

DIFFERENTIATION OF THE LARVAL INSTARS OF *Aedes sollicitans* (WALKER) AND *A. taeniorhynchus* (WIEDEMANN)  
(DIPTERA: CULICIDAE)

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The separation of fourth-instar larvae of the salt-marsh mosquito species, *Aedes (Ochlerotatus) sollicitans* (Walker) and *A. (Ochlerotatus) taeniorhynchus* (Wiedemann), presents no difficulty since the comb scales are markedly different in the two species. Additionally, several other clearly defined differences exist. However, the other larval instars are not so precisely separable. This is particularly true of the second-instar larva. Because of this, a comparative study of all four larval instars has been made. This paper presents the difference found. The need for such a study is particularly indicated in view of the fact that these two species are commonly found breeding together.

The chaetotactic nomenclature used in this paper is after Belkin (1950).

*Aedes (Ochlerotatus) sollicitans* (Walker)

The fourth-instar larva of this species has been described in more or less detail by a number of authors, including Smith (1904), Mitchell (1907), Carpenter, Middlekauff, and Chamberlain (1946), Dyar (1928), Lane (1953), Matheson (1944), Ross (1947), and Carpenter and LaCasse (1955). However, no one has described all of the thoracic and abdominal chaetotaxy. Accordingly, the complete chaetotaxy is figured here (figs. 1-5). Furthermore, counts of numbers of branches have been made for nearly all of the hairs on a small number of specimens (available upon request from the author as mimeographed tables).

The other larval instars have not been previously described. However, Elmore and Fay (1958) reported that the first-instar larva of *A. sollicitans* has two long terminal antennal hairs (fig. 10: hairs 2 and 3) and is thereby readily distinguishable from the first-instar larva of *A. taeniorhynchus*, which has only one long terminal hair (hair 2) on the antenna.

*Fourth-Instar Larva.*

*Antenna* (figs. 1 and 11). Shaft rather dusky beyond antennal hair, cylindrical, slightly tapered distally, sparsely spiculate. Antennal hair (hair 1) inserted dorsally slightly before the middle, with 3-7 branches; hairs 3 and 4 short; hair 2 longer and apically bent.

*Head* (fig. 1). Clypeal spine (hair 1) evenly tapered, acute, curved; hair 2 not seen; hair 3 minute, slender, hair 4 inconspicuous, with 2-4 branches; hair 5 single; hair 6 single, shorter than hair 5; hair 7 with 7-10 spiculate branches; hair 8 single; hairs 9 and 10 single or double; hair 11 with 4-6 branches; hair 12 single; hair 13 with 4-6 branches; hair 14 single or double; hair 15 with 2-4

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branches (occasionally single). Mentum with 9-11 even teeth on either side of middle tooth. Median elements of mouth brushes with comblike tips.

*Thorax* (fig. 2). Smooth. Prothorax: Hairs 1, 5, 6, 7, and 8 large, spiculate. Hair 8 is 0.56 to 0.72 as long as hair 7. Mesothorax: Hairs 5, 6, 7, 8, 9, 10, and 12 large, spiculate. Hairs 13 and 14 small, densely branched. Metathorax: Hairs 7, 9, and 10 large, spiculate. Hairs 8 and 13 small, densely branched.

*Abdomen* (figs. 3, 4, and 5). Smooth. Seg. I: Hairs 6 and 7 large, spiculate. Seg. II: Hair 6 large, spiculate; hair 7 shorter, spiculate. Segs. III to V: Hairs 6 and 13 large, spiculate. Seg. VI: Hair 6 large, spiculate. Seg. VII: Hairs 1 and 13 most pronounced. Seg. VIII: Comb consisting of a patch of 10-46 spines, each spine bearing short baso-lateral spinules. Hair 1 with 4-8 branches; hairs 2 and 4 single; hair 3 with 7-11 branches; hair 5 with 4-8 branches. Siphon: Pale; index 2.03-2.37; acus present; single pair of hair tufts (hair 1) just distal to terminal pecten tooth, with 3-7 finely spiculate branches; pecten composed of a line of 18-28 teeth, rather evenly spaced, most of the teeth with a rather prominent denticle just before the middle and with 1-3 smaller denticles basally. Anal Segment: Anal plate complete; a paired detached acus-like structure basolaterally; spiculation very fine, inconspicuous, without stout spicules laterally on the dorsoposterior margins; hair 1 (*lh*) single, shorter than width of anal plate; hair 2 (*isc*) with 6-14 branches; hair 3 (*osc*) single, about twice length of *isc*; hair 4 (ventral brush) with 16 (once 17) tufts, each tuft arising from the barred area, posterior 4 bars not laterally connected. Anal gills variable in length, shorter than anal plate when larva is reared in brackish water, as long or slightly longer than anal plate when reared in fresh water.

#### *Third-Instar Larva.*

Similar to the fourth-instar larva except as follows: Antennal hair 4 less sharply bent. Hair 8 of the prothorax is 0.21 to 0.44 as long as hair 7. Area of sclerotization of siphon reduced basally, as shown in figure 9. Anal plate incomplete. Two to four of the basal ventral brush tufts not arising from well-defined grid elements (of the barred area). In general, all hairs have fewer branches than they do in the fourth-instar, and on the average there are fewer comb spines and pecten teeth.

#### *Second-Instar Larva.*

Generally similar to the third instar. Area of sclerotization of siphon still more reduced basally, as shown in figure 8. Differing principally in the even more incomplete development of the ventral brush, which has six to nine of the basal tufts not arising from well-defined grid elements. Comb spine and pecten teeth generally fewer in number (table 1).

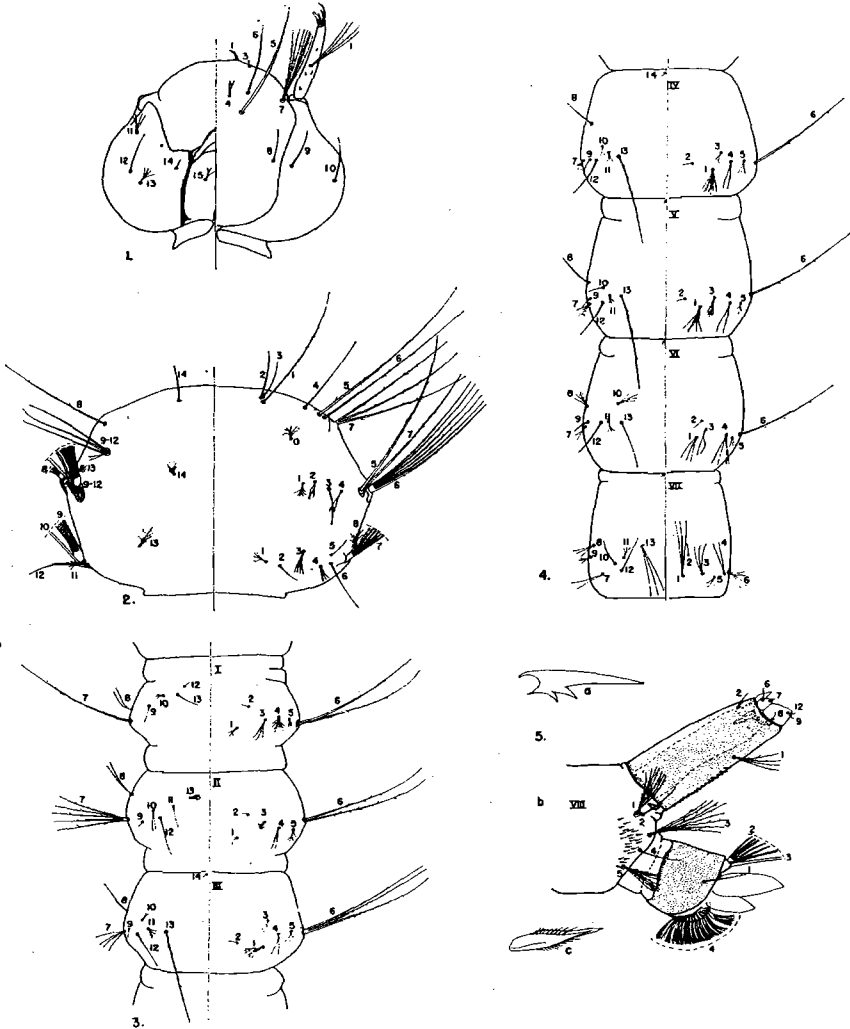
#### *First-Instar Larva.*

Conspicuously differing from the other larval instars in having the egg burster (*eb* in fig. 6) present on the head, and in completely lacking the ventral brush (fig. 7). Terminally, the antennae each have two long hairs and two short ones (fig. 10).

#### *Aedes (Ochlerotatus) taeniorhynchus* (Wiedemann)

The fourth-instar larva of this species has been described in some detail by the following authors: Lane (1953), Carpenter, Middle-

kauff, and Chamberlain (1946), Dyar (1928), Matheson (1944), and Carpenter and LaCasse (1955). However, as with *A. sollicitans*, no one has described all of the chaetotaxy. Since there are no basic differences in the type and position of the body hairs, drawings were not prepared. However, counts of numbers of branches have been



Larva of *Aedes sollicitans*. Fourth instar. (All figures with a center line illustrate the ventral surface on the left and the dorsal surface on the right). Fig. 1, Head; Fig. 2, Thorax; Fig. 3, Abdominal segments I-III; Fig. 4, Abdominal segments IV-VII; Fig. 5, Terminal abdominal segments.

made for all hairs on a small number of specimens (available upon request from the author as a mimeographed table). The first-instar larva has been figured and included in a key to the first-instar larvae of California *Aedes* by Bohart (1954). The other larval instars have not been previously described.

#### *Fourth-Instar Larva.*

Differing from the fourth-instar larva of *A. sollicitans* principally as follows: integument of thorax and abdomen densely spiculate (spicules easily visible at 90x). Hair 8 of prothorax is 0.06 to 0.13 as long as hair 7. Comb consisting of a patch of scales, each scale with a rather even apical fringe of spinules. Anal plate without an acus-like structure; with stout spinules laterally on the dorso-posterior margin. Siphon index 1.5-1.8; most of the pecten teeth with several basodorsal denticles, as well as 1-4 closely spaced ventral denticles before the middle.

#### *Third-Instar Larva.*

Similar to the fourth-instar except as follows: antennal hair 4 less sharply bent. Hair 8 of the prothorax is 0.05 to 0.07 as long as hair 7. Area of sclerotization of siphon reduced basally similar to that shown for *A. sollicitans* in figure 9. Anal plate incomplete. One to three of the basal ventral brush tufts not arising from well-defined grid elements. Body spiculation present but not as pronounced as in the fourth stage. In general, all hairs have fewer branches than they do in the fourth stage, and there are fewer comb spines and pecten teeth. This instar differs from the equivalent instar of *A. sollicitans* in the same manner that the fourth instar does.

#### *Second-Instar Larva.*

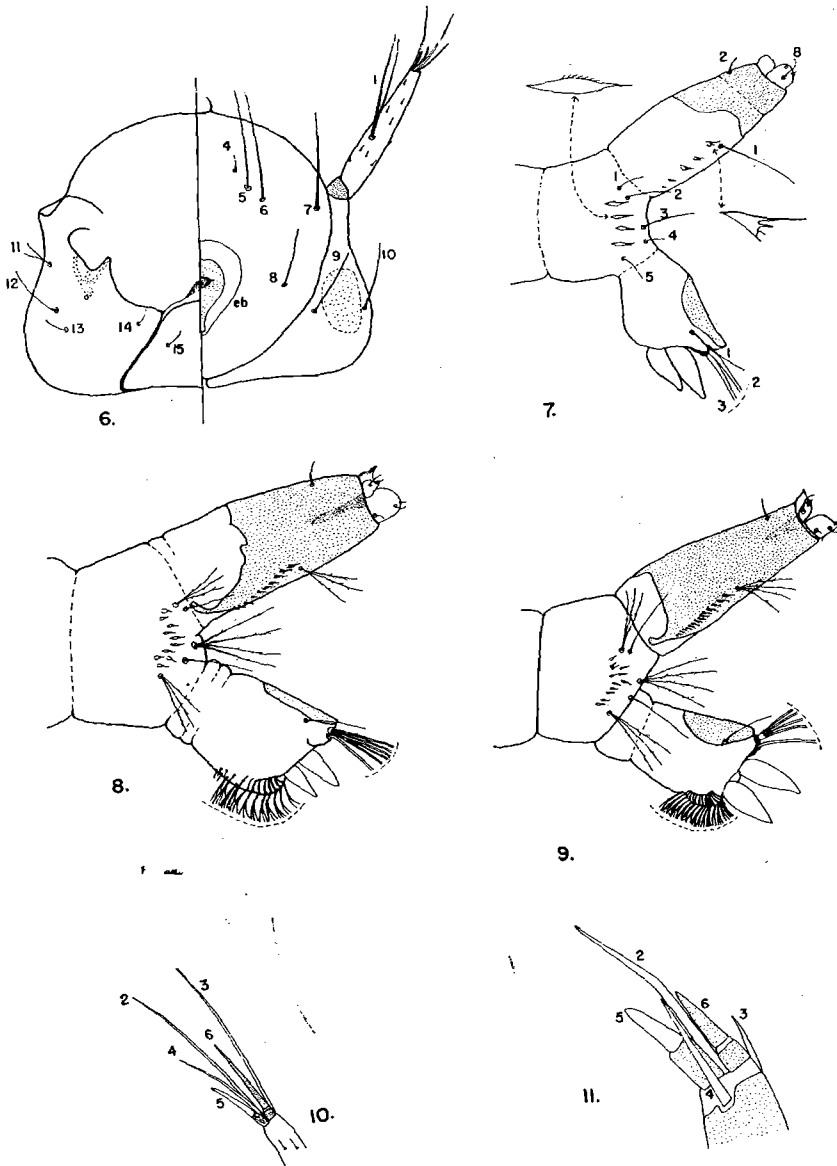
Differing from the third-instar larva in the same manner as described for *A. sollicitans*. This instar differs from the equivalent instar of *A. sollicitans* principally on the shape of the comb teeth. While tending to overlap with the shape of the comb teeth typical for *A. sollicitans*, the patch of comb teeth found on this stage of *A. taeniorhynchus* will differ in that inevitably some of the teeth will have more than one strong apical spine and/or an apical fringe of spinules. The spiculation of the body, so prominent on the fourth instar and less so on the third, is absent or quite indistinct here.

#### *First-Instar Larva.*

This stage is closely similar to the same instar of *A. sollicitans* but differs in the easily determined characteristic of having only one long terminal hair on the antenna.

### *Separation of Instars*

Details sufficient for distinguishing between instars are contained in table 1. Measurements of the head capsule were made in the region of greatest width, which occurred commonly between the ocular areas. Care was taken to use only unflattened specimens for this purpose. The second and third instars are often difficult to distinguish from one another. Reference to figures 8 and 9 shows that the siphonal



Larva of *Aedes sollicitans*. Fig. 6, First instar. Head; Fig. 7, First instar. Terminal abdominal segments; Fig. 8, Second instar. Terminal abdominal segments; Fig. 9, Third instar. Terminal abdominal segments; Fig. 10, First instar. Apex of right antenna; Fig. 11, Fourth instar. Apex of right antenna.

Table 1. Table for separation of the larval instars of *Aedes sollicitans* and *A. taeniorhynchus*.

Instar	Egg burster (eb, fig. 6)	Width of head capsule (in mm.) (range)	Number of comb scales (range)	Number of pecten teeth (range)	Anal plate	Ventral brush Number of basal tufts not arising from grid elements
1st	Present	0.25-0.40	4-6	3-5	Incomplete	No ventral brush
2nd	Absent	0.44-0.58	8-13	8-12	Incomplete	6-9
3rd	Absent	0.70-0.92	10-24	11-21	Incomplete	1-4
4th	Absent	0.92-1.35	9-46	18-28* 12-19**	Complete	0

\**A. sollicitans*.

\*\**A. taeniorhynchus*.

Table 2. Table for separation of *Aedes sollicitans* and *A. taeniorhynchus* in the various larval stages.

Instar	Character	<i>A. sollicitans</i>	<i>A. taeniorhynchus</i>
1st	Terminal antennal setae	Two long setae	Only one long seta
2nd	Comb teeth	With only one pronounced spine (fig. 7)	At least some with apical fringe instead of apical spine
3rd	Prothoracic hair 8	0.21 to 0.44 as long as hair 7	0.05 to 0.07 as long as hair 7
	Body spiculation	Absent	Present (not pronounced)
	Comb teeth	Same as in 2nd instar	Same as in 2nd instar
4th	Prothoracic hair 8	0.56 to 0.72 as long as hair 7	0.06 to 0.13 as long as hair 7
	Comb teeth	Each one a spine, bearing short baso-lateral spinules (fig. 5c)	Each with rather even apical fringe of spinules
	Anal plate	With a paired detached acus-like structure baso-laterally	Without such a structure
		Without stout spiculation	With stout spicules laterally on the dorso-posterior margins
	Pecten teeth	Without baso-dorsal denticles	Most of teeth with several baso-dorsal denticles

sclerotization of the third instar is more complete than that of the second. However, in addition to differences in head capsule width, these two stages are best distinguished on the number of the basal tufts of the ventral brush not arising from lateral grid-element bars, the third stage having significantly fewer (1-4) than the second stage (6-9).

### *Separation of Species*

Table 2 summarizes the characters which aid in the separation of *A. sollicitans* and *A. taeniorhynchus* in the various larval instars. The larvae of these two species are most difficult to separate in the second stage. The only character presently known to be useful for this purpose is the shape of the comb teeth. Although considerable intergradation in shape and spinulation of the comb teeth occurs between the two species, the comb patch of *A. sollicitans* was not seen to have teeth other than with a single strong central spine; whereas, at least some of the comb teeth of *A. taeniorhynchus* have only an apical fringe of spinules or else more than one strong apical spine.

A count of the number of branches of all head and body hairs for a small number of fourth instar larvae of both species is available upon request to the author.

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