

A Description of *Isoaedes*, A New Subgenus of *Aedes* Meigen,
and Its Type-Species, *Ae. (Isa.) cavaticus* New Species
(Diptera: Culicidae)

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ABSTRACT. *Isoaedes*, a new subgenus of *Aedes* Meigen, is defined, discussed and compared to other subgenera of the genus. Descriptions and illustrations are presented for the known stages of the only included species, *cavaticus*, new species. Bionomics and distribution of the latter are given.

INTRODUCTION

The following monotypic new subgenus, *Isoaedes*, is placed in the genus *Aedes* Meigen. The female, male, pupa and larva of this very distinct subgenus are described and compared to other subgenera. A single new species, *Ae. (Isa.) cavaticus*, from Thailand is included and the female and male (including genitalia), pupa and larva are described and illustrated. Its geographical distribution and bionomics are presented.

Nomenclature and chaetotaxy used for the female, male, male genitalia, pupa and larva follow Harbach and Knight (1978a, 1978b), Knight (1970, 1971), Knight and Laffoon (1970a, 1970b, 1971a, 1971b), and Laffoon and Knight (1973). The terminology of the female genitalia follows Reinert (1974). Measurements on the illustrations and in the descriptions are in millimeters. In the pupal and larval descriptions the range for setal branching is followed by the mode in parenthesis. Abbreviations used in the type-data and distribution sections follow: ♀ = female, ♂ = male, p = pupal exuvia, l = larval exuvia and L = whole larva. Information in the bionomics and distribution sections was taken from the collection data sheets and personal communication with E. L. Peyton and D. J. Gould.

SUBGENUS *ISOAEDES* REINERT, NEW SUBGENUS

Type-species: *Aedes cavaticus* Reinert

FEMALE. *Head.* Antenna long, pedicel with a few scattered small scales and short fine setae mesally; maxillary palpus and proboscis dark scaled; vertex and occiput each covered with narrow curved decumbent scales and numerous erect forked scales; eyes contiguous. *Thorax.* Integument pale,

¹The views of the author do not purport to reflect the positions of the Department of the Army or the Department of Defense.

scutum covered with narrow curved scales, similar scales on each lobe of scutellum; acrostichal and dorsocentral setae numerous, long; scutal fossal setae (anterior, lateral, median and posterior), long; antepnotum and postpronotum each with narrow scales, several setae; prosternum, subspiracular area and paratergite bare, the latter narrow; propleuron with 4-7 long setae and only 1-4 broad scales; mesepimeron with a median patch of pale scales, 11-13 short setae dorsad of scale patch, one long seta antero-ventrad of scales. *Legs*. Tibiae I-III and tarsi I-III each dark scaled; posttarsi I,II with ungues equal in size, each with a tooth, III with ungues equal in size, each simple. *Wing*. Alula with a single row of narrow scales on margin; remigial setae present. *Abdomen*. Terga each dark scaled with a pale scaled basal band. *Genitalia*. Tergum VIII and sternum VIII each with a number of broad scales; sternum VIII with a moderately deep median apical indentation; tergum IX with apex with a moderately deep median indentation, 22-32 setae; insula long, tongue-like, 3 or 4 small tuberculi on apical area; lower vaginal sclerite absent; upper vaginal sclerite moderately large, elongate, heavily pigmented; spermathecal eminence membranous and poorly defined, pale spiny excrescences along mesal opening; postgenital lobe moderately long, wide, apex flat or with a small median indentation, 22 or 23 setae; cercus moderately long, scales absent; 3 spherical seminal capsules, one large and 2 slightly smaller ones.

MALE. Essentially as in the female. *Head*. Antenna with numerous long dorsal-ventrally directed setae in each flagellar whorl, distal 2 flagellomeres long; maxillary palpus length slightly shorter than proboscis, 5 segmented, segments 2 and 3 each long, 4 and 5 each short and slightly downturned, 3-5 each with a very few short setae at apex. *Legs*. Posttarsi I, II each with ungues unequal in size and with a tooth, III with ungues equal in size and both simple. *Genitalia*. Tergum IX bilobed, each lobe with 11-24 long and 4-8 short setae, latter ones stout and form a short posterior row; gonocoxite long and moderately broad, mesobasal area of tergal surface with a patch of long stout setae, ventral surface with numerous very long stout setae on apical 0.4-0.5; gonostylus attached at apex of gonocoxite, narrow, moderately long, several scattered short fine setae, a single narrow blunt spiniform at apex; basal mesal lobe small, short, with a few short apical setae and one moderately long stout one; proctiger moderately long, paraproct with a short blunt sternal arm near middle, apex with a few short teeth, cercus with an elongate moderately pigmented plate, cercal setae absent; phallosome with aedeagus moderately long, heavily pigmented, consists of 2 basally and apically connected lateral plates, apex flared with numerous pointed tergally curved teeth and a few stout lateral ones, paramere moderately long; sternum IX moderately large, basal, lateral and median areas pigmented, setae absent.

PUPA. *Cephalothorax*. Ocular plate with cuticular facets not developed; setae 1, 2-CT 1-3 branched, moderately long; 3-CT 1,2 branched, long; 10-12-CT all approximately equal in length. *Abdomen*. Seta 2-I short; 3-I long, usually 2-5 branched; 4-I long, stout, 2-5 branched; 5-I short, thin, single but occasionally 2-3 branched; 3-II long, stout, 5-9 branched; I-VI-VII short, single, 1-VI occasionally 2 branched; 3-VII short, single, occasionally 2 branched; 9-VII long, stout, usually 2 branched, cephalad of 6-VII, the latter short and 1-3 branched; 9-VIII long, stout, 4-8 branched. *Paddle*. Ovoid with apex projected, a few small spicules on apical area; seta 1-P long, stout, usually single (1-3 branched), attached subapically.

LARVA. *Head*. Seta 1-C stout, long; 5, 6-C single, long, approximately equal in length, 5-C slightly laterad and far caudad to 6-C; 4-C 3-6 branched, moderately long, slightly mesad and caudad to 6-C; 7-C 2-4 branched, moderately long, mesad and slightly cephalad to antennal base; 13-C 1, 2 branched. *Antenna*. Seta 1-A short, usually 2 branched, attached 0.43-0.53 from base of antenna; setae 2-6-A attached at apex of antennal shaft. *Thorax*. Seta 1-P long, stout, single; 9-12-M and 9-12-T each located on a large heavily pigmented plate bearing a long stout spine. *Abdomen*. Seta 6-I-VI long, stout, barbed; 13-I-V long, stout, barbed, multiple branched on I,II; 1-5-VIII stout, barbed; comb composed of a patch of 25-35 scales, each with a bluntly rounded apex and stout denticles along lateral and apical margins; 1-X short, stout, single; 2-X moderately long, 2-4 branched; 3-X long, single; 4-X composed of 5 pairs of setae attached to grid, setae long and 2-6 branched; saddle incompletely rings segment X, acus absent. *Siphon*. Heavily pigmented, moderately long; acus detached; pecten with 13-24 teeth, on basal 0.44 of siphon, apical tooth wider spaced than remainder of teeth; seta 1-S long, stout, usually single, attached on basal 0.48-0.54 of siphon distad of pecten.

EGG. Not known.

DISCUSSION. This new subgenus is characterized and separated from other subgenera of *Aedes* by the following: in the adults by the combination of (1) head with narrow curved decumbent scales covering vertex and with numerous erect forked scales on vertex and occiput, (2) antennal pedicel with a very few small scales and several short fine setae on mesal area, (3) both acrostichal and dorsocentral setae numerous and long, (4) scutum and scutellum with only narrow curved scales, (5) subspiracular area bare, (6) paratergite bare and narrow, (7) mesepimeron with a long lower seta, (8) male maxillary palpus length nearly equal to that of proboscis, segments 3-5 each with only a very few short setae at apex, and (9) female posttarsi I and II each equal in size and with a tooth; in the male genitalia by the combination of (1) tergum IX bilobed, each lobe with 11-24 long and 4-8 short setae, the latter stout and in a posterior row, (2) gonostylus long and narrow with a narrow blunt spiniform at apex, (3) paraproct with a short sternal arm near middle, apex with a few short dark teeth, cercal setae absent, (4) aedeagus consists of 2 lateral plates, apex flared with numerous pointed tergally curved teeth, a few stout lateral teeth, and (5) sternum IX without setae; in the female genitalia by the combination of (1) tergum VIII and sternum VIII shape and number of scales, (2) tergum IX with 10-17 setae on each side of midline, (3) insula tongue-like with distal tuberculi, (4) upper vaginal sclerite moderately large, elongate, heavily pigmented, (5) spermathecal eminence membranous, poorly defined, with short spiny excrescences on mesal opening, (6) postgenital lobe wide, moderately long, 10-16 setae on each side of midline, apex flat or with a very small median indentation, (7) cercus moderately long, scales absent, and (8) 3 spherical seminal capsules, one large and 2 slightly smaller ones; in the pupae by the combination of (1) setae 1, 2-CT 1-3 branched, moderately long, 3-CT 1,2 branched, (2) 10-12-CT all approximately equal in length, (3) 3-I long, usually 2-5 branched, (4) 4-I long and stout, 2-5 branched, 5-I short and thin, 1-3 branched, (5) 3-II long and stout, 5-9 branched, (6) 1-VI-VII short and single, occasionally 2 branched on VI, (7) 9-VII long and stout, cephalad and laterad to 6-VII, (8) 9-VIII long and stout, 4-8 branched, and (9) paddle with apex projected, fringe and serrations absent, 1-P long, stout, usually single, attached subapically;

and in the fourth stage larvae by the combination of (1) setae 5, 6-C long and stout, approximately equal in length, 5-C slightly laterad and far caudad to 6-C, 4-C moderately long, 3-6 branched, slightly mesad and caudad to 6-C, (2) 7-C moderately long, 2-4 branched, mesad and slightly cephalad to base of antenna, (3) 1-A short, usually 2 branched (2-3), (4) 1-P long and stout, single, (5) 6-I-VI long, stout and barbed, (6) 13-I-V long, stout and barbed, 13-I multiple branched, (7) comb composed of 25-35 scales arranged in a patch, (8) saddle incompletely rings segment X, acus absent, 1-X short and single, and (9) siphon heavily pigmented, moderately long, acus detached, pecten of 13-24 teeth on basal 0.44 of siphon and with apical tooth wider spaced than remainder of teeth, 1-S long and stout, usually single and attached on basal 0.48-0.54 of siphon, distad of last pecten tooth.

The adults of *Isoaedes* are somewhat similar in habitus to those of members in some groups of subgenera *Diceromyia* Theobald, *Aedimorphus* Theobald, *Ochlerotatus* Lynch Arribalzaga, *Finlaya* Theobald and *Edwardsaedes* Belkin. Adults of *Isoaedes* can be separated from these by the absence of scales on the subspiracular area, presence of a lower mesepimeral seta, development of the male maxillary palpus, and development of the male and female genitalia. The unique development and combination of elements of the male genitalia easily separate *Isoaedes* from all subgenera of *Aedes*. The male genitalia are most similar to those of some *Diceromyia*, some *Stegomyia* Theobald and some *Aedimorphus*, but the above features distinguish *Isoaedes*. The gonostylus is developed much like those of subgenera *Abraedes* Zavortink, *Alanstonea* Mattingly, *Aztecaedes* Zavortink, *Chaetocruuiomyia* Theobald, *Christophersiomyia* Barraud, *Finlaya*, *Geoskusea* Edwards, *Gymnometopa* Coquillett, *Halaedes* Belkin, *Howardina* Theobald, *Huaedes* Huang, *Kompia* Aitken, *Macleaya* Theobald, *Mucidus* Theobald, *Nothoskusea* Dumbleton, *Ochlerotatus*, *Protomacleaya* Theobald, *Pseudoskusea* Theobald, *Rusticooidus* Shevchenko and Prudkina, and *Stegomyia*. The paraproct, with a sternal arm, is somewhat like most African species of *Stegomyia*. The aedeagus of *Isoaedes* differs from those of *Aedimorphus* and *Diceromyia* by the absence of a dorsal flap (see Reinert 1970, 1973). Some groups of subgenera *Diceromyia* and *Stegomyia* have somewhat similar female genitalia to *Isoaedes*, but not the combination of features listed.

Pupal features of importance for this new subgenus are: seta 11-CT approximately equal in length to 10, 12-CT; 4-I long and stout compared to the short and weakly developed 5-I; 3-II long and multiple branched; and paddle with an apical projection, fringe and serrations absent, and 1-P attached subapically. *Ayurakitia* Thurman has the paddle with the apex somewhat similar; however, members of this subgenus are easily recognizable by the very long setae 7-CT and 5-IV-VI, and the hooklike seta 1-P. *Christophersiomyia* and some *Protomacleaya* have similarly developed setae 4, 5-I.

Larval seta 13-I-VI of *Isoaedes* is similar to those of *Ae. (Stg.) hoguei* Belkin and *horrescens* Edwards. Species of the subgenus *Bothaella* Reinert and genus *Heizmannia* Ludlow have a similar siphon, but the apical pecten teeth are not detached. Other subgenera having a pecten with one or more distally separated tooth or teeth are *Aedes* Meigen, *Aedimorphus*, *Edwardsaedes*, *Neomelaniconion* Newstead, *Paraedes* Edwards, *Rhinoskusea* Edwards, and *Verrallina* Theobald and some members of the following, *Finlaya*, *Mucidus*, *Ochlerotatus* and *Rusticooidus*. However, these subgenera do not have the unique combination of larval features outlined for *Isoaedes*. *Aedimorphus*

larvae are easily separated from those of *Isoaedes* by the long multiple branched seta 1-A and the development and arrangement of setae 4-7, 13-C. *Stegomyia* larvae differ in having the comb with teeth not in a patch but in a single row, pecten without detached distal teeth, siphon with acus absent (occasionally small and attached), position of setae 4-6-C and development of seta 1-S. Larvae of *Diceromyia* differ by the development and position of setae 7, 11-C development of pecten and comb, and setae 2, 3-A attached subapically.

BIONOMICS. This information is the same as listed for the type-species.

Aedes (Isoaedes) cavaticus Reinert, New Species

(Figs. 1-6)

FEMALE (Fig. 1). *Head*. Antenna dark brown, 1.03-1.12 length of proboscis, 13 flagellomeres, basal one pale golden-brown with a small patch of several broad golden-brown scales ventroapically, pedicel golden-brown with a few small golden-brown scales and short fine pale setae mesally; clypeus brown, bare; maxillary palpus dark brown scaled, 4 segmented, 0.21-0.23 length of proboscis; proboscis dark brown scaled, 1.01-1.03 length of femur I; eyes contiguous; several dark brown ocular setae, median 2 longer; vertex with integument dark brown, sparsely covered with narrow white decumbent scales and numerous golden-brown long erect forked scales, similar decumbent and erect scales on occiput; lateral surface covered with broad golden-white decumbent scales. *Thorax*. Scutal and pleural integument pale golden-brown; scutum covered with pale golden-brown narrow curved scales; prescutellar space bare; scutellum with a patch of pale golden-brown narrow curved scales on each lobe; long dark brown setae on following areas: 2-4 long and 2,3 minute median anterior promontory, numerous acrostichal (anterior and posterior) arranged in 2 closely positioned rows, numerous dorsocentral (anterior and posterior), scutal fossal (3,4 long and 2-4 minute anterior, 3-6 lateral, 0-3 median and 1,2 posterior), numerous supra-alar, 6 golden posterior medial scutal, 1 postalar callar and scutellar (6-9 long and 2-4 short ones on lateral lobe, 5-7 long and 5-8 short ones on median lobe); antepronota widely separated, each covered with narrow curved white scales, 7-10 long and 2-6 minute dark setae; postpronotum covered with narrow curved scales, golden-brown ones dorsally and white ones ventrally, 5,6 posterior dark setae, usually 2,3 minute setae anteroventrad of posterior long setae; propleuron with 1-4 broad white scales (these scales easily rubbed off), 4-7 dark setae; prosternum, subspiracular area, paratergite, mesomeron, metameron, metepisternum and mesopostnotum bare; postspiracular area with a few broad white scales (a few specimens apparently without scales), 3-7 dark setae; mesepisternum with a moderately large upper and a small lower patch of broad white scales, 2,3 upper and 13-17 posterior dark and golden setae, lower ones shorter; prealar knob with 7-13 dark setae; mesepimeron with a moderately large patch of broad white scales on median area, 11-13 brown setae on upper area dorsad of scales, one long dark seta on lower anterior area. *Legs*. Coxae I-III each with several brown setae, I with broad white scales and a median patch of pale golden-brown scales on anterior surface, II and III each with a small anteroventral patch of broad white scales;

trochanters I-III each with several golden-brown setae and several broad white scales; femora I and II each with anterior surface dark brown scaled, posterior surface of I and II each dark brown scaled with a white scaled longitudinal stripe from base to near apex, stripe dorsal on I and ventral on II, III with anterior and posterior surfaces each dark brown scaled with a ventral longitudinal stripe from base to approximately 0.75-0.80, stripe broad at base and narrow apically, I-III each with a white scaled apical spot, anteromedian and posteromedian on I, anterodorsal and posterodorsal on II and III; tibiae I-III and tarsi I-III each dark brown scaled; posttarsi I-III (Fig. 6) each with 2 ungues, I and II with ungues equal in size, each with a tooth, III with ungues equal in size, both simple. *Wing*. Dorsal and ventral veins dark brown scaled; alula with a row of moderately long brown scales on margin, upper calypter with a row of pale setae on margin; 1,2 dark remigial setae. *Halter*. Pedicel pale; capitellum pale golden-brown scaled. *Abdomen*. Terga I-VII each dark brown scaled with a large laterobasal patch of golden-white scales, a few pale scales dorsobasal on I-IV, dorsobasal golden-white scales form an indistinct band on V and a broad distinct band on VI and VII, these connected to laterobasal pale spots, VI and VII each with posteromesal area of band narrower giving it a bilobed appearance dorsally; sterna II-VII white scaled, III-VII also each with a broad posterior band of dark brown scales. *Genitalia* (Fig. 2). Tergum VIII (VIII-Te) lightly to moderately pigmented, trapezoidal in shape, short setae scattered over apical 0.49-0.66, a few moderately long stouter setae on apical margin, a number of broad scales intermixed with short setae, basolateral seta (BLS) present, entire area covered with minute spicules, 0.6-0.8 retracted into segment VII, VIII-Te index 0.65-0.77, VIII-Te/IX-Te index 2.20-2.46, length 0.25-0.31 mm, width 0.37-0.44 mm; sternum VIII (VIII-S) lightly to moderately pigmented, moderately wide, base slightly concave, apex with a moderately deep median indentation and with a small lobe on each side of indentation, numerous short and a few moderately long setae scattered over apical 0.70-0.78, moderately long stouter setae on apical margin, some with curved tips, setae 1-3-S more or less evenly spaced in a diagonal line, entire area covered with minute spicules, basolateral seta (BLS) present, several broad scales present, apical intersegmental fold lightly to moderately pigmented mesally, VIII-S index 0.66-0.76, length 0.31-0.35 mm, width 0.46-0.48 mm; tergum IX (IX-Te) moderately pigmented, apex with a moderately deep median indentation and with 10-17 short setae on each side of midline, 22-32 total setae, entire area covered with minute spicules, IX-Te index 0.77-0.90, length 0.11-0.13 mm, width 0.14-0.17 mm; insula (I) moderately pigmented, long, tongue-like, covered with minute spicules, 3 or 4 small tuberculi (Tu) on apical area; lower vaginal lip (LVL) heavily pigmented, narrow, covered with minute spicules, lower vaginal sclerite absent; hinge (H) normal; upper vaginal lip (UVL) heavily pigmented, narrow, covered with minute spicules, upper vaginal sclerite (UVS) moderately large, elongate, heavily pigmented; upper atrial wall differentiated into an unpigmented poorly defined membranous spermathecal eminence (SE) with lightly pigmented spiny excrescences (Ex) along mesal opening; postgenital lobe (PGL) moderately long, wide, apex flat or with a small median indentation (0.00-0.15 deep), 10-16 setae on each side of midline, one on each side long and somewhat stouter, 22-23 total setae, covered with minute spicules, basal median apodeme (BMA) heavily pigmented, dorsal PGL index 0.69-0.84, ventral PGL index 1.02-1.25, ventral length 0.11-0.13 mm; perianal membrane with minute spicules; cercus (Ce) moderately long, apex bluntly pointed, mesal margin nearly straight with distal

portion curved slightly outward, outer margin bowed, completely covered with minute spicules, tergal surface with short and moderately long setae scattered over apical 0.60-0.75, several long setae on apical area, those on margin somewhat stouter, scales absent, ventral surface with a few short setae along outer apical margin, index 2.00-2.38, cercus/dorsal PGL index 2.43-2.66, length 0.18-0.22 mm, width 0.09-0.10 mm; 3 heavily pigmented spherical seminal capsules (SCa), one large and 2 medium sized ones, each with a few small seminal capsule pores (SCaP) near orifice, base of accessory gland duct (AGDuB) heavily pigmented.

MALE. Essentially as in the female but with the following differences. *Head* (Fig. 1). Antenna 0.84-0.90 length of proboscis, setae of flagellar whorls numerous and directed mainly dorsal-ventrally, 13 flagellomeres, basal 11 short, apical 2 long; maxillary palpus 0.84-0.92 length of proboscis, 5 segmented, dark brown scaled, segments 2 and 3 long, 4 and 5 short and slightly downturned, 3-5 each with a few short dark setae at apex, approximate length of each segment to total length of maxillary palpus in parentheses, 1 (0.09), 2 (0.28), 3 (0.36), 4 (0.17) and 5 (0.10); proboscis 1.04-1.10 length of femur I. *Thorax*. Anteprenotum with 6-10 long and 2-5 minute setae; prealar knob with 6-9 setae; mesepimeron with 8-10 setae dorsad of scale patch and one long and 2,3 short setae ventrad of scales. *Legs*. Femur I with apical white scaled spot extending from anterior surface dorsally and onto posterior surface; posttarsi I-III (Fig. 6) each with 2 ungues, I and II each with ungues unequal in size, each with a tooth, III with ungues equal in size, both simple. *Abdomen*. Terga II-VII each dark brown scaled with a broad white scaled basal band which is narrow along dorsal midline on II-IV, tergum VIII white scaled; terga with numerous moderately long golden setae along lateral and posterior margins; sternum VIII white scaled. *Genitalia* (Fig. 3). Tergum (IX-Te) heavily pigmented, bilobed, each lobe with 11-24 long and 4-8 short setae, latter ones stout and form a short posterior row, entire surface covered with minute spicules; gonocoxite (Gc) long and moderately broad, tergal surface with short fine setae extending to mesal margin, outer margin with several long stout setae from base to apex, mesobasal area with a patch of long stout setae, scales on lateral and ventral surfaces, ventral surface with numerous very long stout setae on apical 0.4-0.5, basal area with moderately long setae, mesal margin with short setae on basal 0.75, mesal surface membranous; gonostylus (Gs) moderately pigmented, narrow, moderately long, 0.64-0.69 length of gonocoxite, 9-12 short fine setae on apical 0.7 but most numerous on apical 0.25, a single heavily pigmented narrow blunt spiniform at apex; basal mesal lobe (BML) small, short, heavily pigmented, covered with moderately long hairlike spicules, apex with a moderately long stout seta with distal portion curved, 4,5 short thin setae on apical 0.4, a narrow band connects bases of lobes; proctiger (Pr) moderately long, heavily pigmented, paraproct (Ppr) with a short blunt sternal arm near middle, apex very dark and with 3 short teeth, cercus membranous with a pair of small moderately pigmented elongate plates on tergal surface, cercal setae absent; tergum X (X-Te) moderately to heavily pigmented, curved, somewhat expanded at base and apex, with spicules; phallosome (Pha) with aedeagus (Ae) moderately long, heavily pigmented, consisting of 2 lateral plates connected basally and apically, apex flared with 30-40 pointed tergally curved teeth, 2-4 stout lateral teeth, paramere (Par) moderately long, 0.73-0.81 length of aedeagus, moderately pigmented, attached near middle to parameral apodeme (PaA) and at apex to base of aedeagus, parameral apodeme moderately to heavily pigmented, 1.38-1.56 length of paramere, attached from base to near middle to apodeme of gonocoxite; sternum IX (IX-S) moderately large, basal half, lateral margins and a median strip moderately pigmented, remainder membranous, setae absent.

PUPA (Fig. 4). Chaetotaxy and measurements based on 14 pupal exuviae which have associated adult specimens. *Cephalothorax* (CT). Moderately pigmented; ocular plate with cuticular facets not developed; setae 1, 2-CT 1-3 branched, moderately long; 3-CT 1,2 (1) branched, long; 4-CT 1-4 (3) branched; 5, 7-CT 2-4 (3) branched; 6-CT single; 8-CT 4-10 (8) branched; 9-CT 1-3 (2) branched, long. *Metanotal plate* (MP). Moderately pigmented; seta 10-CT 2-8 (4) branched; 11, 12-CT 1-4 (2) branched. *Respiratory trumpet* (T). Moderately to heavily pigmented; index 3.76-4.56, mean 4.19; trumpet length 0.36-0.57 mm, median width 0.10-0.13 mm; pinna on apical 0.27-0.34. *Abdomen*. Moderately pigmented; seta 1-I fanlike with 54-98 (76) aciculate dendritic branches (number of branches measured on basal 0.33 of seta); 2, 9, 10-I single; 3-I 1-6 (3) branched, long; 4-I 2-5 (4) branched, long, stout; 5-I 1-3 (1) branched, short, thin; 6-I 2-8 (3) branched; 7-I 2-4 (2) branched; 0, 2, 9-II single; 3-II 5-9 (5) branched, long, stout; 4-II 2-6 (5) branched; 5-II 2-6 (3) branched; 6-II 2-4 (2) branched; 7-II 1-5 (3) branched; 0, 2, 9, 11, 14-III single; 1-III 2-5 (3) branched; 3-III 1-5 (2) branched, long, stout; 4, 8, 10-III 1-3 (2) branched; 5-III 2-7 (4) branched; 6-III 2-4 (2) branched; 7-III 1,2 (1) branched; 0, 2, 5, 9, 11, 14-IV single, 5-IV very long, stout; 1-IV 2-4 (3) branched; 3-IV 2-9 (5) branched; 4,8, 10-IV 1-3 (2) branched; 6-IV 1-4 (2) branched; 7-IV 1-3 (1) branched; 0, 2, 5, 9, 10, 11, 14-V single, 5-V long, stout; 1, 3, 8-V 1-3 (2) branched; 4-V 2-5 (3) branched; 6-V 2-4 (2) branched; 7-V 1-4 (3) branched; 0, 2, 5, 10, 11, 14-VI single, 5-V long, stout; 1, 7, 9-VI 1,2 (1) branched; 3-VI 1-3 (1) branched; 4-VI 2-5 (2) branched; 6, 8-VI 1-3 (2) branched; 0-2, 5, 11, 14-VII single; 3, 7, 10-VII 1, 2 (1) branched; 4, 6, 8, 9-VII 1-3 (2) branched, 9-VII long, stout, barbed; 0, 4, 14-VIII single; 9-VIII 4-8 (5) branched, long, stout, barbed. *Paddle* (P). Ovoid, apex projected; minute scattered spicules on apical 0.26-0.39 of outer and apical 0.14-0.25 of inner margins; seta 1-P 1-3 (1) branched, stout, attached subapically; index 1.34-1.52, mean 1.45; paddle length 0.73-0.89 mm, maximum width 0.48-0.62 mm.

LARVA (Figs. 5, 6). Description based on detailed analysis of 10 whole larvae and 4 larval exuviae which have associated adults. The larvae exhibit polymorphism in the development of the antenna and lateral palatal brush (LPB). Two larval forms exist: one designated LPB-C, has the antenna moderately long without spicules and the lateral palatal brush with moderately long comb-tipped filaments (46 whole larvae and 21 larval exuviae); and the other form, designated LPB-S, has the antenna very long with very small spicules scattered over most of the ventral surface and the lateral palatal brush with long simple filaments (32 whole larvae and 15 larval exuviae). Two groups of intermediate forms were found and provide a gradation between the above forms and are as follows: the first group, designated LPB-C-I, possesses antenna longer than LPB-C but shorter than LPB-S and has a few very small spicules present or absent and the lateral palatal brush with comb-tipped filaments (6 whole larvae and 8 larval exuviae); and the second group, designated LPB-S-I, has the antenna shorter than LPB-S but longer than LPB-C and with very small spicules and the lateral palatal brush with long simple filaments (6 whole larvae). These forms are outlined in Table 1. *Head* (C). Lightly to moderately pigmented; setae 0-3, 5, 6, 8, 9, 14, 18, 20-C single, 5, 6-C long and approximately equal in length, 5-C slightly laterad and far caudad to 6-C; 4-C 3-6 (4) branched, moderately long, slightly mesad and caudad to 6-C; 7, 15-C 2-4 (2) branched, 7-C moderately long, mesad and slightly cephalad to antennal base; 10, 13-C 1,2 (1) branched; 11-C 3-8 (5)

branched; 12-C 1-4 (2) branched; dorsomentum (Dm) heavily pigmented, 19-25 (22) long teeth; ventromedian cervical sclerite (VmCS) moderately pigmented, small. *Antenna* (A). Moderately long to long (0.36-0.77 mm); moderately pigmented; length to width at attachment of seta 1-A ratio (L/W) 9.06-19.53; seta 1-A 2,3 (2) branched, short, attached 0.43-0.53 from antennal base; setae 2-6-A attached at apex of antennal shaft. *Thorax*. Prothorax (P) with setae 0, 8-P 2-4 (3) branched; 1-6, 9, 10, 12-P single; 7-P 1,2 (2) branched; 11-P 1,2 (1) branched; 14-P 2 branched; 1-P long and stout; 5-7-P, 5-10, 12-M, 7, 9, 10-T barbed; 9-12-P on a small moderately pigmented plate. Mesothorax (M) with setae 1, 2-M 1-3 (2) branched; 3, 5, 11, 12-M 1,2 (1) branched; 4, 7, 10-M single; 6-M 1-4 (2) branched; 8-M 2-4 (2) branched; 9-M 3-6 (3) branched; 13-M 3-7 (4) branched; 14-M 3-5 (4) branched; 9-12-M, T located on large heavily pigmented plates bearing a stout apical spine. Metathorax (T) with seta 1-T 1-3 (2) branched; 2, 5, 6, 10-12-T single; 3, 8, 9-T 2-4 (3) branched; 4-T 2-4 (2) branched; 7-T 3-10 (5) branched; 13-T 2-4 (4) branched. *Abdomen*. Setae 6-I-VI, 7-I-II, 13-I-V long, stout, barbed; 1, 9-I 1-3 (1) branched; 2, 10-I single, 3, 11-I 1,2 (1) branched; 4, 6-I 2-5 (3) branched; 5-I 1-5 (3) branched; 7-I 1,2 (2) branched; 13-I 2-9 (5) branched; 0, 2, 5, 9-11, 14-II single; 1, 7, 8-II 1,2 (2) branched; 3, 12-II 1,2 (1) branched; 4-II 2-6 (4) branched; 6-II 2,3 (2) branched; 13-II 2-6 (5) branched; 0, 2, 3, 5, 9-11, 13-III single; 1, 6, 8, 14-III 1,2 (1) branched; 4, 12-III 1-3 (2) branched; 7-III 2-5 (4) branched; 0, 2, 3, 5, 8-11, 13-IV single; 1, 6, 14-IV 1,2 (1) branched; 4, 12-IV 1,2 (2) branched; 7-IV 3-6 (4) branched; 0-3, 5, 6, 8-13-V single; 4-V 2-5 (2) branched; 7-V 2-5 (3) branched; 14-V 1,2 (1) branched; 0, 2, 3, 5, 6, 9-12, 14-VI single; 1-VI 1-3 (2) branched; 4, 7-VI 1,2 (2) branched; 8-VI 1,2 (1) branched; 13-VI 2-6 (4) branched; 0-2, 4, 7, 10-12, 14-VII single; 3, 5-VII 1,2 (2) branched; 6-VII 2,3 (2) branched; 8-VII 2-6 (4) branched; 9-VII 1-3 (2) branched; 13-VII 1,2 (1) branched; 0, 2, 4-VIII single; 1, 14-VIII 1,2 (1) branched; 3-VIII 4-6 (5) branched; 5-VIII 1-3 (1) branched; 1-5-VIII stout, barbed; VIII with comb composed of 25-35 (32) scales (CS) arranged in a patch between setae 1 and 5, each scale moderately pigmented with a bluntly rounded apex and with stout denticles along lateral and apical margins; 1-X single, short, stout, lightly barbed, attached near middle of caudal portion of saddle; 2-X 2-4 (3) branched, moderately long; 3-X single, very long; 4-X composed of 5 pairs of setae, all attached to grid, 4a-X 2-6 (4) branched, moderately long, 4b-e-X 3-5 (4) branched, long; saddle moderately pigmented, incompletely rings segment X, dorsal length 0.31-0.37 mm, short rows of small spicules on caudal area, acus absent; 4 anal papillae, moderately long, length 1.55-1.90 dorsal length of saddle. *Siphon* (S). Heavily pigmented; moderately long, length 1.14-1.33 mm, index 2.64-3.64, mean 3.22; acus heavily pigmented, detached; pecten on basal 0.31-0.44 of siphon, composed of 13-24 (17) teeth (PT), distal tooth wider spaced than remainder of teeth, each tooth with 1-3 small denticles on ventrobasal area; seta 1-S single, rarely 2 branched, long, stout, base attached on basal 0.48-0.54 of siphon distad of last pecten tooth; 2, 6, 7, 9-S single; 8-S 1-3 (2) branched.

TYPE-DATA. The type-series consists of the holotype male (collection number 07727-9, genitalia slide number T78.18, and associated pupal and larval exuviae on a slide), allotype (collection number 07727-42, genitalia slide number T78.21, and associated pupal and larval exuviae on a slide), and 10 male, 39 female and 20 whole larvae paratypes. Collection data for collection number 07727 (type-series in part) follow: THAILAND, *Kanchanaburi*, Huai Bong Ti, Gang Lawa Cave, 8 September 1976, Kol Mongkolpanya and team

collectors, each specimen collected as a larva from one of several medium or large shallow pools, 8-25 cm deep, containing clear, fresh, temporary, unmoving, cold water, formed by small terraces on rock floor of the cave, approximately 15 m and deeper inside the cave from its mouth, no visible light, a number of bats in cave, and no pupae or adults collected in the cave. The larvae, in the natural habitat were pale in color and moved in a slow, sluggish motion.

The holotype is in excellent condition and is deposited in the U.S. National Museum (Natural History) (USNM). The genitalia are mounted in Canada balsam on a microscope slide and are in excellent condition. A list of the paratypes follows: 07727-1 (♀pl), 07727-2 (♀pl), 07727-3 (♀pl), 07727-4 (♀pl), 07727-5 (♀), 07727-6 (♂pl), 07727-7 (♂pl), 07727-8 (♂pl), 07727-10 (♂pl), 07727-16 (♀pl), 07727-17 (♂pl), 07727-18 (♀pl), 07727-19 (♀pl), 07727-20 (♀pl), 07727-21 (♀p), 07727-22 (♀pl), 07727-23 (♀pl), 07727-24 (♀pl), 07727-25 (♀pl), 07727-26 (♀pl), 07727-27 (♂pl), 07727-28 (♀pl), 07727-29 (♀pl), 07727-30 (♀pl), 07727-31 (♀pl), 07727-32 (♀pl), 07727-33 (♀pl), 07727-34 (♀pl), 07727-35 (♀pl), 07727-36 (♀pl), 07727-37 (♀pl), 07727-38 (♀pl), 07727-39 (♀pl), 07727-40 (♀pl), 07727-41 (♀pl), 07727-43 (♀pl), 07727-44 (♀pl), 07727-45 (♀pl), 07727-46 (♀pl), 07727-47 (♀p), 07727-48 (♀pl), 07727-49 (♀pl), 07727-50 (♀pl), 07727-51 (♂pl), 07727-52 (♂p), 07727-54 (♀pl), 07727-56 (♀pl) and 07727 (20L). Two additional paratype males (KB31-1, KB31-2) complete the type-series and possess the same collection data as for number 07727 except for the date (18 March 1964), collection number (KB31), the collectors (Sumeth Chunchulchern and team), and the immature exuviae were lost when the adults were reared. Paratypes will be deposited as follows: one male and one female (with associated immature exuviae) in the British Museum (Natural History), London, 2 females (with associated immature exuviae) in the Bernice P. Bishop Museum, one female (with associated immature exuviae) in the Florida State Collection of Arthropods, one male and one female (with associated immature exuviae) in the Department of Medical Entomology, Armed Forces Research Institute of Medical Sciences, Bangkok, Thailand, and one female (with associated immature exuviae) in the Office de la Recherche scientifique et technique Outre-Mer (ORSTOM) Museum, Bondy, France. The remainder of the paratypes are in the USNM.

BIONOMICS. Immatures have been collected only from a single cave in Kanchanaburi Province, Thailand, on 3 occasions: 18 March 1964 (collection number KB31), 2 June 1964 (collection numbers 00176, 00177, 00178), and 8 September 1976 (collection number 07727). The immature habitat is fresh, clear, temporary, unmoving, cold water in shallow pools within a cave having no visible light. Larvae were collected scattered throughout the pools and in approximately equal numbers with those of *Uranotaenia sumethi* Peyton and Rattanaarithikul. The cave is located in a mountainous terrain at an elevation of 200 m.

DISTRIBUTION. Material examined: 11♂, 43♀, 95L, 52 with associated skins (46 pl, 6p).

THAILAND. *Kanchanaburi*, Huai Bong Ti, Gang Lawa Cave; 8♂pl, 1♂p, 2♂, 38♀pl, 5♀p, 95L.

DISCUSSION. Since *Ae. cavaticus* is the type-species for the monotypic subgenus *Isoaedes* a discussion and comparison with other subgenera is included there.

Larval polymorphism of *Isoaedes* in the development of the lateral palatal brush and the length of the antenna, is also found in other aedine genera and subgenera. Mattingly (1969) summarizes this phenomenon and lists it for *Ae. (Adm.) marshallii* (Theobald) and *ngong* Van Someren, *Ae. (Dic.) adersi* (Edwards), *Ae. (Fin.) embuensis* Edwards, *ingrami* Edwards and *watteni* Lien, and the following species of *Heizmannia*: *communis* (Leicester), *macdonaldi* Mattingly, *reidi* Mattingly and *scintillans* Ludlow. He also cites examples of polymorphism of the larval lateral palatal brush for *Ae. (Fin.) britteni* Marks and Hodgkin, *Ae. (Hal.) australis* (Erickson), *Ae. (Stg.) horrescens*, *Hs. taiwanensis* Lien and *Opifex fuscus* Hutton.

The slow, sluggish movement of the larvae is probably a result of the cold temperature of the habitat water and the pale larval color is common among arthropods and other animals which live in caves. Larvae were difficult to rear to the adult stage. Specimens transported from the cave to the laboratory for rearing remained alive in the latter for over a month with only a few adults emerging.

The pale integument of the adults appears to correlate with the pale color of other insects which inhabit caves. The long, well developed setae of the adults, especially on the thorax, suggest these structures may increase the tactile ability of these mosquitoes within the dark interior of the cave.

ACKNOWLEDGMENTS

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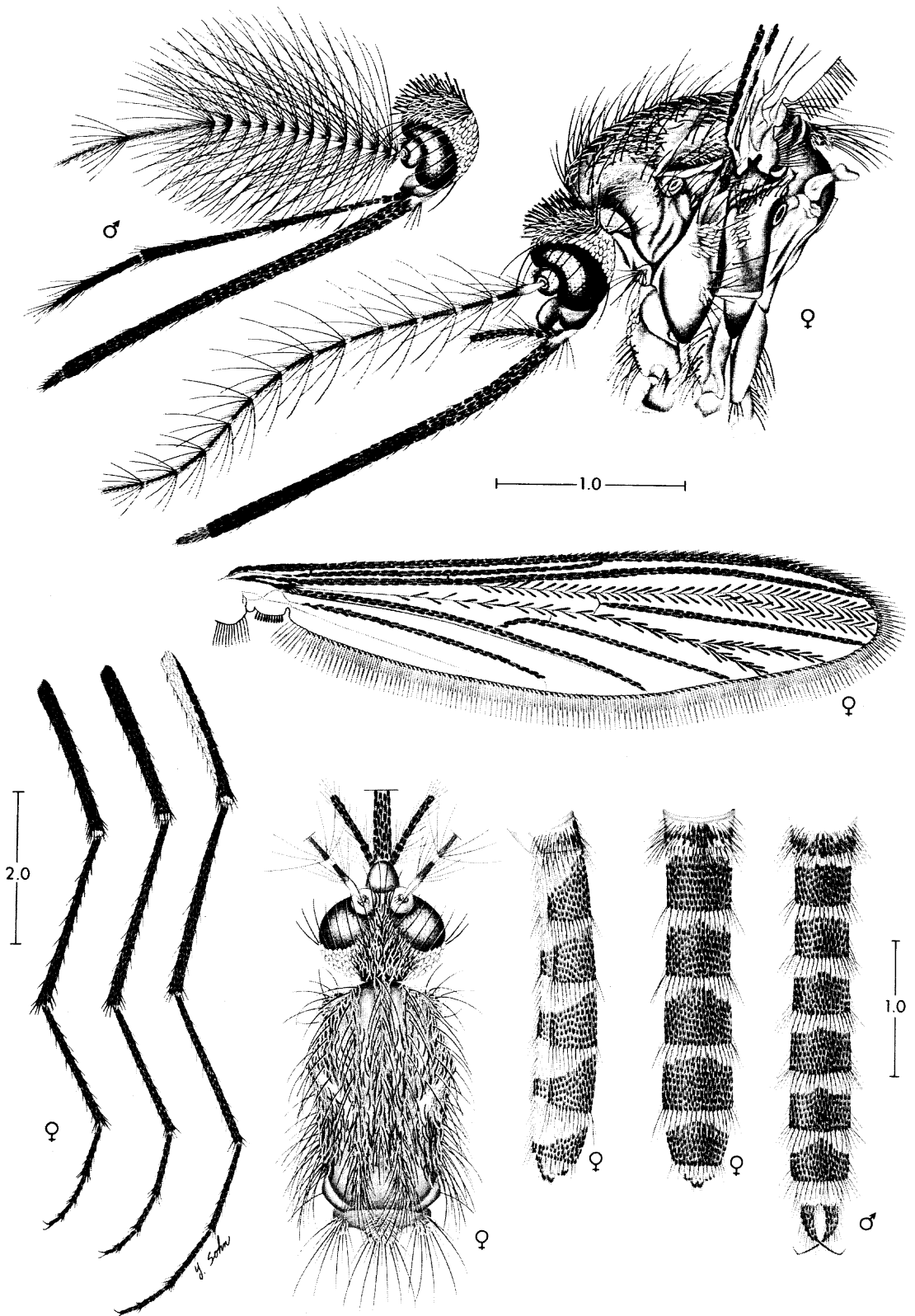
Table 1. Larval polymorphic groups of *Ae. (Isa.) cavaticus*.

| <u>Larval Group</u> | <u>Antennal Length</u> | <u>Antennal Length/Width*</u> | <u>Seta 1-A From Antennal Base</u> | <u>Antennal Spicules</u> |
|---|------------------------|-------------------------------|------------------------------------|--------------------------|
| LPB-C Group** (LPB=Comb-like; A=Short) | 0.36-0.45mm | 9.06-11.82 | 0.43-0.51 | - |
| LPB-C-I Group (LPB=Comb-like; A=Intermediate) | 0.46-0.54mm | 12.44-15.07 | 0.44-0.50 | + |
| LPB-S-I Group (LPB=Simple; A=Intermediate) | 0.53-0.60mm | 11.50-13.89 | 0.47-0.51 | + |
| LPB-S Group (LPB=Simple; A=Long) | 0.63-0.77mm | 15.00-19.53 | 0.51-0.53 | + |

*Antennal width measured at point of attachment of seta 1-A.

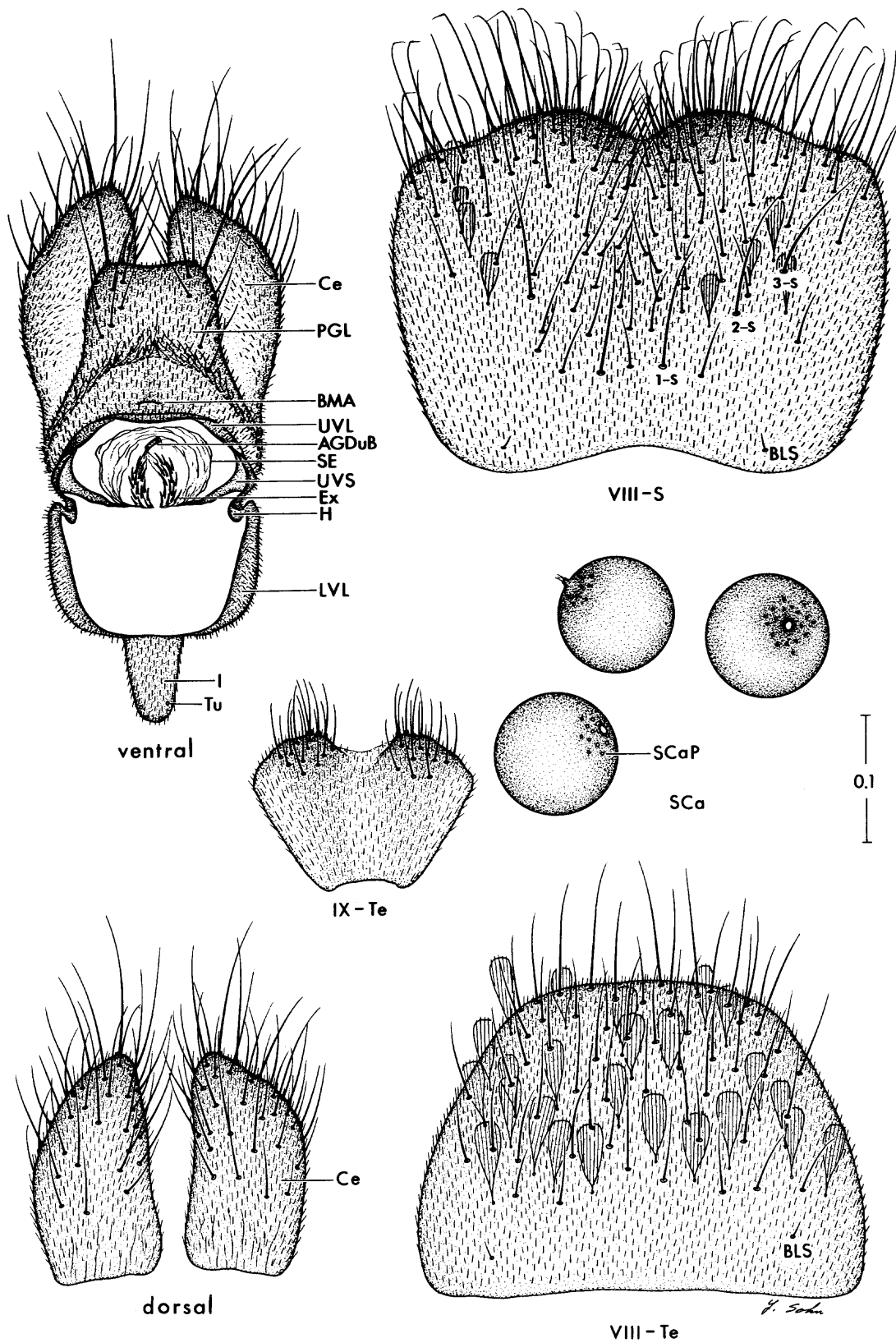
**LPB = lateral palatal brush; A = antenna.

Fig.1



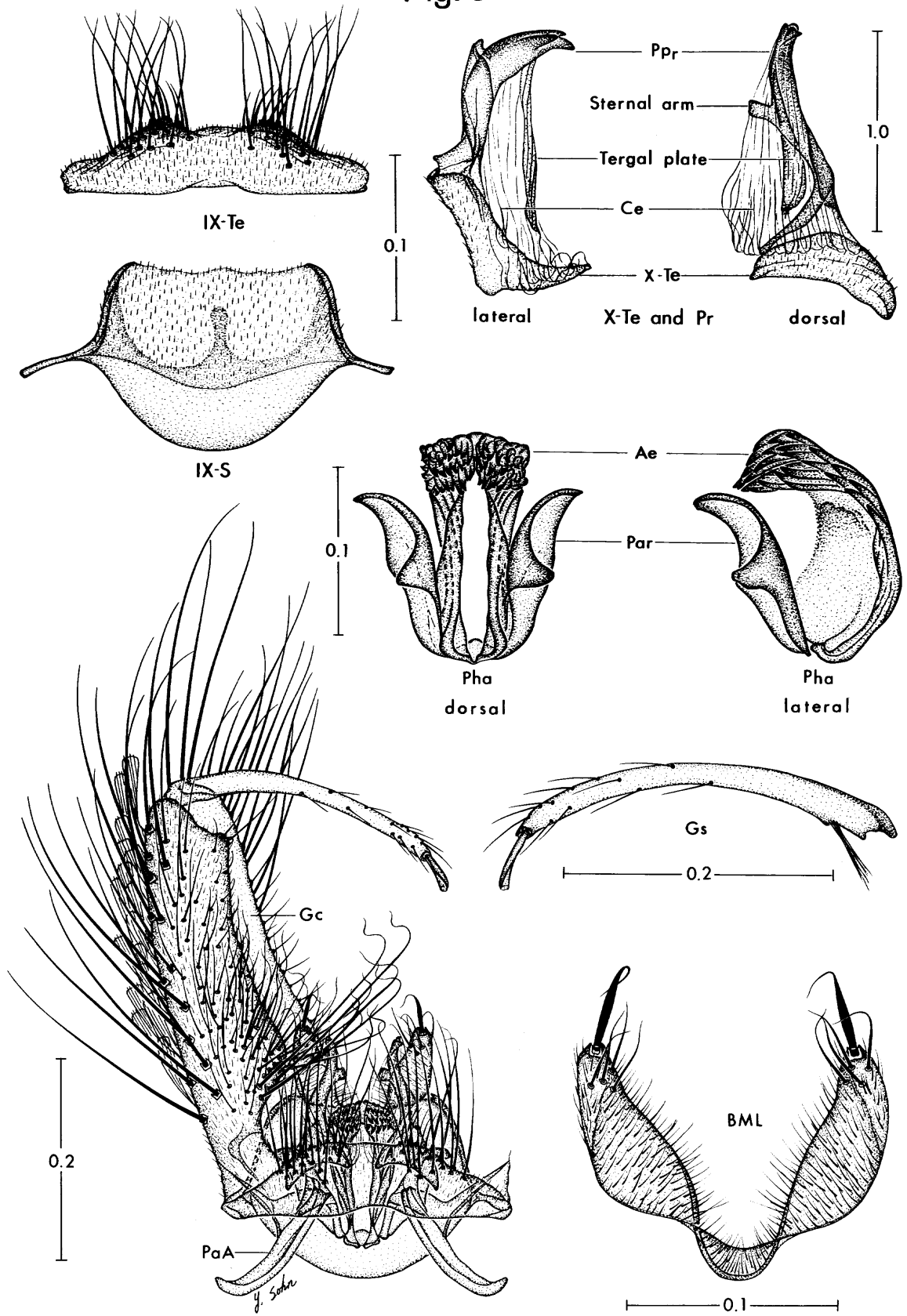
Aedes (Isoaedes) cavaticus

Fig. 2



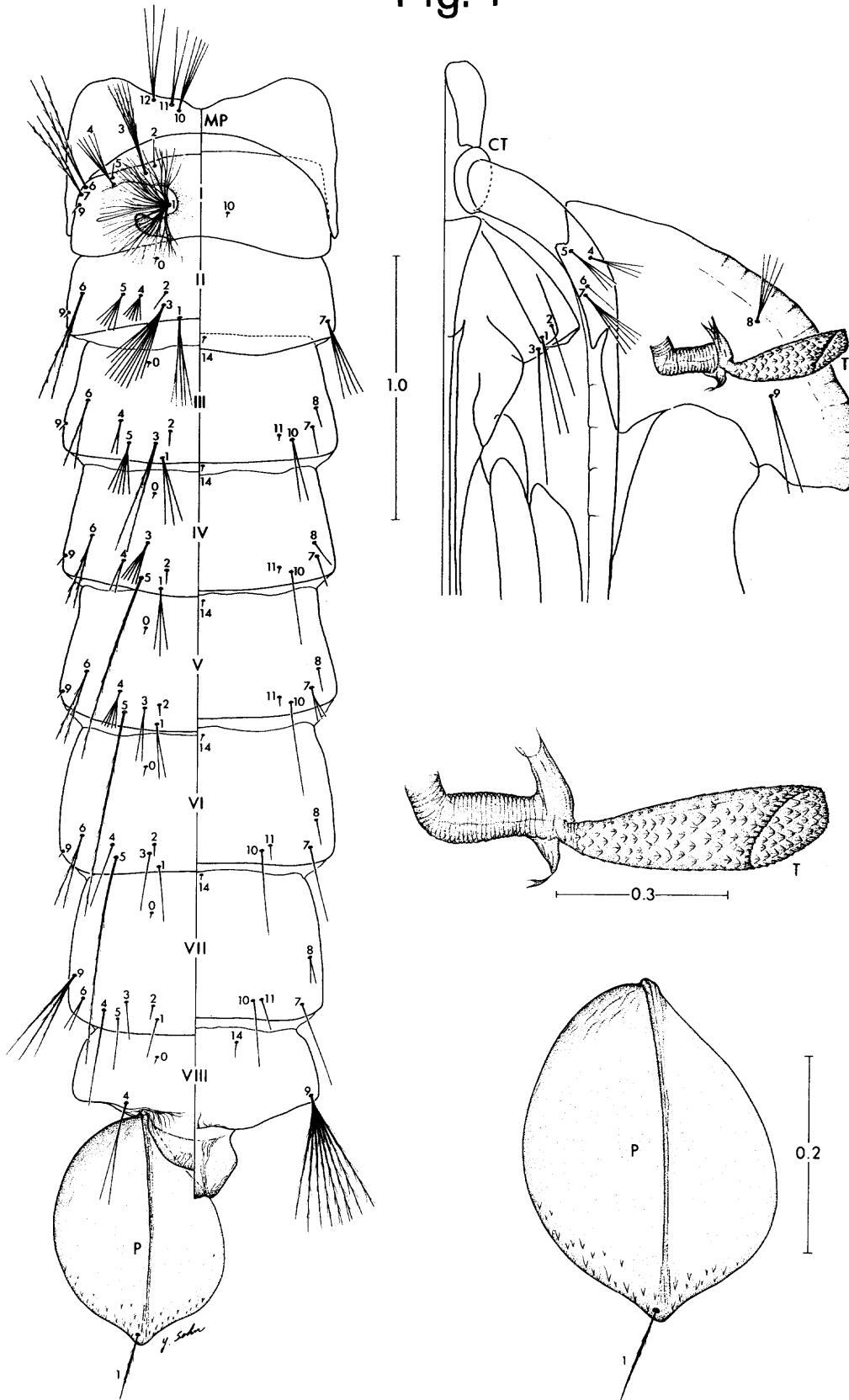
Aedes (Isoaedes) cavaticus

Fig. 3



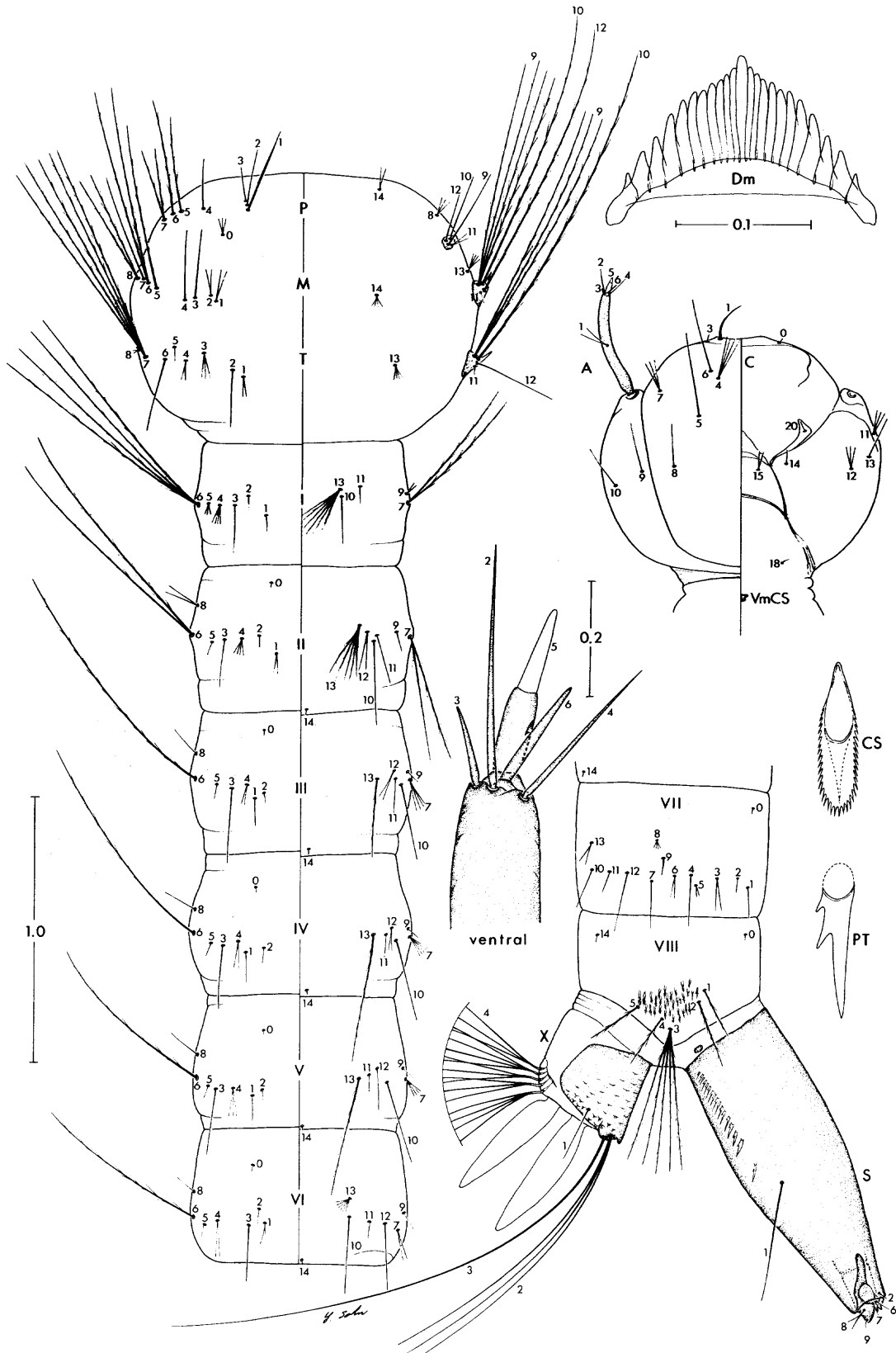
Aedes (Isoaedes) cavaticus

Fig.4



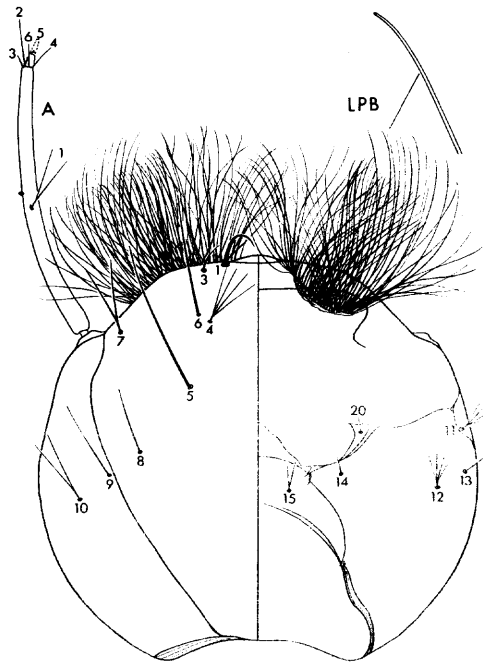
Aedes (Isoaedes) cavaticus

Fig. 5

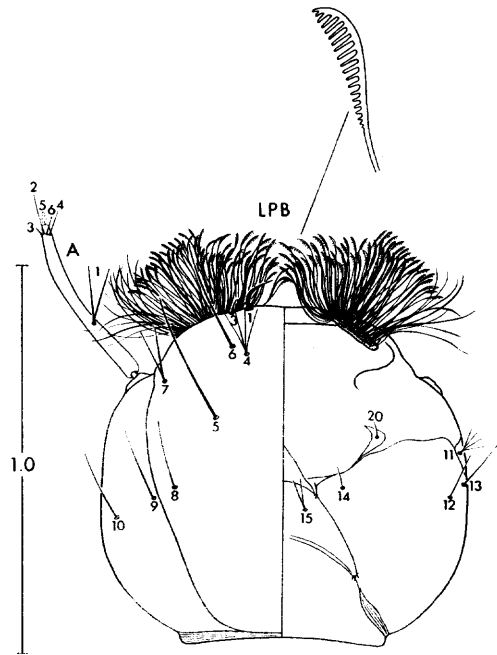


Aedes (Isoaedes) cavaticus

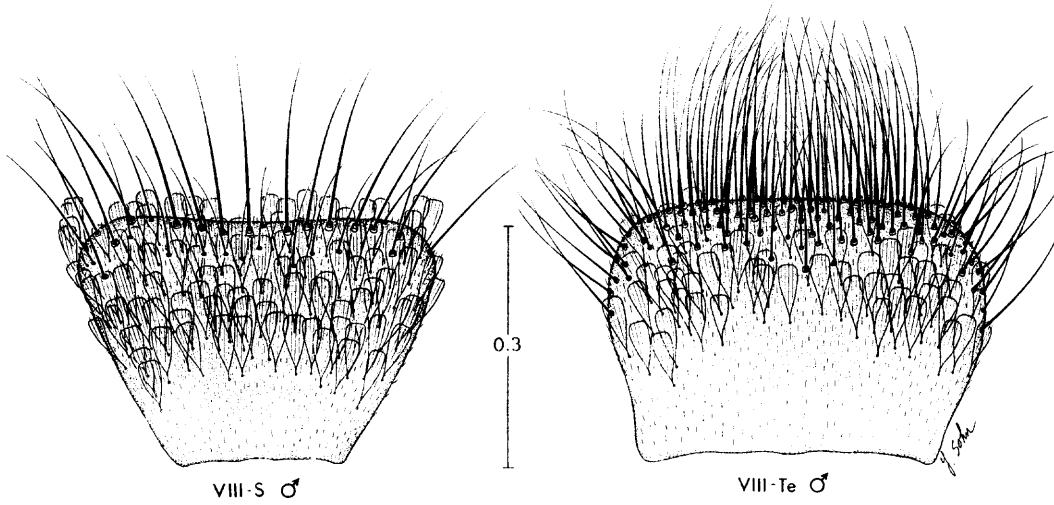
Fig. 6



A=Long to very long
LPB=Long and simple

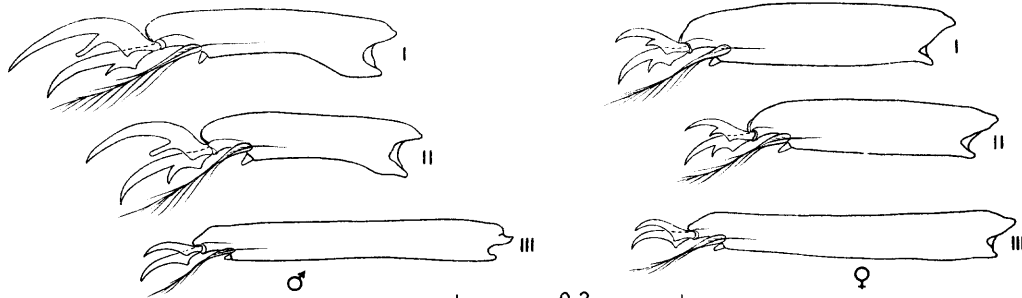


A=Short to moderately long
LPB=Moderately long and comb-tipped



VIII-S ♂

VIII-Te ♂



0.2
Tarsomeres 5 and Posttarsi

Aedes (Isoaedes) cavaticus