

DEPARTMENT OF BIOLOGY.

VOLUME II.

1947.

NUMBER 5.

STUDIES OF QUEENSLAND MOSQUITOES.

Part I.: The *Aedes (Finlaya) kochi* Group with Descriptions
of New Species from Queensland, Bougainville and Fiji.

By

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DATE OF PUBLICATION:

9TH JULY, 1947.

A. H. TUCKER, Government Printer, Brisbane.

PREFACE



In 1943 the Government of Queensland established a National Mosquito Control Committee consisting of the following:—

Director-General of Health (Sir Raphael Cilento), Chairman;

Director-General of Education (Mr. L. D. Edwards);

Professor of Biology (Professor E. J. Goddard);

Lecturer in Economic Entomology (Mr. F. A. Perkins);

Representative (Technical) of the Local Authorities (Dr. L. A. McLean).

One of the functions of the Committee is to institute a research programme dealing with all aspects of the mosquito problem in Queensland.

This paper by Miss Marks is the first of a series dealing with the systematics and biology of Queensland mosquitoes.

The action of the Government of Queensland in making available the necessary funds to enable this work to be carried out is greatly appreciated.

F. A. PERKINS, Secretary,
National Mosquito Control Committee

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STUDIES OF QUEENSLAND MOSQUITOES.

1. THE *AÈDES* (*FINLAYA*) *KOCHI* GROUP WITH DESCRIPTIONS OF NEW SPECIES FROM QUEENSLAND, BOUGAINVILLE AND FIJI.

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(WITH 20 TEXT FIGURES.)

I. INTRODUCTION.

Aedes (*Finlaya*) *kochi* which gives its name to this group of species was described by Dönitz in 1901. Since that date a number of species have been described, some of which for a time have been regarded as synonyms, and have subsequently been again elevated to specific rank. This has been due to the close similarity between the females of different species; when the males have been discovered, marked differences in genitalia characters have enabled the species to be separated. Some members of the group are vicious biters and have considerable nuisance value; *A. kochi* is also an efficient carrier of *Wuchereria bancrofti* and as several species have hitherto been confused under this name, it may prove of some importance to be able to separate them.

Larvae of several species have been figured or described, but hitherto insufficient information has been available to form any clear picture of larval relationships. Various members of the Forces recently stationed in the South-west Pacific area have, by their cooperation, provided a large amount of material for study, in addition to collections made locally. As a result, it has been possible to clear up some of the confusion still existing among certain species, and to gain a broad view of larval relationships which may have some bearing on the evolution of the group.

This paper includes descriptions of males of two described species (*A. kochi*, *A. wallacei*) and of both sexes of four new species (*A. bougainvillensis*, *A. fijiensis*, *A. alocasicola*, *A. gahnicola*); descriptions of larvae of all the foregoing and of *A. solomonis*; descriptions of pupae of *A. kochi*, *A. bougainvillensis*, *A. alocasicola*, *A. gahnicola* and *A. solomonis*; and notes on the distinctive characters of five additional species (*A. poicilius*, *A. samoanus*, *A. flavipennis*, *A. aranetanus*, *A. avistylus*)¹.

II. RELATIONSHIPS WITHIN THE GROUP.

The *kochi* group (*Finlaya* s. str.; *A. poicilius* is the genotype of subgenus *Finlaya*) is clearly marked off from the rest of the subgenus *Finlaya* by having spotted wings with broad wing scales; numerous light spots or rings on femora and tibiae, and banded tarsi; scales of vertex, posterior pronotum and scutellum almost all broad and flat; outstanding scales apically on some abdominal sternites. All known larvae breed in water in plant axils, and have thorax and abdomen clothed with stellate setae.

¹For completeness, reference has also been made to a number of specimens of undescribed or unidentified species. It is understood that species of the *kochi* group occurring in the Philippines will be dealt with in a forthcoming paper by Lt.Cmdr. K. L. Knight, U.S.N. For further information on the group, the reader is referred to the recent paper by Stone and Bohart (1944).

The group is distributed over the Austro-Malayan Region and in the most recent review of it (Stone and Bohart, 1944) nine species are recognised:—

<i>Aedes (Finlaya) kochi</i> (Dönitz, 1901)	New Guinea, New Ireland, Nissan, North and South Queensland.
<i>Aedes (Finlaya) poicilius</i> (Theobald, 1903)	Philippines, India, Malaya, Netherlands Indies.
<i>Aedes (Finlaya) flavipennis</i> (Giles, 1904) . .	Philippines.
<i>Aedes (Finlaya) aranetanus</i> (Banks, 1906)	Philippines, Borneo.
<i>Aedes (Finlaya) samoanus</i> (Grünberg, 1913)	Samoa, Tonga.
<i>Aedes (Finlaya) wallacei</i> Edwards, 1926 . .	New Ireland, New Guinea.
<i>Aedes (Finlaya) avistylus</i> Brug, 1939	Celebes, Boeton, Morotai.
<i>Aedes (Finlaya) solomonis</i> Stone and Bohart, 1944	Solomons.
<i>Aedes (Finlaya) knighti</i> Stone and Bohart, 1944 to which are now added:	Solomons.
<i>Aedes (Finlaya) bougainvillensis</i>	Solomons.
<i>Aedes (Finlaya) fijiensis</i>	Fiji.
<i>Aedes (Finlaya) alocasicola</i>	Sth. Queensland.
<i>Aedes (Finlaya) gahnicola</i>	Sth. Queensland.

On general appearances the group separates into two well defined types:—

1. *Flavipennis* type, with extensive yellow scaling; apical $\frac{2}{3}$ of female proboscis yellow; hind tarsal segments II. and III. with narrow basal black bands, IV. black and yellow (*flavipennis*, *aranetanus*, *avistylus*, *solomonis*).

2. *Kochi* type, with pale scaling less extensive and largely white; female proboscis with medial pale band; hind tarsal segments II. and III. with basal $\frac{1}{2}$ — $\frac{2}{3}$ black, IV. all black (*kochi*, *poicilius*, *samoanus*, *bougainvillensis*, *fijiensis*, *alocasicola*, *gahnicola*).

Wallacei and *knighti* do not fall readily into either group.

The new species described in this paper are all of the *kochi* type, and with the exception of *gahnicola* have at some time been described for *kochi*. Previous authors have lacked a good series of males, females and larvae of *kochi* from New Guinea, and now that these have become available, it has been possible to separate the related species.

Examination of the male genitalia indicates different relationships from the foregoing, the group being again divided into two types.

1. A specialised seta at base of coxite; appendage of harpago expanded and with blunt tip (*kochi*, *bougainvillensis*, *fijiensis*, *wallacei*, *solomonis*).

2. No specialised seta at base of coxite; appendage of harpago slender and sharply pointed (*poicilius*, *alocasicola*, *gahnicola*, *flavipennis*, *aranetanus*, *avistylus*).

Knighti and *samoanus* are intermediate in characters.

Neither general coloration, nor structure of genitalia shows any obvious relationship to geographical distribution, yet the group is one in which geographical speciation would appear to have been active, only *kochi* and *poicilius* having a wide distribution. A study of the larvae of nine identified species, together with figures and descriptions of two more, and larvae of two unidentified species belonging to the group, shows, with certain exceptions, a relationship between the form of the teeth in the distal row of the lateral comb (hereunder for brevity referred to as comb teeth) and the distribution of the species (Fig. 1).

A. kochi may be taken as a basis for comparison as it is a species with a wide range, and one whose chief habitat, New Guinea, is centrally situated in the area of distribution of the group as a whole. *Kochi* (Milne Bay and Lae specimens) has a stout, pointed comb tooth, giving off at $\frac{1}{3}$ from its base a pair of very short, stout, bluntly pointed lateral spines (rarely 3 or 4),

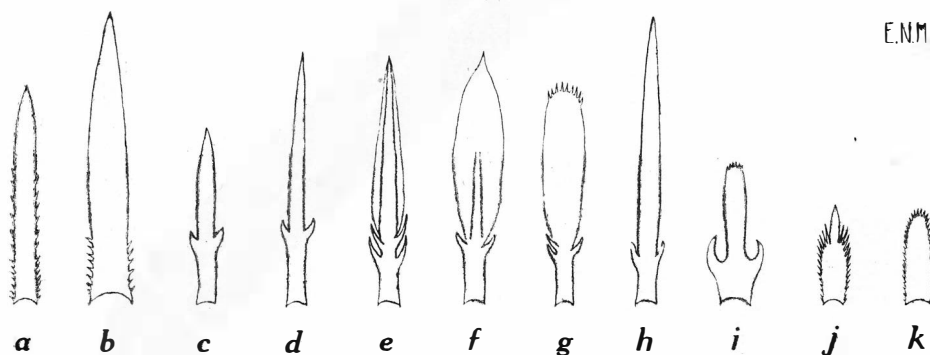


FIG. 1.—Teeth from distal row of lateral comb of various members of the *Aedes kochi* group. *a*, *gahnicola* (S. Q'ld.). *b*, *alocasicola* (S. Q'ld.). *c*, *kochi* (Q'ld. N.G.). *d*, *wallacei* (N.G.). *e*, *bougainvillensis* (Solomons). *f*, *solomonis* (Solomons). *g*, *fijiensis* (Fiji). *h*, sp. near *poicilius* (Philippines). *i*, unidentified species (Borneo). *j*, *avistylus* (Celebes etc.). *k*, *flavipennis* (Philippines). (x 400.)

beyond which the medial spine is stout and tapers to a sharp point. Very little variation is shown over the whole of the range of this species, probably no more than would be shown in a large series from one area. A specimen from Nissan, which is probably near its easterly limit, has one comb tooth with an apically fringed medial spine. In specimens from Alexandra Headland, near its southern limit, comb teeth with 3 or 4 lateral spines occur more frequently, as they do also in specimens from Merauke.

The easterly range of *kochi* in New Guinea coincides with that of *wallacei* and larvae of the two species may be found in the same plant. The comb tooth of *wallacei* bears a general resemblance to that of *kochi*, but the 2 (or occasionally 3) short lateral spines arise at $\frac{1}{4}$ its length, the medial spine being long and slender, tapering to a fine point.

To the east, in the Solomons, the place of *kochi* is taken by *bougainvillensis*, the comb tooth of which is very similar to that of *wallacei*; there are, however, usually two pairs of short, rather slender and sharply pointed lateral spines, and the medial spine, under high magnification, appears to be slightly broadened with almost transparent lateral flanges. *Solomonis* has a similar range to *bougainvillensis* and may breed in the same plant; its comb tooth has 2-4 short lateral spines and the medial spine is broad and flattened, somewhat thickened medially towards its base, and with sharply pointed apex.

In Fiji, the group is represented by *fijiensis*, in which the comb tooth gives off at $\frac{1}{3}$ from its base 2-4 short lateral spines; the medial spine, as in *solomonis*, is broad and flattened, but has a rounded, fringed apex. A similar comb tooth is figured (Buxton and Hopkins, 1927) for *samoanus*, which, so far as is known, represents the most easterly extension of the group in Tonga and Samoa.

Quite a different variation is shown near the southern limit of the range of *kochi*, where it overlaps the distribution of *alocasicola* and *gahnicola*. In both of these the comb tooth, as in *kochi*, is stout and pointed, not flattened or expanded laterally, but differs in the complete absence of lateral spines, bearing instead a fine lateral fringe near its base.

To the west of New Guinea, however, it is not possible on the information available to correlate comb tooth type and distribution. The larva of *flavipennis* (Philippines), which shows the least development of the specialised characters of the group (e.g., stellate setae), has the comb tooth very short with rounded tip, and a fine lateral and apical fringe. A close relationship is indicated to *avistylus* (Celebes, etc.) in which the comb tooth, also very short and laterally and apically fringed, has a short pointed terminal spine arising from the middle of the fringe. An unidentified larva belonging to the group (from a lily-like plant, native name "Berah," Labuan Is., Borneo, vii. 45, Lt. R. L. Lehfeldt) has the comb tooth broadening from its base to $\frac{2}{3}$ its length where it gives off two prominent, curved, pointed lateral spines, and a longer slender medial spine with a very finely fringed rounded apex. Figures of the comb tooth of *poicilius* are somewhat conflicting. Brug (1931) figures a larva from Batavia in which the comb tooth has two pairs of lateral spines and a broad medial spine with rounded tip. As figured by Bonne-Wepster and Brug (1939) there is one pair of small lateral spines and a blunt but slender medial spine. The larva of an undescribed species near *poicilius* from Philippines has a comb tooth with 2-4 short fine lateral spines at about $\frac{1}{3}$ its length, and a very long slender medial spine tapering to a fine point.

To sum up, starting in New Guinea with the comb tooth having a stout, pointed medial spine and short lateral spines, as one passes eastwards the medial spine becomes longer and more slender, develops a flattened lateral flange, the thicker medial portion then becomes reduced, and finally the apex becomes rounded and fringed; the lateral spines persist throughout. Coming south from New Guinea, the medial spine remains stout and unflattened but the lateral spines are lost. West of New Guinea relationships are obscure.

It is to be hoped that larvae of the remaining known species in this group (and there are almost certainly others undescribed) will be found and their characters used to test the validity of these suggestions on the relationships of the species.

III. NOTES ON CHARACTERS AND TERMS USED IN DESCRIPTIONS.

Species in the *Aedes kochi* group resemble one another so closely that descriptions are of necessity detailed.

Larval differences have been found to be of considerable importance in separating species. The characters of chief value on the larva are the number of branches of the head setae, the shape of the teeth in the distal row of the lateral comb, and the pilosity of the siphon. The mentum is practically uniform throughout the group and is therefore figured only for *A. kochi*. The thoracic pleural setae do not appear to afford any well defined specific differences and the stellate setae have not been found of general use. In the following descriptions the terminology is mainly that of Hopkins (1936); the term *simple* has been used for a bare or non-pilose seta, and the term *single* for an unbranched seta.

Pupae of some species have areas of pigmentation forming characteristic patterns. Other distinctive differences occur in the number of branches of the lateral seta on abdominal segment VIII., and in the shape of the paddles, which may be indicated in part by the breadth index (greatest length divided by greatest breadth). In general the chaetotaxy of the species examined showed marked similarity and the range of variation of most setae precluded their use in identification. Owing to the widely differing terminologies in use for the pupal setae, no details of these are given in the text, but in the figures the cephalothoracic setae are shown with the average number of branches and the range of variation of the dorsal abdominal setae is indicated. Where observations on the duration of the pupal period are given, unless otherwise stated, these have been made in the laboratory in Brisbane and can only serve as some indication of the time required under natural conditions.

Among closely related adult female specimens no single character has been found infallible for identification. General coloration of species has been used not without some misgiving, as this is undoubtedly difficult to interpret unless a series of contrasted specimens is available; nevertheless it may be the

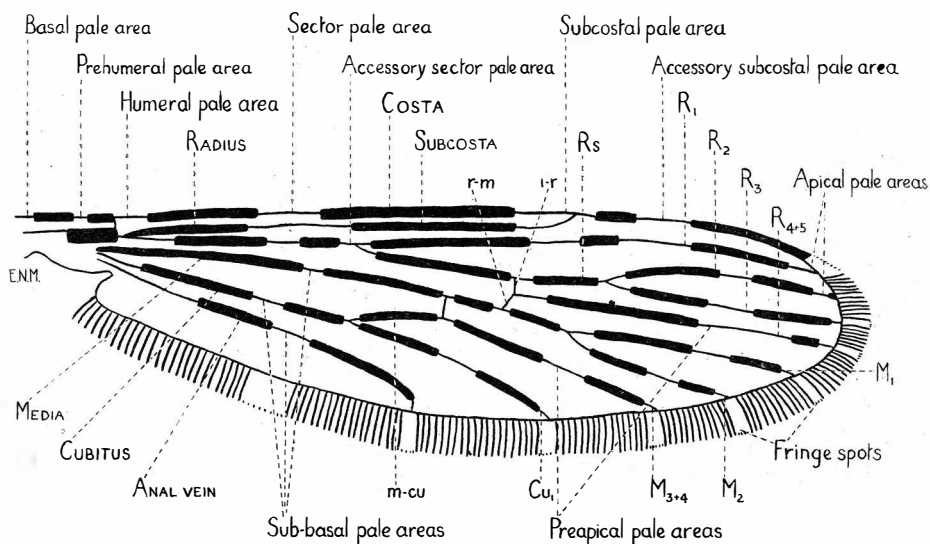


FIG. 2.—Diagram of wing illustrating markings occurring in the *Aedes kochi* group, and nomenclature used for markings and veins.

most satisfactory character for separating females of two very similar species. Proboscis and leg markings, used for separating the group into definite types, are not of value in dividing the *kochi* type further, but leg markings are useful in separating *flavipennis* and its allies. The amount of black sealing on the scutellum and the halteres may assist in distinguishing one species from another.

Wing markings (Fig. 2) have been dealt with in some detail in this paper. The terminology is based on that used by Lee and Woodhill (1944) for Anopheline wings, and names and symbols for wing veins are derived from the same source. Wing markings may show considerable variation within one species and even on one specimen. Those of chief value are the proportion of the subcostal pale area on *C* to the preceding dark spot; the presence of an accessory subcostal pale area on *C* and *R*₁, and the presence and number of preapical pale areas on the remaining veins. The ratio of the fork cells to their stems appears to have some use in distinguishing very similar species.

Structures of the male genitalia provide the most important characters for separating adult specimens. The shape of the style and the size and number of setae near its apex, the number and shape of scales in the inner preapical scale tuft on the coxite and the presence of an additional preapical scale tuft, the presence of a specialised seta near the base of the coxite, and the shape of the appendage of the harpago are characters which serve to distinguish species or groups of species. When specimens are less readily separable, the size and arrangement of the patch of setae at the base of the coxite is of use; some of these setae may have their apices flattened and blade-like but as there is a very variable proportion of such setae in specimens of *kochi* from a wide range of localities, it seems doubtful whether presence or absence of flattened setae, unless correlated with other constant differences, can be considered a character of specific value. The presence tergal to the scale tuft of a patch of small scales, as distinct from setae is a constant and specific character. The shape of the specialised seta, although quite characteristic in some species, is not useful where resemblances are close, as unless the mount has been specially prepared, the seta may be more or less distorted and its exact shape impossible to distinguish. Position and number of setae in patches laterally and apically on the coxite may also be characteristic of a particular species. The coxite has a membranous area on its medial aspect which has the appearance of a longitudinal groove, and the position of setae or scales in relation to this groove is useful in fixing their location for comparative purposes. In the following descriptions of genitalia the usage of Edwards (1941) is followed with regard to the terms *tergal* and *sternal* which describe position, and indicate structures which were originally dorsal and ventral respectively, the tergites being actually ventral and the sternites dorsal in mature specimens.

IV. KEYS TO THE KOCHI GROUP.

(1) Adults—

- | | |
|--|-----------------------------------|
| 1. Hind tarsal segments IV. black and yellow, II. and III with narrow basal black bands; apical two-thirds of female proboscis yellow | 2 |
| Hind tarsal segment IV. all black; female proboscis with medial pale band ¹ ; femora with prominent apical scale tufts .. | 5 |
| 2. Femora with prominent apical ventral tufts of long outstanding scales (Solomons) .. | <i>solomonis</i> Stone and Bohart |
| Femora without such tufts | 3 |
| 3. Hind tarsal segment IV. black, with ochreous marking medially; yellow markings on abdominal tergites II.-IV. in longitudinal streaks (Philippines, Borneo) | <i>aranetanus</i> (Banks) |
| Hind tarsal segment IV. ochreous, with black basal band not more than one-third its length | 4 |
| 4. Fore tarsal segments III. and IV. mainly dark scaled; yellow markings on abdominal tergites appearing as spots or irregular marks, but not as longitudinal streaks (Philippines) | <i>flavipennis</i> (Giles) |
| Fore tarsal segments III. and IV. ochreous, or with no more than a black spot at base of III.; yellow markings on abdominal tergites II.-IV. tending to form longitudinal streaks (Celebes, Boeton, Morotai) | <i>avistylus</i> Brug |

¹ Female of *A. knighti* is unknown.

5. Hind tarsal segments II. and III. with not more than basal two-fifths black; pale scaling suffused with yellow (New Guinea, New Ireland) *wallacei* Edwards
- Hind tarsal segments II. and III. with basal one-half or more black 6
6. Hind tarsal segments II. and III. with basal three-fourths black; halteres entirely pale scaled; *C* with an accessory subcostal pale area (Solomons) *knightsi* Stone and Bohart
- Hind tarsal segments II. and III. with not more than basal two-thirds black; halteres partly or entirely dark scaled 7
7. *C* and R_1 without accessory subcostal pale area¹; no preapical pale areas on remaining veins; scutellum entirely white scaled
- Accessory subcostal pale area usually present on R_1 sometimes on *C*; preapical pale areas usually present on one or more of remaining veins; scutellum usually with some dark scales, at least on mid lobe ..
8. Mesonotum with more or less isolated patches of white scales; pale dorsal patches on abdominal tergites small (South Queensland) *gahnicola* n.sp.
- Mesonotum with extensive and indefinite areas of pale golden scales; large areas of pale golden scales on abdominal tergites (South Queensland) *alocasicola* n.sp.
9. At least one pale area between the subcostal and apical pale areas on *C*; dark scales usually present on all lobes of scutellum
- No pale areas between subcostal and apical pale areas on *C*; dark scales absent from lateral lobes but usually present on midlobe of scutellum 12
10. Pale scaling with admixture of creamy and ochreous, particularly on legs; subcostal pale area on *C* equal in length to preceding dark spot (Samoa, Tonga) .. *samoanus* (Grünberg)
- Black and white species; wings dark scaled with numerous small white dots on all veins 11
11. Posterior pronotum mainly white scaled (India, Malaysia) *poicilius* (Theobald)
- Posterior pronotum mainly black scaled (Philippines) .. sp. near *poicilius*
12. Pale scales of mesonotum pale golden; cell M_1 slightly shorter than its stem (Solomons) *bougainvillensis* n.sp.
- Pale scales of mesonotum frosty white; cell M_1 equal to or longer than its stem 13
13. Sternite V usually with tuft of outstanding scales; tergite VIII. of female with medial basal pale patch; scales in preapical tuft of coxite broad (Queensland, New Guinea, New Ireland, Nissan) *kochi* (Dönitz)
- Sternite V usually without tuft of outstanding scales; tergite VIII. of female without medial basal pale patch; scales in preapical tuft on coxite very narrow (Fiji) *fijiensis* n.sp.

(2) Males (Genitalia)—

1. No specialised seta at base of coxite
Specialised seta at base of coxite 3
2. Style with strong preapical prong on inner side 4
Style without a prong on inner side ..

¹ Even one or two pale scales may be regarded as representing a pale area.

- | | | |
|--|-----------------------------------|----|
| 3. Coxite with a preapical tergal scale tuft in addition to the preapical tuft on its inner aspect | <i>aranetanus</i> (Banks) | |
| Coxite with one preapical scale tuft only, on its inner aspect | <i>avistylus</i> Brug | |
| 4. Preapical scale tuft of 1-3 scales | <i>gahnicola</i> n.sp. | 5 |
| Preapical scale tuft of 6 or more scales | | |
| 5. Appendage of harpago broadened, with blunt apex; style slightly expanded medially | <i>knighti</i> Stone and Bohart | |
| Appendage of harpago slender and sharply pointed | | 6 |
| 6. Style very widely expanded medially | <i>alocasicola</i> n.sp. | |
| Style not widely expanded medially | | 7 |
| 7. Style fairly long, narrowing abruptly on apical third, its appendage about one-half its length; scales in preapical tuft long and slender | <i>flavipennis</i> (Giles) | |
| Style of fairly uniform width; scales in preapical tuft fairly short and broad | | 8 |
| 8. Style very short, about one-fourth length of coxite | <i>poicilius</i> (Theobald) | |
| Style fairly long and slender, about one-half length of coxite; appendage of style about three-fourths its length | sp. near <i>poicilius</i> | |
| 9. Style with 1-3 long setae preapically; preapical scale tuft on coxite of 5-7 long and very narrow scales | <i>fijiensis</i> n.sp. | |
| Style with inconspicuous seta preapically; scales in preapical tuft broad | | 10 |
| 10. Specialised seta with slender stem giving off a number of lateral branches near its apex which support a membranous expansion; associated with it are 3 strong setae broadly expanded on apical fourth; basal patch of setae reduced | .. <i>wallacei</i> Edwards | |
| Specialised setae without lateral branches; large basal patch of setae, some of which may be flattened apically but do not form a distinct group | | 11 |
| 11. Appendage of harpago sharply pointed, broadly triangular; specialised seta of fairly uniform breadth; tuft of setae tergal to the preapical scale tuft scarcely indicated | <i>samoanus</i> (Grünberg) | |
| Appendage of harpago not so short and stout, broadened but with blunt apex; specialised seta with slender stem, broadening medially; a well developed tuft of setae or scales tergal to the preapical scale tuft | | 12 |
| 12. Basal patch of setae on coxite extending as far apically as scale tuft, but concentrated proximally into a well defined circular clump | | 13 |
| Basal patch of setae only slightly concentrated proximally | | 14 |
| 13. Specialised seta with basal half very slender, apical half broad and flattened, with rounded tip .. | <i>solomonis</i> Stone and Bohart | |
| Specialised seta with apical half scarcely broadened and tapering to a sharply pointed tip | sp. near <i>wallacei</i> | |
| 14. A patch of small slender scales and some setae tergal to the preapical scale tuft .. | <i>kochi</i> (Dönitz) | |
| A patch of setae only tergal to the preapical scale tuft | <i>bougainvillensis</i> n.sp. | |

(3) Larvae—

Larvae of the *kochi* group can be distinguished from others of genus *Aedes* by the multiple stellate setae on thorax and abdomen, and triangular patch of 50 or more teeth in the lateral comb.

1. Head seta C 2-3 branched	<i>poicilius</i> (Theobald)	
Head seta C single		2
2. Tooth of distal row of lateral comb without lateral spines		3
Tooth of distal row of lateral comb with 2-4 lateral spines		6
3. Siphon bare; head seta d with not more than 5 branches		4
Siphon pilose; head seta d with not less than 5 branches . .		5
4. Comb tooth short with sides and rounded apex finely fringed; stellate setae of abdomen 3-4 branched	<i>flavipennis</i> (Giles)	
Comb tooth short, laterally and apically fringed, with a short stout pointed terminal spine arising from middle of fringe; stellate setae of abdomen about 10 branched	<i>avistylus</i> Brug	
5. Head setae B 2-3 branched, d 5-11 branched	<i>gahnicola</i> n.sp.	
Head setae B 3-7 branched, d 11-16 branched	<i>alocasicola</i> n.sp.	
6. Medial spine of comb tooth with rounded finely fringed apex		7
Medial spine of comb tooth with tapering pointed apex . .		9
7. Comb tooth very broad and stout basally, giving off at two-fifths from base 2-3 prominent curved lateral spines and a longer, slender medial spine	. . sp.? from Borneo	
Comb tooth with 2-4 short lateral spines at about one-third from base, and broadly expanded medial spine		
8. Siphon bare	<i>samoanus</i> (Grünberg)	
Siphon pilose	<i>fijiensis</i> n.sp.	
9. Head setae B and d 2-3 branched; siphon apparently bare, but with some finely pilose areas	<i>kochi</i> (Dönitz)	
Either head setae B or d, or both, with 4 or more branches; entire siphon pilose		10
10. Head setae B about 12 and d about 15 branched	sp. near <i>poicilius</i>	
Head setae B and d not more than 8 branched		11
11. ¹ Head setae B 3-4 branched, d 4-7 branched; not less than 9 teeth in pecten; comb tooth with medial spine broad and flattened	<i>solomonis</i> Stone and Bohart	
Head setae B 5-6 branched, d 5-8 branched; not more than 8 teeth in pecten; most comb teeth with 4 lateral spines	<i>bougainvillensis</i> n.sp.	
Head setae B 3-4 branched, d 5-6 branched; pecten of 8-10 teeth; comb teeth with long slender medial spine and usually 2 lateral spines	<i>wallacei</i> Edwards	

¹These three species could not be satisfactorily separated in a dichotomous key. Reference should be made to full descriptions of the larvae. Characters of *A. wallacei* in particular are likely to show a wider range of variation than that given.

V. DESCRIPTIONS AND NOTES ON DISTINCTIVE CHARACTERS OF ADULTS, LARVAE AND PUPAE.

(1) *AÈDES* (*FINLAYA*) *KOCHI* (Dönitz).

Culex kochi Dönitz, 1901, *Insekten-Börse*, 18: 38.

Finlaya kochi Theobald, 1903, *Mon. Cul.*, 3: 284.

Finlaya poicilia Theobald, 1907, (in part), *Mon. Cul.*, 4: 520.

Aedes (Finlaya) kochi Edwards, 1924 (in part), *Bull. ent. Res.*, 14: 380; Brug, 1934, *ibid.*, 25: 513.

*Type*¹: Dönitz in describing the female makes no mention of the number of specimens in the type series. The type locality is given as "Habitat: Neu-Guinea," and there is a statement that the male is unknown. Dr. J. Smart states that the collections made by Dönitz are supposed to have been deposited in the Zoological Museum at Berlin.

Allotype ♂, Milne Bay, N.G., 10.viii.43, S. L. Allman (leaf axils of *cunjevoi*), lodged in Museum of the Division of Economic Entomology, Council for Scientific and Industrial Research, Canberra, A.C.T.

Distinctive Characters: Pale scales of mesonotum frosty white, anteriorly forming a pair of more or less complete lateral circles, separated by an indefinite area of black and white scales; mid lobe of scutellum usually with black scaled apex. Hind tarsal I. with narrow medial white band or patch, II. and III. with basal $\frac{1}{2}$ – $\frac{2}{3}$ black. An accessory subcostal pale area usually present on R_1 , cell M_1 equal to, or longer than, its stem. Abdominal sternites with outstanding scales usually on V.-VII., sometimes absent on V. Tergite VIII. of female with a medial basal pale patch. Male genitalia: Coxite with preapical tuft of about 12 long broad scales, and a patch of small elongated narrow scales and setae tergal to this; specialised seta broadened medially; style with inconspicuous seta preapically.

Larva: Head setae B and d 2–3 branched, C single; tooth of distal row of lateral comb with a stout pointed medial spine and usually two short lateral spines; siphon appears bare.

Pupa: Abdomen with indefinitely demarcated darkly pigmented area on tergites I.-IV. Lateral seta of segment VIII. 7–13 branched. Breadth index of paddles 1.1–1.35.

Description of Adult:

Allotype ♂.

Wing length 2.6 mm.

Head clothed mainly with broad flat scales; a medial white stripe, a broad patch of black, and a lateral area of white divided by a black patch; narrow curved white scales at nape, in midline and bordering eyes; mixed dark and pale upright forked scales. Torus dark brown, with flat white scales on medial aspect; first flagellar segment of antenna with a few appressed black

¹See appendix for copy of original description.

scales, flagellar segments dark brown with dense dark brown verticillate hairs; apical segments with short pale hairs. Clypeus dark brown. Palpi slightly longer than proboscis, banded black and white; shaft black basally, with 3 white bands, and a preapical white patch; two apical segments each with long brown hairs and white basal band extending slightly on to preceding segment; terminal segment with white tip. Proboscis about equal in length to fore femur, black scaled, with a narrow medial pale band produced dorsally into a short streak; a small dorsal patch of pale scales at apex.

Thorax: Integument black. Mesonotum clothed with black narrow curved scales, with a pattern of white narrow curved scales, which form an indefinite band along anterior and lateral borders, curving towards the midline behind the scutal angle and then forwards on either side of a medial longitudinal white band (so that on the anterior half of the mesonotum there is a pair of more or less complete lateral white circles); where each lateral band curves forwards it is joined by a line of white scales directed posteriorly and medially, and these, with the medial longitudinal band, merge in a patch of white scales in front of the scutellum; two or three of the white scales on either side of the prescutellar bare area are broadened and lanceolate; patches of white scales laterally above the wing roots. Scutellum clothed with flat white scales, with a few flat black scales near apex of mid lobe. Chaetotaxy: Bristles of mesonotum and scutellum black; a double row of about 12 strong acrostichal bristles terminating in front of the prescutellar space; on either side of the latter is a double row of about 6 bristles continuous anteriorly with a row of 8 strong dorsocentral bristles; there are a couple of strong bristles laterally on the fossae, and a patch of about a dozen supraalar bristles; scutellar bristles 4 to mid lobe and 3-4 to lateral lobes. Metapostnotum dark brown. Anterior and posterior pronotum with flat white scales, the latter with a few narrow curved white scales in its upper anterior angle; flat white scales in small patches on propleuron, lower sternopleuron, paratergite and prealar area, and forming a continuous broad band from subspiracular area across upper sternopleuron and mesepimeron. Pleural bristles brown; 3 propleural; 4 posterior pronotal; 2 postspiracular; 1 upper sternopleural, 2 below it, and a row of 6 along posterior margin of sternopleuron; 8 prealar; 6 upper and no lower mesepimeral bristles.

Legs: Banded black and white. Coxae dark brown with patches of flat white scales above and flat black below. Trochanters black scaled. Femora with a basal white band, 6 or 7 black bands, the distal one being broad, a white kneespot and a tuft of outstanding black scales ventrally at apex. Tibiae with a small patch of white scales at base and white apical band, fore and mid tibiae with 7 or 8 black bands, hind with 4-6 (1 or 2 partially divided by small white patches). Fore and mid tarsal segment I. with basal, medial and apical white bands, fore tarsal II. all black or with a few white scales at tip, mid tarsal II. with apical white band; fore and mid tarsals III. and IV. all black, V. all white; hind tarsal I. with wide basal and apical and narrow medial white bands; apical $\frac{1}{2}$ of II. and $\frac{1}{3}$ of III. white, IV. black, V. white. Claws of fore and mid legs unequal, anterior claw long with a strong tooth; hind claws equal, simple.

Wings: Veins clothed mainly with broad flat scales; largely black scaled with numerous white patches as follows:—C with small basal pale area, prehumeral and humeral (incompletely separated on one wing), sector and

subcostal pale areas (the subcostal being less than $\frac{1}{2}$ the length of the preceding dark spot). *Sc* with sector and apical pale areas. R_1 with basal, humeral, sector and accessory sector pale areas, subcostal and accessory subcostal (incompletely separated by 1 or 2 dark scales), and apical pale areas. Small pale areas at all forks and crossveins, at bases of *Cu* and *An* and at apices of all veins. Preapical pale areas on R_3 , R_{4+5} ; 1 or 2 pale scales preapically on M_1 and M_{3+4} and subbasally on *An*. Pale fringe spots opposite all veins except

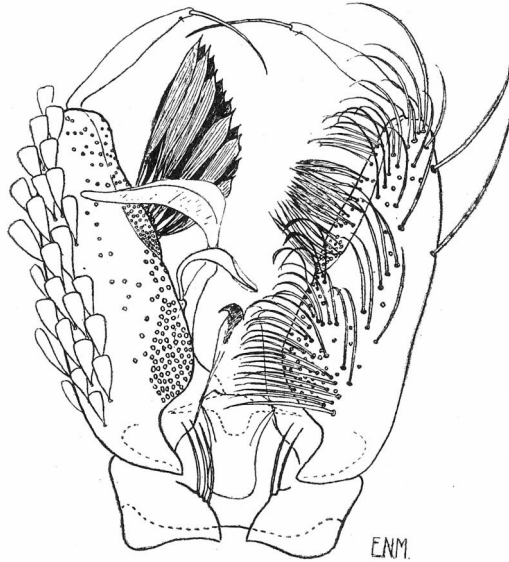


FIG. 3.—♂ genitalia of *Aedes kochi* Dön., x 160.

R_2 . Cell R_2 twice the length of its stem; cell M_1 equal in length to its stem, its base slightly proximal to that of cell R_2 ; *r-m* about $2\frac{1}{2}$ times its length distal to base of M_{3+4} . Halteres with pale stem and black scaled knob, with a few pale scales at base of knob.

Abdomen: Integument brown. Tergites largely black scaled with white to creamy dorsal, and white lateral patches. Tergite I. with some white scales medially at base; II.-V. and VII.-VIII with medial basal pale patches, absent on VI; II.-VII. with paired submedial preapical pale patches, each of which on tergite V. is divided horizontally into two; VI. and VII with apical border of pale scales; I. and VIII. with lateral white border; II.-VII. with lateral preapical white patches. Sternites mainly black scaled with white scales basally and laterally and on III.-IV. and VI.-VII. there are medial preapical white patches; VI. and VII. with apical tufts of outstanding black scales, a reduced tuft on V.; sternite VIII. with basal pale patch and pale scales laterally, and forming incomplete apical border.

♂ *Genitalia* (general description) (Fig. 3).

Coxite black scaled, tapering, $2\frac{1}{2}$ -3 times as long as broad at base; apical $\frac{2}{3}$ with a longitudinal groove along inner aspect. On the sternal side of this groove, just beyond $\frac{1}{2}$ the length of the coxite, is a tuft of 12-16 long broad

outstanding scales, the most distal being the longer; these scales arise from prominent tubercles. Between this scale tuft and the groove is a patch of small elongated narrow scales (showing obvious longitudinal striations) and setae, the setae being less numerous, and proximal and tergal in position (this tuft is best seen when the scales in the large tuft have been removed); distal to these are a few scattered short setae. On the tergal side of the groove there is a large basal patch of medially directed setae, densest proximally, and extending for $\frac{1}{2}$ the length of the coxite; the basal members are long, stout and straight; distally they are curved and some setae on the inner aspect may be flattened on their apical $\frac{1}{3}$; in addition there are scattered setae between the basal patch and the apex of the coxite. On the inner sternal aspect of the coxite at about $\frac{1}{4}$ from base and arising from a prominent tubercle is a curved specialised seta of which the basal third is narrow, the medial third widely expanded, and the apical third appears to taper gradually to a fine point but may be observed to bear a membranous lateral expansion. Style rather less than $\frac{1}{2}$ length of coxite, slightly expanded medially with a short inconspicuous seta on its inner side, just before the apex; appendage terminal, with blunt tip, long, curved, about $\frac{2}{3}$ length of style. Harpago stout; appendage broad, curved, with a wide membranous expansion on the medial portion, and tapering slightly to a rounded tip. Paraproct with a single tooth. Phallosome simple. Lobe of IXth tergite with 1-4 setae.

The following variations were shown in a series of 17 male specimens from various localities:—

Wing length 2.2-2.6 mm. Shaft of palpus may have only 3 white bands. Medial pale band on proboscis may be reduced or absent and pale patch may be absent from tip. Wings: Cell R_2 $1\frac{1}{2}$ -3 times length of its stem. Abdominal tergites VI. and VII. may lack a pale apical border; the paired preapical patches on III.-VII. may each be divided horizontally into two. Other variations are common to both sexes.

The *female* differs from the male as follows:—

Wing length 2.5-3.2 mm. All upright forked scales on head may be dark. Antennae: Tori light brown, medial aspect darker with a patch of flat white and rarely 1 or 2 dark scales; flagellar segments dark brown, with brown hairs, the first flagellar segment clothed with flat black scales and rarely with 1 or 2 pale scales. Palpi $\frac{1}{4}$ - $\frac{1}{3}$ length of proboscis, with white tips, and on some a few white scales at $\frac{1}{2}$ length. Proboscis slightly shorter than fore femur with a broad medial white band $\frac{1}{4}$ - $\frac{1}{3}$ its length, and a prominent patch of white scales dorsally at apex, or rarely a complete apical band. Claws equal, those of fore and mid leg toothed, hind simple. Wings: Cell R_2 $2\frac{1}{2}$ -4 times its stem, cell M_1 1 - $1\frac{2}{3}$ times its stem. Abdomen: Lateral white border of tergites curves dorsally, extending for a short distance along apical border of tergite II. and preapically on III.-V. Tergite VIII. large, triangular in shape, being produced

apically; black scaled with a medial basal pale patch. Sternite VIII. large, black scaled basally, with pale scales laterally and apex bare of scales. Cerci short, brown, with small pale or, rarely, dark flat scales.

The following variations are shown by both sexes:—

The white scaling on mesonotum may be more extensive and the pattern not so well defined; the patch of white scales above the wing root may curve forward to meet the antero-lateral extensions of the prescutellar patch, or these extensions may be absent, and the pattern reduced. There may be some broad flat white scales or narrow curved white only on either side of the prescutellar space. In many specimens the apex of the mid lobe of the scutellum is black scaled; in some there are no black scales at all on the mid lobe, but as all these appear at least partly abraded, it is not clear whether this is a variable character¹. Posterior pronotum usually with a row of flat black scales along its upper margin. Chaetotaxy: 12–18 acrostichal bristles, double row of 6–10 lateral to prescutellar space; 6–10 dorsocentral; 2–4 on fossae; scutellar bristles 4–5 to mid lobe and 3–5 to lateral lobes; 2–4 propleural; 2–3 posterior pronotal; 2–4 postspiracular; 1–2 upper sternopleural with 2–3 below them and 4–6 along posterior margin of sternopleuron; 6–11 prealar and 5–10 upper mesepimeral bristles.

Legs: The first tarsal segment on all legs may have an additional pale patch between the basal and medial bands. Most specimens have a white apical patch on fore tarsal II.; the apical band on mid tarsal II. varies from $\frac{1}{8}$ – $\frac{1}{2}$ length of segment. Some specimens also have apical white patches on fore and mid tarsal III. Apical bands on hind tarsals II. and III. are from $\frac{1}{3}$ to $\frac{1}{2}$ length of segment.

Wings: The prehumeral pale area on *C* may be absent, separate, or confluent with the humeral pale area. On *R*₁, occasionally, the sector and accessory sector pale areas may be confluent, or the accessory subcostal pale area absent. The following pale areas show great variability even in the two wings of one specimen: Preapical pale areas on *R*₂, *R*₃, *R*₄₊₅, *M*₁, *M*₃₊₄; subbasal pale areas on *M*, *Cu* and *An*. Of these the preapical on *R*₄₊₅ is usually present, while the subbasal on *M* has been observed only on female specimens in which also the subbasal on *Cu* occurs more frequently. Usually one or more of these pale areas is present, even if represented by only a few scales, but rarely all are absent; in general they are more numerous in female specimens. Pale fringe spots may not be apparent opposite *R*₂, *R*₃ and *R*₄₊₅. The bases of the fork cells may be level or that of cell *M*₁ slightly proximal; *r-m* $2\frac{1}{2}$ –4 times its length distal to base of *M*₃₊₄. The knob of halteres may be entirely black scaled.

Abdomen: The medial basal patches on some abdominal tergites may be reduced or absent, and rarely the preapical patches are absent also from some segments; or the basal patches may be large, and incompletely separated from the preapical. In a few specimens no outstanding scales are apparent on sternite V.

¹Theobald (1901) describing one of Dönitz's specimens mentions only "flat scales of a grey tint" on the scutellum, but his specimen was somewhat damaged.

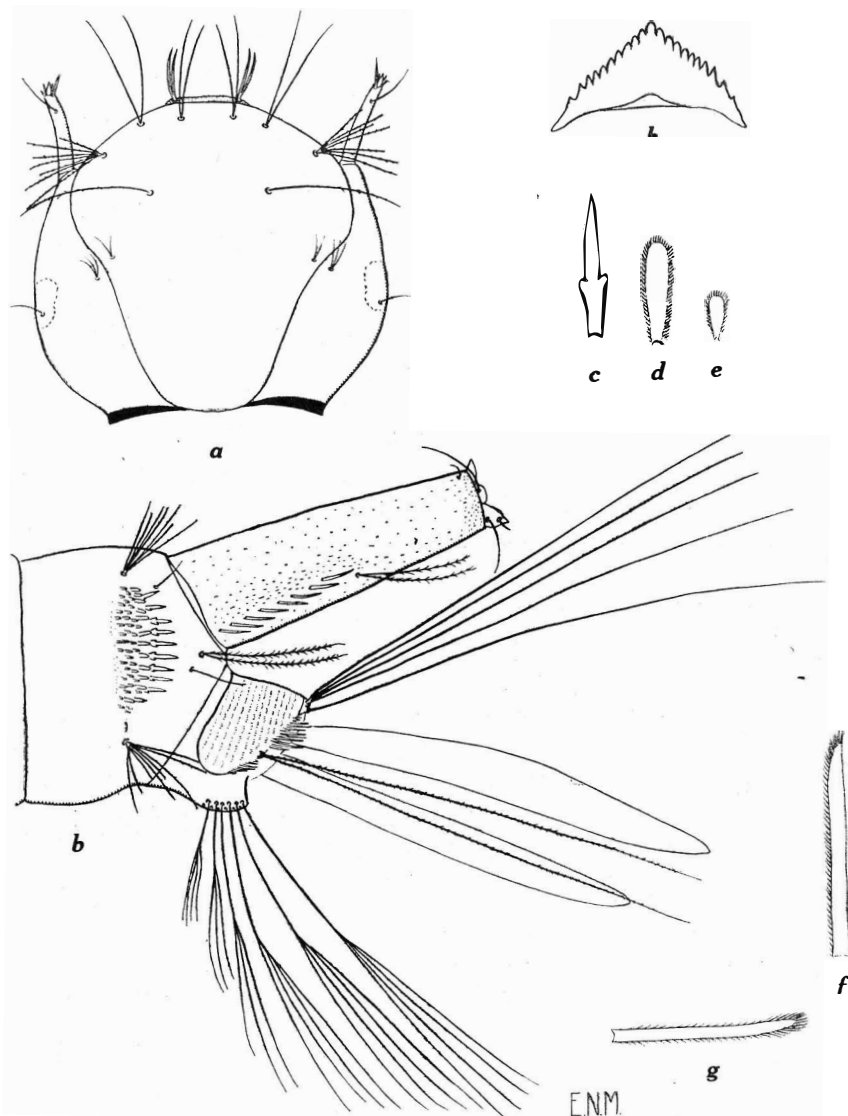


Fig. 4.—Larva of *Aedes kochi* Dön. *a*, head. *b*, terminal segments. *c*, *d* and *e*, teeth from distal, second and proximal rows respectively of lateral comb. *f*, pecten spine. *g*, saddle spine. *h*, mentum. (*a-b*, x 64; *c-g*, x 320; *h*, x 160.)

Description of Larva (Fig. 4).

Length 6.0–7.4 mm. Colour pale, with light brown head and siphon. Thorax and abdomen with prominent stellate setae.

Head: About as broad as long. Antenna about $\frac{1}{4}$ length of head, straight, smooth; tuft a single simple seta, $\frac{1}{2}$ length of antenna, at $\frac{2}{3}$ from base; terminal and subterminal setae all placed at apex, one long, remainder short. Clypeal

spines bifid. Setae A, B and d arising in curved line towards anterior margin of head, their bases about equal distances apart, B being anterior to A, and d at same level as, or slightly behind B; C arising well back, more or less in line with B. A stellate, with 6-10 slightly frayed branches, some with forked tips, longest about length of antenna; B with 2-3 simple branches, slightly longer than antenna; C long, single, frayed (fraying may be inconspicuous); d well developed, about length of antenna, with 2-3 simple branches; e with 2 and f with 3-5 branches. Mentum with one large medial tooth and 9-11 lateral teeth, the most basal being smaller and more widely separated.

Abdomen: On segments I-VI. a pair of long plumose lateral setae; on segment I. with 4-6 (usually 5) branches; II. 3-6 (usually 4) branches; III-VI., usually 2 branches.

8th segment: Lateral comb a triangular patch¹ of about 65-80 overlapping teeth of three sizes, arranged in 4-6 rows. Distal row of 8-15 stout pointed teeth, 60-70 μ in length, each giving off at $\frac{1}{3}$ from its base, 2 (occasionally 3 or 4) very short, stout, bluntly pointed lateral spines, beyond which the medial spine is stout and tapers to a sharp point. Remaining comb teeth are apically rounded, fringed scales, those of second row being about $\frac{2}{3}$ and remainder about $\frac{1}{3}$ length of distal teeth. At the base of the comb are several rows of minute setae. First and fifth pentad setae stellate, with 6-12 branches, frayed and with forked tips; second and fourth single, simple; third with 2-5 plumose branches.

Siphon: Index 2.3-3.0; general appearance is bare, but close examination shows very fine hairs in a fairly dense area around apex of siphon, also along the pecten and sparsely scattered elsewhere. Pecten extending over basal $\frac{1}{2}$ of siphon, composed of 7-14 evenly sized and spaced spines, 84-100 μ in length (in one specimen up to 116 μ) with a fine fringe at apex and along proximal edge. Subventral tuft with 2-3 plumose branches, about opposite end of pecten.

Anal segment: Saddle covering dorsal $\frac{2}{3}$ of segment, finely pilose, bearing on distal and ventral margins long, laterally fringed spines with rounded fringed tips. Lateral seta with 2-4 pilose branches. Caudal setae simple, upper 4-6 branched, lower single. Ventral brush of 10 multiple tufts each with 3-5 branches; no grid. Gills unequal, bluntly pointed, variable in length, the upper pair measuring from $1\frac{1}{2}$ x saddle (Queensland specimens) to almost 5 x saddle in some Merauke specimens; the lower pair correspondingly shorter, up to 4 x saddle.

Description based on 6 specimens from Milne Bay (Bick); 12 from Lae (Borrowdale); 6 from Merauke (Cameron); 1 from Nissan (Dumbleton); 2 from Atherton Tableland, N.Q.'ld. (Cowell and Woodward); 3 from Alexandra Headland, S.Q.'ld. (Wassell).

Description of Pupa (Fig. 5).

General coloration pale, with darkly pigmented areas on upper surface of cephalothorax and basal abdominal tergites. The intensity of pigmentation shows some variation, e.g. specimens from Lae have general coloration creamy, whereas in specimens from South Queensland it is greyish.

¹ Not a single row as stated by Edwards (1932).

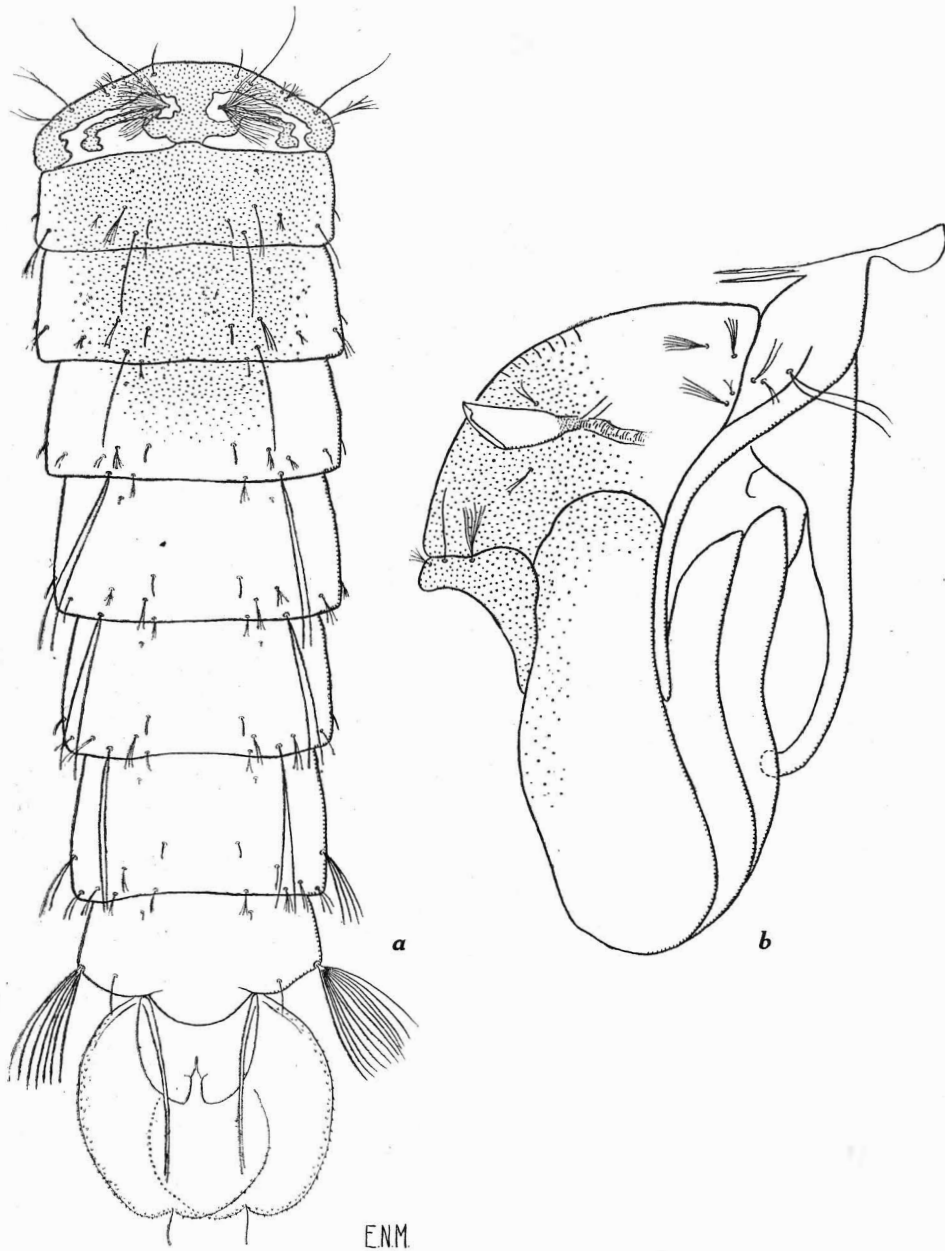


FIG. 5.—Pupal pelt of *Aedes kochi* Dön., x 38. *a*, abdomen (dorsal view). *b*, cephalothorax.

Cephalothorax: Dorsal area with an indefinitely demarcated, darkly pigmented area posterior to level of insertion of trumpets, extending over metapostnotum and in most specimens over upper and posterior margins of wing covers. Trumpet pigmented basally; opening oblique; ratio of meatus to whole 1 : 1.4; apical notch shallow.

Abdomen: An indefinitely demarcated darkly pigmented area on tergites I-IV., slightly reduced laterally on III. and terminating in a large medial basal patch on IV. In a specimen from Nissan the pigmentation appears to extend on to base of tergite V., whereas in Lae and Atherton specimens it extends only to tergite III., and in the Atherton specimens is also reduced laterally. Float setae well developed, dendritic. The longer dorsal abdominal setae are finely pilose. Lateral seta of segment VIII. with 7-13 branches. Paddles broad with denticulate margin and notched apex; paddle seta may be set at base of notch or laterally on it; buttress and midrib moderately developed; breadth index 1.1-1.35.

Duration of pupal period: Maximum time at Lae 36 hours (noted by Borrowdale).

Described from 11 pelts; 4 from Lae (Borrowdale); 2 from Merauke (Cameron); 1 from Nissan (Dumbleton); 1 from Atherton Tableland (Cowell and Woodward); 2 from Alexandra Headland (Wassell); 1 from Dunwich (Marks).

Biology: Larvae are found breeding in leaf axils of banana, taro, cunjevoi, pineapple, crinum and pandanus. Specimens have been examined from the following:—

At Milne Bay *A. kochi-wallacei* series was obtained mostly from banana leaf axils, to a more limited extent in taro and pineapple and very rarely from pandanus (Lt. G. W. Bick, U.S.N., 1944).

At Lae, larvae are found breeding prolifically in the water-holding leaves of banana palms, situated in the jungle near its edge, the plants being usually from five to nine feet in height; smaller plants and those in exposed and sunlit situations dry up too quickly. Larvae are occasionally found in stems of taro, but where bananas and taro are both present they occur almost exclusively in bananas (Cpl. R. W. Borrowdale, iii. 1945).

Specimens have also been examined from taro, Nissan (L. J. Dumbleton), Lake Barrine (E. N. Marks, vi. 1946); pandanus, Merauke (Cpl. C. Cameron, iii. 1945), Cairns (J. L. Wassell, x. 1945), Ingham (E. N. Marks, v. 1946), Noosa (E. N. Marks, iv. 1946); pandanus on an exposed headland, Alexandra Headland (J. L. Wassell, iv. 1945); pandanus and crinum, Dunwich (E. N. Marks, iii. 1946); cunjevoi, Atherton Tableland (Lt. Cowell and Sgt. Woodward, viii. 1944).

Habits: Adults bite readily and *A. kochi* appears to be a common pest species in parts of New Guinea. Taylor (1943) states that the female is a most persistent biter during the day and night. Heydon (1931) records it as a night biting pest species at Rabaul (breeding in pandanus), and (in a personal communication) as a strictly night biting species in the Arawe District, New Britain. Specimens from Dunwich, S.Q'ld., were taken biting in the late afternoon in dry scrub.

Relation to Disease: Taylor (1943): "An efficient intermediary host of *Wuchereria bancrofti*."

G. M. Heydon has communicated the results of an unpublished investigation done in the Arawe district on New Britain, in which a strictly night-biting species bred out from pandanus axils proved to be a very efficient vector of *W. bancrofti*. There is no reason to doubt that it was correctly identified as *A. kochi*.

*Distribution*¹: Specimens have been examined from the following localities:—NEW GUINEA: Milne Bay, 7 ♂♂, 8 ♀♀ (Lt. G. W. Bick, U.S.N. 1944), 1 ♂ (S. L. Allman, 10.viii.43); Lae, 4 ♂♂, 8 ♀♀ (Cpl. R. W. Borrowdale, iii. 1945); Merauke, 4 ♂♂, 5 ♀♀ (Cpl. C. Cameron, iii. 1945). NISSAN (east of New Ireland): 3 ♀♀ (L. J. Dumbleton). NORTH QUEENSLAND: Iron Ridge, 1 ♀ (J. L. Wassell, xii. 1942); Atherton Tableland, 1 ♂, 1 ♀ (Lt. J. R. Cowell and Sgt. R. Woodward, viii. 1944); Lake Barrine 1 ♀ (E. N. Marks, vi. 1946); Cairns, 1 ♂ (J. L. Wassell, x. 1945); Ingham, larva (E. N. Marks, v. 1946). SOUTH QUEENSLAND: Dunwich, Stradbroke Is., 14 ♀♀, 14 ♂♂ (E. N. Marks, xi. 1943 and iii. 1946); Alexandra Headland, 1 ♂ (J. L. Wassell, iv. 1945); Noosa, 2 ♀♀ (E. N. Marks, iv. 1946).

(2) *Aedes (Finlaya) bougainvillensis*, n.sp.

Aedes (Finlaya) kochi Stone and Bohart, 1944 (in part)₁, *Proc. ent. Soc. Washington*, 46: 211.

Types: Holotype ♂, allotype ♀ (with associated larval and pupal skins) and one male paratype, Bougainville Is., Solomon Is., xii. 1944, Lt. J. R. Cowell (reared from larvae taken from axils of lily-like plant, probably *Sararanga* sp.); one morphotype larva (same data). All in University of Queensland collection.

Distinctive Characters: Very close to *A. kochi* from which it differs as follows:—Pale scales of the mesonotum are pale golden, as distinct from frosty white of *kochi*. Cell M_1 usually slightly shorter than its stem. Male genitalia: Coxite with a patch of setae but no scales tergal to the outstanding scale tuft.

Larva: Head setae B 5–6 branched, C single, d 5–8 branched. Siphon strongly pilose. Tooth of distal row of lateral comb with long slender pointed medial spine and usually 4 short lateral spines.

Pupa: Abdomen evenly pigmented including paddles. Lateral seta of segment VIII. 9–12 branched. Breadth index of paddles 1.55–1.85.

Description of Adult:

Holotype ♂.

Wing length 2.1 mm.

Head clothed mainly with broad flat scales, a medial pale stripe, a broad patch of black and a lateral pale area divided by a black patch; narrow curved pale golden scales at nape, in midline, and bordering eyes; upright forked scales dark at nape; some pale in midline and towards vertex. Torus dark brown with flat white scales on medial aspect; first flagellar segment of antenna with a few dark scales; flagellar segments brown with dense brown verticillate hairs, apical segments with short pale hairs. Clypeus dark brown. Palpi slightly longer than proboscis, banded black and white; shaft black basally with 3–4 white bands or patches; two apical segments each with long brown hairs and white basal band extending slightly on to preceding segment, terminal segment with white tip. Proboscis slightly longer than fore femur, black scaled, with a narrow medial pale band broadening dorsally and extending a short distance towards base and in a streak almost to apex; some pale scales dorsally at apex.

Thorax: Integument dark brown. Mesonotum clothed with mixed dark and pale narrow curved scales. The pale scaling is definitely pale golden (not frosty white as in *kochi*). Pale scales in a wide medial anterior patch and in indefinite lines along the anterior and lateral borders, curving round behind

¹ In view of previous confusion of *A. kochi* with related species, records of other authors are not quoted, though it is likely that most of those from New Guinea, New Britain, and New Ireland are correct.

the scutal angles to join the medial patch posteriorly; just before this junction they are themselves joined by a pair of lines produced from the anterior angles of the medial prescutellar pale patch; pale scales also above the wing roots (i.e. similar pattern to *kochi*). Scutellum clothed with flat pale scales with a few dark scales at apex of mid lobe. Chaetotaxy: Bristles of mesonotum and scutellum brown; a double row of about 12 strong acrostichal bristles terminating just in front of the prescutellar space; on either side of the latter is a double row of about 6 bristles, continuous anteriorly with a row of about 6 strong dorsocentral bristles; there are a couple of strong bristles laterally on the fossae and a patch of about 8 supraalar bristles; scutellar bristles 4 to midlobe, 2-3 to lateral lobes. Metapostnotum dark brown. Anterior pronotum with broad flat white scales; posterior pronotum with flat white scales and a few flat black on the upper margin. Patches of flat white scales on propleuron, lower sternopleuron, paratergite and prealar area, and forming an interrupted band from subspiracular area across upper sternopleuron and mesepimeron. Pleural bristles brown; 2 propleural; 3 posterior pronotal; 3 postspiracular; 1 upper sternopleural, a group of 4 immediately below it, and a row of about 5 along posterior margin of sternopleuron; about 9 prealar; about 3 upper and no lower mesepimeral bristles.

Legs: Banded black and white with some yellowish reflections. Coxae dark brown; white scales above and black below on fore coxae, mid and hind bare of scales. Trochanters black scaled. Femora with a basal white band, about 6 or 7 black bands and a white kneespot; a rather inconspicuous tuft of outstanding black scales ventrally at apex. Tibiae banded black and white with patches of white at base and apex. Fore, mid and hind tarsal segment I. with basal and apical bands and a narrow medial band or spot. Fore and mid tarsal II. with a narrow apical patch, III. and IV. black, V. all white. Hind tarsals II. and III. with apical $\frac{1}{2}$ white, IV. all black, V. all white. Claws of fore and mid legs unequal, the anterior claw long with a strong tooth; hind claws equal, simple.

Wings: Veins clothed mainly with broad flat scales; largely black scaled with numerous pale patches as follows: *C* with basal pale area, prehumeral and humeral pale areas confluent or partially separated, sector, subcostal and apical pale areas (the subcostal being less than $\frac{1}{2}$ the length of the preceding dark spot). *Sc* with sector and apical pale areas. R_1 with basal, humeral, sector, accessory sector, subcostal and apical pale areas, and one or two pale scales in accessory subcostal position. Small pale areas also at bases of *Cu* and *An*, apices of all veins, and at all forks and crossveins. Small preapical pale areas on R_{4+5} and M_{3+4} , a few pale scales preapically also on R_3 on one side; a large subbasal pale area on *Cu*. Fringe with pale areas opposite all veins except R_2 . Cell R_2 about twice the length of its stem; cell M_1 slightly shorter than its stem, it base proximal to that of cell R_2 ; *r-m* 4 times its length distal to base of M_{3+4} . Halteres with pale stem and black scaled knob; a few pale scales at base of knob.

Abdomen: Integument brown. Tergites black scaled with large areas of pale scales. Tergite I. with a few pale scales medially. Tergites II.-V. with a broad basal pale patch, continuous with paired submedial longitudinal pale patches extending to the posterior border of the segment and separated by a medial apical dark patch. VI. and VII. with similar but more indefinite markings, and more or less complete apical border of pale scales; VIII. with a pale basal patch. Tergite I. with white scaled lateral border, and V.-VII. with small preapical lateral white patches. Sternites black scaled with basal lateral and medial preapical pale patches on II.-VI.; VII. with basal medial pale patch, VI. and VII. with small tufts of outstanding black scales apically; VIII. black scaled with medial basal pale patch.

♂ *Genitalia* (general description) (Fig. 6).

Coxite black scaled, tapering, about $3-3\frac{1}{2}$ times as long as broad at base; apical $\frac{2}{3}$ with a longitudinal groove along inner aspect. On the sternal side of this groove, just beyond $\frac{1}{2}$ length of coxite, is a tuft of 10-16 long broad outstanding scales, the most distal being the longest; these scales arise from prominent tubercles. Between this scale tuft and the groove is a patch of fine setae; distal to these are scattered fine setae. On the tergal side of the

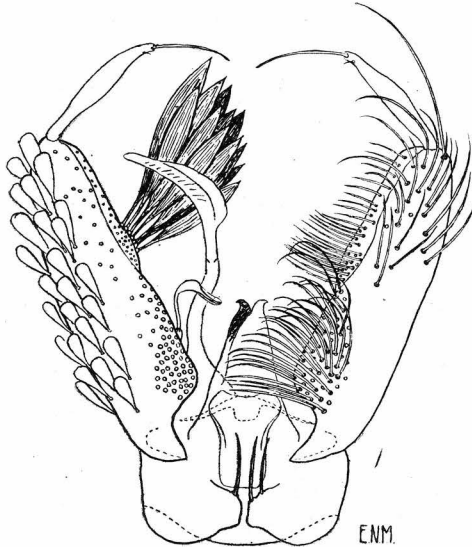


FIG. 6.—♂ genitalia of *Aedes bougainvillensis*, n.sp., x 160.

groove there is a large basal patch of medially directed setae, densest proximally and extending for about $\frac{1}{2}$ length of coxite; the basal members are long and straight, distal ones curved; in addition there are scattered setae between the basal patch and apex of coxite. On the inner sternal aspect of the coxite at about $\frac{1}{5}-\frac{1}{4}$ from base, and arising from a prominent tubercle is a curved specialised seta with narrow stem and widely expanded medial portion, appearing to taper sharply to a narrow pointed apical portion, which may, however, be observed to bear a membranous lateral expansion. Style slightly less than $\frac{1}{2}$ length of coxite, slightly expanded medially with a short inconspicuous seta on its inner side just before the apex; appendage terminal with blunt tip, long, curved, $\frac{2}{3}$ length of style. Harpago stout; appendage broad, curved, with rounded tip, and a wide membranous expansion on medial portion. Paraproct with single tooth. Phallosome simple. Lobe of IXth tergite with 1-2 setae.

♂ *Paratype*.

The paratype male shows the following differences from the type:—

Scutellum with one or two black scales amongst the white at the base of the midlobe in addition to the apical patch; 3 propleural, 2 posterior pronotal, 3-4 postspiracular and 5 upper mesepimeral bristles; prehumeral and humeral pale areas on *C* separate; first mid tarsal with an additional pale patch between the basal and medial bands; abdominal tergites II-VI. with medial basal and paired preapical patches separated, the basal patches being reduced on III-V.; a slightly developed tuft of outstanding scales at apex of sternite V.

Allotype ♀ differs from holotype as follows:—

Wing length 2.3 mm.

Antennae: Torus light brown, medial aspect darker with a patch of flat creamy scales; flagellar segments dark brown with brown hairs; first flagellar segment with dark scales. Palpi $\frac{1}{5}$ length of proboscis, black scaled with one or two pale scales at tip. Proboscis about equal in length to fore femur, black scaled with a medial creamy band $\frac{1}{5}$ its length, and a dorsal pale patch at apex. No flat black scales on posterior pronotum. Hind tarsal segments II. and III. with apical $\frac{2}{5}$ white. Claws equal, those of fore and mid leg toothed, hind simple. Wings: R_1 has the sector pale area missing on one side, though accessory sector is present on both sides; there are 1 or 2 pale scales preapically on R_2 , and R_{4+5} , and a short subbasal pale area on Cu . Cell R_2 $1\frac{1}{2}$ times length of its stem; cell M_1 equal to its stem. Abdomen: Tergites II.-VII. with small medial basal and paired preapical pale spots, VIII. dark with a medial basal pale patch. Tergite II. with white scales forming lateral border and extending a short distance along apical border; III.-VII. with some white scales in an indeterminate line along lateral border curving preapically. Sternites mainly pale scaled basally and dark apically; VI. and VII. with apical tufts of outstanding black scales, and a few outstanding scales also at apex of V. VIII. brown, dark scaled basally, with pale scales laterally; bare of scales and lighter coloured distally. Cerci short, dark, with flat pale scales.

A series from Solomon Is. collected by L. J. Dumbleton and bred from pandanus axils (5 ♂♂, one with associated larval skin, 3 ♀♀, Banika (Russell Is.); 1 ♂ Vella Lavella; 2 ♀♀, locality unstated) show no notable differences from the foregoing specimens in general characters of the adult or larva, but the male genitalia differ as follows:—The more distal setae of the basal patch on the coxite have their curved apical third widened into a broad blade-like pointed expansion; some of the setae in the patch tergal to the scale tuft may be slightly flattened, though not scale-like. These differences by themselves are not considered sufficient to warrant these specimens being regarded as other than variants of *bougainvillensis*.

Males in the above series show the following variations from the type of *bougainvillensis*:—Wings length 2.0-2.2 mm. Shaft of palpus may have three pale bands and two patches, or may have a few pale scales at base. Proboscis may have medial band incomplete dorsally, or a medial dorsal streak only, and no band. Medial anterior pale patch on mesonotum may be reduced, and scutellum entirely pale scaled; 2-4 propleural, 1-3 postspiracular bristles. Mid tarsal I. may have an additional pale patch or band between the basal and medial bands; hind tarsals II.-III. with apical $\frac{2}{5}$ to $\frac{1}{3}$ white. Wing: Prehumeral pale area on C may be separate from humeral, or absent; accessory subcostal pale area on R_1 may be confluent with subcostal; there are no preapical pale areas on R_3 , R_{4+5} or M_{3+4} , and the subbasal on Cu may be absent. Cell R_2 $1\frac{1}{2}$ -2 times length of its stem, the bases of forks level or that of cell M_1 slightly proximal. Abdomen: Tergite I. may be entirely dark scaled dorsally; the basal medial patches on remaining tergites may be quite separate from the preapical patches, and may be reduced to a few scales; in some specimens there may be a reduced tuft of outstanding scales on sternite V.

Females have wing length 2.1-2.5 mm.; medial band $\frac{1}{4}$ - $\frac{1}{3}$ length of proboscis; palpi white tipped and may have a few pale scales medially; mesonotum may have some white scales round its margin, but scales in the middle are golden; flat black scales on upper margin of posterior pronotum; 3-4 postspiracular bristles; mid tarsal III. with white apical patch; there may be a few pale scales preapically on M_{3+4} ; cell M_1 $\frac{2}{3}$ to $\frac{7}{8}$ length of its stem; tergite VII. may have an apical border of pale scales; outstanding scales on sternites V.-VII. (Other variations in thorax, legs, wings and markings of abdominal tergites as for males).

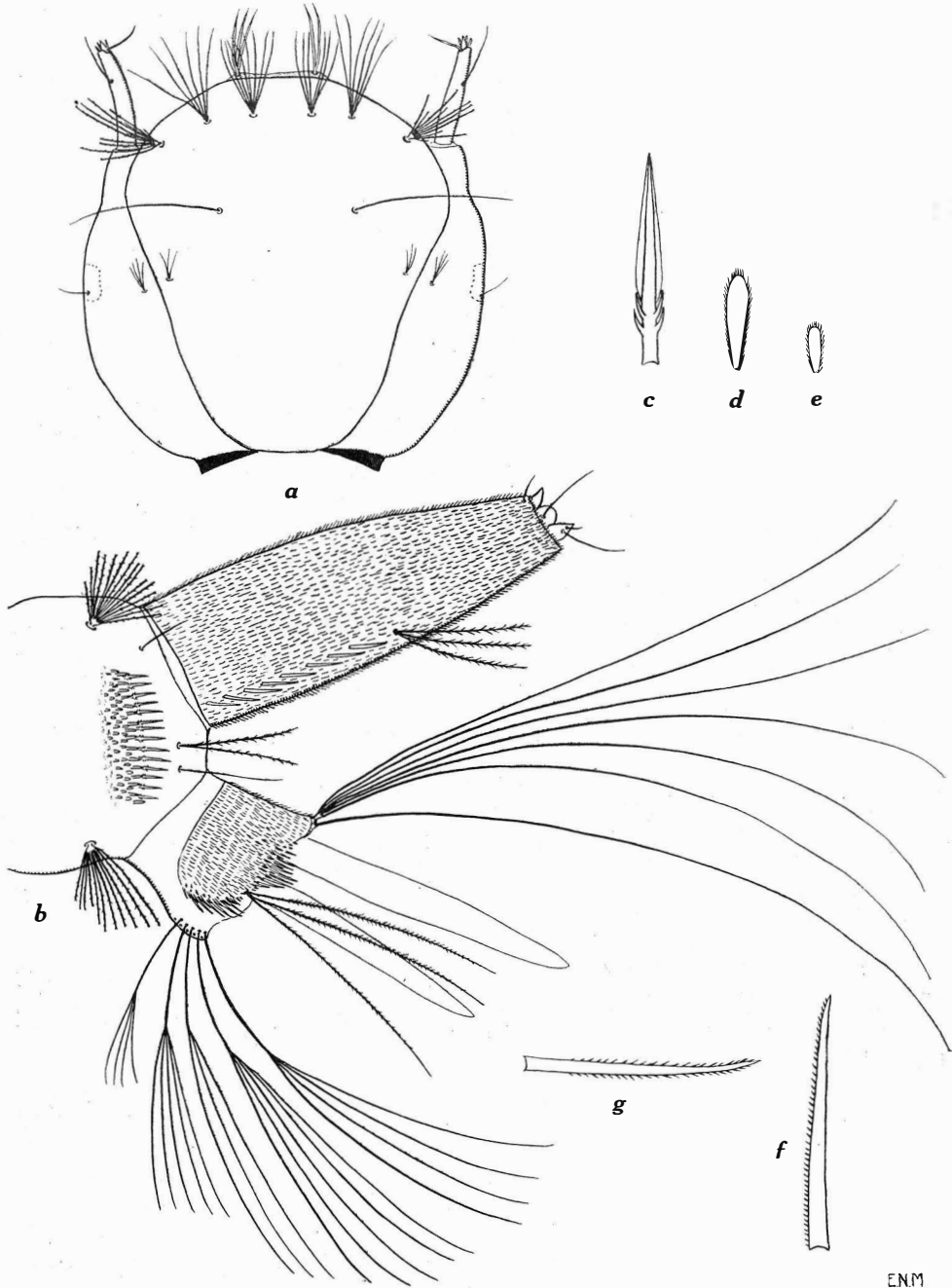


FIG. 7.—Larva of *Aedes bougainvillensis* n.sp. *a*, head. *b*, terminal segments (siphon flattened). *c*, *d* and *e*, teeth from distal, second and proximal rows respectively of lateral comb. *f*, pecten spine. *g*, saddle spine. (*a-b*, x 64; *c-g*, x 320.)

STUDIES OF QUEENSLAND MOSQUITOES.

Description of Larva (Fig. 7).

Length about 6.0 mm. Colour pale, with light brown head and siphon; general appearance greyish (probably due to darker colour of stellate setae on thorax and abdomen) as compared with *A. solomonis*, in association with which it may be found.

Head: About as broad as long. Antenna $\frac{1}{4}$ length of head, straight, smooth, tuft a single or bifid simple seta, $\frac{1}{2}$ length of antenna, at $\frac{2}{3}$ from base; terminal and subterminal setae all placed at apex, one long, remainder short. Clypeal spines with 2-3 slender curved branches. Setae A, B and d arising in a curved line towards anterior margin of head, their bases being about equal distances apart, and B and d being anterior to A. C arising well back, more or less in line with B. A stellate, with 8-11 branches, sparsely frayed, with forked tips, the longest slightly longer than antenna; B with 5-6 simple branches slightly longer than antenna; C long, single, simple, or sparsely frayed; d well developed, stouter than B, with 5-8 slightly flattened branches about length of antenna; e 2-3, f 3-4 branched. Mentum with large medial tooth, and 9 teeth on each side, evenly sized except the most basal which is small and more widely separated.

Abdomen: On segments I.-VI. a pair of long plumose lateral setae; on segment I., 5-6 branched; segment II., 4-5 branched; segments III.-V., 2-3 branched; segment VI., 3-4 branched.

8th segment: Lateral comb a triangular patch of approximately 80 overlapping teeth of three sizes, arranged in 4-5 rows. Distal row of about 17 long pointed teeth, about $92\ \mu$ in length, each stout basally and giving off at $\frac{1}{4}$ from its base 4 (occasionally 2 or 3) short slender pointed lateral spines, beyond which the medial spine is very long and slender, tapering to a fine point (but under high magnification it appears to be broadened, the lateral flanges being almost transparent). Remaining comb teeth are apically rounded, fringed scales, those of 2nd row being about $\frac{1}{2}$ and remainder about $\frac{1}{4}$ length of distal teeth. At the base of the comb are several rows of minute setae. First and fifth pentad setae stellate, their branches frayed, with forked tips; first about 18 branched; second and fourth single, simple; third 2-3 branched, shortly plumose; fifth 13-14 branched.

Siphon: Index about 4.0, strongly pilose. Pecten extending over basal $\frac{2}{3}$ of siphon, composed of 5-8 evenly sized and spaced spines, about $104\ \mu$ in length, finely fringed along proximal edge. Subventral tuft 3 branched, at slightly beyond $\frac{1}{2}$ length of siphon.

Anal segment: Saddle markedly pilose with numerous laterally fringed long and short spines on distal and ventral margins. Lateral seta 3 branched, shortly plumose. Caudal setae simple, upper 5-6 branched, lower single. Ventral brush of 10 multiple tufts each with 2-5 branches (usually 4-5); no grid. Gills long, tapering, unequal, upper pair about $2-2\frac{1}{2}$ x saddle.

Described from morphotype larva and two pelts (correlated with holotype male and allotype female), Bougainville. A pelt from Banika, Russell Is. (correlated with adult male which shows some differences on genitalia from type series), shows the following variations:—Lateral setae on abdominal segment I. 7-8 branched, II. 7 branched. Pecten 5-6 spines. Subventral tuft of siphon bifid. Upper caudal seta 8-9 branched.

Description of Pupa (Fig. 8).

A concolorous brownish pupa, the pigmentation being fairly evenly distributed over the whole integument, including the paddles.

Cephalothorax: Dorsal area somewhat paler anteriorly; remainder concolorous brown. Opening of trumpet oblique; ratio of meatus to whole 1 : 1.4; apical notch shallow.

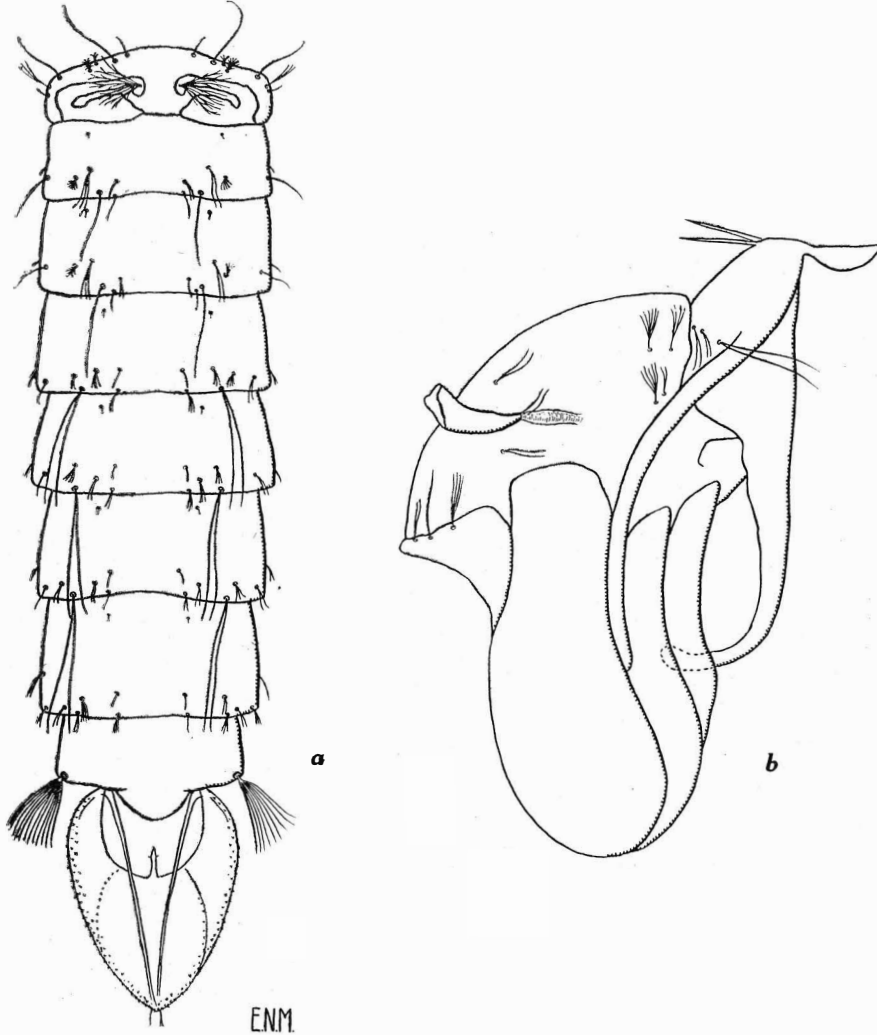


FIG. 8.—Pupal pelt of *Aedes bougainvillensis* n.sp., x 38. a, abdomen (dorsal view). b, cephalothorax.

Abdomen: Fairly evenly pigmented, tendency being for pigment to be slightly denser laterally. Float setae well developed, dendritic. The longer dorsal abdominal setae are finely pilose. Lateral seta of segment VIII. with 9–12 branches. Paddles pigmented, narrow, pointed, with denticulate margin; buttress and midrib moderately developed; breadth index 1.55–1.85.

Duration of pupal period 2–3 days.

Described from two pelts (correlated with holotype male and allotype female), Bougainville.

Biology: Notes by Lt. J. R. Cowell, Bougainville. "Breeding in axils of a lily-like plant with long narrow leaves, grows 3-7 ft. high. A botanist reported on specimens 'that as far as can be ascertained, its family is *Pandanaceae* and genus *Sararanga*.' In this area the plant grows in association with taro in dense rain forest, but as yet no *Aedes kochi* larvae [i.e., *A. bougainvillensis* and *A. solomonis*] have been taken from the leaf axils of taro, in spite of the fact that this plant is frequently found growing alongside *Sararanga* sp. in which *A. kochi* larvae are breeding freely." Samples from this plant included large numbers of *A. solomonis* and only a very small proportion of *A. bougainvillensis*. Specimens bred from pandanus, Banika and Vella Lavella, L. J. Dumbleton.

Distribution: Specimens examined all from Solomon Is., Bougainville. 2 ♂♂, 1 ♀ (Lt. J. R. Cowell, xii.44), 4 ♀♀, Torokina, Bougainville (F. N. Ratcliffe, iv.45); Banika (Russell Is.), 5 ♂♂, 3 ♀♀ and Vella Lavella, 1 ♂ (L. J. Dumbleton).

(3) *AËDES (FINLAYA) FIJIENSIS* n.sp.

Aedes (Finlaya) kochi Edwards, 1935, *Bull. ent. Res.*, 26: 129-130. Stone and Bohart, 1944, (in part), *Proc. ent. Soc. Washington*, 46: 211.

Types: Holotype ♂, allotype ♀, Samabula, Fiji, 13.viii.43, R. A. Lever, D.856, Pandanus.

Paratypes: 1 ♂, 1 ♀ same data as holotype; 1 ♂ R. Nadi, Fiji, 13.x.43, R. A. Lever, D.819; 1 ♂, 1 ♀, Vatuwaga, Fiji, 19.xii.44, R. A. Lever, D.931, Pandanus. Morphotypes: 3 larvae, Vatuwaga, Fiji, 19.xii.44, R. A. Lever, D.931, Pandanus axils.

Holotype ♂, allotype ♀ and morphotype larva in collection of University of Queensland; 1 ♂ and 1 ♀ paratype and morphotype larva returned to R. A. Lever, Department of Agriculture, Suva, Fiji; 1 ♂ and 1 ♀ paratype and morphotype larva in British Museum; 1 ♂ paratype in C.S.I.R. Museum, Canberra, A.C.T.

Distinctive Characters: The adult closely resembles *A. kochi*, the pale scales of the mesonotum being frosty white, though in general the pattern is somewhat reduced; abdominal sternites with outstanding scales usually only on VI. and VII., sometimes a reduced tuft on V. The female is to be distinguished by the absence of a basal medial pale patch on abdominal tergite VIII. The male may be readily separated on genitalia, the scales in the inner preapical tuft being long and narrow, and the long style bearing one or more long setae near its apex.

Larva with head setae B and d 2 branched, C single. It may be distinguished from all except *A. samoanus* by the teeth in the distal row of the lateral comb which have 2-4 short lateral spines near the base and an apically fringed expanded terminal portion, and from *samoanus* by its pilose siphon.

Description of Adult:

Holotype ♂.

Wing length 2.4 mm.

Head clothed mainly with broad flat scales; a medial white stripe, a broad patch of black and a lateral white area divided by a black patch; narrow curved white scales at nape, in midline and bordering eyes; upright forked

scales mostly dark, some pale ones on the pale scaled areas. Torus brown with flat pale scales on medial aspect; first flagellar segment of antenna with a few dark scales, flagellar segments brown with dense brown verticillate hairs; apical segments dark brown with short pale hairs. Clypeus dark brown. Palpi slightly longer than proboscis, banded black and white; shaft with 1 or 2 pale scales at base, 3 white bands and a preapical white patch; 2 apical segments each with long brown hairs and white basal patch extending slightly on to preceding segment; terminal segment with white tip. Proboscis slightly longer than fore femur, black scaled, with a narrow medial band produced dorsally in a short streak towards base; a patch of pale scales dorsally at apex.

Thorax: Integument dark brown. Mesonotum clothed with black, narrow curved scales, with white narrow curved scales along the anterior and lateral margins, extending inwards for a short distance behind the scutal angle, and almost linking with the anterior angles of a patch of narrow curved white scales in front of the scutellum. On either side of the prescutellar bare area, some of the white scales are broader and lanceolate. There are a few pale scales laterally above the wing roots. There is no medial area of pale scales on the anterior half of the mesonotum. Scutellum clothed with flat white scales, and a patch of flat black at apex of midlobe. Chaetotaxy: Bristles of mesonotum and scutellum black; a double row of about 12 strong acrostichal bristles terminating just in front of the prescutellar space; on either side of the latter is a double row of 8 bristles, continuous anteriorly with a row of about 6 strong dorsocentral bristles; a couple of strong bristles laterally on the fossae; a patch of about 10 supraalar bristles; scutellar bristles 4 to mid lobe and 3 to lateral lobes. Metapostnotum dark brown. Anterior pronotum with broad flat white scales. Posterior pronotum with flat white scales and a few flat black on upper margin. Flat white scales in small patches on propleuron, lower sternopleuron, paratergite and prealar area, and forming a continuous broad band from subspiracular area across upper sternopleuron and mesepimeron. Pleural bristles dark brown; 3 propleural, 2 posterior pronotal, 2 postspiracular, 1 upper sternopleural with a group of 4 below it, and a row of about 4 along posterior margin of sternopleuron; 9 prealar, 5-6 upper mesepimeral and no lower mesepimeral bristles.

Legs: Banded black and white. Coxae dark brown; fore and mid with patches of white and black scales, hind bare. Trochanters black scaled. Femora with a basal white band and about 6-8 more or less complete black bands and a white kneespot; a tuft of long outstanding black scales ventrally at apex. Tibiae with a few white scales at base, 6 or 7 black bands and white apical band. Fore and mid tarsal segment I. with narrow basal, medial and apical white bands, II. with narrow apical white band, III. and IV. all black, V. all white. Hind tarsal I. with wide basal and apical and narrow medial white bands, II. and III. with apical $\frac{2}{3}$ white, IV. all black, V. all white. Claws of fore and mid legs unequal, the anterior claw long with a strong tooth; claws of hind legs equal, simple.

Wings: Veins clothed mainly with broad flat scales; largely black scaled with numerous pale patches as follows:—*C* with small basal pale area, prehumeral and humeral pale areas confluent forming a wide pale area; sector, subcostal and apical pale areas (the subcostal being less than $\frac{1}{2}$ the length of the preceding dark spot). *Sc* with sector and apical pale areas. *R*₁ with basal, humeral, sector, accessory sector and subcostal pale areas. Small pale areas also at bases of *Cu* and *An*, apices of all veins, and at all forks and cross veins. A single pale scale preapically on *R*₄₊₅ on one wing; on the other wing,

a single pale scale subbasally on *M*. Fringe with pale areas opposite all veins except R_2 and R_3 . Cell R_2 about 2.7 times the length of its stem; cell M_1 equal to its stem, its base slightly proximal to that of cell R_2 ; $r-m$ 3 times its length **distal** to base of M_{3+4} . Halteres with pale stems and black scaled knobs; one or two pale scales at base of knob.

Abdomen: Integument brown. Tergites black scaled with large areas of pale scales. Tergite I. with pale scales medially. Tergites II.-VI. with broad basal band produced on either side of mid line to fuse with paired preapical patches which in tergites II.-V. tend to fuse with each other medially, forming

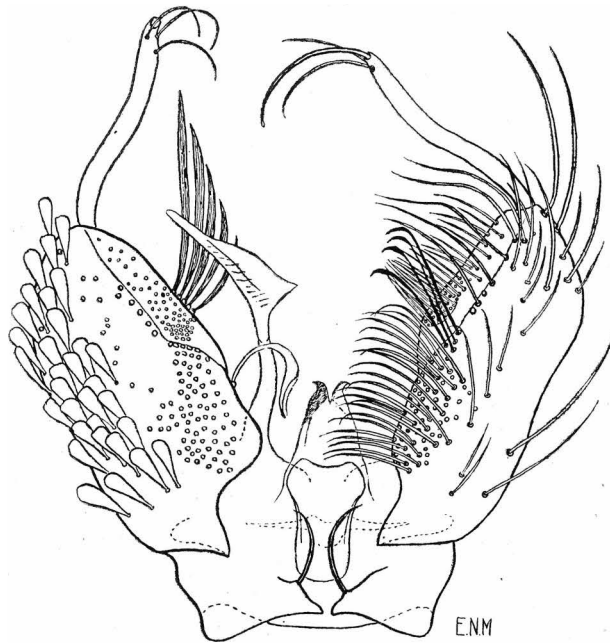


FIG. 9.— ♂ genitalia of *Aedes fijiensis* n.sp., x 160.

a pale square about a central black patch. On tergite VII. the preapical patches are distinct from the basal, and there are a few pale scales along apical border. Tergite VIII. with some pale scales at base and laterally. A lateral white border on tergite I.; II.-IV. with lateral preapical white patches, and a more or less complete lateral white border on V.-VII. Sternites black scaled with basal, lateral and medial preapical white patches; VI. and VII. with prominent tufts of outstanding black scales apically, VIII. black scaled with a few pale scales laterally.

♂ *Genitalia* (general description) (Fig. 9).

Coxite black scaled, tapering, about $2\frac{1}{2}$ times as long as broad at base; apical $\frac{2}{3}$ with a longitudinal groove along inner aspect. On the sternal side of this groove, just beyond $\frac{1}{2}$ length of coxite is a tuft of 5-7 long and very narrow scales, arising from prominent tubercles; the distal scale is about equal in length to style (excluding appendage), basally they become progressively smaller. Between this scale tuft and the groove is a dense patch of fine setae, and distal

to these are scattered fine setae. On the tergal side of the groove there is a large dense basal patch of medially directed setae extending for about $\frac{1}{2}$ length of the coxite; the distal members have their apical fourth bent and somewhat flattened. In addition there is a row of 5-7 long setae along the edge of the groove on the apical half of the coxite and scattered setae laterally and apically. On the inner sternal aspect of the coxite, at about $\frac{1}{4}$ from the base, and arising from a prominent tubercle, is a curved specialised seta, with narrow stem and widely expanded medial portion appearing to taper to a narrow pointed apical portion which may, however, be observed to bear a membranous lateral expansion. Style about $\frac{2}{3}$ length of coxite, slightly curved but not expanded, with 1-3 long setae on its inner side just before apex, these being about $\frac{3}{4}$ length of appendage; the latter is terminal, long and curved, about $\frac{2}{3}$ length of style with a blunt, slightly expanded tip. Harpago stout; appendage broad, curved, widening sharply near its base into a lateral membranous expansion which tapers towards the rounded tip. Paraproct with single tooth. Phallosome simple. Lobe of IXth tergite with a single seta.

♂ *Paratypes.*

The three male paratypes show the following variations from the type:—

Wing length 2.3-2.5 mm. Palpi without white scales at base, and may have an additional preapical pale patch on shaft. The medial band on the proboscis may be produced into a streak towards apex, or restricted to a narrow band. The mesonotal pattern may be slightly more extensive, a line of white scales curving inwards and forwards behind the scutal angle, but there is no definite anterior medial pale patch though there may be a few scattered pale scales; 2-3 postspiracular and 7-9 upper mesepimeral bristles. Wings: There may be an accessory subcostal spot on R_1 and one or two white scales preapically on R_3 ; cell R_2 may be 3 times the length of its stem, and cell M_1 slightly longer than its stem; $r-m$ $2\frac{1}{2}$ -3 times its length distal to base of M_{3+4} . Mid tarsal I. may have an additional white spot between the basal and medial bands. The basal and preapical patches on abdominal tergites may be quite separate. Sternite V. may have a reduced tuft of outstanding scales apically.

Allotype ♀ differs from the holotype as follows:—

Wing length 2.9 mm.

Head: Scaling as in male. Torus yellowish brown, medial aspect darker with some flat white scales; flagellar segments of antenna dark brown with dark verticillate hairs and pale clothing hairs, first flagellar segment with dark scales. Palpi $\frac{1}{4}$ length of proboscis, black scaled with white tip. Proboscis slightly shorter than fore femur, black scaled with a white medial band $\frac{1}{2}$ its length above, wider beneath, and a white patch dorsally at apex.

The scaling on anterior half of the mesonotum is similar to male, but there is a small indefinite medial patch of white scales anteriorly. The posterior half of mesonotum and the scutellum are largely denuded; there are a few pale scales above the wing roots. Three posterior pronotal bristles.

Legs: Mid tarsal II. has a wide apical white band, $\frac{1}{3}$ its length and mid tarsal III. has a small apical white patch. The medial white band on hind tarsal I. is incomplete on one leg, absent on the other. Claws equal, those on fore and mid legs toothed, hind simple.

Wing: An accessory subcostal pale area on R_1 , a wide preapical pale area on R_{4+5} and a few pale scales preapically on R_2 , R_3 and M_1 ; a subbasal pale area on Cu . Fringe with pale areas opposite all veins except R_2 . Cell R_2 3 times the length of its stem, cell M_1 slightly longer than its stem, its base slightly proximal; $r-m$ about 3 times its length to distal to base of M_{3+4} .

Abdomen: Tergite I with a few white scales medially. Tergites II.-VII. with medial basal and paired preapical white patches, the basal patch forming a basal band on II., inconspicuous on III. and IV. and rounded on V.-VII., VI. and VII. with a pale scaled apical border, VIII. entirely black scaled dorsally but with a few white scales along lateral border. Tergites I. and II. have complete white lateral borders, extending a short distance along apical border on II. There is a more or less complete lateral white border, curving towards mid line preapically, on III.-VII. Sternites mainly pale basally and dark apically; tufts of outstanding scales apically on VI. and VII.; VIII. large, exerted, dark scaled basally, bare of scales apically. Cerci short, dark, with some flat white scales.

♀ *Paratypes*.

The two female paratypes show the following variations from the allotype:—Wing length 2.7–2.9 mm. Medial band $\frac{1}{5}$ – $\frac{1}{3}$ length of proboscis. Scutellum white scaled with black scaled tip to mid lobe. Mid tarsal I. with an additional white spot between the basal and medial bands. *Wing*: Preapical pale areas may be absent from R_2 , R_3 , R_{4+5} and M_1 ; there may be pale scales subbasally on M_1 and An in addition to Cu . There may be a reduced tuft of outstanding scales on sternite V.

A single female, labelled “*Aedes (Finlaya) kochi* Fiji” agrees with the foregoing specimens, except that the mesonotal pattern is more extensive, resembling *A. kochi*; fore and mid tarsal III. entirely dark; wings with prehumeral pale area on C reduced or absent; humeral pale area absent.

Description of Larva (Fig. 10).

Length 6.2–6.8 mm. Colour pale, with light brown head and siphon. Thorax and abdomen with prominent stellate setae.

Head: About as broad as long. Antenna $\frac{1}{3}$ length of head, straight, smooth; tuft a single simple seta about $\frac{1}{2}$ length of antenna at $\frac{2}{3}$ from base; and subterminal setae all placed at apex, one long, remainder short. Clypeal spines with 2–3 slender curved branches. Setae A, B and d arising towards anterior margin of head, about equal distances apart; B and d anterior to A, but d posterior to B; C arising well back, more or less in line with B. A stellate, with 6–9 branches, very slightly frayed, with forked tips, the longest slightly longer than antenna; B bifid, almost as long as A, simple; C long, single, may be simple, slightly frayed, or bifurcate towards tip; d well developed, bifid, simple, as long as B; e with 2 and f with 3–4 branches. Mentum with large medial tooth and 9–10 lateral teeth, the most basal being smaller and more widely separated.

Abdomen: On segments I.-VI. a pair of long plumose lateral setae; on segment I. 6–7 branched, II. 5–6 branched, III.-VI. 2–3 branched.

8th Segment: Lateral comb a triangular patch of approximately 90–100 overlapping teeth of three sizes arranged in 5–6 rows. Distal row of 12–16 teeth, 68–72 μ in length, each stout basally and giving off at $\frac{1}{3}$ from its base 2–4 short stout pointed lateral spines, beyond which it expands into a medial broad flattened blade with rounded fringed apex. Remaining comb teeth are

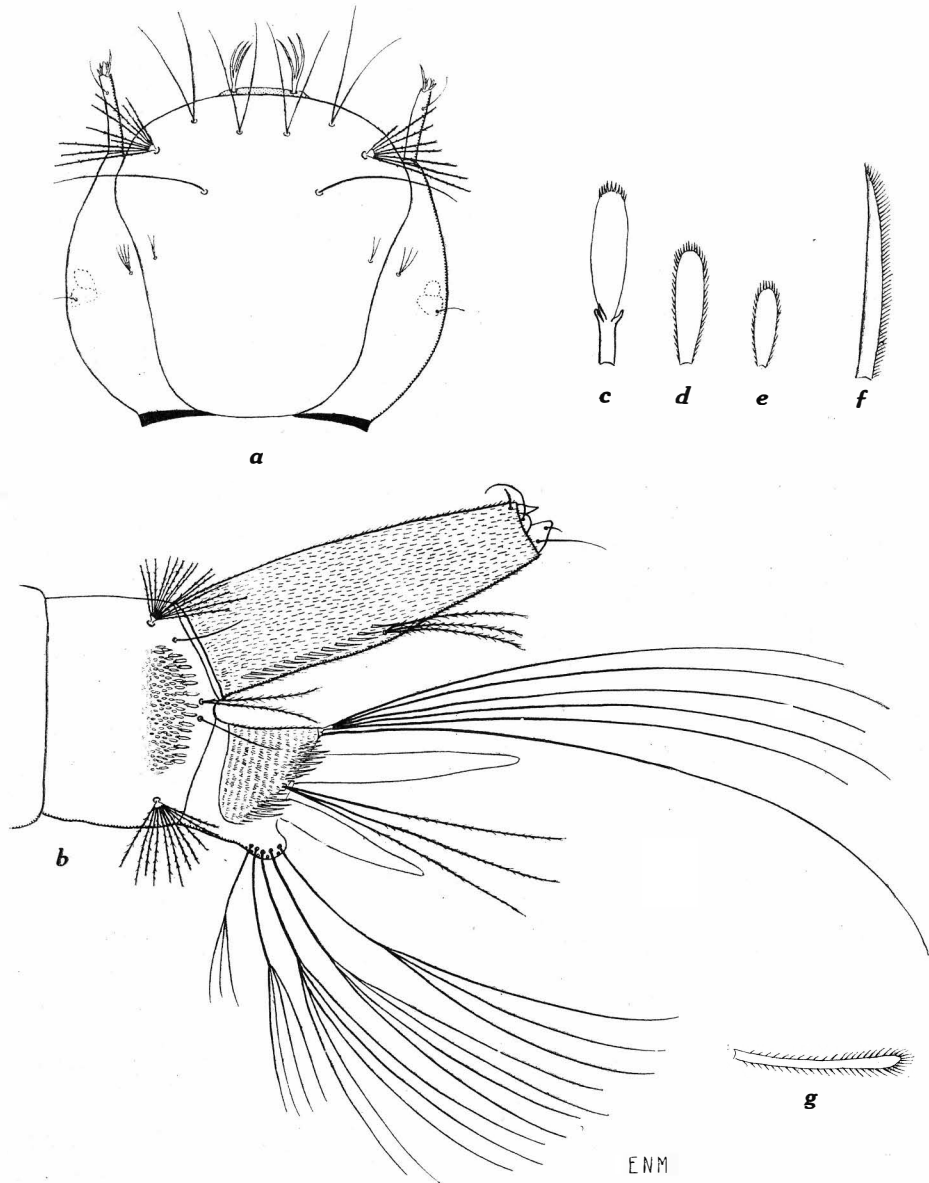


FIG. 10.—Larva of *Aedes fijiensis* n.sp. *a*, head. *b*, terminal segments. *c*, *d* and *e*, teeth from distal, second and proximal rows respectively of lateral comb. *f*, pecten spine. *g*, saddle spine. (*a-b*, x 64; *c-g*, x 320.)

apically rounded, fringed scales, those of second row being $\frac{2}{3}$ and remainder about $\frac{1}{2}$ length of distal teeth. At the base of the comb are several rows of minute setae. First and fifth pentad setae stellate, with about 13 branches, frayed and with forked tips; second and fourth single, simple; third 1-3 branched, sparsely plumose.

Siphon: Index about 3.0, finely pilose. Pecten extending over basal $\frac{1}{2}$ of siphon, composed of 7–12 evenly sized and spaced spines, 88–96 μ in length, finely fringed along proximal edge. Subventral tuft with 2–3 shortly plumose branches, at $\frac{1}{2}$ length of siphon or slightly beyond.

Anal Segment: Saddle covering dorsal $\frac{2}{3}$ of segment, finely pilose, bearing on distal and ventral margins long, laterally fringed spines with rounded fringed tips. Lateral seta trifold, shortly plumose. Caudal setae simple, upper 4–5 branched, lower single. Ventral brush of 10–11 multiple tufts, each with 3–4 branches; no grid. Gills long, tapering, upper pair about $2\frac{1}{4}$ x saddle.

Described from 3 morphotype larvae and one pelt, pandanus axils, Vatuwaga, Fiji, 19.xii.44.

The remaining two larvae in this sample showed the following differences:—

Specimen A. Length 7.7 mm. Head seta d 3–4 branched. Siphonal index 3.5. Upper caudal seta 4–6 branched.

Specimen B. Length 5.5 mm. Head seta A with 12–13 frayed branches; d level with A. Lateral seta on abdominal segment I, 9 branched. Lateral comb 62–68 teeth (similar type to above description). First pentad seta 7 branched, third 3–4 branched. Siphon non-pilose; pecten of 5 teeth extending over slightly less than $\frac{1}{2}$ length of siphon; subventral tuft 5 branched. Saddle with a few fine hairs proximal to the spines, otherwise bare; lateral seta 4 branched; upper caudal seta 6 branched. Gills bluntly pointed, dorsal pair $1\frac{1}{2}$ x saddle.

It seems likely that specimen A is a variant of the larva described as *A. fijiensis*, but without further specimens it is impossible to tell whether specimen B belongs to the same or a different species (? *samoanus*).

Biology: Specimens examined were found breeding in pandanus axils, Samabula (viii. 43) and Vatuwaga (xii. 44) Fiji (R. A. Lever). Edwards (1935): Larvae collected from leaf axils of *Colocasia indica* in or near forest at Nabavatu, Vanuabalavu, and at Bucalevu, Taveuni (R. W. Paine).

Habits: Buxton and Hopkins (1927) state that Bahr records '*F. poecilia*' at Suva as very shy-feeding. Presumably the species referred to was *A. fijiensis*.

Distribution: In addition to the type specimens, only a single female labelled "Fiji" with no details of locality, date or collector, has been examined.

Edwards (1935): Nabavatu, Vanuabalavu, and Bucalevu, Taveuni (R. W. Paine).

(4) *AEDES (FINLAYA) SAMOANUS* (Grünberg)

Finlaya samoana Grünberg, 1913, *Ent. Rundschau*, 30: 130.

Aedes (Finlaya) kochi Buxton and Hopkins, 1925, *Bull. ent. Res.*, 15: 298–300.

Aedes (Finlaya) kochi var. *samoana* Edwards, 1926, *Bull. ent. Res.*, 17: 105; Buxton and Hopkins, 1927, *Res. in Polynesia*, 95–120; Brug, 1934, *Bull. ent. Res.*, 25: 513.

Aedes (Finlaya) samoana Edwards, 1935, *Bull. ent. Res.*, 26: 129–130.

Aedes (Finlaya) samoanus Knight, Bohart and Bohart, 1944, *Keys to Mosquitoes of Aust. Region*: 54; Stone and Bohart, 1944, *Proc. ent. Soc. Washington*, 46: 205–225.

Type: No information is available as to where type is deposited.

Distinctive Characters: General appearance brownish as compared with black and white of *A. kochi* and *A. fijiensis*, due to the pale scaling on mesonotum, legs, wings and abdomen being more extensive and having a considerable admixture of creamy to ochreous scales. Mid lobe of scutellum black tipped, lateral lobes with or without some black scales apically. *C* with subcostal pale area equal to or longer than preceding dark spot, and an accessory subcostal pale area. Tufts of outstanding scales on sternites VI. and VII. Male Genitalia: Coxite with preapical tuft of 10–12 long broad scales but tuft of setae tergal to this is scarcely indicated; a large basal patch of setae; specialised seta at base small, apical half not expanded; style not expanded and without long subterminal seta; appendage of harpago sharply pointed and broadly triangular, shorter and stouter than in *A. kochi*.

Larva: Head setae A 6, B 2–3, C 1 and d 2–3 branched, A, B and d arising in a curved line forwards. Lateral comb about 60 teeth, those of distal row being long and spatulate with a fine short fringe, and with 2–4 short lateral spines near the base; siphon bare.

Notes on Females (based on three imperfect specimens)—

Wing length 3.2 mm. Scaling of head as for *kochi* except that the pale scaling is partly creamy. Palpi white tipped and may have a few white scales medially. Proboscis with pale medial band $\frac{1}{5}$ – $\frac{1}{3}$ its length, and apical dorsal patch or complete ring.

Thorax: Integument brown. Mesonotum clothed with dark brown narrow curved scales with golden narrow curved scales along anterior and lateral borders, curving inwards in indefinite lines behind the scutal angles; patches of golden scales above the wing roots and in front of the prescutellar bare area; on either side of the latter are a few flat pale scales. Scutellum clothed with flat white scales; apex of mid lobe black scaled; lateral lobes may have some black scales apically. Scaling of pleura similar to *kochi*.

Legs: Pale bands, particularly of femora and tibiae, with mixed white to creamy and ochreous scales. A tuft of outstanding scales ventrally at apex of femur. Fore tarsal segment I. with wide pale basal, medial and apical bands dorsally, entirely pale scaled ventrally, II. with pale apical dorsal patch. III. and IV. all black, V. all white. Mid tarsals similar but medial band on I. may be divided by a black patch. Hind tarsal I. with basal, medial and apical pale bands and there may be a pale patch between the basal and medial; II. and III. with apical $\frac{2}{3}$ white, IV. all black, V. all white.

Wings: With large pale areas. *C* with basal pale area separate or continuous with long confluent prehumeral and humeral pale area; long sector pale area; subcostal pale area equal to or almost twice as long as the preceding dark spot, completely or incompletely separated from accessory subcostal pale area; apical pale area. R_1 with basal, humeral, sector, accessory sector, subcostal, accessory subcostal and apical pale areas. Pale scales at all forks and cross veins, apices of all veins and bases of *Cu* and *An*. Preapical pale areas on some or all of the following: R_2 , R_3 , R_{4+5} , M_1 , M_{3+4} , and Cu_1 and there may be extensive pale scaling subbasally on *M* and *An*. Cell R_2 2–2½ times length of its stem; cell M_1 slightly longer than its stem, its base proximal to that of cell R_2 ; *r-m* 3–4 times its length distal to base of M_{3+4} . Halteres with pale stem and black scaled knob, with variable amount of pale scaling at base of knob.

Abdomen: Integument light brown. Tergites I.-VII. may be largely pale scaled dorsally, II.-VII. with some dark scales laterally and a medial longitudinal preapical dark patch, or II.-VII. may be mainly dark scaled dorsally with medial basal and paired preapical pale patches; VIII. dark with a small medial basal pale patch; broad lateral white border curving preapically on II.-VII. Sternites may be extensively pale with some scattered dark scales, or mainly dark with large pale medial patches; an apical border of outstanding dark scales on sternites VI. and VII.

Material Examined: 1 ♀ (Apia, Samoa. Q'd Museum Collection). 2 ♀ ♀ (Savaii, Samoa; Safune 14.v.24; E. H. Bryan Jr., collector. C.S.I.R. Collection).

Biology: Breeding in leaf axils of taro (*Colocasia esculenta*), taamu (*Alocasia macrorrhiza*) and in wild araceae.

Habits: The female is a persistent biter at night, and the bites are extremely irritating (Buxton and Hopkins, 1927).

Distribution: Samoa and Tonga (Edwards, 1926). Paine and Edwards (1927) record from Solomon Is. was probably *A. bougainvillensis* or *A. knighti*.

(5) *AEDES (FINLAYA) POICILIUS* (Theobald)¹.

Finlaya poicilia Theobald, 1903, Mon. Cul., 3: 283; 1907, *ibid.* 4: 520 (in part).

Aedes poicilia Edwards, 1922, *Ind. J. Med. Res.*, 10: 260.

Aedes (Finlaya) poicilia Edwards, 1924, *Bull. ent. Res.*, 14: 380.

Aedes (Finlaya) kochi var. *poicilia* Edwards, 1926, *Bull. ent. Res.*, 17: 104; Brug, 1931, *Arch. f. Hydrobiol. Supp.-Bd.*, 9: 22-24; 1934, *Bull. ent. Res.*, 25: 513-514.

Aedes (Finlaya) poicilius Bonne-Wepster and Brug, 1937, *Geneesk. Tijdschr. Ned. Ind.*, 77: 44-45; 1939, *ibid.*, 79: 1246-1248.

Aedes (Finlaya) poecilus Barraud, 1934, *Fauna Brit. Ind. Dipt.*, 5: 157-159.

Type: Holotype ♀, Penang (Dr. Freer), 24.x.1901, in British Museum.

Distinctive Characters: A black and white species with markings of head, legs and abdomen similar to those of *kochi*. Scutellum with black and white scales on all lobes; posterior pronotum clothed mainly with flat white scales². Wings: White markings in smaller and more numerous white dots than *A. kochi*. There are 2-3 white dots³ between the subcostal and apical on *C*, and 8-10 white dots between the basal and apical on *R*₁. Halteres with pale stem and black scaled knob, with a few white scales at base of knob. Tufts of outstanding scales at apices of abdominal sternites V.-VII. Male genitalia: Coxite with inner preapical tuft of about 8 broad scales, the longest less than half length of coxite; no specialised seta at base. Style very short, about $\frac{1}{4}$ length of coxite, of fairly uniform width, its appendage about $\frac{3}{4}$ its length. Appendage of harpago slender and sharply pointed.

¹This is the type species of the subgenus *Finlaya*, not *A. kochi* as stated by Edwards (1924).

²A closely allied undescribed species, which has been confused with *poicilius* in Philippines, has posterior pronotum clothed mainly with flat black scales; the mesonotal pattern resembles that of *gamicola*. Specimens examined: 1 ♂, 1 ♀ with correlated larval skins, and an additional ♂, bred from pineapple axils, Lucban, Tayabas, Luzon (19 M.G.L. 28. xii. 45). It is understood that this species is to be described at an early date by Lt.-Cmdr. K. L. Knight, U.S.N.

³Bonne-Wepster and Brug (1937) figure only one white dot in this position.

Larva: Head setae A 5-7, B 2, C 2-3, d 3-4 branched; siphon pilose. Tooth of distal row of lateral comb with blunt medial spine, 2-4 lateral spines (in Brug's (1931) figure the apical spine appears expanded, but in Bonne-Wepster and Brug's (1939) figure it is slender); remaining teeth sharply pointed. Pecten 6-13 teeth. Gills long and tapering.

Biology: Recorded as breeding in leaf axils of taro (*Colocasia indica*) and *Crinum* sp. in Java, banana in Philippines. A specimen examined from Philippines was bred from pineapple axils.

Habits: D. H. Colless has supplied a note that at Brunei *poicilius* bit severely at dusk.

Distribution: Specimens have been examined from BORNEO: Brunei town, Nth. Borneo, 1 ♀ (D. H. Colless, 17.vi.1945, taken biting). PHILIPPINES: unstated locality, 1 ♀ (labelled C. T., 18.xi.1945); Lucban, Tayabas, Luzon, 1 ♂ (19 M.G.L., pineapple axil). In addition to these areas, this species has been recorded from India, Burma, Malay Peninsula and Archipelago, Sumatra, Java, Celebes and Dutch New Guinea.

(6) *AEDES (FINLAYA) ALOCASICOLA* n.sp.

Alocasicola.—One living in cunjevoi, *Alocasia* sp.

Aedes (Finlaya) kochi Lee, 1944, Atlas of Mosquito Larvae of the Australasian Region. Australian Military Forces. (Restricted): 63.

Types: Holotype ♂, allotype ♀, Mt. Glorious, Q., 13.ii.45, J. L. Wassell (reared from larvae taken from axils of cunjevoi); twenty-two male and twelve female paratypes, Mt. Glorious, Q., iii.43, iv.43, viii.43, ii.44, ii.45; together with associated larval and pupal skins of holotype and 4 paratype males and 8 morphotype larvae (Mt. Glorious, iv.43, xii.43).

Holotype ♂, allotype ♀, 16 male and 6 female paratypes and 4 morphotype larvae in collection of University of Queensland. A paratype of each sex and morphotype larva sent to C.S.I.R. Museum, A.C.T.; Macleay Museum, University of Sydney; British Museum; U.S. National Museum, Washington. ♂ and ♀ paratypes in Queensland Museum and School of Public Health and Tropical Medicine, Sydney.

Distinctive Characters: Mesonotum without definite pattern, pale scaling extensive and mainly pale golden. In addition, large areas of pale golden scales on abdomen, and admixture of these scales among white on legs and wings give *A. alocasicola* a general brownish appearance when compared with *A. kochi* and *A. gahnicola*, the other mainland species, which are more distinctly black and white. Scutellum white scaled. Wing lacks an accessory subcostal pale area on R_1 . Male genitalia: No specialised seta at base of coxite; distinguished by the widely expanded style.

Larva: Head setae B 4-7 branched, C single, d 12-16 branched. Teeth of distal row of lateral comb are stout, pointed, basally fringed spines without lateral spines. Siphon strongly pilose.

Pupa: Abdomen with pigmented area restricted to medial apical portion of tergite I., whole of tergite II. and large medial apical patch on tergite III. Lateral seta of segment VIII. 4-7 branched. Breadth index of paddles 1.2-1.5.

*Description of Adult:**Holotype* ♂.

Wing Length 2.7 mm.

Head clothed with broad appressed white scales, with a pair of indefinite patches of flat black scales anteriorly on either side of vertex, and a second pair laterally; narrow curved white scales at nape, in midline, and bordering eyes; upright forked scales pale. Torus dark brown with flat white scales on medial aspect; flagellar segments of antenna dark brown with dense brown verticillate hairs; first flagellar segment with a few appressed black scales; apical segments with short silvery hairs. Clypeus dark brown. Palpi slightly longer than proboscis, banded black and white; shaft with four white bands; two terminal segments with basal white bands and long brown hairs; apical segment with white tip. Proboscis about $\frac{1}{2}$ longer than fore femur, black scaled, with narrow medial pale band, a dorsal longitudinal streak of creamy scales which is broadened on the penultimate quarter of its length, and a pale patch dorsally at apex.

Thorax: Integument dark brown. Mesonotum with no definite indication of a pattern, clothed mainly with narrow curved pale golden and white scales, with some intermingled bronzy-black scales; some lanceolate white scales on either side of prescutellar bare area; scutellum clothed with flat white scales. Chaetotaxy: Bristles of mesonotum and scutellum black; a double row of about 14 strong acrostichal bristles terminating just in front of prescutellar space; on either side of the latter is a double row of about 10 bristles, continuous anteriorly with a row of 6 strong dorsocentral bristles; there are a couple of strong bristles laterally on the fossae, and a patch of about 10 supraalar bristles; scutellar bristles 5 to mid lobe and 3-4 to lateral lobes. Metapostnotum dark brown. Anterior pronotum with flat white scales; posterior pronotum with flat white scales, a few flat black along its upper margin and a few narrow curved white scales in upper anterior angle. Flat white scales forming small patches on propleuron, lower portions of subspiracular and postspiracular areas, lower sternopleuron, paratergite and prealar area, and in a large patch forming a continuous broad band on upper sternopleuron and upper mesepimeron. Pleural bristles light brown; 4 propleural; 3 posterior pronotal; 2-3 post-spicacular; 1 upper sternopleural and a row of about 6 along posterior margin of sternopleuron; about 7 prealar; 6 upper mesepimeral, and no lower mesepimeral bristles.

Legs: Banded black and white. Coxae dark brown with white scales above, black below. Trochanters with mixed dark and pale scales. Femora with a basal white band, about 7 black bands, the distal one being broad, and a white kneespot; a tuft of long outstanding black scales ventrally at apex. Tibiae with a small white patch at base and narrow band or patch at apex; fore and mid tibiae with 8-9 and hind with 5-6 black bands. Fore and mid tarsal segment I. with basal, medial and apical white bands, and a white patch posteriorly between basal and medial bands, mid tarsal also with a similar patch between medial and apical bands; II. with a narrow apical white band, III. and IV. all black, V. all white. Hind tarsal I. with a narrow medial, and broad basal and apical white bands; II. and III. with apical half white, IV. all black, V. all white. Claws of fore and mid legs unequal, the anterior claw long with a strong tooth; hind claws equal, simple.

Wings: Veins clothed mainly with broad flat scales; largely black scaled with numerous white patches. *C* with basal, humeral, sector, subcostal and apical pale areas, the subcostal pale area being less than $\frac{1}{2}$ length of preceding dark spot. Corresponding pale areas and an accessory sector pale area on *R*₁. *Sc* with sector and apical pale areas. Small pale areas at all forks and cross veins, at the base of *Cu* and *An*, and at the apices of all veins. Fringe with pale areas opposite the ends of all veins except *R*₂. Cell *R*₂ twice length of its stem; cell *M*₁ equal in length to its stem, its base proximal to that of cell *R*₂; *r-m* 3 times its length distal to base of *M*₃₊₄. Halteres with pale stem and dark scaled knob, with some pale scales at base of knob.

Abdomen: Integument light brown. Tergites black scaled, with large areas of pale golden and white scales dorsally; I. and II. pale medially, II. with a narrow black apical border; III.-VI. with a large medial basal pale patch



FIG. 11.—♂ genitalia of *Aedes alocasicola* n.sp., x 160.

incompletely separated from large paired preapical pale patches; V. and VI. with a row of pale scales apically; VII. with large basal pale area separated by a narrow black band from pale apical border; I. with white lateral border and II.-VI. with white lateral preapical patches; VIII. largely pale scaled. Sternites II.-VIII largely pale scaled with indefinite dark patches; outstanding dark scales at apices of V.-VII.

♂ *Genitalia* (general description) (Fig. 11).

Coxite black scaled, tapering, about $2\frac{1}{2}$ times as long as broad at base, with a longitudinal groove along inner aspect. On the sternal side of this groove at $\frac{2}{3}$ from base of coxite, is a tuft of 7-10 long broad outstanding scales;

the apical scale of the group is often distinctly narrower and longer than the remainder; these scales arise from prominent tubercles. Just proximal to this scale tuft and between it and the groove is a fairly dense patch of fine curved setae; distal to these are scattered fine setae. On the tergal side of the groove there is a large basal patch of medially directed setae, extending almost to the level of the scale tuft; of these the more sternal in position are larger and have their apical half flattened, blade-like and pointed, the more tergal are normally developed and finer; there is no specialised seta. There is a row of long setae laterally from base to apex of coxite, and a patch of about 6 curved setae tergally near the apex. Style $\frac{1}{2}$ length of coxite, narrow at base and apex, widely expanded medially, with a short inconspicuous seta on the inner side just before apex; appendage terminal with blunt tip, long, curved, $\frac{1}{2}$ length of style. Harpago stout; appendage with only a slight membranous expansion on middle portion, and tapering to a narrow pointed tip. Paraproct with single tooth. Phallosome simple. Lobe of IXth tergite with 1-2 setae.

♂ *Paratypes.*

The series of 21 paratype males conform in general to the type specimen, but show the following variations:—

Wing length 2.4-3.3 mm. Head: The patches of flat black scales are in most cases well defined, though variable in size; shaft of palpus may have only 3 white bands; dorsal pale streak on proboscis may almost meet ventrally on penultimate fourth, or may fade out apically or may be almost entirely absent; there may be some white scales ventrally at the base of the proboscis. Thorax: 3-5 propleural; 3-5 posterior pronotal; 3-5 postspiracular; 1-2 upper sternopleural, and 6-14 prealar bristles. Legs: The banding of femora and tibiae is variable. First hind tarsal may have an additional white band or spot between the basal and medial rings. The apical pale bands on hind tarsals II. and III. vary from $\frac{1}{3}$ to $\frac{1}{2}$ length of segment. Wings: Accessory sector pale area on R_1 may be continuous with sector pale area; cell R_2 $2\frac{1}{2}$ times length of its stem. Division of pale areas on abdominal tergites III.-VI. into medial basal and paired preapical patches may be complete. White scales may form a complete lateral border on tergites VI. and VII.

Allotype ♀ differs from holotype as follows:—

Wing length 3.3 mm.

Head with large patches of black scales on either side of medial pale area, immediately behind eyes and not extending back to nape; two smaller areas of black scales on each side laterally; upright forked scales nearly all dark. Torus bright ochreous with a darker area on the medial aspect which bears a patch of creamy scales; first flagellar segment of antenna clothed with small appressed black scales and 1 or 2 pale scales; remainder dark brown, with dark verticillate hairs and silvery clothing hairs. Palpus $\frac{1}{4}$ length of proboscis, black scaled, with some white scales medially and white tip. Proboscis slightly shorter than fore femur, black scaled with a broad medial white band almost $\frac{1}{4}$ its length and a narrow apical ring of white scales.

Thorax: Mesonotum with a greater admixture of dark scales than in type, a large medial patch of white scales in front of scutellum; mesonotal bristles more numerous than in male; about 16 acrostichal and about 14 either side of prescutellar space continuous with a row of 8 dorsocentral; supraalar patch denser. Pleural bristles: 3-4 propleural, 4 posterior pronotal, 3 postspiracular; 12 prealar, 6 upper mesepimeral.

Legs: Some admixture of creamy or pale golden scales in the white bands. First mid tarsal with four white bands and a white patch. Hind tarsal II. with apical $\frac{1}{3}$ white, III. with apical $\frac{2}{3}$ white. Claws on fore and mid legs equal, unidentate, on hind legs equal, simple.

Wing markings similar to type, though pale areas smaller. Cell R_2 3 times length of its stem, cell M_1 $1\frac{1}{2}$ times length of its stem, their bases about level. Knob of halteres with some admixture of pale scales.

Abdomen: Tergites with dorsal pale areas less extensive than in male, mainly pale golden in colour; II. with medial pale area incompletely separated into basal and paired preapical patches; III.-VII. with these patches quite separate, V.-VII. with row of pale scales along apical border; VIII. black, with large basal pale patch; tergite I. with white lateral border; II.-VII. with a line of white scales along lateral border which before reaching the apex curves dorsally for a short distance, and on the distal segments recurves anteriorly. Sternites with golden and white scales medially, dark laterally, V.-VII. with apical border of outstanding black scales; VIII. black scaled with white lateral and medial patches and golden apical border. Cerci dark with flat pale golden scales.

♀ *Paratypes.*

The series of 11 paratype females conform in general to the allotype but show the following variations:—

Wing length 3.0–3.5 mm. Antennae may have dark scales only on first flagellar segment. Medial band on proboscis $\frac{1}{4}$ – $\frac{1}{3}$ its length; apical band may be incomplete ventrally. Palpi may have some white scales at base. Leg markings show the same variation as in paratype males. Wings: Humeral pale spot may be missing from *C*; cell R_2 3–4 times length of its stem; cell M_1 $1\frac{1}{4}$ – $1\frac{1}{2}$ times length of stem; halteres may be entirely black scaled. Variations in pleural chaetotaxy and in abdominal pattern similar to male paratypes.

1 ♂, 1 ♀, Binna Burra, 1 ♀, Maleny, Q., agree with the foregoing specimens, 1 ♀ Binna Burra, has areas of pale golden scaling on mesonotum restricted, simulating the mesonotal pattern of *A. kochi*.

Description of Larva (Fig. 12).

Length 6.5–8.5 mm. Colour pale, with light brown head and siphon. Thorax and abdomen with prominent stellate setae.

Head: About as broad as long. Antenna $\frac{1}{3}$ length of head, straight, smooth; tuft a bifid simple seta $\frac{1}{2}$ length of antenna, at $\frac{2}{3}$ from base; terminal and subterminal setae all placed at apex, one long, remainder short. Clypeal spines with 2–6 curved branches. Setae A, B and d arising in a curved line towards anterior margin of head, the distances A-B and B-d being equal while d-d is slightly greater; B and d are anterior to A, d being level with, or slightly posterior to B; C arising well behind and slightly medial to B. A stellate with 13–20 frayed branches with forked tips, the longest somewhat shorter than antenna; B with 4–7 branches, simple or frayed, about equal in length to antenna; C long, single, simple or frayed; d well developed, as long as A, with 10–16 simple branches; e 2–3 and f 2–4 branched. Mentum with large medial tooth and 9–11 lateral teeth, the most basal being smaller and more widely separated.

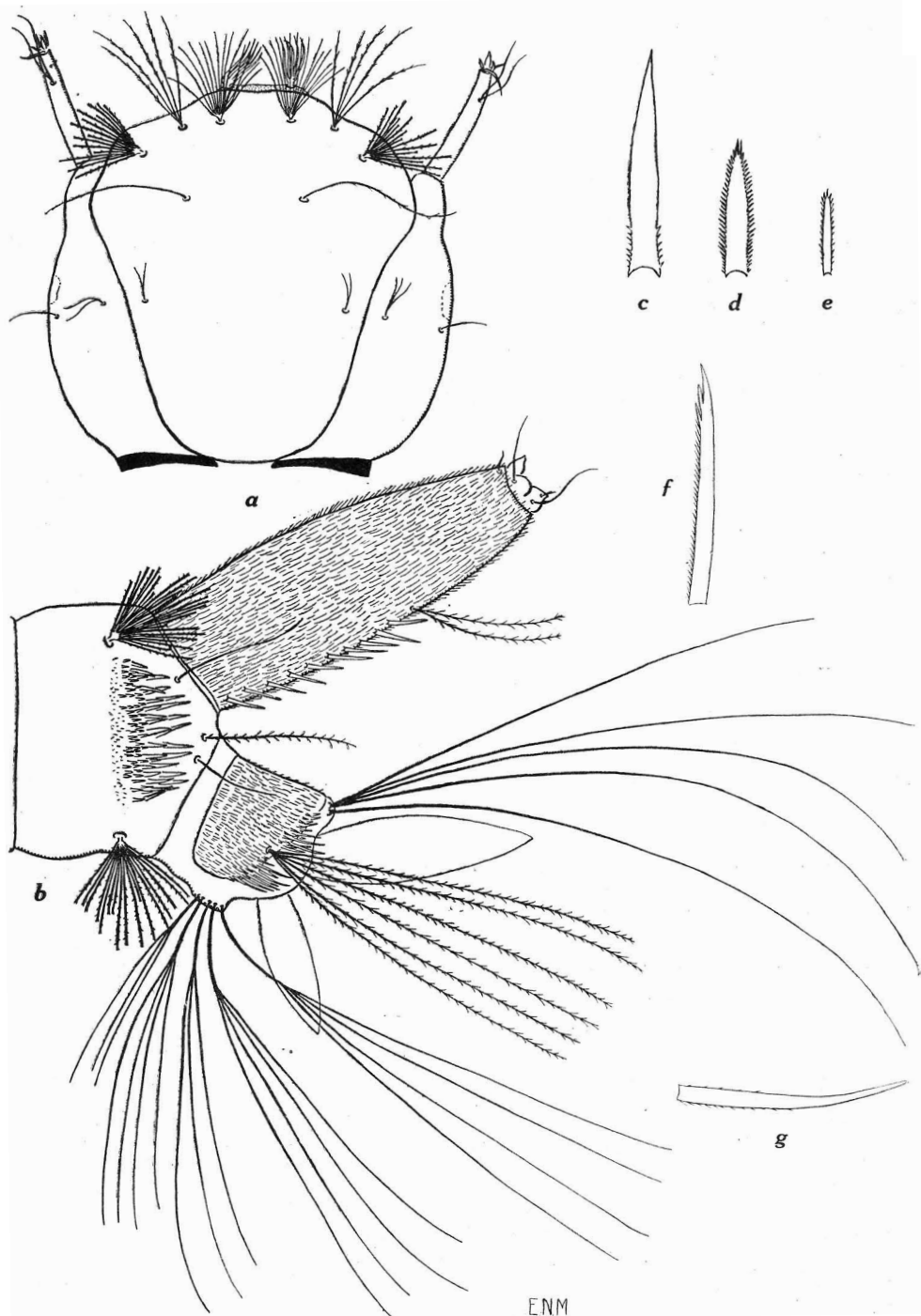


FIG. 12.—Larva of *Aedes alocasicola* n.sp. *a*, head. *b*, terminal segments. *c*, *d* and *e*, teeth from distal, second and proximal rows respectively of lateral comb. *f*, pecten spine. *g*, saddle spine. (*a*-*b*, x 64; *c*-*g*, x 320.)

Abdomen: On segments I.-VI. a pair of long plumose lateral setae; on segment I. 2-5, II. 3-5, III.-VI. 2-3 branched.

8th Segment: Lateral comb a triangular patch of approximately 75-95 overlapping teeth of three sizes arranged in 5-6 rows. Distal row of 15-19 long, stout pointed spines, 88-104 μ in length, evenly tapering, without lateral spines, but with a basal lateral fringe. Remaining comb teeth are apically pointed, fringed scales, those of second row being about $\frac{2}{3}$, and remainder about $\frac{2}{3}$ length of distal teeth. At the base of the comb are several rows of minute setae. First and fifth pentad setae stellate, their branches frayed and with forked tips; first 20-30 branched; second and fourth single, simple; third single or bifid, plumose; fifth 15-23 branched.

Siphon: Index 2.3-2.5; strongly pilose. Pecten extending over basal $\frac{1}{2}$ - $\frac{2}{3}$ of siphon, composed of 7-15 evenly sized and spaced spines, 100-120 μ in length, with a terminal and 1 or 2 lateral apical pointed teeth, and a lateral fringe along remainder of proximal border. Subventral tuft plumose, single or bifid, at about $\frac{2}{3}$ length of siphon. (Note: One specimen had a tooth near apex of siphon, apparently an aberrant pecten tooth.)

Anal Segment: Saddle covering dorsal $\frac{2}{3}$ of segment, strongly pilose, bearing on distal and ventral margins long pointed spines with or without a basal lateral fringe. Lateral seta 3-6 branched, plumose. Caudal setae simple, upper 4-5 branched, lower single. Ventral brush of 9-10 multiple tufts, each with 2-5 branches; no grid. Gills short, pointed, unequal, upper pair $1\frac{1}{2}$ -2 x saddle.

Described from slides of 11 pelts (holotype and 4 paratype males; 6 not correlated with adults) and 8 morphotype larvae; with siphonal index, length of larva and of gills from unmounted specimens, all from Mt. Glorious, Q.

A single specimen from Maleny corresponds to this description. Four specimens from Binna Burra show the following variations: head seta B and upper caudal seta may both be 3 branched.

Description of Pupa (Fig. 13).

General coloration pale with darkly pigmented areas on upper surface of cephalothorax and basal abdominal tergites.

Cephalothorax: Dorsal area with an indefinitely demarcated, darkly pigmented area posterior to level of insertion of trumpets, which extends over metapostnotum (except lateral posterior angles) and may extend slightly over upper margin of wing covers. Trumpet pigmented at base; opening oblique; ratio of meatus to whole 1 : 1.4; apical notch shallow.

Abdomen: An indefinitely demarcated darkly pigmented area covering the whole of tergite II. except lateral posterior angles; extending only on to apex of medial portion of tergite I. and discontinuous with an apical medial patch about $\frac{1}{3}$ width of segment, on tergite III. Float setae well developed, dendritic; the homologous seta on tergite II., while normally 1-4 branched, on one side of one specimen was dendritic with approximately 19 branches. The longer dorsal abdominal setae are finely pilose. Lateral seta of segment VIII. with 4-7 branches. Paddles broad, with denticulate margin, buttress and midrib moderately developed; breadth index 1.2-1.5.

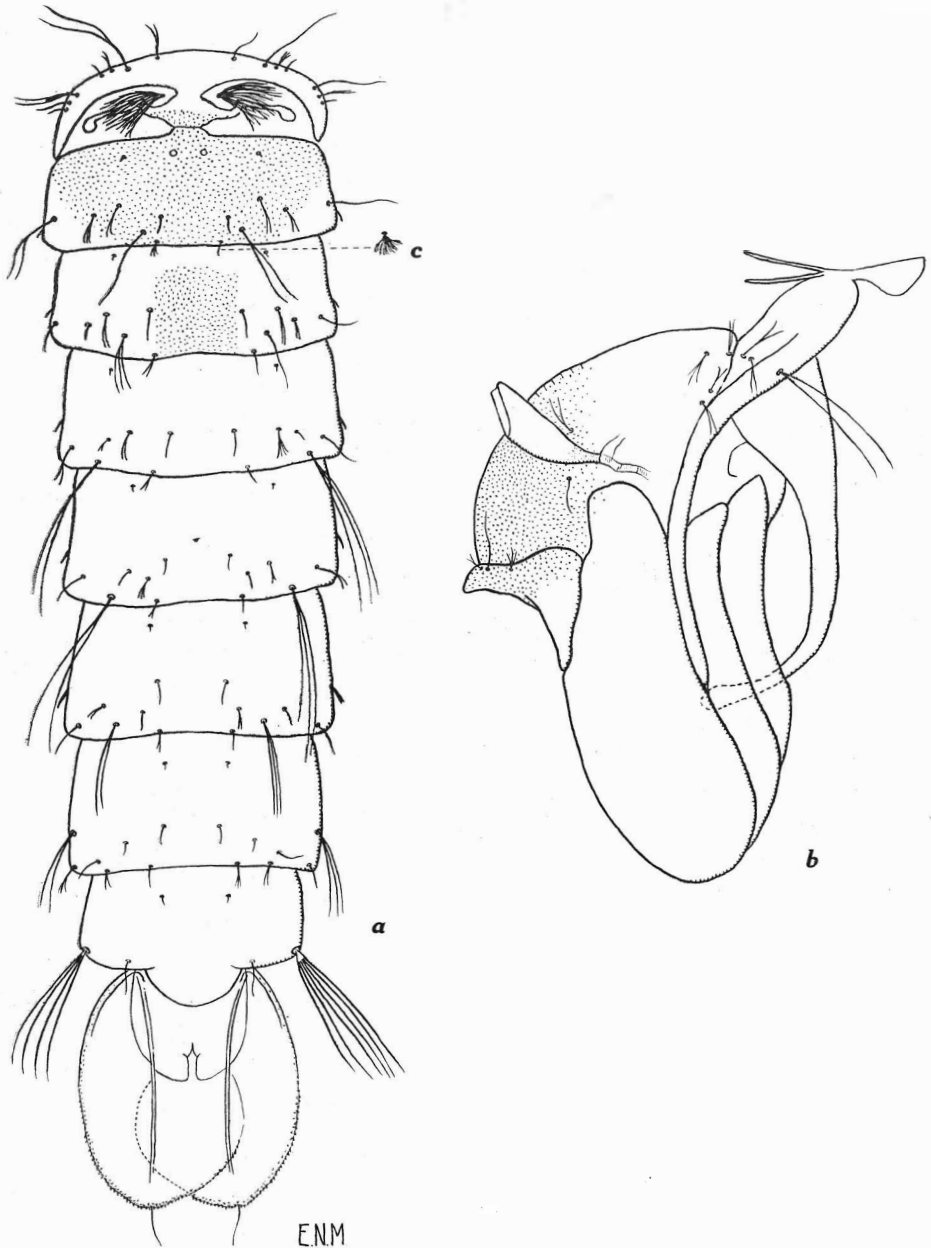


FIG. 13.—Pupal pelt of *Aedes alocasicola* n.sp. x 38. a, abdomen (dorsal view). b, cephalothorax. c, abnormal development of seta indicated.

Duration of pupal period 3–4 days.

Described from 8 pelts, 7 from Mt. Glorious (including holotype and 4 paratypes); 1 from Binna Burra.

Biology: Breeding in axils of cunjevoi (*Alocasia macrorrhiza*) in rain forest.

Habits: Taken biting occasionally in rain forest, but not a vicious biter like *A. kochi* and *A. gahnicola*.

Distribution: In addition to the type series from Mt. Glorious, Q., specimens have been examined from Binna Burra, Lamington National Park, Q. (1 ♂, 2 ♀ ♀, larvae, xi.43, v.44, F. A. Perkins and E. N. Marks); Maleny, Q. (1 ♀, larva, iv.45, J. L. Wassell). It is likely that Bancroft's (1908) specimen of *Finlaya poicilia* from Kedron Brook, S.Q.'land "In scrubs" was in fact *A. alocasicola*, as this would be similar rain forest to its known environment.

(7) **ÆDES (FINLAYA) GAHNICOLA** n.sp.

(*gahnicola*—one living in sword grass, *Gahnia* sp.)

Types: Holotype ♂, allotype ♀ (with associated larval and pupal skins), Caloundra, Q., 13.viii.45, F. A. Perkins and J. L. Wassell (reared from larvae taken from axils of sword grass).

Paratypes: 10 ♂ ♂ and 3 ♀ ♀, same data as holotype; 3 ♂ ♂, 2 ♀ ♀, Palmwoods, Q., 23.iv.45, J. L. Wassell; 1 ♀ Forest Glen, Q., 26.iv.45, J. L. Wassell. (All reared from larvae taken from axils of sword grass; 5 ♂ ♂ and 5 ♀ ♀ with associated larval and pupal skins.) *Morphotypes:* 7 larvae, same data as holotype; 8 larvae, Palmwoods, Q., 23.iv.45, J. L. Wassell.

Holotype ♂, allotype ♀, 8 male and 3 female paratypes and 11 morphotype larvae in collection of University of Queensland. A paratype of each sex and morphotype larva sent to C.S.I.R. Museum, Canberra, A.C.T., British Museum, U.S. National Museum, Washington; male paratype in Queensland Museum; male paratype and morphotype larva in Macleay Museum, University of Sydney.

Distinctive Characters: Mesonotum with more or less isolated patches of white scales, including a pair of oval patches in middle of mesonotum on either side of mid line. General appearance, particularly on wings and legs, is black and white as compared with *A. alocasicola*. Scutellum white scaled. Wing without accessory subcostal pale area on R_1 . Fore tarsal I. with basal white band reduced or absent. Pale dorsal patches on abdominal tergites small. Male genitalia: No specialised seta and no large patch of long setae at base of coxite; inner preapical scale tuft of 1-3 scales; style only slightly expanded.

Larva: Head setae B 2-3 branched, C single, d 7-10 branched; teeth of distal row of lateral comb are stout, pointed, basally fringed spines without lateral spines. Siphon strongly pilose.

Pupa: Abdomen with very indefinite pigmented area on tergites I-IV. Lateral seta of segment VIII. 3-5 branched. Breadth index of paddles 1.5-1.7.

Description of Adult:

Holotype ♂.

Wing length 2.4 mm.

Head clothed mainly with broad flat scales; a medial white band, a broad patch of black, and a lateral white area divided by a black patch; some narrow curved white scales at nape, in midline, and bordering eyes; upright forked scales mainly dark. Torus dark brown with flat white scales on medial aspect; first flagellar segment of antenna with some dark scales; flagellar segments brown, with dense dark brown verticillate hairs, apical segments with short pale hairs. Clypeus dark brown. Palpi slightly longer than proboscis, banded black and white; shaft with some pale scales at base and 3 white bands; two terminal segments with basal white bands and long brown hairs; apical segment with white tip. Proboscis about equal in length to fore femur, black scaled, with a narrow medial pale band which broadens into a short streak dorsally, and a few pale scales dorsally at apex.

Thorax: Integument black. Mesonotum clothed with black narrow curved scales and more or less isolated patches of white narrow curved scales. Along the anterior border there is a medial patch of white, joined by narrower strips to lateral patches above the anterior angles of the posterior pronotum; behind this the pale scaling is discontinued, but there are another pair of patches over the scutal angles, linked by a line of mixed white and bronzy scales to a pair of oval patches in the middle of the mesonotum, on either side of the midline; there are white patches above the wing roots and a medial patch of white and a few bronzy scales in front of the scutellum, with some broadened lanceolate scales on either side of the prescutellar bare area; a narrow broken line of bronzy scales runs back diagonally from the antero-lateral patches towards the middle of the mesonotum; scutellum clothed with broad flat white scales. Chaetotaxy: Bristles of mesonotum and scutellum black; a row of about 12 strong acrostichal bristles reaching back to the prescutellar bare area; on either side of the latter is a double row of 8 bristles continuous with a row of 6 strong dorsocentral bristles; two strong bristles lateral to these on the fossae; a patch of about a dozen supraalar bristles; scutellar bristles 4 to mid lobe, 3 to lateral lobes. Metapostnotum dark brown. Anterior pronotum with flat white scales; posterior pronotum with flat white and a row of flat black along the upper margin; flat white scales in small patches on propleuron, lower sternopleuron, paratergite, and prealar area, and forming an interrupted band across sub- and postspiracular areas, widening on the upper sternopleuron and mesepimeron. Pleural bristles dark brown; 4 propleural; 3 posterior pronotal; 3 postspiracular; 2 upper sternopleural and a row of 4 along posterior border of sternopleuron; 6 upper and no lower mesepimeral bristles.

Legs: Banded black and white. Coxae dark brown, with white scales above and black below; trochanters black scaled. Femora with a basal white band, 5-6 black bands, the distal one being broad, and a white kneespot; a tuft of long outstanding black scales ventrally at apex. Tibiae with a few white scales at base; fore tibia with 6 black bands, and a broad white band at apex; mid tibia with 9 black bands and a few white scales at apex; hind tibia with 5 broad black bands and a narrow white apical band. Fore tarsal segment I. with a few white scales at base, medial and apical white bands; mid tarsal I. with broad basal, medial and apical white bands; fore and mid tarsal II. with apical white band, III. and IV. all black, V. all white. Hind tarsal I. with broad basal, medial and apical white bands (the basal and apical being equal in width to the adjacent black bands), II. and III. with apical $\frac{1}{2}$ white, IV. all black, V. all white. Claws of fore and mid legs unequal, the anterior claw long with a strong tooth; claws of hind legs equal, simple.

Wings: Veins clothed mainly with broad flat scales, largely black scaled with numerous white patches. *C* with small basal pale area, a couple of pale scales in humeral position, sector, subcostal and apical pale areas (the subcostal being about $\frac{1}{3}$ the length of the preceding dark spot). *Sc* with sector and apical pale areas. *R*₁ with black scales at base and a small subbasal pale area, humeral, sector, accessory sector, subcostal and apical pale areas. Small pale areas also at bases of *Cu* and *An*, apices of all veins, and at all forks and cross veins. Fringe with pale areas opposite all veins except *R*₂. Cell *R*₂ almost twice the length of its stem; cell *M*₁ slightly longer than its stem, its base proximal to that of cell *R*₂; *r-m* twice its length distal to base of *M*₃₊₄. Halteres with pale stem and black scaled knob.

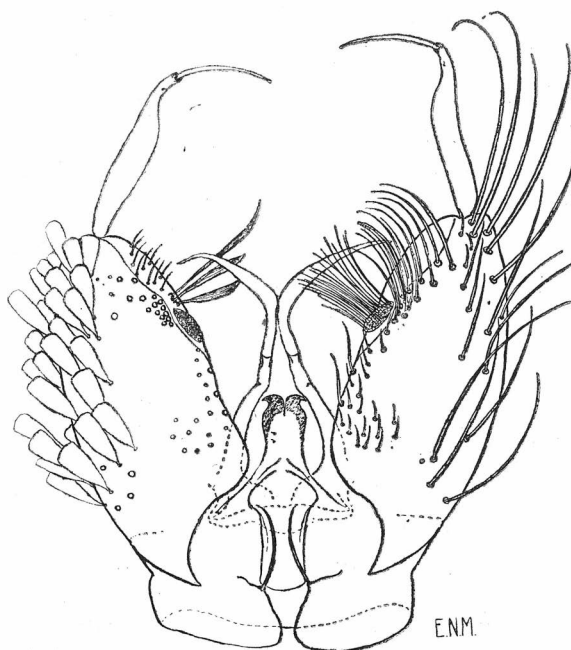


FIG. 14.—♂ genitalia of *Aedes gahnicola* n.sp., x 160.

Abdomen: Integument brown. Tergites black scaled; I. black dorsally; II. with a white medial basal patch; III. with a small medial basal pale golden patch; V.-VII. with 1 or 2 pale scales medially at base; II.-VI. with small paired preapical pale golden patches which on V. have 1 or 2 pale scales separated off from them anteriorly; VII. with 1 or 2 pale scales preapically and small paired apical pale patches; VIII. with medial basal white patch; I. with a lateral border of white scales and II.-VII. with lateral preapical white patches. Sternites dark scaled with white patches; V.-VII. with large paired preapical white patches, and a tuft of outstanding black scales at apex; VIII. white basally and laterally, black apically.

♂ *Genitalia* (general description) (Fig. 14).

Coxite black scaled, tapering, about $2\frac{1}{2}$ times as long as broad at base, with a longitudinal groove along inner aspect. On the sternal side of this groove at $\frac{2}{3}$ from base of coxite is a tuft of 1-3 long outstanding scales, the distal one being long and narrow ($\frac{2}{3}$ length of style); the more proximal being shorter,

and either narrow, or slightly broadened; these scales arise from prominent tubercles. Just proximal to the scale tuft, and between it and the groove, is a dense patch of 30–40 long fine setae, and distal to this are scattered short fine setae. On the tergal side of the groove, opposite this patch and extending towards, but not reaching apex of coxite, is a scattered patch of 12–16 long curved setae. There is no large basal patch, but a small patch of about eight short fine setae at the base of coxite, continuing in a row along the inner aspect for about $\frac{1}{2}$ its length; there is no specialised seta. Laterally there are scattered long setae from base to apex of coxite. Style $\frac{1}{2}$ length of coxite, slightly expanded medially, narrowing on apical $\frac{1}{6}$, with a short inconspicuous seta on its inner side just before tip; appendage terminal, with rounded tip, long, curved, $\frac{3}{8}$ length of style. Harpago stout, appendage with very slight membranous expansion on middle portion, and tapering to a narrow pointed tip. Paraproct with a single tooth. Phallosome simple. Lobe of IXth tergite with 1–2 setae.

♂ *Paratypes.*

The 12 male paratypes show the following variations from the type:—

Wing length 2.1–2.7 mm. Proboscis may be longer than fore femur, and its medial band not produced into a streak. On the mesonotum, the 3 white patches along anterior border may be quite separate; the submedial oval patches may be connected to the prescutellar pale area and there may be some bronzy scales between both of these and the supraalar patch. Three to four bristles to mid lobe of scutellum; 2–4 propleural, 1–3 postspiracular, 1–2 upper sternopleural, 6–8 prealar and 5–6 upper mesepimeral bristles. Legs: Femora and fore tibia with 5–7, mid tibia with 7–9 and hind tibia with 4–5 black bands; fore tarsal I. may have a narrow basal band, but usually white scaling at base is reduced or absent; there may be a white spot between basal and medial bands on fore and mid tarsal I.; hind tarsals II. and III. with apical $\frac{2}{5}$ – $\frac{1}{2}$ white. Wings: *C* usually with small humeral pale area; cell R_2 $1\frac{2}{3}$ – $2\frac{1}{2}$ times length of its stem, cell M_1 1 – $1\frac{1}{3}$ times length of its stem; *r-m* 2 – $2\frac{1}{2}$ times its length distal to base of M_{3+4} . Abdomen: Tergite I. may have 1 or 2 pale scales dorsally; basal medial pale patches may be absent from any or all of tergites III.–VII.; on II. the basal patch may be partly confluent with the preapical; on V. and VI. each preapical patch may be divided horizontally into two patches, one behind the other; there may be a complete lateral white border on VI. and VII.; VIII. white basally and laterally; the tuft of outstanding scales may be reduced on sternite V.

Allotype ♀ differs from the holotype as follows:—

Wing length 2.4 mm.

Head scaling similar though the medial white band is reduced and the submedial black areas enlarged. Tori brown, medial aspect darker and with flat white scales; first flagellar segment of antenna with flat black scales and one or two white scales medially, flagellar segments black, with dark verticillate hairs and light clothing hairs. Palpi $\frac{1}{4}$ length of proboscis, black scaled with white tip. Proboscis slightly shorter than fore femur with a white medial band $\frac{1}{2}$ its length, and a white dorsal patch at apex. Mesonotum black scaled with a continuous broad horizontal white band just distal to the anterior border; the remainder of the pattern similar to type though in general the patches are not so distinct from the connecting portions; scutellum white scaled. Scutellar bristles 4 to mid lobe, 3 to lateral lobes; 3–4 propleural, 3–4 posterior pronotal, 1–2 postspiracular, 6 prealar, 5 upper mesepimeral bristles.

Legs: Hind tarsals II. and III. with apical $\frac{2}{3}$ white; claws equal, those on fore and mid legs toothed, hind simple.

Wings: *C* with small basal, sector, subcostal and apical pale areas, the subcostal being about $\frac{1}{4}$ the length of preceding dark spot, remainder similar to male; cell R_2 3 times the length of its stem, cell M_1 $1\frac{1}{4}$ times length of its stem, its base slightly proximal to that of cell R_2 . Halteres with 1 or 2 pale scales at base of knob.

Abdomen: Tergites black scaled; I. with a couple of white scales medially at apex; II. with basal pale patch; II.-VII. with small paired preapical golden patches; VIII. with a large medial pale basal patch and a few pale scales laterally at base; tergite I. with lateral white border, II.-VII. with white lateral borders recurving preapically. Sternites II.-IV. mainly dark with lateral basal white patches, V.-VII. mainly pale basally with black apical border and tufts of outstanding black scales on VI. and VII., a reduced tuft on V.; VIII. dark scaled with some white scales basally, integument at apex ochreous and apical border with golden scales. Cerci dark with pale scales.

♀ *Paratypes:* The 6 female paratypes show the following variations from the allotype:—

Wing length 2.3–2.6. Head: There may be some admixture of bronzy scales among the white at nape and in midline; first flagellar segment of antenna may have black scales only; medial band of proboscis $\frac{1}{2}$ to $\frac{1}{4}$ its length. Chaetotaxy and markings of mesonotum and legs show same variations as in male paratypes. Wings: Proportion of subcostal pale area to preceding dark spot on *C* variable but less than $\frac{1}{2}$; the subbasal pale area on R_1 may be absent; cell R_2 $2\frac{1}{3}$ – $3\frac{1}{3}$ times length of its stem, the bases of cells R_2 and M_1 level or that of cell M_1 slightly proximal. Abdomen: Dorsal markings of tergites I.-VII. show the same variations as in male paratypes; tuft of outstanding scales on sternite V. may be prominent.

7 ♀♀ Dunwich, Q., have wing length 2.1–2.7 mm.; palpi may have some white scales medially; there may be a very small humeral pale area on costa; otherwise similar to type series.

8 ♀♀, Splitter's Creek, Bundaberg, Q., have wing length 2.2–2.8 mm.; palpi may have some white scales medially; proboscis with medial band $\frac{1}{4}$ to $\frac{1}{3}$ its length, and may have an almost complete pale ring at its tip. Mesonotum with white patches as in type series, but bronzy scales replaced by pale golden, which may be more numerous; in addition to diagonal pale golden lines on the anterior half of the mesonotum, there may be a longitudinal line of pale golden scales extending from the medial anterior white patch to a patch of pale golden continuous with the prescutellar white patch; otherwise similar to type series.

Description of Larva (Fig. 15).

Length 6–7 mm. Colour pale, with light brown head and siphon. Thorax and abdomen with prominent stellate setae.

Head: About as broad as long. Antenna $\frac{2}{3}$ length of head, straight, smooth, tuft a bifid simple seta about $\frac{1}{2}$ length of antenna at about $\frac{2}{3}$ from base; terminal and subterminal setae all placed at apex, one long, remainder short. Clypeal spines with 4–7 curved branches. Setae A, B and d arising in a curved line towards anterior margin of head, their bases being about equal distances apart, and B and d being anterior to A. C arising well back, behind and slightly medial to B. A stellate with 11–18 frayed branches with forked tips, the longest somewhat shorter than antenna; B with 2–3 simple (or occasionally

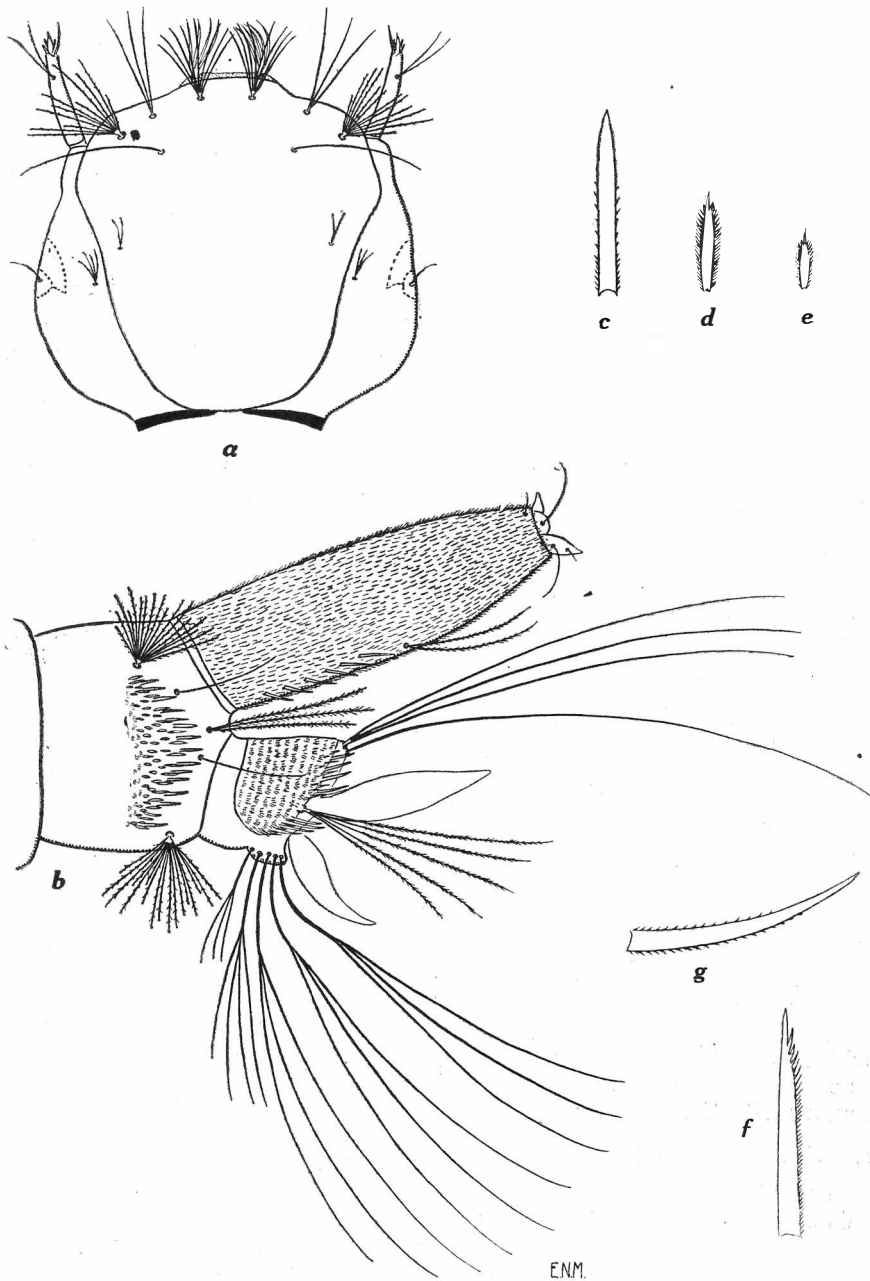


FIG. 15.—Larva of *Aedes gahnicola* n.sp. *a*, head. *b*, terminal segments. *c*, *d* and *e*, teeth from distal, second and proximal rows respectively of lateral comb. *f*, pecten spine. *g*, saddle spine. (*a-b*, x 64; *c-g*, x 320.)

frayed) branches, slightly longer than antenna; C long, single, simple; d well developed, with 5-11 simple branches, equal in length to antenna; e 1-2 and f 2-4 branched. Mentum with large medial tooth and 11-13 lateral teeth, the most basal being smaller and more widely separated.

Abdomen: On segments I.-VI. a pair of long plumose lateral setae. On segment I., 3-5 branched; segment II., 3-4 branched; III.-VI., 2-3 branched.

8th Segment: Lateral comb a triangular patch of 45-75 overlapping teeth, of three sizes, arranged in 4-5 rows. Distal row of 12-17 long stout pointed spines, 80-96 μ in length, evenly tapering, without lateral spines, but with a basal lateral fringe. Remaining comb teeth are apically pointed fringed scales, those of second row being about $\frac{3}{4}$ and remainder about $\frac{2}{3}$ length of distal teeth. At the base of the comb are several rows of minute setae. First and fifth pentad setae stellate with about 17-24 frayed branches with forked tips; second and fourth single, simple; third 2-4 branched, plumose.

Siphon: Index 3.0-3.5; strongly pilose. Pecten extending over basal $\frac{2}{3}$ of siphon, composed of 6-9 evenly sized and spaced spines, 80-96 μ in length, fringed on the proximal edge, coarsely towards apex, more finely towards base. Subventral tuft finely plumose, single or bifid, arising at about $\frac{1}{2}$ length of siphon.

Anal Segment: Saddle covering dorsal $\frac{2}{3}$ of segment, strongly pilose, bearing on distal and ventral margins long pointed spines, the smaller of which have a definite lateral fringe, while the larger may be fringed on their basal half. Lateral seta 4-8 branched, plumose. Caudal setae simple, upper 3-5 branched, lower single. Ventral brush of 10-11 multiple tufts, each with 2-4 branches; no grid. Gills short, pointed, unequal, upper 1-1 $\frac{1}{2}$ x saddle.

Described from 16 specimens (pelts of holotype, allotype and 7 paratypes; 7 morphotype larvae) Caloundra; 11 specimens (3 pelts, one a paratype, and 8 morphotype larvae) Palmwoods; one specimen (pelt of paratype), Forest Glen.

Description of Pupa (Fig. 16).

General coloration greyish with darkly pigmented areas on upper surface of cephalothorax and basal abdominal tergites.

Cephalothorax: Dorsal area with an indefinitely demarcated darkly pigmented area posterior to level of base of trumpets laterally, but extending some distance forward dorsally; pigmentation extends on to metapostnotum (except lateral posterior angles) and upper margin of wing covers. Basal half of trumpet pigmented; opening oblique; ratio of meatus to whole 1 : 1.25; apical notch shallow.

Abdomen: Very indefinite darker pigmentation on tergites I.-IV.; in most specimens a slight darkening basally on tergite V. and in a few also on tergite VI. Float setae well developed, dendritic; the homologous seta on tergite II. usually 1-2 branched but in one specimen with 6 branches. The longer dorsal abdominal setae are finely pilose. Lateral seta of segment VIII. with 3-5 branches. Paddles narrow with denticulate margin; buttress and midrib moderately developed; breadth index 1.5-1.7.

Duration of pupal period about 5-6 days.

Described from 12 pelts (holotype, allotype, and 10 paratypes) from Caloundra, Forest Glen and Palmwoods.

Biology: Found breeding in axils of sword grass (*Gahnia* sp.) in coastal swamps. In addition to larvae from which types and paratypes were reared, larvae were collected from sword grass, Caloundra (J. L. Wassell, 26.iv.45).

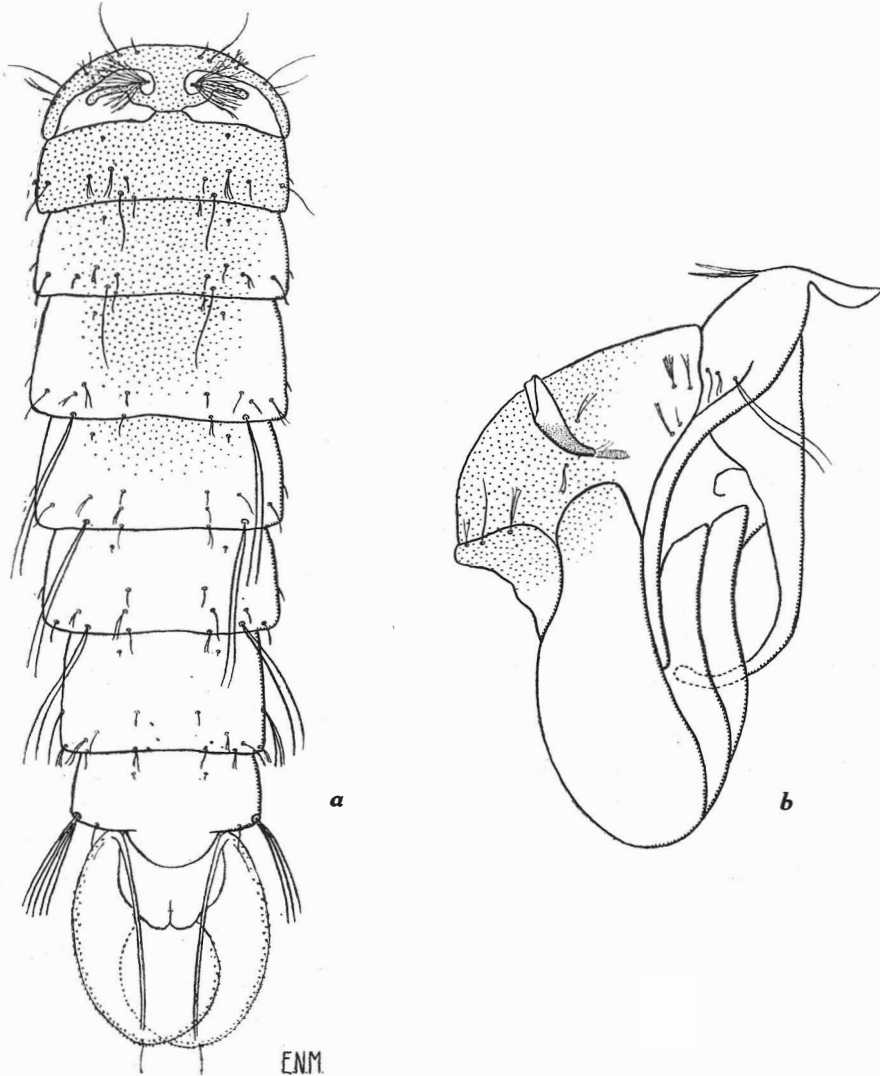


FIG. 16.—Pupal pelt of *Aedes gahnicola* n.sp., x 38. a, abdomen (dorsal view). b, cephalothorax.

Larvae were also collected from axils of pandanus, on coastal headland, Caloundra (J. L. Wassell, 15.viii.45); the pandanus was growing low, and rankly, among thick grass near a drain, so that the breeding place was not dissimilar from sword grass.

Habits: A free and vicious biter when encountered in patches of dry scrub. Specimens taken biting in the late afternoon.

Distribution: In addition to the type series from Caloundra, Palmwoods and Forest Glen, which are all in the one district, specimens have been examined from Dunwich, Stradbroke Is., Q., (14 ♀ ♀, E. N. Marks, xi.43 and iii.46) and Splitter's Creek, Bundaberg, Q. (8 ♀ ♀, J. L. Wassell, 3.x.45). Both these series were taken biting in dry scrub.

(8) AÆDES (FINLAYA) WALLACEI Edwards¹.

Aëdes (Finlaya) wallacei Edwards, 1926, *Bull. ent. Res.*, 17: 105.

Types: Type ♀, Kavieng², New Ireland (Dr. H. G. Wallace) in the British Museum. Edwards stated that the type was returned to G. F. Hill, but it could not be traced in Australian collections. Dr. J. Smart has kindly verified its presence in the British Museum collection and comments that it seems to be in rather poor condition.

Allotype ♂, Lalapipi, New Guinea, 2.x.43, D. Atherton, lodged in Museum of the Division of Economic Entomology, Council for Scientific and Industrial Research, Canberra, A.C.T.

Distinctive Characters: Pale scaling suffused with yellow. Hind tarsal segments II. and III. with not more than basal $\frac{2}{3}$ black, IV. all black. Abdominal sternites V.-VII. with outstanding scales. Specialised seta of coxite with slender stem giving off fine lateral branches near its apex which support a membranous leaf-like terminal expansion.

Larva: Head setae B 3-4 branched, C single, d 5-6 branched. Siphon strongly pilose. Tooth of distal row of lateral comb with long slender pointed medial spine and usually 2 short lateral spines.

Description of Adult:

Allotype ♂.

Wing length 2.6 mm.

Head clothed mainly with broad flat scales, the pale scales being whitish to creamy; a wide medial pale band with lateral to it a patch of black not reaching to nape, followed by broad pale, narrow black and narrow pale bands; narrow curved pale scales at nape, in midline and bordering eyes; upright forked scales mostly pale with some dark ones on the dark scaled areas. Torus dark brown with flat creamy scales on medial aspect; first flagellar segment of antenna with a few dark scales, flagellar segments brown with dense brown verticillate hairs, apical segments with short pale hairs. Clypeus dark brown. Palpi slightly longer than proboscis with dark and pale bands; shaft with three wide pale bands, the distal one being incompletely separated from a following pair of narrow pale bands, and there is also a pale apical band incompletely divided by a black patch; penultimate segment dark scaled ventrally but almost entirely pale scaled above, with a few black scales at apex; terminal segment black scaled with narrow basal and apical pale bands; two apical segments with long brown hairs. Pale scales of palpi are whitish

¹ For a discussion on the possibility of two species being included under *wallacei*, see page 57.

² Edwards (1926) gives the type locality as Kaewung; this is apparently a misprint as G. F. Hill in a personal communication (22. x. 45) states that it is in fact Kavieng.

to creamy and some with ochreous reflections. Proboscis slightly longer than fore femur, black scaled, with a narrow medial pale band which on the dorsal aspect is produced basally and apically into a longitudinal streak; ventrally at about $\frac{2}{3}$ length of the proboscis there is a moderately large patch of pale scales; a small dorsal patch of pale scales at apex forming an incomplete ring.

Thorax: Integument dark brown. Mesonotum clothed medially with black narrow curved scales; on the anterior half there is a broad border of creamy narrow curved scales which extend inwards behind the scutal angle; on the posterior half the black scaling is confined to a medial area, $\frac{1}{3}$ the width of the mesonotum, extending back to the level of the wing root; there are some lanceolate pale scales on either side of the prescutellar bare area. Scutellum clothed with broad flat creamy scales, with a large patch of flat black at the apex of the mid lobe, and smaller black patches at apices of lateral lobes. Chaetotaxy: Bristles of mesonotum and scutellum brown; some of the mesonotal bristles have been lost, but arrangement is as follows:—a row of about 11 strong acrostichal bristles terminating just in front of prescutellar space; on either side of the latter is a double row of about 8 bristles, continuous anteriorly with a row of about 6 strong dorsocentral bristles; 1 strong bristle laterally on the fossae, and a patch of over a dozen supraalar bristles; scutellar bristles 5 to mid lobe, 3–4 to lateral lobes. Metapostnotum dark brown. Anterior pronotum with broad pale scales, white above, pale ochreous below; posterior pronotum with flat ochreous scales, a few flat white below. White scales form a continuous, moderately broad band across upper anterior pronotum, lower posterior pronotum, sub- and postspiracular areas, upper sternopleuron and upper mesepimeron; there are patches of flat white scales also on propleuron, lower sternopleuron, paratergite, and prealar area. Pleural bristles light brown; 3 long and one very small propleural; 3 posterior pronotal; 5–6 postspiracular; a single bristle on upper sternopleuron more or less in line with the row of postspiracular, and immediately below it a patch of 7 bristles, in addition to a row of about 5 bristles along posterior margin of sternopleuron; about 12 prealar; 7 upper and no lower mesepimeral bristles.

Legs: Banded with black and pale scales. Coxae dark brown, fore and mid with white scales above, black below, hind with black scales only. Trochanters black scaled. Femora pale basally, with about eight black bands, white scaling with some admixture of ochreous scales towards tip and an ochreous and white kneespot; a tuft of outstanding scales, mainly black, ventrally at apex. Tibiae with pale scales at base and apex, and pale bands, mainly ochreous on fore tibia, mixed white and ochreous on mid and hind tibiae. Fore tarsal segment I. with narrow basal, medial and apical bands, mainly white, and an additional white band between basal and medial, II. with narrow white apical band, III. and IV. all black, V. all white. Mid tarsal I. incompletely separated into basal and apical and about four intermediate pale bands; II. with medial and wide apical and III. with narrow apical pale bands; IV. all black, V. all white. Hind tarsal I. incompletely separated into wide basal and apical and narrow medial white bands, with intermediate ochreous and white bands and patches; II. with basal $\frac{1}{3}$ and III. with basal $\frac{1}{4}$ black, both with apical $\frac{1}{2}$ white and intervening portion ochreous, IV. all black, V. all white. Claws of fore and mid legs unequal, the anterior claw long with a strong tooth; hind claws equal, simple.

Wings: Veins clothed mainly with broad flat scales in black and whitish to ochreous patches; largely pale scaled, particularly on apical $\frac{1}{3}$. *C* with small basal pale area separated by a small dark spot from a wide confluent prehumeral and humeral pale area; long sector and shorter subcostal, accessory subcostal

and apical pale areas (the subcostal being about $\frac{1}{2}$ the length of the preceding dark spot). *Sc* with sector and apical pale areas. *R*₁ with basal pale area separated by a small dark spot from a long humeral, and shorter sector, accessory sector, subcostal, accessory subcostal and apical pale areas. Pale scales at all forks and cross veins. *R*₂, *R*₃ and *R*₄₊₅ mainly pale scaled distal to *i-r*, with scattered dark scales. *M* with a pale scale subbasally; mixed dark and pale scales on *M*₁ and *M*₂; *M*₃₊₄ mainly pale. *Cu*₁ with basal pale area and mixed dark and pale scales apically. *An* mainly pale scaled with admixture of dark scales. Wing fringe with pale areas opposite all veins except *R*₂, and one between tip of *An* and base of wing. Cell *R*₂ $3\frac{1}{2}$ times the length of its stem, cell *M*₁ $1\frac{1}{4}$ times the length of its stem; bases of cells about level; *r-m* 3 times its length distal to base of *M*₃₊₄. Halteres with pale stem and black scaled knob with a prominent patch of white scales at base of knob.

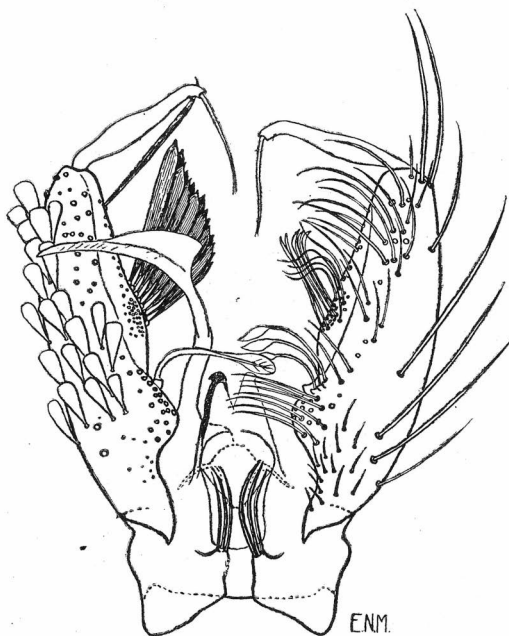


FIG. 17.—♂ genitalia of *Aedes wallacei* Edw., x 160.

Abdomen: Integument brown. Tergites mainly ochreous scaled; tergite I. with some dark scales medially; II.-V. with medial longitudinal black band not reaching to base of segment and on V. separated from the apex by a border of ochreous scales; VI. with some scattered black scales medially; VII. almost entirely ochreous dorsally; VIII. ochreous with one or two dark scales medially; tergites I.-VII. with black scales laterally; I. has a complete lateral border of white scales and V.-VII. have small lateral preapical white patches. Sternites pale scaled basally, dark apically; V.-VII. with tufts of outstanding black scales apically; VIII. dark medially, with ochreous lateral and apical borders.

♂ *Genitalia* (Fig. 17).

Coxites black scaled, slender, tapering, about 3 times as long as broad at base; apical $\frac{2}{3}$ with a longitudinal groove along inner aspect. On the sternal side of this groove, at about $\frac{1}{2}$ length of coxite, is a tuft of approximately 16 broad scales arising from prominent tubercles. Between the scaletuft and the

groove is a dense patch of setae about equal in length to the scales, straight, but somewhat flattened and curved distally; tergal to these and extending to apex of coxite are scattered fine curved setae. On the inner sternal aspect of the coxite near its base, and arising from a prominent tubercle, is a curved specialised seta consisting of a stout basal half, which continues as the thickened midrib of the apical half, tapering to a fine point; on the apical half a lateral membranous expansion is developed, narrow proximally but widening gradually into a broad, rounded, leaf-like apex which is supported by a number of fine branches given off from the midrib. Tergal to this seta and in a line with it are three finer setae, each with its apical fourth broadly expanded. Proximal to these the coxite bears a small basal patch of about 12 long setae, while on the tergal aspect near its base are scattered very short fine setae; there are longer fine setae along the tergal margin of the groove and a patch of long curved setae apically; laterally there are four long setae on the basal half and several near the apex. Style less than $\frac{1}{2}$ length of coxite, slightly expanded medially with a short inconspicuous seta on its inner side near the apex; appendage terminal, slightly curved, $\frac{2}{3}$ length of style with a blunt slightly expanded tip. Harpago stout; appendage broad, curved, widening sharply at a short distance from its base into a lateral membranous expansion which tapers towards the rounded tip. Paraproct with a single tooth. Phallosome simple. Lobe of IXth tergite with 3 curved setae.

1 ♂, Dobodura, N.G., shows the following differences from the allotype:—Wing length 2.3 mm. Shaft of palpus black with four pale bands, two apical segments each with a white basal band extending slightly on to preceding segment; terminal segment with white tip. Hind tarsal II. with black basal $\frac{1}{2}$ and a black spot on the medial ochreous band; III. with black band covering basal $\frac{2}{3}$ dorsally. Wing: No accessory subcostal pale area on *C*; on *R*₁ the sector and accessory sector pale areas are confluent, also the subcostal and accessory subcostal; the remaining veins are dark scaled apically with a few scattered pale scales; cell *R*₂ $2\frac{1}{2}$ times length of its stem, its base distal to that of cell *M*₁; *r-m* $2\frac{1}{2}$ times its length distal to base of *M*₃₊₄. Genitalia correspond closely to the allotype; lobe of IXth tergite with 1-3 setae.

Female: The female differs from the male as follows:—

Wing length: 2.4-2.8 mm.

Head: Scaling similar to male but the dorsal black patches extend to the nape. Tori ochreous, but darker brown in Milne Bay specimens, creamy scales on medial aspect; first flagellar segment of antenna with black scales, flagellar segments dark brown with dark brown verticillate hairs and silvery clothing hairs. Palpi $\frac{1}{5}$ to $\frac{1}{4}$ length of proboscis, black scaled with pale scaled tip. Proboscis slightly shorter than fore femur, with a medial white or ochreous band $\frac{1}{5}$ to $\frac{1}{3}$ its length and an apical dorsal pale patch or complete ring.

Thorax: The pale scaling of mesonotum is less extensive than in the male; the border of creamy scales curves inwards behind the scutal angle and then continues in a line posteriorly to join the pale area in front of the scutellum; it may also curve forwards forming incomplete lateral circles as in *A. kochi* and there may be some creamy scales in the midline anteriorly; the lateral areas above the wing roots may be entirely dark scaled or may have patches of creamy scales. Thoracic chaetotaxy in general similar to male; there may be 2 strong bristles on fossae; 2 long propleural, 3-4 posterior pronotal, 3 postspiracular, a patch of 5 on upper sternopleuron, 9 prealar, and 4 bristles on mid lobe of scutellum.

Legs: Fore tarsal III. may have a white scaled tip; mid tarsal I. may be largely pale scaled, II. may have the apical $\frac{2}{3}$ pale, with scattered black scales, or may have an apical and two medial rings. Hind tarsal I. may have no

intermediate pale markings between the basal, medial and apical bands; hind tarsals II. and III. with basal $\frac{1}{5}$ - $\frac{1}{4}$ black, apical $\frac{2}{3}$ white, and a narrow intervening ochreous ring. Claws equal, fore and mid toothed, hind simple.

Wings: Dark scaling more extensive than in male. *C* lacks an accessory subcostal pale area. On R_1 the humeral and sector pale areas may be confluent, the accessory sector being distinct; the subcostal and accessory subcostal are fused into one long pale area. R_2 with or without a preapical pale area; R_3 , R_{4+5} , M_1 , M_2 , M_{3+4} and Cu_1 with preapical pale areas, or mixed dark and pale scales; An with or without a subbasal pale area or with scattered pale scales, or with a very long basal pale area. Cell R_2 about 2-3 $\frac{1}{2}$ times the length of its stem, cell M_1 equal to or slightly longer than its stem, its base level with or proximal to that of cell R_2 .

Abdomen: Mainly dark scaled; pale scaling ochreous with a varying proportion of white, particularly in the basal patches. Tergite I. with pale scales medially or with pale patches on either side of midline. Tergites II.-VII. with medial basal and paired preapical pale patches. The basal patch may be broad on II., or small, and may be absent from III.; there may be small accessory patches lateral to the preapical patches on II.-V.; the basal and preapical patches may be confluent and there may be a pale apical border on VI. and VII.; VIII. dark with a basal medial pale patch and some pale scales laterally; I.-VII. with white scaled lateral border, complete on I., curving preapically on III.-VII. Sternites with pale scales basally and medially, dark apically, the proportions variable; V.-VII. with tufts of outstanding black scales apically; VIII. with some pale scales at base, dark laterally, apex bare of scales. Cerci with ochreous scales.

Description of Larva (Fig. 18).

Length about 5.5 mm. Colour pale, with light brown head and siphon. Thorax and abdomen with prominent stellate setae.

Head: About as broad as long. Antenna $\frac{1}{4}$ length of head, straight, smooth; tuft a single simple seta $\frac{1}{2}$ length of antenna at $\frac{2}{3}$ from base; terminal and subterminal setae all placed at apex, one long, remainder short. Clypeal spines with 3-4 curved branches. Setae A, B and d arising in a curved line towards anterior margin of head, their bases being about equal distances apart, and B and d being anterior to A. C arising well back, more or less in line with B. A stellate with 8-11 finely frayed branches with forked tips, longest about length of antenna; B with 3-4 simple branches, slightly longer than antenna; C long, single, simple or slightly frayed; d well developed, with 5-6 simple branches, almost as long as B; e with 2 and f with 3-4 branches. Mentum with one large medial tooth and 8-9 lateral teeth, the most basal being smaller and more widely separated.

Abdomen: On segments I.-VI. a pair of long plumose lateral setae; on segments I.-II., 5 branched; segments III.-V., 3 branched; segment VI., 3-4 branched.

8th Segment: Lateral comb a triangular patch of about 90 overlapping teeth, of three sizes arranged in five rows. Distal row of 16-17 long pointed teeth, about 88-96 μ in length, each stout basally and giving off at $\frac{1}{4}$ from its base 2 (occasionally 3) very short and rather slender lateral spines, beyond which the medial spine is very long and slender, tapering to a fine point. Remaining comb teeth are apically rounded fringed scales, those of second row being about $\frac{1}{2}$ and remainder about $\frac{1}{4}$ length of distal teeth. At the base of the comb are several rows of minute setae. First and fifth pentad setae stellate, frayed, with forked tips; first 14-20 branched; second and fourth single, simple; third 2-3 branched, plumose; fifth 12-14 branched.

Siphon: Index about 2.6; strongly pilose. Pecten extending over basal $\frac{2}{5}$ – $\frac{1}{2}$ of siphon, composed of 8–10 evenly sized and spaced spines, 84–100 μ in length, finely fringed along proximal edge. Subventral tuft with 2–3 plumose branches at $\frac{1}{2}$ length of siphon or slightly beyond.

Anal Segment: Saddle covering dorsal $\frac{2}{3}$ of segment, strongly pilose, bearing on distal and ventral margins long pointed spines the smaller of which have a definite lateral fringe, while the larger may be sparsely fringed towards:

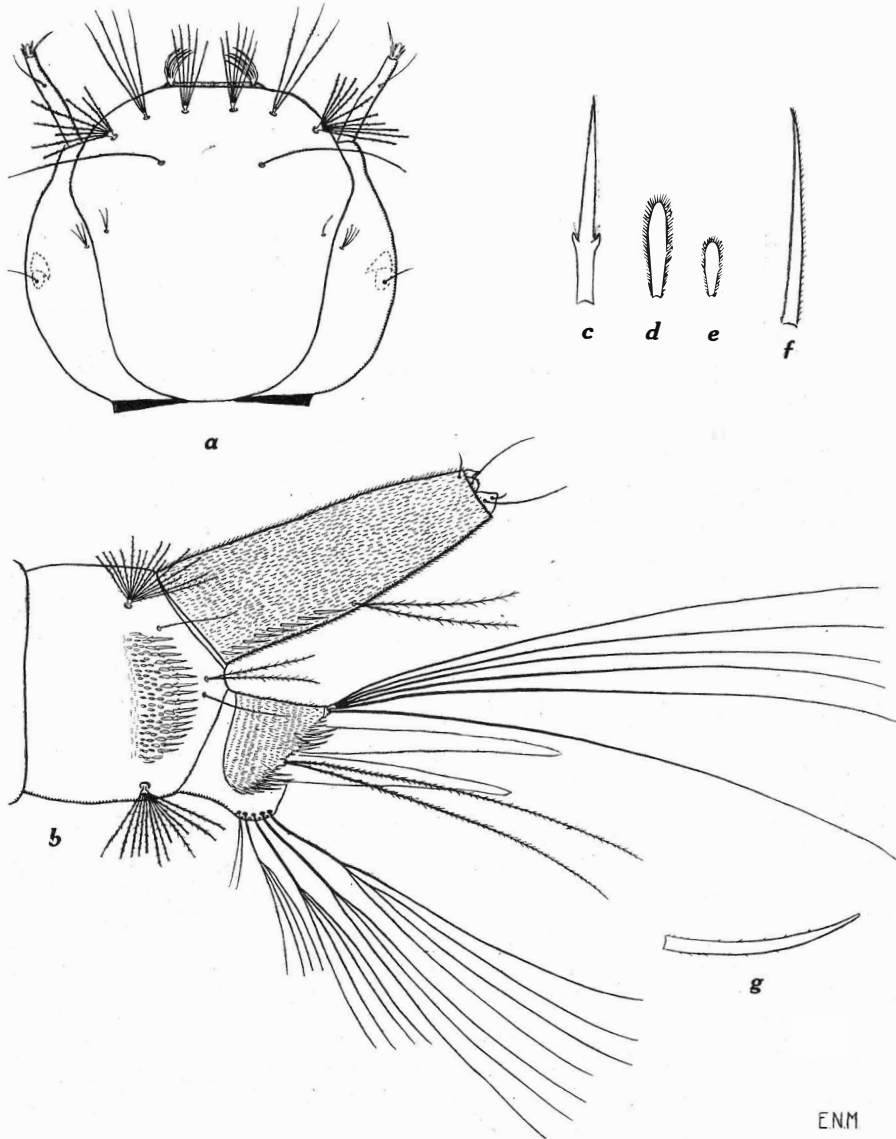


FIG. 18.—Larva of *Aedes wallacei* Edw. *a*, head. *b*, terminal segments. *c*, *d* and *e*, teeth from distal, second and proximal rows respectively of lateral comb. *f*, pecten spine. *g*, saddle spine. (*a-b*, x 64; *c-g*, x 320.)

base. Lateral seta bifid, shortly plumose. Caudal setae simple, upper 4-5 branched, lower single. Ventral brush of 10 multiple tufts, each with 3-5 branches; no grid. Gills long, tapering, unequal; upper pair $2\frac{1}{2}$ -3 x saddle.

Described from one pelt (with correlated adult female) and one whole larva, Milne Bay, 1944 (Bick).

Biology: At Milne Bay *A. kochi-wallacei* series was obtained mostly from banana leaf axils, to a more limited extent in taro and pineapples, and very rarely from pandanus (Lt. G. W. Bick, U.S.N., 1944). Taylor (1934): It appears to breed exclusively in the axils of the leaves of the various species of *Pandanus* (Kavieng, New Ireland, Dr. E. A. and Miss P. Holland).

Habits: Taylor (1934): "enters houses to bite and is a troublesome species at night-time."

Distribution: Specimens have been examined from the following localities:—NEW BRITAIN, 1 ♀ (A. B. Barnett, 1945). NEW GUINEA: Lalapipi, 1 ♂ (D. Atherton, 2.x.1943); Dobodura, 1 ♂, 1 ♀ (F. N. Ratcliffe, x.1943); Terapo, 1 ♀ (F. N. Ratcliffe, x.1943); Lae, 1 ♀ (Cpl. R. W. Borrowdale, vi.1944); Milne Bay, 3 ♀♀, one with correlated larval skin (Lt. G. W. Bick, U.S.N., ix., x. and xii.1944).

Possibility of two species being included under wallacei.

1 ♂, Milne Bay (F. N. Ratcliffe, ix.1943), a badly damaged specimen with wings and proboscis missing, corresponds to *wallacei* on leg characters. Genitalia show well marked differences from those described for *wallacei*, but no other notable differences are apparent, though pale scaling on the mesonotum is rather more extensive. The genitalia of this specimen show some resemblance to those of *A. solomonis* and differ from those described for *wallacei* as follows:—Curved specialised seta at base of coxite is very slightly broadened medially and tapers to a sharp point, without membranous lateral expansion; there are no additional modified setae, but the coxite bears a basal patch of about 40 long curved setae in a rather indefinite circular clump; there are no scattered short setae at the base of the coxite. Style of almost uniform thickness throughout its length.

The indication is that possibly two species are being treated as *wallacei*. However, no distinctive differences could be found between females from Milne Bay and other parts of New Guinea and New Britain. Moreover the condition of the male from Milne Bay makes it impossible to judge whether it may be the same species or distinct from the females collected in that area. In the absence of further information, all the specimens examined, other than the above male, and including larvae from Milne Bay, have been treated in this paper as *A. wallacei*.

(9) *AËDES (FINLAYA) SOLOMONIS* Stone and Bohart.

Aëdes (Finlaya) solomonis Stone and Bohart, 1944, *Proc. ent. Soc. Washington*, 46: 208-209.

Aëdes (Finlaya) flavipennis Knight, Bohart and Bohart, 1944, *Keys to Mosquitoes of Aust. Region*: 52.

Types: Holotype ♂, Guadalcanal, Solomon Islands, March 1944, reared from larvae taken from palm tree (Lechner collector) and paratypes of both sexes from Guadalcanal and Bougainville in U.S. National Museum, Washington. Paratypes in British Museum, and University of Sydney.

Distinctive Characters: (Notes based on type description and on a series of 16 ♂♂ and 16 ♀♀, Bougainville, xii.44, Lt. J. R. Cowell.) Wing length 2.1–2.7 mm. General coloration black with extensive yellow scaling. Proboscis of male with mixed dark and pale scales on apical $\frac{2}{3}$, of female with apical $\frac{1}{2}$ – $\frac{2}{3}$ pale scaled. Mesonotum brown scaled with indefinite patches of whitish scales which may form a pattern somewhat similar to *A. kochi*, or may be more extensive; scutellum white and yellow scaled with a large patch of black at apex of mid lobe, and smaller black patches at apices of lateral lobes. Legs: femora with prominent apical ventral tufts of outstanding black and yellow scales (distinguishes this species from *A. flavipennis*, *A. aranetanus* and *A. avistylus*); fore and mid tarsal segments I–V. yellow, with scattered black patches on I. and small basal black patches on II., III. and sometimes IV.; hind tarsal I. yellow with white basal, medial and apical bands and a few scattered black patches; II. and III. yellow with narrow black basal and white apical bands, IV. yellow with a variable amount of black scaling, V. yellow.

Wings: Pale scaling extensive, yellow and white. *C* with basal pale area separated by small black spot from a long confluent prehumeral and humeral pale area, which is separated by a patch of mixed dark and pale scales from the sector pale area (or all these pale areas may be continuous); a patch of mixed dark and pale scales between sector and subcostal pale areas, and distal to the latter *C* is pale with some black dots. *R*₁ with basal, long humeral, short sector and accessory sector pale areas (or some or all of these may be confluent), a long confluent subcostal and accessory subcostal pale area and an apical pale area. Remaining veins may be largely pale scaled, or with variable number of back spots; *Cu*₁ with pale areas at base and at junction with *m-cu*, intervening portion usually black scaled but there may be a pale area just proximal to *m-cu*. Halteres all yellow or with a few dark scales on knob. Abdominal tergites of male extensively yellow scaled with indefinite medial dark patches; of female, black with medial basal and paired preapical yellow patches; tergite VIII. pale scaled medially; outstanding black scales at apices of sternites V.–VII.

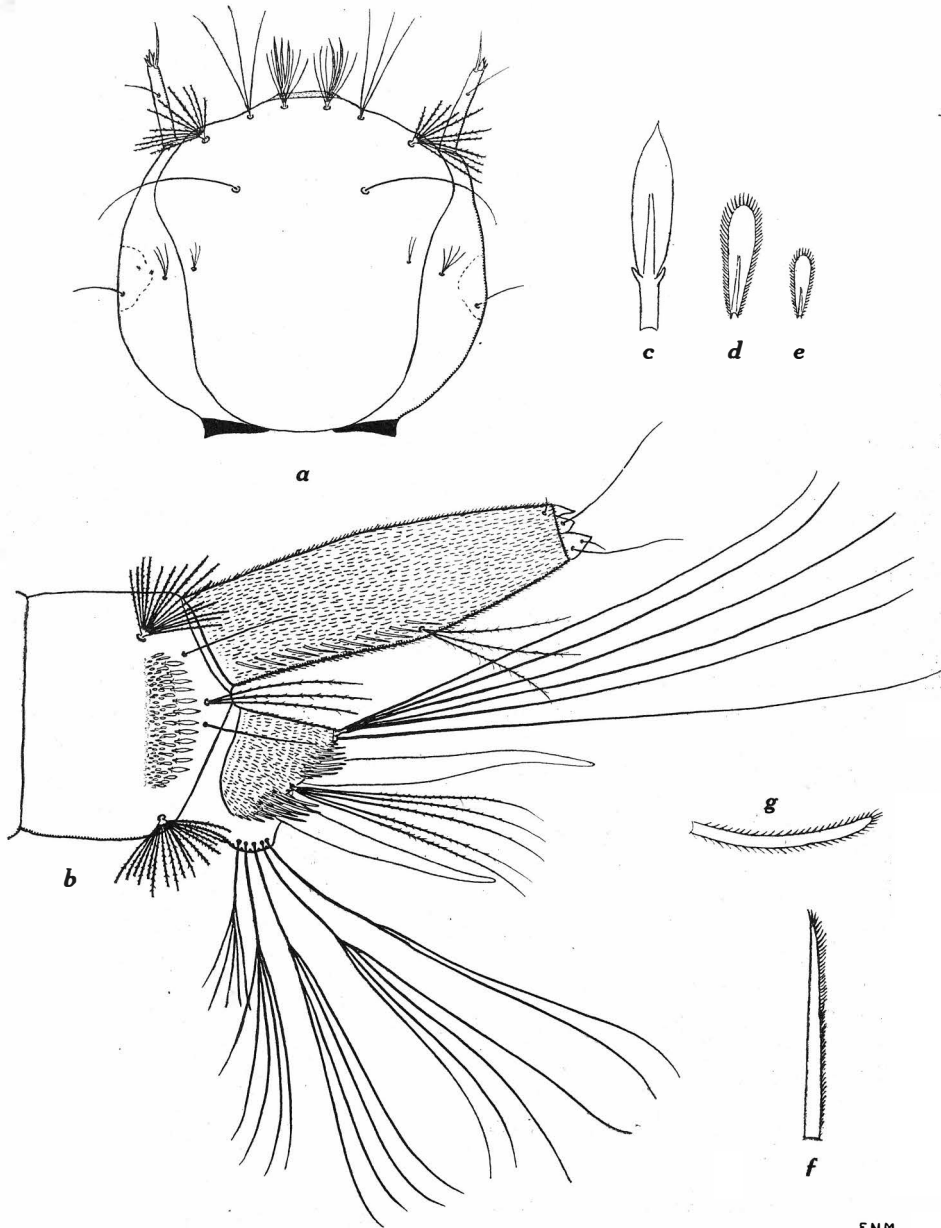
Male Genitalia: General resemblance to *A. kochi*. Coxites black and yellow scaled. Coxite with inner preapical tuft of 11–14 long broad scales, apical to which there may be a single long narrow scale; tergal to the scale tuft is a patch of about a dozen fine setae. On the tergal aspect of coxite is a basal patch of setae extending as far apically as the scale tuft, the basal members being straight and concentrated into a well defined circular clump, the more distal ones scattered, curved, some with their apical half flattened and narrowing abruptly to a pointed tip; on the inner aspect at the base there is a specialised seta with slender stem and broad flattened apical portion with rounded tip. Style slender, slightly expanded medially, with an inconspicuous seta near its tip. Appendage of harpago broad, curved, with wide membranous medial expansion and rounded tip. Paraproct with 1–2 teeth. Lobe of IXth tergite with 1–2 setae.

Larva: Head setae B 3–4 branched, C single, d 4–7 branched. Tooth of distal row of lateral comb with 2–4 short lateral spines and a broad flattened pointed medial spine, somewhat thickened medially towards its base. Siphon finely pilose.

Pupa: Abdomen with sharply demarcated dark medial stripe on tergites I.–IV. Lateral seta of segment VIII. 10–20 branched. Breadth index of paddles 1.25–1.5.

Description of Larva (Fig. 19).

Length 6-6.8 mm. Colour, including head and siphon, whitish. Thorax and abdomen with prominent pale stellate setae. Generally paler in colour than *A. bougainvillensis* in association with which it may be found.



ENM.

FIG. 19.—Larva of *Aedes solomonis* Stone and Bohart. *a*, head. *b*, terminal segments. *c*, *d* and *e*, teeth from distal, second and proximal rows respectively of lateral comb. *f*, pecten spine. *g*, saddle spine. (*a-b*, x 64; *c-g*, x 320.)

Head: About as broad as long. Antenna $\frac{1}{4}$ length of head, straight, smooth; tuft a single simple seta $\frac{1}{2}$ length of antenna at $\frac{2}{3}$ from base; terminal and subterminal setae all placed at apex, one long, remainder short. Clypeal spines with 2-4 curved branches. Setae A, B and d arising in a curved line towards anterior margin of head, their bases being about equal distances apart, and B and d being anterior to A. C arising well back, more or less in line with B. A stellate, with 8-12 frayed branches with forked tips, longest about length of antenna; B with 3-4 simple or slightly frayed branches, longer than antenna; C long, single, simple or slightly frayed; d well developed, with 4-7 somewhat flattened branches as long as antenna; e 2-3, f 3-4 branched. Mentum with medial tooth and 10-11 lateral teeth, the most basal being smaller and more widely separated.

Abdomen: On segments I.-VI. a pair of long plumose lateral setae; on segment I. 6-9, II. 6-8, III.-VI. 2-4 branched.

8th Segment: Lateral comb a triangular patch of approximately 80-100 overlapping teeth, of three sizes, arranged in 4-5 rows. Distal row of 9-14 long pointed teeth, 84-92 μ in length, each stout basally and giving off at $\frac{1}{4}$ - $\frac{1}{3}$ from its base 2-4 (usually 2) short pointed lateral spines, beyond which the medial spine is a broad flattened blade, somewhat thickened medially towards the base, and tapering on its apical $\frac{1}{3}$ to a sharp point. Remaining comb teeth are apically rounded fringed scales, those of 2nd row being about $\frac{2}{3}$, and remainder about $\frac{1}{3}$ length of distal teeth. At the base of the comb are several rows of minute setae. First and fifth pentad setae stellate with about 20 frayed branches with forked tips; second and fourth single, simple; third with 3-5 plumose branches.

Siphon: Index 3.0-3.5; finely pilose. Pecten extending over basal $\frac{1}{2}$ of siphon, composed of 9-14 evenly sized and spaced spines, 84-108 μ in length, finely fringed along proximal edge. Subventral tuft 2-4 branched, plumose, arising at slightly beyond $\frac{1}{2}$ length of siphon.

Anal Segment: Saddle covering dorsal $\frac{2}{3}$ of segment, finely pilose, bearing on distal and ventral margins long blunt apically and laterally fringed spines. Lateral seta 3-5 branched, plumose. Caudal setae simple, upper 5-7 branched, lower single. Ventral brush of 10-11 multiple tufts, each with 3-9 branches; no grid. Gills long, tapering, unequal, upper pair 2-2 $\frac{1}{2}$ x saddle.

Described from slides of 6 larvae and 8 pelts (with correlated adults), with length of larva and siphonal index from five unmounted specimens, all from Bougainville (Cowell).

Description of Pupa (Fig. 20).

General coloration whitish with sharply defined contrasting dark markings on cephalothorax and abdomen.

Cephalothorax: Dorsal area with sharply demarcated darkly pigmented area posterior to level of insertion of trumpets, extending over metapostnotum (except lateral posterior angles), and in a triangular patch across upper portion of wing covers. Trumpet with basal $\frac{1}{3}$ - $\frac{1}{2}$ pigmented; opening oblique; ratio of meatus to whole 1: 1.3; apical notch shallow.

Abdomen: Sharply demarcated dark medial stripe on tergites I-IV., about $\frac{1}{3}$ width of segments. Float setae well developed, dendritic. The longer dorsal abdominal setae are finely pilose. Lateral seta of segment VIII. with 10-20 branches (usually about 16). Paddles with denticulate margin; buttress and midrib moderately developed; breadth index 1.25-1.5.

Duration of pupal period 2-3 days.

Described from 9 pupal pelts (7 having correlated adults) all from Bougainville (Cowell).

Biology: Specimens examined were found breeding in axils of lilylike plant, *Sararanga* sp. (Fam. *Pandanaceae*), Bougainville, xii.44, Lt. J. R. Cowell (see notes on biology of *A. bougainvillensis* with which this species was associated). Stone and Bohart (1944): Larvae taken from palm tree, Gaudalcanal; "Arum-like plant in swamp" and pandanus trees, Bougainville.

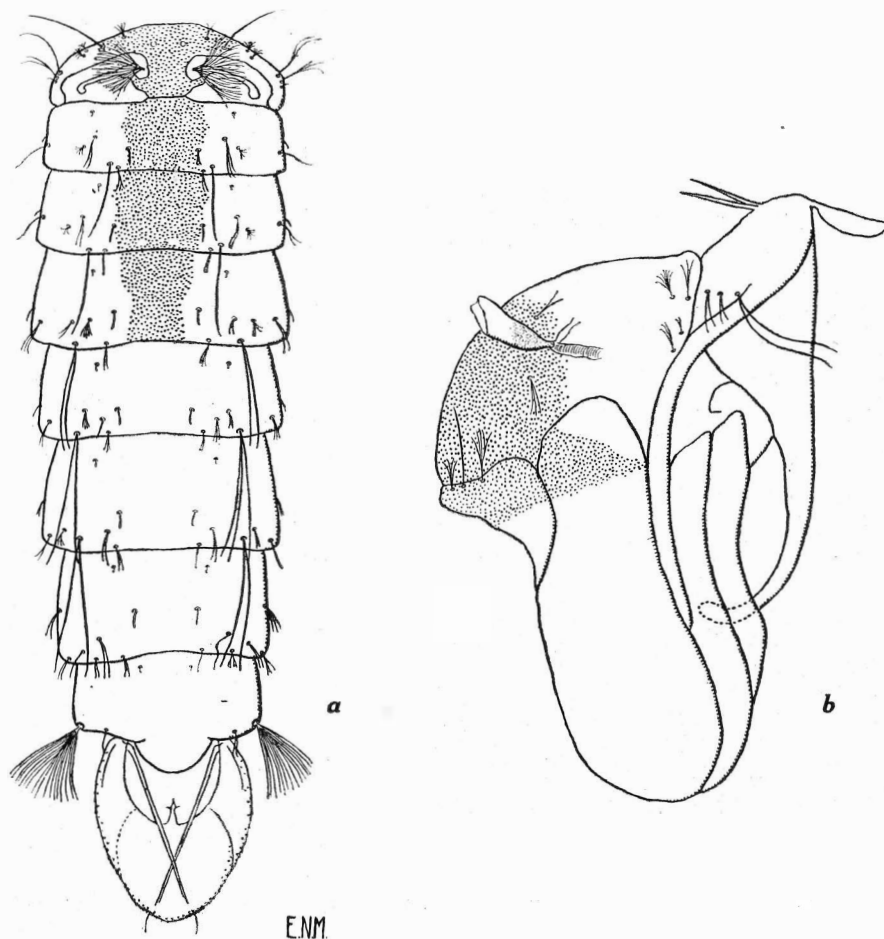


FIG. 20.—Pupal pelt of *Aedes solomonis* Stone and Bohart, x 38. *a*, abdomen (dorsal view). *b*, cephalothorax.

Distribution: Gaudalcanal and Bougainville, Solomon Is. A series of 16 ♂♂ and 16 ♀♀, Bougainville (Lt. J. R. Cowell, xii.44) has been examined (4 ♂♂ and 3 ♀♀ with correlated larval skins), also 1 ♀, Torokina, Bougainville (F. N. Ratcliffe, iv.45). The specimen of *A. flavipennis* recorded by Paine and Edwards (1929) from Roviana, New Georgia, was probably *A. solomonis*.

(10) **ÆDES (FINLAYA) FLAVIPENNIS** (Giles).

Finlaya flavipennis Giles, 1904, *J. Trop. Med. (Hyg.)*, 7: 366; Theobald, 1910, *Mon. Cul.*, 5: 465.

Popea lutea Ludlow, 1905 *Canad. Ent.*, 37: 96; Theobald, 1907, *Mon. Cul.*, 4: 212.

Aedes (Finlaya) flavipennis Edwards, 1922 (in part), *Ind. J. Med. Res.*, 10: 465; 1926 (in part), *Bull. ent. Res.*, 17: 105; 1932 (in part), *Genera Insectorum*, Fasc. 194: 149; Stone and Bohart, 1944, *Proc. ent. Soc. Washington*, 46: 207.

Type: No information is available as to where the type series is deposited. *Type locality:* Philippine Islands.

Distinctive Characters: A black and yellow species, showing a close resemblance to *aranetanus*, *avistylus* and *solomonis*. Distinguished from *solomonis* by the absence of outstanding scale tufts at apices of femora and from *aranetanus* and *avistylus* on the following characters:—fore tarsal segments III. and IV. mainly dark scaled; hind tarsals II. and III. with narrow basal black bands, IV. with a basal black band up to $\frac{1}{3}$ its length. Yellow markings on abdominal tergites appearing as spots or irregular marks, but not as longitudinal streaks. Male genitalia: Coxite with single preapical scale tuft of fairly long slender scales and no specialised seta at base; a row of 3–5 very strong tergally directed setae at base of coxite. Style widening gradually from base, and narrowing abruptly on apical third, but without preapical prong; appendage about one-half length of style. Appendage of harpago slender and pointed.

Larva: Head setae A 2–3, B 2, C single, d 2 branched; B and d arising fairly close together and well anterior to A. Stellate setae of abdomen 3–4 branched. Lateral comb about 50 teeth, those of distal row being short with sides and rounded apex finely fringed (Fig. 1, *k*); remainder not differentiated into rows of varying sizes or types, though the more basal are smaller. Siphon bare.

Biology: Specimens examined were bred from leaf axils (plant unstated). The type series was bred out from water held in banana stumps.

Distribution: This species is known only from the Philippine Islands. Specimens have been examined from Mt. Makiling, Luzon, 2 ♂♂, 3 ♀♀, 2 larvae (19 M.G.L., 30.ix.1945).

(11) **ÆDES (FINLAYA) ARANETANUS** (Banks).

Finlaya aranetana Banks, 1906, *Phil. J. Sci.*, 1: 1001; Theobald, 1910, *Mon. Cul.* 5: 465.

Aedes (Finlaya) flavipennis Edwards, 1922 (in part), *Ind. J. Med. Res.*, 10: 465; 1926 (in part), *Bull. ent. Res.*, 17: 105; 1932 (in part), *Genera Insectorum*, Fasc. 194: 149; Brug, 1934, *Bull. ent. Res.*, 25: 513; 1939, *Tijdschr. v. Ent.*, 82: 107.

Aedes (Finlaya) aranetanus Stone and Bohart, 1944, *Proc. ent. Soc. Washington*, 46: 207.

Types: Type series from Negros Occidental, Philippine Islands. Type of ♂ and ♀ deposited in Entomological collection, Bureau of Science, Manila.

Distinctive Characters: A black and yellow species, showing a close resemblance to *flavipennis*, *avistylus* and *solomonis*. Distinguished from *solomonis* by the absence of outstanding scale tufts at apices of femora, and from *flavipennis* and *avistylus* on the following characters: fore tarsal segments III. and IV. mainly dark scaled, hind tarsals II. and III. with narrow basal black bands; IV. black with some ochreous markings medially. Yellow markings on abdominal tergites II.-IV. tend to form longitudinal streaks. Male genitalia: Coxite with an additional preapical scale tuft tergally; no specialised seta at base; style with strong preapical prong on inner side; appendage of harpago slender and pointed.

Larva unknown.

Biology: The specimens examined were bred from *Colocasia* axils. The type series were captured between buttresses of large Lauaan trees. Banks records a specimen bred from axils of banana leaves.

Distribution: Specimens have been examined from Beaufort, British North Borneo, 1 ♂, 1 ♀ (D. H. Colless, 29.viii.1945). Recorded from Negros Occidental and Luzon, Philippine Is.

(12) *ÆDES* (FINLAYA) *AVISTYLUS* Brug.

Aedes (*Finlaya*) *flavipennis* var. *avistyla* Brug, 1939, *Tijdschr. v. Ent.*, 82: 107.

Aedes (*Finlaya*) *avistyla* Stone and Bohart, 1944, *Proc. ent. Soc. Washington*, 46: 208.

Type: Type series from Lindoe Lake and Kalawara (Celebes) and Baeo-Baeo (Boeton). Type (sex and locality not stated) in British Museum.

Distinctive Characters: A black and yellow species, showing a close resemblance to *flavipennis*, *aranetanus* and *solomonis*. Distinguished from *solomonis* by the absence of outstanding scale tufts at apices of femora and from *flavipennis* and *aranetanus* on the following characters: fore tarsal segments III. and IV. mainly ochreous, though there may be a black dot at base of III.; hind tarsals II., III. and IV. with narrow basal black bands. Yellow markings on abdominal tergites II.-IV. tend to form longitudinal streaks. General coloration more ochreous than *aranetanus*. Male genitalia: Coxite with single scale tuft and no specialised seta at base; there are 3-4 long tergally directed setae at base of coxite, as in *flavipennis*. Style with strong preapical prong on inner side. Appendage of harpago slender and pointed.

Larva: Head setae A 3-4, B 2, C 1-2 and d 2-5 branched; B and d arising fairly close together and well anterior to A. Stellate setae of abdomen about 10 branched. Lateral comb about 50 teeth, those of distal row being short, with lateral and apical fringe and stout, pointed, terminal spine, almost as long as remainder of tooth, arising from middle of fringe (Fig. 1, j)¹. Comb teeth are not differentiated into rows of varying sizes or types, though some of the more basal are smaller and lack the terminal spine. Siphon bare.

Biology: Brug records it as breeding in leaf axils of *Colocasia* and in a bamboo-stump. Specimens examined were also from leaf axils of *Colocasia*.

Distribution: Specimens have been examined from Morotai, 2 ♀ ♀ with correlated larval skins, 2 ♂ ♂, 2 additional larval skins (D. H. Colless, v.1945). Type series from Celebes and Boeton.

¹ Brug's (1939) figure does not illustrate this in sufficient detail to distinguish it from *flavipennis*.

VI. SUMMARY.

1. *Aedes kochi* Dön., an efficient vector of *Wuchereria bancrofti*, was described from the female. A number of species are very similar in markings and several have hitherto been confused with it.

2. Males and larvae show characters useful in separating similarly marked species. An allotype male of *A. kochi* is designated and detailed descriptions of male, larva and pupa are given.

3. Both sexes and larvae of four new species in the *kochi* group are described (*A. bougainvillensis*, *A. fijiensis*, *A. alocasicola*, *A. gahnicola*—the last two from South Queensland), together with the male and larva of *A. wallacei*, larva of *A. solomonis*, and pupae of *A. bougainvillensis*, *A. alocasicola*, *A. gahnicola* and *A. solomonis*. Keys to adults and larvae of the group are provided.

4. The *kochi* group is divisible into two distinct colour types and into two types on male genitalia. These groupings bear no apparent relationship to each other or to geographical distribution. On a comparison of larval characters, it is suggested that it may be possible to correlate distribution with the form of the teeth in the distal row of the lateral comb.

ACKNOWLEDGEMENTS.

For assistance in the preparation of this paper, the writer is indebted to Mr. F. A. Perkins, Lecturer in Entomology, University of Queensland, for his unfailing interest and encouragement; to Mr. D. J. Lee, Department of Zoology, University of Sydney, who made available a number of specimens, including the allotype males of *A. kochi* and *A. wallacei* and specimens collected by L. J. Dumbleton, D. H. Colless and F. N. Ratcliffe, and who gave valuable criticism and advice; to Dr. G. M. Heydon, School of Public Health and Tropical Medicine, Sydney, for allowing the use of his findings in an unpublished investigation on filariasis; to Dr. J. Smart, British Museum of Natural History, who supplied a photostat copy of Dönitz's paper, and particulars of the type of *A. wallacei*; and to the various workers who checked Australian collections for this specimen; to Captain H. Hoogstraal, U.S. Army, who supplied specimens from the Philippines. Constant recourse has been had to Stone and Bohart's paper on the *kochi* group, and information derived therefrom has been used in preparing the keys. The material on which this study is based would not have been available without the enthusiasm and painstaking field work of the numerous collectors, details of whose contributions are given under the various species.

The valuable help of all is very gratefully acknowledged.

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¹ Original paper not consulted.

Appendix: Copy of Original Description of *A. kochi*.*CULEX KOCHI*.

Diagnose: Flügel hell und dunkel gefleckt.

Beine in allen Abschnitten reich geringelt. Abdomen auf dem Rücken mit heller Längszeichnung, auf der Bauchseite mit hellen Vorderrändern der Segmente.

Beschreibung: ♀. Ziemlich kleine Art. Der ganze Körper mit den Anhängen sehr bunt, olivbräunlich und gelblichweiss beschuppt. Kopf dunkel, mit hellem Stirnfleck, der schmaler werdend zum Nacken zieht und sich seitwärts wieder nach vorn umbiegt und an den Augen fleckartig endet. Hinter den Augen stehen seitwärts vereinzelte lange Haare. Rüssel in der Mitte breit hell geringelt, am Ende mit einem kleinen hellen Fleck. Palpen klein, sehr dunkel, mit äusserst zarten, weissen Spitzchen. Fühler mit hellem Wurzelglied; Schaft dunkel, mit weissen Gelenken und grauer Behaarung.

Auf dem dunklen Rückenschild des Thorax zeigt sich eine von schütter stehenden weissen Schuppen gebildete Zeichnung, welche in der Mitte einen Ring darstellt, von welchem Doppelstrahlen ausgehen, die man als Kreuz auffassen kann, dessen vordere Schenkel am Vorderrande seitwärts ausbiegen und sich weiterhin mit den Seitenästen verbinden.

Am Hinterleibe sind die Rückenschilde seitwärts weiss gerandet, und auf ihren Hinterecken liegen weisse Flecke. Ueber den ganzen Rücken verläuft ein heller Mittelstreif, dem, wie es scheint in unregelmässiger Weise, dunklere Flecke eingestreut sind. (Bei den bisher untersuchten drei Stücken dieser Species fehlen hier auf den mittleren Ringen zu viel Schuppen, um eine genaue Beschreibung dieser Zeichnung geben zu können) Die Bauchplatten sind seitwärts und vorn weiss gerandet. An den hinteren Rändern der Abschnitte 5-7 stehen dicht gedrängt aufgerichtete dunkle Schuppen.

Beine mit zahlreichen Ringeln versehen, doch so, dass bald das Weiss, bald das Olivenbraun vorherrscht.

Flügel am Vorderrande mit drei dunklen Flecken, ähnlich wie bei *Anopheles*; der dritte Fleck entspricht seiner Lage nach dem vereinigten dritten und vierten Vorderrandfleck von *Anopheles*. Entsprechende Flecke auf der ersten Längsrippe verbreitern diejenigen des Vorderrandes. Jeder der den dunklen Stellen voraufgehenden hellen Flecke ist durch ein dunkles Pünktchen getheilt. Untere Gabel kaum kürzer als die obere. Alle Gabelungsstellen punktförmig hell beschuppt. Auf dem dunklen Stiel der grossen Gabel ein heller Fleck. Wimpersaum grau, auf den Rippenenden hell.

♂ unbekannt.

Habitat: Neu-Guinea.