DESCRIPTION OF *AEDES (NEOMELANICONION) AUROVENATUS* WORTH (DIPTERA: CULICIDAE)

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ABSTRACT. Males, females, 4th instar larvae and pupae of *Aedes aurovenatus* Worth from the Kruger National Park, South Africa, are described and illustrated. Some aspects of the biology of *Ae. aurovenatus* and other floodwater *Aedes* mosquitoes are discussed. A new key to the males of southern African *Neomelaniconion* species using mainly the genitalia is given.

INTRODUCTION

Most of the known species of *Aedes* Meigen subgenus *Neomelaniconion* Newstead are unique to the African continent (Le Berre and Hamon 1960, McIntosh 1971). Only one species, *Ae. lineatopennis* (Ludlow), is found elsewhere in the world, occurring in the Oriental Region, Australia (Knight and Hull 1953) and in the Maritime Territory of the USSR (Danilov 1977). *Aedes lineatopennis* was recorded from Africa as well (Edwards 1941). However, African specimens were subsequently found to differ morphologically from *Ae. lineatopennis* from elsewhere and a new species, *Ae. mcintoshi* Huang, was described (Huang 1985).

During a survey of the mosquito fauna of the Kruger National Park, South Africa, conducted in 1988 and 1989, several female mosquitoes resembling *Aedes aurovenatus* Worth were collected. Until then, only four females of this species of mosquito had ever been collected (Worth 1960) and all were from a single locality. The possibility existed that this species was merely a mutant or rare polymorphic variant of a similar species of *Neomelaniconion* that had already been described, such as *Aedes circumluteolus* (Theobald).

MATERIALS AND METHODS

Wild-caught mosquitoes were reared in the laboratory using a modified version of the procedure for rearing floodwater *Aedes* developed by Thomas Gargan (personal communication). A detailed description of the rearing method is given below as many other attempts at rearing floodwater *Aedes* have been largely unsuccessful.

Wild-caught females were offered a blood meal and placed in small glass specimen vials (2.5 cm diameter and 5 cm high) containing crumpled soft tissue paper moistened with distilled water. The females laid eggs in the folds of the paper. Soft tissue was found to be more effective for laying of eggs for floodwater *Aedes* than harder filter paper (Thomas Zavortink, personal communication). The eggs were allowed to dry for 2 months at ca. 80% relative humidity before hatching them in partially deoxygenated water. The deoxygenated water consisted of an infusion of 1 litre of distilled water, a clump (12.5 g) of kikuyu grass (*Pennisetum clandestinum* Hochst), 2 plane-tree leaves (*Platanus occidentalis* L.) and a few dried sedge leaves (1.5 g). "Sedges" refer to plants belonging to the family Cyperaceae and are, in most cases, the dominant plants where floodwater *Aedes* occur in southern Africa. The sedge was in fact the most important constituent of the hatching and larval rearing media. The hatching infusion was prepared 2 days prior to flooding the eggs. The eggs hatched within 30-60 minutes after flooding and the larvae were left in the glass vial with the hatching medium for 12 hours before placing them in larger bowls. The larval rearing medium in the larger bowls consisted of 250 ml of the hatching medium, which at this stage was approximately 3 days old, 1 L of

distilled water, a few dried leaves of kikuyu grass, 1 large dried plane-tree leaf and a few blades of dried sedge. The larvae were placed in the rearing medium which was continuously aerated and kept in a warm room (ca. 36°C).

The progeny of single females were reared so that any morphological variation within families could be observed. The terminology used for the adults, except for the wing venation, is found in Harbach and Knight (1980). The wing venation and the nomenclature of the 4th instar larval and pupal chaetotaxy follows that of Belkin (1962).

Material examined. Specimens of *Aedes aurovenatus* were collected as follows:

1. One female resting in long grass on edge of bed of temporary stream. Kruger National Park, Renosterkoppies, 25°7'S, 31°36'E, 3 April 1988. A. Cornel Coll. No. Skuk 4.

2. Five larvae in pool of water in river bed. Kruger National Park, Tshokwane district, Banyani River, 25°42'S, 31°57'E, 10 December 1988. A. Cornel Coll. No. Tchok 1. These larvae were "link-reared" to 1 female and 4 males.

3. Two females collected in a CO_2 baited net trap. Kruger National Park, Pafuri district, 22°30'S, 31°20'E, 5 March 1989. A. Cornel, M. Coetzee and L. Braack. Coll. No. Paf 9. Both these females laid eggs and have family numbers Paf 9.5 and Paf 9.11.

4. Seven females collected in a CO_2 baited net trap. Kruger National Park, Renosterkoppies, 25°7'S, 31°36'E, 10 December 1989. A. Cornel and L. Braack. Coll. No. Skuk 60. One female laid eggs and this family has been numbered Skuk 60.2. In the same locality and date 3 larvae were collected in a pool of water in a river bed next to where females were collected. Larvae were link-reared to male adults. A. Cornel, Coll. No. Skuk 57, 12, 13, and 17.

5. A single larva collected in a pool of water along a small river. Kruger National Park, Tshokwane district, 24°54'S, 31°47'E, 12 December 1989. A. Cornel Coll. No. Skuk 70. The larva was link-reared to an adult female.

All of the above specimens have been deposited in the collection of the South African Institute for Medical Research (S.A.I.M.R.). Other material examined which is kept at the S.A.I.M.R. and the National Institute for Virology (N.I.V.) includes:

Ae. aurovenatus Worth. Holotype ♀ and paratype ♀. South Africa: Ndumu, Natal. Site 16. January 1959. C.B. Worth. S.A.I.M.R.

Ae. albothorax (Theobald). Mozambique: Lumbo. 1960. Coll. and Det. C.B. Worth 1960. 1♂, S.A.I.M.R.; 2♂, N.I.V.

Ae. circumluteolus Theobald. South Africa: Tete district Tongaland, Natal. 1955. Coll. and Det. J. Muspratt 1955. 1♂, S.A.I.M.R.

South Africa: Ndumu. April 1969. Coll. and Det. B. McIntosh. Coll. No. = M760; 6942; 880705-2 BMM. 1♂, N.I.V.

South Africa: Shokwe Pan, Ndumu, Natal. February 1988. Coll. and Det. A. Cornel. Coll. No. = Ndu. 7. 1♂, S.A.I.M.R.

South Africa: Pelendaba, N. Zululand, Natal. February 1989. Coll. M. Coetzee. Det. A. Cornel. Coll. No. = Pele. 1. 1♂, S.A.I.M.R.

Mozambique: Lourenco Marques. 17 June 1942. Coll. and Det. B. De Meillon 1943. 1♂, S.A.I.M.R.

Ae. luridus McIntosh. South Africa: Luckoff, Orange Free State. February 1971. Coll. and Det. B. McIntosh. 1♂, S.A.I.M.R.; 3♂, N.I.V.

South Africa: Bethulie, Orange Free State. 20 March 1969. Coll. and Det. B. McIntosh. 6♂, N.I.V.

Ae. luteolateralis (Theobald). South Africa: Isipingo Beach, Natal. 1946. Coll. and Det. J. Muspratt. 1♂, S.A.I.M.R.

South Africa: St. Lucia, Zululand. 1952. Coll. and Det. J. Muspratt. 1♂, S.A.I.M.R.

South Africa: Durban airport, Natal. April 1956. Coll. and Det. B. McIntosh. Coll. Nos. T552-553. 2♂, N.I.V.

South Africa: Port Shepstone, Natal. February 1971. Coll. and Det. B. McIntosh. Coll. No. T11TM 990B 880705-4. 1♂, N.I.V.

Ae. mcintoshi Huang. South Africa: Mtunzini District, Natal. 27 May 1952. Coll. and Det. J. Muspratt. 1♂, S.A.I.M.R.

South Africa: Seacow Lake, Durban, Natal. 1927. Coll. and Det. F.W. Edwards. 1♂ and 2 pupal and larval exuviae, S.A.I.M.R.

South Africa: Tshokwane, Kruger National Park, Transvaal. 10 December 1988. Net trap baited with CO_2. Coll. and Det. A. Cornel. Coll. No. = Tchok 1. 1 larval exuviae, S.A.I.M.R.

South Africa: Shingwedzi, Kruger National Park. 8 December 1989. Net trap baited with CO_2. Coll. and Det. A. Cornel. Coll. No. = Shing 13. 1♂, S.A.I.M.R.

South Africa: Skukuza, Kruger National Park. 10 December 1989. Net trap baited with CO_2. Coll. and Det. A. Cornel. Coll. No. = Skuk 79. 10 pupal and 12 larval exuviae, S.A.I.M.R.

Ae. palpalis (Newstead). Belgian Congo: Yangambi, Stanleyville Province. 1943. Coll. Dr. Parent and Det. B. De Meillon. Coll. No. = A126/43. 1♂, N.I.V.

Ae. unidentatus McIntosh. South Africa: Villiers, Orange Free State. 24 November 1987. Larval Collection. Coll. and Det. A. Cornel. 3♂, S.A.I.M.R.

South Africa: Olifantsvlei, Transvaal. 20 November 1969. Allotype. Coll. and Det. B. McIntosh. Coll. No. = T558; M886-26, 1♂, N.I.V.

South Africa: Olifantsvlei, Transvaal. November 1969. Coll. and Det. B. McIntosh. Coll. No. = 88009 M 806-29 2♂, N.I.V.

South Africa: Lake Chrissie, Transvaal. February 1970. Coll. and Det. B. McIntosh. Coll. No. = 7015 M836-6 8807024-4. 1♂, N.I.V.

TAXONOMIC TREATMENT

Aedes (Neomelaniconion) aurovenatus Worth 1960. (Figs. 1-4).

Female. *Head* - Proboscis entirely dark. Maxillary palpus approximately 0.1 length of proboscis, entirely dark. Antenna dark except for cuticle of first two flagellomes which are light brown. Pedicel light brown but tending to become slightly darker towards inner side. Clypeus dark brown to black, bare. Occiput with numerous pale yellow erect scales. Vertex with a few pale yellow, erect, forked scales and numerous decumbent pale yellow scales, especially towards anterior end. Interocular space covered with long and short pale yellow setae that project forward. Postgena covered with dark broad decumbent scales and a few dark erect forked scales toward occiput. Ventral edge of postgena with a distinct patch of pale broad decumbent scales. *Thorax* (Fig. 1A) - Dorsal surface of scutum entirely covered with narrow pale yellow to beige scales, except for a narrow medial line of bronze scales which ends just before prescutellar area. Pale yellow scales end abruptly just before lateral edges of scutum. A distinct medial patch of narrow, pale yellow scales on anterior promontory. Setae of scutal angle, antealar and supralar areas bronze-colored. Acrostichal, dorsocentral and prescutellar setae present. Scutellum with narrow, pale yellow scales on all lobes. Paratergite, postspiracular and hypostigmal areas bare. Subspiracular area occasionally with broad pale scales. Propleuron with setae but devoid of scales. Mesokatepisternum with a few dark, broad scales on upper portion and a few pale to dark, broad scales on lower portion. Mesepimeron occasionally with scales on the upper portion and most specimens with two lower mesepimeral setae. Metameron and mesopostnotum bare. Scabellum and pedicel of halter pale, and capitellum dark. *Wing* (Figs. 1B, 1C) - Veins mainly covered with pale scales. Dark, broad scales on basal 0.6 of Costa (C), distal 0.4 with broad pale yellow scales. Secondary and tertiary fringe scales slightly pale. Basal 0.5 of Subcosta (Sc) without scales, distal 0.5 with mainly narrow pale scales. Radial vein (R) with broad yellow scales. Radial sector (Rs) with numerous pale plume scales with a few dark plume scales scattered amongst them. R2 and R3 with slightly pale plume scales. R_{4+5} with broad, pale scales. Media (M) covered with narrow dark scales. M_{1+2} with broad pale scales on distal 0.66, basal 0.33 with broad dark scales. R_{4+5}, M_{3+4}, Cubitus $(Cu)_1$, and Cu_2 all with broad pale scales. Anal vein (1A) with pale narrow scales. *Legs* - Entirely dark. Ungues toothed on fore- and midlegs, simple on hindlegs. *Abdomen* (Fig. 1D) - Tergum I with patches of pale scales on medial area. Broad medial bands and pale basolateral triangular patches on terga II to VI. Terga VII with a broad basal patch of pale scales. Sterna entirely dark. *Genitalia* (Fig. 1E) - The female genitalia are of little taxonomic value and resemble those of other southern African *Neomelaniconion* species.

Male. Similar to the female but differs in the following characters. *Head* - Palpus slightly longer than proboscis, terminal palpomeres with three rows of long setae hairs (2 lateral, 1 ven-

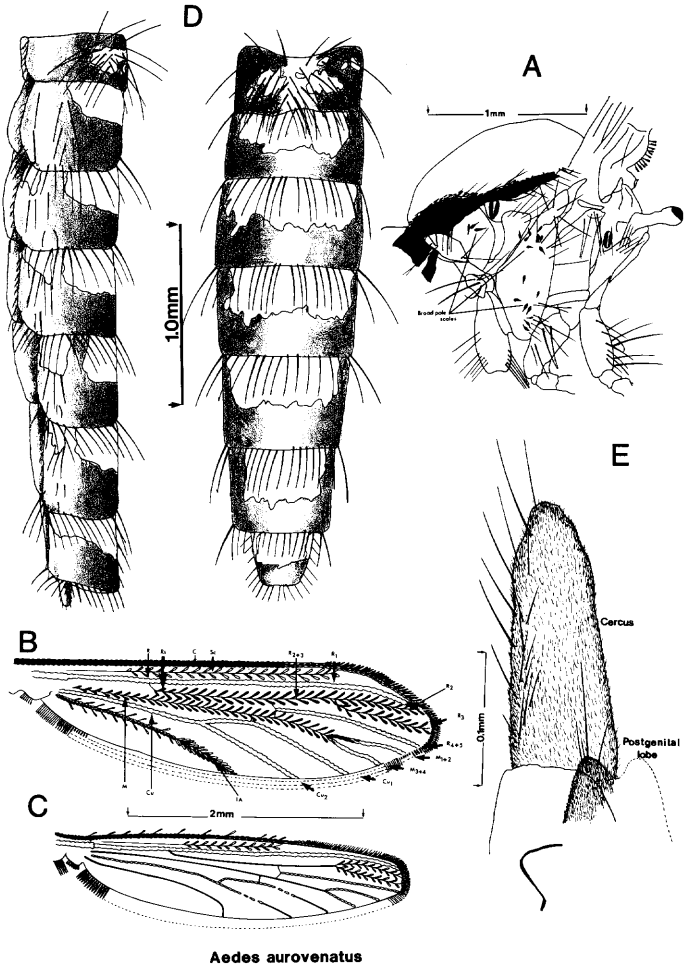

Fig. 1. A. Lateral view of thorax. B. Female wing. C. Male wing drawn to same scale as female wing. D. Dorsal and lateral views of the abdominal terga. E. Ventral view of the female genitalia.

tral), penultimate palpomere with two lateral rows of long setae on apical 0.2. Antennae distinctly plumose with 13 nodes of long setae, extreme base of each seta darker than distal portion. Last two flagellomeres of antennae with short setae except for three long setae at base of final flagellomeres. Areas between nodes of long setae hairs pale in color. *Thorax* - General coloring of scutum similar to the female except that the scaling is less dense. Scaling of wings also less dense and more easily rubbed off. *Abdomen* - Similar to female but without basolateral pale patches. *Genitalia* (Fig. 3C) - Similar to *Ae. mcintoshi* (Huang 1985) but with the following differences. *Ae. mcintoshi* with 8-12 stout spines on inner margin of gonocoxite, *Ae. aurovenatus* with 12-16 stout spines. Both species have long, curved, stout setae on dorsomesal surface of gonocoxite, but in *Ae. mcintoshi* these setae form a dense clump below the stout spines towards the swollen base of gonocoxite. In *Ae. aurovenatus* these long setae are distinctly more numerous towards apex of gonocoxite above level of most apical stout spine.

Larva. Head and siphon reddish brown in color, and darker than rest of body. Size of wild-caught larvae vary according to size of waterbody in which they were found. The larval chaetotaxy is depicted in Figure 2. Range and mode of numbers of branches for each seta are given in Table 1. Mentum resembles those of all other southern African *Neomelaniconion* species, with approximately 20 small teeth on each side of a larger central tooth (Fig. 2D).

Pupa. Integument of whole body light reddish brown in color with the exception of the paddles. Each paddle has two dark brown spots at the base and a larger brown spot towards apex. Character and positions of the setae are shown in Figs. 3A and 3B and the range and mode of the number of branches of these setae are given in Table 2.

Distribution. The original collections of *Ae. aurovenatus* by Worth (1960) in northern Natal together with the collections from the Kruger National Park indicate that this species may be widespread throughout the northeastern low-lying areas of South Africa (Fig. 4). The savanna-type habitat in Mozambique does not differ markedly from that in northern Natal and the Kruger National Park and it is probable that the distribution of *Ae. aurovenatus* extends farther east and north into Mozambique.

Bionomics. *Ae. aurovenatus* larvae were found with *Ae. mcintoshi* in vegetated pools of water in riverbeds. These rivers only flow during exceptionally high rainfall periods. Normally the precipitation is just sufficient to form pools of water in the riverbed. The riverbeds consist of coarse gravel and support a large population of annual plants amongst which the pools of water form. Pools of water without vegetation never had *Ae. aurovenatus* or *Ae. mcintoshi* larvae in them. This association between bodies of water and vegetation seems to be an important breeding requirement for the grassland species of *Neomelaniconion* throughout southern Africa. The fact that *Ae. aurovenatus* and *Ae. mcintoshi* were found in pools of water in riverbeds is, however, contrary to the belief that grassland *Neomelaniconion* species are found only in "dambos" or "vleis" in South Africa. Dambos are defined by Mackel (1974) as shallow, streamless depressions at the headwater of drainage systems in eastern and southern Africa. These occur in the Kruger National Park, but attempts at finding *Neomelaniconion* larvae in them have been unsuccessful. This is probably because the dambos in the Kruger National Park flood too infrequently and do not support large populations of annual plants because of the dry climate.

While rearing the larvae of *Ae. aurovenatus*, it was learned that they develop rapidly and are therefore adapted to live in warm summer conditions when shallow bodies of water heat up to temperatures of 90°F and dry up rapidly. This was also observed in breeding experiments on other floodwater *Aedes*. Those larvae that were slower in developing and did not pupate within 2 weeks often died.

Nothing is known about the adult biology other than that the females are attracted to CO_2 and probably, therefore, feed on vertebrates. A wide variety of mammals occur in both the Kruger National Park and northern Natal where *Ae. aurovenatus* occurs. These animals often feed on the riverine vegetation and therefore would provide a regular source of blood meals for the mosquitoes near larval habitats.

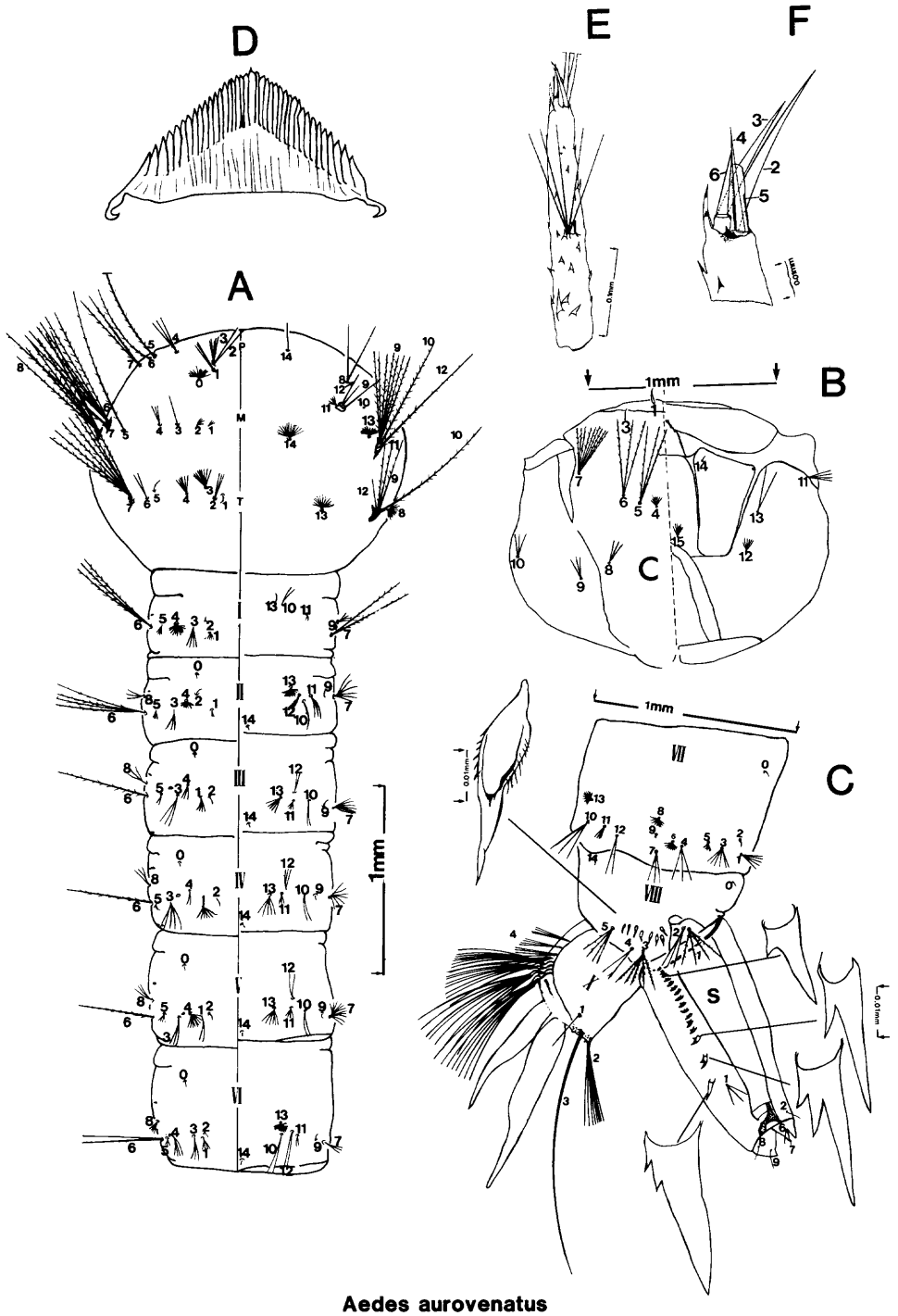

Fig. 2. A. Chaetotaxy of larval thorax and abdominal segments I-VI. B. Larval head. C. Terminal segments of larva. D. Dorsomentum. E. Antenna. F. Tip of antenna.

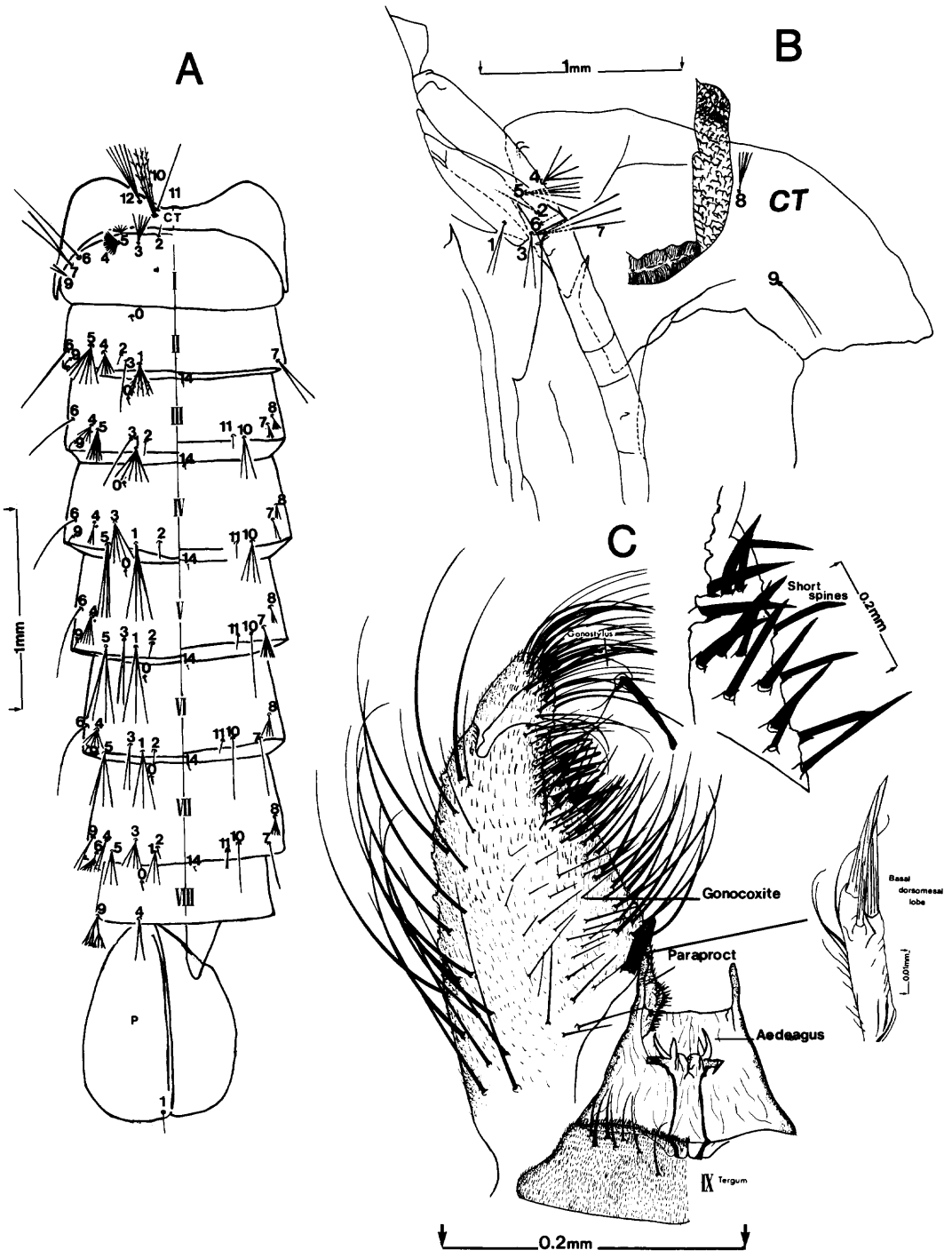

Fig. 3. A. Pupal abdomen. B. Pupal cephalothorax. C. Male genitalia.

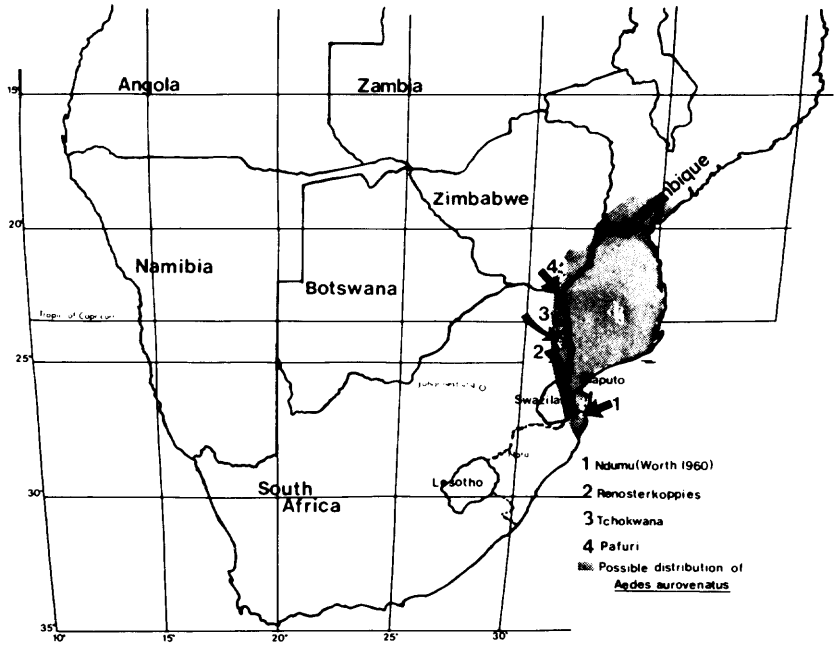

Fig. 4. Map of southern Africa showing the possible distribution of *Ae. aurovenatus*.

Nothing is known about the disease relations of *Ae. aurovenatus*.

DISCUSSION

This is the first time that the complete chaetotaxy of both the larva and pupa of an African species of *Neomelaniconion* has been reported. The setae have been numbered according to Belkin's (1962) description for the subgenus *Edwardsaedes* Belkin, which was found to be most similar to *Ae. aurovenatus*.

McIntosh (1971) published 2 keys to the species of *Neomelaniconion* occurring in South Africa. The key to the females includes *Ae. aurovenatus* and need not be changed. The key to the males could be easily modified by adding an extra couplet at the beginning to include this species as follows:

Pale scales covering the entire dorsal surface of scutum ..... *aurovenatus*
Pale scales restricted to distinctive longitudinal stripes on lateral borders of scutum 2

However, should the scaling on the scutum of males be rubbed off, which is often the case, then the genitalia, which are quite distinctive, can be used to identify the species. A key to distinguish the males of predominantly South African species using mainly the genitalia has therefore been devised and is given below.

Aedes albothorax and *Aedes palpalis* have been included in the key as these mosquitoes occur in neighboring Mozambique which experiences similar climatic conditions. It is therefore possible that both these species occur in areas of South Africa bordering with Mozambique.

Table 1. Chaetotaxy of fourth-instar larvae of *Aedes (Neomelaniconion) aurovenatus* ($n=10$).

Seta No.	Head	Thorax P	Thorax M	Thorax T	Abdominal Segments I	Abdominal Segments II	Abdominal Segments III
0	-	15-26(18)	-	-	-	1	1
1	1	1-4(2)	2-7(4)	1-6(3)	1-6(4)	1-4(4)	3-14(4)
2	-	1-3(2)	1-5(3)	1-4(3)	1	1	1
3	1	2-8(6)	1-2(1)	9-22(20)	2-8(4)	3-7(3)	2-3(3)
4	6-10(8)	2-4(3)	3-5(4)	3-9(6)	9-24(16+17)	8-21(10)	3-4(3)
5	3-5(3)	1	1	1-2(1)	2-9(4)	1-6(6)	1-4(2)
6	2-4(3)	1	4-7(5-6)	1-2(2)	1-4(3)	1-4(3)	1
7	4-10(7)	1-3(2)	1	6-9(7)	1-4(2)	3-10(7)	6-11(7)
8	2-5(3)	1-2(2)	3-8(5)	5-21(14)	-	3-4(3)	2-4(2)
9	3-5(3)	1-2(2)	5-10(8)	3-5(3)	2-5(4)	1-2(1)	1
10	3-6(4)	1-3(1)	1	1	1-4(2)	1	2-3(2)
11	4-7(5)	-	rare	2	1-4(1)	2-5(3)	2-4(2)
12	4-10(6)	1-2(1)	1	1	-	2-3(2)	2-8(2+3)
13	2-3(2)	-	12-28(18)	12-21(17)	1-2(1)	13-24(13)	4-7(5)
14	1-2(1)	1-3(2)	12-20(18)	-	-	1	-
15	4-8(5+6)	-	-	-	-	-	-

Seta No.	IV	V	VI	VII	VIII	X
0	1	-	1	1	-	-
1	3-8(6)	1-10(4+5)	3-7(4)	2-11(5)	3-7(4)	1-3(1)
2	1	1	1	1	1-4(2)	6-10(7)
3	2-5(3)	2-4(3)	2-5(4)	3-7(5)	4-8(2)	1
4	2-5(4)	7-12(9)	3-6(5)	1-4(3)	1-3(2)	
5	1-4(2)	2-4(3)	2-6(4)	1-6(5)	3-6(4)	
6	1	1	1-3(1)	8-16(12)	-	
7	8-13(10)	6-14(11)	3-5(4)	1-4(2)	-	
8	2-5(3)	1-5(3)	3-7(4)	4-15(11)	-	
9	1	1	1	1-4(3)	-	
10	1-3(2)	1-3(2)	1-3(2)	2-4(3)	-	
11	1-4(3)	2-5(3)	2-3(2)	1-4(2)	-	
12	2-5(3)	1-3(2)	1-4(3)	2-3(2)		*1 (1-3(1)
13	5-9(5)	3-6(5)	12-30(20+24)	5-16(12)		**2 6-10(7)
14	1	1	1	-		***3 1
15	-	-	-	-	-	Siphon 1 3-7(4)

Table 2. Chaetotaxy of pupae of *Aedes (Neomelaniconion) aurovenatus* ($n=10$).

Seta No.	Abdominal Segments CT	I	II	III	IV
0	-	-	1	1	1
1	2-3(2)	59-111	5-9(7)	5-10(6)	2-6(3)
2	1-3(2)	1	1	1	1
3	1-3(2)	4-7(5)	1-2(1)	1-2(1)	2-5(3)
4	3-5(4)	8-20(17)	4-12(8)	2-6(4)	5-9(8)
5	3-6(5)	2-7(5)	5-11(6)	5-10(7)	3-5(4)
6	1-2(1)	1	1	1	1-2(1)
7	2-4(3)	1-3(2)	1-3(2)	3-10(6)	1-4(3)
8	3-7(5)	-	-	2-5(5)	1-6(4)
9	2-3(3)	1-3(2)	1	1	1
10	1(1)	-	-	2-3(3)	2-5(3)
11	4-8(5)	-	-	1	1
12	4-7(4)	-	-	-	-
13	-	-	-	-	-
14	-	-	-	1	1

Seta No.	V	VI	VII	VIII	Paddle P
0	1-2(1)	1	1	1	-
1	3-5(4)	3-7(3)	3-5(4)	1	1-1(1)
2	1	1	1	-	-
3	2-5(3)	2-4(2)	4-6(5)	-	-
4	3-7(6)	4-7(4)	2-3(3)	2-4(2)	-
5	3-5(4)	3-4(3)	3-5(3)	-	-
6	1-2(1)	1-2(2)	2-9(6)	-	-
7	3-7(5)	1	1	-	-
8	3-6(4)	2-7(4)	2-6(5)	-	-
9	1	1	1-3(2)	2-5(3)	-
10	1-2(1)	1-2(1)	1-2(1)	-	-
11	1	1	1-2(1)	-	-
12	-	-	-	-	-
13	-	-	-	-	-
14	1	1	1	1	-

The mode (most common number of branches) in parenthesis.

Key to Male *Neomelaniconion* Occurring in South Africa

1. Clump of long setae on distal third of gonostylus ..... *palpalis*
   No long setae on gonostylus 2
2. Position of most apical stout spine at same level or below level of attachment of gonostylus 3
   Position of most apical stout spine more apical than level of insertion of gonostylus 6
3. Stout spines numbering 20 or more ..... *unidentatus*
   Stout spines fewer than 20 4
4. Stout spines numbering fewer than 6 ..... *albothorax*
   Stout spines more than 6 5
5. Long setae on inner margin of gonocoxite more numerous and forming a denser clump below area of stout spines; usually 6-12 stout spines ..... *mcintoshi*
   Long setae on inner margin of gonocoxite more numerous and forming a denser clump above area of stout spines; usually 12-16 stout spines ..... *aurovenatus* Fig. 3
6. Stout spines more than 30 ..... *luteolateralis*
   Stout spines 12-22 7
7. Hind unguis simple; inner margin of gonocoxite markedly broader and more bulbous below stout spines ..... *circumluteolus*
   Hind unguis armed; inner margin of gonocoxite tapering gradually from base to apex ..... *luridus*

As *Ae. aurovenatus* larvae were found together with *Ae. mcintoshi*, it was decided to investigate whether morphological differences in the immature stages could be found to facilitate rapid identification of these two species. The 4th instar larvae were almost identical except for setal differences on segment VIII. All three of the setae tended to have more branches in *Ae. mcintoshi* with 1-VIII, 3-VIII and 5-VIII having 5-9, 7-12 and 5-9 branches respectively. *Ae. aurovenatus* had these setae with 4-8, 1-3 and 3-6 branches (Table 1). A further difference, which was brought to my attention by Thomas Zavortink, is the presence of a common basal plate at the base of 1,2-VIII in *Ae. mcintoshi* but not in *Ae. aurovenatus*. No differences were found between the pupae.

This is the first time a complete description of the immature stages of an African species of *Neomelaniconion* has been published. Further differences in the immature stages of other species of *Neomelaniconion* may be found in future studies.

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REFERENCES CITED

Belkin, J.N. 1962. The mosquitoes of the South Pacific (Diptera, Culicidae). 2 Vols. Univ. Calif. Press, Berkeley.

Danilov, V.N. 1977. Abstract in The Review of Applied Entomology Series B. 65:744.

Edwards, F.W. 1941. Mosquitoes of the Ethiopian Region III. Culicine adults and pupae. Brit. Mus. (Nat. Hist.), London.

Harbach, R.E. and K.L. Knight. 1980. Taxonomists' glossary of mosquito anatomy. Plexus Publishing, Inc., Marlton, New Jersey.

Huang, Y.-M. 1985. A new African species of *Aedes* (Diptera: Culicidae). Mosq. Syst. 17:108-120.

Knight, K.L. and W.B. Hull. 1953. The *Aedes* mosquitoes of the Philippine Islands. III. Subgenera *Aedimorphus, Banksinella, Aedes,* and *Cancraedes* (Diptera, Culicidae). Pac. Sci. 7:453-481.

Le Berre, R. and J. Hamon. 1960. Description de la larve, de la nymphe et de la femelle d'*Aedes (Neomelaniconion) jamoti* Hamon et Rickenbach 1954, et révision des clés détermination concernant le sous-genre *Neomelaniconion* en Afrique au sud du Sahara. Bull. Soc. Path. Exot. 53:1054-1064.

Mackel, R. 1974. Dambos: A study in morphodynamic activity on the plateau regions of Zambia. Catena 1:327-365.

McIntosh, B.M. 1971. The aedine subgenus *Neomelaniconion* Newstead (Culicidae, Diptera) in southern Africa with descriptions of two new species. J. Entomol. Soc. Sth. Afr. 34:319-333.

Worth, C.B. 1960. Description of a new species of the aedine subgenus *Neomelaniconion* from Tongaland, South Africa (Diptera: Culicidae). J. Entomol. Soc. Sth. Afr. 23:312-313.