Mosquito Systematics, 26(3):105–115, 1994

DESCRIPTION OF THE FEMALE, PUPA, AND LARVA OF *AEDES (PARAEDES) BARRAUDI* AND THE PUPA AND LARVA OF *AEDES (PARAEDES) MENONI* (DIPTERA: CULICIDAE)

S. C. TEWARI AND J. HIRIYAN

Centre for Research in Medical Entomology, Post Box No. 11, 4, Sarojini Street, Chinna Chokkikulam, Madurai 625 002, India

ABSTRACT. The female, pupa, and fourth-stage larva of *Aedes (Paraedes) barraudi* (Edwards) and the pupa and fourth-stage larva of *Ae. (Par.) menoni* Mattingly are described and illustrated for the first time and are compared with related species.

INTRODUCTION

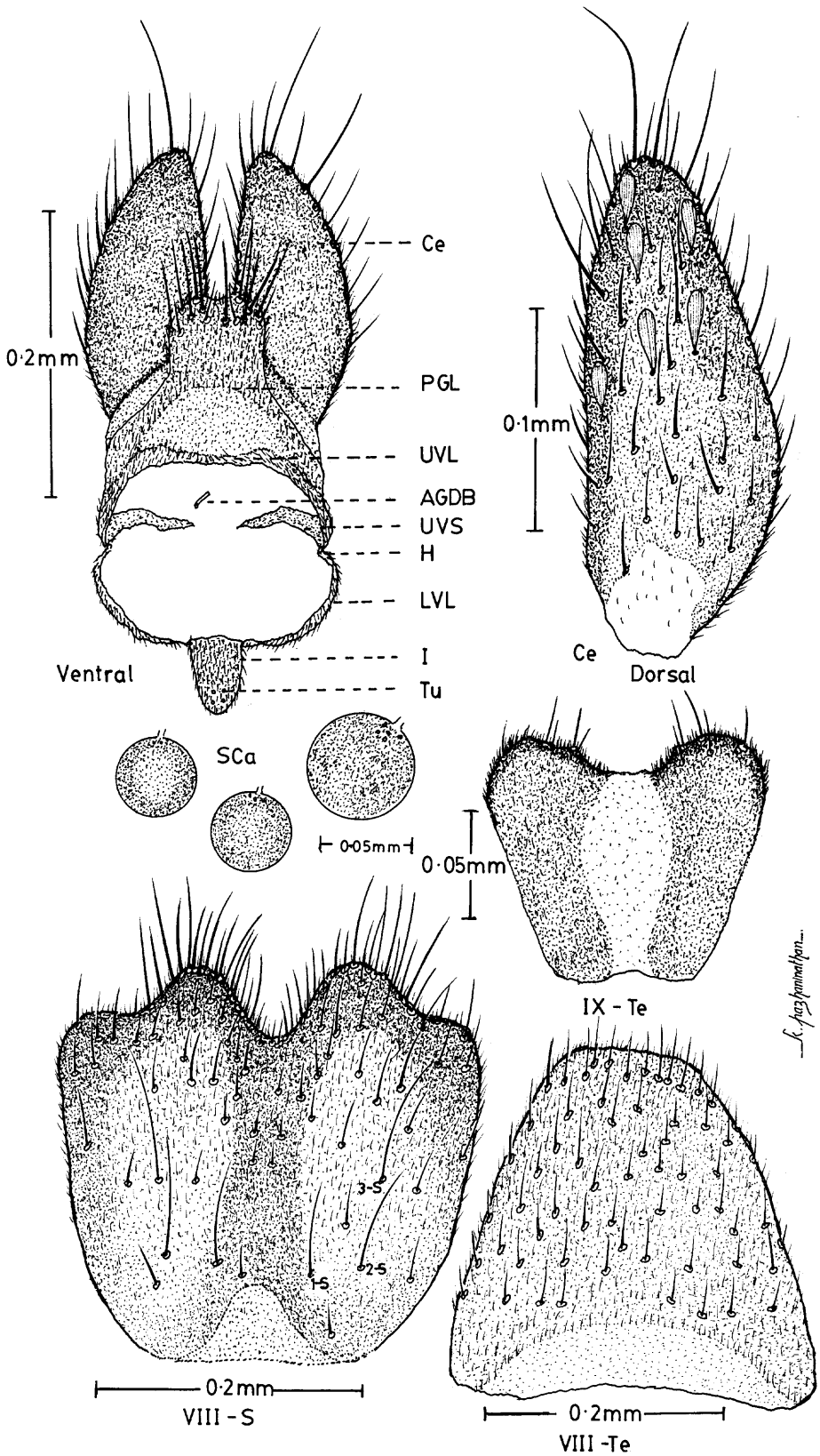
Edwards (1934) described the genus *Paraedes* and included the two Indian species *P. barraudi* and *P. argyrurus*. The latter species was transferred to subgenus *Udaya* (Thurman 1954), leaving *P. barraudi* as the lone representative of *Paraedes*. Mattingly (1958) reduced *Paraedes* to a subgenus of *Aedes* Meigen. At present *Paraedes* includes eight species (*Ae. barraudi, Ae. bonneae* Mattingly, *Ae. chrysoscuta* (Theobald), *Ae. collessi* Mattingly, *Ae. menoni* Mattingly, *Ae. ostentatio* (Leicester), *Ae. pagei* (Ludlow), and *Ae. thailandensis* Reinert) that were reviewed recently by Reinert (1981). In our studies of the mosquito fauna in the Western Ghats, South India, we collected previously undescribed stages of *Ae. barraudi* and *Ae. menoni*. These are described and illustrated here.

Terminology used follows Harbach and Knight (1980, 1982). In descriptions of the immatures, the range of setal branching is followed by the mode in parentheses. Larval and pupal exuviae and male and female genitalia were mounted on slides using Hoyer's medium.

DESCRIPTION

Aedes (Paraedes) barraudi (Edwards)

Female. *Head*: Antenna dark brown, 0.96–1.04 (mean = 0.99) length of proboscis; pedicel dark brown with few broad scales and 1,2 short brown setae mesally; clypeus dark brown, bare; maxillary palpus dark brown-scaled, about 0.14 length of proboscis; proboscis dark brown-scaled, 1.01–1.07 length of forefemur; eyes contiguous; 2 pairs of long, stout, dark brown interocular setae and few narrow white scales; 4,5 well-developed ocular setae; vertex with broad dark brown decumbent scales, postgena with small patch of broad pale scales, narrow line of pale scales on eye margins; occiput with narrow curved white scales and few moderately long brown erect forked scales. *Thorax*: Scutal integument dark brown; scutum covered with narrow curved reddish-brown scales except few narrow curved white scales on following areas: small patches on anterior promontory, fossal, scutal angle, supraalar, scutal ridge, posterior dorsocentral, lateral margin of prescutalar area; and few pale scales on anterior dorsocentral and acrostichal areas; scutum with well-developed reddish-brown setae on anterior promontory, dorsocentral, scutal fossal, and supraalar areas; 2,3 acrostichal setae anteriorly; scutellum with patch of narrow curved white scales on all lobes, 4–6 long and 2,3 short setae on median lobe and 3,4 long and 2,3 short setae on lateral lobe; pleural integument dark brown; antepronotum with broad white scales, 8–11 brown setae; postpronotum with few narrow curved reddish-brown scales dorsally and small patch of narrow curved pale scales posteriorly, 3–


0·2mm
Ce
PGL
UVL
AGDB
UVS
H
LVL
I
Tu
Ventral
0·1mm
Ce
Dorsal
SCa
0·05mm
0·05mm
IX - Te
3-S
2-S
1-S
0·2mm
VIII - S
0·2mm
VIII -Te

5 brown posterior setae; postspiracular area with few broad white scales, 3–5 golden setae; proepisternum with patch of broad white scales, 5–8 golden-brown setae; paratergite bare; mesokatepisternum with upper and lower posterior patch of broad white scales, 6–8 long and 5–7 short golden setae; prealar knob with 5–9 golden setae; mesepimeron with patch of broad white scales anteriorly, 6–10 golden setae posterior to scale-patch. *Legs*: Coxae I–III each with several golden-brown setae and patch of broad white scales, I with few dark brown scales anteriorly; trochanters I–III each with short golden-brown setae and few broad white scales; femora I,II each with dark brown scales anteriorly, III with ventral longitudinal pale-scaled stripe from base to apex on anterior and posterior surfaces, II also with similar stripe posteriorly, I with dorsal pale-scaled stripe posteriorly; femora I–III each with small dorsoapical white-scaled patch; tibiae I–III dark-scaled; posttarsi I–III with ungues equal in size and simple. *Wing*: Dark brown-scaled except for small white-scaled patch at base of costa; alula with narrow pale brown scales; upper calypter with few (4–6) long brown setae; 1,2 golden remigial setae. *Halter*: Pedicel pale; capitellum white-scaled with few pale brown scales at base. *Abdomen*: Terga II–VII dark brown-scaled, each with laterobasal white-scaled patch; sterna brown-scaled; several golden setae on posterior margins of terga and sterna. *Genitalia* (Fig. 1): Tergum VIII covered with minute spicules, moderately pigmented, basal 0.89–0.95 retracted into segment VII, base concave mesally, apex straight, several short setae on apical 0.73–0.85, setae along apex subequal, basolateral setae and scales absent, index 1.00–1.13, length 0.27–0.32 mm, width 0.27–0.30 mm; sternum VIII covered with minute spicules, moderately pigmented, lighter on median lateral areas, anterior margin concave mesally, posterior margin with a deep median indentation forming a lobe on each side of midline, short to moderately long setae on apical 0.88–0.91 of sternum, seta 2-S approximately 0.33 from 1-S, seta 3-S approximately 0.66 from 2-S, index 0.82–1.00, length 0.30–0.37 mm, width 0.36–0.37 mm; tergum IX spiculate with mesal area lightly pigmented, posterior margin with small lobe on each side of midline, each lobe with 4–6 setae, index 0.79–0.86, length 0.10–0.12 mm, width 0.12–0.14 mm; insula spiculate, tongue-shaped with 2–4 small tuberculi; lower vaginal lip with several short to long spicules on the whole surface, moderately pigmented, lower vaginal sclerite absent; upper vaginal lip spiculate, heavily pigmented, upper vaginal sclerite well developed; postgenital lobe covered with short spicules, with moderate to deep median indentation at apex, 6–8 setae on each side of midline; cercus with 1,2 long, stout setae at apex, dorsal surface with several short to long setae and 2–8 broad scales, index 2.8–3.0, length 0.23–0.25 mm, width 0.07–0.08 mm; 1 large and 2 medium-sized spherical seminal capsules; base of accessory gland duct heavily pigmented.

Pupa (Fig. 2a–d). Chaetotaxy as figured and recorded in Table 1 (n = 36). *Cephalothorax*: Seta 5-CT well developed, long, usually with 2 branches; 6-CT single, shorter than 7-CT. *Trumpet*: Index 5.00–5.75 (mean = 5.17). *Abdomen*: Seta 1-I dendritic, 8–12 main branches, each with multiple branches; 3,6-III always single, long, about 1.0 and 0.5 length of following segment, respectively; 5-IV single, long, reaching to segment VI; 5-V,VI always single, very long, reaching to 0.5 of segments VII and VIII, respectively; 9-VIII long, simple, always single. *Paddle*: Spiculate,

←

Fig. 1. *Aedes* (*Paraedes*) *barraudi*, female genitalia. AGDB = accessory gland duct base, Ce = cercus, H = hinge, I = insula, LVL = lower vaginal lip, PGL = postgenital lobe, SCa = spermathecal capsule, Tu = tuberculus, UVL = upper vaginal lip, UVS = upper vaginal sclerite, VIII-S = sternum VIII, VIII-Te = tergum VIII, IX-Te = tergum IX.

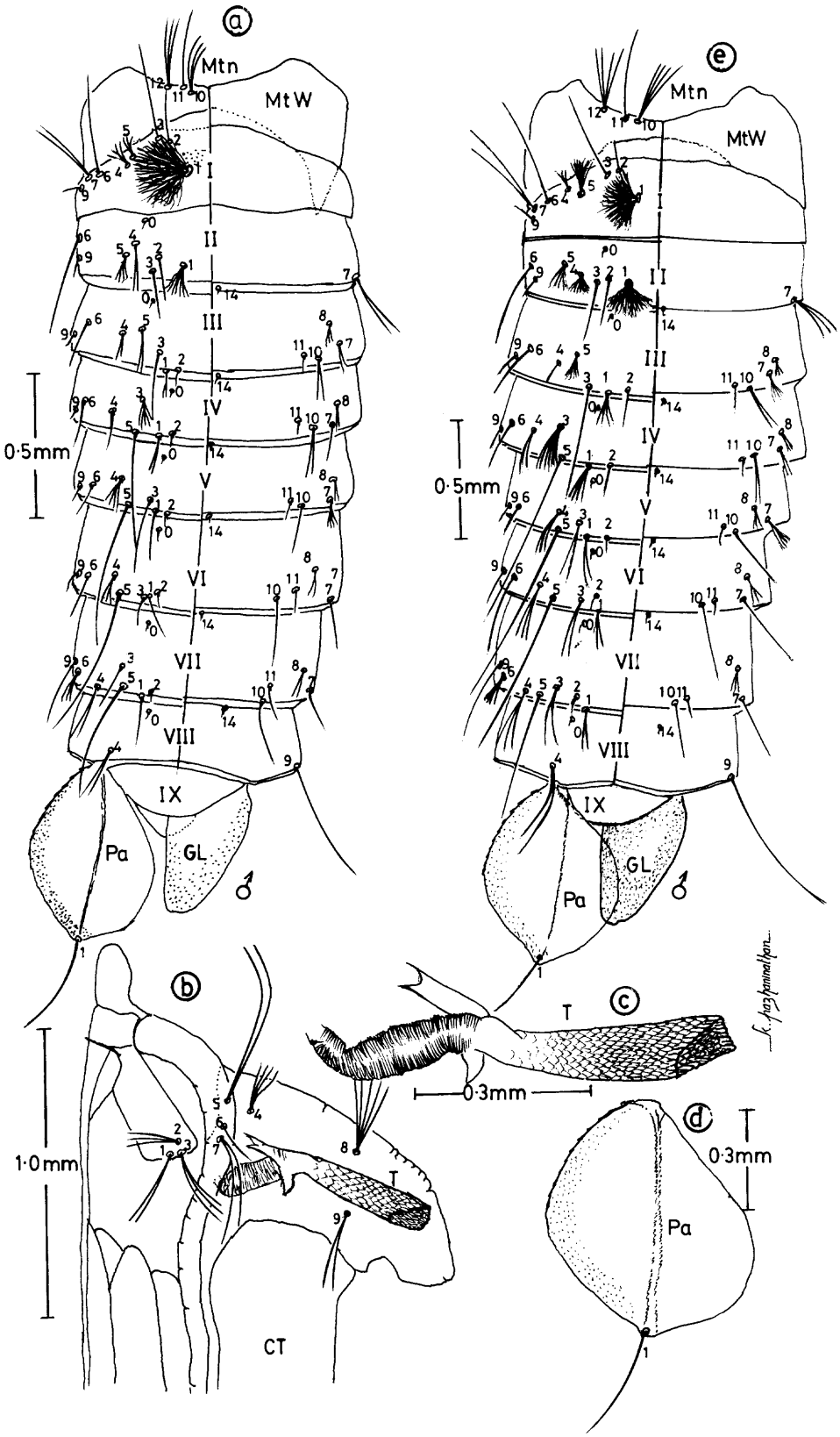

a
Mtn
MtW
I
II
III
IV
V
VI
VII
VIII
IX
Pa
GL
0·5mm
e
Mtn
MtW
Pa
GL
0·5mm
b
CT
T
1·0mm
c
T
0·3mm
d
Pa
0·3mm

Table 1. Chaetotaxy of the pupae of *Aedes* (*Paraedes*) *barraudi*.

Seta no.	Cephalothorax	Abdomen							
	CT	I	II	III	IV	V	VI	VII	VIII
0	—	—	1	1	1	1	1	1	1
1	2–4	8–12[1]	5–10	2–4(2)	2,3(2)	1,2(1)	1,2(1)	1,2(1)	—
2	1–3	1	1,2(1)	1	1	1	1	1	—
3	2–4(3)	1	1	1	4–6(5)	1–3(1)	1,2(1)	1–3(1)	—
4	3–4(4)	3–6(4)	3–5	1–3(2)	1,2(1)	2–4(4)	2–4(3)	1–3(2)	1–3(2)
5	1–3(2)	2–4(3)	1–4(2)	1–3(2)	1	1	1	1	—
6	1	1	1	1	1	1	1	2–5	—
7	1–3(2)	1–4(2)	1–3(2)	1–3(2)	1,2(1)	3–5(4)	1	1	—
8	4–7(5)	—	—	2–4	2,3(2)	2,3(2)	2–4(2)	2–4(2)	—
9	1–3(2)	1	1	1	1	1	1	1	1
10	2–4(3)	—	—	1–3(2)	1–3(2)	1	1	1	—
11	1	—	—	1	1	1	1	1	—
12	2–4(3)	—	—	—	—	—	—	—	—
14	—	—	—	1	1	1	1	1	1

Paddle: 1-P, 1,2(1).
[1] Main branches.

minute serrations on 0.41–0.53 of basolateral outer margin; 1-P long, 0.41–0.50 length of paddle; genital lobe heavily spiculate.

Larva (Fig. 3a–g). Chaetotaxy as figured and recorded in Table 2 (n = 74). *Head*: Moderately pigmented; setae 5,6-C barbed, single to 3 branched; 4-C and 6-C approximately equal distance from 5-C; 7-C barbed, usually with 10 branches; 11-C weakly barbed, usually with 6 branches. *Antenna*: Moderately pigmented, spiculate, especially basally; seta 1-A barbed, usually with 6 branches, inserted about middle of shaft; 2–6-A single, inserted at or near apex. *Thorax*: Setae 5,6,8-P weakly barbed, single; 7-P, 5–10,12-M, and 7,9,10-T barbed. *Abdomen*: Setae 6,7-I barbed; 6-II barbed, usually with 3 branches; 6-III usually single, weakly barbed; segment VIII with 14–18 comb scales in single curved row, each scale fringed with spicules laterally, spicules longer and even apically; 1-X short, single; 2-X moderately long, with about 7 subequal branches; 3-X very long, strong, single; 4-X composed of 8 (4 pairs) long setae on grid, each with 4–6 branches, and 2 short precratal setae; saddle moderately pigmented, incomplete ventrally, acus absent; anal papillae 2 pairs, long, about twice length of saddle. *Siphon*: Pigmentation uniform, moderate; acus well developed; index 2.41–2.73 (mean = 2.61); pecten on basal 0.44–0.60 of siphon, composed of 12–16(14) spines, each with one strong denticle, distal 1 or 2 spines simple, more widely spaced than basal ones; 1-S short, usually with 4 branches, inserted on basal 0.58–0.69 of siphon.

Bionomics. See *Ae. menoni*.

Material examined. Two hundred specimens examined from collections made 19–26 July 1990, as follow: INDIA, Kerala State, Wynad District, Noolpuzha, 1,100 m, S.C. Tewari coll., 1♀; Tamil Nadu State, Nilgiri District, Devarshola, 1,100 m, J. Hiriyan coll., 15♀, 8♀G, 15♂, 19Pe, 20Le, 11 4th-stage larvae; Kozhipalam, 1,050 m, A. Munirathinam coll., 14♀, 2♀G, 10♂, 1♂G, 15Pe, 16Le, 15 4th-stage larvae; Manvayal, 1,100 m, K. Ayanar coll., 9♀, 2♀G, 4♂, 1 4th-stage larva; Pa-

←

Fig. 2. Pupae of (a–d) *Aedes* (*Paraedes*) *barraudi* and (e) *Aedes* (*Paraedes*) *menoni*. CT = cephalothorax, GL = genital lobe, Mtn = metanotum, MtW = metathoracic wing, Pa = paddle, T = trumpet, I–IX = abdominal segments.

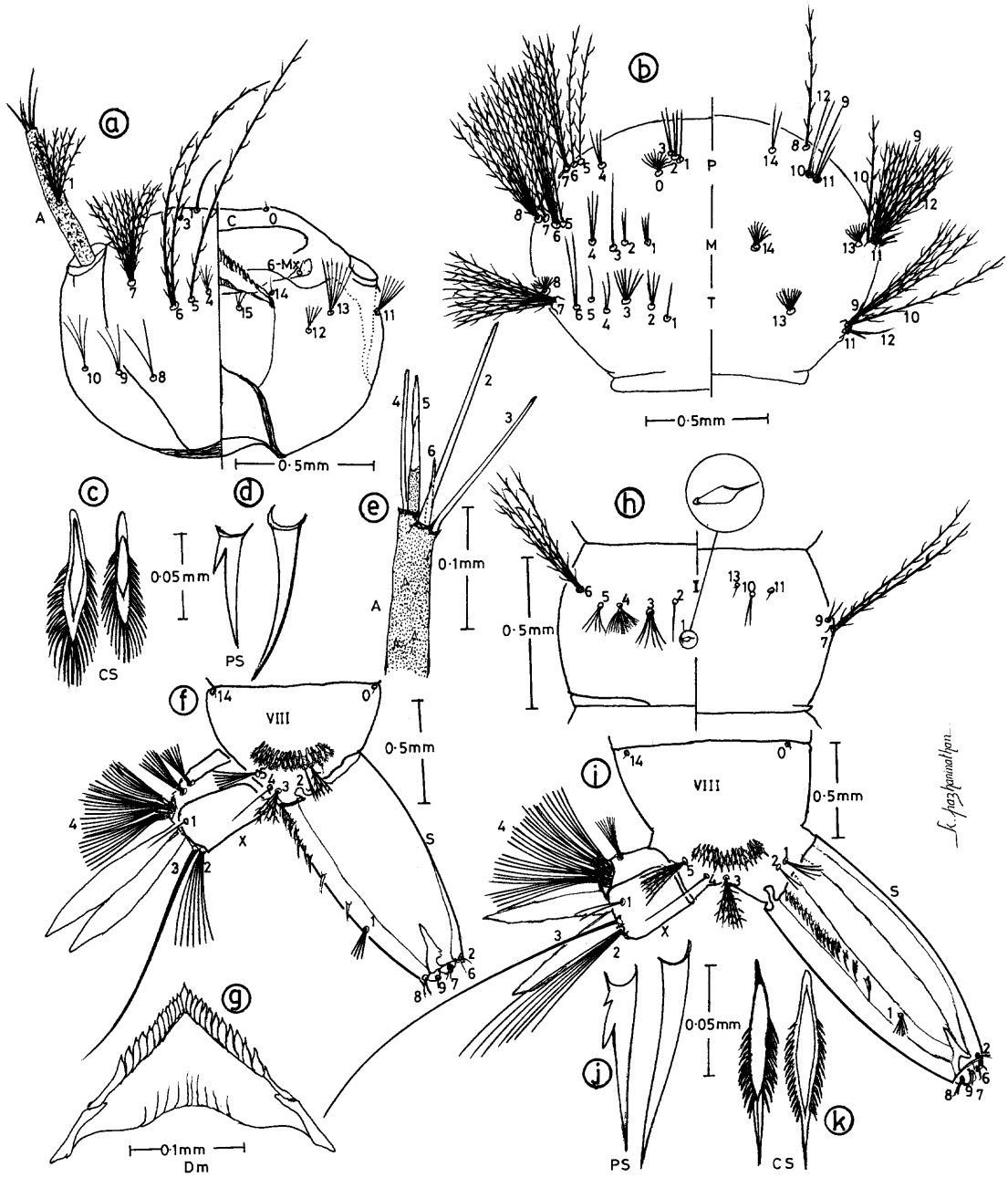


Fig. 3. Fourth-instar larvae of (a–g) *Aedes* (*Paraedes*) *barraudi* and (h–k) *Aedes* (*Paraedes*) *menoni*. A = antenna, C = cranium, CS = comb scale, Dm = dorsomentum, M = mesothorax, P = prothorax, PS = pecten spine, T = metathorax, S = siphon, I,VIII,X = abdominal segments, 6-Mx = seta 6 of maxilla.

danthorai, 1,100 m, S.C. Tewari coll., 1♀, 5♂, 1♂G, 2Pe, 3Le, 8 4th-stage larvae; Velleri, 1,100 m, J. Hiriyan coll., 2♀. From these collections, 2♀, 1♀G, 2♂, 1♂G, 4Pe, 4Le, 2 4th-stage larvae deposited in USNM; 2♀, 1♀G, 1♂, 3Pe, 3Le, 1 4th-stage larva deposited in National Institute of Virology, Pune, India; and 38♀, 10♀G, 31♂, 1♂G, 29Pe, 32Le, 32 4th-

Table 2. Chaetotaxy of the fourth-instar larvae of *Aedes* (*Paraedes*) *barraudi*.

Seta	Head	Thorax			Abdomen							
no.	C	P	M	T	I	II	III	IV	V	VI	VII	VIII
0	1	7–10	—	—	—	1	1	1	1	1	1	1
1	1	1,2(1)	2–4	1,2(1)	1,2(2)	1,2(1)	4–7	4–8(5)	4–7(5)	3–5(4)	3–7	3,4(3)
2	—	1,2(2)	1–3(2)	2–5(3)	1	1,2(1)	1	1	1	1	1	1,2(2)
3	1	1–3(2)	1	5–10	2–5(5)	3–5(4)	2–4(3)	3–5(4)	3,4(3)	2–4(3)	3–6(5)	4,5
4	4–6(5)	2–4(3)	2–4(3)	1–4(2)	7–12	6–10	1–4(2)	2,3(2)	4–6(5)	2–6(5)	2–4(3)	1
5	1–3	1	1	1,2(1)	3–7(4)	2–4(2)	1,2	1,2(1)	1,2	1–3(2)	3–6(5)	6–8(6)
6	1–3	1	5–8	1–3(2)	4–6(4)	2–4(3)	1,2(1)	1	1	1	5–10	—
7	7–12(10)	2,3(3)	1	9–13	2	4–8	5–8	5–8	4–7(6)	2–4(3)	2	—
8	1–3(2)	1	6–8	7–11	—	2,3(2)	2,3(2)	2,3(2)	1–4(2)	3–5(4)	4–9	—
9	2–4(3)	1,2(1)	8–10(9)	3–5(4)	2,3(2)	1	1	1	1	1	2,3(2)	—
10	4	1	1	1	1–3(2)	1	2–4	2,3(2)	2,3(2)	1,2(1)	2,3(2)	—
11	4–7(6)	1–3(2)	1,2(2)	1,2(1)	1–3(2)	1,2(2)	1,2(2)	1–3(2)	1–3(2)	1,2(2)	1–3(2)	—
12	4–7(5)	1	1	1	—	2–4(3)	1–3(2)	1,2(2)	1,2(2)	1,2(1)	2,3(2)	—
13	5–8	—	6–12	6–10	1	10–15	2,3(3)	2,3(2)	2–4(2)	12–18	4–7(6)	—
14	1	2,3(2)	6–10	—	—	—	1	1	1	1	1	1
15	2–4(3)	—	—	—	—	—	—	—	—	—	—	—

Antenna: 1-A, 5–8(6); 2–6A, 1. Abdomen: 1-X, 1; 2-X, 7–9(7); 3-X, 1; 4-X, 8 (each with 4–6 branches). Siphon: 1-S, 2–5(4); 2-S, 1; 6-S, 1; 7-S, 1–3(2); 8-S, 1–3(2); 9-S, 1.

Table 3. Chaetotaxy of the pupae of *Aedes* (*Paraedes*) *menoni*.

Seta no.	Cephalothorax	Abdomen							
	CT	I	II	III	IV	V	VI	VII	VIII
0	—	—	1	1	1	1	1	1	1
1	2–5(3)	15–20[1]	35–45	3–5(4)	2–5(3)	1–4(2)	1–3(2)	1,2(2)	—
2	2–5(4)	1	1,2(1)	1	1	1	1	1	—
3	2–4(3)	1	1,2(1)	1	4–7(6)	1–3(2)	1–3(2)	1–4(2)	—
4	3–5(4)	6–11	5–8(8)	2–4(2)	1,2(2)	3–5(4)	3,4(4)	1–4(3)	2,3(2)
5	1–3(2)	2–4(3)	3–10	3–7(5)	1	1	1	1	—
6	1	1	1	1	1	1	1	3–6(4)	—
7	2,3(2)	2–4(2)	2–4(3)	2–5(4)	1–3(2)	3–6(4)	1	1	—
8	3–7(5)	—	—	2–4(3)	2,3(2)	2,3(3)	2–4(3)	2–5(3)	—
9	2,3(2)	1	1	1	1	1	1	1–3(1)	1
10	2–8(4)	—	—	1–3(2)	2–4(2)	1	1	1,2(1)	—
11	1	—	—	1	1	1	1	1	—
12	4–7(4)	—	—	—	—	—	—	—	—
14	—	—	—	1	1	1	1	1	1

Paddle: 1-P, 1.
[1] Main branches.

stage larvae retained in the museum of Centre for Research in Medical Entomology, Madurai, India.

Aedes (*Paraedes*) *menoni* Mattingly

Pupa (Fig. 2e). Chaetotaxy as figured and recorded in Table 3 (n = 20). *Cephalothorax*: Seta 5-CT long, single to 3 branched; 6-CT shorter than 7-CT, single. *Trumpet*: Index 3.71–4.85 (mean = 4.36). *Abdomen*: Seta 1-I dendritic with 15–20 main branches, each multiply branched; 3,6-III single, about 1.5 and 0.6 length of following segment, respectively; 5-IV single, long, reaching to segment VII; 5-V single, long, reaching to segment VII; 5-VI single, long, reaching to 0.75 of segment VIII; 9-VII long, always single. *Paddle*: Similar to *Ae. barraudi*.

Larva (Fig. 3h–k). Chaetotaxy as figured and recorded in Table 4 (n = 40). *Head*: Moderately pigmented; setae 5–7-C barbed; 11-C weakly barbed, usually with 6 branches. *Antenna*: Similar to *Ae. barraudi*. *Thorax*: Setae 5,8-P weakly barbed, single; 6-P weakly barbed, single or bifid; 7-P barbed, usually with 2 branches; 5–10,12-M barbed; 7,9,10-T barbed. *Abdomen*: Setae 6,7-I barbed; 6-II barbed, with 2–4 branches; 6-III weakly barbed, single; segment VIII with 13–18 comb scales in a single curved row, each scale with strong median apical spine; 2-X moderately long, usually with 7 subequal branches; 3-X very long, strong, single; 4-X with 9,10 setae on grid, each with 5–8 branches, and 1 short precratal seta; saddle moderately pigmented, incomplete ventrally, acus absent; anal papillae 2 pairs, moderately long, about 1.5 length of saddle. *Siphon*: Pigmentation uniform, moderate; acus well developed; index 2.60–2.70 (mean = 2.66); pecten composed of 18–21 spines, each with 1 or 2 basal denticles, distal 1 or 2 spines simple.

Material examined. Ninety-one specimens examined from collections made 19–26 July 1990 and 5–10 September 1990, as follow: INDIA, Tamil Nadu State, Nilgiri District, Bospara, 1,050 m, S.C. Tewari coll., 2♀, 1Pe, 1Le; Devarshola, 1,100 m, J. Hiriyan coll., 14♀, 1♀G, 7♂, 1♂G, 14Pe, 18Le, 11 4th-stage larvae; Kozhipalam, 1,100 m, K. Ayanar coll., 2♀, 3♂, 5Pe, 5Le, 4 4th-stage larvae; Manvayal, 1,100 m, A. Munirathinam coll., 1 4th-stage larva; Velleri, 1,100 m, S.C. Tewari coll., 1♀. From these collections, 2♀, 2♂, 4Pe, 4Le, 2 4th-stage larvae deposited in USNM; 1♀, 1♂, 2Pe, 2Le, 1 4th-stage larva deposited in National Institute of Virology, Pune, India;

Table 4. Chaetotaxy of the fourth-instar larvae of *Aedes* (*Paraedes*) *menoni*.

Seta	Head	Thorax			Abdomen							
no.	C	P	M	T	I	II	III	IV	V	VI	VII	VIII
0	1	8–13	—	—	—	1	1	1	1	1	1	1
1	1	1	3–5(4)	2–5	1	1	4–7	4–6	4–7(5)	5–10(6)	4–6(5)	3,4(4)
2	—	1–3(2)	2	3–5	1	1	1	1	1	1	1	2,3
3	1	1–4(3)	1	10–16	4–7	3–5	2–4(4)	3–5(4)	2–4	2–4(3)	4–7(5)	4–6
4	6–9	2–5(3)	3–5(4)	2–4	12–18	8–14	2,3(2)	1,2(2)	4–7	4,5(5)	3–5(3)	1
5	2	1	1	1	4–6(5)	2,3(2)	1,2	1	1	2,3	3–5(3)	7–11
6	1,2(2)	1,2(1)	5–7(6)	2	3–5(4)	2–4	1	1	1	1,2(1)	11–16	—
7	8–13	2,3(2)	1	5–9	2	4–10	5–10	9–12	7–11	3–5(4)	2,3(3)	—
8	2	1	4–7(6)	8–13	—	2–5(3)	1–3(2)	2,3(2)	2,3(2)	3–6(5)	8–13	—
9	3,4(3)	1,2(1)	7,8(7)	3,4(3)	2,3(2)	1	1	1	1	1	2	—
10	3–5(4)	1	1	1	2	1	1–3(3)	2–4(2)	2,3(2)	1	3,4(4)	—
11	4–6(6)	2–5(4)	2–5	2,3	1	2,3(3)	2	2	1,2(1)	2,3(2)	2,3(2)	—
12	4–7	1	1	1	—	3	2	1,2(2)	1,2(2)	1,2(2)	2,3	—
13	5–10(7)	—	18–22	8–12	1	10–17	3–5(3)	2,3(3)	2–4(3)	10–20	7–9(8)	—
14	1	2–4(3)	8–12	—	—	—	1	1	1	1	1	1
15	2–4(3)	—	—	—	—	—	—	—	—	—	—	—

Antenna: 1-A, 3–6(4); 2–6A, 1. Abdomen: 1-X, 1–3(2); 2-X, 6–8(7); 3-X, 1; 4-X, 9, 10 (each with 5–8 branches). Siphon: 1-S, 5–8; 2-S, 1; 6-S, 1; 7-S, 1,2; 8-S, 2–5; 9-S, 1.

and 16♀, 1♀G, 7♂, 1♂G, 14Pe, 18Le, 13 4th-stage larvae retained in the museum of Centre for Research in Medical Entomology, Madurai, India.

Bionomics. Immatures of *Ae. barraudi* and *Ae. menoni* were collected from crab holes near springs and paddy fields at about 1,100 m altitude. They were found together and in association with *Culex* (*Culex*) *edwardsi* Barraud, *Culex* (*Lophoceraomyia*) *flavicornis* Barraud, *Uranotaenia* (*Pseudoficalbia*) *ohamai* Tanaka, Mizusawa, and Saugstad, *Ur.* (*Pfc.*) *stricklandi* Barraud, and unidentified *Uranotaenia* species.

DISCUSSION

Edwards (1934) placed *Ae. barraudi* in a new genus primarily on the basis of the bare upper calypter of the male, which prevented its inclusion in *Aedes*. Reinert (1981) also reported the bare upper calypter for the two males of the type series. We have examined a total of 31 males, out of which eight have the margin of the upper calypter with one to three long, pale brown setae. However, in all our females the upper calypter was fringed with dark brown setae.

The female of *Ae. barraudi* closely resembles those of *Ae. menoni, Ae. chrysoscuta,* and *Ae. ostentatio.* It can be distinguished easily from *Ae. menoni* by the presence of broad scales on the antepronotum; in *Ae. menoni* these scales are narrow and curved. In addition, the short antenna (0.96–1.04, mean = 0.99, length of proboscis) and scale pattern of the scutum also are useful characters for differentiation. The presence of three spermathecal capsules in the female and posttarsi with simple ungues in *Ae. barraudi* easily differentiate it from *Ae. chrysoscuta* and *Ae. ostentatio,* both of which possess a single, large seminal capsule in the female and posttarsi I,II with toothed ungues.

The pupal chaetotaxy is extremely similar in *Ae. barraudi* and *Ae. menoni.* In the latter, seta 1-II has 35–45 branches and seta 5-IV-VI is well developed and about twice the length of the following segment (Fig. 2e), which easily distinguishes it from the former and other closely related species. Seta 1-II is 5–23 branched and the length of seta 5-IV-VI is less than twice the length of the following segment in *Ae. barraudi, Ae. chrysoscuta,* and *Ae. ostentatio.* Paddle with basal serrations in *Ae. barraudi* and *Ae. menoni* separates these species from *Ae. chrysoscuta* and *Ae. ostentatio* in which only the apical area is serrated.

The fourth-stage larvae of *Ae. barraudi* and *Ae. menoni* are very similar. The former can be distinguished by having the comb scales evenly fringed apically and the ventral brush with two precratal setae, while in the latter species (and *Ae. chrysoscuta* and *Ae. ostentatio*), the comb scales have a distinct, strong, median apical spine and the ventral brush has a single precratal seta. The uniform pigmentation of the siphon and the siphonal index (mean = 2.66) easily differentiate *Ae. menoni* from *Ae. chrysoscuta* and *Ae. ostentatio.* In addition, the presence of a peculiar short, lanceolate abdominal seta 1-I (Fig. 3h) is useful in distinguishing *Ae. menoni* from all other species of the subgenus *Paraedes.*

ACKNOWLEDGMENTS

We are grateful to R. Reuben, Director, Centre for Research in Medical Entomology, Madurai, for her encouragement and guidance. Thanks are due to Shriyuts K. Ayanar and A. Munirathinam for their excellent assistance in field and laboratory work, K. Pazhaninathan for preparing the illustrations, and A. Venkatesh for typing the manuscript.

REFERENCES CITED

Edwards, F.W. 1934. Appendix, pp. 427–453. *In*: P.J. Barraud (ed.), The fauna of British India, including Ceylon and Burma. Diptera. Vol. V. Family Culicidae. Tribes Megarhinini and Culicini. Taylor and Francis, London.

Harbach, R.E. and K.L. Knight. 1980. Taxonomists' glossary of mosquito anatomy. Plexus Publishing, Marlton, NJ.

Harbach, R.E. and K.L. Knight. 1982. Corrections and additions to *Taxonomists'*

glossary of mosquito anatomy. Mosq. Syst. 13(for 1981):201–217.

Mattingly, P.F. 1958. Lectotypes of mosquitoes (Diptera: Culicidae) in the British Museum. Part III. Genera *Sabethes, Udaya* and *Aedes* (subgenera *Paraedes, Cancraedes* and *Skusea*). Proc. R. Entomol. Soc. Lond. Ser. B Taxon. 27:105–108.

Reinert, J.F. 1981. Medical entomology studies—XV. A revision of the subgenus *Paraedes* of the genus *Aedes* (Diptera: Culicidae). Contrib. Am. Entomol. Inst. (Ann Arbor) 18(4):1–91.

Thurman, D.C., Jr. 1954. The discovery of *Paraedes* (*Udaya*) *argyrurus* Edwards, 1934, in Thailand (Diptera: Culicidae). Mosq. News 14:83–86.