

A Redescription of *Aedes (Stegomyia) pseudoscutellaris*
(Theobald) with a Note on the Taxonomic Status
of *Aedes (Stegomyia) polynesiensis* Marks
(Diptera: Culicidae)¹

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

ABSTRACT. Both sexes, larva and pupa of *Aedes (Stegomyia) pseudoscutellaris* (Theobald) from Suva, Viti Levu Island, Fiji Islands are redescribed and illustrated. Notes on *Aedes (Stegomyia) polynesiensis* Marks from the same location are included. Characters for separating *polynesiensis* from *pseudoscutellaris* are given. The taxonomic status of *polynesiensis* is discussed. Special attention is drawn to determine which of these species is the main vector of subperiodic filariasis in the Viti Levu Island of the Fiji group.

Recently, 2 closely related species of the *Aedes (Stegomyia) scutellaris* group were received from the Fiji Islands. One was *Aedes (Stegomyia) pseudoscutellaris* (Theobald) and the other was *Aedes (Stegomyia) polynesiensis* Marks. Both species were collected as females biting man and as males resting, landing, and swarming in the Suva area, Viti Levu Island, Fiji Islands, which is the type locality of *pseudoscutellaris*. Unfortunately, they are extremely similar and very difficult to separate.

The recent report by Rakai et al. (1970) on biting times of *polynesiensis* and *pseudoscutellaris* on Viti Levu, the main island in Fiji, indicated that both species were primarily day-time biters and the numbers of the 2 species caught were 827 for *polynesiensis* and 1,840 for *pseudoscutellaris*. However, no investigation on the transmission of filariasis was made to determine the relative importance of the 2 species as vectors of *Wuchereria bancrofti* on Viti Levu Island.

In view of this situation it has been considered desirable to describe the topotypic material of *pseudoscutellaris* and to give notes on all stages of *polynesiensis* from the same area, Suva, Fiji Islands. In addition, a special effort has been made to analyze and evaluate the characters of such a highly variable species as *pseudoscutellaris* and to compare it with *polynesiensis*. It is hoped that this note will not only help to clarify the situation and enable the entomologist, epidemiologist, ecologist and other field workers to recognize the 2 species but also will stimulate investigations on

1

This 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.

ecology, behavior and transmission of filariasis of these 2 species in the Fiji Islands. In order to facilitate such work diagnostic characters for separating *polynesiensis* from *pseudoscutellaris* are also given.

The nomenclature chosen 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 SEAMP personnel.

The following description is based primarily on specimens collected from Suva, Viti Levu I., Fiji Islands, the type locality of *pseudoscutellaris* collected by Dr. J. C. Hitchcock during November 1973. Material Examined: 2 syntypes (2 females), in BMNH, (Suva, Fiji, F. Jepson). 234 adults (106 males, 128 females), 276 larvae, 241 pupae, 229 adults from individual rearings, 30 male terminalia slides, 8 female terminalia slides (Muanikau Hill, Suva, Viti Levu I., Fiji Islands, November 1973, J. C. Hitchcock).

Aedes (Stegomyia) pseudoscutellaris Theobald)

(Figs. 1, 2, 3, 6).

Stegomyia pseudoscutellaris Theobald, 1910: 156 (♀*). Type locality: Suva, (Viti Levu), Fiji Islands.

MALE. *Head*. Proboscis dark scaled, sometimes with a few pale scales on the ventral side, longer than forefemur; palpus dark, 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 hairs; 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 line not developed, sometimes with a few narrow white scales only; posterior dorsocentral white line present, or at least with some narrow golden or white scales; supraalar line of broad white scales present; lateral prescutal white line present, or at least with some narrow white scales on scutal angle area; 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 instead of a white patch; paratergite with broad white scales; postspiracular area without scales; subspiracular area without scales; patches of broad white scales on propleuron, on the upper and lower portions of

sternopleuron and on the upper and lower portions of mesepimeron; upper sternopleural scale patch reaches to anterior corner of sternopleuron; lower mesepimeral scale patch of medium size and separated from upper mesepimeral scale patch, or sometimes narrowly connected; lower mesepimeron without bristles; 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 rather narrow median white longitudinal stripe which widens at basal 0.25 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 0.25, 0.33, 0.4 - 0.5 and 0.60 - 0.67; 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 scales on laterotergite; tergum II with basal lateral white spots; terga III - VI with basal lateral white spots which are turned dorsomesally; tergum VII with lateral white spots; sternum VIII largely covered with white scales. *Terminalia*. Basimere long, 3.8 times as long as wide, its scales restricted to dorsolateral, lateral and ventral areas, with a patch of hairs on the basomesal area of dorsal surface, mesal surface membranous; claspette simple, long and slender, reaching to 0.6 of basimere, with 4 - 5 distinctly flattened sharply pointed modified setae in a row on apical 0.2 - 0.25 of sternal side, lateral surface with hairs extending basad to about 0.5 of the entire claspette length, apex tergally with setae about 0.66 - 0.75 as long as entire claspette length; distimere simple, elongate, as long as basimere, slightly swollen near tip, with a spiniform process and a few hairs 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 a hairy lobe on each side.

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 apical half or more. *Wing*. With first forked cell about 2 times as long as its stem. *Legs*. Fore- and midlegs with tarsal claws equal, simple. *Abdomen*. Terga II - VII with basal lateral white spots which are turned dorsomesally; segment VIII completely retracted. *Terminalia*. 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 6 larger ones on apical 0.4; tergum IX with well-developed lateral lobes, each with 6 (4 - 7) setae; postgenital plate with a shallow notch; cerci short and broad; 3 spermathecae, one larger than the other 2.

PUPA. *Cephalothorax*. Trumpet about 3.6 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 - 2); 5-C usually double (1 - 2); 6-C single, stouter and shorter than 7-C; 7-C usually double (1 - 2); 8-C with 2-4 branches; 9-C single, long; 10-C usually 2-branched (2 - 4), mesad and caudad of 11-C; 11-C single, stout; 12-C single. *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; I-II usually with 5 (3 - 10) branches, usually primarily branched; 1-III usually double (1 - 3); 1-IV usually single (1 - 2); 2-IV, V mesad of 1-IV, V; 3-II, III single, shorter than segment III; 5-IV-VI single; 5-IV, V usually reaching beyond posterior margin of following segment; 9-I-V small, single, simple; 9-VI, VII usually single (1 - 2), simple, much stouter and longer than preceding ones; 9-VIII usually with 2 main stems (2 - 5) and lateral branches of varying length. *Paddle*. Margins with fringe; seta 1-P single.

LARVA. *Head*. Antenna 0.5 length of head, without spicules; 1-A inserted near middle of shaft, single; 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, 13-C single; 7-C with 2 - 4 branches; 10-C usually double; 11-C usually 3-branched (3 - 5); 12-C usually double (1 - 3); 14, 15-C with 2 - 3 branches; mentum with 10 - 11 teeth on each side. *Thorax*. Seta 1-P usually 3-branched (2 - 4); 2-P single; 3-P usually double (2 - 3); 4-P 2-branched; 5-P usually single (1 - 2); 6-P single; 7-P usually double (2 - 3); 9-P usually single (1 - 3); 11-P usually single (1 - 2); 14-P usually double (2 - 3); 5-M usually single (1 - 2); 6-M with 3 - 4 branches; 7-M single; 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 6-branched (4 - 8); 9-T usually 3-branched (2 - 3); 10, 11-T similar to those on mesothorax; 12-T much reduced. *Abdomen*. Seta 6-I usually 4-branched (3 - 4); 7-I usually single (1 - 2); 6-II usually 3-branched (3 - 4); 7-II usually double (2 - 3); 6-III-V double; 6-VI usually single (1 - 2); 1-VII usually 3-branched (3 - 4); 2-VII usually double (1 - 2); 2-VIII distant from 1-VIII; 1, 5-VIII with 3 - 5 branches; 3-VIII with 3 - 6 branches; 2, 4-VIII single; comb of 10 (8 - 12) scales in a single row, each scale with fine denticles at the base of the apical spine; comb scales sometimes with apical spine split at tip; siphon short, about 2.2 times as long as wide, acus absent; pecten teeth 11 (8 - 16) in number, evenly spaced, each tooth with 3 - 4 basal denticles; 1-S with 4 - 5 branches, inserted beyond last tooth and beyond the middle of the siphon; saddle complete; marginal spicules very small and inconspicuous; 1-X usually 2-branched (2 - 3); 2-X usually 2-branched (1 - 2), rarely 3-branched; 3-X single; ventral brush with 4 pairs of setae on grid, 4a, b-X single; 4c, d-X usually double, rarely 3-branched; no precratal tufts; anal papillae long, about 4 times as long as saddle, sausage-like.

TYPE DATA. *Stegomyia pseudoscutellaris* Theobald, lectotype female (selected by J. N. Belkin, 1962) in British Museum (Natural History) (BMNH) type locality: Suva, Fiji (F. Jepson). Syntype: 1 female, with same data as lectotype, in BMNH.

DISTRIBUTION. This species is presently known only from the Fiji Islands.

TAXONOMIC DISCUSSION. *Aedes pseudoscutellaris*, a member of the *scutellaris* subgroup, is extremely similar to other members of the subgroup. However, the male terminalia of *pseudoscutellaris*, having the claspette simple,

slender, with 4 - 5 distinctly flattened sharply pointed modified setae in a row on apical 0.20 - 0.25 of the sternal side and lateral surface with hairs extending basad to about 0.5 of the entire claspette length, are different from all other known species.

BIONOMICS. The immature stages of *pseudoscutellaris* have been collected in tree holes, gallon drums and cut bamboos on Viti Levu Island. Adult females have been taken biting man and males have been taken resting, landing and swarming on Viti Levu Island.

The above topotypic material was reared from larvae or pupae which were collected from tree holes and reared from eggs which were obtained from wild caught females.

A comparison of the morphological features of the 2 species from Suva, Viti Levu I., Fiji Islands is summarized in Table 1.

MATERIAL. The following summarizes the specimens of the 2 species from Muanikau Hill, Suva, Viti Levu I., Fiji: 14 batches of eggs from 14 mothers (12 of them are collection number (#) 188 and 2 are #214) which were taken biting man in Muanikau Hill were hatched and progeny rearings carried out at the MEP laboratory. The material obtained from the progeny rearings is as follows. (A = #188; C = #214; l & p = larval and pupal skins; L = whole 4th instar larva):

Rearing no.	No. of		No. of slides		Species
	pinned	specimens	l & p	L	
S.P. XV-A-(2)	8	15	23	-	<i>pseudoscutellaris</i>
A-(6)	15	15	31	22	"
A-(7)	6	8	18	1	"
A-(9)	3	3	13	7	<i>polynesiensis</i>
A-(10)	4	3	11	27	"
A-(13)	5	7	13	8	"
A-(14)	1	1	2	4	"
A-(17)	4	6	10	-	<i>pseudoscutellaris</i>
A-(19)	14	8	24	-	"
A-(20)	5	17	22	1	"
A-(21)	3	14	17	-	"
A-(24)	7	14	21	-	"
S.P. XV-C-(1)	5	7	12	13	"
C-(2)	20	13	33	17	"

Fifteen adults were received from the same area as follows: #188, 5♀ *polynesiensis* and 2♀ *pseudoscutellaris*; #214, 3♂ *polynesiensis* and 4♂, 1♀ *pseudoscutellaris*.

Twenty five adults (15♂, 10♀) of individual rearings which were reared from larvae or pupae collected from tree hole (#202) and 69 whole 4th instar larvae from several tree holes from Muanikau Hill were examined as follows: #202, 15♂, 10♀, 11 l, 30 p, 30 L; #203, 20 L; #205, 11 L; #206, 5 L; #207, 3 L. These are all *pseudoscutellaris*.

In addition, I have also examined additional specimens of *Aedes pseudo-scutellaris* from other areas on Viti Levu Island, Fiji as follows: Colo-i-Suva: #191, 7 L, tree hole; # 192, 6♂, 2♀, 10 l&p, 19 L, gallon drum; #193, 1♀, resting; #194, 2 L, 44 gallon drum; #196, 1♂, resting. Naqali: #197, 2 l&p, 33 L, cut bamboo; #198, 6♂, 4♀, 2 l&p, 9 p, 5 L, cut bamboo; #199, 5♂, 2♀, 9 l&p, 3 p, 10 L, cut bamboo; #200, 1♂, landing. Wakanisila: #208, 1♂, swarming; #209, 11 L, tree hole; #211, 8♂, swarming; #212, 1 L, (hairy form¹), tree hole; #213, 1♂, 2 L, (hairy form), tree hole.

DISCUSSION. *Aedes polynesiensis* Marks is a South Pacific taxon, widely distributed throughout the area. It is one of the most important vectors of subperiodic filariasis in the South Pacific. Marks (1951) described *polynesiensis* as a distinct species which had previously been confused with *Aedes pseudoscutellaris*. Woodhill (1954) and Rozeboom and Gilford (1954) proposed that *polynesiensis* be considered as a subspecies of *pseudoscutellaris*, as the result of experiments in crossing *polynesiensis* from Tahiti and Samoa, respectively, with *pseudoscutellaris* from Fiji. They demonstrated that under laboratory conditions small numbers of fertile hybrids are produced using either species as the female parent. Belkin (1962) recognized *polynesiensis* as a full species based on his impression that *polynesiensis* behaves in nature as a perfectly distinct species. However, he indicated that the taxonomic status of *polynesiensis* was open to question.

Based on the evidence of collecting *polynesiensis* with *pseudoscutellaris* from the same area, Muanikau Hill, Suva, and finding no naturally occurring hybrids (intermediates between *polynesiensis* and *pseudoscutellaris*), I believe that *polynesiensis* and *pseudoscutellaris* are specifically distinct. These 2 species are able to coexist in intimate association and yet remain reproductively isolated. Detailed comparative studies on the ecology and behaviour of the 2 species on Muanikau Hill, will be necessary in order to understand the mechanisms which keep the 2 species distinct.

1

In the South Pacific, members of the *pseudoscutellaris* complex have 2 strikingly different types of larvae: (1) the normal, "nonhairy" larva, with relative poor development of the setae of the head, thorax and abdomen, and (2) the "hairy" larva, with stronger development and branching of the setae (5, 7, 11, 14-C; 3, 8-P; 1, 13, 14-M; 1, 4, 8, 13-T; and 1, 2, 5, 13-I-VII, 11-I, 9-II-VII, 7-II-V) of the head, thorax and abdomen, usually stronger pigmentation and spiculation of the siphon and anal saddle. "Hairy" larvae are usually associated with the tree hole habitat.

TABLE 1. Comparison of two *Aedes* (*Stegomyia*) species from Suva, Fiji Islands.

	<i>A. polynesiensis</i>	<i>A. pseudoscutellaris</i>
Adult (male and female)	Posterior dorsocentral line usually not present, sometimes with a few narrow golden yellowish scales; lateral prescutal line not present; hindfemur anteriorly with a broad white longitudinal stripe which widens at basal 0.33 - 0.50. (Fig.6).	Posterior dorsocentral white line present, or at least with some narrow golden or white scales; lateral prescutal white line present, or at least with some narrow white scales on scutal angle area; hindfemur anteriorly with a rather narrow median white longitudinal stripe which widens at basal 0.25. (Fig.6).
Male termin- alia	Claspette simple, without any modified setae on sternal side and sternal surface with hairs on about apical 0.5 of the entire claspette length (best seen from sternal view of the dissected claspette). (Fig. 4).	Claspette simple, with 4 - 5 distinctly flattened sharply pointed modified setae in a row on apical 0.20 - 0.25 of sternal side and lateral surface with hairs extending basad to about 0.5 of the entire claspette length (best seen from lateral view of the dissected claspette). (Fig. 1).
Pupa	Abdominal seta 1-II usually with 6 (3 - 13) branches, usually secondary branched, when 3 - 4 branched then usually primarily branched; 9-VI, VII usually single, stouted and barbed, or forked at tip. (Fig. 4).	Seta 1-II usually with 5 (3 - 10) branches, usually primarily branched; 9-VI, VII usually single (1 - 2), simple. (Fig.1).
Larva	Abdominal seta 1-VII usually with 2 branches (2 - 3), when 3-branched then one usually much smaller than the other two; hair 2-X usually 3-branched, rarely 2-branched; ventral brush setae 4a, b-X double; 4c-X usually with 2 - 3 branches; 4d-X usually with 3 - 4 branches. (Fig. 5).	Seta 1-VII usually 3-branched (3 - 4); 2-X usually 2-branched (1 - 2), rarely 3-branched; ventral brush setae 4a, b-X single; 4c, d-X usually double, rarely 3-branched. (Fig. 2).

Both *polynesiensis* and *pseudoscutellaris* belong to the *scutellaris* subgroup, a complex of closely related and very similar mosquitoes, and are highly variable in both adult ornamentation and in the immature stages. However, certain characters are constant and unique and can be used to distinguish one from the other. In Muanikau Hill, females of *polynesiensis* have often been taken in association with those of *pseudoscutellaris* biting man in the field. Thus great care must be taken in identifying them. The most reliable diagnostic characters for separating *polynesiensis* from *pseudoscutellaris* occur in the adult and larval stages. These have been previously given in Table 1.

It is strongly recommended that future investigations on the transmission of filariasis should be carried out to determine the relative importance of each of these species as a vector of subperiodic filariasis in the various Fiji Islands.

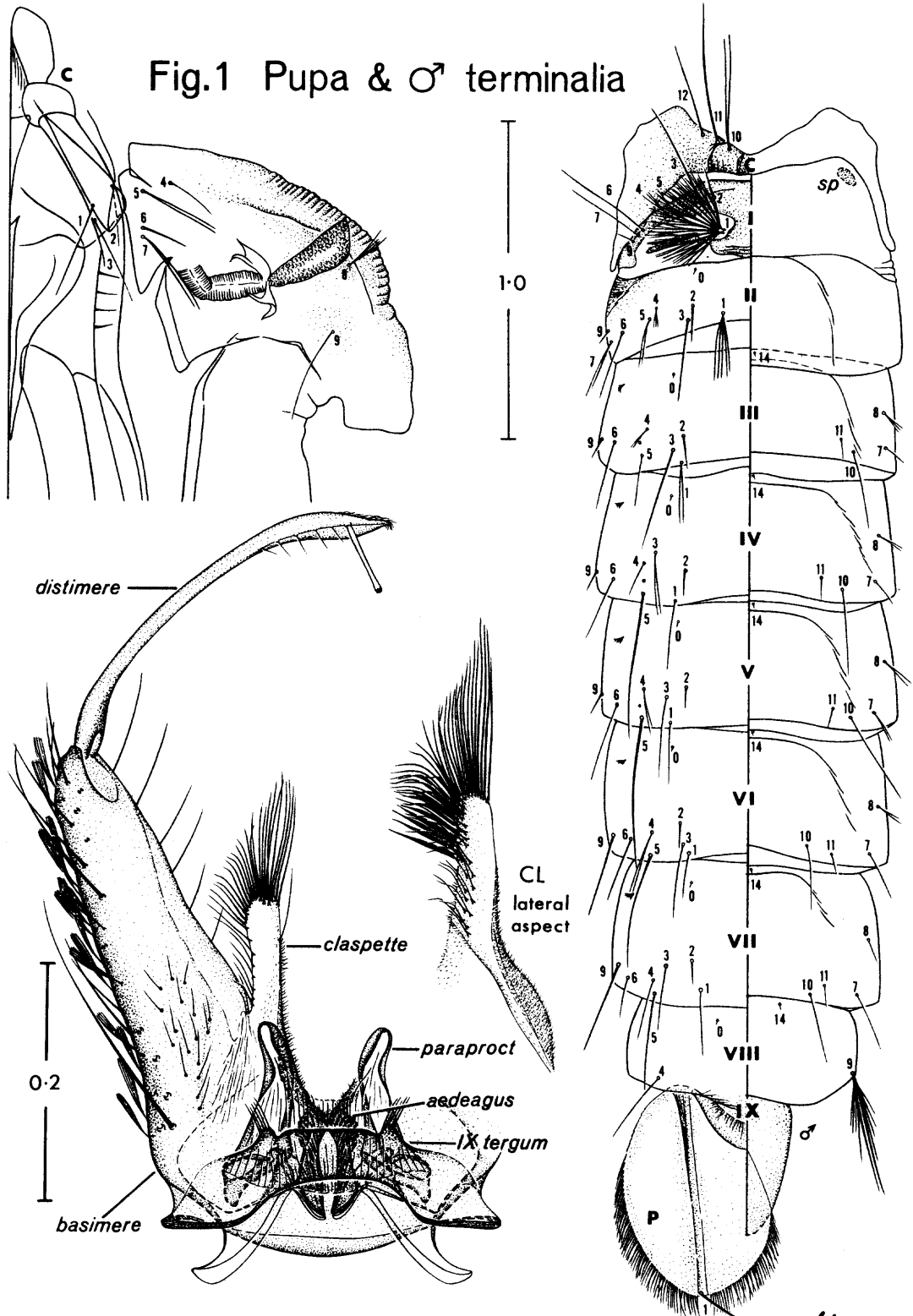
ACKNOWLEDGMENTS

I wish to express my sincere appreciation to Dr. Ronald A. Ward for his helpful assistance and valuable comments regarding this paper and also for a critical review of the manuscript. I am grateful to Dr. James C. Hitchcock, World Health Organization, for the Suva, Fiji material. Special thanks are given to Dr. Botha de Meillon for his kind encouragement; to Mr. E. L. Peyton, for his support; to Mr. Vichai Malikul, for preparing the drawings; to Miss Virginia M. Ford, for assistance in rearing and preparation of specimens.

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 p.
- Marks, E. N. 1951. The vector of filariasis in Polynesia: a change in nomenclature. *Ann. Trop. Med. Parasitol.* 45: 137-40.
- Rakai, I. M., J. D. Naserua, F. N. Macnamara and J. S. Pillai. 1974. Mosquito-borne infections in Fiji. IV. Biting times for village mosquitoes and human filaria transmission potential of *Aedes polynesiensis* and *Aedes pseudoscutellaris*. *J. Med. Entomol.* 11: 588-94.
- Rozeboom, L. E. and B. N. Gilford. 1954. The genetic relationships of *Aedes pseudoscutellaris* Theobald and *A. polynesiensis* Marks (Diptera: Culicidae). *Am. J. Hyg.* 60: 117-34.
- Theobald, F. V. 1910. The Culicidae of Fiji, including two new species. *Entomologist* 43: 155-59.

Woodhill, A.R. 1954. Experimental crossing of *Aedes (Stegomyia) pseudoscutellaris* Theobald and *Aedes (Stegomyia) polynesiensis* Marks (Diptera, Culicidae). Proc. Linn. Soc. N.S.W., 79: 19-20.



Aedes (Stegomyia) pseudoscutellaris (Theobald)

Uchay Mahidul

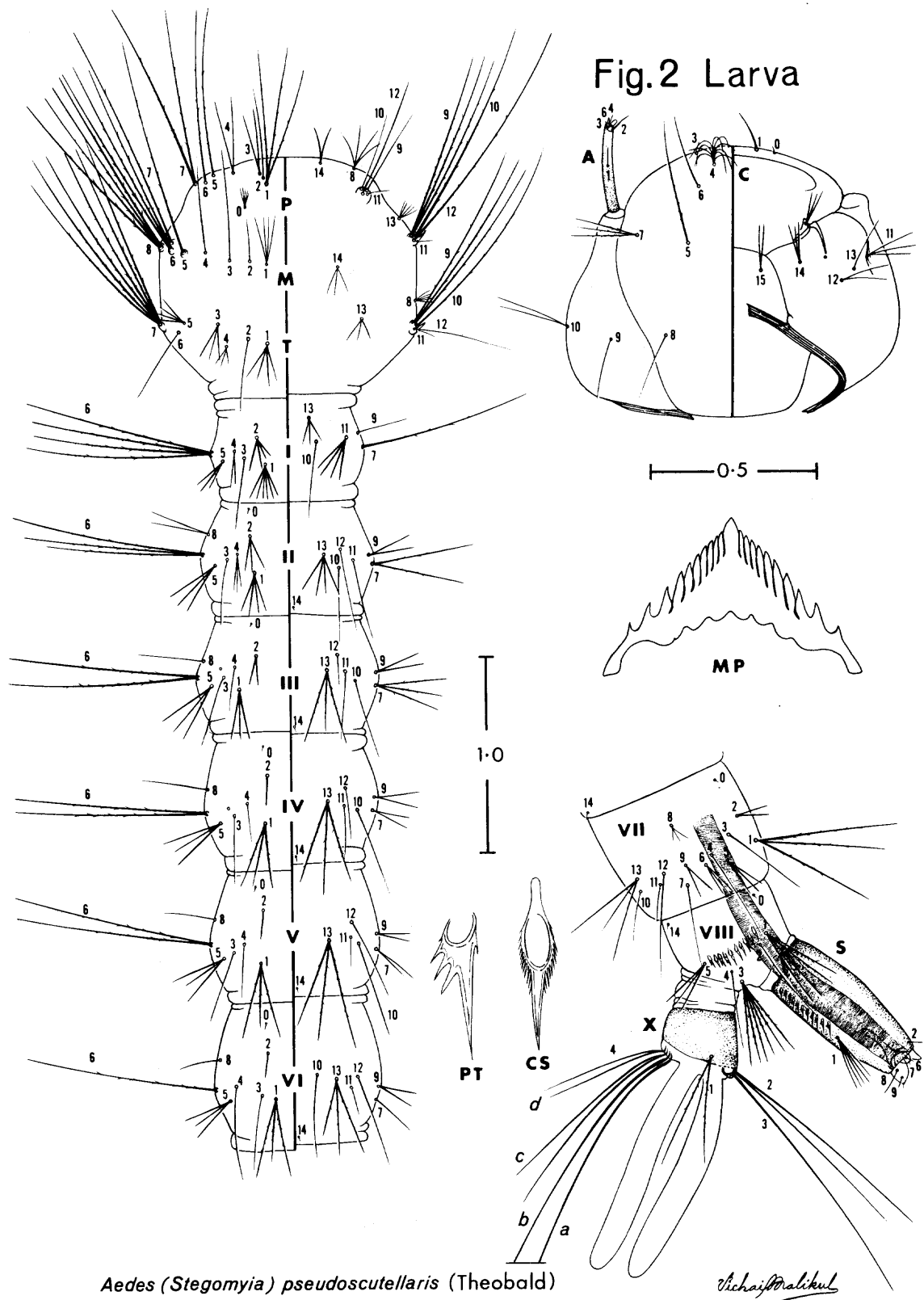
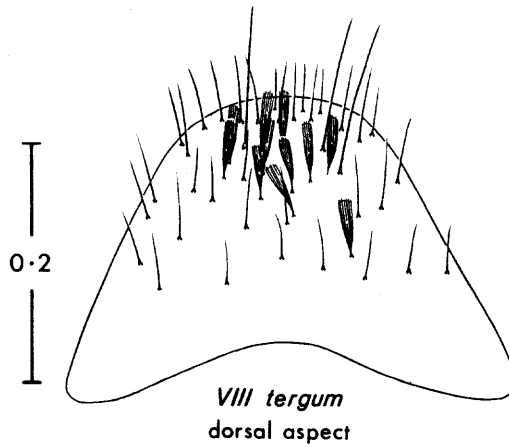
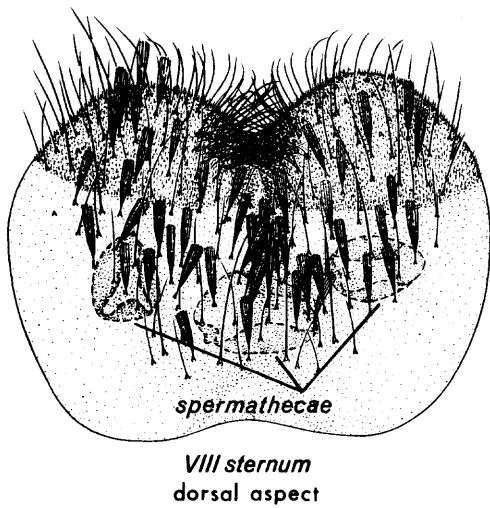
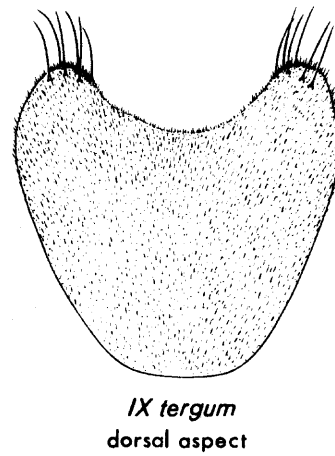
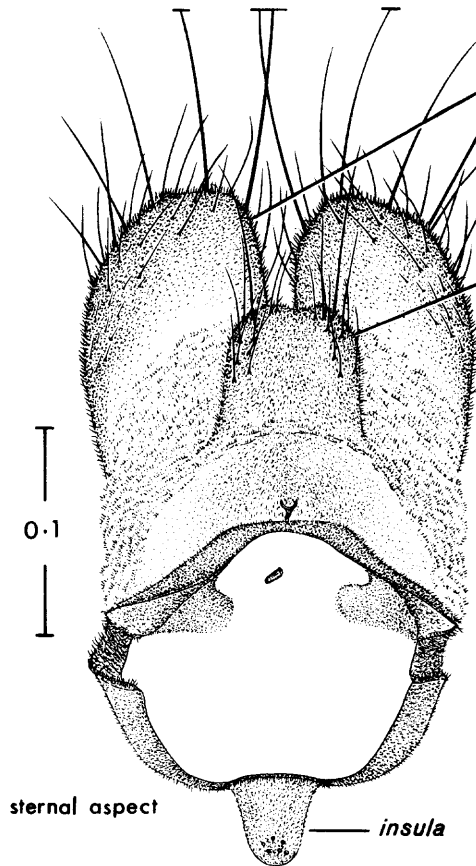


Fig.2 Larva

Aedes (Stegomyia) pseudoscutellaris (Theobald)

Vichai Malikul

Fig.3 ♀ terminalia



Aedes (Stegomyia) pseudoscutellaris (Theobald)

Shahid Malikul

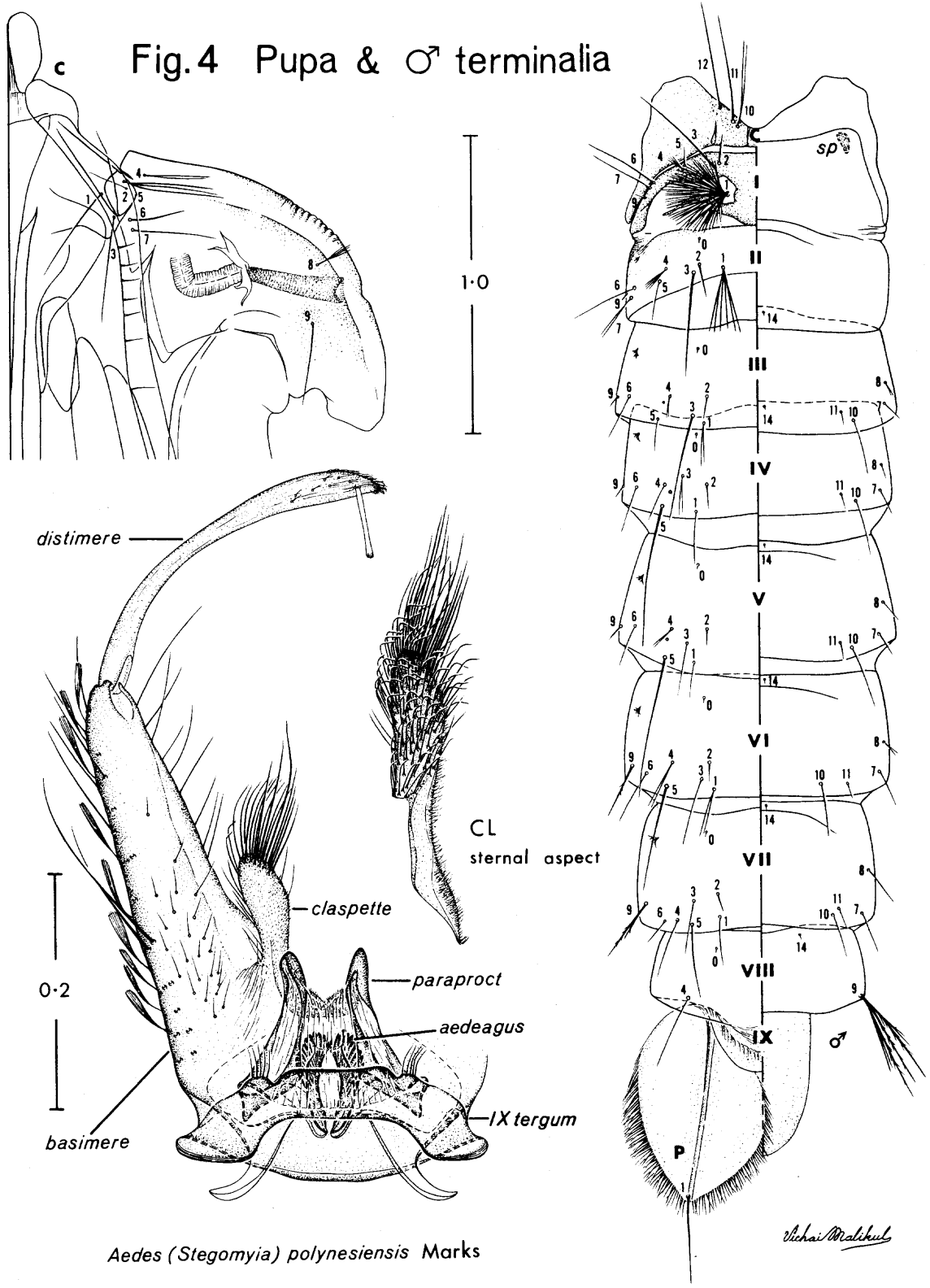
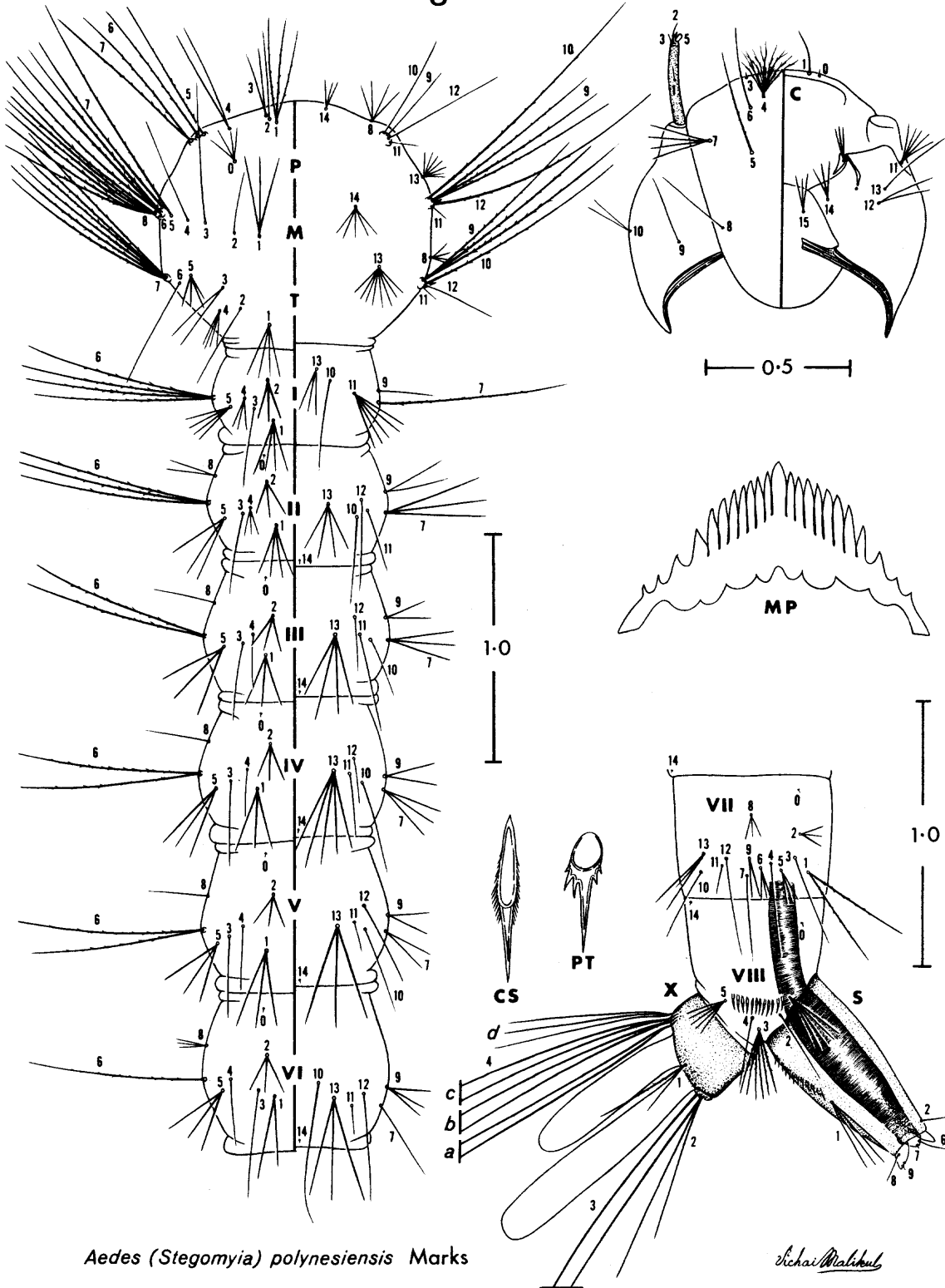


Fig.5 Larva



Aedes (Stegomyia) polynesiensis Marks

Sichai Malinuk

Fig.6

