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REVALIDATION AND DESCRIPTION OF *AEDES (FINLAYA) PALLIROSTRIS* FROM NORTHEASTERN INDIA (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, Tamil Nadu, India

ABSTRACT. *Aedes (Finlaya) pallirostris* Edwards is resurrected from synonymy with *Aedes (Fin.) formosensis* Yamada and the female, male, pupa, and 4th-instar larva are described and compared with closely related species. The synonymy of *Finlaya khasiana* Barraud is transferred from *Ae. formosensis* to *Ae. pallirostris.*

INTRODUCTION

Based on only adult specimens, *Aedes (Finlaya) pallirostris* Edwards and *Finlaya khasiana* Barraud were described from Assam, India, in 1922 and 1923, respectively. The latter was synonymized with *Aedes formosensis* Yamada by Barraud (1934), whereas the former was synonymized with this species by Knight (1968). *Aedes formosensis* was originally described from Taiwan (Yamada 1921). In 1991, during our mosquito faunal surveys in Assam (Northeastern Region, India), no specimens of *Ae. formosensis* were encountered. Instead, we found a mosquito very similar to *Ae. formosensis,* but with male genitalia and other adult characters agreeing with the type specimens of *Ae. pallirostris* housed in The Natural History Museum, London (R. E. Harbach, personal communication). The larva of this species proved to be distinctly different from that of *Ae. formosensis* and a closely related species, *Aedes reinerti* Rattanarithikul and Harrison, described from Thailand. We consider this species to be *Ae. (Fin.) pallirostris* and hereby restore it to full species status. Its female, male, pupa, and 4th-instar larva are described and illustrated and compared with *Ae. formosensis* and *Ae. reinerti.*

The terminology used follows Harbach and Knight (1980, 1982). In the immature descriptions the range of setal branching is followed by the mode in parentheses.

TAXONOMIC TREATMENT

Aedes (Finlaya) pallirostris Edwards

Aedes (Finlaya) pallirostris Edwards, 1992:270 (♀); Barraud 1934:190 (♀); Knight 1948:640 (♀).

Finlaya khasiana Barraud, 1923:407 (♂, ♀); Edwards 1932:151. **TRANSFERRED SYNONYMY.**

Aedes formosensis from Assam, India, of Barraud, 1934:189.

Diagnosis. In the larva, comb scales with 2–5 large, conspicuous apical spines easily distinguish *Aedes pallirostris* from related species. Other differential characters shown in Table 2.

Female. *Head:* Antenna dark brown, about 0.75 (0.70–0.90) length of proboscis; flagellomere 1 with patch of broad dark brown scales, pedicel light brown with mesal patch of brown scales; clypeus dark brown, bare; maxillary palpus dark scaled with pale scales at apex of palpomeres 3, 4 (sometimes absent on 3), about 0.20 (0.19–0.23) length of proboscis; proboscis dark-scaled, about 1.1 length of forefemur, dorsally pale scales visible laterally on middle, pale stripe ventrally from basal 0.15 to 0.80; vertex with submedian patch of broad, decumbent, dark scales with broad pale scales from lateral to dorsal dark submedian area, ocular scales pale, narrow, lateral dark patches of broad scales near ocular line, postgena with pale-scaled patches, pale scales, and pair of long pale setae, 4–6 dark brown ocular setae on each side; occiput with narrow decumbent pale scales and numerous dark erect forked scales (some specimens also with pale scales) extending forward to vertex except on dorsomedian pale line. *Thorax:* Scutal integument reddish brown, scutum covered with narrow scales except on prescutellar area, pattern of pale-scaled lines on dark background as follows: acrostichal line extending posteriorly and forked to enclose prescutellar area, anterior dorsocentral line at level of scutal angle, posterior dorsocentral line curved outward and reaching scutal angle, distorted line from near scutal angle to parascutellum, supraalar pale scales sparse, anterior ones long, linear, thick patch posteriorly over wing root; acrostichal setae present, dark brown, sometimes anterior setae pale, several well-developed dark brown setae on anterior promontory, lateral and posterior scutal fossal, antealar, supraalar (with few pale ones), dorsocentral, and parascutellum; scutellum with patch of broad and narrow white scales separating lateral broad dark-scaled areas on median lobe, lateral lobe with broad dark scales and few narrow white scales, 4, 5 long and 2–4 short pale and dark brown setae on median lobe and 5–7 long and 1–3 short pale and dark brown setae on lateral lobes; pleural integument dark brown, antepronotum largely covered with broad white scales and with few narrow white scales anteriorly, 8–16 pale and dark brown setae; postpronotum mainly covered with narrow

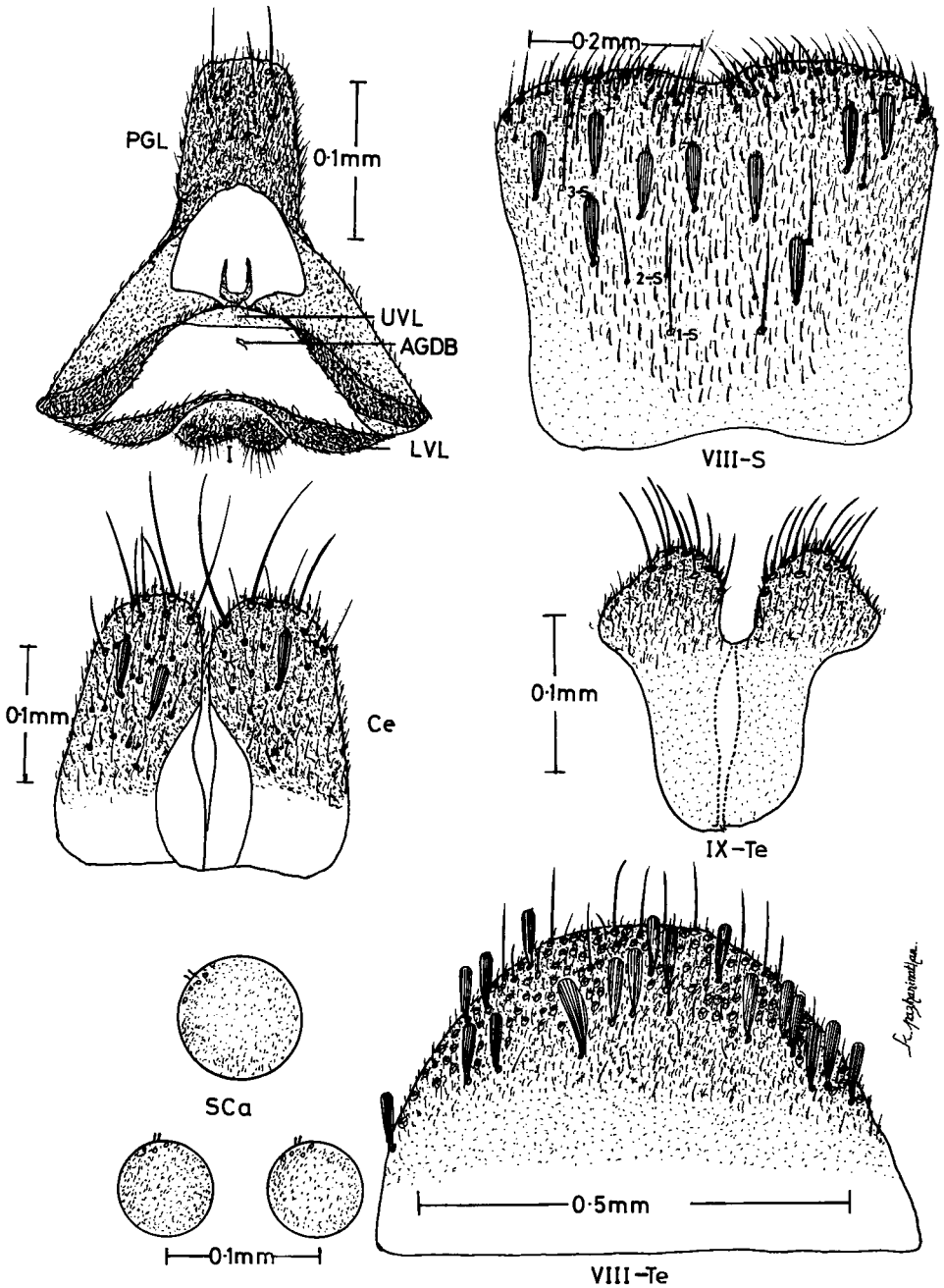

Fig. 1. *Aedes* (*Finlaya*) *pallirostris*, female genitalia. AGDB = accessory gland duct base, Ce = cercus, I = insula, LVL = lower vaginal lip, PGL = postgenital lobe, SCa = spermathecal capsule, UVL = upper vaginal lip, 1-S = seta 1-S, 2-S = seta 2-S, 3-S = seta 3-S, VIII-S = sternum VIII, VIII-Te = tergum VIII, IX-Te = tergum IX.

scales, intermixed with few moderately broad white scales posteriorly, 3, 4 pale setae (occasionally 1, 2 dark setae); paratergite with intermixed broad and narrow white scales; pleura with patches of broad white scales on proepisternum, postspiracular area, subspiracular area, lower prealar knob, mesepimeron, lower and upper mesokatepisternum (scale-patches on lower prealar knob and upper mesokatepisternum more or less contiguous); pleural setae pale, 6–8 on proepisternum, 3–5 on postspiracular area, 10–14 on prealar area, 8–12 on mesepimeron, 5–7 on upper and 5–8 on lower mesokatepisternum. *Legs:* All coxae with broad scales and well-developed pale brown setae, fore- and midcoxae with 2

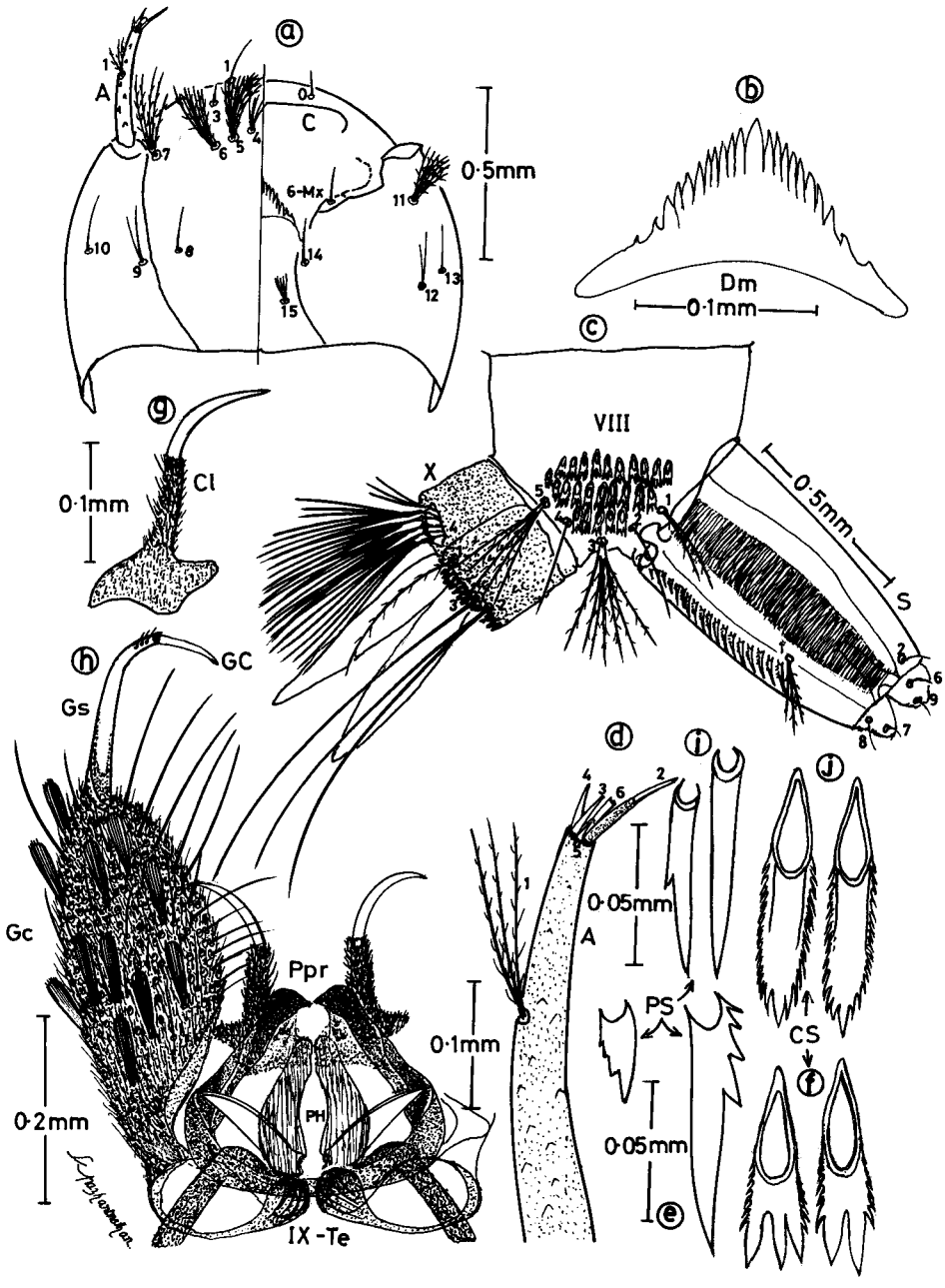

Fig. 2. a–h *Aedes* (*Finlaya*) *pallirostris*. a–f. Fourth-instar larva. g, h. Male genitalia. i, j. *Aedes* (*Finlaya*) *formosensis*. A = antenna; C = cranium; CS = comb scale; Dm = dorsomentum; PS = pecten spine; S = siphon; VIII, X = abdominal segments VIII, X; 6-Mx = seta 6 of maxilla; Cl = claspette; GC = gonostylar claw; Gc = gonocoxite; Gs = gonostylus; Ppr = paraproct; PH = phallosome; IX-Te = tergum IX.

small patches of white scales with median dark-scaled patch, hindcoxa with large patch of pale scales; trochanters pale-scaled; forefemur dark scaled with narrow longitudinal line of pale scales from base to apex on anteroventral and broader line on posterior surfaces; midfemur with narrow pale line anteriorly on about basal 0.5 length, posterior pale area (from base to middle) broad and then narrowed to apex; hindfemur anteriorly with submedian pale area and apicoventral pale patch, posteriorly pale to basal half and remainder dark-scaled; tibiae dark, each with basal white ring and short stripe of white scales anteriorly (longer on hindtibia), line of pale scales on foretibia (entire length)

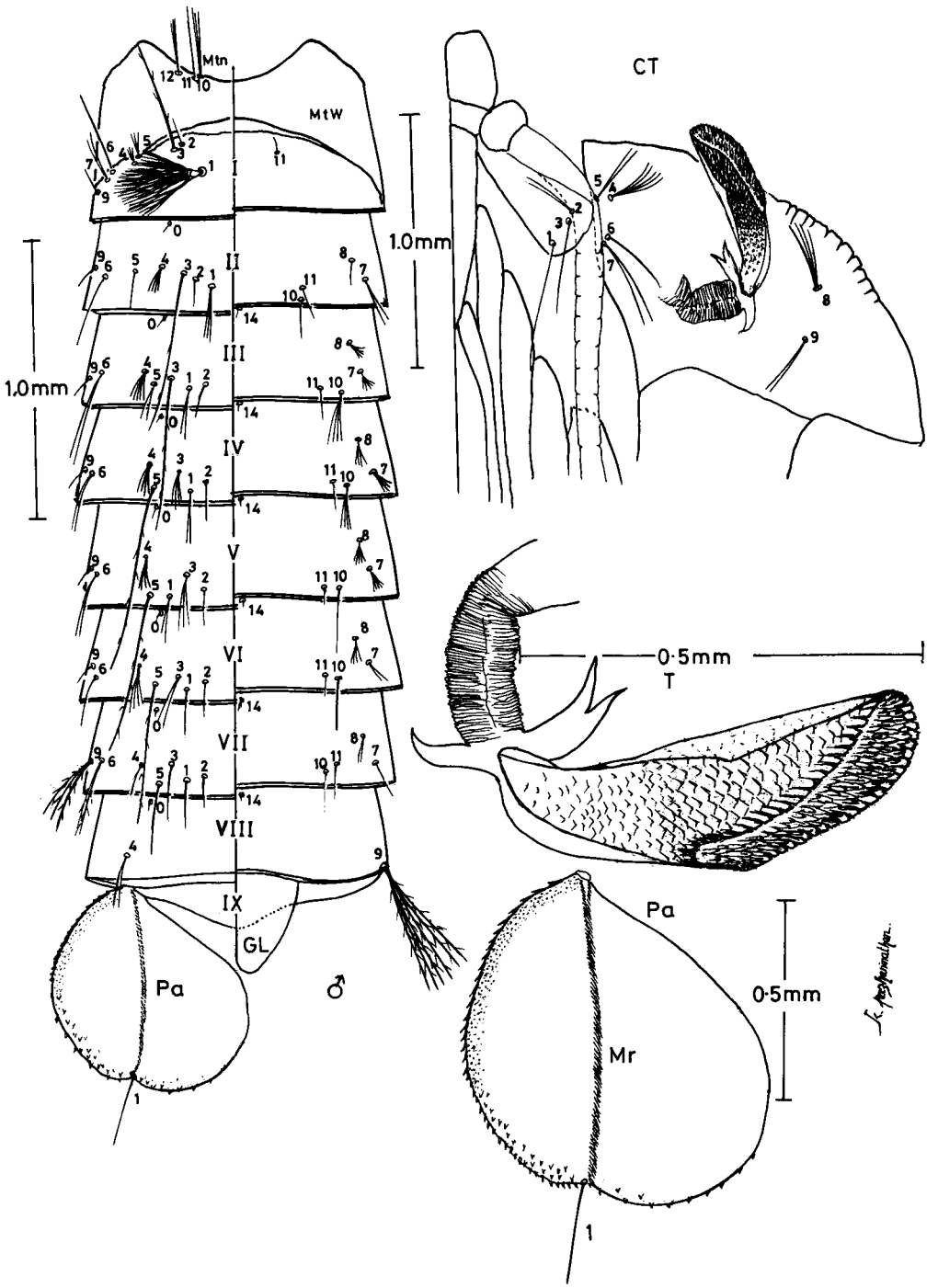

Fig. 3. *Aedes (Finlaya) pallirostris,* pupa. CT = cephalothorax, GL = genital lobe, Mr = midrib, Mtn = metanotum, MtW = metathoracic wing, Pa = paddle, T = trumpet, I–IX = abdominal segments I–IX.

and midtibia (about 0.5 length) on posterior surfaces; fore- and midtarsomeres I, II with distinct basal white bands, narrow band on midtarsus III; hindtarsus with a distinct white band on tarsomeres I–III; ungues equal, fore- and midungues each with tooth, hindungues simple. *Wing:* Dark-scaled, costa with pale line basally reaching to or crossing beyond humeral crossvein. *Halter:* Pedicel with dark scales anteriorly, capitellum pale scaled with small patch of dark scales apically. *Abdomen:* Terga dark

Table 1. Chaetotaxy of the pupa of *Aedes (Finlaya) pallirostris.*[1]

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

[1] Paddle: 1-P, 1.
[2] Eight main branches.

scaled, pale setae on apical and lateral margins of segments, setae abundant on tergum I, tergum I with laterotergite largely covered with snowy white scales, terga II–VII each with patch of snowy white scales basolaterally and a white scale-patch on basomedian areas; sterna dark brown with basal white bands on III, IV. *Genitalia* (Fig. 1): Tergum VIII moderately pigmented, spiculate, apically rounded, covered with broad scales and short setae (long and stronger apically); sternum VIII moderately pigmented, spiculate, slightly concave apically, covered with few scattered broad scales and numerous short setae extending medially to base and scattered laterally; tergum IX lightly pigmented, densely spiculate, deeply emarginate apically with well-developed lateral lobes, each lobe with heavily pigmented margins and 7–11 long setae, index 0.95–1.00; upper and lower vaginal lips narrow, moderately pigmented (upper relatively more pigmented), heavily spiculate; insula lightly pigmented, spiculate, short, bilobed, each lobe with 3–5 small setae; postgenital lobe spiculate, heavily pigmented apically with short setae; basal median apodeme very lightly pigmented; cercus slightly longer than postgenital lobe (index 1.94), apex rounded, covered with short and moderately long setae on apical 0.5 dorsally; 3 spermathecal capsules, one slightly larger than other 2.

Male. Essentially as in female, differing as follows: *Head:* Antenna verticillate, about 0.62 (0.54–0.69) length of proboscis; maxillary palpus 0.75–0.89 (mean = 0.83) length of proboscis with white-scaled patches on palpomeres 3–5 basally, broader ventrally on palpomere 3 and extending dorsally as distinct white band; proboscis dark scaled dorsally with white-scaled patch ventrally and laterally from basal 0.45–0.80. *Legs:* Fore- and midungues unequal, larger ungues with prominent median and basal teeth. *Genitalia* (Figs. 2g, 2h): Tergum IX bilobed, each lobe moderately pigmented with 7–12 setae, sternum IX with 5–7 setae (usually 2 strong, long setae) arranged in irregular row, one specimen with one broad scale attached medially; gonocoxite long, slightly broader basally, densely spiculate and scaled, dorsal surface with row of short, fine setae on basomesal area, scattered, moderate setae (few stronger and longer) along mesal margin, ventrolateral surface with very long, strong setae; gonostylus narrow and long, 0.58 (0.50–0.62) length of gonocoxite, basal area with few or without spicules, 2–5 short, fine setae apically; gonostylar claw short, 0.25 (0.23–0.30) length of gonostylus; claspette with stem densely spiculate, 2–4 setae, filament sickle-shaped, simple, tapering, slightly wider at middle; phallosome with aedeagus simple, short; paraproct with distinct, dark apical tooth, 2–4 cercal setae on each side.

Pupa. Chaetotaxy as in Fig. 3 and recorded in Table 1, based on 20 exuviae. *Cephalothorax:* Trumpet moderately pigmented, index 3.42–3.75 (mean = 3.62); seta 1-CT single, sometimes with 2, 3 fine delicate branches; 6-CT single, shorter than 7-CT. *Abdomen:* Moderately pigmented, 1-I aciculate, dendritic with 8–14 (8) main branches; 2-I–VII single (2-VI sometimes bifid); 3-I–III long, single, sometimes double with delicate branches; 5-IV–VI single, weakly aciculate, longer than succeeding segment; 6-VII aciculate, bifid; 9-I–VI single, occasionally bifid; 9-VII aciculate with 2–4 (3) branches; 11-I–VII short, single; 9-VIII aciculate with 5–10 (6) branches. *Paddle:* Ovoid, apex rounded and slightly emarginate, serrations on basal 0.38–0.50 of outer margin, spiculate on apical 0.11–0.23 of inner and 0.50–0.67 of outer margins; midrib complete, terminates at base of 1-P; seta 1-P single (one specimen trifid at tip), short, about 0.3 length of paddle; index 1.00–1.24 (mean = 1.14).

Larva (Figs. 2a–2f). The description is based on

Table 2. Differential characters for 3 species of the *Aedes chrysolineatus* subgroup.

Character	*Aedes pallirostris*
Adult	
Proboscis–ventral pale scales	f[1] Basal 0.15–0.80 m[1] Basal 0.45–0.80
Antepronotum	Broad and narrow scales intermixed
Paratergite	Broad and narrow scales intermixed
Scutellar lobes	Broad and narrow scales intermixed
Gonostylus	Without spicules
Pupa	
1-I basal branches	8–14 (mode 8)
5-VI length compared to succeeding segment	0.58 or more (mode 0.69)
5-VII length compared to succeeding segment	0.43 or more (mode 0.50)
1-P length compared to paddle	0.24–0.31 (mode 0.29)
Larva	
1-C	Single, simple
5-C branches	12–19 (mode 14)
Comb scales	25–40 scales, each with 2–5 large, prominent spines and few fine spicules laterally up to base
Pecten	15–22 spines with 1–4 denticles, most apical spine attached before insertion of siphonal seta 1-S
1-X	1.00–1.58 (mode 1.28) length of saddle

[1] f = female; m = male.

14 exuviae. *Head:* Antenna about 0.33 length of head, with short scanty spicules; seta 1-A weakly aciculate, with 3, 4 (3) branches inserted at about 0.5 length of antenna; 2–6-A single, attached at apex; 1-C single, long, tapering; 3-C always single; 4-C with 5–7 (5) branches; 5-C weakly aciculate with 12–19 (14) branches; 6-C weakly aciculate with 6–10 (7) branches, 4–6-C cephalad of 7-C; 7-C weakly aciculate with 4, 5 (5) branches; 8-C single, occasionally double; 9-C with 1–4 (2) branches; 10-C single or double; 11-C weakly aciculate with 5–10 branches; 12-C with 1–3 (2) branches; 13-C always single; 14-C strong, single or double; 15-C with 3–6 (5) branches; 6-Mx single (occasionally double), strong, long, about length of 14-C; dorsomentum with 8–11 teeth on either side of broad median tooth. *Thorax* and *abdomen:* Moderately pigmented, extensive twisting of exuviae made it difficult to interpret thoracic and abdominal setae accurately; segment VIII with comb of 25–40 scales arranged in triangular patch, each scale with 2–5 large, prominent apical spines and a few fine spicules laterally to base; 1-X single, aciculate, 1.00–1.58 (1.28) length of saddle; 2-X with 2, 3 (2) branches; 3-X single, occasionally double; 4-X with 10–13 setae (about 5, 6 pairs), each with multiple branches; saddle incomplete, moderately pigmented, spiculate, stronger spicules on caudal margins; acus absent. *Siphon:* Moderately pigmented, spiculate, index 1.64–1.89; acus present; pecten composed of 15–22 evenly spaced spines, basal spine shorter, each spine with 1–4 lateral denticles basally, usually 1, 2 stronger denticles, most apical spine usually attached before insertion of 1-S; seta 1-S with 3, 4 (3) aciculate branches, attached on basal 0.65 of siphon; setae 2, 6–9-S single.

Material examined. We examined 163 specimens, based on collections made in 4 localities in 2 states in the Northeastern Region of India by S. C. Tewari, J. Hiriyan, K. Ayanar, and A. Munirathinam from October to November 1991, as follows: India, Assam, Dhemaji District, Gowal Gaon, plantain leaf axil, 200 m, 7♂, 1♂G, 7♀, 6Pe, 6Le; dusk collection, 1♀; Balisohi, treehole, 300 m, 1♂, 1Pe, 1Le; Dibrugarh District, Khowang, plantain leaf axil, 300 m, 40♂, 7♂G, 55♀, 8♀G, 13Pe, 7Le; Arunachal Pradesh, West Siang, Deepa Basti, bamboo stump, 400 m, 1♂, 1♂G. From these collections, 2♂, 1♂G, 2♀, 1♀G, 4Pe, 4Le, deposited in U.S. National Museum (USNM), Washington, DC; 1♂, 1♂G, 1♀, 1♀G, 2Pe, 2Le, deposited in the Natural History Museum, London; 1♂, 1♂G, 1♀, 1♀G, 2Pe, 2Le, deposited in the Museum of The National Institute of Virology, Pune, India; 45♂, 6♂G, 59♀, 5♀G, 12Pe, 6Le, retained in the Museum of Centre for Research in Medical Entomology, Madurai, India.

Bionomics. *Aedes pallirostris* larvae were found mainly in plantain leaf axils (*Musa* sp.) near human habitations, but a single larva was collected from a bamboo stump and another from a tree hole in a natural forest in a high-rainfall area at low elevation (200–400 m). Species associated with *Ae. pallirostris* larvae included *Aedes* (*Fin.*) *albolateralis* (Theobald), *Aedes* (*Stegomyia*) *albolineatus* (Theobald), *Aedes* (*Stg.*) *albopictus* (Skuse), *Armigeres*

Table 2. Continued.

Aedes formosensis	*Aedes reinerti*
Basal 0.05–0.80	Basal 0.05–1.0
Basal 0.05–0.60	Basal 0.45–1.0
Broad scales only	Broad scales only
Broad scales only	Broad scales only
Broad and narrow scales intermixed	Broad scales only
With spicules	With spicules
8–24 (mode 12)	4–12 (mode 7)
0.61 or more (mode 0.83)	0.61 or less (mode 0.45)
0.64 or more (mode 0.88)	0.67 or less (mode 0.44)
0.27–0.40 (mode 0.38)	0.17–0.36 (mode 0.20)
Single, simple	Bifid, aciculate or brushy-tipped
8–17 (mode 12)	17–34 (mode 25)
29–51 scales, each with fine, lateral spicules basally and coarser spicules along remainder of length, usually apical spicule much more strongly developed	30–74 scales, each with strong median apical spine and smaller, lateral spines diminishing basally into fine lateral spicules
8–13 spines with 1, 2 denticles, may be 1–3 nondentate spines attached even with or beyond insertion of 1-S	10–17 spines, simple or with fine, short denticles on basal 0.50, usually 1, 2 attached even with or beyond insertion of 1-S
About 1.5 length of saddle	1.72–2.85 (mode 2.28) length of saddle

(*Armigeres*) *durhami* Edwards, *Armigeres* (*Leicesteria*) *flavus* (Leicester), *Culex* (*Eumelanomyia*) *malayi* (Leicester), *Ficalbia minima* (Theobald), *Malaya genurostris* Leicester, *Tripteroides* (*Rachionotomyia*) *aranoides* (Theobald), *Tripteroides* (*Tripteroides*) *tarsalis* Delfinado and Hodges, and *Toxorhynchites* (*Toxorhynchites*) *splendens* (Wiedemann). The medical importance of this species is not known.

TAXONOMIC DISCUSSION

Until now the concept of *Ae. formosensis* actually applied to 2 different species, one represented by the lectotype of *Ae. formosensis* and one represented by the holotype of *Ae. pallirostris* and the lectotype of *Finlaya khasiana* (Knight 1968, Ward 1992). We take this opportunity to remove the latter 2 names from synonymy with *Ae. formosensis* and apply them to the species from Assam. Because *Ae. pallirostris* has priority over *Finlaya khasiana,* we are giving this name to the Assam species and recognizing *Finlaya khasiana* as its junior synonym. This action leaves *Ae. formosensis* as a valid species without synonyms.

Based on Knight's (1968) review, *Ae.* (*Fin.*) *pallirostris* belongs to the *Aedes chrysolineatus* (Theobald) subgroup of group D, and its immature and adult characters are very similar to *Ae. formosensis* and *Ae. reinerti.* Both species are almost indistinguishable from *Ae. pallirostris* in the adult stage. However, the larvae are distinctive. We have examined 163 specimens of *Ae. pallirostris* and 8 specimens of *Ae. formosensis.*

In *Ae. pallirostris* larva, the comb scales have 2–5 large, prominent, median spines apically and a few fine spicules laterally to the base (Fig. 2f). This feature clearly distinguishes it from both *Ae. formosensis* and *Ae. reinerti,* which have comb scales with only one strong median apical spine and smaller lateral spines diminishing basally into fine lateral spicules. *Aedes reinerti* has seta 1-C bifid, each branch with long fine barbs or a brushy tip, and is easily separated from *Ae. pallirostris,* in which seta 1-C is simple. In addition, there are comparatively more pecten spines in *Ae. pallirostris,* ranging from 13 to 22 (mode 16) and usually the most apical spine does not extend beyond the point of attachment of seta 1-S (Fig. 2c). In *Ae. formosensis* and *Ae. reinerti* the pecten spines range from 8 to 13 and 10 to 17, respectively, and their most apical spines are level with or beyond the point of attachment of seta 1-S. At present, detailed pupal descriptions of most of the species of the subgroup are not available. However, some partially differential characters are apparent when comparisons are made with the description of *Ae. reinerti* (Rattanarithikul and Harrison 1988) and the specimens of *Ae. formosensis* on loan from the USNM. Despite these similarities with *Ae. formosensis* and *Ae. reinerti,* we recognize *Ae. pallirostris* as a distinct species on the basis of the diagnostic comb scales in the larva and overlapping (partially differential) characters in adult, pupal, and larval stages as shown in Table 2.

The occurrence of *Ae. formosensis* in Assam (India) was reported by Barraud (1934), who de-

scribed the larva of this putative species based on specimens collected on Bali Island, Indonesia (Barraud 1934). It is still possible that more than one species of the *Ae. chrysolineatus* subgroup may occur in this locality, because Rattanarithikul and Harrison (1988) reported common occurrence of *Ae. formosensis* and *Ae. reinerti* immatures together in the same leaf axil in Thailand. However, we found larvae of only one species of this subgroup, and therefore, at present we consider all previous records of *Ae. formosensis* in Assam to refer to *Ae. pallirostris.*

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