THE MOSQUITOES OF OKLAHOMA

By

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PREFACE

The writer has endeavored to list the mosquito species in Oklahoma together with species that have been found near the Oklahoma border. Other pertinent information included concerns the identification, bionomics, distribution and synonymy of each species.

The distribution of the species listed in this work is based on the results of the writer's study plus all previous records that could be found.

I wish to thank my major adviser, Dr. D. E. Howell, without whose help this work would not have been possible. I also wish to thank Dr. R. R. Walton and Dr. J. E. Webster for their guidance in the preparation of this work.

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INTRODUCTION

Mosquitoes constitute one of the most important groups of insects in the world today. In addition to their potentiality as disease carriers they plague man and beast alike with their pestiferous biting.

The literature published on mosquitoes is very extensive and no attempt was made to review material unless it was pertinent to distribution records, identification, synonymy and bionomics of the mosquitoes included in this work.

Rozeboom (1942) made an excellent study of Oklahoma mosquitoes and reported 40 species in the state. Roth (1945) added one additional state record. Griffith (1952) in a statewide survey found 11 new state records which brought the total to 52. Hill, et al. (1958) recorded 55 Oklahoma species.

This work records three new state records and numerous new county records. Culex pipiens and C. quinquefasciatus are considered as a complex in this work and are recorded as one species; therefore, the total Oklahoma species is 58 at this time.

Most of the keys and illustrations in this work have been adapted from Carpenter and LaCasse (1955). No descriptions other than those in the keys are given here as most species have been redescribed numerous times by other authors. Excellent descriptions of all American species north of Mexico are contained in the former publication.

The bionomics tables were adapted in part from Carpenter and LaCasse (1955) and Public Health Publication 772 (1963).

Synonymy utilized here followed that of Stone, Knight, and Starke (1959), and Stone (1961).

METHODS

Field Collections

Larvae. Mosquito larvae of all species are found in aquatic habitats. Some live in permanent waters such as ponds, marshes, or lake margins while others breed only in temporary floodwaters such as ditches, rain pools, overflows, etc.; and still others breed only in treeholes or artificial containers. Mosquitoes breed in almost every type aquatic situation except large areas of open water such as lakes or seas.

Many of the specimens seen in this study were collected at earlier dates and the collector's methods are not known. In collecting larvae in habitats other than treeholes a white enamel dipper with an extension handle was used. In some cases a sampling device (Earle 1956) was utilized to facilitate collecting when large numbers of larvae were present. Treeholes were sampled by using a siphon hose or a large syringe with a bulb attached.

After the larvae were collected they were labelled and transferred to a 95 percent alcohol (ethanol), cellosolve (ethylene glycol monoethyl ether), or kept alive and brought into the laboratory for rearing to adults.

Adults. The adults used in this study were collected by light traps, resting stations, bait traps, while biting, or reared from larvae.

Light traps. Collecting adult mosquitoes in light traps is one of the most common methods utilized today. Its main advantage is the fact that specimens can be collected without the collector being present. It is a very useful method and is used a great deal by persons studying large areas for mosquito abundance and distribution. Some definite disadvantages to light traps include: variability of attractiveness to different species; ease of damaging the specimens by the fans in the traps; and the initial cost.

Biting records. A study of the biting records of mosquitoes is important in determining their medical importance. Unless the important species that bite man are known, the link between the disease and its mosquito vectors may not be recognized, or in the case of pest mosquitoes information needed for control purposes may be lacking. Biting collections give information concerning: species involved, biting time, biting habits, and effect of bite on host.

The biting collections in this study were made by allowing the mosquito to land, settle, begin to feed and then placing a chloroform killing tube over the specimen. A period of 10 to 15 seconds was usually sufficient to kill the mosquito. The specimen was then placed in a pill box and labelled with date, location, time and collector.

Resting stations. This was another method used to collect mosquitoes in this study. Resting stations indicate where the mosquito rests when not flying or feeding, and provides a method of collecting specimens for taxonomic study with little damage to the mosquito. The

procedures used for collecting specimens on resting stations were the same as for biting collections.

For the individual initiating a study without previous experience, Communicable Disease Center Public Health Publication 772 (1963) is highly recommended.

Preparation of Specimens for Study

General. Many methods have been utilized for preparing mosquito larvae and adults for further study. The methods described were found suitable by the writer, although they were not the only methods available.

Adult Females. To prepare adult females for further study the following techniques were used.

1. Insect pins were provided with card points.
2. The tip of the card point was dipped in clear fingernail polish (Revlon, 0108, #61 clear).
3. The mosquito was touched on the side of the thorax with the tip of the card point. This attached the specimen to the card point.
4. Labels with date of collection, location and collector were placed on the pins.
5. The specimens were then ready for study or storage.

Larvae. Permanent mounts.

1. The specimens were preserved in 70 to 90 percent alcohol until ready for processing.

2. The specimens were placed in cellosolve for 1 to 24 hours depending upon the size of larvae and personal workload. There did not seem to be a critical period for removal.
3. A small amount of Canada balsam was placed on a slide.
4. The abdomen was partially severed between the seventh and eighth abdominal segments. This allowed the anal segments to lie flat.
5. The specimen was transferred to the balsam and manipulated to a suitable position.
6. Sufficient balsam to fill the area under the cover glass was added.
7. The cover glass was added.
8. The slide was labelled with date of collection, location, and collector.
9. Specimens were then ready to be identified or placed in an oven for drying.

Temporary mounts.

1. Specimens were preserved in 50 to 70 percent alcohol until ready for use.
2. A small amount of mounting medium was placed on the slide. (Medium used contained 2.5g. type 71-24 polyvinyl alcohol, 15ml. distilled water and 30ml. of lacto-phenol solution.)
3. Specimen was transferred to slide and manipulated to a proper position.
4. Abdomen of specimen was partially severed between seventh and eight segments so anal segments would lie flat.

5. Sufficient medium was added to fill the area under the cover glass.
6. The cover glass was added.
7. Slide was labelled with date of collection, location and collector.
8. Slides were made semipermanent by ringing cover glass with clear fingernail polish or other ringing fluid.
9. Specimens were then ready to be identified or placed in an oven for drying.

DISCUSSION AND RESULTS

General

Due to the geographical location of Oklahoma and to its variety of topographic regions, an overlapping of mosquito distribution occurs in many areas of the state. In fact, a shifting of mosquito distribution may be occurring in Oklahoma. Rozeboom (1942) recorded Anopheles quadrimaculatus only as far west as central Oklahoma. Today it has been recorded throughout the state except for the Panhandle. Rozeboom mentioned the possibility of water impoundments such as, farm ponds, lakes, or reservoirs, aiding this species to move farther west, and records seem to indicate this has been the case. Other species may be affected by these improvements, but studies to prove this are lacking.

Bionomics

A brief summary of the bionomics and medical importance of Oklahoma mosquitoes is given in Table I. Certain species considered most important or that have unusual habits are discussed in more detail.

Treehole Breeding Mosquitoes

Aedes triseriatus is probably the most widely distributed of the treehole breeding mosquitoes in Oklahoma. It has been recorded throughout the state except in the Panhandle. Normally a treehole breeder, this species will also breed in artificial containers. A. zoosophus is

another common treehole breeder. It is usually associated with A. triseriatus in the woody areas of the state. A. hendersoni, recorded for the first time in Oklahoma during this study, was found breeding in two treeholes in Stillwater, Oklahoma. It was associated with A. triseratus and Orthopodomyia signifera in these holes. A. hendersoni has probably always been present in Oklahoma but until Breland (1960) restored its species status it would have been classified as A. triseriatus. Other Oklahoma species that normally breed in treeholes are: Anopheles barberi, Orthopodomyia alba, and Toxorhynchites rutilis septentrionalis.

Temporary Pool Breeders

This is probably the most important group of mosquitoes in the state as far as pest mosquitoes are concerned. Two of the most abundant species are Aedes vexans and Psorophora confinnis. Heavy rains that flood ditches, overflow ponds, lakes, etc., create ideal breeding sites for these and the other temporary pool breeders. The eggs of this group are laid on moist soil and may remain there a number of years. When flooding occurs they hatch and usually develop in 7 to 20 days. This group is generally at its peak in the spring and fall. Dry weather during the summer usually restricts their abundance.

Rock-Hole Mosquitoes

Aedes atropalpus normally breeds in rock crevices along the margins of streams. It has also been found breeding in 50-gallon drums at Fort Sill, Oklahoma.

Anopheles quadrimaculatus, A. punctipennis, A. pseudopunctipennis pseudopunctipennis

These are the most important species of anophelines in Oklahoma. A. quadrimaculatus is usually found breeding in large, clean areas of permanent water with considerable aquatic vegetation. The increasing numbers of manmade reservoirs has considerably increased the distribution of this species. A. punctipennis may be found associated with A. quadrimaculatus or may breed in swamps, pools, rain barrels or a wide variety of habitats. They are usually the first anophelines to appear in the spring. A. pseudopunctipennis pseudopunctipennis typically breed in shallow pools or streams, and they are frequently associated with thick growths of green algae.

Culex Group

This genus has a large variety of breeding habitats, ranging from artificial containers to fringes of large lakes. The most important ones in Oklahoma are probably the Culex pipiens-quinquefasciatus complex, C. tarsalis, C. salinarius, and C. restuans.

Mansonia perturbens

This is the only species of the genus in Oklahoma. The larvae and pupae of this species attach to the underwater portions of aquatic plants and obtain air from the plant. The adults are vicious biters and may become troublesome pests if sufficient numbers are present.

Culiseta inornata

This is the most common species of this genus in Oklahoma. It is usually found during the late fall and early spring. This could be

considered the cold weather species of Oklahoma for it may be found associated with ice. C. inornata may occur in large numbers but normally does not bite man.

Status

The mosquito fauna in Oklahoma today consists of 58 species. Three new state records are listed in the distribution section of this work. The three species and their recorders are: Aedes spencerii, by Rachels; A. hendersoni, by Parsons; and Uranotaenia lowii, by the Fourth U. S. Army Medical Laboratory.

Numerous new county records have been listed. Earlier workers have collected in the areas where these county records were taken, but they usually listed the species by major area type, rather than by specific county.

The author did not collect all the mosquitoes recorded in this work. Most collections were taken from previously-mentioned sources. The following species were collected by the author. The species, stage, habitat, county, and date collected are given.

Aedes atropalpus - larvae - artificial containers and rock holes - Comanche - June 1963. A. hendersoni - larvae and adults - treeholes - Payne - June 1965. A. sollicitans - larvae and adults - biting collections and roadside ditches - Payne - May and June 1965. A. thelcter - light trap - Comanche - June 1963. A. triseriatus - treeholes - larvae and adults - Payne - April, May and June 1965. A. vexans - biting collections - Payne - August 1964 and May 1965. Anopheles punctipennis - larvae and adults - streams and ponds - Payne - April and May 1965. A. quadrimaculatus - larvae - streambeds - margin

of pond - Payne - May 1965. Culex apicalis - larvae - streambed - Payne - May 1965. C. pipiens-quinquefasciatus complex - larvae and adults - ditches, ponds and resting stations - Payne - August and September 1964, July 1965. C. territans - larvae - streambeds - Payne - May 1965. Culiseta inornata - adults and larvae - ditches and resting stations - Payne - February and April 1965. Orthopodomyia signifera - larvae - treeholes - Payne - June 1965. Psorophora ciliata - adults and larvae - roadside ditch, resting stations and biting collections - Payne - June and July 1965. P. confinnis - larvae and adults - roadside ditches, resting stations, and biting collections - Payne - May and June 1965. P. ferox - adults - biting collections - Payne - May 1965. P. signipennis - adults - biting collections - Payne - June 1965.

It is hoped that the county distribution records in this work will aid future workers in mosquito studies in Oklahoma.

KEYS

The following keys include the adult females and fourth instar larvae of Oklahoma and borderline species. See Carpenter and LaCasse (1955) for identification of adult males.

Keys to the Genera

Larvae

1. Abdomen with palmate hairs (Fig. 1L); siphon absent . . . . . .Anopheles

   Abdomen without palmate hairs; siphon present 2

2.(1) Siphon reduced; sawlike teeth present on distal half of siphon (Fig. 2L) . . . . . Mansonia

   Siphon not reduced; without such teeth 3

3.(2) Siphon with pecten (Fig. 8L) 4

   Siphon without pecten (Fig. 4L). 8

4.(3) Siphon with a basal pair of hair tufts (Fig. 5L) . . . Culiseta

   Siphon without a basal pair of hair tufts. 5

5.(4) Siphon with several pairs of hair tufts or single hairs (Fig. 3L). . . . . .Culex

   Siphon with a single pair of tufts, single hair, or without hair 6

6.(5) Eighth abdominal segment with a sclerotized plate (Fig. 6L); head with four enlarged hairs on some species. . .Uranotaenia

Eighth abdominal segment lacking a sclerotized plate; head hairs not greatly enlarged 7

7.(6) Tufts of ventral brush on anal segment arising from within ventral part of anal saddle (Fig. 7L). . . . . Psorophora

Tufts of ventral brush on anal segment arising outside of ventral saddle (Fig. 8L) . . . . . .Aedes

8.(3) Comb scales present on eighth abdominal segment (Fig. 4L) . . . . . .Orthopodomyia

Comb scales absent on eight abdominal segment; normal or enlarged hairs may be present (Fig. 9L). . . . Toxorhynchites

Adults

1. Palpi as long, or nearly as long, as proboscis (Fig. 1A) . . . . . .Anopheles

Palpi distinctly shorter than proboscis (Fig. 2A). 2

2.(1) Proboscis rigid, and curved ventrally at distal tip (Fig. 3A); a large species . . . . . Toxorhynchites

Proboscis not rigid or curved at distal tip. 3

3.(2) Second marginal cell of wing short, less than half as long as its petiole (Fig. 4A); a small blue-scaled species . . . . . .Uranotaenia

Second marginal cell of wing as long or nearly as long as its petiole (Fig. 5A). 4

4.(3) Spiracular bristles present (Fig. 6A). 5

Spiracular bristles absent 6

5.(4) Tip of abdomen pointed . . . . . Psorophora

Tip of abdomen blunt . . . . . Culiseta

6.(4) Wing scales very broad; tip of abdomen blunt 7

Wing scales narrow, or if moderately broad, tip of abdomen pointed. 8

7.(6) Longitudinal lines of white scales on scutum (Fig. 7A) . . . . . .Orthopodomyia

No longitudinal lines of white scales on scutum, light scales may be present. . . . . Mansonia

8.(6) Tip of abdomen pointed; postspiracular bristles present (Fig. 8A). . . . . .Aedes

Tip of abdomen blunt; postspiracular bristles absent . . .Culex

Keys to the Species

Aedes

Larvae

1. Anal segment completely ringed by the saddle (Fig. 8L) 2

Anal segment not completely ringed by the saddle (Fig. 10L) 12

2.(1) Pecten with distal teeth detached (Fig. 8L). 3

Pecten with distal teeth nearly evenly spaced (Fig. 11A) . . .5

3.(2) Siphonal tuft inserted beyond the pecten (Fig. 8L) . . . . . nigromaculis

Siphonal tuft inserted within the pecten 4

4.(3) Twenty-five or more comb scales arranged in a patch; lower head hair 6, double or triple (Fig. 12L) . . . fulvus-pallens

Fifteen to twenty comb scales arranged in an irregular double row; lower head hair 6, single (Fig. 13L). . . . . thelcter

5.(2) Siphonal tuft inserted within the pecten (Fig. 14L) . . . . . .tormentor

Siphonal tuft inserted beyond the pecten (Fig. 11L). 6

6.(5) Preantennal head hair 7, double or triple; anal gills eight times as long as the saddle (Fig. 15L) . . . . . .dupreei

Preantennal head hair 7 with four to twelve branches; anal gills much less than eight times as long as the saddle . . .7

7.(6) Eighth abdominal segment with four to nine comb scales arranged in a single row (Fig. 11L). . . . . atlanticus

Eighth abdominal segment with usually more than nine comb scales in an irregular row or patch. 8

8.(7) Spinules of comb scales thornlike, or if rounded, median longer than submedian spinules 9

Spinules of comb scales rounded apically; median spinule no longer than submedian spinules (Figs. 16L and 17L) . . . . . taeniorhynchus

9.(8) Dorsal apical spine of siphon as long as the apical pecten tooth (Fig. 18L) 10

Dorsal apical spine of siphon shorter than apical pecten tooth 11

10.(9) Siphon about three times as long as wide (Fig. 18L) . . . . . mitchellae

Siphon about two times as long as wide (Fig. 19L) . . . . . .sollicitans

11.(9) Median spinule of comb scales at least two times as long as submedian spinules (Fig. 20L) . . . . . infirmatus

Median spinule of comb scales only slightly longer than submedian spinules (Fig. 21L). . . . . .trivittatus

12.(1) Pecten with at least one of the distal teeth detached (Fig. 10L) 13

Pecten with all of the teeth nearly evenly spaced (Fig. 23L) 16

13.(12) Siphonal tuft inserted within the pecten (Fig. 10L) . . . . . atropalpus

Siphonal tuft inserted beyond the pecten (Fig. 23L). 14

14.(13) Upper head hair 5 with three or more branches. 15

Upper head hair 5, single or double (Fig. 25L) . . . .spencerii

15.(14) Upper head hair 5, lower head hair 6 and preantennal head hair 7 inserted in a straight line; comb scales with submedian spinules extending over halfway to the tip (Fig. 24L) . . . . . cinereus

Upper head hair 5, lower head hair 6 and preantennal head hair 7 not inserted in a straight line; comb scales with submedian spinules extending about halfway to tip (Fig. 26L). . . . . vexans

16.(12) Antenna smooth; antennal tuft represented by a single hair (Fig. 27L) 17

Antenna spiculate; antennal tuft double or multiple. 20

17.(16) Preantennal head hair 7, single (Fig. 27L) . . . . . .aegypti

Preantennal head hair 7, multiple. 18

18.(17) Lateral hair of anal segment inserted near the center of the posterior border of the saddle, a depression of lighter color is on either side near the ventral margin of the saddle (Fig. 22L). . . . . .zoosophus

Lateral hair of anal segment inserted near the lower posterior lateral border of the saddle; light-colored depression absent (Fig. 23L) 19

19.(18) Acus attached to sclerotized part of siphon; anal gills short, usually less than length of anal segment; larvae appear dark colored when alive (Fig. 23L). . . . .triseriatus

Acus detached from sclerotized part of siphon; anal gills long, usually much longer than the siphon; larvae appear light colored when alive (Fig. 28L). . . . . hendersoni

20.(16) Comb scales with a strong median spine and weakly developed submedian spinules that are less than half as long as the median spine (Fig. 29L). . . . . stiticus

Comb scales rounded with some submedian spinules at least two-thirds as long as the median spine (Fig. 30L). . 21

21.(20) Upper head hair 5 with four or more branches; lower head hair 6 with three or more branches 22

Upper head hair 5, single to triple; lower head hair 6, single or double (Fig. 31) 23

22.(21) Comb scales with spinules narrow (Fig. 30L)
. . . . . .canadensis canadensis
Comb scales with spinules wide (Fig. 32L). . . . . .thibaulti

23.(21) Median spinule of comb scale noticeably longer than the submedian spinules 24
Median spinule of comb scales not noticeably longer than the submedian spinules (Fig. 33L). . . . . dorsalis

24.(23) Upper head hair 5, single or double (Fig. 31L) . . . .stimulans
Upper head hair 5, triple (Fig. 34L) . . . . . grossbecki

Adults

1. Proboscis with a white band of scales near the middle (Fig. 10A) 2
Proboscis without a white band near the middle 5

2.(1) Wing scales mostly dark scaled 3
Wing scales with mixed light and dark scales 4

3.(2) Dorsal aspect of abdominal segments with median areas of white or yellow scales on all segments (Fig. 9A)
. . . . . mitchellae
Dorsal aspect of abdominal segments without median areas of white or yellow scales, terminal segments may have lateral white or yellow scales (Fig. 11A). . . taeniorhynchus

4.(2) Last segments of hind tarsi mostly light scaled (Fig. 12A)
. . . . . .sollicitans
Last segments of hind tarsi mostly dark scaled (Fig. 13A).
. . . . . nigromaculis

5.(1) Tarsal segments with distinct white bands, at least on the hind legs (Fig. 14A) 6

Tarsal segments without distinct white bands 13

6.(5) Tarsal segments with bands of white scales on both sides of the joint (Fig. 15A). 7

Tarsal segments with bands of white scales only on the basal part of the joint (Fig. 14A) 9

7.(6) Dorsal aspect of the abdomen with a median line of white scales, or may appear entirely white (Fig. 16A). . . dorsalis

Dorsal aspect of abdomen without a median line of white scales 8

8.(7) Costa at base of wing with a small patch of white scales (Fig. 17A) . . . . . atropalpus

Costa at base of wing with dark scales . . . . . .canadensis canadensis

9.(6) Scutum with white scales forming a lyre-shaped marking (Fig. 18A) . . . . . .aegypti

Scutum without such a marking. 10

10.(9) Hind femora with basal half entirely white scaled (Fig. 14A) . . . . . .zoosophus

Hind femora with mixed white or dark scales or nearly all white. 11

11.(10) Bands of white scales on dorsal aspect of abdomen forming a median inverted V-shaped design (Fig. 19A) . . . . . vexans

Bands of scales on dorsal aspect of abdomen not forming an inverted V-shaped design. 12

12.(11) Wing scales moderately broad and mixed white and dark; scutum with scales forming a median dark brown stripe . . . . . grossbecki

Wing scales narrow, may be mixed white and dark or all dark; scutum nearly evenly colored with light brown to golden scales . . . . . stimulans

13.(5) Scutum with two postlateral dark brown or black spots (Fig. 20A) . . . . . fulvus-pallens

Scutum without such spots. 14

14.(13) Distinct bands (may be triangular in shape) or white or yellow scales on abdomen 15

Bands of white or yellow scales on abdomen absent or indistinct 18

15.(14) Wings with mixed light and dark scales; abdomen with a median line of white scales or appearing nearly all white. . . . . .spencerii

Wings mostly dark scaled though some white scales may be present; abdomen without a median line of white scales 16

16.(15) Abdominal bands of white scales forming a V-shaped design (Fig. 21A) . . . . . thelcter

Abdominal bands of white scales not forming a V-shaped design 17

17.(16) Dorsal aspect of first abdominal segment with a median patch of white scales; white abdominal bands of scales rounded outwardly (Fig. 22A) . . . . . cinereus

Dorsal aspect of first abdominal segment with a patch of brown scales; abdominal bands of white scales rounded inwardly (Fig. 23A). . . . . stiticus

18.(14) Median or lateral longitudinal stripe or patch of silver-white scales on scutum 19

Scutum not marked with silver-white scales though similar areas of white or yellow scales may be present 23

19.(18) Scutum with prelateral stripes of silver-white scales (Fig. 24A) 20

Scutum without prelateral stripes of silver-white scales . . 21

20.(19) Scutum with more dark scales than white or silver (Fig. 24A) . . . . . .triseriatus

Scutum with more white or silver scales than dark (Fig. 25A) . . . . . hendersoni

21.(19) Median broad stripe of white or yellow scales from front to just beyond middle of scutum (Fig. 26A) . . . . infirmatus

Median stripe of silver-white scales extending full length of scutum. 22

22.(21) Scutum with median stripe less than half the width of the dorsal aspect of scutum (Fig. 27A)

. . . . . atlanticus and tormentor (inseparable as adults)

Scutum with median stripe about half the width of the dorsal aspect of scutum; a small species. . . . . .dupreei

23.(18) Median dark stripe of scales becoming broader beyond the middle of the scutum (Fig. 28A). . . . . .thibaulti

Scutum with two broad white stripes of scales separated by a brown median stripe (Fig. 29A). . . . . .trivittatus

Anopheles

Larvae

1. Head hairs 5 to 7 simple, not plumose (Fig. 35L) . . . . .barberi

Head hairs 5 to 7 large and plumose (Fig. 36L) 2

2.(1) Outer clypeal hair 3, simple 3

Outer clypeal hair 3, feathered or branched (Fig. 36L) 4

3.(2) Caudal margin of spiracular plate with a pair of tail-like elongations (Fig. 37L)

. . . . . .pseudopunctipennis pseudopunctipennis

Caudal margin of spiracular plate rounded, tail-like elongations absent (Fig. 38L)

. . . . . .pseudopunctipennis franciscanus

4.(2) Inner clypeal hair 2 with minute feathering near the tip (Fig. 39L) . . . . . .walkeri

Inner clypeal hair 2 simple, no feathering present 5

5.(4) Inner clypeal hairs separated by more than the diameter of the basal tubercule, measure at the tubercule base (Fig. 36L) . . . . . .quadrimaculatus

Inner clypeal hairs separated by less than the diameter of the basal tubercule 6

6.(5) Hairs 0 and 2 on abdominal segments 4 and 5 well developed with four to nine branches (Fig. 1L) . . . . . crucians

Hairs 0 and 2 on abdominal segments 4 and 5 simple usually with one to three branches (Fig. 40L). . . . . punctipennis

Adults

1. All wing scales dark (Fig. 30A). 2

Some wing scales forming white or yellow areas (Fig. 30A). . .4

2.(1) Wings uniformly dark scaled; a small species (Fig. 30A)

. . . . . .barberi

Wings with distinct areas of darker scales 3

3.(2) Median area and vertex of occiput with few pale scales; palpi may or may not have white apical rings on segments (Fig. 32A) . . . . . .walkeri

Median area and vertex of occiput with many pale scales; palpi entirely dark scaled (Fig. 33A). . . . .quadrimaculatus

4.(1) Costa of wing with a white or yellow area only at the outer tip (Fig. 31A) . . . . . crucians

Costa of wing with white or yellow areas on outer third and at outer tip 5

5.(4) Palpi unbanded (Fig. 1A); wing veins 3 and 5 entirely dark scaled. . . . . punctipennis

Palpi banded (Fig. 34A); wing veins 3 and 5 with white or yellow scales 6

6.(5) Terminal segments of palpi dark scaled (Fig. 34A); wing vein 4 mostly dark scaled . . . . .pseudopunctipennis franciscanus

Terminal segments of palpi white or yellow scaled (Fig. 35A); wing vein 4 mostly white scaled

. . . . . .pseudopunctipennis pseudopunctipennis

Culex

Larvae

1. Lower head hair 6, single or double (Fig. 41L) 2

Lower head hair 6 with three or more branches (Fig. 42L) . . .5

2.(1) Siphon with two or three pairs of small subdorsal tufts in addition to the normal tufts (Fig. 43L). 3

Siphon without two or three pairs of subdorsal tufts; normal tufts or hairs present. 4

3.(2) Comb scales thorn-shaped (Fig. 44L); arranged in a single or double row. . . . . .erraticus

Comb scales rounded apically, fringed with subequal spinules (Fig. 45L); arranged in a patch . . . . . peccator

4.(2) Upper head hair 5, single or rarely double (Fig. 41L); basal diameter of siphon twice the apical diameter . . . . . .territans

Upper head hair 5, double or triple (Fig. 46L); basal diameter of siphon less than twice the apical diameter . . . . . apicalis

5.(1) Antenna nearly uniform in shape throughout, antennal tuft inserted near the middle (Fig. 42L) . . . . . restuans

Antenna constricted at the outer third, antennal tuft inserted near the outer third. 6

6.(5) Siphon with several single or possibly double, irregularly spaced hairs (Fig. 47L). . . . . .thriambus

Siphon with multiple pairs of hair tufts (Fig. 48L). 7

7.(6) Pairs of tufts on siphon in a straight line or nearly so (Fig. 3L). . . . . tarsalis

Pairs of tufts on siphon not in a straight line (Fig. 48L) . .8

8.(7) Lower head hair 6 usually with five or more branches 9

Lower head hair 6 with three or four branches. 10

9.(8) Dorsal microsetae on posterior margin of saddle much larger than those at dorsal middle (Fig. 49L) . . . . . peus (formerly stigmatosoma)

Dorsal microsetae on dorsal posterior margin of saddle not much larger than those at dorsal middle (Fig. 48L) . . . . . pipiens-quinquefasciatus complex

10.(8) Thorax deeply spiculate (Fig. 50L) . . . . . .nigripalpus

Thorax not deeply spiculate (Fig. 51L) . . . . . salinarius

Adults

1. Tarsal segments with distinct white bands (Fig. 36A) 2

Tarsal segments without such bands 4

2.(1) Proboscis with a distinct white band near the middle (Fig. 2A). 3

Proboscis without a distinct white band near the middle, an indistinct band may be present. . . . . .thriambus

3.(2) Femora and tibiae with narrow longitudinal lines or spots of white scales on outer sides (Fig. 36L). . . tarsalis

Femora and tibiae without narrow longitudinal lines or spots of white scales on outer sides . . . . . peus (formerly stigmatosoma)

4.(1) Dorsal aspect of abdominal segments with apical bands of white or yellow scales (Fig. 37L) . .*apicalis* or *territans* (It is difficult to separate these in the adult female stage.)

Dorsal aspect of abdominal segments with basal bands of white or yellow scales or all dark scales (Fig. 37A) 5

5.(4) Dorsal aspect of abdominal segments with white or yellow scales forming outwardly rounded bands (Fig. 38A) . . . . . *pipiens-quinquefasciatus* complex

Dorsal aspect of abdominal segments with white or yellow scales forming nearly straight bands, or bands absent. . . .6

6.(5) Abdominal scales yellow to white, or dark. 7

Abdominal scales an orange-yellow color, last segment of abdomen nearly all covered with these scales (Fig. 39A) . . . . . *salinarius*

7.(6) Wing scales slightly broader on vein 2 (Fig. 40A); small dark species . . . . . *erraticus* and *peccator* (inseparable as adult females)

Wing scales narrow on vein 2 8

8.(7) Dorsal aspect of abdomen with broad, white basal bands (Fig. 41A) . . . . . *restuans*

Dorsal aspect of abdomen without broad, white basal bands, lateral patches may be present (Fig. 42A). . . . .*nigripalpus*

Culiseta

Larvae

1. Pecten followed by a row of small tufts (Fig. 52L); antenna long, tuft inserted at distal third or fourth of shaft . . . . . melanura

Pecten not followed by a row of small tufts; antenna short, tuft inserted about in the middle 2

2.(1) Lateral hair of anal segment as long as or longer than the saddle (Fig. 5L) . . . . . inornata

Lateral hair of anal segment shorter than the saddle (Fig. 53L) . . . . . incidens

Adults

1. Hind tarsi with narrow pale bands of scales (Fig. 43A) . . . . . incidens

Hind tarsi entirely dark scaled. 2

2.(1) Costa of wing with mixed white and dark scales (Fig. 44A) . . . . . inornata

Costa of wing entirely dark scaled . . . . . melanura

Mansonia

Larvae

Anal segment with about four hair tufts piercing the saddle (Fig. 54L). . . . . .titillans

Anal saddle with zero, one or two hair tufts piercing the saddle (Fig. 2L) . . . . . perturbens

Adults

Segment 1 of hind tarsi with a median ring of pale white scales (Fig. 45A). . . . . perturbens

Segment 1 of hind tarsi without a median pale ring of scales, a ring may occur at basal part of segment, and there may be light scales over most of the segment . . . . . .titillans

Orthopodomyia

Larvae

Eighth abdominal segment with a sclerotized plate; siphonal tuft large, greater than width of the siphon at point of insertion. . . . . .signifera

Eighth abdominal segment without a sclerotized plate; siphonal tuft small, less than the width of the siphon at the point of insertion. . . . . alba

Adults

The two species recorded in Oklahoma are inseparable as adults (see genera key). . . . . alba and signifera

Psorophora

Larvae

1. Pecten with numerous teeth, usually twenty or more (Fig 7L) 2

Pecten with few teeth, usually less than ten 3

2.(1) Lateral hair of anal segment single, may be forked beyond middle (Fig. 55L) . . . . . howardii

Lateral hair of anal segment with three or four branches (Fig. 7L). . . . . .ciliata

3.(1) Siphonal tuft about as long as the siphon (Fig. 56L) . . . . . discolor

Siphonal tuft small or absent. 4

4.(3) Upper head hair 5 and lower head hair 6 multiple, usually with five or six branches (Fig. 57L) . . . . . .confinnis

Upper head hair 5 and lower head hair 6 single or double (Fig. 58L) 5

5.(4) Upper head hair 5 and lower head hair 6 single (Fig. 58L). . .6

Upper head hair 5 double, lower head hair 6 double or triple 7

6.(5) Antennal tuft with two to four branches (Fig. 58L) . . . . . cyanescens

Antennal tuft with eight to fifteen branches . . . .signipennis

7.(5) Antenna much longer than median length of head 8

Antenna not as long, or slightly longer than median length of head 9

8.(7) Comb scales with submedian spinules curved (Fig. 59L). . .ferox

Comb scales with submedian spinules straight (Fig. 60L) . . . . . .longipalpus

9.(7) Siphon strongly inflated (Fig. 61L). . . . . .horrida

Siphon only slightly inflated. . . . . .varipes

Adults

1. Wing scales mixed dark and light (Fig. 46A). 2

Wing scales mostly dark, a few light scales may be present . .4

2.(1) Outer third of hind femur with a narrow band of white scales (Fig. 47L). . . . . .confinnis

Outer third of hind femur without a narrow band of white scales 3

3.(2) Fringe of wing with alternating light and dark areas; distal portion of wing vein 6 white scaled (Fig. 46A) . .signipennis

Fringe of wing all dark; distal portion of wing vein 6 dark scaled. . . . . discolor

4.(1) Hind legs with very long, shaggy scales; very large species (Fig. 48A) 5

Hind legs without very long scales, they may be somewhat shaggy 6

5.(4) Scutum with a median longitudinal stripe of golden scales (Fig. 49A). . . . . .ciliata

Scutum without a median longitudinal stripe of golden scales . . . . . howardii

6.(4) Hind tarsi entirely dark scaled (Fig. 50A); a number of scales on legs with a metallic purple appearance . . . . . cyanescens

Hind tarsi with white scales on apical segments. 7

7.(6) Last segment of hind tarsi dark scaled (Fig. 51A). . . .varipes

Last segment on hind tarsi white scaled. 8

8.(7) Scutum with a broad median stripe of dark scales 9

Scutum without a broad median stripe of dark scales. . . .ferox

9.(8) Palpi about one-third as long as proboscis (Fig. 52A)

. . . . . .longipalpus

Palpi less than one-third as long as proboscis . . . . .horrida

Uranotaenia

Larvae

1. Upper head hair 5 and lower head hair 6, stout and spinose. 2

Upper head hair 5 and lower head hair 6, course but not directly stout . . . . . anhydor syntheta

2.(1) Prothoracic hair 3 with four to eight branches, barbed, and more than half as long as hairs 1 and 2 (Fig. 62L) . . .lowii

Prothoracic hair 3 with eight to ten branches, smooth and much less than half as long as 1 and 2 (Fig. 63L)

. . . . . sapphirina

Adults

1. Terminal segments of hind tarsi white scaled (Fig. 53A). .lowii

Terminal segments of hind tarsi entirely dark scaled 2

2.(1) Dorsal aspect of scutum with a median line of metallic blue scales (Fig. 54A). . . . . sapphirina

Dorsal aspect of scutum without a median line of metallic blue scales; a distinct lateral outline of these scales is present (Fig. 55A). . . . . anhydor syntheta

Toxorhynchites

Refer to the genera key; there is only one species of this genus recorded in Oklahoma . . . . . .*rutilis septentrionalis*

DISTRIBUTION

New records (NR) have been taken from the following sources: Oklahoma State University Museum; University of Oklahoma Museum; State Health Department, Oklahoma City; Army Corps of Engineers, Tulsa; Fourth U. S. Army Medical Laboratory, San Antonio, Texas; collections by the State Survey Entomologist; student and personal collections.

Oklahoma Mosquitoes

Aedes aegypti (Linnaeus)

Comanche, Love (NR), McCurtain, McIntosh, Payne.

A. atlanticus Dyar and Knab

Comanche, McCurtain, Oklahoma, Payne.

A. atropalpus (Coquillett)

Caddo, Cherokee (NR), Coal (NR), Comanche, Creek (NR), Johnston (NR), Marshall, McIntosh (NR), Murray (NR), Muskogee (NR), Oklahoma, Rogers (NR), Wagoner (NR), Woodward.

A. canadensis canadensis (Theobald)

Alfalfa (NR), Atoka, Choctaw, Coal (NR), Comanche, McCurtain, Murray (NR), Rogers (NR), Woodward (NR).

A. cinereus Meigen

Craig, Johnston, McCurtain, McIntosh, Sequoyah.

A. dorsalis (Meigen)

Alfalfa, Beaver (NR), Beckham (NR), Blaine (NR), Cimarron (NR), Comanche (NR), Cotton (NR), Creek (NR), Dewey (NR), Ellis (NR), Grant (NR), Greer (NR), Harmon (NR), Harper (NR), Jackson (NR), Roger Mills (NR), Texas (NR), Tillman (NR), Woodward (NR).

A. dupreei (Coquillett)

Beckham, Blaine, Canadian, Craig (NR), Johnston (NR), McCurtain, McIntosh, Murray, Oklahoma, Sequoyah.

A. fulvus-pallens Ross

Cleveland (NR), Oklahoma, Pottawatomie.

A. hendersoni Cockerell

Payne (NR), state record.

A. mitchellae (Dyar)

Jackson, Muskogee, Oklahoma.

A. nigromaculis (Ludlow)

Throughout the state.

A. sollicitans (Walker)

Alfalfa, Blaine (NR), Cleveland, Comanche, Cotton, (NR), Dewey (NR), Greer (NR), Harmon (NR), Jackson (NR), Kiowa (NR), Lincoln (NR), Nowata (NR), Oklahoma, Okmulgee (NR), Osage (NR), Payne (NR), Pontotoc (NR), Roger Mills (NR), Texas (NR), Tillman (NR), Woodward (NR).

A. spencerii (Theobald)

Pontotoc (NR), state record.

A. stiticus (Meigen)

Alfalfa (NR), Atoka (NR), Caddo (NR), Comanche (NR), Johnston (NR), Kay (NR), LeFlore (NR), McCurtain (NR), McIntosh (NR), Nowata (NR), Oklahoma, Pushmataha (NR), Rogers (NR).

A. taeniorhynchus (Wiedemann)

Comanche, Oklahoma.

A. thelcter Dyar

Caddo, Canadian, Comanche (NR), Cotton, Custer, Harmon, Logan.

A. tormentor Dyar and Knab

Murray

A. triseriatus (Say)

Throughout the state except Panhandle.

A. trivittatus (Coquillett)

Throughout the state except Panhandle.

A. vexans (Meigen)

Throughout the state.

A. zoosophus Dyar and Knab

Throughout the state except the Panhandle.

Anopheles barberi Coquillett

Blaine (NR), Bryan (NR), Comanche, Johnston (NR), Logan (NR), Mayes, McCurtain, McIntosh, Murray, Nowata, Oklahoma, Payne.

A. crucians Wiedemann

Alfalfa (NR), Bryan, Cherokee, Coal, Comanche, Craig (NR), Creek (NR), Dewey (NR), Johnston (NR), Latimer, LeFlore, McCurain, Murray (NR), Oklahoma, Payne, Pushmataha, Sequoyah (NR), Wagoner.

A. pseudopunctipennis franciscanus McCracken

Beaver, Beckman, Blaine, Comanche, Dewey, Ellis, Greer, Harmon, Harper, Kiowa, Roger Mills, Texas, Woodward (NR).

A. pseudopunctipennis pseudopunctipennis Theobald

Throughout the state.

A. punctipennis (Say)

Throughout the state.

A. quadrimaculatus Say

Throughout the state, no record from Panhandle.

Culex apicalis Adams

Throughout the state..

C. erraticus (Dyar and Knab)

Throughout the state.

C. nigripalpus Theobald

Comanche, Okfuskee (NR).

C. peccator Dyar and Knab

Bryan, Caddo (NR), Comanche (NR), Cotton (NR), McCurtain, Sequoyah (NR).

C. pipiens-quinquefasciatus complex Linnaeus

These two species are considered a complex in this work.

Throughout the state.

C. restuans Theobald

Throughout the state.

C. peus (formerly stigmatosoma) Speiser

Beckham, Blaine, Canadian, Ellis, Harper, Oklahoma.

C. salinarius Coquillett

Throughout the state.

C. tarsalis Coquillett

Throughout the state.

C. territans Walker

Alfalfa, Blaine, Cherokee (NR), Comanche, Delaware (NR), Marshall, Muskogee, Oklahoma, Payne (NR).

C. thriambus Dyar

Comanche, Marshall

Culiseta incidens (Thompson)

Cimarron, Texas.

C. inornata (Williston)

Throughout the state.

C. melanura (Coquillett)

McCurtain, Payne, Tulsa.

Mansonia perturbens (Walker)

Alfalfa, Coal (NR), Comanche (NR), Cotton (NR), Garvin (NR), Johnston (NR), Kiowa (NR), McIntosh (NR), Payne, Pushmataha (NR), Stephens (NR).

Orthopodomyia alba Baker

Comanche, Payne.

O. signifera (Coquillett)

Throughout the state except Panhandle.

Psorophora ciliata (Fabricius)

Throughout the state.

P. confinnis (Lynch Arribalzaga)

Throughout the state.

P. cyanescens (Coquillett)

Throughout the state.

P. discolor (Coquillett)

Throughout the state.

P. ferox (Humboldt)

Atoka (NR), Cherokee (NR), Cleveland (NR), Coal (NR), Comanche, Craig (NR), Custer (NR), Delaware (NR), Dewey (NR), Johnston, Kiowa (NR), LeFlore, Marshall, McCurtain (NR), Murray (NR), Noble (NR), Oklahoma, Okmulgee (NR), Osage (NR), Pontotac (NR), Pushmataha (NR), Sequoyah (NR), Wagoner (NR).

P. horrida (Dyar and Knab)

Bryan, Cleveland (NR), Choctow, Delaware, Johnston (NR), LeFlore, Marshall, McCurtain, McIntosh, Okfuskee, Okmulgee (NR), Payne, Pottawatomie, Sequoyah (NR), Tulsa, Woods.

P. howardii Coquillett

Bryan, Choctaw, Coal, Cotton (NR), Payne, Pottawatomie.

P. longipalpus Roth

Comanche, Johnston, Okmulgee (NR).

P. signipennis (Coquillett)

Throughout the state.

P. varipes (Coquillett)

Toxorhynchites rutilis septentrionalis (Dyar and Knab)

Choctaw (NR), Comanche (NR), LeFlore (NR), McCurtain (NR), Oklahoma, Payne, Pushmataha (NR).

Uranotaenia lowii Theobald

Comanche (NR), state record.

U. sapphirina (Osten Sacken)

Throughout the state except Panhandle.

U. anhydor syntheta Dyar and Shannon

Beaver, Beckham, Blaine, Coal, Comanche, Cotton, Dewey, Ellis, Garfield, Harmon, Harper, Jackson, Johnston, Logan, Murray, Pontotoc, Pottawatomie, Woods.

Borderline Species

Aedes grossbecki Dyar and Knab

Recorded in Red River County, Texas.

A. infirmatus Dyar and Knab

Recorded along the Texas and Arkansas borders.

A. stimulans (Walker)

Recorded in Kansas and Missouri.

A. thibaulti Dyar and Knab

Recorded on the Texas border and in central Arkansas.

Anopheles walkeri Theobald

Recorded in northern Louisiana and central Arkansas.

Mansonia titillans (Walker)

Recorded on the Texas border and in Arkansas.

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APPENDIX A

Table I. Bionomics of Mosquitoes Recorded in Oklahoma.

Species	Medical Importance	Preferred Larval Habitat	Most Common Biting Time	Flight Range
Aedes aegypti	Vector of yellow fever and dengue; vicious biter.	Artificial containers (tin cans, old tires, etc.).	Morning and late afternoon.	1 block to ½ mile.
A. atlanticus	Vicious biter.	Temporary pools.	Daylight in shaded areas.	Unknown.
A. atropalpus	Vicious biter.	Temporary pools in rockholes.	Mornings and evenings.	Unknown.
A. canadensis canadensis	Vicious biter.	Temporary pools.	Daylight in shaded areas.	Probably less than 1 mile.
A. cinereus	Vicious biter.	Temporary pools primarily in or near wooded areas.	Unknown.	Unknown.
A. dorsalis	Possible vector of Western encephalites; vicious biter.	Temporary pools; sometimes brackish waters.	Day or night, worst in evenings.	10-20 miles.
A. dupreei	None known.	Temporary pools, primarily in wooded areas.	Not particularly attracted to man.	Unknown.
A. fulvus-pallens	Vicious biter.	Not definitely known, but has been found in temporary pools.	Day or night.	Unknown.

Table I (cont.) Bionomics of Mosquitoes Recorded in Oklahoma.

Species	Medical Importance	Preferred Larval Habitat	Most Common Bitimg Time	Flight Range
A. grossbecki	Vicious biter.	Temporary pools early in the spring.	Day or night.	Unknown.
A. hendersoni	Vicious biter.	Flooded treeholes.	Unknown.	Unknown.
A. infirmatus	Vicious biter.	Temporary pools.	Daylight in shaded areas and at night.	Unknown.
A. mitchellae	Vicious biter when numerous.	Temporary pools.	Unknown.	Unknown.
A. nigromaculis	Vicious biter.	Temporary pools.	Day or night, worst in evenings.	2-5 miles.
A. sollicitans	Vicious biter.	Temporary pools, usually brackish with sulfates.	Day or night.	5-20 miles.
A. spencerii	Vicious biter.	Temporary pools.	Day or night.	Unknown.
A. stimulans	Vicious biter.	Temporary pools in early spring.	Daylight in shaded areas, and at night.	2 miles plus.
A. stiticus	Vicious biter.	Temporary pools.	Day or night.	25-30 miles.

Table I (cont.) Bionomics of Mosquitoes Recorded in Oklahoma.

Species	Medical Importance	Preferred Larval Habitat	Most Common Biting Time	Flight Range
A. taeniorhynchus	Vicious biter.	Temporary pools, usually brackish.	Day or night.	10-20 miles.
A. thelcter	Unknown.	Temporary pools.	Unknown.	Unknown.
A. thibaulti	Vicious biter.	Flooded bases of trees, primarily sweet and tupelo gum.	Day or night.	Probably less than 1 mile.
A. tormentor	Vicious biter.	Temporary pools.	Unknown.	Unknown.
A. triseriatus	Vicious biter.	Flooded treeholes; occasionally artificial containers.	Morning or evening in wooded areas.	½-1 mile.
A. trivittatus	Vicious biter.	Temporary pools.	Daylight or evening.	Probably less than 1 mile.
A. vexans	Vicious biter.	Temporary pools.	Day or night.	5-20 miles.
A. zoosophus	Vicious biter.	Flooded treeholes; occasionally artificial containers.	Usually morning or evening in wooded areas.	Unknown.
Anopheles barberi	None known.	Flooded treeholes and stumps.	Evening.	Unknown.

Table I (cont.) Bionomics of Mosquitoes Recorded in Oklahoma.

Species	Medical Importance	Preferred Larval Habitat	Most Common Biting Time	Flight Range
A. crucians	Possible vector of malaria.	Swamps, road ruts, lake or pond margins.	Nights or cloudy days.	1 mile.
A. pseudopunctipennis franciscanus	None known.	Shallow pools with vegetation, particularly green algae.	Usually night.	1 mile.
A. pseudopunctipennis pseudopunctipennis	None in United States; vector of malaria in Mexico, Central and South America.	Same as A. p. franciscanus.	Usually night.	1 mile.
A. punctipennis	A potential but not thought to be an important vector of malaria.	Fresh water pools, streams, and lake margins, prefers cool water.	Daylight in shaded areas and evenings.	1 mile.
A. quadrimaculatus	Primary vector of malaria in United States.	Clean, partially shaded fresh water with vegetation.	Usually in the evening.	1 mile.
A. walkeri	Potential vector of malaria.	Fresh water marshes, ponds, and lakes with vegetation.	Day or night.	1-2 miles.
Culex apicalis	None known.	Woodland pools and streams.	Not known to feed on man.	Unknown.

Table I (cont.) Bionomics of Mosquitoes Recorded in Oklahoma.

Species	Medical Importance	Preferred Larval Habitat	Most Common Biting Time	Flight Range
C. erraticus	None known.	Permanent water with vegetation.	Night.	Unknown.
C. nigripalpus	Potential vector of St. Louis encephalitis.	Flooded fresh water fields, ditches, pools.	Evenings.	Unknown.
C. peccator	None known.	Fresh water pools and marshy areas.	Unknown.	Unknown.
C. pipiens-quinquefasciatus complex	A known vector of St. Louis and western encephalitis and Wuchereria bancrofti; a troublesome pest.	Permanent water with or without pollution; artificial containers.	Nights usually in houses.	1 mile or more.
C. restuans	Possible encephalitis vector.	Fresh water pools, ditches, etc.; artificial containers.	Unknown.	Unknown.
C. salinarius	None known.	Grassy pools, bays, ditches of fresh or brackish water.	Usually at night.	Unknown.
C. peus (formerly stigmatosoma)	Possible encephalitis vector.	Permanent or temporary, clear or polluted fresh water.	Rarely feeds on man.	Unknown.

Table I (cont.) Bionomics of Mosquitoes Recorded in Oklahoma.

Species	Medical Importance	Preferred Larval Habitat	Most Common Biting Time	Flight Range
C. tarsalis	A known vector of St. Louis and western encephalitis; a troublesome pest.	Wide range of clean or polluted fresh waters.	Evening and night.	2-5 miles.
C. territans	None known.	Ponds and marshes with vegetation.	Not known to feed on man.	Unknown.
C. thriambus	None known.	Marshes, rock pools and variety of fresh water habitats.	Not known to feed on man.	Unknown.
Culiseta incidens	Potential vector of St. Louis and Japanese B encephalitis.	Wide range of temporary or permanent waters; artificial containers.	Unknown.	Unknown.
C. inornata	Potential vector of western or Japanese B encephalitis.	Wide range of habitats; temporary or permanent water; artificial containers.	Does not usually bite man.	Probably less than 1 mile.
C. melanura	Potential vector of encephalitis.	Normally in small, permanent bodies of water in swampy areas.	Does not usually bite man.	100-1000 yards.

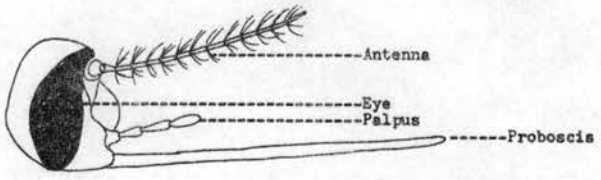
Table I (cont.) Bionomics of Mosquitoes Recorded in Oklahoma.

Species	Medical Importance	Preferred Larval Habitat	Most Common Biting Time	Flight Range
Mansonia perturbens	Potential vector of encephalitis; vicious biter.	Ponds with vegetation; larvae attach to underwater portion of plants.	Evening and night.	Several miles.
M. titillans	Potential vector of encephalitis; vicious biter.	Same as *M. perturbens*.	Evening and night.	Several miles.
Orthopodomyia alba	None known.	Flooded treeholes and stumps; possibly artificial containers.	Not known to bite man.	Unknown, probably short.
O. signifera	None known.	Flooded treeholes and stumps.	Not known to bite man.	Unknown, probably short.
Psorophora ciliata	Vicious biter.	Temporary pools.	Day or night.	5 miles or more.
P. confinnis	Vicious biter.	Temporary pools, ricefields.	Day or night.	5 miles or more.
P. cyanescens	Vicious biter.	Temporary pools.	Day or night.	5 miles or more.
P. discolor	Vicious biter.	Temporary pools.	Day or night.	Unknown.

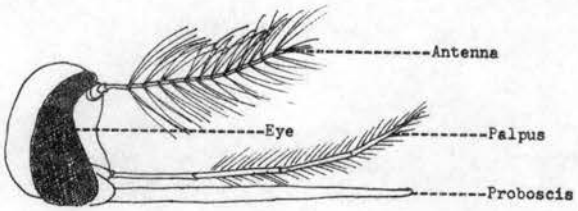
Table I (cont.) Bionomics of Mosquitoes Recorded in Oklahoma.

Species	Medical Importance	Preferred Larval Habitat	Most Common Biting Time	Flight Range
P. ferox	Vicious biter.	Temporary pools.	Day or night.	Unknown.
P. horrida	Vicious biter.	Temporary pools.	Day or night.	Unknown.
P. howardii	Vicious biter.	Temporary pools.	Day or night.	Unknown.
P. longipalpus	Unknown but probably vicious biter.	Temporary pools.	Unknown.	Unknown.
P. signipennis	Bites man but is not considered as much a pest as other Psorophora.	Temporary pools.	Day or night.	Unknown.
P. varipes	Vicious biter.	Temporary pools.	Day or night.	Unknown.
Toxorhynchites rutilis septentrionalis	Larvae are predaceous on other mosquito larvae.	Flooded treeholes and artificial containers.	Not known to bite man.	Unknown.
Uranotaenia lowii	None known.	Margins of grassy, shallow ponds and lakes.	Not known to bite man.	Unknown.
U. sapphirina	None known.	Permanent ponds and lakes with vegetation.	Not known to bite man.	Unknown.
U. anhydor syntheta	None known.	Grassy ditches; streams, ponds, lakes with vegetation.	Not known to bite man.	Unknown.

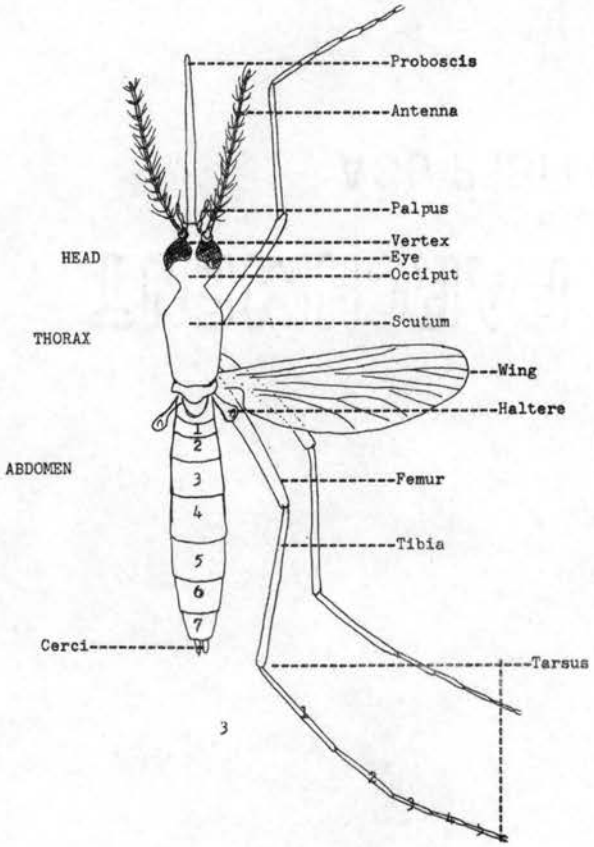
APPENDIX B


Antenna
Eye
Palpus
Proboscis

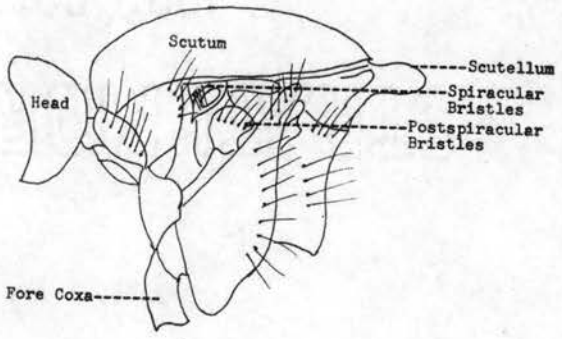
1


Antenna
Eye
Palpus
Proboscis

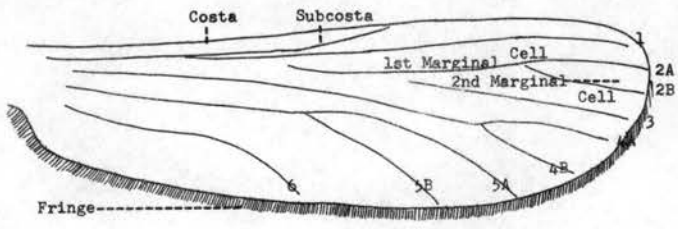
2


Proboscis
Antenna
Palpus
Vertex
Eye
Occiput
HEAD
THORAX
Scutum
Wing
Haltere
ABDOMEN
1
2
3
4
5
6
7
Femur
Tibia
Cerci
Tarsus

3


Scutum
Head
Scutellum
Spiracular Bristles
Postspiracular Bristles
Fore Coxa

4


Costa
Subcosta
1st Marginal Cell
2nd Marginal Cell
1
2A
2B
3
4B
5B
5A
6
Fringe

5

PLATE I

The following figures illustrate the important diagnostic characters utilized in the keys of this work. Figures are not drawn to scale.

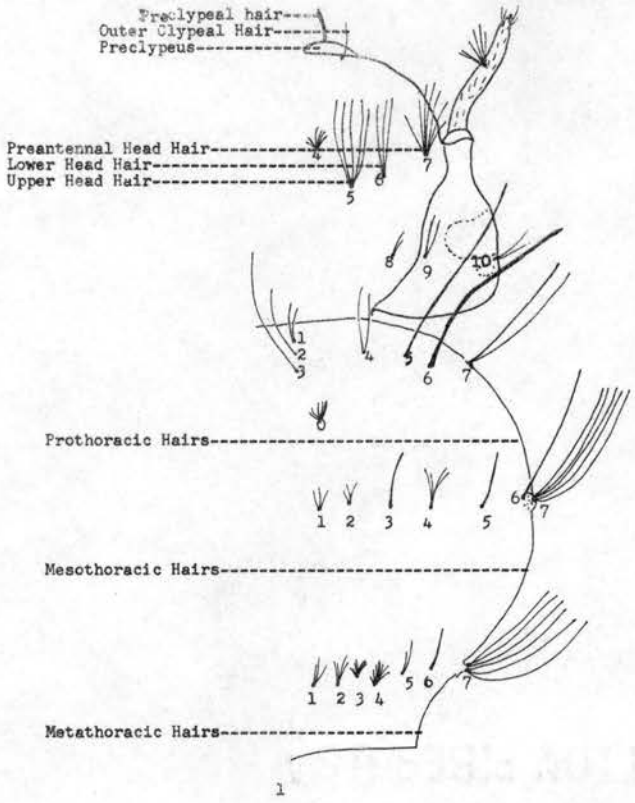
Fig. 1. Adult female, head.

Fig. 2. Adult male, head.

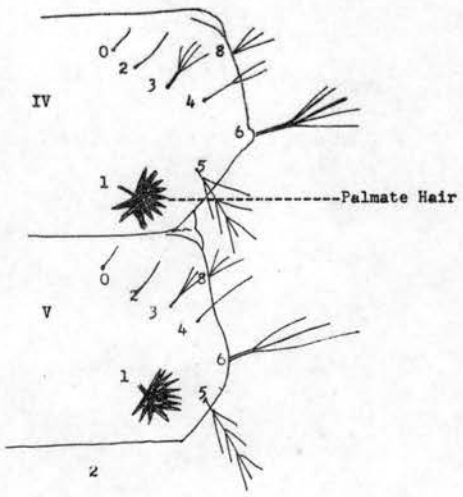
Fig. 3. Adult female, head, thorax and abdomen.

Fig. 4. Adult female, head and thorax.

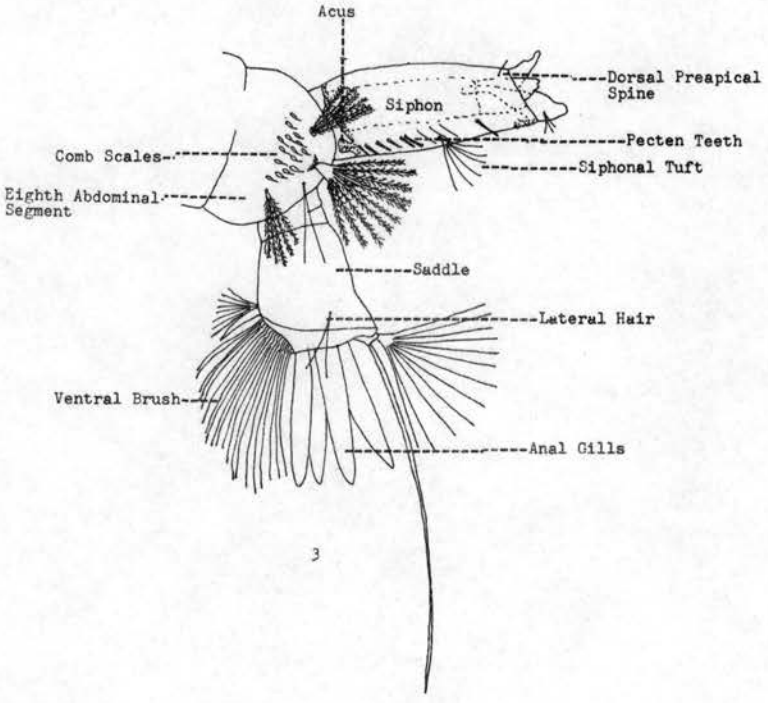
Fig. 5. Adult female, wing.


Preclypeal hair
Outer Clypeal Hair
Preclypeus
Preantennal Head Hair
Lower Head Hair
Upper Head Hair
Prothoracic Hairs
Mesothoracic Hairs
Metathoracic Hairs

1

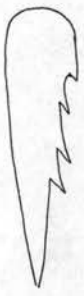

IV
V
Palmate Hair

2


Acus
Siphon
Dorsal Preapical Spine
Pecten Teeth
Siphonal Tuft
Comb Scales
Eighth Abdominal Segment
Saddle
Lateral Hair
Ventral Brush
Anal Gills

3

4



5

PLATE II

The following figures illustrate the important diagnostic characters utilized in the keys of this work. Figures are not drawn to scale.

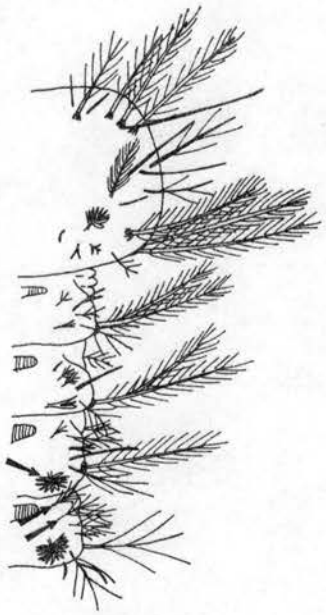
Fig. 1. Larva, head and thorax.

Fig. 2. Larva, abdominal segments.

Fig. 3. Larva, anal segments.

Fig. 4. Larva, comb scale.

Fig. 5. Larva, pecten tooth.



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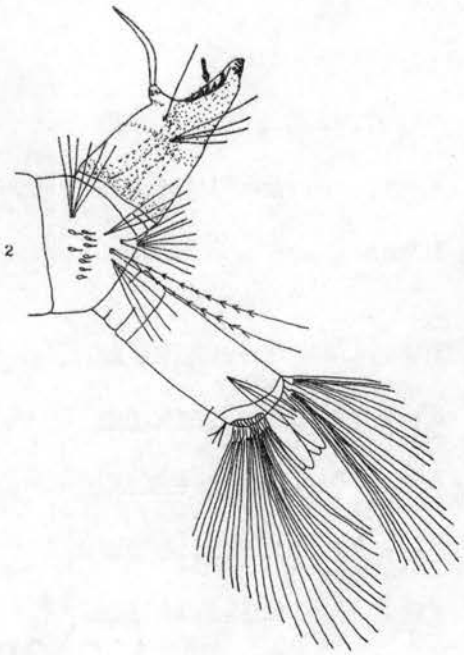
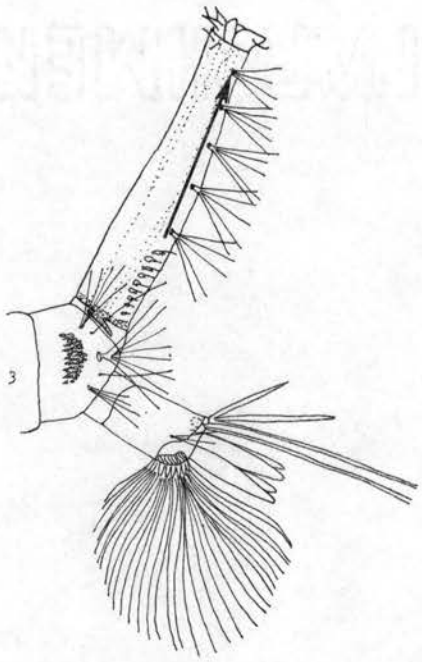


2



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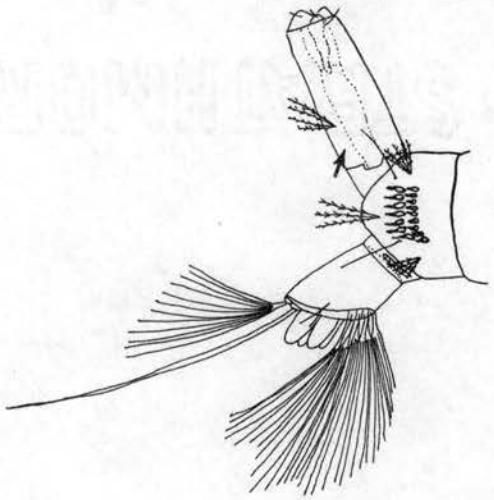

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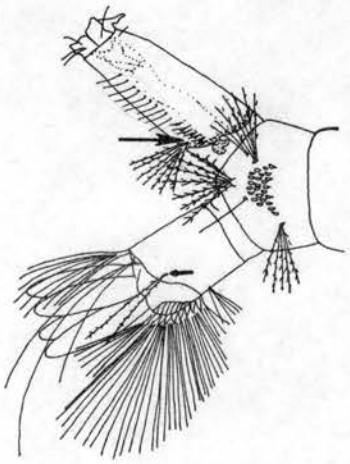


5

PLATE III

The figures in Plates III-XIV correspond with the keys in the text. Arrows indicate diagnostic characters of the species concerned. Figures are not drawn to scale.

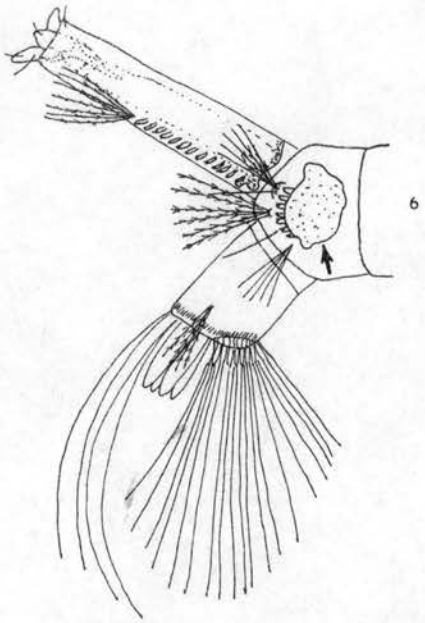
Fig. 1L. *Anopheles crucians* Wiedemann.

Fig. 2L. *Mansonia perturbens* (Walker).

Fig. 3L. *Culex tarsalis* Coquillett.

Fig. 4L. *Orthopodomyia alba* Baker.

Fig. 5L. *Culiseta inornata* (Williston).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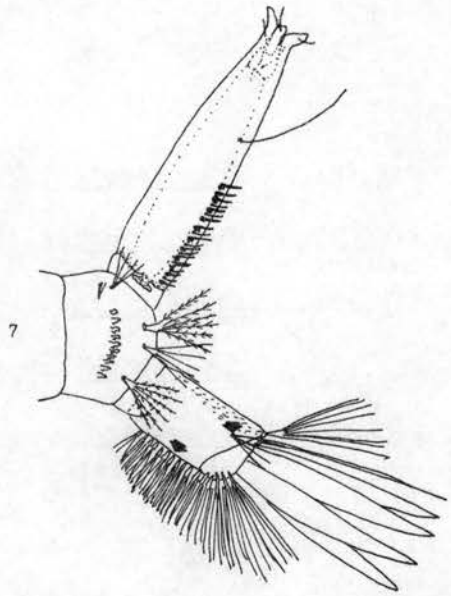
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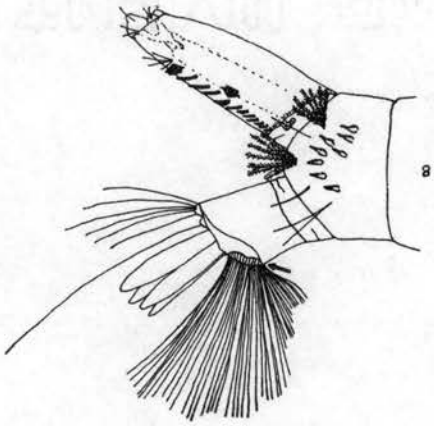
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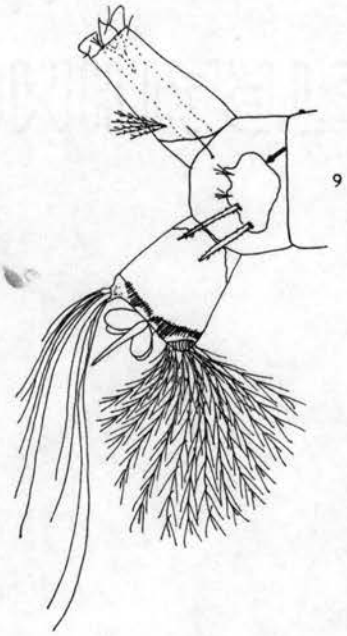
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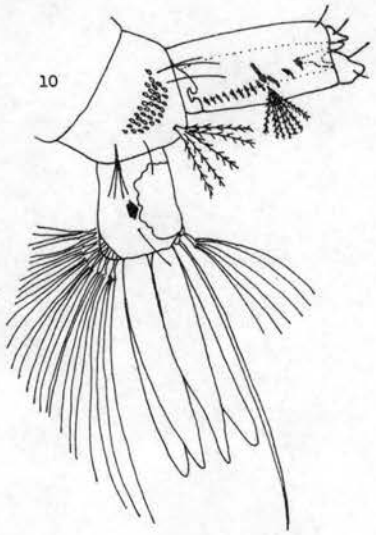

10

PLATE IV

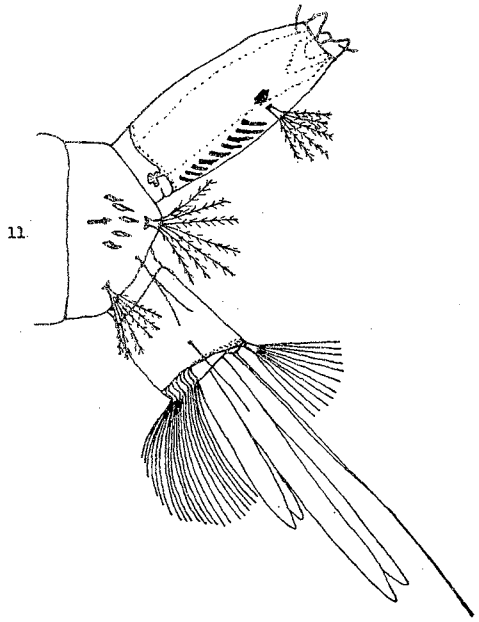
Fig. 6L. Uranotaenia spp.

Fig. 7L. Psorophora ciliata (Fabricius).

Fig. 8L. Aedes nigromaculis (Ludlow).

Fig. 9L. Toxorhynchites rutilis septentrionalis (Dyar and Knab).

Fig. 10L. Aedes atropalpus (Coquillett).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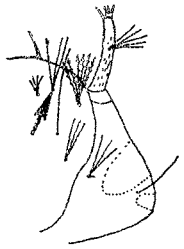
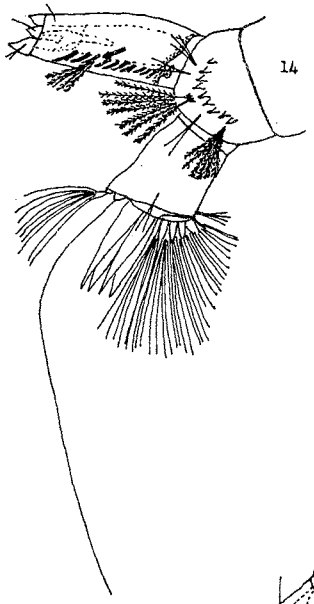

12.


13.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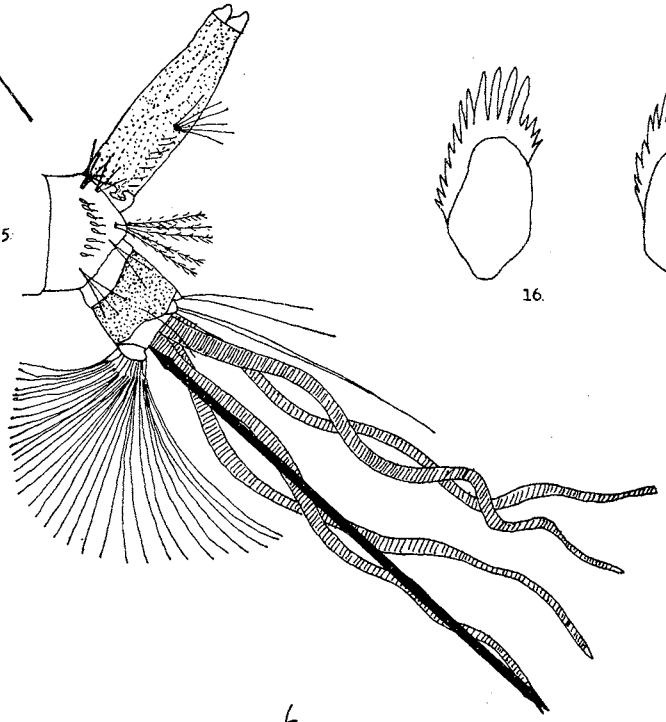
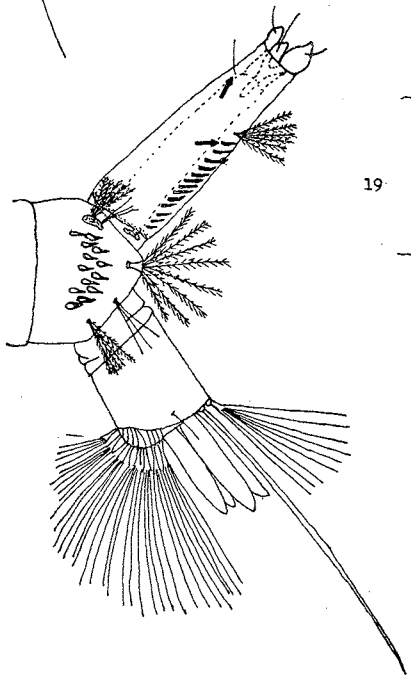

15.

16.


17.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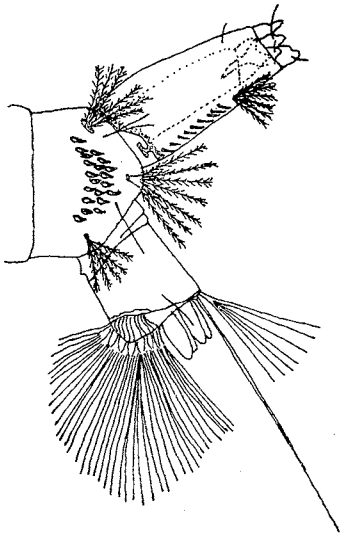

19.


20.


21.

PLATE V

Fig. 11L. Aedes atlanticus Dyar and Knab.

Fig. 12L. A. fulvus-pallens Ross.

Fig. 13L. A. thelcter Dyar.

Fig. 14L. A. tormentor Dyar and Knab.

Fig. 15L. A. dupreei (Coquillett).

Fig. 16L. A. taeniorhynchus (Wiedemann).

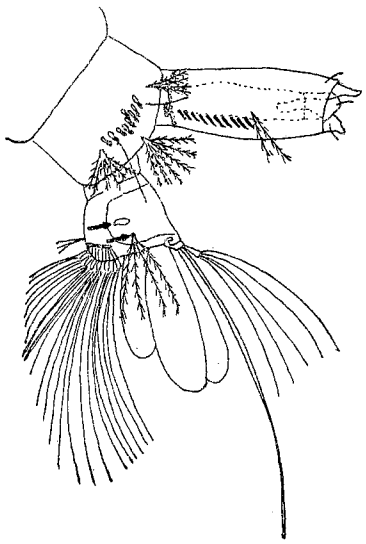
Fig. 17L. A. taeniorhynchus (Wiedemann).

Fig. 18L. A. mitchellae (Dyar).

Fig. 19L. A. sollicitans (Walker).

Fig. 20L. A. infirmatus Dyar and Knab.

Fig. 21L. A. trivittatus (Coquillett).



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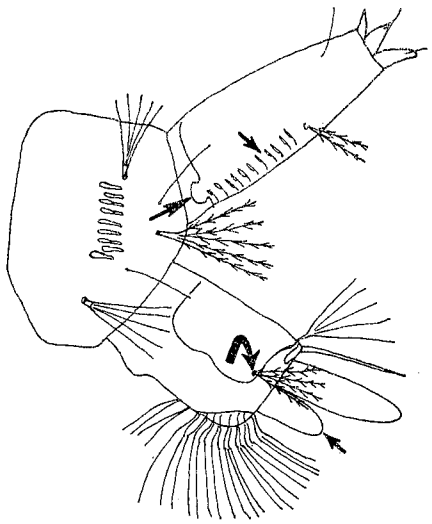

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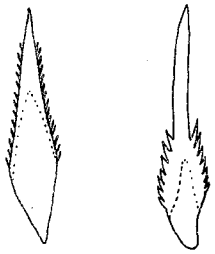

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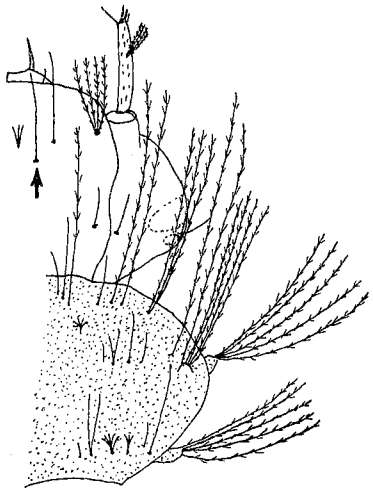
26

29



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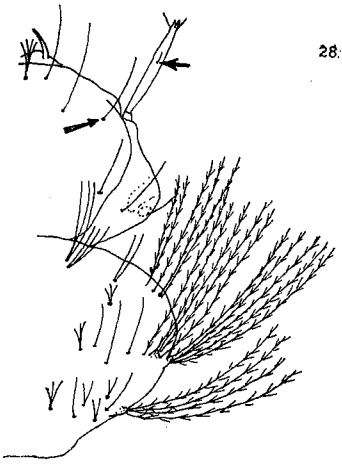

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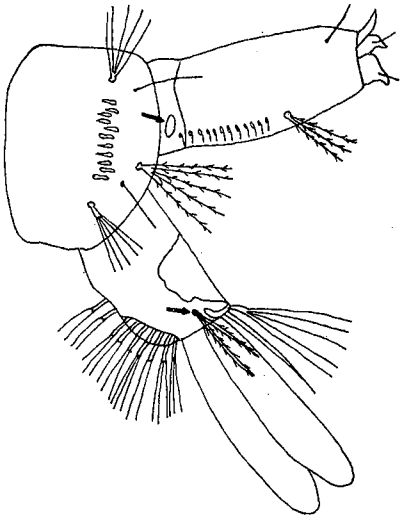

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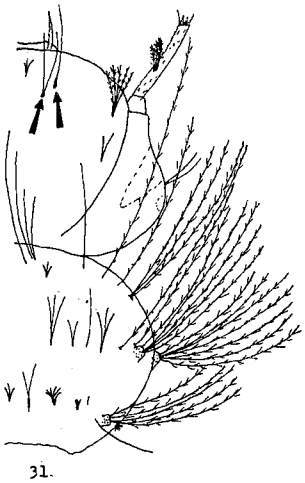


31

32

33

PLATE VI

Fig. 22L. *Aedes zoosophus* Dyar and Knab.

Fig. 23L. *A. triseriatus* (Say).

Fig. 24L. *A. cinereus* Meigen.

Fig. 25L. *A. spencerii* (Theobald).

Fig. 26L. *A. vexans* (Meigen).

Fig. 27L. *A. aegypti* (Linnaeus).

Fig. 28L. *A. hendersoni* Cockerell.

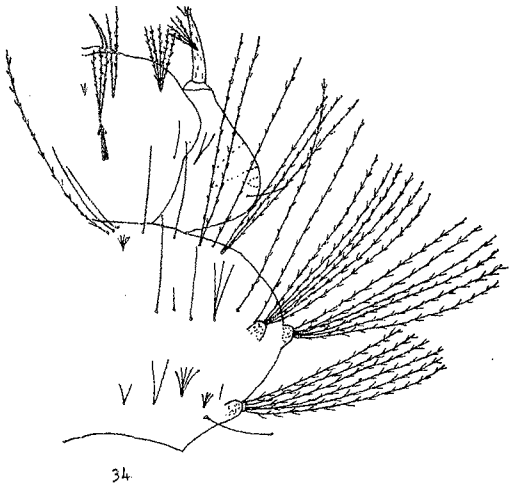
Fig. 29L. *A. stiticus* (Meigen).

Fig. 30L. *A. canadensis canadensis* (Theobald).

Fig. 31L. *A. stimulans* (Walker).

Fig. 32L. *A. thibaulti* Dyar and Knab.

Fig. 33L. *A. dorsalis* (Meigen).



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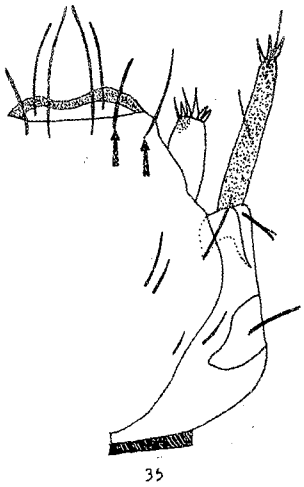

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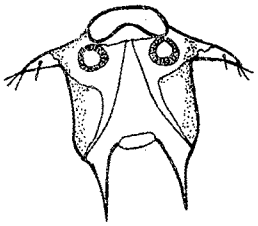

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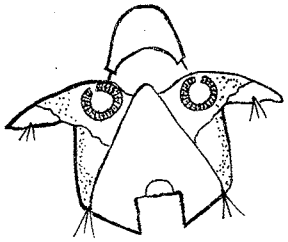

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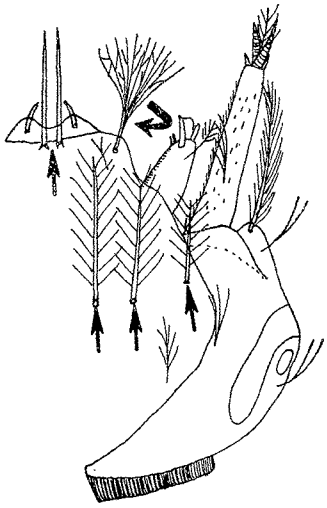

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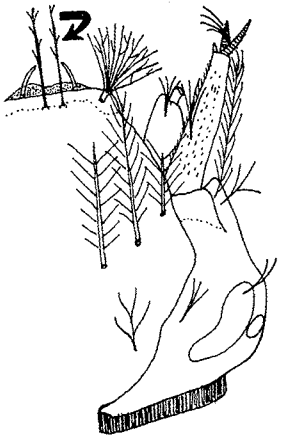

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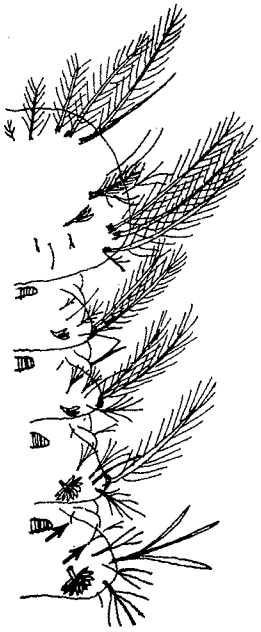

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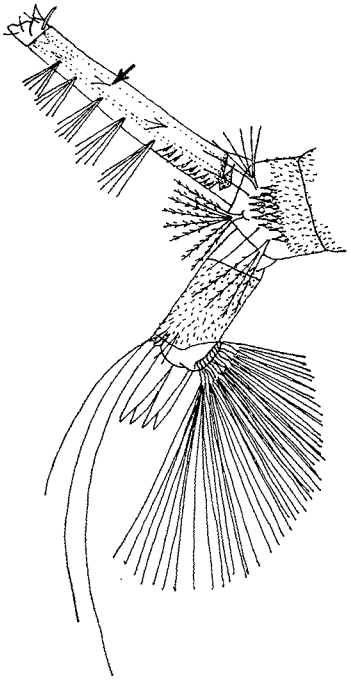

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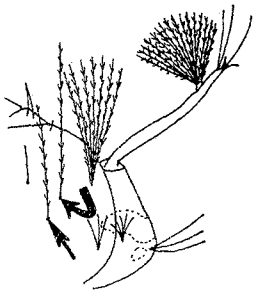

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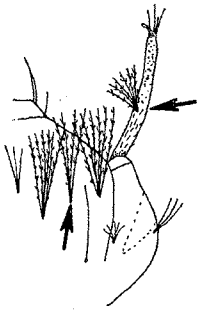


42

45

PLATE VII

Fig. 34L. Aedes grossbecki Dyar and Knab.

Fig. 35L. Anopheles barberi Coquillett.

Fig. 36L. A. quadrimaculatus Say.

Fig. 37L. A. pseudopunctipennis pseudopunctipennis Theobald.

Fig. 38L. A. pseudopunctipennis franciscanus McCracken.

Fig. 39L. A. walkeri Theobald.

Fig. 40L. A. punctipennis (Say).

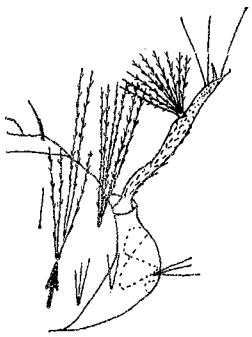
Fig. 41L. Culex territans Walker.

Fig. 42L. C. restuans Theobald.

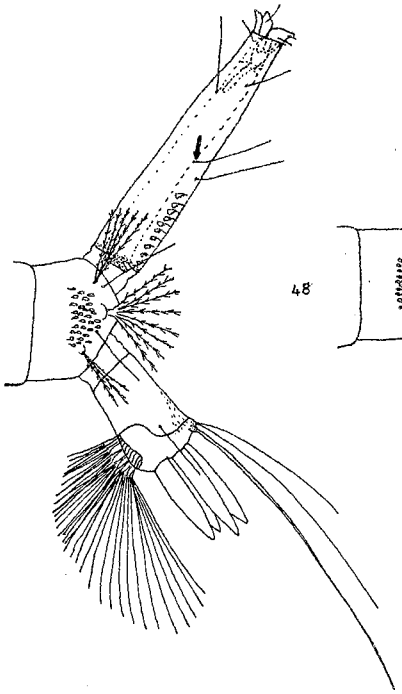
Fig. 43L. C. erraticus (Dyar and Knab).

Fig. 44L. C. erraticus (Dyar and Knab).

Fig. 45L. C. peccator Dyar and Knab.



46.



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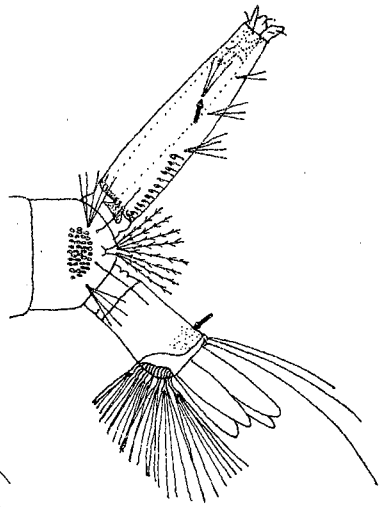

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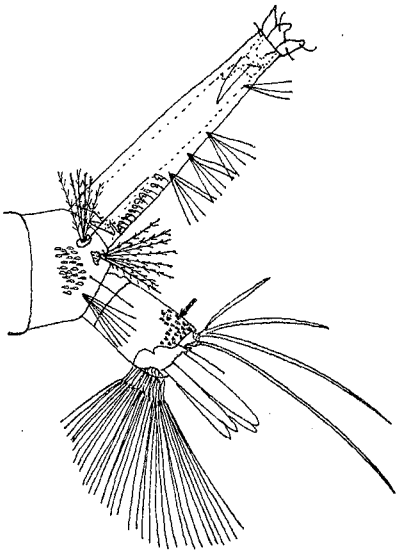

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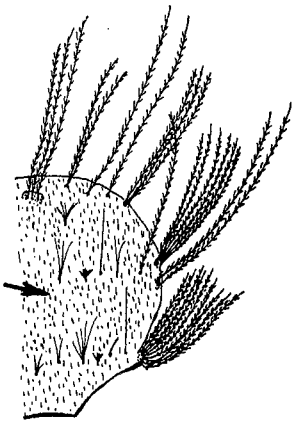

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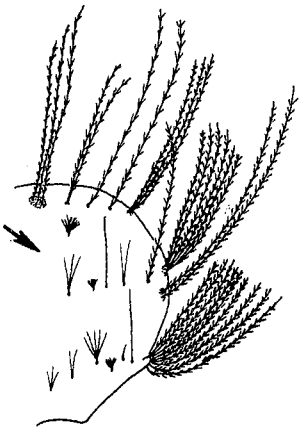

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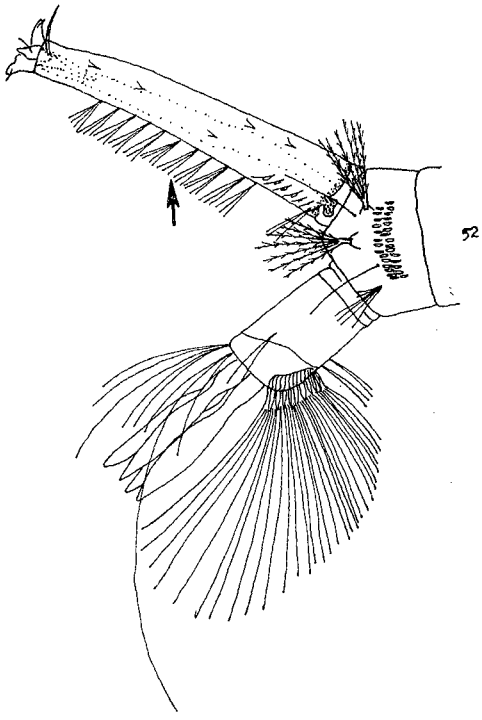

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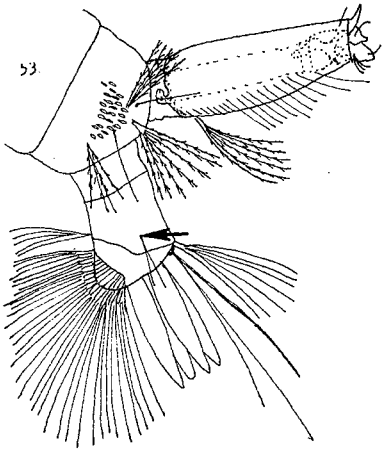

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PLATE VIII

Fig. 46L. Culex apicalis Adams.

Fig. 47L. C. thriambus Dyar.

Fig. 48L. C. pipiens-quinquefasciatus Linnaeus.

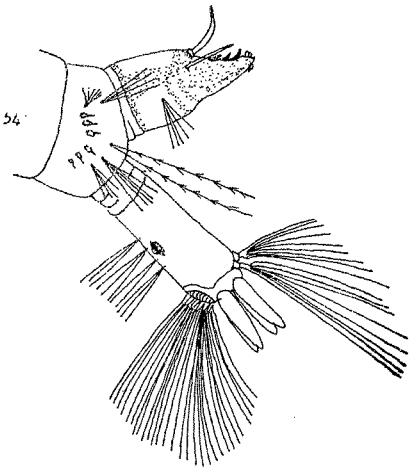
Fig. 49L. C. peus Speiser.

Fig. 50L. C. nigripalpus Theobald.

Fig. 51L. C. salinarius (Coquillett).

Fig. 52L. Culiseta melanura (Coquillett).

Fig. 53L. C. incidens (Thompson).



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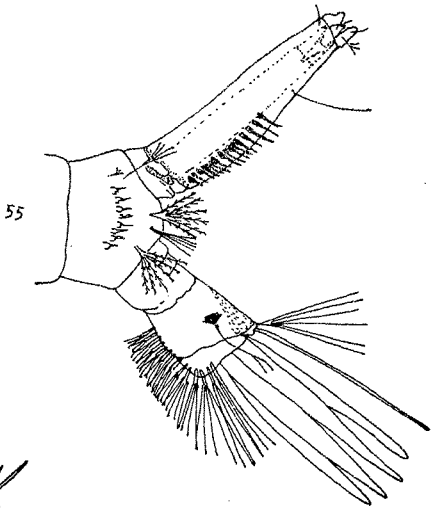

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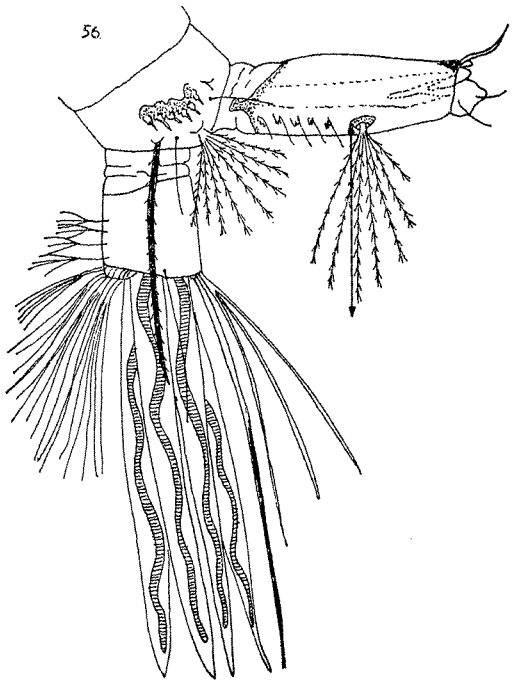

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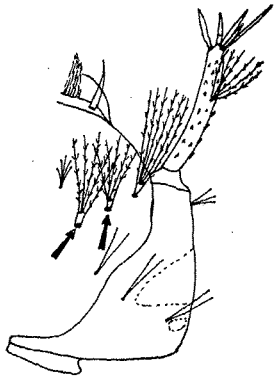

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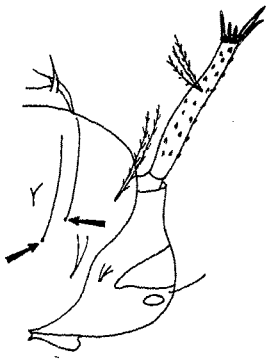

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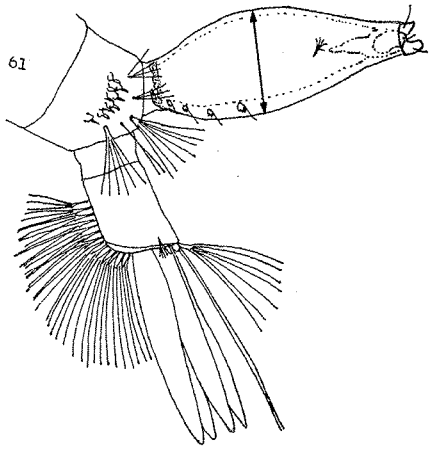

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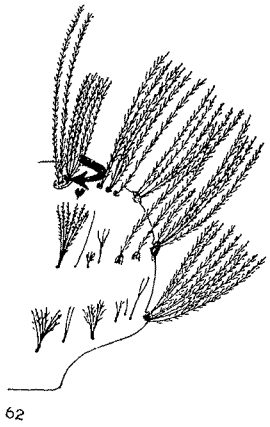

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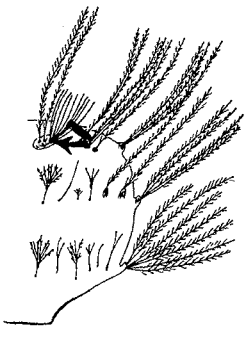

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PLATE IX

Fig. 54L. *Mansonia titillans* (Walker).

Fig. 55L. *Psorophora howardii* Coquillett.

Fig. 56L. *P. discolor* (Coquillett).

Fig. 57L. *P. confinnis* (Lynch Arribalzaga).

Fig. 58L. *P. cyanescens* (Coquillett).

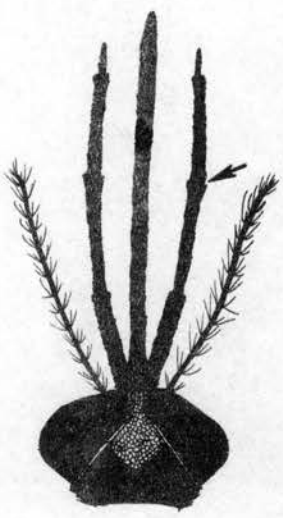
Fig. 59L. *P. ferox* (Humboldt).

Fig. 60L. *P. longipalpus* Roth.

Fig. 61L. *P. horrida* (Dyar and Knab).

Fig. 62L. *Uranotaenia lowii* Theobald.

Fig. 63L. *U. sapphirina* (Osten Sacken).



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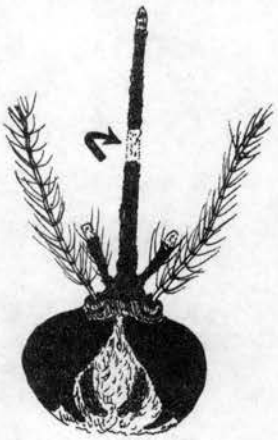

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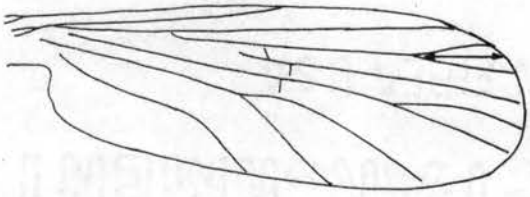

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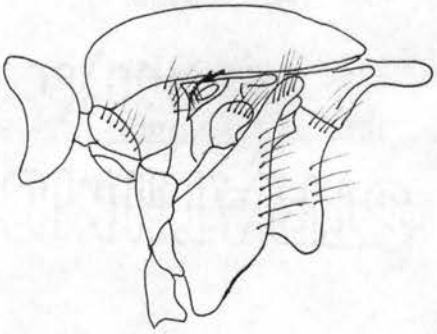

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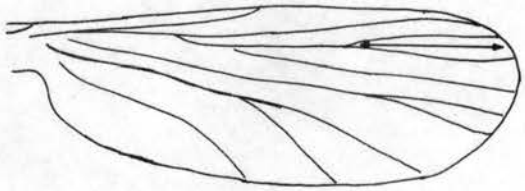

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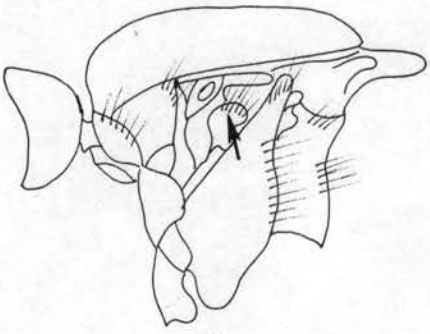

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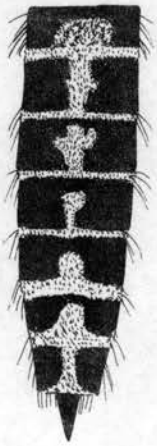

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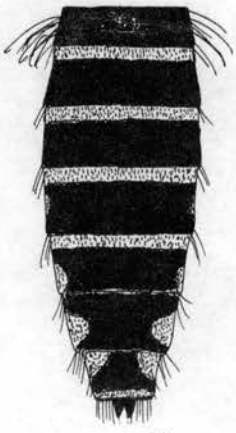

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PLATE X

Fig. 1A. *Anopheles punctipennis* (Say).

Fig. 2A. *Culex tarsalis* Coquillett.

Fig. 3A. *Toxorhynchites rutilis septentrionalis* (Dyar and Knab).

Fig. 4A. *Uranotaenia spp.*

Fig. 5A. *Culex spp.*

Fig. 6A. Adult female.

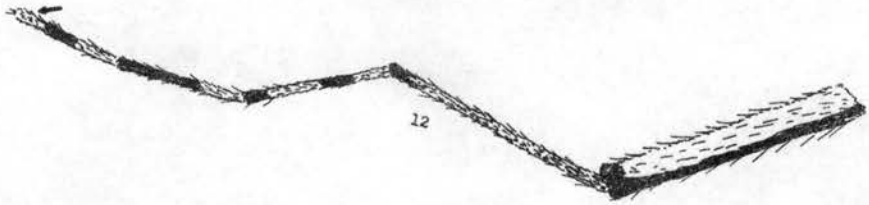
Fig. 7A. *Orthopodomyia spp.*

Fig. 8A. Adult female.

Fig. 9A. *Aedes mitchellae* (Dyar).

Fig. 10A. *A. taeniorhynchus* (Wiedemann).

Fig. 11A. *A. taeniorhynchus* (Wiedemann).



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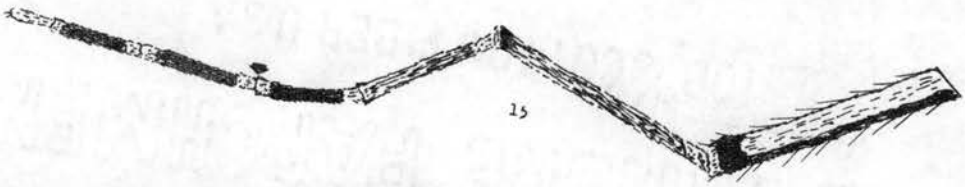

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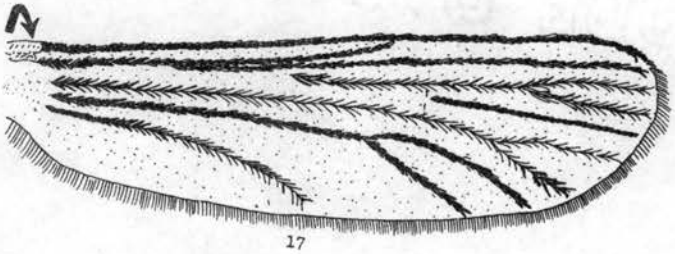

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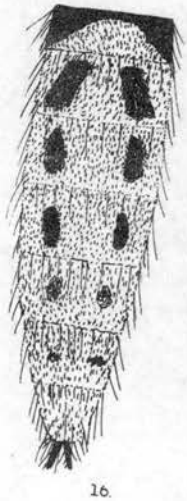

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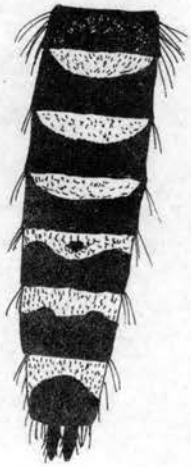

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PLATE XI

Fig. 12A. Aedes sollicitans (Walker).

Fig. 13A. A. nigromaculis (Ludlow).

Fig. 14A. A. zoosophus Dyar and Knab.

Fig. 15A. A. dorsalis (Meigen).

Fig. 16A. A. dorsalis (Meigen).

Fig. 17A. A. atropalpus (Coquillett).

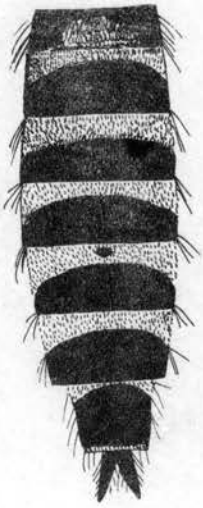
Fig. 18A. A. aegypti (Linnaeus).

Fig. 19A. A. vexans (Meigen).

Fig. 20A. A. fulvus-pallens Ross.

Fig. 21A. A. thelcter Dyar.

Fig. 22A. A. cinereus Meigen.



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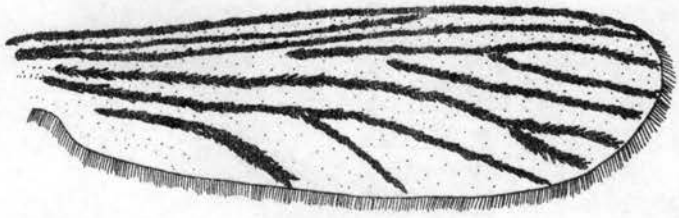

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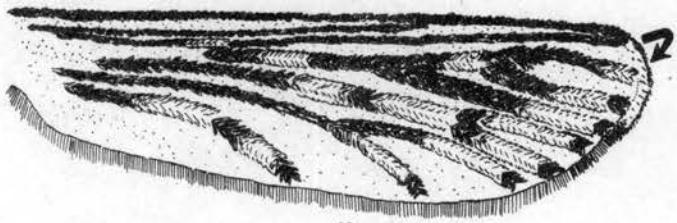

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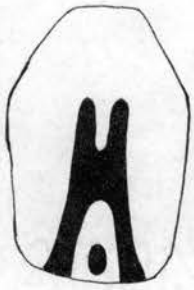

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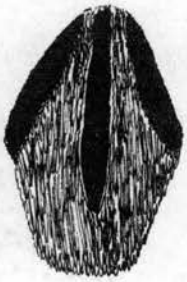

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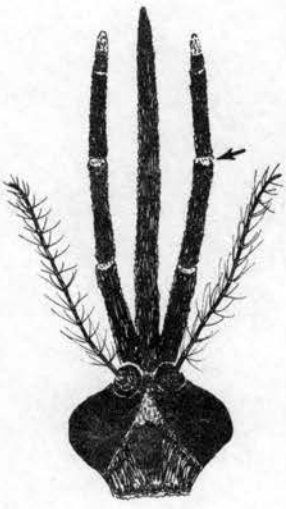

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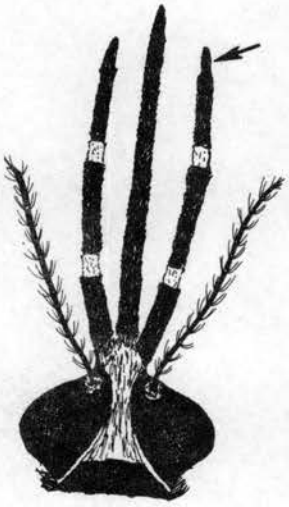

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PLATE XII

Fig. 23A. A. stiticus (Meigen).

Fig. 24A. A. triseriatus (Say).

Fig. 25A. A. hendersoni Cockerell.

Fig. 26A. A. infirmatus Dyar and Knab.

Fig. 27A. A. atlanticus Dyar and Knab.

Fig. 28A. A. thibaulti Dyar and Knab.

Fig. 29A. A. trivittatus (Coquillett).

Fig. 30A. Anopheles barberi Coquillett.

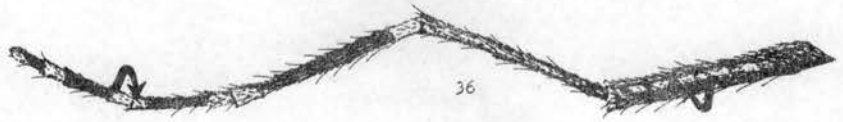
Fig. 31A. A. crucians Wiedemann.

Fig. 32A. A. walkeri Theobald.

Fig. 33A. A. quadrimaculatus Say.

Fig. 34A. A. pseudopunctipennis pseudopunctipennis Theobald.

Fig. 35A. A. pseudopunctipennis franciscanus McCracken.



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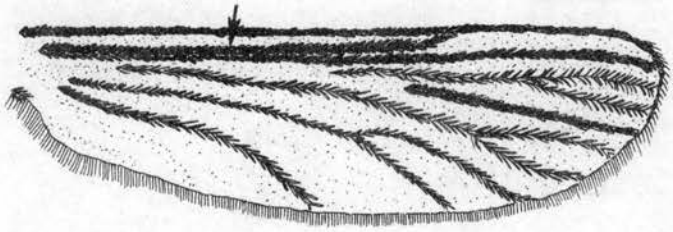

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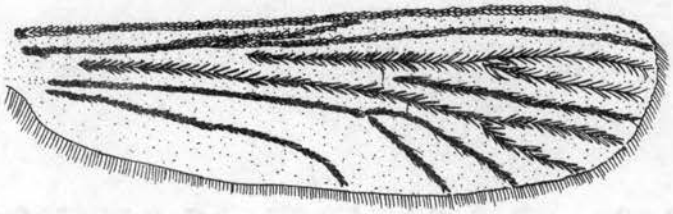

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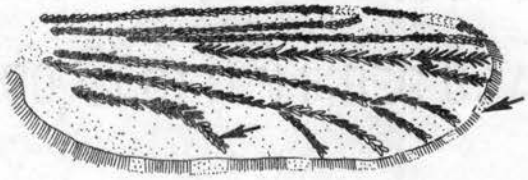

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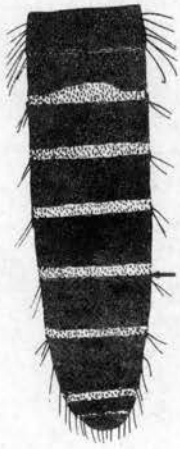

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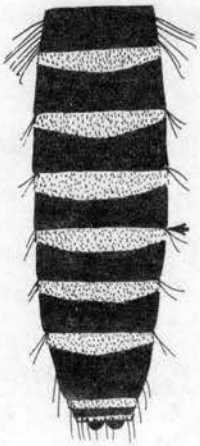

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PLATE XIII

Fig. 36A. *Culex tarsalis* Coquillett.

Fig. 37A. *C. territans* Walker.

Fig. 38A. *C. pipiens-quinquefasciatus* Linnaeus.

Fig. 39A. *C. salinarius* Coquillett.

Fig. 40A. *C. erraticus* (Dyar and Knab).

Fig. 41A. *C. restuans* Theobald.

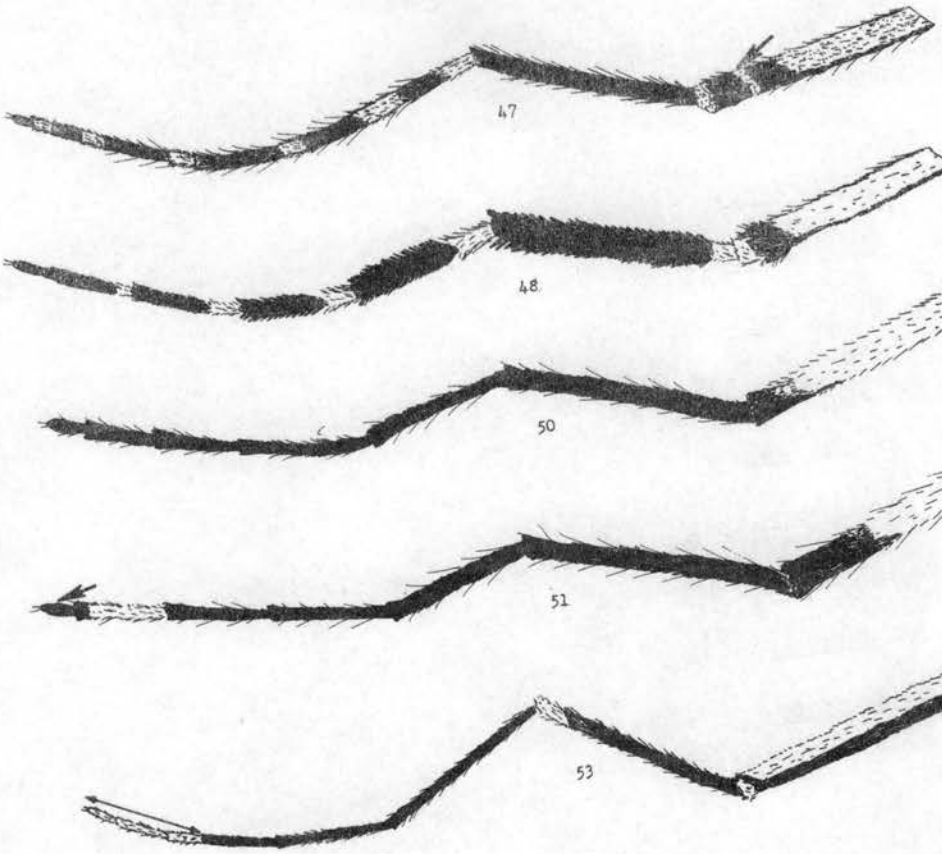
Fig. 42A. *C. nigripalpus* Theobald.

Fig. 43A. *Culiseta incidens* (Thompson).

Fig. 44A. *C. inornata* (Williston).

Fig. 45A. *Mansonia perturbens* (Walker).

Fig. 46A. *Psorophora signipennis* (Coquillett).



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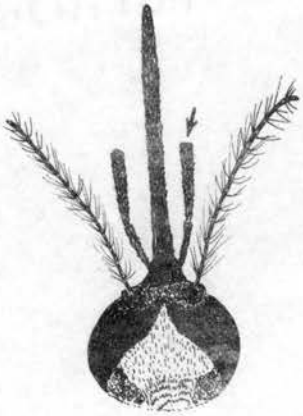

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PLATE XIV

Fig. 47A. *Psorophora confinnis* (Lynch Arribalzaga).

Fig. 48A. *P. ciliata* (Fabricius).

Fig. 49A. *P. ciliata* (Fabricius).

Fig. 50A. *P. cyanescens* (Coquillett).

Fig. 51A *P. varipes* (Coquillett).

Fig. 52A. *P. longipalpus* Roth.

Fig. 53A. *Uranotaenia lowii* Theobald.

Fig. 54A. *U. sapphirina* (Osten Sacken).

Fig. 55A. *U. anhydor syntheta* Dyar and Shannon.

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