

# Taxonomy of *Aedes aegypti* and Related Species

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## INFRASPECIFIC TAXONOMY

This subject has been discussed at some length by Mattingly (1957, 1958). *Aedes aegypti* exhibits a continuous spectrum of colour variation, from very pale forms at one end to very dark ones at the other. There is good evidence for associating colour differences with important behavioural differences, and the situation seems, therefore, to call for some sort of taxonomic treatment. It is, however, a difficult situation taxonomically and one which can only be met by somewhat unconventional procedures.

Comparison with the *Culex pipiens* complex is interesting. Here the analogue of the pale form of *A. aegypti*, i.e., *A. aegypti* var. *queenslandensis*, might be *C. p.* var. *molestus*. Both are highly domestic, at least in certain parts of their range. In var. *molestus*, man-made underground breeding-places are used as refuges in colder latitudes, and autogeny is highly developed as an adjunct to this type of behaviour. In both respects, there is a marked difference from *C. p. pipiens*. In warmer latitudes selection by the environment is diminished, and both distinctions break down. It is possible that var. *queenslandensis* may be less domestic in some of the hotter and drier parts of its range, but the author has no evidence of this. All evidence available indicates that it is everywhere highly man-adapted. The best quantitative evidence comes from the Kenya coast, where it occurs together with darker forms. Here the difference in behaviour between the two was such as seriously to confuse the assessment of the results of spraying with residual insecticides (Mattingly, 1957, 1958).

At the other end of the spectrum are the dark, more or less wild forms of *A. aegypti* found in the more humid parts of Africa, which show a marked reluctance to bite man and may even prefer natural, as opposed to artificial, breeding-places. The best known of these are certain populations from western

Uganda and western Kenya, but another was recently recorded from the Niger delta (Boorman & Service, 1960). Although there is, as in the *C. pipiens* complex, a continuous spectrum of behavioural and colour variation, an arbitrary infraspecific classification may have some utility. Very dark, relatively wild forms of *A. aegypti* appear to be confined to Africa and to be absent at least from the very dry parts of that continent. The indications seem to be that, at least until recently, var. *queenslandensis* was similarly restricted to relatively dry peripheral areas. This would possibly justify the treatment of the darker forms as a subspecies, and it is tentatively proposed the name ssp. *formosus* be given for these. With the opening up of communications and other man-made alterations in the environment, however, this situation may well prove unstable, so that the distinction no longer remains tenable. Var. *queenslandensis* occurs commonly in all parts of the range outside Africa, and it does not seem possible to give it more than varietal rank. On this basis, there remains no alternative but to treat the intermediate forms as the type form.

The discovery that the species described by Linnaeus as *Culex aegypti* was not, in fact, the yellow-fever mosquito, but a species of *Ochlerotatus*, has also necessitated highly unconventional nomenclatorial treatment. As a result of a nearly unanimous vote on the part of the Commissioners of the International Commission for Zoological Nomenclature, the name *A. aegypti* is now firmly attached to a neotype and a long series of brother and sister paratypes all nearly at the centre of the range of colour variation (Mattingly, Stone & Knight, 1962; China, 1964). On theoretical grounds, it might have been better to have designated as the type form the wild, dark African populations and to have chosen a neotype from among these. There are some grounds for believing that they may represent the ancestral *A. aegypti* from which the paler forms have been derived. These grounds appear to be uncertain, however, and it is therefore preferred to

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make the choice of neotype a matter of practical convenience:

#### ORIGINS OF *A. AEGYPTI*

In considering the possible origins of *A. aegypti*, the most interesting form of this species is ssp. *mascarensis*. This is a good geographical subspecies, confined to Mauritius, where *A. aegypti* s.str. no longer occurs. It is a wild forest mosquito differing from the type form in some striking colour characters. The two are, nevertheless, fully reproductively compatible in both directions (McClelland & Mamet, 1962). The most striking difference from the type form lies in the presence of white or whitish scales covering the whole of the mesonotum almost as far back as the wing roots. This type of scutal pattern is unknown elsewhere in Group A of the *Stegomyia* subgenus and for this reason *A. mascarensis* was formerly placed in Group B. There are, however, patches of broader white scales on the shoulders recalling the anterolateral patches characteristic of Group A. The pattern as a whole closely resembles that found in some species of the Oriental *A. (Finlaya) niveus* group. For reasons given below, it is not believed that too much weight should be given to characters of this kind in assessing relationships. There is, however, a general suggestion that the subgenus *Stegomyia* may be related to tree-hole and rock-pool breeding *Finlaya*. It remains an open question which of these should be regarded as the primitive breeding-place of *A. aegypti* (Mattingly, 1957).

#### RELATIONSHIPS WITHIN GROUP A

The subgenus *Stegomyia*, as currently defined, contains about 100 species. It is divided into 8 species groups lettered from A to H. *A. aegypti* is placed in Group A, which includes 34 species. All of these, except the aberrant *A. chemulpoensis* from China and Korea, are African, and all of the African species are included except *A. vittatus*, which is placed in the monotypic Group D; *A. amaltheus*, which is placed in Group B; and *A. unilineatus*, which is placed in Group C. Diagnostic characters for Groups A, B and D, and suggestions as to subgroups, will be found in Mattingly (1965). On morphological grounds, the nearest relatives of *A. aegypti* have long been thought to be the *A. simpsoni* complex (*A. simpsoni*, *A. woodi* and *A. strelitziae*), together with *A. subargenteus* and the related

*A. kivuensis*. Confirmation of the relationship to *A. simpsoni* is perhaps to be found in the successful crossing of this species with *A. aegypti* by McClelland (1961). *A. simpsoni* is widespread in Africa, but this is undoubtedly due, in part, to human transportation in the leaf axils of plants used as articles of commerce. Apart from this, there is a general association of *A. subargenteus* and the *A. simpsoni* complex with the East African lowlands, from Kenya to Cape Province, and also, interestingly, with Malawi (Mattingly, 1952, 1953). The mosquito fauna of Malawi has some characteristics suggestive of a meeting-place between the East- and West-African faunas. *A. kivuensis* is known only from the area north of Lake Kivu, and this is interesting, because *A. aegypti* has been found in the same area as a wild mosquito breeding in rock holes in lava about 10 km from the nearest human settlement (Mattingly, 1952).

#### RELATIONSHIP WITH GROUP C

The successful hybridization of *Aedes albopictus* with *A. aegypti* (Woodhill, 1959) raises the possibility of naturally occurring hybridization between Groups A and C. This possibility is given added interest by the discovery in Mauritius of a species, *A. vinsoni*, having much the appearance of an *A. albopictus-mascarensis* hybrid (Mattingly, 1964). The possibility of natural hybridization in Mauritius is admitted; however, it is not considered that this process is likely to have been of any importance in the evolution of *Stegomyia* in general. Other examples carrying a possible suggestion of hybridization are *A. amaltheus*, from Zambia, Southern Rhodesia and Botswana, which has scutal markings as in Group A and male terminalia as in Groups B and C, and *A. granti*, from Socotra, which combines features of the *A. albopictus* and *A. scutellaris* subgroups of Group C. It is true that *A. granti* exhibits the curious type of pleural scaling characteristic of the *scutellaris* subgroup, while the abdominal tergal white bands are basal, as in *albopictus*, but, on the other hand, the characteristic posterior displacement of the abdominal tergal bands is found, apparently at the varietal level, in the Group B species *A. annandalei* (Mattingly, 1965). The situation is analogous to that which would arise if one pressed too far the attempt to derive *Stegomyia* from the *A. niveus* group of *Finlaya* on the basis of the very close similarity in scutal ornamentation noted above. Equally cogent resemblances could be

quoted suggesting the derivation of Groups B and E from the *A. (Finlaya) papuensis* group. Phylogenetic speculation is an amusing intellectual pastime but it needs to be backed by sophisticated

genetical studies if it is to have any practical utility. At present not enough is known to claim with any confidence that the subgenus *Stegomyia* is monophyletic.

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