

Two New Afrotropical Subgenera of the Mosquito Genus *Culex* (Diptera, Culicidae)*

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As a result of study of the literature on mosquitoes of the Afrotropical Region (Ethiopian Region, Africa south of the Sahara) and examination of material in the Martsinovskiy Institute collections, two new monotypical subgenera of *Culex* from that Region are here proposed.

1. *Afrocullex* subgen. n.

Type species: *Pseudohowardina lineata* Theobald, 1912: 92.

Synonym: *Culex pulchrithorax* Edwards, 1914: 73.

The unique representative of this subgenus was originally described as *Pseudohowardina lineata* Theobald, 1912,** but soon thereafter it was transferred to *Culex* (Edwards, 1914). Inasmuch as there was already a *C. lineatus* Von Huboldt, 1819, it was given the new name *C. pulchrithorax* Edwards, 1914, but inasmuch as *Culex lineatus* Von Humboldt is actually a member of the genus *Psorophora* (Knight and Stone, 1977), the designation *C. lineatus* Theobald, 1912, must be considered valid and *C. pulchrithorax* Edwards, 1914, becomes a synonym of it.

The subgeneric and group assignments of *C. lineatus**** have also undergone numerous changes. It first was assigned to the *rima* Group of *Culex*, which "corresponds more or less to the subgenus *Neoculex* in Dyar" (Edwards, 1922), than to the subgroup *Neoculex* s. str. or *Apicalis* Subgroup of the subgenus *Neoculex* (Edwards, 1932). Later, it was assigned to a monotypical *Pulchrithorax* Group, then assigned to the subgenus *Neoculex* with a query ("The systematic position of this species remains open" and "the genitalic structure of its ♂ is not typical of this subgenus"—Edwards, 1941). This assignment was followed by other authors (Muspratt, 1955; Worth and De Meillon, 1960).

In a revision of the subgenera *Neoculex* and *Mochthogenes* of the genus *Culex* resulting in the replacement of these by a group of 3 subgenera (*Neoculex*, *Maillotia*, and *Eumelanomyia*), Sirivanakarn (1971) left *C. lineatus* in the monotypical *Pulchrithorax* Group, but included that in the new subgenus *Maillotia* Theo. and removing it from the subgenus *Neoculex*. This author, however, erred in stating that all species of mosquitoes examined by him lacked scales on the coxites of the ♂ genitalia, because they are present in *C. lineatus*. Furthermore, the figure of the ♂ genitalia in his work, supposedly after Edwards (1941), differs from the original in a number of details—for

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***Pseudohowardina* Theo. cannot be accepted as the designation for this new subgenus because it is a synonym of the subgenus *Ochlerotatus* of the genus *Aedes* (Knight and Stone, 1977).

***In all hereinafter mentioned literature citations it figures as *C. pulchrithorax*.

example, in convex outer margins of the phallosome rather than straight or weakly concave, shorter in its distal part, a single denticle on each half of its inner side instead of 2-3, and the shape and position of the processes in the region of the preapical furrow of the coxites. Thus, the correctness of placing *C. lineatus* in the subgenus *Maillotia* also becomes less than justified.

On the basis of all these data, we remove *C. lineatus* from *Maillotia* and erect for it the new subgenus *Afroculex* of the genus *Culex* and characterize the new taxon following morphological characters (by the description and figure of the species in Edwards, 1941).

Imago with mesonotal pattern very unusual in the genus *Culex*, consisting of 5 sharp narrow pale longitudinal stripes in its entire length on black background, thus resembling species of the subgenera *Finlaya* and *Stegomyia* of the genus *Aedes*; for example, hardly differing from *A. (Fin.) pulchrithorax* Edw. It differs from *Culex* sg. *Barraudius* also in that the hindbasitarsus is approximately as long as the hindtibia rather than shorter. From *Lutzia* it differs in the presence of only a single lower mesepimeral seta. The ♂ of *Afroculex* differs from those of both of these subgenera, close to it in genitalic structure, also long palpi (as long as proboscis rather than longer than it) and

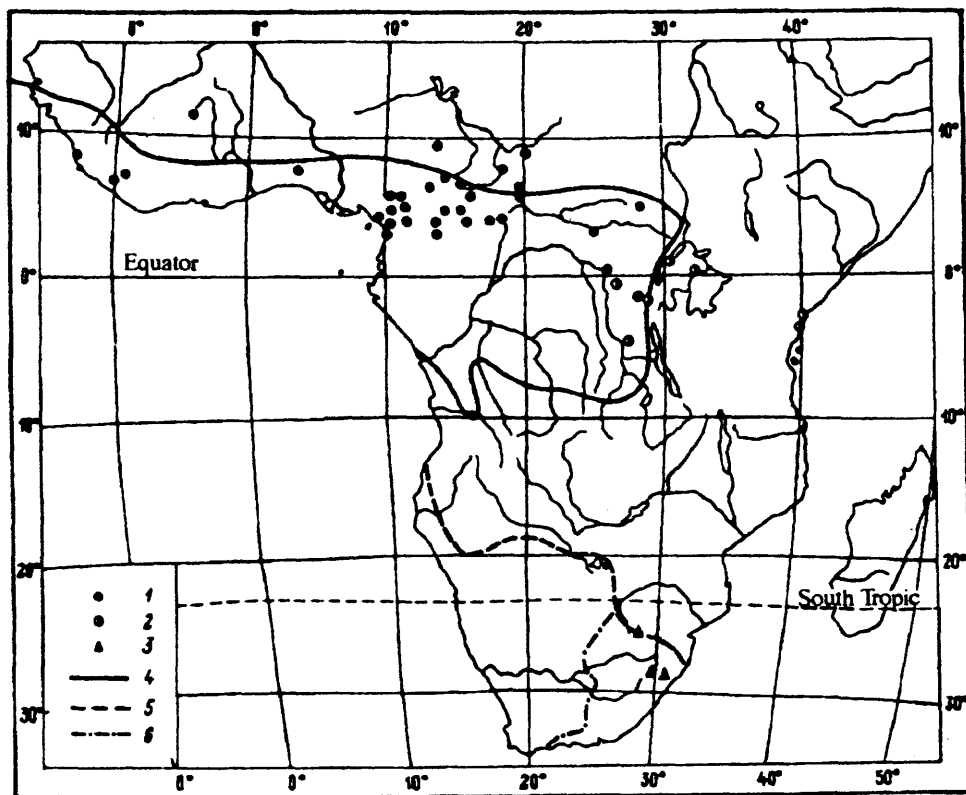


Fig. 1. Geographical distribution of mosquitoes belonging to *Culex* (*Kitzmilleria* and *Afroculex* subgenera nov.) (from various sources). 1) *C. (Kitzmilleria) moucheti* Evans; 2) *C. (K.) moucheti* subsp.?; 3) *C. (Afroculex) lineatus* Von Humb.; 4) Limits of West African (Guinean-Congolese) Subprovince of the South African Province (according to Physico-Geographical Atlas of the World, 1964); 5) Limits of South African Subprovince of the Afrotropical Province (according to same source); 6) Limits between steppe (eastern) and arid (western) zones of the South African Subprovince (according to Chapin, 1932).

lacking hairs on it. The structure of the pharynx of ♀s of *C. lineatus* also differs from that of all 15 species of Afrotropical *Neoculex* sbgg. *N.* and *Maillotia* (new sense) as presented in the figures by Edwards (1941), as well as from that of the subgenera *Lutzia* and *Barraudius*.

The ♂ genitalia of *Afrocullex* differ from those of all other subgenera of *Culex* in lacking setae on the lobes of tergite IX and in the process of sternite X (paraproct), coming off laterally rather than from the base, almost from the tip. With regard to the presence of scales on the coxites, it is similar only to the subgenus *Barraudius*, but it differs from it in undivided preapical margin and in the presence of denticles on each half of the inner side of the phallosome, as in the subgenus *Lutzia*; i.e., according to this character, *Afrocullex* is intermediate between these subgenera although it additionally differs from both of them in lacking lateral processes of the phallosome.

The larvae of *C. lineatus* still remain unknown. Edwards (1941) linked their discovery with definition of the subgeneric position. The species seems to be a rare one whose biology is entirely unknown. It has been assumed that its reproduction takes place in surface bodies of water (Hopkins, 1952; Muspratt, 1955).

As may be seen in Fig. 1, the Subgenus *Afrocullex* is so far known from only three points in South Africa (in the Provinces of Transvaal and Natal) and most likely is confined to the eastern steppe part (veldt) of the South African Subprovince of the Afrotropical Province. The datum on the distribution of *C. lineatus* in Mozambique (Knight and Stone, 1977) is based on an error in Edwards (1941), where in a table of the geographical distribution of mosquitoes (p. 481) by countries of southern Africa, the species is cited for Mozambique instead of South Africa. This information is appearing in the literature (Worth and De Meillon, 1960), but it is not in agreement with the facts, although it is still possible that in the future the species may be found in the southern part of that country in an area not far from where it has been found in South Africa, as well as in Lesotho, Swaziland, and Botswana.

2. *Kitzmilleria*, subgen. n.

Type species: *Culex moucheti* Evans, 1923: 89.

The subgenus is named for J. B. Kitzmiller, U.S.A., in recognition of his great contributions to the study of the genetics of mosquitoes.

C. moucheti has been left in the subgenus *Culex* s.s. (Knight and Stone, 1977) in spite of its obvious difference from other species therein, especially in larval and pupal characters. Certain authors (Tageau and Adams, 1952) have called it aberrant, but Edwards (1929) wrote that when he first saw its larva he thought that it belonged to a new, undescribed genus. Study of the literature on the morphology of the species (Evans, 1923; Edwards, 1929, 1941; Hopkins, 1959) and examination of 10 larvae (8 of 4th instar and 2 of 2nd instar) from Mwamba, Zaire, collected by N. N. Plotnikova, September, 1960, indicate that the species certainly belongs to a new subgenus *Kitzmilleria*, which may be characterized as follows.

The imago is distinguished by the orange color of the erect occipital scales, separating it from all other species of *Culex* s. s.*

*Edwards (1941) pointed out that the imago of *C. moucheti* also had as distinctive characters the structure of the abdominal sternites, which are wholly covered with bright-colored scales, and the orange color of the base of the antennae (torus). According to this same author, however, such an abdomen is also possessed by *C. antennatus* Beck, and according to Haddow et al. (1951), the torus in *C. moucheti* may be not only orange but also brown.

Morphological characters of 4th instar larvae of *Cx. moucheti* (from literature and autopsy)

Character	Zaire			Liberia (Peters. 1956)
	Kisangani (Edwards, 1929; Hopkins, 1952)		Mwamba (autopsy)	
	description	figures		
Number of branches				
of hairs:				
1-A	4-5	3	1-4	
1-P	3	4	4-6 (usually 5)	
2-P	2	simple	simple	
3-P	2	3	2-3	
6-II	4-5	6	4-6	
1-III	4-5	6	3	
6-IV	3	4	3-5	
3-VIII	7-8	9	5-8 (usually 5)	6
1-S	5-6	5-7	2-7	6
2-X	6	8	6-11	8
No. of scale brushes	2-3	4	2(0?) -5 (avg. 3)	
No of siphonal tufts	2 pairs	3 pairs (2 subventral, 1 subdorsal)	3 pairs (2 subventral, 1 subdorsal)	
Number of branches				
of hairs:				
5-C	2-3		2-4	
6-C	2-3		2-5	
7-C	4-5		5-11	
8-C	2-3		3-5	
9-C	simple, on level with 8-C		4-9, well behind 8-C	
6-I	3-4		2-4	
7-II	4-5		3-6	
13-III	4-5		3-4	
2-IV	simple		1-2	
1-X	5-6		3-4 (usually 3)	2-3
Siphonal index	1.2		0.56-0.71 (avg. 0.6)	
No. of denticles on subthoracic plate	c. 15 (7 each side of median one)		17-21 (8-10 each side of median one)	

The genitalia of the ♂ has a phallosome comprising not 2 simple plates, as in *Culex* s.s., but only one, each half of which has 2 apical processes. In this, *Kitzmilleria* is to be compared with the subgenera *Lutzia* and *Barraudius* of *Culex*, but it differs from each of them in that the inner processes of the phallosome are not longer, but shorter, than the outer ones, and from *Lutzia* in that denticles are lacking on the inner side of the phallosome in both halves. It differs from *Barraudius* in that it lacks scales on the coxites.

The pupae differ in many characters (Edwards, 1929, 1941), especially in the shape of the spiracular tubes ("little horns"), which in *C. moucheti* not only are not cylindrical, as they are in other species of *Culex* s.s., but also are widened apically even more strongly than in species of *Anopheles*.

Larvae of instar IV differ in their very short siphons, scarcely distinguishable siphonal tufts (1-s), lack of "fins" (4-X) and siphonal pecten. reduction of setae of abdominal segment VIII, weak development of many body hairs, and gills. Such a short siphon and small siphonal tufts are found in no other species of *Culex* in the world, and the lack of a siphonal pecten occurs only in



Fig. 2. *Culex moucheti* Evans, siphons of 4th instar larvae. A) from Kisangani, N Zaire (after Edwards, 1929); B) from Mwamba, E Zaire (subsp.?, original).

one other species, *C. dispectus* Bram, known only from Southeast Asia (Thailand) and in the monotypical subgenus *Thaiomyia* set up for it, but in it, the siphon and its appurtenances are normally developed (Bram, 1966, 1967). The lack of 4-X is characteristic of only one other species of *Culex*, *C. (Culiciomyia) harleyi* Peters, but its larva has normally developed siphonal apparatus (Peters, 1955). Furthermore, in *C. moucheti*, in distinction from other species of *Culex* s.s., prothoracic hairs 1- and 3-P are not simple, but branched.

In our study of the literature of the morphology of the 4th instar larva of *C. moucheti* (Edwards, 1929; Hopkins, 1952), we found a whole series of discrepancies between the descriptions of these authors and their figures,* which is reflected in the upper part of the table for 2 larvae from Liberia (Peters, 1956) and 8 spms. from E Zaire that we examined personally. As may be seen from the table, the data we obtained eliminate the discrepancies in most of the characters, although not for the branching of hairs 2-P or for the number of siphonal tufts, which are shown correctly in the figures and cited incorrectly in the descriptions (2-branched 2-P hairs instead of simple, and 2 pairs of siphonal tufts instead of 3).** The same appears with regard to scale brushes; they were not found on one side of abdominal segment VIII in one of the larvae of *C. moucheti* examined by us. However, we cannot state confidently that they are always lacking, since in this larva they could have been removed ("pulled out by the root"); i.e., along with the base and adjoining vestiture, hairs 3-VIII were lacking on that side of segment VIII, as well as the scale brushes.

In the lower half of the table, the other morphological characters are listed by which the 4th instar larvae of *C. moucheti* that we examined differed in one degree or another from the characters cited in the literature. It can be seen from the table that the data we obtained greatly vary in many characters from data given in the literature. The discrepancies in the literature concerning some of the characters are eliminated—for example, the branching of hairs 2-IV and 1-X. At the same time, our data for other characters differ substantially from data given in the literature, as may also be seen from the table, principally concerning hairs 9-C and the siphonal index. In the larvae we examined, these hairs consisted of 4-9 branches of approximately the same length as those of 8-C, found distinctly posterior to them, while in the literature these are cited as simple and

*The descriptions and figures of the larvae of *Cx. moucheti* in these works are substantially the same, inasmuch as the second author borrowed them nearly completely from the first.

**Strictly speaking, for the second of these characters, incorrect data are cited in Edwards' descriptions (1929) concerning the presence of only 2 pairs of siphonal tufts in larvae of *C. moucheti* generally, but not in Hopkins (1952) concerning 2 pairs of subventral tufts on the siphon, which in general agrees with the fact. This author, however, nowhere in the descriptions says anything about one more pair of tufts subdorsally and subapically, as shown in the figures by both authors (Fig. 2A).

long, sometimes longer than the 8-C, and situated at nearly the same level. The siphonal index in the specimens we examined averages half the amount cited in the literature.* Furthermore, the siphons of these larvae are also not as cylindrical as those shown in the drawings by these authors. They have rather distinct apical narrowing and strongly truncated conical shape (ratio of width at base to width at apex as 1.07-1.19, mean 1.13). In addition, the distal subventral siphonal tuft may be located not only the middle of the siphon (as cited in the literature), but also considerably more proximally or distally—for example, near the tip of the siphon (Fig. 2B).

As shown in Fig. 1, the subgenus *Kitzmilleria* is distributed predominantly in the northern half of the equatorial zone of the African continent, from Sierra Leone in the west to Kenya in the east, and is basically confined to the West African (Guinean-Congolese) Subprovince of the Afro-tropical Province, i.e., to moist evergreen tropical forest, forest-savanna, and moist (Guinean) savanna. The locality of the larvae that we collected (Mwamba, 5° E.) and examined seems to be the southernmost point of known distribution in 10 tropical African countries (Sierra Leone, Liberia, Burkina Faso, Nigeria, Cameroon, Central African Republic, Zaire, Sudan, Uganda, and Kenya),** where *C. moucheti* appears to be a rather common specie. In the western half of the Central African Republic, for example, its numbers do not seem to be very high, but in the Guinean Savanna subzone, it nonetheless appears to be 20 times as abundant as in forest and forest-savanna according to Cordellier and Geoffroy (1976).*** These authors made a survey of the most suitable of these subzones for the mentioned species. Their results, however, did not agree with the data of Mbongu-Sodi (1983), whose collections with a sweep net in low vegetation around populated places in tropical forest in the vicinity of Kisangani, Zaire, yielded 1021 spms. of *C. moucheti* of a total of 8874 mosquitoes (11.5%), in 6 genera with 18 species.

In our opinion, *C. moucheti*, in the eastern part of its range (E Zaire, Uganda, and Kenya), possibly consists of a new undescribed subspecies, for which the following data on its morphology, biology, and geographical distribution offer support.

1. As mentioned above, Edwards (1929, 1941) indicated that the imago of *C. moucheti* differs from all other Afrotropical species of *Culex* in orange-colored torus, although according to Haddow et al. (1951), the torus in specimens from W Uganda may be very dark, nearly brown.
2. Edwards (1941) indicates in his figure certain differences in the ♂ genitalia of Kisangani spms. of *C. moucheti* and those from Lobuto, Zaire (SW of Kisangani).
3. It is possible that the specimens of larvae that we studied from Mwamba, E Zaire, represent a new subspecies, which, as noted above, differs in several morphological characters, especially those of the siphon.

4. The reproductive sites of *C. moucheti* are quite various: holes in various kinds of trees, especially papaya, stumps of banana and oil palm, small puddles and ditches, containers of water, depressions in leaves, and even cavities in shells (Hopkins, 1952; Rageau and Adams, 1952; Van Someren et al. 1955; Lewis, 1956; Peters, 1956). However, in W Uganda, larvae of this species

*The siphons of our specimens seem more flattened in preparation than those used for measuring the siphonal index, but even if the full correction is made (100%), their flatness (the possibility is ultimately only theoretical) (i.e., if one increases the siphonal index obtained to $\pi/2 = 1.57$, then in this case also its value: 0.9-1.1, average 1.0) will be less than the data in the literature.

**In the latest catalogues of mosquitoes (Knight and Stone, 1977; White, 1980) *Cx. moucheti* is not listed from Sierra Leone, Burkina Faso, and Central African Republic.

***In this work the author of the species is cited incorrectly: Edwards, 1923, instead of Evans, 1923 (p. 15).

are mainly found in lavatories (Haddow et al., 1951; Hopkins, 1952), i.e., in situations evidently quite different from those in which the others reproduce, in spite of their multifariousness. Unfortunately, the labels with the specimens of *C. moucheti* larvae that we studied and that gave us the impression of being a new subspecies lack any indication of their reproductive site.

5. There is nothing in the literature concerning *C. moucheti* attacking man. Hamon (1963) notes that in the Bogo-Dulaso district (Burkina Faso) they do not attack man. It is characteristic that the ♀s of this species from Cameroon reared from the egg in the laboratory do not feed on humans and that they starved to death (Rageau and Adam, 1952). The only ♀ of *C. moucheti* with blood in the alimentary canal was taken in a light trap in the vicinity of Entebbe (Uganda). According to precipitation reaction, it drank blood of a bird (Williams, 1963). An exception is that mosquitoes from West Uganda that attack man usually occur in forests and on plantations both by day and by night (Haddow, 1945; Haddow et al., 1951).

6. As may be seen in fig. 1, the distribution of *C. moucheti* in eastern Africa is far outside the borders of the Western-African Subprovince, right up to the shores of the Indian Ocean, which is its eastern limit. This territory, comprising E Zaire, Uganda, and Kenya, is also the range of the taxon we consider to be that of the new subspecies of *C. moucheti* (Fig. 1), sympatric with the nominate (western) subspecies in E Zaire, W Uganda. Possibly this eastern subspecies will eventually also be found in Rwanda, Burundi, and Tanzania.

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