250-14 and 250-102 (♂), WRBU Acc. 1179. Scale bars are 1.0 mm and do not apply to magnified insets. 21. Dorsal view of ♀ abdomen. 22. Lateral view of ♀ abdomen. 23. Anterior view of ♀ hindtarsus and apex of hindtibia. 24. Dorsal view of ♂ abdomen. 25. Lateral view of ♂ abdomen. 26. Anterior view of ♂ hindtarsus and apex of hindtibia.

Figs. 27-33. Male genitalia (Figs. 27-31) and pupal exuviae (Figs. 32, 33) of *Culex yojoae*. Drawn from Honduran specimens (WRBU Acc. 1179) HONC 250-110 (phallosome), HONC 250-111 (dissected genitalia), and HONC 250-23 and 250-29 (pupa). Scale bars are in millimeters. 27. Mesal view of gonocoxopodite. 28. Lateral and mesal views of lateral plate. 29. Dorsal view of phallosome. 30. Dorsal view of proctiger. 31. Dorsal view of ninth tergal lobes. 32. Anterior lateral quadrant of pu-

pal cephalothorax (CT). 33. Metathorax and abdomen (P=paddle; each magnified inset is 0.05 mm across).

Fig. 34. Larva of *Culex yojoae*. Drawn from Honduran specimens HONC 250 and HONC 250-29, WRBU Acc. 1179. Scale bar is 1.0 mm; scale does not apply to enlargements of dorsomentum, spiracular apodeme, pecten spine, or comb scale; each magnified inset of spiculation is 0.07 mm across.

Figs. 35, 36. Dorsal view of mesonotum and scutellum (Fig. 35) and lateral view of pleuron (Fig. 36) of ♀ *Culex aquarius*. Drawn from Costa Rican specimens CR 300-12, 300-90, 300-101. Scale bar is 1.0 mm.

Figs. 37-42. Adult *Culex aquarius*. Drawn from Costa Rican specimens CR 300-12, 300-90, 300-101 (♀) and CR 300-106 and 300-107 (♂). Scale bars are 1.0 mm and do not apply to magnified insets. 37. Dorsal view of ♀ abdomen. 38. Lateral view of ♀ abdomen. 39. Anterior view of ♀ hindtarsus and apex of hindtibia. 40. Dorsal view of ♂ abdomen. 41. Lateral view of ♂ abdomen. 42. Anterior view of ♂ hindtarsus and apex of hindtibia.

Figs. 43-49. Male genitalia (Figs. 43-47) and pupal exuviae (Figs. 48, 49) of *Culex aquarius*. Drawn from Costa Rican specimens CR 300-11, 300-13 and Panamanian specimen PA 640-104 (genitalia), and Costa Rican specimen CR 300-90 and Panamanian specimen PA 643-108 (pupa). Scale bars are in millimeters. 43. Mesal view of gonocoxopodite. 44. Lateral and mesal views of lateral plate. 45. Dorsal view of phallosome. 46. Dorsal view of proctiger. 47. Dorsal view of ninth tergal lobes. 48. Anterior lateral quadrant of pupal cephalothorax (CT). 49. Metathorax and abdomen (P=paddle; each magnified inset is 0.05 mm across).

Fig. 50. Larva of *Culex aquarius*. Drawn from Panamanian specimens PA 643-115 and PA 643. Scale bar is 1.0 mm; scale does not apply to enlargements of dorsomentum, spiracular apodeme, pecten spine, or comb scale; each magnified inset of spiculation is 0.07 mm across.

Fig. 51. Larva of *Culex chidesteri*. Drawn from Panamanian specimens PA 19-101, 19-104, and 19-108. Scale bar is 1.0 mm; scale does not apply to enlargements of dorsomentum, spiracular apodeme, pecten spine, or comb scale; each magnified inset of spiculation is 0.07 mm across.

Table 1. Number of branches of pupal setae of *Culex (Culex) pseudostigmatosoma*. Based on counts made on 10 specimens from 9 collections made in Mexico, Guatemala, Honduras, Costa Rica, and Panama.

no.	CT	Abdominal segments										Paddle		
		I	II	III	IV	V	VI	VII	VIII	IX	P			
0	-	-	1	1	1	1,2(1) ^a	1	1	1	1	1	1	-	-
1	2-5(4)	6-8(7)	5-18(8)	4-7(6)	5-10(7)	3-6(5)	3,4(3)	3,4(3)	3,4(3)	3,4(3)	3,4(3)	3,4(3)	1	1
2	2-4(2)	1,2(1)	1,2(1)	1	1	1	1	1	1	1	1	1	-	1
3	2-5(3)	2	2-5(2)	2,3(2)	2-6(4)	1,2(2)	1,2(2)	1,2(2)	1,2(2)	1,2(2)	1,2(2)	1,2(2)	-	-
4	2,3(2)	4-7(6)	3-6(4)	4-7(5)	2-7(2)	4-6(5)	2-4(4)	2-4(4)	2-4(4)	2-4(4)	2	2	-	-
5	3,4(4)	2-5(3)	3-5(4)	2-8(5)	2-5(4)	2	2	2	2	2	2	2	-	-
6	3	1	1	2-6(3)	2,3(3)	3-5(3)	3	3	3	3	3-7(4)	3-7(4)	-	-
7	2	2,3(2)	2	4-7(5)	2-5(4)	3-6(5)	1	1	1	1	1	1	-	-
8	2-8(4)	-	-	3-9(7)	2-7(3)	2-5(3)	2-4(3)	2-4(3)	2-4(3)	2-4(3)	2-7(3)	2-7(3)	-	-
9	2	1-3(2)	1	1,2(1)	1,2(1)	1	1	1	1	1	3-6(4)	3-6(4)	6-10(7)	-
10	3-6(5)	-	-	1-3(2)	1,2(2)	1	1	1	1	1	1	1	-	-
11	2,3(2)	-	-	1	1	1	1,2(1)	1,2(1)	1,2(1)	1,2(1)	2	2	-	-
12	2-4(3)	-	-	-	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	-	-	-	1	1	1	1	1	1	1	1	1	1	-

^aRange (mode).

Table 2. Number of branches of fourth-instar larval setae of *Culex (Culex) pseudostigmatosoma*. Based on counts made on 10 specimens from 10 collections made in Mexico, Guatemala, Honduras, Costa Rica, and Panama.

Seta	Abdominal segments												
	Head	Thorax											
no.	C	P	M	T	I	II	III	IV	V	VI	VII	VIII	X
0	-	6-14(7) ^a	-	-	-	1	1	1	1	1	1	1	-
1	1	1	4-6(6)	4-7(5)	5-11(6)	3-6(4)	4,5(4)	3,5(4)	2-6(4)	3,4(3)	3-7(4)	4-7(7)	3-6(3)
2	-	1	2,3(2)	2	2,3(2)	1,2(1)	1,2(1)	1	1	1	1	1	3-4(3)
3	1	1	1	3,4(3)	1,2(2)	1,2(1)	1,2(1)	1,2(1)	1	1	1,2(1)	6-9(8)	1
4	1	2	1,2(2)	4-7(5)	5-13(6)	3-7(5)	2-5(4)	1-5(1)	2-5(3)	1-3(1)	1	1	6
5	6-8(6)	1	1	2,3(2)	4-7(5)	3-6(4)	3-5(4)	2-6(4)	2-5(4)	3-5(4)	3-8(4)	4,5(4)	-
6	3-5(4)	1	1	1	3,4(3)	3	2	2	2	2	7-15(7)	-	-
7	7-11(8)	3	1	5-10(8)	2	4-7(5)	5-10(7)	6-9(6)	4-9(5)	1	1,2(1)	1a-S,	5-11(6)
8	5-8(8)	2,3(2)	5-7(5)	5-7(5)	-	1	2	2	2	1-8(2)	4-10(4)	1b-S,	5-11(5)
9	6-10(8)	1	5-7(6)	5-7(7)	2-4(3)	1	1	1	1	1	2-5(4)	1c-S,	4-9(5)
10	2-4(3)	1	1	1	1	1	1	1	1	1	1	1d-S,	4-8(6)
11	3-7(4)	3-8(5)	4-6(4)	3-5(4)	3-7(4)	2,3(3)	1-4(2)	2-4(2)	2,3(2)	2-4(3)	2-4(3)	1e-S,	4-9(6)
12	3-6(4)	1	1	1	2,3(2)	2,3(2)	2-5(3)	1,2(2)	1	1	1	1f-S,	4-10(4)
13	1-3(2)	-	5-10(5)	6-8(6)	2-4(3)	5-7(6)	4-6(5)	4,5(4)	3-5(4)	6-11(7)	3-5(5)	1g-S,	2-6(5)
14	2-4(2)	1	5-8(6)	-	-	-	1	1	1	1	1	1h-S,	4-7(4)
15	4,5(4)	-	-	-	-	-	-	-	-	-	-	-	-

^aRange (mode).

Table 3. Number of branches of pupal setae of *Culex (Culex) yojjoae*. Based on counts made on 10 specimens from the type series.

no.	CT	Abdominal segments										Paddle		
		I	II	III	IV	V	VI	VII	VIII	IX	P			
0	-	-	1	1	1	1	1	1	1	1	1	-	-	-
1	3	7-11(8) ^a	4-6(4)	4-8(7)	5-9(5)	4-6(4)	2-4(3)	2-4(3)	2-4(3)	2-4(3)	2-4(3)	1	1	1
2	2-4(3)	1	1	1	1	1	1	1	1	1	1	-	-	1
3	3	2,3(2)	2	2,3(2)	4-7(7)	2	1-3(2)	1,2(1)	1,2(1)	1,2(1)	1,2(1)	-	-	-
4	2-5(4)	4,5(5)	2-6(4)	4-7(6)	2-5(4)	2-4(4)	3-5(4)	2	2,3(2)	2	2	-	-	-
5	3-6(5)	2-6(4)	2-7(5)	6-8(6)	4,5(5)	2-4(2)	2-4(3)	2	2,3(2)	2	2,3(2)	-	-	-
6	2,3(2)	1	1	2,3(3)	2,3(3)	3,4(3)	2-4(3)	2-4(3)	3-5(5)	3-5(5)	3-5(5)	-	-	-
7	2,3(2)	2,3(2)	2	4-6(5)	2-4(3)	3-6(4)	1	1	1	1	1	-	-	-
8	3-5(4)	-	-	3-5(4)	2-5(2)	2-4(3)	2-4(2)	2-4(2)	2,3(2)	2,3(2)	2,3(2)	-	-	-
9	2-4(3)	1-3(1)	1	1	1	1	1	1	1	1	3-5(4)	6-9(9)	-	-
10	8-16(8)	-	-	2	1,2(2)	1,2(1)	1	1	1	1	1	-	-	-
11	2,3(3)	-	-	1	1	1,2(1)	1,2(2)	1,2(2)	1-3(2)	1-3(2)	1-3(2)	-	-	-
12	3,4(4)	-	-	-	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	-	-	-	1	1	1	1	1	1	1	1	1	-	-

^aRange (mode).

Table 4. Number of branches of fourth-instar larval setae of *Culex (Culex) yojoeae*. Based on counts made on 10 specimens from the type series.

Seta no.	Head				Thorax				Abdominal segments							
	C	P	M	T	I	II	III	IV	V	VI	VII	VIII	X			
0	-	5-9(5) ^a	-	-	-	I	I	I	I	I	I	I	-			
1	1	1	2-5(2)	3,4(3)	3-6(4)	3-5(3)	3-5(4)	3-5(4)	4-6(5)	2-5(3)	4-6(4)	5-8(6)	2,3(2)			
2	-	1	1-3(2)	1-4(2)	1	1	1	1	1	1	1	1	3,4(3)			
3	1,2(1)	2	1	2-4(3)	1-3(2)	1,2(1)	1,2(2)	1-3(2)	1	1,2(2)	1,2(1)	7-9(8)	1			
4	1	2	2	2-4(3)	4-8(7)	3-5(4)	1	1	2-5(4)	2,3(3)	1	1	6			
5	3-6(5)	1	1	1	2-6(5)	1,2(2)	2,3(2)	2	2,3(2)	2,3(2)	2-5(5)	4-6(5)	-			
6	1-4(3)	1	1	1	3	3,4(3)	2,3(3)	3	2,3(3)	2	5-10(8)	-	-			
7	6-9(6)	3	1	6-9(8)	2	4-6(5)	4-6(5)	4-7(5)	4-6(4)	1	1,2(1)	1a-S,	3-5(4)			
8	2-4(3)	2	5-7(6)	3-7(4)	-	1,2(1)	1-3(2)	1-3(2)	1,2(2)	2-5(2)	2-5(4)	1b-S,	3-5(4)			
9	4-6(5)	1	5-7(5)	5-8(6)	1-3(2)	1	1	1	1	1	1,2(2)	1c-S,	3,4(4)			
10	2-7(2)	1	1	1	1	1	1	1	1	1	1	1d-S,	2-5(4)			
11	3,4(4)	3-5(4)	2-5(2)	2-4(2)	2-4(2)	2-4(2)	1-3(2)	1-3(2)	1-3(2)	2,3(2)	2,3(2)	1e-S,	3-5(3)			
12	3-5(4)	1	1	1	1,2(2)	1-3(2)	1,2(1)	1-3(1)	1,2(1)	1	1	1f-S,	2-4(4)			
13	2,3(3)	-	3-6(6)	4-7(5)	1-4(2)	4-11(5)	3-6(5)	3-6(5)	4-6(5)	5-8(6)	3-8(6)	-	-			
14	2-4(3)	1	3-7(5)	-	-	-	1	1	1	1	1	1	-			
15	3-8(4)	-	-	-	-	-	-	-	-	-	-	-	-			

^aRange (mode).

Table 5. Number of branches of pupal setae of *Culex (Culex) aquarius*. Based on counts made on 10 specimens from 4 collections made in Costa Rica and Panama.

no.	CT	Abdominal segments											Paddle		
		I	II	III	IV	V	VI	VII	VIII	IX	P	P			
0	-	-	1	1	1	1	1	1	1	1	1	1	1	-	-
1	3-5(3) ^a	8-10(8)	4-9(8)	5-9(7)	4-8(7)	4-5(5)	3-5(5)	2-5(3)	-	1	1	1	1	1	1
2	2-5(3)	1,2(1)	1,2(1)	1	1	1,2(1)	1	1	1	1	1	1	1	1	1
3	2-4(3)	2,3(2)	1,2(2)	1,2(2)	3-8(5)	1-4(1)	2	1-3(2)	-	-	-	-	-	-	-
4	2-6(3)	4-6(5)	2-5(2)	2-6(4)	2,3(2)	2-4(3)	2-4(2)	1,2(2)	2	-	-	-	-	-	-
5	2-6(3)	2-4(4)	2-6(4)	4-7(6)	3,4(4)	2,3(2)	2	1,2(1)	2	-	-	-	-	-	-
6	2,3(3)	1	1	3,4(3)	3,4(3)	3,4(3)	3,4(3)	3-7(4)	3,4(3)	-	-	-	-	-	-
7	2	2,3(2)	2	3-5(4)	2-4(3)	3-6(4)	1	1	1	1	1	1	1	1	1
8	4,5(4)	-	-	2-4(2)	2-4(3)	2-4(3)	2-4(2)	2,3(2)	2-4(2)	2,3(2)	2,3(2)	2,3(2)	2,3(2)	2,3(2)	2,3(2)
9	2-4(3)	1,2(1)	1	1	1	1	1	3,4(3)	1	1	1	3,4(3)	6-9(6)	6-9(6)	6-9(6)
10	5-9(8)	-	-	1,2(2)	2	1	1	1	1	1	1	1	1	1	1
11	2,3(2)	-	-	1	1	1	1,2(1)	1-3(2)	1,2(1)	1,2(1)	1-3(2)	1-3(2)	1-3(2)	1-3(2)	1-3(2)
12	3-5(3)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	-	-	-	1	1	1	1	1	1	1	1	1	1	1	1

^aRange (mode).

Table 6. Number of branches of fourth-instar larval setae of *Culex (Culex) aquarius*. Based on counts made on 10 specimens from 4 collections made in Costa Rica and Panama.

Seta no.	Head			Thorax			Abdominal segments									
	C	P	M	T	I	II	III	IV	V	VI	VII	VIII	X			
0	-	5-11(7) ^a	-	-	-	1	1	1	1	1	1	1	-			
1	1	1	2,3(3)	2-4(4)	3-10(5)	2-7(2)	3-5(4)	4,5(4)	4-6(5)	3-5(4)	4-6(5)	4-6(5)	2,3(2)			
2	-	1	2,3(2)	1,2(2)	1,2(2)	1,2(1)	1	1	1	1	1	1	2-4(3)			
3	1	1	1	1-5(2)	1,2(2)	1,2(1)	1,2(1)	1,2(2)	1-3(1)	1,2(1)	1,2(1)	7-9(7)	1			
4	1	2	2	4-7(4)	5-8(6)	4-6(4)	1-4(1)	1-3(1)	1-5(4)	2,3(2)	1	1	6			
5	4-7(5)	1	1	1-4(1)	3-6(5)	2-4(3)	2-5(2)	2,3(2)	2-4(2)	2-4(2)	2-4(4)	4-6(5)	-			
6	2-4(3)	1	1	1	3	3	2	2	2	2	4-12(6)	-	-			
7	6-9(8)	2,3(2)	1	7-10(9)	2	3-6(4)	5-8(5)	2-10(5)	4-7(6)	1	1,2(2)	1a-S,	3,4(4)			
8	3,4(4)	2	5-7(7)	5-7(5)	-	1	1,2(2)	2-6(2)	2	2-4(2)	4-12(5)	1b-S	3-5(4)			
9	5-7(5)	1	5-8(6)	6-8(8)	2-4(2)	1,2(1)	1	1	1	1	2-6(3)	1c-S	2-5(4)			
10	2,3(2)	1	1	1	1,2(1)	1-3(1)	1	1	1	1	1	1d-S	3-6(4)			
11	2-4(3)	2-5(3)	2-4(3)	2,3(2)	2-6(5)	1,2(2)	1,2(2)	1-3(2)	1-3(2)	2-5(2)	2-4(3)	1e-S	2-4(4)			
12	2-4(3)	1	1	1	1,2(2)	2	1,2(2)	1,2(2)	1	1-3(1)	1,2(1)	1f-S	2-4(3)			
13	2,3(3)	-	5-8(6)	4-7(7)	2-7(3)	5-10(6)	4-6(5)	4-6(5)	3-6(5)	5-8(7)	4-7(5)	-	-			
14	2-4(2)	1	5-7(5)	-	-	-	1	1	1	1	1	1	-			
15	3-6(4)	-	-	-	-	-	-	-	-	-	-	-	-			

^aRange (mode).

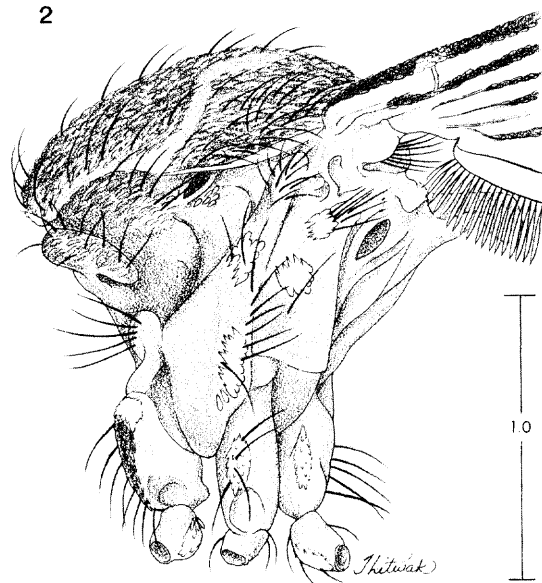
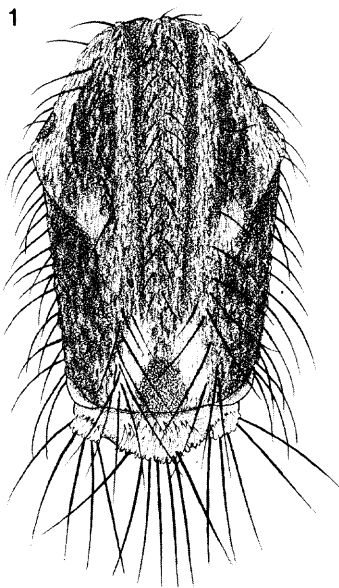
Table 7. Larval characters in three new species of *Culex* (*Culex*) and the most similar species, *Culex chidesteri*.

Larval character ^a	Mean \pm SD and range for species			
	<i>Cx. chidesteri</i> (n=9)	<i>Cx. pseudostigmatosoma</i> (n=52)	<i>Cx. yojoae</i> (n=25)	<i>Cx. aquarius</i> (n=12)
Ant. tuft ratio	0.69 \pm 0.02 0.68 - 0.74	0.72 \pm 0.02 0.67 - 0.78	0.73 \pm 0.10 0.28 - 0.81	0.75 \pm 0.02 0.71 - 0.80
Saddle index	5.61 \pm 0.64 5.18 - 7.21	3.65 \pm 0.19 3.25 - 4.17	4.33 \pm 0.27 3.88 - 5.01	4.46 \pm 0.36 3.97 - 5.02
Siphon index	7.57 \pm 0.88 6.47 - 9.27	5.77 \pm 0.52 4.80 - 6.87	5.10 \pm 0.33 4.53 - 5.72	5.96 \pm 0.58 4.89 - 7.10
Pecten ratio	0.21 \pm 0.05 0.16 - 0.30	0.23 \pm 0.02 0.18 - 0.27	0.23 \pm 0.02 0.19 - 0.27	0.22 \pm 0.02 0.19 - 0.26
SAd ratio	0.19 \pm 0.02 0.16 - 0.21	0.27 \pm 0.02 0.22 - 0.32	0.35 \pm 0.03 0.28 - 0.42	0.27 \pm 0.02 0.23 - 0.29
Seta 1a-S ratio	0.14 \pm 0.02 0.10 - 0.16	0.26 \pm 0.03 0.21 - 0.31	0.29 \pm 0.02 0.25 - 0.34	0.26 \pm 0.03 0.22 - 0.31
No. pecten spines ^b	10 9 - 11	10 7 - 12	8 7 - 10	11 11 - 14
No. siphon tufts ^b	9 9 - 11	7 6 - 8	6 5 - 6	6 6 - 6

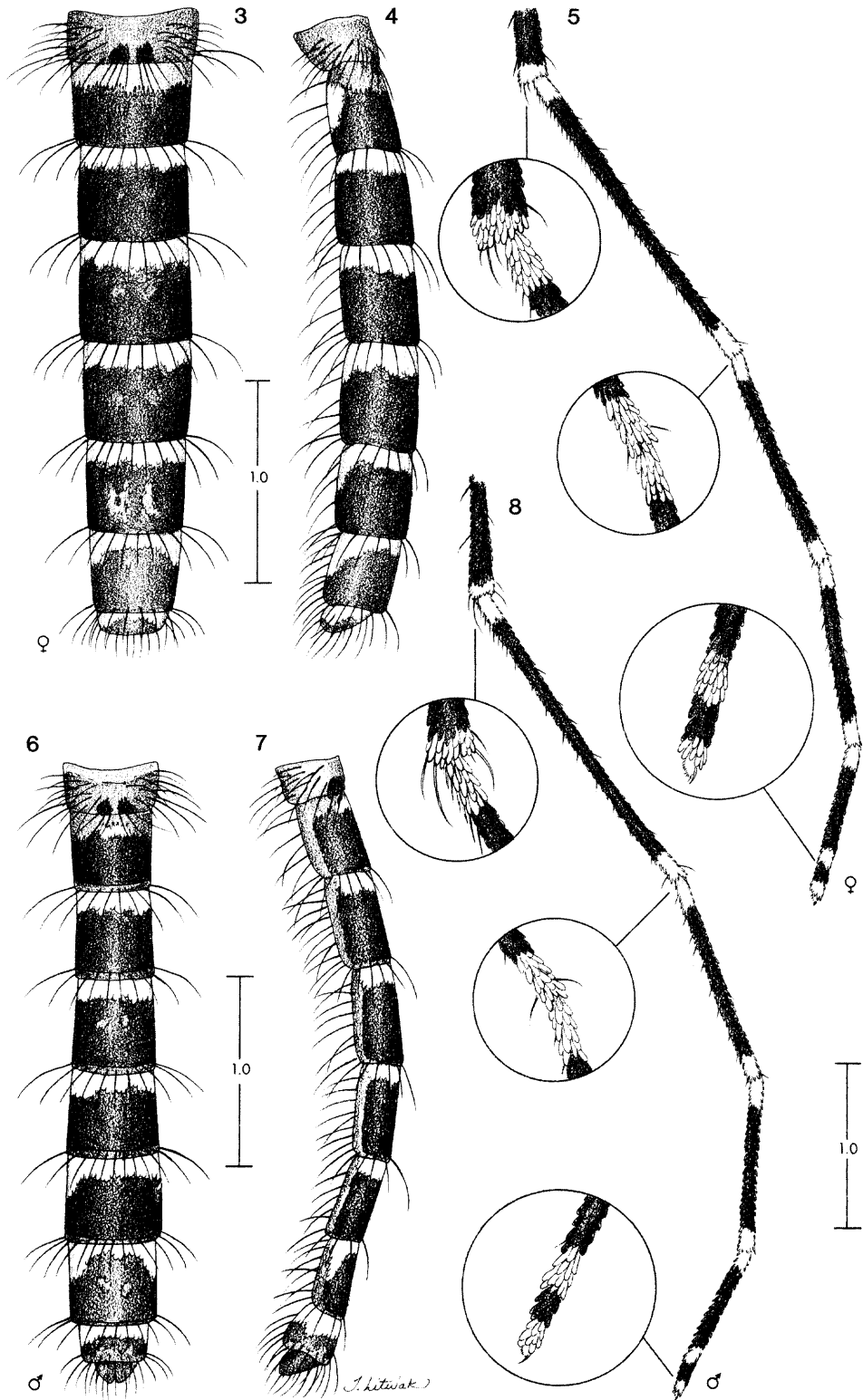
^aAnt. tuft ratio = distance base of antenna to seta 1-A divided by length of antenna; saddle index = dorsal siphon length divided by dorsal saddle length; siphon index = dorsal saddle length divided by width of siphon at base; pecten ratio = distance from base of siphon to last pecten spine divided by dorsal siphon length; SAd ratio = length of spiracular apodeme divided by dorsal siphon length; seta 1a-S ratio = distance from base of siphon to first siphon tuft (seta 1a-S) divided by dorsal siphon length.

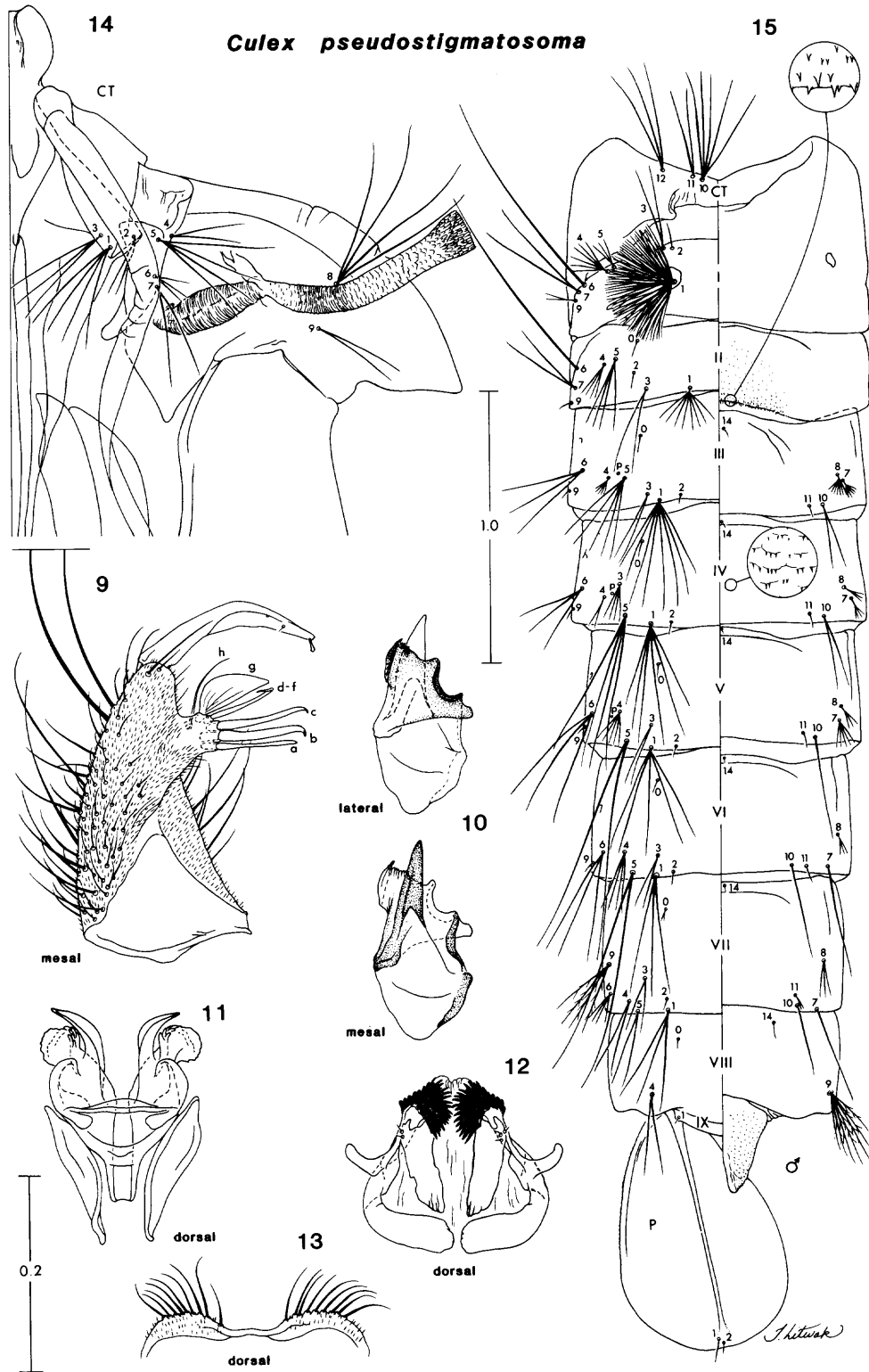
^bMode instead of mean \pm SD.

Culex pseudostigmatosoma

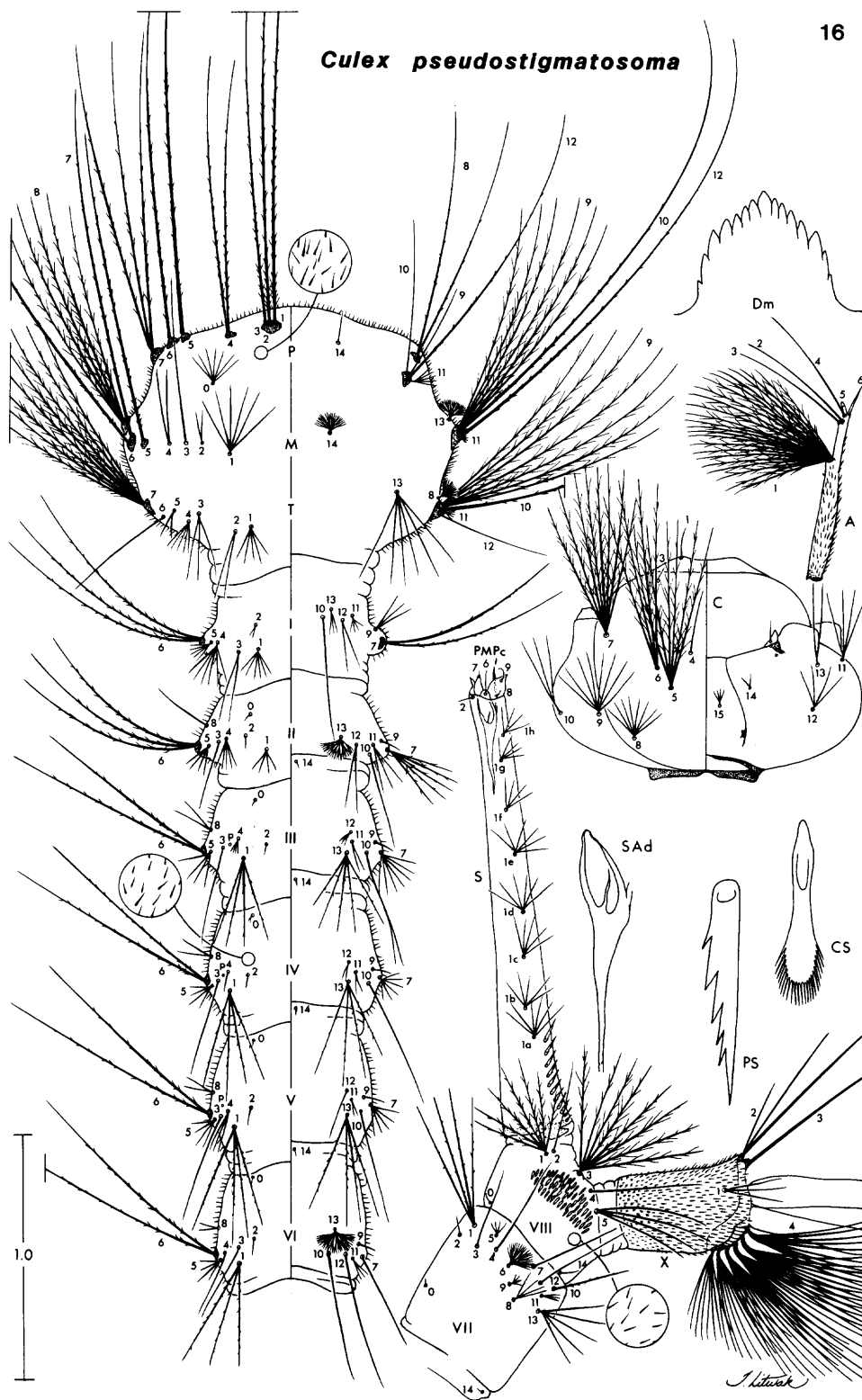


Culex pseudostigmatosoma



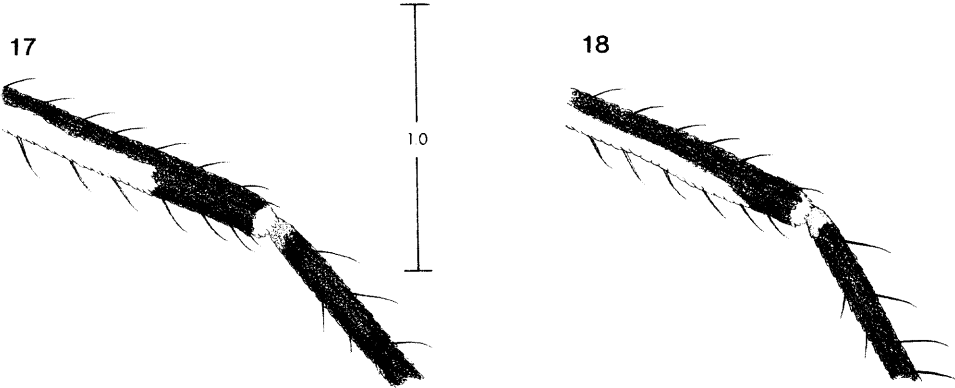


Culex pseudostigmatosoma

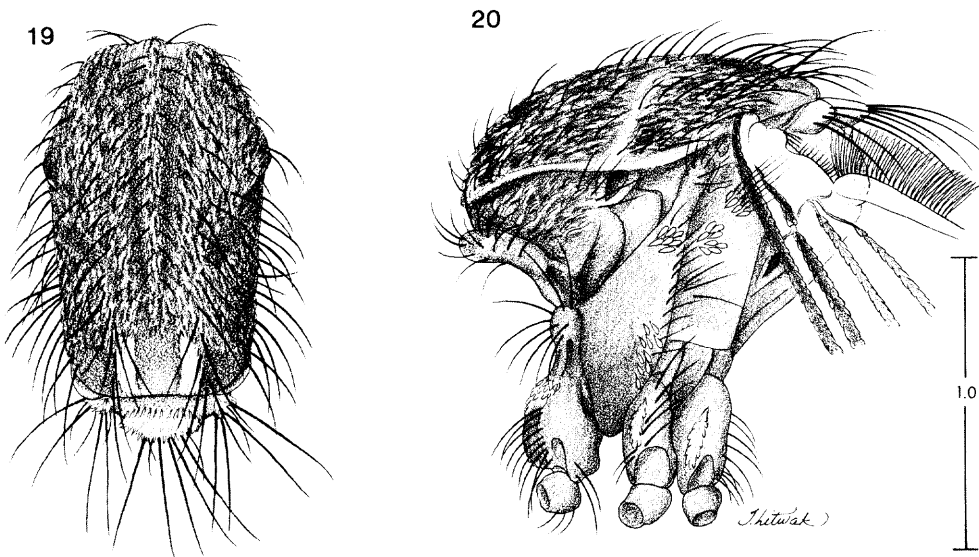


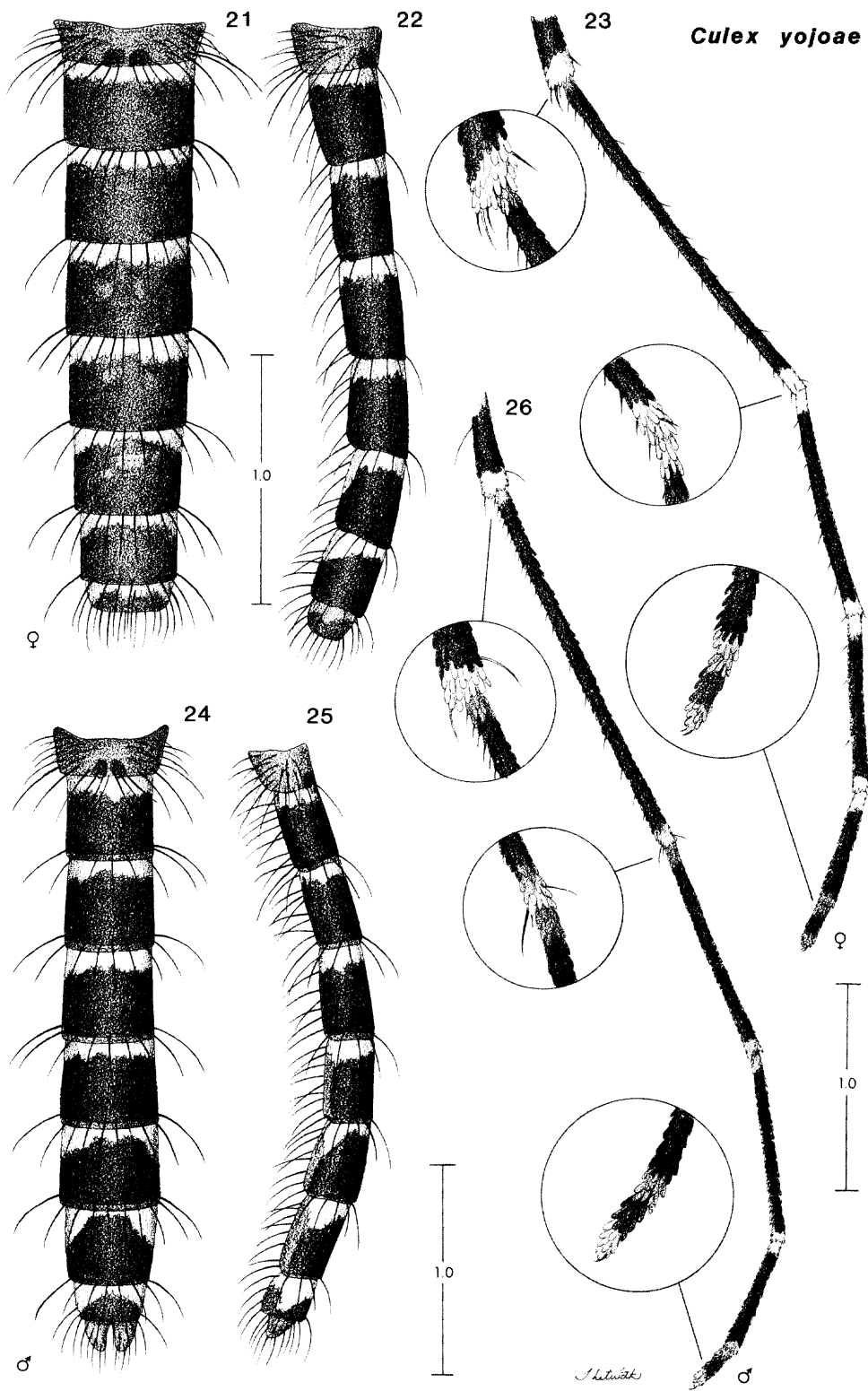
Culex stigmatosoma

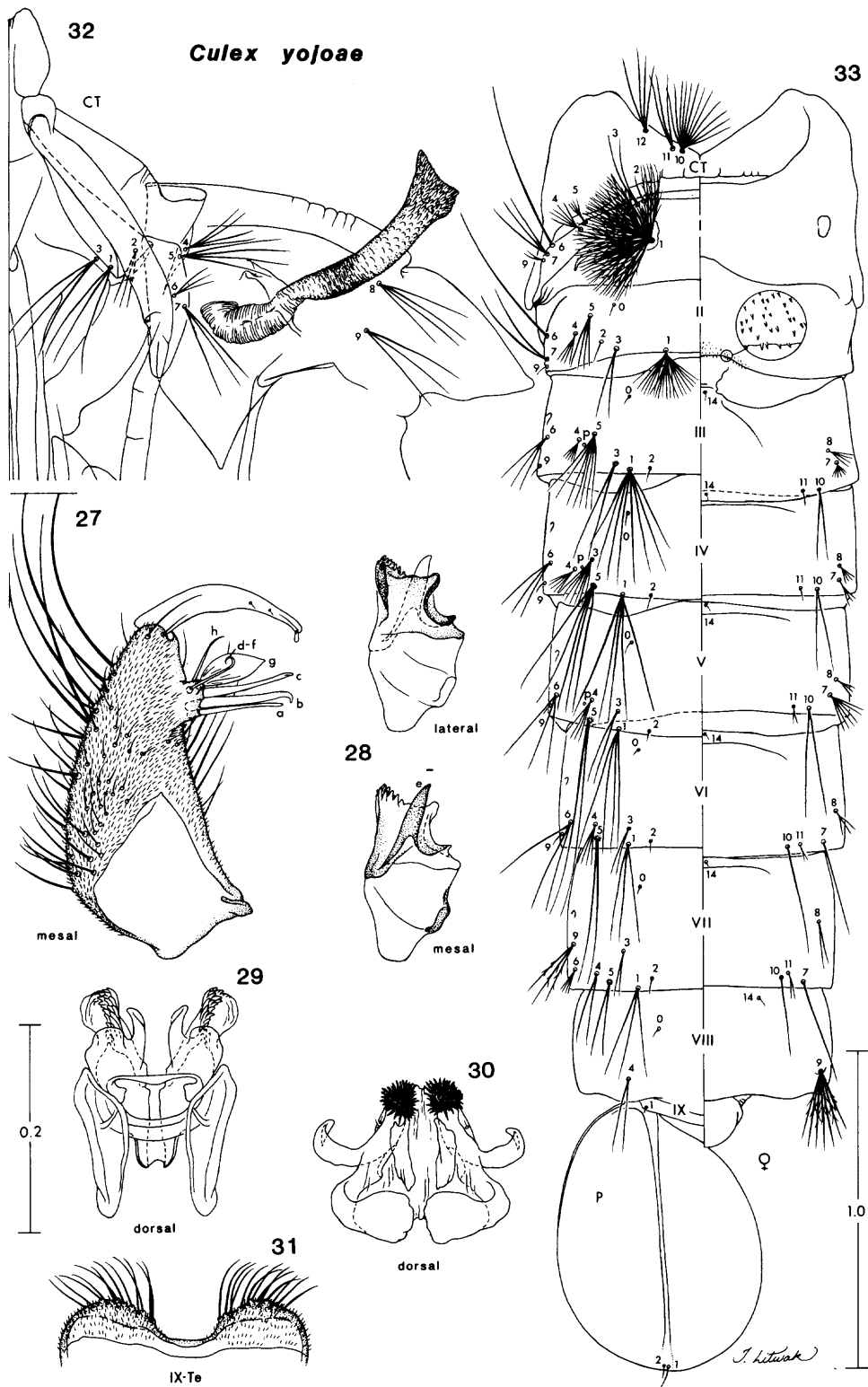
Culex pseudostigmatosoma



Culex yojoae

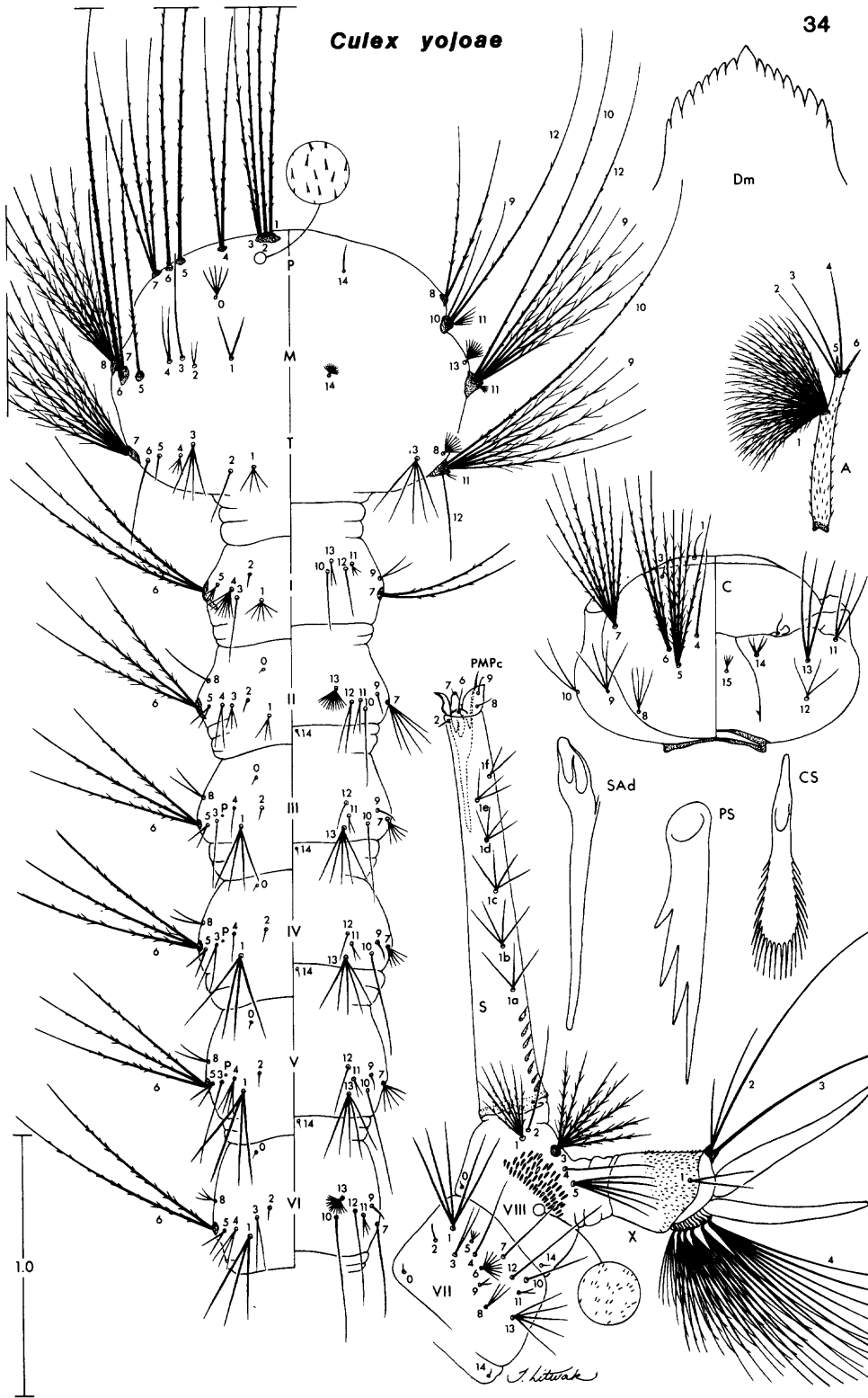






Culex yojoae

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Culex aquarius

