

NOTES ON THE TAXONOMY OF THE *AÈDES SCUTELLARIS* GROUP, AND NEW RECORDS OF *A. PAULLUSI* AND *A. ALBOPICTUS* (DIPTERA: CULICIDAE).

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(One Text-figure.)

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*Synopsis.*

A Malayan form of *Aedes* "*scutellaris*" is shown by hybridization experiments to be fully interfertile with the type form from New Guinea. It is described as *A. s. malayensis*, subsp. nov., and it is proposed that *A. hensilli* of the Carolines be also considered a subspecies of *A. scutellaris*. Records are also given of *A. paullusi* from North Borneo and *A. albopictus* from New Guinea.

In an earlier paper (Colless, 1957), a form of *Aedes* "*scutellaris*"\* was recorded from Singapore. The form was there identified as *A. hensilli* Farner and it was noted that it also appeared to be conspecific with the Philippine form, described as *A. scutellaris* by Knight and Hull (1952). It was thought at that time that it might be a recent immigrant into Malaya, established in only the one locality, but there are now records from two other localities: Pulau Jarak, a small island in Malacca Strait, and Kuantan, on the east coast. The form is therefore distributed right around Malaya, although its foothold seems rather precarious; it is probably restricted to the offshore islands and the immediate coast, by competition from the widespread and abundant *A. albopictus*.

A study has been made of the identity and taxonomic status of this form and hybridization tests have been carried out with *Aedes scutellaris scutellaris* from New Guinea. The results and taxonomic conclusions are discussed below. Records are also given of another member of the group from North Borneo, and of the related *A. albopictus* from New Guinea.

A. HYBRIDIZATION EXPERIMENTS.

*Material and Methods.*

Colonies of the Malayan form from Singapore, and *A. s. scutellaris*, from Hollandia, New Guinea, were established from eggs kindly supplied by Mr. W. Chellapah and Dr. R. Sloof respectively. Crosses were made in both directions, using newly emerged adults (sexed in the pupal stage), held on 80° F. and circa 80% R.H., in cages of 1 cub. ft. capacity. One cross was made with *scutellaris* as the male parent and two in the reverse direction. Some 50-100 males were used in each experiment, and a similar number of females of the Malayan form. Difficulties with the parent colony allowed the use of only five female *scutellaris* in one cross, and 12 in the other, but clear-cut results were obtained. Eggs were kept moist for 48 hours and then dried, usually for about one week, but up to six weeks in one instance. F<sub>2</sub> adults were obtained from each cross, but no backcrosses were attempted. All colonies were held in the same room, but no evidence of cross-contamination appeared in the results.

*Results.*

Detailed quantitative records were not kept, but the results are simply presented in the statement that the cross appeared to be a complete success in both directions. Egg production, hatching percentages, sex ratios, and vigour of adults and larvae showed no apparent deviation from normal; in fact, the hybrid colonies flourished better than those of the *scutellaris* parent, which, for some unknown reason, were difficult to maintain.

\* I am following the convention of Reid (1950), of using the species-group name in inverted commas for members whose precise identity is in doubt.

The only obvious morphological difference between the parent forms lies in the shape of the basal lobe of the male coxite, a stable and very distinctive character (Figs 1a, 1c). In F1 progeny from all crosses the form of the lobe was intermediate, with perhaps a slightly stronger resemblance to the Malayan form. Moreover, in some 20 specimens dissected, it showed very little variation. In the F2 progeny, there was obvious segregation into a variety of forms, some approaching those of the parents and F1, others of various intermediate types (Figs 1d, 1e, 1f). Subjective estimates of shape are difficult, but I would say that none (of some 30 specimens dissected) was absolutely identical with *scutellaris* and few, if any, with the Malayan form. The character is obviously determined by a number of genes.

#### Discussion.

No genetic barrier could be demonstrated between the two forms and, in view of their allopatric distributions, sub-specific status seems appropriate for the Malayan form. The question remains of its relationship to other Malaysian forms and the very similar *A. hensilli* of the Caroline Islands. From Knight and Hull (1952), it appears to be identical with their "*A. scutellaris*" from the Philippines, and the male terminalia seem identical with those of *A. hensilli* (Bohart and Ingram, 1946; Bohart, 1956). The latter is distinguishable, however, by having hind tarsal segment V partly black, and segment IV at least half black, although there is a variant population in Truk in which some 50% have segment V all white (Bohart and Ingram, *op. cit.*). Clearly, *hensilli* has evolved from an isolated eastern population of the Malayan form, and some of the Truk specimens may not be distinguishable from it. (It is not clear whether such variant specimens occur in Palau, to the west.)

*A. s. scutellaris* is known to occur in the south-western islands of the Carolines and it is worth noting that such specimens (as figured by Bohart, *op. cit.*) have the apex of the basal lobe more prominent and rounded than usual. It is, in fact, very similar to that seen in some of the above hybrids. One of the lobes figured for *A. hensilli* (Bohart, *op. cit.*, fig. 10g) is also rather reminiscent of certain segregants. It is, then, plausible that some degree of hybridization has occurred in these islands. It is also conceivable that the variation in colour of tarsal scaling in *hensilli* is the result of secondary intergradation, i.e., introgression of genes from *scutellaris* or, in Truk, from the local *scutoscriptus*. In any case, *hensilli* would seem to be better treated as a subspecies of *scutellaris*.

It seems therefore that, in addition to the Australian *A. s. katharinensis*, three distinct subspecies can be recognized: *s. scutellaris*, extending into, perhaps, the Moluccas, and north into the Carolines; *s. hensilli* of the Carolines, typically represented on Ulithi, and with variant forms, possibly due to hybridization, on other islands; and another subspecies in Malaya, the Philippines, and other islands of the archipelago (probably including Sumatra). The western limits of the type form and eastern limits of the Malayan form are not yet known, and zones of intergradation or clinal variation may yet be discovered. Formal recognition of these forms is proposed in the next section.

#### B. SYSTEMATICS.

##### AÈDES (STEGOMYIA) SCUTELLARIS SCUTELLARIS (Walker).

*Culex scutellaris*, Walker, 1859; *Proc. Linn. Soc. London*, 3: 77. (Aru Islands.) (For full synonymy, see Bohart, *op. cit.*)

Full descriptions are given by previous authors (see Bohart, *op. cit.*), but only Marks (1954, p. 372) discusses the critical features of the basal lobe of the coxite. This has a very characteristic truncate appearance as follows: Expanded portion, in lateral view, with sides more or less parallel, sternal angle rather sharp; modified setae usually 4-6 in number, set on a slight prominence; apical portion of the lobe only slightly rounded or almost square, the inner face with the long setae concentrated near the apex (see Fig. 1c, and Marks, 1954, Plate 18).

Also, hind tarsal segment IV has the pale band covering about 0.7 of its length.

*Distribution*: New Hebrides; Rennell and Bellona Is.; New Guinea; Australia (Cape York); Carolines (Palau and western atolls); Aru; probably also some islands of the Moluccas.

*AËDES (STEGOMYIA) SCUTELLARIS MALAYENSIS*, subsp. nov.

*Types*. Holotype male, allotype female (both from laboratory colony), and 10 paratypes of each sex, in the Australian National Insect Collection, Canberra. Paratype series also to be lodged in the British Museum, United States National Museum, and the Bishop Museum, Hawaii.

*Type locality*: Pulau Hantu, Keppel Harbour, Singapore (see Colless, 1957, for exact locality).

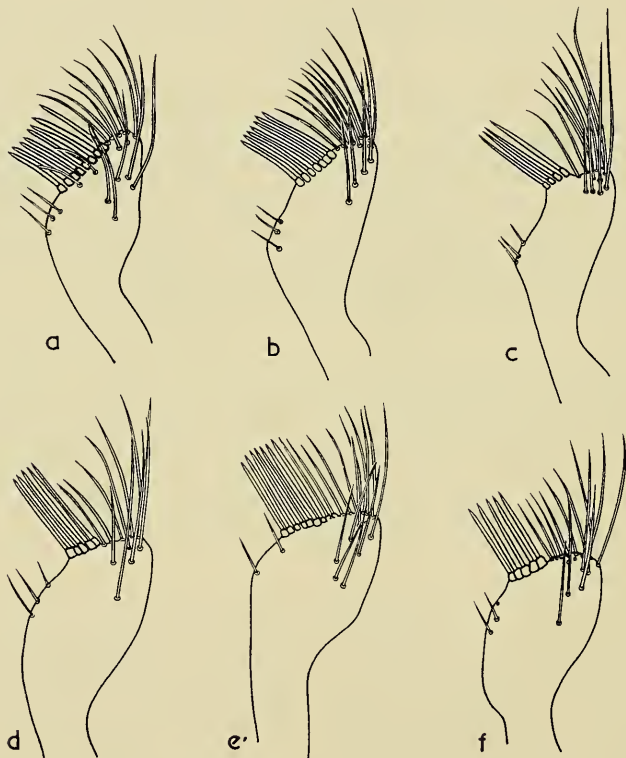


Fig. 1. Basal lobes of male coxites. (a) *A. s. malayensis*, (b) F1 hybrid, (c) *A. s. scutellaris*, (d-f) F2 hybrids.

*Adult*. Differs from *A. s. scutellaris* only as follows: Basal lobe of male coxite with the expanded portion subtriangular in lateral view, not truncate, the sides not parallel but tapering, sternal angle rounded; modified setae usually 7-10 in number, forming a more prominent row, not set on a prominence; inner face with long apical setae extending further basally.

*Specimens examined*: *Singapore*: Numerous specimens from the type locality, and their descendants in laboratory culture; collections in 1954, 1957, 1960 (W. Chellapah). *Malaya*: Kuantan, 6 ♂♂, 6 ♀♀ (R. H. Wharton); Pulau Jarak, 3 ♂♂, 5 ♀♀, 4.xi.1958 (W. W. Macdonald). Also known from the Philippines.

*AËDES (STEGOMYIA) SCUTELLARIS HENSILLI* Farner.

*Aëdes hensilli*, Farner, 1945; *Proc. biol. Soc. Wash.*, 58: 59. (Ulithi Atoll, Carolines.) (See Bohart, *op. cit.*, for other references.)



*Adult.* Closely similar to *A. s. malayensis* in almost all respects, including the male terminalia. Differing from that form, and *A. s. scutellaris*, as follows: Hind tarsal segment V black on about the apical half; segment IV with the pale band covering only about 0.4-0.6 of its length.

Variant populations are known, in which a proportion of specimens have segment V all white, but this condition has not been recorded from the type locality.

*Distribution.* Generally throughout the Caroline Islands, as far east as Nukuoro Atoll.

AÈDES (STEGOMYIA) PAULLUSI Stone & Farner.

*Aedes paullusi*, Stone & Farner, 1945; *Proc. Biol. Soc. Wash.*, 58: 155. (Samar, Philippines) Knight & Hull, 1952, *Pac. Sci.*, 6: 178.

Originally described from the Philippines, this species has also been reported from various Indonesian islands. Marks (1954) pointed out that, with the exception of Sangir Is., some of these records may refer to *A. alorensis*. It can now be reported with certainty that *paullusi* is widespread in North Borneo; I have specimens from both east and west coasts and the interior. Strangely enough, all were reared from larvae taken in tree holes, bamboo stumps, etc.; none was ever taken biting around the breeding places.

The species is readily recognized by the pale anterior stripe on the mid-femur, the antero-lateral stripe on the scutum, and the characteristic male terminalia.

*Specimens seen:* North Borneo: Tawau, Feb., 1960, 3 ♂♂, 5 ♀♀; Keningau, Aug., 1956, 9 ♂♂, 2 ♀♀; Jesselton, Sept., 1945, 1 ♀, and July-Aug., 1956, 7 ♂♂, 7 ♀♀ (all coll. D. H. Colless).

AÈDES (STEGOMYIA) ALBOPICTUS (Skuse).

*Culex albopictus* Skuse, 1894, *Indian Museum Notes*, 3: 20. (Calcutta.)

This widespread species has been reported on a number of occasions from New Guinea, but such records have generally been considered doubtful, and possibly referring to the closely related *A. scutellaris*. *A. albopictus* can now be recorded with confidence from Hollandia, Western New Guinea, as it was present as a contaminant in a batch of *scutellaris* eggs received from that area. The specimens have been checked thoroughly, including the male terminalia, and their identity is certain. It is not known, however, how widespread the species is around Hollandia, nor how long it has been there.

*Acknowledgements.*

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