

A New Species of *Culex* (*Eumelanomyia*) Theobald
with Notes on Three other Species from Malaysia
(Diptera: Culicidae)¹

Sunthorn Sirivanakarn² and Shivaji Ramalingam³

ABSTRACT. *Culex* (*Eumelanomyia*) *macrostylus* n. sp. from Pahang, Malaya is described, the male genitalia and larva are illustrated; additional new records with brief taxonomic discussions of *tenuipalpis* Barraud, *pluvialis* Barraud and notes on the hitherto unknown pupa and larva of *hackeri* Edwards are given.

This paper is an addition to the revision of *Culex* (*Eumelanomyia*) in Southeast Asia and adjacent areas (Sirivanakarn 1972). The material on which this study is based was obtained from the collections by the Mosquitoes of Malaysia Project team under the leadership of the junior author in Peninsular Malaysia during 1968-69 and in Sabah in 1970. Included in this material are excellent series of reared specimens with all associated stages, of the new species, *tenuipalpis* Barraud 1924, *hackeri* Edwards 1923 and some wild caught adults of *pluvialis* Barraud 1924.

The subgenus *Eumelanomyia* as currently interpreted (Sirivanakarn 1971, 1972) belongs to a complex of related *Culex* subgenera, which also includes *Lophoceraomyia*, *Culiciomyia* and *Acalleoemyia*. Among these, *Eumelanomyia* exhibits the strongest affinity with *Lophoceraomyia*. Morphologically, *Eumelanomyia* appears to be most generalized and primitive and probably represents the original stock from which *Lophoceraomyia* and perhaps also *Culiciomyia* were derived.

As in *Lophoceraomyia*, *Eumelanomyia* species are usually minute or relatively small, slender, dark, nondescript and unrecognizable in the females but are strongly differentiated from one another in the male genitalia, the relative length of the male palpus and sometimes also in the plumosity of the male antennal flagellum. In Southeast Asia and other adjacent areas in the

1

This work was supported by Research Contract No. DAMD-17-74-C-4086 and Research Grant No. DADA 17-73-6977 from the U. S. Army Medical Research and Development Command, Office of the Surgeon General, Washington, D. C.

2

Medical Entomology Project, Smithsonian Institution, Washington, D. C. 20560.

3

Department of Parasitology, Faculty of Medicine, University of Malaya, Kuala Lumpur, Malaysia.

Oriental region, the majority of *Eumelanomyia* species are separated from those of *Lophoceraomyia* and *Culiciomyia* in the *adults* of both sexes by the presence of acrostichal bristles which extend from the extreme anterior promontory to near the anterior border of the prescutellar space of the mesonotal disc; in the *males* by the length of the palpus which is usually as short as in the females, or sometimes varies from 0.5 to longer than the proboscis, the presence of small, minor whorls of short setae in addition to normal large whorls of long hairlike setae on the antennal flagellum and by the absence of modified tufts of scales or setae on the antennal flagellomeres; in the *male genitalia* by the relatively simple, typically oval or slightly modified oval-shaped lateral plate of the phallosome, the absence of basal sternal process of the proctiger and by the absence of spiny crest of spicules on the outer subapical margin of the distimere. The *pupae* are very similar to the ground pool forms in the *Fraudatrix* Group of *Lophoceraomyia* from which they cannot be separated with certainty but are distinct from *Culiciomyia* in the smaller size, the relatively long, slender, cylindrical trumpet, with the pinna slit extending to the meatus and in seta 10-C being usually double. The *larvae* resemble *Lophoceraomyia* more closely than any other subgenus. They can, however, be recognized by the usually weak or rather short setae 5, 6-C, seta 14-P double, setae 6-I, II double and seta 7-I single, pecten teeth narrow, elongate, with a fine barb of numerous spicules, the presence of 4-7 pairs of siphonal tufts and the ventral brush (seta 4-X) usually with 6 pairs of branches setae. For a more complete characterization of the subgenus and other discussions, consult Sirivanakarn (1972: 3-7).

Of the 27 *Eumelanomyia* species previously known in Southeast Asia and adjacent areas (Sirivanakarn 1972), 7 have been recorded from Malaysia. These are: *brevipalpis* (Giles), *foliatus* Brug, *malayi* (Leicester), *hackeri*, *simplicicornis* Edwards, *malayensis* Sirivanakarn and *selai* Klein and Sirivanakarn. Subsequently, Ramalingam and Pillai (1973) provided a new record of *tenuipalpis* from Malaya, while an additional new record of *pluvialis* and the description of a new species are given below, bringing the total to 10 species for Malaysia (including Sabah) and to 28 for the Oriental region.

Culex (*Eumelanomyia*) *macrostylus* n. sp.

(Fig. 1)

FEMALE. Wing: 3.0 mm. Forefemur: 1.5 mm. Proboscis: 1.7 mm. Small, light brown species; in general as described for the subgenus (Sirivanakarn 1972: 3-4) with the following diagnostic features. *Head.* Decumbent scales on dorsocentral area of vertex entirely narrow, linear, predominantly yellowish brown in center, whitish on anterior margin, forming a distinct ocular line; erect scales slender, numerous and entirely dark brown; lateral patch of broad appressed scales grayish or bluish white. Palpus dark scaled, very short, about 0.1 of proboscis length. Proboscis dark scaled; labial basal setae 8 in number, all dark, bristlelike, longest ones as long as palpus. *Thorax.* Mesonotal integument pale brown; mesonotal scales narrow, moderately dense, entirely brown except for a few pale ones on extreme anterior promontory and humerus; acrostichal bristles well developed on anterior two-thirds

of mesonotal disc. Integument of pronotum and pleuron uniformly pale brown or same color as mesonotum; *apn* with a few bristles and short setae, scales absent; anterior surface of *ppn* practically bare or without scales and setae cephalad of posterior bristles; scales on *ppl*, *stp* and *mep* entirely absent; 1 lower *mep* bristle present; upper *mep* bristles 5, 6, all weak, short and pale yellowish. *Legs*. Forecoxa covered with pale dingy white scales on anterior surface, setae and bristles weak and rather sparse; anterior surface of hindfemur with a broad longitudinal pale stripe extending from base to apex; the rest of legs entirely dark scaled. *Wing*. Scales on all vein dark and dense; plume scales on veins R_2 , R_3 and R_4 & 5 narrow, clavate. *Abdomen*. Terga entirely dark brown or black scaled; sterna slightly paler or nearly as dark as terga; lateral or basolateral pale marking absent.

MALE. Essentially similar to female in general characters and in the length of palpus. *Antenna*. Flagellar whorls weakly plumose, minor whorls of short setae distad of normal whorls well developed.

MALE GENITALIA (Fig. 1). *Segment IX*. Tergal lobes small, bearing 7, 8 weak setae; sternum without any scales or setae. *Basimere*. Abnormally large and broad, about 0.35 mm in length; inner tergal surface below subapical lobe lightly swollen, with a broad patch of numerous weak and short setae; strong setae or bristles sparse, restricted to lateral tergal surface. *Subapical Lobe*. Large and strongly modified; proximal and distal divisions widely separated; proximal division represented by a prominent, elongate stem, bearing on its apex 3 stout rods and 1 large, flattened bladeliike seta, lateral surface of proximal portion of stem with a row of 6, 7 strong acute setae on lower margin, a median row of 10 lanceolate setae and an upper row of 1 lanceolate leaflet and 1 strong normal seta; distal division small, not elongate, bearing a close-set row of 1 large boot-shaped rod, 2 strong blades and 1 large, distally fringed, comblike rod. *Distimere*. Large, somewhat resembling a goose head, its length about 0.25 mm; basal portion thick, median portion strongly swollen on outer surface, apical portion lightly tapered into a blunt beak; outer margin of apical 0.5 finely serrated with minute spicules; ventral and dorsal subapical tiny setae absent; subapical claw slender, with apex slightly projecting beyond apex of beak. *Phallosome*. Lateral plate typically oval-shaped, bearing 10-12 strong denticles on inner tergal surface and several weak denticles on apical margin. *Proctiger*. Apical crown large, dark, consisting of 6-8 flattened spicules laterally and numerous fine spicules mesally; paraproct and cercal sclerite well sclerotized; basal sternal process absent; cercal setae relatively strong and distinct, 3 in number.

PUPA. Abdomen: 2.2 mm. Paddle: 0.65 mm. Trumpet: 0.55 mm, index 10. As described and figured for *tenuipalpis* (Sirivanakarn 1972: 49; fig. 11), differing from it in the following features. *Cephalothorax*. Setae 1, 5 and 8-C shorter and weaker, each with 5, 4 branches. *Abdomen*. Seta 1-II shorter, weaker and less dendritic; 5-IV usually 3, 4 branched (2-4), its length as long as or shorter than segment following; 6-III, IV usually triple (2-3); 6-V, VI triple; 4-VIII usually double.

LARVA (Fig. 1). Head: 0.72 mm, Siphon: 1.0 mm, index 5-6. Saddle: 0.3 mm; siphon/ saddle ratio 3.5. Essentially as described and figured for *tenuipalpis* (Sirivanakarn 1972: 49; fig. 11), differing from it in the following features. *Head*. Seta 5-C single, minute, as long as 4-C; 12-C single or double; 13-C double. *Thorax*. Seta 4-P 3, 4 branched; 8-P strong, subequal to 7-P; 13-T minute, rather inconspicuous, 4 branched. *Abdomen*. Setae 6-III-VI triple; 1-III-VI 4, 5 branched. Comb scales more numerous, 60 or more in number. Saddle seta 1-X longer, as long as saddle, triple; 2-X single; ventral brush (4-X) with 6 pairs of setae, 1, 2 of which are detached from grid. *Siphon*. As in *tenuipalpis*, distal portion strongly tapered and curved dorsad; subventral tufts strong, 7 pairs, first 6 proximal pairs strongest, subequal, 3, 4 branched; most proximal 6, 7 times as long as siphonal width at point of attachment; most distal pair shortest, double; seta 2-S dark, spiniform; seta 9 of ventral valve of spiracular apparatus strong, dark, with hooked apex.

TYPE-DATA. *Holotype* ♂ (no. 3387-12) with associated pupal and larval skins and slide of genitalia, Genting Heights, Pahang, MALAYSIA, small ground pool in primary rain forest, 5,800 feet (ca. 1,757 m), 17 December 1969, Chia Y. Wang and S. W. James, deposited in USNM; *Allotype* ♀ (no. 3387-11) with associated pupal and larval skins; Paratypes: 1, ♀ (no. 3387-100), 2L (no. 3387), 1L (no. 1518), same data and depository as holotype.

DISTRIBUTION. known only from Malaysia. *Material examined*: 1♂, 2♀, 3L 3 with associated immature skins (1 p, 2 lp), as indicated in the TYPE-DATA.

TAXONOMIC DISCUSSION. *Culex macrostylus* n. sp. can be readily separated from all other *Eumelanomyia* species in Southeast Asia by the unique modifications of the basimere, subapical lobe and distimere of the male genitalia as described and illustrated. On the basis of the adult, male phallosome, larval and pupal morphology, *macrostylus* evidently falls into the *tenuipalpis* subgroup of the *Mochthogenes* group as defined by Sirivanakarn (1972: 47-54). The *tenuipalpis* subgroup as interpreted, includes *tenuipalpis*, *richei* Klein, *hayashii* Yamada, *hackeri* and *kiriensis* Klein and Sirivanakarn. Among these *macrostylus* is exceedingly similar to *hackeri* and *kiriensis* in having the male palpus as short as that of the female and to *hackeri* and *tenuipalpis* in the broad oval-shaped lateral plate of the male phallosome, larval and pupal characters. The adults of *macrostylus* differ slightly from these species in paler coloration and in having more weakly plumose flagellum of the male antenna. The pupa differs from *tenuipalpis* and *hackeri* in the weaker 3, 4 branched setae 1, 5 and 8-C and the triple branched seta 6-V, VI. The larva, although closely resembling that of *tenuipalpis*, can be separated from the latter and from *hackeri* by the stronger seta 8-P which is subequal to 7-P, the weak, inconspicuous seta 13-T, seta 6-III-VI triple, saddle seta 2-X single and by the presence of 7 pairs of the siphonal tufts (5 pairs in *tenuipalpis* and *hackeri*).

BIONOMICS. *Culex macrostylus* occurs at a high elevation in mountainous areas as *tenuipalpis* and *hackeri*. Larvae and pupae were collected from small ground pools under partial or heavy shade of tropical rain forest at elevations ranging from 1,500-1,700 m. Water in the breeding site was fresh,

containing numerous fallen leaves and tree branches. They were not numerous and only a few were taken on 2 occasions, one of which (coll. no. 1518) was found in association with the specimens of *hackeri*. The adults were all reared from larvae and pupae.

Culex (Eumelanomyia) tenuipalpis Edwards

Culex tenuipalpis Barraud 1924: 1278(♂*, ♀)

Culex (Neoculex) tenuipalpis Barraud 1934: 351(♂*, ♀, L*)

Culex (Eumelanomyia) tenuipalpis Barraud, Sirivanakarn 1972: 49(♂*, ♀*, P*, L*)

DISCUSSION. *Culex tenuipalpis* can be readily separated from other South-east Asian species of *Eumelanomyia* in the *adults* by the entirely narrow, linear decumbent scales on the dorsum of vertex of the head; in the *male* by palpus about 0.5 of the proboscis length; in the *male genitalia* by the broad oval-shaped lateral plate of the phallosome and the presence of a few scattered minute setae in the basal portion of the distimere; in the *pupa* by the strong, double setae 1 and 8-C, seta 10-C double, setae 5-IV-VI and 6-III-VI double and seta 4-VIII single; in the larva by the minute seta 8-P which is markedly reduced to about the same magnitude of seta 4-P, setae 6-I-VI double, siphon strongly tapered and curved upwards in the distal portion and the presence of 5 pairs of strong siphonal tufts.

All stages of *tenuipalpis* from Malaya essentially conform to the descriptions and figures of Sirivanakarn (1972: 48-9, figs. 10C, D; 11). As in the material from Thailand, the adults especially the males from Malaysia, are variable in the presence or absence of poorly defined basal pale bands on the abdominal terga but exhibit no difference from typical specimens in India or from those in Thailand in the details of the genitalia and in the relative length of the palpus. In the immature stages, the Malaysian pupae are variable in the pigmentation of the integument but show no difference from those from Thailand in the detailed chaetotaxy. The Malaysian larvae apparently agree very well with the previous description and figure except for having seta 8-P more strongly reduced or less conspicuous than seta 4-P, seta 6-III-VI usually double or sometimes triple and in having 5.0-5.5 pairs of siphonal tufts.

DISTRIBUTION. In addition to the previous records from India and northern Thailand (Sirivanakarn 1972), *tenuipalpis* has also been reported from the Cameron Highlands, Pahang, Malaysia (Ramalingam and Pillai 1973: 271). The latter record, which is confirmed here, is based on the examination of 4♂, 4♀, 3 whole larvae, 6 associated pupal and/or larval skins in collections no. 1520 and 1521 at elevations of 1,500-1,700 m.

Culex (Eumelanomyia) hackeri Edwards*Culex hackeri* Edwards 1923: 4(♂)*Culex (Mochthogenes) hackeri* Edwards, Edwards 1932: 195 (taxonomy)*Culex (Eumelanomyia) hackeri* Edwards, Sirivanakarn 1972: 52(♂*, ♀*)

DISCUSSION. *Culex hackeri* is closely related to *tenuipalpis* from which it can be readily separated in the female cibarial armature by the presence of more numerous teeth; in the male by the shorter palpus which is about 0.2 of the proboscis length and in the male genitalia by the absence of minute setae in the basal portion of the distimere.

This somewhat obscure species has, until recently, been known only from the adult males and females in the original type-series from the Cameron Highlands, Pahang, Malaysia. Recently, several adults, including these from the type-locality, with some associated larval and pupal stages have been obtained for study and examination. The adults in the recently obtained material essentially agree with the descriptions and figures of Sirivanakarn (1972: 52-3, fig. 14A, B). The associated larvae and pupae are as described and figured for *tenuipalpis* (Sirivanakarn 1972: 49, fig. 11) from which they are virtually indistinguishable. At the type locality in the Cameron Highlands, Pahang, *hackeri* has been found to be sympatric with *tenuipalpis* without any apparent intergradation in their diagnostic male features.

DISTRIBUTION. In addition to the previous record from the type-locality, *hackeri* has now been recorded also from *Selangor*, Malaysia and *Sabah*, Malaysia (N. Borneo). The additional material currently examined includes 8♂, 17♀, 6 whole larvae; 3 with associated larval and/or pupal skins (coll. no. 1518, 1519, 1571), all collected from stream pools in Cameron Highlands, elevation 1,500-1,900 m, *Pahang* and *Perak*; 2♀ (coll. no. 3418), field catch, elevation 170 m, Ulu Gombak, *Selangor* and 2♂, 2♀, 2p; 4 with associated pupal skins (coll. no. 570), from a rock pool, elevation 1,700 m, Mt. Kinabalu, *Sabah*.

Culex (Eumelanomyia) pluvialis Barraud*Culex pluvialis* Barraud 1924: 1281(♂*, ♀)*Culex (Mochthogenes) pluvialis* Barraud 1934: 356(♂*, ♀)*Culex (Eumelanomyia) pluvialis* Barraud, Sirivanakarn 1972: 42(♂*)

DISCUSSION. *Culex pluvialis* can be separated from 2 closely related species, *campilunati* Carter and Wijesundara and *selai* by the keys, descriptions and figure of Sirivanakarn (1972: 42-3, fig. 9A). This species was previously known only from the males in the original type-series from *Bombay*, India. The assignment of the Malaysian adult specimens to *pluvialis* is only tentative but appears to be correct as the males agree very closely with the type. The only slight differences noted are the smaller size and the rather broad ovate plume scales on all wing veins. The Malaysian males and females can be recognized by the relatively small size (wing length about 2.0 mm), decumbent scales of vertex largely narrow, linear in the center, slightly broad clavate along the upper eye margin and pleural integument very pale,

contrasting sharply with dark brown to almost black mesonotum; in the male by having palpus as short as in the female and in the male genitalia by the characteristic leaflets and other specialized setae of the subapical lobe and the shape and denticulation of the lateral plate of the phallosome as illustrated by Sirivanakarn (1972: fig. 9A). The female cibarial armature is also distinct in the presence of about 30 acute teeth of which 6-7 median ones are very fine and sharply pointed; the lateral ones are coarser and abruptly pointed.

DISTRIBUTION. The additional new record of *pluvialis* is based on 3♂ and 2♀ (coll. no. 2121), field catch, from Kg. Tanjong Rabok, *Selangor*, Malaysia. These specimens were incorrectly identified in the field as *khazani*.

ACKNOWLEDGEMENTS

We thank Ronald A. Ward, E. L. Peyton and John F. Reinert for reading the manuscript, Thelma Ford Smith for preparing the illustration and Owilda Curtis for typing the manuscript. We are also grateful to the members of the Mosquitoes of Malaysia Project team, Messrs. Samuel W. James, K. Ramakrishna and Sulaiman bin Omar for collecting the specimens.

REFERENCES CITED

- Barraud, P. J. 1924. A revision of the culicine mosquitoes of India. Part XIII. Further description of Indian species of *Culex* L. including three new species. Indian J. Med. Res. 11: 1275-82.
- _____. 1934. The fauna of British India, including Ceylon and Burma. Diptera. Vol. V. Family Culicidae, Tribes Megarhinini and Culicini. Taylor and Francis, London, 463 p.
- Edwards, F. W. 1923. Mosquito notes.-IV. Bull. Entomol. Res. 14: 1-9.
- _____. 1932. Diptera, Fam. Culicidae. In P. Wytzman, Genera Insectorum. Desmet-Verteneuil, Brussels. Fasc. 194, 258 p.
- Ramalingam, S. and A. G. Pillai 1972. Ten new records of mosquitoes occurring in West Malaysia. Southeast Asian J. Trop. Med. Publ. Hlth. 4: 271-2.
- Sirivanakarn, S. 1971. Contributions to the mosquito fauna of Southeast Asia. XI. A proposed reclassification of *Neoculex* Dyar based principally on the male terminalia. Contrib. Am. Entomol. Inst. (Ann Arbor). 7(3): 62-85.
- _____. 1972. Contributions to the mosquito fauna of Southeast Asia. XIII. The genus *Culex*, subgenus *Eumelanomyia* Theobald in Southeast Asia and adjacent areas. Contrib. Am. Entomol. Inst. (Ann Arbor). 8(6): 1-86.

Fig. 1

