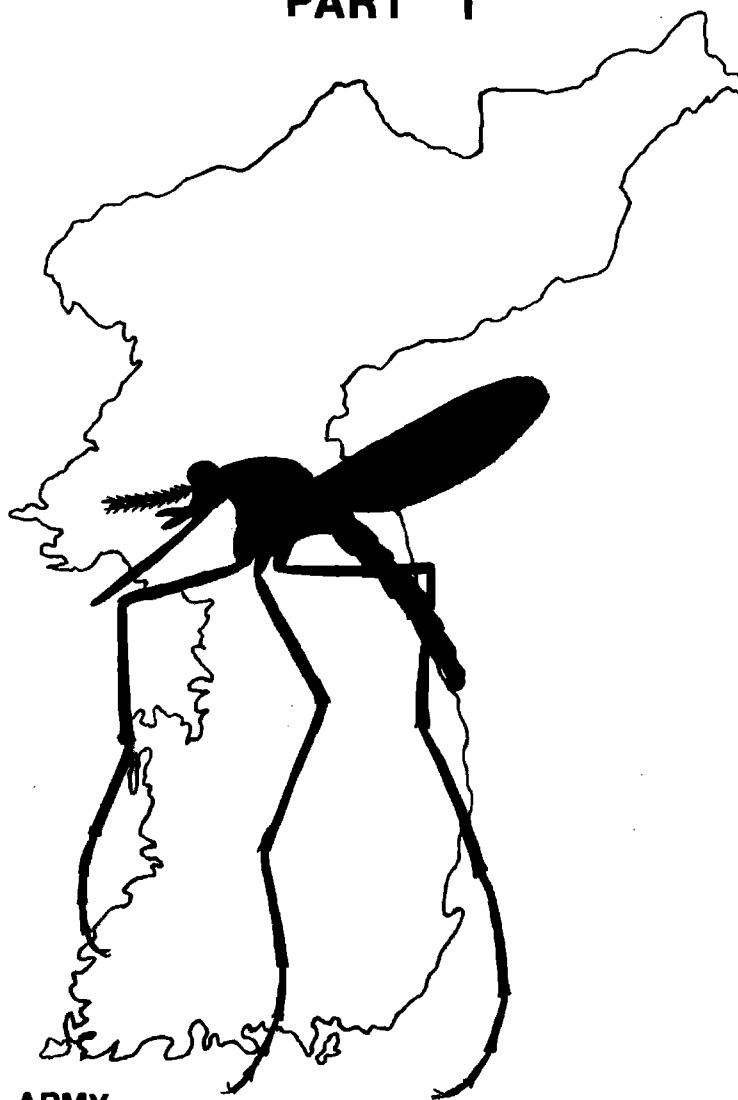


WALTER REED BIOSYSTEMATICS UNIT  
MUSEUM SUPPORT CENTER  
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WASHINGTON, D.C. 20560

**ILLUSTRATED TAXONOMIC KEYS TO GENERA  
AND SPECIES OF FEMALE  
MOSQUITOES OF KOREA**

**PART I**



DEPARTMENT OF THE ARMY  
5TH PREVENTIVE MEDICINE UNIT  
18TH MEDICAL COMMAND  
APO SAN FRANCISCO 96301

BY

KWAN WOO LEE AND PETER J. EGAN

JUNE 1985

# Report Documentation Page

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FEMALE MOSQUITOES OF KOREA

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PART 1

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JUNE 1985

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## PREFACE

Lee and Lien's (1970) "Pictorial Keys to the Mosquitoes of Korea" has been utilized for 15 years as the most comprehensive taxonomic manual for identification of the non-Anopheline mosquitoes of Korea. During this period many species have been recorded as new to Korea. However, much of this new taxonomic information has been distributed in a number of scientific publications. This work attempts to combine this information into a single document, as well as synthesize revised taxonomic synonyms of species occurring in Korea. Based on the available publications, the total number of mosquitoes recorded in Korea is now 51 species representing 9 genera. At present, the 5th Preventive Medicine Unit, U.S. Army is continuing its mosquito surveillance program on the taxonomy, biology and distribution of the mosquito fauna.

The preparation of these new illustrated keys is part of this ongoing study. An attempt has been made to produce a key as simple and accurate as possible. The illustrations, to include key characteristics, were selected from a composite of several specimens representing all species listed.

As collections of specimens continue, there is a possibility that additional species will be found in Korea. We hope this publication will provide useful information for all army and civilian entomologist, including pest control operators.

The authors wish to express their sincere thanks to Colonel Francis L. O'Donnell, Commander, and Major James W. Carroll, Executive Officer, 5th Preventive Medicine Unit (PMU), U.S. Army, for their support and editorial review of the manuscript, and also to Major Robert L. Frommer, U.S. Army E.H.E. Agency Pacific, for his advice and review.

FIGURE 1. MORPHOLOGY OF ADULT MOSQUITO(FEMALE)

A. FEMALE - LATERAL ASPECT

HEAD

1. eye (compound eye)
2. vertex
3. tempus
4. clypeus
5. pedicel
6. flagellum ] -antenna
7. palpifer
8. palpus
9. labium
10. labellum ] -proboscis

THORAX

11. anterior pronotal lobe
12. posterior pronotal lobe
13. scutum
14. scutal suture
15. scutellum
16. postnotum
17. paratergite
18. propleuron
19. spiracular area
20. mesothoracic spiracle
21. postspiracular area
22. subspiracular area
23. prealar knob
24. sternopleuron
25. mesepimeron
26. mesomeron
27. metathoracic spiracle
28. metepisternum
29. metepimeron ] -metapleuron
30. metameron

WING

31. wing (left)
32. halter

LEG

33. hindcoxa
34. hindtrochanter
35. hindfemur
36. hindtibia
37. hindtarsus
38. claw

ABDOMEN

39. tergum
40. laterotergite
41. sternum

GENITALIA

42. cercus
43. postgenital plate

B. FEMALE HEAD - DORSAL ASPECT

1. eye (compound eye)
2. vertex
3. interocular space
4. tempus
5. nape
6. vertical bristles
7. temporal bristles
8. clypeus
9. scape
10. pedicel ] -antenna
11. flagellomere 1
12. palpifer
13. palpus
14. proboscis (labium)

C. THORAX - DORSAL ASPECT

1. anterior promontory
2. scutal angle
3. scutal suture
4. fossal area
5. prescutellar space
6. acrostichal bristles
7. anterior dorsocentral bristles
8. posterior dorsocentral bristles
9. humeral bristles
10. angular bristles
11. posterior fossal bristles
12. supraalar bristles
13. prescutellar bristles
14. scutellum
15. anterior pronotal lobe

D. FORETARSOMERE 5 - MALE

1. ventrobasal swelling
2. midventral process
3. anterior claw
4. posterior claw
5. empodium

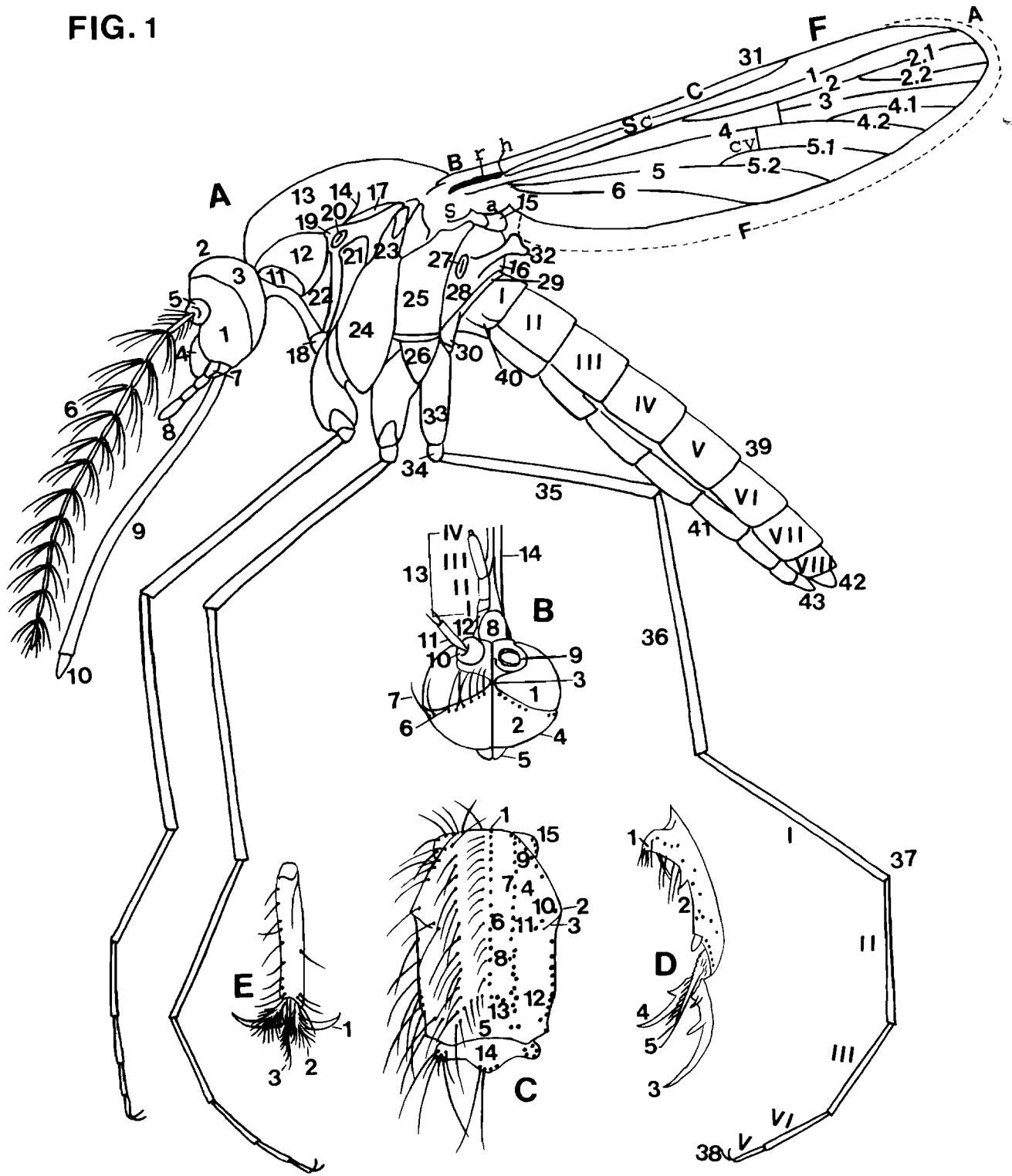
E. FORETARSOMERE 5 - FEMALE

1. claw
2. pulvillus
3. empodium

## F. WING

- A. apex of wing
  - a. alula
  - B. base of wing
  - C. costa
  - cv. cross vein
  - F. fringe
  - h. humeral cross vein
  - r. remigium(or stem vein)
  - Sc. subcosta
  - S. squama
- 1, first longitudinal vein(Radius, R1)
  - 2, Second longitudinal(Radius sector, Rs)
  - 2.1, upper or anterior branch of 2nd longitudinal(R2)
  - 2.2, lower or posterior branch of 2nd longitudinal(R3)
  - 3, third longitudinal(R4+5)
  - 4, fourth longitudinal(Media,M)
  - 4.1, upper branch of 4th longitudinal(M1)
  - 4.2, lower branch of 4th longitudinal(M2)
  - 5, fifth longitudinal(Cubitus,Cu)
  - 5.1, upper branch of 5th longitudinal(Cu1)
  - 5.2, lower branch of 5th longitudinal(Cu2)
  - 6, sixth longitudinal(Anal, An)

FIG. 1





# KEY TO THE GENERA OF CULICIDAE

1. Palpus about as long as proboscis (Fig. 2);  
 abdominal tergites never entirely covered with  
 scales but with sparse hairs (Fig. 3) . . . . . Anopheles

- Palpus much shorter than proboscis (Fig. 4);  
 abdominal tergites entirely covered with scales  
 (Fig. 5) . . . . . 2

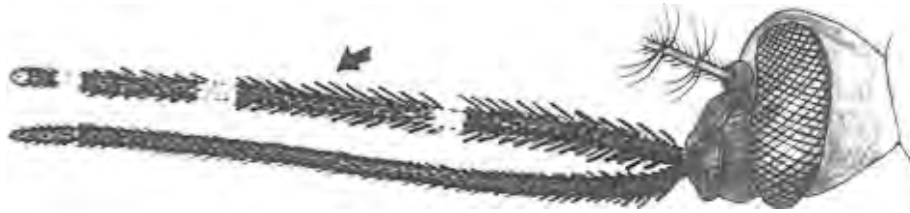


FIGURE 2

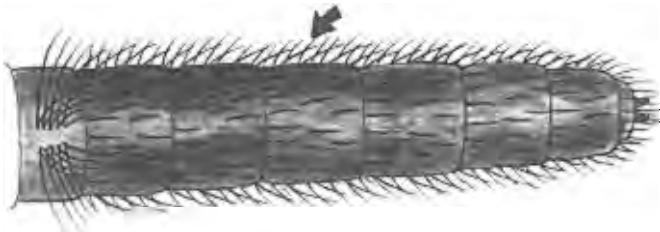


FIGURE 3



FIGURE 4

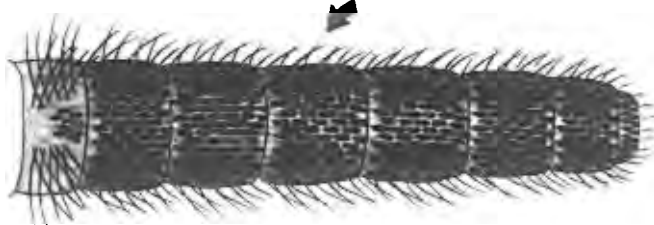


FIGURE 5

2. Proboscis rigid, apical 1/2 more slender and  
 bent downwards, or hooked (Fig. 6); a V-shaped  
 thickening in hindmargin of wing between bran-  
 ches of vein 5 (Fig. 7) . . . . . Toxorhynchites christophi

- Proboscis more flexible, usually of uniform  
 thickness, but sometimes swollen at tip, not  
 hooked (Fig. 8); no V-shaped thickening in hind  
 margin of wing between branches of vein 5 (Fig. 9) . . . . . 3



FIGURE 6

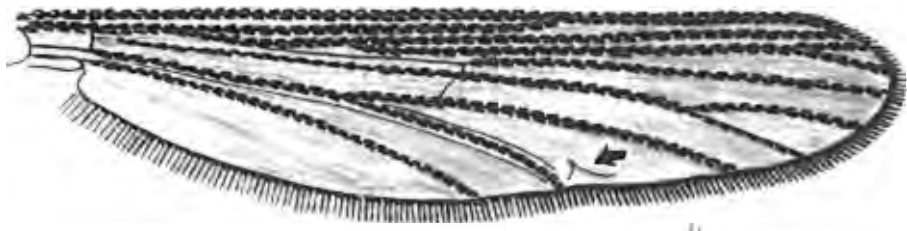


FIGURE 7



FIGURE 8

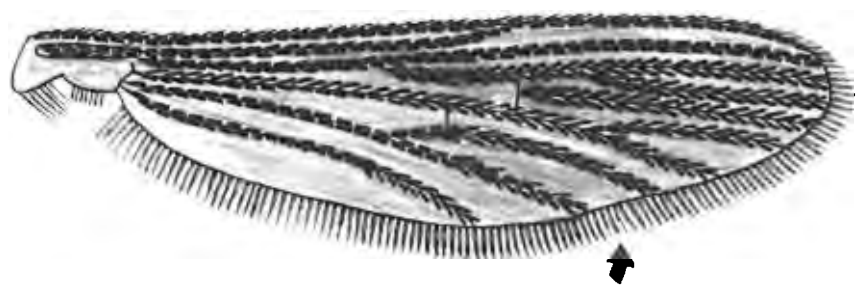


FIGURE 9

- 3. Pulvilli present (Fig. 10) . . . . . Culex
- Pulvilli absent or rudimentary (Fig. 11). . . . . 4



FIGURE 10

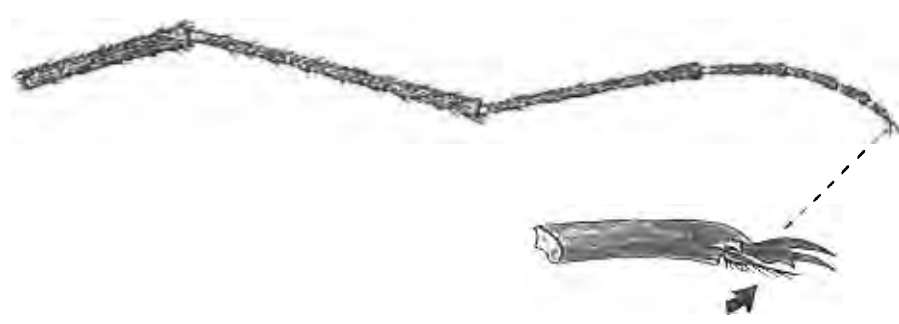


FIGURE 11

- 4. Postspiracular bristles absent (Fig. 12) . . . . . 5
- Postspiracular bristles present (Fig. 13) . . . . . 8



FIGURE 12

FIGURE 13

- 5. Fairly numerous hairs on underside of wing at base of subcosta (Fig. 14); femora unspotted (Fig. 15) . . . . . 6
- Base of subcosta without such hairs (Fig. 16); femora spotted or speckled (Fig. 17) . . . . . 7

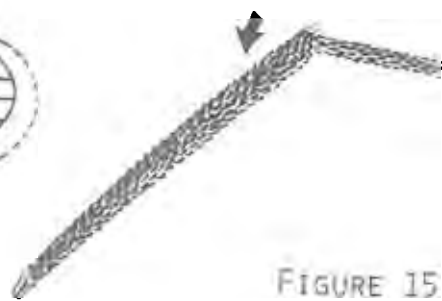
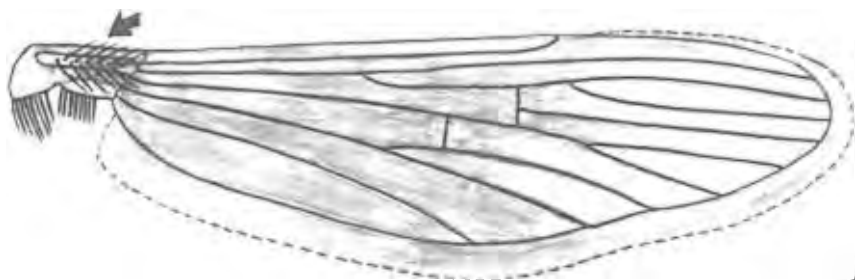


FIGURE 14

FIGURE 15

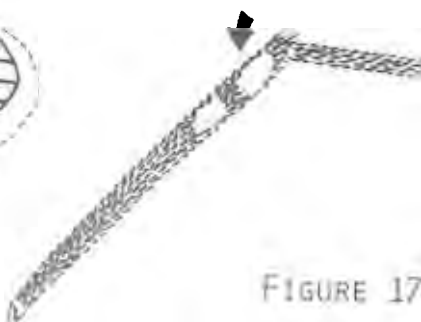
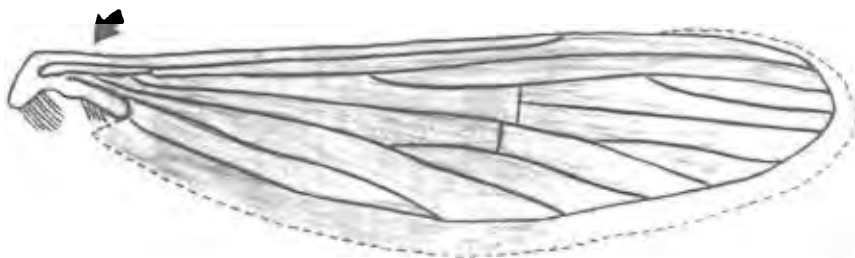


FIGURE 16

FIGURE 17

6. Tarsal segments dark throughout (Fig. 18). . . Culiseta kanayamensis

Tarsal segments with faint-white bands at base  
and sometimes also at apex (Fig. 19) . . . . . Culiseta nipponica



FIGURE 18



FIGURE 19

7. Femora spotted with white scales (Fig. 20);  
body almost dark on dorsal part . . . . . Tripteroides bambusa

Femora speckled with dark brown scales (Fig. 21);  
body entirely ochreous . . . . . Mansonia ochracea

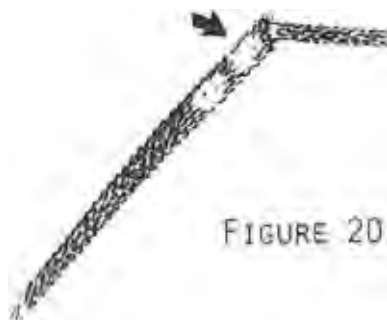


FIGURE 20

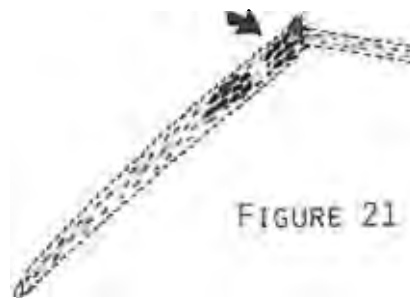


FIGURE 21

8. Anterior pronotal lobes of normal size and well separated; postnotum without hairs (Fig. 22) . . . . . 9

Anterior pronotal lobes enlarged and close together; postnotum with a group of small hairs (Fig. 23) . . . Heizmannia lii

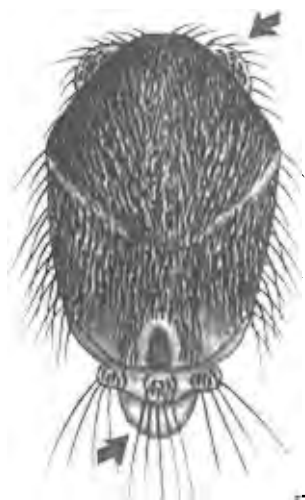


FIGURE 22



FIGURE 23

9. Wing scales narrow and not asymmetrical (Fig. 24); scutum varied in markings (Fig. 25) . . . . . 10

Wing scales broad and mostly asymmetrical (Fig. 26); scutum with broad creamy to pale-greenish longitudinal sub-lateral stripes (Fig. 27) . . . . . Mansonia uniformis

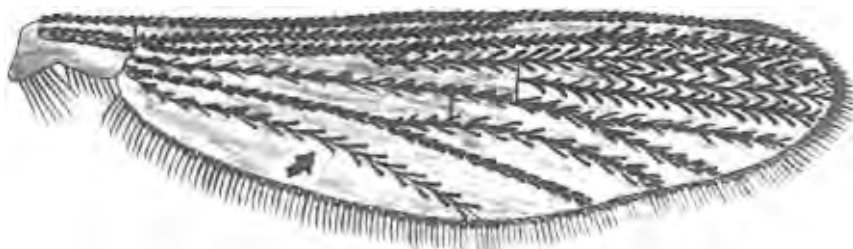


FIGURE 24



FIGURE 25

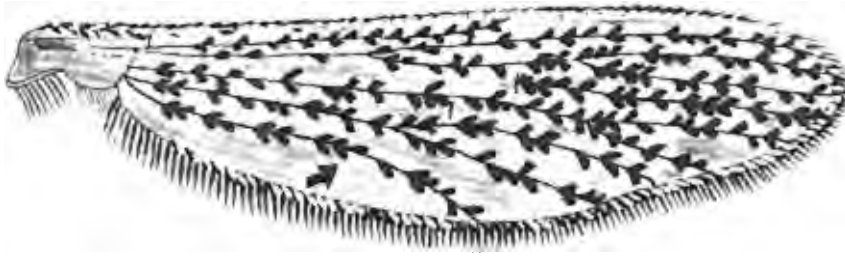


FIGURE 26

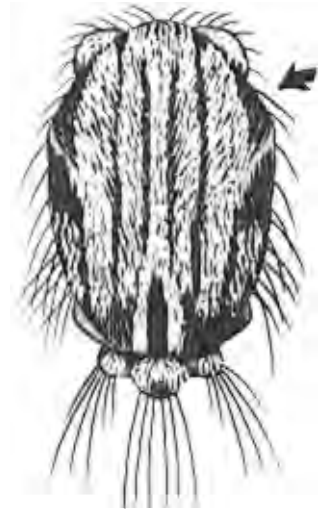


FIGURE 27

10. Proboscis slender and straight (Fig. 28) . . . . . Aedes  
 Proboscis rather stout, outer half tapered and turned  
 downward (Fig. 29) . . . . . Armigeres subalbatus



FIGURE 28

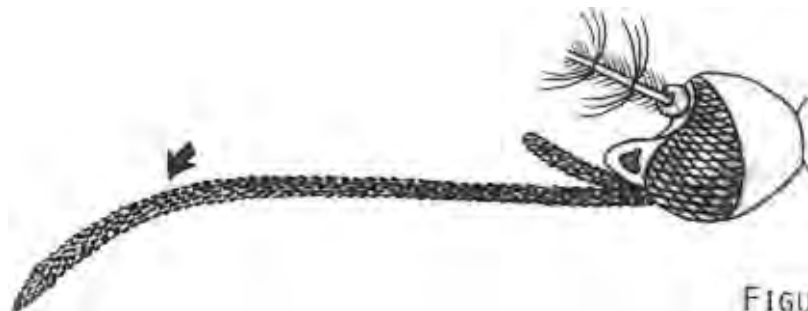


FIGURE 29

KEY TO THE SPECIES OF ANOPHELES

- 1. Palpus with white bands (Fig. 30) . . . . . 2
- Palpus without bands (Fig. 31) . . . . . 6



FIGURE 30



FIGURE 31

- 2. Apical fringe spot present (Fig. 32) . . . . . 3
- Apical fringe spot absent (Fig. 33) . . . . . Anopheles pullus



FIGURE 32



FIGURE 33

3. Two pale spots on costa; vein 6 with 1 median dark spot (Fig. 34) . . . . . 4
- Three pale spots on costa; vein 6 with 2 median dark spots (Fig. 35) . . . . . Anopheles sineroides

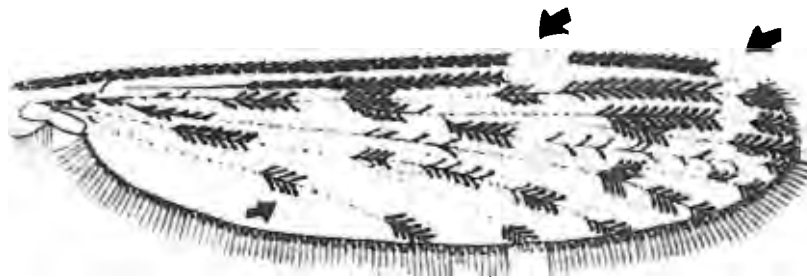


FIGURE 34



FIGURE 35

4. Pale basal band of palpal segment 3 at most as wide as other bands (Fig. 36) . . . . . 5
- Pale basal band of palpal segment 3 broader than other bands (Fig. 37) . . . . . Anopheles yatsushiroensis



FIGURE 36



FIGURE 37



5. Midcoxa with a distinct upper patch of pale scales (Fig. 38); pale fringe spot at termination of vein 5.2 present (Fig. 39) . . . . . Anopheles sinensis

Midcoxa without upper patch of pale scales (a few scales occasionally present, but not forming a definite patch) (Fig. 40); pale fringe spot at termination of vein 5.2 absent (Fig.41) . . Anopheles lesteri



FIGURE 38



FIGURE 39



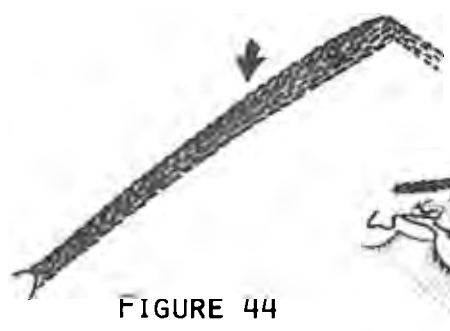
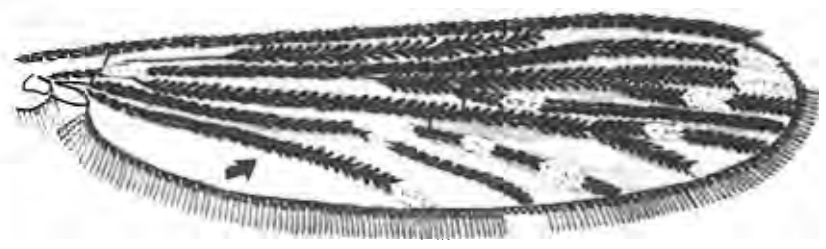
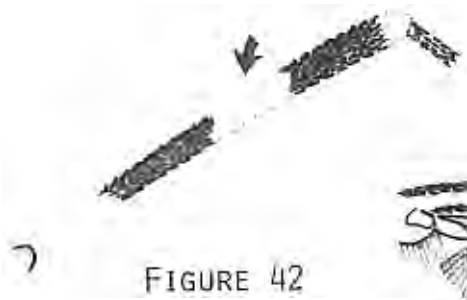
FIGURE 40



FIGURE 41

6. Hindfemur banded (Fig. 42); vein 6 with dark scales except tip (Fig. 43) . . . . . Anopheles lindesayii japonicus

Hindfemur not banded (Fig. 44); vein 6 with basal, median and apical dark spots (Fig. 45) . . . Anopheles koreicus



# KEY TO THE SPECIES OF CULEX

1. Lower mesepimeral bristles numerous (subgenus Lutzia) (Fig. 46) . . . . . 2
- At most three lower mesepimeral bristles, usually one or none (Fig. 47) . . . . . 3



FIGURE 46



FIGURE 47

2. Second to fourth abdominal tergites with narrow apical bands or dark, fifth to seventh broadly pale golden (Fig. 48) . . . . . Culex fuscanus
- Abdominal tergal bands all about the same width (Fig. 49) . . . . . Culex halifaxii

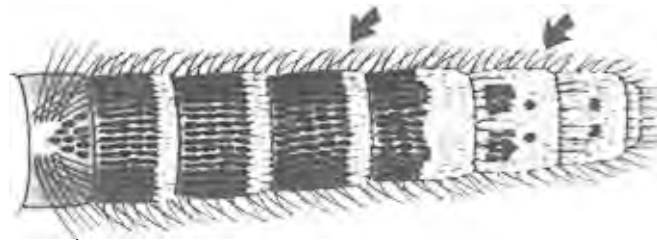


FIGURE 48

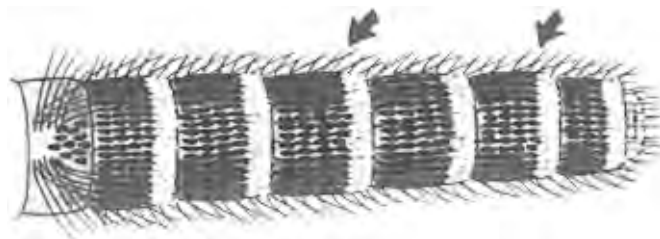


FIGURE 49

- 3. Proboscis with a pale band in the middle (Fig. 50) . . . . . 4
- Proboscis without a pale band (Fig. 51) . . . . . 12



FIGURE 50



FIGURE 51

- 4. Wing spotted with pale scales (Fig. 52) . . . . . 5
- Wing not spotted (Fig. 53) . . . . . 7

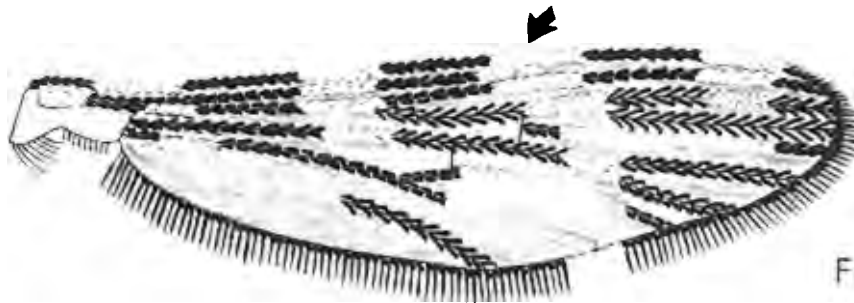


FIGURE 52

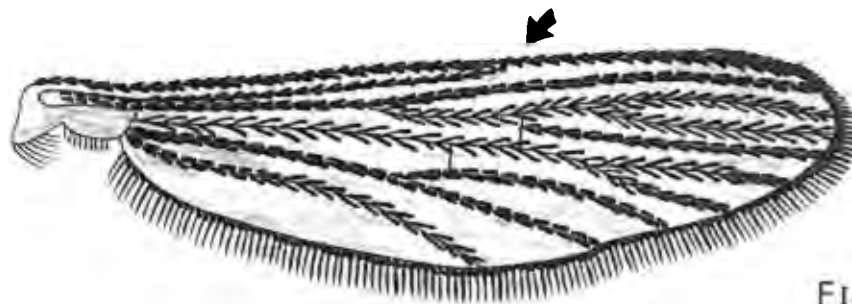


FIGURE 53

5. Wing with a basal pale spot on costa and vein 1;  
 first pale costal spot extending over vein 4;  
 vein 5.2 broadly pale at tip (Fig. 54) . . . . . Culex orientalis

Wing without a basal pale spot on costa and  
 vein 1; first pale costal spot extending only  
 onto subcosta; vein 5.2 entirely dark or narrowly  
 pale at tip (Fig. 55) . . . . . 6

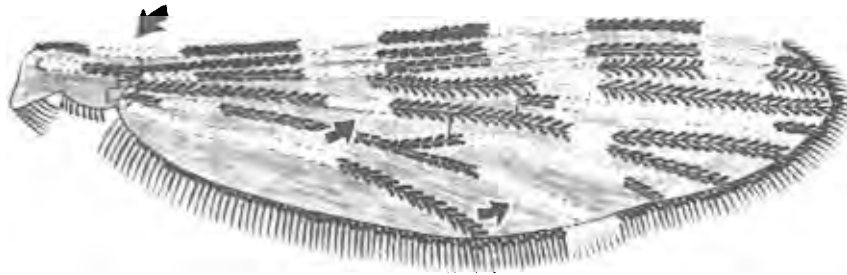


FIGURE 54

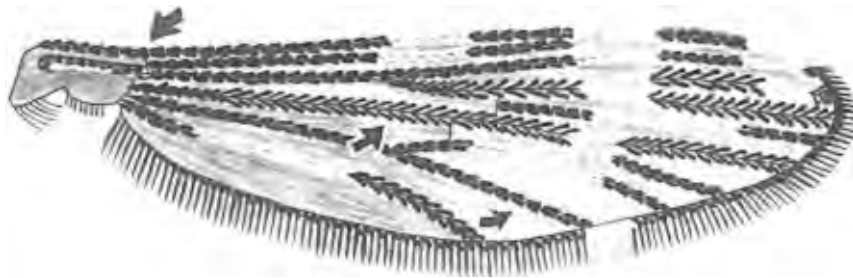


FIGURE 55

6. Abdominal terga IV-VI frequently with a pair of  
 distal spots; VII with pale apical band usually  
 broad (Fig. 56) . . . . . Culex jacksoni

Abdominal terga without distal spots; VII with  
 pale apical band narrow or reduced (Fig. 57) . . . . . Culex mimeticus

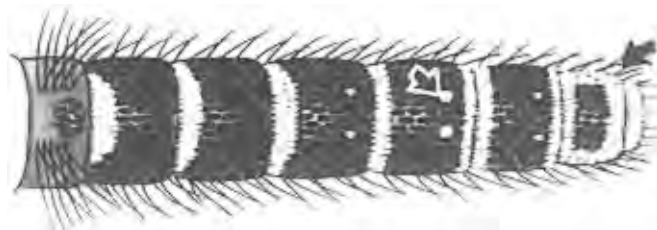


FIGURE 56

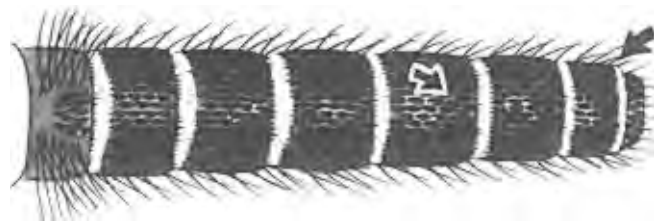


FIGURE 57

7. Abdominal tergites with pale apical bands, or both apical and basal (Fig. 58) . . . . . 8
- Abdominal tergites with basal pale bands, dark scaled apically (Fig. 59) . . . . . 9

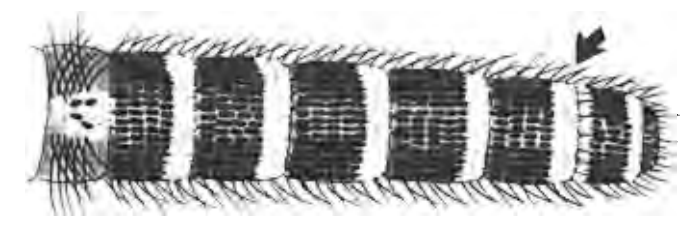


FIGURE 58

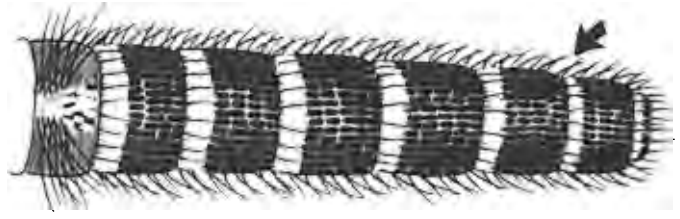


FIGURE 59

8. Wing veins distinctly speckled with pale brownish and dark scales (Fig. 60) Culex bitaeniorhynchus
- Wing veins not speckled, scales all dark (Fig. 61). . . Culex sinensis

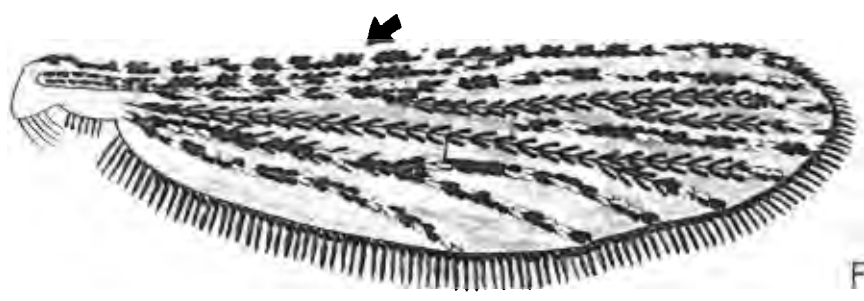


FIGURE 60

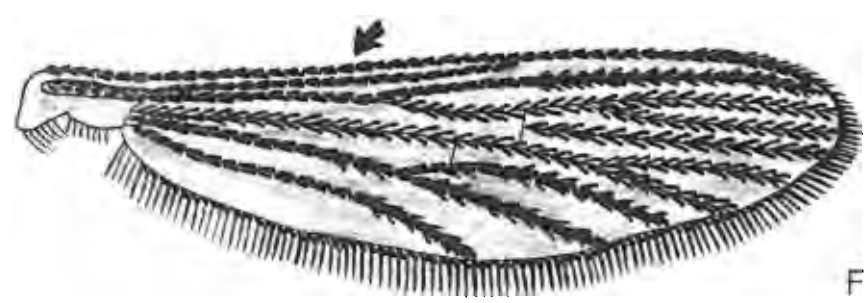


FIGURE 61

9. Anterior two-thirds of scutum almost entirely clothed with white scales (Fig. 62) . . . . . Culex whitmorei  
 Scutum uniformly brown with pattern of golden scales (Fig. 63) . . . . . 10



FIGURE 62



FIGURE 63

10. Anterior surface of midfemora speckled with pale scales (Fig. 64) . . . . . Culex sitiens  
 Anterior surface of midfemora not speckled (Fig. 65) . . . . . 11



FIGURE 64



FIGURE 65

11. Upright forked scales on median area of vertex pale (Fig. 66) hind femur with dark stripe of scales on dorsal border (Fig. 67) . . . . . Culex pseudovishnui

- Upright forked scales on median area of vertex dark (Fig. 68); hind femur without dark stripe of scales on dorsal border (Fig. 69) . . . . . Culex tritaeniorhynchus



FIGURE 66



FIGURE 68



FIGURE 67



FIGURE 69

12. Tergal bands absent (Fig. 70) . . . . . 13  
 Tergal bands present (Fig. 71) . . . . . 14

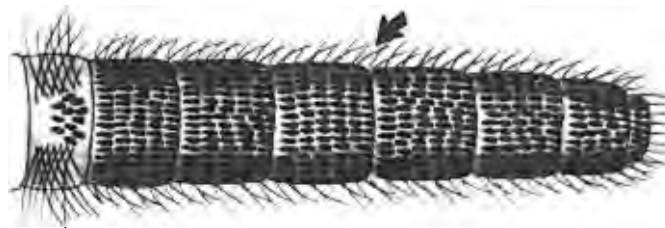


FIGURE 70

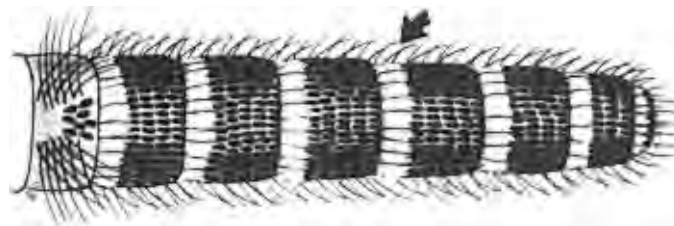


FIGURE 71



13. Sternites entirely dark (Fig. 72); segment 1 of hindtarsi slightly longer than tibia or almost the same (Fig. 73) . . . . . Culex hayashii hayashii

Sternites pale ochreous scaled, makes pale ochreous lateral patches (Fig. 74); segment 1 of hindtarsi distinctly shorter than tibia (Fig. 75) . . . Culex inatomii

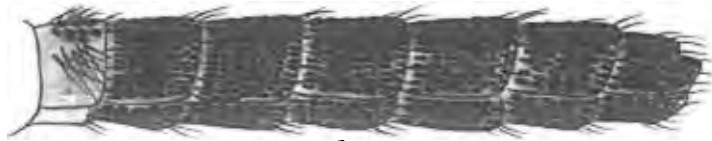


FIGURE 72

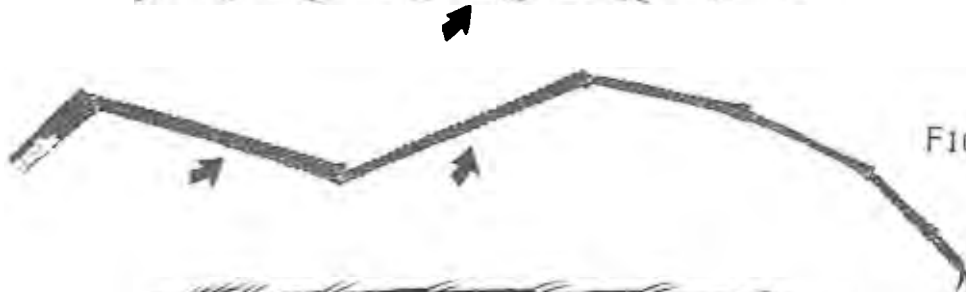


FIGURE 73

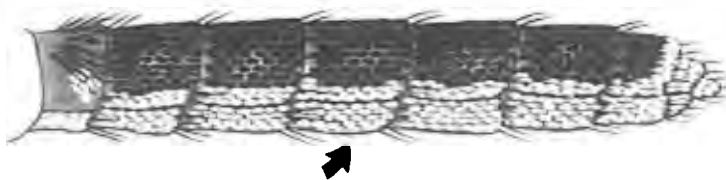


FIGURE 74



FIGURE 75

14. Tergal bands apical (Fig. 76) . . . . . Culex rubensis

Tergal bands basal (Fig. 77) . . . . . 15

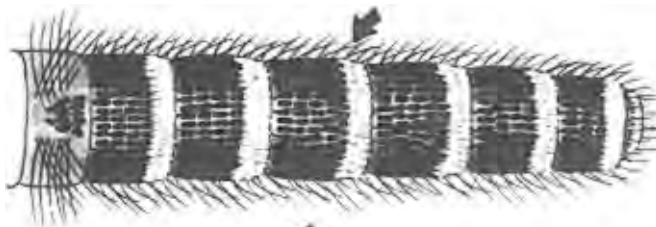


FIGURE 76

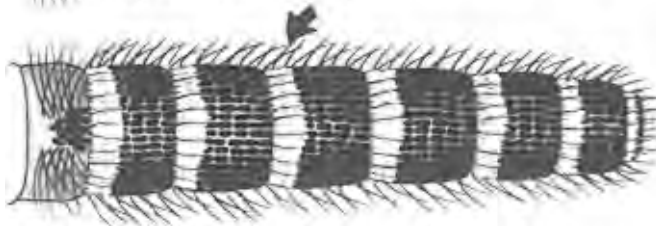


FIGURE 77

15. Pleuron with prominent scale patches; thorax without dark patch (Fig. 78) . . . . . 16
- Pleuron without prominent scale patches; thorax with dark patch from posterior pronotal lobe to halter (Fig. 79) . . . . . 18



FIGURE 78



FIGURE 79

16. Fore and midfemora and tibia palestribed on anterior or dorsal margin (Fig. 80) . . . . . Culex vagans
- Fore and midfemora and tibia not striped on anterior or dorsal margin (Fig. 81) . . . . . 17



FIGURE 80



FIGURE 81

17. Basal tergal bands medially broadened, usually not connected with laterobasal patches on anterior segments, confluent with laterobasal patches on one or a few posterior segments (Fig. 82); palpus not pale-tipped dorsally (Fig. 83). . . Culex pipiens quinquefasciatus

Basal tergal bands even in width, connected with laterobasal patches (Fig. 84); palpus pale-tipped dorsally (Fig. 85) . . . . . Culex pipiens pallens



FIGURE 82

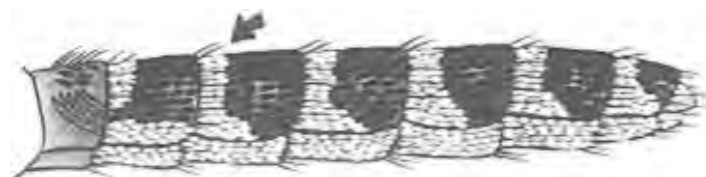


FIGURE 84

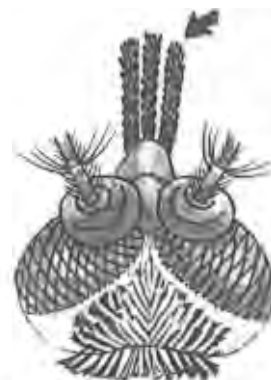


FIGURE 83



FIGURE 85

18. Vertex with a large triangular median patch of pale narrow curved scales (Fig. 86) . . . . . Culex kyotoensis

Vertex with pale bronze-yellowish narrow curved scales at middle and with numerous dark brown erect forked scales (Fig. 87) . . . . . Culex sasai

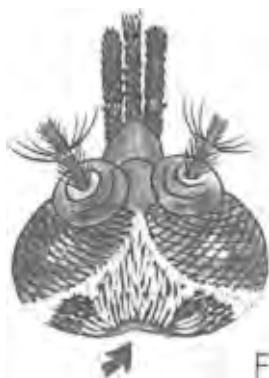


FIGURE 86



FIGURE 87

KEY TO THE SPECIES OF AEDES

- 1. Tarsi not banded (Fig. 88) . . . . . 2
- Tarsi banded (Fig. 89) . . . . . 6



FIGURE 88

FIGURE 89

- 2. Scutum with white or yellow shoulder patches (Fig. 90) . . . . . 3
- Scutum without definite markings (Fig. 91) . . . . . 4

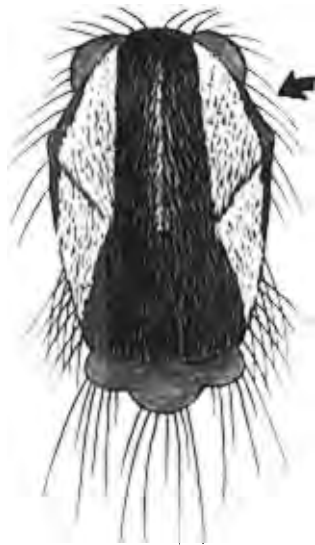


FIGURE 90



FIGURE 91

3. Scutum with white shoulder patches; scutellum with broad dark scales (Fig. 92) . . . . . Aedes nipponicus
- Scutum with yellow shoulder patches; scutellum with curved white scales (Fig. 93) . . . . . Aedes lineatopennis

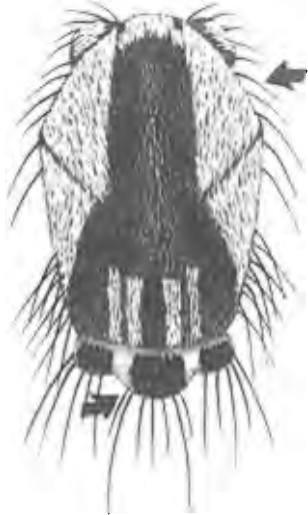


FIGURE 92

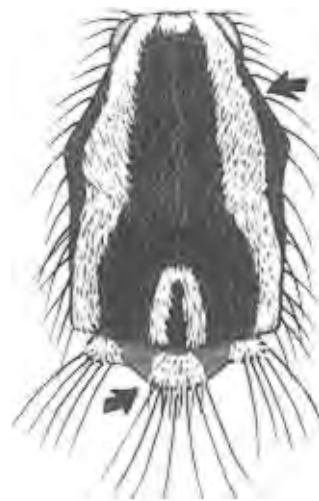


FIGURE 93

4. Scutellum with narrow curved scales (Fig. 94) . . . . . 5
- Scutellum with broad white appressed scales (Fig. 95) . . . . . Aedes alboscuteUellatus



FIGURE 94



FIGURE 95

5. Anterior and posterior pronotal lobe with white broad appressed scales; subspiracular area with a patch of broad white scales (Fig. 96) . . . . . Aedes oreophilus

Anterior and posterior pronotal lobe with narrow curved yellowish scales; subspiracular area without a patch of scales (Fig. 97) . . . . . Aedes esoensis



FIGURE 96



FIGURE 97

6. Scutellum with broad appressed scales (Fig. 98) . . . . . 7  
 Scutellum with narrow curved scales (Fig. 99) . . . . . 10

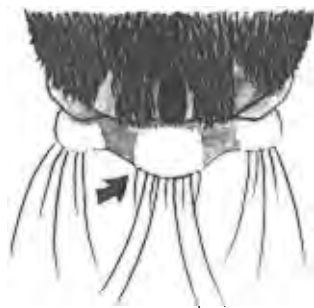


FIGURE 98

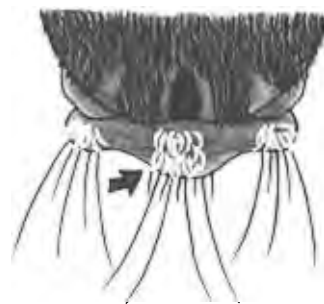


FIGURE 99

7. First two segments of fore and midtarsi banded;  
tibia without a patch (Fig. 100) . . . . . 8

First three segments of fore and midtarsi banded;  
all tibiae with a narrow white patch at basal  
third (Fig. 101) . . . . . Aedes chemulpoensis



FIGURE 100



FIGURE 101

8. Scutum with anterior median stripe and short  
paired posterior submedian stripes (Fig. 102) . . . . . 9

Scutum with median stripe and long paired,  
anteriorly curved outer stripes (Fig. 103) . . . . . Aedes galloisi



FIGURE 102



FIGURE 103

9. Scales above wing base yellowish pale, narrow and curved (Fig. 104) . . . . . Aedes flavopictus flavopictus  
 Scales above wing base silvery white and more or less broad (Fig. 105) . . . . . Aedes albopictus



FIGURE 104

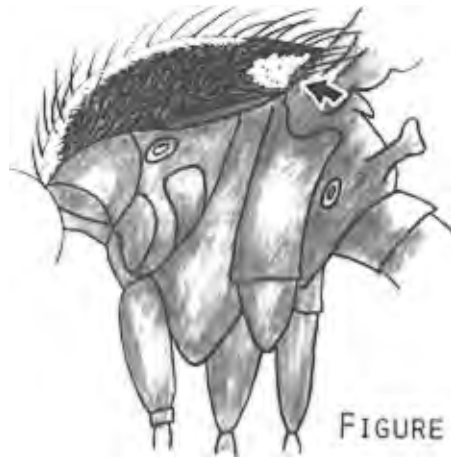


FIGURE 105

10. Eighth abdominal segment narrow and completely retractile (Fig. 106); wings speckled at least on terminal portion of subcosta and vein 1 or on basal portion of costa, vein 1, 5 and 6 (Fig. 107) . . . . . 11  
 Eighth abdominal segment not completely retractile (Fig. 108); wings not speckled (Fig. 109). . . . . 12



FIGURE 106



FIGURE 107



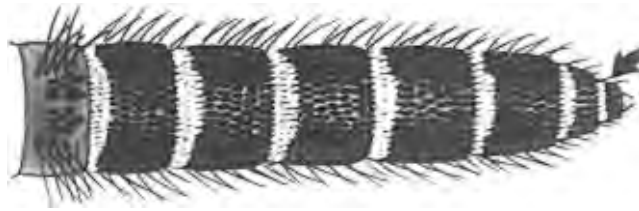


FIGURE 108

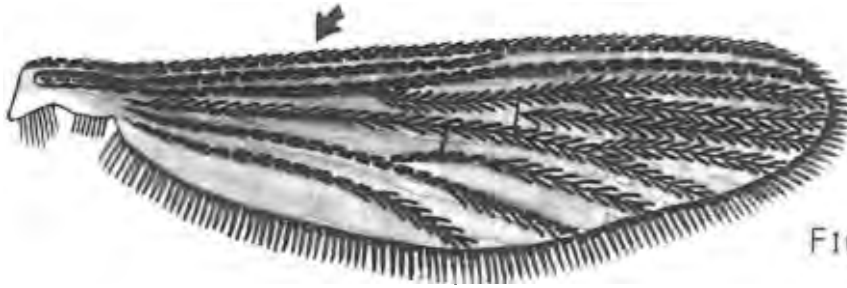


FIGURE 109

11. Scutum with two pale submedian stripes forking posteriorly (Fig. 110); last segment of mid and hindtarsi entirely white (Fig. 111) . . . . . Aedes dorsalis

Scutum uniformly covered with yellowish to brown scales (Fig. 112); last segment of mid and hindtarsi dark apically (Fig. 113) . . . . . Aedes vexans nipponii



FIGURE 110

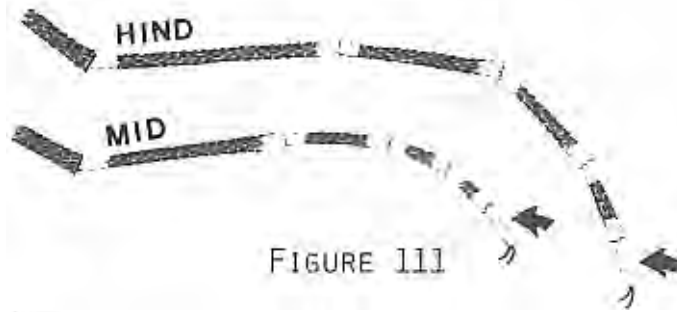


FIGURE 111



FIGURE 112

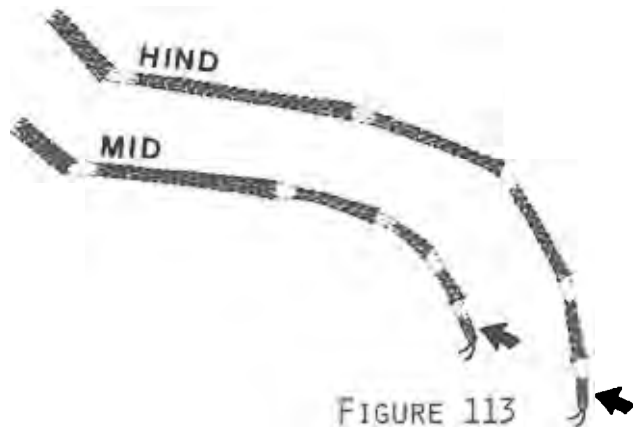
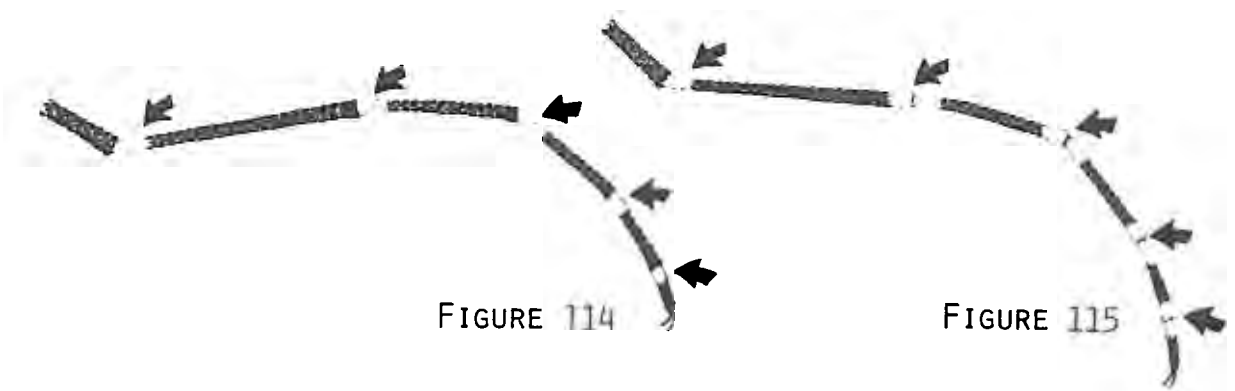
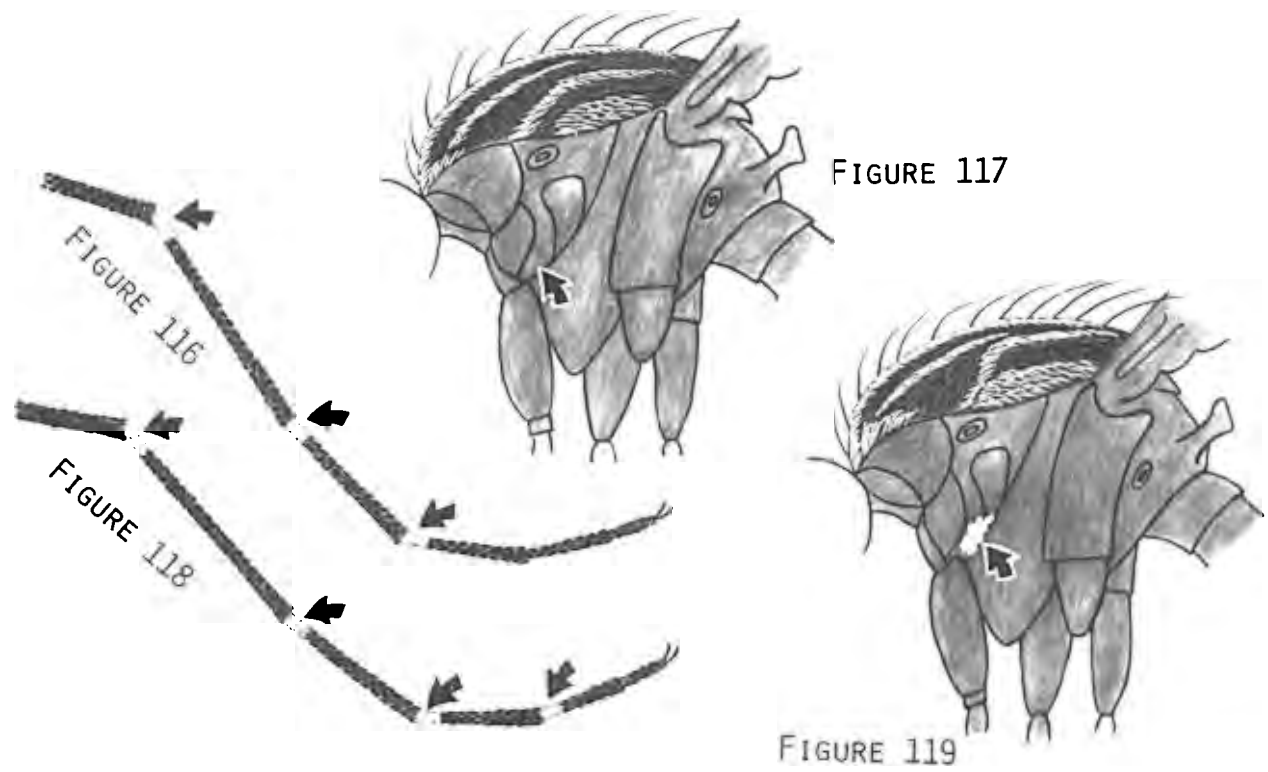


FIGURE 113

12. Hindtarsus with pale band at base of segments only (Fig. 114) . . . . . 13
- Hindtarsus with pale bands at both ends of some segments (Fig. 115) . . . . . 14



13. First three tarsal segments of hindleg basally banded (Fig. 116); subspiracular area without scales (Fig. 117) . . . . . Aedes japonicus japonicus
- First four tarsal segments of hindleg basally banded (Fig. 118); subspiracular area with a line of broad white scales (Fig. 119) . . . . . Aedes koreicus



14. Scutum mostly dark with the pale scales arranged in more or less definite lines (Fig. 120,121) . . . . . 15
- Scutum with a large area of white or whitish scales (Fig. 122) . . . . . Aedes seoulensis



FIGURE 120



FIGURE 121

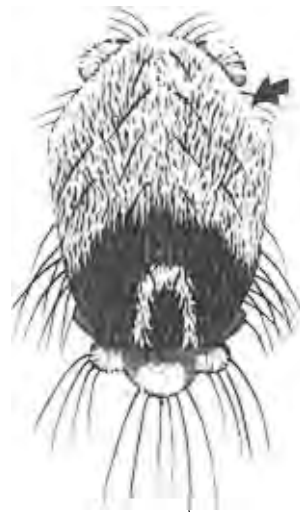


FIGURE 122

15. Palpus entirely dark (Fig. 123) . . . . . Aedes alektorovi
- Palpus pale at tip (Fig. 124) . . . . . 16

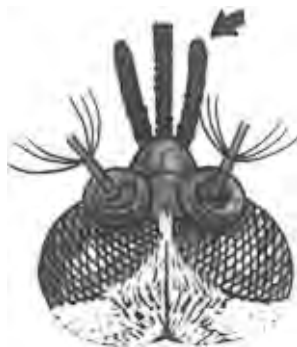


FIGURE 123

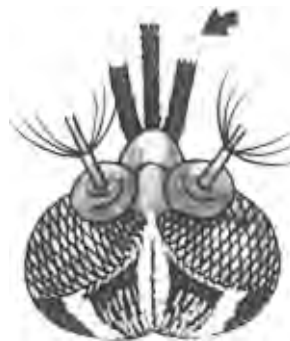


FIGURE 124

16. Last segment of hindtarsus entirely white;  
last two segments of foretarsus entirely  
dark (Fig. 125) . . . . . Aedes hatorii

Last segment of hindtarsus dark at apex;  
last two segments of foretarsus banded  
(Fig. 126) . . . . . Aedes togoi

