

J. Natn. Sci. Coun. Sri Lanka 1995 23(4): 183-211

ILLUSTRATED KEYS TO THE GENERA OF MOSQUITOES (DIPTERA: CULICIDAE) IN SRI LANKA

F.P. AMERASINGHE

Department of Zoology, University of Peradeniya, Peradeniya.

(Received: 01 May 1995; accepted: 11 August 1995)

Abstract: Illustrated keys are provided for the identification of the adults, pupae and fourth stage larvae of 17 genera of mosquitoes (Diptera: Culicidae) occurring in Sri Lanka. The genera included are *Aedeomyia* Theobald, *Aedes* Meigen, *Anopheles* Meigen, *Armigeres* Theobald, *Coquillettidia* Dyar, *Culex* Linnaeus, *Ficalbia* Theobald, *Heizmannia* Ludlow, *Hodgesia* Theobald, *Malaya* Leicester, *Mansonia* Blanchard, *Mimomyia* Theobald, *Orthopodomyia* Theobald, *Topomyia* Leicester, *Toxorhynchites* Theobald, *Tripteroides* Giles, and *Uranotaenia* Lynch Arribalzaga. Genus *Topomyia* is listed for the first time from Sri Lanka, based on as-yet undescribed material deposited in the collections of the Natural History Museum, Washington DC., USA.

Key words: Adults, generic keys, larvae, mosquitoes, pupae, Sri Lanka.

INTRODUCTION

Mosquitoes are a group of nematoceros Diptera that are of medical or veterinary importance because many species are involved in the transmission of human and animal diseases. A total of 141 species belonging to 16 genera are currently listed from Sri Lanka.^{1,2} The majority of these species are harmless to humans and livestock, but several have been implicated in the transmission of diseases such as malaria, dengue, bancroftian and brugian filariasis, Japanese encephalitis, dirofilariasis, and setariasis in the country. In addition, some mosquito-transmitted arboviruses that are potentially encephalitogenic, and others of unknown aetiology occur on the island,³ and their local vectors are not known. The taxonomy of Sri Lankan mosquitoes is, therefore, a subject of some importance.

There have been a few attempts to develop keys and descriptions for the identification of Sri Lankan mosquitoes by workers such as Carter,^{4,5} Senior-White,⁶ and Carter & Wijesundara.⁷ All of these date to the first half of this century, and are of limited scope, dealing with one or more life stages of species in a limited number of genera. In the main, regional or other country keys such as those published by Edwards,⁸ Christophers,⁹ Barraud,¹⁰ Thurman¹¹ and Reid¹² have been used for the identification of local mosquitoes. More recently, a thorough revision of the Oriental and Southeast Asian fauna, contained in a large number of publications by specialists in different mosquito genera, was done as a result of the Southeast Asia Mosquito Project (SEAMP) and Medical Entomology Project (MEP) of the Smithsonian Institution during 1965-1985. These taxonomic works are not readily accessible to local workers. Moreover, being regional in scope, they often include species or groups of species not represented in the island, making them somewhat inconvenient to the average user who is not a specialist taxonomist, but desires to identify local genera or

species in the course of surveillance and control operations, or for research. There is thus a need for modern taxonomic keys to identify local mosquitoes to be made available to medical entomologists working in Sri Lanka.

As part of ongoing studies on the taxonomy of local mosquitoes, the present author has published keys for the identification of adult and larval anopheline mosquitoes,^{13,14} and keys to anopheline pupae.¹⁵ The scope of these studies has now been widened to include other genera that contain representatives of medical or veterinary importance and, eventually, to cover the entire known local fauna. Since at least 16 genera occur in the island (a species of an additional genus, *Topomyia*, occurs¹⁶ but has not yet been formally reported in the literature), it is thought desirable at this stage to publish keys for the identification of the major life stages (i.e., adults, pupae, fourth stage larvae) of these genera.

METHODS AND MATERIALS

The genera included in this work are *Aedeomyia* Theobald, *Aedes* Meigen, *Anopheles* Meigen, *Armigeres* Theobald, *Coquillettidia* Dyar, *Culex* Linnaeus, *Ficalbia* Theobald, *Heizmannia* Ludlow, *Hodgesia* Theobald, *Malaya* Leicester, *Mansonia* Blanchard, *Mimomyia* Theobald, *Orthopodomyia* Theobald, *Topomyia* Leicester, *Toxorhynchites* Theobald, *Tripteroides* Giles, and *Uranotaenia* Lynch Arribalzaga. The inclusion of *Topomyia* is based on the reported collection during the Smithsonian Institutions' Medical Entomology Project in 1975, of an as-yet undescribed species of the genus from the Kalatuwawa area.¹⁶ This material is deposited in the collections of the Natural History Museum, Washington DC., USA. It is thought desirable to include this in the key because local workers who may encounter species of the genus will otherwise have difficulty in generic-level identification.

Recently published keys to mosquito genera¹⁷⁻²⁰ were used as the basic literature sources to formulate the present key. Key characters and key steps were modified so as to be consistent with the characteristics of the local species representing the different genera. This was evaluated on the basis of both a survey of published taxonomic works relating to the local species, as well as by the direct examination of adult, pupal and larval material from reference material available at the Department of Zoology, University of Peradeniya. The illustrations were drawn by the author, and are semi-diagrammatic representations of characters used in the keys, to assist those unfamiliar with the morphology and chaetotaxy of mosquito adult and immature stages. They follow the standard conventions established for mosquito taxonomic publications.²¹

In several instances where only a single species of a genus is represented on the island, generic characters used in the keys are sufficient to identify the species. These cases are: *Aedeomyia* (only *Ad. catasticta* Knab), *Coquillettidia* (only *Cq. crassipes* [van der Wulp]), *Ficalbia* (only *Fi. minima* [Theobald]), and *Malaya* (only *ML. genurostris* Leicester).

Brief notes are provided at the end of each key where comment on the characters used is felt to be necessary. It needs to be emphasized that taxonomic keys are only a rapid and convenient guide to identification, based on the examination of a few important characters at each step. In cases of doubt, it will be necessary for workers to consult published literature with detailed descriptions of generic characters, or refer the specimens to a recognized taxonomist or Museum for confirmation of identification.

KEYS TO THE GENERA OF SRI LANKA MOSQUITOES

(A) KEY TO ADULTS

1. Proboscis long, recurved; posterior margin of wing emarginate just beyond tip of vein *CuA* (Fig 1a) *Toxorhynchites*
- Proboscis straight or only slightly curved; posterior margin of wing evenly rounded or only slightly emarginated (Fig. 1b) 2
- 2(1). Scutellum evenly rounded, with evenly distributed setae; female maxillary palp almost as long as proboscis (Fig. 2a), male palp long, apex expanded to form a club; abdominal segments with only occasional scales *Anopheles*
- Scutellum trilobed, with setae in 3 groups; female maxillary palp markedly shorter than proboscis (Fig. 2b), male palp variable in length, not clubbed at apex (except in some *Mimomyia*); abdominal segments densely covered by scales 3
- 3(2). Mid- and hindfemora with large sub-erect apical scale tufts; female antennal flagellomeres short and thick, basal flagellomere with prominent scale tuft; male antenna with the two terminal flagellomeres markedly thickened (Fig. 3a) *Aedeomyia catasticta*
- Femora and antenna otherwise (Fig 3b) 4
- 4(3). Fore- and midtarsomere 1 distinctly longer than other four tarsomeres combined, tarsomere 4 of fore- and midlegs short, about as long as wide; wing spotted, as in many species of *Anopheles* (Fig. 4a) *Orthopodomyia*
- Fore- and midtarsomere 1 shorter than other four tarsomeres combined, tarsomere 4 of fore- and midlegs much longer than wide; wing variable (Fig. 4b) 5
- 5(4). Prespiracular area with setae or covered with scales (Fig. 5a) 6
- Prespiracular area bare (Fig. 5b) 9

- 6(5). Scutum with conspicuous median longitudinal double line of broad scales, usually white or silver; other scutal scales narrow (Fig. 6a) 7
- Scutum without median longitudinal double line of broad pale or dark scales; broad or narrow pale scales may be present along scutal margin (fig. 6b) 8
- 7(6). Proboscis swollen apically, upturned and with long apical setae (Fig. 7a) *Malaya genurostris*
- Proboscis slender, if at all only with slightly swollen labellum at tip, not upturned or with long apical setae (Fig. 7b) *Topomyia*
- 8(6). Cell *R2* of wing always shorter than vein *R2+3*; vein *1A* reaching wing margin before, or at most very slightly beyond base of vein *mcu* (Fig 8a) *Uranotaenia*
- Cell *R2* at least as long as vein *R2+3*; vein *1A* reaching wing margin well beyond base of vein *mcu* (Fig. 8b) *Tripteroides*
- 9(5). Mesopostnotum with setae; scutum with broad metallic decumbent scales (Fig. 9a) *Heizmannia*
- Mesopostnotum without setae; scutum with narrow scales (Fig. 9b) 10
- 10(9). Outstanding scales on outer half of wing with emarginate tips; vein *1A* reaching wing margin before, or at most, very slightly beyond base of vein *mcu* (Fig. 10a) *Hodgesia*
- Outstanding scales on outer half of wing without emarginate tips; vein *1A* reaching wing margin well beyond base of vein *mcu* (Fig. 10b), except *Aedes* subgenus *Canraedes* 11
- 11(10). Postspiracular setae present (Fig. 11a) (note presence of alveoli if setae missing) 12
- Postspiracular setae absent (Fig. 11b) or obscured by heavy scalation 14
- 12(11). Dorsal surface of wing with broad, asymmetrical dark and pale scales intermixed (Fig. 12a) *Mansonia*
- Dorsal surface of wing with narrow scales, if broad, then not asymmetrical (Fig. 12b) 13

- 13(12). Proboscis rather stout, laterally compressed and curved downwards; occiput with broad decumbent scales (Fig. 13a) *Armigeres* subgenus *Armigeres*
- Proboscis more slender, not laterally compressed or notably curved; occiput with at least some decumbent scales narrow (except in subgenus *Stegomyia*) (Fig. 13b) (in part) *Aedes*
- 14(11). Alula bare or with broad flat decumbent scales (Fig. 14a) *Mimomyia*
- Alula fringed with narrow scales or moderately broad erect scales (Fig. 14b) 15
- 15(14). Postspiracular area covered with broad scales (Fig. 15a) 16
- Postspiracular area without scales (Fig. 15b) 17
- 16(15). Postspiracular area dark scaled dorsally and white scaled ventrally; female palpus 0.4 - 0.7 length of proboscis (Fig. 16a) *Armigeres* subgenus *Leicesteria*
- Postspiracular area with pale scales only; female palpus less than 0.4 length of proboscis (Fig. 16b) (in part) *Aedes*
- 17(15). Female antenna with flagellomere 1 approx. three times the length of flagellomere 2; male proboscis greatly swollen on distal third or more; palpus very short, seldom longer than clypeus (Fig. 17a) *Ficalbia minima*
- Female antenna with flagellomere 1 approx. equal length of flagellomere 2; male proboscis only slightly swollen apically; palpus longer than clypeus (Fig. 17b) 18
- 18(17). Pulvilli absent; tarsal claws prominent on all legs; abdominal terga with purple metallic scales; wing with yellow scales (Fig. 18a) *Coquillettidia crassipes*
- Pulvilli well developed at least on hindleg; tarsal claws usually small, inconspicuous; abdominal terga and wing scales otherwise (Fig. 18b) *Culex*

NOTE: Key step 11 - Postspiracular setae are present on all Sri Lankan *Aedes*, but may be obscured by scales that may also be present on this area (e.g., in some species of subgenus *Stegomyia*); thus characters for separating *Aedes* from both branches of this step are included in the key.

(B) KEY TO PUPAE

1. Seta 1-X present; seta 9-VIII reduced; paddle without apical seta (Fig. 19a) *Toxorhynchites*
- Seta 1-X absent; seta 9-VIII and paddle various (Fig. 19b) 2
- 2(1). Seta 9-IV-VII distinct stout spine arising at or near posterolateral angle of segment (Fig. 20a) 3
- Seta 9-IV-VII small, usually weak, if stout, then not arising at or near postero-lateral angle of segment (Fig. 20b) 4
- 3(2). Paddle smooth on both margins, deeply cleft at apex; seta 1-Pa at least half as long as paddle; seta 5-IV-VI with long aciculate median branch and short lateral branches (Fig. 21a) *Aedeomyia catasticta*
- Paddle with distinct fine fringe, spicules or teeth on at least lateral margin, not cleft at apex; seta 1-Pa various; seta 5-IV-VI single or branched, but without long aciculate median branch (Fig. 21b) *Anopheles*
- 4(2). Trumpets modified for insertion into aquatic plant tissue (Fig. 22a) 5
- Trumpets otherwise (Fig. 22b) 7
- 5(4). Seta 1-I single or bifid (Fig. 23a) 6
- Seta 1-I with more than 4 branches (Fig. 23b) (in part) *Mimomyia*
- 6(5). Some abdominal setae well developed; trumpet with strongly sclerotized spine-like process at apex (Fig. 24a) *Mansonia*
- All abdominal setae minute; trumpet with less strongly developed spine-like process at apex (Fig. 24b) *Coquillettidia crassipes*
- 7(4). Trumpet with long, narrow tragus from near base (Fig. 25a) *Hodgesia*
- Trumpet without tragus (Fig. 25b) 8

- 8(7). Setae 1,2-*Pa* absent; paddles small, usually with pointed apex
(Fig. 26a) 9
- At least Seta 1-*Pa* present; if absent, then paddles never
 small or with pointed apex (Fig. 26b) 11
- 9(8). Trumpet subcylindrical, inner and outer walls widely
 separated (Fig. 27a) 10
- Trumpet subconical, or with inner and outer walls closely
 apposed or both (Fig. 27b) *Tripteroides*
- 10(9). Seta 6-*VII* relatively well developed, arising cephalad of
 seta 9-*VII* (Fig. 28a) *Malaya genurostris*
- Seta 6-*VII* usually less well developed, arising close to and
 laterad of seta 9-*VII* (Fig. 28b) *Topomyia*
- 11(8). Paddle with inner half deeply excavated near base, usually
 much broader than outer half; seta 9-*IX* usually
 present (Fig. 29a) *Uranotaenia*
- Paddle otherwise; seta 9-*IX* absent (Fig. 29b) 12
- 12(11). Paddle margins with long delicate fringe
 (Fig. 30a) 13
- Paddle margins smooth, serrated, or with short spicules
 (Fig. 30b) 15
- 13(12). Seta 6-*VI* very strongly developed, longer and much stouter
 than 5-*VI* (Fig. 31a) *Armigeres*
- Seta 6-*VI* otherwise (Fig. 31b) 14
- 14(13). Seta 9-*VI* minute, smaller than other setae on segment
 (Fig. 32a) *Heizmannia*
- Seta 9-*VI* larger than or equal in size to at least some setae on
 segment (Fig. 32b) (in part) *Aedes*
- 15(12). Paddle margins strongly serrate (Fig. 33a) 16
- Paddle margins smooth or with short spicules (Fig. 33b) 17

- 16(15). Paddle serrate on outer margin only; trumpet less than 10 times as long as width (Fig. 34a) *Ficalbia minima*
- Paddle serrate on both margins; trumpet long, at least 10 times as long as width (Fig. 34b) (in part) *Mimomyia*
- 17(15). Trumpet with well developed sub-basal tracheation; seta 2-*Pa* present in addition to 1-*Pa*; paddle margin smooth (Fig. 35a) *Culex*
- Trumpet with rudimentary sub-basal tracheation; seta 2-*Pa* absent; paddle margin smooth or with short spicules (Fig. 35b) 18
- 18(17). Seta 8-*C* arising level with or slightly posterior to base of trumpet, nearly level with 9-*C*; seta 9-*VII-VIII* long, stout, plumose, 9-*VIII* half or more the length of the paddle; paddle more or less rectangular with thickened basal part on outer edge, paddle margin smooth; seta 1-*Pa* small (Fig. 36a) *Orthopodomyia*
- Seta 8-*C* arising anterior to or at most slightly posterior to base of trumpet, very much anterior to 9-*C*; seta 9-*VII-VIII*, or paddle shape, or paddle margin, or seta 1-*Pa* (or all these characters) otherwise (Fig. 36b) *Aedes*

NOTES: Key step 5 - *Mimomyia hybrida* will key out here; other species of the genus will key out to step 15.

Key step 14 - *Aedes* with long paddle fringe spicules (primarily subgenus *Stegomyia*, excepting *Ae. aegypti*) will key out here. Others will key out to step 18.

Key step 17 - Seta 2-*Pa* is present on all known Sri Lankan representatives of the subgenera *Culex*, *Culiciomyia*, *Lophoceraomyia*, and *Lutzia*. In subgenus *Eumelanomyia*, only the pupae of *Cx. brevipalpis* (seta 1-*Pa* absent, 2-*Pa* present), *Cx. malayi* and *Cx. pluvialis* (both seta 1,2-*Pa* present) are known; those of *Cx. castrensis* and *Cx. campilunati* are unknown. Thus for the present, the occurrence of seta 2-*Pa* can be considered diagnostic for Sri Lankan *Culex*.

Key steps 17 & 18 - Mattingly¹⁷ and Rattanarithikul¹⁸ use the relative positions of seta 8,9-*C* to separate genus *Culex* (8-*C* arising nearly level with 9-*C*) from *Aedes* (8-*C* distinctly anterior to 9-*C*). However, this is not a good character since the latter condition (8-*C* markedly anterior to 9-*C*) is seen in many Sri Lanka species of *Culex*, for example, in the subgenera *Culex* and *Lophoceraomyia*. The above two authors also separate *Culex* and *Aedes* on the basis of seta 9-*VII* being

located cephalad of the posterolateral corner of segment VII in *Culex*, and at the posterolateral corner in *Aedes*. This too, does not hold true for many Sri Lankan *Aedes*, especially species of the subgenus *Aedimorphus*.

Key step 18 - Genus *Orthopodomyia* is defined on the basis of a combination of 4 characters, which serve to separate it from *Aedes*, since no single character is diagnostic. Resemblances in characters between *Orthopodomyia* and the eleven subgenera of Sri Lankan *Aedes* can be resolved as follows: (1) Subgenus *Verrallina* has seta 9-VII-VIII weak and 1-6 branched (these seta large, multi-branched and plumose in *Orthopodomyia*); (2) Subgenus *Aedimorphus* has seta 9-VII-VIII moderately large and 2-14 branched, but seta 9-VIII is less than half the length of the paddle (equal to or greater than this length in *Orthopodomyia*); (3) Subgenus *Stegomyia* in Sri Lanka has the paddle with distinct, often very long, fringe spicules and seta 1-Pa long and single or multibranched (smooth paddle margins and very short, single seta 1-Pa in *Orthopodomyia*); (4) Subgenus *Canraedes* (*Ae. simplex* Theobald only) has fringe spicules on both paddle margins and a long seta 1-Pa (smooth paddle margins and very short seta 1-Pa in *Orthopodomyia*); (5) Subgenus *Neomelanoconion* (*Ae. lineatopennis* [Ludlow] only) has seta 9-VII-VIII multibranched but extremely small, and the paddle with small marginal spicules (large, multibranched, plumose seta 9-VII-VIII and smooth paddle margin in *Orthopodomyia*); (6) Subgenus *Diceromyia* has setae 9-VII single, 9-VIII 2-3 branched, and 1-Pa long (seta 9-VII-VIII multibranched and plumose, seta 1-Pa very short in *Orthopodomyia*); (7) Subgenus *Christophersomyia* has seta 1-Pa extremely long (very short in *Orthopodomyia*); (8) Subgenus *Rhinoskusea* has seta 9-VII multibranched but small, and seta 1-Pa long and 3-6 branched (seta 9-VII multibranched but large, seta 1-Pa single, very short in *Orthopodomyia*); (9) Subgenus *Paraedes* has setae 9-VII long and 1-3 branched, 9-VIII long and single, and 1-Pa long (setae 9-VII-VIII large and multibranched, 1-Pa very short in *Orthopodomyia*); (10) Subgenus *Mucidus* has seta 9-VII-VIII multibranched and small, with 9-VIII less than half the length of the paddle, and seta 1-Pa short but generally 2-branched (seta 9-VII-VIII multibranched and large, 9-VIII equal to or greater than half the length of the paddle, and 1-Pa short but single in *Orthopodomyia*); (11) Subgenus *Finlaya* of *Aedes* in the Oriental region has not been revised in its entirety to-date and as such, generalizations regarding pupal characters have to be regarded as provisional. However, species of the subgenus have the origin of seta 8-C distinctly anterior to 9-C unlike *Orthopodomyia* where the two setae are nearly level. Also, *Finlaya* in general possess a rounded paddle with a long seta 1-Pa compared to the angular shape with a very short seta 1-Pa that is characteristic of *Orthopodomyia*.

(C) KEY TO LARVAE

1. Siphon absent; seta 1 palmate on most abdominal terga
(Fig. 37a).....*Anopheles*
- Siphon present; seta 1 not palmate on abdominal terga
(Fig. 37b) 2
- 2(1). Siphon short, attenuated, with saw-toothed process near apex.
adapted for piercing plant tissue (Fig. 38a) 3
- Siphon cylindrical in shape, if attenuated apically then without
saw-toothed process (Fig. 38b) 4
- 3(2). Antenna with part distal to setae 2,3-A as long as or longer
than proximal part; saddle with at most 2 weak setae
ventrally (Fig. 39a)*Coquillettidia crassipes*
- Antenna with part distal to setae 2,3-A less than 0.5 as long as
proximal part; saddle with 3-4 robust setae ventrally
(Fig. 39b)*Mansonia*
- 4(2). Ventral brush (4-X) with 1-2 pairs of setae (Fig. 40a)..... 5
- Ventral brush (4-X) with 4 or more pairs of fan-like setae
(Fig. 40b) 7
- 5(4). Seta 5 or 6-P usually single, not stellate; 6-M or 7-T usually
stout spine; comb scales usually in single row
(Fig. 41a)*Tripteroides*
- Setae 5 and 6-P large, stellate; 6-M and 7-T never stout or
spine-like; comb scales usually in 2 or more rows (Fig. 41b) 6
- 6(5). Abdominal segments IV-VI with stellate setae or maxillary
palpus well developed or siphon index at least 6.0
(Fig. 42a)*Topomyia*
- Abdominal segments IV-VI without stellate setae; maxillary
palpus undeveloped; siphon index at most 4.0
(Fig. 42b)*Malaya genurostris*
- 7(4). Antenna enlarged, markedly curved and flattened; siphon with
paired hooks and branched setae at tip
(Fig. 43a)*Aedeomyia catasticta*
- Antenna and siphon otherwise (Fig. 43b) 8

- 8(7). Siphon with 3 or more pairs of setae *I-S*
(Fig. 44a) *Culex*
- Siphon with 1 pair of setae *I-S* (Fig. 44b) 9
- 9(8). Siphon without pecten (Fig. 45a) 10
- Siphon with pecten (Fig. 45b) 13
- 10(9). Lateral palatal brush with 6-10 curved, stout rods; comb scales
absent (Fig. 46a) *Toxorhynchites*
- Lateral palatal brush with numerous fine, simple or pectinate
filaments; comb scales present (Fig. 46b) 11
- 11(10). Distal part of antenna with joint, apical part freely
movable; setae *2,3-A* attached at joint
(Fig. 47a) *Mimomyia* subgenus *Etorleptomyia*
- Distal part of antenna without joint; setae *2,3-A* attached
apically or sub-apically (Fig. 47b) 12
- 12(11). Abdominal segment VIII with a dorsal sclerotized plate,
sometimes also present on segment VII; seta *I-A* large,
with 4 or more branches (Fig. 48a) *Orthopodomyia*
- Abdominal segments VII and VIII without sclerotized plates;
seta *I-A* minute, usually single or bifid (Fig. 48b) *Armigeres*
- 13(9). Seta *I-S* attached near siphon base (Fig. 49a) 14
- Seta *I-S* attached beyond basal 0.33 of siphon
(Fig. 49b) 15
- 14(13). Seta *I-C* simple; pecten with at least 3 teeth, usually more
(Fig. 50a) *Hodgesia*
- Seta *I-C* strongly barbed; pecten with at most 2 teeth
(Fig. 50b) *Ficalbia minima*
- 15(13). Distal part of antenna with joint, apical part freely movable;
setae *2,3-A* attached at joint
(Fig. 47a) *Mimomyia* subgenus *Mimomyia*
- Distal part of antenna without joint; setae *2,3-A* attached
apically or sub-apically (Fig. 47b) 16

- 16(15). Venter of head with hypostomal suture absent or incomplete, not reaching the posterior tentorial pit; comb scales usually attached to comb plate; seta 5 and/or 6-C often spine-like; (Fig. 51a) *Uranotaenia*
- Venter of head with well developed hypostomal suture extending from level of mentum to posterior tentorial pit; comb scales not borne on comb plate; setae 5, 6-C not spine-like; (Fig. 51b)..... 17
- 17(16). Seta 4-C large, multibranched, subequal in size to 7-C; 6-C with two unequal branches (Fig. 52a), rarely single *Heizmannia*
- Seta 4-C small, variously branched, less than 0.5 length of 7-C; if 4-C longer, 6-C never with two unequal branches or head sub-quadrangle (*Mucidus*) or seta 4-C closer to 6-C than to 5-C (*Stegomyia*) (Fig. 52b) *Aedes*

NOTE: Key step 16 - The absence or only partial development of a hypostomal suture is absolutely diagnostic for genus *Uranotaenia*, and separates it from all other genera.¹⁷

Figures 1-52 are semi-diagrammatic representations of key characters. Abbreviations used in the illustrations are as follows:

A	= antenna	P	= prothorax
Alu	= alula	PA	= postspiracular area
1-A	= anal vein	Pa	= paddle
C	= cranium	Pb	= proboscis
CP	= comb plate	PT	= pecten teeth
CS	= comb scale	PTP	= posterior tentorial pit
CT	= cephalothorax	Pv	= pulvillus
CuA	= cubitus anterior vein	S	= siphon
Em	= empodium	Sa	= saddle
Fe	= femur	Scu	= scutum
Flm	= flagellomere	Stm	= scutellum
HyS	= hypostomal suture	T	= metathorax
M	= mesothorax	Ta	= tarsal segment
MP	= metanotal plate	Tg	= tragus
Mpn	= mesopostnotum	TP	= tergal plate
Mx	= maxilla	Tr	= trumpet
Mxp	= maxillary palpus	U	= unguis
mcu	= mediocubital crossvein	X	= tenth abdominal segment

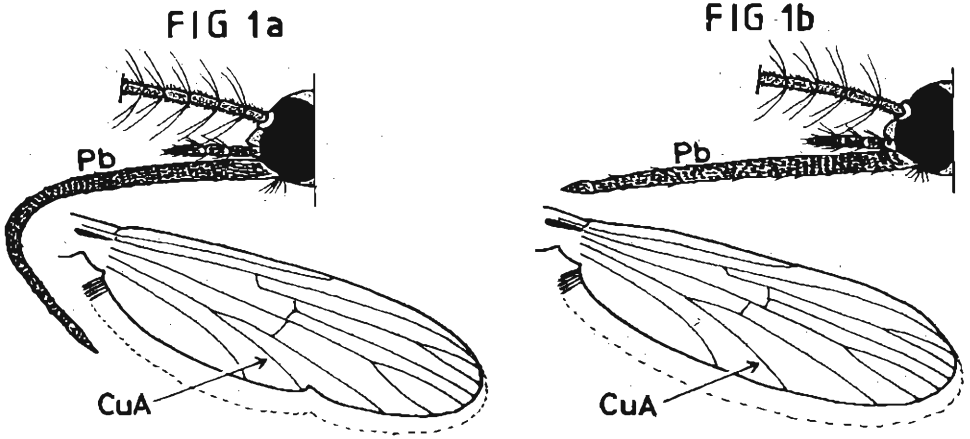


Figure 1a,b: Lateral views of proboscis shape, and dorsal views of posterior margin of wing showing presence or absence of indentation near terminus of vein CuA.

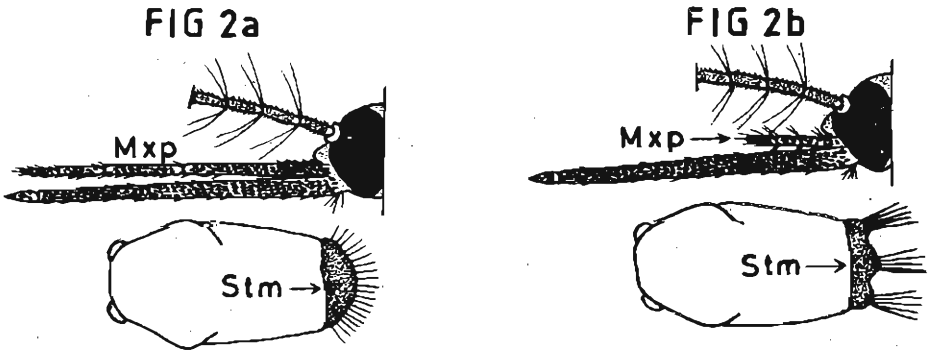


Figure 2a,b: Lateral views of relative lengths of maxillary palpi, and dorsal views of scutellum shape and setal distribution.

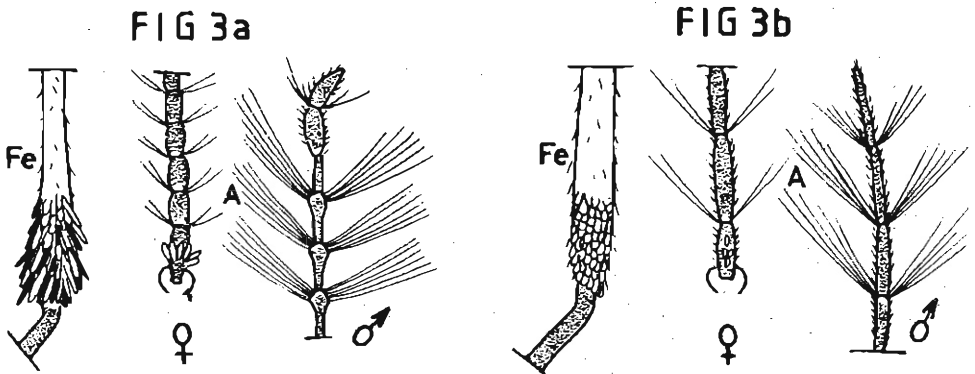


Figure 3a,b: Lateral views of scalation near tibiofemoral joint of hindfemur, and dorsal views of shape and scalation of male and female antennal flagellomeres.

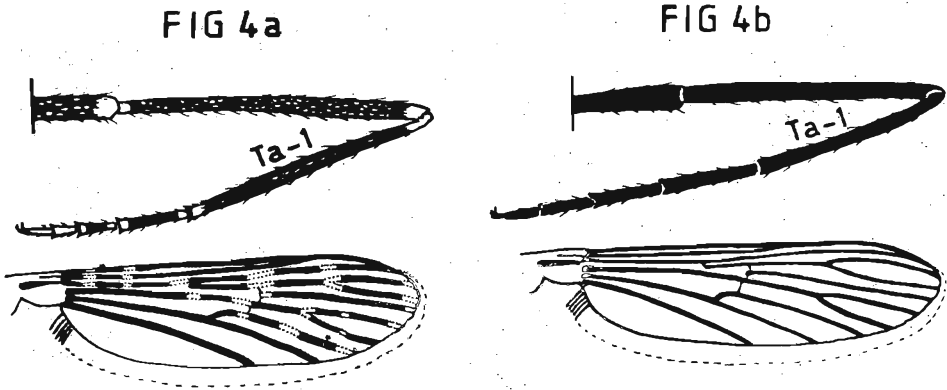


Figure 4a,b: Lateral views of midleg showing length of tarsomere-1 relative to tarsomeres 2-5, and dorsal views of wing with or without pale markings on veins.

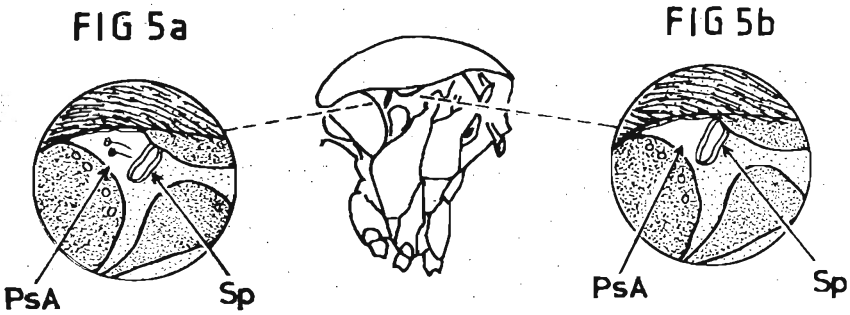


Figure 5a,b: Lateral views of thorax showing presence or absence of setae on prespiracular area.

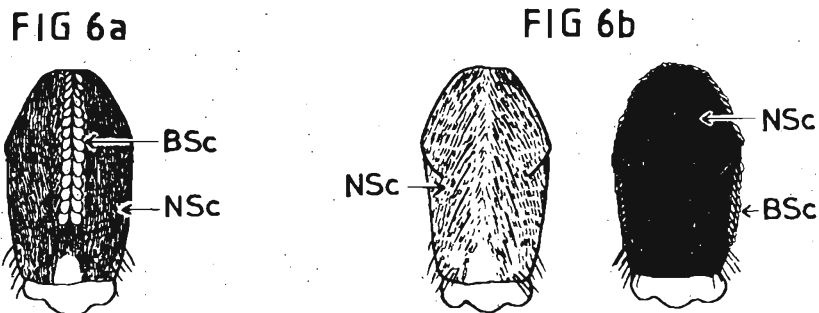


Figure 6a,b: Dorsal views of scutum showing different patterns of broad and narrow scalation.

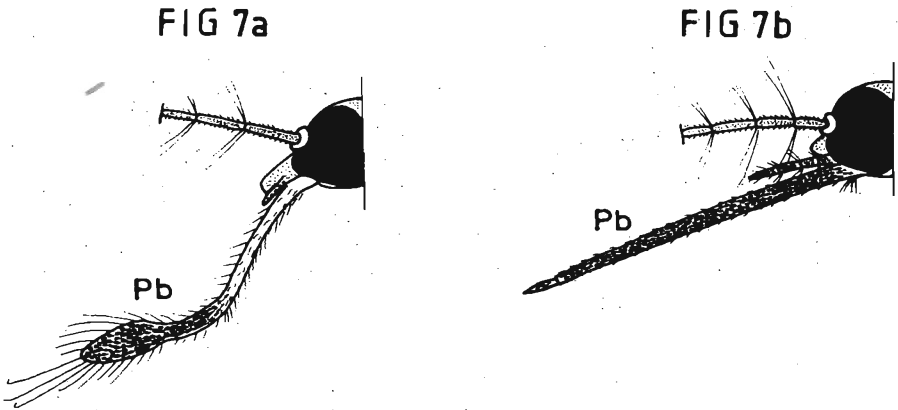


Figure 7a,b: Lateral views of densely setose, terminally swollen proboscis and normal proboscis.

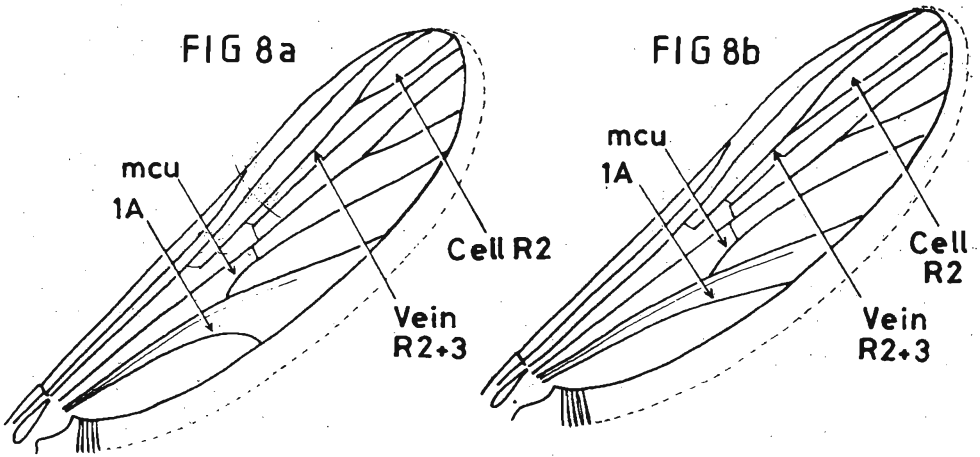


Figure 8a,b: Dorsal views of wing showing terminus of vein 1-A in relation to mcu.

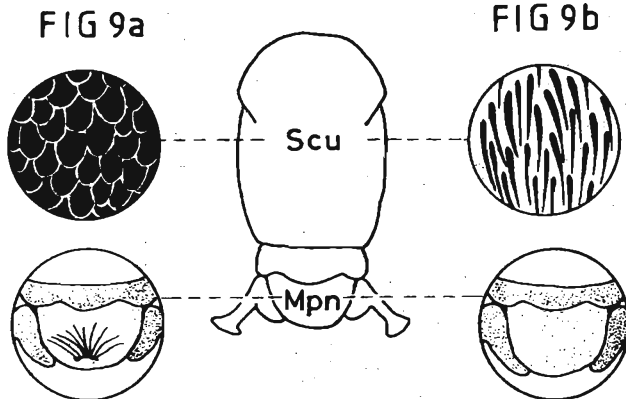


Figure 9a,b: Dorsal views of thorax showing sculation of scutum and presence or absence of setae on mesopostnotum.

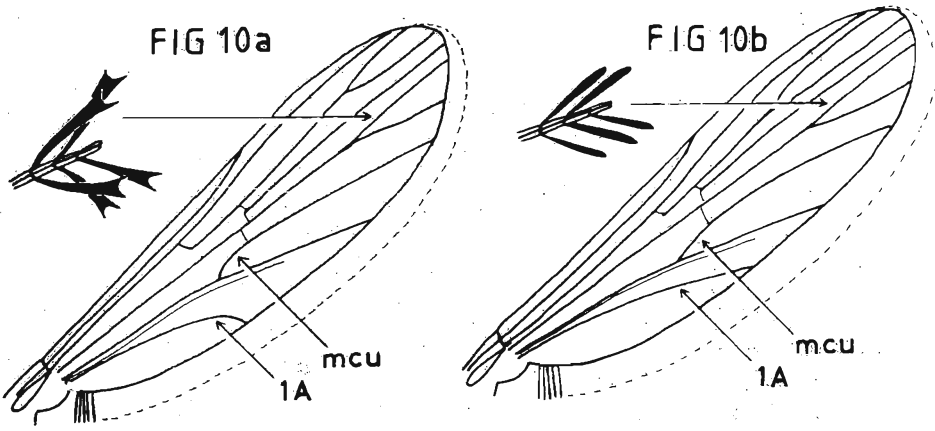


Figure 10a,b: Dorsal views of wing showing nature of outstanding scales and terminus of vein 1-A in relation to mcu.

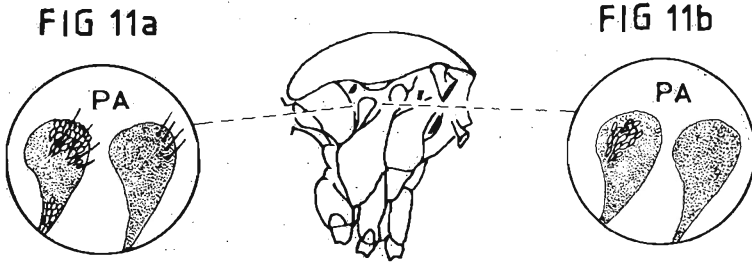


Figure 11a,b: Lateral views of thorax showing presence or absence of setae on postspiracular area.

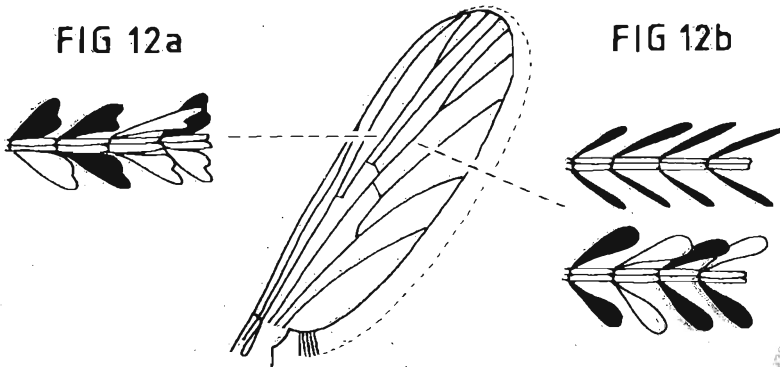


Figure 12a,b: Dorsal views of wing showing symmetry of broad and narrow scales.

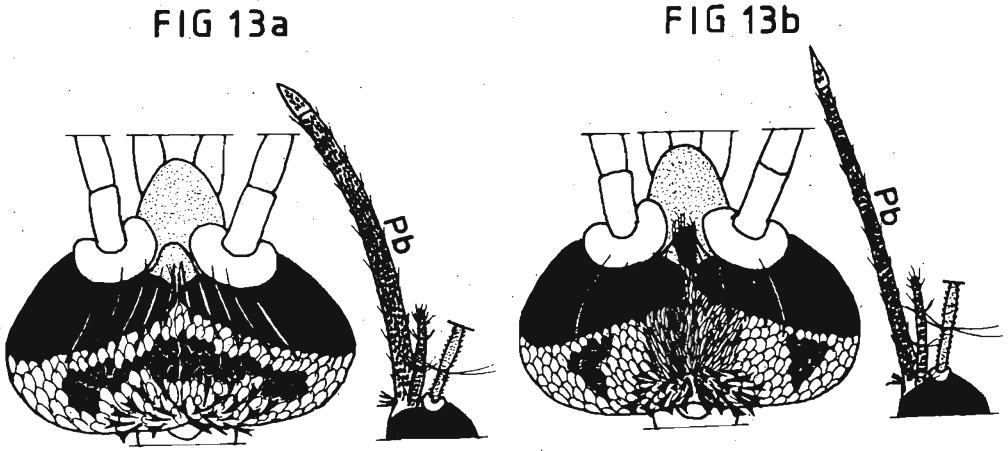


Figure 13a,b: Dorsal and lateral views of head showing decumbent scales on occiput, curvature of proboscis, respectively.

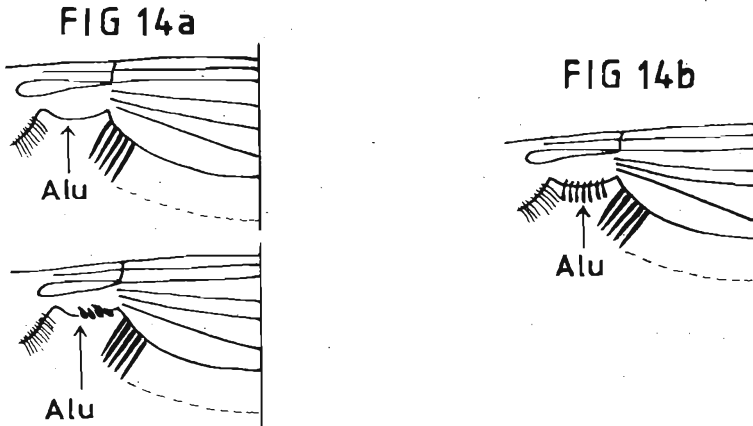


Figure 14a,b: Dorsal views of wing showing sculation on alula.

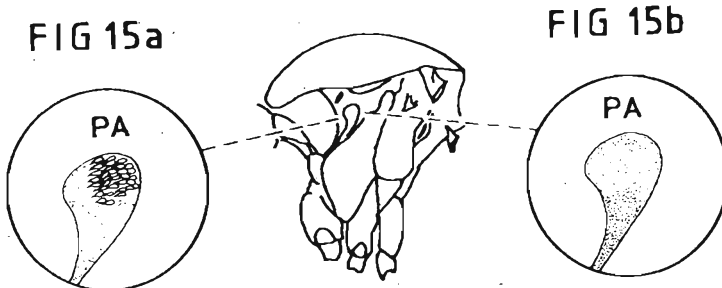


Figure 15a,b: Lateral views of thorax showing presence or absence of scales on postspiracular area.

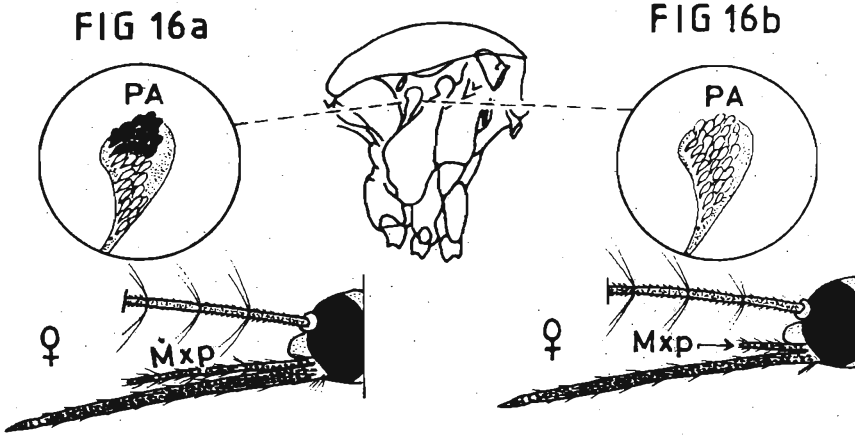


Figure 16a,b: Lateral views of thorax showing scalation of postspiracular area, and of head showing nature of maxillary palpus.

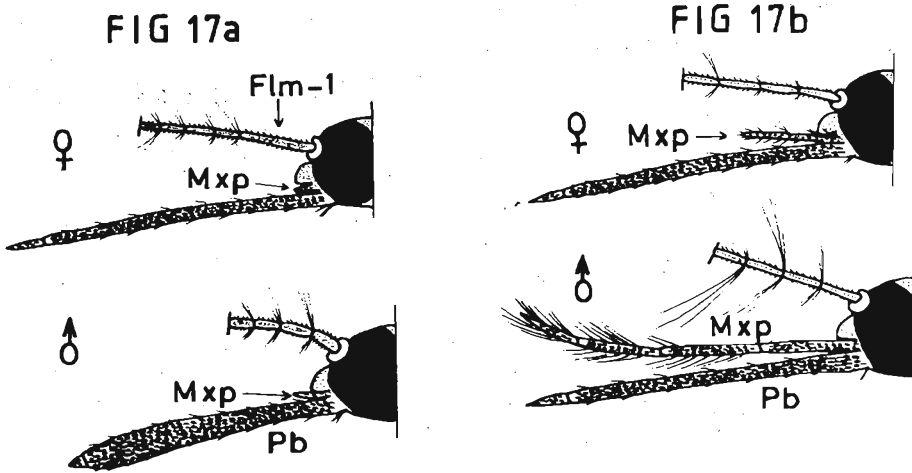


Figure 17a,b: Lateral views of head showing nature of male and female maxillary palpus.

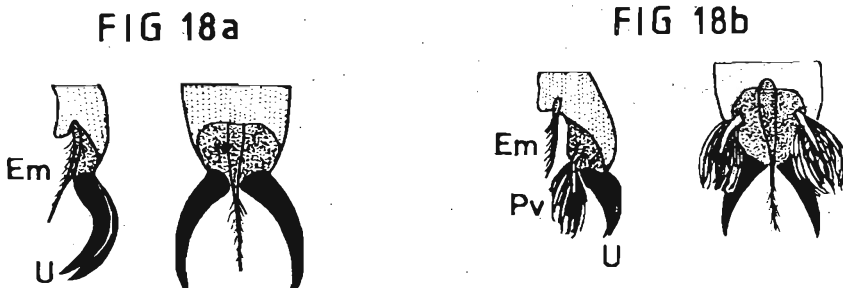


Figure 18a,b: Lateral and ventral views of hindleg showing empodium and pulvillus.

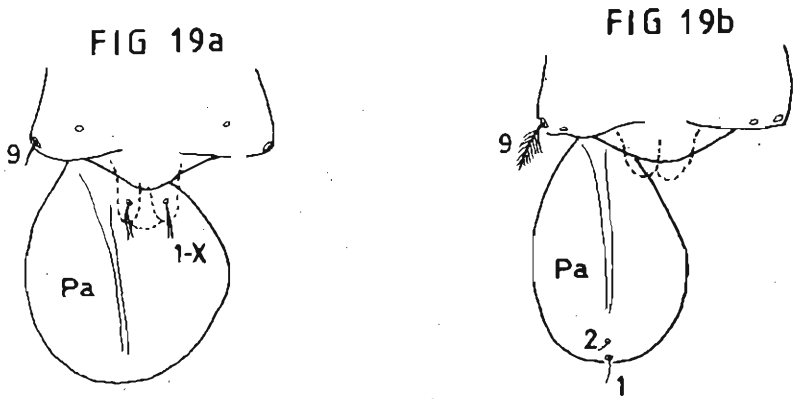


Figure 19a,b: Dorsal views of posterior end of pupal abdomen, showing presence or absence of seta 1-X.

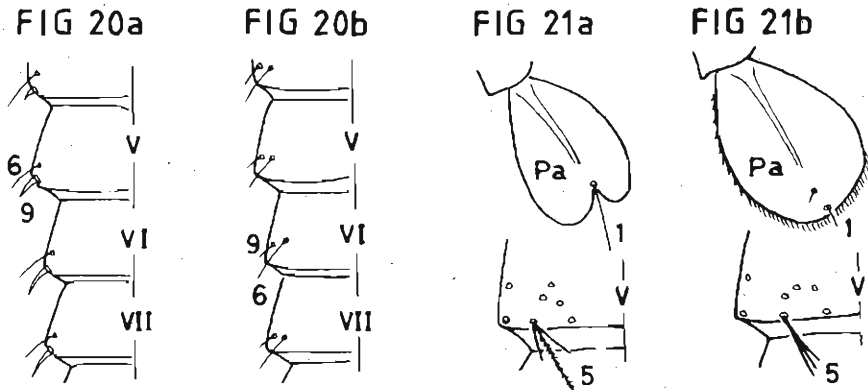


Figure 20a,b: Dorsal views of abdominal setae 9-IV-VII.

Figure 21a,b: Dorsal views of paddle showing nature of margin and seta 1-Pa, and of abdominal segment V showing nature of seta 5-V.

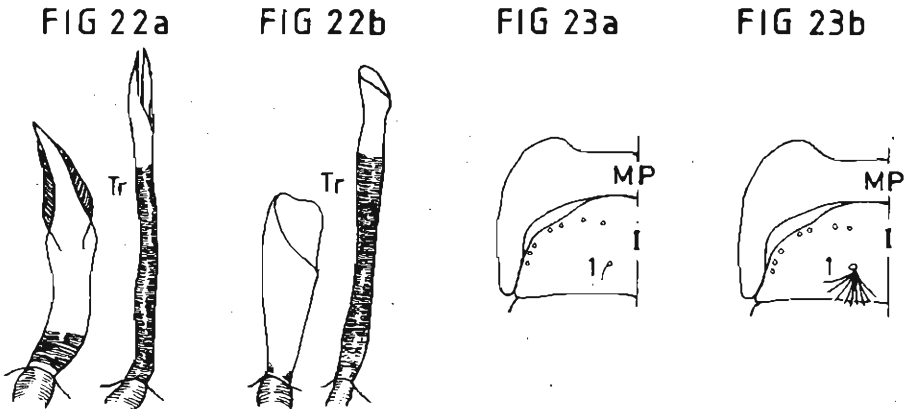


Figure 22a,b: Lateral views of root-piercing and non-piercing trumpets.

Figure 23a,b: Dorsal views of abdominal seta 1-I.

FIG 24a

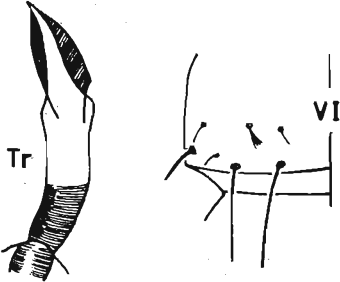


FIG 24b

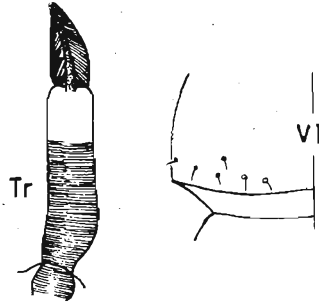


Figure 24a,b: Lateral views of root-piercing trumpets, and dorsal views of setal development on abdominal segment VI.

FIG 25a

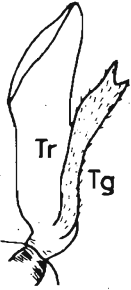


FIG 25b



FIG 26a



FIG 26b

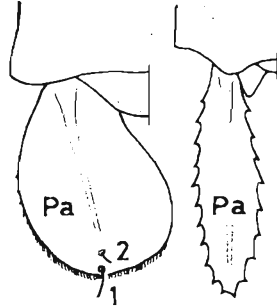


Figure 25a,b: Lateral views of trumpet with and without tragus. Figure 26a,b: Dorsal views of spiculation on paddle margin.

FIG 27a

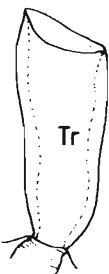


FIG 27b

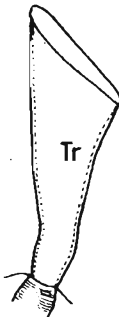


FIG 28a

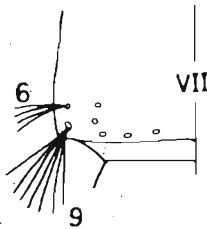


FIG 28b

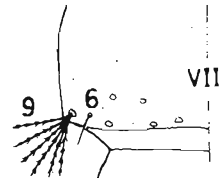


Figure 27a,b: Lateral views of trumpet showing separation of inner and outer walls.

Figure 28a,b: Dorsal views of relative positions and development of abdominal setae 6,9-VII.

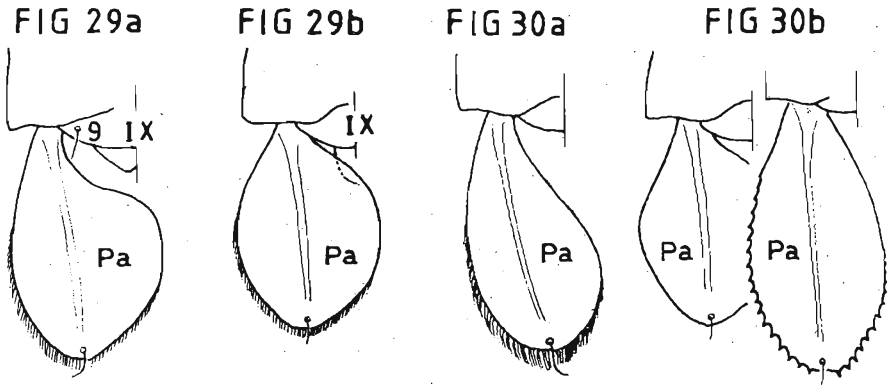


Figure 29a,b: Dorsal views of posterior end showing presence or absence of seta 9-IX, and shape of inner margin of paddle.

Figure 30a,b: Dorsal views of paddle showing spiculation of margin.

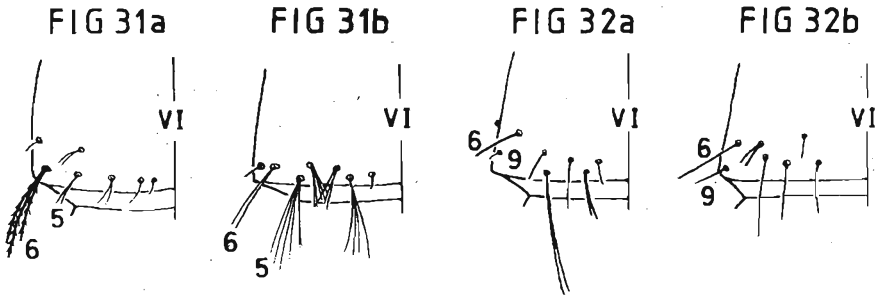


Figure 31a,b: Dorsal views of relative development of abdominal setae 5,6-VI.

Figure 32a,b: Dorsal views of abdominal seta 9-VI in relation to size of other setae on segment 6.

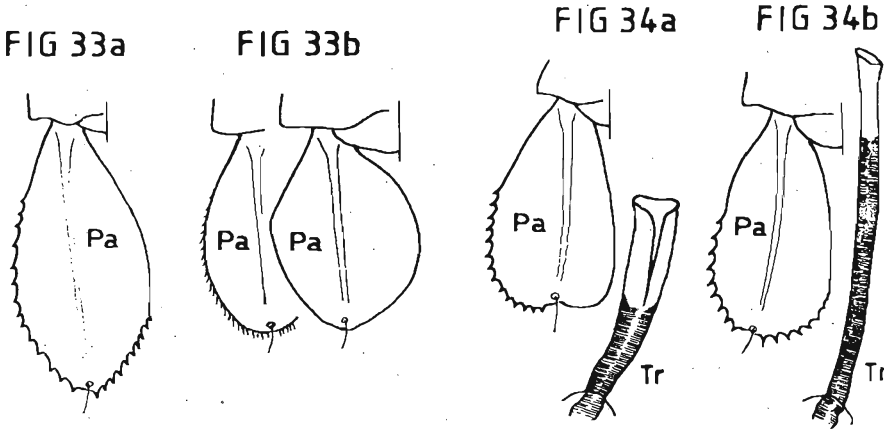


Figure 33a,b: Dorsal views of paddle showing spiculation of margin.

Figure 34a,b: Dorsal views of paddle showing spiculation of margin, and lateral views of trumpet showing relative length.

FIG 35a

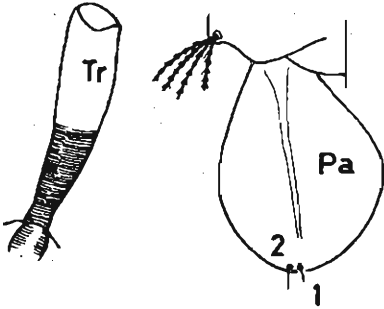


FIG 35b

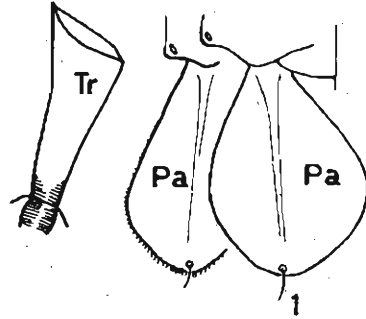


Figure 35a,b: Lateral views of subbasal tracheation on trumpet and dorsal views of paddle showing setae 1,2-Pa.

FIG 36a

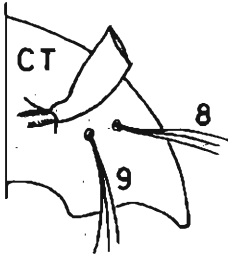


FIG 36b

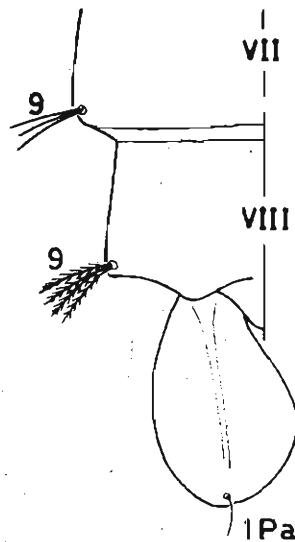
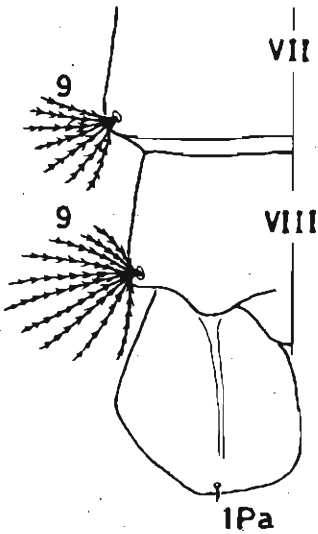
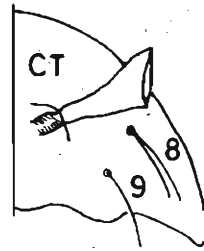


Figure 36a,b: Dorsal views of cephalothorax showing relative positions of setae 8,9-CT and dorsal views of abdominal setae 9-VII-VIII and paddle.

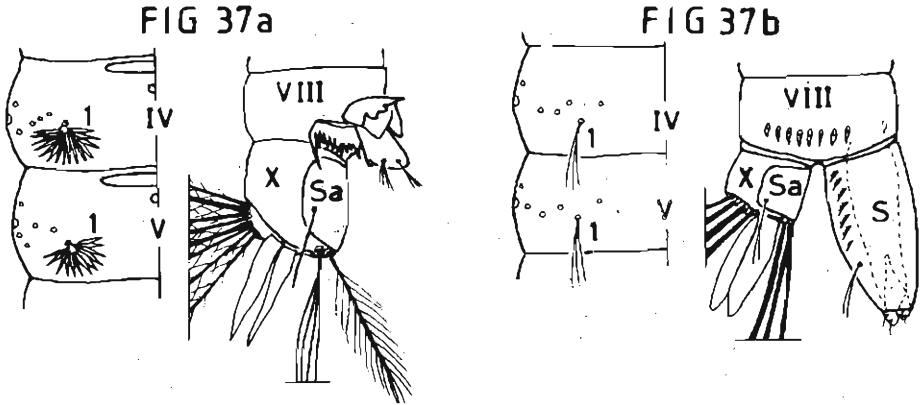


Figure 37a,b: Dorsal views of abdominal setae 1-IV-V and lateral views of posterior abdomen showing presence or absence of siphon.

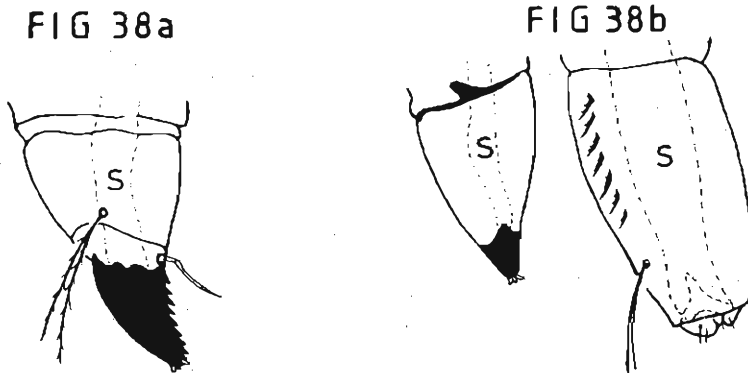


Figure 38a,b: Lateral views of saw-toothed and non-toothed siphons.

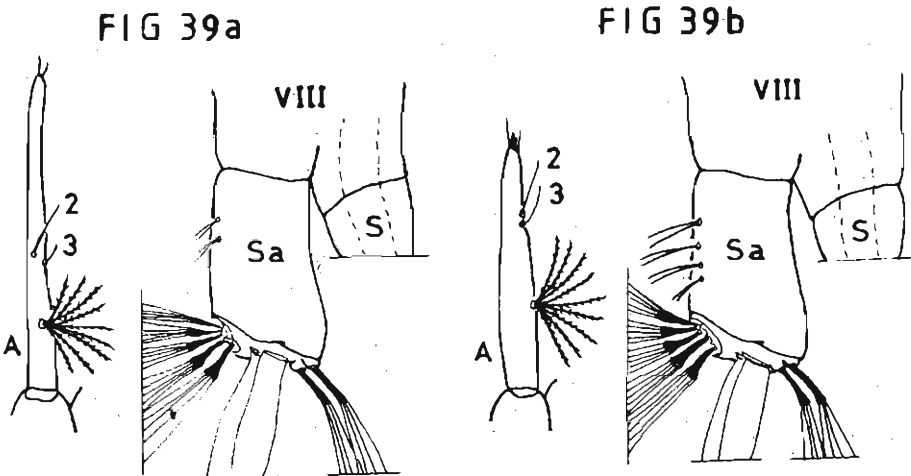


Figure 39a,b: Dorsal views of antenna showing positions of setae 2,3-A and lateral views of saddle setae.

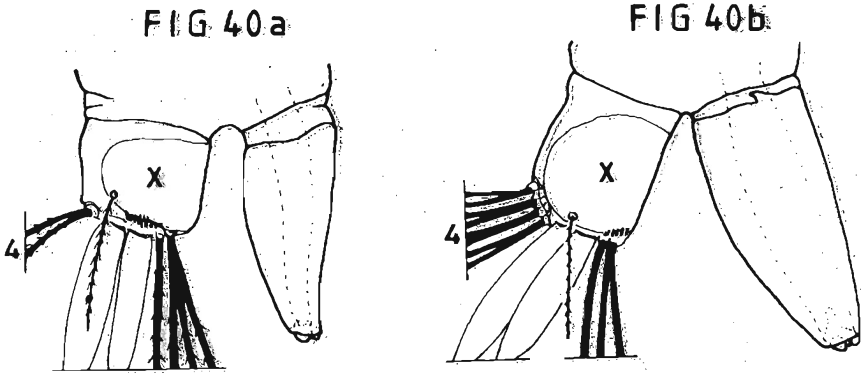


Figure 40a,b: Lateral views of ventral brush setae 4-X.

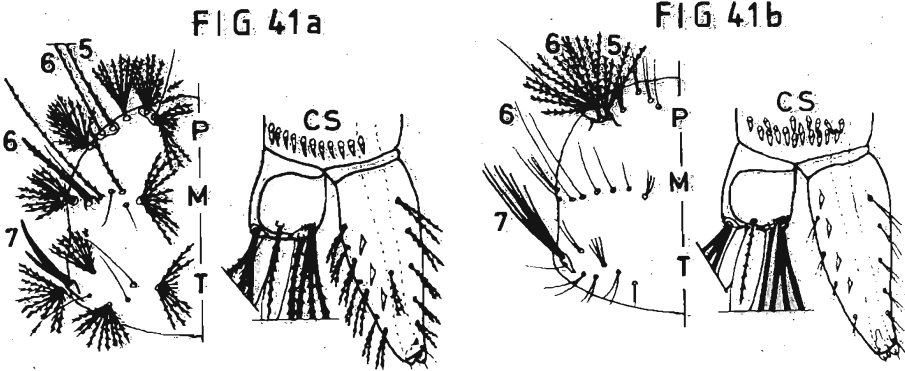


Figure 41a,b: Dorsal views of thoracic setae 5, 6-P, 6-M and 7-T and lateral views of comb scale arrangement.

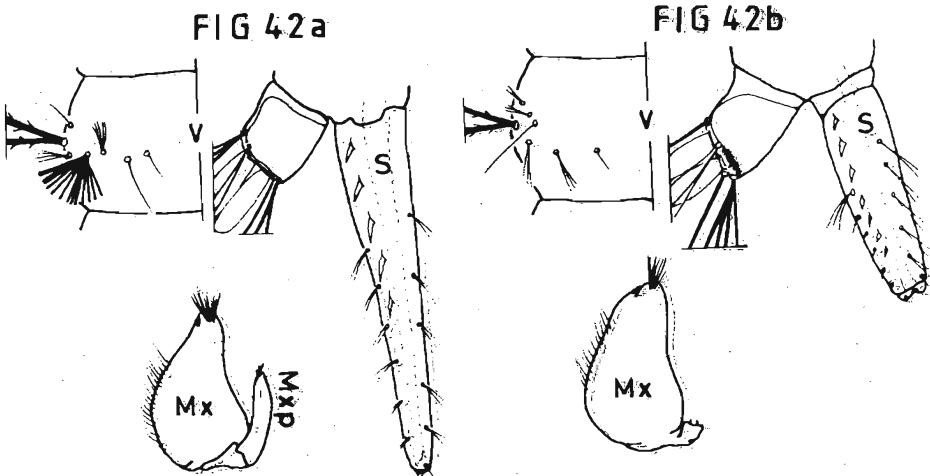


Figure 42a,b: Dorsal views of setae on abdominal segment V, lateral views of siphon, and ventral views of maxilla showing presence or absence of palpus.

FIG 43a

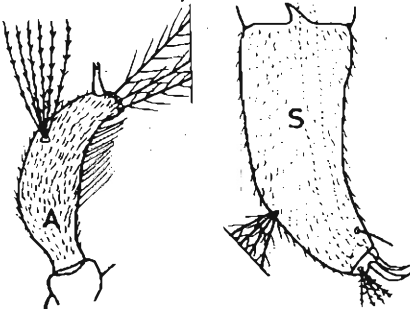


FIG 43b

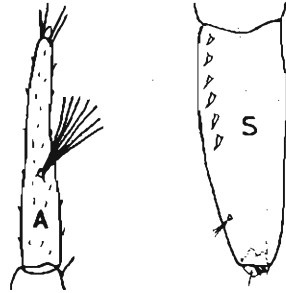


Figure 43a,b: Dorsal views of antenna and lateral views of siphon showing presence or absence of terminal paired hooks.

FIG 44a

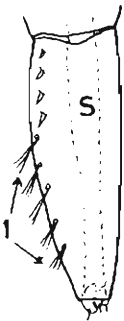


FIG 44b

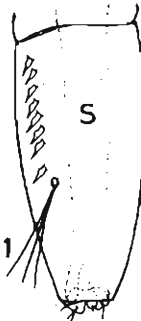


Figure 44a,b: Lateral views of the number of seta I-S on siphon.

FIG 45a

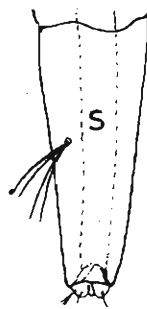


FIG 45b

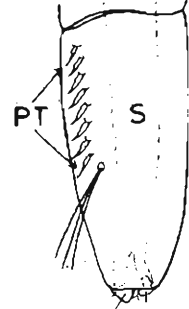


Figure 45a,b: Lateral views of siphon showing presence or absence of pecten.

FIG 46a

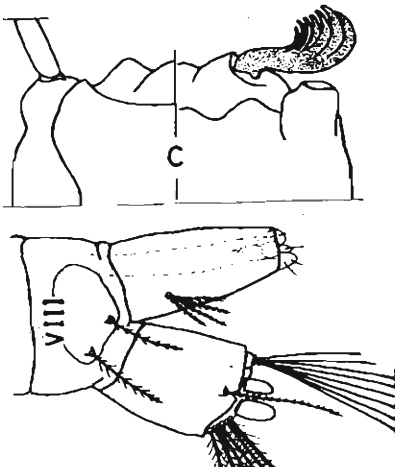


FIG 46b

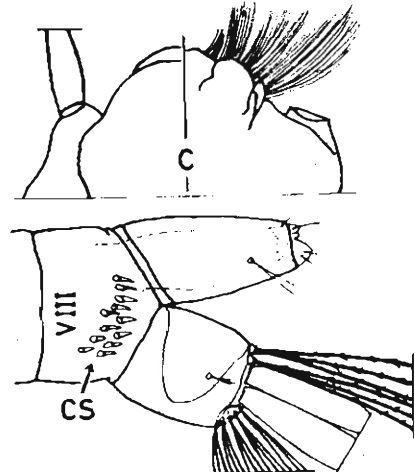


Figure 46a,b: Ventral views of palatal brush, and lateral views of abdominal segment VIII showing presence or absence of comb scales.

FIG 47a

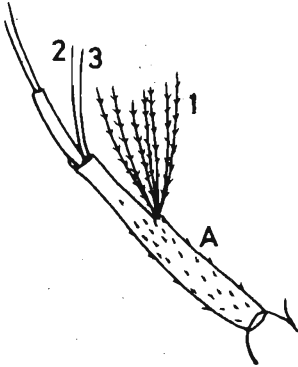


FIG 47b

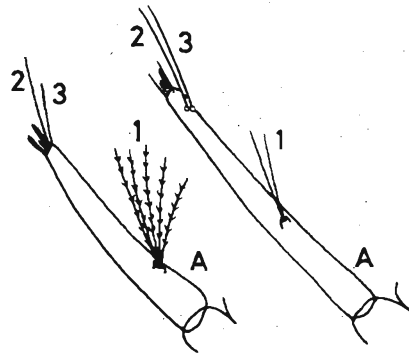


Figure 47a,b: Dorsal views of antenna showing presence or absence of joint, and points of attachment of setae 2,3-A.

FIG 48a

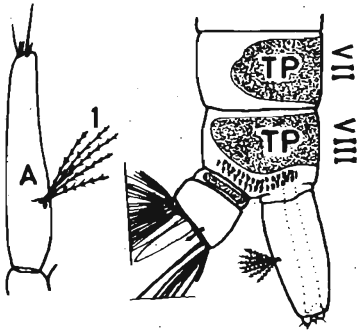


FIG 48b

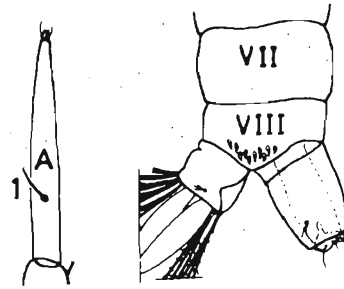


Figure 48a,b: Dorsal views of antennal seta 1-A, and lateral views of abdominal segments VII and VIII showing presence or absence of tergal plates.

FIG 49a

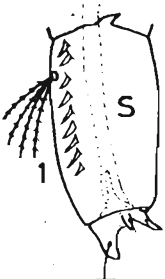


FIG 49b

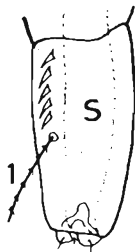


FIG 50a

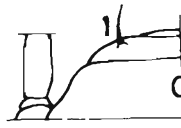


FIG 50b

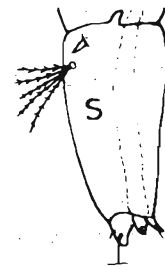
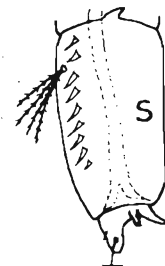
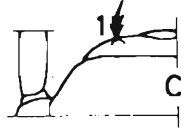


Figure 49a,b: Lateral views of siphon showing different points of attachment of seta 1-S.

Figure 50a,b: Dorsal views of head showing nature of seta 1-C, and lateral views of pecten teeth on siphon.

FIG 51a

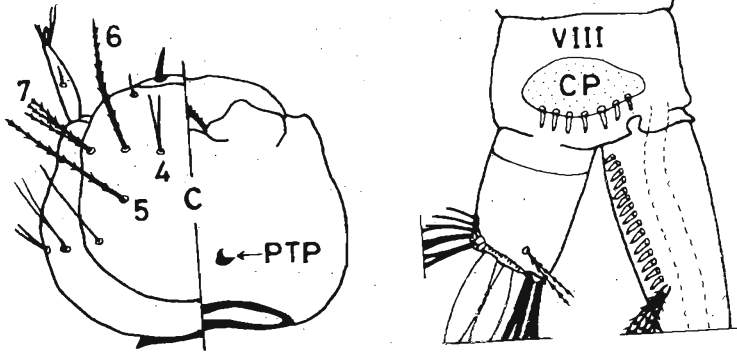


FIG 51b

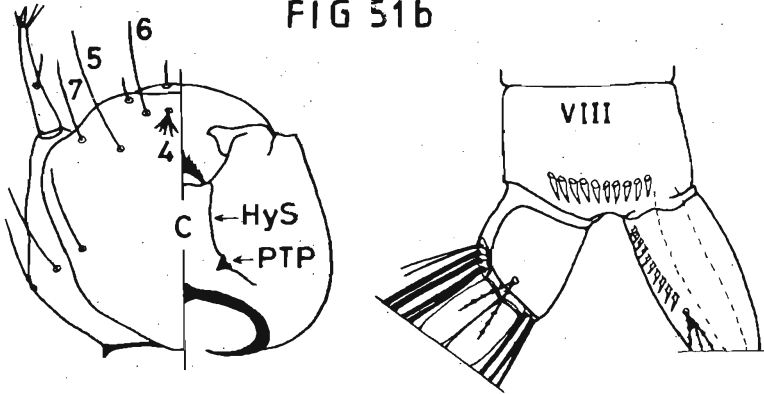


Figure 51a,b: Dorsal/ventral halves of head showing nature of seta 5,6-C and presence or absence of hypostomal suture respectively, and lateral views of abdominal segment VIII showing presence or absence of comb plate.

FIG 52a

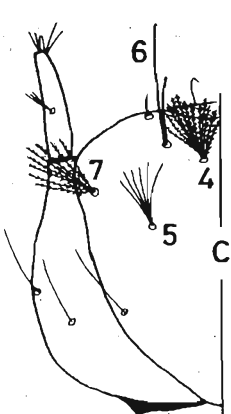


FIG 52b

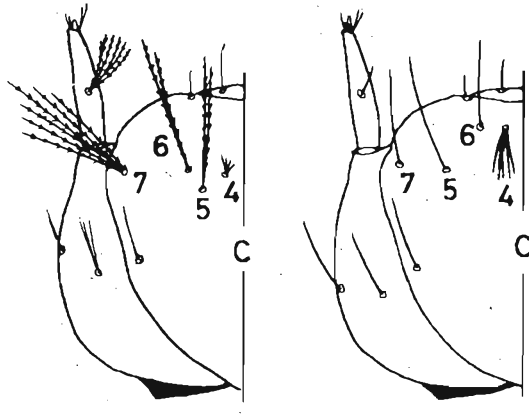


Figure 52a,b: Dorsal views of head showing nature and position of seta 4-C relative to 6,7-C.

Acknowledgement

I thank Dr. W.A. Samarawickrema for reviewing the draft manuscript, and for his encouragement of this work.

References

1. Amerasinghe F.P. (1991). *A catalogue of the mosquitoes (Diptera : Culicidae) of Sri Lanka*. Natural Resources Energy and Science Authority of Sri Lanka, Colombo. 23 pp.
2. Amerasinghe F.P. (1993). A new species of *Heizmannid* from Sri Lanka. *Mosquito Systematics* 25: 110-115.
3. Peiris J.S.M., Amerasinghe P.H., Amerasinghe F.P., Calisher C.H., Perera L.P., Arunagiri C.K., Munasingha N.B. & Karunaratne S.H.P.P. (1994). Viruses isolated from mosquitoes collected in Sri Lanka. *American Journal of Tropical Medicine & Hygiene* 51(2): 154-161.
4. Carter H.F. (1924). The anopheline mosquitoes of Ceylon. 1. The differential characters of the adults and larvae. *Ceylon Journal of Science (D)* 1: 57-95.
5. Carter H.F. (1950). The genus *Taeniorhynchus* Lynch Arribalzaga (Diptera: Culicidae) with special reference to species occurring in Ceylon. *Ceylon Journal of Science (B)* 24: 1-26.
6. Senior-White R. (1927). Notes on Ceylon mosquitoes. II. The larvae of the commoner non-anopheline mosquitoes. *Spolia Zeylanica* 14: 61-76.
7. Carter H.F. & Wijesundara D.P. (1948). Notes on some Ceylon culicine mosquitoes. *Ceylon Journal of Science (B)* 23: 135-151.
8. Edwards F.V. (1922). A synopsis of adult oriental culicine (including megarhinine and sabethine) mosquitoes. Part 1. *Indian Journal of Medical Research* 10: 249-293.
9. Christophers S.R. (1933). *The Fauna of British India, including Ceylon and Burma. Diptera Vol. IV. Family Culicidae. Tribe Anophelini*. Taylor & Francis, London. pp. 371.
10. Barraud P.J. (1934). *The Fauna of British India, including Ceylon and Burma. Diptera Vol. V. Family Culicidae. Tribes Megarhinini and Culicini*. Taylor & Francis, London. 463 pp.
11. Thurman E.H.B. (1959). A contribution to a revision of the Culicidae of northern Thailand. *Bulletin A-100, University of Maryland Agricultural Experimental Station*. 186 pp.

12. Reid J.A. (1968). Anopheline mosquitoes of Malaya and Borneo. *Studies from the Institute for Medical Research Malaysia. Government of Malaysia.* No.31. 903 pp.
13. Amerasinghe F.P. (1990). A guide to the identification of the anopheline mosquitoes (Diptera : Culicidae) of Sri Lanka. I. Adult females. *Ceylon Journal of Science (Biological Science)* **21**: 1-16.
14. Amerasinghe F.P. (1992). A guide to the identification of the anopheline mosquitoes (Diptera : Culicidae) of Sri Lanka. II. Larvae. *Ceylon Journal of Science (Biological Science)* **22**: 1-13.
15. Amerasinghe F.P. A guide to the identification of the anopheline mosquitoes (Diptera : Culicidae) of Sri Lanka. III. Pupae. *Journal of the National Science Council of Sri Lanka* **23**(3): 115-129.
16. Jayasekera N. & Chelliah R.V. (1981). An annotated checklist of mosquitoes of Sri Lanka. 16 pp. *MAB Publication No. 8.* National Science Council of Sri Lanka, Colombo.
17. Mattingly P.F. (1971). Contributions to the mosquito fauna of Southeast Asia. XII. Illustrated keys to the genera of mosquitoes (Diptera: Culicidae). *Contributions of the American Entomological Institute* **7**(4): 1-84.
18. Rattanaarithikul R. (1982). A guide to the genera of mosquitoes (Diptera: Culicidae) of Thailand with illustrated keys, biological notes and preservation and mounting techniques. *Mosquito Systematics* **14**: 139-208.
19. Darsie R.F. & Pradhan S.P. (1990). The mosquitoes of Nepal: their identification, distribution and biology. *Mosquito Systematics* **22**: 69-130.
20. Reuben R., Tewari S.C., Hiriyan J. & Akiyama J. (1994). Illustrated keys to species of *Culex* (*Culex*) associated with Japanese encephalitis in southeast Asia (Diptera: Culicidae). *Mosquito Systematics* **26**: 75-96.
21. Harbach R.E. & Knight K.L. (1980). *Taxonomists' glossary of mosquito anatomy.* Plexus Publishing Inc., New Jersey. 415 pp.