



Morphological redescription of *Culex (Microculex) davisi* and *Cx. (Mcx.) imitator* (Diptera: Culicidae) including structures and stages not previously described

DEBORA NATALIA BANGHER^{1,2,3} & MARINA STEIN^{1,2}

¹Instituto de Medicina Regional, Universidad Nacional del Nordeste, Av. Las Heras 727 3500, Resistencia, Argentina.

²Consejo Nacional de Investigaciones Científicas y Técnicas, CCT, Nordeste

³Corresponding author. E-mail: deborabangher@gmail.com

Abstract

The adults, male genitalia and fourth-instar larva of *Culex (Microculex) imitator* Theobald and *Culex (Microculex) davisi* Kumm, and the pupa of the latter species, are re-described. The female genitalia of both species and the pupa of *Culex (Microculex) imitator* are described for the first time. Information on distribution, bionomics and taxonomy is also included.

Key words: Mosquito, *Microculex*, Taxonomy, Argentina

Introduction

Culex (Microculex) imitator was described by Theobald (1903) from males. Later, other authors described the female and fourth-instar larva (Kumm, 1933; Senevet & Abonnenc, 1939; Lane & Whitman, 1951; Cova Garcia *et al.*, 1966), with the pupa and female genitalia remaining unknown.

Culex (Mcx.) davisi was first described in 1933 by Kumm from males, females and fourth-instar larvae. Lane (1953) redescriptioned some aspects of the male and female and provided a poor description of the pupa. Finally, Cotrim & Galati (1977) redescriptioned the male and larva but the descriptions are poor. No author has described the female genitalia. Identification based on morphological characteristics used in available keys can be confusing so the purpose of this paper is to provide a complete description of *Cx. imitator* and *Cx. davisi* to aid the unequivocal recognition of these species.

Material and methods

Larvae and pupae were collected from bromeliads (*Aechmea distichanta* Lemaire) in Chaco Province (northeastern Argentina) and Jujuy Province (northwestern Argentina). Several larvae were individually reared to obtain adults. The adults were pin-mounted and the immature stages and male and female genitalia were dissected and mounted in Canada balsam on microscope slides. Specimens were deposited in the collection of the Entomology Laboratory of Instituto de Medicina Regional, National University of Northeast, Argentina. The identification of specimens was done using the dichotomous keys and original descriptions of Lane (1953), Forattini (1962, 1965, 2002), Bram (1967), Darsie (1985) and Consoli & Lourenço de Oliveira (1994). The morphological terminology follows Harbach (2013) and abbreviations for the genus and subgenus are those for Reinert (2001).

Life stages are indicated as follows: M (male), MG (male genitalia), FMG (female genitalia); F (female), Pe (pupal exuviae) and Le (larval exuviae). An asterisk following an abbreviation indicates that the life stage was at least partially illustrated. Measurements are given in millimetres, as a range followed by the mean in parentheses; counts and ratios are formatted similarly.

Culex (Microculex) imitator Theobald

Culex imitator Theobald, 1903: 175 (M) Type locality: São Paulo, São Paulo State, Brazil; Kumm, 1933: 564 (M*, F*, L*); Senevet & Abonnenc, 1939: 115 (L*); Rozeboom & Komp, 1950: 155 (M*).

Culex (Microculex) argenteoumbrosus Theobald, 1907: 461 (M, F; *Microculex*). Type locality: Rio de Janeiro, Guanabara, Brazil (BM).

Culex (Microculex) daumasturus Dyar & Knab 1906: 220 (L*). Type locality: La Brea, Trinidad (USNM).

Culex (Microculex) vector Dyar & Knab 1906: 220 (L*). Type locality: Trinidad (USNM).

Female. Small mosquito, general color brownish. **Head:** Occiput with decumbent silvery-white scales mixed with dark-brownish scales, erect scales brown, fine and long. Proboscis with dark brown scales, as long as forefemur, length 1.5–1.7 mm (mean 1.5 mm). Maxillary palpus 0.20–0.40 mm (mean 0.20 mm) covered with black scales, second palpomere with some central white scales. Antenna light brown, thin and slightly shorter than proboscis. **Thorax:** Integument brown, scutum with curved short dark brown scales, mixed with short bronze scales. Scutum with silver scales forming a small spot on mid-anterior portion and followed by non-continuous fringes laterally that extend to prescutellar area. Anterior dorsocentral and acrostichal areas with 2 bare bands flanked by brown scales, followed by 2 lateral white scale-spots surrounded by brown-dark scales. Prescutellar area with dark center portion surrounded by silvery scales (Fig. 1A). Scutellar scales whitish. Median lobe of scutellum with 6 long dark brown setae; lateral lobes with 2 or 3 (3) setae. Pleura with integument pale brown, with central brown spot and silver upper mesokatepisternal scales. Remainder of pleural setae golden: 3 or 4 (4) proepisternal, 2 or 3 (3) prealar, 7–10 (8) upper and 1 lower mesepimeral, 4 or 5 (4) upper and 4–6 (6) lower mesokatepisternal setae. Pre- and postspiracular setae absent. Mesopostnotum without scales, integument bright dark brown. **Wing:** Length 2.1–2.5 mm (mean 2.2 mm) narrow light brown scales on all veins, a characteristic shared by members of the *Culex* subgenus *Culex*. **Halter:** Capitellum with white scales and dark brown scales on apical portion. **Legs:** Coxae with long, thick and brown setae. Anterior surfaces of femora with white scales, brownish posteriorly. Fore- and midtibia with basal white spot; hindtibia covered completely with dark scales. Fore- and midtarsomeres (I–IV) with some basal white scales; tarsomere V, of the same legs, with dark scales. Hindtarsomeres with a wide basal ring of white scales, sometimes on tarsomere V the white ring covers half of the tarsomere. Ungues dark and simple. **Abdomen:** Terga with dark scales and small semi-circular basal white spots. Sterna with basal white bands in all segments. Tergum VIII covered with white scales. Abdominal length 1.7–2.0 mm (mean 1.8 mm). Abdominal setae well developed and abundant. **Genitalia:** Cercus thin and long, postgenital lobe long and wide, slightly shorter than cerci, with 2 small central setae on basal part, apically with 3 setae in lines on each side, the apical more developed. Insula normal, upper and lower vaginal lip weakly sclerotized (Fig. 2A).

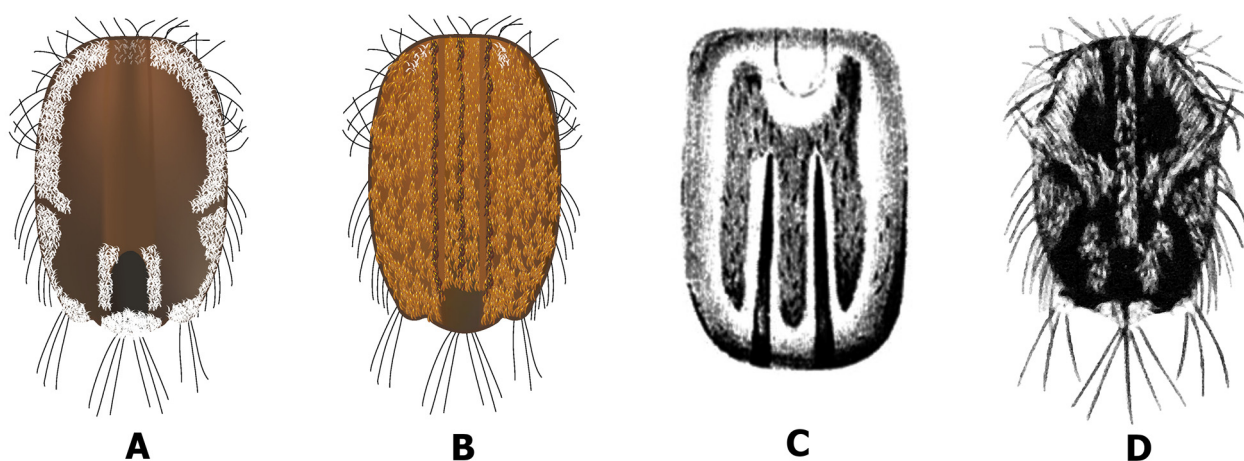


FIGURE 1. Dorsal views of scutum of: A, *Culex (Mx.) imitator* of the present study. B, *Culex (Mx.) davisi* Kumm. C, *Culex (Mx.) imitator* Theobald (1903). D, *Culex (Mx.) imitator* of Kumm (1933).

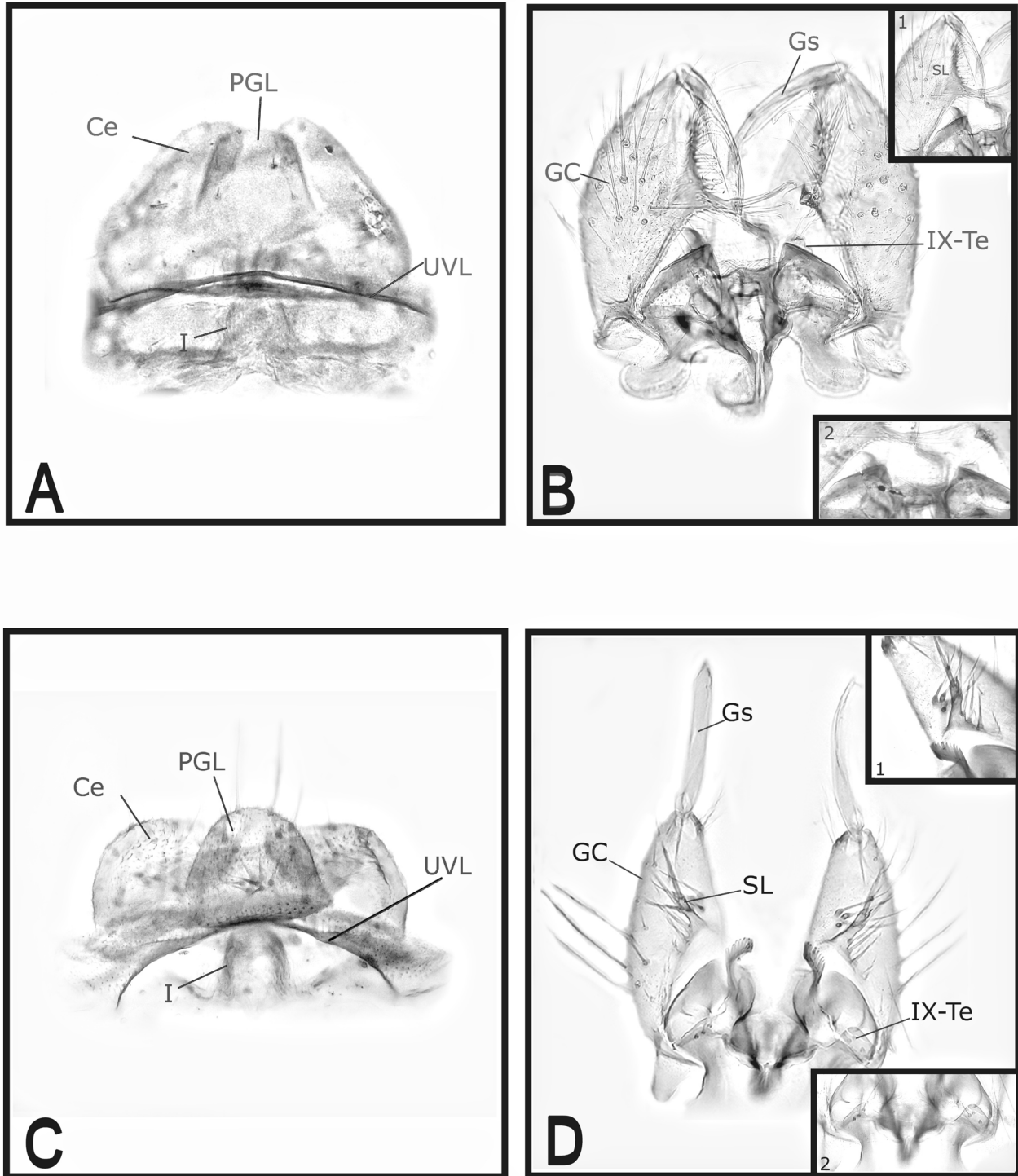


FIGURE 2. Genitalia. A, female *Culex (Mcx.) imitator*. B, male *Culex (Mcx.) imitator*, 1. detail of the subapical lobe; 2. detail of the tergum IX. C, female *Culex (Mcx.) davisi*. D: male *Culex (Mcx.) davisi*, 1. detail of the subapical lobe; 2. detail of the tergum IX. Ce = cercus; GC = gonocoxite; Gs = gonostylus; I = insula; PGL = postgenital lobe; SL = subapical lobe; UVL = upper vaginal lip; IX-Te = tergum IX.

Male. Smaller than female. *Head:* Integument brown. Vertex with decumbent curved and thin silver scales, erect scales bright yellow. Maxillary palpus longer than proboscis. Palpomere 1 with dark scales and palpomeres 2–5 with black scales and white basal rings. Palpomeres 3–5 with long black setae. Proboscis slightly shorter than maxillary palpus, with dark brown scales. Antenna strongly verticillate, light brown-scaled, slightly shorter than proboscis. Scutum, abdomen, legs and wing like those of female. *Genitalia* (Fig. 2B): Gonocoxite conical, dorsal

surface with numerous setae of different sizes in sclerotized tubercles. Subapical lobe divided. Inner division with 19 or 20 (19) long apical setae. Outer division with 2 long strong setae at apex and 6 short thin setae at base. Gonostylus simple, half as long as gonocoxite, with rounded base and widened in proximal half, with smooth surface, with 2 small setae near apex. Gonostylar claw small, bifurcate. *Aedeagus*: Lateral plate large with 1 strong retrorse tooth characteristic of the subgenus. *Tergum IX*: Rounded, with 2 lobes separated by central concavity, with 2 or 3 setae on each in rows. Paraproct crown with 9 digitiform-shaped spicules.

Pupa (Fig. 3). Chaetotaxy as figured; range and modal number of branches in Table 1. *Cephalothorax*: Integument hyaline with conspicuous spicules, width 1.98–2.39 mm (mean 2.18 mm) length 2.02–2.44 mm (mean 2.23 mm). Trumpet conical, light brown, darker at base, index 5–8.41 (mean 6.7). Tracheal area hyaline, length 0.07–0.12 mm (mean 0.10 mm). Meatus length 0.44–0.52 mm (mean 0.49 mm). *Abdomen*: Length 2.37–2.54 mm (mean 2.45 mm), width 0.68–0.73 mm (mean 0.70 mm), integument hyaline. Seta 1-I, with more than 80 branches. Paddle ovoid and hyaline, buttress darker. Length 0.57–0.63 mm (mean 0.60 mm), width 0.42–0.48 mm (mean 0.45 mm), index 1.23–1.35 (mean 1.29). Seta 1-Pa with 4 branches, 2-Pa usually single (1,2).

TABLE 1. Number of pupal setae of *Culex (Microculex) imitator* Theobald (5 specimens, modes in parentheses).

Seta no.	CT	Abdominal segments								Paddle
		I	II	III	IV	V	VI	VII	VIII	
0	–	–	1	1	1	1	1	1	1	–
1	2	80+	14–19	2–5 (2)	2,3 (3)	2,3 (2)	1–3 (2)	2,3 (2)	–	4
2	1	1,2 (2)	1	1,2 (2)	1	1,2 (1)	1–3 (1)	1	–	1,2 (1)
3	2,3 (3)	1	1	1–3	2,3 (2)	1,2 (1)	1–3 (1)	1,2 (1)	–	–
4	2	4	1–4 (3)	1–3 (2)	2–6 (2)	3–5 (3)	2	1–3	1,2 (1)	–
5	3	3,4 (3)	1–4 (3)	1,2 (2)	2,3 (2)	2,3 (2)	1,2 (2)	2,3 (2)	–	–
6	2	1	1–3 (1)	1	1	1,2 (1)	1–3 (1)	1–4 (3)	–	–
7	2,3 (2)	1,2 (1)	1	1–4 (1)	2	1–3	1	1	–	–
8	1	–	–	4,5 (4)	2	2,3 (2)	2,3 (2)	1–5	–	–
9	2	1	2	1	1	1	1,2 (1)	2–4 (3)	4,5 (4)	–
10	1	2	–	1,2 (1)	1,2 (1)	1	1	1,2	–	–
11	2	–	–	1	1	1	1	1,2	–	–
12	1	–	–	–	–	–	–	–	–	–
13	–	–	–	–	–	–	–	–	–	–
14	–	–	–	1	1	1	1	1	1	–

CT = cephalothorax.

Larva (fourth-instar) (Fig. 4). Chaetotaxy as figured; range and modal number of branches in Table 2. *Head*: Wider than long, width 0.89–1.16 mm (mean 1.02 mm), length 0.65–0.81 mm (mean 0.73 mm), integument light brown. Collar dark brown. Dorsomentum with 8 dark teeth on each side of median tooth. Setae 0,1,3,4-C single, smooth; 2-C absent; 5-C with 4–6 (5) branches, 6-C with 1 or 2 (1) branches, 7-C with 6–8 (6) branches, 8-C with 2–4 (2) branches, 9-C with 3–6 (6) branches, 10-C with 1 or 2 (2) branches, 11-C with 5–7 (6) branches, 12-C with 4–6 (4) branches, 13-C with 5 or 6 (5) branches, 14-C single; 15-C with 2 or 3 (3) branches, 6-Mx single. Setae 5–7-C aciculate, others simple. *Antenna*: Length 0.43–0.50 mm (mean 0.45 mm), covered with small spicules. Seta 1-A with 4–10 (9) aciculate branches, inserted about 0.67 from base. Setae 2–6-A single. *Thorax*: Integument hyaline, smooth. Setae 1–3-P and 9–12-M inserted on common tubercles. Prothoracic formula: 1- (1-2) - (4-6) - (1-2) -1-1-1. *Abdomen*: Integument hyaline, smooth. Setae 6-I,II double, 7-I with 2 or 3 (2) branches, 7-II with 5–7 (5) branches. *Segment VIII*: Comb with more than 60 small scales of same size, arranged in 4 rows forming a triangular patch, each with a central apical spicule 4 times longer than lateral spicules. *Siphon*: Integument light brown, smooth, length 1.64–2.21 mm (mean 1.93 mm), width 0.12–0.20 mm (mean 0.16 mm). Index 11.83. Pecten on basal third of siphon, with 8–10 spines of different sizes. Seta 1-S in 5 pairs, all same size, equal to or shorter than

width of siphon at point of insertion, with 3–5 (3) branches. Setae 2,6–9-S single. *Segment X*: Length 0.32–0.24 mm (mean 0.28 mm), width 0.15–0.23 mm (mean 0.19 mm). Saddle complete, light brown (similar to siphon), covered with conspicuous spicules. Seta 1-X with 4–9 (5) branches, 2-X single, smooth, 3-X with 1 or 2 (1) branches, 4-X with 7 or 8 (7) branches. Anal papillae 2 times length of segment X, integument hyaline.

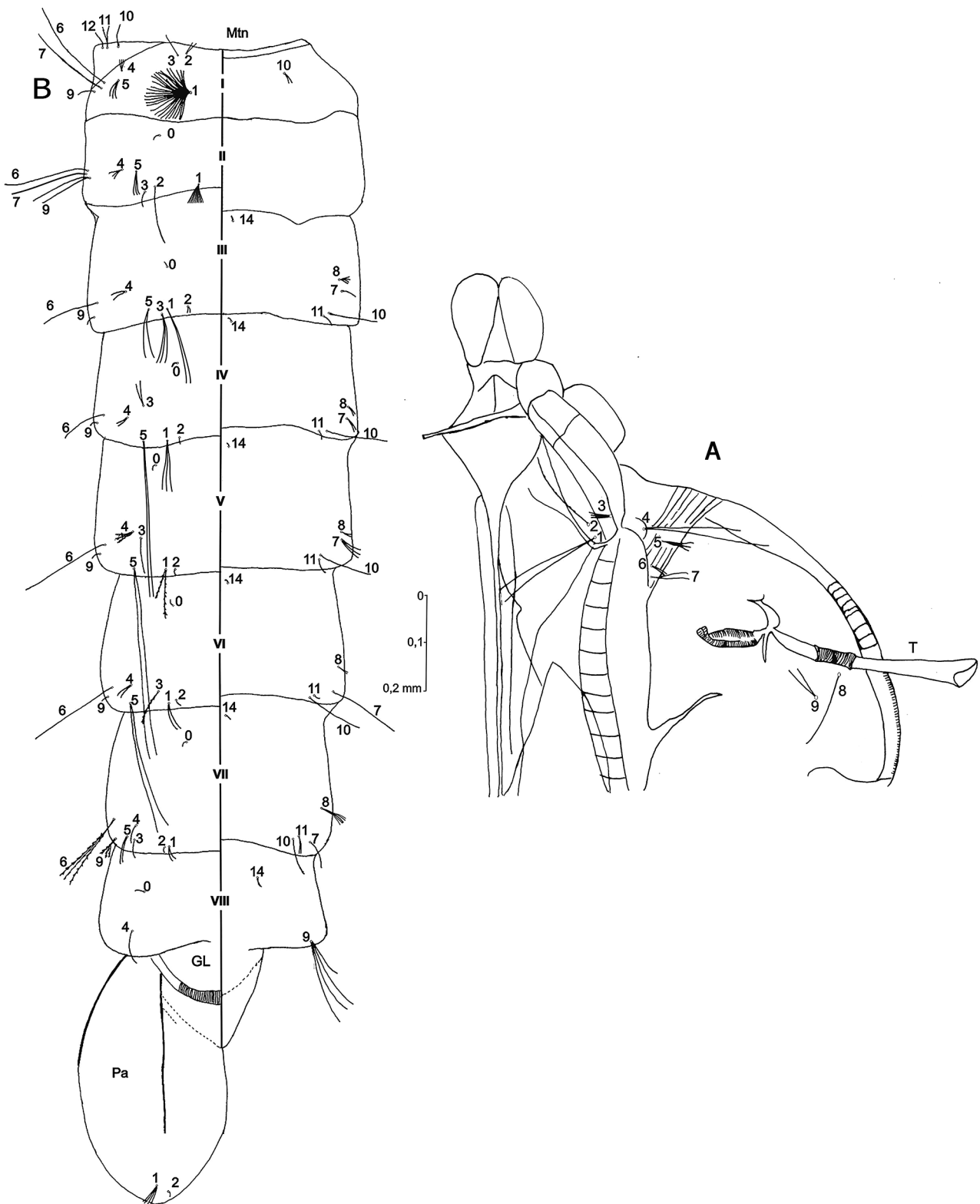


FIGURE 3. Pupa of *Culex (Mcx.) imitator*. A, cephalothorax. B, metanotum and abdomen. GL = genital lobe; Mtn – metanotum; Pa = paddle; T = trumpet; I–VIII = abdominal segments.

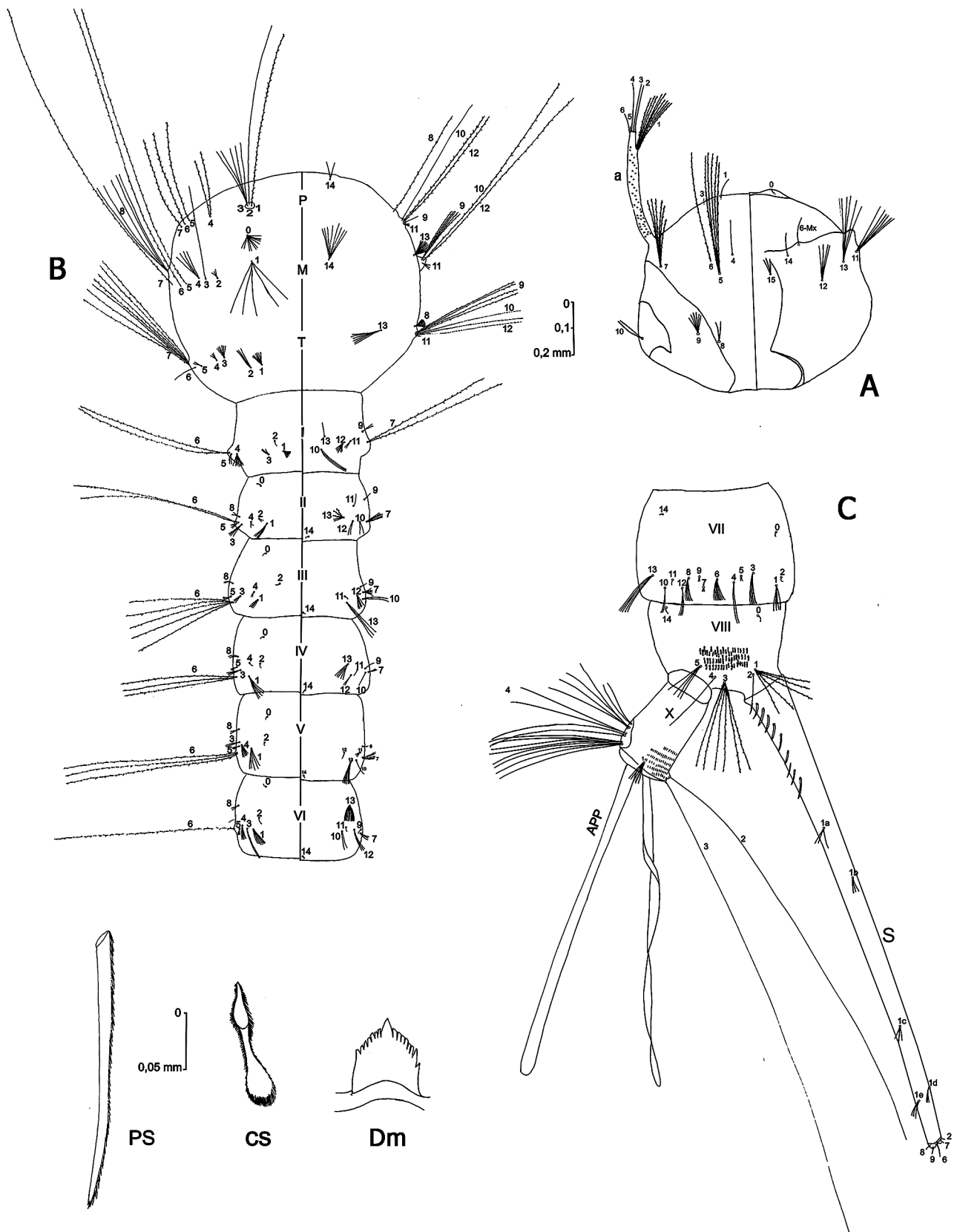


FIGURE 4. Larva of *Culex (Mx.) imitator*. A, head. B, thorax and abdominal segments I–VI. C, abdominal segments VII–X. a = antenna; APP = anal papilla; CS = comb scale; Dm = dorsomentum; M = mesothorax; P = prothorax; PS = pecten spine; S = siphon; T = metathorax; I–X = abdominal segments.

TABLE 2. Number of branches for fourth-instar larval setae of *Culex (Microculex) imitator* Theobald (10 specimens, modes in parentheses).

Seta no.	Head		Abdominal segments													Siphon
	Thorax		P	M	T	I	II	III	IV	V	VI	VII	VIII	X		
0	1	7-10 (10)	-	-	-	-	1	1	1	1	1	1	1	1	-	-
1	1	5,6 (5)	5-7 (7)	8,9 (9)	4,5 (5)	3-6 (4)	5,6 (5)	4-6 (5)	5-7 (7)	2-4 (4)	3-5 (5)	4-9 (5)	3-5 (3)			
2	-	1,2 (1)	3-5 (3)	1,2 (1)	1,2 (2)	1	1	1	1	1,2 (1)	1-6 (1)	1	1			
3	1	4-6 (5)	3-6 (6)	2-4 (3)	2-6 (4)	2-4 (3)	3,4 (3)	2,3 (2)	1,2 (2)	7,8 (7)	6-11 (6)	1,2 (1)	?			
4	1	1,2 (2)	4,5 (4)	5-8 (6)	2-5 (2)	2,3 (2)	1	5,6 (6)	5,6 (5)	2-5 (2)	1-3 (1)	7,8 (7)	?			
5	4-6 (5)	1	1,2 (2)	1-4 (2)	3-5 (3)	5	4,5 (5)	4,5	4-6 (6)	1-3 (2)	3-6 (4)	-	?			
6	1,2 (1)	1	1,2 (1)	2	2	4,5 (5)	3-5 (3)	2,3	1	11-13 (13)	-	-	1			
7	6-8 (6)	1	6-8 (7)	2,3 (2)	5-7 (5)	4-6 (5)	4-6 (4)	6,7 (6)	3,4	2,3 (3)	-	-	1			
8	2-4 (2)	1	10-14 (10)	2	2	2	2	2	2-4 (2)	6,7 (7)	-	-	1			
9	3-6 (6)	1-3 (1)	3-5 (5)	1-3 (2)	1,2 (1)	1	1	1	1	2,3 (2)	-	-	1			
10	1,2 (2)	1	1	2,3 (3)	2	1,2	1,2 (1)	1,2 (1)	1,2 (2)	2,3 (3)	-	-	?			
11	5-7 (6)	3,4 (3)	3,4 (3)	2-4 (2)	1	1,2 (1)	1,2 (1)	3	1-3	1	-	-	?			
12	4-6 (4)	1-3 (2)	1	2,3 (2)	4-7 (7)	2-4 (2)	3-5 (5)	1,2 (2)	1	4,5 (4)	-	-	-			
13	5,6 (5)	-	10-14 (12)	5-7 (6)	1,2 (1)	4,5 (5)	1-3 (3)	5,6 (5)	5-7 (6)	11-14 (14)	4,5 (5)	-	-			
14	1	2-5 (2)	6-8 (8)	-	-	1	1	1	1	1	1	-	-			
15	2,3 (3)	-	-	-	-	-	-	-	-	-	-	-	-			
6-Mx	1	-	-	-	-	-	-	-	-	-	-	-	-			
		Seta 1-A		Comb scale												
		4-10 (9)		60+												

P = prothorax ; M = mesothorax; T = metathorax.

**Pecten
spines
8-10 (10)**

Specimens examined. 6M, 6F, 6L, 5Le, 5Pe, 4 MG, 2FG as follows: Argentina, Chaco Province, km 1031 on National Route No. 11 (27° 10' S 58° 58' W), 1M, 1F, 15.V.02; 1F, 1FG, 10.IV.03; 1M, 1MG, 11.VII.01; 1F, 1FG, 2.VIII.01, Stein coll. and det.; Monte Alto (27° 26' S 58° 55' W), 1M, 1MG, 1F, 7.VI.01, Stein coll. and det.; Pampa del Indio (26° 01' 60" S 59° 55' 00" W), 1F, 1L, 25.VIII.11; 1F, 2Le, 2Pe, 16.III.11; 2Le, 2Pe, 19.III.10; 1Le, 1Pe 14.VII.11; 3L, 20.X.10; 1M 10.XI.10; 1L, 27.I.11, Bangher coll. and det.; Jujuy Province, San Salvador de Jujuy (24° 11' 08" S 65° 17' 58" W), 2M, 2MG, 1L, III.2011, Bromeliad, Linares coll., Stein det.

Culex (Microculex) davisi Kumm

Culex (Microculex) davisi Kumm, 1933: 565 (M*, F*, L*). Type locality: São Salvador, Bahia, Brazil; Lane 1953: 528 (M*, F, L); Cotrim & Galati, 1977: 185 (M*, L*); Townsend, 1990: 65 (type info); Rozeboom & Komp, 1950: 1; Stone *et al.*, 1959: 279; Forattini *et al.*, 1970: 39.

Female. Size and characteristics of scales of vertex like those of *Cx. imitator*. General color light brownish. Proboscis with light brown scales, darker at apex, as long as forefemur, length 1.5–2.1 mm (mean 2 mm). Maxillary palpus 0.2–0.5 mm (mean 0.2 mm); palpomeres 3 and 4 with white basal spot, 5 all black. Maxillary palpus twice length of clypeus. *Thorax:* Scutum covered with pale brown scales with some white scales in central anterior portion and sides. Dorsocentral lines bare extending from the anterior and ending a little before the prescutellar area. These lines bare, delimited by dark brown scales mixed with light brown and golden scales. Prescutellar area dark brown, completely bare. Scutellum with 6 setae on midlobe and 3 on each lateral lobe, all setae long, thick, dark brown and shiny (Fig. 1B). Pleural integument pale brown, with central brown spot and silver mesokatepisternal scales. Pleural setae: 5 proepisternal, 3 prealar, 8 upper mesanepimeral, 1 lower mesanepimeral, 4 upper mesokatepisternal, 7 lower mesokatepisternal, 4 postpronotal. Pre- and postspiracular setae absent. Mesopostnotal integument bright dark brown, without scales. *Wing:* Length 2–3 mm (mean 2.5 mm), covered with narrow light brown scales. *Halter:* Capitellum with white scales and dark brown scales on apical portion. Scabellum and pedicel pale. *Legs:* Coxae with thin, clear setae. Femora and tibiae with dark scales on anterior surface and pale scales on posterior surface, and some short setae. Tibiae with narrow apical white rings and tarsomeres with narrow basal white rings. Ungues simple. *Abdomen:* Length: 2.0–2.5 mm (mean 2.0 mm). Terga and sterna covered with dark scales and broad basolateral white bands. Tergum VIII with dark scales. Abdominal setae developed and abundant. *Genitalia:* Postgenital lobe short, rounded with 3 setae in line on each side, the most apical longer and thick. Cercus curved and elongate. Upper vaginal lip weakly sclerotized. Insula normal (Fig. 2C).

Male. Like female except for following differences. *Head:* Maxillary palpus with white band at base of palpomeres 3–5; terminal palpomeres with long black setae. Proboscis slightly shorter than palpus, covered with light brown scales and with a central pale ring. Antenna light brown, verticillate, slightly shorter than proboscis. Scutum, abdomen, legs, wings, color and features as described for female. *Genitalia:* (Fig. 2D): Gonocoxite 2.5 times longer than width. Subapical lobe with 2 divisions. Inner division with 2 strong terminal setae, 1 short thin seta on stem and 3 short thick setae at base of lobe. Outer division with 2 long terminal setae, 2 short terminal setae and 1 small thin basal seta. Gonostylus less than half length of gonocoxite, smooth, with 2 small setae at apex. Gonostylar claw bifurcate. *Aedeagus:* Lateral plate large, with 1 strong retrorse tooth characteristic of the subgenus. *Tergum IX:* With 2 well-separated lobes, each with 7 long setae. Paraproct crown with 10 digitiform spicules.

Pupa (Fig.5). Chaetotaxy as figured; range and modal number of branches in Table 3. *Cephalothorax:* Integument with conspicuous spicules. Width 0.99–1.19 mm (mean 1.07 mm), length 1.03–1.23 mm (mean 1.10 mm). Trumpet conical, light brown, darker near base. Index 3.33 – 4.66 (4). Tracheal area hyaline, length 0.09–0.15 mm (mean 0.09 mm). Meatus length 0.38–0.47 mm (mean 0.42 mm). Metanotum small, seta 10-CT with 2 or 3 (3) branches, 11-CT single, 12-CT with 1–3 (3) branches. *Abdomen:* Length 2.71–3.30 mm (mean 3.00 mm), width 0.84–0.94 mm (mean 0.89 mm). Integument hyaline. First 5 terga with a darker coloration centrally. Paddle ovoid, hyaline, buttress darker, 2.5 times longer than segment VIII, length 0.71–0.76 mm (mean 0.73 mm), width 0.45–0.58 mm (mean 0.51 mm). Index 1.08–1.62 (1.35). Seta 1-Pa with 2 or 3 (2) branches, seta 2-Pa absent.

Larva (fourth-instar) (Fig. 6). Chaetotaxy as figured; range and modal number of branches in Table 4. *Head:* Wider than long, covered with spicules, width 0.86–2.25 mm (mean 1.17 mm), length 0.75–0.98 mm (mean 0.86

mm). Integument light brown. Collar dark brown. Dorsomentum triangular, dark brown, with 9 teeth on each side of middle tooth. Setae 1,3,8,10-C single; 0,2-C absent; 4-C with 5–9 (6) branches, one longer, thicker and aciculate, 5-C with 3–7 (5) branches, 6-C with 2 or 3 (3) branches, 7-C with 5–7 (6) branches, 9-C with 7–10 (7) branches, 11-C with 6–8 (6) branches, setae 12,15-C with 2–4 (3) branches, 13-C with 1 or 2 (1) branches, 14-C with 4–6 (5) branches, 6-Mx with 1–7 (3) branches. Setae 4,8,10,11,13,15-C and 6-Mx smooth, others aciculate. *Antenna*: Length 0.30–0.45 mm (mean 0.37 mm), covered with small spicules. Seta 1-A with 1–3 (3) branches inserted 0.67 from base. Setae 2–6-A single, thick. *Thorax*: Integument hyaline, smooth. Setae 1–3-P and 9–12-P inserted on common tubercles. Prothoracic formula: (4-6)-1-(4-6)-(2-3)-1-1-(3-5). *Abdomen*: Integument hyaline, smooth. Setae 0,8-I absent. Seta 1-I with 8–11 (10) branches, 2-I with 1 or 2 (1) branches, 3-I with 2–4 (2) branches, 4-I with 4–6 (5) branches, setae 5,13-I with 1–3 (2) branches, seta 6-I with 2 or 3 (3) branches, 7-I with 2–4 (3) branches, setae 9,11-I with 1 or 2 (2) branches, 10-I with 6–8 (8) branches, 12-I with 7–9 (7) branches. Seta 6-II with 2 or 3 (3) branches, 7-II with 3–5 (3) branches. *Segment VIII*: Comb with 27–36 small scales of same size, each with a central apical spike-like spicule and lateral fringe of shorter spicules, arranged in 4 rows forming a triangular patch. Seta 5-VIII half length of segment X. *Siphon*: Integument light brown, smooth, with minute spicules, length 1.23–2.19 mm (mean 1.92 mm), width 0.20–0.33 mm (mean 0.25 mm). Index 7.52. Pecten on basal third of siphon, with 13–16 spines of different sizes. Seta 1-S in 5 pairs, with 2–4 (3) branches, apical seta smaller with 1 or 2 (1) branches. Setae 2,6–9-S single. *Segment X*: Length 0.28–0.37 mm (mean 0.31 mm), width 0.26–0.42 mm (mean 0.32 mm). Saddle complete, light brown (similar to siphon), spicules large, on posterior area of segment. Seta 1-X with 2–4 (3) branches, 2-X single, 3-X with 1 or 2 (1) branches, 4-X with 7 or 8 (7) branches. Anal papillae 3 times length of segment X, hyaline.

TABLE 3. Number of pupal setae of *Culex (Microculex) davisi* Kumm (5 specimens, modes in parentheses).

Seta no.	CT	Abdominal segments								Paddle	
		I	II	III	IV	V	VI	VII	VIII		
0	–	–	1	1	1	1	1	1	1	1	–
1	1,2 (1)	100+	10–20	4–7 (4)	2–4 (2)	1–3 (2)	2,3 (2)	1–3 (1)	–	–	2,3 (2)
2	1,2 (1)	1	1	1–3 (1)	1	1	1	1	–	–	–
3	1,2 (2)	1	1,2 (1)	2–4 (2)	2–4 (4)	1,2 (1)	1–3 (1)	1,2 (2)	–	–	–
4	2–4 (4)	4–6 (4)	3–5 (3)	1–3 (3)	2–4 (2)	2–5 (4)	2–4 (2)	1,2 (2)	1,2 (1)	–	–
5	3–5 (4)	1–3	2	2,3 (2)	2,3 (2)	1,2 (2)	1–3	1,2 (2)	–	–	–
6	1,2 (2)	1,2 (1)	1,2 (1)	1	1	1,2 (1)	1	3–5 (4)	–	–	–
7	1–3 (2)	1,2 (2)	3–5 (3)	2–4 (4)	1–4 (3)	2–4 (3)	1	1–3 (1)	–	–	–
8	1,2 (2)	–	3	2–5 (3)	2–4 (2)	1,2 (2)	2,3 (2)	3,4 (4)	–	–	–
9	2	1	1	1	1	1	1,2 (1)	3,4 (4)	4–6 (5)	–	–
10	2–3 (3)	–	–	1,2 (1)	1,2 (2)	1,2 (1)	1,2 (1)	1,2 (1)	–	–	–
11	1	2	–	1	1	1	1	1,2 (2)	–	–	–
12	1–3 (3)	–	–	–	–	–	–	–	–	–	–
13	–	–	–	–	–	–	–	–	–	–	–
14	–	–	–	1	1	1	1	1	1	1	–

CT = cephalothorax.

Specimens examined: 5M, 7F, 6L, 6Le, 6Pe, 4 MG, 2FG as follows: Argentina, Chaco Province: km 1031 on National Route No. 11 (27° 10' S 58° 58' W), 1M, 30.IX.03; 1M 3.XII.02, Stein coll. and det.; Monte Alto (27° 26' S 58° 55' W) 1F 25. X.01 (km 7), Stein coll. and det.; Pampa de Indio (26° 01' 60" S 59° 55' 00" W) 2 Le, 2Pe, 1F, 1M, 1MG, 8.XII.09 (No. 1, No. 7), Bangher and Oria coll. Bangher det.; 2L, 9.IV.10; 3L, 15.IX.10; 1L, 2Le, 2 Pe, 1F, 12.I.11 (N°122); 1Le, 1Pe, 1F, 16.II.11 (No. 304); Bangher and Oria coll., Bangher det.; 1Le, 1Pe, 1F, 14.V.11 (N°170), 1F, 2M, 2 MG, 27. I.11. 1F, 12. V.10. Bangher and Oria coll. Bangher det.; Colonia Benitez (27° 19' 60" S 58° 55' 60" W) 2FG, 1MG 18.III.16. (N° 8, N° 9). Bangher coll. and det.

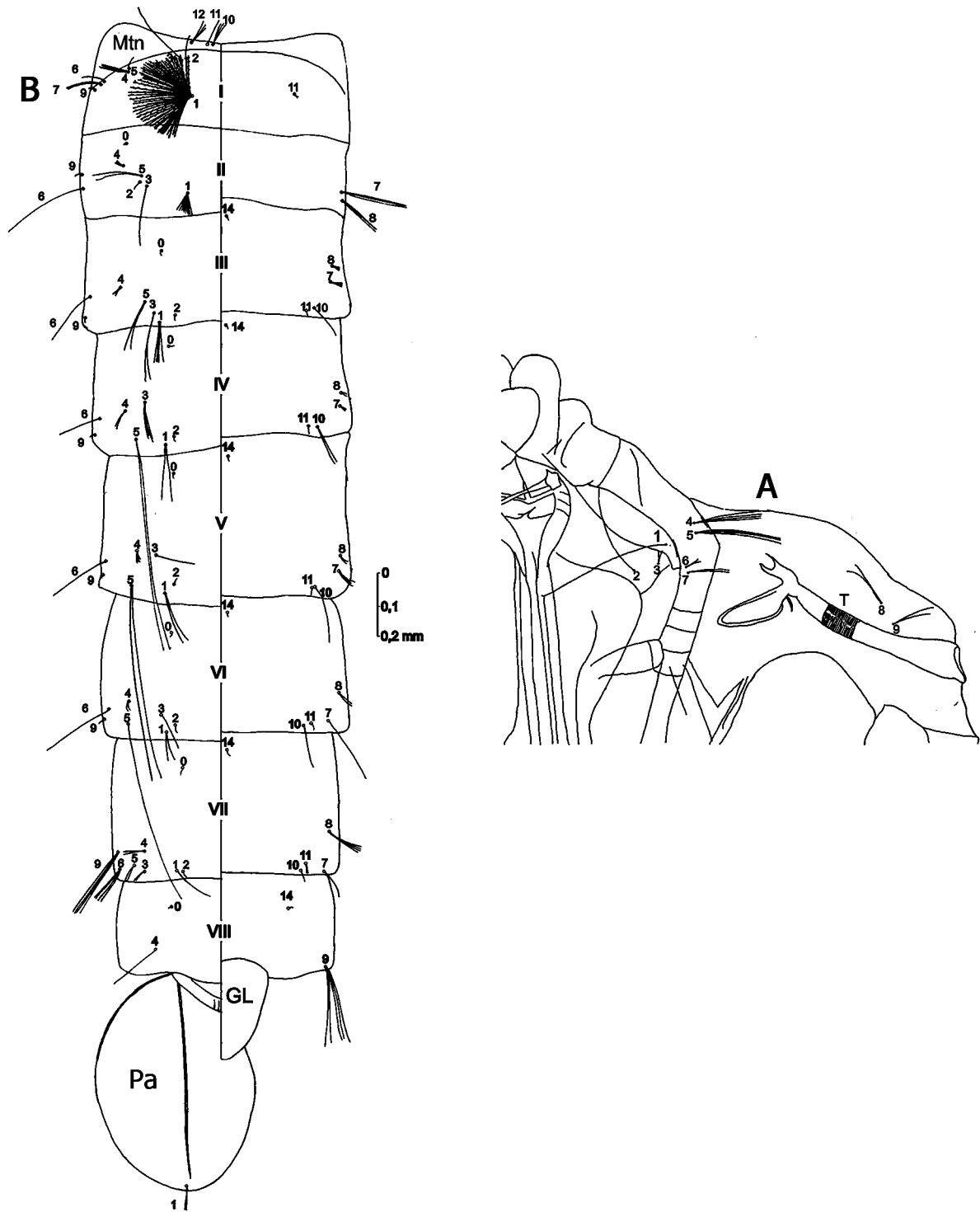


FIGURE 5. Pupa of *Culex (Mex.) davisi*. A, cephalothorax. B, metanotum and abdomen. GL = genital lobe. Mtn – metanotum; Pa = paddle; T = trumpet; I–VIII = abdominal segments.

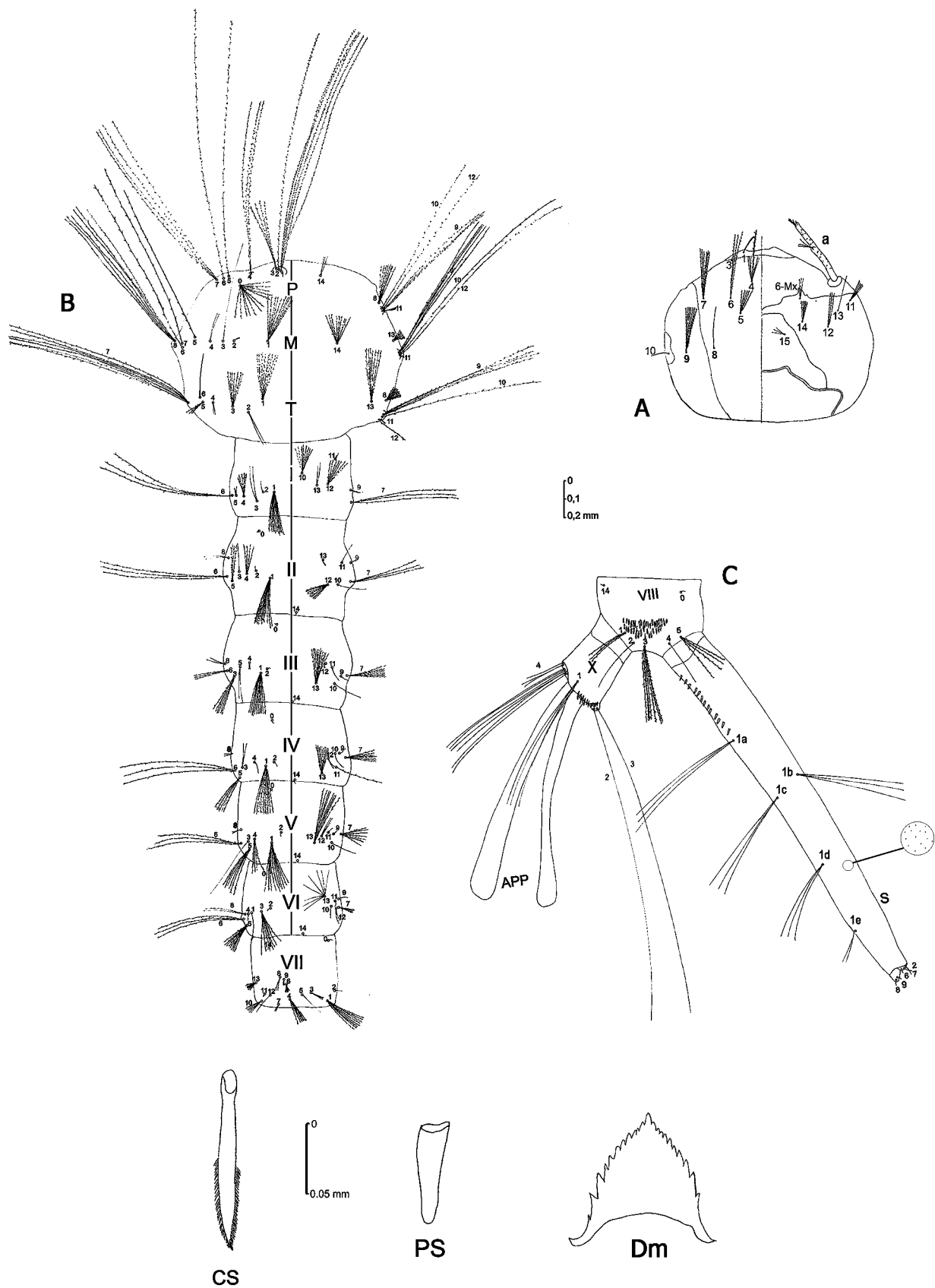


FIGURE 6. Larva of *Culex (Mx.) davisi*. A, head. B, thorax and abdominal segments I–VI. C, abdominal segments VII–X. a = antenna; APP = anal papilla; CS = comb scale; Dm = dorsomentum; S = siphon; T = metathorax; I–X = abdominal segments.

TABLE 4. Number of branches for fourth-instar larval setae of *Culex (Microculex) davisi* Kumm (10 specimens, modes in parentheses).

Seta no.	Head		Abdominal segments										Siphon		
	Thorax		P	M	T	I	II	III	IV	V	VI	VII		VIII	X
0	-	10-12 (12)	-	-	-	-	1	1	1	1	1	1	1	-	-
1	1	4-6 (5)	9-11 (10)	8-13 (9)	8-11 (10)	9-13 (11)	8-11 (11)	5-11 (11)	7-10 (10)	1,2 (1)	8-10 (8)	3-5 (3)	2-4 (3)	2-4 (3)	
2	-	1	1-3 (2)	1-3 (2)	1,2 (1)	1-3 (1)	1,2 (1)	1	1,2 (1)	1	1,2 (1)	1	1	1	
3	1	4-6 (4)	1	5-7 (7)	2-4 (2)	1-3 (1)	6-8 (6)	1-3 (2)	1	7-10 (7)	1-4 (4)	6-8 (7)	1,2 (1)	-	
4	5-9 (6)	2,3 (3)	1-3 (2)	2	4-6 (5)	3-5 (4)	2-4 (2)	1,2 (1)	2-4 (4)	2-4 (2)	7-10 (7)	1	7,8 (7)	-	
5	3-7 (5)	1	1	2-4 (3)	1-3 (2)	4-7 (5)	1,2 (2)	4-8 (7)	5-7 (6)	6-8 (8)	1,2 (1)	4-6 (4)	-	-	
6	2,3 (3)	1	1	1	2,3 (3)	2,3 (3)	2-4 (3)	2-4 (3)	2,3 (3)	2,3 (3)	7-11 (8)	-	-	1	
7	5-7 (6)	3-5 (4)	1	5-7 (6)	2-4 (3)	3-5 (3)	5-8 (6)	5-7 (7)	6-8 (7)	4-6 (4)	1-4 (3)	-	-	1	
8	1	8-10 (8)	5-7 (6)	10-13 (13)	1-3 (2)	1-3 (2)	1-3 (2)	2,3 (2)	2,3 (2)	2-4 (3)	1-4 (2)	-	-	1	
9	7-10 (7)	2,3 (3)	3-6 (5)	3-5 (4)	1,2 (2)	1	1,2 (1)	1	1	1,2 (1)	1-3 (3)	-	-	1	
10	1	1,2 (1)	1	1	6-8 (8)	1-3 (1)	1	1	1	1	7-9 (8)	-	-	?	
11	6-8 (6)	2-4 (3)	2,3 (2)	2,3 (2)	1,2 (2)	1,2 (1)	1	1	1	1,2 (1)	2,3 (3)	-	-	?	
12	2-4 (3)	1	1	1	7-9 (7)	8-10 (10)	1-3 (2)	2-4 (2)	2,3 (3)	2-4 (3)	1	-	-	Pecten spine 13-16 (13)	
13	1,2 (1)	-	12-14 (12)	7	1-3 (2)	2,3 (2)	7-11 (11)	8-11 (10)	8-10 (8)	8-14 (8)	8-10 (8)	-	-		
14	4-6 (5)	2-4 (3)	8-15 (9)	-	-	1	1	1	1	1	1	1	-	-	
15	2-4 (3)	-	-	-	-	-	-	-	-	-	-	-	-	-	
6-Mx	1-7 (3)	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Seta 1-A		Comb scale												
	1-3 (3)		27-36 (35)												

P = prothorax; M = mesothorax; T = metathorax.

Systematics

Distributions. *Culex (Mx.) imitator* is known from Argentina, Brazil, Colombia, Ecuador, French Guiana, Guyana, Mexico, Suriname, Trinidad and Tobago, Uruguay and Venezuela (Walter Reed Biosystematics Unit, 2013). It is recorded from the following provinces in Argentina: Chaco, Corrientes, Formosa, Santa Fé, Tucumán, Misiones, Entre Rios, Salta (Rossi & Lestani, 2014) and Jujuy (Linares *et al.*, 2016). *Culex (Mx.) davisi* is known from Brazil and Argentina. In Argentina, it is recorded from the provinces of Chaco and Corrientes (Rossi & Lestani, 2014) and Jujuy (Linares *et al.*, 2016).

Bionomics. The immature stages of *Cx. imitator* and *Cx. davisi* were collected from bromeliads. They were found with larvae of *Toxorhynchites haemorrhoidalis separatus* Lynch Arribálzaga, *Aedes terreus* Walker, *Haemagogus spegazzinii* Bréthes, *Tx. theobaldi* Dyar & Knab, *Wyeomyia muehlensi* Petrocchi and *Wy. (Phoniomyia)* species. Lane (1953) indicated that females prefer to feed on birds. Stein *et al.* (2011, 2013) did not capture specimens of *Microculex* on chicken, rabbit or human bait, despite the large number of immature specimens found in nearby larval habitats. Lourenço-de-Oliveira & Heyden (1986) had the same results using horse, cow, sheep and frog bait, and classified these species as hematophagous on ectothermal animals.

Health importance. Neither *Cx. davisi* nor *Cx. imitator* are known to be of medical importance.

Taxonomy. Adults of subgenus *Microculex* are small and have on the scutum a pattern of dark, gold or silver scales. Acrostichal setae are present or absent, the antepnotum has narrow scales and the mesokatepisternum has scales. The legs have white basal bands on the tarsomeres (most species) or are totally covered with dark scales (in some species). The larvae of *Culex* are distinguished from the larvae of other genera by the following characters: seta 2-C usually absent, seta 3-C located on the dorsal part of the head, sometimes absent; palatal brushes normal; mandible normal, no lateral lobe at base; maxillary brush well developed; seta 12-I and comb always present; siphon with three or more pairs of prominent setae, pecten normally present; saddle usually complete, sometimes incomplete, reduced but never divided into dorsal and ventral sclerites; ventral brush (setae 4-X) usually with three or more pairs of setae. Larvae of subgenus *Microculex* are distinguished from the larvae of other subgenera of *Culex* by the following characteristics: antenna constricted near seta 1-A, which is inserted on the upper half of the antenna. Seta 2-C weakly developed or absent; seta 3-P shorter than setae 1,2-P; comb with many scales in a patch; siphon usually very long and thin; seta 1-S inserted distal to pecten; saddle long, complete; seta 1-X small, multiple-branched; setae 2,3-X long, single; ventral brush with 4 pairs of setae, character shared with larvae of subgenus *Phytotelmatomyia*. The pupae of species of subgenus *Microculex* are distinguished by the following: trumpet long and thin; tracheoid area present, meatus without a slit at the proximal part of the pinna; seta 2-III inserted mesal to 1-III; seta 2-VI inserted lateral to 1-IV; seta 9-VIII relatively long, almost as long as tergum VIII; caudal lobe of tergum VIII does not cover the lateral part of tergum IX; seta 1-Pa present, seta 2-Pa absent (Harbach, 2013).

The description of the coloration and arrangement of the scutal scales of *Cx. imitator* given above differs from the descriptions provided by Theobald (1903) (Fig. 1C) and Kumm (1933) (Fig. 1D). The female of *Cx. imitator* is easily distinguished from the other three species that are known to occur in Argentina by the arrangement and color of the scutal scales and the presence of distinct wide bands of white scales at the basal of the hindtarsomeres. The male genitalia exhibit the general characteristics of the subgenus, but are easily distinguished from those of other species of the subgenus by the number and shape of the setae of the apical lobe of the gonocoxite (Kumm, 1933).

The characteristics of the female of *Cx. davisi* are similar that those described for *Cx. neglectus* Lutz but can be distinguished by the presence of a spot of pale scales on the femur-tibial and tibia-tarsal junctions and the presence of basolateral bands of white scales on the terga. The male genitalia exhibit differences from the original descriptions. In Kumm (1933), tergum IX is said to have seven setae and in Cotrim & Galati (1977) 8 or 9 long setae; nevertheless, in our specimens, tergum IX has two well-separated lower lobes with 6 setae on each lobe. The paraproct crown is composed of 10 digitiform spicules, however Cotrim & Galati (1977) describe it as having 13 blades.

The pupa of *Cx. imitator* is similar to the pupae of other species of subgenus *Microculex* but can be distinguished by the setal index of the cephalothorax, which is 2-1-3-2-3-2-2-1-2 in *Cx. imitator* and 1-1-2-3-2-2-2-2 in *Cx. pleuristriatus* Theobald (Cotrim & Galati, 1977). Setae 10,11,12-T have are single, double and single respectively in *Cx. imitator*; triple, single and double respectively in *Cx. pleuristriatus*. Setae 5-VI,VII are double and long in *Cx. imitator*, triple and small in *Cx. pleuristriatus* and single or double in *Cx. neglectus*. Seta 6-VI is

double in *Cx imitator* and triple in *Cx pleuristriatus*. *Culex neglectus* in Lane & Whitman (1951) and *Cx. pleuristriatus* in Cotrim & Galati (1977) are described as having seta 1-Pa double, whereas, by the same authors, 1-Pa is present with 4 branches in *Cx. imitator*. Seta 2-Pa of *Cx. imitator* is described herein, for the first time, as having 1 or 2 branches. The pupa of *Cx. davisi*, which has not been described until now, differs from the other species of subgenus *Microculex* known to occur in Argentina by the following characteristics: seta 6-VI single, seta 1-Pa with 2 or 3 branches and 2-Pa absent.

Larvae of *Cx. imitator* are distinguished from larvae of other species of subgenus *Microculex* by having seta 6-C single or double. Seta 6-Mx is described here for the first time; prothoracic index 1-(1-2)-(4-6)-(1-2)-1-1-1; comb with more than 60 scales arranged in 4 rows; seta 1-S in five non-aligned pairs, all the same size, siphonal index 11.83; pecten composed of 8–10 spines. In *Cx. davisi*, seta 4-C has 5–9 branches; prothoracic index (4-6)-1-(4-6)-(2-3)-1-1-(3-5)-(8-10); comb VIII with 27–36 scales; siphonal index 7.52; siphon with 4 aligned setae 1-S of the same size and a shorter apical seta; pecten comprised of 12–16 spines. The anal papillae are 3 times longer than segment X in both species.

Larvae of *Cx. imitator* are similar to those of *Cx. neglectus* but can be distinguished by the following characteristics: comb of segment VIII with more than 60 scales (fewer than 40 in *Cx. neglectus*); siphonal index 11.83 *imitator* whereas it is 14 in *Cx. neglectus*; and the anal papillae are three times longer than segment X, whereas they are only 1.5 times longer in *Cx. neglectus* (Cova Garcia *et al.*, 1966).

Larvae of *Cx. davisi* are similar to those of *Cx. pleuristriatus* but they can be distinguished by the prothoracic index, which is (4-6)-1-(4-6)-(2-3)-1-1-(3-5) in *Cx. davisi* and 3.1.3-2-1-1-2-4-1.1.2.3 in *Cx. pleuristriatus*, and the siphonal index is 7.5 in *Cx. davisi* and 5.0 in *Cx. pleuristriatus*. The siphon of *Cx. davisi* has 4 long seta 1-S and a smaller one, whereas *Cx. pleuristriatus* has 5 or 6 long seta 1-S and 1 smaller apical seta.

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