

THREE NEW SPECIES OF *CULEX* SUBGENUS *CULICIOMYIA* THEOBALD
FROM SOUTHEAST ASIA AND A REDESCRIPTION OF THE TYPE
OF *C. TRICUSPIS* EDWARDS FROM ALOR,
LESSER SUNDA ISLANDS, INDONESIA
(DIPTERA: CULICIDAE)¹

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ABSTRACT—The 3 new species of *Culex* (*Culiciomyia*) described and illustrated in this paper are: **lampangensis** from Thailand, **delfinadoae** from the Philippines, and **ramalingami** from West Malaysia (Malaya). The redescription of *C. tricuspis* is based on the holotype male from Alor, Lesser Sunda Islands, Indonesia.

During a preliminary study of specimens of *Culex* which accumulated at the Southeast Asia Mosquito Project during 1968–1971, 3 new species of *Culiciomyia* Theobald were discovered, but the descriptions presented herein have long been postponed because of a plan to include them with other species in a single revision. However, as such an extensive work has not been carried on, it appears appropriate to describe these species now so that they can be recognized and identified in the field by fellow workers who have been collaborating with the Project in collecting and sending specimens from various parts of Southeast Asia. As these species exhibit a great deal of morphological differentiation from other known members of *Culiciomyia* the descriptions given below will, accordingly draw attention to certain taxonomic characters for consideration in a future attempt to characterize the subgenus as well as to develop a scheme of internal classification within the subgenus. In addition to the descriptions of 3 new species, *C. tricuspis* Edwards (which has been removed from *Neoculex* Dyar to *Culiciomyia* (Sirivanakarn, 1971)) is redescribed for comparative purposes and for clarification of its identity, affinity, and taxonomic status.

The descriptions of the news species are based on specimens collected by the U.S. Army Medical Component, SEATO Laboratory in Thailand, by M. D. Delfinado and the Noona Dan Expedition in the Philippines, and by S. Ramalingam's team of collectors in West Malaysia. The redescription of *C. tricuspis* from Alor, Lesser Sunda Islands, Indonesia, is based on a single type male at the British Museum (N.H.).

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All designated holotypes and allotypes will be deposited in the U.S. National Museum (USNM), Washington, D.C. The paratypes and other identified specimens will be placed for future reference in the Southeast Asia Mosquito Project (SEAMP), Smithsonian Institution.

The format and terminology used in the descriptions and illustrations follow the preceding papers on *Culex* by Bram (1967), Sirivanakarn (1972), and others in the series of publications by the Southeast Asia Mosquito Project. In facilitating identification, a taxonomic discussion summarizing the best diagnostic features and the means for separating the species from other previously known forms is provided.

Culex (Culiciomyia) lampangensis n. sp

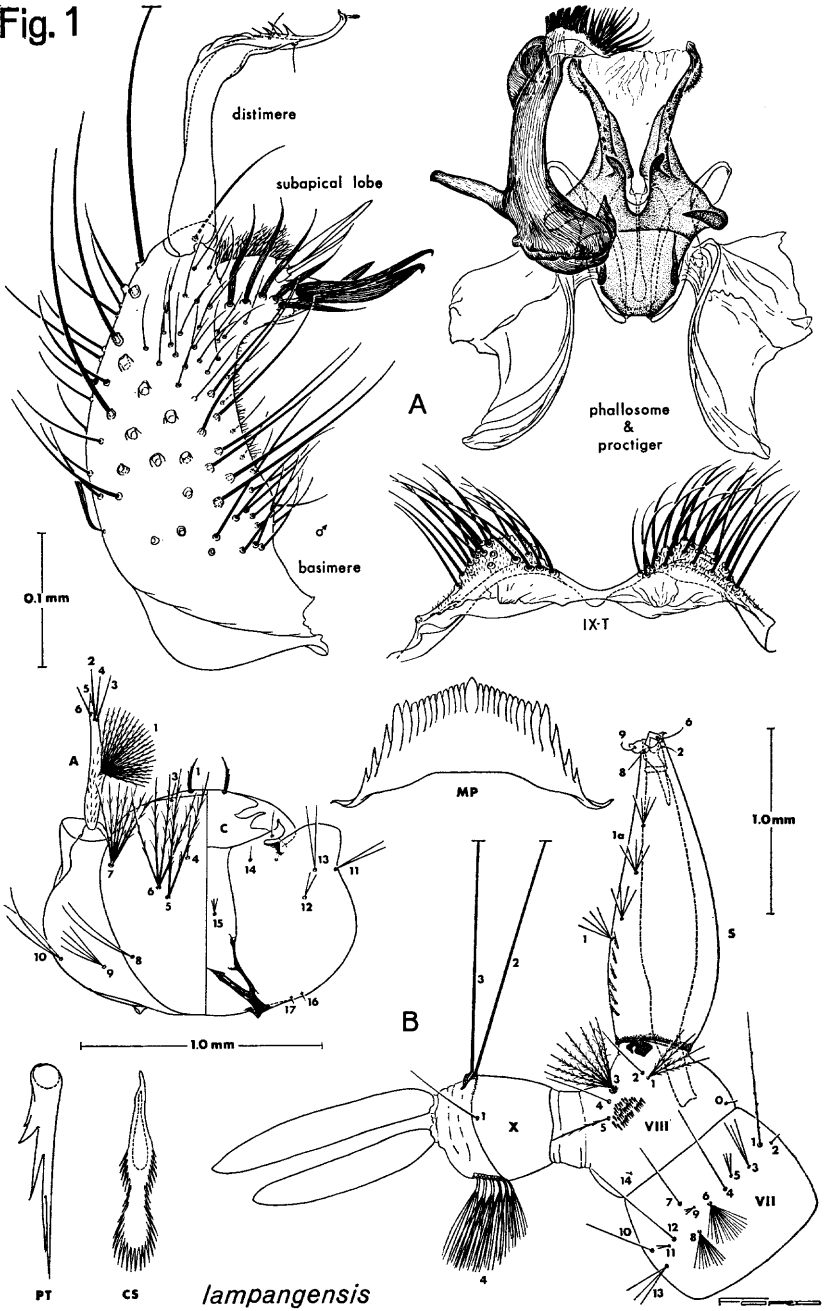
fig. 1A, ♂ terminalia; 1B, larva

Female: Wing 4.0–4.5 mm, fore femur 2.1–2.3 mm, proboscis 2.3–2.5 mm, abdomen 3.0–3.5 mm. Medium to large in size, general facies resembling *C. pallidothorax* as described and figured by Bram (1967:137–143; 144). *Head*. Decumbent scales on dorsum of vertex narrow and pale yellowish, coarser and darker on lateral and posterolateral areas; scales on both sides of eyes broad, forming distinct lateral white patches; erect scales numerous, dark to black, sometimes slightly pale towards apices; palpus and proboscis dark scaled; proboscis with 4–6 dark labial basal setae, 2 lateral ones longest, about as long as palpus. *Thorax*. Scutum and scutellum dark greenish; scutal scales dark, numerous and very dense, all narrow and fine, producing a smooth appearance; pleuron same color as scutum, without definite dark band or spot on upper half; 1 or 2 lower mesepimeral bristles present; scales practically absent. *Legs and Wings*. Without marked coloration. *Abdomen*. Terga II–VII with pale basal bands; sterna pale yellowish scaled.

Male: In general as described in female. *Head*. Palpus longer than proboscis by the length of terminal segment; palpal segment 3 with ventral lateral row of 8–10 transparent scales; segments 4, 5 strongly plumose; proboscis with submedian false joint and median ventral tuft of 10 long and dark setae; antennal flagellum strongly plumose. *Terminalia* (fig. 1A). Very similar to *pallidothorax* and *papuensis*, differing strikingly in the following features; tergal lobe of segment IX large and prominent with 20 or more very strong setae; subapical lobe of basimere elongate; number of strong setae on distal division fewer than in the 2 species mentioned; leaflet absent; sternal apical spiculate lobe reduced or poorly developed; lateral plate of phallosome with 1 large inner basal denticle and a series of very weak denticles towards apex, latter sometimes not developed or absent; basal sternal process of proctiger slender and long, as in *papuensis*, but longer than in *pallidothorax*.

Pupa: Abdomen 3.2 mm, paddle 0.8 mm, trumpet 0.58 mm, index about 5. Extremely similar to *pallidothorax* and *papuensis* as figured by Bram (1967: 146, 152), differing in the combination of following chaetotaxy. *Cephalothorax*. Hair 8-C usually triple (2–4); 9-C single or double. *Abdomen*. Hairs 7-I-II usually double (2–3); 5-IV 3–4 branched (2–4).

Fig. 1



Larva: (Fig. 1B). Head 1.0 mm, siphon 1.7 mm, saddle 0.5 mm. Extremely similar to *pallidothorax* and *papuensis* as described and figured by Bram (1967: 148, 154), differing from both as follows: *Head*. Hair 1-C flat, dark, spiniform and usually with lateral barb of fine spicules, sometimes divided into 2 distal spines; hair 5-C double; 6-C usually triple (3-4). *Thorax*. Hair 1-P triple; 2-P single; 3-P double; 7,8-P triple. *Abdomen*. Ventral brush (hair 4-X) of saddle consisting of 5-6 pairs of hairs.

Type Data. Holotype, male (01888-8) with associated pupal and larval skins and slide of terminalia (69/795), Ban Pha Daeng, Lampang, THAILAND, elevation 500 meters, pool in dry streambed, 31 March 1967, K. Mongkolpanya (USNM). Allotype, female (01888-1) with associated pupal and larval skins, same data as holotype (USNM). Paratypes, 9 males (01888-2,3,4,5,6,9,10,11,15) with associated pupal and larval skins, 3 females (01888-7,13,14) with associated pupal and larval skins, same data as holo- and allotypes (SEAMP).

Distribution: Material examined: 243 adults (121 males, 122 females), 71 individual rearings (21 pupal, 50 larval), 69 whole larvae. THAILAND. Chiang Mai, Doi Sutep; 2 males (terminalia only). Nan, Pha Daeng Khawi; 2 males, 2 lp. Lampang, Ngao, Ban Pha Daeng; 117 males, 122 females, 47 lp, 21 p, 69L.

Taxonomic Discussion: *C. lampangensis* is extremely similar to *pallidothorax* Theobald and *papuensis* (Taylor) in all stages and apparently falls into a complex with these 2 species. The adults are generally separated from *pallidothorax* by the absence of dark band or spots on the upper part of the pleura and from *papuensis* by the presence of basal transverse white bands on the abdominal terga. The male terminalia are most diagnostic and are readily distinguished from the other 2 species by (1) a larger and more prominent tergal lobe of segment IX; (2) more strong setae on the tergal lobe; (3) fewer setae and smaller sternal apical spiculose lobe on the distal part of the subapical lobe and (4) fewer and considerably weaker denticles on the distal tergal surface of lateral plate of the phallosome. The pupa is not clearly distinguished from *pallidothorax* or *papuensis* except for the combination of diagnostic hair branches as indicated in the above description. The larva resembles the other 2 species in most features of the chaetotaxy and in the shape of the siphon and appears to show a great deal of overlap with *papuensis*. It can, however, be recognized by the dark, flat, spinelike head hair 1-C and by the presence of 5-6 pairs of hairs in ventral brush of the saddle (4 pairs in *pallidothorax* and usually 4 pairs in *papuensis*).

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Fig. 1. *Culex (Culiciomyia) lampangensis* n. sp. A, male terminalia: basimere and distimere; phallosome and proctiger; IX-T, lobes of ninth tergum. B, fourth instar larva: head; MP, mental plate; PT, pecten tooth; CS, comb scale; terminal segments.

Biology: *C. lampangensis* is fairly common in the locality where it was found and appears to be restricted to a high elevation in the northern part of Thailand. Most of the adults were obtained from rearing the larvae or pupae collected in ground pools in a dry stream-bed or along a stream margin under heavy shade of forest.

Culex (Culiciomyia) tricuspis Edwards

fig. 2A, ♂ terminalia

Culex trifidus Edwards 1926, Bull. Entomol. Res. 17:108 (♂). Rejected as a junior homonym of *C. (Melanoconion) trifidus* Dyar 1921 by Edwards (1930).

Culex tricuspis Edwards 1930, Bull. Entomol. Res. 21:294. New name for *C. trifidus* Edwards (1926).

Culex (Neoculex) tricuspis, Edwards 1932, in Wytzman Genera Insect. 194:194 (taxonomy); Mattingly and Marks 1955, Proc. Linn. Soc. New South Wales, 80:163 (♂*).

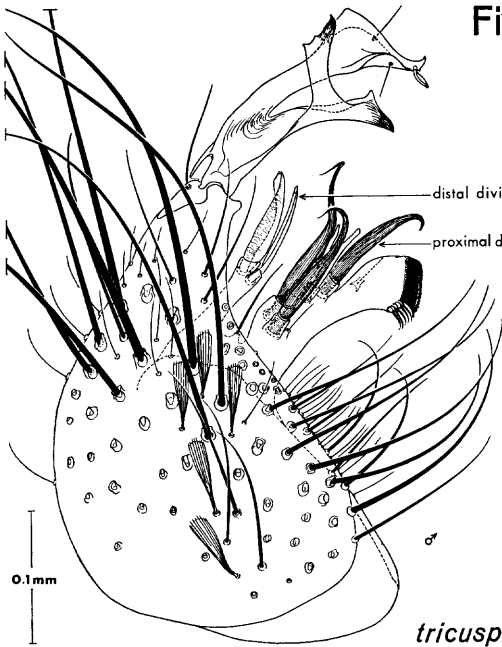
Culex (Culiciomyia) tricuspis, Sirivanakarn 1971, Contrib. Amer. Entomol. Inst. 7:62-85 (taxonomy).

Female: Unknown.

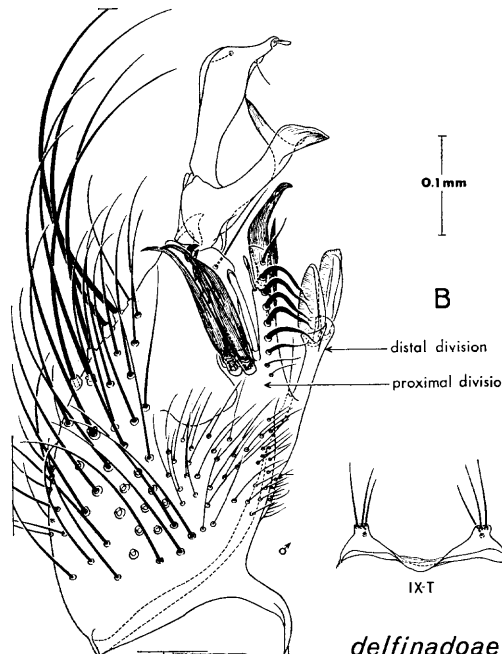
Male: Wing 3.3 mm, fore femur 2.1 mm, proboscis 2.6 mm. In general similar to most forms of *Culiciomyia* except for the following. *Head*. Decumbent scales on dorsum of vertex predominantly broad and pale; erect scales moderately dense, all dark; palpus exceeding proboscis length by nearly the full length of segment 5, segment 2 thick, swollen at middle, segment 3 without ventral lateral row of transparent scales, segments 4 and 5 very weakly plumose; proboscis without submedian false joint, median ventral tuft of setae absent. *Thorax*. Scutum and scutellum light brown; pleuron same color as scutum, scales practically absent, 1 lower mesepimeral bristle present. *Legs and wings*. Without marked coloration. *Abdomen*. Terga II-VII with narrow pale apical bands; sterna entirely pale. *Terminalia* (fig. 2A). Basimere abnormally large, basal half swollen, distal half narrow, 5 scales present; subapical lobe strongly modified, with elongate stemlike proximal and distal divisions, projecting mesad; stem of proximal division with broad truncate apex, bearing a close-set row of dark and flat spicules, dorsal surface of main stem with 2 dark strongly curved rods distad, 2 dark stout distally curved rods and 2-3 strong flattened setae basad; stem of distal division shorter and smaller than proximal one, with 1 stout club-shaped leaf and 1 blade on its apex; distimere divided into 2 arms, dorsal arm bears tiny ventral seta and similar seta dorsally just beyond middle and slender claw subapically, dorsal subapical crest of spines absent; ventral arm with oblique truncate apex and perpendicular process projecting dorsad; phallosome vaselike, similar to most forms of *Culiciomyia*; lateral plate with strong basal denticle, distal tergal surface entirely bare; proctiger with large crown consisting of close-set row of flat and blunt spicules laterally and profuse tuft of filaments internally, the latter projecting from both crowns and meshed together in the middle; lateral paraproct well

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Fig. 2. Male terminalia. A, *Culex (Culiciomyia) tricuspis* Edwards, basimere and distimere; phallosome; proctiger. B, *Culex (Culiciomyia) delphinadoae* n. sp., basimere and distimere; phallosome; proctiger; IX-T, lobes of ninth tergum.

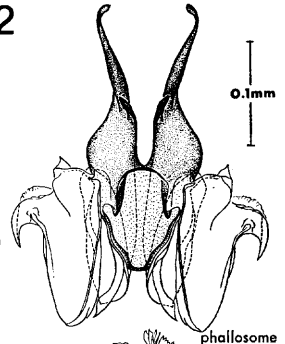


tricuspis

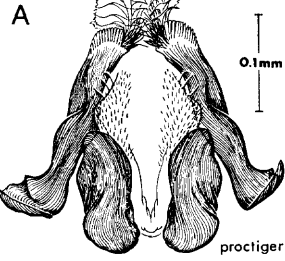


delfinadoae

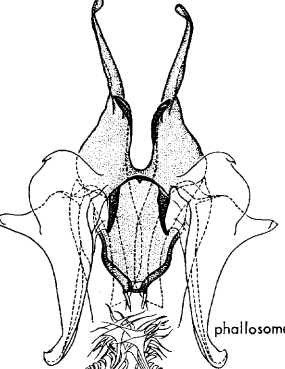
Fig. 2



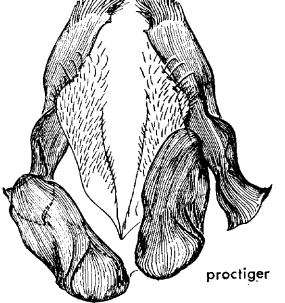
phallosome



proctiger



phallosome



proctiger

sclerotized, basal sternal process absent; cercal sclerite membranous, with a large patch of strong spicules in center, 3-4 minute cercal setae.

Pupa and Larva: Unknown.

Type Data: Holotype, male (10.046), Alor, Lesser Sunda Islands, INDONESIA, January 1926, Dr. Rodenwaldt; deposited in the British Museum (N.H.).

Distribution: Known only from the type locality.

Taxonomic Discussion: *C. tricuspis* was previously assigned to the subgenus *Neoculex* by Edwards (1932) on the basis of the absence of transparent scales in the distal part of palpal segment 3 and the presence of pale apical bands on the abdominal terga. This was later followed by Mattingly and Marks (1955) who interpreted it to be an annectant between *Culiciomyia* and *Neoculex*. However, for the same reasons as given by Edwards, they were justified in retaining it with the latter subgenus. In the current study (Sirivanakarn, 1971), I re-examined the type and transferred this species to *Culiciomyia*. On the basis of detailed comparative morphology, particularly the type of the male phallosome, I am quite convinced that this is correct and that it indicates a more accurate affinity for this species than in the previous treatments.

C. tricuspis as described here is generally very similar to most forms of *Culiciomyia* but differs in the complete absence of a ventral lateral row of transparent scales on male palpal segment 3 and in the absence of a ventral tuft of setae in the middle of labium. The male terminalia are strikingly different from any other known form of *Culiciomyia* in the spectacular modifications of the subapical lobe of the basimere, distimere, and proctiger. The phallosome is similar to all other *Culiciomyia* except for the absence of denticles on the distal tergal surface of the lateral plate. It shows the closest affinity with *delfinadoae* n. sp. described below, and with the latter it apparently forms a distinct group within the subgenus *Culiciomyia*.

Biology: Nothing is known about its biology.

Culex (Culiciomyia) delfinadoae n. sp.

fig. 2B, ♂ Terminalia

Female: Wing 3.8 mm, fore femur 2.3 mm, proboscis 2.3 mm. In general similar to *C. tricuspis*, differing from it as follows: *Head*. Decumbent scales on dorsum of vertex narrower, occupying a broader area in center. *Abdomen*. Terga II-VII entirely dark or sometimes with indistinct pale apical bands on terga III-VII.

Male: Extremely similar to *C. tricuspis* in general and in the absence of a ventral lateral row of transparent scales in the distal half of palpal segment 3, differing as follows: *Head*. Palpus longer, exceeding proboscis by little more than the length of segment 5; segment 2 uniformly slender, middle part not swollen. *Terminalia* (fig 2B). Extremely similar to *tricuspis*, differing chiefly

in the following: basimere apparently without scales; proximal division of subapical lobe with slender elongate stem bearing on its apex 2 dark, stout rods and row of 5-8 kinked setae extending from base to near apex, its base with cluster of 4 dark stout rods and 1 bladlike seta; distal division with slender stem bearing 2 equal club-shaped leaves apically; distimere furcates as in *tricuspis*, dorsal arm (sometimes appearing to be ventral) more or less uniformly thick from point of furcation to about 0.75 of length, distal 0.25 abruptly tapered to pointed apex, 1 tiny ventral and a similar dorsal seta present subapically; ventral arm (sometimes appearing to be dorsal) terminates in sharp point apically, with perpendicular process ending in acute angle; phallosome and proctiger essentially similar to *tricuspis* in most details; apical part of lateral plate of phallosome usually entirely bare, sometimes with a few extremely weak denticles.

Pupa and Larva: Unknown.

Type Data: Holotype, male with terminalia slide (69/601), Tawi Tawi, Sanga Island, PHILIPPINES, crabhole, April 1967, M. D. Delfinado (USNM). Allotype, female (USNM) and paratypes (13 males and 1 female), same locality and data as holotype (SEAMP). This species is named in honor of Dr. M. D. Delfinado, former taxonomist at the Southeast Asia Mosquito Project, who collected the specimens of this species.

Distribution: Material examined: 15 males, 2 females. PHILIPPINES, Palawan, Balabac, Dalawan Bay; 1 male with terminalia slide (SEAMP 66-657), 9 Oct 61, Noona Dan Expedition. Sanga Sanga Island, Tawi Tawi; 14 males, 2 females, as indicated in the type data.

Taxonomic Discussion: *C. delfinadoe* is very closely related to *tricuspis*. It is distinguished from the latter species by the details of the subapical lobe of the basimere and by a few other features as given above. As in *tricuspis*, it is similar to other forms of *Culiciomyia* in the type of the male phallosome and in several external features, but is strongly differentiated in several features of the basimere, distimere, and proctiger as described and illustrated.

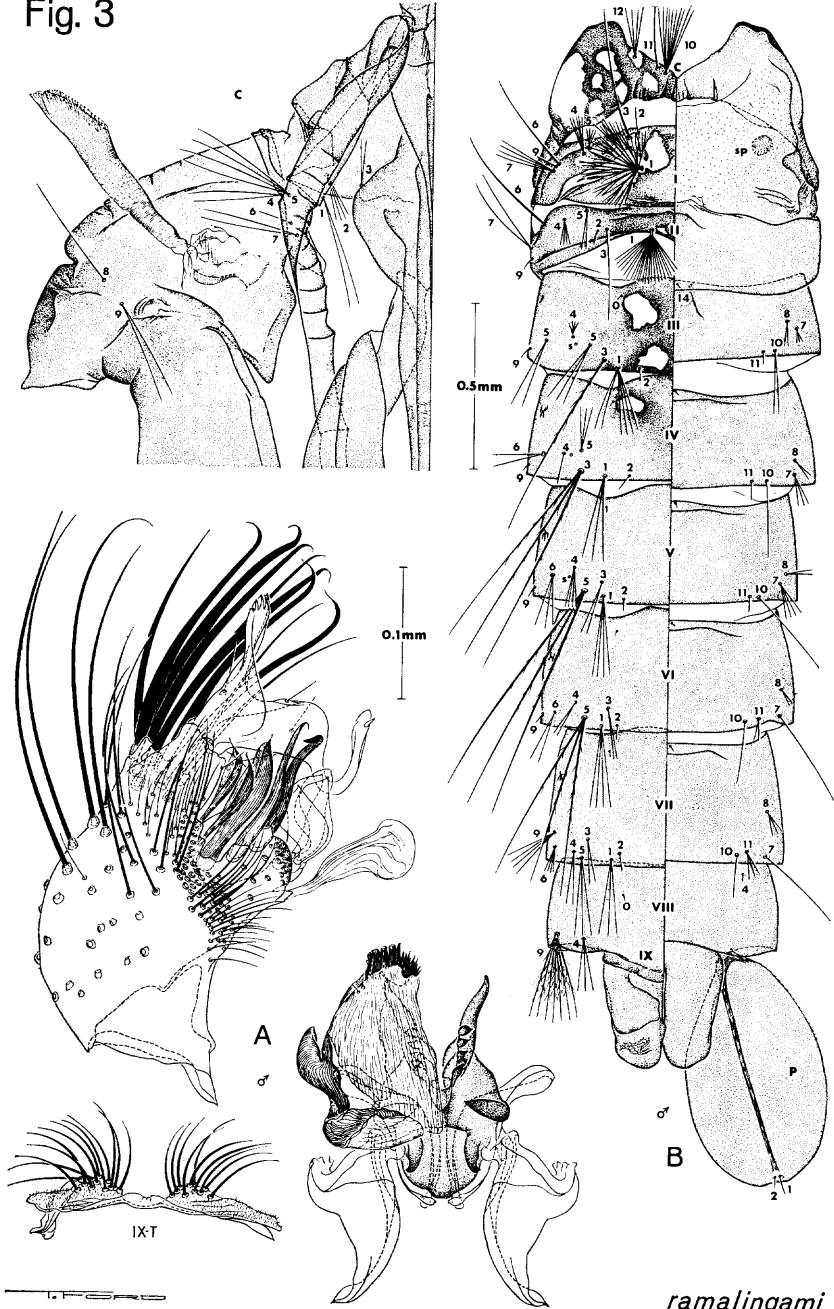
Biology: The adults of this species were collected from 2 localities in the Philippines and those from the type locality were reported to be collected from a crabhole, suggesting that it may breed in this habitat. Nothing more is known about its biology.

Culex (Culiciomyia) ramalingami n. sp.

fig. 3A, ♂ Terminalia; 3B, Pupa; 4, Larva

Female: Wing 3.0 mm, fore femur 1.6 mm, proboscis 1.9 mm. Small to medium sized, brownish species; in general similar to most forms of *Culiciomyia*; differing chiefly in the following. *Thorax*. Scutum, scutellum and pleuron dark brown; scutal scales narrow, dark, rather sparse, more or less resembling *Lophoceraomyia* species. *Abdomen*. Terga very dark to black scaled dorsally, slightly

Fig. 3



ramalingami

pale laterally, terga V-VII sometimes with lateral pale scaling extending dorsad; sterna entirely pale scaled.

Male: In general similar to female; differs from other *Culiciomyia* species in the following. *Head*. Distal half of palpal segment 3 with ventral lateral row of about 8 shorter transparent scales; proboscis slender, submedian false joint absent, median ventral tuft of setae absent. *Terminalia* (fig. 3A). Strongly modified; basimere abnormally large, broad oval, with prominent tuft of about 10 very long, flattened golden brown bristles towards apex laterally; all setae covering lateral tergal surface strong, bristlelike; subapical lobe as detailed in figure; distimere odd-shaped, with bifurcation as figured; phallosome and proctiger essentially similar to most forms of *Culiciomyia*; lateral plate with 1 large inner basal denticle, followed distally by row of 5 smaller denticles; paraproot of proctiger with short basal sternal process; cercal sclerite well sclerotized; 1 or 2 cercal setae.

Pupa: (fig. 3B). Abdomen 2.7 mm, paddle 0.76 mm, trumpet 0.7 mm. Differing from most forms of *Culiciomyia* in the following. Trumpet lightly to strongly swollen at middle, basal and distal parts narrowed. *Cephalothorax*. Integument of metanotum with striking pattern of dark sclerotized areas and pale unsclerotized spots; hair 1-C strong, double; 5-C strong, 5-8b. *Abdomen*. Segments I-IV dark, each with pair of clear, unsclerotized spots along dorsal midline; other segments without such spots; hairs 5-IV-VI dark and long, double or triple; 6-IV-VI usually double (2-3). *Paddle*. Pale, distal external margin indistinct; apical hairs 1, 2-P minute; male genital lobe large, about 0.5 of paddle length.

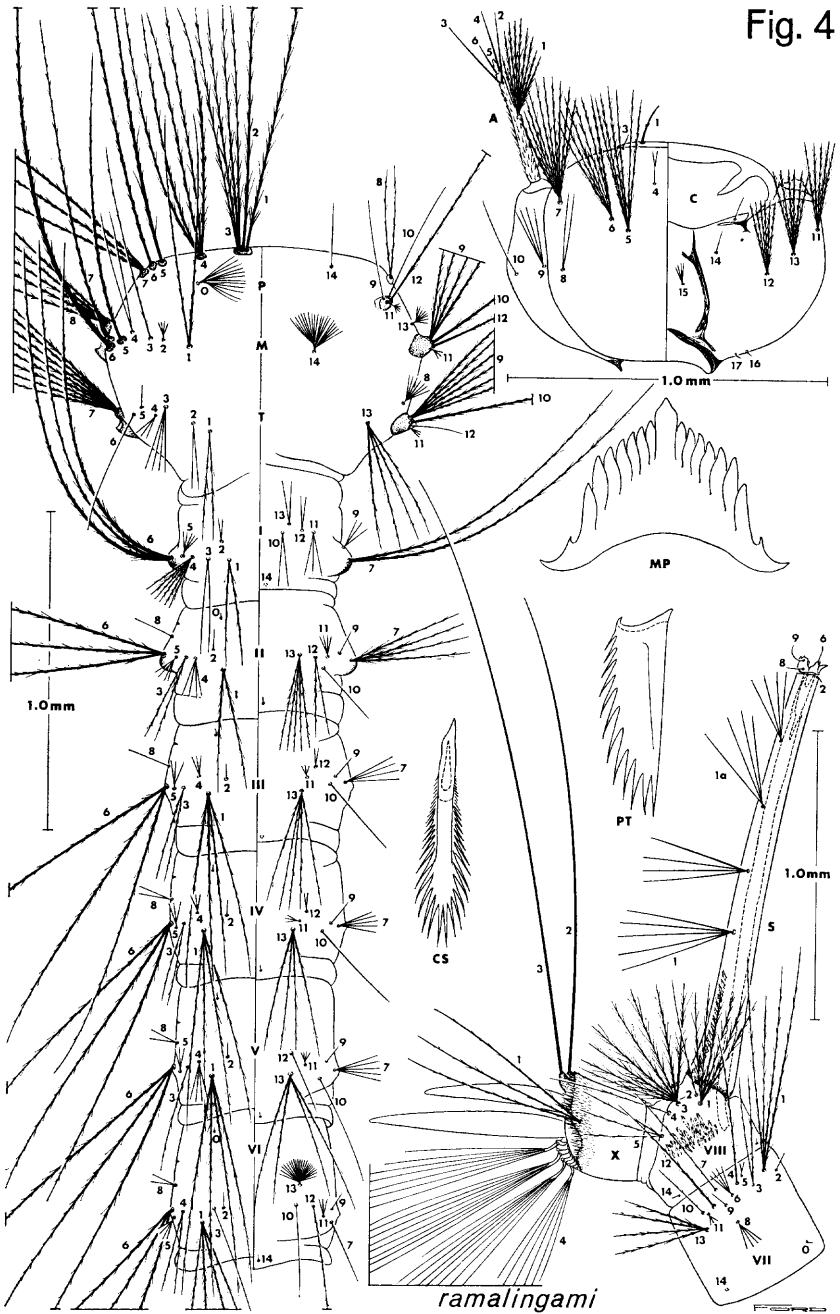
Larva: (fig. 4). Head 0.78 mm, siphon 1.3 mm, index 9-10, saddle 0.26 mm, siphon/saddle ratio about 5. In general resembling most forms of *Culiciomyia*, with the following distinctive features: *Head*. Antenna short, about 0.5 of length of head; head hair 1-C apparently flat, simple or sometimes with lateral barb of fine spicules; hairs 5,6-C with 5-6 pectinate branches; 7-C strongly plumose, 10-12b. *Thorax*. Spiculation not developed; hairs 1,2-P equally long, single; 3-P slightly shorter than 1,2-P, 3-5b; 7-P 3b; 8-P usually double (1-2); 1-M,T very strong, single or double. *Abdomen*. Segments II-VI with distinct patches of fine spicules on ventral surface; all hairs strong; about 30 comb scales, all with fringe of fine spicules; siphon slender and long, distally tapering; 15-20 pecten teeth; 8 strong siphonal tufts, arranged in 4 regular pairs, each tuft 4-6b, most proximal one 3-4 times as long as siphon width at point of attachment, the rest gradually shorter. *Anal segment*. Dorsal subapical margin of saddle moderately spiculated; hair 1-X strong, about 2 times as long as saddle; ventral brush (4-X) with 4 pairs of hairs; anal papillae slender, distally tapering, about 2 times as long as saddle.

Type Data: Holotype, male (814-28) with associated pupal and larval skins and slide of terminalia, leaf axil of a plant, elevation sea level, 8 mi. north of Tanjong, Tualang, Perak, WEST MALAYSIA,

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Fig. 3. *Culex (Culiciomyia) ramalingami* n. sp. A, male terminalia: basimere and distimere; phallosome and proctiger; IX-T, lobes of ninth tergum. B, pupa: cephalothorax, dorsal view; metanotum and abdomen, dorsal view.

Fig. 4



19 October 1967, S. Ramalingam's team of collectors, Univ. Malaysia, Kuala Lumpur (USNM). Allotype, female (814-33) with associated pupal and larval skins, same data as holotype (USNM). Paratypes, 5 males (814-11,14,18,22,27) with associated pupal and larval skins and terminalia slides; 6 males (814-13,15,17,21,24,30) with associated pupal and larval skins; 7 females (814-10,12,16,19,20,23,25) with associated pupal and larval skins; 1 female (814-102) with associated pupal skin, same data as holotype (SEAMP). This species is named in honor of Dr. S. Ramalingam, Dept. Parasitology, Univ. Malaysia who provided the specimens for study.

Distribution: Material examined: 12 males, 9 females, 21 individual rearings (1 pupal, 20 larval), 6 whole larvae, all from Perak, WEST MALAYSIA, as indicated in the type data.

Taxonomic Discussion: This is one of the most distinct forms of *Culiciomyia* and can be easily recognized by the unique male terminalia and by several features of the pupa and larva. The female and general adult features are apparently quite similar to *Lophoceraomyia* Theobald but can be readily distinguished from most members of this subgenus in the female by lateral pale scaling of the abdominal terga and in the male by the features of the palpus and antenna. The unique male terminalia shows spectacular modification in several features of basimere and distimere but resembles most *Culiciomyia* species in the type of phallosome and proctiger. The pupa, unlike other *Culiciomyia* species, is most distinct in coloration pattern and in the presence of unsclerotized clear spots on the metanotum and abdominal segments I-IV. The larva is superficially similar to *C. fragilis* Ludlow and *bailyi* Barraud as described and figured by Bram (1967), but is clearly distinguished from them by several features of the chaetotaxy and siphon as described and illustrated.

Biology: All specimens of *ramalingami* in the type series were collected from leaf axils of a plant at the height of about 1 meter above the ground in open swamp at sea level. The adult biology is practically unknown.

ACKNOWLEDGMENTS

I am indebted to Dr. Botha de Meillon, Principal Investigator of the Southeast Asia Mosquito Project for reviewing the manuscript and for suggesting some improvements. I also wish to thank Dr. Peter F. Mattingly for the loan of the type of *C. tricuspis* at the British Museum (N.H.), and Miss Thelma Ford at the Southeast Asia Mosquito Project for preparing the illustration.

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Fig. 4. *Culex (Culiciomyia) ramalingami* n. sp., fourth instar larva. Head; thorax and abdomen; terminal segment; CS, comb scale; PT, pecten tooth; MP, mental plate.

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