

A New Man-biting Species of *Aedes* (*Paraedes*) from Southeast Asia
(Diptera: Culicidae)¹

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ABSTRACT

The adults, female and male genitalia, pupa and fourth stage larva of *Aedes* (*Paraedes*) *thailandensis*, a new species from Thailand and Vietnam, are described, illustrated and compared to related species. Biological information of the adult and immature stages is given.

INTRODUCTION

The following man-biting new species, *thailandensis*, from Thailand and Vietnam is included in the subgenus *Paraedes* Edwards of the genus *Aedes* Meigen. The adult male and female, pupa and fourth stage larva are described and illustrated.

Nomenclature and chaetotaxy used for the female, male, male genitalia, pupa and larva follow Knight (1970, 1971), Knight and Laffoon (1970a, 1970b, 1971a, 1971b) and Laffoon and Knight (1973). The terminology of the female genitalia follows Reinert (1974). In pupal and larval descriptions the mode of each seta is in parenthesis.

Aedes (*Paraedes*) *thailandensis* n. sp.
(Figs. 1-4)

MALE. *Head*. Antenna brown, 1.09-1.16 length of proboscis, setae of flagellar whorls directed mainly dorsoventrally, 13 flagellomeres, basal 11 short and apical 2 long, pedicel dark brown with a few short fine hairs and small dark scales mesally; clypeus dark brown, bare; maxillary palpus dark

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brown scaled, short, 4-segmented, 0.11-0.12 length of proboscis; proboscis dark brown scaled, 1.07-1.14 length of femur I; eyes contiguous; several dark brown ocular setae, median 2 longer; vertex with broad dark brown decumbent scales and a few broad white ones intermixed, a few narrow curved scales on median anterior area and on ocular line, also a few long erect forked pale scales on median area, lateral surface covered with broad dark brown scales except for a large patch of broad white ones on area anterior to antepronotum, a few similar scales on postgena; occiput with narrow curved decumbent creamy-white scales and a number of long erect forked scales, median ones creamy-white and lateral ones dark brown. *Thorax*. Scutal integument dark reddish-brown; scutum covered with narrow curved dark reddish-brown scales except for narrow curved creamy-white scales on following areas: median anterior promontory, scutal fossal area (on anterior and along margin over lateral area to scutal angle), along scutal ridge, a few on anterior dorsocentral area, several on supra-alar area, and a stripe of golden-brown narrow curved scales on acrostichal area from anterior to posterior; prescutellar space bare; scutellum with narrow curved creamy-white scales on each lobe, median lobe also with a few broader pale brown ones at base; dark brown setae on following areas: 4-5 median anterior promontory, numerous dorsocentral (anterior and posterior), scutal fossal (3-5 anterior and 2-4 lateral), numerous supra-alar, 4-6 posterior medial scutal, 1 postalar callar and scutellar (2-4 long and 2-3 short ones on lateral lobe, 4-5 long and 3-6 short ones on median lobe); pleural integument dark brown; antepronota widely separated, covered with white scales, broad ones on anterior area and narrow curved ones on posterior area, 8-14 dark setae; postpronotum with narrow curved reddish-brown scales on dorsal area, narrow curved white scales on median area and broad white scales on posterior and lower areas, 4-7 posterior dark setae; propleuron with broad white scales, 14-22 white and brown setae; prosternum, subspiracular area, mesomeron, metameron and mesopostnotum bare; postspiracular area with a patch of broad white scales, 2-4 brown setae; paratergite with numerous narrow white scales; mesepisternum with a large upper and small lower patch of broad white scales, 3-4 upper and 10-15 posterior pale brown setae, lower ones shorter; prealar knob with 5-12 golden-brown setae; mesepimeron with a large patch of broad white scales on upper anterior area, 8-12 golden setae on upper posterior area. *Legs*. Coxae I-III with golden to pale brown setae, I with broad white and a small median patch of brown scales on anterior surface, II and III each with a small patch of broad white scales on lateral surface; trochanters I-III each with small broad white scales; femora I-III each with anterior surface dark brown scaled, I also with a narrow dorsal pale scaled stripe on basal 0.6-0.7, II also with a broad ventral pale scaled stripe on basal 0.75-0.85, III also with a broad ventral white scaled stripe on basal 0.8-0.9, stripe narrower distally, I-III each with posterior surface dark brown scaled with a well developed white scaled stripe from base to apex, stripe dorsal on I, ventral on II and III; tibiae I-III and tarsi I-III each dark brown scaled; posttarsi I-III each with 2 ungues, I and II with ungues unequal in size, both simple, III with ungues equal in size, both simple. *Wing*. Dorsal and ventral veins dark brown scaled except for 2-4 white ones at base of costa and 2-5 white ones dorsally and ventrally at base of radius next to remigium; alula with several narrow brown scales on margin; upper calypter with a row of pale hairs on margin; 1 remigial seta. *Halter*.

Pedicel pale; capitellum brown scaled with a few pale ones dorsally. *Abdomen.* Terga I-VIII each with dark brown scales and a large laterobasal patch of white scales, white patches longer on V-VII and extending slightly onto dorsal surface, VIII also with a broad basal band of white scales which connects with laterobasal white scaled patch; sterna white scaled, V-VII each also with a narrow posterior band of dark brown scales, bands broader on lateral area, VIII dark brown scaled with a few white scales on laterobasal area; terga and sterna with a number of short to moderately long setae, mostly along lateral and posterior margins, tergum VIII with apex broadly concave with numerous moderately long thin setae forming a dense patch, a number of long stout setae basad of apical patch, mesal ones stouter, sternum VIII with apex broadly concave with several moderately long and a few long thin setae on margin. *Genitalia* (Fig. 1). Tergum IX heavily pigmented with caudal margin with a medium sized lobe on each side of midline, each lobe bears 3-6 short thin setae, cephalic margin deeply emarginate, entire surface covered with minute spicules, lateral margins narrowly connected to sternum IX; gonocoxite heavily pigmented, moderately long, moderately broad, tergal surface with an elongated patch of short fine setae extending from near base to near apex on mesal area and with a number of very long stout setae along outer margin and lateral surface, sternal surface with mesal margin somewhat flared and with an elongated patch of very long stout setae from near base to apex, a few of basomesal setae short, long thin setae scattered over remainder of sternal surface, numerous broad scales on sternal and lateral surface, mesal surface membranous, tergal, sternal and lateral surfaces covered with minute spicules; gonostylus moderately long, approximately 0.77 length of gonocoxite, attached at apex of gonocoxite, bifid, inner arm thumb-like with 9-15 very short setae scattered over dorsal surface, ventral surface with a row of 5-7 very short setae and apical area with several short spicules forming short indistinct rows, outer arm with basal area narrow and apical area expanded into a broad flat flap; basal mesal lobe complex, connected to gonocoxite at base of mesal membrane, divided at base into 2 long caudally produced arms, dorsomesal arm flattened, moderately broad, apex with 5 moderately long flattened setae and a small mesal lobe, a few short spicules at base of arm, outer area of arm connected by a delicate membrane to mesal surface of gonocoxite, ventral arm long, narrow, basal portion curved ventrad and apical portion curved dorsad and mesad of outer arm, basal portion of arm covered with short spicules, apex with 3 long setae, basal mesal lobe connected mesally to its mate by a broad band which is covered with short spicules; proctiger short, apical portion of paraproct heavily pigmented and curved tergally into a blunt point, cercus membranous with a small moderately pigmented dorsal plate connected to paraproct, cercal setae absent; phallosome with aedeagus short, divided into 2 heavily pigmented lateral plates which are connected basally, each plate curved tergomesad with 2-3 long basomesal teeth, paramere approximately 0.8 length of aedeagus, parameral apodeme narrow, approximately 1.76 length of paramere; sternum IX heavily pigmented, apical margin rounded and extended far cephalad, 2-4 long stout setae on caudomesal area.

FEMALE. Habitus similar to male but with the following differences.

Head. Antennal flagellomere 1 with basal 0.75 golden and with several small

brown scales, pedicel golden-brown, 1.14-1.20 length of proboscis; maxillary palpus 0.16-0.19 length of proboscis; proboscis 1.05-1.14 length of femur I.

Thorax. Setal differences: 4-6 median anterior promontory, scutal fossal (4-6 anterior and 3-5 lateral), 2-4 anterior acrostichal, scutellar (4-6 long and 4-5 short on lateral lobe, 5-6 long and 5-7 short ones on median lobe), 10-15 anteprenotal, 12-16 propleural, 5-7 postspiracular, 3-4 upper and 13-16 posterior mesepisternal, 9-13 on prealar knob and 10-16 upper mesepimeral. *Legs.* White scaled stripes on posterior surfaces of femora larger, white stripe on femur II covering most of posterior surface; tarsomeres I-III equal in size, all simple. *Wing.* Remigium with 1-2 setae. *Genitalia* (Fig. 2). Tergum VIII moderately pigmented, base concave mesally, apex straight or slightly convex, numerous short setae scattered over apical 0.89-0.93, setae along apex short and thin, basolateral seta absent, covered with minute spicules, scales absent, basal 0.9-1.0 retracted into segment VII, VIII-Te index 0.92-0.98, VIII-Te/IX-Te index 2.23-2.60, length 0.22-0.26 mm, width 0.22-0.28 mm; sternum VIII moderately pigmented with a large median area lightly pigmented, base slightly concave mesally, apex with a moderately deep median indentation (0.17-0.22 deep) and a medium sized lobe on each side of midline, short to moderately long setae on apical 0.88-0.96, setae 1-3-S in a more or less diagonal line, 1-S basomesad, 2-S approximately 0.38 from 1-S, 3-S apicolaterad and approximately 0.62 from 2-S, covered with minute spicules, scales absent, apical intersegmental fold lightly pigmented, VIII-S index 0.86-0.96, length 0.26-0.29 mm, width 0.30-0.32 mm; tergum IX moderately pigmented with mesal area lightly pigmented, apex with a small median indentation and with 4-7 (usually 4-5) setae on each side of midline, 8-12 total setae, covered with minute spicules, IX-Te index 0.90-0.94, length 0.09-0.10 mm, width 0.10-0.11 mm; insula moderately pigmented, long, tongue-like, 3-5 small tuberculi each with a minute spicule, tuberculi situated near middle of insula length, covered with minute spicules; lower vaginal lip moderately pigmented, narrow, numerous long spicules scattered over surface, lower vaginal sclerite absent; upper vaginal lip heavily pigmented, narrow, covered with short spicules, upper vaginal sclerite moderately pigmented, medium sized; postgenital lobe moderately long, moderately broad, apex with a small to moderately deep median indentation (0.10-0.22 deep), 4-7 setae on each side of midline, 9-14 total setae, covered with short spicules, dorsal PGL index 0.98-1.09, ventral PGL index 1.68-2.00, ventral length 0.10-0.13 mm; perianal membrane with scattered short spicules; cercus moderately long, apex rounded with 2-3 long setae, completely covered with short spicules, dorsal surface with a number of short to moderately long setae on apical 0.81-0.85, scales absent, ventral surface with a few short setae on outer margin, cercus index 2.85-2.97, cercus/dorsal PGL index 3.04-3.55, cercus length 0.20-0.24 mm; one large seminal capsule, heavily pigmented, spherical, several small seminal capsule pores near orifice, base of accessory gland duct heavily pigmented.

PUPA (Fig. 3). Description based on 6 skins which had associated adults. Ocular plate with moderately developed cuticular facets. Cephalothorax, metanotal plate and abdominal terga I-III with heavily pigmented areas. *Respiratory trumpet.* Moderately pigmented, index 3.21-3.63, mean 3.35. *Cephalothorax.* Seta 1-CT triple to 6-branched (3); 2,3-CT triple to

5-branched (4); 1-3-CT approximately equally developed; 4-CT with 4-7(5) branches; 5-CT with 4-8(4) branches; 6-CT single; 7-CT double to 5-branched (4); 8-CT with 5-10(9) branches; 9-CT triple to 6-branched (4). *Metanotal plate*. Seta 10-MP with 4-6(5) branches; 11-MP single, very long; 12-MP triple to 6-branched (5), located on a tubercle. *Abdomen*. Seta 1-I with 32-53(48) branches on basal third; 2,6,9-11-I single; 3-I single to triple (2); 4-I with 5-8(7) branches; 5-I double or triple (2); 7-I double to 4-branched (2); 0,2,6,9-II single, 2-II stout, very long, only slightly shorter than 3-II; 1-II with 6-12(8) branches, removed from caudal margin of tergum; 3-II single or double (2), laterad and slightly caudad of 2-II; 4-II with 4-7(5) branches, located near 3-II, mesad and far caudad of 5-II; 5-II with 5-9(6) branches; 7-II triple to 4-branched (3); 0,2,3,9,11,14+III single; 1+III with 5-9(8) branches; 4-III double or triple (2); 5-III with 6-11(7) branches; 6-III with 4-8(4) branches; 7-III single or double (1); 8-III double to 5-branched (3); 10-III triple to 5-branched (3); 0,2,4,5,7,9,11,14-IV single; 1-IV with 4-8(7) branches; 3-IV with 6-7(7) branches; 6-IV double to 6-branched (3); 8-IV double to 4-branched (2); 10-IV double to 4-branched (3); 0,2,5,9,11,14-V single; 1-V with 4-6(5) branches; 3-V triple or 4-branched (3); 4-V with 5-7(5) branches; 6-V with 5-6(5) branches; 7-V with 4-7(5) branches; 8-V double to 5-branched (3); 10-V single to triple (2); 0,2,5,9-11,14-VI single; 1-VI triple to 6-branched (6); 3-VI double or triple (3); 4-VI triple to 6-branched (4); 6-VI double to 6-branched (3); 7-VI single or double (2); 8-VI triple to 5-branched (3); 0,2,7,10,11,14-VII single; 1,4-VII double to 4-branched (3); 3-VII double to 5-branched (4); 5-VII single or double (2); 6-VII with 4-7(4) branches, caudad and noticeably mesad of 9-VII; 8-VII triple to 6-branched (4); 9-VII single to triple (2); 0,9-VIII single; 9-VIII very long; 4-VIII single or double (2); 14-VIII single or double (1). *Paddle*. Circular, broad; very minute serrations on distal portion of basal 0.28-0.42 of outer margin; very minute spicules on apical 0.58-0.72 of outer and apical 0.09-0.13 of inner margins; midrib reaches apex; seta 1-P single, long; index 1.01-1.19, mean 1.09.

LARVA (Fig. 4). Description based on 6 skins which are associated with adults. Abdomen of each skin is twisted and damaged. *Head*. Moderately pigmented; setae 0,1,3-C single, 1-C long, stout; 4-C with 5-7(6) branches, short, mesad and only slightly caudad of 5-C; 5-C triple, very long, stout, barbed; 6-C double or triple (2), very long, stout, barbed, slightly cephalad and laterad of 5-C; 4-C and 6-C each approximately equal distance from 5-C; 7-C with 5-9(7) branches, long, stout, barbed; 8-C single to triple (2); 9-C double to 4-branched (3); 10-C double to 5-branched (3); 8-10-C short; 11-C with 4-8(6) branches; 12-C with 7-8(8) branches, short; 13-C with 5-7(6) branches, moderately long; 14,18-C single; 15-C double or triple (3); 6-mp single; dorsomentum with 26-28 (usually with 28) teeth, heavily pigmented; ventromedian cervical sclerite heavily pigmented, fragmented. *Antenna*. Long, moderately pigmented, with numerous short spicules scattered over entire shaft; seta 1-A triple to 4-branched (3), stout, moderately long, barbed, attached 0.45-0.50 from base; 2-5-A attached at apex. *Thorax*. Seta 0-P with 7-12(9) branches; 1,5,6,8,10,12-P single; 2,14-P double; 3-P double to 4-branched (2); 4-P single or double (1); 7-P double or triple (2); 9-P single or double (2); 11-P double to 4-branched (3); 1-M double or triple (2); 2,5,

7,10-12-M single; 3-M triple to 4-branched (3); 4-M with 4-7(4) branches; 6-M triple to 4-branched (4); 8-M with 4-5(4) branches; 9-M with 4-5(5) branches; 13-M with 10-16(10) branches; 14-M with 5-8(8) branches; 1-T double to triple (3); 2-T single to triple (2); 3-T with 5-9(9) branches; 4,6-T double or triple (2); 5,10,12-T single; 7-T with 4-6(4) branches; 8-T with 8-13(9) branches; 9-T triple; 11-T single to triple (1); 13-T with 7-8(7) branches.

Abdomen. Setae 0,4,14-VIII single; 1-VIII with 4-7(4) branches; 2-VIII double or triple (2); 3-VIII with 8-13(10) branches; 5-VIII triple to 5-branched (4); comb on VIII composed of 12-18 (usually 15-17) scales arranged in a single curved row, each scale moderately pigmented with a stout pointed median spine and short denticles along lateral margins; 1-X single or double (2), short; 2-X with 4-5(5) branches, moderately long; 3-X single, very long, approximately twice length of 2-X; ventral brush with 9-10 setae on grid, each with 3-9 (caudal ones 5-9) branches; saddle moderately pigmented, acus absent, incompletely rings segment X.

Siphon. Moderately pigmented; acus well developed; index 1.77-1.91, mean 1.87; pecten on basal 0.59-0.66, composed of 18-24 (usually 21-22) teeth, distal 1-2 teeth spine-like, without denticles and wider spaced than remainder, each tooth with one large and 1-2 small ventral denticles near base, apex flattened and with several long denticles; 1-S with 4-6(4) branches, short, attached on basal 0.63-0.67 of siphon and even with or slightly distad of last pecten tooth; 2-S single, short, attached on caudal margin of siphon; 3,6,7,9-S single; 8-S double to 4-branched(3).

TYPE-DATA. The type-series consists of the holotype male, allotype, and 6 male and 37 female paratypes. The holotype with its associated pupal skin is deposited in the U. S. National Museum (Natural History) (USNM) and possesses the following information on the adult labels and collection data sheet: THAILAND, *Prachin Buri*, Ban Bu Phram, 28 July 1971, 06045-102 (collection number), Kol Mongkolpanya and team (collectors), T75.18 (genitalia preparation number), collected as a pupa from clear, fresh, temporary, unmoving water in a small crab hole, in a heavily shaded area of a secondary scrub, in a valley, and at an elevation of 150 m. The holotype is in excellent condition. The genitalia are mounted in Canada balsam on a microscope slide and are in excellent condition. The allotype with its associated pupal skin possesses the following collection information: THAILAND, *Prachin Buri*, Ban Tub Lan, 11 August 1971, 06061-101, Kol Mongkolpanya and team, immature collection data as for holotype except for elevation which is 80 m. Paratypes are as follows: 06038-1 (♀ pl), 06038-2 (♀ pl), 06038-100 (♀ p), collection data as for allotype except date which is 27 July 1971; 06045-7 (♀ pl), 06045-9 (♀ pl), 06045-11 (♀ pl), 06045-100 (♂), 06045-101 (♂ p), 06045-104 (♀ p), 06045 (♀), collection data as for holotype; 06055-100 (♂ p), 06055-101 (♂ p), collection data as for allotype except date which is 29 July 1971; 06061-1 (♀ pl), 06061-100 (♂ p), 06061-102 (♂ p), collection data as for allotype; and 06062 (28 ♀), collected biting man in a secondary deciduous forest with bamboo, in partial shade, in mountainous terrain and at an elevation of 500 m, on 12 August 1971, at Khao Chang Chalut, other data as for holotype. The type-specimens are deposited in the USNM except for 2 female and one male paratypes (with associated skins) which will be deposited in the British Museum (Natural History) and 2 female paratypes (one with associated skin)

which will be deposited in the Bernice P. Bishop Museum.

DISTRIBUTION. 85 specimens examined: 55♀, 8♂, 16 with associated skins (6 pl, 10 p).

THAILAND. *Khon Kaen*, Amphoe Chum Phae, Pha Dong Larn; 8♀. *Nakhon Ratchasima*, Amphoe Pak Chong, Nong Sa Rai; 1♀. *Nan*, Ban Sala; 1♂p. *Prachin Buri*, Ban Bu Phram, Ban Tub Lan, Khao Chang Chalut; 1♂p (holotype), 1♀p (allotype), 6♀ pl, 2♀ p, 5 ♂p, 29♀ and 1♂ (paratypes), 6♀.

VIETNAM. *Khanh Hoa*, Duc My; 2♀.

BIONOMICS. The usual immature habitat is fresh water in crab holes located at elevations of 80-150 m. Immatures in Thailand were collected from clear, temporary, unmoving water in small crab holes (5 times), once from a small wheel track, located in partially and heavily shaded areas of secondary scrub and in a bamboo grove, all located in valley terrain, and at elevations from 80-300 m.

Adults have been taken in Thailand feeding on man in heavy vegetation of a forest (1900-2000 hrs), a secondary deciduous forest, bamboo groves (500 m elevation), and resting in forest vegetation. In Vietnam one female was collected biting man (2000 hrs) near a salt marsh and an additional female was taken in a CDC light trap.

DISCUSSION. The adult habitus of both sexes of *thailandensis* is very similar, a condition which differs from the marked sexual dimorphism of most species of the subgenus. Adults of *thailandensis* are easily separated from the other species of *Paraedes* (*barraudi* (Edwards), *bonneae* Mattingly, *collessi* Mattingly, *menoni* Mattingly, *ostentatio* (Leicester) and *pagei* (Ludlow)) by the combination of antepnotum with broad and a few narrow white scales, paratergite with narrow white scales, postpronotum with broad white scales, and the scale patterns of the vertex and scutum. The male genitalia of *thailandensis* are very distinctive, as are all species of the subgenus *Paraedes*, in the development of the gonostylus and basal mesal lobes. Female genitalia of *thailandensis* can be separated from the other species of the subgenus by the combination of the following features: sternum VIII shape and pale pigmented median area; tergum VIII shape and nearly covered with setae; and number of setae on tergum IX. From *menoni* it is distinguished by having only a single seminal capsule while *menoni* has 3.

The pupa of *thailandensis* can be distinguished from *bonneae*, *collessi* and *ostentatio* by the following: paddle very broad; length of seta 9-VIII approximately equal to length of paddle; and seta 5-VI very long, noticeably longer than segment VII.

Larvae of *thailandensis* are easily separated from those of the other known species of the subgenus (*bonneae*, *collessi* and *ostentatio*) by the shape and larger number of pecten teeth (18-24) and the lesser number of branches of setae 5-C and 6-C.

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LIST OF FIGURE ABBREVIATIONS

Female Genitalia

AGDuB	= Accessory gland duct base	LVL	= Lower vaginal lip
Ce	= Cercus	PGL	= Postgenital lobe
DPGL	= Line of attachment of peri-anal membrane to dorsal surface of PGL	SCa	= Seminal capsule
H	= Hinge	SCaP	= Seminal capsule pore
I	= Insula	UVL	= Upper vaginal lip
IX-Te	= Tergum 9	UVS	= Uppervaginal sclerite
		VIII-S	= Sternum 8
		VIII-Te	= Tergum 8

Male Genitalia

Ae	= Aedeagus	PaA	= Parameral apodeme
BML	= Basal mesal lobe	Par	= Paramere
Gc	= Gonocoxite	Pha	= Phallosome
Gs	= Gonostylus	Ppr	= Paraproct
IX-S	= Sternum 9	Pr	= Proctiger
IX-Te	= Tergum 9	X-Te	= Tergum 10

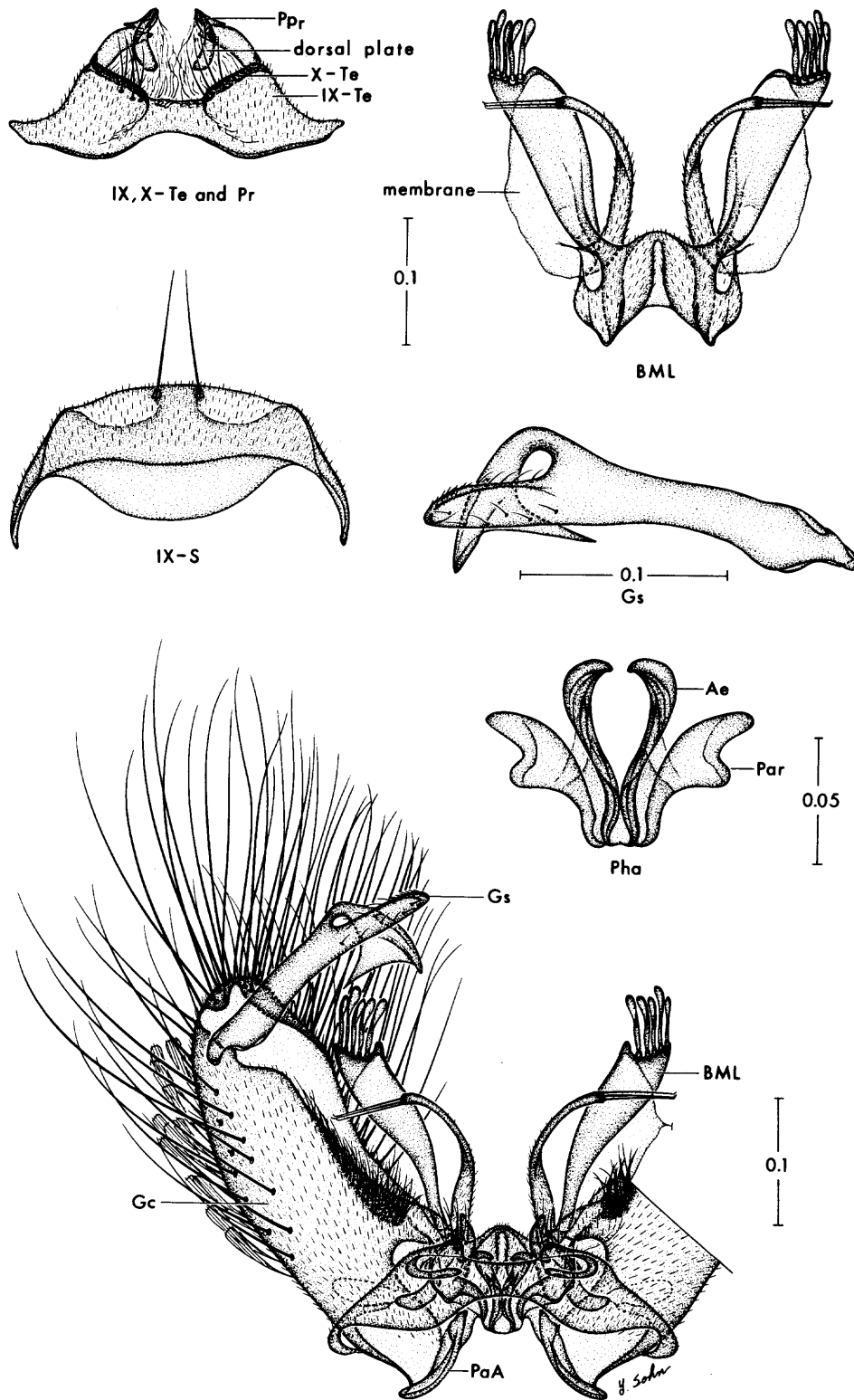
Pupa

CT	= Cephalothorax	MP	= Metanotal plate
I-VIII	= Abdominal segments 1-8	P	= Paddle
		T	= Respiratory trumpet

Larva

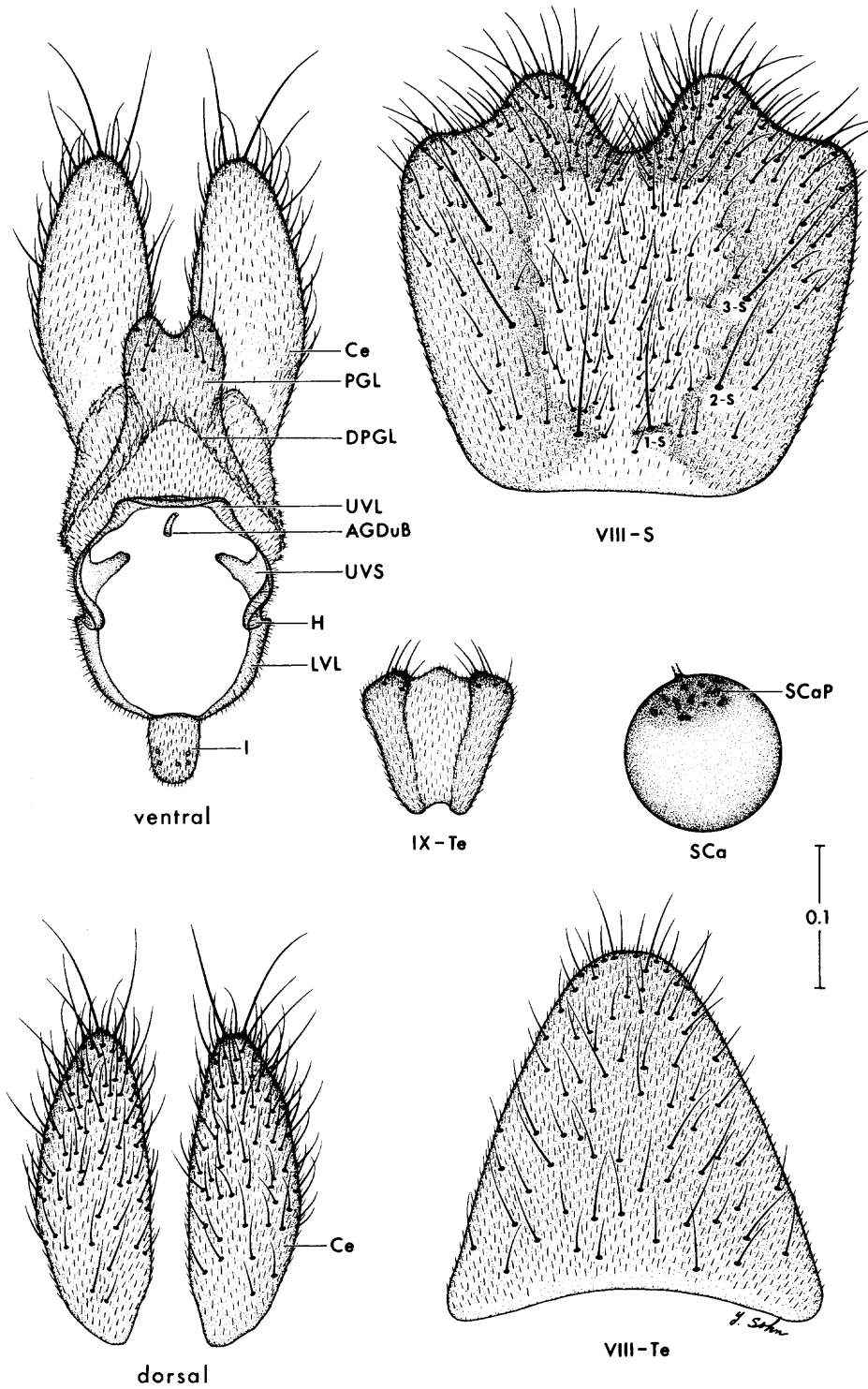
A	= Antenna	M	= Mesothorax
C	= Head	MP	= Mouthpart
CS	= Comb scale	P	= Prothorax
Dm	= Dorsomentum	PT	= Pecten tooth
VIII,X	= Abdominal segments 8,10	S	= Siphon
		T	= Metathorax

Fig. 1



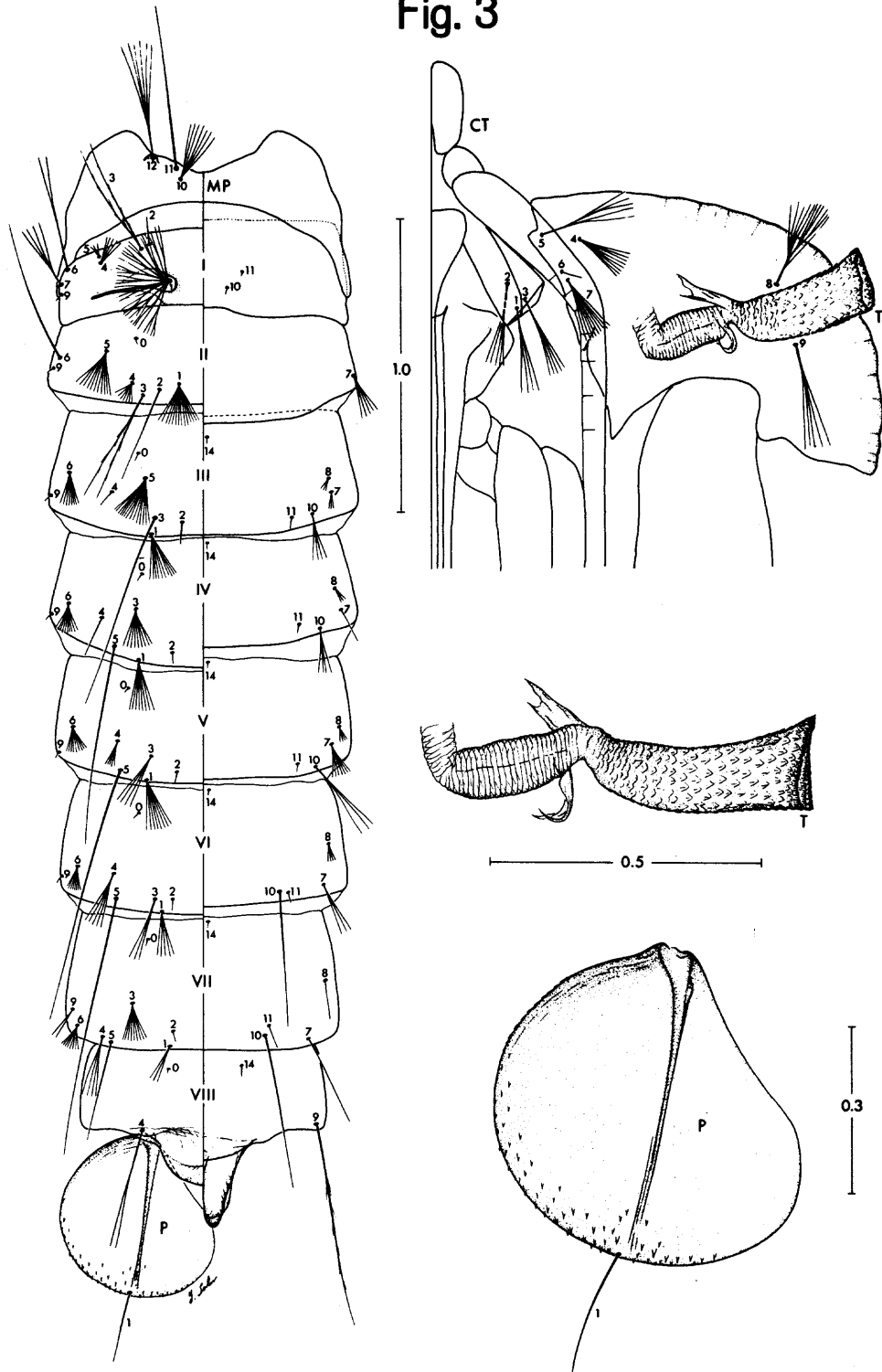
Aedes (Paraedes) thailandensis

Fig. 2



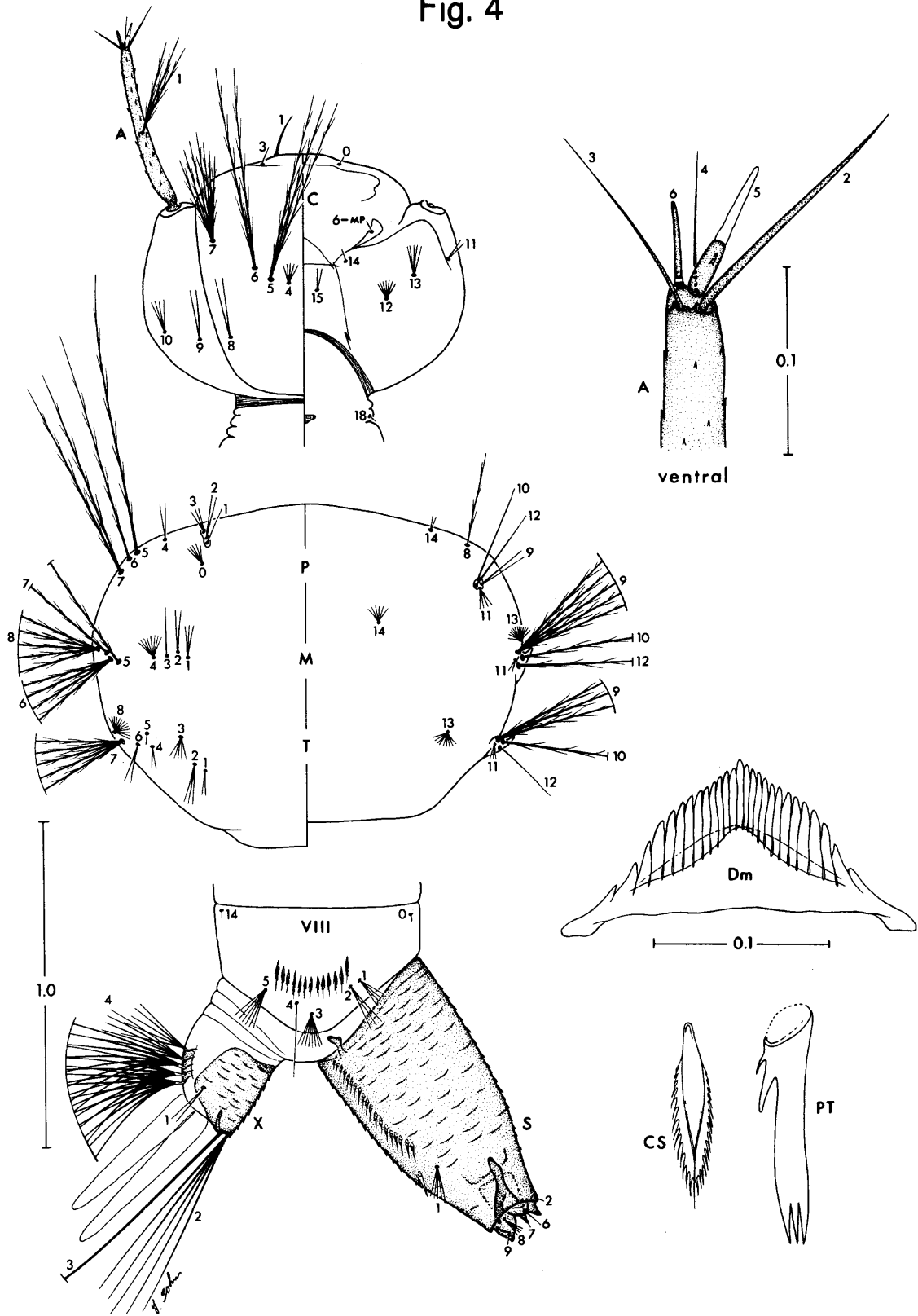
Aedes (Paraedes) thailandensis

Fig. 3



Aedes (Paraedes) thailandensis

Fig. 4



Aedes (Paraedes) thailandensis