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A pictorial key to the species of *Aedes* (*Ochlerotatus* and *Coetzeemyia*) in the Afrotropical Region (Diptera: Culicidae)

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Abstract

Six species of the subgenus *Ochlerotatus* and one species of the subgenus *Coetzeemyia* of the genus *Aedes* in the Afrotropical Region are treated in a pictorial key based on diagnostic morphological features. Brief remarks on the new reclassification of the genus *Aedes* are also included.

Key words: Culicidae, mosquitoes, identification key, Africa

Introduction

Accurate species identification is of the utmost importance to any field studies of mosquitoes. Precise and simple keys are essential tools to successfully identify any target species. To assist entomologists and other field workers in identification of mosquitoes from Africa, we prepared a supplemental pictorial key to adult males and females of *Aedes* (*Ochlerotatus* and *Coetzeemyia*). This key will assist in the identification of *Aedes* species that may potentially carry viruses and other pathogens. Correct identifications are essential to the management and control of vector species, including prevention of epidemics of infectious diseases in many areas. A few diagnostic characters, indicated by a double asterisk (**), were added where necessary to facilitate identification. Images of the diagnostic morphological structures of the adult head, thorax, leg and wing are also included in the supplemental pictorial key.

The term “Afrotropical Region” as used herein is the recommended term in zoogeography for the old name “Ethiopian Region” (Crosskey & White, 1977). This area is approximately encompassed within 35° south to 20° north latitude, and 18° west to 52° east longitude (see Map 1, in Huang 1990: 59). This area also corresponds to the “Ethiopian Area” of the World Mosquito Faunal Areas (see Belkin 1962, Vol. 2, page 18).

Material and methods

This study is based on specimens in the Department of Entomology, National Museum of Natural History, Smithsonian Institution (USNM). Other specimens were borrowed from individuals and institutions mentioned in the acknowledgments.

The terminology follows Harbach & Knight (1980, 1982) with the exception of “tarsal claws”, which is retained for “ungues”. The wing venation follows Belkin (1962).

Result and discussion

Huang (2001) published a key entitled “A Pictorial Key for the Identification of the Subfamilies of Culicidae, Genera of Culicinae, and Subgenera of *Aedes* Mosquitoes of the Afrotropical Region (Diptera: Culicidae)”. This paper, “A Pictorial Key to *Aedes* (*Ochlerotatus* and *Coetzeemyia*) in the Afrotropical Region (Diptera: Culicidae)”. (see Appendix 1), was prepared as an add-on to the Huang (2001) key. This key is formatted so that it can be merged with the Huang (2001) key for mosquito identification. Detailed steps should be followed in using the Huang (2001) key with the merged supplemental key (Appendix 1): A Pictorial Key to the Species of *Aedes* (*Ochlerotatus* and *Coetzeemyia*) in the Afrotropical Region (Diptera: Culicidae). From Page 34 of Huang (2001) key, with **Part 3. Key to Subgenera of *Aedes*, ADULTS**, follow the key to Page 35, then to Page 36 (Thorax. Scutellum with all narrow scales), to key out to *Ochlerotatus*. Using Appendix 1, the supplemental key, add Page 36A (1st page), Page 36B (2nd page), Page 36C (3rd page A, and 3rd page B), Page 36D (4th page), to key out to *Aedes* (*Ochlerotatus*), for six species, and Page 36E (5th page), to key out to *Aedes* (*Coetzeemyia*), for one species.

Classification of the Genus *Aedes* Meigen (in the broad traditional sense, prior to Reinert 2000). Edwards (1932: 130) recognized the following characters as the primary basis for the classification of *Aedes*: (1) shape of the phallosome, (2) presence or absence of claspettes, and (3) shape of the male palpus. These characters were used extensively in his “Keys to Subgenera” (Edwards 1932: 130-132).

In “Mosquitoes of the Ethiopian Region, in the Subgenus *Ochlerotatus* Lynch Arribalzaga”, Edwards (1941: 115) included four species from Africa: (1) *fryeri* (Theobald) (1912b: 84), from Aldabra Island; (2) *caballus* (Theobald) (1912a: 93), from Onderstepoort, Transvaal, South Africa; (3) *chelli* (Edwards) (1915: 275), from Dido, Kenya (from synonymy); and (4) *caspius* (Pallas) (Edwards, 1921: 299), from Arabia. In addition, Muspratt (1953: 51) described *Ae. (Och.) harrisoni* from the Hex River Valley, Cape Province, South Africa; and Muspratt (1953: 55) *Ae. (Och.) breedensis* from Worcester, Breede River Valley, Cape Province, South Africa; and McIntosh (1973: 262) described *Ae. (Och.) juppi* from Onderstepoort, South Africa.

Knight & Stone (1977), in their world catalog of mosquitoes, and White (1980) in his catalogue of the Diptera of the Afrotropical Region reported seven species of African *Ochlerotatus* from the Afrotropical Region. Danilov (1981: 86-87) transferred *Ae. fryeri* (Theobald) from the Subgenus *Ochlerotatus* to the Subgenus *Levua* Stone & Bohart, and his proposal has usually been followed in papers to the present. Thus, the Subgenus *Ochlerotatus* in the Afrotropical Region now consists of six species. Subsequently, Huang *et al.* (2010) removed *Ae. fryeri* from the Subgenus *Levua* Stone & Bohart (= genus *Levua* of Reinert *et al.* 2004) and placed it in the new monotypic Subgenus *Coetzeemyia* Huang, Mathis & Wilkerson.

The Subgenus *Coetzeemyia* is briefly characterized by having the subspiracular area without scales. It is represented by only one species, *Ae. (Coetzeemyia) fryeri* (Theobald). The African Subgenus *Ochlerotatus* is characterized by having the subspiracular area with broad white scales. It is represented by three species-groups: (1) the Breedensis Group (*Ae. (Och.) breedensis* Muspratt and *Ae. (Och.) harrisoni* Muspratt); (2) the Caspius Group (*Ae. (Och.) caspius* (Pallas)); and the Caballus Group (*Ae. (Och.) caballus* (Theobald), *Ae. (Och.) chelli* (Edwards), and *Ae. (Och.) juppi* McIntosh).

In our supplement pictorial key (Appendix 1), we include all known species of the *Aedes* (*Ochlerotatus* and *Coetzeemyia*) from the Afrotropical Region, as listed below.

Subgenus *Ochlerotatus*

1. *Aedes (Ochlerotatus) breedensis* Muspratt, 1953
2. *Aedes (Ochlerotatus) caballus* (Theobald, 1912a)
3. *Aedes (Ochlerotatus) caspius* (Pallas, 1771)
4. *Aedes (Ochlerotatus) chelli* (Edwards, 1915)
5. *Aedes (Ochlerotatus) harrisoni* Muspratt, 1953
6. *Aedes (Ochlerotatus) juppi* McIntosh, 1973

Subgenus *Coetzeemyia*

1. *Aedes* (*Coetzeemyia*) *fryeri* (Theobald, 1912b)

Medical Importance. *Aedes* (*Ochlerotatus*) *caballus* (Theobald) has been reported as a vector of Rift Valley fever (Gear *et al.* 1955), Wesselsbron Virus and Middelburg Virus (Kokernot *et al.* 1957, 1958, 1960). Moreover, individuals of this species were found to be naturally infected with West Nile Virus (Arbovirus Unit, SAIMR, unpublished; McIntosh 1973). McIntosh *et al.* (1962) isolated the Spondweni Virus from a pool of 42 female mosquitoes identified as either *Ae. fryeri* or *Ae. (Aedimorphus) fowleri* and collected in Lumbo, Mozambique.

Remarks. Due to taxonomic confusion in the past, *Ae. (Och.) caballus* included three species (*Ae. caballus*, *Ae. chelli*, and *Ae. juppi*).

Although Reinert *et al.* (2004, 2006, 2008, 2009) substantially revised the classification of the tribe Aedini, and some of their conclusions are warranted, we do not accept herein their classification because their results were based on partial treatments of several groups. Consequently, a large number of species remains without subgeneric placement. The African subgenus *Ochlerotatus*, for example, which currently consists of six species, has three species (*Ae. caballus*, *Ae. chelli*, *Ae. juppi*) placed in their new subgenus, *Ochlerotatus* (*Juppius*); however, the other three species (*Ae. breedensis*, *Ae. caspius*, *Ae. harrisoni*) remain unplaced (see Reinert *et al.* 2009). Thus, the new reclassification of the genus *Aedes* proposed by Reinert *et al.* (2004, 2006, 2008, 2009) is incomplete and needs comprehensive taxonomic analysis.

In the present paper, we follow Edwards' (1932) classification of the genus *Aedes*, retaining both *Ochlerotatus* and *Coetzeemyia* as subgenera of the genus *Aedes*.

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<http://dx.doi.org/10.1017/s0007485300040207>
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Appendix 1.

A Pictorial Key to the Species of *Aedes* (*Ochlerotatus* and *Coetzeemyia*) in the Afrotropical Region (Diptera: Culicidae)

Page 36A (1st page)

**

Thorax. Scutellum with narrow white
scales on all lobes



Thorax. Subspiracular area with
white scales



to Page 36B (2nd page)

Thorax. Subspiracular area
without scales



to Page 36E (5th page)

FIGURE 1. (Page 36A, 1st page). *Aedes (Ochlerotatus) breedensis*.

FIGURE 2. (Page 36A, 1st page). *Aedes (Ochlerotatus) breedensis*.

FIGURE 3. (Page 36A, 1st page). *Aedes (Coetzeemyia) fryeri*.

Page 36B (2nd page)

Head. Proboscis speckled with pale scales, or with pale scales on basal 0.50-0.75

Head. Proboscis with all dark scales



or

to Page 36C (3rd page B)



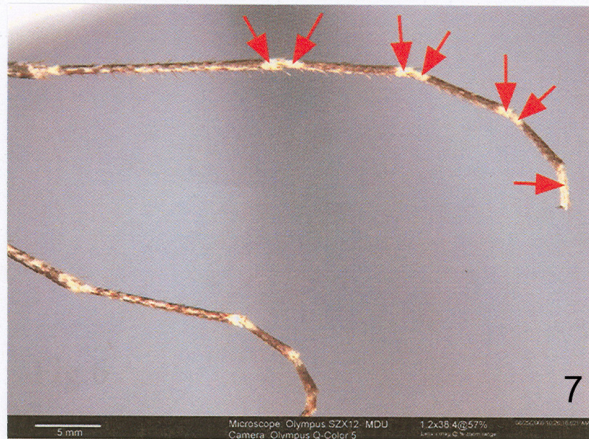
to Page 36C (3rd page A)

FIGURE 4. (Page 36B, 2nd page). *Aedes (Ochlerotatus) breedensis*.

FIGURE 5. (Page 36B, 2nd page). *Aedes (Ochlerotatus) caspius*.

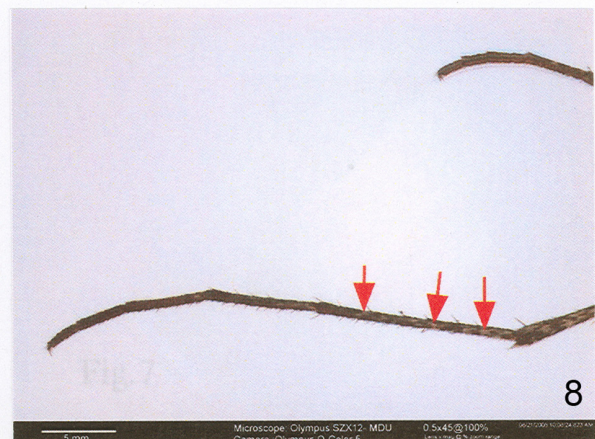
FIGURE 6. (Page 36B, 2nd page). *Aedes (Ochlerotatus) harrisoni*.

Leg. Hindtarsi with pale scales on joints of tarsomeres 1-2, 2-3 and 3-4, tarsomere 5 all white



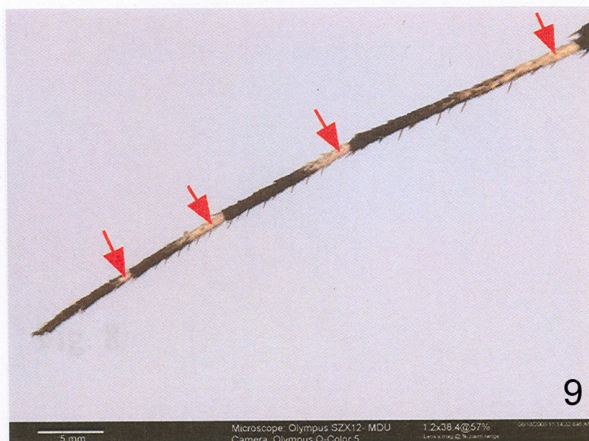
Aedes (Ochlerotatus) caspius

Leg. Hindtarsi without pale bands, with pale scales speckled at least on tarsomere 1



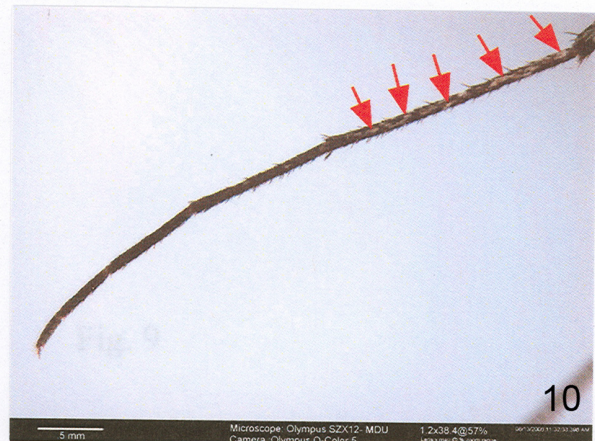
Aedes (Ochlerotatus) breedensis

Leg. Hindtarsi with basal pale bands on some tarsomeres



to Page 36D (4th page)

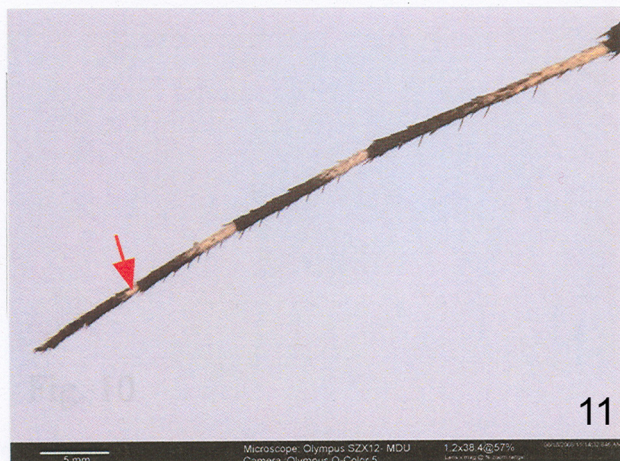
Leg. Hindtarsi without basal pale bands, with pale scales speckled on tarsomere 1



Aedes (Ochlerotatus) harrisoni

- FIGURE 7.** (Page 36C, 3rd page A). *Aedes (Ochlerotatus) caspius*.
FIGURE 8. (Page 36C, 3rd page A). *Aedes (Ochlerotatus) breedensis*.
FIGURE 9. (Page 36C, 3rd page B). *Aedes (Ochlerotatus) juppi*.
FIGURE 10. (Page 36C, 3rd page B). *Aedes (Ochlerotatus) harrisoni*.

Leg. Hindtarsomere 4 with distinct basal pale band

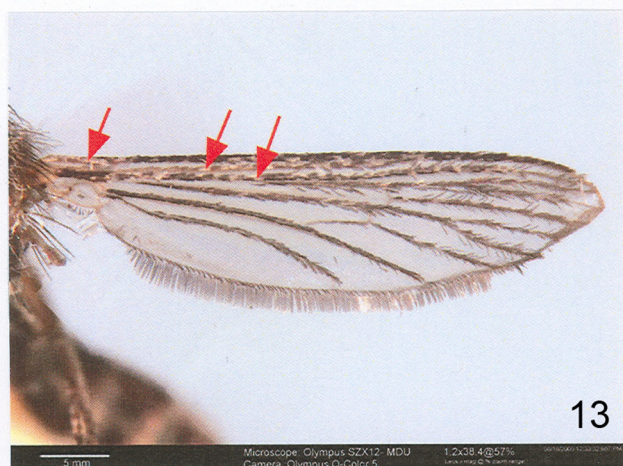


Leg. Hindtarsomere 4 without distinct basal pale band



Aedes (Ochlerotatus) juppi

Wing. Wing speckled with pale scales on anterior 3 veins (C, Sc, & R1)



Wing. Wing not speckled, at most with few pale scales on basal area of C vein



Aedes (Ochlerotatus) caballus

Aedes (Ochlerotatus) chelli

FIGURE 11. (Page 36D, 4th page). *Aedes (Ochlerotatus) juppi*.

FIGURE 12. (Page 36D, 4th page). *Aedes (Ochlerotatus) caballus*.

FIGURE 13. (Page 36D, 4th page). *Aedes (Ochlerotatus) caballus*.

FIGURE 14. (Page 36D, 4th page). *Aedes (Ochlerotatus) chelli*.

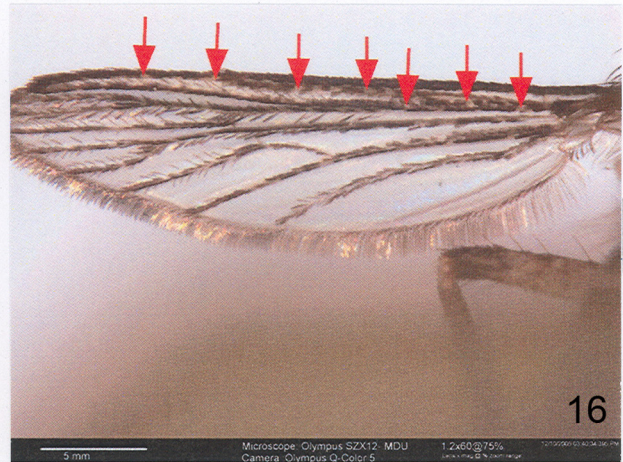
** 1

Head. Proboscis speckled with pale scales



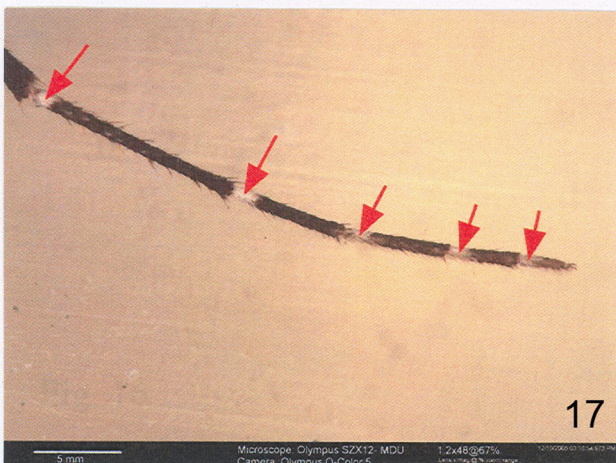
** 2

Wing. Wing speckled with pale scales



** 3

Leg. Hindtarsi with basal white bands on tarsomeres 1-5



Aedes (Coetzeomyia) fryeri

FIGURE 15. (Page 36E, 5th page). *Aedes (Coetzeomyia) fryeri*.
FIGURE 16. (Page 36E, 5th page). *Aedes (Coetzeomyia) fryeri*.
FIGURE 17. (Page 36E, 5th page). *Aedes (Coetzeomyia) fryeri*.