CONTRIBUTIONS TO THE MOSQUITO FAUNA OF SOUTHEAST ASIA. XI.

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ABSTRACT

A reclassification of *Neoculex* proposed here is based on the comparative morphology of the male terminalia as well as on other correlated external characters of the adults. In this scheme, three subgenera: *Neoculex*, *Maillotia* and *Eumelanomyia* instead of two, *Neoculex* and *Mochthogenes*, as proposed by Edwards (1932), are recognized. The subgenera *Maillotia* and *Eumelanomyia* are resurrected from synonymy with *Neoculex* and *Mochthogenes* which Edwards (1930) treated as a full subgenus is suppressed by synonymizing it with *Eumelanomyia*. The species *tricuspis* Edwards 1930 is transferred to *Culiciomyia* and *sumatranus* Brug 1931 and *caeruleus* King & Hoogstraal 1947 to *Lophoceraomyia*.

Over 80 species previously assigned to *Neoculex* and *Mochthogenes* in the synoptic catalog of Stone et al. (1959) and Stone (1961, 1963, 1967, and 1970) are placed in various species groups of the three subgenera. Keys to the subgenera, groups and subgroups are provided and each category is briefly defined with regard to systematics and zoogeography.

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A PROPOSED RECLASSIFICATION OF *NEOCULEX* DYAR BASED PRINCIPALLY ON THE MALE TERMINALIA[1]

By

Sunthorn Sirivanakarn[2]

INTRODUCTION AND HISTORY OF PREVIOUS CLASSIFICATIONS

The subgenus *Neoculex* Dyar 1905 in the broad sense of Edwards (1932, 1941) has remained perhaps one of the most poorly understood subgenera of *Culex*. The subgenus, as defined by Edwards, with the material at his disposal, is a heterogeneous array of several distinct lineages of 70 or more species known at the present time. These species are mostly restricted to certain zoogeographical regions. The one exception is *territans* (Walker, 1856) from North America which is also known to occur in some European countries. Records of species from different areas are as follows: 33 from the Ethiopian region, 8 from the Mediterranean subregion, 9 from the Oriental region, 9 from the Australasian region (Australia and New Guinea), 5 from the South Pacific and 6 from the Nearctic region.

No attempt has yet been made to revise *Neoculex* on a world basis, but there have been a good number of taxonomic papers dealing with local species in several regional works (see references below). Edwards' subgeneric interpretation and his internal classification have been largely followed by a few critical comments. Mattingly & Marks (1955) and Belkin (1962) pointed out the weaknesses regarding the relationships between Edwards' species groups, but these were limited to brief statements. A critical examination of Edwards' scheme is made here to set a stage for the further development of a phylogenetic classification. The main purpose of the present attempt is to lay out certain basic and significant features not used by Edwards in his interpretation of *Neoculex*. The basis of this discussion includes the study of his work and the re-examination of almost all species which he used in devising his scheme.

Edwards' interpretation of *Neoculex* was based on many superficial characters which greatly overlap with those of other subgenera, particularly *Mochthogenes*, *Lophoceraomyia*, *Culiciomyia* and to some extent even with those of other *Culex* subgenera. He apparently defined all species involved on the basis of the simple phallosome of the male terminalia which he did not describe in detail. This has resulted in some incorrect subgeneric assignments of certain species to the subgenus. Edwards' description of the male phallosome is brief and also appears to conceal a number of significant features with regard to its varied shape and the relative position of the tergal bridge which connects the two lateral plates. This point will be considered and illustrated below in my interpretation of various species groups. It suffices to mention that the shape of the phallosome is quite constant in certain lineages and appears to be strongly differentiated. The other characters which appear to be more or less consistently correlated with the differences in shape of the phallosome, but were not considered by Edwards are: texture of the spicules of the

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proctiger crown, number of rodlike setae in the proximal division of the subapical lobe and the presence or absence of scale patches on the pleura. A brief summary of Edwards' scheme is as follows:

In grouping species in the subgenus *Neoculex*, Edwards (1932) suppressed 3 genera of Theobald (1907, 1910) including *Maillotia*, *Eumelanomyia* and *Protomelanoconion* by reducing them to synonymy with the genus *Neoculex* Dyar (1905). The genus *Neoculex*, as originally conceived by Dyar, was based on *C. territans* (Walker 1856) from North America, a form which shows a great deal of superficial resemblance to some members of the *pipiens* group of subgenus *Culex*. In clarifying his classification, Edwards separated 3 groups in the subgenus, namely: group A. *Neoculex s. str.* or *apicalis* group, group B. *Eumelanomyia* or *albiventris* group and group C. *Protomelanoconion* or *uniformis* group. These groups are distinguished by the relative length of male palpi, texture of decumbent scales on vertex and presence or absence of apical bands on abdominal terga. Later, in his work on the Ethiopian species, he (1941) split group A. into 3 groups by incorporating features of the female buccopharyngeal armature, color pattern of pleural integument and certain conspicuous ornamentation. This subdivision resulted in: group A. *pulchrithorax*, group B. *Neoculex s. str.* and group C. *rima* group. The original groups B. and C. became groups D. and E. The first and second treatments are essentially similar in outline and scope and in 1947, King & Hoogstraal followed this scheme by recognizing another additional group F. *pedicellus* from New Guinea. A critical study of Edwards' system indicates that he lumped a number of unrelated forms in *Neoculex s. str.* group and his group characters largely overlapped and remained confused. The relationships between these groups are not at all clear and the entire treatment appears to suffer from the lack of uniformity in most parts. A broader examination of his system reveals the difficulties he experienced in ranking certain species groups. This is quite obvious from his treatment of *Mochthogenes* as a subgenus separated from the *Protomelanoconion* or *uniformis* group of *Neoculex* based on the relative length of the male palpi which are as short as in the female of all *Mochthogenes* species but are longer in the *Protomelanoconion* species. Although such treatment is convenient in practice since species of *Mochthogenes* share these characters, the relationship with *Protomelanoconion* on the basis of the male terminalia and many other characters do not seem to warrant its separation. The two groups, as recently pointed out by Bram (1969), are also so similar in the larval stage to be treated in the same subgenus.

In my current study of *Neoculex* in Southeast Asia and other adjacent areas, the difficulty presented by Edwards' classification are illustrated by the following examples. Four species, namely *tenuipalpis* Barraud 1924, *hayashii* Yamada 1917, *hackeri* Edwards 1923 and *kiriensis* Klein & Sirivanakarn 1969, all with extremely similar male terminalia and several external characters, but with palpi of different lengths, will, according to Edwards, have to be placed in either *Neoculex* or *Mochthogenes*. Similarly *tricuspis* Edwards 1930, at present in *Neoculex*, should in fact be reassigned to *Culiciomyia; sumatranus* Brug 1931 and *caeruleus* King & Hoogstraal 1947 on the other hand rightly belong to *Lophoceraomyia*.

In developing the following scheme of reclassification, I have been fortunate in having the opportunity to re-examine several authenticated specimens, including the types and identified specimens of species used by Edwards in his revision of the world fauna, by Mattingly (1953) in his work on the Mediterranean species and other type specimens from several areas, at the British Museum. In addition, while undertaking the revision of the Indomalayan species at Southeast Asia Mosquito Project, I have also seen specimens of the North American species and others from several areas in the reference collections of the United States National Museum.

The history of the classification of *Neoculex* and *Mochthogenes* is summarized in table I below.

TABLE I. HISTORY OF THE CLASSIFICATION OF *NEOCULEX* AND *MOCHTHOGENES*

EDWARDS (1932)	EDWARDS (1941) KING & HOOGSTRAAL (1947)	PRESENT CLASSIFICATION
Subgenus *Neoculex*	Subgenus *Neoculex*	Subgenus *Neoculex*
A. *Neoculex s.* str. or *apicalis* group	A. *Pulchrithorax* group	1. *territans* group
B. *Eumelanomyia* or *albiventris* group	B. *Neoculex s. str.* or *apicalis* group	2. *pseudomelanoconia* group
C. *Protomelanoconion* or *uniformis* group	C. *Rima* group	3. *crassistylus* group
	D. *Eumelanomyia* or *albiventris* group	Subgenus *Maillotia*
	E. *Protomelanoconion* or *uniformis* group	1. *pulchrithorax* group
Subgenus *Mochthogenes*	F. *Pedicellus* group (King & Hoogstraal 1947)	2. *hortensis* group
		3. *seyrigi* group
	Subgenus *Mochthogenes*	Subgenus *Eumelanomyia*
		1. *eumelanomyia* group
		2. *rubinotus-rima* group (subgroups: *rubinotus*, *rima*)
		3. *protomelanoconion* group
		4. *mochthogenes* group (subgroups: *hinglungensis*, *uncinatus*, *inconspicuosus*, *malayi*, *castrensis*, *femineus*, *otachati*, *tenuipalpis*)

A CONSIDERATION OF THE PROPOSED RECLASSIFICATION

The adults of all species, previously assigned to *Neoculex* and *Mochthogenes* and to be considered at present are generally distinguished from other *Culex* subgenera as follows: From *Lophoceraomyia* by the absence of scale tufts on the male antennal flagellum; from *Culiciomyia* by the absence of a row of lanceolate scales on the ventral surface of segment 3 of the male palpus; from *Acalleomyia* by the narrow scutellar scales; from *Barraudius* and *Lasiosiphon* by having tarsomere 1 of the hind tarsus about as long as the tibia and by the absence of scales on the basimere of the male terminalia; from *Culex* and *Lutzia* by the absence of basal sternal processes on the proctiger of the male terminalia ; and from all New World subgenera including *Melanoconion*, *Aedinus*, *Isostomyia*, *Carrollia*, *Mochlostyrax*, *Microculex*,and *Micraedes* by the absence of a basal hook on the lateral plate of the male phallosome.

Taxonomic Characters. As indicated earlier in the introduction, basis to the present interpretation of various species groups and their reclassification is the comparative morphology of the phallosome and other correlated characters in the proctiger crown and subapical lobe of the male terminalia. The shape of the phallosome is not only of taxonomic significance in this interpretation, but also provides, in addition to other conspicuous characters, a clear-cut separation of all species involved from other closely related subgenera of *Culex*. It appears that there are at least 3 basic types of male phallosome present among species of *Neoculex* as interpreted by Edwards. These are: Type I tubular, elongate with the axis of the two lateral plates more or less parallel and with the tergal bridge located above the middle or near the apex of the lateral plate; Type II more or less globular or subspherical with tergal bridge as in I or at the middle of the lateral plate; Type III slightly modified from type II in being oval with tergal bridge at or slightly below the midpoint of the lateral plate. In the proctiger crown, there are two kinds of spicules; one of these is flat and blunt, the other fine and pointed. In certain lineages, the crown may consist of flat or fine spicules only, or a mixture of both. In the subapical lobe, there is a great deal of variation in the development of parts and the number of specialized setae, however, the features which appear to be correlated with different types of phallosome are the presence of 2 or 3 rodlike setae in the proximal division and the presence or absence of a leaflet (foliform seta) in the distal division.

In the external morphology, a number of conspicuous characters which are of practical value in separating species groups at various levels are: (1) presence or absence of pleural scaling, (2) color and texture of scutal scales, (3) relative length of male palpus and (4) presence or absence of pale abdominal banding. These and a few other features may be correlated with the terminalia to a certain extent and have been considered here in developing key and group characters.

The female buccopharyngeal armature and the immature stages may also prove to be useful in developing this classification but because of insufficient material, no attempt has been made here to incorporate them with the present scheme.

Systematics. In the present interpretation, I believe it would be much sounder, considering both the comparative male terminalia and, to some extent, zoogeography to recognize at least 3 principal subgeneric categories among 80 or more species known at the present time. In the general outline presented below, I recognize *Neoculex*, *Maillotia* and *Eumelanomyia* as distinct subgenera based on differences in the shape of the male phallosome as discussed above. The subgenera *Maillotia* and *Eumelanomyia* are resurrected from synonymy under *Neoculex* and the subgenus *Mochthogenes* is downgraded to a species group of *Eumelanomyia*.

These three subgenera are further subdivided into groups and subgroups wherever it is appropriate to accomodate all species presently listed in

Neoculex and *Mochthogenes* in Stone et al. (1959) and Stone (1961, 1963, 1967 and 1970), except *caeruleus* King & Hoogstraal 1947; *sumatranus* Brug 1931 and tricuspis Edwards 1930. The first two of these I am transferring to *Lophoceraomyia* and *tricuspis* to *Culiciomyia*. The assignment of some species to groups below the subgeneric level has been based only on the published descriptions and may need future realignment in order to indicate a more accurate affinity.

OUTLINE OF THE PROPOSED SCHEME OF RECLASSIFICATION

Subgenus I. *NEOCULEX* Dyar 1905.

(1). territans group with *territans* (Walker 1856); *apicalis* Adam 1903; *boharti* Brookman & Reeves 1950; *reevesi* Wirth 1948; *arizonensis* Bohart 1950; *derivator* Dyar & Knab 1906; *deserticola* Kirkpatrick 1924; *judaicus* Edwards 1926; *impudicus* Ficalbi 1889; *rubensis* Sasa & Takahashi 1948 and *martinii* Medschid 1930.

(2). *pseudomelanoconia* group with *pseudomelanoconia* (Theobald 1907); *postspiraculosus* Lee 1944; *chaetoventralis* (Theobald 1910); *douglasi* Dobrotworsky 1956; *latus* Dobrotworsky 1956; *fergusoni* (Taylor 1914); *cheesmanae* Mattingly & Marks 1955; *dumbletoni* Belkin 1962; *gaufini* Belkin 1962 and *millironi* Belkin 1962.

(3). *crassistylus* group with *crassistylus* Brug 1934; *pedicellus* King & Hoogstraal 1947 and *leonardi* Belkin 1962.

Subgenus II. *MAILLOTIA* (Theobald 1907).

(1). *pulchrithorax* group with *pulchrithorax* Edwards 1914.

(2). *hortensis* group with *hortensis* Ficalbi 1889; *arbieeni* Salem 1938 and *quettensis* Mattingly 1955.

(3). *seyrigi* group with *seyrigi* Edwards 1941; *peringueyi* Edwards 1924; *salisburensis* Theobald 1901 and *avianus* de Meillon 1943.

Subgenus III. *EUMELANOMYIA* (Theobald 1909).

(1). *eumelanomyia* group with *albiventris* Edwards 1922; *andersianus* Edwards 1941; *acrostichalis* Edwards 1941; *vinckei* Hamon, Holstein & Rivola 1961(1962); *kanyamwerima* Someren 1951; *kilara* Someren 1951; *garioui* Bailly-Choumara & Rickenbach 1966.

(2). *rubinotus-rima* group

(a). *rubinotus* subgroup with *rubinotus* Theobald 1901; *kingianus* Edwards 1927; *andreanus* Edwards 1927; *pseudoandreanus* Bailly-Choumara 1965 and *simplicicornis* Edwards 1930.

(b). *rima* subgroup with *rima* Theobald 1901; *subrima* Edwards 1941; *galliardi* Edwards 1941; *calabarensis* Edwards 1941; *wigglesworthi* Edwards 1941; *insignis* (Carter 1911); *sunyaniensis* Edwards 1941; *albertianus* Edwards 1941; *wansoni* Worlfs 1945; *adami* Hamon & Mouchet 1955; *laplantei* Hamon, Adam & Mouchet 1955;

amaniensis Someren & Hamon 1964 and *chauveti* Brunhes & Rambelo 1968.

(3). *protomelanoconion* group with *brevipalpis* (Giles 1902); *stellatus* Someren 1947 and *horridus* Edwards 1922.

(4). *mochthogenes* group

(a). *hinglungensis* subgroup with *hinglungensis* Chu 1957; *culionicus* Delfinado 1966; *tricontus* Delfinado 1966 and *cataractarum* Edwards 1923.

(b). *uncinatus* subgroup with *uncinatus* Delfinado 1966.

(c). *inconspicuosus* subgroup with *inconspicuosus* (Theobald 1908); *simpliciforceps* Edwards 1935; *castor* de Meillon & Lavoipierre 1944; *hamoni* Brunhes et al. 1967; *mijanae* Brunhes et al. 1967 and *orstom* Brunhes et al. 1967; perhaps also *bokorensis* Klein & Sirivanakarn 1969.

(d). *malayi* subgroup with *malayi* (Leicester 1908); *laureli* Baisas 1935 and *yeageri* Baisas 1935.

(e). *castrensis* subgroup with *castrensis* Edwards 1922; *foliatus* Brug 1932; *latifoliatus* Delfinado 1966; chiyutoi Baisas 1935 and *shrivastavii* Wattal, Kalra & Krishnan 1966.

(f). *femineus* subgroup with *femineus* Edwards 1926.

(g). *otachati* subgroup with *otachati* Klein & Sirivanakarn 1969.

(h). tenuipalpis subgroup with tenuipalpis Barraud 1924; hayashii Yamada 1917; hackeri Edwards 1923; pluvialis Barraud 1924; kiriensis Klein & Sirivanakarn 1969; selai Klein & Sirivanakarn 1969; campilunati Carter & Wijesundara 1948; and perhaps also *okinawae* Bohart 1953; *lini* Lien 1968; *khazani* Edwards 1922; and *iphis* Barraud 1924.

KEY TO THE SUBGENERA

1. Phallosome elongate, more or less uniformly cylindrical, H-shaped in tergal view with tergal bridge above the midpoint or near apex of lateral plate; proctiger with crown of flat and blunt spicules; pleuron usually with broad scale patches on propleuron, upper corner and lower border of sternopleuron, anterior upper mesepimeron and occasionally also on postspiracular area . . . Subgenus *NEOCULEX*

Phallosome short, stout, oval or subspherical in shape with tergal bridge at or below the midpoint of lateral plates; proctiger with crown of flat and blunt spicules or fine pointed spines; pleural scaling present as above or absent 2

2(1). Proctiger with crown of flat and blunt spicules entirely or with some coarse pointed spines in addition; pleural scaling present; scutal scales usually pale or sand-colored . . . . . Subgenus *MAILLOTIA*

Proctiger usually with a crown of fine pointed spines only, or sometimes with a few coarse ones in addition; pleural scaling entirely absent; scutal scales predominantly dark brown . . . . . Subgenus *EUMELANOMYIA*

Subgenus I. *NEOCULEX* Dyar

1905 *Neoculex* Dyar, Proc. ent. Soc. Wash. 7:45; Type species *Culex territans* Walker 1856, original designation.

1932 *Culex (Neoculex)* in part of Edwards, Gen. Insect. Dipt. Fam. Culicidae, Fasc. 194:193-195.

Culex (Neoculex) in part of Edwards (1941: 249-270); King & Hoogstraal (1947: 65-69); Mattingly & Marks (1955: 166-175); Dobrotworsky (1956: 105-114); Belkin (1963: 238-247); and Dobrotworsky (1965: 193-202).

Subgeneric Characters. As diagnosed in the key to subgenera, with the following additional features. Medium to large sized species, wing length over 3.0 mm. *Head.* Male palpi as long as or longer than proboscis; antenna strongly plumose. *Thorax.* Scutal scales usually predominantly pale, sometimes with striking pattern of coloration or entirely dark; pleuron usually with extensive broad scale patches on propleuron, upper corner and posterior lower border of sternopleuron and anterior upper mesepimeron, sometimes also on postspiracular area and prealar area; rarely absent entirely. *Abdomen.* Terga with or without apical or basal bands, sometimes with apicolateral pale spots. *Male Terminalia.* (Fig. 1) Phallosome elongate, tubelike, H-shaped in tergal view or slightly modified, tergal bridge usually near to or almost at the apex of lateral plate, rarely at the middle, a few denticles present or absent; proctiger with crown of flat and blunt spicules only or also with a few coarse pointed spines in addition; subapical lobe always with 2 long rodlike setae in the proximal division; distal division with only narrow flattened setae, broad leaflets absent.

Systematics. Species which are strictly or provisionally placed within this subgenus are generally similar in the configuration of the phallosome, proctiger and features of the subapical lobe as described above. They may be well divided into 3 groups on the basis of slight differences in phallosome structure, presence or absence of pleural scaling as in the following key.

KEY TO THE GROUPS OF SUBGENUS *NEOCULEX*

1. Phallosome uniformly tubular in shape with tergal bridge between the midpoint and apex of lateral plates; pleural scaling always present; abdominal terga with apical pale bands; scutal scales sand-colored . . . . . *territans* group

Phallosome broad in apical half, narrow in basal half; tergal bridge nearly at or below the apex of lateral plates; pleural scaling present or absent; abdominal terga with apical or basal pale bands, apicolateral spots or sometimes entirely dark; scutal scales usually entirely dark or sometimes partly golden brown 2

2(1). Tergal bridge nearly at the apex of lateral plates; distimere usually slender, sickle shaped; proximal and distal divisions of subapical lobe usually clearly separated but not elongated; pleural scaling usually present . . . . . *pseudomelanoconia* group

Tergal bridge at or just above the midpoint of lateral plates; distimere modified from above; proximal and distal divisions of subapical lobe elongated into stemlike lobes; pleural scaling entirely absent or sometimes only a few scales present on sternopleuron . . . . . *crassistylus* group

TERRITANS GROUP

This group includes 6 species from the Nearctic (mainly North America); *territans* (also known in Europe), *apicalis*, *boharti*, *reevesi*, *arizonensis* and *derivator*; 1 species from northern Palearctic of the Oriental region: *rubensis* and 4 species from the Mediterranean, namely *deserticola*, *judaicus*, *impudicus* and *martinii*. The group can be easily recognized by the predominantly pale or sand-colored scutal scales, presence of broad scale patches on 3 or 4 areas of pleura and presence of apical banding on abdominal terga, as indicated in the key.

PSEUDOMELANOCONIA GROUP

This group contains 6 species from Australia: pseudomelanoconia, *chaetoventralis*, *douglasi*, *fergusoni*, *latus* and *postspiraculosus* and 4 species from the South Pacific: *cheesmanae*, *dumbletoni*, *gaufini* and *millironi*. The extent of the pleural scaling is variable, but the shape of the phallosome and the characteristic crown of the proctiger are very constant in nearly all species involved. According to Dobrotworsky (1956: 105) the members of this group could be well divided into two subgroups, one involving *fergusoni* and *latus* with apical abdominal banding or apicolateral abdominal spots and presence of pleural scaling, the other involving *douglasi* and *pseudomelanoconia* with basal abdominal banding and reduced pleural scaling.

CRASSISTYLUS GROUP

Two members of this group: *crassistylus* and *pedicellus* are known from New Guinea and the other one, *leonardi*, is from the South Pacific. They are strikingly differentiated from the other two groups in the almost complete absence of pleural scaling, modified shape of distimere, development of parts of the subapical lobe and in having striations on the upper tergal surface of the lateral plate of the phallosome. They are probably derived from members in the pseudomelanoconia group.

Subgenus II. *MAILLOTIA* (Theobald)

1907 *Maillotia* Theobald, Mon. Cul. 4:274; Haplotype: *pilifera* (presently known as *hortensis*).
Culex (Neoculex) in part of Edwards (1932: 193); Edwards (1941: 249); Mattingly (1955: 376-389).

Subgeneric Characters. As given in the key to the subgenera with the following additional description. Very similar in general external features to the *territans* group of subgenus *Neoculex*, but pleural scaling is more extensive, sometimes scale patch also present on prosternum and scutal scales rather coarse. *Male Terminalia.* (Fig. 2) Phallosome short, broad, oval, subspherical or cup-shaped from tergal view, tergal bridge at or just above the midpoint of lateral plates, denticles not developed or sometimes only a few ones present on apex; proctiger heavily sclerotized with a relatively large crown of flat and blunt spicules arranged in comblike fashion or sometimes mixed with coarse pointed spines in the form of a tuft; proximal division of subapical lobe with 2 or sometimes 3 rodlike setae, distal division with few short narrow setae or none; distimere more or less modified.

Systematics. This is perhaps the most primitive of the three subgenera. It is rather heterogeneous consisting of species which are perhaps better placed with either *Neoculex* or *Eumelanomyia*. However, as they show the type of phallosome, and other features, somewhat intermediate between the other two subgenera, I think it is probably better to consider them as belonging to a subgenus of their own. As they are either exclusively Ethiopian or Mediterranean, it seems better to treat them this way.

KEY TO THE GROUPS OF SUBGENUS MAILLOTIA

1. Head, scutum and pleuron with a pattern of silvery white scale lines contrasting sharply with dark scaled background; apex of proctiger of male terminalia with a heavily sclerotized plate bearing a small crown of coarse spicules . . . . . *pulchrithorax* group
   Head, scutum and pleuron without above ornamentation; apex of proctiger of male terminalia without heavily sclerotized plate, but with crown of flat and blunt spicules or of coarse pointed spines 2

2(1). Proximal part of subapical lobe with 2 rodlike setae; lateral plate of phallosome without denticles . . . . . *hortensis* group
   Proximal part of subapical lobe with 3 rodlike setae; apex of lateral plate of phallosome with some denticles . . . . . *seyrigi* group

PULCHRITHORAX GROUP

This group, as keyed above, corresponds to Edwards' group A (1941: 249) with only one species, namely, the Ethiopian *C. pulchrithorax*. Its outstanding ornamentation on the dorsum of head, scutum, pronotum and upper pleura is very distinctive as described and illustrated by Edwards (1941: 254). The female buccopharyngeal armature is, however, rather similar to species in the *seyrigi* group.

HORTENSIS GROUP

This group contains 3 or perhaps more species from the Mediterranean. Their external characters are more or less similar to the territans group of *Neoculex*, but with propleural scale patch extended to prosternum in some species. At present, 3 forms, namely *hortensis*, *arbieeni* and *quettensis* are grouped together here. They appear to show the characters of the subgenus better than the other two groups.

SEYRIGI GROUP

I tentatively place 4 forms, namely *seyrigi*, *peringueyi*, *salisburensis* and *avianus*, all from the Ethiopian region, in this group, based on the characters given in the key. They are similar to members of the *hortensis* group in external features, but the male phallosome and other features of the male terminalia resemble members in the subgenus *Eumelanomyia*.

Subgenus III. *EUMELANOMYIA* Theobald

1909 *Eumelanomyia* Theobald, Mon. Cul. 5:240; Haplotype: *inconspicuosus* (presently known as *albiventris*).
1910 *Protomelanoconion* Theobald, Mon. Cul. 5:462; Haplotype: *fusca* (presently known as *horridus*).
1930 *Culex (Mochthogenes)* Edwards, Bull. ent. Res. 21:306; Type: *C. malaya* Leicester 1908.
Culex (Neoculex) in part of Edwards (1932: 193-195); Edwards (1951: 249-269); Barraud (1934: 347-352); Bohart & Ingram (1946); Bohart (1953:187); Delfinado (1966:124-128); Bram (1967: 23-32).
Culex (Mochthogenes) of Edwards (1932:195; 1941:277-279); Barraud (1934:352-359); Baisas (1935:175-177); Delfinado (1966:128-135); Bram (1967:33-42).

Subgeneric Characters. As indicated in the key to subgenera, with the following additional description. Small to medium sized, wing length usually not more than 3.0 mm., dark brown to black species. *Head.* Male palpus from 0.2 to longer than the length of proboscis; antennal flagellomeres 1-10 usually with a single whorl of long hairs each, sometimes also with a much smaller whorl of short but conspicuous hairs in addition (Fig. 3). *Thorax.* Scutal scales narrow and usually entirely dark, rarely pale; pleural scaling absent or only a few scales present on upper corner of sternopleuron. *Abdomen.* Terga entirely dark or with apical bands, apicolateral pale spots, rarely with basal bands. *Male Terminalia.* (Fig. 3) Phallosome small, generally broad, oval or subspherical in shape; tergal bridge at or below the midpoint of lateral plates; usually with several denticles over the upper tergal surface, rarely bare; proctiger with small dark crown of fine spinelike spicules, some coarse ones present or absent; proximal division of subapical lobe always with 3 rodlike setae; distal division usually with at least a broad leaflet; distimere slender, sickle-shaped or else modified.

Systematics. Members of this subgenus can be easily distinguished from the other two subgenera by smaller size, dark scaled scutum and the absence of scale patches on the pleura. The phallosome is variable among different species but all are remarkably constant with regard to shape and position of tergal bridge and do not appear to overlap in these characters with species in *Neoculex*. The fine texture of the spicules of the proctiger crown and the presence of 3 rodlike setae in the proximal division of the subapical lobe are also characteristics of this subgenus.

This subgenus contains the majority of species from the Ethiopian region and the Indomalayan part of the Oriental region. The number of species involved is the largest of the 3 subgenera recognized here. They are divided into 4 major groups as follows:

KEY TO THE GROUPS OF SUBGENUS *EUMELANOMYIA*

1.	Male palpus as long as or longer than proboscis; flagellomeres 1 to 10 of male antenna each with a single large whorl of long hairs	2
	Male palpus from 0.2 to 0.75 the length of proboscis; flagellomeres 1 to 10 of male antenna each with a smaller whorl in addition to a large normal whorl (Fig. 3) [3]	3
2(1).	Decumbent scales in center of vertex broad; acrostichal bristles absent; tergal bridge of phallosome present or absent	*eumelanomyia* group
	Decumbent scales in center of vertex narrow; acrostichal bristles present; tergal bridge of phallosome present	*rubinotus-rima* group
3(1).	Male palpus about 0.75 the length of proboscis; acrostichal bristles absent; lower anterior mesepimeral bristle absent . . .	*protomelanoconion* group
	Male palpus usually about 0.2 the length of proboscis, sometimes longer to about 0.75; acrostichal bristles present; lower anterior mesepimeral bristle usually present	*mochthogenes* group

EUMELANOMYIA GROUP

This group corresponds to Edwards' group B (1932) and group D. (1941) or *albiventris* group. Five species, all from the Ethiopian region are placed here: *albiventris*, *andersianus*, *vinckei*, *acrostichalis* and *kanyamwerima* and perhaps also *kilara* and *garioui*. The group is characterized as in the key and may be further subdivided into two subgroups on the basis of presence or absence of a tergal bridge of the phallosome. Certain members of this group appear to show affinity to the subgenus *Culiciomyia*.

RUBINOTUS-RIMA GROUP

This group corresponds to the *rima* group or group C and *Neoculex s. str.* group, in part, of Edwards (1941). It could be subdivided into 2 subgroups: 1) *rubinotus* subgroup with *rubinotus*, *kingianus*, *andreanus*, *pseudoandreanus* from the Ethiopian region and *simplicicornis* from the Indomalayan

[3] As illustrated, the term "normal whorl" as used here refers to the large tuft of 10 to over 20 long hairs arising from a series of tubercles encircling the middle part of each flagellomere, whereas the term "small or minor whorl" refers to a much smaller tuft with 4-8 short hairs arising near the junction of the flagellar segments.

area (Borneo) by having abdominal terga entirely dark and by having the pleural integument uniformly dark brown; and 2) *rima* subgroup with *rima, subrima, galliardi, calabarensis, wigglesworthi, insignis, albertianus, wansoni* and perhaps also *sunyaniensis* and others as listed by having apical band or apicolateral spots on abdominal terga and by having a pattern of dark and pale areas on the pleura. The members in the *rubinotus* subgroup show strong affinity to the subgenus *Lophoceraomyia* on the basis of several characters indicating that the latter subgenus is probably derived from them.

PROTOMELANOCONION GROUP

This group includes *brevipalpis*, a dominant form from several areas in the Oriental region, horridus from the Ethiopian region and *stellatus* from Seychelles. It is closely related to the *mochthogenes* group, but with longer male palpi and differing in other constant features as indicated in the key.

MOCHTHOGENES GROUP

This group is dominant in the Indomalayan areas and other southern parts of the Oriental region in which it is represented by many distinct lineages (see list above). It is perhaps represented by a single lineage (*inconspicuosus* subgroup) in the Ethiopian region. In the South Pacific, it is represented by a single species *(femineus)*. I recognize 8 subgroups in this group. They are separated as follows:

KEY TO THE SUBGROUPS OF GROUP *MOCHTHOGENES*

1.	Decumbent scales in the center of vertex entirely or predominantly broad along anterior ocular line	2
	Decumbent scales in the center of vertex entirely narrow	5
2(1).	Distimere of male terminalia simple, sickle shaped	3
	Distimere of male terminalia strongly modified from above	4
3(2).	Lateral plate of phallosome without large internal process; minor flagellar whorls of short hairs of male antenna present . . .	*hinglungensis* subgroup
	Lateral plate of phallosome with a large internal process; minor flagellar whorls of short hairs of male antenna absent.	*uncinatus* subgroup
4(2).	Distimere sharply angled at the middle of dorsal curvature, its basal half thick, distal half narrow and tapered to a curved spine.	*inconspicuosus* subgroup
	Distimere divided into a short dorsal and a long ventral arm	*malayi* subgroup

5(1). Male antennal flagellar whorls with rather weak and relatively few hairs; size minute or very small, wing length usually not exceeding 3.0 mm. 6
Male antennal flagellar whorls with strong and numerous hairs; size relatively large, wing length usually 3.0 mm. or more 7

6(5). Abdominal terga entirely dark; phallosome of male terminalia short and oval in shape; basimere small, slender and conical in shape . . . . . *castrensis* subgroup
Abdominal terga with basal pale bands; phallosome of male terminalia tubular in shape; basimere swollen and broadly oval in shape . . . . . *femineus* subgroup

7(5) Male phallosome heavily sclerotized and dark, lateral plate rodlike and pointed with some heavy lateral teeth . . . . . *otachati* subgroup
Male phallosome weakly sclerotized and pale yellow or brown, lateral plate oval or subspherical in shape; teeth confined to inner tergal surface . . . . . *tenuipalpis* subgroup

As indicated in the above key, the *mochthogenes* group is rather complex as it contains several lineages, most of which can be easily recognized by the short male palpus more or less similar to the female. Only the *tenuipalpis* subgroup, as far as known, consists of some members with male palpi longer than those of the females. These are *tenuipalpis*, *hayashii* and *okinawae* which Edwards (1932:194-195) and Bohart (1953:187) placed with the *protomelanoconion* group of *Neoculex s. lat.* The *femineus* subgroup is also rather anomalous in male terminalia but since it shows several characters common to most *mochthogenes* members, I place it here for the present.

Culex gamma Seguy (1924, Encycl. ent., :47) was described from larva only and cannot definitely be placed with any subgenus according to the present scheme.

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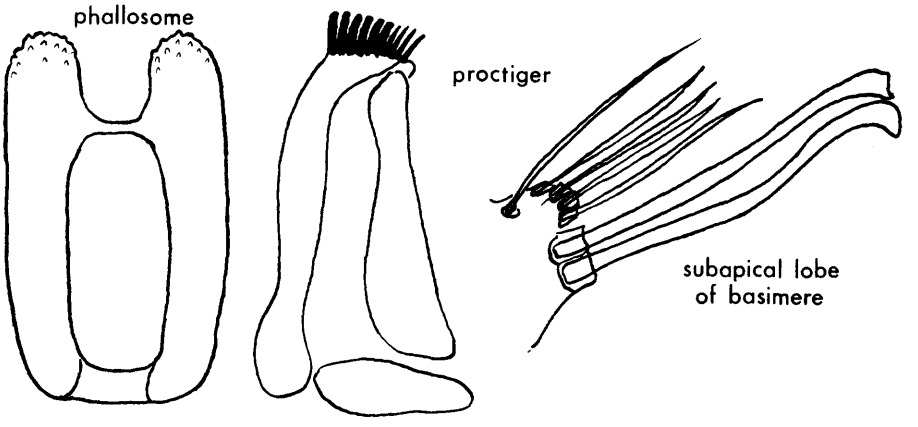
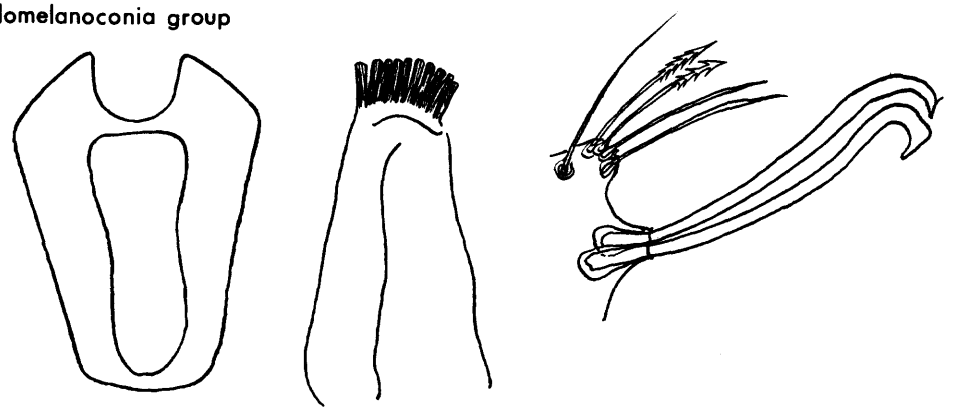
Fig.1

Territans group



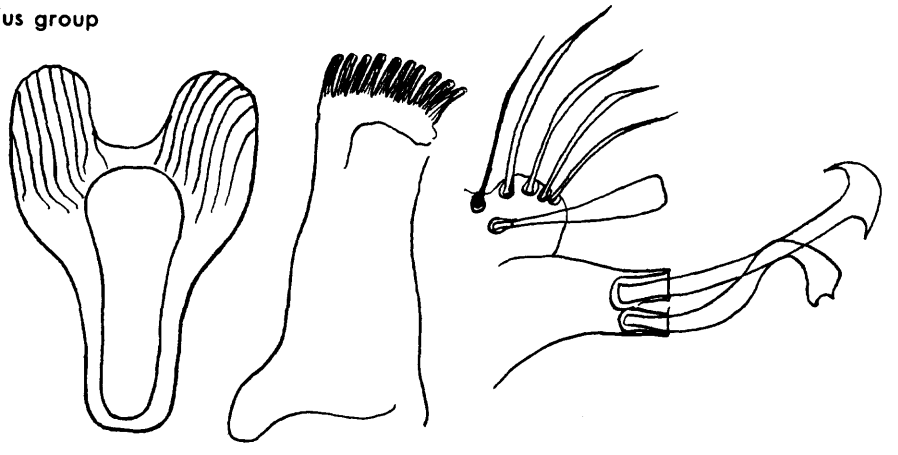
C.territans

Pseudomelanoconia group



C.pseudomelanoconia (after Dobrotworsky 1965)

Crassistylus group



C.leonardi (after Belkin 1962)

Fig. 2

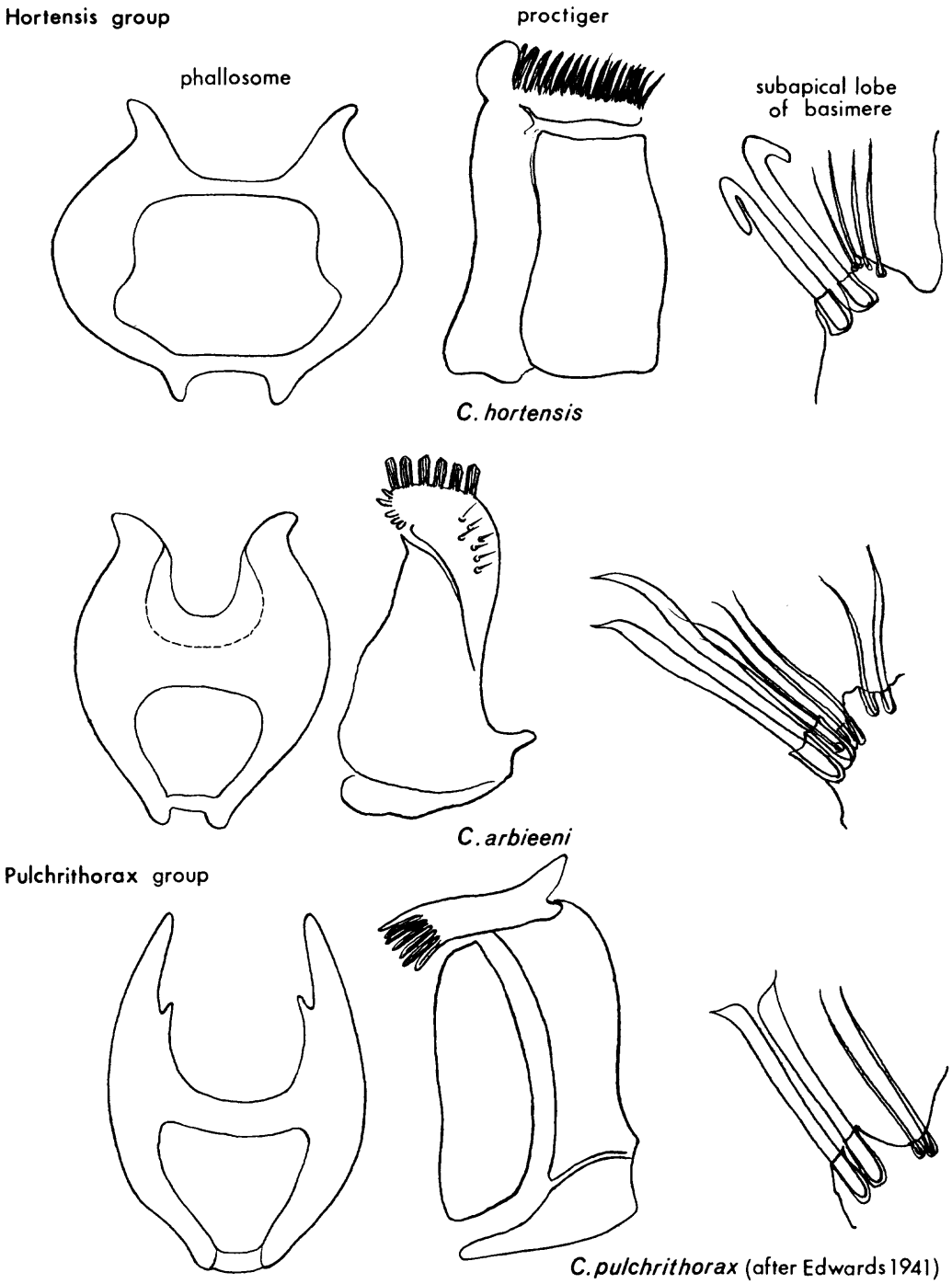
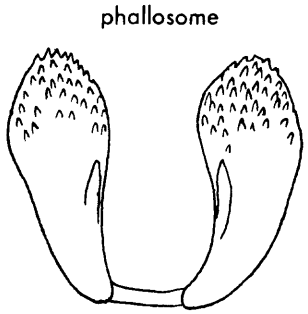
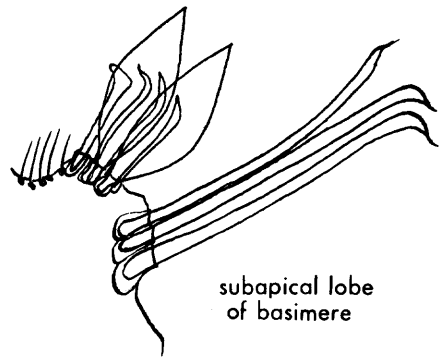

Hortensis group
phallosome
proctiger
subapical lobe
of basimere
C. hortensis
C. arbieeni
Pulchrithorax group
C. pulchrithorax (after Edwards 1941)

Fig. 3

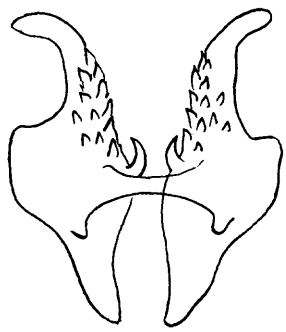
Eumelanomyia group

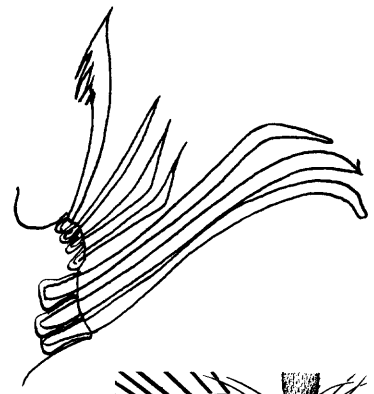




C. albiventris (after Edwards 1941)

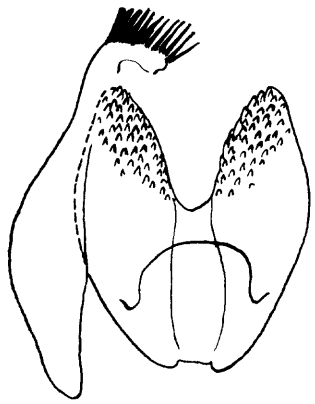
Rubinotus–rima group

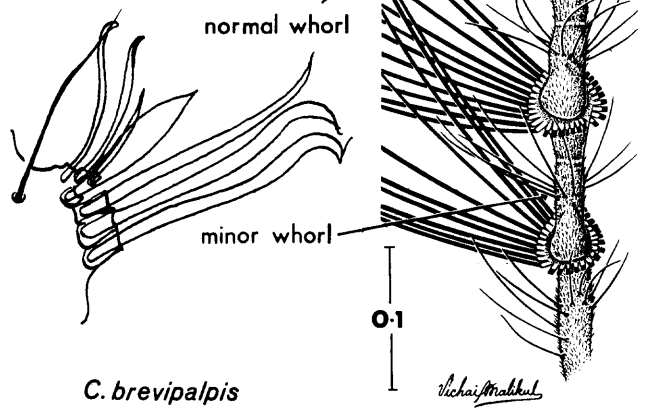




C. kingianus
(after Edwards 1941)

Protomelanoconia group





C. brevipalpis

Vichai Malikul

INDEX

Valid names are in roman type, synonyms are italicized. Italicized page numbers indicate the primary treatment of the subgenus. Numbers in parentheses refer to the figures of the male terminalia of the species in question.