CONTRIBUTIONS TO THE MOSQUITO FAUNA OF SOUTHEAST ASIA. V. GENUS *AEDES*, SUBGENUS *DICEROMYIA* THEOBALD IN SOUTHEAST ASIA.[1]

By

John F. Reinert[2]

INTRODUCTION

The subgenus *Diceromyia* was originally described by Theobald (1911: 151) as a distinct genus based on a single African species. Several Oriental species of the present subgenus were initially included in *Aedes (Skusea)* Theobald by Edwards (1922: 272) but later (1929: 341) he placed them in *Dendroskusea*, as a separate subgenus of *Aedes*. Edwards (1932: 172) combined the existing 4 African and 5 Oriental species under the genus *Aedes* subgenus *Diceromyia* and separated the species into group A (African species) and group B (Oriental species). At the present time 8 species from the Ethiopian Zoogeographical Region (Appendix: Table 1) and 11 species from the Oriental Zoogeographical Region (Appendix: Table 2) are recognized as belonging to *Aedes (Diceromyia)*. For a discussion of the inclusion of *kanarensis* see Mattingly (1965:66).

The present paper deals with the 7 species from Southeast Asia of which one is described as new and the male of *platylepidus* Knight and Hull and the female of *whartoni* Mattingly are described for the first time. Keys to the adults, pupae and larvae of the Oriental species are given. For the detailed descriptions of the Oriental species not found in the Southeast Asia area see: Khokhar and Tariq (1966: 117) *periskelatus;* Reuben (1967: 234) *ramachandrai;* Barraud (1934: 275, 444) *micropterus* and *kanarensis*. Descriptions and a key to the adults of most of the African species are given by Edwards (1941: 214). He also gives the descriptions to 3 of the pupae. A key to pupae of the African species is given by De Meillon, Parent and Black (1945: 93). The larvae of 6 species from Africa are described and illustrated by Hopkins (1952: 116, 213) and included in a key to the *Aedes*. Other important papers dealing with African species of *Diceromyia* not mentioned above are: Doucet (1951: 69) *grassei;* Wolfs (1958: 298) *bananea;* and De Meillon (1943: 94) *zethus*.

Abbreviations used in the references to literature conform to the World List of Scientific Periodicals, 3rd ed., Academic Press, 1952. An asterisk following the abbreviations used (♀ = female, ♂ = male, P = pupa, L = larva) indicates that at least some portion of that sex or stage is figured. Distribution records are indicated as follows: countries are in capital letters,

---

[1]This work was supported by Research Contract No. DA-49-193-MD-2672 from the U.S. Army Medical Research and Development Command, Office of the Surgeon General and carried out at the Southeast Asia Mosquito Project, Washington, D.C.

[2]Major, MSC, U.S. Army, Department of Entomology, Walter Reed Army Institute of Research, Walter Reed Army Medical Center, Washington, D.C. 20012.

where known administrative divisions are in italics and place names have the first letter capitalized.

Specimens of the following species of *Aedes (Diceromyia)* have been examined by me: *adersi* (Edwards), *fascipalpis* (Edwards), *franciscoi* Mattingly, *furcifer* (Edwards), *iyengari* Edwards, *micropterus* (Giles), *periskelatus* (Giles), *platylepidus* Knight and Hull, *ramachandrai* Reuben, *reginae* Edwards, *scanloni* n. sp., *taylori* Edwards, *whartoni* Mattingly, and *zethus* De Meillon and Lavoipierre.

GENUS *AEDES* MEIGEN
SUBGENUS *DICEROMYIA* THEOBALD

Diceromyia Theobald 1911, Rep. Wellcome trop. Res. Lab. 4(B): 151. Type species: *Diceromyia africana* Theobald; Edwards 1917, Bull. ent. Res. 7: 214.

Aedes (Skusea) Edwards 1922, Indian J. med. Res. 10(1): 272 (partim); Barraud 1928, Indian J. med. Res. 16: 357 (partim).

Aedes (Dendroskusea) Edwards 1929, Bull. ent. Res. 20: 341. Type species: Culex *micropterus* Giles.

Aedes (Diceromyia) Edwards 1932, Genera Insectorum, Fasc. 194: 172; Barraud 1934, Fauna Brit. India, Diptera 5: 271; Edwards 1941, Mosq. Ethiopian Region 3: 214; Hopkins, 1952, Mosq. Ethiopian Region 1: 115; Mattingly 1959, Culic. Mosq. Indomalayan Area 4: 34.

FEMALE. *Head.* Torus with patch of fine short hairs, scales or both mesally; 1st flagellomere usually with a few small scales; palpus 0.2 - 0.3 length of proboscis; proboscis slender, from slightly longer to slightly shorter than fore femur; eyes usually contiguous; orbital and frontal bristles well developed; orbital line covered with pale scales; decumbent scales of vertex mainly, to all, broad, forming pale and dark patches, erect scales few to numerous (absent in *platylepidus*); erect scales always numerous on occiput. *Thorax.* Scales of scutum broad, narrow or both; scutellum with broad flat scales (except in *flavicollis* which has narrow scales, *furcifer* and *taylori*, which have broad scales on the lateral lobes and broad with a few narrow ones on the center lobe); anterior promontory, humeral and supraalar bristles always present, other bristles on scutum well developed to absent, scutellum with well developed bristles; postnotum bare; anterior pronotal lobes widely separated with well developed bristles and scales; pleuron with a patch of broad white scales on each of the following areas: subspiracular (except in *platylepidus*), propleural, sternopleural, and mesepimeral; all species,except *platylepidus*, have broad or narrow pale scales on the paratergite; bristles present on the following pleural areas: posterior pronotal, propleural, postspiracular, upper and lower sternopleural, prealar, and upper mesepimeral (lower present or absent); upper edge of meron above base of hind coxa. *Legs.* Fore and mid coxae with pale scale patches; femora scaling varied, fore and mid femora swollen in comparison to hind femur, tibial scaling varied; tarsi with tarsomeres dark, spotted or basally banded; fore and mid tarsal claws toothed (African species) or simple (Oriental species), hind tarsal claws simple. *Wing.* Usually dark and pale scaled, pale scales may be restricted to a basal patch on the costa (scales all dark on wings of *micropterus* and *reginae*); dorsal scales broad at least on costa, subcosta and usually a portion of the radius and cubitus; cells R_2 and M_2 longer than their stems; anal vein terminating well beyond fork of cubitus; alula with scales along margin and a

small apical patch in some species; squama with hair fringe; 1-3 remigial bristles present. *Halter.* With pale stem and dark scaled knob (some species with a few pale scales at base of knob). *Abdomen.* Terga scaling variable but with some pale scales, bands or patches present; tergum I with a rectangular patch of white scales on the lateral tergite; sterna pale scaled or with pale basal bands; segment VIII extended or retracted into segment VII, when segment VIII is extended the cerci are retracted within it and not dorsally visible. *Terminalia.* Cerci short and broad; spermatheca triple.

MALE. Similar to female in general habitus. *Head.* Antenna plumose with hairs directed mainly dorsally and ventrally; palpus with apical and subapical segments very short, slightly thickened, and usually turned somewhat downward; 3 distal segments with a few hairs; palpus slightly longer to slightly shorter than proboscis (0.6 length of proboscis in *platylepidus*). *Legs.* Fore and mid tarsal claws unequal with larger claw toothed, hind claws smaller, equal and simple. *Terminalia.* IXth tergum bilobed with several dorsal hairs on each lobe; basimere usually broad (may be moderately broad in some species) with several apical long bristles and numerous small bristles on dorsal and ventral sides (few smaller bristles in *fascipalpis*); distimere with spiniform attached subapically (except in *micropterus*); basal mesal lobe with fine short hairs or with moderately to well developed bristles, connected sternally by a narrow membranous strip to its mate; phallosome with aedeagus divided into two lateral plates each bearing several teeth (number of lateral teeth reduced in *flavicollis* and *grassei*); paraproct simple, with apex, lateral margin and base moderately sclerotized, cercal setae absent.

PUPA. The pupae of the Oriental species do not, at this time, present any clear-cut subgeneric characters. They do, however, have certain similarities. *Cephalothorax.* Hairs 6, 8, 9, 11-C single; trumpet short (moderately long in *whartoni*). *Abdomen.* Hair 9-I-VI is small and stout while 9-VII is stout and at least one-half the length of segment VII; 9-VIII is stout and longer than segment VII; hairs 2, 3-I-VII are single; most of the other abdominal hairs are usually forked or branched and extremely variable; paddles oval with hair 1-P well developed.

LARVA. *Head.* Hair 1-C long, slender and pointed; 3-C single; 4, 7-C multiple; 6-C with 1-3 branches; 6-C anterior to 5-C and on a more-or-less longitudinal line with it; 4-C anteromesal to 5-C and usually posteromesal to 6-C; antenna short (moderately long in *whartoni*), smooth or spiculate and hair 1-A single to 5-branched; mouthbrushes in some species with pectinate setae; mentum with 8-12 teeth on each side. *Thorax.* Meso- and metapleural tubercles with variously developed spines. *Abdomen.* Comb consisting of 4-25 scales arranged in 1 or 2 rows, scales usually with a fine lateral fringe; siphon short (moderately long in *whartoni*), hair 1-S single to 3-branched and attached beyond apical pecten tooth at about the middle of the siphon; pecten with 5-14 evenly spaced teeth, each with denticles on ventral margin to apex; hair 1-X single to 5-branched; 2-X with 2-7 branches; 3-X single; 8-11 hair tufts in ventral brush, with usually 1-3 tufts proximad of grid; saddle incomplete, usually covered with fine spicules; anal papillae with rounded apices and varying in length.

Oriental species also have the following additional characters in common. *Head.* 5-C long and single (sometimes double in *periskelatus*); 8-C single; 9-C single (single or double in *periskelatus*); 10-C usually double; 11-C with 5-18 branches; 12-C with 2-4 branches; basal maxillary hair stout and single (3-5 branched in *periskelatus*); antenna with hair 5-A rectangular and leaflike.

DISTRIBUTION.[1] Species of the subgenus *Diceromyia* are about evenly divided between the Ethiopian Zoogeographical Region (8 species) and the Oriental Zoogeographical Region (11 species). In the Ethiopian Region species have been collected from: BOTSWANA (Bechuanaland), DEMOCRATIC REPUBLIC OF THE CONGO (Belgian Congo), ETHIOPIA, GAMBIA, GHANA (Gold Coast), KENYA, MALAGASY REPUBLIC (Madagascar), MALAWI (Nyasaland), NIGERIA, PORTUGUESE GUINEA, RHODESIA (Southern Rhodesia), SENEGAL, SOUTH AFRICA, SUDAN, TANZANIA (Tanganyika), UGANDA, UPPER VOLTA, ZAMBIA (Northern Rhodesia) and from the Oriental Region: BURMA, CEYLON, INDIA (mainland and Nicobar Islands), INDONESIA, WEST MALAYSIA, PHILIPPINES, SINGAPORE, and THAILAND.

ZOOGEOGRAPHY. The geographical distribution of the subgenus *Diceromyia* is confined chiefly to the savanna and forest fringe areas of the Ethiopian and Oriental Zoogeographical Regions. Eight species are limited to the former area and 11 to the latter with no exchange of species between the two regions. The subgenus may have evolved in the Indian area and then dispersed to the Ethiopian Region when the climate and vegetation of the intervening area were more propitious. As the climate changed, the favorable environmental corridor ceased to exist and the populations of the two areas dispersed and evolved in their respective regions. Their present ranges correspond more or less with definite climatic and vegetation zones found in these regions.

A more detailed discussion on the zoogeography of the subgenus is in press.

TAXONOMIC DISCUSSION. The subgenus *Diceromyia*, although being quite varied in chaetotaxy and pilotaxy, possesses a combination of characters that allows it to be separated from the other subgenera of *Aedes*. The male exhibits the most distinctive features, these being: palpus with the two terminal segments very short; antenna with the plume hairs directed mainly dorsally and ventrally; the terminalia which have the aedeagus divided into two lateral plates each bearing several teeth and the absence of cercal setae on the paraproct (the characters of the terminalia fit into Section B, Subsection 3 of the classification system given by Belkin (1962: 326). A similar palpus is found in some *Stegomyia*, *Ochlerotatus* and *Finlaya* while the antenna is typical of *Aedimorphus*. The toothed aedeagus and the paraproct are similar to those of *Aedimorphus* and *Stegomyia*.

Other characters of the adults that are constant are the presence of pale scales on the paratergite and the vertex with two or three dark areas alternating with pale patches (except in *platylepidus* which has the paratergite bare and different markings on the vertex). These features are, however, found in many species of *Stegomyia* and *Aedimorphus*. A number of species of *Diceromyia* from both the African and Oriental regions have the wing scales very broad and the leg markings similar to species of *Mansonia*.

The females have the cerci short and broad and the spermatheca triple. Females of the Oriental species have the tarsal claws simple while those of the African species are toothed. Female specimens can usually be separated from those of the other subgenera of *Aedes* by a combination of the characters mentioned.

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

[1] Former name of country enclosed in parenthesis.

whartoni is distinctive and differs in having a moderately long trumpet, paddle with tiny spicules on the proximal 0.5 of the outer margin, and in the structure of hairs 3-C, 9-VIII and 1-P.

The larval characters listed for the subgenus are shared by members of *Stegomyia* and *Aedimorphus*. Larvae of *Diceromyia* can usually be separated from these two subgenera by the shape of the comb scales and pecten teeth or a combination of the other characters given for the subgenus.

BIOLOGY AND MEDICAL IMPORTANCE. Two species of African *Diceromyia* have been shown to be potential vectors of human pathogens. A number of other African and Oriental species are known to feed on man but have not been investigated for pathogen transmission. Lewis (1943: 73) lists *taylori* as an important potential vector of yellow fever virus in the Sudan and also considers *furcifer* as being suspected in this connection. He mentions that these two species were collected in large numbers at ground-level biting man and that they are probably very active fliers or long-lived. Mattingly (1949a, b) Haddow et al. (1951) and Van Someren et al. (1955), however, record these species feeding in or below the canopy. Haddow (1961: 324) states that the *furcifer-taylori* group is arboreal and crepuscular but that these mosquitoes will also bite freely at ground-level when forest or brush is scarce or absent and that they are very resistant to drought and heat. He also mentions that they rarely enter huts and tents even in areas where they are very prevalent outside. Haddow records the biting habits of another species, *adersi*, as nocturnal and arboreal. The interesting mating behavior of *taylori* is recorded by Hamon et al. (1955). These researchers observed males of this species mating with females while the latter were actually engorging.

During disease transmission experiments in Southern Rhodesia, Paterson and McIntosh (1964: 54), used wild caught females of the *furcifer-taylori* group and showed that they were efficient vectors of chikungunya virus between monkey and monkey and between monkey and mouse. They also reported the accidental transmission of chikungunya virus to two workers in the laboratory by members of the *furcifer-taylori* group.

The adults of *scanloni* n. sp. in Thailand were collected both in light traps and resting on the inside of houses. A number of investigators report species of Oriental *Diceromyia* feeding on man. Scanlon and Esah (1965: 143) record *iyengari* biting man in Thailand in the forest fringe and scrub areas. Specimens of *ramanchandrai* were collected during all seasons of the year in India either in vegetation or biting man according to Reuben (1967: 236). Mattingly (1959: 43) states the holotype female of *franciscoi* was collected in a trap using human bait.

Hopkins (1952) summarizes the breeding habitats of African species as primarily tree holes but specimens were also collected in rot holes, axil of a banana leaf, water pot and an iron tank. *A. furcifer* and *taylori* were recorded breeding in rock pools by Lewis (1943: 69), while Van Someren et al. (1955: 482) collected *taylori* larvae from pineapple tops and steps cut into coconut palm trees and *adersi* larvae were taken from bamboo pots, coconut shells and domestic utensils. The Oriental species are primarily bamboo and tree hole breeders as reported by Barraud (1934). Knight and Hull (1951: 201) also collected larvae of *platylepidus* from a fallen coconut spathe and a log depression.

The eggs of *Diceromyia* are drought-resistant. This adaptation enables the subgenus to survive during dry periods. In Africa eggs of *furcifer* that had been laid in bamboo pots more than 14 months earlier were flooded and hatched, demonstrating that the eggs of this species are very resistant to desiccation (Muspratt, 1955: 174). Mattingly (1959: 2, 43) reports that in

Malaya eggs of *franciscoi* were laid in bamboo pots hung at about 30 feet from the ground in a mango tree.

LIST OF SPECIES IN SOUTHEAST ASIA

1. *Aedes (Diceromyia) franciscoi* Mattingly
2. *Aedes (Diceromyia) iyengari* Edwards
3. *Aedes (Diceromyia) platylepidus* Knight and Hull
4. *Aedes (Diceromyia) punctipes* Edwards
5. *Aedes (Diceromyia) reginae* Edwards
6. *Aedes (Diceromyia) scanloni* n. sp.
7. *Aedes (Diceromyia) whartoni* Mattingly

KEYS TO THE ORIENTAL SPECIES[1] MALES AND FEMALES

1.	Prescutellar bristles absent	2
	Prescutellar bristles present	5
2(1).	Anterior mesonotum covered with broad scales	3
	Anterior mesonotum covered with narrow scales	4
3(2).	Paratergite and posterior pronotum bare	*platylepidus* (p.12)
	Paratergite and posterior pronotum with broad scales	*franciscoi* (p. 8)
4(2).	First hind tarsomere with a basal white band, rest of hind tarsomeres dark	*kanarensis*
	Hind tarsomeres 1, 2, 3 and 4 with basal white bands	*whartoni* (p.19)
5(1).	Scales on wing all dark	6
	Some scales on wing pale	7
6(5).	Pleural integument dark brown; apices of all femora with lateral white spots; lateral surface of head dark scaled	*micropterus*
	Pleural integument pale yellow; apices of all femora dark scaled; lateral surface of head pale scaled	*reginae* (p.15)
7(5).	Tarsi, palpus and proboscis each without a dorsal line of white scales	8
	Tarsi, palpus and proboscis each with a dorsal line of white scales	*ramachandrai*
8(7).	Wing with pale scales on bases of costa and at least on one other vein	9
	Wing with pale scales only on base of costa	*iyengari* (p.10)

[1] The keys include Oriental species which may yet be found to occur in Southeast Asia.

9(8). Wing with pale scales on base of cubitus 10
Wing with pale scales on basal third of subcosta, scales on cubitus dark . . . . . *periskelatus*

10(9). Wing with pale scales on base of radius; palpus with apical pale band . . . . . *scanloni* n. sp. (p. 17)
Wing with dark scales on radius; palpus dark . . *punctipes* (p. 14)

PUPAE

1. Paddle hair 1-P single 1
Paddle hair 1-P with 2-5 branches . . . . . *whartoni* (p. 20)

2(1). Paddle edge with fine hairs; hair 1-II double 3
Paddle edge with spicules; hair 1-II single . . . . . *micropterus, reginae* (p. 16)

3(2). Hair 5-VI, equal to or longer than length of segment VII; 9-VIII single or double 4
Hair 5-VI shorter than length of segment VII; 9-VIII with three branches . . . . . *franciscoi* (p. 9)

4(3). Hair 1-V single or double; 9-VII one-half length of segment VII . . . . . *iyengari* (p. 11)
Hair 1-V with 3-6 branches; 9-VII three-fourths length of segment VII . . . . . *periskelatus*

LARVAE

1. Antenna with spicules on basal one-half, hair 1-A double 2
Antenna without spicules, hair 1-A single 3

2(1). Basal maxillary hair single; saddle hair 1-X single . . . . . *whartoni* (p. 20)
Basal maxillary hair with 3-5 branches; saddle hair 1-X with 3-4 branches . . . . . *periskelatus*

3(1). Siphon hair 1-S single; saddle hair 1-X single or double 4
Siphon hair 1-S with 2-3 branches; saddle hair 1-X with 3-5 branches . . . . *micropterus, reginae* (p. 16)

4(3). Comb composed of 5-10 scales arranged in one row . . . . . *iyengari* (p. 12)
Comb composed of 15-25 scales arranged in two rows . . . . . *franciscoi* (p. 9)

Immatures of *kanarensis, punctipes, ramachandrai* and *scanloni* n. sp. are unknown. The larva of *platylepidus* is not known with certainty.

DESCRIPTIONS OF THE SPECIES OCCURRING IN SOUTHEAST ASIA

AEDES (DICEROMYIA) FRANCISCOI MATTINGLY

Figs. 1, ♂♀; 7, ♂ terminalia; 10, 11, pupa; 14, larva.

Aedes (Diceromyia) franciscoi Mattingly 1959, Culic. Mosq. Indomalayan Area 4: 42 (♂, ♀*, L, P); Mattingly 1961, Culic. Mosq. Indomalayan Area 5: 59 (♂*, P, L).

FEMALE. *Head.* Antenna dark brown, longer than the proboscis, torus with a patch of pale scales and short fine hairs mesally, flagellomere 1 with a few small pale scales and equal in length to flagellomere 2; clypeus dark, bare; palpus dark with apex pale, 0.25 length of proboscis; proboscis dark with a few pale scales ventrally at about middle, slightly longer than fore femur; vertex with alternating dark and pale broad decumbent scale patches, two patches of pale scales separated by a central dark area, another pale patch on each side with dark scales below, a few dark erect scales posterior to orbital line and numerous short ones on occiput. *Thorax.* Anterior mesonotum covered with loosely attached broad brown scales with a few paler ones intermixed, broad white scales extending around anterior margin to about scutal angle; posterior mesonotum with overlapping longer dark brown scales on posterior portion extending laterally and anteriorly over supraalar bristles, same type of scales extending over and completely covering scutellum, a few broad white scales above paratergite; anterior promontory, humeral, supraalar and scutellar bristles well developed, others absent; pleural integument dark brown; anterior pronotal lobe covered with bristles and long broad white scales; upper posterior pronotum with broad brown scales, middle with broad white scales and 4 posterior bristles; propleuron with broad white loose fitting scales, and 5-6 bristles; prosternum bare; postcoxal membrane with broad white scales on upper 0.5; spiracular area bare; postspiracular area with 4 bristles; subspiracular and hypostigial areas with broad white scales; paratergite with broad white scales along margin; sternopleuron with upper and lower broad white scale patches and upper and posterior bristles; prealar area with an upper patch of bristles and broad white scales; mesepimeron with a patch of broad white scales over anterior, upper and posterior areas, a patch of upper and 2-4 middle bristles. *Legs.* Coxae with white scale patches, fore and mid coxae also with some dark scales; trochanters white scaled; femora with two more or less distinct subapical white bands anteriorly, other white scale patches present; fore and mid tibiae with 5 lateral white spots and a small apical white spot, hind tibia with subapical white band, a dorsoapical and 3 lateral white spots; fore and mid tarsi with tarsomere 1 having a narrow basal white band, a small dorsal white spot at about the middle and one at apex, tarsomeres 2-5 with small dorsobasal pale spots (spots indistinct on 4 and 5 in some specimens); hind tarsomere 1 with a dorsoapical pale spot, 3 white bands (one at base, one at about 0.3 of the length and one at about 0.6 of the length), tarsomeres 2 and 3 each with a narrow white basal band, a dorsoapical spot and a tiny dorsal white spot at about the middle, tarsomeres 4 and 5 each with a dorsobasal pale spot. *Wing.* Dorsal veins covered with broad brown scales and with a patch of white scales on anterior margin of costa from the base to the humeral crossvein and a few at base of the remigium; broad brown scales along posterior margin of wing above fringe scales; alula with broad brown scales on fringe and a small dorsoapical patch; 1-2 remigial bristles. *Halter.* With stem pale and knob brown scaled, a few pale scales ventrally. *Abdomen.* Terga with brown and pale markings, tergum I with a large pale scale patch covering most of dorsal surface; terga II-VI each

with a pair of dorsolateral semicircular pale bands with dorsal ends touching in middle on terga II-IV (bands more distinct on anterior terga), terga II-VI each with a narrow dorsoapical fringe of broad yellow scales (yellow scales more numerous on posterior terga), tergum VII with a few scattered pale scales; posterior margins of terga and sterna fringed with golden hairs (hairs more numerous on sterna); segment VIII completely retracted into segment VII.

MALE. Similar to female in general habitus. *Head.* Palpus with basal pale band on terminal segment, a few pale scales at about the middle of segments 1-3; palpus approximately equal to proboscis; proboscis with a narrow pale band at about the middle. *Wing.* Pale scaling on wing somewhat reduced. *Abdomen.* Tergal scale patterns more distinct than on female; tergum VIII with dorsobasal white scale patch. *Terminalia.* Tergum IX bilobed with 13-15 bristles on each lobe, the outer 7-8 bristles longer; basimere short and broad with a patch of moderately long flattened bristles on the tergomesal margin extending from below the apex to the base, a small flattened lobe with fine hairs extending above these bristles to apex, numerous long bristles on dorsal surface and shorter ones on ventral surface, scales numerous on lateral margin and extending onto dorsal and ventral surfaces; distimere shorter than basimere by about length of the spiniform, thickened and tapering to a blunt apex, spiniform dark, attached subapically and extending slightly beyond tip of distimere; basal mesal lobe with 15-18 moderately long flattened bristles, basal connecting fold covered with short hairlike spicules; phallosome with aedeagus divided into two lateral plates each with 7-9 teeth; sternum IX with 4-5 bristles along posterior margin.

PUPA. *Cephalothorax.* Hairs 1-3, 10, 12-C single; 4, 5, 7-C single or double. *Abdomen.* Hair 1-II-III forked or double; 3-III single, shorter than the length of segment III; 1-V double or forked; 5-VI single, shorter than the length of segment VII; 9-VII one-half to two-thirds length of segment VII; 9-VIII with 3 branches, from slightly shorter to slightly longer than the length of segment VII. *Paddle.* With hairlike spicules along most of the outer (distal 0.75) and inner (distal 0.5) margins; paddle hair 1-P single.

LARVA. *Head.* Hair 4-C with 14-25 branches; 6-C double; 7-C with 6-10 branches; 10-C single with 8-13 branches; 12-C with 2-4 branches; antenna short, without spicules and with hair 1-A single and attached at about 0.62 distance from base. *Thorax.* Hair 9-M stellate with 6-7 branches; hair 4-T with 2-3 branches and hair 5-T single or double. *Abdomen.* Hair 2-I-VIII single; hair 1-VIII with 2-3 branches; comb consisting of 15-25 scales in two irregular rows, most of the scales in anterior row smaller, scales with a fine fringe along margins and the bluntly pointed apex; siphon index approximately 2.0-2.2; hair 1-S single and reaching apex of siphon (minus valves); pecten with 9-16 teeth, with denticles along ventral and apical margins; hair 1-X single or double and about 1.0-1.5 length of saddle; hair 2-X with 4-6 branches; 10 hair tufts in ventral brush, 2-3 tufts proximad of grid; saddle covered with short rows of fine spicules on lateral surface; anal papillae blunt, slightly shorter than siphon.

TYPE DATA. Holotype female, Kampong Sireh, *Selangor*, WESTERN MALAYSIA, 9 Oct. 1952, J. A. Reid; and paratype female, P. Blakang Mati, SINGAPORE, 22 April 1955, D. H. Colless, in the British Museum.

DISTRIBUTION. Specimens examined: WESTERN MALAYSIA, *Selangor*, Rantau Panjang 4 males and 3 females with associated larval and pupal skins and 1 male. *Other Distribution.* As in type data.

TAXONOMIC DISCUSSION. *A. franciscoi* is easily recognized by the presence of broad scales completely covering the mesonotum, absence of prescutellar bristles, presence of broad white scales on the postcoxal membrane,

and the subapical pale bands on the anterior surface of the femora. The most marked difference in the male terminalia is the presence of 15-18 moderately long flattened bristles on the basal mesal lobe.

The larvae resemble *iyengari* in general appearance but can easily be separated by the presence of 15-25 comb scales arranged in two rows and head hair 10-C being single. In *iyengari* there are 5-10 comb scales in a single row and head hair 10-C is double.

BIOLOGY. Mattingly (1959: 2, 43) states that Dr. E. E. McClure, U.S. Army Medical Research Unit, obtained eggs that were laid in a bamboo pot hung in a mango tree about 30 feet from the ground at Rantau Panjang. Mattingly believes that this species feeds and breeds almost exclusively at this height. The holotype female was collected in a trap with human bait. The allotype, two other males and three females were also reared from eggs laid in bamboo pots at the afore-mentioned height and location (Mattingly 1961: 59) on various dates in January 1959.

AEDES (DICEROMYIA) IYENGARI EDWARDS

Figs. 2, ♂♀; 9, ♂ terminalia; 10, 11, pupa; 13, larva.

Aedes (Skusea) iyengari Edwards 1923, Bull. ent. Res. 14: 4 (♀); Brug 1932, Bull. ent. Res. 23: 78 (L*, P*).

Aedes (Skusea) punctissimus Barraud 1928, Indian J. med. Res. 16: 360 (♂*, ♀).

Aedes (Dendroskusea) iyengari Edwards 1929, Bull. ent. Res. 20: 341.

Aedes (Diceromyia) iyengari Edwards 1932, Genera Insectorum, Fasc. 194: 173; Barraud 1934, Fauna Brit. India, Diptera 5: 273 (♂*, ♀, L); Mattingly 1957, Culic. Mosq. Indomalayan Area 2: 13 (P*); Mattingly 1959, Culic. Mosq. Indomalayan Area 4: 38 (♂*, ♀*, P*, L*); Mattingly 1961, Culic. Mosq. Indomalayan Area 5: 58 (♂*).

FEMALE. *Head.* Antenna dark brown, longer than the proboscis, torus with a patch of dark scales and short fine hairs mesally, flagellomere 1 with a few dark scales, 1.3 length of flagellomere 2, and with basal 0.5 swollen; clypeus dark, bare; palpus dark with a few pale scales at apex, 0.25-0.3 length of proboscis; proboscis dark with a faint subapical pale spot, about 1.2 length of fore femur; vertex with alternating dark and pale broad decumbent scale patches, two patches of pale scales separated by a central dark area, another pale patch on each side with dark scales below, a few long narrow erect scales posterior to orbital line and numerous short ones on occiput (the erect scales on occiput vary from dark to pale). *Thorax.* Anterior mesonotum covered with narrow curved brown scales with a few pale scales intermixed, narrow white scales on anterior margin, a small pale spot of narrow scales above anterior end and another above posterior end of paratergite; posterior mesonotum with overlapping long, brown, broad scales along posterior portion and extending over and completely covering scutellum, a patch of similar scales on supraalar areas; anterior promontory, humeral, 2-4 anterior dorsocentral, supraalar and scutellar bristles well developed, 3-4 poorly developed prescutellar bristles present, others absent; pleural integument dark brown; anterior pronotal lobe covered with white scales, narrow curved scales above and broad ones below, and several long bristles; upper posterior pronotum with narrow curved brown scales and a few white ones posteriorly, middle with a patch of broad white scales, 3-4 posterior bristles; propleuron with broad white scales and 4-5 bristles; prosternum bare; upper postcoxal membrane with a few pale scales; spiracular area bare; postspiracular area

with 4-6 bristles; subspiracular and hypostigial areas with broad white scales; paratergite with narrow curved white scales along margin; sternopleuron with upper and lower broad white scale patches and upper and posterior bristles; prealar area with an upper patch of bristles and broad white scales; mesepimeron with an upper patch of broad white scales over anterior, upper and posterior areas, a patch of upper and 2-3 middle bristles. *Legs.* Coxae with white scale patches, fore and mid coxae also with dark scales; trochanters white scaled; anterior surface of femora with apex white, subapical white band and various other white scale patterns (see figures); fore tibia with apical pale band, dorsobasal pale spot and 5-6 dorsolateral pale spots over rest of surface, mid tibia with apical pale band and 5 dorsolateral pale spots, hind tibia with apical lateral pale scales, dorsobasal pale spot and 5-6 dorsolateral pale spots; fore tarsus with tarsomere 1 having pale scales at apex and base and a pale band at about middle, tersomeres 2 and 3 with a few dorsobasal pale scales, mid tarsus with tarsomere 1 having basal and middle pale bands and a dorsoapical pale spot, tarsomere 2 with some dorsal pale scales at base, middle and apex, tarsomere 3 with a few dorsobasal pale scales, hind tarsus with tarsomere 1 having a basal and 2 middle pale bands and a few apical pale scales, tarsomere 2 with a few pale dorsal scales at base, middle and apex, tarsomere 3 with a few dorsobasal scales. *Wing.* Dorsal veins covered with broad brown scales with a patch of white scales at the base of the costa; broad brown scales along posterior margin of wing above fringe scales; alula with narrow brown scales on fringe; 1-2 remigial bristles. *Halter.* With pale stem and knob brown scaled with a few pale scales ventrally. *Abdomen.* Terga with brown and pale markings, tergum I with a dorsobasal pale spot and a dorsoapical pale fringe, terga II-IV each with lateral pale bands curving onto dorsum and meeting at base in middle, also with 2 admedian pale spots near apical margin (on some specimens the bands and admedian pale spots are indistinct on terga II-IV), terga V-VII each with lateral pale spots and 2 admedian pale spots near apical margin; posterior margins of terga and sterna fringed with golden hairs (hairs more numerous on sterna); segment VIII completely retracted into segment VII.

MALE. Similar to female in general habitus. *Head.* Palpus with basal bands on terminal 2 segments and a median band on segment 3; palpus slightly longer than the proboscis; proboscis with an indistinct pale narrow band just past the middle. *Terminalia.* Tergum IX bilobed with 15-18 approximately equal bristles on each lobe and covered with fine spicules; basimere short and broad with a patch of moderately long flattened bristles on tergomesal margin near apex, bristles, with only basal portion flattened, in 2-3 irregular rows extending along tergomesal margin from patch to near base, long bristles extending along dorsolateral margin from base to apex, a patch of short bristles on dorsal surface below attachment of distimere, ventral surface covered with scattered short bristles and fine spicules, sternomesal margin with 2-3 long flattened bristles near base, numerous long scales on lateral and ventral surfaces with a few on dorsobasal area; distimere short, thickened in the center and tapering to a long blunt point, dark spiniform long and flattened (over 0.5 length of distimere), attached subapically and extending beyond apex; basal mesal lobe with 5-6 short bristles on a small apical lobe, rest of surface and fold connecting it to its mate covered with fine hairlike spicules; phallosome with aedeagus divided into two lateral plates each with 8-11 teeth; sternum IX with 4 bristles at the center.

PUPA. *Cephalothorax.* Hairs 1-3, 7-C single; 4, 5, 10, 12-C single, forked or 2-3 branched. *Abdomen.* Hair 1-II-III double; 3-III single and as long as segment III; 1-V single or double; 5-VI single and equal to or longer than segment VII; 9-VII single and from 0.5 to equal the length of segment VII;

9-VIII double, occasionally single. *Paddle.* With hairlike spicules along outer (distal) 0.75 and inner (distal) 0.5 margins; paddle hair 1-P single.

LARVA. *Head.* Hair 4-C with 14-21 branches; 6-C double; 7-C with 6-15 branches; 10-C double; 11-C with 10-14 branches; 12-C with 2-4 branches; antenna short, without spicules and with hair 1-A single and attached at about 0.66 distance from base. *Thorax.* Hair 9-M stellate with 5-7 branches; 4, 6-T single. *Abdomen.* Hair 2-I-VIII single; hair 1-VIII with 2-4 branches; comb consisting of 5-10 scales in a single row, scales with a fine fringe from base to the bluntly pointed apex; siphon index approximately 2.2-2.4; hair 1-S single and reaching apex of siphon (minus valves); pecten with 6-14 teeth, each with denticles along ventral and apical margins; hair 1-X single and twice as long as the saddle; hair 2-X with 4-6 branches; 9-10 hair tufts in ventral brush, 2-3 tufts proximad of grid; anal papillae blunt and slightly longer than the siphon.

TYPE DATA. *A. iyengari* Edwards holotype female, No. 1686, Meenglas, *Jalpaiguri*, INDIA, 6 Aug. 1921, M. O. T. Iyengar in British Museum; paratype female same data, in Iyengar Collection; *A. punctissimus* Barraud cotypes male and female; Karwar, INDIA, Sept. 1921, P. J. Barraud, said to be in the Malaria Institute of India (Barraud 1928: 361).

DISTRIBUTION. Specimens examined: THAILAND, *Chiang Mai,* Doi Sutep 10 whole larvae, Oct. 1955, Thurman. INDIA, *Assam,* Dibrugarh 3 whole larvae , 8 July 1943, D. E. Hary. INDONESIA, *Java* 3 males, 6 females, 1 male and 1 female with associated pupal and larval skins, and 3 pupal and larval skins. INDIA 1 male and 2 females. *Other Distribution.* INDIA, Calcutta, Matiabruz, Garden Reach (Barraud 1934: 275); Kidderpore (Mattingly 1959: 39). INDONESIA, Djakarta (Wijono 1962); Sumba (Bonne-Wepster 1954: 93); Bandoeng, *Purmerend Island* (Mattingly 1959: 39). BURMA, Rangoon (Barraud 1934: 275). THAILAND, *Chiang Mai,* Doi Pui Mt. (Scanlon and Esah 1965: 143).

TAXONOMIC DISCUSSION. The adult habitus of *iyengari* is very similar to that of *scanloni* and is discussed under that species. The male terminalia has similarities to that of *franciscoi.* The major differences from *franciscoi* are: basimere with 2-3 long bristles near base of the sternomesal margin; distimere shorter and apical 0.5 more tapering, spiniform longer and flatter; and basal mesal lobe with 5-6 short bristles attached to a small apical lobe. The larva resembles *franciscoi* but can be easily separated by the presence of only 5-10 comb scales arranged in a single row while *franciscoi* has 15-25 comb scales in two rows.

BIOLOGY. Brug (1932: 79) collected larvae in bamboo stumps from Java at about sea level. Bonne-Wepster (1954: 93) records the larvae breeding in bamboo stumps and tree holes. Scanlon and Esah (1965: 143) report *iyengari* biting man at an altitude of 1,000 feet in the forest fringe or in scrub areas near Doi Pui, *Chiang Mai,* Thailand.

AEDES (DICEROMYIA) PLATYLEPIDUS KNIGHT AND HULL

Figs. 3, ♂♀; 10, ♂ terminalia.

Aedes (?) platylepidus Knight and Hull 1951, Pacif. Sci. 5: 201 (♀); Knight and Hull 1953, Pacif. Sci. 7: 480 (?L).

Aedes (Diceromyia) platylepidus, Mattingly 1959, Culic. Mosq. Indomalayan Area 4:43 (♀, ?L).

FEMALE. *Head.* Antenna brown, slightly shorter than the proboscis, torus with a large patch of broad silvery scales mesally, flagellomere 1 pale,

with a few dark scales and slightly longer than flagellomere 2; clypeus dark, bare; palpus dark with apical portion swollen, about 0.2 length of proboscis; proboscis dark, approximately equal to fore femur; vertex with broad overlapping blackish-brown scales and an anteromedian patch of broad silvery scales, a patch of pale translucent scales at extreme lower lateral margin, numerous short black erect scales confined to occiput. *Thorax.* Anterior and posterior mesonotum covered with overlapping broad blackish-brown scales and extending over and completely covering scutellum (mesonotal scales possess a metallic luster); anterior promontory, humeral, supraalar and scutellar bristles well developed, others absent; pleural integument dark brown; anterior pronotal lobe covered with bristles and broad brown scales; posterior pronotum with 3 posterior bristles; propleuron covered with a patch of broad silvery scales and 1 bristle; prosternum covered with broad silvery scales; paratergite, spiracular, subspiracular and hypostigial areas bare; postspiracular area with 2-3 small bristles; a large patch of overlapping broad silvery scales covering upper and lower sternopleural and anterior, lower, upper and posterior mesepimeral areas, 1 small golden posterior bristle on sternopleuron and a few golden upper bristles on mesepimeron. *Legs.* Coxae with pale silvery scales, mid coxa also with some brown scales; trochanters with pale and a few dark scales; fore and mid femora dark with a few pale scales at apex, hind femur with basal 0.6 and apex pale scaled; tibiae dark; fore tarsus dark, mid and hind tarsomere 1 with a pale dorsobasal spot, hind tarsomere 3 with a pale spot along most of dorsal surface (a few dark scales on dorsal surface at base and apex). *Wing.* Dorsal veins mostly covered with broad brown scales, narrow scales on R_s, R_2, R_3 and median veins; small brown scales along posterior margin of wing above fringe scales ; alula with narrow brown scales along fringe; 1 remigial bristle. *Halter.* With pale stem and knob brown scaled. *Abdomen.* Terga with brown and pale markings, terga II-VI with basolateral pale translucent bands extending a short distance onto dorsum, tergum VII with a dorsobasal pale translucent band; terga with a few hairs along posterior margins and sterna fringed with numerous hairs; segment VIII completely retracted into segment VII.

MALE. Similar to female in general habitus. *Head.* Antenna about 0.6 length of proboscis; palpus dark, 0.6 length of proboscis; proboscis downcurved at about middle, with a few pale translucent scales ventrally on apical 0.25, longer than fore femur. *Legs.* Femora without pale scales at apex; tarsi dark except for a pale anterobasal spot on hind tarsomere 1. *Terminalia.* Tergum IX with lateral lobes covered with fine hairlike spicules, each lobe with 2 long scales and 5-6 bristles mesally; basimere with a large patch of flattened bristles along tergomesal margin, those on basal portion longer, dorsal surface with a number of short scattered bristles and a number of long ones along lateral margin and apex, sternomesal margin covered with a long patch of flattened bristles, ventral and lateral surfaces covered with scales; distimere with basal 0.5 thickened and apical 0.5 narrow and curved with apex blunt, spiniform about 0.5 length of apical narrow portion of distimere, dark, thick, long, curved and attached at about middle of distimere, basal mesal lobe covered with fine hairlike spicules; phallosome with aedeagus long and divided into 2 lateral plates each with 8-10 teeth, basal piece large; proctiger long; sternum IX covered with tiny spicules.

PUPA. Unknown.

LARVA. Not certainly known. Knight and Hull (1953: 480) provisionally attributed 3 whole larvae, 2 from Irahuan River (3 miles inland), *Palawan* and 1 from Cape Melville, *Balabac* to this species or *Heizmannia scintillans* Ludlow. Mattingly (1957: 32) states the the larvae do not fit *Heizmannia* very well.

The larvae have head hairs 4 single, 7 single or double and siphon hair 1 inserted before, near or beyond apical pecten tooth which does not compare favorably with the other species of *Aedes (Diceromyia)* from Southeast Asia which have head hairs 4 and 7 multiple and stellate and siphon hair 1 always beyond apical pecten tooth.

The larvae were collected from a large metal packing container in the jungle and from a large, thorny palm frond lying on the ground at the edge of a mangrove area which is more like some species of *Stegomyia* than the bamboo and tree hole breeding *Diceromyia*.

TYPE DATA. Holotype female, No. 810.8, Puerto Princesa, *Palawan*, PHILIPPINES, 24 May, 1945, J. L. Laffoon and Dr. D. R. Johnson; paratype female (fragment), No. 1620.1, Cape Melville, *Balabac*, 23 June 1945, J. L. Laffoon; and paratype female (terminalia on slide), No. 1608.2, Cape Melville, *Balabac;* PHILIPPINES, 23 June 1945, D. R. Johnson, in U.S. National Museum. Paratype female, No. 1608.2, in K. L. Knight collection.

DISTRIBUTION. Specimens examined: PHILIPPINES, *Palawan*, holotype female, *Balabac*, 3 female paratypes, *Basilon*, *Isabella* 1 male and 1 female.

TAXONOMIC DISCUSSION. *A. platylepidus* possesses a number of characters that differ from most *Diceromyia* in the Oriental region. The most marked differences are: the scale pattern of the vertex, absence of scales on the hypostigial, subspiracular, posterior pronotal, and paratergite areas; presence of scales on the prosternum, and reduction of sternopleural bristles.

The primary differences in the male terminalia are: tergum IX with two lateral lobes, each bearing 2 long scales and 5-6 bristles mesally; presence of flattened bristles along the sternomesal margin on basimere; large basal piece of phallosome; and a long proctiger. The male palpus also is shorter than in other species.

Even with these differences there exists a number of major characters that fit the definition of the subgenus and they are: simple tarsal claws of the female, male antenna with hairs directed mainly dorsally and ventrally, male palpus with apical 2 segments very short, and structure of the male terminalia.

Unfortunately, the larval and pupal skins from the adults mentioned in the distribution could not be found.

BIOLOGY. The holotype was collected as a larva from a small tree hole along the coast, the paratypes were also collected as larvae, one in a fallen coconut spathe and the other from a depression in a log in a mangrove area. One male and 1 female were collected (by K. L. Knight, 27 September, 1945) as larvae from bamboo stakes.

AEDES (DICEROMYIA) PUNCTIPES EDWARDS

Aedes (Skusea) punctipes Edwards 1921, Bull. ent. Res. 12: 77 (♀).
Aedes (Diceromyia) punctipes Edwards 1932, Genera Insectorum, Fasc. 194: 174; Barraud 1934, Fauna Brit. India, Diptera 5: 273 (♀).

FEMALE. *Head.* Antenna missing; palpus dark, slightly longer than 0.25 length of proboscis which is dark and equal in length to fore femur; vertex with alternating dark and pale broad decumbent scale patches, two patches of pale scales separated by a central dark area, another pale patch on each side with dark scales below. *Thorax.* Anterior mesonotum covered with narrow curved bronzy-brown scales, narrow white scales on anterior margin;

posterior mesonotum with blackish-brown broad scales along posterior and extending over and completely covering scutellum, a patch of similar scales on supraalar areas; mesonotal bristles mostly denuded, probably rather long and dense; anterior pronotal lobe and posterior pronotum with broad white scales; some other pleural areas with flat white scales. *Legs.* Femora brown scaled each with a preapical pale band, white at apex, and pale on ventral surface, fore and mid femora with white markings basal to preapical band; tibiae with apices pale scaled, fore tibia with 3 pale anterior spots, mid and hind tibiae each with 4 pale anterior spots; tarsomere 1 of fore tarsus with a basal pale band and a dorsoapical pale spot, tarsomere 2 with a dorsobasal pale spot; tarsomere 1 of mid tarsus with a basal pale band and dorsal pale spots at middle and apex, tarsomere 2 with a dorsobasal pale spot; hind tarsomere 1 with pale bands at base and middle and a dorsoapical pale spot, tarsomere 2 with dorsobasal and dorsoapical pale spots. *Wing.* Dorsal veins covered with broad brown scales but a few longer and narrower scales toward tips of the veins and along lower margin of cubitus$_1$, a patch of pale scales at base of costa and cubitus. *Abdomen.* Terga with brown and pale markings, tergum I with a large pale patch in middle, terga II-VII each with a lateral pale spot, which is not quite basal and extends a short way onto dorsum; sterna mostly pale with posterior sterna dark scaled apically; segment VIII completely retracted into segment VII.

MALE, PUPA and LARVA. Unknown.

TYPE DATA. Holotype female, Maymyo, *Mandalay,* BURMA, 11 Dec. 1913, Major Bennett, in the Indian Museum.

DISTRIBUTION. Known only from the type locality.

TAXONOMIC DISCUSSION. No material was available for examination. The above is based on the original description given by Edwards (1921: 77) and one by Barraud (1934: 273) who had also examined the type specimen.

The description of *punctipes* is similar to those of *iyengari* and *scanloni* but there are definite differences which are discussed under the taxonomic discussion of *scanloni.*

BIOLOGY. Not known but Edwards (1921: 77) speculates that it is probably a tree hole breeder.

AEDES (DICEROMYIA) REGINAE EDWARDS

Figs. 4, ♂♀; 8, ♂ terminalia, larva; 10, 12, pupa.

Aedes (Skusea) reginae Edwards 1922, Indian J. med. Res. 10: 272 (♂).
Aedes (Diceromyia) reginae Edwards 1932, Genera Insectorum, Fasc. 194: 174; Barraud 1934, Fauna Brit. India, Diptera 5: 277 (♂, ♀, L).

FEMALE. *Head.* Antenna brown, longer than the proboscis, torus with a patch of dusky scales and short fine hairs mesally, flagellomere 1 with a few dusky scales, 1.3 length of flagellomere 2, and with basal 0.5 pale; clypeus bare; palpus dark scaled, slightly over 0.25 length of proboscis; proboscis dark scaled, about 1.1 length of fore femur; vertex with alternating dark and pale broad decumbent scale patches, two patches of pale scales separated by a central dark area, another dark patch on each side with pale scales below, a number of long brown erect scales posterior to orbital line (a few scattered over rest of vertex) and numerous ones on occiput. *Thorax.* Anterior mesonotum covered with narrow curved golden-brown scales and with narrow white scales on anterior margin; posterior mesonotum with similar scales; scales by posterior dorsocentral, prescutellar and supraalar bristles somewhat longer and broader but still narrow, a small spot of narrow curved

white scales on ante-alar areas; anterior promontory, humeral, anterior and posterior fossal, acrostichal, anterior and posterior dorsocentral, supraalar, prescutellar and scutellar bristles well developed; scutellum with lobes covered with broad dark brown scales; pleural integument pale yellow; anterior pronotal lobe covered with scattered white narrow scales and several bristles; posterior pronotum with narrow brownish scales, middle with a patch of narrow white scales and 4 posterior bristles; propleuron with broad white scales and 4-5 bristles; prosternum, hypostigial area, postcoxal membrane and spiracular area with a few broad white scales; paratergite with a few pale narrow curved scales along margin; sternopleuron with upper and lower small patches of broad white scales and upper and posterior bristles; prealar area with a patch of bristles and a few broad white scales; mesepimeron with a small patch of broad white scales over anterior and posterior areas, a patch of upper and 1-3 middle bristles. *Legs*. Coxae with white scale patches, anterior coxa also with a few dark scales; trochanters white scaled; femora mainly brown scaled, hind femur with a pale scaled area on anterior lower 0.5 not reaching apex; tibiae brown scaled with apical pale scales; tarsi with tarsomeres dark. *Wing*. Dorsal veins covered with brown scales, broad scales on costa, subcosta, R_1 and R_{4+5} and cubitus, rest of veins covered with narrow scales; small scales along posterior margin of wing above fringe scales; alula with narrow brown scales along fringe; 2-3 remigial bristles. *Halter*. With pale stem and knob brown scaled. *Abdomen*. Terga brown scaled with pale markings, terga II-VII with basolateral pale bands which are broader on anterior sterna and may completely cover sterna II and III; posterior margins of terga and sterna fringed with golden hairs which are more numerous on the latter; segment VIII completely retracted into segment VII.

MALE. Similar to female in general habitus. *Head*. Palpus brown scaled, slightly longer than the proboscis. *Terminalia*. Tergum IX bilobed with 11-12 bristles on each lobe and covered with fine spicules, basimere short and broad basally, with moderately long bristles covering most of dorsal surface and long ones along lateral margin to apex, dorsal and ventral surfaces covered with small spicules, sternomesal margin with a few scattered short bristles and an apical short flattened lobe with 1 long bristle and several short hairs, numerous scales on ventral and lateral surfaces; distimere long, narrow and curved with a short dark spiniform attached subapically and extending beyond apex; basomesal lobe covered with fine hairlike spicules and with an apical patch of 8-10 moderately long bristles; phallosome with aedeagus divided into two lateral plates each with 8-9 teeth; sternum IX with 7-8 bristles at the center.

PUPA. *Cephalothorax*. Hairs 2-4, 7, 10, 11-C single; 1, 5-C single or double. *Abdomen*. Hair 1-II-V single; 3-III single, longer than length of segment III; 5-VI single, equal to the length of segment VII; 9-VII single, slightly over one-half length of segment VII; 9-VIII with 2-3 branches, slightly longer than segment VII. *Paddle*. With small spicules along outer (distal) 0.5 and inner (distal) 0.5 margins; paddle hair 1-P single or occasionally forked.

LARVA. *Head*. Hair 4-C with 5-15 branches; 6-C single; 7-C with 5-13 branches; 10-C double; 11-C with 5-18 branches; 12-C with 3-4 branches; antenna short, without spicules and with hair 1-A single and attached at about 0.65 distance from base. *Thorax*. Hair 9-M stellate with 3-4 branches; hair 4-T single or double and 5-T with 2-3 branches. *Abdomen*. Abdominal segments with numerous stellate hairs; hair 2-I-VIII with 1-4 branches, usually 2-3 branched; hair 1-VIII with 2-4 branches; comb consisting of 7-10 scales in one row, scales with fine fringe along margins and a bluntly pointed apex; siphon index approximately 1.4-1.6; hair 1-S with 2-3 branches and not

reaching apex of siphon; pecten with 4-10 teeth with denticles along ventral and apical margins; hair 1-X with 3-5 branches and about 1.2 length of saddle; hair 2-X with 4-7 branches; 10-11 hair tufts in ventral brush, 1-2 tufts proximad of grid; saddle covered with short rows of fine spicules on lateral surface; anal papillae broad and blunt, approximately 0.75 length of siphon.

TYPE DATA. Types 1 male and 3 females, Colombo, CEYLON, 1913, James, in the British Museum.

DISTRIBUTION. Specimens examined: CEYLON, Colombo 3 females, 2 males with associated larval and pupal skins. INDIA, *Nicobar Islands* 1 female. INDIA, mainland 1 female. *Other Distribution.* INDIA, Kharghpur, Bengal-Nagpur Rly. (Barraud 1934: 277).

TAXONOMIC DISCUSSION. *A. reginae* is very similar to *micropterus* in the adult habitus and the male terminalia. It has the pleural integument pale yellow, the apices of all femora dark scaled and the lateral surface of the head pale scaled compared to *micropterus* in which the pleural integument is dark brown, the apices of all femora with lateral white spots and the lateral surface of the head dark scaled. The male terminalia of *reginae* also differ from *micropterus* in having the basimere shorter, wider and with more numerous bristles along the lateral margin. The larvae are very similar to *micropterus* but differ, according to Mattingly (1959: 38), in having the inner mouthbrush setae pectinate, papilliform appendage of antenna short and undifferentiated, and hair 2-X with 4-7 branches. *A. micropterus* has the mouthbrushes without pectinate setae, papilliform appendage of antenna long, narrow and partly differentiated into two, and hair 2-X with 3-4 branches. *A. reginae* differs from the other Oriental species in having numerous stellate hairs on the abdominal segments.

BIOLOGY. The larvae of the type specimens were collected from tree holes (Edwards 1922: 272).

AEDES (DICEROMYIA) SCANLONI n. sp.

Figs. 5, ♂♀; 9, ♂ terminalia.

FEMALE. *Head.* Antenna dark brown, longer than the proboscis, torus with a patch of dark scales and short fine hairs mesally, flagellomere 1 with a few small dark scales and 1.3 length of flagellomere 2; clypeus dark, bare; palpus dark with apical pale band which is wider mesally, slightly longer than 0.25 length of proboscis; proboscis dark brown, slightly longer than fore femur; vertex with alternating dark and pale broad decumbent scale patches, two patches of pale scales separated by a central dark area, another pale patch laterally on each side with dark scales below, a few dark long narrow erect scales posterior to orbital line and numerous short narrow ones on occiput which also has a few pale erect scales. *Thorax.* Anterior mesonotum covered with narrow curved brown scales, narrow curved white scales around anterior margin, a small white patch above paratergite and one on the anterior margin of supraalar area; posterior mesonotum with overlapping long brown broad scales along posterior and extending over and completely covering scutellum, a patch of similar scales on supraalar area; anterior promontory, humeral, 2-4 anterior dorsocentral, supraalar and scutellar bristles well developed, 3-4 poorly developed prescutellar bristles present, others absent; pleural integument dark brown; anterior pronotal lobe covered with white scales and several long bristles, narrow curved scales above and broad ones below; upper posterior pronotum with narrow curved brown scales and a few white ones posteriorly, middle with a patch of broad white scales, 4 posterior bristles; propleuron with broad white scales and 3-4 bristles; prosternum bare;

postcoxal membrane and spiracular area bare; postspiracular area with 4 bristles; subspiracular and hypostigial areas with broad white scales; paratergite with narrow curved white scales; sternopleuron with upper and lower broad white scale patches and upper and posterior bristles; prealar area with a patch of bristles and a few broad white scales; mesepimeron with a patch of broad white scales over anterior and posterior areas, a patch of upper and 2 middle bristles. *Legs.* Coxae with white scale patches, fore and mid coxae also with dark scales; trochanters white scaled; anterior of femora with a few pale scales laterally at apex, a subapical pale band and various other pale scale patterns (see figures); tibiae each with 4 dorsolateral evenly spaced pale spots and apical pale scales; fore tarsus with tarsomere 1 having pale dorsal scale patches at base, apex and middle, tarsomeres 2-4 with a few dorsobasal pale scales; mid tarsus with tarsomere 1 having pale spots at base, apex and 2 in middle, tarsomeres 2 and 3 with a few dorsobasal pale scales; hind tarsus with tarsomere 1 having pale bands at base and 2 in middle, and a few pale apical scales, tarsomeres 2-4 each with a dorsobasal pale spot and a few dorsoapical pale scales. *Wing.* Dorsal veins covered with broad brown scales with white ones at bases of costa, radius and cubitus (in some specimens 1 or 2 pale scales at base of anal vein also); small brown scales along posterior margin of wing above fringe scales; alula with narrow to broad brown scales along fringe and a short second row above; 1-2 remigial bristles. *Halter.* With pale stem and knob brown scaled with a few pale scales ventrally. *Abdomen.* Terga with brown and pale markings, tergum I with a large dorsal pale patch from base to apex, terga II-VII each with a lateral pale patch, tergum II with a large dorsobasal pale patch, terga V-VI with 2 admedian pale spots near apical margin in the holotype (some paratypes also with 2 admedian pale indistinct spots on terga III, IV and VII); posterior margins of terga and sterna fringed with golden hairs which are more numerous on the latter; segment VIII completely retracted into segment VII.

MALE. Similar to female in general habitus. *Head.* Palpus with broad basal pale band on terminal segment, segment 4 with a few dorsobasal pale scales and a median pale band on segment 3; palpus slightly longer than the proboscis; proboscis with an indistinct pale narrow band just past middle. *Terminalia.* Tergum IX bilobed with 8-10 more or less equal bristles on each lobe and covered with fine spicules; basimere short and broad with a patch of moderately long flattened bristles along upper 0.5 of tergomesal margin, shorter flattened bristles extending along tergomesal margin to base in 2-3 irregular rows, long bristles extending along dorsolateral margin from base to apex, ventral surface covered with scattered short bristles and fine spicules, sternomesal margin with 6-9 moderately long flattened bristles near base, numerous long scales on lateral and ventral surfaces with a few on dorsobasal area; distimere short, thickened in the center and tapering to a blunt point, spiniform dark, long and flattened (over 0.5 length of distimere), attached sub-apically and extending beyond apex; basal mesal lobe covered with fine hairlike spicules and with numerous short flattened bristles on apical portion; phallosome with aedeagus divided into two lateral plates each with 10-11 teeth; sternum IX with normally only 2 bristles at the center (paratype NB 681 with 4 bristles).

PUPA and LARVA. Unknown.

TYPE DATA. Holotype female, U-50B, *Nakhon Ratchasima*, THAILAND, 29 May 1963, Resting Collection; allotype male, Don Mung Road, *Krung Thep*, THAILAND, 30 Aug. 1955, M. N. R.; 1 female paratype, U-50 with same data as holotype; 1 male terminalia, paratype, on slide and 2 female paratypes with same data as allotype; 1 male paratype, NB1135, Pak Kret, *Nonthaburi*, THAILAND, 23 Aug. 1964, resting in house; 1 male

paratype, NB681, from an island in the Chao Phraya River, Pak Kret, *Nontha-buri,* THAILAND, 16 June 1964, light trap collection; 1 male terminalia (adult lost) paratype, T-5033, slide 2317, Udornthani, *Udon Thani,* THAILAND, 15 Sept. 1962, light trap. All type specimens deposited in the U.S. National Museum.

DISTRIBUTION. In THAILAND from the following changwats: *Krung Thep, Nakhon Ratchasima, Nonthaburi,* and *Udon Thani.*

TAXONOMIC DISCUSSION. *A. scanloni* is very similar to *iyengari* and *punctipes* in the adult habitus. The primary differences from *iyengari* are: presence of pale scales on the wing at the bases of the radius and cubitus; postcoxal membrane bare; and the tergal markings, especially terga I and II which have large dorsal pale areas. The male terminalia also has a number of marked differences from *iyengari.* These differences are: tergum IX with 8-10 bristles; basimere with longer patch of flattened bristles on tergomesal margin, without a patch of short bristles on dorsal surface below attachment of distimere, with basal mesal lobe covered with approximately 25-35 short flattened bristles, sternomesal margin with 6-9 moderately long bristles near base; and with normally only 2 bristles on sternum IX.

The primary differences from *punctipes* are: presence of apical pale band on palpus; legs with more extensive pale markings; pale scales on the wing at the base of the radius, and terga V-VI with 2 admedian pale spots near apical margin.

This species is named for LTC John E. Scanlon in recognition of his valuable work on mosquitoes in Southeast Asia.

BIOLOGY. Adults were collected in light traps and resting in houses.

AEDES (DICEROMYIA) WHARTONI MATTINGLY

Figs. 6, ♂♀; 7, ♂ terminalia; 10, 12, pupa; 15, larva.

Aedes (Diceromyia) whartoni Mattingly 1965, Culic. Mosq. Indomalayan Area 6: 65 (♂*, P*, L*).

FEMALE. *Head.* Antenna dark brown, longer than the proboscis, torus with some short fine hairs mesally, flagellomere 1 with a few small dark scales on basal 0.5 and 1.3 length of flagellomere 2; clypeus dark, bare; palpus dark, slightly over 0.25 length of proboscis which is dark and slightly longer than fore femur; vertex with alternating dark and pale broad decumbent scale patches of variable size, 2 small pale patches separated by a central dark area, another pale patch on each side with dark scales below, a few erect scales posterior to orbital line and numerous ones on occiput. *Thorax.* Anterior mesonotum, covered with long narrow curved blackish-brown scales with narrow white scales around anterior margin, a patch of broad white scales above and extending down over paratergite; posterior mesonotum with overlapping long black broad scales along posterior and extending over and completely covering scutellum, similar scales extending forward and covering supraalar area; anterior promontory, humeral, supraalar and scutellar bristles well developed, others absent; pleural integument dark brown; anterior pronotal lobe with some bristles and covered with broad white scales; upper and middle posterior pronotum covered with a patch of broad blackish-brown scales, 4-5 posterior bristles; propleuron covered with broad white scales and 2-3 bristles; prosternum bare; postcoxal membrane and spiracular area bare; postspiracular area with 4-5 bristles; subspiracular and hypostigial areas with broad white scales; paratergite completely covered with overlapping broad white scales; sternopleuron with upper and lower broad white scale patches and upper and posterior bristles; prealar

area with a patch of bristles; mesepimeron with a patch of broad white scales over anterior and posterior areas; a patch of upper bristles present, other bristles absent. *Legs*. Coxae with white scale patches, fore coxa also with brown scales; trochanters white scaled; femora each with a subapical white band, a very narrow basal pale band and white scales at apex; tibiae brown and with a few dorsoapical pale scales; fore and mid tarsomere 1 each with a dorsobasal pale spot, mid tarsomeres 2-4 with a few dorsobasal pale scales, hind tarsomeres 1 and 2 each with a basal pale band, hind tarsomeres 3, 4 and usually 5 with a dorsobasal pale spot. *Wing*. Dorsal veins covered with broad brown scales and a patch of white scales at base of the costa; small broad scales along posterior margin of wing above fringe scales; alula with broad brown scales along fringe and a second row above; 1 remigial bristle. *Halter*. With pale stem and knob brown scaled. *Abdomen*. Terga with dark brown and white markings, terga I-VII dark dorsally, terga II-VII each with a lateral white spot near basal margin; posterior margins of terga and sterna fringed with golden hairs (hairs more numerous on sterna), basally sterna II-VII with prominent white bands; segment VIII completely retracted into segment VII.

MALE. Similar to female in general habitus. *Head*. Palpus dark, slightly longer than the proboscis. *Abdomen*. Terga VI-VIII with lateral white spots extending onto dorsum. *Terminalia*. Tergum IX bilobed with 9-15 bristles on each lobe, and covered with fine spicules; basimere short and broad basally, with numerous long bristles on dorsal surface and along the tergomesal margin, a number of longer bristles on upper lateral surface and at apex, a few short bristles along sternomesal margin and ventral surface, also a patch of 10-12 long bristles near base of sternomesal margin, a few short hairs at apex mesally, numerous dark scales on ventral, lateral and laterobasal portion of dorsal surface, ventral and dorsobasal surfaces covered with small spicules; distimere long and curved with a lateral flaplike structure just past center in most specimens, spiniform dark, short, attached subapically and extending beyond apex; basal mesal lobe with 5-9 moderately long bristles on a small apical lobe, rest of surface and narrow fold connecting it to its mate covered with fine hairlike spicules; phallosome with aedeagus divided into two lateral plates each with 9-11 teeth; sternum IX with 1-2 stout bristles at the center.

PUPA. *Cephalothorax*. Hairs 1, 2-C double; 3-C with 2-3 branches; 4, 5, 7, 12-C single or double; 10-C single or 3-branched; trumpet moderately long. *Abdomen*. Hair 1-II-VI single or double; 1-VII single; 3-III single, longer than the length of segment III; 5-VII single, slightly less than 0.5 the length of segment VII; 9-VII single or with 2-4 branches, longer than the length of segment VII. *Paddle*. With tiny spicules along proximal 0.5 of outer margin; paddle hair 1-P with 2-5 branches.

LARVA. *Head*. Hair 4-C large, stellate with 11-21 branches; 6-C double; 7-C with 3-9 branches; 10-C single or with 2-3 branches; 11-C stellate with 7-12 branches; 12-C with 3-4 branches; antenna long, with a few spicules on basal 0.5, hair 1-A double and attached at about 0.65 distance from base. *Thorax*. Hair 9-M stellate with 3-4 branches; hairs 4, 5-T single. *Abdomen*. Hair 2-I-VIII single, hair 1-VIII single, seldom double; comb consisting of 10-14 scales in 2 irregular rows, scales with sharp pointed apex and fringe on basal 0.75 of lateral margins; siphon index approximately 3.6-4.1; siphon covered with minute spicules and apical 0.5 conical; hair 1-S single, not reaching apex of siphon; pecten with 9-14 teeth, with denticles along the ventral and apical margins; hair 1-X single, slightly longer than saddle; hair 2-X with 2-3 branches; 8-9 hair tufts in ventral brush, 1-2 tufts proximad of grid; saddle covered with short rows of fine spicules on lateral surface;

anal papillae blunt, short and approximately 0.3-0.5 length of siphon.

TYPE DATA. Holotype male with associated larval and pupal skins, No. 0923/9, Ulu Gombak, WEST MALAYSIA, 20 Nov. 1958, W. W. Macdonald, in British Museum.

DISTRIBUTION. Specimens examined from the following changwats in THAILAND: *Lampang* 2 females and 1 male with associated larval and pupal skins, 1 female with associated pupal skin, 1 whole larva; *Nan* 1 female with associated larval and pupal skins; *Phangnga* 2 females and 3 males with associated larval and pupal skins, 8 females and 5 males with associated pupal skins, 1 female and 2 males and 12 whole larvae; *Ranong* 2 females and 3 males with associated larval and pupal skins, 2 males with associated pupal skins and 1 male; *Tak* 1 female and 1 male. WESTERN MALAYSIA, *Selangor*, The Gap 1 female with associated pupal skin, 1 male and 4 females, Ulu Gombak 1 female with associated larval and pupal skins, 1 male and 2 females.

TAXONOMIC DISCUSSION. *A. whartoni* is a dark species and easily separated from the other Oriental species of *Diceromyia* by the absence of anterior dorsocentral and prescutellar bristles, presence of a patch of broad white scales above and extending over the paratergite, broad blackish-brown scales on the posterior pronotum, and lateral tergal markings of the abdomen. The male terminalia resembles those of *reginae*, *micropterus* and *periskelatus* but can be readily separated by the presence of a patch of 10-12 long bristles on the sternomesal margin of the basimere near the base and the flaplike structure (when present) on the distimere. The larvae are easily recognized from the other species of Oriental *Diceromyia* by the presence of the long antenna and siphon. It is like *franciscoi* in having two rows of comb scales but differs in having only 10-14 scales compared to 15-25 scales in *franciscoi*.

BIOLOGY. Immatures in Thailand have been collected from fresh, colored water in large and small split bamboo, bamboo internodes, and bamboo stumps; 1-2 meters above the ground; in mountain, hilly and valley terrain; in partial and heavy shade; in secondary rain forests and secondary bamboo groves; and at an altitude of 100 to 1,600 meters (most commonly collected at altitudes of 200-300 meters in secondary rain forests). One collection of larvae was taken from a hole in a log lying on the ground. Mattingly (1965: 66) records *A. whartoni* breeding in fallen bamboos in Malaya.

In Thailand immatures were collected in association with the following species of mosquitoes: *Aedes albolineatus, albopictus* and *niveus* group; *Anopheles asiaticus; Armigeres durhami; Culex* species; *Heizmannia* species; *Orthopodomyia albipes* and *andamanensis; Toxorhynchites gravelyi* and *leicesteri; Tripteroides aranoides* and *similis; Udaya argyrurus;* and *Uranotaenia bimaculata* and *lutescens*.

ACKNOWLEDGEMENTS

I am grateful to Dr. Botha de Meillon, Responsible Investigator, Southeast Asia Mosquito Project (SEAMP) and to Dr. Alan Stone, Agriculture Research Service, U.S. Department of Agriculture, for their many helpful suggestions and criticisms during the course of the work and preparation of the final manuscript. Sincere thanks are given to LTC John E. Scanlon, U.S. Army, E.L. Peyton and Dr. Yiau-Min Huang, all of the Southeast Asia Mosquito Project, for their helpful suggestions and encouragement. Dr. P. F. Mattingly kindly read the manuscript and made many helpful suggestions. The loan of important material, obtained for me by SEAMP, from Dr. P. F. Mattingly, Department of Entomology, British Museum (Natural History); Dr. E.C.C. van Someren, Division of Insect-Borne Diseases, Nairobi, Kenya;

Dr. T. Ramachandra Rao, Virus Research Centre, Poona, India; The Director, South African Institute for Medical Research, Johannesburg; Dr. L. Rozeboom, Johns Hopkins University; and Dr. J. Bonne-Wepster, Instituut voor Tropische Hygiene en Geographische Pathologie, Amsterdam, The Netherlands, is acknowledged with sincere appreciation. I am particularly indebted to the personnel of the SEATO Medical Research Laboratory, Thailand, for the collection and preparation of many valuable specimens. Thanks are extended to Mr. C. John Lane for his valuable work as curator, Mrs. Elaine R. Hodges for preparing the immature and male terminalia illustrations, the artists of the U.S. Army 406th Medical Laboratory, Tokyo, Japan, for preparing the adult habitus illustrations, and Miss Helle Starcke for typing the manuscript for offset reproduction. To my wife, Mollie, I am especially appreciative for her assistance in typing the drafts.

LITERATURE CITED

BARRAUD, P. J.
1928. A revision of the culicine mosquitoes of India. Part. XXIV. Indian J. med. Res. 16(2): 357-375.

1934. The fauna of British India including Ceylon and Burma. Diptera 5, family Culicidae, tribes Megarhinini and Culicini. Taylor and Francis, London, 463 pp.

BELKIN, J. N.
1962. The mosquitoes of the South Pacific. Univ. Calif. Press, Berkeley, 2 vols., 608 and 412 pp.

BONNE-WEPSTER, J.
1954. Synopsis of a hundred common non-anopheline mosquitoes of the Greater and Lesser Sundas, the Moluccas, and New Guinea. Roy. trop. Inst. Amst. Spec. Pub. 111, 147 pp.

BRUG, S. L.
1932. Notes on Dutch East Indian mosquitoes. Bull. med. Res. 23(1): 73-83.

DE MEILLON, B.
1943. New records, and new species of Nematocera (Diptera) from the Ethiopian region. J. ent. Soc. S. Africa 6: 90-113.

DE MEILLON, B., M. PARENT and L. O'C. BLACK.
1945. Descriptions of new larvae and pupae of Ethiopian Culicini. Bull. ent. Res. 36(1): 85-101.

DOUCET, J.
1951. Les moustiques de la region de Perimet. Mem. Inst. Sci. Madagascar (A)6: 63-82.

EDWARDS, F. W.
1917. Notes on Culicidae with descriptions of new species. Bull. ent. Res. 7: 201-229.

EDWARDS, F. W.
1921. Mosquito notes. II. Bull. ent. Res. 12(1):69-80.

1922. A synopsis of adult Oriental culicine (including megarhinine and sabethine) mosquitoes. Part I. Indian J. med. Res. 10(1): 249-293.

1923. Mosquito notes. IV. Bull. ent. Res. 14(1): 1-9.

1929. Mosquito notes. VIII. Bull. ent. Res. 20(3): 321-343.

1932. Genera Insect. Diptera, Fam. Culicidae. Fascicle 194. Desmet-Verteneuil, Brussels. 258 pp.

1941. Mosquitoes of the Ethiopian region. III. Culicine adults and pupae. British Museum (Natural History), London, 499 pp.

HADDOW, A. J.
1961. Studies on the biting habits and medical importance of East African mosquitoes in the genus *Aedes*. II. - Subgenera *Mucidus, Diceromyia, Finlaya* and *Stegomyia*. Bull. ent. Res. 52: 317-351.

HADDOW, A. J., E. C. C. VAN SOMEREN, W. H. R. LUMSDEN, J. O. HARPER, and J. D. GILLETT.
1951. The mosquitoes of Bwamba County, Uganda. VIII. Records of occurrence, behaviour and habitat. Bull. ent. Res. 42: 207-238.

HAMON, J., E. ABONNENC and E. NOEL.
1955. Contribution a l'etude des Culicides de l'ouest du Senegal. Ann. Parasit. hum. comp. 30: 278-308.

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. British Museum (Natural History), London, 355 pp.

KHOKHAR, R.R. and Z. K. TARIQ.
1966. A re-description of *Aedes (Diceromyia) periskelatus* (Giles, 1902) (Diptera: Culicidae). Pakistan J. Sci. 18(3-4): 117-123.

KNIGHT, K. L. and W. B. HULL.
1951. Three new species of *Aedes* from the Philippines (Diptera, Culicidae). Pacif. Sci. 5(2):197-203.

1953. The *Aedes* mosquitoes of the Philippine Islands III. Subgenera *Aedimorphus, Banksinella, Aedes*, and *Cancraedes* (Diptera, Culicidae). Pacif. Sci. 7: 453-481.

LEWIS, D. J.
1943. Mosquitoes in relation to yellow fever in the Nuba Mountains, Anglo-Egyptian Sudan. Ann. trop. Med. Parasit. 37(1): 65-76.

MATTINGLY, P.F.
1949a. Studies on West African forest mosquitoes. I. Bull. ent. Res. 40: 149-168.

1949b. Studies on West African forest mosquitoes. II. Bull. ent. Res. 40: 387-402.

1957. The culicine mosquitoes of the Indomalayan area. Part II. Genus *Heizmannia* Ludlow. British Museum (Natural History), London, 57 pp.

1959. The culicine mosquitoes of the Indomalayan area. Part IV. Genus *Aedes* Meigen, subgenera *Skusea* Theobald, *Diceromyia* Theobald, *Geoskusea* Edwards and *Christophersiomyia* Barraud. British Museum (Natural History), London, 61 pp.

1961. The culicine mosquitoes of the Indomalayan area. Part V. Genus *Aedes* Meigen, subgenera *Mucidus* Theobald, *Ochlerotatus* Lynch Arribalzaga and *Neomelaniconion* Newstead. British Museum (Natural History), London, 62 pp.

1965. The culicine mosquitoes of the Indomalayan area. Part VI. Genus *Aedes* Meigen, subgenus *Stegomyia* Theobald (Groups A, B, and D). British Museum (Natural History), London, 67 pp.

MUSPRATT, J.
1955. Research on South African Culicini (Diptera, Culicidae). III. A check-list of the species and their distribution, with notes on taxonomy, bionomics and identification. J. ent. Soc. S. Africa 18(2): 149-207.

PATERSON, H.E. and B.M. McINTOSH.
1962. Further studies on the Chikungunya outbreak in Southern Rhodesia in 1962. II. Transmission experiments with the *Aedes furcifer-taylori* group of mosquitoes and with a member of the *Anopheles gambiae* complex. Ann. trop. Med. Parasit. 58(1):52-55.

REUBEN, R.
1967. *Aedes (Diceromyia) ramachandrai*, n. sp. (Diptera: Culicidae) from southern India. J. med. Ent. 4(2): 234-236.

SCANLON, J.E. and S. ESAH.
1965. Distribution in altitude of mosquitoes in northern Thailand. Mosquito News 25(2): 137-144.

THEOBALD, F.V.
1911. A new genus and two new species of culicine from the Sudan. Rep. Wellcome trop. Res. Lab. 4(B): 151-156.

VAN SOMEREN, E.C.C., C. TEESDALE and M. FURLONG.
1955. The mosquitoes of the Kenya coast; records of occurrence, behaviour and habitat. Bull. ent. Res. 46: 463-493.

WIJONO, K.
1962. The culicine mosquitoes in Djakarta, Indonesia. Unpublished thesis, Univ. Utah, 53 pp.

WOLFS, J.
1958. Deux Culicidae nouveaux du Congo belge (Diptera: Nematocera). Rev. Zool. Bot. Africa 58(3-4): 297-298.

APPENDIX: TABLE 1

Species of *Aedes (Diceromyia)* occurring in the Ethiopian Zoogeographical Region.

SPECIES	FEMALE	MALE	PUPA	LARVA	EGG
adersi	X	X*	-	X*	-
bananea	X	-	-	-	-
fascipalpis	X*	X*	X	X*	-
flavicollis	X*	X*	X	X	-
furcifer	X*	X*	X*	X	-
grassei	X	X*	-	-	-
taylori	X	X*	X	X*	-
zethus	X	X*	X	X*	-

X = Indicates stage has been described in the literature.
* = Indicates a portion of the stage has been figured in the literature.
- = Indicates no description or figure.

APPENDIX: TABLE 2

Species of *Aedes (Diceromyia)* occurring in the Oriental Zoogeographical Region.

SPECIES	FEMALE	MALE	PUPA	LARVA	EGG
franciscoi	X**	X**	X**	X**	-
iyengari	X**	X**	X**	X**	-
kanarensis	X	-	-	-	-
micropterus	X	X*	-	X*	-
periskelatus	X	X*	X*	X*	-
platylepidus	X**	X**	-	X?	-
punctipes	X	-	-	-	-
ramachandrai	X*	X*	-	-	-
reginae	X**	X**	X**	X**	-
scanloni	X**	X**	-	-	-
whartoni	X**	X**	X**	X**	-

X = Indicates stage has been described in the literature.
* = Indicates a portion of the stage has been figured in the literature.
** = Indicates a portion of the species is figured in the present paper.
? = Indicates not a positive association.
\- = Indicates no description or figure.

Fig. 1

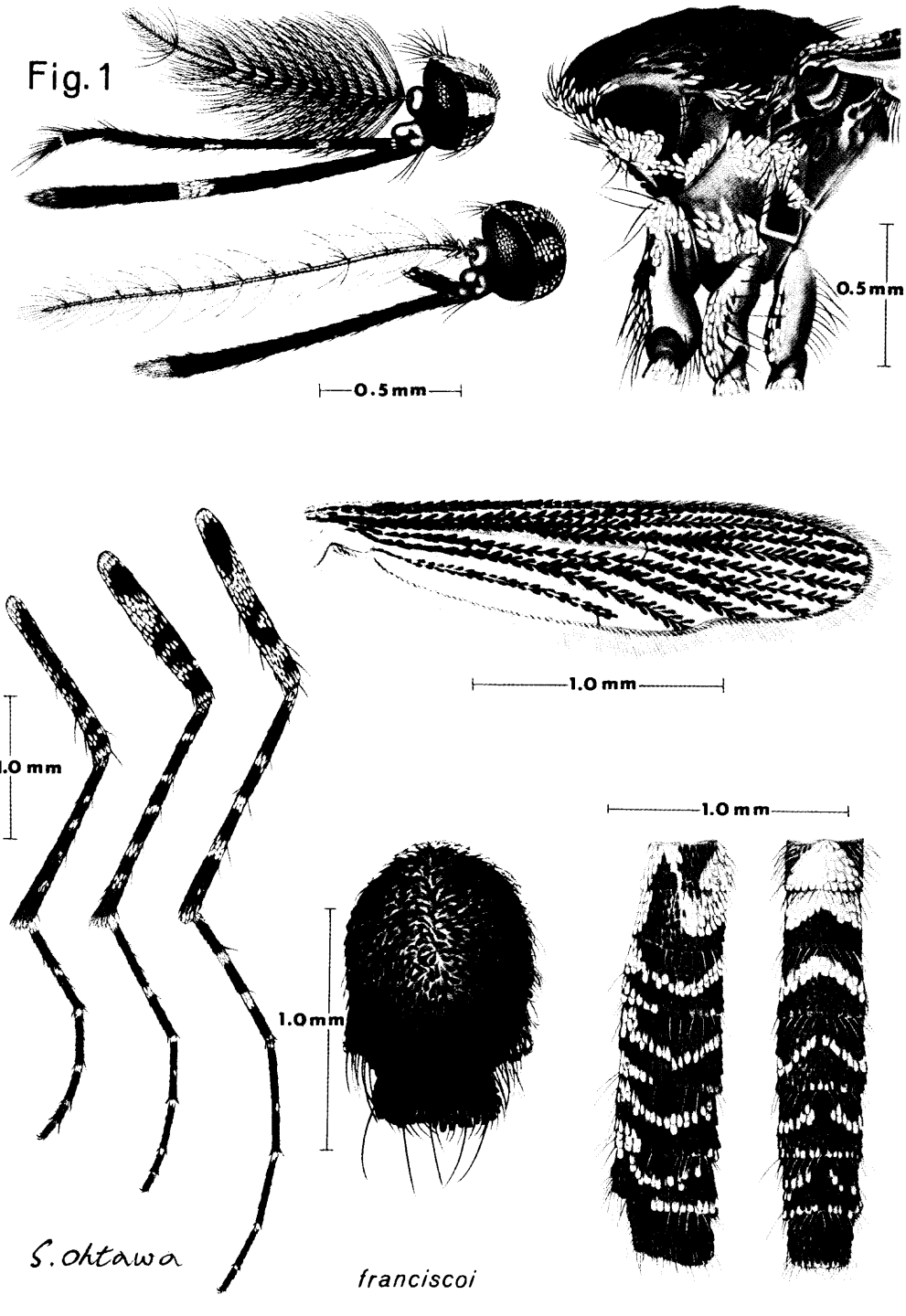
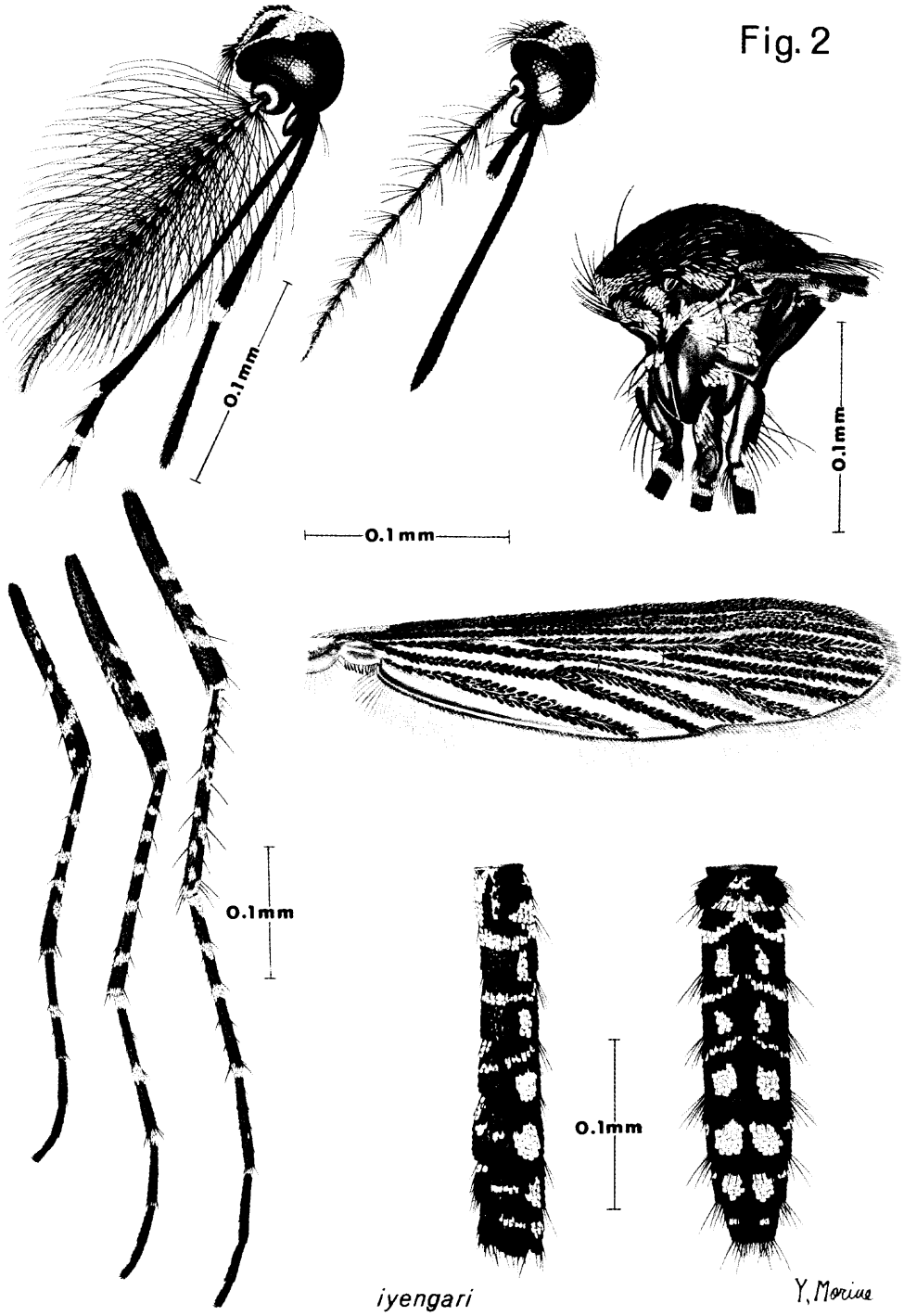


Fig. 2



iyengari

Y. Morine

Fig.3

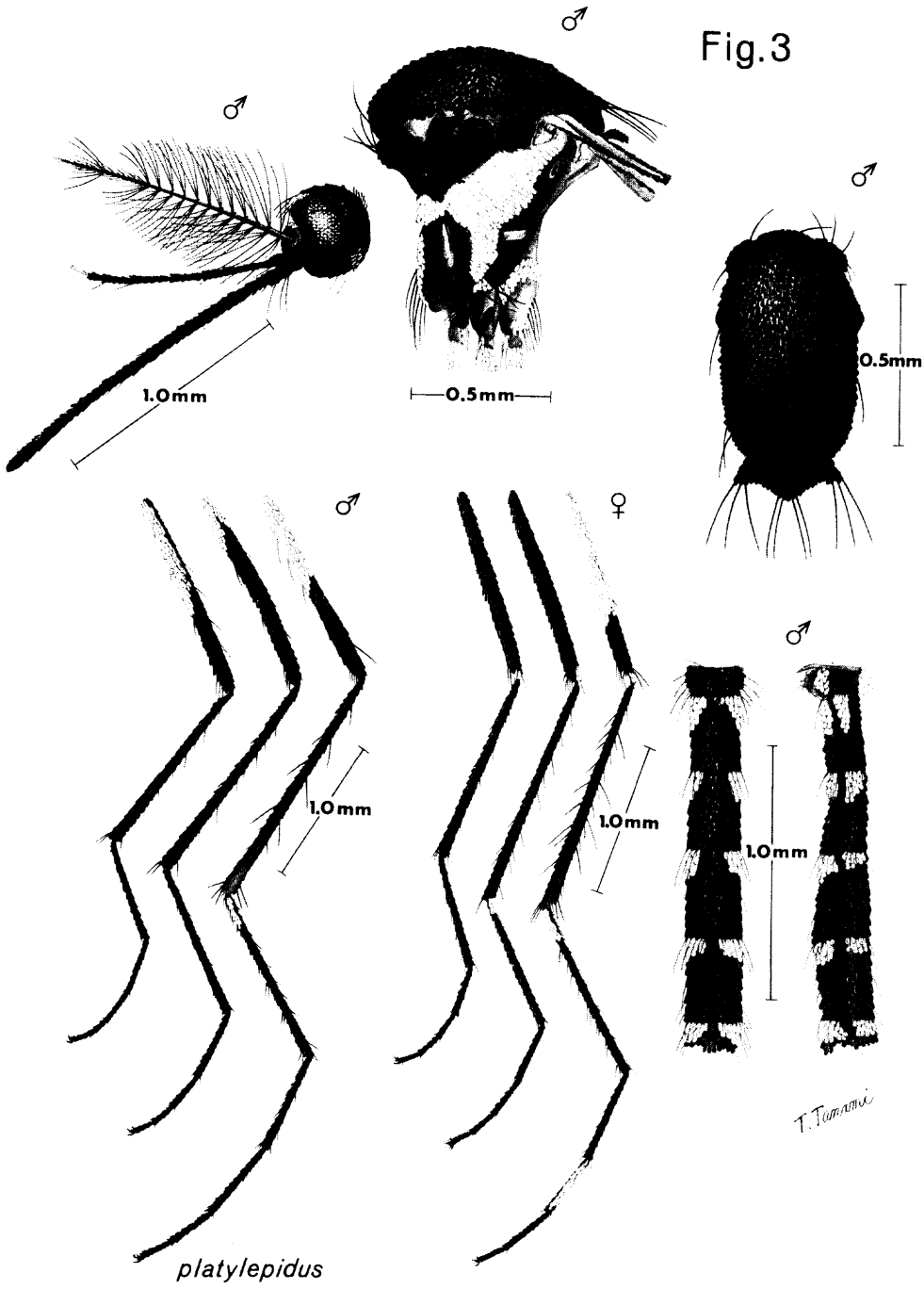


Fig.4

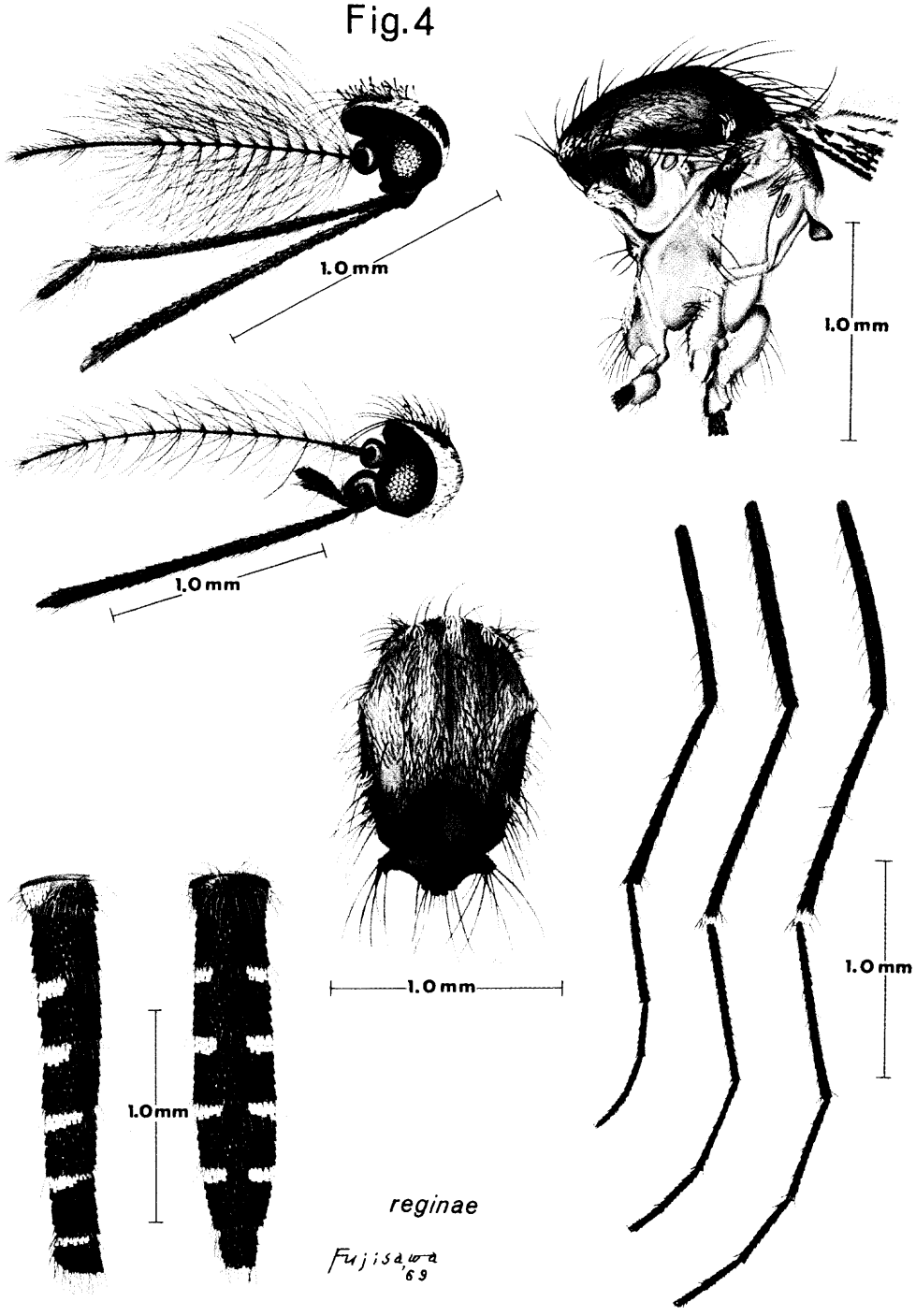


Fig. 5

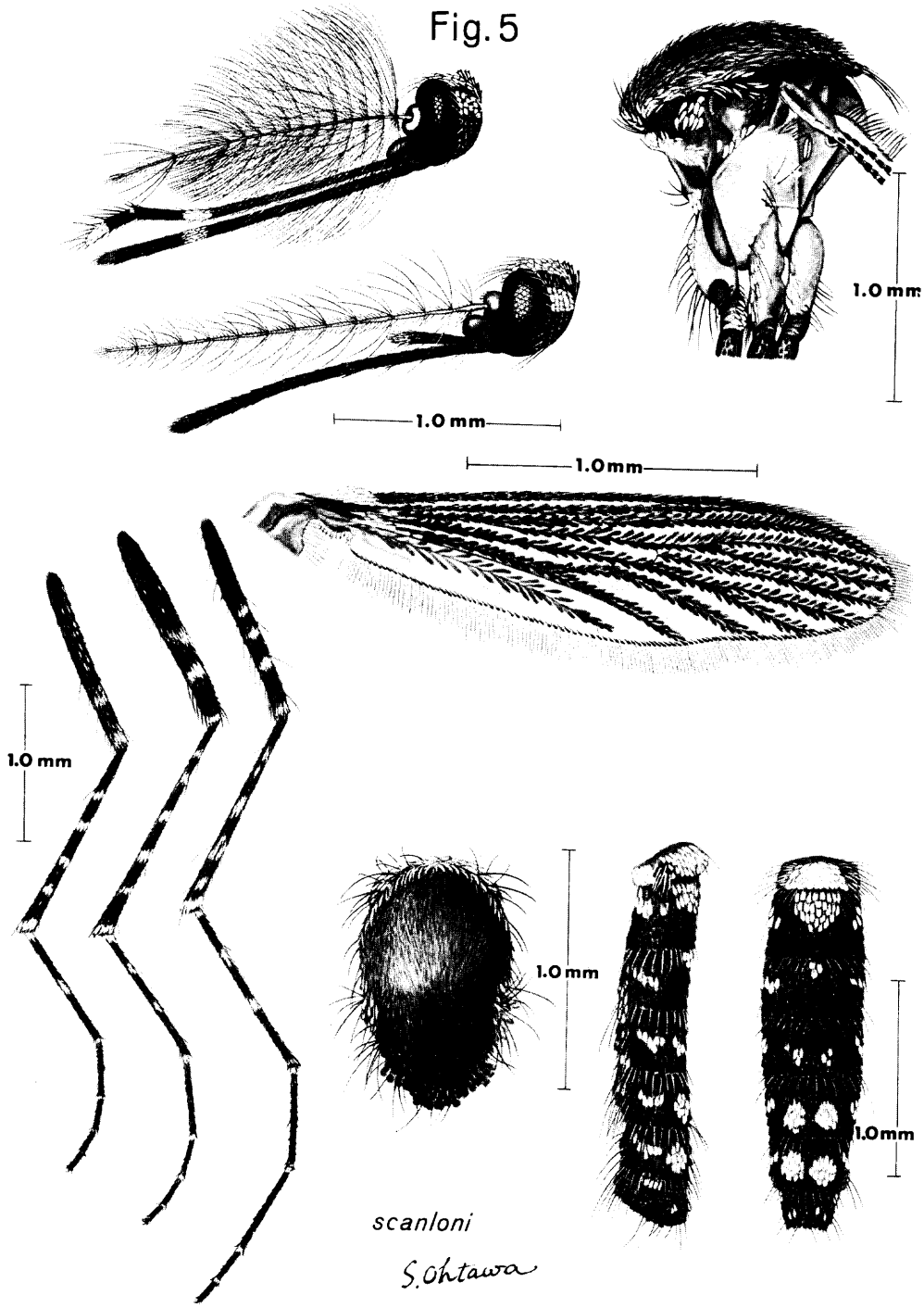


Fig.6

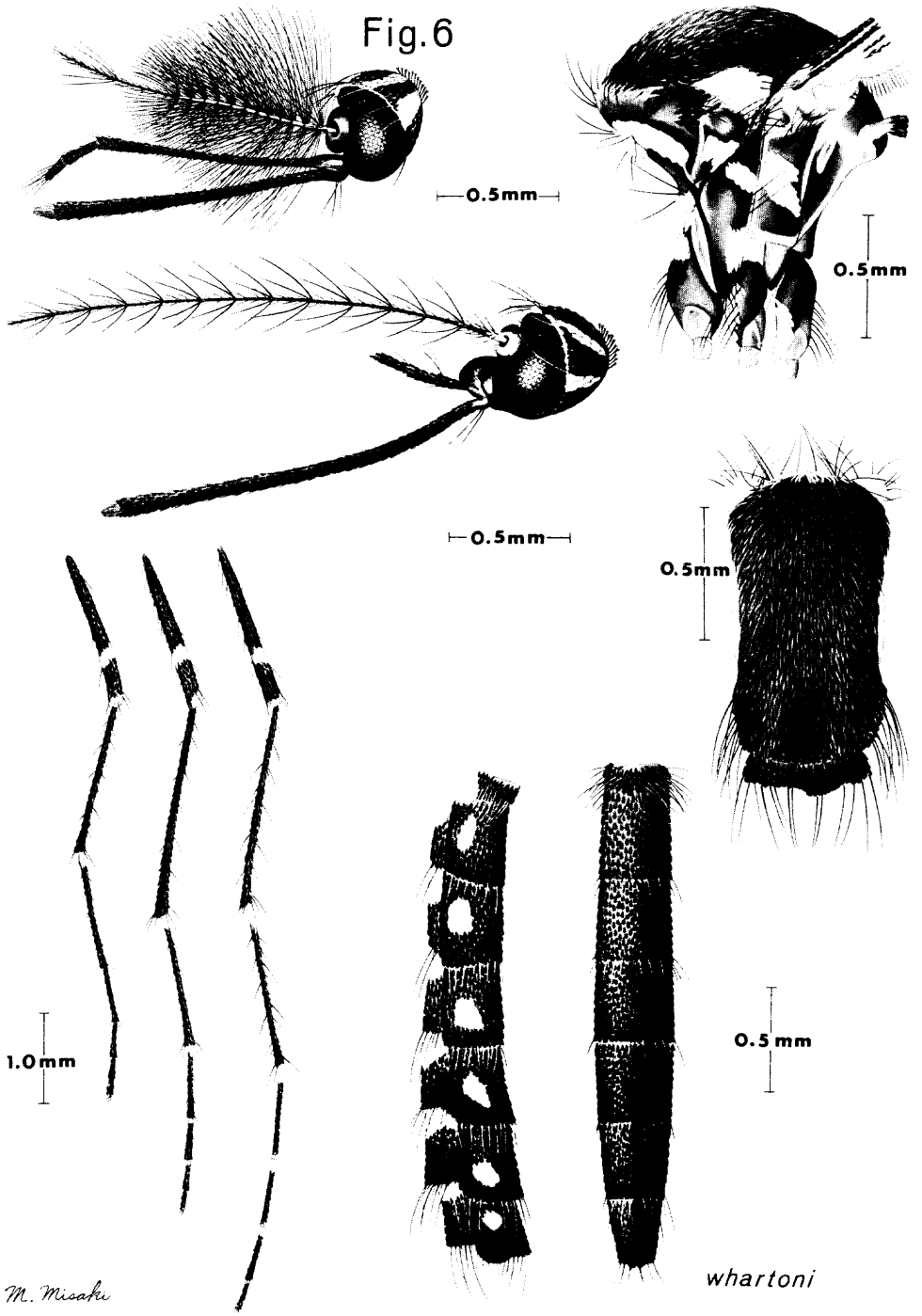
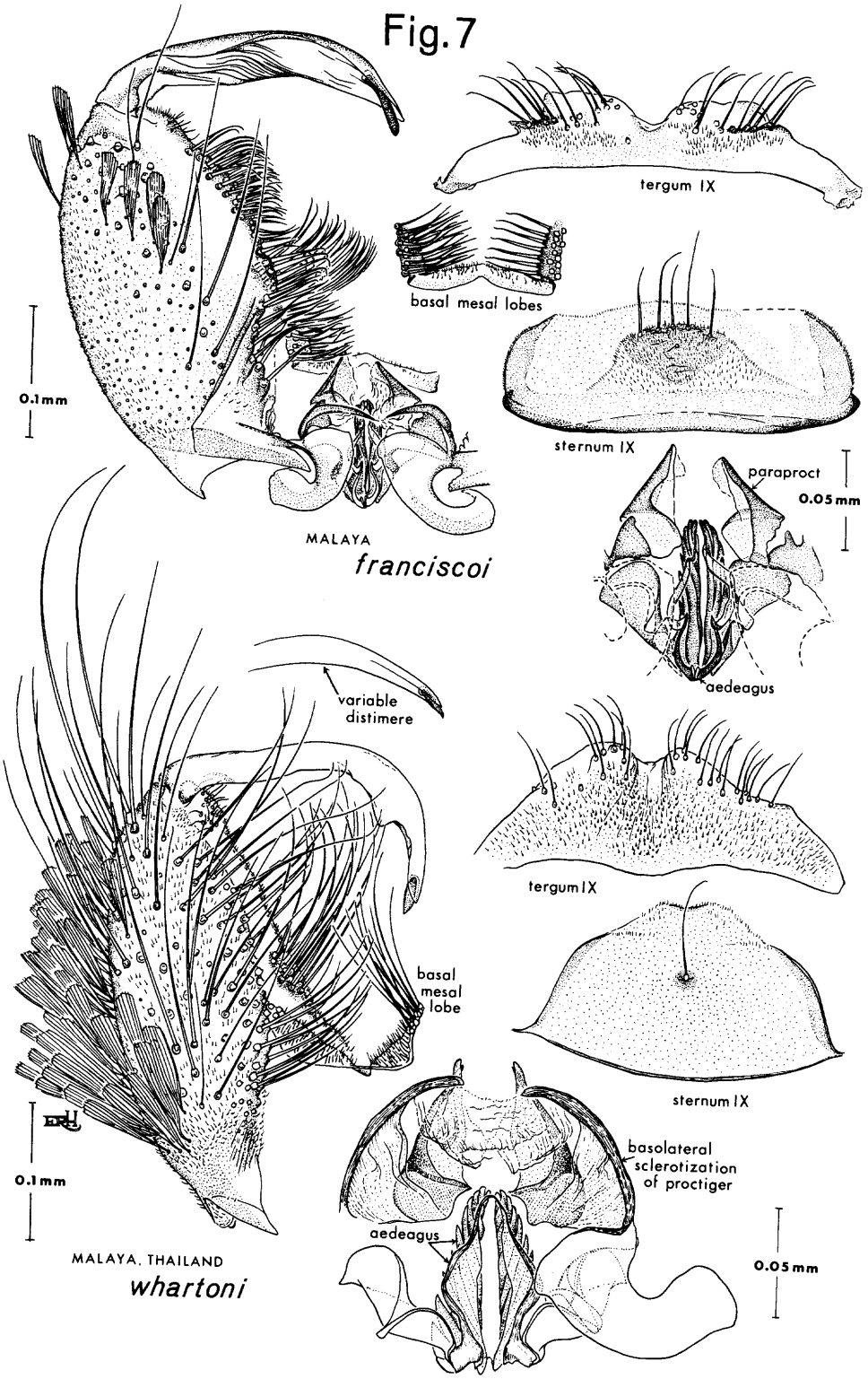


Fig.7


tergum IX
basal mesal lobes
0.1mm
sternum IX
paraproct
0.05mm
MALAYA
franciscoi
aedeagus
variable distimere
tergum IX
basal mesal lobe
sternum IX
basolateral sclerotization of proctiger
aedeagus
0.1mm
0.05mm
MALAYA, THAILAND
whartoni

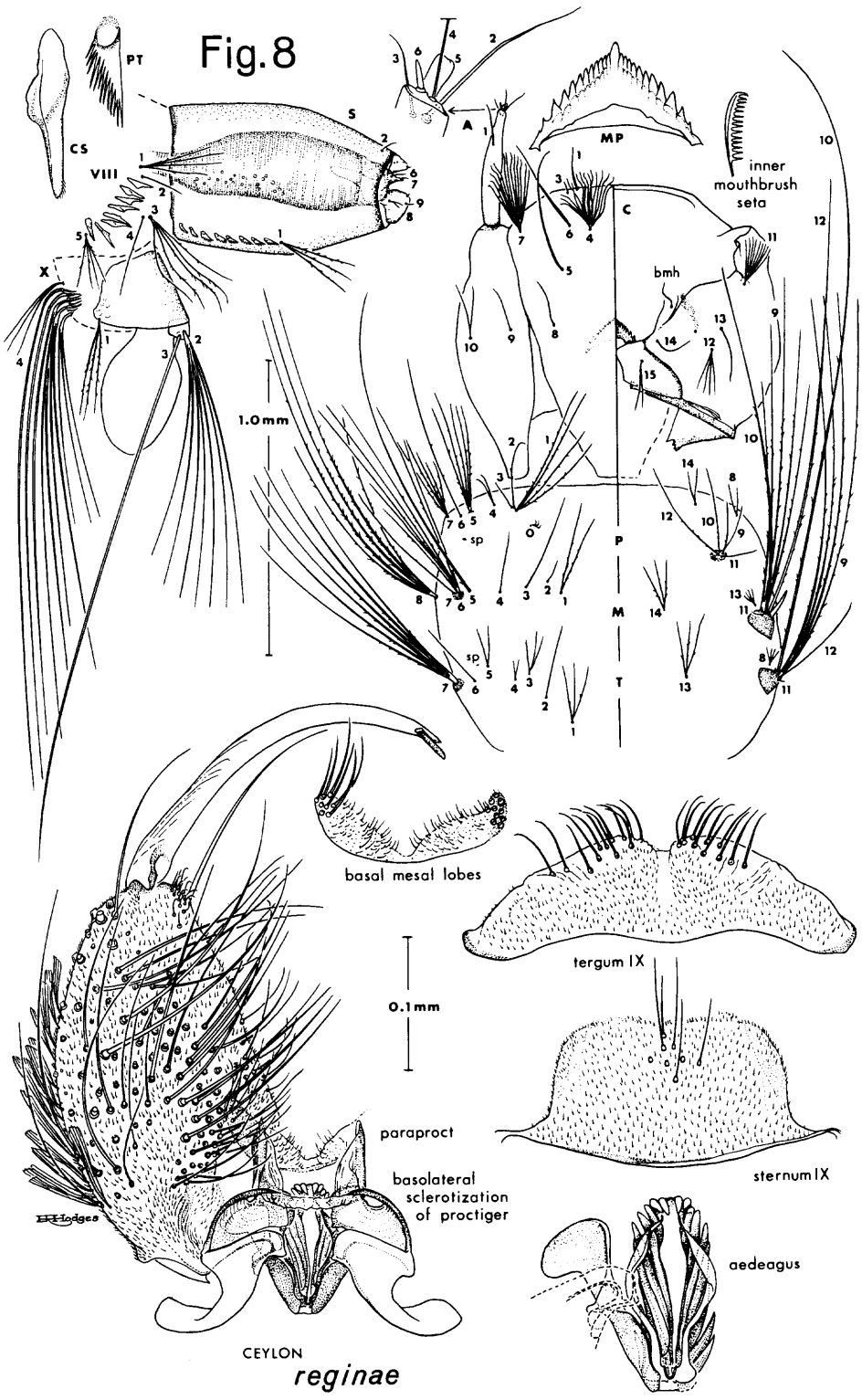


Fig.8
PT
CS
VIII
S
X
1.0mm
A
MP
C
P
M
T
sp
inner
mouthbrush
seta
bmh
basal mesal lobes
tergum IX
0.1mm
sternum IX
paraproct
basolateral
sclerotization
of proctiger
aedeagus
CEYLON
reginae

Fig.9

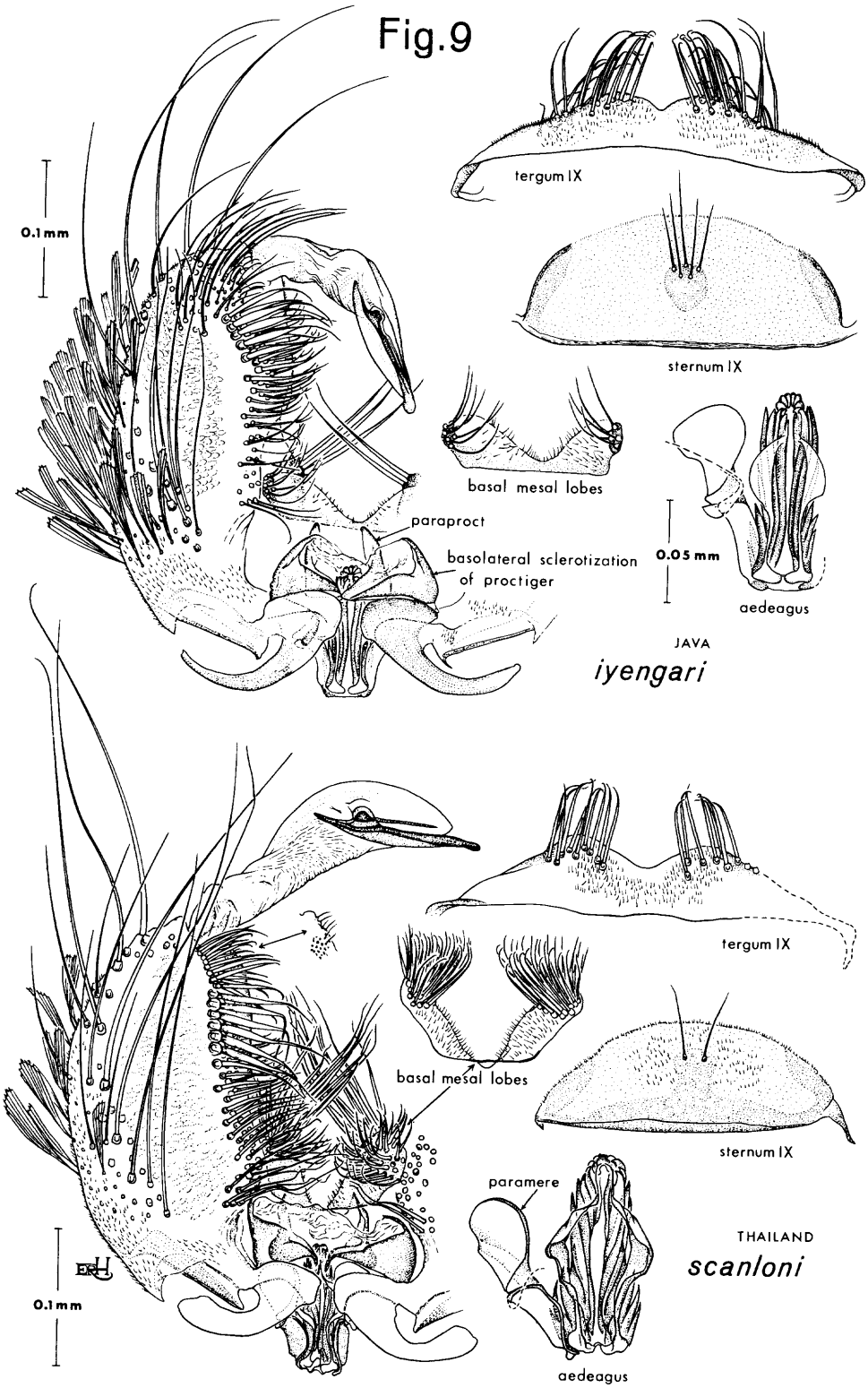
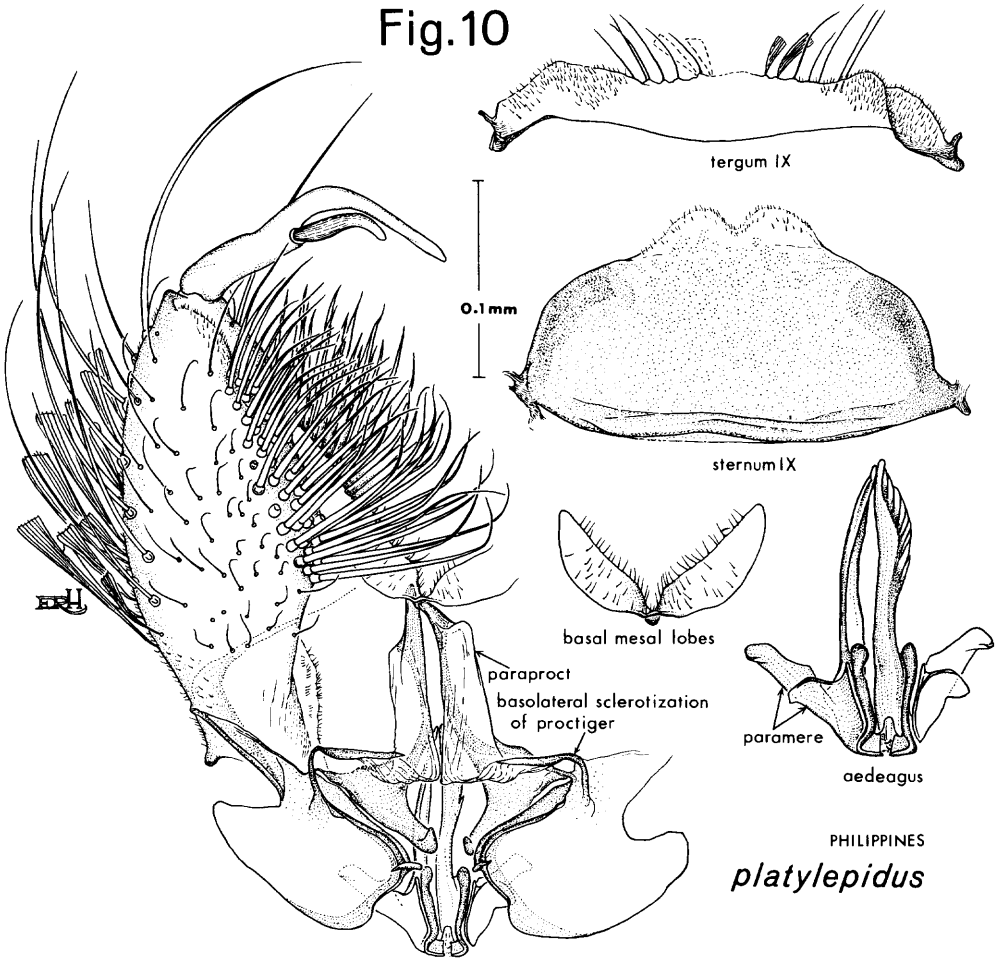
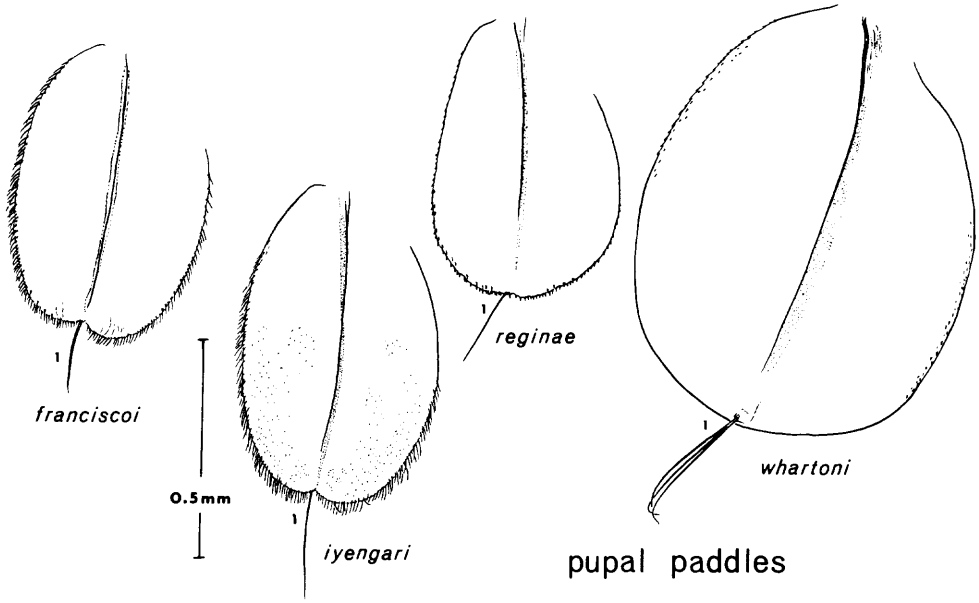

0.1 mm
tergum IX
sternum IX
basal mesal lobes
paraproct
basolateral sclerotization of proctiger
0.05 mm
aedeagus
JAVA
iyengari
tergum IX
basal mesal lobes
sternum IX
paramere
aedeagus
THAILAND
scanloni
0.1 mm

Fig.10





pupal paddles

Fig.11

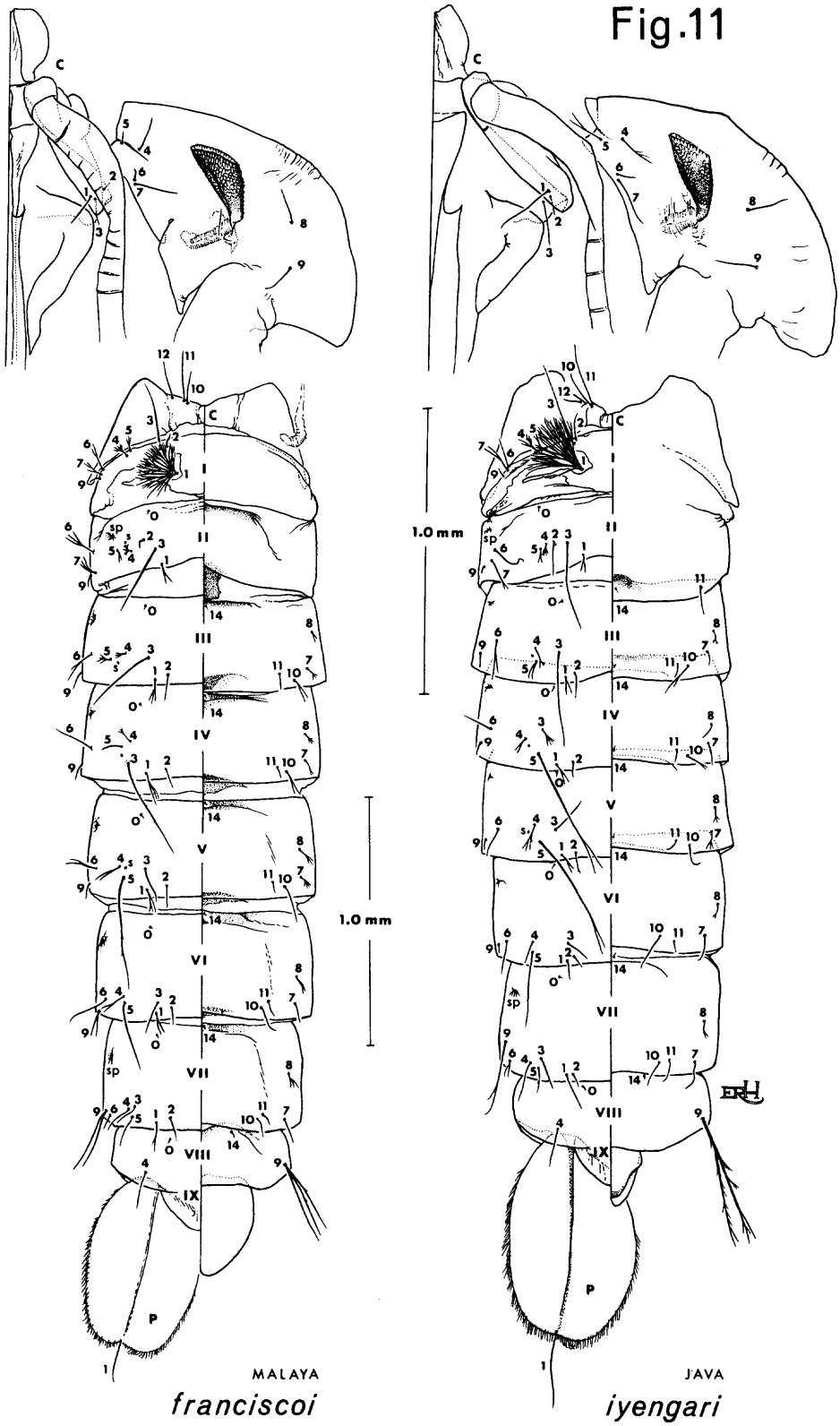
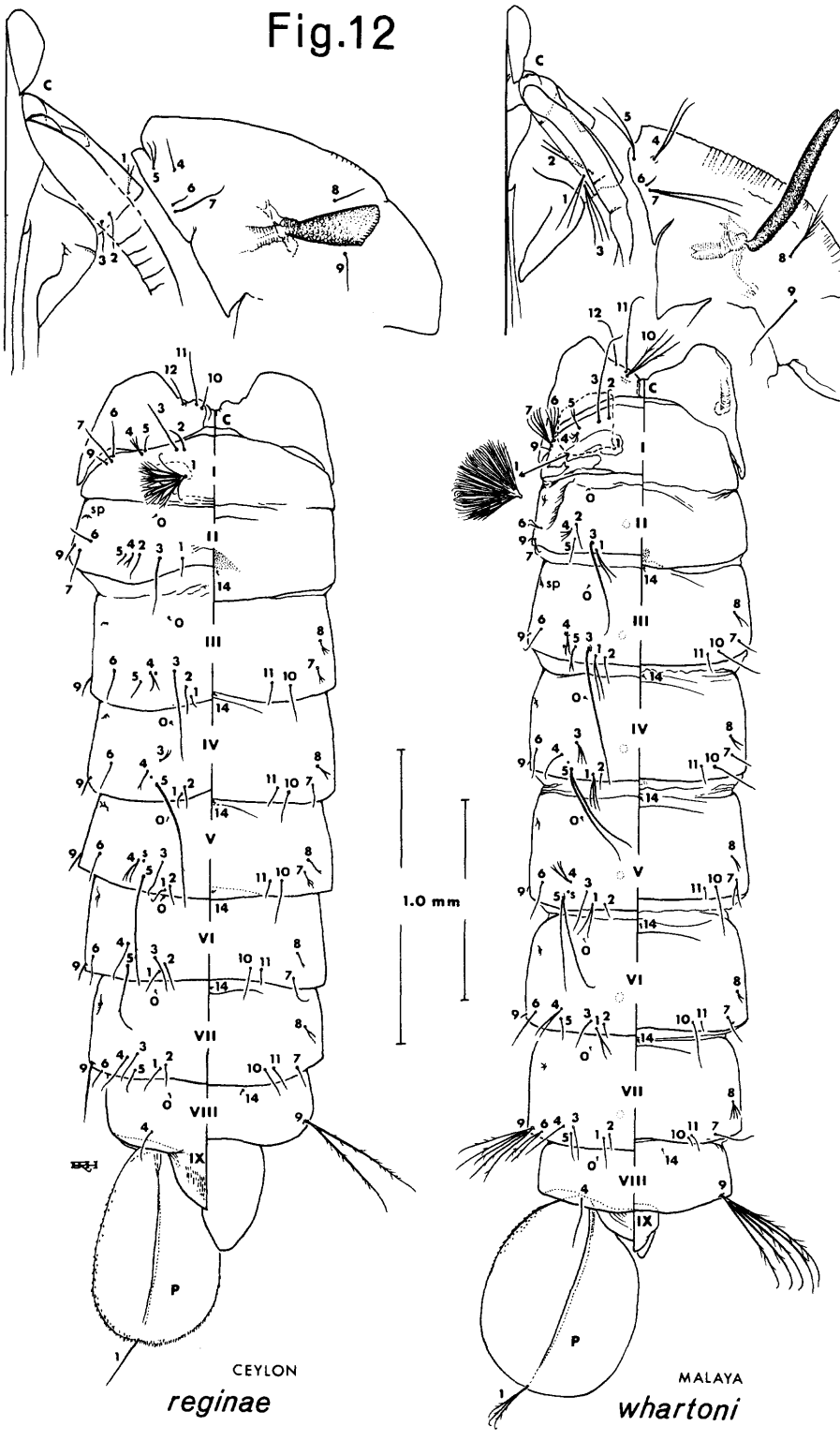


Fig.12



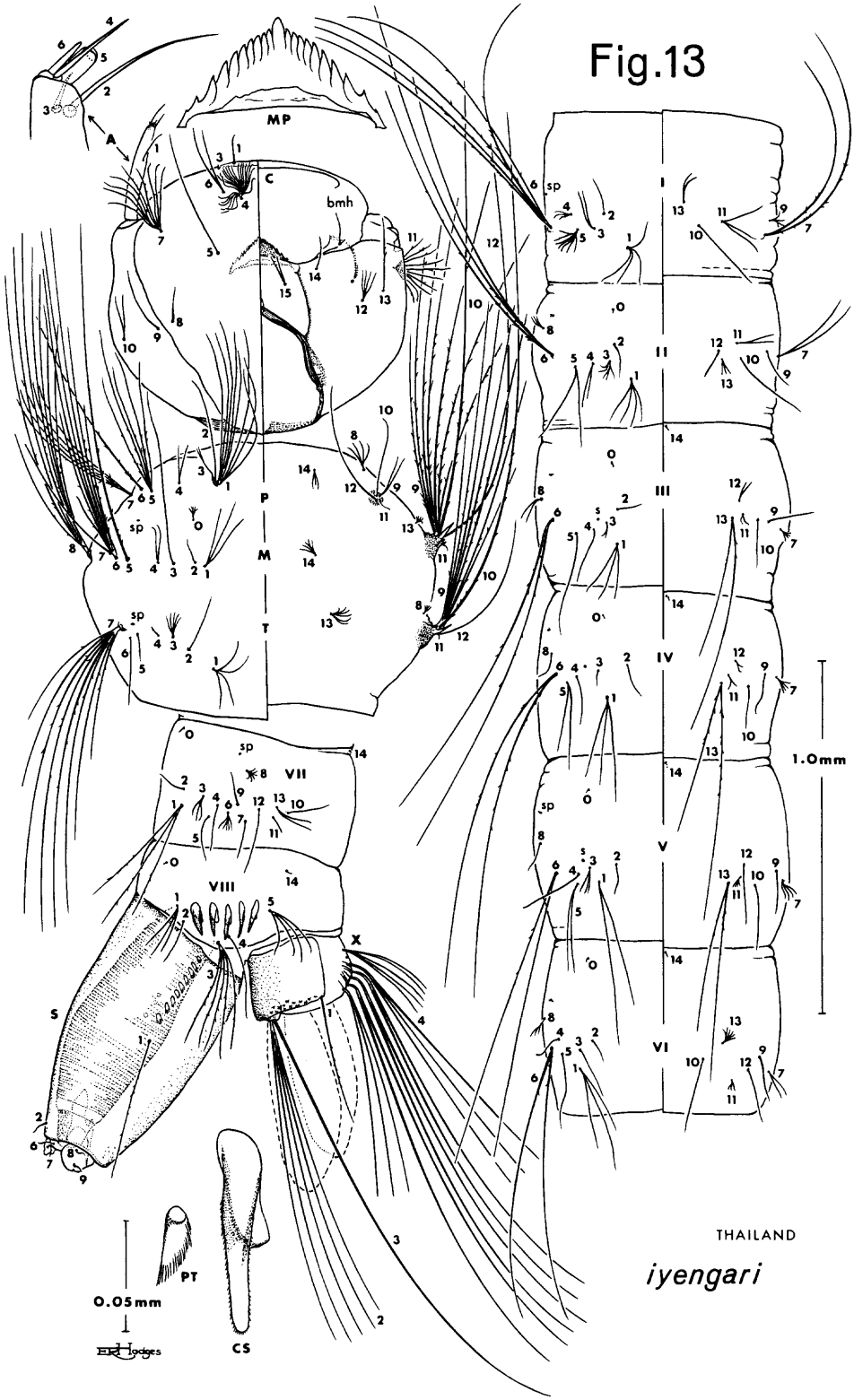


Fig.13
MP
C
bmh
P
M
T
sp
I
II
III
IV
V
VI
VII
VIII
X
S
PT
CS
1.0mm
0.05mm
THAILAND
iyengari

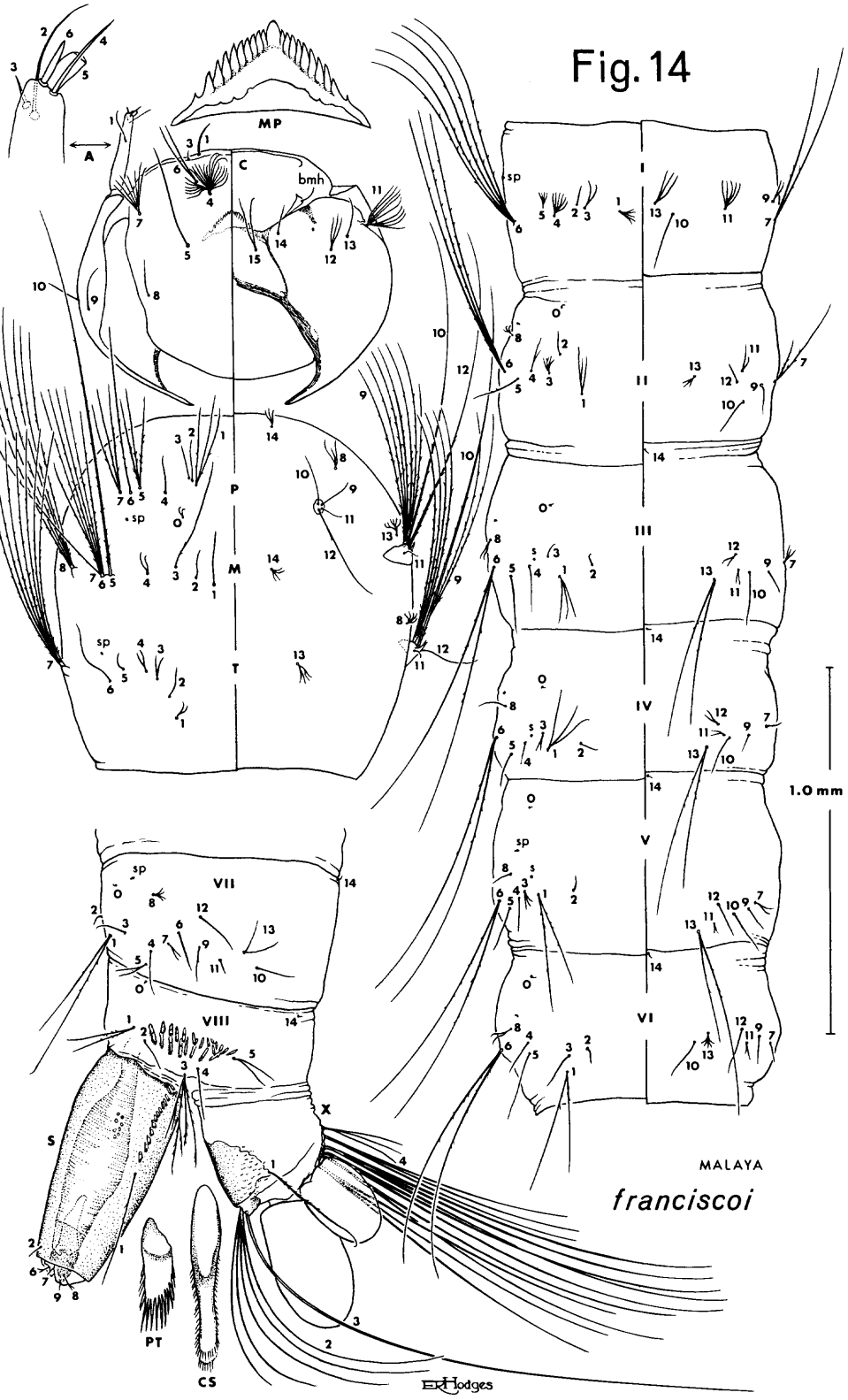


Fig. 14
MP
A
C
bmh
P
M
T
I
II
III
IV
V
VI
VII
VIII
X
S
PT
CS
sp
1.0 mm
MALAYA
franciscoi
Ed Hodges

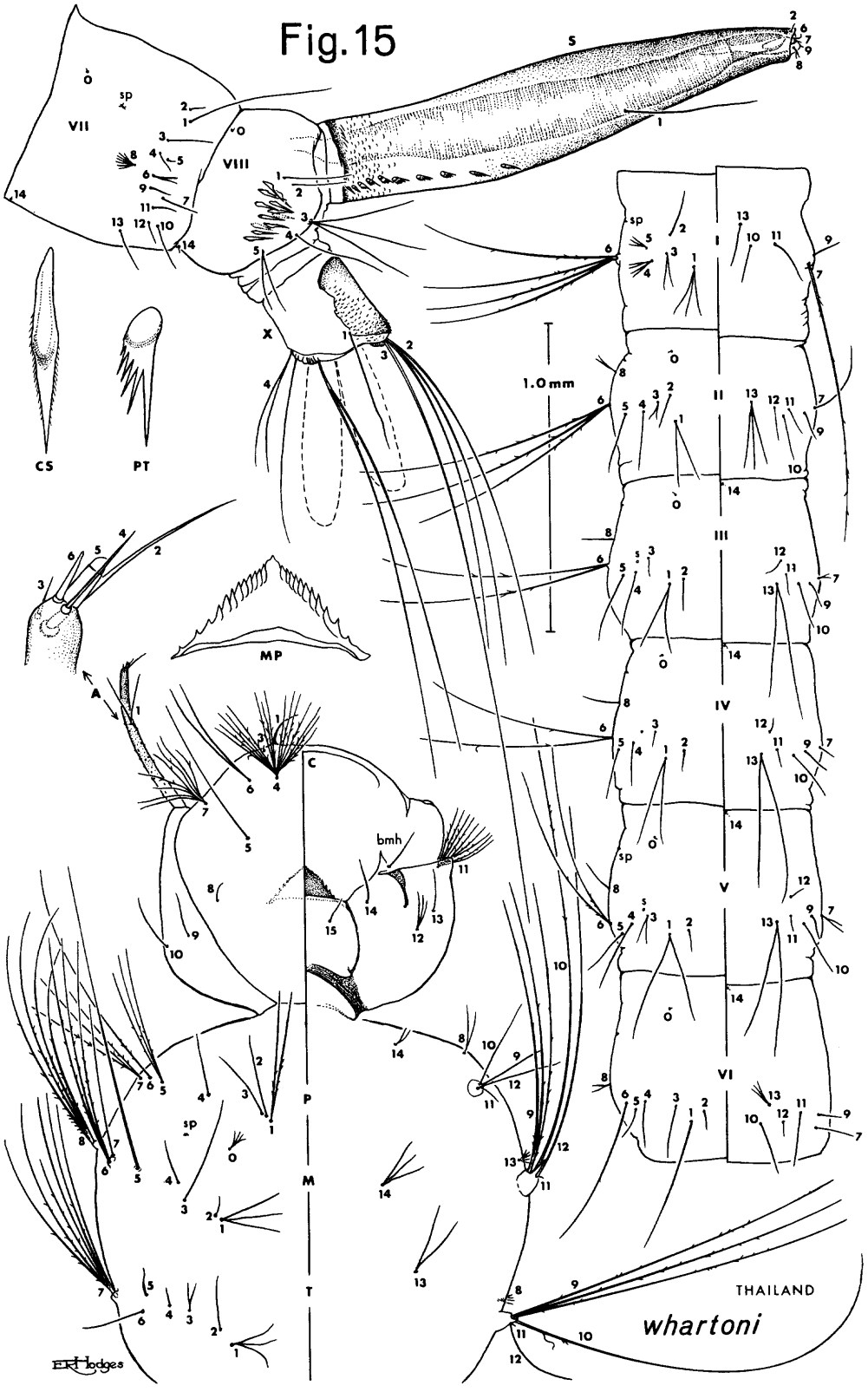


Fig.15
VII
VIII
X
S
CS
PT
MP
A
C
P
M
T
bmh
sp
1.0mm
I
II
III
IV
V
VI
THAILAND
whartoni
E.H.Hodges

INDEX

Valid names are set in roman type, synonyms are italicized. The italicized pages are those which begin the primary treatment of the taxon. Numbers in parenthesis refer to the figures illustrating the species in question.