

Generic and subgeneric status of aedine mosquito species (Diptera: Culicidae: Aedini) occurring in the Australasian Region

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Abstract

Species of Aedini occurring in the Australasian Region are listed with their current generic-level assignments. The purpose of this list is to enable entomologists, public health personnel, and mosquito control workers to more quickly become familiar with recent formal taxonomic changes within the tribe.

Key words: Diptera, Culicidae, Aedini, Australasian Region, checklist, mosquitoes

Introduction

The most recent listings of aedine mosquitoes occurring in the Australasian Region (Foley 2002, Debenham and Hicks 1989) require revision because of modifications to generic-level taxa based on phylogenetic relationships recognized within the tribe Aedini (Reinert *et al.* 2004). This study is the largest cladistic analysis published to date on the Culicidae and includes 172 morphological characters of all life stages (eggs, fourth-instar larvae, pupae, females and genitalia, and males and genitalia) and 119 aedine species from all currently recognized genera and subgenera of the tribe. Adhering to the *International Code of Zoological Nomenclature* (International Commission on Zoological Nomenclature 1999), the cladistic analyses of Reinert *et al.* (2004) resulted in significant changes to the generic classification of the tribe, and the terminations of some species names were changed to agree in gender with newly recognized genera.

In the revised classification that resulted from the phylogenetic analyses, the genus *Aedes* Meigen is restricted to the former subgenus *Aedes*, which includes species outside the Australasian Region. Former subgenera of *Aedes*, i.e., *Christophersiomyia* Barraud, *Edwardsaedes* Belkin, *Huaedes* Huang, *Leptosomatomyia* Theobald, *Lorrainea* Belkin, *Neomelaniconion* Newstead, *Scutomyia* Theobald, and *Stegomyia* Theobald, are now recognized as genera. Former subgenera of *Ochlerotatus* Lynch Arribalzaga, i.e., *Finlaya* Theobald, *Geoskusea* Edwards, *Halaedes* Belkin, *Levua* Stone & Bohart, *Mucidus* Theobald, and *Rhinuskusea* Edwards, now have full generic status. *Armigeres* Theobald, *Heizmannia* Ludlow, *Opifex* Hutton, and *Verrallina* Theobald are still recognized as genera and their subgeneric classifications remain unchanged, except for *Opifex*, which now includes two monobasic subgenera, *Nothoskusea* Dumbleton and *Opifex*.

Twenty genera and 230 species (1 with subspecies) of Aedini are currently recognized in the Australasian Region, but only 116 of the species are now classified in one or other of the genera. One hundred and fourteen species of the region previously included in the subgenera *Bruceharrisonius* Reinert (1 species), *Chaetocruuiomyia* Theobald (8 species), *Finlaya* (47 species), *Macleaya* Theobald (3 species), *Molpemyia* Theobald (3 species), *Ochlerotatus* (43 species), *Pseudoskusea* Theobald (4 species), and subgenus uncertain (1 species) of *Ochlerotatus*, and four species of subgenus *Aedimorphus* Theobald of *Aedes* cannot be placed in a currently recognized genus and are regarded as *incertae sedis* (a Latin term meaning “of uncertain seat or affinity; used as a category of uncertain taxonomic position”) within Aedini. These species are indicated in the checklist below as belonging to genus (subgenus) of authors, e.g., *Aedes (Aedimorphus) sensu auctorum* (a Latin term meaning in the sense of authors; given to indicate that a name of uncertain taxonomic position — *incertae sedis* — is used in the sense of previous authors). These generic-level designations are not to be interpreted as having formal status. They are merely temporary repositories for the species listed below them. As an example, *Aedes (Aedimorphus) vexans* Meigen is a valid species of uncertain generic and subgeneric placement that was previously placed in the subgenus *Aedimorphus* of *Aedes*. Once the phylogenetic relationships of *incertae sedis* species have been analyzed, they will be retained in their current genera, assigned to new genera, or placed in genera resurrected from synonymy with the genera in which they were previously assigned. However, we emphasize that until such studies have been accomplished, *incertae sedis* species should continue to be cited with their accustomed generic and subgeneric affiliations. Studies are currently underway to resolve the taxonomy of the *incertae sedis* taxa.

Abbreviations used for the genera (2 letters) and subgenera (3 letters) of Culicidae follow Reinert (2001) and Reinert *et al.* (2004). The abbreviations for genera and subgenera of Aedini in the Australasian Region are indicated before the species listed below.

See Reinert *et al.* (2004) for a discussion of *Ae. (Adm.) vexans* and the synonymy of *nocturnus* (Theobald) with it. *Armigeres ventralis* (Walker) is considered a *nomen dubium* (a Latin term meaning a name of unknown or doubtful application because it is impossible

to establish the taxon to which it should be referred) (see discussion in Lee *et al.*, 1988:30).

Species with taxonomically valid generic and subgeneric placement

Tribe Aedini *sensu* Belkin, 1962

Genus *Armigeres* Theobald, 1901

Subgenus *Armigeres*

Ar. (Arm.) breinli (Taylor, 1914)

Ar. (Arm.) denbesteni Brug, 1925

Ar. (Arm.) lacuum Edwards, 1922

Ar. (Arm.) malayi (Theobald, 1901)

Ar. (Arm.) milnensis Lee, 1944

Ar. (Arm.) obturbans (Walker, 1859)

Ar. (Arm.) papuensis Peters, 1963

Subgenus *Leicesteria* Theobald, 1904

Ar. (Lei.) annulipalpis (Theobald, 1910)

Genus *Christophersiomyia* Barraud, 1923

Cr. chionodes (Belkin, 1962)

Genus *Edwardsaedes* Belkin, 1962

Ed. imprimens (Walker, 1860)

Genus *Finlaya* Theobald, 1903

Fl. alocasicola (Marks, 1947)

Fl. avistylus (Brug, 1939)

Fl. bougainvillensis (Marks, 1947)

Fl. burnetti (Belkin, 1962)

Fl. dobrotworskyi (Marks, 1958)

Fl. fijiensis (Marks, 1947)

Fl. flavipennis (Giles, 1904)

Fl. franclemonti (Belkin, 1962)

Fl. freycinetiae (Laird, 1957)

Fl. fuscipalpis (Belkin, 1962)

Fl. fuscitarsis (Belkin, 1962)

Fl. gahnicola (Marks, 1947)

Fl. hollingsheadi (Belkin, 1962)

Fl. josephinae (Marks, 1958)

Fl. knighti (Stone & Bohart, 1944)

Fl. kochi (Doenitz, 1901)

Fl. maffii (Taylor & Tenorio, 1974)

Fl. neogeorgiana (Belkin, 1962)

Fl. oceanica (Belkin, 1962)

Fl. samoana Grunberg, 1913

- Fl. schlosseri* (Belkin, 1962)
Fl. solomonis (Stone & Bohart, 1944)
Fl. tutuilae (Ramalingam & Belkin, 1965)
Fl. wallacei (Edwards, 1926)
- Genus *Geoskusea* Edwards, 1929
Ge. becki (Belkin, 1962)
Ge. daggyi (Stone & Bohart, 1944)
Ge. fimbripes (Edwards, 1924)
Ge. longiforceps (Edwards, 1929)
Ge. lunulata (King & Hoogstraal, 1946)
Ge. perryi (Belkin, 1962)
Ge. tonsa (Edwards, 1924)
- Genus *Halaedes* Belkin, 1962
Ha. ashworthi (Edwards, 1921)
Ha. australis (Erichson, 1842)
Ha. wardangensis (Brust, Ballard, Driver, Hartley, Galway & Curran, 1998)
- Genus *Heizmannia* Ludlow, 1905
Subgenus *Heizmannia*
H. (Hez.) aurea Brug, 1932
- Genus *Huaedes* Huang, 1968
Hu. medialis (Brug, 1932)
Hu. variepictus (King & Hoogstraal, 1946)
Hu. wauensis (Huang, 1968)
- Genus *Leptosomatomyia* Theobald, 1905
Lp. aurimargo (Edwards, 1922)
- Genus *Levua* Stone & Bohart, 1944
Le. geoskusea (Amos, 1944)
- Genus *Lorrainea* Belkin, 1962
Lo. dasyorrrhus (King & Hoogstraal, 1946)
Lo. lamellifera (Bohart & Ingram, 1946)
- Genus *Mucidus* Theobald, 1901
Mu. alternans (Westwood, 1835)
Mu. aurantius aurantius (Theobald, 1907)
Mu. aurantius chrysogaster Taylor, 1927
Mu. painei (Knight, 1948)
- Genus *Neomelaniconion* Newstead, 1907
Ne. lineatopenne (Ludlow, 1905)
- Genus *Opifex* Hutton, 1902
Subgenus *Nothoskusea* Dumbleton, 1962
Op. (Not.) chathamicus (Dumbleton, 1962)
Subgenus *Opifex*
Op. (Opi.) fuscus Hutton, 1902

- Genus *Rhinoskusea* Edwards, 1929
Rh. longirostris (Leicester, 1908)
- Genus *Scutomyia* Theobald, 1904
Sc. albolineata (Theobald, 1904)
- Genus *Stegomyia* Theobald, 1901
St. aegypti (Linnaeus, 1762)
St. albopicta (Skuse, 1895)
St. annandalei Theobald, 1910
St. aobae (Belkin, 1962)
St. cooki (Belkin, 1962)
St. futunae (Belkin, 1962)
St. gurneyi (Stone & Bohart, 1944)
St. hebridea (Edwards, 1926)
St. hensilli (Farner, 1945)
St. hoguei (Belkin, 1962)
St. horrescens (Edwards, 1935)
St. katherinensis (Woodhill, 1949)
St. kesseli (Huang & Hitchcock, 1980)
St. marshallensis (Stone & Bohart, 1944)
St. paullusi (Stone & Farner, 1945)
St. pernotata (Farner & Bohart, 1944)
St. polynesiensis (Marks, 1951)
St. pseudoscutellaris (Theobald, 1910)
St. quasiscutellaris (Farner & Bohart, 1944)
St. robinsoni (Belkin, 1962)
St. rotumae (Belkin, 1962)
St. scutellaris (Walker, 1858)
St. tabu (Ramalingam & Belkin, 1965)
St. tongae (Edwards, 1926)
St. tulagiensis (Edwards, 1926)
St. upolensis (Marks, 1957)
St. varuae (Belkin, 1962)
- Genus *Verrallina* Theobald, 1903
Subgenus *Neomacleaya* Theobald, 1907
Ve. (Nma.) campylostylus (Laffoon, 1946)
Ve. (Nma.) neomacrodixoa (King & Hoogstraal, 1947)
Ve. (Nma.) panayensis (Ludlow, 1914)
- Subgenus *Verrallina*
Ve. (Ver.) azueosquamata (Bonne-Wepster, 1948)
Ve. (Ver.) bifoliata (King & Hoogstraal, 1947)
Ve. (Ver.) butleri (Theobald, 1901)
Ve. (Ver.) carmenti (Edwards, 1924)
Ve. (Ver.) cuccioi (Belkin, 1962)

- Ve. (Ver.) cunninghami* (Taylor, 1944)
Ve. (Ver.) embiensis (Huang, 1968)
Ve. (Ver.) foliformis (King & Hoogstraal, 1947)
Ve. (Ver.) funerea (Theobald, 1903)
Ve. (Ver.) killertonis (Huang, 1968)
Ve. (Ver.) leilae (King & Hoogstraal, 1947)
Ve. (Ver.) lineata (Taylor, 1914)
Ve. (Ver.) mccormicki (Belkin, 1962)
Ve. (Ver.) milnensis (King & Hoogstraal, 1947)
Ve. (Ver.) multifolium (King & Hoogstraal, 1947)
Ve. (Ver.) obsoleta (Huang, 1968)
Ve. (Ver.) parasimilis (King & Hoogstraal, 1947)
Ve. (Ver.) quadrifolium (Brug, 1934)
Ve. (Ver.) quadrispinata (King & Hoogstraal, 1947)
Ve. (Ver.) reesi (King & Hoogstraal, 1947)
Ve. (Ver.) sentania (King & Hoogstraal, 1947)
Ve. (Ver.) similis (Theobald, 1910)
Ve. (Ver.) simpla (King & Hoogstraal, 1947)
Ve. (Ver.) trispinata (King & Hoogstraal, 1947)
Ve. (Ver.) vanapa (Huang, 1968)
Ve. (Ver.) variabilis (Huang, 1968)

***Incertae sedis* species with provisional generic and subgeneric placement**

- Genus *Aedes* Meigen, 1818, *sensu auctorum*
 Subgenus *Aedimorphus* Theobald, 1903, *sensu auctorum*
 Ae. (Adm.) alboscuteatus (Theobald, 1905)
 Ae. (Adm.) caecus (Theobald, 1901)
 Ae. (Adm.) lowisii (Theobald, 1910)
 Ae. (Adm.) vexans (Meigen, 1830)
- Genus *Ochlerotatus* Lynch Arribalzaga, 1891, *sensu auctorum*
 Subgenus *Bruceharrisonius* Reinert, 2003, *sensu auctorum*
 Oc. (Brh.) aureostriatus (Doleschall, 1857)
- Subgenus *Chaetocruuiomyia* Theobald, 1910, *sensu auctorum*
 Oc. (Cha.) calabyi (Marks, 1963)
 Oc. (Cha.) elchoensis (Taylor, 1929)
 Oc. (Cha.) humeralis (Edwards, 1922)
 Oc. (Cha.) macmillani (Marks, 1964)
 Oc. (Cha.) moloensis (Taylor, 1929)
 Oc. (Cha.) spinosipes Edwards, 1922
 Oc. (Cha.) tulliae (Taylor, 1929)
 Oc. (Cha.) wattensis (Taylor, 1929)

Subgenus *Finlaya* Theobald, 1903, *sensu auctorum*

- Oc. (Fin.) albilabris* (Edwards, 1925)
Oc. (Fin.) alboannulatus (Macquart, 1850)
Oc. (Fin.) alticola (Bonne-Wepster, 1948)
Oc. (Fin.) anggiensis (Bonne-Wepster, 1937)
Oc. (Fin.) argenteitarsis (Brug, 1932)
Oc. (Fin.) argyronotum (Belkin, 1962)
Oc. (Fin.) australiensis (Theobald, 1910)
Oc. (Fin.) biocellatus (Taylor, 1915)
Oc. (Fin.) britteni (Marks & Hodgkin, 1958)
Oc. (Fin.) buxtoni (Belkin, 1962)
Oc. (Fin.) candidoscutellum (Marks, 1947)
Oc. (Fin.) clintoni (Taylor, 1946)
Oc. (Fin.) derooki (Brug, 1932)
Oc. (Fin.) dobodurus (King & Hoogstraal, 1946)
Oc. (Fin.) gani (Bonne-Wepster, 1940)
Oc. (Fin.) gracilelineatus (Bonne-Wepster, 1937)
Oc. (Fin.) hollandius (King & Hoogstraal, 1946)
Oc. (Fin.) horotoi (Taylor, 1921)
Oc. (Fin.) iwi (Marks, 1955)
Oc. (Fin.) keefei (King & Hoogstraal, 1946)
Oc. (Fin.) lauriei Carter, 1920
Oc. (Fin.) mackerrasi (Taylor, 1927)
Oc. (Fin.) mallochi (Taylor, 1944)
Oc. (Fin.) milsoni (Taylor, 1915)
Oc. (Fin.) monocellatus (Marks, 1948)
Oc. (Fin.) notoscriptus (Skuse, 1889)
Oc. (Fin.) novalbitarsis (King & Hoogstraal, 1946)
Oc. (Fin.) occidentalis (Skuse, 1889)
Oc. (Fin.) palmarum (Edwards, 1924)
Oc. (Fin.) papuensis (Taylor, 1914)
Oc. (Fin.) plagosus (Marks, 1959)
Oc. (Fin.) plumiferus (King & Hoogstraal, 1946)
Oc. (Fin.) quasirubithorax (Theobald, 1910)
Oc. (Fin.) quinquelineatus (Edwards, 1922)
Oc. (Fin.) roai (Belkin, 1962)
Oc. (Fin.) rubiginosus (Belkin, 1962)
Oc. (Fin.) rubrithorax (Macquart, 1850)
Oc. (Fin.) rupestris (Dobrotworsky, 1959)
Oc. (Fin.) shehzadae (Qutubuddin, 1972)
Oc. (Fin.) stanleyi (Peters, 1963)
Oc. (Fin.) subalbitarsis (King & Hoogstraal, 1946)
Oc. (Fin.) subauridorsum (Marks, 1948)

- Oc. (Fin.) subbasalis* (Dobrotworsky, 1962)
Oc. (Fin.) toxopeusi (Bonne-Wepster, 1948)
Oc. (Fin.) tsiliensis (King & Hoogstraal, 1946)
Oc. (Fin.) tubbutiensis (Dobrotworsky, 1959)
Oc. (Fin.) wasselli (Marks, 1947)

Subgenus *Macleaya* Theobald, 1903, *sensu auctorum*

- Oc. (Mac.) littlechildi* (Taylor, 1933)
Oc. (Mac.) stoneorum (Marks, 1977)
Oc. (Mac.) tremulus (Theobald, 1903)

Subgenus *Molpemyia* Theobald, 1910, *sensu auctorum*

- Oc. (Mol.) auridorsum* (Edwards, 1922)
Oc. (Mol.) pecuniosus (Edwards, 1922)
Oc. (Mol.) purpureus (Theobald, 1910)

Subgenus *Ochlerotatus*, *sensu auctorum*

- Oc. (Och.) aculeatus* (Theobald, 1903)
Oc. (Och.) andersoni (Edwards, 1926)
Oc. (Och.) antipodeus Edwards, 1920
Oc. (Och.) burpengaryensis (Theobald, 1905)
Oc. (Och.) cacozelus (Marks, 1963)
Oc. (Och.) calcariae (Marks, 1957)
Oc. (Och.) camptorhynchus (Thomson, 1869)
Oc. (Och.) clelandi (Taylor, 1914)
Oc. (Och.) continentalis (Dobrotworsky, 1960)
Oc. (Och.) cunabulanus (Edwards, 1924)
Oc. (Och.) edgari (Stone & Rosen, 1952)
Oc. (Och.) eidsvoldensis (Mackerras, 1927)
Oc. (Och.) explorator (Marks, 1964)
Oc. (Och.) flavifrons (Skuse, 1889)
Oc. (Och.) hesperonotius (Marks, 1959)
Oc. (Och.) hodgkini (Marks, 1959)
Oc. (Och.) imperfectus (Dobrotworsky, 1962)
Oc. (Och.) inexpectatus (Bonne-Wepster, 1948)
Oc. (Och.) linesi (Marks, 1964)
Oc. (Och.) luteifemur (Edwards, 1926)
Oc. (Och.) macintoshi (Marks, 1959)
Oc. (Och.) mcdonaldi (Belkin, 1962)
Oc. (Och.) nigrithorax (Macquart, 1847)
Oc. (Och.) nivalis (Edwards, 1926)
Oc. (Och.) normanensis (Taylor, 1915)
Oc. (Och.) perkinsi (Marks, 1949)
Oc. (Och.) phaecasiatus (Marks, 1964)
Oc. (Och.) procax (Skuse, 1889)
Oc. (Och.) pseudonormanensis (Marks, 1949)

Oc. (Och.) purpuraceus (Brug, 1932)
Oc. (Och.) purpureifemur (Marks, 1959)
Oc. (Och.) purpuriventris (Edwards, 1926)
Oc. (Och.) ratcliffei (Marks, 1959)
Oc. (Och.) sagax (Skuse, 1889)
Oc. (Och.) sapiens (Marks, 1964)
Oc. (Och.) silvestris (Dobrotworsky, 1961)
Oc. (Och.) spilotus (Marks, 1963)
Oc. (Och.) stricklandi Edwards, 1912
Oc. (Och.) subalbirostris (Klein & Marks, 1960)
Oc. (Och.) theobaldi (Taylor, 1914)
Oc. (Och.) turneri (Marks, 1963)
Oc. (Och.) vigilax (Skuse, 1889)
Oc. (Och.) vittiger (Skuse, 1889)

Subgenus *Pseudoskusea* Theobald, 1907, *sensu auctorum*

Oc. (Psk.) bancroftianus (Edwards, 1921)
Oc. (Psk.) culiciformis (Theobald, 1905)
Oc. (Psk.) multiplex (Theobald, 1903)
Oc. (Psk.) postspiraculosus (Dobrotworsky, 1961)

Subgenus uncertain

Oc. daliensis (Taylor, 1916)

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