

A New Species of *Aedes* (*Stegomyia*)
from Sri Lanka (Ceylon)
(Diptera: Culicidae)¹

Yiau-Min Huang
Medical Entomology Project
Smithsonian Institution
Washington, D. C. 20560

ABSTRACT. Both sexes, larva and pupa of *Aedes* (*Stegomyia*) *krombeini*, n. sp., from Sri Lanka are described and illustrated. Characters for separating the new species from closely allied ones are given.

A new species belonging to the *scutellaris* group of the genus *Aedes* subgenus *Stegomyia* was collected by Y.-M. Huang and E. L. Peyton from Sri Lanka. The *scutellaris* group is one of the most important groups of *Stegomyia* from the standpoint of transmission of human pathogens. In view of the medical importance of the subgenus *Stegomyia*, it has been considered desirable to describe the new species at this time. Since the biting habits and potential as a vector of human pathogens of this species are not known, it is hoped that this note will stimulate further investigations on this species.

The nomenclature for the chaetotaxy of the larva and pupa and the terminology of the structural parts of the adult as used in this paper largely follows that of Belkin (1962) with subsequent modification by this investigator.

Aedes (*Stegomyia*) *krombeini* n. sp.
(Figs. 1, 2, 3, 5)

This species is named for Dr. Karl V. Krombein, Senior Entomologist in the Department of Entomology, National Museum of Natural History, Washington, D. C. and Principal Investigator of the "Biosystematic Studies of the Insects of Ceylon" project, Smithsonian Institution, in recognition and appreciation of his contributions to our knowledge of the mosquito fauna of Sri Lanka.

¹This work was supported by Research Contract No. DAMD-17-74C-4086 from the U. S. Army Medical Research and Development Command, Office of the Surgeon General, Washington, D. C.

²Field work was sponsored by Smithsonian Research Grant SFG-0-6955. Smithsonian Institution, Washington, D. C. 20560.

MALE. *Head.* Proboscis dark scaled, sometimes with a few pale scales on the ventral side, longer than forefemur; palpus dark, slightly shorter than proboscis, with a white basal band on each of segments 2-5; those on segments 4, 5 incomplete dorsally; segments 4, 5 subequal, slender, upturned, and with only a few short setae; antenna plumose, shorter than proboscis; clypeus bare; torus covered with white scales except on dorsal side; decumbent scales of vertex all broad and flat; erect forked scales dark, not numerous, restricted to occiput; vertex with a median stripe of broad white scales, with broad dark ones on each side interrupted by a lateral stripe of broad white scales followed by a patch of white broad ones ventrally. *Thorax.* Scutum with narrow dark scales and a prominent median longitudinal stripe of similar white ones, median stripe from anterior margin, narrows slightly posteriorly and reaches to the beginning of the prescutellar space; prescutellar white line present, or at least with some narrow yellowish or white scales; posterior dorsocentral white line present, or sometimes with a few narrow yellowish or pale scales; supraalar line of broad white scales present; acrostichal bristles absent; dorsocentral bristles present; scutellum with broad white scales on all lobes and with a few broad dark ones at apex of mid lobe; anterior pronotum with broad white scales; posterior pronotum with narrow dark scales on upper portion and with broad white scales on lower portion forming a white stripe rather than a white patch; paratergite with broad white scales; postspiracular area without scales; subspiracular area with or without white scales; patches of broad white scales on propleuron, and on the upper and lower portions of sternopleuron and mesepimeron; upper sternopleural scale patch reaches to anterior corner of sternopleuron; mesepimeral scale patches connected forming a V-shaped white scale patch, the open side of the V being directed backwards; lower mesepimeron without setae; metameron bare. *Wing.* With dark scales on all veins except for a minute basal spot of white scales on costa; first forked cell about 1.5 times as long as its stem. *Halter.* With dark scales. *Legs.* Coxae with patches of white scales; knee spots present on all femora; fore- and midfemora anteriorly dark; hindfemur anteriorly with a broad white longitudinal stripe which widens at the base and is separated from apical white scale patch; all tibiae anteriorly dark; fore- and midtarsi with basal white bands on tarsomeres 1, 2; hindtarsus with basal white bands on tarsomeres 1-4, the ratio of length of white band to the total length of tarsomere is 0.33, 0.33, 0.40 and 0.60; tarsomere 5 all white; fore- and midlegs with tarsal claws unequal, the larger one toothed, the smaller one simple; hindleg with tarsal claws equal, simple. *Abdomen.* Segment I with white scales on laterotergite; tergum II dark dorsally, with basal lateral white spots only; terga III, IV usually dark dorsally, with basal lateral white spots which are turned dorsomesally, sometimes tergum IV with a sub-basal median white spot as well; or sometimes tergum IV with incomplete sub-basal transverse white band which is connected to the lateral spots; terga V, VI usually with a complete sub-basal transverse white band (or occasionally interrupted with several dark mesad scales) which is connected to the lateral spots; sometimes terga V, VI dark dorsally, with basal lateral white spots which are turned dorsomesally; tergum VII with lateral white spots only; sternum VIII entirely covered with white scales. *Terminalia.* (Fig. 1) Basimere 3 times as long as wide, its scales restricted to dorso-lateral, lateral and ventral areas, with a patch of setae on the basomesal

area of dorsal surface, mesal surface membranous; claspette simple, with distal expanded part square in shape in lateral aspect (dissected claspette), sternal and tergal sides more or less parallel and apicosternal angle present, with 4 or 5 modified setae, set in a row on a slight prominence on apicosternal angle; distimere simple, elongate, as long as basimere, with a spiniform process and a few setae near apex; aedeagus with a distinct sclerotized lateral toothed plate on each side; paraproct without teeth; cercal setae absent; tergum IX with middle truncated and with lateral setose lobes.

FEMALE. Essentially as in the male, differing in the following respects: *Head*. Palpus 4-segmented, about 0.2 length of proboscis, with white scales on more than apical half. *Wing*. With first forked cell about twice as long as its stem. *Legs*. Fore- and midlegs with tarsal claws equal, simple. *Abdomen*. Terga II-IV dark dorsally, with basal lateral white spots which are turned dorsomesally; terga V-VII usually with a complete sub-basal transverse white band (or occasionally interrupted with several dark mesad scales) connected to the lateral spots; sometimes terga V, VI dark dorsally, with basal lateral white spots which are turned dorsomesally, tergum VII with complete sub-basal transverse white band (or occasionally interrupted with several dark mesad scales) which is connected to the lateral spots; or sometimes terga V-VII dark dorsally, with basal lateral white spots which are turned dorsomesally; segment VIII completely retracted. *Terminalia*. (Fig. 3) Sternum VIII with a deep U-shaped notch at middle and with conspicuous rounded lateral lobes; insula longer than broad, with minute setae and with 4-6 larger ones on apical 0.4-0.5; tergum IX with well developed lateral lobes, each with 4 or 5 setae; postgenital plate with a shallow notch; cerci short and broad; 3 spermathecae, one larger than the other 2.

PUPA. (Fig. 1) *Cephalothorax*. Trumpet about 4 times as long as wide at the middle; setae 1, 3-C single, longer than 2-C; 2-C usually single (1-2); 4-C usually single (1-3); 5-C usually double (1-4); 6-C single, much stouter and slightly shorter than 7-C; 7-C usually double (1-2); 8-C usually with 4-7 branches (2-9); 9-C single, long; 10-C usually with 3-6 branches (2-8), mesad and caudad of 11-C; 11-C single, stout; 12-C usually single (1-2). *Abdomen*. Seta 1-I well developed, with more than 10 branches, dendritic; 2-I single; 3-I single, long; 2, 3-I not widely separated, distance between them as distance between 4, 5-I; 1-II usually with 9-15 branches (6-18); 1-III usually with 2-3 branches (1-11); 1-IV usually double (1-3); 2-IV, V mesad of 1-IV, V; 3-II, III single, shorter than segment III; 5-IV-VI single, usually not reaching beyond posterior margin of following segment; 9-I-V small, single, simple; 9-VI, VII usually single, simple, much stouter and longer than preceding ones; sometimes 9-VII single or split at tip; 9-VIII usually with a main stem (1-2) and lateral branches of varying length. *Paddle*. Margins with fringe; seta 1-P single; male genital lobe long and broad, longer than wide.

LARVA. (Fig. 2) *Head*. Antenna 0.5 length of head, without spicules; 1-A inserted near middle of shaft; inner mouth brushes pectinate at tip; seta 4-C well developed, branched, closer to 6-C than 5-C, cephalad and mesad of

6-C; 5-C single, long; 6-C single, stout; 8, 9, 10, 13-C single; 7-C usually double; 11-C usually 3-branched (3-5); 12-C usually double (2-3); 14, 15-C with 2-3 branches; mentum with 11-12 teeth on each side. *Thorax*. Seta 1-P usually 3-branched (2-3); 2-P single; 3-P double; 4-P usually 2-branched (2-3); 5, 6-P single; 7-P double; 9-P usually single; 11-P usually single (1-2); 14-P double; 5, 7-M single; 6-M with 3-4 branches; 8-M with 4-6 branches; 9-M usually 3-branched (2-3); 10, 12-M single, long, stout; 11-M single, small; 7-T usually 5-branched (4-7); 9-T usually 2-branched (2-3); 10, 11-T similar to those on mesothorax; 12-T much reduced. *Abdomen*. Seta 6-I usually 3-branched (2-3); 7-I usually single (1-2); 6-II usually 2-branched (2-3); 7-II usually double (2-3); 6-III-V double; 6-VI single; 1-VII usually 2-branched (2-3), long; 2-VII usually single (1-2); 2-VIII distant from 1-VIII; 1, 5-VIII with 3-4 branches; 3-VIII with 4-8 branches; 2, 4-VIII single; comb of 10 (8-12) scales in a single row, each scale with fine denticles or fringes at the base of the apical spine; sometimes a few (2-6) comb scales connected at base; siphon about 2.5 times as long as wide, acus absent; pecten teeth 10-19 in number, evenly spaced, each tooth with 1-3 basal denticles; 1-S with 3-5 branches, inserted beyond last tooth and usually before the middle of the siphon; saddle incomplete; marginal spicules very small and inconspicuous; 1-X usually 2-branched (2-3); 2-X usually 2-branched (1-2); 3-X single; ventral brush with 4 pairs of setae on grid, each seta single except 4d-X usually double (1-2), sometimes 4c, d-X double; no precratal tufts; anal papillae about 2.5 times as long as saddle, sausage-like.

TYPE-DATA. Holotype male (14-14) with associated larval and pupal skins and terminalia slide (75/386), Udawattekele, Kandy District, Central Province, SRI LANKA, collected as a larva in a large tree hole, 2 m above ground level, partially shaded, in a secondary rain forest located in mountainous terrain, altitude 600 m, VI-22-1975. Deposited in the U. S. National Museum (USNM). Allotype female (14-22) with associated larval and pupal skins, all with same data as holotype. Deposited in the USNM. Paratypes: 30 males, 15 females as follows: 13 males (14-1, 3, 4, 5, 7, 9, 10, 11, 12, 16, 19, 26, 27) with associated larval and pupal skins and terminalia slides (75/379, 75/380, 75/381, 75/382, 75/365, 75/383, 75/384, 75/385, 75/366, 75/387, 75/388, 75/367, 75/368), 2 females (14-2, 8) with associated larval and pupal skins and terminalia slides (75/369, 75/370), 1 male (14-25), 8 females (14-13, 15, 18, 21, 23, 24, 28, 29) with associated larval and pupal skins, all with same data as holotype; 1 male (14-100) with associated pupal skin and terminalia slide (75/342), 15 males (14-101, 103, 105, 106, 108, 109, 110, 111, 112, 114, 116, 117, 119, 121, 122), 5 females (14-102, 104, 107, 113, 115) with associated pupal skins, collected as a pupa in a large tree hole, all with same data as holotype. Deposited in the USNM, Bernice P. Bishop Museum (BBM), British Museum (Natural History) (BMNH), and National Museums of Sri Lanka, Colombo.

DISTRIBUTION. 475 specimens examined: 110♂, 141♀, 38♂ terminalia, 11♀ terminalia, 116 individual rearings (59 l, 116 p).

SRI LANKA. Central Province: Kandy District - Udawattekele (VI-22-1975), 80♂, 81♀, 29♂ terminalia, 11♀ terminalia, 116 individual rearings (59 l, 116 p); (VI-25-1975), 2♂, 13♀; Wakarawatte (VI-23-1975), 2♂, 6♀, 2♂ terminalia; Peradeniya, Royal Botanic Gardens (VI-30-1975), 11♂, 19♀, 3♂ terminalia; Southern Province: Galle District - Kanneliya, Sinharaja Forest (VII-

13-1975), 4♂, 4♀, 2♂ terminalia; Western Province: Kalutara District - Morapitiya, Sinharaja Forest (VII-18-1975), 11♂, 18♀, 2♂ terminalia. All collections by Y.-M. Huang and E. L. Peyton.

TAXONOMIC DISCUSSION. *Aedes krombeini* is a member of the *scutellaris* subgroup, having the supraalar white line complete and well developed, with broad flat scales over wing root and toward the scutellum. The adult is very similar to *andrewsi* Edwards, an Indomalayan species of the *scutellaris* subgroup, especially when the abdomen has basal lateral white spots which are turned dorsomesally and lacks a complete white band. It can be recognized, however, in having the wing with a minute basal spot of white scales on the costa, the hindtarsus has basal white bands on tarsomeres 1-4, and the ratio of length of white band to total length of tarsomere is 0.33, 0.33, 0.40 and 0.60; in *andrewsi* the wing has no basal spot of white scales on the costa, the hindtarsus has basal white bands on tarsomeres 1-4, and the ratio of length of white band to total length of tarsomere is 0.20, 0.25, 0.33 and 0.50.

The male terminalia of *krombeini* are very similar to *andrewsi* and *scutellaris* (Walker), a Papuan species of the *scutellaris* subgroup, in having the claspette with the distal expanded part square in shape in lateral aspect (dissected claspette), sternal and tergal surfaces more or less parallel and apicosternal angle present. It can easily be distinguished from *andrewsi* by the absence of several distinctly long and stout setae on apicotergal area; in *andrewsi* (Fig. 4) the claspette has several distinctly longer and stouter setae on the apicotergal area. It can also easily be distinguished from *scutellaris* by having the claspette with apicosternal angle rather close to apicotergal angle, with 4 or 5 modified setae in a row on a slight prominence on apicosternal angle; in *scutellaris* (Fig. 4) the claspette has apicosternal angle well separated from apicotergal angle, with 5 or 6 modified setae, set on a prominence close to apicosternal angle area.

In Sri Lanka, *krombeini* is apparently a common species. It has probably been mistaken for *albopictus* (Skuse), which is also a common species in the area. The immature stages of *krombeini* are often found in association with *albopictus* in the field, increasing the likelihood for misidentification. The larva of *krombeini* can be distinguished from *albopictus* by having seta 1-VII usually with 2 (2-3) long branches; in *albopictus* seta 1-VII is usually 4-, sometimes 3-branched, and always much shorter and stronger. The pupa of *krombeini* has seta 6-C much stouter than 7-C and it is at least 0.75 the length of 7-C. The male genital lobe is long and broad, longer than wide. It can also be distinguished from *albopictus* which has seta 6-C usually about half the length of 7-C. The male genital lobe of *albopictus* is short and broad, about as long as wide.

Aedes albopictus (Fig. 5) is a member of the *albopictus* subgroup, having the supraalar white line not clearly defined, with only narrow scales over the wing root, and the abdominal tergal markings basal and not connected with the lateral markings; it can thus easily be distinguished from *krombeini*, (Fig. 5).

Aedes krombeini is an Oriental species of the *scutellaris* group, as defined by Huang (1972). It is known from only Sri Lanka.

REMARKS. *Aedes scutellaris* occurs in Ceram, Ambon, Aru Islands and New Guinea in the Papuan area. Carter (1950) reported *scutellaris* from Sri Lanka. It is probable, however, that the new species described here was misidentified by Carter as *scutellaris*. *Aedes scutellaris* apparently does not occur in Sri Lanka. No specimens of *scutellaris* were found among a very large amount of material examined by the author from many localities, nor is it present in the collections of the British Museum (Natural History) from Sri Lanka.

Mattingly (1954) described an unnamed *Aedes (Stegomyia)* sp. of the *scutellaris* group from a single male from the Maldive Islands. Due to the very poor condition of the specimen, the true identity of the Maldive Islands form can not be ascertained until more adequate material from this location is available.

BIOLOGY. The immature stages of *krombeini* have been collected mainly in tree holes, bamboo stumps, root holes and stump holes. They have also been found in a log hole, rock pool, bamboo internode, wheel rut, footprint and an artificial container. On 22 occasions the immature stages were associated with *albopictus* and twice with *Aedes (Stegomyia) mediopunctatus* (Theobald).

ACKNOWLEDGMENTS

I am grateful to Dr. Ronald A. Ward and Mr. E. L. Peyton for the helpful assistance in connection with this paper and for critical review of the manuscript. I also extend my thanks to Mr. Vichai Malikul for preparing the drawings.

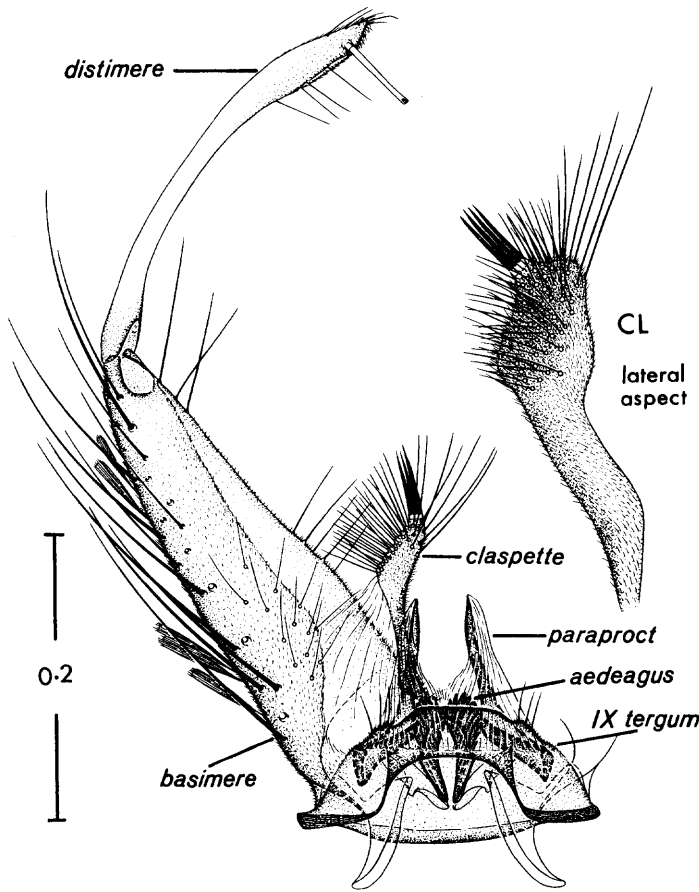
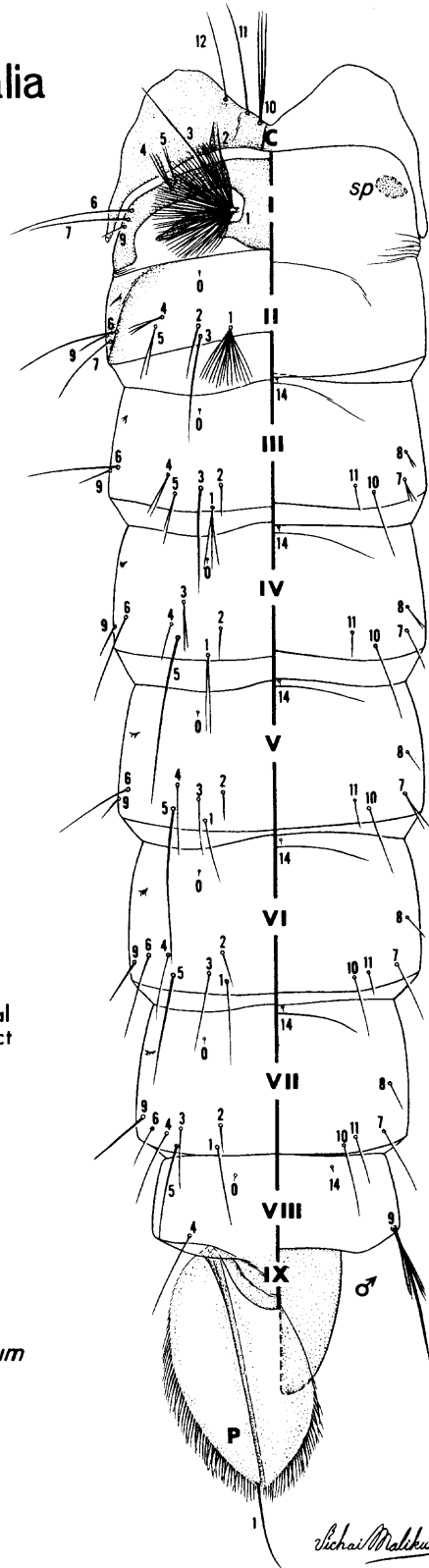
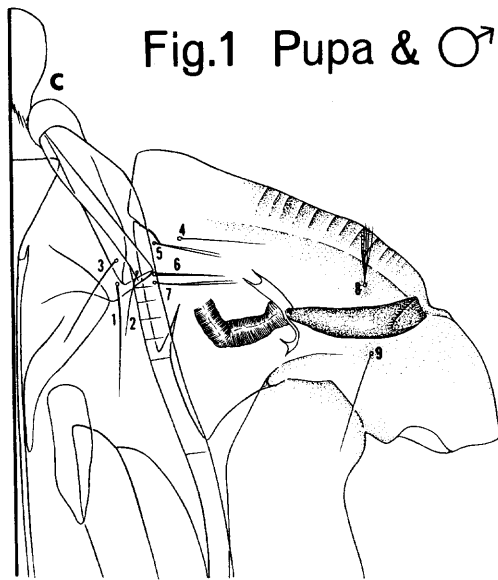
I also wish to express my gratitude to Dr. Karl V. Krombein, Department of Entomology, National Museum of Natural History, for his kindness, inviting me to participate in the Insects of Ceylon Project; to Dr. (Mrs.) W. T. T. P. Gunawardane, Assistant in Entomology, National Museums of Sri Lanka, Colombo, for her indispensable help and much kindness during the field work in Sri Lanka.

REFERENCES CITED

- Belkin, J. N. 1962. The mosquitoes of the South Pacific (Diptera, Culicidae). Univ. Calif. Press, Berkeley and Los Angeles, 2 vols., 608 and 412 pp.
- Carter, H. F. 1950. Ceylon mosquitoes: Lists of species and names of mosquitoes recorded from Ceylon. Ceylon J. Sci. (B) 24(2): 85-115.

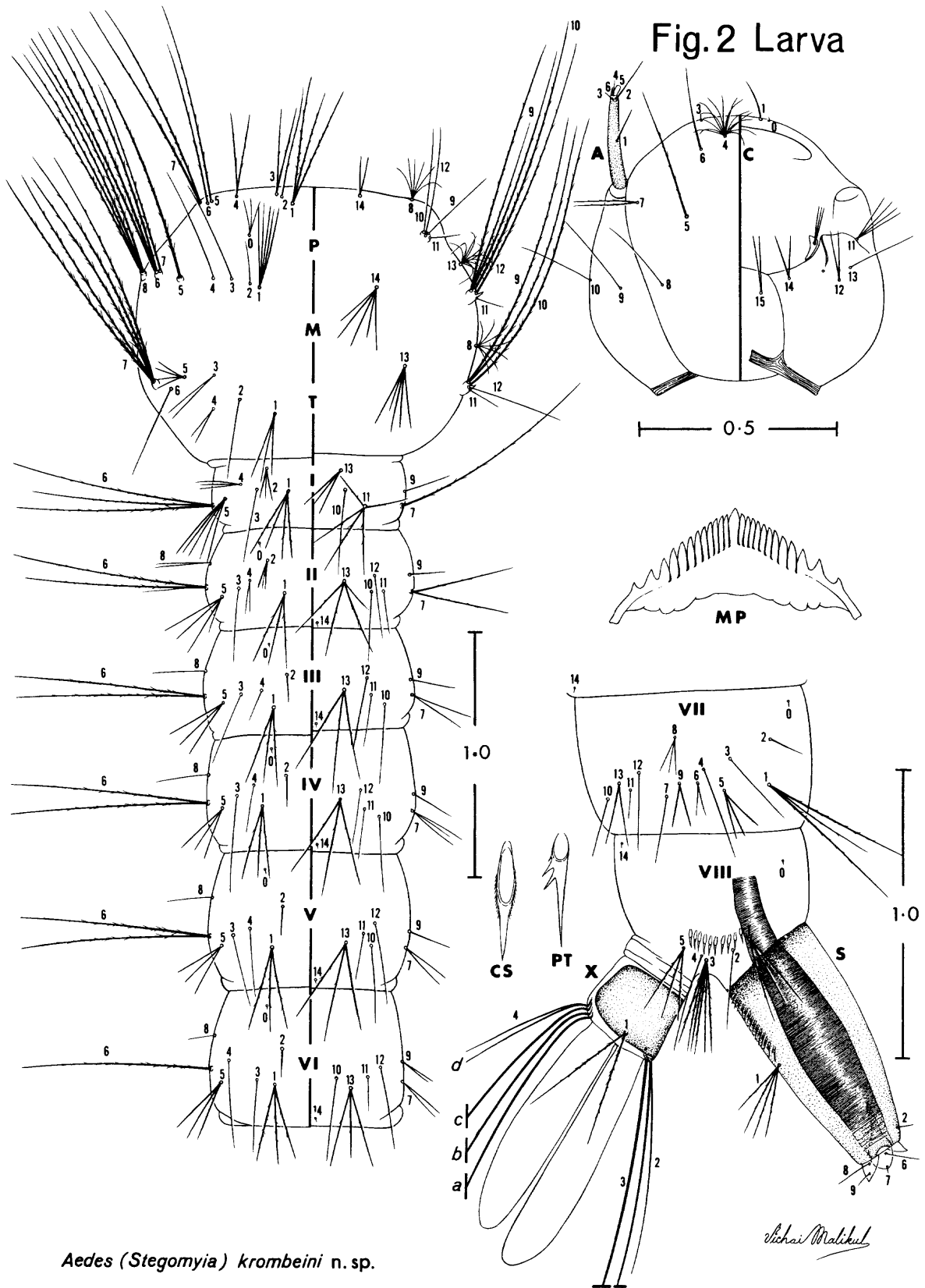
- Huang, Y.-M. 1972. Contributions to the mosquito fauna of Southeast Asia. XIV. The subgenus *Stegomyia* of *Aedes* in Southeast Asia. I. - The *scutellaris* group of species. Contr. Am. Entomol. Inst. (Ann Arbor) 9(1): 1-109.
- Mattingly, P. F. 1954. Notes on the subgenus *Stegomyia* (Diptera, Culicidae), with a description of a new species. Ann. Trop. Med. Parasit. 48(3): 259-70.

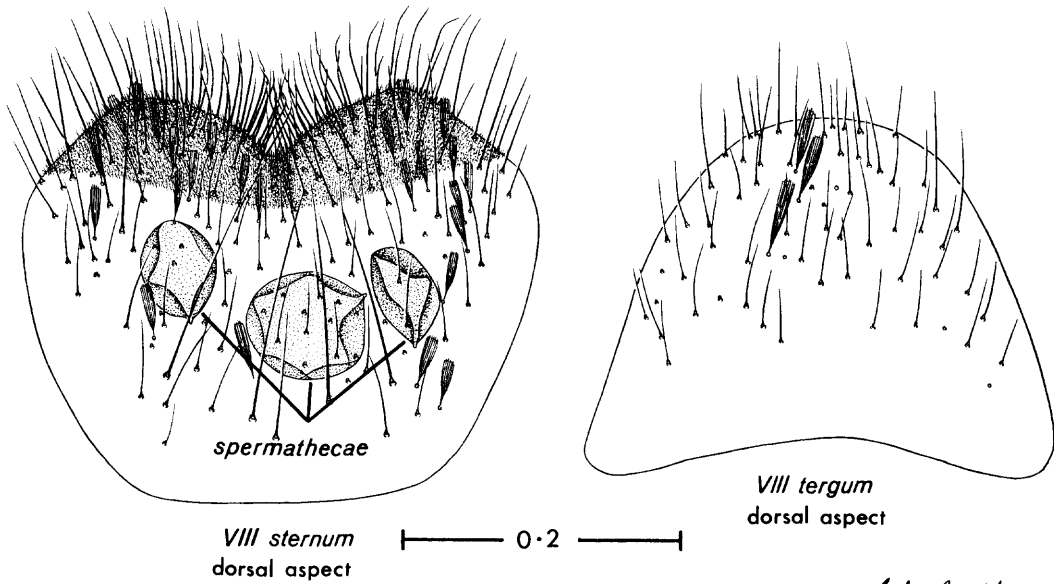
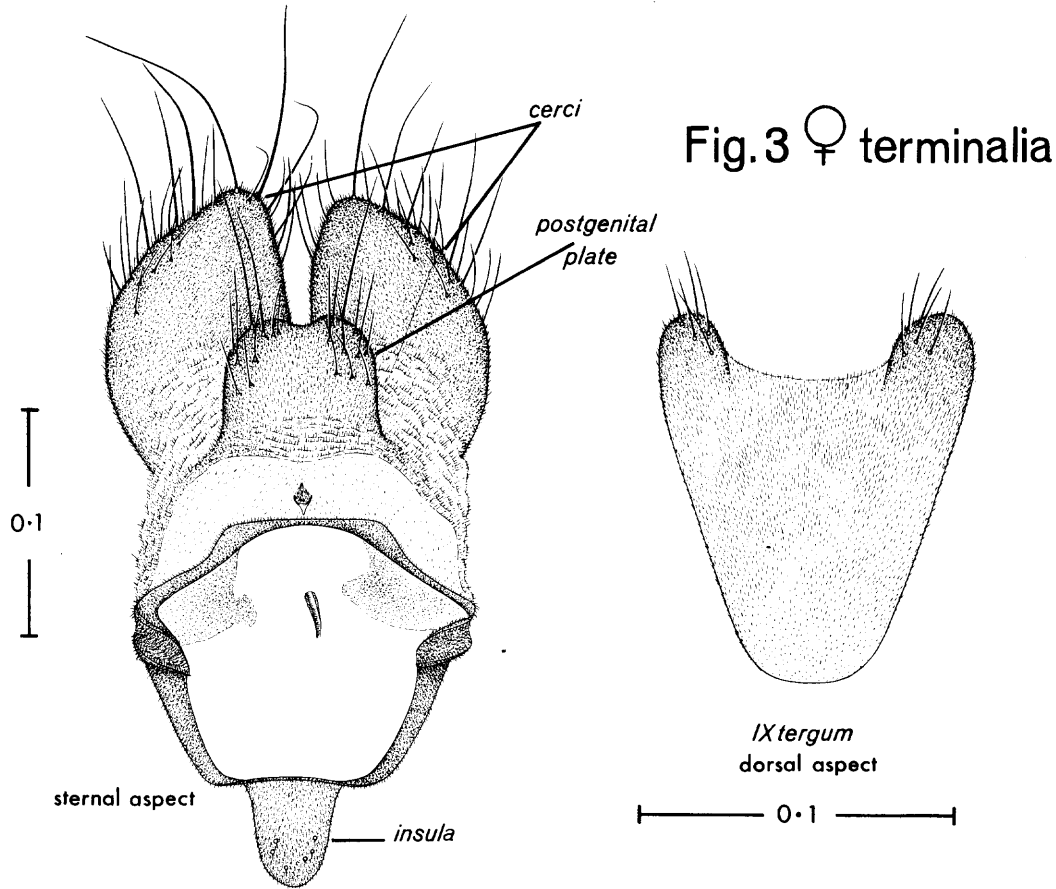
Fig.1 Pupa & ♂ terminalia



Aedes (Stegomyia) krombeini n.sp.

Sichai Malikul

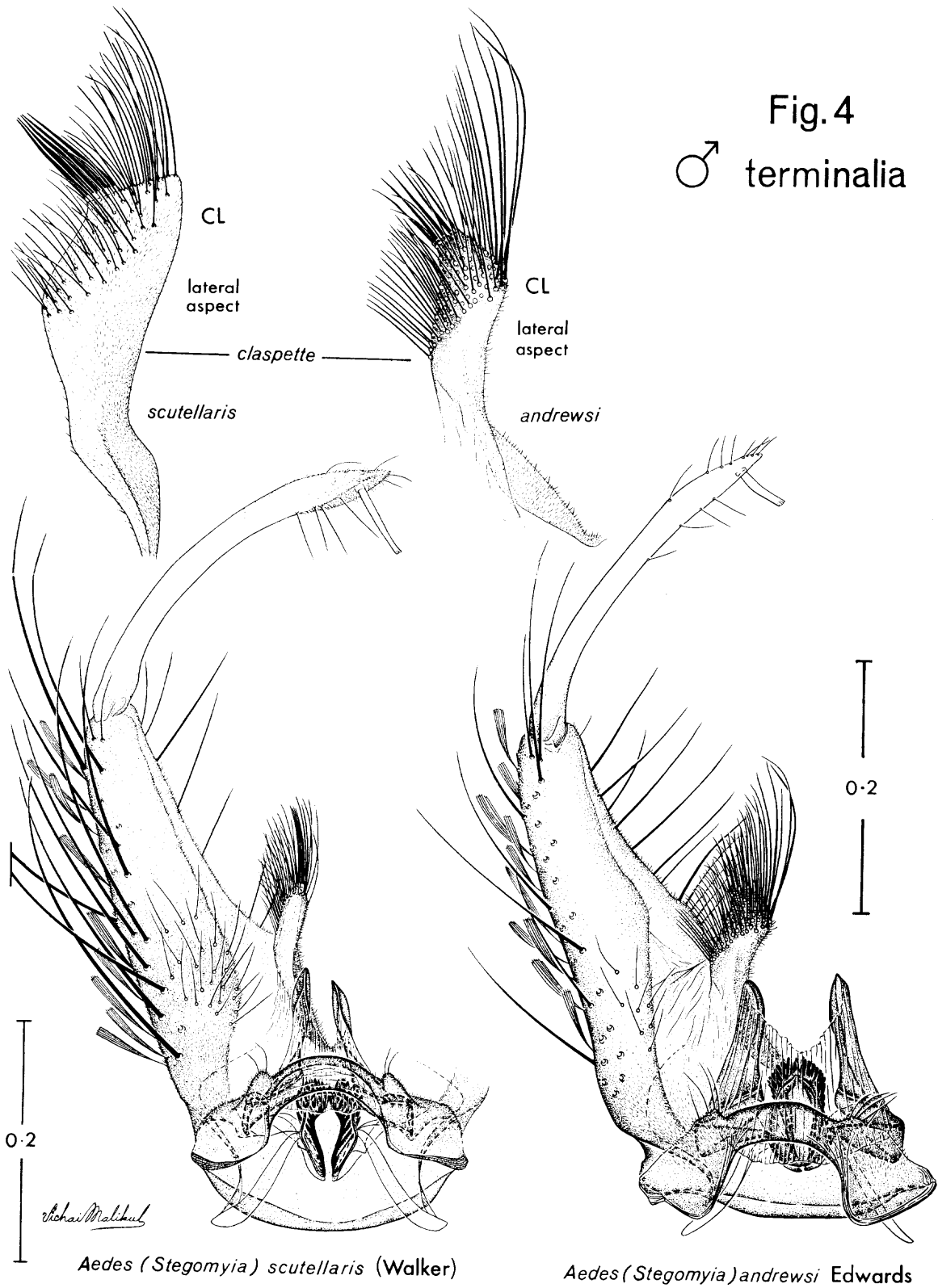




Aedes (Stegomyia) krombeini n.sp.

Sichai Malikul

Fig. 4
♂ terminalia



Aedes (Stegomyia) scutellaris (Walker)

Aedes (Stegomyia) andrewsi Edwards

Fig. 5

