

The Identity of Two Species of *Stegomyia*
Belonging to the *Aedes albolineatus* Group
(Diptera : Culicidae)¹

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

ABSTRACT. *Aedes (Stegomyia) hoogstraali* Knight and Rozeboom and *Ae. (Stg.) impatibilis* (Walker) are 2 distinct species. Characters for separating *impatibilis* from *hoogstraali* are given. Male terminalia, female, female terminalia and pupa of *impatibilis* and female terminalia of *hoogstraali* are described and illustrated. The range of *Ae. impatibilis* is extended to include the Philippines.

This paper has been prepared to clarify the identity of 2 species in the *albolineatus* group of species in the subgenus *Stegomyia* Theobald, genus *Aedes* Meigen.

Walker (1859) described *impatibilis* from an insect collection made at Makassar, Celebes (Sulawesi) by Alfred Russell Wallace and placed it in the genus *Culex* Linnaeus. The species was described from a male, but the specimen labelled as type in the British Museum (Natural History) (BMNH) is a female. The original description can apply equally well to a male or a female as no sexual characters were mentioned.

Knight and Rozeboom (1946) described *Aedes (Stegomyia) hoogstraali* from the Philippine Islands. Subsequently, Knight and Hull (1952) discovered that *Culex impatibilis*, which Edwards (1932:162) had placed in synonymy with *Ae. aegypti* (Linnaeus), is a member of the *Ae. albolineatus* group and resurrected it from synonymy. Although the type-specimen of *impatibilis* is in poor condition, Knight and Hull (1952:188) indicated that sufficient scaling remained to identify the specimen as *hoogstraali* in the key of Knight and Rozeboom (1946:83) but not enough to differentiate the 2. Since then, the identity of the 2 species was open to question.

While working on the *albolineatus* group of the subgenus *Stegomyia*, I discovered that 2 closely related species from San Jose, Mindoro, Philippines (1945, E.S. Ross), had been identified as *hoogstraali*. One of the species is

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

hoogstrooli which is known to occur just in the Philippines. The second species is *impatibilis* which was previously known from the Celebes (Sulawesi) and is reported for the first time from the Philippines.

Both *impatibilis* and *hoogstraali* belong to the *albolineatus* group, a complex of closely related and very similar mosquitoes, which 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. The collection of *impatibilis* and *hoogstraali* from a tree hole in the same area, San Jose, Mindoro, Philippines (V-17-1945, E.S. Ross), suggests that the 2 species are specifically distinct. It has been considered desirable to give a detailed description of all known stages of the 2 species so that the identity of *impatibilis* and *hoogstraali* should no longer remain in doubt.

The nomenclature chosen for the chaetotaxy of the larva and pupa and the terminology of structural parts of the adult follows that of Belkin (1962) and Huang (1977).

Aedes (Stegomyia) hoogstraali Knight and Rozeboom
(Figs. 1, 2, 3, 4A)

Aedes (Stegomyia) hoogstraali Knight and Rozeboom 1946:92 (♂*, ♀, L*, P*);
Aedes (Stegomyia) hoogstraali Knight and Rozeboom, Knight and Hull 1952:187
(? *impatibilis*) (taxonomy).

MALE. Head. Proboscis dark scaled, without pale scales on ventral side, longer than forefemur; palpus dark, about 0.83 of proboscis, 5-segmented, 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 on inner side only; decumbent scales of vertex all broad and flat, except for a patch of narrow white scales at anterior median area contiguous to a broad 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 broad white scales ventrally; erect forked scales dark, not numerous, restricted to occiput. Thorax. Scutum with narrow dark scales and a broad median longitudinal stripe of similar white ones from anterior margin, extending posteriorly through pre-scutellar space, with a few broad white scales on posterior prescutellar space, connected with broad white scales on midlobe of scutellum; a patch of narrow creamy-white scales on lateral margin just before the level of the wing root, extending forward over the paratergite and the mesothoracic spiracle toward scutal angle and backward over the wing root toward scutellum; acrostichal bristles absent; dorsocentral bristles present; scutellum with broad white scales on midlobe and broad dark scales on lateral lobe; anterior pronotum with narrow creamy-white scales; posterior pronotum with narrow creamy-white scales; paratergite without scales; patches of broad white scales on propleuron, the upper and lower portions of sternopleuron and the upper portion of mesepimeron; lower mesepimeron without bristles; metameron bare. Wing. With dark scales on all veins, sometimes with a minute basal spot of white scales on the costa; with 1-2

remigial bristles; cell R_2 about equal to R_{2+3} . Halter. With dark scales. Legs. Coxae with patches² of white scales; knee-spot absent on forefemur, or sometimes with a few white scales only, present on mid- and hindfemora; fore- and midfemora anteriorly dark; hindfemur anteriorly with basal 0.67 white, a dark patch present which separates the basal white stripe from the apical white scale patch except on the lower portion of anterior surface, or sometimes except on the ventral side; all tibiae anteriorly dark, without any white band; fore- and midtarsi with basal white band on tarsomere 1, sometimes midtarsus with a few white scales on basal area of tarsomere 2 as well; hindtarsus with basal white bands on tarsomeres 1,2; the ratio of the length of white band to the total length of tarsomere is 0.25, 0.33-0.40; tarsomere 3 with basal 0.4-0.5 white on dorsal side only; tarsomeres 4,5 all dark; fore- and midlegs with tarsal claws unequal, all toothed; hindleg with tarsal claws equal, simple. Abdomen. Segment I with white scales on laterotergite; terga II-III dark dorsally, with basal lateral white spots only; tergum IV with indication of, or dotted subbasal white band; terga V-VII each with a subbasal white band which is connected with the lateral spots; sterna II-VII with basal white bands; sternum VIII largely covered with white scales. Terminalia. Basimere long, about 3.0 times as long as wide, its scales restricted to lateral and ventral areas, with numerous short, curved-tipped setae along mesal side of dorsal surface; claspette with 3 stout, spine-like setae and several shorter and slender setae on apex; distimere simple, elongate, about 0.7 as long as basimere, tapering to a blunt apical point, with a long, slender, acutely tapered, spini-form process at basal 0.33; aedeagus with 12-16 apical teeth on each side; paraproct usually with 3 lobe-like (2-3) processes apically; cercal setae absent; tergum IX concave at middle, usually with 4-5 setae (3-7) on each side.

FEMALE. Essentially as in the male, differing in the following respects: Head. Palpus 4-segmented, about 0.17 of proboscis. Legs. Fore- and midlegs with tarsal claws equal, all simple. Abdomen. Sternum II largely covered with white scales; sterna III-VII with basal white bands; segment VIII completely retracted. Terminalia. Sternum VIII with middle part shallow concave; insula longer than broad, with minute setae and with 4-6 larger ones on apical 0.33; tergum IX with lateral lobes, each with 3-4 setae; postgenital plate shallow notch; cerci short and broad; 3 spermathecae, one larger than the other 2.

PUPA. Cephalothorax. Trumpet about 3.0 as long as wide at the middle; seta 1,3-C single, longer than 2-C, 2-C usually double (1-2), 4-C single or double, 5-C usually double (1-3), about as long as 4-C, 6-C usually single (1-2), much shorter than 7-C, 7-C usually with 3 branches (1-3), 10-C usually with 3 branches (1-4), mesad and caudad of 11-C, 11-C single, stout. 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 same as distance between 4,5-I; 1-II usually with 3 branches (2-5); 2-IV, V mesad of 1-IV, V; 1-III usually double (2-4); 1-IV usually double (1-3); 3-II, III single, shorter than segment III, 5-IV, V, VI single, sometimes double, short, not reaching beyond posterior margin of following segment; 9-I-VI small, single, simple; 9-VII, VIII much longer and stouter than preceding ones; 9-VII usually double (1-4), barb-

ed; 9-VIII usually with 5 branches (4-8) and barbed. Paddle. Margins without fringe of very long hair-like spicules, with slight spicules only; seta 1-P usually with 2-3 branches (2-5).

LARVA. Head. Antenna 0.5 length of head, with fine spicules basally; 1-A inserted at about middle of shaft, usually single (1-2); 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 with 8-18 branches, 6-C usually single (1-4), 7-C with 9-14 branches, 8, 10, 13-C single, 9-C double, 11-C with 12-15 branches, 12-C usually with 4 branches (3-5), 14-C usually with 3 branches (2-6), 15-C usually with 3-4 branches; mentum with 10-12 teeth on each side. Thorax. Seta 1-P usually with 5 branches (3-5), 2-P single, 3-P usually with 4 branches (4-5), 4-P usually with 3 branches (2-3), 5-P long, about as long as 7-P, usually with 4 branches (3-5), 6-P single, 7-P usually with 4-5 branches, 9-P usually with 3 branches (2-3), 11-P single, 14-P usually with 2-3 branches, 5,7-M single, 6-M usually with 6 branches (5-7), 8-M usually with 6 branches (5-7), 9-M with 3 branches, barbed, 10,12-M single, long, stout and barbed, 11-M single, small; 7-T usually with 5 branches (4-6), 9-T with 3 branches, 10,11-T similar to those on mesothorax, 12-T much reduced. Abdomen. Seta 6-I usually with 4 branches (3-8), 7-I single; 6-II-VI double, sometimes 6-II 3-branched; 7-II usually with 4 branches (2-4); 1-VII usually with 4 branches (3-4), 2-VII single; comb of 6-10 scales in a row, not arising from a sclerotized plate, each scale with free portion rather short, shorter than attached portion, without fine denticles on basal portion of apical spine; seta 2-VIII distant from 1-VIII, 1,5-VIII usually with 4 branches (3-4), 3-VIII usually with 4 branches (4-7), 2,4-VIII single; saddle incomplete; marginal spicules small; 1-X usually with 2 branches (2-3), 2-X usually with 4 branches (3-5), 3-X single; ventral brush with 5 pairs of setae on grid, each seta usually with 2-3 branches (2-5); no precratal tufts; anal papillae sausage-like, about 1.5-2.8 as long as saddle. Siphon. About 2.2-2.5 as long as wide, acus present; 3-6 pecten teeth in a straight row, each tooth with 2-5 basal denticles; 1-S usually with 4-6 branches (2-6), inserted beyond last tooth and in line with the teeth.

TYPE-DATA. *Aedes (Stegomyia) hoogstraali* Knight and Rozeboom, holotype male, with associated larval and pupal skins and terminalia on slides, in U.S. National Museum, Washington, DC (USNM); type-locality : Subic Bay, Luzon, PHILIPPINES, VI-27-1945 (E. S. Zolick and F. E. Zedeck). Paratypes : 1 female with associated larval and pupal skins, with same data as holotype; 2 males, 1 female, with associated larval and pupal skins, VII-16-1945, 1 male with associated larval and pupal skins and terminalia slide, VII-18-1945, 1 female with associated larval and pupal skins, VII-19-1945, Subic Bay, Luzon, PHILIPPINES, (M. J. MacMillan, L. E. Rozeboom and F. E. Zedeck), in USNM; 1 male, 1 female, Subic Bay, Luzon, PHILIPPINES, VII-18-1945 (M. J. MacMillan, L. E. Rozeboom, and F. E. Zedeck), in Johns Hopkins University, School of Hygiene, Baltimore, MD.

DISTRIBUTION. 79 specimens examined : 18♂, 12♀, 13♂ terminalia, 5♀ terminalia, 19 individual rearings (15 l, 16 p).

PHILIPPINES. Luzon : Subic Bay (VI-1945, E. S. Zolick and F. E. Zedeck), 1♂, 1♀, 1♂ terminalia, 1♀ terminalia, 2 individual rearings (2 l, 2 p); (VII-1945, M. J. MacMillan, L. E. Rozeboom and F. E. Zedeck), 4♂, 3♀, 1♂ terminalia, 7 individual rearings (5 l, 5 p). Laguna - Mt. Makiling (VII-1969, Y.-M. Huang and E.L. Peyton), 1♂, 1♂ terminalia, 1 individual rearing (1 p). Mindoro : San Jose (I-VI-1945, E. S. Ross), 12♂, 8♀, 10♂ terminalia, 4♀ terminalia, 9 individual rearings (8 l, 8 p).

TAXONOMIC DISCUSSION. The adult differs from all members of the *albolineatus* group except *impatibilis* in having the scutellum with broad white scales on the midlobe and broad dark scales on the lateral lobes and the median scutal stripe extending posteriorly to scutellum. It is extremely similar to *impatibilis* but can be distinguished from it by the presence of white scales on hind-tarsomere 3.

The male terminalia of *hoogstraali* are very similar to those of *impatibilis*, having the distimere simple, elongate, with a long, slender spiniform process at basal 0.33, claspette with 3-4 short stout, spine-like setae and several slender setae on apex, aedeagus with more than 10 apical teeth on each side and paraproct with 2-3 apical lobe-like processes. However, they can be distinguished from those of *impatibilis* by having the basimere long, about 3 times as long as wide, with numerous short, curved-tipped setae along mesal side of dorsal surface and without any long, stout ones along mesal side of dorsal surface and tergum IX concave at middle.

The larva differs from the other known members of the *albolineatus* group in having the marginal spicules of anal saddle small and inconspicuous and comb scales in a single row, not arising from a sclerotized plate.

The pupa can be differentiated from other members of this group except *impatibilis* in having seta 5-C short, about as long as 4-C, and seta 9-VII single or branched, much longer and stouter than 9-VI; 1-P with at most 5 branches. It is extremely similar to and indistinguishable from that of *impatibilis*.

BIONOMICS. The immature stages of *hoogstraali* have been collected mainly in bamboo stumps and tree holes in the Philippines. It has also been found in a tin can at Subic Bay, Luzon (Knight and Rozeboom 1946:93).

Aedes (Stegomyia) impatibilis (Walker)
(Figs. 4B, 4C, 4D, 5, 6)

Culex impatibilis Walker 1859:91 (♂).

Aedes (Stegomyia) impatibilis (Walker), Knight and Hull 1952:187 (resurrected from synonymy with *aegypti*).

MALE. Head. Proboscis dark scaled, without pale scales on ventral side, longer than forefemur; palpus dark, shorter than proboscis, 5-segmented, 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 on inner side only; erect scales dark, not numerous, restricted to occiput; vertex with a patch of narrow white scales at anterior median area continued by a broad 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 broad white scales ventrally. Thorax. Scutum with narrow dark scales and a broad median longitudinal stripe of similar white ones from anterior margin, extending posteriorly through prescutellar space and connected with broad white scales on midlobe; sometimes with a few broad white scales on posterior prescutellar space as well; a patch of narrow creamy-white scales on the lateral margin just before the level of the wing root, extending forward over the paratergite and the mesothoracic spiracle toward scutal angle and backward over the wing root toward scutellum; acrostichal bristles absent; dorsocentral bristles present; scutellum with broad white scales on midlobe and broad dark scales on lateral lobe; anterior pronotum with narrow creamy-white scales; posterior pronotum with narrow creamy-white scales; paratergite without scales; patches of broad white scales on propleuron, on the upper and lower portions of sternopleuron and on the upper portion of mesepimeron; lower mesepimeron without bristles; metameron bare. Wing. With dark scales on all veins, sometimes with a minute basal spot of white scales on the costa; with 1-2 remigial bristles; cell R_2 about equal to R_{2+3} . Halter. With dark scales. Legs. Coxae with patches of white scales; knee-spot absent on forefemur, present on mid- and hindfemora; fore- and midfemora anteriorly dark; hindfemur anteriorly with basal 0.75 white, a dark patch present which separates the basal white stripe from the apical white scale patch except on the lower portion of anterior surface; all tibiae anteriorly dark, without any white band; fore- and midtarsi with basal white band on tarsomere 1; hindtarsus with basal white bands on tarsomeres 1,2; the ratio of the length of white band to the total length of tarsomere is 0.25-0.33, 0.5; tarsomeres 3-5 all dark; fore- and midlegs with tarsal claws unequal, all toothed; hindleg with tarsal claws equal, simple. Abdomen. Segment I with white scales on laterotergite; terga II-IV dark dorsally, with basal lateral white spots only; terga V-VII each with a subbasal white band which is connected with the lateral spots; sometimes tergum IV with a dotted subbasal white band; sternum VIII largely covered with white scales. Terminalia. Basimere rather short and broad, about 2.2 as long as wide, its scales restricted to lateral and ventral areas, with some long, stout, curved-tipped setae along mesal side of dorsal surface; claspette usually with 3 (3-4) stout, spine-like setae and several slender setae on apex; distimere simple, elongate, about 0.75 of basimere, tapering to a blunt apical point, with a long, slender, spiniform process at basal 0.33; aedeagus with 15-16 apical teeth on each side; paraproct with 2 lobe-like processes apically; cercal setae absent; tergum IX with middle part nearly flat, with 6-8 setae on each side.

FEMALE. Essentially as in the male, differing in the following respects. Head. Palpus 4-segmented, about 0.17 of proboscis. Thorax. Scutum with a broad median longitudinal stripe of narrow white scales which reaches from anterior margin, extending posteriorly through prescutellar space and connected with broad white scales on midlobe. Wing. With dark scales on all veins except for a minute basal spot of white scales on the costa. Legs. Fore- and midlegs with

tarsal claws equal, all simple. Abdomen. Terga II-VII dark dorsally, with basal lateral white spots only; sternum II largely covered with white scales; sterna III-VII with basal white bands (cannot be seen in male); segment VIII completely retracted. Terminalia. Sternum VIII with middle part shallow concave; insula about as long as wide, with minute setae; tergum IX with lateral lobes, each with 3-4 setae; postgenital plate without shallow notch; cerci short and broad; 3 spermathecae, one larger than the other 2.

PUPA. Cephalothorax. Trumpet about 3.5 as long as wide at the middle; seta 1,3-C single, longer than 2-C, 2-C single, 4-C single, 5-C double, short, shorter than 4-C, 6-C single, stout, shorter than 7-C, 7-C single, 10-C 2-branched, mesad and caudad of 11-C, 11-C single, stout. 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 same as distance between 4,5-I; 1-II with 3 branches; 2-IV,V slightly laterad of 1-IV,V; 1-III with 3 branches; 1-IV with 2-3 branches; 3-II,III single, shorter than segment III; 5-IV-VI single, short, not reaching beyond posterior margin of following segment; 9-I-VI small, single, simple; 9-VII,VIII much longer and stouter than preceding ones; 9-VII single and barbed, or double; 9-VIII with 5-6 branches and barbed. Paddle. Margins without fringe; seta 1-P 2-branched.

TYPE-DATA. *Culex impatibilis* Walker, type-female in BMNH; type-locality: Makassar, Celebes, INDONESIA, (Wallace).

DISTRIBUTION. 10 specimens examined: 3♂, 2♀, 3♂ terminalia, 1♀ terminalia, 2 individual rearings (1 p).

INDONESIA. Celebes (Sulawesi): Makassar (Wallace), 1♀.

PHILIPPINES. Mindoro: San Jose (V-X-1945, E. S. Ross), 3♂, 1♀, 3♂ terminalia, 1♀ terminalia, 2 individual rearings (1 p).

TAXONOMIC DISCUSSION. *Aedes (Stegomyia) impatibilis* is a member of the *albolineatus* group, which has the palpi without white scales, vertex with a patch of narrow white scales at anterior median area, dorsocentral bristles present and paratergite without scales. It can be distinguished from all members of the *albolineatus* group in having the scutellum with broad white scales on midlobe and broad dark scales on lateral lobes, median scutal stripe extending posteriorly to scutellum and hindtarsomere 3 entirely dark.

The male terminalia of this species have the spiniform as a long, slender process at basal 0.33 of distimere, basimere rather short and broad, about 2.2 as long as wide, with some long, stout, curved-tipped setae along mesal side of dorsal surface and tergum IX with middle part nearly flat, with 6-8 setae on each side. Thus, it differs from all other species that have been described in this group.

The larva of *impatibilis* is unknown and the pupa is indistinguishable from that of *hoogstraali*.

I have examined the female type-specimen of *Culex impatibilis* and concur with Knight and Hull (1952) on its assignment to the *Aedes albolineatus* group of species.

Based on Walker's (1859) original description and the female type-specimen, I have identified and described the species from the Philippines as *impatibilis*. However, until topotypic material is available it will not be definitely possible to confirm the identity of the Philippine species. Should the Philippine material prove to be distinct, which I rather doubt, then a new name would be required for Philippine *impatibilis*.

BIONOMICS. The immature stages of *impatibilis* have been collected from tree holes in Mindoro, Philippines.

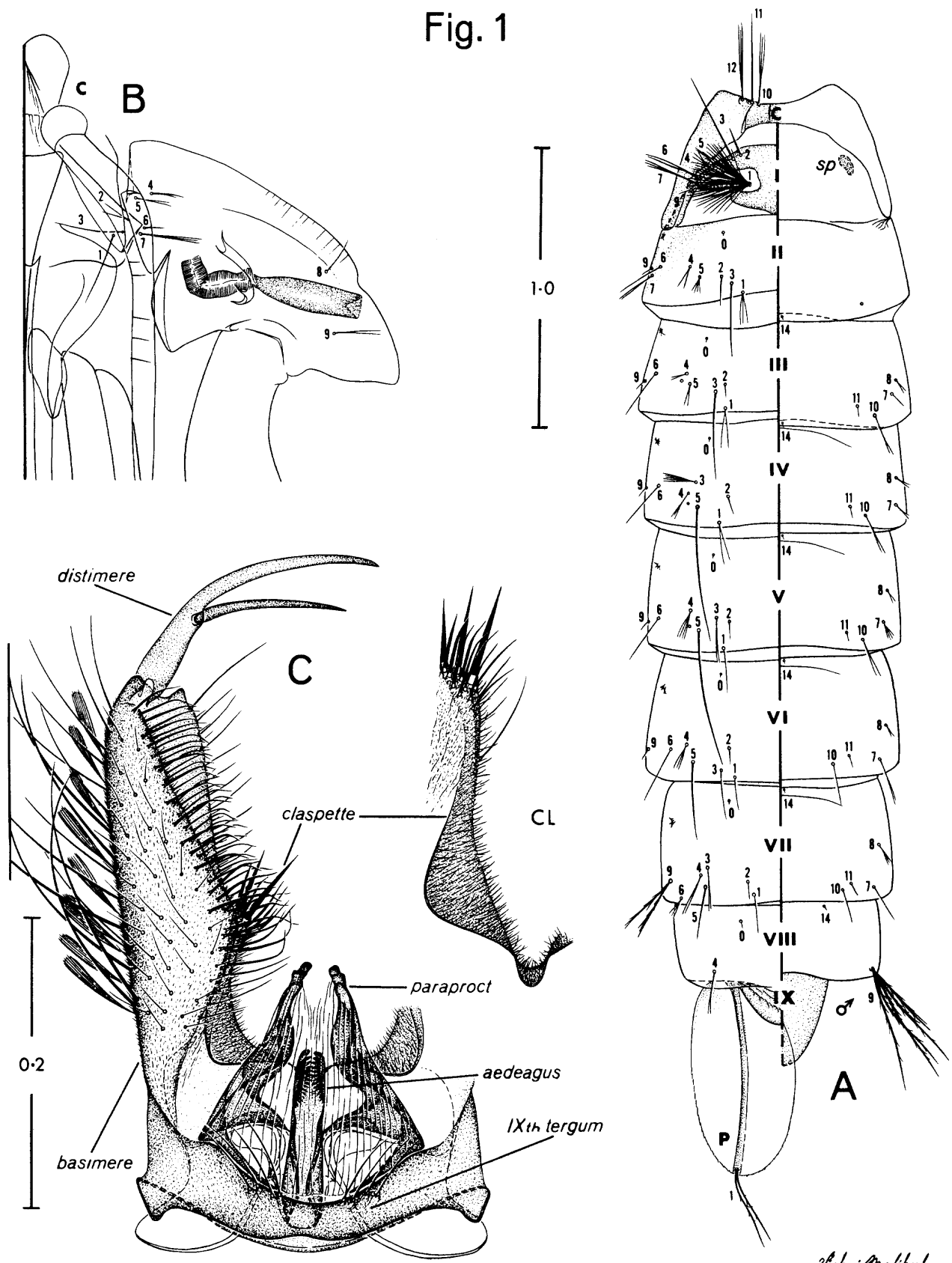
ACKNOWLEDGEMENTS

I am grateful to Dr. Ronald A. Ward and Mr. E.L. Peyton for a critical review of the manuscript and their valuable comments. I also extend my thanks to Mr. Vichai Malikul for preparing the drawings.

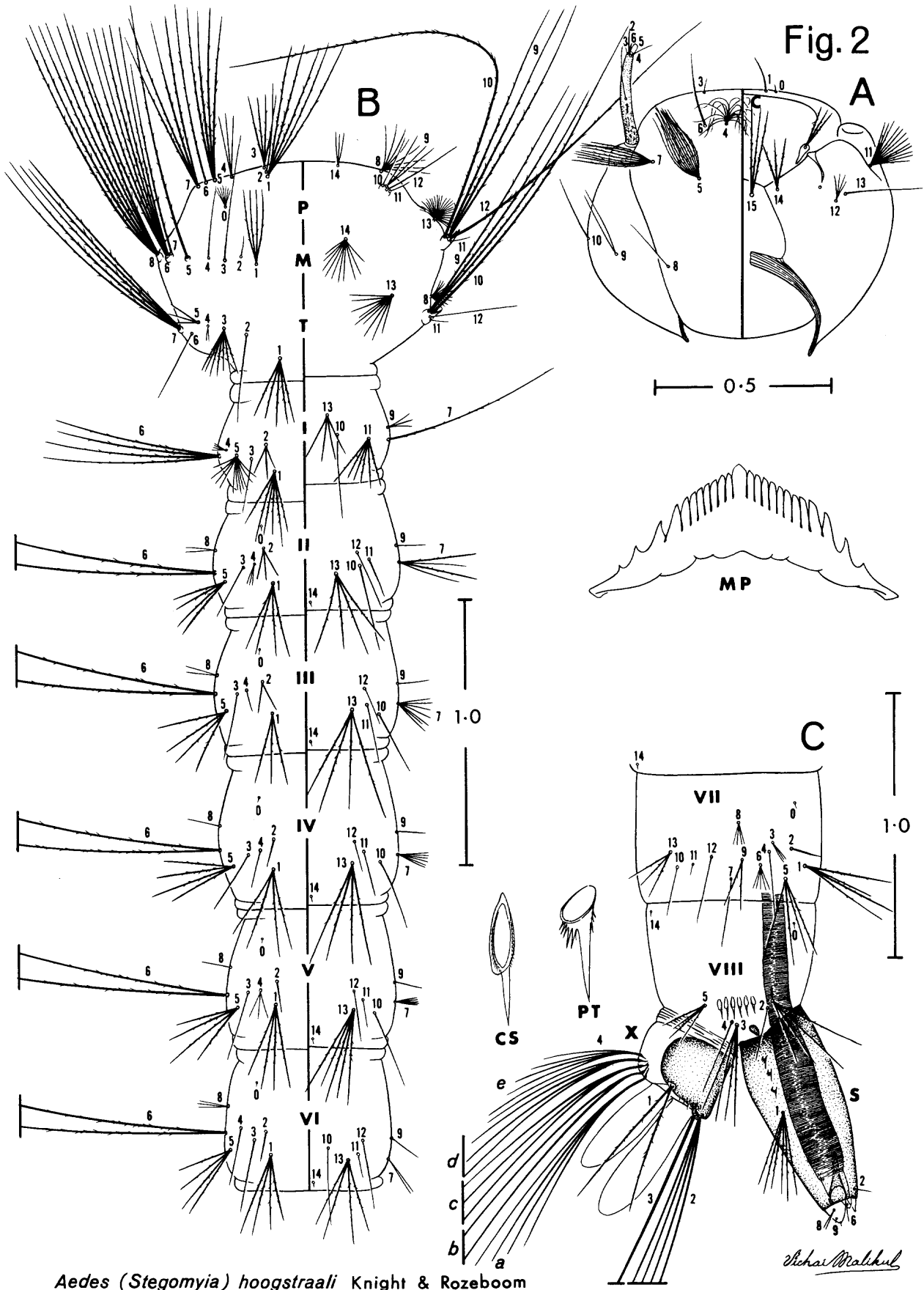
REFERENCES

- 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.
- Edwards, F. W. 1932. Diptera. Fam. Culicidae. In P. Wytsman, Genera Insectorum, Desmet-Verteneuil, Brussels, Fasc. 194, 258 p., 5 pl.
- Huang, Y.-M. 1977. Medical entomology studies. VII. The subgenus *Stegomyia* in Southeast Asia. II-The *edwardsi* group of species. III-The *w-albus* group of species. (Diptera: Culicidae). Contrib. Am. Entomol. Inst. 14(1):1-111.
- Knight, K. L. and W. B. Hull. 1952. The *Aedes* mosquitoes of the Philippine Islands. II. Subgenera *Skusea*, *Christophersiomyia*, *Geoskusea*, *Rhinoskusea*, and *Stegomyia* (Diptera, Culicidae). Pacif. Sci. 6:157-89.
- Knight, K. L. and L. E. Rozeboom. 1946. The *Aedes* (*Stegomyia*) *albolineatus* group (Diptera, Culicidae). Proc. Biol. Soc. Wash. 59:83-98.
- Walker, F. 1859. Catalogue of the dipterous insects collected at Makassar in Celebes, by Mr. A. R. Wallace, with descriptions of new species. J. Proc. Linn. Soc. Lond. Zool. 4:90-172.

Fig. 1



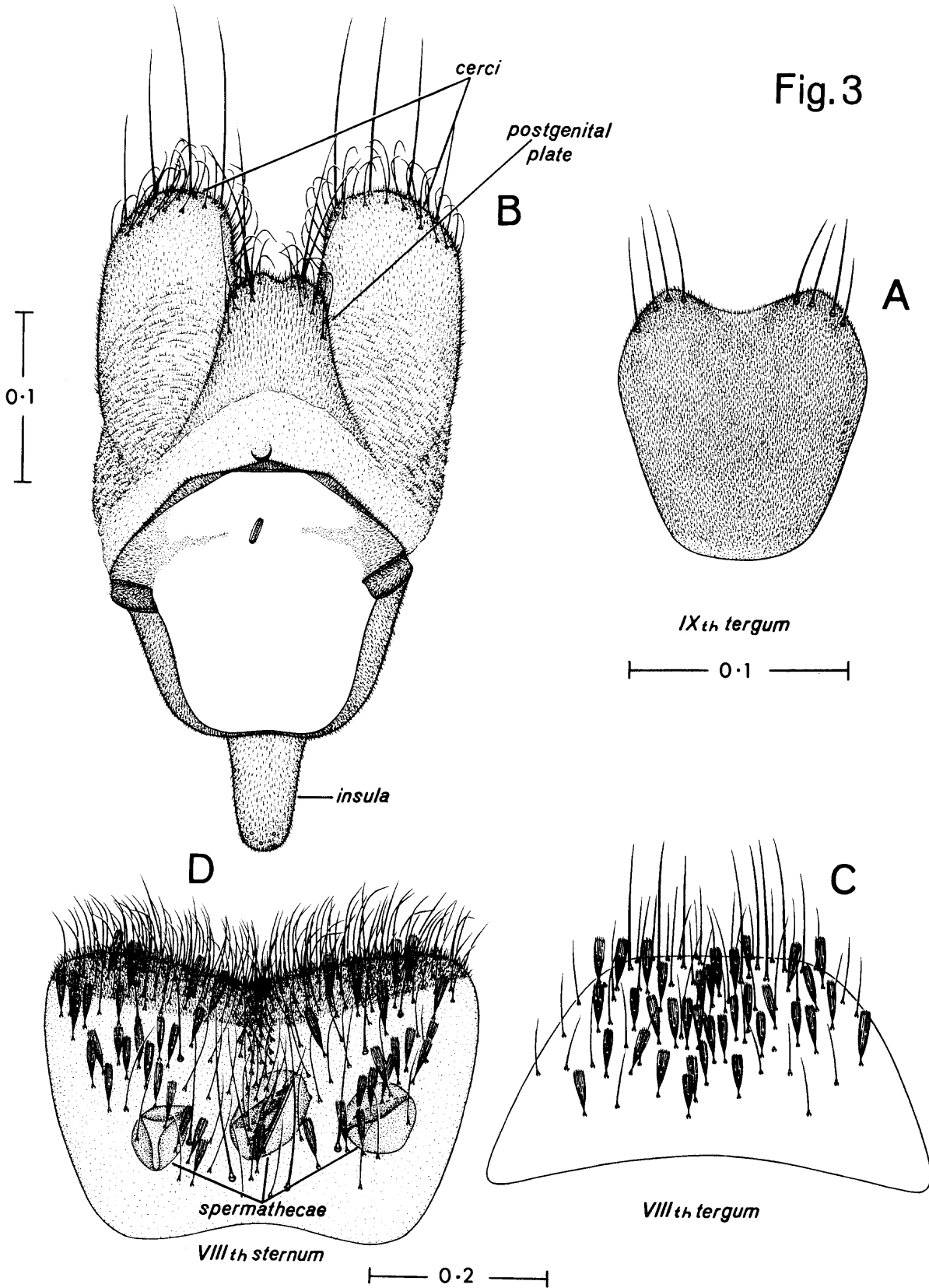
Aedes (Stegomyia) hoogstraali Knight & Rozeboom



Aedes (Stegomyia) hoogstraali Knight & Rozeboom

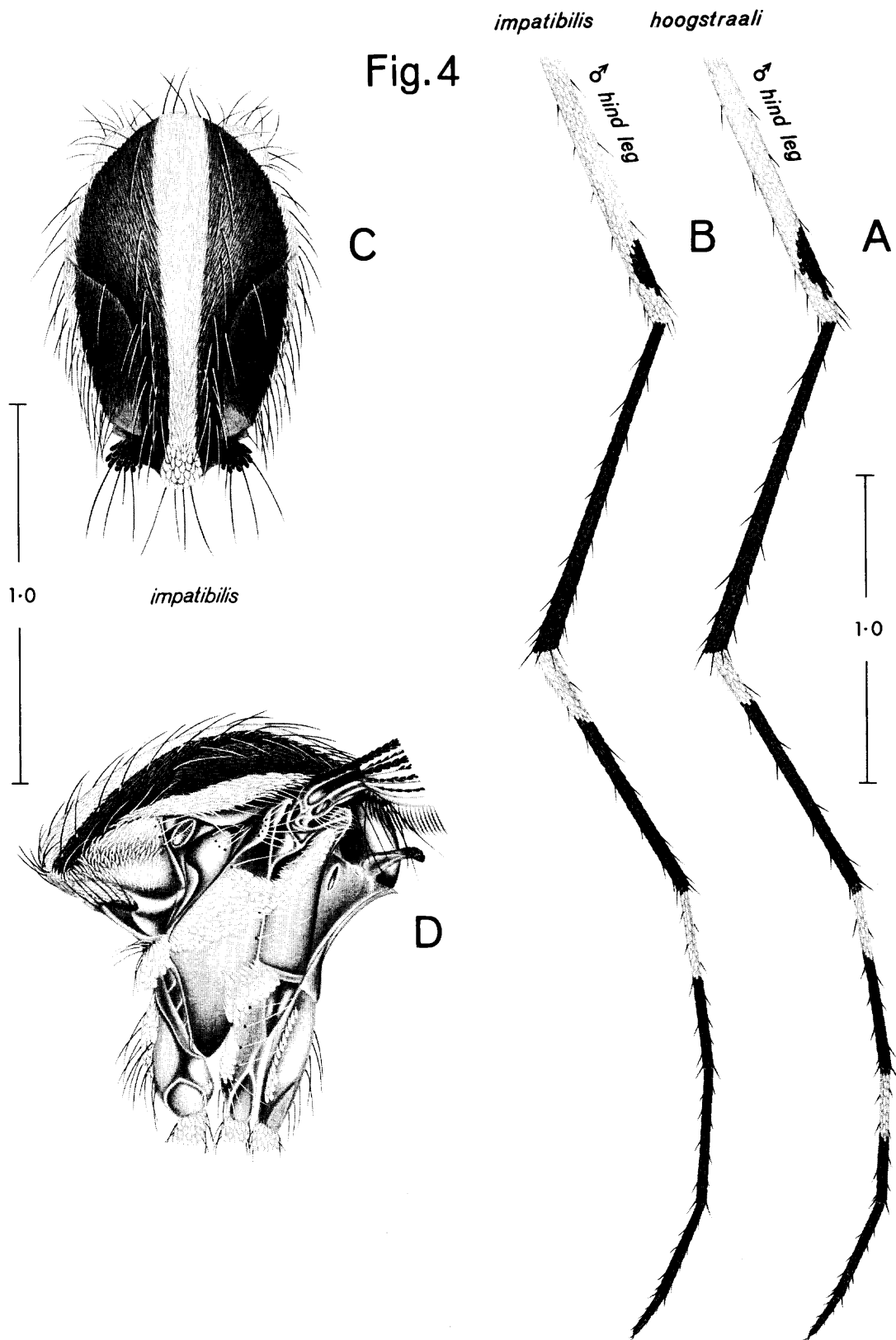
Nehal Malikul

Fig. 3



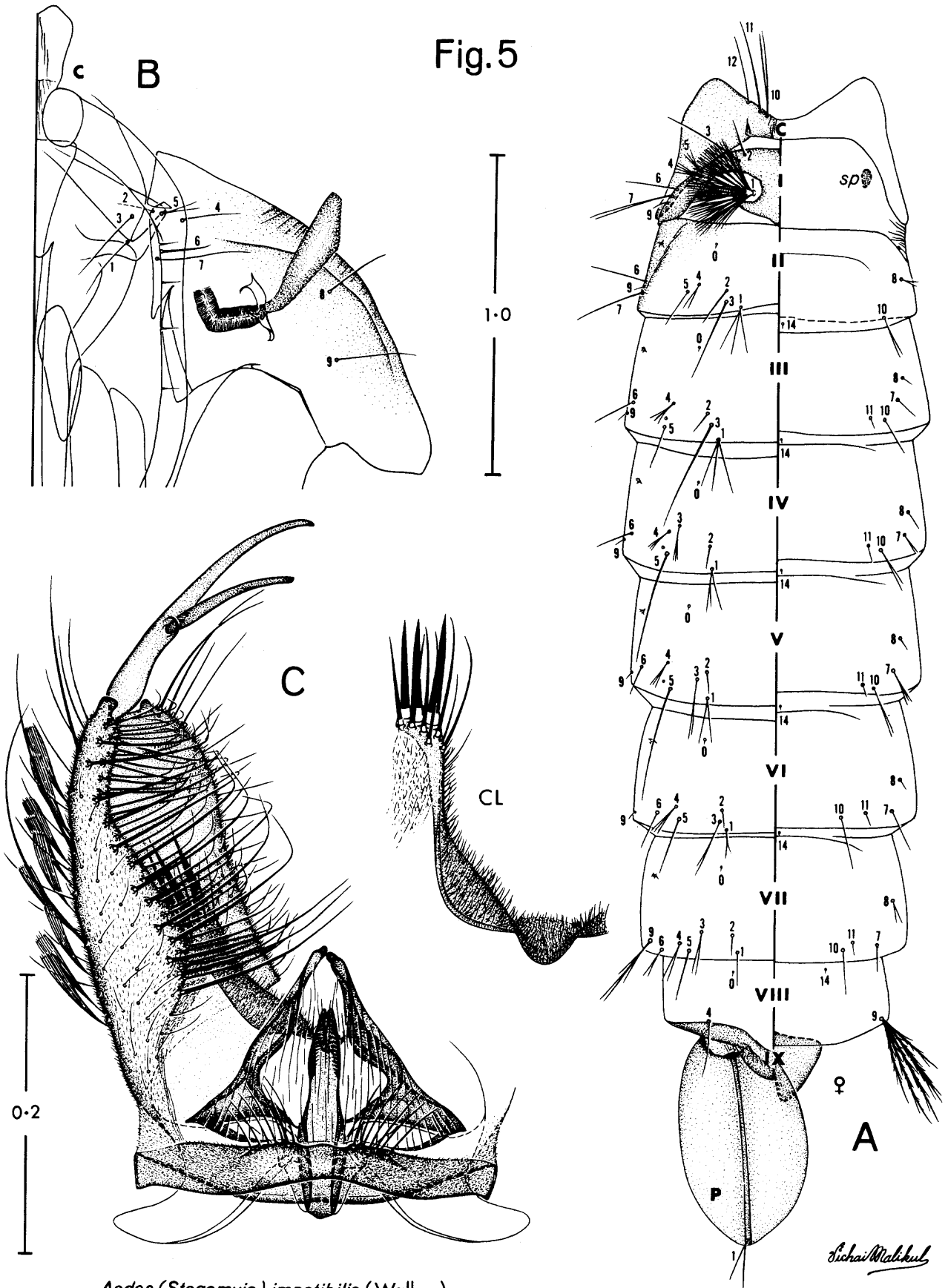
Aedes (Stegomyia) hoogstraali Knight & Rozeboom

Sichai Malikul



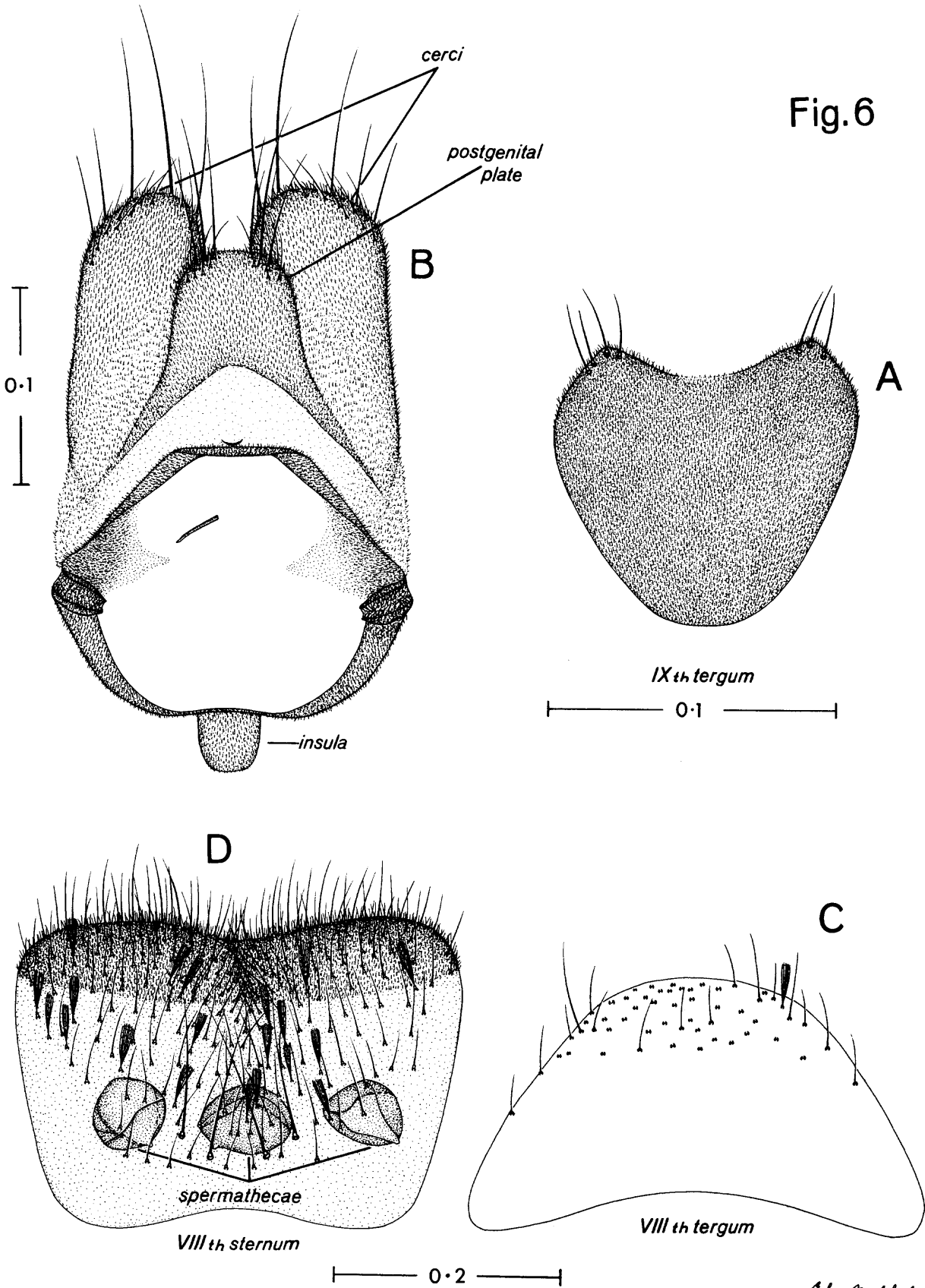
Aedes (Stegomyia) impatibilis (Walker)

Sichai Malikul



Aedes (Stegomyia) impatibilis (Walker)

Fig.6



Aedes (Stegomyia) impatibilis (Walker)

P. Chai Malikul