

Redescription of *Culex (Eumelanomyia) richei* (Diptera: Culicidae), with Treatments of the Previously Unknown Life Stages and a Record of its Occurrence in Thailand¹

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ABSTRACT. *Culex (Eumelanomyia) richei* is reported and described from Chiang Mai Province, Thailand. The female, pupa and fourth-instar larva are described for the first time.

INTRODUCTION. In October of 1985 we made a collection of immature mosquitoes on Doi Inthanon, the highest mountain of Thailand located in Chiang Mai Province, which contained larvae of two species of *Culex (Eumelanomyia)*. One of these, *Culex oresbius*, proved to be a new species closely related to *macrostylus* Sirivanakarn and Ramalingam (Harbach and Rattanakul 1988). The other species was identified as *richei* Klein based on the genitalia of a single male reared from a pupa. Association with the larval stage of this species was established through a male reared from a larva collected on Doi Inthanon in 1981. This specimen had intact genitalia and was previously misidentified as *foliatus* Brug based on overt characteristics of the larval exuviae. Two females distinguishable from *oresbius* and resembling the male of *richei* in overall appearance were bred from pupae contained in the collection made in 1985, but the pupal exuviae of these specimens were lost.

Culex richei has not been treated in the literature since it was described from a single male captured in the Bokor Hills, Kampot Province, Kampuchea (Klein 1970). The primary objectives of this publication are to describe and illustrate the previously unrecognized life stages of this species and to report its occurrence in Thailand.

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

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Culex (Eumelanomyia) richei Klein

Adult. A small brown mosquito without distinctive markings and special features; described from two females and two males from Doi Inthanon, Thailand.

FEMALE. Scaling predominantly brown, darker on proboscis, wings and abdominal terga. *Head:* Antenna brown, length about 1.6 mm. Proboscis uniformly dark-scaled; length about 1.9 mm; labial basal setae as long as maxillary palpus. Maxillary palpus short, length 0.3 mm, about 0.16 length of proboscis; dark-scaled. Forked scales of vertex light brown, slender; falcate scales yellowish brown; lateral spatulate scales whitish. *Thorax:* Integument brown. Scutum with uniform covering of fine golden-brown scales, scales larger and noticeably paler on anterior promontory; with complete row of acrostichal setae, these about 0.5 length of dorsocentral setae, all setae dark brown. Scutellar scales same as scutal scales; lateral lobes of scutellum each with 3,4 large setae, median lobe with 5 large setae. Antepronotum with pale setae and few scales. Postpronotum with few pale scales on anterodorsal margin; with curved row of 5 setae on posterodorsal margin. Pleural setae yellow: 4,5 upper proepisternal, 5 prealar, 5,6 upper mesokatepisternal, 10,11 lower mesokatepisternal, 6,7 upper mesepimeral and 1 lower mesepimeral, upper and lower mesokatepisternal setae in more or less continuous row; pleura with some inconspicuous pale scales on upper proepisternum and along bases of lower mesokatepisternal setae. *Wing:* Length 3.2 mm; cell R₂ about 2.5 length of vein R₂₊₃; cell M₁ 0.7 length of cell R₂; entirely dark-scaled. *Halter:* Scabellum pale, pedicel and capitellum dark. *Legs:* Anterior surface of forecoxa pale-scaled; anterolateral surfaces of mid- and hindcoxae with longitudinal patch of pale scales; coxal setae all pale. Trochanters pale except for small dark spot on mesal surface. Forefemur mainly dark-scaled, with posteroventral stripe of pale scaling; anterior and dorsal surfaces of midfemur dark-scaled, other surfaces pale-scaled; hindfemur mainly pale-scaled, with narrow dorsal stripe of dark scales beginning near base, gradually widening distally and abruptly encircling femur before apex. Tibiae and tarsi entirely dark-scaled. Ungues small, simple, dark. Pulvilli distinct, whitish. *Abdomen:* Tergum I with median posterior patch of dark scales; terga II-VIII entirely dark-scaled. Sterna pale-scaled.

MALE. Coloration and scaling as in female. *Head:* Antenna strongly plumose, minor whorls present; length 1.5 mm. Proboscis normal; false joint not apparent. Maxillary palpus long, length 1.7 mm, 0.9 length of proboscis [about 0.8 length of proboscis in holotype], terminal palpomeres 4 and 5 sparsely setose. *Thorax:* Median lobe of scutellum with 6 large setae. Pleura with 4 prealar setae, 9 lower mesokatepisternal setae and 5,6 upper mesepimeral setae. *Wing:* Length 2.8 mm. *Legs:* Ungues dark, simple; fore- and midungues subequal, anterior fore- and midunguis larger than posterior ones; hindungues small, equal. *Genitalia* (Fig. 1): Ninth tergal lobe small, with 3,4 short setae. Gonocoxite normal, dorsolateral margin with 2,3 moderately long curved setae in longitudinal line near base [holotype with 4]; subapical lobe distinct but not prominent, undivided, very near tip of gonocoxite, bearing 11 close-set setae: 3 stout rodlike setae with hooked apices, a slender simple seta, 4 flat setae of different lengths [the shortest has thickened lateral margins representing 2 of the 3 simple setae which Klein (1970)

described in the holotype] and a compressed, distally pectinate (comblike) seta in more or less straight row with an acuminate foliform seta [broader in holotype] and a slender, distally bent, simple seta on lateral side of row. Gonostylus unmodified; gonostylar claw short, flattened at tip. Phallosome as broad as long, lateral plate broadly fused (laterally) with aedeagal sclerite; lateral plate roughly broadly oval in dorsal view, with some 8-12 denticles on dorsomesal surface and apical margin, joined basally (anterodorsally) to plate of opposite side by short and narrow dorsal aedeagal bridge; aedeagal sclerite about same size as lateral plate, joined to sclerite of opposite side by short and narrow ventral aedeagal bridge. Proctiger without special features; paraproct with small basolateral thumblike process, crown with dense cluster of flattened, curved, pointed denticles. Cercal sclerite and tergum X elongate, simple; 2 cercal setae.

Pupa (Fig. 1). Described from two exuviae (males); character and placement of setae as figured, numbers of branches in Table 1. *Cephalothorax*: Lightly tanned, scutum, metanotum and legs darker. Setae 1,5,10-CT double; 8,11-CT single or double, more often double; 12-CT double or triple. *Trumpet*: Moderately and evenly tanned; gently flared distally; mean index 10.2 (width measured at midlength); tracheoid area long, about 0.5 trumpet length; pinna with short slit extending about 0.06 mm into meatus. *Abdomen*: Lightly tanned, anterior terga slightly darker; length about 2.4 mm. Seta 1-II plumose/dendritic with about 30 simple branches; 9-III,IV and sometimes 9-VI ventral; 6-III-VI double, about 0.5 length of tergum following; 5-IV-VI double, longer than tergum following, 5-V longer than 5-IV,VI, about 1.5 length of tergum following; 4-VIII single. *Genital lobe*: Lightly tanned; length about 0.3 mm. *Paddle*: Very lightly tanned, buttress and midrib slightly darker; buttress distinct to midlength of paddle; midrib complete to near apex; mean length 0.68 mm, mean width 0.41 mm, mean index 1.65. Seta 1-P present, stronger than 2-P, both single.

Larva (Fig. 2). Based on the examination of 12 larvae and a single exuviae; character and positions of setae as figured, numbers of branches in Table 2. *Head*: Wider than long; length 0.64-0.75 mm, mean 0.70 mm; width 1.08-1.19 mm, mean 1.13 mm; moderately tanned. Dorsomentum heavily tanned; usually with 7 teeth (6,7) on either side of median tooth. Seta 1-C pigmented, stout, slightly bent mesad, pointed; 2-C usually present, minute; 4,5-C with 1-3 branches, more often double, 5-C about twice length of 4-C; 6-C not well developed, not much longer than 5-C, with 2-4 branches, frequently 3; 9,12-C observed in one specimen (exuviae) only (see table for numbers of branches); 11-C single or double in nearly equal frequencies; 14-C with 2-5 branches, often 3, diverging in a single plane; 16-C present; 17-C apparently absent. *Antenna*: Length 0.66-0.72 mm, mean 0.68 mm, very nearly length of head; lightly to moderately tanned, basal margin and distal part darker; aciculae primarily on dorsal and lateral surfaces of proximal part. Seta 1-A with about 22 branches (15-27); 2,3-A subapical; 5-A as long or longer than 6-A, distal hyaline part longer than basal opaque part. *Thorax*: Integument hyaline, smooth. Seta 4-P weak and short, about 0.3 length of 3-P, with 2-5 branches, often 3; 7-P usually double, occasionally single; 8-P single. Seta 1-M short, not much longer than 2-M, usually double (1-3); 4-M long, about 0.7 length of 3-M. Seta 12-T usually forked, with 1-6 branches, often triple; 13-T normal, with 3-6 branches occurring in nearly equal frequencies. *Abdomen*: Integument hyaline, surface smooth except for rows of minute spicules around comb. Seta 6-III-VI double (6-VI triple on one side of one specimen examined); 13-III-VI normal, developed like 1-III-V. *Segment VIII*: Comb with 43-60 scales, mean 53; scales evenly

fringed on sides and apex. *Siphon*: Index 5.38-6.71 (width measured at base), mean 6.20; straight, cylindrical, little if at all tapered; lightly tanned, basal ring and acus darker. Pecten with 9-14 spines, mode 12; spines long and slender, increasing in length distally, with complete ventral row of spicules, spicules closer together and more numerous distally. Seta 1-5 in 5 pairs; 1a,b,c,d-S with 3 or 4 branches, commonly 4, length about twice diameter of siphon at point of attachment; 1e-S with 1-3 branches, usually double; shorter, length about 1.5 times diameter of siphon at point of attachment. *Segment X*: Saddle complete; lightly tanned; length 0.30-0.37 mm, mean 0.35 mm, siphon/saddle index 3.11-3.68, mean 3.43. Seta 1-X with 2-6 branches, often triple, shorter than saddle; 2-X with 3 or 4 branches, normally 3; 4-X in 6.5 or 7 pairs (13 or 14 setae), normally one seta borne proximal to grid. Anal papillae long and tapered, about twice length of saddle.

Material examined. Twenty specimens from four collections made on Doi Inthanon, Amphur Cham Thong, Chiang Mai Province, THAILAND: 1 fourth-instar larva, collection no. 07906, flood pool, 1,700 m, 7 July 1978; 1 male with associated pupal and larval exuviae and genitalia on slides, collection no. 08420-7, seepage, about 1,500 m, 24 April 1981; 1 male with associated pupal exuviae and genitalia on slides, 2 females and 8 fourth-instar larvae, collection no. TH 26, pond, 1,400 m, 5 October 1985; 3 fourth-instar larvae, collection no. and habitat unknown, 1986(?). These specimens are deposited in the National Museum of Natural History (NMNH), Smithsonian Institution, Washington, DC. Comparison was made with the holotype male, genitalia on slide (in NMNH), from Popork Vil, Kampot Province, Kampuchea.

Bionomics. The immature stages of *richei* have been collected in clean bodies of standing water and seepage in tropical forest at higher elevations in association with *Anopheles (Cellia) splendidus* Koidzumi, *Aedes (Finlaya) pulchriventer* (Giles), *Culex (Culex) edwardsi* Barraud, *Cx. (Cux.) mimulus* Edwards, *Cx. (Cux.) vishnui* Theobald and *Cx. (Eumelanomyia) oresbius* Harbach and Rattanarithikul. The holotype of this species was collected resting between rocks near a rushing stream in forest at an altitude of approximately 850 m (Klein 1970). Other than this nothing is known about the bionomics or disease relations of this species.

Systematics. *Culex richiei* is a member of the Tenuipalpis Subgroup of the Mochthogenes Group which also includes *hayashii* Yamada, *hackeri* Edwards, *tenuipalpis* Barraud and *kiriensis* Klein and Sirivanakarn in the Oriental Region (Sirivanakarn 1972). Females of this group can be separated only by the structure of the cibarial armature. The cibarial armature of *richei* was not investigated. Males of the group are easily recognized by the development of the setae borne on the subapical lobe of the gonocoxite. Only in the male of *hayashii* does the length of the maxillary palpus approach that of *richei*. Based on the two pupal exuviae of *richei* available for examination, it appears that the character of seta 1-II and a combination of certain setal branchings described by Sirivanakarn (1972) and Sirivanakarn and Ramalingam (1976) will serve to distinguish this species from the other members of the group. The larva of *kiriensis* is unknown, but that of *richei* differs from the others in the form of the comb scales, the development of setae 4-P and 1-S and a combination of other setal modifications indicated by the authors cited above.

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Table 1. Number of branches for pupal setae of *Culex (Eumelanomyia) richiei* Klein.^a

Seta Number	CT	Abdominal Segments										Paddle		
		I	II	III	IV	V	VI	VII	VIII	IX	P			
0	-	-	1	1	1	1	1	1	1	1	1	1	-	-
1	2	120	30	3-6(3)	4-6(4)	3-5	2,3	1,2(2)	-	1	1	1	1	1
2	2,3(3) ^b	1	1	1	1	1	1	1	-	1	1	1	-	1
3	1	1,2	2	2	3-6	1	1	1,2(2)	-	1	1,2(2)	-	-	-
4	1	2,3(2)	3,4	3-5(3)	1	3-6(3)	2,3	1	1	1	1	1	-	-
5	2	1	2,4(4)	3,4	2	2	2	1	-	1	1	-	-	-
6	1,2(1)	1	1	2	2	2	2	1,2(2)	-	1	1,2(2)	-	-	-
7	1	1,2(1)	1,2(1)	2-4(3)	2,3(3)	4,5	1	1	-	1	1	-	-	-
8	1,2(2)	-	-	2,3(3)	2	1,2	1,2(2)	1	-	1	1	-	-	-
9	1	1	1	1	1	1	1	1,2(2)	3,4(4)	1	1,2(2)	-	-	-
10	2	. ^c	-	2,3(2)	1	1	1	1	-	1	1	-	-	-
11	1,2(2)	-	-	1	1	1	1	1,2(2)	-	1	1,2(2)	-	-	-
12	2,3	-	-	-	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	-	-	-	1	1	1	1	1	1	1	1	1	-	-

^aBased on counts made on two male exuviae.^bRange (mode).^cAlveolus only.

Table 2. Number of branches for fourth-instar larval setae of *Culex (Eumelanomyia) richei* Klein.^a

Seta Number	Head C	P	Thorax M	T	Abdominal Segments					VII	VIII	X
					I	II	III	IV	V			
0	-	6-10(7) ^b	-	-	1	1	1	1	1	1	1	-
1	1	1	1-3(2)	1,2(1)	1,2(1)	1-3(1)	2-5(3)	2-5(4)	3-6(4)	2-4(3)	3-5(4)	2-6(3)
2	0,1(1)	1	2-5(3)	2-4(3)	1	1	1	1	1	1	1	3,4(3)
3	1	1	2-4(3)	3-7(4)	1-4(3)	1-3(1)	1,2(2)	1,2(1)	1	1	2-5(3)	6-8(7)
4	1-3(2)	2-5(3)	2-5(4)	3-5(3)	4-10(7)	3-8(6)	1-4(3)	1-3(2)	3-8(5)	2,3(3)	1	2-7(7)
5	1-3(2)	1	1	1,2(1)	2-4(3)	1-3(1)	1-3(2)	1-3(2)	1-5(2)	1,2(2)	1-5(2)	1-4(2)
6	2-4(3)	1	1	1	2	2	2	2	2	2,3(2)	5-9(7)	-
7	4-7(5)	1,2(2)	1	4-7(6)	1	2-5(5)	4-8(5)	4-8(7)	4-8(5)	2-4(3)	1	-
8	2-6(4)	1	2-5(5)	3-6(5)	-	1	2	2	1-3(2)	1-3(2)	2-4(3)	1a-S, 3,4(4)
9	4 ^c	1	3-5(4)	3-7(5)	1-3(2)	1	1	1	1	1	1-3(2)	1b-S, 3,4(4)
10	1-3(2)	1	1,2(1)	1	1,2(1)	1	1,2(1)	1,2(2)	1	1	1	1c-S, 3,4(4)
11	1,2(2)	3-7(5)	1-4(2)	1-4(2)	1-3(2)	1-3(3)	1-3(2)	1,2(2)	1,2(2)	1-3(2)	1-4(2)	1d-S, 3,4(4)
12	3 ^c	1	1	1-6(3)	1-3(2)	1-4(2)	1-3(2)	1-3(2)	1	1	1	1e-S, 1-3(2)
13	1,2(2)	-	8-18(8)	3-6(4)	1-3(2)	6-16(13)	2-4(3)	1-4(3)	2-5(3)	19-32(24)	1-4(2)	-
14	2-5(3)	2	7-11(10)	-	-	-	1	1	1	1	1	-
15	6-10(7)	-	-	-	-	-	-	-	-	-	-	-
16	1	-	-	-	-	-	-	-	-	-	-	-

^a Based on counts made on 11 larvae and one larval exuviae.

^b Range (mode).

^c Observed in one specimen only (exuviae).

Fig. 1

Culex (Eumelanomyia) richei



