

# Kansas Entomological Society

Volume 16

October, 1943

Number 4

## A KEY TO THE CULEX (DIPTERA, CULICIDAE) OF THE SOUTHEASTERN UNITED STATES, BY MALE TERMINALIA.

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At the present time twelve species of *Culex* have been recorded from nine of the southeastern states, as shown in Table 1. These have been placed in three subgenera:

*Culex*:—*bahamensis*, *nigripalpus*, *pipiens*, *quinquefasciatus*, *restuans*, *salinarius*, *tarsalis*.

*Neoculex*:—*apicalis*.

*Melanoconion*:—*atratus*, *erraticus*, *pilosus*, *peccator*.

The males of the subgenus *Melanoconion* are so similar that they can be positively identified only by an examination of their genitalia. This is also true of the subgenus *Culex*, although in this group the external differences between some of the species are more distinct, and after some experience one may identify them by markings alone. However an examination of the genitalia is often necessary to identify positively the species of the genus *Culex*. This is particularly true of specimens which have been damaged in light trap collections.

The technique used in studying the genitalia is a simple one taken from King (unpublished). The last two or three segments of the abdomen are clipped off with a fine pointed scissors and transferred to 10% KOH. This is heated for three to five minutes, care

<sup>1</sup>Grateful acknowledgement is made to Major S. J. Carpenter, Sn. C. and to Capt. W. W. Middlekauff, Sn. C., of the Entomology Department of the Fourth Service Command Medical Laboratory, for their many helpful suggestions.

It is desired to express appreciation to Col. Sanford W. French, M. C., Chief, Medical Branch, Fourth Service Command, and Col. Dwight M. Kuhns, M. C., Commanding Officer, Fourth Service Command Laboratory, for their assistance in making possible the development of the entomological program of the Fourth Service Command.

Appreciation is further expressed to Brig. Gen. James S. Simmons, M. C. and Col. W. A. Hardenbergh, Sn. C., Preventive Medicine Section, Office of the Surgeon General, U. S. Army, Washington, D. C.

Table 1. Distribution of the species of *Culex* in the Southeastern United States.

Species	Recorded from <sup>1</sup>									
	Fla.	Ga.	Ala.	Miss.	La.	Ark.	Tenn.	N. C.	S	C.
<i>apicalis</i>	x	x	x	x	x	x	x	x	x	x
<i>atratus</i>	x									
<i>bahamensis</i>	x									
<i>erraticus</i>	x	x	x	x	x	x	x	x	x	x
<i>nigripalpus</i>	x	x	x		x					x
<i>peccator</i>	x	x	x	x	x	x	x	x	x	x
<i>pilosus</i>	x	x	x	x	x				x	x
<i>pipiens</i>		x	x					x	x	x
<i>quinquefasciatus</i>	x	x	x	x	x	x	x	x	x	x
<i>restuans</i>	x	x	x	x	x	x	x	x	x	x
<i>salinarius</i>	x	x	x	x	x	x	x	x	x	x
<i>tarsalis</i>						x	x	x		

being taken to prevent boiling. With the aid of a pipette the specimen is then transferred to distilled water and rinsed. Heating the water will help remove the remainder of the tissue. The chitinous structures remain undissolved. The specimen is then placed in a drop of glycerine on a slide, and dissected with a pair of minuten nadeln at the end of applicator or match sticks. It is best to use the high power of a binocular dissecting microscope for this procedure.

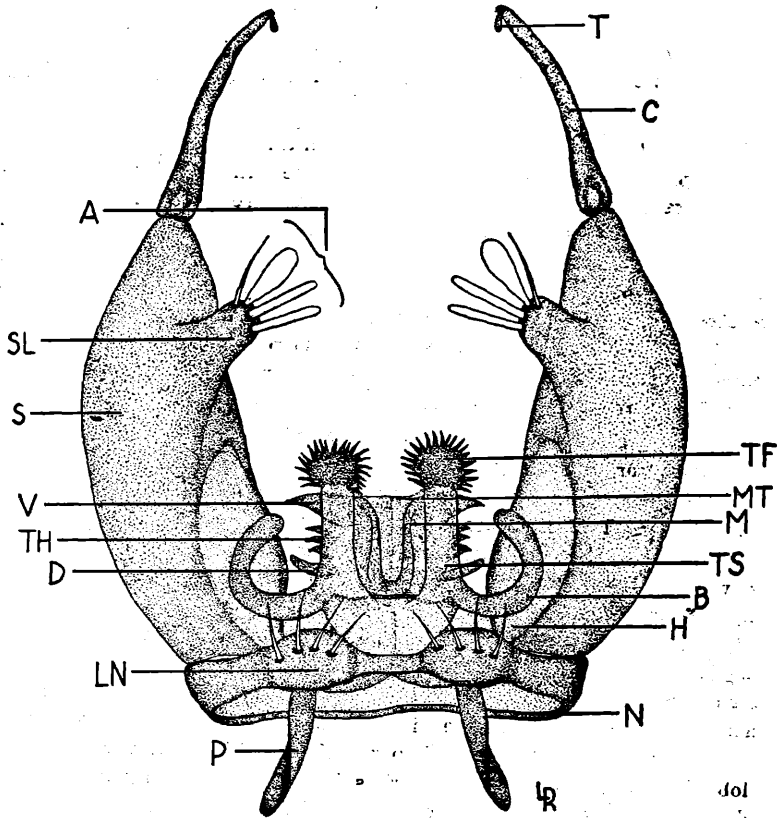
If a permanent mount is desired, the dissection may be made in a drop of chloral gum<sup>2</sup> and covered with a cover slip. In most cases it is well to separate the various structures so that they can be examined from all sides. In the present paper almost all of the figures were drawn from dissected structures which had been separated and mounted individually. Once mounted, the specimen should be examined under the low and high powers of a compound microscope to see all the details.

<sup>1</sup>From King, Roth, Toffaleti and Middlekauff, 1943.

<sup>2</sup>The formula for chloral gum is:

Gum arabic (clear lumps or powdered)	8	gms.
Distilled water	8	c. c.
Glycerin	5	c. c.
Chloral hydrate	70	gms.
Glacial acetic acid	3	c. c.

(From King, Bradley and McNeel, 1942.)



**A**  
Fig. A.

A diagrammatic drawing of a genitalia, more or less typical, of the subgenus *Culex* (Dorsal view).

A=appendages of the subapical lobe of the sidepiece; B= basal arm of the tenth sternite; C=clasper; D=dorsal arm of the mesosome; H=hollow of the sidepiece; LN=lobe of the ninth segment; M=mesosome; MT=membranous portion of the tenth segment; N=ninth segment; P=plate of paramere; S=sidepiece; SL=subapical lobe of the sidepiece; T=terminal spine of the clasper; TF=tuft of the tenth sternite; TH=tooth on the mesosome; TS=tenth sternite; V=ventral arm of the mesosome.

(The setae and pilosity of the sidepiece have not been drawn; only one pair of paramere plates is shown.)

Figures of the genitalia of most of the species of *Culex* can be found in the literature (Dyar, 1928; Matheson, 1929; Rozeboom, 1942, etc.). However these are often drawn or photographed on too small a scale to show the important structures.

The following description of the genitalia (Fig. A) is more or less typical for the subgenus *Culex*. The other subgeneric differences are discussed in the key. Only structures which are actually used in the key will be described and most of these characters for the different species have been illustrated. Fig. A is drawn from the dorsal position. Shortly after emergence the male terminalia rotates 180 degrees so that the tergites are actually on the underside. If the specimen is mounted with the claspers up, the tergites are turned upwards and are in their proper morphological position. This is referred to as the dorsal side.

Those segments posterior to the seventh abdominal segment are considered as comprising the male terminalia complex. The genitalia (hypopygium) begins with ninth segment (N) which is a complete chitinous ring. The ninth tergites are more or less developed depending on tinous ring. The ninth tergites are more or less developed depending on developed lobes (LN) which are so distinctive that they can be used to differentiate species. A large pair of appendages, the sidepieces (S) are attached to the sides of the ninth segment. These sidepieces are hollowed (H) basally on the inner surface to house the other structures. A more or less prominent subapical lobe (SL) arises near the upper part of the sidepiece and bears several appendages (A) of various sizes and shapes. Herms (1939) states that this lobe is a projection of the interbasal fold that has migrated up the dorsal side toward the apex of the sidepiece. A long clasper (C) which usually ends in a small terminal spine (T) is articulated from the apical end of the sidepiece. Lying between the sidepieces and within the ring formed by the ninth segment are several important structures, one of which is the tenth segment. This arises from the ninth segment and is a membranous structure (MT) with two supporting pigmented arms, the tenth sternites (TS), each bearing a tuft (TF) or a row of spines. These spines are usually darkly pigmented and therefore very conspicuous. A fairly stout, curved or straight basal arm (B) may arise near the base of the tenth sternite, and in some species curves down and extends ventrally around the mesosome. The mesosome (M) or peneal sheath, the other of the important structures between the sidepieces, lies behind the tenth sternite, is very complex and quite distinctive in each species of the subgenus *Culex*. Each mesosomal plate often possesses a dorsal (D) and ven-

tral (V) arm and some forms have teeth-like (TH) structures arising from between these arms. Parameres (P) are present but have not been used in the key.

**KEY TO THE SPECIES OF CULEX BY MALE TERMINALIA**

1. Tenth sternite with an apical tuft of short bristles or spines (Figs. 4, 11, 14, 17, 21) ----- Subgenus *Culex* 2
  - Tenth sternite comb-shaped apically, with a row of fairly stout teeth (Figs. 26, 27, 30) ----- 8
2. Subapical lobe a prominent elevation arising at about the apical third of the sidepiece and bearing five to eight appendages; clasper with a small, rounded terminal spine; patches of setae lacking from both the sidepiece and the subapical lobe (Figs. 1, 9, 12, 15, 19) ---- 3
 

Subapical lobe fairly long and stout, thumb-shaped, arising from about the middle of the sidepiece and bearing three short stout apical rods, two of these with bent tips; a patch of broadened setae on the lobe below the rods, another patch of long slender setae at the base of the lobe and a third medianly outward on the sidepiece; clasper without a terminal spine (Fig. 23)  
----- *Culex bahamensis*
3. Subapical lobe of sidepiece with eight appendages (Fig. 1); base of tenth sternite produced laterally into a blunt point or a short, nearly straight arm (Figs. 4, 5, 6); ventral arm of mesosome curved outwardly toward the sidepiece giving a wing-like appearance (Figs. 2, 7) ----- 4
 

Subapical lobe with five or six appendages (Figs. 9, 12, 15, 19); base of tenth sternite produced into a long, stout, strongly curved arm (Figs. 11, 14, 17, 21); ventral arm of mesosome, not as above ----- 5
4. Dorsal arm of mesosome, slender, somewhat pointed, lying at about right angles to the wings of the ventral arms (Figs. 2, 3) ----- *Culex quinquefasciatus*

Dorsal arm of the mesosome broad, semicylindrical in appearance, usually with a truncate tip; this arm placed obliquely and extending toward the tip of the ventral arm (Figs. 7, 8) ----- *Culex pipiens*

(In regions where both of these species are found, intermediate forms have been noted and at times it is difficult to identify positively either of these mosquitoes.)

5. Subapical lobe of the sidepiece with a distinct broad, flattened leaf (Figs. 12, 15, 19) ----- 6  
 Leaf of the subapical lobe narrow, little if any wider than the rods; the other appendages of the lobe usually include two stout rods and two slender setae (Fig. 9); tenth sternites terminating in a crown of sharply pointed inner bristles and blunt outer ones (Fig. 11); ventral arm of the mesosome consisting of two median, vertical, blade-like processes; dorsal arm a stout tapering horn which originates from the base; several stout teeth between the two arms (Fig. 10)-----*Culex tarsalis*
6. Mesosomal plate with two arms and with a median row or group of short, fairly stout teeth (Figs. 16, 20)----- 7  
 Mesosomal plate without a median row of teeth, the processes consisting of a short dorsal arm and a longer ventral arm which has a small tooth near the base (Fig. 13); subapical lobe of the sidepiece with three rods, a leaf, and two setae (Fig. 12)-----*Culex restuans*
7. Ninth tergite deeply cleft with fairly stout setae arising on the prominent angles (Fig. 18); eighth abdominal segment with a patch of small stout setae, somewhat centrally placed on the apical margin (Fig. 18); mesosomal plate with a stout dorsal arm and a long horn from near the base (Fig. 16); lobe of the sidepiece with a leaf, three rods, and a seta (Fig. 15); several spines on one side of the tuft of the tenth sternite short and bluntly rounded (Fig. 17) -----*Culex nigripalpus*  
 Ninth tergite somewhat rudimentary, the central margin only slightly concave with a row of slender setae along the outer corners (Fig. 22); eighth abdominal segment without a patch of short stout setae; dorsal arm of the mesosomal plate short, bent in the middle at about a right angle, with a pointed tip (Figs. 20, 21); subapical lobe of the sidepiece with three rods, a leaf and two setae (Fig. 19); spines of the tenth sternite all sharp pointed (Fig. 21) ----- *Culex salinarius*
8. Subapical lobe of the sidepiece with a distinct division (Figs. 28, 32, 33); mesosomal plate with a long, curved basal arm (basal hook), directed ventrally (except in *Culex atratus*) (Figs. 29, 30, 31) Subgenus *Melanoconion* 9  
 (For figures of *Culex atratus* and the ninth tergite of other *Melanoconions*, see Roth and Young, 1943.)

Subapical lobe not distinctly divided and bearing two stout rods with curved pointed tips and several shorter serrated and pointed setae; the serrated setae stout and blade-like (Fig. 24); mesosomal plate without a basal hook, the apical end of each studded with small denticles and both halves joined near the top by a transverse bridge (Fig. 25); lobes of ninth tergite two widely separated knob-like elevations each studded with a few small setae (Fig. 27).---Subgenus *Neoculex*, *Culex apicalis*

9. Apical division of the subapical lobe of the sidepiece with a distinct broad leaf (Figs. 28, 33; Roth & Young, Fig. 1) 10

Apical division of the subapical lobe lacking an expanded leaf but with several rod-like filaments; basal division divided into two subequal arms, each with a long, stout, capitate filament at the tip; apical swelling of the clasper cap-shaped, tapering abruptly and with a hirsute upper margin (Fig. 32); lobes of the ninth tergite finger-like projections from the corners of a broad spicular plate, which has a central oval or irregularly ovate lacuna; one or two smooth setae on each lobe and several grouped on the posterior corners of the plate (Roth and Young, Fig. 7) ----- *Culex pilosus*

10. Clasper gradually tapered with very little apical swelling (Fig. 28; Roth and Young, Fig. 1) ----- 11

Clasper greatly enlarged apically with the outer and front margin of the expanded quadrangular portion hirsute, the stem stout and constricted near the middle; basal division of the subapical lobe with one arm bearing a stout filament at the tip and a second filament arising from about the middle of the stem; apical division of the lobe with a very large fan-shaped leaf on a short stem with one long and two shorter stout filaments, plus a fine seta (Fig. 33); lobes of the ninth tergite roughly triangular, approximate, the outer and lower margins and basal portion of each with long, smooth setae arising from conspicuous tubercles (Roth and Young, Fig. 6) ----- *Culex peccator*

11. Lobes of the ninth tergite ovate, prominent, with numerous smooth setae arising from prominent tubercles; numerous small spicules on the lower base of each lobe (Roth and Young, Fig. 5); apical division of the

subapical lobe with an expanded leaf, a long hooked filament, and several smaller filaments; basal division divided into two subequal arms, each with a long stout, capitate filament at the tip (Fig. 28) ----- *Culex erraticus*

Lobes of the ninth tergite somewhat pear-shaped with a number of barbed setae arising from the basal half (Roth and Young, Fig. 2); basal portion of the subapical lobe with an upper stout rod-like seta and a slender lower one from its base; apical division curved from the base of the basal with a broad ribbed leaf from its tip, behind which arises a stout recurved seta; two conspicuous slender setae arise on the outer side of the apical division each with a smaller, inconspicuous seta from near its base (Roth and Young, Fig. 1); mesosomal plate a stout, curved, simple blade... *Culex atratus*

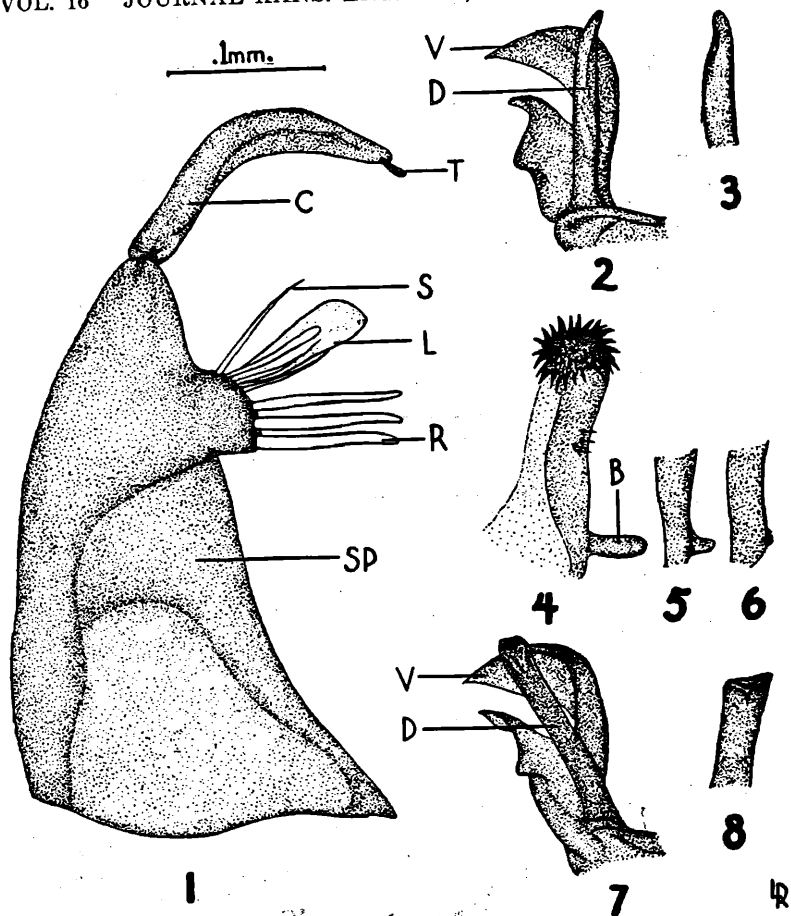
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#### PLATES

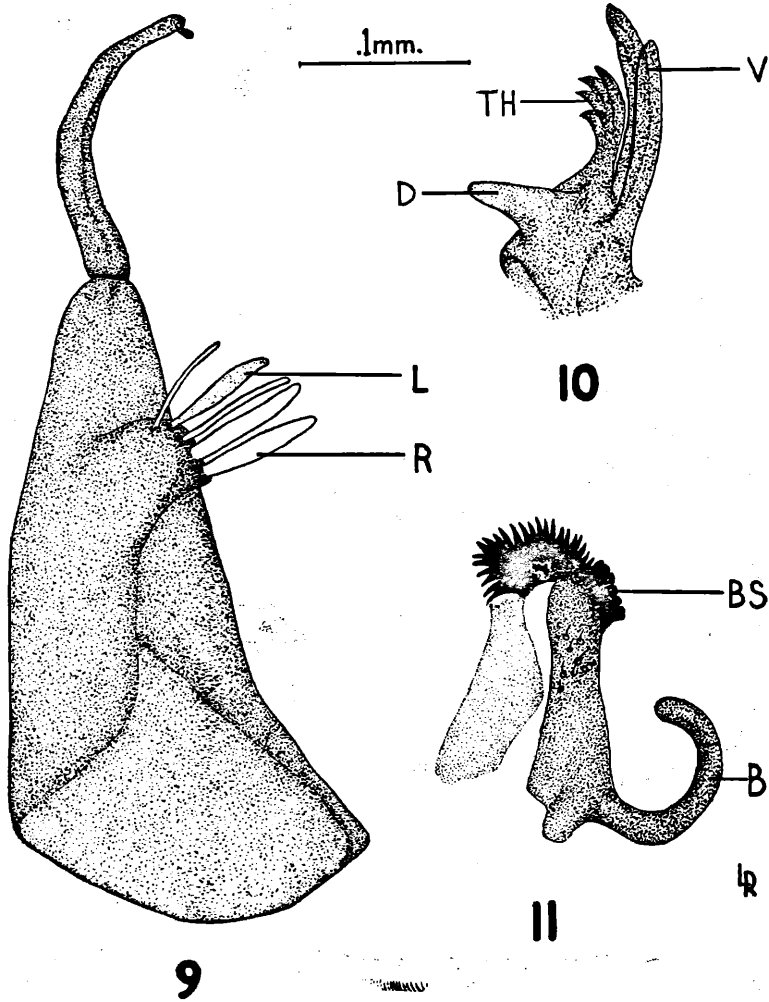
(Figs. 1-33)

All figures have been outlined with the aid of an ocular grid. Except for Figs. 25 and 27 only one side of the paired structure has been drawn. The outer setae and pilosity of the sidepieces have not been indicated. The sidepiece itself has been drawn to show the inner surface.



**Culex quinquefasciatus Say and Culex pipiens L.**

- Fig. 1. Sidepiece of *C. quinquefasciatus*. (similar in *C. pipiens*). C=clasper; L=leaf; R=Rod; S=seta; SP=sidepiece; T=terminal spine.
- Fig. 2. Mesosomal plate of *C. quinquefasciatus*. (dorsal view) D=dorsal arm; V=ventral arm.
- Fig. 3. Apical half of the dorsal arm of the mesosome of *C. quinquefasciatus*. (lateral view)
- Fig. 4. Tenth sternite of *C. quinquefasciatus*. (somewhat similar in *C. pipiens*) B=basal arm.
- Figs. 5. 6. Variations in the basal arm of the tenth sternite in *C. quinquefasciatus*. (somewhat similar in *C. pipiens*)
- Fig. 7. Mesosomal plate of *C. pipiens*. (dorsal view) D=dorsal arm; V=ventral arm.
- Fig. 8. Apical half of the dorsal arm of the mesosome of *C. pipiens*. (lateral view)

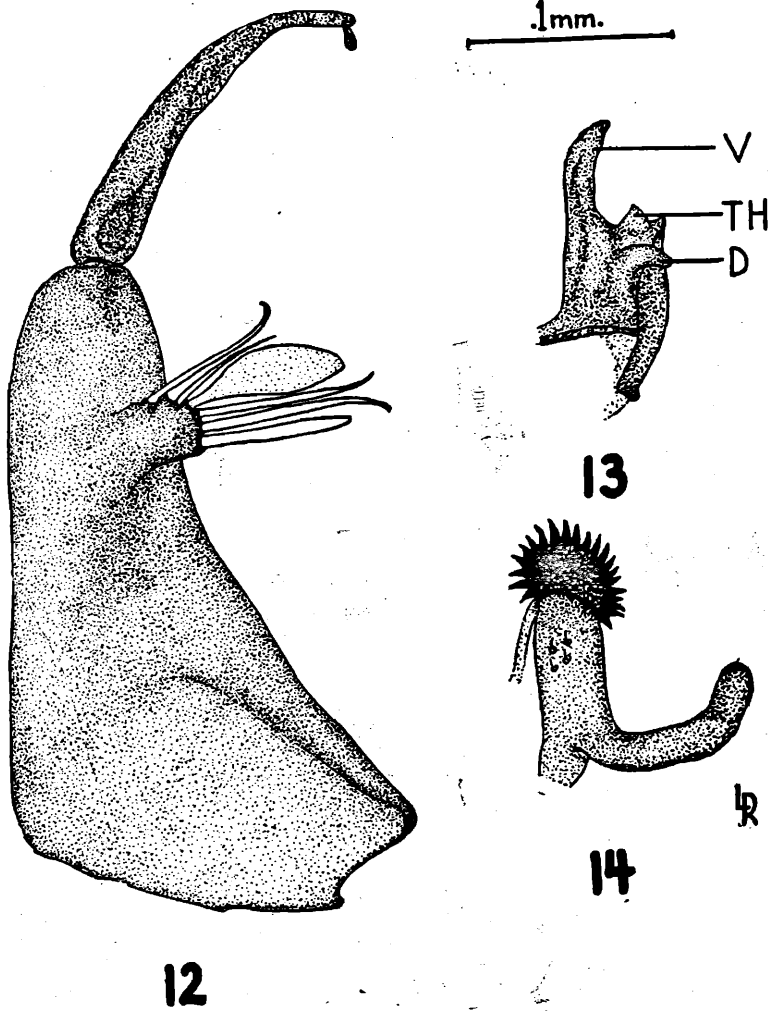


*Culex tarsalis* Coq.

Fig. 9. Sidepiece. L=leaf; R=Rod.

Fig. 10. Mesosomal plate. D=dorsal arm; TH=tooth; V=ventral arm.

Fig. 11. Tenth sternite. B=basal arm; BS=blunt spine.

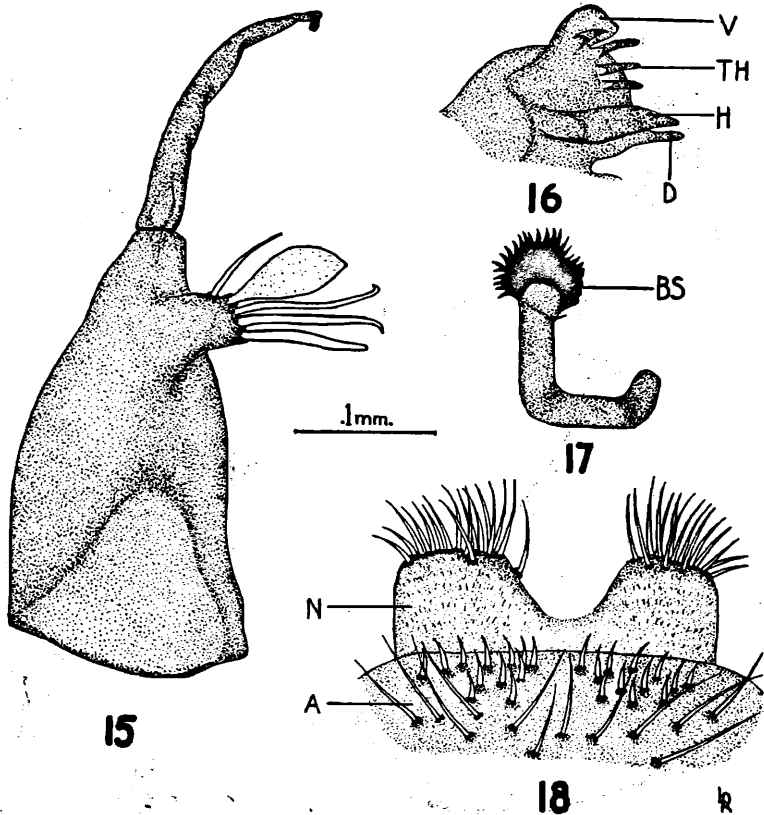


*Culex restuans*-Theob.

Fig. 12. Sidepiece.

Fig. 13. Mesosomal plate. D=dorsal arm; TH=tooth; V=ventral arm.

Fig. 14. Tenth sternite.



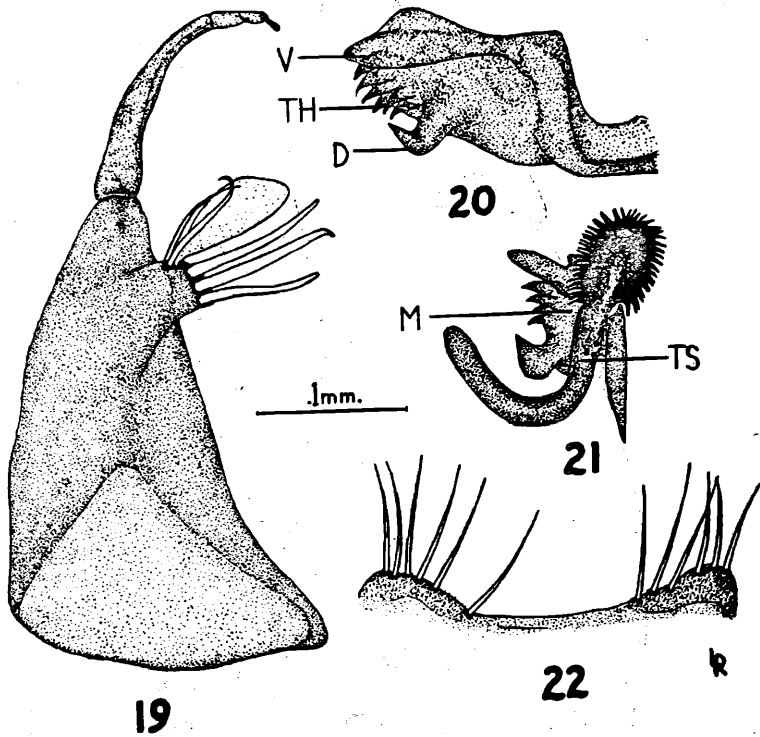
*Culex nigripalpus* Theob.

Fig. 15. Sidepiece.

Fig. 16. Mesosomal plate. (lateral view; inner side). D=dorsal arm; H=horn; TH=tooth; V=ventral arm.

Fig. 17. Tenth sternite. BS=blunt spine.

Fig. 18. Ninth tergite (N) and eighth abdominal segment (A).



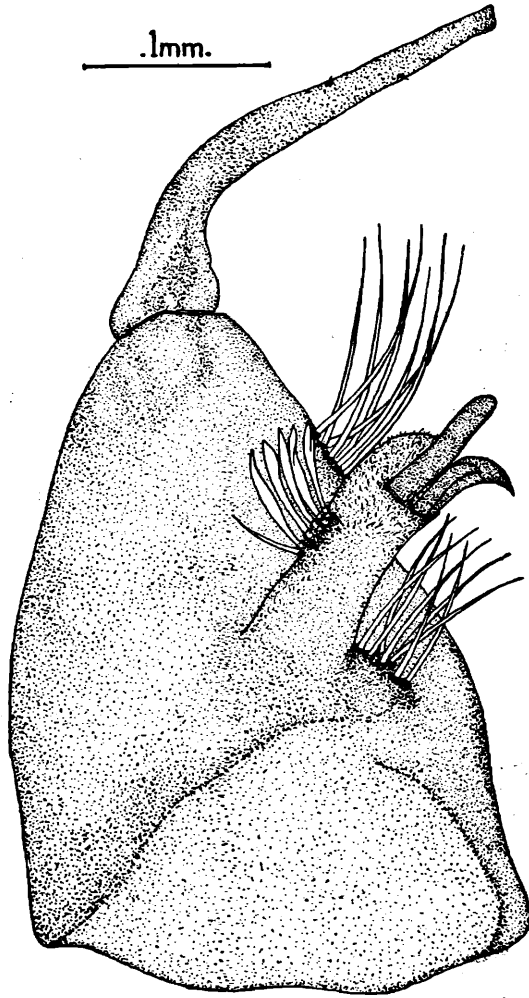
*Culex salinarius* Coq.

Fig. 19. Sidepiece.

Fig. 20. Mesosoma plate (lateral view; inner side); D=dorsal arm; TH=tooth; V=ventral arm.

Fig. 21. Tenth sternite (TS) and mesosoma plate (M). (dorsal view).

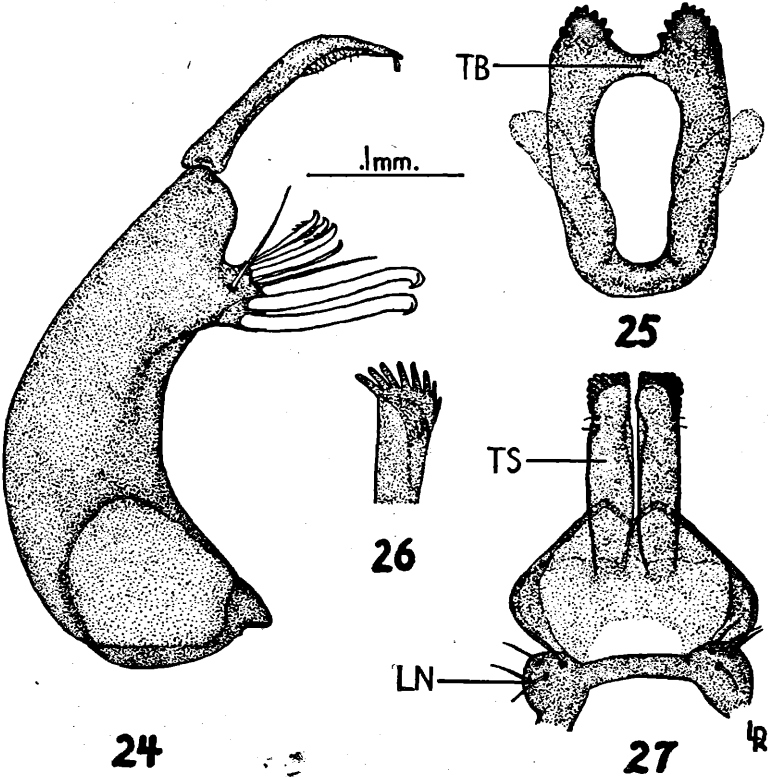
Fig. 22. Ninth tergite.



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*Culex bahamensis* D. and K.

Fig. 23. Sidepiece.



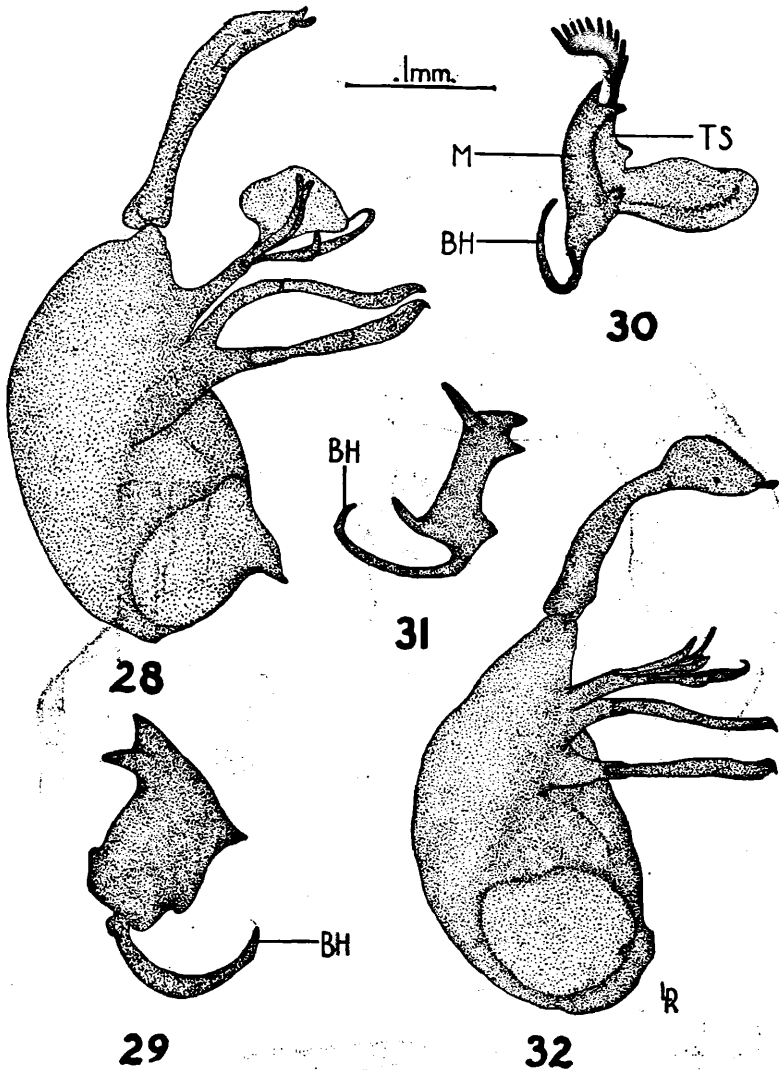
*Culex apicalis* Adams

Fig. 24. Sidepiece.

Fig. 25. Mésosome. TB=transverse bridge.

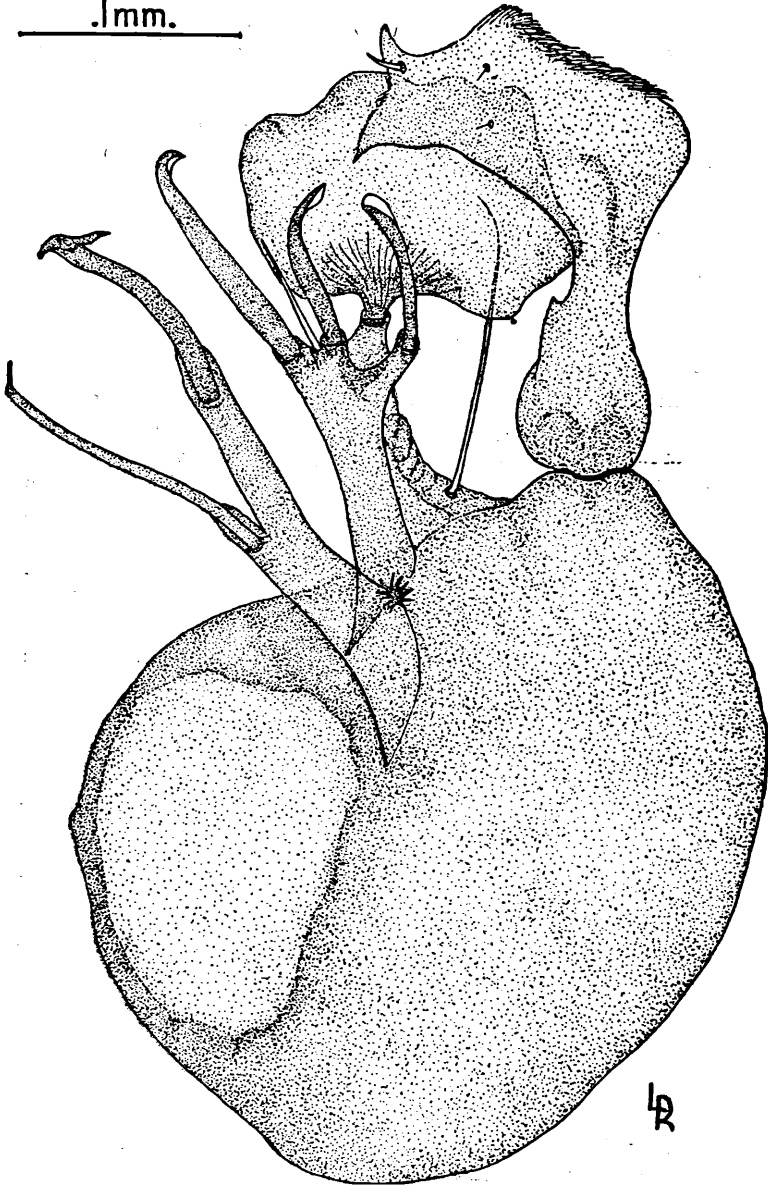
Fig. 26. Apical half of the tenth sternite. (dorsal view; flattened).

Fig. 27. Tenth sternites (TS) and ninth tergite. LN=lobe of ninth tergite.



*Culex erraticus* D. and K. and *Culex pilosus* (D. and K)  
 Fig. 28. Sidepiece of *C. erraticus*.  
 Fig. 29. Mesosomal plate of *C. erraticus*. (lateral view); BH=basal hook.  
 Fig. 30. Tenth sternite (TS) and mesosomal plate (M) of *C. erraticus*. BH=basal hook. (dorsal view).  
 Fig. 31. Mesosomal plate of *C. pilosus*. (lateral view). BH=basal hook.  
 Fig. 32. Sidepiece of *C. pilosus*

.1mm.



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Fig. 33. Sidepiece.

*Culex peccator* D. and K.  
(133)