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ILLUSTRATED KEYS TO THE ANOPHELES MOSQUITOES OF THE PHILIPPINE ISLANDS

by

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To

FRANCISCO EDLAGAN BAISAS
Dean of Philippine Culicidologists

we respectfully dedicate this work.
His contribution to the knowledge
of Philippine mosquitoes
is without measure.

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The loan of specimens from the U.S. National Museum, through the courtesy of Drs. Alan Stone and Botha DeMeillon, is appreciated.

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INTRODUCTION

The first illustrated keys to the *Anopheles* mosquitoes of the Philippines were prepared by Russell and Baisas (1934, 1936). Periodically, since then keys have been produced (Simmons and Aitken, 1942; Bohart, 1945; Mendoza, 1954 a, b; Baisas and Bañez, 1957; and Baisas and Dowell, 1965).

The keys presented herein are an effort to produce simplified, well-illustrated guides to the identification of the Philippine anophelines, and have been tested extensively for the past two years on participant classes at the Malaria Eradication Training Center. The latest supra-specific concepts, especially those introduced by Reid (1968) are incorporated. Likewise, additional specific and sub-specific taxa are included.

Both the adult female and fourth instar larval stages have been dealt with in the keys. Captions for the key illustrations may be known by consulting the Table of Key Figures, page 1. The essential morphology of these forms, discussed in the succeeding sections, will enable the user to follow the keys successfully.

CLASSIFICATION OF PHILIPPINE ANOPHELES

The systematic index to the Philippine *Anopheles* species below follows the arrangement made by Reid and Knight (1961) and Reid (1968). It updates the checklists of Delfinado (1965) and Baisas and Dowell (loc. cit.). Unlike previous lists, here the former "groups" under subgenus *Cellia* are elevated to "series" which match the long-used series of the subgenus *Anopheles*. Furthermore, closely related species are arranged into "species groups", not "complexes" or "groups", as formerly done. With these changes the classification becomes much less complicated. Where trinomials are used in the paper, the third name indicates subspecies, i.e., *Anopheles gigas formosus* Ludlow. No scientific name lower than subspecies is recognized as valid.

One series name change is adopted here, i.e., *Pyretophorus* for *Pseudomyzomyia*, as suggested by Reid (1968).

The listing of the species groups to which the Philippine species belong, where applicable, serves to demonstrate the relationship of the local taxa to the Oriental anopheline fauna as a whole.

It was the opinion of Reid (1966, 1968) that *A. subpictus* Grassi may be absent from the Philippine Islands. Investigation of reared associated *"indefinitus"* from the saline, fish ponds near Manila has shown that some of these specimens are identical to the description of *"subpictus"* given by Reid. Likewise, *A. vagus vagus* Donitz has never been reported from the Philippines since King (1932) described the insular form, *A. v. limosus*. It has recently been collected from Mindanao Island by the authors. Therefore, these two are included in the keys and considered to be members of the Philippine fauna.

A new subspecies of *ludlowae* has recently been described by Darsie and Ramos (1969), and named *ludlowae cabrerai*. Reference was made to it by Baisas and Dowell (loc. cit.) and Reid (1968) as a variety of *ludlowae* which bears three dark spots on the anal vein instead of the usual two. It has been included in the following keys.

SYSTEMATIC INDEX
ANOPHELES OF THE PHILIPPINES

Genus *Anopheles* Meigen
- Subgenus *Anopheles* Meigen
  - *Anopheles* series Edwards
    - *aitkenii* species group
      - *acaci* Baisas
      - *aitkenii* James
      - *bengalensis* Puri
      - *fragilis* (Theobald)
      - *insulaeflorum* (Swellengrebel and Swellengrebel de Graaf)
    - *lindesayi* species group
      - *gigas formosus* Ludlow
      - *lindesayi benguetensis* King
  - *Myzorhynchus* series Edwards
    - *albotaeniatus* species group
      - *balerensis* Mendoza
      - *ejercitoi* Mendoza
    - *bancroftii* species group
      - *pseudobarbirostris* Ludlow
    - *barbirostris* species group
      - *franciscoi* Reid
      - *manalangi* Mendoza
      - *vanus* Walker
    - *hyrcanus* species group
      - *lesteri* Baisas and Hu
      - *peditaeniatus* (Leicester)
      - *pseudosinensis* Baisas
    - *umbrosus* species group
      - *baezai* Gater

samarensis Rozeboom
Subgenus *Cellia* Theobald
Myzomyia series Christophers
minimus species group
filipinae Manalang
mangyanus (Banks)
minimus flavirostris (Ludlow)
Neocellia series Christophers
karwari (James)
maculatus Theobald
annularis species group
annularis Van der Wulp
philippinensis Ludlow
Neomyzomyia series Christophers
kochi Donitz
kolambuganensis Baisas
tessellatus Theobald
leucosphyrus species group
balabacensis baisasi Colless
balabacensis balabacensis Baisas
cristatus King and Baisas
riparis riparis King and Baisas
Pyretophorus series Edwards
indefinitus (Ludlow)
subpictus Grassi
vagus limosus King
vagus vagus Donitz
ludlowae species group
litoralis King
ludlowae ludlowae (Theobald)
ludlowae cabrerai Darsie and Ramos
parangensis (Ludlow)

The Adult Female

MORPHOLOGY OF ADULT FEMALE

It is assumed that the user is already able to distinguish not only members of the Family Culicidae from other dipterous insects, but can also differentiate anopheline from culicine mosquitoes. If not, the reader is referred to Borror and Delong (1963) for the former and to Russell et al. (1963) or Delfinado (1966) for the latter.

The description below is by no means complete, but contains sufficient background to comprehend the key points. Certain structures need to be defined in order to understand the morphology.

1. **Sclerites** – The integument of insects is made up of hardened plates called sclerites, separated either by lines, known as **sutures**, or membranes of various sizes. The body of the adult mosquito is composed primarily of sclerites, whereas the larval body is largely membranous.

2. **Hairs and Scales** – It is necessary to be able to differentiate between scales and hairs in adult mosquitoes. A **hair** is round, tapers from base toward apex, and it is movable, being connected to the body by a socket, called **trichopore**. The **scales** are flattened, immobile, without a trichopore, and usually widening, although the wing fringe scales are pointed, apically.

The females of *Anopheles* may be distinguished from those of other Philippine culicids by their long palpi, almost as long as the proboscis and by scutellum which is evenly rounded and beset by an unbroken, evenly spaced row of hairs posteriorly, see Fig. 1. Another characteristic is their living posture while at rest or taking a blood meal. Typically the body is held at a distinct angle from the resting surface and their thorax and abdomen form a straight line with the proboscis.

The Head

The spherical head, seen in Fig. 2, is about as wide as long, with compound eyes occupying a large portion of each side. Projecting forward are five appendages, the median slender proboscis, above which are the two palpi, and extending from the head between the eyes, the two antennae.

The **proboscis** is an elongate structure about one-fourth the total length of the body. The visible portion is the labium, a sheath covering the piercing stylets. It is clothed with scales, usually uniformly dark with a light colored tip, the labella. In some species the apical half is wholly or partially beset with pale or flavescent scales.

The two, five-segmented **palpi** are also covered with scales, which are sometimes large, giving the structures a shaggy appearance. The scalation is either entirely dark or more often with pale banding. The terminal pale band is called **apical**; the next one, **subapical**, and the intervening dark band separating them is also called the **subapical dark band**. The number of pale bands may vary within one species, for the subapical dark band may be missing, or in others it may be found added where it normally is absent.

The **antennae** are composed of two basal elements, the small **scape** and bulbous **torus**. The remaining 14 rod-like segments, or flagellomeres, are collectively called the **flagellum**. Each flagellar part is adorned with a whorl of hairs, excepting the last, these hairs being much longer and more numerous in the male antennae.

The Thorax

The thorax (Fig. 3) consists of three segments, called **prothorax**, **mesothorax** and **metathorax**. In mosquitoes, the mesothorax is greatly expanded at the expense of the other two. The dorsal aspect of the thorax is made up of

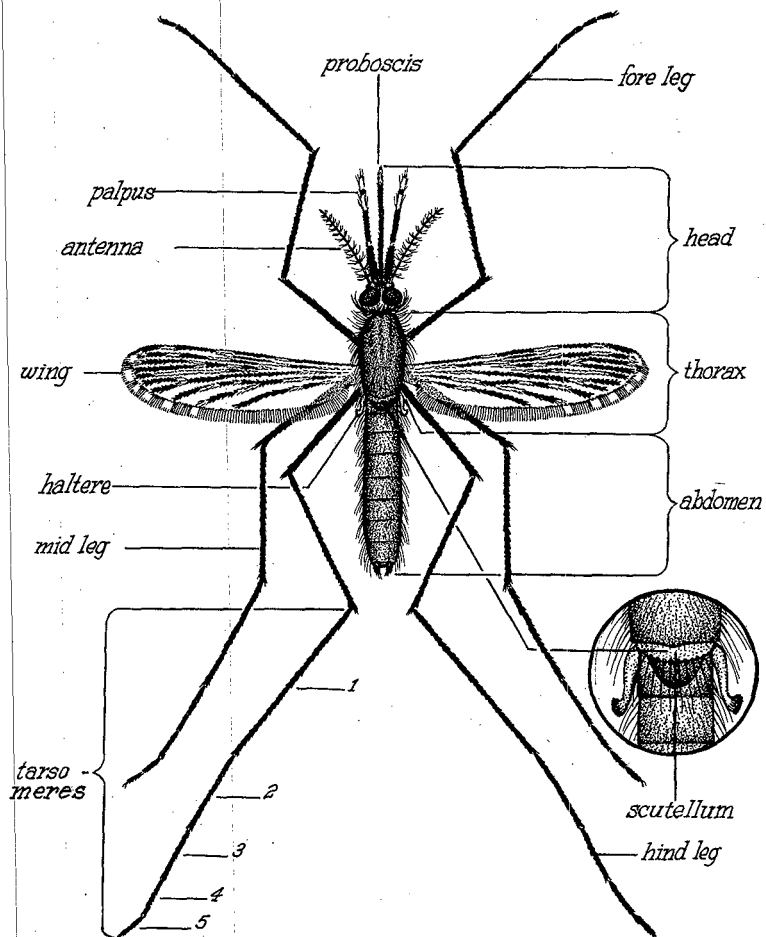


Figure 1. Portrait of *Anopheles minimus flavirostris,* showing general morphology of a female anopheline (17x).

(Redrawn from Russell and Baisas, 1936)

the **mesonotum** (mn) and two smaller posterior sclerites, the **scutellum** (sc) and the **postnotum** (pn). The lateral portions of the anterior third of the mesonotum are somewhat depressed and are known as the **fossae** (fo). In most anophelines, scales are absent but hairs present on the dorsum of the thorax.

The lateral aspect of the thorax is known as the **pleuron.** It is composed of a number of sclerites which contain groups of hairs, or bristles. For the names and locations of the principal ones, see Fig. 3. The important sclerite and bristle group for the recognition of Philippine *Anopheles* females is the **propleuron** (prp) and its bristles (1).

Mosquitoes have one pair of functional wings attached to the mesothorax and one vestigial pair, called the **halteres,** on the metathorax. The former consists of a membrane supported by a network of veins. The veins have been named by the Comstock-Needham system in this key; see Fig. 4A for an illustration of the nomenclature. The wings are very important in the identification of Philippine anophelines. The ornamentation, especially the costal wing spots, is a salient feature. For an understanding of the pattern and terminology used here, see Fig. 4B.

Each of the six legs is composed of nine parts, as shown in Fig. 5. Leg characters are commonly used in the identification of Philippine anophelines. Various spotting and banding of pale and dark scales will be encountered. Spots may be confused with bands, so it is necessary to make sure the pale scales extend completely around the segment.

The Abdomen

The abdomen is composed of eight visible segments designated by Roman numerals I-VIII (Fig. 6), each consisting of a dorsal sclerite, the **tergite** (te), and a ventral one, the **sternite** (st). In most anopheline females these abdominal sclerites have few or no scales; however, in some, scales or scale tufts may be present. These dorsal and ventral sclerites are separated by a membranous integument, the **pleural membrane** (pm). No pleural sclerites are present on the abdomen. The terminal segments constitute the female **genitalia,** and the lobe-like **cerci** (ce) are protruding at the posterior end.

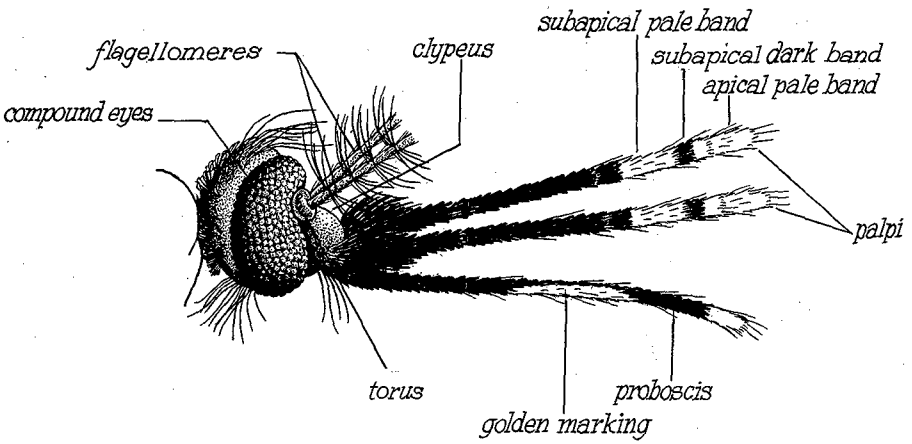


Figure 2. Head of anopheline, showing details of morphology (60x).

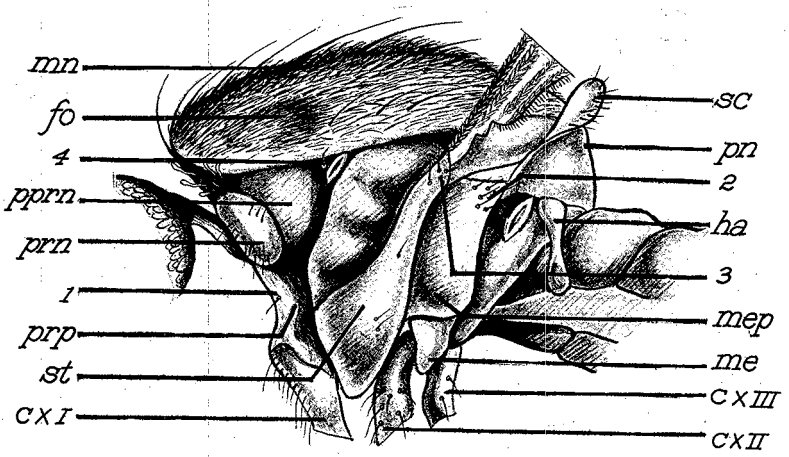
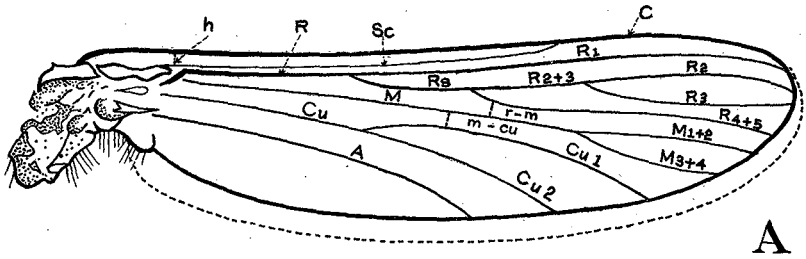


Figure 3. Thorax of anopheline showing sclerites and bristle (hair) groups (60x).

Legend:

cxI	coxa of prothorax	**mn**	mesonotum	**1**	propleural bristle
cxII	coxa of mesothorax	**pn**	postnotum	**2**	upper mesepimeral bristles
cxIII	coxa of metathorax	**prn**	pronotum	**3**	prealar bristles
fo	fossa of mesonotum	**pprn**	postpronotum	**4**	spiracular bristle
ha	haltere	**prp**	propleuron		
me	meron	**sc**	scutellum		
mep	mesepimeron	**st**	sternopleuron		



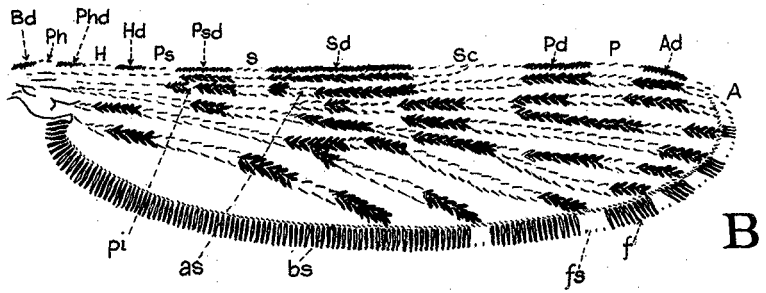


Figure 4. Wing of anopheline (44x).

A. Venation by Comstock-Needham System:

A	anal vein	**M**	medial vein	**Rs**	radial sector vein
C	costal vein	**m-cu**	medio-cubital cross-vein	**r-m**	radio-medial cross-vein
Cu	cubital vein	**R**	radial vein	**Sc**	subcostal vein
h	humeral cross-vein				

B. Markings on hypothetical wing:

A	apical pale spot	**fs**	fringe spot	**pi**	pale interruption
Ad	apical dark spot	**H**	humeral pale spot	**Ps**	presector pale spot
as	accessory sector pale spot	**Hd**	humeral dark spot	**Psd**	presector dark spot
Bd	basal dark spot	**P**	preapical pale spot	**S**	sector pale spot
bs	border scales	**Pd**	preapical dark spot	**Sc**	subcostal pale spot
f	fringe scales	**Ph**	prehumeral pale spot	**Sd**	sector dark spot
		Phd	prehumeral dark spot		

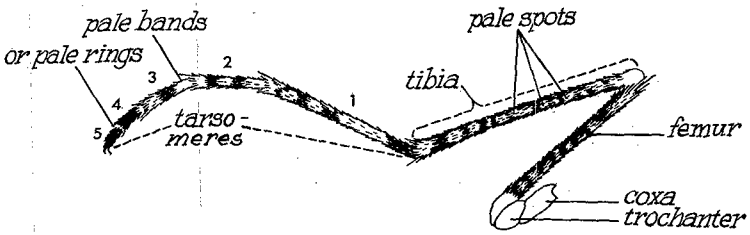


Figure 5. Leg of anopheline showing individual segments and markings (25x).

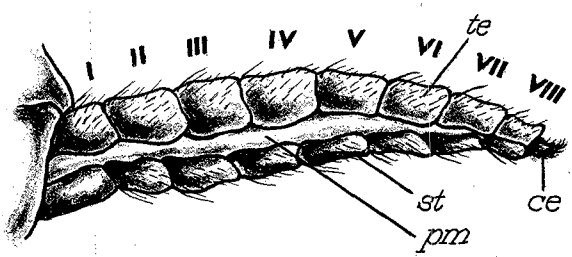


Figure 6. Abdomen of anopheline showing segments; **ce** — cercus; **pm** — pleural membrane; **st** — sternite; **te** — tergite (31x).

Illustrated Key to Adult Females of Philippine Anopheles

1. Costal vein of wing with three or fewer pale spots, or if more than three, then sector pale spot absent (Fig. 7) (Subgenus *Anopheles)* 2

Costal vein of wing with four or more pale spots, sector pale spot always present (Fig. 8) (Subgenus *Cellia*) 14

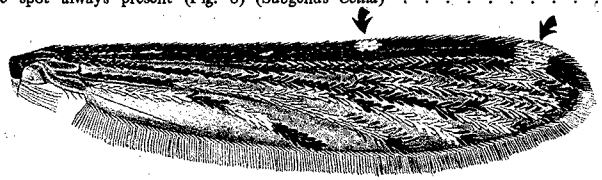


Figure 7. (33x)

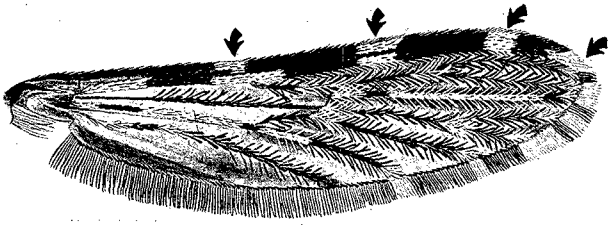


Figure 8. (42x)

2(1). Femora of forelegs distinctly swollen in basal half (in dried specimens swollen portion usually collapsed and with longitudinal depression) (Fig. 9); palpi shaggy in appearance sometimes only in basal half (Fig. 10) (*Myzorhynchus* series) 3

Femora of forelegs not swollen (Fig. 11), or only slightly (Fig. 12), in basal half; palpi not shaggy (Fig. 13) (*Anopheles* series) 12

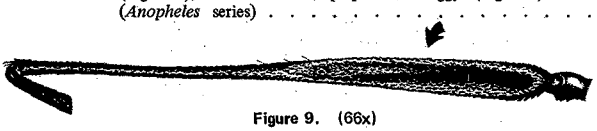


Figure 9. (66x)

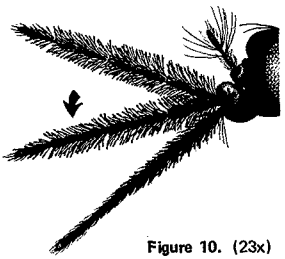


Figure 10. (23x)

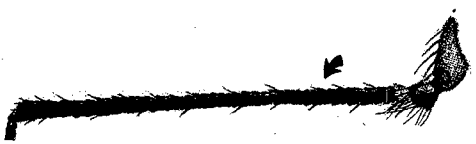


Figure 11. (34x)

Figure 12. (51x)

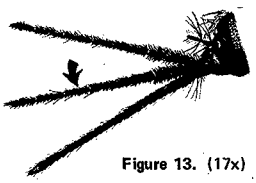


Figure 13. (17x)

3(2). Palpi without pale bands (Fig. 14) 4

Palpi with pale bands (Fig. 15) (*hyrcanus* species group) 10

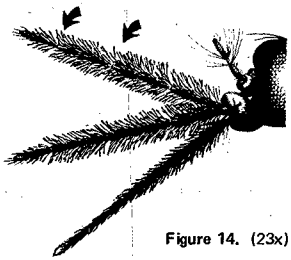


Figure 14. (23x)

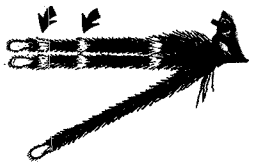


Figure 15. (24x)

4(3). Sternite of abdominal segment VII without tuft of dark scales (Fig. 16) 5

Sternite of abdominal segment VII with tuft of dark scales (Fig. 17) 7

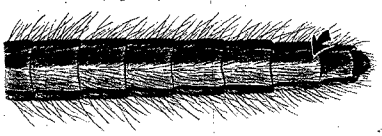


Figure 16. (34x)

Figure 17. (29x)

5(4). Tarsomeres 4-5 of hind legs with at most narrow pale bands (Fig. 18) (*umbrosus* species group) . . . . . *samarensis*
baezai

Tarsomeres 4-5 of hind legs either all pale or with broad pale bands (Fig. 19) (*albotaeniatus* species group) 6

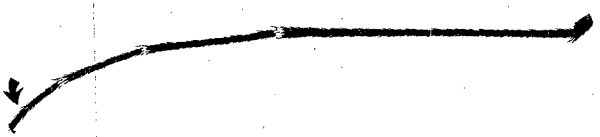


Figure 18. (21x)

Figure 19.

6(5). Tarsomeres 4-5 of hind legs entirely pale scaled (Fig. 20) . . . . . *balerensis*

Only tarsomere 5 of hind legs entirely pale scaled (Fig. 21) . . . . . *ejercitoi*

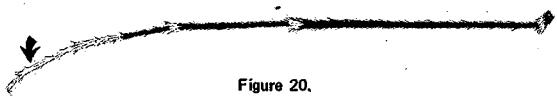


Figure 20.

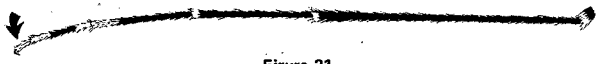


Figure 21.

7(4). Femora of all legs with many scattered pale scales on ventral aspect (Fig. 22); broad pale scales, usually in medio-sub-basal tufts, present on abdominal sternites II-VIII (Fig. 23) (*bancroftii* species group) . . . . . *pseudobarbirostris*

Femora without scattered pale scales on ventral aspect (Fig. 24); pale scales on abdominal sternites few or absent (Fig. 25) (*barbirostris* species group) 8

Figure 22. (55x)

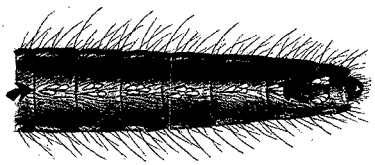


Figure 23. (25x)

Figure 24. (66x)

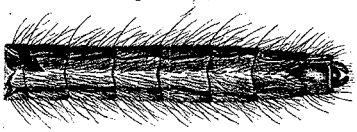


Figure 25. (21x)

8(7). Pale spot on fringe of wing opposite vein R_{4+5} narrow, not extending to vein M_{1+2} (Fig. 26) . . . . . *franciscoi*

Pale spot on fringe of wing opposite vein R_{4+5} broad, extending at least to vein M_{1+2} (Fig. 27) 9

Figure 26. (35x)

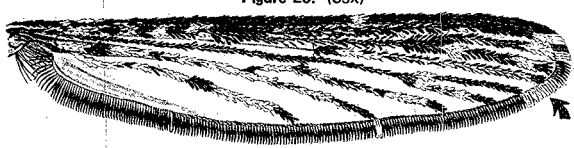


Figure 27. (26x)

9(8). Propleural bristles not numerous, usually with 7 or fewer (Fig. 28) . . . . . *vanus*

Propleural bristles numerous, usually with more than 9 (Fig. 29) . . . . . *manalangi*

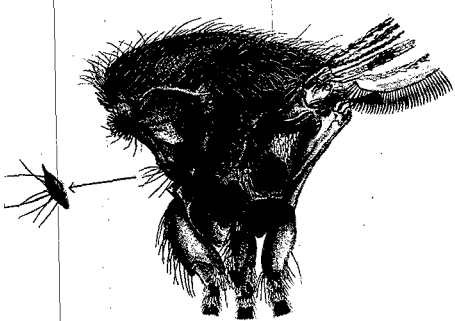


Figure 28. (21x)

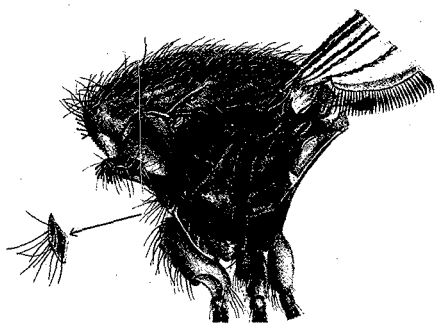


Figure 29. (21x)

10(3). Tarsomeres of hind legs with broad, pale bands, that on apex of third tarsomere extending over onto base of fourth (Fig. 30) . . . . . *peditaeniatus*

Tarsomeres of hind legs with narrow, pale bands, fourth tarsomere without basal, pale band (Fig. 31) 11

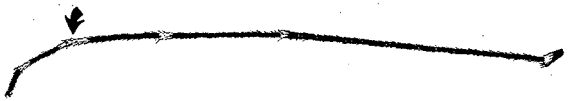


Figure 30. (25x)

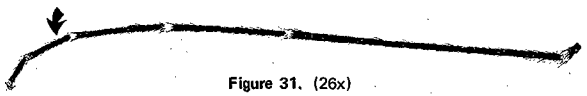


Figure 31. (26x)

11(10). Coxae of mid legs with pale scales (Fig. 32); humeral cross-veins with scales present (Fig. 33) . . . . . *pseudosinensis*

Coxae of mid legs and humeral cross-veins without scales (Figs. 34, 35) . . . . . *lesteri*

Figure 32. (42x)

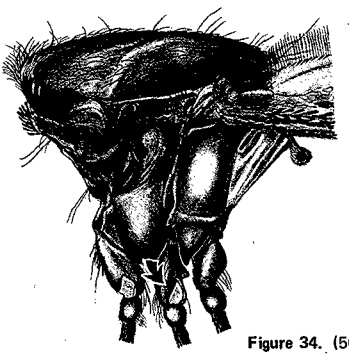


Figure 34. (50x)

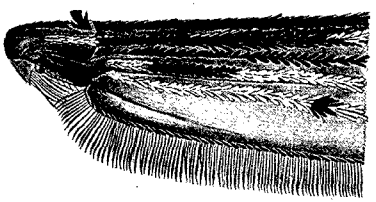


Figure 33. (46x)

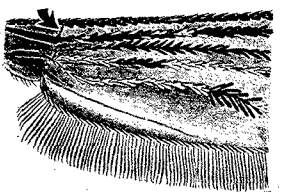


Figure 35. (50x)

12(2). Wings and legs entirely dark scaled (Figs. 36, 37); resting posture in life *Culex*-like (*aitkenii* species group) . . . . . *acaci*
aitkenii
bengalensis
fragilis
insulaeflorum

Wings and legs with pale markings (Figs. 38, 39) (*lindesayi* species group) 13

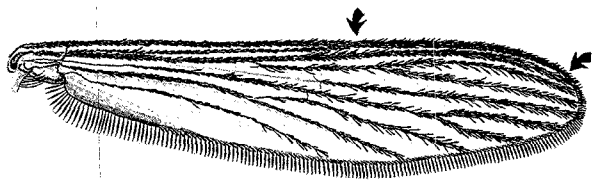


Figure 36. (29x)

Figure 37. (15x)

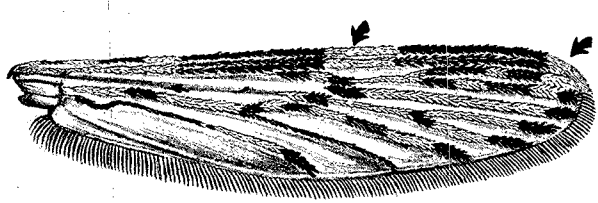


Figure 38. (22x)

Figure 39. (18x)

13(12). Femora of hind legs with broad, pale band at about the middle (Fig. 40); only apical pale spot present on costal vein of wing (Fig. 41) . . . . . *lindesayi benguetensis*

Femora of hind legs without pale band at about the middle (Fig. 42); costal vein with four or five broad, pale spots (Fig. 43) . . . . . *gigas formosus*

Figure 40. (29x)

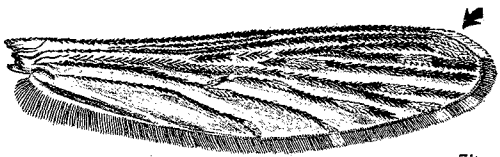


Figure 41. (25x)

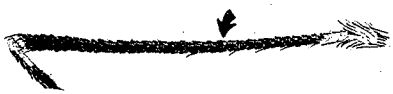


Figure 42. (25x)

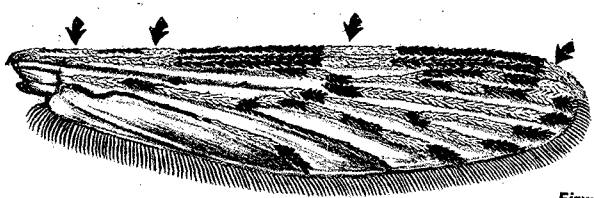


Figure 43. (22x)

14(1). Last tarsomere on hind legs entirely pale (Fig. 44) (*Neocellia* series) 15

Last tarsomere of hind legs either entirely, or at least partially, dark scaled (Fig. 45) 18

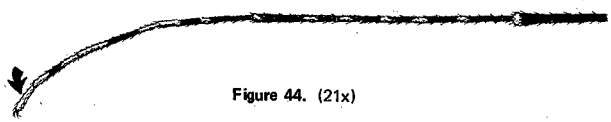


Figure 44. (21x)

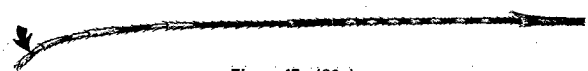


Figure 45. (23x)

15(14). Legs extensively spotted as well as banded (Fig. 46) . . . . . *maculatus*

Legs unspotted or with only a few, but with bands (Fig. 47) 16

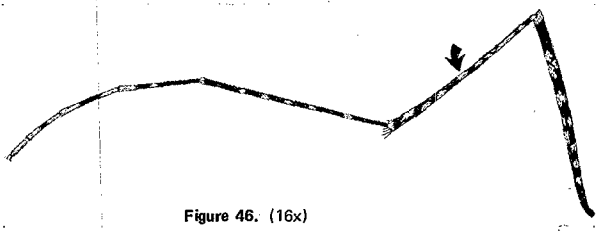


Figure 46. (16x)

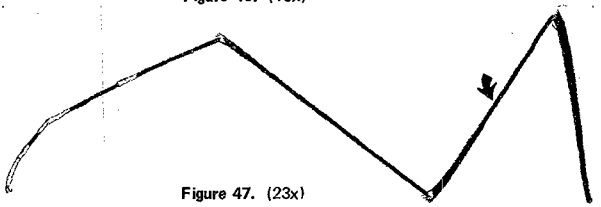


Figure 47. (23x)

16(15). Hind tarsomeres 3-5 with broad, pale bands, only tarsomere 5 all pale (Fig. 48); palpi with four pale bands (Fig. 49) . . . . . *karwari*

Hind tarsomeres 3-5 all pale scaled (Fig. 50); palpi with three pale bands (Fig. 51) (*annularis* species group) 17

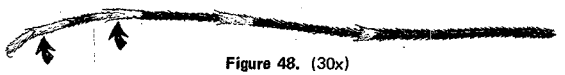


Figure 48. (30x)

Figure 49. (33x)

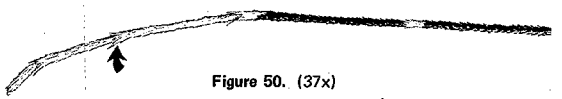


Figure 50. (37x)

Figure 51. (33x)

17(16). Fork of wing vein Cu covered with dark scales; subcostal pale spot absent or incomplete on Vein R_1 (Fig. 52) . . . . . *annularis*

Fork of wing vein Cu covered with pale scales; subcostal pale spot usually complete on vein R_1 (Fig. 53) . . . . . *philippinensis*

Figure 52. (46x)

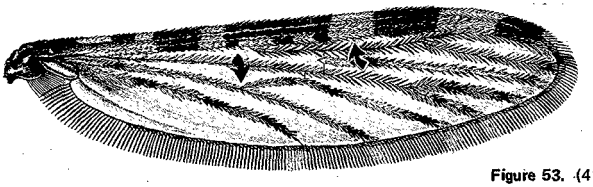


Figure 53. (41x)

18(14). Wing vein A with four or more dark spots (Fig. 54), or if fewer than four, then abdominal sternites II-VI with tufts of dark scales (Fig. 55) (*Neomyzomyia* series) 19

Wing vein A with two or three dark spots (Fig. 56); abdominal sternites II-VI without tufts of dark scales (Fig. 57) 25

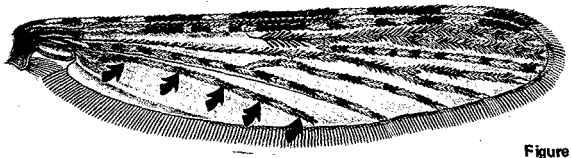


Figure 54. (28x)

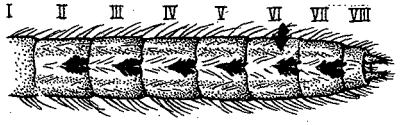


Figure 55. (27x)

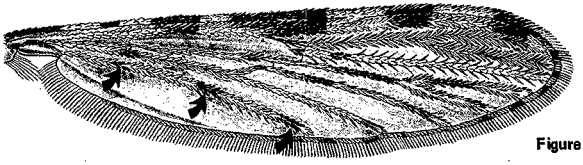


Figure 56. (32x)

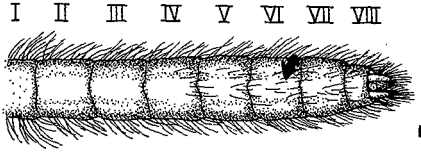


Figure 57. (25x)

19(18). Prominent tufts of dark scales present on sternites of abdominal segments II-VII (Fig. 58) . . . . . *kochi*

Tufts of dark scales absent, or if present, only on sternite of abdominal segment VII (Fig. 59) 20

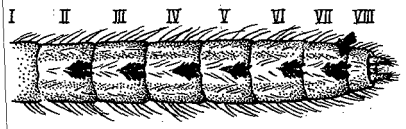


Figure 58. (27x)

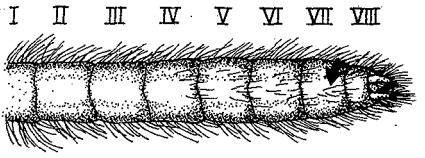


Figure 59. (25x)

20(19). Tibio-tarsal joint of hind legs with conspicuous, broad, pale bands (Fig. 60) (*leucosphyrus* species group) 21

Tibio-tarsal joint of hind legs with no pale bands, or at most narrow bands or spots (Fig. 61) 24

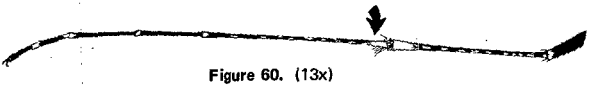


Figure 60. (13x)

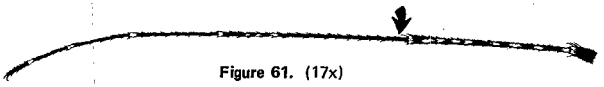


Figure 61. (17x)

21(20). Presector dark spot of vein R with one or more pale interruption on at least one wing (Fig. 62); apical pale band of hind tibiae without longitudinal dark stripe (Fig. 63) 22

Presector dark spot of vein R without pale interruptions (Fig. 64); apical pale band of hind tibiae interrupted by longitudinal dark stripe ventrally or laterally (Fig. 65) 23

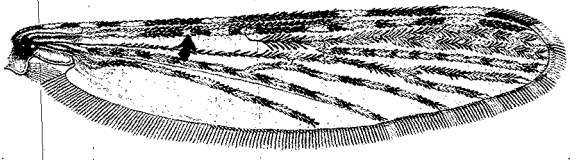


Figure 62. (28x)

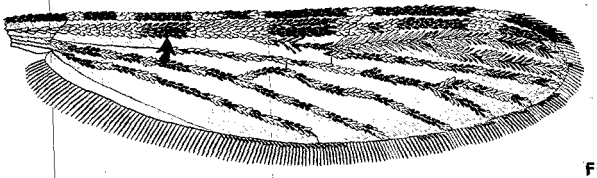


Figure 64. (38x)

Figure 63.

Figure 65.

22(21). Basal-most part of presector dark spot of vein R usually extending no farther than level of presector pale spot, but sometimes to center of humeral dark spot of costa (Fig. 66); tarsomere 4 of hind legs with prominent basal pale band, at least on one leg (Fig. 67) . . . . . *balabacensis balabacensis*

Basal-most part of presector dark spot of vein R extending well into level of humeral dark spot of costa, sometimes even to humeral pale spot (Fig. 68); tarsomere 4 of hind legs without basal pale band or with very narrow one (Fig. 69) . . . . . *balabacensis baisasi*

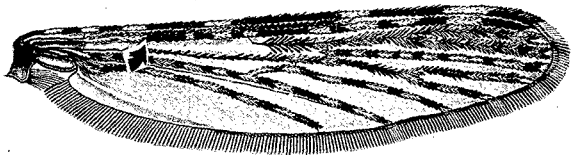


Figure 66. (28x)

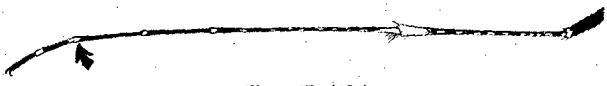


Figure 67. (13x)

Figure 68. (38x)

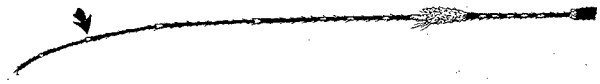


Figure 69. (22x)

23(21). Costal vein without prehumeral pale spot (Fig. 70); proboscis/fore-femur ratio less than 0.90 . . . . . *cristatus*

Costal vein nearly always with prehumeral pale spot (Fig. 71); proboscis/fore-femur ratio greater than 0.90. . . . . *riparis riparis*

Figure 70. (38x)

Figure 71. (38x)

24(20). Tergites of abdominal segments with very few or no scattered, broad, pale scales (Fig. 72); apical half of proboscis golden, excepting narrow preapical, dark band (Fig. 73) . . . . . *tessellatus*

Tergites of abdominal segments with many scattered, broad, pale scales (Fig. 74); proboscis usually with some golden scales, but confined to narrow preapical band or patch (Fig. 75) . . . . . *kolambuganensis*

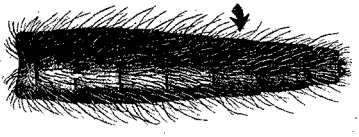


Figure 72. (34x)

Figure 74. (34x)

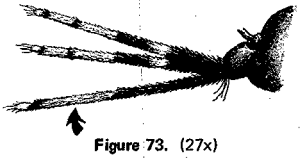


Figure 73. (27x)

Figure 75. (33x)

25(18) Fork of wing vein Cu with dark scales (Fig. 76) (*Myzomyia* series; *minimus* species group) 26

Fork of wing vein Cu with pale scales (Fig. 77) (*Pyretophorus* series) 28

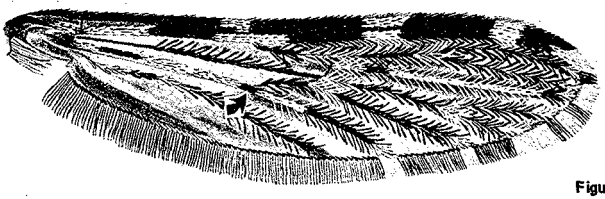


Figure 76. (42x)

Figure 77. (38x)

26(25). Wing vein A with three dark-scaled areas, fringe opposite this vein pale (Fig. 78); subapical dark band of palpi subequal in length to subapical pale band (Fig. 79) . . . . . , *filipinae*

Wing vein A with only two dark areas, distal one long, basal one short, fringe opposite this vein dark (Fig. 80); subapical dark band of palpi shorter than subapical pale band (Fig. 81) 27

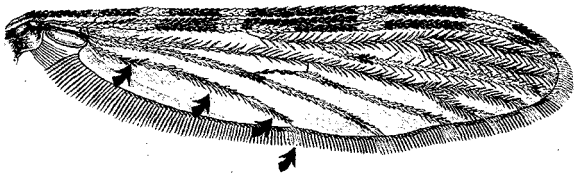


Figure 78. (40x)

Figure 79. (33x)

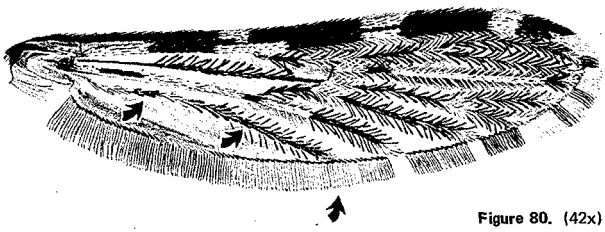


Figure 80. (42x)

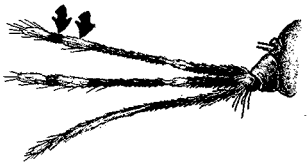


Figure 81. (32x)

27(26). Proboscis with ventral golden patch, usually confined to apical half (Fig. 82); basal third of costal vein usually dark, or with only one pale spot present (Fig. 83) . . . . . *minimus flavirostris*

Proboscis without golden patch (Fig. 84); basal third of costal vein with two pale spots present (Fig. 85) . . . . . *mangyanus*

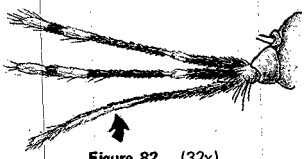


Figure 82. (32x)

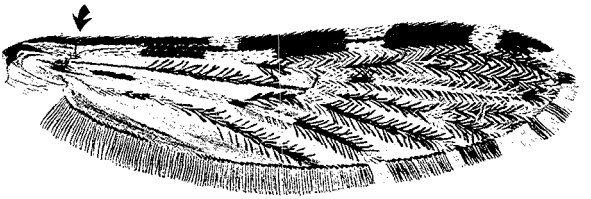


Figure 83. (42x)

Figure 84. (32x)

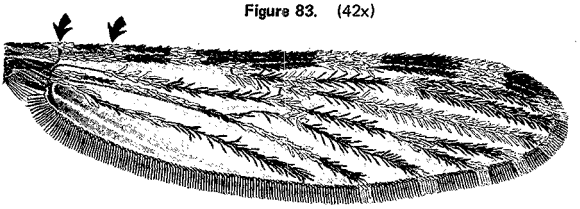


Figure 85. (38x)

28(25). Legs spotted as well as banded (Fig. 86) (*ludlowae* species group) 29

Legs not spotted but with bands (Fig. 87) 32

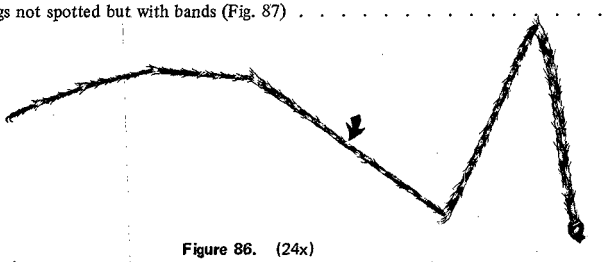


Figure 86. (24x)

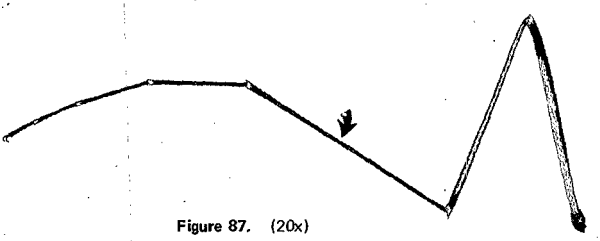


Figure 87. (20x)

29(28). Tarsomeres 1-4 of hind legs with one or more pale bands in addition to those at joints (Fig. 88) . . . . . *parangensis*

Tarsomeres 1-4 of hind legs without complete pale bands, other than those at joints, though spotted on 1-2 (Fig. 89) 30

Figure 88.

Figure 89. (30x)

30(29). Ventral aspect of mid and hind femora and tibiae unspotted and covered with golden scales (Fig. 90) . . . . . *litoralis**

Ventral aspect of mid and hind femora and tibiae spotted with dark and pale scales (Fig. 91) 31

Figure 90. (31x)

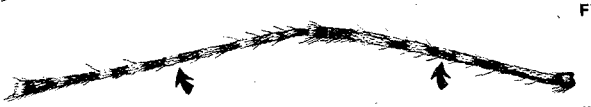


Figure 91. (33x)

31(30). Wing vein A with two dark-scaled spots (Fig. 92) . . . . . *ludlowae ludlowae*

Wing vein A with three dark-scaled spots (Fig. 93) . . . . . *ludlowae cabrerai*

Figure 92. (36x)

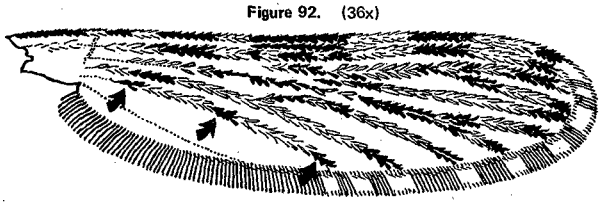


Figure 93. (36x)

*Since *A. sundaicus* Rodenwaldt may occur in the Philippines, it would key to *litoralis* in this table. It may be distinguished from *litoralis* by the absence of the prehumeral pale spot on the wing.

32(28). Subapical dark band of palpi narrow, usually less than one-third as long as apical pale band (Fig. 94); preapical dark spot of wings narrower than pale spots on either side (Fig. 95)* 33

Subapical dark band of palpi usually one-third or more as long as apical pale band (Fig. 96); preapical dark spot of wings broader than pale spots on either side, or if narrower, then presector dark spot on vein R one-half or more as long as that on costa (Fig. 97) 34

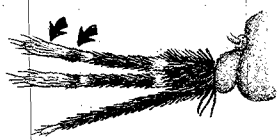


Figure 94. (43x)

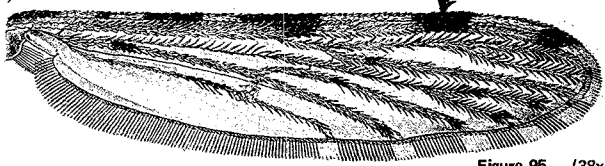


Figure 95. (38x)

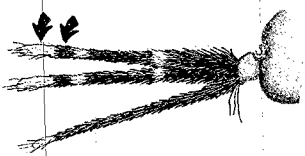


Figure 96. (35x)

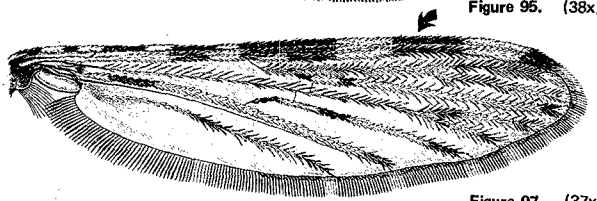


Figure 97. (37x)

33(32). Proboscis with subapical pale area (Fig. 98); prehumeral area of costal wing vein with pale scales (Fig. 99) . . . . . *vagus vagus*

Proboscis without subapical pale area (Fig. 99a); prehumeral area of costa all dark scaled (Fig. 99b) . . . . . *vagus limosus*

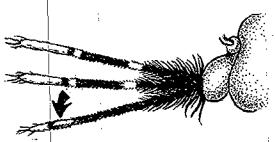


Figure 98. (43x)

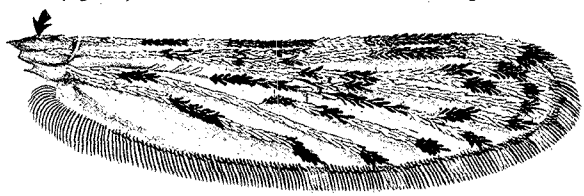


Figure 99. (38x)

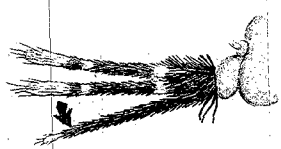


Figure 99a. (43x)

Figure 99b. (37x)

*Second character does not apply to most of *vagus vagus* examined.

34(32). Subapical pale band of palpi one-third or less as long as subapical dark band (Fig. 99c) . . . . . *subpictus*

Subapical pale band of palpi usually one-half or more as long as subapical dark band (Fig. 99d) . . . . . *indefinitus*

Figure 99c. (30x)

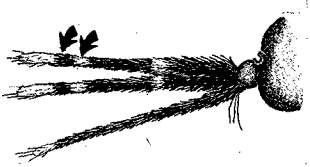


Figure 99d. (35x)

The Fourth Instar Larva

MORPHOLOGY OF THE LARVA

The anopheline larvae are readily distinguished from other kinds of mosquito larvae by the absence of an elongate siphon on the eighth abdominal segment, and the presence of palmate hairs (Hair 1) on some or all of abdominal segments I-VII. The attitude of the live anopheline larvae when at rest on the surface of the water is characteristic, for they lie parallel to the top, whereas, most culicine larvae lie at a distinct angle to the surface.

The body of the mosquito larva is largely membranous, and beset by sclerites, such as the head capsule, abdominal tergal plates, spiracular apparatus and anal saddle. There are also numerous hairs attached both to the sclerites and to the membranes. The study of hairs (setae) is called **chaetotaxy** and the complete chaetotaxy of *Anopheles litoralis* King is depicted in Figs. 100-103. The nomenclature of Belkin (1951) is employed for the larval hairs. The morphology of individual hairs, shown in Fig. 104, is singularly important in identification of larvae.

The larva is divided into three distinct body regions; the **head**, somewhat flattened; the **thorax**, consisting of three fused segments, each indicated by its own set of hairs; and the **abdomen**, with eight obvious segments and two markedly modified structurally.

There are four larval instars, each separated by a moulting of the skin (ecdysis). A rapid, morphological identification of the four instars may be made by using the following simple key:

a. Egg breaker present on frontoclypeus . . **First Instar**
aa. Egg breaker absent . . . . . b
b. Hair 16 of maxillary palpus absent . . . . . **Second Instar**
bb. Hair 16 of maxillary palpus present c
c. Imaginal eye absent . . . . . **Third Instar**
cc. Imaginal eye present . . . . . **Fourth Instar**

The fourth instar is obviously the largest in size, but unless one is familiar with relative sizes of the species, it may be a poor character to follow. For instance, the third instar of *Anopheles manalangi* Mendoza may be larger than the fourth instar larva of *Anopheles filipinae* Manalang. The accompanying key is based on the fourth instar, but in most instances may also be used to identify the third instar.

The mature fourth instar larvae (pre-pupae) can be recognized by the appearance of the pupal hairs under their skin.

The following detailed description applies to the fourth instar anopheline larva.

Head

The head is composed of a completely sclerotized capsule, Fig. 100. Three major plates are visible on the head, the **frontoclypeus** (fc), dorsally, and the two **lateral plates** (lp) which meet on the ventral side. A prominent line known as the **epicranial suture** (ep) separates the frontoclypeus from the lateral plates. Anteriorly are the **antennae** (an) and **mouthparts**. The antenna bears a hair on the shaft and several at its terminus. In some species the shaft hair (No. 1) is large, multibranched and located near the middle of the shaft, while in others it is small, simple and positioned in the basal one-third. The most conspicuous structures of the mouthparts are the **mouth brushes** (mb) terminal in position. The **maxillary palpi** (mxp) are prominent lobes just medio-ventral to the antennae, which bear subapical hairs (No. 16 of some authors: see Christophers, 1933 and Baisas and Dowell, 1965). On each lateral plate are found two eyes, a prominent **imaginal eye** (ie) and small, posterior, **larval eye** (le). The posterior border of the head is heavily sclerotized and called the **collar** (co). In early instars this collar is much wider.

Some of the 15 pairs of head hairs are of major importance in identification. The **inner** and **outer clypeal hairs**, head hairs 2 and 3, are widely used. The clypeal hairs may be simple, forked at tip, frayed, variously branched or dendritic, a term applied to branching which appears like the branches of a tree; see Fig. 104, A-D, L, M. The outer clypeal hairs are often difficult to see because they overlie the mouth brushes. It helps to view them with the 43x objective of a compound microscope. The same power will be necessary to see the frayings, or minute side branches, of the clypeal hairs. Less often used are the posterior clypeal and the sutural and transsutural hairs — hairs 4, 8 and 9, respectively. Hair 16 on the maxillary palpi is not named by Belkin, but it is included for convenience since it is useful in larval instar recognition.

Thorax

The thorax is the thickest part of the body, and composed of three segments, the **prothorax, mesothorax and metathorax.** They are completely fused into one large body region, but the evidence of segmentation is found in the chaetotaxy, for there are three distinct set of hairs; see Fig. 103.

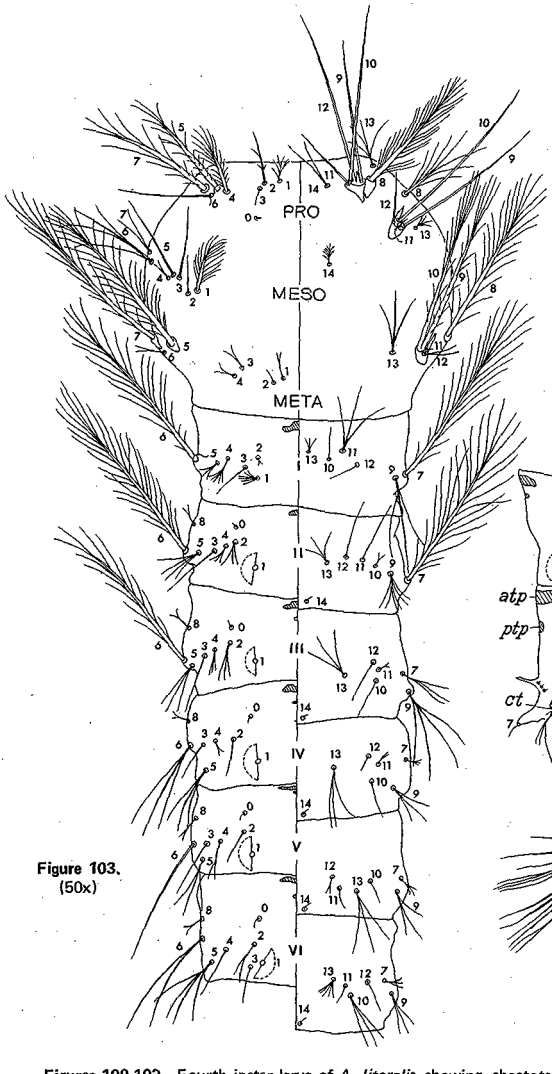


Figure 103. (50x)

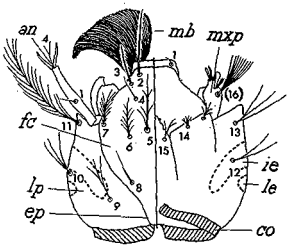


Figure 100. (50x)

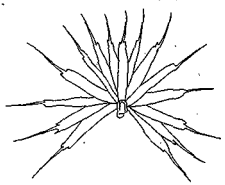


Figure 101. (310x)

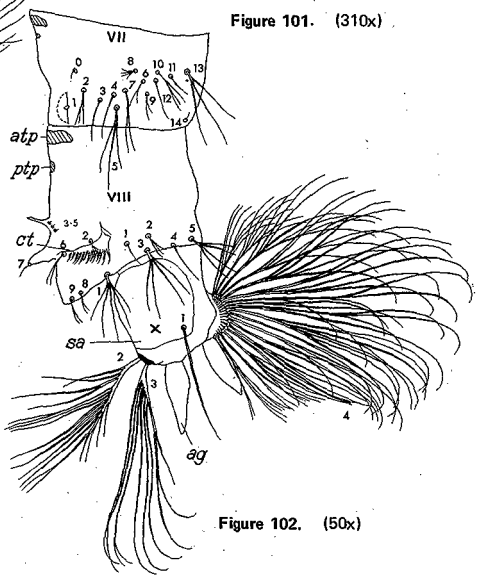


Figure 102. (50x)

Figures 100-103. Fourth instar larva of *A. litoralis*, showing chaetotaxy. 100. Head, dorsal – left, ventral – right; 101. Palmate hair of abdominal segment IV; 102. Terminal segments of abdomen; 103. Thorax and abdominal segments I-VI, dorsal – left, ventral – right. *Legend:*

ag	– anal gill	**ep**	– epicranial suture	**mxp**	– maxillary palpus
an	– antenna	**fc**	– frontoclypeus	**ptp**	– posterior tergal plate
atp	– anterior tergal plate	**ie**	– imaginal eye	**sa**	– anal saddle
co	– collar	**le**	– larval eye	**PRO**	– prothorax
ct	– comb teeth	**lp**	– lateral plate	**MESO**	– mesothorax
		mb	– mouth brush	**META**	– metathorax

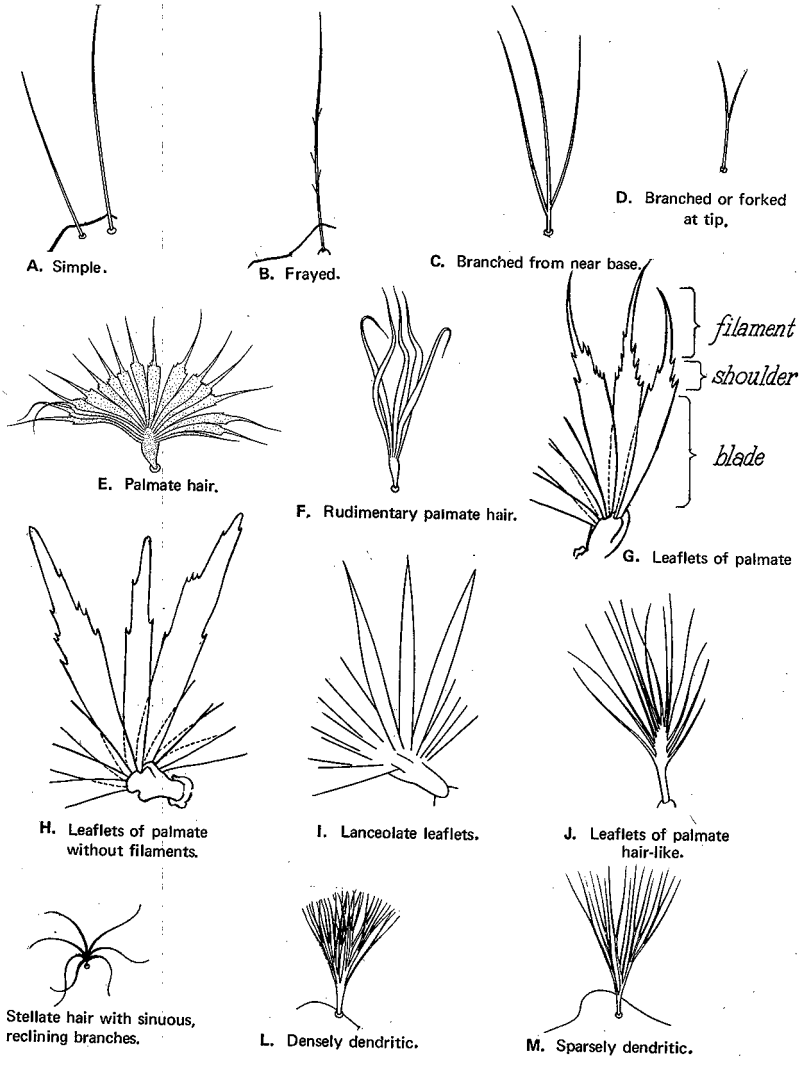


Figure 104. Morphology of Hairs.

Certain thoracic hairs are used as diagnostic characters. The submedian prothoracic hairs 1, 2 and 3 show differences not only in the number of branches, but also the configuration of their bases. Sometimes their trichopores are set into sclerotized tubercles, which at times are joined together. **Mesothoracic hair 4** (hair 5 of Puri, 1960, and Baisas and Dowell, loc. cit.) in one species has reclining, sinuous branches which form a star shape (stellate), whereas normally the branches are erect (Fig. 104. C, K). The **pleural hair groups**, hairs 9-12, on the ventral side of each thoracic segment are important because they differ in the number of branches among the various species. They are distinctive because each group of four hairs arises from a common tubercle. **Metathoracic hair 3** may have hair-like or leaf-like branches. In the latter case it is known as the **metathoracic palmate hair.**

Abdomen

Following the interpretation of Snodgrass (1959) and Puri (loc. cit.), the abdomen consists of 10 segments of which the first seven are similar in composition; see Fig. 102. The eighth is modified to bear the spiracular apparatus, and the latter is composed of elements of both the eighth and ninth abdominal segments. Two sets of hairs, as interpreted by Belkin, on the eighth segment support the opinion that actually two segments are represented, VIII and IX. The terminal segment is the tenth, which ends in the anus, carries large dorsal and ventral tufts of hairs and possesses four **anal gills** (ag), thin-walled, tracheated **lobes** or **papillae.**

Each of the first eight abdominal segments has a sclerotized plate dorsally, called the **anterior tergal plate** (atp). Posterior to it on some segments are one or more smaller sclerites known as **posterior tergal plates** (ptp). The tergal plates may be difficult to see if the alimentary canal is filled with dense material. The tenth segment also has a large dorsal plate, called the **saddle** (sa). The larvae belonging to *Myzomyia* series have large anterior tergal plates, sometimes almost covering the entire dorsal surface of the segment.

The normal complement of hairs on the abdominal segments is 15 hairs, Nos. 0-14; however, VIII, IX and X have fewer; see Figs. 103, 102.

Certain abdominal hairs have decided importance as recognition characters. The **palmate hairs** (Hairs No. 1) are salient features on I-VII. Figure 104, E-J, show the various forms. The palmates may have leaf-like, flattened branches (E, G, I) or hair-like parts (J). The usual leaflet has a basal flat part, the blade, terminal, attenuated portion, the filament, and a section in between where a series of notches occur, usually with a more or less flattened area, known as the shoulder (G). Some species have the notches but no distinct shoulders. Others are without the attenuated filament, the end being blunt (H). A well developed palmate will usually have 10 or more leaflets like those just described (E). A rudimentary palmate hair (F) commonly has two to eight leaflets, lanceolate in shape, i.e., not very wide and with few or no notches.

Next in importance are the **lateral hairs** (Hairs No. 6) on abdominal segments III-VI; see Fig. 103. These are usually the longest hairs on the segment. Their length in relation to each other, number and mode of branching are useful characters. The **antepalmate hairs** (Hairs No. 2) particularly on abdominal segment VII are utilized for identification.

The **spiracular apparatus** on VIII (Fig. 127) consists of a central depression, the respiratory fossa, in which the spiracles are located. The spiracles constitute the only point of intake for atmospheric air required by the larva in respiration. Surrounding the fossa are four protective structures, the fan-shaped plate (ap) anteriorly, the two lateral papillae (lpa), and the posterior, concave scoop (sc). The anterior plate sometimes bears a long, thin, appendage, the **stigmal club** (scl), which extends posteriorly between the spiracles and overlies the scoop. The scoop has two lateral plates, forming the side walls, and a median plate, heavily sclerotized anteriorly.

On either side of the spiracular apparatus are strongly sclerotized plates, the **combs**, or **pecten.** In the Philippine anopheline larvae the posterior edge of the comb carries a number of teeth, usually several long and many more distinctly short. However, they may be subequal or have graduated lengths. Their bases ordinarily have fine serrations.

Illustrated Key to Fourth Instar Larvae of Philippine Anopheles*

1. Inner clypeal hairs (Hair 2) close together, the distance between their bases less than the distance between the bases of the inner and outer (Hair 3) clypeal hairs (Fig. 105A); antennal hair (Hair 1) multibranched, often large (Fig. 105B) (Subgenus *Anopheles*) 2

Inner clypeal hairs widely separated, the distance between their bases usually more than the distance between the bases of the inner and outer clypeal hairs (Fig. 106A); antennal hair simple and minute (Fig. 106B) (Subgenus *Cellia*) 17

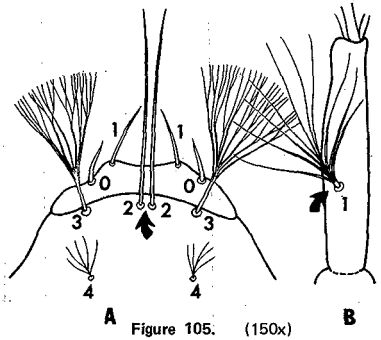


Figure 105. (150x)

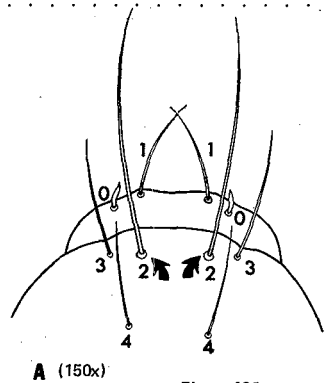


Figure 106.

2(1). Outer clypeal hairs simple or with fewer than 10 short, lateral branches (Fig. 107) (*Anopheles* series) 3

Outer clypeal hairs dendritic, with 20-60 branches (Fig. 108), or if fewer than 20, then abdomen without palmate hairs (Hair 1) (Fig. 123) (*Myzorhynchus* series) 9

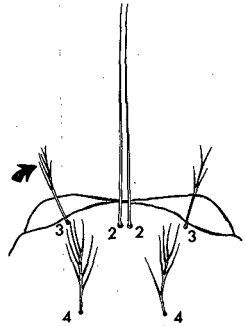


Figure 107. (150x)

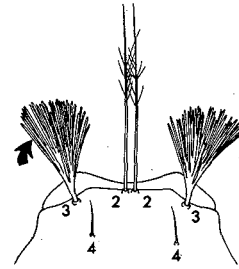


Figure 108. (150x)

*Larvae of *A. balerensis* and *A. ejercitoi* unknown.

3(2). Palmate hairs on abdominal segment I hair-like, simple or with two or three branches (Fig. 109) (*lindesayi* species group) 4

Palmate hairs on abdominal segment I well developed (Fig. 110) (*aitkenii* species group) 5

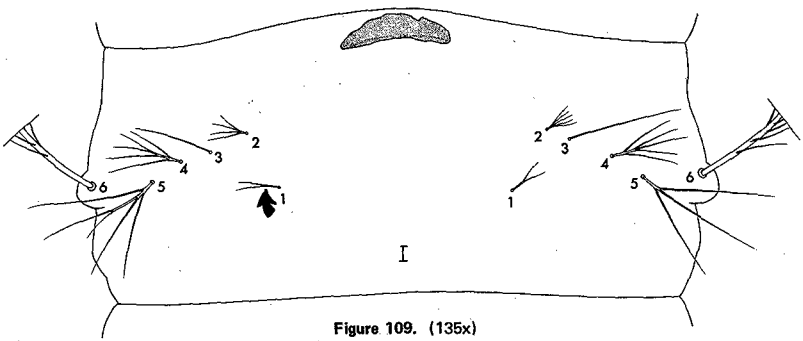


Figure 109. (135x)

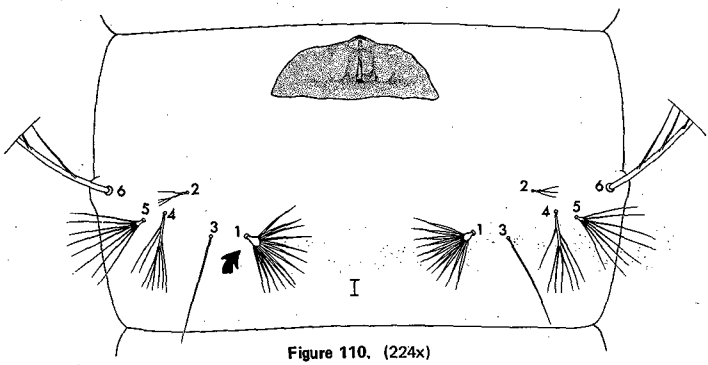


Figure 110. (224x)

4(3). Leaflets of abdominal palmate hairs without filaments (Fig. 111) . . . . . *gigas formosus*

Leaflets of abdominal palmate hairs with distinct filaments (Fig. 112) . . . . . *lindesayi benguetensis*

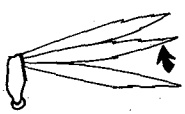


Figure 111. (350x)

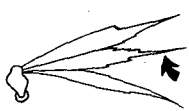


Figure 112. (350x)

5(3). Inner clypeal hairs simple, their bases closer together than distance to outer clypeals (Fig. 113); lateral hairs of abdominal segment III with three to nine branches (Fig. 114) . . . . . *insulaeflorum*

Inner clypeal hairs branched or frayed, and their bases not much closer together than the distance to the outer clypeals (Fig. 115); lateral hairs of abdominal segment III with 20-50 branches (Fig. 116) 6

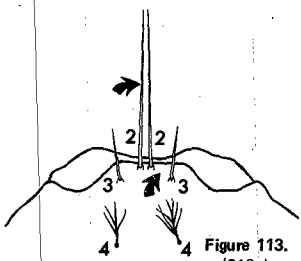


Figure 113. (210x)

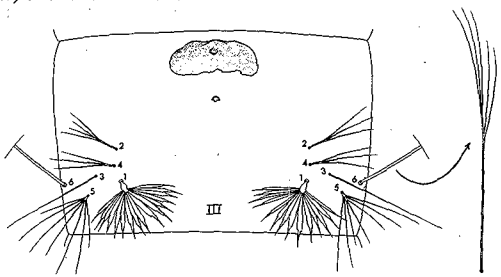


Figure 114. (120x)

(90x)

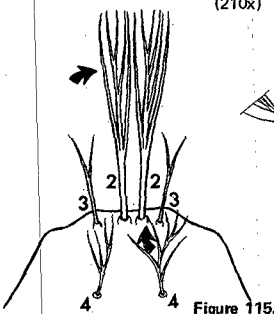


Figure 115. (250x)

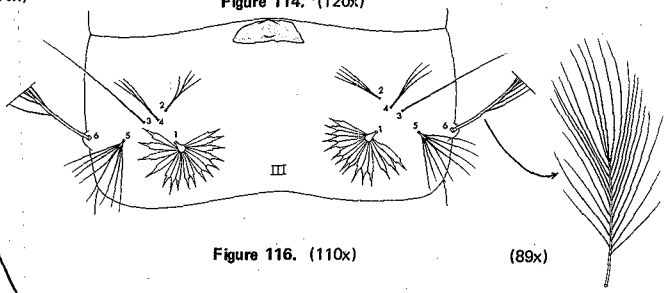


Figure 116. (110x)

(89x)

6(5). Middle area of inner clypeal hairs with fine side frayings, stem single or two- to three-branched (Fig. 117) . . . . . *fragilis*

Middle area of inner clypeal hairs without such fine frayings, stem with two to 14 branches (Fig. 118) 7

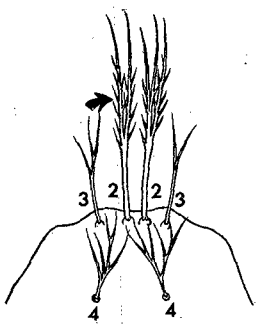


Figure 117. (230x)

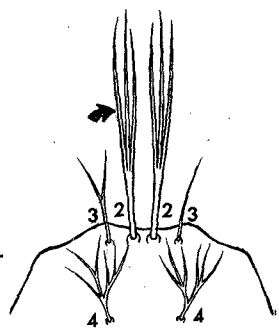


Figure 118. (220x)

7(6). Inner clypeal hairs with branches closely appressed and distinctly bent downwards, mostly with 10 or more branches (Fig. 119) . . . . . *acaci*

Inner clypeal hairs with branches well separated and easily distinguishable, not bent down, with fewer than nine branches (Fig. 120) 8

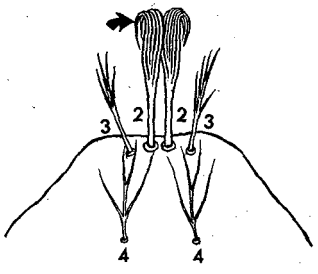


Figure 119. (220x)

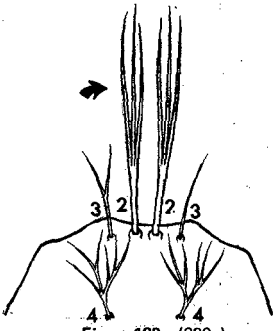


Figure 120. (220x)

8(7). Inner clypeal hairs with two or three branches, all beginning about one-fourth of the distance from base (Fig. 121) . . . . . *aitkenii*

Inner clypeal hairs usually with four to seven branches, if two- or three-branched, then branches beginning one-third or farther from base (Fig. 122) . . . . . *bengalensis*

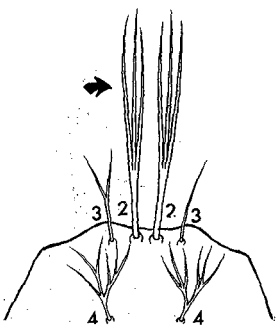


Figure 121. (220x)

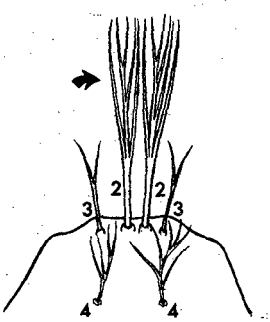


Figure 122. (250x)

9(2). Palmate hairs undeveloped on thorax and abdomen, branches hair-like (Fig. 123) (*umbrosus* species group) 10

Palmate hairs well developed on at least some abdominal segments, branches broad, leaf-like (Fig. 124) 11

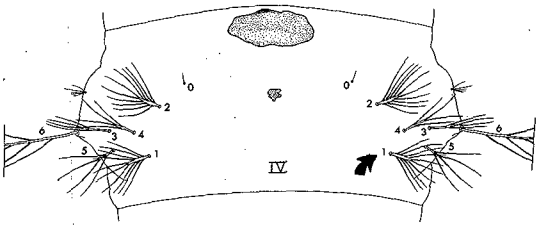


Figure 123. (98x)

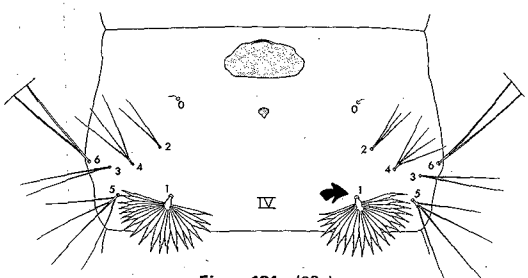


Figure 124. (92x)

10(9). Outer clypeal hairs simple or with two to five branches (Fig. 125) . . . . . *samarensis*

Outer clypeal hairs dendritic, with more than 10 branches (Fig. 126) . . . . . *baezai*

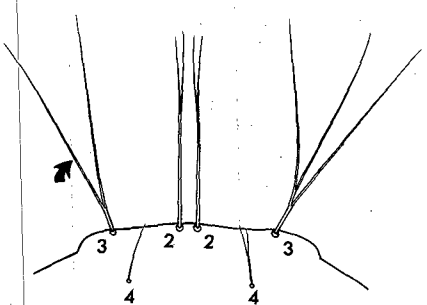


Figure 125. (240x)

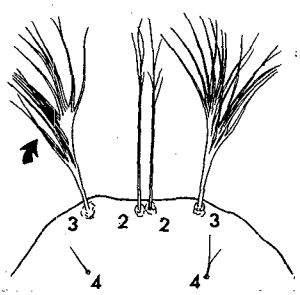


Figure 126. (250x)

11(9). Stigmal club present on spiracular apparatus (Fig. 127, scl); antennal shaft swollen basally, narrowing only beyond hair I (Fig. 128) (*bancroftii* species group) . . . . . *pseudobarbirostris*

Stigmal club absent (Fig. 129); antennal shaft gradually narrowing apically (Fig. 130) 12

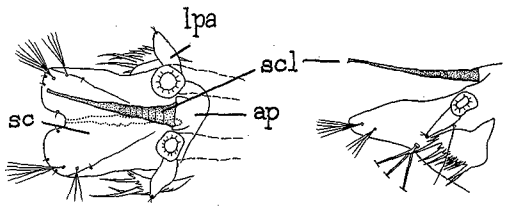


Figure 127. Dorsal-left; lateral-right (89x).

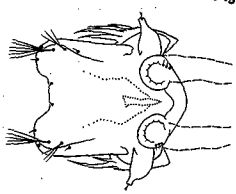


Figure 129. Dorsal view (102x)

ap	anterior plate
lpa	lateral papilla
sc	scoop
scl	stigmal club

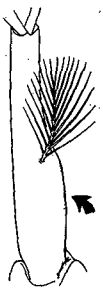


Figure 128. (190x)

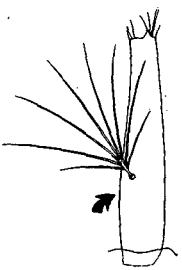


Figure 130. (165x)

12(11). Prothoracic hair 1 simple or with two or three short branches at tip (Fig. 131) (*hyrcanus* species group) 13

Prothoracic hair 1 with four to 15 branches (Fig. 132) (*barbirostris* species group) 15

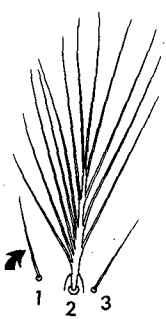


Figure 131. (250x)

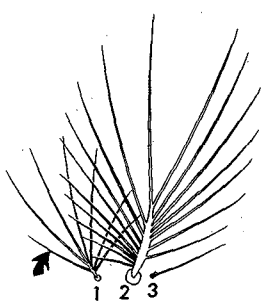


Figure 132. (220x)

13(12). Mesothoracic hair 4 weakly stellate, with six or more reclining, sinuous branches (Fig. 133) . . . . . *peditaeniatus*

Mesothoracic hair 4 with three or four short, erect branches (Fig. 134) 14

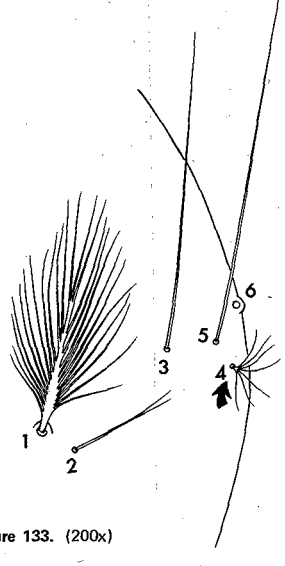


Figure 133. (200x)

MESO

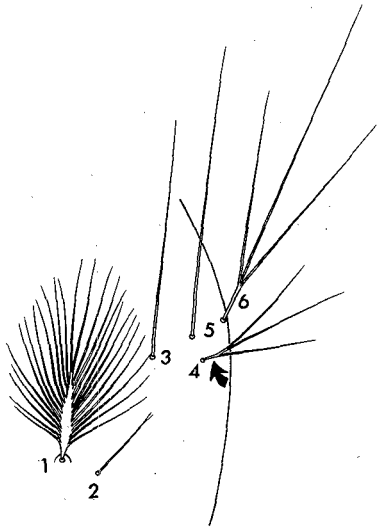


Figure 134. (170x)

14(13). Inner clypeal hairs split apically into two or more branches (Fig. 135) . . . . . *pseudosinensis*

Inner clypeal hairs simple (Fig. 136) . . . . . *lesteri*

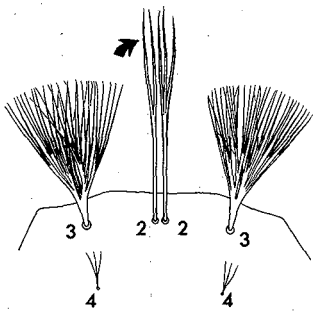


Figure 135. (108x)

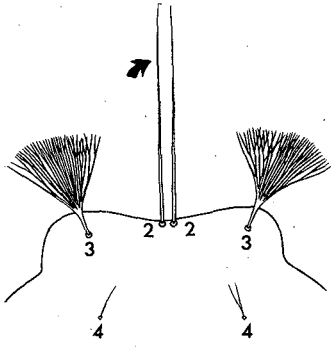


Figure 136. (135x)

15(12). Outer clypeal hairs densely dendritic, usually with 30-40 branches (Fig. 137) . . . . . *manalangi*

Outer clypeal hairs sparsely dendritic, usually with 16-25 branches (Fig. 138) 16

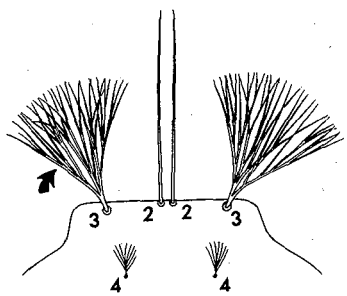


Figure 137. (155x)

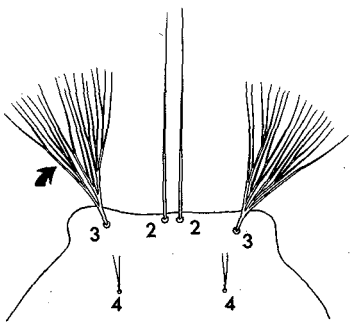


Figure 138. (195x)

16(15). Palmate hairs on abdominal segment II not pigmented (Fig. 139) . . . . . *vanus*

Palmate hairs on abdominal segment II at least partially pigmented (Fig. 140) . . . . . *franciscoi*

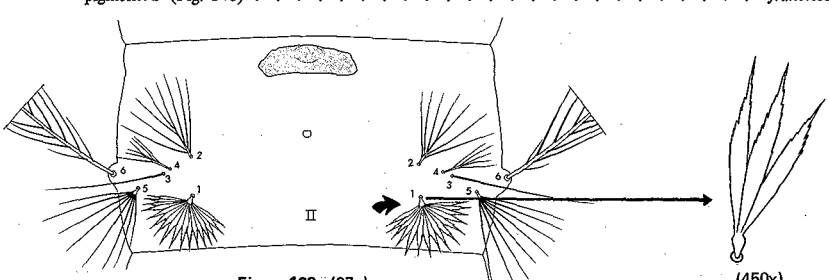


Figure 139. (97x)

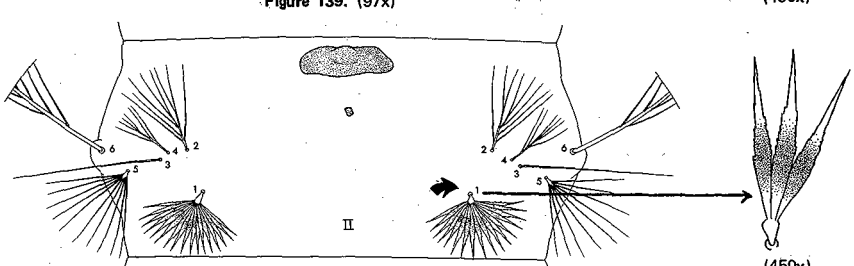


Figure 140. (130x)

17(1). Anterior tergal plates on abdominal segments large (Fig. 141) (*Myzomia* series; *minimus* species group) 18

Anterior tergal plates on abdominal segments small (Fig. 142) 20

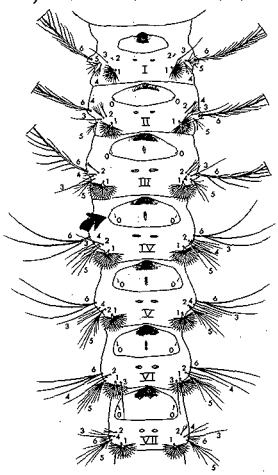


Figure 141. (45x)

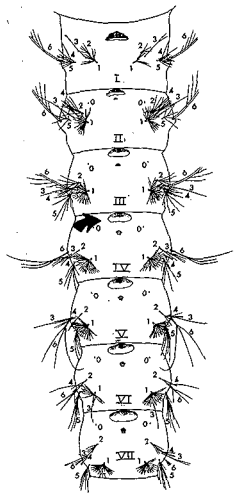


Figure 142. (39x)

18(17). Anterior tergal plate on abdominal segment II not indented, usually convex, posteriorly (Fig. 143). . . . . *filipinae*

Anterior tergal plate on abdominal segment II indented posteriorly (Fig. 144) 19

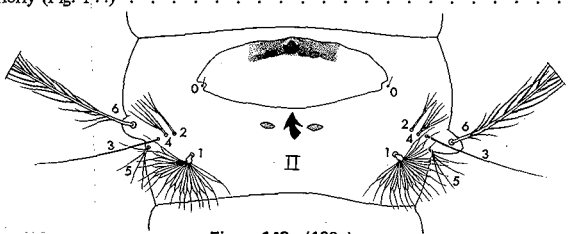


Figure 143. (120x)

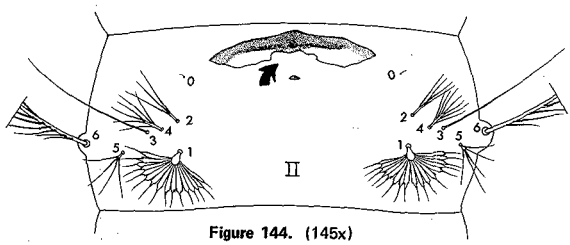


Figure 144. (145x)

19(18). Abdominal segment VII with antepalmate hairs (Hair 2) split near base into three or more branches, and with anterior tergal plate narrowing laterally (Fig. 145) . . . . . *minimus flavirostris*

Abdominal segment VII with antepalmate hairs single or forked at tip only, and with anterior tergal plate rectangular in shape, not narrowing laterally (Fig. 146) . . . . . *mangyanus*

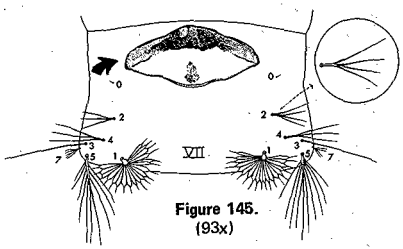


Figure 145. (93x)

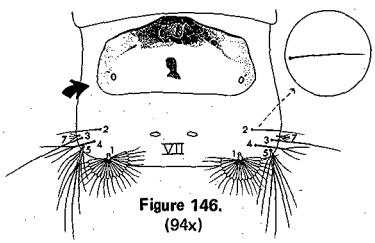


Figure 146. (94x)

20(17). Inner clypeal hairs either frayed or branched (Fig. 147) (*Neocellia* and *Neomyzomyia* series) 21

Inner clypeal hairs simple (Fig. 148) (*Pyretophorus* series) 31

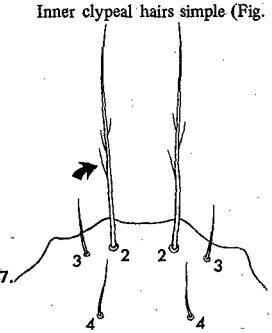


Figure 147. (230x)

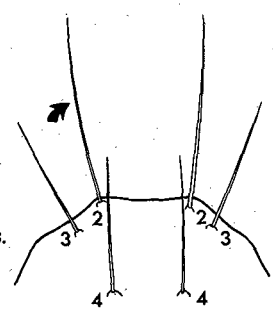


Figure 148. (170x)

21(20). Outer clypeal hairs with long branches (Fig. 149) (*annularis* species group) 22

Outer clypeal hairs simple, frayed or with a few short branches (Fig. 150A, B) 23

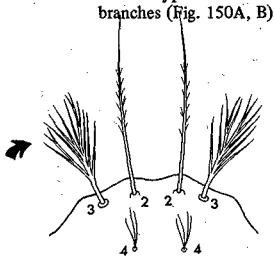
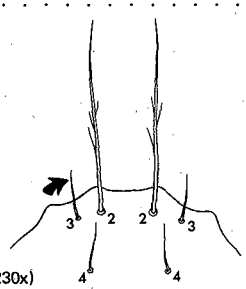
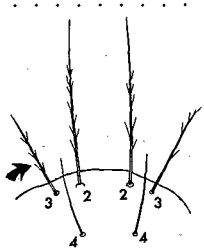


Figure 149. (160x)



A (230x)



B (210x)

Figure 150.

22(21). Tubercles of prothoracic hairs 1 and 2 fused and deeply pigmented (Fig. 151) . . . . . *annularis*

Tubercles of prothoracic hairs 1 and 2 separated and pale or transparent (Fig. 152) . . . . . *philippinensis*

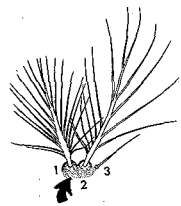


Figure 151. (135x)

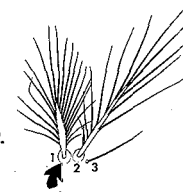


Figure 152. (175x)

23(21). Palmate hairs of abdominal segment II not fully developed, hair-like or at most with thin leaflets (Fig. 153) 24

Palmate hairs of abdominal segment II fully developed with clearly differentiated leaflets (Fig. 154) 27

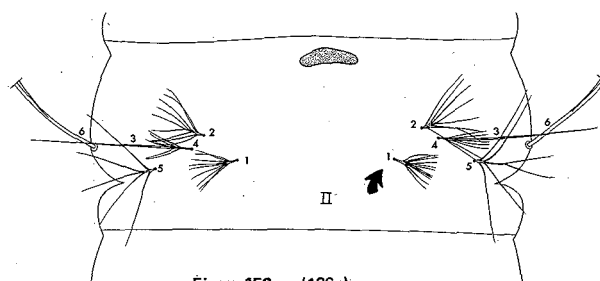


Figure 153. (126x)

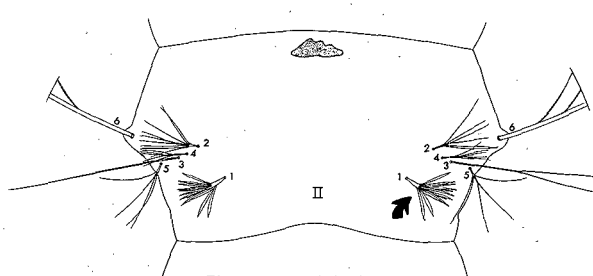


Figure 154. (120x)

24(23). Leaflets of palmate hairs on abdominal segments III-VII lanceolate; lateral hairs of abdominal segment III with fewer than 10 branches (Fig. 155) . . . . . *tessellatus*

Leaflets of palmate hairs on abdominal segments III-VII with distinct shoulders and filaments, lateral hairs of abdominal segment III with more than 10 branches (Fig. 156) 25

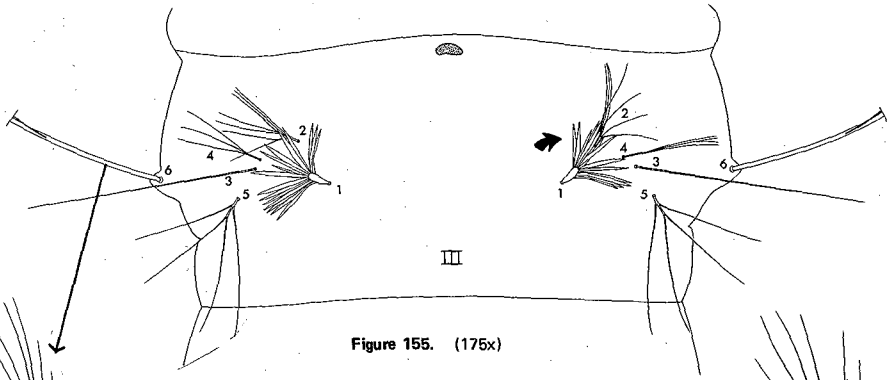


Figure 155. (175x)

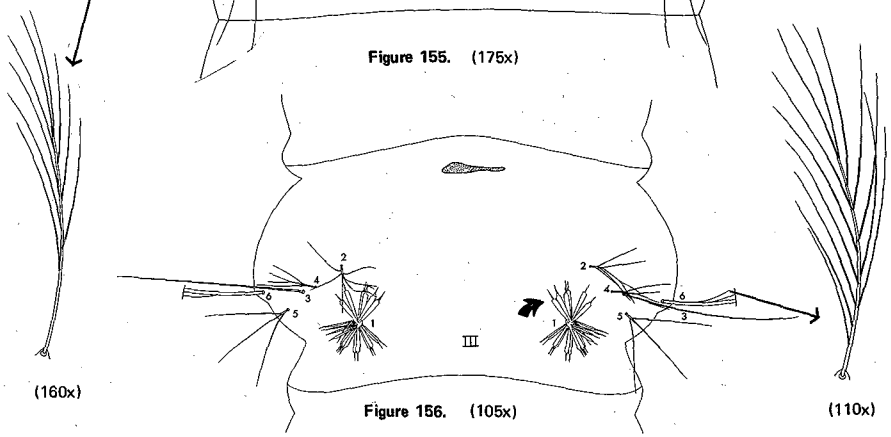


Figure 156. (105x)

25(24). Abdominal segment II with palmate hairs moderately developed, usually with thin lanceolate leaflets (Fig. 157) . . . . . *balabacensis balabacensis*

Abdominal segment II with palmate hairs weakly developed, branches hair-like or only slightly flattened (Fig. 158) 26

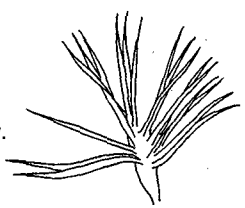


Figure 157. (520x)

Figure 158. (570x)

26(25). Hair 9 on abdominal segment I with not more than four branches on either side (Fig. 159) . . . . . *balabacensis baisasi*

Hair 9 on abdominal segment I with five or more branches on at least one side (Fig. 160) . . . . . *riparis riparis*

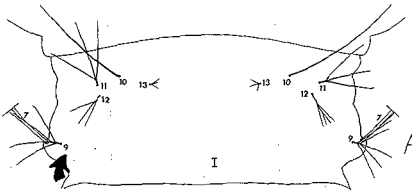


Figure 159. (85x)

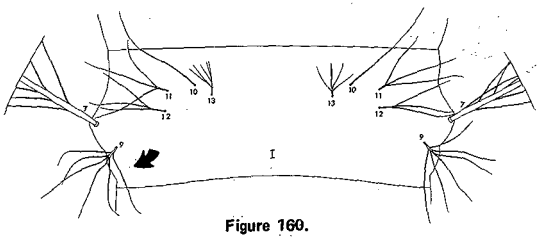


Figure 160.

27(23). Prothoracic hair 1 weak, with 10 or fewer branches (Fig. 161); palmate hairs on abdominal segments III-VII pale at tips (Fig. 162). . . . . *kochi*

Prothoracic hair 1 stout, with more than 12 branches (Fig. 163); palmate hairs on abdominal segments III-VII entirely pigmented (Fig. 164) 28

Figure 161. (160x)

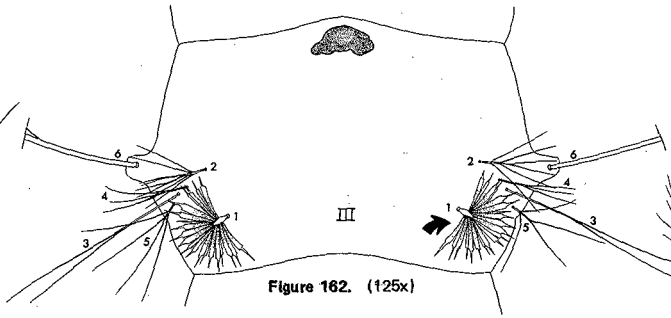


Figure 162. (125x)

Figure 163. (170x)

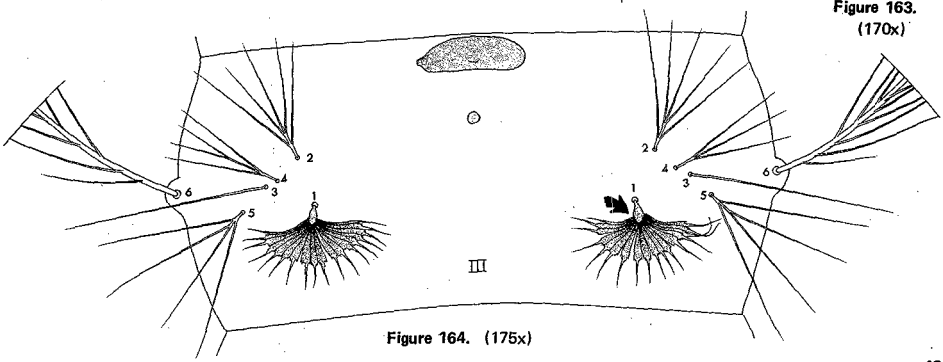


Figure 164. (175x)

28(27). Lateral hairs of abdominal segments IV-V less than half the length of lateral hairs of abdominal segment III, those on VI still shorter (Fig. 165) . . . . . *kolambuganensis*

Lateral hairs of abdominal segments IV-VI over half as long as those of abdominal segment III, often subequal (Fig. 166) 29

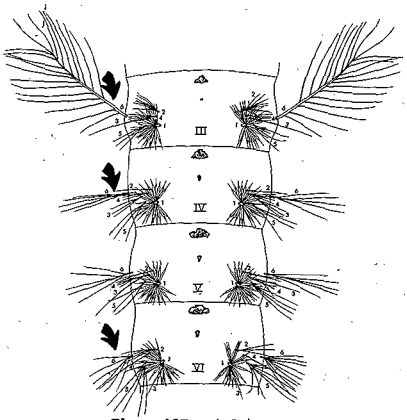


Figure 165. (48x)

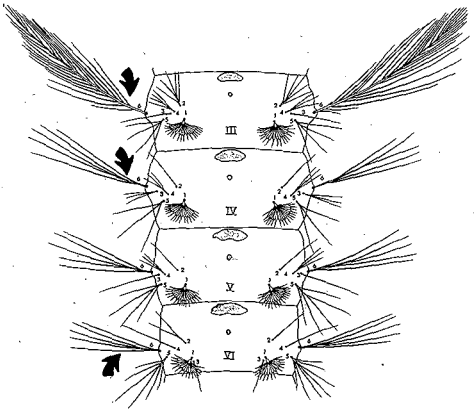


Figure 166. (58x)

29(28). Posterior clypeal hairs (Hair 4) with unusually long, lateral branches, similar to outer clypeal hairs (Fig. 167) . . . . . *cristatus*

Posterior clypeal hairs long or short, but without long lateral branches, usually single (Fig. 168) 30

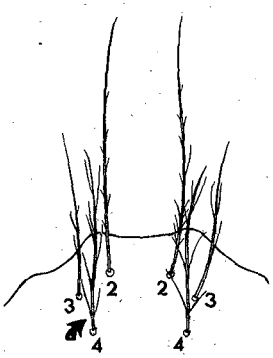


Figure 167. (180x)

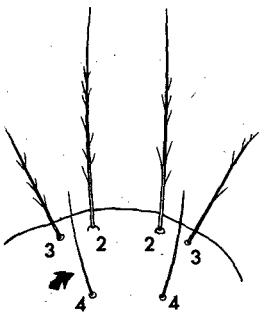


Figure 168. (210x)

30(29). Leaflets of abdominal palmate hairs short and blunt, without filaments (Fig. 169) . . . . . *karwari*

Leaflets of abdominal palmate hairs with long and pointed filaments (Fig. 170) . . . . . *maculatus*

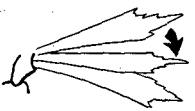


Figure 169. (620x)

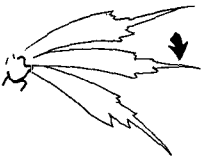


Figure 170. (540x)

31(20). Lateral hairs on abdominal segments IV-V with branches arising some distance from base along length of hair, commonly four- to five-branched (Fig. 171) . . . . . *ludlowae ludlowae*
ludlowae cabrerai

Lateral hairs on abdominal segments IV-V with branches all arising from near base, usually two- or three-branched (Fig. 172) 32

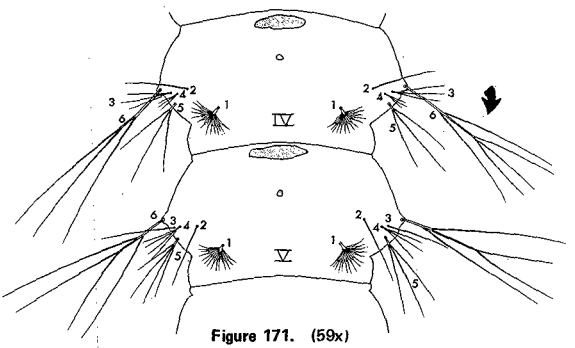


Figure 171. (59x)

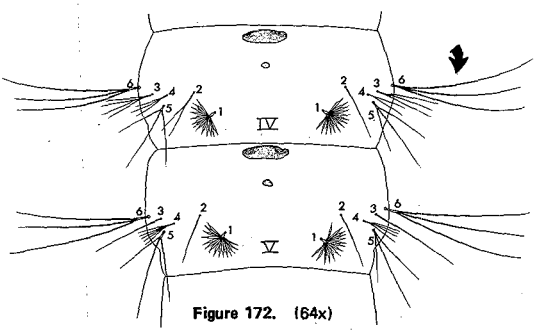


Figure 172. (64x)

32(31). Prothoracic hairs 2 and 1 each with eight or fewer branches (Fig. 173); comb teeth subequal in length (Fig. 174) . . . . . *litoralis*

Prothoracic hairs 2 and 1 each with nine or more branches (Fig. 175); comb with distinct long and short teeth (Fig. 176) 33

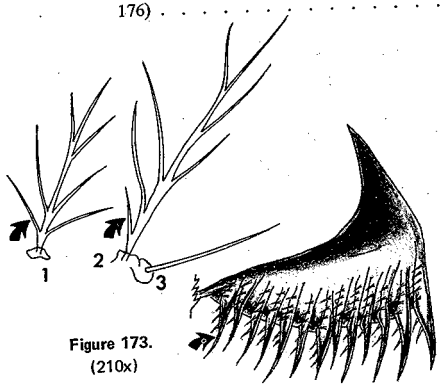


Figure 173. (210x)

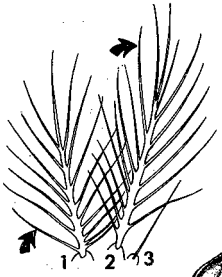


Figure 175. (280x)

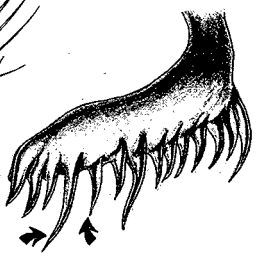


Figure 176. (330x)

Figure 174. (310x)

33(32). One of prothoracic (Hairs 9, 10, 12) and mesothoracic (Hairs 9, 10) pleural hairs feathered (Fig. 177A) . . . . . *parangensis*

Prothoracic and mesothoracic pleural hairs simple or not more than two- or three-branched (Fig. 177B) 34*

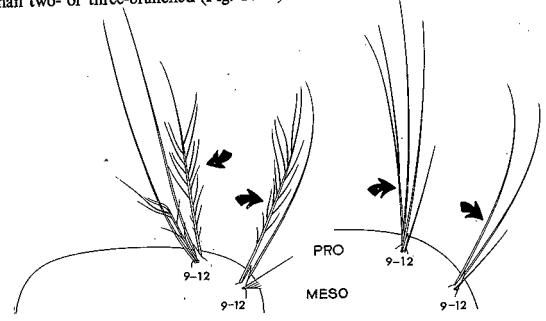


Figure 177. (67x)

*Since *A. sundaicus* Rodenwaldt may occur in the Philippines, its larvae will come out in this key to the second part of couplet 33. It may be distinguished from *vagus limosus* and *indefinitus* by mesothoracic hair 4, which in *sundaicus* has three branches from near base, and in the latter two, is double, or if three-branched, the third arises from halfway along the hair.

34(33). Outer and posterior clypeal hairs usually one-third or less as long as inner clypeal hairs (Fig. 178) 35

Outer and posterior clypeal hairs usually one-half or more as long as inner clypeal hairs (Fig. 179) 36

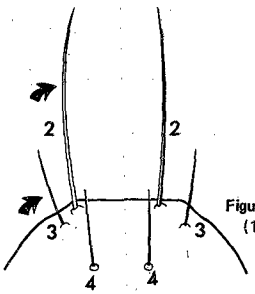


Figure 178. (160x)

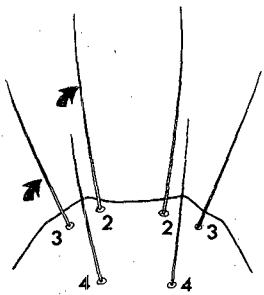


Figure 179. (185x)

35(34). Posterior clypeal hairs placed very near to, and closer together than, inner clypeal hairs (Fig. 180) . . . . . *vagus vagus*

Posterior clypeal hairs placed farther back on frontoclypeus and their bases the same distance from mid-dorsal line as inner clypeals, or only slightly closer together (Fig. 181) . . . . . *vagus limosus*

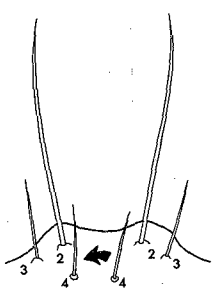


Figure 180. (150x)

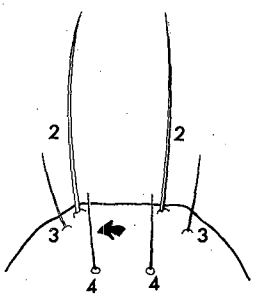


Figure 181. (160x)

36(34). Prothoracic hair 1 usually with 13 or more branches (Fig. 182) . . . . . *indefinitus*

Prothoracic hair 1 mostly with 12 or fewer branches (Fig. 183) . . . . . *subpictus*

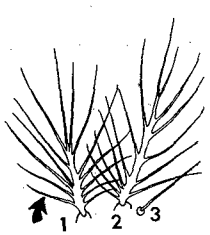


Figure 182. (220x)

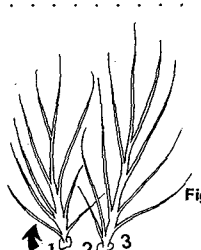


Figure 183. (230x)

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