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PUPAE OF THE NEARCTIC ANOPHELINE MOSQUITOES  
NORTH OF MEXICO

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## PUPAE OF THE NEARCTIC ANOPHELINE MOSQUITOES NORTH OF MEXICO<sup>1</sup>

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In view of the attention that has been centered on nearly all phases of the life history, taxonomy and control of Nearctic anopheline mosquitoes it is extraordinary that the pupal stage of most species has been almost completely neglected. Only five of the fifteen species have been more or less completely described in the pupal stage. The purpose of this study, therefore, is to describe (or redescribe), and give illustrations of the anopheline pupae of the Nearctic region north of Mexico and to present a tentative key for their identification.

The system of chaetotaxy used by the writer in a previous paper on mosquito pupae (Penn, 1949) has been made obsolete by the comparative study of Knight and Chamberlain (1948). The system proposed by them has been adopted here and is followed without change.

It is a pleasure to acknowledge with thanks the cooperation of the following in obtaining pupae of certain species for this study: Dr. Robert Matheson and Mr. Richard F. Darsie, Jr. of Cornell University; Dr. Alan Stone of the U. S. Bureau of Entomology and Plant Quarantine; Dr. Richard M. Bohart of the University of California; Dr. Luis Vargas of the Mexican Instituto de Salubridad y Enfermedades Tropicales; and Drs. Thomas F. Hall and W. E. Snow of the Tennessee Valley Authority.

Abbreviations found in the text of the paper have the following equivalents. Location of specimens examined: *CU* = Cornell University; *TU* = Tulane University; and, *USNM* = U. S. National Museum; collectors: *GHB* = George H. Bick; *GHP* = George H. Penn; *JVB* = John V. Baus; *LLE* = Leslie L. Ellis; *MHP* = Mimi H. Penn; *RFD* = Richard F. Darsie, Jr.; *RM* = Robert Matheson; *RMB* = Richard M. Bohart; and *WVK* = Willard V. King.

### TENTATIVE KEY TO THE PUPAE OF NEARCTIC ANOPHELES

1. Seta  $\delta$ -VIII with at least five smaller side branches. . . . . 2  
   Seta  $\delta$ -VIII without side branches, either acute or shallowly cleft at tip. . . . 13
2. Paddle margin with conspicuous, closely spaced, coarse, wide teeth laterally. (Figure 1) . . . . . *A. walkeri*  
   Paddle margin various, but never with closely spaced, coarse teeth. . . . . 3
3. Seta  $\delta$ -VII long and thin, gradually tapering to an acute point; seta  $\delta$ -V at least seven times longer than its diameter. . . . . 4  
   Seta  $\delta$ -VII short and stout, usually with blunt apex, or, if with sharp apex,

<sup>1</sup> The first of a series of reports resulting from researches on *Mosquitoes and Other Aquatic Insects* supported by the University Council on Research of the Tulane University of Louisiana.

- not gradually tapering; seta 8-V never more than five times longer than its diameter. . . . . 6
4. Seta 8-VII more than ten times longer than its diameter; seta 8-VIII with less than 9 side branches; seta 2-II less than 3-forked; seta 2-III less than 5-forked; seta 2-IV and 5-IV less than 3-forked; seta 2-V simple or 2-forked; seta 2-VI always simple; seta 5-III less than 7-forked. (Figure 2).  
*A. occidentalis*
- Seta 8-VII about seven times longer than its diameter; seta 8-VIII with more than 12 side branches; seta 2-II more than 5-forked; seta 2-III more than 6-forked; seta 2-IV and 5-IV more than 5-forked; seta 2-V more than 3-forked; seta 2-VI more than 2-forked; seta 5-III more than 8-forked. . . . . 5
5. Terminal paddle seta (8) 2-branched; seta 5-IV less than 8-forked; seta 3-I less than 4-forked; generally found only west of the Rocky Mountains. (Figure 3). . . . . *A. freeborni*
- Terminal paddle seta (8) always simple; seta 5-IV more than 9-forked; seta 3-I more than 6-forked; generally found only east of the Rocky Mountains. (Figure 10). . . . . *A. crucians*
6. Terminal paddle seta (8) usually with 3 or 4 smaller side branches (occasionally only one side branch, but seta never simple). . . . . 7
- Terminal paddle seta (8) always simple. . . . . 8
7. Setae 7 and 10 on segment II about equal in length; seta 5 more than 7-forked on segments III and IV, less than 3-forked on segments V and VI, and more than 3-forked on VIII; seta 2-IV more than 6-forked. (Figure 4)  
*A. quadrimaculatus*
- Seta 7-II at least twice the length of 10-II; seta 5 less than 6-forked on segments III and IV, more than 4-forked on segments V and VI, and not more than 2-forked on VIII; seta 2-IV less than 5-forked. (Figure 5). . . . . *A. atropos*
8. Seta 7-II at least three times the length of 10-II. (Figure 6). . . . . *A. aztecus*
- Seta 7-II more or less equal in length to 10-II, or, seta 7-II not more than twice the length of 10-II. . . . . 9
9. Seta 8-IV averaging about half or less the length of 8-VII. . . . . 10
- Seta 8-IV averaging two-thirds or more the length of 8-VII. . . . . 11
10. Seta 4-IV simple; seta 5-IV less than 6-forked; seta 6-IV more than 5-forked; seta 7-VII simple; cephalothoracic setae: 7 more than 2-forked, 10 simple, and 11 more than 3-forked. (Figure 7). . . . . *A. punctipennis*
- Seta 4-IV more than 2-forked; seta 5-IV more than 6-forked; seta 6-IV less than 4-forked; seta 7-VII more than 3-forked; cephalothoracic setae: 7 simple, 10 more than 2-forked, and 11 less than 2-forked. (Figure 8) *A. earlei*
11. Seta 5 more than 13-forked on segment IV, more than 9-forked on V, more than 8-forked on VI, and more than 7-forked on VII; seta 4-II more than 3-forked near tip. (Figure 9). . . . . *A. georgianus*
- Seta 5 less than 11-forked on segment IV, less than 8-forked on V, less than 7-forked on VI, and less than 5-forked on VII; seta 4-II usually simple, and never more than 2-forked near tip. . . . . 12

12. Seta 5-III more than 8-forked; seta 3-I more than 6-forked; seta 4-I usually 2-forked or simple; metanotal seta 10 simple. (Figure 10) . . . . . *A. crucians*  
 Seta 5-III less than 7-forked; seta 3-I less than 4-forked; seta 4-I more than 2-forked; metanotal seta 10 more than 2-forked. (Figure 11) . . . . . *A. bradleyi*
13. Setae 8-VII and VIII approximately twice the length of 8-VI; seta 5-III very small, simple; seta 2 on segments VI and VII very small, less than one-tenth the length of the respective segments. (Figure 12) . . . . . *A. barberi*  
 Setae 8-VI, VII and VIII approximately same length; seta 5-III medium to long, four- or more forked; seta 2 on segments VI and VII very long, exceeding lengths of the respective segments. . . . . 14
14. Seta 5-I long, four to five times longer than 6-I; seta 7-II nearly twice the length of 10-II. (Figure 13) . . . . . *A. franciscanus*  
 Seta 5-I small, sub-equal to 6-I; seta 7-II less than the length of 10-II. (Figure 14) . . . . . *A. albimanus*

ANOPHELES (ANOPHELES) WALKERI Theobald (1901)

Pupa heretofore undescribed. However, Hurlbut (1941) gave a few general notes on the species; Burgess (1946) described the dorsal pigmentation of living pupae; Sabrosky (1946) included the species in a key to the pupae of Michigan anophelines; and, Vargas and Matheson (1948) included it in a key to the pupae of the *maculipennis* complex of North America.

*Specimens Examined.* Seven pupal exuviae as follows: NEW YORK: 1 ♀ from Cayuta Lake, Schuyler County, VI-14-46, GHP, GHB (TU 37). TENNESSEE: 2 ♂♂ and 4 ♀♀ from Reelfoot Lake, Obion County, IX-10-39, G. E. Quinby (USNM).

*Cephalothorax.* Postocular, anterothoracic, dorsal and supra-alar setae all small or medium and rather inconspicuous except seta 7 which is long and simple. Metanotal setae as follows: 10 medium, simple; 11 medium, three- to four-forked; 12 long, three-forked.

*Abdomen.* All dorsal setae non-plumose. *Segment I:* 3 medium, simple or rarely three-forked; 4 medium, four- to two-forked; 5 long, two-forked near tip, range from simple to three-forked; 6 medium, five- to six-forked; 7 medium-long, three-forked near middle, or rarely simple; 8 small, three-forked to simple; 10 medium, five- to six-forked.

*Segment II:* 1 very small, simple; 2 medium, six- to seven-forked; 3 medium, six- to seven-forked; 4 medium, stout, simple to two-forked near tip; 5 small, five- or six-forked; 6 small, four- to six-forked; 7 small, three- or four-forked; 8 small, transparent spine; 10 medium, five-forked, or rarely four-forked.

*Segment III:* 1 very small, simple or two-forked; 2 medium, five- or six-forked; setae 3, 4 and 6 inconspicuous on this and segments IV through VII; 5 medium, five- to seven-forked; 7 medium, five- to three-forked; 8 small, stout, dark-pigmented spine about three times the length of 8-II.

*Segment IV:* 1 very small, simple on this and all following segments; 2 medium-long, five- or six-forked; 5 medium, five-forked, or rarely ten-forked; 7 medium, three- or four-forked; 8 similar to and about twice the length of 8-III.

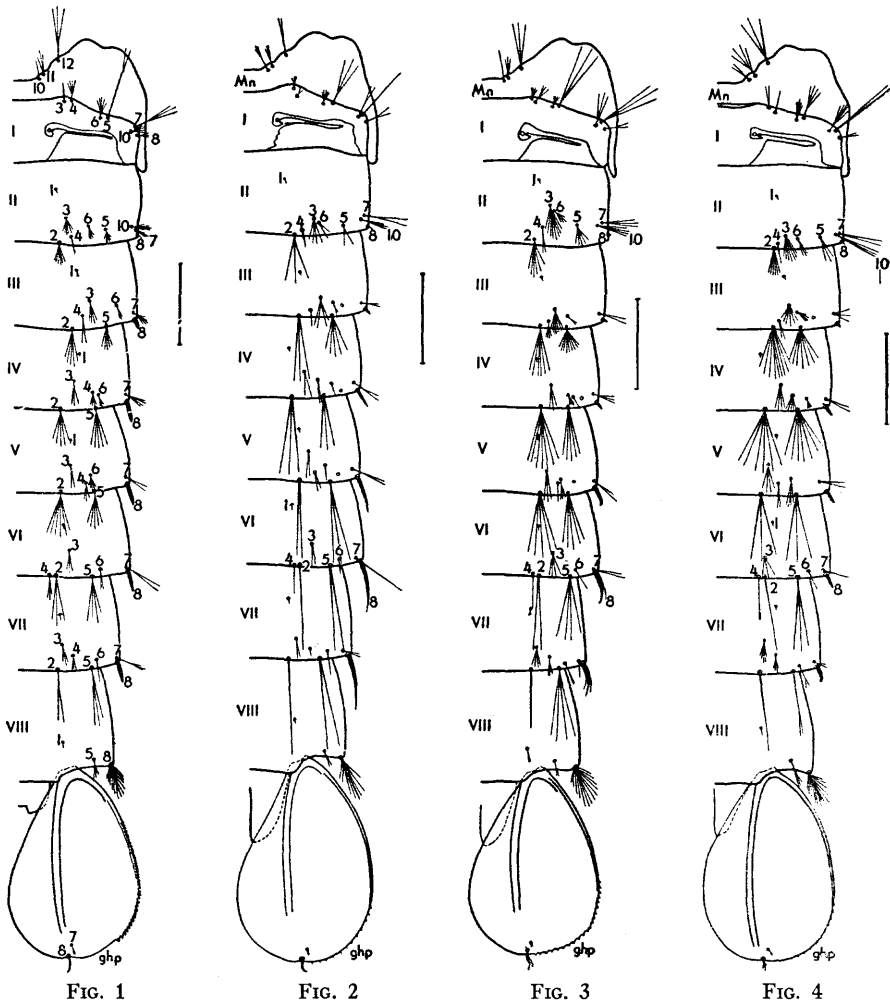


FIG. 1. *Anopheles walkeri*. Right dorsal aspect of metanotum and abdomen of female from Tennessee.<sup>2</sup>

FIG. 2. *Anopheles occidentalis*. Right dorsal aspect of metanotum and abdomen of male from California.

FIG. 3. *Anopheles freeborni*. Right dorsal aspect of metanotum and abdomen of male from California.

FIG. 4. *Anopheles quadrimaculatus*. Right dorsal aspect of metanotum and abdomen of male from Louisiana.

*Segment V*: 2 long, six- to four-forked; 5 medium-long, five- to four-forked; 7 medium, two- to four-forked; 8 similar to and averaging slightly longer than  $\delta$ -IV.

*Segment VI*: 2 long, three- or four-forked; 5 long, four- to six-forked; 7 medium-long, two- to four-forked; 8 similar to and about equal to  $\delta$ -V.

<sup>2</sup> Vertical bar to right of this and other figures equals 0.5 mm.

*Segment VII*: 2 long, two-forked; 5 long, three- to four-forked; 7 medium, three-forked near tip; 8 similar to and averaging slightly shorter than 8-VI.

*Segment VIII*: 5 small, three-forked, or rarely two- or four-forked; 8 dark, basally about same length as 8-VII with twelve to sixteen smaller side branches.

*Paddle*: Buttress broad at base, giving way almost immediately to a series of short, coarse, blunt teeth which increase gradually in size nearly to apex; remainder of margin either entire, or with a few scattered short, fine hairs around apex. Accessory seta (7) very small, two- to three-forked; terminal seta (8) medium, stout, simple or rarely split at tip.

ANOPHELES (ANOPHELES) OCCIDENTALIS Dyar and Knab (1906)

Pupa incompletely described by Aitken (1945) who included a figure of the terminal abdominal segments, and by Vargas (1943) who included a complete figure of the metanotum and abdominal segments; Vargas and Matheson (1948) included the species in a key to the Nearctic pupae of the *maculipennis* complex and gave figures of the metanotum, abdomen and trumpet of specimens from California. Burgess (1946) gave a brief description of the dorsal pigmentation of living pupae.

*Specimens Examined*. Three pupal exuviae as follows: CALIFORNIA: 1 ♂ and 2 ♀♀ from 10 mi. s. San Francisco, San Francisco County, IX-17-47, RMB (TU 706).

*Cephalothorax*. Postocular, anterothoracic, dorsal and supra-alar setae small to medium except seta 7 which is rather long and simple. Metanotal setae as follows: 10 medium, three-forked to simple; 11 small, two- to three-forked; 12 long, two- to three-forked near middle.

*Abdomen*. All dorsal setae non-plumose. *Segment I*: 3 small, two-forked, or simple to three-forked; 4 small, two-forked, or simple to four-forked; 5 long, three- to two-forked; 6 small, five- to seven-forked; 7 long, simple or two-forked; 8 medium, simple or two-forked near middle; 10 medium, two- to four-forked.

*Segment II*: 1 very small, simple on this and all following segments; 2 conspicuous, medium-long, three- to two-forked; 3 medium, four- to seven-forked; 4 small, stout, simple or two-forked at tip; 5 small, three- to two-forked; 6 small, two- to six-forked; 7 medium-long, two-forked; 8 small, thin, transparent; 10 medium, three-forked.

*Segment III*: Setae 3, 4 and 6 rather inconspicuous, small to medium and variously forked on this and segments IV through VII; 2 long, three- to five-forked; 5 medium-long, five-forked, range from three- to seven-forked; 7 small, two-forked; 8 small, stout, transparent and roughly equal to or very slightly longer than 8-II.

*Segment IV*: 2 long, three- to two-forked; 5 long, three- to two-forked; 7 medium, longer than 8, two-forked or simple; 8 dark-pigmented, tapered to an acute point, roughly twice the length of 8-III.

*Segment V*: 2 long, two-forked or simple; 5 long, three- to two-forked; 7 medium, about equal to 8, two-forked or simple; 8 similar to and roughly twice the length of 8-IV.

*Segment VI*: 2 long, simple; 5 long, two-forked; 7 long, roughly equal to 8, simple; 8 similar to and varying from a half longer to twice the length of 8-V.

*Segment VII*: 2 long, simple; 5 long, two-forked or simple; 7 small, less than one-

fourth the length of  $\delta$ , simple or two-forked;  $\delta$  similar to and averaging a third longer than  $\delta$ -VI.

*Segment VIII*: 5 small, two-forked;  $\delta$  shorter than  $\delta$ -VII, with six to eight smaller side branches.

*Paddle*: Apical half of lateral margin with a few widely spaced fine teeth. Accessory seta (7) very small, two-forked or simple; terminal seta ( $\delta$ ) small, stout, simple and slightly curved.

ANOPHELES (ANOPHELES) FREEBORNI Aitken (1939)

Pupa incompletely described by Aitken (1945) who included a figure of the terminal abdominal segments; Burgess (1946) presented a photograph of the dorsum of living pupae and included a few notes on the pigmentation.

*Specimens Examined*. Three pupal exuviae as follows: CALIFORNIA: 2 ♂♂ and 1 ♀ from Davis, Yolo County, VIII-?-46, RMB (TU 703).

*Cephalothorax*. Postocular, anterothoracic, dorsal and supra-alar setae all medium in size and rather inconspicuous except seta 7 which is long and simple. Metanotal setae as follows: 10 medium, simple or two-forked near tip; 11 small, three-forked, range from two- to four-forked; 12 long, three- or two-forked.

*Abdomen*. All dorsal setae non-plumose. *Segment I*: 3 small, four- or three-forked; 4 small, three-forked, range from two- to four-forked; 5 long, three- or two-forked; 6 small, four- or five-forked; 7 long, three- or two-forked; 8 medium, simple to three-forked; 10 medium, two- to four-forked.

*Segment II*: 1 small, simple seta on this and all following segments; 2 medium, five- to seven-forked; 3 medium, seven- to ten-forked; 4 medium, two-forked or simple; 5 medium, four- or five-forked; 6 small, two- to six-forked; 7 medium, three- to five-forked; 8 small, non-pigmented spine; 10 two- to four-forked, subequal to 7 in length.

*Segment III*: Setae 3, 4 and 6 rather small and unimportant on this and segments IV through VII; 2 long, six- to eight-forked; 5 medium, nine- to eleven-forked; 7 medium, three- or two-forked; 8 small, light-brown pigmented spine subequal to  $\delta$ -II in length.

*Segment IV*: 2 long, seven- to five-forked; 5 long, five- to eight-forked; 7 medium, at least twice the length of  $\delta$ , two- or three-forked;  $\delta$  similar to and two to three times the length of  $\delta$ -III.

*Segment V*: 2 long, five- to three-forked; 5 long, five- to three-forked; 7 medium, slightly longer than  $\delta$ , two-forked, range from simple to three-forked;  $\delta$  one-third longer to twice the length of  $\delta$ -IV, dark-pigmented, slightly curved, and with one or two small side branches on some specimens.

*Segment VI*: 2 long, two-forked; 5 long, four-forked, or two- to three-forked; 7 medium, subequal to  $\delta$ , simple or two-forked;  $\delta$  dark-pigmented, well curved inwards, sometimes with smaller side branches, nearly twice the length of  $\delta$ -V.

*Segment VII*: 2 long, simple or two-forked; 5 long, four-forked, or two- to three-forked; 7 small, less than half the length of  $\delta$ , two-forked, or three- to four-forked;  $\delta$  similar and subequal to  $\delta$ -VI.

*Segment VIII*: 5 small, two- to three-forked; 8 shorter than 8-VII, dark-pigmented, with fourteen to thirteen smaller side branches.

*Paddle*: Distal half of lateral margin with widely spaced fine teeth. Accessory seta (7) very small, simple or two-forked; terminal seta (8) small, stout, slightly curved, two-branched.

ANOPHELES (ANOPHELES) QUADRIMACULATUS (Say, 1824)

Pupa heretofore undescribed although Vargas (1943) included a figure of the metanotum and dorsal abdominal segments without a description; Aitken (1945) included a few notes on pupae from Jefferson County, Florida; Burgess (1946) described the pigmentation of the dorsum of living pupae and included a photograph; Sabrosky (1946) included the species in a key to the pupae of Michigan anophelines; and, Vargas and Matheson (1948) included it in a key to the pupae of the *maculipennis* complex in North America.

*Specimens Examined*. Twenty-five pupal exuviae as follows: LOUISIANA: 1 ♂ from Chalmette, St. Bernard Parish, XI-7-47, GHP, LLE, JVB (TU 125); 2 ♂♂ and 6 ♀♀ from Robert, Tangipahoa Parish, VII-31-48, GHP, MHP (TU 717); 1 ♀ from 1 mi. s. Covington, St. Tammany Parish, VIII-16-48, GHP, MHP (TU 793); 2 ♂♂ and 2 ♀♀ from 1.5 mi. n. Madisonville, St. Tammany Parish, VIII-16-48, GHP, MHP (TU 794); 1 ♂ and 2 ♀♀ from 3 mi. n. Franklin, St. Mary Parish, VIII-25-48, GHP, MHP (TU 105). SOUTH CAROLINA: 1 ♂ from Parris Island, Beaufort County, VI-19-45, GHB (TU P-488); 5 ♂♂ and 2 ♀♀ from Parris Island, Beaufort County, VII-23-45, GHB (TU P-509).

*Cephalothorax*. Postocular, anterothoracic, dorsal and supra-alar setae all medium or small and unimportant except seta 7 which is long and simple. Metanotal setae as follows: 10 medium, two-forked near tip, range from simple to three-forked; 11 medium, three- or four-forked; 12 long, usually three-forked, range from two- to five-forked.

*Abdomen*. All dorsal setae non-plumose. *Segment I*: 3 small, three- to five-forked, or rarely two-forked; 4 small, three-forked, or occasionally simple or two-forked; 5 medium, five- to three-forked; 6 small, five- to nine-forked; 7 long, two- to four-forked; 8 small, two-forked or simple, or rarely four-forked; 10 medium, five- or six-forked, or occasionally two-forked.

*Segment II*: 1 very small, simple on this and all following segments; 2 medium, six- to four-forked; 3 medium, six- to eight-forked; 4 small, simple or two-forked near tip; 5 medium, three- or four-forked; 6 small, five- to three-forked; 7 long, two- to four-forked; 8 small, transparent peg; 10 long, two- to five-forked.

*Segment III*: Setae 3, 4 and 6 rather inconspicuous, small to medium on this and segments IV through VII; 2 long, seven- to nine-forked; 5 medium, seven- to eleven-forked; 7 small, two- to four-forked; 8 small, dark-pigmented peg about twice the length of 8-II.

*Segment IV*: 2 long, six- to eight-forked; 5 long, seven- to eight-forked; 7 medium, two- to three-forked; 8 similar to and almost twice the length of 8-III.

*Segment V*: 2 long, two- to three-forked, or rarely simple; 5 long, three- to two-forked; 7 medium, two- to three-forked; 8 similar to and slightly longer than 8-IV.

*Segment VI*: 2 long, simple; 5 long, three- or two-forked; 7 medium, simple; 8 similar to and slightly longer than 8-V.

*Segment VII*: 2 long, simple; 5 long, two- or three-forked near tip, rarely simple; 7 small, simple or two-forked; 8 similar to and slightly longer than 8-VI.

*Segment VIII*: 5 medium, three-forked, or rarely four-forked; 8 with stout, dark base and ten to sixteen smaller side branches.

*Paddle*: Margin very finely serrate laterally at apex of buttress, from there on with short, widely scattered fine hairs around apical third. Accessory seta (7) small, two-forked, or occasionally simple or three-forked; terminal seta (8) light brown, medium, usually with one or two smaller side branches, rarely simple, usually straight.

#### ANOPHELES (ANOPHELES) ATROPOS Dyar and Knab (1906)

The pupa has not been described previously although Beyer (1923) included a few non-diagnostic lines in a discussion of the species, and Vargas and Matheson (1948) included it in a key to the Nearctic pupae of the *maculipennis* complex.

*Specimens Examined*. Two pupal exuviae as follows: FLORIDA: 2 ♀♀ from the road to St. George, Nassau County, VIII-16-45, A. E. Pritchard Nos. 104, 105 (USNM).

*Cephalothorax*. Postocular, dorsal and supra-alar setae absent from both specimens. Anterotheracic: 4 medium, four-forked; 5 medium, five-forked; 6 medium, two-forked; 7 long, simple or two-forked. Metanotal: 10 medium, two-forked; 11 medium, two-forked; 12 medium, three-forked.

*Abdomen*. All dorsal setae non-plumose. *Segment I*: 3 small, simple; 4 small, two- or three-forked; 5 medium, two- or three-forked; 6 missing from both specimens; 7 long, three-forked; 8 small, simple; 10 medium, six- or seven-forked near base.

*Segment II*: 1 small, simple on this and all following segments; 2 medium, five- or six-forked; 3 small, four-forked; 4 medium, stout, simple; 5 small, three-forked; 6 small, simple; 7 medium, three- or two-forked; 8 very small, transparent, stout spine; 10 small, three- or four-forked near base.

*Segment III*: Setae 3, 4 and 6 all small and unimportant on this and segments IV through VII; 2 medium-long, five- to seven-forked; 5 medium, six- or five-forked; 7 medium, three- to six-forked; 8 small, dark-pigmented, stout spine at least twice the length of 8-II.

*Segment IV*: 2 long, four-forked; 5 long, four-forked; 7 medium, two- or three-forked; 8 similar to and about twice the length of 8-III.

*Segment V*: 2 long, two-forked; 5 long, four- to six-forked; 7 medium, two-forked; 8 similar to and about the same length as 8-IV.

*Segment VI*: 2 long, two-forked; 5 long, four- to five-forked; 7 medium, two-forked near apex; 8 similar to and about same length as 8-V.

*Segment VII*: 2 long, simple or two-forked; 5 long, four- or three-forked; 7 small, simple, very inconspicuous; 8 similar to and about one-third longer than 8-VI.

*Segment VIII*: 5 small, two-forked; 8 with stout basal spine about equal to 8-VII with eight to nine smaller side branches.

*Paddle*: Buttress strong, descending from base two-thirds of way to apex, with a

fringe of small teeth which give way to a fringe of rather inconspicuous short fine hairs on apical third of lateral margin. Accessory seta (7) small, simple; terminal seta (8) short, three- to four-forked near middle.

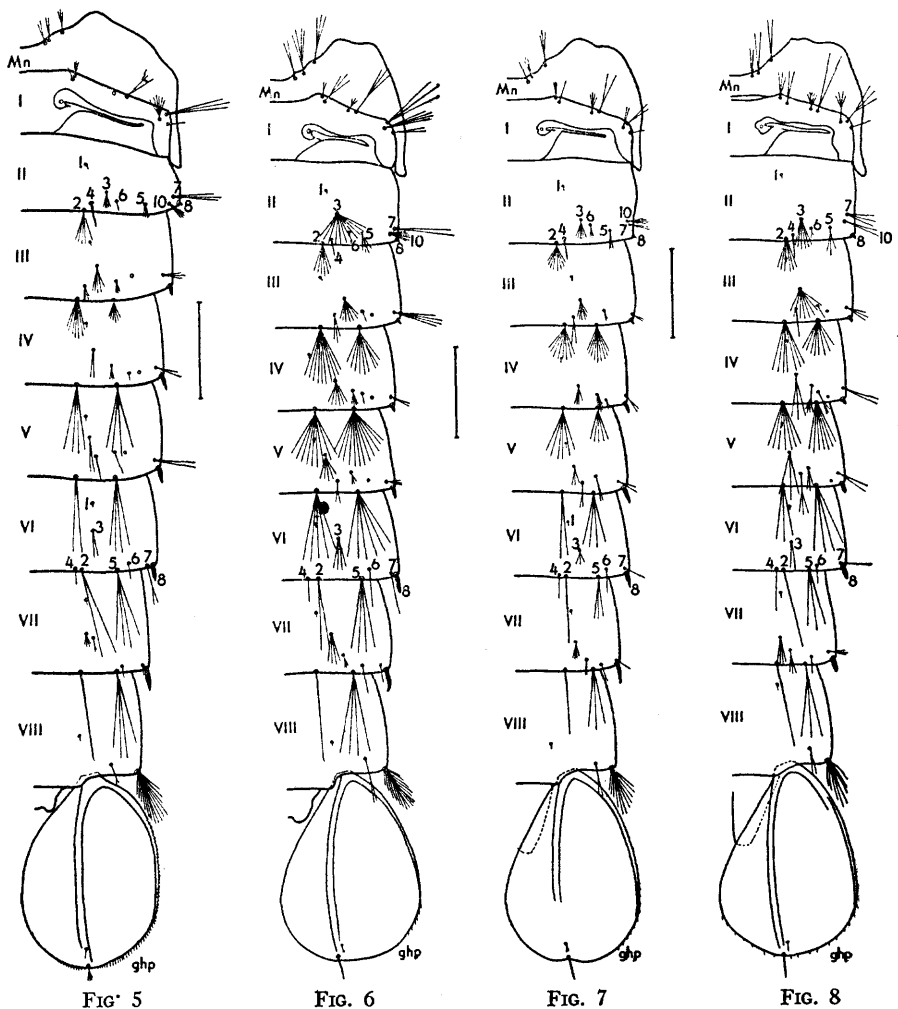


FIG. 5. *Anopheles atropos*. Right dorsal aspect of metanotum and abdomen of female from Florida.

FIG. 6. *Anopheles aztecus*. Right dorsal aspect of metanotum and abdomen of female from Mexico.

FIG. 7. *Anopheles punctipennis*. Right dorsal aspect of metanotum and abdomen of male from New York.

FIG. 8. *Anopheles earlei*. Right dorsal aspect of metanotum and abdomen of male from Michigan.

#### ANOPHELES (ANOPHELES) AZTECUS Hoffmann (1935)

Pupa undescribed previously although Vargas (1943) gave a figure of the metanotum and abdominal segments, and Vargas and Matheson (1948) included it in a

key to pupae of the Nearctic *maculipennis* complex and included a photograph of the trumpets of specimens from Xochimilco, D.F., Mexico.

I am unaware of any records of this species north of the Mexican border, but since its affinities properly lie with the American species it has been included here.

*Specimens Examined.* Two pupal exuviae as follows: MEXICO: 2 ♀♀ from "Sta. Ursula Coapa," Distrito Federal, A. M. Palacios (*TU 138*).

*Cephalothorax.* Specimens littered with debris so that postocular, anterothoracic and supra-alar setae were indistinguishable. Dorsal seta (8) medium, simple. Metanotal setae: 10 medium, two- to four-forked at tip; 11 medium, four- to three-forked; 12 long, three-forked at tip.

*Abdomen.* All dorsal setae non-plumose. *Segment I:* 3 small, two- to five-forked; 4 medium, three- to six-forked; 5 long, three- to four-forked near tip; 6 small, three- to six-forked; 7 long, three- to two-forked; 8 medium, two-forked or simple; 10 long, four- to five-forked.

*Segment II:* 1 very small, simple on this and all following segments; 2 medium, six-forked; 3 medium-long, nine- to eleven-forked; 4 small, simple or two-forked at tip; 5 small, four-forked; 6 small, two-forked; 7 long, two- or three-forked; 8 small, stout, transparent spine; 10 small, six- or seven-forked.

*Segment III:* Setae 3, 4 and 6 rather unimportant on this and segments IV through VII; 2 medium, six- to ten-forked; 5 small, eight- to ten-forked; 7 medium-long, four-forked; 8 similar to and nearly twice the length of 8-II.

*Segment IV:* 2 long, nine- or ten-forked; 5 long, eight- to twelve-forked; 7 medium, two-forked; 8 similar to and about a third longer than 8-III.

*Segment V:* 2 long, five- or six-forked; 5 long, six- to four-forked; 7 small, three-forked; 8 darker, but nonpigmented, about twice the length of 8-IV.

*Segment VI:* 2 long, two-forked or simple; 5 long, four- to five-forked; 7 medium-long, simple; 8 similar to and slightly longer than 8-V.

*Segment VII:* 2 long, simple; 5 long, four-forked; 7 small, simple; 8 similar to and about same length as 8-VI.

*Segment VIII:* 5 medium-long, two- to three-forked near tip; 8 base similar to 8-VI in shape and length, but with about sixteen smaller side branches.

*Paddle:* Margin entire, or with only three or four small spines near apex of but-tress on lateral side. Accessory seta (7) small, simple or two-forked at tip; terminal seta (8) medium, stout, simple, straight.

#### ANOPHELES (ANOPHELES) PUNCTIPENNIS (Say, 1823)

Pupa variously treated by a number of authors, including the following: Howard, Dyar and Knab (1912-1917) gave a figure of the whole pupa in lateral view and brief non-diagnostic notes; Senevet (1930) gave a complete detailed description and figure of the metanotum and dorsal abdominal segments of specimens from Illinois; Matheson (1944) gave a figure of the whole pupa in lateral view without descriptive notes; Aitken (1945) gave an incomplete description and figure of the terminal abdominal segments of specimens from California; Burgess (1946) described the dorsal pigmentation of living pupae and included a figure; and, Sabrosky (1946) included the species in a key to the pupae of Michigan anophelines.

*Specimens Examined.* Fourteen pupal exuviae as follows: CALIFORNIA: 1 ♀ from Green Valley, Solano County, VIII-29-46, RMB (TU 704). MEXICO: 2 ♂♂ and 1 ♀ from Ixmiquilpan, Hidalgo, J. Martinez (TU 137). NEW YORK: 1 ♀ from Cornell Fish Hatchery, Tompkins County, V-24-46, GHP, GHB (TU 33); 1 ♂ and 1 ♀ from 6 mi. e. Ithaca, Tompkins County, V-24-46, GHP, GHB (TU 34); 2 ♂♂ and 2 ♀♀ from Ithaca, Tompkins County, VI-25-47, RFD (TU 133); 2 ♂♂ and 2 ♀♀ from Ithaca, Tompkins County, VIII-5-47, RFD (TU 134).

*Cephalothorax.* Postocular, anterothoracic, dorsal and supra-alar setae all medium or small and otherwise inconspicuous. Metanotal setae as follows: 10 medium, usually simple, rarely two-forked near tip; 11 medium, usually three-forked, occasionally four- or five-forked; 12 long, usually three-forked, range from two- to four-forked.

*Abdomen.* All dorsal setae non-plumose. *Segment I:* 3 small, usually three-forked, occasionally four- or five-forked; 4 medium, simple or two-forked, rarely three-forked; 5 long, two- to three-forked; 6 medium, four- or five-forked, rarely two-forked; 7 medium, two- to three-forked at tip; 8 small, simple or rarely two-forked; 10 medium, two- to five-forked.

*Segment II:* 1 small, simple on this and all following segments; 2 medium, four- to twelve-forked; 3 medium, seven- or six-forked, rarely four-forked; 4 medium, stout, simple; 5 medium, three- to four-forked; 6 small, two- to four-forked; 7 medium, usually two-forked, occasionally three- or four-forked; 8 small, transparent spine; 10 medium, four- to three-forked.

*Segment III:* Setae 3, 4 and 6 medium or small and unimportant on this and segments IV through VII; 2 medium, usually eight-forked, range from six- to ten-forked; 5 medium, usually eight-forked, range from six- to nine-forked; 7 small, usually two-forked, rarely three-forked; 8 small, dark-pigmented, stout, a little more than twice the length of 8-II.

*Segment IV:* 2 long, six- to five-forked; 5 medium, five- to seven-forked; 7 medium, simple to two-forked; 8 similar to and a little less than twice the length of 8-III.

*Segment V:* 2 long, two- to three-forked; 5 long, four- to three-forked; 7 medium, simple or rarely two-forked near tip; 8 similar to and about a third longer than 8-IV.

*Segment VI:* 2 long, simple; 5 long, four- to three-forked; 7 medium, simple; 8 similar to and averaging slightly longer than 8-V.

*Segment VII:* 2 long, simple or occasionally two-forked; 5 long, three- or four-forked, or rarely six-forked; 7 small, simple; 8 similar to and averaging nearly twice the length of 8-IV.

*Segment VIII:* 5 medium, simple to two- or three-forked; 8 stout dark base with eight to eleven smaller side branches.

*Paddle:* Margin very finely serrate laterally at tip of buttress, either entire or with very fine, widely scattered hairs from there on around apex of paddle. Accessory seta (7) small, two-forked to simple; terminal seta (8) light brown, medium thin, simple, straight or slightly curved or hooked.

#### ANOPHELES (ANOPHELES) EARLEI Vargas (1935)

Previously undescribed although Vargas (1943) included a few remarks and gave figures of the metanotum and abdomen of specimens from Cayuta Lake, N. Y.;

Matheson (1944) included a figure of the terminal abdominal segments under the name of *occidentalis*; and Vargas and Matheson (1948) included it in a key to Nearctic pupae of the *maculipennis* complex and gave figures of the metanotum, abdomen and trumpet of specimens from Cayuta Lake, N. Y.

*Anopheles earlei* has not been generally recognized as distinct from *occidentalis* of the west coast, although the characters shown recently by Vargas (1943) and by Vargas and Matheson (1948) in their illustrations of the pupa, and fully described here certainly point to the validity of *earlei* as a distinct species. All records of *occidentalis* from localities at least as far west as Wisconsin are probably referable to *earlei*.

*Specimens Examined.* Two pupal exuviae as follows: MICHIGAN: 1 ♂ from Bessy Creek at Douglas Lake, Cheboygan County, V-10-22, RM (CU 1027-1712). NEW YORK: 1 ♂ from Cayuta Lake, Schuyler County, V-30-42, RM (CU 1027-1333).

*Cephalothorax.* Postocular, anterothoracic, dorsal and supra-alar setae all medium or small and unimportant except seta 7 which is long and simple. Metanotal setae as follows: 10 medium, two-forked near tip; 11 medium, two-forked; 12 long, two-forked or simple.

*Abdomen.* All dorsal setae non-plumose. *Segment I:* 3 medium, two- to four-forked; 4 medium, two- to four-forked; 5 long, two-forked; 6 small, five- to three-forked; 7 long, two- or three-forked; 8 small, simple or two-forked; 10 medium, two- to four-forked.

*Segment II:* 1 very small, simple on this and all following segments; 2 medium, six-forked; 3 medium, four- to eight-forked; 4 medium, simple; 5 medium, three- or five-forked; 6 small, three- or two-forked; 7 medium, three- or two-forked; 8 small, stout, transparent spine; 10 medium, two- or three-forked.

*Segment III:* Setae 3, 4 and 6 rather unimportant on this and segments IV through VII; 2 long, six- or seven-forked; 5 medium, eight- to ten-forked; 7 medium, three- or two-forked; 8 similar to and ranging from equal to twice the length of 8-II.

*Segment IV:* 2 long, five- to seven-forked; 5 long, six- to ten-forked; 7 medium, two-forked to simple; 8 non-pigmented, though darker, and ranging from one-third longer to twice the length of 8-III.

*Segment V:* 2 long, three- to two-forked; 5 long, three- to five-forked; 7 medium, simple or two-forked; 8 similar to and slightly longer than 8-IV.

*Segment VI:* 2 long, simple or two-forked; 5 long, three- to five-forked; 7 medium, simple; 8 similar to and slightly longer than 8-V.

*Segment VII:* 2 long, simple; 5 long, two- to five-forked; 7 small, three- or four-forked; 8 similar to and slightly longer than 8-VI.

*Segment VIII:* 5 medium, two-forked near tip; 8 transparent, base about equal to 8-VII, with eight to twelve smaller side branches.

*Paddle:* Apical third of lateral and medial margins with a fringe of fine short hairs. Accessory seta (7) small, simple; terminal seta (8) small, straight, simple.

#### ANOPHELES (ANOPHELES) GEORGIANUS King (1939)

Pupa heretofore undescribed although Burgess (1946) presented a few notes on the pigmentation of living pupae.

*Specimens Examined.* Five pupal exuviae as follows: GEORGIA: 1 ♂ and 4 ♀ from Quitman, Brooks County, II-16-38, WVK No. 1957 (USNM).

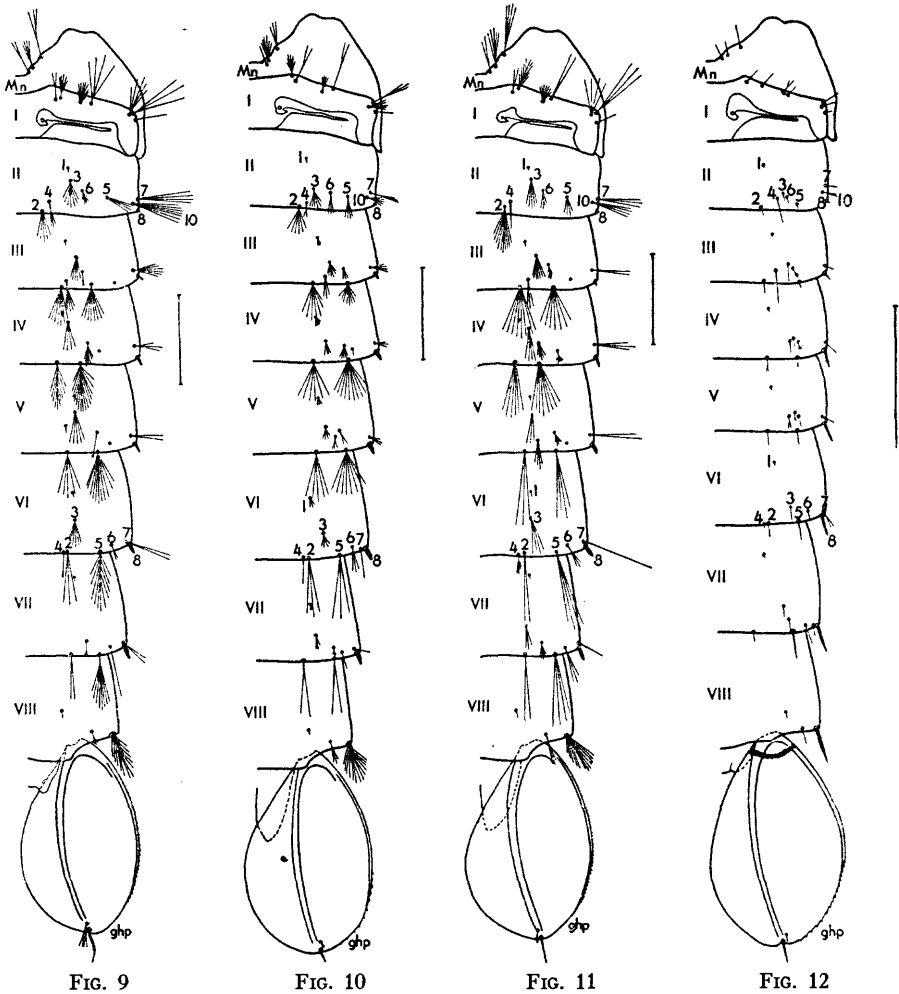


FIG. 9

FIG. 10

FIG. 11

FIG. 12

FIG. 9. *Anopheles georgianus*. Right dorsal aspect of metanotum and abdomen of female from Georgia.

FIG. 10. *Anopheles crucians*. Right dorsal aspect of metanotum and abdomen of male from Louisiana.

FIG. 11. *Anopheles bradleyi*. Right dorsal aspect of metanotum and abdomen of male from Florida.

FIG. 12. *Anopheles barberi*. Right dorsal aspect of metanotum and abdomen of female from Missouri.

*Cephalothorax.* Postocular, anterothoracic, dorsal and supra-alar setae all medium in size and unimportant except seta 7 which is long and simple or two-forked. Metanotal setae as follows: 10 medium, simple or two- to three-forked near tip; 11 medium, four- to seven-forked; 12 medium-long, three- or four-forked.

*Abdomen.* All dorsal setae non-plumose. *Segment I:* 3 small, two- or three-forked; 4 small, five- to eight-forked; 5 long, three- or four-forked, rarely two-forked; 6 small, seven- to nine-forked; 7 long, three- to six-forked; 8 medium, simple, or rarely two-forked near tip; 10 medium, five- to nine-forked.

*Segment II:* 1 small, simple on this and all following segments; 2 medium, five- to seven-forked near base; 3 medium, four- to seven-forked; 4 medium, rather stout, three- to seven-forked near apex; 5 medium, four- to six-forked; 6 small, six- to seven-forked; 7 long, usually four-forked, rarely three-forked; 8 small, thin, transparent spine; 10 long, four- to seven-forked.

*Segment III:* Setae 3, 4 and 6 rather inconspicuous, small medium and rather unimportant on this and segments IV through VII; 2 medium-long, seven- to ten-forked; 5 medium, six- to twelve-forked; 7 medium, four- to six-forked; 8 small, dark-pigmented spine, roughly twice the length and diameter of 8-II.

*Segment IV:* 2 long, eight- to sixteen-branched; 5 long, thirteen- to twenty-branched; 7 medium, usually three-forked, rarely two-forked; 8 stout, dark spine averaging twice the length and diameter of 8-III.

*Segment V:* 2 long, five- to seven-forked; 5 long, nine- to fourteen-forked; 7 medium, usually two-forked, rarely simple or three-forked; 8 similar to and averaging slightly longer than 8-IV.

*Segment VI:* 2 long, two- to six-forked; 5 long, eight- to eleven-forked; 7 medium two-forked; 8 similar to and averaging slightly longer than 8-V.

*Segment VII:* 2 long, two- to three-forked, rarely simple; 5 long, seven- to eleven-forked; 7 small, two-forked, rarely three-forked; 8 similar to and averaging slightly longer than 8-VI.

*Segment VIII:* 5 small, two- to four-forked; 8 with a stout dark base similar to 8-VII and ten to eighteen smaller side branches.

*Paddle:* Lateral margin with short, very fine teeth from the base three-fourths of the way to the apex. Accessory seta (7) small, two- to four-forked near basal third; terminal seta (8) medium, dark-pigmented, slightly curved.

#### ANOPHELES (ANOPHELES) CRUCIANS Wiedemann (1828)

Pupa heretofore undescribed although Mitchell (1907) included figures of the whole pupa in lateral aspect and a ventral view of the paddles, and Burgess (1946) gave notes on the dorsal pigmentation of the living pupae.

*Specimens Examined.* Seven pupal exuviae as follows: LOUISIANA: 1 ♂ and 1 ♀ from Waggaman, Jefferson Parish, X-17-47, LLE, JVB (*TU 116*); 3 ♀ ♀ from 3 mi. sw. Franklinton, Washington Parish, VIII-13-48, GHP, MHP (*TU 779*); 1 ♀ from Covington, St. Tammany Parish, VIII-16-48, GHP, MHP (*TU 796*); 1 ♀ from 3 mi. n. Franklin, St. Mary Parish, VIII-25-48, GHP, MHP (*TU 105*).

*Cephalothorax.* Postocular, anterothoracic, dorsal and supra-alar setae small or medium and rather inconspicuous except seta 7 which is long, thin and simple. Metanotal setae as follows: 10 medium, simple; 11 medium, five- or six-forked, or rarely three-forked; 12 medium, usually three-forked, range from two- to five-forked.

*Abdomen.* All dorsal setae non-plumose. *Segment I:* 3 medium, six- to eight-forked; 4 long, usually two-forked, occasionally simple; 5 long, two- or three-forked

near apex; 6 medium-small, four- to eleven-forked; 7 long, usually three-forked near middle, range from simple to four-forked; 8 small, simple or rarely two-forked; 10 small, usually five-forked, range from three- to seven-forked.

*Segment II:* 1 small, simple on this and all following segments; 2 small, seven- to six-forked; 3 small, usually six-forked, occasionally eight-forked; 4 small, stout, two-forked at tip to simple; 5 small, three- to four-forked, rarely two-forked; 6 small, three-forked; 7 medium, two- or three-forked, or occasionally simple; 8 very small, transparent, thin spine; 10 small, two- to seven-forked.

*Segment III:* Setae 3, 4 and 6 all small and unimportant on this and segments IV through VII; 2 medium, seven- to twelve-forked; 5 medium, eight- to fourteen-forked; 7 small, two- to eight-forked; 8 dark-pigmented, stout, about twice the length of 8-II.

*Segment IV:* 2 medium, six- to ten-forked; 5 medium, nine- to eleven-forked; 7 small, three- or four-forked, rarely simple; 8 similar to and about twice the length of 8-III.

*Segment V:* 2 medium, three- to five-forked; 5 medium, eight- to four-forked; 7 small, three- or two-forked, rarely simple; 8 similar to and slightly longer than 8-IV.

*Segment VI:* 2 medium, three- or two-forked; 5 medium, three- to six-forked; 7 small, simple; 8 similar to and slightly longer than 8-V.

*Segment VII:* 2 medium, two-forked to simple, rarely three-forked; 5 medium, two- to five-forked, rarely simple; 7 small, simple; 8 similar to and about same length as 8-VI.

*Segment VIII:* 5 medium-small, two- or three-forked, or occasionally four-forked; 8 with base about equal to 8-VII with twelve to fifteen smaller side branches.

*Paddle:* Margin with evenly spaced fine teeth on lateral side. Accessory seta (7) very small, simple or two-forked; terminal seta (8) small, stout, simple.

#### ANOPHELES (ANOPHELES) BRADLEYI King (1939)

Pupa heretofore undescribed or figured.

*Specimens Examined.* Twenty pupal exuviae as follows: FLORIDA: 2 ♂♂ and 1 ♀ from Brevard County, II-25-38, T. E. McNeel, WVK No. 1958 (*USNM*). LOUISIANA: 4 ♂♂ and 3 ♀♀ from Michoud, Orleans Parish, I-9-48, GHP, LLE, JVB (*TU 140*). SOUTH CAROLINA: 1 ♂ and 1 ♀ from Parris Island, Beaufort County, VII-28-45, GHB (*TU P-515*); 1 ♂ and 5 ♀♀ from Horse Island, Beaufort County, X-18-45, GHB (*TU P-527*); 1 ♂ and 1 ♀ from Ladies Island, Beaufort County, X-21-45, GHB (*TU P-528*).

*Cephalothorax.* Postocular, anterothoracic, dorsal and supra-alar setae all medium in size and rather unimportant except seta 7 which is long and simple. Metanotal setae as follows: 10 long, two-forked above middle, occasionally three- or four-forked above middle; 11 long, four- or five-forked, rarely two- to three-forked; 12 long, three- to four-forked.

*Abdomen.* All dorsal setae non-plumose. *Segment I:* 3 medium, two-forked, occasionally three- or four-forked; 4 medium, various, range from two- to nine-forked; 5 long, two- to three-forked; 6 small, usually six- or seven-forked, range from

two- to eight-forked; 7 long, two- to four-forked; 8 medium, simple to two-forked; 10 medium, four- to six-forked.

*Segment II:* 1 small, simple on this and all following segments; 2 long, five- to eleven-forked; 3 medium, five- to nine-forked; 4 medium, stout, simple, or rarely two-forked near tip; 5 small, three- or four-forked; 6 small, three- to seven-forked; 7 long, two- to four-forked; 8 small, thin, transparent spine; 10 two- to four-forked, slightly shorter than 7.

*Segment III:* Setae 3, 4 and 6 small to medium in size, for the most part inconspicuous and unimportant on this and segments IV through VII; 2 medium-long, six- to nine-forked; 5 medium, four- to seven-forked; 7 medium, two- to four-forked; 8 small, dark, stout, about twice the length and diameter of 8-II.

*Segment IV:* 2 long, six- to nine-forked; 5 long, seven- to ten-forked; 7 medium, nearly three times the length of 8, three-forked; 8 similar to and about twice the length and diameter of 8-III.

*Segment V:* 2 long, two- to six-forked; 5 long, four- to eight-forked; 7 long, two-forked; 8 similar to and averaging slightly longer than 8-IV.

*Segment VI:* 2 long, two- to four-forked, or occasionally simple; 5 long, three- to six-forked; 7 long, simple, or rarely two-forked at tip; 8 similar to and averaging slightly longer than 8-V.

*Segment VII:* 2 long, two-forked, or rarely simple; 5 long, three- to five-forked; 7 small, roughly twice the length of 8, two-forked, or rarely simple; 8 similar to and averaging slightly longer than 8-VI.

*Segment VIII:* 5 medium, two- to four-forked; 8 short, dark basal spine with nine to sixteen smaller side branches.

*Paddle:* Basal four-fifths of lateral margin with evenly spaced short fine teeth; apical fifth entire. Accessory seta (7) very small, usually three-forked, occasionally simple or two-forked; terminal seta (8) small, dark, simple, usually straight.

#### ANOPHELES (ANOPHELES) BARBERI Coquillett (1903)

Pupa heretofore undescribed.

*Specimens Examined.* Five pupal exuviae as follows: ALABAMA: 1 ♂ and 2 ♀ from Florence, Lauderdale County, IX-14-48, W. E. Snow (*TU 800*). MISSOURI: 2 ♀ from Camp Crowder, Newton County, VII-20-42 and IX-16-42, A. B. Gurney (*USNM*).

*Cephalothorax.* Postocular, anterothoracic, dorsal and supra-alar setae all small or medium and rather inconspicuous except seta 7 which is long and three-forked. Metanotal setae as follows: 10 small, simple or two-forked; 11 small, simple; 12 medium, simple or two-forked.

*Abdomen.* All dorsal setae non-plumose. *Segment I:* 3 small, simple; 4 small, simple to five-forked; 5 small, simple or two-forked; 6 small, simple to four-forked; 7 small, simple to three-forked; 8 small, simple; 10 small, simple to two-forked.

*Segment II:* 1 very small, simple on this and all following segments; 2 small, simple to three-forked; 3 small, simple; 4 medium, simple to three-forked near tip; 5 small, four- to eight-forked; 6 small, simple; 7 small, simple to two-forked; 8 small, thin transparent seta; 10 small, two-forked.

*Segment III:* Setae 3, 4 and 6 all small and inconspicuous on this and segments IV through VII; 2 small, simple; 5, small, simple; 7 small, simple to three-forked; 8 thin, dark-pigmented, about three times the length of 8-II.

*Segment IV:* 2 small, two-forked; 5 small, simple; 7 small, simple or three-forked; 8 stouter than and about a third longer than 8-III.

*Segment V:* 2 small, simple to three-forked; 5 small, simple; 7 small, simple to three-forked; 8 similar to and slightly longer than 8-IV.

*Segment VI:* 2 small, simple; 5 medium, stout, simple; 7 small, two- to four-forked near tip; 8 similar to and about the same length as 8-V.

*Segment VII:* 2 small, simple or two-forked; 5 medium-long, stout, simple; 7 small, simple; 8 similar to and nearly twice the length of 8-VI.

*Segment VIII:* 5 small, simple; 8 similar to and a little more than twice the length of 8-VI, without side branches.

*Paddle:* With a series of widely spaced, fine, sharp teeth on apical half of lateral margin. Accessory seta (7) very small, simple or two-forked; terminal seta (8) medium, stout, simple, straight.

#### ANOPHELES (ANOPHELES) FRANCISCANUS McCracken (1904)

Following the conclusions of Aitken (1945) I have considered all western United States specimens of the *pseudopunctipennis* complex as being the form described as *franciscanus* by McCracken. The pupa of this species was partially described and illustrated by Aitken (1945) from California. Typical Mexican *pseudopunctipennis* may occur in Texas and western Louisiana, but no pupal specimens from this area were available in connection with this study. However, a single pupal exuviae in the USNM from Ancon, Canal Zone which I examined did not show characters which would distinguish it from Californian or New Mexican specimens of *franciscanus*. Senevet (1934) described the pupa of *pseudopunctipennis* but his specimens were also from the Canal Zone.

*Specimens Examined.* Fourteen pupal exuviae as follows: CALIFORNIA: 2 ♀ ♀ from Van Nuys, Los Angeles County, W. W. Farrar (*USNM*); 2 ♂ ♂ and 1 ♀ from Monticello, Napa County, X-8-47, RMB (*TU 708*). NEW MEXICO: 3 ♀ ♀ from Isleta, Bernalillo County, VI-21-48, A. Miller, J. Gonzales (*TU 441*); 2 ♂ ♂ and 4 ♀ ♀ from Las Cruces, Dona Ana County, VI-24-48, A. Miller, J. Gonzales (*TU 442*).

*Cephalothorax.* Postocular, anterothoracic, dorsal and supra-alar setae all small or medium or otherwise inconspicuous except seta 7 which is very long and simple. Metanotal setae as follows: 10 medium, simple or two-forked; 11 small, simple to three-forked near tip; 12 medium, two-forked at tip.

*Abdomen.* All dorsal setae non-plumose. *Segment I:* 3 medium, simple to three-forked; 4 medium, simple to two-forked; 5 long, three- or two-forked; 6 small, four-forked, range from simple to five-forked; 7 long, simple; 8 medium, two-forked, range from simple to three-forked near tip; 10 medium, four-forked, range from three- to five-forked.

*Segment II:* 1 very small, simple on this and all following segments; 2 medium-long, six- to three-forked; 3 medium, four-forked, range from three- to five-forked; 4 medium, simple or two-forked near tip; 5 small, four-forked, range from three-

five-forked; 6 small, two- to five-forked; 7 long, simple or two-forked at tip; 8 a thin, transparent seta nearly twice the length of  $\delta$ -III; 10 medium, three-forked, or four- to five-forked.

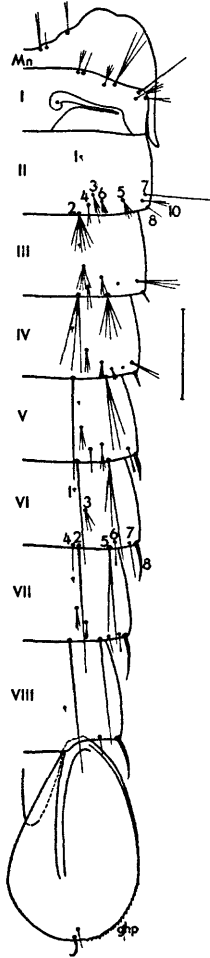


FIG. 13

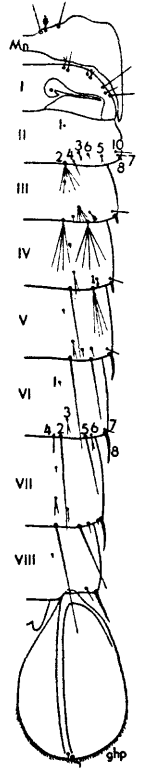


FIG. 14

FIG. 13. *Anopheles franciscanus*. Right dorsal aspect of metanotum and abdomen of male from New Mexico.

FIG. 14. *Anopheles albimanus*. Right dorsal aspect of metanotum and abdomen of female from Texas.

*Segment III*: Setae 3, 4 and 6 small or unimportant on this and segments IV through VII; 2 very long, three-forked; 5 medium-long, five-forked, range from four- to nine-forked; 7 medium, three- or four-forked; 8 short, stout, nonpigmented.

*Segment IV*: 2 very long, two-forked, range from simple to three-forked; 5 very long, three-forked; 7 medium, two- to four-forked; 8 similar to and averaging a little less than twice the length of  $\delta$ -III.

*Segment V:* 2 very long, simple to two-forked; 5 very long, two- to three-forked; 7 medium, two- or three-forked; 8 similar to and averaging about twice the length of 8-IV.

*Segment VI:* 2 very long, simple or two-forked; 5 very long, two-forked; 7 medium, two-forked at tip or simple; 8 similar to and averaging about a third longer than 8-V.

*Segment VII:* 2 very long, simple; 5 very long, two-forked or simple; 7 small, simple or two-forked at tip; 8 similar to and averaging slightly longer than 8-VI.

*Segment VIII:* 5 small, simple or two-forked; 8 similar to 8-VII, but slightly shorter, without side branches.

*Paddle:* Postero-lateral margin with a row of rather stout, slightly hooked short spines which reach to the apex of the paddle. Accessory seta (7) small, simple or two-forked near tip; terminal seta (8) medium, definitely curved and hook-like.

ANOPHELES (NYSSORHYNCHUS) ALBIMANUS Wiedemann (1821)

The pupa was included in a key to seven Neotropical species of the subgenus *Nyssorhynchus* by Root (1926), and Senevet (1931) gave a complete description and figures of the trumpet, metanotum and abdomen of specimens without specific locality data.

*Specimens Examined.* Six pupal exuviae as follows: MEXICO: 1 ♀ from Villahermosa, Tabasco (TU 177). TEXAS: 2 ♂♂ and 3 ♀♀ from Brownsville, Cameron County, IX-17-44, T. M. Burns (USNM).

*Cephalothorax.* Postocular, anterothoracic, dorsal and supra-alar setae all rather small and inconspicuous. Metanotal setae as follows: 10 and 12 simple, subequal in length; 11 small, simple to three- or four-forked.

*Abdomen.* All dorsal setae non-plumose. *Segment I:* 3 small, two- or three-forked; 4 small, simple; 5 small, simple to three-forked; 6 small, simple or two-forked; 7 small, simple; 8 medium, simple; 10 long, simple.

*Segment II:* 1 small, simple on this and all following segments; 2 medium-long, six- or seven-forked, range from three- to eight-forked; 3 small, four- to six-forked; 4 medium, stout, simple; 5 small, two- or three-forked; 6 small, simple; 7 small, simple or two-forked; 8 small, stout, transparent spine with blunt tip; 10 medium, simple.

*Segment III:* Setae 3, 4 and 6 all small and inconspicuous on this and segments IV through VII; 2 long, usually four-forked, range from three to six; 5 long, usually seven-forked, range from six- to nine-forked; 7 medium, simple or rarely two-forked near tip; 8 dark brown pigmented, stout, about twice as long as 8-II.

*Segment IV:* 2 long, simple; 5 usually four-forked, occasionally five- to seven-forked; 7 small, simple; 8 similar to and slightly longer than 8-III.

*Segment V:* 2 long, simple; 5 long, simple; 7 small, simple; 8 dark, brown-pigmented, curved medially and tapered sharply to apex, about three times the length of 8-IV.

*Segment VI:* 2 long, simple; 5 long, simple; 7 small, simple; 8 similar to and slightly longer than 8-V.

*Segment VII:* 2 long, simple; 5 long, simple; 7 very small, simple; 8 similar to and about same length as 8-VI.

*Segment VIII*: 5 small, simple or two-forked;  $\delta$  similar to and about same length as  $\delta$ -VII.

*Paddle*: Apical third of paddle with a short fringe of fine hairs extending around the apex. Accessory seta (7) short, simple; terminal seta ( $\delta$ ) stout, simple, and slightly curved.

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