

## *CULEX (MICRAEDES) BISCAYNENSIS* N. SP. FROM FLORIDA (DIPTERA: CULICIDAE)

THOMAS J. ZAVORTINK<sup>1</sup> AND GEORGE F. O'MEARA<sup>2</sup>

**ABSTRACT.** The female, male, male genitalia, pupa, and larva of *Culex biscaynensis*, a new species in the Bisulcatus Group of subgenus *Micraedes*, are described and illustrated. The species, which is presently known only from south Florida, United States, is most similar to *Culex (Micraedes) antillumagnorum* Dyar.

**KEY WORDS** *Culex*, Culicidae, mosquitoes, new species, Florida

### INTRODUCTION

The new species in the Bisulcatus Group of *Culex (Micraedes)* described below was first discovered in south Florida in May 1996 when immatures were collected in bromeliads at the Fairchild Tropical Garden (O'Meara and Evans 1997). Because earlier surveys of bromeliad-breeding mosquitoes in south Florida by Fish (1976) and Frank et al. (1988) did not detect this species, and because of its very restricted distribution in Dade County, it is possible that this mosquito has been introduced into Florida through the importation of exotic bromeliads. However, because the species is not known to occur elsewhere, there is also the possibility that it is a previously undetected native species.

### MATERIALS AND METHODS

This study is based on new material collected in south Florida in 1996 and in the Bahamas in 1997 and on older material borrowed from the United States National Museum. The new material consists of reared adults, many of which have associated larval and pupal skins, and immatures. These specimens were reared and prepared for study according to standard entomological procedures. The borrowed material includes a small number of specimens representing all stages of other species in the Bisulcatus Group and specimens collected in the Bahamas for the "Mosquitoes of Middle America" project (Belkin and Heinemann 1975). Unfortunately, the Bahamian material collected for the "Mosquitoes of Middle America" project consists of immatures and male genitalia only because the associated adults have not been located.

The format for the species description follows Berlin (1970) in large part. The measurements of adult structures were determined from single, slide-mounted specimens. In an attempt to bring the morphological terminology used for mosquitoes into conformity with that used for other Diptera, we follow Judd's (1996) lead in giving preference to the

terminology used in the *Manual of Nearctic Diptera* (McAlpine et al. 1981). Terminology for structures or stages not included in the *Manual of Nearctic Diptera* follows Harbach and Knight (1980) in part. However, we do not use the term pecten spine for the individual elements of the pecten on the siphon of the larva, for it is erroneous to do so. The term spine is properly used for immovable, multicellular outgrowths of the body wall and should not be used for noncellular projections that are purely cuticular. The term pecten tooth is used instead. The type series is deposited in the California Academy of Sciences.

### RESULTS AND DISCUSSION

#### *Culex (Micraedes) biscaynensis* Zavortink and O'Meara, n. sp.

Figs. 1, 2

**Types.** *Holotype:* Male with associated larval and pupal skins (TJZ 80-21), Fairchild Tropical Garden or Matheson Hammock County Park, Dade County, Florida, United States (25°40.1'N, 80°16.7'W), larva from bromeliad leaf axil, 17 July 1996, G. F. O'Meara and L. E. Evans, Jr., collectors. *Allotype:* Female with associated larval and pupal skins (TJZ 80-20), same data as holotype. *Paratypes:* Five males with associated larval and pupal skins (TJZ 80-10-13, 19), 7 females with associated larval and pupal skins (TJZ 80-14-18, 22, 23), 22 males, 12 females, 34 pupal skins, 15 larvae, 42 larval skins, same data as holotype (TJZ 80); 10 larvae, same data as holotype except collected 15 May 1996 (TJZ 79).

**Diagnosis.** *Culex (Micraedes) biscaynensis* is most similar to *Culex antillumagnorum* Dyar of the Bisulcatus Group but may be distinguished from that species as follows: in the larva by 1) a greater number of branches, usually at least 4 (3-6), in seta 6-I; 2) a shorter siphon (1.22-1.43 mm); 3) a smaller siphon index (9.2-12.2); and 4) a pecten that extends farther distad on the siphon (0.35-0.45); in the pupa by seta 9-CT, which is usually double (1-3 b) and subequal in length to seta 8-CT; and in the male genitalia by the stronger and longer seta c of the proximal division of the subapical lobe of the gonocoxite, this seta extending far beyond the apex of the stem of seta a. *Culex biscaynensis*

<sup>1</sup> Department of Biology, University of San Francisco, San Francisco, CA 94117-1080.

<sup>2</sup> Florida Medical Entomology Laboratory, IFAS, University of Florida, 200 9th Street SE, Vero Beach, FL 32962.

may be distinguished from specimens of *Micraedes* collected in the Bahamas by the following larval characters, alone or in combination: 1) the greater number of branches, usually at least 4 (3–6), in seta 6-I; 2) the posterior comb scales that have the distal elements of the fringe enlarged but not distinctly spinelike; 3) the darkened apex of the siphon; 4) the pecten that extends farther distad on the siphon (0.35–0.45); 5) the slender distal pecten teeth that have 1 or 2 enlarged denticles; 6) the dark brown dorsal caudolateral marginal spicules on the anal saddle; and 7) the presence of several caudolateral marginal spicules on the anal saddle ventrad of seta 1-X.

**Female.** Wing, 3.04 mm; proboscis, 1.84 mm; forefemur, 1.59 mm; abdomen, 2.1 mm. **Head:** Integument brown to dark brown. Eyes black; contiguous above antennae. Vertex and occiput with narrow, curved decumbent scales and erect scales; decumbent scales very narrow (linear) and dingy white to brown medially, broader and whiter laterally, whiter and denser along margin of eyes; erect scales moderately long, forked apically, yellow, yellow-brown, or brown medially and yellow to yellow-brown laterally. Side of head with broad, flat white or cream scales. Ventral half of head without scales or with only a few scattered scales. Frontal bristles 1 pair; upper postocular bristles usually 4 pairs (3, 4 pairs), stronger and longer than lower postocular bristles; lower postocular bristles 2 pairs. Clypeus light brown to brown; bare. Proboscis longer than forefemur; apical 3rd depressed; basal setae 5–7; dark scaled, but scales of underside appearing pale at some angles of observation. Palpus moderately long, 0.34 length of proboscis; palpomeres 3, 3rd about 1.9 length of 2nd; slender; dark scaled. Antenna subequal to proboscis in length; pedicel light brown to brown, with a few short, fine, weakly pigmented setae mesally; base of flagellomere 1 concolorous with pedicel, apex of flagellomere 1 and flagellomeres 2–13 dark brown; flagellomeres 2–13 with 6 moderately long bristles in basal whorl. **Thorax:** Scutal integument light brown, brown, or reddish-brown. Dorsocentral, prescutellar, humeral, and supraalar bristles strong, long; acrostichal, posterior fossal, and parascutellar bristles shorter and finer. Scutal scales small, narrow, curved, dark auburn to dark brown; anterior promontory sometimes with a few pale scales. Scutellar integument light to moderate brown. Scutellar bristles strong, long, 6, 7 on midlobe, 4, 5 on lateral lobes. Scutellar scales small, narrow, curved, dark brown, few on lateral lobes. Paratergite bare. Antepronotum integument whitish; with 10–15 bristles/setae; without scales. Postpronotum integument whitish, sometimes very light brown above or entirely light brown; with 3–5 bristles/setae; with a few small, narrow, curved, dark brown scales along upper edge. Pleural integument usually predominantly whitish, including lower katepisternal and lower mesepimeral areas; postspiracular and sub-

spiracular areas or entire pleuron sometimes light brown. Pleuron with bristles/setae on proepisternum (4–8), katepisternum (4–7 upper, 9–13 lower; 1 or 2 of uppermost lower bristles strong, long), prealar area (2, 3), and upper mesepimeron (4–11); lower mesepimeron without bristles. Pleuron without scales except for a small patch of a few scales on lower katepisternum and sometimes 1 or 2 scales on upper mesepimeron. **Legs:** Coxae with dingy white to light brown scales on external surface. Trochanters with light and dark scales ventrally. Forefemur dark scaled except for light scales in short streak at base of anterior surface and in long streak on posterior surface; midfemur dark scaled except for light scales in streak on posterior and ventral surfaces; hindfemur light scaled with dark scales along dorsal surface and at apex. Tibiae and tarsi dark scaled. All claws small, simple. **Wing:** Dark scaled. Veins Rs, R<sub>2+3</sub>, R<sub>2</sub>, R<sub>3</sub>, and stem of M with narrow plume scales. Stem vein with 1–3 dorsal bristles. **Haltere:** Stem light; knob dark scaled. **Abdomen:** Laterotergite with numerous moderately long bristles/setae. Tergites II–VII with large basolateral white- or cream-scaled patch; without light-scaled basal band. Sternites II–VII cream scaled, a few dark scales sometimes present apically on distal segments.

**Male.** Wing, 2.68 mm; proboscis, 1.93 mm; forefemur, 1.71 mm. Similar to female except for sexual differences. Clypeus yellow to brown. Proboscis longer than forefemur. Palpus moderately long, 0.40 proboscis length; palpomeres 4, 3rd about 1.4 length of 2nd, 4th minute; dark scaled. Pedicel enlarged; yellowish to dark brown. Flagellum strongly plumose; flagellomeres 12 and 13 elongate, 13 about 1.1 length of 12. Claws of fore- and midlegs enlarged, unequal; larger claw with submedian tooth.

**Male genitalia (Fig. 1).** *Segment IX:* Tergite lobe prominent, moderately broad; IX-T setae in group of 6–8 (5–9) basad of tergite lobe, moderately long; 1 additional moderately long seta sometimes present on tergite far laterad of main group of setae. *Gonocoxite:* Length about 2.2–2.8 times width measured just basad of subapical lobe; mesal half of tergal surface and mesal surface without setae; lateral half of tergal surface, lateral surface, and lateral half of sternal surface with many long bristles, these most abundant on sternal surface; mesal half of sternal surface with many setae that become progressively shorter and finer mesad; scales usually absent, sometimes 1 or more present near base of tergal, lateral, or sternal surface. *Subapical lobe:* Proximal division prominent; seta a with long columnar stem, strong, rodlike, flattened and slightly hooked at apex; seta b with short columnar stem, subequal in strength to seta a but longer, rodlike, flattened and slightly hooked at apex; seta c without stem, moderately strong, simple, extending far beyond apex of stem of seta a. Distal division with long, slender, simple

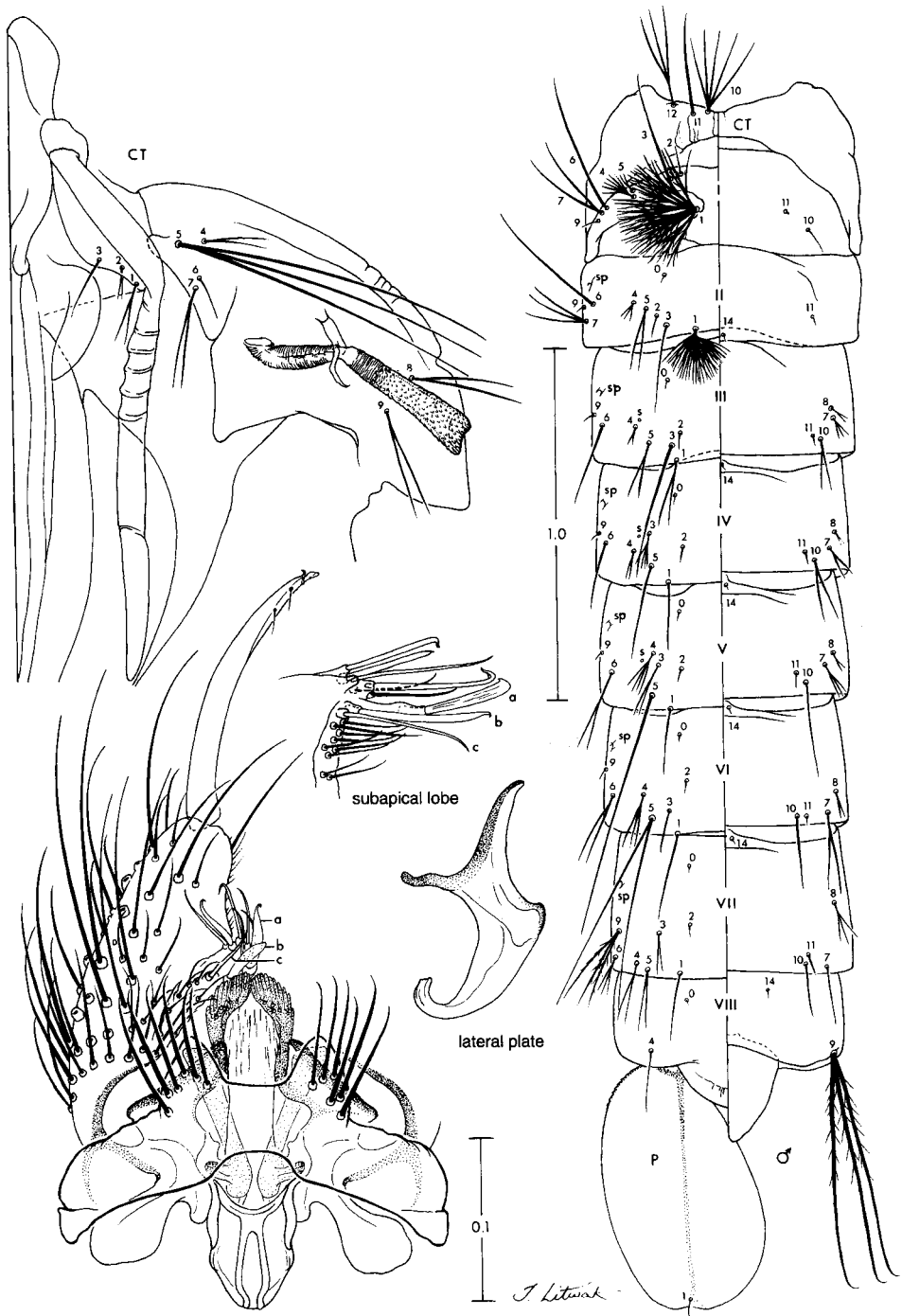


Fig. 1. *Culex (Microaedes) biscaynensis*, male genitalia and pupa. Scales in mm.

seta laterad, a short stem bearing a long, moderately strong seta that is flattened and hooked at apex, a shorter moderately strong seta that is flattened and hooked at apex, and, farthest mesad, an even shorter moderately strong seta that is flattened and sometimes hooked at apex. Area be-

tween proximal and distal divisions with 2 slender setae that may be flattened apically. *Gonostylus*: Length about 0.75–0.83 length of gonocoxite; simple, slender, tapered distad; 2, 3 small setae near apex, sometimes with 1 moderately long subbasal seta on external (sternal) surface. *Proctiger*: Par-

Table 1. Chaetotaxy of the pupa of *Culex (Micraedes) biscaynensis*.

Seta no.	Cephalo-thorax	Abdominal segments								
		I	II	III	IV	V	VI	VII	VIII	
0	—	—	1	1	1	1	1	1	1	1
1	2 (1-3)	9 (6-9) <sup>1</sup>	31 (22-45)	2 (1-3)	1 (1, 2)	1 (1, 2)	1 (1, 2)	1 (1, 2)	1 (1, 2)	—
2	2 (1, 2)	1 (1, 2)	1	1	1	1	1 (1, 2)	1 (1, 2)	1 (1, 2)	—
3	1 (1, 2)	1	1 (1, 2f)	1 (1-5f)	4 (2-5)	2 (1-4)	1 (1, 2)	2 (1-3)	—	—
4	2 (2-4)	6 (4-7)	3 (2-5)	2 (1-4)	2 (1, 2)	4 (2-7)	3 (1-3)	2 (1, 2)	1 (1-3)	1 (1-3)
5	3 (2-4)	2 (1-3)	2 (1-3)	2 (1, 2)	1 (1, 2)	1 (1, 2)	2 (1, 2)	2 (1-3)	—	—
6	1	1 (1, 2)	1	1 (1, 2)	1 (1, 2)	2 (1, 2)	2 (1-3)	3 (2-4)	—	—
7	2 (2, 3)	2 (1-3)	3 (1-4)	3 (2-5)	2 (2-5)	3 (2-5)	2 (2, 3)	1 (1, 2)	—	—
8	2 (2-4)	—	—	2 (1, 2)	2 (1-3)	2 (2, 3)	2 (2-4)	3 (1-5)	—	—
9	2 (1-3)	1 (1, 2)	1	1	1	1	1 (1, 2)	3 (2, 3)	3 (3, 4)	—
10	5 (3-9)	1 (1, 2)	—	2 (1, 2)	2 (1-3)	1 (1, 2)	1 (1, 2)	1 (1, 2)	—	—
11	1	1	1	1	1	1 (1, 2)	1 (1, 2)	1 (1, 2)	—	—
12	3 (2-5)	—	—	—	—	—	—	—	—	—
14	—	—	—	1	1	1	1	1	1	1

<sup>1</sup> Main branches. Paddle: 1-P, 1.

apocro crown a uniform row of 10-13 large, spine-like spicules. Cercal setae 2-5.

**Pupa (Fig. 1).** Abdomen length, 2.6 mm; trumpet length, 0.40-0.47 mm; paddle length, 0.69-0.74 mm. Position and development of setae as figured; range in setal branches in Table 1. Countershaded, dorsum (at water surface in life) light brown, fading to light straw-colored ventrally on cephalothorax and posteriorly on abdomen. **Cephalothorax:** Seta 5-CT very strongly developed, long, extending beyond bases of setae 8, 9-CT, usually 3 b (2-4); seta 7-CT usually double (2, 3 b); setae 8, 9-CT subequal in length, seta 8-CT usually double (2-4 b), seta 9-CT usually double (1-3 b); seta 11-CT single; seta 12-CT usually 3 b (2-5). **Trumpet:** Moderately long; subcylindrical basally, compressed laterally at and beyond middle, flared apically; tracheoid distinct, short, 0.25-0.30 trumpet length; pinna short, 0.12-0.26 trumpet length. Index calculated with dorsoventral depth at mid length 5.3-6.3; calculated with side-to-side width at mid length 9.6-11.0. Base and middle portion light straw-colored, tracheoid dark brown, apex light to dark brown. **Abdomen:** Seta 1-II dendritic, with 22 or more (22-45) fine branches; seta 3-I-III sometimes stronger and longer than illustrated, seta 3-I single; seta 5-IV usually single (single, double), varied in development, as short and fine as seta 3-II to nearly as long and strong as seta 5-V; seta 5-V, VI sometimes stronger and longer than illustrated, 5-V usually single (single, double), seta 5-VI usually double (single, double); seta 6 usually single (single, double) on I-IV, usually double (1-3 b) on V, VI, usually 3 b (2-4) on VII; seta 6-I 1.6-2.3 times length of seta 7-I, seta 6-II 1.9-2.8 times length of seta 7-II; seta 7-I usually double (1-3 b), seta 7-II usually 3 b (1-4); seta 9-III-VII cephalad of seta 6 of same segment; seta 9-VII strongly developed, 2.1-3.2 times length of 6-VII, usually 3 b (2, 3); seta 9-VIII long, 2.0-2.3 times length of segment VIII, usually 3 b (3, 4), the branches sometimes

weakly sigmoidally curved, their tips curved or hooked. Male genital lobe extending to 0.29 of paddle; female genital lobe extending to 0.16 of paddle. **Paddle:** Length 2.3-2.5 times length of segment VIII; index 1.5-1.8; margin without spicules; apex usually shallowly emarginate or truncate.

**Larva (Fig. 2).** Head width, 1.02-1.10 mm; siphon length, 1.22-1.43 mm; anal saddle length, 0.22-0.26 mm. Position and development of setae as figured; range in setal branches in Table 2. **Head:** Predominantly light straw-colored, collar dark brown. Width 1.1-1.3 length. Seta 4-C single; seta 5-C usually 5, 6 b (4-7); seta 6-C 4-6 b; seta 7-C usually 9, 10 b (8-12); seta 9-C usually 2, 3 b (1-4); seta 15-C short, fine, usually double (1-4 b), not reaching level of base of hypostoma. **Hypostoma** dark brown; with broad median tooth, 7-9 narrower teeth on each side that become progressively larger laterad and usually with single tooth on side below largest lateral tooth. **Antenna:** Length 0.5 length of head; light straw-colored, with distinct spicules in basal 0.5-0.6. Seta 1-A usually 9-11 b (7-12). **Thorax:** Seta 0-P stellate, usually 13-18 b (12-19); seta 7-P single; seta 14-P single, moderately long, slender, attenuate; seta 1-M, T stellate, usually 10-15 b (9-20). **Abdomen:** Stellate setae light brown. Seta 1-I-VII stellate, usually 13-18 b (10-23); seta 2-I-VII stellate, usually 11-16 b (8-17); seta 4-I, II, V stellate, usually 4-7 b (3-9) on II, V; seta 5-II-VII stellate, usually 11-13 b (8-16); seta 6-I usually 4 b (3-6); setae 7-III-VI and 9-II-VI stellate, usually 8-13 b (6-14); setae 11-I and 6, 8, 10-VII stellate, usually 8-10 b (7-12); seta 13-I-VII stellate, usually 12-16 b (9-21) on I-VI, usually 6-11 b (6-17) on VII. **Segment VIII:** Comb scales weakly pigmented, in triangular patch of 3 or 4 somewhat irregular rows; 37-55; all scales fringed, distal elements of fringe enlarged, but without distinct apical spine. Seta 1-VIII stellate, usually 13-17 b (11-19); seta 5-VIII stellate, usually 5-9 b (4-11). **Siphon:** Index 9.2-12.2. Predom-

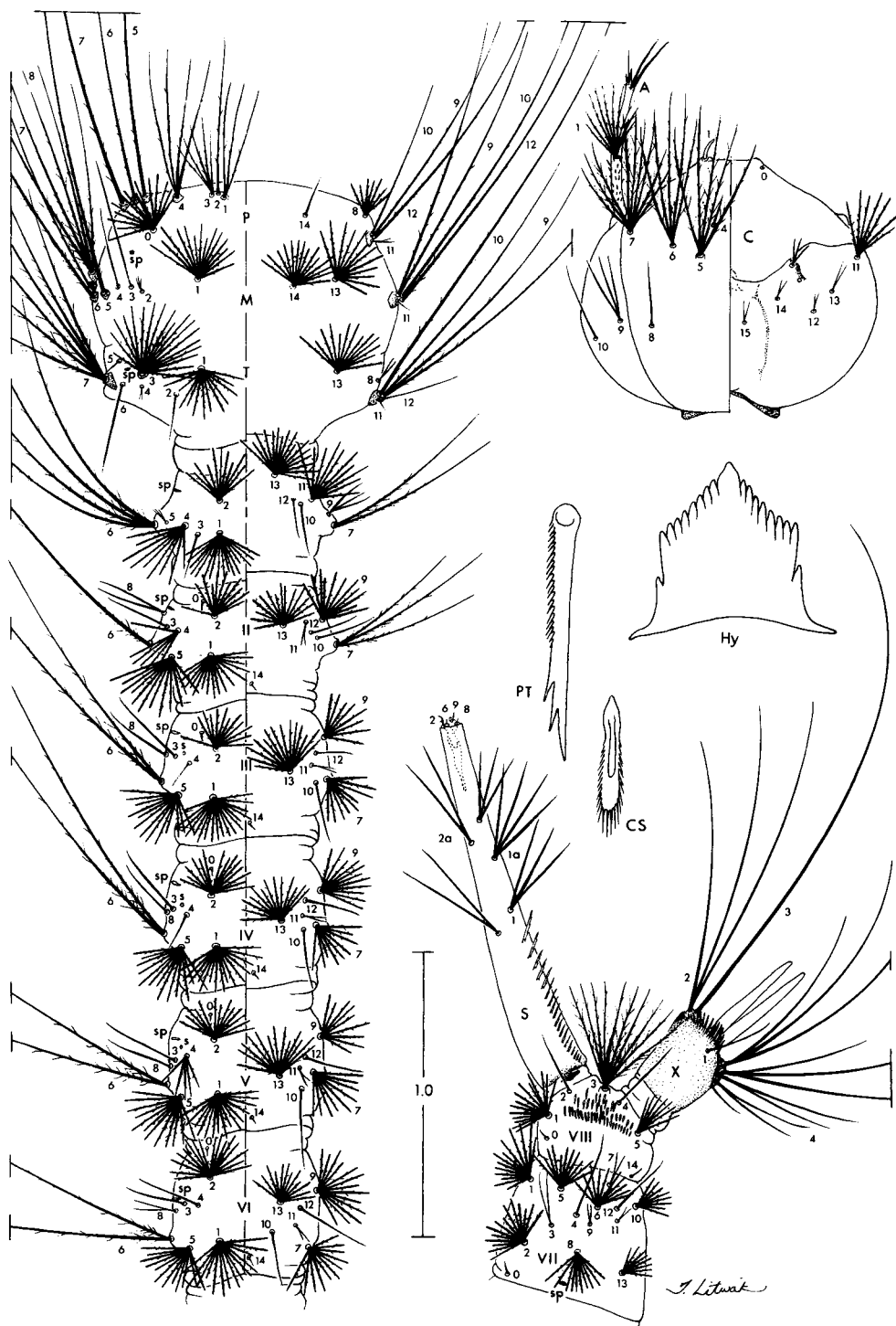


Fig. 2. *Culex (Microaedes) biscaynensis*, 4th-stage larva. Scale in mm.

Table 2. Chaetotaxy of the larva of *Culex (Micraedes) biscaynensis*.<sup>1</sup>

Seta no.	Head	Thorax			Abdominal segments	
		P	M	T	I	II
0	1	14 (12-19)	—	—	—	1
1	1	3 (3, 4)	14 (11-20)	13 (9-20)	16 (12-23)	16 (13-22)
2	—	1	3 (2, 3)	1	11 (8-16)	11 (8-16)
3	—	5 (3-6)	1	18 (13-26)	1	1
4	1	4 (3-6)	1	2 (2-4)	9 (8-12)	6 (4-9)
5	5 (4-7)	1 (1, 2)	1	1	3 (2-4)	12 (10-16)
6	5 (4-6)	1 (1, 2)	1	1	4 (3-6)	1
7	9 (8-12)	1	1	6 (5-8)	2	3 (2-4)
8	1	7 (5-10)	5 (4-6)	2 (2, 3)	—	2 (1-3)
9	3 (1-4)	1	2 (2-4)	3 (2-4)	3 (3-5)	11 (6-12)
10	1 (1, 2)	1	1	1	1	1
11	7 (4-12)	2 (1, 2)	1	1	10 (7-12)	2 (1, 2)
12	2 (2, 3)	1	1	1	1	1
13	2 (1-3)	—	12 (8-18)	13 (11-18)	16 (12-21)	14 (13-21)
14	2 (1, 2)	1	14 (10-19)	—	—	—
15	2 (1-4)	—	—	—	—	—

<sup>1</sup> Antenna: 1-A, 10 (7-12); 2, 4-A, 1 (1, 2); 3, 5, 6-A, 1. Siphon: 1-S, 3 (2-5); proximal 1a-S, 4 (3-5); distal 1a-S, 3 (2-4); 2-S, 1; proximal 2a-S, 2 (2, 3); distal 2a-S, 2 (2, 3); 6, 8, 9-S, 1. Anal segment: 1-X, 1 (1, 2); 2-X, 3 (2-4); 3-X, 1; 4a-X, 3 (3, 4); 4b-X, 3 (3, 4); 4c-X, 2 (2, 3); 4d-X, 2 (1, 2); 4e-X, 1 (1, 2).

inantly light straw-colored, acus and basal ring brown to dark brown, distal 0.15 usually brown; very weakly imbricate basally. Pecten extending 0.35-0.45 length of siphon; pecten teeth 15-23, weakly pigmented, slender, each longer than preceding tooth, with small denticles on lower edge, distal teeth also often with 1 or 2 enlarged distal denticles. Subventral setae (1-S, 1a-S) usually 3 pairs (3, 4 pairs), proximal 2 pairs (2, 3 pairs) strongly developed, subequal, usually 3, 4 b (2-5), distal pair moderately developed, 2, 3 b (2-4). Subdorsal setae (2a-S) 2 pairs, proximal pair usually arising basad of seta 1-S and either basad or distad of last pecten tooth, longest hair on siphon, 2, 3 b, distal pair shorter, 2, 3 b. *Anal segment*: Saddle complete; straw-colored, brownish near edges, particularly dorsally and caudally; weakly spiculate. Caudolateral marginal spicules extending slightly ventrad of seta 1-X; spicules 15-24, dorsal dark brown, ventral lighter; long, slender, those in dorsal 0.5 of row apparently simple, those in ventral 0.5 with large denticles on lower edge. Seta 1-X usually single (rarely double); seta 2-X usually 3 b (2-4). Ventral brush usually with 5 pairs of setae (9, 10 individual setae); larger setae (4a, 4b-X) usually 3 b (3, 4); smallest setae (4e-X) usually single (rarely double), at least 1 of pair very small and proximad of grid. Anal papillae 4, slender, dorsal and ventral subequal in length, 1.4-2.7 times length of anal saddle.

**Etymology.** The specific name *biscaynensis* refers to Biscayne Bay that lies just off shore from the known distribution of this species.

**Systematics.** *Culex biscaynensis* belongs to the *Bisulcatus* Group, which is strongly differentiated from other groups of *Micraedes* in all stages (Berlin 1970). Except for the presence of *Cx. biscaynensis*

in Florida, this group of species is restricted to the islands bordering the Caribbean Sea and the Bahama Islands, with *Cx. antillumagnorum* occurring on the Greater Antilles and St. Thomas, *Culex arawak* Berlin occurring on Jamaica, *Culex bisulcatus* (Coquillett) occurring on the Lesser Antilles and St. Croix, and populations derived from *Cx. antillumagnorum* occurring in the Bahamas.

Of the previously described species in the *Bisulcatus* Group, *Cx. biscaynensis* is most similar to *Cx. antillumagnorum* but with some characteristics found in other species of the group. *Culex biscaynensis* is most easily distinguished in the larval stage, by the characters given in the diagnosis. Berlin (1970) used the number of branches in seta 6-I to distinguish *Cx. antillumagnorum* (6-I triple) and *Cx. bisulcatus* (6-I with 5 or 6 branches); in *Cx. biscaynensis* the number of branches in the specimens examined by us falls between these values, with 6-I usually having at least 4 branches but with the number ranging from 3 to 6. Berlin also drew attention to differences in the development of seta 14-P and the distal comb scales that could be used to separate *Cx. antillumagnorum* (seta 14-P single, moderately long, slender, attenuate; distal comb scales with a narrow apical spine) and *Cx. bisulcatus* (seta 14-P spikelike, usually double or triple; distal comb scales with a recurved apical spine). In *Cx. biscaynensis*, these characteristics are more similar to their condition in *Cx. antillumagnorum* than in *Cx. bisulcatus*. However, a subtle difference is that in *Cx. biscaynensis* the posterior comb scales have the distal elements of fringe enlarged, but none are distinctly spinelike. The siphon of *Cx. biscaynensis* usually bears 3 pairs of subventral setae, and early in this study we thought this would separate the larvae from all other species of

Table 2. Extended.

Abdominal segments					
III	IV	V	VI	VII	VIII
1	1	1	1	1	1
18 (13-21)	15 (10-21)	15 (13-22)	14 (10-16)	13 (10-16)	14 (11-19)
12 (9-16)	14 (10-16)	13 (9-16)	16 (10-17)	14 (10-17)	1
1	1	1	1	2 (1, 2)	10 (7-11)
1	1	5 (3-6)	1	1 (1, 2)	1
13 (9-15)	13 (9-16)	12 (9-13)	12 (9-13)	11 (8-14)	7 (4-11)
2	2	2	2	10 (5-12)	—
9 (7-11)	9 (7-12)	9 (7-12)	11 (6-11)	2 (1-4)	—
1 (1, 2)	1	1	2 (2, 3)	10 (7-12)	—
8 (7-12)	11 (7-12)	9 (8-13)	13 (7-14)	2 (2-5)	—
1	1	1	1	8 (7-12)	—
2 (1, 2)	2 (1, 2)	2 (1-3)	2 (1-3)	2 (1-3)	—
1	1	1	1	1	—
14 (11-19)	13 (10-18)	13 (10-17)	12 (9-17)	8 (6-17)	—
1	1	1	1	1	1
—	—	—	—	—	—

*Micraedes* because Berlin does not indicate any departure from 4 pairs of these setae in any of the species. However, some of the larvae of *Cx. antillumagnorum* and *Cx. bisulcatus* we have examined also have only 3 pairs of these setae. The pupa of *Cx. biscaynensis* may be distinguished from the pupae of both *Cx. antillumagnorum* and *Cx. bisulcatus* by the development of setae 8, 9-CT. In *Cx. biscaynensis*, these setae are subequal in length and both are usually double (8-CT 2-4 b, 9-CT 1-3 b). In both *Cx. antillumagnorum* and *Cx. bisulcatus*, seta 8-CT is longer than 9-CT, and 1 or both of these setae are single. In both *Cx. biscaynensis* and *Cx. antillumagnorum* seta 6-I, II of the pupa is considerably longer than seta 7 of the corresponding segment. According to Berlin, the longer seta 6-I, II of *Cx. antillumagnorum* distinguishes this species from *Cx. bisulcatus*, but it is obvious to us that this distinction is not absolute. The minor differences in the shape of the paddle evident in our illustration of *Cx. biscaynensis* and Berlin's illustrations of *Cx. antillumagnorum* and *Cx. bisulcatus* are most likely not diagnostic. We have seen too few pupae of species other than *Cx. biscaynensis* to evaluate the apparent differences, but the paddle of *Cx. biscaynensis* is not always as rounded or as emarginate as shown, and if the other species are also variable, then the differences shown are not characteristic of the species. As noted in our description of the pupa, the branches of seta 9-VIII of *Cx. biscaynensis* are sometimes weakly sigmoidally curved, and the tips of the branches are always curved or hooked. The form of these branches is somewhat similar to that of seta 1-CT of the pupa of many species of sabethine mosquitoes, and setae of this type may be used to anchor the pupa to objects in their phytotelm habitats. Berlin does not describe or show the tips of the branches of seta 9-VIII as being curved or hooked in the pupae of *Cx. antillumagnorum* or *Cx. bisulcatus*, but E. L. Pey-

ton has kindly examined pupae of these species for us and reports (in litt.) that the tips of the branches are hooked. The male genitalia of *Cx. biscaynensis* are similar to those of *Cx. antillumagnorum* in having numerous, moderately long setae on the lobes of tergite IX (usually 6-8 [5-9] in *Cx. biscaynensis*) and in lacking setae on the mesal half of the tergal surface of the gonocoxite. The species differ in development of seta c of the proximal division of the subapical lobe of the gonocoxite, as noted in the diagnosis. Seta c in *Cx. biscaynensis* is almost as long and strong as in *Cx. bisulcatus*. Berlin considered the presence of a relatively long seta near the base of the external surface of the gonostylus to be a diagnostic characteristic of *Cx. arawak*. However, this seta is sometimes developed in *Cx. biscaynensis* (it is present on 3 gonostyli of the 9 genitalia preparations we have examined). The adults of *Cx. biscaynensis* are probably not separable from those of the other species in the *Bisulcatus* Group. We describe the palpus of *Cx. biscaynensis* as having fewer palpomeres than the other species, but this is only because we have not counted the palpifer as a segment. Berlin describes the pleural integument of species in the *Bisulcatus* Group as being yellowish, and it is in the sample of specimens we have examined. We believed that *Cx. biscaynensis* was different, with the pleural integument being predominantly whitish and contrasting with the considerably darker scutal integument. However, as the adults of the type series raised in San Francisco have aged, the pleural integument of some specimens (16 of 44 pinned adults) has darkened and is now light brown. Seven of the 8 pinned males that were relaxed in order to remove their genitalia now have a brownish pleural integument, so the darkening may in some way result from exposure to humid conditions. Many of the adults with the whitish pleural integument display an irregular blue or blue-green subcuticular

staining on the pleuron and basal abdominal sternites.

Although the subgenus *Micraedes* was not known to occur north of the range of *Cx. antillumagnorum* in the Greater Antilles at the time of Berlin's (1970) revision, it is now known to occur in 3 more northern localities. Belkin and Heinemann (1975) reported the subgenus from New Providence Island in the Bahamas and O'Meara and Evans (1997) reported it in south Florida. The subgenus occurs on at least 1 other Bahamian island, Lee Stocking Island, where it was collected recently by D. Scott Taylor. As part of this project, we have studied the specimens from New Providence and Lee Stocking islands as well as those from south Florida. All 3 of these northern populations are quite similar to *Cx. antillumagnorum* and appear to be derived from the same lineage as it. In all these northern populations, the siphon of the larvae is shorter (1.14–1.51 mm) than in *Cx. antillumagnorum* (1.5–1.7 mm) and has a smaller index (8.5–12.2) than in that species (18.0–20.0), and seta c of the proximal division of the subapical lobe of the gonocoxite tends to be longer and stronger than in *Cx. antillumagnorum*. However, each of these northern populations has evolved its own peculiarities, particularly in the larva. Belkin and Heinemann (1975) reported the New Providence population as *Cx. antillumagnorum* and, indeed, of the 3 northern populations, it is the most similar to that species. There are several larval differences, though, and this population may represent an undescribed species. The population on Lee Stocking Island is the most distinctive of the northern populations, with numerous larval differences, and undoubtedly represents yet another undescribed species. The diagnosis above gives characters that distinguish the larva of *Cx. biscaynensis* from larvae of the Bahamian populations of the subgenus.

**Bionomics.** The immatures of *Cx. biscaynensis* have been collected in the native Florida epiphytic bromeliads *Tillandsia utriculata* L. and *Tillandsia fasciculata* Swartz and in exotic terrestrial bromeliads, where they have been associated with *Wyeomyia mitchellii* (Theobald), *Wyeomyia vanduzeei* Dyar and Knab, and *Culex quinquefasciatus* Say (O'Meara and Evans 1997).

**Distribution.** *Culex biscaynensis* is known at present only from south Florida. Material examined: 177 specimens; 28 males, 20 females, 48 pupae, 81 larvae; 14 individual larval rearings.

**United States.** Florida. *Dade Co.*: Fairchild

Tropical Garden or Matheson Hammock County Park, type series, see above.

## ACKNOWLEDGMENTS

We thank E. L. Peyton of the Walter Reed Biosystematics Unit for arranging the loan of specimens from the United States National Museum and for examining additional specimens, Len Evans of the Florida Medical Entomology Laboratory for assistance in collecting specimens in south Florida, D. Scott Taylor of the Brevard Mosquito Control District for collecting specimens on Lee Stocking Island, and Taina Litwak of Litwak Illustration Studio for preparation of the illustrations. We also thank Phil Lounibos and Dick Darsie for reading the manuscript and offering suggestions for its improvement. We are also indebted to Dick Darsie for bringing the diagnostic value of pupal setae 8, 9-CT to our attention. This is Florida Agricultural Experiment Station journal series no. R-06486.

## REFERENCES CITED

- Belkin, J. N. and S. J. Heinemann. 1975. Collection records of the project "Mosquitoes of Middle America." 3. Bahama Is. (BAH), Cayman Is. (CAY), Cuba (CUB), Haiti (HAC, HAR, HAT) and Lesser Antilles (LAR). Mosq. Syst. 7:367–393.
- Berlin, O. G. W. 1970. Mosquito studies (Diptera, Culicidae). XVIII. The subgenus *Micraedes* of *Culex*. Contrib. Am. Entomol. Inst. (Ann Arbor) 5(1) (for 1969): 21–63.
- Fish, D. 1976. Structure and composition of the aquatic invertebrate community inhabiting epiphytic bromeliads in south Florida and the discovery of an insectivorous bromeliad. Ph.D. Dissertation. University of Florida, Gainesville, Florida.
- Frank, J. H., J. P. Stewart and D. A. Watson. 1988. Mosquito larvae in axils of the imported bromeliad *Billbergia pyramidalis* in southern Florida. Fla. Entomol. 71: 33–43.
- Harbach, R. E. and K. L. Knight. 1980. Taxonomists' glossary of mosquito anatomy. Plexus Publishing, Inc., Marlton, NJ.
- Judd, D. D. 1996. Review of the systematics and phylogenetic relationships of the Sabethini (Diptera: Culicidae). Syst. Entomol. 21:129–150.
- McAlpine, J. F., B. V. Peterson, G. E. Shewell, H. J. Teskey, J. R. Vockeroth and D. M. Wood. 1981. Manual of Nearctic Diptera, Vol. 1. Biosystematics Research Institute, Ottawa, Ontario, Canada (Research Branch Agriculture Canada, Monogr. No. 27).
- O'Meara, G. F. and L. E. Evans, Jr. 1997. Discovery of a bromeliad-inhabiting *Culex* (*Micraedes*) sp. in South Florida. J. Am. Mosq. Control Assoc. 13:208–210.