Studies on the Mosquitoes in the Yaeyama Islands, Japan 3. Description of the Male, Pupa and Larva of *Aedes (Verrallina) iriomotensis* (Diptera: Culicidae)

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ABSTRACT. The adult male, pupa and 4th stage larva of *Aedes iriomotensis* Tanaka and Mizusawa are described and illustrated for the first time. Biological notes of the species and a key to 3 species of the subgenus *Verrallina* occurring in the Yaeyama Is. are given.

INTRODUCTION

On the basis of the adult female, *Aedes (Verrallina) iriomotensis* Tanaka and Mizusawa, 1973 was described as a distinct species from Iriomotejima, the Southern Ryukyu Is. Japan, and was recognized as a member of the *butleri* Series of Section A by Reinert (1974). Additional material of the species was obtained from its type locality in 1976 and 1978 for the project "Studies on the mosquitoes in the Yaeyama Is." (Miyagi and Toma 1978), and it is now possible to describe and illustrate the hitherto unknown male, pupa and larva of the species. The method of presentation, terminology and abbreviations used in the description follow Reinert (1974).

MALE. *Head.* Antenna with 13 flagellomeres, plumose, 1.14 length of proboscis; flagellomere 13 2.7 length of 12. Maxillary palpus 0.14 length of proboscis; proboscis 1.18-1.24 length of femor I; eye separated in front; several ocular setae; scales on head all broad and decumbent except for a few narrow curved ones along coronal stuture and on occiput. *Thorax.* Scutum blackish brown, with narrow curved dark scales; 4-5 median anterior promontaries, 8-10 dorsocentrals (anterior and posterior), 10-13 acrostichals; 1-2 fossals, 4-5 supraalars, 8-10 prescutellars; all these setae strong; anterior pronotum with a few scales and 5-7 setae; scutellar with 2-3 lateral and 4 median strong setae; small median apical patch of white scales absent; posterior pronotum with 3-4 setae; propleuron with 3-4 setae; subspiracular and paratergite without scales and setae; postspiracular with 2 setae; prealar with 4-6 setae; sternopleura with a small upper and a lower patch of broad pale scales and with 2-3 upper and 2-3 posterior setae and with many fine setae; mesepimeron with a large median patch of pale scales and 5-7 upper and 2-3 median setae. *Legs.* Coxae I-III each with well developed setae and an anterior patch of several white scales but III without scales; claws of I(Fig. 3E) and II unequal, the larger one with a long blunt tipped median tooth; claws of III (Fig. 3D) simple and equal in length. *Wing.* Length, 1.9-2.5 mm. *Abdomen.* Terga covered with dark scales; tergum I without laterobasal whitish scales; terga II-VIII with laterobasal patches of whitish scales, the patches not extending dorsally; sterna I-VIII with small basal bands of white scales. *Genitalia* (Fig. 3A, B). Tergum IX (Fig. 1G) moderately to heavily pigmented, band-like with median caudal margin slightly concave, it is strongly fused to tergum X and proctiger and narrowly

connected laterally to sternum IX. Paraproct (Fig. 1G) not separated from proctiger and restricted to a heavily pigmented band along the lateroapical margin of proctiger, apex strongly pigmented without fine or coarse setae. Sternum IX (Fig. 1F) trapezoid in shape, with about 10 fine setae in middle near apex. Gonocoxite (Fig. 1H) short and broad, heavily pigmented with several strong bristles; tergobasal portion membranous, dorsal surface with apex extended into a moderately long lobe which bears 2-3 moderately long pigmented blunt or pointed, flattened leaf-like apical spines and several well developed setae; inner ventral surface (Fig. 1D) with 2 moderately to heavily pigmented projections, the subapical one small and curved, with a well developed stout spine and 3 fine setae on apical and subapical part, another large one (Fig. 3C) situated near gonostylus, basally bifurcate. Gonostylus long (Fig. 1C and 3C), moderately pigmented, with many well developed dorsal bristles, the arm strongly curved near apex, apically bifurcate. Basal mesal lobe (Fig. 1H) moderately pigmented covered with small spicules, one or 2 of them somewhat conspicuous. Opisthophallus (Fig. 1E) consists of a lightly to moderately pigmented tergal transverse bridge which is placed between parameres. Phallus (Fig. 1E) placed mostly under prosophallus, consists of a pair of moderately long pigmented, narrowly separated, caudally produced arms which are jointed near their center by a narrow sternal bridge, the apex pointed and pigmented. Prosophallus (Fig. 1E) lightly pigmented, consists of a pair of moderately long widely separated acuminate arms, laterocaudal margin formed into a narrow moderately pigmented process which attached to apical margin of paramere. Paramere (Fig. 1E) heavily pigmented, short, 0.64 length of phallic arm, somewhat curved and pointed at apex.

LARVA. Chaetotaxy as figured in Fig. 2 and recorded in Table 1. *Head.* Width of head 0.99-1.00 mm. Seta 4-C fine, 3-5 branched nearly on 7-C level; 5-C most frequently 3 branched and posterior to 6-C which has 3-4 branches and is posterior to 7-C; 7-C with 5-7 branches; 12-C with 3-6 branches; dorsomentum (Fig. 2C) with 25-30 teeth. Antenna (Fig. 2B). Moderately long (0.29-0.31 mm), lightly pigmented with several small scattered spicules; seta 1-A with 4-6 branches, moderately long; 2-A long, 0.4 length of antenna, with a subapical constriction; 3-A short, 0.24-0.28 length of 2-A; 4-A moderately long, 0.50-0.55 length of 2-A; 6-A short, as long as 3-A. *Abdomen.* Comb scales (Fig. 3F) 10-12, arranged in an irregular single or double row, each scale with a stout median apical spine and fine denticles on laterobasal area. *Siphon.* Moderately pigmented; acus well developed; index 2.0-3.0, length 0.75-0.82 mm; pecten on basal 0.50-0.55 of siphon, composed of 10-14 (usually 12) teeth, the apical 1-3 teeth slightly longer and wider spaced than the remainder of teeth, each teeth long, slender and with one stout (rarely another fine) ventrobasal denticles (Fig. 3G); seta 1-S with 2-6 branches, placed beyond pecten at basal 0.66 of siphon; 1-X single, moderately long, placed nearer to ventral margin of saddle than to dorsomedian line; 4-X with 8-10 setae on grid and 1-4 precratal shorter ones, the former with 4-7 (usually 5) branches, the latter with 2-4 branches.

PUPA. Chaetotaxy as figured in Fig. 1 and recorded in Table 2. Mental plate, area between respiratory trumpets and terga I-VII on median area moderately to heavily pigmented. Respiratory trumpet moderately long, heavily pigmented; index 4.5-5.8, average 5.2; paddle ovoid, minute serrations on distal margin; seta 1-P single; midrib reaches apex; index 1.30-1.45, average 1.39.

SPECIMENS EXAMINED. The following immature stages and associated adults were examined; 20 ♂, 5 whole larvae and 10 larval and pupal skins. This material was reared from eggs obtained from 7 engorged females collected at Funaura, Iriomotejima, April 1976 (I. Miyagi) and 10 whole larvae collected at Komi, Iriomotejima, February 1978 (I. Miyagi). 4 ♂, 4 larvae and pupae will be deposited in the collection of the Entomological Institute, Hokkaido University, Sapporo, Japan and of the U. S. National Museum, Smithsonian Institution respectively.

BIOLOGICAL NOTES. In the forest of Iriomotejima, the Southern Ryukyu Islands, Japan, 3 species of the subgenus *Verrallina* are known to occur: *Aedes iriomotensis* Tanaka and Mizusawa, *Aedes atriisimilis* Tanaka and Mizusawa and *Aedes nobukonis* Yamada (=*Aedes ishigakiensis* Bohart, 1956). Among them, *iriomotensis* is the most common and the female bites readily at night and during the day in the forest. Numerous females were collected by man-biting catches in Iriomotejima but only a single collection of the larvae was made in a small shallow ground pool in a bamboo forest, February 1978.

In observation cages, we observed unusual mating habits of the male *iriomotensis*. The males spend much time flying and skating over the surface of the water searching for newly emerged females. The male sometimes stays on the head of an emerging female and then the male copulates on the water surface while the female is still emerging.

TAXONOMIC DISCUSSION. As stated by Tanaka and Mizusawa (1973), the adult female of *Aedes iriomotensis* is closely related to *Aedes dux* Dyar and Shannon, 1925 from the Philippines. The larva and pupa of the species are also very similar to the latter, however, it can be easily separated by the male genitalia. The arm of the gonostylus is strongly curved and bifurcated near apex, while in *dux* it tapers to a curved tip without bifurcation; the paraproct is not separated from the proctiger and is restricted to a small heavily pigmented band in *iriomotensis*, while in *dux* it is slender and joined distally (Delfinado, 1967).

The 3 species of the male and larva of the subgenus occurring in the Yaeyama Is. may be easily separated by the following keys.

MALE

1. Scutum with integument blackish brown; paraproct short, not separated from proctiger . . . . . *iriomotensis*
   Scutum with integument reddish brown; paraproct remarkably long and separated from proctiger 2

2(1). Larger species, wing length about 3.0 mm; gonostylus with 2 long apical spines . . . . . *atriisimilis*
   Smaller species, wing length about 2.3 mm; gonostylus expanded at middle, distally curved to a narrow tip, without conspicuous spines . . *nobukonis*

LARVA

1. Setae 5,6-C with 2 branches; 1-A with 1,2 branches. . . . . *nobukonis*
Setae 5, 6-C more than 3 branched; 1-A with more than 3 branches. . . . 2

2(1). Seta 5-C most frequently 7 branched; 6-C most often 5 branched; siphonal index 3.0-3.4, length 0.89-0.98 mm; 13-16 pecten teeth on basal 0.75 . . . . . *.atriisimilis*
Head hair 5-C most frequently 3 branched; 6-C with 3-4 branches; siphonal index 2.0-3.0, length 0.75-0.82 mm.; 10-14 pecten on basal 0.55 . . . . . *.iriomotensis*

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Table 1. Chaetotaxy of the 4th instar larva of *Aedes (Verrallina) iriomotensis*

Seta No.	Head	Thorax			Abdomen							
		Pro-	Meso-	Meta-	I	II	III	IV	V	VI	VII	VIII
0	-	8-15	-	-	1	1	1	1	1	1	1	1
1	1	1	2-3	3-4	1	1	5	6	6-8	6	5	5-6
2	-	2-3	2-4	1-6	1	1	1	1	1	1	1	2-3
3	1	2-4	1-3	3-8	5-6	3-5	4-6	5	4-5	4	5-7	7-9
4	3-5	3-6	3-5	1-5	20	8-10	3-5	4	7	7	4-6	1
5	3-4	1	1	1	1-5	3-5	2	3	2	2	2-5	6-10
6	3-4	1	6-7	3-4	2-3	1-3	1	1	1	1	4-5	
7	5-7	2	1	6-8	1-2	5-7	6	7-8	7-8	5-8	8-10	1-S= 3-6
8	1-4	1	6-7	7-10	2-10	3-3	1	1	1	3	10	1-X= 1
9	2-3	1-3	5-7	3-4	3-4	1-2	?	1	1	1	2	2-X= 5-7
10	2-4	1	1	1	2-4	1	2-3	2-3	2	2	3-4	3-X= 1
11	4-6	3-5	1	1	1-3	3-4	2-3	1	2	?	2-4	Antenna 1-A= 6
12	3-6	1-6	1-2	1	-	1-4	2-6	2	1-2	2	4-5	
13	2-3	-	10-20	5-9	1	5-20	10	3	?	10	4-5	
14	1	3-4	3-5			1						1
15	1-4											

Chaetotaxy based on 5 whole larvae and 5 larval skins which have associated adult specimens.

Table 2. Chaetotaxy of the pupa of *Aedes (Verrallina) iriomotensis*

Seta No.	Cephalo-thorax	Abdomen I	II	III	IV	V	VI	VII	VIII	Paddle
0	-	-	1	1	1	1	1	1		
1	2	15-20	7-15	2-3	4-6	2-3	3-4	3-4		1
2	3	1	1	1	1	1	1	1		
3	2-3	6-8	1	1	4-5	4-5	4-5	5		
4	3-4	5-7	4-5	1	3	3	3	3	2-4	
5	4-5	4-5	4-5	4	2-3	2-3	2	1		
6	1	1	1	3	1-2	2-3	2	4		
7	3-5	1	4-5	1-2	2-3	3	1	1-2		
8	4-6	?	?	2	4	1-2	1	2-3		
9	3	1	?	1	1	1	1	1	1-2	
10	3-4	?	?	2-3	3	1	1	1-2		
11	1	?	?	1	1	1	1	1		
12	4-5									

Chaetotaxy based on 10 pupal skins which have associated adult specimens.

Fig. 1. Pupa (A-B) and male genitalia (C-H).

A. Mental plate (Mp), abdominal segments (I-VIII) and paddle(P).

B. Cephalothorax (CT).

C. Gonostylus, different aspects.

D. Projections of inner ventral surface of gonocoxite.

E. Paramere (Par), phallus (Ph), prosophallus (Po) and opisthophallus (Op), dorsal aspect.

F. Sternum IX.

G. Tergum IX, X and paraproct (Ppr).

H. Apical part of gonocoxite and basal mesal lobe (BML), different view.

Fig. 1

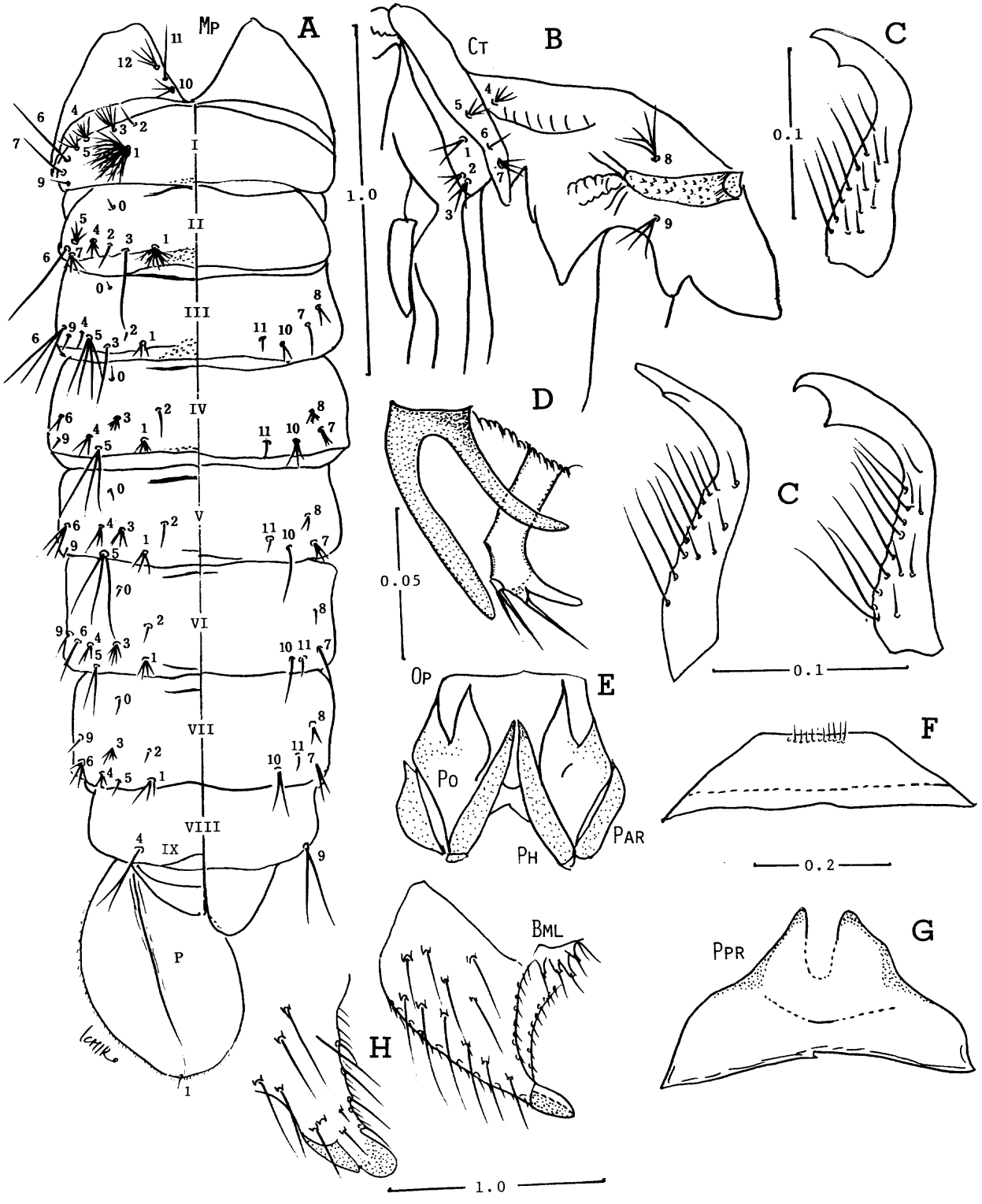
A
MP
I
II
III
IV
V
VI
VII
VIII
IX
P
B
CT
1.0
C
0.1
D
0.05
C
0.1
OP
E
PO
PH
PAR
F
0.2
BML
H
G
PPR
1.0

Fig. 2. 4th instar larva.

A. Head.

B. Apex of antenna.

C. Dorsomentum.

D. Pro-(P), meso-(M) and metathorax (T).

E. Abdominal segments VIII, X, siphon (S), pecten teeth (PT) and comb scales (CS).

Fig.2

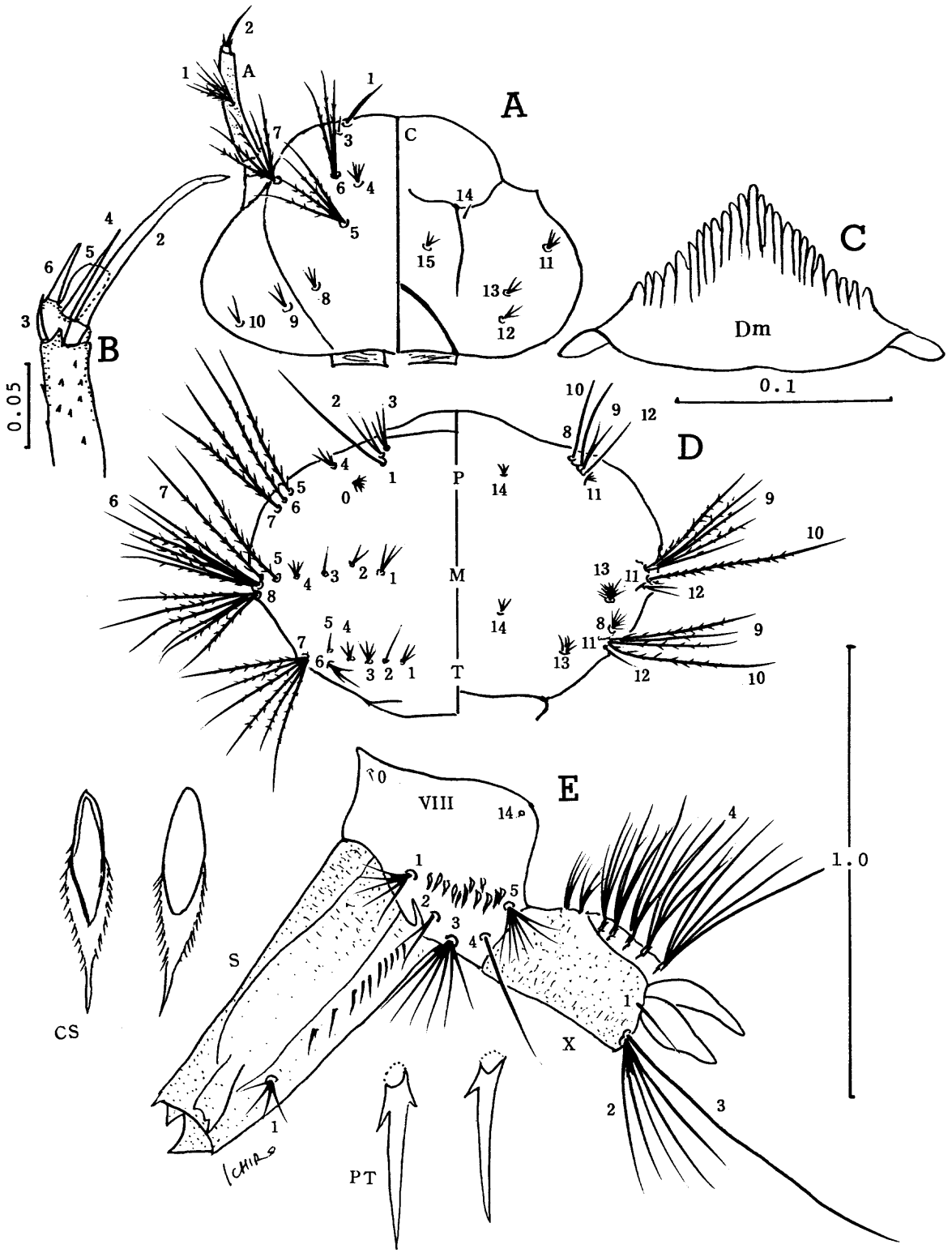

Fig. 3. Adult male (A-E) and 4th instar larva.

A. Male genitalia, dorsal aspect. X200

B. id., ventral aspect. X200

C. Gonostylus and projections of inner ventral surface of gonocoxite. X350

D. Claw III. X40

E. Claw I. X40

F. Comb scales. X640

G. Pecten teeth, ventral aspect. X190

Fig. 3