

GENUS Aedes, SUBGENUS Aedimorphus THEOBALD
IN SOUTHEAST ASIA

By

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GENUS Aedes, SUBGENUS AEDIMORPHUS THEOBALD
IN SOUTHEAST ASIA

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This paper is the first comprehensive revision of the Aedes (Aedimorphus) in Southeast Asia and deals with 14 species and 1 subspecies. These species are completely described and compared with closely related forms occurring in the Pacific Islands and Oriental Zoogeographical Regions. Pupae of caecus, culicinus, mediolineatus, orbitae, pampangensis and pipersalatus and larvae of culicinus and orbitae are described for the first time. Stages of the following species are also illustrated for the first time: caecus pupa; culicinus female, pupa and larva; mediolineatus pupa; orbitae female, male, pupa and larva; pallidostriatus female; and pampangensis female and pupa. Keys to the adults, pupae and larvae of Southeast Asian species are given.

New synonymies in this paper are: lowisii (= mindoroensis); pampangensis (= niveoscutellum); and vexans (= nocturnus and stenoetrus). Aedes nummatus is transferred from Aedimorphus to the subgenus Diceromyia of Aedes.

INTRODUCTION

The subgenus Aedimorphus was originally described by Theobald (1903a: 290) as a distinct genus based on a single African species, domesticus (Theobald). A number of Oriental species now included with Aedimorphus were at various times placed under other genera and subgenera. Felt (1904: 391c) erected a new genus, Ecculex, for the species vexans (Meigen) (= sylvestris Theobald). The following year, Ludlow (1905: 94) described a new genus Reedomyia for his new species pampangensis. During this same year, Theobald described 3 new genera: Pecomymia (1905a: 23) for taeniorhynchoides (= maculata Theobald), Pseudograbhamia (1905c: 243) for pipersalatus (= maculata Theobald), and Lepidotomyia (1905b: 80) for alboscutecllatus Theobald. Geitonomyia was described by Leicester (1908: 134) for caecus (Theobald) and Leslie-myia by Christophers (1911: 68) for his new species taeniorhynchoides. Edwards (1913: 227) placed several of the Oriental species in the genus Ochlerotatus Lynch Arribalzaga but later (1922b: 466) transferred them to the genus Aedes (Meigen) subgenus Ecculex.

Two Oriental species, alboscutecllatus and vexans, were moved by Edwards (1924: 372) to the subgenus Aedimorphus and the next year (1925: 267) he synonymized Ecculex with this subgenus. In the Genera Insectorum, Edwards (1932:

165) reviewed Aedimorphus from a worldwide standpoint and divided it into 8 groups. The first comprehensive study of the subgenus in the Oriental area was conducted by Barraud (1928: 655) in India. He later (1934: 246) revised the Indian species. Knight and Hurlbut (1949: 29) and Knight and Hull (1951: 200) modified Edward's group classification of the Aedimorphus.

This paper deals with 14 species and 1 subspecies from Southeast Asia and compares them to closely related species in the Oriental and Pacific Islands Zoogeographical Regions. Pupae of caecus, culicinus, mediolineatus, orbitae, pampangensis and pipersalatus and larvae of culicinus and orbitae are described for the first time herein. Stages of the following species are also illustrated for the first time: caecus pupa; culicinus female, pupa and larva; mediolineatus pupa; orbitae female, male, pupa and larva; pallidostriatus female; and pampangensis female and pupa. Keys to the adults, pupae and larvae of the Southeast Asian species are given. For original descriptions of the Oriental and Pacific Islands species not found in Southeast Asia see: Theobald (1905b: 86) trimaculatus; Edwards (1914: 77) jamesi; Barraud (1928: 662) syntheticus (as fisheri); Stone (1939: 163) oakleyi; Carter and Wijesundara (1948: 139) argenteoscutellatus; Knight and Hurlbut (1949: 27) senyavinensis; and Bohart (1956: 63) trukensis. For taxonomic information on the African species check Edwards (1941) and Hopkins (1952).

New synonymies in this paper are: lowisii (= mindoroensis); pampangensis (= nivescutellum); and vexans (= nocturnus and stenoetrus). Aedes nummatus Edwards is transferred from Aedimorphus to the subgenus Diceromyia Theobald.

During the course of this revision, I examined all specimens and types of Aedimorphus in the United States National Museum (Natural History) and the British Museum (Natural History) as well as specimens from numerous individual and museum collections.

Abbreviations used in references to literature conform to the World List of Scientific Periodicals, 4th edition, Butterworths, Washington, 1963. In the synonymy sections, an asterisk following the abbreviations used (A = adult, F = female, M = male, P = pupa, L = larva, E = egg) indicates that at least some portion of that sex or stage is figured. Abbreviations used in the pupal descriptions, tables and key are: C = cephalothorax; P = paddle; and I-VIII = abdominal segments 1 through 8. In larval descriptions the range of hair branching is followed by the mode branching in parentheses and the following abbreviations signify: A = antenna; C = head; M = mesothorax; P = prothorax; S = siphon; T = metathorax; and VIII, X = abdominal segments 8 and 10. Distribution records are indicated as follows: countries are in capital letters; where known, administrative divisions are in italics; and place names have the first letter capitalized.

The nomenclature and chaetotaxy used for females, males and male genitalia follow Knight (1970) and Knight and

Laffoon (1970a, 1970b, 1971) and those for the pupa and larva follow Belkin (1962). The terminology of the female genitalia is taken from Coher (1948). In the pupal descriptions, the number of branches on abdominal hair 1-I is measured on the basal 0.33 of the hair.

Southeast Asia, in this study, is composed of southern China, East Pakistan, Assam, Burma, North Vietnam, South Vietnam, Taiwan, Philippines, Indonesia, Laos, Cambodia, Thailand, Malaysia, Singapore, Andaman and Nicobar Islands, Southern Ryukyus, Hainan and The Pescadores.

GENUS Aedes MEIGEN

SUBGENUS Aedimorphus THEOBALD

Aedimorphus Theobald 1903, Monogr. Cul. 3: 290 (July).
Haplotype: Uranotaenia domestica Theobald.

Catageiomyia Theobald 1903, Mem. Lpool. Sch. trop. Med.
10 (App.): i (Nov.). Haplotype: Catageiomyia
senegalensis Theobald.

Ecculex Felt 1904, Bull. N. Y. St. Mus. 78: 391c. Ortho-
type: Culex sylvestris Theobald.

Reedomyia Ludlow 1905, Can. Ent. 37: 94. Haplotype:
Reedomyia pampangensis Ludlow.

Lepidotomyia Theobald 1905, Ann. Mus. nat. Hist. Hung. 3:
80. Haplotype: Lepidotomyia alboscuteolata Theobald.

Pecomomyia Theobald 1905, J. econ. Biol. 1: 23. Haplotype:
Pecomomyia maculata Theobald.

Polyleptomyia Theobald 1905, Genera Insec., Fasc. 26: 21.
Haplotype: Stegomyia albocephala Theobald.

Pseudograbhamia Theobald 1905, J. Bombay nat. Hist. Soc.
16: 243. Haplotype: Pseudograbhamia maculata
Theobald.

Duttonia Newstead 1907, in Newstead, Dutton and Todd, Ann.
trop. Med. Parasit. 1: 17. Logotype: Duttonia
tarsalis Newstead.

Mimetculex Theobald 1908, Rep. Wellcome trop. Res. Lab. 3:
258. Haplotype: Mimetculex kingii Theobald.

Geitonomyia Leicester 1908, Cul. Malaya, p. 134. Haplotype:
Culex caecus Theobald.

Myxosquamus Theobald 1909, Colon. Rep. misc. Ser. No. 237:
7; Theobald 1910, Monogr. Cul. 5: 225. Haplotype:
Myxosquamus confusus Theobald.

Stenoscutus Theobald 1909, Colon. Rep. misc. Ser. No. 237:
7; Theobald 1910, Monogr. Cul. 5: 263. Haplotype:
Stenoscutus africanus Theobald.

Bathosomyia Theobald 1909, Colon. Rep. misc. Ser. No. 237: 9; Theobald 1910, Monogr. Cul. 5: 267. Haplotype: Bathosomyia abnormalis Theobald.

Neopecomyia Theobald 1909, Colon. Rep. misc. Ser. No. 237: 12; Theobald 1910, Monogr. Cul. 5: 261. Haplotype: Neopecomyia uniannulata Theobald.

Leslieomyia Christophers 1911, Paludism 2: 68. Haplotype: Leslieomyia taeniorhynchoides Christophers.

FEMALE. Head. Antenna brown, 0.87-1.14 length of proboscis, pedicel usually pale with a patch of short fine hairs, scales or both mesally, flagellomere 1 pale with a few small scales; clypeus brown, bare; maxillary palpus 0.17-0.28 length of proboscis; proboscis usually brown with pale ventral markings, 0.98-1.33 length of femur I; eyes narrowly separated; interocular and ocular setae well developed; ocular line covered with pale scales (punctifemoris has broad scales on this area); vertex with dorsum covered with narrow decumbent scales except in punctifemoris and wainwrighti which have dorsum covered with broad decumbent scales; numerous erect forked scales on occiput and vertex extending anteriorly to ocular line (vertex of wainwrighti without erect forked scales). Thorax. Scutum covered with narrow curved scales (punctifemoris also has small patches of broad scales), arrangement and color of scale patterns varies with the species; scutellum with scales broad, narrow or both; median anterior promontory, acrostichal (absent in wainwrighti), anterior and posterior dorsocentral (anterior ones absent in wainwrighti), scutal fossal, supra-alar, posterior medial scutal, postalar callular, and median and lateral

scutellar bristles well developed; antepronota widely separated with narrow curved scales (culicinus, punctifemoris, vexans and wainwrighti have some broad scales) and several well developed bristles; postpronotum with narrow curved scales (culicinus, vexans and vexans nipponii also have a few broad ones and punctifemoris has only broad scales) and 3-10 posterior bristles; propleuron with broad scales (mediolineatus and pallidostriatus have narrow scales) and several bristles; postspiracular area with broad or narrow scales (alboscutellatus, lowisii, orbitae, punctifemoris and wainwrighti without scales) and 4-11 bristles; subspiracular area with 1 or 2 patches of scales (nigrostriatus and orbitae have this area bare and alboscutellatus and lowisii have a patch of short fine hairs); mesepisternum with an upper and a posterior patch of broad scales and several upper and posterior bristles, lower ones shorter; prealar knob without scales (mediolineatus, pallidostriatus, taeniorhynchoides, vexans and vexans nipponii have a few scales) and several bristles; paratergite with scales (lowisii without scales); mesepimeron with a patch of broad scales and several bristles on upper area, lower area bare; other pleural areas bare. Legs. Coxae I-III each with several bristles and usually broad scales; trochanters I-III with broad scales; femora I-III with various scale patterns but usually each with a white dorsoapical spot, III usually with most of anterior pale scaled; tibiae I-III with various scale patterns; tarsi I-III with basal bands, dorso-basal pale spots or without ornamentation (lowisii also has

apical pale scales on tarsomeres); posttarsi I-III each with 2 ungues, I-II each bearing a tooth and III usually simple (may be toothed in pampangensis and vexans). Wing. Dorsal veins usually covered with moderately broad brown scales with a small pale patch at base of costa, a few species with pale scales intermixed; alula with narrow scales along fringe; remigium with 1-4 bristles, usually 2. Abdomen. Tergum I with a rectangular patch of pale scales on laterotergite; terga with or without basal pale bands and usually with lateral pale spots; sterna usually pale scaled with some brown markings; terga and sterna with numerous golden bristles, mostly along posterior margins. Genitalia. Segment VIII distinctly bilobed ventroapically, usually retracted into segment VII and not visible dorsally; tergum IX bilobed with 3-16 short bristles on each lobe, lateral portions lightly sclerotized and membranous mesally, entire surface covered with tiny spicules; cerci usually completely extended and visible dorsally, each cercus long, flat with tips sharply rounded, tergal surface covered with short bristles, apical ones longer, entire tergal and sternal surfaces covered with tiny spicules; postgenital plate with a deep median apical indentation, 4-10 bristles on each lobe, entire surface covered with tiny spicules; cowl membranous; IX sternum and sigma narrow and covered with minute spicules; atrial plate well developed; insula tongue-like, membranous and covered with tiny spicules; 3 spermathecae, 1 large and 2 slightly smaller ones except in alboscuteclatus, culicinus,

jamesi, lowisii and oakleyi which have 1 large spermatheca and 2 rudimentary ones.

MALE. Similar to female in general habitus. Head. Antenna plumose with hairs directed mainly dorsally and ventrally; maxillary palpus with apical 2 segments short and down-turned with numerous apical and ventrolateral bristles, antepenultimate segment with apical portion somewhat swollen and with several ventrolateral bristles, longer than proboscis by 0.50 to 1.00 length of apical segment. Legs. Posttarsi I-III each with 2 ungues, I-II with ungues unequal, each bearing a tooth, III equal, simple (pallidostriatus, pipersalatus, punctifemoris and taeniorhynchoides have III unequal and simple). Genitalia. Tergum IX bilobed with 3-11 bristles on each lobe, entire surface covered with minute spicules; gonocoxite moderately long to long and moderately broad, dorsal surface usually covered with scattered short bristles with longer ones at apex, lateral margin with long stout bristles from base to apex, ventral surface usually with long stout bristles on distal 0.50, scattered scales on lateral and ventral surfaces; gonostylus usually complex with apical portion expanded into a mesal lobe and a lateral horn-like structure (gonostylus blade-like in vexans and vexans nipponii), gonostylar claw attached mesally near middle and usually 1 or more accessory claws at apex; basal mesal lobe with 3-38 bristles and covered with short hair-like spicules; proctiger short to long, paraproct smooth and bluntly pointed or slender with a rounded apex and a

subapical thumb-like process, cercal setae absent; phallosome with aedeagus with 2 lateral plates connected basally, each plate with 4-7 teeth and covered by a dorsal flap, paramere long; sternum IX large with the entire surface covered with minute spicules and 2-15 bristles near center.

The genitalia of the Oriental species is divided into 2 types based on characteristics of the phallosome and proctiger. Type I (Fig. 14) has the aedeagus divided into 2 lateral plates connected basally, each plate bears 4-7 short blunt lateral teeth on distal 0.50 and is covered with a pigmented dorsal flap which is narrow distally and broadly rounded proximally. The proctiger is short and the paraproct is distally slender and apically rounded with a subapical thumb-like process. The majority of the Oriental species have type I genitalia. Type II (Fig. 20) has the aedeagus divided into 2 lateral plates connected basally, each plate bears 5-6 long, longitudinal lateral teeth with tergally curved apices and is covered with a pigmented dorsal flap which is narrow distally and tapers to a broad base. The proctiger is long and the paraproct is narrow with a bluntly pointed apex.

PUPA. The pupae of the species that occur in Southeast Asia do not, at this time, present any clear-cut subgeneric characters. The pupal chaetotaxy is summarized as follows: Cephalothorax. Hairs 1, 2-C with 2-8 branches; 3-C with 2-5 branches; 4-C single to 8 branched; 5-C single to 9 branched; 6, 9-C single to 4 branched; 7-C with 2-11 branches; 8-C with

2-9 branches. Metanotum. Hair 10-C with 4-33 branches; 11-C single; 12-C single to 11 branched. Abdomen. Hairs 0-II-VIII single; 1-I with 16-46 branches, 1-II with 3-49 branches, 1-III with 3-18 branches, 1-IV with 2-13 branches, 1-V single to 10 branched, 1-VI single to 13 branched, 1-VII single to 10 branched; 2-I-VII single or double; 3-I-III single to triple, 3-IV with 2-12 branches, 3-V single to 5 branched, 3-VI single to 8 branched, 3-VII with 2-16 branches; 4-I with 2-7 branches, 4-II with 2-16 branches, 4-III, VIII single to 8 branched, 4-IV single to 4 branched, 4-V single to 14 branched, 4-VI single to 11 branched, 4-VII single to 10 branched; 5-I with 2-18 branches, 5-II with 2-14 branches, 5-III with 2-13 branches, 5-IV-V single to 5 branched, 5-VI single to 6 branched, 5-VII single to 9 branched; 6-I single to triple, 6-II single to 5 branched, 6-III-VI single to 8 branched, 6-VII with 3-14 branches; 7-I, IV single to 6 branched, 7-II single to 10 branched, 7-III with 2-9 branches, 7-V single to 11 branched, 7-VI single to 4 branched, 7-VII single to 5 branched; 8-III, VII single to 7 branched, 8-IV-VI single to 5 branched; 9-I-VI single, 9-VII with 2-11 branches, 9-VIII with 4-14 branches; 10-III single to 6 branched, 10-IV, VII single to 5 branched, 10-V single to 4 branched, 10-VI single to triple; 11-III-V single, 11-VI single or double, 11-VII single to 4 branched; 14-III-VIII single. Paddle. Hair 1-P single to triple and short. The respiratory trumpet is moderately broad and usually moderately pigmented. The paddle is ovoid, with tiny to minute

serrations along the basal 0.50 of outer margin, usually with tiny spicules along apical margin, and the midrib does not reach the apex.

LARVA. The larval chaetotaxy and features of the South-east Asian species are summarized as follows: Head. Hairs 1, 3-C single; 4-C with 2-13 branches, usually with 5-7 branches; 5-C single to 9 branched, usually with 4-7 branches; 6-C single to 9 branched, usually with 4-6 branches; 7-C with 4-16 branches, usually with 6-10 branches; 8, 9-C single to 6 branched, usually with 2-4 branches; 10-C single to 4 branched, usually double or triple; 11-C with 2-10 branches, usually with 3-6 branches; 12-C with 3-10 branches, usually with 3-6 branches; 13-C single to 9 branched, usually with 2-4 branches; 14-C single or double, usually single; 15-C single to 7 branched, usually with 2-5 branches; basal maxillary hair single; mental plate with 22-36 teeth.

Antenna. Usually moderately pigmented, slightly incurved distally, usually numerous short stout spicules on shaft; hair 1-A with 3-16 branches, usually with 5-10 branches, inserted at 0.36-0.52 from base; 2-A long; 3-A approximately equal to or about 0.50 length of 2-A. Thorax. Hair 0-P with 3-21 branches, usually with 5-10 branches; 1, 5, 6-P single; 2, 3, 9, 11-P single to 4 branched, usually double or triple; 4, 8-P single to 7 branched, usually double or triple; 7-P with 2-4 branches, usually double or triple; 10, 12-P single or double, usually single; 14-P single to triple, usually single or double; 1-M single to 8 branched, usually with 3-5

branches; 2-M single to 5 branched, usually with 2-4 branches; 3-M single to 5 branched, usually single to triple; 4-M with 2-9 branches, usually with 3-4 branches; 5-M single to triple, usually single; 6-M with 3-10 branches, usually with 4-6 branches; 7, 10, 12-M single; 8-M with 3-10 branches, usually with 5-8 branches; 9-M with 3-10 branches, usually with 6-9 branches; 11-M single or double, usually single; 13-M with 3-12 branches, usually with 5-8 branches; 14-M with 4-11 branches, usually with 5-8 branches; 1-T single to 4 branched, usually single or double; 2-T with 2-13 branches, usually with 3-6 branches; 3-T with 2-28 branches, usually with 6-10 branches; 4-T with 2-6 branches, usually with 3-4 branches; 5, 10-T single; 6-T single to 5 branched, usually single to triple; 7-T with 5-14 branches, usually with 6-10 branches; 8-T with 3-12 branches, usually with 4-7 branches; 9-T with 2-9 branches, usually with 4-6 branches; 11-T single or double, usually single; 12-T single to triple, usually single or double; 13-T with 4-19 branches, usually with 5-9 branches. Abdomen. Hairs 0, 14-VIII single; 1-VIII with 3-12 branches, usually with 4-9 branches; 2-VIII single to 5 branched, usually double or triple; 3-VIII with 5-27 branches, usually with 6-12 branches; 4-VIII single to 4 branched, usually double or triple; 5-VIII with 4-10 branches, usually with 4-7 branches; comb of 7-32 scales, usually arranged in 2 irregular rows; 1-X single to 4 branched, usually single to triple; 2-X with 5-15 branches, usually with 8-12 branches; 3-X single; ventral brush varies from

8 hairs on grid and 4 precratal ones to 14 hairs on grid and 3 precratal ones; saddle usually moderately pigmented with small spicules along posterior margin, incompletely rings segment X; 4 anal gills usually moderately long to long and slender. Siphon. Usually moderately pigmented; index 2.11-9.00; pecten with 10-23 teeth, distal 2-4 teeth smooth and wider spaced than remainder which have a slender attenuate filament with 1-4 lateral denticles; hair 1-S with 3-7 branches, usually with 4-6 branches, inserted at 0.50-0.85 from base.

EGG. The egg of only one species, vexans, has been described. The following account is taken from Horsfall and Craig (1956: 370) and Kalpage and Brust (1968: 711).

Chorion. Distinct surface reticulation in reflected light; pattern consists of axially linear cells, hexagonal and polygonal in shape, 2.5-5 times as long as wide; cell wall with chain-like appearance at 150-200 X magnification; cleared chorion shows chain-like cell walls which appear to consist of 2-3 beaded rows; cell walls more raised at anterior end than elsewhere; 4-6 distinct circular bossed areas within the cells; exochorion transparent and thin. Color. Shiny bronze. Shape. Usually spindle-shaped with a distinct taper at anterior end; greatest curvature on ventral side; greatest diameter between anterior 0.33 and middle; occasionally eggs appear bilaterally symmetrical. Size. Length 630-756 microns and the dorsoventral diameter at the widest point is 167-216 microns.

The most striking features of the egg are the bronze coloring and linear appearance of the reticulation.

DISTRIBUTION. Species of Aedimorphus are confined to the Ethiopian, Oriental, Pacific Islands and northern portion of the Australian Zoogeographical Regions with the exceptions of vexans which has a wide distribution and is found in the Holarctic, Oriental, Pacific Islands and Australian Zoogeographical Regions and vexans nipponii which is confined to the eastern part of the Palearctic Zoogeographical Region.

Eighty-one species and 5 subspecies (Table 16) of Aedimorphus are endemic to the Ethiopian Zoogeographical Region. This area contains the largest number of species and shares only vexans with other regions. The Oriental Zoogeographical Region possesses 18 species (Table 11) and shares 5 (Table 12) of these with the Australian, 2 (Table 13) with the Palearctic, 3 (Table 14) with the Pacific Islands and 1 (Table 15) with the Nearctic Zoogeographical Regions.

Species of Aedimorphus have been collected from each of the countries in the Oriental and Ethiopian Zoogeographical Regions.

TAXONOMIC DISCUSSION. The subgenus Aedimorphus possesses a combination of characters that allows it to be separated from the other subgenera of Aedes. The most distinctive features are exhibited by the male, these being: antenna with the plume hairs directed mainly dorsally and

ventrally; maxillary palpus with the 2 apical segments short and down-turned with numerous apical and ventrolateral bristles, antepenultimate segment with apical 0.25 somewhat swollen and with several ventrolateral bristles and longer than proboscis by 0.50 to 1.00 length of apical segment; genitalia with gonostylus complex and usually expanded distally, proctiger short to long, paraproct smooth and bluntly pointed or slender with apex rounded and a subapical thumb-like process, cercal setae absent and the phallosome which has the aedeagus composed of 2 lateral pigmented plates connected basally, each plate with 4-7 short blunt lateral teeth on distal 0.50 or 5-6 long, longitudinal lateral teeth with tergally curved apices (vexans and its allies) and covered with a pigmented dorsal flap; and tarsomere 5 of tarsus I ventrally concaved with the base projecting posteroventrally into a protuberance with 4 short stout curved spines at apex and a pair of short bristles each arising from a conical tubercle located near the middle of the ventral margin. A similar maxillary palpus is also found in Ochlerotatus, and some Finlaya Theobald and Chaetocruomyia Theobald while the antenna is typical of Diceromyia. The toothed aedeagus of the vexans group is also similar to Diceromyia and Stegomyia Theobald but is easily separated from the latter by the presence of the dorsal flap and from the former by the flap being pigmented and semirigid while in Diceromyia it is unpigmented and membranous (for a discussion of the Diceromyia see Reinert 1970). The tarsomere 5 of Aedimorphus resembles

those of the tarsi I of Psorophora Robineau-Desvoidy and Culex Linnaeus. Aedimorphus males are easily separated from Ochlerotatus, Finlaya and Chaetocruiomyia by the structure of the aedeagus which is simple and nontoothed in the latter 3 subgenera. The structure of the maxillary palpus of Stegomyia is markedly different from Aedimorphus.

Other important characteristics of the adults are: vertex with narrow curved decumbent scales medially (punctifemoris and wainwrighti with vertex covered with broad decumbent scales); erect forked scales numerous on occiput and vertex extending anteriorly to ocular line (these scales restricted to occiput in wainwrighti); female maxillary palpus short, 0.17-1.33 length of proboscis; acrostichal and dorsocentral bristles well developed and numerous (acrostichal and anterior dorsocentral bristles absent in wainwrighti); scutum covered with narrow curved scales (a few patches of broad scales in punctifemoris); antepronotum and postpronotum usually with narrow curved scales; scutellum with narrow, broad or both types of scales; and lower mesepimeron without bristles or scales.

The females have the following features: genitalia with segment VIII partially or completely retracted into segment VII, cerci long, narrow and visible dorsally, postgenital plate with a deep median apical indentation (moderately deep in taeniorhynchoides), insula tongue-like and covered with minute spicules, 3 spermathecae approximately equal in size except for the alboscutellatus group which has 1 large and 2

rudimentary spermathecae; and posttarsi of legs I-II with unguis toothed and unguis of III usually simple. Ochlerotatus and Neomelaniconion Newstead have similar cerci but can be easily separated by the former having bristles on the insula and the latter with the postgenital plate without a deep median apical indentation. The insula of Aedimorphus resembles those of Stegomyia and Diceromyia but the cerci of the latter 2 species are short and broad. Female specimens usually can be separated from those of the other subgenera of Aedes by a combination of the characters mentioned.

For a long time, Aedes nummatus has been considered as an aberrant Aedimorphus. It possesses some features of Aedimorphus but contains a greater number of important characters of Diceromyia, notably features of the male maxillary palpus, male genitalia and female genitalia. I am therefore transferring this species to the subgenus Diceromyia.

The pupae of the Oriental species are very similar, especially in the chaetotaxy, shape of the respiratory trumpet and structure of the paddle.

Aedimorphus larvae have a number of distinctive features such as: antenna slightly incurved distally and with short stout spicules on shaft, hair 1-A stellate with 3-16 branches; siphon with distal 2-4 teeth smooth and wider spaced than remainder which have a slender attenuate filament with 1-4 lateral denticles, pecten teeth on basal 0.50 of siphon and hair tuft inserted on distal 0.50; ventral brush of abdominal segment X varies from 8 hairs on grid and 4 precratal

ones to 14 hairs on grid and 3 precratal ones; and saddle and siphon usually with an acus.

BIOLOGY AND MEDICAL IMPORTANCE. Females of many species of Aedimorphus readily feed on man and, at times, may be very serious pests. Some species such as taeniorhynchoi-des (Aslamkhan and Salman 1969: 194) and pallidostriatus prefer feeding on cattle rather than on man. Temples et al. (1970: 339) summarized the feeding preferences of vexans in the Hawaiian Islands as follows: man--2.4 percent, bovine--50.7 percent, horse--37.2 percent, dog--4.7 percent, pig--1.6 percent and unknown host--3.4 percent. In Malaysia, Standfast (1967: 193) found that vexans readily fed on man between 1800 and 0600 hours with a peak in feeding around 2400 hours and a smaller one around 0500 hours.

In the United States, vexans has been found naturally infected with western equine encephalitis virus (Burroughs and Burroughs 1954: 33) and has experimentally transmitted the virus of eastern encephalitis (Chamberlain et al. 1954: 280). Experimental transmission of fowl pox virus to chickens by vexans was demonstrated by Matheson, Brunett and Brody (1931: 218); and Hu (1931: 628) and Yen (1938: 193) showed experimentally that this species was a fairly good carrier of Dirofilaria immitis Leidy. Aspöck (1965: 767) and Mattingly (1969: 79) report that vexans is concerned in the transmission of Tahyna virus in central Europe.

Aedes vexans nipponii is suspected of being a vector of Japanese B encephalitis virus in Japan (La Casse and Yamaguti 1948: 104).

Hodes (1946: 358) experimentally transmitted this virus to mice through the bite of vexans nipponii. This species of mosquito is not believed to be a vector of Wuchereria bancrofti Cobbold since the larvae of this parasite died in the body cavity of the mosquito as reported by Yamada (1927) and Newton, Wright and Pratt (1945: 256).

In Africa, Middelburg virus has been isolated from the following species of Aedimorphus: albocephalus (Theobald) (Worth, Paterson and de Meillon 1961: 588), dentatus (Theobald), leesoni Edwards and cumminsi (Theobald) (Robin et al. 1969: 113). The virus vector in Senegal seems to be comminsi and sheep apparently play a part in the maintenance of the virus (Robin et al. 1969: 117). The latter found Middelburg virus primarily in cattle and rarely in man.

Smithburn and Haddow (1944: 265), while working in Africa, isolated Semliki Forest virus from naturally infected members of the abnormalis Theobald group. Rift Valley fever virus was isolated from a pooled sample of 50 percent albocephalus and 50 percent tarsalis (Newstead) in Africa by Smithburn, Haddow and Gillett (1948: 117). The African Bunyawera virus was found in a pooled sample containing 5 subgenera of Aedes (8 species of Aedimorphus) by Smithburn, Haddow and Mahaffy (1946: 190). In Tongaland, Union of South Africa, Spondweni virus was isolated from cumminsi, Wesselsbron virus from minutus (Theobald) and an unidentified

virus from marshallii (Theobald) by Worth, Paterson and de Meillon (1961: 588).

Bauer (1928: 267), while working in Africa, experimentally transmitted the yellow fever virus to monkeys by the bite of stokesi Evans (recorded as apicoannulatus Edwards).

The typical breeding sites of Aedimorphus are temporary and semipermanent fresh water ground pools. Some species have been collected from other habitats such as artificial containers, rockholes, etc., but usually only when their normal breeding places had dried up. Aedes irritans and vexans have been taken from brackish pools.

Eggs of vexans are deposited in shallow areas that are subject to inundation. Horsfall (1956: 66) found that embryonated eggs of vexans are able to withstand adversities such as drought, cold and premature submersion often for long periods of time. He also stated the basic hatching stimulus for the eggs is a decrease in the content of dissolved oxygen in the water. Gjullin, Yates and Stage (1950: 268) reported that eggs in field cages showed little or no mortality over 2 years, but for longer periods viability rapidly decreased and less than 1 percent survived 4 years. Eggs of vexans deposited 1 year may hatch throughout the following season but usually most eggs that survive the winter hatch the following spring (Miller 1930 cited Horsfall 1955: 523). Horsfall (1955: 523) stated that eggs in natural sites can withstand prolonged freezing without detrimental effects.

KEYS TO THE SPECIES OF AEDES (AEDIMORPHUS)

IN SOUTHEAST ASIA

KEY TO THE ADULTS

1. Head with only broad scales on vertex; antepnotum with broad silvery scales..... 2
- Head with narrow scales mesally on vertex; antepnotum with narrow curved white or golden scales, or if broad scales present these are not silvery..... 3
- 2(1). Vertex of head with erect forked scales; postpronotum with a few broad silvery scales; tarsi dark..... punctifemoris
- Vertex of head without erect forked scales; postpronotum bare; tarsi with white bands..... wainwrighti
- 3(1). Tarsi II-III with basal white bands or dorsobasal white spots..... 4
- Tarsi II-III without basal white bands or spots (some species may have lateral longitudinal white stripes)..... 10
- 4(3). Wing with dorsal veins brown scaled or with a small spot of white scales at base of costa; femora I-II with anterior brown..... 5
- Wing with dorsal veins with white and brown scales intermixed or with a number of white scales on posterior margin of costa; femora I-II with a large number of white scales intermixed with brown ones..... 7

- 5(4). Scutellum with broad and narrow scales on each lobe; tarsus III with a narrow basal white band on tarsomere 5..... caecus
- Scutellum with broad silvery scales on each lobe; tarsus III with tarsomere 5 pale scaled..... 6
- 6(5). Maxillary palpus brown scaled; tarsi I-II each with tarsomere 5 pale scaled..... lowisii
- Maxillary palpus with white scales; tarsi I-II each with tarsomere 5 brown scaled..... orbitae
- 7(4). Wing brown with numerous white scales (30% or more of scales white) intermixed on all dorsal veins, including anal vein..... 8
- Wing without numerous white scales intermixed on all dorsal veins, anal vein brown scaled..... 9
- 8(7). Prealar knob with a few broad white scales; scutellum with only narrow curved white scales on midlobe... taeniorhynchoides
- Prealar knob without scales; scutellum with broad white scales and occasionally a very few narrow curved ones on midlobe..... pipersalatus
- 9(7). Abdomen with terga III-IV each with an incomplete apical median longitudinal white stripe which may or may not connect with basal bands; lower subspiracular scale patch connects, or nearly so, with postspiracular scale patch..... vexans nipponii
- Abdomen with terga III-IV without apical median longitudinal white stripe; lower subspiracular scale patch does not connect with postspiracular scale patch..... vexans

- 10(3). Propleuron with narrow curved scales;
scutum with 2-3 distinct longitudinal
white stripes..... 11
- Propleuron with broad scales; scutum
without white stripes..... 12
- 11(10). Anterior margin of wing pale scaled;
femora II-III each brown with an
anterior median longitudinal white
stripe..... pallidostriatus
- Anterior margin of wing brown scaled;
femora II-III without anterior longi-
tudinal white stripe..... mediolineatus
- 12(10). Scutal integument pale with a pair of
dark stripes on dorsocentral areas;
tarsi yellow scaled..... nigrostriatus
- Scutal integument uniformly dark;
tarsi brown scaled..... 13
- 13(12). Scutellum with narrow curved white
scales on each lobe; subspiracular
area with 2 patches of broad white
scales..... culicinus
- Scutellum with broad silvery-white
scales on each lobe; subspiracular
area with 1 patch of moderately broad
white scales or with a patch of short
fine hairs and without scales..... 14
- 14(13). Abdomen with terga III-IV brown dorsally;
subspiracular area with a patch of white
scales..... pampangensis
- Abdomen with terga III-IV with dorso-
basal white bands; subspiracular area
with a patch of short fine hairs.....
..... alboscuteallatus

KEY TO THE FOURTH STAGE LARVAE

1. Siphon with patches of spicules, these
may be restricted to apex..... 2
- Siphon without spicules..... 3
- 2(1). Siphon with lateral patch of spicules
near middle; head hair 6-C with 6-9
branches..... orbitae
- Siphon without lateral patch but
usually with a dorsal patch of
spicules; head hair 6-C with 4-5
branches..... caecus
- 3(1). Mesothoracic hair 5-M double or triple;
siphon long, index 7.50-9.00..... pampangensis
- Mesothoracic hair 5-M single; siphon
short to moderately long, index 2.11-7.91..... 4
- 4(3). Comb scales short, without a long median
spine but with lateral denticles..... 5
- Comb scales with a long stout pointed
median spine and short denticles along
lateral margins of base..... 6
- 5(4). Comb scales short with a short stout
median spine and short denticles
along lateral margins; siphon index
5.00-5.56..... pipersalatus
- Comb scales short without stout median
spine, short denticles along margin
and apex; siphon index 3.00-4.08.....
..... alboscuteallatus
- 6(4). Abdominal hairs 1,2-VIII attached to
a basal plate; head hair 6-C single to
double; head hair 8-C single..... vexans
vexans nipponii
- Abdominal hairs 1,2-VIII not on a
basal plate; head hair 6-C with 3-6
branches; head hair 8-C with 2-6
branches..... 7

7(6). Prothoracic hair 7-P double; meta-
 thoracic hair 7-T with 5-6 branches;
 siphon index 3.88-4.50..... culicinus

Prothoracic hair 7-P triple; meta-
 thoracic hair 7-T with 7-14 branches;
 siphon index 5.93-7.91..... 8

8(7). Prothoracic hair 0-P with 4-5 branches;
 metathoracic hair 1-M single..... pallidostriatus

Prothoracic hair 0-P with 6-12 branches;
 metathoracic hair 1-M double to 5
 branched..... mediolineatus

DESCRIPTIONS OF THE SPECIES OCCURRING
IN SOUTHEAST ASIA

AEDES (AEDIMORPHUS) ALBOSCUTELLATUS (THEOBALD)

Lepidotomyia alboscuteUellata Theobald 1905, Ann. Mus. nat.
Hung. 3: 80 (F*); Brunetti 1907, Rec. Indian Mus.
1: 339.

Lepidotomyia AlboscuteUellata Theobald, Leicester 1908, Cul.
Malaya, p. 132 (M,F).

Culex argentinotus Banks 1909, Philipp. J. Sci. 4: 547
(M,F).

Reedomyia alboscuteUella Theobald, Theobald 1907, Monogr. Cul.
4: 261 (F*); Theobald 1910, Monogr. Cul. 5: 257.

Reedomyia alboscuteUellata Theob., Brunetti 1912, Rec. Indian
Mus. 4: 487.

Ochlerotatus alboscuteUellatus Theob., Brunetti 1920, Rec.
Indian Mus. 17: 139; Senior-White 1923, Cat. Indian
Insects, Cul., p. 76.

Aedes omurensis Yamada 1921, Annot. zool. jap. 10: 73
(M*,F).

Aedes (Ecculex) alboscuteUellatus Theobald, Edwards 1922b,
Indian J. med. Res. 10: 467.

Aedes (Aedimorphus) alboscuteUellatus (Theo.), Edwards 1924,
Bull. ent. Res. 14: 372 (F); Barraud 1934, Fauna Brit.
India, Diptera 5: 250 (M*,F).

Aedes (Aedimorphus) alboscuteUellata Theobald, Dyar and Shannon
1925, Insecutor Inscit. menstr. 13: 76.

Aedes (Aedimorphus) alboscuteUellatus (Theobald), Barraud 1928,
Indian J. med. Res. 15: 659 (M*,F); Bohart 1945,
Navmed. 580, p. 62; Hsiao and Bohart 1946, Navmed.
1095, p. 22; Penn 1949, nat. Hist. Misc. 40: 1 (P*,
L*); La Casse and Yamaguti 1950, Mosquito Fauna Japan
and Korea, p. 130 (M*,F*); Knight and Hull 1953, Pacif.
Insects 7: 457 (M*,F,L*); Stone et al. 1959, Thomas

Say Found. 6: 190; Belkin 1962, Mosquitoes S. Pacif., p. 425 (M*,F,P*,L*); Assam and Bonne-Wepster 1964, Zool. Bijdr. 6: 96 (M,F,L*); Mohrig 1967, Angew. Parasit. 8: 80 (F*); Pao and Knight 1970, Mosquito Syst. Newsletter 2: 105 (L*).

Aedes (Aëdimorphus) alboscuteUellatus Theobald, Edwards 1932, Genera Insec., Fasc. 194: 167.

Aedes (Aedimorphus) alboscuteUellatus Theobald, Bonne-Wepster 1954, Doc. med. Geogr. Trop. 6: 236 (M,F,L*).

FEMALE (Fig. 1). Head. Antenna dark brown, approximately 1.14 length of proboscis, pedicel pale with a few small brown scales and a patch of short fine brown hairs mesally, flagellomere 1 with basal 0.50 pale and with a few small brown scales; clypeus dark, bare; maxillary palpus brown scaled, approximately 0.17 length of proboscis; proboscis brown scaled with a ventral pale area from near base to apical 0.25, approximately 1.12 length of femur I; vertex with dorsum covered with narrow decumbent scales arranged in an anteromedian diamond-shaped brown group and the remainder whitish; lateral surface covered with broad pale scales, an anterodorsal dark patch and a dusky area anterior to antepnotum; numerous dark brown erect forked scales on occiput and vertex extending anteriorly to ocular line. Thorax. Scutal integument brown; scutum covered with narrow curved reddish-black scales, narrow curved white scales forming distinct spots on scutal fossal areas (lateral and posterior) and supra-alar area at base of wing, indistinct spots on anterior promontory area, anterior scutal fossal area and at scutal angle, a few similar scales scattered on area mesally to acrostichal setae and along lateral margins of prescutellar

space; scutellum with a patch of long, broad overlapping silvery scales on each lobe; median anterior promontory, acrostichal, dorsocentral (anterior and posterior), scutal fossal (anterior, 2-3 lateral and 1-2 posterior), supra-alar, several posterior medial scutal, 1 postalar callular and scutellar (lateral and median) bristles reddish-black and well developed, others absent; pleural integument brown; antepronotum with narrow curved and a few broad white scales, several moderately long brown bristles; postpronotum with narrow dark brown scales dorsally and a few white ones posteroventrally, 4-5 dark posterior bristles; propleuron with a patch of broad silvery-white scales, several dark bristles; postspiracular area with 6-7 light brown bristles; subspiracular area with a patch of short fine light brown hairs; mesepisternum with an upper and a posterior patch of broad silvery-white scales, several upper and posterior brown bristles, lower ones shorter; prealar knob with several dark brown bristles; paratergite with a few dusky-white scales (these scales usually rubbed off); mesepimeron with a patch of broad silvery-white scales and several brown bristles on upper area; other pleural areas bare. Legs. Coxae I-III each with several brown bristles, I with anterior covered with broad pale brownish scales and a small dorsal patch of silvery-white ones, II with an anterior patch of broad silvery-white scales, III with a small anteroventral patch of silvery-white scales; trochanters I-III with a few broad white scales; femora I-III brown, I with a few lateroapical white scales,

II-III each with a dorsoapical white spot, III with an anteroventral longitudinal pale stripe, wide at base and tapering at apex, I-III each with posterior with a longitudinal pale stripe, wide at base and tapering to apex, stripe dorsal on I and ventral on II-III; tibiae I-II brown, each with a dorsoapical white scale patch and a posteroventral longitudinal pale stripe, III brown with an apical white band; tarsi I-III brown; posttarsi I-III each with 2 ungues, I-II equal, each bearing a tooth, III equal, simple. Wing. Dorsal veins covered with moderately broad brown scales; costa with a patch of white scales at base; ventral veins brown scaled; alula with narrow brown scales along fringe; 2 remigial bristles. Halter. Pedicel pale, capitellum brown scaled. Abdomen. Tergum I brown with a rectangular patch of white scales on laterotergite; terga brown, III-VII each with a few dorsobasal pale scales (pale scales occasionally forming narrow indistinct bands), a few dorsomedian pale scales on VI in some specimens, II-VII each with a large laterobasal white spot; sterna white each with apical 0.25 brown scaled, brown apical bands broader on posterior sterna; terga and sterna with numerous golden bristles, mostly along posterior margins. Genitalia. Segment VIII distinctly bilobed ventroapically, retracted into segment VII; tergum IX bilobed with 3-6 bristles on each lobe; cercus long, completely extended and visible dorsally; postgenital plate with a deep median apical indentation with 5-8 bristles on each lobe; insula tongue-like, membranous, covered with tiny spicules; 3 spermathecae, 1 large and 2 rudimentary ones.

MALE (Fig. 1). Similar to female in general habitus.

Head. Maxillary palpus brown, longer than proboscis by length of apical segment; vertex without anterodorsal dark patch on lateral surface. Thorax. Antep pronotum with a few broad pale scales; postpronotum with fewer scales. Legs. Posttarsi I-III each with 2 ungues, I-II with ungues unequal each bearing a tooth, III equal, simple. Abdomen. Tergum I with a lateral band of white scales on laterotergite; terga III-VIII each with a broad basal pale band; sternum VIII white scaled. Genitalia (Fig. 14). Tergum IX strongly bilobed with 4-6 bristles on each lobe, entire surface covered with minute spicules; gonocoxite long and moderately broad, dorsal surface with short fine bristles forming an elongate patch along tergomesal margin from apex to base and extending over basal 0.25, long stout bristles along outer lateral margin from base to apex and on apical 0.35 of ventral surface, scattered short to moderately long bristles mesally on basal 0.65 of ventral surface, scattered scales on lateral and ventral surfaces; gonostylus with pedicel narrow and short, distal 0.50 greatly expanded with a lateroapical horn-like flap bearing a number of moderately long fine hairs, mesal margin of expanded portion with a moderately long flattened, pigmented gonostylar claw near base and 3 small and 1 medium-sized accessory claws distally, 3-4 moderately long fine hairs along apical margin and 9-16 short fine hairs scattered over tergal surface of expanded area; basal mesal lobe short and rounded apically, distal 0.40 with 3-4 short

bristles, entire surface covered with short hair-like spicules; proctiger short, paraproct with a subapical thumb-like process, cercal setae absent; phallosome with aedeagus of type I with 2 lateral plates connected basally, each plate with 5-6 short, blunt, lateral teeth on distal 0.55 and covered with a dorsal flap, paramere long, approximately 0.83 length of lateral plate; sternum IX large, entire surface covered with minute spicules, 3-5 bristles near center.

PUPA (Fig. 21). Chaetotaxy as figured and recorded in Table 1. Cephalothorax. Hair 5-C with 4-6 branches, 7-C with 3-4 branches; 8-C with 5-9 branches. Respiratory trumpet. Moderately pigmented; with scattered minute spicules on distal 0.65 of inner surface; index 3.50-4.50, average 3.87. Metanotum. Hair 10-C with 3-5 branches; 12-C with 4-7 branches. Abdomen. Hair 5-I with 6-11 branches; 1-II with 3-7 branches; 4-II with 2-5 branches; 1-III with 6-10 branches; 6-VI with 2-4 branches; 1-VII with 4-6 branches; 6-VII with 4-10 branches; 9-VII with 2-5 branches; 11-VII double or triple. Paddle. Ovoid; with very minute serrations along basal 0.50 of outer margin; tiny spicules along apical 0.50 of outer and apical 0.20 of inner margins; midrib does not reach apex; hair 1-P short, double or triple; index 1.09-1.30, average 1.21.

LARVA (Fig. 28). Chaetotaxy as figured. Head. Hairs 1, 3-C single; 4-C with 3-5(3) branches; 5-C with 3-7(3) branches; 6-C with 2-5(3) branches; 7-C with 4-8(6) branches;

8-C with 2-4(4) branches; 9, 11-C with 3-6(4) branches; 10-C double or triple (3); 12-C with 3-5(5) branches; 13-C double or triple (2); 14-C single or double (1); 15-C with 3-7(4) branches; basal maxillary hair single; mental plate with 32-36(34) teeth. Antenna. Lightly pigmented; numerous spicules on basal 0.25 and a few scattered over remainder of shaft; hair 1-A with 5-7(5) branches, inserted at 0.40-0.47 from base; 2-A long; 3-A approximately 0.34 length of 2-A.

Thorax. Hair 0-P with 6-11(10) branches; 1, 5, 6, 12-P single; 2-P with 2-4(3) branches; 3-P with 3-4(4) branches; 4-P with 3-7(4) branches; 7, 11-P with 2-4(2) branches; 8, 10-P single or double (1); 9-P double or triple (3); 14-P single to triple (2); 1-M with 3-7(4) branches; 2-M with 2-4(2) branches; 3-M with 3-5(3) branches; 4-M with 4-9(5) branches; 5, 7, 10, 12-M single; 6-M with 3-5(4) branches; 8-M with 5-7(6) branches; 9-M with 6-7(6) branches; 11-M single or double (1); 13-M with 5-10(7) branches; 14-M with 4-10(8) branches; 1, 5, 10-T single; 2-T with 4-10(8) branches; 3-T with 7-12(11) branches; 4-T with 3-4(4) branches; 6-T with 2-5(4) branches; 7-T with 5-7(6) branches; 8-T with 5-12(7) branches; 9-T with 4-6(5) branches; 11-T single or double (2); 12-T single to triple (2); 13-T with 9-19(14) branches. Abdomen. Hairs 0, 14-VIII single; 1-VIII with 6-11(6) branches; 2-VIII with 2-4(3) branches; 3-VIII with 6-16(9) branches; 4-VIII single or double (2); 5-VIII with 5-9(7) branches; comb with 17-25(19) scales arranged in 3 irregular rows, scales each short and blunt with stout

denticles on margins and apex; 1-X double or triple (2); 2-X with 7-12(11) branches; 3-X single; ventral brush varies from 9 hairs on grid and 3 precratal ones to 12 hairs on grid and 2 precratal ones, usually with 9 hairs on grid and 3 precratal ones; saddle moderately pigmented with minute ridges, incompletely rings segment, with a few spicules along posterior margin, acus present; 4 anal gills long, each with a broad base and tapering to a pointed apex. Siphon. Moderately pigmented with minute ridges over entire surface; acus present; index 3.00-4.08, pecten with 15-20(17) teeth, apical 1-3 teeth smooth and wider spaced than remainder which have a slender attenuate filament with 1-2 basal denticles; hair 1-S with 4-6(5) branches, inserted at 0.59-0.67 from base.

TYPE DATA. Lepidotomyia alboscuteclata Theobald, holotype female, Simbang, Huon Gulf, New Guinea, AUSTRALIA, July 1898, Biro, in Magyar Nemzeti Museum, Budapest, Hungary; Culex argentinotus Banks, syntypes male and female, Pinagsalaan Well, Taytay, Rizal, Luzon, PHILIPPINES, 13-16 May 1909, C. S. Banks, types nonexistent (Stone et al. 1959: 190); Aedes omurensis Yamada, 4 female and 2 male syntypes, 5 female and 1 male paratypes, Omura, Kyushu, JAPAN, syntype No. 35, in Medical Zoology Laboratory, Institute for Infectious Diseases, University of Tokyo, Tokyo, Japan.

DISTRIBUTION. Specimens examined--145 males, 181 females, 156 pupae, 78 larvae and 157 individual rearings (137 pupal, 20 larval) from the following locations: INDIA, Assam, Golaghat; INDONESIA, Ceram, Lisabata, Wahari; Java, Rawaloh, Tjibodas, Mt. Gede, Tijlatjap; New Guinea, Tanah Merah, Upper

Digul River; Sumatra, Bengkoelem, Blang Kedjeren, Dermaja, Dramajoe, Benkoclen, Kotta Tjane, Mocra Tebo; MALAYSIA, Pahang, Cameron's Highlands; Sarawak, Kuching; Selangor, Kuala Lumpur, Ulu Gambok; Segambut; PHILIPPINES, Batangas, Pto. Tomas; Leyte, Jinamoc Is.; Luzon, La Union, Anastacio, Bacnotan; Mindoro, Caminawit, Kabakan, San Jose; Palawan, Puerta Princisa; Samar, San Antonio, Calaccad, Tawi Tawi Is.; SOLOMON ISLANDS, Bunana; New George Is., Munda; SOUTH VIETNAM, An-Khe, Plei Ku; THAILAND, Khon Kaen; Lampang; Maha Sarakham; Nakhon Ratchasima; Nan; Narathiwat; Songkhla; Ubon Thani; Talum. Other distribution. ADMIRALTY ISLANDS (Belkin 1962: 427, Iyengar 1955: 42); AUSTRALIA, Northern Territory, Daly River, Doctor's Gully (Edwards 1924: 372); Queensland (Edwards 1922b: 467); BURMA (Edwards 1922b: 467); Bhamo (Barraud 1934: 251); CEYLON, Matate (Senior-White 1923: 76); YORK ISLAND (Taylor 1934: 20); INDIA, Bombay Deccan, Tavargatti; Upper Assam Valley (Barraud 1928: 659); Belgaum; Bengal, Sukna, Darjeeling; Bihar, Pusa; Assam, Sibsagar (Barraud 1934: 251); Poona City (Rao and Rajagopalalan 1957: 10); INDONESIA, Sumatra, Atchin; Benkoelen, Air Prioeaka; Djambi, Moeara Tebo; Lamong, Lampong (Brug and Edwards 1931: 258); New Guinea, Inanwatan, Hollandia, P. Pam, Sokori Plain (Assam and Bonne-Wepster 1964: 98); Morotai (Bonne-Wepster 1954: 237); JAPAN, Omura, Kiushu (Yamada 1921: 76); NEW BRITAIN, Taylor 1934: 20); NEW GUINEA, Friedrich-Wilhelmshafen, Huon Golf, Simbang (Theobald 1905b: 81); PHILIPPINES, Zamboanga, Pettit Barracks; Mindanao (Dyar and Shannon 1925: 77); Rizal, Taytay, Pinagsalaan Well (Banks 1909: 548); Laguna, Los Banos (Bohart 1945: 63); Palawan, Bacungan; Samar, Osmena; Zamboanga, Mercedes, Zamboanga City (Knight and Hull 1953: 459); SOLOMON ISLANDS, Bougainville (Belkin 1962: 427); THAILAND, Nakhon Phanom (Parrish 1963b: 2); SOUTH VIETNAM, Phan Rang (Parrish 1968a: 3).

TAXONOMIC DISCUSSION. Aedes alboscuteUellatus is very similar to the following Oriental and Pacific Islands species in the adult habitus: jamesi, lowisii, oakleyi, senyavinensis, culicinus and trukensis. It can be easily separated from the first 2 species by the dark tarsi and from the latter 3 species by the broad silvery scales on the scutellum. AlboscuteUellatus differs from oakleyi by the following characters: femora II-III each with a dorsoapical silvery spot;

abdominal terga with very narrow basal white bands; and head with an anterodorsal brown spot on lateral surface; while oakleyi has: femora II-III each with a small lateroapical white spot; abdominal terga with broad basal white bands; and head entirely pale scaled.

In addition to the above features, alboscuteUellatus also has the subspiracular area with only short fine hairs and the postspiracular area without scales. The female possesses 1 large and 2 rudimentary spermathecae and shares this feature with culicinus, jamesi, lowisii and oakleyi. The illustration of the female genitalia of alboscuteUellatus by Hara (1957: 91) shows 1 large and 2 slightly smaller spermathecae and therefore must belong to some other species.

The male genitalia of alboscuteUellatus is similar to those of culicinus, jamesi, lowisii, oakleyi and senyavinensis. The following character combination can be used in separating alboscuteUellatus from the other related species: gonostylus with 9-16 short fine hairs scattered over tergal surface of expanded area; gonostylar claw with apex pointed; 3-4 accessory claws; aedeagus with 5-6 lateral teeth on each plate; basal mesal lobe with 3-4 bristles; tergum IX with 4-6 bristles on each lobe; and sternum IX with 3-5 bristles; culicinus possesses: gonostylus with 17-24 short fine hairs on tergal surface of expanded area; no accessory claws; aedeagus with 6-7 lateral teeth on each plate; basal mesal lobe with 6-10 bristles; tergum IX with 4-8 bristles on each lobe; and sternum IX with 3-5 bristles; jamesi possesses:

gonostylus with 23-24 short fine hairs on tergal surface of expanded area; 2 accessory claws; aedeagus with 4-5 lateral teeth on each plate; basal mesal lobe with 4-5 bristles; tergum IX with 5-7 bristles on each lobe; and sternum IX with 3-4 bristles; lowisii possesses: gonostylus with 1-8 short fine hairs on tergal surface of expanded area; 4-5 accessory claws; aedeagus with 6-7 lateral teeth on each plate; basal mesal lobe with 4-5 bristles; tergum IX with 3-4 bristles on each lobe; and sternum IX with 4 bristles; oakleyi possesses: gonostylus with 12-15 short fine hairs on tergal surface of expanded area; gonostylar claw with apex blunt; 2 accessory claws; aedeagus with 5 lateral teeth on each plate; basal mesal lobe with 4 bristles; tergum IX with 3-4 bristles on each lobe; and sternum IX with 5-6 bristles; and senyavinensis possesses: gonostylus with 31-34 short fine hairs on tergal surface of expanded area; 2 accessory claws; aedeagus with 5-6 lateral teeth on each plate; basal mesal lobe with 8 bristles; tergum IX with 5-6 bristles on each lobe; and sternum IX with 8 bristles.

The larva of alboscuteclatus is similar to pipersalatus and can be recognized by a difference in the shape of the comb scales and the siphon index which is 3.00-4.08 and in pipersalatus is 5.00-5.56.

BIOLOGY. In the Philippines, immatures have been collected from water in ground pools, foxholes and sunlit roadside ponds; adults have been taken biting man and cattle and resting in foxholes. Adults have also been collected feeding

on cattle and man in forests in Thailand, in the jungles of Ceram in the afternoon and in Malaysia during the evening. In Java, adults have been taken at an altitude of 4,000 feet. Immatures have been collected from jungle pools in Malaysia, from a road rut completely covered with grass in New Guinea and from clear water in a primeval forest in Sumatra.

Immatures have been found in flooded swamp areas, woodland pools, rockholes and potholes in a streambed while adults were collected biting during the daytime in forested areas of the Solomon Islands (Belkin 1962: 426). In Malaysia, Macdonald (1957: 21) states this species bites man in inland forests and has been taken at treetop levels. Macdonald and Traub (1960: 100) also record the larvae in ground pools in this country. Steffan (1966: 212) in New Guinea found larvae in shallow pools at the edge of the jungle, open areas, wheel ruts and had taken the adults in carabao baited traps. In India, larvae were collected from jungle pools (Barraud 1928: 659, 1934: 251) and adults from indoor shelters (Rao and Rajagopalan 1957: 10). Penn (1948: 245) made a larval collection in the Philippines from a permanent ditch which contained clear, stagnant water with a pH of 6.5. Females have been taken at a light in Malaysia (Edwards 1928: 53).

AEDES (AEDIMORPHUS) CAECUS (THEOBALD)

Culex caecus Theobald 1901, Monogr. Cul. 1: 413 (F*); Giles 1902, Handb., 2nd. Ed., p. 415 (F); Blanchard 1905, Moust., p. 305 (F); Theobald 1905, Genera Insec., Fasc. 26: 26; Brunetti 1907, Rec. Indian Mus. 1: 343.

Pecomomyia caeca Theobald, Theobald 1907, Monogr. Cul. 4:268 (M,F*); Theobald 1910, Monogr. Cul. 5: 260; Brunetti 1912, Rec. Indian Mus. 4: 459.

Geitonomyia Caecus (Theobald), Leicester 1908, Cul. Malaya, p. 134.

Ochlerotatus caecus Theob., Brunetti 1920, Rec. Indian Mus. 17: 137.

Aedes (Ecculex) caecus Theo., Edwards 1922b, Indian J. med. Res. 10: 467.

Aëdes (Aëdimorphus) caecus Theo., Brug 1924, Bull. ent. Res. 14: 436 (L*); Borel 1930, Coll. Soc. Path. exot. Monogr. 3: 271 (M*,F,L*); Edwards 1932, Genera Insec., Fasc. 194: 170; Barraud 1934, Fauna Brit. India, Diptera 5: 257 (M*,F,L*).

Aedes (Aedimorphus) caecus (Theo.), Barraud 1928, Indian J. med. Res. 15: 663 (M*,F); Stone et al. 1959, Thomas Say Found. 6: 191.

Aedes (Aedimorphus) caecus Theobald, Bonne-Wepster 1954, Doc. med. Geogr. Trop. 6: 237 (M,F*,L*).

FEMALE (Fig. 2). Head. Antenna dark brown, approximately 1.10 of proboscis, pedicel pale with a few small pale scales and a patch of short fine black hairs mesally, flagellomere 1 pale with a few small brown scales; clypeus dark brown, bare; maxillary palpus brown scaled, approximately 0.18 length of proboscis; proboscis brown scaled with pale scales on lateral and ventral surfaces from near base to distal 0.25, pale area somewhat broader basally, approximately 1.04 length of femur I; vertex with dorsum covered with narrow decumbent scales arranged in an anterior brown

patch and white scales laterally and posteriorly; lateral surface covered with broad pale scales and an anterodorsal dark patch; numerous dark brown erect forked scales on occiput and vertex extending anteriorly to ocular line.

Thorax. Scutal integument dark brownish-black; scutum covered with narrow curved reddish-black scales, narrow curved white scale patches on median anterior promontory area, scutal fossal areas (extending from anterior area along margin and onto lateral area), along scutal ridge from scutal angle posteromesally onto dorsocentral setal line, supra-alar area from base of wing posteromesally to dorsocentral setal line, posterior medial scutal area and along margins of prescutellar space; scutellum with a patch of narrow curved white scales and a few broad white ones on each lobe, broad scales on lateral lobes longer than on median lobe; median anterior promontory, acrostichal, dorsocentral (anterior and posterior), scutal fossal (anterior, 2-3 lateral and 1 posterior), supra-alar, several posterior medial scutal, 1 postalar callular and scutellar (lateral and median) bristles reddish-black and well developed, others absent; pleural integument dark brown; antepronotum with narrow curved white scales, several long golden to brown bristles; postpronotum covered with narrow curved scales, dark reddish-black ones anteriorly and dorsally, large lower patch of white ones, 6-7 posterior brown bristles; propleuron with a patch of broad white scales, several golden bristles; postspiracular area with a patch of broad white

scales and a few narrow covered ones anteriorly, 5-8 golden bristles; subspiracular area with 2 patches of broad white scales, lower one larger; mesepisternum with an upper and a posterior patch of broad white scales, several upper and posterior golden bristles, lower ones shorter; prealar knob with several golden bristles; paratergite with a row of moderately broad white scales on lateroventral margin; mesepimeron with a patch of broad white scales and several golden bristles on upper area; other pleural areas bare.

Legs. Coxae I-III each with several dark brown bristles, I with anterior covered with broad white scales and a patch of brown ones at about middle, II with anterior covered with broad white scales, III with an anteroventral small patch of broad white scales; trochanters I-III each with a patch of broad white scales; femora I-III each with a dorsobasal white spot and a few apical white scales on lateral surfaces, I-II each with anterior brown and a few pale scales on ventral surface, III with anterior and posterior brown with a white stripe from base to near apex, stripe broad basally and tapering to a point apically, I-II with posterior white with a brown stripe from base to apex, stripe ventral on I and dorsal on II; tibiae I-III brown, I with a posteroventral longitudinal white stripe and a dorsoapical white spot, II-III each with a posterior longitudinal white stripe, a narrow basal white band and a few dorsoapical white scales, stripe on III on apical 0.80; tarsi I-II brown with tarsomeres 1-3 each with a dorsobasal white spot;

tarsus III with tarsomeres 1-3 each with a narrow basal white band, tarsomere 4 with a dorsobasal white spot; posttarsi I-III each with 2 ungues, I-II equal, each bearing a tooth, III equal, simple. Wing. Dorsal veins covered with moderately broad brown scales; costa with a patch of broad white scales at base; ventral veins brown scaled; alula with narrow brown scales along fringe; 2 remigial bristles. Halter. Pedicel pale, capitellum white scaled with a few brown scales mesally. Abdomen. Terga brown; tergum I with a few basomedian pale scales and a rectangular patch of white scales on laterotergite; terga II-VI each with a basal white band, bands wider on III-V in Thailand specimens; tergum VII with a few basomedian and apical white scales; terga II-VII each with a large laterobasal white patch covering most of lateral surface, a few brown scales forming an indistinct dark spot toward the center of each white patch, on some specimens white patch reduced or absent on VII and brown scales more numerous on lateral surfaces of III-VI; sterna white scaled with a narrow posterior brown band on III-IV and usually a few brown scales on posterior of V-VI; terga and sterna with numerous golden bristles, mostly along posterior margins. Genitalia. Segment VIII distinctly bilobed ventroapically, retracted into segment VII; tergum IX bilobed with 3-6 bristles on each lobe; cercus long, completely extended and visible dorsally; postgenital plate with a deep median apical indentation with 4-8 bristles on each lobe; insula tongue-like, membranous, covered with tiny

spicules; 3 spermathecae, 1 large and 2 slightly smaller ones.

MALE (Fig. 2). Similar to female in general habitus.

Head. Maxillary palpus brown with segments 2-5 each with a white basal band, longer than proboscis by 0.50 length of apical segment; vertex with narrow scaled area reduced.

Legs. Posttarsi I-III each with 2 ungues, I-II with ungues unequal, each bearing a tooth, III equal, simple. Abdomen.

Terga II-VII each with a narrow dorsobasal white band connected to a laterobasal white patch; tergum VIII completely white scaled; sterna III-VIII with a narrow posterior brown band. Genitalia (Fig. 15). Tergum IX strongly bilobed with 4-8 bristles on each lobe, entire surface covered with minute spicules; gonocoxite long and moderately broad, dorsal surface covered with scattered short fine bristles and a few moderately long ones on 0.30 of lateroapical margin, numerous long stout bristles along lateral margin from base to apex, ventral surface with long stout bristles on apical 0.25 and along distal 0.60 of sternomesal margin, a few moderately long bristles below and mixed with long ones, scattered scales on lateral and ventral surfaces; gonostylus with pedicel long and narrow, base somewhat broader, distal 0.38 expanded into a mesal lobe and a lateral, narrow, apically rounded horn attached approximately 0.78 from base with a short fine hair at apex, mesal expanded lobe with a moderately long, somewhat flattened, apically pointed gonostylar claw attached mesally near base, 3-5 short stout

bristles along apical margin, mesal one short and others each increasing in length, 3 short fine hairs along mesal margin of distal 0.50 of pedicel; basal mesal lobe short and rounded apically, distal 0.25 with 5-8 short bristles, entire surface covered with short hair-like spicules; proctiger short, paraproct with a subapical thumb-like process, cercal setae absent; phallosome with aedeagus of type I with 2 lateral plates connected basally, each plate with 6-7 short blunt lateral teeth on distal 0.58 and covered with a dorsal flap, paramere long, approximately 0.90 length of lateral plate; sternum IX large, entire surface covered with minute spicules, 7-15 bristles near center.

PUPA (Fig. 22). Chaetotaxy as figured and recorded in Table 2. Patches of spicules on middorsal ridge of cephalothorax extending to metanotum, on metanotum mesally between hairs 10-C and on abdomen between hairs 1-I. A minute additional hair (4a) on III-V between bases of hairs 4 and 5. Hair 5-C with 2-5 branches; 7-C with 2-4 branches; 8-C with 5-7 branches. Respiratory trumpet. Lightly pigmented; with scattered minute spicules on distal 0.75 of inner surface; index 3.67-4.21, average 3.85. Metanotum. Hair 10-C with 7-11 branches; 12-C with 5-8 branches. Abdomen. Hair 5-I with 6-10 branches; 1-II with 20-32 branches; 4-II with 2-5 branches; 1-III with 5-8 branches; 6-VI single or double; 1-VII with 2-5 branches; 6, 9-VII with 3-7 branches; 11-VII single. Paddle. Ovoid; with very minute serrations along basal 0.55 of outer margin; minute spicules on distal

dorsolateral 0.25 of outer surface; midrib does not reach apex; hair 1-P short, single; index 1.14-1.47, average 1.25.

LARVA (Fig. 29). Chaetotaxy as figured. Head. Hairs 1, 3, 14-C single; 4-C with 4-8(5) branches; 5-C with 5-7(5) branches; 6-C with 4-5(4) branches; 7-C with 7-11(9) branches; 8, 10-C with 2-4(3) branches; 9-C with 3-4(3) branches; 11-C with 4-10(6) branches; 12-C with 5-8(5) branches; 13-C with 5-7(6) branches; 15-C with 4-6(5) branches; basal maxillary hair single; mental plate with 22-24(22) teeth. Antenna. Lightly pigmented; spicules scattered over entire shaft, more numerous on basal 0.50; hair 1-A with 5-7(5) branches, inserted at 0.45-0.52 from base; 2-A long; 3-A approximately 0.50 length of 2-A. Thorax. Hair 0-P with 5-12(5) branches; 1, 5, 6, 10, 12-P single; 2, 8-P double; 3-P with 2-4(3) branches; 4, 11-P with 2-4(2) branches; 7-P double or triple (3); 9-P single to triple (2); 14-P single to double (1); 1-M with 3-6(3) branches; 2-M with 1-5(1) branches; 3, 11-M single to double (1); 4-M with 3-7(3) branches; 5, 7, 10, 12-M single; 6-M with 4-7(5) branches; 8, 9-M with 5-9(7) branches; 13-M with 4-10(8) branches; 14-M with 5-9(6) branches; 1, 12-T single to triple (1); 2-T with 3-6(5) branches; 3-T with 6-16(9) branches; 4-T with 3-5(4) branches; 5, 10-T single; 6-T with 2-4(3) branches; 7-T with 7-10(9) branches; 8-T with 4-7(5) branches; 9-T with 5-8(7) branches; 11-T single or double (1); 13-T with 6-9(8) branches. Abdomen. Hairs 0, 4, 14-VIII single; 1-VIII with 5-8(6) branches; 2-VIII with

2-4(3) branches; 3-VIII with 8-15(12) branches; 5-VIII with 4-7(5) branches; comb with 23-32(24) scales arranged in 3 irregular rows, scales short and bluntly rounded with short stout denticles along lateral and apical margins; 1, 3-X single; 2-X with 9-12(11) branches; ventral brush varies from 9 hairs on grid and 2 precratal ones to 10 hairs on grid and 2 precratal ones, usually with 10 hairs on grid and 1 precratal hair; saddle lightly pigmented with minute ridges, incompletely rings segment, with a few spicules along posterior margin, acus absent; 4 anal gills long, each with a broad base and tapering to a pointed apex. Siphon.

Lightly pigmented with ridges over entire surface; 2-4 rows of stout spicules circling apex; usually a dorsal and a ventral patch of spicules at about middle of siphon, these patches vary considerably from one to both absent to both extending over 0.45 of the siphon; acus absent; index 3.13-3.47; pecten with 16-23(21) teeth, apical 2-3 teeth longer, smooth and wider spaced than remainder which have a slender attenuate filament with 1-3 basal denticles; hair 1-S with 4-6(5) branches, inserted at 0.77-0.83 from base.

TYPE DATA. Culex caecus Theobald, holotype female, Klang Mangrove Swamp, Selangor, MALAYSIA, 28 October 1899, A. L. Butler, in British Museum (Natural History).

DISTRIBUTION. Specimens examined--398 males, 623 females, 346 pupae, 543 larvae and 569 individual rearings (341 pupal, 228 larval) from the following locations: CAMBODIA, Phnom-Penh; CHINA, Shanghai, Yunnan; EAST PAKISTAN, Chittagong Hill Tracts, Rangamatti; INDIA, Assam, Chabua,

Dibrugarh, Doom Dooma, Tezpur; Malabar Coast; INDONESIA, Ceram, Ilatoenora; Java, Batavia, Gomrong, Padaherang, Pelaboean Ratoe, Rawallah, Uodjowarna; Sumatra (?), Katta Tjane; MALAYSIA, Kedah, Changlum, Sintok F. R.; Kelantan, Bertam; Pahang, Bt. Belong, Chegar, Kuala Lipis, Merapoh, Perah; Perlis, Bt. Bintang F. R., Chior F. R., Kg. Gunong, Kg. Prok Buah, Mata Ayer, To'Kayaman; Selangor, Ampang F. R., Klang Mangroves, Puchong, Segambut, Ulu Gombak, Ulu Klang; Trengganu, Kula Brang, Marang; Segambut, Serdang; PHILIPPINES, Palawan, Panitian; SINGAPORE; SOUTH VIETNAM, An-Khe, Bu Dop, Duc My, Tay Minh; THAILAND, Chiang Mai; Kanchanaburi; Khon Kaen; Lampang; Mae Hongson; Nakhon Ratchasima; Nakon Si Thammarat; Nan; Narathiwat; Phangnga; Ranong; Songkhla; Tak. Other distribution. BURMA, Rangoon (Barraud 1934: 258); EAST PAKISTAN, Rangamatti, Chittagong Hill Tracts (Barraud 1934: 258); INDIA, Assam, Dinapur; Bengal, Sukna; Colaghat (Barraud 1934: 258); E. Himalayas (Theobald 1910a: 21); INDONESIA, New Guinea; Sumatra (McDonald 1957: 21); Sumatra, Atchin, Kotta Tjane; Djambi, Moeara Tebo (Brug and Edwards 1931: 258); MALAYSIA, Selangor, Kepong, Panjang (McDonald 1957: 21); NEPAL, Gandaki, Kaski, Pokhara (Joshi et al. 1965: 139); SOUTH VIETNAM (Borel 1930: 271); THAILAND, Chieng Moeang (Causey 1937: 413).

TAXONOMIC DISCUSSION. Aedes caecus shares a number of characters with vexans which became evident during this study when a number of adult female caecus were found in several museum collections labeled as vexans. It can be separated from vexans by the following features: femur II with anterior brown scaled; scutum with 3-4 bristles on scutal fossal area; scutellum with both narrow curved and broad white scales on each lobe; postspiracular area with 5-6 bristles; prealar knob without scales; and female palpus brown while vexans has: femur II with white scales intermixed with brown ones on anterior; scutum with 7-10 bristles on scutal fossal area; scutellum with narrow curved golden-white scales on each lobe; postspiracular area with 8-9 bristles; prealar knob with a few broad white scales; and

female palpus with apex white scaled. Caecus also superficially resembles culicinus from which it is easily distinguished by the banded tarsi.

The pupa is characterized by the following features: a large patch of spicules mesally between abdominal hairs 1-I; hairs 4a-III-V minute; hairs 10-V-VI long and single; and hair 7-VI long and single.

The larval stage resembles orbitae and is discussed under that species.

Edwards (1913: 228) synonymized Aedes suknaensis Theobald with Aedes imprimens Walker but later (1934: 170) he questionably included it with caecus. Barraud (1928: 663) listed suknaensis as a synonym of imprimens but stated that he thought suknaensis and caecus were possibly conspecific. In this same article (Plate 61, Fig. 1) he also illustrated the male genitalia of caecus but mistakingly called it imprimens. Later, Barraud (1934: 257) followed Edwards and listed suknaensis as a synonym of caecus. I have examined a cotype of suknaensis from Sukna, India, in the British Museum (Natural History) and find it not to be caecus but very similar to imprimens. It differs, however, from imprimens in having denser patches of scales on the pleural thoracic areas and scutellum and possessing a number of short fine golden hairs mixed with the single patch of broad white scales on the subspiracular area. Aedes suknaensis belongs in the subgenus Edwardsaedes Belkin and may be a distinct species from imprimens, but since no males

have been found and the habitus of the adults are very similar I am retaining it with imprimens for the present.

Aedes caecus can be separated from imprimens by having 2 patches of scales on the subspiracular area.

BIOLOGY. In Thailand, immatures have been collected from water in a rice paddy, ground pools, pits, puddles, elephant tracks and a posthole. Larvae in South Vietnam were taken from water in a tire, marshy depression, rock pool, foxhole, ground pools, artificial container, pool in a concrete piling and a jungle pool. In Java, larvae were collected in wheel ruts and adults taken indoors. Adults were collected biting cattle, and larvae from hoofprints in Malaysia. Larvae in India were found in muddy puddles and a swamp.

Larvae were collected from a buffalo wallow on a high plateau in Thailand (Causey 1937: 413); ground pools in China (Chow 1949: 129); and natural pools in open jungle in India (Barraud 1934: 258) and New Guinea (Steffan 1966: 212). In Malaysia, adults readily fed on man and domestic animals and immatures were collected from pools and earthenware pots (Macdonald 1957: 21).

AEDES (AEDIMORPHUS) CULICINUS EDWARDS

Aedes (Ecculex) culicinus Edwards 1922a, Indian J. med. Res. 10: 271 (M*, F); Edwards 1922b, Indian J. med. Res. 10: 467.

Aedes (Aedimorphus) culicinus (Edw.), Barraud 1928, Indian J. med. Res. 15: 667 (M*, F).

Aedes (Aedimorphus) culicinus Edwards, Edwards 1932,
Genera Insec., Fasc. 194: 169; Barraud 1934, Fauna
Brit. India, Diptera 5: 252 (M*,F).

Aedes (Aedimorphus) culicinus Edwards, Stone et al. 1959,
Thomas Say Found. 6: 191.

FEMALE (Fig. 3). Head. Antenna dark brown, approximately equal in length to proboscis, pedicel dark with a few small dusky scales and a patch of short fine brown hairs mesally, flagellomere 1 with a few dusky scales; clypeus dark, bare; maxillary palpus brown scaled, approximately 0.17 length of proboscis; proboscis brown scaled with a pale ventral stripe extending from near base to distal 0.25, approximately 1.06 length of femur I; vertex with dorsum covered with narrow decumbent scales arranged in an antero-median diamond-shaped brown group and the remainder white; lateral surface covered with broad white scales, an anterodorsal dark patch and a dusky area anterior to the antepnotum; numerous dark brown erect forked scales on occiput and vertex extending anteriorly to the ocular line. Thorax. Scutal integument dark brown; scutum covered with narrow curved reddish-brown scales; narrow curved white scales forming patches on anterior promontory area, scutal fossal areas (one on anterior extending along margin onto lateral area and a patch on posterior area), scutal angles, supraalar areas, posterior medial scutal area and along lateral margins of prescutellar space; scutellum with a patch of narrow curved white scales on each lobe; median anterior promontory, acrostichal, dorsocentral (anterior and

posterior), scutal fossal (anterior, 3-4 lateral, 1-2 median and 1 posterior), supra-alar, several posterior medial scutal, 1 postalar callular and scutellar (lateral and median) bristles reddish-black and well developed; pleural integument brown; antepronotum with narrow curved white scales and some moderately broad ones, several long brown bristles; postpronotum with narrow curved brown scales dorsally and white ones posteriorly, a lower posterior patch of broad white scales, 5-7 posterior brownish bristles; propleuron with a patch of broad white scales, several pale bristles; postspiracular area with a patch of broad white scales, 5-7 golden bristles; subspiracular area with 2 patches of broad white scales, lower one larger; mesepisternum with an upper and a posterior patch of broad white scales, several upper and posterior pale bristles, lower ones shorter; prealar knob with several pale brown bristles; paratergite with a row of broad white scales; mesepimeron with a patch of broad white scales and several pale bristles on upper area; other pleural areas bare.

Legs. Coxae I-III each with several pale bristles, I with anterolateral white scales and a lateral brown patch, II with anterior white scaled; trochanters I-III each with a patch of broad white scales; femora I-III each with a few pale lateral scales at apex, II-III each with an anteroventral white stripe, wider on III, I-III each with a posterior broad white longitudinal stripe from base to approximately 0.75, stripe dorsal on I and ventral on II-III;

tibiae I-III with anterior brown, a few dorsal and lateral pale scales at apices, posterior brown with a longitudinal pale stripe, I with stripe posteroventral, II-III with stripe posteromedian; tarsi I-III brown; posttarsi I-III each with 2 ungues, I-II equal, each bearing a tooth, III equal, simple. Wing. Dorsal veins covered with moderately broad brown scales; costa with white scales at base and on posterior at humeral cross vein; ventral veins brown scaled; alula with narrow brown scales along fringe; 2 remigial bristles. Halter. Pedicel pale, capitellum white scaled. Abdomen. Terga brown; tergum I with a few dorsomedian white scales and a rectangular patch of white scales on laterotergite; terga II-VI each with a narrow dorsobasal white band; tergum VII with a triangular dorsobasal pale patch; terga II-VI each with a large laterobasal white spot, a few brown scales in center of spots, VII with a few lateromedian white scales; sterna pale scaled with lateromedian pale brown spots; terga and sterna with numerous pale golden bristles, mostly along posterior margins. Genitalia. Segment VIII distinctly bilobed ventroapically, retracted into segment VII; tergum IX bilobed with 6-10 bristles on each lobe; cercus long, 0.60 extended and partially visible dorsally; postgenital plate with a deep median apical indentation with 4-8 bristles on each lobe; insula tongue-like, membranous, covered with tiny spicules; 3 spermathecae, 1 large and 2 rudimentary ones.

MALE (Fig. 3). Similar to female in general habitus.

Head. Maxillary palpus with dorsal pale scale patches on

middle of segments 2 and 3, longer than proboscis by length of apical segment; vertex without anterodorsal dark scale patch on lateral surface. Legs. Posttarsi I-III each with 2 ungues, I-II with ungues unequal, each bearing a tooth, III equal, simple. Wing. Dorsal veins completely brown scaled. Abdomen. Tergum I with a lateral band of white scales on laterotergite; terga II-VIII each with a narrow dorsobasal white band, usually 2-4 white scales on latero-median surfaces of II-VII. Genitalia. Tergum IX bilobed with 4-8 bristles on each lobe, entire surface covered with minute spicules; gonocoxite long and moderately broad, dorsal surface with a large dense patch of short bristles along tergomesal margin from near base to distal 0.30, numerous long stout bristles on lateral margin from base to apex, ventral surface with similar bristles on distal 0.25 with moderately long and short ones proximally, scattered scales on lateral and ventral surfaces; gonostylus with pedicel short and broad, distal 0.50 greatly expanded with a laterotergal horn-like flap covered with numerous long fine hairs and terminating in an apical point, mesal margin of expanded portion with a short flat curved pigmented gonostylar claw mesally near middle, a patch of 6-13 fine hairs basal to claw and a tergal patch of 5-9 similar ones, 8-11 fine hairs along apical margin; basal mesal lobe short and rounded apically, distal 0.50 with 6-10 short bristles, entire surface covered with short hair-like spicules; proctiger short, paraproct with a subapical thumb-like process, cercal setae absent;

phallosome with aedeagus of type I with 2 lateral plates connected basally, each plate with 6-7 short, blunt, lateral teeth on distal 0.54 and covered with a dorsal flap, paramere long, approximately 0.78 length of lateral plate; sternum IX large, entire surface covered with minute spicules, 3-5 bristles near center.

PUPA (Fig. 23). Chaetotaxy as figured and recorded in Table 3. Cephalothorax. Hair 5-C with 4-6 branches; 7-C with 3-5 branches; 8-C with 5-9 branches. Respiratory trumpet. Moderately pigmented; with scattered minute spicules on distal 0.65 of inner surface; index 3.61-4.90, average 4.37. Metanotum. Hair 10-C with 6-9 branches; 12-C with 4-7 branches. Abdomen. Hair 5-I with 7-12 branches; 1-II with 14-20 branches; 4-II with 2-5 branches; 14-II single; 1-III with 7-13 branches; 6-VI double or triple; 1-VII with 5-8 branches; 6-VII with 6-9 branches; 9-VII with 4-5 branches; 11-VII double. Paddle. Ovoid; with very minute serrations along basal 0.55 of outer margin; tiny spicules along apical 0.45 of outer and apical 0.30 of inner margins; midrib does not reach apex; hair 1-P short, single or double; index 1.13-1.34, average 1.22.

LARVA (Fig. 30). Chaetotaxy as figured. Head. Hairs 1, 3, 14-C single; 4-C with 5-7(7) branches; 5-C with 3-4 (3) branches; 6-C triple; 7-C with 4-6(6) branches; 8-C with 2-6(2) branches; 9-C with 2-5(5) branches; 10-C single or double (2); 11-C with 2-5(3) branches; 12-C with 3-4(4)

branches; 13-C with 4 branches; 15-C double; basal maxillary hair single; mental plate with 23-25 teeth. Antenna. Moderately pigmented; scattered stout spicules over entire shaft, spicules somewhat longer past middle; hair 1-A with 5-8(7) branches, inserted at 0.37-0.42 from base; 2-A long; 3-A approximately 0.96 length of 2-A. Thorax. Hair 0-P with 7-10 (8) branches; 1, 5, 6, 8, 10, 12, 14-P single; 2, 7, 11-P double; 3-P with 3-4(3) branches; 4-P double or triple (2); 9-P single or double (2); 1-M with 3-8(4) branches; 2-M with 2-4(3) branches; 3-M single or double (1); 4-M double or triple (3); 5, 7, 10-12-M single; 6-M with 4-6(4) branches; 8-M with 3-4(4) branches; 9-M with 3-6(5) branches; 13-M with 4-5(5) branches; 14-M with 5-8(5) branches; 1-T single to triple (3); 2-T with 4-13(6) branches; 3-T with 4-8(5) branches; 4, 9-T with 2-4(3) branches; 5, 10-12-T single; 6-T single or double (2); 7-T with 5-6(5) branches; 8-T with 4-6(4) branches; 13-T with 4-7(5) branches. Abdomen. Hairs 0, 14-VIII single; 1-VIII with 3-4(4) branches; 2-VIII double; 3-VIII with 7-10(8) branches; 4-VIII double or triple (2); 5-VIII with 5-7(5) branches; comb with 14-20(17) scales arranged in 2 irregular rows, scales each with a long stout pointed median spine and short denticles along lateral margins of base; 1-X double or triple (2); 2-X with 8-10(8) branches; 3-X single; ventral brush varies from 8 hairs on grid and 4 precratal ones to 9 hairs on grid and 4 precratal ones; saddle lightly pigmented, incompletely rings segment, with a few spicules along posterior margin, acus absent; 4

anal gills long, tapering to a blunt apex. Siphon. Lightly pigmented; acus absent; index 3.88-4.50, pecten with 11-14 (11) teeth, apical 2-3 teeth smooth and wider spaced than remainder which have a slender attenuate filament with 1-2 basal denticles; hair 1-S with 3-5(4) branches, inserted at 0.70-0.72 from base.

TYPE DATA. There has been some confusion about the location of the types of Aedes (Ecculex) culicinus Edwards. In the original description of the species, Edwards (1922a: 272) states the holotype male and allotype female were collected at Delhi, INDIA, April 1911, Major S. R. Christophers, and deposited in the Central Malaria Bureau, Kasauli, and 1 paratype female from Amritsar, INDIA, April 1911, Major S. R. Christophers, was deposited in the British Museum. Barraud (1928: 667) lists the holotype male in the Central Malaria Bureau and the allotype female and paratype female in the British Museum but in 1934 (page 252) he states all the types are in the British Museum. Stone et al. (1959: 191) lists the holotype male and allotype female in the Malaria Institute of India, Delhi, India. I have examined the collection in the British Museum (Natural History) and only the paratype female from Amritsar is there. The primary types are in the collection at the National Institute of Communicable Diseases, Delhi, India, which received the collections from the Central Malaria Bureau.

DISTRIBUTION. Specimens examined--16 males, 101 females,, 100 pupae, 2 larvae, 100 individual rearings (100 pupal), from the following locations: CAMBODIA, Kiriro; INDIA, Punjab, Amritsar; THAILAND, Kanchanaburi; Khon Kaen; WEST PAKISTAN, West Punjab, Lahore. Other distribution. INDIA, Delhi, Kasauli (Edwards 1922a: 272); Karnal (Barraud 1934: 252); WEST PAKISTAN, Lahore, Changa Manga National Forest (Aslamkhan and Salman 1969: 193).

TAXONOMIC DISCUSSION. The adult habitus and female and male genitalia of culicinus are similar to alboscuteclatus and are discussed under that species. The most distinctive features of the adults are: scutellum with narrow white curved scales on each lobe; postpronotum with a few posterior broad white scales in addition to narrow curved ones; tarsi dark scaled; and female with 1 large and 2 rudimentary spermathecae.

The most distinctive characters of the larvae are: comb of 14-20 scales each of which has a long stout pointed median spine and stout denticles along lateral margins of the base; pecten of 11-14 teeth; siphon index of 3.88-4.50; head hair 6-C triple; and metathoracic hair 9-T double or triple.

BIOLOGY. Immatures were collected from ground pools in Thailand and Malaysia.

Aslamkhan and Salman (1969: 185, 186, 189, 193) in West Pakistan list culicinus as making up 7.58 percent of the daytime and 12.4 percent of the nighttime human biting mosquito collections. This species, however, preferred to feed on cattle to man at a ratio of 3:1 during nighttime tests. Adults made up 31.6 percent of light trap mosquito collections.

The immatures are found in ground pools with grassy margins and decomposing algae on the bottom. Aedes culicinus occurs in West Pakistan throughout the year but the numbers increase from April until a peak population is reached in July when relative humidity is very high and breeding places are abundant.

AEDES (AEDIMORPHUS) LOWISII (THEOBALD)

Reedomyia lowisii Theobald 1910, Monogr. Cul. 5: 257 (M*,F*); Brunetti 1912, Rec. Indian Mus. 4: 487.

Ochlerotatus lowisii Theob., Brunetti 1920, Rec. Indian Mus. 17: 140.

Aedes (Ecculex) lowisi Theobald, Edwards 1922b, Indian J. med. Res. 10: 466.

Ochlerotatus lowisi Theobald, Senior-White 1923, Cat. Indian Insects, Cul., p. 79.

Aedes (Aedimorphus) lowisi (Theo.), Barraud 1928, Indian J. med. Res. 15: 658(F); Stone et al. 1959, Thomas Say Found. 6: 194.

Aedes (Aedimorphus) lowisi Theobald, Edwards 1932, Genera Insec., Fasc. 194: 168; Barraud 1934, Fauna Brit. India, Diptera 5: 250 (M,F).

Aedes (Aedimorphus) mindoroensis Knight and Hull 1951, Pacif. Sci. 5: 199 (M*,F); Knight and Hull 1953, Pacif. Sci. 7: 459 (M,F); Stone et al. 1959, Thomas Say Found. 6: 194. NEW SYNONYMY.

FEMALE (Fig. 4). Head. Antenna dark brown, approximately 0.91 length of proboscis, pedicel brown with several small pale scales and a patch of short fine brown hairs mesally, flagellomere 1 with a few small dark scales; clypeus dark, bare; maxillary palpus dark, brown scaled, approximately 0.17 length of proboscis; proboscis dark

brown scaled with a pale ventral stripe extending from near base to distal 0.25, pale area narrow basally becoming broad distally, approximately 1.18 length of femur I; vertex with dorsum covered with narrow decumbent scales arranged in an anteromedian diamond-shaped dark group and the remainder golden; lateral surface covered with broad pale scales, an anterodorsal dark patch and a dusky area anterior to antepnotum; numerous long dark brown erect forked scales on occiput and vertex extending anteriorly to ocular line.

Thorax. Scutal integument reddish-brown; scutum covered with narrow curved reddish-black scales, scattered narrow curved white scales forming indistinct spots on anterior promontory area, supra-alar areas, and posterior medial scutal area, similar scales forming a distinct pair of small circular patches on both anterior and posterior scutal fossal areas; scutellum with a patch of broad silvery scales on each lobe; median anterior promontory, acrostichal, dorso-central (anterior and posterior), scutal fossal (anterior, 1 lateral and 1-2 median), supra-alar, several posterior medial scutal, 1 postalar callular and scutellar (lateral and median) bristles black and well developed, others absent; pleural integument dark brown; antepnotum with a few narrow curved pale scales, several long dark bristles; postpnotum with scattered narrow curved dark scales on dorsal 0.50, 5-6 posterior long brownish-black bristles; propleuron with a patch of broad pale scales, several short golden bristles; postspiracular area with 5-7 brown or black bristles; subspiracular area with a few narrow brownish hair-like

scales; mesepisternum with an upper and a posterior patch of broad silvery scales, several upper and posterior dark bristles, lower ones shorter; prealar knob with several golden-brown bristles; paratergite bare; mesepimeron with a patch of broad silvery scales and several brown bristles on upper area; other pleural areas bare. Legs. Coxae I-III each with several golden bristles, I with anterior covered with broad brownish scales and a small patch of broad white ones dorsally and one ventrally, II with a patch of broad white scales anteriorly, III with a few broad white scales anteroventrally; trochanters I-III each with a patch of broad white scales; femur I with an anterior and a posterior apical white spot, II-III with a dorsoapical white spot, I-II with anterior brown, I with a posterior narrow dorsal pale line from base to apex, pale area broad basally and tapering apically, I with a posteroventral white stripe, II with a posterodorsal white stripe; III brown with anterior and posterior ventrobasal white areas, areas broad basally and tapering to a point at about 0.25 from apex; tibiae I-III brown, each with a dorsoapical white spot; tarsi I-III brown, I with tarsomere 1 having a few dorsoapical yellowish scales, tarsomere 2-4 each with a few dorsobasal and dorsoapical yellowish scales, tarsomere 5 covered with yellowish scales, II with tarsomere 1 having a few dorsoapical yellowish scales, tarsomere 2 with a few dorsobasal and dorsoapical yellowish scales, tarsomere 3-4 each with a narrow basal yellowish band and a few dorsoapical yellowish scales,

tarsomere 5 completely covered with yellowish scales, III with tarsomere 1 having a few dorsoapical pale scales, tarsomeres 2-4 each with a narrow pale basal band and a few dorsoapical pale scales, tarsomere 5 completely pale scaled. Wing. Dorsal veins covered with moderately broad brown scales; costa with a patch of broad silvery scales at base; ventral veins brown scaled; alula with narrow brown scales along fringe; 2 remigial bristles. Halter. Pedicel pale, capitellum brown scaled. Abdomen. Terga brown with a few dorsobasal pale scales forming narrow bands on III-VI, a small triangular dorsobasal pale spot on VII; tergum I with a rectangular patch of white scales on laterotergite; terga II-VII with large laterobasal white spots; sterna with pale basal scales and brown apical ones, apical brown band becomes broader on posterior sterna; terga and sterna with numerous golden bristles, mostly along posterior margins. Genitalia. Segment VIII distinctly bilobed ventroapically, retracted into segment VII; tergum IX bilobed with 4-5 bristles on each lobe; cercus long, 0.75 extended and visible dorsally; postgenital plate with a deep median apical indentation with 4-6 bristles on each lobe; insula tongue-like, membranous, covered with tiny spicules; 3 spermathecae, 1 large and 2 rudimentary ones.

MALE. Similar to female in general habitus. Head. Maxillary palpus brown, longer than proboscis by length of apical segment. Thorax. Anteprenotum with a few broad silvery scales. Legs. Posttarsi I-III each with 2 ungues,

I-II with unguis unequal, each bearing a tooth, III unequal, simple. Abdomen. Tergum I with a lateral band of silvery-white scales on laterotergite; terga III-VII with basal bands of white scales; segment VIII removed with terminalia and coloration lost. Genitalia. Tergum IX slightly bilobed with 3-4 bristles on each lobe, entire surface covered with minute spicules; gonocoxite long and moderately broad with short bristles scattered over dorsal surface, long stout bristles along outer lateral margin from base to apex, ventral surface with long stout bristles on distal 0.55, most numerous along sternomesal margin, scattered short ones on proximal 0.45, scattered scales on lateral and ventral surfaces; gonostylus with pedicel narrow to moderately broad, distal 0.50 expanded with a lateroapical horn-like flap bearing numerous short fine hairs, mesal margin of expanded portion with a basal short, flattened pigmented gonostylar claw and 4-5 short stout accessory bristles, 6-7 short bristles at apex, 1-2 short hairs on the tergal surface on the type of mindoroensis and 7-8 on the type of lowisii; basal mesal lobe short and rounded apically, apical 0.30 with 4-5 short bristles, entire surface covered with short hair-like spicules; proctiger short, paraproct with a small subapical thumb-like process, cercal setae absent; phallosome with aedeagus of type I with 2 lateral plates connected basally, each plate with 6-7 short blunt lateral teeth on distal 0.50 and covered with a dorsal flap, paramere long, approximately

0.90 length of lateral plates; sternum IX large, entire surface covered with minute spicules, 4 bristles near the center.

PUPA AND LARVA. Not known.

TYPE DATA. Reedomyia lowisii Theobald, syntypes female and male, Andaman Islands, INDIA, Lowis, in British Museum (Natural History); Aedes (Aedimorphus) mindoroensis Knight and Hull, holotype male and 4 paratype females, Calapan (erroneously printed "Calopan" on label), Mindoro Island, PHILIPPINES, 1 February 1916, Bottcher, in British Museum (Natural History).

DISTRIBUTION. Specimens examined--3 males and 14 females from the following locations: INDIA, Andaman Islands; INDONESIA, Celebes, Paloe, Hadjene; C. Sulawesi, Lambarese; PHILIPPINES, Calapon. Other distribution. INDONESIA, Moluccas (Stone et al. 1959: 194, Steffan 1966: 212); MALAYSIA, Sarawak (Moulton 1914: 47).

TAXONOMIC DISCUSSION. The adult habitus and female and male genitalia of lowisii are very similar to alboscuteclatus and are discussed under that species. The most distinctive features of the adults are: scutellum with broad silvery scales on each lobe; postspiracular area without scales; subspiracular area with only short fine hairs; paratergite bare; tarsi banded with pale scales, tarsomeres 5 yellow scaled; and female with 1 large and 2 rudimentary spermathecae.

BIOLOGY. Larvae were collected in shallow water in a primeval forest and adults were taken biting man and resting

in a cowshed in Celebes. Adults were also collected from a Malaise trap in Indonesia.

AEDES (AEDIMORPHUS) MEDIOLINEATUS (THEOBALD)

Culex trilineatus Theobald 1901, Monogr. Cul. 2: 105 (F*); Giles 1902, Handb. 2nd Ed., p. 464(F); Blanchard 1905, Moust., p. 330(F); Theobald 1905, Genera Insec., Fasc. 26: 27; Theobald 1910, Monogr. Cul. 5: 359; Brunetti 1912, Rec. Indian Mus. 4: 476.

Culex mediolineatus Theobald 1901, Monogr. Cul. 2: 113(F); Giles 1902, Handb., 2nd Ed., p. 431(F); Blanchard 1905, Moust., p. 369(F); Theobald 1905, Genera Insec., Fasc. 26: 27; Brunetti 1907, Rec. Indian Mus. 1: 349.

Ochlerotatus mediolineatus Theo., Edwards 1913, Bull. ent. Res. 4: 228; Brunetti 1920, Rec. Indian Mus. 17: 137; Senior-White 1923, Cat. Indian Insects, Cul., p. 79.

Aedes (Ecculex) mediolineatus Theobald, Edwards 1922b, Indian J. med. Res. 10: 467.

Aedes (Aedimorphus) mediolineatus (Theo.), Barraud 1928, Indian J. med. Res. 15: 665 (M*,F); Stone et al. 1959, Thomas Say Found. 6: 194.

Aëdes (Aëdimorphus) mediolineatus Theo., Borel 1930, Coll. Soc. Path. exot. Monogr. 3: 268 (M*,F,L*); Edwards 1932, Genera Insec., Fasc. 194: 171.

Aëdes (Aëdimorphus) mediolineatus (Theobald), Barraud 1934, Fauna Brit. India, Diptera 5: 263 (M*,F).

FEMALE (Fig. 5). Head. Antenna dark brown, approximately 0.94 length of proboscis, pedicel pale with a few small brown scales and a patch of short fine brown hairs mesally, flagellomere 1 with a few small pale brown scales; clypeus brown, bare; maxillary palpus golden scaled, approximately 0.22 length of proboscis; proboscis golden scaled with apical 0.25 dusky, approximately 1.22 length of femur I; vertex with dorsum covered with narrow curved decumbent

golden scales; lateral surface covered with broad golden scales, some specimens also with a small anterodorsal dark spot; numerous golden-brown erect forked scales on occiput and vertex extending anteriorly to ocular line, erect scales somewhat darker on lateral margins of occiput. Thorax.

Scutal integument reddish-brown; scutum covered with narrow curved reddish-brown scales, narrow curved white scales forming a pair of stripes on dorsocentral areas extending from anterior scutal fossal area to scutellum, similar scales on supra-alar areas from scutal angle to posterior of wing base and on anterior and lateral margins of prescutellar space (scales nearly covering this area), narrow curved golden scales, forming a stripe on acrostichal area extending from median anterior promontory area to posterior medial scutal area; scutellum with a patch of narrow curved golden scales on each lobe; median anterior promontory, acrostichal, dorsocentral (anterior and posterior), scutal fossal (anterior, 3-5 lateral, 2-3 median and 1-2 posterior), supra-alar, several posterior medial scutal, 1 postalar callular and scutellar (lateral and median) bristles golden-brown and well developed; pleural integument light brown; antepronotum covered with narrow curved golden-white scales, several golden bristles; postpronotum covered with narrow curved scales, a few reddish-brown ones dorsally and remainder golden-white, 6-8 golden bristles; propleuron with long moderately broad and narrow golden-white scales, several golden bristles; postspiracular area with a patch of narrow

curved and a few moderately broad golden-white scales, 7-10 golden bristles; subspiracular area with a small patch of narrow curved golden-white scales; mesepisternum with an upper and a posterior patch of broad golden-white scales, several upper and posterior golden bristles, lower ones shorter; prealar knob with a few narrow golden-white scales, several golden bristles; paratergite covered with narrow curved golden-white scales; mesepimeron with a patch of broad golden-white scales and several golden bristles on upper area; other pleural areas bare. Legs. Coxae I-III each with several golden bristles; I-II each with anterior covered with broad golden-white scales; III with a few anteroventral golden-white scales; trochanters I-III each with broad white scales; femora I-III each with a small dorsoapical spot of white scales, I with anterior white with a few intermixed light brown scales ventrally, II with anterior brown with a few white scales intermixed on apical 0.25, III with anterior white with an anterodorsal brown stripe on distal 0.75, stripe broader apically, I-III with posterior white, I with a ventral brown stripe from near base to apex, II with a few pale brown scales on distal 0.25, III with a triangular patch of brown scales on dorsoapical 0.20; tibiae I-III white, I with a dorsoanterior longitudinal brown stripe, II with a ventral longitudinal brown stripe, III with a dorsal and a ventral longitudinal brown stripe and a small dorsoapical white spot; tarsi I-III brown, I with an anterior and a posterior longitudinal white stripe on tarsomeres 1-2 occasionally on 3, II with tarsomere 1 with numerous white scales

intermixed with brown ones and a dorsobasal white spot, tarsomere 2 with a few white scales intermixed with brown ones, tarsomeres 1-3 with a posterior longitudinal white stripe and occasionally on tarsomere 4, III with a dorso-basal white spot on tarsomere 1, an anterior and a posterior longitudinal white stripe on tarsomere 1 and basal 0.50 of tarsomere 2; posttarsi I-III each with 2 ungues I-II equal, each bearing a tooth, III equal, simple. Wing. Dorsal veins covered with moderately broad brown scales; costa with broad whitish scales along basal 0.33 of posterior margin; dusky scales on subcosta; ventral veins brown with white scales along basal 0.33 of posterior margin of costa, similar scales on basal 0.33 of subcosta; alula with narrow brown scales along fringe; 2 remigial bristles. Halter. Pedicel pale, capitellum golden-white scaled. Abdomen. Tergum I covered with golden-white scales, laterotergite with a rectangular patch of whitish scales; terga II-VI light brown, each with a broad median longitudinal golden-white stripe and a narrower longitudinal golden-white stripe on lateral margins, V-VI often with brown areas reduced; tergum VII covered with golden scales; sterna covered with golden-white scales; terga and sterna with numerous golden bristles, mostly along posterior margins. Genitalia. Segment VIII distinctly bilobed ventroapically, mostly retracted into segment VII; tergum IX bilobed with 7-16 bristles on each lobe; cercus long, completely extended and visible dorsally; postgenital plate with a deep median apical indentation with 6-10 bristles on each lobe; insula tongue-like,

membranous, covered with tiny spicules; 3 spermathecae, 1 large and 2 slightly smaller ones.

MALE (Fig. 5). Similar to female in general habitus.

Head. Maxillary palpus golden scaled, segments 2-5 each with a small dorsoapical brown spot, longer than proboscis by 0.50 length of apical segment. Thorax. Postspiracular area without scales; subspiracular area with a few broad white scales. Legs. Posttarsi I-III each with 2 ungues, I-II with ungues unequal, each bearing a tooth, III equal, simple. Abdomen. Tergum I white with a median brown scale patch, laterotergite with a patch of whitish scales; terga II-VII brown each with a dorsobasal triangular patch of golden-white scales on lateral margins, reaching from base to apex, VII often nearly entirely golden scaled; tergum VIII white scaled; sterna golden-white scaled, VIII with a median patch of brown scales. Genitalia (Fig. 16). Tergum IX strongly bilobed with 6-8 bristles on each lobe, entire surface covered with minute spicules; gonocoxite long and moderately broad with short bristles scattered over entire dorsal surface, lateral surface with long stout bristles from base to apex, ventral surface with long stout bristles on distal 0.45, scattered moderately long bristles mesally below long ones, somewhat more numerous along sternomesal margin, scattered scales on lateral and ventral surfaces; gonostylus with pedicel moderately broad, distal 0.50 expanded with a lateroapical horn-like flap bearing a short fine subterminal hair, mesal margin of expanded portion with a moderately long, flattened,

pigmented gonostylar claw and a short fine hair near its base, 3 short fine hairs along apex and 3-5 short fine hairs scattered over tergal surface, a lateroapical thumb-like process covered with numerous short fine hair-like spicules; basal mesal lobe short and rounded apically, apical 0.50 with 4-6 short bristles, entire surface covered with short hair-like spicules; proctiger short, paraproct with a subapical thumb-like process, cercal setae absent; phallosome with aedeagus of type I with 2 lateral plates connected basally, each plate with 6-7 short blunt lateral teeth on distal 0.40 and covered with a dorsal flap, paramere long, approximately 0.85 length of lateral plate; sternum IX large, entire surface covered with minute spicules, 2-3 bristles near the center.

PUPA (Fig. 24). Chaetotaxy as figured and recorded in Table 4. Cephalothorax. Hair 5-C with 3-5 branches; 7-C with 2-5 branches; 8-C with 2-6 branches. Respiratory trumpet. Moderately pigmented; with scattered minute spicules on distal 0.90 of inner surface; index 3.74-4.56, average 4.25. Metanotum. Hair 10-C with 11-24 branches; 12-C with 4-5 branches. Abdomen. Hair 5-I with 8-17 branches; 1-II with 17-28 branches; 4-II with 6-10 branches; 1-III with 7-18 branches; 6-VI with 2-4 branches; 1-VII with 3-6 branches; 6-VII with 8-12 branches; 9-VII with 5-11 branches; 11-VII single to triple. Paddle. Ovoid; with very minute serrations along basal 0.55 of outer margin; midrib does not reach apex; hair 1-P short, single or double; index 1.10-1.35, average 1.26.

LARVA (Fig. 31). Chaetotaxy as figured. Head. Hairs 1, 3, 14-C single; 4, 12-C with 5-9(6) branches; 5, 6-C with 4-6(5) branches; 7-C with 8-11(10) branches; 8-C double or triple (2); 9, 10-C double or triple (3); 11-C with 3-6(5) branches; 13-C with 3-5(3) branches; 15-C with 2-5(3) branches; basal maxillary hair single; mental plate with 22-23 (23) teeth. Antenna. Heavily pigmented; numerous stout spicules scattered over shaft, longer at about middle; hair 1-A with 6-13(8) branches, inserted at 0.36-0.48 from base; 2-A long; 3-A approximately equal in length of 2-A. Thorax. Hair 0-P with 6-12(7) branches; 1, 5, 6, 10, 12-P single; 2-P single or double (2); 3-P with 3-4(4) branches; 4, 8, 9-P double; 7-P triple; 11-P double or triple (2); 14-P single or double (1); 1-M with 2-5 (2) branches; 2-M single or double (2); 3, 11-M single or double (1); 4-M with 2-4(3) branches; 5, 7, 10, 12-M single; 6-M with 5-10(8) branches; 8-M with 6-12(7) branches; 9-M with 6-9(8) branches; 13-M with 3-6(5) branches; 14-M with 6-10(9) branches; 1-T single to triple (1); 2-T with 2-5(3) branches; 3-T with 6-11(8) branches; 4-T with 3-4(3) branches; 5, 10-T single; 6-T single or double (2); 7-T with 8-14(11) branches; 8-T with 3-6(4) branches; 9-T with 6-9(6) branches; 11, 12-T single or double (1); 13-T with 5-14(7) branches. Abdomen. Hairs 0, 14-VIII single; 1-VIII with 4-9(5) branches; 2, 4-VIII double or triple (2); 3-VIII with 8-18(15) branches; 5-VIII with 8-11 (10) branches; comb with 9-19(15) scales arranged in 2 irregular rows, scales with a long stout pointed median spine .

and short denticles along lateral margins; 1-X with 3-4(4) branches; 2-X with 12-15(14) branches; 3-X single; ventral brush varies from 8 hairs on grid and 4 precratal ones to 9 hairs on grid and 3 precratal ones, usually with 8 hairs on grid and 4 precratal ones; saddle moderately pigmented with minute ridges, incompletely rings segment, with a few spicules along posterior margin and small ridges over entire saddle, acus present; 4 anal gills very long and slender.

Siphon. Moderately pigmented with minute ridges over entire surface; acus present; index 5.93-7.01; pecten with 10-14 (12) teeth, apical 3-4 teeth smooth and wider spaced than remainder which have a slender attenuate filament with 1-2 lateral denticles; hair 1-S with 5-7(5) branches, inserted at 0.72-0.78 from base.

TYPE DATA. Culex mediolineatus Theobald holotype female, Thayetmyo, BURMA, August, E. Y. Watson, 94-4 and Culex trilineatus holotype female with same data as mediolineatus, both in British Museum (Natural History).

DISTRIBUTION. Specimens examined--70 males, 222 females, 79 pupae, 170 larvae and 82 individual rearings (47 pupal, 35 larval) from the following locations: BURMA, Thayetmyo; CAMBODIA, Phnon-Penh; MALAYSIA, Perlis; Kedah; SOUTH VIETNAM, An-Khe, Ben Kay, Chu-Lai, Cu-Chi, Danang, Di An, Kon Tum, Kon Tun, Long Van, Nha Trang, Phan Rang, Phnom-Penh, Pho Bai, Phu-Loi, Phuoc Vinh, Qui-Nhon, Saigon, Tan San Nhut, Vinh Thanh; THAILAND, Chiang Mai; Chon Buri; Khon Kaen; Lampang; Nakhon Ratchasima; Nan; Surat Thani; Udon Thani. Other distribution. CHINA, Hainan Island (Chu 1957: 158, 1958: 109); INDONESIA; Sumatra, Djambi, Moeara Tebo (Brug and Edwards 1931: 258); Java (Barraud 1934: 264); THAILAND, Nakhon Phanom, Takhli, Ubon (Parrish 1968b: 2); SOUTH VIETNAM, Borel 1930: 268); Phan Rang, Phu Cat, Pleiku (Parrish 1968a: 3).

TAXONOMIC DISCUSSION. Aedes mediolineatus is similar in the adult habitus to pallidostriatus. It possesses the following features: wing with anterior margin of costa dark brown scaled; femur II with anterior mainly dark scaled and anterior of femur III mainly white scaled; abdomen with dorsolateral longitudinal brown bands on terga II-IV; and postpronotum with 6-7 bristles, which distinguish it from pallidostriatus which has: wing with anterior margin of costa golden scaled; femora II-III each with anterior brown with a median longitudinal white stripe from base to apex; abdomen with terga completely golden scaled. The gonostylus of the male genitalia of mediolineatus is markedly different from that of pallidostriatus.

The pupa of mediolineatus has a very similar chaetotaxy to pallidostriatus and it is difficult to separate them. They usually can be separated by abdominal hair 1-I which has 17-30 branches in mediolineatus and 30-46 branches in pallidostriatus.

The larva of mediolineatus is also very similar to pallidostriatus but can be separated from it by thoracic hairs 0-P which has 6-12 branches and hair 1-M which has 2-5 branches, while pallidostriatus has hair 0-P with 4-5 branches and hair 1-M single.

BIOLOGY. In Thailand, immatures were collected from ground pools, flood pools, grassy pool in vegetable garden, Huey Keo city moat and a marsh and adults were taken biting man, resting in a stable, in a house and a light trap.

Larvae were collected from ground pools, tire, artificial container, ditch, marshy depression, flood pools, swamp, rock pools, wheel track, footprints and a rice paddy and adults were taken in light traps in South Vietnam.

Macdonald (1957: 21) obtained specimens of medio-lineatus that he identified as Aedes (Aedimorphus) near pallidostriatus from human bait collections in Malaysia. Adults were collected in scrub or open forest at 1,000 feet in Thailand (Scanlon and Esah 1965: 139, 143).

AEDES (AEDIMORPHUS) NIGROSTRIATUS (BARRAUD)

Aëdimorphus nigrostriatus Barraud 1927, Indian J. med. Res. 14: 549 (M*,F).

Aedes (Aedimorphus) nigrostriatus Barr., Barraud 1928, Indian J. med. Res. 15: 666 (M*,F).

Aëdes (Aëdimorphus) nigrostriatus Barraud, Edwards 1932, Genera Insec., Fasc. 194: 171; Barraud 1934, Fauna Brit. India, Diptera 5: 262 (M*,F).

Aedes (Aedimorphus) nigrostriatus (Barraud), Stone et al. 1959, Thomas Say Found. 6: 195.

FEMALE. Head. Antenna brown, approximately 1.04 length of proboscis, pedicel pale with a few small yellow scales and a patch of short fine brown hairs mesally, flagellomere 1 pale with a few small yellow scales; clypeus light brown, bare; maxillary palpus golden scaled, approximately 0.28 length of proboscis; proboscis golden scaled with a small ventrobasal patch of brown scales, approximately 1.04 length of femur I; vertex with dorsum covered with narrow curved decumbent yellow scales; lateral surface covered with

broad pale yellow scales; numerous light brown erect forked scales on occiput and vertex extending anteriorly to ocular line. Thorax. Scutal integument pale with dark reddish-brown areas forming a pair of stripes on dorsocentral areas from anterior margin to scutellum and a spot on supra-alar area anterior to wing base; scutum covered with narrow curved golden scales with narrow curved reddish-brown ones on dark areas of integument; scutellum with a patch of narrow curved golden scales on each lobe and a few reddish-brown ones on laterobasal areas of median lobe; median anterior promontory, acrostichal, dorsocentral (anterior and posterior), scutal fossal (anterior, 4-5 lateral, 1-2 median and 2-3 posterior), supra-alar, several posterior medial scutal, 1 postalar callular and scutellar (lateral and median) bristles pale brown and well developed; pleural integument light brown; antepronotum with narrow curved golden scales, several golden-brown bristles; postpronotum with narrow curved golden scales, 3-5 golden-brown posterior bristles; propleuron with broad golden scales, several golden bristles; postspiracular area with a few narrow golden scales, 5-7 golden bristles; mesepisternum with a small upper and a posterior patch of broad golden scales, several upper and posterior golden-brown bristles, lower ones white and shorter; prealar knob with several golden bristles; paratergite with a few narrow golden scales; mesepimeron with a patch of broad golden scales and several golden bristles on upper area; other pleural areas bare. Legs. Coxa I-III each with several golden-brown bristles, I-II each with

anterior covered with broad golden scales, III with a small anteroventral patch of similar scales; trochanters I-III each with broad golden scales; femora I-III golden, I with a narrow posteroventral longitudinal brown stripe from base to near apex, II with a broad anterobasal longitudinal brown stripe from base to apical 0.20 and a narrow anterior subapical brown band, III with a narrow anterior and posterior subapical brown band; tibiae I-III yellow, II with an indistinct anteroventral longitudinal brown stripe on basal 0.50; tarsi I-III yellow; posttarsi I-III each with 2 ungues, I-II equal, each with a tooth, III equal, simple. Wing. Dorsal veins covered with moderately broad golden scales except for the following brown scaled areas: apical 0.25 of costa pale brown; remigium and basal 0.50 of radius (a few yellow scales on posterior margin), apical 0.50 of radial sector, radius₂ and basal 0.50 of radius₃; media from radiomedial crossvein to furcation, basal 0.60 of media₁, and cubitus; membrane darkened in region of crossveins; ventral veins with scaling similar to dorsal ones; alula with narrow yellow scales along fringe; 1-2 remigial setae. Halter. Pedicel pale, capitellum golden scaled. Abdomen. Terga golden scaled, I with a rectangular patch of white scales on laterotergite, II-VII each with a laterobasal white scale patch; sterna golden scaled; terga and sterna with numerous golden bristles, mostly along posterior margins. Genitalia. Segment VIII distinctly bilobed ventroapically, completely retracted into segment VII;

tergum IX bilobed with 7-13 bristles on each lobe; cercus long, 0.75 extended and visible dorsally; postgenital plate with a deep median apical indentation with 5-7 bristles on each lobe; insula tongue-like, membranous, covered with tiny spicules; 3 spermathecae, 1 large and 2 slightly smaller ones.

MALE. Similar to female in general habitus. Head. Maxillary palpus golden with apical segment brown, segment 4 golden dorsally and brown laterally, segments 2-3 each with a narrow apical brown band, longer than proboscis by 0.75 length of apical segment; proboscis golden with a longitudinal brown stripe on basal 0.40 of ventral surface. Legs. Femur I also with an anteroventral brown stripe on basal 0.50; tibia III with an indistinct dorsal brown stripe; tarsus I with a few light brown apical scales on tarsomeres 3-4; posttarsi I-III each with 2 ungues, I-II with ungues unequal, each bearing a tooth, III equal, simple. Abdomen. Terga yellow scaled; sterna yellow scaled with a few brown scales on lateral surfaces of III-VI, a few brown scales along posterior margins of VI-VII. Genitalia. Tergum IX bilobed with 5-7 bristles on each lobe, entire surface covered with minute spicules; gonocoxite long and moderately broad, dorsal surface with scattered bristles, lateral surface with numerous long stout bristles from base to apex, ventral surface with a number of moderately long to long bristles and some short proximal ones, scattered scales on lateral and ventral surfaces; gonostylus with

distal 0.62 expanded into a large mesal oblong-shaped lobe and a lateral longer, narrow, strongly incurved, tapering horn which bears a row of long thin hairs mesally near middle, mesal expanded lobe with a laterobasal short stout bristle, a mesal protuberance with a curved pigmented claw attached, 3 short fine hairs apically, a patch of long hair-like spicules proximad of claw, and 7-12 short fine hairs scattered over tergal surface; basal mesal lobe short and rounded apically, distal 0.40 with several short bristles, entire surface covered with short hair-like spicules; proctiger short, paraproct with a small subapical thumb-like process, cercal setae absent; phallosome with aedeagus of type I with 2 lateral plates connected basally, each plate with 5-6 short blunt lateral teeth on distal 0.50 and covered with a dorsal flap, paramere long, approximately 0.82 length of lateral plate; sternum IX large, entire surface covered with minute spicules, 3-4 bristles near center.

PUPA AND LARVA. Not known.

TYPE DATA. Aedimorphus nigrostriatus Barraud, syntypes male and female, Golaghat, Assam, INDIA, 17 November 1925, Capt. P. J. Barraud, caught in jungle, in British Museum (Natural History); 1 paratype male and 1 paratype female, with same data as syntypes, in Indian Museum, Calcutta.

DISTRIBUTION. Specimens examined--2 males and 5 females from the following locations: BURMA, Pegu, Rangoon; INDIA, Assam, Golaghat.

TAXONOMIC DISCUSSION. Aedes nigrostriatus resembles Aedes trimaculatus but can be separated from this species by the ornamentation and integument color of the scutum. In nigrostriatus the scutal integument is pale with dark reddish-brown areas forming a pair of stripes on the dorsocentral areas and a circular spot on the supra-alar area anterior to the wing base, while trimaculatus has the scutal integument reddish-brown with the scutal fossal areas and pre-scutellar space pale. The color of the scutal scales is the same as the underlying integument on these 2 species.

BIOLOGY. Larvae were collected from muddy pools in India.

Females in a freshly-fed condition have been collected from cowsheds in India (Barraud 1927: 551).

AEDES (AEDIMORPHUS) ORBITAE EDWARDS

Lepidotomyia Taeniata Leicester 1908, Cul. Malaya, p. 133 (M,F); Brunetti 1912, Rec. Indian Mus. 4: 459.

Ochlerotatus taeniatus Leices., Brunetti 1920, Rec. Indian Mus. 17: 140.

Aedes orbitae Edwards 1922a (nom nov), Indian J. med. Res. 10: 260.

Aedes (Ecculex) orbitae Edwards 1922b (nom nov for taeniata Leicester, non Wiedemann 1928), Indian J. med. Res. 10: 466.

Aedes (Aedimorphus) orbitae Edw., Edwards and Given 1928, Bull. ent. Res. 18: 344(L); Edwards 1932, Genera Insec., Fasc. 194: 168; Edwards in Barraud 1934, Fauna Brit. India. Diptera 5: 250 (M.F).

Aedes (Aedimorphus) orbitae Edwards, Stone et al. 1959,
Thomas Say Found. 6: 195.

FEMALE (Fig. 6). Head. Antenna dark brown, approximately 1.06 length of proboscis, pedicel pale brown with a few small brown scales and a patch of short fine dark brown hairs mesally, flagellomere 1 pale with a few small brown scales; clypeus dark brown, bare; maxillary palpus dark brown scaled with apex silvery-white, occasionally a few white scales on base of segment 4, approximately 0.19 length of proboscis; proboscis dark brown scaled with a white ventral spot extending onto lateral surfaces approximately 0.67 from base (occasionally this spot forms a complete band), approximately 1.04 length of femur I; vertex with dorsum covered with narrow curved decumbent scales arranged in an anteromedian diamond-shaped dark brown group and the remainder golden-white; lateral surface covered with broad white scales, an anterodorsal black patch and a dark area anterior to antepnotum; numerous brown erect forked scales on occiput and vertex extending anteriorly to ocular line.

Thorax. Scutal integument brown; scutum covered with narrow curved reddish-black scales, narrow curved white scale patches on median anterior promontory area, scutal fossal areas (extending from anterior area along margin and onto lateral area), small circular patch on posterior scutal fossal area, supra-alar area above posterior of paratergite, similar scales along anterior margin of scutal ridge from scutal angle posteromesally 0.50 to dorsocentral area and

scattered over area mesally to dorsocentral setae; scutellum with a patch of broad overlapping silvery-white scales on each lobe; median anterior promontory, acrostichal, dorso-central (anterior and posterior), scutal fossal (anterior, 4-5 lateral and 1 posterior), supra-alar, several posterior medial scutal, 1 postalar callular and scutellar (lateral and median) bristles reddish-black and well developed, others absent; pleural integument dark brown; antepronotum covered with narrow curved white scales, several dark bristles; postpronotum sparsely covered with narrow curved scales, reddish-black ones dorsally and a few posteriorly with a patch of white ones mesally, 6-7 posterior dark bristles; propleuron with a patch of broad silvery-white scales, several golden bristles; postspiracular area with 4-7 golden bristles; mesepisternum with an upper and a lower patch of broad silvery-white scales, several upper and posterior golden bristles, lower ones shorter; prealar knob with several golden-brown bristles; paratergite with broad silvery-white scales on lateral surface; mesepimeron with a patch of broad silvery-white scales and golden bristles on upper area; other pleural areas bare. Legs. Coxae I-III each with several brown bristles, I with anterior and lateral surfaces covered with broad brown scales with a dorsal white patch, II-III each with a patch of broad white scales on anterior surface; trochanters I-III each with broad white scales; femora I-III each brown, with a narrow basal white band and a dorsoapical silvery-white spot, I with a narrow antero-ventral white stripe on basal 0.33 in some specimens, III

with an anteroventral longitudinal white stripe from base to apex, I-III each with posterior brown, I with a posterodorsal white stripe from base to apex, II-III each with a posteroventral white stripe, broad basally and tapering to apex; tibiae I-III brown, each with a few ventrobasal pale scales, I with a dorsoapical silvery-white spot, III with a few lateroapical silvery-white scales, I with a posteroventral longitudinal white stripe from base to apex, II-III each with a posteromedian longitudinal white stripe, II with stripe from base to near apex, III with stripe on apical 0.65 (stripe on III absent or reduced in some specimens); tarsi I-III brown, I with tarsomeres 2-3 each with a dorso-basal white spot, II with tarsomeres 1-3 each with a dorso-basal white spot, a few dorsoapical white scales on tarsomere 1, III with tarsomeres 1-4 each with a broad basal white band, and a few dorsoapical white scales, tarsomere 5 white scaled; posttarsi I-III each with 2 ungues, I-II equal, each bearing a tooth, III equal, simple. Wing. Dorsal veins covered with moderately broad brown scales; costa with a patch of white scales at base; ventral veins brown scaled; alula with narrow brown scales along fringe; 2 remigial bristles. Halter. Pedicel pale, capitellum white scaled with a few brown scales at base. Abdomen. Tergum I brown with a rectangular patch of silvery-white scales on latero-tergite; terga II-VII brown dorsally (a few basomedian pale scales on II-IV in some Malayan specimens), each with a lateromedian white scale patch, sometimes extending to base

along lateral margins on III-VII; sterna white scaled with a brown posterior band on sterna II-VI; terga and sterna with numerous golden bristles, mostly along posterior margins. Genitalia. Segment VIII distinctly bilobed ventro-apically, usually retracted into segment VII; tergum IX bilobed with 5-7 bristles on each lobe; cercus long, completely extended and visible dorsally; postgenital plate with a deep median apical indentation with 5-7 bristles on each lobe; insula tongue-like, membranous, covered with tiny spicules; 3 spermathecae, 1 large and 2 slightly smaller ones.

MALE (Fig. 6). Similar to female in general habitus. Head. Maxillary palpus brown with segments 3-5 each with a basal white band, segment 2 with a dorsal white spot near middle, longer than proboscis by length of apical segment; proboscis with median white spot forming a band; vertex with median narrow brown scaled stripe reduced. Legs. Tibia III without posteromedian white stripe; posttarsi I-III each with 2 ungues, I-II with ungues unequal, each bearing a tooth, III equal, simple. Abdomen. Terga III-VII each with a basomedian patch of white scales in addition to lateromedian white patches (basomedian patches small in some specimens), patch small on VII; tergum VIII and sternum VIII completely white scaled. Genitalia. Tergum IX strongly bilobed with 6-8 bristles on each lobe, entire surface covered with minute spicules; gonocoxite long and moderately broad, dorsal surface with short fine hairs along tergomal margin

and a few moderately long bristles at median forming somewhat of a longitudinal line on basal 0.50, short bristles on remainder of area, lateral margin with long stout bristles from base to apex, ventral surface with long stout bristles on distal 0.45, most numerous on sternomesal margin, scattered short to moderately long bristles over remainder of area, scattered scales on lateral and ventral areas; gonostylus with pedicel long, narrow and somewhat incurved, distal 0.38 expanded into a mesal lobe and a lateral, narrow, incurved, apically pointed horn attached approximately 0.78 from base with a short fine hair at apex, mesal expanded lobe with a moderately long, flattened, curved, and apically blunt gonostylar claw attached mesally near middle, 3-5 long stout bristles along apical margin, mesal 1-2 bristles shorter and others equal in length, 3 short fine hairs along mesal margin of distal 0.30 of pedicel; basal mesal lobe short and rounded apically, distal 0.50 with 12-14 short bristles, entire surface covered with short hair-like spicules; proctiger short, paraproct with a subapical thumb-like process, cercal setae absent; phallosome with aedeagus of type I with 2 lateral plates connected basally, each plate with 4-5 short blunt lateral teeth on distal 0.60 and covered with a dorsal flap, paramere long, approximately 0.89 length of lateral plate; sternum IX large, entire surface covered with minute spicules, 5-10 bristles near center.

PUPA (Fig. 25). Chaetotaxy as figured and recorded in Table 5. A patch of spicules on metanotum between hairs

12-C and 1 on abdomen between hairs 1-I. Cephalothorax.

Hair 5-C with 3-6 branches; 7-C with 3-5 branches; 8-C with 7-9 branches. Respiratory trumpet. Lightly pigmented; with scattered minute spicules on distal 0.65 of inner surface; index 3.30-4.06, average 3.67. Metanotum. Hair 10-C with 17-33 branches; 12-C with 5-10 branches. Abdomen. Hair 5-I with 7-16 branches; 1-II with 32-49 branches; 4-II with 3-6 branches; 1-III with 8-17 branches; 6-VI single; 1-VII with 3-6 branches; 6-VII with 6-11 branches; 9-VII with 4-6 branches; 11-VII single. Paddle. Ovoid; with very minute serrations along basal 0.55 of outer margin; midrib does not reach apex; hair 1-P short, single; index 1.05-1.32, average 1.17.

LARVA (Fig. 32). Chaetotaxy as figured. Head. Median mouth brushes pectinate apically; hairs 1, 3, 14-C single; 4-C with 7-13(10) branches; 5-C with 6-9(8) branches; 6, 13-C with 6-9(7) branches; 7-C with 9-16(13) branches; 8-C double or triple (2); 9-C with 2-4(3) branches; 10-C double or triple (3); 11-C with 5-8(5) branches; 12-C with 5-10(8) branches; 13-C with 6-9(7) branches; 15-C with 3-5(4) branches; basal maxillary hair single; mental plate with 27-29 (28) teeth. Antenna. Lightly pigmented; scattered small spicules over entire shaft, more numerous on basal 0.50; hair 1-A with 3-5(4) branches, inserted at 0.49-0.52 from base; 2-A long; 3-A approximately 0.34 length of 2-A. Thorax. Hair 0-P with 10-21(15) branches; 1, 5, 6, 10, 12-P single; 2, 9, 11, 14-C double or triple (2); 3-P with

3-4(3) branches; 4-P single to triple (2); 7-P triple; 8-P double or triple (3); 1-M with 3-4(4) branches; 2-M single to triple (2); 3, 5, 7, 10, 12-M single; 4-M with 3-6(4) branches; 6-M with 5-9(7) branches; 8-M with 7-10(8) branches; 9, 14-M with 6-10(7) branches; 11-M single or double (1); 13-M with 5-10(6) branches; 1, 12-T single to triple (1); 2-T with 3-6(5) branches; 3-T with 8-18(11) branches; 4-T with 2-4(3) branches; 5, 10-T single; 6-T double or triple (2); 7-T with 8-13(10) branches; 8-T with 4-8(6) branches; 9-T with 5-8(6) branches; 11-T single or double (1); 13-T with 6-11(9) branches. Abdomen. Hairs 1, 2-VIII on common basal plate; hairs 0, 14-VIII single; 1-VIII with 6-10(7) branches; 2-VIII double or triple (3); 3-VIII with 13-27(15) branches; 4-VIII single to triple (1); 5-VIII with 6-10(9) branches; comb with 20-30(27) scales arranged in 3 irregular rows, scales moderately long and rounded apically with stout denticles on lateral margins and apex; 1, 3-X single; 2-X with 8-12(9) branches; ventral brush varies from 9 hairs on grid and 3 precratal ones to 10 hairs on grid and 2 precratal ones, usually with 10 hairs on grid and 2 precratal ones; saddle moderately pigmented with minute ridges, incompletely rings segment (covers approximately 0.50 of segment), with numerous spicules along posterior margin and small ridges over entire saddle, acus absent; 4 anal gills long and slender tapering to an apical point. Siphon. Moderately pigmented with minute ridges over entire surface; with a small dorsoapical and ventroapical patch of spicules (patches do not join on lateral

surface); a large patch of spicules on lateral surface near middle; acus absent; index 3.40-4.67; pecten with 18-22(18) teeth, apical 2-3 teeth smooth or with a very tiny median denticle and wider spaced than remainder which have a slender attenuate filament with 1-3 lateral denticles; hair 1-S with 4-7(5) branches, inserted 0.80-0.85 from base.

TYPE DATA. There are 2 male and 4 female syntypes of Aedes orbitae in the British Museum (Natural History). Lectotype female of Aedes (Aedimorphus) orbitae is hereby designated and bears the following data: Lepidotomyia taeniata Leicester, Kuala Lumpur, FED. MALAY STATES, 6 February 1903, Dr. G. F. Leicester, Culex Alboscutellata var. Annul, bred larvae from muddy water in rut made by wagon wheel in wagon track into jungle 5 3/4 miles Pakang Rd., Kuala Lumpur; allolectotype male is also hereby designated and bears the following data: same as lectotype except var. Annul absent and date is 25 February 1903; 1 paratype male with same data as allolectotype; 2 paralectotype females with same data as lectotype except one has date of 8 February 1903; and 1 paralectotype female with the following data: Culex trifeliat, 31 January 1903, taken on wagon rd., high patch jungle Pahang Rd. 5 3/4 miles, remainder of data same as lectotype.

DISTRIBUTION. Specimens examined--52 males, 58 females, 75 pupae, 58 larvae and 75 individual rearings (53 pupal, 22 larval) from the following locations: MALAYSIA, North Borneo, Forest Camp, Kalabakan, Ta Waw; Pahang, Cheggar Perah, Gunong Benom; Perak, Chior F. R.; Perlis, Bt. Bintang F. R.; Selangor, Kota Belud, Kuala Lumpur, Sabak, Ulu

Gombak; SINGAPORE; THAILAND, Nakon Si Thammarat; Narathiwat; Phangnga; Prachinburi; Ranong; Yala. Other distribution.
SINGAPORE, Gunong Pulai (Edwards 1928: 344).

TAXONOMIC DISCUSSION. Aedes orbitae resembles jamesi and lowisii in the adult habitus. It can be easily distinguished from these species by the bare subspiracular area, shape of the gonostylus of the male genitalia and presence of 1 large and 2 slightly smaller spermathecae in the female genitalia. The male genitalia of orbitae is similar to caecus and punctifemoris. It is easily separated from these two species by having 12-14 bristles on the basal mesal lobe while caecus has 5-8 bristles and punctifemoris has 4-6 bristles. Other distinctive features of the adults are: scutellum with broad silvery scales on each lobe; postspiracular area without scales; and tarsi banded with white scales, tarsus III with tarsomere 5 white scaled.

The pupa is characterized by the following features: trumpet broad; hair 10-C with 17-33 branches; hair 1-II with 32-49 branches; hair 7-V long and single; and hairs 10-IV-V long and single.

The larva resembles caecus from which it can be separated by: a lateral patch of spicules at about middle of siphon; hairs 1, 2-VIII on common basal plate; and hair 6-C with 6-9 branches, while caecus has: a dorsal and ventral patch of spicules near middle of siphon; hairs 1, 2-VIII not on a plate; and hair 6-C with 4-5 branches. Other distinctive features of orbitae are: hair 4-C with 7-13 branches; hair 13-C with 6-9 branches; and comb with 20-30 scales.

BIOLOGY. Larvae were collected from water in hoof-prints and adults were taken biting man in Thailand.

In Malaysia, larvae were collected from temporary pools on muddy ground in inland forests and adults taken biting man by Macdonald (1957: 21). In this country, Macdonald and Traub (1960: 100) also obtained immatures from cart tracks and hoofprints and Leicester (1908: 134) collected larvae from ruts in a jungle wagon track.

AEDES (AEDIMORPHUS) PALLIDOSTRIATUS (THEOBALD)

Culex pallidostriatus Theobald 1907, Monogr. Cul. 4: 410 (M*,F); Brunetti 1912, Rec. Indian Mus. 4: 473.

Culex parascelos Theobald 1910, Rec. Indian Mus. 4: 18(F); Theobald 1910, Monogr. Cul. 5: 379; Brunetti 1912, Rec. Indian Mus. 4: 473.

Ochlerotatus ochraceus Theo., Edwards 1911, Bull. ent. Res. 2: 250 (Oriental records only).

Ochlerotatus pallidostriatus (Theo.), Edwards 1913, Bull. ent. Res. 4: 228; Brunetti 1920, Rec. Indian Mus. 17: 140.

Aedes (Ecculex) pallidostriatus Theobald, Edwards 1922b, Indian J. med. Res. 10: 467.

Ochlerotatus pallidostriatus Theobald, Senior-White 1923, Cat. Indian Insects, Cul., p. 81.

Aedes (Aedimorphus) pallidostriatus (Theo.), Barraud 1928, Indian J. med. Res. 15: 665 (M*,F); Stone et al. 1959, Thomas Say Found. 6: 196; Qutubuddin 1960 Mosquito News 20: 358 (M).

Aëdes (Aëdimorphus) pallidostriatus Theobald, Edwards 1932, Genera Insec., Fasc. 194: 171.

Aëdes (Aëdimorphus) pallidostriatus (Theobald), Barraud 1934, Fauna Brit. India, Diptera 5: 261 (M*,F,L*).

FEMALE (Fig. 7). Head. Antenna dark brown, approximately 0.91 length of proboscis, pedicel pale with a few small dusky scales and a patch of short fine brown hairs mesally, flagellomere 1 pale with a few small pale scales; clypeus pale, bare; maxillary palpus golden scaled with short dark brown bristles, approximately 0.20 length of proboscis; proboscis golden scaled with apical 0.25 dusky, approximately 1.11 length of femur I; vertex with dorsum covered with narrow curved golden decumbent scales; lateral surface covered with broad golden-white scales; numerous golden erect forked scales on occiput and vertex extending anteriorly to ocular line. Thorax. Scutal integument light reddish-brown; scutum covered with narrow curved bronzy scales, narrow curved whitish-golden scales forming a pair of stripes on dorso-central areas from anterior scutal fossal areas to scutellum and a less distinct stripe on acrostichal area from anterior promontory area to posterior medial scutellar area, similar scales covering supra-alar area from scutal angle to posterior of wing base, posterior medial scutal area and pre-scutellar space; scutellum with narrow curved whitish-golden scales on each lobe; median anterior promontory, acrostichal, dorsocentral (anterior and posterior), scutal fossal (anterior, 2-4 lateral, 1-3 median and 2-3 posterior), supra-alar, several posterior medial scutal, 1 postalar callular and scutellar (lateral and median) bristles reddish-brown and well developed; pleural integument golden-brown; antepnotum covered with narrow curved golden scales, numerous

golden bristles; postpronotum covered with narrow curved golden scales, 9-10 golden bristles; propleuron with narrow curved golden scales, numerous golden bristles; postspiracular area with a patch of narrow curved golden scales, 7-8 golden bristles; subspiracular area with a patch of narrow curved golden scales; mesepisternum with an upper patch of moderately broad golden scales, a posterior patch of broad golden scales, several upper and posterior golden bristles, lower ones shorter; prealar knob with a few narrow curved golden scales, several golden bristles; paratergite with narrow curved golden scales on lateral and ventral surfaces; mesepimeron with a patch of broad golden scales and numerous golden bristles on upper area; other areas bare. Legs. Coxae I-III each with several golden bristles and a patch of moderately broad golden-white scales, I with scales on anterior and lateral surfaces, II with scales on anterior surface, III with a small anteroventral patch; trochanters I-III each with a patch of broad white scales; femur I with anterior white with an indistinct median longitudinal brown stripe, posterior white with a ventral longitudinal brown stripe from base to apex; femora II-III with anterior brown, each with a median longitudinal white stripe from base to apex, stripe broader on III and completely covers basal 0.25, II-III with posterior white with a few brown scales forming an indistinct stripe on apical 0.25; tibiae I-III each white with a dorsal and a ventral longitudinal brown stripe from base to apex; tarsi I-III brown each with an anteromedian

and a posteromedian longitudinal white stripe on tarsomeres 1-3 and occasionally on tarsomeres 4 of II-III; posttarsi I-III each with 2 ungues, I-II equal, each bearing a tooth, III equal, simple. Wing. Dorsal veins covered with moderately broad scales; costa and subcosta covered with golden scales with a few brown scales along posterior of costa (anterior always golden scaled); radius, cubitus and anal veins each with a few golden scales intermixed with brown scales on basal 0.65; remainder of veins brown scaled; remigium golden scaled with brown scales along anterior margin; ventral veins brown scaled with basal 0.75 of costa and basal 0.50 of radius covered with golden scales; alula with narrow golden-brown scales along fringe; 2 golden remigial bristles. Halter. Pedicel pale, capitellum white scaled. Abdomen. Terga and sterna covered with golden scales and with numerous golden bristles, mostly along posterior margins; tergum I with a rectangular patch of golden-white scales on laterotergite. Genitalia. Segment VIII distinctly bilobed ventroapically, mostly retracted into segment VII; tergum IX bilobed with 10-12 bristles on each lobe; cercus long, 0.75 extended and visible dorsally; postgenital plate with a deep median apical indentation with 5-7 bristles on each lobe; insula tongue-like, membranous, covered with tiny spicules; 3 spermathecae, 1 large and 2 slightly smaller ones.

MALE (Fig. 7). Similar to female in general habitus. Head. Maxillary palpus golden scaled with a dorsoapical

brown spot on segment 2, longer than proboscis by length of apical segment. Thorax. Postspiracular area without scales. Legs. Posttarsi I-III each with 2 ungues, I-II with ungues unequal, each bearing a tooth, III unequal, simple. Abdomen. Terga brown, I with a few dorsomedian golden scales, II-VI each with a narrow golden basal band and a dorsomedian stripe not reaching posterior margins of terga, a few lateral golden scales on VI-VII, VII golden with a pair of admedian brown patches, VIII golden scaled; sterna golden scaled. Genitalia (Fig. 17). Tergum IX strongly bilobed with 7-8 bristles on each lobe, entire surface covered with minute spicules; gonocoxite long and moderately broad, dorsal surface, except tergomesal margin, covered with short thin bristles, lateral surface covered with long stout bristles from base to apex, ventral surface with a few long stout bristles at apex, distal 0.40 with moderately long stout bristles becoming very numerous on sternomesal margin, remainder of area with scattered short bristles, scattered scales on lateral and ventral surfaces; gonostylus with pedicel very short and broad, distal 0.67 expanded into a large mesal lobe and a lateral narrow, slightly longer, incurved, tapered horn attached approximately 0.67 from base, mesal expanded lobe with lateral margin concave, apex broad and flat with 3 short hairs near lateral margin and 2 similar ones near mesal margin, mesal margin of lobe with a small apical concave area bearing a short, strongly curved, pigmented gonostylar claw, a short fine hair near base of claw and a

patch of moderately long hair-like spicules along mesal margin proximad from base of claw, 3 short fine hairs dorsally near middle of lobe; basal mesal lobe short and rounded apically, distal 0.50 with 5-6 short thin bristles, entire surface covered with short hair-like spicules; proctiger short, paraproct with a subapical thumb-like process, cercal setae absent; phallosome with aedeagus of type I with 2 lateral plates connected basally, each plate with 4 short blunt lateral teeth on distal 0.58 and covered with a dorsal flap, paramere long, approximately 0.95 length of lateral plate; sternum IX large, entire surface covered with minute spicules, 6-7 bristles near center.

PUPA. Chaetotaxy as recorded in Table 6. Cephalothorax. Hair 5-C with 3-6 branches; 7-C double or triple; 8-C with 2-6 branches. Respiratory trumpet. Moderately pigmented; with scattered minute spicules on distal 0.85 of inner surface; index 4.25-4.81, average 4.52. Metanotum. Hair 10-C with 10-18 branches; 12-C with 3-7 branches. Abdomen. Hair 5-I with 8-15 branches; 1-II with 9-36 branches; 4-II with 5-9 branches; 1-III with 7-18 branches; 6-VI double or triple; 1-VII with 5-9 branches; 6-VII with 8-13 branches; 9-VII with 3-8 branches; 11-VII single to triple. Paddle. Ovoid; with very minute serrations along basal 0.60 of outer margin; midrib does not reach apex; hair 1-P short, single; index 1.24-1.70, average 1.40.

LARVA (Fig. 33). Chaetotaxy as figured. Head. Hairs 1, 3, 14-C single; 4-C with 6-7(7) branches; 5, 6-C with

4-6(5) branches; 7-C with 5-12(7) branches; 8, 10-C double or triple (2); 9, 13-C double or triple (3); 11-C with 3-6 (4) branches; 12-C with 3-5(5) branches; 15-C single or double (2); basal maxillary hair single; mental plate with 24-27(27) teeth. Antenna. Moderately to heavily pigmented; numerous stout spicules scattered over shaft, those near and distad of middle longer; hair 1-A with 7-14(9) branches inserted at 0.43-0.47 from base; 2-A long; 3-A approximately equal in length to 2-A. Thorax. Hair 0-P with 4-5(4) branches; 1, 5, 6, 10, 12, 14-P single; 2, 8-P double or triple (2); 3-P double or triple (3); 4, 11-P single to triple (2); 7-P triple; 9-P single or double (2); 1, 3, 5, 7, 10, 12-M single; 2-M with 2-4(3) branches; 3-M with 3-4(3) branches; 6-M with 5-7(6) branches; 8-M with 5-8(8) branches; 9-M with 4-8(6) branches; 11-M single or double (1); 13-M with 5-8(6) branches; 14-M with 6-8(6) branches; 1, 11, 12-T single or double (1); 2-T with 3-4(3) branches; 3-T with 5-10(6) branches; 4-T with 2-4(3) branches; 5, 10-T single; 6-T single to triple (2); 7-T with 7-12(9) branches; 8-T with 4-7(5) branches; 9-T with 6-8(6) branches; 13-T with 5-9(5) branches. Abdomen. Hairs 0, 14-VIII single; 2-VIII with 4-5(4) branches; 2-VIII single to triple (2); 3-VIII with 8-17(14) branches; 4-VIII double or triple (2); 5-VIII with 7-10(7) branches; comb of 14-20(16) scales arranged in 2 irregular rows, scales with a long stout pointed median spine and short denticles along lateral margins of base; 1-X with 2-4(2) branches; 2-X with 9-13(12) branches; 3-X

single; ventral brush varies from 8 hairs on grid and 3 precratal ones to 9 hairs on grid with 3 precratal ones, usually with 9 hairs on grid and 3 precratal ones; saddle moderately pigmented with minute ridges, incompletely rings segment, with small spicules along posterior margin, acus absent; 4 anal gills very long and slender tapering to an apical point. Siphon. Moderately pigmented with minute ridges over entire surface; acus very small; index 6.50-7.91; pecten with 12-15 (15) teeth, apical 6-7 teeth smooth, apical 3-4 wider spaced than remainder which have a slender attenuate filament with 1-2 lateral denticles near middle; hair 1-S with 5-6(5) branches, inserted 0.72-0.77 from base.

TYPE DATA. Culex pallidostriatus Theobald, syntypes male and female, INDIA, S. Christophers, in British Museum (Natural History); holotype female Culex parascelos Theobald, Madras Town, Madras, INDIA, 30 October 1908, in Indian Museum (Barraud 1928: 665, 1934: 261).

DISTRIBUTION. Specimens examined--12 males, 20 females, 5 pupae, 22 larvae and 6 individual larval rearings from the following locations: CEYLON, Kapitigalla, Kurunegala, Peradeniya, Trincomali; INDIA, Bengal, Tezgaon, Tinpahar near Rajmahal; Bihar, Pusa; Bombay Deccan, Belgaun; Madras, Madras; Punjab, Karnal; United Provinces, Anwarganj; THAILAND, Nanchanaburi; WEST PAKISTAN, Lahore, Shah Zada. Other distribution. INDIA, Bengal, Dum Dum; Cuttack, Delhi, Manhupar, Trombay, Bombay Harbour (Barraud 1928: 665); MALAYSIA, Kedah, Kampong Bukit Kechik; Negri Sembilan, Port Dickson, Pulau Mertajam (McDonald 1957: 21); THAILAND, Chaingmai (Thurman and Thurman 1955: 222); WEST PAKISTAN, Kohat, Kohat-Hangu Valley (Qutubuddin 1960: 358).

TAXONOMIC DISCUSSION. Aedes pallidostriatus is similar in adult habitus and pupal and larval chaetotaxy to mediolineatus and is discussed under that species. The male

terminalia of these 2 species can be separated from each other by the shape of the gonostylus.

BIOLOGY. Larvae were collected in India from ground pools. Adults were taken biting cattle in West Pakistan. In Ceylon, larvae were collected from paddy fields.

In India, Barraud (1934: 262) found the immatures in open pools formed by rain and seepage, water filled dikes, ditches and borrow pits.

AEDES (AEDIMORPHUS) PAMPANGENSIS (LUDLOW)

Reedomyia Pampangensis Ludlow 1905, Can. Ent. 37: 94 (F).

Reedomyia niveoscutella Theobald 1905, J. econ. Biol. 1: 22 (F*); Theobald 1907, Monogr. Cul. 4: 259 (M*,F); Theobald 1910, Monogr. Cul. 5: 253. NEW SYNONYMY.

Reedomyia niveoscutellata Theob., Brunetti 1907, Rec. Indian Mus. 1: 362; Theobald 1907, Monogr. Cul. 4: 259 (M*,F); Brunetti 1912, Rec. Indian Mus. 4: 487.

Reedomyia pampangensis Ludlow, Brunetti 1907, Rec. Indian Mus. 1: 362; Theobald 1907, Monogr. Cul. 4: 258 (F); Theobald 1910, Monogr. Cul. 5: 253; Brunetti 1912, Rec. Indian Mus. 4: 487; Stone and Knight 1956, J. Wash. Acad. Sci. 46: 223.

Ochlerotatus niveoscutellatus Theob., Brunetti 1920, Rec. Indian Mus. 17: 139; Senior-White 1923, Cat. Indian Insects, Cul., p. 80.

Ochlerotatus pampangensis Ludl., Brunetti 1920, Rec. Indian Mus. 17: 140.

Aedes (Ecculex) alboscutellatus Theobald, Edwards 1922b, (in part), Indian J. med. Res. 10: 467; Edwards 1932 (in part), Genera Insec., Fasc. 194: 167.

Aedes (Ecculex) niveoscutella Theobald, Edwards 1922b, Indian J. med. Res. 10: 467.

Aëdes (Aëdimorphus) niveoscutella Theobald, Dyar and Shannon 1925, Insecutor Inscit. menstr. 13: 76; Borel 1930, Coll. Soc. Path. exot. Monogr. 3: 267 (M*); Edwards 1932, Genera Insec., Fasc. 194: 168; Barraud 1934, Fauna Brit. India, Diptera 5: 251 (M,F).

Aedes (Aedimorphus) niveoscutella (Theo.), Barraud 1928,
Indian J. med. Res. 15: 659 (F).

Aëdes (Aëdimorphus) alboscuteUellatus Theobald, Edwards 1932
(in part), Genera Insec., Fasc. 194: 167.

Aedes (Aedimorphus) pampangensis (Ludlow), Bohart 1945, U. S.
Navmed. 580, p. 53 (M,F); Knight and Hull 1953, Pacif.
Insects 7; 454 (M*,F,L*); Stone et al. 1959, Thomas
Say Found. 6: 196.

Aedes (Aedimorphus) niveoscutellum (Theobald), Stone et al.
1959, Thomas Say Found. 6: 195.

FEMALE (Fig. 8). Head. Antenna brown, approximately 1.10 length of proboscis, pedicel pale with a patch of short fine brown hairs mesally (a few small brown scales also present on specimens from India), flagellomere 1 pale with a few small brown scales; clypeus light brown, bare; maxillary palpus golden-brown scaled, approximately 0.19 length of proboscis; proboscis golden-brown scaled with apical 0.25 darker, ventral surface slightly paler (entirely golden scaled in specimens from India), approximately equal in length to femur I; vertex with dorsum covered with narrow decumbent scales, anterior 0.25 brownish and the remainder white; lateral surface covered with broad white scales and with an anterodorsal dark patch; numerous golden-brown erect forked scales on occiput and vertex extending anteriorly to the ocular line. Thorax. Scutal integument reddish-brown; scutum covered with narrow curved pale reddish-brown scales, narrow curved white scales forming small patches on median anterior promontory area, anterior scutal fossal area and supra-alar area from scutal angle to wing base; scutellum completely covered with overlapping broad silvery-white

scales; median anterior promontory, acrostichal, dorso-central (anterior and posterior), scutal fossal (anterior, 2-4 lateral, and 1 posterior), supra-alar, several posterior medial scutal, 1 postalar callular and scutellar (lateral and median) bristles reddish-black and well developed, others absent; pleural integument pale brown; antepronotum covered with narrow curved white scales, several long golden to dark bristles; postpronotum covered with narrow curved scales, anterior and dorsal ones pale reddish-black, remainder white, 6-7 dark posterior bristles; propleuron with a patch of broad white scales, several long golden bristles; postspiracular area with a patch of broad white scales, 6-7 golden bristles; subspiracular area with a small patch of narrow curved white scales; mesepisternum with an upper and a posterior patch of broad white scales, several upper and posterior long golden bristles, lower 8-10 bristles shorter; prealar knob with numerous golden bristles; paratergite with narrow curved white scales along lateral and ventral margins; mesepimeron with a patch of broad white scales and numerous pale golden bristles on upper area; other pleural areas bare. Legs. Coxae I-III each with several pale golden bristles, I with anterior covered with broad white scales and a few light brown ones laterally, II with anterior covered with broad white scales, III with a small anterodorsal and an antero-ventral patch of broad white scales; trochanters I-III each with a patch of broad white scales; femora I-III each with a dorsoapical white spot, I-II with anterior brown, III with

anterior pale and dorsoapical 0.30 brown, I with dorsal 0.75 of posterior pale and remainder brown, II-III each with basal 0.60 of posterior pale and remainder light brown dorsally; tibiae I-II pale, I with an anterior longitudinal brown stripe, II with a ventral longitudinal brown stripe, III brown with an anterior and a posterior pale longitudinal stripe; tarsi I-II brown each with a posteroventral longitudinal pale stripe on tarsomere 1 and basal 0.50 of tarsomere 2, II also with a small elongated dorsobasal pale spot; tarsus III brown occasionally with a posteroventral longitudinal pale stripe on tarsomere 1; posttarsi I-III each with 2 ungues, I-II equal, each bearing a tooth, III equal, 1 bearing a tooth. Wing. Dorsal veins covered with brown moderately broad scales; costa with a few pale scales at base and along the posterior margin at the humeral cross vein; ventral veins brown scaled with pale scales on basal 0.25 of subcosta and a few on posterior of costa; alula with narrow brown scales along fringe; 2-4 remigial bristles.

Halter. Pedicel pale brown, capitellum white scaled.

Abdomen. Terga brown dorsally; tergum I occasionally with a few pale scales dorsally and a rectangular patch of white scales on laterotergite; tergum V with a basomedian pale stripe extending 0.50 posteriorly and a few pale scales along posterior margin; tergum VI with a median triangular pale scale patch extending from base to posterolateral margins; tergum VII with basomesal pale scales; terga II-VI each with a broad longitudinal pale band on lateral surfaces;

specimens from India also with the following: terga II-IV with a few median basal pale scales, VI with more pale scales posteriorly, and VII nearly completely pale scaled; sterna pale scaled; terga and sterna with numerous golden-brown bristles, mostly along posterior margins. Genitalia. Segment VIII distinctly bilobed ventroapically, retracted into segment VII; tergum IX bilobed with 6-8 bristles on each lobe; cercus long, 0.60 extended and partially visible dorsally; postgenital plate with a deep median apical indentation with 6-10 bristles on each lobe; insula tongue-like, membranous, covered with tiny spicules; 3 spermathecae, 1 large and 2 slightly smaller ones.

MALE (Fig. 8). Similar to female in general habitus. Head. Maxillary palpus brown with a broad lateral patch of pale scales near base of segment 2, longer than proboscis by 0.50 length of apical segment; vertex without anterodorsal dark scale patch. Thorax. Postspiracular area without scales. Legs. Tarsi I-II each with posteroventral longitudinal pale stripe usually reduced to basal 0.75 of tarso-
mere 1; posttarsi I-III each with 2 ungues, I-II with ungues unequal, each bearing a tooth, III equal, simple. Abdomen. Terga I-VII brown, each with a narrow indistinct longitudinal pale stripe on lateral surfaces; tergum VIII with a large laterobasal pale scale patch. Genitalia (Fig. 18). Tergum IX bilobed with 5-8 bristles on each lobe, entire surface covered with minute spicules; gonocoxite moderately long and broad, dorsal surface with a median patch of long stout

bristles from near base to apex, somewhat shorter and thinner bristles laterad and extending over lateral margin from base to apex; tergomesal margin with a dense patch of short, somewhat flattened, curved bristles near middle, a number of short thin bristles distad and a few proximad of patch, ventral surface covered with scattered short bristles and long stout ones on distal 0.30, long bristles more numerous on sternomesal margin, scattered scales on lateral and ventral surfaces; gonostylus with pedicel very short and broad, distal 0.80 greatly expanded with a laterotergal flap-like structure bearing 2 dense lateral patches of very long thin hairs near middle and numerous short fine hairs extending to apex which terminates in a small incurved pigmented point, remainder of expanded portion concave dorsally with a short, flat, apically tapering gonostylar claw attached mesally approximately 0.80 from base, 4 smaller accessory claws along apical margin, numerous short fine hairs forming a large patch on tergal and sternal surfaces; basal mesal lobe short and rounded apically, distal 0.55 with 2-3 short stout apical bristles and 2-3 short fine ones, entire surface covered with short hair-like spicules; proctiger short, paraproct with a subapical thumb-like process, cercal setae absent; phallosome with aedeagus of type I with 2 lateral plates connected basally, each plate with 6-7 short blunt lateral teeth on distal 0.57 and covered with a dorsal flap, paramere long, approximately 0.98 length of lateral plate; sternum IX large, entire surface covered with minute spicules, 5-7 bristles near center.

PUPA (Fig. 26). Chaetotaxy as figured and recorded in Table 7. Cephalothorax. Hair 5-C with 6-9 branches, 7-C with 8-11 branches; 8-C with 8-11 branches. Respiratory trumpet. Moderately pigmented; with scattered minute spicules on distal 0.85 of inner surface; index 4.53-5.20, average 4.89. Metanotum. Hair 10-C with 13-16 branches; 12-C with 3-11 branches. Abdomen. Hair 5-I with 10-18 branches; 1-II with 24-40 branches; 4-II with 6-11 branches; 1-III with 10-16 branches; 6-VI with 6-8 branches; 1-VII with 7-10 branches; 6-VII with 7-14 branches; 9-VII with 5-7 branches; 11-VII with 2-4 branches. Paddle. Ovoid; with very minute serrations along basal 0.50 of outer margin; midrib does not reach apex; hair 1-P short, single or double; index 1.18-1.25, average 1.22.

LARVA (Fig. 34). Chaetotaxy as figured. Head. Hairs 1, 3, 14-C single; 4-C with 5-7(6) branches; 5-C with 5-8(6) branches; 6-C with 4-7(5) branches; 7-C with 8-13(10) branches; 8-C with 2-4(3) branches; 9-C with 2-5(3) branches; 10-C single or double (2); 11-C with 3-6(4) branches; 12-C with 3-6(5) branches; 13, 15-C with 2-4(2) branches; basal maxillary hair single; mental plate with 32-34(33) teeth. Antenna. Moderately pigmented; numerous stout spicules scattered over shaft, more numerous near middle; hair 1-A with 6-10 branches, inserted 0.35-0.42 from base; 2-A long; 3-A approximately 0.50 length of 2-A. Thorax. Hair 0-P with 5-12(6) branches; 1, 5, 6, 10, 12-P single; 2-P double or triple (2); 3, 7-P double or triple (3); 4, 9, 11-P with

2-4(3) branches; 8, 14-P double; 1-M with 3-4(4) branches; 2-M with 2-4(3) branches; 3-M with 2-5 branches; 4-M with 4-6(4) branches; 5-M double or triple (3); 6-M with 3-6(4) branches; 7, 10, 12-M single; 8-M with 7-10(8) branches; 9-M with 7-10(7) branches; 11-M single or double (1); 13-M with 5-12(6) branches; 14-M with 7-11(7) branches; 1, 5, 10, 11-T single; 2-T with 4-7(5) branches; 3-T with 17-28(17) branches; 4-T with 3-6(3) branches; 6-T double or triple (3); 7-T with 6-11(7) branches; 8-T with 5-7(5) branches; 9-T with 5-8(8) branches; 12-T single to triple (2); 13-T with 9-14(9) branches. Abdomen. Hairs 0, 14-VIII single; 1-VIII with 4-9(7) branches; 2-VIII with 2-5(3) branches; 3-VIII with 8-13(12) branches; 4-VIII with 2-4(3) branches; 5-VIII with 5-8(8) branches; comb with 18-23(20) scales arranged in 3 irregular rows, scales with a long stout pointed median spine and short denticles along lateral margins of base; 1-X double or triple (2); 2-X with 10-15(14) branches; 3-X single; ventral brush varies from 9 hairs on grid and 3 precratal ones to 10 hairs on grid and 3 precratal ones, usually with 9 hairs on grid and 3 precratal ones; saddle lightly pigmented with minute ridges, incompletely rings segment, with a few spicules along posterior margin, acus present; 4 anal gills long, each broad at base and tapering to a pointed apex. Siphon. Lightly pigmented with minute ridges; acus present; index 7.50-9.00; pecten with 15-18(15) teeth, apical 3-4 teeth larger, smooth and wider spaced than remainder which have a long slender attenuate filament with

1-2 basal denticles; hair 1-S with 4-5(4) branches, inserted 0.69-0.74 from base.

TYPE DATA. Reedomyia Pampangensis Ludlow, 3 syntype females, Angeles, Pampanga, Luzon, PHILIPPINES, September, Dr. Eugene R. Whitmore, caught in the woods and in the quarters, types nonexistent (Stone 1970: 151). There is one specimen in the United States National Museum (Natural History) which bears labels with the following data:
Reedomyia pampangensis Ludlow, Camp Wm. McKinley, Rizal, P. I., Oct. 25, Nov. 3, 05, Type; Type No. 27795 U.S.N.M. The first label is in Ludlow's handwriting, but since the specimen was collected after date of publication (March 1905) of the original description, it cannot be considered as the type. No other type material of pampangensis was found. Knight and Hull (1953: 454) considered the above specimen as the type but later Stone and Knight (1956: 223) indicated it could not be the type since it was collected after publication of the name. Reedomyia niveoscutella Theobald, holotype female, INDIA, Capt. James, in British Museum (Natural History).

DISTRIBUTION. Specimens examined--26 males, 91 females, 11 pupae and 29 larvae from the following locations: INDIA, Bihar, Pusa, Sharma; INDONESIA, Sumatra, Atjeh, Kroeng Raja; PHILIPPINES, Luzon, Calaccad, Nunoz Necija; Camarines Sur; Leyte, Mahaplag; Mindanao, Pasananco, Pettit Barracks, Zamboanga; Mindoro, San Jose; Pampanga, Camp Stotsenberg; Pangasinan, Camp Gregg, Sison, Tayng; Rizal, Camp Nichols, N. Ecija; Zambales, Subic Bay; SOUTH VIETNAM, An-Khe; THAILAND, Surasthani. Other distribution. INDIA, Purneah, Kierpur (Barraud 1928: 660); INDONESIA, Sumatra, Atchin (Brug and Edwards 1931: 258); Java (Barraud 1934: 252);

PHILIPPINES, Luzon, Olongapo; Manila, Quezon City; Zamboanga, Pettit Barracks, San Ramon City, Zamboanga (Knight and Hull 1953: 457); Pampanga, Angeles (Ludlow 1905: 95). SOUTH VIETNAM (Borel 1930: 26); Binh Thuy, Phan Rang, Pleiku (Parrish 1968a: 3, 4).

TAXONOMIC DISCUSSION. Aedes pampangensis has a somewhat superficial resemblance to mediolineatus and pallidostriatus in the pleural scale markings but is easily distinguished from these species by the presence of broad silvery-white scales on the scutellum and the absence of longitudinal white stripes on the scutum. The broad silvery-white scales on the scutellum is also reminiscent of alboscutellatus and its relatives, but pampangensis is easily separated from these species by the absence of dorsal spots on the scutum and the abdominal terga which are dark scaled dorsally and completely white scaled laterally. The gonostylus of the male genitalia of pampangensis is greatly expanded and very distinctive when compared to other members of the subgenus.

The pupa of pampangensis is distinctive in having abdominal hair 1-I-VIII well developed, hair 1-C with 5-8 branches, 4-C with 6-8 branches, 7-C with 8-11 branches, 5-II with 10-14 branches, 6-IV-V with 5-8 branches and 6-VI with 6-8 branches.

The larva of pampangensis resembles those of mediolineatus and pallidostriatus in having a very long siphon but can be separated from these 2 species by mesothoracic hair 5-M which is double or triple and metathoracic hair 3-T which has 17-28 branches while mediolineatus and

pallidostriatus have hair 5-M single and 3-T with 5-11 branches.

BIOLOGY. Immatures were collected from a grassy pond, road canal, rice field, small flooded area near road, grassy ground pool, and along the shaded bank of a clear water stream containing algae and vegetation in the Philippines. In West Pakistan, adults were taken biting cattle.

Larvae were collected from scattered rain pools in a grassy area and from a grassy pool in the bed of a temporary stream in the Philippines by Knight and Hull (1953: 457).

AEDES (AEDIMORPHUS) PIPERSALATUS (GILES)

Stegomyia pipersalata Giles in Theobald 1901, Monogr. Cul. 2: 316 (M,F); Giles 1902, Handb., 2nd Ed., p. 372 (F*); Blanchard 1905, Moust., p. 264 (F); Brunetti 1907, Rec. Indian Mus. 1: 332; Theobald 1910, Monogr. Cul. 5: 607; Brunetti 1912, Rec. Indian Mus. 4: 448.

Pseudograbhamia maculata Theobald 1905, J. Bombay nat. Hist. Soc. 16: 243 (M,F); Brunetti 1907, Rec. Indian Mus. 1: 140; Theobald 1907, Monogr. Cul. 4: 314 (M,F*); Brunetti 1912, Rec. Indian Mus. 4: 460.

Ochlerotatus pipersalatus (Giles), Edwards 1913, Bull. ent. Res. 4: 227 (M,F); Brunetti 1920, Rec. Indian Mus. 17: 138; Senior-White 1923, Cat. Indian Mus, Cul., p. 81.

Aedes (Ecculex) pipersalatus Giles, Edwards 1922b, Indian J. med. Res. 10: 467.

Aedes (Aedimorphus) pipersalatus (Giles), Barraud 1928, Indian J. med. Res. 15: 664; Stone et al. 1959, Thomas Say Found. 6: 196; Qutubuddin 1960, Mosquito News 20: 358 (M).

Aëdes (Aëdimorphus) pipersalatus Giles, Edwards 1932, Genera Insec., Fasc. 194: 170.

Aëdes (Aëdimorphus) pipersalatus (Giles), Barraud 1934, Fauna Brit. India, Diptera 5: 258 (M*,F,L*).

FEMALE (Fig. 9). Head. Antenna dark brown, approximately equal to length of proboscis, pedicel brown with a few small dusky scales and a patch of short fine brown hairs mesally, flagellomere 1 pale basally with a few small dusky scales; clypeus dark, bare; maxillary palpus brown scaled with apical 0.25 white, apical hairs also white, approximately 0.18 length of proboscis; proboscis brown scaled dorsally with a few intermixed white scales, white ventrally from near base to distal 0.25, approximately 1.26 length of femur I; vertex with dorsum covered with narrow curved decumbent scales arranged in an anteromedian diamond-shaped brown group and the remainder white; broad white scales extending halfway down lateral surface with broad brown ones below and also forming an anterodorsal patch; numerous dark brown erect forked scales on occiput and vertex extending anteriorly to ocular line. Thorax. Scutal integument dark brown; scutum covered with narrow curved reddish-black scales; narrow curved white scales forming small circular patches on median anterior promontory area, scutal fossal areas (one each on anterior, lateral and posterior areas), scutal angle, supra-alar area (a patch anterior to and a small indistinct spot posterior to wing base and a patch medially near dorso-central setal line), posterior medial scutal area and extending posteriorly along lateral margins of prescutellar space, similar scales scattered over area mesally to dorso-central setae; scutellum with a patch of broad and a few narrow curved white scales on each lobe; median anterior

promontory, acrostichal, dorsocentral (anterior and posterior), scutal fossal (anterior, 2-4 lateral, 1-2 median and 2-3 posterior), supra-alar, several posterior medial scutal, 1 postalar callular and scutellar (lateral and median) bristles reddish-black and well developed; pleural integument dark brown; antepronotum with narrow curved white scales, several long dark bristles; postpronotum covered with narrow curved scales, reddish-black ones dorsally and white ones medially, 5-6 posterior dark bristles; propleuron with a patch of broad white scales, several golden bristles; postspiracular area with a patch of broad white scales, 4-5 golden bristles; subspiracular area with 2 patches of broad white scales, lower one larger; mesepisternum with median, upper and posterior patches of broad white scales, median patch small, several upper and posterior golden bristles, lower ones shorter; prealar knob with several golden bristles; paratergite with broad white scales on lateroventral margin; mesepimeron with a large patch of broad white scales and several golden bristles on upper area; other pleural areas bare. Legs. Coxae I-III each with several brown or golden bristles, I with broad brown scales and a few white ones intermixed on anterior and lateral surfaces, a small patch of broad white ones dorsally, II with anterior covered with broad brown scales and a small patch of broad white ones dorsally, III with a few broad white scales posteriorly; trochanters I-III each with a patch of ventral broad dusty-white scales, a few white apical ones on III; femora I-III

brown, each with anterior and posterior with intermixed white scales and a dorsoapical white spot, posterior of II-III with numerous white scales nearly covering basal 0.50 of II and basal 0.75 of III; tibiae I-III brown, each with intermixed white scales and a small dorsoapical white spot, I with an indistinct posteroventral longitudinal white stripe, II with an indistinct posteromedian longitudinal white stripe; tarsi I-III brown, I with tarsomeres 1-2 each with a basal white band, tarsomere 3 with a dorsobasal white spot, II with tarsomeres 1-3 each with a basal white band, tarsomeres 4 with a dorsobasal white spot, with a dorsobasal white spot, a few scattered white scales on tarsomere 1; posttarsi I-III each with 2 ungues, I-II equal, each bearing a claw, III equal, simple. Wing. Dorsal veins covered with moderately broad brown scales with white ones intermixed, approximately 30 percent of the scales white; costa with a small white spot at base; ventral veins brown scaled with white scales intermixed; alula with narrow brown scales along fringe; 1-2 remigial bristles. Halter. Pedicel pale, capitellum white scaled. Abdomen. Terga brown with broad dorsobasal white bands on II-VI and a few basal pale scales on VII; tergum I with several white scales mesally and a rectangular patch of white scales on laterotergite; terga II-VII each with a lateromedian patch of white scales, patches not connected to dorsal bands; sterna with lateral areas mainly pale scaled, median and posterior areas brown; terga and sterna with numerous golden bristles, mostly along posterior

margins. Genitalia. Segment VIII distinctly bilobed ventro-apically, extended from segment VII and visible dorsally; tergum IX bilobed with 4-7 bristles on each lobe; cercus long, completely extended and visible dorsally; postgenital plate with a deep median apical indentation with 5-7 bristles on each lobe; insula tongue-like, membranous, covered with tiny spicules; 3 spermathecae, 1 large and 2 slightly smaller ones.

MALE (Fig. 9). Similar to female in general habitus. Head. Maxillary palpus brown with dorsobasal white spots on apical 2 segments, a few scattered white scales on antepenultimate segment, longer than proboscis by length of apical segment; proboscis brown with a few scattered ventral white scales. Legs. Tarsus I with tarsomere 1 also with a few scattered white scales, tarsomere 4 with a basal white band; tarsus III with tarsomere 5 with a narrow basal white band; posttarsi I-III each with 2 ungues, I-II with ungues unequal, each bearing a tooth, III unequal, simple. Wing. Basal white spot on costa reduced. Abdomen. Terga brown with broad basal white bands on II-VII and a few latero-median white scales on V-VII; tergum VIII white with a few lateral brown scales. Genitalia. Tergum IX strongly bilobed with 5-7 bristles on each lobe, entire surface covered with minute spicules; gonocoxite long and moderately broad, dorsal surface with a few scattered short fine bristles, mostly along tergomesal margin, lateral surface with numerous long stout bristles from base to apex, ventral surface with a number of

moderately long to long stout bristles on distal 0.35 and scattered short ones over the remainder, scattered scales on lateral and ventral surface; gonostylus with pedicel very short and broad, distal 0.63 expanded into a large mesal lobe and a lateral longer, narrow, slightly incurved, tapered horn attached approximately 0.43 from base with a very short fine apical hair, mesal expanded lobe with a long, flattened, pigmented gonostylar claw attached mesally near middle, a short fine hair near base of claw and short hair-like spicules extending from claw proximad, 2-3 short fine hairs near apex and 3-4 similar ones scattered over tergal surface of lobe; basal mesal lobe short and rounded apically, distal 0.25 with 4-5 short bristles, entire surface covered with short hair-like spicules; proctiger short, paraproct with a small subapical thumb-like process, cercal setae absent; phallosome with aedeagus of type I with 2 lateral plates connected basally, each plate with 4-7 short blunt lateral teeth on distal 0.60 and covered with a dorsal flap, paramere long, approximately 0.98 length of lateral plate; sternum IX large, entire surface covered with minute spicules, 2-3 bristles near center.

PUPA. Chaetotaxy as recorded in Table 8. Cephalothorax. Hair 5-C with 3-5 branches; 7-C with 3-6 branches; 8-C with 2-7 branches. Respiratory trumpet. Moderately pigmented; with scattered minute spicules on distal 0.75 of inner surface; index 3.06-4.38, average 3.72. Metanotum. Hair 10-C with 5-9 branches; 12-C with 4-7 branches. Abdomen. Hair

5-I with 7-16 branches; 1-II with 13-20 branches; 4-II with 7-16 branches; 14-II single; 1-III with 6-10 branches; 6-VI double or triple; 1-VII with 3-6 branches; 6-VII with 6-14 branches; 9-VII with 3-6 branches, 11-VII single or double. Paddle. Ovoid; with very minute serrations along basal 0.50 of outer margin; midrib does not reach apex; hair 1-P short, single; index 1.18-1.53, average 1.41.

LARVA (Fig. 35). Chaetotaxy as figured. Head. Hairs 1, 3, 14-C single; 4, 6-C with 4-6(5) branches; 5, 11-C with 5-7(5) branches; 7-C with 6-10(6) branches; 8, 13-C with 2-4(3) branches; 9-C with 3-4(3) branches; 10-C double or triple (2); 12-C with 4-6(4) branches; 15-C single to triple (1); basal maxillary hair single; mental plate with 25-32 (25) teeth. Antenna. Lightly pigmented; numerous spicules scattered over entire shaft; hair 1-A with 5-9(6) branches, inserted 0.38-0.45 from base; 2-A long; 3-A approximately 0.50 length of 2-A. Thorax. Hair 0-P with 5-7(6) branches; 1, 5, 6, 10-P single; 2, 9-P double or triple (2); 3, 4, 7-P double or triple (3); 8-P single or double (2); 11-P double; 12, 14-P single or double (1); 1-M with 3-5(4) branches; 2-M single or double (1); 3-M with 2-4(3) branches; 4-M with 3-6(4) branches; 5, 7, 10, 11, 12-M single; 6-M with 4-6(5) branches; 8-M with 6-8(7) branches; 9-M with 6-10(6) branches; 13-M with 5-10(6) branches; 14-M with 5-8(6) branches; 1, 11, 12-T single or double (1); 2, 4-T with 3-5(4) branches; 3-T with 10-23(16) branches; 5, 10-T single; 6-T double or triple (2); 7-T with 6-10(6) branches; 8-T with

4-6(6) branches; 9-T with 4-7(6) branches; 13-T with 5-12(5) branches. Abdomen. Hairs 0, 14-VIII single; 1-VIII with 4-7(5) branches; 1-VIII single to triple (2); 3-VIII with 6-12(10) branches; 4-VIII double or triple (2); 5-VIII with 4-8(5) branches; comb with 18-30(18) scales arranged in 3 irregular rows, scales with a short stout apical spine and short denticles along lateral margins; 1-X single or double (1); 2-X with 8-14(9) branches; 3-X single; ventral brush varies from 9 hairs on grid and 3 precratal ones to 11 hairs on grid and 1 precratal hair, usually with 10 hairs on grid and 2 precratal ones; saddle lightly pigmented with minute ridges, incompletely rings segment, with a few spicules along posterior margin, acus absent; 4 anal gills long, each with a broad base and tapering to a pointed apex. Siphon. Moderately pigmented with minute ridges; acus present; index 5.00-5.56; pecten with 15-19(17) teeth, apical 2-3 teeth longer, smooth and wider spaced than remainder which have a slender attenuate filament with 1-3 basal denticles; hair 1-S with 3-4(3) branches, inserted 0.61-0.68 from base.

TYPE DATA. Stegomyia pipersalata Giles, holotype female, Jhansi, Gonda, N. W. Provinces, INDIA, August 1900, Lt. Col. G. M. Giles, in British Museum (Natural History); Pseudograhamia maculata Theobald, syntypes female and male, Galgamuwa, CEYLON, August 1902, Green, in British Museum (Natural History).

DISTRIBUTION. Specimens examined--12 males, 23 females, 2 pupae, 10 larvae and 2 individual larval rearings from the following locations: CAMBODIA, Kiriron; CEYLON, Galgamuwa, Polgahawela; INDIA, Belgaum, Bombay Deccan, Tavargatti; Northwest, Gonda; THAILAND, Kanchanaburi. Other distribution. CEYLON, Colombo (James 1914: 262); Andankulam near Trincomalee (Carter and Wijesundara 1948: 141); INDIA, North West Provinces, Gonda, Jhansi (Giles 1902: 372); Madras City, Pusa (Senior-White 1923: 81); Bengal; Central Provinces; Anwarganj, Cownpore District; Cuttack, Kamptee, Nagpur District, Madhupur, Pusa, Ranihat (Barraud 1928: 664); Poona, Baramati (Rao and Rajagopalan 1957: 10); Bombay, Kamptee, Belgaum, Tawargatti; Bihar, Ranihat; Orissa, Cuttack, Uttar Pradesh, Anwarganj, Kanpur, Dehra Dun, Kalsi (Wattal et al. 1958: 223); WEST PAKISTAN, Baradari Garden, Bolarum (Qutubuddin 1951: 30).

TAXONOMIC DISCUSSION. Aedes pipersalatus is similar to taeniorhynchoides and vexans in the adult habitus. Pipersalatus possesses the following features: scutum with definite white scale patches; postprocoxal membrane bare; scutellum with a patch of broad and a few narrow curved white scales on midlobe; prealar knob without scales; and wing with approximately 30 percent of the scales white and intermixed with brown ones while taeniorhynchoides has the following: scutum lighter scaled with indistinct dorsal patches of white scales; postprocoxal membrane with a few small broad white scales; scutellum with only narrow curved white scales on midlobe; prealar knob with a small patch of broad white scales on lateroventral margin; and wing with approximately 40 percent of the scales white and intermixed with brown ones. From vexans these 2 species are easily separated by the large number of white scales intermixed with brown ones on most of the dorsal veins of the wing. Other features of pipersalatus are: scutal fossal area of scutum with 4-5 bristles; postpronotum with 5-6 posterior bristles; and postspiracular area

with 4-5 bristles while vexans possesses the following: scutal fossal area of scutum with 9-11 bristles; postpronotum with 8-10 bristles; and postspiracular area with 8-9 bristles.

The postgenital plate of the female genitalia has a deep median apical indentation in pipersalatus but in taeniorhynchoides there is only a small median apical indentation.

The male genitalia of pipersalatus is very similar to taeniorhynchoides but can be separated by the shape and chaetotaxy of the gonostylus.

The pupa of pipersalatus resembles culicinus and can be separated from this species by abdominal hair 4-II which has 7-16 branches as compared to 2-5 branches in culicinus.

The chaetotaxy of the larva is similar to alboscute-latus and is discussed under that species.

BIOLOGY. Larvae were collected in jungle pools in India. Pupae were found in paddy fields and in a coconut treehole in Ceylon.

In India, immatures were collected from ground pools and water-filled ditches (Barraud 1934: 260) and adults were taken in indoor shelters and biting outdoors (Rao and Rajagopalan 1957: 10).

Aedes (Aedimorphus) punctifemoris (Ludlow)

Stegomyia punctifemore Ludlow 1921, Mil. Surg. 49: 690 (F).

Aedes (Stegomyia) punctifemore Ludlow, Edwards 1922b, Indian J. med. Res. 10: 465.

Aedes (Finlaya?) punctifemore Ludlow, Dyar and Shannon 1925, Insecutor Inscit. menstr. 13: 75 (F).

Aedes (Aedimorphus) punctifemore Ludlow, Dyar 1925, Insecutor Inscit. menstr. 13: 217 (M); Edwards 1932, Genera Insec., Fasc. 194: 168.

Aedes (Aedimorphus) punctifemore (Ludlow), Edwards in Barraud 1934, Fauna Brit. India, Diptera 5: 443 (F).

Aedes (Aedimorphus) punctifemore (Ludlow), Bohart 1945, Navmed 580, p. 64 (M, F*); Knight and Hull 1953, Pacif. Sci. 7: 459 (M*, F).

Aedes (Aedimorphus) punctifemoris (Ludlow), Stone et al. 1959, Thomas Say Found. 6: 196.

FEMALE (Fig. 10). Head. Antenna dark brown, approximately equal in length to proboscis, pedicel pale with a patch of broad silvery scales and a few short fine brown hairs mesally, flagellomere 1 pale with a few small brown scales; clypeus dark brown, bare; maxillary palpus brown scaled with tuft of pale hairs at tip, approximately 0.18 length of proboscis; proboscis golden-brown scaled with apical 0.25 and basal 0.10 dark brown, approximately 1.33 length of femur I; vertex and sides covered with broad decumbent scales, dorsum with an anteromedian diamond-shaped light brown group and remainder silvery-white; lateral surface with an anterodorsal triangular light brown patch separated from lower brown area by a white stripe extending from eye margin posteromesally to occiput; narrow white scales and numerous dark brown erect forked scales on occiput, fewer scales on vertex which extend to ocular line.

Thorax. Scutal integument dark brownish-black; scutum covered with narrow curved reddish-black scales, broad silvery

scales forming patches on anterior promontory area, scutal fossal areas (anterior, lateral and posterior areas each with a circular patch), supra-alar area with a small patch anterior to and one posterior to wing base, posterior medial scutal area, prescutellar space along posterolateral margins and a few scattered broad white scales among posterior dorsocentral bristles; scutellum with a patch of broad silvery scales on each lobe (one Philippine specimen with broad pale brown scales on median lobe); median anterior promontory, acrostichal, dorsocentral (anterior and posterior), scutal fossal (anterior, 3-4 lateral, 1-2 posterior), supra-alar, several posterior medial scutal, 1 postalar callular and scutellar (lateral and median) bristles reddish-black and well developed, others absent; pleural integument dark reddish-brown; antepronotum with a few broad silvery scales, several dark bristles; postpronotum with narrow curved reddish-black scales dorsally and a posterior patch of broad silvery scales, 4-5 posterior dark bristles; propleuron with a patch of broad silvery scales, several dark bristles; postspiracular area with 4-5 dark bristles; subspiracular area with 2 small patches of broad silvery scales; mesepisternum with a small upper and a small posterior patch of broad silvery scales, several upper and posterior dark bristles, lower ones shorter; prealar knob with several dark bristles; paratergite covered with broad silvery scales; mesepimeron with a small patch of broad silvery scales and 5-6 dark bristles on

upper area; other pleural areas bare. Legs. Coxae I-III each with several dark bristles, I with broad brown scales on anterior and lateral surfaces and a dorsal patch of silvery scales, II with an anteromedian silvery patch of scales with a few brown ones below, III with a few anteroventral pale brown scales; trochanters I-III each with brown scales; femora I-III brown, each with a dorsoapical silvery spot and several broad silvery scales scattered over anterior surface; femur I with posterior brown with several broad silvery scales intermixed; femora II-III each with basal 0.75 mainly brownish-white scaled, remainder brown; tibiae I-III brown, each with a dorsoapical silvery spot and several broad silvery scales scattered over surfaces, mainly on anterior surface; tarsi I-III brown; posttarsi I-III each with 2 ungues, I-II equal, each bearing a tooth, III equal, simple. Wing. Dorsal veins covered with moderately broad brown scales with a silvery patch at base of costa; alula with narrow brown scales along fringe; 2-3 remigial bristles. Halter. Stem pale brown, knob brown scaled. Abdomen. Terga brown; tergum I with a rectangular patch of silvery-white scales on laterotergite; terga II-VII each with a small laterobasal patch of silvery scales; sterna brown scaled; terga and sterna with numerous golden-brown bristles, mostly along posterior margins. Genitalia. Segment VIII distinctly bilobed ventroapically, retracted into segment VII; tergum IX bilobed with 4-6 bristles on each lobe; cercus long, 0.75 extended and visible dorsally;

postgenital plate with a deep median apical indentation with 5-7 bristles on each lobe; insula tongue-like, membranous, covered with tiny spicules; 3 spermathecae, 1 large and 2 slightly smaller ones.

MALE (Fig. 10). Similar to female in general habitus. Head. Maxillary palpus brown, longer than proboscis by length of apical segment. Thorax. Propleuron with only 1-3 dusky-white scales, numerous dark bristles. Legs. Posttarsi I-III each with 2 ungues, I-II with ungues unequal, each bearing a tooth, III unequal, simple. Abdomen. Tergum I brown with a patch of silvery scales on laterotergite; terga II-VII brown each with a small laterobasal patch of silvery scales; tergum VIII silvery; sterna brown with an incomplete white stripe on lateral margins of sterna III-VIII. Genitalia (Fig. 19). Tergum IX strongly bilobed with 6-7 bristles on each lobe, entire surface covered with minute spicules; gonocoxite long and moderately broad, dorsal surface with a few long stout bristles along lateral margin and scattered moderately long and short ones over remainder of area, very short fine bristles along tergomesal margin, lateral surface with long stout and a few moderately long bristles, ventral surface with long stout bristles on distal 0.45 and moderately long ones along sternomesal margin, very numerous on distal 0.75, scattered short bristles over remainder of area, scattered scales on lateral and ventral surfaces; gonostylus with pedicel moderately long, narrow and somewhat

incurved, distal 0.46 expanded into a mesal lobe and a lateral short tapering apically pointed horn attached approximately 0.72 from base with a short fine hair at apex, mesal expanded lobe with a moderately long, flattened, curved, apically blunt gonostylar claw attached mesally near middle, 2 short stout bristles at apex and 2-4 slightly smaller ones along apical margin, 3-4 short fine hairs on tergal surface proximad of claw; basal mesal lobe short and rounded apically, distal 0.45 with 4-6 short bristles, entire surface covered with short hair-like spicules; proctiger short, paraproct with a subapical thumb-like process, cercal setae absent; phallosome with aedeagus of type I with 2 lateral plates connected basally, each plate with 5-6 short blunt lateral teeth on distal 0.56 and covered with a dorsal flap, paramere long, approximately 0.80 length of lateral plate; sternum IX large, entire surface covered with minute spicules, 4-5 bristles near center.

PUPA AND LARVA. Not known.

TYPE DATA. Stegomyia punctifemore Ludlow, holotype female, Fort Wm. McKinley, Rizal, Luzon, PHILIPPINES, 20 August 1921, in United States National Museum (Natural History).

DISTRIBUTION. Specimens examined--2 males and 21 females from the following locations: EAST PAKISTAN, Dinajpur, Thakurgaon; INDIA, Bihar, Gaya; PHILIPPINES, Luzon, Wack-Wack; Rizal, Camp Nichols, Ft. Wm. McKinley.

TAXONOMIC DISCUSSION. Aedes punctifemoris is a very distinct species and is easily recognized by the following features: vertex covered with broad scales; scutum with patches of broad white scales; antepronotum and postpronotum each with a few broad white scales; postspiracular area without scales; femora and tibiae with broad white scales intermixed with the brown ones; and tarsi dark scaled.

BIOLOGY. Adults were taken in light traps in the Philippines.

AEDES (AEDIMORPHUS) TAENIORHYNCHOIDES (CHRISTOPHERS)

Pecomomyia maculata Theobald 1905 (non Meigen 1804), J. econ. Biol. 1: 23 (F*); Theobald 1907, Monogr. Cul. 4: 266 (M*, F*); Brunetti 1907, Rec. Indian Mus. 1: 340; Theobald 1910, Monogr. Cul. 5: 260; Brunetti 1912, Rec. Indian Mus. 4: 460.

Leslieomyia taeniorhynchoides Christophers 1911, Paludism 2-3: 68 (M, F).

Ochlerotatus taeniorhynchoides (Chris.), Edwards 1913, Bull. ent. Res. 4: 227 (M, F).

Ochlerotatus taeniorhynchoides Chris., Brunetti 1920, Rec. Indian Mus. 17: 141; Senior-White 1923, Cat. Indian Insects, Cul., p. 83.

Aedes (Ecculex) taeniorhynchoides Chr., Edwards 1922b, Indian J. med. Res. 10: 467.

Aedes (Aedimorphus) taeniorhynchoides (Chris.), Barraud 1928, Indian J. med. Res. 15: 665 (M*, F); Stone et al. 1959, Thomas Say Found. 6: 197.

Aëdes (Aëdimorphus) taeniorhynchoides Christophers, Edwards 1932, Genera Insec., Fasc. 194: 170.

Aëdes (Aëdimorphus) taeniorhynchoides (Christophers), Barraud 1934, Fauna Brit. India, Diptera 5: 260 (M*, F).

FEMALE (Fig. 11). Head. Antenna dark brown, approximately 0.98 length of proboscis, pedicel dark brown with a few small broad brownish-white scales and a patch of short fine brown hairs mesally, flagellomere 1 with basal 0.40 pale and with a few small white scales; clypeus dark brown, bare; maxillary palpus brown scaled, segment 4 with white scales on apical 0.50 and a few at base, also an apicomesal patch of short white hairs, approximately 0.22 length of proboscis; proboscis white scaled, apical 0.25 and basal 0.11 brown with a few white scales intermixed, a few brown scales intermixed on dorsal surface of white area, approximately 1.28 length of femur I; vertex with dorsum covered with narrow curved decumbent white scales with a few narrow curved golden-brown ones intermixed on anteromedian area; lateral surface covered with broad white scales with an anterodorsal patch of dark brown ones; numerous golden-brown erect forked scales on occiput and vertex extending anteriorly to ocular line. Thorax. Scutal integument dark reddish-brown; scutum covered with narrow curved golden-brown scales with narrow curved white ones forming indistinct patterns as follows: small circular patches on anterior promontory area, anterior and median scutal fossal areas, scutal angle, and posterior medial scutal area, a large patch covering most of supra-alar area, prescutellar space with a patch along lateral margins and meeting in center, similar scales scattered along lateral margin of scutal fossal area and scutal ridge, and among seta on

acrostichal and dorsocentral areas; scutellum with a patch of narrow curved white scales on each lobe and a few long broad white ones on lateral lobes and occasionally 2-4 on median lobe; median anterior promontory, acrostichal, dorsocentral (anterior and posterior), scutal fossal (anterior, 3-5 lateral, 1-2 median and 2-3 posterior), supra-alar, several posterior medial scutal, 1 postalar callular and scutellar (lateral and median) bristles reddish-brown and well developed; pleural integument dark brown; antepronotum covered with narrow curved white scales, several brown bristles; postpronotum covered with narrow curved scales, a few golden-brown ones dorsally and white ones below, 7-8 reddish-brown posterior bristles; propleuron covered with broad white scales, several brown bristles; postspiracular area with a patch of broad white scales and a few narrow curved white ones, 4-6 golden bristles; subspiracular area with 2 patches of broad white scales, lower one longer; mesepisternum with an upper and a posterior patch of broad white scales, several upper and posterior golden bristles, lower ones shorter; prealar knob with a small patch of broad white scales on lateroventral margin, several golden bristles; paratergite with moderately broad curved white scales; mesepimeron with a large patch of broad white scales and several golden bristles on upper area; other pleural areas bare. Legs. Coxae I-III each with several brown bristles, I-II each with a patch of broad white scales dorsally and broad brown ones below with a few intermixed

white scales, III with a small anteroventral patch of broad white scales; postprocoxal membrane with a few small broad white scales; trochanters I-III each with broad white scales; femora I-III each with anterior brown with a large number of white scales intermixed, an apical white spot and a narrow basal white band, I with posterior brown with a large number of white scales intermixed, II-III each with posterior white with brown scales intermixed on apical 0.30; tibiae I-III each brown with a large number of white scales intermixed, posterior surfaces white with a few pale brown scales intermixed and each with a narrow basal white band and a small dorsoapical white spot; tarsus I brown with tarsomere 1 with a ventral longitudinal white stripe, tarsomeres 1-3 each with a basal white band, tarsomeres 4-5 each with a dorsobasal white spot, tarsomeres 1-2 each with a few intermixed white scales; tarsus II brown with tarsomere 1 with a ventral longitudinal white stripe, tarsomeres 1-4 each with a basal white band, tarsomere 5 with a dorsobasal white spot, tarsomeres 1-3 each with a few intermixed white scales; tarsus III brown with tarsomeres 1-5 each with a basal white band, tarsomeres 1-3 each with a few intermixed white scales; posttarsi I-III each with 2 ungues, I-II equal, each with a tooth, III equal, simple. Wing. Dorsal veins covered with intermixed broad brown and white scales, approximately 40 percent of the scales white; costa with a patch of white scales at base; ventral veins with intermixed brown and white scales; alula with narrow brown scales along

fringe; 2 remigial bristles. Halter. Pedicel pale, capitellum white scaled. Abdomen. Tergum I brown with a median patch of white scales, laterotergite with a rectangular patch of white scales; terga II-VI each brown with a dorsobasal white band connected more or less with a laterobasal white patch, a few brown scales intermixed in lateral patches; tergum VII with a small median dorsobasal white patch and a large laterobasal white patch; terga II-VII each with a few intermixed white scales becoming more numerous on VI-VII; sterna white scaled with numerous brown scales intermixed; terga and sterna with numerous golden bristles, mostly along posterior margins. Genitalia. Segment VIII distinctly bilobed ventroapically, usually extended from segment VII and visible dorsally; tergum IX bilobed with 6-10 bristles on each lobe; cercus long, completely extended and visible dorsally; postgenital plate with a small median apical indentation with 5-7 bristles on each lobe; insula tongue-like, membranous, covered with tiny spicules; 3 spermathecae, 1 large and 2 slightly smaller ones.

MALE (Fig. 11). Similar to female in general habitus. Head. Maxillary palpus brown with scattered white scales on each segment, apical 2 segments each with a dorsobasal white spot, longer than proboscis by length of apical segment; proboscis brown with numerous white scales intermixed and a golden band just past middle. Abdomen. Terga II-VII brown, each with a basal white band, VIII all white; sternum VIII brown with a laterobasal white spot. Legs. Posttarsi

I-III each with 2 ungues, I-II with ungues unequal, each bearing a tooth, III unequal, simple. Genitalia. Tergum IX strongly bilobed with 8-11 bristles on each lobe, entire surface covered with minute spicules; gonocoxite long and moderately broad, dorsal surface with scattered short fine bristles, lateral surface with numerous long stout bristles from base to apex, ventral surface with long stout bristles on distal 0.40, short to moderately long bristles over remainder of area, scattered scales on lateral and ventral surfaces; gonostylus with pedicel very short and broad, distal 0.65 expanded into a large mesal lobe and a lateral longer, narrow, slightly incurved, tapered horn attached approximately 0.28 from base with a short fine apical hair, mesal expanded lobe with a long, flattened, strongly tapered, pigmented gonostylar claw attached mesally near middle with a short fine hair near base and short hair-like spicules from claw proximad, 5-6 short fine hairs along apical margin and 4 similar ones on tergal surface of lobe near middle; basal mesal lobe short and rounded apically, distal 0.55 with 6-7 short bristles, entire surface covered with short hair-like spicules; proctiger short, paraproct with a small subapical thumb-like process, cercal setae absent; phallosome of type I with 2 lateral plates connected basally, each plate with 6 short blunt lateral teeth on distal 0.57 and covered with a dorsal flap, paramere long, approximately 0.90 length of lateral plate; sternum IX large, entire surface covered with minute spicules, 4-5 bristles near center.

PUPA AND LARVA. Not known.

TYPE DATA. Pecomylia maculata Theobald, holotype female, INDIA, Capt. James, one wing mounted on microscope slide with the following information: INDIA, Capt. James, I.M.S. Coll., in the British Museum (Natural History).

There has been some confusion about the location of the types of Leslieomyia taeniorhynchoides Christophers. In the original description of the species, Christophers (1911: 72) states the types (2 males and 1 female) were collected in September at Amritsar, INDIA, and deposited in the collection of the Central Malaria Bureau, Kasauli. Barraud (1928: 665) lists the types of taeniorhynchoides in the Central Malaria Bureau collection but in 1934 (page 260) he states they are in the British Museum. Stone et al. (1959: 197) also lists the types in the British Museum (Natural History). The types of taeniorhynchoides were not found in the collection at the British Museum and after checking Barraud's correspondence on file there I found that he had never sent them to the British Museum. They are in the collection at the National Institute of Communicable Diseases, Delhi, India, which received the collection from the Central Malaria Bureau.

DISTRIBUTION. Specimens examined--10 males and 30 females from the following locations: INDIA, Ambala, Chandigarh; Punjab, Amritsar, Karnal; WEST PAKISTAN, Lahore, Lahore, Shah Zada. Other distribution. CHINA, Hainan Island (Chu 1957: 158, 1958: 109); INDIA, Delhi (Barraud 1928: 665); THAILAND (Thurman 1959: 121,

1963: 54); Chiengmai, Chiengmai (Scanlon and Esah 1965: 139); SOUTH VIETNAM, Phan Rang (Parrish 1968a: 3); WEST PAKISTAN, Lahore, Changa Manga Forest (Aslamkhan and Salman 1969: 194).

TAXONOMIC DISCUSSION. The adult habitus and female and male genitalia of taeniorhynchoides are similar to piper-salatus and are discussed under that species. Females of taeniorhynchoides also resemble vexans from which they can be separated by the large number of white scales intermixed with brown ones on most of the dorsal veins of the wing and postspiracular area with 4-6 bristles (vexans has 8-9 bristles). The aedeagus, proctiger and gonostylus of the male genitalia of taeniorhynchoides are markedly different from those of vexans.

BIOLOGY. Adults were taken biting cattle in West Pakistan.

Immatures were collected in India from ground pools (Barraud 1934: 261) and from a small muddy puddle (Christophers 1911: 72). In West Pakistan, this species was taken from cattle biting collections after dusk and rarely attracted to human bait (Aslamkhan and Salman 1969: 194). Adults were collected in scrub or open forests at 1,000 to 4,500 feet in Thailand (Scanlon and Esah 1965: 139, 143).

AEDES (AEDIMORPHUS) VEXANS (MEIGEN)

Culex vexans Meigen 1830, Syst. Besch. zweifl. Ins. 6: 241 (F); Theobald 1903, Monogr. Cul. 3: 404 (M*, F*); Giles 1902, Handb., p. 416 (M*, F*); Blanchard 1905, Moust., p. 309 (M*, F*); Theobald 1905, Genera Insec., Fasc. 26: 26.

- Culex nocturnus Theobald 1903, Monogr. Cul. 3: 159 (F*);
Theobald 1905, Genera Insec., Fasc. 26: 25; Theobald
1910, Monogr. Cul. 5: 324. NEW SYNONYMY.
- Culicada minuta Theobald 1907, Monogr. Cul. 4: 338 (F*);
Theobald 1910, Monogr. Cul. 5: 294; Brunetti 1912,
Rec. Indian Mus. 4: 462.
- Culex stenoetrus Theobald 1907, Monogr. Cul. 4: 395 (F);
Brunetti 1912, Rec. Indian Mus. 4: 475.
- Culex pseudostenoeetrus Theobald 1910, Monogr. Cul. 5:
343 (F*).
- Culicada eruthrosops Theobald 1910, Monogr. Cul. 5: 299
(F*); Brunetti 1912, Rec. Indian Mus. 4: 462.
- Culex nocturnus var. niger Theobald 1913 in Sarasin and
Roux, Nova Caledonia A., Zool. 1: 164 (A).
- Ochlerotatus stenoetrus (Theo.), Edwards 1913, Bull. ent.
Res. 4: 228.
- Ochlerotatus vexans variety stenoetrus Theo., Edwards 1917,
Bull. ent. Res. 7: 219.
- Ochlerotatus vexans Mg., Edwards 1917, Bull. ent. Res.
7: 218; Brunetti 1920, Rec. Indian Mus. 17: 135;
Senior-White 1923, Cat. Indian Insects, Cul., p. 83.
- Aedes (Ecculex) vexans (Mg.), Edwards 1921, Bull. ent.
Res. 12: 322.
- Aedes (Ecculex) vexans Mg., Edwards 1922b, Indian J. med.
Res. 10: 467.
- Aedes (Aedimorphus) vexans Meigen, Edwards 1924, Bull.
ent. Res. 14: 372; Brug 1924, Bull. ent. Res. 14:
436 (L); Dyar and Shannon 1925, Insecutor Inscit.
menstr. 13: 77; Buxton and Hopkins 1925, Bull.
ent. Res. 15: 300 (L); Borel 1930, Coll. Soc.
Path. exot. Monogr. 3: 275 (M*,F); Lee 1944,
Atlas Mosq. Larvae Australian Region p. 72 (L*);
Natvig 1948, Suppl. Norsk ent. Tidsskr. 1: 412
(M*,F,L*).
- Aedes (Aedimorphus) vexans (Meigen), Barraud 1928, Indian
J. med. Res. 15: 660 (M*,F*); Penn 1949, Pacif.
Sci. 3: 60 (P*); Horsfall and Craig 1956, Ann. ent.
Soc. Am. 49: 370 (E*); Stone et al. 1959, Thomas
Say Found. 6: 198; Assem and Bonne-Wepster 1964,
Zool. Bijdr. 6: 99 (M,F,L*); Mohrig 1967, Angew.
Parasit. 8: 80 (F*); Kalpage and Brust 1968, Can.
J. Zool. 46: 711 (E*); Pao and Knight 1970, J. Geo.
ent. Soc. 5: 115 (L*).

Aëdes (Aëdimorphus) vexans (Meigen), Barraud 1934, Fauna Brit. India, Diptera 5: 253 (M*,F,L).

Aedes (Aedimorphus) vexans Meigen, Bohart 1945, U. S. Navmed. 580, p. 64 (M*,L); Bonne-Wepster 1954, Doc. med. Geogr. Trop. 6: 239 (M,F,L*).

Aedes (Aedimorphus) vexans nocturnus (Theobald), Bohart and Ingram 1946, U. S. Navmed. 1055, p. 15 (M,F,P*,L); Yamaguti and La Casse 1950, Mosquito Fauna Guam, p. 73 (M*,F*,L*); Knight and Hull 1953, Pacif. Sci. 7: 460 (M*,F,L*); Bohart 1956 (1957), Insects Micronesia 12: 59 (M*,F,L*); Stone et al. 1959, Thomas Say Found. 6: 198; Lein 1962, Pacif. Insects 4: 627.

Aedes (Aedimorphus) nocturnus (Theobald), Belkin 1962, Mosquitoes S. Pacif., p. 427 (M*,F,P*,L*); Stone 1963, Proc. ent. Soc. Wash. 65: 130; Belkin 1965, Contr. Am. ent. Inst. 1(4): 23.

Aedes (Aedimorphus) stenoetrus (Theo.), Barraud 1928, Indian J. med. Res. 15: 661 (M*,F*); Stone et al. 1959, Thomas Say Found. 6: 197.

Aëdes (Aëdimorphus) stenoetrus Theobald, Edwards 1932, Genera Insec., Fasc. 194: 170.

Aëdes (Aëdimorphus) stenoetrus (Theobald), Barraud 1934, Fauna Brit. India, Diptera 5: 255 (M*,F).

FEMALE (Fig. 12). Head. Antenna dark brown, approximately 1.02 length of proboscis, pedicel pale brown with several small white scales and a patch of short fine dark hairs mesally, flagellomere 1 pale with a few small pale scales; clypeus light brown, bare; maxillary palpus brown scaled with white scales at apex, base of segment 4 and occasionally along outer lateral margin of segments 3-4, approximately 0.18 length of proboscis; proboscis brown scaled dorsally with scattered white scales on basal 0.75, ventral and lateral surfaces golden-white from near base to apical 0.25 which is entirely dark, approximately 1.22

length of femur I; vertex with dorsum covered with narrow curved decumbent scales, an anteromedian diamond-shaped brown group and the remainder white; surface covered with broad scales, an anterodorsal black patch with white ones below and a second lower black patch in some specimens, occasionally a large patch of dusky scales anterior to antepnotum, small narrow decumbent white scales on occiput and posterior to the anterodorsal black patch; numerous golden and brown erect forked scales on occiput and vertex extending anteriorly to ocular line. Thorax. Scutal integument dark brownish-black; scutum covered with narrow curved reddish-black scales, scutal patterns vary considerably but usually with narrow curved white scale patches on median anterior promontory area, scutal fossal areas extending from anterior area along margin and onto lateral area, small patch at scutal angle, supra-alar area above posterior of paratergite extending to posterior of wing base, posterior medial scutal area, along lateral margins of prescutellar space and among posterior dorsocentral setae, an indistinct patch of narrow dusky-white scales lateral to posterior dorsocentral setae above supra-alar white patch; scutellum with a patch of narrow curved white scales on each lobe; median anterior promontory, acrostichal, dorsocentral (anterior and posterior), scutal fossal (anterior, 4-7 lateral, 1-2 median and 2-3 posterior), supra-alar, several posterior medial scutal, 1 postalar callular and scutellar (lateral and median) bristles reddish-black and well developed; pleural integument dark to light brown; antepnotum covered with narrow

curved white scales with a few broad white ones anteriorly, several dark bristles; postpronotum dark, completely covered with narrow curved scales, a small patch of lower posterior white ones and the remainder reddish-black, some specimens also with a few lower broad white scales, 7-10 dark posterior bristles; propleuron with a patch of broad white scales, several golden bristles; postspiracular area with a large patch of narrow curved or moderately broad scales or both, 7-9 golden bristles; subspiracular area with 2 patches of broad white scales, lower one longer; mesepisternum with an upper and a posterior patch of broad white scales, several upper and posterior golden bristles, lower ones shorter; prealar knob with a small patch of long broad white scales on lateroventral margin, several golden bristles; paratergite with a patch of white scales on lateral margin, scales vary in shape, some specimens with narrow curved ones, some with moderately broad ones and some with both types; mesepimeron with a patch of broad white scales and several golden bristles on upper area; other pleural areas bare. Legs. Coxae I-III each with several golden bristles, I-II each with anterior covered with broad white scales, I also with a few to a large patch of broad brown ones near middle, III with an anterodorsal and an anteroventral patch of broad white scales; trochanters I-III each with broad white scales; femora I-III each with anterior brown with varying amounts of white scales intermixed and a dorsoapical white spot, III with a broad longitudinal

white stripe tapering from base to apical 0.25, I-II each with a narrow basal white band, in some specimens there are only a few scattered white scales on I but there are always numerous ones on II (Oriental Region); femora I-III each with posterior with a broad longitudinal white stripe tapering from base to apical 0.25 and the remainder brown with intermixed white scales, stripe dorsal on I and ventral on II-III; tibiae I-III each brown with a few scattered white scales, a narrow basal white band and posterior longitudinal white stripe from base to apex, stripe posteroventral on I; tarsi I-III brown, I with tarsomeres 2-3 each with a basal white band, tarsomere 1 usually with a small dorsobasal white spot and a posterior longitudinal white stripe, tarsomere 4 with a dorsobasal white spot, II with tarsomeres 1-3 each with a basal white band, tarsomere 4 with a dorsobasal white spot, tarsomere 1 with a posterior longitudinal white stripe, III with tarsomeres 1-5 each with a basal white band, tarsomere 1 with a few scattered white scales; posttarsi I-III each with 2 ungues, I-II equal, each with a tooth, III equal, simple, occasionally toothed. Wing. Dorsal veins covered with moderately broad brown scales; costa with a small patch of white scales at base and along posterior margin from just before humeral cross vein to apical 0.66, some specimens also with scattered white scales on radius and median; ventral veins brown scaled; alula with narrow brown scales along fringe; 2-3 remigial bristles. Halter. Pedicel pale, capitellum white scaled with a few brown scales mesally. Abdomen.

Terga brown; tergum I with a few basomedian white scales, laterotergite with a rectangular patch of white scales; terga II-VI each with a dorsobasal broad white band, posterior margins of bands vary from being straight to notched mesally; terga VI-VII each with a narrow apical white band, VII also with a pair of laterobasal triangular white patches on dorsum, patches occasionally forming a notched basal band; tergum VII with a few white scales on apical margin; terga II-VII each with a large laterobasal patch of white scales, patches not connected with dorsal bands; sterna creamy-white scaled with a few brown scales mesally on III-VII; terga and sterna with numerous golden bristles, mostly along posterior margins. Genitalia. Segment VIII distinctly bilobed ventroapically, retracted into segment VII; tergum IX bilobed with 5-7 bristles on each lobe; cercus long, completely extended and visible dorsally; postgenital plate with a deep median apical indentation with 6-8 bristles on each lobe; insula tongue-like, membranous, covered with tiny spicules; 3 spermathecae, 1 large and 2 slightly smaller ones.

MALE (Fig. 12). Similar to female in general habitus. Head. Maxillary palpus brown, segments 2-5 each with a dorsobasal white spot, longer than proboscis by 0.75 of apical segment; vertex with anteromedian brown and anterodorsal black scale patches reduced. Legs. Tibia II with posterior white stripe broad; posttarsi I-III each with 2 ungues, I-II with ungues unequal, each bearing a tooth, III equal, simple, occasionally toothed. Abdomen. Terga brown

without lateral spots; tergum II with basal white band, posterior margin of band straight; terga III-VII each with a basal white band broad on lateral margins and deeply notched mesally, some specimens also with a few median apical white scales; tergum VIII white; sterna white with an indistinct median longitudinal brown stripe, stripe indistinct on VIII. Genitalia (Fig. 20). Tergum IX strongly bilobed with 6-11 bristles on each lobe, entire surface covered with minute spicules; gonocoxite long and moderately broad, dorsal surface with long stout bristles along lateral margin from base to apex, short thin bristles along tergo-mesal margin from base to apex and similar ones extending along base to lateral margin, lateral surface with long stout bristles from base to apex, ventral surface with long stout bristles on distal 0.60 of sternomesal margin, a few similar ones on apical 0.25 of area, short to moderately long bristles on proximal sternomesal margin and scattered over remainder of surface, scattered scales on lateral and ventral surfaces; gonostylus approximately 0.69 length of gonocoxite, moderately broad throughout length with distal 0.20 tapering to a blunt point with 1-2 short fine hairs at apex, laterotergal surface somewhat curved dorsally and covered with short hair-like spicules on apical 0.50, gonostylar claw long, narrow, pigmented, with apex blunt, 9-15 short fine hairs scattered over distal 0.60; basal mesal lobe short with apical 0.25 rounded, somewhat expanded and bearing 25-38 short bristles, entire surface covered with

short hair-like spicules; proctiger long, paraproct narrow with apex bluntly pointed and strongly pigmented, cercal setae absent; phallosome with aedeagus of type II with 2 lateral plates connected basally, each plate with 5-6 long, longitudinal lateral teeth with tergally curved apices and covered with a dorsal flap, paramere long, approximately 0.94 length of lateral plate; sternum IX large, entire surface covered with minute spicules, 4-5 bristles near center.

PUPA (Fig. 27). Chaetotaxy as figured and recorded in Table 9. Two to three rows of spicules mesally along posteroventral margin of abdomen II. Cephalothorax. Hair 5-C single to triple; 7-C with 2-5 branches; 8-C with 2-4 branches. Respiratory trumpet. Moderately pigmented; with scattered minute spicules on distal 0.75 of inner surface; index 2.70-3.24, average 2.96. Metanotum. Hair 10-C with 4-11 branches; 12-C single to triple. Abdomen. Hair 5-I with 2-8 branches; 10-I single; 1-II with 5-14 branches; 4-II with 2-4 branches; 1-III with 3-5 branches; 6-VI single or double; 1-VII single to triple; 6-VII with 2-5 branches; 9-VII with 2-4 branches; 11-VII single. Paddle. Ovoid; with very minute serrations along basal 0.55 of outer margin; tiny spicules along apical 0.45 of outer and apical 0.25 of inner margins; midrib does not reach apex; hair 1-P short, single; index 1.17-1.49, average 1.28.

LARVA (Fig. 36). Chaetotaxy as figured. Head. Median mouth brushes pectinate apically; hairs 1, 3, 8, 14-C single;

4, 15-C with 3-5(4) branches; 5, 9, 10, 13-C single to triple (2); 6, 9, 10, 13-C single or double (1); 7-C with 7-11(9) branches; 11-C with 3-8(6) branches; 12-C with 3-9 (5) branches; basal maxillary hair single; mental plate with 27-32(29) teeth. Antenna. Short and moderately pigmented; with small stout spicules scattered over shaft, more numerous on basal 0.50; hair 1-A with 5-10(8) branches, inserted 0.36-0.44 from base; 2-A long; 3-A approximately 0.50 length of 2-A. Thorax. Hair 0-P with 4-5(4) branches; 1, 2, 5, 6, 10, 12-P single; 3-P single to triple (2); 4, 9, 14-P single to double (1); 7-P double or triple (3); 8-P with 3-7(4) branches; 11-P with 2-4(3) branches; 1, 2, 4-M with 2-4(3) branches; 3, 5, 7, 10, 11, 12-M single; 6-M with 5-8(5) branches; 8-M with 6-9(6) branches; 9-M with 5-8(6) branches; 13-M with 4-9(4) branches; 14-M with 4-6(4) branches; 1, 4-T with 2-4(3) branches; 2-T with 2-4(2) branches; 3-T with 3-7(5) branches; 5, 10, 12-T single; 6, 11-T single or double (1); 7-T with 7-10(9) branches; 8-T with 4-5(4) branches; 9-T with 4-6(4) branches; 13-T with 5-9(6) branches. Abdomen. Hairs 1, 2-VIII on common basal plate; hairs 0, 14-VIII single; 1-VIII with 5-12(8) branches; 2, 4-VIII double or triple (2); 3-VIII with 6-10(9) branches; 5-VIII with 7-10(9) branches; comb of 7-12(8) scales arranged in 1-2 irregular rows, scales with a long stout pointed median spine and short denticles along lateral margins of base; 1, 3-X single; 2-X with 5-8(7) branches; ventral brush varies from 12 hairs on grid and 4 precratal

ones to 14 hairs on grid and 3 precratal ones, usually with 13 hairs on grid and 3 precratal ones; saddle moderately pigmented, incompletely rings segment, with small spicules along posterior margin, acus present; 4 anal gills long and tapering to a blunt point. Siphon. Moderately pigmented with minute ridges over entire surface; acus large; index 2.11-3.10; pecten with 13-18(16) teeth, apical 2-3 teeth larger, smooth or with a minute basal denticle and wider spaced than remainder which have a slender attenuate filament with 1-3 basal denticles; hair 1-S with 5-6(5) branches, inserted 0.50-0.69 from base.

TYPE DATA. Culex vexans Meigen, holotype female, near Berlin, GERMANY, Ruthe, in Museum National d'Histoire Naturelle, Paris, France; Culex arabiensis Patton, syntypes male and female, Ulub Camp and Carter, West Aden Protectorate, types nonexistent; Culex articulatus Rondani, ITALY, location of type unknown; Aedes euochrus Howard, Dyar and Knab, Popcum, British Columbia, CANADA, 2 August 1903, J. Fletcher, type no. 12057, in United States National Museum (Natural History); Culicada eruthrosops Theobald, holotype female, Trincomalee, CEYLON, November 1906, E. Green, in British Museum (Natural History); Culex malariae Grassi, ITALY, location of type unknown; Culicada minuta Theobald, holotype female, INDIA, Dr. Christophers, in British Museum (Natural History); Culex nocturnus var. niger Theobald, holotype female (?), Canala, NEW CALEDONIA, in Naturhistorisches Museum, Basel, Switzerland; Culex nocturnus Theobald, 2

syntype females, Ba, FIJI ISLANDS, April-June, Hall, in British Museum (Natural History); Culex parvus Macquart, Bordeaux, Gironde, FRANCE, type nonexistent; Culex stenoe-trus Theobald, holotype female, Maskeliya, CEYLON, April 1905, E. E. Green, in British Museum (Natural History); Culex pseudostenoe-trus Theobald, holotype female, Hakgala, CEYLON, 30 August 1907, E. Green, in British Museum (Natural History); Culex sylvestris Theobald, syntype female, Rondeau Provincial Park, Kent Co., Ontario, CANADA, 16 September 1899, E. M. Walker, from the interior of a sandy wood of white pine with a few hard woods, and syntype male, De Grassi Pt., Lake Simcoe, Ontario, CANADA, 19 July 1899, E. M. Walker, from grass and low herbs in a wood of maple, aspen, balsam and fir, both in British Museum (Natural History).

DISTRIBUTION. Specimens examined--537 males, 1,437 females, 136 pupae, 276 larvae and 129 individual rearings (45 pupal, 84 larval) from the following locations: AUSTRIA, Marchegg; BURMA, Rangoon; CANADA, British Columbia, Prince George; Manitoba, Aweme, Winnipeg; Ontario, De Grassi Pt., Lake Simcoe, Rondeau Provincial Park, Kent Co.; CEYLON, Hakgala, Maskeliya, Newara-Eliya, Trincomalee, Weligama; CHINA, Yunnan; FIJI, Lani, Lawaga, Nacaugai, Nausori, Penang, Soso, Suva; FRANCE, Lyon; GERMANY; INDIA, Assam, Chabua, Shillong, Tinsukia; Bengal, Darjeeling, Sukna; Kashmir, Srinagar; Madras, Coonoor; Punjab, Ambala; Bombay Deccan, Tavargatti, Nilgiris, Palnis, Kodai Ranal; INDO-NEZIA, Flores; Celebes, Bwool, Molino, Paloe, Pare-Pare, Saleier; Ceram, Honititoe, Lisiela, Paniwal, Piroe, Vatoenceoe, Warasuva; Java, Angki, Batavia, Gombong, Tjilatjap; New Guinea, Mambave River, Oeta; Sumatra, Atjch, Bengkoelen, Ranau; Timor, Atamboea; Amboina, Digoel River, Lisabata, Mamoedjoe, Vabaena near Boeton; IRAN, Enzebi; IRAQ, Baghdad; ITALY, Lucca; MACEDONIA, Bajirli, Keulike; MALAYSIA, Kedah, Serdang; North Borneo, Membakut; Pahang, Mela, M. Lipis; Perak, Lasah; Selangor, Puchong, Sabak; Trengganu, Marang; Kg. Saban, Semporna, Knantan, Kota Belud, Timbang; MARIANA ISLANDS, Saipan; NEW CALEDONIA, Puebo;

NEW HEBRIDES, Espirita Santo, Mai Is., Segond Channel;
 PHILIPPINES, Camarines Sur, Iriga; Laguna, Balian; Leyte,
Abuyog, Alangalang, Burauen, Carigara, Dulag, Gabas, Gulf,
Jinamoc Is., Mahaptag, Tacloban, Tarragona, Tolosa; Luzon,
Wack-Wack; Manila; Mindanao, Bunawan, Dargo, Kabakan,
Ludlow Barracks, Parang, Pettit Barracks, Zamboanga,
Torrey Barracks; Mindoro, Camiauawit Point, San Jose; Moun-
tain Province, Trinidad; Palawan, Panakan, Panitian, Quezon,
Puerto Princesa, Tarusan; Pampanga, Camp Stotsenberg; Panga-
sinan, Bayambang, San Fabian, Sison, Tayug; Rizal, Alabany,
Camp Nichols, Ft. Wm. McKinley, Pasig River; Samar, San
Antonio; Calaccad, Camp Eldridge, Iloilo, Libjo, Los Banos,
Port of Parany, Sanga Sanga Is., Lapit-Lapit, Tawi Tawi Is.,
Batu Batu, Tayabas, Infanta; ROMANIA, Bessavabia, Comana
Vlasca; SAMOA, Aeipata, Upolu Is.; SOUTH VIETNAM, An-Khe,
Cu-Chi, Dalat, Lai Khe, Long Binh, Nha Trang, Plei Ku;
 SWEDEN, Stockholm; TAIWAN, Haping, Hwalien, Kelaipao,
Shyolin; THAILAND, Chiang Mai; Chon Buri; Chumphor; Kan-
chanaburi; Krabi; Krung Thep; Lampang; Nakhon Ratchasima;
Nakon Si Thammarat; Narathiwat; Phrae; Songkhla; Surat
Thani; TIBET, Yatung; U.S.A. Florida, California; Hawaii;
Indiana; Kentucky; Maine; Michigan; Mississippi; Missouri;
Nebraska; New York; Ohio; Oregon; Utah; Virginia; Washington;
Washington, D. C.; U.S.S.R., Siberia, Amagu, Kudia River,
Irkutsk, Okeanskya; Saratow. Other distribution. AUSTRALIA,
New Guinea, Gamadodo, Milne Bay, Papua (Penn 1949b: 61);
New Guinea, Finschhafen, Saidor (Bick 1951: 412); New
Guinea, Wewak-Maprik Road Area (Standfast 1967: 192);
 CAROLINE ISLANDS (Bohart 1956: 59, Belkin 1962: 429);
 CANADA, Alberta; New Brunswick; Nova Scotia; Prince Edward
Island; Quebec; Saskatchewan; Yukon (Carpenter and La Casse
 1955: 265); CEYLON, Perodeniya (Theobald 1907: 411);
Colombo (James 1914: 262); CHINA, Hainan Island (Chu 1958:
 109); ELLICE ISLANDS (Iyengar 1955: 46); Nui Island, Funa-
futi (Belkin 1962: 429); Nui Island, Niuafu (Bohart and
 Ingram 1946: 16); FIJI (Theobald 1903a: 160, Bohart 1956:
 59, Lee 1944: 72, Edwards 1924: 372, Iyengar 1955: 44);
Taveuni, Viti Levu, Vanua Levu, Makongai, Kandavu (Belkin
 1962: 429); FRANCE, Alsace (Li and Ulu 1933: 105);
 FRIENDLY ISLANDS (Stone et al. 1959: 198); GILBERT ISLANDS,
Tarawa (Belkin 1962: 429); INDIA, Madras City (Senior-White
 1923: 83); Calcutta (Li and Wu 1933: 105); Poona City,
Manjri, Baramati (Rao and Rajagopalan 1957: 10); Central
Provinces, Pachmari; Northwest Frontier, Kohat, Abbottabad;
Assam, Golaghat, Khumtai, Nongpoh; United Provinces,
Bhowali, Naini, Tal (Barraud 1928: 661); Nilgiri Hills,
Kodaikanal (Barraud 1928: 662); Palni Hills (Barraud 1934:
 255); Coonor (Patton 1922: 67); Karachi (Hicks and Chand
 1936: 520); INDONESIA, Celebes, Ternate (Li and Wu 1933:
 105); New Guinea, Hollandia, Kaimana, Manokwari, Merauke,
Sorong, Tjof Island (Assem and Bonne-Wepster 1964: 101);
Borneo (Edwards 1922b: 467); Sumatra, Atchin, Blang
Kedjeren, Kotta Tjane, Takengon; Benkoelen, Air Prioekan;
Djambi, Moeara Tebo; Krakatau (Brug and Edwards 1931: 258);

Soemba, Pajeti (Brug 1925: 668); Sumba; Molaccas (Bonne-
Wepster 1954: 241); Bengaii, Madoera (Brug 1924a: 36);
 ITALY (Blanchard 1905: 310); Taranto (Li and Wu 1933: 105);
 LOYALTY ISLANDS, Ouvea, Mare (Belkin 1962: 429); MALAYSIA,
Selangor, Ulu Gombak (McDonald and Traub 1960: 100); Sarawak
 (Moulton 1914: 47); MARIANA ISLANDS (Bohart 1956: 59,
Iyengar 1955: 45); Guam; Saipan, Magicienne Bay (Bohart and
Ingram 1946: 41); Guam, Agat Bay, Dededo Ordot, Hilaan
Point, Inarajan, Merizo, Nimitz Beach, Umatac (Hull 1952:
 1291); Guam (Reeves and Rudnick 1951: 641, Yamaguti and La
Casse 1950: 73); MARSHALL ISLANDS, Ebon Island, Ebon Atoll
 (Bohart 1956: 59, Bohart and Ingram 1946: 22); MAURITIUS
 (Li and Wu 1933: 105); NETHERLANDS (Blanchard 1905: 310);
 NEW CALEDONIA, Houailon (Li and Wu 1933: 105, Buxton and
Hopkins 1927: 91, Edwards 1924: 372); Art, Belep; widely
 distributed on main island; Ile des Pins (Belkin 1962: 429);
 NEW HEBRIDES (Iyengar 1955: 43, Knight and Hull 1953: 462);
Espiritu Santo (Perry 1946: 16); Aneityum, Efate, Emae,
Futuna (Belkin 1962: 429); PALAU ISLANDS (Stone et al. 1959:
 198); PHILIPPINES, Bulaca, Tunkong Manga; Mindanao, San
Ramon; Palawan, Bacungam, Iwahig Penal Colony, Balsahen and
Tacbueros Rivers; Samar, Osmena; Zambales, Olongapo, Subic
Bay (Knight and Hull 1953: 462); Tunkulan (Edwards 1929:
 5); ROTUMA ISLAND (Belkin 1962: 429, 1965: 23); SCANDINAVIA
 (Blanchard 1905: 310); SOMOAN ISLANDS, Lalomanu, Laulii,
Mulifanua, Upolu Island, Aleipata (Buxton and Hopkins 1927:
 91); Savaii (Belkin 1962: 429, Bohart and Ingram 1946: 16);
 SOUTH AFRICA, Transvaal, Warmbaths District (Muspratt 1955:
 172); SOUTHERN COOK ISLANDS, Rarotonga (?) (Belkin 1962:
 429); SOUTH VIETNAM (Borel 1930: 275); Bien Hoa, Cam Ranh
Bay, Nha Trang, Phan Rang Phu Cat, Pleiku, Tan Son Nhut,
Tuy Hoa (Parrish 1968a: 2-5); TAIWAN, Tainan, Hsinhua;
Taipei, Tamshui; (Lien 1962: 628); Takao (Edwards 1921a:
 629); TANZANIA, Zanzibar, Pemba Island (Li and Wu 1933: 105);
 THAILAND, Trang (Causey 1937: 414); Ban-U-Tapao, Nakhon
Phanom, Takhli, Udorn (Parrish 1968b: 2-4); Chieng Mai,
Doi Pui Mt. (Scanlon and Esah 1955: 139); TIBET (Buxton
 and Hopkins 1927: 91); TOKALAU ISLANDS (Belkin 1962: 429);
 TONGA ISLANDS (Knight and Hull 1953: 462); Nukualofa (Li
 and Wu 1933: 105, Edwards 1924: 372, Buxton and Hopkins
 1927: 91); Niutao, Niutatobutabu (Bohart and Ingram 1946:
 16); Niuafoou, Tangatabu (Belkin 1962: 429); U.A.R., Egypt
 (Li and Wu 1933: 105); U.S.A., Arizona; Arkansas; Colorado;
Connecticut; Delaware; Georgia; Idaho; Illinois; Iowa; Kansas;
Louisiana; Maryland; Massachusetts; Minnesota; Montana; New
Hampshire; New Mexico; North Carolina; North Dakota; Oklahoma;
Pennsylvania; Rhode Island; South Carolina; South Dakota;
Tennessee; Texas; Vermont; West Virginia; Wisconsin; Wyoming;
 (Carpenter and La Casse 1955: 264); Hawaiian Islands, Kauai
Island, Oahu Island (Joyce and Nakagawa 1963: 273); U.S.S.R.,
Azov, Rostovan-Don, Voronezh (Li and Wu 1933: 105); WALLIS
 ISLANDS, Uea (Belkin 1962: 429); WEST INDIES (Li and Wu
 1933: 105); WEST PAKISTAN, Lahore (Ansari 1959: 25);
 YUGOSLAVIA, Skoplje (Li and Wu 1933: 105).

TAXONOMIC DISCUSSION. Aedes vexans is similar in the adult habitus and male genitalia to vexans nipponii and syntheticus. It has several smaller differences from vexans nipponii but the most pronounced one is the scaling of the abdominal terga (see couplet 15 of the female key for this separation). Femora II of vexans and vexans nipponii have a number of white scales randomly intermixed with brown ones on the anterior surface while in syntheticus the anterior of femur II is brown with a median row of distinct white spots. The male genitalia of syntheticus has 5 flattened blade-like bristles while those of vexans and vexans nipponii have 25-38 short bristles. The adult habitus of vexans has a semblance to caecus which is discussed under that species. Aedes (Ochlerotatus) vigilax (Skuse) is very similar to vexans in the adult habitus and is often confused with it but can be separated from vexans by the presence of a small patch of broad white scales on the mesepisternum immediately below the prealar knob and by the absence of scales on the subspiracular area. The male genitalia of these 2 species are also very distinctly different.

The features of the pupal and larval stages of vexans and vexans nipponii tend to overlap and therefore cannot be separated with certainty.

Belkin (1962: 427) gave full species status to the members of vexans occurring on the Pacific Islands and based this determination on the branching of the larval head hairs 5, 6-C and minor differences in the adult habitus. After

examining specimens of vexans from a number of areas in its range I found that the species is extremely variable in the size and habitus of the adults and the chaetotaxy of the immatures. Barr (1954: 24) also records the variability of the larval head hairs 5, 6-C of vexans. Specimens of vexans many times exhibit a noticeable variation within local populations as well as variances between geographical populations. The 2 female syntypes of nocturnus in the British Museum (Natural History) and other specimens from the Pacific Islands that I have examined seem to fall within the normal variation of characters of adult habitus, female and male genitalia, and pupal and larval chaetotaxy of vexans from the remainder of its distribution. I am therefore synonymizing nocturnus with vexans since there is a lack of sufficient biological, behavioral and genetical data on the Pacific Island populations and since specimens from these populations fall within the variable range of morphological characters of other populations within the distribution of vexans.

BIOLOGY. Immatures were collected from: ground pools, swamp, ditch, foxhole, rice paddy, marshy depression and seepage spring in South Vietnam; abandoned posthole, ground pool, ditch and a marsh in Thailand; temporary puddle, flood pool, grassy pool, fish pond, sunlit ground pool, small flooded area near road, ditch, rain pools in pasture, carabao wallow and an open muddy algae-filled pond in the Philippines; hoofprints in Fiji; ground pool in Taiwan;

ground pools in India; stagnant water in a roadside ditch in Burma; and in pool, artificial container, and in brackish water pool and pools in alang-alang in Indonesia. Adults were taken biting man and horses, in light traps, resting in houses and bamboo forests in Thailand; biting man and in light traps in the Philippines; and in houses in Indonesia.

Immatures have been recorded from the following habitats: temporary rain puddles, grassy swamps and drainage ditches in the Philippines (Perry 1946: 16, Knight and Hull 1953: 462); unshaded pools and ditches, in salt, brackish or fresh water (Assem and Bonne-Wepster 1964: 101), artificial containers, hoofprints, pools, ponds and ditches in New Guinea (Steffan 1966: 212); clear water pools containing grass in Guam (Yamaguti and La Casse 1950: 78); in ditches and ponds in Malaysia (Macdonald 1957: 21); in ground pools and artificial receptacles in Thailand (Causey 1937: 414); newly flooded rice fields and ground pools in Taiwan (Lien 1962: 628); and ground pools in China (Chow 1949: 129); Adults have been taken in indoor shelters in India (Rao and Rajagopalan 1957: 10); feeding on man (Standfast 1967: 193), and cattle (Macdonald 1957: 21), and in an indoor evening catch in Malaysia (Macdonald 1956: 233); commonly taken while trying to bite humans at night and from a light trap in the Philippines (Knight and Hull 1953: 462); females bite man, cows and buffaloes at night in Taiwan (Lien 1962: 628). In Thailand vexans was found in scrub or open forests and in heavy forest and at elevations from 1,000 to 4,500 feet (Scanlon and Esah 1965: 139, 143).

AEDES (AEDIMORPHUS) VEXANS NIPPONII (THEOBALD)

Culicada nipponii Theobald 1907, Monogr. Cul. 4: 337 (F*).

Ochlerotatus vexans variety nipponii Theo., Edwards 1917, Bull. ent. Res. 7: 219.

Ochlerotatus vexans Mg., Brunetti 1920 (in part), Rec. Indian Mus. 17: 135; Senior-White 1923 (in part), Cat. Indian Insects, Cul., p. 83.

Aedes (Ecculex) vexans variety nipponii Theobald, Edwards 1921, Bull. ent. Res. 12: 322.

Aedes vexans var. nipponii Theobald, Ho 1931, Bull. Fan meml. Inst. Biol. 2: 131 (M*,F).

Aedes (Aedimorphus) vexans var. nipponii Theobald, Edwards 1932, Genera Insec., Fasc. 194: 171.

Aedes (Aedimorphus) vexans (Meigen), Barraud 1934 (in part), Fauna Brit. India, Diptera 5: 253.

Aedes (Aedimorphus) vexans Meigen, Feng 1938, Peking nat. Hist. Bull. 12: 291; Hsiao 1945, Navmed. 630, p. 66.

Aedes (Aedimorphus) vexans nipponii (Theobald), Bohart 1946, U. S. Navmed. 961, p. 10; Bohart and Ingram 1946, U. S. Navmed. 1055, p. 69 (M*,L*); Hsiao and Bohart 1946, U. S. Navmed. 1095, p. 22; La Casse and Yamaguti 1947, Mosquitoes Japan, 2: 39(L*); La Casse and Yamaguti 1948, Mosquito Fauna Japan and Korea, p. 100 (M*,F*,P*,L*); La Casse and Yamaguti 1950, Mosquito Fauna Japan and Korea, p. 125 (M*,F*,P*,L*); Yoshimeki 1955, Ecol. Rev., Jap. 14: 81 (L*); Hara 1957, Jap. J. exp. Med. 27: 66 (F*); Stone et al. 1959, Thomas Say Found. 6: 199.

FEMALE (Fig. 13). Head. Antenna dark brown, approximately 0.88 length of proboscis, pedicel pale with a number of small white scales and a few short fine brown hairs mesally, flagellomere 1 pale with a few dusky scales; clypeus dark, bare; maxillary palpus brown scaled with white scales at base of segment 4 and at base and apex of segment 5, usually several white scales scattered over segments 3-5,

approximately 0.20 length of proboscis; proboscis brown scaled with a broad longitudinal ventral stripe from near base to apical 0.25, stripe extends up lateral surfaces and onto dorsolateral areas, in some specimens the stripe forms a nearly complete band, apical 0.25 always dark brown, approximately 1.26 length of femur I; vertex with dorsum covered with narrow decumbent scales arranged in a small anteromedian diamond-shaped golden-brown group and the remainder white, narrower white scales on posterior margin of occiput; lateral surface covered with broad scales, an anterodorsal black patch with white ones below; numerous long golden-brown erect forked scales on occiput and vertex extending anteriorly to ocular line. Thorax. Scutal integument dark brown; scutum covered with narrow curved reddish-brown scales (specimens from Japan have scales golden-brown), narrow curved white scales forming patches on anterior promontory area, scutal fossal area extending from anterior area along margin and onto lateral area, supra-alar area from above middle of paratergite to posterior of wing base, posterior median scutal area, along lateral margins of prescutellar space and among posterior dorsocentral setae; scales nearly cover prescutellar space in some specimens; scutellum with a patch of narrow curved white scales on each lobe; median anterior promontory, acrostichal, dorsocentral (anterior and posterior), scutal fossal (anterior, 4-5 lateral, 1-3 median and 1-6 posterior), supra-alar, several posterior medial scutal, 1 postalar callular and scutellar (lateral and median) bristles reddish-brown

and well developed; pleural integument brown; antepronotum covered with narrow curved white scales, several golden and brown bristles; postpronotum covered with narrow curved reddish-brown scales, a small posteroventral patch of narrow curved and usually a few broad white scales, 8-9 posterior dark bristles; propleuron with a patch of broad white scales, several golden bristles; postspiracular area with a patch of moderately broad white scales, 7-11 golden bristles; subspiracular area with 2 patches of broad white scales, lower one large and frequently connected with postspiracular patch; mesepisternum with a large upper and a posterior patch of broad white scales, patches usually connected or nearly so, several upper and posterior golden bristles, lower ones shorter; prealar knob with a few broad white scales on lateroventral margin, several golden bristles; paratergite covered with white scales, scales vary in shape, some specimens with broad ones, some with narrow curved ones and some with both; mesepimeron with a large patch of broad white scales and several golden bristles on upper area; other pleural areas bare. Legs. Coxae I-III each with several brown to golden bristles, I-II each with anterior white scaled, I with a patch of brown scales at middle, III with an anterodorsal and an anteroventral patch of white scales; trochanters I-III each with a patch of broad white scales; femora I-III each with anterior brown and with a dorsoapical white spot, I-III each with a narrow basal white band and numerous scattered white scales, I

with 30-60 percent of scales white, III with a broad longitudinal white stripe tapering from base to apical 0.25, remainder with scattered white scales; femora I-III each with posterior white, I with scattered brown scales on posteroventral area, II-III each with scattered brown scales on apical 0.25; tibiae I-III each with a few scattered white scales and a narrow basal white band, I with ventral and posterior areas white, II with dorsal and posterior areas white, a small brown area on dorsal surface at base and at apex, III with a posterior longitudinal pale stripe; tarsi I-III brown, I with tarsomeres 2-3 each with a narrow basal white band, tarsomere 1 and basal 0.50 of tarsomere 2 with a posterior longitudinal pale stripe, II with tarsomeres 1-4 each with a narrow basal white band, tarsomeres 1-2 each with a posterior longitudinal pale stripe, tarsomere 5 with a few laterobasal white scales, III with tarsomeres 1-5 each with a narrow basal white band, tarsomere 1 and basal 0.50 of tarsomere 2 with a posterior longitudinal pale stripe; posttarsi I-III each with 2 ungues, I-II equal, each bearing a tooth, III equal, simple, occasionally each with a tooth. Wing. Dorsal veins covered with moderately broad brown scales; costa with a patch of white scales at base and along basal 0.50 of posterior margin; subcosta, radius, cubitus and occasionally anal veins with a few white scales intermixed on basal 0.50; ventral veins brown with some white scales on posterior margin of costa and on subcosta at humeral cross vein; alula with narrow

brown scales along fringe; 2-3 remigial bristles. Halter. Pedicel pale, capitellum white scaled. Abdomen. Terga brown with somewhat variable white markings; tergum I with dorsum white with a few intermixed lateral brown scales, laterotergite with a rectangular patch of white scales; tergum II with a large basomedian triangular white patch; terga III-VI each with a dorsobasal white band, bands very broad laterally and becoming narrower mesally, III-V each with an incomplete median apical longitudinal white stripe which may or may not connect with basal bands; terga VI-VII varies from each with a large dorsoapical triangular white spot and VII with a pair of small basolateral triangular white patches on dorsum to VI-VII each white with a dorsal brown V-marking pointing anteriorly; terga II-VII each with a large laterobasal white patch which may nearly cover lateral surfaces but is not connected with dorsobasal bands; sterna white scaled with brown scales forming a narrow indistinct longitudinal stripe on III-VII; terga and sterna with numerous golden bristles, mostly along posterior margins. Genitalia. Segment VIII distinctly bilobed ventro-apically, mostly retracted into segment VII; tergum IX bilobed with 5-8 bristles on each lobe; cercus long, completely extended and visible dorsally; postgenital plate with a deep median apical indentation with 5-8 bristles on each lobe; insula tongue-like, membranous, covered with tiny spicules; 3 spermathecae, 1 large and 2 slightly smaller ones.

MALE (Fig. 13). Similar to female in general habitus. Head. Maxillary palpus brown with segments 2, 4-5 each with a dorsobasal white spot, segment 3 with a basal white band, longer than proboscis by length of apical segment; vertex with anteromedian narrow golden-brown scale patch and anterodorsal broad black scale patch reduced. Legs. Tarsi I-III with posterior longitudinal stripes reduced; posttarsi I-III each with 2 ungues, I-II with ungues unequal, each bearing a tooth, III equal, simple. Abdomen. Terga II-VI with basal white bands which are expanded posteriorly on lateral surfaces, VII with large lateral triangular patches nearly connected medially, III-V with median apical longitudinal white stripes reduced to a few pale scales in some specimens; tergum VIII white; sternum VIII white with a median longitudinal brown band. Genitalia. Identical to that of Aedes vexans.

PUPA. Chaetotaxy as recorded in Table 10. Two to three rows of spicules mesally along posteroventral margin of abdomen II. Cephalothorax. Hair 5-C with 2-4 branches; 7-C with 2-4 branches; 8-C with 3-6 branches. Respiratory trumpet. Moderately pigmented; with scattered minute spicules on distal 0.75 of inner surface; index 2.89-3.82, average 3.26. Metanotum. Hair 10-C with 4-10 branches; 12-C single to triple. Abdomen. Hair 5-I with 2-5 branches; 10-I single; 1-II with 4-10 branches; 4-II with 2-4 branches; 1-III with 3-6 branches; 6-VI single or double; 1-VII single to triple; 6-VII with 3-4 branches; 9-VII with 2-4 branches;

11-VII single. Paddle. Ovoid; with very minute serrations along basal 0.55 of outer margin; tiny spicules along apical 0.45 of outer and apical 0.30 of inner margins; midrib does not reach apex; hair 1-P short, single or double; index 1.42-1.82, average 1.59.

LARVA. Chaetotaxy as follows: Head. Median mouth brushes pectinate apically; hairs 1, 3, 8-C single; 4-C with 2-4(4) branches; 5-C single to 4(3) branched; 6, 14-C single or double (1); 7-C with 7-12(9) branches; 9, 10-C single or double (2); 11-C with 4-10(7) branches; 12-C with 4-7(5) branches; 13-C single to triple (2); 15-C with 4-6 (4) branches; basal maxillary hair single; mental plate with 25-27(26) teeth. Antenna. Short and moderately to heavily pigmented; with small stout spicules scattered over shaft, most numerous on basal 0.50; hair 1-A with 5-10(6) branches, inserted 0.38-0.45 from base; 2-A long; 3-A approximately 0.50 length of 2-A. Thorax. Hair 0-P with 3-6(5) branches; 1, 2, 4, 5, 6, 9, 10, 12-P single; 3-P double or triple (2); 7-P double or triple (3); 8-P with 2-4(3) branches; 11-P single to triple (2); 14-P single or double (1); 1, 2, 4-M with 2-4(3) branches; 3, 11-M single or double (1); 5, 7, 10, 12-M single; 6-M with 5-6(5) branches; 8-M with 5-7(6) branches; 9-M with 6-7(6) branches; 13-M with 5-9(7) branches; 14-M with 4-6(5) branches; 1-T single to triple (2); 2-T double or triple (3); 3-T with 2-7(6) branches; 4-T with 2-5(4) branches; 5, 6, 10, 12-T single; 7-T with 6-11(7) branches; 8, 9-T with 4-6(5)

branches; 11-T single or double (1); 13-T with 5-8(5) branches. Abdomen. Hairs 1, 2-VIII on common basal plate; hairs 0, 14-VIII single; 1-VIII with 4-12(8) branches; 2, 4-VIII double or triple (2); 3-VIII with 5-12(8) branches; 5-VIII with 6-9(9) branches; comb of 9-11(9) scales arranged in 1-2 irregular rows, scales with a long stout pointed median spine and short denticles along lateral margins of base; 1-X single or double (1); 2-X with 6-9(8) branches; 3-X single; ventral brush varies from 11 hairs on grid and 3 precratal ones to 13 hairs on grid and 3 precratal ones, usually with 11 hairs on grid and 3 precratal ones; saddle moderately pigmented with minute ridges, incompletely rings segment, with small spicules along posterior margin, acus present; 4 anal gills long and tapering to a blunt point. Siphon. Moderately pigmented with minute ridges over entire surface; acus large; index 2.42-3.86; pecten with 9-11(9) teeth; apical 2-3 teeth longer, smooth or with a minute lateral denticle and wider spaced than remainder which have a slender attenuate filament with 1-3 basal denticles; hair 1-S with 5-7(5) branches, inserted 0.57-0.64 from base.

TYPE DATA. Culicada nipponii Theobald, holotype female, Karnizana, JAPAN, 25 August 1903, Mr. Cornford, in British Museum (Natural History).

DISTRIBUTION. Specimens examined--23 males, 62 females, 30 pupae, 39 larvae and 30 individual rearings (5 pupal, 25 larval) from the following locations: CHINA,

Kiangsu, Peking, Shanghai, Yenching; Manchuria, Mukden, Tetsusci; JAPAN, Karnizana; Saitama, Honshu, Sagiyama; KOREA, Taegu; RYUKYU ISLANDS, Ishigaki Is., Inota III; Okinawa, Dyama, Ganiko, Kuba, Myiazato, Naha, Oyama; Miyako Is.; U.S.S.R., Siberia. Other distribution. CHINA, Honan, Kai Feng, Chi Kung Shan, Hsin Yang (Su and Ch'ii 1956: 219); Hopei (Ma and Feng 1956: 172); Yunnan, Chefang (Chow 1949: 129); Chekiang, Hangchow, Hwangyen, Iwui Pingyang, Tienmushan; Kiangsu, Shanghai, Nanking; Kwangtung, Canton, Swatow; Liaoning, Hailung; Tibet, Chumbi Valley; Yunnan, Gadzu Beta (Feng 1938: 291); JAPAN, Hokkaido, Sapporo; Honshu, Yodo; Sendai (La Casse and Yamaguti 1950: 129); Asahikawa, Kagoshima (Hara 1957: 66); Hokkaido, Sendai, Tokyo (Hsiao and Bohart 1946: 22); Nagasak (Omori et al. 1952: 281); Fukui, Tadasu-Mura (Omori 1951: 310); Okayama, Tokoku (Sasa 1949: 99); Tochigi, Shiobara, Tomatsuri, Utsunomiya (Kurashige 1964: 75, 84, 94); Funaoka (Kato and Toriumi 1950: 468).

TAXONOMIC DISCUSSION. Aedes vexans nipponii is similar in the adult habitus and female and male genitalia to vexans and is discussed under that species.

BIOLOGY. Larvae were collected on Okinawa from ground pools, rice paddy, stream, swamp, ditch and a small pond.

Immatures have been collected from natural water pools and swamps in China (Feng 1938: 291), from Japanese decorative garden pools, rice paddy ditches, stone urn, bamboo stump, small cup and seepage pool from broken pipe in Japan (La Casse and Yamaguti 1947: 40) and from temporary, partially shaded, fresh water ground pools containing leaves in Okinawa (Bohart and Ingram 1946: 69). In Japan larvae of vexans nipponii were collected from paddy fields in association with Culex pipiens, Culex tritaeniorhynchus, Culex orientalis, Culex hayashii, Culex bitaeniorhynchus and Aedes dorsalis (Kato 1956: 157). The feeding period

in Japan of this species extended from 1600 to 0700 hours with a peak feeding time from 1730 to 2200 hours (Kato and Toriumi 1950: 468). Sasa (1949: 101), while working in Japan, collected adults very early in the spring and believes that it hibernates as adults during the winter. Adults were taken both during the day and night biting man in Japan (La Casse and Yamaguti 1948: 104, 1950: 129).

AEDES (AEDIMORPHUS) WAINWRIGHTI BAISAS

Aedes (Aedimorphus) wainwrighti Baisas 1946, Mon. Bull. Bur. Hlth. Philipp., Manila 22: 34 (F); Knight and Hull 1953, Pacif. Sci. 7: 464 (F); Stone et al. 1959, Thomas Say Found. 6: 199.

FEMALE. Head. Antenna dark brown, pedicel dark with a small patch of broad silvery scales mesally; clypeus dark brown, bare; maxillary palpus dark brown scaled, approximately 0.17 length of proboscis; proboscis dark brown scaled, slightly shorter than femur I; vertex and lateral surface covered with broad decumbent scales, dorsum with an anteromedian triangular patch of silvery scales that broadens anteriorly and extends as a fine line along eye margin, a dark scaled spot laterad of median spot, remainder of vertex and lateral surface pale brownish (almost whitish under different lighting); narrow dark scales and a few erect scales on occiput. Thorax. Scutal integument brownish; scutum covered with narrow dark brown scales with a broad median silvery line on anterior 0.50; scutellum with broad silvery scales on median lobe; a pair of dorsocentral

Kiangsu, Peking, Shanghai, Yenching; Manchuria, Mukden, Tetsusci; JAPAN, Karnizana; Saitama, Honshu, Sagiyama; KOREA, Taegu; RYUKYU ISLANDS, Ishigaki Is., Inota III; Okinawa, Dyama, Ganiko, Kuba, Myiazato, Naha, Oyama; Miyako Is.; U.S.S.R., Siberia. Other distribution. CHINA, Honan, Kai Feng, Chi Kung Shan, Hsin Yang (Su and Ch'ii 1956: 219); Hopei (Ma and Feng 1956: 172); Yunnan, Chefang (Chow 1949: 129); Chekiang, Hangchow, Hwangyen, Iwui Pingyang, Tienmushan; Kiangsu, Shanghai, Nanking; Kwangtung, Canton, Swatow; Liaoning, Hailung; Tibet, Chumbi Valley; Yunnan, Gadzu Beta (Feng 1938: 291); JAPAN, Hokkaido, Sapporo; Honshu, Yodo; Sendai (La Casse and Yamaguti 1950: 129); Asahikawa, Kagoshima (Hara 1957: 66); Hokkaido, Sendai, Tokyo (Hsiao and Bohart 1946: 22); Nagasak (Omori et al. 1952: 281); Fukui, Tadasu-Mura (Omori 1951: 310); Okayama, Tokoku (Sasa 1949: 99); Tochigi, Shiobara, Tomatsuri, Utsunomiya (Kurashige 1964: 75, 84, 94); Funaoka (Kato and Toriumi 1950: 468).

TAXONOMIC DISCUSSION. Aedes vexans nipponii is similar in the adult habitus and female and male genitalia to vexans and is discussed under that species.

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in Japan of this species extended from 1600 to 0700 hours with a peak feeding time from 1730 to 2200 hours (Kato and Toriumi 1950: 468). Sasa (1949: 101), while working in Japan, collected adults very early in the spring and believes that it hibernates as adults during the winter. Adults were taken both during the day and night biting man in Japan (La Casse and Yamaguti 1948: 104, 1950: 129).

AEDES (AEDIMORPHUS) WAINWRIGHTI BAISAS

Aedes (Aedimorphus) wainwrighti Baisas 1946, Mon. Bull. Bur. Hlth. Philipp., Manila 22: 34 (F); Knight and Hull 1953, Pacif. Sci. 7: 464 (F); Stone et al. 1959, Thomas Say Found. 6: 199.

FEMALE. Head. Antenna dark brown, pedicel dark with a small patch of broad silvery scales mesally; clypeus dark brown, bare; maxillary palpus dark brown scaled, approximately 0.17 length of proboscis; proboscis dark brown scaled, slightly shorter than femur I; vertex and lateral surface covered with broad decumbent scales, dorsum with an anteromedian triangular patch of silvery scales that broadens anteriorly and extends as a fine line along eye margin, a dark scaled spot laterad of median spot, remainder of vertex and lateral surface pale brownish (almost whitish under different lighting); narrow dark scales and a few erect scales on occiput. Thorax. Scutal integument brownish; scutum covered with narrow dark brown scales with a broad median silvery line on anterior 0.50; scutellum with broad silvery scales on median lobe; a pair of dorsocentral

bristles toward anterior border (these may actually be median anterior promontory bristles) and a stronger pair above level of wing bases, 2 pairs of prescutellars (posterior dorso-central bristles), rather few supra-alars and scutellar (lateral and median) bristles; pleural integument darker brown than scutum; antepronotum with a small patch of silvery flat scales, about 7 stiff, tawny bristles; postpronotum with 3 tawny bristles, but without scales; propleuron with a round patch of silvery scales, 4-5 tawny bristles; postspiracular area with 6 tawny bristles; subspiracular area with a narrow elongate patch of silvery scales astride suture between this area and mesepisternum; mesepisternum with a fairly large round upper patch and a lower one of silvery scales, 1 upper and 3-4 lower (posterior) tawny bristles; prealar knob with 4-5 tawny bristles; paratergite covered with a dense patch of broad silvery scales; mesepimeron with a patch of silvery scales and several weak bristles on upper area. Legs. Coxae I-III each with an elongate patch of silvery scales; femora I-III each dark brown with ventral surface and base pale, II with an apical silvery spot, III with basal 0.50 of anterior and posterior surfaces pale and a large apical silvery spot; tibiae I-III each dark brown; tarsi I-III each dark brown with a white basal band on tarsomere 1, band indistinct on I, marked on II and apparently still wider on III as indicated by the remaining portion of the tarsomere. Wing. Dark scaled. Abdomen. Terga dark scaled; tergum I with laterotergite silvery scaled; terga II-VII each with a laterobasal patch

of silvery scales (patches broadened, basally), patches visible dorsally on V-VII; sterna III-VII pale with posterior portions dark scaled. Genitalia. Segment VIII completely retracted into segment VII.

MALE, PUPA AND LARVA. Not known.

TYPE DATA. Aedes (Aedimorphus) wainwrighti Baisas, holotype female, Llavac, Infanta, Tayabas, Luzon, PHILIPPINES, 29 May 1940, Mr. Pablo Sunico, collected in a mosquito trap; holotype nonexistent (Stone 1970: 151).

DISTRIBUTION. Known only from type locality.

TAXONOMIC DISCUSSION. The above description has been rewritten from the original one by Baisas (1946).

Aedes wainwrighti possesses a number of features that differ from most other species of Aedimorphus in the Oriental Region. The most marked differences are: pedicel with a patch of broad silvery scales mesally; erect scales of head restricted to occiput; reduction in number or absence (see description above) of anterior dorsocentral bristles on scutum; and vertex of head with dorsum covered with broad decumbent scales (punctifemoris is the only other Oriental species with this character) which are more reminiscent of Stegomyia than Aedimorphus.

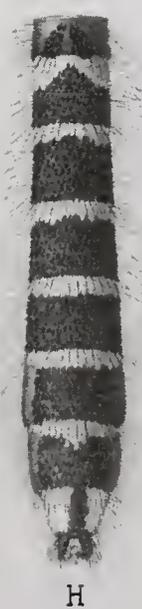
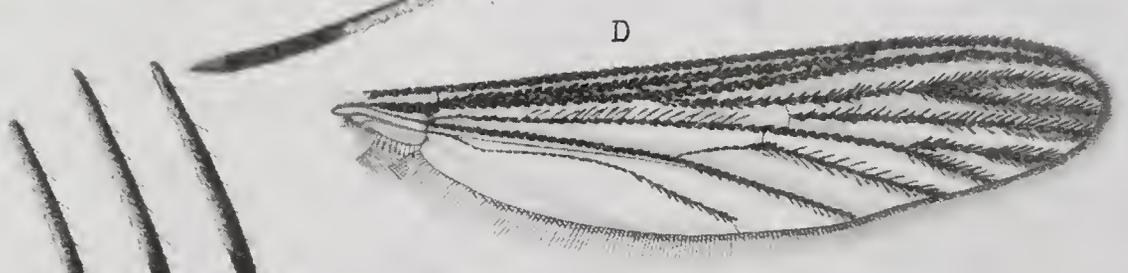
Even with these differences there are a number of characters shared by other Oriental Aedimorphus and since the type has been lost, the male has never been found and

no new material has been collected, I am for the present retaining wainwrighti in this subgenus.

BIOLOGY. The holotype was collected in a mosquito trap.

APPENDIX 1 (FIGURES 1 TO 36)

Figure 1. Aedes alboscuteUellatus adult male and female habitus. A. Male head (lateral), B. Female head and thorax (lateral), C. Female legs (anterior), D. Female wing (dorsal), E. Female head and thorax (dorsal), F. Female abdomen (dorsal), G. Female abdomen (lateral), H. Male abdomen (dorsal).



Sci. Rep.

Figure 2. Aedes caecus adult male and female habitus.

A. Male head (lateral), B. Female head and thorax (lateral), C. Female legs (anterior), D. Female wing (dorsal), E. Female head and thorax (dorsal), F. Female abdomen (dorsal), G. Female abdomen (lateral), H. Male abdomen (dorsal).

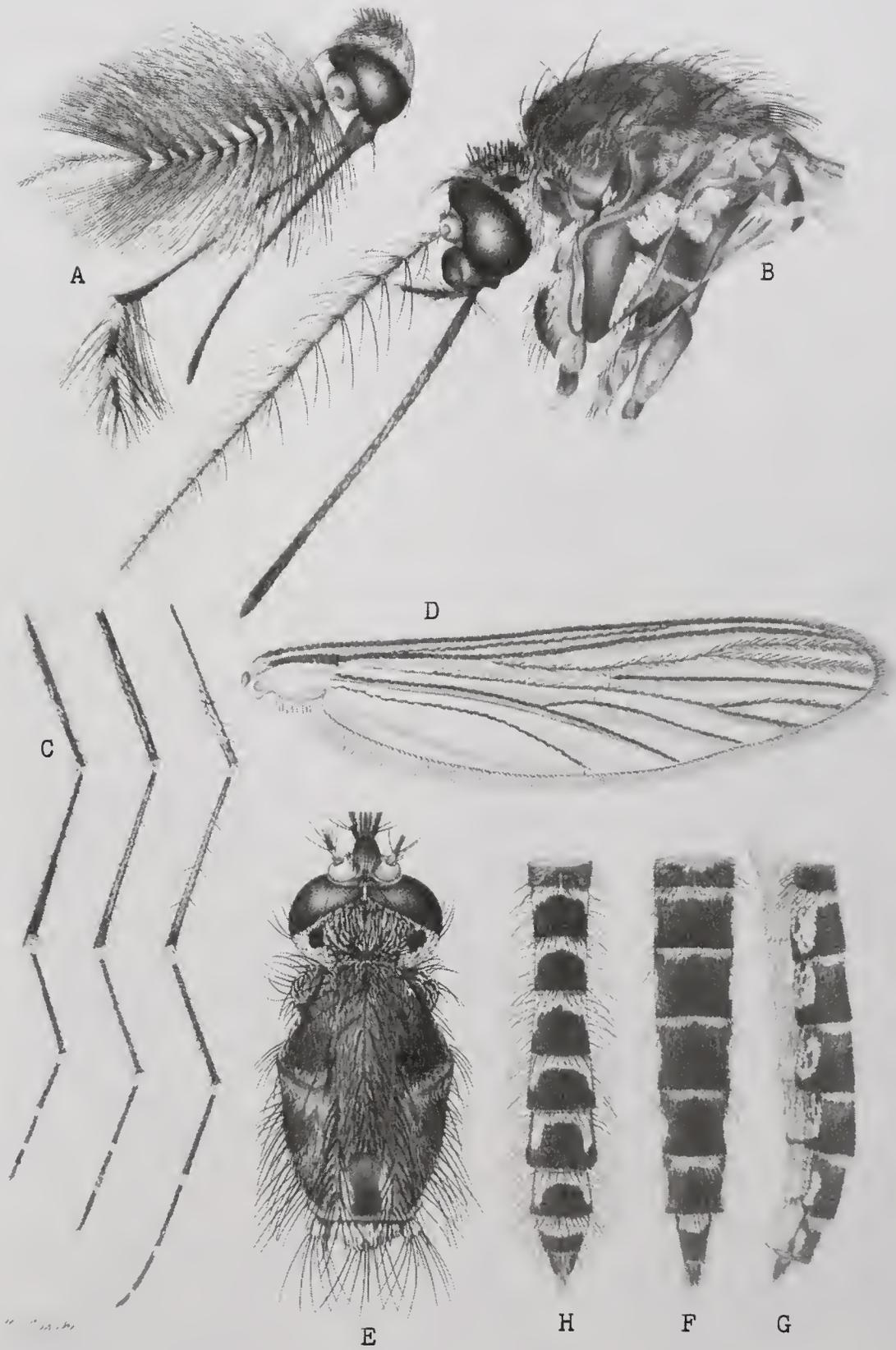
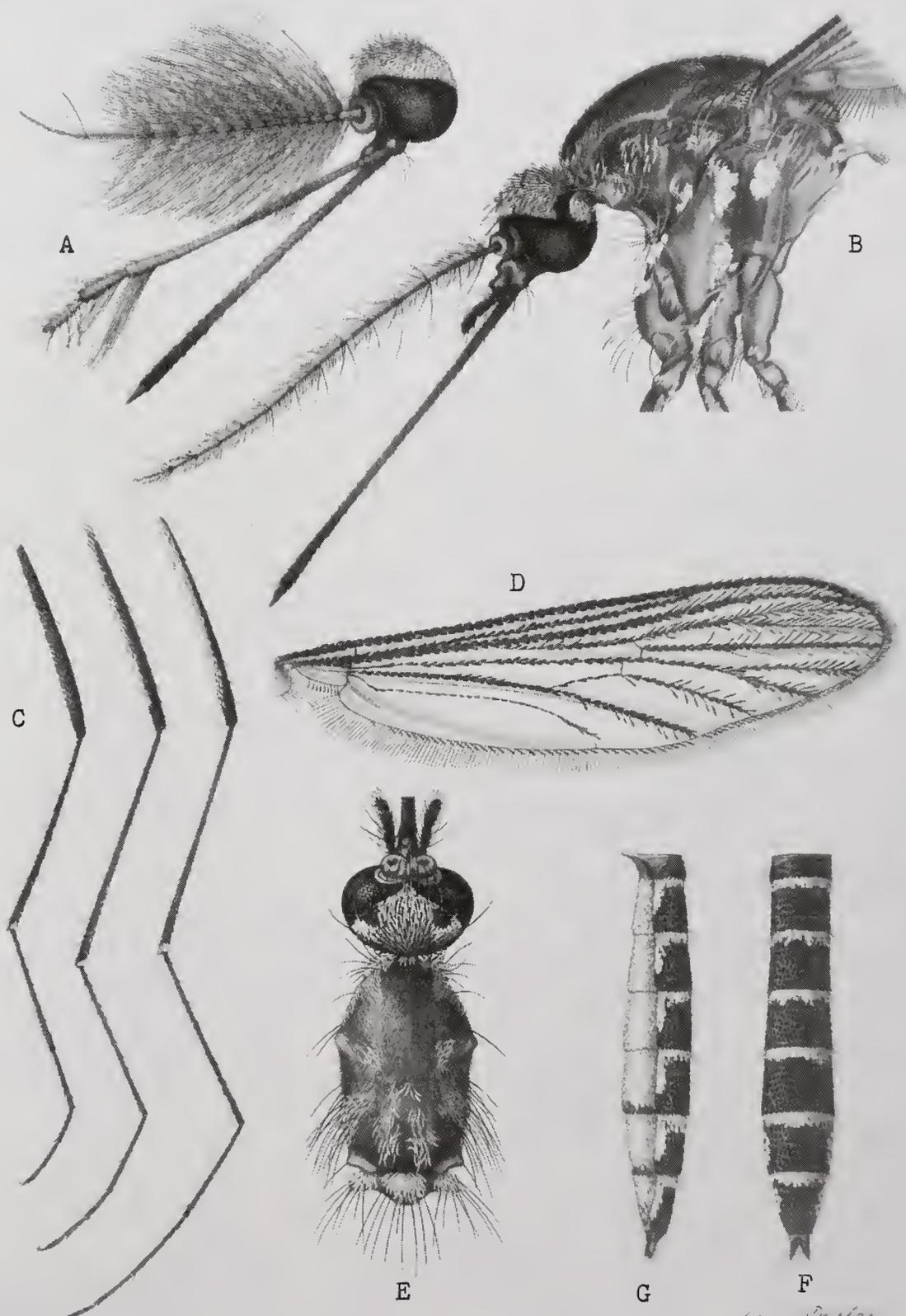


Figure 3. Aedes culicinus adult male and female habitus.

A. Male head (lateral), B. Female head and thorax (lateral), C. Female legs (anterior), D. Female wing (dorsal), E. Female head and thorax (dorsal), F. Female abdomen (dorsal), G. Female abdomen (lateral).



Tabanus

Figure 4. Aedes lowisii adult female habitus.

- A. Female head and thorax (lateral),
- B. Female legs (anterior), C. Female wing (dorsal),
- D. Female head and thorax (dorsal), E. Female abdomen (dorsal),
- F. Female abdomen (lateral).

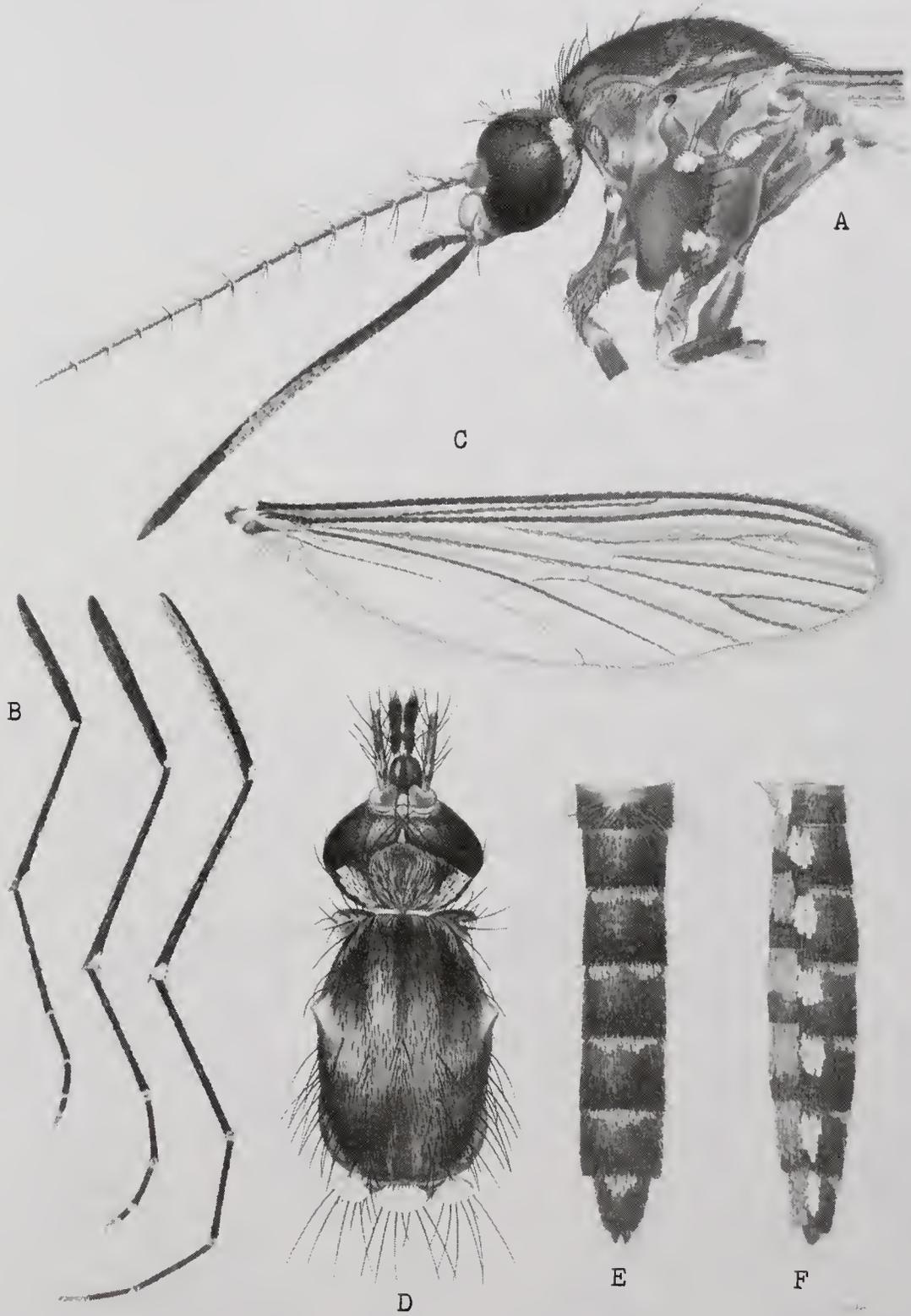


Figure 5. Aedes mediolineatus adult male and female habitus. A. Male head (lateral), B. Female head and thorax (lateral), C. Female legs (anterior), D. Female wing (dorsal), E. Female head and thorax (dorsal), F. Female abdomen (dorsal), G. Female abdomen (lateral), H. Male abdomen (dorsal).

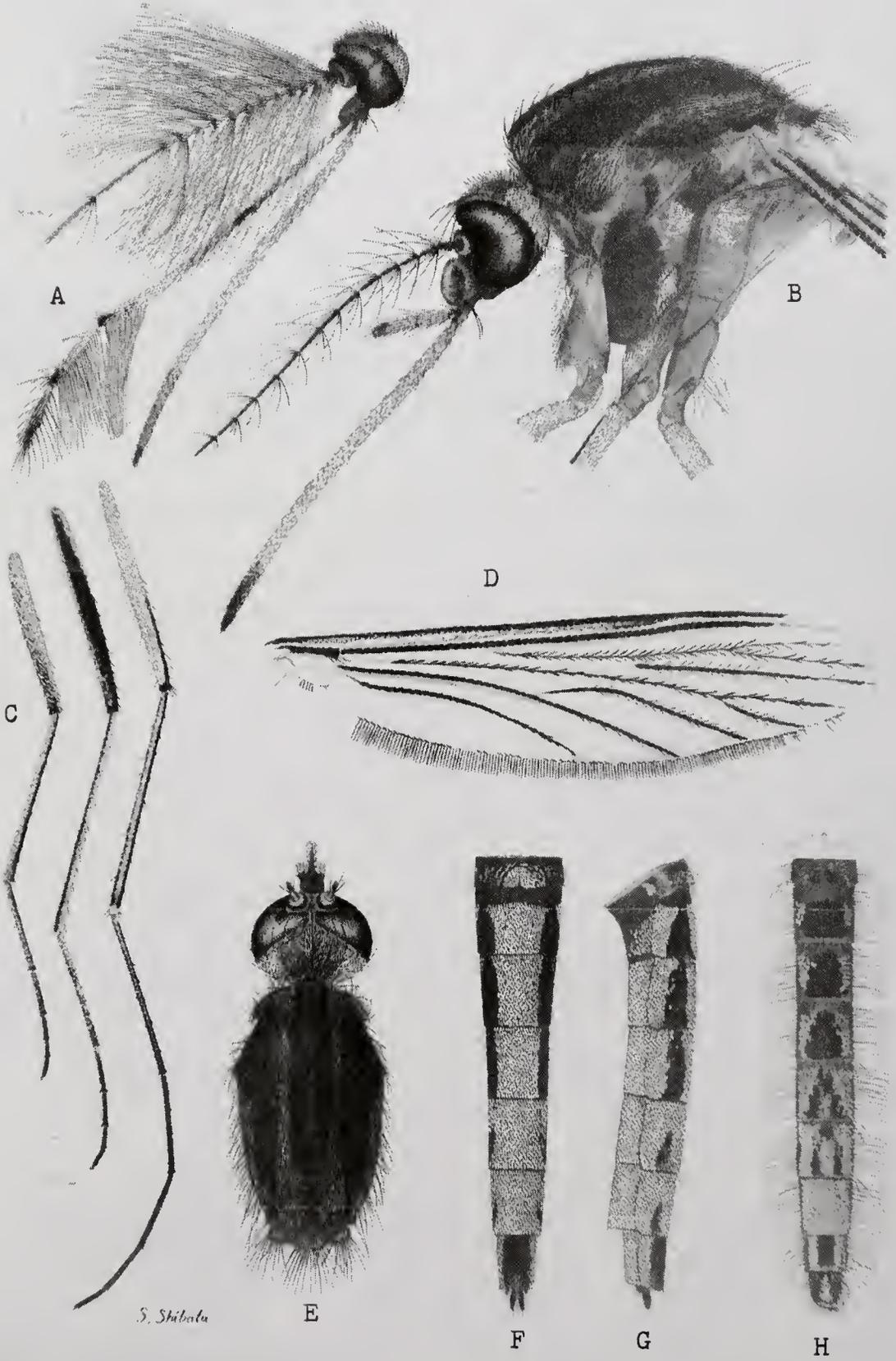


Figure 6. Aedes orbitae adult male and female habitus.
A. Male head (lateral), B. Female head and thorax (lateral), C. Female legs (anterior), D. Female wing (dorsal), E. Female head and thorax (dorsal), F. Female abdomen (dorsal), G. Female abdomen (lateral), H. Male abdomen (dorsal).

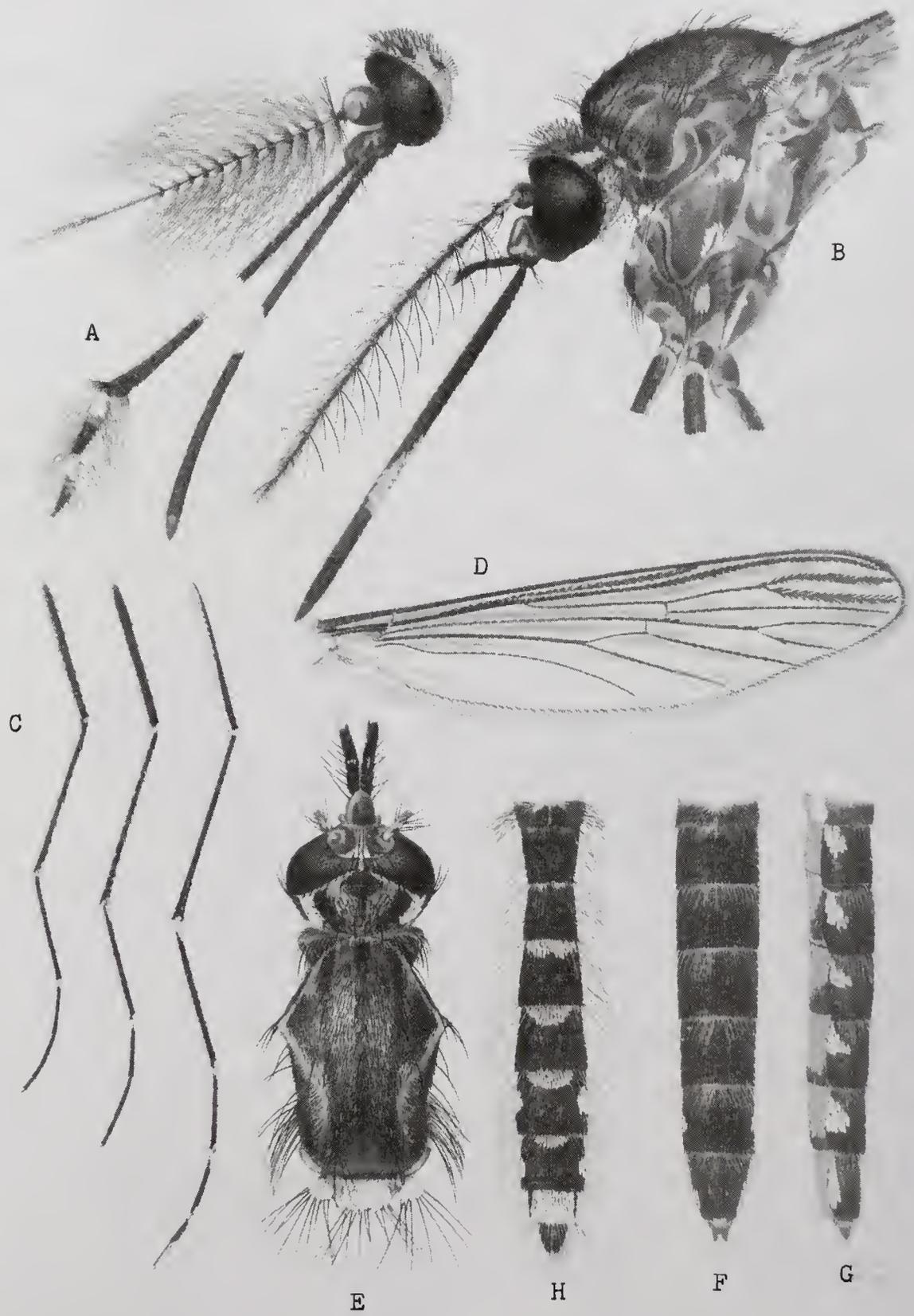


Figure 7. Aedes pallidostriatus adult male and female habitus. A. Male head (lateral), B. Female head and thorax (lateral), C. Female legs (anterior), D. Female wing (dorsal), E. Female head and thorax (dorsal), F. Female abdomen (dorsal), G. Female abdomen (lateral).

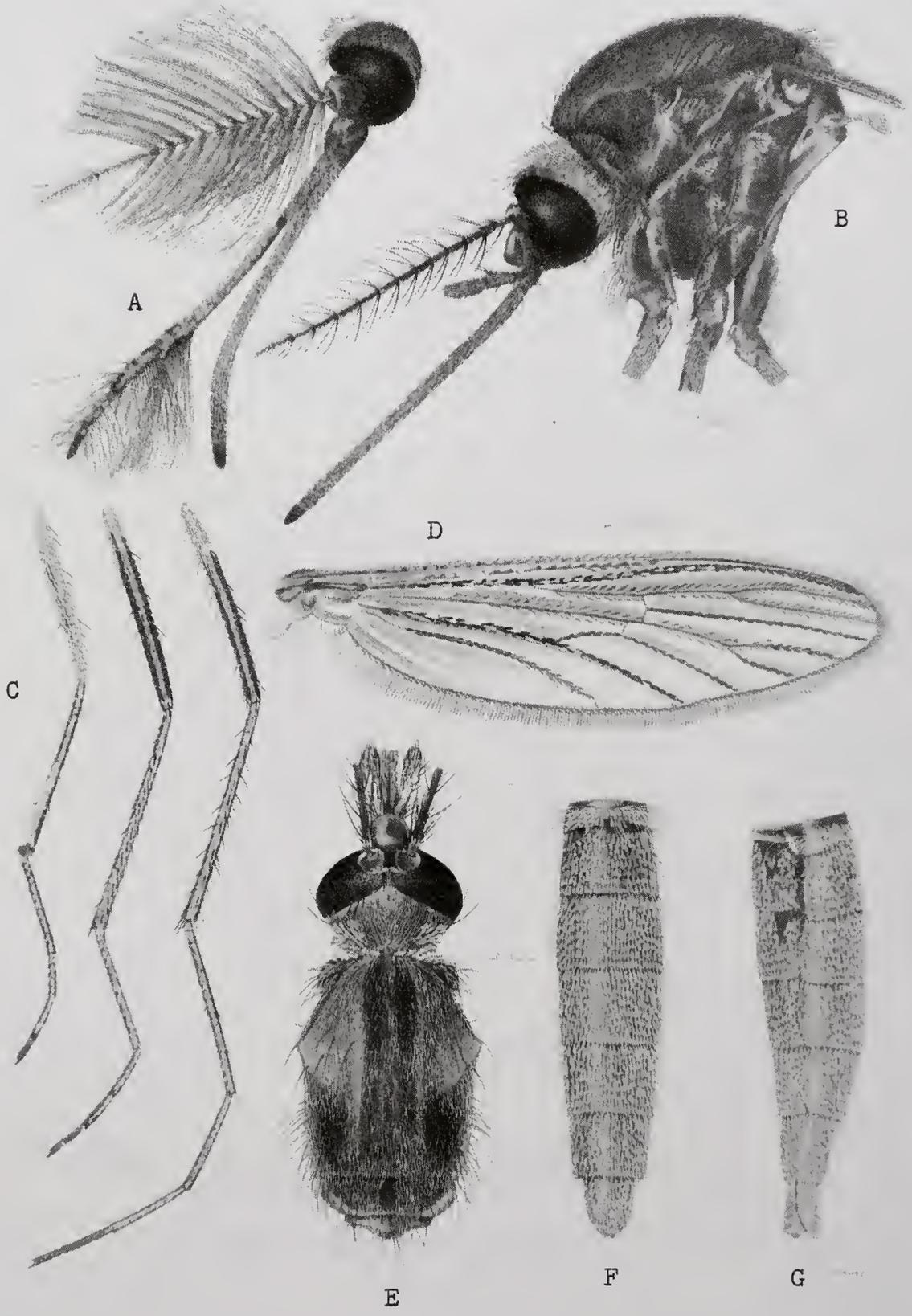


Figure 8. Aedes pampangensis adult male and female habitus. A. Male head (lateral), B. Female head and thorax (lateral), C. Female legs (anterior), D. Female wing (dorsal), E. Female head and thorax (dorsal), F. Female abdomen (dorsal), G. Female abdomen (lateral).

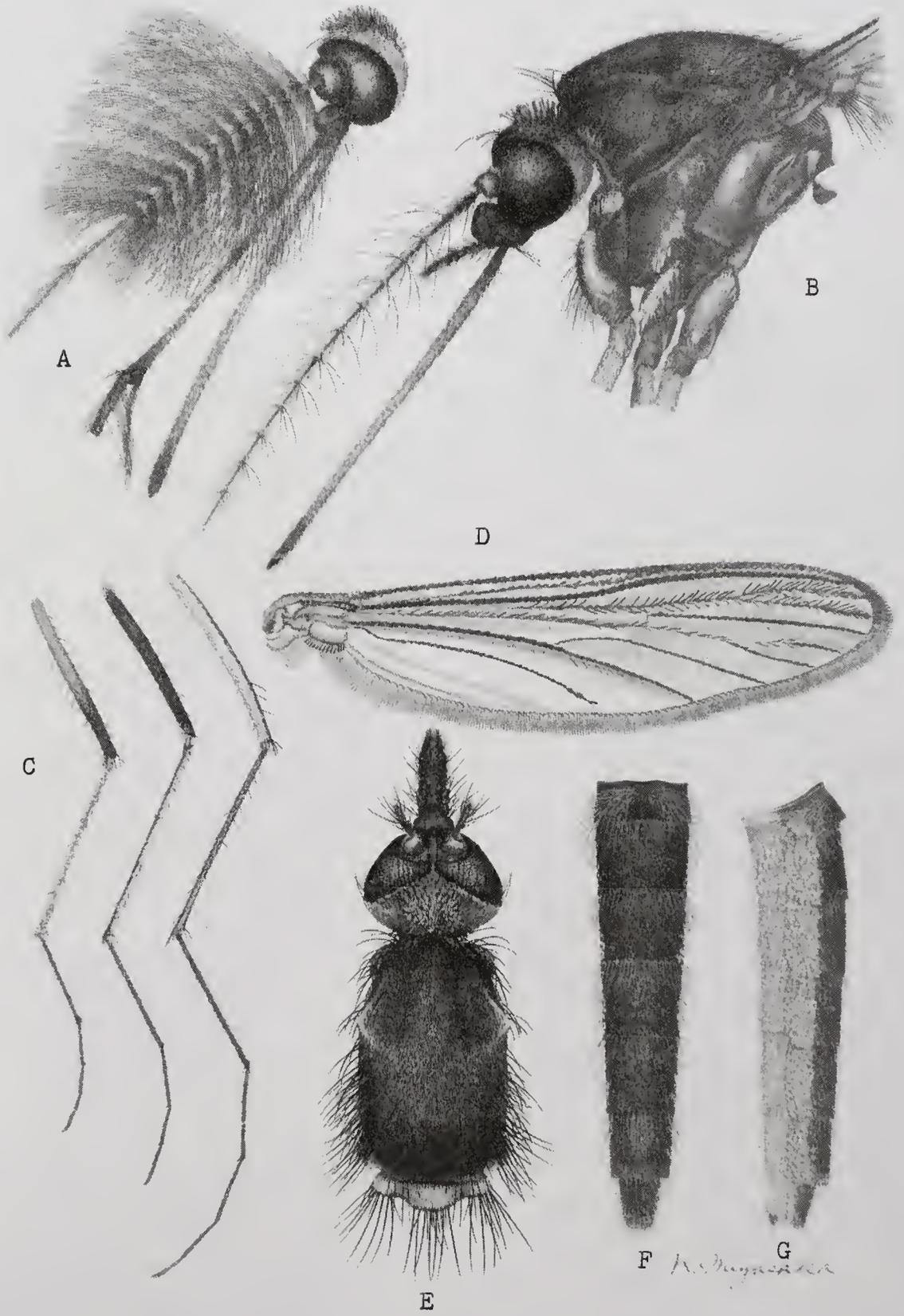


Figure 9. Aedes pipersalatus adult male and female habitus. A. Male head (lateral), B. Female head and thorax (lateral), C. Female legs (anterior), D. Female wing (dorsal), E. Female head and thorax (dorsal), F. Female abdomen (dorsal), G. Female abdomen (lateral).

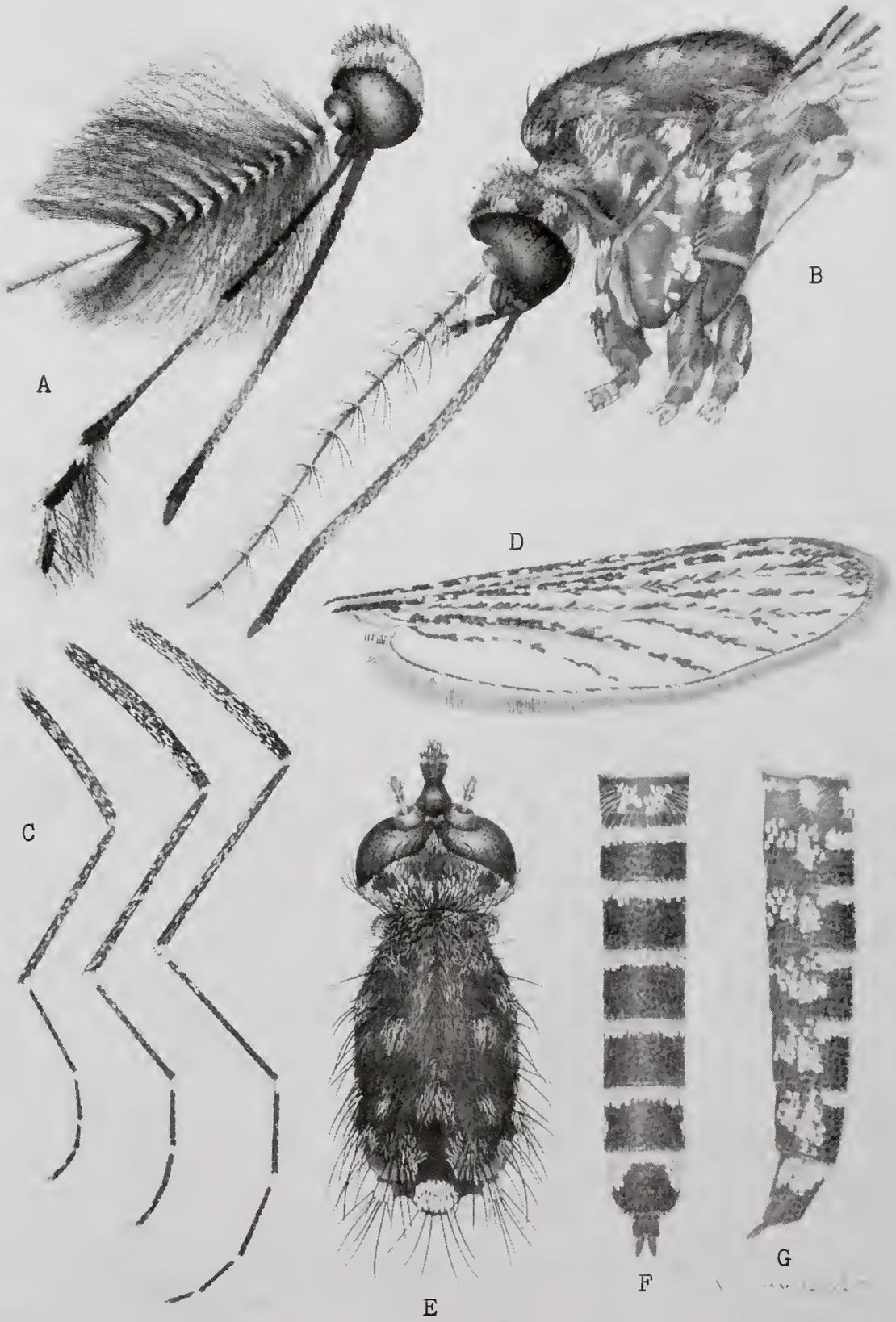
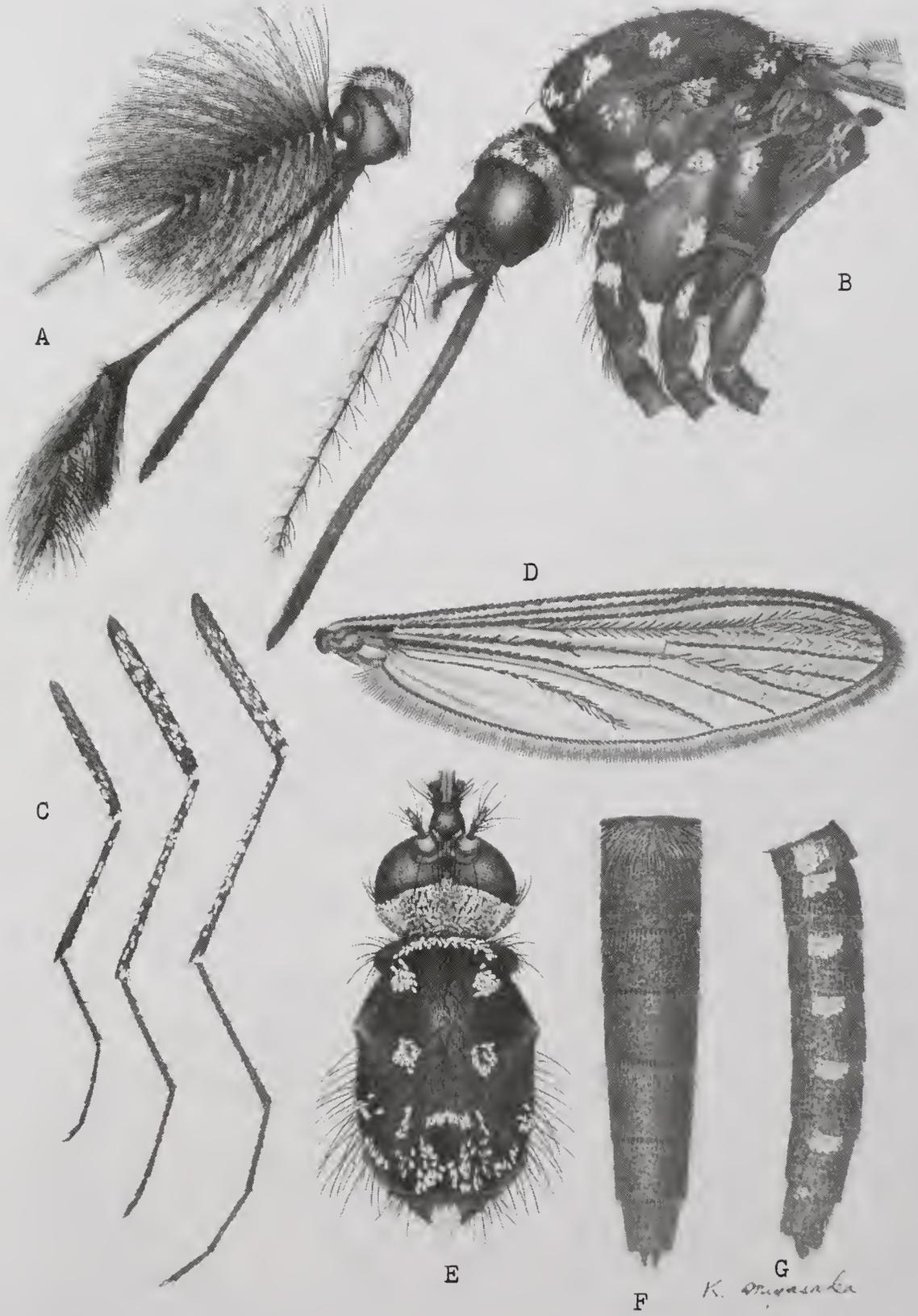


Figure 10. Aedes punctifemoris adult male and female habitus. A. Male head (lateral), B. Female head and thorax (lateral), C. Female legs (anterior), D. Female wing (dorsal), E. Female head and thorax (dorsal), F. Female abdomen (dorsal), G. Female abdomen (lateral).



K. Onoasaka

Figure 11. Aedes taeniorhynchoides adult male and female habitus. A. Male head (lateral), B. Female head and thorax (lateral), C. Female legs (anterior), D. Female wing (dorsal), E. Female head and thorax (dorsal), F. Female abdomen (dorsal), G. Female abdomen (lateral).

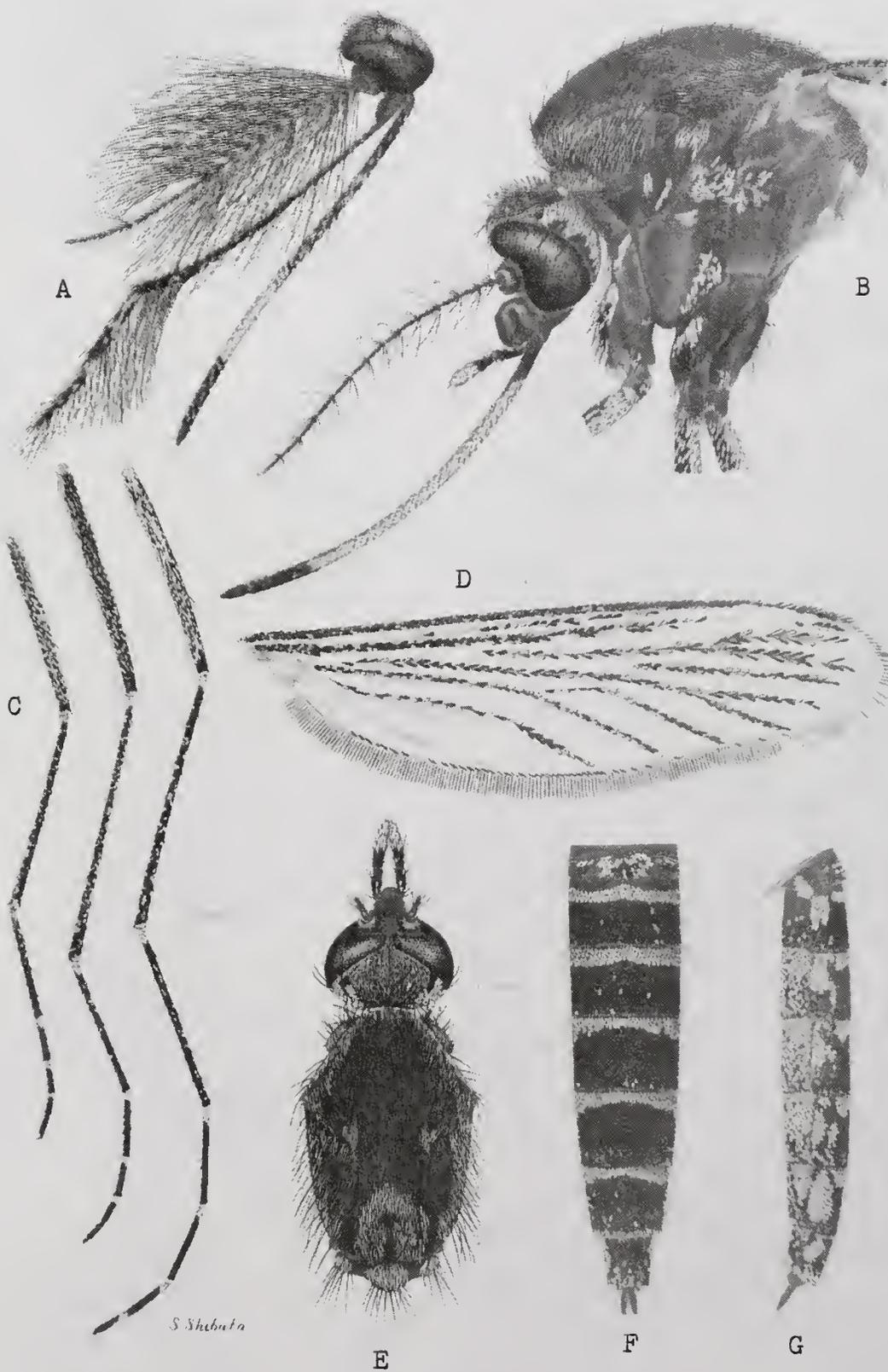


Figure 12. Aedes vexans adult male and female habitus.

A. Male head (lateral), B. Female head and thorax (lateral), C. Female legs (anterior), D. Female wing (dorsal), E. Female head and thorax (dorsal), F. Female abdomen (dorsal), G. Female abdomen (lateral), H. Male abdomen (dorsal).

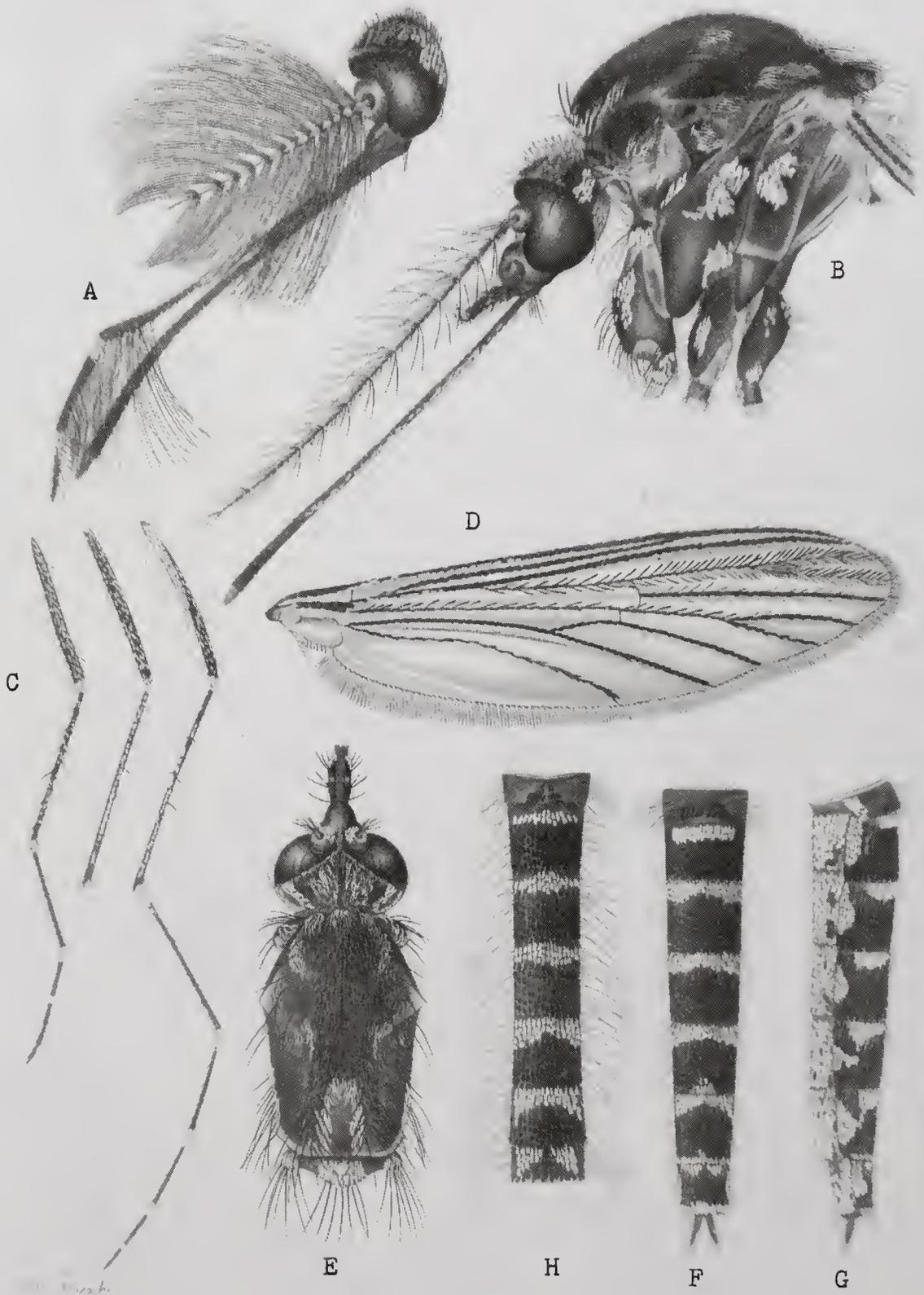


Figure 13. Aedes vexans nipponii adult male and female habitus. A. Male head (lateral), B. Female head and thorax (lateral), C. Female legs (anterior), D. Female wing (dorsal), E. Female head and thorax (dorsal), F. Female abdomen (dorsal), G. Female abdomen (lateral), H. Male abdomen (dorsal).

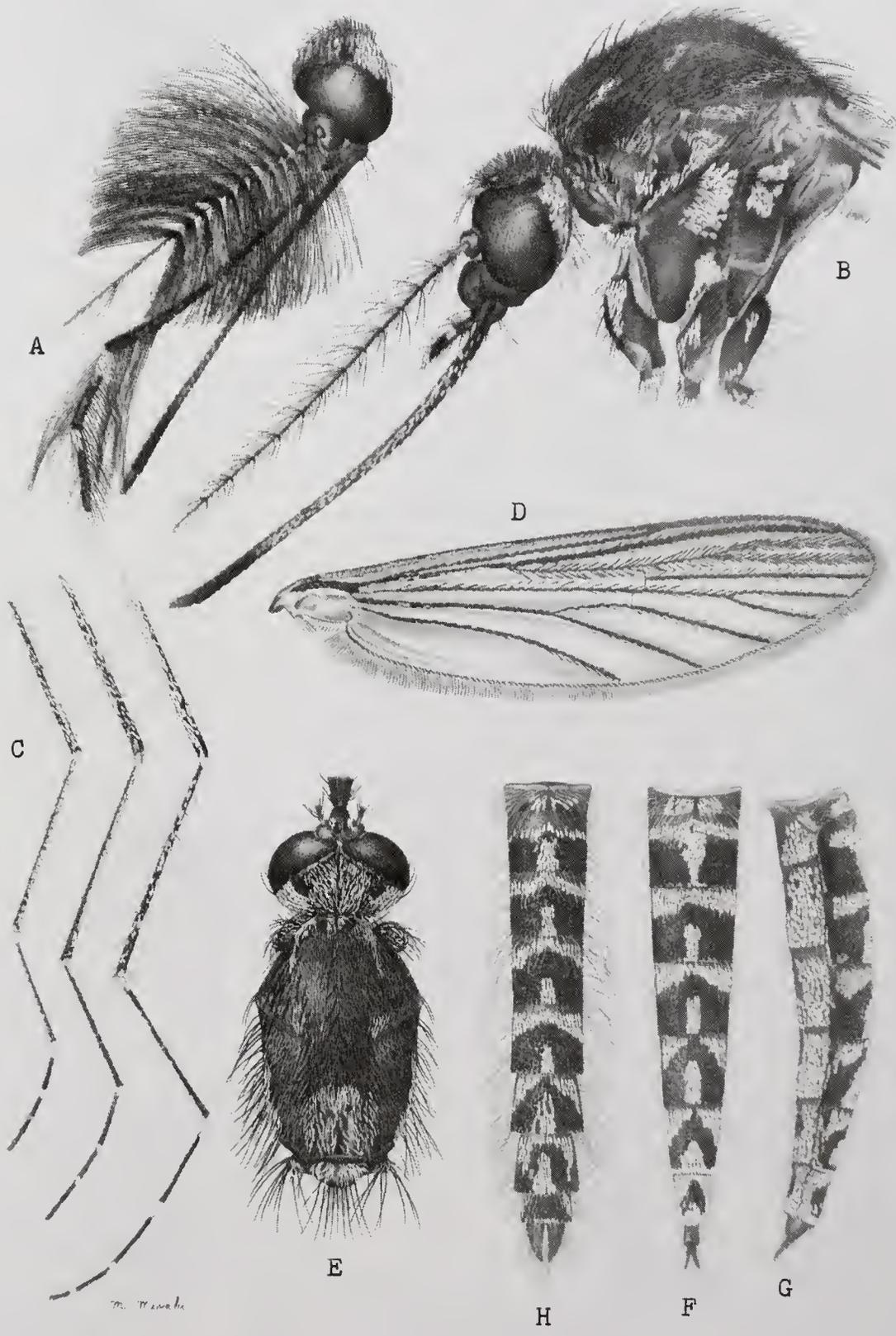


Figure 14. Aedes alboscuteUellatus male genitalia.
A. Male genitalia (tergal), B. Gonostylus, C. Tergum IX, D. Sternum IX,
E. Basal mesal lobes, F. Phallosome.

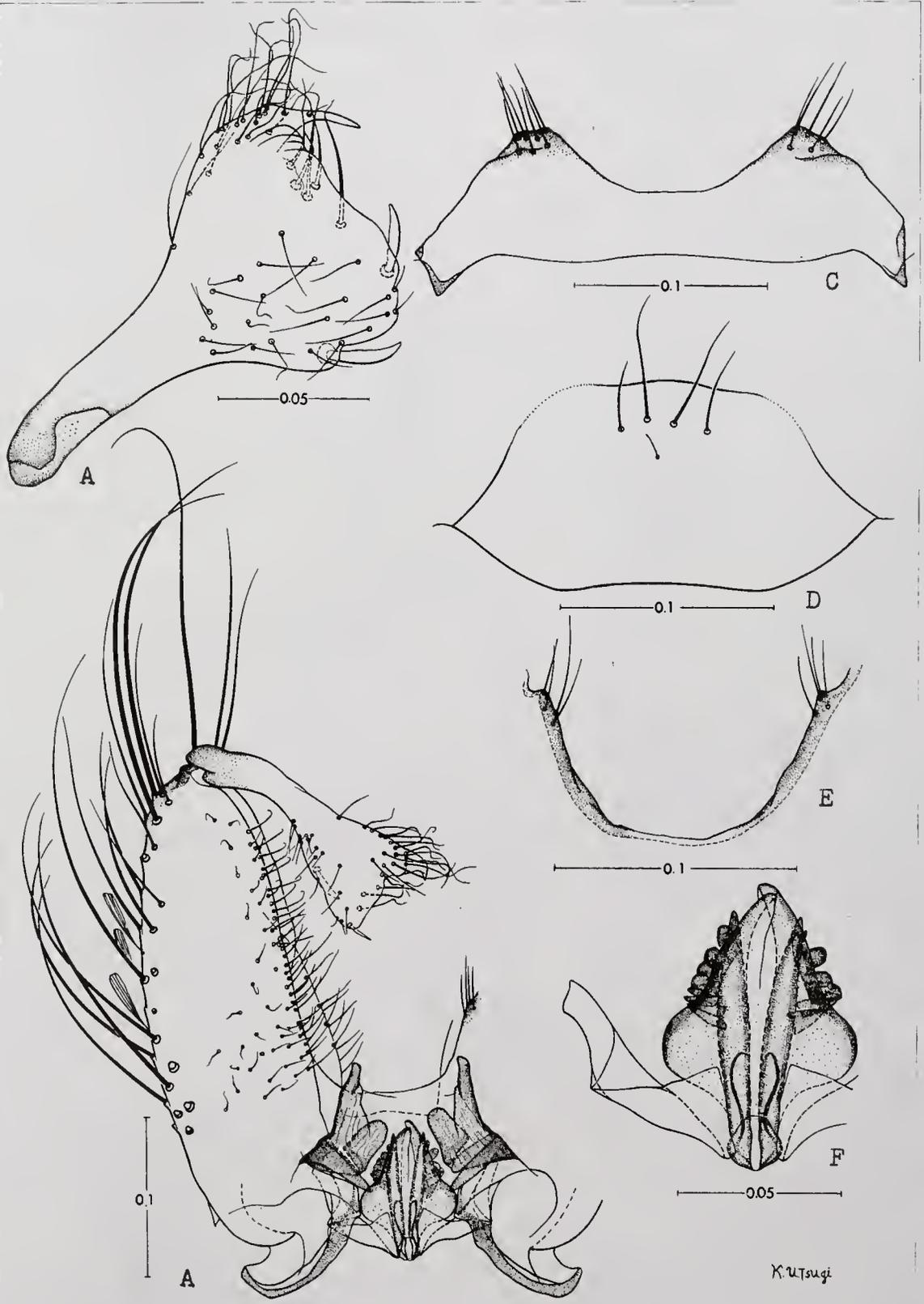


Figure 15. Aedes caecus male genitalia. A. Male genitalia (tergal), B. Gonostylus, C. Tergum IX, D. Sternum IX, E. Basal mesal lobes, F. Phallosome.

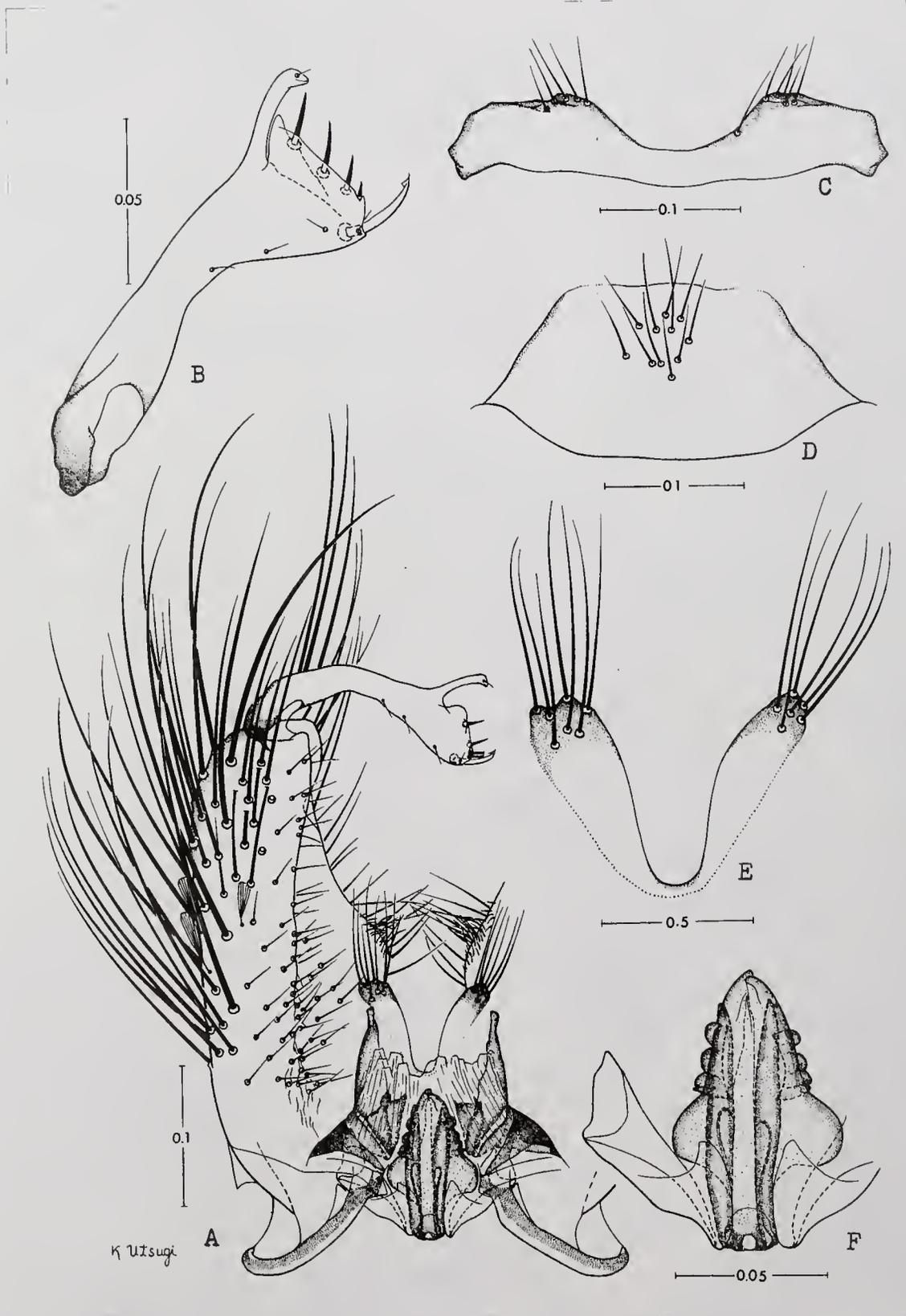


Figure 16. Aedes mediolineatus male genitalia.

A. Male genitalia (tergal), B. Gonostylus, C. Tergum IX, D. Sternum IX, E. Basal mesal lobes, F. Phallosome.

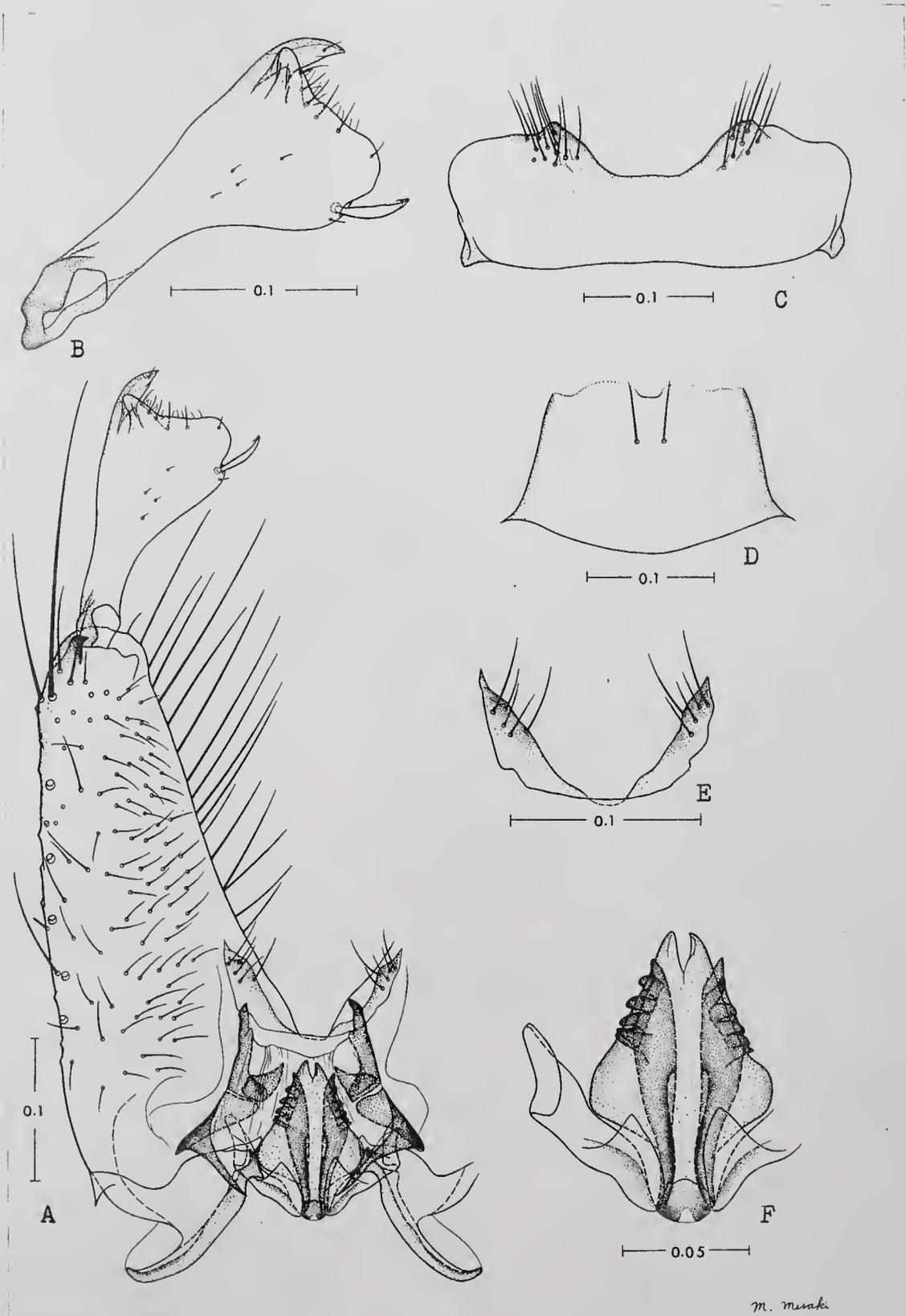


Figure 17. Aedes pallidostriatus male genitalia.

A. Male genitalia (tergal), B. Gonostylus, C. Tergum IX, D. Sternum IX, E. Basal mesal lobes, F. Phallosome.

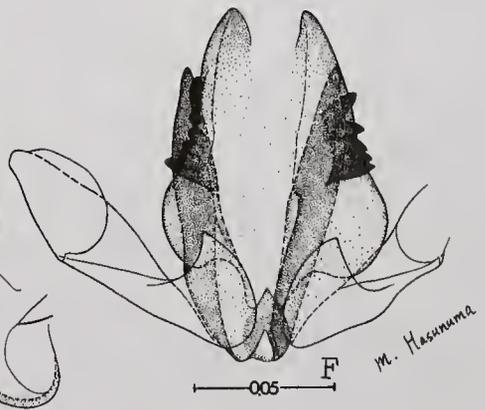
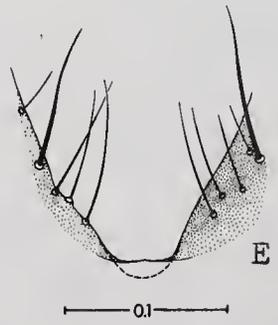
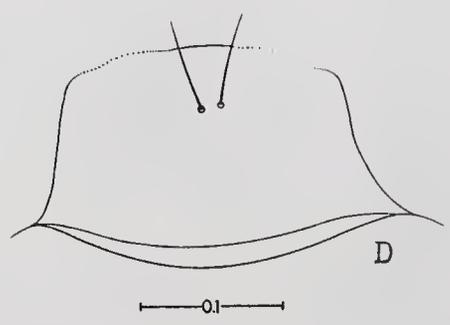
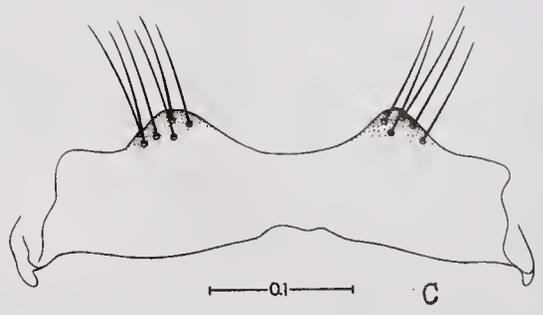
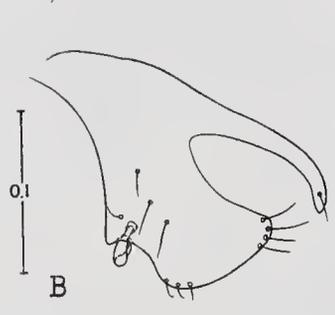


Figure 18. Aedes pampangensis male genitalia.

A. Male genitalia (tergal), B. Gonostylus, C. Tergum IX, D. Sternum IX, E. Basal mesal lobes, F. Phallosome.

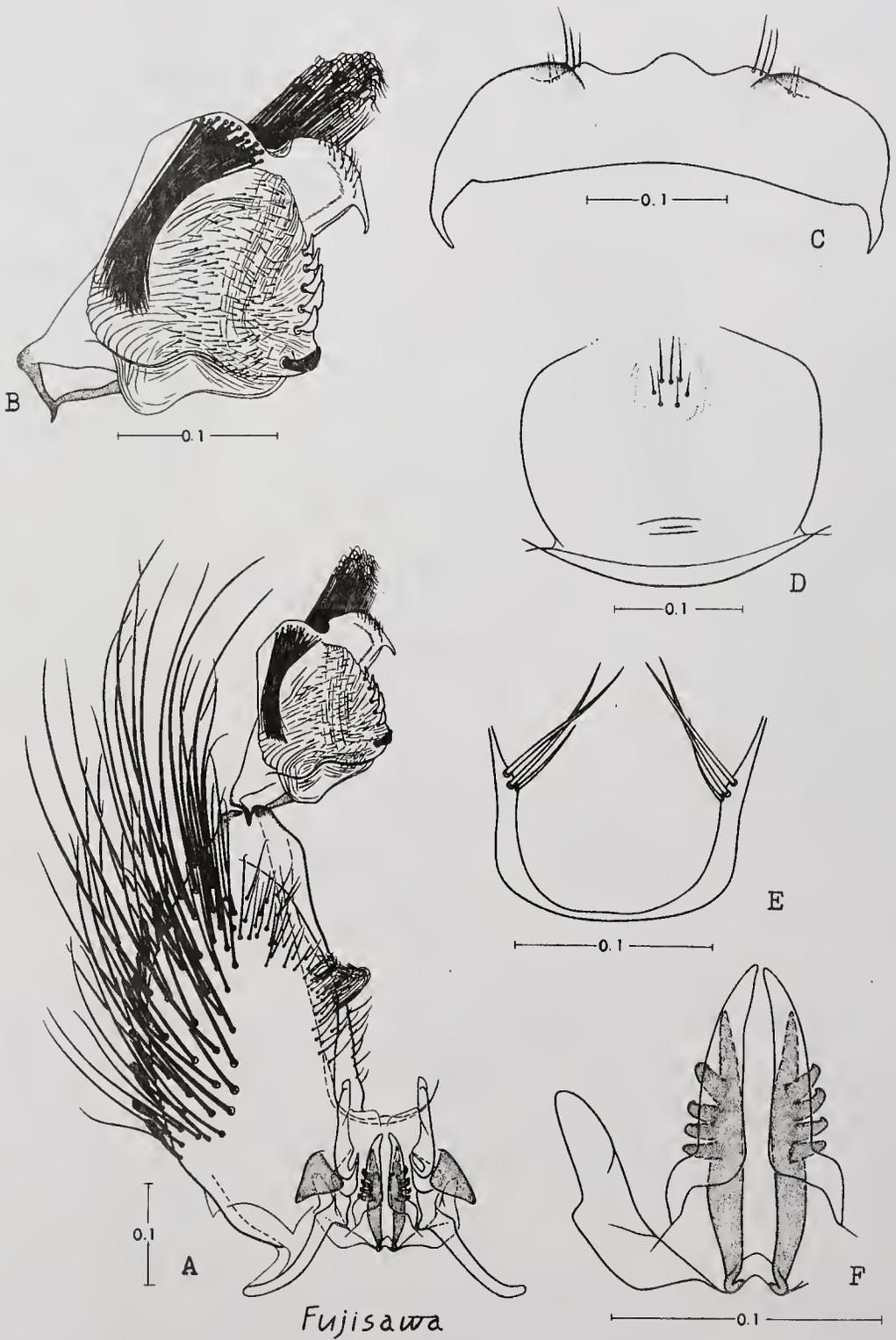
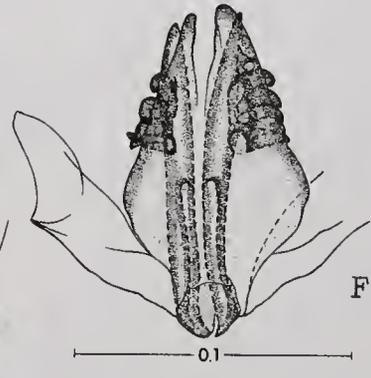
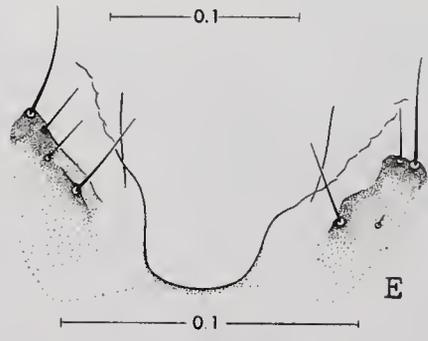
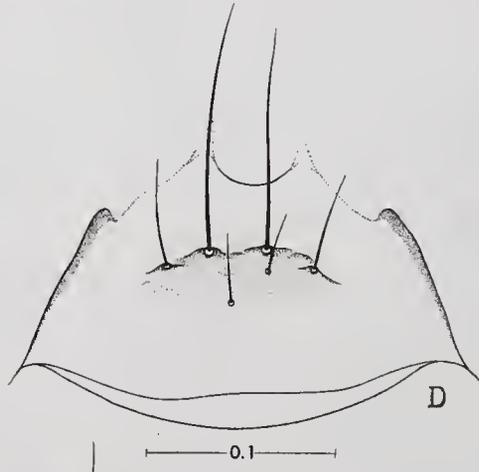
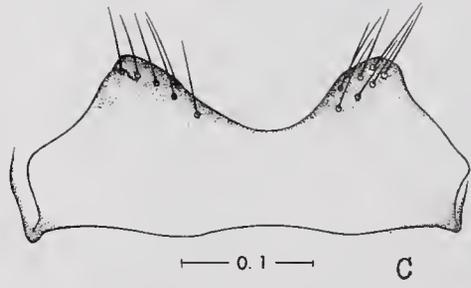
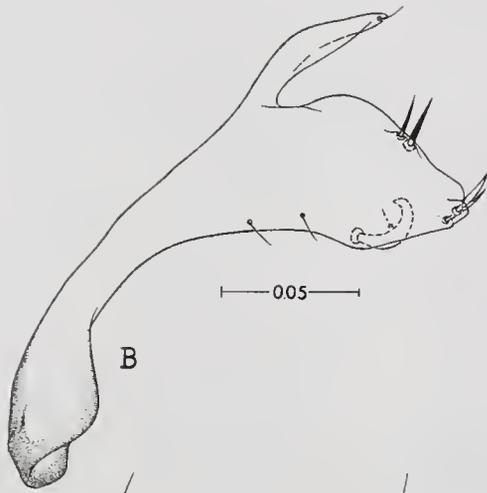


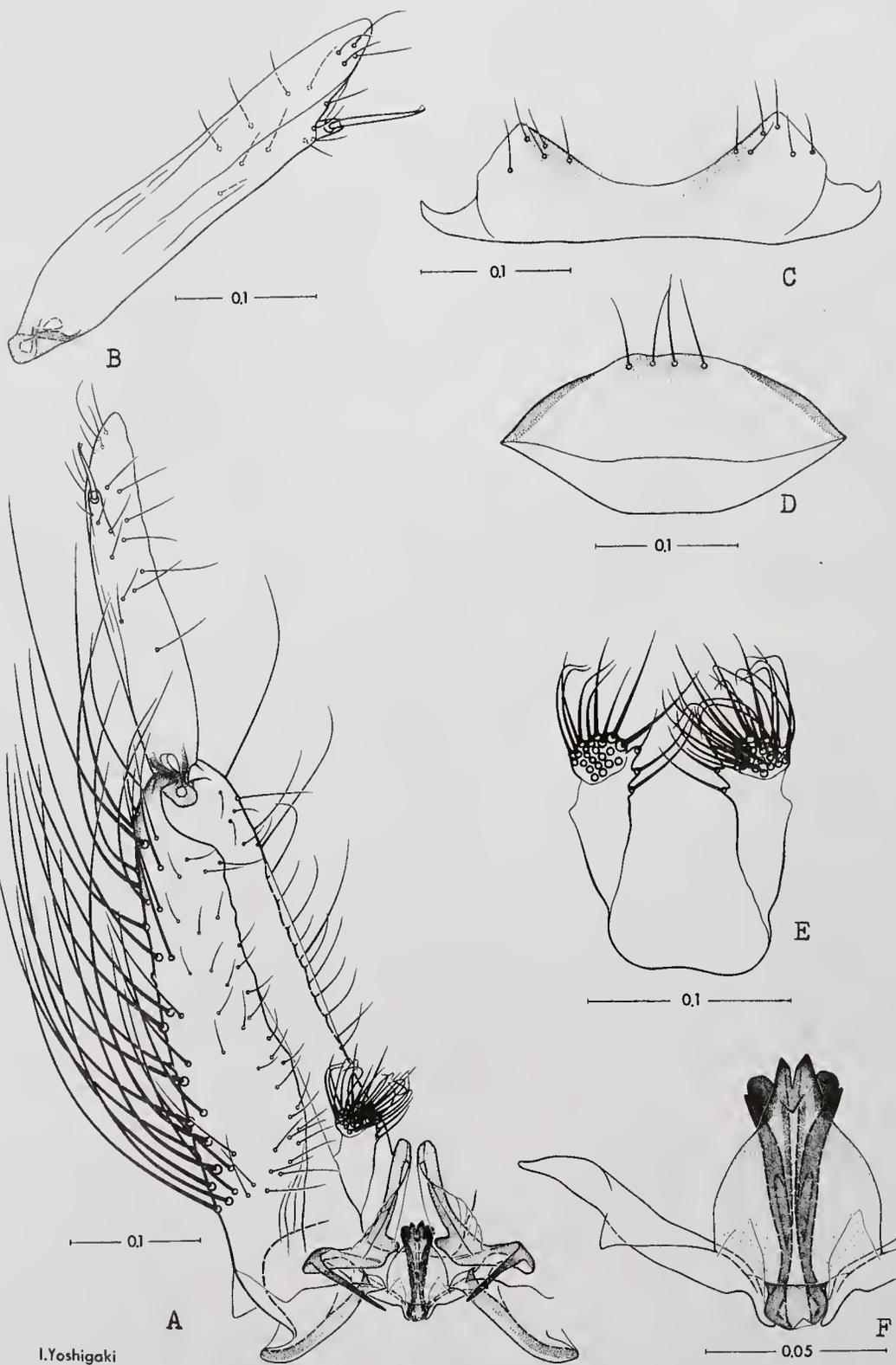
Figure 19. Aedes punctifemoris male genitalia.

A. Male genitalia (tergal), B. Gonostylus, C. Tergum IX, D. Sternum IX, E. Basal mesal lobes, F. Phallosome.



K. Usugi

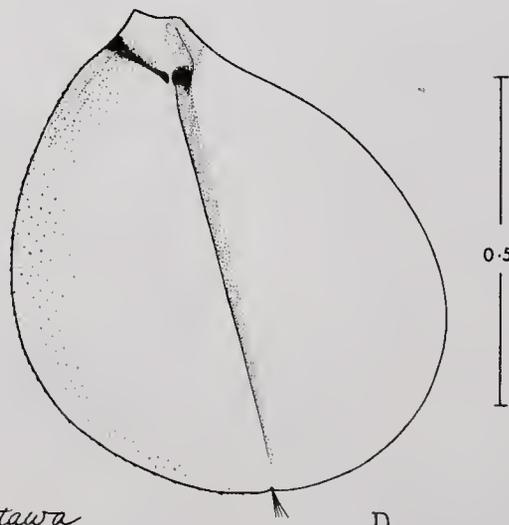
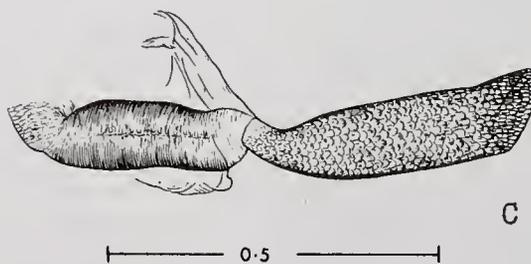
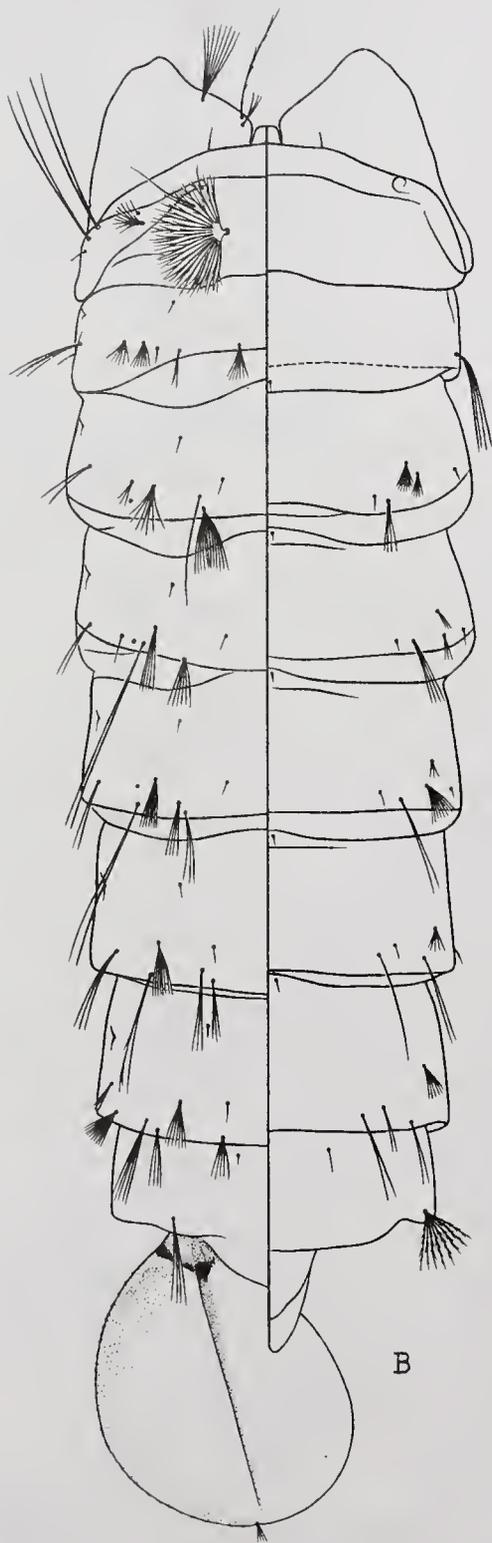
Figure 20. Aedes vexans male genitalia. A. Male genitalia (tergal), B. Gonostylus, C. Tergum IX, D. Sternum IX, E. Basal mesal lobes, F. Phallosome.



I. Yoshigaki

Figure 21. Aedes alboscuteUellatus pupa.

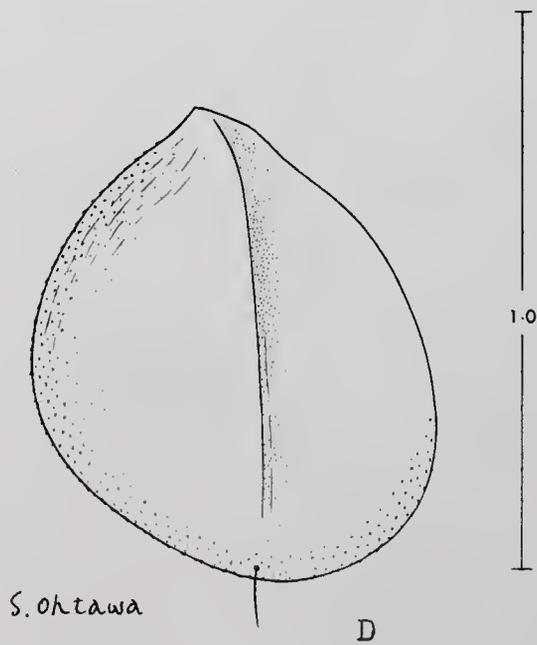
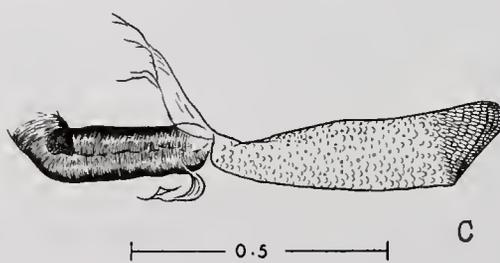
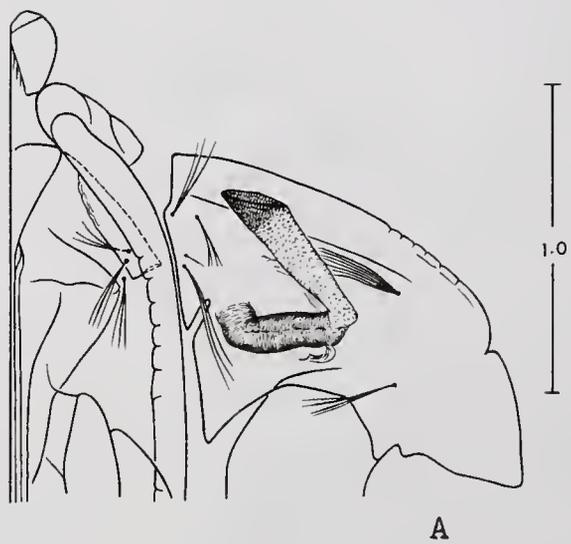
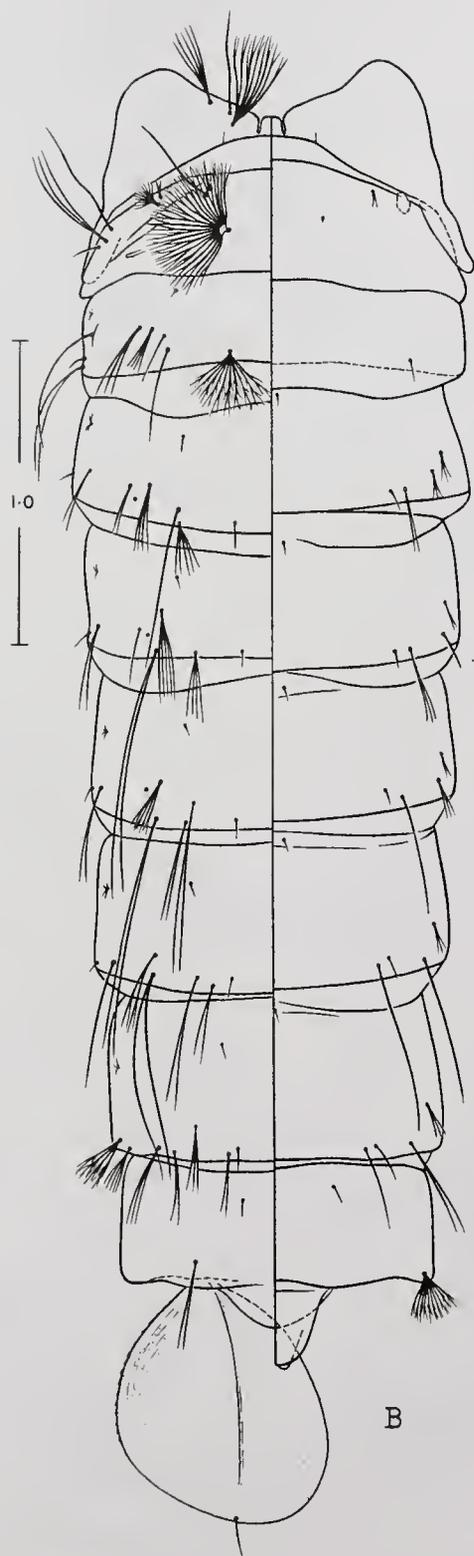
A. Cephalothorax, B. Metanotum,
abdomen and paddle, C. Respiratory
trumpet, D. Paddle.



S. oktawa

D

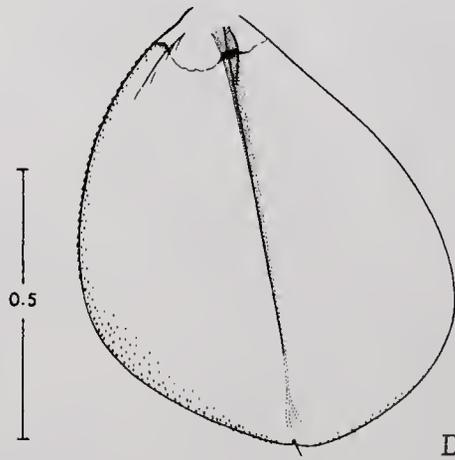
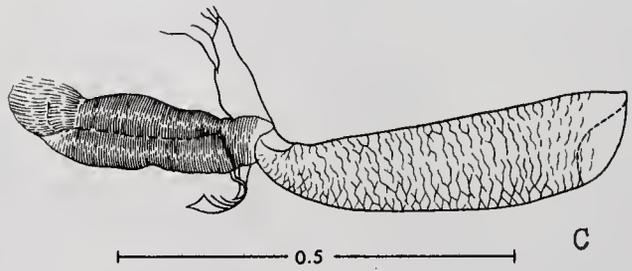
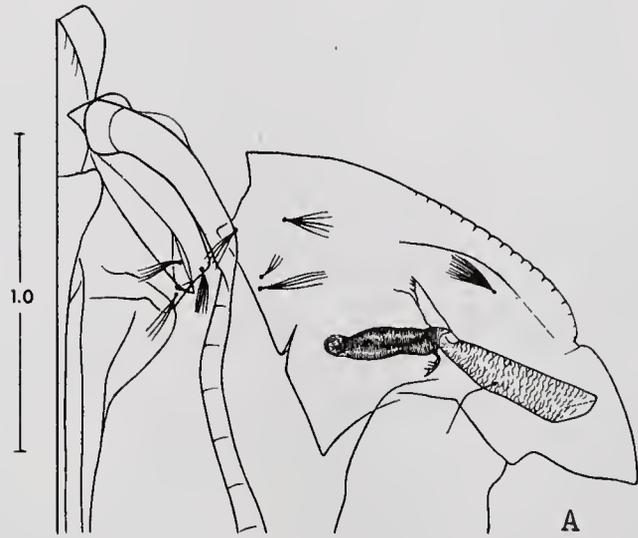
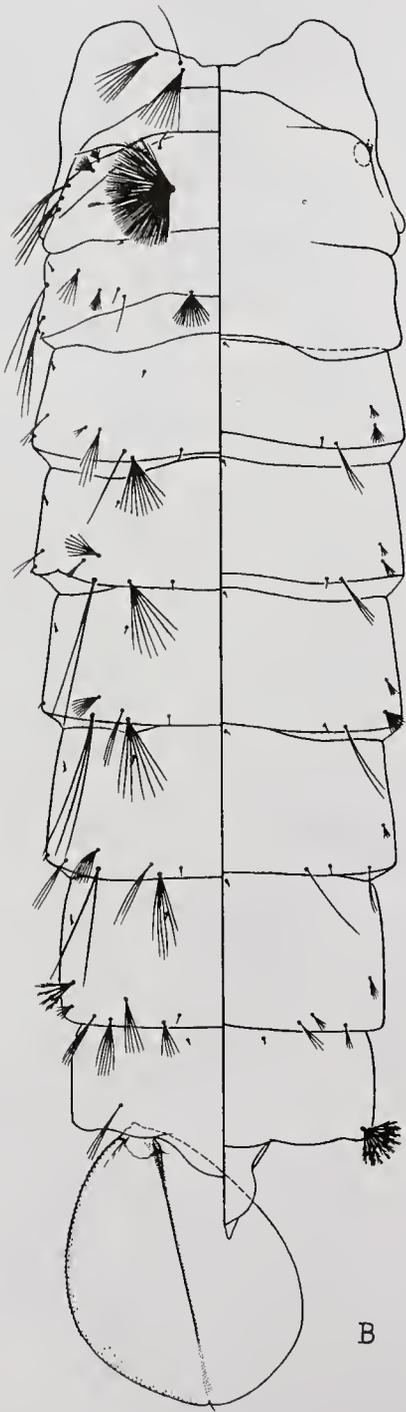
Figure 22. Aedes caecus pupa. A. Cephalothorax,
B. Metanotum, abdomen and paddle,
C. Respiratory trumpet, D. Paddle.



S. ohtawa

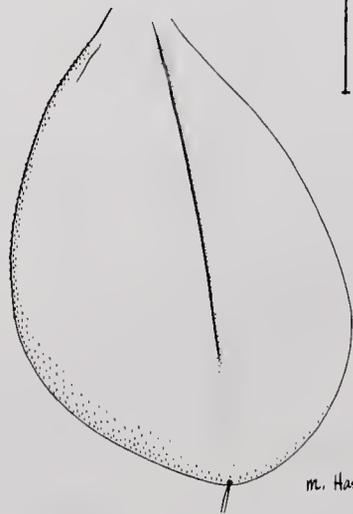
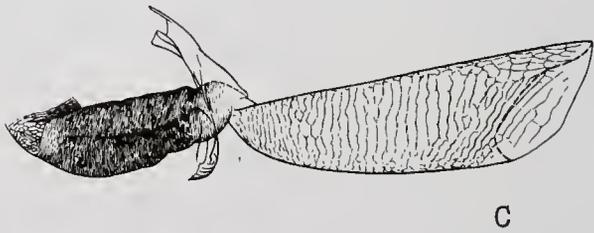
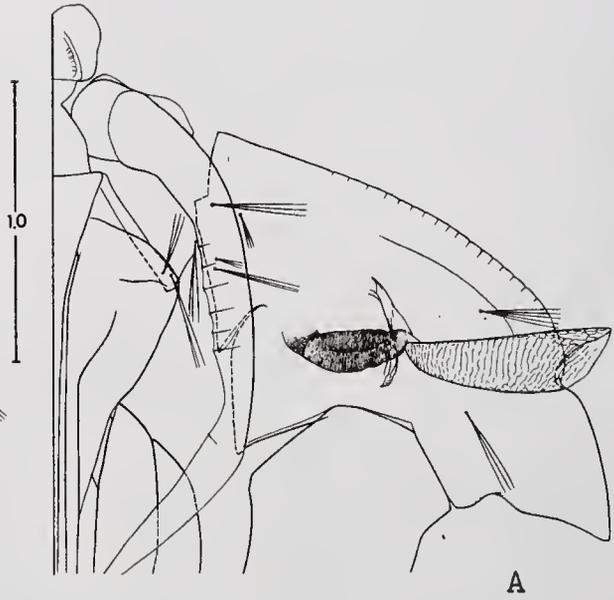
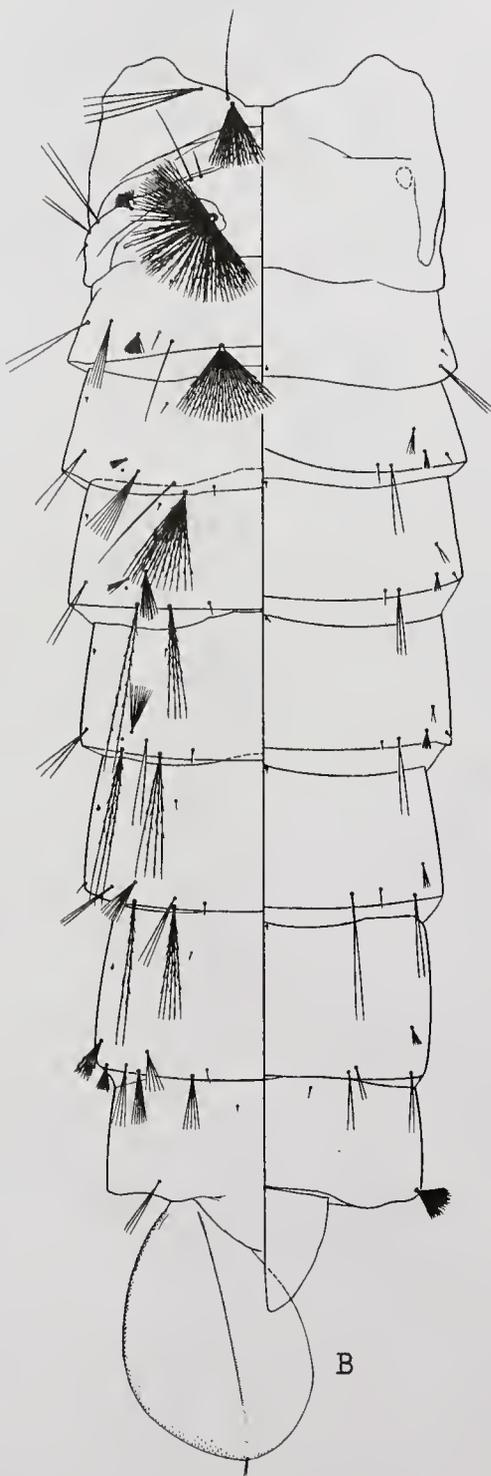
D

Figure 23. Aedes culicinus pupa. A. Cephalothorax,
B. Metanotum, abdomen and paddle,
C. Respiratory trumpet, D. Paddle.



Sonobe

Figure 24. Aedes mediolineatus pupa. A. Cephalothorax,
B. Metanotum, abdomen and paddle,
C. Respiratory trumpet, D. Paddle.



m. Hasunuma

Figure 25. Aedes orbitae pupa. A. Cephalothorax,
B. Metanotum, abdomen and paddle,
C. Respiratory trumpet, D. Paddle.

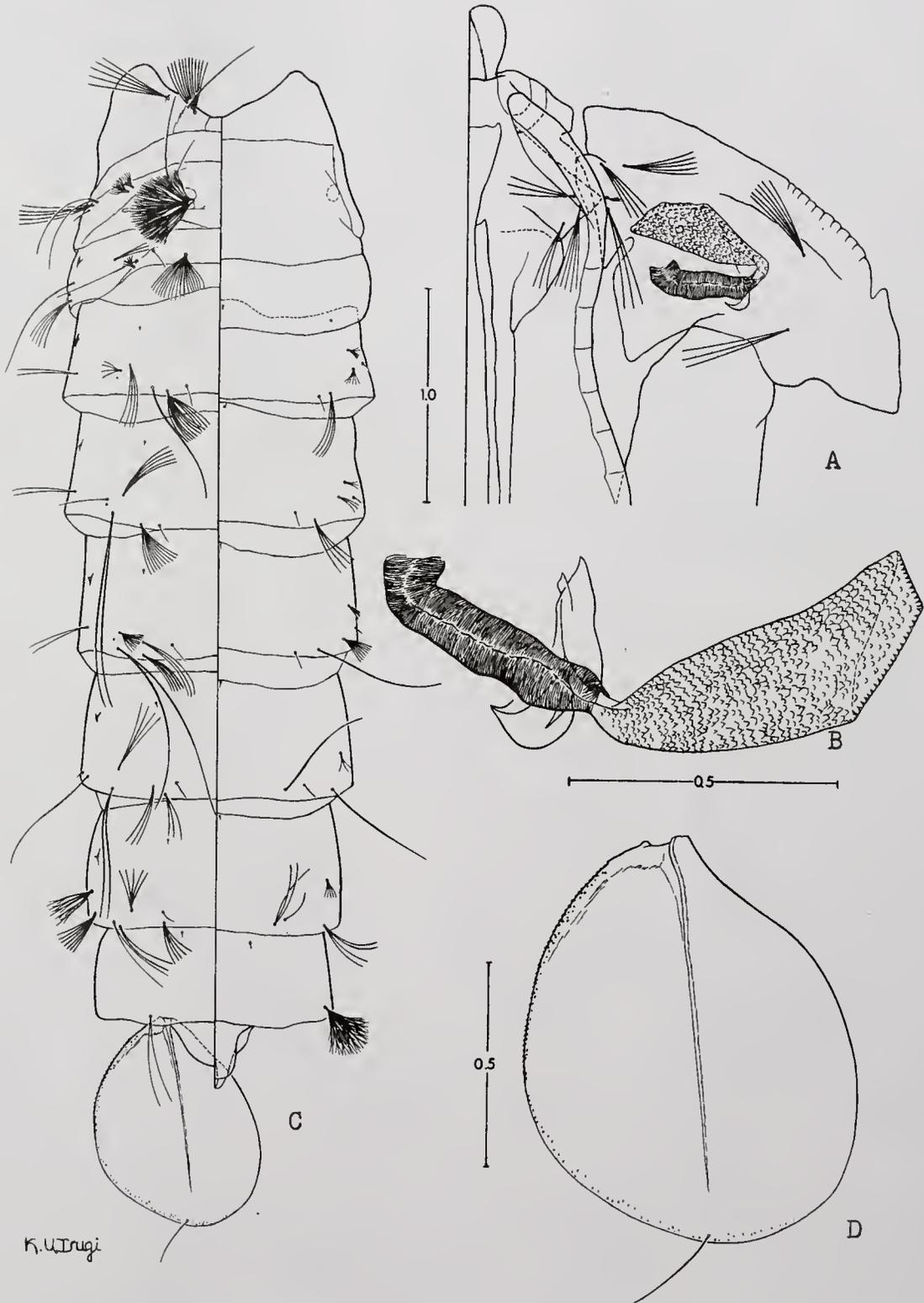


Figure 26. Aedes pampangensis pupa. A. Cephalothorax,
B. Metanotum, abdomen and paddle,
C. Respiratory trumpet, D. Paddle.

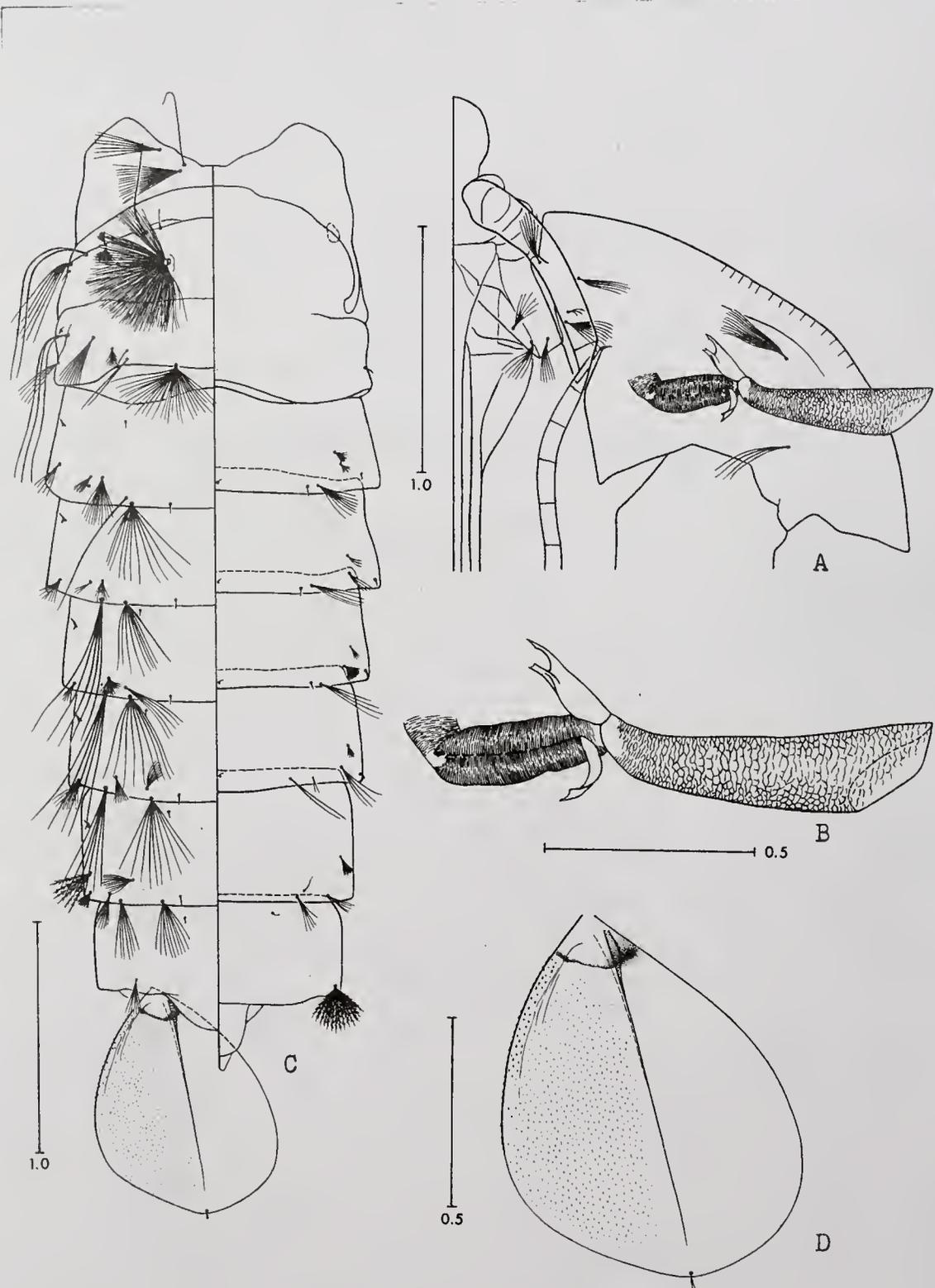
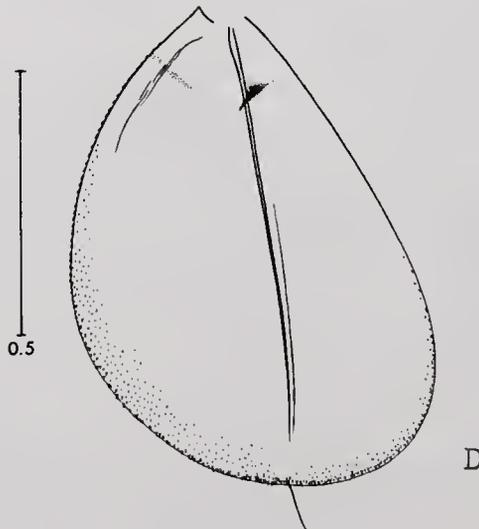
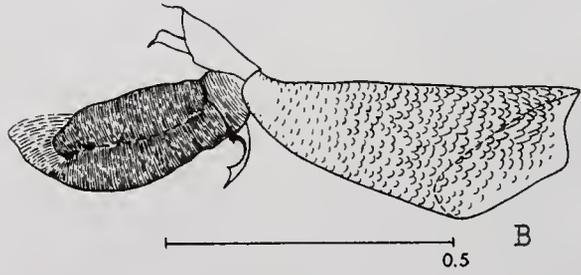
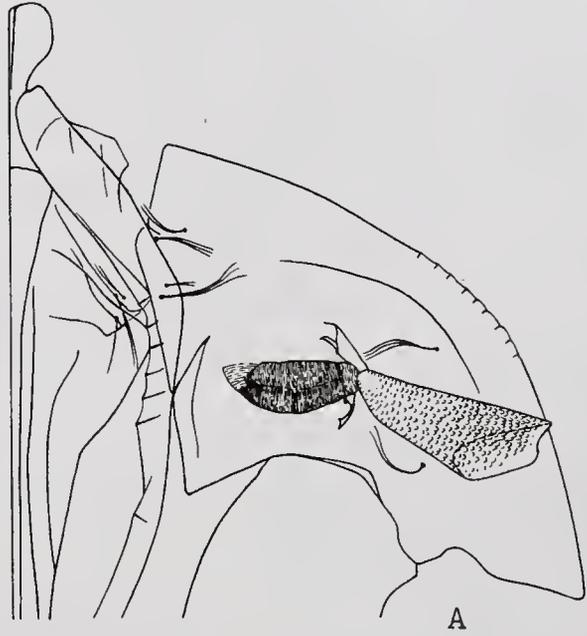
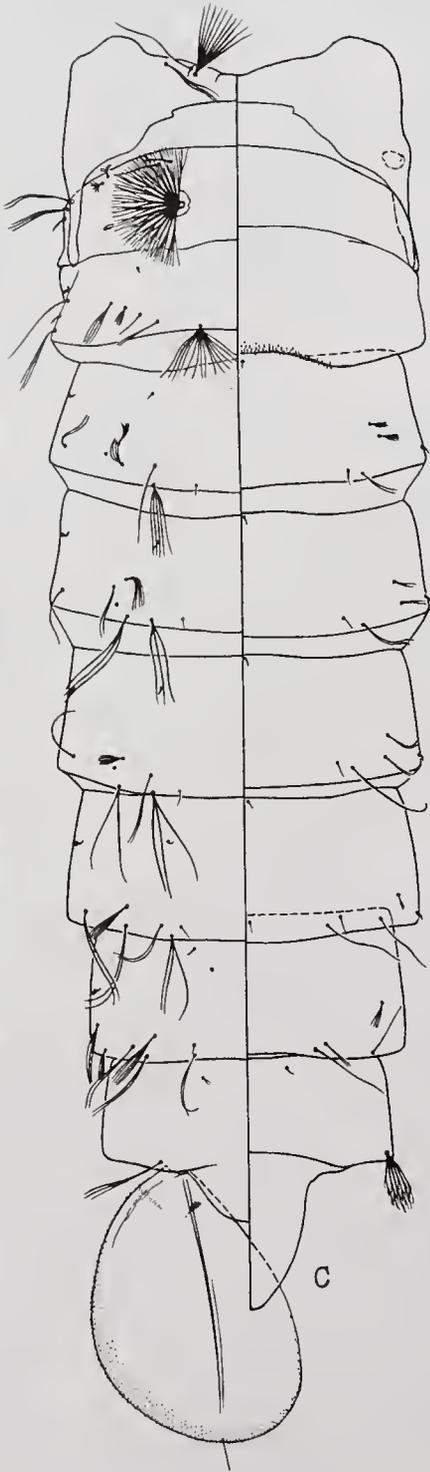


Figure 27. Aedes vexans pupa. A. Cephalothorax,
B. Metanotum, abdomen and paddle,
C. Respiratory trumpet, D. Paddle.



sonobe

Figure 28. Aedes alboscuteUellatus larva.

A. Head, B. Antenna (apex),
C. Mental plate, D. Thorax,
E. Abdomen, F. Distal abdominal
segments and siphon, G. Comb
scale, H. Pecten tooth.

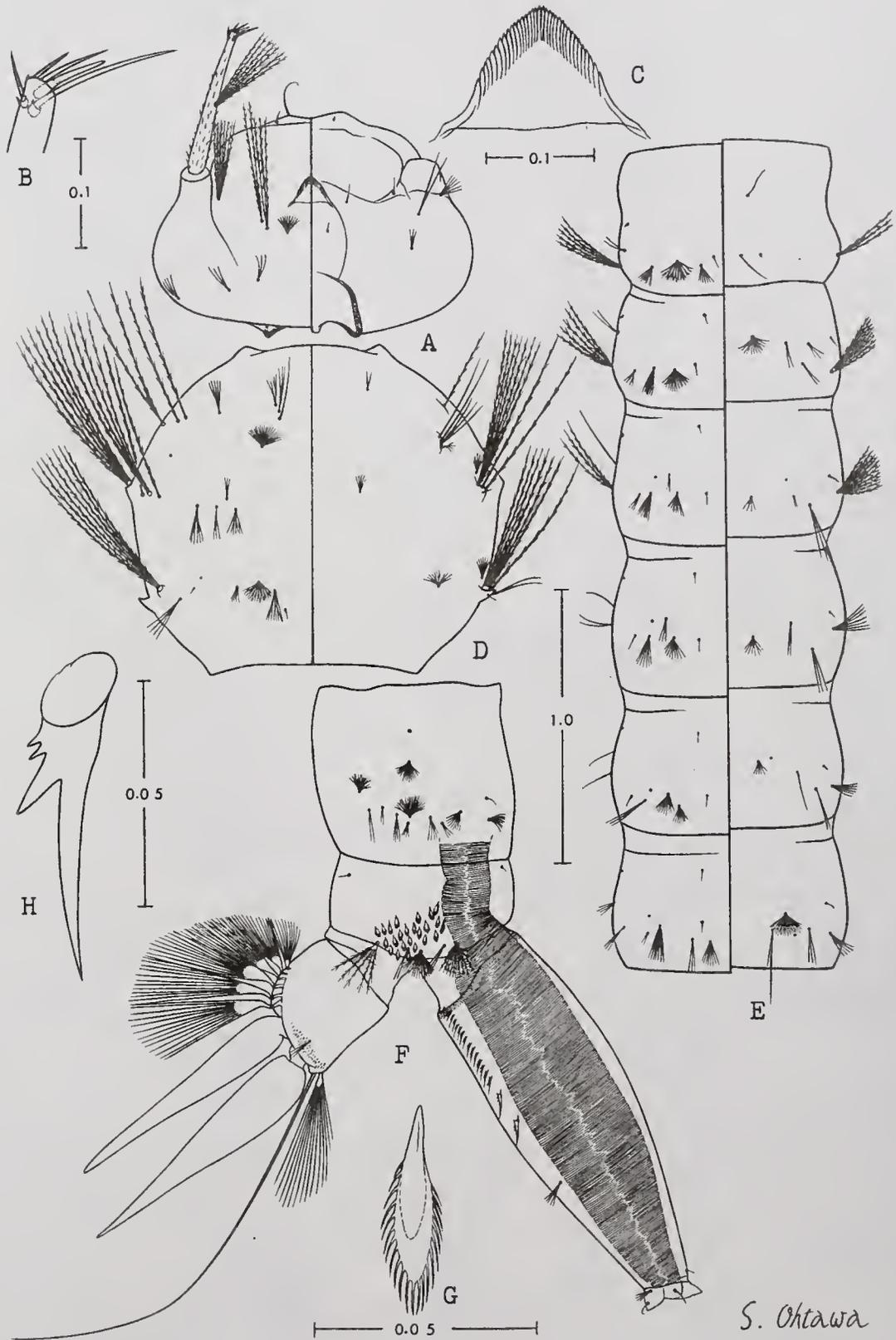
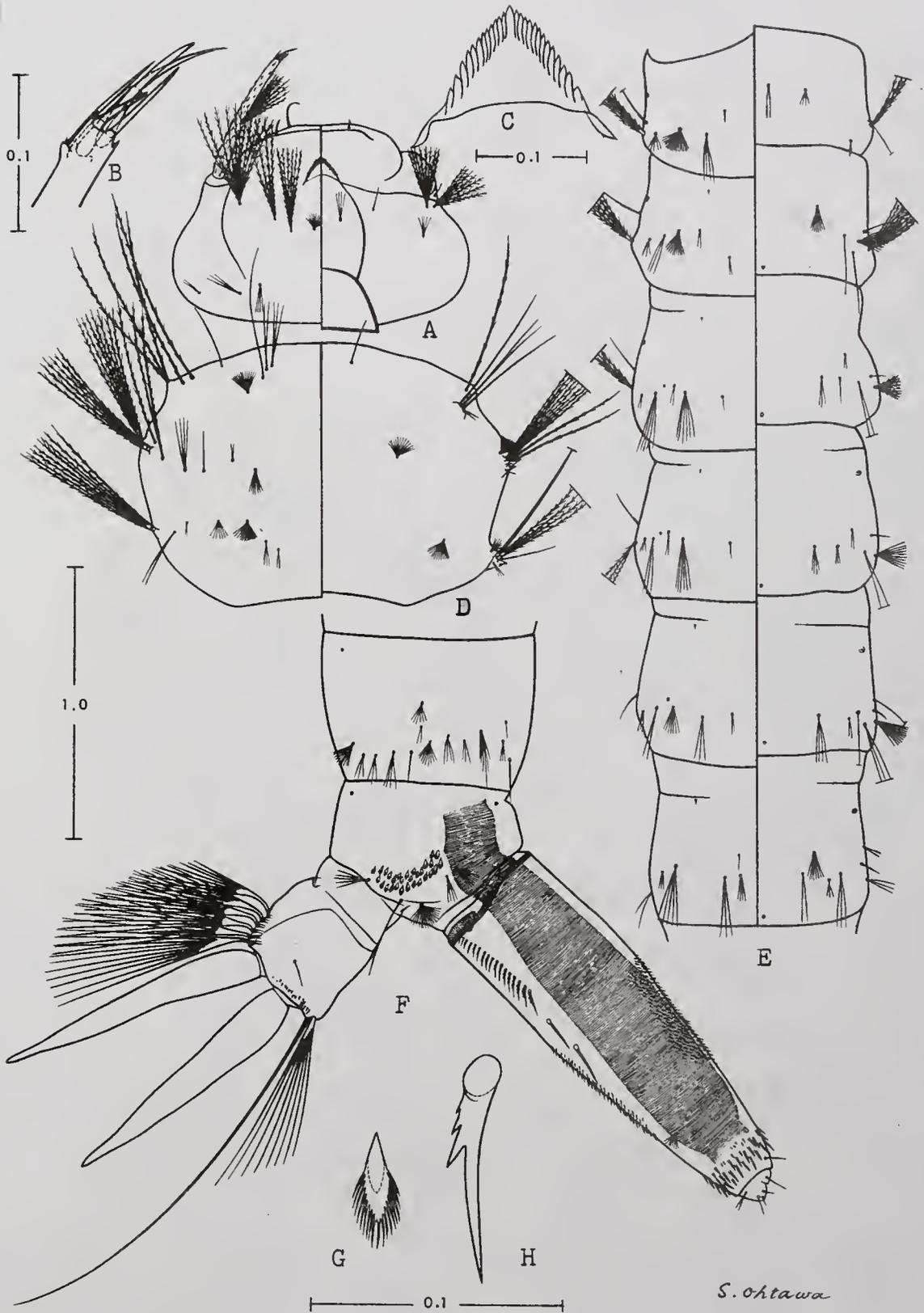


Figure 29. Aedes caecus larva. A. Head,
B. Antenna (apex), C. Mental
plate, D. Thorax, E. Abdomen,
F. Distal abdominal segments and
siphon, G. Comb scale, H. Pecten
tooth.



S. ohtawa

Figure 30. Aedes culicinus larva. A. Head,
B. Antenna (apex), C. Mental plate,
D. Thorax, E. Abdomen, F. Distal
abdominal segments and siphon,
G. Comb scale, H. Pecten tooth.

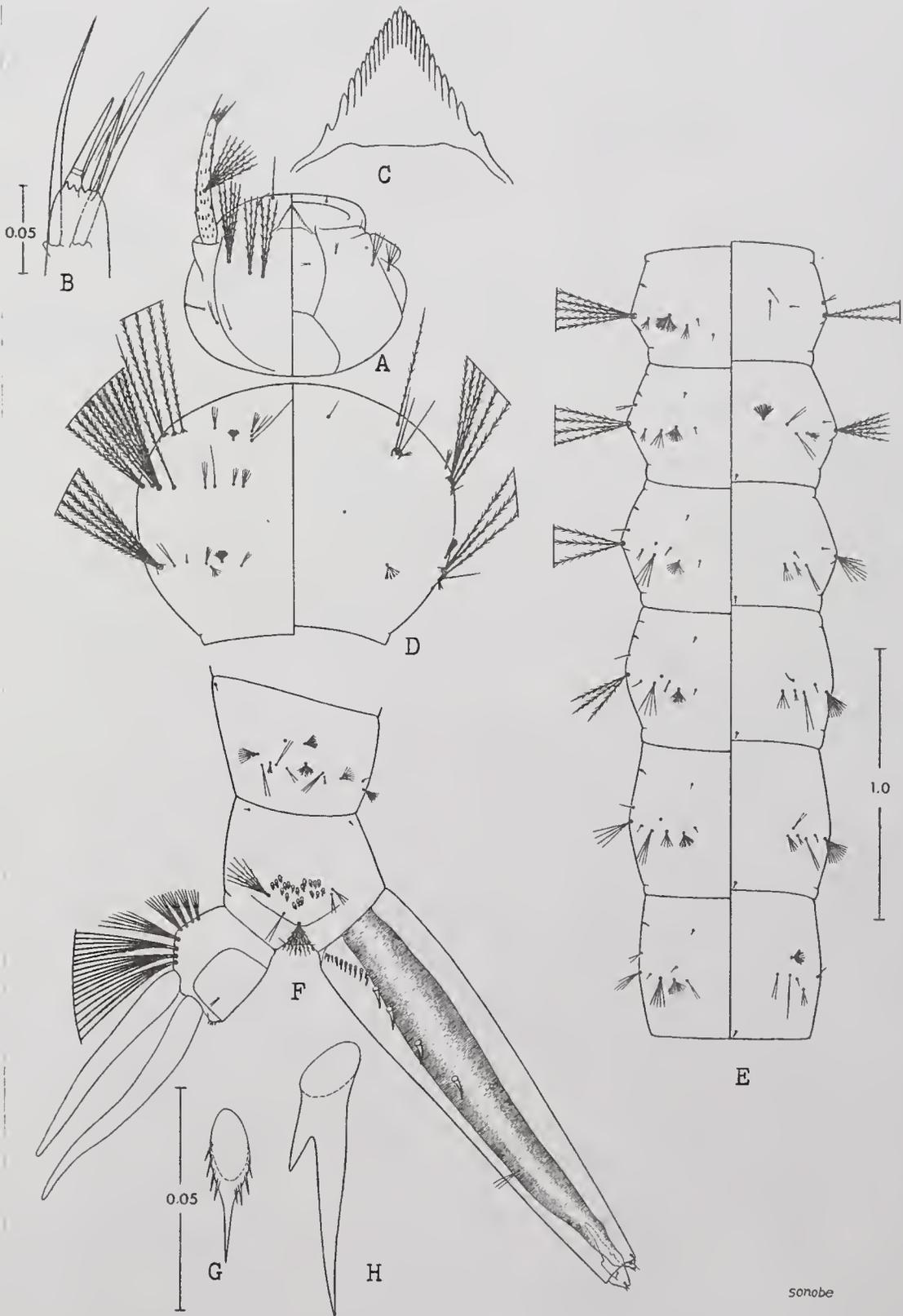


Figure 31. Aedes mediolineatus larva. A. Head,
B. Antenna (apex), C. Mental plate,
D. Thorax, E. Abdomen, F. Distal
abdominal segments and siphon, G.
Comb scale, H. Pecten tooth.

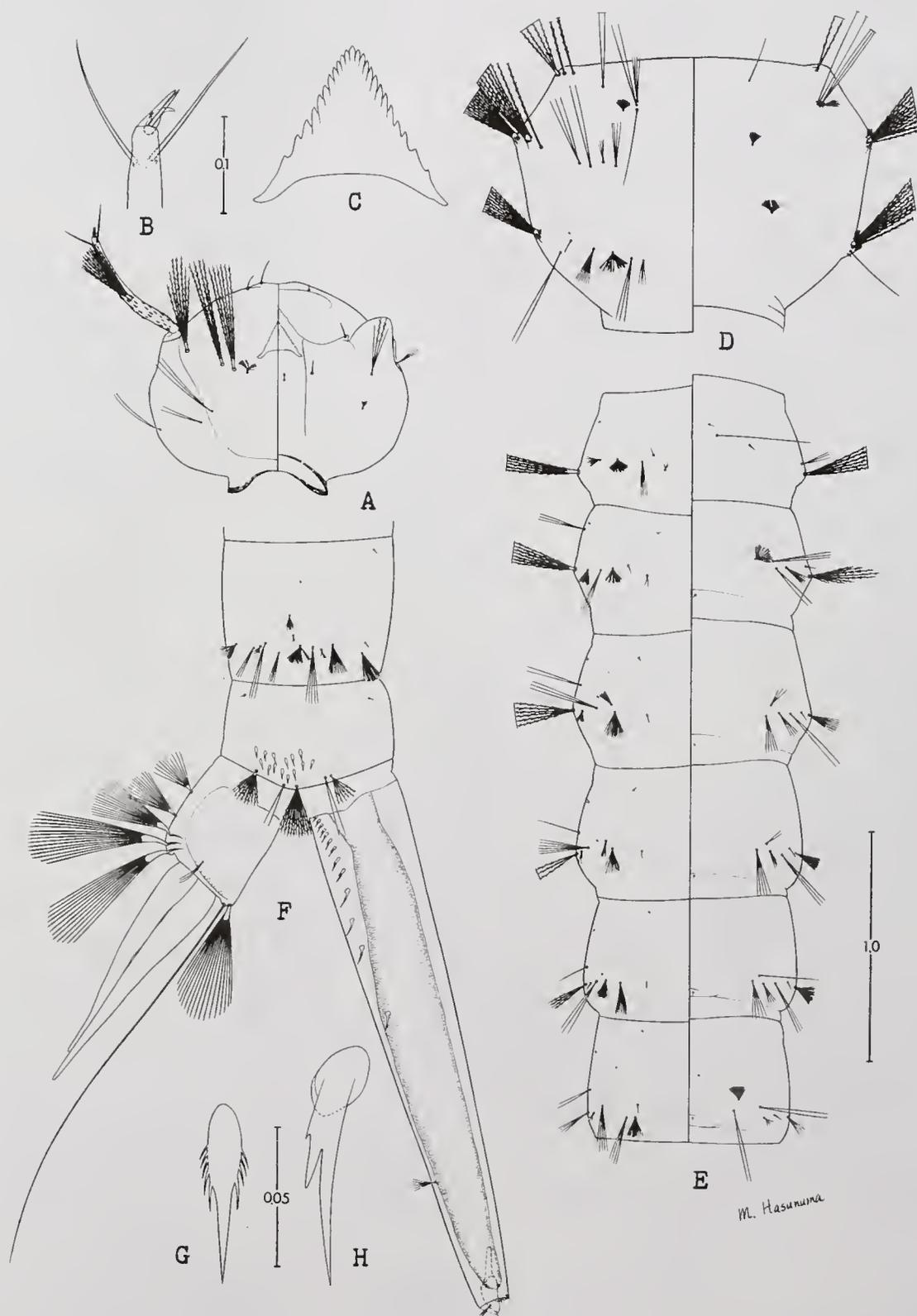
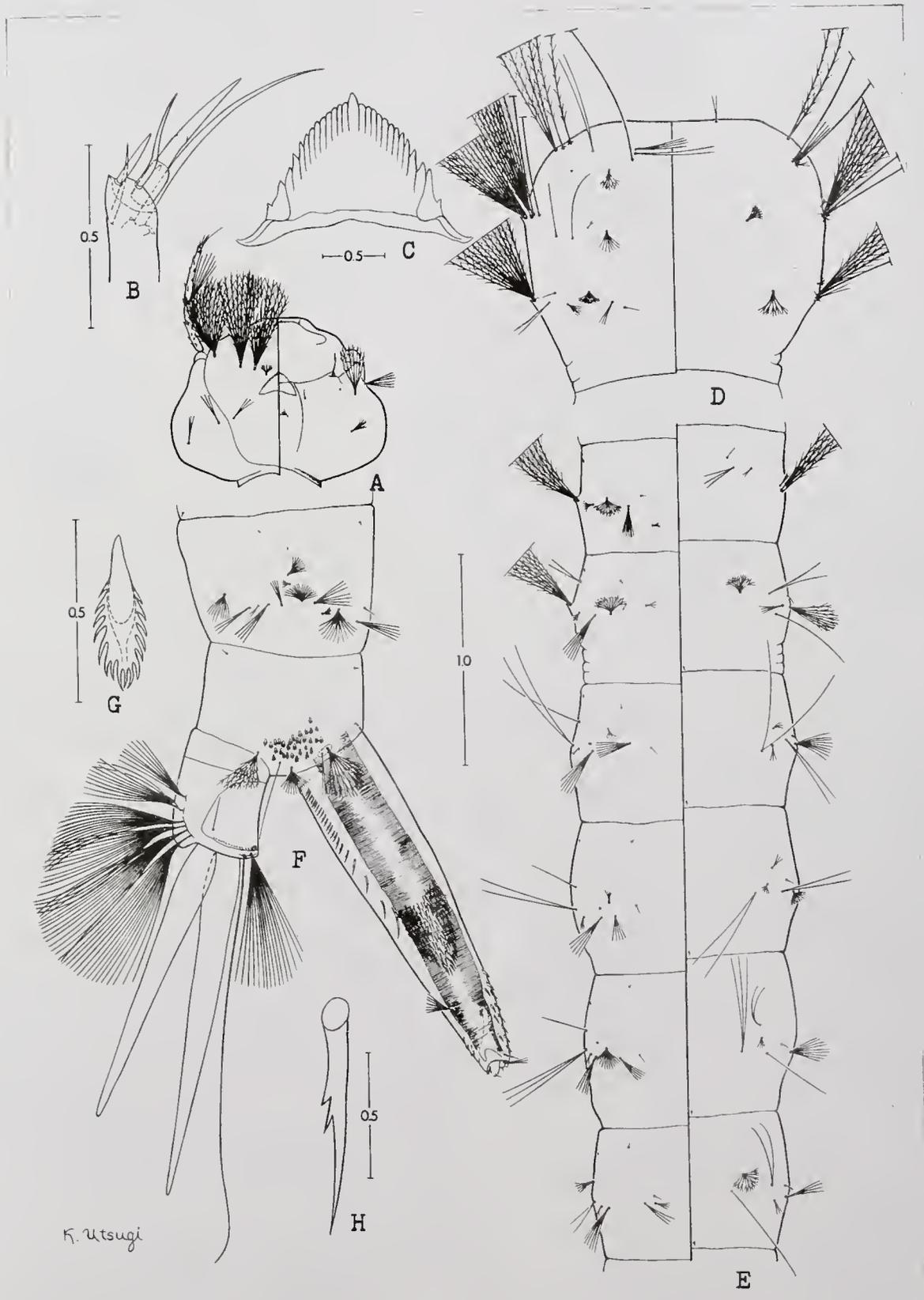


Figure 32. Aedes orbitae larva. A. Head,
B. Antenna (apex), C. Mental
plate, D. Thorax, E. Abdomen,
F. Distal abdominal segments and
siphon, G. Comb scales, H. Pecten
tooth.



K. Utsugi

Figure 33. Aedes pallidostriatus larva. A. Head,
B. Antenna (apex), C. Mental plate,
D. Thorax, E. Abdomen, F. Distal
abdominal segments and siphon,
G. Comb scale, H. Pecten tooth.

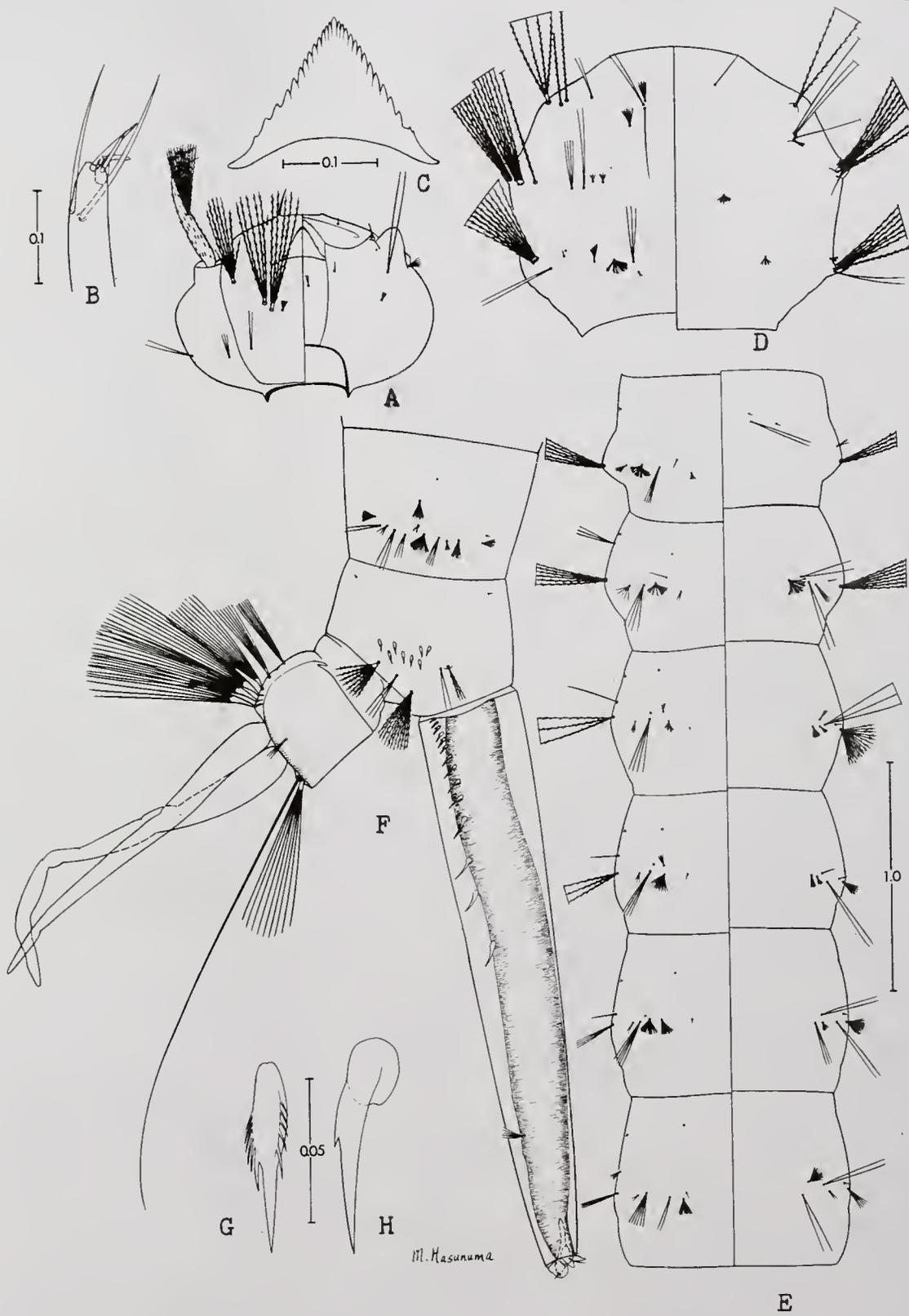


Figure 34. Aedes pampangensis larva. A. Head,
B. Antenna (apex), C. Mental plate,
D. Thorax, E. Abdomen, F. Distal
abdominal segments and siphon,
G. Comb scale, H. Pecten tooth.

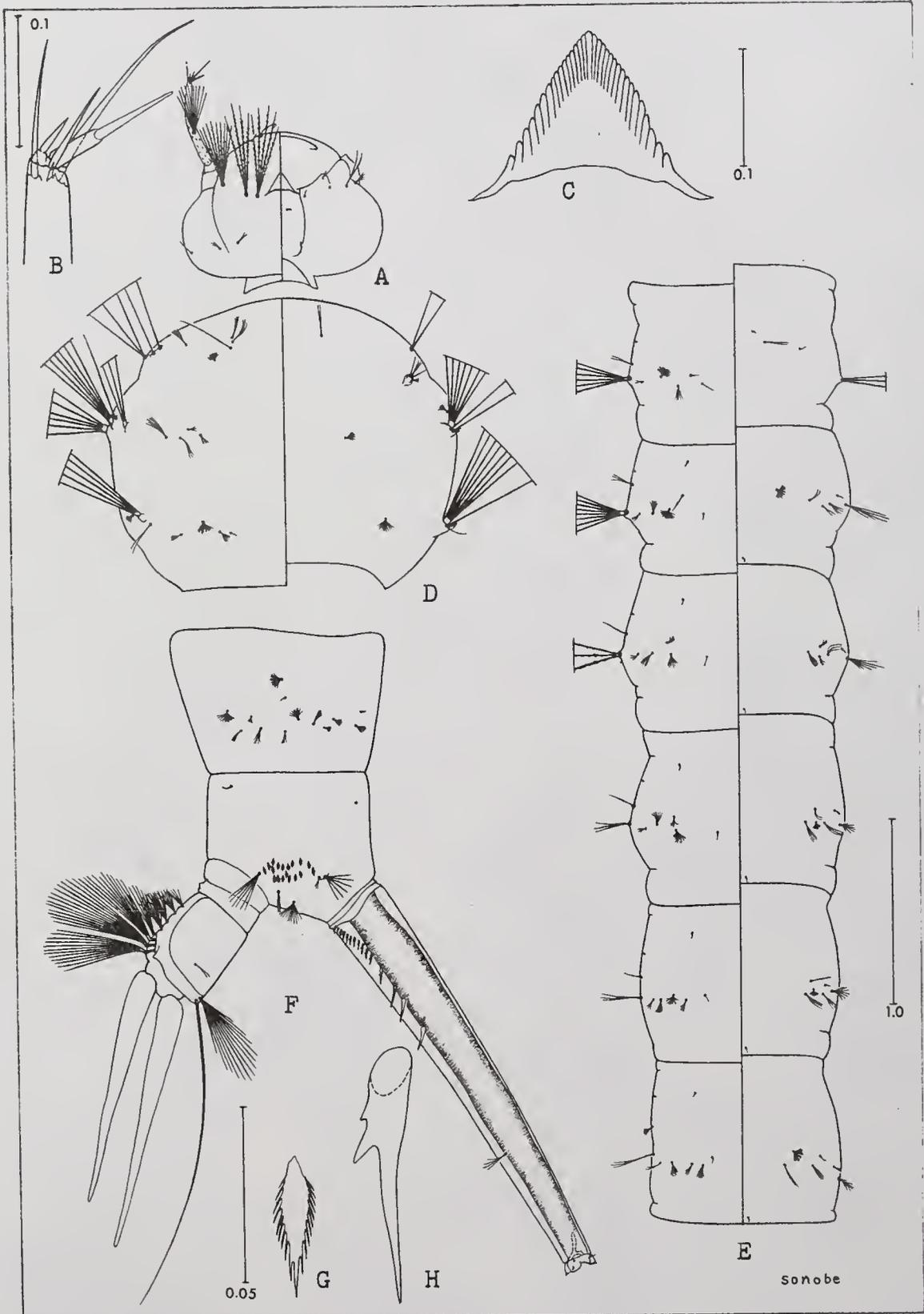


Figure 35. Aedes pipersalatus larva. A. Head,
B. Antenna (apex), C. Mental plate,
D. Thorax, E. Abdomen, F. Distal
abdominal segments and siphon,
G. Comb scale, H. Pecten tooth.

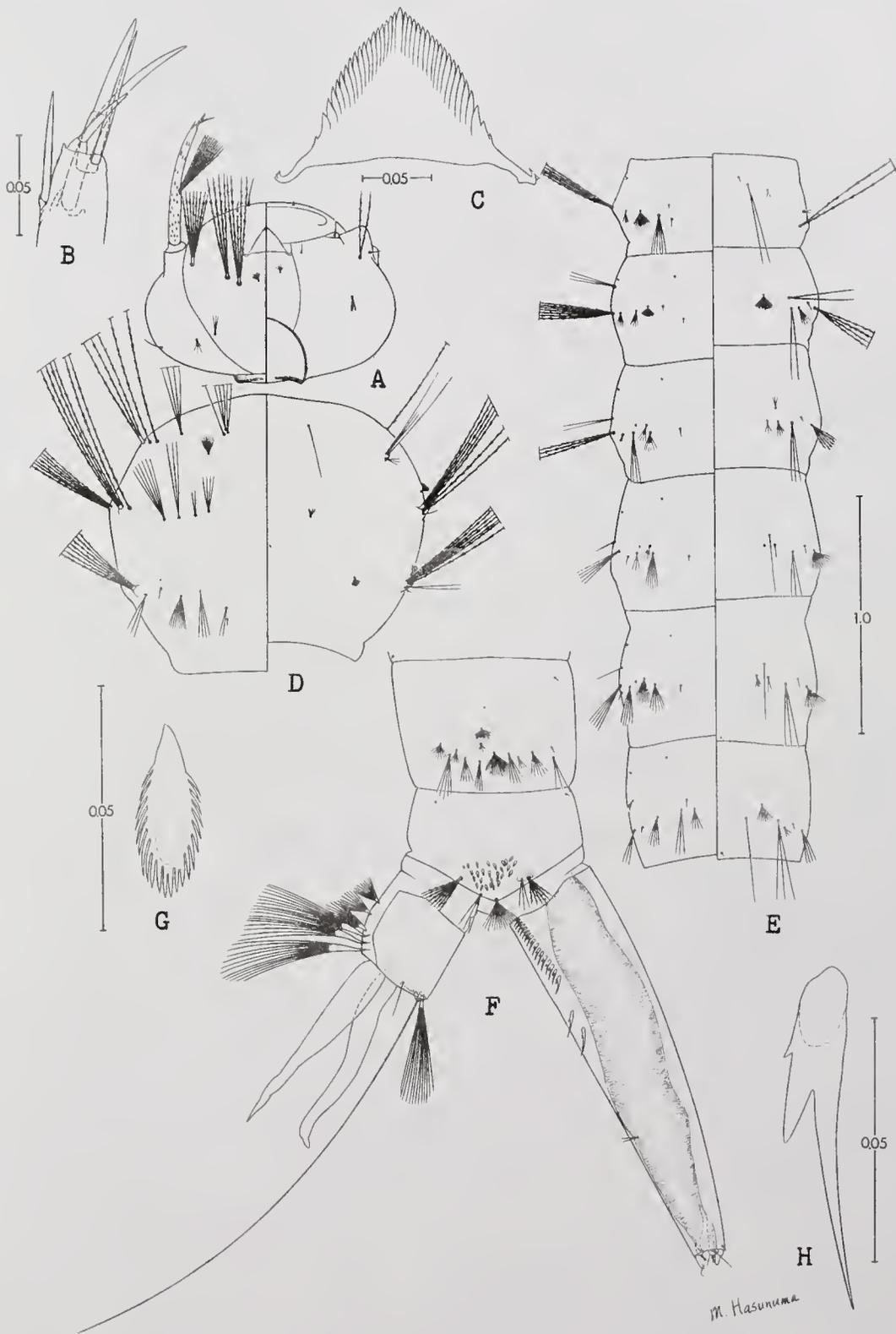
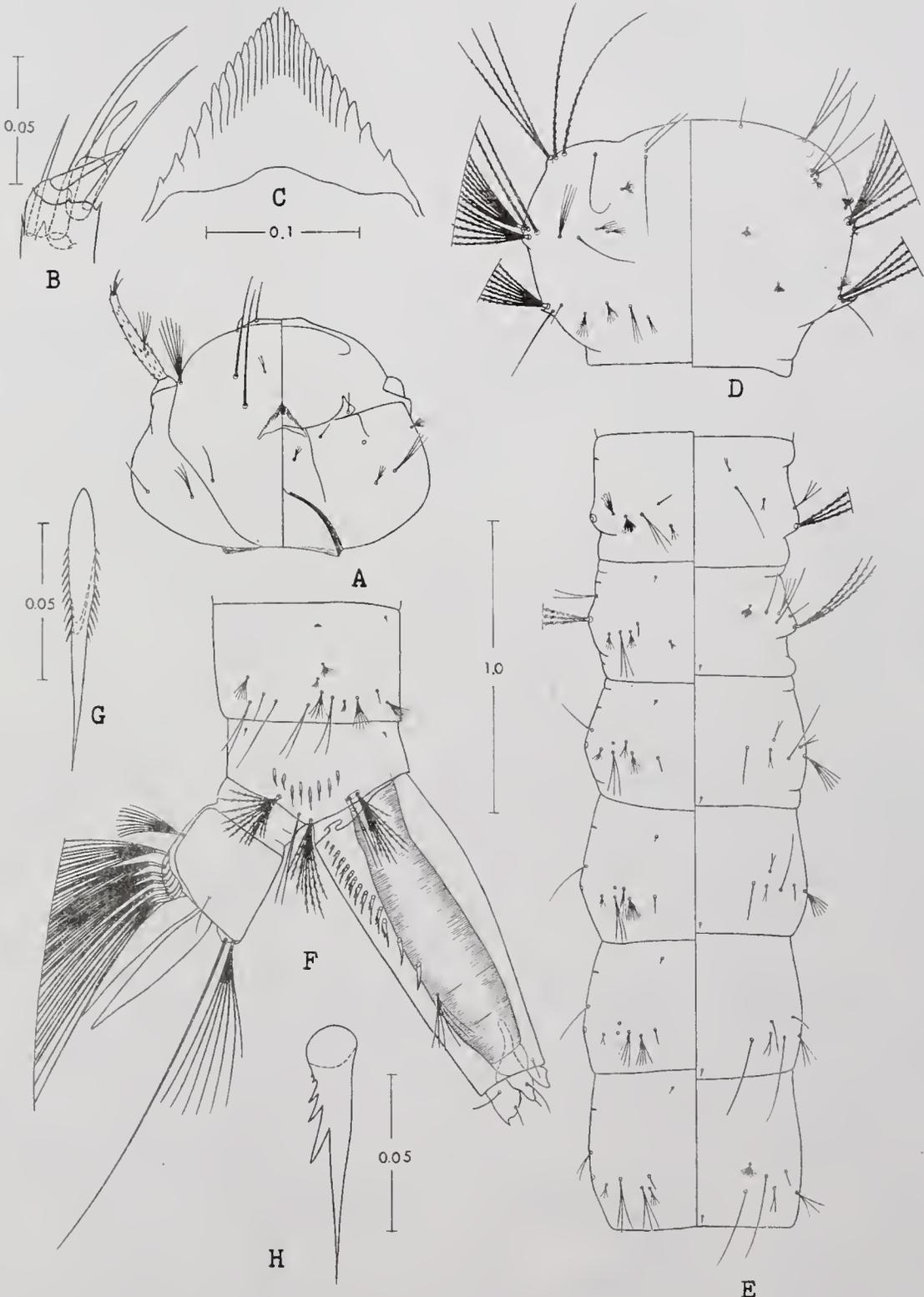


Figure 36. Aedes vexans larva. A. Head,
B. Antenna (apex), C. Mental
plate, D. Thorax, E. Abdomen,
F. Distal abdominal segments and
siphon, G. Comb scale, H. Pecten
tooth.



n. misaki

APPENDIX 2 (TABLES 1 TO 15)

TABLE 1. Record of the branching of the setae on the pupae of Aedes (Aedimorphus) alboscuteUellatus

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
Cephalothorax				Abdomen I (Cont.)			
1	2-4	3	2.6	6	2-3	2	2.3
2	2-4	3	3.1	7	2-3	2	2.4
3	2-4	3	2.8	9	1	1	1
4	3-5	4	4.1	Abdomen II			
5	4-6	5	5	0	1	1	1
6	2-3	2	2.3	1	3-7	4	4.7
7	3-4	4	3.8	2	1	1	1
8	5-9	6	6.3	3	1-2	2	1.6
9	1-3	3	2.3	4	2-5	3	3.5
Metanotum				5	3-6	5	4.6
10	3-5	3	3.5	6	1-3	3	2.6
11	1	1	1	7	2-3	2	2.1
12	4-7	5	5.4	9	1	1	1
Abdomen I				Abdomen III			
1	17-22	18	18.6	0	1	1	1
2	1	1	1	1	6-10	7	7.7
3	1	1	1	2	1	1	1
4	2-5	2	2.7	3	1	1	1
5	6-11	8	7.7	4	2-4	2	2.7

TABLE 1. Continued.

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
Abdomen III (Cont.)				Abdomen V			
5	3-8	4	5.1	0	1	1	1
6	2-4	3	3.1	1	2-5	4	3.7
7	2-4	2	2.6	2	1	1	1
8	2-4	4	3.7	3	2-5	3	3.1
9	1	1	1	4	4-9	5	6.1
10	2-4	3	2.8	5	2	2	2
11	1	1	1	6	1-3	2	2.1
14	1	1	1	7	5-9	6	6.3
Abdomen IV				8	2-3	3	2.6
0	1	1	1	9	1	1	1
1	3-6	5	4.4	10	2-3	2	2.1
2	1	1	1	11	1	1	1
3	3-6	5	4.6	14	1	1	1
4	2-4	2	2.7	Abdomen VI			
5	2	2	2	0	1	1	1
6	1-3	3	2.2	1	2-4	4	3.4
7	2-3	2	2.3	2	1	1	1
8	2-4	2	2.6	3	2-4	3	2.9
9	1	1	1	4	3-9	5	4.8
10	2-4	3	2.7	5	2-3	2	2.2
11	1	1	1	6	2-4	3	2.8
14	1	1	1	7	2	2	2

TABLE 1. Continued.

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
Abdomen VI (Cont.)				Abdomen VII (Cont.)			
8	2-4	3	2.9	7	1-3	2	2.1
9	1	1	1	8	3-4	3	3.2
10	1	1	1	9	2-5	3	3.1
11	1	1	1	10	2-3	2	2.4
14	1	1	1	11	2-3	2	2.1
Abdomen VII				14	1	1	1
0	1	1	1	Abdomen VIII			
1	4-6	4	4.4	0	1	1	1
2	1	1	1	4	2-4	3	3
3	2-6	4	3.7	9	4-7	6	6.2
4	3-5	3	3.7	14	1	1	1
5	3-6	4	3.9	Paddle			
6	4-10	5	6.4	1	2-3	2	2.2

TABLE 2. Record of the branching of the setae on the pupae of Aedes (Aedimorphus) caecus

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
Cephalothorax				Abdomen I (Cont.)			
1	3	3	3	6	1	1	1
2	2-4	3	2.8	7	2-5	3	2.8
3	2-4	3	2.8	9	1	1	1
4	3-6	4	4.1	Abdomen II			
5	2-5	4	3.6	0	1	1	1
6	1-3	1	1.5	1	20-32	21	25.2
7	2-4	3	3.1	2	1	1	1
8	5-7	5	5.6	3	1	1	1
9	3-4	3	3.1	4	2-5	4	4.3
Metanotum				5	3-5	4	4.1
10	7-11	9	9	6	1-2	1	1.1
11	1	1	1	7	1-3	2	2.1
12	5-8	5	5.9	9	1	1	1
Abdomen I				Abdomen III			
1	18-30	21	24.1	0	1	1	1
2	1	1	1	1	5-8	7	7.1
3	1	1	1	2	1	1	1
4	2-5	3	3.6	3	1	1	1
5	6-10	7	7.3	4	2-3	3	2.6

TABLE 2. Continued.

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
Abdomen III (Cont.)				Abdomen IV (Cont.)			
4a	1	1	1	11	1	1	1
5	4-6	5	4.7	14	1	1	1
6	2-4	3	3	Abdomen V			
7	2-5	2	2.7	0	1	1	1
8	2-4	2	2.5	1	3-6	4	4.1
9	1	1	1	2	1	1	1
10	2-4	3	3	3	2-3	3	2.7
11	1	1	1	4	3-7	5	5.1
14	1	1	1	4a	1	1	1
Abdomen IV				5	2	2	2
0	1	1	1	6	2-3	2	2.2
1	4-6	6	5.2	7	5-8	5	5.9
2	1	1	1	8	2-3	2	2.1
3	4-7	5	5.1	9	1	1	1
4	1-2	2	1.9	10	1	1	1
4a	1	1	1	11	1	1	1
5	2-3	2	2.2	14	1	1	1
6	2-4	3	2.9	Abdomen VI			
7	2-3	2	2.2	0	1	1	1
8	2-3	2	2.3	1	2-5	4	3.8
9	1	1	1	2	1	1	1
10	2-4	3	2.7	3	2-3	3	2.6

TABLE 2. Continued.

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
Abdomen VI (Cont.)				Abdomen VII (Cont.)			
4	3-6	4	4.3	5	2-4	2	2.6
5	1-3	2	2.1	6	3-7	4	4.7
6	1-2	1	1.2	7	1-2	1	1.2
7	1-2	1	1.1	8	2-4	2	2.8
8	1-3	2	2.1	9	3-7	5	5.1
9	1	1	1	10	1-3	2	1.9
10	1	1	1	11	1	1	1
11	1	1	1	14	1	1	1
14	1	1	1	Abdomen VIII			
Abdomen VII				0	1	1	1
0	1	1	1	4	2-4	3	3.1
1	2-5	3	3.3	9	7-11	9	8.6
2	1	1	1	14	1	1	1
3	3-7	5	4.7	Paddle			
4	2-4	3	3.2	1	1	1	1

TABLE 3. Record of the branching of the setae on the pupae of Aedes (Aedimorphus) culicinus

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
Cephalothorax				Abdomen I (Cont.)			
1	3-4	3	3.4	6	1-3	2	2.1
2	2-4	3	3.1	7	2-4	3	2.7
3	3-4	3	3.3	9	1	1	1
4	3-4	3	3.4	Abdomen II			
5	4-6	4	4.9	0	1	1	1
6	2	2	2	1	14-20	14	15.9
7	3-5	4	4.3	2	1	1	1
8	5-9	7	6.4	3	1	1	1
9	2-3	3	2.6	4	4-8	5	5.3
Metanotum				5	4-7	5	5.6
10	6-9	7	7.1	6	1-2	2	1.6
11	1	1	1	7	2-4	3	2.6
12	4-7	4	5.3	9	1	1	1
Abdomen I				14	1	1	1
1	16-24	21	20	Abdomen III			
2	1-2	1	1.2	0	1	1	1
3	1	1	1	1	7-13	8	8.9
4	2-6	4	3.9	2	1	1	1
5	7-12	11	9.3	3	1	1	1

TABLE 3. Continued.

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
Abdomen III (Cont.)				Abdomen V			
4	3-5	4	3.8	0	1	1	1
5	4-8	5	5.1	1	4-9	5	5.4
6	2-3	3	2.6	2	1	1	1
7	3-5	3	3.5	3	2-4	3	2.9
8	3-5	4	4.1	4	4-7	6	5.8
9	1	1	1	5	2-3	2	2.1
10	1-4	2	2.3	6	1-3	2	2.1
11	1	1	1	7	4-8	6	6.2
Abdomen IV				8	2-4	3	3.1
0	1	1	1	9	1	1	1
1	4-9	5	5.8	10	1-2	1	1.4
2	1	1	1	11	1	1	1
3	4-7	6	5.5	14	1	1	1
4	2-3	2	2.4	Abdomen VI			
5	2	2	2	0	1	1	1
6	2-3	2	2.3	1	3-7	5	5.4
7	2-4	3	3.2	2	1	1	1
8	2-5	3	3.1	3	2-4	3	3.2
9	1	1	1	4	3-8	4	5.2
10	1-3	3	2.4	5	2-3	3	2.6
11	1	1	1	6	2-3	3	2.7
14	1	1	1	7	2	2	2

TABLE 3. Continued.

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
Abdomen VI (Cont.)				Abdomen VII (Cont.)			
8	3-4	4	3.6	7	2-4	3	2.6
9	1	1	1	8	2-6	3	3.5
10	1	1	1	9	4-5	4	4.4
11	1	1	1	10	2-3	2	2.2
14	1	1	1	11	2	2	2
Abdomen VII				14	1	1	1
0	1	1	1	Abdomen VIII			
1	5-8	6	5.9	0	1	1	1
2	1	1	1	4	3-5	4	3.9
3	4-7	5	5.4	9	7-11	9	8.6
4	3-6	4	3.9	14	1	1	1
5	4-8	7	6.3	Paddle			
6	6-9	7	7.6	1	1-2	1	1.4

TABLE 4. Record of the branching of the setae on the pupae of Aedes (Aedimorphus) mediolineatus

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
Cephalothorax				Abdomen I (Cont.)			
1	3-5	4	3.6	6	1-2	1	1.1
2	3-4	4	3.6	7	2-3	2	2.4
3	2-4	3	2.9	9	1	1	1
4	2-4	3	3.3	Abdomen II			
5	3-5	4	3.8	0	1	1	1
6	2-4	3	3.1	1	17-28	22	22.8
7	2-5	4	3.6	2	1-2	1	1.1
8	2-6	3	3.6	3	1-2	1	1.3
9	2	2	2	4	6-10	7	7.6
Metanotum				5	4-8	6	5.5
10	11-24	12	13.8	6	1	1	1
11	1	1	1	7	1-4	2	2.6
12	4-5	4	4.4	9	1	1	1
Abdomen I				Abdomen III			
1	17-30	22	24.6	0	1	1	1
2	1	1	1	1	7-18	15	12.2
3	1	1	1	2	1	1	1
4	3-6	4	4.2	3	1	1	1
5	8-17	12	13.9	4	2-8	4	3.9

TABLE 4. Continued.

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
Abdomen III (Cont.)				Abdomen V			
5	4-9	5	5.6	0	1	1	1
6	2-4	2	2.3	1	3-6	5	4.5
7	2-5	3	3.4	2	1	1	1
8	3-6	4	4.4	3	2-3	2	2.4
9	1	1	1	4	7-11	9	8.3
10	2-4	3	2.7	5	2-3	2	2.5
11	1	1	1	6	2-3	2	2.3
14	1	1	1	7	5-10	7	7.2
Abdomen IV				8	2-5	3	3.3
0	1	1	1	9	1	1	1
1	3-7	5	5.1	10	1	1	1
2	1	1	1	11	1	1	1
3	5-12	6	7.6	14	1	1	1
4	2-6	4	3.9	Abdomen VI			
5	2-4	3	2.6	0	1	1	1
6	2-4	2	2.6	1	4-5	5	4.6
7	2-4	3	2.7	2	1	1	1
8	2-4	2	2.6	3	2-3	2	2.3
9	1	1	1	4	4-8	5	5.1
10	2-3	2	2.1	5	2-5	4	3.2
11	1	1	1	6	2-4	3	2.7
14	1	1	1	7	1-2	1	1.2

TABLE 4. Continued.

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
Abdomen VI (Cont.)				Abdomen VII (Cont.)			
8	3-5	4	3.8	7	2-3	3	2.6
9	1	1	1	8	3-7	5	5.6
10	1	1	1	9	5-11	5	6.8
11	1	1	1	10	1-3	2	2.3
14	1	1	1	11	1-3	2	1.8
Abdomen VII				14	1	1	1
0	1	1	1	Abdomen VIII			
1	3-6	4	4.4	0	1	1	1
2	1	1	1	4	2-4	3	2.9
3	3-7	5	5.1	9	7-14	8	8.9
4	2-5	3	3.2	14	1	1	1
5	3-6	5	4.6	Paddle			
6	8-12	11	10.5	1	1-2	2	1.9

TABLE 5. Record of the branching of the setae on the pupae of Aedes (Aedimorphus) orbitae

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
Cephalothorax				Abdomen I (Cont.)			
1	3-6	5	4.5	6	2-3	2	2.4
2	3-4	3	3.3	7	3-6	4	4.3
3	2-3	3	2.6	9	1	1	1
4	3-6	4	4.3	Abdomen II			
5	3-6	4	3.9	0	1	1	1
6	2-3	2	2.1	1	32-49	38	40.5
7	3-5	4	3.7	2	1	1	1
8	7-9	7	7.5	3	1	1	1
9	2-4	3	2.9	4	3-6	5	4.8
Metanotum				5	3-5	4	4.2
10	17-33	18	22.3	6	1-3	2	1.8
11	1	1	1	7	2-6	4	4.2
12	5-10	5	6.1	9	1	1	1
Abdomen I				Abdomen III			
1	16-24	21	21.1	0	1	1	1
2	1	1	1	1	8-17	12	11.5
3	1	1	1	2	1	1	1
4	3-7	4	4.4	3	1	1	1
5	7-16	10	10.1	4	2-5	4	3.6

TABLE 5. Continued.

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
Abdomen III (Cont.)				Abdomen V			
5	3-5	4	3.9	0	1	1	1
6	1-4	4	2.8	1	5-10	6	6.5
7	2-5	4	3.7	2	1	1	1
8	2-5	4	3.8	3	2-3	3	2.7
9	1	1	1	4	5-11	8	7.3
10	4-6	4	4.3	5	2	2	2
11	1	1	1	6	1-3	2	1.8
14	1	1	1	7	5-8	7	6.8
Abdomen IV				8	2-4	2	3.3
0	1	1	1	9	1	1	1
1	5-11	10	8.6	10	1	1	1
2	1	1	1	11	1	1	1
3	4-7	4	5.3	14	1	1	1
4	1-2	2	1.6	Abdomen VI			
5	2	2	2	0	1	1	1
6	1-3	2	2.4	1	4-7	5	5.1
7	1-3	2	1.9	2	1	1	1
8	2-4	3	2.9	3	2-4	3	3.2
9	1	1	1	4	4-6	5	4.8
10	3-5	4	3.9	5	1-2	2	1.8
11	1	1	1	6	1	1	1
14	1	1	1	7	1-3	2	1.9

TABLE 5. Continued.

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
Abdomen VI (Cont.)				Abdomen VII (Cont.)			
8	2-4	2	2.2	7	1-3	2	1.9
9	1	1	1	8	3-5	3	3.6
10	1	1	1	9	4-6	5	5.2
11	1	1	1	10	2-3	2	2.4
14	1	1	1	11	1	1	1
Abdomen VII				14	1	1	1
0	1	1	1	Abdomen VIII			
1	3-6	4	4.1	0	1	1	1
2	1	1	1	4	2-3	3	2.7
3	4-6	5	4.9	9	8-13	9	10.2
4	2-4	3	2.7	14	1	1	1
5	2-4	2	2.7	Paddle			
6	6-11	7	8.1	1	1	1	1

TABLE 6. Record of the branching of the setae on the pupae of Aedes (Aedimorphus) pallidostriatus

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
Cephalothorax				Abdomen I (Cont.)			
1	2-4	3	3	6	1-2	1	1.4
2	2-3	3	2.8	7	2-4	3	3.1
3	3-4	3	3.3	9	1	1	1
4	3-5	3	3.6	Abdomen II			
5	3-6	4	4.4	0	1	1	1
6	2-4	2	2.4	1	9-36	21	22.1
7	2-3	3	2.9	2	1	1	1
8	2-6	3	4.8	3	2-3	3	2.6
9	2-3	2	2.3	4	5-9	7	7
Metanotum				5	2-9	6	4.9
10	10-18	12	13.3	6	1-3	2	1.9
11	1	1	1	7	3-4	4	3.6
12	3-7	4	4.7	9	1	1	1
Abdomen I				Abdomen III			
1	30-46	35	37.7	0	1	1	1
2	1	1	1	1	7-18	18	13.4
3	1-2	1	1.2	2	1	1	1
4	4-7	5	5	3	1	1	1
5	8-15	10	10.4	4	3-5	5	4.4

TABLE 6. Continued.

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
Abdomen III (Cont.)				Abdomen V			
5	3-11	8	7.1	0	1	1	1
6	2-4	3	2.8	1	4-6	6	5.4
7	4-7	5	5.4	2	1	1	1
8	3-7	4	4.8	3	2-3	3	2.6
9	1	1	1	4	5-9	8	7.3
10	2-3	2	2.3	5	3-4	3	3.1
11	1	1	1	6	2-3	3	2.6
14	1	1	1	7	8-11	8	8.7
Abdomen IV				8	3-5	4	4
0	1	1	1	9	1	1	1
1	5-13	7	7.7	10	1-3	1	1.3
2	1	1	1	11	1	1	1
3	4-10	7	6.9	14	1	1	1
4	2-5	3	3	Abdomen VI			
5	2-3	3	2.9	0	1	1	1
6	2-6	3	3.6	1	4-9	5	6.4
7	3-6	4	4.1	2	1	1	1
8	3-4	3	3.1	3	2-4	3	3.2
9	1	1	1	4	3-7	6	5.6
10	2-4	3	2.9	5	3-4	3	3.4
11	1	1	1	6	2-3	3	2.5
14	1	1	1	7	2-3	2	2.1

TABLE 6. Continued.

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
Abdomen VI (Cont.)				Abdomen VII (Cont.)			
8	3-4	4	3.6	7	1-4	3	2.4
9	1	1	1	8	3-7	3	4
10	1-2	1	1.1	9	3-8	6	5.9
11	1-2	1	1.1	10	1-3	2	1.9
14	1	1	1	11	1-3	1 ^o	1.5
Abdomen VII				14	1	1	1
0	1	1	1	Abdomen VIII			
1	5-9	7	6.5	0	1	1	1
2	1	1	1	4	2-3	3	2.8
3	4-9	7	7.8	9	7-13	9	9.8
4	2-4	4	3.4	14	1	1	1
5	5-9	7	6.7	Paddle			
6	8-13	10	10.6	1	1	1	1

TABLE 7. Record of the branching of the setae on the pupae of Aedes (Aedimorphus) pampangensis

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
Cephalothorax				Abdomen I (Cont.)			
1	5-8	5	6	6	2-3	2	2.2
2	4-8	5	5.6	7	4-6	5	4.8
3	3-5	5	4.3	9	1	1	1
4	6-8	7	6.9	Abdomen II			
5	6-9	6	7.5	0	1	1	1
6	2-4	3	3	1	24-40	36	33.6
7	8-11	9	8.9	2	1	1	1
8	7-12	12	10.5	3	1-2	2	1.6
9	2-4	3	2.9	4	6-11	6	7.8
Metanotum				5	10-14	10	11.4
10	13-16	13	14.3	6	2-5	3	3.2
11	1	1	1	7	6-10	6	7
12	3-11	6	6.6	9	1	1	1
Abdomen I				14	1	1	1
1	21-42	35	32.3	Abdomen III			
2	1	1	1	0	1	1	1
3	1	1	1	1	10-16	12	12.4
4	5-7	6	4.9	2	1	1	1
5	10-18	15	14.6	3	1	1	1

TABLE 7. Continued.

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
Abdomen III (Cont.)				Abdomen V			
4	4-8	4	5.3	0	1	1	1
5	9-13	11	10.8	1	5-9	8	8.6
6	4-8	6	6.1	2	1	1	1
7	4-6	5	4.9	3	3-5	4	4
8	4-7	6	5.9	4	9-14	12	11.6
9	1	1	1	5	3-5	3	3.8
10	2-5	2	3.1	6	5-8	5	5.9
11	1	1	1	7	7-11	9	8.9
14	1	1	1	8	3-4	3	3.4
Abdomen IV				9	1	1	1
0	1	1	1	10	2-4	3	3
1	5-11	7	7.6	11	1	1	1
2	1	1	1	14	1	1	1
3	5-9	8	7.4	Abdomen VI			
4	3-6	3	4.1	0	1	1	1
5	2-5	3	3.1	1	7-13	9	9.5
6	5-8	6	6.6	2	1	1	1
7	4-6	4	4.4	3	4-8	4	5.4
8	3-4	3	3.4	4	7-11	8	9.9
9	1	1	1	5	3-6	5	4.4
10	3-5	4	4.3	6	6-8	8	7.3
11	1	1	1	7	2-4	3	2.8
14	1	1	1	8	4-6	4	4.8

TABLE 7. Continued.

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
Abdomen VI (Cont.)				Abdomen VII (Cont.)			
9	1	1	1	7	2-5	4	4.1
10	1-3	2	2	8	3-7	5	5.3
11	1	1	1	9	5-7	6	6.1
14	1	1	1	10	2-5	4	3.6
Abdomen VII				11	2-4	3	2.8
0	1	1	1	14	1	1	1
1	7-10	7	8.1	Abdomen VIII			
2	1	1	1	0	1	1	1
3	9-16	11	12.1	4	5-8	7	6.4
4	4-10	6	7.1	9	11-14	14	12.9
5	5-9	7	7.3	14	1	1	1
6	7-14	10	10.1	Paddle			
				1	1-2	2	1.8

TABLE 8. Record of the branching of the setae on the pupae of Aedes (Aedimorphus) pipersalatus

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
Cephalothorax				Abdomen I (Cont.)			
1	2-3	3	2.6	6	1-3	1	1.5
2	2-4	3	2.9	7	3-5	3	3.4
3	2-4	2	2.6	9	1	1	1
4	3-4	3	3.3	Abdomen II			
5	3-5	4	4.3	0	1	1	1
6	2-4	3	2.9	1	13-20	18	17.4
7	3-6	4	4.2	2	1	1	1
8	2-7	5	4.6	3	1	1	1
9	2-4	2	2.6	4	7-16	8	9.4
Metanotum				5	4-7	5	4.9
10	5-9	6	6.2	6	1-3	3	2.2
11	1	1	1	7	2-4	3	3.1
12	4-7	4	5	9	1	1	1
Abdomen I				14	1	1	1
1	21-38	31	29.1	Abdomen III			
2	1	1	1	0	1	1	1
3	1	1	1	1	6-10	7	7.8
4	3-6	6	5.2	2	1	1	1
5	7-16	9	10.9	3	1	1	1

TABLE 8. Continued.

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
Abdomen III (Cont.)				Abdomen V			
4	3-6	5	4.6	0	1	1	1
5	3-7	4	4.8	1	3-5	4	3.8
6	2-4	2	2.6	2	1	1	1
7	3-9	4	4.9	3	2-3	2	2.1
8	3-5	3	3.5	4	4-8	5	5.3
9	1	1	1	5	2-3	2	2.3
10	2-4	3	2.8	6	2-4	3	2.7
11	1	1	1	7	5-8	7	6.7
14	1	1	1	8	2-3	3	2.8
Abdomen IV				9	1	1	1
0	1	1	1	10	1-2	1	1.1
1	3-6	6	4.9	11	1	1	1
2	1	1	1	14	1	1	1
3	5-7	5	5.3	Abdomen VI			
4	2-5	3	3.7	0	1	1	1
5	2	2	2	1	3-7	5	4.4
6	1-4	2	2.5	2	1	1	1
7	3-5	3	3.3	3	2-3	2	2.2
8	2-3	2	2.4	4	3-6	5	4.7
9	1	1	1	5	2-5	3	2.7
10	2-3	2	2.3	6	2-3	2	2.4
11	1	1	1	7	2	2	2
14	1	1	1	8	2-3	3	2.8

TABLE 8. Continued.

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
Abdomen VI (Cont.)				Abdomen VII (Cont.)			
9	1	1	1	8	2-5	3	3.6
10	1-2	1	1.2	9	3-6	4	4.3
11	1	1	1	10	1-2	2	1.8
14	1	1	1	11	1-2	2	1.6
Abdomen VII				14	1	1	1
0	1	1	1	Abdomen VIII			
1	3-6	4	4.3	0	1	1	1
2	1	1	1	4	3-4	3	3.1
3	3-8	5	5.2	9	7-10	7	7.1
4	2-4	3	2.8	14	1	1	1
5	3-6	4	4.2	Paddle			
6	6-14	8	9.1	1	1	1	1
7	2-3	2	2.1				

TABLE 9. Record of the branching of the setae on the pupae of Aedes (Aedimorphus) vexans

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
Cephalothorax				Abdomen I (Cont.)			
1	2-3	2	2.3	6	1-2	1	1.1
2	2-3	2	2.1	7	1-3	1	1.2
3	2	2	2	9	1	1	1
4	1-4	2	2.5	10	1	1	1
5	1-3	2	2.4	Abdomen II			
6	1-4	1	1.7	0	1	1	1
7	2-5	3	3.2	1	5-14	10	9.4
8	2-4	4	3.4	2	1	1	1
9	1-2	2	1.8	3	1-2	2	1.7
Metanotum				4	2-4	3	2.7
10	4-11	7	7	5	2-5	4	3.3
11	1	1	1	6	1-3	1	1.2
12	1-3	1	1.7	7	1-3	1	1.4
Abdomen I				9	1	1	1
1	17-25	21	21	Abdomen III			
2	1	1	1	0	1	1	1
3	1	1	1	1	3-5	4	3.9
4	2-4	2	2.8	2	1	1	1
5	2-8	3	3.9	3	1-2	1	1.2

TABLE 9. Continued.

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
Abdomen III (Cont.)				Abdomen V			
4	1-4	3	2.5	0	1	1	1
5	2-6	4	3.8	1	1-3	2	2.1
6	1-3	1	1.5	2	1	1	1
7	2-4	3	2.9	3	1-4	2	1.9
8	1-4	2	2.1	4	1-5	3	2.9
9	1	1	1	5	1-2	2	1.8
10	1-3	1	1.8	6	1-2	1	1.2
11	1	1	1	7	1-5	2	2.9
14	1	1	1	8	1-3	1	1.3
Abdomen IV				9	1	1	1
0	1	1	1	10	1	1	1
1	2-5	3	3	11	1	1	1
2	1	1	1	14	1	1	1
3	2-7	5	4.2	Abdomen VI			
4	1-5	1	1.9	0	1	1	1
5	1-3	2	2.1	1	1-3	2	1.8
6	1-3	1	1.6	2	1	1	1
7	2-4	2	2.4	3	1-4	1	1.4
8	1-3	1	1.7	4	1-4	2	2.2
9	1	1	1	5	1-2	2	1.9
10	1-2	1	1.4	6	1-2	1	1.4
11	1	1	1	7	1-2	1	1.1
14	1	1	1	8	1-2	2	1.6

TABLE 9. Continued.

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
Abdomen VI (Cont.)				Abdomen VII (Cont.)			
9	1	1	1	8	1-4	2	2.1
10	1	1	1	9	2-4	3	3.3
11	1	1	1	10	1	1	1
14	1	1	1	11	1	1	1
Abdomen VII				14	1	1	1
0	1	1	1	Abdomen VIII			
1	1-3	1	1.6	0	1	1	1
2	1	1	1	4	1-2	2	1.7
3	2-5	3	2.9	9	4-7	5	5.3
4	1-3	2	2.8	14	1	1	1
5	1-3	1	1.6	Paddle			
6	2-5	3	3.5	1	1	1	1
7	1	1	1				

TABLE 10. Record of the branching of the setae on the pupae of Aedes (Aedimorphus) vexans nipponii

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
Cephalothorax				Abdomen I (Cont.)			
1	2-3	3	2.6	6	1-2	1	1.4
2	2-3	2	2.1	7	2-4	3	2.9
3	2-4	2	2.3	9	1	1	1
4	2-3	3	2.9	10	1	1	1
5	2-4	3	2.8	Abdomen II			
6	1-4	3	2.4	0	1	1	1
7	2-4	4	3.4	1	4-10	6	7.2
8	3-6	5	4.5	2	1	1	1
9	1-2	1	1.4	3	1-2	1	1.1
Metanotum				4	2-4	3	2.8
10	4-10	5	5.8	5	2-4	3	2.9
11	1	1	1	6	1-2	1	1.3
12	1-3	2	1.6	7	2-4	2	2.6
Abdomen I				9	1	1	1
1	16-22	18	18.4	Abdomen III			
2	1	1	1	0	1	1	1
3	1	1	1	1	3-6	4	4.3
4	1-3	3	2.7	2	1	1	1
5	2-5	3	3.3	3	1-2	1	1.1

TABLE 10. Continued.

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
Abdomen III (Cont.)				Abdomen V			
4	2-4	3	2.8	0	1	1	1
5	2-6	4	4.1	1	2-4	3	3
6	1-3	1	1.9	2	1	1	1
7	2-3	3	2.6	3	2-4	2	2.6
8	1-5	3	2.8	4	1-4	3	2.8
9	1	1	1	5	2-3	2	2.1
10	1-3	2	1.8	6	1-2	2	1.7
11	1	1	1	7	1-4	2	2.3
14	1	1	1	8	1-3	2	1.9
Abdomen IV				9	1	1	1
0	1	1	1	10	1	1	1
1	2-5	3	3.2	11	1	1	1
2	1	1	1	14	1	1	1
3	3-5	5	4.6	Abdomen VI			
4	1-3	2	2.1	0	1	1	1
5	2-3	2	2.1	1	2-4	3	2.8
6	1-3	2	1.8	2	1	1	1
7	1-3	2	1.8	3	1-3	1	1.3
8	1-3	2	2	4	2-4	3	3
9	1	1	1	5	2	2	2
10	1-3	2	2	6	1-2	2	1.8
11	1	1	1	7	1-2	1	1.1
14	1	1	1	8	2-3	2	2.2

TABLE 10. Continued.

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
Abdomen VI (Cont.)				Abdomen VII (Cont.)			
9	1	1	1	8	2-4	3	2.7
10	1	1	1	9	2-4	3	3
11	1	1	1	10	1	1	1
14	1	1	1	11	1	1	1
Abdomen VII				14	1	1	1
0	1	1	1	Abdomen VIII			
1	1-3	2	1.9	0	1	1	1
2	1	1	1	4	1-3	2	2.1
3	2-6	3	3.3	9	4-7	5	5.4
4	1-3	2	1.8	14	1	1	1
5	2-3	2	2.2	Paddle			
6	3-4	4	3.6	1	1-2	1	1.2
7	1-2	1	1.1				

TABLE 11. Species of Aedes (Aedimorphus) occurring in the Oriental Zoogeographical Region

Species	Female	Male	Pupa	Larva	Egg
<u>alboscuteUellatus</u>	X**	X**	X**	X**	-
<u>argenteoscutellatus</u>	-	X*	-	-	-
<u>caecus</u>	X**	X**	X**	X**	-
<u>culicinus</u>	X**	X**	X**	X**	-
<u>jamesi</u>	X	X*	-	X*	-
<u>lowisii</u>	X**	X*	-	-	-
<u>mediolineatus</u>	X**	X**	X**	X**	-
<u>nigrostriatus</u>	X	X*	-	-	-
<u>orbitae</u>	X**	X**	X**	X**	-
<u>pallidostriatus</u>	X**	X**	X	X**	-
<u>pampangensis</u>	X**	X**	X**	X**	-
<u>pipersalatus</u>	X**	X**	X	X**	-
<u>punctifemoris</u>	X**	X**	-	-	-
<u>syntheticus</u>	X	X*	-	X*	-
<u>taeniorhynchoides</u>	X**	X**	-	-	-
<u>trimaculatus</u>	X*	X*	-	-	-

TABLE 11. Continued.

Species	Female	Male	Pupa	Larva	Egg
<u>vexans</u>	X**	X**	X**	X**	X*
<u>wainwrighti</u>	X	-	-	-	-

X = Indicates stage has been described in this paper or in the literature.

* = Indicates a portion of the stage has been figured in the literature.

** = Indicates a portion of the stage is figured in this paper.

- = Indicates no description or figure.

TABLE 12. Species of Aedes (Aedimorphus) occurring in the Australian Zoogeographical Region

Species	Female	Male	Pupa	Larva	Egg
<u>alboscuteUellatus</u>	X**	X**	X**	X**	-
<u>caecus</u>	X**	X**	X**	X**	-
<u>lowisii</u>	X**	X*	-	-	-
<u>vexans</u>	X**	X**	X**	X**	X*

X = Indicates stage has been described in this paper or in the literature.

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TABLE 13. Species of Aedes (Aedimorphus) occurring in the Palearctic Zoogeographical Region

Species	Female	Male	Pupa	Larva	Egg
<u>alboscuteUellatus</u>	X**	X**	X**	X**	-
<u>vexans</u>	X**	X**	X**	X**	X*
<u>vexans nipponii</u>	X**	X**	X*	X*	-

X = Indicates stage has been described in this paper or in the literature.

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TABLE 14. Species of Aedes (Aedimorphus) occurring in the Pacific Ocean Islands Region

Species	Female	Male	Pupa	Larva	Egg
<u>alboscuteUellatus</u>	X**	X**	X**	X**	-
<u>caecus</u>	X**	X**	X**	X**	-
<u>oakleyi</u>	X*	X*	X*	X*	-
<u>senyavinensis</u>	X	X*	X*	X*	-
<u>trukensis</u>	X	-	-	-	-
<u>vexans</u>	X**	X**	X**	X**	X*

X = Indicates stage has been described in this paper or in the literature.

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- = Indicates no description or figure.

TABLE 15. Species of Aedes (Aedimorphus) occurring in the Nearctic Zoogeographical Region

<u>Species</u>	<u>Female</u>	<u>Male</u>	<u>Pupa</u>	<u>Larva</u>	<u>Egg</u>
<u>vexans</u>	X**	X**	X**	X**	X*

X = Indicates stage has been described in this paper or in the literature.

* = Indicates a portion of the stage has been figured in the literature.

** = Indicates a portion of the stage is figured in this paper.

TABLE 16. Species of Aedes (Aedimorphus) occurring in the Ethiopian Zoogeographical Region

Species	Female	Male	Pupa	Larva	Egg
<u>abnormalis</u>	-	X*	-	-	-
<u>abnormalis</u> <u>kabwachensis</u>	X	X*	X	X	-
<u>albocephalus</u>	X*	X*	X*	X*	-
<u>alboventralis</u>	X*	-	-	-	-
<u>apicoannulatus</u>	X	X	-	-	-
<u>argenteopunctatus</u>	X*	X*	-	X*	-
<u>bedfordi</u>	X	X*	-	-	-
<u>bevisi</u>	X	X*	X	X*	-
<u>boneti</u>	-	X*	-	-	-
<u>boneti kumbae</u>	-	X*	X	X*	-
<u>caliginosus</u>	X	X*	-	-	-
<u>capensis</u>	X*	X*	-	X*	-
<u>centropunctatus</u>	X	X*	X*	X*	-
<u>congolensis</u>	X	X*	-	-	-
<u>chamboni</u>	X*	X*	-	-	-
<u>cumminsii</u>	X*	X*	X	X*	-
<u>dalzieli</u>	X*	X*	-	X	-
<u>dentatus</u>	X*	X*	-	X*	-
<u>dialloi</u>	-	X*	-	-	-
<u>domesticus</u>	X	X*	X	X*	-

TABLE 16. Continued.

Species	Female	Male	Pupa	Larva	Egg
<u>durbanensis</u>	X*	X*	X*	X*	-
<u>ebogoensis</u>	-	X*	-	-	-
<u>eritreae</u>	X	X*	-	-	-
<u>eritreae karoensis</u>	X	X*	-	X*	-
<u>falabreguesi</u>	-	X*	-	-	-
<u>filicis</u>	X*	X*	X*	X*	-
<u>fowleri</u>	X*	X*	X	X*	-
<u>gibbinsi</u>	X	X*	X*	X	-
<u>gilliesi</u>	X	X	-	-	-
<u>grenieri</u>	-	X*	-	-	-
<u>grjebinei</u>	-	X	-	-	-
<u>hamoni</u>	X*	X*	-	-	-
<u>haworthi</u>	X*	X*	X	X*	-
<u>hirsutus</u>	X	X*	X*	X*	-
<u>holocinctus</u>	-	X	X*	X*	-
<u>hopkinsi</u>	X	X*	X	X*	-
<u>insolens</u>	X	-	-	-	-
<u>irritans</u>	X*	X*	X*	X*	-
<u>kapretwae</u>	X	X	-	X*	-
<u>kennethi</u>	X	X	-	X*	-
<u>lamborni</u>	X	X*	X	X*	-
<u>leesoni</u>	-	X*	-	-	-
<u>leesoni verna</u>	X	X*	X	X*	-
<u>leptolabis</u>	-	X*	X*	X	-

TABLE 16. Continued.

Species	Female	Male	Pupa	Larva	Egg
<u>leucarthrius</u>	X	-	-	-	-
<u>lokojoensis</u>	-	X*	X	X	-
<u>longiseta</u>	-	X*	-	-	-
<u>lottei</u>	-	X*	-	-	-
<u>mansouri</u>	X	X*	-	-	-
<u>marshallii</u>	X*	X*	X*	X*	-
<u>mattinglyi</u>	X	X*	X*	X*	-
<u>microstictus</u>	-	X*	-	-	-
<u>minutus</u>	X*	X*	-	X*	-
<u>mixtus</u>	-	X*	-	X	-
<u>mutilus</u>	X	X*	X*	X	-
<u>natronius</u>	X	X*	-	X*	-
<u>neobiannulatus</u>	X	-	-	-	-
<u>ngong</u>	X	X	X	X	-
<u>nigricephalus</u>	X*	X*	X*	X*	-
<u>nyounae</u>	-	X*	X*	X*	-
<u>ochraceus</u>	X*	X*	-	X*	-
<u>ovazzai</u>	-	X*	-	-	-
<u>pachyurus</u>	X	X*	-	X	-
<u>phyllolabis</u>	X	X*	X*	X*	-
<u>pseudotarsalis</u>	X	X*	X*	X*	-
<u>pubescens</u>	X	X*	-	-	-
<u>punctothoracis</u>	X*	X*	-	-	-
<u>quasiunivittatus</u>	X*	X*	-	X*	-

TABLE 16. Continued.

Species	Female	Male	Pupa	Larva	Egg
<u>reali</u>	-	X*	-	-	-
<u>rickenbachi</u>	-	X*	X*	X*	-
<u>semlikiensis</u>	X*	X*	-	-	-
<u>seychellensis</u>	X*	-	-	-	-
<u>simulans</u>	X*	X*	X	X*	-
<u>smithburni</u>	X	X*	-	-	-
<u>stokesi</u>	X	X*	X	X*	-
<u>subdentatus</u>	X	X*	-	-	-
<u>tarsalis</u>	X*	X*	X	X*	-
<u>tauffliebi</u>	-	X*	-	-	-
<u>teesdalei</u>	X	X	X*	X	-
<u>tiptoni</u>	-	-	-	X*	-
<u>tricholabis</u>	X	X*	-	-	-
<u>tricholabis bwamba</u>	-	X	X*	X*	-
<u>vexans</u>	X**	X**	X**	X**	X*
<u>wendyal</u>	X	X*	X	X*	-
<u>wigglesworthi</u>	X	X*	X*	X*	-
<u>yangambiensis</u>	-	X*	X*	X*	-
<u>yvonneae</u>	-	X*	-	-	-

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REFERENCES CITED

- Ansari, M. A. R. 1959. A report on the culicine mosquitoes in the collection of the Department of Entomology and Parasitology (I. H. P. M.), Lahore. Pakistan J. Hlth. 8: 25-36.
- Aslamkhan, M., and C. Salman. 1969. The bionomics of the mosquitoes of the Changa Manga National Forest, West Pakistan. Pakistan J. Zool. 1(2): 183-205.
- Aspöck, H. 1965. Studies of Culicidae (Diptera) and consideration of their role as potential vectors of arboviruses in Australia. XII Int. Congr. Ent., London, p. 767-769.
- Assem, J. V. D., and J. Bonne-Wepster. 1964. New Guinea Culicidae, a synopsis of vectors, pests and common species. Zool. Bijdr. 6: 1-136.
- Baisas, F. E. 1946. Notes on Philippine mosquitoes, X. Some species of Aedes (Finlaya) and (Aedimorphus). Mon. Bull. Bur. Hlth. Philipp. 22(3): 21-37.
- Banks, C. S. 1909. Four new Culicidae from the Philippines. Philipp. J. Sci. 4(6): 545-551.
- Barr, A. R. 1954. A note on the chaetotaxy of Aedes vexans (Meigen, 1830). Mosquito News 14(1): 24-25.
- Barraud, P. J. 1927. A revision of the culicine mosquitoes of India Part XXI. Descriptions of new species of Aedimorphus and Finlaya, with notes on Stegomyia albolineata (Theo.). Indian J. med. Res. 14(3): 549-554.
- Barraud, P. J. 1928. A revision of the culicine mosquitoes of India Part XXIII. The genus Aedes (sens. lat.) and the classification of the subgenera. Descriptions of the Indian species of Aedes (Aedimorphus), Aedes (Ochlerotatus), and Aedes (Banksinella), with notes on Aedes (Stegomyia) variegatus. Indian J. med. Res. 15(3): 653-669.
- Barraud, P. J. 1934. The fauna of British India including Ceylon and Burma. Diptera V, family Culicidae, tribes Megarhinini and Culicini. Taylor and Francis, London. 463 p.

- Bauer, J. H. 1928. The transmission of yellow fever by mosquitoes other than Aedes aegypti. Am. J. trop. Med. 8: 261-282.
- Belkin, J. N. 1962. The mosquitoes of the South Pacific. Univ. Calif. Press, Berkeley, 2 vol., 608 and 412 p.
- Belkin, J. N. 1965. Mosquito studies (Diptera, Culicidae) IV. The mosquitoes of the Robinson-Peabody Museum of Salem expedition to the southwest Pacific, 1956. Contr. Am. ent. Inst. 1(4): 11-34.
- Bick, G. H. 1951. The ecology of the mosquito larvae of New Guinea. Pacif. Sci. 5: 392-431.
- Blanchard, R. 1905. Les moustiques histoire naturelle et medicale. F. R. de Rudeval, Paris. 673 p.
- Bohart, R. M. 1945. A synopsis of the Philippine mosquitoes. U. S. Navmed. Bull. 580, 88 p.
- Bohart, R. M. 1946. A key to the Chinese culicine mosquitoes. U. S. Navmed. 961, 23 p.
- Bohart, R. M. 1956(1957). Insects of Micronesia Diptera: Culicidae. Insects Micronesia 12(1): 1-85.
- Bohart, R. M., and R. L. Ingram. 1946. Mosquitoes of Okinawa and islands in the Central Pacific. U. S. Navmed. 1055, 110 p.
- Bonne-Wepster, J. 1948. Results of the third Archbold expedition 1938-1939 (Diptera, Culicidae). Notes on the mosquitoes collected by the Neth. Indian-American expedition to central and north New Guinea. Treubia 19(2): 305-322.
- Bonne-Wepster, J. 1954. Synopsis of a hundred common non-anopheline mosquitoes of the Greater and Lesser Sundas, the Moluccas and New Guinea. Doc. med. Geogr. Trop. 6: 208-246.
- Borel, E. 1930. Les moustiques de la Cochinchine et du Sud-Annam. Coll. Soc. Path. exot. Monogr. 3: 1-423.
- Brug, S. L. 1924a. De voornaamste Ned. Indische Culicinen. Vereen. Bevordering Geneesk. Wetenschappen Ned. Indie. 53 p.
- Brug, S. L. 1924b. Notes on Dutch-East-Indian mosquitoes. Bull. ent. Res. 14: 433-442.

- Brug, S. L. 1925. Aanteekeningen omtrent muskieten (III).
Geneesk. Tijdschr. Ned.-Indie 65: 661-671.
- Brug, S. L., and F. W. Edwards. 1931. Fauna Sumatrensis.
Culicidae (Diptera). Tijdschr. Ent. 74: 251-261.
- Brunetti, E. 1907. Annotated catalogue of Oriental
Culicidae. Rec. Indian Mus. 1: 297-377.
- Brunetti, E. 1912. Annotated catalogue of Oriental Culicidae-
Supplement. Rec. Indian Mus. 4: 403-517.
- Brunetti, E. 1920. I. Catalogue of Oriental and south
Asiatic Nematocera. Rec. Indian Mus. 17: 1-300.
- Burroughs, A. L., and R. N. Burroughs. 1954. A study of
the ecology of western equine encephalomyelitis virus
in the upper Mississippi River Valley. Am. J. Hyg.
60: 27-36.
- Buxton, P. A., and G. H. E. Hopkins. 1925. The early
stages of Samoan mosquitoes. Bull. ent. Res. 15:
295-301.
- Buxton, P. A., and G. H. E. Hopkins. 1927. Researches in
Polynesia and Melanesia.--Parts I-IV. London Sch.
Hyg. & trop. Med., p. 1-260.
- Carpenter, S. J., and W. J. La Casse. 1955. Mosquitoes of
North America (north of Mexico). Univ. Calif. Press,
Berkeley. 360 p.
- Carter, H. F., and D. P. Wijesundara. 1948. Notes on
some Ceylon culicine mosquitoes. Ceylon J. Sci.
(B) 23(3): 135-151.
- Causey, O. R. 1937. Some anopheline and culicine mosquitoes
of Siam with remarks on malaria control in Bangkok.
Am. J. Hyg. 25(2): 400-420.
- Chamberlain, R. W., R. K. Sikes, D. B. Nelson, and W. D.
Sudia. 1954. Studies on the North American arthropod-
borne encephalitides VI. Quantitative determinations
of virus-vector relationships. Am. J. Hyg. 60: 278-285.
- Chow, C. Y. 1949. Culicine mosquitoes collected in western
Yunnan, China during 1940-1942 (Diptera, Culicidae).
Proc. ent. Soc. Wash. 51(3): 127-132.
- Christophers, S. R. 1911. Notes on mosquitoes. III. A
new culicine, Leslieomyia taeniorhynchoides nov. gen.
et sp. Paludism 2-3: 68-72.

- Chu, F-I. 1957. Collection of megarhine and culicine mosquitoes from Hainan Island, South China, with description of a new species. *Acta zool. sinica* 9: 145-164.
- Chu, F-I. 1958. Advances in the study of culicine mosquitoes of Hainan, South China. *Indian J. Malar.* 12: 109-113.
- Coher, E. I. 1948 (1949). A study of the female genitalia of Culicidae: With particular reference to characters of generic value. *Ent. Am.* 28(3): 75-112.
- Dyar, H. G. 1925. Note on the male of Aedes punctifemore Ludlow. (Diptera, Culicidae). *Insecutor Inscit. menstr.* 13: 217.
- Dyar, H. G., and R. C. Shannon. 1925. The types of Philippine mosquitos described by Ludlow and other notes on the fauna (Diptera, Culicidae). *Insecutor Inscit. menstr.* 13(4-6): 66-89.
- Edwards, F. W. 1911. The African species of Culex and allied genera. *Bull. ent. Res.* 2(3): 241-268.
- Edwards, F. W. 1913. New synonymy in Oriental Culicidae. *Bull. Ent. Res.* 4: 221-242.
- Edwards, F. W. 1914. New species of Culicidae in the British Museum, with notes on the genitalia of some African Culex. *Bull. ent. Res.* 5: 63-81.
- Edwards, F. W. 1917. Notes on Culicidae, with descriptions of new species. *Bull. ent. Res.* 7: 201-229.
- Edwards, F. W. 1921a. H. Sauter's Formosan collection: Culicidae. *Ann. Mag. nat. Hist. (9th Series)* 8: 629-632.
- Edwards, F. W. 1921b. A revision of the mosquitos of the palaeartic region. *Bull. ent. Res.* 12: 263-351.
- Edwards, F. W. 1922a. A synopsis of adult Oriental culicine (including megarhine and sabethine) mosquitoes. Part I. *Indian J. med. Res.* 10(1): 249-293.
- Edwards, F. W. 1922b. A synopsis of adult Oriental culicine (including megarhine and sabethine) mosquitoes. Part II. *Indian J. med. Res.* 10(2): 430-475.
- Edwards, F. W. 1923. Mosquito notes.--IV. *Bull. ent. Res.* 14(1): 1-9.
- Edwards, F. W. 1924. A synopsis of the adult mosquitoes of the Australasian region. *Bull. ent. Res.* 14: 351-401.

- Edwards, F. W. 1925. Mosquito notes.-V. Bull. ent. Res. 15(3): 257-270.
- Edwards, F. W. 1928. Insects of Samoa, Nematocera. British Museum (Nat. Hist.), London. (4) Fasc. 2: 23-102.
- Edwards, F. W. 1929. Philippine nematoceros Diptera II. Culicidae. Notulae Entomologicae 9: 1-14.
- Edwards, F. W. 1932. Genera Insec. Diptera, Fam. Culicidae. Fasc. 194. Desmet-Verteneuil, Brussels. 258 p.
- Edwards, F. W. 1941. Mosquitoes of the Ethiopian region. III.-Culicine adults and pupae. Brit. Mus. (Nat. Hist.), London. 499 p.
- Edwards, F. W., and D. H. C. Given. 1928. The early stages of some Singapore mosquitoes. Bull. ent. Res. 18: 337-357.
- Felt, E. P. 1904. Mosquitoes or Culicidae of New York State. Bull. N. Y. St. Mus. No. 79, p. 241-400.
- Feng, L.-C. 1938. A critical review of literature regarding the records of mosquitoes in China Part II. Subfamily Culicinae, tribes Megarhinini and Culicini. Peking nat. Hist. Bull. 12(4): 285-318.
- Giles, G. M. 1902. A handbook of the gnats or mosquitoes giving the anatomy and life history of the Culicidae together with descriptions of all species noticed up to the present date. 2nd Ed. John Bale, Sons and Danielsson, LTD., London. 530 p.
- Gjullin, C. M., W. W. Yates, and H. H. Stage. 1950. Studies on Aedes vexans (Meig.) and Aedes sticticus (Meig.), flood-water mosquitoes, in the lower Columbia River Valley. Ann. ent. Soc. Am. 43: 262-275.
- Hara, J. 1957. Studies on the female terminalia of Japanese mosquitoes. Jap. J. exp. Med. 27: 45-91.
- Hicks, E. P., and D. Chand. 1936. A mosquito survey of Karachi Air Port. Rec. Malaria Surv. India 6: 515-535.
- Ho, C. 1931. Study of the adult culicids of Peiping. Bull. Fan Meml. Inst. Biol., Peiping 2: 107-175.
- Hodes, H. L. 1946. Experimental transmission of Japanese B. encephalitis by mosquitoes and mosquito larvae. Bull. John Hopkins Hosp. 79: 358-359.

- Hopkins, G. H. E. 1952. Mosquitoes of the Ethiopian Region. I.-Larval bionomics of mosquitoes and taxonomy of culicine larvae. 2nd Ed. With notes and addenda by P. F. Mattingly. Brit. Mus. (Nat. Hist.), London. 355 p.
- Horsfall, W. R. 1955. Mosquitoes--their bionomics and relation to disease. Ronald Press, New York. 723 p.
- Horsfall, W. R. 1956. Eggs of floodwater mosquitoes III (Diptera, Culicidae). Conditioning and hatching of Aedes vexans. Ann. ent. Soc. Am. 49: 66-71.
- Horsfall, W. R., and G. B. Craig, Jr. 1956. Eggs of floodwater mosquitoes IV. Species of Aedes common in Illinois (Diptera: Culicidae). Ann. ent. Soc. Am. 49: 368-374.
- Hsiao, T. Y. 1945. Epidemiology of diseases of naval importance in China. U. S. Navmed. 630, 149 p. & 9 App.
- Hsiao, T.-Y., and R. M. Bohart. 1946. The mosquitoes of Japan and their medical importance. U. S. Navmed. 1095, 44 p.
- Hu, S. M. K. 1931. Studies on host-parasite relationships of Dirofilaria immitis Leidy and its culicine intermediate hosts. Am. J. Hyg. 14: 614-629.
- Hull, W. B. 1952. Mosquito survey of Guam. U. S. Armed Forces Med. J. 3(9): 1287-1295.
- Iyengar, M. O. T. 1955. Distribution of mosquitoes in the South Pacific region. South Pacific Commission tech. Papers, No. 86, 47 p.
- James, S. P. 1914. Summary of a year's mosquito work in Colombo. Indian J. med. Res. 2: 227-267.
- Joshi, G., S. Pradhan, and R. F. Darsie, Jr. 1965. Culicine, sabethine and toxorhynchitine mosquitoes of Nepal including new country records (Diptera: Culicidae). Proc. ent Soc. Am. 67(3): 137-146.
- Joyce, C. R. and P. Y. Nakagawa. 1963. Aedes vexans nocturnus (Theobald) in Hawaii. Proc. Hawaiian ent. Soc. 18: 273-280.
- Kalpage, K. S., and R. A. Brust. 1968. Mosquitoes of Manitoba. I. Descriptions and a key to Aedes eggs (Diptera: Culicidae). Can. J. Zool. 46: 699-718.

- Kato, M. 1956. Analysis of the mosquito larval population in the paddy field. *Ecol. Rev.* 14(2): 155-161.
- Kato, M., and M. Toriumi. 1950. Studies in the associative ecology of insects I. Nocturnal succession of a mosquito association in the biting activity. *Sci. Rep. Tohoku Univ. (Biol.)* 18(4): 467-472.
- Knight, K. L. 1970. A mosquito taxonomic glossary I. Adult head (external). *Mosq. Syst. Newsletter* 2(1): 23-33.
- Knight, K. L., and W. B. Hull. 1951. Three new species of Aedes from the Philippines (Diptera, Culicidae). *Pacif. Sci.* 5(2): 197-203.
- Knight, K. L., and W. B. Hull. 1953. The Aedes mosquitoes of the Philippine Islands III. Subgenera Aedimorphus, Banksinella, Aedes, and Cancraedes (Diptera, Culicidae). *Pacif. Sci.* 7: 453-481.
- Knight, K. L. and H. S. Hurlbut. 1949. The mosquitoes of Ponape Island, eastern Carolines. *J. Wash. Acad. Sci.* 39: 20-34.
- Knight, K. L. and J. L. Laffoon. 1970a. A mosquito taxonomic glossary III. Adult thorax. *Mosq. Syst. Newsletter* 2(3): 132-146.
- Knight, K. L., and J. L. Laffoon. 1970b. A mosquito glossary IV. Adult thoracic appendages. *Mosq. Syst. Newsletter* 2(4): 165-177.
- Knight, K. L., and J. L. Laffoon. 1971. A mosquito taxonomic glossary V. Abdomen (except female genitalia). *Mosq. Syst. Newsletter* 3(1): 8-24.
- Kurashige, Y. 1964. Ecological studies on mosquitoes I. Ecology of mosquitoes in Tochig; Prefecture, Japan. *Bull. Faculty Liberal Arts, Utsunomiya Univ., Japan* 13(2): 55-103.
- La Casse, W. J., and S. Yamaguti. 1947. Mosquitoes of Japan. Part II. Larvae of the common mosquitoes of Japan. *Off. Surg., H. Q. 1 Corps APO* 301. 143 p.
- La Casse, W. J., and S. Yamaguti. 1948. Mosquito fauna of Japan and Korea. *Off. Surg., H. W. 1 Corps APO* 301. 273 p.
- La Casse, W. J., and S. Yamaguti. 1950. Mosquito fauna of Japan and Korea. *Off. Surg., H. Q. 8th Army APO* 343. 213 p.

- Lee, D. J. 1944. An atlas of the mosquito larvae of the Australasian region. Tribes--Megarhinini and Culicini. H. Q. Australian Mil. Forces. 119 p.
- Leicester, G. F. 1908. The Culicidae of Malaya. Stud. Inst. med. Res. F. M. S. 3: 18-261.
- Li, F-S., and S-C. Wu. 1933 (1934). The mosquitoes of Hangchow, Chekiang. Yb. Bur. Ent., Hangchow 3: 97-123.
- Lien, J. C. 1962. Non-anopheline mosquitoes of Taiwan: Annotated catalog and bibliography. Pacif. Insects 4(3): 615-649.
- Ludlow, C. W. 1905. Mosquito notes.-III. Can. Ent. 37: 94-102, 129-135.
- Ludlow, C. S. 1921. A new Philippine mosquito (Diptera, Culicidae). Mil. Surg. 49: 690-691.
- Ma, S-F., and L. C. Feng. 1956. The mosquito species and their breeding habits as observed in representative parts of Hopei Province. Acta ent. Sinica 6(2): 169-191.
- Macdonald, W. W. 1956. A mosquito survey at Kuala Lumpur airport with special reference to Aedes aegypti. Med. J. Malaya 10(3): 232-245.
- Macdonald, W. W. 1957. Malaysian parasites--XVI. An interim review of the non-anopheline mosquitoes of Malaya. Stud. Inst. med. Res. F. M. S., No. 28, p. 1-34.
- Macdonald, W. W. and R. Traub. 1960. Malaysian parasites--XXXVII. An introduction to the ecology of the mosquitoes of the lowland dipterocarp forest of Selangor, Malaya. Stud. Inst. med. Res. F. M. S., No. 29, p. 79-109.
- Matheson, R., E. L. Brunett, and A. L. Brody. 1931. The transmission of fowl-pox by mosquitoes, preliminary report. Poultry Sci. 10: 211-223.
- Mattingly, P. F. 1969. The biology of mosquito-borne disease. Am. Elsevier Publ. Co., Inc., N. Y. 184 p.
- Meigen, J. W. 1830. Systematische Beschreibung der bekannten Europäischen zweiflügeligen Insekten. Aachen u. Hamm. Band 6, 401 p.
- Mohrig, W. 1967. Die taxonomische bedeutung der struktur weiblicher genitalien in culiciden-tribus Aedini. Angew. Parasit. 8: 67-100.

- Moulton, J. C. 1914. The mosquitoes of Borneo. Rep. Sarawak Mus. 13: 46-48.
- Muspratt, J. 1955. Research on South African Culicini (Diptera, Culicidae). II.--A check-list of the species and their distribution, with notes on taxonomy, bionomics and identification. J. ent. Soc. S. Afr. 18(2): 149-207.
- Natvig, L. R. 1848. Contributions to the knowledge of the Danish and Fennoscandian mosquitoes. Culicini. Norsk ent. Tidsskr., Suppl. I. 567 p.
- Newstead, R., J. E. Dutton, and J. L. Todd. 1907. Insects and other arthropoda collected in the Congo Free State. Ann. trop. Med. Parasit. 1: 1-113.
- Newton, W. L., W. H. Wright, and I. Pratt. 1945. Experiments to determine potential mosquito vectors of Wuchereria bancrofti in the continental United States. Am. J. trop. Med. 25: 253-261.
- Omori, N. 1951. Ecological studies of mosquitoes at Fukui District II. Results of weekly collections at cow-ched in 1950 and comparison of these results with those obtained by human-baited trap in 1949. Nagasaki Igakkai Zassi 26(12): 309-314.
- Omori, N., M. Osima, H. Bekku, and K. Fujisaki. 1952. On the mosquitoes found in Nagasaki Prefecture. Nagasaki Igakkai Zassi 27(4): 281-284.
- Pao, B., and K. L. Knight. 1970a. The fourth instar larval mandible and maxilla of selected Aedes (Aedimorphus) species (Diptera, Culicidae). Mosquito Syst. Newsl. 2(3): 98-131.
- Pao, B., and K. L. Knight. 1970b. Morphology of the fourth stage larval mouthparts of Aedes (Aedimorphus) vexans (Diptera: Culicidae). J. Geo. ent. Soc. 5(3): 115-137.
- Parrish, D. W. 1968a. The occurrence and known human-disease relationships of mosquitoes on USAF installations in the Republic of Vietnam. USAF 5th epid. Flight. 23 p.
- Parrish, D. W. 1968b. The occurrence and known human-disease relationships of mosquitoes of USAF installations in Thailand. USAF 5th epid. Flight. 18 p.

- Patton, W. S. 1922. Note on the value of a tame cow for collecting the blood-sucking Diptera of a locality. *Indian J. med. Res.* 10(1): 66-68.
- Penn, G. H. 1948. Biological notes on "dry season" mosquitoes from Caminawit Point, Mindoro, P. I. (Diptera, Culicidae). *Proc. ent. Soc. Wash.* 50(9): 241-248.
- Penn, G. H. 1949a. The larva and pupa of Aedes (Aedimorphus) alboscuteclatus (Diptera, Culicidae). *Chicago Acad. Sci. nat. Hist. Misc.* 40: 1-4.
- Penn, G. H. 1949b. The pupae of the mosquitoes of New Guinea. *Pacif. Sci.* 3: 3-85.
- Perry, W. J. 1946. Keys to the larval and adult mosquitoes of Espiritu Santo (New Hebrides) with notes on their bionomics. *Pan-Pacif. Ent.* 22: 9-18.
- Qutub-ud-din, M. 1951. The culicine mosquitoes of Hyderabad-Deccan City and their bionomics as observed during 1943-45. *Pakistan J. Hlth.* 1(2): 26-32.
- Qutubuddin, M. 1960. The mosquito fauna of Kohat-Hangu Valley, West Pakistan. *Mosquito News* 20(4): 355-361.
- Rao, T. R., and P. K. Rajagopalan. 1957. Observations on mosquitoes of Poona District, India, with special reference to their distribution, seasonal prevalence and the biology of adults. *Indian J. Malr.* 11(1): 1-54.
- Reeves, W. C. and A. Rudnick. 1951. A survey of the mosquitoes of Guam in two periods in 1948 and 1949 and its epidemiological implications. *Am. J. trop. Med.* 31: 633-658.
- Reinert, J. F. 1970. Contributions to the mosquito fauna of Southeast Asia.--V Genus Aedes, subgenus Diceromyia Theobald in Southeast Asia. *Contr. Amer. ent. Inst.* 5(4): 1-43.
- Robin, Y., M. Cornet, P. Bres, G. Hery, and R. Chateau. 1969. Isolement d'une souche de virus Middelburg a partir d'un lot d'Aedes (A.) cumminsi recoltés a Bandia (Senegal). *Bull. Soc. Pathol. exot.* 62(1): 112-118.
- Sasa, M. 1949. Zoophilism, hibernation and appearance of mosquitoes of Japan. *Jap. med. J.* 2(2): 99-107.

- Scanlon, J. E., and S. Esah. 1965. Distribution in altitude of mosquitoes in northern Thailand. *Mosquito News* 25(2): 137-144.
- Senior-White, R. 1923. Catalogue of Indian Insects Part 2--Culicidae. Superintendent Govt. Print. India, Calcutta. 124 p.
- Smithburn, K. C., and A. J. Haddow. 1946. Isolation of yellow fever virus from African mosquitoes. *Am. J. trop. Med.* 26: 261-271.
- Smithburn, K. C., A. J. Haddow, and J. D. Gillett. 1948. Rife Valley fever; isolation of the virus from wild mosquitoes. *Brit. J. exp. Path.* 29: 107-121.
- Smithburn, K. C., A. J. Haddow, and A. F. Mahaffy. 1946. A neurotropic virus isolated from Aedes mosquitoes caught in the Semliki Forest. *Am. J. trop. Med.* 26: 189-208.
- Standfast, H. A. 1967. Biting times of nine species of New Guinea Culicidae (Diptera). *J. med. Ent.* 4(2): 192-196.
- Steffan, W. A. 1966. A checklist and review of the mosquitoes of the Papuan subregion (Diptera: Culicidae). *J. med. Ent.* 3(2): 179-237.
- Stone, A. 1939. Two new Aedes from Guam (Diptera, Culicidae). *Proc. ent. Soc. Wash.* 41(5): 162-165.
- Stone, A. 1963. A synoptic catalog of the mosquitoes of the world, supplement II (Diptera: Culicidae). *Proc. ent. Soc. Wash.* 65(2): 117-140.
- Stone, A. 1970. A synoptic catalog of the mosquitoes of the world, supplement IV (Diptera: Culicidae). *Proc. ent. Soc. Wash.* 72(2): 137-171.
- Stone, A., and K. L. Knight. 1956. Type specimens of mosquitoes in the United States National Museum: II, The genus Aedes (Diptera, Culicidae). *J. Wash. Acad. Sci.* 46(7): 213-228.
- Stone, A., K. L. Knight, and H. Starcke. 1959. A synoptic catalog of the mosquitoes of the world (Diptera, Culicidae). *Thomas Say Found.* 6: 1-358.
- Su, S-C., and M-C. Ch'ii. 1956. A mosquito survey in Kai Feng and Chi Kung Shan of Hsin Yang, Honan Province. *Acta ent. Sinica* 6(2): 219-225.

- Taylor, F. H. 1934. A check list of the Culicidae of the Australian region. Australia Dep. Hlth. Svc. Publ. No. 1, 24 p.
- Tempelis, C. H., R. O. Hayes, A. D. Hess, and W. C. Reeves. 1970. Blood-feeding habits of four species of mosquito found in Hawaii. Am. J. Trop. Med. Hyg. 19(2): 335-341.
- Theobald, F. V. 1901a. A monograph of the Culicidae of the World. Br. Mus. (nat. Hist.), London. vol. 1, 424 p.
- Theobald, F. V. 1901b. A monograph of the Culicidae of the World. Br. Mus. (nat. Hist.), London, vol. 2, 391 p.
- Theobald, F. V. 1903a. A monograph of the Culicidae of the World. Br. Mus. (nat. Hist.), London. vol. 3, 359 p.
- Theobald, F. V. 1903b. Report on a collection on mosquitoes or Culicidae, etc., from Gambia, and descriptions of new species. Mem. Lpool. Sch. trop. Med. 10(App.): i-xi.
- Theobald, F. V. 1905a. New Culicidae from India, Africa, British Guiana, and Australia. J. econ. Biol. 1(1): 17-36.
- Theobald, F. V. 1905b. A catalogue of the Culicidae in the Hungarian National Museum with descriptions of new genera and species. Ann. Mus. nat. Hung. 3: 61-119.
- Theobald, F. V. 1905c. Some new mosquitoes from Ceylon. J. Bombay nat. Hist. Soc. 16: 237-250.
- Theobald, F. V. 1905d. Genera Insectorum. Diptera, Fam. Culicidae. Fasc. 26, Belgium. 50 p.
- Theobald, F. V. 1907. A monograph of the Culicidae or mosquitoes. Br. Mus. (nat. Hist.), London. vol. 4, 639 p.
- Theobald, F. V. 1908. New mosquitoes from the Sudan and list and synoptic table of all the known Sudanese species. Wellcome Res. Lab Report 3: 249-267.
- Theobald, F. V. 1909. Descriptions of the new mosquitoes collected by Dr. Graham in Ashanti. Colonial Report Misc. No. 237, 31 p.

- Theobald, F. V. 1910a. Second report on the collection of Culicidae in the Indian Museum, Calcutta, with descriptions of new genera and species. Rec. Indian Mus. 4: 1-33.
- Theobald, F. V. 1910b. A monograph of the Culicidae or mosquitoes. Br. Mus. (nat. Hist.), London. vol. 5, 646 p.
- Theobald, F. V. 1913. Culicidae from New Caledonia and the Loyalty Islands. In F. Sarasin u. I. Roux, Nova Caledonia. A. Zool. Band 1(3): 161-164.
- Thurman, E. H. B. 1959. A contribution to a revision of the Culicidae of northern Thailand. Univ. Md. Agr. Exp. Sta. Bull. A-100, 182 p.
- Thurman, E. B. 1963. The mosquito fauna of Thailand (Diptera: Culicidae). Proc. IX Pacif. Sci. Cong. 9: 47-57.
- Thurman, D. C., Jr., and E. B. Thurman. 1955. Report of the initial operation of a mosquito light trap in northern Thailand. Mosquito News 15(4): 218-224.
- Worth, C. B., H. E. Paterson, and B. de Meillon. 1961. The incidence of arthropod borne viruses in a population of culicine mosquitoes in Tongaland, Union of South Africa. Am. J. trop. Med. Hyg. 10: 583-592.
- Yamada, S. 1921. Descriptions of ten new species of Aedes found in Japan, with notes on the relation between some of these mosquitoes and the larva of Filaria bancrofti Cobbold. Annot. zool. jap. 10(6): 45-81.
- Yamada, S-I. 1927. An experimental study on twenty-four species of Japanese mosquitoes regarding their suitability as intermediate hosts for Filaria bancrofti Cobbold. Sci. Rep., Govt. Inst. Infect. Dis., Tokyo Imperial Univ. 6: 559-622.
- Yamaguti, S., and W. J. La Casse. 1950. Mosquito fauna of Guam. H. Q. 8th Army. 101 p.
- Yen, C-H. 1938. Studies on Dirofilaria immitis Leidy with special reference to the susceptibility of some Minnesota species of mosquitoes to the infection. J. Parasit. 24: 189-205.
- Yoshimeki, M. 1955. Morphological studies on the tracheal system of two Culicini larvae, Culex pipiens L. var. pallens Coquillet [t] and Aedes vexans nipponii Theobald. Ecol. Rev., Japan 14: 81-89.

BIOGRAPHICAL SKETCH

John Francis Reinert was born March 21, 1940, in Fairmont, Oklahoma. In May, 1958, he graduated Valedictorian from Douglas High School, Douglas, Oklahoma.

Majoring in entomology, he received the Bachelor of Science degree in May, 1962, and was also commissioned a second lieutenant in the U. S. Army; and the Master of Science degree was earned in August, 1965, from Oklahoma State University, Stillwater, Oklahoma.

During the periods 1962-1964 and August, 1965-July, 1966, he served in the U. S. Army as a medical entomology instructor teaching officer and enlisted courses at Medical Field Service School, Fort Sam Houston, Texas; and as an Army Research Team member surveying for ectoparasites at Big Bend National Park, Texas, Brownsville, Texas, and Cerra Potosi, Mexico.

From July, 1966-July, 1967, he was commanding officer of an Army Entomological Survey Unit in Thailand.

He attended the Army Advanced Officer Training Course, Fort Sam Houston, Texas, from July, 1967-December, 1967.

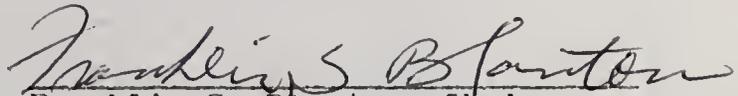
From January, 1968-August, 1968, he was assigned to Walter Reed Army Institute of Research, Washington, D. C., with duty assignment as a mosquito taxonomist to Southeast Asia Mosquito Project, U. S. National Museum.

From September, 1968, to the present, he has worked toward the Doctor of Philosophy degree. In May, 1969, he was promoted to the rank of major.

His wife is the former Mary Helen Harn, San Antonio, Texas, and they are parents of a daughter, Mary Melayne.

He has authored 11 published scientific papers on entomology. He holds membership in Alpha Zeta, Gamma Sigma Delta, Phi Sigma, Sigma Xi, the Florida, Kansas, Newell, and Washington Entomological Societies, and the National Geographic Society.

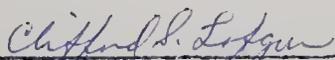
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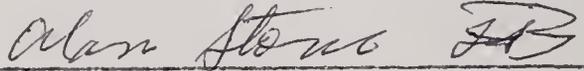
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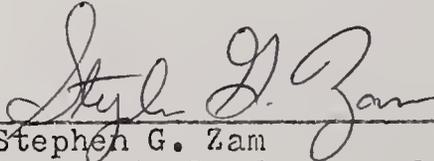

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This dissertation was submitted to the Dean of the College of Agriculture and to the Graduate Council, and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

August, 1971


Dean, College of Agriculture

Dean, Graduate School

